Resodyn
ACOUSTIC MIXERS

LabRAM II Jacketed Vessel Users' Manual

Resodyn Acoustic Mixers, Inc. 130 N. Main Street, Suite 630, Butte, MT 59701 (406) 497-5333 www.resodynmixers.com

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1 Introduction

The Resodyn Jacketed Vessel is a processing accessory designed for use with the Resodyn LabRAM II mixing platform. The Jacketed Vessel allows heating or cooling before, during, or after the mixing process via heat transfer fluid or "jacket" flowing through the outer fixture h=enclosing the mixing vessel.

ResonantAcoustic® Mixing (RAM) utilizes acoustic energy to mix liquids, powders, slurries, and pastes rapidly, efficiently, and thoroughly. Please refer to the Users' Manual provided with the LabRAM II mixer for more detailed information about RAM technology and visit www.resodynmixers.com.

This manual will provide vital LabRAM II Jacketed Vessel information on the following:

- Understanding the major components
- Setting up the Jacketed Vessel hardware
- Safe operation of the Jacketed Vessel using a LabRAM II
- Cleaning and maintenance of the equipment
- Obtaining additional accessories or replacement parts

Key features of the LabRAM II Jacketed Vessel:

- Control of fluid temperature from 0°F cooling to 302°F heating (-18°C to 150°C)
- Facilitates mix quality when temperature control is required
- Access ports to enable use of the vacuum processing option
- Enables temperature monitoring with access port for RTD hardware
- Removable, replaceable mixing vessel liner in multiple sizes

The Jacketed Vessel system provides the following processing advantages:

- Improved mixing results via constant or ramped temperature operation before, during, or after mixing
- Control of heating/cooling fluid using LabRAM< II's integrated Operating System
- Recording of vacuum and temperature measurements
- Durable stainless steel construction is compatible with most mixing materials and coolants, including steam, water, antifreeze, hot oil, etc.

Not covered in this manual are:

- Details, use, operation, or repair of LabRAM II, Pharma RAM II, or LabRAM II H mixers. Please refer to those manuals for more information
- Heat transfer fluid heating, cooling, circulation, and control systems. Call 406 497-5333 for more information about heater chiller cooling options

2 Definitions and Abbreviations

Acceleration:	A change in velocity with respect to time that is expressed in "*g*." Different mix media mixes at different accelerations, based on the material and the expected results,
Damping:	A term to quantify the instantaneous amount of energy absorbed by the mix media while mixing.
g:	A measure of acceleration expressed as a multiple of the gravitational acceleration applied to the vessel and mix media during mixing. For example, 10 *g* is 10 times the force of gravity. It may also be shown as *g* or *g*'s. Another term that may be used to describe the acceleration is "gravities."
Headspace:	The volume of compressible air, gas, or void space above the mix media in the vessel that is not occupied by the mix media.
Mixing Media:	Defined as the liquid or solid material inside the mixing vessel.
Mixing Power:	The amount of power being delivered by the RAM system to perform mixing.
Mixing Regime:	Specific modes of mixing. For example, a fluid will change regimes as it undergoes changes in acceleration, from an incompressible liquid containing few headspace bubbles, to a fluid that is fully integrated with the compressible headspace such that the two are indistinguishable from each other.
PTFE:	Polytetrafluoroethylene, also known as Teflon™
RAM:	ResonantAcoustic® Mixing or ResonantAcoustic® Mixer.
Resonance:	The frequency (nominally 60 Hz) at which the system operates in the most efficient manner.
RTD:	Resistance Temperature Detector used to measure the temperature of processing materials
Service Loop:	A gradual arc in lines and cables connected to the Jacketed Vessel to accommodate the vertical movement of the LabRAM II mixing platform during operation.
SS:	Stainless Steel
Vacuum:	Internal vessel pressure that is less than atmospheric pressure. (If using vacuum in combination with heating/chilling, please refer the appropriate Resodyn Vacuum System Manual, or other vacuum utility in use for processing.)

3 Safety Information

Every effort has been made to assure that the LabRAM II Jacketed Vessel is easy to use, reliable, and safe. This section outlines the general safety considerations and highlights important information with caution and warning symbols used throughout this document.

3.1 *General Safety and Assembly Considerations*

For safe operation, the LabRAM II Jacketed Vessel should be operated only within the limits outlined in the system specifications. Specifically, the following classification defines acceptable use and conditions for the LabRAM II Jacketed Vessel:

- 0º to 302°F (-18ºC to 150°C) jacket temperature
- -14.7 to 50 psig (0 to 4.5 bar absolute) product vessel pressure
- 0 to 50 psig (~1 to 4.5 bar absolute) jacket pressure
- Suitable for intermittent or continuous operation.
- For use in non-hazardous environments or, if used with the LabRAM II H mixing platform, in hazardous environments as classified by the United States National Electrical Code (NEC) Class I Div I and Class II Div I.

3.2 *Warnings and Cautions*

Throughout the manual, the following symbol is used to identify warnings and cautions:

	*The caution symbol indicates a potential hazardous situation which could result in minor injury or damage to the product.*

3.3 *Important Safety Notes*

	This equipment should only be operated by trained and qualified personnel with access to and knowledge of the equipment functions.

Mixing operations can generate heat and internal pressure depending on material and mixer accelerations. Always pre-test materials and processes. Do not mix materials longer than what has been characterized as safe.

Note: Changes in noise level or frequency are common during mixing operations.

	**WARNINGS:** Failure to properly seal the heat transfer fluid circuit prior to starting the pump or failure to depressurize the heat transfer fluid circuit prior to opening may result in leakage of heat transfer fluid from the circuit. Use appropriate measures to protect operator and equipment. Turn heat transfer fluid pump off before removing or installing tubing or opening the Jacketed Vessel. **CAUTIONS:** Use recommended fittings only. Use of improper fittings and/or improper connection to fittings may result in leakage at the fittings. A (user supplied) heat transfer fluid circuit pressure relief/bypass valve must be installed in a potentially high-pressure system to prevent the pump from exceeding the maximum rated pressure; i.e., 50 psig (3.5 bar) for the Jacketed Vessel system. A (user supplied) product-side pressure relief valve must be installed (i.e. in the vacuum line) if the LabRAM II Jacketed Vessel is used in applications where the process pressure inside the mixer could exceed 50 psig.

4 General Notes

For use with the LabRAM ll mixer, the Jacketed Vessel assembly consists of:

- Jacket fixture that attaches to the LabRAM II Resonator Plate
- Removable mixing vessel
- Fixture lid with RTD and vacuum ports.

The system bolts into place, replacing the vessel holder on the LabRAM ll and features ports for an RTD temperature probe port and two vacuum lines. The system's metallic surfaces are 316 stainless steel.

4.1 *System Description*

The LabRAM II Jacketed Vessel accessory consists of the following:

- One 316 stainless steel (SS) Jacketed Vessel fixture with 1/8" female NPT connections for heating/cooling transfer fluid inlet and outlet
- One 500 ml/16 oz. payload capacity 316 stainless steel mixing vessel
- One 316 stainless steel fixture lid with fittings for vacuum lines and RTD probe
- One stainless steel Sanitary Quick-Clamp
- Four Viton O-rings (two large and two small), required for face seal between Jacketed Vessel fixture and removable mixing vessel, and between the removable mixing vessel and Jacket fixture lid.

  For O-rings of special materials, please call 406-497-5333
- 6" long 316 SS sheathed Resistance Temperature Detector (RTD)
- PTFE RTD sleeve, ½" PTFE front and rear ferrules, and compression nut
- RTD Cable
- Vacuum lines connecting LabRAM II vacuum ports to Jacketed Vessel fixture Lid
- Four tube plugs (for operation without vacuum, includes two extra)
- Four bolts with washers for anchoring the Jacketed Vessel fixture to the LabRAM II platform
- Two braided SS flex hoses for Jacketed Vessel heating/cooling transfer fluid service loop connections to back panel of LabRAM II

A cutaway of the LabRAM II Jacketed Vessel system including significant components is shown in Figure 4-1.

Note: A compatible LabRAM II mixer and heat/cooling transfer fluid supply system are not included in the Jacketed Vessel components, but are required for its use. Refer to the user manual for your heater/chiller system for installation and operating instructions. If you need a heat transfer supply system, please contact Resodyn at 406-497-5333.

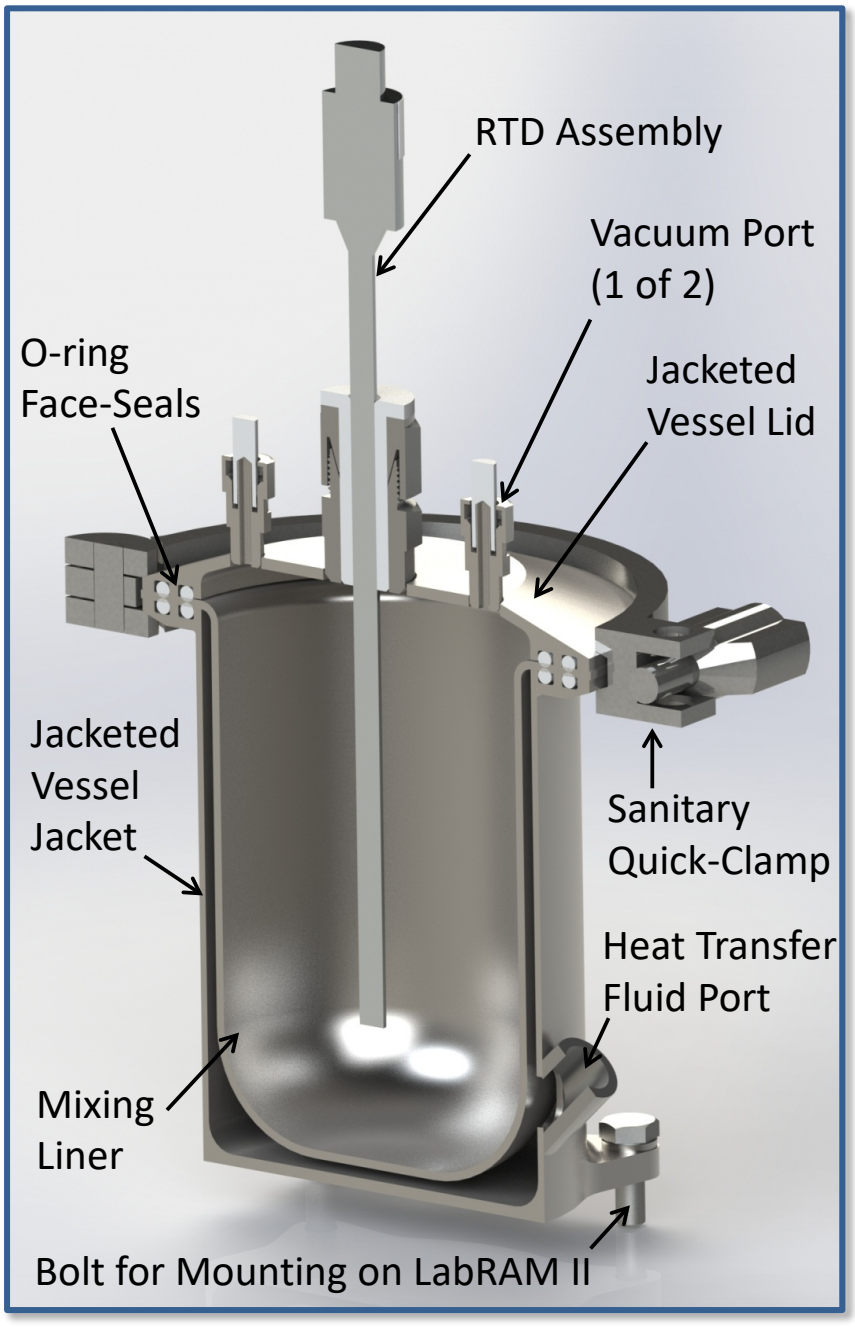

Figure 4-1. Jacketed vessel cutaway showing the components included in the assembly (except hoses and cables).

5 Installation

5.1 *Jacketed Vessel Assembly – Component Pictures*

Key components of the Jacketed Vessel assembly are shown below. They will be referred to throughout this manual.

1. Figure 5-1 shows the main parts of the Jacketed Vessel: the Jacketed Vessel fixture (inside which heating/cooling transfer fluid flows), the removable mixing vessel (in which mix materials are added and mixed), and the Jacketed Vessel fixture lid (with integrated RTD and vacuum ports).
2. In Figure 5-2 the fully assembled Jacketed Vessel is pictured mounted on a LabRAM II mixer resonator plate with all connections attached. Note that each line or cable attached to the Jacketed Vessel fixture forms a gradual arc (or service loop) to accommodate the vertical movement of the LabRAM II mixing platform during operation.
3. In Figure 5-3 the RTD assembly is shown inserted through the RTD PTFE sleeve, ½" nut, back ferrule, and front ferrule.

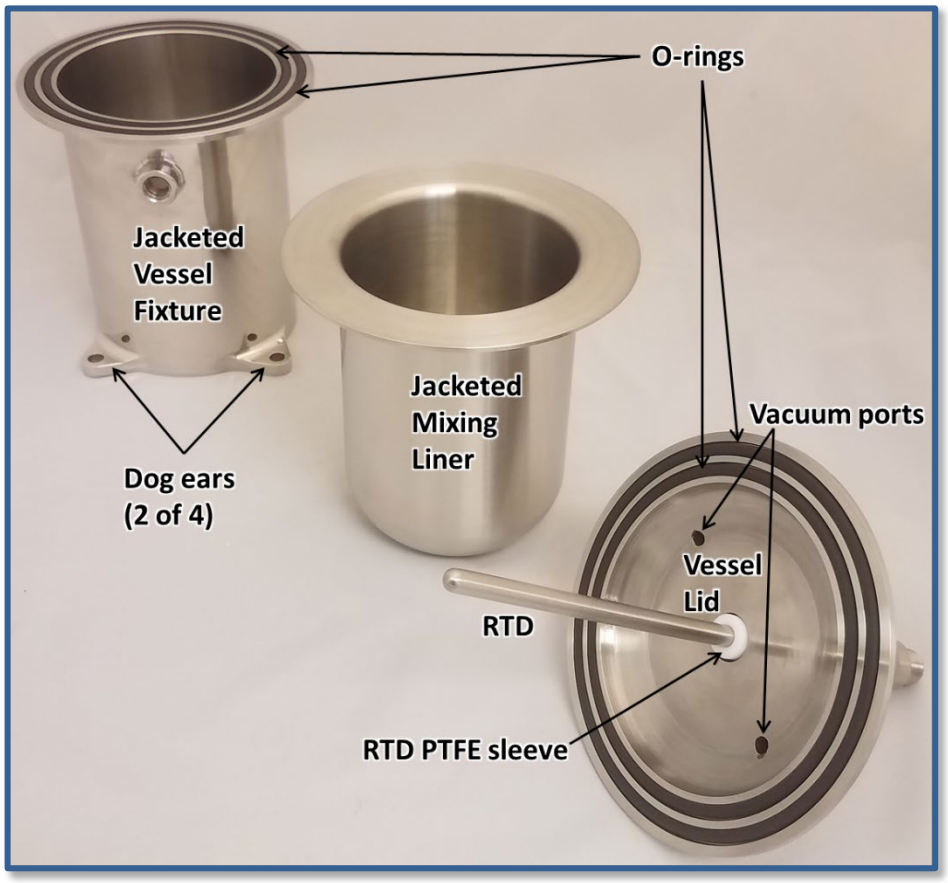

Figure 5-1. Jacketed vessel main components.

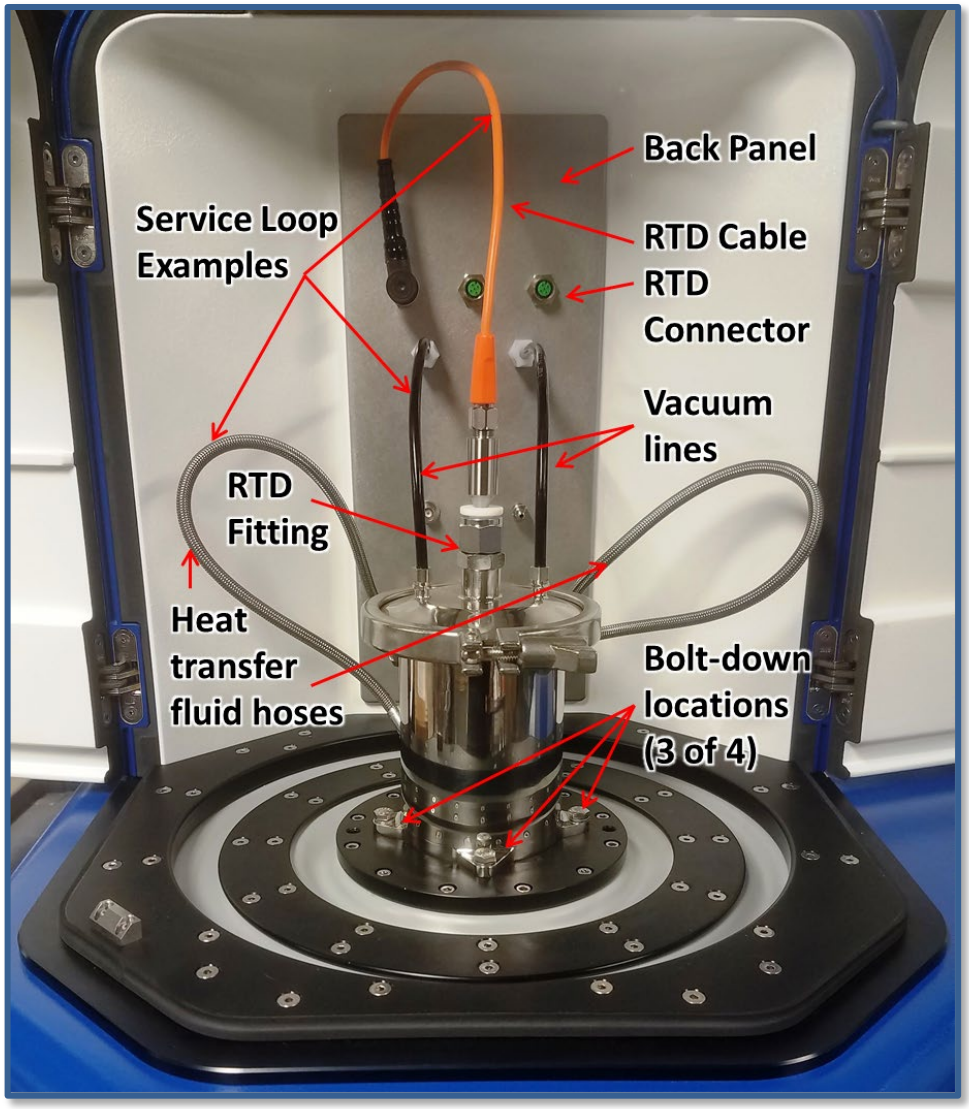

Figure 5-2. Jacketed Vessel mounted on a Resodyn LabRAM II mixer.

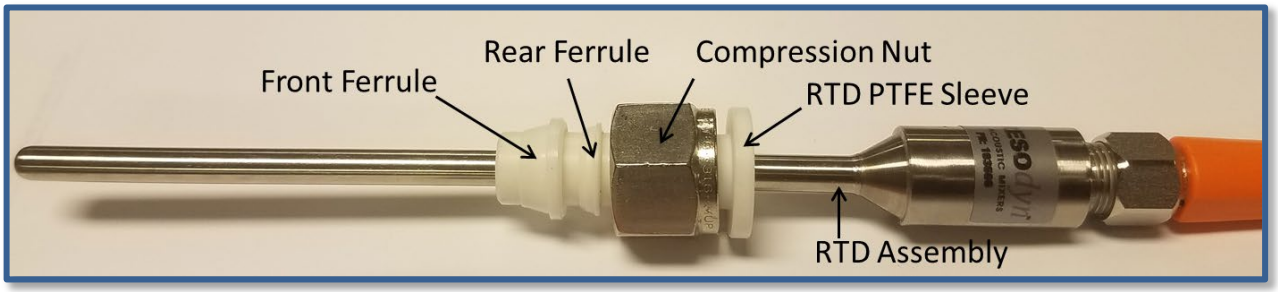

Figure 5-3. RTD assembly, sleeve, nut, and ferrules used to seal the RTD feed.

5.2 *Jacketed Vessel Accessory Installation and Removal*

This section provides instructions for the installation and removal of a Jacketed Vessel on the LabRAM II.

1. Make sure the LabRAM II mixer is turned off whenever installing, manipulating, or removing the Jacketed Vessel assembly.
2. Carefully remove the existing vessel holder on the LabRAM II machine.
3. Locate the four bolt holes for mounting the Jacketed Vessel fixture on the LabRAM II (Figure 5-2) payload plate.

   Attach the Jacketed Vessel fixture to the payload plate using the four mounting bolts. The washers should be installed between the bolt heads and Jacketed Vessel fixture mounting feet, one on each foot, with the orientation shown in Figure 5-2. Torque to 76 in-lbf (8.6 N-m).
4. Connect the stainless steel flex hoses to the Jacketed Vessel by threading the male NPT fitting on the end of one hose into each of the female NPT fittings on the outside of the Jacketed Vessel fixture. Apply thread sealant to ensure a leak-free connection.
5. Install the O-Rings in the Jacketed Vessel fixture. For the large O-Ring groove use the large O-Ring (part number 003306) and use the small O-Ring (part number 003305) in the small O-Ring groove.
6. Attach each of the Heat Transfer Fluid Hoses to the back panel of the LabRAM II mixer as shown in Figure 5.2. The Jacketed Vessel should work equally well regardless of the direction of flow, but if a specific flow direction is desired, note the hose locations.
7. Place the removable Mixing Vessel on top of the now mounted and installed Jacketed Vessel fixture.
8. Place an O-Ring in each of the two O-Ring grooves of the fixture lid. For the large O-Ring groove use the large O-Ring (part number 003306) and use the small O-Ring (part number 003305) in the small O-Ring groove.

   NOTE: Applying a thin layer of vacuum grease (customer supplied) on each O-Ring in the Lid will provide better vacuum. Verify any material is compatible with the vessel and the materials being processed.
9. Place the Jacketed Vessel fixture lid over the broad, removable Mixing Vessel rim, orienting the vessel lid so that vacuum ports form a parallel line with the back panel (see Fig 5.2). Use the Sanitary Quick-Clamp to clamp the lid in place, tightening the clamp nut until the clamp is hand tight.
10. Insert the PTFE Sleeve for the RTD through the hole in the center of the Compression Nut and Rear and Front Ferrules (as shown in Figure 5.3), with the wide rim on top of the nut. Insert the RTD tip through the hole in the center of the PTFE sleeve (Figure 5.3) and mount this assembly onto the fitting on the top of the Jacketed Vessel fixture lid as shown in Figure 4.1. Do not cross-thread the fittings or damage the ferrules.

11. Adjust the RTD height until the tip extends the desired distance from the bottom of the lid to the desired depth into the removable Mixing Vessel. If the RTD does not slide easily through the PTFE Sleeve, loosen the Compression Nut.
12. Attach the L shaped end of the RTD cable to the back panel. The cable will be pointed upward when properly attached to the back panel. Hand tighten the connection.
13. Orient the RTD connector to align with pins in the RTD, push gently into place, and tighten the nut to attach the RTD Cable to top of the RTD. Take care not to damage the pins inside the RTD. Rotate the RTD until all twists are removed. The RTD cable should form a smooth service loop similar to the one shown in Figure 5.2.

	Make sure to rotate the RTD cable to eliminate any twists. Leaving twists in the cable length will reduce the life of the cable and may reduce the life of the RTD

14. Tighten the Compression Nut on the Jacketed Vessel fixture lid until the RTD is held snugly in place at the desired depth. The RTD should not slide up or down relative to the Jacketed Vessel lid during resonant acoustic mixing at high (i.e. 100 *g*) accelerations.
15. If process vacuum is to be used, loosen the white compression nuts in the back panel and thread each of the Vacuum Lines from the vacuum unit through the back of the panel to form a gradual 90 degree arc (service loop) down to the Jacketed Vessel fixture lid as shown in Figure 5.2.
16. Attach the Vacuum Lines to the compression fittings in the Jacketed Vessel Lid by inserting the tubing as far into the lid as possible without forcing, and tightening the compression nut. Then hand-tighten the white compression nuts on the back panel, ensuring that the tubing forms a smooth arc as pictured in Figure 5.2.
17. If process vacuum is not to be used, insert a PTFE Tube Plug (part number 102665) into the vacuum and sensor compression fittings on top of the lid. Note that 2 spare Tube Plugs are included with the unit for times that the vacuum lines are not connected.
18. With the Jacketed Vessel assembly clamped closed, check the vacuum and heating/cooling transfer fluid circuits at full pressure and flow rate to make sure they do not leak. Fix any leaks prior to use.
19. Isolate the Jacketed Vessel assembly from the vacuum pressure (if used) and heating/cooling transfer fluid supply pressure (e.g. turn off the heat transfer fluid pump).

	If the Jacketed Vessel is not isolated from the heating/cooling transfer fluid supply pressure before unclamping the Jacketed Vessel, heat transfer fluid will leak out onto the mixer platform.

20. Removal is the reverse of installation. Be sure to isolate the Jacketed Vessel from the vacuum pressure (if used) and heating//cooling transfer fluid supply pressure (e.g. turn off the heat transfer fluid pump) as the first step. When removing the mix liner, some heat transfer fluid may drip from the mix liner. It may also be extremely cold or hot. Use proper PPE.

	When removing the mix liner, some heat transfer fluid will drip off the mix liner, it may be extremely cold or hot. Use proper PPE.

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6 Operating Instructions

6.1 *LabRAM II Jacketed Vessel Accessory Operation*

1. Isolate the Jacketed Vessel from the vacuum pressure (if used) and heating/cooling transfer fluid supply pressure (e.g. turn off the heat transfer fluid pump).

	If the Jacketed Vessel is not isolated from the heating/cooling transfer fluid supply pressure before unclamping the Jacketed Vessel, transfer fluid will leak out onto the mixer platform.

2. Loosen and remove the Sanitary Quick-Clamp and remove the Jacketed Vessel fixture lid from the Jacketed Vessel fixture.
3. Add any ingredients you will be mixing to the removable Mixing Vessel (and if appropriate, place the Mixing Vessel back inside the Jacketed Vessel fixture making sure the O-rings are in place).
4. Replace the lid (with O-rings in place) on top of the removable Mixing Vessel and use the Sanitary Quick-Clamp to clamp the lid in place, tightening down the clamp nut until the clamp contacts the Jacketed Vessel fixture around the entire perimeter and the clamp is hand tight.
5. Begin flowing or circulating heating/cooling transfer fluid through the Jacketed Vessel and allow the system to come to the desired mixing temperature. If any leaks are observed in the system, stop the flow and fix the leaks.

6. Use the LabRAM II and vacuum pump (if used) to perform the desired processing (see LabRAM II users' guide and vacuum pump manual for operating directions).

7. Once the mixing is completed, isolate the Jacketed Vessel assembly from the vacuum pressure (if used) and heating/cooling transfer fluid supply pressure (e.g. turn off the heat transfer fluid pump).

	If the Jacketed Vessel is not isolated from the transfer fluid supply pressure before unclamping the Jacketed Vessel, transfer fluid will leak out onto the mixer platform.

8. Loosen and remove the Sanitary Quick-Clamp and remove the Jacketed Vessel fixture lid from the removable Mixing Vessel to recover the processed material. Take care not to contaminate the materials with the transfer fluid from the underside of the Mixing Vessel liner.

7 Service Information

7.1 *Maintenance and Service*

The LabRAM II Jacketed Vessel accessory should only be operated when it is in good working condition. If the system shows any signs of visible damage or fails to operate as outlined in this manual, the system should not be operated.

If necessary, contact your Resodyn Acoustic Mixers customer service representative for questions or additional technical support related to the mixer.

Technical Support for Mixer and Jacketed Vessel Operation and Maintenance:

Phone: (406) 497-5333 Fax: (406) 497-5206 e-mail: service@resodynmixers.com	Resodyn Acoustic Mixers 130 North Main, Suite 630 Butte, Montana 59701

8 Supplemental Information

8.1 *Replacement Parts*

Item	Quantity	Part Number	Description
1	1	102759	Jacketed Vessel Jacket
2	1	2805	Sanitary Quick-Clamp,
3	4	2806	Washer, 1/4"
4	1	3306	O-Ring, Large, Viton
5	1	3305	O-Ring, Small, Viton
6	4	A01A-0250-20-00750-ABB	1/4" Hex Head Bolt
7	1	102760	Mixing Liner, 16 oz., Stainless
8	1	102761	Jacketed Vessel Lid
9	1	102784	RTD PTFE Sleeve
10	1	3305	O-Ring, Small, Viton
11	1	3306	O-Ring, Large, Viton
12	1	903345	RTD Cable (not shown)
13	1	903324	RTD Assembly, 6" Probe
14	1	2956	1/2" PTFE Ferrule Set
15	4	102665	Tube Plug, PTFE
16	2	1339	Heat Transfer Fluid Hose for Service Loop (not shown)
17	2	3285	Antistatic Tubing for Vacuum Lines (not shown)

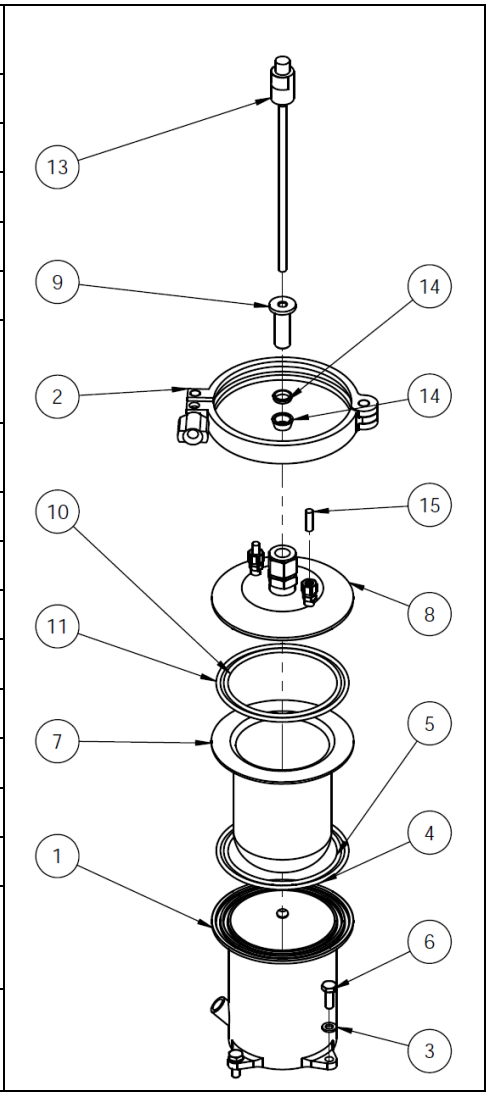

Figure 8-1: LabRAM II Jacketed Vessel Components

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