



Thermo Scientific

## TCF-20 Rotor

for the Thermo Scientific Sorvall LYNX Centrifuge

### Instruction Manual

50133975-a • 05 / 2013 • Superspeed Centrifuge



Thermo Scientific

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## Preface

Before starting to use the rotor, read through this instruction manual carefully and follow the instructions.

Failure to follow the instructions and safety information in this instruction manual will result in the expiration of the seller's warranty.

## Items Supplied

**Table 1**  
Zonal Mode  
Rotor Package  
(75003013)

| Article No. | Item                 | Quantity | Check                    |
|-------------|----------------------|----------|--------------------------|
| 49609       | Septa                | 1        | <input type="checkbox"/> |
| 75000601    | Tube Holder Assembly | 1        | <input type="checkbox"/> |
| 75000604    | Titanium Rotor Body  | 1        | <input type="checkbox"/> |
| 75004012    | Rotor Cover          | 1        | <input type="checkbox"/> |
| 75004052    | Tool Kit             | 1        | <input type="checkbox"/> |
| 75004051    | Zonal Mode Assembly  | 1        | <input type="checkbox"/> |

**Table 2**  
Continuous Flow  
Rotor Package  
(75003012)

| Article No. | Item                     | Quantity | Check                    |
|-------------|--------------------------|----------|--------------------------|
| 49609       | Septa                    | 1        | <input type="checkbox"/> |
| 75000601    | Tube Holder Assembly     | 1        | <input type="checkbox"/> |
| 75000604    | Titanium Rotor Body      | 1        | <input type="checkbox"/> |
| 75004012    | Rotor Cover              | 1        | <input type="checkbox"/> |
| 75004052    | Tool Kit                 | 1        | <input type="checkbox"/> |
| 75000605    | Continuous Flow Assembly | 1        | <input type="checkbox"/> |

## Intended Use

This rotor is a laboratory product used to separate substance mixtures of different sizes and densities.

If the rotor is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

This rotor should be operated by trained specialists only.

## Precautions

In order to ensure safe operation of the Thermo Scientific TCF-20 rotor, the following general safety regulations must be followed:

- Observe all safety instructions.
- Never exceed maximum rotor speed under any circumstances.
- Always reduce (derate) rotor speed as instructed in this manual whenever:
  - » the rotor speed/temperature combination exceeds the solubility of the gradient material and causes it to precipitate.
  - » the compartment load exceeds the maximum allowable compartment load specified (average fluid density greater than 1.2 g/mL). Failure to reduce rotor speed under these conditions can cause rotor failure.
- Keep surfaces of the rotor and spindle clean. Always clean the rotor with a neutral mild soap or detergent solutions. Never use any abrasive tools to clean the rotor („Maintenance and Care“ on page 57).
- Do not use rotors which show any signs of damage.
- Always lift, carry and handle the rotor with care. Dropping a rotor may render the rotor unusable. If a rotor is dropped, contact Thermo Fisher Scientific for an inspection.
- If any unusual vibrations, sounds or odors occur, turn off the centrifuge immediately and do not operate the centrifuge until the cause of the improper behavior is determined and repaired.
- Use only accessories and parts which have been approved by Thermo Fisher Scientific.

Pay particular attention to the following aspects:

- Do not operate or precool the rotor at the critical speed, as this will have a detrimental effect on centrifuge component life. („Critical Speed“ on page 18).
- Do not operate the rotor unless it has a full fluid load (1350 mL) as described in this manual. Operating the rotor with less than a full fluid load may cause damage to the centrifuge and/or rotor due to the shifting mass of the fluid
- Operating the rotor with the cover not properly seated can cause rotor failure with subsequent damage to the centrifuge.

Centrifugation of hazardous substances:

- Do not centrifuge explosive or flammable materials or substances which could react with one another.
- Do not centrifuge any material capable of producing flammable or explosive vapors or creating extreme exothermic reactions.
- Do not centrifuge toxic or radioactive materials or any pathogenic micro-organisms without suitable safety precautions.

When centrifuging microbiological samples from the Risk Group II (according to the “Laboratory biosafety manual” of the World Health Organization (WHO)), aerosol-tight biological seals have to be used.

For materials in a higher risk group, extra safety measures have to be taken.

- If toxins or pathogenic substances have gotten into the centrifuge or its parts, appropriate disinfection measures have to be taken („Cleaning and Decontamination“ on page 57).
- If a hazardous situation occurs, turn off the power supply to the centrifuge and leave the area immediately.

## Symbols used in this manual

Observe the information contained in the instruction manual to keep yourself and your environment safe.



This symbol refers to general hazards.

CAUTION means that material damage could occur.

WARNING means that injuries or material damage or contamination could occur.



This symbol refers to biological hazards.



## Rotor Specifications

**Table 3**  
Rotor Specifications

| Description   | Specification in the Thermo Scientific™ Sorvall™ Lynx 6000 Superspeed Centrifuge |
|---|--|
| Weight of empty rotor   | 7.80 kg (17.2 lbs)   |
| Total capacity (nominal)  | 1,350 mL   |
| Maximum speed   | 20,000 rpm   |
| Critical speed  | 4,200 rpm  |
| Max. / Min. / Avg. radius   | 96.0 mm / 36.0 mm / 66.0 mm  |
| Maximum RCF value at $r_{\text{max}} / r_{\text{min}} / r_{\text{avg}}$ | 42,931 x g / 16,099 x g / 29,400 xg  |
| Diameter  | 213 mm (8.40 in)   |
| Design load   | 1350 mL at 1.2 g/mL  |
| K-factor at maximum speed   | 620  |

## Parts and Accessories

The rotor body assembly is composed of:

- a rotor
- septa
- rotor cover
- feed device assembly

The rotor body and cover are machined from a titanium forging for strength and corrosion resistance. The Valox™ septa is inserted into the rotor body to divide the chamber into six sector-shaped compartments. The upper, internal surface of the rotor body is threaded to accommodate the circular threaded rotor cover which is sealed to the body by a large O-ring.

To perform all operating instructions included in this manual, it is necessary to have additional assemblies and equipment not supplied with the rotor. Table 1 and Table 2 list the assemblies and equipment required to complete all possible TCF-20 Rotor applications in the Sorvall Lynx 6000 superspeed centrifuge.

**Table 4**  
Parts and  
Accessories  
(see „Appendix“  
on page 69 for  
details on Figure  
Item Numbers)

| Figure Item No. | Catalog No. | Item Description                        |
|-----------------|-------------|---|
| 01              | 75000604    | Titanium Rotor Body                     |
| 02              | 75004012    | Rotor Cover                             |
| 03              | 49609       | Septa                                   |
| 04              | 75000601    | Tube Holder Assembly                    |
| 05              | 75004006    | O-Ring Set for Continuous Flow Assembly |
| 06              | 75004007    | O-Ring Set for Zonal Mode Assembly      |
| 07              | 75004008    | Screws and small parts                  |
| 08              | 75004052    | Tool Kit                                |
| 09              | 75004050    | Bearing Kit                             |
| 10              | 75000605    | Continuous Flow Assembly                |
| 11              | 75004051    | Zonal Mode Assembly                     |
| 12              | 75003503    | Peristaltic Pump                        |
| 13              | 13117       | Latex Tubing                            |

Additional equipment and accessories may be needed for the desired application:

- Syringe with Blunt 18 Gauge Needle
- 5 mL Syringe with 20 Gauge Needle
- Peristaltic Pump
- Regulator
- Chiller

Before proceeding, be sure you have all necessary assemblies and equipment for the desired application.





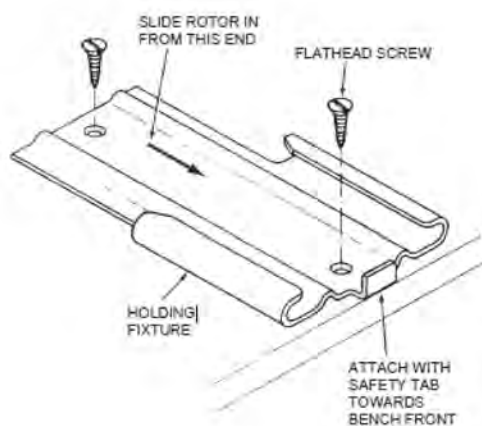


# Rotor Preparation and Installation

## Rotor Holding Fixture

The rotor holding fixture (Catalog No. 52540) is used to hold the rotor during loading and unloading procedures to prevent disturbances of the gradient. Secure the rotor holding fixture to a work bench with the two flathead screws supplied.

Figure 1  
Rotor Holding  
Fixture



## Before a Run

### To prepare for a run

1. Read the important safety information („Precautions“ on page 10).
2. Level the rotor to ensure equal dispersion of the density gradient.
3. Ensure the rotor spud hole is clean and free.
4. Inspect the O-rings in the rotor assembly for cracks, tears, and abrasions; replace if necessary.
5. Remove any blockage from the feed lines of the septa and the distributor
6. Lubricate the threads of the rotor body with the lubricant (Catalog No. 76003786).
7. Check the compatibility of all materials used („Chemical Compatibility Chart“ on page 75).
8. Make sure all rotor parts and accessories have been cleaned as explained („Maintenance and Care“ on page 57).

## Compartment Loads in Excess of Design Mass

There is a recommended design mass established for each rotor representing the maximum mass that can be carried in the rotor. The total mass should not exceed the recommendation unless the rotor speed is reduced proportionately. If the density of the solution is greater than 1.2 g/mL, use the following formula to determine the reduced speed:

$$n_{adm} = n_{max} \sqrt{\frac{1.2 \text{ g/mL}}{\text{average fluid density}}}$$

$n_{adm}$  = admissible speed

$n_{max}$  = maximum speed

## Critical Speed

The critical speed is that speed at which any rotor imbalance will produce a driving frequency equal to the resonant frequency of the rotating system (that is, the rotor and the centrifuge drive). At this speed, the rotor may produce large amplitude vibrations which can be felt in the instrument frame. Mass imbalance will contribute to increased vibration intensity at the critical speed. Avoid operating the rotor at the critical speed, which is approximately 4,200 rpm for the TCF-20 Rotor in the Sorvall LYNX 6000 superspeed centrifuge.





## Rotor Installation

Before installing the rotor, make sure that the rotor's center hole and centrifuge spindle are clean and dry, and free of nicks and scratches. Wipe these surfaces clean before installing the rotor.



### CAUTION

Unapproved or incorrectly combined accessories can cause serious damage to the centrifuge.

### To install the rotor

1. Open the door of the centrifuge and if necessary remove any dust, foreign objects or residue from the chamber.
2. Hold the rotor over the centrifuge spindle and let it slide slowly down the centrifuge spindle.
3. Ensure that the rotor has been correctly identified by the Sorvall LYNX 6000 superspeed centrifuge.

The rotor is now securely in place and ready for operation.

## Removing the Rotor

### To remove the rotor

1. Open the centrifuge door.
2. Remove part assemblies or cap.
3. Firmly press the rotor unlocking tool (Catalog No. 75000602) into the center of the rotor to engage the release of the rotor from the centrifuge spindle.
4. Lift the rotor off the centrifuge drive spindle and place it in the rotor holding fixture.
5. Open the rotor lid by seating the rotor cover wrench on the rotor cover and turning the clockwise (left-hand thread).

### NOTICE

Threads contaminated with dirt, dried lubricant, metal particles, or threads insufficiently lubricated can cause rotor components to stick. Do not use excessive force to loosen components. Routinely clean metal threads and apply lubricant (Catalog No. 70006692). Contact your Thermo Fisher Scientific representative for issues.



## Zonal Operation

### Calculation of Sedimentation Time in Aqueous (Non-gradient) Solutions

The time required to sediment a particle in water at 20 °C through the maximum rotor path length (that is, the distance between  $r_{\min}$  and  $r_{\max}$ ) can be calculated using the equation:

$$t = \frac{K}{S_{20,W}}$$

where:

$t$  = sedimentation time in hours

$K$  = the clearing factor for the rotor (defined below).

$S_{20,W}$  = the sedimentation coefficient for the particle of interest in water at 20 °C as expressed in Svedbergs\*

The clearing (or  $K$ ) factor (in hours per Svedberg) is defined by the equation:

$$K = (253000) \left[ \ln \left( \frac{r_{\max}}{r_{\min}} \right) \right] \left( \frac{1000}{\text{rotor speed}} \right)^2$$

Where  $r_{\max}$  and  $r_{\min}$  are the maximum and minimum rotor radii, respectively, and rotor speed is expressed in rpm.

See [„RCF-Values“ on page 65](#) for a list of  $K$  factors for the TCF-20 Rotor, at speeds from 1,000 rpm to 20,000 rpm (in increments of 500 rpm).

Example: The TCF-20 Rotor has a  $K$  factor of 620 at the maximum permitted speed (20,000 rpm).

If the particles to be sedimented have a sedimentation coefficient of 10S, the estimated run time required at maximum speed will be:

$$t = \frac{620}{10S} = 62 \text{ hours}$$

Note that the calculation assumes particles in water at 20 °C. If the suspending medium is denser or more viscous than water, the sedimentation time will be greater.

\*The sedimentation coefficient ( $S$ ) in seconds, for a particle in a centrifugal field is defined by the equation  $S = (dx/dt) [1/(\omega^2 x)]$ ; where  $dx/dt$  = sedimentation velocity of the particle in cm/s;  $\omega$  = rotor speed in rad/s; and  $x$  = the distance of the particle from the axis of rotation in centimeters. Conventionally, experimentally determined values of sedimentation coefficients are multiplied by  $10^{13}$  to convert them to Svedberg units (S), so a particle with an experimentally determined sedimentation coefficient of  $10^{-11}$  seconds is usually referred to in the literature as a “100 S particle.” Since the value determined for the sedimentation coefficient is dependent on the density and viscosity of the solution in which centrifugation is performed, values are usually reported for the standard conditions of infinite dilution in water at 20 °C, and designated  $S_{20,W}$ .



## Running Statically Loaded Gradients (Sealed Operation)

To run statically loaded gradients in the TCF-20 Rotor, follow the operating instructions supplied with the rate controller and centrifuge.

### Rotor Assembly and Rotor Precooling

#### NOTICE

If your desired application requires precooling of the rotor and sample, be sure to precool your sample separately. Follow the instructions below to precool your rotor in the centrifuge. If desired, precool your rotor to the required temperature, assemble the rotor following steps 1 through 10 below then proceed to step „Rotor Loading“. Refer to „Figure 2“ and „Figure 3“, respectively for location and identification of parts and tools required for operation.

#### To assemble the rotor

1. Place the rotor body into the rotor holding fixture (Catalog No. 52540).
2. Using the dissecting needle (Catalog No. 66026); carefully remove the O-rings in the rotor assembly. Inspect each of the O-rings for cracks, tears or abrasions; replace if necessary. Lubricate each O-ring with a light film of lubricant (Catalog No. 76003500), then reinsert each O-ring into its respective part.



#### CAUTION

All O-rings used in the rotor assembly should be routinely checked for cracks, tears or abrasions and replaced when necessary. Lubricate the O-rings as directed. Failure to properly maintain the O-rings can result in an incomplete seal.

3. Place the septa (Catalog No. 49609) into the rotor body with a slight twisting motion.
4. Lubricate the threads of the rotor cover at several places around the circumference with lubricant grease (Catalog No. 75003786). Place the cover onto the rotor body, then turn it clockwise until it drops onto the threads of the rotor body. Turn the cover counterclockwise until tight (this will spread the grease over the threads). Use wrench (Catalog No. 49724) to securely tighten the cover.



#### CAUTION

Before running the TCF-20 Rotor in the centrifuge, make sure the rotor cover is properly seated. Operating the rotor with the cover not properly seated can cause rotor failure with subsequent damage to your centrifuge.

5. Use both hands to remove the rotor assembly from the rotor holding fixture and carefully lower it onto the centrifuge drive spindle.

6. Check that the rotor is level by placing a spirit level on the flat surface of the rotor cover (this will ensure equal dispersion of the gradient during operation). If the rotor is not level, adjust the centrifuge feet accordingly.
7. Place the distributor body (Catalog No. 52425) of the feed device assembly (Catalog No. 49634) in position through the hole in the rotor cover. Slowly rotate the distributor body to engage the guide pins (located on the bottom of the distributor body) with the corresponding holes in the septa.
8. Place the holddown plate (Catalog No. 52416) on the distributor body (the top of the holddown plate can be identified by the three large screw holes). Align the three screw holes of the holddown plate with the corresponding holes in the distributor body. Insert the three socket head screws (Catalog No. 62987) through both parts. Turn the assembly (which includes the holddown plate, distributor body, and septa) while pressing down firmly on one of the screws until it aligns with the corresponding threaded hole of the rotor body spindle and drops into place. Use the T-Wrench to alternately tighten the screws until they are firmly and evenly tightened.
9. Close the centrifuge door. Precool the rotor to the desired temperature by using the pretempering function on the Sorvall LYNX 6000 centrifuge.
10. At the end of centrifugation run, when the rotor has decelerated to 0 rpm, open the centrifuge door.

## Rotor Loading

### To load the rotor

1. With the rotor at rest and the centrifuge door open, slide the silicone tubing from a peristaltic pump through one of the two inlet ports located on the left back side of the centrifuge (remove the rubber plug).
2. Connect the silicone tubing from the peristaltic pump to the feed adapter (Catalog No. 49007) then insert the feed adapter into the center of the distributor body.
3. Check that all lines are loading gradient properly. Turn the peristaltic pump on, then squeeze the silicone tubing near the feed adapter to create a back pressure. When the tubing is released, the fluid should purge the air from all loading lines resulting in an even flow through all channels. Repeat procedure to be sure all lines flow evenly.
4. Load the gradient into the rotor using the peristaltic pump, light end first. The gradient must flow smoothly through all the loading lines or it will be distributed unevenly between the six compartments of the septa.



### CAUTION

Always run the TCF-20 Rotor with a full fluid load (1350 ml). Running the rotor with less than a full fluid load may cause damage to the centrifuge and/or rotor due to the shifting mass of the fluid. If enough sample is not available an overlay should be used to increase the rotor contents to 1350 mL.

5. When all the gradient is loaded, open the centrifuge door and carefully remove the silicone tubing from the feed adapter and from the inlet port. Replace the rubber plug in the inlet port hole.
6. Remove the feed adapter from the distributor body.
7. Use a syringe with a blunt 18 gauge needle to load equal amounts of sample into each of the six small holes of the holddown plate.
8. Place the sealing cover (Catalog No. 52417) over the distributor body. Insert the three socket head screws (Catalog No. 66329) into the sealing cover then align with the distributor body. Use the T-Wrench to alternately tighten the screws until they are firmly and evenly tightened.
9. Close the centrifuge door. Perform the run as explained in the centrifuge instruction manual.

## Unloading and Disassembling the Rotor

### NOTICE

Once the rotor has stopped spinning, do not bump or jar the centrifuge. Any disturbance may remix the delicate separations.

### To unload and disassemble the rotor

1. At the end of the run, open the centrifuge door. Slide the silicone tubing from the peristaltic pump through one of the two inlet ports located on the left back side of the centrifuge (remove the rubber plug).
2. Use the T-Wrench to remove the three socket head screws from the sealing cover. Remove the sealing cover.
3. Lubricate the feed adapter O-ring (Catalog No. 63037) using lubricant (Catalog No. 75003600).
4. Connect the silicone tubing to the feed adapter, insert the feed adapter into the center of the distributor body.
5. Before unloading the rotor, check that all lines unload evenly and smoothly as follows:
  - a. Set the speed control of the peristaltic pump to a higher than normal rate.
  - b. Turn the peristaltic pump on and squeeze the tubing near the feed adapter to create a vacuum. Release the tubing; when the tubing is released there should be a rush of bubbles up through the adapter as the feed lines clear. No more bubbles should appear in the effluent from the distributor body and all lines should unload at the same time.
  - c. Reset the peristaltic pump to its normal unloading rate.



### CAUTION

The density gradient being pumped from the rotor must flow smoothly through all feed lines so that the gradient will unload evenly from the six compartments.

**NOTICE**

Occasionally with very viscous solutions of 55% w/w sucrose or higher, small bubbles will appear in the effluent even after the above procedure is completed. To eliminate this problem, reduce the unloading rate until the viscous end of the gradient (or cushion) has been pumped from the rotor. Then, reset the unloading rate of the peristaltic pump to the normal rate.

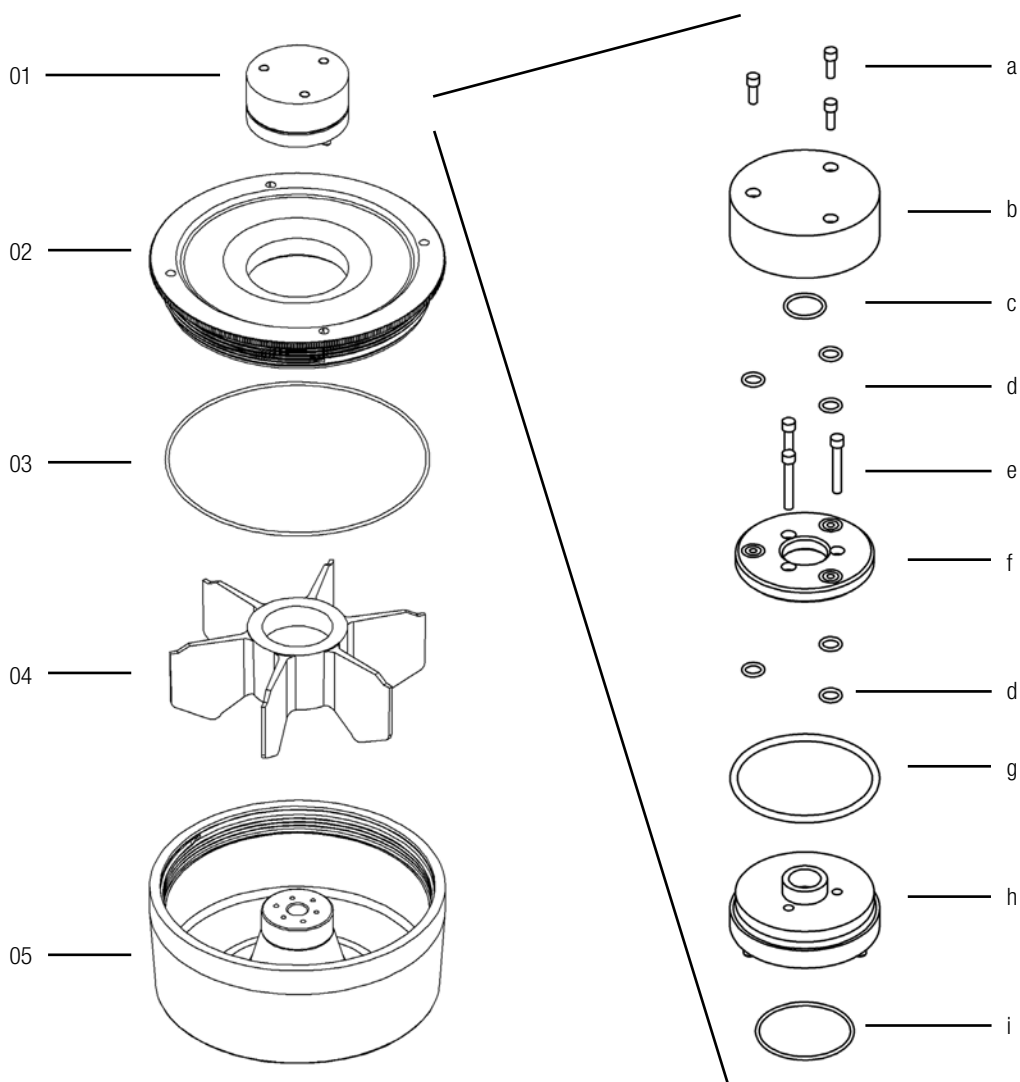
6. Close the centrifuge door to maintain temperature within the rotor chamber. Unload the rotor, do not exceed 75 mL/min.
7. After rotor unloading, remove the feed adapter from the distributor body.
8. Disassemble the distributor assembly:
  - a. Remove the three socket head screws that secure the holddown plate in place. Remove the holddown plate.
  - b. Remove the distributor body.
9. Firmly press the rotor unlocking tool (Catalog No. 75000602) into the center of the rotor to engage the release of the rotor from the centrifuge drive spindle.
10. Lift the rotor off the centrifuge drive spindle and place it in the rotor holding fixture.
11. Remove the rotor cover and the septa.
12. Clean and store the rotor and parts (see „Maintenance and Care“ on page 57).

## Rotor Assembly Parts and Accessories for Sealed Operation

To run statically loaded gradients or sealed operation, make sure all parts are clean and in good working order.

**Figure 2**

Rotor Assembly for Sealed Operation. See „Table 5“ for description of numbered items



**Table 5**  
Rotor Assembly for  
Sealed Operation  
(key to Figure 2)

| Figure Item Number                        | Quantity Supplied | Catalog Number | Description                                    |
|---|-------------------|----------------|--|
| 01  |                   | 75004051       | Sealed Feed Device Assembly                    |
| a   | 3                 | 66329          | Hexagon Socket Screw<br>8/32 x 0.437" VA       |
| b   | 1                 | 52417          | Screw Cap                                      |
| c   | 1                 | 66330          | O-Ring,<br>17.2 x 1.8 mm, 75 Shore             |
| d   | 6                 | 61289          | O-Ring, Buna,<br>7.7 x 11.3 x 1.8 mm, 75 Shore |
| e   | 3                 | 62987          | Hexagon Socket Screw<br>8/32 x 1.125" VA       |
| f   | 1                 | 52416          | Holddown Plate                                 |
| g   | 1                 | 64578          | O-Ring, Viton,<br>66.3 x 3.6, 75 Shore         |
| h   | 1                 | 52425          | Distributor Body                               |
| i   | 1                 | 66308          | O-Ring, Viton,<br>44.9 x 1.8 mm, 75 Shore      |
| 02  | 1                 | 75004012       | Rotot Lid                                      |
| 03  | 1                 | 90840          | O-Ring,<br>178.8 x 2.6 mm, 75 Shore            |
| 04  | 1                 | 49609          | Septa  |
| <i>not shown;<br/>used with the septa</i> | 6                 | 66193          | O-Ring, Viton,<br>4.5 x 1.8 mm, 75 Shore       |
| 05  | 1                 | 75000604       | Rotorbody                                      |

## Batch Operation (Sealed)

### Rotor Precooling

#### NOTICE

If your desired application requires precooling of the rotor and sample, be sure to precool your sample separately. Follow the instructions below to precool your rotor in the centrifuge. If desired, precool your rotor refrigerating it to the required temperature, assemble the rotor following steps 1 through 10 below then proceed to step „Rotor Assembly, Loading and Unloading“.

Refer to „Figure 2“ , respectively for location and identification of parts and tools required for operation.

#### To precool the rotor

1. Place the rotor body into the rotor holding fixture.
2. Using the dissecting needle (Catalog No. 66026); carefully remove the O-rings in the rotor assembly. Inspect each of the O-rings for cracks, tears or abrasions; replace if necessary. Lubricate each O-ring with a light film of lubricant (Catalog No. 76003500), then reinsert each O-ring into its respective part.



#### CAUTION

All O-rings used in the rotor assembly should be routinely checked for cracks, tears or abrasions and replaced when necessary. Lubricate the O-rings as directed. Failure to properly maintain the O-rings can result in an incomplete seal.

3. Place the septa (Catalog No. 49609) into the rotor body with a slight twisting motion.
4. Lubricate the threads of the rotor cover at several places around the circumference with lubricant grease (Catalog No. 76003786). Place the cover onto the rotor body, then turn it clockwise until it drops onto the threads of the rotor body. Turn the cover counterclockwise until tight (this will spread the grease over the threads). Use wrench (Catalog No. 49724) to securely tighten the cover.

## NOTICE

Before running the TCF-20 Rotor in the centrifuge, make sure the rotor cover is properly seated. Clearance between the rotor body and rotor cover should be no greater than 0.64 mm (0.025 inches).

Operating the rotor with the cover not properly seated can cause rotor failure with subsequent damage to your centrifuge.

5. Use both hands to remove the rotor assembly from the rotor holding fixture and carefully lower it onto the centrifuge drive spindle.
6. Check that the rotor is level by placing a spirit level on the flat surface of the rotor cover (this will ensure equal dispersion of the gradient during operation). If the rotor is not level, adjust the centrifuge feet accordingly.
7. Place the distributor body (Catalog No. 52425) of the sealed feed assembly in position through the hole in the rotor cover. Slowly rotate the distributor body to engage the guide pins (located on the bottom of the distributor body) with the corresponding holes in the septa.
8. Place the holddown plate (Catalog No. 52416) on the distributor body (the top of the holddown plate can be identified by the three large screw holes). Align the three screw holes of the holddown plate with the corresponding holes in the distributor body. Insert the three socket head screws (Catalog No. 62987) through both parts. Turn the assembly (which includes the holddown plate, distributor body, and septa) while pressing down firmly on one of the screws until it aligns with the corresponding threaded hole of the rotor body spindle and drops into place. Use the T-Wrench to alternately tighten the screws until they are firmly and evenly tightened.
9. Close the centrifuge door. If necessary, precool the rotor.
10. At the end of the centrifugation run, when the rotor has decelerated to 0 rpm, open the centrifuge door.
11. Disassemble the distributor assembly as follows:
  - a. Remove the three socket head screws that secure the holddown plate in place. Remove the holddown plate.
  - b. Remove the distributor body.
12. Firmly press the rotor unlocking tool (Catalog No. 75000602) into the center of the rotor to engage the release of the rotor from the spindle.
13. Lift the rotor off the centrifuge drive spindle and place it in the rotor holding fixture.
14. Remove the rotor cover.



## Rotor Assembly, Loading and Unloading

### To assemble, load and unload the rotor

1. With the rotor placed in the rotor holding fixture, use the dissecting needle (Catalog No. 66026) supplied to carefully remove the O-rings in the rotor assembly. Inspect each of the O-rings for cracks, tears or abrasions; replace if necessary. Lubricate each O-ring with a light film of lubricant (Catalog No. 76003500), then reinsert each O-ring into its respective part.



#### CAUTION

All O-rings used in the rotor assembly should be routinely checked for cracks, tears or abrasions and replaced when necessary. Lubricate the O-rings as directed. Failure to properly maintain the O-rings can result in an incomplete seal.

2. Fill the rotor body with the sample to be processed (making sure that all six sector-shaped compartments have equal fluid levels).
3. Lubricate the threads of the rotor cover at several places around the circumference with lubricant grease (Catalog No. 76003786). Place the cover onto the rotor body, then turn it clockwise until it drops onto the threads of the rotor body. Turn the cover counterclockwise until tight (this will spread the grease over the threads). Use wrench assembly (Catalog No. 49724) to securely tighten the cover.



#### CAUTION

Before running the TCF-20 Rotor in the centrifuge, make sure the rotor cover is properly seated. Clearance between the rotor body and rotor cover should be no greater than 0.64 mm (0.025 inches). Operating the rotor with the cover not properly seated can cause rotor failure with subsequent damage to your centrifuge.

4. Using both hands remove the rotor assembly from the rotor holding fixture and carefully lower it onto the centrifuge drive spindle.
5. Check that the rotor is level by placing a spirit level on the flat surface of the rotor cover (this will ensure equal dispersion of the gradient during operation). If the rotor is not level, adjust the centrifuge feet accordingly.
6. Place the distributor body (Catalog No. 52425) in position through the hole in the rotor cover. Rotate the distributor body slowly to engage the guide pins (located on the bottom of the distributor body) with the corresponding holes in the septa.
7. Place the holddown plate (Catalog No. 52416) on the distributor body (the top of the holddown plate can be identified by the three large screw holes). Align the three screw holes of the holddown plate with the corresponding holes in the distributor body. Insert the three socket head screws (Catalog No. 62987) through both parts. Turn the assembly (which includes the holddown plate, distributor body, and septa) while pressing down firmly on the head of one screw until it aligns with the corresponding threaded hole of the rotor body spindle and drops into place. Use the T-Wrench to alternately tighten the three socket head screws until they are firmly and evenly tightened.

8. Place the sealing cover over the distributor body. Insert the three socket head screws (Catalog No. 66329) into the sealing cover, then turn the sealing cover until the screws drop into place. Use the T-Wrench to alternately tighten the screws until they are firmly and evenly tightened.
9. Close the centrifuge door and perform the run as explained in the centrifuge instruction manual.
10. At the end of the run and the rotor decelerated to zero rpm, open the centrifuge door.
11. Remove the three socket head screws that secure the sealing cover. Remove the sealing cover.
12. Disassemble the distributor assembly:
  - a. Remove the three socket head screws that secure the holddown plate in place. Remove the holddown plate.
  - b. Remove the distributor body.
13. Firmly press the rotor unlocking tool (Catalog No. 75000602) into the center of the rotor to engage the release of the rotor from the spindle.
14. Lift the rotor off the centrifuge spindle and place it in the rotor holding fixture.
15. Remove the rotor cover.
16. Aspirate any unwanted solution. The sedimented particles will be packed against the wall of the rotor.
17. Remove the septa.
18. Use a rubber, wooden or Teflon® coated spatula to remove the sedimented particles from the wall of the rotor.
19. Clean and store the rotor and parts (see „Maintenance and Care“ on page 57).

## Batch Operation (Unsealed)

### Rotor Precooling

#### NOTICE

If your desired application requires precooling of the rotor and sample, be sure to precool your sample separately. Follow the instructions below to precool your rotor in the centrifuge. If desired, precool your rotor refrigerating it to the required temperature, assemble the rotor following steps 1 through 10 below then proceed to step „Rotor Assembly, Loading and Unloading“. Refer to „Figure 3“, respectively for location and identification of parts and tools required for operation.

#### To precool the rotor

1. Place the rotor body into the rotor holding fixture.
2. Using the dissecting needle (Catalog No. 66026); carefully remove the O-rings in the rotor assembly. Inspect each of the O-rings for cracks, tears or abrasions; replace if necessary. Lubricate each O-ring with a light film of lubricant (Catalog No. 76003500), then reinsert each O-ring into its respective part.

**CAUTION**

All O-rings used in the rotor assembly should be routinely checked for cracks, tears or abrasions and replaced when necessary. Lubricate the O-rings as directed. Failure to properly maintain the O-rings can result in an incomplete seal.

3. Place the septa (Catalog No. 49609) into the rotor body with a slight twisting motion.
4. Lubricate the threads of the rotor cover at several places around the circumference with lubricant grease (Catalog No. 75003786). Place the cover onto the rotor body, then turn it clockwise until it drops onto the threads of the rotor body. Turn the cover counterclockwise until tight (this will spread the grease over the threads). Use wrench (Catalog No. 49724) to securely tighten the cover.

**CAUTION**

Before running the TCF-20 Rotor in the centrifuge, make sure the rotor cover is properly seated. Clearance between the rotor body and rotor cover should be no greater than 0.64 mm (0.025 inches). Operating the rotor with the cover not properly seated can cause rotor failure with subsequent damage to your centrifuge.

5. Use both hands to remove the rotor assembly from the rotor holding fixture and carefully lower it onto the centrifuge drive spindle.
6. Check that the rotor is level by placing a spirit level on the flat surface of the rotor cover (this will ensure equal dispersion of the gradient during operation). If the rotor is not level, adjust the centrifuge feet accordingly.
7. Place the unsealed distributor feed device assembly (Catalog No. 49635) in position through the hole in the rotor cover. Slowly rotate the unsealed distributor feed device assembly to engage the guide pins in the corresponding holes in the septa.
8. Place the three cap screws (Catalog No. 62987) in the distributor feed device assembly. Turn the rotor body and distributor/septa in opposite directions until the cap screws align with the drive adapter and drop into place (apply light pressure to one screw to locate the holes). Use the T-Wrench to alternately tighten the screws until they are firmly and evenly tightened.

**CAUTION**

Do not overtighten the cap screws. The cap screws must be evenly tightened to properly seal the distributor feed device assembly.


9. Close the centrifuge door. If necessary, precool the rotor.
10. At the end of the centrifugation run, when the rotor has decelerated to 0 rpm, open the centrifuge door.
11. Use the T-Wrench to loosen the three cap screws securing the distributor feed device assembly in place. Then, remove the screws.

12. Remove the distributor feed device assembly by pulling upward; turn clockwise if necessary.
13. Firmly press the rotor unlocking tool (Catalog No. 75000602) into the center of the rotor to engage the release of the rotor from the spindle.
14. Lift the rotor off the centrifuge drive spindle and place it in the rotor holding fixture.
15. Remove the rotor cover turning it clockwise; use wrench assembly (Catalog No. 49724) if necessary.


## Rotor Assembly, Loading and Unloading

### To assemble, load and unload the rotor

1. With the rotor placed in the rotor holding fixture, use the dissecting needle (Catalog No. 66026) supplied to carefully remove the O-rings in the rotor assembly. Inspect each of the O-rings for cracks, tears or abrasions; replace if necessary. Lubricate each O-ring with a light film of lubricant (Catalog No. 75003600), then reinsert each O-ring into its respective part.

|  |                |
|--|----------------|
|   | <b>CAUTION</b> |
| All O-rings used in the rotor assembly should be routinely checked for cracks, tears or abrasions and replaced when necessary. Lubricate the O-rings as directed. Failure to properly maintain the O-rings can result in an incomplete seal. |                |

2. Fill the rotor body with the sample to be processed (making sure that all six sector-shaped compartments have equal fluid levels).
3. Lubricate the threads of the rotor cover at several places around the circumference with lubricant grease (Catalog No. 75003786). Place the cover onto the rotor body, then turn it clockwise until it drops onto the threads of the rotor body. Turn the cover counterclockwise until tight (this will spread the grease over the threads). Use wrench assembly (Catalog No. 49724) to securely tighten the cover.

|   |                |
|---|----------------|
|    | <b>CAUTION</b> |
| Before running the TCF-20 Rotor in the centrifuge, make sure the rotor cover is properly seated. Clearance between the rotor body and rotor cover should be no greater than 0.64 mm (0.025 inches). Operating the rotor with the cover not properly seated can cause rotor failure with subsequent damage to your centrifuge. |                |

4. Using both hands remove the rotor assembly from the rotor holding fixture and carefully lower it onto the centrifuge drive spindle.
5. Check that the rotor is level by placing a spirit level on the flat surface of the rotor cover (this will ensure equal dispersion of the gradient during operation). If the rotor is not level, adjust the centrifuge feet accordingly.
6. Place the distributor feed device assembly (Catalog No. 49635) in position through the hole in the rotor cover. Rotate the distributor slowly to engage the guide pins into the corresponding holes of the septa.

7. Place the three cap screws (Catalog No. 62987) in the distributor feed device assembly. Turn the rotor and distributor/septa in opposite directions until the screws align with the centrifuge drive adapter and drop into place (apply light pressure to one screw to locate the holes). Use the T-Wrench to alternately tighten the three cap screws until they are firmly and evenly tightened.
8. Close the centrifuge door and perform the run.
9. At the end of the run and with the rotor decelerated to 0 rpm, open the centrifuge door.
10. Use the T-Wrench to loosen the three cap screws securing the distributor feed device assembly in place. Remove the cap screws.
11. Remove the distributor feed device assembly by pulling upward; turn clockwise if necessary.
12. Firmly press the rotor unlocking tool (Catalog No. 75000602) into the center of the rotor to engage the release of the rotor from the centrifuge spindle.
13. Lift the rotor off the centrifuge drive spindle and place it in the rotor holding fixture.
14. Remove the rotor cover.
15. Aspirate any unwanted solution. The sedimented particles will be packed against the wall of the rotor.
16. Remove the septa.
17. Use a rubber, wooden or Teflon™ coated spatula to remove the sedimented particles from the wall of the rotor.
18. Clean and store the rotor and parts (see „Maintenance and Care“ on page 57).

Rotor Assembly Parts and Accessories for Unsealed Operation

To run statically loaded gradients, make sure all parts are clean and in good working order.

Figure 3  
Rotor Assembly  
for Unsealed  
Operation.  
See „Table 6“ for  
description of  
numbered items

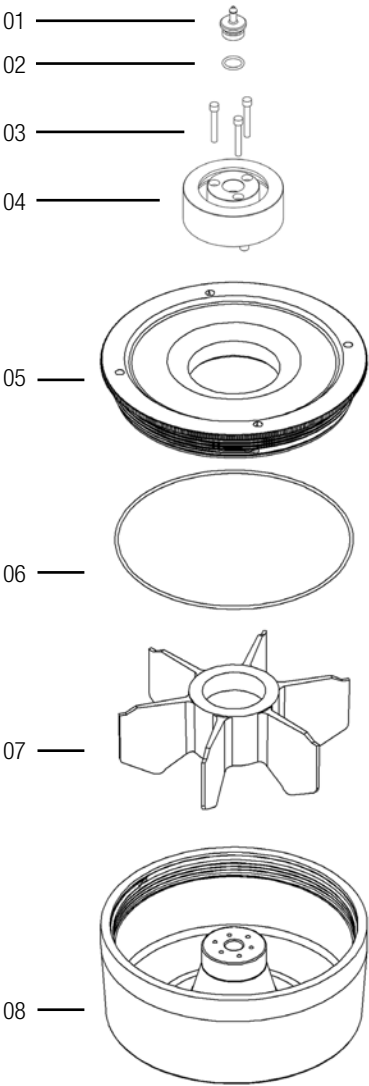


Table 6  
Rotor Assembly  
for Unsealed  
Operation.  
(key to Figure 3)

| Figure Item Number                | Quantity Supplied | Catalog Number | Description                               |
|-----------------------------------|-------------------|----------------|---|
| 01                                | 1                 | 49007          | Feed Adapter                              |
| 02                                | 1                 | 63037          | O-Ring, Viton,<br>12.7 x 1.8 mm, 75 Shore |
| 03                                | 3                 | 62987          | Hexagon Socket Screw 8/32 x<br>1.125" VA  |
| 04                                | 1                 | 49635          | Unsealed Distributor Feed Assembly        |
| 05                                | 1                 | 75004012       | Rotor Lid                                 |
| 06                                | 1                 | 90840          | O-Ring,<br>178.8 x 2.6 mm, 75Shore        |
| 07                                | 1                 | 49609          | Septa                                     |
| not shown;<br>used with the septa | 6                 | 66193          | O-Ring, Viton,<br>4.5 x 1.8 mm, 75 Shore  |
| 08                                | 1                 | 75000604       | Rotorbody                                 |



## Continuous Flow Operation

### Pre-run Safety Check

#### Performing a safety check

1. Secure the rotor holding fixture to a workbench or table as shown in Figure 1 to prepare the TCF-20 Rotor for operation when using continuous flow applications.
2. Follow all precautions („Precautions“ on page 10)
3. Inspect the rotor cover O-ring, the seven O-rings in the continuous flow system and the six O-rings in the septa for cracks, tears or abrasions; replace if necessary.
4. Inspect the feed lines in the septa, adapter and the feed device assembly for blockage („Figure 11“ on page 45).
5. Lubricate the threads of the inlet/outlet assembly with lubricant grease (Catalog No. 75003786).
6. Ensure that all rotor parts, continuous flow parts, and accessories are free of encrusted material and have been cleaned („Maintenance and Care“ on page 57).

### Derating for Sediment Build Up

If a suspension having a sediment specific gravity ( $\rho$ ) greater than 1.2 g/mL is to be separated using the continuous flow system, the depth of the sediment must be limited for safe operation.

#### To derate for sediment build up

1. Select the graph („Figure 4“ through „Figure 10“) which corresponds to your desired operating speed.
2. Select the supernatant ( $\rho$ ) specific gravity on the abscissa of the graph.
3. Select the proper sediment specific gravity curve and read the maximum allowable SEDIMENT DEPTH on the ordinate of the graph.
4. If the sediment depth is too small, go to a lower operating speed until sediment depth requirements are satisfied. The rotor must not be operated above this speed.

With the sediment depth determined from the derating curves, the depth can be converted to a collection volume using „RCF-Values“ on page 65.

Knowing the suspension concentration and collection volume, the maximum volume of suspension that can be run through the rotor can be calculated.

EXAMPLE: If the sediment depth is 1.5 cm, this results in a collection volume of 450 mL. If the suspension concentration is 50 mL of sediment per liter of solution, 9 liters of suspension can be run through the rotor and sediment removed before running any additional solution through the rotor.



## Derating Charts for Sediment Specific Gravities ( $\rho$ )

Figure 4  
TCF-20 Derating  
Chart for Sediment  
Specific Gravities  
( $\rho$ ) higher than 1.2  
g/mL, 20,000 rpm

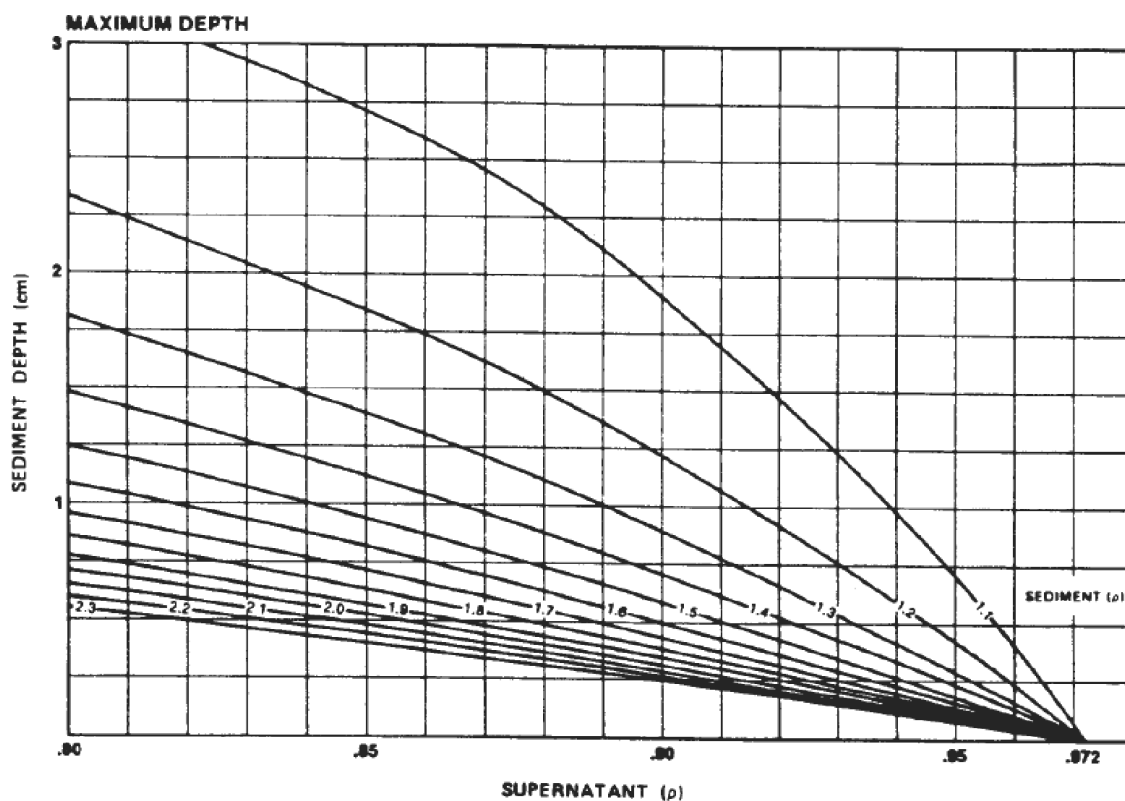


Figure 5  
TCF-20 Derating  
Chart for Sediment  
Specific Gravities  
( $\rho$ ) higher than 1.2  
g/mL, 19,000 rpm

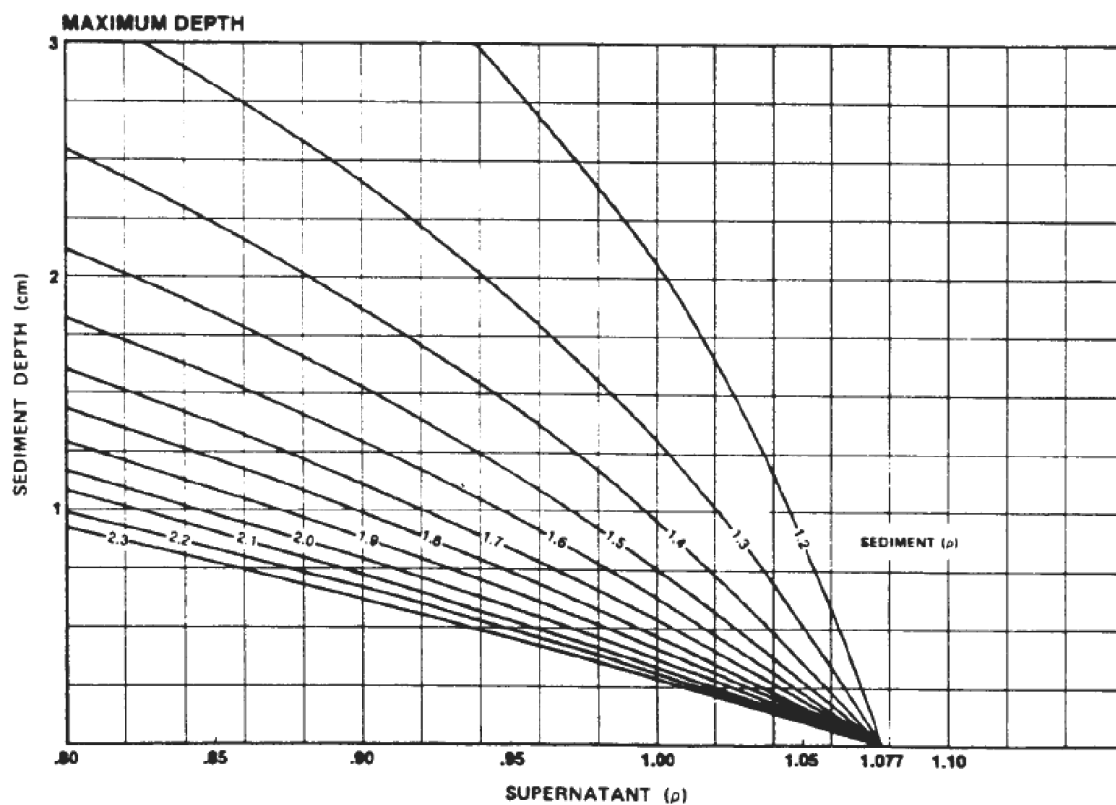


Figure 6  
TCF-20 Derating  
Chart for Sediment  
Specific Gravities  
( $\rho$ ) higher than 1.2  
g/mL, 18,000 rpm

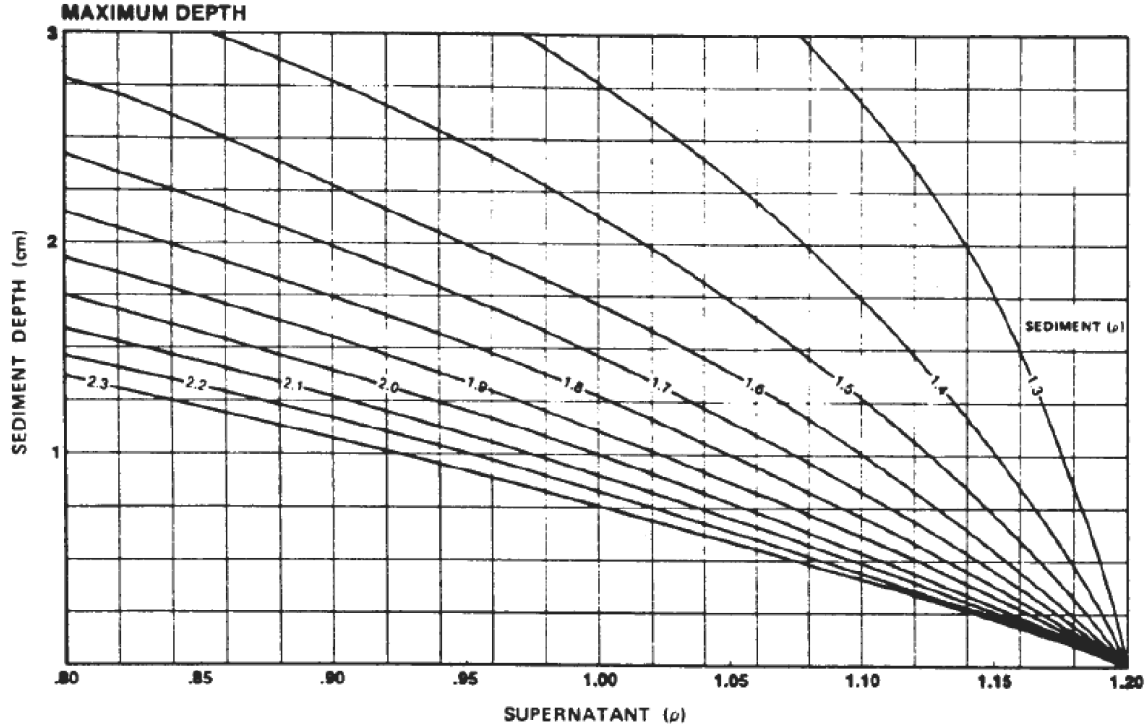


Figure 7  
TCF-20 Derating  
Chart for Sediment  
Specific Gravities  
( $\rho$ ) higher than 1.2  
g/mL, 17,000 rpm

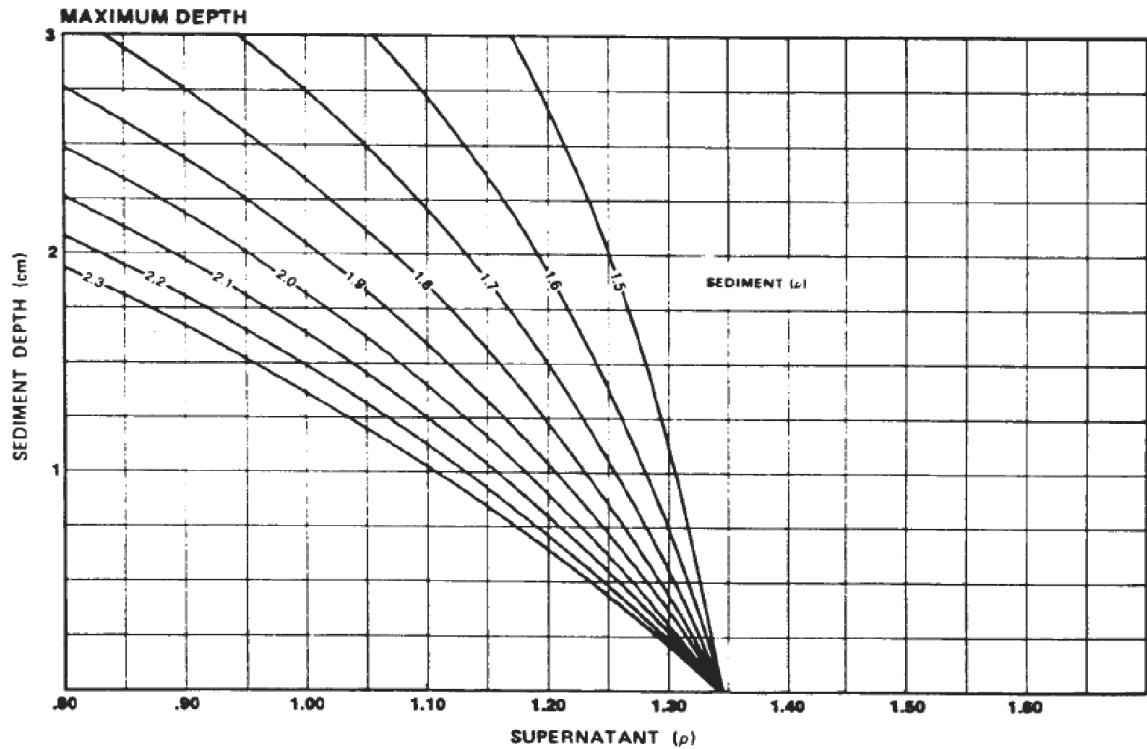


Figure 8  
TCF-20 Derating  
Chart for Sediment  
Specific Gravities  
( $\rho$ ) higher than 1.2  
g/mL, 16,000 rpm

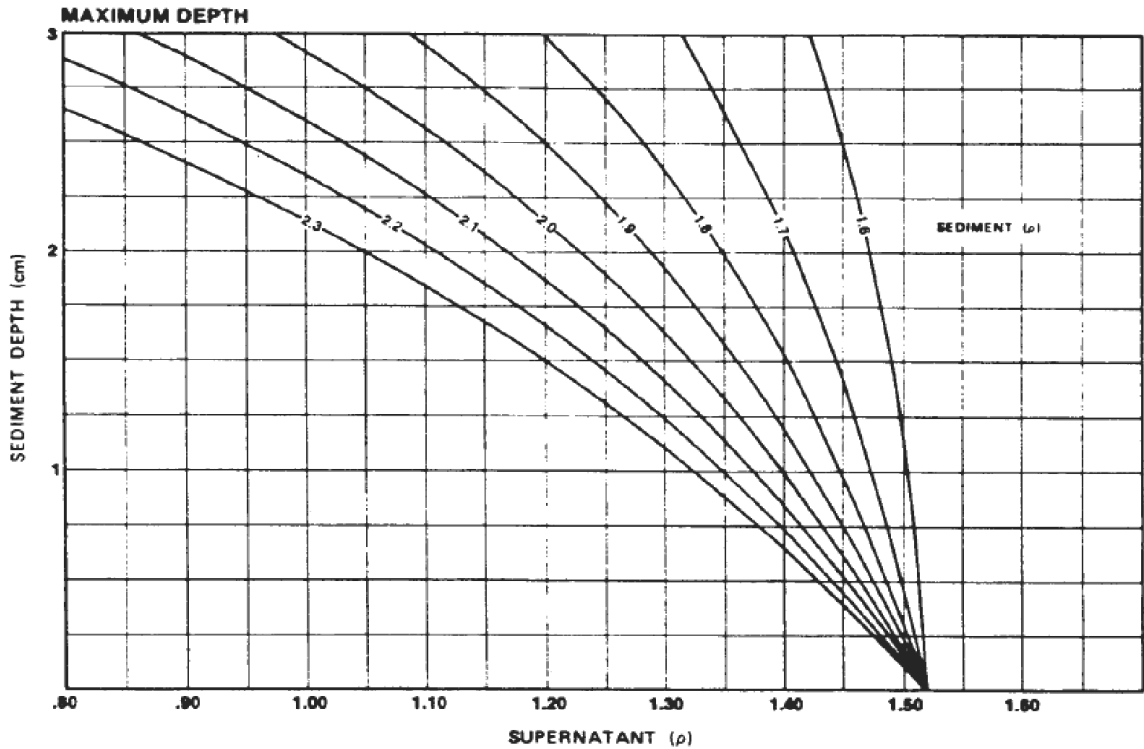


Figure 9  
TCF-20 Derating  
Chart for Sediment  
Specific Gravities  
( $\rho$ ) higher than 1.2  
g/mL, 15,000 rpm

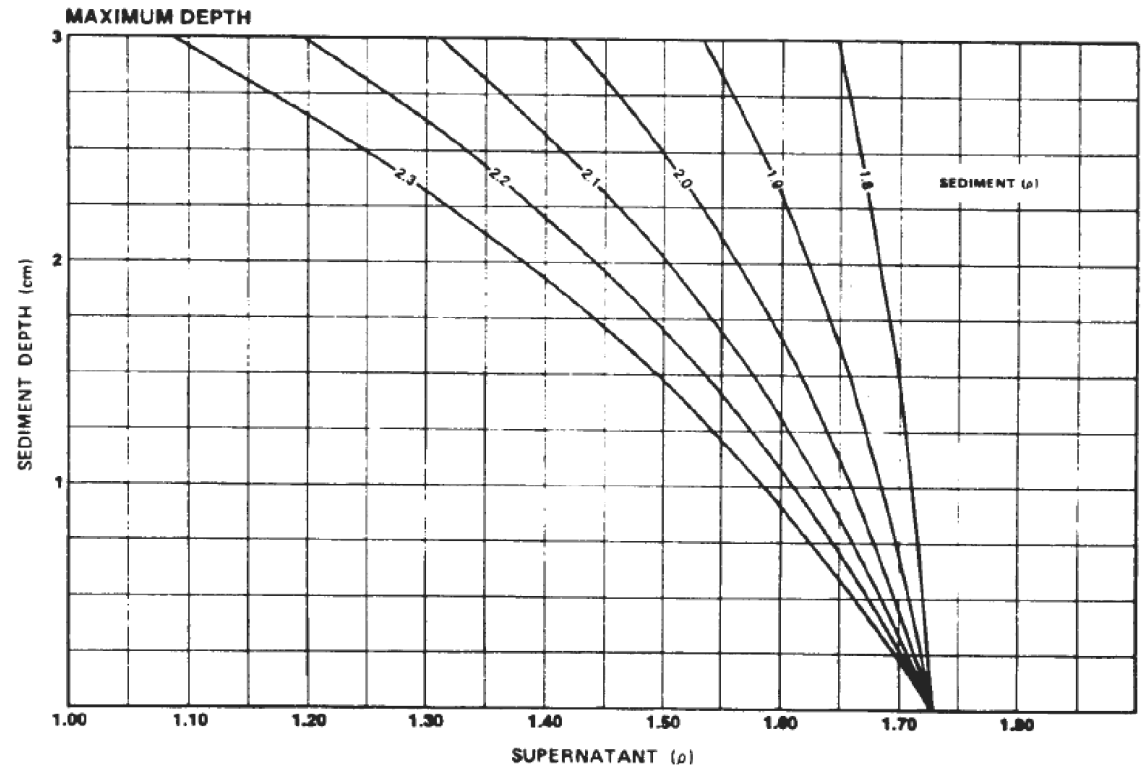
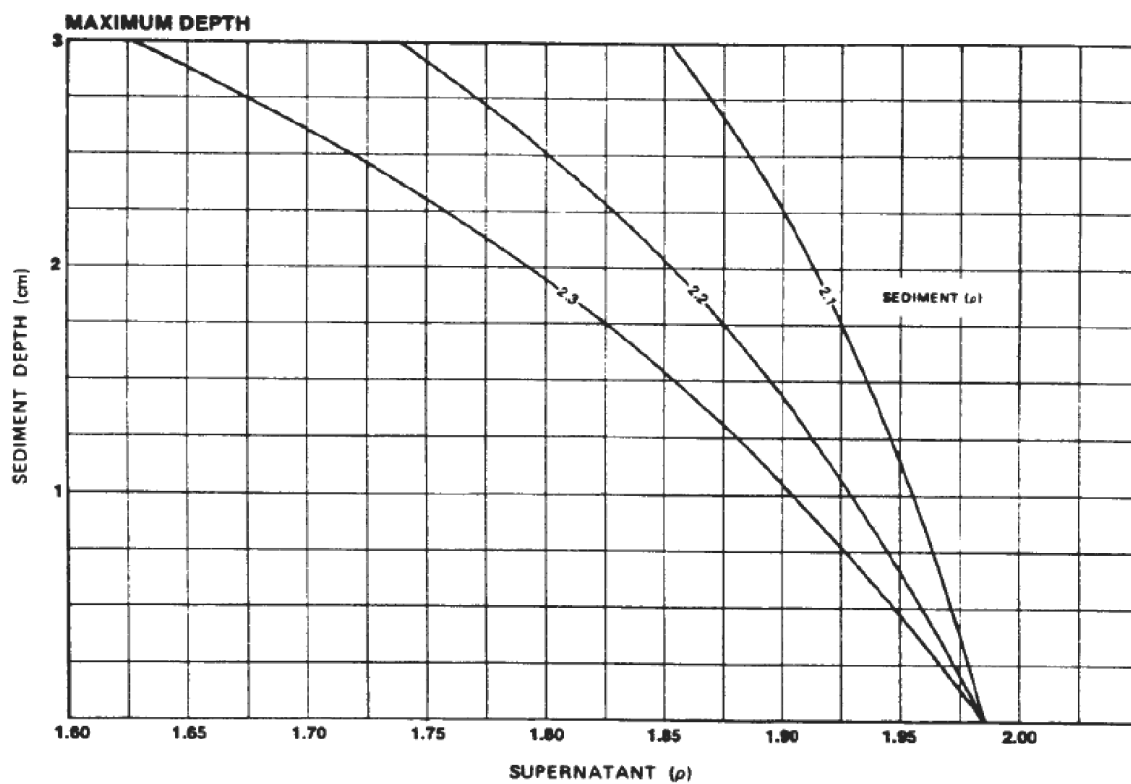


Figure 10  
TCF-20 Derating  
Chart for Sediment  
Specific Gravities  
( $\rho$ ) higher than 1.2  
g/mL, 14,000 rpm



## Assembling the TCF-20 Continuous Flow System

### Inlet/Outlet Assembly

#### To assemble the Inlet/Outlet Assembly

#### NOTICE

All threads of the continuous flow assembly are left handed. Refer to „Figure 11“, respectively, for location and identification of parts and tools required for operation.

1. Use the dissecting needle (Catalog No. 66026) supplied to carefully remove the rotor cover O-rings and O-rings in the septa. Inspect the O-rings for cracks, tears or abrasions; replace if necessary. Lubricate each O-ring with a light film of lubricant (Catalog No. 76003500) then reinsert each O-ring into its respective part.
2. Place the lift assembly (Catalog No. 70063005) into the bottom of the distributor cap (Catalog No. 13004).
3. Place the vapor seal (Catalog No. 13012) over the lift assembly.
4. Position the bearing housing (Catalog No. 13006) over the top of the distributor cap and hand tighten.
5. Lubricate the bearings using the lubricant-filled syringe (Catalog No. 13127) supplied with the bearing assembly. Apply small dots (1-2 mm<sup>2</sup>) of lubricant to the inner and outer race of each bearing at the ball points shown in „Figure 15“ on page 58. Rotate each bearing by hand to spread the lubricant evenly through the bearing. If any resistance is felt the bearings are worn and should be replaced.

#### NOTICE

Step 5 must be done before every run to ensure the proper operating conditions of the bearings.

6. Place the pair of bearing into the bearing housing. Be sure the shielded sides of the bearings face outward.
7. Add the bearing clamp ring (Catalog No. 13007) then hand tighten.
8. Use the lift plate wrench (Catalog No. 75000603) to insert the inlet/outlet connector assembly (Catalog No. 13029) down through the top of the assembly. Tighten securely. Test the assembly by holding the inlet/outlet connector assembly in one hand and rotate the rest of the assembly (it should rotate freely and without interference).

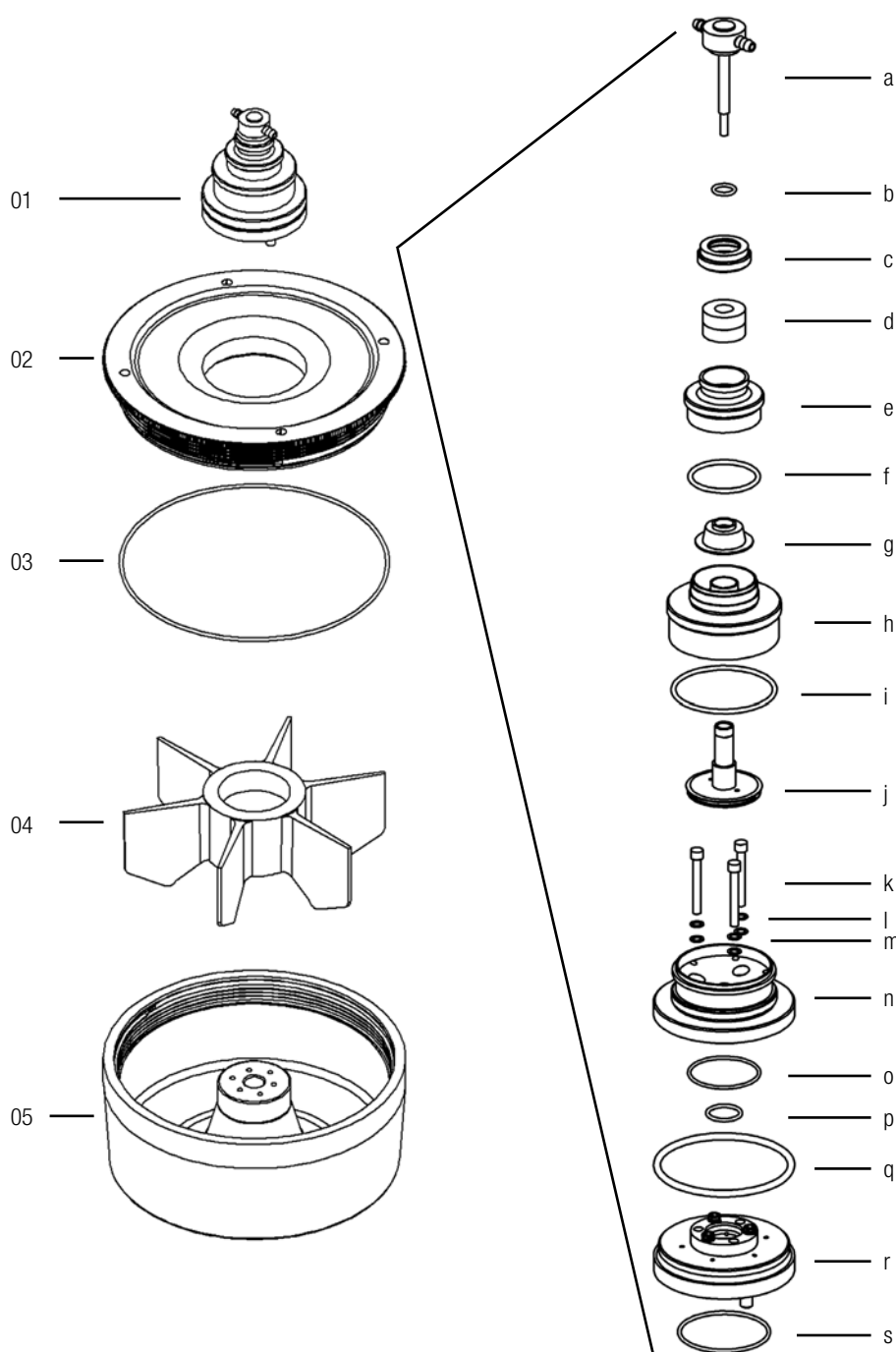
## Continuous Flow Adapter Assembly

The continuous flow adapter is comprised of the feed device assembly (Catalog No. 49634) and adapter (Catalog No. 49030).

### To assemble the continuous flow adapter assembly

1. Use the dissecting needle (Catalog No. 66026) supplied to carefully remove the O-rings in the continuous flow adapter (Catalog No. 49030) and feed device assembly (Catalog No. 49634). Inspect the O-rings for cracks, tears or abrasions; replace if necessary. Lubricate each O-ring with a light film of lubricant (Catalog No. 76003500), then reinsert each O-ring into its respective part.
2. Slip the Adapter over the Feed Device Assembly and compress to mate the two pieces, forming the continuous flow adapter.

**Figure 11**  
TCF-20 Continuous  
Flow System.  
See „Table 7“  
for description of  
numbered items




**Table 7**  
TCF-20 Continuous  
Flow System  
(key to Figure 11)

| Figure Item Number                        | Quantity Supplied | Catalog Number | Description                               |
|---|-------------------|----------------|---|
| 01  | 1                 | 75000605       | Continuous Flow Assembly                  |
| a   | 1                 | 13029          | Inlet/Outlet Connector Assembly           |
| b   | 1                 | 60737          | O-Ring, 0.375 x 0.063                     |
| c   | 1                 | 13007          | Bearing Clamp Ring                        |
| d   | 2                 | 68085          | Bearing Lifter                            |
| e   | 1                 | 13006          | Bearing Housing                           |
| f   | 1                 | 60738          | O-Ring, 1.313 x 0.094                     |
| g   | 1                 | 13012          | Vapor Seal                                |
| h   | 1                 | 13004          | Distributor Cap                           |
| i   | 1                 | 60739          | O-Ring, Viton,<br>50.8 x 2.4 mm, 75 Shore |
| j   | 1                 | 70063005       | Lift Assembly                             |
| k   | 3                 | 62988          | Hexagon Socket Screw                      |
| l   | 3                 | 49056          | Washer, Stainless Steel                   |
| m   | 3                 | 13081          | Washer, Nylon                             |
| n   | 1                 | 49030          | Adapter                                   |
| o   | 1                 | 62343          | O-Ring, 35 x 1.6 mm                       |
| p   | 1                 | 64576          | O-Ring, 15.6 x 1.8 mm                     |
| q   | 1                 | 64578          | O-Ring, Viton,<br>66.3 x 3.6 mm, 75 Shore |
| r   | 1                 | 49634          | Rotor Lid                                 |
| s   | 1                 | 66308          | O-Ring,<br>17.2 x 1.8 mm, 75 Shore        |
| 02  | 1                 | 75004012       | Rotor Cover                               |
| 03  | 1                 | 90840          | O-Ring,<br>178.8 x 2.6 mm, 75 Shore       |
| 04  | 1                 | 49609          | Septa                                     |
| <i>not shown;<br/>used with the septa</i> | 6                 | 66193          | O-Ring, Viton,<br>4.5 x 1.8 mm, 75 Shore  |
| 05  | 1                 | 75000604       | Titanium Rotor Body                       |


## Final Assembly

### To assemble the continuous flow rotor

1. Slide the rotor body into the rotor holding fixture.
2. Place the septa (Catalog No. 49609) in the rotor body using a slight twisting motion.
3. Fill the rotor body with 1350 mL of desired sample.

|  |                |
|--|----------------|
|   | <b>CAUTION</b> |
| <p>Always run the TCF-20 Rotor with a full fluid load (1350 mL). Running the rotor with less than a full fluid load can cause damage to the centrifuge and/or rotor due to the shifting mass of the fluid. If enough sample is not available, an overlay should be used to increase the rotor contents to 1350 mL.</p> |                |

4. Place the rotor cover on the rotor body. Turn the cover clockwise until it drops onto the threads of the rotor body; then turn counterclockwise until tight. Use the wrench handle assembly to securely tighten the cover.

|   |                |
|---|----------------|
|   | <b>CAUTION</b> |
| <p>Before running the TCF-20 Rotor in the centrifuge, make sure the rotor cover is properly seated. Clearance between the rotor body and rotor cover („Figure 16“ on page 65) should be no greater than 0.64 mm (0.025 inches). Operating the rotor with the cover not properly seated can cause rotor failure with subsequent damage to your centrifuge.</p> |                |

5. Use both hands to remove the rotor assembly from the rotor holding fixture and carefully lower it onto the centrifuge drive spindle.
6. Check that the rotor is level by placing a spirit level on the flat surface of the rotor cover. If the rotor is not level, adjust the centrifuge feet accordingly.
7. Place the assembled continuous flow adapter („Continuous Flow Adapter Assembly“ on page 45) through the rotor cover. Slowly rotate the adapter to engage the guide pins into the corresponding holes of the septa. When fully seated, the surface of the continuous flow adapter assembly will be flush with the rotor cover.

|  |                |
|--|----------------|
|                       | <b>CAUTION</b> |
| <p>Failure to properly seat the continuous flow adapter assembly may cause damage to the guide pins.</p> |                |



8. Onto each cap screw (Catalog No. 62988, 3 each), place a stainless steel washer (Catalog No. 49056) and a nylon washer (Catalog No. 13081). The stainless steel washer should be placed closest to the head of the cap screw.
9. Place the three cap screws through the holes of the continuous flow adapter assembly. While turning the rotor in one direction, rotate the continuous flow adapter assembly/septa in the opposite direction until the screws align with the holes in the centrifuge adapter and drop into place (apply light pressure to one of the screws to locate the holes). Use the T-wrench to alternately tighten the three cap screws.
10. Precool the rotor, if necessary, to the desired temperature by using the pretempering function on the Sorvall LYNX 6000 centrifuge with the centrifuge door closed.
11. At the end of the precooling run when the rotor has stopped spinning, open the centrifuge door and attach the inlet/outlet assembly („Figure 11“ on page 45) to the continuous flow adapter assembly. Tighten the left-handed threaded cap securely.

## NOTICE

Use glycerin or mineral oil as a sealing fluid. Add the oil through one of the small holes in the bearing housing using a 20 gauge hypodermic needle (2.5 ml to 3.0 ml of fluid is required for an adequate seal)

12. Prepare and connect the latex tubing (Catalog No. 13117) to the Inlet/Outlet Connector Assembly as follows („Figure 12“):
  - a. Place the center of the latex tubing over a block of wood. Hold the tubing in place with the sharp end of the tube slotter (Catalog No. 13042) supplied. Tap the tube slotter with a hammer to pierce both sides of tubing (this will form a slot in the tubing).
  - b. Hold the tubing tightly against the nipples of the Inlet/Outlet Connector Assembly; place one end of the slotted section of tubing over one nipple, then stretch the tubing over the other nipple.



## CAUTION

Never use two separate pieces of latex tubing on the inlet/outlet assembly. To do so can result in loss of sample and/or damage to the centrifuge should the tubing become detached from the inlet/outlet assembly. Always use the tube slotter to prepare the latex tubing for use as explained above.

13. Position the remaining portion of tubing through the two inlet ports located on the right side of the centrifuge chamber. Be sure to leave some slack in the tubing remaining in the chamber.
14. Install the tube holder assembly (Catalog No. 75000601), see „Tube Holder Assembly“ on page 51.
15. Loosen the upper thumbscrew and slide the tubing holder so that the crossbar is above the center of the rotor.
16. Fasten the upper thumbscrew securely.
17. Place the latex tubing in the tubing holder assembly as follows („Figure 13“):

- a. Loosen the Inner thumbscrew on the tubing holder crossbar, then thread the tubing in the guides provided on the crossbar (from both sides of the inlet/outlet assembly). Be sure the tubing shows no kinks or sharp bends.
- b. Adjust the height of the crossbar.

## NOTICE

There should be no more than 4 to 6 cm (1.575 to 2.362 inches) clearance between the lower end of the rubber gasket of the rotor chamber and the top of the continuous flow ring; if necessary, reposition the continuous flow ring.



## CAUTION

Make sure there is enough clearance between the top of the Tube Holder Assembly (Catalog No. 75000601) and the centrifuge door to allow for safe closing of the centrifuge door without bending or pinching of the tubing.

- c. Tighten the Inner thumbscrew.
- d. Thread the tubing over the top of the tubing holder assembly through the guides located on top of the holder. Eliminate excess slack in the tubing.

Figure 12  
Attaching the  
tubing to the Inlet/  
Outlet Connector  
Assembly

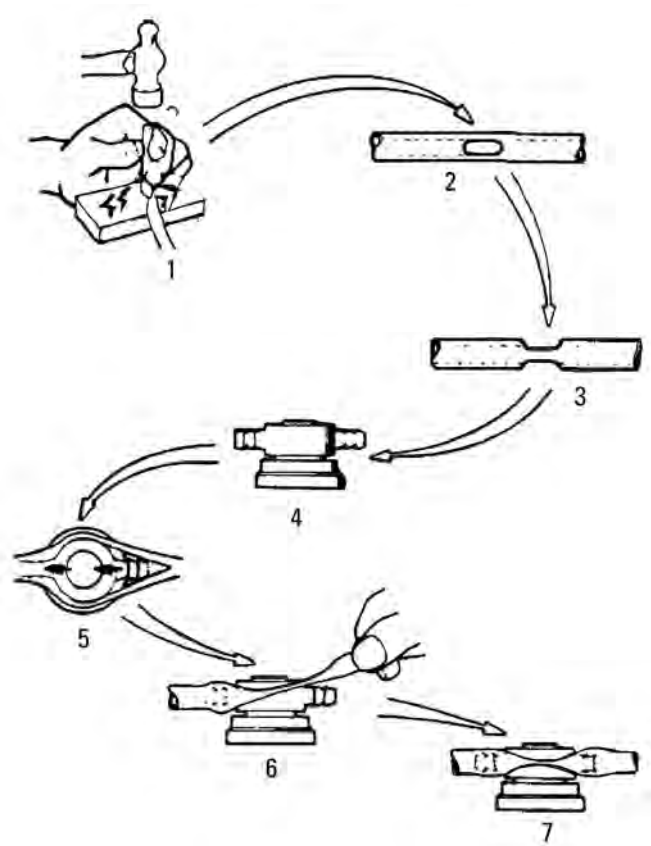
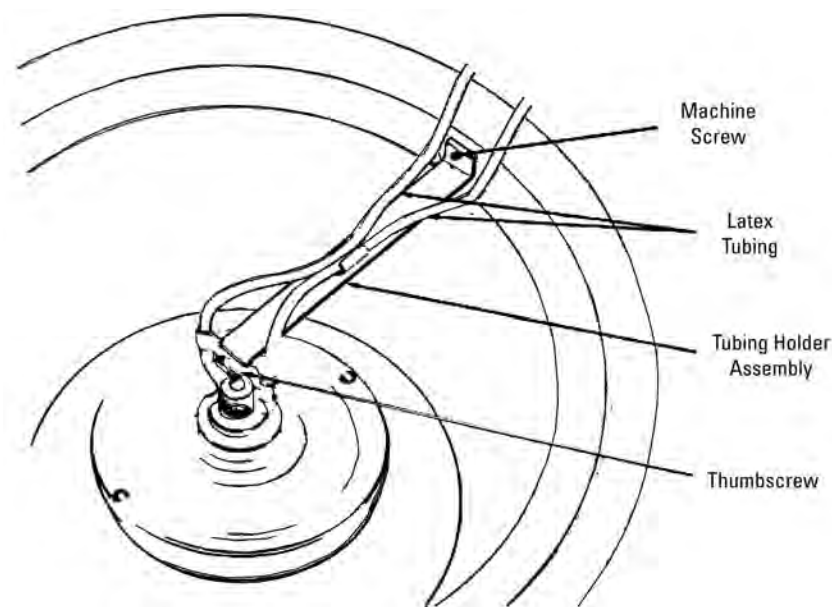


Figure 13  
Tube Holder  
Assembly  
Attachment



## Tube Holder Assembly

### To assemble the tube holder in the Sorvall LYNX 6000 superspeed centrifuge

#### NOTICE

Refer to „Figure 14“ for identification of parts of the tube holder assembly.

1. Open the centrifuge lid.



#### WARNING

Remove the continuous flow ring when using rotors other than the TCF-20 Continuous Flow Rotor.

2. Remove the rubber plug located at the left side of the rubber gasket at the top of the rotor chamber in the Sorvall LYNX 6000 centrifuge.
3. Install the continuous flow ring (Catalog No. 20900500)
  - a. Loosen the upper thumbscrew (Catalog No. 20430313) and slide the tube holder assembly to one side.
  - b. Fasten the upper thumbscrew, making sure the tubing holder assembly will not move during installation of the kit and the rotor.
  - c. Position the continuous flow ring in the chamber and securely tighten the setscrew (Catalog No. 20420230). If you encounter difficulties, use a pair of pliers to tighten the setscrew.



#### CAUTION

Make sure there is enough clearance between the top of the tube holder assembly (Catalog No. 75000601) and the centrifuge door to allow for safe closing of the centrifuge door without bending or pinching of the tubing.

#### NOTICE

There should be no more than 4 to 6 cm (1.575 to 2.362 inches) clearance between the lower end of the rubber gasket of the rotor chamber and the top of the continuous flow ring; if necessary, reposition the continuous flow ring.

4. Assembly and install the TCF-20 continuous rotor in the centrifuge ([„Assembling the TCF-20 Continuous Flow System“](#) on page 44).

Figure 14  
Tube Holder  
Assembly. See  
„Table 8“ for  
description of  
numbered items

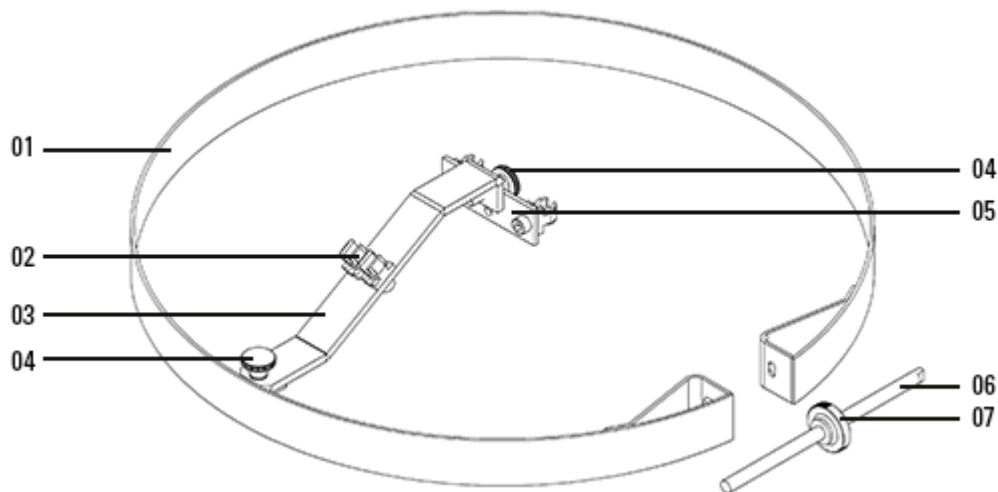


Table 8  
Tube Holder  
Assembly (key to  
Figure 14)

| Figure Item Number | Quantity Supplied | Catalog Number | Description          |
|--------------------|-------------------|----------------|----------------------|
| 01                 | 1                 | 20900500       | Continuous Flow Ring |
| 02                 | 4                 | 20220624       | Tubing Guides        |
|                    | 4                 | 20510279       | Hexagon Socket Screw |
| 03                 | 1                 | 70063004       | Tube Holder          |
| 04                 | 2                 | 20430313       | Thumbscrew           |
|                    | 2                 | 20480135       | Washer, VA           |
|                    | 2                 | 20480167       | Nut                  |
| 05                 | 1                 | 20058286       | Crossbar             |
| 06                 | 1                 | 70063003       | Threaded Rod         |
| 07                 | 1                 | 20420230       | Set Screw            |
|                    | 2                 | 20220416       | Cable Clip           |

# Operating the TCF-20 Continuous Flow System

## To operate the TCF-20 continuous flow system

### NOTICE

During a centrifuge run, the timer of the centrifuge should be set to HOLD to prevent shut-off at the end of a timed period if the run is not completed

1. Connect the inlet tubing to the reservoir containing the particle suspension (an arrow stamped on the top of the inlet/outlet assembly indicates the direction of flow through the rotor) and direct the outlet tubing into a collecting vessel.
2. Close the centrifuge door and perform the run as explained in the centrifuge instruction manual.

### NOTICE

The minimum operating speed for the continuous flow system is 8000 rpm. When processing small or hard-to-sediment particles, top speed should be reached and maintained for several minutes before beginning sample flow through the rotor.

3. Begin sample flow through the rotor when the desired operating speed is reached. Flow through the rotor should begin after approximately 150 mL of solution has been introduced. If flow rate does not begin, increase the inlet pressure. Maximum flow rate cannot be attained unless the reservoir containing the particle suspension is between 61 cm to 76 cm (24 to 30 inches) above the rotor. If desired a peristaltic pump may be used to accelerate the flow rate.

## End of Run

In order to “pack” the residual particles remaining in the rotor body, continue centrifugation for several minutes after all the suspension has been processed. If desired, pass several hundred milliliters of water or saline through the rotor before you begin to decelerate the rotor.

### To end the continuous flow run

1. Stop the sample flow.
2. Decelerate the rotor.
3. As soon as deceleration begins, insert the tip of the polyethylene bottle (Catalog No. 60753) supplied into the end of the outlet tubing and aspirate until the rotor stops spinning (this will prevent leakage of excess fluid produced during deceleration. If desired, a peristaltic pump may be used to extract excess fluid from both the inlet and outlet tubing. Pumping of excess fluid is more efficiently performed before the rotor deceleration. Excess fluid is produced during acceleration; as the rotor body expands it takes in additional fluid, then as the rotor decelerates it contracts and this fluid is released resulting in excess fluid in the rotor).
4. When the rotor stops spinning, open the centrifuge door and remove the latex tubing from the tubing holder assembly then remove the tubing holder.

5. Disconnect the latex tubing from the nipples of the Inlet/Outlet Connector Assembly.
6. Loosen the inlet/outlet assembly, if necessary using the strap wrench (Catalog No. 75000606) supplied. Remove the inlet/outlet assembly from the rotor.
7. Use a plastic pipette to withdraw the liquid.
8. Use the T-Wrench to loosen the three cap screws.
9. Carefully remove the continuous flow adapter by pulling it in a straight upward motion. If the Adapter becomes detached from the feed device assembly remove the feed device assembly with the lifting wrench (Catalog No. 49058) supplied.
10. Disassemble the inlet/outlet assembly and the continuous flow assembly. Clean all parts („Cleaning and Decontamination“ on page 57).
11. Firmly press the rotor unlocking tool (Catalog No. 75000602) into the center of the rotor to engage the release of the rotor from the spindle
12. Carefully lift the rotor off the drive spindle and place it in the rotor holding fixture.
13. Remove the rotor cover.
14. Remove the residual supernatant remaining in the center of the rotor body by aspiration.
15. Remove the sediment from the rotor using a rubber, wooden or Teflon™-coated spatula.
16. Clean the rotor assembly („Cleaning and Decontamination“ on page 57).







## Maintenance and Care

### Cleaning and Decontamination

#### Cleaning



#### CAUTION

These procedures are for general cleaning purposes only. If the rotor or any of its parts are exposed to a contaminate, they must be decontaminated first, then washed.

#### Cleaning the TCF-20 Rotor

1. Wash the rotor body and rotor cover:

Wash the rotor body and rotor cover with warm water and a mild, pH neutral, non-alkaline detergent after each use. It is particularly important to wash the rotor and cover immediately after any spills have occurred. Most laboratory chemicals can be removed with lukewarm, 1% solution of a mild, pH neutral, non-alkaline detergent. Rinse the rotor and cover well, inside and out. After rinsing, dry thoroughly with a soft absorbent cloth.

2. Wash the septa, distributor, adapter, feed device assembly, distributor body, and holddown plate:

To prevent clogging of all feed lines and ports, fill the polyethylene bottle with water then place the tip of the bottle into each feed line and port then flush clean.

3. Wash the bearings:

Place the bearings in a beaker containing 50 mL of Toluene solvent. Put the beaker into an ultrasonic cleaner and let the bearings soak for three to five minutes. If you do not have an ultrasonic cleaner, stir the solvent periodically. If necessary repeat this step using fresh solvent until all lubricant has been removed. When the bearings are clean, remove them from the solvent and dry the bearings as follows:


- i. Lay the bearings on a clean absorbent cloth with their shielded sides facing up; leave them there until all of the solvent has drained out and bearings are completely dry.

or

- ii. Dry the bearings with an air blast, but make sure the bearings do not rotate while being dried.


## Decontamination

All parts except the continuous flow system bearings may be autoclaved at temperatures up to 121 °C (250 °F) at 15 psi for 15 minutes. Ethylene oxide, a 2% glutaraldehyde solution, or ultraviolet radiation are also recommended methods of sterilization.

|   |                |
|---|----------------|
|  | <b>CAUTION</b> |
| Do not autoclave the continuous flow system bearings.                             |                |

### To decontaminate the TCF-20 rotor

1. For general radioactive decontamination, use a solution of equal parts of 70% ethanol, 10% SDS, and water.
2. Follow this with ethanol rinses, then deionized water rinses, and dry with a soft absorbent cloth.
3. Dispose of all wash solutions in proper radioactive waste containers.

|  |                |
|--|----------------|
|   | <b>CAUTION</b> |
| Before using any cleaning, disinfecting, or decontaminating methods except those recommended, users should check with Thermo Fisher Scientific that the proposed method will not damage the equipment. |                |

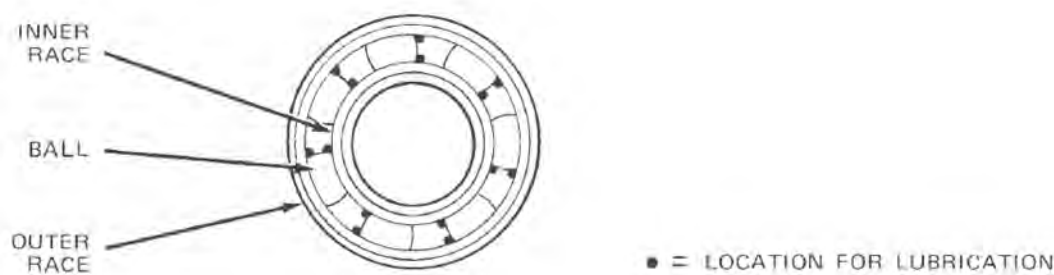
## Bearing Lubrication

Before every continuous flow run, lubricate the bearings of the TCF-20 rotor system.

### To lubricate the bearings

1. Use the lubricant-filled syringe, supplied with the bearings, and apply small dots (1-2 mm<sup>2</sup>) of lubricant to the inner and outer race of each bearing at the ball locations („Figure 15“).
2. Rotate each bearing by hand to spread the lubricant evenly through the bearing.

**Figure 15**  
Lubrication Points  
of the Bearings



## Service Decontamination Policy



### WARNING

Because of the characteristics of the samples likely to be processed in this rotor, biological or radioactive contamination may occur. Always be aware of this possibility and take normal precautions. Use appropriate decontamination procedures should exposure occur.

If a centrifuge or rotor that has been used with radioactive or pathogenic material requires servicing by Thermo Fisher Scientific personnel, either at the customer's laboratory or at a Thermo Fisher Scientific facility, comply with the described procedure to ensure the safety of all personnel.

### To comply with the service decontamination policy

1. Clean the centrifuge or rotor to be serviced of all encrusted material and decontaminate it („Cleaning and Decontamination“ on page 57) prior to servicing by the Thermo Fisher Scientific representative or returning it to the Thermo Fisher Scientific facility. There must be no radioactivity detectable by survey equipment.

Clean and decontaminate your centrifuge or rotor as follows:

- a. Remove rotor from the rotor chamber.
- b. Remove, wash, and decontaminate motor sealing gasket and pad.
- c. Decontaminate lid, rotor chamber, and drive using an appropriate method.
- d. Remove all encrusted material from around the motor and drive assemblies.

For rotor:

Decontaminate rotor using an appropriate method. If any assembled part, or the rotor cover is stuck, notify Thermo Fisher Scientific representative. Be prepared with the name and nature of the sample so the Thermo Fisher Scientific Chemical Hazards Officer can decide whether to authorize the rotor's return to a Thermo Fisher Scientific facility.

2. Complete and attach Decontamination Information Certificate to the centrifuge or rotor before servicing or returning to a Thermo Fisher Scientific facility. If Certificate is not available, attach a written statement verifying decontamination (what was contaminant and what decontamination method was used).

If the centrifuge or rotor must be returned to a Thermo Fisher Scientific facility:

1. Contact your Thermo Fisher Scientific representative to obtain a Return Service Order Number (RSO No.). Be prepared with the name and serial number of the centrifuge or rotor and the repairs required.
2. Send item(s) with the RSO No. clearly marked on the outside of packaging to the address obtained from your Thermo Fisher Scientific representative.

## NOTICE

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

If a centrifuge or rotor to be serviced does not have a Decontamination Information Certificate attached and, in Thermo Fisher Scientific's opinion presents a potential radioactive or biological hazard, the Thermo Fisher Scientific representative will not service the equipment until proper decontamination and certification is complete. If Thermo Fisher Scientific receives a centrifuge or rotor at its Service facilities which, in its opinion, is a radioactive or biological hazard, the sender will be contacted for instructions as to disposition of the equipment. All disposition costs will be borne by the sender.





## Disposal



### WARNING

When removing the centrifuge and accessories from use for disposal you have to clean and if necessary disinfect or decontaminate the entire system. In doubt contact the Thermo Fisher Scientific customer service.

For the disposal of the rotor mind the regulations in your country. In doubt contact the Thermo Fisher Scientific Customer Service for the disposal of the centrifuge.

For the countries of the European Union the disposal is regulated by the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC.

Mind the information on transport and shipping within the centrifuge instruction manual.

## WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:



Thermo Fisher Scientific has contracted with one or more recycling or disposal companies in each European Union (EU) Member State, and these companies should dispose of or recycle this product. See [www.thermoscientific.com/rohsweee](http://www.thermoscientific.com/rohsweee) for further information on Thermo Fisher Scientific's compliance with these Directives and the recyclers in your country.





## RCF-Values

Relative Centrifugal Force (RCF) refers to the force during centrifugation that moves the particulate outward from the center of rotation. This force is proportional to the radial distance and the square of the rotor speed. The RCF value is determined by the following formula:

$$RCF = 11.18 (r)(rpm/1000)^2$$

when  $r$  = the radius in centimeters from the centerline of the rotor to the point in the tube where RCF value is required

and rpm = the rotor speed in revolutions per minute

„Figure 17“ represents the volume occupied by a liquid within the spinning rotor in relation to the maximum internal radius of the rotor, 9.52 cm (3.75 inches). The points marked A, B, C and D in „Figure 16“ correspond to inflection points on the curve in „Figure 17“ and may be used as reference points.

„Table 9“ may be used in conjunction with „Figure 17“. In „Table 9“, representative volumes are listed along with their inside vertical surface radii. The determination of RCF can be helpful when a cushion is used since the actual forces exerted against the sample can be accurately noted. For example, if a 100 mL cushion and a 900 mL gradient were used, then the sample introduced, the forces developed on the sample at 10,000 rpm will range from 6,600 at the free fluid surface of the gradient to 10,300 at the interface of gradient and cushion.

**Figure 16**  
TCF-20 Volume vs.  
Radius. Clearance  
between the rotor  
cover and rotor  
body is shown.

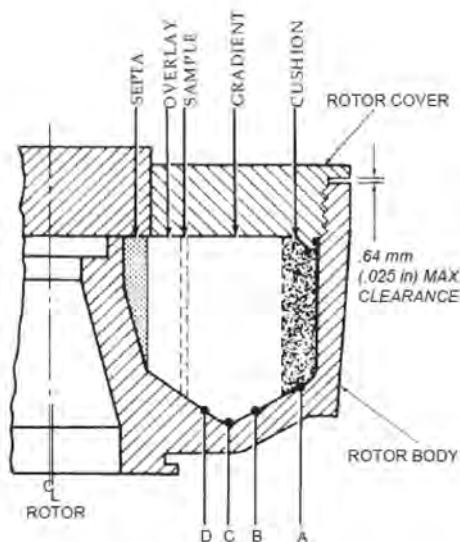
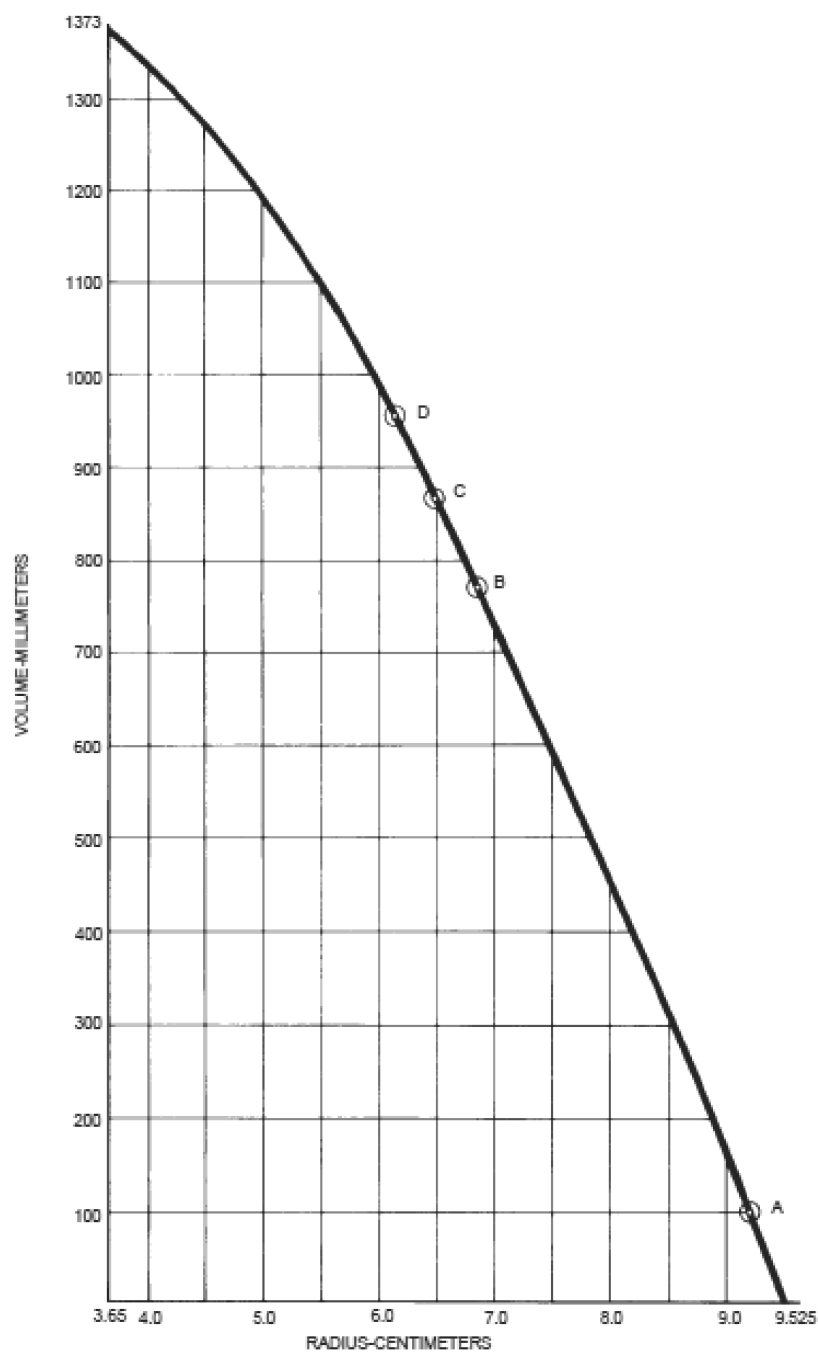


Figure 17  
Graphical  
Representation of  
TCF-20 Volume vs.  
Radius



**Table 9**  
TCF-20 Rotor  
RCF-values and  
K-factors

| r (cm)   | 3,6       | 4,3   | 4,9   | 5,5   | 5,9   | 6,3   | 6,7   | 7,1   | 7,4   | 7,8   | 8,1   | 8,5   | 8,8   | 9,2   | 9,6   |          |
|----------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|
| Vol (mL) | 1373      | 1300  | 1200  | 1100  | 1000  | 900   | 800   | 700   | 600   | 500   | 400   | 300   | 200   | 100   | 0     |          |
| rpm      | RCF (x g) |       |       |       |       |       |       |       |       |       |       |       |       |       |       | K-factor |
| 1000     | 40        | 48    | 55    | 61    | 66    | 70    | 75    | 79    | 83    | 87    | 91    | 95    | 98    | 103   | 107   | 248150   |
| 1500     | 91        | 108   | 123   | 138   | 148   | 158   | 169   | 179   | 186   | 196   | 204   | 214   | 221   | 231   | 241   | 110289   |
| 2000     | 161       | 192   | 219   | 246   | 264   | 282   | 300   | 318   | 331   | 349   | 362   | 380   | 394   | 411   | 429   | 62037    |
| 2500     | 252       | 300   | 342   | 384   | 412   | 440   | 468   | 496   | 517   | 545   | 566   | 594   | 615   | 643   | 671   | 39704    |
| 3000     | 362       | 433   | 493   | 553   | 594   | 634   | 674   | 714   | 745   | 785   | 815   | 855   | 885   | 926   | 966   | 27572    |
| 3500     | 493       | 589   | 671   | 753   | 808   | 863   | 918   | 972   | 1013  | 1068  | 1109  | 1164  | 1205  | 1260  | 1315  | 20257    |
| 4000     | 644       | 769   | 877   | 984   | 1055  | 1127  | 1198  | 1270  | 1324  | 1395  | 1449  | 1520  | 1574  | 1646  | 1717  | 15509    |
| 4500     | 815       | 973   | 1109  | 1245  | 1336  | 1426  | 1517  | 1607  | 1675  | 1766  | 1834  | 1924  | 1992  | 2083  | 2173  | 12254    |
| 5000     | 1006      | 1202  | 1370  | 1537  | 1649  | 1761  | 1873  | 1984  | 2068  | 2180  | 2264  | 2376  | 2460  | 2571  | 2683  | 9926     |
| 5500     | 1218      | 1454  | 1657  | 1860  | 1995  | 2131  | 2266  | 2401  | 2503  | 2638  | 2739  | 2875  | 2976  | 3111  | 3247  | 8203     |
| 6000     | 1449      | 1731  | 1972  | 2214  | 2375  | 2536  | 2697  | 2858  | 2978  | 3139  | 3260  | 3421  | 3542  | 3703  | 3864  | 6893     |
| 6500     | 1700      | 2031  | 2315  | 2598  | 2787  | 2976  | 3165  | 3354  | 3495  | 3684  | 3826  | 4015  | 4157  | 4346  | 4535  | 5873     |
| 7000     | 1972      | 2356  | 2684  | 3013  | 3232  | 3451  | 3670  | 3890  | 4054  | 4273  | 4437  | 4656  | 4821  | 5040  | 5259  | 5064     |
| 7500     | 2264      | 2704  | 3081  | 3459  | 3710  | 3962  | 4213  | 4465  | 4654  | 4905  | 5094  | 5345  | 5534  | 5786  | 6037  | 4412     |
| 8000     | 2576      | 3077  | 3506  | 3935  | 4222  | 4508  | 4794  | 5080  | 5295  | 5581  | 5796  | 6082  | 6297  | 6583  | 6869  | 3877     |
| 8500     | 2908      | 3473  | 3958  | 4443  | 4766  | 5089  | 5412  | 5735  | 5977  | 6300  | 6543  | 6866  | 7108  | 7431  | 7754  | 3435     |
| 9000     | 3260      | 3894  | 4437  | 4981  | 5343  | 5705  | 6067  | 6430  | 6701  | 7064  | 7335  | 7697  | 7969  | 8331  | 8694  | 3064     |
| 9500     | 3632      | 4339  | 4944  | 5549  | 5953  | 6357  | 6760  | 7164  | 7467  | 7870  | 8173  | 8576  | 8879  | 9283  | 9686  | 2750     |
| 10000    | 4025      | 4807  | 5478  | 6149  | 6596  | 7043  | 7491  | 7938  | 8273  | 8720  | 9056  | 9503  | 9838  | 10286 | 10733 | 2481     |
| 10500    | 4437      | 5300  | 6040  | 6779  | 7272  | 7765  | 8258  | 8751  | 9121  | 9614  | 9984  | 10477 | 10847 | 11340 | 11833 | 2251     |
| 11000    | 4870      | 5817  | 6629  | 7440  | 7981  | 8523  | 9064  | 9605  | 10011 | 10552 | 10958 | 11499 | 11904 | 12446 | 12987 | 2051     |
| 11500    | 5323      | 6358  | 7245  | 8132  | 8723  | 9315  | 9906  | 10498 | 10941 | 11533 | 11976 | 12568 | 13011 | 13603 | 14194 | 1876     |
| 12000    | 5796      | 6923  | 7889  | 8855  | 9499  | 10142 | 10786 | 11430 | 11913 | 12557 | 13040 | 13684 | 14167 | 14811 | 15455 | 1723     |
| 12500    | 6289      | 7512  | 8560  | 9608  | 10307 | 11005 | 11704 | 12403 | 12927 | 13626 | 14150 | 14848 | 15373 | 16071 | 16770 | 1588     |
| 13000    | 6802      | 8125  | 9258  | 10392 | 11148 | 11903 | 12659 | 13415 | 13982 | 14737 | 15304 | 16060 | 16627 | 17383 | 18138 | 1468     |
| 13500    | 7335      | 8761  | 9984  | 11207 | 12022 | 12837 | 13652 | 14467 | 15078 | 15893 | 16504 | 17319 | 17930 | 18746 | 19561 | 1362     |
| 14000    | 7889      | 9423  | 10737 | 12052 | 12929 | 13805 | 14682 | 15558 | 16215 | 17092 | 17749 | 18626 | 19283 | 20160 | 21036 | 1266     |
| 14500    | 8462      | 10108 | 11518 | 12928 | 13869 | 14809 | 15749 | 16689 | 17394 | 18335 | 19040 | 19980 | 20685 | 21625 | 22566 | 1180     |
| 15000    | 9056      | 10817 | 12326 | 13835 | 14841 | 15848 | 16854 | 17860 | 18615 | 19621 | 20376 | 21382 | 22136 | 23143 | 24149 | 1103     |
| 15500    | 9670      | 11550 | 13161 | 14773 | 15847 | 16922 | 17996 | 19071 | 19876 | 20951 | 21757 | 22831 | 23637 | 24711 | 25786 | 1033     |
| 16000    | 10303     | 12307 | 14024 | 15741 | 16886 | 18031 | 19176 | 20321 | 21179 | 22324 | 23183 | 24328 | 25186 | 26331 | 27476 | 969      |
| 16500    | 10958     | 13088 | 14914 | 16741 | 17958 | 19176 | 20393 | 21611 | 22524 | 23741 | 24654 | 25872 | 26785 | 28003 | 29220 | 911      |
| 17000    | 11632     | 13893 | 15832 | 17771 | 19063 | 20355 | 21648 | 22940 | 23910 | 25202 | 26171 | 27464 | 28433 | 29725 | 31018 | 859      |
| 17500    | 12326     | 14723 | 16777 | 18831 | 20201 | 21570 | 22940 | 24310 | 25337 | 26706 | 27733 | 29103 | 30130 | 31500 | 32869 | 810      |
| 18000    | 13040     | 15576 | 17749 | 19923 | 21372 | 22821 | 24270 | 25718 | 26805 | 28254 | 29341 | 30790 | 31876 | 33325 | 34774 | 766      |
| 18500    | 13775     | 16453 | 18749 | 21045 | 22575 | 24106 | 25637 | 27167 | 28315 | 29846 | 30993 | 32524 | 33672 | 35202 | 36733 | 725      |
| 19000    | 14530     | 17355 | 19776 | 22198 | 23812 | 25427 | 27041 | 28655 | 29866 | 31481 | 32691 | 34306 | 35517 | 37131 | 38745 | 687      |
| 19500    | 15304     | 18280 | 20831 | 23382 | 25082 | 26783 | 28483 | 30183 | 31459 | 33159 | 34435 | 36135 | 37411 | 39111 | 40811 | 653      |
| 20000    | 16099     | 19230 | 21913 | 24596 | 26385 | 28174 | 29962 | 31751 | 33093 | 34882 | 36223 | 38012 | 39354 | 41142 | 42931 | 620      |




















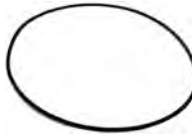












## Appendix

The shown pictures are just examples. They may differ in color. The size of the shown objects, especially the O-Rings, has to be used with the associated size.

**Table 10**  
Parts and  
Accessories

| Catalog No.     | Item Description                                 | Quantity | Picture  |
|-----------------|--|----------|--|
| 75000604        | Titanium Rotor Body                              |          |    |
| 75004012        | Rotor Cover                                      |          |    |
| 49609           | Septa  | 1        |    |
| 75000601        | Tube Holder Assembly                             | 1        |   |
| <b>75004006</b> | <b>O-Ring Set Zonal</b>                          |          |  |
| 61289           | O-Ring, Buna,<br>7.7 x 11.3 x 1.8 mm, 75 Shore   | 12       |   |
| 63037           | O-Ring, Viton,<br>12.7 x 11.3 x 1.8 mm, 75 Shore | 2        |   |
| 64578           | O-Ring, Viton,<br>66.3 x 3.6, 75 Shore           | 2        |  |
| 66308           | O-Ring, Viton,<br>44.9 x 1.8 mm, 75 Shore        | 2        |  |
| 66330           | O-Ring,<br>17.2 x 1.8 mm, 75 Shore               | 2        |   |
| 90840           | O-Ring,<br>178.8 x 2.6 mm, 75 Shore              | 2        |  |
| 76003500        | Lubricant  | 1        |  |

| Catalog No.     | Item Description                            | Quantity | Picture  |
|-----------------|---|----------|--|
| <b>75004007</b> | <b>O-Ring Set Continuous Flow</b>           |          |  |
| 60738           | O-Ring, 1.313 x 0.094                       | 2        |     |
| 60739           | O-Ring, Viton, 50.8 x 2.4 mm, 75 Shore      | 2        |     |
| 62343           | O-Ring, 1.375 x 0.063                       | 2        |     |
| 64576           | O-Ring, 0.614 x 0.070                       | 2        |     |
| 64578           | O-Ring, Viton, 66.3 x 3.6, 75 Shore         | 2        |    |
| 66308           | O-Ring, Viton, 44.9 x 1.8 mm, 75 Shore      | 2        |     |
| 90840           | O-Ring, 178.8 x 2.6 mm, 75 Shore            | 2        |    |
| 60737           | O-Ring, 0.375 x 0.063                       | 2        |    |
| 61289           | O-Ring, Buna, 7.7 x 11.3 x 1.8 mm, 75 Shore | 12       |   |
| 76003500        | Lubricant                                   | 1        |  |
| <b>75004008</b> | <b>Screws and small parts</b>               |          |  |
| 62987           | Hexagon Socket Screw 8/32 x 1.125" VA       | 6        |   |
| 62988           | Hexagon Socket Screw                        | 6        |   |
| 66329           | Hexagon Socket Screw 8/32 x 0.437" VA       | 6        |   |
| 70009824        | Corrosion Protection Oil                    | 1        |   |
| 75003786        | Lubricant Grease                            | 2        |  |
| 49056           | Washer, Stainless Steel                     | 6        |   |
| 13081           | Washer, Nylon                               | 6        |   |



| Catalog No. | Item Description      | Quantity | Picture  |
|-------------|-----------------------|----------|--|
| 75004052    | Tool Kit              |          |  |
| 49058       | Wrench Lifting        | 1        |    |
| 49724       | Wrench                | 1        |    |
| 52540       | Rotor Holding Fixture | 1        |    |
| 66026       | Dissecting Needle     | 1        |     |
| 92365       | Allen Wrench 9/64     | 1        |    |
| 92366       | Allen Wrench 5/32     | 1        |  |
| 75000602    | Unlock Tool           | 1        |  |
| 75000603    | Lift Plate Wrench     | 1        |   |
| 75000606    | Strap Wrench          |          |  |
| 75000634    | Tubing Slotter        | 1        |  |
| 75004212    | Spring Clip           | 1        |   |
| 70063016    | Adapter Unit          | 1        |   |

| Catalog No.     | Item Description   | Quantity | Picture  |
|-----------------|--|----------|--|
| <b>75004050</b> | <b>Bearing Kit</b>   |          |  |
| 13127           | Bearing Lubricating Grease   | 1        |    |
| 68085           | Bearing Lifter   | 2        |     |
| 75000605        | Continuous Flow Assembly<br>(for details see „TCF-20<br>Continuous Flow System“ on<br>page 46)   |          |     |
| 75004051        | Zonal Mode Assembly<br><br>Sealed<br>(for details see „Rotor Assembly<br>for Sealed Operation.“ on page<br>28 )<br><br>Unsealed<br>(for details see „Rotor Assembly<br>for Unsealed Operation.“ on<br>page 37) |          |     |
| 75003503        | Peristaltic Pump   |          |  |
| 13117           | Latex Tubing, diameter 3.75 mm   |          |  |





## Chemical Compatibility Chart

| CHEMICAL                   | MATERIAL | ALUMINUM | ANODIC COATING for ALUMINUM | BUNA N | CELLULOSE ACETATE BUTYRATE | POLYURETHANE ROTOR PAINT | COMPOSITE Carbon Fiber/Epoxy | DELRI <sup>TM</sup> | ETHYLENE PROPYLENE | GLASS | NEOPRENE | NORLY <sup>TM</sup> | NYLON | PET <sup>1</sup> , POLYCLEAR <sup>TM</sup> , CLEARCRIMP <sup>TM</sup> | POLYALLUMER | POLYCARBONATE | POLYESTER, GLASS THERMOSET | POLYETHERIDE | POLYETHYLENE | POLYPROPYLENE | POLYSULFONE | POLYVINYL CHLORIDE | FLUON A <sup>TM</sup> , TEFLON <sup>TM</sup> | SILICONE RUBBER | STAINLESS STEEL | TITANIUM | TYGON <sup>TM</sup> | VITON <sup>TM</sup> |
|----------------------------|----------|----------|-----------------------------|--------|----------------------------|--------------------------|------------------------------|---------------------|--------------------|-------|----------|---------------------|-------|---|-------------|---------------|----------------------------|--------------|--------------|---------------|-------------|--------------------|--|-----------------|-----------------|----------|---------------------|---------------------|
| 2-mercaptoethanol          |          | S        | S                           | U      | /                          | S                        | M                            | S                   | /                  | S     | U        | S                   | S     | U   | S           | S             | /                          | S            | S            | S             | S           | U                  | S  | S               | S               | S        | S                   | S                   |
| Acetaldehyde               |          | S        | /                           | U      | U                          | /                        | /                            | /                   | M                  | /     | U        | /                   | /     | /   | M           | U             | U                          | U            | M            | M             | /           | M                  | S  | U               | /               | S        | /                   | U                   |
| Acetone                    |          | M        | S                           | U      | U                          | S                        | U                            | M                   | S                  | S     | U        | U                   | S     | U   | S           | U             | U                          | U            | S            | S             | U           | U                  | S  | M               | M               | S        | U                   | U                   |
| Acetonitrile               |          | S        | S                           | U      | /                          | S                        | M                            | S                   | /                  | S     | S        | U                   | S     | U   | M           | U             | U                          | /            | S            | M             | U           | U                  | S  | S               | S               | S        | U                   | U                   |
| Alconox <sup>TM</sup>      |          | U        | U                           | S      | /                          | S                        | S                            | S                   | /                  | S     | S        | S                   | S     | S   | S           | M             | S                          | S            | S            | S             | S           | S                  | S  | S               | S               | S        | S                   | U                   |
| Allyl Alcohol              |          | /        | /                           | /      | U                          | /                        | /                            | S                   | /                  | /     | /        | /                   | S     | /   | S           | S             | M                          | S            | S            | S             | /           | M                  | S  | /               | /               | S        | /                   | /                   |
| Aluminum Chloride          |          | U        | U                           | S      | S                          | S                        | S                            | U                   | S                  | S     | S        | S                   | M     | S   | S           | S             | S                          | /            | S            | S             | S           | S                  | S  | M               | U               | U        | S                   | S                   |
| Formic Acid (100%)         |          | /        | S                           | M      | U                          | /                        | /                            | U                   | /                  | /     | /        | /                   | U     | /   | S           | M             | U                          | U            | S            | S             | /           | U                  | S  | /               | U               | S        | /                   | U                   |
| Ammonium Acetate           |          | S        | S                           | U      | /                          | S                        | S                            | S                   | /                  | S     | S        | S                   | S     | S   | S           | S             | U                          | /            | S            | S             | S           | S                  | S  | S               | S               | S        | S                   | S                   |
| Ammonium Carbonate         |          | M        | S                           | U      | S                          | S                        | S                            | S                   | S                  | S     | S        | S                   | S     | S   | S           | U             | U                          | /            | S            | S             | S           | S                  | S  | S               | M               | S        | S                   | S                   |
| Ammonium Hydroxide (10%)   |          | U        | U                           | S      | U                          | S                        | S                            | M                   | S                  | S     | S        | S                   | S     | /   | S           | U             | M                          | S            | S            | S             | S           | S                  | S  | S               | S               | S        | M                   | S                   |
| Ammonium Hydroxide (28%)   |          | U        | U                           | S      | U                          | S                        | U                            | M                   | S                  | S     | S        | S                   | S     | U   | S           | U             | M                          | S            | S            | S             | S           | S                  | S  | S               | S               | S        | M                   | S                   |
| Ammonium Hydroxide (conc.) |          | U        | U                           | U      | U                          | S                        | U                            | M                   | S                  | /     | S        | /                   | S     | U   | S           | U             | U                          | S            | S            | S             | /           | M                  | S  | S               | S               | S        | /                   | U                   |
| Ammonium Phosphate         |          | U        | /                           | S      | /                          | S                        | S                            | S                   | S                  | S     | S        | S                   | S     | /   | S           | S             | M                          | /            | S            | S             | S           | S                  | S  | S               | M               | S        | S                   | S                   |
| Ammonium Sulfate           |          | U        | M                           | S      | /                          | S                        | S                            | U                   | S                  | S     | S        | S                   | S     | S   | S           | S             | S                          | /            | S            | S             | S           | S                  | S  | S               | U               | S        | S                   | U                   |
| Amyl Alcohol               |          | S        | /                           | M      | U                          | /                        | /                            | S                   | S                  | /     | M        | /                   | S     | /   | M           | S             | S                          | S            | S            | M             | /           | /                  | /  | U               | /               | S        | /                   | M                   |
| Aniline                    |          | S        | S                           | U      | U                          | S                        | U                            | S                   | M                  | S     | U        | U                   | U     | U   | U           | U             | U                          | /            | S            | M             | U           | U                  | S  | S               | S               | S        | U                   | S                   |
| Sodium Hydroxide (<1%)     |          | U        | /                           | M      | S                          | S                        | S                            | /                   | /                  | S     | M        | S                   | S     | /   | S           | M             | M                          | S            | S            | S             | S           | S                  | S  | M               | S               | S        | /                   | U                   |
| Sodium Hydroxide (10%)     |          | U        | /                           | M      | U                          | /                        | /                            | U                   | /                  | M     | M        | S                   | S     | U   | S           | U             | U                          | S            | S            | S             | S           | S                  | S  | M               | S               | S        | /                   | U                   |
| Barium Salts               |          | M        | U                           | S      | /                          | S                        | S                            | S                   | S                  | S     | S        | S                   | S     | S   | S           | S             | M                          | /            | S            | S             | S           | S                  | S  | S               | M               | S        | S                   | S                   |
| Benzene                    |          | S        | S                           | U      | U                          | S                        | U                            | M                   | U                  | S     | U        | U                   | S     | U   | U           | U             | M                          | U            | M            | U             | U           | U                  | S  | U               | U               | S        | U                   | S                   |
| Benzyl Alcohol             |          | S        | /                           | U      | U                          | /                        | /                            | M                   | M                  | /     | M        | /                   | S     | U   | U           | U             | U                          | U            | U            | U             | /           | M                  | S  | M               | /               | S        | /                   | S                   |
| Boric Acid                 |          | U        | S                           | S      | M                          | S                        | S                            | U                   | S                  | S     | S        | S                   | S     | S   | S           | S             | S                          | U            | S            | S             | S           | S                  | S  | S               | S               | S        | S                   | S                   |
| Cesium Acetate             |          | M        | /                           | S      | /                          | S                        | S                            | S                   | /                  | S     | S        | S                   | S     | /   | S           | S             | /                          | /            | S            | S             | S           | S                  | S  | S               | M               | S        | S                   | S                   |
| Cesium Bromide             |          | M        | S                           | S      | /                          | S                        | S                            | S                   | /                  | S     | S        | S                   | S     | S   | S           | S             | /                          | /            | S            | S             | S           | S                  | S  | S               | M               | S        | S                   | S                   |

| CHEMICAL                  | MATERIAL | ALUMINUM | ANODIC COATING for ALUMINUM | BUNAN | CELLULOSE ACETATE BUTYRATE | POLYURETHANE ROTOR PAINT | COMPOSITE Carbon Fiber/Epoxy | DELFIN™ | ETHYLENE PROPYLENE | GLASS | NEOPRENE | NORYL™ | NYLON | PET*, POLYCLEAR™, CLEARCRIMP™ | POLYALLOMER | POLYCARBONATE | POLYESTER, GLASS THERMOSET | POLYMERIDE | POLYETHYLENE | POLYPROPYLENE | POLYSULFONE | POLYVINYL CHLORIDE | RULON A™, TEFLON™ | SILICONE RUBBER | STAINLESS STEEL | TITANIUM | TYGON™ | VITON™ |
|---------------------------|----------|----------|-----------------------------|-------|----------------------------|--------------------------|------------------------------|---------|--------------------|-------|----------|--------|-------|-------------------------------|-------------|---------------|----------------------------|------------|--------------|---------------|-------------|--------------------|-------------------|-----------------|-----------------|----------|--------|--------|
| Cesium Chloride           |          | M        | S                           | S     | U                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Cesium Formate            |          | M        | S                           | S     | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Cesium Iodide             |          | M        | S                           | S     | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Cesium Sulfate            |          | M        | S                           | S     | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Chloroform                |          | U        | U                           | U     | U                          | S                        | S                            | M       | U                  | S     | U        | U      | M     | U                             | M           | U             | U                          | U          | M            | M             | U           | U                  | S                 | U               | U               | U        | M      | S      |
| Chromic Acid (10%)        |          | U        | /                           | U     | U                          | S                        | U                            | U       | /                  | S     | S        | S      | U     | S                             | S           | M             | U                          | M          | S            | S             | U           | M                  | S                 | M               | U               | S        | S      | S      |
| Chromic Acid (50%)        |          | U        | /                           | U     | U                          | /                        | U                            | U       | /                  | /     | /        | S      | U     | U                             | S           | M             | U                          | M          | S            | S             | U           | M                  | S                 | /               | U               | M        | /      | S      |
| Cresol Mixture            |          | S        | S                           | U     | /                          | /                        | /                            | S       | /                  | S     | U        | U      | U     | U                             | U           | U             | /                          | /          | U            | U             | /           | U                  | S                 | S               | S               | S        | U      | S      |
| Cyclohexane               |          | S        | S                           | S     | /                          | S                        | S                            | S       | U                  | S     | U        | S      | S     | U                             | U           | U             | M                          | S          | M            | U             | M           | M                  | S                 | U               | M               | M        | U      | S      |
| Deoxycholate              |          | S        | S                           | S     | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Distilled Water           |          | S        | S                           | S     | S                          | S                        | S                            | S       | S                  | S     | S        | S      | S     | S                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Dextran                   |          | M        | S                           | S     | S                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Diethyl Ether             |          | S        | S                           | U     | U                          | S                        | S                            | S       | U                  | S     | U        | U      | S     | U                             | U           | U             | U                          | U          | U            | U             | U           | U                  | S                 | S               | S               | S        | M      | U      |
| Diethyl Ketone            |          | S        | /                           | U     | U                          | /                        | /                            | M       | /                  | S     | U        | /      | S     | /                             | M           | U             | U                          | U          | M            | M             | /           | U                  | S                 | /               | /               | S        | U      | U      |
| Diethylpyro-carbonate     |          | S        | S                           | U     | /                          | S                        | S                            | S       | /                  | S     | S        | U      | S     | U                             | S           | U             | /                          | /          | S            | S             | S           | M                  | S                 | S               | S               | S        | S      | S      |
| Dimethylsulfoxide         |          | S        | S                           | U     | U                          | S                        | S                            | S       | /                  | S     | U        | S      | S     | U                             | S           | U             | U                          | /          | S            | S             | U           | U                  | S                 | S               | S               | S        | U      | U      |
| Dioxane                   |          | M        | S                           | U     | U                          | S                        | S                            | M       | M                  | S     | U        | U      | S     | U                             | M           | U             | U                          | /          | M            | M             | M           | U                  | S                 | S               | S               | S        | U      | U      |
| Ferric Chloride           |          | U        | U                           | S     | /                          | /                        | /                            | M       | S                  | /     | M        | /      | S     | /                             | S           | /             | /                          | /          | S            | S             | /           | /                  | /                 | M               | U               | S        | /      | S      |
| Acetic Acid (Glacial)     |          | S        | S                           | U     | U                          | S                        | S                            | U       | M                  | S     | U        | S      | U     | U                             | U           | U             | U                          | M          | S            | U             | M           | U                  | S                 | U               | U               | S        | /      | U      |
| Acetic Acid (5%)          |          | S        | S                           | M     | S                          | S                        | S                            | M       | S                  | S     | S        | S      | S     | M                             | S           | S             | S                          | S          | S            | S             | S           | M                  | S                 | S               | M               | S        | S      | M      |
| Acetic Acid (60%)         |          | S        | S                           | U     | U                          | S                        | S                            | U       | /                  | S     | M        | S      | U     | U                             | M           | U             | S                          | M          | S            | M             | S           | M                  | S                 | M               | U               | S        | M      | U      |
| Ethyl Acetate             |          | M        | M                           | U     | U                          | S                        | S                            | M       | M                  | S     | S        | U      | S     | U                             | M           | U             | U                          | /          | S            | S             | U           | U                  | S                 | M               | M               | S        | U      | U      |
| Ethyl Alcohol (50%)       |          | S        | S                           | S     | S                          | S                        | S                            | M       | S                  | S     | S        | S      | S     | U                             | S           | U             | S                          | S          | S            | S             | S           | S                  | S                 | S               | M               | S        | M      | U      |
| Ethyl Alcohol (95%)       |          | S        | S                           | S     | U                          | S                        | S                            | M       | S                  | S     | S        | S      | S     | U                             | S           | U             | /                          | S          | S            | S             | M           | S                  | S                 | S               | U               | S        | M      | U      |
| Ethylene Dichloride       |          | S        | /                           | U     | U                          | /                        | /                            | S       | M                  | /     | U        | U      | S     | U                             | U           | U             | U                          | U          | U            | U             | /           | U                  | S                 | U               | /               | S        | /      | S      |
| Ethylene Glycol           |          | S        | S                           | S     | S                          | S                        | S                            | S       | S                  | S     | S        | S      | S     | /                             | S           | U             | S                          | S          | S            | S             | S           | S                  | S                 | S               | M               | S        | M      | S      |
| Ethylene Oxide Vapor      |          | S        | /                           | U     | /                          | /                        | U                            | /       | /                  | S     | U        | /      | S     | /                             | S           | M             | /                          | /          | S            | S             | S           | U                  | S                 | U               | S               | S        | S      | U      |
| Ficoll-Hypaque™           |          | M        | S                           | S     | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | /                             | S           | S             | /                          | S          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Hydrofluoric Acid (10%)   |          | U        | U                           | U     | M                          | /                        | /                            | U       | /                  | /     | U        | U      | S     | /                             | S           | M             | U                          | S          | S            | S             | S           | M                  | S                 | U               | U               | U        | /      | /      |
| Hydrofluoric Acid (50%)   |          | U        | U                           | U     | U                          | /                        | /                            | U       | /                  | /     | U        | U      | U     | U                             | S           | U             | U                          | U          | S            | S             | M           | M                  | S                 | U               | U               | U        | /      | M      |
| Hydrochloric Acid (conc.) |          | U        | U                           | U     | U                          | /                        | U                            | U       | M                  | /     | U        | M      | U     | U                             | M           | U             | U                          | U          | /            | S             | /           | U                  | S                 | U               | U               | U        | /      | /      |
| Formaldehyde (40%)        |          | M        | M                           | M     | S                          | S                        | S                            | S       | M                  | S     | S        | S      | S     | M                             | S           | S             | S                          | U          | S            | S             | M           | S                  | S                 | S               | M               | S        | M      | U      |
| Glutaraldehyde            |          | S        | S                           | S     | S                          | /                        | /                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | /                  | /                 | S               | S               | S        | /      | /      |
| Glycerol                  |          | M        | S                           | S     | /                          | S                        | S                            | S       | S                  | S     | S        | S      | S     | S                             | S           | S             | S                          | /          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Guanidine Hydrochloride   |          | U        | U                           | S     | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | U               | S        | S      | S      |
| Haemo-Sol™                |          | S        | S                           | S     | /                          | /                        | /                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |

| CHEMICAL                    | MATERIAL | ALUMINUM | ANODIC COATING for ALUMINIUM | BUNA N | CELLULOSE ACETATE BUTYRATE | POLYURETHANE ROTOR PAINT | COMPOSITE Carbon Fiber/Epoxy | DELRI <sup>TM</sup> | ETHYLENE PROPYLENE | GLASS | NEOPRENE | NORYL <sup>TM</sup> | NYLON | PET <sup>TM</sup> , POLYCLEAR <sup>TM</sup> , CLEARCRIMP <sup>TM</sup> | POLYALLOMER | POLYCARBONATE | POLYESTER, GLASS THERMOSET | POLYMERIDE | POLYETHYLENE | POLYPROPYLENE | POLYSULFONE | POLYVINYL CHLORIDE | RULON A <sup>TM</sup> , TEFLON <sup>TM</sup> | SILICONE RUBBER | STAINLESS STEEL | TITANIUM | TYGON <sup>TM</sup> | VITON <sup>TM</sup> |   |
|-----------------------------|----------|----------|------------------------------|--------|----------------------------|--------------------------|------------------------------|---------------------|--------------------|-------|----------|---------------------|-------|--|-------------|---------------|----------------------------|------------|--------------|---------------|-------------|--------------------|--|-----------------|-----------------|----------|---------------------|---------------------|---|
| Hexane                      |          | S        | S                            | S      | /                          | S                        | S                            | S                   | /                  | S     | S        | U                   | S     | U  | M           | U             | S                          | S          | U            | S             | S           | M                  | S  | U               | S               | S        | U                   | S                   |   |
| Isobutyl Alcohol            |          | /        | /                            | M      | U                          | /                        | /                            | S                   | S                  | /     | U        | /                   | S     | U  | S           | S             | M                          | S          | S            | S             | /           | S                  | S  | S               | /               | S        | /                   | S                   |   |
| Isopropyl Alcohol           |          | M        | M                            | M      | U                          | S                        | S                            | S                   | S                  | S     | U        | S                   | S     | U  | S           | U             | M                          | S          | S            | S             | S           | S                  | S  | S               | M               | M        | M                   | S                   |   |
| Iodoacetic Acid             |          | S        | S                            | M      | /                          | S                        | S                            | S                   | /                  | S     | M        | S                   | S     | M  | S           | S             | /                          | M          | S            | S             | S           | S                  | S  | M               | S               | S        | M                   | M                   |   |
| Potassium Bromide           |          | U        | S                            | S      | /                          | S                        | S                            | S                   | /                  | S     | S        | S                   | S     | S  | S           | S             | S                          | S          | S            | S             | S           | /                  | S  | S               | S               | M        | S                   | S                   | S |
| Potassium Carbonate         |          | M        | U                            | S      | S                          | S                        | S                            | S                   | /                  | S     | S        | S                   | S     | S  | S           | U             | S                          | S          | S            | S             | S           | S                  | S  | S               | S               | S        | S                   | S                   |   |
| Potassium Chloride          |          | U        | S                            | S      | /                          | S                        | S                            | S                   | S                  | S     | S        | S                   | S     | S  | S           | S             | /                          | S          | S            | S             | S           | S                  | S  | S               | U               | S        | S                   | S                   |   |
| Potassium Hydroxide (5%)    |          | U        | U                            | S      | S                          | S                        | S                            | M                   | /                  | S     | S        | S                   | S     | /  | S           | U             | S                          | S          | S            | S             | S           | S                  | S  | M               | U               | M        | S                   | U                   |   |
| Potassium Hydroxide (conc.) |          | U        | U                            | M      | U                          | /                        | /                            | M                   | /                  | M     | S        | S                   | /     | U  | M           | U             | U                          | U          | S            | M             | /           | M                  | U  | /               | U               | U        | /                   | U                   |   |
| Potassium Permanganate      |          | S        | S                            | S      | /                          | S                        | S                            | S                   | /                  | S     | S        | S                   | U     | S  | S           | S             | M                          | /          | S            | M             | S           | U                  | S  | S               | M               | S        | U                   | S                   |   |
| Calcium Chloride            |          | M        | U                            | S      | S                          | S                        | S                            | S                   | S                  | S     | S        | S                   | S     | S  | S           | M             | S                          | /          | S            | S             | S           | S                  | S  | S               | M               | S        | S                   | S                   |   |
| Calcium Hypochlorite        |          | M        | /                            | U      | /                          | S                        | M                            | M                   | S                  | /     | M        | /                   | S     | /  | S           | M             | S                          | /          | S            | S             | S           | M                  | S  | M               | U               | S        | /                   | S                   |   |
| Kerosene                    |          | S        | S                            | S      | /                          | S                        | S                            | S                   | U                  | S     | M        | U                   | S     | U  | M           | M             | S                          | /          | M            | M             | M           | S                  | S  | U               | S               | S        | U                   | S                   |   |
| Sodium Chloride (10%)       |          | S        | /                            | S      | S                          | S                        | S                            | S                   | S                  | /     | /        | /                   | S     | S  | S           | S             | S                          | /          | S            | S             | S           | S                  | /  | S               | S               | M        | /                   | S                   |   |
| Sodium Chloride (sat'd)     |          | U        | /                            | S      | U                          | S                        | S                            | S                   | /                  | /     | /        | /                   | S     | S  | S           | S             | S                          | /          | S            | S             | /           | S                  | /  | S               | S               | M        | /                   | S                   |   |
| Carbon Tetrachloride        |          | U        | U                            | M      | S                          | S                        | U                            | M                   | U                  | S     | U        | U                   | S     | U  | M           | U             | S                          | S          | M            | M             | S           | M                  | M  | M               | M               | U        | S                   | S                   |   |
| Aqua Regia                  |          | U        | /                            | U      | U                          | /                        | /                            | U                   | /                  | /     | /        | /                   | /     | U  | U           | U             | U                          | U          | U            | U             | /           | /                  | /  | /               | /               | S        | /                   | M                   |   |
| Solution 555 (20%)          |          | S        | S                            | S      | /                          | /                        | /                            | S                   | /                  | S     | S        | S                   | S     | S  | S           | S             | /                          | /          | S            | S             | S           | /                  | S  | S               | S               | S        | S                   | S                   |   |
| Magnesium Chloride          |          | M        | S                            | S      | /                          | S                        | S                            | S                   | S                  | S     | S        | S                   | S     | S  | S           | S             | S                          | S          | S            | S             | S           | S                  | S  | S               | M               | S        | S                   | S                   |   |
| Mercaptoacetic Acid         |          | U        | S                            | U      | /                          | S                        | M                            | S                   | /                  | S     | M        | S                   | U     | U  | U           | U             | /                          | S          | U            | U             | S           | M                  | S  | U               | S               | S        | S                   | S                   |   |
| Methyl Alcohol              |          | S        | S                            | S      | U                          | S                        | S                            | M                   | S                  | S     | S        | S                   | S     | U  | S           | U             | M                          | S          | S            | S             | S           | S                  | S  | S               | M               | S        | M                   | U                   |   |
| Methylene Chloride          |          | U        | U                            | U      | U                          | M                        | S                            | S                   | U                  | S     | U        | U                   | S     | U  | U           | U             | U                          | U          | M            | U             | U           | U                  | S  | S               | M               | U        | S                   | U                   |   |
| Methyl Ethyl Ketone         |          | S        | S                            | U      | U                          | S                        | S                            | M                   | S                  | S     | U        | U                   | S     | U  | S           | U             | U                          | U          | S            | S             | U           | U                  | S  | S               | S               | S        | U                   | U                   |   |
| Metrizamide <sup>TM</sup>   |          | M        | S                            | S      | /                          | S                        | S                            | S                   | /                  | S     | S        | S                   | S     | /  | S           | S             | /                          | /          | S            | S             | S           | S                  | S  | S               | M               | S        | S                   | S                   |   |
| Lactic Acid (100%)          |          | /        | /                            | S      | /                          | /                        | /                            | /                   | /                  | /     | M        | S                   | U     | /  | S           | S             | S                          | M          | S            | S             | /           | M                  | S  | M               | S               | S        | /                   | S                   |   |
| Lactic Acid (20%)           |          | /        | /                            | S      | S                          | /                        | /                            | /                   | /                  | /     | M        | S                   | M     | /  | S           | S             | S                          | S          | S            | S             | S           | M                  | S  | M               | S               | S        | /                   | S                   |   |
| N-Butyl Alcohol             |          | S        | /                            | S      | U                          | /                        | /                            | S                   | /                  | /     | S        | M                   | /     | U  | S           | M             | S                          | S          | S            | S             | M           | M                  | S  | M               | /               | S        | /                   | S                   |   |
| N-Butyl Phthalate           |          | S        | S                            | U      | /                          | S                        | S                            | S                   | /                  | S     | U        | U                   | S     | U  | U           | U             | M                          | /          | U            | U             | S           | U                  | S  | M               | M               | S        | U                   | S                   |   |
| N, N-Dimethyl-formamide     |          | S        | S                            | S      | U                          | S                        | M                            | S                   | /                  | S     | S        | U                   | S     | U  | S           | U             | U                          | /          | S            | S             | U           | U                  | S  | M               | S               | S        | S                   | U                   |   |
| Sodium Borate               |          | M        | S                            | S      | S                          | S                        | S                            | S                   | S                  | S     | S        | S                   | U     | S  | S           | S             | S                          | /          | S            | S             | S           | S                  | S  | M               | S               | S        | S                   | S                   |   |
| Sodium Bromide              |          | U        | S                            | S      | /                          | S                        | S                            | S                   | /                  | S     | S        | S                   | S     | S  | S           | S             | S                          | /          | S            | S             | S           | S                  | S  | M               | S               | S        | S                   | S                   |   |
| Sodium Carbonate (2%)       |          | M        | U                            | S      | S                          | S                        | S                            | S                   | S                  | S     | S        | S                   | S     | S  | S           | U             | S                          | S          | S            | S             | S           | S                  | S  | S               | S               | S        | S                   | S                   |   |

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|----------------------------------|----------|----------|-----------------------------|--------|----------------------------|--------------------------|------------------------------|---------|--------------------|-------|----------|--------|-------|-------------------------------|-------------|---------------|----------------------------|------------|--------------|---------------|-------------|--------------------|-------------------|-----------------|-----------------|----------|--------|--------|
| Sodium Dodecyl Sulfate           |          | S        | S                           | S      | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | S          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Sodium Hypochlorite (5%)         |          | U        | U                           | M      | S                          | S                        | M                            | U       | S                  | S     | M        | S      | S     | S                             | M           | S             | S                          | S          | S            | M             | S           | S                  | S                 | M               | U               | S        | M      | S      |
| Sodium Iodide                    |          | M        | S                           | S      | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Sodium Nitrate                   |          | S        | S                           | S      | /                          | S                        | S                            | S       | S                  | S     | S        | S      | S     | S                             | S           | S             | S                          | /          | S            | S             | S           | S                  | S                 | U               | S               | S        | S      | S      |
| Sodium Sulfate                   |          | U        | S                           | S      | /                          | S                        | S                            | S       | S                  | S     | S        | S      | S     | S                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Sodium Sulfide                   |          | S        | /                           | S      | S                          | /                        | /                            | /       | S                  | /     | /        | /      | S     | S                             | S           | U             | U                          | /          | /            | S             | /           | /                  | /                 | S               | S               | M        | /      | S      |
| Sodium Sulfite                   |          | S        | S                           | S      | /                          | S                        | S                            | S       | S                  | M     | S        | S      | S     | S                             | S           | S             | M                          | /          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Nickel Salts                     |          | U        | S                           | S      | S                          | S                        | S                            | /       | S                  | S     | S        | /      | /     | S                             | S           | S             | S                          | /          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Oils (Petroleum)                 |          | S        | S                           | S      | /                          | /                        | /                            | S       | U                  | S     | S        | S      | S     | U                             | U           | M             | S                          | M          | U            | U             | S           | S                  | S                 | U               | S               | S        | S      | S      |
| Oils (Other)                     |          | S        | /                           | S      | /                          | /                        | /                            | S       | M                  | S     | S        | S      | S     | U                             | S           | S             | S                          | S          | U            | S             | S           | S                  | S                 | /               | S               | S        | M      | S      |
| Oleic Acid                       |          | S        | /                           | U      | S                          | S                        | S                            | U       | U                  | S     | U        | S      | S     | M                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | M               | U               | S        | M      | M      |
| Oxalic Acid                      |          | U        | U                           | M      | S                          | S                        | S                            | U       | S                  | S     | S        | S      | S     | U                             | S           | U             | S                          | S          | S            | S             | S           | S                  | S                 | S               | U               | M        | S      | S      |
| Perchloric Acid (10%)            |          | U        | /                           | U      | /                          | S                        | U                            | U       | /                  | S     | M        | M      | /     | /                             | M           | U             | M                          | S          | M            | M             | /           | M                  | S                 | U               | /               | S        | /      | S      |
| Perchloric Acid (70%)            |          | U        | U                           | U      | /                          | /                        | U                            | U       | /                  | S     | U        | M      | U     | U                             | M           | U             | U                          | U          | M            | M             | U           | M                  | S                 | U               | U               | S        | U      | S      |
| Phenol (5%)                      |          | U        | S                           | U      | /                          | S                        | M                            | M       | /                  | S     | U        | M      | U     | U                             | S           | U             | M                          | S          | M            | S             | U           | U                  | S                 | U               | M               | M        | M      | S      |
| Phenol (50%)                     |          | U        | S                           | U      | /                          | S                        | U                            | M       | /                  | S     | U        | M      | U     | U                             | U           | U             | U                          | S          | U            | M             | U           | U                  | S                 | U               | U               | U        | M      | S      |
| Phosphoric Acid (10%)            |          | U        | U                           | M      | S                          | S                        | S                            | U       | S                  | S     | S        | S      | U     | /                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | U               | M               | U        | S      | S      |
| Phosphoric Acid (conc.)          |          | U        | U                           | M      | M                          | /                        | /                            | U       | S                  | /     | M        | S      | U     | U                             | M           | M             | S                          | S          | S            | M             | S           | M                  | S                 | U               | M               | U        | /      | S      |
| Physiologic Media (Serum, Urine) |          | M        | S                           | S      | S                          | /                        | /                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Picric Acid                      |          | S        | S                           | U      | /                          | S                        | M                            | S       | S                  | S     | M        | S      | U     | S                             | S           | S             | U                          | S          | S            | S             | S           | U                  | S                 | U               | M               | S        | M      | S      |
| Pyridine (50%)                   |          | U        | S                           | U      | U                          | S                        | U                            | U       | /                  | U     | S        | S      | U     | U                             | M           | U             | U                          | /          | U            | S             | M           | U                  | S                 | S               | U               | U        | U      | U      |
| Rubidium Bromide                 |          | M        | S                           | S      | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Rubidium Chloride                |          | M        | S                           | S      | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | S             | /                          | /          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Sucrose                          |          | M        | S                           | S      | /                          | S                        | S                            | S       | S                  | S     | S        | S      | S     | S                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Sucrose, Alkaline                |          | M        | S                           | S      | /                          | S                        | S                            | S       | /                  | S     | S        | S      | S     | S                             | S           | U             | S                          | S          | S            | S             | S           | S                  | S                 | S               | M               | S        | S      | S      |
| Sulfosalicylic Acid              |          | U        | U                           | S      | S                          | S                        | S                            | S       | /                  | S     | S        | S      | U     | S                             | S           | S             | /                          | S          | S            | S             | /           | S                  | S                 | S               | U               | S        | S      | S      |
| Nitric Acid (10%)                |          | U        | S                           | U      | S                          | S                        | U                            | U       | /                  | S     | U        | S      | U     | /                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | M               | S               | S        | S      | S      |
| Nitric Acid (50%)                |          | U        | S                           | U      | M                          | S                        | U                            | U       | /                  | S     | U        | S      | U     | U                             | M           | M             | U                          | M          | M            | M             | S           | S                  | S                 | U               | S               | S        | M      | S      |
| Nitric Acid (95%)                |          | U        | /                           | U      | U                          | /                        | U                            | U       | /                  | /     | U        | U      | U     | U                             | M           | U             | U                          | U          | U            | M             | U           | U                  | S                 | U               | S               | S        | /      | S      |
| Hydrochloric Acid (10%)          |          | U        | U                           | M      | S                          | S                        | S                            | U       | /                  | S     | S        | S      | U     | U                             | S           | U             | S                          | S          | S            | S             | S           | S                  | S                 | S               | U               | M        | S      | S      |
| Hydrochloric Acid (50%)          |          | U        | U                           | U      | U                          | S                        | U                            | U       | /                  | S     | M        | S      | U     | U                             | M           | U             | U                          | S          | S            | S             | S           | M                  | S                 | M               | U               | U        | M      | M      |
| Sulfuric Acid (10%)              |          | M        | U                           | U      | S                          | S                        | U                            | U       | /                  | S     | S        | M      | U     | S                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | U               | U               | U        | S      | S      |
| Sulfuric Acid (50%)              |          | M        | U                           | U      | U                          | S                        | U                            | U       | /                  | S     | S        | M      | U     | U                             | S           | U             | U                          | M          | S            | S             | S           | S                  | S                 | U               | U               | U        | M      | S      |
| Sulfuric Acid (conc.)            |          | M        | U                           | U      | U                          | /                        | U                            | U       | M                  | /     | /        | M      | U     | U                             | S           | U             | U                          | U          | M            | S             | U           | M                  | S                 | U               | U               | U        | /      | S      |
| Stearic Acid                     |          | S        | /                           | S      | /                          | /                        | /                            | S       | M                  | S     | S        | S      | S     | /                             | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | M               | M               | S        | S      | S      |
| Tetrahydrofuran                  |          | S        | S                           | U      | U                          | S                        | U                            | U       | M                  | S     | U        | U      | S     | U                             | U           | U             | /                          | M          | U            | U             | U           | U                  | S                 | U               | S               | S        | U      | U      |

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|--------------------------|----------|----------|------------------------------|-------|----------------------------|--------------------------|------------------------------|----------|--------------------|-------|----------|--------|-------|--|-------------|---------------|----------------------------|------------|--------------|---------------|-------------|--------------------|-------------------|-----------------|-----------------|----------|--------|--------|
| Toluene                  |          | S        | S                            | U     | U                          | S                        | S                            | M        | U                  | S     | U        | U      | S     | U  | U           | U             | S                          | U          | M            | U             | U           | U                  | S                 | U               | S               | U        | U      | M      |
| Trichloroacetic Acid     |          | U        | U                            | U     | /                          | S                        | S                            | U        | M                  | S     | U        | S      | U     | U  | S           | M             | /                          | M          | S            | S             | U           | U                  | S                 | U               | U               | U        | M      | U      |
| Trichloroethane          |          | S        | /                            | U     | /                          | /                        | /                            | M        | U                  | /     | U        | /      | S     | U  | U           | U             | U                          | U          | U            | U             | U           | U                  | S                 | U               | /               | S        | /      | S      |
| Trichloroethylene        |          | /        | /                            | U     | U                          | /                        | /                            | /        | U                  | /     | U        | /      | S     | U  | U           | U             | U                          | U          | U            | U             | U           | U                  | S                 | U               | /               | U        | /      | S      |
| Trisodium Phosphate      |          | /        | /                            | /     | S                          | /                        | /                            | M        | /                  | /     | /        | /      | /     | /  | S           | /             | /                          | S          | S            | S             | /           | /                  | S                 | /               | /               | S        | /      | S      |
| Tris Buffer (neutral pH) |          | U        | S                            | S     | S                          | S                        | S                            | S        | /                  | S     | S        | S      | S     | S  | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Triton X/100™            |          | S        | S                            | S     | /                          | S                        | S                            | S        | /                  | S     | S        | S      | S     | S  | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Urea                     |          | S        | /                            | U     | S                          | S                        | S                            | S        | /                  | /     | /        | /      | S     | S  | S           | M             | S                          | S          | S            | S             | /           | S                  | S                 | S               | M               | S        | /      | S      |
| Hydrogen Peroxide (10%)  |          | U        | U                            | M     | S                          | S                        | U                            | U        | /                  | S     | S        | S      | U     | S  | S           | S             | M                          | U          | S            | S             | S           | S                  | S                 | S               | M               | S        | U      | S      |
| Hydrogen Peroxide (3%)   |          | S        | M                            | S     | S                          | S                        | /                            | S        | /                  | S     | S        | S      | S     | S  | S           | S             | S                          | M          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Xylene                   |          | S        | S                            | U     | S                          | S                        | S                            | M        | U                  | S     | U        | U      | U     | U  | U           | U             | M                          | U          | M            | U             | U           | U                  | S                 | U               | M               | S        | U      | S      |
| Zinc Chloride            |          | U        | U                            | S     | S                          | S                        | S                            | U        | S                  | S     | S        | S      | S     | S  | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | U               | S        | S      | S      |
| Zinc Sulfate             |          | U        | S                            | S     | /                          | S                        | S                            | S        | S                  | S     | S        | S      | S     | S  | S           | S             | S                          | S          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |
| Citric Acid (10%)        |          | M        | S                            | S     | M                          | S                        | S                            | M        | S                  | S     | S        | S      | S     | S  | S           | S             | S                          | M          | S            | S             | S           | S                  | S                 | S               | S               | S        | S      | S      |

<sup>1</sup>Polyethyleneterephthalate

## Key

S – Satisfactory.

M – Moderate attack, may be satisfactory for use in centrifuge depending on length of exposure, speed involved, etc.; suggest testing under actual conditions of use.

U – Unsatisfactory, not recommended.

/ – Performance unknown; suggest testing, using sample to avoid loss of valuable material.

## NOTICE

Chemical resistance data is included only as a guide to product use. Because no organized chemical compatibility data exists for materials under the stress of centrifugation, when in doubt we recommend pretesting sample lots.





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