SORVALL®

SORVALL®
Cellwasher 2

OPERATING INSTRUCTIONS

Kendro®

PN 04505-32

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SORVALL® Cellwasher 2

Cell Washing System

Kendro Laboratory Products
Asheville, North Carolina
U.S.A.

SORVALL® Kendro

PN 04505-32
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This manual is a guide to the use of the

SORVALL® Cellwasher 2 Cell Washing System

Data herein has been verified and is believed adequate for the intended use of the Cellwasher 2. Because failure to follow the recommendations set forth in this manual could produce personal injury or property damage, always follow the recommendations set forth herein. Kendro does not guarantee results and assumes no obligation for the performance of centrifuges or other products that are not used in accordance with the instructions provided. This publication is not a license to operate under, nor a recommendation to infringe upon, any process patents.

The SORVALL Cellwasher 2 is intended to be used in strict accordance with The American Association of Blood Banks' guidelines defined in the most recent edition of the AABB Technical Manual (published by AABB Press. Bethesda, MD).

Publications prior to the Issue Date of this manual may contain data in apparent conflict with that provided herein. Please consider all data in this manual to be the most current.

WARNING, CAUTION, and *NOTE* within the text of this manual are used to emphasize important and critical instructions.

> *WARNING* informs the operator of a hazard or an unsafe practice that could result in personal injury, affect the operator's health, or contaminate the environment.
>
> *CAUTION* informs the operator of an unsafe practice that could result in damage of equipment.
>
> *NOTE* highlights essential information.

CAUTION and *WARNING* are accompanied by a hazard symbol ⚠ and appear in the left sidebar near the information they correspond to.

Important Safety Information

Certain potentially dangerous conditions are inherent to the use of all centrifuges. To ensure safe operation of this centrifuge, anyone using it should be aware of all safe practices and take all precautions described below and throughout this manual.

WARNING

When using radioactive, toxic, or pathogenic materials, be aware of all characteristics of the materials and the hazards associated with them in the event leakage occurs during cell washing. If leakage does occur, neither the Cellwasher 2 nor the rotor can protect you from particles dispersed in the air. To protect yourself, we recommend additional precautions be taken to prevent exposure to these materials, e.g., use of controlled ventilation or isolation areas.

Always be aware of the possibility of contamination when using radioactive, toxic, or pathogenic materials. Take all necessary precautions and use appropriate decontamination procedures if exposure occurs.

Never use any material capable of producing flammable or explosive vapors, or creating extreme exothermic reactions.

Use only tubes that meet the criteria provided in this manual (see Tube Selection and Use, Chapter 3). Results may be affected if tubes are not within specifications. If tubes are of inadequate strength so that tube breakage occurs, sample and test results will be lost, the rotor and distributor could be damaged, and during required cleanup, contact with sharp glass fragments could result in personal injury.

CAUTION

Do not operate Cellwasher 2 without a rotor properly installed on the drive shaft. See Rotor and Distributor Installation, Chapter 2.

Do not operate the Cellwasher 2 with a rotor out of balance. To do so can cause damage to the Cellwasher 2 drive assembly. See Rotor Loading and Balancing, Chapter 2.

We recommend using Coomb's control cells to confirm all negative results.

The Cellwasher 2 can be damaged if connected to the wrong voltage. Check the voltage before plugging the instrument into a power source. Kendro is not responsible for incorrect installation.

Always maintain the Cellwasher 2 in the recommended manner. See Chapter 4, Maintenance.

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Chapter 1: DESCRIPTION

This manual contains information required to operate and maintain the SORVALL® Cellwasher 2 Cell Washing System. If you require additional information regarding operation or maintenance, please contact Kendro for assistance. In the United States, call Kendro toll-free 1-800-522-7746; outside the United States, contact the nearest Kendro office (see back cover) or your local representative for SORVALL® products. SORVALL® product information is available on our internet web site at ***http://www.kendro.com*** or ***http://www.kendro.de.***

Cellwasher 2 Description

The Cellwasher 2 is designed to perform the washing phase of the Coomb's Procedure automatically. In normal AUTO mode operation, after placing two or three drops of a pre-prepared 2 to 5% red blood cell/saline suspension* into each tube, the Cellwasher 2 will automatically add saline, spin at high speed to concentrate the cells, decant the saline, and agitate to resuspend the washed cells for the addition of Coomb's reagent. The Cellwasher 2 is also capable of being used manually as a low speed centrifuge, spinning at either of two preset speed ranges (LOW speed or HIGH speed mode, see *Cellwasher 2 Specifications* on next page).

The Cellwasher 2 combines a peristaltic saline pump and a wet chamber centrifuge in one cabinet. The centrifuge portion uses a dedicated DA-12 Rotor, which is a unique dual-angle swinging-bucket rotor that is designed to accommodate up to 12 each of either 3 ml or 5 ml tubes. The Cellwasher 2 is microprocessor-controlled, featuring a front control panel with sensor-touch keys and a digital timer for the wash cycle. Other features include a saline-detect system with an audible low-saline warning, and an agitate cycle that ensures complete resuspension of cells and eliminates manual agitation.

Applications Information

The Cellwasher 2 is intended to be used in routine blood work to speed up and simplify the procedures for determining human blood groups and types. Often, the results of blood tests made using the Cellwasher 2 determine donor/patient compatibility for blood transfusions, and the results of these tests must be accurate to prevent serious transfusion reactions. If testing procedures provided by the reagent manufacturers are not followed exactly, or if test materials are outdated, accurate test results cannot be guaranteed.

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* The Cellwasher 2 *is not* designed to *automatically* separate donor whole blood to create the necessary 2 to 5% red blood cell/saline suspension. The Cellwasher 2 may, however, be used as a centrifuge to *manually* separate red blood cells from whole blood.

False Coomb's readings can be caused by any of the following:

- Improper ratio of patient serum and cells.
- Incomplete washing of cells.
- Contaminated saline or supply tubing.
- Improper decanting of saline solutions.
- Inactive Coomb's serum.
- Failure to add Coomb's serum to a tube.
- Improper final centrifugation.
- Inaccurate reading or recording of results.

W A R N I N G

We recommend using Coomb's control cells to confirm all negative results.

While the Cellwasher 2 provides accurate washing, decanting, and a proper speed for the final spin, it does not eliminate all potential errors. Proper laboratory procedures require adequate controls of all tests performed with this instrument (***read the WARNINGS***). Refer to Tables 4-5, 4-6, and 4-7 for applications troubleshooting information. When using the Cellwasher 2, always follow standard laboratory procedures in handling and disposing of blood serum, and observe safety precautions and good laboratory practices.

W A R N I N G

The SORVALL Cellwasher 2 is intended to be used in strict accordance with The American Association of Blood Banks' guidelines defined in the most recent edition of the AABB Technical Manual (published by AABB Press. Bethesda, MD).

Cellwasher 2 Specifications

Dimensions:

Depth		35.6 cm (14.0 inches)
Width		31.8 cm (12.5 inches)
Height:	Lid closed	36.8 cm (14.5 inches)
	Lid open	57.2 cm (22.5 inches)

Mass (Weight): . . . . . 16.4 kg (36.0 lbs)

Motor Type: . . . . . 3-speed induction

*Speeds:**

60 Hz Models:	Low	1100 to 1200 rpm
	High	3500 to 3600 rpm
	Decant	550 to 600 rpm
50 Hz Models:	Low	1400 to 1500 rpm
	High	2900 to 3000 rpm
	Decant	550 to 600 rpm

Length of Modes:

Automatic	Each multi-step wash cycle is 80 seconds, except on 100V 50 Hz models, which have 90-second cycles.
Manual	High or low, optional, up to 999 seconds if timed; high speed indefinite if in HOLD

* Speed in revolutions per minute (rpm) is related to angular velocity, ω, according to the following:

$$\omega = (\text{rpm})\left(\frac{2\pi}{60}\right) = (\text{rpm})\,(0.10472)$$

Where w = rad/s. All further references in this manual to speed will be designated as rpm.

Time Display Accuracy: ..... ±3% (Manual Mode*)

Noise Level: ..... <60 dB**

Rotor Radii:

$r_{maximum}$	9.43 cm
$r_{average}$	6.015 cm
$r_{minimum}$	2.60 cm

Relative Centrifugal Force:

60 Hz Models:	Low	at r_{max}	127 to 152 *g*
		at r_{avg}	81 to 97 *g*
		at r_{min}	35 to 42 *g*
	High	at r_{max}	1290 to 1365 *g*
		at r_{avg}	823 to 871 *g*
		at r_{min}	356 to 376 *g*
50 Hz Models:	Low	at r_{max}	206 to 237 *g*
		at r_{avg}	132 to 151 *g*
		at r_{min}	57 to 65 *g*
	High	at r_{max}	886 to 948 *g*
		at r_{avg}	565 to 605 *g*
		at r_{min}	244 to 261 *g*

*Electrical Requirements:****

Electrical Supply ..... 120V ±10%. 60 Hz, 5A
100V ±10%. 60 Hz, 5A
100V ±10%. 50 Hz, 5A
230V ±10%. 50 Hz, 2.5A

WARNING

Tubes must be able to withstand up to 1365 *g* (948 *g* in 50 Hz operation) when run at a 45° angle with tube walls point-loaded and otherwise unsupported. Using tubes of inadequate strength could result in tube breakage: sample and test results will be lost, the rotor and distributor could be damaged, and cleanup will be required. During cleanup, be aware that glass fragments are sharp, and contact could result in personal injury.

Tube Requirements:

Tube Strength		Centrifuge-rated to handle at least 1365 *g* unsupported (for 50 Hz operation, at least 948 *g* unsupported)
Tube Material:		Type 1, class A borosilicate or equivalent high-strength rolled glass (such as Pyrex®)
Tube Style:		Round bottom, thick walled, rimless (no flange or bead)
Tube Size:	Volume (all places)	5 ml or 3 ml****
	Diameter	5 ml: 12 mm +0.0/–0.5 3 ml: 10 mm +0.0/–0.5
	Length	75 mm ±1.5
	Wall Thickness	0.9 mm ±0.1

* At the start of a Manual run, the timer function is delayed for several seconds before beginning, so that timing occurs only when the rotor is spinning; the timer is inactive during the initial aggitation step that occurs before the spin starts.

** The maximum noise output with the instrument running at HIGH speed, measured 3 feet from the front panel at an approximated operator's height.

*** Electrical requirements are indicated on the rating plate on the back of the instrument.

**** A set of Adapter Clips (Catalog No. 04330, 12/pkg., supplied) is required when using 3 ml, 10 mm diameter tubes in the DA-12 Rotor.

Accessories

The accessories listed in Table 1-1 are supplied with all Cellwasher 2 models.

Table 1-1. Accessories Supplied

Catalog Number	Description
43260	Distributor Assembly – for 12 mm x 75 mm and 10 mm x 75 mm tubes
12977	Tubing Kit containing: 1- 255 mm (10 inch) long frosted Pump Tubing 1- 1650 mm (65 inch) long, large diameter (5/16 inch i.d., 7/16 inch o.d.) clear Tygon® Tubing from which to cut: 1- Overflow Tubing 150 mm (6 inch) long 1- Discharge Tubing 200 mm (8 inch) long 1- Drain Tubing (cut desired length from remainder; 1220 mm [48 inch] supplied on new product) 1- 2900 mm (114 inch) long, small diameter (1/4 inch i.d., 3/8 inch o.d.) clear Tygon® Tubing from which to cut: 1- Flow Tubing 305 mm (12 inch) long 1- Vent Tubing 150 mm (6 inch) long 1- Supply Tubing (cut desired length from remainder; 610 mm [24 inch] supplied on new product) 1- Pump Connector 2- Y-Connectors 2- Adjustable Tubing Clamps 2- Nylon Cable Ties Installation Instructions
12925	Flow Control Valve
04285	DA-12 Rotor (includes a set of 12 Adapter Clips for use with 3 ml 10 mm x 75 mm tubes, Catalog No. 04330)
12796	Rotating Bowl Assembly

SORVALL® 5 ml, 12 mm x 75 mm Pyrex® tubes (Catalog Number 03102, 50/box), and SORVALL® 3 ml, 10 mm x 75 mm Pyrex® tubes (Catalog Number 03100, 50/box) are not supplied, but are recommended for use in the Cellwasher 2.

Chapter 2: INSTALLATION

This chapter contains the information needed to unpack and install the SORVALL® Cellwasher 2.

Unpacking

As soon as you receive your Cellwasher 2, carefully inspect it for any shipping damage that may have occurred. If you find any damage, please report it immediately to the transportation company and file a damage claim, then notify Kendro. Check all packages received against the shipping list and, after unpacking, check the accessories received against Table 1-1 on page 1-4; if any items are missing, contact Kendro (see back cover).

Location

Place the Cellwasher 2 on a sturdy, level bench or table near a sink, drain, or waste container that can receive the decanted saline. The following factors should be considered when selecting a location:

CAUTION

Cooling air is drawn into the Cellwasher 2 from all four sides of the base. Be sure that the entrances are not obstructed.

WARNING

During operation, never lean on or move the instrument, keep the defined clearance area clear of all objects (including all hazardous and flammable materials), and do not work within the clearance area.

- Allow a 150 mm (6 inch) clearance area behind the instrument for tubing and a waste container. For safe operation, maintain a 50 mm (2 inch) "clearance envelope" on all sides.

  Personnel should know that the Cellwasher 2 routinely deals with significant energy levels and could move suddenly in the unlikely event of a rotor failure. Laboratory management procedures should require that no person or any hazardous materials are within the clearance envelope while the Cellwasher 2 is operating. During operation, personnel should be instructed not to lean on or move the Cellwasher 2, not to stay within the clearance envelope longer than necessary for operational reasons, and not to deposit potentially hazardous materials within the clearance envelope.
- Allow a 610 mm (24 inch) clearance above the tabletop or bench surface for lid to open.
- Drainage in the Cellwasher 2 is accomplished by gravity, so the discharge tubing must extend downward from the instrument to drain, sink, or waste receptacle.
- The preferred location for the saline supply is either at or above instrument level.
- To obtain best results, minimize tubing length from the saline supply to the Cellwasher 2 and from the Cellwasher 2 to the drain, sink, or waste receptacle.

Environmental Conditions

An ambient temperature range of 10°C to 38°C (50°F to 100°F) should be maintained for Cellwasher 2 operation. The relative humidity can be up to 90%, non-condensing.

The Cellwasher 2 is intended for use in 1) a Pollution Degree 2 Environment, 2) an installation category II supply circuit, and 3) at a maximum altitude of 2000 meters. The Cellwasher 2 is a Class A product and is not intended for home use. If used in a domestic environment, it may cause radio interference, in which case the user may be required to take adequate measures.

Electrical Requirements

WARNING

The receptacle used should be a grounded 3-wire system. If it is not, the equipment must be grounded to reduce the possibility of electrical shock.

The Cellwasher 2 has a 3-wire (2-pole and earth) power cord with a universal keyed plug that inserts into a receptacle at the back of the instrument. The other end must be connected to the appropriate power supply as specified below and on the rating plate on the back of the instrument.

120V ±10%, 60 Hz, 5A; 100V ±10%, 60 Hz, 5A;
100V ±10%, 50 Hz, 5A; or 230V ±10%, 50 Hz, 2.5A

Cellwasher 2 120V and 100V power cords use a NEMA 5-15P three-prong molded plug with a ground pin and parallel blades that will fit Hubbell receptacle No. 5261 for 120 volts. 230V power cords are CE-rated, and are supplied with a 3-pin plug that fits a 16A CEE-17 single-phase receptacle (2-pole and earth).

The ON/OFF main power switch has a 3-Amp fuse; however, for emergency disconnect purposes, we recommend a separate means of power interruption in a remote location.

Tubing Installation

NOTE The overflow tubing serves as an emergency liquid exit to protect instrument components in the event of tube breakage or drain blockage. To ensure that potentially biohazardous liquid does not exit into the work surface, route overflow tubing to a 250 ml (or larger) open waste container.

The Cellwasher 2 comes with the tubing already connected to the instrument, but not installed in the peristaltic pump (do not open the tubing replacement kit, save it for future use). To complete the tubing installation, unwrap the bundle of tubing at the back of the instrument and, referring to figure 2-1 and table 2-1, install the tubing according to the procedure that follows.

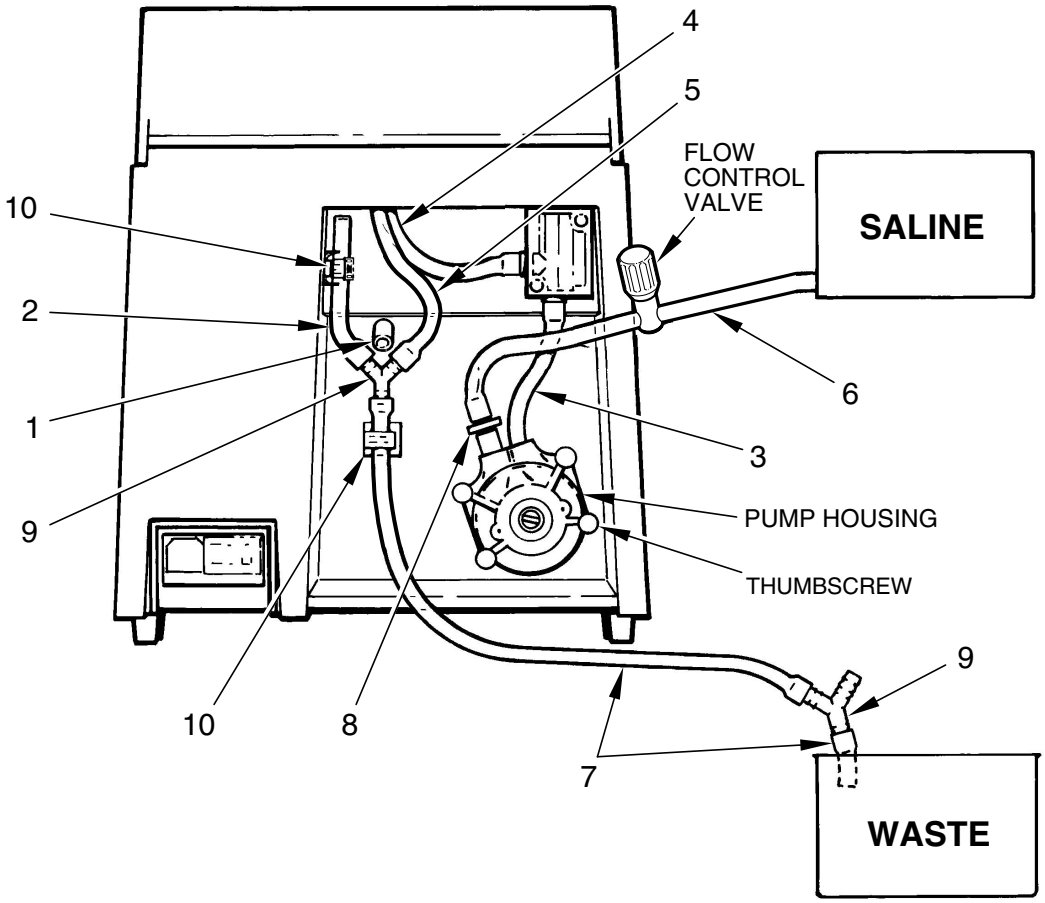


Figure 2-1. Cellwasher 2 Tubing Diagram

Table 2-1. Parts Location: Tubing Diagram (keyed to figure 2-1)

Item	Description
1*	Overflow Tubing (from overflow tray), 150 mm (6 inch)
2	Vent Tubing, 150 mm (6 inch)
3	Pump Tubing, 255 mm (10 inch), frosted
4	Flow Tubing (to nozzle), 305 mm (12 inch)
5	Discharge Tubing (from collector ring), 200 mm (8 inch)
6	Supply Tubing, 610 mm (24 inch),
7	Drain Tubing 1220 mm (48 inch),
8	Pump Connector
9	Y-Connector
10	Adjustable Tubing Clamp

* In the event of saline residual in the rotor chamber (for example, from overfill of tubes or tube breakage) saline will exit through this tube. Under normal operating conditions, saline will exit through the drain tubing not through the overflow tube.

1. Unscrew the four knurled thumbscrews from the peristaltic pump, and remove the front half of the pump housing (do not remove the pump roller assembly).

2. Turn the roller assembly so that one of the rollers is in the 11 o'clock position.

3. Position the 255 mm (10 inch) frosted pump tubing (with pump connector) in front of the pump so that the connector is positioned just above the left side of the pump, then without turning the roller assembly, route the pump tubing around the rollers.

4. Pull up on the two ends of the pump tubing to fit the tubing between the pump housing and the lower roller.

NOTE Do not try to fit the pump tubing with a sharp object, this could puncture the tubing.

5. With the pump tubing properly positioned in the back half of the pump housing, reinstall the front half of the housing. Gently stretch the ends of the pump tubing to eliminate slack while fitting the front half of the housing in place.

6. Visually check to make sure that the front half of the housing is properly aligned and fully seated against the back half (a gap indicates that the pump tubing is pinched; if so, remove the front half of the housing and repeat steps 3 through 6).

7. Install the four thumbscrews and hand-tighten.

8. Check the pump tubing installation by turning the roller assembly shaft counterclockwise using pliers (the rollers should rotate smoothly without pinching tubing).

W A R N I N G

Saline solution from some manufacturers contain sodium azide as a preservative. If this solution is discharged directly down the drain, explosive azide salts may form as the sodium azide reacts with the plumbing. Check with your saline supplier before discharging saline from the Cellwasher 2 into a drain.

9. If the 610 mm (24 inch) supply tubing is too long, cut it to an appropriate length, then slide the flow control valve (catalog number 12925, supplied) onto the supply tubing, and connect the end of the supply tubing to a saline supply reservoir.

NOTE The preferred location for the saline supply is either at or above instrument level. If, at some later time, the saline reservoir is moved from its original location, recheck the saline volume by priming the system as directed in Chapter 3, Operation, Priming the System.

10. Make sure the drain tubing flows downward to an open sink, drain, or waste receptacle because drainage is accomplished by gravity. Use the shortest length of drain tubing possible (if the 1220 mm (48 inch) tubing is too long, cut it to an appropriate length) and make sure the drain tubing is positioned so there is no upward travel to result in a "trap" for collected waste fluid.

11. Ideally, the drain tubing should be positioned so that it can not become immersed in collected waste fluid. However, if there is a possibility that the drain tubing will become immersed in waste fluid, cut the drain tubing at a convenient point near the waste receptacle and insert the Y-Connector. Always insert a Y-Connector in the drain line when using a waste receptacle.

NOTE The Y-Connector prevents pressure from building up in the drain tubing due to submerged tubing or air blockage. Failure to vent the drain tubing by installing the Y-Connector can result in improperly decanted samples.

12. If necessary, use additional tubing and connectors from the Tubing Kit shipped with the Cellwasher 2 to supply saline and discharge waste properly.

Rotor and Distributor Installation

a. DA-12 Dual Angle Rotor and Rotating Bowl Installation

1. Open the lid of the Cellwasher 2.

NOTE There may be one or more holes in the stainless steel rotating bowl. The holes are for balancing purposes only and will not affect the performance of the rotating bowl.

2. Position the rotating bowl assembly (catalog number 12796, supplied) over the motor drive shaft. Align the two drive pins in the bowl with the slot in the drive shaft (see figure 2-2). Slide the bowl down the drive shaft until the two pins in the bowl engage the rubber drive ring. Press the bowl down firmly.

3. Slide the DA-12 Rotor (catalog number 04285, supplied) over the drive shaft and lower it gently into the bowl.

4. Hold the edge of the bowl and turn the rotor slowly until the drive pins in the bowl engage the rotor and the rotor drops down onto the bottom of the bowl.

b. Distributor Installation

Place the Distributor (catalog number 43260, supplied) over the rotor knob (see figure 2-3). Turn the distributor until its three pins engage the three holes in the rotor. Press the distributor down until it is completely seated on the rotor.

⚠ CAUTION

If the rotating bowl assembly, rotor, and distributor are not installed properly, damage to the instrument could result. Before operating the Cellwasher 2:

- Make sure the drive pins in rotating bowl are engaged in the rubber drive ring and in the rotor.
- Make sure the distributor is firmly seated on the rotor with the distributor pins completely engaged in the rotor (see figure 2-3).

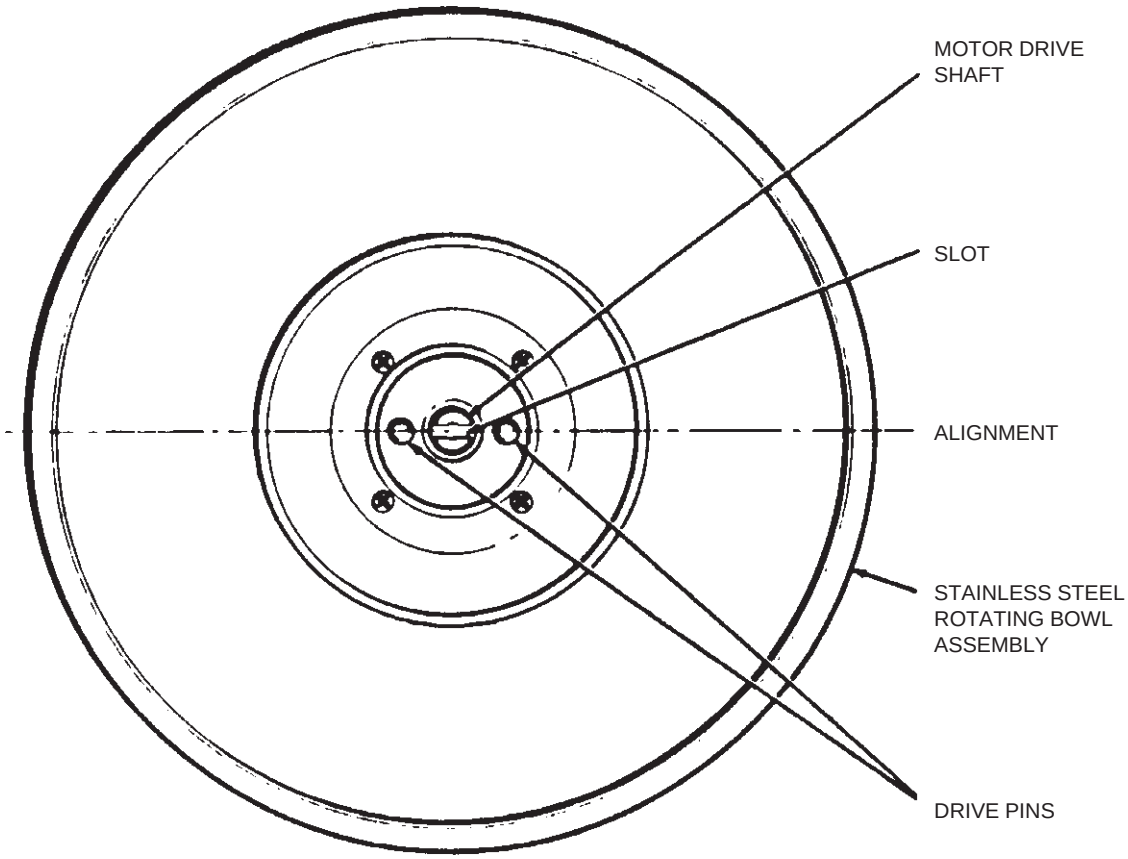


Figure 2-2. Stainless Steel Rotating Bowl Installation

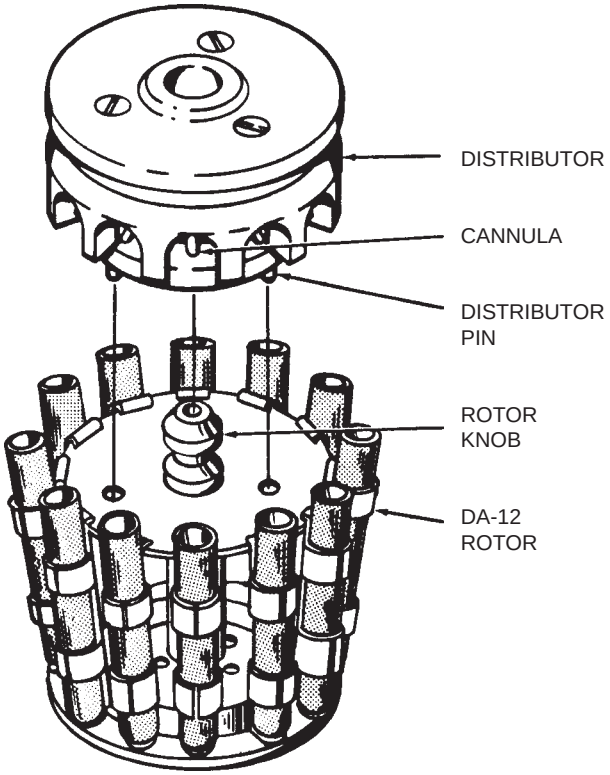


Figure 2-3. Distributor Installation

Rotor Loading and Balancing

WARNING

Results may be affected if tubes are not within the specifications provided in Chapter 1 on page 1-3. Using tubes of inadequate strength could result in tube breakage: sample and test results will be lost, the rotor and distributor could be damaged, and cleanup will be required. During cleanup, contact with glass fragments could result in personal injury.

The Cellwasher 2 can process any balanced load up to twelve tubes. When using less than a full complement of tubes, place the tubes in opposing compartments to ensure that the rotor is symmetrically balanced (see figure 2-4). The volume of saline delivered through the distributor will be the same; at the locations without tubes, the saline will be dispensed into the basin and drained off. ***Read the WARNING.***

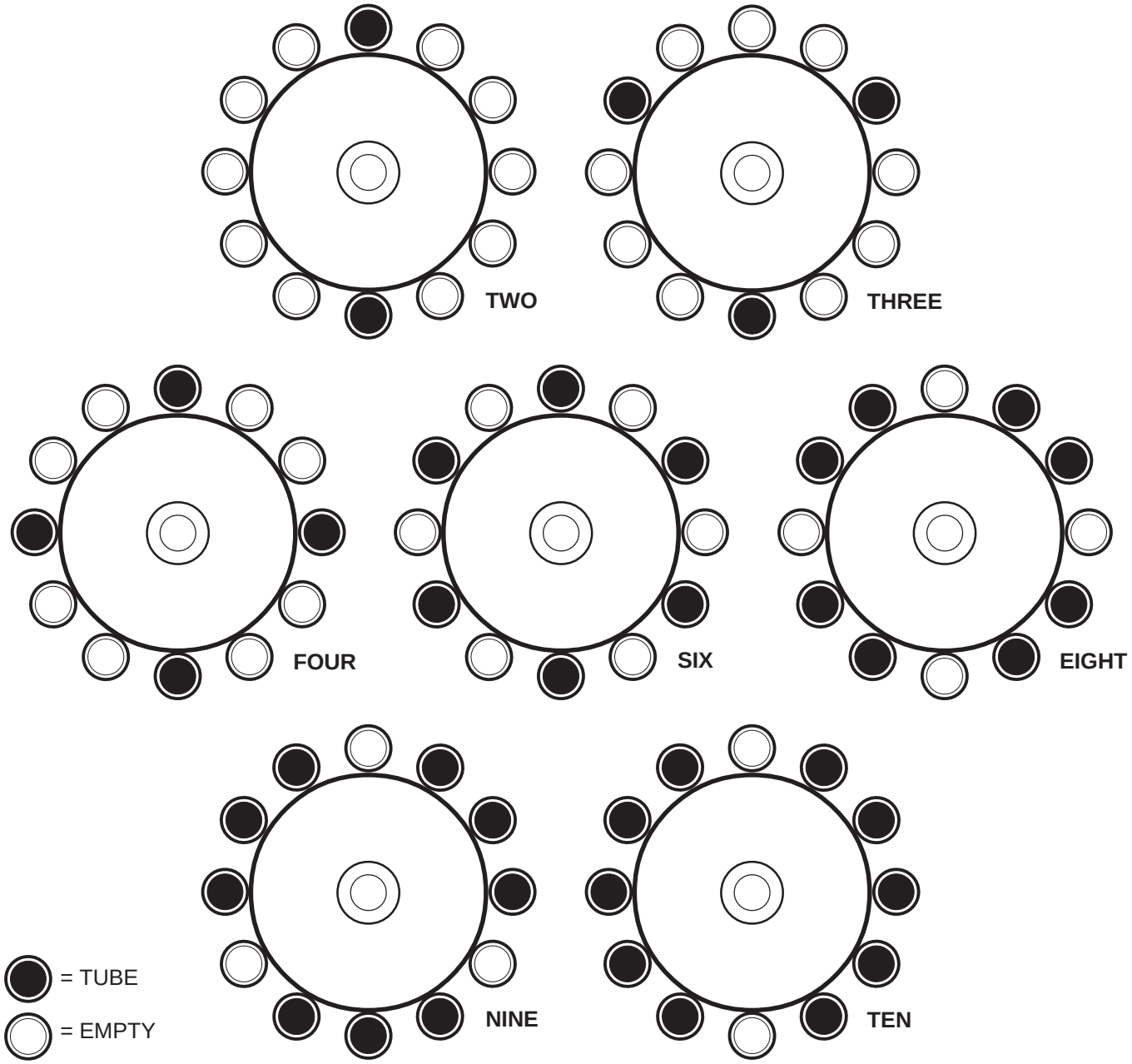


Figure 2-4. Tube Placement for Balancing Less Than Twelve Tubes

Chapter 3: OPERATION

This chapter describes the controls, indicators and operating procedures for the SORVALL® Cellwasher 2.

Controls and Indicators

WARNING

The SORVALL Cellwasher 2 is intended to be used in strict accordance with The American Association of Blood Banks' guidelines defined in the most recent edition of the AABB Technical Manual (published by AABB Press. Bethesda, MD).

All controls and indicators for the Cellwasher 2 are located on the front panel keyboard, except for the main power switch and the remote saline flow control valve. The sensor-touch controls register commands visually and/or audibly.

Power to the instrument is controlled by a switch located in the lower right hand corner of the Cellwasher 2, beneath the keyboard. The symbol "I" indicates ON, while the symbol "O" indicates the OFF position. Switching the power off erases any manually programmed spin times from the memory.

Table 3-1 lists and describes the controls and indicators that can be found on the front panel. Figure 3-1 identifies each item and shows the location on the keyboard.

Table 3-1. Cellwasher 2 Controls and Indicators
(keyed to Figure 3-1)

Item	Name	Acceptance Signal	Function
1	AUTO	LED* Lights up, accompanied by one beep.	Selects AUTO run mode for automatic wash cycle.
2	HIGH	LED* lights up, accompanied by one beep.	Selects HIGH speed run for duration of time selected, or indefinitely if HOLD is selected.
3	LOW	LED* lights up, accompanied by one beep.	Selects LOW speed run for duration of time selected; HOLD is not to be selected.
4	CHECK	LED* lights up, accompanied by one beep.	When in AUTO mode only, stops at the end of any step in the wash cycle to allow verification of procedure.
5	CYCLE	Panel key illuminates, digital cycle display accompanied by one beep.	Selects 1, 2, 3 or 4 wash cycles during the AUTO mode.

(continued)

*LED, or light emitting diode, refers to the small amber light adjacent to the panel button.

Table 3-1. Cellwasher 2 Controls and Indicators ***(continued)***

Item	Name	Acceptance Signal	Function
6	CYCLE DISPLAY		Displays the number of wash cycles selected in the AUTO mode.
7	TIME DISPLAY		Displays the time selected for AUTO, HIGH, or LOW mode in seconds.
8	TIME	Digital time display, accompanied by one beep.	In HIGH or LOW mode only, selects duration of centrifugation time in seconds.
9	START	LED* lights up, accompanied by one beep.	Starts the mode selected.
10	STOP	LED* lights up, accompanied by one beep.	Stops the spin in progress. In AUTO, HIGH, or LOW mode, the program will return to conditions at the start of the run.
11	PRIME	Single beep.	Primes the pump for 6 seconds.
12	AG	Single beep.	Agitates the rotor for 5 seconds to resuspend cell button.
13	CLEAR	Single beep.	In HIGH or LOW mode only, clears digital display so that time can be reset.
14	ALARM OFF		In AUTO mode only, turns off the alarm.
15	STEP		In AUTO mode only, bypasses one step at a time in the wash cycle for each push of the button.
16	HOLD	Single beep.	In HIGH mode only, sets the centrifuge to spin indefinitely; not to be selected in LOW mode.
17	ALARM	Single beep, ALARM lights up.	In AUTO mode only, activates an alarm that sounds at the end of the cycle.
18	SALINE	SALINE lights up.	Lights up when saline supply is interrupted during AUTO fill.
19	LID	LED* lights up.**	Opens the lid latch at the end of a run.
20	ALARM	ALARM lights up.	In AUTO mode only, lights up to indicate the alarm will sound at the end of the run.

*LED, or light emitting diode, refers to the small amber light adjacent to the panel button.
**The Cellwasher 2 can only be opened when the LID light is illuminated.

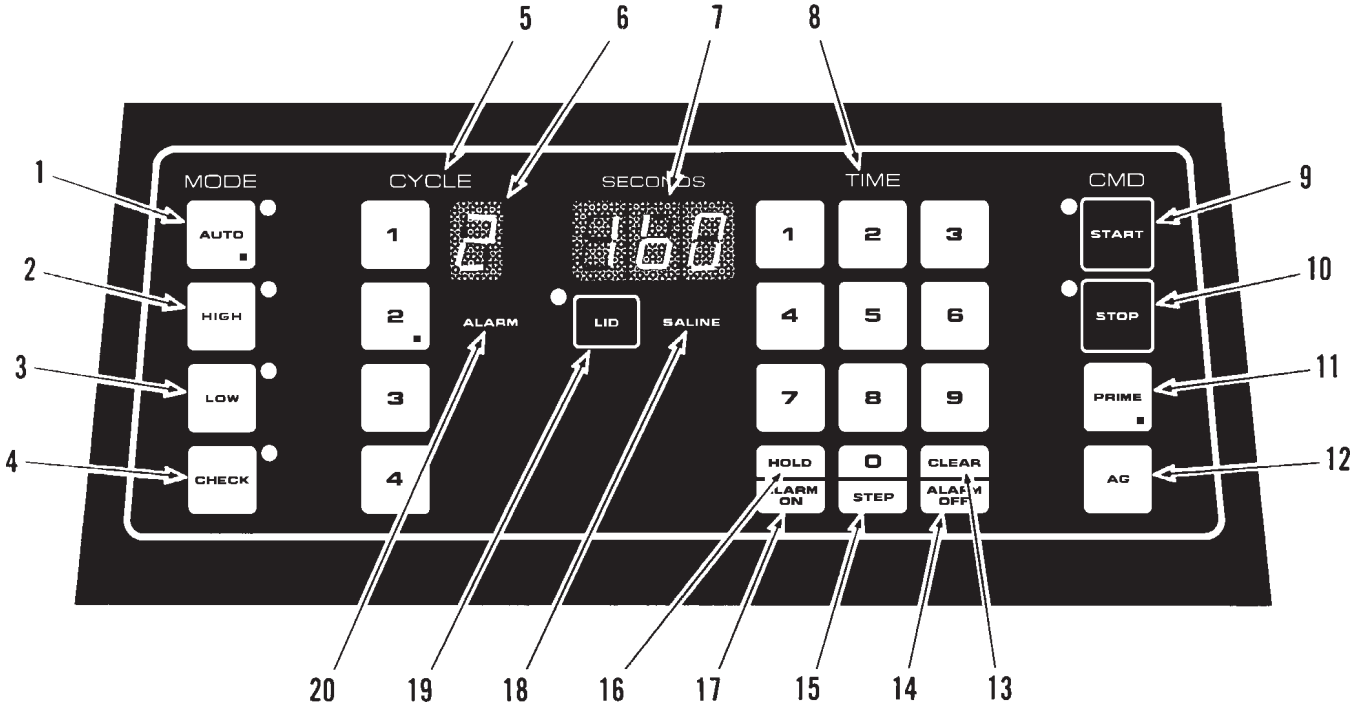


Figure 3-1. Cellwasher 2 Controls and Indicators

Principles of Operation

The SORVALL® Cellwasher 2 has three modes of operation: AUTO, HIGH, and LOW. In the AUTO mode, the washing steps of the Coomb's Procedure are performed automatically. In the HIGH and LOW modes, the Cellwasher 2 spins at a fixed speed (see Chapter 1, Cellwasher 2 Specifications, page 1-2).

NOTE The Cellwasher 2 *is not* designed to be able to *automatically* separate donor whole blood to create the 2 to 5% red blood cell/saline suspension that is required for washing cells. The Cellwasher 2 may, however, be operated as a centrifuge to *manually* separate red blood cells from whole blood (refer to *b. HIGH and LOW Modes* on page 3-4). To prevent loss of blood sample and avoid the subsequent blood cleanup required, ***do not*** attempt to use the AUTO mode to separate whole blood.

a. The AUTO Mode

In the AUTO mode, the Cellwasher 2 performs a 80-second wash cycles* that include the following steps: fill, high speed spin, decant, and agitate. The AUTO mode proceeds automatically through the number of wash cycles selected, unless interrupted by the operator or by the SALINE alarm.

* 100V 50Hz models perform 90-second wash cycles.

The operator can interrupt the AUTO mode at any point to check the progress of the wash cycle by pressing the CHECK button. When the CHECK button is activated, the Cellwasher 2 will stop at the end of the washing step in progress (fill, spin, or decant).

The instrument may also stop if the saline supply is interrupted. The SALINE alarm will sound, and the cycle in progress will stop after the filling step. To restart the instrument, the pump must be primed until the saline flow is continuous (see Auto Operation, step b. SALINE alarm, page 3-8). When the Cellwasher 2 is restarted, it begins at the next step of the wash cycle – the high speed spin.

The information programmed into the Cellwasher 2 at the start of the AUTO cycle remains in memory until the POWER switch is turned off.

b. HIGH and LOW Modes

NOTE The HIGH speed mode allows the Cellwasher 2 to be used as a centrifuge to separate red blood cells from donor whole blood, for use in the creation of the 2 to 5% red blood cell/saline suspension that is required for washing cells. To do so, fill tubes with the desired proportions of whole blood and saline, then perform a 30 to 60 second run in the HIGH speed mode according to standard protocols.

The HIGH and LOW modes are used for agglutination spins. These spins are preceded by a 5 second agitation to allow reagent and sample to mix. After agitation, the samples are spun at a constant rate of speed for the amount of time selected. The spin time programmed by the operator remains in the memory for that mode, appearing automatically in the digital TIME display whenever that mode is selected. Once the run begins, the TIME displays counts down the spin time in seconds to zero. At the end of the spin, the rotor will come to a stop. The Cellwasher 2 lid cannot be opened until the light next to the LID button is illuminated.

NOTE Depending on run conditions and component variability from instrument to instrument, the rotor may still be rotating slowly after the LID light is illuminated.

Tube Selection and Use

The Cellwasher 2 is designed to use either 5 ml 12 x 75 mm, or 3 ml 10 x 75 mm*, glass centrifuge tubes (saline flow must be adjusted to one size tube or the other). In normal operation, tubes are subjected to significant stress, making the use of high-strength centrifuge tubes necessary to avoid tube breakage. The Cellwasher 2 spins tubes at a 45° angle with tube walls point-loaded and otherwise unsupported. Maximum RCF generated may be as high as 1365 *g* (948 *g* in 50 Hz operation), and adequate tubes would typically be strength-rated for an even higher *g*-force, as tube manufacturers' strength ratings are based on the tubes being fully supported.

W A R N I N G

Tubes must be able to withstand up to 1365 *g* (948 *g* in 50 Hz operation) when run at a 45° angle with tube walls point-loaded and otherwise unsupported. Using tubes of inadequate strength could result in tube breakage: sample and test results will be lost, the rotor and distributor could be damaged, and cleanup will be required. During cleanup, be aware that glass fragments are sharp, and contact could result in personal injury.

Use only centrifuge tubes that meet the following criteria.

Tube Material		Type 1, class A borosilicate or equivalent high-strength rolled glass (such as Pyrex®)
Tube Style		Round bottom, thick walled, rimless (no flange or bead)
Tube Size:	Volume (all places)	5 ml or 3 ml*
	Diameter	12 mm +0.0/–0.5 (5 ml) 10 mm +0.0/–0.5 (3 ml)*
	Length	75 mm ±1.5
	Wall Thickness	0.9 mm ±0.1

NOTE As additional criteria, do not use tubes that have been dropped, scratched, or that have a visible defect, as they may not be able to withstand centrifugation.

Be advised that, even if you do not intend to reuse tubes, you may find that centrifuge-rated tubes of adequate strength are often labeled reusable, not disposable. SORVALL® 5 ml 12 x 75 mm Pyrex® tubes (Catalog Number 03102, 50/box) and SORVALL® 3 ml 10 x 75 mm Pyrex® tubes (Catalog Number 03100, 50/box) are not supplied, but are recommended for use in the Cellwasher 2.

* Before using 3 ml, 10 mm diameter tubes, a set of Adapter Clips (Catalog No. 04330, 12/pkg., supplied) must be installed on the DA-12 Rotor.

Priming the System & Adjusting Saline Fill Volume

NOTE If sterilization is required, follow the *Decontamination* procedure in Chapter 4 on page 4-2, then prime the system as described below.

The Cellwasher 2 must be primed and adjusted using the following procedure at installation, and whenever the saline supply reservoir or the tubing is changed.

NOTE When the saline flow is interrupted, prime the Cellwasher 2 as described in Auto Operation, step b. SALINE alarm, page 3-8.

To Prime the System:

1. Open the lid (press LID button).

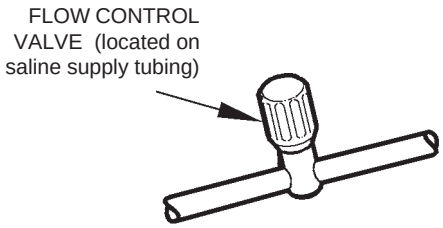
2. Select: MODE [AUTO] CYCLE [2]

3. Holding a graduated cylinder under the saline dispenser in the lid, press:

   CMD [PRIME]

NOTE If air bubbles remain in the tubing, repeat the PRIME command. Air bubbles may cause uneven distribution of saline in the test tubes.

4. Once air bubbles have been removed, empty the graduated cylinder and repeat step 3 to check total saline volume. If an adjusted total fill volume (based on tube fills) has previously been determined, compare the collected volume to that volume; if not, initial recommended coarse-adjust total volumes are 54 ml for 12 mm (5 ml) tubes, or 36 ml for 10 mm (3 ml) tubes.



5. If total volume is not correct, adjust the flow control valve (turn counterclockwise to allow more saline or clockwise to allow less), then repeat steps 3 and 4 until the desired total volume is obtained. *This completes coarse-adjustment based on nominal total volume;* ***a fine-adjustment based on tube fills is still required****.*

6. Place 12 tubes in the DA-12 rotor, close the lid, press START, and then press CHECK. After filling is complete, the lid light will come on. Press the LID button, open the lid and check the saline level in each tube.

7. Fine-adjust saline volume based on tube fills as follows:

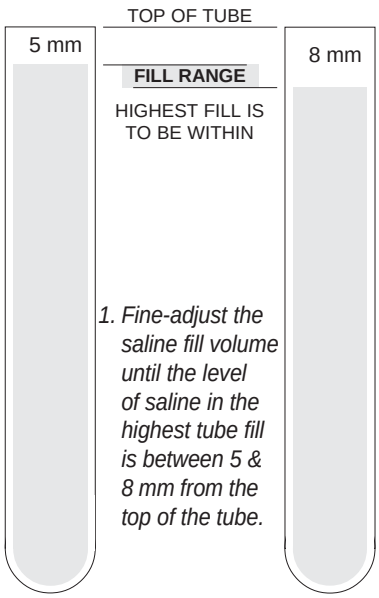
Fine-Adjusting Saline Fill Volume Based On Tube Fills

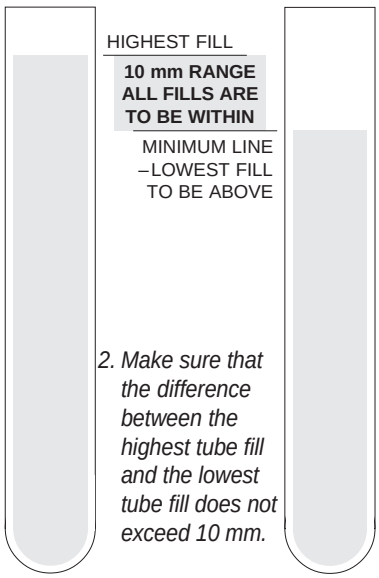
This adjustment procedure is required when the system is initially set up, when priming the system, or whenever saline fill volume adjustments are required.

NOTE Correct tube fills are necessary for proper cell washing; we recommend that you check fill volume periodically. Fill volume should also be checked whenever the saline supply reservoir is moved or replaced.

To check, install tubes with samples in all 12 places, start an AUTO run, and press CHECK. The Cellwasher 2 will stop after the fill step – open the lid and examine the level of saline in each tube. Fill volume is considered acceptable if:

- When using the recommended tubes (page 3-5), the level of saline in the highest tube fill is between 5 and 8 mm (0.2 and 0.3 inch) from the top of the tube.
- the difference between the highest fill tube and lowest fill tube is not more than 10 mm (0.4 inch).





Using a graduated cylinder (following the procedure on the previous page), first adjust the flow control valve to the previously-determined *adjusted total fill volume* (if an adjusted total fill volume has not yet been established, set the volume to 54 ml for 12 mm diameter [5 ml] tubes, or to 36 ml for 10 mm diameter [3 ml] tubes). After adjusting to achieve the desired total fill volume, fine-adjust the volume based on tube fills.

Install tubes in all 12 places, and after filling, check each tube to determine the highest tube fill –the highest fill should be between 5 and 8 mm (0.2 and 0.3 inch) from the top of the tube when recommended tubes are used – adjust the flow control valve and recheck fills as required. After the highest tube fill is correct, make sure that the difference between the highest tube fill and the lowest tube fill is not more than 10 mm (0.4 inch), equating to a maximum variance of approximately 0.7 ml in 12 mm diameter tubes, or 0.45 ml in 10 mm diameter tubes – troubleshoot if the fill variance is too great.

If, after initially coarse-adjusting the total fill volume (to 54 or 36 ml), the flow control valve had to be readjusted based on tube fills, again use a graduated cylinder to measure the new *adjusted total fill volume* and record the new value to use as an initial coarse-adjustment point for subsequent checks (volume adjustments will continue to change due to tube lot tolerances and normal changes to system flow over time).

WARNING

During operation, never lean on or move the instrument, keep the defined clearance area clear of all objects (including all hazardous and flammable materials), and do not work within the clearance area (see Location in Chapter 2).

Auto Operation

a. The basic operating sequence in the AUTO mode is as follows:

1. Press the LID button to open the lid.
2. Install the rotor, tubes, and distributor as described in Chapter 2, Installation.
3. Close the lid.
4. Select: MODE [AUTO] CYCLE [1-4]
5. For an audible signal at the end of the run, press ALARM ON.
6. Press START to begin the run.

NOTE If you wish to check for proper fill, press CHECK after beginning the run. At the end of the fill step, the Cellwasher 2 will stop. Examine the level of saline in each tube. Fill is considered acceptable if:

- When using the recommeded tubes (page 3-5), the level of saline in the highest tube fill is between 5 and 8 mm (0.2 and 0.3 inch) from the top of the tube.
- the difference between the highest fill tube and lowest fill tube is not more than 10 mm (0.4 inch).

Press START to continue run.

7. At the end of the run, if the alarm sounds, press ALARM OFF to turn off the alarm.
8. Once the lid LED is illuminated, press LID to open the lid.

b. SALINE alarm – this alarm will sound during the filling step if the saline supply is interrupted. To deactivate the alarm and correct the problem, prime the Cellwasher 2 as follows:

1. Open the lid (press LID button).
2. Holding a graduated cylinder under the saline dispenser in the lid, press: CMD [PRIME]

NOTE The SALINE alarm will not shut off until the PRIME button is pressed.

3. Close the lid and press START to continue the wash cycle in progress.

NOTE The SALINE alarm may also indicate broken or obstructed tubing. If the saline reservoir is adequate, check the tubing. Clean or replace tubing if necessary (see Chapter 4, Maintenance).

To ensure adequate washing, perform one additional wash cycle at the completion of the cycles in progress.

c. During AUTO operation, the following features may also be used:

- CHECK button – the automatic wash cycle can be checked after any step (fill, spin, or decant) by pressing the CHECK button during that step. The Cellwasher 2 will automatically stop at the end of the step in progress, and the lid may then be opened. After checking the tubes, close the lid and press START to continue run.

- STOP button – when STOP is pressed, the run in progress will stop immediately. When the LID light goes on, the lid may be opened. When the Cellwasher 2 is restarted, it will begin the programmed cycle over again unless steps are bypassed (see STEP button, Table 3-1).

- STEP button – if the AUTO mode is interrupted by a STOP command, it will restart at the beginning of the programmed run. To move the sequence ahead (to avoid refilling tubes for instance), press the STEP button once for each step in the cycle to be bypassed.

WARNING

During operation, never lean on or move the instrument, keep the defined clearance area clear of all objects (including all hazardous and flammable materials), and do not work within the clearance area (see Location in Chapter 2).

High and Low Speed Operation

a. To operate the Cellwasher 2 in the HIGH or LOW speed mode, proceed as follows:

1. Press the LID button to open the lid.

2. Install the rotor, tubes, and distributor as described in Chapter 2, Installation.

3. Select:

NOTE When HIGH or LOW is pressed, the time selected for the previous run will appear automatically in the digital time display. In the HIGH and LOW modes, the spin time that is input remains in the memory of that mode until a new time is input, or until the power is switched off.

After the START button is pressed, agitation will occur automatically for 5 seconds before the run begins. The time will count down in seconds. At the end of the run, the lid light will come on. Press LID to open the lid.

NOTE Depending on run conditions and component variability from instrument to instrument, the rotor may still be rotating slowly after the lid is opened.

NOTE The Cellwasher 2 is not intended to perform repetitive Low Speed TIMED runs without allowing a rest period of at least 10 minutes between runs with the door open to allow the motor to cool. Failure to allow the motor to cool between repetitive Low Speed runs can cause the motor to overheat and shut down.

b. During HIGH or LOW speed operation, the following features may also be used:

- AGITATE – pressing the AG button, when the rotor is not spinning, will provide an additional 5 seconds of agitation.

- HOLD – after selecting HIGH mode only, press HOLD to provide an indefinite spin period; HOLD is not to be selected in LOW speed mode. To end the run, press STOP.

NOTE The Low Speed Mode is not intended for continuous use; performing lengthy Low Speed HOLD runs could cause the motor to overheat and shut down. Because of this, Low Speed HOLD runs are not recommended.

Tube Breakage

Necessary Action to Prevent Instrument Malfunction

WARNING

In the event of tube breakage, be careful to avoid personal injury due to sharp fragments. Always make sure all glass is removed, including any pieces that may have become lodged in the overflow and drain tray exits and tubing. Also, make sure that the overflow container is empty before resuming use.

Tube breakage followed by an inadequate cleanup can be a major cause of instrument malfunction. Residual glass fragments can block drains and cannulas, leading to flooding of internal components and an accelerated buildup of encrusted salt/media. Every time tube breakage occurs, or if fluid exits through the overflow tubing or appears from under the cabinet, a thorough cleaning and inspection should be completed before continued operation. Disconnect power and decontaminate the Cellwasher 2 as required, then perform the cleaning and inspection as follows:

1. In the lid, separate the collector ring from the retaining ring by removing the four mounting screws and stepwashers (for parts identification, refer to Figure 4-1 on page 4-3). Clean all glass and residue from both sides of the collector ring, and from inside its drain nozzle and the connected discharge tubing. Using water, be sure the collector ring drains freely through the tubing – if not, clear blockage and recheck as required. Clean the surface of the retaining ring and its O-ring, then reassemble, making sure the collector ring is fully seated on the retainer ring before securing it with screws and stepwashers.

CAUTION

The distributor is balanced as an assembly. In extreme cases, if it must be disassembled for cleaning, all parts must be marked for position/orientation so that it will be in balance after reassembly.

2. Remove and clean the distributor assembly, the rotor, and the rotating bowl assembly. On the distributor assembly, make sure that no fragments have fallen down inside the center area, to ensure that cannulas will not become obstructed, and make sure cannulas have not been damaged. On the rotating bowl assembly, make sure that no fragments have become situated between parts by checking that the lift plate mechanism slides up and down freely.

3. Clean the wet guard (black plastic liner) that covers the chamber and top deck, then remove it. Locate the small white overflow tray, which is positioned directly under, and obstructed by, the decant coil (a black ring around the top of the motor assembly). Clean all glass and residue from the overflow tray, and from inside its drain nozzle and the connected overflow tubing. Using water, be sure the overflow tray drains freely through the tubing (being careful not to overflow the tray, if drainage is still impaired) – if not, clear blockage and recheck as required.

4. Reinstall the wet guard, then, being sure to engage the drive pins on each, reinstall the rotating bowl assembly, the rotor, and the distributor assembly. If the problem recurs, contact Kendro Service.

Momentary Power Interruption

W A R N I N G

To avoid exposure to a spinning rotor and potential for personal injury, if a momentary power failure terminates a run, wait at least ten seconds (from when power was lost) before trying to open the lid.

If a momentary power interruption occurs when a run is in progress with the rotor spinning, it can take up to ten seconds before the rotor comes to a stop. Do not open the lid with the rotor spinning.

Emergency Sample Recovery

W A R N I N G

This procedure is included for *emergency sample recovery only* and should never be used for any purpose other than those explained in this section.

When the main power shuts off the brake will not operate. Wait until the rotor stops spinning before using the mechanical override.

If, while the rotor is spinning, the Cellwasher 2 main power shuts off due to a power failure or system malfunction, the lid is designed not to open, to keep the operator safe. For emergency situations such as these, where the rotor has stopped spinning but the LID button will not allow access to the chamber, a mechanical override is provided to allow sample recovery.

The mechanical override is located on the left side of the Cellwasher 2 as shown in figure 3-2, below. To operate the override, insert a small screwdriver or similar object into the hole and push to cause the latch pin to disengage the striker plate and release the lid.

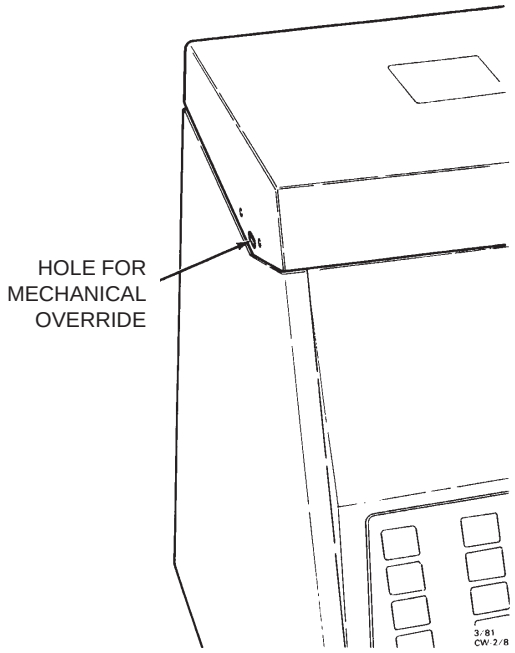


Figure 3-2. Location of Mechanical Override

Chapter 4: MAINTENANCE

This chapter describes routine maintenance procedures that should be performed on a regular basis, with the specific time interval or duty cycle determined by the user, and based on product use. It is also the responsibility of the user to make certain that these procedures are followed whenever necessary. If further service is needed, contact Kendro or your local representative for SORVALL® products.

WARNING

There are no user-serviceable items inside the Cellwasher 2. Due to the hazards involved, repair should only be attempted by a qualified technician who is familiar with electronics and trained in the servicing of this product.

Preventive Maintenance

The following preventive maintenance checks and cleaning procedures should be performed regularly. If etiologic or biologically hazardous materials are processed in the Cellwasher 2, be sure appropriate decontamination procedures have been followed before inspecting or cleaning the instrument.

a. Inspection

- Inspect the vents on the bottom of the Cellwasher 2 to be sure they are not blocked, and remove any obstructions.
- Check all sealing surfaces, tubing, liners, and the collecting ring assembly for cleanliness and good condition.
- Inspect the distributor, rotor, and stainless steel rotating bowl:

  1. Remove the distributor from the top of the rotor; check for cracks and make sure cannulas are not bent, damaged, or clogged. From underneath, make sure the metal clip that holds the distributor to the rotor is not cracked or broken.
  2. Remove the DA-12 rotor from the rotating bowl assembly. Make sure that the rotor does not wobble on its base. Make sure that the pivot pin at the top of each tube holder is not loose. Also, check the gaps in the tube holder bands – gaps may widen over time due to centrifugal force, and the rotor should not be used if the gaps become greater than 2 mm. *Do not compress the tube holder bands to close the gaps*; bands are precisely shaped to support tubes during centrifugation, and tube support will be compromised if the bands are deformed in this manner (***read the WARNING***).
  3. Remove the stainless steel rotating bowl assembly (located in the rotor chamber, directly beneath the rotor), and inspect the rotating bowl assembly for signs of cracks or corrosion.

WARNING

Continued use of a rotor with tube holder band gaps greater than 2 mm, or that has had bands compressed to close the gaps, can cause tube breakage, possibly resulting in instrument damage or personal injury.

NOTE If inspection reveals that any part of the Cellwasher 2 is not functioning properly, do not use the instrument until it is repaired.

b. Cleaning

CAUTION

All saline solutions have long term corrosive effects. Routine cleaning and maintenance are essential to ensure safe and efficient operation.

- Clean the Cellwasher 2 cabinet with a damp cloth and mild detergent.
- Wipe up spills from the interior and exterior whenever they occur.
- Remove the rotor, distributor, and rotating bowl and wash them with warm water and mild detergent.
- Remove the collecting ring assembly and tubing for routine cleaning as follows (see figure 4-1):

    1. From the back of the instrument, open the adjustable tubing clamp that secures the Y-Connector in place and remove the discharge tubing from the Y-Connector (see figure 2-1).
    2. Remove the four mounting screws and step washers securing the collecting ring assembly to the lid.
    3. Pull the collecting ring assembly away from the lid, and pull the discharge tubing up through the wet guard (molded black liner).
    4. Disconnect the flow tubing from the spray nozzle in the lid and pull it through the hole in the retainer ring.
    5. Separate the collector ring assembly by pulling the collector ring off.
    6. Remove discharge tubing and flow tubing, wash with warm water and mild detergent, and reinstall (see figure 2-1).
    7. Wash the retainer ring, O-ring seal, and collector ring with warm water and mild detergent.
    8. To reassemble, place the retainer ring on work surface (small opening down), and work the O-ring seal around the large opening of the retainer ring until it is fully seated in the groove. Then, place the collector ring so that it rests concentrically over the O-ring seal and press firmly into place.

NOTE Make sure the nozzle for the discharge tubing on the collector ring aligns with the groove in the wet guard when the collecting ring assembly is reinstalled in the lid.

    9. Reinstall the collecting ring assembly by reversing steps 1 through 4 of this procedure.

NOTE When replacing the four mounting screws, make sure the flat side of each step washer faces the screw head.

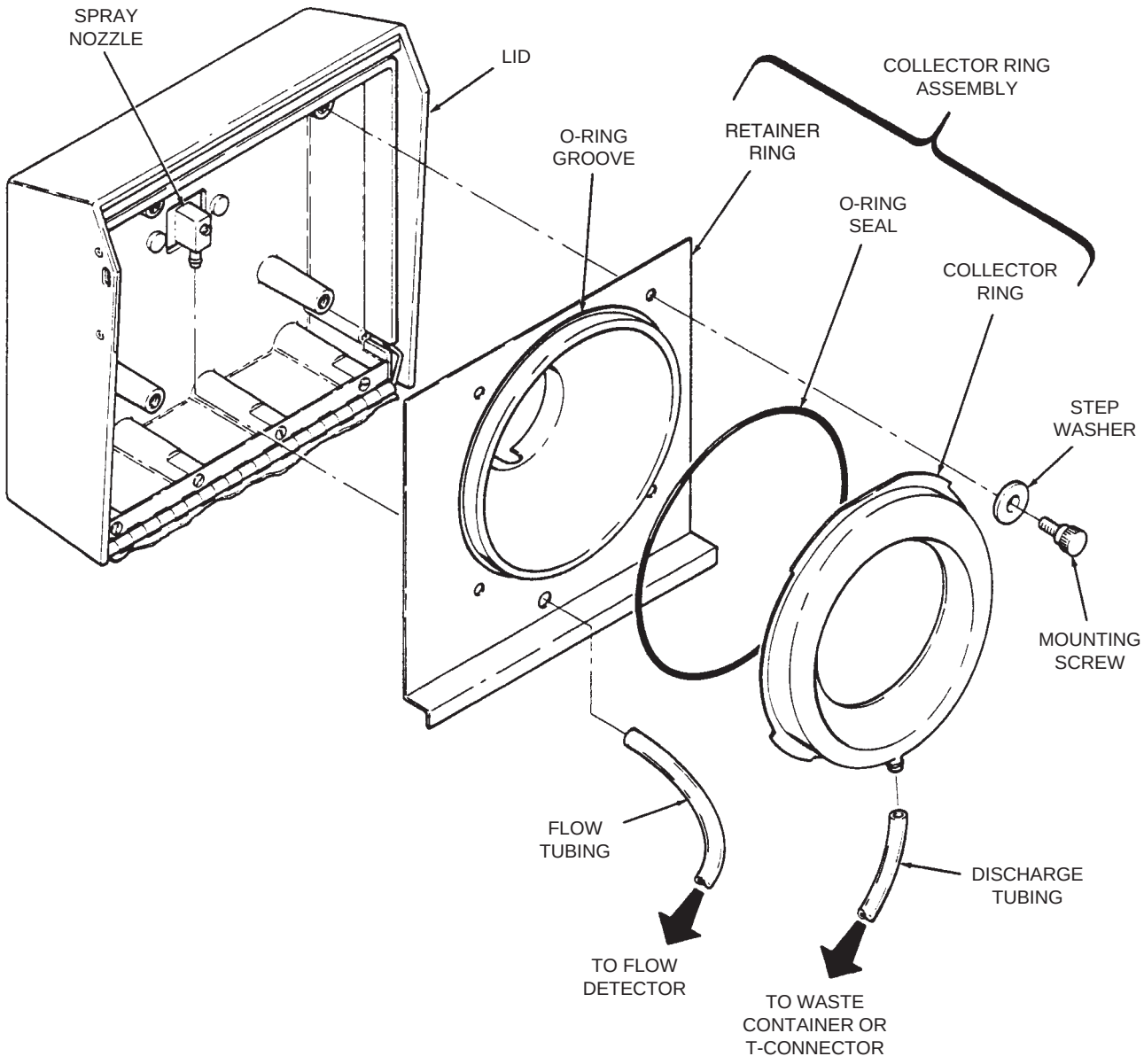


Figure 4-1. Collecting Ring Assembly, Exploded View

c. Decontamination

WARNING

If tubes have been broken in the Cellwasher 2, be aware of the potential for residual glass fragments and take extra precautions.

The Cellwasher 2 is intended for use with human blood. Always observe Universal Precautions.

The Cellwasher 2 is intended for use in Coomb's testing and incorporates the use of human blood. If the Cellwasher 2 has been used with other hazardous materials, be aware of all hazards involved and decontaminate using additional appropriate methods. As a guide, the SORVALL® Product Guide contains descriptions of commonly used decontamination methods and a chart showing method compatibility with various materials. Otherwise, observe Universal Precautions and proceed as directed on the next page.

If the Cellwasher 2 is operational

1. Prepare a 3-10% solution of household liquid chlorine bleach.

2. Soak a wash rag or sponge with the bleach solution and gently wipe the bowl assembly, the wet guard, and the inner portion of the Cellwasher 2, making sure all encrusted material is gone. Do this step twice.

3. Disconnect the supply tubing from the saline supply and set the tubing to draw from the bleach solution.

4. Pump the bleach solution through the Cellwasher 2 for four cycles.

5. Set the tubing to draw from clean water and follow the bleach solution with 4 to 12 water washes, so that no bleach remains.

6. Reconnect the tubing to the saline supply and follow the water washes with four cycles of saline.

7. Check the pH level to make sure it is normal. If not, continue with saline cycles until pH checks normal.

8. Open the lid, turn the main power switch OFF, and unplug the power cord. Wipe all parts (including parts inside the lid and chamber, the cabinet, the control panel, and the front surface of the main power switch) with a 70% ethanol solution and allow to dry (do not flood the switch or power cord connector areas).

If the Cellwasher 2 is not operational

1. Turn the power switch OFF, unplug the power cord, and open the lid using the mechanical override (see page 3-12, Emergency Sample Recovery). Remove tubes (if any) from the DA-12 rotor.

2. Prepare a 3-10% solution of household liquid chlorine bleach. Disassemble the collector ring assembly (see Cleaning, page 4-2); immerse components for 10 minutes in the bleach solution.

3. Remove the discharge tubing, vent tubing, and drain tubing along with any Y-connectors, draining any excess saline from the pieces. Immerse and completely fill the tubing and connectors in the bleach solution (try not to leave any air in the tubing); keep them immersed for 10 minutes.

NOTE Depending on the age or condition of the tubing, as well as the type or amount of contamination, you may choose to replace tubing instead of decontaminating it. If so, discard contaminated tubing in an appropriate manner, then, after the instrument has been decontaminated, install a Tubing Replacement Kit (Catalog No. 12977, supplied), following instructions supplied in the kit.

4. Individually remove the distributor, the DA-12 rotor, and the stainless steel bowl. Immerse the distributor for 10 minutes in the bleach solution. Wipe the DA-12 rotor and stainless steel bowl using a 70% solution of ethanol, making sure that all encrusted material is gone, then rinse with water. Repeat the ethanol wash a second time.

5. Remove the wet guard (black plastic liner) from the chamber. Soak a wash rag or a sponge in the bleach solution and gently wipe the wet guard and the inner portion of the unit (including the nozzle and inside of the lid, the motor shaft and the decant coil). Make sure that all encrusted material is gone.

6. Make sure a container is positioned to collect fluid from the overflow tubing. Pouring slowly so that the tray doesn't overflow, pour some bleach solution into the white plastic overflow tray (below the decant coil) this should drain out freely through the overflow tubing. Follow with clean water to rinse.

7. Wipe the entire cabinet, including the control panel and the front surface of the main power switch, with 70 % ethanol (do not flood the power switch or power cord connector areas).

8. After 10 minutes in the bleach solution, remove all components that had been soaking and rinse with water several times.

9. Allow all components to dry, then reassemble the unit as before.

NOTE When reinstalling the four mounting screws of the collector ring assembly, make sure that the flat side of each step washer is against the screw head.

Service Decontamination Policy

If a Cellwasher 2 requires servicing by Kendro personnel, either at the customer's laboratory or at a Kendro facility, comply with the following to ensure the safety of all personnel.

If the Cellwasher 2 has been used with other hazardous materials, be aware of all hazards involved and decontaminate using additional appropriate methods. As a guide, the SORVALL® Product Guide contains descriptions of commonly used decontamination methods and a chart showing method compatibility with various materials. Otherwise, if a Cellwasher 2 requires servicing by Kendro, proceed as follows:

1. Decontaminate the Cellwasher 2 to be serviced, and clean it of all encrusted material prior to servicing by a Kendro representative or returning it to the Kendro facility. There must be no radioactivity detectable by survey equipment. Decontaminate according to the instructions that begin on page 4-3.

2. Complete and attach a Decontamination Information Certificate (in the back of this manual) to the Cellwasher 2 before servicing.

   In addition to those included with in this book, Decontamination Information Certificates are available from the local Kendro Representative or Field Service Engineer. In the event that certificates are not available, a signed, written statement certifying that the unit has been properly decontaminated, identifying what the contaminants were and outlining the decontamination procedures used will be acceptable.

NOTE The Field Service Engineer will note on the Customer Service Repair Report if decontamination was required and, if so, what the contaminant was and what procedure was used. If no decontamination was required, it will be so stated.

If a Cellwasher 2 to be serviced does not have a Decontamination Information Certificate attached and, in Kendro's opinion presents a potential radioactive or biological hazard, the Kendro representative will not service the equipment until proper decontamination and certification is complete.

If the Cellwasher 2 must be returned to a Kendro facility:

1. Contact your Kendro representative to obtain an Equipment Return Decontamination Form; be prepared with the product name (Cellwasher 2), serial number and the repairs required.

2. Complete the Equipment Return Decontamination Form and return it to Kendro. Upon receipt of a completed form, a Returned Material Authorization Number (RMA Number) will be issued to you.

3. With the RMA Number clearly marked on the outside of packaging, send the items to the address obtained from your Kendro representative.

NOTE United States federal regulations require that parts and instruments *must* be decontaminated before being transported. Outside the United States, check local regulations.

If equipment is received at Kendro facilities without a valid RMA Number on the outside of the shipping container and a completed Equipment Return Decontamination Form on file, the equipment will be treated as a potential contamination hazard, and will not be serviced until decontamination certification has been completed. The sender will be contacted for instructions regarding disposition of the equipment in question; all disposition costs will be borne by the sender. If contaminated equipment is received at Kendro facilities, both the carrier and appropriate authorities shall be notified.

Parts Replacement

To order replacement parts, telephone toll-free 800-522-7746 in the United States. Outside the United States, contact Kendro or your local representative for SORVALL® products (see back cover for a partial list). Be prepared to supply the product name (Cellwasher 2), serial number, and a description of the parts required.

Tubing Replacement

If tubing is damaged and must be replaced, install tubing supplied in the Tubing Replacement Kit (Catalog No. 12977) following installation instructions supplied with the kit.

Fuse Replacement

To replace the fuse in the power supply adapter:

1. Unplug the power cord.
2. Remove the power cord from the power supply adapter.
3. Slide the clear plastic guard to the left of the power cord connection.
4. Pull out the FUSE PULL lever. The end of the fuse will pop out.
5. Remove the fuse, and replace it with the appropriate slow-blow fuse. (Fuse rating is indicated on rear nameplate).
6. Move the guard to the right, and replace the power cord.

Troubleshooting

W A R N I N G

There are no user-serviceable items inside the Cellwasher 2. Due to the hazards involved, repair should only be attempted by a qualified technician who is familiar with electronics and trained in the servicing of this product.

Tables 4-1 through 4-4 contain troubleshooting information for some common problems that occur during operation of the Cellwasher 2. The customer should not attempt any further troubleshooting.

Tables 4-5 through 4-7 contain applications troubleshooting information which identify possible causes of false negative results, false positive results, or inconsistent reaction strength.

Table 4-1. Troubleshooting Chart: Problem A

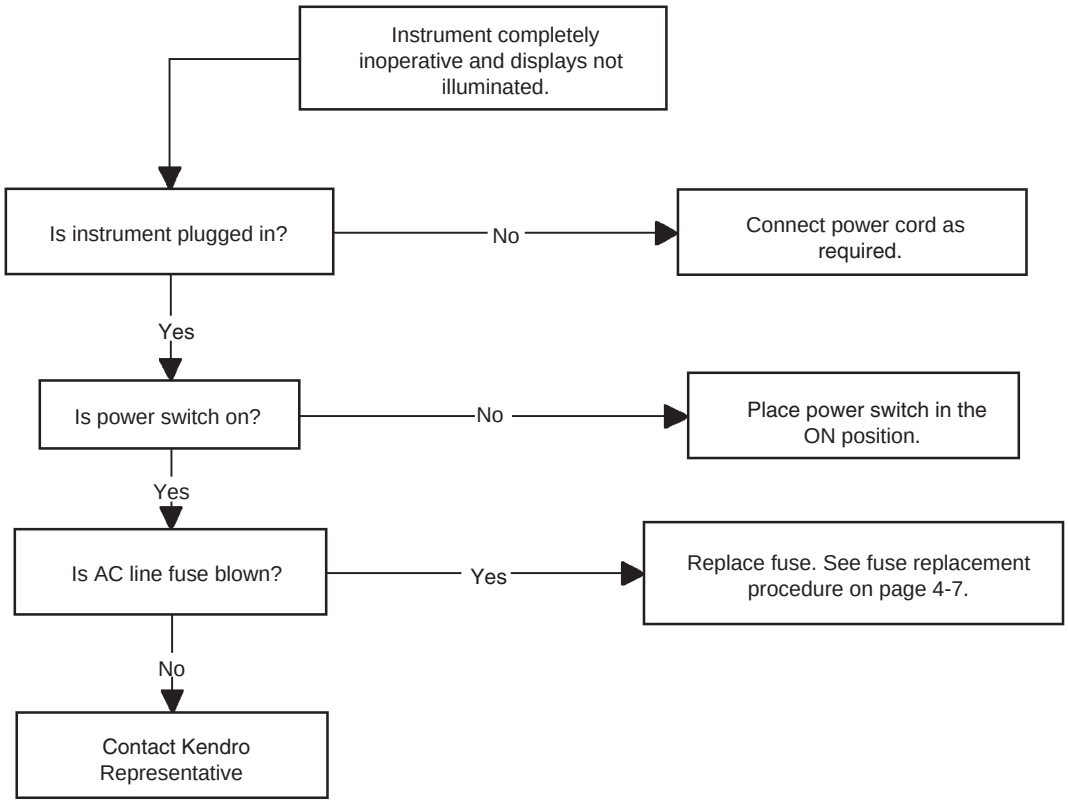


Table 4-2. Troubleshooting Chart: Problem B

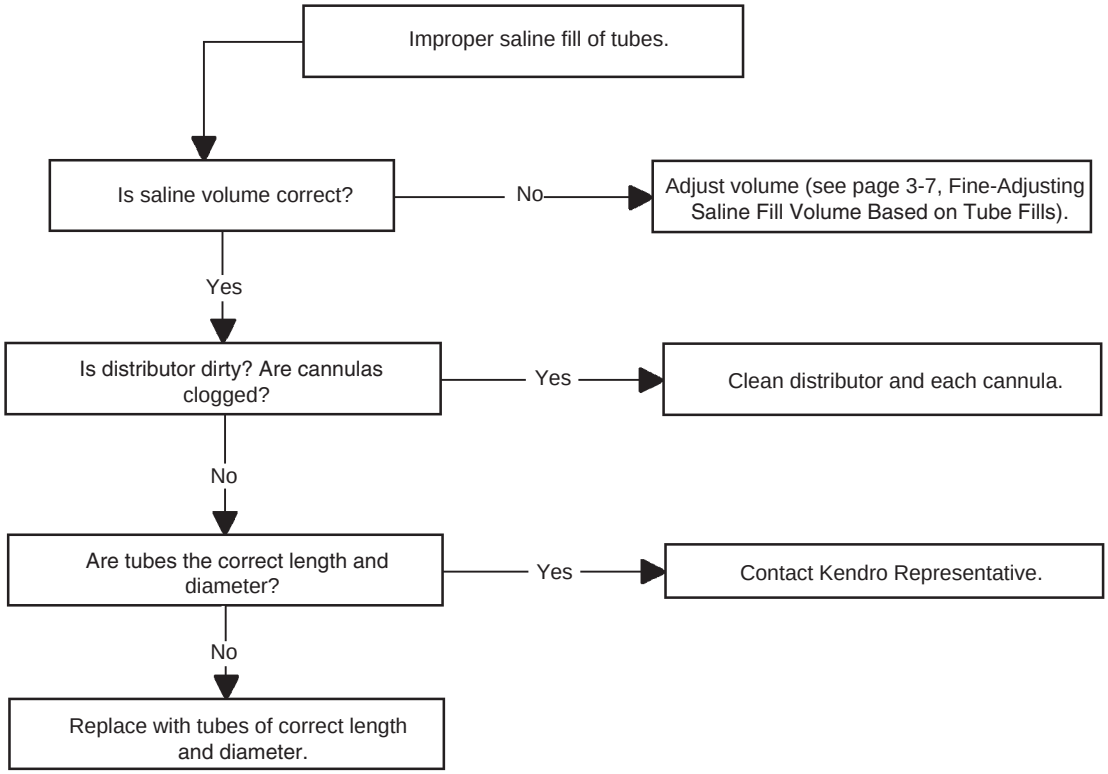


Table 4-3. Troubleshooting Chart: Problem C

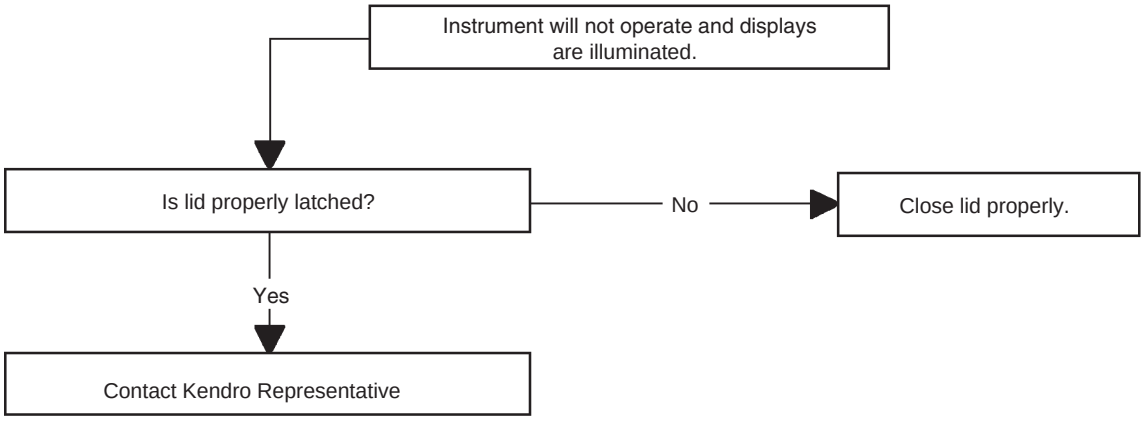
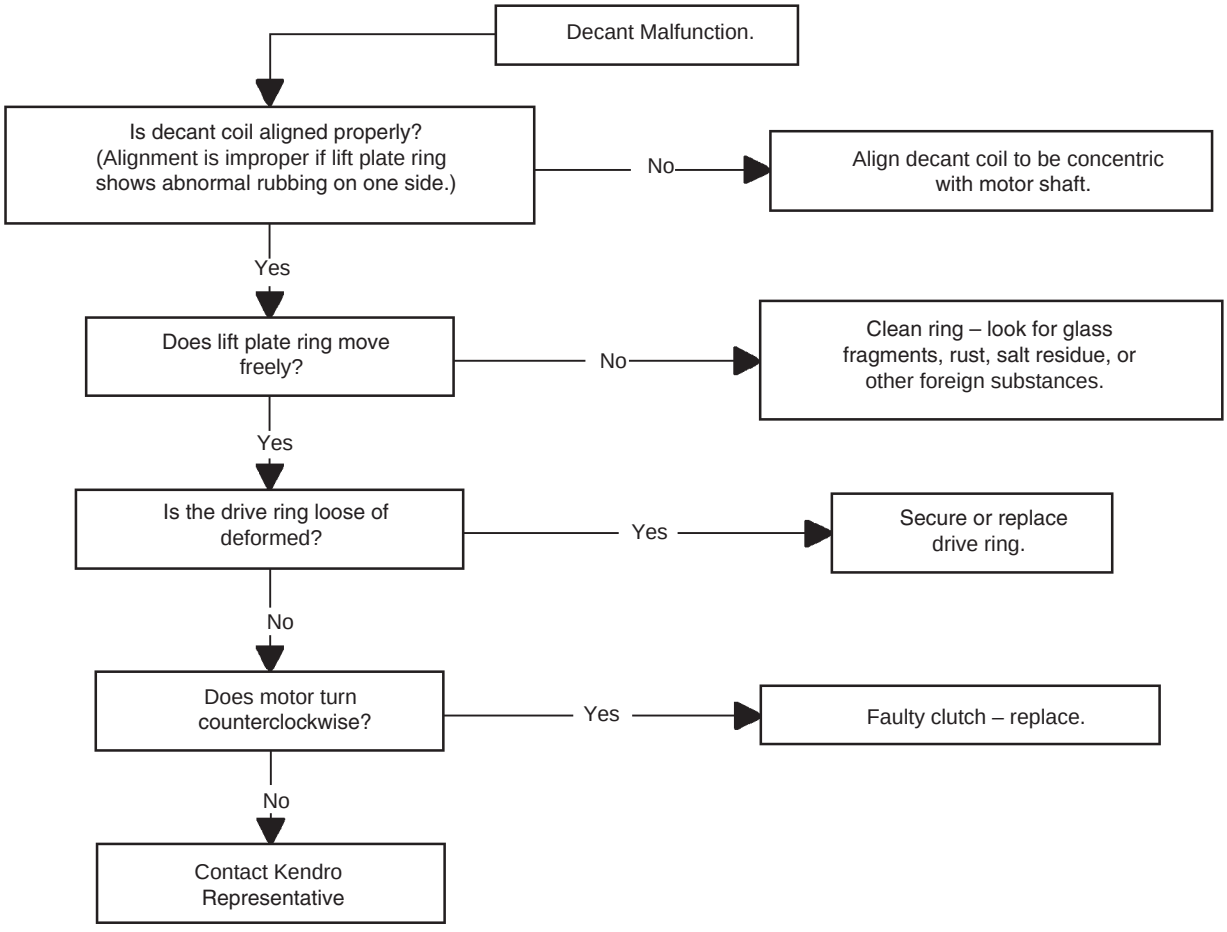


Table 4-4. Troubleshooting Chart: Problem D (see figures 4-2 and 4-3)



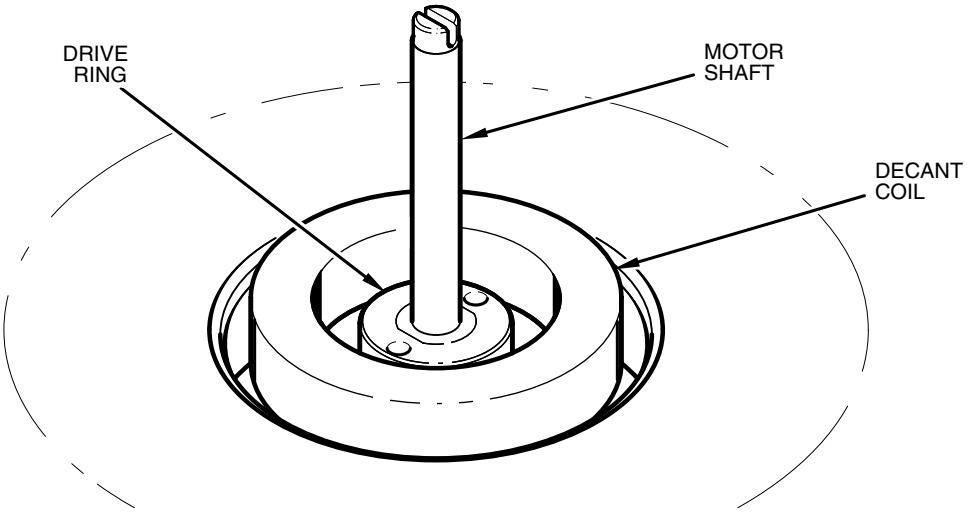


Figure 4-2. Location of Decant Coil and Drive Ring

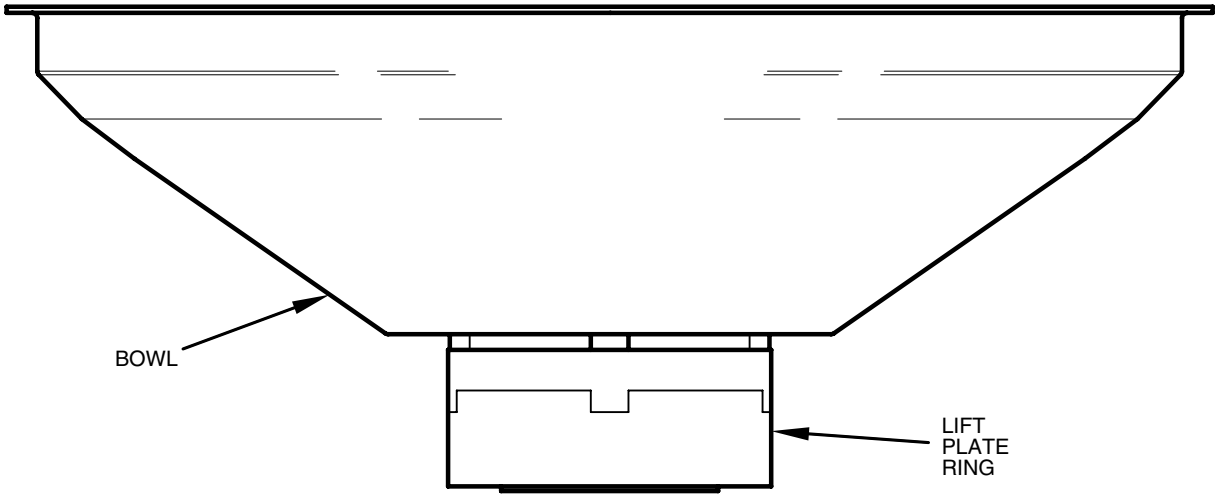


Figure 4-3. Location of Lift Plate Ring

Table 4-5. Applications Troubleshooting Chart: False Negative Results

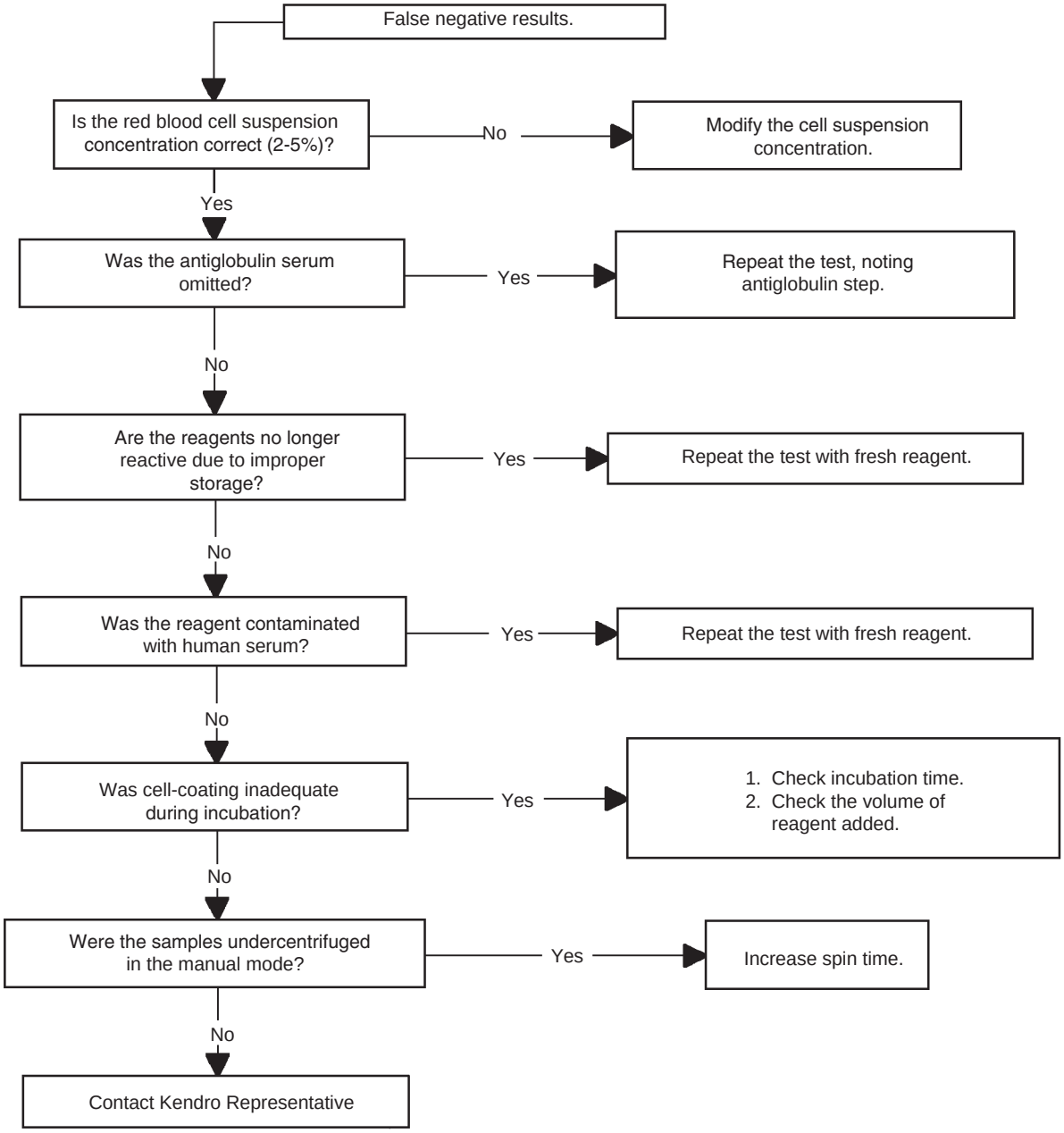


Table 4-6. Applications Troubleshooting Chart: False Positive Results

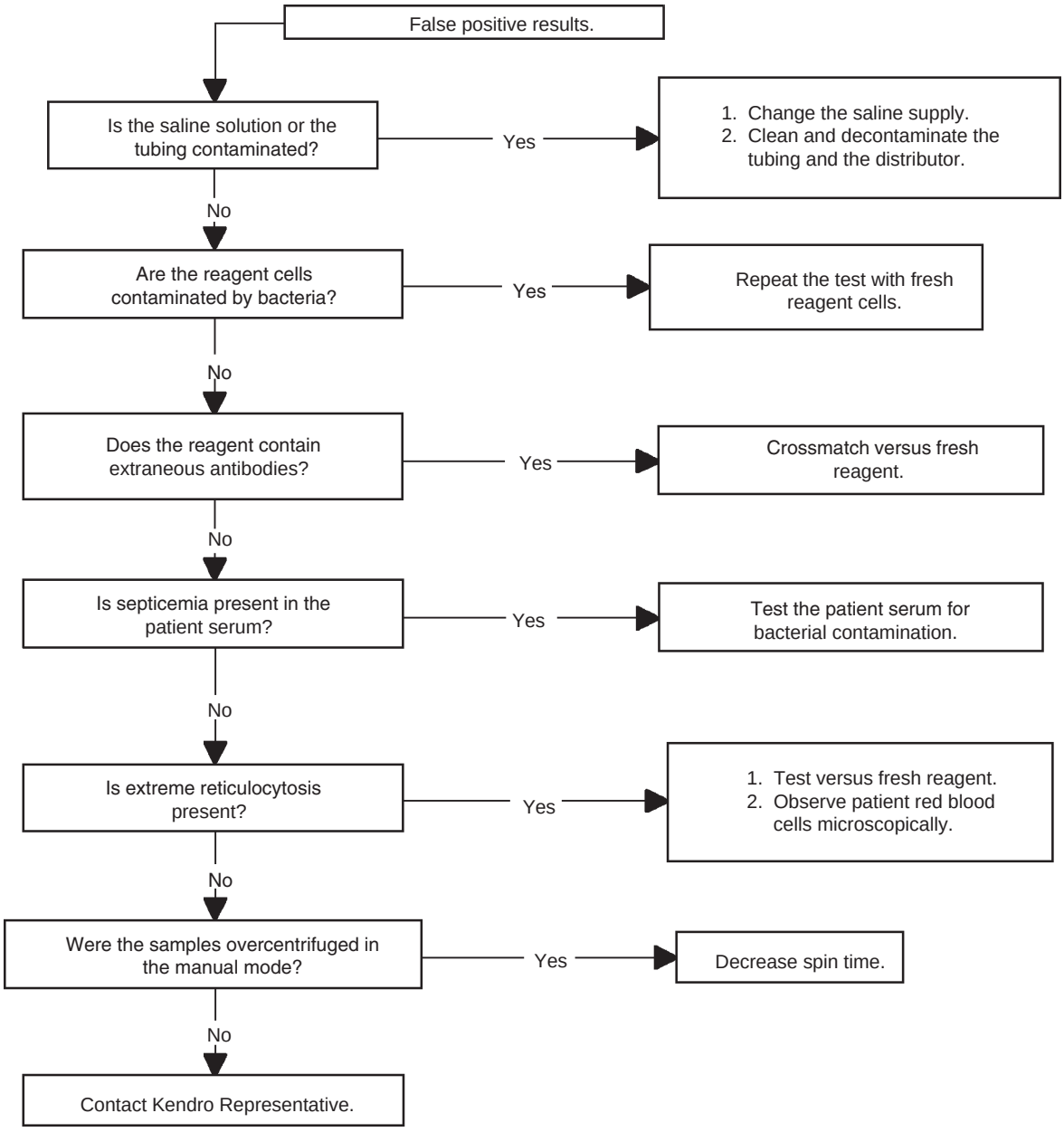
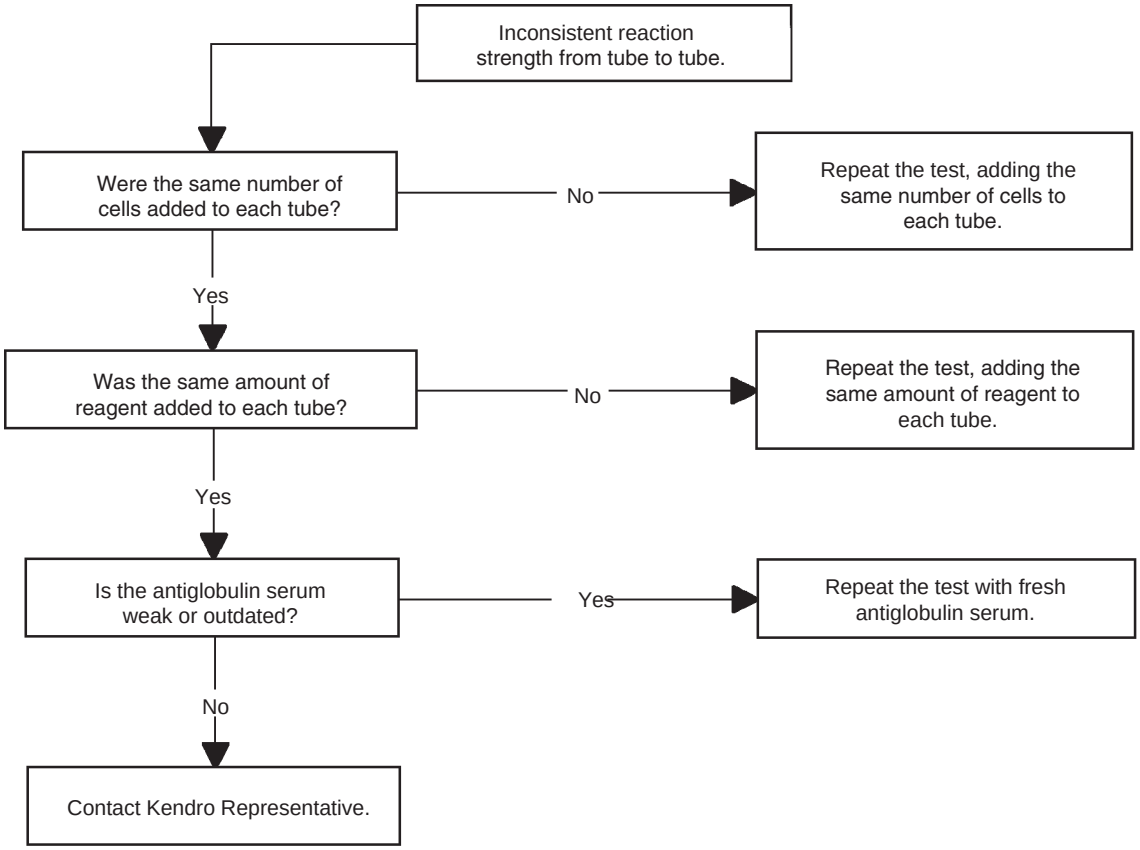


Table 4-7. Applications Troubleshooting Chart: Inconsistent Reaction Strength



APPENDIX

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