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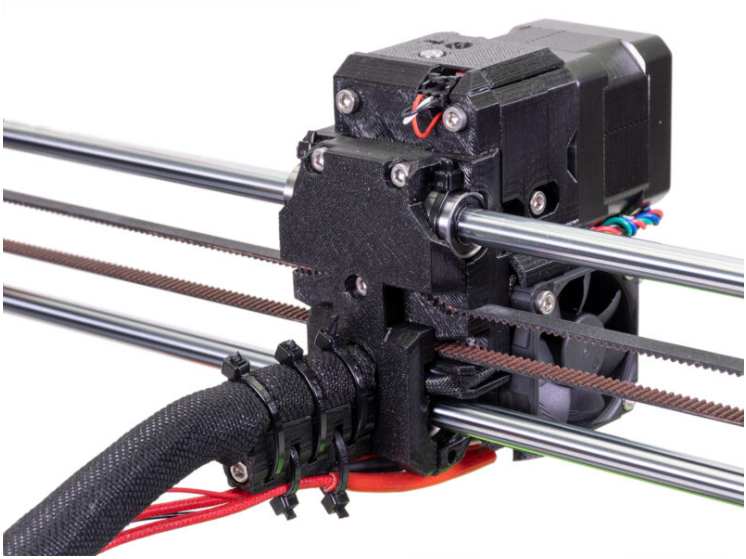
How to replace bearings on the X-axis (MK3S+)



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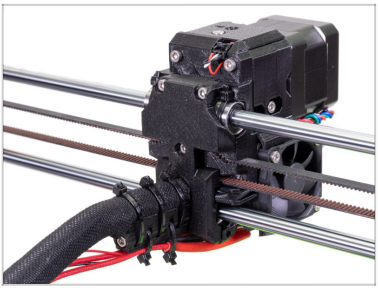
STEP 1 Introduction

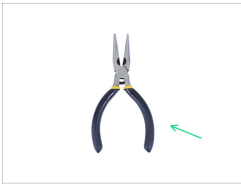


- This guide will take you through the replacement of the **X-axis bearings** on the **Original Prusa i3 MK3S+**.
- All necessary parts are available in our eshop shop.prusa3d.com.

ⓘ Note that you have to be logged in to access the spare parts section.

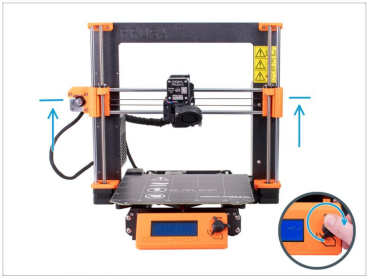
- For replacing Y-axis bearings, please use this guide: How to replace bearings on the Y-axis (MK3S+)

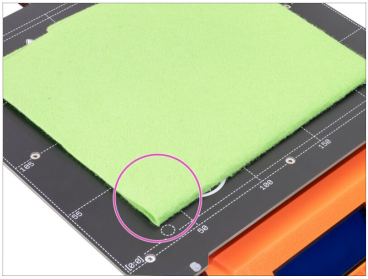
STEP 2 Tools necessary for this guide



- **For this chapter, please prepare:**
- 2.5mm Allen key ball-end recommended
- Needle-nose pliers
- Cloth or piece of fabric 15x15cm
- Permanent marker

STEP 3 Preparing the printer



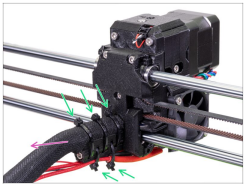
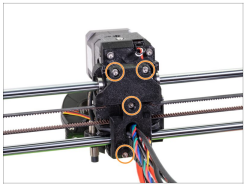
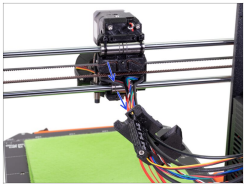


- Take the steel sheet off.
- Press the LCD knob for 1 second and rotate to lift the Z-axis to approximately half of its height.
- Use a thick enough piece of cloth or fabric to cover the heatbed. This is to ensure you don't damage the heatbed surface during the disassembly.

⚠ **Make sure the printer is cooled down to room temperature.** Check the temperatures on the printer display.

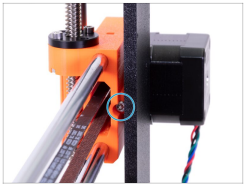
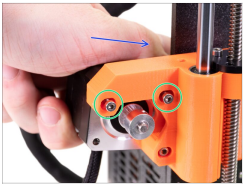
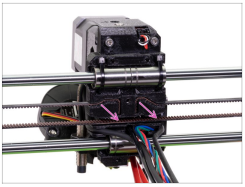
- Turn the printer OFF and unplug it from electricity.

STEP 4 Removing the x-carriage-back

- Cut all zip ties on the extruder.
- Remove the textile sleeve. There is no need to remove the entire sleeve. Keep the other end attached to the electronics box.
- Release the four screws on the x-carriage-back.
- Remove the x-carriage back from the extruder. Keep the x-carriage-back hanging on the cable bundle.

STEP 5 Removing the X belt

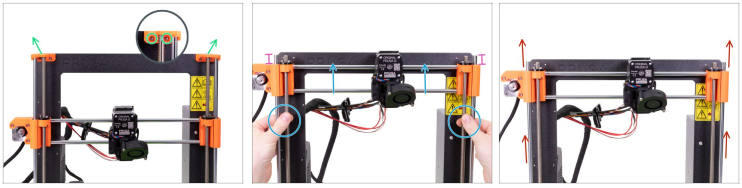




- Loosen the tensioning screw on the backside of the x-end-motor part. No need to remove the screw.

ⓘ The tensioning mechanism may be a bit different on earlier MK3/MK3S printers. Although this guide is intended for MK3S+, it is also applicable to the earlier ones if you are aware of the difference.

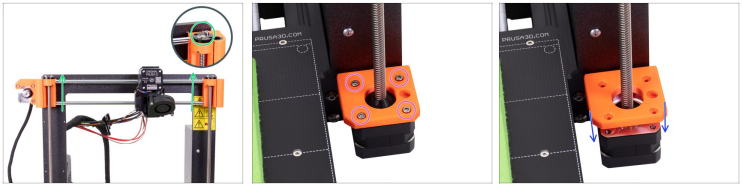
- Release two M3 screws from the X-axis motor. No need to remove them from the plastic part.
- Rotate the X-axis motor as indicated towards the frame. And slightly tighten the upper screws to fix the position of the motor. It's just temporary.
- Pull out both ends of the X-axis belt and remove the entire belt from the printer.

STEP 6 Removing the smooth rods



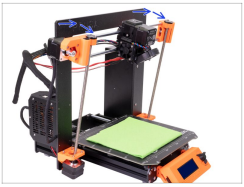
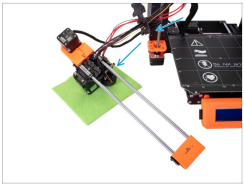
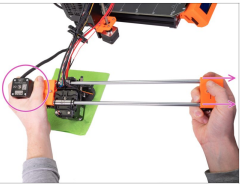
- Release two screws on each z-axis-top. Remove both z-axis-tops from the printer.
- Use your fingers and manually rotate both threaded Z-axis rods equally to move the Z-axis up.
- Stop rotating when both smooth rods are sticking out 1cm (1/2") from the x-ends.
- Pull both smooth rods out of the printer.

STEP 7 Releasing the Z-axis motors



- Manually rotate both threaded rods until the top surface of the threaded rod is flush with the black nut.
- Release four screws on the right z-axis-bottom. No need to remove them completely.
- Carefully place the Z-axis motor onto your work surface.
- Repeat the last two steps for the left Z-axis motor.

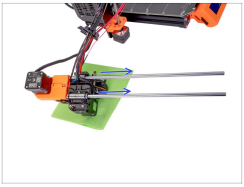
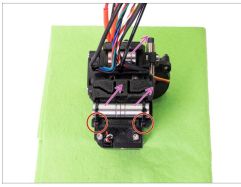
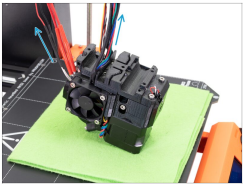
STEP 8 Removing the X-axis

- Slightly tilt the X-axis outwards.
- Manually rotate both threaded rods some more until the X-axis comes out of the rods.
- Carefully place the X-axis next to the printer as can be seen in the picture.
- Hold the x-end-motor (left printed part) with your hand and pull out the x-end-idler (right printed part) with your other hand.

  ⚠ Clearances in printed parts may vary slightly. In some cases, removing the part may be difficult. It may be necessary to use somewhat more force. **But be careful not to get hurt or damage the cables!**

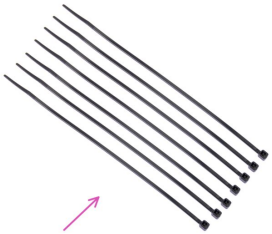
STEP 9 Removing the old bearings

- Carefully slide the extruder out of the X-axis.

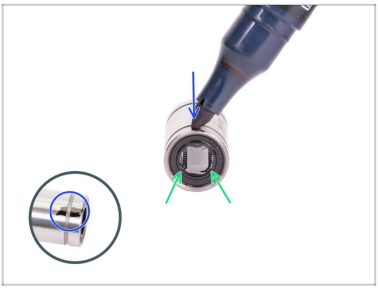
  ⓘ Keep the extruder on the cloth.
- Cut both zip ties on the bearings.
- Remove three bearings from the extruder.
- Place the extruder together with the cloth onto the heatbed as seen in the picture.
- Make sure the hotend cable bundle (3 cables) and the extruder cables (5 cables) are separated from each other. See the picture.

STEP 10 New bearings: parts preparation



- **For the following steps, please prepare:**
- New linear bearing (3x)
- Zip tie (7x)
- Several paper towels to wipe oil and grease from the bearing surface.

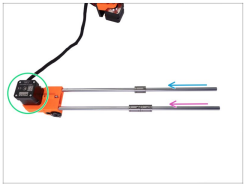
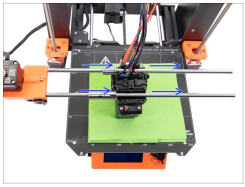
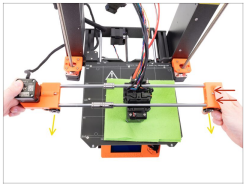
STEP 11 Marking the bearings



- Wipe grease from the outer surface of the bearing with a paper towel.
- Position the bearing so that you can see two rows of balls. Like in the picture.
- Make a line with a permanent marker on the outer surface of the bearing, above the middle between two rows of balls.
- Use the same procedure for the remaining two bearings.

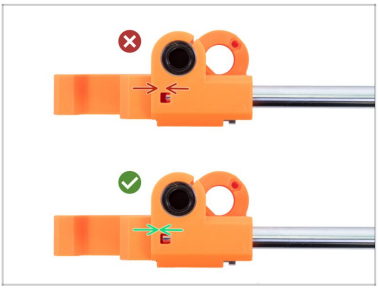
ⓘ We will use these markings in the upcoming steps to achieve the desired bearing orientation.

STEP 12 Mounting the new bearings

- Make sure the X-axis motor is on the left and facing up.
- Gently slide one bearing onto the rod further away. **Do not try to slide the bearing onto the rod tilted. Do not use excessive force!**
- Carefully slide the two other bearings onto the rod closer to you. **Same here, do not use too much force and not tilt the rod vs. bearing!**
- Place both smooth rods into the channels in the extruder x-carriage. This is to make 100% sure cables are guided correctly.
- Slide the X-end-idler back onto the smooth rods. You may need to use a lot of force, but yet be careful. **Do not use a hammer, F clamp or a similar tool.** Keep the part perpendicular to the rods during insertion.
- Make sure that both trapezoidal (plastic) nuts are pointing towards you.

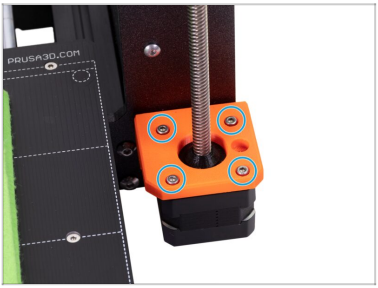
STEP 13 Checking the rods insertion



- There is a special opening in the top/bottom of both X-ends to check if you pressed the smooth rod all the way in.
- If the rod is not fully inserted in the plastic part, use even more force. **But be careful not to get hurt.**

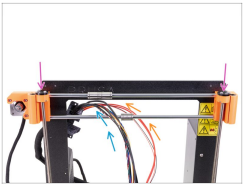
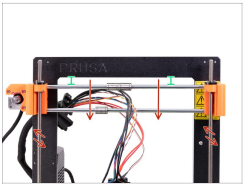
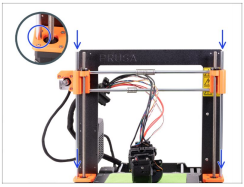
⚠ **Do not use a hammer or similar tool.** You may crack the plastic part.

STEP 14 Securing the Z-axis motors



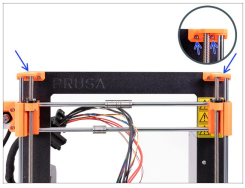
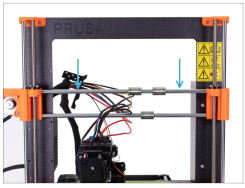
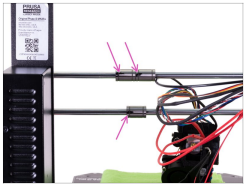
- Secure each Z-axis motor to the z-axis-bottom with four M3x10 screws. Tighten evenly and carefully as you might break the printed parts.

STEP 15 Mounting the X-axis

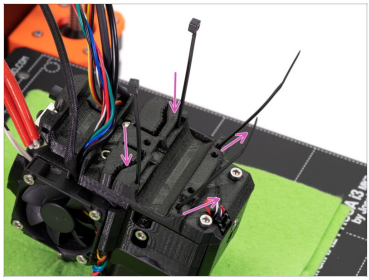
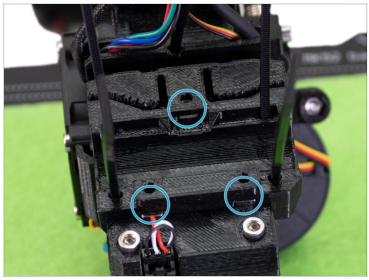
- Place the X-axis assembly with the black nuts pointing up onto the tops of the Z-axis threaded rods.
- **Once again make sure that:**
  - The extruder cable bundle is above the lower smooth rod.
  - The hotend cables are below the lower smooth rod.
- Turn the threaded rods simultaneously counter-clockwise to move the Z-axis a little lower.
- Leave a gap of approximately 1 cm (1/2") between the X-axis and the frame.
- Gently insert both smooth rods through the bearings inside the X-axis all the way down into printed parts. **Do not apply too much force and do not tilt the rods!**

STEP 16 Mounting the z-axis-tops

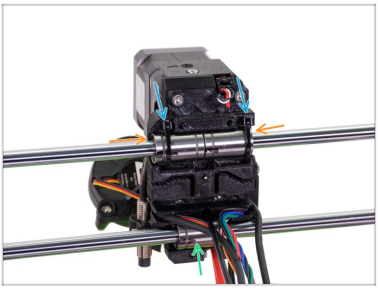
- Mount both z-axis-top parts onto the frame and secure each of them with two M3x10 screws.
- Manually move the Z-axis to half of its height.
- Turn the printer around so that the electronics box and PSU are facing you.
- Align the bearings so that the markings are facing you too.

STEP 17 Preparing the zip ties

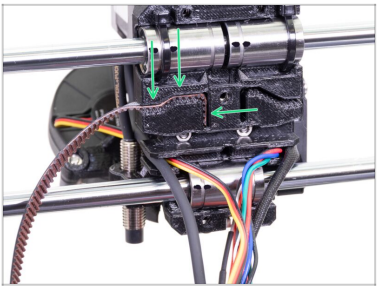
- Insert the zip ties in the X-carriage like in the picture.
- Look carefully to see if any of the square nuts on the back of the extruder have fallen out. Later insertion would be difficult.

STEP 18 Mounting the extruder



- Place the extruder onto the bearings and align the bearings as seen in the picture. The top couple must fit perfectly.
  The exact position of the lower one doesn't matter for now.
- Turn all three bearings so that the markings are facing exactly backward.
- Tighten the zip ties up and cut the remaining parts off.
- Make sure the lower bearing fits properly in the plastic part.

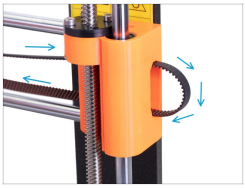
STEP 19 X-axis belt assembly

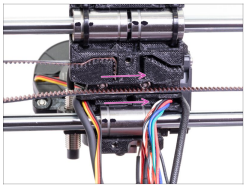


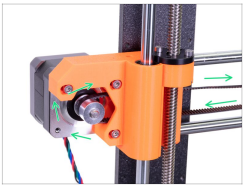
- Insert the flat part of the X-axis belt into the X-carriage as in the picture.

ⓘ Use a screwdriver or the smallest Allen key to push the belt in.

STEP 20 X-axis belt assembly

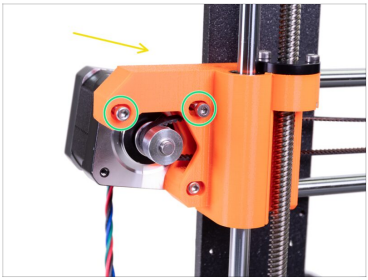


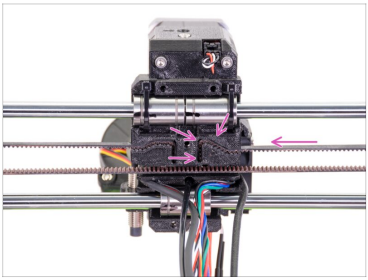




- Guide the X-axis belt through the X-end-idler and around the 623h bearing.
- Continue guiding the belt through the X-carriage.
- Guide the X-axis belt through the lower part of the X-end-motor, around the GT2-16 pulley and back to the X-carriage.

STEP 21 X-axis belt assembly

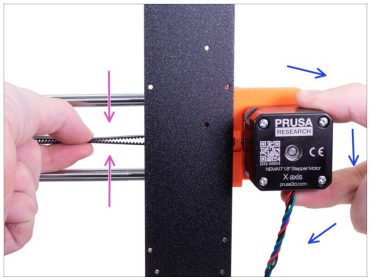


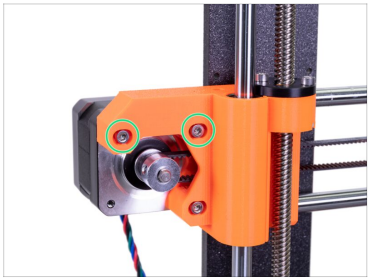


- Before you attach the belt into the x-carriage, please release the two upper M3 screws holding the motor on the X-end.
- Rotate the X-axis motor as indicated towards the frame.
- Insert the flat part of the X-GT2 belt into the X-carriage as in the second picture.

ⓘ Use a screwdriver or the smallest Allen key to push the belt in.

STEP 22 Tensioning the X-axis belt



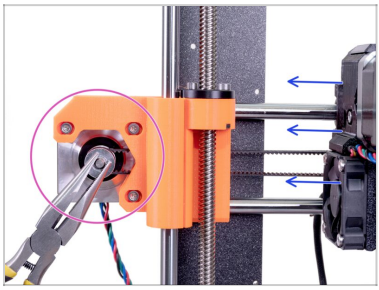


- Using the right hand rotate the motor to its original position and hold it there (tension is applied to the belt).
- Using two fingers on your left hand push the belt together. Very little force should be needed for bending the belt, BUT the belt shouldn't be bent by its own weight before being pressed with your fingers - it must be straight.

ⓘ If you are struggling to rotate the motor back into position, the belt tension is too high.

- Depending on the belt being under or overstretched, adjust the position of the belt in the X-carriage.
- When done, rotate the motor to its original position and tighten the M3 screws up again.

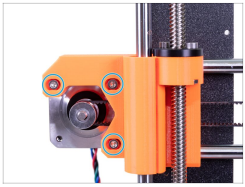
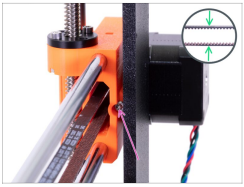
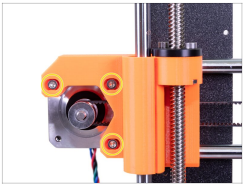
STEP 23 Testing the X-axis belt



- Use the technique described below to test if the belt is stretched properly.
- Use pliers to hold the X-axis motor shaft.
- Move the extruder towards the X-axis motor. Don't use excessive force.
- If the belt is stretched properly, you should feel some resistance and the extruder won't move at all. If the belt is too loose, it will deform (create a "wave") and jump over the teeth on the pulley.

ⓘ Belt too loose? Return to the previous step and repeat all steps until now. You have to rotate the motor and retighten the belt in the X-carriage. Shortening the belt length by moving one or two teeth outside X-carriage should be enough.

STEP 24 Fine-tuning the x-axis belt

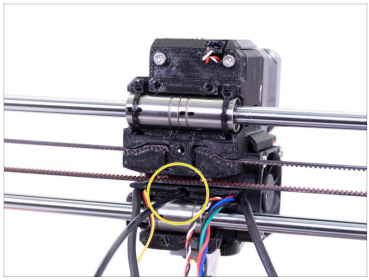




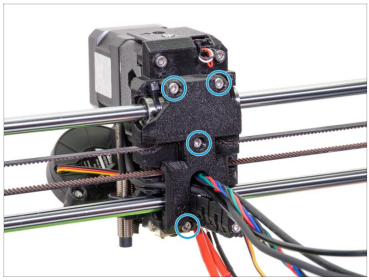
In this step, we will finish adjusting the belt tension. Please read the instructions first, your belt might have proper tension set already, then there is no need for additional screw adjustment.

- First, slightly release all the screws holding the motor. Otherwise, the "tensioner" won't work (the motor must be able to move).
- Using ball-end Allen key start tightening the screw on the rear side of the X-end-motor, but after each turn or two check the tension in the belt.
- For the optimal performance, the belt must feel stiff if you pinch it with your fingers. Move the extruder all the way to the X-end-idler and try the belt tension in the middle of the X-axis.
- When you achieve an optimal tension, please tighten the screws up again.

In case you are experiencing X-axis failures during calibration or skipped layers in the X direction, adjust this screw accordingly. Tightening the screw stretches the belt. Releasing the screw has the opposite effect. And don't forget to release the screws on the motor first :)

STEP 25 Mounting the x-carriage-back



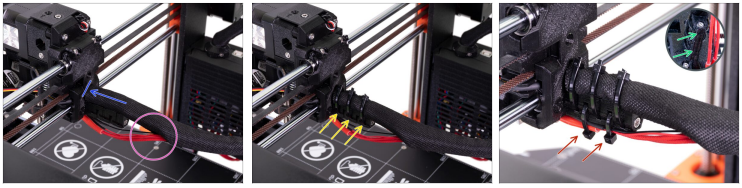


⚠ Before proceeding further, **make sure the nylon filament does not fall out** of the extruder. If it does, please use the instructions in the MK3S+ assembly manual to install it.

- Place the x-carriage-back onto the extruder. Use all four M3x10 screws and tighten the X-carriage-back up.

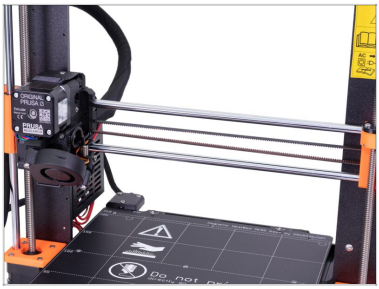
⚠ **DO NOT tighten the screws using unreasonable force!!** Make sure you don't squeeze the bearings between the printed parts unevenly.

STEP 26 Tightening the textile sleeve up



- Wrap the entire cable bundle with the textile sleeve.
- Guide the hotend cables into the textile sleeve like in the picture.
- Take 3 zip ties and insert them into the lower row of holes on the cable-holder and secure the textile sleeve.
- **ATTENTION!** Before tightening the zip ties, add the cables from the hotend. Use the channel in the printed part to arrange them properly.
- Secure the hotend cables with two zip ties in the upper row. **Do not overtighten** the zip ties. You may damage the cables.

STEP 27 You are almost finished!



- Before you start printing, you need to calibrate the Z-axis.
  - Remove the cloth from the heatbed.
  - Place the steelsheet back on the heatbed.
  - Turn the printer ON.
  - On the printer screen navigate to *Calibration -> Calibrate Z* and following the instructions on the display.
- **Great job!** It was not so easy, but you have just successfully replaced the X-axis bearings!

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