Manual for mechanical tube cleaning of:

Chiller- and heat exchanger tubes

Cleaning with water

goodwaybenelux.com

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Goodway Benelux recommends using the following personal protection equipment when performing tube cleaning of heat exchangers:



Work gloves



Safety glasses



Work clothing

Tube cleaner type: Goodway RAM-4X

The RAM-4X can be used with or without water, in this manual you can find the steps for a **cleaning with water**.



1. Setting up the machine

1. **Positioning the machine**
   Place the RAM-4X as close as possible to the heat exchanger to minimize hose and shaft length. Also, ensure proper working space for the operators to work in a safe and correct manner. The RAM-4X should always be positioned horizontally, ensuring the flexible shaft exits the machine in a straight manner.
2. **Connecting the water supply**
   Connect a water hose to the water inlet of the RAM-4X. Make sure it is properly attached; the water flow should be 10-15 liters per minute at 2-3 bar. Water pressure should not exceed 3 bar to avoid seal damage. A cold-water supply is required to cool the flexible shaft core and the cleaning brushes/tools during operation.
3. **Connecting the power supply**
   Connect the power cable of the RAM-4X to a suitable electrical outlet. The RAM-4X is designed to operate on either 50 or 60 Hz frequencies. Never use a 50 Hz machine on a 60 Hz power supply, or the other way around.
4. **Activating the surge protection**
   Activate the surge protection on the CFGI of the RAM-4X power cable. Press the reset/activation button on the surge protection unit before starting the machine. A humming sound will come from the machine indicating it has powered on. Also, a green light will be lit showing you the RAM-4X is ready to be used.
5. **Performing a final check**
   Perform one last check to see if both the water and power sources are correctly connected. If you have performed all these steps correctly, the tube cleaning system should be ready for use. Perform a check by pressing the foot pedal found in the RAM-4X casing, and ensure the system activates on demand.

2. Connecting the flexible shaft and brushes

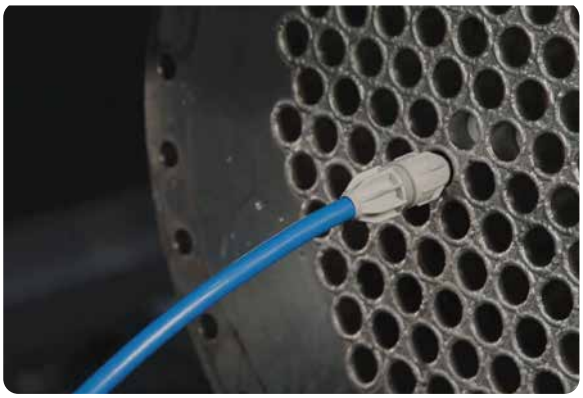
1. **Preparing the flexible shaft**
   For tube cleaning with water, always use blue Goodway flexible shafts. Fully unroll the flexible shaft before connecting it to the machine. Ensure the shaft is free of twists or knots. Keep the shaft as straight as possible along the working area. Excessive bends can cause additional strain on the rotating shaft and may reduce its lifespan.
2. **Connecting the flexible shaft**
   Connect the flexible shaft to the machine. When the shaft is inserted correctly, a click should be heard. Gently pull on the shaft to confirm that it is securely connected. If the shaft remains in place, the connection is properly locked. Make sure both quick connect clamps coming from the machine are flush with the casing.
3. **Checking the shaft length**
   Verify that the flexible shaft is slightly longer than the tube length. The additional length compensates for the distance between the machine and the tube entry point.
4. **Connecting the cleaning tools**
   Attach the appropriate cleaning tool or brush to the flexible shaft. Select the correct cleaning brush or tool, depending on the level of fouling and the tube type. The RAM-4X only rotates clockwise, which means threaded brushes and tools should be used. If required, consult the Goodway Benelux customer service team for guidance on selecting the correct cleaning tools.
5. **Marking the shaft length**
   Insert the shaft into the tube and manually feed it forward until it reaches the end of the tube. Ensure that the cleaning tool does not fully exit the tube; brushes may extend partially beyond the tube end if necessary. Use the white locator tool on the shaft to indicate that the end of the tube has been reached. This marker helps the operator confirm that the full tube length has been cleaned during operation.
   1. Note: ESGB brushes used for enhanced tubes, need to fully exit the tube instead of only partly.
   2. Note: Special tools have additional safety instructions, which are mentioned further down in the manual.
6. **Checking tool sizing**
   Confirm that the selected cleaning tool or brush size matches the internal tube diameter. The brush should be slightly oversized within the tube ensuring a good mechanical cleaning effect can be achieved, when brushes lose their oversize fit, they should be replaced by a new brush.
7. **Final testing of the equipment**
   Insert the brush or tool into the tube and press the footswitch to start the machine. The system will begin operating and the tool or brush will start rotating immediately. The water flush system will activate with a short delay of a few seconds. Verify that water begins flowing through the shaft to ensure the system is not operating in a dry-cleaning condition. Never rotate special cleaning tools outside of the tubes! You are now ready to start the cleaning process.





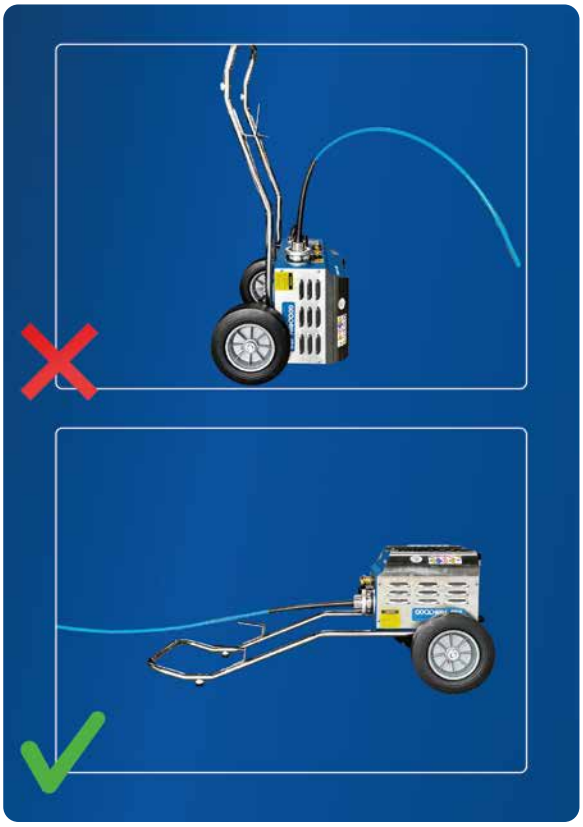


For tube cleaning with water, always use blue Goodway flexible shafts.

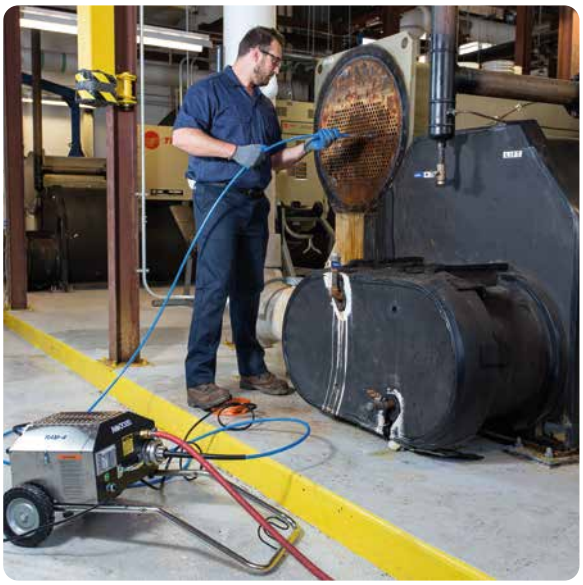


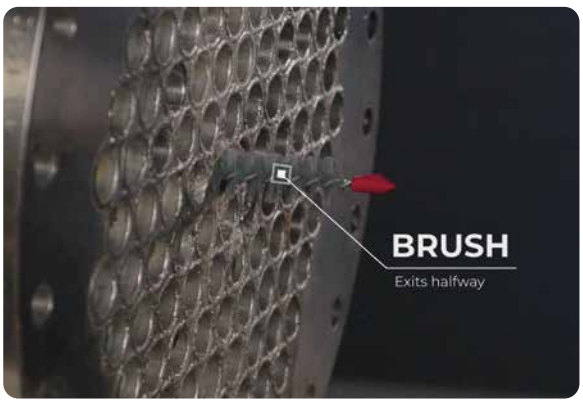
3. Cleaning the tubes

1. **Using the foot switch**
   The RAM-4X is equipped with a single direction footswitch, meaning that the machine can rotate clockwise only. The system is therefore compatible exclusively with threaded shafts, brushes, and tools. In heavy-duty industrial applications, the threaded connection provides the strongest attachment and minimizes the risk of failure.
2. **Using the flexible shaft**
   While the machine is running, manually feed the shaft through the tubes. If a blocked or heavily fouled section is encountered, apply light pressure and move the shaft up and down slightly to assist the cleaning process. Allow the cleaning tool or brush to perform the work without excessive force.
3. **Cleaning the first few tubes**
   The result of the cleaning partially depends on the speed of the brushes going through the tubes. Ensure sufficient time is spent inside the tubes and do not rush the process. After the first few tubes, operators can inspect the results and change the cleaning speed or brushes used if necessary to achieve satisfactory cleaning results.
4. **Using the white locator tool**
   Goodway flexible shafts are equipped with a white locator tool, in the previous steps you have already marked it at the correct length. When cleaning the tubes, the operator now knows he/ she has reached the end of the tubes when the white locator tool hits the tube sheet.
5. **Cleaning the tubes**
   Repeat the cleaning process for all the tubes.
6. **Regularly checking the flexible shaft**
   Regularly check the flexible shaft during cleaning, it is a great indicator of the process. If, during cleaning, the shaft is stable and relaxed it means the brush or tool is doing it work correctly. However, when the shaft is heavily vibrating or even curling up, something is going wrong. Either the tool is too big for the tubes and creates too much resistance, or the fouling is more than expected and creates greater resistance. Either slow down the process or use smaller cleaning tools. Too much stress on the flexible shaft will reduce operational lifetime. If the shaft is excessively curling and no changes are made, there is a bigger risk of the shaft breaking down.
7. **Regularly checking the brushes and tools**
   Check brushes periodically during cleaning. If they have worn out, replace them with a new brush to ensure consistent cleaning results throughout all heat exchanger tubes. Depending on the brush type, oversize, deposit type, and other factors, the wear rate will vary. Generally speaking, 1 brush can be used for 20 to 50 tubes.



The RAM-4X should always be positioned horizontally, ensuring the flexible shaft exits the machine in a straight manner.





4. Special cleaning tools and accessoiries



Flex hub scraper tool

Use flex hub scraper tools to remove heavy deposit buildup or for opening up blocked segments of the tubes. After that, use nylon abrasive brushes to remove the remaining deposit layer. These tools automatically adapt to the tube inner diameter. Make sure the correct tool size is used for the tube inner diameter.

Important:

- Never rotate these tools outside of the tubes, blades can shoot out of the tool when there is no resistance from the tube wall and cause serious injury.
- Never use these tools on soft materials, such as copper-nickel alloys, titanium, or similar metals. There is always a small risk the tool creates scratches over a longer periode of usage.
- Never use these tools on internally enhanced heat exchanger tubes, only use on smooth tubes. Only use on straight tubes.

Flex hub tool sizing:





Adjustable buffing tool

Use adjustable buffing tools to remove hard deposit buildup on tube walls or for opening up blocked segments of the tubes. Primarily used for smaller tubes, where the flex hub scraper is not available. Buffing tools have stainless steel wires which need to be extended to match the tube size. This can be done by simultaneously turning the bolts on both sides in the opposite direction.

Important:

- Always ensure the stainless-steel wires are fully extended, thereby ensuring the drill tip is correctly centered in the tubes.
- Never use these tools on soft materials, such as copper-nickel alloys, titanium, or similar metals.
- Never use these tools on internally enhanced heat exchanger tubes, only use on smooth tubes. Only use on straight tubes.

2-pass cleaning for heavy fouling

Explanation: In some cases – particularly with boiler firetubes – the fouling buildup inside the tubes can be severe. In such situations, a brush alone may not be sufficient to remove the deposits. A specialized cleaning tool is needed first to remove the bulk of the buildup. Afterwards, nylon abrasive brushes can be used to eliminate the remaining fouling and provide a slight polishing effect for optimal cleaning results.

Instructions: For the initial cleaning pass, Goodway Benelux recommends using the Goodway flex hub scrapers, which are highly effective at removing hard deposit buildups inside tubes. These tools can also be used to fully open and clear clogged tubes. Afterwards, use nylon abrasive brushes to remove the remaining layer of deposits.



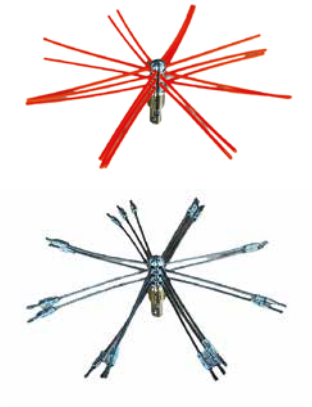


Nylon abrasive brushes

Nylon abrasive brushes are used to remove light to medium hard deposits from tube walls and polishing tubes, after using a heavier cleaning tool – if necessary.

Important:

- Use directly for light to medium deposits and after a flex hub scraper in case of hardened deposits and/ or blocked tubes.
- Use with an oversize compared to the tube inner diameter, usually around 5 millimeters.



Nylon and stainless-steel spider brushes

Spider brushes are used to remove all kinds of deposits from tubes, piping, and hoses between 90-900 millimeters in diameter.

Important:

- Use with a 25 to 50% oversize, compared to the piping inner diameter.
- Use 4 strand variants for pipes with tight bends, use 10 strands for more thorough deposit removal.
- Always use the GTC-DRY-C connector coupling to connect these tools to Goodway flexible shafts.
- Nylon spider brushes are not food-grade certified and should therefore not be used in applications involving direct contact with food products or ingredients.
- Stainless steel strands can potentially generate sparks inside tubes or pipes. The brushes and associated equipment are not ATEX-certified and should not be used in explosive or flammable environments.



GTC-DRY-C connector

Use the GTC-DRY-C connector coupling to connect spider brushes and chainsweepers to Goodway flexible shafts.



Chainsweeper

Chainsweepers are designed to remove medium to hard deposits from straight or bent tubes and pipes. These tools are used to remove the initial layer of hard deposits or debris, before using different cleaning brushes or tools to remove the remainder of the deposits.

Important:

- Always use the GTC-DRY-C connector coupling to connect these tools to Goodway flexible shafts.

5. After-use maintenance and storage

RAM-4X (periodic) maintenance

After each use:

1. After a wet tube cleaning, the machine will always have a slight amount of water inside of it. Removing this water before storage will avoid limescale deposits forming and (if possible) freezing of the unit when it is in cold storage. Disconnect the water hose and dry run the machine for a couple of seconds. You will see water coming out of the part where the shaft is connected. As soon as the water flow stops, it is ready for storage.

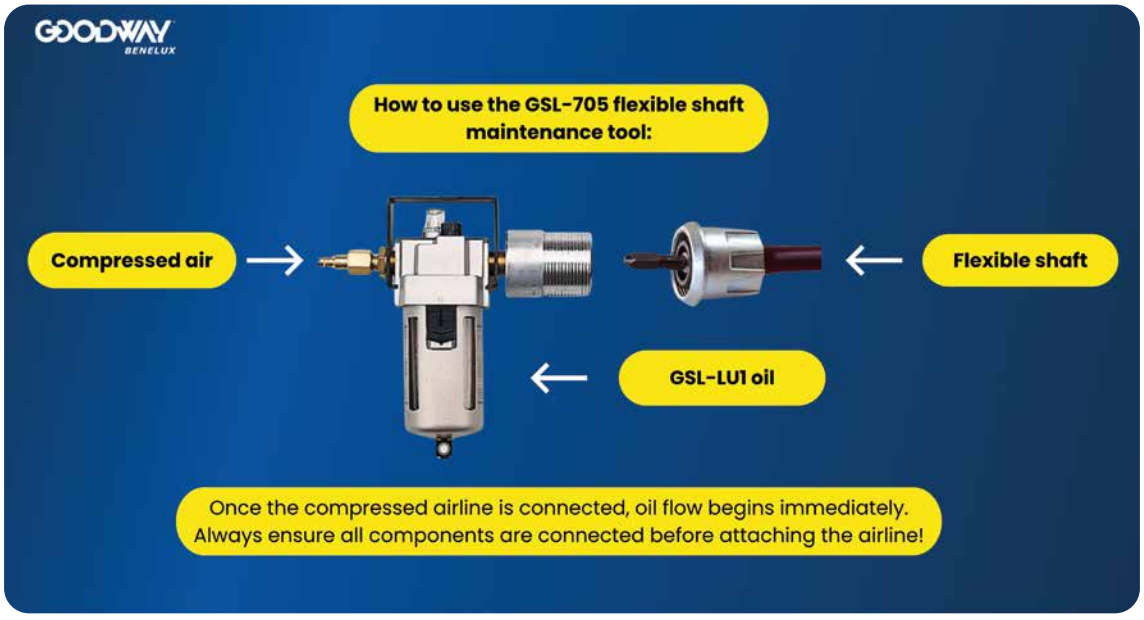
Periodic maintenance:

1. Lubricate chain and sprockets every 100 hours of running time with a good grade nondetergent SAE 20 to 50 weight petroleum-bases oil or NLGI no. 1 or no. 2 grade mixedbase or lithium-soap grease. Always ensure power is off before performing maintenance works.
2. Apply lubricant to chain sparingly and then wipe off excess.
3. Check all louvers and water drain holes for obstructions.
4. Check for decaying hoses and wire insulation.
5. Check for leaks.

Flexible shaft maintenance

After a wet tube cleaning, there will always be some water left inside of the shaft (blue) casing. If this water remains inside, it will interact with the steel core of the shaft. This can lead to corrosion and oxidation and thus a shorter lifetime. Use the Goodway GSL-705 tool with GSL-LU1 lubricant oil to remove left over water and provide a protecting layer of special shaft lubricant.

1. Connect the GSL-705 to the flexible shaft and make sure that the cup is full of GSL-LU1 lubricant. As soon as you connect a compressor airline to the tool, it will directly be activated. So, make sure that everything is properly connected before the air supply is connected.
2. As soon as oil starts to come out of the shaft, you can decouple and put the shaft in storage. Depending on the shaft length, this can take between 15-30 seconds.
3. When using the shaft after storage be cautious of oil coming out, we recommend rotating the shaft outside of the tubes for the first 20-30 seconds with water, to ensure that all left over oil is removed.



6. Safety instructions and precautions

Important safety instructions

- Read all instructions before using unit. Failure to follow all instructions may result in serious injury.
- Keep objects, loose clothing, hair, and body parts away from openings and moving parts.
- Do not overreach or stand on unstable support. Keep good footing and balance at all times.
- Stay alert – watch what you are doing!
- Do not operate the product when fatigued or under the influence of alcohol or drugs.
- Keep operation area clear of all persons.
- Use personal safety equipment. Always wear work gloves, safety glasses, and adequate work clothing.
- Use only GOODWAY recommended accessories and replacement parts.

Operational precautions

- Do not use in an environment or on objects that are above 175°F (79°C).
- Do not use with flammable or explosive fluids such as gasoline, fuel oil, kerosene, etc. Do not use in explosive atmospheres.
- Keep clear of moving shaft. Make sure the shaft will not catch on anything while in use.
- Check flexible shaft for weak or worn condition before each use. Make certain that all connections are tight and secure.
- If the machine does not operate properly or is damaged contact Goodway Customer Service.
- Disconnect the plug from the power source and turn off water supply before disconnecting hoses, fittings, or flexible shaft and before making any adjustments or changing accessories. Such preventive safety measures reduce the risk of starting the unit accidentally.
- Check for misalignment or binding of moving parts, breakage of parts, and any other condition which may affect the tool's operation. If damaged, have the tool serviced before using. Many accidents are caused by poorly maintained tools.
- If servicing this unit, use only identical replacement parts. Follow instructions in the maintenance section of this manual. Use of unauthorized parts or failure to follow maintenance instructions may create a risk of electric shock or injury.
- Be sure to select the proper size flexible shaft and tool for the job. Do not force the tool. Use the correct tool for the application.
- **DANGER:** Do not operate the unit with the covers removed when moving parts and electrical connections are exposed.

Electrical precautions

- Never expose the unit to rain or the elements. Store unit indoors in a cool, dry area.
- Make certain that the power source conforms to the requirements of the equipment.
- For proper protection, this product must be grounded. Always plug the power cord into a properly grounded receptacle. Improper connection of the equipment grounding conductor introduces risk of electrocution. Check with a qualified electrician or service personnel if you are in doubt as to whether an outlet is properly grounded.
- **DANGER:** Never remove the grounding prong from the power cord plug or use an adapter that eliminates ground.
- This unit is equipped with a Ground Fault Circuit Interrupter (GFCI) at the plug end of the cord for electrocution protection. Do not remove this device! If replacement of the plug or cord becomes necessary, use only identical replacement parts that include GFCI protection.
- **WARNING:** To reduce the risk of electrocution, keep all connections dry and off the ground. Do not handle the unit or electrical plug with wet hands.
- When unplugging the power cord, grasp the plug – not the cord.
- Unplug the power cord when servicing the unit or leaving the machine unattended.
- Do not pull on the power cord, close a door on the cord or pull the cord around sharp corners. Keep the cord away from hot surfaces.
- Do not use the machine if it has a damaged cord or plug.

7. Troubleshooting

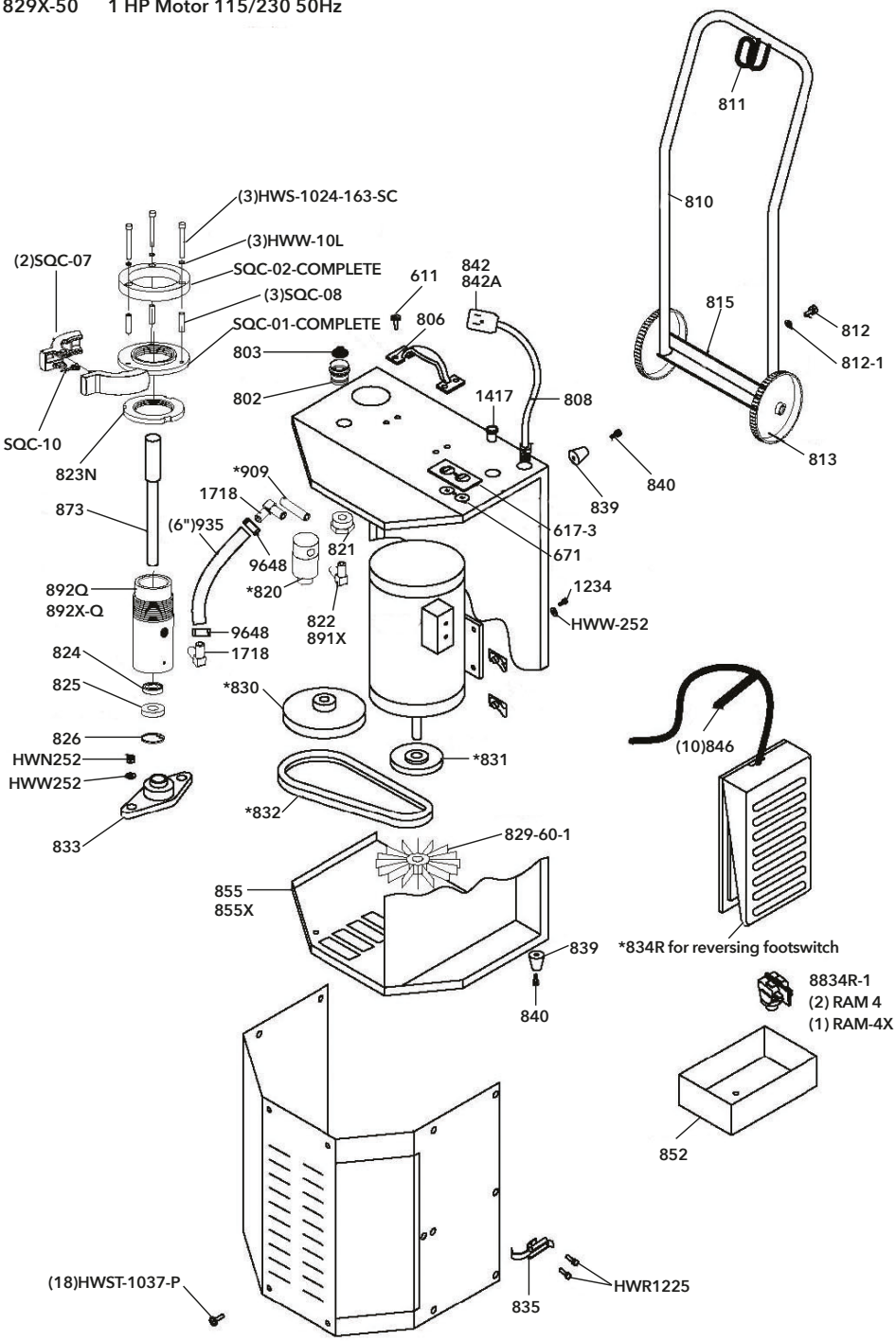
Problem	Probable cause	Remedy
Runs for short period of time and stops (power light remains on).	• Leak in air control circuit. • Air switch leaking (rare).	• Disconnect power, remove cover. Check wiring connections. Disconnect air hoses from air switches to allow foot pedal bellows to inflate to full height. Reconnect and tighten all connections. • Replace air switch
Water leaking from base.	• Leak in water circuit plumbing. • Leak at shaft manifold seal.	• Disconnect power, remove cover. • Check hoses and fittings for leaks. • Check for leak where drive shaft. • Enters shaft manifold.
Runs for short period of time and stops (power light off), GFCI trip/won't reset.	• Electrical short to ground.	• If GFCI continually trips call Goodway. There may be an unsafe electrical condition!
Motor runs but shaft does not turn.	• Problem with water supply. • Inlet screen clogged. • Main inlet solenoid valve not working.	• Disconnect power, remove cover. Check chain and sprockets. • Replace shaft fittings and/or core.
No water through flexible shaft.	• Electrical short to ground.	• Water supply not on, restrictions in hose or hose too small, water supply pressure insufficient. • Remove hose and clean screen. • Disconnect power, remove cover. Check solenoid wiring and connections.

Problem not listed - call Goodway Benelux customer service: +31 183 216 170

8. Parts list and exploded view

*820	Solenoid Valve 115 RAM 4	
820X	Solenoid Valve 115 RAM-4X	
820A	Solenoid Valve 230 RAM 4	
820XA	Solenoid Valve 230 RAM-4A	
*829-P	1/2 HP Motor 115/230 60Hz	
829-50--P	1/2 HP Motor 115/230 50Hz	
829X	1 HP Motor 115/230 60Hz	
829X-50	1 HP Motor 115/230 50Hz	

*812	5"x1/2"	Pulley RAM 4 2:1
830-1	4"x1/2"	Pulley RAM-4X 1:1
831	2.5"x1/2"	Pulley RAM 4
831X-1	4"x5/8"	Pulley RAM-4X 2:1
831X-2	4"x5/8"	Pulley RAM-4X 1:1
*832	V Belt 21" RAM 4	
*832-1	V Belt 22" RAM-4X	
*909	Nipple RAM-4X	



RAM 4/RAM-4X