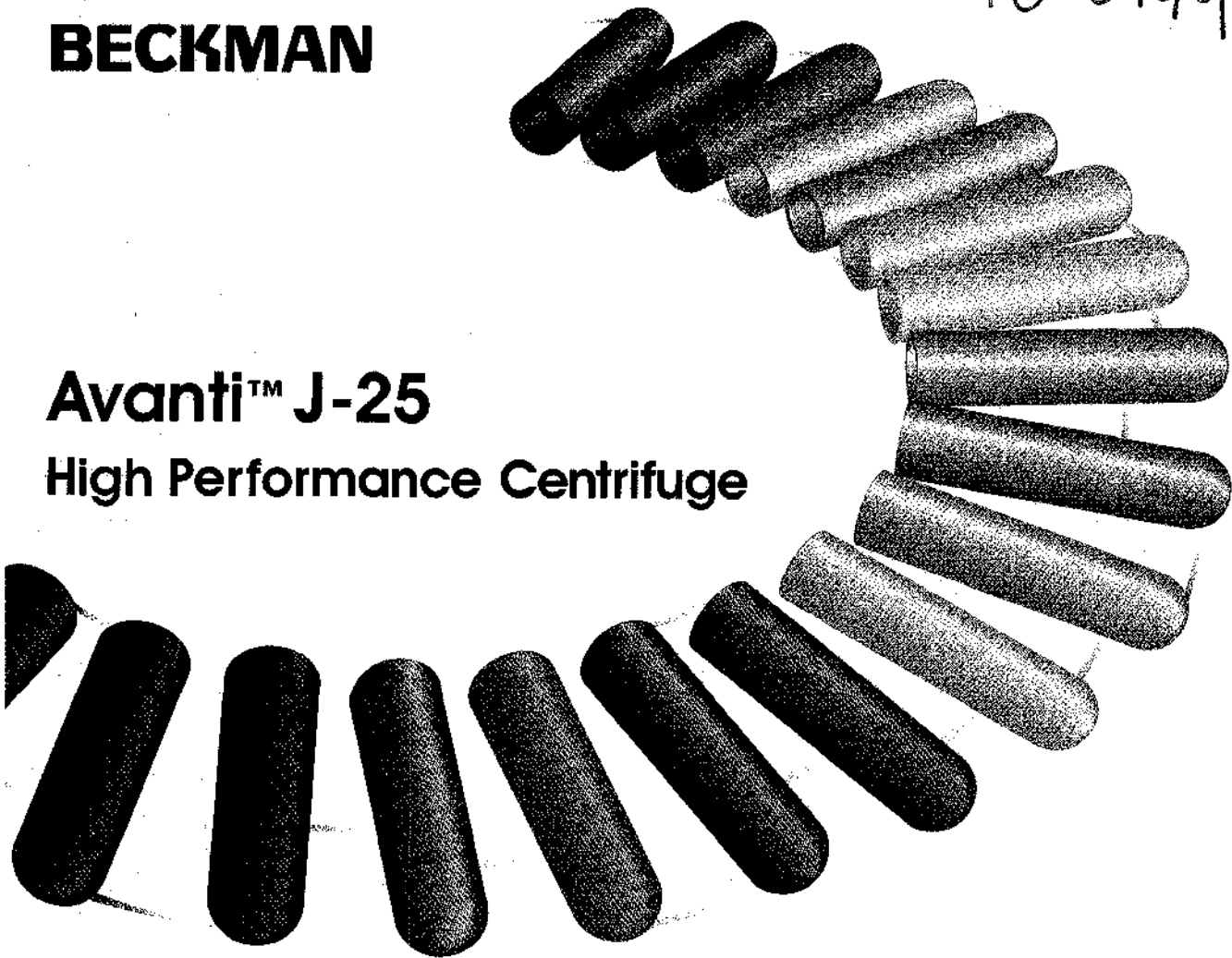


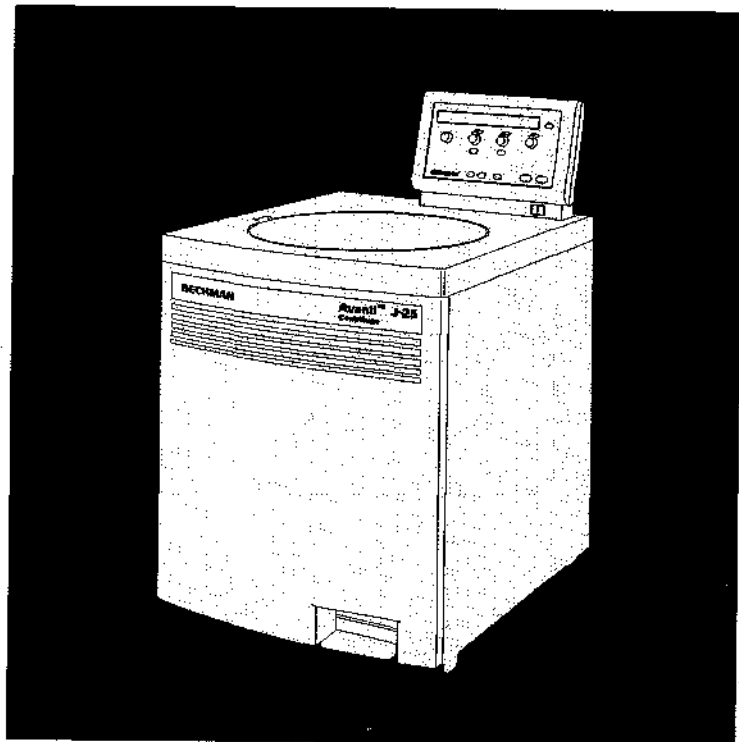
PO-0144 J325-IM-2







BECKMAN

Avanti™ J-25
High Performance Centrifuge



Instruction Manual



Symbol Symbol Symbole Símbolo Simbolo 記号	Title / Titel / Titre / Título / Titolo / 名称
	Dangerous voltage Gefährliche elektrische Spannung Courant haute tension Voltaje peligroso Pericolo: alta tensione 危険電圧
	Attention, consult accompanying documents Achtung! Begleitpapiere beachten! Attention, consulter les documents joints Atención, consulte los documentos adjuntos Attenzione: consultare le informazioni allegate 注意、添付資料を参照のこと
	On (power) Ein (Netzverbindung) Marche (mise sous tension) Encendido Acceso (sotto tensione) 入 (電源)
	Off (power) Aus (Netzverbindung) Arrêt (mise hors tension) Apagado Spento (fuori tensione) 切 (電源)
	Protective earth (ground) Schutzleiteranschluß Liaison à la terre Puesta a tierra de protección Collegamento di protezione a terra 保護アース (接地)
	Earth (ground) Erde Terre Tierra Scarica a terra アース (接地)



SAFETY NOTICE

This safety notice summarizes information basic to the safe operation of the equipment described in this manual. The international symbol displayed above is a reminder that all safety instructions should be read and understood before installation, operation, maintenance, or repair of this instrument. When you see the symbol on other pages, pay special attention to the safety information presented. Observance of safety precautions will also help to avoid actions that could damage or adversely affect the performance of the instrument.

Other symbols may also be displayed on the equipment. These are reproduced and described under CONVENTIONS in Section 1.

Safety During Installation and/or Maintenance

Be sure to use the anchoring system to secure the centrifuge in place. The anchoring system is designed to reduce the possibility of injury or damage which could result from instrument movement in the event of a major rotor mishap.

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 turned off and the instrument is disconnected from the main power source, and refer such servicing to qualified personnel.

Electrical Safety

To reduce the risk of electrical shock, this equipment uses a three or five-wire electrical cord and plug to connect this equipment to earth-ground. 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 instrument.

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

Safety Against Risk of Fire

This centrifuge is not designed for use with materials capable of developing flammable or explosive vapors. Do not centrifuge such materials (for example, chloroform or ethyl alcohol) in this instrument nor handle or store them near the centrifuge.

Mechanical Safety

For safe operation of the equipment, observe the following:

- Use only the Beckman rotors and accessories designed for use in this centrifuge.
- Before starting the centrifuge, make sure that the rotor tie-down knob is securely fastened.
- Do not exceed the maximum rated speed of the rotor in use.
- NEVER attempt to slow or stop a rotor by hand.
- Do not lift or move the centrifuge while a rotor is turning.
- If a glass tube should break inside the chamber, be careful when examining or cleaning the gasket or chamber, as sharp glass fragments may be embedded in their surfaces.
- NEVER attempt to override the door interlock system while the rotor is spinning.
- Do not lean on the centrifuge or place items on it while it is operating.

Chemical and Biological Safety

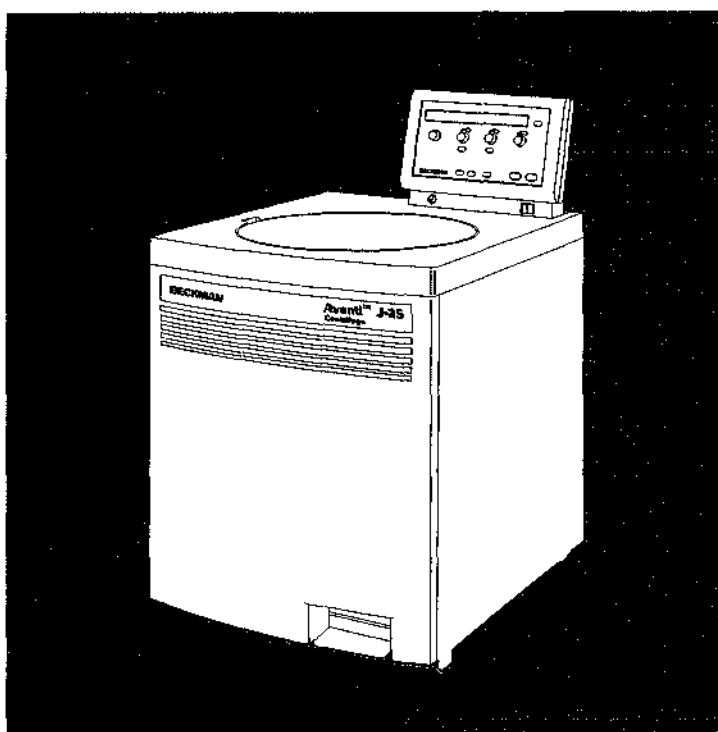
If pathogenic, toxic, or radioactive samples are intended to be used in this centrifuge, it is the responsibility of the user to ensure that all necessary safety regulations, guidelines, precautions, and practices are adhered to accordingly. Ask your laboratory safety officer to advise you about the level of containment required for your application and about proper decontamination or sterilization procedures to follow if fluids escape from their containers.

- Observe all cautionary information printed on the original solution containers prior to their use.
- Because leaks, spills, or loss of sample may generate aerosols, observe proper safety precautions.
- Instrument O-rings have not been designed as bioseals for aerosol or liquid 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.
- Handle all infectious samples 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 instrument and accessories before requesting service by a Beckman Field Service representative.

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Avanti™ J-25 High Performance Centrifuge



Instruction Manual

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Contents

	Page
INTRODUCTION	
<i>Scope of this Manual</i>	vii
<i>Conventions</i>	viii
<i>Notes, Cautions, and Warnings</i>	viii
<i>Typographic Conventions</i>	ix
<i>Radio Interference</i>	ix
<i>Canadian Regulations</i>	x
SECTION 1: SPECIFICATIONS AND PREINSTALLATION REQUIREMENTS	
Specifications	1-1
Control Features	1-1
Operational Features	1-2
Physical Data	1-2
Preinstallation Requirements	1-2
Electrical Requirements	1-3
Additional Requirements for Three-Phase Power	
Connections	1-6
Space and Location Requirements	1-6
Securing the Centrifuge to the Floor	1-8
Using J2 Series Rotors in the Avanti J	1-9
Checking for Rotor Drive Pins	1-9
Using the JA-18 Rotor	1-10
Using the JCF-Z Continuous Flow/Zonal Rotor	1-10
SECTION 2: DESCRIPTION	
Instrument Function and Safety Features	2-1
Instrument Function	2-1
Safety Features	2-2
Housing and Door	2-3
Rotor Chamber	2-3
Drive	2-4
Friction Reduction System (FRS)	2-4
Temperature Sensing and Control	2-5
Controls and Indicators	2-6
Power Switch	2-6
Control Panel	2-7
System Keys	2-10

SECTION 3: OPERATION	
Preparation and Loading	3-2
Entering Run Parameters	3-3
Selecting a Rotor	3-3
Setting Run Speed	3-4
Setting Run Time	3-6
Setting Run Temperature	3-8
Setting Acceleration and Deceleration Rates	3-9
Setting Up an Elutriation Run	3-11
Starting a Run	3-13
Changing Parameters During a Run	3-14
Stopping a Run	3-15
Unloading the Centrifuge	3-16
Summary of Avanti J-25 Run Steps	3-17
SECTION 4: TROUBLESHOOTING	
Diagnostic Messages	4-1
Accessing the Rotor in Case of Power Failure	4-4
If the JCF-Z is Misidentified as a JA-18 Rotor	4-8
SECTION 5: CARE AND MAINTENANCE	
Maintenance	5-2
Replacing the Air Filter	5-2
Cleaning	5-2
Decontamination	5-3
Sterilization and Disinfection	5-4
Circuit Breaker and Fuses	5-4
Storage and Transport	5-5
Storage	5-5
Returning a Centrifuge	5-5
Supply List	5-6
Replacement Parts and Supplies	5-6
APPENDIX: TEMPERATURE CALIBRATION PROCEDURE	

Illustrations

	Page
Figure 1-1. Avanti J-25 Single-Phase Power Connections	1-4
Figure 1-2. Avanti J-25 Three-Phase “Y” Power Connections	1-4
Figure 1-3. Correct and Incorrect Three-Phase Configurations.....	1-6
Figure 1-4. Rear View and Dimensions.....	1-7
Figure 1-5. Checking the Rotor for Drive Pins	1-9
Figure 2-1. Interior View of the Rotor Chamber.....	2-4
Figure 2-2. Temperature Control Diagram	2-5
Figure 2-3. The Power Switch	2-6
Figure 2-4. The Control Panel	2-7
Figure 3-1. Acceleration and Deceleration Settings Graph	3-10
Figure 3-2. Elutriation Controls.....	3-11
Figure 4-1. Emergency Door Release Latch Access	4-5
Figure 4-2. Manual Door Release	4-6
Figure 4-3. Front Panel Retaining Strip.....	4-7

Tables

	Page
Table 3-1 Rotor Type Abbreviations.....	3-4
Table 3-2 Acceleration Settings	3-9
Table 3-3 Deceleration Settings	3-9
Table 4-1. Diagnostic Message Chart	4-2

To obtain additional copies of this manual or referenced publications, contact Beckman Instruments, Technical Publications Department, 1050 Page Mill Road, Palo Alto, CA 94304, U.S.A., telephone (415) 859-1753; fax (415) 859-1375.

SCOPE OF THIS MANUAL

This manual is designed to familiarize you with the Beckman Avanti™ J-25 centrifuge, its functions, specifications, operation, and routine operator care and maintenance.

- Section 1 contains system specifications and instructions for preparing your site for installation of the centrifuge.
- Section 2 contains an overall description of the centrifuge, including a description of system controls and indicators.
- Section 3 summarizes procedures for operating the centrifuge.
- Section 4 lists system diagnostic messages, together with probable causes and required corrective actions.
- Section 5 contains procedures for routine maintenance, as well as a brief list of supplies and replacement parts.
- The Appendix contains a procedure to use when temperature control within $\pm 1^{\circ}\text{C}$ is required.

We recommend that you read this entire manual, especially the SAFETY NOTICE and all safety-related information, before operating the instrument or performing instrument maintenance.

 **NOTE**

If the centrifuge is used in a manner other than specified in this manual, the safety and performance of this equipment could be impaired. Further, the use of any equipment other than that recommended by Beckman has not been evaluated for safety. Use of any equipment not specifically recommended in this manual is the sole responsibility of the user.

CONVENTIONS

Certain symbols are used in this manual to call out safety related and other important information. These are reproduced and described on the inside cover and/or below.

NOTES, CAUTIONS, AND WARNINGS

 **NOTE**

Used to call attention to information that should be followed during installation, use, and/or servicing of the equipment.



CAUTION

Used to indicate a potentially hazardous situation which, if not avoided, may result in minor or moderate injury and/or mechanical damage. It is also used to alert against unsafe practices.

**WARNING**

Used whenever an action or condition may potentially cause serious personal injury or loss of life. Mechanical damage may also result.

**WARNING**

Indicates high voltage or risk of electric shock. Turn the power switch off and disconnect the equipment from the main power source. Refer servicing of all areas displaying warning symbols to service personnel.

TYPOGRAPHIC CONVENTIONS

Certain typographic conventions are used throughout this manual to distinguish names of user interface components, such as keys and displays.

- Names of control panel knobs, such as ROTOR and SPEED, appear in all capital letters.
- Names of control panel keys, such as **START** and **STOP**, appear in boxes.
- Names of display fields, such as **TEMP°C** or **SPEED**, appear in bold type.

RADIO INTERFERENCE

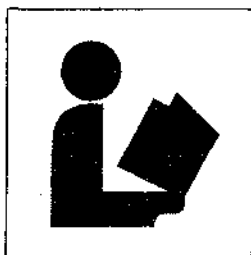
This instrument has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with

this instruction manual, may cause interference to radio communications. Operation of this equipment in a residential area may cause interference, in which case the user will be required to correct the interference at his own expense.

CANADIAN REGULATIONS

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de Classe A prescrites dans le reglement sur la brouillage radioelectrique edicte par le Ministere des Communications du Canada.



Specifications and Preinstallation Requirements

SPECIFICATIONS

Only values with tolerances or limits are guaranteed data. Values without tolerances are informative data, without guarantee.

CONTROL FEATURES

Speed

Setting range	100 to 25 000 rpm in 100-rpm increments below 10 000 rpm; in 500-rpm increments above 10 000 rpm or equivalent rcf (in 100 × g increments)
Elutriation speed setting range.....	0 to 6 000 rpm in 10-rpm or 10 × g increments
Speed display	from 0 to 10 000 rpm, indicates actual rotor speed ±10 rpm from 10 000 to 25 000 rpm, indicates actual rotor speed ± 0.1%, or equivalent rcf

Time

Setting range	to 180 min or continuous (hold)
Time display.....	indicates run time remaining (timed run) or elapsed time (hold run)

Temperature

Setting range	-20 to +40°C (in 1°C increments)
Rotor temperature	±2°C of set temperature (after equilibration)
Ambient temperature range	16 to 38°C (60 to 100°F)
Cooling fluid	Refrigerant 404A (HFC)

Acceleration	maximum or slow
Deceleration	maximum, slow, or off



OPERATIONAL FEATURES

Door	8.2-cm (3.75-in.) thick structural foam with steel plate
Rotor chamber diameter	40.6 cm (16 in.)
Friction Reduction System (FRS)	A mechanical rotary vane pump reduces chamber pressure to one-quarter atmosphere (190 mm [7.5 in.] Hg)

PHYSICAL DATA

Width	71 cm (28 in.)
Depth	86 cm (34 in.)
Depth (including air diverter extending from back panel)	102 cm (40.25 in.)
Height, door closed	86 cm (34 in.)
Height to top of control head	116 cm (45.5 in.)
Height to top of open door	141 cm (55.5 in.)
Weight	264 kg (583 lb)
Clearances (for adequate ventilation)	
Sides	7.6 cm (3 in.)
Back (place air diverter against the wall)	16 cm (6.25 in.)
Surface finish	polyester control panel with polycarbonate coating overlay; polyurethane enamel on door and covers; vinyl paint on other surfaces
Maximum heat dissipation into room under steady-state conditions	7500 Btu/h (2.0 kW/hr)
Humidity restrictions	<95% (noncondensing)
Noise level 0.91 m (3 ft) in front of instrument at 25 000 rpm	57 dBa

PREINSTALLATION REQUIREMENTS

Do not attempt to install this instrument. Its purchase price includes installation by Beckman personnel. Installation by anyone other than an authorized Beckman representative invalidates any warranty covering the instrument.

Preinstallation requirements have been sent prior to shipment of the instrument. The following information is provided in case the centrifuge must be relocated.

The Avanti™ J-25 will be installed upon initial purchase by a Beckman Field Service representative after preinstallation requirements for power and site preparation have been met. The following equipment is required for preinstallation:

- Voltmeter
- Single phase: two 30-ampere circuit protectors
- Three phase: three 16-ampere circuit protectors
- Power receptacle (see Figure 1-1 or 1-2)
- Drill for drilling holes in the floor for installation of anchoring kit bolts (see Securing the Centrifuge to the Floor, later in this section). A 9.5 mm (3/8-inch) drill is required for concrete floors. A 6.4 mm (1/4-inch) drill is required for wood floors.

ELECTRICAL REQUIREMENTS

To accommodate different supply power voltages and frequencies, three different versions of the Avanti J-25 are available:

Nominal Instrument Voltage Rating	Beckman Part Number	Beckman Part Number (Elutriation System)	Nominal Supply Frequency	Plug Included
Single-phase, 200/208/240 V	363102	363110	50/60 Hz, 24 A	yes
Single-phase, 230 V	363104	363112	50 Hz, 24 A	no
Three-phase, 220/380 V + Neutral	363105	363113	50 Hz, 12 A	no

Prior to instrument purchase, the power configuration should be determined and the appropriate instrument ordered.

Figure 1-1 shows the power connection for single-phase Avanti J-25 centrifuges; Figure 1-2 shows the power connection for three-phase Avanti J-25 centrifuges. The single-phase system includes earth ground and two power leads with 30-ampere circuit protectors. The three-phase system includes earth ground and three power leads with minimum 16-ampere circuit protectors and common neutral connection.

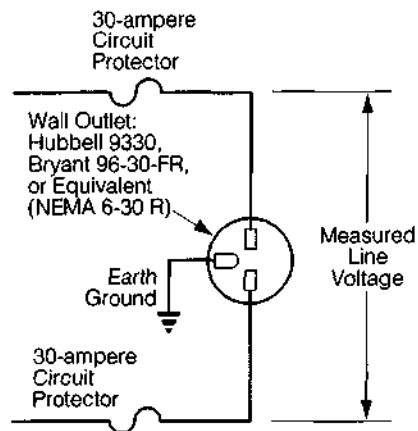


Figure 1-1. Avanti J-25 Single-Phase Power Connection

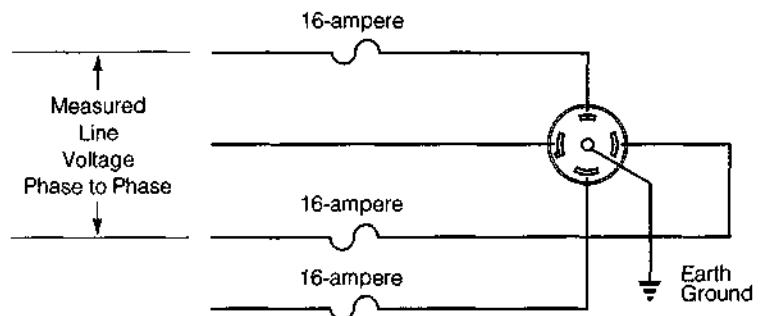


Figure 1-2. Avanti J-25 Three-Phase "Y" Power Connection



WARNING



To reduce the risk of electrical shock, this equipment uses a three-wire or five-wire electrical cord and plug to connect the centrifuge to earth-ground. To preserve this safety feature, make sure that the matching wall outlet receptacle is properly wired and earth-grounded.

The Avanti J-25 centrifuge comes with one of three available types of power cords. For single phase 200/208/240 V connections, a permanently attached three-wire UL/CSA approved cord with a NEMA type 6-30P plug is provided. For single-phase 230 V connections, a

permanently attached three-wire CENELEC harmonized cord without plug is provided. For three-phase connections, a permanently attached five-wire CENELEC harmonized cord without plug is provided. The open end of the harmonized cords should be terminated with a certified single- or three-phase connector suitable for the power supplied in the country of intended use.

The Avanti J-25 centrifuge requires a single grounded outlet, either 50/60 Hz single-phase, 185 V to 264 V, 30 A, or 50 Hz three-phase, 312 V to 456 V plus neutral, 16 A. In order for loading not to exceed 80% of the nominal service capacity, only one Avanti J-25 centrifuge should be installed per circuit.

Required Wire Connections

Wire Insulation Color	Terminal	Symbol	
		Harmonized	North American
Green/Yellow	Earth ground		
Light Blue	Neutral	N	L
Brown	Live or Line	L	L
Black (three-phase connections only)	Live or Line (qty 2)	L	L

The service should originate directly from a main power line transformer at a power source known to be clear of erratic loads, spikes, and electromagnetic interference. The circuit to the centrifuge should be additionally protected with properly rated thermal circuit breakers at the service panel.

To ensure safety, the instrument should be wired to a remote emergency switch (preferably outside the room where the centrifuge is housed, or adjacent to the exit from that room), in order to disconnect the instrument from the main power source in case of a malfunction.

ADDITIONAL REQUIREMENTS FOR THREE-PHASE POWER CONNECTIONS

There are several different three-phase configurations. For power service to the Avanti J-25, the "Y" connected three-phase configuration shown in Figure 1-3 must be used. Also note the following information:

- The steady state current draw of the centrifuge can be as high as 12 amperes per phase, depending on the voltage.
- Inrush current to the centrifuge is 100 amperes for up to 2 seconds during the refrigeration start period. Circuit breakers, whether thermal or magnetic actuating, must be a "motor start" delay type.
- The centrifuge can tolerate a drop of 15 volts during the start period at low line voltage (see Figure 1-3 for the acceptable voltage ranges). The mains power for the centrifuge must be of sufficient wire gauge to provide this condition. The wire gauge required at a particular site must be determined by a facilities engineer at that site.

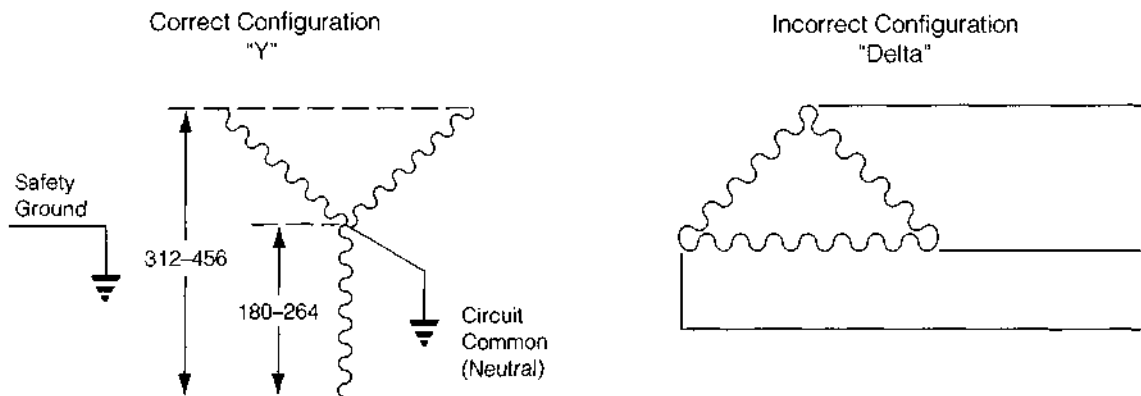


Figure 1-3. Correct and Incorrect Three-Phase Configurations

SPACE AND LOCATION REQUIREMENTS

- Locate the instrument on a clean, level floor.
- In addition to space for the instrument itself, allow a 7.7-cm (3-in.) clearance on each side of the instrument and a 16-cm (6.25-in.) clearance behind the instrument for air circulation. The side clearances include enough space for the magnetized document holder, which can be attached to either side of the centrifuge.

The air diverter, shown in Figure 1-4, should touch (or nearly touch) the wall behind the centrifuge. The power cord should be placed to one side of the air diverter (as shown). To avoid damaging the power cord when installing or moving the centrifuge, be sure to move the cord out of the way before pushing the centrifuge against the wall.

- Ambient temperature should not exceed 38°C (100°F) or premature component failure may result.
- Select a location with good ventilation, away from heat-producing laboratory equipment.

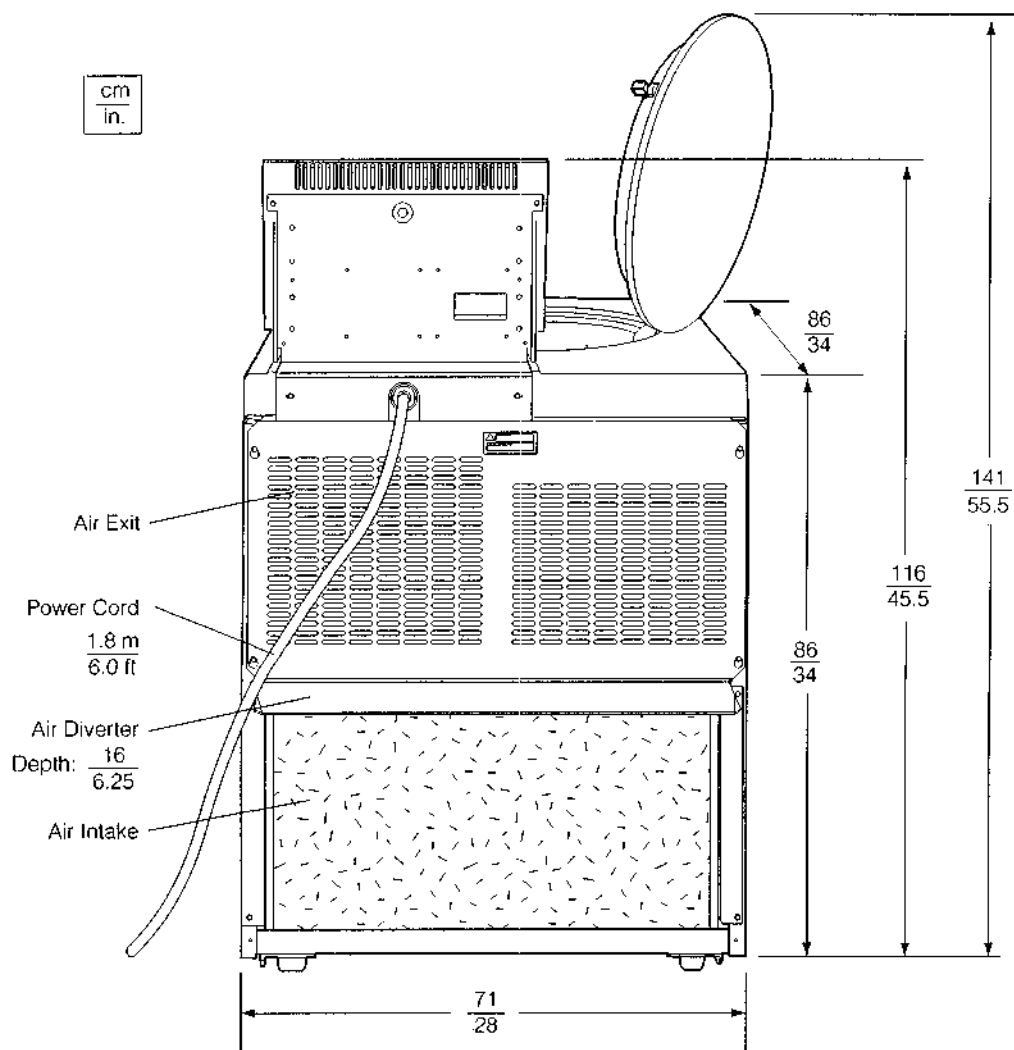


Figure 1-4. Rear View and Dimensions



WARNING

Do not place the centrifuge near areas containing flammable reagents or combustible fluids. Vapors from these materials could enter the instrument's air system and be ignited.

SECURING THE CENTRIFUGE TO THE FLOOR

Avanti J series centrifuges are certified to meet the requirements of the European CE mark. An underlying standard of this mark is the International Electrotechnical Commission (I.E.C.) Standard 1010-1, *Safety Requirements for Electrical Equipment, Control and Laboratory Use*; and subpart 1010-2-020, *Particular Requirements for Laboratory Centrifuges*.

For the Avanti J-25 centrifuge to comply with this standard, it must be secured to the floor using the anchoring hardware shipped with the instrument. This will prevent the centrifuge from moving in the unlikely event of a rotor mishap.

Complete instructions for installing the anchoring kit are packaged with the hardware, which is shipped with the centrifuge. The instructions (document number J325-TB-003) include a full-size template to be used as a guide for drilling holes in the floor. Refer to this document for additional installation instructions.

NOTE

Beckman representatives are not equipped to drill holes in your floor. The holes must be drilled *before* your scheduled installation.

USING J2 SERIES ROTORS IN THE AVANTI J



CAUTION

Do not use the Beckman JA-10 or JS-7.5 rotor in an Avanti J series centrifuge before reading this information.

CHECKING FOR ROTOR DRIVE PINS

All rotors used in Avanti J series centrifuges must have drive pins in the rotor drive hole (see Figure 1-5). These drive pins engage with the centrifuge spindle hub to ensure that the rotor does not slip during acceleration. Some Beckman rotors, including the JA-10, the JS-7.5, and the JA-14, have been manufactured without drive pins because pins were not needed when these rotors were used in J2 series centrifuges.

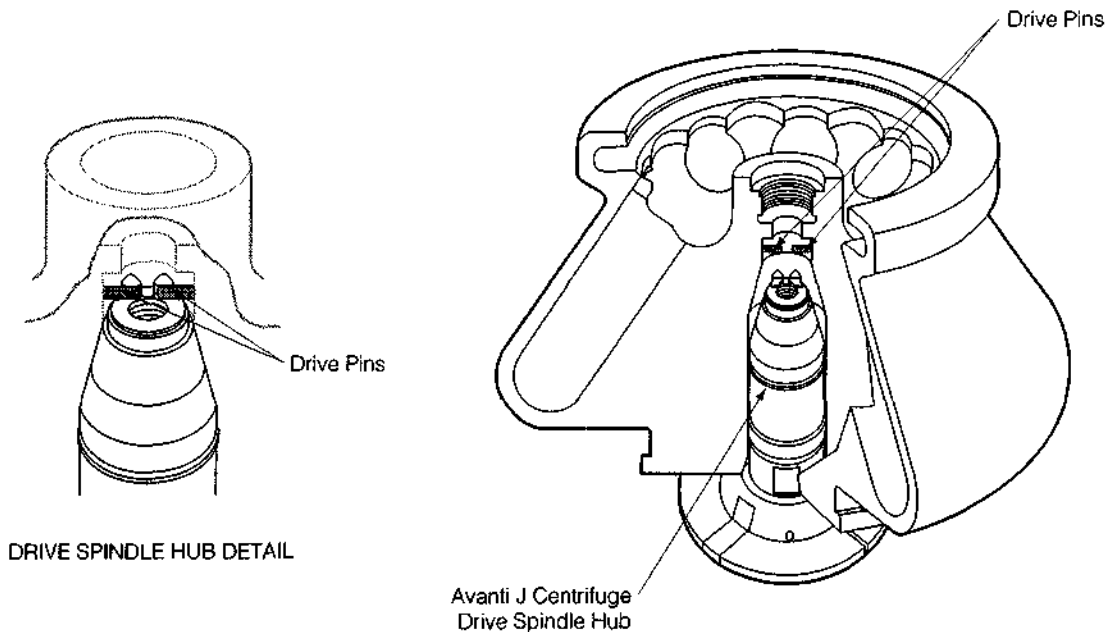


Figure 1-5. Checking the Rotor for Drive Pins

Check all J2 series rotors for drive pins before using them in an Avanti J series centrifuge and do not use rotors without drive pins in the Avanti J. To check for drive pins, hold the rotor up or turn it on its side and look into the drive hole. If you do not see two metal pins in the hole, do not use the rotor in the Avanti J. Call your local Beckman office for information on returning the rotor to the factory for upgrading.

USING THE JA-18 ROTOR

In Avanti J series centrifuges, the JA-18 rotor must be run with the lid attached. See the JA-18 rotor manual (document J-TB-035) for complete rotor usage instructions.

USING THE JCF-Z CONTINUOUS FLOW/ZONAL ROTOR

Zonal Bracket Kits

A special bracket and mounting hardware are required when the JCF-Z Continuous Flow/Zonal Rotor is used in the Avanti J. These parts are contained in the Zonal Bracket Kit (part number 363843). Kit part number 363843 includes a bracket, mounting hardware, and assembly instructions. Kit 363843 is for use with Cole-Parmer tubing size 16 (6.4 mm [$1/4$ -in.] O.D.), the tubing size most commonly used in the JCF-Z rotor.

Two additional kits are available, one which contains adapters for size 14 tubing (4.8 mm [$3/16$ -in.] O.D.) and one which contains adapters for size 15 tubing (9.6 mm [$3/8$ -in.] O.D.). If you wish to use either of these sizes of tubing, you will need to purchase one of these kits in addition to the basic kit (363843).

See Replacement Parts and Supplies in Section 5 for a complete list of Zonal Bracket Kit part numbers and kit contents.

Ensuring Correct JCF-Z Rotor Identification

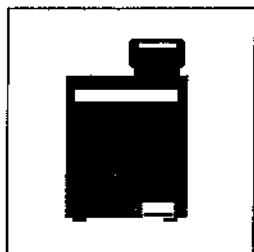
The Avanti J-25 centrifuge's dynamic rotor identification system can, under two specific conditions, misidentify the JCF-Z continuous flow/zonal rotor as a JA-18 fixed angle rotor. These conditions and corrective actions are listed below.

NOTE

.....
If the JCF-Z rotor is misidentified as a JA-18 rotor, the run speed will be limited to 18 000 rpm, the maximum speed for the JA-18 rotor. (The maximum speed for the JCF-Z rotor is 21 000 rpm.)
.....

- When the bearings in the JCF-Z rotating seal assembly get old or worn, the resulting “drag” on the bearings changes the rotor’s dynamic properties, making them similar to those of the JA-18 rotor. If rotor misidentification occurs when your JCF-Z rotor is used, first perform three runs from 0 to 5000 rpm and back to 0 rpm. If rotor misidentification recurs, replace the bearings. See the JCF-Z rotor instruction manual (document JCFZ-IM) for bearing replacement instructions. Be sure to follow instructions in the next paragraph for “wearing in” the bearings.
- On the first few uses of a new JCF-Z rotor, or when the bearings have been replaced in an older JCF-Z rotor, lubrication has not yet been thoroughly distributed around the bearings in the bearing housing. The excess lubrication produces drag on the bearings, which can change the rotor’s dynamic properties enough to cause rotor misidentification. To “wear in” the bearings and distribute the lubrication, perform three runs from 0 to 5000 rpm and back to 0 rpm.

Description

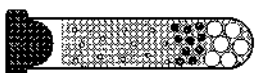
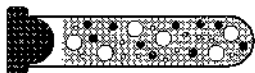


This section provides a brief physical and functional description of the Beckman Avanti J-25 centrifuge. The operating controls and indicators are also described; instructions for their use are in Section 3. Chemical resistances of materials listed in this manual can be found in Beckman publication IN-175.

Refer to the appropriate rotor instruction bulletins for rotor descriptions.

INSTRUMENT FUNCTION AND SAFETY FEATURES

INSTRUMENT FUNCTION



The Beckman Avanti J-25 is a refrigerated floor-model, high-performance centrifuge that generates centrifugal forces required for a wide variety of applications. Together with one of the many Beckman J series high-speed rotors, the instrument applications include:

- Routine processing such as sample preparations, pelleting, extractions, purifications, concentrations, phase separations, and spin column and spin filter centrifugations.
- Rapid sedimentation of protein precipitates, large particles, and cell debris.
- Preparation of subcellular organelles such as mitochondria, nuclei, and crude microsomes.
- Separation of blood cells and cellular components.
- Nucleic acid precipitation.

- Virus isolation.
- Bacteriophage isolation.
- Gradient separation, for example, Ficoll-Hypaque¹ and Percoll.¹

The Avanti J-25 centrifuge is microprocessor-controlled, providing interactive operation. The instrument design features a brushless switched-reluctance drive motor,² automatic rotor identification system, FRS (friction reduction system) vacuum control circuitry, and a temperature control system with automatic temperature compensation unique for each compatible rotor.

The user interface consists of a digital display which can be toggled to show either actual centrifuge values or user-entered setup values, knobs for parameter entry, and other system control keys. Diagnostic messages on the control panel will light to alert the user if any problems occur during operation.

SAFETY FEATURES

- The door mechanism locks when a run is started to prevent operator contact with spinning rotors. It can be unlocked and opened by stepping on the foot pedal *only* when the power is on and the rotor is at rest.
- A steel casing surrounds the rotor chamber to provide operator protection.
- An automatic rotor identification system detects which Beckman rotor is installed in the centrifuge during acceleration and prevents the rotor from running above its maximum rated speed.

The system memory contains a list of all Beckman rotors that can be run in the centrifuge, along with unique physical properties and the maximum speed of each rotor. Shortly after a run starts, the system measures the physical properties of the installed rotor and looks for a match with one of the rotors on its rotor list. If the system identifies a rotor different than the one entered by the user and the set speed is above the maximum for the identified rotor, the system will reduce the set speed to the maximum permitted for that rotor. Because this rotor identification method occurs while the rotor is spinning, it is referred to as "dynamic" rotor identification.

¹ Registered trademarks of Pharmacia AB.

² Manufactured under license from Switched Reluctance Drives Limited, Leeds, U.K.

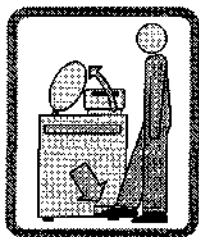
 **NOTE**

Excessive ice buildup in the chamber can affect the function of the dynamic rotor identification system. Removing ice and moisture from the chamber between runs will prevent this from happening.

- An imbalance detector monitors the system during operation, causing automatic shutdown if rotor loads are severely out of balance.

HOUSING AND DOOR

The instrument control housing is made of aluminum and molded structural foam. The door and structural-foam cover panels are finished with polyurethane enamel. The control panel is covered by a protective overlay made of coated polycarbonate.



The door is opened by stepping on a foot pedal, which is located at the bottom right front of the instrument. This pedal unlocks the two door latches, and a coil spring mechanism raises the door smoothly to the open position. The door is hinged at the back left to open at a 60-degree angle to the centrifuge side panels, providing good clearance during loading and unloading of the centrifuge.

Electronic controls prevent a run from starting unless the door is shut and locked, thus preventing operator contact with spinning rotors. The door locks when **(START)** is pressed, or when the **POWER** switch is turned off. If the rotor is not spinning, the door will unlock. In the event of a power failure, the door lock can be manually unlocked for sample recovery (see Section 4, TROUBLESHOOTING).

ROTOR CHAMBER

The 40.6-cm (16-in.) diameter, stainless steel rotor chamber is shown in Figure 2-1. The rotor drive shaft and thermistor are visible in the chamber bottom. A silicone rubber gasket around the chamber opening ensures sealing. (Instrument gaskets have *not* been qualified as bioseals for aerosol containment.)

Description

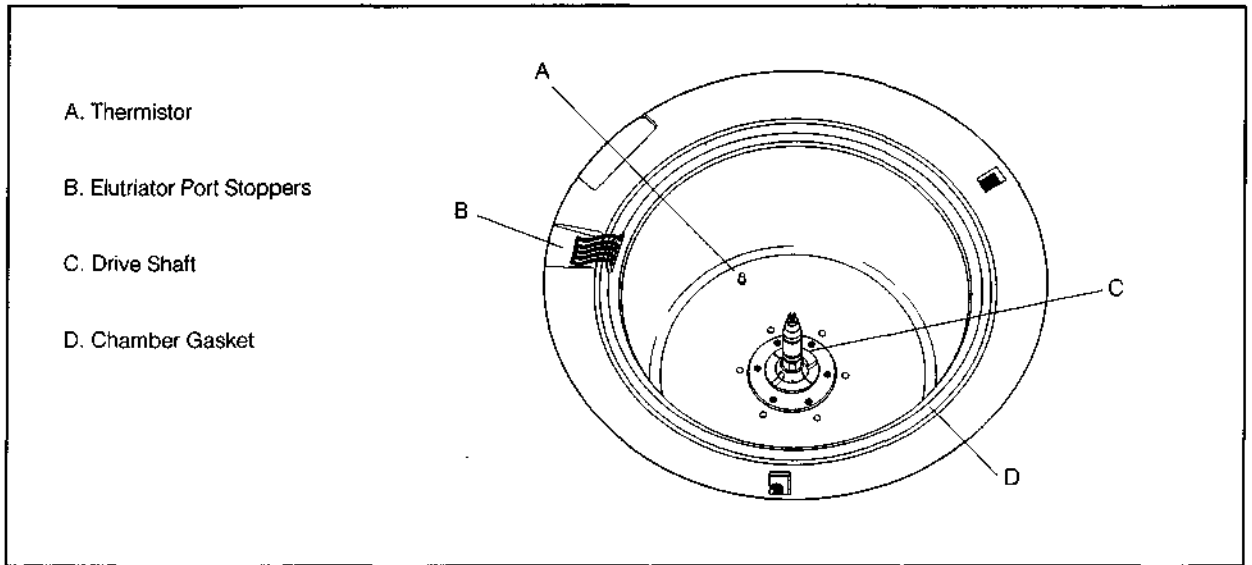


Figure 2-1. Interior View of the Rotor Chamber

DRIVE

The drive shaft is directly driven by a brushless, high-torque, switched-reluctance motor. The instrument's resilient suspension minimizes disturbance of the sample during acceleration and deceleration, and reduces damage to the drive shaft if an imbalance occurs during centrifugation.

FRICION REDUCTION SYSTEM (FRS)

The Avanti J-25 uses a friction reduction system (FRS) in which a mechanical rotary vane vacuum pump reduces chamber pressure to approximately one quarter atmosphere (190 mm Hg). The pump turns on after the run is started, before rotor friction reaches a high level. When the required vacuum level is reached, the pump turns off. Vacuum in the chamber is vented during rotor deceleration.

TEMPERATURE SENSING AND CONTROL

Run temperature can be set between -20 and $+40^{\circ}\text{C}$, in 1°C increments. If no set temperature is entered, the centrifuge automatically selects the last entered temperature.

The refrigeration condenser is mounted in the lower rear of the centrifuge, and the evaporator surrounds the rotor chamber. A thermistor inside the bottom of the rotor chamber senses the temperature of the air in the chamber and causes the compressor to cycle on and off when necessary.

The system further adjusts the chamber temperature based on the unique physical properties of the installed rotor, to ensure that the rotor stays within $\pm 2^{\circ}\text{C}$ of the set temperature (after equilibration). For fastest equilibration, the rotor may be precooled or prewarmed outside the centrifuge and then run in the centrifuge until the system reaches the necessary run temperature (before the run is started). The time required for a rotor to reach equilibration depends on the rotor mass and its pre-run temperature.

Although the chamber temperature will fluctuate during a run (indicated in the **TEMP** $^{\circ}\text{C}$ display), the rotor's large mass keeps the sample temperature substantially constant throughout the run (see Figure 2-2).

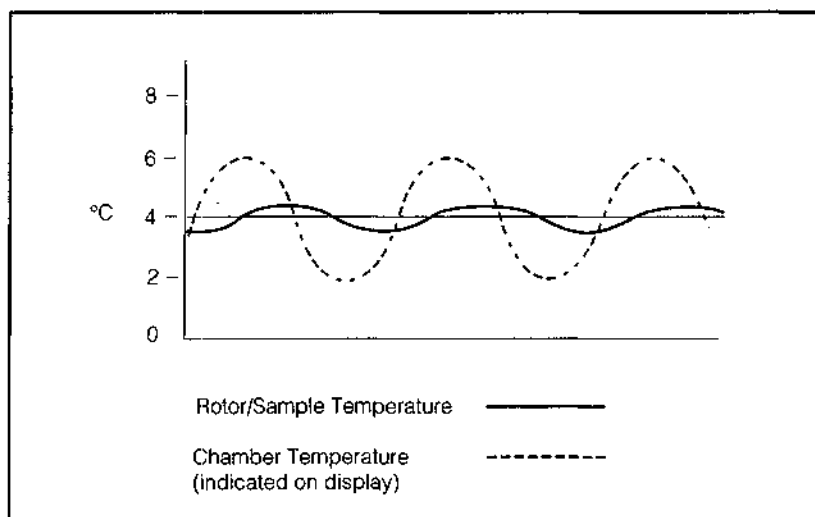


Figure 2-2. Temperature Control Diagram

The set temperature is also maintained after the run ends, to prevent freezing or warming of the sample. The chamber temperature will drop several degrees at the end of a run, when frictional heating of the air caused by the spinning rotor stops. Again, the rotor mass keeps the sample temperature within $\pm 2^{\circ}\text{C}$ of set temperature, even though the air temperature in the chamber fluctuates. When a run is complete, until the door is opened the compressor will continue to cycle on and off as necessary to maintain the sample within $\pm 2^{\circ}\text{C}$ of set temperature, at 4°C . At set temperatures other than 4°C , greater fluctuation may occur.

NOTE

In the unlikely event of a complete cooling system failure, the drive will switch off if the chamber temperature reaches 45°C . Restarting the centrifuge will not be possible until the chamber is cooled.

CONTROLS AND INDICATORS

POWER SWITCH

The power switch is located below the control panel (see Figure 2-3). This two-position rocker switch (I, on; O, off) controls electrical power to the centrifuge.

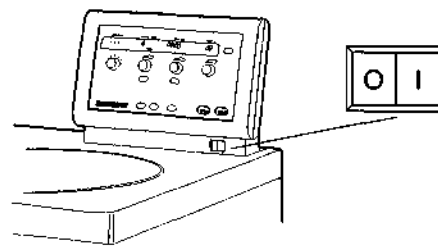


Figure 2-3. The Power Switch

CONTROL PANEL

The control panel (Figure 2-4) is mounted at an angle on the centrifuge top rear for easy visibility and access. It contains a digital display for actual and setup values, knobs and touch keys for parameter entry, and additional touch keys for system control.

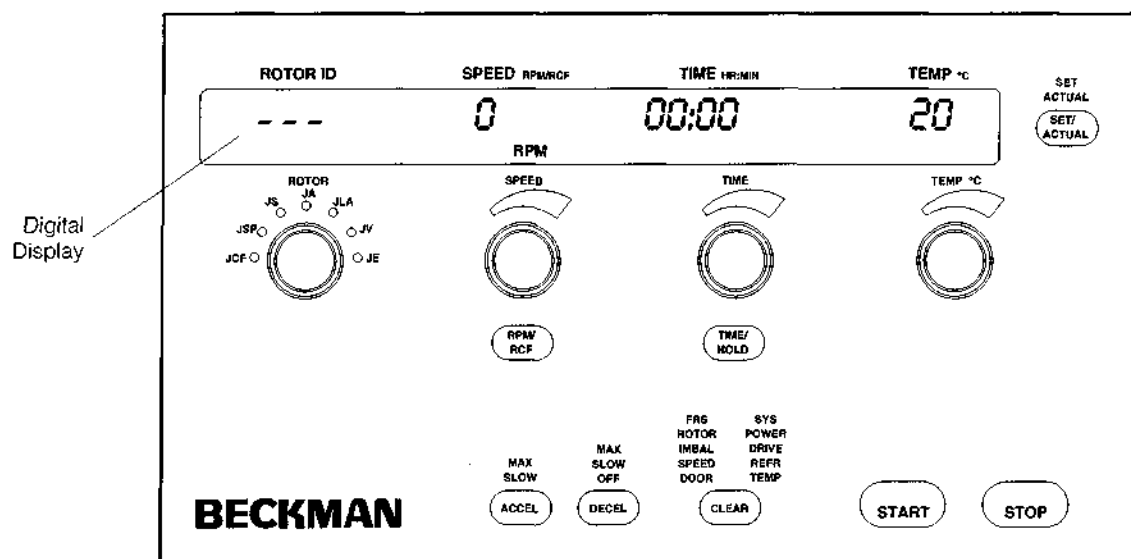


Figure 2-4. The Control Panel

Digital Display

The display shows current status of the instrument whenever the power is turned on.

- The display shows both actual centrifuge values and user-set parameters. The **SET/ACTUAL** key is used to toggle between the two views.
- During a run, actual values are displayed. If you turn a knob (other than the TIME knob) during operation, the display will change to show the set values. If no parameters are entered or changed for 5 seconds, the display will revert to showing actual values.
- During a timed run, the **TIME** display shows the *remaining run time in hours and minutes*. The **TIME** display begins counting down when **START** is pressed and continues counting down to 0, when deceleration begins. When the rotor decelerates to 0 rpm, "End" flashes in the **TIME** display.

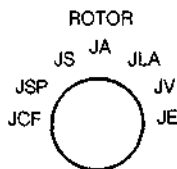
- When HOLD is selected (no run time is specified), the **TIME** display shows the *time elapsed since* **(START)** was pressed. After 3 hours (180 minutes) have elapsed, the timer will reset to 0 and continue counting elapsed time until **(STOP)** is pressed.

Knobs and Touch Keys

The rotor name, speed, time, and temperature settings are entered by turning the appropriate knob until the desired value is displayed. A graphic above each parameter knob indicates that the value increases as the knob is turned to the right (clockwise), and decreases as the knob is turned to the left (counterclockwise).

Touch keys allow the user to start and stop the centrifuge, and to select speed mode (RPM or RCF), time mode (specific run length or hold for continuous operation), and acceleration and deceleration rates, and to toggle the display between set and actual values.

ROTOR



The ROTOR knob is used to select the rotor name. As you turn the knob, the name of each Beckman rotor that can be run in the centrifuge appears in succession in the **ROTOR ID** display, and the LED by each rotor type abbreviation lights when appropriate. Rotor type abbreviations are defined in Table 3-1 (in Section 3).

Selecting a rotor name allows proper speed setting in RCF mode and proper temperature control. If you do not select a rotor name, parameter settings may change when the dynamic rotor identification system has determined which rotor is actually installed.

SPEED



Pressing the **(RPM/RCF)** key selects the speed mode (RPM or RCF). The speed range is from 100 rpm to the maximum speed of the rotor in use (up to 25 000 rpm).

- In RPM mode, each SPEED knob increment is 100 rpm at speeds up to 10 000 rpm. Above 10 000 rpm, each knob increment is 500 rpm.
- In RCF mode, at g -forces less than or equal to $3000 \times g$, each SPEED knob increment is equivalent to incrementing/decrementing the speed by $100 \times g$. At g -forces greater than $3000 \times g$, each SPEED knob increment is equivalent to incrementing/decrementing the speed by $250 \times g$.
- Speed increments for elutriator rotors are either 10 rpm or $10 \times g$.

TIME



Two time modes are available. The HR:MIN mode is used for runs of specified lengths. The HOLD mode is used for continuous runs of unspecified lengths. The **(HOLD)** key is used to toggle between the two modes.

In HR:MIN mode:

- The TIME knob is used to set run time, which can be set up to 3 hours and 0 minutes (180 minutes).
- Each TIME knob increment is 1 minute. A full turn of the knob equals 60 minutes.
- The time setting can be changed during a run.
- During a run, the time remaining in the run is displayed. When 0 is reached, the run ends and the rotor decelerates to a stop.

In HOLD mode:

- When HOLD mode is selected, the time display shows the word *HOLD*.
- During a run, the time elapsed is displayed. When the display reaches 3 hours and 0 minutes, the system automatically resets the display to 0 and begins counting the elapsed time again. The run will continue until **(STOP)** is pressed.
- If you switch from HOLD mode to HR:MIN mode during a run, the system remembers the previous time setting. Turning the TIME knob increments or decrements the set time from that point.

TEMPERATURE



The TEMP °C knob is used to select the desired rotor temperature, from -20 to +40 °C.

- The minimum and maximum allowable set temperatures depend on the set speed and the installed rotor. If a temperature is entered that cannot be achieved by the installed rotor at the set speed, the **TEMP°C** field will flash.
- If the instrument identifies a rotor different from the one entered by the user, or if the set speed is changed, the new values may cause the set temperature to be unachievable. (The **TEMP°C** field will flash.)

Description

ACCELERATION
ACCEL

The **ACCEL** key is used to select either maximum or slow acceleration. An indicator light above the **ACCEL** key will show the selection. Acceleration rates are described in Table 3-3 (in Section 3).

DECELERATION
DECEL

The **DECEL** key is used to select maximum or slow deceleration, or off (no brake). An indicator light above the **DECEL** key will show the selection. Deceleration rates are described in Table 3-4 (in Section 3).

SYSTEM KEYS

START

The **START** key is used to start a run. When **START** is pressed, the display will immediately show the actual centrifuge values. The green **START** light flashes during acceleration until set speed is reached, and then remains on continuously until deceleration begins.

STOP

The **STOP** key is used to stop a run; the red **STOP** light blinks during deceleration. The centrifuge decelerates to a complete stop according to the deceleration setting. Deceleration can be terminated and the centrifuge restarted by pressing **START**.

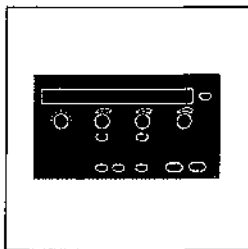
CLEAR

The **CLEAR** key is used to stop the flashing of a diagnostic indicator light. See Section 4, TROUBLESHOOTING, for information on diagnostic messages.

**SET/
ACTUAL**

The **SET/ACTUAL** key toggles the display view between set and actual values. The indicator for the selected view will be lit.

Operation



This section contains detailed centrifuge operating procedures. A summary is provided at the end of this section. If you are an experienced user of this centrifuge, you can turn to the summary for a quick review of operating steps.

Refer to the appropriate rotor bulletin for instructions on preparing the rotor for centrifugation.

**WARNING**

Normal operation may involve the use of solutions and test samples that are pathogenic, toxic, or radioactive. Operator error or tube failure may generate aerosols. Do not run potentially hazardous materials in this centrifuge unless all appropriate safety precautions are taken.

**WARNING**

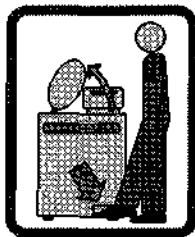
The centrifuge must not be used near flammable liquids or vapors, and such materials should not be run in the centrifuge. Do not lean on the centrifuge or place items on it while it is operating.

PREPARATION AND LOADING

For fast temperature equilibration, cool or warm the rotor to the desired operating temperature before the run.

Action	Result
---------------	---------------

- | | |
|---|---|
| 1. Turn the power switch on (I). | Power is applied to the system, and the display is illuminated. |
| 2. Step on the foot pedal to open the door. | The door will open. |



3. Install the rotor according to the instructions in the appropriate rotor bulletin. Always run the rotor with a balanced load. (If you are using a swinging bucket rotor, fill all positions on the yoke with buckets.)



CAUTION

Do not drop the rotor onto the drive hub. The shaft can be bent if the rotor is forced sideways or dropped onto the hub. Install the rotor by centering it over the hub and carefully lowering it straight down.

4. Securely attach the rotor lid knob, or tie-down knob in rotors without lids, to the drive shaft by turning it to the right (clockwise).



NOTE

If the knob turns loosely and you do not feel threads engaging, the rotor drive hole pins may not be properly seated on the centrifuge hub. Lift the rotor up above the hub, rotate it slightly, and lower it onto the hub again. Tighten the knob.



Action

Result



CAUTION

If the rotor is left in the centrifuge between runs, make sure the rotor is seated on the drive hub and the tie-down knob is tight before each run. (Remove the rotor from the centrifuge if you anticipate a long period between runs.)

5. Close the centrifuge door firmly.

ENTERING RUN PARAMETERS

SELECTING A ROTOR

All Beckman J2 series rotors currently manufactured can be used in the Avanti J-25 centrifuge.¹ Use the ROTOR knob to select the specific rotor needed for the run.

NOTE

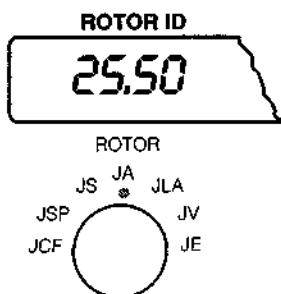
Before using a J2 series rotor, check to make sure that it has drive pins. (see "Using J2 Series Rotors in the Avanti J" in Section 1 of this manual.)

Action

Result

1. Turn the ROTOR knob until the required rotor number appears in the display.

Small green LEDs by each rotor type abbreviation (see Table 3-1) will light one at a time as the rotors of that type appear in the display. For example, when the JA indicator is lit, the names of all available Beckman fixed angle rotors will appear one after the other in the display. In the illustration below, the JA-25.50 rotor is selected.



NOTE

The JA-18 fixed angle rotor must be run with the lid attached.

¹ The JCF-Z Continuous Flow/Zonal Rotor can be used in the continuous flow configuration only. Zonal runs cannot be performed in the Avanti J-25.

Action

Result

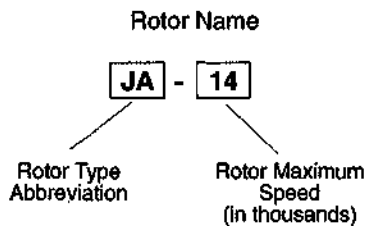
Table 3-1. Rotor Type Abbreviations

Type Abbreviation	Description
JCF	continuous flow rotors
JSP	special type rotors (for future use)
JS	swinging bucket rotors
JA	fixed angle rotors
JLA	lightweight fixed angle rotors
JV	vertical tube rotors
JE	elutriator rotors

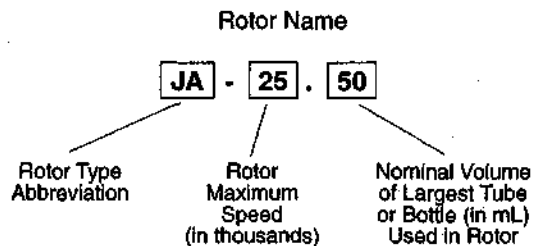
What Do Beckman J Series Rotor Names Mean?

New Beckman J series rotors have a different naming style than older J series rotors.

*Naming of J Series Rotors
Manufactured Before 1994*






*Naming of J Series Rotors
Manufactured After January, 1994*



SETTING RUN SPEED

The speed can be set up to the maximum rated speed of the selected rotor (25 000 rpm maximum). The speed can be set in either revolutions per minute (rpm) or relative centrifugal field (rcf).

Setting RPM

Action	Result
<p>1. Check to see if the red RPM light is lit on the display. If it is lit, go to step 3.</p>	<p>RPM is the default speed mode. If the centrifuge is already in the RPM mode, skip step 2 and go on to step 3.</p>
<p>2. Press the RPM/RCF key to select the RPM mode.</p>	<p>On the display, the red RPM LED lights.</p>
	
<p>3. Turn the SPEED knob until the required rpm appears in the SPEED display (from 100 to the maximum rated speed of the rotor).</p>	<p>NOTE</p> <p>If the speed is set under 10 000 rpm, each SPEED knob increment increases or decreases the speed by 100 rpm. Above 10 000 rpm, each knob increment increases or decreases the speed by 500 rpm.</p> <p>If an elutriation rotor is selected, the SPEED knob increments are 10 rpm.</p> <p>The corresponding rcf will automatically be calculated. Pressing RPM/RCF will toggle the display to show the rcf value.</p>
	

Setting RCF

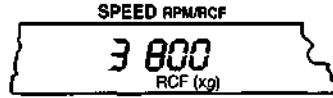
Action	Result
<p>1. Check to see if the red RCF light is lit on the display. If it is lit, go to step 3.</p>	<p>If the centrifuge is already in RCF mode, skip step 2 and go on to step 3.</p>

Action

Result

2. Press the **RPM/RCF** key to select the RCF mode.

On the display, the red RCF ($\times g$) LED lights.



3. Turn the SPEED knob until the required rcf value appears in the SPEED display.

NOTE

If the g -force is $3\,000 \times g$ or less, each SPEED knob increment is $100 \times g$. If the setting is above $3\,000 \times g$, each knob increment is $250 \times g$.

If an elutriation rotor is selected, the SPEED knob increments are $10 \times g$.

The corresponding rpm will automatically be calculated, and pressing **RPM/RCF** will toggle the display to show the rpm value).



SETTING RUN TIME

Use the **TIME/HOLD** key to select one of two time modes: HR:MIN (for setting a specific run length), or HOLD (for continuous operation).

Setting a Timed Run

Action

Result

1. If the system is in HOLD mode, press the **TIME/HOLD** key to select the HR:MIN mode.

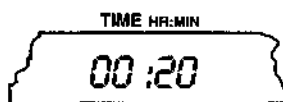
HR:MIN mode is the default mode, so unless **TIME/HOLD** was previously pressed, the HR:MIN mode is already selected.



Action

Result

- Turn the TIME knob until the required run length (from 1 minute to 180 minutes [3 hours]) appears in the TIME display.



If you enter more than 59 minutes in the minutes field, the system automatically converts the entry to hours and minutes after **(ENTER)** is pressed.

For example, an entry of **00:90** is displayed as **01:30**.



- When all run parameters are entered, press **(START)**.

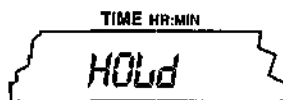
The rotor will begin to accelerate and the display will begin showing the remaining run time. The run will end when the time counts down to zero or when **(STOP)** is pressed.

Setting a Continuous (HOLD) Run

Action

Result

- Press the **(TIME/HOLD)** key to select the HOLD mode.



"HOLD" appears in the display.

- When all run parameters are entered, press **(START)**.

The rotor will begin to accelerate and the display will begin showing the elapsed time.

The time will count up to 3 hours, 0 minutes, and then will reset to 0 and continue counting.

- Press **(STOP)** to end the run.

The rotor will decelerate to a stop.

SETTING RUN TEMPERATURE

Run temperature can be set between -20 and $+40^{\circ}\text{C}$ in 1°C increments.

NOTE

For runs at other than room temperature, refrigerate or warm the rotor beforehand for fast equilibration. For low-temperature runs, precool the system by running a precooled rotor for 30 minutes at the required temperature. Set the speed to 2000 rpm.

Action

1. Turn the TEMP $^{\circ}\text{C}$ knob until the display shows the required temperature.



Result

After you release the knob, the display shows the temperature you entered. After 5 seconds, it reverts to showing the actual current chamber temperature, as measured by the thermistor in the bottom of the chamber.



When the run begins, the display shows the rotor temperature $\pm 2^{\circ}\text{C}$ (after a period of temperature equilibration).

NOTE

The system controls the chamber temperature to within $\pm 2^{\circ}\text{C}$ of the set temperature. To control temperature within $\pm 1^{\circ}\text{C}$ of set, perform the temperature calibration procedure provided in the Appendix.

SETTING ACCELERATION AND DECELERATION RATES

Tables 3-2 and 3-3 describe the function of the acceleration and deceleration settings. Figure 3-1 provides a graphic representation of these settings.

Table 3-2. Acceleration Settings

Maximum Acceleration	Slow Acceleration
Full torque is used from 0 rpm until set speed is reached.	A timed cubic curve, lasting approximately 2 minutes (can be longer or shorter depending on the rotor), is used from 0 to 500 rpm. Above 500 rpm, full torque is used until set speed is reached.
Application: hard pelleting	Application: delicate gradients

Table 3-3. Deceleration Settings

Maximum Deceleration	Slow Deceleration	Off
Full brake is used from set speed to near 0 rpm, to bring the rotor to a stop in the shortest possible time. Reduced brake is used during the last few rpm until 0 is reached, to minimize disturbance of the sample.	Reduced torque is used from set speed to 500 rpm, causing deceleration to 500 rpm to take twice as long as maximum deceleration. (The exact rate depends on the mass of the installed rotor. Larger rotors will take longer.) Deceleration time from 500 to 0 rpm is approximately 2 minutes (larger rotors take longer).	No brake is used. Rotor coasts to 0 rpm. This process can take up to 1 hour, depending on the rotor in use and the speed at the start of deceleration.
Application: hard pelleting	Application: delicate gradients, soft pelleting	Application: extremely delicate gradients

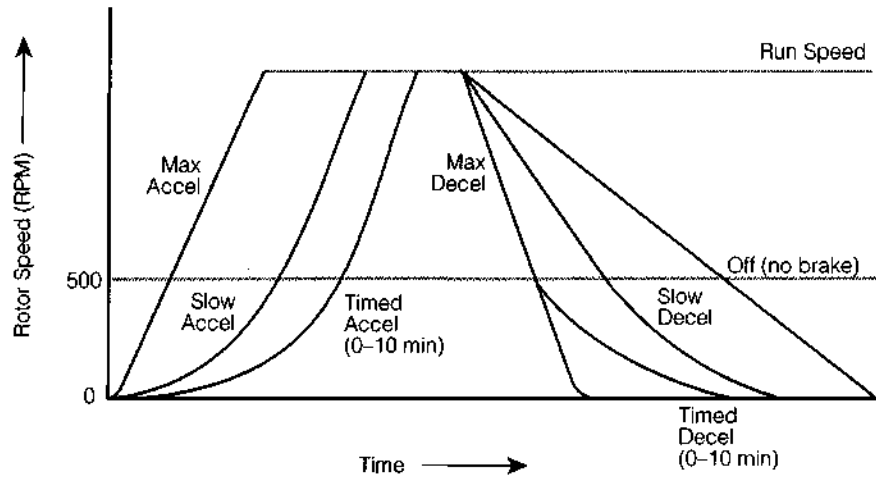


Figure 3-1. Acceleration and Deceleration Settings Graph

Setting the Acceleration Rate

NOTE

The default setting for both acceleration and deceleration is maximum (MAX). If the MAX indicator lights are already lit, no input is required. To choose a different setting, follow the steps below.

Action

1. Press the **ACCEL** key to toggle between the MAX and SLOW acceleration settings.

Result

The selected setting will light.



Setting the Deceleration Rate

<i>Action</i>	<i>Result</i>
1. Press the DECEL key repeatedly until the required deceleration setting, MAX, SLOW, or OFF, is highlighted.	The selected setting will light.



SETTING UP AN ELUTRIATION RUN

If your Avanti J-25 centrifuge is equipped for elutriation, it will have elutriation controls to the left of the power switch (see Figure 3-2). It will also have a view port in the door, and an elutriation power box mounted to the back of the control panel. See the appropriate elutriator rotor manual for complete rotor setup and operating instructions.

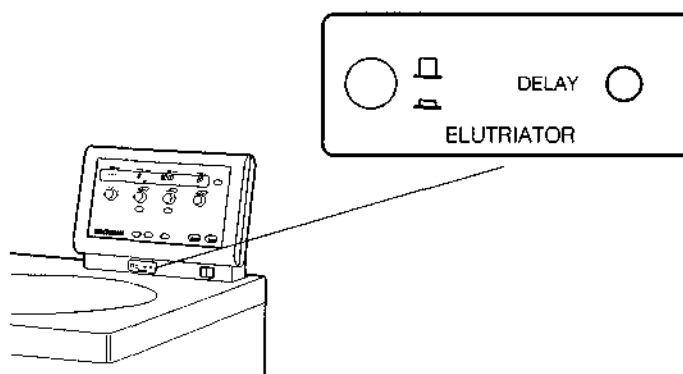


Figure 3-2. Elutriation Controls

Action

Result

1. Install the rotor.

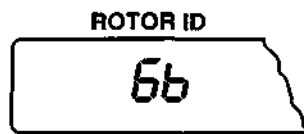
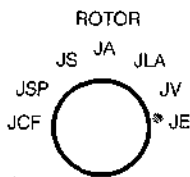


2. Set up sample and buffer reservoirs and tubing lines as described in the rotor manual. Route the tubing lines through the elutriator port holes at the left side of the door seal.

Close the centrifuge door.

3. Turn the ROTOR knob to the JE position.

6b appears in the ROTOR ID display.



4. Enter the remaining run parameters. Refer to the appropriate rotor manual for rotor setup and operating instructions.

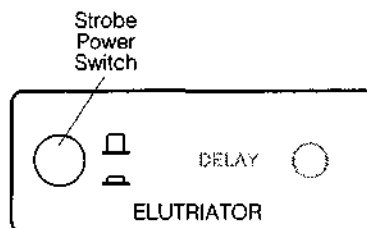
The run is ready to begin.

5. Press **(START)**.

The rotor accelerates to set speed.

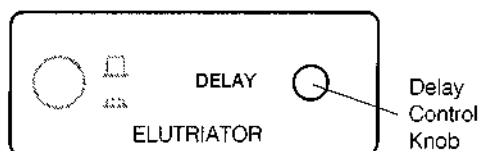
6. When the rotor reaches set speed, turn on the strobe controls by pressing the strobe power switch.

The power switch indicator will light.



Action

- When the rotor speed has stabilized, look through the port in the centrifuge door and turn the DELAY knob until the elutriation chamber in the rotor is synchronized with the strobe. (The chamber will appear to be motionless.)

Result

Sample can now be injected into the lines. See the rotor instruction manual for detailed instructions.

NOTE

At the end of the run, after disassembling the liquid and power lines, be sure to replace the black rubber stoppers in the ports at the left side of the centrifuge door. Failure to seal these openings will prevent proper operation of the FRS system, which will cause a diagnostic shut down during the next run.

STARTING A RUN**Action**

- Check that all parameters are correct and the door is firmly closed.
- Press **(START)**.

Result

The display will start showing actual centrifuge values within 5 seconds. The LED on the **(START)** key will flash during acceleration. When set speed is reached, the light stays on continuously until the centrifuge begins decelerating.

As the run begins, the dynamic rotor identification system identifies the installed rotor. The system verifies that the user-selected rotor and the installed rotor are the same.

If the system detects that the installed rotor is not the rotor that the user selected with the ROTOR knob, and the speed selected by the user is *greater* than the installed rotor's maximum permitted speed, the system will reduce the run speed to the maximum allowed for the installed rotor.



WARNING

Do not attempt to override the door interlock system while the rotor is spinning.

CHANGING PARAMETERS DURING A RUN

While a run is in progress, run parameters (speed, time, temperature, and acceleration or deceleration setting) can be changed without stopping the run. The time setting can also be changed from continuous to a specified run length, or from a specified run length to continuous.



NOTE

- The rotor name cannot be changed during a run.
- The acceleration setting cannot be changed after acceleration starts.
- The deceleration setting cannot be changed after deceleration starts.

Points to remember about changing time settings during a run:

- To increase or decrease the remaining run time, turn the knob to the desired run time. The system will add the new remaining time to (or subtract from) the time already elapsed, and the display will show the new remaining run time.



NOTE

If you turn the TIME knob to a value less than the length of time the centrifuge has already been running, the run will end and the rotor will begin to decelerate immediately. For example, if the centrifuge has been running for 20 minutes and you turn the knob until 10 shows in the display, the run will end.

- To set a completely new run time while a timed run is in progress, turn the **TIME** knob to the new time setting and press **(START)**. The system will ignore any elapsed time.
- To change from HR:MIN mode to HOLD mode, press the **(TIME/HOLD)** key. The display will show the total accumulated run time and will begin counting the time elapsed from that point.
- To change from HOLD mode to HR:MIN mode, press the **(TIME/HOLD)** key and turn the **TIME** knob until the run length appears in the display. Press **(START)**. The system will ignore any elapsed time and will begin displaying the time remaining in the run.

STOPPING A RUN

A timed run will end automatically when the **TIME** display counts down to zero. "End" will flash in the **TIME** display. To end a **HOLD** run or a run in progress for any reason, press **(STOP)**.

NOTE

If a diagnostic condition causes the run to stop, with or without use of the brake, the appropriate diagnostic message will light and the light on the **(STOP)** key will flash until the rotor comes to a complete stop.

Action

Result

1. Press **(STOP)** to initiate deceleration.
2. After the rotor stops spinning, step on the foot pedal to open the door.

The light on the **(STOP)** key will flash until the rotor comes to a stop.

NOTE

During runs at very cold temperatures, nominally -10°C or below, ice may form around the door opening, causing the door to stick shut. If this happens, press firmly on the door in several locations around the door opening and step on the foot pedal again.

To minimize icing, remove moisture from inside the chamber between runs by wiping the chamber with a clean cloth.

UNLOADING THE CENTRIFUGE

At the end of a run, unload the rotor following the instructions in the appropriate rotor instruction bulletin.

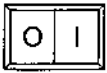

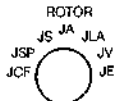









CAUTION

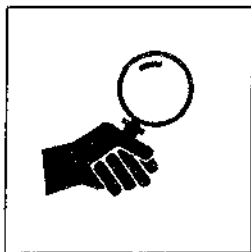
If disassembly reveals evidence of leakage, and pathogenic or radioactive materials are involved, the operator should assume that some fluid escaped the rotor. Apply appropriate safety and decontamination procedures to the centrifuge and accessories.

SUMMARY OF AVANTI J-25 RUN STEPS

For runs at other than room temperature, refrigerate or warm the rotor beforehand for fast equilibration. For low-temperature runs, precool the system by running a 30-minute cycle (with a precooled rotor installed) at the required temperature with the speed set at 2000 rpm.

1		Press the POWER switch to on (I). Open the centrifuge door.
2		Install the rotor. Make sure that the rotor load is balanced and that the rotor is securely fastened to the centrifuge drive hub. Close the centrifuge door.
3		Select a rotor number by turning the ROTOR knob until the installed rotor name appears in the ROTOR ID display.
4		Turn the SPEED knob until the required run speed (rpm) appears in the SPEED display. Or press (RPM/RCF) to select RCF mode and turn the SPEED knob until the required rcf appears in the SPEED display.
5		Turn the TIME knob until the required run length appears in the TIME display. Or, press (TIME/HOLD) for continuous operation.
6		Turn the TEMP knob until the required temperature appears in the TEMP °C display.
7		Set the acceleration rate — press (ACCEL) to select MAX (maximum) or SLOW.
8		Set the deceleration rate — press (DECEL) to select MAX (maximum), SLOW, or OFF (no brake).
9		Check that all parameters are correct and that the door is closed. Press (START).
10		Wait for the set time to count down to zero, or end the run by pressing (STOP).
11		When the run is complete, open the door and unload the rotor.

Troubleshooting



This section lists conditions that cause the diagnostic messages on the control panel to flash, and tells you how to proceed. Other troubleshooting instructions are also provided. System maintenance procedures are contained in Section 5. For any problems not covered here, contact your Beckman Field Service representative.

NOTE

It is your responsibility to decontaminate the instrument, as well as any rotors and accessories, before requesting service by Beckman Field Service representatives.

DIAGNOSTIC MESSAGES

FRS	SYS
ROTOR	POWER
IMBAL	DRIVE
SPEED	REFR
DOOR	TEMP

CLEAR

If a problem occurs during operation, the appropriate diagnostic message will light and a beep will sound to alert you to the condition. See Table 4-1 for a list of the diagnostic messages, the probable causes, and the recommended actions to take.

Two kinds of diagnostic conditions can occur.

- *Cautionary diagnostic messages* alert you to a condition that may need attention when the run is complete. Cautionary diagnostic messages provide information only; they do not shut down the run in progress. Press **(CLEAR)** to stop the light from flashing. If the condition still exists, the diagnostic message will begin flashing again, even though the run continues.
- *Shutdown diagnostic messages* occur when a problem exists that prevents the run from continuing. The diagnostic message will flash and the red **(STOP)** key light will also flash, indicating that the rotor is decelerating to a stop. You can press **(CLEAR)** to stop the

diagnostic message from flashing. However, if the diagnostic condition still exists (for example, if the rotor is out of balance), another beep will sound and the message will start flashing again.

Table 4-1 contains information on causes and recommended actions for each diagnostic condition. If you are unable to correct the problem, call Beckman Field Service (in the United States, call 1-800-551-1150; outside of the U.S., call your local Beckman office). To help the Field Service representative diagnose and correct the problem, provide as much information about the situation as you can.

- Write down the diagnostic message.
- Note the operating situation when the diagnostic condition occurred (for example, rotor in use, speed, or load type).
- Note any unusual environmental and/or operating conditions (for example, ambient temperature, or voltage fluctuations).
- Add any other information you think may be helpful.

Table 4-1. Diagnostic Message Chart

Diagnostic Message	Problem	Result	Recommended Action
FRS (friction reduction system)	FRS integrity is not established within 10 seconds after the pump is turned on	Run shuts down with maximum brake	<ul style="list-style-type: none"> • Check and clean door sealing area and door gasket. • Make sure that elutriator port stoppers are in place at left side of door seal (see Figure 2-1).
	FRS level does not reach 163 mm Hg within 90 seconds	Run shuts down with maximum brake	Call Beckman Field Service.*
	FRS level reaches 163 mm Hg but then rises and stays above 188 mm Hg for 45 seconds	Run continues	Press CLEAR to stop LED from flashing.
	FRS level reaches 163 mm Hg but then rises and stays above 188 mm Hg for 60 seconds	Run shuts down with maximum brake	Call Beckman Field Service.

Continued —

* In the U.S., call 1-800-551-1150. Outside the U.S., contact your local Beckman office.

Table 4-1. Diagnostic Message Chart (continued)

Diagnostic Message	Problem	Result	Recommended Action
IMBAL (imbalance)	Rotor load is imbalanced	Run shuts down with maximum brake	Reload rotor with labware and sample symmetrically balanced. (Refer to rotor instruction bulletin.)
ROTOR	System-identified rotor does not match user-selected rotor; set speed <i>below</i> rotor maximum	Run continues	Press CLEAR to stop LED from flashing.
	System-identified rotor does not match user-set rotor; set speed <i>above</i> rotor maximum	System lowers run speed to the maximum of the rotor identified by system	Press CLEAR to stop LED from flashing.
	System cannot identify rotor (dynamic rotor ID system malfunction)	Run shuts down with maximum brake	Check rotor and restart run.
	No rotor in chamber	Run starts; within seconds the system determines that no rotor is installed and the run shuts down with maximum brake	Install rotor and restart run.
SPEED	Speed control system is malfunctioning	Rotor spinning above set speed; run shuts down with maximum brake.	Call Beckman Field Service.*
DOOR	Door is not latched properly or interlock is out of position	DOOR LED lights after START is pressed and system shuts down.	Open the door and close it firmly; press CLEAR to stop LED from flashing. Restart the run.
	Door stays locked after rotor stops spinning	Sample cannot be retrieved	Restart the centrifuge and perform a brief run. If door will still not open after deceleration, call Beckman Field Service.
	Door latches do not close and lock	Run cannot start	Check the latch hole (at left of door) for debris. Gently clean the area with a lintless cloth or tissue. Be careful not to damage sensitive electronics in the area.
SYS (system)	There is a problem with the system control software, EPROM, or RAM	System shuts down	Call Beckman Field Service.

Continued —

* In the U.S., call 1-800-551-1150. Outside the U.S., contact your local Beckman office.

Table 4-1. Diagnostic Message Chart (continued))

Diagnostic Message	Problem	Result	Recommended Action
POWER	Momentary power failure; rotor does not come to a complete stop	Run continues when power resumes; elapsed time continues counting from current value	Press (CLEAR) to stop LED from flashing.
	Power failure; rotor comes to a complete stop	Run restarts when power resumes; elapsed time starts counting from 0	Press (CLEAR) to stop LED from flashing.
DRIVE	Drive system malfunctioning (for example, over current, over/under voltage, components over temperature)	Run stops, usually with no brake. Door may not unlock for up to an hour.	Call Beckman Field Service.* Before trying to open the door, listen carefully and make sure that no sound is coming from the chamber (indicating a spinning rotor). Follow the directions under ACCESSING THE ROTOR IN CASE OF POWER FAILURE , below.
REFR (refrigeration system)	Refrigeration system malfunctioning	Run shuts down with maximum brake	Call Beckman Field Service.
TEMP	System temperature goes above +4°C or below -2°C of set temperature after set temperature is reached	Run continues. TEMP display continues to show rotor temperature ± 2°C.	If the rotor temperature does not affect your protocol, press (CLEAR) and let the run continue. Otherwise, press (STOP) and call Beckman Field Service.
	Actual temperature exceeds +8°C over set temperature	Run shuts down with maximum brake	Call Beckman Field Service.

* In the U.S., call 1-800-551-1150. Outside the U.S., contact your local Beckman office.

ACCESSING THE ROTOR IN CASE OF POWER FAILURE



WARNING

Any maintenance procedure requiring removal of a panel exposes the operator to the possibility of electrical shock and/or mechanical injury. Therefore, turn the power off (O) and disconnect the instrument from the main power source, and refer such maintenance to qualified service personnel.



WARNING

Before performing this procedure, verify that the rotor is not spinning by listening carefully for any noise coming from the chamber. Proceed only if the instrument is quiet. Never attempt to override the door interlock system while the rotor is spinning.

If the facility power fails only momentarily, the centrifuge will resume operation when the power is restored and the rotor will return to the set speed. In the event of an extended power failure, it may be necessary to override the door-locking mechanism manually to remove the rotor and retrieve your sample.

To access the door-locking mechanism, the instrument front panel must be removed. Two latches secure the front panel in place; these latches are accessible through two holes at the upper right and left of the panel (see Figure 4-1).

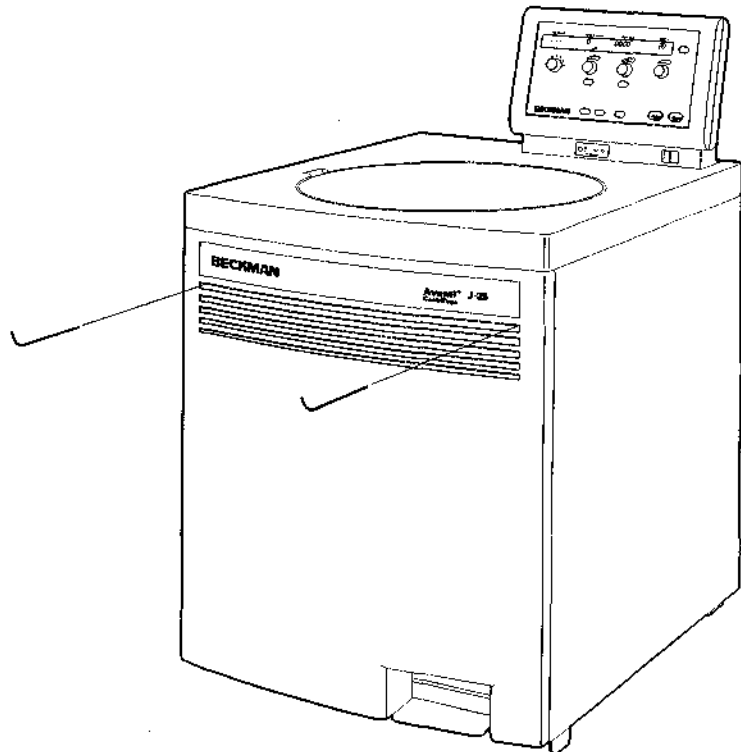


Figure 4-1. Emergency Door Release Latch Access

Action

1. Turn the power switch to off (O) and unplug the power cord from the main source.
2. Insert a 4-mm or 5/32-in. allen wrench straight through one of the holes (either one) and turn the wrench to the left (counterclockwise) about one-half turn.
3. Repeat step 2, inserting the allen wrench through the other hole.
4. Lift the front panel up and off the centrifuge; set it aside.

Result

The latch will disengage.

After the second latch disengages, the front panel will fall forward about an inch from the top. The bottom of the front panel is held in place by three grooved brackets, attached to the front panel, that seat over a metal retaining strip on the centrifuge bottom panel.

You will see an inner front panel that extends about halfway down from the centrifuge top (see Figure 4-2). Below this inner panel is a black manual door release interlock lever (see Figure 4-2).

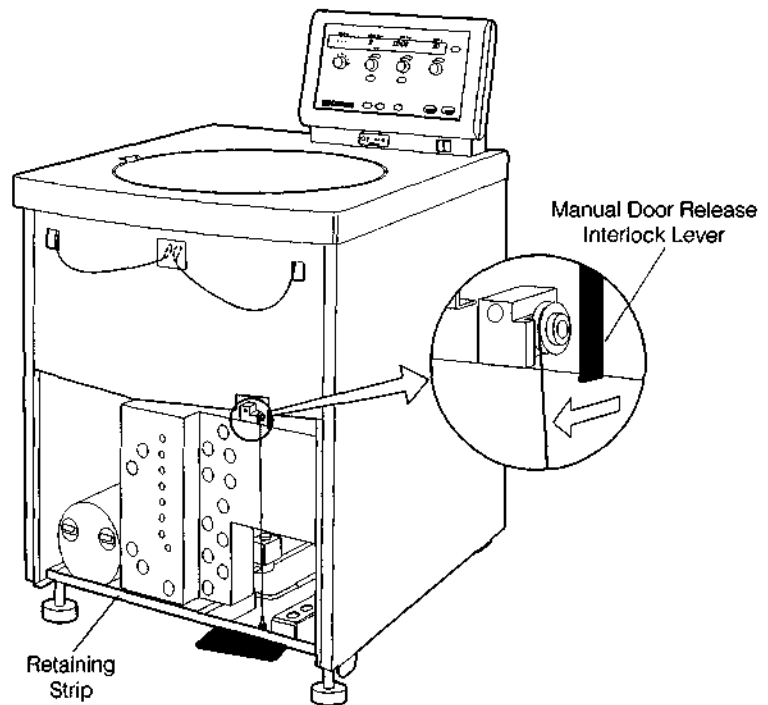


Figure 4-2. Manual Door Release

Action

Result

5. Pull the interlock lever out and left (at about a 45-degree angle). While holding it out, step on the foot pedal.

6. After the door opens, first release the foot pedal and then release the interlock lever.

The door will open.

7. Remove your sample.



WARNING

Never try to slow or stop the rotor by hand.

To replace the panel on the centrifuge,

Action

Result

1. Holding the panel at the top (with the instrument label facing out), insert the three grooved brackets on the bottom inside of the door over the front panel retaining strip (see Figure 4-3). Push the top of the front panel into place.

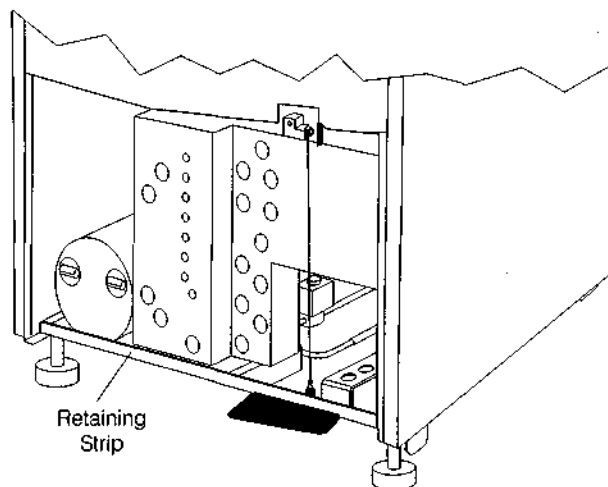


Figure 4-3. Front Panel Retaining Strip

Action	Result
2. Hold the left top edge in place and insert the allen wrench through the hole. Turn to the right (clockwise) about one-half turn, until you reach a stop.	The first latch will engage.
3. Repeat step 2 on the hole on the right side.	The second latch will engage.

IF THE JCF-Z ROTOR IS MISIDENTIFIED AS A JA-18 ROTOR

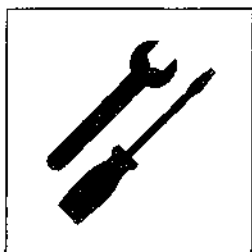
The Avanti J-25 dynamic rotor identification system can, under two specific conditons, misidentify the JCF-Z rotor as a JA-18 fixed angle rotor. These conditions are described fully in Section 1. Corrective actions are listed below.

If your JCF-Z rotor is new, run the rotor from 0 to 5000 rpm and back to 0 rpm three times. This procedure will distribute lubricant around the bearings in the rotating seal assembly, reducing drag.

If your JCF-Z is older, follow the same procedure as for a new JCF-Z rotor (perform three runs from 0 to 5 000 rpm and back to 0 rpm) to ensure that the bearings are properly lubricated. If misidentification recurs after the third run, when the bearings are lubricated, this indicates that that bearings are worn and need to be replaced. Replace the bearings following the instructions in the JCF-Z manual (JCFZ-IM).

NOTE

If the JCF-Z rotor is misidentified as a JA-18 rotor, the run speed will be limited to 18 000 rpm, the maximum speed for the JA-18. (The maximum speed for the JCF-Z rotor is 21 000 rpm.)



Care and Maintenance

This section describes routine care and maintenance procedures that you should perform regularly or as required. For maintenance not covered in this manual, contact your local Beckman Field Service representative.¹ Diagnostic conditions are discussed in Section 4, TROUBLESHOOTING. Refer to the appropriate rotor bulletin and the chemical resistance list (Beckman publication IN-175) for instructions on the care of rotors and their accessories.

NOTE

It is your responsibility to decontaminate the instrument, as well as any rotors and accessories, before requesting service by a Beckman Field Service representative.



WARNING

Any maintenance procedure or 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 (O) and the centrifuge is disconnected from the main power source, and refer such servicing to qualified service personnel.



WARNING

Do not use alcohol or other flammable substances in or near operating centrifuges.

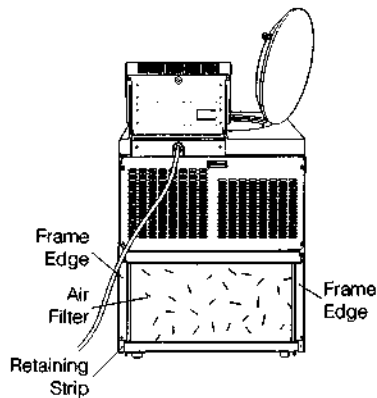
¹ In the U.S., call 1-800-551-1150. Outside the U.S., contact your local Beckman office.

MAINTENANCE

Perform the following procedures regularly to ensure continued performance and long service life of the centrifuge.

- Regularly inspect the interior of the centrifuge chamber for accumulations of sample, dust, or glass particles from broken sample tubes. Clean as required (see CLEANING, below).
- Regularly check the air filter on the back panel for obstructions. Keep vents clear and clean.
- Use a clean cloth or sponge to wipe condensation out of the rotor chamber between runs to prevent chamber icing.
- If chamber icing occurs, defrost the system and wipe moisture out of the chamber before use. To defrost the system, set the temperature to 30°C for 20 minutes. (These are suggested settings which may be adjusted as appropriate for your laboratory conditions.)

REPLACING THE AIR FILTER



The air filter is not fastened to the centrifuge, so no tools are required for removal or installation. Check the air filter regularly and replace it about once a year, or more often if it looks dirty.

1. To remove the air filter, hold the side edges and lift the filter straight up until the bottom edge is above the centrifuge bottom retaining strip. Pull the filter out, bottom edge first, and discard it.
2. Install a new filter (Beckman part number 885218). The filter has a directional arrow on one of its edges; install the filter with this arrow pointing toward the centrifuge. Holding the filter by the side edges, insert the top half behind the frame edge and lift up until the bottom half clears the lower frame edge. Then set the bottom edge down.

CLEANING

Frequent cleaning is recommended to prolong the life of the centrifuge. Always clean up spills when they occur to prevent corrosives or contaminants from drying on component surfaces.

- To prevent accumulations of sample, dust, and/or glass particles from broken sample tubes, keep the chamber clean and dry by frequent wiping with a cloth or paper towel. For thorough cleaning, wash the chamber using a mild detergent such as Beckman Solution 555™, diluted 10 to 1 with water. Rinse thoroughly and dry completely.
- Clean the centrifuge exterior surfaces by wiping with a cloth dampened with Solution 555, diluted 10 to 1 with water. Do not use acetone.
- Clean the drive hub regularly using Solution 555 (diluted 10 to 1 with water) and a soft brush. Rinse thoroughly and dry completely.

Tube Breakage

If a glass tube breaks, and all the glass is not contained in the bucket or rotor, it will be necessary to thoroughly clean the interior of the chamber.



WARNING

Be careful when examining or cleaning the chamber and chamber gasket, as sharp glass fragments may be embedded in their surfaces.

- Examine the chamber gasket to make sure that no glass particles are retained in it. Carefully remove any glass particles that may remain.
- Carefully wipe away any glass particles that remain in the chamber.

DECONTAMINATION



If the instrument and/or accessories are contaminated with radioactive or pathogenic solutions, perform all appropriate safety and decontamination procedures. Refer to publication IN-175 to be sure the decontamination method will not damage any part of the instrument.

STERILIZATION AND DISINFECTION

The centrifuge is finished with urethane paint. Ethanol (70%)² may be used on this surface. See publication IN-175 for chemical resistances of centrifuge and accessory materials.

While Beckman has tested these methods and found that they do not damage the centrifuge, no guarantee of sterility or disinfection is expressed or implied. When sterilization or disinfection is a concern, consult your laboratory safety officer regarding proper methods to use.

CIRCUIT BREAKER AND FUSES



There are no user-replaceable fuses in the Avanti J-25 centrifuge.

If the circuit breaker trips for any reason, the power switch will move to the OFF (O) position. Reset the circuit breaker by turning the power switch back to the ON (I) position.

You should reset the circuit breaker only once. If it trips again, *do not reset it*. Call your Beckman Field Service representative for assistance.



CAUTION

Repeated attempts to reset the circuit breaker can cause substantial damage to electrical and electronic components.

During a run, if a temporary power outage occurs and power is restored shortly, the run will continue and the elapsed time will continue counting where it left off before the power outage. The POWER diagnostic message will light; press **CLEAR** to stop it from flashing.

If the speed drops below 5% of the set speed before the power resumes, the run will restart from the beginning and the time remaining will begin to count down to zero. The POWER diagnostic message will light; press **CLEAR** to stop it from flashing.

² Flammability hazard. Do not use in or near operating centrifuges.

STORAGE AND TRANSPORT

STORAGE

Before storing a centrifuge for an extended period, cover the centrifuge to protect it from dust and dirt. Temperature and humidity conditions for storage should meet the environmental requirements described under SPECIFICATIONS.

RETURNING A CENTRIFUGE

The image shows a Returned Goods Authorization (RGA) form. It includes a header with the text 'RGA' and a grid of fields for entering return details. The form is partially filled out with text, including a return address and a description of the item being returned.

Before returning a centrifuge or accessory for any reason, prior permission (a Returned Goods authorization form) must be obtained from Beckman Instruments. Contact your local Beckman office to obtain the RGA form and instructions for packaging and shipping.

To protect our personnel, it is the customer's responsibility to ensure that all parts are free from pathogens and/or radioactivity. Sterilization and decontamination must be done before returning the parts.

All parts must be accompanied by a note, plainly visible on the outside of the box or bag, stating that they are safe to handle and that they are not contaminated with pathogens or radioactivity. Failure to attach this notification will result in return or disposal of the items without review of the reported problem.

SUPPLY LIST

Refer to the appropriate rotor bulletin for materials and supplies needed for rotors.

NOTE

To receive copies of referenced publications, contact Beckman Instruments, Technical Publications Department, 1050 Page Mill Road, Palo Alto, CA 94304, U.S.A., telephone (415) 859-1753; fax (415) 859-1375.

REPLACEMENT PARTS AND SUPPLIES

Air filter	885218
Beckman Solution 555™ (1 qt)	339555
Zonal Bracket Kit for Cole-Parmer size 16 tubing	
(6.4-mm [1/4-in.] O.D.)	363843
Zonal Bracket (qty 1)	363818
Thumbscrew, stainless steel, M4 (threads) × 19 mm (qty 2)	893412
Thumbscrew, stainless steel, M4 (threads) × 12 mm (qty 2)	893411
Cable Clamp, nylon, 6.4-mm (1/4-in.) I.D. (qty 10)	000499
Zonal Tubing Adapter for Cole-Parmer size 14 tubing	
(4.8-mm [3/16-in.] O.D.)	363844
Note: kit 363843 is also required.	
Tubing Adapter, stainless steel, for size 14 tubing (qty 2)	363830
Cable Clamp, nylon, 4.8-mm (3/16-in.) I.D. (qty 10)	003343
Zonal Tubing Adapter for Cole-Parmer size 15 tubing	
(9.6-mm [3/8-in.] O.D.)	363845
Note: kit 363843 is also required.	
Tubing Adapter, stainless steel, for size 15 tubing (qty 2)	363831
Cable Clamp, nylon, 9.6-mm (3/8-in.) I.D. (qty 10)	000596

Temperature Calibration Procedure

The Avanti J-25 centrifuge specification for temperature control is $\pm 2^{\circ}\text{C}$ of the set temperature. That means that your sample will stay within 2°C of set temperature at all times (after rotor and system equilibration, described below). The following procedure is provided for those cases in which temperature control within $\pm 1^{\circ}\text{C}$ is required.

In this procedure, you will measure the temperature of your sample after equilibrating the rotor temperature for a minimum of 30 minutes. Based on the test results, you can then adjust the centrifuge temperature setting to bring your sample as close as possible to the required temperature.

1. Precool the rotor in a refrigerator. The length of precooling time depends on how different the rotor starting temperature is from the required run temperature.
2. Install the precooled rotor with adapters, if applicable, and tubes or bottles filled with sample buffer or water (if higher than 2°C).
3. Set the speed to 2000 rpm, the time to 30 minutes, and the temperature to the required run temperature. Start the run.
4. When the 30-minute run is complete, set the required run speed, and set the run time to 1 hour.

NOTE

It is imperative that the system be given sufficient time to equilibrate before the temperature of the rotor contents is measured. The length of time required for equilibration depends on the rotor and centrifuge starting temperatures and the ambient room temperature.

Temperature Calibration Procedure

5. When the 1-hour run is complete, measure the temperature of the buffer or water using a thermometer or thermocouple.
6. If the measured and set temperatures are different, note how many degrees different they are and adjust the set temperature up or down that number of degrees.

For example:

If the required sample temperature is	And the measured buffer/water temperature is	Set the temperature to
2°C	4°C	0°C
5°C	4°C	6°C

AVANTI™ J SERIES CENTRIFUGE 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 (3 years for the drive motor) after delivery of the Avanti™ J Series 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. 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.

REPLACEMENT

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.

CONDITIONS

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.

Beckman shall be released from all obligations under all warranties either expressed or implied, if the product covered hereby is 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.

DISCLAIMER

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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Notice Regarding Use of Beckman JLA-10.500, JA-12, JA-25.50, JA-25.15, and JA-30.50 Fixed Angle Rotors in J2 Series Microprocessor-Controlled Centrifuges

READ THIS BEFORE USING YOUR NEW ROTOR IN A J2 SERIES CENTRIFUGE

Introduction

This rotor was purchased after the initial release of the Beckman J2 series microprocessor-controlled centrifuges. The original system firmware contained the names of all Beckman J2 series rotors available for use in the centrifuge, their maximum speeds, and temperature compensation values important for proper temperature control of each rotor. Rotors introduced more recently are not contained in the original firmware.

New firmware is now available and can be installed in the field by a Beckman Field Service representative. We recommend that you call Beckman Field Service to schedule a service call for this purpose. To contact Beckman Field Service, call 1-800-551-1150 in the U.S.; outside the U.S., contact your local Beckman office.

NOTE

The following centrifuges require the firmware upgrade: J2-MI, J2-MC, J2-21M, and J2-21M/E. *You can still run your new rotor in these centrifuges, even if your centrifuge has the old firmware. However, for accurate automatic temperature control, you should have the firmware upgraded by Beckman.*

This document contains a procedure for checking your centrifuge to see if it has old or new firmware. You should do this first. If you have the old firmware, then go to the next section for instructions on how to manually add the identification code for your new rotor to your system firmware.

Checking the Centrifuge System Firmware

Before you run your new rotor, check to see whether your J2 series centrifuge has old or new firmware by following the steps below.

1. Press the **(ROTOR)** key.
2. Enter the identification code for your rotor on the keypad (see the Table below). The code appears in the RPM display, and the CODE indicator light below the display flashes.

Rotor Name	Rotor Code
JLA-10.500	10.5
JA-12	12
JA-25.50	25.5
JA-25.15	25.1
JA-30.50	30.5

3. Press **(ENTER/RECALL)**.
 - *If the new firmware is installed*, the centrifuge will accept the entry. The code will disappear from the display. You can proceed with regular operation.
 - *If the new firmware has not been installed*, the code you entered will flash repeatedly, indicating that it is not recognized. Follow the instructions in the next section to proceed with immediate operation. In addition, call Beckman Field Service to arrange a service call for J2 series centrifuge firmware update.

Manually Entering the Rotor into Centrifuge Memory

You can enter the new rotor code into your centrifuge's system memory, so that the centrifuge will recognize the rotor name and maximum speed. Follow the steps below.

1. On the centrifuge panel, press and hold the **(ROTOR)** key. While holding **(ROTOR)**, press **(PROG SAVE)**. Release both keys. The rotor display area will show 1—.—. This indicates that you are ready to program the first entry, which is the rotor identification code. Enter the code from the table above, press and hold the **(ROTOR)** key, press **(PROG SAVE)**, and then release both keys.
2. The rotor display should now show 2 —.—. You are now ready to program the second entry, which is the rotor's maximum speed. Enter the speed in the following format: for 10,000 rpm, enter 10.0; for 12,000 rpm, press 12.0, etc. Press and hold **(ROTOR)**, press **(PROG SAVE)**, and release both keys.

3. The rotor display should now show 3 —.—. The third entry programs the temperature compensation for the rotor. It is not possible, however, to enter a compensation value at this step unless the centrifuge firmware has been updated. You must enter 0. Entering temperature compensation is discussed in the next section, and in the rotor manual under TEMPERATURE.
4. To complete the entry, press and hold **(ROTOR)**, then press **(ENTER/RECALL)**, and release both keys. The display should now return to normal.

If you make an error, or if you wish to review the entered information, press both **(ROTOR)** and **(PROG SAVE)** repeatedly to cycle through levels 1, 2, and 3. The program can only be logged into memory from level 3, and only when an entry is made in all three fields.

Once this procedure is complete, the microprocessor memory will retain the information and it will not have to be entered again. When you are ready to run the rotor, simply enter the rotor code.

Adjusting the Temperature Compensation

The J2 series centrifuge firmware contains temperature control information specific to each J2 series rotor, to ensure that the rotor reaches the set temperature at the set speed. Manual entry of a rotor code using the procedure described above will provide overspeed protection only. For accurate automatic temperature control of your new rotor in a J2 series centrifuge, you will need the updated firmware.

Until the new firmware is installed, if precise temperature control is required, you should perform a dynamic temperature calibration, measure the temperature of the rotor contents with a thermometer, and manually adjust the temperature compensation, if required. Follow the steps below.

You will need a thermometer calibrated in 0.2°C, and two large bottles or tubes of water.

1. Precool the rotor and water, in a refrigerator or in the centrifuge, to the approximate run temperature.
2. Turn the centrifuge power on and turn the key switch to NORMAL.
3. Open the chamber door and install the precooled rotor. Load two tubes or bottles containing equal volumes of water into opposing positions in the rotor.
4. Enter the rotor code.
5. Enter speed and temp. Enter 9999 for time.
6. Press **(START)**.
7. After about one hour of centrifugation, record the temperature in the digital display. Then press **(STOP)**.
8. As soon as the STOP light goes out, open the chamber door and dunk the thermometer into one of the water-filled containers for a few seconds to precool it. Then measure and record the temperature of the second water-filled container.

9. Compare the two recorded temperatures. If the rotor is colder or warmer than the displayed temperature, add or subtract the temperature difference using the **COMP ADJ** key when repeating these run conditions.
- If the rotor is *colder*, enter positive digits. For example, if the water temperature measures -6°C and the display shows -4°C , the rotor is too cold and the temperature must be adjusted *up* 2°C to make the rotor temperature and the display temperature the same (therefore, +2 is the COMP ADJ).
 - If the rotor is *warmer*, enter negative COMP ADJ digits to adjust the rotor temperature *down* the required number of degrees.

To add or subtract from the compensation value

1. Press **COMP ADJ**. The word COMP flashes below the TEMPERATURE display and the display flashes.
2. Enter the required compensation value on the keyboard. To enter a negative number, first press the **±** key. A minus sign appears on the display. Press **±** again to remove the minus sign.
3. Check the TEMPERATURE display. If the entry is incorrect, press **CE** and reenter the digits.
4. Press **ENTER/RECALL**.

NOTE

To clear a COMP ADJ entry, press **COMP ADJ**, **0**, and press **ENTER/RECALL**.

When the COMP ADJ value is entered, you are ready to proceed with the run.

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