

SIEMENS

MOBILETT XP Digital

SP

Maintenance Instructions

System

incl. DHHS

The protocol SPR8-230.832.30.03.02 is required for these instructions

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The document corresponds to the version/revision level effective at the time of system delivery. Revisions to hardcopy documentation are not automatically distributed.

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Table of Contents

1	General	5
	Performance of work	5
	Special notes	6
	Icons	7
	Information on product safety and protective measures	8
	System overview - user	11
	Orientation	12
	System overview - Service	13
	Cleaning	15
2	General maintenance information	16
	Required documents	16
	Required tools, test equipment and aids	17
	Material replacement	18
	Log	19
	Information for the USA only	20
	Explanation of the test items	21
	Information on the protective conductor resistance test	22
	Information on measuring the leakage current	24
	Information on measuring the patient leakage current	28
	Technical Safety Checks (TSC)	31
3	Inspection and maintenance	36
	Visual check	36
	Damage	36
	Mechanical inspection	37
	Back wheels and support rollers	37
	Front transport wheels	39
	Brakes	40
	Support arm transport lock	41
	Handles	42
	Collimator adjustment knobs	42
	Arm system and single tank	42
	Single tank holder	46
	Power cable	47
	Lubrication	47
	Function inspection	49
	Operating data	49
	Displaying the control panel	50
	Checking the radiation indicator	50
	Manual termination of exposure	51

Collimator	52
Lamp replacement.	52
Checking the illuminance.	55
Light field/radiation field.	55
Battery and motor drive inspection	58
Batteries	58
Motor drive.	58
Options	59
DAP measuring system.	59
Remote control	59
Checking the kV/mAs exposure parameters.	60
kV accuracy	60
mAs accuracy	62
Reproducibility test (USA only)	65
Checking the image quality.	68
Dose measurement	68
Resolution	68
Contrast.	68
Hardcopy	68
Protective conductor test.	69
Leakage current measurement.	70
Patient leakage current measurement	71
Cleaning	72
4 Changes to previous version	73

1 General

1.1 Performance of work



Any technician duly assigned by the local Siemens office is authorized to perform maintenance and service work.

Certain tasks may also be performed by other technical personnel (e.g. the customer's hospital technicians). These tasks are marked by the icon shown here.

In such cases it is absolutely necessary:

- to observe all instructions in the text and graphics;
- to use the specified tools, test equipment and aids.

You can also contact your national Siemens Uptime Service Center for support.

1.2 Special notes

⚠ DANGER	An immediate danger that will cause death or serious physical injury if disregarded.
	⇒
⚠ WARNING	A danger that can cause death or serious physical injury if disregarded.
	⇒
⚠ CAUTION	A danger that will or can lead to minor or moderate physical injury and/or damage to property if disregarded.
	⇒
NOTICE	A danger that will or can lead to an undesirable result or state other than death, physical injury or property damage.
	⇒
NOTE	Information that explains the proper way to use devices or to carry out a process, i.e., provides pointers and tips.

1.3 Icons



Warning about ionizing radiation or radioactive substances. Tests and adjustments that must be performed with the radiation switched on are indicated by this radiation warning icon.



Dangerous electrical voltage > 25 V~ or > 60 V-.



Caution! General hazard warning.



ESD: Warning about electrostatically sensitive components.



Report icon. Used to indicate entries in certificates.



Certain tasks can also be performed by other technical personnel (e.g. the customer's hospital technicians).

Certain sections apply only to the USA. These sections are marked with this icon.

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Fig. 1:

1.4 Information on product safety and protective measures

 **DANGER**

While performing maintenance and service work on the MOBILETT XP digital with open covers, it is possible to come into contact with components under voltage.

Carelessness can result in death or serious bodily injury.

When conducting maintenance and service work, follow:

- ⇒ the product-specific safety information contained in the technical documentation,
 - ⇒ and the general safety information (TD00-000.860.01...).
-

 **DANGER**

Remove or install components only if:

- ⇒ - The system is switched off, and
 - ⇒ - The capacitors are discharged, and
 - ⇒ - The ESD guidelines are followed, and
 - ⇒ - The batteries have been disconnected.
-

 **DANGER**

Releasing radiation:

- ⇒ Checks and settings for which radiation must be released are to be marked with the radiation warning symbol.
 - ⇒ Radiation protection measures are to be used.
-

⚠ DANGER

To avoid electrical shock from components under voltage, also be aware that:

The capacitors of the capacitor bank can be electrically charged even when the system is switched off and the power cable is disconnected!

In the case of an error, individual capacitors of the capacitor bank can still be electrically charged when disconnected from the charging circuit!

Disconnect the battery blocks in the XP Digital prior to maintenance and service work!

Carelessness can result in death or serious bodily injury.

- ⇒ Make sure that no parts or tools fall into the unit;
- ⇒ Do not touch potentially dangerous components (Fig. 2 / p. 10)
- ⇒ If loose parts must be removed from the unit, use only insulated tools;
- ⇒ Protect the work area so that no other persons are able to touch the unit while the covers are open!

- Switch the unit off before servicing or maintenance. Always disconnect the power plug first.
- Ensure that the main switch is turned off.
- The capacitor bank discharges to < 40 V in approx. 15 minutes.
 - ⇒ The safety covers can be removed after this period has elapsed.
- Prior to performing any work, it must be verified that areas with dangerous voltage are voltage-free (Fig. 2 / p. 10).

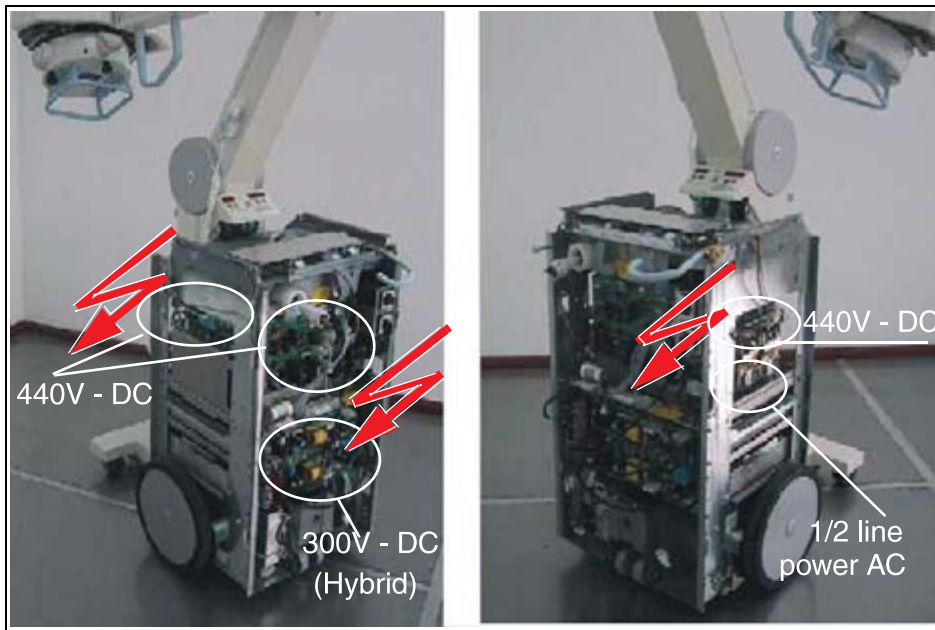


Fig. 2: Locations with dangerous voltage

With the housing covers open and safety covers removed:

Back:

CAUTION: DC voltage (440V) at capacitor bank (D927)

CAUTION: DC voltage (300 V) from the battery block to PCB D982!

Always disconnect the battery plug from BK1-BK4.

Left:

CAUTION: DC voltage (440V) directly at the capacitor bank!

Right:

CAUTION: DC voltage (440V) directly at the capacitor bank!

CAUTION: AC voltage (> 100V or > 60V half line voltage) at power supplies U1 and U2 as long as the power cord is connected.

1.5 System overview - user

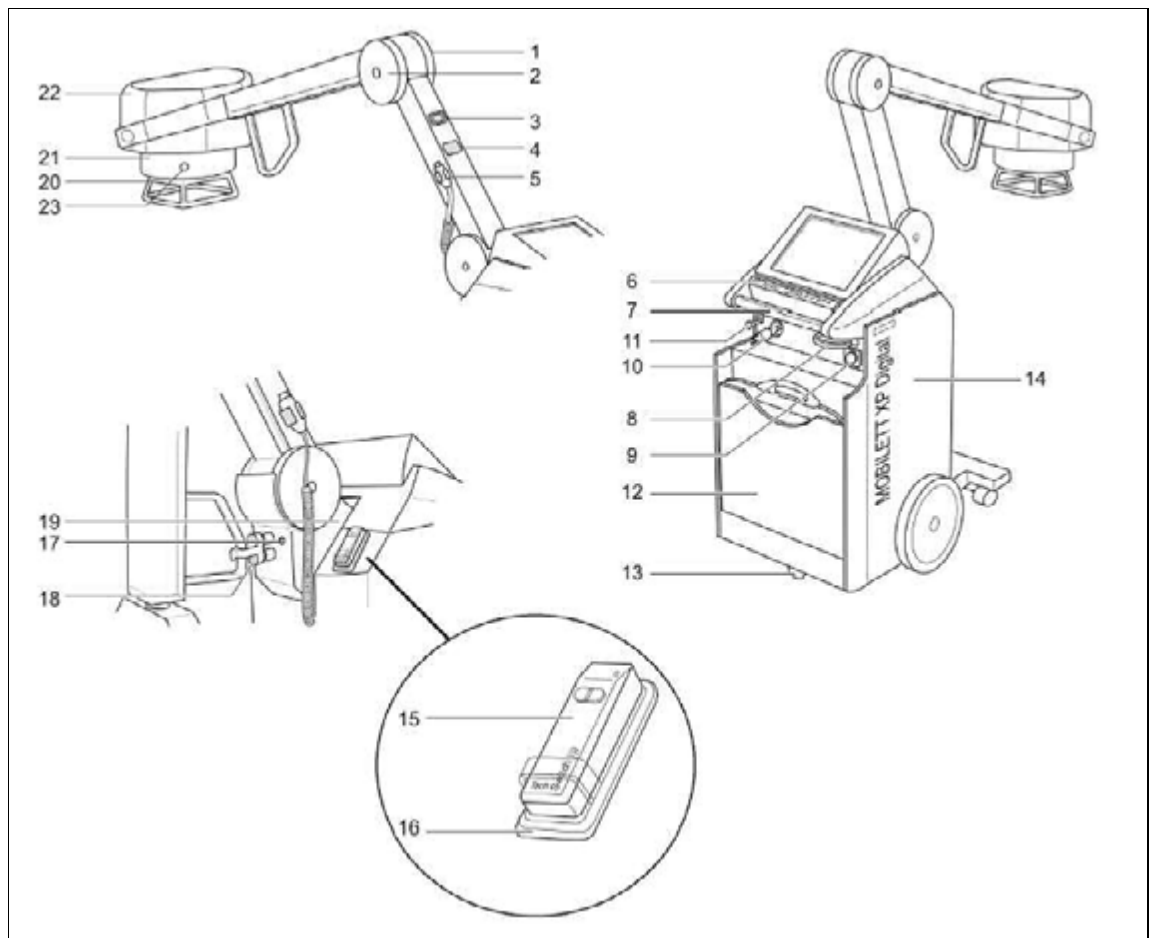


Fig. 3: User overview

(1) Hanger for lead apron	(13) Rollers
(2) Articulated arm	(14) Console with chassis
(3) Sensor for IR remote control (optional)	(15) IR remote control (optional)
(4) DAP display (optional)	(16) Holder for IR remote control (optional)
(5) Exposure switch (S27)	(17) Potential equalization connector
(6) Control panel and display field	(18) Transport safety device
(7) Transport handle/motor control	(19) Stand column
(8) Hand/parking brake handle	(20) DAP ionization chamber (optional)
(9) Main switch	(21) Collimator
(10) Power cable	(22) X-ray tube assembly
(11) Brake handle for cable winch	(23) Light localizer buttons (two sides)
(12) CXDI-50G detector holder	n.a.

1.6 Orientation

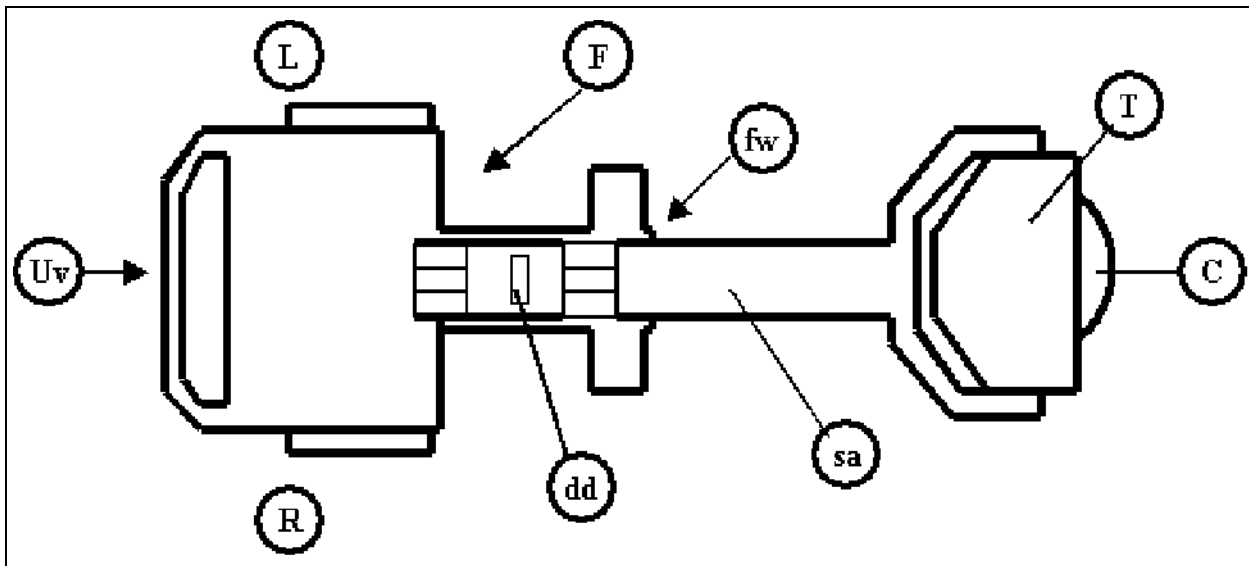


Fig. 4: Top view of system_01

System orientation to clarify the technical description	
Abbreviations	Explanation
Uv	User view - back (U ser v iew)
L	Left side of unit (l eft)
R	Right side of unit (r ight)
F	Front (f ront)
fw	Front wheels (f ront w heels)
sa	Support arm (s upport a rm)
T	Tube (single t ank)
C	Collimator (c ollimator)
dd	DAP display (d ose d isplay)

NOTE	<p>These orientation indicators are used in all technical documents. Descriptions are always from the “forward travel” user view. Always use this perspective when communicating with third parties (e.g., USC/HSC).</p>
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1.7 System overview - Service

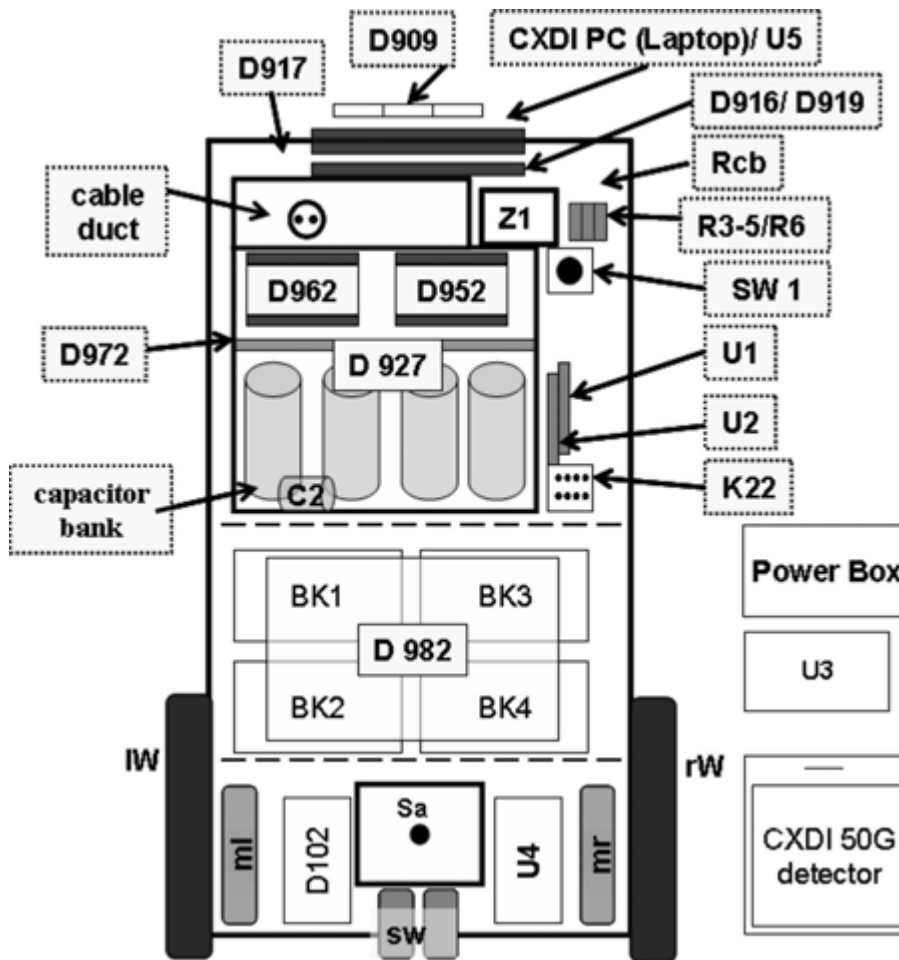


Fig. 5: Schematic overview of XP Digital

MOBILETT XP Digital parts	
Abbreviations	Explanation
D916/D919	CPU board/X-ray interface
D 917	Galvanic separation for S27/DAP/remote
Rcb	Remote control board (remote control option)
SW1	Key switch, power ON/OFF
Z1	Line filter
C1 (R1)	Capacitor for inverter with discharge resistor (front left side/not shown here)
C2 (R2)	Starter capacitor with discharge resistor
R3-R5, R6 (X9)	Capacitor bank discharge resistor (front right side)
Capacitor bank	12 x 10 mF capacitors, mounted on D972
K22	Main relay

D909	X-ray display and keyboard
U1	+5V/± 15V power supply
U2	+24V power supply
D927	Power supply
D952	Capacitor bank charging board (behind D927)
D962	kV inverter (behind D927)
D972	Capacitor bank board (behind D927)
Sa	Support arm adjusting spring
lw/rw/sw	Support rollers and back wheels
D982	Battery charger
D102	Motor drive control
BK1/BK2	Battery block, left
BK3/BK4	Battery block, right
mr/ml	Motor right/motor left
CXDI PC	Laptop for the imaging system
CXDI detector	CXDI flat detector
Power box	Connecting unit between CXDI PC and CXDI detector
U3	DC converter 300V DC/24V DC
U4	Inverter 24V DC/220V AC
U5	Power supply CXDI PC (laptop)
Optional parts for MOBILETT XP Digital (not shown in illustration)	
DAP chamber	Dose area product measuring chamber
D991	DAP adapter board (within the collimator cover)
DAP display	DAP display board (in the lower arm segment cover)

1.8 Cleaning

- Always disconnect the MOBILETT from the power supply and switch it off before cleaning or disinfecting it.
- Never use abrasive cleaners or cleaning agents with solvents (e.g. cleaning solutions, alcohol or spot removers), since they may damage housing surfaces.
- Do not spray anything on or into the unit.
- Wipe off the MOBILETT with a cloth moistened in water or a diluted, lukewarm solution of water and dishwashing liquid.

For more information, see the Chapter on "Cleaning and disinfection" in the operating instructions.

2 General maintenance information

2.1 Required documents

- **General safety information** TD00-000.860.01...
- Startup instructions SPR8-230.814.30...
- Quality assurance SPR8-230.820.30...
- Instructions for part replacement SPR8-230.841...
- Troubleshooting instructions SPR8-230.840....
- Wiring diagram SPR8-230.844.30...
- Operator manual SPR8-230.621.30..
- Technical safety checks/protocol* SP00-000.834.01..

* Within the purview of DIN VDE 075-1, we recommend documenting the results of the maintenance both in the maintenance protocol and in the TSC protocol. The protocols should be filled out completely and handed over to the client after maintenance is complete.

2.2 Required tools, test equipment and aids

- Standard service tool kit
- Measuring device for leakage current and patient leakage current, e.g.: 51 38 727 Y0766
- Ground wire tester or e.g.: 51 38 727 Y0766
- 2.1 mm precision copper filter (or alternatively, copper filter set 4406 120 RV090) 90 00 598 RV090
- Dose meter, e.g.: PTW DIADOS 97 17 612 Y0388
- Densitometer, e.g., DensiX-LE 52003 49 51 286 Y0388
- Digital multimeter, e.g.: Fluke 8060 A 97 02 101 Y4290
- Centering cross 96 60 051 RE999
- mAs meter (e.g.: 81 60 400) or 2-channel storage oscilloscope with \pm -2.5% accuracy
- kV meter (works with the filter comparison method) or 2-channel storage oscilloscope with \pm 2.5% accuracy
- 2-channel storage oscilloscope with 2.5% accuracy, e.g.: Fluke Scope Meter 199 CM 73 92 074
- Spring balance for 350 N
- Torque wrench for 8-40 Nm, e.g.: 99 00 846 RE999
- Calibration tool for the "DAP measurement system" option 65 84 978
- Adjuster for tensioning the drive belt 65 64 301
- Rope (min. length 4 m; min. tensile strength 1000 N)
- Loctite 242
- Viscogen oil
- 2 pieces of wood, approx. 50 x 75 x 500 mm

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- Lux meter (USA only)

2.3 Material replacement

Material	Material no.	Interval
Collimator lamp	08392016	12 months
Battery pack (left) BK1/BK2	08392024	24 months
Battery pack (right) BK3/BK4	08392032	24 months
Cable winch complete	06508746	48 months
Option		
Remote control batteries	1x9V alkaline	12 months

Replace damaged or missing screws.

NOTE

**Only replace damaged or missing screws with steel screws.
All Allen screws must have a tensile strength of 8.8.**

Materials needed for periodic replacement can be requested from the responsible local Uptime Service Center.

2.4 Log

The maintenance protocol must be completed and signed. Replacement and repair measures must be listed separately in the protocol under "Work procedures performed".

2.5 Information for the USA only

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To ensure compliance with the applicable regulations in the "US Federal Performance Standard", the user of the MOBILETT XP Digital is responsible for performing maintenance procedures at least once each year.

Neither the system manufacturer nor its representatives assume any responsibility in the event of non-compliance with the above requirements.

2.6 Explanation of the test items

Test item Abbreviation	Explanation
SI	Safety inspection
SIE	Electrical safety inspection
SIM	Mechanical safety inspection
PM	Preventive Maintenance
PMP	Periodic preventive maintenance
PMA	Preventive maintenance adjustments
PMF	Preventive maintenance function, check operating values
Q	Quality check
QIQ	Image quality test
QSQ	System quality test
SW	Software maintenance

The maintenance protocol lists these abbreviations for the test items.

2.7 Information on the protective conductor resistance test

Observe the instructions in the "Safety Rules for Installation and Repair" (ARTD-002.731.17 ...).

The protective conductor resistance must be measured, documented, and evaluated during maintenance.

NOTE

For evaluation purposes, the first measured value and the values documented during maintenance or safety checks must be compared to the measured values. A sudden or unexpected increase in the measured values may indicate a defect in the protective conductor connections - even if the limit value of 0.2 ohms is not exceeded. (Protective conductor or contacts).

The measurement must be performed according to DIN VDE 0751, Part 1 (see ARTD Part 2). The protective conductor resistance for all touchable conductive parts must be measured during the normal operating state of the system.

Make sure that control cables or data cables between the components of the system are not mistaken for protective conductor connections.

During the measurement, move the power cable and additional connection cables with an integrated protective conductor section by section to detect cable breaks.

The protective conductor resistance must not exceed 0.2 Ohms.

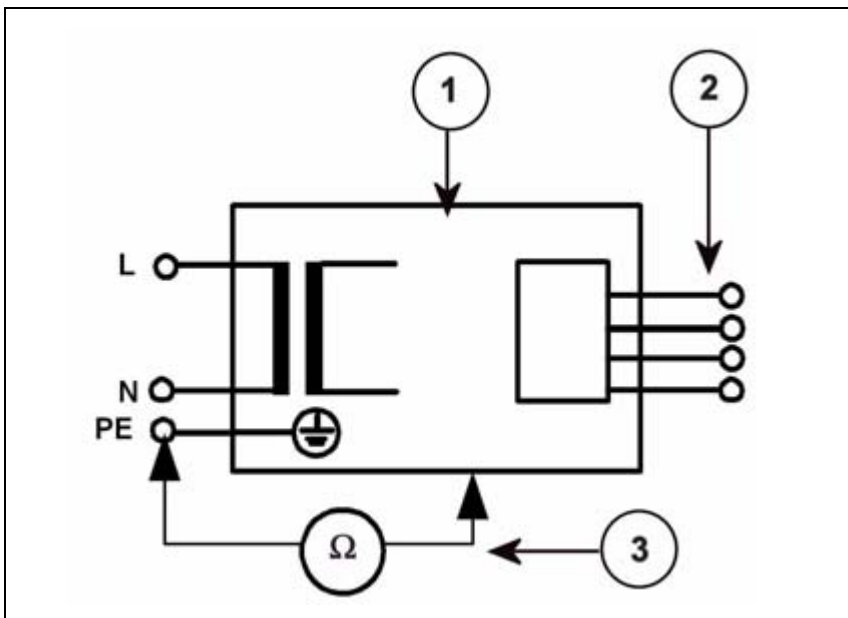


Fig. 1: Measuring circuit for measuring the protective conductor resistance for units that are disconnected from power, in compliance with DIN VDE 0751-1/2001-10, Fig. C2.

- Pos. 1 = System
- Pos. 2 = Application part type B (if available)
- Pos. 3 = Measurement setup (integrated into measuring device)

The values determined, including the measuring points, must be recorded and assessed in the protective conductor resistance report.

The measuring procedure and the measuring device used (designation and serial number) must also be documented.

NOTE

File the protective conductor resistance report in the "Certificates" register no. 9 in the system binder.

NOTE

A new report must be created if the protective conductor resistance measurements are not documented.

A new protective conductor resistance report can be found in the startup instructions SPR8-230.814.30.03. Separate this report from these instructions, fill it out, and file it in the "Certificates" register no. 9 in the system binder. If values are newly determined, they must be recorded as first measured values. The evaluation is omitted in this case.

2.8 Information on measuring the leakage current

NOTE

During maintenance, the leakage current measurement must be conducted and recorded as a repeat measurement.

However, the first measured value must be newly determined and a new report must be created under the following conditions:

- Lack of documentation for leakage current measurement
- Deviation of the local line voltage from the line voltage documented in the report (e.g., location change/operator change)
- When a different procedure for measuring the leakage current than the one documented in the report is used.

For the purpose of traceability, reference to the new report must be written in the old report. The reason for newly determining the first measured value must be documented and confirmed with a name and signature.

Observe the instructions in the "Safety Rules for Installation and Repair" (ARTD-002.731.17 ...).

⚠ WARNING

Electrical voltage!

Non-compliance can lead to severe injury and even death.

- ⇒ **The leakage current measurement may be performed on systems of protection class I only after the protective conductor test has been passed.**

First measured value

The first measured value has already been determined and documented in the leakage current report. The measuring procedure was also recorded.

The measurement was performed with the recorded line voltage and with the recorded measuring equipment.

Measurement

Perform the measurement according to DIN VDE 0751, Part 1 (see ARTD-002.731.17....), and record the determined value.

The measuring procedure indicated in the report must be used.

If the first measured value has to be newly determined (see previous information), a measuring procedure can be selected (direct measurement or differential measurement).

Measurement of the leakage current according to the differential current method (measurement setup according to (Fig. 2 / p. 25)) must be given preference, since this method is not dangerous to the person performing the measurement and other persons.

However, please note the minimum resolution of the leakage current measuring device and any additional manufacturer information restricting the use of the measuring device.

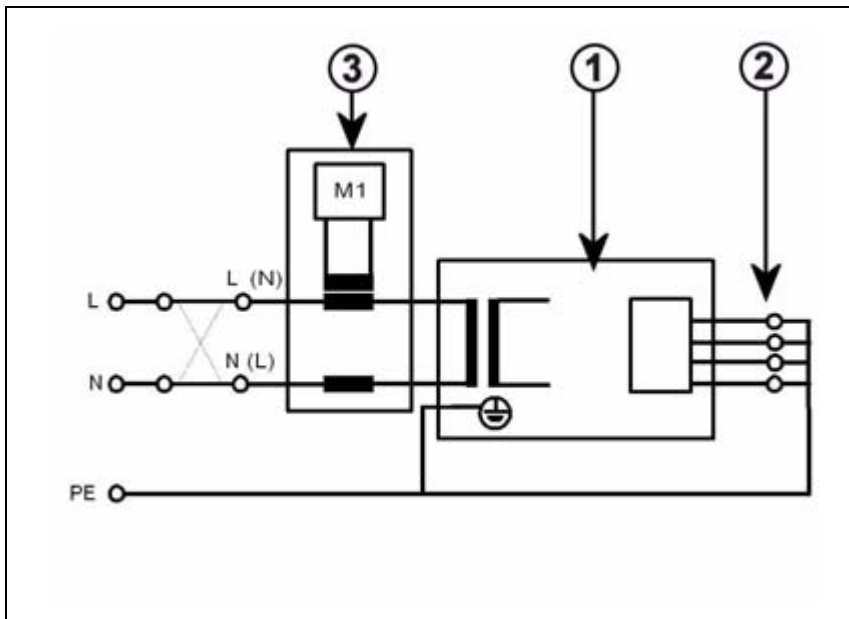


Fig. 2: Measuring circuit for measuring the system leakage current according to the differential current method in compliance with DIN VDE 0751-1/2001-10, Fig. C6 for protection class I.

- Pos. 1 = System
- Pos. 2 = Application part type B (if available)
- Pos. 3 = Measurement setup (integrated into measuring device)

If the direct measurement of the leakage current is used (measurement setup according to [\(Fig. 3 / p. 26\)](#)), the system must be insulated during the measurement and must not be touched.

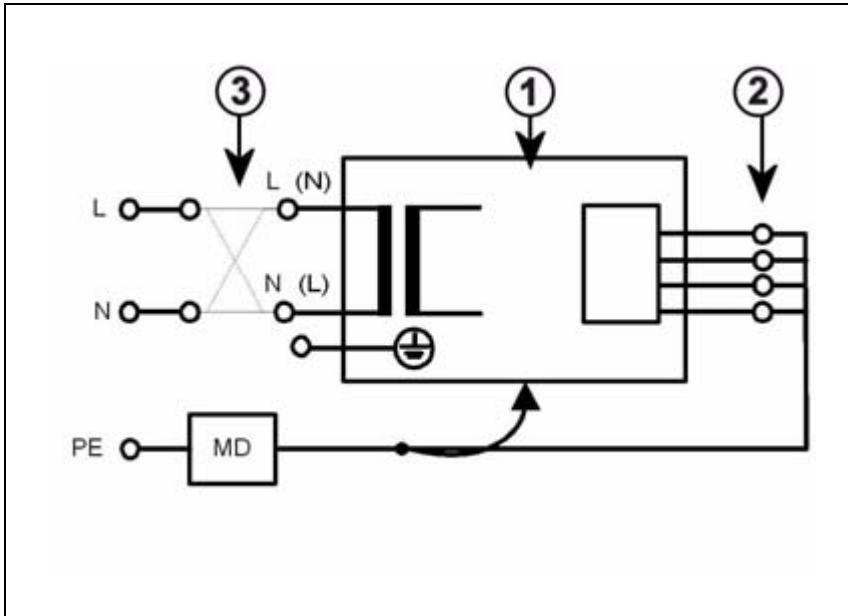


Fig. 3: Measuring circuit for direct measurement of the system leakage current in compliance with DIN VDE 0751-1/2001-10, Fig. C5 for protection class I.

- Pos. 1 = System
 Pos. 2 = Application part type B (if available)
 Pos. 3 = Measurement setup (integrated into measuring device)



WARNING

Electrical voltage!

Non-compliance can lead to severe injury and even death.

- ⇒ **No housing parts of the system may be touched during direct measurement of the leakage current (measurement setup according to (Fig. 3 / p. 26)).**
- ⇒ **Third-person access to the system must be prevented.**

The system must be switched on during measurement. Measuring devices with automated measuring sequences must therefore be set to manual measurement.

Enter the highest value in the leakage current report .

This value must not exceed the permissible leakage current values according to DIN VDE 0751-1/2001-10, Table F.1, line "leakage current for devices according to remarks 1 and 3", of 2.5 mA.

Measure and record the current line voltage. If the measured line voltage deviates from the nominal voltage, correct the measured value to the value corresponding to a measurement at the nominal value of the line voltage. This must also be documented.

Document the measuring procedure (differential measurement or direct measurement) and the measuring device used (designation and serial number).

In the case of repeat measurements, the measured value must also be evaluated.

NOTE

For evaluation purposes, the first measured value and the values documented during maintenance or safety checks must be compared to the measured values. A sudden or unexpected increase in the measured values may indicate that a fault has occurred in the primary power supply circuit (insulation damage, damage from moisture, defective interference suppressor, etc.) - even if the limit value of 2.5 mA is not exceeded.

The evaluation is not necessary in the case of a new determination.

NOTE

File the leakage current report in the "Certificates" register no. 9 in the system binder.

NOTE

A new report must be created if the leakage current measurements are not documented.

A new leakage current report can be found in the startup instructions SPR8-230.814.30.03. Separate this report from these instructions, fill it out, and file it in the "Certificates" register no. 9 in the system binder. If values are newly determined, they must be recorded as first measured values. The evaluation is omitted in this case.

2.9 Information on measuring the patient leakage current

Observe the instructions in the "Safety Rules for Installation and Repair" (ARTD-002.731.17 ...).

On systems of protection class I with type B application part, the patient leakage current must be measured, documented, and evaluated during maintenance on each application part.

If the application part has a surface of non-conductive material, it must be covered with a conductive material (such as aluminum foil). The conductive surface must be large enough to approximate the contact surface of the patient with the application part.

With a flat detector, completely cover the contact surface with aluminum foil.

Hold the aluminum foil securely to the application part to be measured using approx. 0.5 N/cm² of pressure during the measurement.



WARNING

Electrical voltage!

Non-compliance can lead to severe injury and even death.

⇒ **The patient leakage current measurement may be performed on systems of protection class I only after the protective conductor test has been passed.**

First measured value

The first measured values have already been determined and documented in the patient leakage current report.

The measuring procedure and the measuring device used (designation and serial number) have been documented as well.

Measurement

The patient leakage current must be measured for each application part.

The measurement must be made according to DIN VDE 0751, Part 1 (see ARTD-002.731.17...).

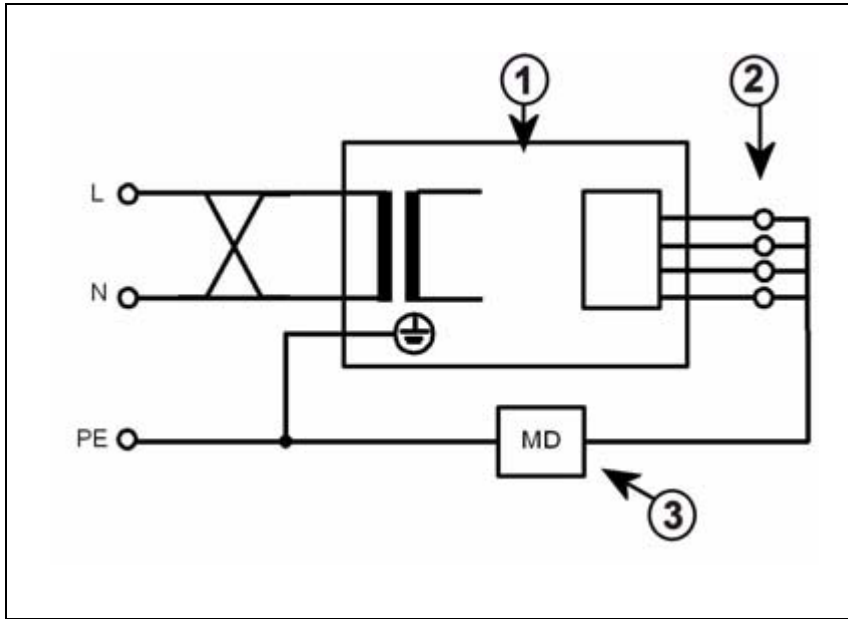


Fig. 4: Measuring circuit for measurement of the patient leakage current in a type B application part with a protective conductor in compliance with DIN VDE 0751-1/2001-10, Fig. C10.

- Pos. 1 = System
- Pos. 2 = Application part type B
- Pos. 3 = Measurement setup (integrated into measuring device)

The system must be switched on during measurement. Measuring devices with automated measuring sequences must therefore be set to manual measurement.

The same measuring conditions as in the first measurement apply.

The values determined in the repeat measurement, including the application parts/measuring points, must be recorded and assessed in the patient leakage current report.

The values for each application part may not exceed the permissible leakage current values according to DIN VDE 0751-1/ 2001-10, table F.1, line "patient leakage current" of 0.01 mA for direct current and 0.1 mA for alternating current.

Document the measuring procedure and the measuring device used (designation and serial number).

In the case of repeat measurements, the measured values must also be evaluated.

NOTE

For evaluation purposes, the first measured value and the values documented during maintenance or safety checks must be compared to the measured values. A sudden or unexpected increase in the measured values may indicate a defect in the system (protective conductor connection damage, insulation damage, damage from moisture, etc.) - even if the limit value of 0.01 mA for direct current and 0.1 mA for alternating current is not exceeded.

The evaluation is not necessary in the case of a new determination.

NOTE

File the patient leakage current report in the "Certificates" register no. 9 in the system binder.

NOTE

A new report must be created if the patient leakage current measurements are not documented.

A new patient leakage current report can be found in the startup instructions SPR8-230.814.30.03. Separate this report from these instructions, fill it out, and file it in the "Certificates" register no. 9 in the system binder. If values are newly determined, they must be recorded as first measured values. The evaluation is omitted in this case.

2.10 Technical Safety Checks (TSC)

Abbreviation: TSC = Technical Safety Checks

NOTE

Within the purview of DIN VDE 0751-1, the operator of medical engineering products has to perform technical safety checks at regular intervals.

The checks listed in these maintenance instructions include all technical safety checks required by DIN VDE 0751-1.

A separate protocol with the print number SP00.000.834.01... is available for each technical safety check.

Within the purview of DIN VDE 0751-1, we recommend documenting the maintenance results both in the maintenance protocol and in the TSC protocol. The protocols should be filled out completely and handed over to the client after maintenance is complete.

The table below assigns each technical safety check listed in document SP00.000.834.01... to the corresponding maintenance work.

Test report/ Technical safety checks	Maintenance instructions for the check/comments
1. Identification data	n.a.
2. General checks	n.a.
2.1 Visual inspection: Is there any damage affecting safety?	3.1.1 Damage, checks: SIM Covers SIM Detector/cassette holder SIM Control and display panel SIM Release cable SIM Single tank SIM Collimator
2.2 Are all cables and cable guides secure and without any visible damage?	3.2.9 Power cable, checks: SIM Power cable check SIM General cable winch information 3.2.9.1 Power plug, check: SIM Power plug check 3.2.7.5 Cable harness for the arm system, check: SIM Damage-free

Test report/ Technical safety checks	Maintenance instructions for the check/comments
2.3 Are undamaged accessories being used?	3.1.1 Damage, check: SIM DAP (optional) SIM Remote control (optional)
2.4 System radiation protection devices present and undamaged? (No on-site radiation shield)	3.3.3 Check of the radiation indicator, checks: SIE Radiation indicator SIE Ready indicator SIE Acoustic signal 3.3.4 Manual termination of exposure, checks: SIE "ERR 39" display SIE Acoustic signals
2.5 Are the required operator documents complete, present and legible?	3.1 Visual inspection, check: SI Customer documentation Ask the customer for additional required operator documents and check them for completeness, availability, and legibility.
2.6 Are all warning labels in place and recognizable?	3.1 Visual inspection, check: SIM Signs
2.7 Are the operating symbols, light indicators and button labels OK?	3.3.2 Control panel displays, checks: SIE kV/mAs 7-segment displays SIE kV/mAs displays according to operating instructions
3. Electrical checks	n.a.
3.1 Measurement of ground wire resistance	3.10 Protective conductor test, check: SIE Protective conductor test
3.2 Leakage current or equivalent leakage current measurement	n.a.
3.2.1 Leakage current measurement	3.11 Leakage current measurement, check: SIE Leakage current measurement
3.2.2 Equivalent leakage current measurement	n.a.
3.3 Patient leakage current or equivalent patient leakage current measurement	n.a.

Test report/ Technical safety checks	Maintenance instructions for the check/comments
3.3.1 Patient leakage current measurement	3.12 Patient leakage current measurement, check: SIE Patient leakage current measurement
3.3.2 Equivalent patient leakage current measurement	n.a.
4. Mechanical checks	n.a.
4.1 Are all wall, ceiling and floor mountings secure and undamaged?	n.a.
4.2 Are all mechanically moved system parts clean and running smoothly (lubricated, if required)?	3.2.4 Support arm transport lock, checks: SIM Transport lock check SIM Locking mechanism 3.2.7.1 Movement of the arm system, checks: SIM Movement of the arm system SIM Movement of the single tank holder SIM Movement of the single tank
4.3 Cables, chains, belts, and spindles without signs of wear?	3.2.1.1 Back wheels, checks: SIM Drive belts
4.4 Mobile equipment: Are the wheels, rollers and brakes OK?	3.2.1.1 Back wheels, check: SIM Brake pad SIM Secure attachment SIM Smooth rotation 3.2.1.2 Support rollers, checks: SIM Secure attachment SIM Smooth rotation 3.2.2 Front transport wheels, checks: SIM Secure attachment SIM Smooth rotation 3.2.3 Brakes, checks: SIM Uniformity SIM Braking force
4.5 Is there any unusual noise during operation (e.g. gearing)?	3.2.7.1 Movement of the arm system, checks: SIM Movement of the arm system
5. Functional checks	n.a.

Test report/ Technical safety checks	Maintenance instructions for the check/comments
5.1 Function of the emergency-stop switch	n.a.
5.2 Are the warning devices functioning properly?	3.3.3 Check of the radiation indicator, checks: SIE Radiation indicator SIE Ready indicator SIE Acoustic signal
5.3. Do all system movements stop properly in their end positions?	n.a.
5.4 Does the collision protection device stop all system movements properly (e.g. collision protection)?	n.a.
5.5. Are all safety distances (wall, floor, ceiling) met or ensured by other appropriate measures (such as light barriers)?	n.a.
5.6. Are the other safety shutdown devices functioning properly (e.g. safety floor plate)?	n.a.
5.7 Are the positions of the table and system reproducible (e.g. zero positions, layer height, etc.)?	n.a.

Test report/ Technical safety checks	Maintenance instructions for the check/comments
<p>6. Product-specific checks</p>	<p>3.2.5 Handles, check: SIM Attachment</p> <p>3.2.6 Collimator adjustment knobs, check: SIM Attachment</p> <p>3.2.7.2 Arm system attachment, check: SIM Screws and lock nuts</p> <p>3.2.7.3 Arm connector, check: SIM Screws and nuts</p> <p>3.2.7.4 Adjusting screw and cantilever, checks: SIM Lock nuts SIM Attachment of the base</p> <p>3.2.7.8 Single tank holder, checks: SIM Holder screw connections SIM Single tank screw connections</p> <p>3.6.1 DAP measuring system (optional), check: SIE Function of the DAP measuring system</p> <p>3.6.2 Remote control (optional), check: SIE Function of the remote control</p>
<p>7. Check results/evaluation:</p>	<p>Evaluate the long-term trends of the ground wire resistance and the leakage current by comparing the current measuring values to those of the preceding technical safety checks. A sudden or unexpected increase in the measured values may indicate a safety-related defect - even if the limit values are not exceeded.</p> <p>Enter the results of the check.</p> <p>Have the operator, or a person authorized by the operator, sign the TSC protocol.</p> <p>Hand the TSC protocol over to the operator, or a person authorized by the operator.</p>

3 Inspection and maintenance

3.1 Visual check

SIM Signs

- Check all signs on the system with the model and serial numbers as well as warnings. The placement of these signs is described in the operating instructions ("Signs" chapter).
- Verify that all signs are present and legible.

SI Customer documentation

- The customer must be able to provide the following documents. The documents are to be checked for availability, completeness, and legibility.
 - Operating instructions
 - Start-up protocol
 - Last maintenance protocol
 - Quality assurance protocol

U
S

- Maintenance records
- Service reports for repairs and adjustments
- DHHS documentation

3.1.1 Damage

- Check the unit for external damage (cracks, breaks, scratches, corrosion etc.).
- Check whether the single tank or the collimator show any signs of mechanical defects that can impair radiation protection.
- Repair or replace defective parts.

SIM Covers

SIM Detector and detector holder

- Check the condition of the detector side covers and replace them if necessary.

SIM Control panel and display panel

SIM Release cable

SIM Single tank

SIM Collimator

SIM DAP (optional)

- The DAP ionization chamber should not have any scratches.
- No damage to DAP supply line, plug or display

SIM Remote control (optional)

- No damage to remote control

3.2 Mechanical inspection

⚠ WARNING

There is a danger of life-threatening electrical shock. It is possible to come into contact with live parts when the covers are removed. Carelessness can result in death or serious bodily injury.

⇒ Follow the general and product-specific protective measures.

3.2.1 Back wheels and support rollers

NOTE

First perform the following work steps listed in the "Back wheels and support rollers" section one side. Then check the other side in the same manner.

- Elevate one side of the system by placing a piece of wood under the chassis (Fig. 1 / p. 37).
- Secure the wheel on the other side with 2 blocks. Ensure that the MOBILETT XP Digital is secure!
- Remove the wheel cap and wheel (Fig. 1 / p. 37).

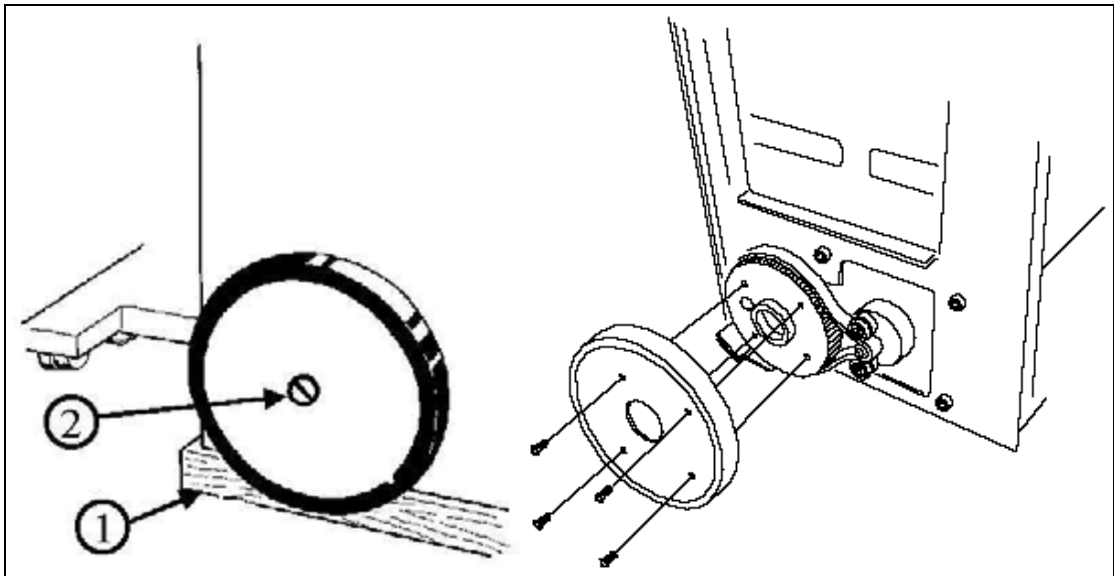


Fig. 1: Braked wheels

3.2.1.1 Back wheels

SIM Brake pad

- Check the brake pad (Fig. 2 / p. 38). The brake pad must be > 1mm. If worn (pad < 1mm), replace the brake according to the "Replacement of parts" instructions.

SIM Drive belt

- Check the condition/tension of the drive belt (Fig. 1 / p. 37) (the adjustment procedure for the drive belt is described in the "Replacement of parts" instructions).

NOTE

Under normal operating conditions, the drive belt does not need to be readjusted during the life of the system.

SIM Secure attachment

- Securely reattach the wheel.

SIM Smooth rotation

- Ensure smooth rotation of the wheel.

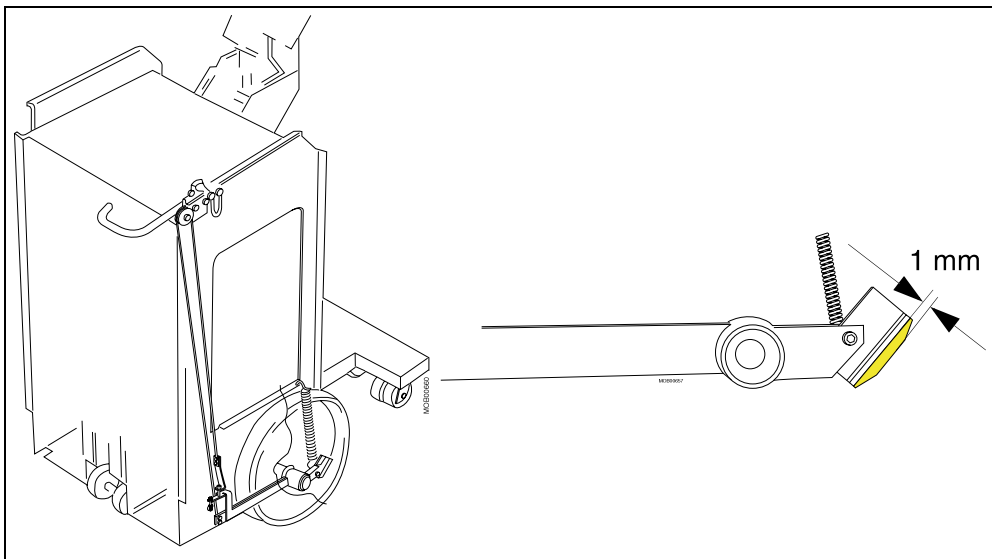


Fig. 2: Smooth rotation

3.2.1.2 Support rollers

- Lock the back transport wheels with the parking brake.
- Elevate one side of the system.

SIM Secure attachment

- Ensure attachment of the support rollers (Fig. 3 / p. 39).

SIM Smooth rotation

- Ensure smooth rotation of the rollers (Fig. 3 / p. 39).

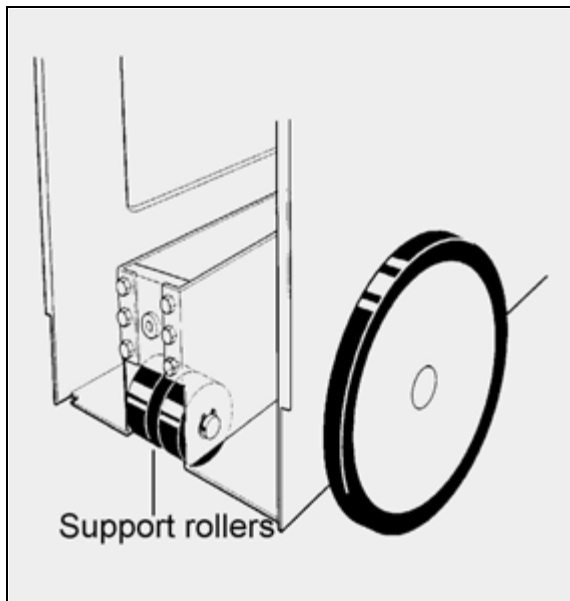


Fig. 3: Rollers

3.2.2 Front transport wheels

- Lock the back transport wheels with the parking brake.
- Elevate the front transport wheels with a piece of wood ([Fig. 4 / p. 39](#)).

SIM Secure attachment

- Ensure attachment of the wheels.

SIM Smooth rotation

- Ensure smooth rotation of the wheels.

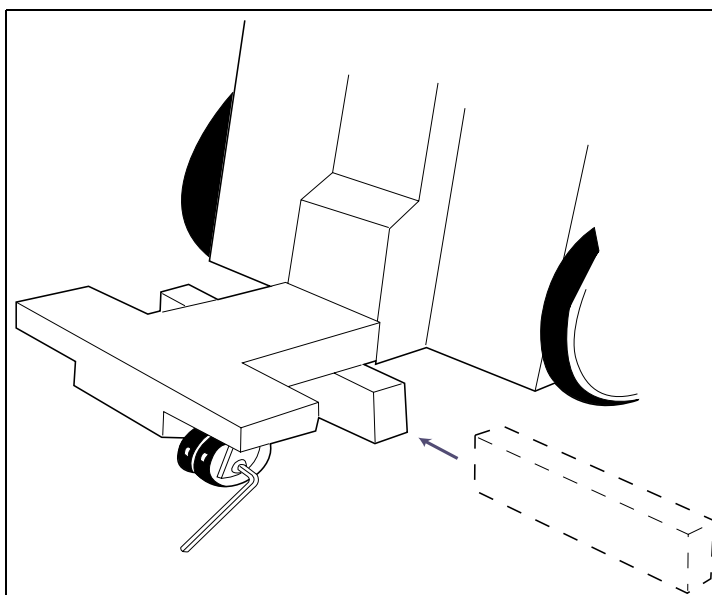


Fig. 4: Raise the front of the system

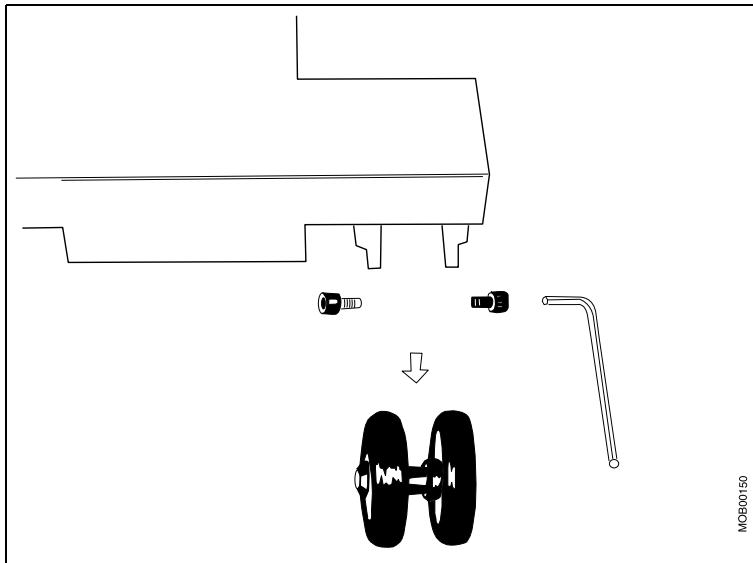


Fig. 5: Installing the front transport wheels

3.2.3 Brakes

SIM Uniformity

- The brake pad should not rub during transport.
- Brake the system during transport.
 - ⇒ The system should not pull to one side during braking.

SIM Braking force

- Activate the brake.
- Use the spring balance to pull the system forward and backward.
 - ⇒ The system should not move under 350N (adjusting the brakes is described in the "Replacement of parts" instructions).

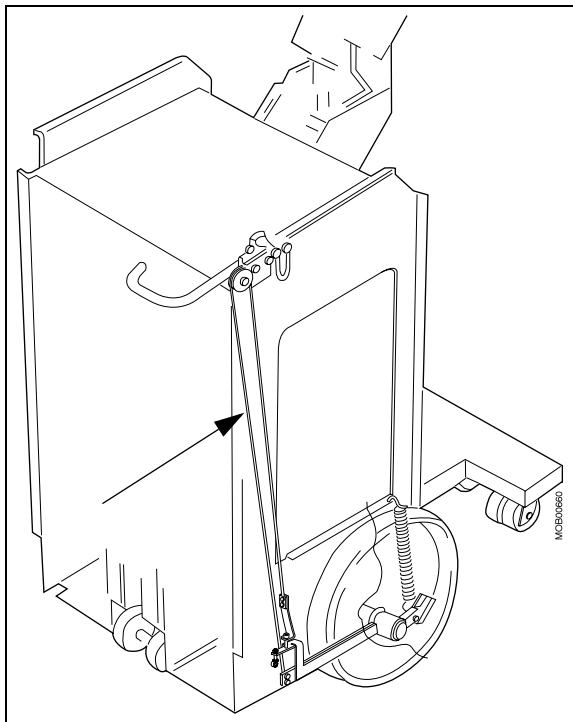


Fig. 6: Hand brake

3.2.4 Support arm transport lock

SIM Checking transport lock

- Check the transport lock for mechanical defects. Replace lock, if damaged.

SIM Locking mechanism

- Verify that the support arm handle engages securely in the transport lock.

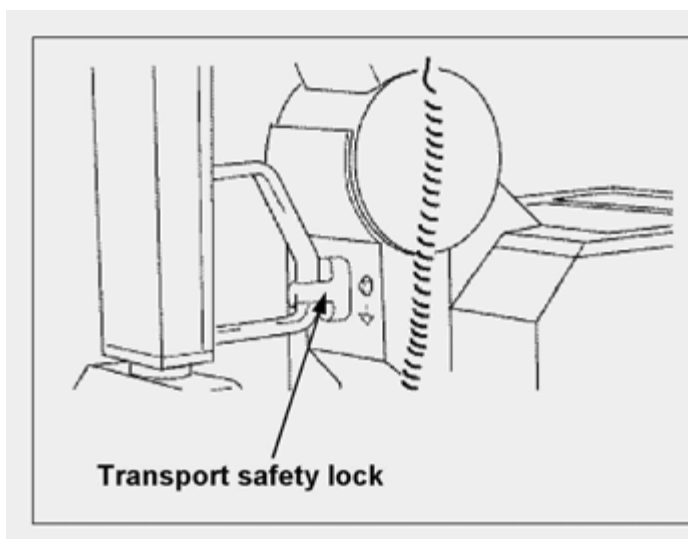


Fig. 7: Support arm and transport safety lock handle

3.2.5 Handles

SIM Attachment

- Verify that the support arm and collimator handles are undamaged and securely attached. Tighten screws and replace defective parts as necessary.

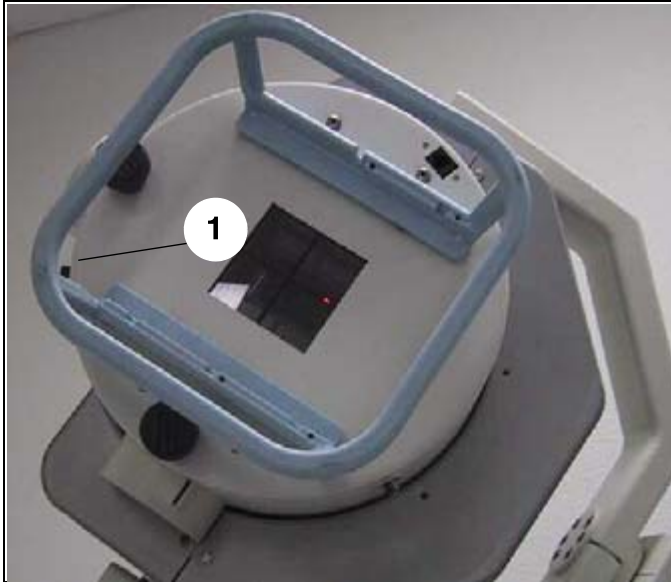


Fig. 8: Collimator handle

3.2.6 Collimator adjustment knobs

SIM Attachment

- Verify that the collimator adjustment knobs are properly seated.

3.2.7 Arm system and single tank

3.2.7.1 Moving the arm system

SIM Moving the arm system

- Move the support arm into all the usual positions. The arm should not move up or down after you release it. (To adjust the friction brakes, refer to the "Replacement of parts" instructions).

SIM Moving the single tank holder

- The single tank holder must be easy to turn and maintain any position.

SIM Moving the single tank

- The single tank must be easy to turn and maintain any position.

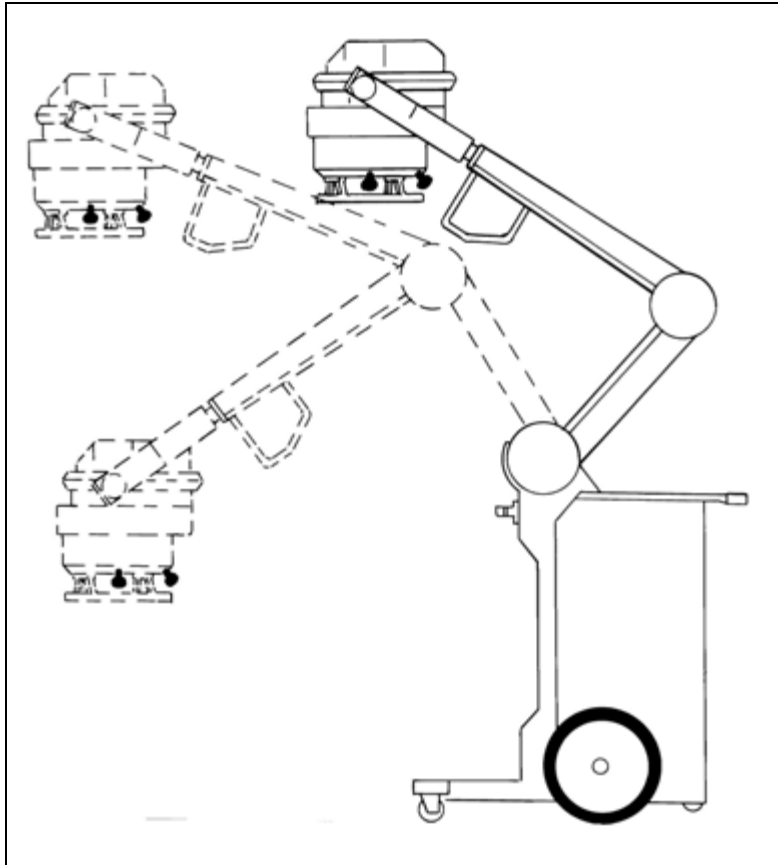


Fig. 9: Arm system

3.2.7.2 Arm system attachment

- Remove the top and bottom arm covers from the column.

SIM Screws and lock nuts

- Check that the screws and lock nuts are seated securely ([Fig. 10 / p. 44](#)).

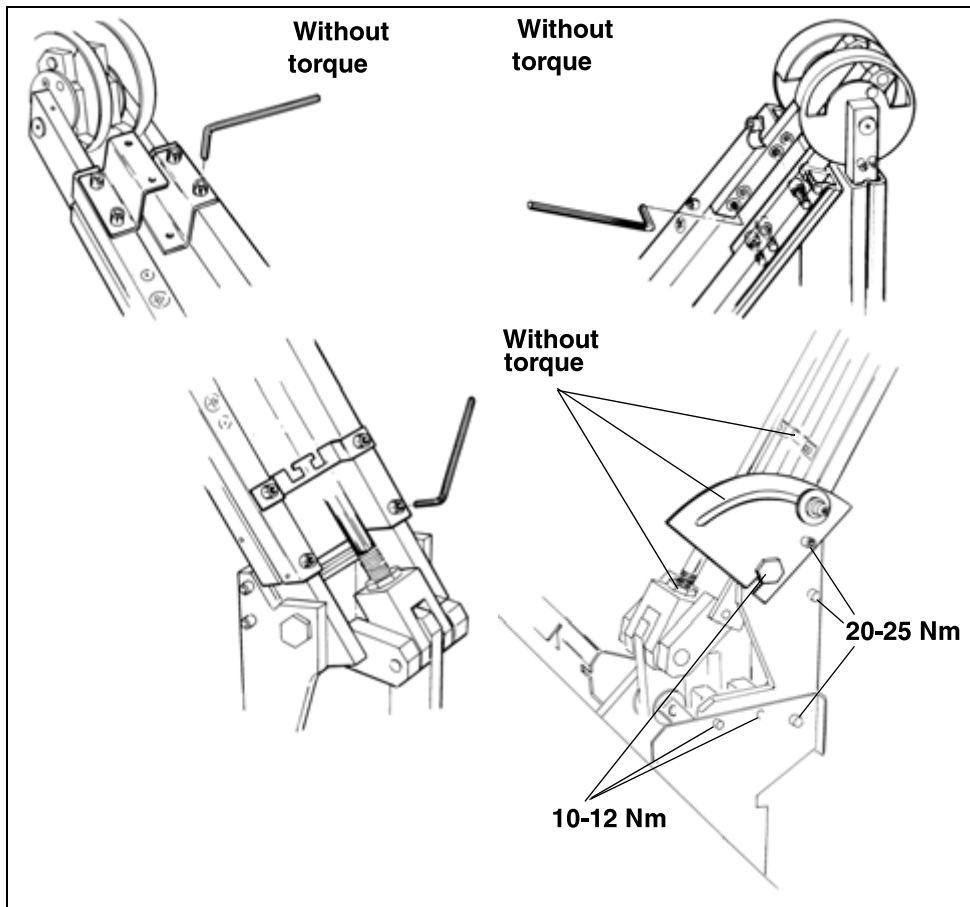


Fig. 10: Arm system attachment

3.2.7.3 Arm connector

- Remove the covers from the bottom arm articulation.

NOTE

For easier reassembly, note the disassembly sequence.

SIM Screws and nuts

- Check that the screws and nuts are seated securely .

3.2.7.4 Adjusting screw and cantilever

⚠ WARNING

Uncontrolled system movements pose danger of injury.

The support can fall if the adjusting screws are unscrewed incorrectly!

⇒ Carelessness can result in death or serious bodily injury.

SIM Lock nuts

- Verify that the lock nuts on the adjusting screw are properly seated (Fig. 11 / p. 45).

SIM Attaching the base

- Verify that the base attachment in the chassis is secure (Fig. 11 / p. 45).

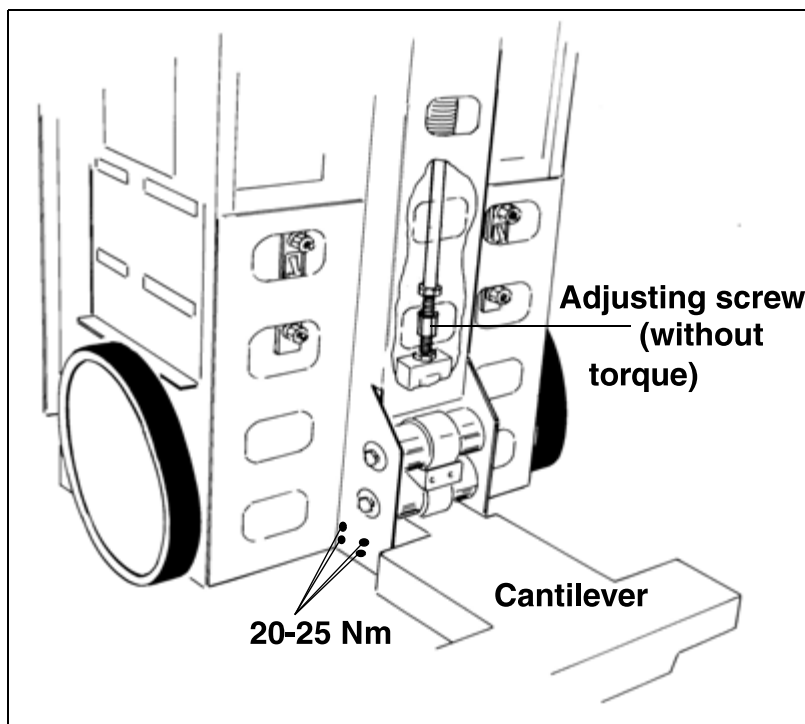


Fig. 11: Adjusting screw and cantilever attachment

3.2.7.5 Cable harness for the arm system

SIM Undamaged

- Check all support arm cabling for damage (stretching, twisting, insulation cracks). Pay special attention to the stress points of moving elements (Fig. 12 / p. 46).
- Replace any damaged cables.

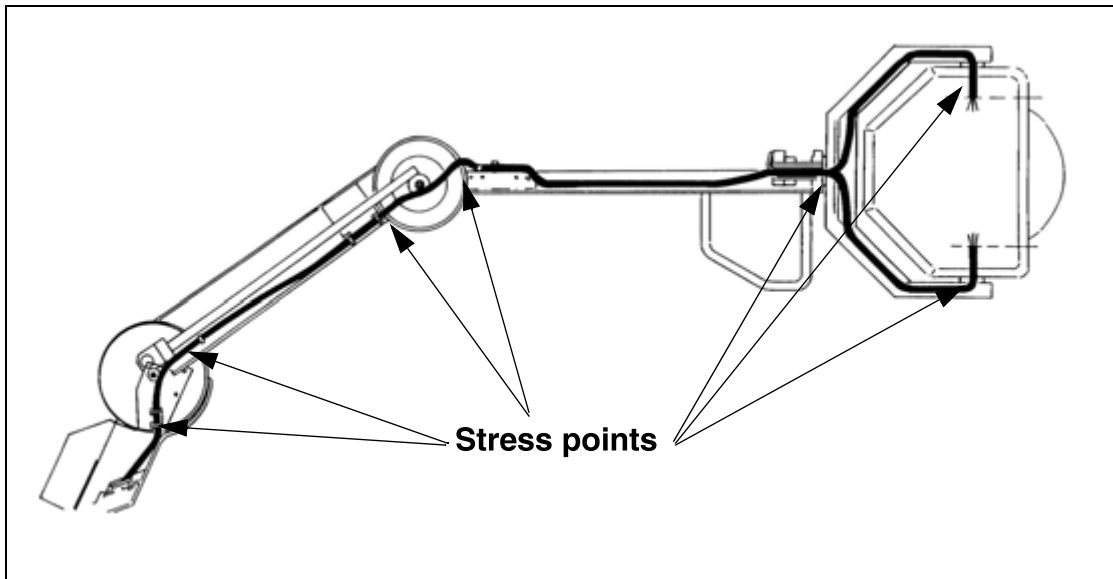


Fig. 12: Cable stress points

3.2.8 Single tank holder

SIM Holder screw connections

- Verify that the screw connections on the support arm holder are secure.

SIM Single-tank screw connections

- Verify that the four screws on the single tank are secure.
 - ⇒ Completely remove any loose screw connections and screw them in again using LOCTITE 242.

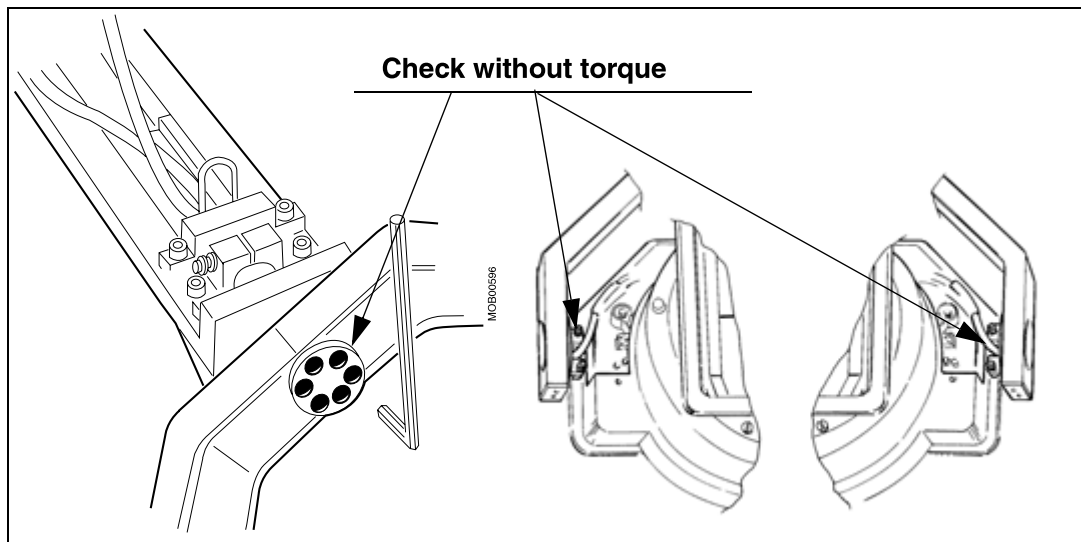


Fig. 13: Holder and single tank attachment

3.2.9 Power cable

NOTE

**Replacement of cable winch including cable:
MOBILETT XP Digital every 4 years**

PMP Cable winch replacement

- If the replacement interval has been reached, replace the cable winch according to the "Replacement of parts" instructions.

SIM Checking the power cable

- Pull the entire power cable (6m) out of the cable winch. Check the cable for damage.

SIM General cable winch information

- Pull the entire power cable (6 m) out of the cable winch. Hold the cable while coiling and move it up and down until the cable is fully coiled. Verify that the cable winch and the brake work properly.

PMP Cleaning

- Clean the power cable with a cloth. Dampen the cloth with a mixture of lukewarm water and household cleaner.

3.2.9.1 Power plug

SIM Checking the power plug

- Check the power plug for proper functioning.
- Open the plug and check the terminals and strain relief.
 - ⇒ The ground wire has to be slightly longer than the other wires (applies to all plug types).

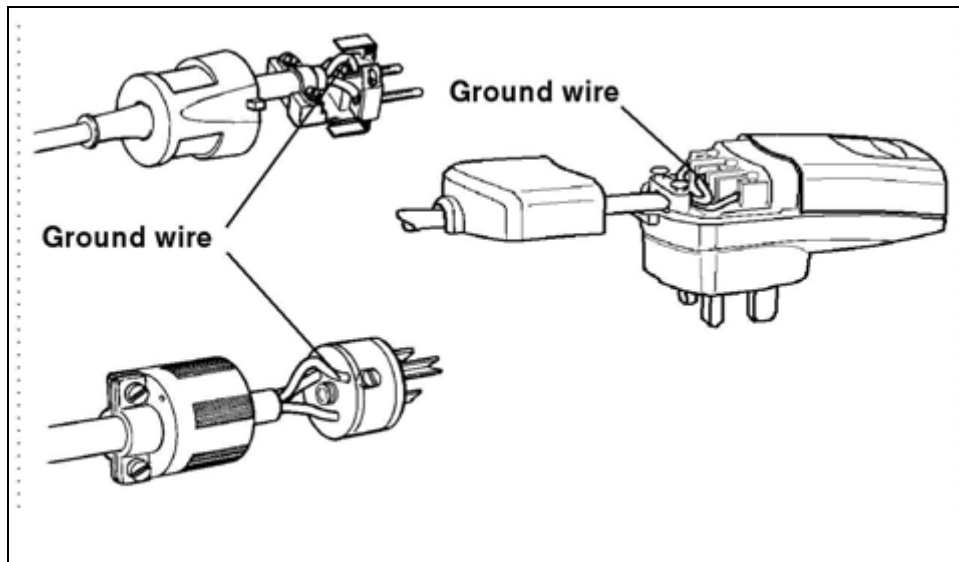


Fig. 14: Ground wire

3.2.10 Lubrication

PMP Pull-bar slide bushing

Lubricate the pull bar of the side bushing (Fig. 15 / p. 48).

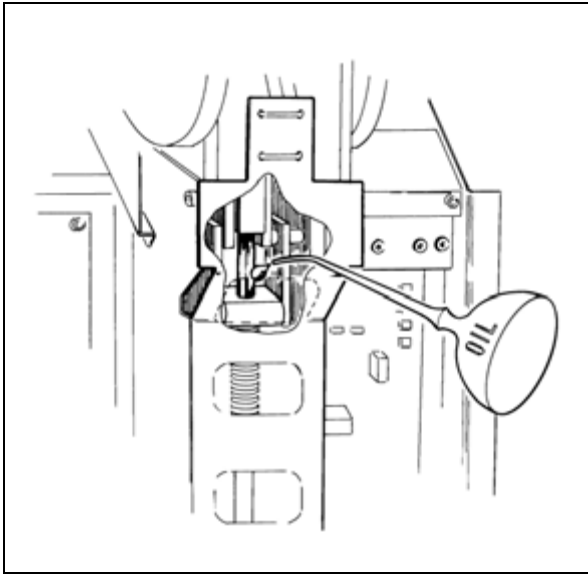


Fig. 15: Lubrication point

3.3 Function inspection

3.3.1 Operating data

Activating service programs

- Switch off the system, unplug the power plug, remove the top cover and place it sideways on a table or the like. Do not disconnect any cables.
- Move service switch SW2B into position 2 (service) board D916 (CPU) (Fig. 16 / p. 49).
- - Switch the system on.
 - ⇒ "Pr 1" is displayed on the control panel.
- Use the mAs+/mAs- buttons to select the desired service program.

NOTE

The X-ray function is deactivated during an active service program.

For detailed information, see Troubleshooting Instructions SPR8-230.840...

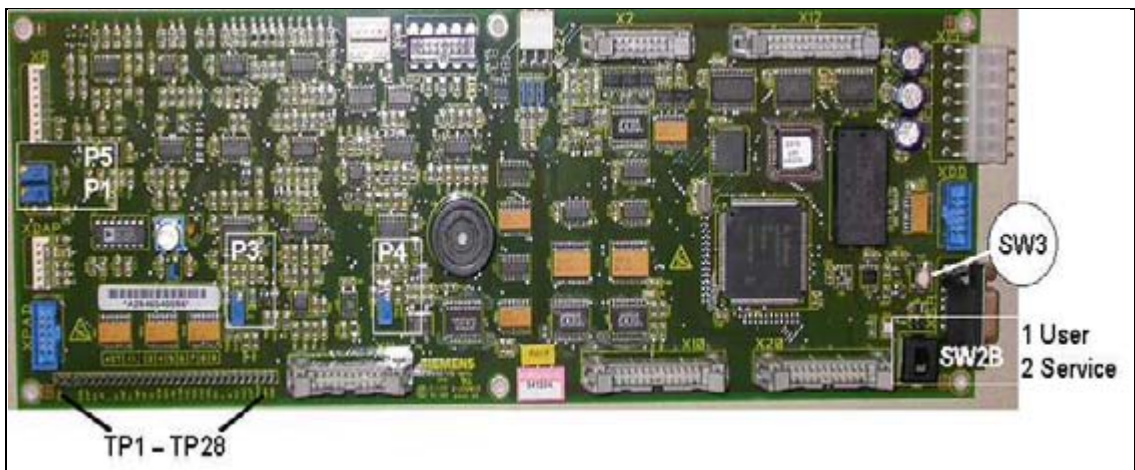


Fig. 16: CPU D916

3.3.1.1 Reading out the operating information

PMF Exposure counter

- Select ServiceProgram 02 and record the "exposure" counter status in the protocol.

PMF Error memory

- Select ServiceProgram 03 and read out the error memory. If a defective component message is displayed, check it according to the troubleshooting instructions. Reset the memory in service program 04.
- Switch off the system.
- Return service switch SW2B D916 (CPU) to position 1 (user).

3.3.2 Displaying the control panel

PMF Mains display

- The yellow line voltage control LED must be lit when the line voltage plug is plugged in (3/Fig. 17 / p. 50).
- System ON.

PMF kV/mAs default values

SIE kV/mAs segment displays

- The kV/mAs default values must display and be completely legible (take the default values from the start-up protocol).

PMF Ready indicator

- The green ready LED (2/Fig. 17 / p. 50) should light up within 15 seconds of "system ON".

SIE kV/mAs displays according to operating instructions

- Select all kV/mAs values.

3.3.3 Checking the radiation indicator



Fig. 17: Control and display

SIE Radiation indicator

SIE Ready indicator

SIE Acoustic signal

- System is switched on.
- Set 81 kV and 10 mAs.
- Initiate an exposure.



The radiation indicator (1/Fig. 17 / p. 50) lights up during the exposure; at the same time an acoustic signal sounds and the "ready" light goes out.

- The "ready" light (2/Fig. 17 / p. 50) goes on again within a maximum of 15 seconds.

3.3.4 Manual termination of exposure

The user must be able to cancel an exposure at any time.

SIE "ERR 39" display

SIE Acoustic signals



- System is switched on.
- Set a midrange kV value (e.g., 70 kV) and the highest possible mAs value.
- Release an exposure and interrupt it immediately.
 - ⇒ The display then reads "ERR 39" and several short acoustic signals are emitted ("ERR 39 = exposure aborted). Acknowledge the error message with the "collimator light" key on the control panel.

3.4 Collimator

3.4.1 Lamp replacement

PMP Annual replacement of the collimator lamp



The collimator lamp should be replaced every 12 months.

Tools and auxiliary materials required

- Rope for securing the support arm (approx. 4m long)
- Allen wrench set
- Screw driver set 1-6 (Phillips head and slotted head screws)

24V/100W lamp - Siemens order no.: 08392016

NOTE

Do not touch the lamp with bare hands. Touch the bulb only with a clean, dry cloth.

Required work steps:

- Switch off the system and possibly disconnect the power plug.
- Use a rope or tightening belt to secure the system support arm against lifting (B/Fig. 18 / p. 53).
 - ⇒ The single tank should rest securely on a table or the like.
- Remove the two adjustment knobs of the collimator (2 mm Allen wrench) (C/Fig. 19 / p. 53).
 - ⇒ Note the position of the knobs during removal.
- Disconnect the plug of the DAP measurement chamber (if present).
- Open the collimator cover (1/Fig. 20 / p. 54).
 - ⇒ Turn the cover and remove the connections: DAP plug; light switch, ground wire (Fig. 21 / p. 54).
- Remove the protective cover from the lamp (4/Fig. 22 / p. 54).
- Replace the lamp (6/Fig. 23 / p. 55).
 - ⇒ The light filament of the lamp must be positioned directly over the rectangular light aperture.
- To reassemble, repeat the above steps in reverse order.

PMF Light localizer function

- Turn the system ON and test the function of the light for all 3 light localizer buttons.

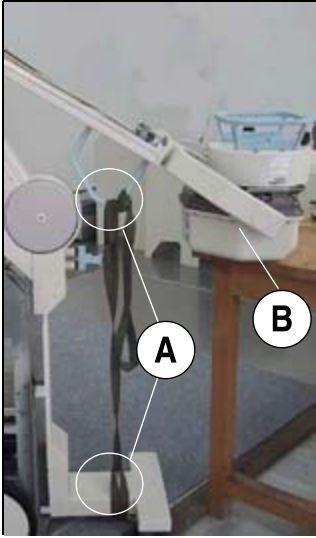


Fig. 18: Single-tank service position

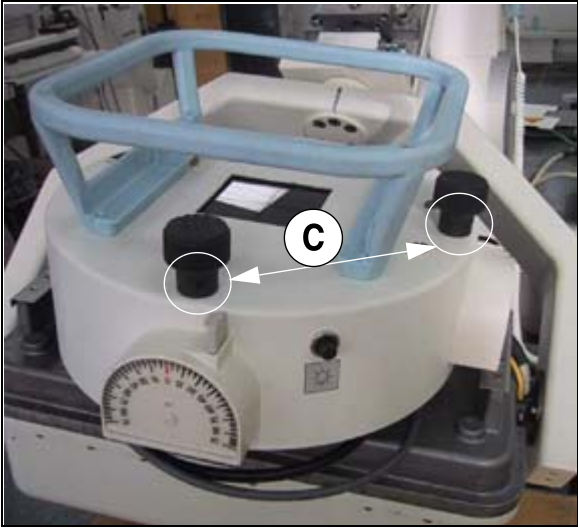


Fig. 19: Collimator rotary knobs

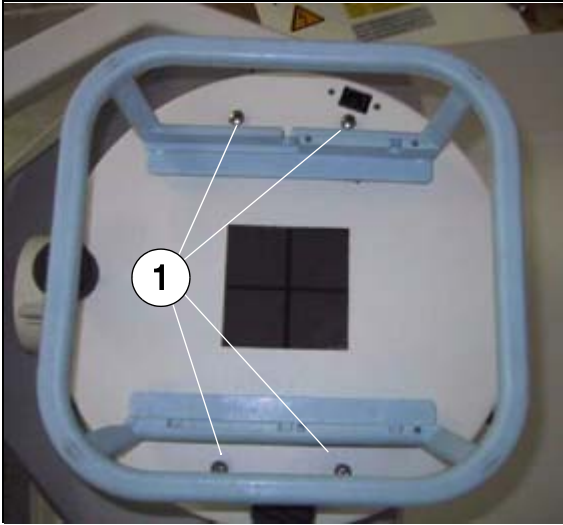


Fig. 20: Collimator cover

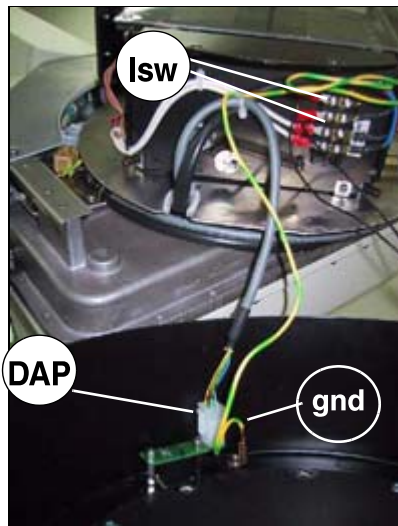


Fig. 21: Terminals in the cover

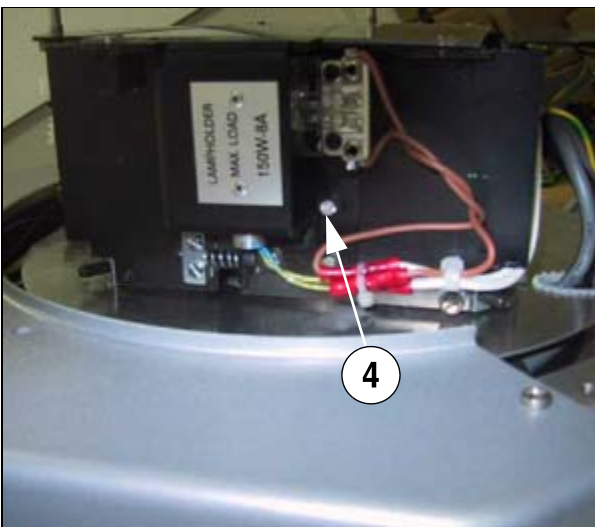


Fig. 22: Lamp socket

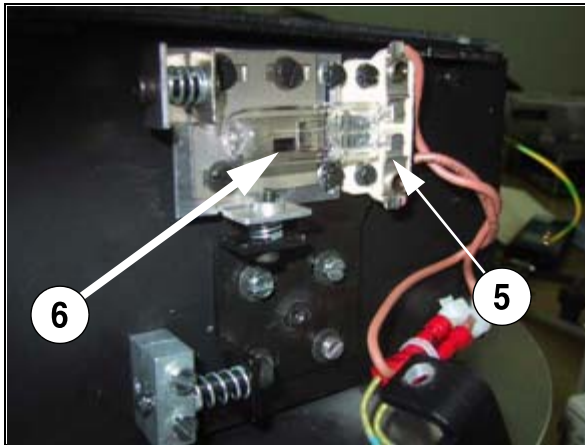


Fig. 23: Collimator lamp

3.4.2 Checking the illuminance

U Required measuring instrument:
S - Lux meter

PMF **Illuminance**

- Log the illuminance.

If the light localizer is switched on for illuminating the radiation field, the average illuminance must be at least 180 Lux at a distance of 100 cm. The average illuminance is determined in that measurements are performed approximately in the center of each of the four light field quadrants (Fig. 24 / p. 55).

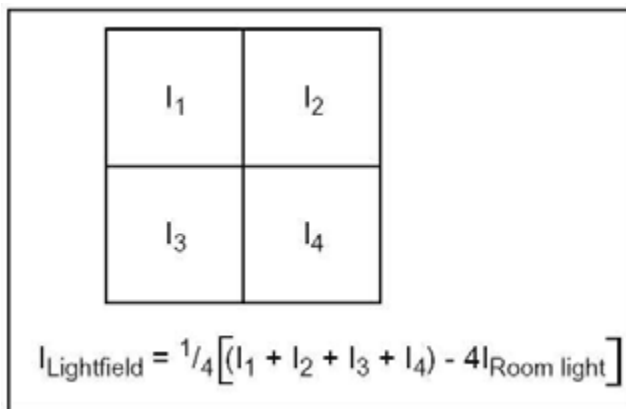


Fig. 24: Illuminance

3.4.3 Light field/radiation field

Checking the light and radiation field

- Place the detector (35 cm x 43 cm) on the tabletop.

- Set the central beam so that it is vertical.
- Set a vertical SID of 100 cm.
 - ⇒ Use the tape measure in the collimator to measure to the top surface of the detector.
- Switch on the light localizer and adjust a light field of approx. 30x30 cm on the detector.
- Place the lead ruler (centering cross) centered on the detector.
- Measure the light field and make a note of the dimensions (Fig. 25 / p. 56).
- Position a washer as a side marker.



Fig. 25: Centering cross

- Create a test patient.
- Select an organ program from the "TEST" area with approx. 60 kV, 4mAs.
 - ⇒ "Exposure ready" appears in the top right corner on the monitor.
- Initiate exposure.



Evaluation: Light field to radiation field

QSQ Deviation $((A + C) / SID)$

QSQ Deviation $((B + D) / SID)$

- Evaluate the deviations (A, C and B, D) between the recorded light field and the radiation field edges on all four sides using the centering cross (Fig. 26 / p. 57). Use the zoom function as necessary.
 - ⇒ The total permissible deviation (disregarding the prefix) amounts to a maximum of 1.7% of the SID. If the deviation is > 1.7%, the collimator must be adjusted (see the "Replacement of Parts" instructions).
Log the deviation.

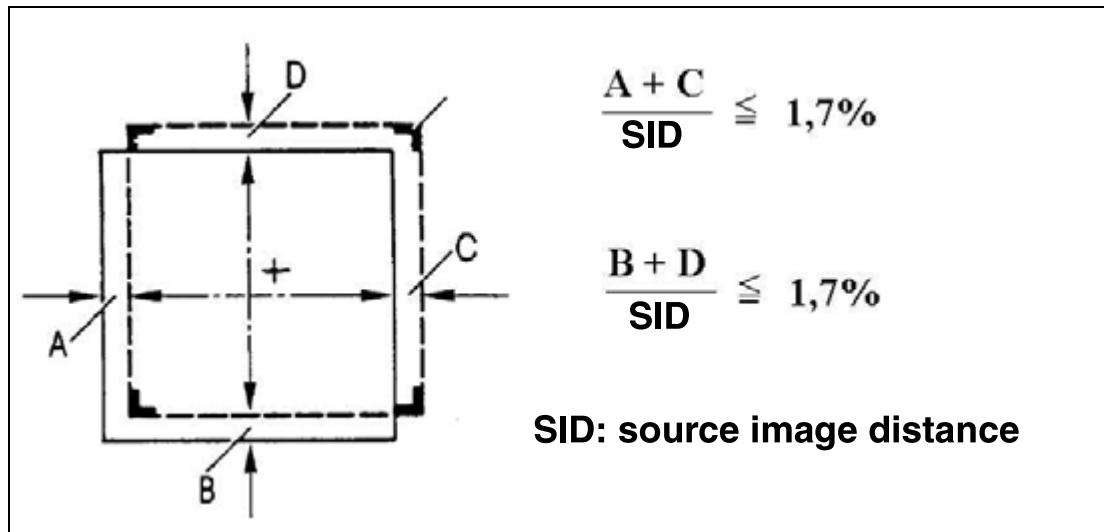


Fig. 26: Light field/radiation film

3.5 Battery and motor drive inspection

3.5.1 Batteries

NOTE

The life of battery packs BK1-BK4 is estimated at 12-24 months. There is no acceptable measuring procedure to determine the battery quality.

Battery life is dependent on the charging and discharging times which are largely determined by the user.

The user must provide the charge/discharge time ratio.

The longest charging time is approx. 12 hrs. The three LEDs light up yellow on the control panel (3/ Fig. 27 / p. 58).

One discharge cycle allows for 80 exposures with maximum kV/mAs values and transport operation of approx. 3,000 m.

Realistic statement: The MOBILETT does not need to be charged during the 12-hour workday.

If the minimum battery charge is reached in < 5 hrs., the battery must be replaced.

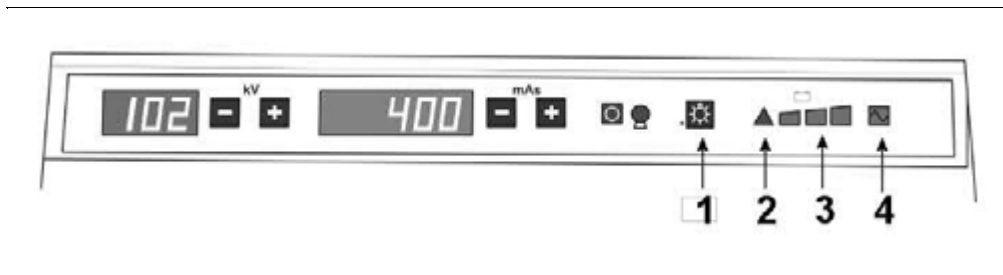


Fig. 27: Battery status display

PMF Charging performance

- Ask operating personnel about the charging cycles.
 - ⇒ If necessary, replace the batteries as described in the "Replacement of parts" instructions.

3.5.2 Motor drive

NOTE

Completely reassemble the system and attach all the covers for the following work procedures.

PMF Forward/backward

PMF Slow/fast

- Turn the system ON and release the hand brake.
- Check the transport movements according to the operating instructions.

3.6 Options

3.6.1 DAP measuring system

Measuring device for dose area product (**D**ose **A**rea **P**roduct).

The DAP measuring device is used to measure the kerma area product (kerma = kinetic energy released in matter) during an X-ray examination. It is primarily used to record the radiation dose a patient has been exposed to.

The DAP is calibrated at the factory.

SIE **Function of the DAP measuring system**



- System is switched on.
- Press the Test button on the DAP display.
 - ⇒ The subsequently displayed value must be between 80-120 μGym^2 (DAP resolution range 0.1 μGym) or 8-12 μGym (DAP resolution range 0.01 μGym) for a high-resolution chamber.
 - ⇒ If the display is incorrect, the measuring device must be calibrated. See the "Replacement of parts" instructions (SPR8-230.841...).
- Verify the function of the DAP measuring system by releasing an exposure.
 - ⇒ A measured value is displayed in the DAP display as a function of the object in the beam path.

3.6.2 Remote control

PMP **Battery replacement for remote control (yearly)**

- Replace the battery (9V alkaline).

SIE **Remote control function**



- Check the function of the remote control.
- Switch on the light localizer of the collimator.
- Initiate an exposure.

3.7 Checking the kV/mAs exposure parameters

3.7.1 kV accuracy

Requirement:

The measured kV values must be within the limit values, see tables.

One of two measuring methods can be used:

1.) kV meter procedure:

- kV meter based on the filter comparison method (e.g. PTW Nomex)
Use the correction factor given in the kV meter operating instructions for non-invasive kV measurements.

2.) Oscilloscope method:

- Storage oscilloscope with a measuring accuracy of $\pm 2.5\%$

kV meter method:**NOTE**

The inherent filtration (AL equivalent) of MOBILETT XP Digital is 3.1mmAl (single tank plus collimator).

An installed DAP measurement chamber increases the inherent filtration by 0.4 mm AL.

- System is switched on.
- Select the analog operating mode.
- Prepare the kV meter for the measurement according to the operating instructions.
- Place the measuring detector on a suitable surface and center the single tank with respect to the measuring detector (Fig. 28 / p. 61).
- Set the source-image distance to the value specified in the kV meter operating instructions.
- Use the light localizer to collimate to the measuring detector.

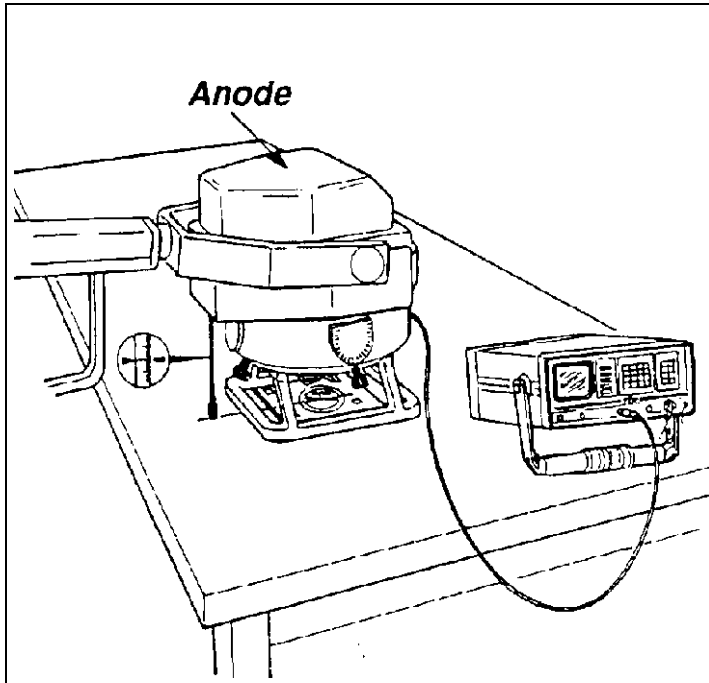


Fig. 28: kV measurement



- Set the following exposure parameters and initiate an exposure after each setting:

kV meter Select	Exposure parameters		Limit values
DC voltage	52 kV	50 mAs	49.0 - 55.0 kV
	81 kV	20 mAs	77.0 - 85.0 kV
	133 kV	12.5 mAs	126.4 - 139.6 kV

PMF kV accuracy 52 kV, 50 mAs

PMF kV accuracy 81 kV, 20 mAs

PMF kV accuracy 133 kV, 12.5 mAs

Record the measured values.

Oscilloscope method:

"KVS" measuring point for the nominal value and "KV" measuring point for the actual value. The measuring ratio is 30 kV/V.

- Open the top system cover and place the cover sideways on a table or the like. Do not disconnect any cables.

- Connect the oscilloscope to the measuring points of the (CPU) D916 TP "KV" and "KVS" (also see the troubleshooting instructions). Oscilloscope setting: Channel 1 = TP KV 1V/div, channel 2 TP KVC 2V/div, trigger channel 2, trigger stage 2.5 V, 2V/div, 50 ms/div (oscilloscope setting: Channel 1 = TP KV 1V/div, channel 2 TP KVC 2V/div, trigger channel 2, trigger stage 2.5 V, 2V/div, 50 ms/div)
 - ⇒ Oscilloscope setting: Channel 1 = TP "KV" 1V/div, channel 2 TP "KVS" 2V/div, trigger channel 2, trigger stage 2.5 V, 50 ms/div
- Follow the same procedure as described in "kV meter method".

3.7.2 mAs accuracy

Requirement:

The measured mAs values must be within the limit values, see tables.

One of two measuring methods can be used:

1.) mAs meter method:

- mAs meter (e.g., MAS meter 8160400 with a measuring accuracy of 1 % ± 1 decimal place)

2.) Oscilloscope method:

- Storage oscilloscope with a measuring accuracy of ± 2.5%

Oscilloscope method:

- Open the top cover of the MOBILETT XP Digital and place it sideways on a table or the like. Do not disconnect any cables.
- Connect the oscilloscope to the "JR" and "GND" measuring points on CPU D916.
- Switch on the MOBILETT XP Digital.
- Select the analog operating mode.
 - ⇒ After switching the unit on, wait approx. 5 minutes for it to stabilize.
- Release exposures according to the table.



Parameter setting		Allowable mAs value
kV	mAs	
40	5	4.7 - 5.3
81	2	1.9 - 2.1
133	10	9.5 - 10.5

The mAs value can be calculated with the help of the oscilloscope display.

Calculating the mAs value (example):

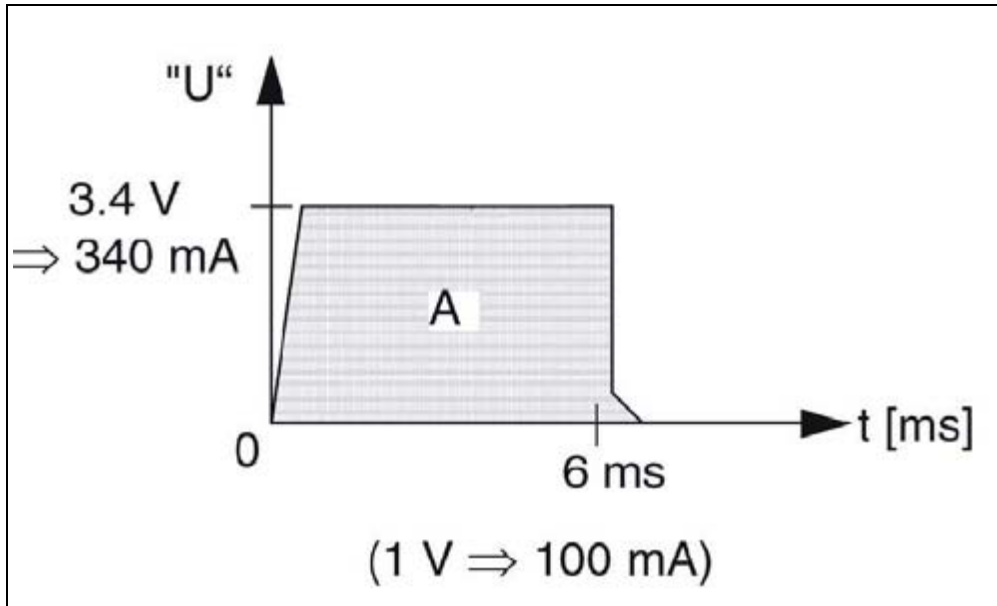


Fig. 29: mAs calculation

Surface "A" corresponds to the mAs value.

$$\begin{aligned} \text{mAs} &= \text{Tube current} \times \text{Exposure time} \\ \text{mAs} &= 340 \text{ mA} \times 0.006 \text{ s} = 2.0 \text{ mAs} \end{aligned}$$

- PMF kV accuracy 40 kV, 5 mAs**
- PMF kV accuracy 81 kV, 2 mAs**
- PMF kV accuracy 133 kV, 10 mAs**

- Calculate and record the mAs values.

mAs meter method:

Use of the mAs jumper on PCB D907 directly on the single tank.

- Remove the cover from single tank and connect the mAs meter to D907 (1/ Fig. 30 / p. 64).
- Follow the same procedure as described in the "Oscilloscope method" section.

For more information on the measuring technique, refer to the user manual for the mAs meter.

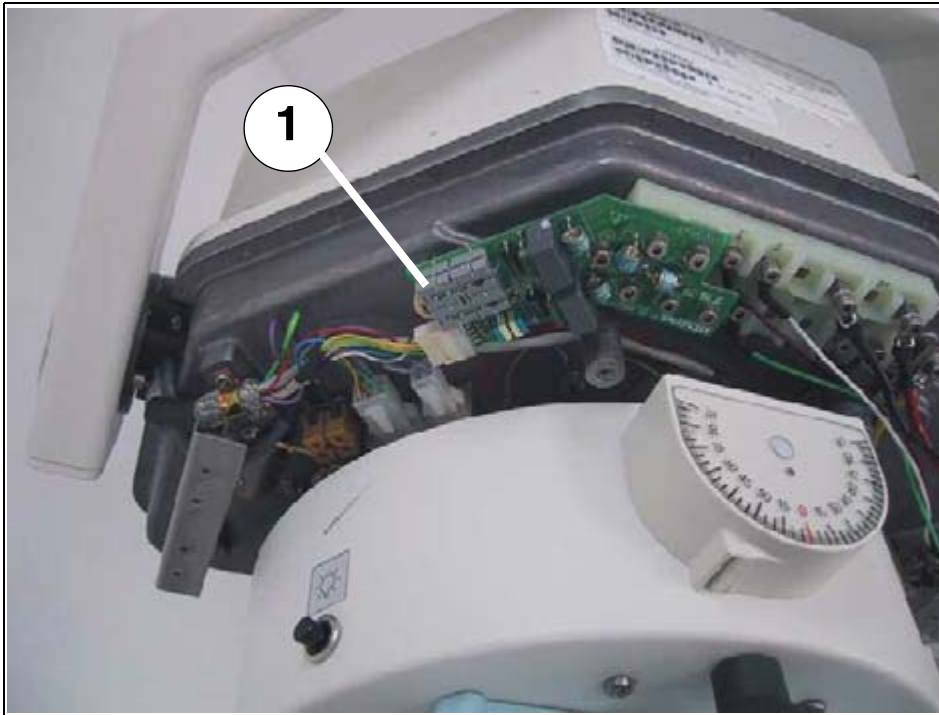


Fig. 30: mAs jumper D907

3.8 Reproducibility test (USA only)

Requirement:

The coefficient of variation for the radiation dose for any combination of exposure parameters does not exceed 0.045. This requires operation at the line voltage compliant with Siemens specifications.

NOTE

In the following test, 10 sequential exposures are taken within one hour.

The exposure parameters should be briefly set to different values following each measurement.

Required measuring instrument:

- Dosimeter

Procedure:



- After switching the system on, wait until its temperature has stabilized. The unit is ready for these measurements after 15 minutes.
- Initiate the number of exposures with the specified exposure data:
 - 85 kV, 1.0 mAs, 10 exposures.
- Measure the dose for each exposure.
- Reset the display prior to each new measurement.

Calculations: Coefficient of variation C

Coefficient of variation C is determined for a series of 10 dose measurements with the following formula:

$$C = \frac{s}{\bar{x}} = \frac{1}{\bar{x}} \left[\sum_{i=1}^n \frac{(x_i - \bar{x})^2}{n - 1} \right]^{1/2}$$

Fig. 31:

- s = Standard deviation resulting from the measurements
-
- x = Average measurement of the series
- x_i = i. measurement of series
- n = Number of individual measurements in series

The following shows an example of the procedure. Follow this procedure and record the result in the protocol.

Coefficient of variation C must be ≤ 0.045 .

If the value obtained is > 0.045 , locate and correct the cause according to the troubleshooting instructions.

QSQ Determine coefficient of variation C.

Example for determining coefficient of variation C:

Step 1)

- 10 exposures with recorded measurements (fictitious measured values).

Exposure (n=10)	Measured values (xi)
1	1.01
2	1.02
3	1.03
4	1.04
5	1.03
6	1.02
7	1.02
8	1.01
9	1.03
10	1.04

Step 2)

- Addition of measured values:

$$\Sigma = 1.01 + 1.02 + 1.03 + 1.04 + 1.03 + 1.02 + 1.02 + 1.01 + 1.03 + 1.04 = 10.25$$

$$\bar{x} = \frac{\Sigma}{n} = \frac{10.25}{10} \Rightarrow \bar{x} = 1.025$$

Fig. 32:

Step 3)

Calculation of the standard deviation:

$$s = \sqrt{\frac{(x_1 - \bar{x})^2}{n-1} + \dots} =$$

Fig. 33:

$$\sqrt{\frac{(1.01-1.025)^2}{9} + \frac{(1.02-1.025)^2}{9} + \frac{(1.03-1.025)^2}{9} + \frac{(1.04-1.025)^2}{9} + \frac{(1.03-1.025)^2}{9} + \frac{(1.02-1.025)^2}{9} + \frac{(1.02-1.025)^2}{9} + \frac{(1.01-1.025)^2}{9} + \frac{(1.03-1.025)^2}{9} + \frac{(1.04-1.025)^2}{9}} = s$$

Fig. 34:

$$\sqrt{2.5 \times 10^{-5} + 2.8 \times 10^{-6} + 2.8 \times 10^{-6} + 2.5 \times 10^{-5} + 2.8 \times 10^{-6} + 2.8 \times 10^{-6} + 2.8 \times 10^{-6} + 2.5 \times 10^{-5} + 2.8 \times 10^{-6} + 2.5 \times 10^{-5}} \Rightarrow s = 0.0108$$

Fig. 35:

Step 4)

- Calculation of the coefficient:

$$C = \frac{s}{x} = \frac{0.0108}{1.025} = 0.0105$$

Fig. 36:

In this example, the generator complies with the specification:

C = 0.0105, hence it is ≤ 0.0450.

3.9 Checking the image quality

In the course of maintenance, the image quality must be checked and documented in accordance with the document "Quality assurance, SPR8-230.820.30...". File the completed quality assurance report in the "Certificates" register no. 9 in the system binder.

3.9.1 Dose measurement

QIQ Dose measurement

- See "Quality assurance, SPR8-230.820.30...".

3.9.2 Resolution

QIQ Resolution

- See "Quality assurance, SPR8-230.820.30...".

3.9.3 Contrast

QIQ Contrast

- See "Quality assurance, SPR8-230.820.30...".

3.9.4 Hardcopy

Only necessary when a hardcopy camera is configured.

QIQ Hardcopy

- See "Quality assurance, SPR8-230.820.30...".

3.10 Protective conductor test

SIE Protective conductor test

Observe the protective conductor resistance test information in these instructions.

- Perform the protective conductor test with all covers closed, according to ARTD-002.731.17....

The protective conductor resistance must not exceed 0.2 Ohms.

- The values determined, including the measuring points, must be recorded and assessed in the protective conductor resistance report.
- The measuring procedure and the measuring device used (designation and serial number) must also be documented.

NOTE

File the protective conductor resistance report in the "Certificates" register no. 9 in the system binder.

NOTE

A new report must be created if the protective conductor resistance measurements are not documented.

A new protective conductor resistance report can be found in the startup instructions SPR8-230.814.30.03. Separate this report from these instructions, fill it out, and file it in the "Certificates" register no. 9 in the system binder. If values are newly determined, they must be recorded as first measured values. The evaluation is omitted in this case.

3.11 Leakage current measurement

SIE Leakage current measurement

Observe the leakage current measurement information in these instructions.

- Perform the leakage current measurement with all covers closed, according to ARTD-002.731.17....

The measuring procedure indicated in the report must be used. If the first measured value has to be newly determined, a measuring procedure can be selected (direct measurement or differential measurement).

The limit value of 2.5 mA may not be exceeded.

 WARNING
--

Electrical voltage!

Non-compliance can lead to severe injury and even death.

⇒ **No housing parts of the system may be touched during direct measurement of the leakage current .**

⇒ **Third-person access to the system must be prevented.**

- The system must be switched on during measurement. Measuring devices with automated measuring sequences must therefore be set to manual measurement.
- Document the measuring procedure (differential measurement or direct measurement) and the measuring device used (designation and serial number).
- Measure and record the current line voltage. If the measured line voltage deviates from the nominal voltage, correct the measured value to the value corresponding to a measurement at the nominal value of the line voltage. This must also be documented.
- The highest value must be entered in the leakage current report and evaluated.

NOTE

File the leakage current report in the "Certificates" register no. 9 in the system binder.

NOTE

A new report must be created if the leakage current measurements are not documented.

A new leakage current report can be found in the startup instructions SPR8-230.814.30.03. Separate this report from these instructions, fill it out, and file it in Register 9, "Certificates", in the system binder. If values are newly determined, they are to be recorded as first measured values. The evaluation is omitted in this case.

3.12 Patient leakage current measurement

SIE Patient leakage current measurement

Observe the patient leakage current measurement information in these instructions.

- Perform the patient leakage current measurement with all covers closed, according to ARTD-002.731.17....
- Measure the patient leakage current at the flat detector.
- The limit values of 0.01 mA for direct current and 0.1 mA for alternating current may not be exceeded.
- The system must be switched on during measurement. Measuring devices with automated measuring sequences must therefore be set to manual measurement.
- Document the measuring procedure and the measuring device used (designation and serial number).
- The value determined must be entered in the patient leakage current report and evaluated.

NOTE

File the patient leakage current report in the "Certificates" register no. 9 in the system binder.

NOTE

A new report must be created if the patient leakage current measurements are not documented.

A new patient leakage current report can be found in the startup instructions SPR8-230.814.30.03. Separate this report from these instructions, fill it out, and file it in the "Certificates" register no. 9 in the system binder. If values are newly determined, they must be recorded as first measured values. The evaluation is omitted in this case.

3.13 Cleaning

PMP Cleaning

- Dampen a cloth with a mixture of lukewarm water and regular household cleaner. Clean the entire system.

4 Changes to previous version

Section	Paragraph	Revision
General maintenance information	Information on the protective conductor resistance test	New paragraph added
General maintenance information	Information on measuring the leakage current	New paragraph added
General maintenance information	Information on measuring the patient leakage current	New paragraph added
Inspection and maintenance	Protective conductor test	Completely rewritten
Inspection and maintenance	Leakage current measurement	Completely rewritten
Inspection and maintenance	Patient leakage current measurement	New paragraph added

