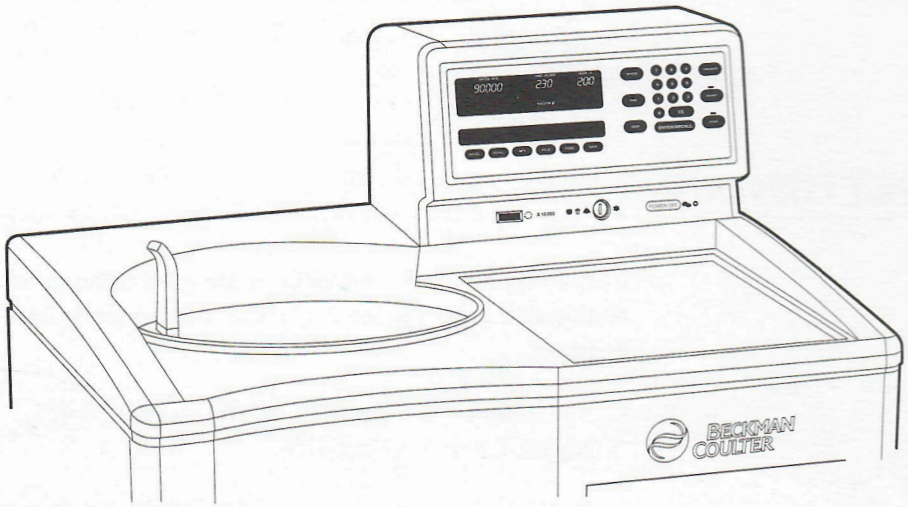
CANADIAN REGULATIONS

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 présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe A prescrites dans le reglement sur le brouillage radioelectrique édicté par le Ministère des Communications du Canada.



SPECIFICATIONS

CONTROL CHARACTERISTICS

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

Speed

Set speed	1000 rpm to maximum speed* in increments of 100 rpm
Speed control	Actual rotor speed will be ±20 rpm of the set speed (above 1000 rpm)

* Maximum speed will be 100 000 rpm or 90 000 rpm for the current models. Models purchased earlier may include maximum speeds of 80 000, 70 000, or 60 000 rpm.

Speed display	Indicates rotor speed in increments of 10 rpm at speeds below 1000 rpm, and increments of 100 rpm at speed above 1000 rpm
Time	
Set time	Up to 99 hours and 59 minutes; HOLD for runs of unspecified length
Time display	Indicates time remaining in timed runs, time elapsed in HOLD runs, and estimated time remaining in $\omega^2 t$ runs
Temperature	
Set temperature	0 to 40°C in increments of 1°C
Temperature control	±0.5°C of set temperature
Temperature display	Indicates rotor temperature in increments of 0.1°C
Temperature stability	Within 0.3°C of set after equilibration
Ambient temperature range	15 to 40°C
$\omega^2 t$ Integrator	
Set $\omega^2 t$	Up to 9.99×10^{14} radians squared per second
$\omega^2 t$ display	Shows accumulated centrifugal force to three significant digits (in exponential notation)
Acceleration	Selection from two profiles: maximum acceleration from 0 rpm to set speed, or slow acceleration from 0 to 500 rpm, followed by maximum acceleration to set speed
Deceleration	Selection from three profiles: full dynamic braking to 0 rpm, slow (full brake to 500 rpm followed by reduced braking to a gentle stop), or no brake
Operation	Standard, programmed, or delayed start; instrument memory can store up to nine programs
Key Switch	Used to select normal or zonal operation

OPERATIONAL FEATURES

Revolution Counter	Displays accumulated total number of rotor revolutions in tens of thousands
Barrier Ring	41-mm (1.63-in.) heat-treated steel alloy armor ring surrounded by a 12-mm (0.50-in.) steel vacuum chamber to provide full protection for the operator
Door	17.5-mm (0.69-in.) high-strength structural steel
Vacuum	Diffusion pump in series with a mechanical pump typically reduces chamber pressure to below 5 microns (0.7 Pa)

Instrument Classification	S (uses all Beckman Coulter preparative rotors except Types 35 and 42.1 rotors with serial numbers 1299 or lower)
Diagnostic Messages	See Section 4: TROUBLESHOOTING AND MAINTENANCE

NOTE

The Optima L series ultracentrifuges have been designed and tested to operate safely indoors at altitudes up to 2 000 m (6 562 ft).

PHYSICAL DATA

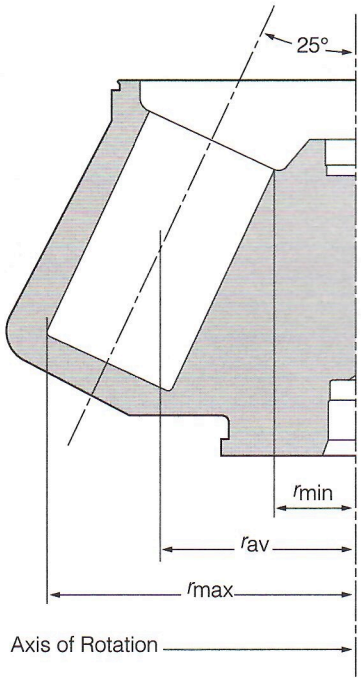
Weight	465 kg (1025 lb)
Height (overall)	120.7 cm (47.5 in.)
Width	94.0 cm (37 in.)
Depth	67.3 cm (26.5 in.)
Ventilation clearances	5.1 cm (2 in.) sides; 15.2 cm (6 in.) rear
Finishes	
Keypad	coated polycarbonate
Top surface	urethane paint
Other surfaces	acrylic baking enamel
Maximum heat dissipation into the room	1.0 kW (3400 Btu/hr)
Humidity restrictions	<95% (non-condensing)
Noise level measured 0.91 m (3 ft) in front of the instrument	<57 dBa
Installation (overvoltage) category	II
Pollution degree	2†

† Normally only nonconductive pollution occurs; occasionally, however, a temporary conductivity caused by condensation must be expected.

L5-TB-021H
November 1999

INSTRUCTIONS FOR USING THE TYPE 19 ROTOR

In Beckman Coulter Class H, R, and S Preparative Ultracentrifuges



SPECIFICATIONS

Maximum speed	19 000 rpm
Density rating at maximum speed	1.2 g/mL
Relative Centrifugal Field* at maximum speed	
At r_{max} (133.4 mm)	53 900 × g
At r_{av} (83.9 mm)	33 900 × g
At r_{min} (34.4 mm)	13 900 × g
k factor at maximum speed	951
Conditions requiring speed reductions	see RUN SPEEDS
Number of rotor cavities	6
Available bottle:	
Nominal dimensions	60 × 121 mm
Nominal capacity	250 mL
Nominal rotor capacity	1500 mL
Approximate acceleration time to maximum speed (rotor fully loaded)	12 min
Approximate deceleration time from maximum speed (rotor fully loaded)	13 min
Weight of fully loaded rotor	17 kg (38 lb)
Rotor material	aluminum

* Relative Centrifugal Field (RCF) is the ratio of the centrifugal acceleration at a specified radius and speed ($r\omega^2$) to the standard acceleration of gravity (g) according to the following formula:

$$RCF = \frac{r\omega^2}{g}$$

where r is the radius in millimeters, ω is the angular velocity in radians per second (2π RPM /60), and g is the standard acceleration of gravity (9807 mm/s²). After substitution:

$$RCF = 1.12\, r \left(\frac{RPM}{1000}\right)^2$$

CA-0302-.1-FNG
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OPTIMA™ SERIES *No other ultracentrifuge sy*

Optima Series enhanced ultracentrifuges are designed from top to bottom to optimize your lab's productivity. Each model offers you the best of all possible worlds — superb versatility, plus reliability, plus ease of use, plus safety — for a specific set of application needs. So whether you require a top-of-the-line performer (XL-100K or L-90K), solid workhorse (LE-80K), or convenient tabletop (TLX), there's an optimal ultracentrifugation solution from Beckman for your lab.

Every Optima instrument gives you a ideal blend of performance, versatilit reliability, and safety for your needs. An with their compact, contoured design, they f easily into your existing workspace

OPTIMAL PRODUCTIVITY

Unsurpassed speed and g-force capabilities

- Achieves up to 100,000 rpm/ 802,400 × *g* in the floor model XL-100K, and up to 120,000 rpm/ 625,000 × *g* in the tabletop TLX

Shorter run times

- *g*-Max™ system accessories expand rotor volume range and shorten run time
- Tubes can be filled by eye without weighing each sample
- Easy, intuitive operation and multiple user program storage make set-up fast and easy

OPTIMAL VERSATILITY

Accessories and rotors for every application

- Unsurpassed choice of rotors, tubes, and adapters — all tested as an optimized system
- Innovative supplies like *k*onical™, OptiSeal™, and Quick-Seal™ tubes maximize the efficiency of every separation
- Selection of speed and operational features to meet your work and budget needs

OPTIMAL SAFETY

Ensures safety for the user

- Imbalance-tolerant drive minimizes small operator errors
- DRIC (Dynamic Rotor Inertia Check) contributes to maximum user safety
- Diagnostic displays alert users to error conditions
- Safety-engineered positive door lock with armored door, chamber ring, and man-hole cover design
- Designed and tested to provide quality and safety, ensured by CE Marking and UL/CSA approval

Safety for the environment

- Uses no CFCs or other ozone-depleting chemicals of any kind
- Consumes less power and generates 1/3 the heat of other instruments
- Optional HEPA filter kits enhance bio-safety

CE *As the first ultracentrifuge system to earn CE Marking, Optima instruments, rotors, and accessories meet the highest reliability and safety standards in the world, including:*

- *Quality assurance — ISO 9001*
- *Product safety — IEC 1010-1, IEC 1010-2-020**
- *Electromagnetic compatibility — EN 55011, EN 50082-1 & IEC 801-2, 801-3, 801-4*

* *IEC 1010-2-020 regulations require manufacturers to test instruments and rotors as a system. Use of an Optima instrument with a non-Beckman rotor invalidates the Maximum Credible Accident (MCA) testing required by these regulations.*

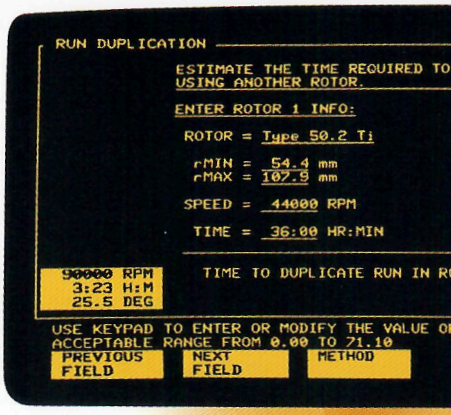
em optimizes your work so quickly, so easily.

Optima Series instruments, rotors, tubes, and accessories are designed and tested as a system to assure the highest quality of separations — from 20-minute plasmids to large volume subcellular fractionation.

OPTIMA™ SERIES *Simple, intuitive controls n*

Optima Series ultracentrifuges are quick and simple to set up and use. Intuitive controls and innovative user software help improve your lab's productivity by making run set-up as simple as a few button-pushes. All Optima instruments feature an easy-to-read digital display that keeps you constantly informed of operating conditions.

The XL-100K control panel offers you the ultimate in simplicity. It adds menu-driven operations that optimize run times, separation efficiency, and system safety to a variety of keypad-based functions. What's more, the XL-100K performs a variety of calculations and conversions including those for run duplicat and pelleting time.



OPTIMAL SIMPLICITY

Programmable, push-button set-up

- Microprocessor control
- User-customized programs can be stored and recalled with the push of a button
- Programmable delay start for a convenient finishing time
- Accel/decel profiles provide an instant customization of operating conditions
- Simplifies user setup with automatic preheating, precooling, vacuum, and dry cycle

More useful information at your fingertips

- Run-time diagnostics keep you constantly informed of key run conditions
- Display of total centrifugal effect of a run in radians squared per second contributes to run-to-run reproducibility

OPTIMAL RELIABILITY

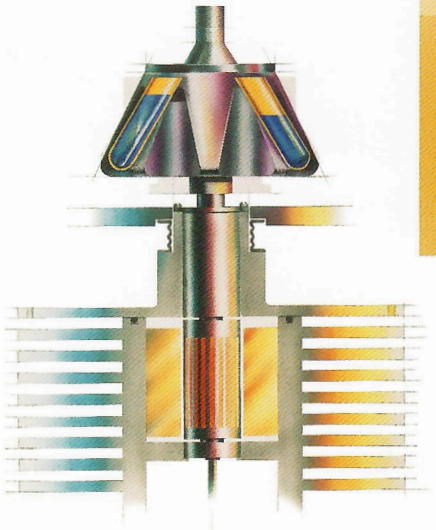
Reliable, low-maintenance drive

- Vacuum-encased drive eliminates common wear points for long drive life
- Moisture-purging vacuum system drastically reduces vacuum-pump maintenance
- Air-cooled drive and thermoelectric cooling and heating eliminate need for compressors and liquid refrigerants — No CFC's!

Solid, easy-to-maintain design

- Battery-backed memory protects stored protocols
- All mechanical components can be easily accessed through the front of the instrument

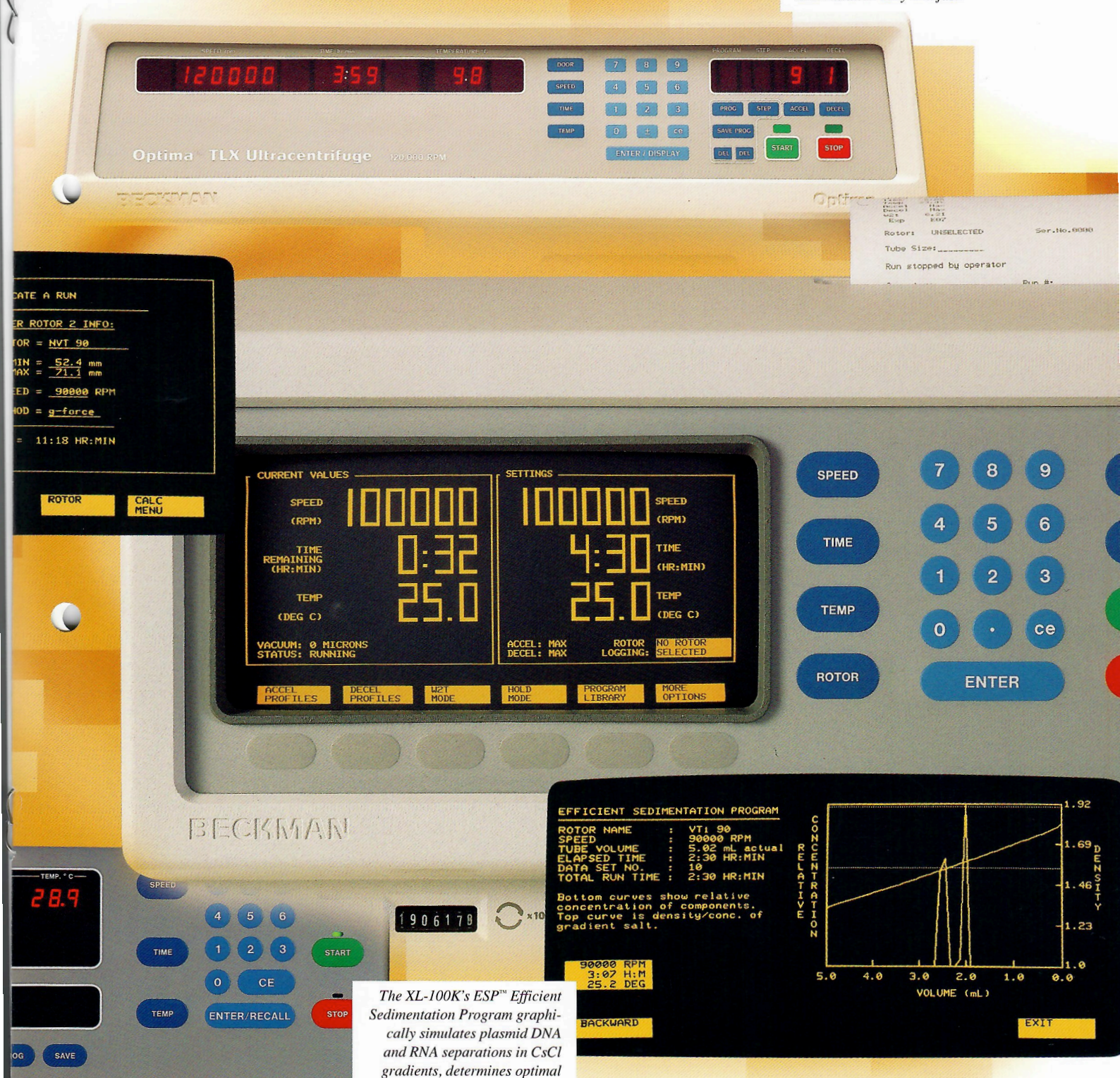
The L-90K and LE-80K are operate effortlessly and intuitively through a solid-state panel similar to that o the XL-100K. It offers finger-touch control of run parameters, a choice of accel/decel profiles that meet routine operating conditions, and rapid recall of user programs for repetitive runs.



The imbalance-tolerant Optima drive safely accommodates tubes that are under- or over-filled by as much as 10%. It also improves productivity by eliminating time required to weigh each tube.

ke your ultracentrifugation more productive.

The Optima TLX shares the elegant simplicity that typifies the Optima Series. The intuitive layout of the control panel makes run set-up and initiation easy and fast.



The XL-100K's ESP™ Efficient Sedimentation Program graphically simulates plasmid DNA and RNA separations in CsCl gradients, determines optimal run conditions for your specified rotor/tube/sample combination, and then stores these parameters in memory for the run.

OPTIMA™ SERIES *A system unmatched for meeting your application needs.*

At the heart of the Optima system is a superb selection of innovative rotors and accessories that lets you customize your centrifuge system for your specific research needs. What's more, every aspect of Beckman technology — down to the simplest tube plug — is designed to take full advantage of Optima productivity.

Type 100 Ti rotor

- Spins up to 8 × 6.5 mL tubes up to 802,400 × *g* @ 100,000 rpm in the XL-100K

Near Vertical Tube (NVT™) rotors

- New NVT-100 Near Vertical Rotor spins up to 8 × 5.1 mL tubes at forces up to 750,000 × *g*
- Significantly reduces run times by holding tubes at a very narrow angle
- Prevents contact between pelleted/floated components and the bands of interest

OptiSeal™ tubes

- Allows reliable sealing with the touch of your finger — no tools are required
- Wide necks accommodate standard pipettes to make loading and unloading as easy as possible

Quick-Seal™ tubes

- Provides the secondary bio-containment that is so crucial in today's lab
- Uses simple hand-held sealing tool

konical™ tubes

- Improves pelleting efficiency by concentrating pelleted materials in narrowed tip
- Available in open-top and Quick-Seal™ designs

g-Max™ adapter system

- Shortens run times by up to 50%
- Achieves a higher *g*-force than conventional adapters through shorter pathlengths

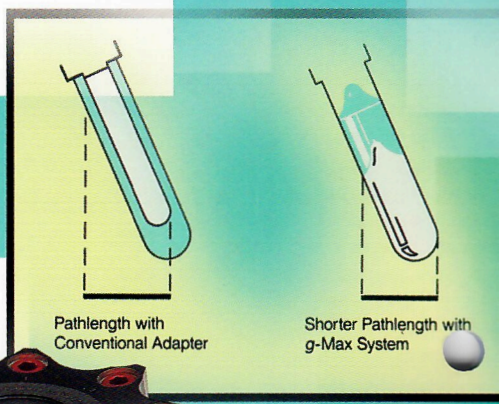
YOUR BECKMAN PLUS

In science, service, support and partnership

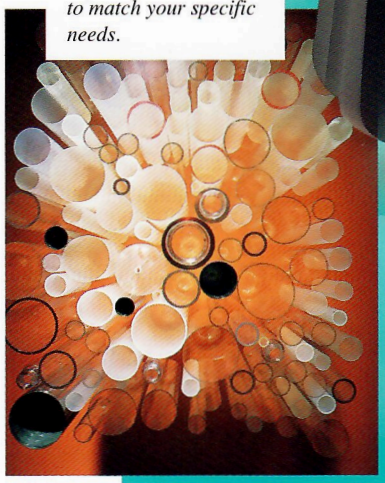
When you bring the benefits of the Optima Series to your lab, you bring the benefits of an extra dimension of personalized service and support with you: the Beckman Plus. This unparalleled level of customer service is what makes it possible for us to respond to your needs with unique solutions.

For more information about the Optima Series for enhanced ultracentrifugation, contact your local Beckman representative. Or, visit our Internet site at http://www. beckman.com

g-Max™ Adapter System – shorter separation times for small samples.



A wide variety of tubes to match your specific needs.



Near Vertical Tube Rotors (NVT™) – including the new NVT-100 with forces up to 750,000 × g.

Type 100 Ti rotor – forces up to 802,400 × for efficient separatio

FIXED ANGLE ROTOR

Rotor	*Max. rpm*	*Max. Force and k Factor*	*Tube Size*	*Max. Rotor Capacity*	*Order Number*
Type 100 Ti	100,000	802,400 *g* *k* = 15	1/2 × 2 1/2" 13 × 64 mm	8 × 6.5 mL 52 mL	363013
Type 90 Ti	90,000	694,000 *g* *k* = 25	5/8 × 3" 16 × 76 mm	8 × 13.5 mL 108 mL	355530
Type 70 Ti	70,000	504,000 *g* *k* = 44	1 × 3 1/2" 25 × 89 mm	8 × 39 mL 312 mL	337922
Type 70.1 Ti	70,000	450,000 *g* *k* = 36	5/8 × 3" 16 × 76 mm	12 × 13.5 mL 162 mL	342184
Type 50.2 Ti	50,000	302,000 *g* *k* = 69	1 × 3 1/2" 25 × 89 mm	12 × 39 mL 468 mL	337901
Type 50.4 Ti	50,000	312,000 *g* *k* = 33	1/2 × 2 1/2" 13 × 64 mm	44 × 6.5 mL 286 mL	347299
Type 45 Ti	45,000	235,000 *g* *k* = 133	1 1/2 × 4" 38 × 102 mm	6 × 94 mL 564 mL	339160
Type 42.2 Ti	42,000	223,000 *g* *k* = 9	.29 × .8" 7 × 20 mm	72 × 230 µL 16.5 mL	343007
Type 25	25,000	92,500 *g* *k* = 62	5/16 × 2" 8 × 51 mm	100 × 1 mL 100 mL	347261
Type 19	19,000	53,900 *g* *k* = 951	2 3/8 × 4 3/4" 60 × 120 mm	6 × 250 mL 1500 mL	325632

NVT™ NEAR VERTICAL TUBE ROTORS

Rotor	*Max. rpm*	*Max. Force and k Factor*	*Tube Size*	*Max. Rotor Capacity*	*Order Number*
NVT 100	100,000	750,000 *g* *k* = 8	1/2 × 2" 13 × 51 mm	8 × 5.1 mL 40.8 mL	365898
NVT 90	90,000	645,000 *g* *k* = 10	1/2 × 2" 13 × 51 mm	8 × 5.1 mL 40.8 mL	362752
NVT 65	65,000	402,000 *g* *k* = 21	5/8 × 3" 16 × 76 mm	8 × 13.5 mL 108 mL	362755
NVT 65.2	65,000	416,000 *g* *k* = 15	1/2 × 2" 13 × 51 mm	16 × 5.1 mL 81.6 mL	361073

VERTICAL TUBE ROTORS

Rotor	*Max. rpm*	*Max. Force and k Factor*	*Tube Size*	*Max. Rotor Capacity*	*Order Number*
VTi 90	90,000	645,000 *g* *k* = 6	1/2 × 2" 13 × 51 mm	8 × 5.1 mL 40.8 mL	362751
VTi 65.1	65,000	401,700 *g* *k* = 13	5/8 × 3" 16 × 76 mm	8 × 13.5 mL 108 mL	362759
VTi 65.2	65,000	416,000 *g* *k* = 10	1/2 × 2" 13 × 51 mm	16 × 5.1 mL 81.6 mL	362754
VTi 50	50,000	242,000 *g* *k* = 36	1 × 3 1/2" 25 × 89 mm	8 × 39 mL 312 mL	362758

You can determine the material of any rotor by its model number: Floor Model Rotors: *fixed angle, vertical tube and swinging bucket rotors with the "Ti" designation are made of titanium; other fixed angle rotors and the spindles of swinging bucket rotors are aluminum (all swinging bucket rotors listed have titanium buckets). Continuous flow rotors listed are titanium.* **Tabletop Rotors**: *rotors are made of titanium except for the aluminum TLA-45 and the aluminum spindle of the TLS-55 swinging bucket rotor (buckets of the TLS-55 are titanium).*

For detailed rotor information, request Bulletin No.BR-8101A.

SWINGING BUCKET ROTORS

Rotor	*Max. rpm*	*Max. Force and k Factor*	*Tube Size*	*Max. Rotor Capacity*	*Order Number*
SW 60 Ti	60,000	485,000 *g* *k* = 45	7/16 × 2 3/8" 11 × 60 mm	6 × 4 mL 24 mL	335650
SW 55 Ti	55,000	368,000 *g* *k* = 48	1/2 × 2" 13 × 51 mm	6 × 5 mL 30 mL	342196
SW 41 Ti	41,000	288,000 *g* *k* =124	9/16 × 3 1/2" 14 × 89 mm	6 × 13.2 mL 79.2 mL	331336
SW 40 Ti	40,000	285,000 *g* *k* = 137	9/16 × 3 3/4" 14 × 95 mm	6 × 14 mL 84 mL	331301
SW 28	28,000	141,000 *g* *k* = 246	1 × 3 1/2" 25 × 89 mm	6 × 39 mL 234 mL	342204
SW 28.1	28,000	150,000 *g* *k* = 276	3/8 × 4" 16 × 102 mm	6 × 17 mL 102 mL	342214

CONTINUOUS FLOW AND ZONAL ROTORS (For use in Optima™ XL and Optima L)

Rotor	*Max. rpm*	*Max. Force*	*Capacity*	*Typical Sample Volume*	*Order Number*
CF-32 Ti	32,000	102,000 *g*	430 mL	NA	357557
Ti-14	48,000	172,000 *g*	665 mL	20 - 50 mL	328911
Ti-15	32,000	102,000 *g*	1675 mL	50 - 200 mL	328913

TABLETOP ROTORS

Rotor	*Max. rpm*	*Max. Force and k Factor*	*Tube Size*	*Max. Rotor Capacity*	*Order Number*
MLA-130	130,000	1,019,000 *g* *k* = 8.7	11 × 32 mm	10 × 2 mL 20 mL	367114
MLA-80	80,000	444,000 *g* *k* = 29	16 × 58 mm	8 × 8 mL 64 mL	367096
MLS-50	50,000	268,000 *g* *k* = 71	13 × 51 mm	4 × 5 mL 20 mL	367280
MLN-80	80,000	390,000 *g* *k* = 20	16 × 58 mm	8 × 8 mL 64 mL	367100
TLA-120.1	120,000	627,000 *g* *k* = 8	8 × 34 mm	14 × .5 mL 7 mL	362224
TLA-120.2	120,000	627,000 *g* *k* = 8	11 × 34 mm	10 × 2.0 mL 20 mL	362046
TLA-100	100,000	436,000 *g* *k* = 7	7 × 20 mm	20 × .2 mL 4 mL	343840
TLA-100.3	100,000	541,000 *g* *k* = 14	13 × 32 mm	6 × 3.5 mL 21 mL	349481
TLA-110	110,000	657,000 *g* *k* = 20	13 × 51 mm	8 × 5.1 mL 40.8 mL	366735
TLA-55	55,000	186,000 *g* *k* = 66	11 × 38 mm	12 × 1.5 mL 18 mL	366725
TLN-120	120,000	585,000 *g* *k* = 7	8 × 35 mm	8 × 1.2 mL 9.6 mL	357683
TLN-100	100,000	450,000 *g* *k* = 14	13 x 38 mm	8 × 3.9 mL 31.2 mL	357614
TLV-100	100,000	400,000 *g* *k* = 14	11 × 32 mm	8 × 2.0 mL 16 mL	347375
TLS-55	55,000	259,000 *g* *k* =50	11 × 34 mm	4 × 2.2 mL 8.8 mL	346936

Notes. *Chart lists maximum force for each rotor when run at its maximum speed in an ultracentrifuge capable of achieving that speed, i.e., a rotor with a top speed of 100,000 rpm can be run at that speed in the XL-100K, but only 90,000 rpm in the L-90K.*

MODEL	MAX SPEED g-force	Part No. 220/240 VAC, 50Hz CE Marking	Part No. 200/240 VAC, 50/60Hz UL/CSA Approved
Optima XL-100K	*100,000 RPM 802,400 × g*	*365669*	*365671*
Optima XL-80K	*80,000 RPM 602,000 × g*	*365665*	*365666*
Optima L-90K	*90,000 RPM 694,000 × g*	*365670*	*365672*
Optima L-70K	*70,000 RPM 504,000 × g*	*365677*	*365678*
Optima LE-80K	*80,000 RPM 602,000 × g*	*365667*	*365668*

	MAX SPEED g-force	Part No. 220/240 VAC 50Hz	Part No. 110 VAC 60Hz	Part No. 100 VAC 60Hz	CE Marking UL/CSA Approved
Optima MAX	*120,000 RPM 1,019,000 × g*	*364300*	*364301*	*364302*	*YES*
Optima MAX-E	*100,000 RPM 609,000 × g*	*364310*	*364311*	*364312*	*YES*
Optima TLX	*120,000 RPM 625,000 × g*	*361544*	*361545*	*361546*	*YES*

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