

[Maintenance Procedure]

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

Check Item	Check Details	Check Methods	Timing				Safety	Comments
			1	2	3	4		
1 Installation environment check								
(1) X-ray irradiation display lamp check	Check that the in-use display lamp is lighted correctly. If defective, report to the facilities manager.	Visual, etc.	*	*	*	*	@	
(2) Temperature and humidity measurement	Measure the temperature and humidity (for the allowed range, see the specifications for the equipment targeted for inspection). Example (ZUD-*40D/DS) Ambient temperature: 10 to 35°C, relative humidity: 30 to 75%	Measuring instrument	*	*	*	*		
2 Power supply check								
(1) Insulation resistance measurement	Switch off the power breaker and power supply, and measure the insulation resistance between the primary power line and the ground terminal. (2 MΩ minimum at 500 VDC) Measuring instrument: Insulation resistance gauge Measurement locations: (1)Between U and E, (2)Between V and E, (3)Between W and E, (4)Between L100 and E, (5)Between L0 and E	Measuring instrument				*	@	
(2) Power voltage measurement	Use a digital multimeter to measure the power source (single phase 100 V: Three-phase 200 V/400 V) for each equipment.	Measuring instrument	*	*	*	*		
(3) Ground wire check	Check whether the ground wire is loose.	Visual, etc.	*	*	*	*	@	
3 Unit condition check								
(1) Outward view of unit	Check for contamination or major scratches on each unit.	Visual, etc.	*	*	*	*		
(2) Unit nameplate	Check for missing nameplate, or for contamination or scratches.	Visual, etc.	*	*	*	*		
(3) Unit cleaning	Use cleaner to clean each unit.	Visual, etc.	*	*	*	*		
(4) Cable connection conditions check	Check the cable terminal and connector connections between each unit.	Visual, etc.	*	*	*	*		
(5) Cable conditions check	Check the conditions (rubbing, twisting, pulling, etc.) of cables connecting the units.	Visual, etc.	*	*	*	*		
(6) Unit fixing condition check	Check the floor fastening conditions. Check for looseness in nuts and bolts.	Visual, etc.	*	*	*	*	@	
(7) Surrounding environment for units	Check for obstructive objects around the units.	Visual, etc.	*	*	*	*	@	
(8) Interphone operation	Check for abnormalities.	Check the operation.	*	*	*	*		
(9) Caution displays	Check for operation limiting tape and caution nameplates.	Visual, etc.					@	

Check Item	Check Details	Check Methods	Timing				Safety	Comments
			1	2	3	4		
4 R/F table								
A R/F Table Unit								
A-1 Table up/down mechanism (for ZS-5DS only)	a. Check tension in roller chain	Place a ruler up against the upper surface of the chain between the sprockets, and rotate the gearbox by hand to see that there are no gaps.	*	*	*	*	@	Important Measurement position: See the ZS-5D/5DS Installation Manual
	b. Check sprocket	No scratches or abnormal shavings		*		*	@	
	c. Check chain coupling	Check clip insertion		*		*	@	
	d. Roller chain damage and lubrication	No abnormalities Apply grease after inspection		*		*	@	
	e. Overrun limit switch operation	Check for abnormalities.		*		*	@	
	f. Stop accuracy (Potentiometer operation)	Check for abnormalities.				*		
	g. Check for abnormal noise and vibration	Check for abnormalities.		*		*		
	h. Belt damage and tension	No abnormalities Replace if worn or damaged. Pull on it with a 5 kg force, and check that deflection is 4 to 6 mm.			*	*		
	i. Rack and pinion wear and lubrication	No abnormalities Apply grease after inspection				*	@	
	j. Rail wear and attachment	No abnormalities Apply grease after inspection				*		
	k. Bearing abnormal noise and attachment	No abnormalities Apply grease after inspection		*		*		
	l. Check the pulley and sprocket attachment	Check for abnormalities.		*		*		
	m. Check tightness of motor, gearbox, tension sprocket, and mounting screws	Check for abnormalities.		*		*	@	

Check Item	Check Details	Check Methods	Timing				Safety	Comments
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A-2 Table tilt mechanism	a. Check tension in roller chain	Place a ruler up against the upper surface of the chain between the sprockets, and rotate the gearbox by hand to see that there are no gaps.	*	*	*	*	@	ZS-5DS only Measurement position: See the ZS-5D/5DS Installation Manual
	b. Check sprocket	No scratches or abnormal shavings		*		*	@	ZS-5DS only
	c. Check chain coupling	Check clip insertion		*		*	@	ZS-5DS only
	d. Roller chain damage and lubrication	No abnormalities Apply grease after inspection		*		*	@	ZS-5DS only
	e. Overrun limit switch operation	Check for abnormalities.		*		*	@	
	f. Stop accuracy (Potentiometer operation)	Check for abnormalities.				*		
	g. Check for abnormal noise and vibration	Check for abnormalities.		*		*		
	h. Belt damage and tension	No abnormalities Replace if worn or damaged. Pull on it with a 5 kg force, and check that deflection is 4 to 6 mm.		*		*		Measurement position: See the ZS-5D/5DS Installation Manual
	i. Gear wear and lubricating oil	No abnormalities Apply grease after inspection				*	@	
	j. Rail wear and attachment	No abnormalities Apply grease after inspection				*		
	k. Bearing abnormal noise and attachment	No abnormalities Apply grease after inspection		*		*		
	l. Check the pulley and sprocket attachment	Check for abnormalities.		*		*		
	m. Check tightness of motor, gearbox, tension sprocket, and mounting screws	Check for abnormalities.		*		*	@	
	n. Safety sensor action to prevent foot catching	Check for abnormalities.				*	@	
A-3 Table left/right movement mechanism	a. Stopping accuracy (limit switch operation)	Check for abnormalities.		*		*	@	
	b. Damage to tabletop front guard plate	No abnormalities Replace when damaged.		*		*	@	
	c. Damage to tabletop rear guard plate	No abnormalities Replace when damaged.		*		*	@	
	d. Check for abnormal noise and vibration	Check for abnormalities.		*		*		
	e. Gear wear and lubricating oil	No abnormalities Apply grease after inspection		*		*		
	f. Rail wear and attachment	No abnormalities Apply grease after inspection				*		
	g. Bearing abnormal noise and attachment	No abnormalities Apply grease after inspection		*		*		
	h. Check the gear attachment	Check for abnormalities.		*		*		
	i. Check tightness in motor and other mounting screws	Check for abnormalities.		*		*	@	

Check Item	Check Details	Check Methods	Timing				Safety	Comments
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A-4 F/R unit movement mechanism	a. Check tension in roller chain	Pull on it with a 10 kg force, and check that deflection is 9 to 11 mm.	*	*	*	*	@	Measurement position: See the ZS-5D/5DS Installation Manual
	b. Check sprocket	No scratches or abnormal shavings		*		*	@	
	c. Check chain coupling	Check clip insertion		*		*	@	
	d. Roller chain damage and lubrication	No abnormalities Apply grease after inspection		*		*	@	
	e. Overrun limit switch operation	Check for abnormalities.		*		*	@	
	f. Stop accuracy (Potentiometer operation)	Check for abnormalities.		*		*		
	g. Check for abnormal noise and vibration	Check for abnormalities.		*		*		
	h. Belt damage and tension	No abnormalities Replace if worn or damaged. Pull on it with a 5 kg force, and check that deflection is 4 to 6 mm.			*	*		Measurement position: See the ZS-5D/5DS Installation Manual
	i. Gear wear and lubricating oil	No abnormalities Apply grease after inspection				*		
	j. Rail wear and attachment	No abnormalities Apply grease after inspection				*		
	k. Bearing abnormal noise and attachment	No abnormalities Apply grease after inspection		*		*		
	l. Check the pulley and sprocket attachment	Check for abnormalities.		*		*		
	m. Check tightness of motor, gearbox, and tension mechanism mounting screws	Check for abnormalities.		*		*	@	
A-5 Compression unit drive mechanism	a. Check tension in roller chain	Pull on it with a 2 kg force, and check that deflection is 9 to 11 mm.	*	*	*	*	@	Measurement position: See the ZS-5D/5DS Installation Manual
	b. Check compression	Check that compression is 80 N. Adjust if outside range (vertical, horizontal positions)		*		*	@	
	c. Check for surface scratches	Check for abnormalities.		*		*		
	d. Check for abnormal noise	Check for abnormalities.				*		
	e. Chain damage and tension	No abnormalities Apply grease after inspection		*		*		
	f. Rail wear and lubrication	No abnormalities Apply grease after inspection		*		*		
	g. Bearing looseness and abnormal noise	No abnormalities Apply grease after inspection		*		*		
	h. Check tightness of the motor and gearbox mounting screws	Check for abnormalities.		*		*	@	

Memo: 1 N = 0.101972 kgf

1 kgf = 9.80665 N

80 N \approx 8.2 kgf

Check Item	Check Details		Check Methods	Timing				Safety	Comments
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A-6 X-ray tube extension mechanism (when mounted only)	a. Extension fastening		Check for abnormalities.		*		*	@	
	b. Check for abnormal noise and vibration		Check for abnormalities.		*		*		
	c. Rail wear and attachment		Check for abnormalities.				*		
	d. Extension check, limit switch operation		No abnormalities Apply grease after inspection		*		*	@	
	e. Degree of collimator leaf opening		Check for abnormalities.		*		*		
	f. Runnerflex damage		Check for abnormalities.		*		*		For 1.8 m and 2 m options only
A-7 X-ray tube oblique unit mechanism (option)	a. Overrun limit switch operation		Check for abnormalities.		*		*	@	
	b. Stop accuracy (Potentiometer operation)		Check for abnormalities.				*		
	c. Check for abnormal noise and vibration		Check for abnormalities.		*		*		
	d. Belt damage and tension		No abnormalities Replace if worn or damaged. Pull on it with a 2.5 kg force, and check that deflection is 1 to 3 mm.		*		*		Measurement position: See the ZS-5D/5DS Installation Manual
	e. Gear wear and lubricating oil		No abnormalities Apply grease after inspection				*	@	
	f. Rail wear and attachment		No abnormalities Apply grease after inspection				*		
	g. Bearing abnormal noise and attachment		No abnormalities Apply grease after inspection		*		*		
	h. Check the pulley and sprocket attachment		Check for abnormalities.		*		*		
	i. Check tightness of motor, gearbox, tension sprocket, and mounting screws		Check for abnormalities.		*		*	@	
A-8 X-ray tube swiveling unit mechanism (option) Or X-ray tube swiveling 180 degree unit mechanism (option)	a. Neck swivel fastening		Check for abnormalities.				*		
	b. Check for abnormal noise and vibration		Check for abnormalities.		*		*		
	c. Tube spherical ring wear and attachment		No abnormalities Apply grease after inspection		*		*		
	d. Neck swivel check, and limit switch operation		Check for abnormalities.		*		*		
	e. Check for a ball plunger		Check for abnormalities.		*		*		
	f. Base plate wear with a ball plunger and it lubricating oil		No abnormalities Apply grease after inspection		*		*		Only X-ray tube swiveling 180 degree unit
	g. Check function of F/R unit movement switch	Check operation switch operation	Check for abnormalities.				*	@	
		Check for display errors	Check for abnormalities.				*		
Check terminal and connector contacts		Check for abnormalities.				*			
A-9 Shoulderrest	a. Fixing screw looseness, damage		Check for abnormalities.		*		*	@	
	b. Spring effectiveness, damage		Check for abnormalities.		*		*	@	
A-10 Footrest	a. Fixing area looseness, damage		Check for abnormalities.		*		*	@	
	b. Spring effectiveness, damage		Check for abnormalities.		*		*	@	
	c. Shoe damage		Check for abnormalities.		*		*	@	
A-11 Grip bar, grip	a. Fixing screw looseness, damage		Check for abnormalities.		*		*	@	
A-12 Other, accessory parts	a. Fixing screw looseness, damage, and operations check		Check for abnormalities.		*		*	@	

Check Item	Check Details	Check Methods	Timing				Safety	Comments
			1	2	3	4		
B1 Cassette spot filming mechanism (for cassette spot film type)								
B1-1 Carriage mechanism	a. Check cassette loading and unloading operation	Check for abnormalities.		*		*		
	b. Fix cassette sizes	Check for abnormalities.		*		*		
	c. Check abnormal noise during bearing or slide unit operation	Check for abnormalities.		*		*		
	d. Check parts connections	Check for abnormalities.		*		*		
B1-2 Carriage feed mechanism	a. Check cassette size detection operation	Check for abnormalities.		*		*		
	b. Stop accuracy (Potentiometer servo operation)	Check for abnormalities.		*		*	Take photo, and make decision.	
	c. Check for abnormal noise and vibration	Check for abnormalities.		*		*		
	d. Belt damage and tension (X axis)	No abnormalities Replace if worn or damaged. Pull on it with a 1.5 kg force, and check that deflection is 14 to 16 mm.			*		*	Measurement position: See the ZS-5D/5DS Installation Manual
	e. Belt damage and tension (Y axis)	No abnormalities Replace if worn or damaged. Pull on it with a 1 kg force, and check that deflection is 21 to 23 mm.			*		*	Measurement position: See the ZS-5D/5DS Installation Manual
	f. Gear wear and lubrication	No abnormalities Apply grease after inspection			*		*	
	g. Rail damage	No abnormalities Apply grease after inspection			*		*	
	h. Bearing abnormal noise and attachment	No abnormalities Apply grease after inspection			*		*	
	i. Check the pulley and timing pulley attachment	Check for abnormalities.			*		*	
	j. Check tightness of motor, gearbox, tensioner, and other mounting screws	Check for abnormalities.			*		*	
B1-3 Mask mechanism	a. Check the operation.	Check for abnormalities.			*		*	
	b. Check abnormal noise	Check for abnormalities.			*		*	
	c. Wire rope damage, tension, fastening	No abnormalities Replace when damaged. Apply grease after inspection			*		*	
B1-4 Cable connections	Check terminal and connector contacts	Check for abnormalities.			*		*	

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			1	2	3	4		
B2 Cassette tray mechanism (for cassette tray type only)								
B2-1 Cassette tray mechanism	a. Cassette detection, cassette position and size detection Limit switch operation	Check for abnormalities.		*		*		Use PC to check signal.(See Installation Manual)
	b. Rail guide wear and fastenings	Check for abnormalities.				*		
	c. Rail damage	Check for abnormalities.		*		*		
	d. Sensor holding and rotation	Check for abnormalities.				*		Only for F3
C Collimator								
C-1 Open/close mechanism	a. Check for abnormal noise	Check for abnormalities.				*		
	b. Wire rope damage and attachment.	No abnormalities Apply grease after inspection				*		
C-2 Dimensions of the effective irradiation field	Check the dimensions.	See the Installation Manual.				*		
C-3 Control circuits	Check terminal and connector contacts	Check for abnormalities.				*		
C-4 Installation	Check tightness of the mounting screws	Check for abnormalities.		*		*	@	
D Control panel and wiring								
D-1 Remote console	a. Check emergency stop operation	Check for abnormalities.		*		*	@	
	b. Check operation switch operation	Check for abnormalities.				*	@	
	c. Check for display errors	Check for abnormalities.				*		
	d. Check terminal and connector contacts	Check for abnormalities.				*		
D-2 Local console (Option)	a. Check emergency stop operation	Check for abnormalities.		*		*	@	
	b. Check operation switch operation	Check for abnormalities.				*	@	
	c. Check for display errors	Check for abnormalities.				*		
	d. Check terminal and connector contacts	Check for abnormalities.				*		
D-3 Unit side console	a. Check emergency stop operation	Check for abnormalities.		*		*	@	
	b. Check operation switch operation	Check for abnormalities.				*	@	
	c. Check for display errors	Check for abnormalities.				*		
	d. Check terminal and connector contacts	Check for abnormalities.				*		
D-4 Cable connectors	a. Check for cable damage	Check for abnormalities.		*		*	@	
	b. Check terminal and connector contacts	Check for abnormalities.		*		*		
D-5 Bolts, nuts, and floor fasteners	Check tightness of the mounting screws	Check for abnormalities.		*		*	@	
						*		
E Warning labels	Check label posting conditions	No abnormalities Replace fallen or damaged labels (For the posting position of each warning label, see the Instruction Manual)		*		*	@	

Check Items	Check details	Measurement and inspection methods	Timing				Safety	Comments
			1	2	3	4		
5	X-ray tube unit							
(1)	X-ray tube unit conditions	Check for operation abnormalities.		*		*		
(2)	X-ray tube unit attachment	Check tightness of the mounting screws		*		*		
6	X-ray high voltage generator unit							
(1)	Check the control relay operation	Check for operation abnormalities.		*		*	@	
(2)	Check fuse	Use measuring instrument to check for abnormalities.		*		*		
(3)	Check PCB power voltage	Use measuring instrument to check for abnormalities. For the measurement locations, see the Installation Manual.		*		*		
(4)	Fluoroscopy operation	Check that there are no abnormalities in operation.		*		*		
(5)	Starter operation	Check that there are no abnormalities in operation.		*		*		
(6)	Radiography operation	Check that there are no abnormalities in operation.		*		*		
(7)	Tube voltage precision and reproducibility	Measure the tube voltage. * For details, see Inspection Data Measurement Procedure, 3.2 and 3.3				*		
(8)	Tube current precision and reproducibility	Measure the tube current. * For details, see Inspection Data Measurement Procedure, 3.2 and 3.3				*		
(9)	Radiography time precision and reproducibility	Measure the radiography time. * For details, see Inspection Data Measurement Procedure, 3.2				*		
(10)	Radiography tube current product precision and reproducibility	Measure the radiography tube current time product. * For details, see Inspection Data Measurement Procedure, 3.2				*		
(11)	High voltage cables and bushing	Remove the bushing, and visually check for discharge marks, abnormalities in packing, etc. Also, wipe away old grease, replace packing, and apply grease.				*		
(12)	Insulating oil	Visual check of deterioration				*		
(13)	Maximum fluoroscopy dosage	Use measuring instrument to check that it does not exceed values regulated in the Medical Law.		*		*	@	
(14)	Dose display value accuracy	Check that the calculated or measured dose display value is within the standard ($\pm 30\%$)				*	@	
(15)	Automatic control (Use standard phantoms to check changes in tube voltage, tube current, and radiography time)							
	A Fluoroscopy IBS balance condition	Check the continuous fluoroscopy and pulse fluoroscopy balance conditions. For SDR-100, see the Image Quality Adjustment Data Procedure and the M517-E461 SDR-100 Image Quality Adjustment Manual or M517-E636 SDR-150C Image Quality Adjustment Manual				*		
	B Phototimer radiography condition	Perform phototimer radiography, and check the density. For SDR-100, see the Image Quality Adjustment Data Procedure and the M517-E461 SDR-100 Image Quality Adjustment Manual or M517-E636 SDR-150C Image Quality Adjustment Manual				*		

Check Items	Check details	Measurement and inspection methods	Timing				Safety	Comments
			1	2	3	4		
7 Image processing unit (I.I, camera,FP sensor)								
(1) Exterior	Check for abnormalities.	Visual, etc.		*		*		
(2) Image brightness non-uniformity, scratches, contamination	Check for abnormalities.	Visual, etc.		*		*		
(3) Check pixel value (fluoroscopy, radiography)	See the Image Quality Adjustment Data Measurement Procedure and M517-E461 SDR-100 Image Quality Manual or M517-E636 SDR-150C Image Quality Adjustment Manual	Check the operation.				*	For F3,perform sensor calibration befor checking	
(4) Connector looseness, cable damage	Check for abnormalities.	Visual, etc.		*		*	For F3,perform sensor calibration befor checking	
(5) Check general image quality	See the Image Quality Adjustment Data Measurement Procedure and M517-E461 SDR-100 Image Quality Manual or M517-E636 SDR-150C Image Quality Adjustment Manual	Measuring instrument				*	For F3,perform sensor calibration befor checking	
8 Image processing unit								
(1) Image collection operation	Check that there are no abnormalities in operation (check collection operation during image adjustment data collection operation)	Check the operation.		*		*		
(2) Image processing function	Check that there are no abnormalities in operation (check collection operation during image adjustment data collection operation)	Check the operation.		*		*		
(3) Image read-out, write	Check that there are no abnormalities in operation (check collection operation during image adjustment data collection operation)	Check the operation.		*		*		
(4) Print operation	Check that there are no abnormalities in print operations to laser imager, thermal printer, etc.	Check the operation.		*		*		