

# Extractor King

Closed Loop Extraction Equipment & Accessories · Langley, BC, Canada

## BASIC OPERATION GUIDE

# Science King Stainless Steel Reactors

Set-up, solvent compatibility, safe operating limits, daily operation, cleaning, maintenance and troubleshooting for Science King stainless steel reactors.

**Covers:** Science King 100L Jacketed Stainless Steel Reactor, Stainless Steel Crystallization Reactor and Stainless Steel Decarboxylation Reactor.

Read this whole guide before first use and keep it with the reactor. Where this guide and the reactor's nameplate or the documents supplied with it differ, follow the nameplate and those documents. Questions: 1.888.609.KING (5464) · [admin@extractorking.com](mailto:admin@extractorking.com) · [extractorking.com](http://extractorking.com)

## Contents

---

- |                                     |                                         |
|-------------------------------------|-----------------------------------------|
| 1. Safety first                     | 9. Charging and stirring                |
| 2. Stainless or glass?              | 10. Heating and cooling                 |
| 3. Solvent compatibility            | 11. Decarboxylation and crystallization |
| 4. Know your reactor                | 12. Draining and shutdown               |
| 5. Operating limits                 | 13. Cleaning                            |
| 6. Unpacking and inspection         | 14. Maintenance                         |
| 7. Assembly and leak test           | 15. Troubleshooting                     |
| 8. Connecting the chiller or heater | 16. Storage                             |

## 1 Safety first

---

### The four rules that prevent most stainless reactor accidents

1. **Use only compatible solvents** (section 3). Chlorides and strong acids attack stainless steel.
2. **Never heat a closed system.** Always keep a vent path open through the condenser, a bubbler or the vacuum line.
3. **Never exceed the pressure ratings on the nameplate,** for the vessel or the jacket. If the vessel has no pressure rating stamped on it, treat it as vacuum to atmospheric only.
4. **You cannot see inside.** Watch the temperature, the pressure gauge and the sight glass (if fitted), and never leave a running reactor unattended.

- **Personal protection:** safety glasses or a face shield, a lab coat or chemical apron, and chemical-resistant gloves. Add insulated gloves: the steel shell, lid and fittings get as hot or as cold as the jacket fluid.
- **Flammable solvents (ethanol, isopropanol and others):** run in a well-ventilated area with no ignition sources. Bond and ground the vessel, frame and receiving containers to prevent static sparks. A standard motor and controller are **not** explosion-proof: if the area may contain flammable vapour, use an explosion-proof or air-driven motor and controls rated for that area, installed to your local code.
- **Electrical:** connect only to a grounded supply of the voltage on the nameplate (standard units are 220 V single phase; 3 phase on request). Keep the motor, speed controller and cords dry. Unplug before moving, cleaning or servicing. After switching off, wait at least 5 minutes before opening a variable-speed controller.
- **Moving parts:** keep hair, loose clothing, sleeves and jewellery away from the stirrer shaft and coupling.
- **Opening the lid:** only when the vessel is back at atmospheric pressure and near room temperature.

## 2 Stainless or glass?

---

The two reactors work the same way: a vessel with a heating/cooling jacket, a stirrer and a condenser. The differences are in what they can safely hold and how you look after them.

|                           | Stainless steel reactor                                                                    | Glass reactor                                       |
|---------------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <b>Solvents</b>           | Ethanol, isopropanol (IPA) and other compatible solvents.<br><b>No corrosive solvents.</b> | Almost any solvent, including corrosive ones        |
| <b>Strength</b>           | Will not shatter; handles knocks, heavy batches and production use                         | Fragile; can crack from impact or temperature shock |
| <b>Temperature change</b> | Tolerates faster changes, but ramp anyway to protect the seals                             | Must ramp slowly (about 1 to 2 °C per minute)       |
| <b>Visibility</b>         | None, except through a sight glass if fitted                                               | See the whole batch                                 |
| <b>Cleaning</b>           | No chlorine, bleach or steel wool                                                          | No abrasives or hydrofluoric acid                   |

### 3 Solvent compatibility

Science King stainless reactors are made for ethanol and isopropanol (IPA), the usual solvents for extraction, winterization and decarboxylation. Other non-corrosive solvents, such as heptane, hexane and acetone, are generally compatible.

#### Never put these in a stainless reactor

- **Hydrochloric acid**, or any acid or salt containing chloride.
- **Bleach** (sodium hypochlorite) or chlorine-based cleaners and sanitisers.
- **Chlorinated solvents** such as dichloromethane (DCM) and chloroform. With water or heat they can form hydrochloric acid.
- **Strong acids** (sulphuric, nitric and others) and strong hot alkalis.
- Salt water or brine, and anything that leaves chloride on the steel.

Chlorides break through the protective layer on stainless steel and cause pitting, rust and cracking, especially when hot. The damage is often hidden until a weld or the jacket wall leaks. If your process needs a corrosive solvent, use a glass reactor.

If you are unsure about a solvent, call us before you use it.

### 4 Know your reactor

- **Inner vessel:** stainless steel; holds the batch.
- **Heating/cooling jacket:** the circulating fluid from your chiller or heater flows here and sets the batch temperature.
- **Outer vacuum jacket** (jacketed models): an evacuated insulating layer. It keeps heat in, keeps cold in, and stops frost and condensation forming on the outside.

| Part                                      | What it does                                                                                                                  |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Lid with ports                            | Centre port for the stirrer shaft; side ports for the condenser, temperature probe, pressure gauge, addition and vacuum/vent. |
| Stirrer motor, speed controller and shaft | Mixes the batch. The shaft seal in the lid keeps vacuum.                                                                      |
| Condenser                                 | Condenses vapour for reflux or collection.                                                                                    |
| Temperature probe and gauges              | Your only view of the batch. Check they read correctly before each run.                                                       |
| Sight glass (if fitted)                   | Lets you see the liquid level, foaming and clarity.                                                                           |
| Bottom discharge valve                    | Drains the vessel.                                                                                                            |
| Jacket inlet and outlet                   | Connect to the chiller or heater.                                                                                             |

The crystallization and decarboxylation reactors are built to your batch size, so fittings differ by build. Check the packing list and drawings supplied with your reactor.

## 5 Operating limits

**The nameplate on your reactor sets the limits.** Where this table and the nameplate differ, use the lower figure.

| Limit                                  | Value                                                                                                                               |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Pressure inside the vessel</b>      | As stamped on the nameplate. No stamped rating means vacuum to atmospheric only.                                                    |
| <b>Heating/cooling jacket pressure</b> | As stamped on the nameplate. Fit a pressure relief or bypass on the circulator line.                                                |
| <b>Working temperature</b>             | Within the range on the nameplate. The gaskets and shaft seal, not the steel, usually set the limit.                                |
| <b>Rate of temperature change</b>      | Ramp rather than step; it protects the gaskets, seals and welds.                                                                    |
| <b>Maximum fill</b>                    | 80% of nominal volume (about 80 L in a 100 L reactor). Leave more room for batches that foam, such as decarboxylation (section 11). |
| <b>Stirrer</b>                         | Start at the lowest speed. Never run at high speed with an empty vessel.                                                            |

## 6 Unpacking and inspection

1. Check every item against the packing list. Keep the crate and packing in case anything needs to be returned.
2. Inspect the vessel, welds, jacket nozzles, gauges and sight glass for dents, cracks or transit damage. If anything is damaged, take photos and contact us right away.
3. Retighten all frame bolts, clamps and fittings; they loosen in transit.

4. Clean the reactor before first use (section 13) to remove polishing compound and oil from manufacture.

## 7 Assembly and leak test

---

1. Place the frame on a firm, level floor in a ventilated area. Lock the casters.
2. Check every gasket sits fully in its groove. Tighten lid bolts and clamps evenly in a cross pattern.
3. Couple the motor to the shaft. Turn the shaft by hand: it must turn freely, run true and not touch the probe, baffles or vessel wall.
4. Fit the condenser, probe and gauges. Cap unused ports.
5. Ground the frame and vessel.
6. **Leak test:** with the vessel empty, pull vacuum, close the valve to the pump and watch the gauge for 5 to 10 minutes. A rising reading means a leak. Check the lid gasket, shaft seal, port caps, bottom valve and hose connections.

**Do not pressure-test the vessel yourself** unless it has a stamped pressure rating, and then never above that rating.

## 8 Connecting the chiller or heater

---

1. Use hoses and fittings rated for the full temperature range and the jacket pressure. Insulate them for cold work.
2. Connect the circulator **supply to the lower jacket port and the return to the upper port**, so the jacket fills completely and air escapes from the top. If your ports are labelled differently, follow the labels.
3. Never close a valve on the jacket return while the pump is running, and never shut in a full jacket that will warm up.
4. Choose a fluid for your temperature range: water or a water/glycol mix for moderate temperatures, a low-temperature heat transfer fluid for deep cold, a silicone heat transfer fluid for high temperatures. Use steam only if the jacket's nameplate allows it.
5. Start circulation at room temperature and check every joint for leaks before you change temperature.

**Outer vacuum jacket.** If frost or condensation forms on the outside of the reactor during cold work, the insulating jacket has lost its vacuum. Call us for the procedure for your model.

## 9 Charging and stirring

---

1. Confirm the bottom valve is closed and the reactor is grounded.
2. Add liquids through the addition port and solids through the solids port. Pre-cool or pre-heat liquids where practical.
3. Do not fill above 80% of the nominal volume.
4. Start stirring at the lowest speed and raise it slowly, listening for knocking or vibration. Thick batches need lower speeds.

5. Check the shaft seal for vapour or liquid leaks while running.

## 10 Heating and cooling

---

1. Start stirring and circulation first.
2. Change the circulator set-point in steps or with its ramp function, rather than jumping straight to the final temperature.
3. Watch both the jacket temperature and the batch temperature. Log them on important runs. You cannot see the batch, so trust the probe and check it reads correctly.
4. Start coolant through the condenser before you heat, and keep the system open to a vent or to the vacuum line through a cold trap.
5. For vacuum work, pull vacuum first, then heat. When finished, cool first, then let air or inert gas back in slowly.

## 11 Decarboxylation and crystallization

---

### Decarboxylation

- Decarboxylation gives off carbon dioxide gas. **The reactor must stay vented** through the condenser or a vent line for the whole run. Never seal it.
- The batch bubbles and foams as the gas comes off. Fill well below the 80% mark and raise the temperature gradually so the foam does not climb into the condenser.
- Stir slowly to release the gas evenly. The run is finished when bubbling stops at the set temperature.
- Hot oil causes severe burns. Let the batch cool to a safe handling temperature before draining.

### Crystallization

- Cool slowly and steadily using the circulator's ramp. Slow cooling grows larger, cleaner crystals; fast cooling gives fine crystals that are hard to filter.
- Stir slowly, or not at all, as your process requires, so the crystals are not broken up.
- If the bottom valve is blocked by crystals, warm it gently. Never force it.

## 12 Draining and shutdown

---

1. Slow or stop the stirrer.
2. Return the vessel to atmospheric pressure.
3. Place a grounded container rated for the product and its temperature under the valve, then open the bottom valve slowly.
4. Bring the jacket back toward room temperature.
5. Stop the circulator. If you disconnect it, drain the jacket. If it stays connected, make sure the jacket is not shut in.
6. Switch off and unplug. Clean the reactor straight away.

## 13 Cleaning

---

1. Rinse with a solvent that dissolves the residue (ethanol or isopropanol for most extracts).
  2. Wash with warm water and a mild, **chloride-free** detergent, using a soft brush or a non-metal pad.
  3. Rinse several times with clean water, then dry completely. Water left standing leaves spots and can start corrosion.
- **Never** use bleach, chlorine sanitisers or hydrochloric acid cleaners.
  - **Never** use steel wool or carbon-steel brushes. They leave iron particles that rust on the stainless surface.
  - Make sure cleaning chemicals are also safe for the gaskets and seals.
  - If rust spots or pitting appear, stop and call us. Light surface rust can be removed and the steel re-passivated with a citric acid passivation product; deep pits need inspection.
  - Flush the heating/cooling jacket about once a year to remove scale and sludge.

## 14 Maintenance

---

| When                                     | What to do                                                                                                                                            |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Before every run                         | Check the gauges and probe, hoses and clamps, and the grounding connection.                                                                           |
| Weekly in regular use                    | Check the shaft seal for leaks, the gaskets, stirrer alignment, and frame and clamp tightness. Look inside for discolouration, rust spots or pitting. |
| When vacuum gets worse or vapour escapes | Replace the shaft seal.                                                                                                                               |
| When hard, flattened or cracked          | Replace the gaskets and O-rings.                                                                                                                      |
| About every 12 months                    | Replace the lid gasket set. Flush the jacket. Check the gauges against a known reference. Have a noisy motor checked.                                 |

Keep a spare lid gasket set, shaft seal and bottom-valve seals on hand. Parts are available at [extractorking.com](http://extractorking.com), or call us.

## 15 Troubleshooting

| Problem                              | Likely cause                                                                   | What to do                                                                                                 |
|--------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Vacuum won't hold                    | Worn gasket, uneven lid bolts, open port or valve, worn shaft seal, weak pump  | Re-seat or replace gaskets, re-tighten evenly, cap ports, replace the shaft seal, test the pump on its own |
| Rust spots or pitting inside         | Chlorides (bleach, salt, chlorinated solvent), steel wool, water left standing | Stop using the reactor and call us; find and remove the source                                             |
| Batch foams into the condenser       | Overfilled, heated too fast, gas release during decarboxylation                | Fill less, ramp more slowly, stir gently                                                                   |
| Jacket fluid leaks                   | Loose fitting, too much circulator pressure                                    | Re-tighten, lower the pressure, add a bypass                                                               |
| Motor stalls or slows                | Batch too thick, impeller fouled, shaft misaligned                             | Lower the speed or load, clear the impeller, re-align                                                      |
| Frost or condensation on the outside | The outer vacuum jacket has lost its vacuum                                    | Call us                                                                                                    |
| Slow heating or cooling              | Low flow, air in the jacket, scale or sludge in the jacket                     | Check the hoses for kinks, purge air, flush the jacket                                                     |

## 16 Storage

- Store the reactor clean and completely dry, with the jacket drained.
- Leave valves slightly open so the seals do not take a set.
- Cover the reactor against dust, lock the casters and unplug the unit.

**Need help?** Live chat at [extractorking.com](https://extractorking.com), call 1.888.609.KING (5464) or email [admin@extractorking.com](mailto:admin@extractorking.com). Have your model and serial number ready. You can save your serial number in My account → My machines.

This guide gives general operating practice for stainless steel reactors and does not replace your own risk assessment, your local electrical and fire codes, or the safety data sheets for the materials you process. Extractor King Industries Inc. · Langley, BC, Canada · Guide version 1.0, October 2026.