Introduction

Congratulations on the purchase of your new V.I.C. 9! This convenient tabletop vacuum investing and casting system will provide you with top-quality, reliable casting capabilities for many years, given reasonable care and routine maintenance. To assure safe operation and to maximize its benefits, read this manual completely before operating your V.I.C. 9.

Vacuum casting is an efficient, flexible method of casting. With V.I.C. 9, you can cast both small and large parts and cast any size flask interchangeably. Vacuum casting with your V.I.C. 9 is safer than centrifugal casting and provides excellent results, allowing fewer gas inclusions and less shrinkage porosity.
**Shipping List**

Your V.I.C. 9 is shipped in two cartons:

**Carton 1 contains:**
- V.I.C. 9 machine cabinet with pre-installed vacuum pump
- Vacuum table pad
- Casting table pad
- One pint of vacuum oil

**Carton 2 contains:**
- Bell jar

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**Installation & Setup**

1. Unpack machine and check carton contents against the shipping list at left.
2. Place V.I.C. 9 cabinet on a sturdy, level work surface.
3. Open cabinet and add vacuum oil until oil level reaches the full mark on the vacuum sight gauge on the front of the cabinet. Do not overfill oil! Your first pint of Rio vacuum oil is included.
5. Attach bell jar hose at the back of the V.I.C. 9 cabinet and to the side of the bell jar. Tighten the hose clamps onto the fittings with a standard screwdriver.
6. Place the investing table vacuum pad and bell jar on the larger investing table platform. Place the casting table pad on the smaller casting table platform.
7. Plug your V.I.C. 9 casting machine into a grounded 110/115-volt AC outlet.

*Please Note:* Your V.I.C. 9 cabinet has pre-drilled mounts to accommodate The Assistant™ (see page 8), a convenient crucible holder that allows you to melt metal in place and pour it in perfect alignment with your flask. The Assistant virtually eliminates the risk of spilling molten metal on the way to the flask! The Assistant is not included with your V.I.C. 9 machine, but it can be easily installed into the pre-drilled mounts if purchased separately.

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**Machine Features**

- Easy-open, front-lift cabinet gives full access to all routine maintenance.
- Spring-mounted investing table enhances air bubble elimination.
- High-heat polyurethane hoses throughout the machine provide maximum protection from flask blowout damage.
- Side-draw bell jar holds more flasks and protects vacuum pump from moisture and investment debris.
- 6” high-heat cast pad.
- Vacuum pad on top of investing table ensures a proper seal.
- Easy-to-use toggle switch allows easy change from investing to casting and back.
- Powerful 5cfm vacuum pump (115V; 60Hz).
- Easy-access oil sight gauge on pump.
- Easy-to-use top-access oil fill port and bottom drain port.
- The Assistant™ crucible holder (optional) accurately controls metal-pouring to make casting easier and safer.
General Safety Precautions

Investing and casting are processes that require forethought and precautions. Planning for every step of the investing and casting processes in your shop is a responsibility you owe to yourself and your co-workers. Safety precautions and protective attire are a must for investing, melting and casting.

• Wear protective clothing and eyewear when investing and casting. Proper safety precautions should always be taken.

• Molten metal will cause severe burns and can start fires. Make sure no flammable materials are near the casting area.

• Plan a place to put the hot flask after casting where you nor anyone else can accidentally come in contact with it. Remember, flasks with temperatures of several hundred degrees look the same as cold flasks.

• If you have a helper, plan the actions both of you will take during your casting process before you begin.

• Keep close watch on the torch flame. It can burn something or someone from quite a distance. Take care not to melt your bell jar. If you do, replace it right away. The bell jar is not safe if it has been cracked, scratched or damaged by a torch flame or molten metal.

• Never push on the top of the bell jar while it is under vacuum. When a bell jar breaks, it first implode and then explodes, sending sharp pieces of shattered plastic around the room. To ensure a good seal, check to make sure the pad under the bell jar rim is clean and free of dirt or debris, then gently press the rim of the bell jar securely against the rubber investing pad when vacuum is first applied.

⚠️ WARNING: Investment powder contains free silica. Inhalation silica is dangerous and may cause progressive, irreversible lung injury over time. Always wear a respirator appropriate for use with investment when investing and quenching flasks, and completely clean up investment from your work area. Wear an OSHA approved respirator during investing processes and work in a well-ventilated space with a draft that pulls air away from you when handling investment powder. Never use a vacuum cleaner unless it is designed to pick up respirable silica (particles as fine as 5 microns).

Please read, understand and follow all of the safety recommendations offered on the MSDS available with your investment product.

Please Note: Visit riogrande.com or see your Rio Grande Tools & Equipment catalog for all the proper safety accessories—including eyewear, gloves, aprons, masks, and respirators recommended for investing, metal-melting and casting, as well as safety equipment for your entire shop.

Investing

CAUTION: Always test the vacuum seal between the jar and pad before mixing investment. To test the vacuum seal, moisten the underside of the bell jar rim with a clean sponge. Place the bell jar over the vacuum table and rubber vacuum pad. If needed, apply slight pressure around the rim of the jar. Never apply pressure to the top of the bell jar. NEVER push down on the top of the bell jar under vacuum. This can cause the bell jar to break and implode.

Preparation

Prepare flasks to be invested. For consistent casting results, use Wax Web™ (see page 8) in every flask.

Using Wax Web™

Wax Web is a clean-burning wax mesh that increases the efficiency of vacuum casting. Because Wax Web creates a network of gas evacuation channels around the inside of your flask, it directs the power of the vacuum equally around the perimeter of the mold. It’s simple to use!

1. Roll the Wax Web sheet into a cylinder and position it flush with the inside top of the flask. Wax Web should not extend more than 70%–80% along the inside of the flask. Trim it if necessary.

2. Secure Wax Web in place with bobby pins or melt it to the flask at several points with a heated wax tool.

3. As you build your sprue tree, always allow at least 1/2" of space between the top of the wax patterns and the level of investment in the flask (perhaps more for large or heavy items). Please Note: Because a 1/6" gap should always be left between the investment level and the top lip of the flask for a good seal when casting, the top of your sprue tree should never be closer than 5/6" to the top of the flask. This precaution, along with strictly controlled investing procedures, will help prevent flask blowouts.
Investing Procedure

1. Measure investment and water according to the manufacturer’s instructions included in your investment.
2. Place the pre-measured water into your mixing bowl.
3. Add pre-weighed investment.
4. Stir for 5 minutes to blend water and powder to the consistency appropriate for your particular type of investment.
5. When mixing is complete, place the bowl of investment on the investing platform. Position the bell jar squarely over the bowl, move toggle switch to the invest position, and turn on the power.
6. Vacuum investment until proper vacuum is achieved (investment mixture should bubble, rise, and fall during this step). This operation should take 90 seconds.

**Please Note:** The vacuum gauge should indicate full vacuum in less than a minute. Investment in the bowl will crest at this time and begin to release air bubbles. The precise mercury reading indicating full vacuum depends on your altitude. At sea level, full vacuum occurs at 29" of mercury. For each 1000 feet of altitude, the gauge registers approximately .9" less mercury (e.g.: at 5000 feet altitude, full vacuum occurs at about 24.5""). To release the vacuum, move the toggle switch to the CAST position, then turn the power off.

7. Remove mixing bowl and place flask(s) on the vacuum table. Check that all flasks fit under the bell jar. Tip flask slightly and pour investment along the inside of the flask until your wax patterns are covered. Don’t pour the investment directly over wax trees; this can damage wax patterns and cause air bubbles to occur. Once patterns are covered, set the flask on a level surface, and fill with investment to 1/8" below the top of the flask. Use a rubber flask extender to prevent investment overflow during further vacuuming. Wipe the edge of the bell jar with a clean sponge, and cover flask(s) with the bell jar.
8. Move toggle switch to invest position and turn power on. Vacuum flasks for 90 seconds.
9. Move the switch to the cast position to release the vacuum on the bell jar. Turn the power off. For maximum mold strength, carefully remove flasks to a level surface and allow flasks to sit for two hours before burnout. Clean top ring of flask with a moistened sponge before set up.

Maintenance Note:

After investing several flasks, it is normal for some moisture to collect in the vacuum pump oil. Overnight, or when the pump is idle, the oil and water will separate and the water should be removed before the next use of the pump. To drain the water from your vacuum pump, position your V.I.C. 9 at the edge of the work table, open the drain spout and let water run out (it will be mixed with oil and appear foamy). When the oil runs clear, close the spout. Replace vacuum oil to the full oil level mark as needed. **Important:** Never overfill the V.I.C. 9 with oil.

**WARNING!**

Investment contains a blend of crystalline silica. Prolonged inhalation of this product may be harmful. IARC reports that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in forms of quartz or cristabolite from occupational sources. Symptoms may not appear until permanent lung damage has occurred. Persons who use this product should have periodic physical examinations for silica exposure. Work areas should be periodically tested to determine the amount of airborne crystalline silica compared to OSHA and MSHA accepted standards. ALWAYS wear NIOSH-approved breathing protection for crystalline silica dust when working with product or when possible exposure to product dust exists. Users must comply with all applicable health and safety regulations relating to the safe handling of crystalline silica. See MSDS for information.

California Prop 65 Warning: This product contains crystalline silica, a chemical known to the State of California to cause cancer.
How To Determine Metal Weight for Wax Trees

Knowing how to determine the correct metal weight for each wax tree before you cast ensures that you melt the right amount of metal for your cast, making your casting process more cost-effective and more reliable.

SPECIFIC GRAVITIES:

24KY = 19.32
18KY = 15.58
14KY = 13.07
10KY = 11.57
Fine silver = 10.49
Sterling = 10.36
Platinum = 21.54
Caster's brass chunks = 8.4
Caster's white bronze chunks = 8.1
Ancient bronze = 8.8
Yellow bronze = 8.4
Manganese bronze = 8.3
Nickel silver = 8.8
Alpaca = 8.6

PROCEDURE:

Step 1
First, weigh your wax models along with main and gate sprues. Then add an additional 10% to account for your button.

Step 2
Multiply that total by the specific gravity of the metal you’re casting (see table above for a general guideline).

Step 3
Example: For a 5-gram wax model, add 0.5 (10% of 5g) to get a total wax weight of 5.5g. For a 14KY gold casting, multiply 5.5g x 13.07 s.g. The amount of 14KY gold needed for this tree is 71.89 grams.

Casting Torch-Melted Metal

⚠️ WARNING! Before your begin casting, read, understand and follow all the safety precautions provided in this handbook, starting on page 2.

Before Casting:
• The rim of the solid flask should be clean and free from investment to allow for a proper seal against the casting pad and to prevent loose investment from being pulled into the pump.
• To protect the bell jar, place it on the bell jar stand away from the casting area.
• For casting solid flasks, place the white casting pad on the casting table plate; both must be free of dirt and investment. Align the pad with the hole in the center of the table.

Important Notes:
• When casting, be organized. Have your tools in place and ready to use. Plan in advance the exact sequence of events necessary to successfully complete your cast, and make sure you have everything you need.
• Be sure to cast each flask as quickly as possible (within 5 minutes) after removing it from the oven to prevent unnecessary heat loss.
⚠️ WARNING! Always wear appropriate safety glasses to protect your eyes during any metal melting, casting and quenching process.
Casting Steps

1. To season a new crucible, place a small amount of Matt’s Casting Flux™ in a clean crucible. Heat flux to form a thin glassy glaze inside the crucible. Repeat as necessary, using a small quantity of Matt’s casting flux. Too much will cause an excessive glassy slag buildup in the crucible.

2. Make sure that any remelt metal used is very clean and dry (free of oxides, investment, pickle residue and moisture).

3. Place the proper amount of metal in the preheated crucible for the pattern or patterns invested in the mold.

4. Remove the flask from oven and place it on the casting pad of the casting machine with sprue opening up.

5. Turn the switch to “Cast” to test for a good vacuum seal between the gasket and the flask, then switch to “Invest” to turn the pump off. If a good vacuum is not achieved, check to ensure that the rim of the flask is clean and free from investment debris.

6. With a good reducing flame (mix is more gas than oxygen), heat the metal. Use a flame large enough that it will cover the whole melt.

7. When the metal starts to melt, switch to the “Cast” position. Check the vacuum gauge to make sure the vacuum has resealed.

8. Bring the metal to the desired casting temperature and stir it with a carbon stirring rod through the flame of the torch.

   • Once the metal heating starts, do not remove the torch from the melt for any reason. If exposed to air, hot or molten metal will readily oxidize (bond with oxygen from the atmosphere). Oxidation causes the formation of copper and/or zinc oxides which have a very different composition and appearance than original casting alloy. We know these oxides as ‘firescale,’ and it is difficult or impossible to remove after casting.

9. Use the torch to cover both the melt and the pour hole in the crucible. Tip the crucible to pour the metal quickly and smoothly into the sprue opening of the mold.

   • To minimize firescale on your cast models, keep the flame constantly on the molten metal as it is poured into the flask. Stir the melt with a carbon stirring rod before casting. Use the flame to protect the metal from oxidizing as it is poured into the flask.

10. Play the torch flame on the end of sprue button until the button solidifies.

11. Maintain a vacuum on the flask for 30–45 seconds while the metal in the flask solidifies.

12. Release the vacuum by switching to the “Invest” position, then remove the flask.

13. Let the flask stand on a heat-resistant surface until the red color is completely gone from the button (you can use an empty solid flask on the end of the mold flask to create a dark enclosure above the sprue button that will allow you to judge its color).

   **IMPORTANT:** Do not leave flasks to cool on the casting table as this will cause undue wear on the silicon casting pad.

Casting with a Melting Furnace

If you will be using a melting furnace to melt your metal, most of the steps will be the same.

1. The crucible in furnaces is usually graphite and will not need to be seasoned.

2. Place the necessary amount of metal for the pattern or patterns invested in the mold into the preheated crucible.

3. Set the furnace and allow the metal to begin heating.

4. When the metal reaches casting temperature, remove the flask from oven and place it on the casting pad of the casting machine with sprue opening up.

5. Turn the switch to “Cast” to test for a good vacuum seal between the gasket and the flask. If a good vacuum is not achieved, check to ensure that the rim of the flask is clean and free from investment debris.

6. Use tongs to lift the crucible (or simply tilt the furnace if it has that feature) and pour the metal quickly and smoothly into the sprue opening of the mold.

7. Maintain a vacuum on the flask for 30–45 seconds while the metal in the flask solidifies.

8. Release the vacuum by switching to the “Invest” position, then remove the flask.
Maintenance

The easy-open front of the V.I.C. 9 allows complete access to all components for maintenance.

Changing the Vacuum Oil

Changing the vacuum oil prevents dirt and moisture from clogging your machine. Completely change the oil once every 30 hours of machine operation to keep your V.I.C. 9 at peak performance. Important: Never overfill the V.I.C. 9 with oil.

To Change the Vacuum Oil:
1. Position the V.I.C. 9 at the edge of the work table, so that the drain spout extends just over the edge of the table.
2. Place a container (at least pint-size) under the drain spout.
3. Remove the oil fill cap, then open the oil drain valve.
4. Allow oil to drain completely.
5. Close the oil drain valve.
6. Refill pump with fresh vacuum oil through the oil fill port.
7. Check the oil level through the oil level sight gauge.
8. Replace the oil fill cap.
9. Dispose of used oil properly at an oil recycling facility.

Flushing the Vacuum Pump

Protect your vacuum pump from damage caused by internal dirt. We recommend periodically flushing the vacuum oil with Rio flushing oil (order #706-017) once every 90 hours of machine operation.

IMPORTANT: Never attempt to cast with flushing oil in your V.I.C. 9 caster. This lightweight cleaning oil will not provide sufficient protection for your vacuum pump under actual working pressures.

To Flush the Vacuum Pump:
1. Drain oil (steps 1–5 at left).
2. Fill machine 2/3 full with Rio flushing oil.
3. Turn machine on and run 3–4 minutes.
4. Drain flushing oil completely.
5. Refill with Rio vacuum oil (steps 6–8 above).
6. Dispose of used oil properly at an oil recycling facility.

Cleaning the Vacuum Chamber

Periodically (and after any flask blowout), clean any accumulated investment and metal from the bottom of the vacuum chamber.

1. Dislodge the mesh screen (order #705-168) from the casting machine table and clean or replace it.
2. Open the front of the machine cabinet to access the vacuum chamber.
3. Remove the black rubber cap from the bottom of the vacuum chamber. You’ll find a soft ceramic-like high-heat fiber pad inside the cap, or in the vacuum chamber. Be careful not to damage this filter as you remove debris and clean the chamber and cap. If the cap or fiber pad are damaged, replace them.
4. Make sure the high-heat fiber pad is secure in the cap, and replace the cap on the bottom of the vacuum chamber.
# Accessories

See our website or your catalog for more information and pricing on these supplies. Your catalog includes a handy order number index that provides a page number reference for each order number.

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<td>The Assistant™</td>
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<tr>
<td>Carbon stirring rods</td>
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<td>Crucibles</td>
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<td>Wax Web™</td>
<td>702-200 to 702-203</td>
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## Replacement Parts

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<td>Bell jar, side-draw, 9&quot;</td>
<td>702-155</td>
<td>Vacuum line filter</td>
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<tr>
<td>Casting pad</td>
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<td>Casting table screen</td>
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<td>Investing pad</td>
<td>705-165</td>
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<td>Rubber boot (vacuum chamber)</td>
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