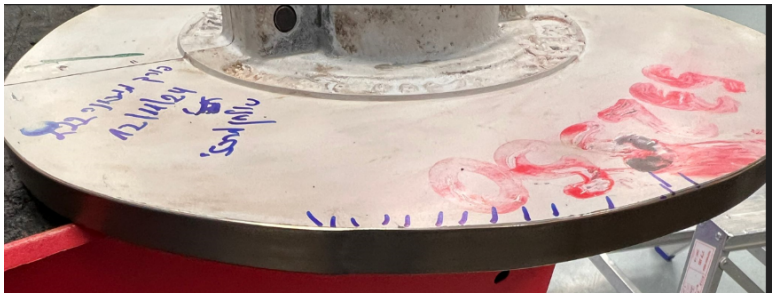
Replacement of cam (532550) driving from the center of the machine to the support and testing stations in machine 222

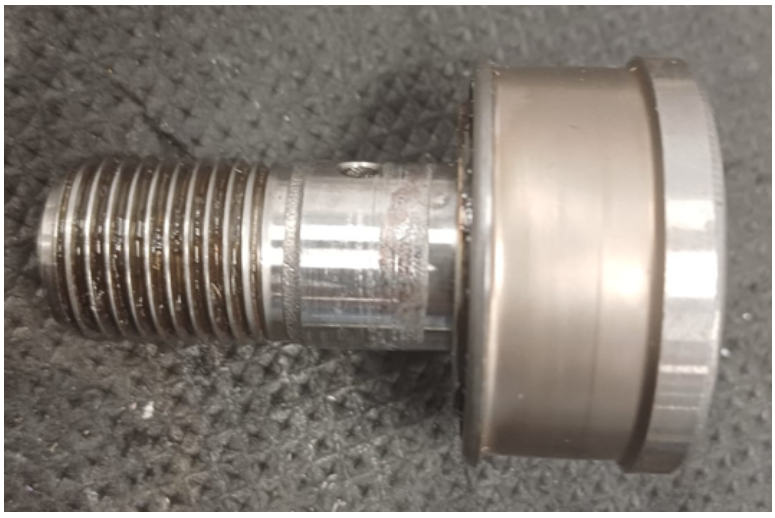
Registrar: Tzvika Ivyagi and Fadi Sleiman. 12.12.2024

Technical team performing: Austin Ashmoz, Ghassan Maron.

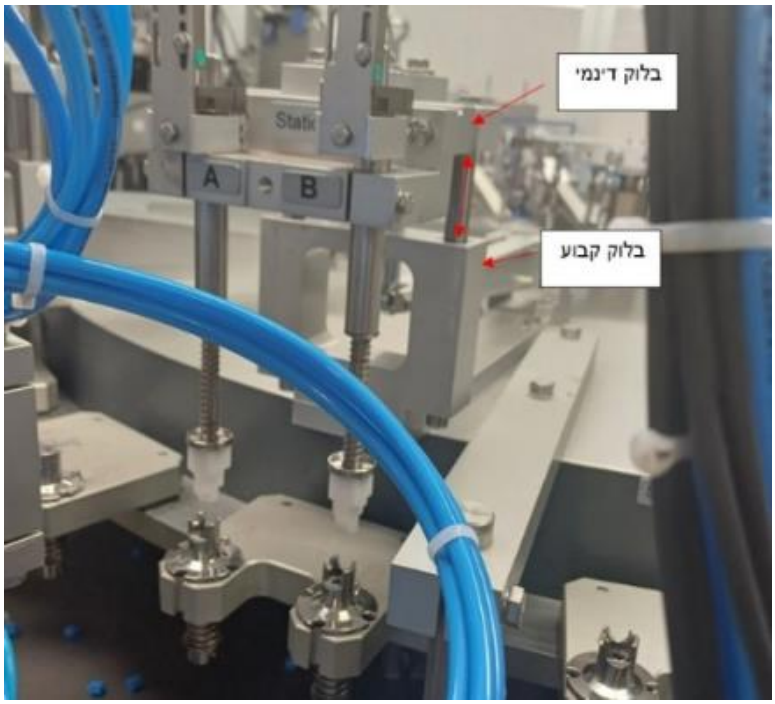
Background: In the past year, the same cam was replaced twice (before 11/2024), and the spring piston was also replaced once (for added safety). Each time, after almost two months, the cam wore out again.

- On 12.11.2024 in work order 581433 lot 242668277-03 bag number 291, the machine was inspected again and the following findings were recorded:
- The cam and cam follower were worn out - replaced with new ones.

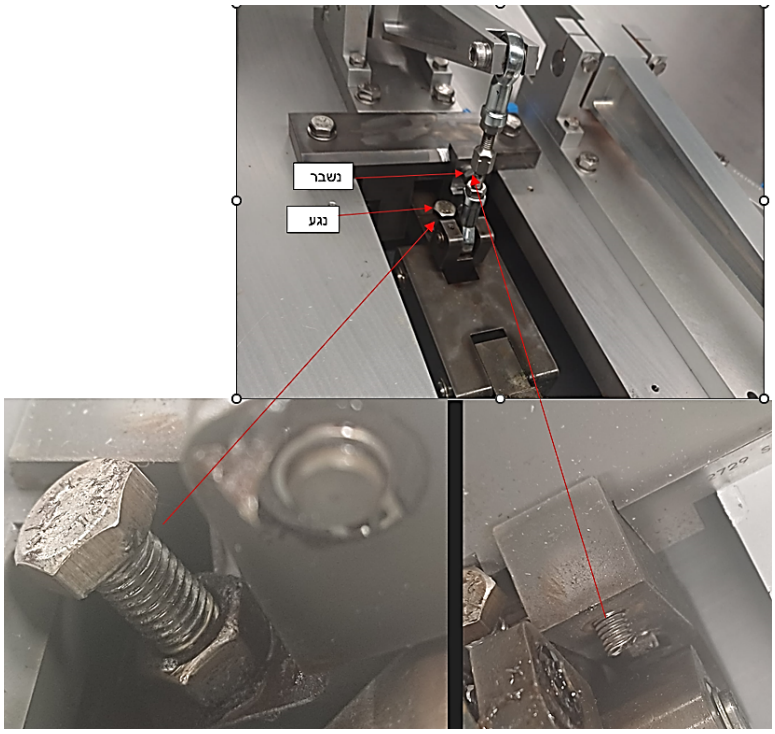




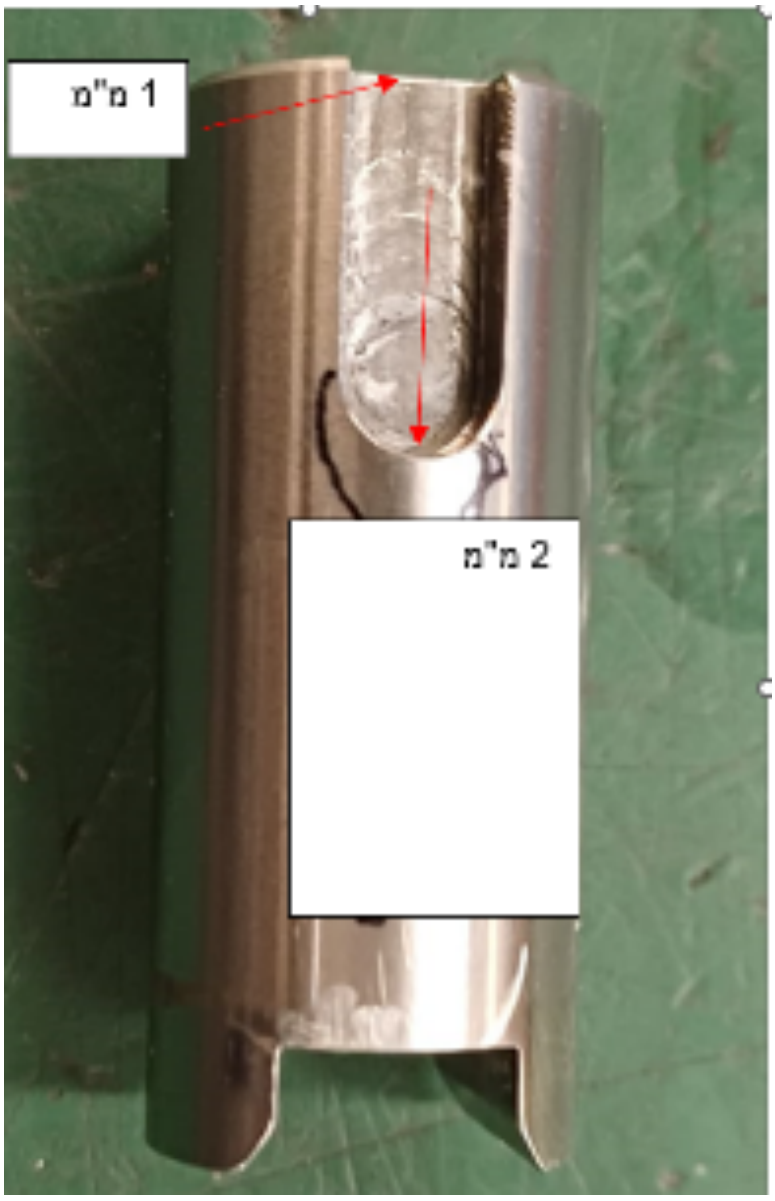
- Station 24 - When the station moves all the way down, it stops on the block, meaning there was no gap between the fixed block and the dynamic block. However, in this state, the cam follower was checked and it appears that it does not rotate, indicating that the station is functioning properly and the cam is not separating from the cam follower. In all of this, it is necessary to adjust so that there is a safety clearance - at least a few millimeters.



- Bolt station - Body support during bolt insertion:
- When the station is in the locking state, the screw (the mechanical stopper) touches the block holding it – the block was ground down.
- The top screw holding the entire mechanical brake assembly broke and was replaced with a new one.
- When the station is in idle mode (during table rotation), the stop screw head hit the base plate, which could have caused mechanical pressure on the cam in the affected area - corrected so that there is a large clearance between the screw and the plate.
- When the body's support was in the most forward position, the joint was not straight – it was aimed to be straight.



The slot positioning the body support bushings in the rotational plane was enlarged by approximately 2 mm, and additionally, 1 mm was milled from its rear part.



The machine was operated after adjustments and checked after a week. It was inspected by a technician and no vibrations were observed.

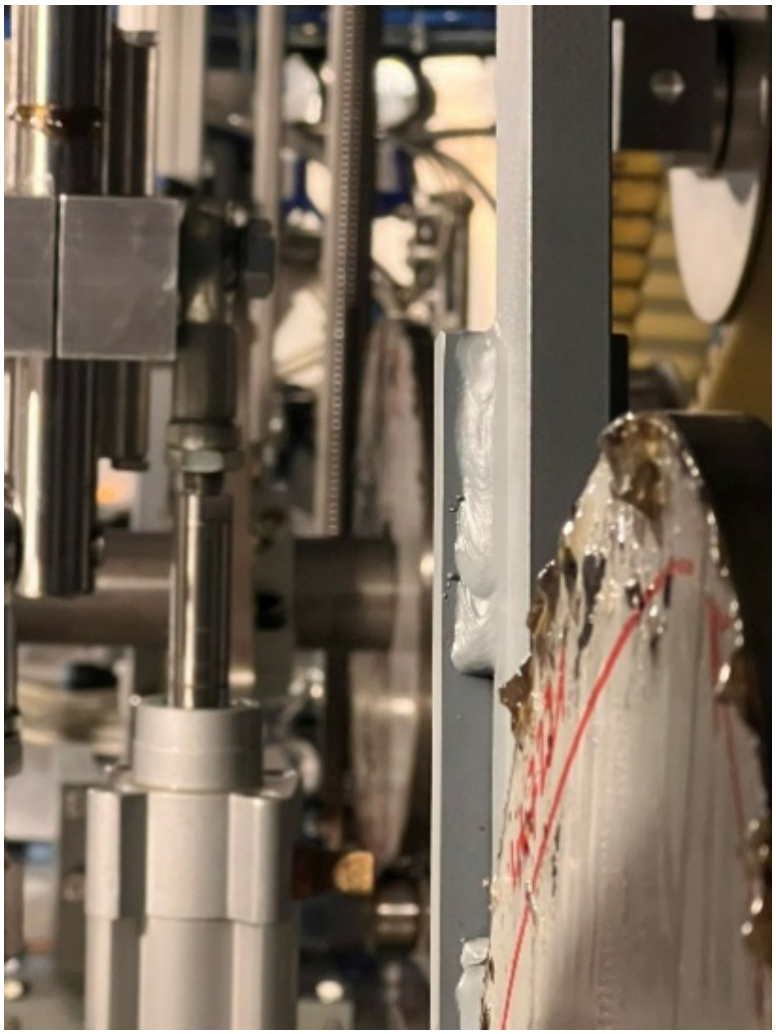
- On 24/11/24 during a repeat inspection, vibrations were again observed on the test station table.
- Upon inspection, it appears that the cam follower is stuck and not machined – replaced.
- After disassembly, signs of wear were observed on it, and no fresh grease was visible.
- On the new cam, wear marks were observed on the cam edge; it was decided to replace it in a subsequent operation.
- Grease pipe disassembler, upon inspection it appeared empty of grease, we were unable to inject grease into it using a manual grease gun – the valve connected to the grease manifold was replaced, and grease was injected into the pipe.

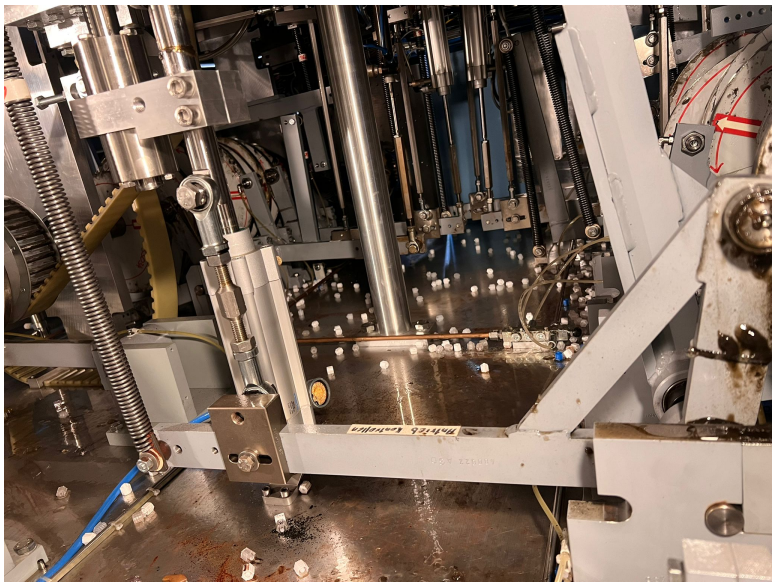
- After reassembly on the arm with a cam follower, grease was observed to be exiting the bearing during manual greasing.
- Additionally, an inspection of the central axis for freedom of movement was performed after disconnecting all stations connected to it - found to be normal.
- The lower part of the lower vertical motion bearing was inspected - it was found that the holder of the
- The lower centering bearing may contact the bearing screws – a clearance of only 0.4 mm is present.
- On the block above the screws, contact marks from the screw were found.
- It was decided to increase the distance in the continuation operation.
- On 12/2/24 we performed a follow-up action:
- Replacing a new cam, checking the grease outlet at the cam follower, and peripheral greasing
- Increasing the clearance between the vertical bearing and the upper block by approximately 5 mm

- We increased the automatic grinding frequency in the machine from once every 40,000 to once every 30,000.
- On 12/8/24, we performed a repeat inspection of the cam clearance:
- During the inspection, we found that there is a large play in the axis on which the arm is mounted.

- We replaced the bearings in this arm, and in the other arm that sits on the shaft (the fixed rotator).
- We observed that the amount of grease coming out of the cam tail is small.
- We installed a new valve on the grease pipe, but no grease came out when we connected to the splitter.
- As a result, we connected a grease tube from another arm (adjacent and more accessible) to this cam follower, and for the arm from which we disconnected, we connected a grease tube with a Y connector from another grease tube.
- Nir will look for valves with a built-in 4-pipe connection.
- In the test on machine 221, we saw that it is configured to grease every 10,000 cycles.
- We changed the setting to 10,000 also on machine 222.
- In every grease pulse – a small drop of grease is released at the cam follower.
- Follow-up activities to be carried out in the coming weeks:
- Follow-up cam lubrication inspection in a week, and thereafter once every two weeks until the next quarterly treatment.
- Monitoring for the absence of vibrations on the workstation tables once a week during the upcoming month, after which the inspection frequency can be spaced out.
- Order of new grease line connection valves, with a 4 mm connection.
- On 7/01/24, slight vibrations were detected at the testing stations.
- The inspection revealed that the cam follower had begun to wear again. Additionally, it was noticed that the cam follower was heating up unreasonably.
- We rechecked the entire assembly:
- It was also found that the lower bushing of the lever connecting rod to the arm is worn.
- It was decided to replace the quick release valves on the piston, as well as to weaken the end-of-stroke shock absorbers on the piston.
- In addition, the production engineering team (Lior, Dobi, Rotem) recommended increasing the pressure inside the piston, based on the assumption that the cam follower does disconnect from the arm during the arm's downward movement, and upon reattachment, a small impact occurs between the cam follower and the cam.
- We increased the pressure from 4 bar to 5 bar.
- We conducted an experiment in which we lowered the pressure in the piston to 2 bar, and then observed that vibrations developed in the test stations both during the increase and the decrease.
- The piston stroke was examined in the two extreme positions of the cam:
- When the piston is fully open towards the arm - there is a clearance of 15 mm to the end of the piston's stroke.
- When the piston is completely closed against the arm - there is a clearance of 50 mm to the end of the piston stroke.
- Grease checked – intact. The cam follower is found with grease inside it.
- The cam – there is slight damage at the point where the arm is in the lower position, currently causing very minor vibrations.

- On 20/01/20 we inspected the arm of the test stations in machine 223 at Delton.
- Pressure in the spring piston – Bar 4.





- On 29/01/25 vibrations appeared at the station:

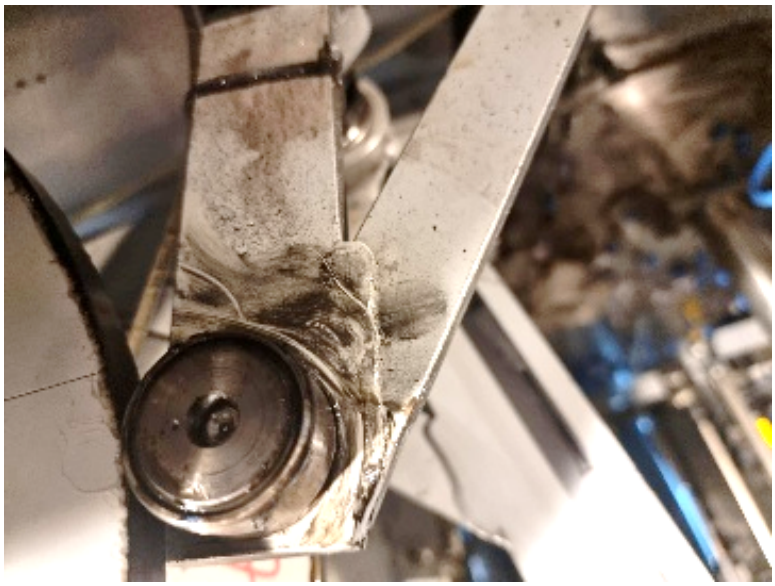
- The cam follower is well grooved but shows signs of wear.
- On 2/3/25, the following actions were performed:
- Replacement of the lower apple bearing in the rod (a disc was missing between it and the stroke block)
- Replacement of cam and cam follower (including an additional ring between the bushing and the arm)
- Arm shaft bearing clearance check – normal
- Checking the free movement of the table up and down, and a repetitive check against the nut support - normal
- Free grease flow check between the hose connector and the cam follower – Good (Images 2+3)
- Increasing the piston pressure to 5.5 bar
- Verification of automatic greasing setting – every 10,000 cycles
- Adjusting the parallelism of the two blocks guiding the rod that raises and lowers the small table (Image 1)

Important – In the area located in front of stations 7-8, the table vibrates slightly despite the reinforcements, and these vibrations are visible in the supports of the segment stations! These are not vibrations coming from the cam at this stage when everything is normal below.

In the last three cams, the damage occurred at the same point - in the idle state, during the rotation of the table.
We examined the cam area while in motion. We did not find any possible causes for the damage occurring at the cam location.

- Follow-up activities to be carried out in the coming weeks:
- Checking subsequent cam lubrication in a week, and thereafter every two weeks until the next three-month treatment.
- Monitoring for the absence of vibrations on the test station table once a week during the upcoming month, after which the inspection frequency can be spaced out.
- Transferring the findings for consultation with Sortimat - Nir Lustig + Production Engineering
- On 6/2/25, an inspection was conducted in collaboration with Yair Kafri:
- We tested vibrations at a pressure of 5 bar in the piston – no vibrations were felt in the cam or the test station table.
- We tested vibrations at 3 bar pressure in the piston – no vibrations were felt in the cam and on the inspection station table.

- Slow-motion filming was performed in both of the above cases. It does not appear that the cam follower separates from the cam at either of the two pressures.
- We checked the rear support at the Ohm station – intact, no looseness or collisions
- We checked the central rod – no play – the movement of the rod in the bearing is free up and down.
- Audit dated 25/2/11:
- Functional



- Inspection dated 3/3/25:
- There are slight wear marks on the cam follower; it was replaced with a new cam follower supplied by Sortimat.
- The old cam follower is disassembled while it rotates freely and threads properly.