

General Radiography System

# **RADspeed Pro**

Standard Maintenance Procedures



## Introduction

Thank you for choosing a Shimadzu product. This product is classified as **special maintenance management medical equipment**. And it is requiring specialist knowledge and skills for maintenance, repairs, and other management.

Medical institutions are responsible for maintenance of special maintenance management medical equipment and they have a responsibility to perform maintenance based on established inspection plans. However, it is permitted to outsource maintenance work to a party authorized to provide repair for medical equipment (repairer authorized to repair special maintenance management medical equipment).

The Shimadzu service centers have skilled technicians with much experience. And they have specialist knowledge of medical equipment. These centers are ready to provide the customer with maintenance that the customer can rely on with confidence. Since maintenance items for this product include items that may be dangerous if undertaken by the customer, please let these maintenance items be handled by the skilled technicians at the Shimadzu sales and service centers.

### 1. Maintenance Procedure Manual

This maintenance procedure manual provides descriptions of the inspection items required for safe and confident utilization of this product, including details of each item, and the checks and handling methods required for them.

Maintaining the safety and effectiveness of the increasingly sophisticated medical equipment that has appeared in recent years is an extremely important part of providing superior medical care for patients. Appropriate maintenance operations based on this maintenance procedure manual are absolutely essential for maintaining medical equipment performance and assuring safety.

### 2. Medical Equipment Safety Management Supervisor

According to a revision of Japanese Medical Service Act (a law for partial amendments to the Medical Service Act and other laws in order to establish a system to provide quality medical services, Act No. 84 of 2006), managers of hospitals and other medical institutions now have a responsibility to have a supervisor for safe use of medical equipment (medical equipment safety management supervisor). Medical equipment safety management supervisors need to be a full-time employee with sufficient experience and knowledge about appropriate usage of medical equipment, maintenance procedures, and medical equipment and have necessary qualifications.

According to the law, medical equipment safety management supervisors have a responsibility to establish a system for safety management of all medical equipment managed by hospitals or other medical institutions determined by Japanese Pharmaceutical Affairs Law. They also need to make a plan for maintenance procedures for medical equipment under instructions of the manager of the respective hospital or other medical institution and implement the plan appropriately as their duties.

### 3. Adoption of Maintenance Plans, and Suitable Implementation

Implementation of maintenance requires consulting the maintenance items noted in documentation attached to the equipment, and then adopting an inspection plan. Moreover, maintenance plans should be adopted for each model type, and they should include records of the implementation schedule, the name of the medical equipment, the name of the manufacturer and seller, the model, the implementation conditions, and the inspection and repair details.

In addition, the medical equipment characteristics should be taken into account for evaluation of maintenance implementation conditions, usage conditions, and repair conditions, etc., and for reviews of maintenance plans from the standpoint of medical safety.

## 4. Precautions During Maintenance

Maintenance can be categorized into daily maintenance (inspections before work and inspections after work) and periodic maintenance.

Daily inspections shall be performed in accordance with items noted in the Instruction Manual and other documentation attached to the equipment, and implemented by people who are familiar with the equipment. Daily maintenance checklists for each equipment are available. To obtain one, please contact the Shimadzu sales and service centers.

Periodic inspection items include operation checks, adjustments, fine-tuning, replacement of deteriorated parts, and cleaning, to ensure safe and stable equipment operations and to maintain performance. If not implemented, it can result in shortening equipment service life and the occurrence of serious accidents. Since these inspections involve many items inside the equipment, inspection undertaken by the customer could be dangerous. Therefore, please outsource periodic maintenance work to a repairer authorized to repair special maintenance management medical equipment.

## 5. Periodic Inspections (Content, Methods, Items, and Timing)

The details, methods, items, and timing of periodic inspections for this product are described in the attached Maintenance Procedures.

Refer to the attached Safety Inspection Procedures when conducting selected safety-related maintenance works.

## 6. Periodic Replacement Parts and Consumables Lists, and Replacement Timing and Methods

While equipment performance is at its peak at time of delivery, accuracy can deteriorate over time due to parts deterioration and wear, etc., resulting in a steady degradation of equipment performance that can lead to poor image quality and reduced equipment operation efficiency. To ensure safe, confident use of the equipment, periodic replacement of parts with limited lifetimes is needed to maintain the equipment's initial performance at time of delivery.

The attached Maintenance Replacement Parts List provides lists of replacement parts and consumables for this equipment, as well as the replacement period. Since replacement of parts and consumables could be dangerous if undertaken by the customer, it is better to ask the Shimadzu sales and service centers for replacement, together with your requests for maintenance.

## 7. Inquiries Related to Maintenance

Contact your Shimadzu sales and service center for inquiries related to maintenance.

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# RADspeed Pro General Radiography System

## Maintenance Procedures

This procedure manual is applicable to the maintenance operations for the RADspeed Pro general radiography system.

For the maintenance operations of the system components configuring the mechanical units (ceiling-mounted X-ray tube support, bucky stand, and bucky table), refer to separate materials.

This procedure manual consists of Pre-Maintenance Check Items, Inspection Data Measurement Procedures, Image Quality Adjustment Data Measurement Procedures, Maintenance Procedures, and Maintenance Report.

Follow this procedure manual to implement maintenance, and enter the results in the Maintenance Report.

The Maintenance Report consists of a cover sheet, internal cover sheets, system component list, inspection results reports, inspection data entry form, and image quality adjustment data entry forms.

### Pre-Maintenance Check Items

Before performing the inspection, check and prepare the following items.

- (1) Pre-maintenance preparation, (2) Inspection items, (3) Inspection content, (4) Inspection method,
- (5) Safety-related operations, (6) Inspection cycle, (7) Maintenance report,
- (8) Standard operation time, (9) Other precautions

#### (1) Pre-Maintenance Preparation

- 1) Check the previous maintenance report, service report, and daily operations report, etc., to grasp the system conditions.
- 2) Notify the customer of the current inspection items, and obtain approval for them. In addition, prepare the parts scheduled to be replaced.
- 3) Prepare the maintenance procedures, maintenance report (for entry of inspection report), and inspection completion certification.
- 4) Prepare the tools, consumable parts, and measuring instruments listed below that are required for inspection. (Check in advance that the measuring instruments operate correctly.)

No.	Tools, Consumable Parts, etc.	Qty	Remarks	No.	Tools, Consumable Parts, etc.	Qty	Remarks
1	Standard tool set	1		11	"Periodic inspection in progress" sign	1	
2	High voltage cable tightening tool	1		12	Screw storage box	1	For temporary storage of removed screws
3	Packing	1		13	Anhydrous ethanol, wipes, cleaner, etc.	1	
4	Silicon grease	1		14	Lubricating oil, grease, Loctite, blowers, etc.	1	
5	Acrylic phantom (30 cm)	1		15	Vacuum cleaner	1	Use as needed.
6	Test chart (penetration chart)	1		16	Static electricity prevention kit	1	Use as needed.
7	Head and chest phantom	1	Use as needed.	17	Sheet	1	
8	Computer	1	Use as needed.	18	Light	1	
9	Li film, storage box	1	Use as needed.	19	Digital camera	1	Use as needed.
10	Lead apron	1					

No.	Measuring Instruments, etc.	Qty	Remarks	No.	Measuring Instruments, etc.	Qty	Remarks
1	Thermohygrometer	1	Example: TH-101 data logger	7	Tube voltage gauge	1	Use as needed.
2	Insulation resistance gauge	1	Example: HIOKI 3119 or equivalent	8	Tube current gauge	1	Use as needed.
3	Digital multimeter	1	Example: Fluke 87 series or equivalent	9	mAs gauge	1	Use as needed.
4	Oscilloscope	1	With storage function of 100 MHz or more	10	Dosimeter	1	Use as needed.
5	Densitometer	1	Use as needed.	11	Earthing resistance measurement device	1	Use as needed.
6	Sensitometer (exposure meter)	1	Use as needed.				

## (2) Inspection Items

- Inspection items are as listed below.

1) Installation environment	2) Power supply	3) Equipment conditions
4) X-ray tube unit	5) X-ray generator	6) Imaging unit
7) Imaging unit	8) Image processing unit	9) Accessory equipment, and others

- Perform inspections for items marked with an asterisk in the inspection cycle column in the Maintenance Procedures.

## (3) Inspection Content

- For inspection content, see the inspection content column in the Maintenance Procedures.

## (4) Inspection Method

- Implement the inspection according to the following methods.
  - 1) Operation: Operate the equipment to perform inspections.
  - 2) Visual, etc.: Visually inspect, listen for operation noises, etc., using the five senses to perform inspections.
  - 3) Measuring instruments: Use measuring instruments, tools, test charts, phantoms, and consumable parts, etc., to perform inspections, checks, and adjustments.
- Use the methods marked with a circle in the inspection method column in the Maintenance Procedures, to perform inspections.

## (5) Safety-Related Operations

- Safety-related operations are noted by an "@" added to the safety column in the Maintenance Procedures.

## (6) Inspection Cycle

- Periodic inspections are classified as being performed twice a year, with a cycle of every six months.
- If a periodic inspection is performed once a year, treat it as a fourth period item in the inspection cycle column in the Maintenance Procedures.

## (7) Maintenance Report

- 1) The Maintenance Report consists of a cover sheet, internal cover sheets, system component list, inspection results reports, inspection data entry forms, and image quality adjustment data entry forms.
- 2) The inspection results report uses the following codes to report the inspection results.  
A: Normal, B: Adjusted, C: Repaired, D: Replaced, E: Cleaned, F: Filled oil, G: Special notes, /: Not applicable
- 3) For locations marked with a circle in the measurement value entry column of the inspection results report, enter measurement values into the Inspection Data Entry Form.  
For data measurement, see the Inspection Data Measurement Procedures.
- 4) Enter any items that need a special report in the special notes column.

## (8) Standard Operation Time

- The standard operation time for these procedures is one day (8 hours) for one person.

## (9) Other Precautions

- 1) Pay particular attention to tidiness, and ensure safe operations.
- 2) Post a "periodic inspection in progress" sign.
- 3) Before inspection, record the equipment usage conditions, and when the inspection is completed, restore the equipment to the pre-maintenance condition.  
In particular, do not forget to record the panel display and switch conditions! (A digital camera plus notebook PC is very convenient!)
- 4) When switching on the equipment power during inspection operations, first check the safety of fellow workers before switching on the power.
- 5) When the operation is completed, clean up the equipment.
- 6) When the operation is completed, perform a systems operation check.
- 7) When the operation is completed, check the number of all measuring instruments and tools, etc.

# Inspection Data Measurement Procedure

## 1. Introduction

Some maintenance items require the use of measuring instruments to perform inspections.

Precautions are shown for these items when taking data. In addition, the measurement procedures and equipment settings during measurement are also shown.

See the procedures in this manual to perform the measurement, and then enter the data in the Inspection Data Entry Form.

## 2. Precautions

- 2-1 If the measured data values show fluctuation, record the average value as the measured value.
- 2-2 Values to be adjusted should meet the values prescribed by JIS (e.g. Z 4702 and 4703). When values are measured based on other standards, follow the standards and record the title of the respective standards.
- 2-3 If the values set in the Inspection Data Form are changed due to changes in the equipment specifications, enter the changed values in the form.

## 3. Data Measurement Procedures (Power Voltage, Radiography, and Automatic Exposure)

### 3-1 Power supply

Measurement points: Measure the voltage at the following two points.  
High voltage instrument power input points (3-phase 400 V or 200 V)  
T1-40 transformer front terminal block X2 L0–L100 (single phase 100 V)

Measurement method: Measure with a voltmeter (RMS). If the value fluctuates over time, also enter the amplitude of fluctuation.

Tolerated value: Must be within the range of toleration ( $\pm 10\%$ ) in the equipment specifications. (Refer to 2.4 in the Installation Manual.)

Remarks: The RMS value is the total amount of heat consumed at resistance when the sine wave voltage is measured, which corresponds to the DC voltage consuming the same amount of heat. (RMS: Root Mean Square)

### 3-2 Radiography

#### a) Radiography tube voltage

Measurement points: Measure the radiography tube voltage at the following two points.

- i) 60 kV, 0.1 sec, 80 % of the selectable maximum tube current (1 step down from the maximum)
- ii) 100 kV, 0.1 sec, 80 % of the selectable maximum tube current (1 step down from the maximum)

Measurement method: On the UD CONT2002/2002X board CP32 TKV (1 V/20 kV), use an oscilloscope for measurement.

Tolerated value: Must be within the range ( $\pm 10\%$ ) prescribed by JIS. If not in range, it needs readjustment.

#### b) Radiography tube current

Measurement points: Measure the radiography tube current at the following two points (large focus and small focus).

- i) 100 kV, 0.1 sec, selectable minimum tube current
- ii) 80 kV, 0.1 sec, 80 % of the selectable maximum tube current (1 step down from the maximum)

Measurement method: On the UD CONT2002/2002X board CP13 TMA (1 V/200 mA), use an oscilloscope for measurement.

Tolerated value: Must be within the range ( $\pm 20\%$ ) prescribed by JIS. If not in range, it needs readjustment.

## c) Radiography time

Measurement points: Measure the radiography time at the following two points.

- i) 100 kV, 32 msec, any tube current
- ii) 100 kV, 0.1 sec, 80 % of the selectable maximum tube current (1 step down from the maximum)

Measurement method: On the UD CONT2002/2002X board CP32 TKV (1 V/20 kV), use an oscilloscope to monitor the radiography tube voltage waveform, and measure the radiography time.

Tolerated value: Must be within the range ( $\pm (10 \% + 1 \text{ ms})$ ) prescribed by JIS.

## d) Radiography tube current time product

Measurement points: Measure the radiography tube current time product at the following two points.

- i) 100 kV, 0.5 mAs
- iii) 60 kV, 100 mAs

Measurement method: On the UD CONT2002/2002X board CP13 TMA (1 V/200 mA), use an oscilloscope for measurement the tube current waveform, and calculate the  $\text{mA} \times \text{s}$  (sec).

Tolerated value: Must be within the range ( $\pm (10 \% + 0.2 \text{ mAs})$ ) prescribed by JIS.

## 3-3 Fluoroscopy

## a) Fluoroscopy tube voltage

Measurement points: Measure the tube voltage at the 115 kV and 75 kV points.

Measurement method: On the UD CONT2002/2002X board CP32 TKV (1 V/20 kV), use an oscilloscope or PC for measurement.

Tolerated value: Must be within the range ( $\pm 10 \%$ ) prescribed by JIS. If not in range, it needs readjustment.

## b) Fluoroscopy tube current

Measurement point: Measure the tube current at 60 kV.

Measurement method: On the UD CONT2002/2002X board CP13 TMA (DC fluoroscopy 1 V/1 mA, Pulse fluoroscopy 1 V/10 mA), use an oscilloscope or PC to measure the tube current waveform.

Tolerated value: Must be within the range ( $\pm 20 \%$ ) prescribed by JIS. If not in range, it needs readjustment.

## 3.4 Automatic exposure

## a) Bucky radiography with phototimer

Use phantoms (e.g.: 5 cm, 10 cm, 15 cm, 20 cm, etc.) corresponding to chest front, side, and general abdomen radiography, and other objects, to perform phototimer radiography in the X-ray conditions (e.g.: 80 kV, 20 mAs, SID 120 cm) used at the hospital, and record the radiography time that was actually measured.

In addition, develop the radiography film and measure the density. (Use the same development condition and densitometer each time.)

# Image Quality Adjustment Data Measurement Procedures

## 1. Introduction

For the maintenance items related to image quality inspection and adjustment, precautions for data acquisition are described. In addition, the measurement procedures and equipment settings during measurement are also described.

See the procedures in this manual to perform the measurement, and then enter the data in the image quality adjustment data entry forms.

## 2. Image Quality Adjustment Data Entry Forms

The image quality adjustment data entry forms consist of the following five sheets.

2-1 AEC ADJUST DATA (Adjustment)

2-2 Resolution

2-3 Software Version

2-4 UD150B-40 Initial Setting Data Sheet (UD Initial Setting)

## 3. Precautions

3-1 If the measured data values show fluctuation, record the average value as the measured value.

3-2 If the values set in the Inspection Data Form are changed due to changes in the equipment specifications, enter the changed value in the form.

3-3 Suspension wire

Check that wires are not damaged or frayed (splayed). Check that there are no abnormalities in terminal processing.

Wire condition can be inspected by rubbing it with a cloth.

Also, check that the same tension is applied on two wires (one should not be longer than the other).

3-4 Screw tightness check on each unit

Check tightness of the mounting screws for fixing each unit.

3-5 Operation check for each operating unit

Operate each operating unit and then check that there are no abnormalities in noise, vibration, change in application force, braking force, click stop and other operations.

If any abnormalities are detected, adjust them.

## 4. Data Measurement Procedures

4-1 Power supply voltage

Measure voltage with a voltmeter (RMS). If the value fluctuates over time, also enter the amplitude of fluctuation.

4-2 Air-conditioning

Acquire data and check that it operates within the conditions prescribed in the equipment specifications.

## Maintenance Procedures

- Before starting the inspection operation, post a "periodic inspection in progress" sign in a location where it is easy to see.

No.	Inspection Item	Inspection Content	Inspection Method					Safety	Inspection Cycle	
			Operation	Visual Check, etc.	Cleaning	Replacement	Measuring Instrument		First Time	Second Time
<b>1 Checking installation environment</b>										
(1)	X-ray exposure indicator	Check that the indicator is lighted correctly during use. If defective, report to the facility manager.		O				@	*	*
(2)	Temperature and humidity	Measure the temperature and humidity (for the allowed range, refer to the specifications for the equipment to be inspected).					O		*	*
<b>2 Checking equipment usage status</b>										
(1)	Equipment appearance	Check for major contamination or damages on each unit.		O					*	*
(2)	Nameplate	Check for missing nameplate, or for contamination or damages.		O	O				*	*
(3)	Surrounding environment of the equipment	Check for obstructions around the equipment.		O				@	*	*
<b>3 Checking the power source and grounding</b>										
(1)	Power supply voltage measurement	Use a digital multimeter to measure the power source (single phase 100 V/200 V; three-phase 200 V/400 V) for each equipment.					O		*	*
(2)	Grounding wire connection	Check the grounding wire.	O					@	*	*

## Maintenance Procedures

No.	Inspection Item	Inspection Content	Inspection Method				Safety	Inspection Cycle	
			Operation	Visual Check, etc.	Cleaning	Replacement		First Time	Second Time
<b>4 X-ray generator</b>									
(1)	Starter operation	Check that there are no abnormalities in operation.	○						*
(2)	Radiography operation	Check that there are no abnormalities in operation.	○					*	*
(3)	Fluoroscopy operation	Check that there are no abnormalities in operation.	○					*	*
(4)	Tube voltage precision and reproducibility	Measure the tube voltage. • For details, see 3-2 and 3-3 in the Inspection Data Measurement Procedures.				○			*
(5)	Tube current precision and reproducibility	Measure the tube current. • For details, see 3-2 and 3-3 in the Inspection Data Measurement Procedures.				○			*
(6)	Tube current precision and reproducibility	Measure the tube current. • For details, see 3-2 and 3-3 in the Inspection Data Measurement Procedures.				○			*
(7)	Radiography time precision and reproducibility	Measure the radiography time. • For details, see 3-3 in the Inspection Data Measurement Procedures.				○			*
(8)	Radiography tube current time product precision and reproducibility	Measure the radiography tube current time product. • For details, see 3-3 in the Inspection Data Measurement Procedures.				○			*
(9)	High voltage cables and bushing	Remove the bushing, and check for discharge marks and abnormalities in packing, etc. Also, wipe away old grease, replace packing, and apply grease.		○	○				*
(10)	Control circuit	Measure connectors, control operation, and standard voltage of the CPU board.	○						*
(11)	Automatic exposure	Check that the densities are constant under the radiography conditions determined at installation.	○					*	*
(12)	Area dosimeter	Check the area dosimeter.	○			○		*	*
(13)	Check the contactor cable fastening screw	Check the screws that fasten the cable. (MG-L, MG-RS, MG-C, MG-D, MG-F(option))		○			@	*	*

## Maintenance Procedures

No.	Inspection Item	Inspection Content	Inspection Method					Safety	Inspection Cycle	
			Operation	Visual Check, etc.	Cleaning	Replacement	Measuring Instrument		First Time	Second Time
5	X-ray tube unit									
(1)	X-ray tube unit conditions	Check that there are no abnormalities in the appearance of X-ray tube unit and its rotating sound.		○				@	*	*
(2)	X-ray tube unit attachment	Check that the X-ray tube unit attachments are not loose or wobbly and have no problems.		○					*	*
(3)	High voltage cables and bushing	Remove the bushing, and check for discharge marks and abnormalities in packing, etc. Also, wipe away old grease, replace packing, and apply grease.		○		○				*
6	Collimator									
(1)	Open/close mechanism	Check the operation noise and wire rope conditions.	○	○					*	*
(2)	Effective field of view	Check the field of view.		○				@	*	*
(3)	Main unit fixing	Check tightness of the main unit fixing screws.		○				@		*
(4)	Camera unit fixing (Option)	RC-300 only. Perform the "Camera Calibration" described in the RC-300 Installation Instructions.		○						*

## Maintenance Procedures

No.	Inspection Item	Inspection Content	Inspection Method					Safety	Inspection Cycle	
			Operation	Visual Check, etc.	Cleaning	Replacement	Measuring Instrument		First Time	Second Time
<b>7 Interlocking equipment</b>										
(1)	Operations	Check that there are no abnormalities in operating noise.	<input type="radio"/>	<input type="radio"/>					*	*
(2)	Stopping accuracy	Check the stopping conditions (positions, etc.).	<input type="radio"/>					@	*	*
(3)	Operations of a brake and clutch	Check the conditions of a brake and clutch. Replace them if they are worn out.	<input type="radio"/>			<input type="radio"/>		@		*
(4)	Tension and lubrication of belts	Check the belt conditions and apply grease as needed.	<input type="radio"/>						*	*
(5)	Emergency stop switch operation	Check the emergency stop switch operation.		<input type="radio"/>				@	*	*
(6)	Tightness of screws for mounting a motor, etc.	Check tightness of the fixing screws.		<input type="radio"/>				@		*
<b>8 Tube support (first unit)</b>										
(1)	Column vertical movement	Check vertical movement, noise, and stopping conditions.	<input type="radio"/>						*	*
		Check the wire rope conditions.		<input type="radio"/>				@	*	*
		Check tightness of screws for mounting each unit of a column.	<input type="radio"/>					@	*	*
(2)	Right/left and back/forth movement	Check right and left movement, noise, and stopping conditions.	<input type="radio"/>						*	*
		Check the center-finder operation.	<input type="radio"/>							*
		Check tightness of screws for mounting rails and bearings.	<input type="radio"/>					@		*
(3)	Tube rotation around vertical axis	Check rotation, noise, and stopping conditions.	<input type="radio"/>						*	*
		Check the index position.	<input type="radio"/>							*
		Check tightness of screws for mounting a tube support.	<input type="radio"/>					@		*
(4)	Tube rotation	Check rotation, noise, and stopping conditions.	<input type="radio"/>						*	*
		Check the index position.		<input type="radio"/>						*
		Check the angle display.	<input type="radio"/>						*	*
		Check tightness of screws for mounting a rotating part on a tube.	<input type="radio"/>					@		*
(5)	Operation switches and monitor display	Check the switch operation.	<input type="radio"/>							*
		Check the contact of terminals and connectors.	<input type="radio"/>							*
		Check the monitor display.		<input type="radio"/>						*
(6)	Spring balance	Measure the amount of hanging down of the X-ray tube when unlocked from the upper end of the vertical stroke not combined with power assist: 150 mm or less combined with power assist: 60 mm or less	<input type="radio"/>							*

## Maintenance Procedures

No.	Inspection Item	Inspection Content	Inspection Method					Safety	Inspection Cycle	
			Operation	Visual Check, etc.	Cleaning	Replacement	Measuring Instrument		First Time	Second Time
9 Tube support (second unit)										
(1)	Column vertical movement	Check vertical movement, noise, and stopping conditions.	○						*	*
		Check the wire rope conditions.		○				@	*	*
		Check tightness of screws for mounting each unit of a column.	○					@	*	*
(2)	Right/left and back/forth movement	Check right and left movement, noise, and stopping conditions.	○						*	*
		Check the center-finder operation.	○							*
		Check tightness of screws for mounting rails and bearings.	○					@		*
(3)	Tube rotation around vertical axis	Check rotation, noise, and stopping conditions.	○						*	*
		Check the index position.	○							*
		Check tightness of screws for mounting a tube support.	○					@		*
(4)	Tube rotation	Check rotation, noise, and stopping conditions.	○						*	*
		Check the index position.		○						*
		Check the angle display.	○						*	*
		Check tightness of screws for mounting a rotating part on a tube.	○					@		*
(5)	Operation switches and monitor display	Check the switch operation.	○							*
		Check the contact of terminals and connectors.	○							*
		Check the monitor display.		○						*
(6)	Spring balance	Measure the amount of hanging down of the X-ray tube when unlocked from the upper end of the vertical stroke not combined with power assist: 150 mm or less combined with power assist: 60 mm or less	○							*

## Maintenance Procedures

No.	Inspection Item	Inspection Content	Inspection Method					Safety	Inspection Cycle	
			Operation	Visual Check, etc.	Cleaning	Replacement	Measuring Instrument		First Time	Second Time
10	Horizontal bucky									
(1)	Tabletop vertical movement	Check vertical movement, noise, and stopping conditions.	○						*	*
		Stopping accuracy	○							*
		Check the belt conditions.		○				@	*	*
		Check the gear (screw rod) conditions and apply grease as needed.		○				@		*
		Check the emergency stop switch operation.	○					@	*	*
(2)	Tabletop slide	Check vertical movement, noise, and stopping conditions.	○							*
		Check tightness of screws for mounting rails and bearings.		○				@		*
(3)	Bucky support	Check vertical movement, noise, and stopping conditions.	○							*
		Check tightness of screws for mounting rails and bearings.		○				@		*
(4)	Bucky unit	Check grid movement, noise, and stopping conditions.	○							*
		Check the grid attachment and removal.	○							*
11	Vertical bucky									
(1)	R/F table slide	Check vertical movement, noise, and stopping conditions.	○						*	*
		Check the wire rope conditions. Replace it if it is damaged.		○				@		*
		Check tightness of screws for mounting rails and bearings.		○				@	*	*
(2)	Bucky unit	Check grid movement, noise, and stopping conditions.	○							*
		Check the grid attachment and removal.	○							*
12	Checking overall system operations									
(1)	Overall operations after inspection	Check the radiography operation.	○						*	*
		Check linked operations with related equipment.	○							*

General Radiography System  
**RADspeed Pro**  
Maintenance Replacement Parts List

## Maintenance Contract Periodic Replacement Parts List

Instrument Name: UD150B-40L-40L-40E/F

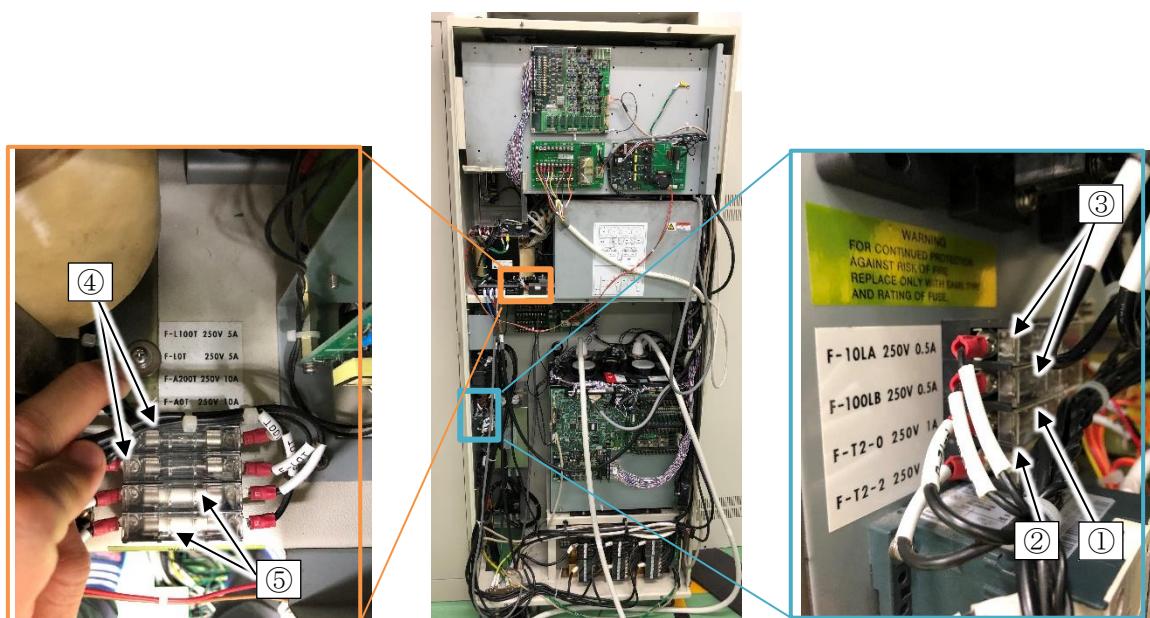
### Battery

No.	P/N	Part Name	Remarks	B-40 Every 2 years	L-40 Every 2 years	L-40E/F Every 2 years
1	565-13276	CR2450	Use in UD CONT PBC	1	1	1

### Fuse (Control cabinet)

No.	P/N	Part Name	Model name	Remarks	B-40 Every 2 years	L-40 Every 2 years	L-40E/F Every 2 years
1	072-01664-20	FUSE, 313 001P	F-T2-0	1A/250VAC *	1	1	1
	072-01659-12	FUSE, FLQ1(ROHS)		1A/500VAC *			
2	072-01664-20	FUSE, 313 001P	F-T2-2	1A/250VAC *	1	1	1
	072-01659-12	FUSE, FLQ1(ROHS)		1A/500VAC *			
3	072-01664-15	FUSE313.500P	F-10LA	0.5A/250VAC	1	1	1
	072-01664-15	FUSE 313.500P	F-100LB	0.5A/250VAC	1	1	1
4	072-01664-33	FUSE 313 005	F-L0T	5A/250VAC	1	1	1
	072-01664-33	FUSE 313 005	F-L100T	5A/250VAC	1	1	1
5	072-01665-34	FUSE 326 010	F-A0T	10A/250VA	1	1	1
	072-01665-34	FUSE 326 010	F-A200T	10A/250VA	1	1	1

\* : It is an alternative. Please exchange for the same type of item as before the exchange.



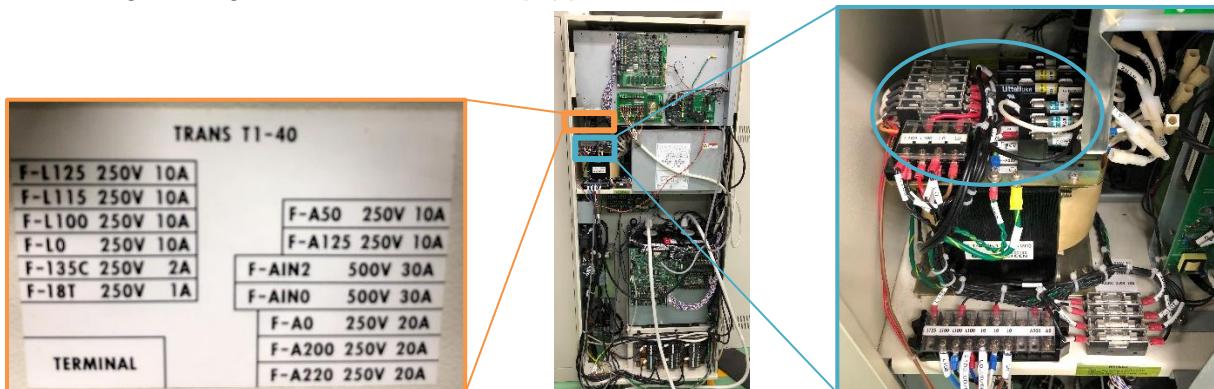
## Fuse (High voltage transformer T1-40) \*

No.	P/N	Part Name	Model name	Remarks	B-40 Every 2 years	L-40 Every 2 years	L-40E/F Every 2 years
1	072-01665-34	FUSE 326 010	F-L0	10A/250VAC	1	1	1
2	072-01665-34	FUSE 326 010	F-L100	10A/250VAC	1	1	1
3	072-01665-34	FUSE 326 010	F-L115	10A/250VAC	1	1	1
4	072-01665-34	FUSE 326 010	F-L125	10A/250VAC	1	1	1
5	072-01659-38	FUSE FLQ30	F-A IN0	30A/500VAC	1	1	1
6	072-01659-38	FUSE FLQ30	F-A IN2	30A/500VAC	1	1	1
7	072-01659-86	FUSE FLM20	F-A0	20A/250VAC	1	1	1
8	072-01665-34	FUSE 326 010	F-A50	10A/250VAC	1	1	1
9	072-01665-34	FUSE 326 010	F-A125	10A/250VAC	1	1	1
10	072-01659-86	FUSE FLM20	F-A200	20A/250VAC	1	1	1
11	072-01659-86	FUSE FLM20	F-A220	20A/250VAC	1	1	1
12	072-01664-26	FUSE 313 002	F-135C	2A/250VAC	1	1	1
13	072-01664-20	FUSE 313 001	F-18T	10A/250VAC	1	1	1

## Fuse (High voltage transformer T1-40X) \*

No.	P/N	Part Name	Model name	Remarks	B-40 Every 2 years	L-40 Every 2 years	L-40E/F Every 2 years
1	072-02041-01	FUSE, AC500VBL1030T*	F-A-200	20A/500VAC	1	1	1
2	072-01665-34	FUSE 326 010	F-A125	10A/250VAC	1	1	1
3	072-01665-34	FUSE 326 010	F-A50	10A/250VAC	1	1	1
4	072-01659-86	FUSE FLM20	F-A0	20A/250VAC	1	1	1
5	072-01659-88	FUSE FLM30	F-AIN0	30A/250VAC	1	1	1
6	072-01659-88	FUSE FLM30	F-AIN2	30A/250VAC	1	1	1
7	072-01664-20	FUSE 313 001	F-18T	1A/250VAC	1	1	1
8	072-01664-26	FUSE 313 002	F-135C	2A/250VAC	1	1	1
9	072-01665-34	FUSE 326 010	F-L0	10A/250VAC	1	1	1
10	072-01665-34	FUSE 326 010	F-L100	10A/250VAC	1	1	1
11	072-01665-34	FUSE 326 010	F-L115	10A/250VAC	1	1	1
12	072-01665-34	FUSE 326 010	F-L125	10A/250VAC	1	1	1

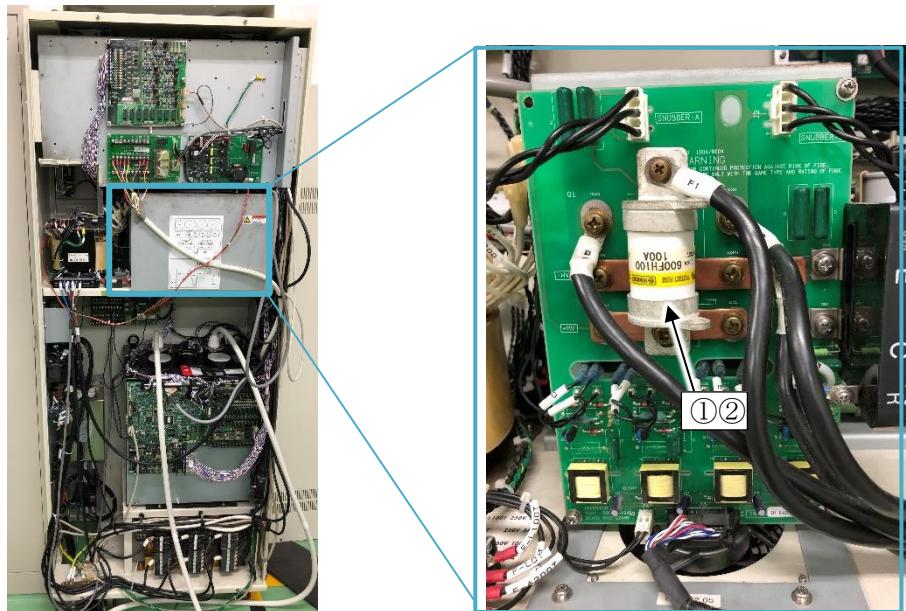
\* : The High voltage transformer T1 is equipped with either T1-40 or T1-40X.



**Fuse (IGBT unit)**

No.	P/N	Part Name	Model name	Remarks	B-40 Every 2 years	L-40 Every 2 years	L-40E/F Every 2 years
1	072-06033-09	FUSE 600FH	F1A	125A/600VAC	1	1	1
2	072-06037-10	FUSE 660GH-125	F1B*	125A/660VAC	1	1	-

\* : UD150B-40 and UD150BC-40 only.

**Fuse (XAT-2H, Option)**

Not used in RADspeed Pro.

**Hand switch**

No.	P/N	Part Name	Remarks	B-40 Every 2 years	L-40 Every 2 years	L-40E/F Every 2 years
1	571-64129	HAND SWITCH, C2U-23	Illumination type	1	1	-
	571-64136	HAND SWITCH, C2U-24		-	-	1

Contactor<sup>※1</sup>

No.	P/N	Part Name	Remarks	B-40 Every 8 years	L-40 Every 8 years	L-40E/F Every 8 years
1	065-40001-05	SCN2AC100V2A2B <sup>※2</sup>	MG-L/MG-RS	2	2	2
	065-41137-01	MC-40A AC100V <sup>※3</sup>				
2	065-41136-01	MR-4 AC100V 4 <sup>※4</sup>	MG-C	1	1	1
3	065-40262-01	SH-5AC100V1A4B <sup>※5</sup>	MG-D	1	1	1
4	065-40001-05	SCN2AC100V2A2B <sup>※2</sup>	MG-F(Fluoro option)	1	1	1

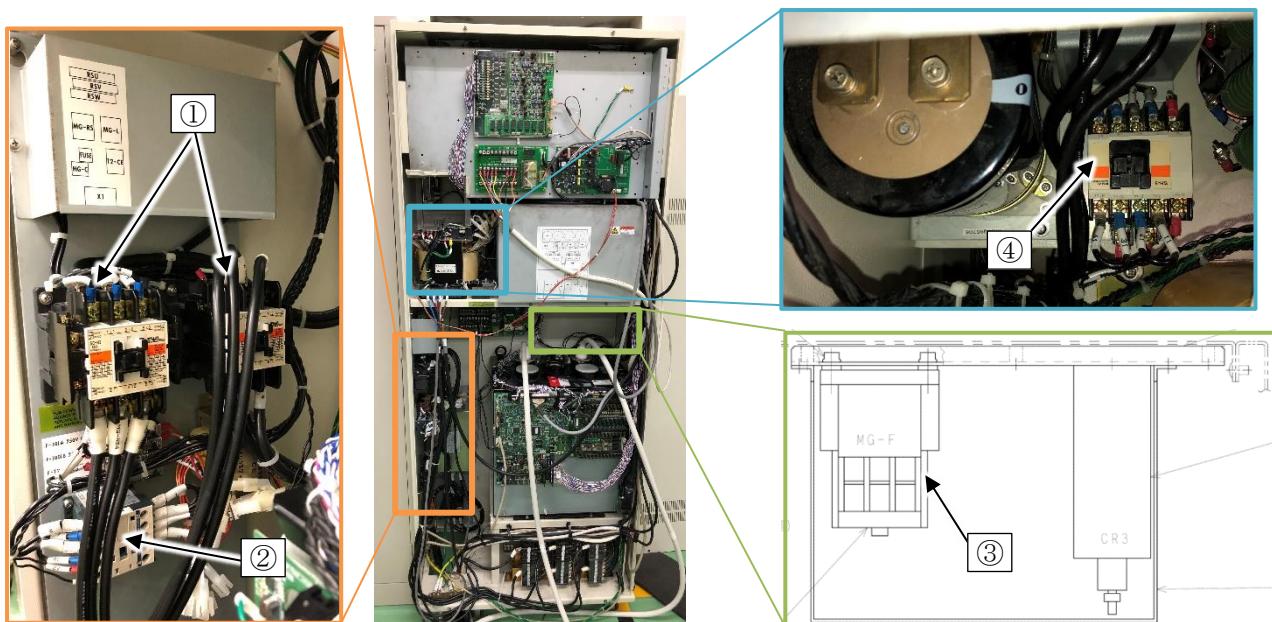
※1 : Please replace to the same model as the one installed on the unit.

※2 : If the installed product is "065-40001-01 SCN2AC100V2A2B", replace it with this contactor.

※3 : If the installed product is "065-41133-01 GMC-40 AC100V", replace it with this contactor.

※4 : If the installed product is "065-41134-01 GMR-4 4A AC100V", replace it with this contactor.

※5 : If the installed product is "065-40261-01 SH-5AC100V1A4B", replace it with this contactor.



Maintenance Contract Periodic Replacement Parts ListInstrument Name: CH-200

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 1 years	Every 2 years	Every 5 years	Every 10 years
1	072-01664-37	Fuse,313010	10A/32VAC		1		
2	072-01664-33	Fuse,313005	5A/250VAC		2		
3	062-65012-03	Lamp、JM12V106W5H	R-300 For Halogen type	1			
4	565-13276	CR2450	Use in CHC PCB		1		
5	563-64883-01	Sub Wire Pulley Assy					1
6	563-64883-02	Sub Wire Pulley Assy					1
7	563-72780	Wire Rope, 7x19 (φ2.38)				2	

Maintenance Contract Periodic Replacement Parts ListInstrument Name: CH-200M

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 1 years	Every 2 years	Every 5 years	Every 10 years
1	072-01664-37	Fuse,313010	10A/32VAC		1		
2	072-01664-33	Fuse,313005	7A/250VAC		2		
3	062-65012-02	Lamp、JM12V100W10H	R-20J For Halogen type		1		
4	563-64883-01	Sub Wire Pulley Assy					1
5	563-64883-02	Sub Wire Pulley Assy					1
6	563-72780	Wire Rope, 7x19 (φ2.38)				2	
7	565-13276	BATTERY, CR2450	Use in CH DRIVER18 PCB		1		

Maintenance Contract Periodic Replacement Parts ListInstrument Name: BR-120M/120

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 2 years	Every 3 years	Every 5 years	Every 10 years
1	566-24706-02	Wire RopeASSY					2
2	570-67002	Electric Magnet				2	
3	072-01664-20	Fuse,313001	1A/250VAC	2			

Instrument Name: BR-120T

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 2 years	Every 3 years	Every 5 years	Every 10 years
1	566-24706-03	Wire RopeASSY					2
2	570-67002	Electric Magnet				2	
3	072-01664-20	Fuse,313001	1A/250VAC	2			
4	563-78431-01	Tilt operation wire			1		

Maintenance Contract Periodic Replacement Parts ListInstrument Name: FH-20HR/HS FH-21HR/HS

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 1 years	Every 2 years	Every 5 years	Every 10 years
1	072-01664-30	Fuse, 313 003	3A/250VAC		2		
2	566-24706-01	Wire ASSY, FH					2

Maintenance Contract Periodic Replacement Parts ListInstrument Name: BK-200/BK-120

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 1 years	Every 2 years	Every 5 years	Every 10 years
1	032-21301-30	V-Belt2-5MS650				1	
2	072-01664-34	Fuse,313005			1		
3	072-01664-35	Fuse, 313007			1		
4	563-58803-01	Potentio A Assy				1	

Maintenance Contract Periodic Replacement Parts ListInstrument Name: BK-120M/MK

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 1 years	Every 2 years	Every 5 years	Every 10 years
1	072-01664-20	Fuse,313001	1A/250VAC		2		
2	072-01664-33	Fuse,313005	5A/250VAC		2		
3	072-01664-30	Fuse,326005	5A/250VAC		2		
4	032-20609-08	V-Belt, Red M27				1	

Maintenance Contract Periodic Replacement Parts ListInstrument Name: BK-12H/BK-12HK/BKU-12Hi

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 1 years	Every 2 years	Every 5 years	Every 10 years
1	072-01664-20	Fuse,313001	1A/250VAC		2		

Maintenance Contract Periodic Replacement Parts ListInstrument Name: DR(U)-200

Breakdown of Parts

No.	P/N	Part Name	Remarks	Every 2 years
1	0742-60408	Fan,MU1225S-11	Inside Cabinet	3
2	072-01659-38	Fuse,FLQ30	Inside Cabinet	2
3	072-01659-83	Fuse,FLQ10	Inside Cabinet	1
4	072-01659-84	Fuse,FLQ12	Inside Cabinet	1

## Revision History

Rev.	Date	Revisions
First edition	Feb. 25, 2016	Newly created
A	Aug. 6, 2021	<ul style="list-style-type: none"> <li>Added maintenance procedure (13) for X-ray generator</li> <li>The description method of UD regular replacement parts has been significantly changed and regular replacement parts have been added.</li> <li>Corrected P / N errors in regular replacement parts and changed discontinued products to replacement products.</li> <li>Add parts information etc. to the remark column</li> </ul>
B	Sep. 30, 2021	Added CH spring balance check item
C	Apr. 8, 2022	<ul style="list-style-type: none"> <li>Added contactor type and notes</li> <li>Correction of errors</li> </ul>
D	Dec.1.2022	<ul style="list-style-type: none"> <li>Revise Periodical Replacement Parts</li> </ul>
E	Apr. 5, 2024	<p>Revised for RADspeed Pro SR-5 Version</p> <ul style="list-style-type: none"> <li>Added maintenance procedure No. 6(4). This is for camera option.</li> </ul> <p>Periodic replacement parts for BK120/200</p> <ul style="list-style-type: none"> <li>Corrected the replacement cycle for 032-21301-30 to 5 years from 10 years. 5 years is stated in the instruction manual (M511-E076).</li> </ul>