
4 Preventive Maintenance

CAUTION

All replacement procedures should be performed with the controller turned off and unplugged. Proper precautions should be taken to protect electronics from damage caused by static discharge.

Preventive Maintenance Procedure

Once a year (or sooner, if necessary) the following preventive maintenance procedures shall be performed by a Sagian ORCA system customer engineer or Sagian-trained third-party service representative.

A. Remove the rail chain.

1. Using a 2.5 mm Allen wrench, remove the plate on the left end cap.
2. Using a no. 2 Pozidriv screwdriver, take off the rail cover by removing the four screws on either side of each end cap, move the arm to the far right end of the rail and slide the cover off.
3. Disconnect the torso from the chassis by removing the six shoulder screws at the base of the robot.
4. Slowly lift the arm up and disconnect the chassis/torso cable from P2 on the chassis connector PCB.
5. Remove the right rail chain tensioner and disengage the rail chain from it.
6. Thread the rail chain through the two drive sprockets and out from under the chassis casting.
7. Remove the left rail chain tensioner and disengage the rail chain from it.

B. Grease the rail.

1. Use the grease gun filled with rail grease (part no. 6040-0820).
2. Engage the grease gun to the fitting protruding from under the left edge of the chassis casting. Pump in new grease while gently moving the chassis assembly along the rail until old grease oozes from beneath the rail car.
3. Manually move the chassis assembly up and down the entire length of the rail 10–20 times to distribute the grease evenly.
4. Wipe off excess grease with a rag, and clean away any debris that has collected along the rail or on the mini-platforms.

C. Install a new rail chain.

1. Cut a piece of rail chain approximately 1.2 m long (for a 1 m rail assembly), 2.35 m long (for a 2 m rail assembly), or 3.5 m long (for a 3 m assembly). Use the old rail chain as a reference guide.
2. Engage the new rail chain in the teeth of the left rail chain tensioner and screw the rail chain tensioner into the left end cap.
3. Apply a small portion of locking compound (part no. 0470-0501) in the gap between the rail chain tensioner screw head and rail chain tensioner.
4. Thread the rail chain around the drive sprockets.
5. Engage the new rail chain in the teeth of the right rail chain tensioner and loosely screw the rail chain tensioner into the right end cap.

D. Tension the rail chain.

1. Move the chassis assembly to the extreme left end of the rail.
2. Place the rail chain tensioner gauge (part no. G1203-61620) at the center of the rail chain.
3. Slip the rail chain into the slot on the rail chain tensioner gauge.
4. Push the tensioner piston all the way down then release it (this will load the rail chain tensioner gauge).
5. Obtain a reading by depressing the reset button on the rail chain tensioner gauge.
6. Repeat steps 4 and 5 until a consistent reading is obtained.
7. Proper tensions for each rail length are shown in the table below:

Rail Length	Tension (+/- 0.025 lb.)
1m	1.4
2m	0.7
3m	0.5

8. To adjust the tension, tighten or loosen the right rail chain tensioner.
9. Repeat steps 4 and 5 until a consistent reading is obtained.

10. Place a small amount of locking compound (part no. 0470-0501) in the gap between the rail tensioner and the screw head.

CAUTION

When replacing belts, it is extremely important that they are not forced on or off pulleys, especially over pulley flanges. Forcing belts in such a manner may cause small nicks which, in turn, can severely reduce belt life.

E. Replace the shoulder belt.

1. Using a 2.5 mm Allen wrench, take off the left torso cover by removing the four cap screws.
2. Using a 2.5 mm Allen wrench, individually remove the three screws that hold the shoulder motor-mounting bracket to the torso and apply Loctite 242 to each. Replace each screw but do not tighten.
3. Remove the shoulder belt.
4. Slip the new shoulder belt over the shoulder motor pinion and the shoulder joint.
5. Tighten the belt by pushing down on the shoulder motor-mounting bracket until the belt is taut; significant force is not required because the weight of the motor is nearly sufficient to achieve adequate belt tension.
6. Tighten the bracket screws.

F. Replace the elbow belt and wrist (upper arm) belt.

1. Take off the upper arm cover by removing the two screws with a 2.5 mm Allen wrench.
2. Release tension on the belts by disengaging them from the swing arms.
 - a. Rotate the wrist belt swing arm (top, outer swing arm) clockwise until the belt no longer touches the idler wheel; slowly release the swing arm so that the wrist (upper arm) belt is free of the idler wheel.
 - b. Rotate the elbow belt swing arm (bottom, inner swing arm) clockwise until the belt no longer touches the idler wheel; slowly release the swing arm so that the elbow belt is free of the idler wheel.
3. Using a 3 mm Allen wrench, individually remove the three bracket-mounting screws, apply Loctite 242 to each, and loosely replace one screw.
4. Remove the elbow belt and wrist (upper arm) belt.
5. Slip the new belts on their respective gears and pinions (the inner belt is the elbow belt and goes directly to the elbow joint at one end and the larger motor pinion on the other; the outer belt is the wrist (upper arm) belt and goes to the wrist pulley at one end and the smaller motor pinion on the other).
6. Tension the belts by engaging the swing arms (the outer swing arm supplies tension to the wrist (upper arm) belt, while the inner swing arm supplies tension for the elbow belt).
7. Install remaining two 3mm screws in the mounting bracket, and then tighten the three bracket-mounting screws.

G. Replace the wrist belt (forearm)

1. Take off the forearm cover by removing the two screws with a 2.5 mm Allen wrench.
2. Disconnect the shoulder-forearm cable from the forearm-hand cable.
3. Release the belt tension by rotating the idler arm counterclockwise and moving the belt away from the smooth idler wheels.
4. Slip the belt off the transfer shaft pinion at the elbow joint.
5. Remove the belt by slipping the other end off the large gear at the wrist joint.
6. Slip the new belt over the large forearm pulley assembly.
7. Slip the other end of the belt over the transfer shaft pinion protruding through the elbow joint.
8. Reposition the idler arm (rotate 225 degrees clockwise) to take up slack in the belt.
9. Reconnect the shoulder-forearm cable to the forearm-hand cable. Replace cables in the cable saddles.

H. Check all cables for abrasion and/or nicks. Replace as needed.**I. Check that no mini-platform bolts have come loose. Tighten if necessary.****J. Check that no rail bolts have come loose. Tighten if necessary.****K. Slip the chassis/torso cable under the rail cable clamp and reconnect it to P2 on the chassis connector PCB.****L. Reconnect the arm by attaching the torso to the chassis using the six mounting screws.****M. Replace the left torso cover.****N. Replace the upper arm cover.****O. Replace the rail cover.****P. Inspect the pinch rack assembly.**

1. Clean the bottom of the left and right slide rack shells.
2. Check that the left and right latches open and close freely. Clean and lubricate as needed.
3. Visually inspect all assemblies for excessive wear or play. Clean and adjust as needed.

Q. Replace the forearm cover.

R. Calibrate the arm.

WARNING

Failure to calibrate the robot after servicing will cause unexpected results which can lead to possible serious physical injury and/or damage to the robot, equipment, and other items located in the work cell.

S. Run the MDS rail diagnostics procedure (RUN_RAIL_DIAGNOSTICS).

T. Clean the top surface of all finger stands and the top and bottom surfaces of all finger blanks.

U. Adjust the finger stand(s).

1. Remove any fingers from the finger stand.
2. Individually remove each of the two height adjustment screws that hold the floating deck to the finger stand base, apply Loctite 242 to each screw, and loosely reinstall.
3. Insert the finger stand spacer (part no. G1203-21990) between the flotation deck and the finger stand base.
4. Completely tighten the height adjustment screws with the finger stand spacer in place.
5. Loosen each screw 1/4 turn and remove the finger stand spacer.

Required Preventive Maintenance Tools

Finger Stand Spacer	G1203-21990
Rail Chain Tensioner Gauge	G1203-61620
#2 Pozidriv screwdriver	8710-0900
Metric Allen Wrench Set (1–5 mm)	8710-1358
Small flat-head screwdriver	8730-0008
ESD Kit	9300-1608
Grease Gun	8710-1968

Required Preventive Maintenance Parts (Consumables)

1-Meter Rail Chain	G1203-61811
2-Meter Rail Chain	G1203-61821
3-Meter Rail Chain	G1203-61831
Elbow Belt	1500-0865
Wrist Belt (Upper Arm)	1500-0866
Wrist Belt (Forearm)	1500-0870
Shoulder Belt	1500-0874
LocTite 242 (0.5 ml)	0470-0205
Locking Compound	0470-0501
Rail Grease (70 g)	6040-0820