BECKMAN

TJ-6R
Tabletop Centrifuge

Instruction Manual

SAFETY NOTICE

This safety notice summarizes information basic to the safe operation of the equipment described in this manual. Observance of safety precautions will help to avoid actions that could damage or adversely affect the performance of the centrifuge. It is recommended that the user read the entire manual carefully before attempting to operate the centrifuge.

Safety During Installation and/or Maintenance

Any servicing of this equipment that requires removal of any covers can expose parts which involve the risk of electric shock or personal injury. Make sure that the power switch is off and the centrifuge is disconnected from the main power source, and refer such servicing to qualified personnel.

(50-Hz centrifuge only) To avoid possible rotor overspeed problems, do not connect the centrifuge if the nominal power source is other than what is shown on the instrument rating plate on the rear panel. Do not rewire the centrifuge; call your Beckman Service representative to make the proper modification and update the name-rating plate accordingly.

Electrical Safety

To reduce the risk of electrical shock, make sure that the matching wall outlet receptacle is properly wired and earth-grounded. Check that the line voltage agrees with the voltage listed on the name-rating plate affixed to the centrifuge.

Do not place containers holding liquid on or near the chamber door. If they spill, liquid may get into the centrifuge and damage electrical or mechanical components.

Safety Against Risk of Fire

Certain electrical circuits within this centrifuge are protected by fuses against overcurrent conditions. For continued protection against the risk of fire, replace only with the same type and rating specified.

This centrifuge is not designed for use with materials capable of developing flammable or explosive vapors. Do not centrifuge such materials (such as chloroform or ethyl alcohol) in this instrument nor handle or store them within the required 30-cm (1-ft) clearance "envelope" surrounding the centrifuge.

Mechanical Safety

For safe operation of the equipment, observe the following:

- Use only the rotors and accessories designed for use in this centrifuge.
- Do not exceed the maximum rated speed of the rotor in use.
- NEVER attempt to slow or stop the rotor by hand.
- Do not lift or move the centrifuge while the rotor is spinning.
- NEVER attempt to override the door interlock system while the rotor is spinning.
- Maintain a 30-cm (1-ft) clearance envelope around the centrifuge while it is running. During operation you should come within the envelope only to adjust instrument controls, if necessary. Never bring any flammable substances within the envelope. Never lean on the centrifuge or place items on the centrifuge while it is operating.

Chemical and Biological Safety

Normal operation may involve the use of solutions and test samples that are pathogenic, toxic, or radioactive. Such materials should not be used in this centrifuge, however, unless *all necessary safety precautions are taken.*

- Observe all cautionary information printed on the original solution containers prior to their use.
- Because spills may generate aerosols, observe proper safety precautions for aerosol containment.
- Handle body fluids with care because they can transmit disease. No known test offers complete assurance that they are free of micro-organisms. Some of the most virulent—Hepatitis (B and C) and HIV (I-V) viruses, atypical mycobacteria, and certain systemic fungi—further emphasize the need for aerosol protection.
- Other infectious samples must also be handled according to good laboratory procedures and methods to prevent spread of disease.
- Dispose of all waste solutions according to appropriate environmental health and safety guidelines.

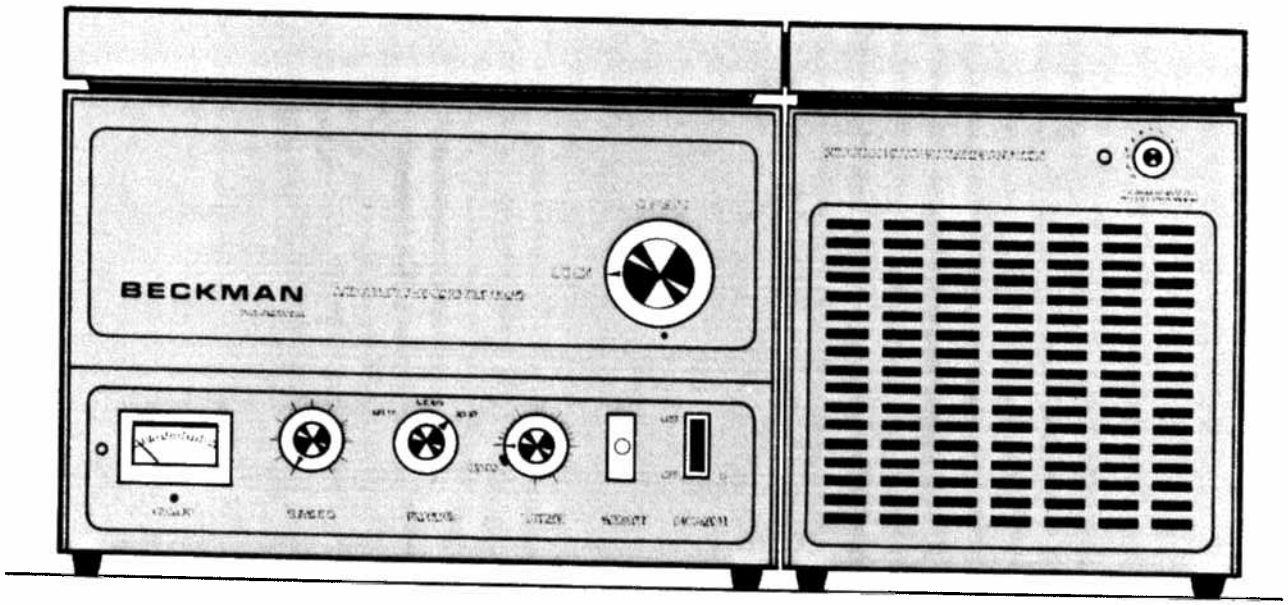
It is your responsibility to decontaminate the centrifuge and accessories before requesting service by our Field Service representative.

TJ6R-IM-8
October 1986

BECKMAN

TJ-6R

Tabletop Centrifuge



Instruction Manual

GE-0706-.1-GP
PUBLISHED BY SPINCO DIVISION OF BECKMAN INSTRUMENTS, INC., PALO ALTO, CALIFORNIA 94304

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General Information

The Model TJ-6 can be purchased with or without the Model TJ-R refrigeration unit. When purchased together, the pair is designated the TJ-6R System.

Although the TJ-R refrigeration accessory is a separate unit, it does not function independently of the TJ-6 Centrifuge. The TJ-R gets its power from the centrifuge. A power cable, permanently attached to the rear of the centrifuge, has a connector that mates with a receptacle on the rear of the TJ-R. When the two are connected, power is supplied to the TJ-R through an interlock switch in the door-control mechanism of the centrifuge. The switch is activated when the door-control knob on the centrifuge is turned to LOCK.

Figure 1. Model TJ-6R

Specifications

Instrument	
Speed Control	Continuously variable
Braking System	Two-range dynamic plus coast
RPM Indicator	Direct-reading meter, 0-7000 rpm
Timer	
Range	30 min
Resolution	1 min
	HOLD position for continuous runs
Temperature Range	Adjustable 2 to 20°C
Electrical Rating	
North America	60 Hz, 120 V, 11.5A
International	50 Hz, 220, 230, or 240 V; 6A
Safety and Convenience	Door interlock system, rotor stop indicator, imbalance detector, steel cabinet, stainless steel buckets, color-coded tube racks
Dimensions	
Height, door open	35¼ in.(895 mm)
Height, door closed	14¾ in.(375 mm)
Access height	12½ in.(318 mm)
Overall width	33 in. (838 mm)
Overall depth	23¾ in.(603 mm)
Recommended Minimum Clearances	
Right side	2 in.(50 mm)
Left side and rear	4 in.(100 mm)
Weight	212 lb (95 kg)
Refrigeration Unit	¼ hp (200W)

TA-10 ROTOR*

Rated run speed	5700 rpm
Relative centrifugal field at r_{max} (123 mm)	4470 *g*
Number of tube cavities	10
Tube cavity angle	35°
Hole diameter	31 mm
Maximum single-cavity load at rated speed (including tube and cap)	120 grams
Approximate acceleration time (full load)	1 min
Approximate deceleration time (full load and HIGH BRAKE setting)	1.6 min

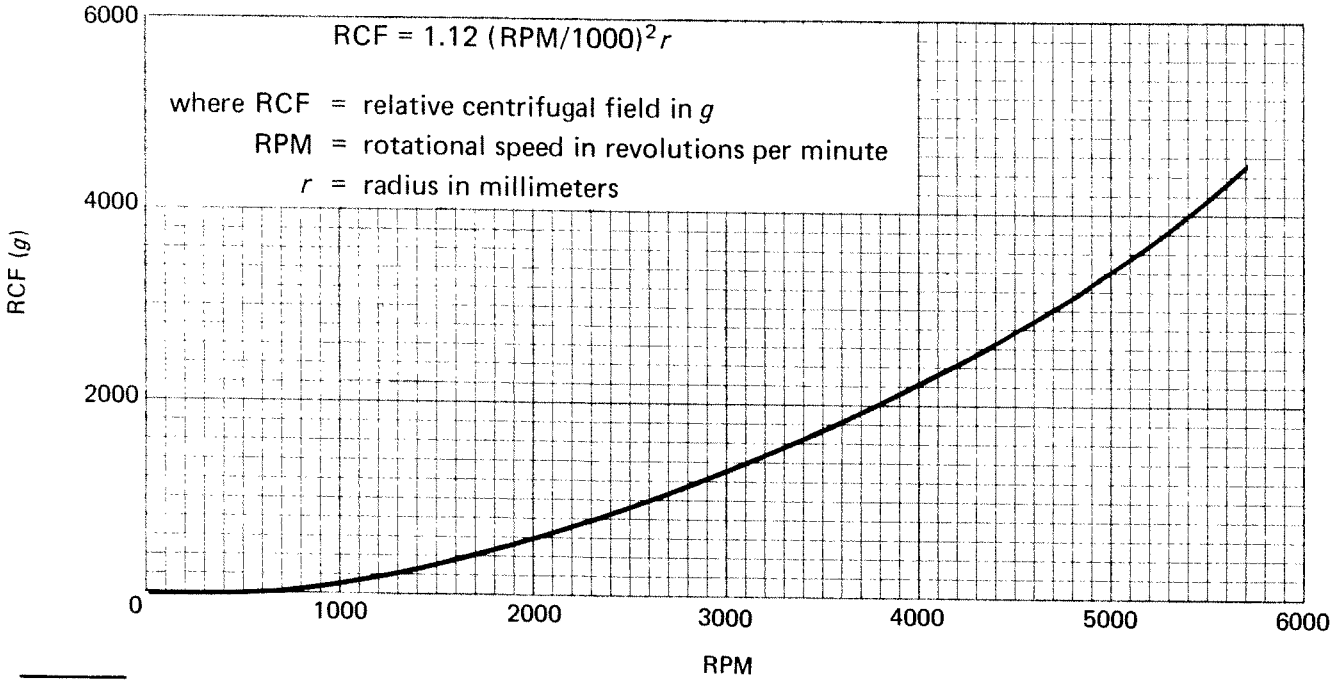


Figure 2. Relative Centrifugal Field versus Speed for the TA-10 Rotor at r_{max} = 123 mm.

*U.S. Pat. No. 4,010,890; French Pat. No. 77-00732; Japanese U.M. 1,462,551

TA-24 Rotor*

Rated run speed	5700 rpm
Relative centrifugal field at r_{max}	
outer row (123 mm)	4470 x *g*
inner row (108 mm)	3920 x *g*
Number of tube cavities	24
Tube cavity angle	35°
Hole diameter	19 mm
Maximum tube length for full complement of tubes (19 mm diameter)	124 mm
Maximum single-cavity load at rated speed	36 grams
Approximate acceleration time (full load)	1 min
Approximate deceleration time (full load and HIGH BRAKE setting)	1.6 min

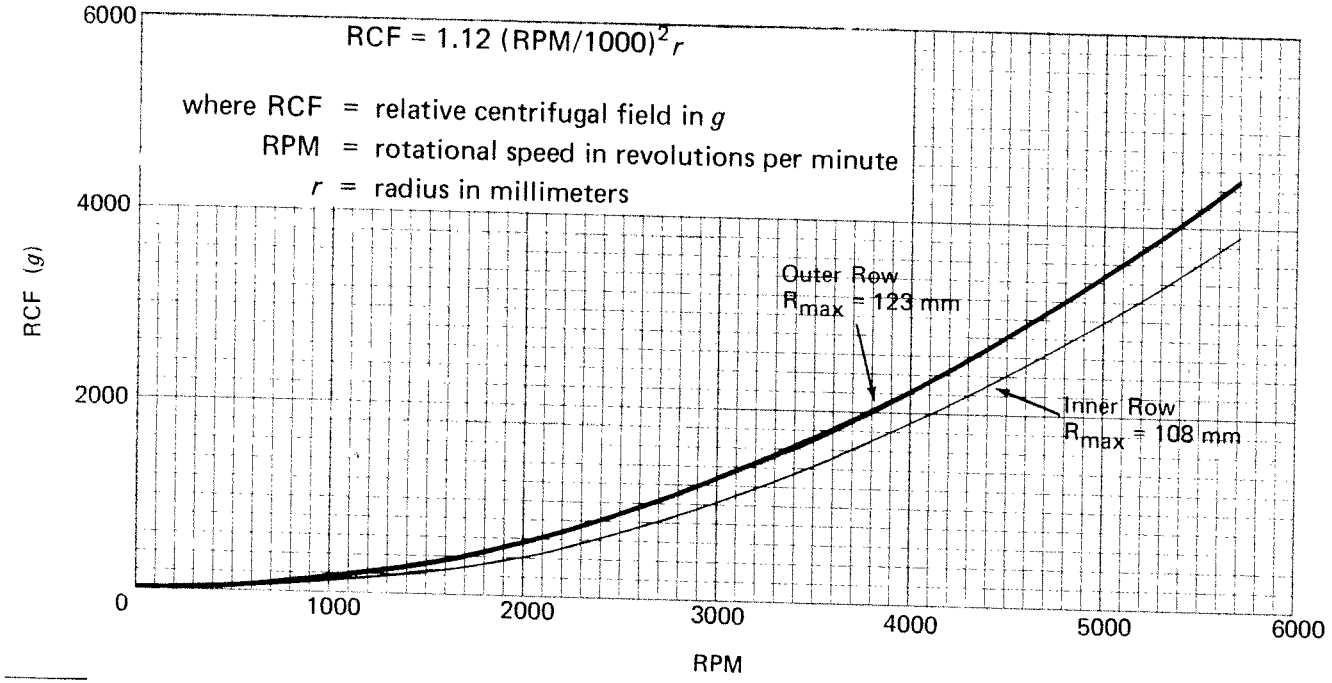


Figure 3. Relative Centrifugal Field versus Speed for the TA-24 Rotor at r_{max} = 108 mm and 123 mm.

*U.S. Pat. No. 4,010,890; French Pat. No. 77-00732; Japanese U.M. 1,462,551

TH-4 Rotor with Buckets *

Rated run speed	2700 rpm
Relative centrifugal field at r_{max} (186 mm)	1520 x *g*
Number of buckets	4
Maximum load per bucket at rated speed (not including weight of buckets)	800 grams
Approximate acceleration time (full load)	1.5 min
Approximate deceleration time (full load and HIGH BRAKE setting)	3.0 min

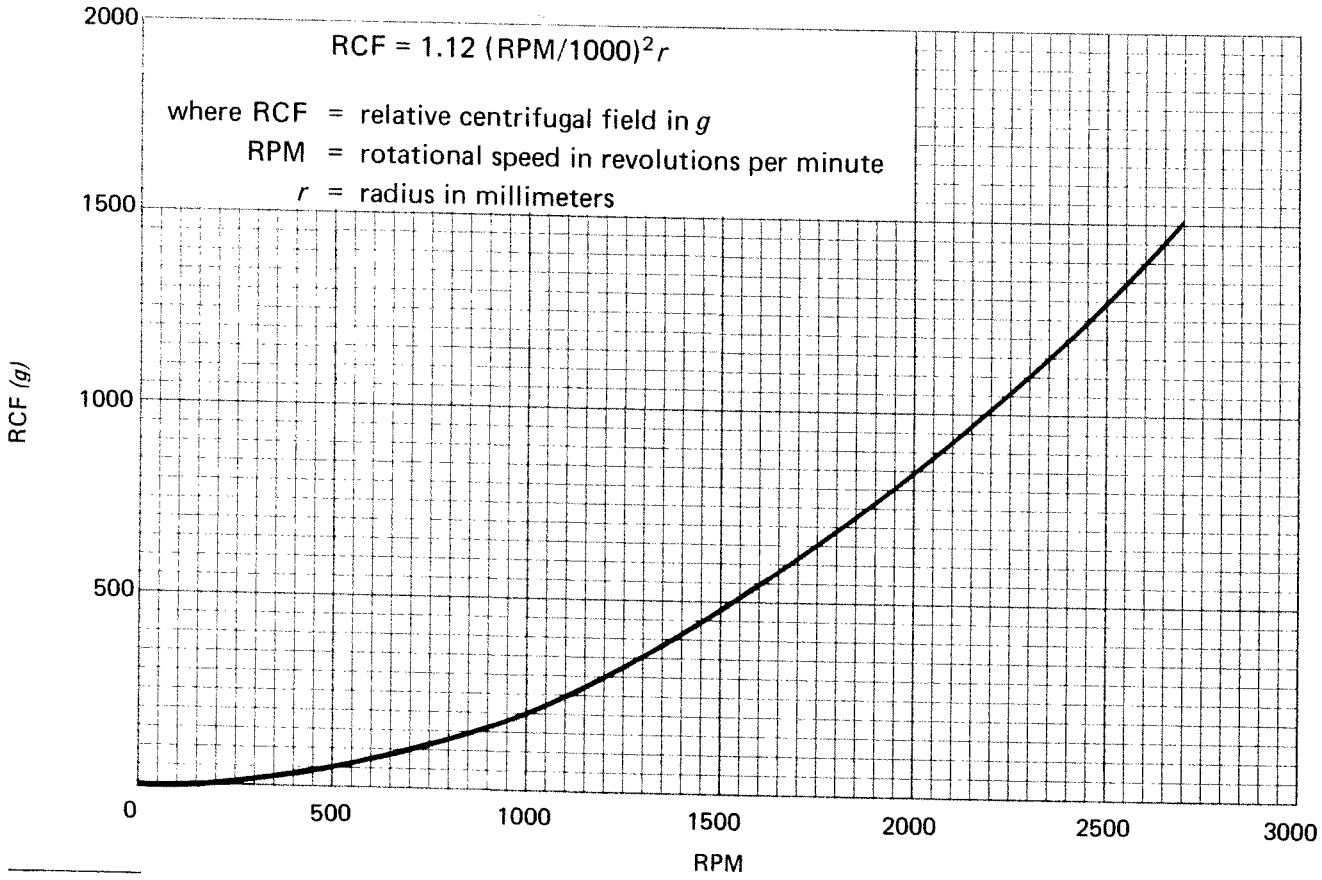


Figure 4. Relative Centrifugal Field versus Speed for the TH-4 Rotor with Buckets at r_{max} = 186 mm.

*U.S. Pat. No. 4,148,433

TH-4 Rotor with 100-mL Tube Holders

Rated run speed	2800 rpm
Relative centrifugal field at r_{max} (201 mm)	1764 x *g*
Number of tube cavities	4
Maximum load per cavity at rated speed (including tube, and cap if any)	240 grams
Approximate acceleration time (full load)	1 min
Approximate deceleration time (full load and HIGH BRAKE setting)	2 min

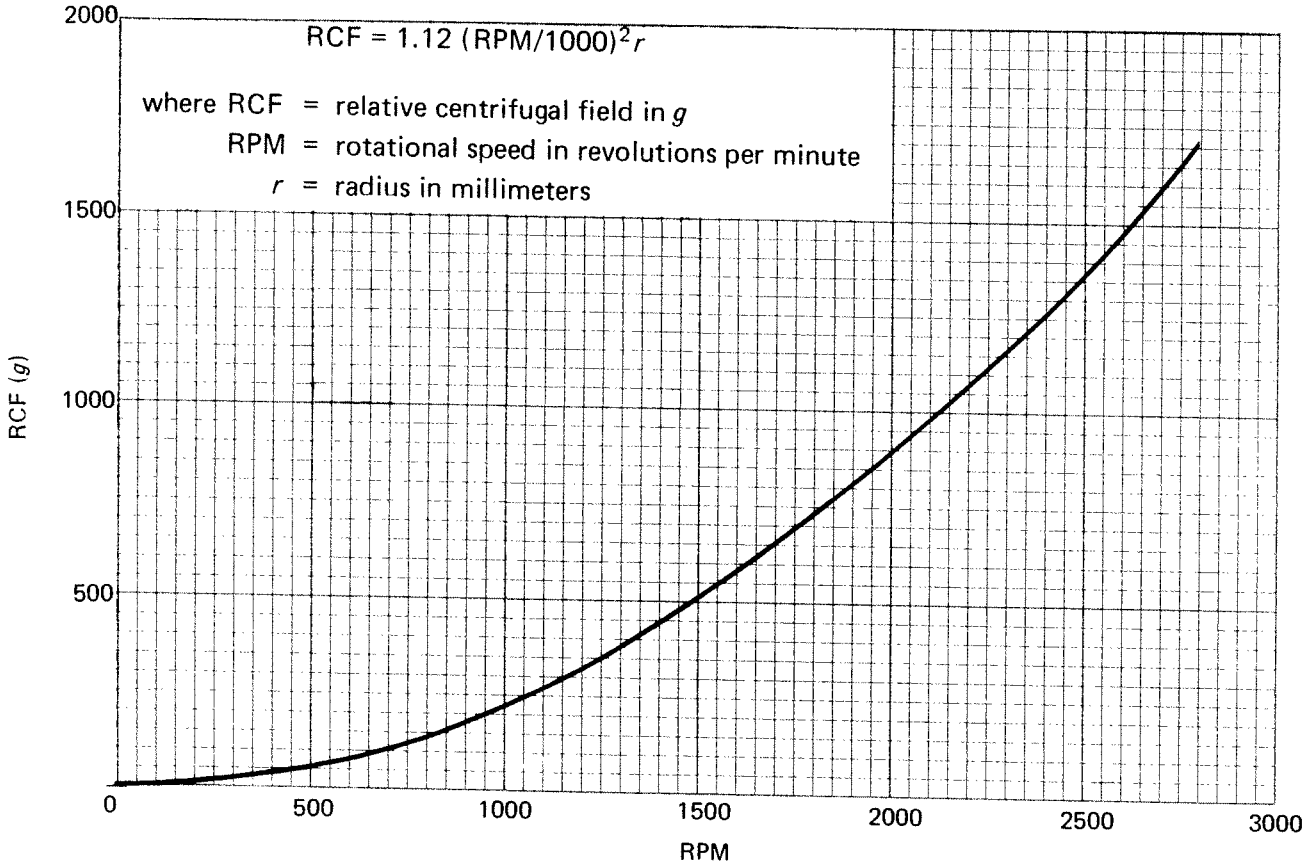


Figure 5. Relative Centrifugal Field versus Speed for the TH-4 Rotor with 100-mL Tube Holders at r_{max} = 201 mm.

TH-4 Rotor with Micro-Test Plate Carriers

Rated run speed	2750 rpm
Relative centrifugal field at r_{max} (165 mm)	1400 x *g*
Number of carriers	4
Maximum load per carrier at rated speed (not including weight of carrier)	150 grams
Approximate acceleration time (full load)	2.0 min
Approximate deceleration time (full load and HIGH BRAKE setting)	2.5 min

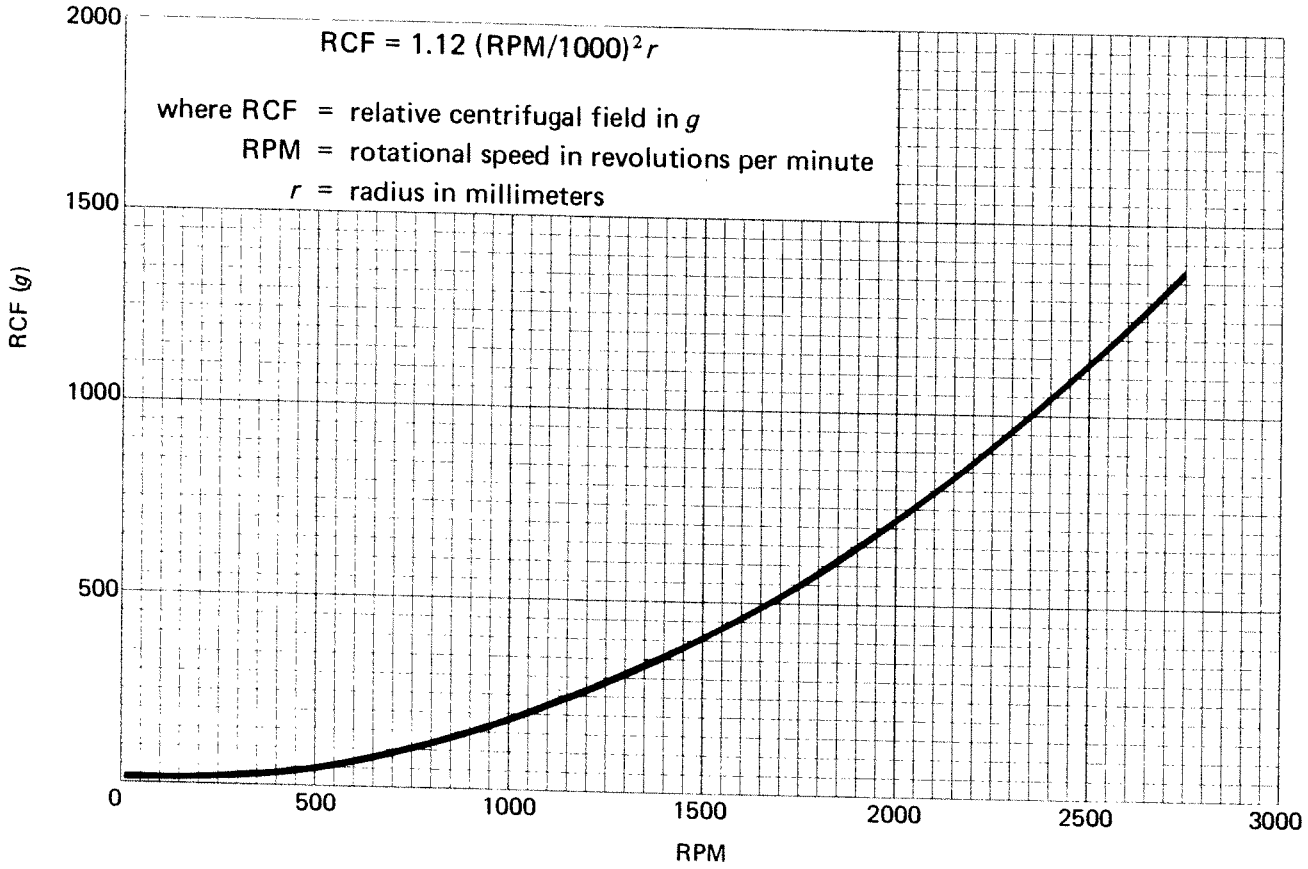


Figure 6. Relative Centrifugal Field versus Speed for the TH-4 Rotor with Micro-Test Plate Carriers at r_{max} = 165 mm.

CONTROLS AND INDICATORS

Door Control

The counterbalanced door is hinged at the back and released from the front panel. When the control knob is turned to the LOCK position and a run is started, the door will stay locked until the run is over. An emergency override for the interlock can be used if the door cannot be opened after the rotor has stopped. Refer to the Emergency Door-Opening Procedure under Operation, below.

Power Switch

The illuminated rocker switch at the lower right side of the control panel controls all power to the instrument.

Start Button

The START button, when pressed and released, starts the rotor drive, provided that POWER is ON, the TIME control is not set to zero, and the SPEED control is set to 4 or above.

Timer

The TIME control can be set for automatically timed runs from 1 to 30 min duration, with 1-min resolution. The HOLD position permits runs of indefinite duration.

Brake Switch

The three-position BRAKE switch controls the dynamic brake. At the end of a run (timer reads zero), the rotor will decelerate more or less rapidly depending on rotor design, loading, and the position of the BRAKE switch.

Speed Control

The SPEED control adjusts the power applied to the centrifuge drive motor. The numbers around the dial are arbitrary and are intended for use by the operator in returning to a previously used setting. Actual rotor speed is indicated by the RPM meter. At any given setting, the rotor speed will vary slightly if the line voltage changes.

RPM Indicator

The RPM meter indicates true rotor speed.

> **NOTE:** Full rotor stop is not necessarily indicated when the RPM meter reaches zero. The rotor stop light to the left of the meter serves that function.

Rotor Stop Light

When the rotor is not turning and the door-control knob is in the locked position, the red light is on.

Refrigeration Unit

The pilot light next to the temperature control knob indicates when power is supplied to the refrigeration unit. Normally, when the centrifuge door control is in the locked position, the refrigerator pilot light will be on. When the door control is in the OPEN position, the light will be off.

Dial settings approximate the temperatures that will be achieved, in degrees Celsius, when the TH-4 rotor is spinning fully loaded with 10- or 12-mL tubes at rated rotor speed and an average ambient temperature of 20 to 30°C. Temperature control is continuously variable from 0 to 20°C (the rotor must be spinning in order for the cooling system to operate properly).

NAME RATING PLATE

When corresponding with Beckman regarding the Model TJ-6 or the Model TJ-R, always mention the serial number. The serial number will be found stamped on the name rating plate (Figure 7) affixed to the rear of the instrument.

Figure 7. Typical Name Rating Plate

REFRIGERATION CHARGING LABEL

The refrigeration charging label shown in Figure 8 is affixed to the rear of the Model TJ-R. A replacement label will be provided free of charge if you write to Beckman Instruments Marketing Department, 1050 Page Mill Road, Palo Alto, CA 94304.

Figure 8. Refrigeration Charging Label.

Installation

UNPACKING

Check for visible damage and notify the carrier if any is found.

Before connecting the power cable, and with the instrument upright, turn the door control to OPEN. Open the door and remove the chamber bowl and gasket by pulling up on the periphery of the gasket. (Do not remove the gasket from the bowl.) Gently pull out the foam insulation, noting its orientation. Remove the red tie-down screw (Figure 9), then pull the motor forward and remove the foam block. *Do not operate the instrument until both the screw and the foam block have been removed.* Reinstall the foam insulation as it was, with the vertical piece to the rear. When reinstalling the bowl, seat it at one point, firmly positioning the gasket within the opening in the housing, then tap it at the diametrically opposite point on the perimeter to force it down. Take care that the gasket does not fold under as the bowl is installed. The gasket should fit evenly around the bowl when it is in place.

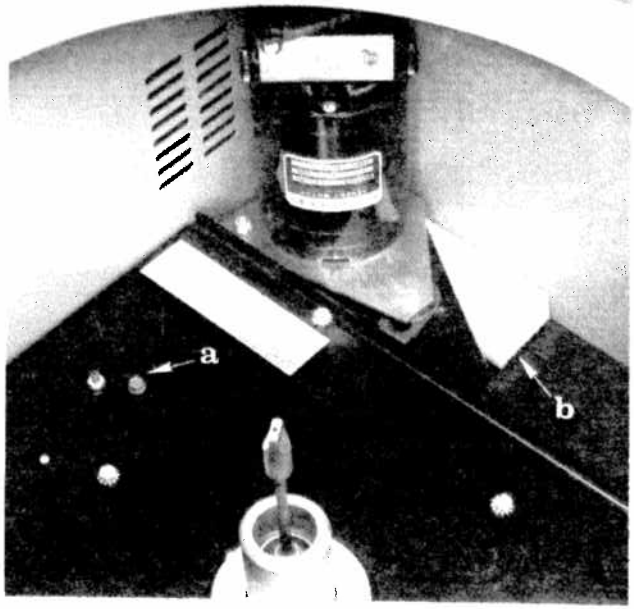


Figure 9. Shipping Materials to Be Removed before Operating the Centrifuge. a) *Tie-down screw,* b) *Foam block*

SITE SELECTION

Ambient temperatures during operation should not exceed 40°C. Do not place the instrument near storage or dispensing areas for reagents or combustible fluids. (This is to prevent such materials from entering the instrument's air system and possible ignition by sparking motor brushes.) Maintain the minimum clearances specified in Figure 10.

The combined weight of the TJ-R and the TJ-6 with loaded rotor requires a sturdy bench or cabinet surface capable of supporting approximately 212 lb (95 kg). There must be no sag in the supporting surface or the two units may not be properly aligned.

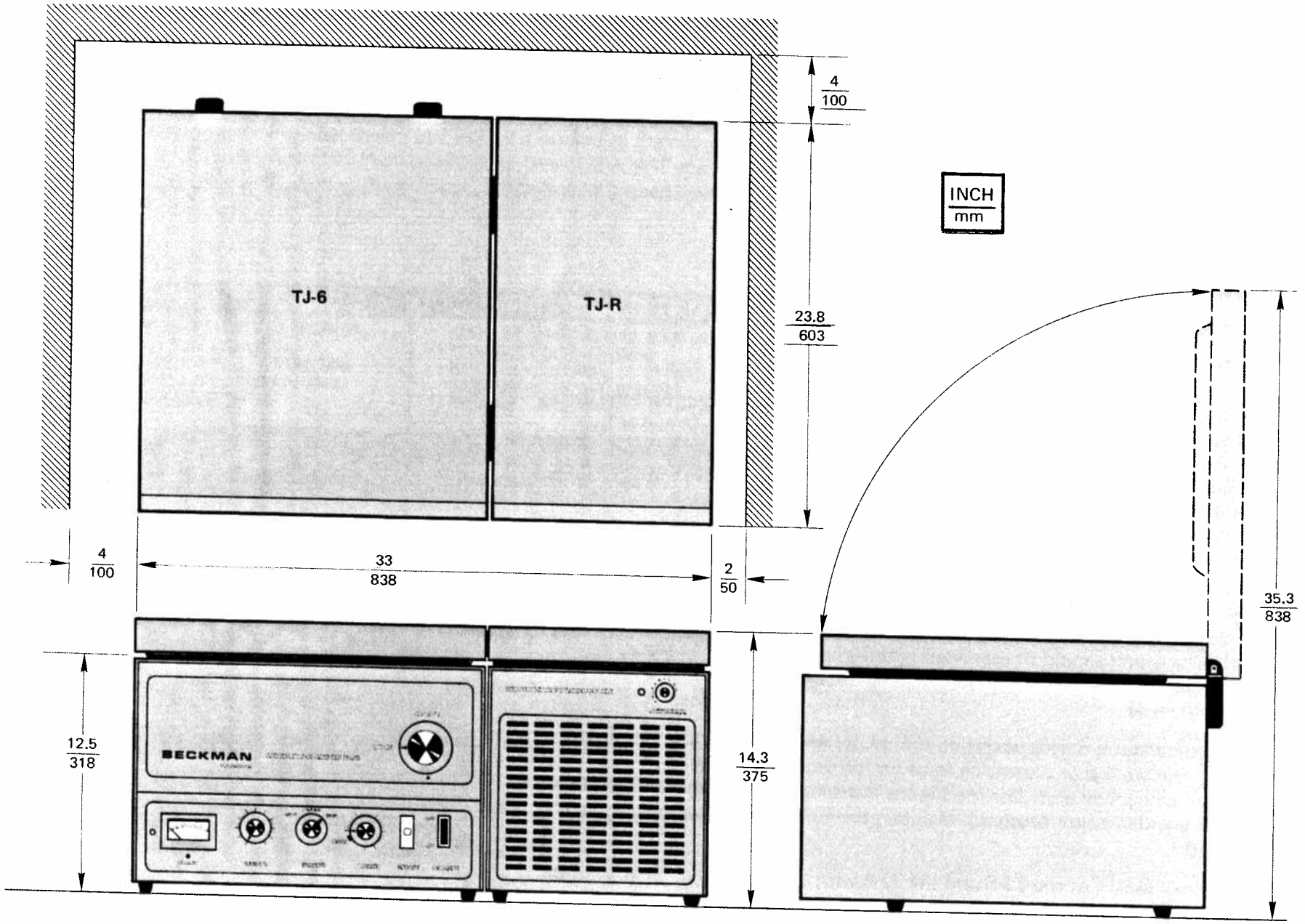


Figure 10.Dimensions and Clearances, TJ-6R

INSTALLATION

Air ducts in the left side of the refrigeration unit mate with similar openings in the right side of the centrifuge door to provide a path for refrigerated air into the centrifuge. The two units must be properly positioned against one another for effective transfer of air. Any gaps will impair performance by admitting room air into the system, which will result in excessive condensation and necessitate frequent defrosting, especially in humid climates. Make sure that the units are visually level. Open the lid of the centrifuge and press the TJ-R refrigeration unit firmly against the TJ-6 centrifuge (Figure 10). Connect the cord from the TJ-6 centrifuge to the male receptacle on the back of the TJ-R refrigeration unit.

WARNING

To avoid possible rotor overspeed problems, do not connect the instrument if the nominal power source is other than what is shown on the instrument name rating plate on the rear panel. Do not rewire the instrument; call your Beckman Service Representative to make the proper modification.

Plug the power cord from the TJ-6 Centrifuge into a wall outlet.

Rotors and Accessories

Rotors that can be used in the TJ-6 Centrifuge include the TH-4, a four-place swinging bucket rotor capable of carrying a wide range of tube sizes—from 1 to 100 mL; the TA-10, a 10-place fixed angle rotor for 50-mL tubes; and the TA-24, a 24-place fixed angle rotor for 15-mL tubes.

The TH-4 Rotor

The TH-4 rotor can be run with buckets, 100-mL tube holders, or Micro-Test Plate carriers in any balanced combination. The buckets used with the TH-4 rotor are of stainless steel. Test tubes are supported in the buckets by Maxi-Carrier tube racks, which can also be used in the laboratory as test tube racks. Each color designates a different tube size, but all Maxi-Carriers fit the same buckets. Table 1 gives information on the tube sizes that each Maxi-Carrier can accommodate.

Table 1. Tubes and Cushions for TH-4 Maxi-Carrier Tube Racks

Maxi-Carrier			Maximum Tube Diameter (mm)	Maximum Tube Length* (mm)	Rubber Cushions	
Color	Part Number	Number of Places			Part Number	Quantity
Light green	340130	60	7	125	—	—
Blue	339285	30	12	125	342601	30
Orange	339282	24	14	125	342602	24
Purple	339279	18	16	130	342603	18
Dark green	339276	10	18	134	342604	10
Yellow	339273†	4	29.3	136	342605	4
Red	339288	1	250-mL bottles		—	—

*The maximum length when running a fully loaded Maxi-Carrier is given. Longer tubes can be run if placed in the center holes of the Maxi-Carrier where there is more clearance between tube and rotor yoke. Always check new tube lengths for clearance by swinging the bucket up by hand before filling tubes. Be sure to include the cap if used.

†In addition to four 50-mL tubes, the 339273 rack can also hold four 10 x 75 or 12 x 75 tubes (maximum tube length 130 mm).

The aluminum 100-mL tube holders used with the TH-4 rotor have a single cavity to hold one 100-mL tube (maximum dimensions 45 x 160 mm). A rubber pad supplied with each tube holder fits in the cavity to cushion the tube.

Lubrication is not essential for proper operation of the rotor; however, a thin film of Spinkote™ lubricant applied to the pivot surfaces of the hinge pins (the surface that touches the buckets) will let the buckets swing more freely.

To make balancing easier, buckets are supplied in matched sets. The weight of each bucket is marked on its side. Maxi-Carriers are color coded according to tube size. All Maxi-Carriers that are the same color weigh the same and hold the same size tubes.

Carriers for Micro-Test Plates are available for the TH-4 rotor. Each carrier holds one plate for a total of four plates per run. See publication TJ6-TB-008 for instructions regarding the use of Micro-Test Plate carriers in the TH-4 rotor.

The TA-10 and TA-24 Fixed Angle Rotors

The TA-10 rotor has a solid aluminum body with 10 tube cavities for 50-mL tubes (maximum dimensions 31 x 117 mm). The TA-24 rotor has a solid aluminum-alloy body with 24 cavities[1] for 15-mL tubes (maximum dimensions 19 x 126 mm). Longer tubes may be used if the diameters are less than the maximum specified, or if the tubes are not placed in adjacent holes (that is, if every other cavity is loaded so that there is an empty cavity between any two tubes).

[1] In two rows; outer row: 16 cavities, inner row: 8 cavities.

Run Procedure

WARNING

Operator error or tube failure may generate aerosols. Toxic, pathogenic, or radioactive materials must not be run in the TJ-6 centrifuge unless the instrument is operated in an appropriate enclosure and all appropriate safety precautions are taken.

The centrifuge must not be used in the vicinity of flammable liquids or vapors, and such materials must not be run in the centrifuge.

Do not lift or move the centrifuge when the drive motor and rotor are turning.

CAUTION

Do not bend the driveshaft when installing or removing the rotor.

LOADING

The TH-4 Rotor

CAUTION

Always run the TH-4 rotor with buckets, Micro-Test Plate carriers, or 100-mL tube holders in all four positions, even if no loads are placed in them.

To ensure optimal performance and stability, the TH-4 rotor must be run with balanced loads. This means that opposing buckets and their contents must weigh approximately the same, within 10 grams,[2] and that partially filled Maxi-Carriers must be balanced by proper positioning of tubes. If Maxi-Carriers are to be run partially filled, then each tube must be placed in its Maxi-Carrier so that its weight is balanced by a tube in a diametrically opposed (viewed across the center of the yoke) position in the opposite Maxi-Carrier. See Figure 11 for examples of properly positioned tubes in partially filled Maxi-Carriers.

Improper positioning of tubes in partially filled Maxi-Carriers not only will affect the balance between opposing buckets but also prevent the buckets from achieving optimal horizontal position. See Figure 12. During a run, a bucket will always swing 90° from its rest position. Therefore, if a bucket is not properly loaded so that weight is equally distributed on either side of its pivotal axis, it will not hang vertically at rest and will not swing to a horizontal position during a run. As a result, extra stress is placed on the tubes during the run, and the possibility of breakage is increased.

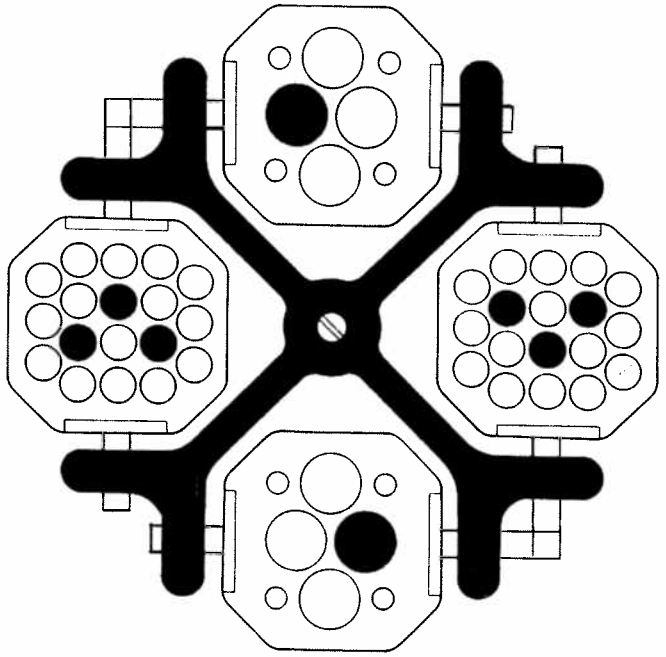


Figure 11. An Example of Centered and *Balanced Opposing Bucket Loads. Empty buckets can be used, but the rotor must not be run with buckets missing.*

[2] The instrument will shut off if imbalance is excessive.

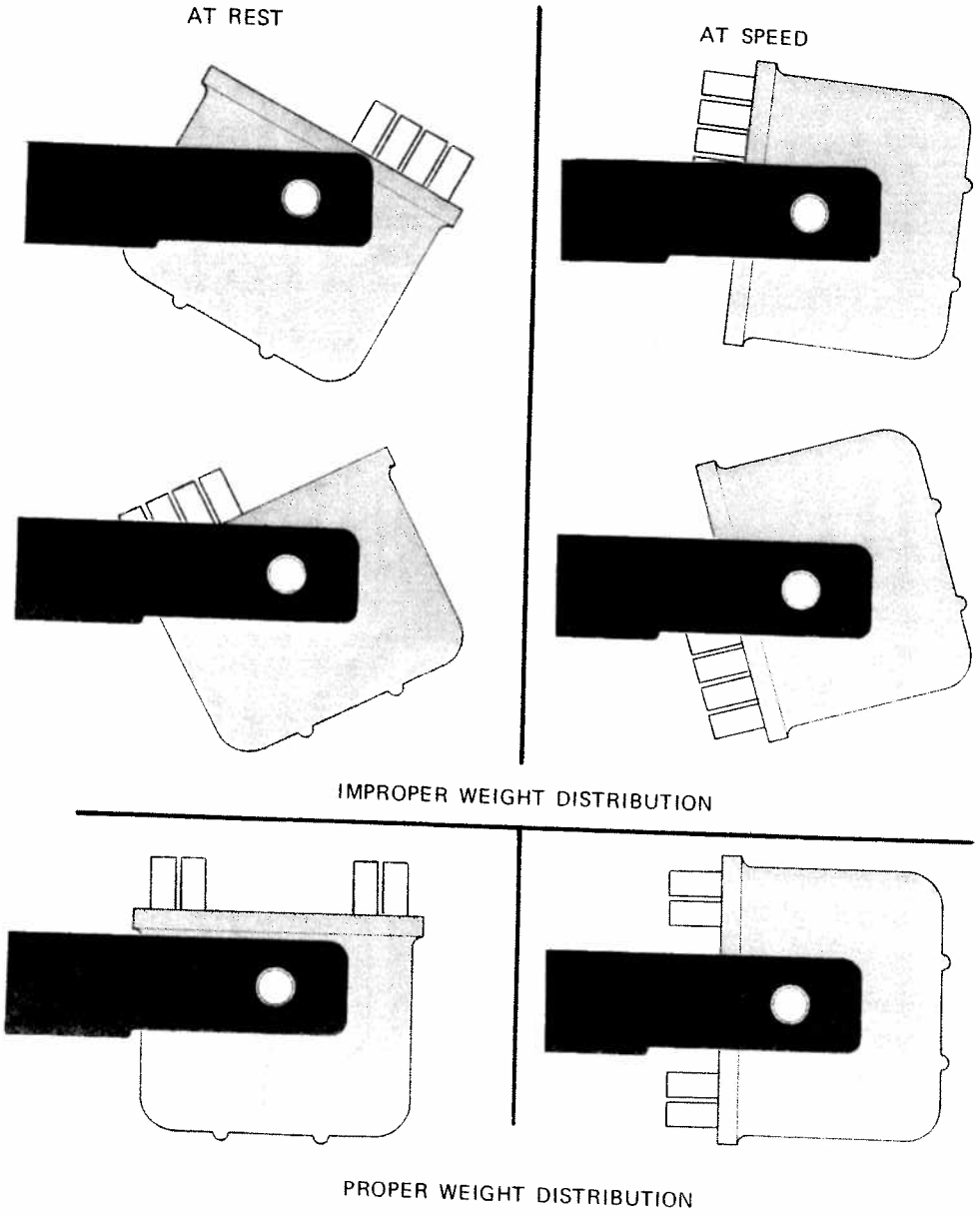


Figure 12. Examples of How the Horizontal Swing of Buckets Is Affected by Proper and Improper Weight Distribution

Do not pour samples directly into buckets or tube holders. It is not necessary to fill all the buckets or tube holders, but an empty container must be opposite an empty container. Check tube length by placing a Maxi-Carrier with empty tubes in a bucket and manually swinging the bucket to the horizontal position to be sure that the tubes will clear the yoke. This is important.

Fixed Angle Rotors

Load the rotor symmetrically so that opposing loads weigh within 10 grams of one another. Install the rotor lid. When the rotor spins, the air pressure differential will hold the lid firmly in place.

SPEED DERATING

"Maximum" loads specified in the rotor specifications are for operation at the rotor's rated speed. Heavier loads may be used if the rotor is run at the lower speed determined by the appropriate formula:

TH-4 with Buckets

$$\text{Speed} = \sqrt{\frac{800}{\text{load (grams)}^*}} \times 2700$$

*per bucket (not including weight of bucket)

TH-4 with 100-mL Tube Holders

$$\text{Speed} = \sqrt{\frac{240}{\text{load (grams)}^*}} \times 2800$$

*per cavity, including tube, and cap if any (not including weight of tube holder)

TH-4 with Micro-Test Plate Carriers

$$\text{Speed} = \sqrt{\frac{150}{\text{load (grams)}^*}} \times 2750$$

*per carrier, not including weight of carrier

TA-10

$$\text{Speed} = \sqrt{\frac{120}{\text{load (grams)}^*}} \times 5700$$

*Single cavity including tube and cap

TA-24

$$\text{Speed} = \sqrt{\frac{36}{\text{load (grams)}^*}} \times 5700$$

*Single cavity including tube and cap

RUN PROCEDURE

WARNING

Do not operate the centrifuge with the chamber bowl out of the instrument.

CAUTION

Always run rotors with balanced loads.

Turn the door control to LOCK.

Turn ON the POWER switch.

NOTE: The POWER switch may be left on all day, if desired, but should be turned off for long periods of disuse. It should not be used to stop individual runs except in emergencies, as the rotor stop light is inoperable when the power is off.

Select refrigeration temperature. The dial is calibrated in degrees Celsius.

NOTE: The refrigeration unit must be on at all times when the centrifuge is running, or the samples will overheat. To run at the highest possible controlled temperature (i.e., as near as possible to ambient), set the temperature control to 20, then slowly turn it clockwise until the refrigeration unit starts. This is the maximum reliable setting.

Set the run TIME.

Select the BRAKE rate. HIGH is the most practical setting. LOW and OFF are needed only when a pellet is desired and there is a possibility of remixing.

Press and release the START button. The instrument starts when the button is released.

Turn the SPEED control to 10. Slow rotation of the speed control, starting at zero and reaching the extreme clockwise position in 5 to 10 s, is easy on the drive system and will minimize current surges.

When the instrument reaches the desired speed, as indicated by the RPM meter, adjust the speed control as required to maintain the desired speed.

NOTES: a). Acceleration and deceleration times for rotors are given in the specifications.

b). If power is interrupted, the drive will turn off and the instrument will go into the braking mode. This will happen if someone turns off the power switch or tries to open the door, or if facility power fails momentarily. The electrical timer will stop, indicating the remaining run time. To restart, press the START button.

c). Calibration of the RPM meter is described under Maintenance, below.

d). To end the run for any reason, turn the timer to zero. (Turning the power off will also terminate the run, but this should be done only in emergencies, as the rotor stop light will not operate if the power is off.)

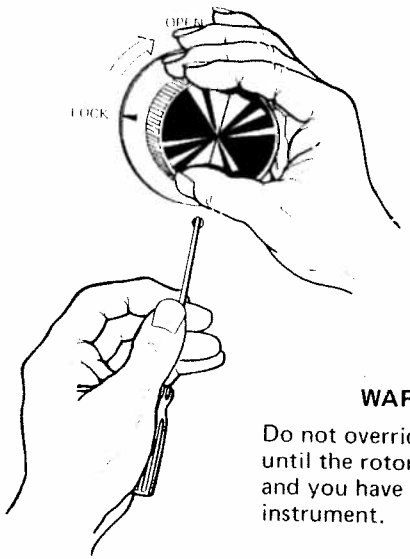
When the timer is turned off or allowed to go to zero, the brake is applied (if set to HIGH or LOW), even if the power switch is off. The period of slight vibration that you may have noticed when the rotor first begins to turn now recurs as it slows. This normal precession occurs at a different speed for each rotor. The door interlock will keep the door locked until the rotor has virtually stopped. Complete stop is indicated when the stop light on the panel comes on.

EMERGENCY STOP

Turn the POWER switch OFF or pull the plug.

EMERGENCY DOOR-OPENING PROCEDURE

To override the interlock, insert a small screwdriver or other tool into the small hole below the door control knob. Raise the handle so that the tip of the tool depresses the mechanism as far as possible. While doing this, turn the door control knob to OPEN. (If the screwdriver is inserted too far, it will interfere with the rotation of the knob. If this happens, withdraw the screwdriver and continue turning the knob.)



WARNING

Do not override the door lock until the rotor has stopped and you have unplugged the instrument.

Leave the power on and the centrifuge door closed between runs. This will keep the system in standby condition for optimal temperature pulldown during the run. Recovery will depend on the interval between runs. If maximal cooling is required and the time between runs is 30 min or longer, precooling of the instrument may be necessary prior to the next run—failure to precool the instrument may cause the temperature of cold samples to rise briefly during the first part of the run. Precooling is not necessary if the runs last 15 min or longer. To precool the instrument, let it run with the rotor installed for 10-15 min at 1000-2000 rpm.

When runs are not being made, such as overnight and on weekends, allow the system to defrost by turning the power off or by leaving the centrifuge door unlocked. *This is important.* After very long runs at low temperatures, expect defrosting to take a few hours.

The capacity of the drain pan is approximately 350 ml. In normal use, with frequent defrosting as recommended, drainage will evaporate. If defrosting is too infrequent, the drain pan will overflow. No electrical components will be affected, but there will be water on the bench. (An overflow outlet is provided on the rear of the instrument to which a drain line can be connected, if desired.)

PREVENTING ICE BUILDUP

Although the usual 10- or 15-min runs at settings yielding 4-6°C will not cause icing in the refrigeration unit, runs of many hours below 4°C may. Icing can also be caused by leaving the refrigeration at a low temperature for long periods when runs are not being made, such as over a weekend. Ice formation can clog the drain, causing water to be blown into the centrifuge bowl. Defrosting must be done *every day*, except in a very dry climate.

FACTORS RESPONSIBLE FOR TEMPERATURE VARIATIONS

Actual temperatures will vary with the length of the run, the size and number of tubes, the rotor configuration, the room temperature, the altitude, and with physical variations among instruments. To prevent samples from freezing, operation should be limited to a setting of 4 or higher, especially for runs of several hours, unless the system has been calibrated with the specific rotor and load.

Maintenance

Maintenance of the TJ-6R is minimal because of the simple design of its moving parts and the use of such highly dependable components as sealed bearings, which eliminate the need for regular lubrication.

CLEANING

The instrument's vinyl finish may be wiped with a damp cloth or washed with a mild detergent or spray vinyl cleaner. Do not use acetone or solvents. The interior of the rotor chamber should be kept clean by frequent wiping with a cloth or paper towel.

WARNING

Always disconnect the power cord before removing the bowl.

The bowl is easily removed for cleaning when spills have occurred. Rinse well and dry thoroughly before replacing.

Cleaning, including wiping up spills, is necessary to prolong the life of the instrument and rotor components. Always clean away spills when they occur, to prevent corrosives or contaminants from drying on component surfaces. When cleaning, use the following methods for the components listed.

Buckets and Bowl

Wash stainless steel buckets and aluminum bowl using soap, detergent, or cleanser; rinse; dry in air or with a towel.

Rotors, Yokes, and 100-mL Tube Holders

When spills occur, wash the components in warm water. When caustic materials have been run, wash the rotor and 100-mL tube holders immediately after each run with a lukewarm, dilute solution of a mild detergent of nearly neutral pH, such as Beckman Solution 555™ (diluted 5 or 10 to 1 with water). This preparation is preferred because most laboratory detergents are too strong for anodized finishes. Use a test tube brush (available in the Rotor Cleaning Kit) to clean tube cavities, but do not allow the wire in the brush to scratch the surface. Rinse immediately with distilled water and air-dry upside down. Do NOT use acetone to dry the rotor.

TUBE BREAKAGE

If a tube should break and all the glass is not contained in the stainless steel bucket, it will be necessary to *thoroughly clean the interior of the chamber bowl.* Disconnect the power cord and remove the bowl. Remove the gasket and rinse the gasket under running water to make sure that no glass particles are retained in it. Use a vacuum to clean the insulated panel on the underside of the door. Make sure that Maxi-Carriers are clean and that the rubber cushions are in place. Any fine black powder on the underside of the door is the result of sand-blasting of the aluminum bowl by glass particles and should be removed.

Plastic Maxi-Carriers

Remove the top level of plastic Maxi-Carrier (with care) for cleaning. Do not try to remove the bottom level; it is permanently attached to the sides. Wash with soap or detergent. Scrub with a brush, if necessary, or use a dishwasher. Rinse and dry.

STERILIZATION

Rotor components can be sterilized by using ethylene oxide or Zephiran Chloride, or by autoclaving up to 125°C.

DRIVE BELT REPLACEMENT

WARNING

Any maintenance procedure requiring removal of the bottom panel exposes the operator to the possibility of electrical shock and mechanical injury. For this reason, such service should be done only by trained and qualified personnel. DISCONNECT THE POWER CORD BEFORE REMOVING THE BOTTOM PANEL.

Access

REMOVE THE ROTOR and close and lock the door. Tip the instrument onto its back.

CAUTION

Do not open the door while the instrument is on its back. The door is spring loaded and will fly open, bending the hinges, which will then have to be replaced.

Remove four feet and two screws (Figure 13) and remove the bottom panel.

NOTE: Star washers are for grounding the bottom panel.

Belt Removal and Replacement

CAUTION

The drive belt may be damaged if it is forced over the pulley flange while under tension. Lift the motor as far as possible when removing or replacing the belt.

1. Take hold of the post shown in Figure 14 and lift the motor as far as it will go. Holding the motor in this position, remove the old belt, working it off the motor pulley first.

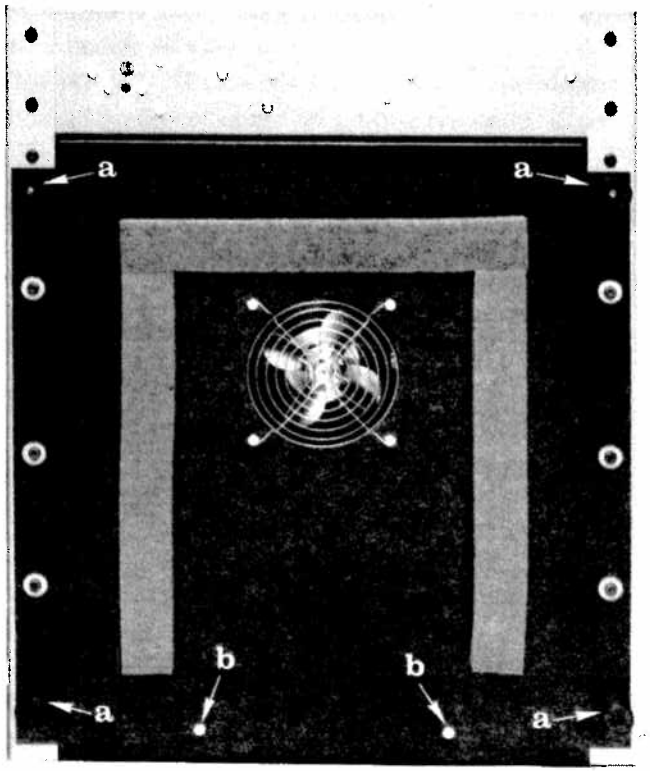


Figure 13. Bottom View of the Model TJ-6. Remove four rubber feet (a) and two screws (b) to gain access to lower maintenance points. CAUTION. Do not try to open the door when the instrument is in this position.

2. Slip the new belt over the fan pulley and, holding the post as before, work the belt over the motor pulley, making sure that it is properly seated before allowing the motor to come back to its natural position.
3. Replace the bottom plate and make a brief test run.

FUSE REPLACEMENT

Remove the rotor and close and lock the door.

Remove the bottom plate as described under Drive Belt Replacement, above. See Figure 14 for fuse location. For 50-Hz instruments connected to 220, 230, or 240-V source, use 4-A, 250-V time delay fuse. For 60-Hz instruments connected to 120-V source, use 7-A, 125-V time delay fuse.

HINGE LUBRICATION

When necessary, lubricate the centrifuge door hinges with 30-weight or heavier oil. Just one drop of oil at each of six points on each hinge will ensure smooth operation and long life. Use oil very sparingly. Too much oil will adversely affect the damping action of the hinge. A suggested procedure is to close the lid and apply one drop of oil to each of the two oiling points shown in Figure 15. Then open the lid and apply a drop at each of the four oiling points shown in Figure 16.

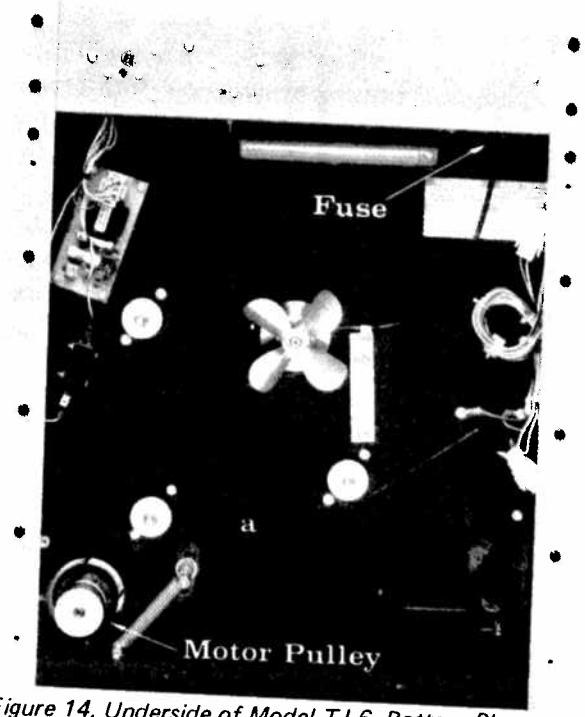


Figure 14. Underside of Model TJ-6, Bottom Plate Removed. Lift post "a" to relieve tension when removing or replacing belt.

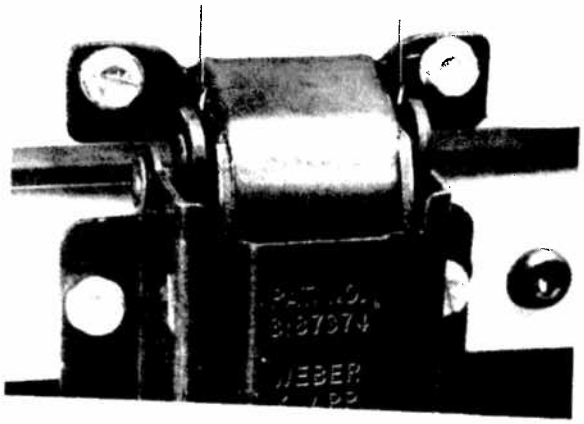


Figure 15. Hinge Lubrication, Rear Oiling Points

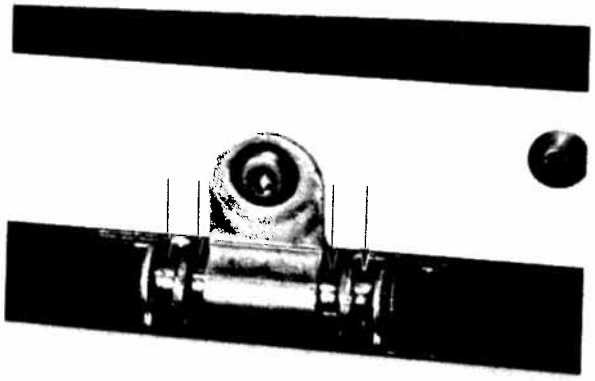


Figure 16. Hinge Lubrication, Front Oiling Points

INTERLOCK CABLE ADJUSTMENT

If the centrifuge door-control knob cannot be turned to OPEN after the rotor has stopped, use the Emergency Door-Opening Procedure (under Operation, above). Turn the rotor counterclockwise and try again. If it continues to malfunction, check the gap between the interlock cable and the fan pulley. (The gap should be approximately 1 mm when the knob is in the LOCK position.) Remove the rotor and close and lock the door. Remove the bottom plate as described under Drive Belt Replacement, above, and loosen the nut (a) shown in Figure 17. Move the assembly to bring the tip of the interlock cable to within about 1 mm (±0.25 mm) of the knurled flange on the drive pulley.

NOTE: (U.S. and Canadian customers) A dime is about 1 mm thick.

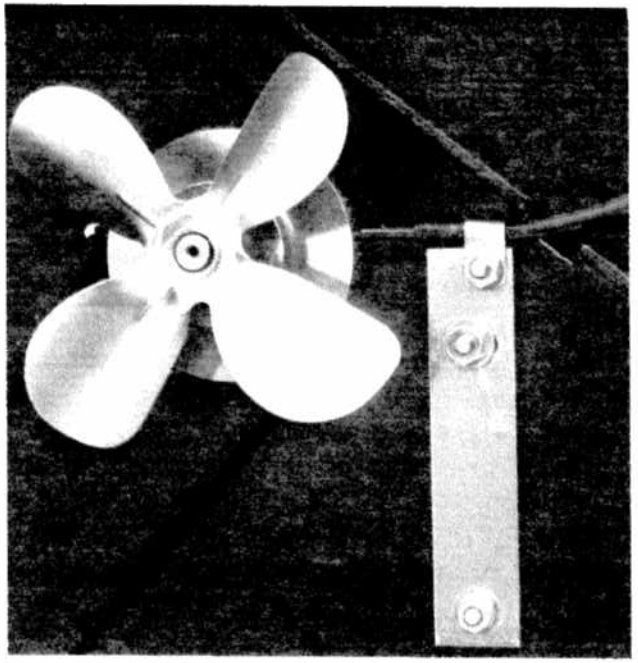


Figure 17. Interlock Cable. Loosen clamping nut "a" to adjust clearance.

MOTOR BRUSH INSPECTION AND REPLACEMENT

WARNING

Turn off the power.

NOTE: This procedure should be done periodically by trained service personnel. Inspect the brushes one at a time and return each *to its own cavity in its exact former orientation.* Since brush materials vary considerably, only Beckman-approved replacement brushes should be used.

With the centrifuge right side up, remove the bowl and foam liner. See Figure 18. Remove the brushes one at a time and inspect them. The contact surfaces should be bright. A very black matte surface is indicative of arcing, due to excessive brush wear or hanging up in the brush holder.

On some brushes, a horizontal groove indicates 50% of the original length. When the brush is worn to this point, it should be replaced. Brushes should not be allowed to wear down to less than 3/8 in. (10 mm).

When reinstalling the brush, be sure to orient the cap so that the tabs fit inside the cavity. If the tabs are splayed, squeeze them together so that they are parallel or slant in a little. If there is any question of whether the brush orientation is the same as before, perform the Wear-in Procedure for New Brushes, as given below.

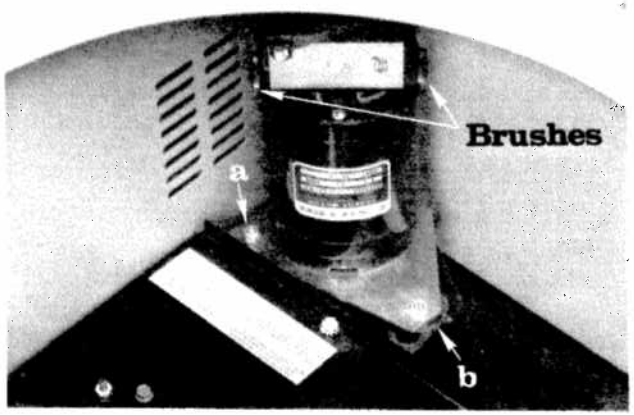


Figure 18. Interior of Centrifuge (Bowl and Foam Liner Removed) Showing Location of Motor Brushes and Lubrication Points.

This is a good time to lubricate the motor mounting plate (Figure 18). Use two drops of 30-weight oil at the pivot bolt *(a)* and the slot *(b)* so that the plate can move as required to maintain proper tension on the drive belt. Replace the foam liner and the bowl.

Wear-in Procedure for New Brushes

New brushes should be permitted to conform to the commutator *before running the centrifuge with a rotor.* Perform the following procedure.

1. Replace the foam liner and the bowl. *Do not install the rotor.*
2. Close the lid
3. Turn the TIME control to HOLD
4. Set the SPEED control to zero
5. Press the START button
6. Start the drive slowly with the SPEED control. Adjust the speed so that the RPM meter indicates between 2000 and 2500 rpm. Do not exceed 2500 rpm.
7. Let the instrument run overnight.

RPM METER CALIBRATION

NOTE: For optimal accuracy, calibrate the RPM meter at the rated speed of the rotor that you will be using.

1. Open the centrifuge door and use a blunt object to compress the sides of the plastic plug in the center of the door so that it can be removed. Remove the plug.

CAUTION

Do not try to push the plug out without compressing the sides; it may break.

2. Mount the rotor and make a pencil mark on the center of the rotor.
3. Close the door and pull the centrifuge forward a few inches over the edge of the table, just far enough to expose the calibration adjustment hole under the control panel. See Figure 19.
4. With instrument power still off, zero the RPM meter by adjusting the screw under the meter scale on the control panel (Figure 19).

Figure 19. RPM Meter, Showing Zero Adjust (a) and Calibration (b) Hole

5. Set the door-control knob to LOCK and the SPEED control to 10.
6. Set the TIME control to 10 and the BRAKE control to HIGH, turn the POWER switch ON, and press the START button.
7. When the rotor reaches the desired speed, take a stroboscopic reading through the hole in the centrifuge door.[3] See Figure 20.
8. Turn the adjustment screw under the control panel (Figure 19) to set the RPM meter so that it agrees with the stroboscopic reading.
9. Turn the instrument off and allow the rotor to come to a complete stop.
10. Reposition the instrument in its former position.
11. Reinstall the plastic plug in the door. (If this is not done, excessive frosting will occur.)

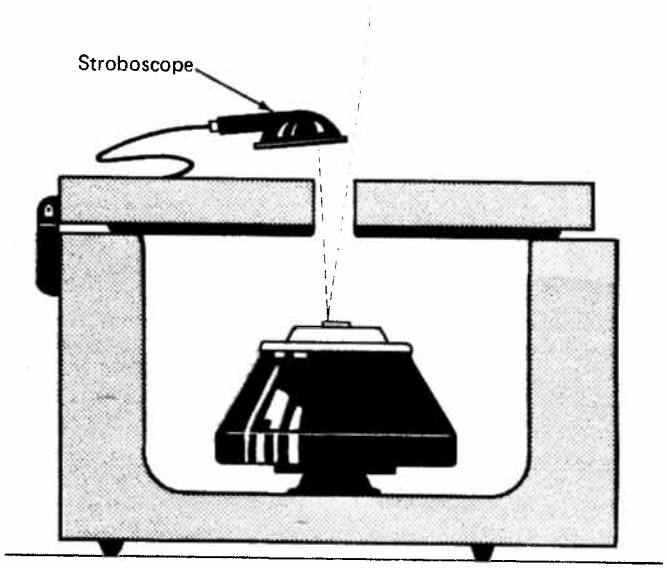


Figure 20. RPM Meter Calibration

REFRIGERATOR DUCT TERMINALS

The duct terminals on the TJ-R refrigeration unit (Figure 21) should be greased once a year with a light film of silicone grease.

DYNAMIC TEMPERATURE CALIBRATION

To check the temperature of your instrument, do the following (make sure that the units are flush against one another).

1. Place two 12 x 100-mm glass tubes, two-thirds filled with water, in opposing Maxi-Carriers. Close the instrument door.
2. Set the temperature dial to 4°C. Select the desired speed and spin the water samples for the desired time.
3. When the run is complete, open the door. Immerse the bulb of a precooled thermometer in the first tube for ten seconds. Then immerse it in the second tube and record the temperature. Adjust the temperature setting accordingly to achieve your desired run temperature.

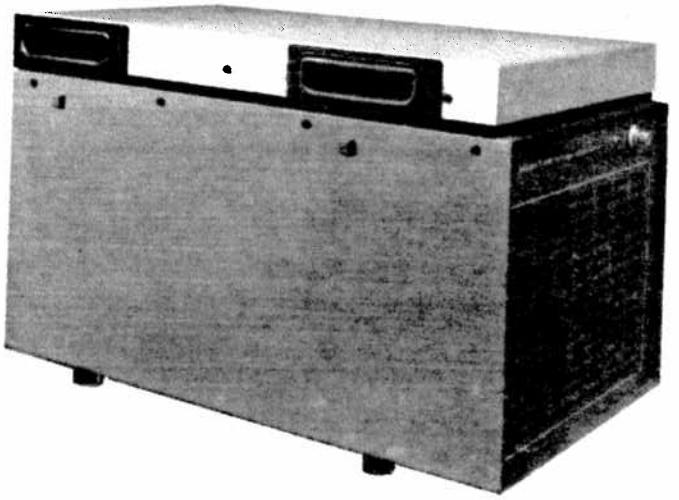


Figure 21. Model TJ-R, Showing Duct Terminals

[3] E.g., *Strobotac 1531 AB,* available from General Radio, West Concord, Massachusetts 01781.

Troubleshooting

Problem	Cause	Solution
Motor shuts off before rotor reaches set speed		1. Balance tubes within 10 g 2. Load rotor symmetrically 3. Check buckets for unusual additional loads such as broken tubes, spilled liquid, and accumulated condensed water
Rotor cannot achieve top speed	1. Line voltage is below rating 2. Brushes worn 3. New brushes 4. Worn motor commutator	1. Check by plugging instrument into a circuit that is not overloaded. 2. Replace brushes* 3. Allow brushes to seat by running instrument overnight at 2000-2500 rpm (without a rotor) 4. Motor must be replaced*
Erratic or no braking	Brushes worn	Replace brushes*
Rotor cannot be removed from the shaft	Rotor seized on the shaft	**CAUTION** To avoid bending and permanently damaging the shaft, do not apply any lateral force to the rotor. 1. Take out plastic plug in center of rotor 2. Insert a ¼-20 screw in the hole 3. Hold the rotor steady to keep it from turning and turn the screw to force the rotor off the shaft 4. Clean the shaft and bore with alcohol 5. To prevent recurrence, coat the shaft with a light film of Spinkote

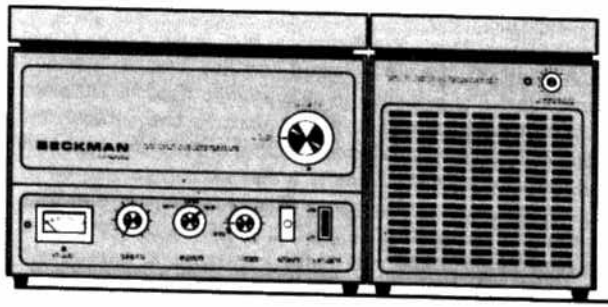
*To be performed only by a qualified, trained service person

[Continued]

Troubleshooting

Problem	Cause	Solution
Unable to achieve low sample temperature	Length of run too short	Precool the system
Condensation in centrifuge chamber	1. Improper defrosting of refrigeration unit	1. Defrost unit completely by setting refrigeration control to 20 and speed to 1000 rpm. Check mating of refrigeration unit to centrifuge, check lid gasket and plastic plug
	2. Door left open on cold unit	2. After proper defrosting, run the unit with refrigeration.
Rotor warm to the touch	1. Refrigeration unit frosted	1. Defrost refrigeration unit
	2. Refrigeration unit not functioning properly	2. Call Beckman Service
Water on bench	1. Drain line loose, broken or displaced	1. Check
	2. Tray overflow due to excessive frosting and/or improper defrosting	2. Defrost and check drain line

Parts and Accessories List



Use only Beckman-approved parts and accessories for maximum reliability and to keep your warranty in effect.

Drive belt	878513
Drive motor brushes (2)	340536
Timer, 50-Hz	339236
Timer, 60-Hz	339229
Bowl gasket	339228
Spindle assembly	340341
Spindle boot	339224
Drive motor assembly*	340342
Maxi-Carrier tube racks	see Table 1
Fuse for 50-Hz instrument	865608
Fuse for 60-Hz instrument	881293
Holder assembly for 100-mL tubes	340125
Rubber pad for 100-mL tube holder	339271
Stainless steel bucket†	340138
Stainless steel buckets, matched set of four	340124
Beckman Solution 555	339555
Rotor Cleaning Kit	339558
Micro-Test Plate carriers (set of 4)	342076
Spinkote lubricant	306812
Silicone vacuum grease	335148

* Because the motor is matched to the TJ-6 rotor, a replacement motor must be ordered from Beckman Instruments, or the warranty will be invalid. Dangerous overspeeding can result from using a mismatched motor.

† Indicate weight in grams of bucket to be matched.

Warranty

Subject to the exceptions and upon the conditions specified below, Beckman agrees to correct, either by repair, or, at its election, by replacement, any defects of material or workmanship which develop within one (1) year after delivery of the Model TJ-6/TJ-6R Centrifuge (the product), to the original Buyer by Beckman or by an authorized representative, provided that investigation and factory inspection by Beckman discloses that such defect developed under normal and proper use.

Some components and accessories by their nature are not intended to and will not function for one (1) year. A complete list of such components or accessories is maintained at the factory and at each Beckman District Sales Office. The lists applicable to the products sold hereunder shall be deemed to be part of this warranty. If any such component or accessory fails to give reasonable service for a reasonable period of time, Beckman will repair or, at its election, replace such component or accessory. What constitutes either reasonable service and a reasonable period of time shall be determined solely by Beckman.

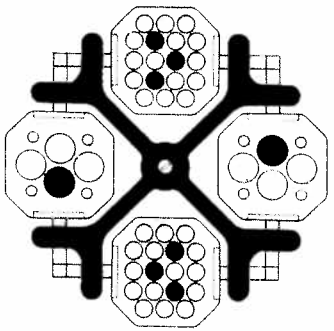
Any product claimed to be defective must, if requested by Beckman, be returned to the factory, transportation charges prepaid, and will be returned to Buyer with the transportation charges collect unless the product is found to be defective in which case Beckman will pay all transportation charges.

Beckman makes no warranty concerning products or accessories not manufactured by it. In the event of failure of any such product or accessory, Beckman will give reasonable assistance to the Buyer in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

Subject to the exceptions and upon the conditions specified below, Beckman agrees to correct, either by repair, or, at its election, by replacement, any defects of material or workmanship which develop within seven (7) years after delivery of the TJ-6/R rotors (the product(s)), to the original Buyer by Beckman or by an authorized representative, provided that investigation and factory inspection by Beckman discloses that such defect developed under normal and proper use.

Beckman shall be released from all obligations under all warranties, either expressed or implied, if the product(s) covered hereby are repaired or modified by persons other than its own authorized service personnel, unless such repair by others is made with the written consent of Beckman, or unless such repair in the sole opinion of Beckman is minor, or unless such modification is merely the installation of a new Beckman plug-in component for such product(s).

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND THAT BECKMAN SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER ARISING OUT OF THE MANUFACTURE, USE, SALE, HANDLING, REPAIR, MAINTENANCE, OR REPLACEMENT OF THE PRODUCT.



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