September 2005, Printed in Japan

ST-480 ST-480M
RS-4/6 RS-480

Swinging Bucket rotor

INSTRUCTION
AND
SERVICE MANUAL

To ensure proper operation of the centrifuge, be sure to read this manual carefully before operating it.
Also, keep this manual handy so that you can refer to it at any time.

NOTE

■The products being indicated in this Instruction Manual are designed for operators with expert knowledge and are intended only to be used by such qualified operators observing the indicated precautions for respective purposes. For persons lacking necessary expert knowledge, these products may be difficult to use properly and may even pose a danger to use. When the aforesaid persons lacking the necessary expert knowledge are using these products, do so under appropriate supervision and guidance of a qualified operator possessing the necessary expert knowledge.

■Do not distribute this manual within the U.S.A., Mexico, Canada and Australia as the products advertised in the manual shall not be distributed in these countries.

For information added or modified after October 2005, please contact your local dealer.

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[**16 Pages**]
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Safety Instructions

The centrifuge and the manual indicate important information in order to ensure safe operation of the centrifuge and to prevent physical injuries and property damages. Be sure to understand the meanings of the following indications and follow the instructions.

1. Explanation of indication

Indication	Meaning
⚠ **WARNING**	It is a possibility of serious accident resulting in death or serious injury.
⚠ **CAUTION**	It is a possibility of accident resulting in slight or non-fatal injury or property damage.

■ "Serious injury" is defined as injuries such as loss of eyesight, burn (high/low temperature), electric shock, bone fracture, poisoning causing aftereffects, or any other injuries requiring long-term medical treatment at hospital.

■ "Non-fatal injury" is defined as burns, electric shock, or any other injuries which do not require long-term medical treatment at hospital. "Property damage" is defined as expansion damage related to damage to equipment or other property.

2. Explanation of pictorial marks

Pictorial marks	Meaning
	Indicates prohibition (things you must not do). Details are shown near the mark, using illustration or sentences.
	Indicates requirements (things you have to do). Details are shown near the mark, using illustration or sentences.

Table of Contents

General Notes　Be sure to follow them.

Since large electrical and mechanical energies are present on the centrifuge and rotor, reasonable care is required for their handling.
Otherwise, failure may occur resulting in property damages or fatal physical injuries.
In order to prevent them from happening, be sure to follow the instruction given below.

⚠WARNING

（1）Maximum load

Do not exceed the maximum load of rotor and bucket.
The rotor or bucket used beyond the allowable load level can be damaged, thereby causing an accident.

（2）Maximum speed

Keep the rotor and bucket speed below the maximum speed.
Excessive speed may cause damage to the rotor, bucket and the centrifuge. The maximum speed depends on the rotor and bucket strength.

（3）Modification and unspecified parts

Do not modify, nor use unspecified parts.
Unauthorized retrofit of the centrifuge, rotor or bucket, or use of unauthorized parts for them can result in accidents.

（4）Hazardous material

Do not put any hazardous material (explosive, chemically active, organic, or radiation containing material, or material contaminated by pathogenic microorganisms) as a sample of the centrifuge and do not place it closer than 30 cm to avoid a secondary accident should the centrifuge accidentally rotate and contact the material.

（5）Lid

Do not open the lid when the rotor is spinning.
Physical contact with the spinning rotor or bucket may cause serious injury.

（6）Sterilization

Ensure that the rotor or bucket may not be heated beyond 100 ℃.
It is prohibited to implement the autoclave or dry disinfection for the rotor or bucket, otherwise they can be damaged and, as the result, accidents.

（7）Rotor and drive shaft during rotation

Do not touch rotor and drive shaft during the rotation.
Physical contact with the spinning rotor or drive shaft may cause serious injury.

（8）Damaged, corroded, rusted or deformed

Discontinue use of the equipment when its rotor or the buckets found to have been damaged, corroded, rusted or deformed.
Otherwise failure may occur.

（9）Lifetime of rotors

Use of rotors beyond the lifetime may lead to breakage of the rotor.
If the rotor is used continuously even after the lifetime of the rotor has expired, should the rotor get damaged an accident may occur.

⚠ CAUTION

（１）Toxic or radioactive substances etc.

When centrifuging of substances contaminated with pathogenic bacteria, or toxic or radioactive substances, always use containers that are pathogenic bacteria, toxic substance or radiation proof.
Otherwise, infections, intoxication or radioactive exposure accidents may occur.

（２）Fasten a rotor

Ensure that the rotor is firmly fastened to the drive shaft.
If not positively held in place, the rotor or centrifuge can be damaged, thereby causing accidents.

（３）Bucket

The same type buckets must be provided to every rotor yoke.
If not positively held in place, the rotor or centrifuge can be damaged, thereby causing accidents.

（４） Tube

Use the same type of tubes.
The wrong arrangement will cause imbalance and resulting in damage to rotor, bucket or the centrifuge, thereby causing accidents.

（５）Balance of sample

Keep the load (of the sample, bucket, etc.) balanced.
If an appropriate balance is not provided, unexpected accidents can result from a damaged rotor or centrifuge.

（６）Cushion

Replace the cushion when the glass or plastic tube is cracked.
If the cushion with glass fragment cut to it is used, the tube is easily cracked.

（７）Cleaning

Do not use detergents exceeding the range of pH 5-8 or chlorine detergents for washing purposes.
Corrosion may damage the rotor and bucket resulting in damage to the centrifuge.

（８）Buckets swing up

Be careful not to exhaust any grease in the bucket groove.
If the buckets are not swung up smoothly, accidents can result from a dameged rotor or centrifuge.

NOTE　Regarding other precautions, observe those that appear in the instruction manuals for the respective centrifuge models.

Usable Centrifuge

⚠WARNING

(1) Do not use any rotors other than those specified in (2) and (3) below.
If centrifuges other than those specified are used, the rotors and buckets may be broken, resulting in a serious accident.

(2) The centrifuges that can mount as of September 2005 are as follows:
This information is subject to addition or change.
For information after October 2005, please contact your local dealer.

Rotor	Model
ST-480	5200, 5910
RS-4/6	5200
ST-480M	5220, 5420, 5922
RS-480	6500, 6930, 7700

(3) Centrifuges that can mount, though their production was discontinued are as follows:

Rotor	Model	Standard Serial No.	Reconstruction of the shaft is necessary Serial No.
ST-480 RS-4/6	5010, 5100, 5310, 5700 5800, 8010, 8100, 8700	All	—
ST-480M	5400, 5900, 5920	All	—
RS-480	6700	From Q80187	Before Q80186
	6800	From S30286	Before S30285
	6900, 7930	All	—
	7800	From S60108	Before S60107
	7820	From S10188	Before S10187

Contact your local dealer, in case that for reconstruction of the shaft is necessary.

When installing a centrifuge, always read the Instruction Manual for that centrifuge.

Lifetime of rotors

⚠WARNING

Use of rotors beyond the lifetime may lead to breakage of the rotor.
If the rotor is used continuously even after the lifetime of rotors has expired, should the rotor get damaged, the main unit of the centrifuge suddenly may start to rotate; this could result in an accident causing injury or death.

Lifetime of rotors is 7 years after the delivery.

When 7 years have passed after the delivery, discontinue operation of the centrifuge to replace the rotor with a new one.
Earlier replacement, however, is required if any corrosion, lowered strength, flaw or deform due to incorrect operation is detected on the rotor.
In such case, contact your local dealer and be sure to have the rotor checked before reusing it.

Section 1 Mounting the Rotor

1 – 1. Mounting ST-480 or ST-480M Rotor

⚠CAUTION

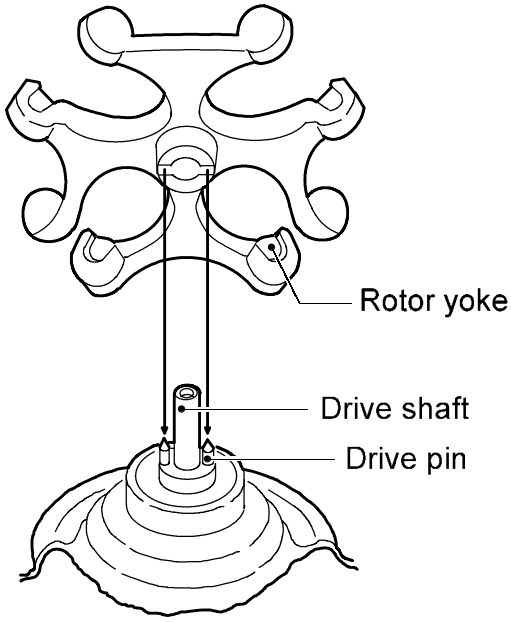
Make sure that the rotor is firmly fastened to the drive shaft with the rotor knob.

Since the rotor is not fastened onto the shaft when these parts are loose,excessive vibrations will occur and damage the equipment and the rotor, or the rotor cover may fly off inflicting physical injury.

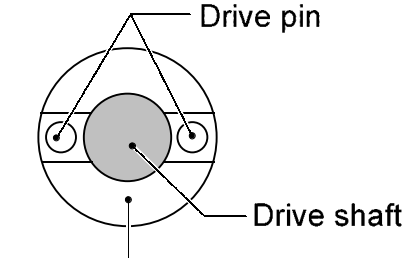
1. Align the groove of the rotor bottom with the drive pins and have them jointed.
   When use ST-480M, align ◀ mark shown in the drawing below with the drive pins. When align, the groove of the rotor bottom and the drive pins face each other and have them jointed.

2. Insert the rotor to the bottom of the drive shaft and tighten the rotor knob by turning clockwise.

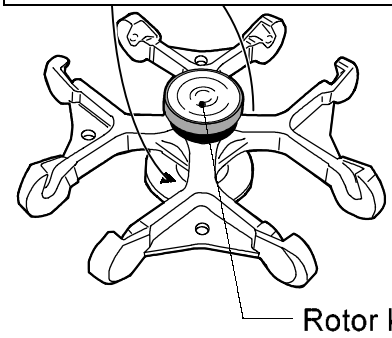
3. After installation of the rotor, hold the rotor yoke and attempt to move it up and down to ensure that there is no play.



ST-480 Rotor



◀ mark indication to align with the drive pin at 2 places.
(Only ST-480M)



Do not start it in the condition that the rotor knob got loose.

If the groove of the rotor is not inserted with the drive pins, the rotor knob can not be fastened.
In such a case, reinstall the rotor.

1 – 2. Mounting RS-4/6 Rotor

⚠CAUTION

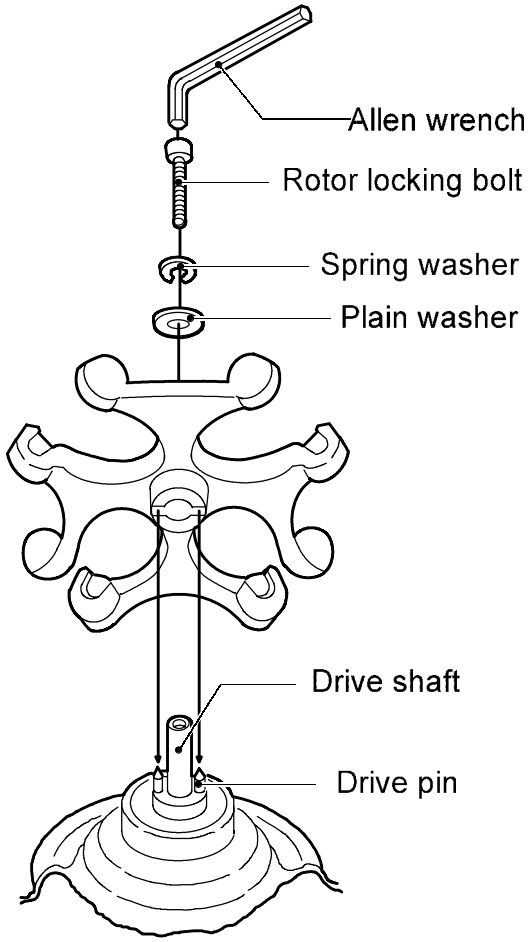
Make sure that the rotor is firmly fastened to the drive shaft with the rotor locking bolt.

Since the rotor is not fastened onto the shaft when these parts are loose,excessive vibrations will occur and damage the equipment and the rotor may fly off inflicting physical injury.

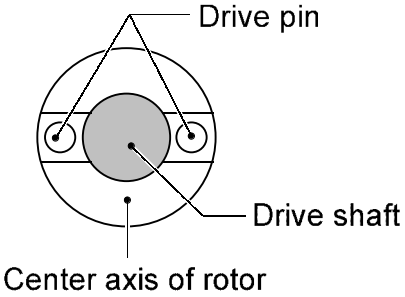
1. Align the groove of the rotor bottom with the drive pins and have them jointed.

2. Fit the rotor yoke onto the drive shaft until it is firmly seated fasten the rotor yoke with the rotor locking bolt located at the rotor center. Use a allen wrench, turning clockwise for fastening.

3. After installation of the rotor, hold the rotor yoke and attempt to move it up and down to ensure that there is no play.



RS-4/6 Rotor



Do not start the operation when the rotor locking bolt is removed.

If the groove of the rotor is not inserted with the drive pins, the rotor locking bolt can not be fastened.
In such a case, reinstall the rotor.

1 – 3. Mounting RS-480 Rotor

⚠CAUTION

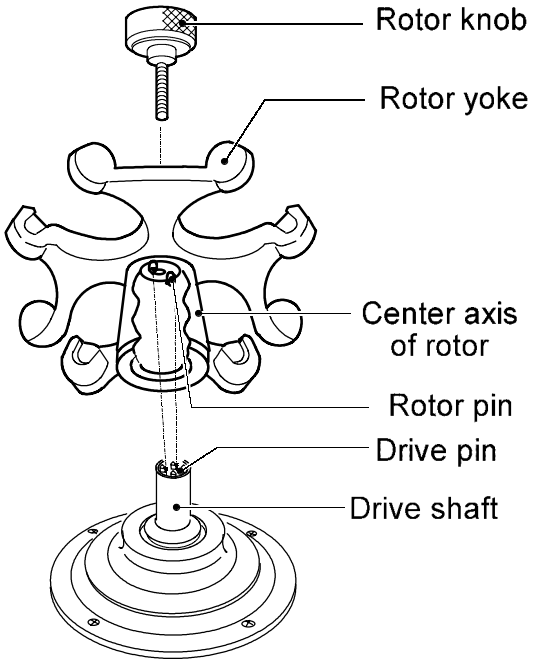
Make sure that the rotor is firmly fastened to the drive shaft with the rotor knob.

Since the rotor is not fastened onto the shaft when these parts are loose,excessive vibrations will occur and damage the equipment and the rotor, or the rotor cover may fly off inflicting physical injury.

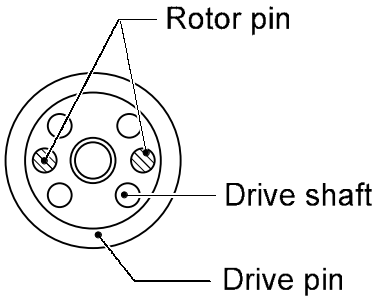
1. Insert the rotor onto the drive shaft so that the rotor pin in its center axis of rotor may not meet the drive pin on the drive shaft.

2. Fix the rotor yoke by rotor knob, and then tighten while rotor knob it by turning clockwise.

3. After installation of the rotor, hold the rotor yoke and attempt to move it up and down to ensure that there is no play.



RS-480 Rotor



Do not start the operation when the rotor knob is removed.

When the rotor pin on the bottom end of the rotor is hitting the drive pin on the drive shaft,the rotor knob cannot be tightened fully.
In such a case, reinstall the rotor.

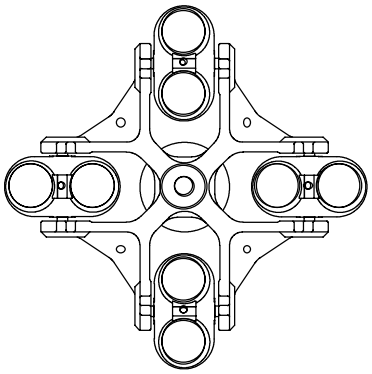
1－4. Cautions on Use of the Rotor

[1] Setting Buckets

⚠CAUTION

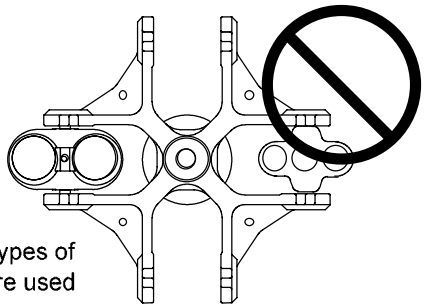
The same type buckets must be provided to every (4places) rotor yoke.
If not positively held in place, the rotor or centrifuge can be damaged, thereby causing accidents.

Correct



Wrong

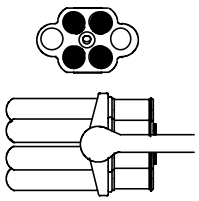
Not every necessary location is provided with a bucket.



Different types of buckets are used in parallel.

[2] Tube distribution method

Correct



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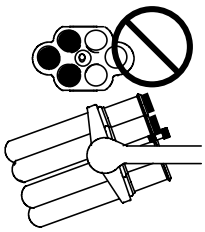
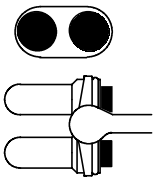


Correct



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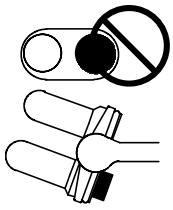


⚠CAUTION

■ **Distribute the tubes symmetrically about the center of the bucket.**

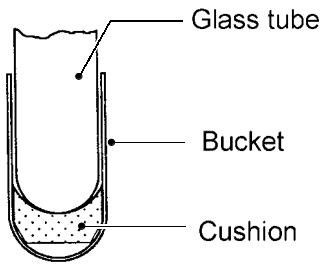
- Appropriate balance is lost and violent vibrations can result if tubes are incorrectly arranged. And, unexpected accidents can result from such violent vibrations.
- The settling chamber may be tilted since the tubes can't be maintained horizontal during rotation.
- When you don't have enough number of tubes, dummy tubes shall be used to maintain symmetry of the both sides.

■ **Keep the load balanced symmetrically within 2.0 gram.**

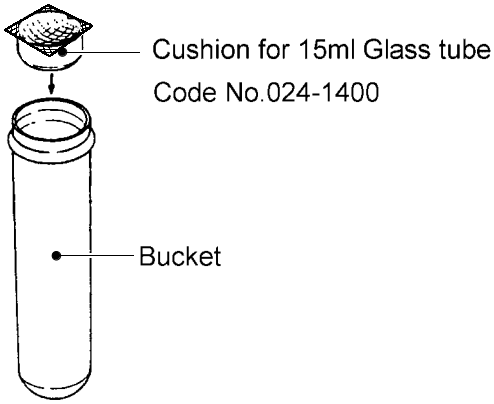
[3] Cushions

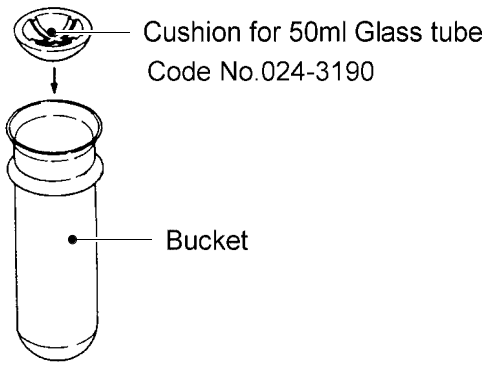
When glass tubes are used, be sure to use the cushion to avoid damage.
Insert the cushion into the tube rack so that its concave side faces upward.
If a glass tube is damaged, replace the cushion.
If broken pieces of the glass tube are contained in the cushion, the glass tube will be broken again.

Do not insert the cushion upside down or in a slanted position, otherwise, the glass tube may be damaged or you may not be able to remove it.



Insert the cushion into the tube rack so that its concave side faces upward.



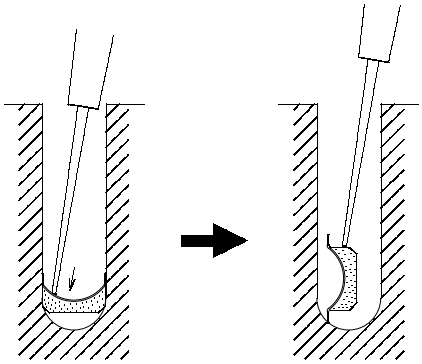


How to remove cushion

① Stick the cushion with an eyeleteer or a pair of pointed tweezers.

② Raise the cushion perpendicularly on the bucket bottom.

③ Stick the side of the cushion to take it out.



[3] Cleaning

⚠CAUTION

Do not use detergents exceeding a pH range of 5 - 8, or chlorinated detergents normally used for washing.
Corrosion may damage the rotor resulting in damage to the centrifuge.

(1) Bucket and rotor are removed from a centrifuge.
(2) Wash the bucket and the rotor with the neutral detergent and warm water and rinse with the distilled water.
(3) Dry the inside before you operate the centrifuge.
If water has accumulated inside the rotor, place the rotor with its bottom side up and dry it completely.

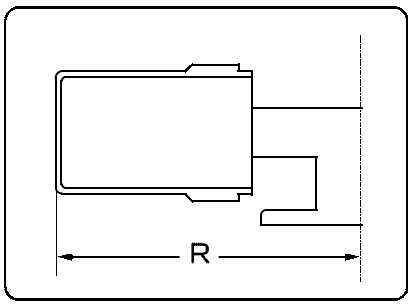
1 – 5. Standard accessories

RS-4/6 Rotor

1. Rotor locking bolt ·····1Pc
2. Spring washer ·····1Pc
3. Plain washer·····1Pc
4. Allen wrench ·····1Pc

Section 2 Specification

2－1. ST-480, ST-480M, RS-4/6 and RS-480 Swinging Bucket Rotors



Rotor	Maximum Weight kg
ST-480	2.9
ST-480M	3.0
RS-4/6	2.8
RS-480	3.1

（1） Max. speed, Max. RCF and Refrigeration characteristics

Model	Maximum Speed rpm	Maximum R C F ×g	Refrigeration characteristics At 25℃ of ambient temperature.
5010 5310 5100 5400 5200 5420 5220	5,000	4,640	—
5700 6800 5800 6900 5900 6930 5910 7800 5920 7820 6500 7930 6700			The temperature of a sample can be cooled down to 0℃ at least at maximum speed.
5922			The temperature of a sample can be cooled down to 4℃ at least at maximum speed.
7700	5,000	4,639	The temperature of a sample can be cooled down to 0℃ at least at maximum speed.
8010 8100	3,100	1,780	—
8700			The temperature of a sample can be cooled down to 4℃ at least at maximum speed.

（2） Indication of Centrifugal Force

The centrifugal force at each speed being indicated by the centrifuge is based on the following condition:

R : A maximum radius of 16.6 cm.
【The maximum radius of 50ml × 4 (No.053-7110 bucket)】.

In case of conditions other than the above, substitute the actual values for the "speed" and "radius" in the following formula to calculate the centrifugal force:

$$\text{Centrifugal force RCF}(\times g) = 11.18 \times \left(\frac{\text{Speed N (rpm)}}{1000}\right)^2 \times \text{Rotation Radius R(cm)}$$

(3) Specification

① Using the bucket for Code No.053-4810, 053-5010, 053-5020, 053-7030, 053-7050, 053-7110, 053-7130, 053-7150, 053-7190, 053-7300.

Nominal Capacity ml	Number of Tube	Tubes Material *1	Tube Sizes Dia. × Length mm	Form *2	Tubes Code No.	Allowable Speed rpm	R C F × g	Adaptor Code No.	Bucket Code No.	Cushion Code No.	Maximum Radius R cm	Allowable load gram *3
2	64	PL	9.5-11 × 36-42	C	—	3,000	1,570	—	053-7030	Cushion is included with bucket. 24-6290	15.6	60
10	48	GL	12-13.3 × 46-110	R	052-6320		1,600		053-7190		15.9	230
15	4	PL	17 × 121	C	Conical tubes FALCON etc.	5,000	4,583	055-5750 The measure against a Biohazard. *4	053-7110	Use bucket without cushion.	16.4	145
15	4	GL	15-17.2 × 86-110	C R	052-6360 052-6330		4,560	055-7400	053-7110	024-1400	16.3	
15	8	GL				3,500	2,232		053-7150			240
15	12	GL					2,273	—	053-4810		16.6	140
15	16	PL	17 × 121	C	Conical tubes FALCON etc.	3,000	1,770		053-7300		17.6	
15	16	GL	15-17.2 × 86-110	C R	052-6360 052-6330	3,500	2,273		053-7050		16.6	270
15	32	GL							053-7130			
10	32	PL GL		R	Blood collection tubes							
50	8	GL	27-38 × 100-110	R	052-6370	3,500	2,273		053-7150	024-3190	16.6	240
50	4	GL				5,000	4,640		053-7110			145
50	4	FEP PSF PC PPCO	27-29 × 100-108	R	NALGE NUNC 3114-0050 3115-0050 3118-0050 3119-0050		4,440	055-4310 The measure against a Biohazard. *4	053-7110	Use bucket without cushion.	15.9	
50	4	PL	30 × 117	C	Conical tubes FALCON etc.		4,560	055-5760 The measure against a Biohazard. *4	053-7110	Use bucket without cushion.	16.3	
50	4	PL					4,640	—	053-5010	024-1480	16.6	
50	8	PL				3,500	2,270		053-5020			240

*1 PL : Plastic FEP : Teflon FEP PC : Polycarbonate
GL : Pyrex Glass PSF : Polysulfone PPCO : Polypropylene copolymer

*2 C : Conical R : Round type

*3 Allowable load per bucket.
This load includes the weight of the sample, adaptor, cushion, tube, cap, etc.
The weight of bucket is not included in the allowable load.

*4 Be sure to remove the cushion and then use the adaptor.

Cont' d. on next page.

② Using the bucket for Code No.053-5790.

Code No.053-5790 bucket can be used only in Model 5700、5800、5900、5910、5920、5922、6500、6800、6900、6930、7700、7800 or 7930 centrifuges.

Nominal Capacity ml	Number of Tube	Tubes Material *1	Tube Sizes Dia. × Length mm	Form *2	Tubes Code No.	Allowable Speed rpm	R C F × g	Adaptor Code No.	Cushion Code No.	Maximum Radius R cm	Allowable load gram *3
10	16	GL PL	15-17.2 × 86-110	R	Vacutainer tube	5,000	4,640	—	024-1400	16.6	130
15	16	PL	17 × 121	C	Conical tubes FALCON etc.			055-1270 *4	Use bucket without cushion.		
15	16	GL	15-17.2 × 86-110	R	052-6330			—	024-1400		

*1 PL : Plastic GL : Pyrex Glass

*2 C : Conical R : Round type

*3 Allowable load per bucket.
This load includes the weight of the sample, adaptor, cushion, tube, cap, etc.
The weight of bucket is not included in the allowable load.

*4 Be sure to remove the cushion and then use the adaptor.

NOTE

Our company cannot accept responsibility for any accidents that are caused by unauthorized retrofit of the rotor or bucket, or that result from the use of an unspecified adapter.