PHILIPS

PM manual

Intera /Achieva

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PHILIPS

PM manual

Section 1 - General

1 INTRODUCTION

To perform the instructions in the PM manual correctly, you must be aware of the right precautions and you must perform the preparations described in this chapter.

2 WHAT'S NEW

Revision	
DMR194718 Rev00	▪ Added: 4.5 Recording results ▪ Added: 3.5 Disabling/ Enabling ICAS alerting
DMR211932 Rev00	▪ New DMR number ▪ PM schedule changed ▪ Removed: Disable/Enable Philips Service Agent, and ICAS alerting
DMR211932 Rev01	▪ Clerical change
DMR211932 Rev02	▪ Added: preparation chapter ▪ Sub-chapter ‘’Recording results’’ adapted
DMR211932 Rev03	▪ Added Safety chapter
DMR211932 Rev04	▪ Added Safety chapter
DMR211932 Rev05	▪ Changes in chapter 4.2 ‘PM Remote Possibilities via RADAR and PRS’
DMR211932 Rev06	▪ Formatting corrections.

3 SAFETY

- The system is designed and manufactured according to the international standards for medical equipment.
- You must read the instructions given in this manual before you start the installation or service work.
  - Although you may have done work on similar systems in the past, the design and/or the procedures may have been updated since that time.

WARNING

- It is only permitted to install released configurations of the system.
  - It is not permitted to replace or add non-released items to the configuration during installation or service.
- Be careful when you access, touch, test, adjust, or service the system.
- Obey all Warnings and Cautions given in this manual.
- You must also read and obey the safety instructions given in the document ‘General safety messages’.

WARNING

Apply correct torques when creating electrical connections.
The values are mentioned in the chapters dealing with the specific connections.
Incorrectly installed connections can cause discharges and eventually fire.

WARNING

Close all cabinets when left unattended and after completion of service activities.

WARNING

Persons with a pacemaker, neurostimulator, insulin pump or other bio-stimulation device, implants consisting of ferromagnetic material, such as surgical clips, artificial cardiac valves and prosthesis, or with metal splinters, must not go into a strong magnetic field.

Such persons must stay outside the ‘controlled zone’. If such persons enter the controlled zone, they risk serious injury or death.

WARNING

- The RF amplifiers must be installed, operated, and serviced by qualified personnel.
- Do not touch electrical parts in the RF chain while the power is on.
- RF power can cause heating, severe burns and other injuries.
- During installation: make sure that the power switch of the RF amplifier is set to off during installation and when connecting or disconnecting cables.
- During operation: never operate an amplifier without having the RF output terminated into the load of the MRI.
- During service: make sure that the power switch of the RF amplifier is set to off during service actions in the RF chain.
- Do not operate the RF amplifiers with removed covers. There are voltages inside the power amplifier that can kill.
- Consult the technical manual supplied with the amplifier before servicing.

WARNING

Do not touch conductive system parts before verification of the ground connections.

WARNING

Unless required in the procedure document, you MUST use non-magnetic tools for work done inside the examination room when the magnet is energized.
If you do not obey these instructions, there is a risk of death or serious injury.

NOTE

The cable connections of the energization cables must be marked to identify that they are correctly torqued.

4 PREPARATION

A proper preparation is essential for an efficient PM visit minimizing time on site.

4.1 Parts and Tools

PM manual section ‘’material list’’ lists the various replacement parts and special tools that are needed for each step in a planned maintenance visit. Although parts indicated for a PM visit may not necessarily be used, some parts need to be replaced based on their condition. Therefore, it is important that all listed parts and tools are available before the actual PM visit starts.

4.2 PM Remote Possibilities via RADAR and PRS

According PM manual section ‘’timetable’’ there are multiple items identified as remote possibilities. By executing as many of these activities as possible remotely during the preparation, time on site is minimized. RADAR System Report already contains a couple of these items.

Specific remote PM possibilities for the sealed magnet (part of the Ingenia Ambition system) are not implemented at the moment in RADAR and PRS. They have to to be defined.

1. Check site conditions (temperature and humidity) (10 minutes) - RADAR
2. PIQT (15 minutes) - RADAR
3. Check SPT spec files (11 minutes) – PRS FTP and InCenter
4. Use analyzer (new System Inspector) (5 minutes) – PRS Telnet (zip files) and FTP (download)

And depending on the type of magnet also:

5. Check refrigeration system performance (15 minutes) – RADAR
6. Check fill pressure (2 minutes) - RADAR

Mentioned times are as indicated in the timetable, so these times can be saved on site.

RADAR has the PIQT results for the last successful PIQT. These results are relevant only if the PIQT has been done recently by the customer. If not, the PIQT has to be performed on site.

4.3 Planning

Sufficient time on site needs to be arranged for completing all tasks matching the PM visit. PM manual section ‘’timetable’’ lists the tasks to be executed during which visit. The timetable indicates the time required for each task and as such can be used for planning purposes.

The order of tasks and the way tasks are clustered in visits are optimized for workflow. However, parallel execution of certain tasks needs to be considered in order to minimize on site time.

Depending on the actual situation on site the optimal workflow can be different. Based on the site situation and the PM manual section ‘’timetable’’ estimations, appropriate time should be planned for the PM visit. Note that the time between tasks when switching from one task to another is not included in the numbers, so additional time need to be planned for that (around 30-45 minutes).

4.4 Execution

PM manual section ‘’timetable’’ lists the tasks to be executed during which visit. The PA (Performance Assurance) tool PM content is derived from this timetable.

The order of tasks and the way tasks are clustered in visits are optimized for workflow. However, to minimize on site time parallel execution of certain tasks need to be considered as presented in the planning chapter.

In the timetable the tasks are classified as mandatory, mandatory (safety), optional or workflow step:

- **Mandatory**: This task needs to be done always, when prescribed in the visit. You can handover the system if any mandatory task fails or is out of specification, but you should plan a corrective action.

  Correction during PM, although sometimes indicated in the PM manual, should only be done if time on site permits this.

- **Mandatory (Safety)**: This task needs to be done always, when prescribed in the visit and is performed for safety reasons. You must not handover the system if any safety task fails or is out of specification.

  On a fail, stop PM and execute a corrective action. Possibly a follow-up visit has to be scheduled to complete PM when time on site is limited.

  The final PIQT after the PM execution also has this classification, because after PM the system should operate within specification. However, depending on which parameter is out of specification, it may be decided to plan a future corrective action visit.

- **Optional**: This task can be skipped depending on local and/or customer agreements.

- **Workflow Step**: This task is mentioned as workflow step.

In case not all PM tasks could be finished in the allowed time on site, a follow-up PM visit should be planned.

4.5 Recording results

- Record the results of a PM visit according to your organizations’ local agreements.
- For most markets the PM results must be recorded in the PA (Performance Assurance) tool. Therefore, this chapter assumes the use of PA.
  - The PA tool contains all PM tasks listed in the PM manual section ‘’timetable’’ and PM task results are to be reported in the tool.
  - If the PA tool is not used in your local organization then make sure that you store the results in another way, according to local agreements.
- A PM visit is complete when:
  - Every task has a result reported or if a task is not required has status set to “Not Installed”.
  - Result is either “1st Result OK” or “OK after Correction” + info text when corrected.
  - Reported values are within specification.

In this way a compliant PM visit has been executed.

5 USING THE PM MANUAL

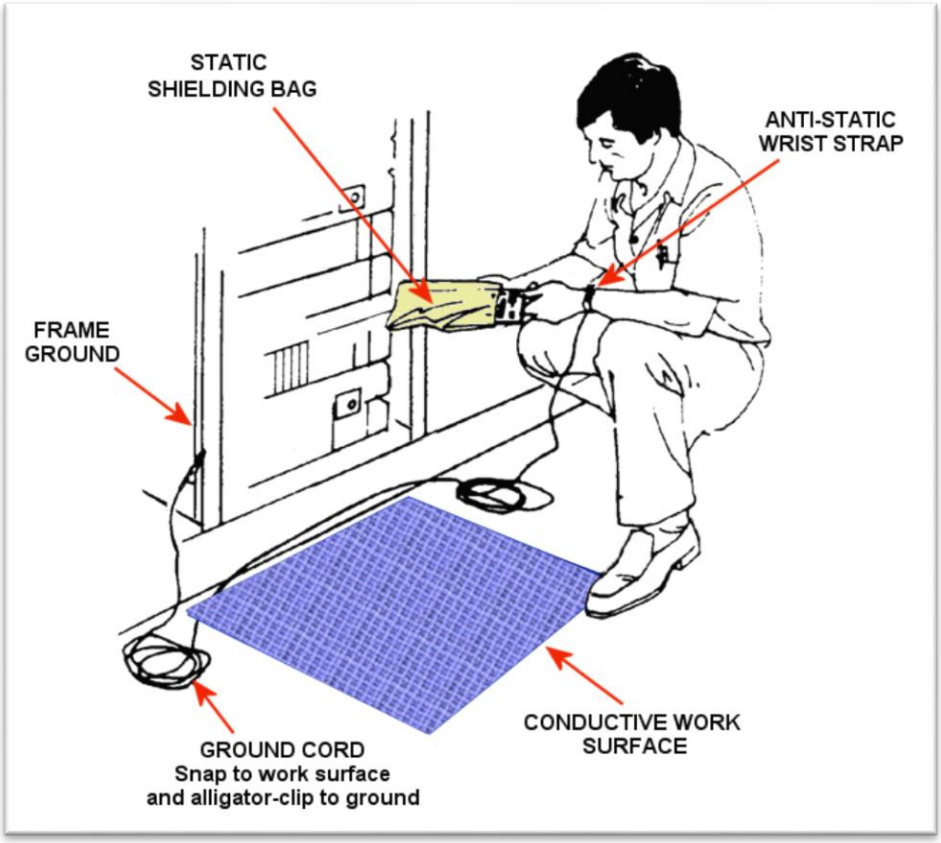
- Some functions and/or parts of a medical system require more frequent PM than other functions and/or parts.
- The PM time table indicates in which visit you need to do a PM task.
  - The PM schedule is designed and based on **four** PM sessions in **two** years.
  - The time between successive sessions is **six** months.
  - The tasks are listed in the preferred order of execution.
  - The time table in this manual is always leading.
  - A test/inspection always needs to be performed if the time table of this manual states this.
- The material list shows the required tools.
  - Tools and materials are specified per PM visit.
  - The tools required for every visit are listed in the material list.

6 ESD INSTRUCTIONS TO PREVENT ELECTRO STATIC DISCHARGE

The service engineer instructions for handling static sensitive printed circuit boards and other devices are in following order:

1. Transport the printed circuit board (PCB) in its static shielding bag or box to the location where it shall be installed.
2. Attach the wristband to your wrist and attach the ground cord of the wristband to the portable anti-static mat.
3. Attach the second grounding cord to the portable anti-static mat, on top of the wrist grounding cord.
4. Attach the crocodile clip to a reliable ground of the cabinet or operator console, where the PCB has to be installed.
5. Remove the PCB from the cabinet or operator console and place it on the portable anti-static mat.
6. Use the anti-static mat for hardware programming or replacement of socket-mounted components on the PCB.
7. Place the "repaired" board back in its slot in the cabinet or operator console.
8. Remove the "replacement" board from its static shielding container or bag
9. Insert the "replacement" board in its slot in the cabinet or operator console.
10. Place the "removed" board in the static shielding container (or bag) of the "replacement" board.
11. Disconnect the wrist strap.
12. Return the "removed" board in its static shielding container to the repair depot according to standard procedures.

Figure 1 - ESD protection



PM manual

Section 2 - System level

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for:

- Systems: **Intera**, **Achieva**, and **Multiva**
- Configured with: **CDAS** or **DDAS**
- Subsystem: **System level**

2 WHAT'S NEW

Revision	
DMR194361_R00	▪ 3.5.1 Internal cleaning reconstructor: Updated procedure ▪ 3.5.2 Internal cleaning SCC (DDAS only): Introduced ▪ 3.5.3 Dust filter CDAS: Updated procedure filter inspection ▪ 3.5.7 Dust filter backend miscellaneous box: Updated procedure filter inspection ▪ 3.5.8 Internal cleaning Host Computer: Updated procedure ▪ 3.5.9 Internal cleaning DVD-PC: Moved from CH10 to here, updated procedure ▪ 3.5.10 Internal cleaning External MO drive: Moved from CH10 to here ▪ 3.5.11 Internal cleaning EWS: Moved from CH10 to here, updated procedure ▪ 3.5.12 Dust filter patient ventilation: updated inspection procedure ▪ 3.8 Check of site conditions: different temp specs for ≤R3 and ≥R5 systems
DMR211933_R00	▪ New DMR number ▪ Updated: 3.1 Firmware check S30 , 3.2 Check door switch , 3.3 Check gradient airflow circuit , 3.4 Visual inspection , 3.5.1 External cleaning , 3.5.5 Dust filter and fan RF amplifier , 3.5.7 Internal cleaning Host Computer , 3.5.9 Internal cleaning External MO drive , 3.6 RF-enclosure , 3.7.1 16 CH Knee Coils- Achieva and Ingenia Locking Handle repair , 3.7.2 Check -5V PS , 3.8 Check of site conditions , 3.8.1 Remote procedure (If remote) , 3.9 Check for dust in hybrid box and body coil , 3.9.1 Clean the hybrid box (1.5T only) , 3.9.2 Clean the body coil (1.5T and 3.0T) , 3.10.1 Introduction , 3.10.2 Checking the version of the SPT spec file (on-site procedure) , 3.10.3 Checking the version of the SPT spec file (remote procedure) , 3.10.4 Comparing and downloading the SPT spec file. Removed: 3.11 Periodic image quality test (PIQT)
DMR211933_R01	▪ Revision update (no content change)
DMR211933_R02	▪ Updated: IOP Firmware check S30 RF-Amplifier; SPT spec files; Dust prevention. ▪ Added: 3.11 S23 RF-amplifier tube ▪ Updates for software R5.1.10 / R3.2.10 and DDAS
DMR211933_R03	▪ Updated temperature specs for Achieva systems that are upgraded from <=R3 to R5
DMR211933_R04	▪ Added: Check shock indicator(s) RF-coil(s) ▪ Added: Install ODU Extractor and Guiding Pins Kit ▪ Added: Install quick change head on PICU socket
DMR211933_R05	▪ Updated: Check door switch (SAFETY) ▪ Updated: Install quick change head on PICU socket
DMR211933_R06	▪ Updated: Check door switch (SAFETY)

3 PROCEDURES

3.1 IOP Firmware check S30 RF-Amplifier

In the S30 RF-amplifier, a battery check is automatically executed every week at the same date and time. The exact time of the check is determined by the last time the unit is turned ON, and is only changed if the last check was executed more than one week prior. Due to a flaw in the design of this test, the amplifier can randomly experience a fault that results in a scan abort for units in the field.

The IOP firmware update corrects the battery check so it no longer creates faults. It will now be executed only at user request (i.e. after command issued by the scanner). The amplifier will no longer fault for a low battery but it will provide exact information about the battery condition.

1. On InCenter, go to the General download area MR.
2. Find and download the zip file that contains the S30 RF-amp IOP firmware.
3. Unzip the file.

4. Follow the instructions included in the zip file. **To avoid compatibility issues, do not use other "USB to serial adapters" than the one mentioned in the instructions.**

3.2 Check door switch (SAFETY)

Test the 'stop scan' function by opening the RF door:

If the stop scan function, by opening the RF door has been disabled/bridged then:

1. Check if the customer signed the informed refusal form (DMR270848). If this is the case then record the result: “Form signed”
2. Else: Notify the customer that the RF door has been disabled/bridged and inform the customer of the associated risks. See also the Training document: “Entering examination room during scanning” (DMR270849)
3. Enable door switch, or, if the customer does not want the door switch to be enabled, request to sign the informed refusal form (DMR270848)
4. Record the result: “Form signed”

Else:

1. Start a PIQT or any other scan
2. Open the RF door to the examination room.
3. Check that the scan stops.

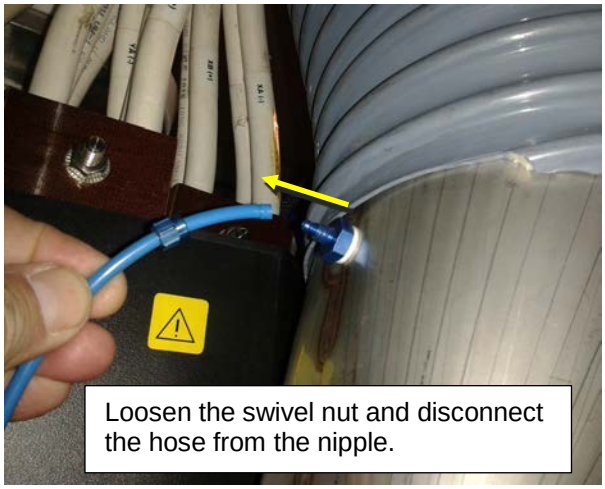
3.3 Check gradient airflow circuit (SAFETY)

1. Remove top covers to get access to the air duct(s) at the rear of the magnet.
2. Find the air hose nipple on the air duct.
3. Loosen the swivel nut and disconnect the hose from the nipple. See Figure 1.

Test procedure:

4. Start PIQT or any other scan.
5. The scan must abort now and the following warning should appear on the screen:
   Airflow in magnet bore is insufficient, check if hospital fan is running. Scan aborted after error.
6. Reconnect the air hose to the air nipple and fully tighten the swivel nut.
7. Install the top covers again.
8. Again, start PIQT or any other scan.
9. When the scan starts without error, the test is passed and can be stopped.

Figure 1 – Air hose nipple on the air duct



3.4 Visual inspection

1. Do a check on the patient support and the magnet cover for completeness and/or damage. If there is damage, repair or order replacements for the damaged cover(s).
2. Do a check on the seal between the cone covers and the body coil. If the seal is not elastic anymore or has come loose, replace the seal.
3. Check if safety signs are required and present (IEC 60601-2-33).
4. Do a check on all phantoms for damage or poor condition (cracks in the phantom enclosures, or bubbles in the liquid). If you find defective phantom(s), order replacement(s) for them. In case of bubbles the phantom should be refilled and replacement is not needed.

5. Speak to the person responsible for local quality control and find out if a hardcopy of the operators' manual (Instructions for use (IFU)) (IEC 60601-2-33) must be available on site. Make sure that the hardcopy is available if necessary.

NOTE

The operator manual is always available in the software,
but for some countries there must also be a hardcopy available on site.

If you find issues that affect safety:

1. Tell the relevant safety officer
2. Make arrangements for corrective measures to be taken.

Only for Germany: (MedGV/MPG & IEC 60601-2-33)
Überprüfen sie, ob die folgenden Gegenstände vorhanden und vollständig sind:

1. Warnschilder
2. Gebrauchsanweisung
3. Wartungsplan und Inspektionsplan

3.5 Dust prevention

NOTE

Make sure that you follow all regulations and agreements on
the use of a vacuum cleaner on the customer site.

3.5.1 External cleaning computers and operator equipment cabinet (OEC)

1. Make sure that there is no dust on the external surfaces of the computers. Remove dust with a vacuum cleaner.
2. Make sure that there is no dust in any air inlets or air outlets.
3. Make sure that the operator equipment cabinet is free of dust. Remove any dust with a vacuum cleaner.

3.5.2 Internal cleaning all computers

Clean the interior of **all** MR system computers. Depending on the system, these computers can include:

- Host computer
- Reconstructor computer
- Host / Recon combined computer
- Scan Control Computer SCC (DDAS only)
- DVD-PC

Procedure

1. Shut down the computer by pressing and holding the power button.
2. Get access to the interior of the computer.
3. Carefully clean the interior with a vacuum cleaner. Avoid contact with components and wiring.
4. Make sure that these parts are clean:
   a) Fans
   b) Heat sinks

c) Air Inlets

d) Air Outlets

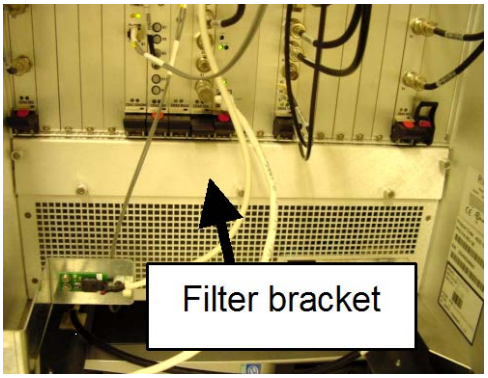
5. Close the computer housing
6. Start the computer by pressing the power button
7. Listen if any of the fans is/are producing high acoustic noise levels. If this is the case then replace the fan.

3.5.3 Dust filter CDAS

Procedure

1. Disconnect cables or move the cables aside during removing of the bracket to reach the dust filter (see Figure 2).
2. Remove the bracket and take out the filter.
3. Inspect the CDAS filter according to the flow chart below. Start with cell 1:

Figure 2 - Filter bracket



1

- Does the filter look like this?

Yes ►

2

1. No action required, put the filter back in place.
2. Record the inspection result:

   "Clean – Filter Reused"
3. Go to step 4 on page 10.

No ▼

3

- Does the filter look like this?

Yes ►

4

1. Clean the filter with a vacuum cleaner.
2. Is the filter clean?

   (Filter must be cleaner than intermediate, see Cell 3)

Yes ►

5

1. Put the filter back in place
2. Record the inspection result:

   "Intermediate – Filter Cleaned"
3. Go to step 4 on page 10.

No ▼

6

1. Go to cell 8

No ▼

7

1. Replace the filter with a new one

   "Intermediate – Filter Replaced"
2. Go to step 4 on page 10.

8

- Does the filter look like this or worse?

Yes ►

9

1. Replace the filter with a new one
2. Record the inspection result:

   "Dirty – Filter Replaced"
3. Go to step 4 on page 10.

4. Make sure that the filter is correctly positioned (the metal wire frame on the upper side).
5. Make sure that the airflow direction is correct (see Figure 3).
6. Install the filter bracket.
7. Make sure that all fans function correctly.

Figure 3 - Air flow

3.5.4 Dust filter and fan RF-amplifier

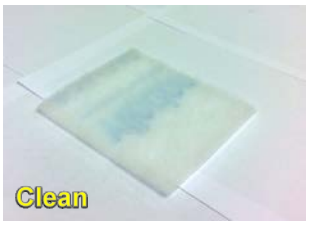
Skip this chapter if you have a solid state RF-amplifier e.g. S30.

1. Clean the filter.
2. Replacement depends on the condition of the filter (FSE to determine if filter replacement is necessary).

3.5.5 Dust filter backend miscellaneous box

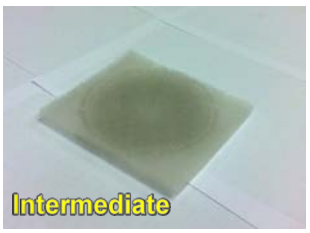
Procedure

1. Dismount the lower front panel of the backend miscellaneous box.
2. Inspect the dust-filter visually on contamination:



If the dust-filter looks like this:

-no action required, put the filter back
-record the inspection result:
"Clean – Filter Reused"



If the dust-filter looks like this:

-replace the filter with a new one
-record the inspection result:
"Intermediate – Filter Replaced"

If the dust-filter looks like this (or worse):

-replace the filter with a new one
-record the inspection result:
"Dirty – Filter Replaced"

Figure 4 –Placing the filter in the backend miscellaneous box.

3. Mount the lower front panel.
4. Make sure that the airflow to the host computer and peripheral equipment is not obstructed.

3.5.6 Internal cleaning External MO drive

1. Power OFF the external MO drives (if not already done).
2. Spray some anti-static compressed air into the lid of the MO drive to prevent accumulation of dust around the laser unit.

3.5.7 Dust filter patient ventilation

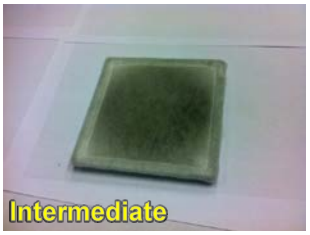
Dust filters of the patient ventilation are located in the System Filter Box in the exam room (Figure 5) or in the patient ventilation unit in the tech room (Figure 6).

Procedure for the system-filter-box

1. Remove the two cosmetic-covers from the system-filter-box.
2. Remove the dust-filter from the air-intake-duct of the system-filter-box (Figure 5).
3. Inspect the dust-filter visually on contamination:

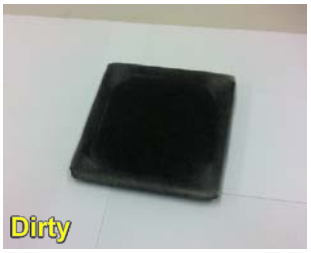
If the dust-filter looks like this:

-no action required, put the filter back in place.
-record the inspection result: **"Clean – Filter Reused"**



If the dust-filter looks like this:

-replace the filter with a new one
-record the inspection result:
"Intermediate – Filter Replaced"



If the dust-filter looks like this (or worse):

-replace the filter with a new one
-record the inspection result: **"Dirty – Filter Replaced"**

4. Install the cosmetic covers.
5. Make sure that the patient ventilation system functions properly.

Procedure for the patient ventilation unit.

1. Locate the filter in the air-inlet of the patient ventilation unit. Refer to Figure 6
2. Remove the lower cover of the air-inlet to get access to the dust-filter. Refer to Figure 7
3. Remove the dust-filter from the air-intake-duct of the patient ventilation unit.
4. Inspect the dust-filter visually for contamination. Refer to step 3 of the Procedure for the system-filter-box for guidelines for replacement and recording of inspection results.
5. Install the cover of the air-inlet.
6. Make sure that the patient ventilation system functions properly.

Figure 5 - Patient ventilation filter in SFB

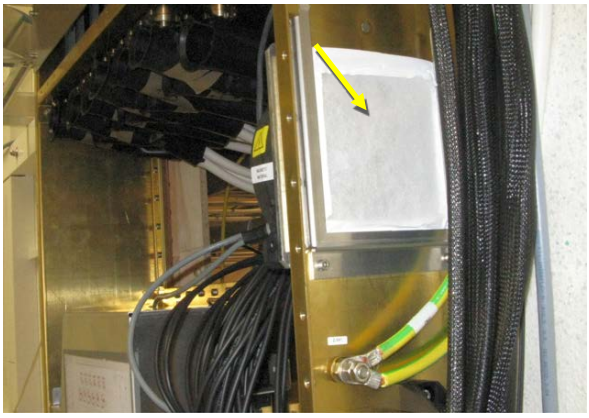


Figure 6 - Patient ventilation unit-air-inlet

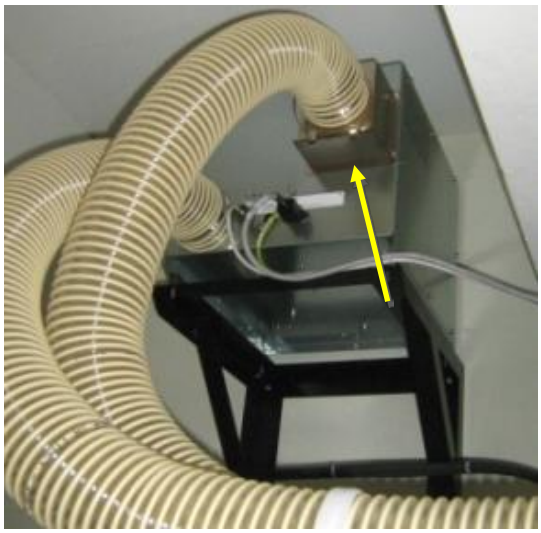
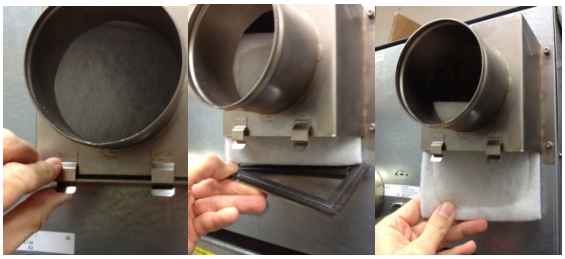


Figure 7 – PVU filter replacement



3.5.8 Check for dust in hybrid box and body coil

Dust in the hybrid box and body coil can cause image artifacts due to arcing and spikes. The hybrid box and body coil must be free of dust to prevent image quality problems.

Procedure

1. Move the patient table into its lowest position.
2. Power OFF the RF amplifier.
3. Remove the two lower covers of the system filter box.
4. Power OFF the front-end power supply (FEPSU) in the system filter box.
5. Remove the cover of the PICU/UIM/UIH, front and rear.
6. Remove the bridge section.
7. Remove both the front and rear cone covers to get access to:
   - the body coil (1.5T and 3.0T)
   - the hybrid box (1.5T only)

3.5.8.1 Clean the hybrid box (1.5T only)

1. Remove the top plate from the hybrid box.
2. Look inside the hybrid box for dust.
3. If there is dust, use a soft brush to carefully remove the dust. Make sure that you do not make the dust airborne.
4. Install the top plate on the hybrid box.

3.5.8.2 Clean the body coil (1.5T and 3.0T)

1. Look inside the body coil for dust (the bottom body coil cover is transparent).
2. If there is dust inside the body coil, remove the inner top cover of the body coil. To help you put the covers of the body coil in the same way, first put a mark on the front and rear side of the cover. Carefully pull out the covers by hand: start on one side of the cover, when one side is loose, the cover can be taken out.
3. Remove the inner bottom cover: start on one side.
4. Use a soft brush to carefully remove the dust. Make sure that you do not make the dust airborne.

NOTE

Dust in the hybrid box and body coil can be prevented by creating a slight over-pressure in the examination room, as indicated in the Planning Reference Data. This will prevent dust from entering the examination room when the door of the RF-enclosure is open. Most dust particles are sucked into the system by the cooling system of the gradient coil.

3.6 RF-enclosure

1. Do a visual inspection of the door(s) of the RF-enclosure. Make sure that:
   a) The sticky fingers are in good condition.
   b) The door(s) close correctly.
   c) There are no loose screws.
2. If you find any defects, tell the customer. Do a check with the customer to find who is responsible for correcting defects in the RF-enclosure.
3. If the maintenance of the RF enclosure is a Philips responsibility, correct the defects found during PM, or schedule a corrective action.

3.7 Check of RF-coils (SAFETY)

3.7.1 Check shock indicator(s) RF-coil(s)

1. Check for each pluggable coil whether it has a shock indicator
2. If the coil has a shock indicator then check if it has tripped
3. If you find a coil with tripped shock indicator then check with your customer if he/she had problems with the functioning of the coil and put a new shock indicator on the coil. If problems are indicated then run an SPT with that coil to check its functioning. If the coil is not functioning correctly follow the corrective maintenance instructions.

3.7.2 Check RF-coils for damage

The RF-coils contain high voltage elements. There must be no damage to the RF coil cover, or to the cable insulation.

1. For all RF-coils, do a check on these parts for damage and wear:
   a) Covers
   b) Cables
   c) Insulation
   d) Connectors: Install all connectors and feel if they are loose.
2. If you find damage, wear, or dirt follow the corrective maintenance instructions.

3.7.3 Check the RF-coil closing mechanism

For the following RF-coils only with corresponding numbers (if available):

- SENSE KNEE 16CH 1.5T 4535 301 0418x
- 1.5T 16CH RECEIVE KNEE iRF 4535 302 5267x
- T/R KNEE COIL-16-3.0T-IRF 4535 302 9819x
- 3.0T 16CH HRK COIL 4535 301 0419x

Do a check on the closing mechanism. Look if the following symptoms are present:

Symptoms

- When you close the latch to secure anterior part of the knee coil to the base:
  - You hear a loud popping noise
  - It is difficult to close the latch

Cause

- Screws inside have come loose allowing cover and handle to deform under pressure.

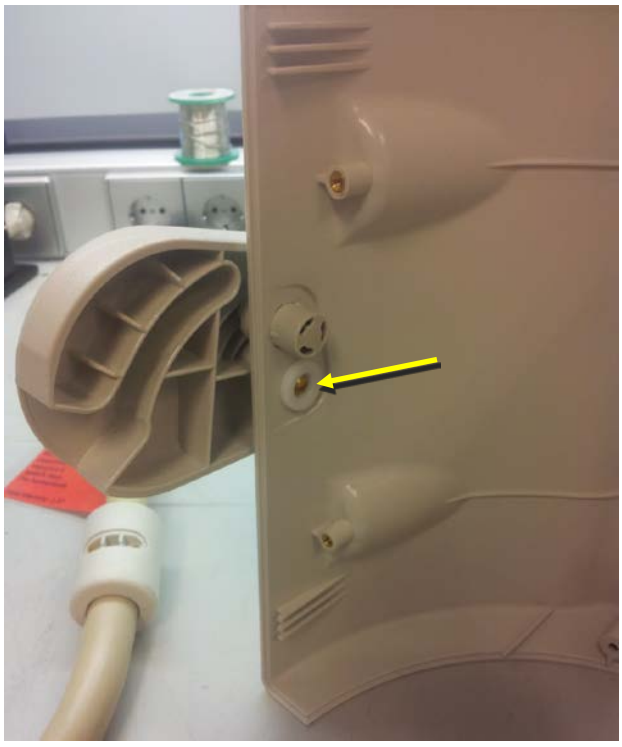
Repair Instructions

1. Carefully remove and save the 4 small rubber caps that cover the screw holes on the top of the anterior piece using a small flat screwdriver. Remove the screws.

2. Do the same for the 4 screws on the underside of the Coil's Anterior piece.

3. Carefully remove the cover from the body of the coil anterior.

4. Carefully tighten the two brass screws that are seen inside the cover.
   - If the screws are already tight, or if they spin freely then leave it as it is.
5. Carefully install the cover onto the body of the coil anterior
6. Install the screws in reverse order of their removal.
7. Install the rubber covers over the screws.
8. Do a check on the coil for smooth operation of the locking handle.



3.8 Install ODU Extractor and Guiding Pins Kit

The ODU Extractor and Guiding Pins Kit contains:

- Guiding pins (Figure 8)
- Extraction clips (Figure 9)
- Protective covers
- Installation instructions

to convert 5 RF coils, so the amount of ODU Extractor and Guiding Pins Kits needed depends on the amount of RF Coils on site. (See the material list for 12NC).

Procedure:

1. If not already present: install the guiding pins on the existing RF coil connectors for all coils present on site, except for TR connectors
2. If not already present: install the extraction clips on all RF coil connectors, except for TR connectors
3. If not already present, attach the new connector cover to the coil cable using the beaded tie, to be compatible with the longer guiding pins.

Figure 8- Guiding pins

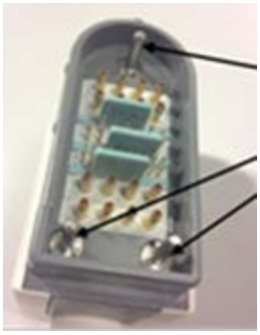


Figure 9- Extraction clips

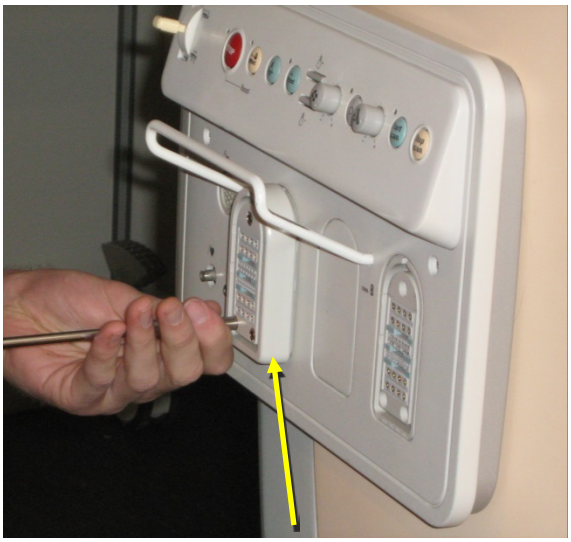
3.9 Install quick change head on PICU socket

Procedure:

1. Check if there is a Quick Change Head (QCH) (Figure 10) present on both PICU A and PICU B
2. If not, for Key Market North America - only order the Quick Change Head (QCH) if:
    a. You are also replacing Cables MC1-X30 or X32.
    b. You have replaced Cables MC1-X30 or X32 in the last 6 months.
    c. Your site has an existing Quick Change Head that has failed.
    d. Your site has been identified as a high usage for MC1-X30 and X32 due to 2 or more replacements per year.

3. If not, for all other markets outside NA:
Make an educated consideration to either:
    a. Follow NA guidelines or
    b. Implement on a *pro-active* base for maximum effect on PICU connectors that do not show signs of wear yet.

Figure 10- Quick Change Head (QCH)



4. There is a QCH-kit for 1.5T and one for 3.0T, also containing the installation instructions. One kit is enough to update one PICU connector.

   See the material list for 12NC's (There is no QCH for the TR connector)

NOTE

It is important to install the QCH, because RF coils where the new guiding pins have been installed, **no longer fit** on a system that does not have the QCH installed.

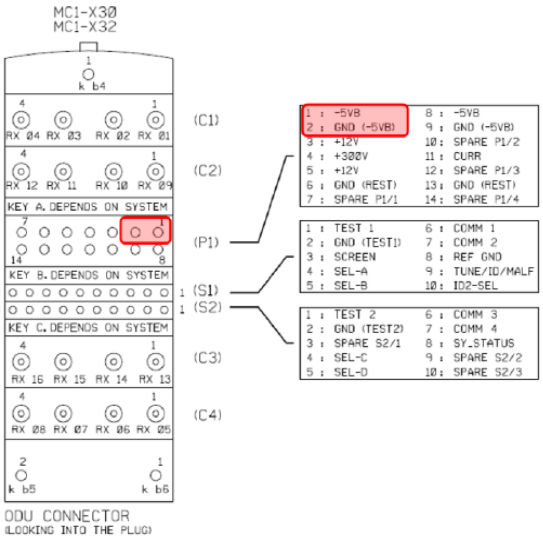
3.10 Check -5V Power supply FEPSU

Precondition:

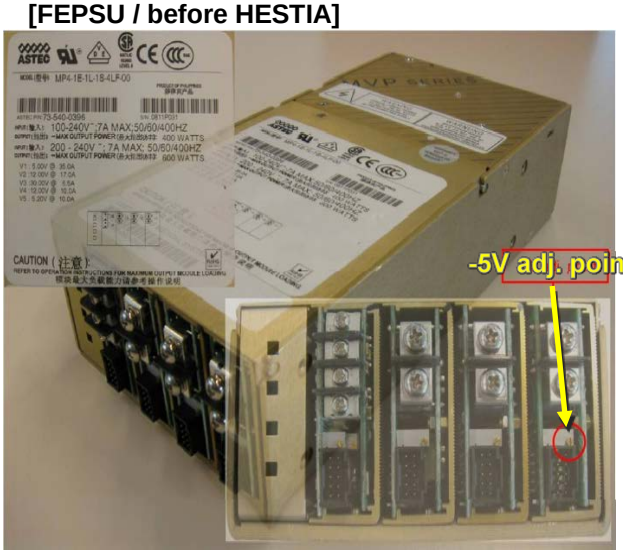
- System is on Standby
- No receive coil connected except for body coil
- All devices (PHD/wBTU/MEU/UIH) are powered ON

Measurement:

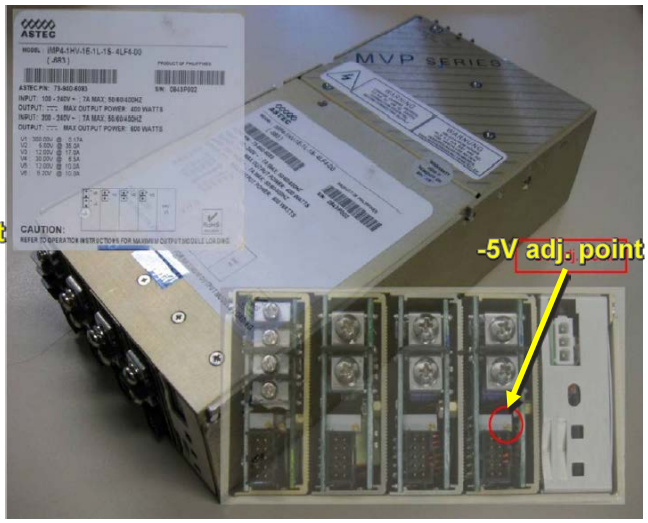
1. Measure -5VB at ODU connector. See figures that follow.
   - The specification is: -4.95 +/- 0.05 V.
   - From experience in the field, the best value is: **-4.920 V**.
2. If the voltage is within specification (spec. = -4.95 +/- 0.05 V), leave as it is
3. If the voltage is out of specification (spec. = -4.95 +/- 0.05 V), adjust FEPSU power supply. For adjustment point see pictures of the FEPSU before/after Hestia below:



[FEPSU / before HESTIA]



[FEPSU / after HESTIA]



3.11 Check of site conditions

Check if the following site conditions are met. (If the system is active on Radar, the following conditions can be checked remotely via Radar).

Table 1 - Site conditions

	Examination room ≤R3	Examination room ≥R5[1]	Technical room
Temperature	20 - 24 °C	18 - 22 °C	15 - 24 °C
Relative humidity	40% - 70%,	40% - 70%,	30% - 70%,

If values are out of spec, then take action to get these site conditions within specification. In most situations, the customer must take care of the site conditions. If the site conditions are not within specifications the customer must be notified about this.

NOTE

If you have an upgraded Achieva from <=R3 to R5 then the old spec is maintained (20-24 deg C)

CAUTION

When the humidity in the examination room is too low,
spikes can be the result and possibly causing image artifacts.
In general, too low humidity in the examination room is associated with more service cost.

3.11.1 Remote procedure (If remote)

1. Go to Radar
2. Search for the SRN of the system.
3. Check the temperature and humidity of the exam room and technical room.
4. Compare the values in the overview to Table 1.

3.11.2 On site procedure (If not remote)

1. Do the following tests in the service application: Table 2,

[1] If you have an upgraded Achieva from <=R3 to R5 then the old spec is maintained (20-24 deg C)

3. Table 3, and Table 4 summarize the procedures that are needed to check the values of temperature and humidity.
4. Check that that all values (both actual and overview) are within the specification limits in Table 1.

Table 2 - Instructions for R5 systems ≥R5.1.10, and R3 systems ≥R3.2.10 to check the required values of temperature and humidity

		Exam room	Tech room
Hum	Actual	Corrective Maintenance > Diagnostics > DAS and PFEI > PFEI boards selftest	NA
	Overview	Corrective Maintenance > Diagnostics > DAS and PFEI > Overview exam.room temp. & rel. hum.	Corrective Maintenance > Diagnostics > DAS and PFEI > Overview tech.room temp. & rel. hum.
Temp	Actual	Corrective Maintenance > Diagnostics > DAS and PFEI > PFEI boards selftest	NA
	Overview	Corrective Maintenance > Diagnostics > DAS and PFEI > Overview exam.room temp. & rel. hum.	Corrective Maintenance > Diagnostics > DAS and PFEI > Overview tech.room temp. & rel. hum.

Table 3 - Instructions for R5 systems ≤R5.1.8 to check the required values of temperature and humidity

		Exam room	Tech room
Hum	Actual	Adjustments>Diagnostic Procedures>CDAS and PFEI>PFEI boards selftest	Adjustments>Diagnostic Procedures>CDAS and PFEI>Actual tech.room temp. & rel. hum
	Overview	Adjustments>Diagnostic Procedures>CDAS and PFEI>Overview exam.room temp. & rel. hum	Adjustments>Diagnostic Procedures>CDAS and PFEI>Overview tech.room temp. & rel. hum
Temp	Actual	Adjustments>Diagnostic Procedures>CDAS and PFEI>PFEI boards selftest	Adjustments>Diagnostic Procedures>CDAS and PFEI>Actual tech.room temp. & rel. hum
	Overview	Adjustments>Diagnostic Procedures>CDAS and PFEI>Overview exam.room temp. & rel. hum	Adjustments>Diagnostic Procedures>CDAS and PFEI>Overview tech.room temp. & rel. hum

Table 4 - Instructions for systems <R3.2.10 to check the required values of temperature and humidity

		Exam room	Tech room
Hum	Actual	Adjustments>Diagnostic Procedures>RF> PFEI>PFEI boards selftest	Adjustments>Diagnostic Procedures>CDAS> Tech.room temp. & rel. hum.
	Overview	Adjustments>Diagnostic Procedures>CDAS> Exam.room temp. & hum. overv.	Adjustments>Diagnostic Procedures>CDAS> Tech.room temp. & hum. overv.
Temp	Actual	Adjustments>Diagnostic Procedures>RF> PFEI>PFEI boards selftest	Adjustments>Diagnostic Procedures>CDAS> Tech.room temp. & rel. hum.
	Overview	Adjustments>Diagnostic Procedures>CDAS> Exam.room temp. & hum. overv.	Adjustments>Diagnostic Procedures>CDAS> Tech.room temp. & hum. overv.

3.12 SPT spec files

Do the actions in this section remote for systems that are remotely accessible.

3.12.1 Introduction

SPT spec files (SPT specification files) are files that contain upper / lower limits for the results of SPT measurements. If a particular SPT result is outside the limits that are set in the spec file, this result is marked as 'out of spec' in the MRL (printed in red, and with an asterisk (*) behind the result).

SPT spec files are part of the initial software, updates are available on InCenter.

For the spec files, the following naming conventions are used:

Spec file: `(aaa)r(b)v(c)l(d)_gr(e)_rf(f)_l(gg)_(hh) [_iii].(iiii)`
-or- `(aaa)r(b)v(c)l(d)_gr(e)_l(gg)_(hh)[_iii].(iiii)`

`(aaa)`	:	System type **t15** = 1.5T system **t30** = 3.0T system
`(b)`	:	Release number
`(c)`	:	Version number
`(d)`	:	Level number
`(e)`	:	Gradient chain **3** = Omega 1.5T **4** = Omega HP 1.5T **7** = Omega 3.0T **8** = Omega HP 3.0T
`(f)`	:	RF transmit configuration **0** = standard **1** = multitransmit
`(gg)`	:	Level of spec file
`(hh)`	:	RF coils '**nt**' = new technology coils '**st**' = standard technology coils
`[_iii]`	:	Spec type (can be omitted) '**ref**' = reference '**tpl**' = template
`(jjjj)`	:	'**typ**' = typical, spec used by factory user '**spec**' = spec used by service user '**cust**' = customer

Figure 11 - Example of results that are 'out of spec'.

Patient	BODYT	
Scan_Name	B36:TSE,105	
Meas_Ok	OK	
Verify_Ok	NOT OK*	
S/N (C)	134.92	
S/N (B)	147.04	S > 127
B/sd(B)	1.88	
Art_Level	2.44	
Int_Unif	3.16	
T/C-20	8.33*	S < 7
C-20/C-10	1.97	S < 2
C-10/C+10	89.7*	S > 92
C+10/C+20	0	S < 1
C+20/Max	0	S < 1

Example:

Filename '`t15r3v2l3_gr3_rf0_l03_nt.spec`'

The example filename above indicates that:

- This is the spec file for service users of an Achieva 1.5T system with software release R3.2.3.
- The spec file is for a system with an Omega gradient chain and standard RF transmit configuration.
- This spec file contains the specifications for new technology coils and is the 3rd level of this spec file.

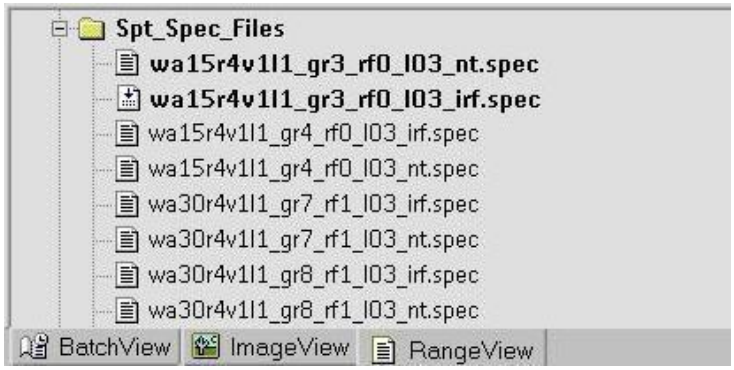
3.12.2 Checking the version of the SPT spec file (on-site procedure)

If the level of the SPT spec file of the system is known via the remote procedure (see chapter 3.12.3), go to chapter 3.12.4.

1. Use one of these methods to enable service access:
   - Service Access with the hardware key on the host.

– Service Access with the challenge/response mechanism.

2. Minimize the Service Application.
3. Select: **Application Software** in the MR Boot Configuration Manager
4. Select: **System > SPT...**
5. Select: **RangeView** tab
6. Expand: **Spt_Range_Files** folder
7. Expand: **Spt_Spec_Files** folder



8. Look up the file names in bold letters and note the level of the .spec file in the last part of the file name. In figure above: ***_l03_irf.spec** '03' represents the level: **03**

3.12.3 Checking the version of the SPT spec file (remote procedure)

1. Go to PRS portal
2. Enter the system reference number in the search box that is in the top right corner.
3. Select “enter” or select the “search” button.
4. Select: **Applications** window > **Device** tab > **Secure FTP (Passive)**. The Telnet credentials are pre-filled.
5. Select: **Ok**
6. Go to:
   - For **R>3**, go to: **G:\spt\range**
   - For **R≤3**, go to: **G:\spt\spt_range_files**
7. Find the level of the current spec files by looking at the last part of the file name. Refer to chapter 3.12.1.

3.12.4 Comparing and downloading the SPT spec file

1. Go to InCenter: http://incenter.medical.philips.com.
2. Go to **Service > Products & Solutions > Magnetic Resonance**.
3. On the right-hand side of the screen, under **MR Links**, select **MR Download Area**. A new window opens.
4. Select **Download Area for IQ spec files**. Always use the newest .spec files.
5. Lookup the applicable software release and system type in the list.
6. Compare the mentioned level (noted between brackets) with the level checked in 3.12.2 or 3.12.3.
   - If the level on InCenter is higher, continue with step 7.
   - If the level on InCenter is lower or the same, continue with the next PM task
7. Download the applicable zip file.
8. Extract all files in the zip file.
9. Copy the files to the host computer of the system.
   - For **R>3**, copy the files to: **G:\spt\range**
   - For **R≤3**, copy the files to: **G:\spt\spt_range_files**

SPT will use the new spec files the next time SPT is started. The new spec files are automatically moved to the correct folders and replace the old spec files.

3.13 Check operating hours of S23 RF-amplifier tubes

3.13.1 Tube operating hours determination

NOTE

See chapter 3.13.4 for general RF-amplifier tube information..

Do a check on the RF-amplifier tube operating hours. If the operating hours are more than the permitted maximum, replace the tube. Start at cell 1 in the table that follows:

1

- Is the tube admin log attached to the RF-amplifier?

No ▶

2

1. Attach the tube admin log (see chapter 3.13.6) to the RF-deck handle with a plastic pouch and a cable-tie.
2. Go to cell 5.

Yes ▼

3

- Are all tube operating hours recorded on the tube admin log?

No ▶

4

- Are both PA tubes operating hours recorded?

No ▶

5

1. Do procedure in chapter 3.13.2 to get the IPA tube operating hours.
2. Do procedure in chapter 3.13.5 to remove the cover of the S23 RF deck.
3. Do procedure in chapter 3.13.3 to get the PA tube operating hours.
4. Go to cell 8.

Yes ▼

6

1. Do procedure in chapter 3.13.2 to get the IPA tube operating hours.
2. Do procedure in chapter 3.13.3.3 to calculate PA tube operating hours
3. Go to cell 9.

Yes ▼

7

1. Do procedure in chapter 3.13.2 to get the IPA tube operating hours.
2. Go to cell 8.

8

1. Update the tube administration log with the values determined. (Serial number administration is optional for the IPA tube).
2. Go to cell 9.

9

- Are the tube's operating hours more than the maximum operating hours (18000 hours)?

No ▶

10

1. Go to cell 12.

Yes ▼

11

1. Plan or do a replacement for tubes that exceed maximum operating hours.
   See 'SPD RF Chain' for replacement instructions
2. Go to cell 12.

12

1. If necessary, do the reverse procedure in chapter 3.13.5 to reinstall the cover of the S23 RF deck.
2. End of procedure.

3.13.2 How to get the IPA tube operating hours

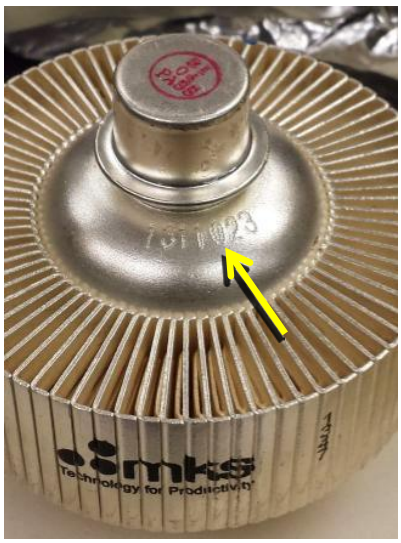
1. Startup the service application
2. Select:
   - For R5 systems ≤R5.1.8, and R3 systems <R3.2.10
     Diagnostic procedures > RF > RF-amp > RF amp info overview
   - For R5 systems ≥R5.1.10, and R3 systems ≥R3.2.10
     Corrective Maintenance > Diagnostics > RF > RF amplifier > RF-AMP info overview
3. Read the value of parameter "**ETL: Hours ipa**"

3.13.3 How to get the PA tube operating hours

3.13.3.1 Read the "Year/month production code" on tubes manufactured by MKS

- On tubes manufactured by **MKS**, the production code is engraved on the top of the tube (Figure 12).
  - It is not necessary to remove the tube from the S23 to read the engraved production code.
- The code format for MKS tubes is: **YYMMxxx** (**YY**= Year, **MM**=Month, **xxx**=batch number)
  - In the example in Figure 12, the code '**1311023**' gives: Year **2013**, Month **11** and batch number **023**.
  - The year/month production code in this example means **November 2013**.
- Go to chapter 3.13.3.3 to calculate the PA tube operating hour values.

Figure 12 - MKS PA tube, with location of serial number



3.13.3.2 Read the "Year/month production code" on tubes manufactured by Eimac

- On tubes manufactured by **Eimac**, the production code is engraved on the top of the tube (Figure 13).
  - It is not necessary to remove the tube from the S23 to read the engraved production code.
- The code format for Eimac tubes is: **YMDxxxx** (**Y**= Year, **M**=Month, **D**=Day, **xxxx**=batch number)
  - See Table 5 for year code translations, and see Table 6 for month code translations.
  - In the example in Figure 13 the code '**ZED0078**' gives: Year **2008**, Month **05**, and batch number **0078**. The third letter is not used.
  - The year/month production code in this example means **May 2008**.
- Go to chapter 3.13.3.3 to calculate the PA tube operating hour values.

Figure 13 - Eimac PA tube, location of serial number

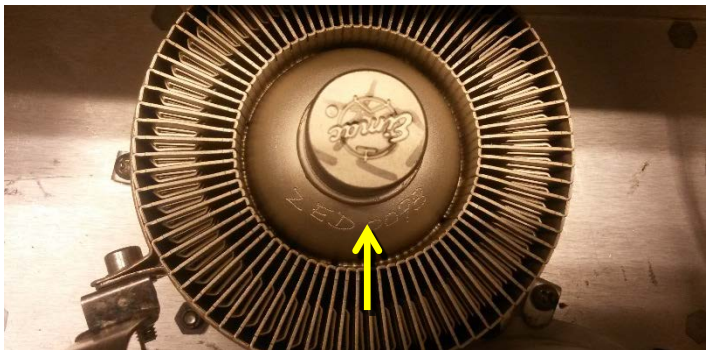


Table 5 : Eimac tube year code table

Eimac tube year production codes							
Year	Code		Year	Code		Year	Code
2000	R		2009	A		2018	K
2001	S		2010	B		2019	L
2002	T		2011	C		2020	M
2003	U		2012	D		2021	N
2004	V		2013	E		2022	O
2005	W		2014	F		2023	P
2006	X		2015	G		2024	Q
2007	Y		2016	H		2025	R
2008	Z		2017	J		2026	S

Table 6 : Eimac tube month code table

Eimac tube month of production codes							
Month	Code		Month	Code		Month	Code
01	A		05	E		09	J
02	B		06	F		10	K
03	C		07	G		11	L
04	D		08	H		12	X

3.13.3.3 PA tubes operating hours calculation

NOTE

If you know how many hours the site scans per month, use those hours instead of an average of 250 operating hours per month.

- **When the tube admin log contains records of PA tube installation/inspection during PM or CM:**

  a) Tube operating months = (today's year/month) – (year/month of the most recent record)

  b) Tube operating hours = ((tube operating months) x (250* operating hours/month)) + (most recent recorded operating hours).
  * - Where 250 is the average operating hours per month. See note above.

- **When the tube admin log <u>does not</u> contain PA tube records:**

  Use the tube year/month production code values and the following formula to calculate the PA tube operating hour values:

  a) Tube operating months = (today's year/month) – ((tube year/month production code) – 6 months**)
  ** - Where 6 months is the average logistic throughput time.

  b) Tube operating hours = (tube operating months) x (250* operating hours/month) * see note above

  c) Write the calculated operating hours in the tube admin log, with today's date in 'date of activity'.

- *Example calculation:*

  a) Tube operating months = (today's year/month '201412') – ((tube year/month production code '201104') – 6 months) = **38**

  b) Tube operating hours = 38 x 250 = **9500 hours**

3.13.4 RF-amplifier Tube information

Tube and RF-amplifier replacement: DO's and DON'Ts

- RF-amplifiers and RF-amplifier part (especially tubes) replacements have a substantial contribution to the total annual service costs for Philips MR systems.
- This chapter tells you about the DO's and DON'Ts regarding tubes to avoid unnecessary costs.

DO NOT

- **Do not** replace tubes to try and solve problems with Image Quality, patient heating or defective RF-coils.
- **Do not** replace a tube that has operated for less than a month if it has had less than 5 arcing occurrences.
- **Do not** replace tubes which have changed in color.
- **Do not** replace two PA tubes at the same time, and do not replace the full tube set. There is a very low risk that two or more tubes will fail at the same time.
- **Do not** exchange tubes as a preventive / planned maintenance action when the lifetime on the tube administration log has not been exceeded.

DO

- Use the tube administration log attached to the S23. (If there is no log, use the form in chapter 3.13.6 and attach it to the S23.
- Determine the moment of preventive tube replacement by use of the tube administration log on the S23.
- Tubes are expensive. To reduce costs you must only replace a tube when necessary:
  - When the tube is defective.
  - Or when the tube has reached the maximum operating hours.
- Put some tubes in your local stock to easily find the defect tube on-site and replace defect tube only.
- Check the internal fuses of the RF-amplifier (S26B only)
- Always re-initialize the RF-amplifier by turning off the mains CB, wait 10 seconds and retry.
- Always use the instructions SPD RF-chain section 'RF-amplifier fault and warning codes and related service actions'.
- Always use the 50 Ohm load as output termination when troubleshooting gain and/or lin. problems.
- Always source RF-amplifier tubes via the Philips Healthcare service parts supply chain.

General tube information:

- It is permitted to mix old and new PA tubes. Tube matching is not very important.
- It is permitted to mix different tube manufacturers (MKS and Eimac).
- An incidental early tube defect does not give any indication about the remaining lifetime of the other tubes.
- Arcing in one tube does not cause arcing in other tubes, and does not give any indication about the remaining lifetime of the other tubes.

3.13.5 Get access to the tube compartment

WARNING

There are voltages that can kill inside the power supply and RF decks. Before you remove any equipment cover you must:

1. Disconnect the AC mains supply.
2. Wait at least ten minutes to let the power supplies discharge fully.

WARNING

Do not connect power to the RF-amplifiers when any covers are removed, or when any interlock is defeated because this can cause damage to tubes and other components.

Tools needed:

- Cross-type screwdriver, #2 size
- Blade-type screwdriver, 6 mm
- Thick-bladed screwdriver - to discharge high voltage
- MKS-supplied tube-pulling pliers - use only for tube removal, not installation

Do these steps:

1. Turn OFF the amplifier.
2. Set the mains circuit breaker to OFF (Figure 14).

Figure 14 - Front panel and mains circuit breaker

3. Disconnect the mains power cord from the rear of the unit (Figure 15).

Figure 15 - Rear panel and mains power cord

WARNING

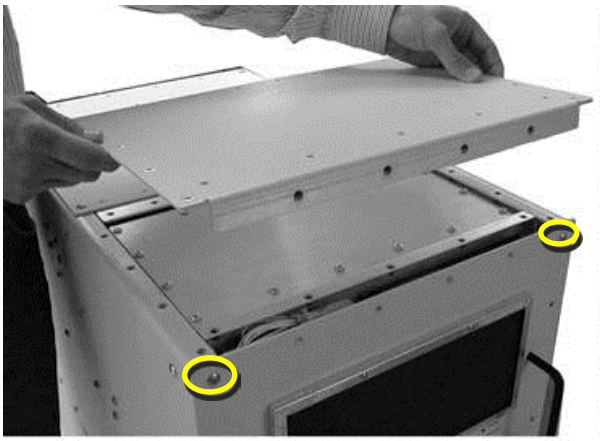
There are voltages that can kill inside the RF amplifier.
You must wait at least ten minutes to let the power supplies discharge fully after you disconnect the power.

4. Wait at least ten minutes for the high-voltage power supplies to discharge.

CAUTION

There are many components inside the system that are sensitive to static discharge. Obey the ESD instructions to prevent component damage.

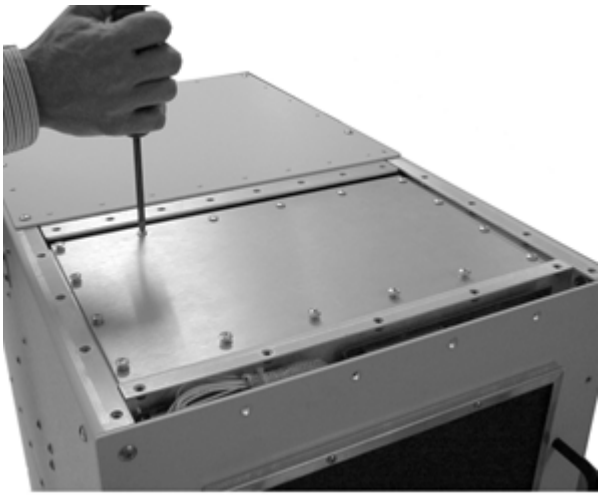
Figure 16 – Tube compartment exterior panel


REMOVING TUBE COMPARTMENT EXTERIOR PANEL

5. Remove the RF deck top panel which is closest to the front of the amplifier (Figure 16).
   - The top panel is directly above the tube compartment.
   - Remove twenty-one screws from the top of the panel, and four from the top edge of the front panel.
   - **Do not remove the screws at the top-left and top-right of the front panel** (circled in (Figure 16)).

After removing the tube compartment exterior panel the interior tube compartment cover is visible Figure 17.

Figure 17 – Interior tube compartment cover


REMOVING INTERIOR TUBE COMPARTMENT COVER

6. Remove the interior tube compartment cover.
   - The sixteen cover screws are "captive". They are released with a one-third turn counter-clockwise and remain in the cover.

Figure 18 shows the two-tube S23A-64 PA arrangement.

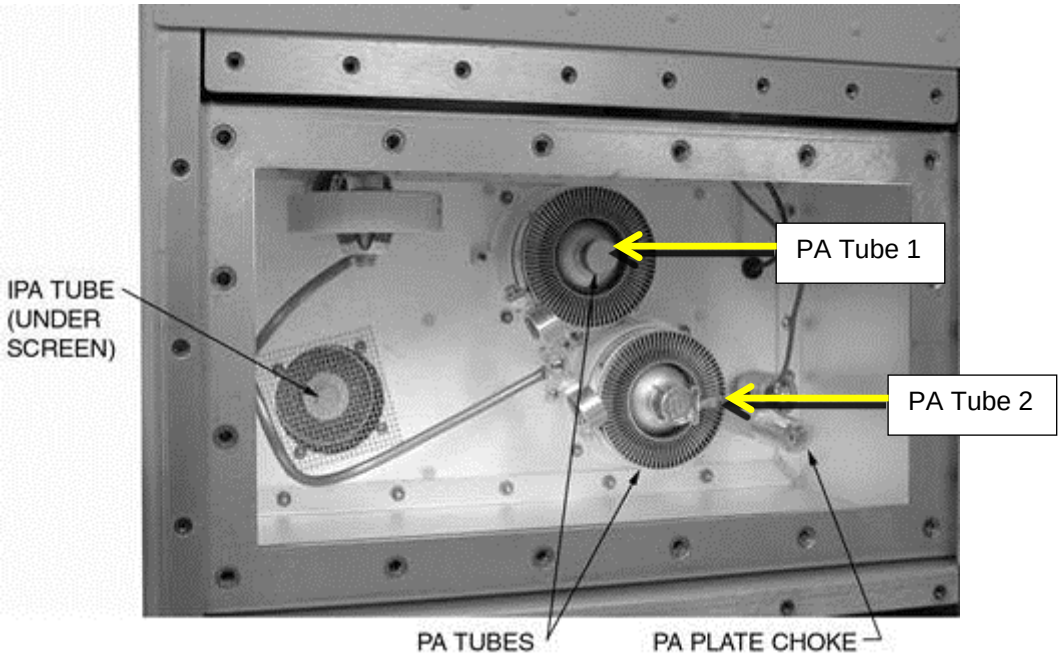
- The S24A-42 uses only one tube; likewise other component differences will be noted.
- The differences will not affect this procedure.

WARNING

There can be dangerous voltages on the tubes and other components in the compartment.
You must carefully do the instruction in step 7 to discharge any remaining high voltage before you touch any item in the compartment.

7. Discharge any remaining high voltage on all components in the compartment:
   a) Get a thick-bladed screwdriver with an electrically insulated handle.
   b) Make sure that you hold the screwdriver only by the insulated handle. Do not touch any electrically conductive part.
   c) Carefully use the screwdriver blade to connect the chassis ground to the top of the PA plate choke (Figure 18) to discharge any residual high voltage that may be present.

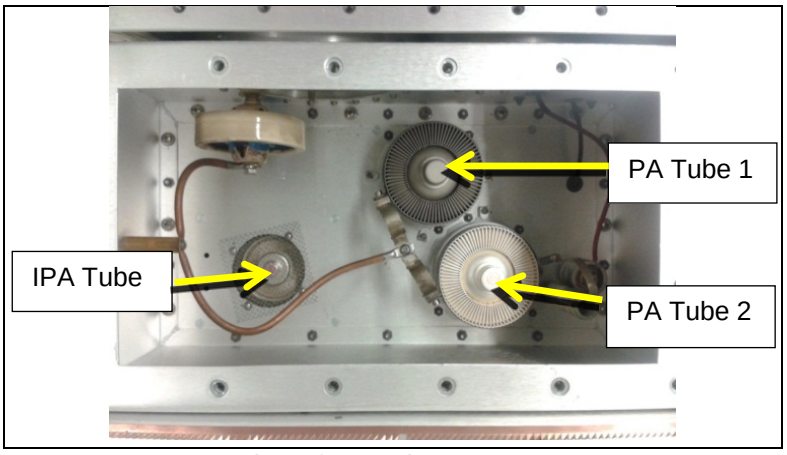
Figure 18 - Tube compartment



3.13.6 Tube administration log form

Tube hour administration log S23 RF-amp This form should stay attached to the RF-deck!							
Date of activity	Reason for replacement or performed activity	IPA tube counter (hours)	Installed serial IPA tube	PA tube1 calculated operating hours	Installed serial PA tube1	PA tube2 calculated operating hours	Installed serial PA tube2

- First read chapter '**Tube and RF-amplifier replacement: DO's and DON'Ts**' in the SPD RF-chain, or the PM Manual (refer to chapter 3.13.4 in Section 2 of the PM Manual).
- Only replace a tube when:
  - Instructed in the S23 fault code table described in the SPD RF-chain.
  - Or when the tube operating hours are more than the 18000 hours maximum. Refer to chapter 'Tube operating hours determination' in the SPD RF-chain, or in the PM manual Section 2.
- When calculating tube operating hours use an average running hours on a site of 250 hours/month.
  - If there are accurate running hours recorded, use those values instead of the average above.
- When you are doing a repair on the S23 only replace the defective PA tube.
  - Do not replace the other PA tube unless the operating hours of that tube are more than the maximum.



Top view of S23 tube compartment

PHILIPS

Healthcare, MRI

PM manual

Section 3 - Mains distribution Intera/Achieva/Multiva

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for:

- System(s): **Intera**, **Achieva**, and **Multiva**
- Configured with: **CDAS**, and **DDAS**
- Subsystem: **Mains distribution**.

2 WHAT'S NEW

Revision	
DMR132651_R00	▪ Modular structure ▪ Removed duplicate measurement between SFB and Examination room display option.
DMR132651_R01	▪ Added Multiva to title
DMR132651_R02	▪ Added Omniva to title
DMR211934_R00	▪ New DMR number ▪ Changes: 3.2 Leakage current measurements (SAFETY)
DMR211934_R01	▪ Revision update (no change)
DMR211934_R02	▪ Added: Note and Warning text improvements; Leak tester tool code. ▪ Update new safety sheets / Earth bonding tests
DMR211934_R03	▪ Added: Multiva DDAS.
DMR211934_R04	▪ LCC2BB is backward compatible of LCC2B. ▪ DACC has a new configuration sMDU which is located at the top of the DACC cabinet.

3 ABBREVIATIONS

ACC	Additional Component Cabinet
DACC	Data Acquisition & Control Cabinet
CDAS	C (version) Data Acquisition System
DDAS	D (version) Data Acquisition System
IGCI	Integrated Gradient Chain Interface
HOS	High Order Shim
LCC	Liquid Cooling Cabinet
gMDU	Global Mains Distribution Unit
sMDU	Smart Mains Distribution Unit
MEU	Magnet Electronic Unit
RFA	RF Amplifier
RMMU	Remote Magnet Monitoring Unit
SACU	System Air Cooling Unit
SSC	Scan Control Computer
OEC	Operator Equipment Cabinet
TCI	Transmit Control Interface
PMU	Power Monitoring Unit
SFB	System Filter box
PHD	Physiology Display
ERD	Examination Room Display
PFEI	Patient Front End Interface
WA	Wide Aperture
PE	Protective Earth

4 PROCEDURES

The system supports three types of cooling configurations for the gradient amplifiers, gradient coils and the magnet:

- Separate cooling units (in case of **MDU**, **MDU-E** or **sMDU**).
- Liquid Cooling Cabinet (LCC, LCC II* or LCC2BB) with integrated cryo-cooler. The LCC is powered from the **i-MDU**, the LCC II is powered from the **gMDU** or **sMDU** and the LCC2BB is powered from the **sMDU**.

The tests for these configurations are described below.

4.1 Earth bonding test (SAFETY)

This must be done with a bonding tester. The clip must be connected to the protective earth rail in the mains distribution unit, and the probe to central protective earth terminal of the cabinets, **or** to a conductive part of the enclosure.

WARNING

Switch off all mains power during this test.
There are voltages which can kill inside the mains distribution unit.
Do not touch the connections.

WARNING

The earth-bonding tester is magnetic and must be kept as far away as possible from the magnet.

CAUTION

When a trained engineer does the measurement, this is a safe procedure. If more people are working in the examination room during the PM, it is not permitted to take a magnetic tool inside the room. Longer measurement cables must be used, or the test must be done later.

The check can be done when the magnet is on field. **The engineer must know that the earth-bonding tester is magnetic and must be as kept as far away as possible from the magnet**. Depending on the size of the examination room, it is not always possible to put the bonding tester outside the examination room.

This test shall be performed with a bonding tester. Depending on the prescribed measurement in Table 1 and Table 2 the clip of the bonding tester must be connected to the central PE of:

- MDU (Figure 1);
- SFB (Figure 3);
- Magnet (Figure 4);

The probe must be pushed to central protective earth terminal of the cabinets, or to a conductive part of the enclosure.

Figure 1 - Central PE of gMDU

Figure 2 - Central PE of sMDU

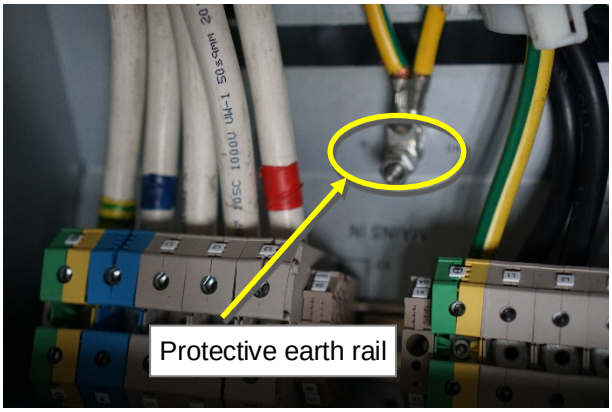


Figure 3 – Central PE of the SFB

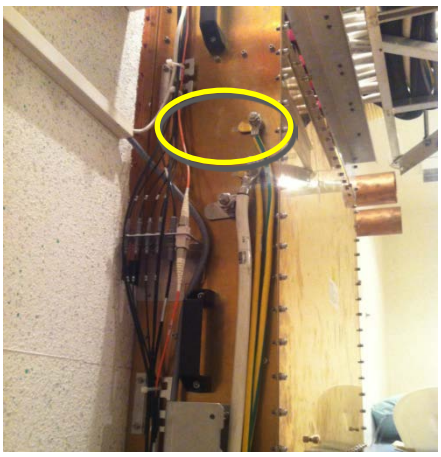
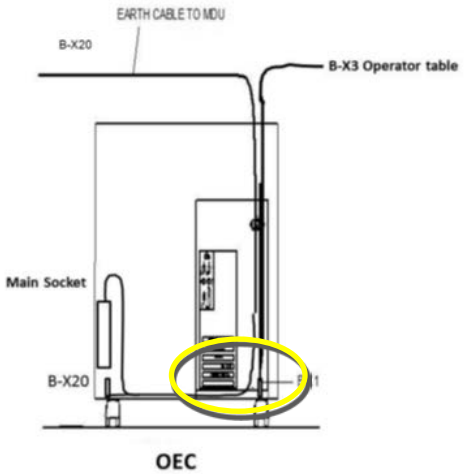


Figure 4 - Central PE of the Magnet

Figure 5 - Central PE of the Console



1. First measure the electrical resistance between the points mentioned in Table 1 the for the **iMDU/MDU(E)**, Table 4 for the **gMDU** or Table 7 for the **sMDU**:

- **iMDU/MDU(E):** If the measured values in Table 1 are within spec, then continue with measuring the resistance between the points mentioned in Table 2 and Table 3, else check the earth cable connections.
- **gMDU:** If the measured values in Table 4 are within spec, then continue with measuring the resistance between the points mentioned in Table 5 and Table 6, else check the earth cable connections.
- **sMDU**: If the measured values in Table 7 are within spec, then continue with measuring the resistance between the points mentioned in Table 8 and Table 9, else check the earth cable connections.

2. Make sure that the earth connections are not corroded
3. Make sure that every earth connection is tightened including the earth connection from the site.

4.1.1 Earth bonding test iMDU / MDU(E)

Table 1 - Earth bonding measurement result list iMDU / MDU(E)

Earth bonding measurements					
System part		**Central PE**	**Central PE**	**Max resistance**	**Measured [mΩ]**
SFB		MDU	SFB	30mΩ	
Magnet		SFB	Magnet	30mΩ	

Table 2 - Earth bonding measurement result list iMDU / MDU(E)

Earth bonding measurements					
System part		**Central PE**	**Enclosure of**	**Max resistance**	**Measured [mΩ]**
MDU		MDU	RF-enclosure	30mΩ	
MDU		MDU	MDU (door) (note 1)	50mΩ	
LCC (if applicable)		MDU	Transformer	100mΩ	
LCC(if applicable)		MDU or SFB	LCC Cover electronic box (note 2)	100mΩ	
LCC(if applicable)		MDU or SFB	Cryo Compressor	100mΩ	
LCC(if applicable)		MDU or SFB	Cabinet (note 1)	100mΩ	
LCC(if applicable)		MDU or SFB	Cabinet door	150mΩ	
Heat exchangers (if applicable)		MDU or SFB	Heat exchanger Grad Amp.	100mΩ	
Heat exchangers (if applicable)		MDU or SFB	Heat exchanger Grad Coil.	100mΩ	
NTDAC/DACC		MDU or SFB	Mains Inlet Unit	100mΩ	
NTDAC/DACC		MDU or SFB	Cabinet (note 1)	100mΩ	
DACC		MDU or SFB	Front cover (note 1)	150mΩ	
NTDAC/DACC		MDU or SFB	CDAS	100mΩ	
NTDAC/DACC		MDU or SFB	Reconstructor chassis	150mΩ	
NTDAC/DACC		MDU or SFB	RFA	100mΩ	
NTDAC/DACC		MDU or SFB	MN RFA (option)	100mΩ	
NTDAC/DACC		MDU or SFB	PMU (option)	100mΩ	
NTDAC/DACC		MDU or SFB	HOS	100mΩ	
ACC (if applicable)		MDU or SFB	MN RFA (option)	100mΩ	
ACC (if applicable)		MDU or SFB	PMU (option)	100mΩ	
ACC (if applicable)		MDU or SFB	Cabinet (note 1)	100mΩ	
ACC (if applicable)		MDU or SFB	Front cover (note 1)	150mΩ	

Note 1: Any conductive part of the cabinet, door or chassis can be used, do not use eye tags of cables
Note 2: Inside cover (PE) for LCC

Table 3 - Earth bonding measurement result list iMDU / MDU(E)

Earth bonding measurements					
System part		**Central PE**	**Central PE**	**Max resistance**	**Measured [mΩ]**
Grad Amp1		MDU or SFB	Cabinet (note 1)	100mΩ	
Grad Amp1		MDU or SFB	Front cover (note 1)	150mΩ	
Grad Amp2 (if applicable)		MDU or SFB	Cabinet (note 1)	100mΩ	
Grad Amp2 (if applicable)		MDU or SFB	Front cover (note 1)	150mΩ	
Gradient Switch (if applicable)		iMDU or SFB	Gradient switch	100mΩ	
Gradient Switch (if applicable)		iMDU or SFB	Gradient switch door	150mΩ	
PAT. Vent.		SFB	Pat. Vent Cabinet (note 1)	100mΩ	
Operator Console		SFB or Magnet	PE of OEC (Console)	50mΩ	
Operator Console		SFB or Magnet	PE of SSC (Console)	100mΩ	
Operator Console		SFB or Magnet	Host computer Chassis	100mΩ	
Patient table		SFB or Magnet	Patient table (note 1)	100mΩ	
Examination room		SFB or Magnet	PHD (option)	150mΩ	
Examination room		SFB or Magnet	ERD (option)	100mΩ	
Examination room		SFB or Magnet	RMMU	150mΩ	
Examination room		SFB or Magnet	PFEI	100mΩ	

Note 1: Any conductive part of the cabinet, door or chassis can be used, do not use eye tags of cables
Note 2: Inside cover (PE) for LCC

4.1.2 Earth bonding test gMDU

Table 4 - Earth bonding measurement result list gMDU

Earth bonding measurements					
System part		**Central PE**	**Central PE**	**Max resistance**	**Measured [mΩ]**
SFB		gMDU	SFB	30mΩ	
Magnet		SFB	Magnet	50mΩ	

Table 5 - Earth bonding measurement result list gMDU

Earth bonding measurements					
System part		**Central PE**	**Enclosure of**	**Max resistance**	**Measured [mΩ]**
gMDU		gMDU	RF-enclosure	30mΩ	
gMDU		gMDU	gMDU (door) (note 1)	50mΩ	
gMDU		gMDU	Transformer inside the gMDU (if applicable)	50mΩ	
LCC		gMDU or SFB	LCC Cover electronic box (note 2)	100mΩ	
LCC		gMDU or SFB	Cryo Compressor	100mΩ	
LCC		gMDU or SFB	Cabinet (note 1)	100mΩ	
LCC		gMDU or SFB	Front cover (note 1)	150mΩ	
DACC		gMDU or SFB	Mains Inlet Unit	100mΩ	
DACC		gMDU or SFB	Cabinet (note 1)	100mΩ	
DACC		gMDU or SFB	CDAS	100mΩ	
DACC (DDAS only)		gMDU or SFB	SCC	100mΩ	
DACC (DDAS only)		gMDU or SFB	TCI	100mΩ	
DACC		gMDU or SFB	Reconstructor chassis	150mΩ	
DACC(if applicable)		gMDU or SFB	RFA or WCRFA	100mΩ	
DACC		gMDU or SFB	AIBO	100mΩ	
DACC		gMDU or SFB	Front cover (note 1)	150mΩ	
DACC		gMDU or SFB	Switch	150mΩ	
DACC		gMDU or SFB	HOS	100mΩ	
DACC		gMDU or SFB	MN RF (option)	100mΩ	
DACC		gMDU or SFB	PMU (option)	100mΩ	
ACC (if applicable)		gMDU or SFB	Mains Inlet Unit (note 1)	100mΩ	
ACC (if applicable)		gMDU or SFB	RFA1 or WCRFA	100mΩ	
ACC (if applicable)		gMDU or SFB	RFA2	100mΩ	
ACC (if applicable)		gMDU or SFB	Circulator	100mΩ	
ACC (if applicable)		gMDU or SFB	Cabinet (note 1)	100mΩ	
ACC (if applicable)		gMDU or SFB	Front cover (note 1)	150mΩ	
ACC (if applicable)		MDU or SFB	MN RFA (option)	100mΩ	
ACC (if applicable)		MDU or SFB	PMU (option)	100mΩ	

Note 1: Any conductive part of the cabinet, door or chassis can be used, do not use eye tags of cables
Note 2: Inside cover (PE) for LCC

Table 6 - Earth bonding measurement result list gMDU

Earth bonding measurements					
System part		**Central PE**	**Central PE**	**Max resistance**	**Measured [mΩ]**
Grad Amp		gMDU or SFB	IGC1	100mΩ	
Grad Amp		gMDU or SFB	Cabinet (note 1)	100mΩ	
Grad Amp		gMDU or SFB	Front cover (note 1)	150mΩ	
PAT. Vent.		SFB	Pat. Vent Cabinet (note 1)	100mΩ	
Operator Console		SFB or Magnet	PE of OEC (Console)	50mΩ	
Operator Console		SFB or Magnet	PE of SSC (Console) (if applicable)	100mΩ	
Operator Console		SFB or Magnet	Host computer Chassis	100mΩ	
Operator Console		SFB or Magnet	Host/Recon Combined computer Chassis	100mΩ	
Patient table		SFB or Magnet	Patient table (note 1)	100mΩ	x
Examination room		SFB or Magnet	PHD (option)	150mΩ	
Examination room		SFB or Magnet	ERD (option)	100mΩ	
Examination room		SFB or Magnet	RMMU	150mΩ	
Examination room		SFB or Magnet	PFEI	100mΩ	X

Note 1: Any conductive part of the cabinet, door or chassis can be used, do not use eye tags of cables
Note 2: Inside cover (PE) for LCC

4.1.3 Earth bonding test sMDU

Table 7 - Earth bonding measurement result list sMDU

Earth bonding measurements					
System part		**Central PE**	**Central PE**	**Max resistance**	**Measured [mΩ]**
SFB		sMDU	SFB	30mΩ	
Magnet		SFB	Magnet	50mΩ	

Table 8 - Earth bonding measurement result list sMDU

Earth bonding measurements					
System part		**Central PE**	**Enclosure of**	**Max resistance**	**Measured [mΩ]**
sMDU		sMDU	RF-enclosure	30mΩ	
LCC		sMDU or SFB	LCC Cover electronic box (note 2)	100mΩ	
LCC		sMDU or SFB	Cryo Compressor	100mΩ	
LCC		sMDU or SFB	Cabinet (note 1)	100mΩ	
LCC		sMDU or SFB	Front cover (note 1)	150mΩ	
DACC		sMDU or SFB	Cabinet (note 1)	100mΩ	
DACC		sMDU or SFB	Transformer box inside the DACC	50mΩ	
DACC (DDAS only)		sMDU or SFB	SCC	100mΩ	
DACC (DDAS only)		sMDU or SFB	TCI	100mΩ	
DACC(if applicable)		sMDU or SFB	RFA or WCRFA	100mΩ	
DACC		sMDU or SFB	AIBO	100mΩ	
DACC		sMDU or SFB	Front cover (note 1)	150mΩ	
DACC		sMDU or SFB	Switch	150mΩ	
DACC		sMDU or SFB	MN RF (option)	100mΩ	
DACC		sMDU or SFB	PMU (option)	100mΩ	
ACC (if applicable)		sMDU or SFB	Mains Inlet Unit (note 1)	100mΩ	
ACC (if applicable)		sMDU or SFB	RFA1 or WCRFA	100mΩ	
ACC (if applicable)		sMDU or SFB	RFA2	100mΩ	
ACC (if applicable)		sMDU or SFB	Circulator	100mΩ	
ACC (if applicable)		sMDU or SFB	Cabinet (note 1)	100mΩ	
ACC (if applicable)		sMDU or SFB	Front cover (note 1)	150mΩ	
ACC (if applicable)		MDU or SFB	MN RFA (option)	100mΩ	
ACC (if applicable)		MDU or SFB	PMU (option)	100mΩ	

Note 1: Any conductive part of the cabinet, door or chassis can be used, do not use eye tags of cables
Note 2: Inside cover (PE) for LCC

Table 9 - Earth bonding measurement result list sMDU

Earth bonding measurements					
System part		**Central PE**	**Central PE**	**Max resistance**	**Measured [mΩ]**
Grad Amp		sMDU or SFB	IGC1	100mΩ	
Grad Amp		sMDU or SFB	Cabinet (note 1)	100mΩ	
Grad Amp		sMDU or SFB	Front cover (note 1)	150mΩ	
PAT. Vent.		SFB	Pat. Vent Cabinet (note 1)	100mΩ	
Operator Console		SFB or Magnet	PE of OEC (Console)	50mΩ	
Operator Console		SFB or Magnet	PE of SSC (Console) (if applicable)	100mΩ	
Operator Console		SFB or Magnet	Host computer Chassis	100mΩ	
Operator Console		SFB or Magnet	Host/Recon Combined computer Chassis	100mΩ	
Patient table		SFB or Magnet	Patient table (note 1)	100mΩ	x
Examination room		SFB or Magnet	PHD (option)	150mΩ	
Examination room		SFB or Magnet	ERD (option)	100mΩ	
Examination room		SFB or Magnet	RMMU	150mΩ	
Examination room		SFB or Magnet	PFEI	100mΩ	x

Note 1: Any conductive part of the cabinet, door or chassis can be used, do not use eye tags of cables
Note 2: Inside cover (PE) for LCC

4.2 Leakage current measurements (SAFETY)

WARNING

Do not touch the connections!
There are voltages which can kill inside the mains distribution unit.

1. Make sure that the system is in standby mode. (There must not be any activity in the Test software or Application Software)
2. Make sure that all sub-systems are operational (not in wait or other non-operational mode).
3. Make sure that the clamp-on leak tester is in 'filtered' mode (low pass filter).

4. Use the HIOKI clamp-on leak tester (TC012), or equivalent test tool, to measure the earth leakage current of the system at the input connection of the **MDU**, **i-MDU**, **gMDU** or **sMDU**:

Figure 6 – HIOKI clamp-on leak tester for gMDU

Figure 7 – HIOKI clamp-on leak tester for sMDU

For **MDU** and **iMDU**:

a) Measure the differential current from the "three phases and neutral".

b) **Requirements:** leakage current (L1, L2, L3, N) < 11 mA

For **gMDU 400V/50Hz** and **gMDU 400V/60Hz** (L1, L2, L3, N, PE):

a) Measure the differential current from the "three phases and neutral".

b) **Requirements:** leakage current (L1, L2, L3, N) according to the specs in Table 11.

For **gMDU 480V/60Hz** (L1, L2, L3, PE):

a) Measure the differential current from the "three phases ". (L1, L2, L3 of the system input)

b) **Requirements:** leakage current (L1, L2, L3,) according to the specs in Table 11.

c) Because this gMDU is equipped with an isolation transformer (T1), you must measure the leakage current of the secondary circuit separately. Measure the differential current from the "three phases and neutral".

d) **Requirements:** leakage current of the transformer 400V output (L1, L2, L3, N) according to the specs in Table 11.

For **sMDU (**L1, L2, L3, N, PE):

a) Measure the differential current from the "three phases and neutral"**.**

b) **Requirements:** leakage current (L1, L2, L3, N) according to the specs in Table 11.

5. If the measured leakage current (L1, L2, L3, N) is more than the required value:
   a) Search for the branch circuit which has a high individual leakage current (> 5 mA).
   b) Disconnect this circuit
   c) Do the measurement again.
   d) Check disconnected equipment for failures.

Table 10 - Leakage current measurement list iMDU / MDU(E)

Leakage current measurement list				
System part	**System mode**	**Description**	**Spec.**	**Measured [mA]**
MDU				
	Leakage current (L1, L2, L3, N)	System input	< 11 mA	

Table 11 - Leakage current measurement list gMDU

Leakage current measurement list				
System part	**System mode**	**Description**	**Spec.**	**Measured [mA]**
gMDU	**gMDU 400 V, 50 Hz & 400 V, 60 Hz**			
	Leakage current (L1, L2, L3, N)	System input	< 11 mA	
gMDU	**gMDU 480 V, 60 Hz**			
	Leakage current (L1, L2, L3)	System input	< 11 mA	
	Leakage current (L1, L2, L3, N)	Transformer output	< 11 mA	

Table 12 - Leakage current measurement list sMDU

Leakage current measurement list				
System part	**System mode**	**Description**	**Spec.**	**Measured [mA]**
sMDU	**sMDU**			
	Leakage current (L1, L2, L3, N)	System input	< 11 mA	

PHILIPS

Healthcare, MRI

PM manual

Section 4 - Gradient system 271/274/281+

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for all 271/274/281 gradient subsystems.

2 WHAT'S NEW

This section describes the updates made in the document.

Revision	
DMR194512_Rev00	• Module for 271/281 • Deleted: Check the Intera 3.0 T gradient strips (replaced by busbars)
DMR211935_R00	• New DMR number • Changes: 3.2 Check gradient coil connections , 3.3 Check gradient switch (Nova Dual/Quasar Dual) , 3.4 Door interlock test , 3.4.1 Door interlock test C271/C281+ , 3.4.2 Gradient switch box (in combination with 2x C271 or 2x C281+) , 3.4.3 Door interlock test C274 , 3.5 Dust filter and fan gradient system.
DMR211935_R01	• Revision update, clerical changes.
DMR211935_R02	• 3.1 : Added procedure for **Copley 274 at R8-R12 BDAS only**

3 PROCEDURES

3.1 Gradient coil temperature sensors detection circuit (Safety)

Skip for Copley 274 (R8-R12 BDAS)

Procedure:

1. Start PIQT or any other scan.
2. While the scan is running, disconnect connector DGBX4 at the Gradient Chain Interface (GCI) in the top the gradient amplifier. The scan aborts and the 'green OK LED' (left top) of the GCI will be 'off '. The following warning message appears on the console: 'Gradient coil is overheated! Scan aborted after error'.
3. Select: **Proceed**
   Reconnect connector DGBX4 at the GCI in the top the gradient amplifier.
4. Select: **Start scan**
   The system continues scanning without a scan abort.
5. Select: **Stop scan**

For Copley 274 at R8-R12 BDAS only

Procedure:

1. Start PIQT or any other scan.
2. While the scan is running, disconnect connector DIBX53 at the Gradient controller D2 in the gradient interface in top of the gradient amplifier. The scan aborts and the master power supply will switch to low power. The following warning message appears on the console: 'Gradient coil is overheated! Wait 15 minutes before restarting. Scan aborted after error'.

3. Select: **Proceed**
   Reconnect connector DIB-X53 at the Gradient controller D2 in the gradient interface in top of the gradient amplifier.
4. Select: **Start scan**
   The system continues scanning without a scan abort.
5. Select: **Stop scan**

3.2 Check gradient coil connections (Safety)

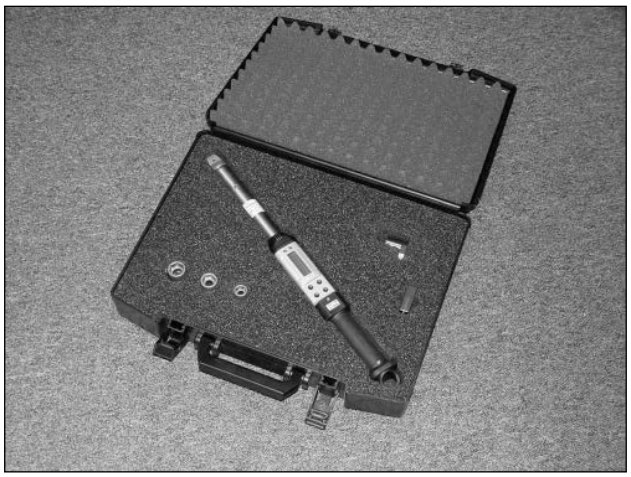
For this check, a **non-magnetic** torque wrench must be used.

Tools:

- Non-magnetic toolkit.
- Non-magnetic torque wrench (8122 102 7688x or when still available 8122 102 7449x)

Figure 1 - 8122 102 7688x

Figure 2 - 8122 102 7449x



NOTE

Look for color differences between the insulation of single gradient cables. The color of the insulation can change when a cable becomes too hot. This can occur when a defective cable connection increases the resistance of a contact.

Table 1 – Checking gradient coil connection

Gradient amplifier type	Gradient coil type[1]	Gradient coil Software name	Unpacked part number (factory use only)[1]	Service packed part number	PM Action
C274	TNF	Watercooled	n.a.	45221313095x 45221313413x (1T only) 45221313412x 45221318001x	Re-torque coil connections
C274 or C271	TNF2	Watercooled2	45221318002x	45221321597x	Re-torque coil connections
C274 or C271	TNF2S	Watercooled2	45221318004x	45980004691x	Re-torque coil connections
C281	Triton	Watercooled3	45221318006x	45221321598x	Re-torque coil connections
C281 or C78X	AG30S	Watercooled4	45221318007x	98960301346x	Check for color change[2]
C281 or C78X	TNF3	Watercooled5	45221318009x	45221325244x	Check for color change[2]

[1]) Type and number is visible at the service end (electrical connections side) of the coil.
[2]) When a gradient connection changed color, plan a corrective action to re-torque.

1. Do a visual inspection of:
   - Busbars and taped gradient strips
   - Gradient coil connections
   - Gradient cable connections
2. Look for color differences between the insulation of the single gradient cables.
   - If there are color changes, do a check on the cable connection. Loosen the connection and fasten it with the correct torque as follows.
     - Gradient coil 40 Nm
     - Gradient cable suspension 20 Nm
     - Gradient filters 20 Nm
     - Gradient switch box 15-20 Nm
     - Gradient amplifier 20 Nm

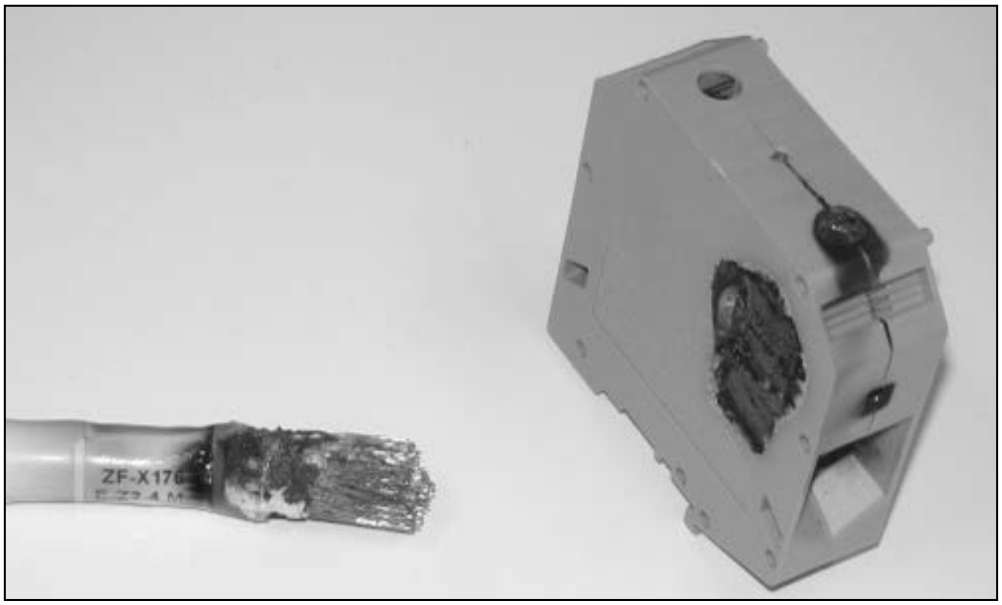
3.3 Check gradient switch (Nova Dual/Quasar Dual)

1. **Only for first PM, 6 months after system installation:** Re-torque all gradient cable connections of in- and output terminals of the gradient switch box (Specified torque: 15-20 Nm).
2. **For all PMs:** Check for coloring of the gradient cables close to the terminal blocks.

NOTE

Color differences between the insulation of single gradient cables can be caused by a bad connection. The color of the insulation can change when a cable becomes too hot, because of the increase of the resistance of a contact. A cable could eventually burn. See Figure 3.

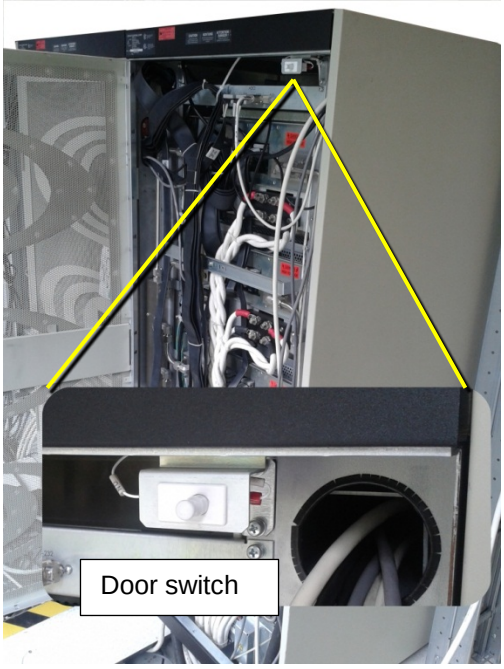
Figure 3 – A burned field-returned Gradient switch connection



Door interlock test (Safety)

3.3.1 Door interlock test C271/C281+

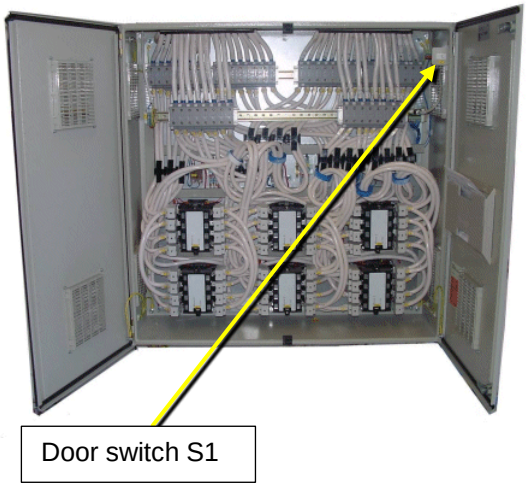
1. Start PIQT or any other scan.
2. While scanning, open the rear door to release the door switch.
   When the rear door is opened, the door switch forces the amplifier into low power. This results in a scan abort.
3. The High Voltage light must switch off and the scan must stop.
4. If the scan does not stop, then check the door switch.
5. Close the rear door and start the scan again. When the scan starts without an abort it can be stopped.
6. Repeat the test for the second cabinet, if applicable.



3.3.2 Gradient switch box (in combination with 2x C271 or 2x C281+)

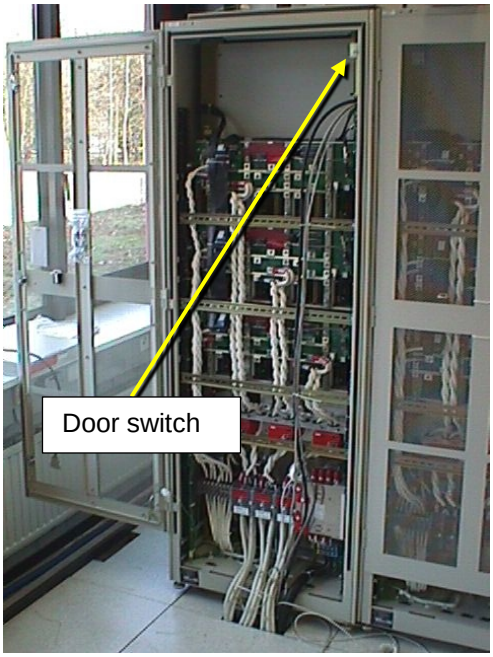
1. Start PIQT or any other scan.
2. While scanning, open the ‘gradient switch’ doors to activate the door switch S1.
   When the rear door is opened, the door switch forces the amplifier into low power. This results in a scan abort.
3. The High Voltage light at the gradient amplifier must switch off and the scan must stop.
4. If the scan does not stop, then check the door switch.
5. Close the ‘gradient switch’ doors and start the scan again. When the scan starts without an abort it can be stopped.

Figure 4 - Gradient switch



3.3.3 Door interlock test C274

1. Start PIQT or any other scan.
2. While scanning, open the rear door to release the door switch.
   When the rear door is opened, the door switch forces the amplifier into low power. This results in a scan abort.
3. The High Voltage light must switch off and the scan must stop.
4. If the scan does not stop, then check the door switch.
5. Close the rear door and start the scan again. When the scan starts without an abort it can be stopped.
6. Repeat the test for the second cabinet, if applicable.



3.4 Dust filter and fan gradient system

Skip this chapter if the Copley 78x gradient amplifier is present in the system (i.e. visually check in the Technical room or check online using the service application).

Required tools:

- vacuum cleaner
- small flashlight

NOTE

Make sure that you follow all regulations and agreements on the use of a vacuum cleaner on the customer site.

3.4.1.1 Copley 274 gradient amplifier

1. Clean the filters of the fan units. Use a vacuum cleaner.
2. Do a check on the function of the C274 fans:
   a) Generate a graddump file and check the airflow.
   b) Press the Inhibit switch on one of the C274 controllers.
   c) Start a scan.
   d) The scan will abort and generate a graddump file:
   G:\log\GRADDUMP_20YYMMDDTTTTTT.log
   (Where: YY= year, MM=month, DD=day, TTTTTT=time)
   e) Open the file and look for **Airflow**.

Figure 5 –Example graddump file

```
     X1    X2    X3    X4    Y1    Y2    Y3    Y4    Z1    Z2    Z3    Z4
-------------------------------------------------------------------------

Airflow [-]  Spec=1.0:2.0  Shutdown limit=none
M:   1.6   1.6   1.6   1.6   1.7   1.6   1.5   1.5   1.6   1.6   1.6   1.6
```

   f) Values close to zero indicate a defective fan.

3.4.1.2 Copley 271 / Copley 281+ gradient amplifier

1. Clean the filters in the front door of the cabinets (if applicable). Use a vacuum cleaner.
2. Clean the air inlet of the 3 amplifier axes and the high voltage DC power supply. Use a vacuum cleaner.
3. Do a check on the function of the fans in the 3 amplifier axes and the high voltage DC power supply.
   a) Use a small flashlight to shine onto the fan. Make sure that the fan blades turn.
   b) Hold a small piece of paper in front of the fan and make sure that it is sucked to the fan. The air flow must be from front to back.

PHILIPS

PM manual

Section 4 - Gradient Systems C78x and C2118/GLI2

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for all C78x and C2118 gradient sub systems.

2 WHAT'S NEW

Revision	
DMR124657_R00	▪ Initial version
DMR124657_R01	▪ Minor textual changes
DMR124657_R02	▪ Minor textual changes
DMR124657_R03	▪ Removed visual inspection of the fans ▪ Moved: 3.1 Gradient coil temperature sensors detection circuit for C78X only (SAFETY), from System Level chapter to this system. ▪ Added: 3.2 Interlock test of inner front cover (Safety)
DMR124657_R04	▪ Updated procedure: 3.2 Interlock test of inner front cover (Safety)
DMR211936_R00	▪ New DMR number ▪ Removed procedure: 3.2 Interlock test of inner front cover (Safety)
DMR211936_R01	▪ Revision update, clerical changes
DMR211936_R02	▪ Added: 3.2 Check gradient coil connections (SAFETY)
DMR211936_R03	▪ Changed visual inspection of gradient cables / connections
DMR211936_R04	▪ C2118 added
DMR211936_R05	▪ Gradient coil temperature sensors detection circuit GLI2 for C2118 only (SAFETY) added
DMR211936_R06	▪ Clerical changes

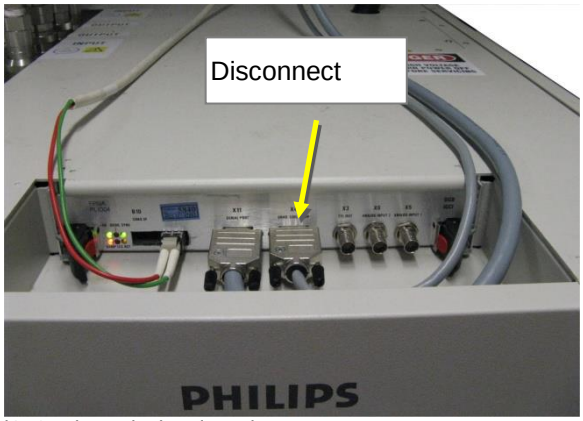
3 PROCEDURES

3.1 Gradient coil temperature sensors detection circuit for C78X only (SAFETY)

Procedure:

1. Start PIQT or any other scan
2. While the scan is running, disconnect connector DGBX4 at the Gradient Chain Interface (IGCI) on the top the gradient amplifier (Figure 1). The scan aborts and the ‘green OK LED’ (left-hand side top) of the IGCI will be ‘off ‘. The following warning message appears on the console: ‘Gradient coil is overheated! Scan aborted after error’.
3. Select **Proceed**
   Reconnect connector DGBX4 at the IGCI in the top the gradient amplifier.
4. Select **Start scan**
   The system continues scanning without a scan abort.
5. Select **Stop scan**

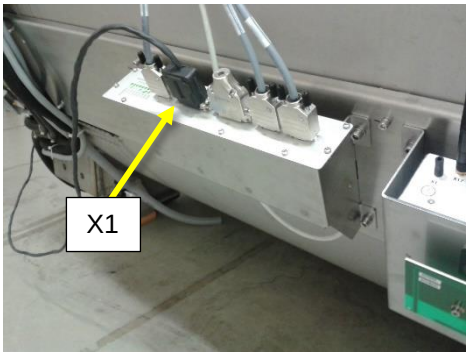
Figure 1 – IGCI board on top of amplifier



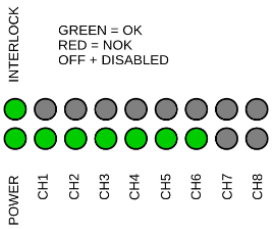
(C787 shown in the picture)

3.2 Gradient coil temperature sensors detection circuit GLI2 for C2118 only (SAFETY)

1. Remove the turret side cover to gain access to the GLI2.
2. Unscrew connector X1 from the GLI2, but leave it connected.



The GLI2 shows next green LEDs.



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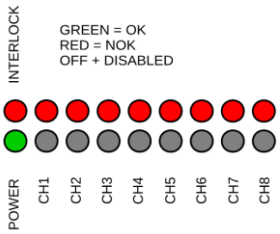
3. Start a scan.
4. While scanning, disconnect connector X1 from the GLI2.

The GLI2 shows next red LEDs and a green power LED.



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5. The scan must abort and the gradient amplifier must be disabled.
6. Click: **Proceed**
7. Check if the following warning message appears on the operator console: **Gradient coil is overheated!**
   - Know that when you do this test, it is not necessary to wait 15 minutes for the gradient coil to cool. The gradient coil has not overheated.
8. Reconnect and fixate connector X1 to the GLI2.
9. Select another patient and start a scan. No warning message must appear.
10. Stop the scan.
11. Reinstall the side cover.

3.3 Check gradient coil connections (SAFETY)

NOTE

Look for signs of too much heat on the gradient connections. When contacts become too hot the color of the connections can darken. This heating can occur when a defective or loose cable connection increases the resistance of a contact.

Table 1 – Checking gradient coil connections

Gradient amplifier type	Gradient coil type[1]	Gradient coil Software name	Unpacked part number (factory use only)[1]	Service packed part number
C78x	AG30S	Watercooled4	45221318007x	98960301346x
C78x	TNF3	Watercooled5	45221318009x	45221325244x
C78x	WA30S	WideAperture1	45221330576x	45980035659x
C78x	WA15	WideAperture1_NoShimcoil	45980014715x	45980035660x
C2118	WB30S	Wide Aperture2	45980001888x	45980076917x

1) Type and number is visible at the service end (electrical connections side) of the coil.

1. Do a visual inspection of:
   a) Busbars
   b) Gradient coil connections
   c) Gradient cable connections
2. Look for signs of too much heat on the gradient connections:
   - When contacts become too hot the color of the connections can darken.
   - This heating can occur when a defective or loose cable connection increases the resistance of a contact.
3. If you see signs of too much heat on the connections, you must make sure that the connections are correctly torqued:
   a) Refer to the applicable gradient coil service documentation for the correct torque values.
   b) Use a non-magnetic wrench to loosen the connection.
   c) Use a non-magnetic torque wrench to torque the connection to the correct value.

PM manual

Section 5 - Liquid cooling Neslab / Eaton Williams

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for all Neslab and Eaton Williams sub systems.

2 WHAT'S NEW

This section describes the updates made in the document.

Revision	
DMR193823_ R00	▪ Document dedicated to Neslab / Eaton Williams heat exchangers ▪ New: 3.3 Glycol level measurement
DMR211937_ R00	▪ New DMR number ▪ Changes to: 3.2 Check the water hoses, 3.3 Glycol level measurement, 3.4 The Neslab system 3 gradient amplifier heat exchanger procedures, 3.5 The Eaton Williams heat exchanger (with inhibited water) procedures.
DMR211937_ R01	▪ Revision update, clerical changes
DMR211937_ R02	▪ Text improvements for readability / clarity.
DMR211937_ R03	▪ Update: 3.3 Measurement of glycol concentration
DMR211937_ R04	▪ Updated: 3.4.1 Check the coolant level 3.5.1 Check the coolant level

3 PROCEDURES

NOTE

The PM procedures for the Eaton Williams gradient coil heat exchanger also apply to the Neslab system 2 gradient coil heat exchangers, if they have been converted to use water with corrosion inhibitor and biocide additives.

The systems covered by this procedure have one of the following types of heat exchangers:

- The Neslab system 3 gradient amplifier heat exchanger.
- The Eaton Williams gradient coil heat exchanger.

For further details, refer to water-cooled gradient chain compatibility (4522 981 09361) manual, which can be found on InCenter.

3.1 Safety issues

WARNING

Wear safety goggles and rubber gloves when you do maintenance on the liquid cooling system. The inhibitor and biocide in the coolant can cause damage to your skin and eyes.

- The coolant for the gradient coil is distilled water with inhibitor and biocide additives.
  - In the USA and Canada the biocide type is NX1106.
  - In all countries except USA and Canada the biocide type is NX1164.
- The inhibitor biocide packaging contains a 10 ml bottle of inhibitor, and a 5 ml bottle of biocide.
- For detailed safety and disposal information, refer to the Material Safety Data Sheets:
  - Inhibitor AZ8104: MSDS_25307_Inhibitor_AZ8104
  - Biocide NX1106 (USA and Canada only): MSDS_25641_Biocide_NX1106
  - Biocide NX1164 (all countries except USA and Canada): MSDS_09615_Biocide_NX1164
- The Material Safety Data Sheets are available from InCenter under general/safety.

WARNING

When the gradient amplifier is switched on there can be a voltage on the metal parts of the water connections at the patient side of the gradient coil. **The current is not dangerous, but know that if you touch these connections you can receive a weak electrical shock**. This warning is given to inform you of this possibility and to prevent accidents resulting from unexpected shocks.

3.2 Check the water hoses

You must do a check for damage and leaks on the water hoses of the primary water circuit (Figure 1). If one of these connections breaks it will cause serious flooding.

1. Make sure that there are no leaks at the hose connections.
   a) If water leaks between the hose and the hose connector, tighten the hose clamp.
   b) If water leaks between the hose connector and the cabinet / unit, re-install the hose connector.
2. Look for indications that the hose has moved at the point where it is attached (Figure 2).
   – There should be no gap between the hose and the hose connector.
   – If the hose is not tightly attached the water pressure can push it away from the connector.
3. Apply force to the hose with your hand. Make sure that the hose is tightly attached to the hose connector.
4. Repeat steps (1-4) for the connections at the hospital side.

Figure 1 – Check the hose connections of the primary circuit

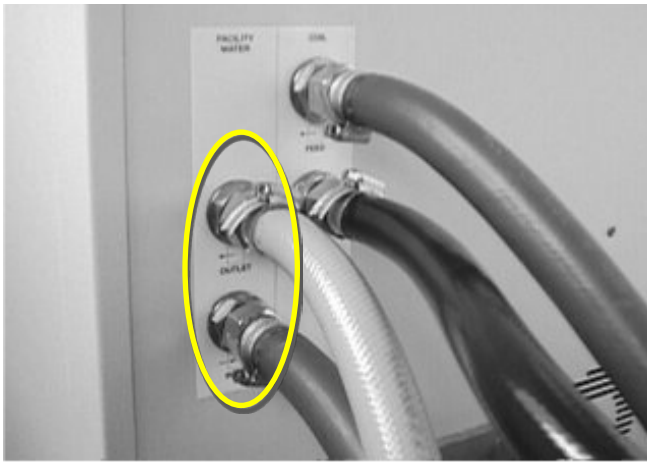
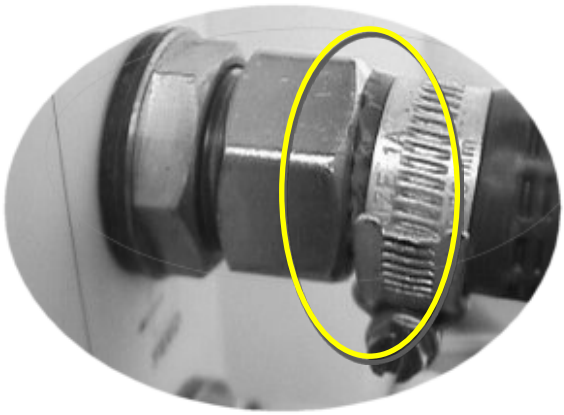


Figure 2 – Connection of primary water hose



3.3 Measurement of glycol concentration

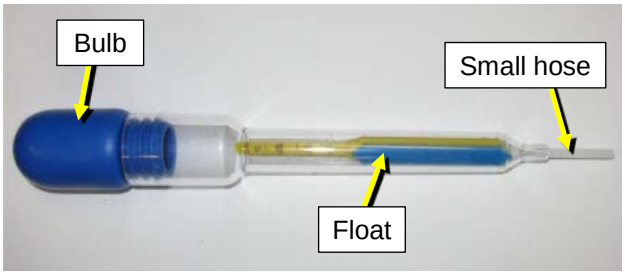
Required tool:

- 4598 004 9920x Glycol content indicator (TC647)

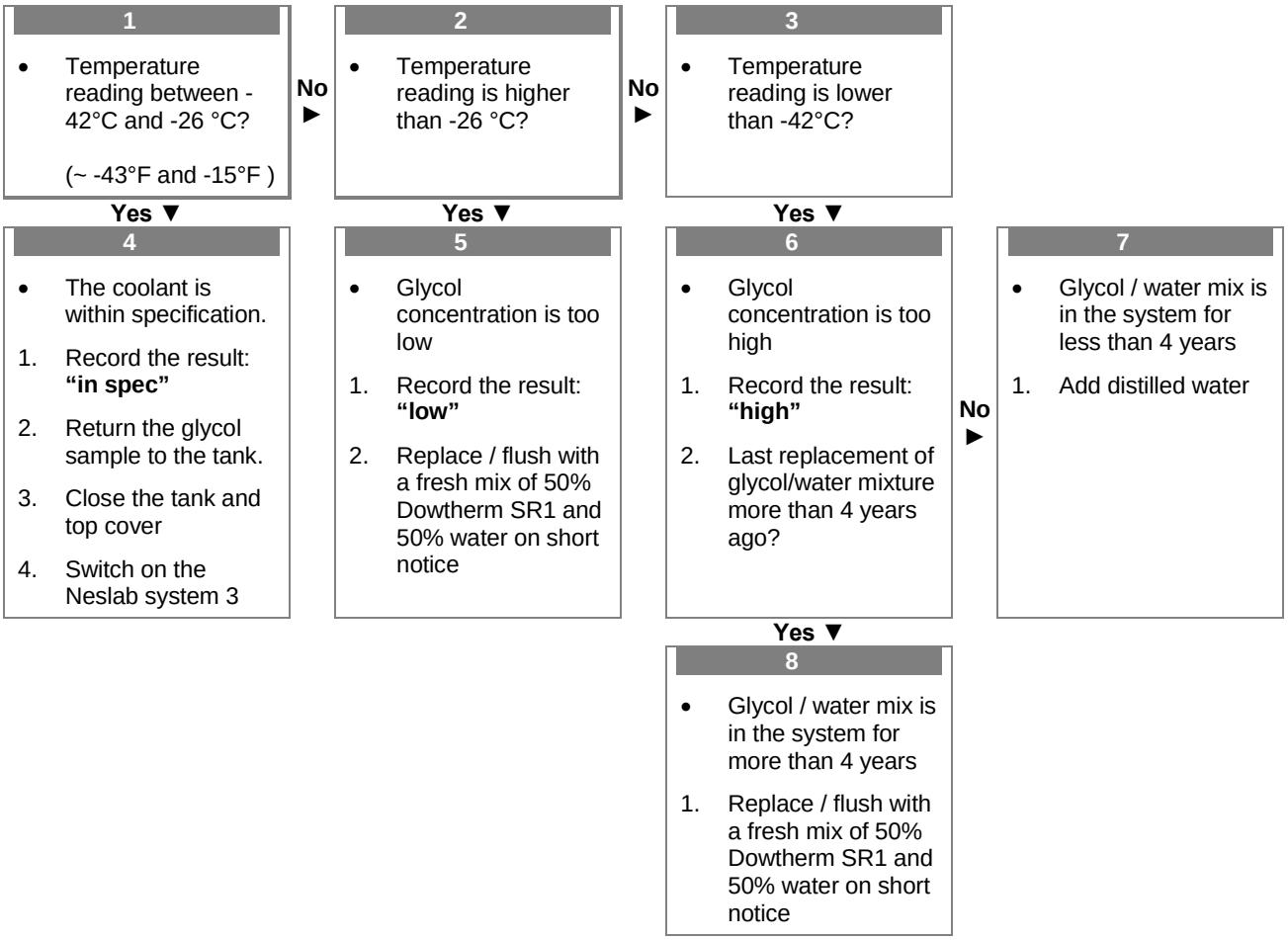
Prepare the indicator:

1. Assemble the parts of the indicator (Figure 3).

Figure 3- Glycol content indicator



2. Switch off the Neslab system III.
3. Open the top cover.
4. Open the tank
5. Insert the small hose of the 'glycol content indicator' into the coolant.
6. Squeeze the bulb, then release the bulb slowly to draw the coolant sample (approx. 50 ml) into the 'glycol content indicator'. **Hold the pressure on the bulb when the float floats freely**.
7. Hold the 'glycol content indicator' vertical and take reading at the surface of the coolant. **Make sure that no air bubbles are attached to the float**.
8. Read the temperature and continue with cell 1 in the chart that follows.
9. After the measurement, put the coolant sample back into the tank.



- For replacement / flushing procedures the coolant see the SPD's for the applicable cooling units.
- High glycol concentration will cause, among others, gradient amplifiers cold plate over temps and can eventually result in gradient amplifier failures.
- Low glycol concentration will eventually damage the aluminum gradient amplifier cold plate because of corrosion.

NOTE

The spare part 'DOWTERM SR1 PACKED 1322 530 3150x' contains a 25 liter mixture of 50% Dowtherm SR1 (inhibited ethylene glycol) and 50% water.

3.4 Neslab system 3 gradient amplifier heat exchanger procedures

3.4.1 Check the coolant level

Required materials, if the system needs filling:

- Dowtherm SR1 25l container 13225303150x

Procedure:

1. Power OFF the heat exchanger.
2. Open the top cover tank cover.
3. Open the tank, check the coolant level.
4. Fill the reservoir with coolant until the coolant level reaches the base of the threaded filler neck of the tank.
5. Close the tank, install the tank cover.
6. Power ON the heat exchanger.

3.4.2 Gradient amplifier heat exchanger interlocks (Neslab system 3) (Safety)

1. **For ≥ R2.5 only**: Login under **MRService** and start the Application Software.
2. **For < R2.5 only:** Select: **System > Scan Definition Context > Scan List**
3. Select: **SPT** icon (in the Basic Viewing Group).
4. Open: **Batch Files**
5. Open: **PIQT**
6. Right click: **PIQT**
7. Click: **Run batch**
8. Position the phantom according to the procedure given on the screen.
9. Click: **Proceed**. The scans will be executed automatically.
10. While the scan is running, disconnect connector DGBX7 at the gradient control interface (GCI) in the top the gradient amplifier. The scan aborts and the ‘green OK LED’ (left top) of the GCI will be ‘off ‘ and all amplifier axes will be disabled (all display’s will be blank). This warning message appears on the console:
    - General error detected by the coil heat exchanger.
    - Low water level detected by the coil heat exchanger.
    - Low water flow detected by the coil heat exchanger.
    - High outflow water temperature detected by the coil heat exchanger.
    - Scan aborted after error.
11. Select: **Proceed**
12. Re-connect connector DGBX7 at the GCI in the top the gradient amplifier.
13. The amplifier axes can show an ‘improper power up fault’ or a ‘rack fault’.
14. Power OFF the gradient amplifiers in the MDU extension to reset the gradient amplifiers.
15. Wait approximately 20 seconds.
16. Power ON the gradient amplifiers in the MDU extension.
17. The ‘green OK LED’ (left top) of the GCI will be still ‘off ‘, it will be ‘on’ (lit) after the next scan is started.
18. Select: **Start scan**
19. The system continues scanning without a scan abort.
20. Select: **Stop scan**

3.5 Eaton Williams heat exchanger (with inhibited water) procedures

3.5.1 Check the coolant level

Skip this procedure when the coolant must be replaced.

1. Power OFF the heat exchanger.
2. Open the top cover tank cover.
3. Open the tank, check the coolant level.
4. Fill the reservoir with coolant until the coolant level reaches the base of the threaded filler neck of the tank.
5. Close the tank, install the tank cover.
6. Power ON the heat exchanger.

3.5.2 Flushing the gradient coil water cooling system

- Once every two years (and after replacement of the heat exchanger and/or gradient coil), the external filter insert must be replaced and **the distilled water with added inhibitor and biocide of the complete system must be flushed**.
- The gradient coil cooling system must be flushed until the water is clean. Any debris will eventually cause low flow errors. Therefore, it may be necessary to perform the flushing procedure several times before system is clean again.

Required tools and materials:

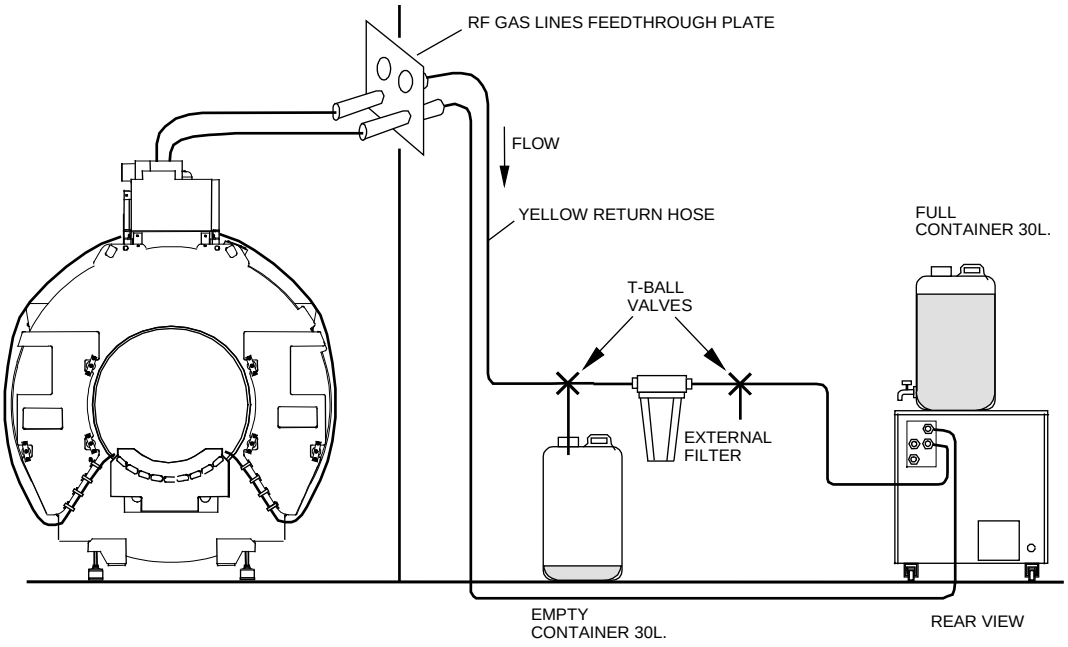
- Arrange locally: 30 liters distilled water (in one or two containers), needed for each flushing procedure.
- Arrange locally: empty 30 liter container (or smaller containers with a total capacity of 30 liters).
- Funnel.
- Water additives: 9896-030-22501 GRAD COIL KIT NX1106 & AZ8104 **(only for USA and Canada)**

  - or -
- Water additives: 9896-030-22491 GRAD COIL KIT NX1164 & AZ8104 (all countries except USA and Canada)

Preparation:

- Set up the containers for the flushing procedure as shown in Figure 4.

Figure 4 – The flushing setup



Procedure:

1. Power OFF the heat exchanger.
2. Put the valves in the filter exchange position. See Figure 5 and Figure 6.

Figure 5 - Filter exchange position

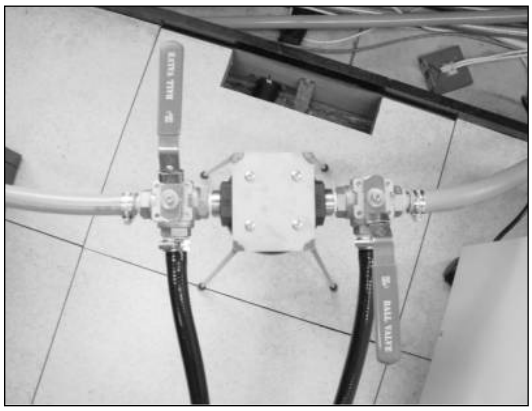
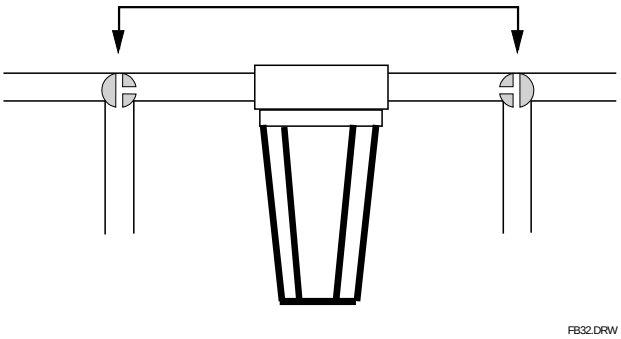


Figure 6 - Filter exchange position



3. Unscrew the blue filter housing. Pour the water from the blue filter housing in to an empty container.
4. Pull the filter from the filter top.
5. Insert the new filter.
6. Ensure that the 'O' ring in the blue filter housing is in place and screw the blue filter housing on to the filter top.
7. Take off the cover of the heat exchanger.
8. First, ensure that the 3 strainers (one inlet strainer and two pump strainers) are clean.
9. When done, install the cover of the heat exchanger.
10. Open the top-access to the tank reservoir. Open the tank, top-up the tank, and close it again.
11. Position the empty container near the external filter with the two valves. Install the two flush hoses to the free hose barbs at the valves, if not yet done.
12. Put the flush hose connected to the valve at the external filter inlet into the empty container (Figure 7)
13. Put the valves into the flush position (Figure 8)

Figure 7 - Flush position

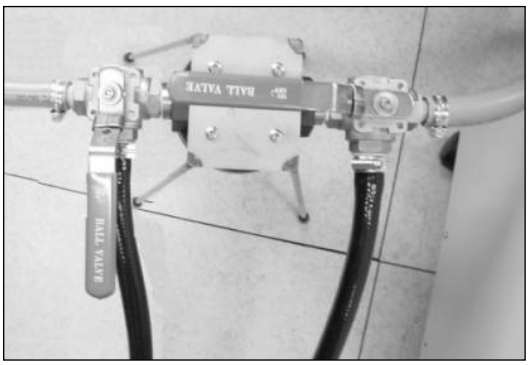
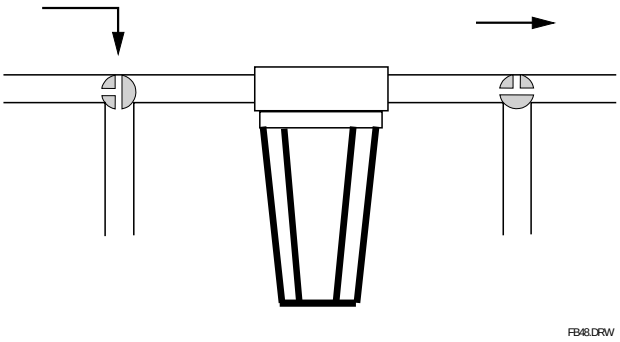


Figure 8 - Flush position



14. Power ON the heat exchanger.
15. Water returned from the gradient coil will flow into the empty container. After a short time, a low level of the reservoir tank will be detected and the heat exchanger will stop.
16. Power OFF the heat exchanger and top-up the reservoir tank with distilled water.
17. Repeat step 14 to 16 until the empty container is filled with 30 liters of TNF-II coolant.

18. Put the valves into the normal operation position. See Figure 9 and Figure 10.

Figure 9 - Normal operation

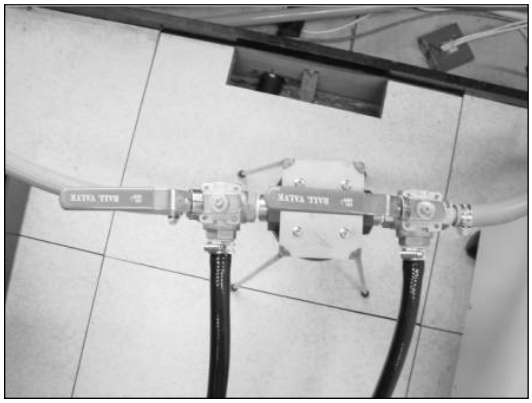
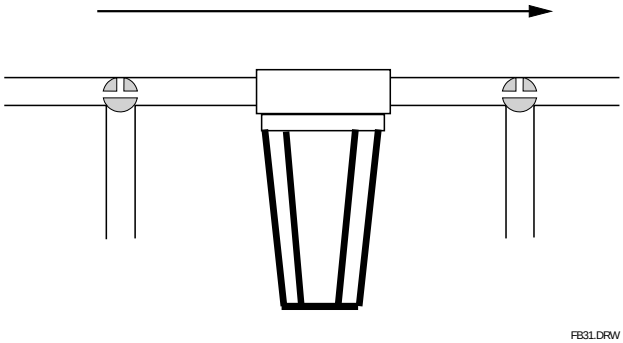


Figure 10 - Normal operation



19. Top-up the reservoir tank, power ON the heat exchanger again, and run it until it stops again because of low level. If it still runs after 5 minutes, check the water level in the reservoir tank and if necessary, top it up to the base the treaded filler neck.
20. Run the heat exchanger for a couple of minutes and check the system for water leaks.
21. If there are no leaks, continue with the next step.
22. Put on gloves and safety goggles to avoid skin contact.
23. Add the contents of the bottle marked ‘Biocide’ to the reservoir tank.
24. Allow the system to run for about 15 seconds.
25. Add the contents of the bottle marked ‘Inhibitor’ to the reservoir tank.
26. Allow the system to run for 20 minutes now, to ensure the solutions have been thoroughly distributed through the system.
27. Top up the reservoir with distilled water to the base of the threaded filler neck.
28. Install the reservoir plug again and close the reservoir tank cover of the heat exchanger.
29. Check the following read-outs:
    - Make sure that the re-circulation pressure does not exceed **79.8 psi (5.5 bars)** This pressure is not adjustable! It depends of the load.
    - Make sure that pressure fluctuation does not exceed **7.3 psi (0.5 bars).**
    - Make sure that the re-circulation temperature is about **25 °C**. (When the set point is reached, the IDLE light must light.)
30. Fill in the 'date of setting to work' at EW label for the maintenance period and stick it at the back of the heat exchanger under the EW type plate.

Disposal:

1. Discard the replaced coolant in accordance with local regulations.

CAUTION

You must discard the replaced coolant in accordance with local regulations.

3.5.3 Gradient coil heat exchanger interlocks (Eaton Williams) (Safety)

1. **For ≥ R2.5 only:** Login under **MRService** and start the Application Software.
2. **For < R2.5 only:** Select: **System > Scan Definition Context > Scan List**
3. Select: **SPT** icon (in the Basic Viewing Group).
4. Open: **Batch Files**
5. Open: **PIQT**
6. Right click: **PIQT**
7. Click: **Run batch**
8. Position the phantom according to the procedure given on the screen.
9. Click: **Proceed.** The scans will be executed automatically.
10. Drag:**QA1** to the left window. While the scan is running, disconnect connector DGBX6 at the Gradient Chain Interface (GCI) in the top the gradient amplifier. The scan aborts and the ‘green OK LED’ (left top) of the GCI will be ‘off ‘. This warning message appears on the console:
    - General error detected by the coil heat exchanger.
    - Low water level detected by the coil heat exchanger.
    - Low water flow detected by the coil heat exchanger.
    - High outflow water temperature detected by the coil heat exchanger.
    - Scan aborted after error.
11. Select: **Proceed**
12. Re-connect connector DGBX6 at the GCI in the top the gradient amplifier.
    The ‘green OK LED’ (left top) of the GCI will be ‘on ‘ now.
13. Select: **Start scan**
14. The system continues scanning without a scan abort.
15. Select: **Stop scan**

PM manual

Section 5 - Liquid cooling LCC

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for all LCC systems.

2 WHAT'S NEW

This section describes the updates made in the document.

Revision	
DMR193844_R00	▪ Dedicated document for LCC systems ▪ New: 3.4 Glycol level measurement
DMR211938_R00	▪ New DMR number ▪ Changes: 3.1 Required materials , 3.3 Check the water hoses , 3.4 Glycol level measurement , 3.5.1 Check the coolant level , 3.5.3 Gradient coil coolant flushing , 3.6.1 Check the coolant level , 3.6.4 Check the LCC interlock
DMR211938_R01	▪ Revision update, clerical changes
DMR211938_R02	▪ Text improvements for readability / clarity.
DMR211938_R03	▪ Update 3.4.2 Measurement of glycol concentration
DMR211938_R04	▪ Update chapter 3.5.4
DMR211938_R05	▪ Editorial updates
DMR211938_R06	▪ R05 content corrected according content in R04 for LCC

3 PROCEDURES

3.1 Safety issues

WARNING

Wear safety goggles and rubber gloves when you do maintenance on the liquid cooling system. The inhibitor and biocide in the coolant can cause damage to your skin and eyes.

- The coolant for the gradient coil is distilled water with inhibitor and biocide additives.
  - In the USA and Canada the biocide type is NX1106.
  - In all countries except USA and Canada the biocide type is NX1164.
- The inhibitor biocide packaging contains a 10 ml bottle of inhibitor, and a 5 ml bottle of biocide.
- For detailed safety and disposal information, refer to the Material Safety Data Sheets:
  - Inhibitor AZ8104: MSDS_25307_Inhibitor_AZ8104
  - Biocide NX1106 (USA and Canada only): MSDS_25641_Biocide_NX1106
  - Biocide NX1164 (all countries except USA and Canada): MSDS_09615_Biocide_NX1164
- The Material Safety Data Sheets are available from InCenter under general/safety.

WARNING

When the gradient amplifier is switched on there can be a voltage on the metal parts of the water connections at the patient side of the gradient coil. **The current is not dangerous, but know that if you touch these connections you can receive a weak electrical shock**. This warning is given to inform you of this possibility and to prevent accidents resulting from unexpected shocks.

3.2 Check the water hoses

1. Do a visual check for leaks on all hose connections.
2. If you find a leak on a hose connection, make sure that the hose clamp is fully tightened.
3. If the hoses or pipes are leaking, start a corrective action to repair the leak.

3.3 Glycol concentration measurement

3.3.1 Procedure to get a coolant sample

1. Remove the LCC front cover.
2. Switch off the LCC
3. Tilt the electronics box forward
4. Use a small cup to catch a gradient amplifier coolant sample.
5. Open the drain /filling valve at the GA pump to get a gradient amplifier coolant sample (approx. 50 ml).
6. Close the valve.
7. Move the electronics box back to its normal position and make sure that it is safely attached.
8. Install the front cover
9. Switch on the LCC.

3.3.2 Measurement of glycol concentration

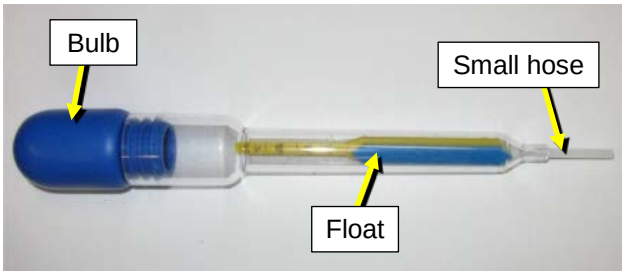
Required tool:

- 4598 004 9920x Glycol content indicator (TC647)

Prepare the indicator:

1. Assemble the parts of the indicator (Figure 1).

Figure 1- Glycol content indicator



2. Insert the small hose of the 'glycol content indicator' into the coolant.
3. Squeeze the bulb, then release the bulb slowly to draw the coolant sample (approx. 50 ml) into the 'glycol content indicator'. **Hold the pressure on the bulb when the float floats freely**.
4. Hold the 'glycol content indicator' vertical and take reading at the surface of the coolant. **Make sure that no air bubbles are attached to the float**.
5. Read the temperature and continue with cell 1 in the chart that follows

Figure 2 – Taking a coolant sample

1
- Temperature reading between -42°C and -26 °C?

(~ -43°F and -15°F)

No ►

2
- Temperature reading is higher than -26 °C?

No ►

3
- Temperature reading is lower than -42°C?

Yes ▼ (from 1)

4
- The coolant is within specification.

1. Record the result: **"in spec"**
2. No further action required

Yes ▼ (from 2)

5
- Glycol concentration is too low

1. Record the result: **"low"**
2. Replace / flush with a fresh mix of 50% Dowtherm SR1 and 50% water on short notice

Yes ▼ (from 3)

6
- Glycol concentration is too high

1. Record the result: **"high"**
2. Last replacement of glycol/water mixture more than 4 years ago?

No ►

7
- Glycol / water mix is in the system for less than 4 years

1. Add distilled water

Yes ▼ (from 6)

8
- Glycol / water mix is in the system for more than 4 years

1. Replace / flush with a fresh mix of 50% Dowtherm SR1 and 50% water on short notice

- For replacement / flushing procedures the coolant see the SPD's for the applicable cooling units.
- High glycol concentration will cause, among others, gradient amplifiers cold plate over temps and can eventually result in gradient amplifier failures.
- Low glycol concentration will eventually damage the aluminum gradient amplifier cold plate because of corrosion.

6. After the measurement, dispose of the coolant sample according to local regulations.

NOTE

The spare part 'DOWTERM SR1 PACKED 1322 530 3150x' contains a 25 liter mixture of 50% Dowtherm SR1 (inhibited ethylene glycol) and 50% water.

3.4 LCC 9896 030 13901/2 and LCC 9896 030 13911/2 procedures

These types of LCCs do not have blue swivel nuts (see Figure 8).

3.4.1 Check the coolant level

1. Remove the LCC cabinet front cover.
2. Check the level indicators of the GC and GA tank.
3. Fill the GC and GA tank to the maximum level.

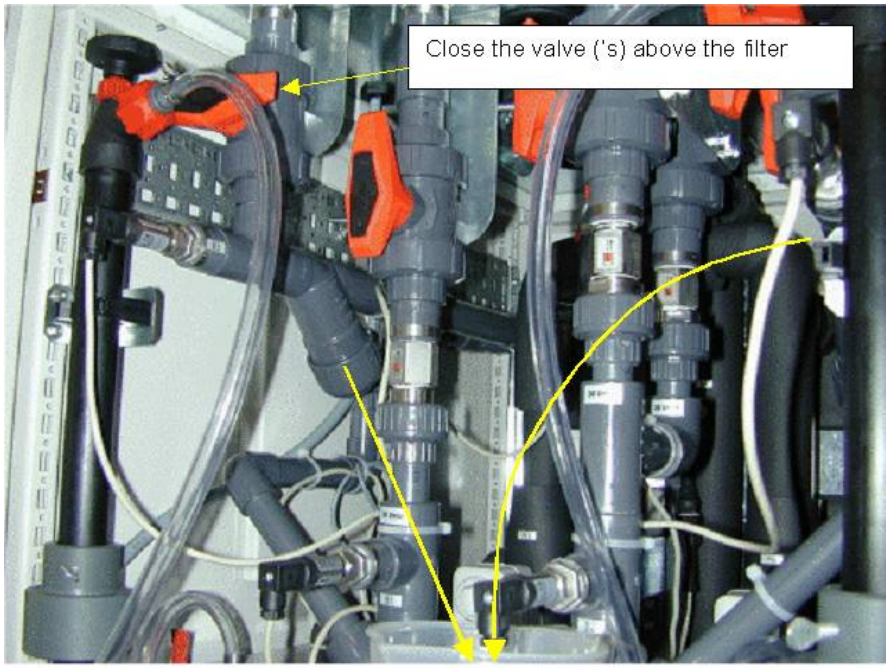
If the GC tank has to be topped up frequently, it is advised to store a canister with distilled water that has the inhibitor and biocide already mixed in.

3.4.2 Cleaning the secondary GC and GA filter

Procedure:

1. Remove the LCC cabinet front cover.
2. Power OFF the mains power to the LCC in the mains distribution unit.

Figure 3 - The flow restrictors



3. Close the ball valve (s) directly above the filter.
4. Hold a cup under the filter housing and unscrew the filter. A little coolant will spill.
5. Remove the filter screen from the housing and clean it.
6. Install the cleaned filter screen in the filter housing.
7. Install the assembled filter in the LCC.
8. Add the spilled coolant to the tank.
9. Open the valve(s).
10. Check for leaks.

11. Repeat this action for the GA circuit
12. Power ON the mains power to the LCC in the mains distribution unit.
13. Install the LCC cabinet front cover.

3.4.3 Gradient coil coolant flushing

The complete gradient coil water with inhibitor and biocide has to be replaced.

Required tools and materials:

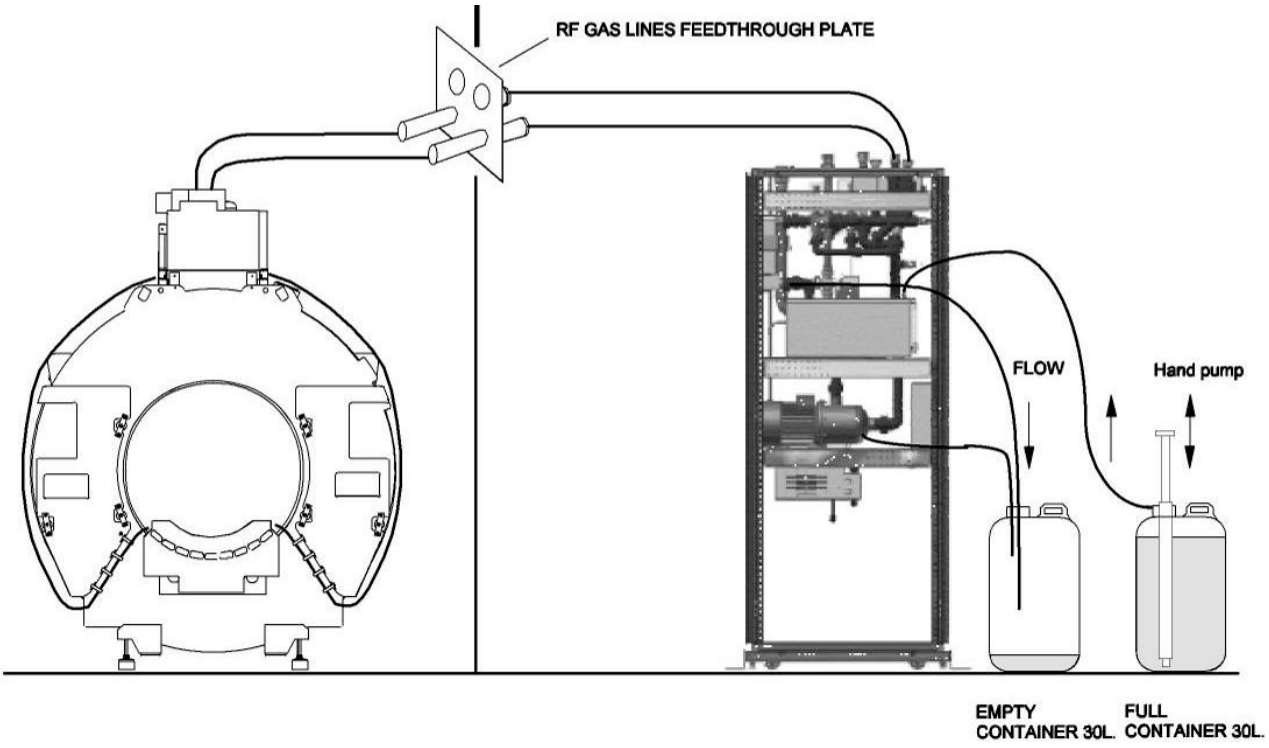
- Arrange locally: 30 liters distilled water (in one or two containers), needed for each flushing procedure.
- Arrange locally: empty 30 liter container (or smaller containers with a total capacity of 30 liters).
- Water additives: 9896-030-22501 GRAD COIL KIT NX1106 & AZ8104 **(only for USA and Canada)**

  - or -
- Water additives: 9896-030-22491 GRAD COIL KIT NX1164 & AZ8104 (all countries except USA and Canada)

Preparation:

- Set up the containers for the flushing procedure as shown in Figure 4.

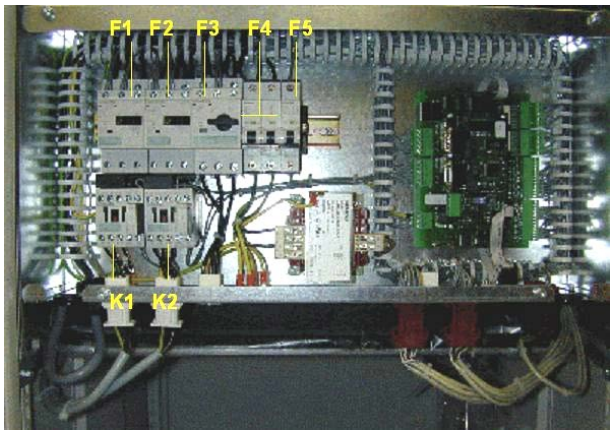
Figure 4 - The flush setup



Procedure:

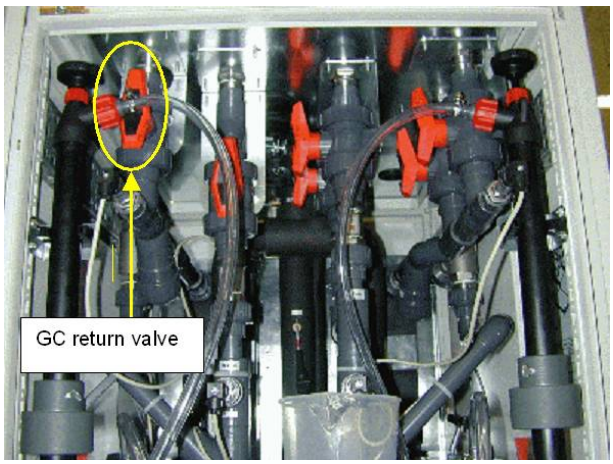
1. Power OFF the pump by switching OFF F1 (Figure 5). Keep the controller switched ON!

Figure 5 - Location of the switches



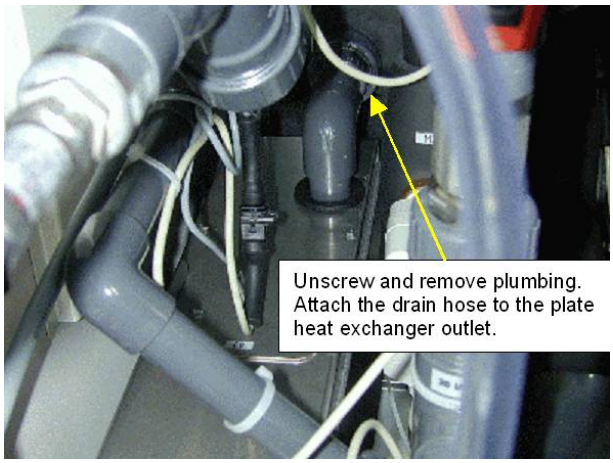
2. Close the valve of the return line from the gradient coil. See Figure 6.
3. Unscrew the outlet of the plate heat exchanger of the gradient coil circuit, see Figure 7.
4. Remove the PVC plumbing (Figure 7).
5. Screw the coolant drain hose to the outlet of the plate heat exchanger (Figure 7).
6. Put the other end in an empty container and fasten it somehow to the container. Notice that the water flows with approximately 18 liters per minute (Figure 4).
7. Connect an additional drain hose to the drain valve of the motor of the gradient coil circuit and put the other end in the empty container (Figure 4).
8. Open the drain valve at the pump and drain the tank contents into the container.

Figure 6 - Location of the GC return valve



9. Close the pump drain valve.
10. Insert the hand pump of the gradient coil circuit into the container with the new distilled water.
11. Fill the tank by operating the hand pump.
12. Open the valve of the return line from the gradient coil.
13. Power ON the pump by switching ON F1.
14. The pump will fill the circuit with the new distilled water and drain the old coolant into the empty container until the low level switch in the LCC tank is activated because of low level.
15. Power OFF the pump by means of switching OFF F1.
16. Fill the tank again and power ON the pump by switching ON F1. Repeat this until the wastewater container is filled (25 liter).

Figure 7 – Unscrew and remove plumbing



17. Power OFF the pump by means of switching OFF F1.
18. Remove the drain hose and install the PVC plumbing to connect the plate heat exchanger outlet to the tank.
19. Re-fill the tank with the distilled water just below the maximum level.
20. Verify the systems for leaks. If there are no leaks, continue.

21. Add the biocide and inhibitor additives through tank opening for the low level switch.
22. Power ON the pump by means of switching ON F1.
23. Check the level and if necessary add coolant.

Disposal:

1. Discard the replaced coolant in accordance with local regulations.

CAUTION
 You must discard the replaced coolant in accordance with local regulations.

3.4.4 Check the LCC interlock

Procedure:

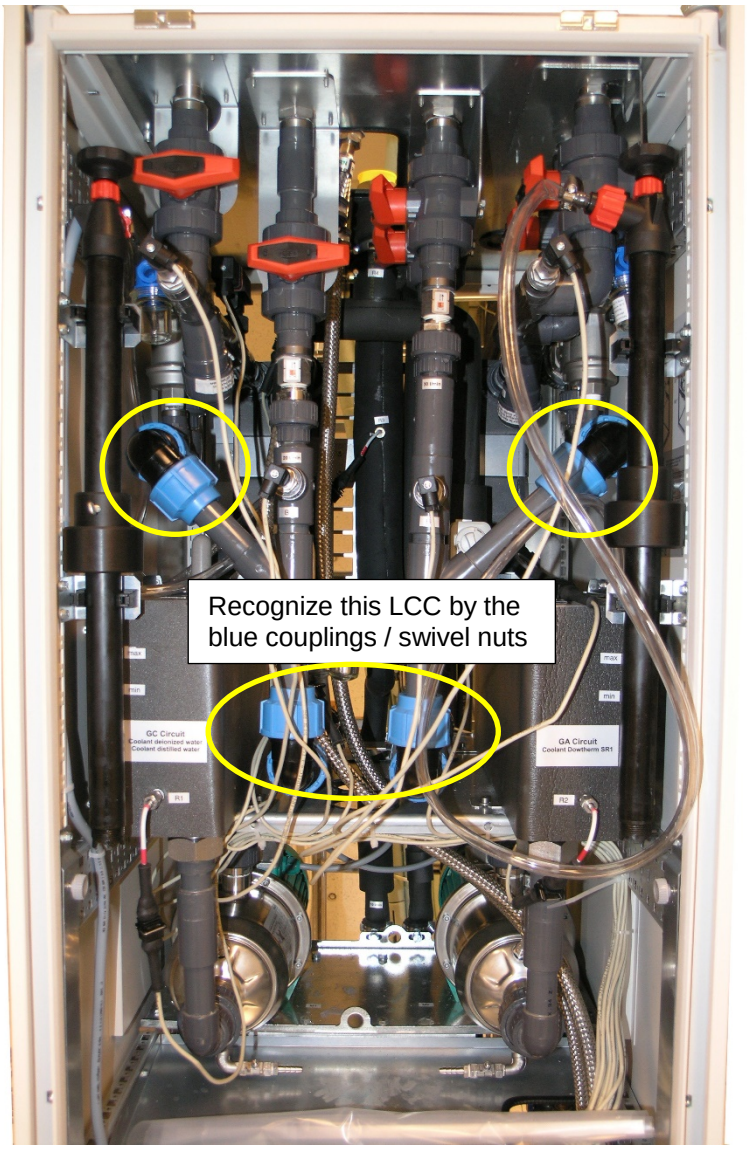
1. Start a scan.
2. Disconnect the level switch of either the GC or GC circuit.
3. Check that the LCC stops with an error code and gradient axis amplifiers are switched off.
4. Press Proceed
5. Check the central logfile for: LCC interlock detected.

6. Connect the level switch.
7. Reset the LCC electronics by toggling F4 or F5.
8. A 3 minute calibration run is started for the 3 way valve actuators.
9. When the LCC starts pumping again, the gradient amplifiers start up.
10. Start a second scan. No warning message should appear.
11. Stop the scan to quit the test.

3.5 LCC 9896 030 13903/4 and LCC 9896 030 13913/4 procedures

This type of LCC is easy to recognize by the blue swivel nuts as indicated in Figure 8.

Figure 8 - LCC with blue swivel nuts



3.5.1 Check the coolant level

1. Remove the LCC cabinet front cover.
2. Check the level indicators of the GC and GA tank.
3. Fill the GC and GA tank to the maximum level.

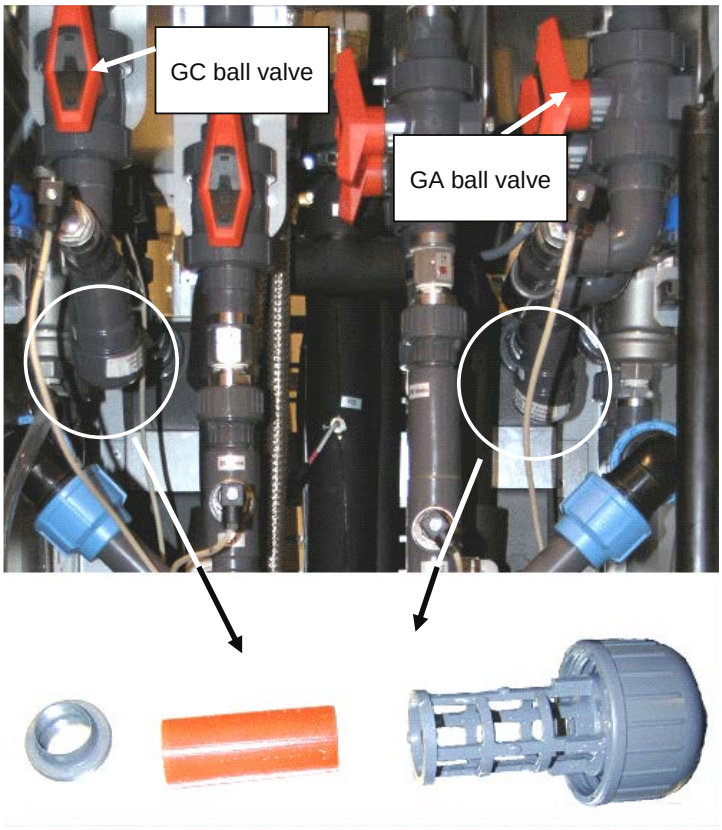
If the GC tank has to be topped up frequently, it is advised to store a canister with distilled water that has the inhibitor and biocide already mixed in.

3.5.2 Cleaning the secondary GC and GA filter

Procedure:

1. Remove the LCC cabinet front cover.
2. Power OFF the mains power to the LCC in the mains distribution unit.

Figure 9 - The filter



3. Close the GC ball valve and the GA ball valves directly above the filter.
4. Hold a cup under the filter housing and unscrew the filter. A little coolant will spill.
5. Remove the filter screen from the housing and clean it.
6. Install the cleaned filter screen in the filter housing.
7. Install the assembled filter in the LCC.
8. Add the spilled coolant to the tank.
9. Open the GC valve.
10. Check for leaks.
11. Repeat the steps 4 up to 10 for the GA circuit
12. Power ON the mains power to the LCC in the mains distribution unit.
13. Install the LCC cabinet front cover.

3.5.3 Gradient coil coolant flushing

The complete gradient coil water with inhibitor and biocide has to be replaced.

Required tools and materials:

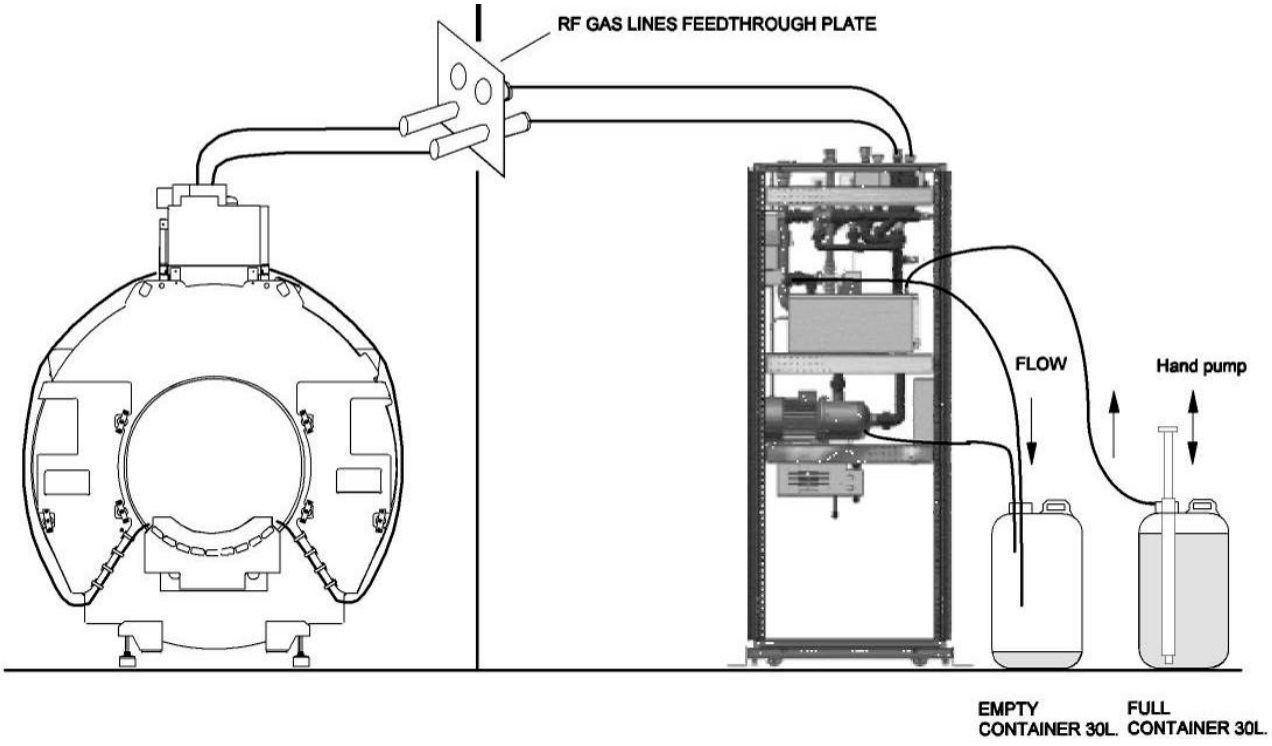
- Arrange locally: 30 liters distilled water (in one or two containers), needed for each flushing procedure.
- Arrange locally: empty 30 liter container (or smaller containers with a total capacity of 30 liters).
- Water additives: 9896-030-22501 GRAD COIL KIT NX1106 & AZ8104 **(only for USA and Canada)**

  - or -
- Water additives: 9896-030-22491 GRAD COIL KIT NX1164 & AZ8104 (all countries except USA and Canada)

Preparation:

- Set up the containers for the flushing procedure as shown in Figure 4.

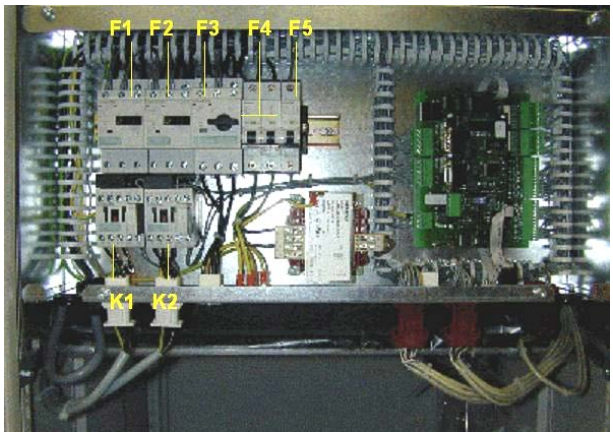
Figure 10 - The flush setup



Procedure:

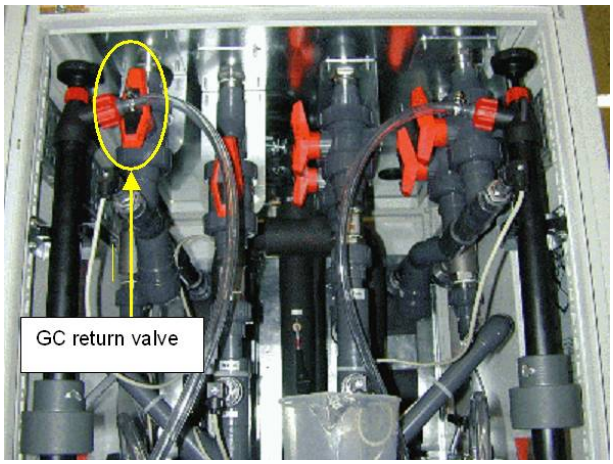
1. Power OFF the pump by switching OFF F1 (Figure 5). Keep the controller switched ON!

Figure 11 - Location of the switches



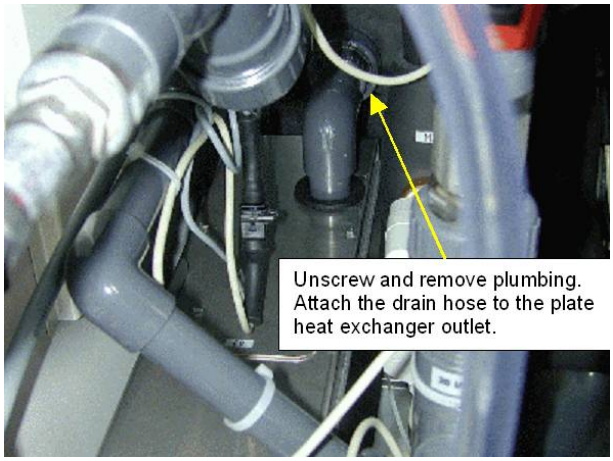
2. Close the valve of the return line from the gradient coil. See Figure 6.
3. Unscrew the outlet of the plate heat exchanger of the gradient coil circuit, see Figure 7.
4. Remove the PVC plumbing (Figure 7).
5. Screw the coolant drain hose to the outlet of the plate heat exchanger (Figure 7).
6. Put the other end in an empty container and fasten it somehow to the container. Notice that the water flows with approximately 18 liters per minute (Figure 4).
7. Connect an additional drain hose to the drain valve of the motor of the gradient coil circuit and put the other end in the empty container (Figure 4).
8. Open the drain valve at the pump and drain the tank contents into the container.

Figure 12 - Location of the GC return valve



9. Close the pump drain valve.
10. Insert the hand pump of the gradient coil circuit into the container with the new distilled water.
11. Fill the tank by operating the hand pump.
12. Open the valve of the return line from the gradient coil.
13. Power ON the pump by switching ON F1.
14. The pump will fill the circuit with the new distilled water and drain the old coolant into the empty container until the low level switch in the LCC tank is activated because of low level.
15. Power OFF the pump by means of switching OFF F1.
16. Fill the tank again and power ON the pump by switching ON F1. Repeat this until the wastewater container is filled (25 liter).

Figure 13 – Unscrew and remove plumbing



17. Power OFF the pump by means of switching OFF F1.
18. Remove the drain hose and install the PVC plumbing to connect the plate heat exchanger outlet to the tank.
19. Re-fill the tank with the distilled water just below the maximum level.
20. Verify the systems for leaks. If there are no leaks, continue.
21. Add the biocide and inhibitor additives through tank opening for the low level switch.
22. Power ON the pump by means of switching ON F1.
23. Check the level and if necessary add coolant.

Disposal:

1. Discard the replaced coolant in accordance with local regulations.

CAUTION

You must discard the replaced coolant in accordance with local regulations.

3.5.4 Check the LCC interlock

Procedure:

1. Start a scan.
2. Disconnect the level switch of either the GC or GC circuit.
3. Check that the LCC stops with an error code and gradient axis amplifiers are switched off.
4. Press Proceed
5. Check the central logfile for: LCC interlock detected.

6. Connect the level switch.
7. Reset the LCC electronics by toggling F4 or F5.
8. A 3 minutes calibration run is started for the 3 way valve actuators.
9. When the LCC starts pumping again, the gradient amplifiers start up.
10. Start a second scan. No warning message should appear.
11. Stop the scan to quit the test.

PHILIPS

MRI

PM manual

Section 5 - Liquid cooling LCC2x

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for all LCC2 liquid cooling systems. These are: the LCC2, LCC2A, LCC2B and LCC2BB.

The LCC2 was introduced in 2009.*In 2011 Q3 the LCC2A, which is produced by a different supplier, will replace LCCII in shipped new systems. LCC2A is downward compatible with LCCII and LCC (as a complete unit), although a minimum software level of R3.2.2 is required for this LCC2A. LCC2A is form fit function identical to LCCII, FRU's for LCC2A are completely different compared to LCCII. Therefore some LCC2A procedures are added. LCC2B replaced LCC2A when the water cooled RF amplifier was introduced. The LCC2BB was introduced in 2016. LCC2BB is identical to LCC2B, but has different FRU part numbers.

2 WHAT'S NEW

Revision	
DMR196329_Rev00	▪ Initial version
DMR211941_R00	▪ New DMR number ▪ Changes: 3.2 The water hoses , 3.3 Glycol level measurement and cooling loop re-pressurize , 3.3.2 Measurement of glycol level , 3.3.3 Re-pressurize the cooling loop , 3.5 Gradient Coil circuit flushing , 3.5.6 Set the flow , 3.5.7 Coolant disposal , 3.6 LCC2B check GC/WC RFA and GA filling pressure.
DMR211941_R01	▪ Revision update, clerical changes
DMR211941_R02	▪ Updated for R5.1.9 / R4.1.9
DMR211941_R03	▪ Text improvements for readability / clarity9 ▪ Updated for R5.1.10 / R3.2.10
DMR211941_R04	▪ Merged the document of the LCC2(A) and LCC2B into one document ▪ Textual update: 3.3.2 Measurement of glycol concentration
DMR211941_R05	▪ Update LCC2BB ▪ Water flow setting change
DMR211941_R06	Editorial changes
DMR211941_R07	Editorial changes
DMR211941_R08	Added: 3.6 Check filling pressure 3.6.1 Determine when to re-pressurize the coolant loop

3 PROCEDURES

3.1 Safety issues

WARNING

Wear safety goggles and rubber gloves when you do maintenance on the liquid cooling system. The inhibitor and biocide in the coolant can cause damage to your skin and eyes.

- The coolant for the gradient coil is distilled water with inhibitor and biocide additives.
  - In the USA and Canada the biocide type is NX1106.
  - In all countries except USA and Canada the biocide type is NX1164.
- The inhibitor biocide packaging contains a 10 ml bottle of inhibitor, and a 5 ml bottle of biocide.
- For detailed safety and disposal information, refer to the Material Safety Data Sheets:
  - Inhibitor AZ8104: MSDS_25307_Inhibitor_AZ8104
  - Biocide NX1106 (USA and Canada only): MSDS_25641_Biocide_NX1106
  - Biocide NX1164 (all countries except USA and Canada): MSDS_09615_Biocide_NX1164
- The Material Safety Data Sheets are available from InCenter under general/safety.

WARNING

When the gradient amplifier is switched on there can be a voltage on the metal parts of the water connections at the patient side of the gradient coil. **The current is not dangerous, but know that if you touch these connections you can receive a weak electrical shock**. This warning is given to inform you of this possibility and to prevent accidents resulting from unexpected shocks.

3.2 The water hoses

1. Do a visual check for leaks on all hose connections.
2. If you find a leak on a hose connection, make sure that the hose clamp is fully tightened.
3. If the hoses or pipes are leaking, start a corrective action to repair the leak.

3.3 Glycol concentration measurement and cooling loop re-pressurize

CAUTION

- Taking a coolant sample from the GA loop will reduce the filling pressure of the loop.
- If the filling pressure drops below 2 Bar, re-pressurize the cooling loop as described in the service documentation for the affected unit.

3.3.1 Procedure to get a coolant sample

Remove the LCC front cover.

Switch off the LCC.

Tilt the electronics box forward.

Use a small cup to catch a gradient amplifier coolant sample.

Open the drain/filling valve at the GA pump to get a gradient amplifier coolant sample (approx. 50 ml).

Close the valve.

Move the electronics box back to its normal position and make sure that it is safely attached.

Install the front cover

Switch on the LCC.

3.3.2 Measurement of glycol concentration

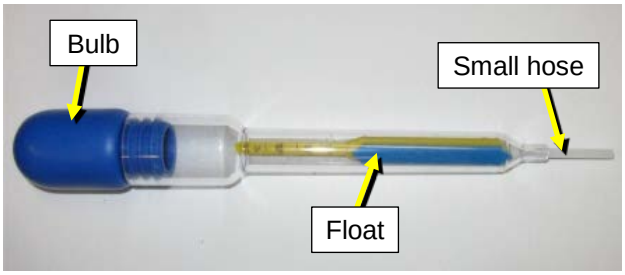
Required tool:

- 4598 004 9920x Glycol content indicator (TC647)

Prepare the indicator:

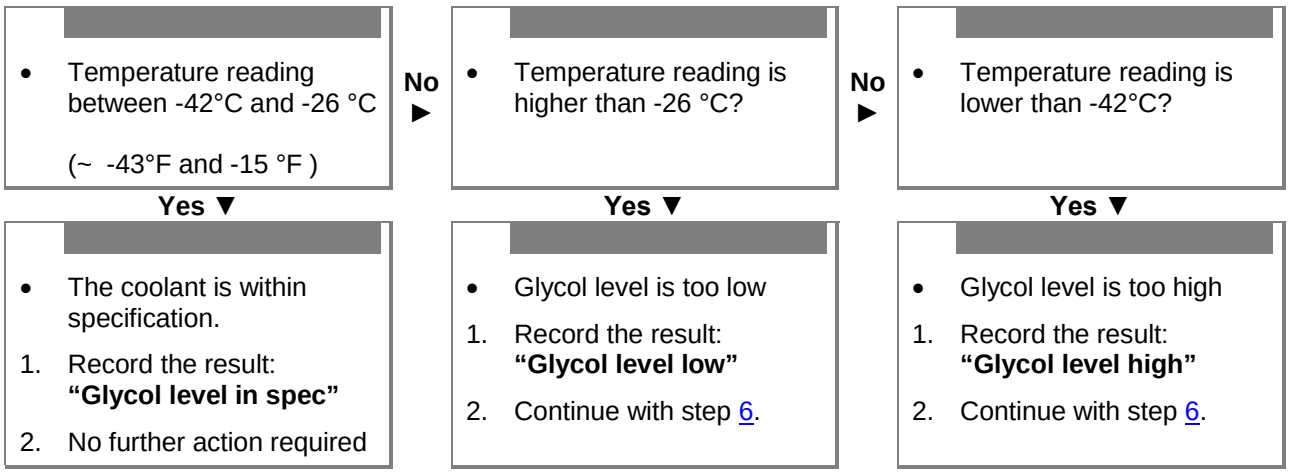
1. Assemble the parts of the indicator (Figure 1).

Figure 1- Glycol content indicator



2. Insert the small hose of the 'glycol content indicator' into the coolant.
3. Squeeze the bulb, then release the bulb slowly to draw the coolant sample (approx. 50 ml) into the 'glycol content indicator'. **Hold the pressure on the bulb when the float floats freely**.
4. Hold the 'glycol content indicator' vertical and take reading at the surface of the coolant. **Make sure that no air bubbles are attached to the float**.
5. Read the temperature and continue with cell 1 in the chart that follows

Figure 2 – Taking a coolant sample



6. If the glycol level is out of spec, the cooling loop must be replaced / flushed with a fresh mix of 50% Dowtherm SR1 (inhibited ethylene glycol) and 50% water on short notice.
   - For different coolant replacement / flushing procedures, refer to the service documentation for different cooling units.
   - High glycol level will cause, among other problems, gradient amplifiers cold plate over temps and can eventually result in gradient amplifier failures.
   - Low glycol level will eventually damage the aluminum gradient amplifier cold plate because of corrosion.
7. After the measurement, dispose of the coolant sample according to local regulations.

NOTE

The spare part 'DOWTERM SR1 PACKED 1322 530 3150x' contains a 25 liter mixture of 50% Dowtherm SR1 (inhibited ethylene glycol) and 50% water.

NOTE

Because the flushing procedure requires more coolant than the cooling loop contains, these systems need 2x 'DOWTHERM SR1 PACKED 1322 530 3150x' for flushing.
Store the remaining coolant onsite for future corrective actions.

3.3.3 Re-pressurize the cooling loop

- Re-pressurize the cooling loop as described in the service documentation for the affected unit.

3.4 Clean the primary strainer (filter)

NOTE

This filter is a protection for the LCC to catch incidental debris from the primary supply coolant. The customer must install a larger capacity external filter (not a Philips part) between hospital connections and the primary water hoses, if the hospital cooling water system or chiller coolant doesn't meet the primary water specification, according site planning reference document.

Required tool:

- 32 mm Open ended wrench (or adjustable wrench).

Procedure:

1. Switch OFF the mains power to the LCC2 in the mains distribution unit.
2. Remove the cabinet front cover.
3. Close the ball valves before and after the filter in the primary loop.
4. Remove the insulation temporarily, to gain access to the dirt trap.
5. Hold a cup under the filter housing, to catch the coolant which will spill from the filter.
6. Unscrew the dirt trap with a 32 mm wrench.

Figure 3 Primary circuit LCC2 (LCC2A is similar)

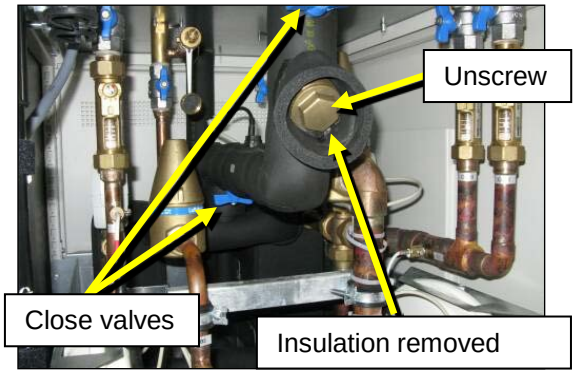
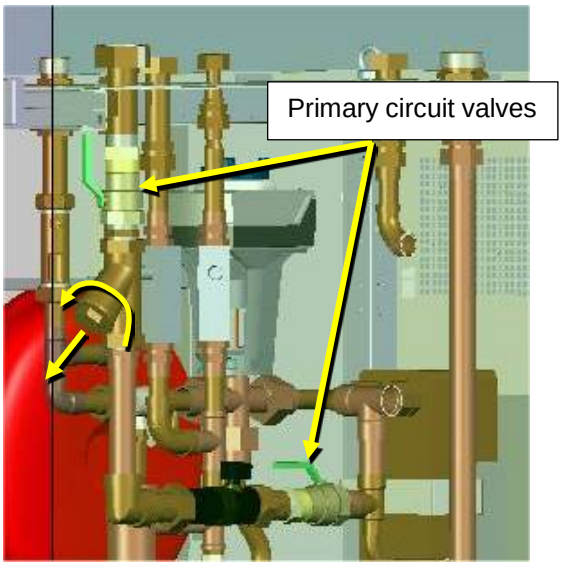
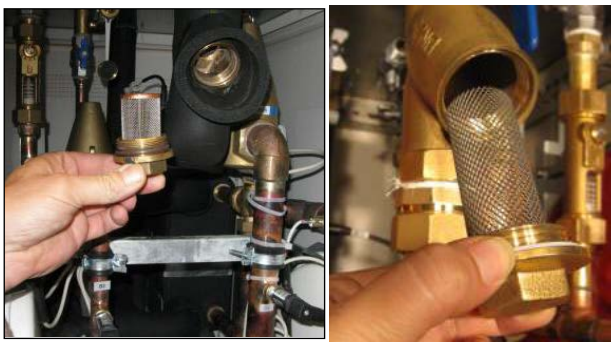


Figure 4 - Primary circuit LCC2B / LCC2BB



7. Remove the strainer and rinse it with water until it is clean.
8. Insert the cleaned or new replacement strainer in the dirt trap and install it in the dirt trap housing.
9. Install the insulation.
10. Open the ball valves before and after the filter in the primary loop.
11. Switch ON the mains power to the LCC2 in the mains distribution unit.
12. Install the cabinet front cover.

Figure 5 - Remove the strainer (LCC2, LCC2B and LCC2BB)



3.5 Gradient Coil circuit flushing

Required tools and materials:

- Arrange locally: 30 liters distilled water (in one or two containers), needed for each flushing procedure.
- Arrange locally: empty 30 liter container (or smaller containers with a total capacity of 30 liters).
- Water additives:
  - 9896-030-22501 GRAD COIL KIT NX1106 & AZ8104 **(only for USA and Canada)**

  - or -

  - 9896-030-22491 GRAD COIL KIT NX1164 & AZ8104 (all countries except USA and Canada)

Preconditions:

- The expansion vessel must be pressurized to 1 bar air pressure. Refer to service documentation of the applicable LCC2.
- **Inhibitor and biocide must be added to the distilled water in the canister**. Because the LCC2 has a closed loop system, it is impossible to add inhibitor and biocide afterwards.

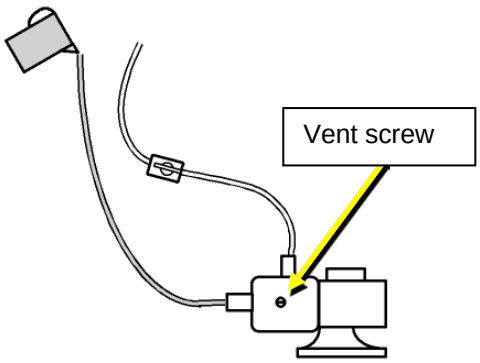
3.5.1 Before flushing

1. Remove the cabinet front panel.
2. Power off the LCC:
   a. For LCC2: Open the electronic box, switch off Q1, Q2 and F1.
   b. For LCC2A, LCC2B and LCC2BB: In the MDU, set switch Q2 (gMDU) or Q1 (sMDU) to OFF to disconnect the LCC2X (and cryo compressor) from mains power.
3. To get access to the fill and drain valves, loosen the electronic box and tilt it forward.
4. Unwind the plastic splash guard sheet and use it to cover the electronic box.
5. Put the filling pump in front of the LCC.
6. Make sure that the filling pump is still powered off.

3.5.2 Prime the filling pump

1. Fill the filling pump through the suction hose with coolant.
2. Open the vent screw a little, when coolant comes out, the pump is primed.
3. Close the vent screw and insert the suction hose into the canister with coolant.

Figure 6 - The filling pump



3.5.3 Flushing

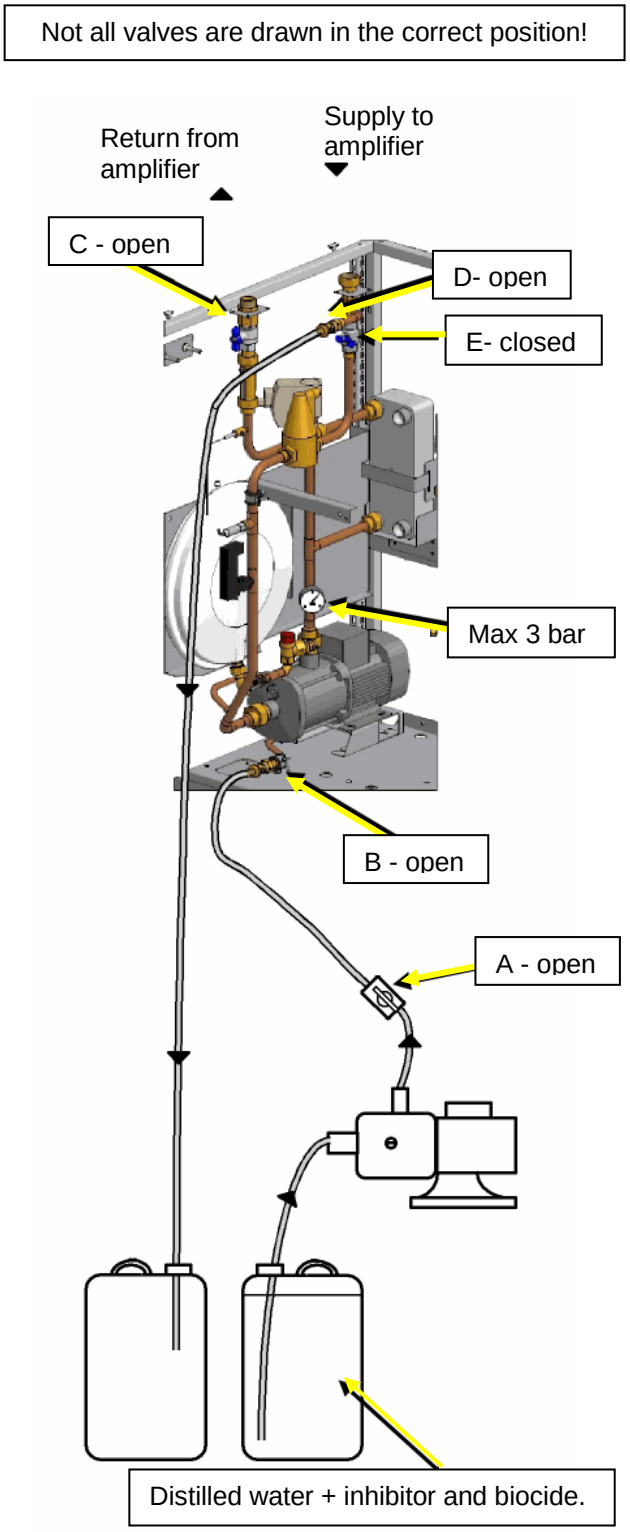
3.5.3.1 Flush GC (LCC2)

1. The pressure vessel valve must always be open!
2. Prime the filling pump.
3. **Add the inhibitor and biocide to the canister water**.
4. Connect the hoses to the LCCII. See Figure 7.
5. Set valves A, B, C and D open.
6. Set valve E closed.
7. Connect the filling pump to the DACC mains inlet.
8. Switch **on** the filling pump.
9. The GC cooling circuit will flush.
10. **Constantly monitor the pressure gauge! It must not exceed 3 bar.**
11. When the empty canister is full, the water is flushed.
12. Switch **off** the filling pump.
13. Put the drain hose in the fresh water canister, with the suction hose (as with filling).
14. Switch **on** the filling pump.
15. Let the water circulate until there is no air in the hoses visible.
16. **For next steps, you must do them quickly because of the pressure increase!**
17. Close valve D.
18. Close valve A while you keep the pressure between 2 and 2.5 bar. Quickly switch **off** the pump.
19. Use valve A to release pressure until it is approximately **2 bar**.
20. Close valve B.
21. Open valve A, to release the pressure in the hose
22. Open valve E.
23. Do a check for leaks.
24. Done.

If pressure is too low, retry:

1. Open valve A and B.
2. Switch on the pump and continue from step 18.

Figure 7 - Flushing GC LCCII



- When done, disconnect the filling pump and drain it. See chapter 2.5.4.

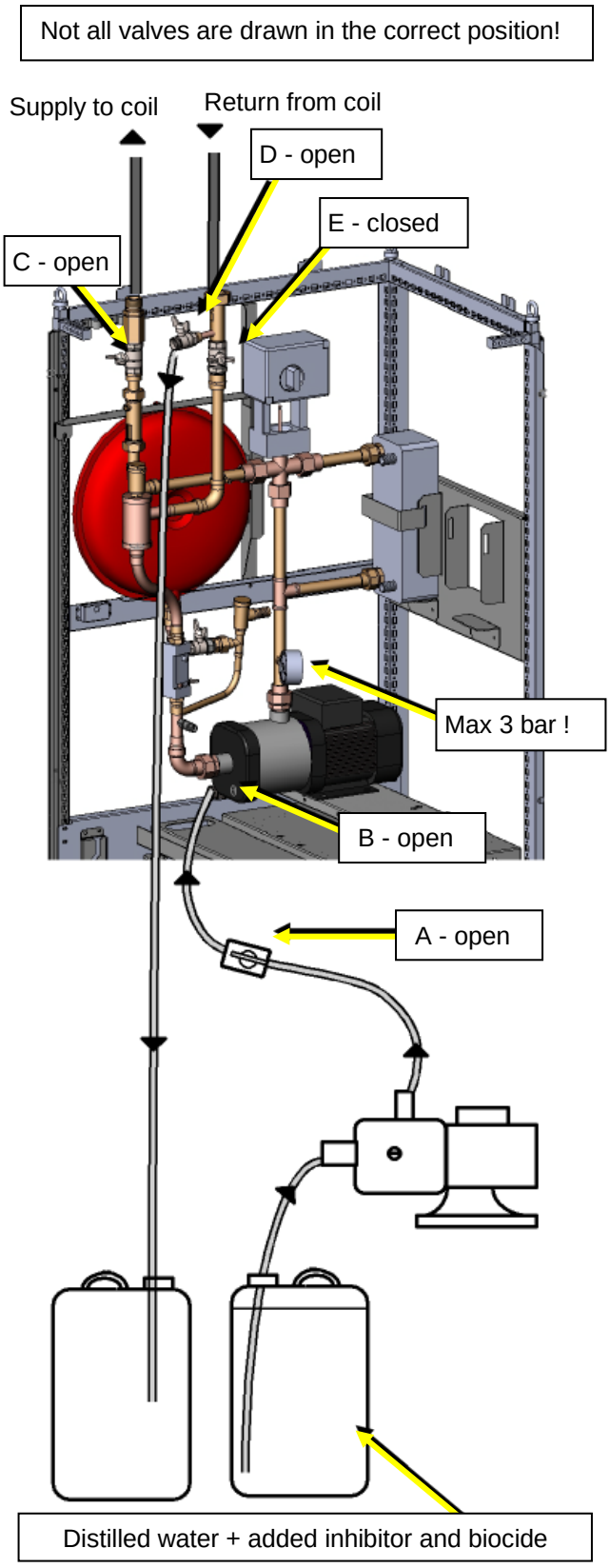
3.5.3.2 Flush GC (LCC2A)

1. The pressure vessel valve must be open always!
2. Prime the filling pump.
3. **Add the inhibitor and biocide to the canister water.**
4. Connect the hoses to the LCC2A as shown in the picture.
5. Set valves A, B, C and D to open.
6. Set valve E to closed.
7. Connect the filling pump to the DACC mains inlet.
8. Switch **on** the filling pump.
9. The GC cooling circuit will fill.
10. **Constantly monitor the pressure gauge! It must not exceed 3 bar.** (If this occurs the overpressure valve will open and eject coolant!)
11. When the empty canister is full, the water is flushed.
12. Switch **off** the filling pump.
13. Put the drain hose in the fresh water canister, with the suction hose (as with filling).
14. Switch **on** the filling pump.
15. Let the water circulate until there is no air in the hoses visible.
16. **For next steps, you must do them quickly because of the pressure increase!**
17. Close valve D.
18. Close valve A while you keep the pressure between 2 and 2.5 bar. Quickly switch **off** the pump.
19. Use valve A to release pressure until it is approximately **2 bar**.
20. Close valve B.
21. Open valve A, to release the pressure in the hose
22. Open valve E.
23. Do a check for leaks.
24. Done.

If pressure is too low, retry:

1. Open valve A and B.
2. Switch on the pump and continue from step 16.

Figure 8 – Flushing GC LCC2A



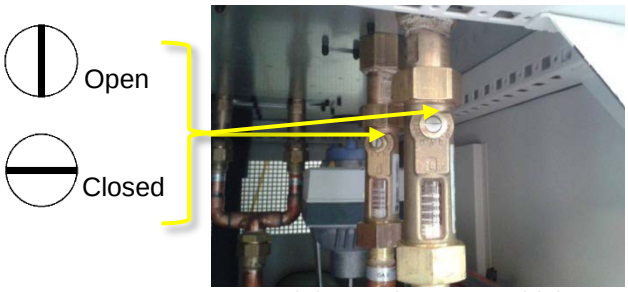
- When done, disconnect the filling pump and drain it. See chapter 2.5.4

3.5.3.3 Flush the GC / WC RFA cooling loop (LCC2B / LCC2BB)

CAUTION

Monitor the pressure gauge of the secondary loop while filling.
The pressure must stay below 3 bar!
Make sure that the pump is on the same level or below the canister (the pump is not self-priming).

- All loops must be filled separately.
- Each loop can be closed or opened with its flow setter.



(Figure shows GA side)

Preconditions:

1. The pressure vessel valve must always be open!
2. Before you fill with coolant, the pressure vessel must be pressurized to 1.0 bar (0.9 - 1.1 bar, 13 – 16 PSI) air pressure.

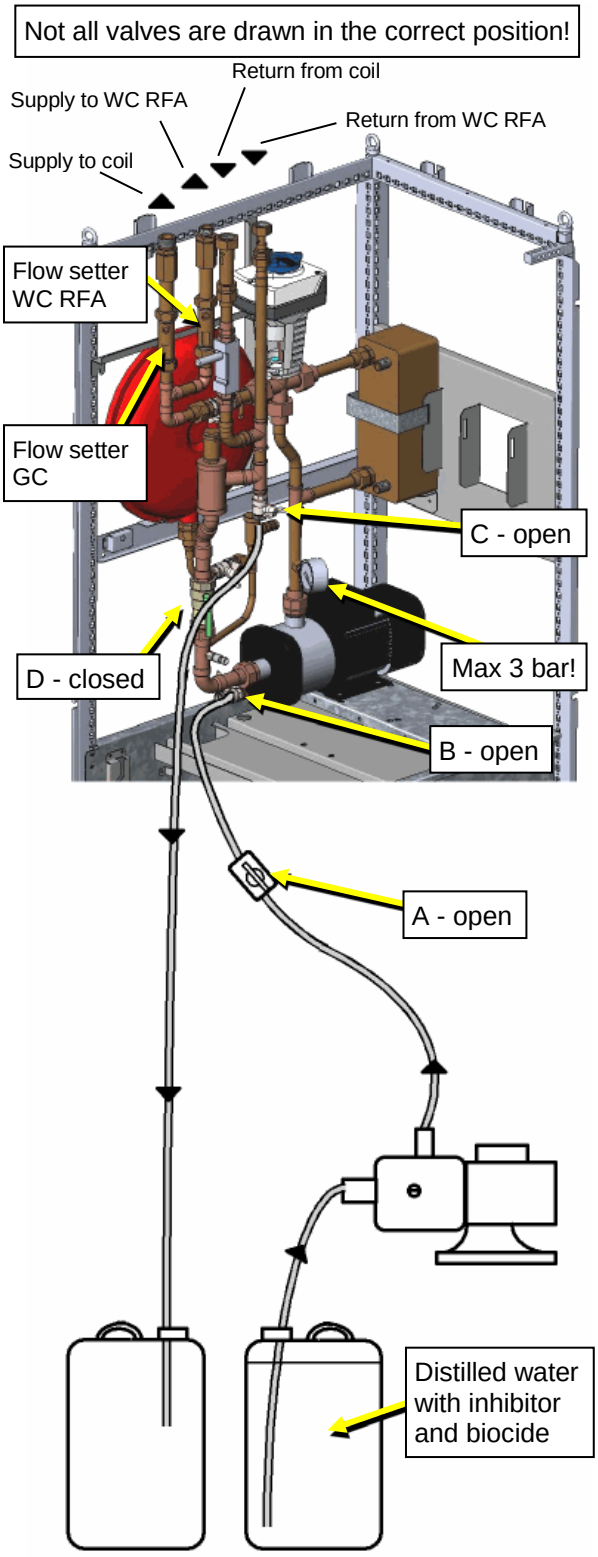
Setup for flushing:

3. Connect the filling pump to the DACC or sMDU mains inlet.
4. **Add the inhibitor and biocide to the canister water**.
5. Connect the hoses to the LCC2B/LCC2BB as shown in the picture.
6. Prime the filling pump.
7. Set valves A, B and C to open.
8. Set valve D to closed.
9. **Open the GC flow setter and close the WCRFA flow setter**

Start filling:

10. Switch on the filling pump.
11. The GC cooling circuit fills.
12. **Constantly monitor the pressure gauge! It must not exceed 3 bar** (if this occurs the overpressure valve will open and eject coolant!).
13. Let the water circulate until there is no air visible in the hoses.
14. **Open the WCRFA flow setter and close the GC flow setter**
15. The WC RFA cooling circuit fills.
16. **Constantly monitor the pressure gauge! It must not exceed 3 bar** (if this occurs the overpressure valve will open and eject coolant!).
17. Let the water circulate until there is no air visible in the hoses
18. **Open both the WCRFA flow setter and the GC flow setter**
19. To vent trapped air from the circuit, while the water circulates, open valve D a little, for a short time. Close valve D again.
20. **For next steps, you must do them quickly because of the pressure increase!**
21. Close valve C.
22. Close valve A while you keep the pressure between 2 and 2.5 bar. Quickly switch off the pump.
23. Use valve A to release pressure until it is approx. **2 bar**.
24. Close valve B.
25. Open valve A, to release the pressure in the hose
26. Open valve D.
27. Do a check for leaks.
28. Done.

Figure 9 – Flushing GC LCC2B / LCC2BB



If pressure is too low, retry:

1. Open valve A and B.
2. Switch on the pump and continue from step ##.

When done, disconnect the filling pump and drain it. See chapter 2.5.4.

It is advised to store the remaining water with inhibitor and biocide on site for future corrective actions.

3.5.4 Drain the filling pump

1. Open the valve in the filling hose to release the pressure from the hose.
2. Disconnect the filling hose from the GC pump ‘filling / drain port’ and put the end in the distilled water container.
3. Pull the suction hose form the canister with distilled water.
4. Operate the filling pump shortly to eject the water from the pump and hose.
5. Open the lower drain port of the filling pump and drain the remaining 2.5 liter water from the pump.

3.5.5 Switch on the pumps

Precondition: The secondary circuits must be filled with coolant.

3.5.5.1 Switch on the LCC2 pumps

1. Switch on Q1, Q2 and F1.
2. The displays on the LCC II printed circuit board will first show 1 1 (initializing).
3. If both circuits are started at the same time, GA will be delayed with 1 to 2 seconds.
4. The initialization phase will take 145 s (50 Hz), 175 s (60 Hz).
5. When the display shows 5 5 (start up flow), the pumps will start.
6. After some time the displays show **2 2** (normal control).

3.5.5.2 Switch on the LCC2A or LCC2B/LCC2BB pumps

For LCC2A and LCC2B: In the gMDU, set switch Q2 to ON to connect the LCC2 (and cryo compressor) to mains power.

- The LCD displays at the LCC2A electronic box will wake up.
- The pumps will eventually start. Know that GA will start 1 to 2 seconds after GC (and

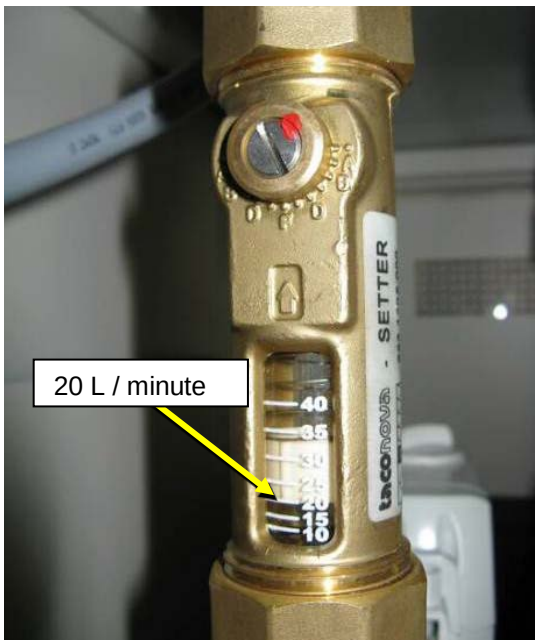
3.5.6 Check the flow

- When the pumps are running the flow for the different coolant flows can be set.

GC gradient coil loop

- Make sure that the flow is 20 liters / minute

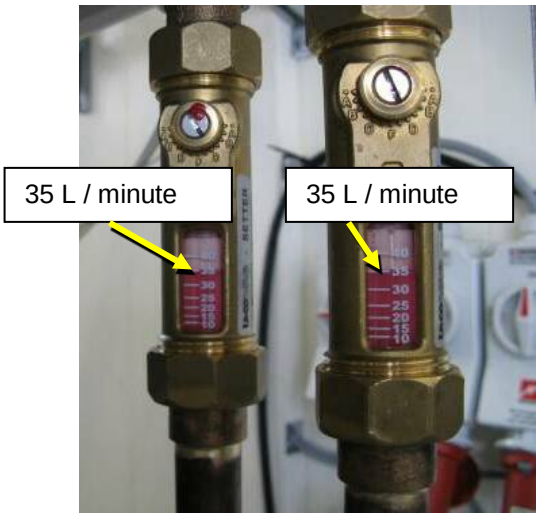
Figure 10 - GC flow setter



GA cooling loops for C787

- Make sure that both the flows are: 35 liters / minute.
  - When the flow setters are set to 35 L / min the actual flow through each gradient amplifier is 30 L / min. This is because the flow setters are calibrated for pure water.

Figure 11 - GA flow setters



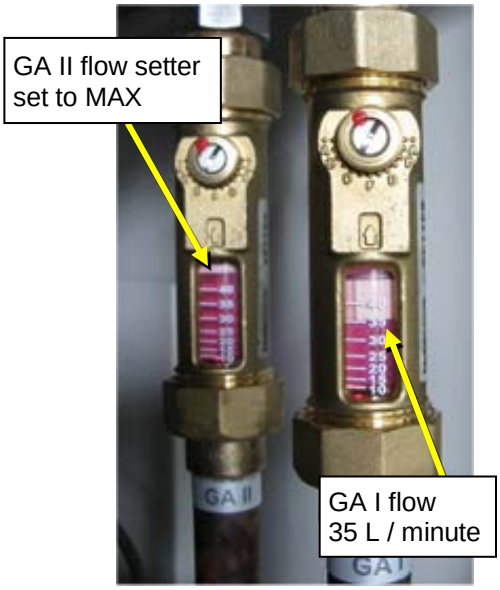
GA cooling loops for C781

- Make sure that the GA I flow (gradient amplifier connected) is 35 liters / minute.
- Make sure that the flow for the GA II flow setter (bypass connected) is MAX.

NOTE

When the GA II flow setter is not set to max, the bypass loop can sound noisy.

Figure 12 - GA flow setters (GA II by-pass)



WC RF amplifier circuit

Set the RF amplifier flow setter (Figure 13) to the correct flow, depending on the type of RF amplifier which is used.

See next flow requirements per RF amplifier type:

Figure 13 - Locate the RF amplifier flow setter

WDH1.5T: 16 – 20 L / min

Figure 14 - WDH1.5T

S35: 9 - 11 L / min

Figure 15 - S35

AN8137 16 - 20 L / min

Figure 16 - AN8137

3.5.7 Coolant disposal

1. Discard the replaced coolant in accordance with local regulations.

CAUTION

You must discard the replaced coolant in accordance with local regulations.

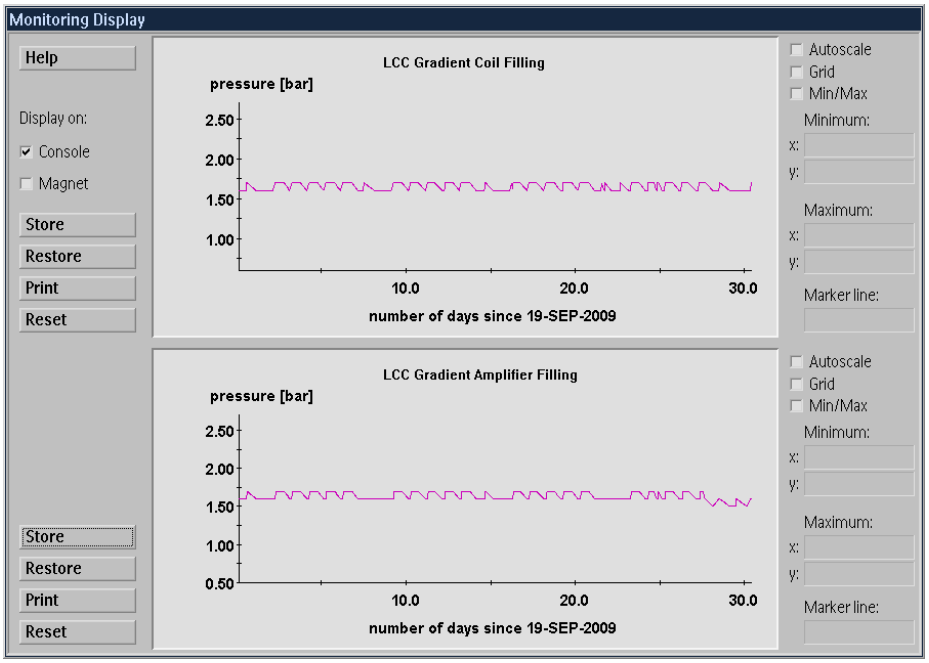
3.6 Check filling pressure

Determine Actual Filling Pressures and Filling Pressure Slopes.

With the Service Application the *actual filling pressures* of the GA and GC secondary cooling circuits are determined. In addition, the GA and GC *pressure slopes* can be determined manually from the graphs generated by the application. For this, the LCC monitoring file is used which may contain up to 30 days of data. Follow the steps described below to determine the actual pressures and pressure slopes of the GA and GC cooling circuits.

1. Logon to MRService.
2. Start the Service Application.
3. Select ‘Corrective Maintenance’.
4. Select ‘Diagnostics’.
5. Select ‘Liquid Cooling Cabinet (LCC)’.
6. Select ‘LCC pressure sensors overview’.
7. Press the ‘Next’ to proceed. The monitor screen pops up behind the PSC screen.

Figure 17 - LCC filling pressure graph



8. If filling pressure continues to fall, there is a leak somewhere in the cooling loop.
9. If you check 'Min/Max in the monitor screen, it shows minimum and maximum filling pressures of the GA and GC cooling circuits as well as the GC and GA filling pressure graphs'.
10. Note the minimum values to determine the actual GA and GC pressures. If the actual pressures cannot be determined, then use the pressure gauges of the LCC for this with the LCC pumps switched off.
11. Manually determine the GA and GC pressure slopes from the displayed graphs. Note that the slope of the pressure curve should not be positive. If the slope is increasing, constant or if it cannot be determined in time then use the value of 1 mbar/day.

3.6.1 Determine when to re-pressurize the coolant loop

The procedure to determine when to service the MR system cooling regarding the GA and GC filling pressures of the secondary cooling circuits is described below. Figure 18 shows the flow chart of the process.

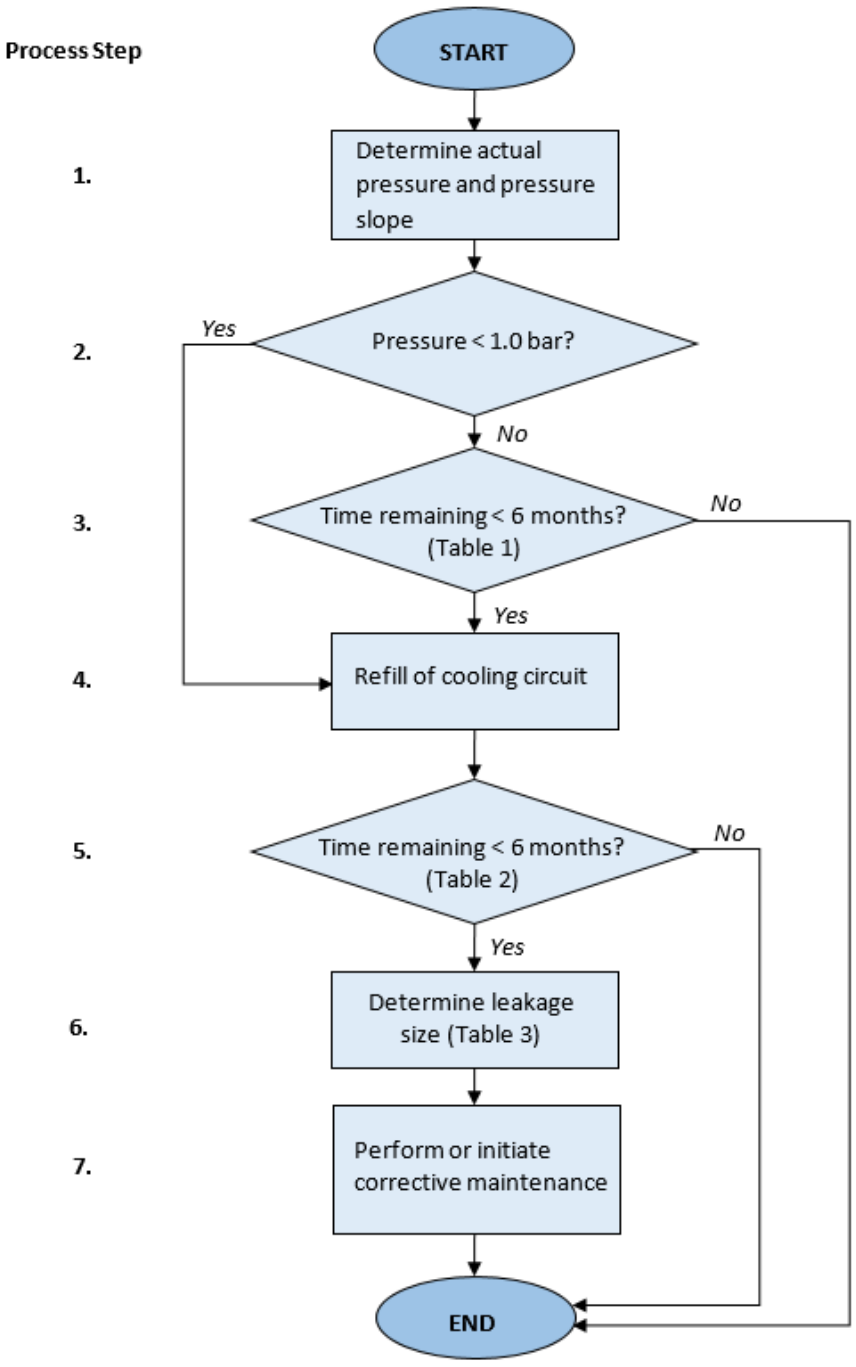
For each of the GA and GC cooling circuits, the filling pressure procedure has the following steps:

1. Determine the *actual pressure* [bar] and the *pressure slopes* [mbar/day] with the Service Application, as described in the previous subsection. This input is required for the steps 3, 5 and 6 of the filling pressures procedure.
2. If a filling pressure is < 1.0 bar then proceed to step 4. Otherwise, proceed to step 3.
3. Estimate the time remaining for the filling pressure to reach the critical value of 1.0 bar. Table 1 shows the remaining time for the actual pressure (along rows) and pressure slope (along columns) found in step 1. If the remaining time < 6 month (red colored cells), then proceed to step 4. Otherwise, proceed to step 5.
4. Refill the cooling circuit. See the applicable LCC SPD.
5. Estimate the time to the next refill with the help of Table 2 (similar to step 3). If the listed time < 6 months (red colored cell) then proceed to step 6. Otherwise, the service procedure is completed.
6. Determine the size of the water leakage with the help of Table 3. This is for the purpose of providing information only for step 7.
7. Perform or initiate *Corrective Maintenance (CM)*, i.e. check the cooling circuit for water leakage(s) and resolve the leakage(s). Consider checking the hose connections at the gradient coil for signs of leakage, in particular the short hoses between the coil part and the manifold. In case of leaks, tighten and/or replace the corresponding couplings.

NOTE

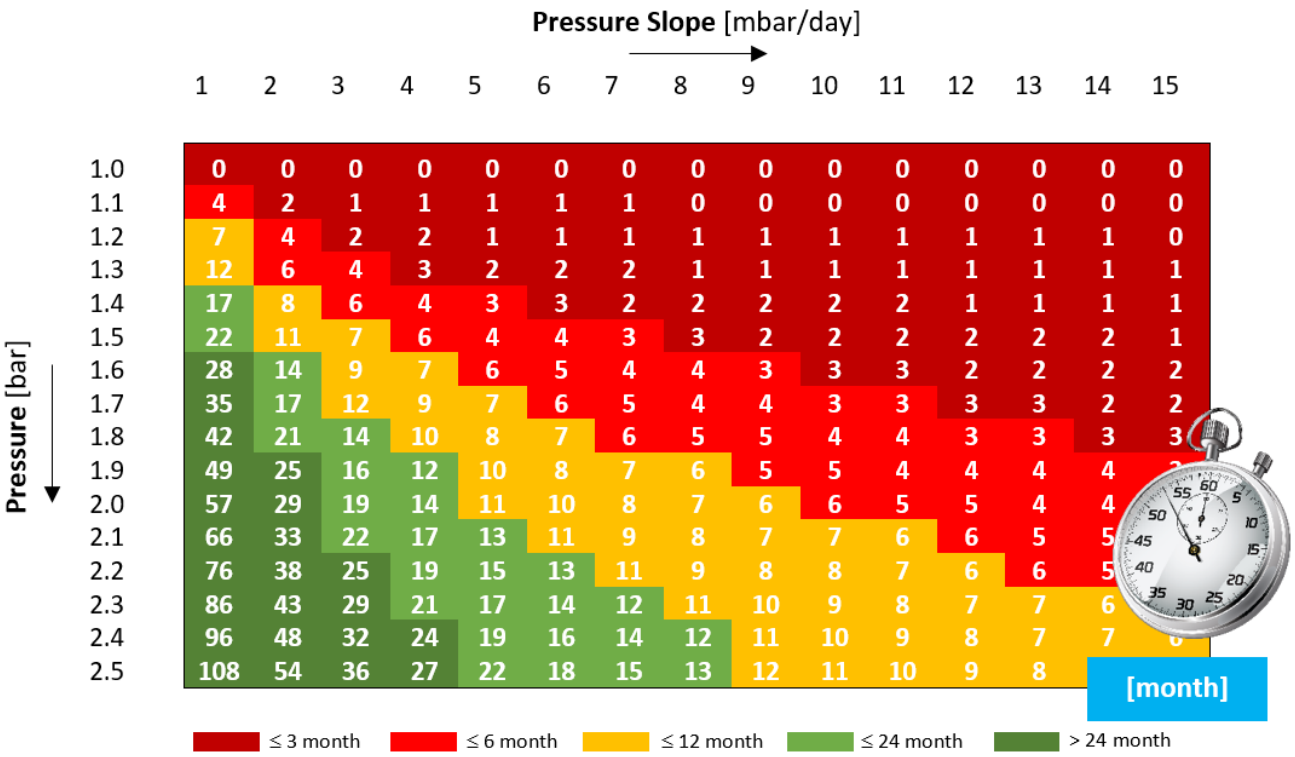
Make sure that the LCC pump is running
when checking the secondary cooling circuit for leakages.

Figure 18 – flow chart how to determine when to re-pressurize



The estimated time for the filling pressure to become critical (1.0 bar), if the MR system cooling is left unattended (no refill or corrective action). The time remaining is expressed in [month].

Table 1 – When to re-pressurize



The estimated time for the filling pressure to become critical (1.0 bar), if the MR system cooling is refilled (re-pressurization to 2.5 bar). The time remaining is expressed in [month].

Table 2 – When to re-pressurize again

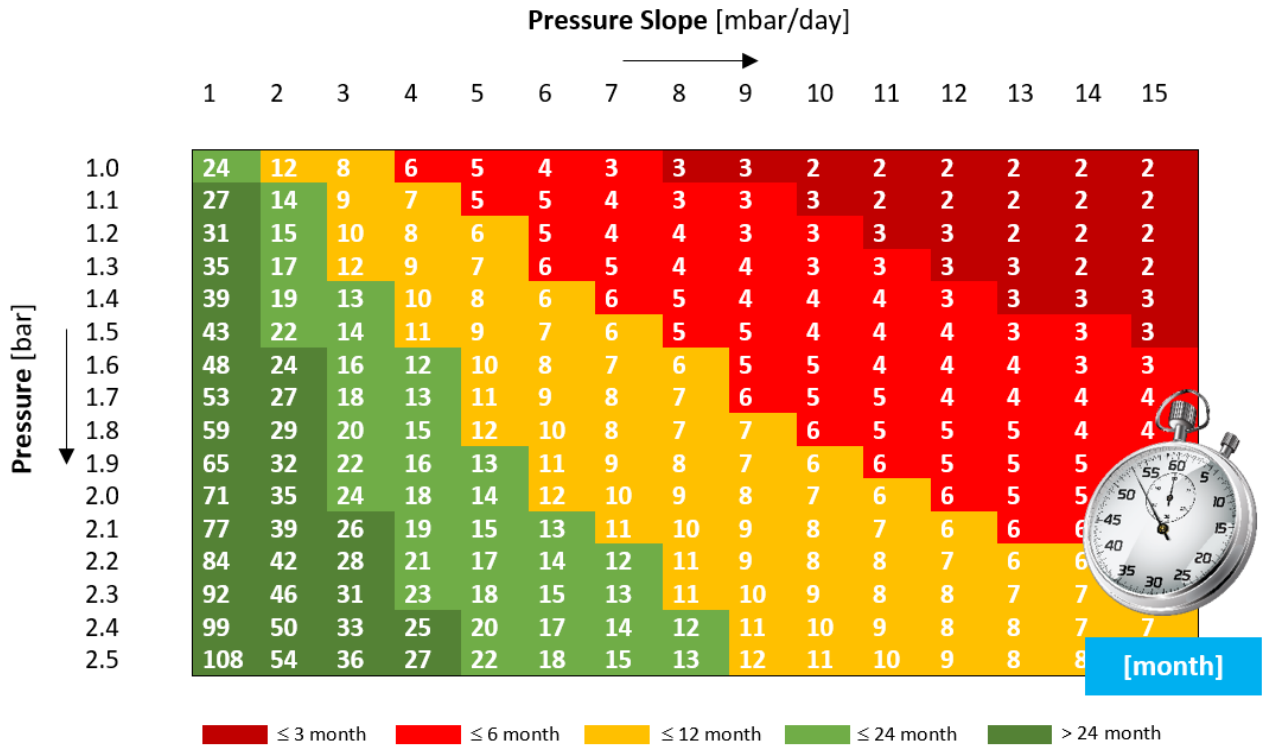


Table 3 - The estimated size of the coolant leakage

Pressure [bar] \ Pressure Slope [mbar/day]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
1.1	5	9	14	18	23	27	32	36	41	45	50	54	59	63	68
1.2	4	8	12	17	21	25	29	33	37	41	45	50	54	58	62
1.3	4	8	11	15	19	23	26	30	34	38	42	45	49	53	57
1.4	3	7	10	14	17	21	24	28	31	35	38	42	45	49	52
1.5	3	6	10	13	16	19	22	26	29	32	35	38	42	45	48
1.6	3	6	9	12	15	18	21	24	27	30	33	36	38	41	44
1.7	3	5	8	11	14	16	19	22	25	27	30	33	36	38	41
1.8	3	5	8	10	13	15	18	20	23	26	28	31	33	36	38
1.9	2	5	7	10	12	14	17	19	21	24	26	29	31	33	36
2.0	2	4	7	9	11	13	16	18	20	22	24	27	29	31	33
2.1	2	4	6	8	10	12	15	17	19	21	23	25	27	29	31
2.2	2	4	6	8	10	12	14	16	18	20	21	23	25	27	29
2.3	2	4	6	7	9	11	13	15	17	18	20	22	24	26	28
2.4	2	3	5	7	9	10	12	14	16	17	19	21	22	24	26
2.5	2	3	5	7	8	10	11	13	15	16	18	20	21	[ml/day]	

3.7 Testing the LCC interlock

1. Remove the LCC front panel.
2. Open the LCC electronic box.
3. Remove the outer panel of the C781 or C787 gradient amplifier.
4. Start a scan.
5. When the system is scanning, close these valves in the LCC:
   - LCC2 and LCC2A: GC supply shut off valve and the GA1 and GA2 supply shut off valves
   - LCC2B and LCC2BB: GC/WC RFA shut off valve and GA shut off valve (located at the suction side of the pump
6. Make sure that the LCC stops within a couple of seconds.
7. Make sure that the gradient axis amplifier output is switched off (green high voltage light off).

Figure 19 Supply shut off valves LCC2

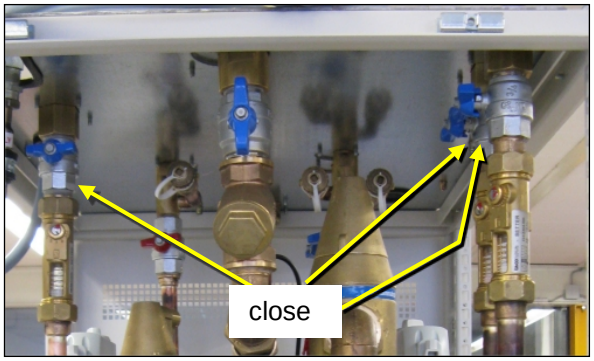


Figure 20 Supply shut off valves LCC2A

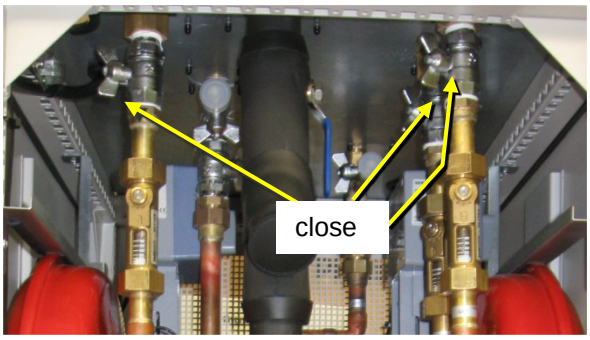
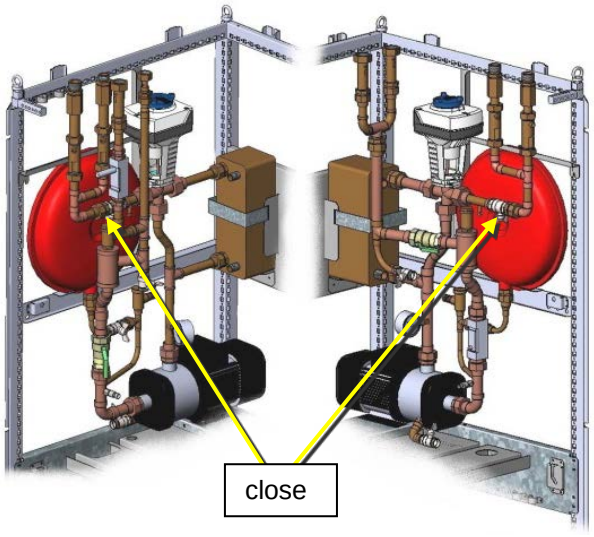


Figure 21 Supply shut off valves LCC2B and LCC2BB



8. Make sure that on the IGCI board (Figure 22), the red LED of the LCC is **on**.

Figure 22 – LEDs on IGCI board

9. Click **Proceed**.
10. Make sure that the central log file contains the text: **LCC interlock detected**.
11. Open the closed valves.
12. Reset the LCC electronics by toggling the following circuit breaker off/on:
    a. LCC2: F1 or F2
    b. LCC2A: QF1 or QF2
    c. LCC2B: QF
    d. LCC2BB: QF1

- A 3 minutes (approximate) calibration run is started for the 3 way valve actuators.
- When the LCC starts pumping again, the gradient amplifier starts up as well.
- The LCC and G.Amp red LED on the IGCI board is off again.

13. Start a second scan.
14. **Make sure that no warning message appears**.
15. Stop the scan to quit the test.
16. Install all covers.

▼*[R1.5T] [Ingenia] [Ingenia CX] [Achieva] CSIP 1 (22-08-2017-FB)*

3.8 Test the LCC2B flow interlock

This procedure applies only to LCC2B.

1. Remove the LCC front panel.
2. Open the LCC electronic box.
3. Start a scan.
4. When the system is scanning, close in the LCC the gradient coil shut off valve.

Figure 23 – LCC2B: Supply shut off valve

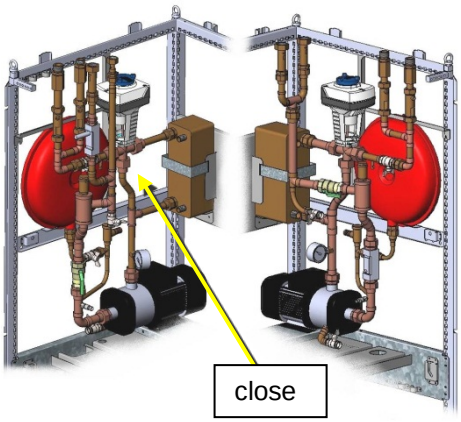


Figure 24 – LEDs on IGCI board

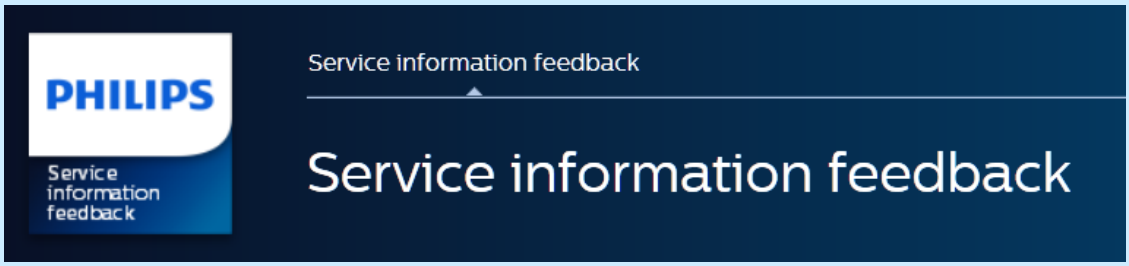
5. Make sure that the LCC stops within a couple of seconds.
6. Make sure that the gradient axis amplifier output is switched off (green high voltage light off).
7. Use a step ladder to see the IGCI board on top of the gradient amplifier.
   - Make sure that on the IGCI board (Figure 18), the red LED of the LCC is **ON**.
8. Open the GC shut off valve in the LCC.
9. Reset the LCC electronics by setting circuit breaker QF to OFF, and then to ON.
   - A 3 minute (approximate) calibration run is started for the 3 way valve actuators.
   - When the LCC starts pumping again, the gradient amplifier starts up as well.
   - The LCC and G. Amp red LED on the IGCI board is off again.
10. Start a second scan.
11. **Make sure that no warning message appears**.
12. Stop the scan to quit the test.
13. **Record** PASS in the field **Heat exchanger flow interlock** in IATD2.

Do not install the covers at this time (because you must test the pressure interlock in chapter.

PM manual

Section 6 - Refrigeration system

NOTE



To give your feedback:

1. Click on this link: Service information feedback portal.
2. In your browser, under **My feedback** click on **new item**.
3. Give your feedback and enter the DMR and Rev. shown in the footer of the page that you want to give feedback on.

(DMR 211945 Rev05)

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for:

- Subsystem: **HC-8E**, **CSW-71**, **F-50** and **F-40** refrigerator subsystems.

2 WHAT'S NEW

Revision	
DMR132748_R00	▪ Modular structure of the PM document ▪ 3.1 Check pressure of the compressor: check equalization pressure. This can only be done when compressor is not running. ▪ Removed: Check water and oil circuit ▪ 3.2 Check water flow: Updated procedure
DMR132748_R01	▪ Added Multiva to title (PM manual compatible with Multiva)
DMR179830_R00	▪ Textual changes ▪ Updated: 3.3 Check boil off (updated reference) ▪ Updated: 3.5 Check cryogenic performance(replace procedure with reference) ▪ Removed: Adsorber replacement
DMR211945_R00	▪ Removed: 3.3 Inspection gas lines. ▪ Updated: 3.1 Check quench pipe bolts , 3.2 Check pressure of the compressor , 3.4 Check boil off (only for 10K)
DMR211945_R01	▪ Revision update, clerical changes
DMR211945_R02	▪ Added link to Compressor SPD in: 3.1 Check pressure of the compressor
DMR211945_R03	▪ Added specs for F-40 compressor
DMR211945_R04	▪ Editorial changes ▪ 3.2 Check water flow: Somitomo graphs instead of fixed flow specification
DMR211945_R05	▪ 3.2 Check water flow Added info: LCC2B and LCC4 with factory installed HC flow temperature sensor.

3 PROCEDURES

3.1 Check pressure of the compressor

1. Check the compressor while it's operating. (One or two pressure gauges at the front side of the compressor)

Table 1 – Compressor unit specications

Cryo-Cooler and Compressor measurements and verifications	Spec.	
Dynamic Pressure (Compressor On)	HC-8E	310-350 psig
	CSW-71	2.00-2.20 MPa
	F-50	1.90-2.20 MPa
	F-40	268-305 psig

2. If the pressure indication of the Compressor Unit is lower than specified value, then charge with helium gas. For this procedure, refer to the service documentation for your compressor.
3. If the pressure in the compressor is below the minimum, the compressor cannot work to keep the magnet cold. This increases the possibility of helium loss or quench.

3.2 Check water flow

1. Check if there is a flow meter present in the LCC cabinet that is connected to the return water hose of the compressor. If there is a flow meter present go to step 4, else go to step 2.

   <u>LCC2B rev 5</u> or higher (last digit of the 12nc) and <u>LCC4 rev 6</u> or higher (last digit of the 12nc), have a factory installed flow temperature sensor in the helium compressor water return line. The flow and temperature sensor values can be read from the LCC E-box display. Just scroll through the screens by pressing the up or down arrow. (Eventually these values will also become available remotely.)

The HC flow shows in liter per hour.

The HC return temperature shows in ^{0}C.

2. If there is no flow meter installed one can still be ordered, such that it is possible to measure the water flow through the compressor. The 11 NC for such a flow meter is 45980002762x.
3. Install the flow meter. Consult the applicable LCC service documentation for the procedure to install the flow meter.
4. Check if the water flow meets the specs for your compressor, depending on the LCC inlet temperature. If the water flow is out of spec, check the LCC main flow (For details see LCC service documentation). If the main flow is also within spec, then most likely the flow is restricted. Restriction is caused either, by the compressor or connected water hoses or LCC plumbing. In that case the compressor will be back-flushed. Measure the flow again after flushing the compressor. If it is still below spec, contact your local FRT.

Helium compressor HC-8E

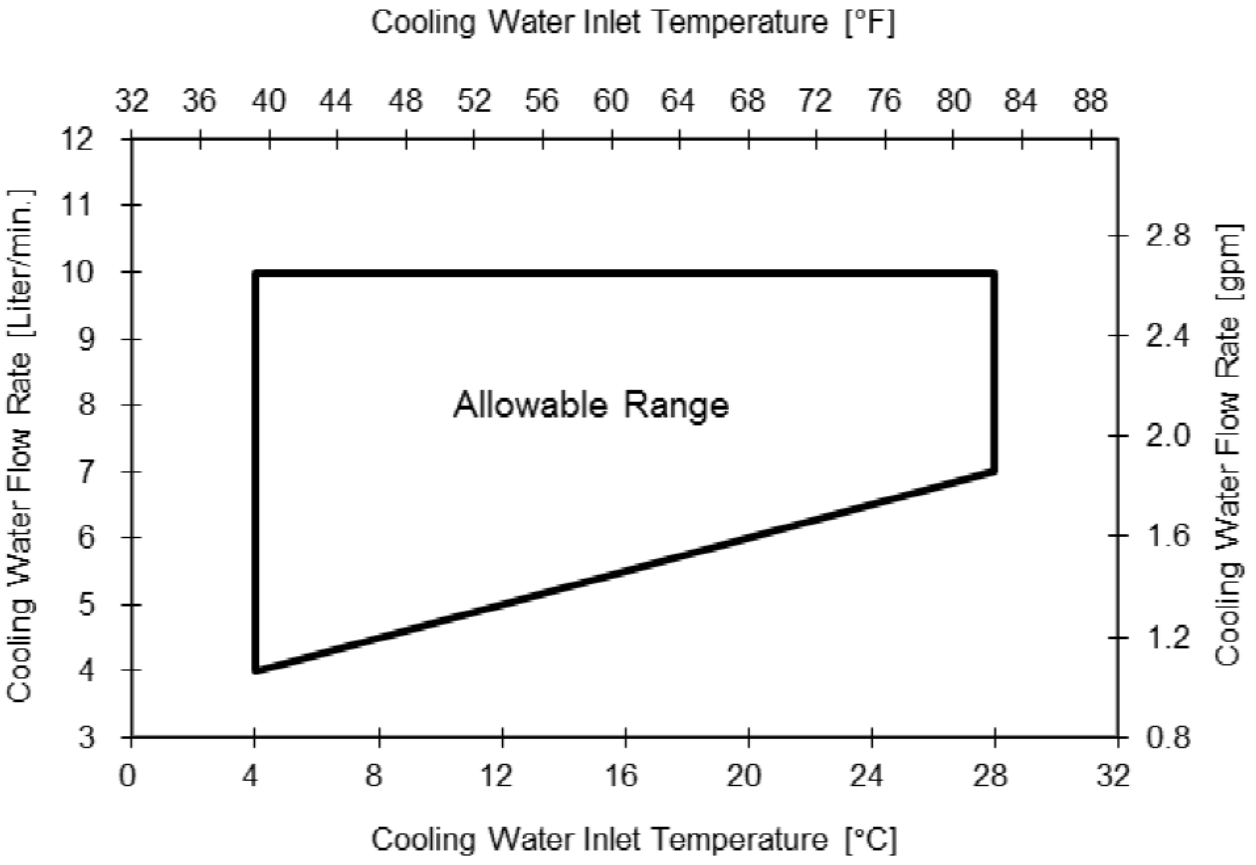
The applicable flow / temperature specifications for the **APD** cryo compressors (10K) (per APD manual):

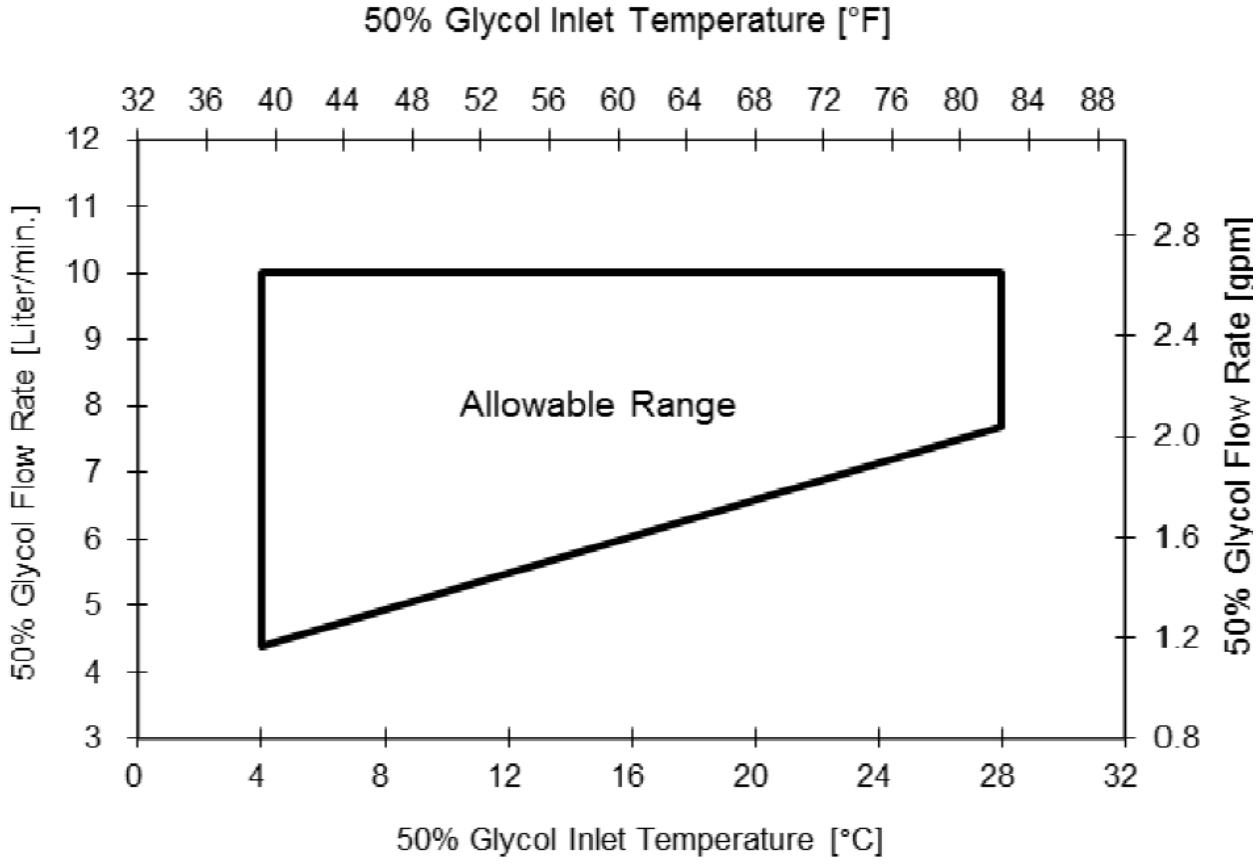
Cooling water inlet temperature *:	5º C (40º F) to 15º C (60º F)
Cooling water flow *:	5.7 l/m (1.5 gpm) to 9.5 l/m (2.5 gpm)

*) Temperature and flow are independent parameters.

Helium compressors CSW71, F50 and F40

The applicable flow / temperature specifications for the **CSW71, F50 and F40** cryo compressors (4K) is shown in next graphs (per Sumitomo manual):





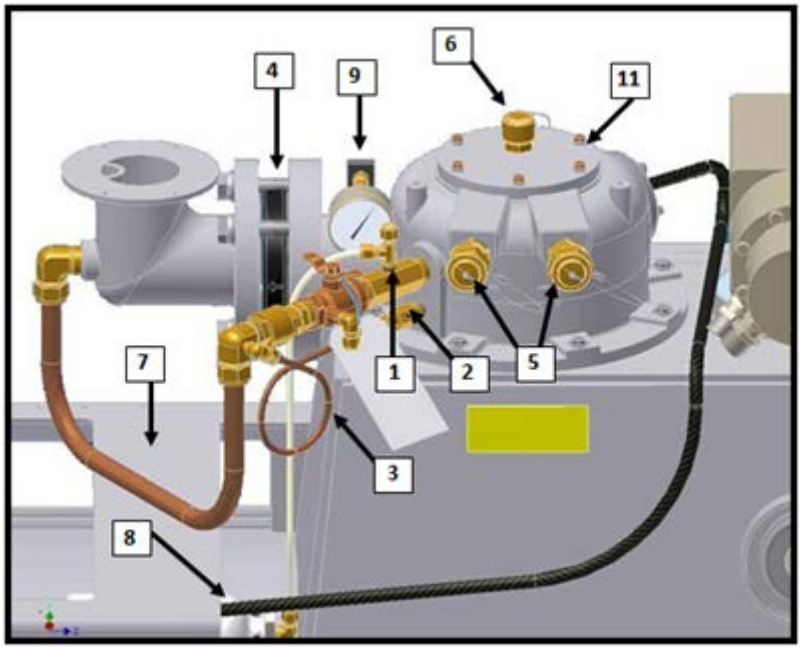
3.3 Check boil off [only for 10K]

1. Check the boil off: refer to 10K Refrigerator Check Sheet for the procedure and specifications.
   - This procedure can be performed remotely by downloading the STT_magnet.txt file from the **G:\STT** directory on the system via PRS portal.
   - If the system is active on Radar, this test can be skipped, because the boil off is monitored remotely.

3.4 Check for leaks [only for 10K]

1. Use snoop to do a check for leaks at positions **1**, **4** (circumferentially), **5**, and **6**.

Figure 1 – Leak check positions 10K magnet



3.5 Check cryogenic performance [only for 4K]

Refer to Reading the STT log.

1. This procedure can be performed remotely by downloading the STT_magnet.txt file from the **G:\STT** directory on the system via PRS portal
2. If the system is active on Radar, this test can be skipped, because the cryogenic performance is monitored remotely.

PM manual

Section 7 - Magnet system

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for the magnet subsystem.

2 WHAT'S NEW

Revision	
DMR132749_R00	▪ Modular structure of the PM document ▪ Removed: Check the helium level and boil off: this check is done in the refrigerator system chapter. ▪ Removed: Check the ERDU function: this check is already done via applicable PM session in FSF ▪ Removed: Battery Check: the battery check is included for all systems in ERDU tests (DHF 103704) ▪ 3.2 Water drain: (moved from system level chapter, to here) ▪ 3.3 Helium gas venting pipe inspection inside the RF cage: (moved from system level chapter, to here) ▪ 3.4 Helium gas venting pipe inspection outside the RF cage: (moved from system level chapter, to here)
DMR132749_R01	▪ Added Multiva to title
DMR180694_R00	▪ Removed:Check for cracked welds (only for 3T Titan magnets with triton gradient coil).
DMR195459_R00	▪ Removed: Check DPS ▪ Added picture of drain hole location for Ingenia magnets (Ludwig or Mozart)
DMR211946_R00	▪ New DMR number. Added: 3.3 Check helium vent pipe bolts , 3.4 Check helium vent pipe outlet , 3.5 ERDU test magnet ON. Removed: 3.3 Helium gas venting pipe inspection inside the RF cage , 3.4 Helium gas venting pipe inspection outside the RF cage.
DMR211946_R01	▪ Revision update, clerical changes
DMR211946_R02	▪ Added: Check helium over-pressure detection circuit (4K only) (SAFETY) ▪ Removed: Check ERDU battery
DMR211946_R03	▪ Added: Gecko and Ranger magnets. ▪ Corrections for Zebra magnet.
DMR211946_R04	▪ Added caution to the magnet field ON test, not to disconnect ZC-X107 ▪ Added warning to the magnet field ON test, that a disconnected cable will disable the functioning of exam room ERDU button ▪ For RMMU-1: Disconnect at ZC-X104 instead of MR-J4 ▪ For RMMU-1: Replace incorrect cable MRJ2 - ZC-X104 if necessary ▪ For RMMU-2: Disconnect at ZC-X213 instead of ZC-X211
DMR211946_R05	▪ Added Installation of the ERDU button cover + label
DMR211946_R06	▪ Adapted chapter 3.3
DMR211946_R07	▪ Adapted chapter 3.4
DMR211946_R08	▪ CSIP changes
DMR211946_R09	▪ Added: 3.2 Check for 3-inch metal burst disks

3 PROCEDURES

3.1 Check seals on the ERDU buttons [Not for ERDU buttons with a key]

Make sure that the seals on the ERDU buttons are available not damaged. (Not applicable for ERDU buttons equipped with a key).

3.2 Check for 3-inch metal burst disks

1. Check the burst disk!
   If there still is a 3-inch metal burst disk installed at the magnet, make sure that the dedicated FCO team is scheduled to replace the 3-inch metal burst disk. **See FCO78100486 for details.**

2. Replace all not installed 3-inch metal burst disks (4598 008 84671, disk labeled as 4598 007 5326**1**) on-site with a 3-inch graphite burst disk (453501049831)
   *Note: This replacement includes all not installed 3" metal burst disks' (4598 007 5326**1**) with or without a green dot.*

3-inch Metal Burst Disk.

3-inch Metal Burst Disk with a Green Dot

3-inch Metal Burst Disk 12NC location

Return all 3-inch metal burst disks (4598 008 84671, disk labeled as 4598 007 5326**1)** to SPS as a defective part "**D**" 4598 008 8467**1** using the box and label from the FCO kit.
Disks should be returned for collection and possible inspection. Parts should not be made defective.

Place a copy of the FCO Action Notification Report in the box with the returned burst disk.

For non-blue print markets the disk(s) must be send to:

Kevin Jordan
450 Old Niskayuna Rd,
Latham, NY 12110-0461
United States

If there are no 3-inch metal burst disks on site anymore, no further action is required.

3.3 Water drain (SAFETY)

It is very important is to check if the water drain in the quench vent system is available and open (drain holes are not blocked). If more drains have been made, mention this in the site documentation and with a label on top of the magnet.

Procedure:
Do the following checks on the Helium Vent Pipe inside the examination room.

- The drain hole for the applicable magnet as indicated in (figure 1).
- Any other water drains along the helium vent pipe

1. Insert a non-magnetic wire into the hole (wire diameter smaller than 2 mm).

- If the wire can be inserted for more than 10 mm, the water drain is open and the test has been performed successfully.
- If water flows out of the drain hole during insertion of the wire, allow all the water to drain. Plan a service visit to find the root cause of the presence of water.
- Do not perform any magnet service actions (energizing/discharge, shimming, LHe refill, coldhead service) before all the water has been drained out of the vent pipe.

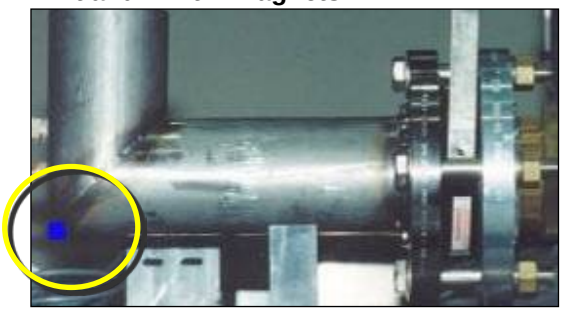
2. Check that all water drain holes are labeled along the helium vent pipe inside the examination room. If a drain is not clearly visible, mark the position with a marker pen so it can be easily found during the next PM visit.

Figure 1 - Water drain hole locations

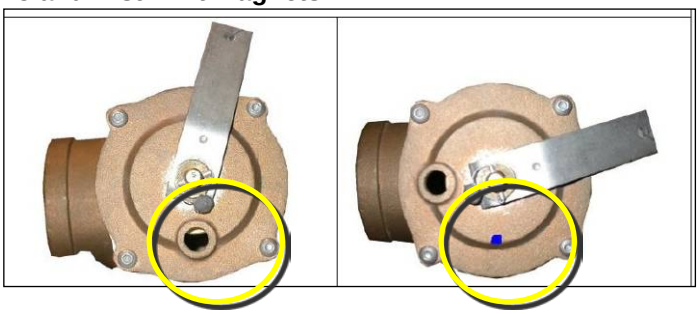
3T Titan magnets

Rex or HFO

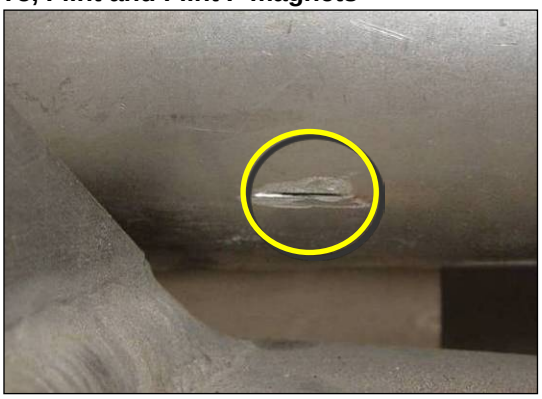
Flint and Flint-F magnets



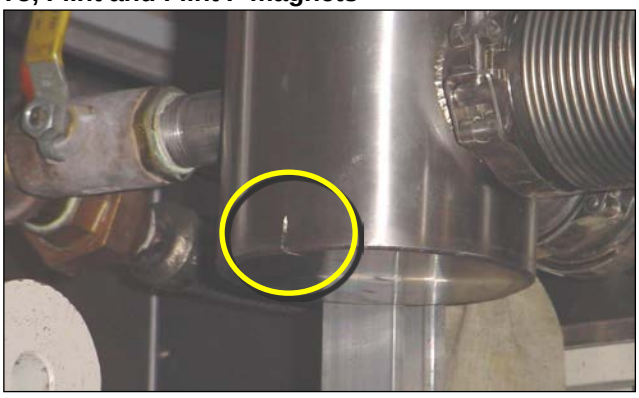
T5 and first Flint magnets



T5, Flint and Flint F magnets

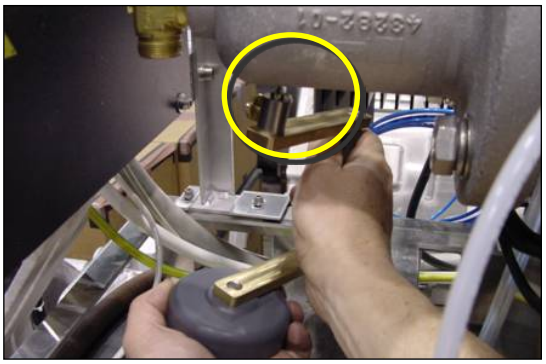


T5, Flint and Flint F magnets



AISA magnet with a horizontal burst disk

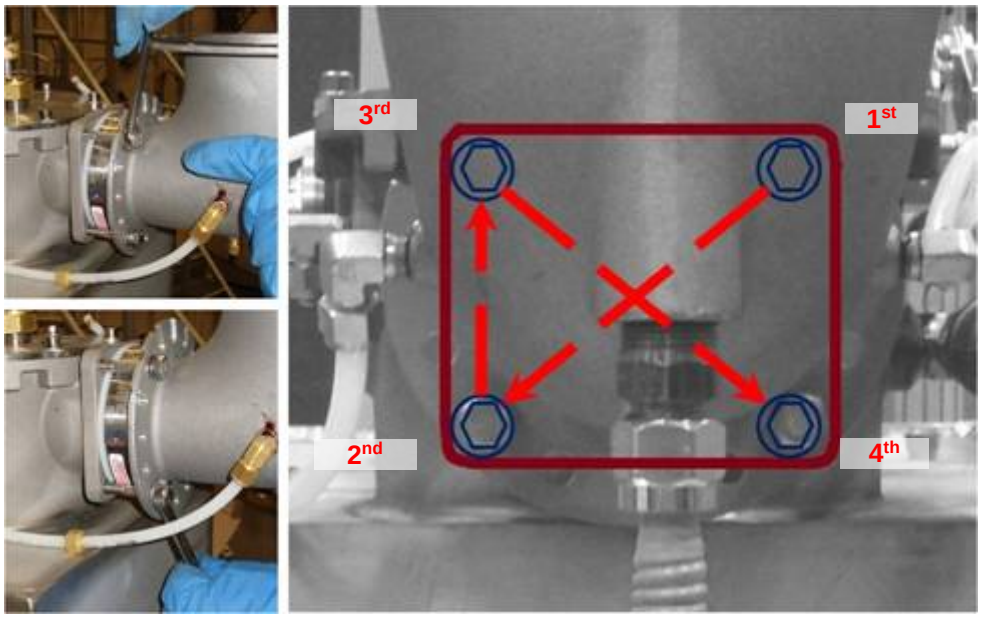
F2000 and Zebra

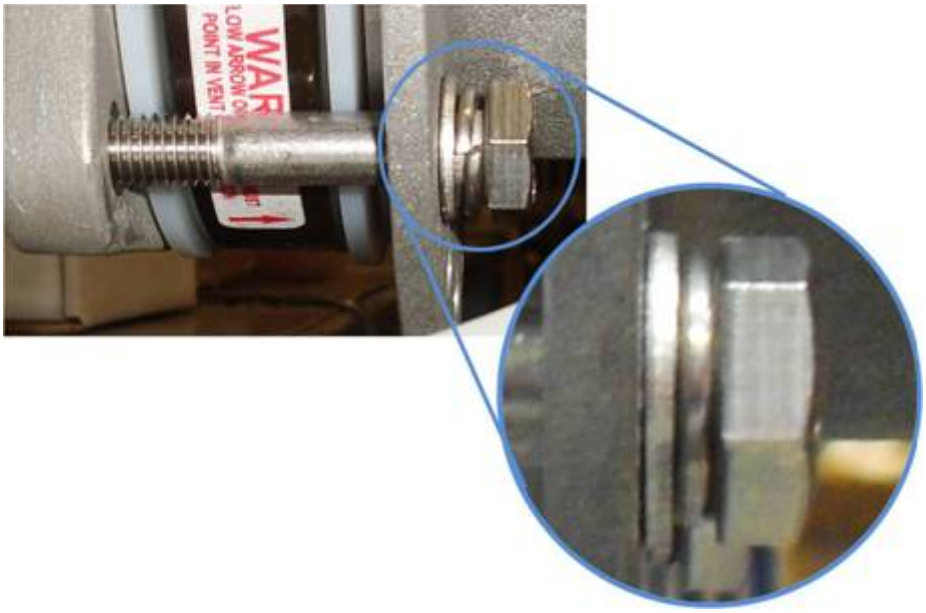


Ludwig, Mozart, Rex, HFO, Gecko, and Ranger

3.4 Check helium vent pipe bolts

1. Tighten the fasteners in this diagonal pattern until you compress the lock washers.



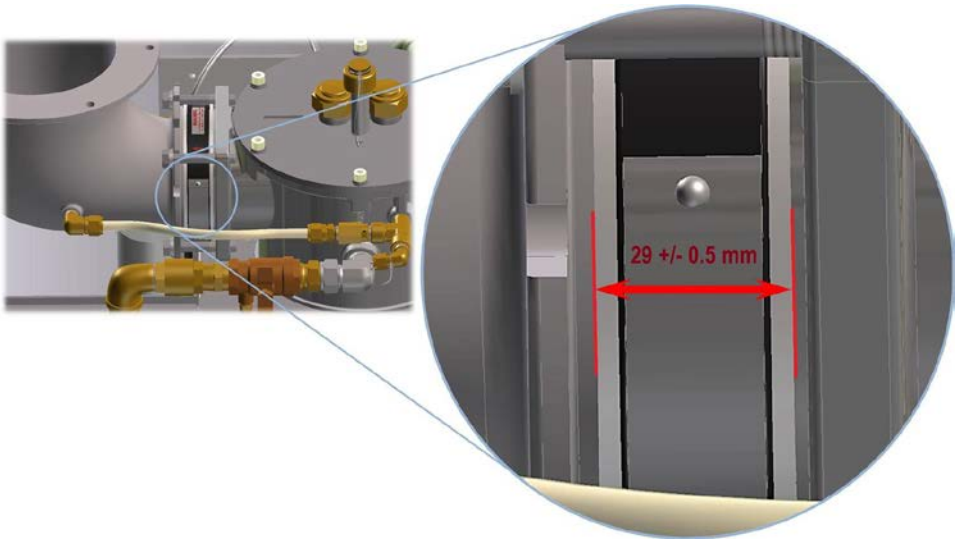


2. After the lock washers have become compressed, continue to tighten the fasteners to make sure that the magnet does not leak helium.

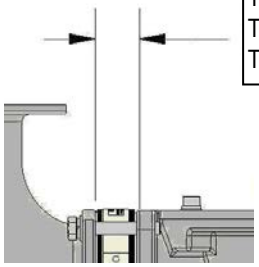
   If you are tightening an elbow that uses:

   - Seal assemblies and four M10 fasteners — continue the diagonal tightening procedure for an additional 3/4 to 1 full turn.
   - Seal assemblies and four M16 fasteners — continue the diagonal tightening procedure for an additional 1/4 to 1/2 turn.
   - A metal burst disk — continue the diagonal tightening procedure for an additional 1/8 to 1/4 turn.

Seal assemblies: All four fasteners are fully tightened when the distance between the seal assemblies' outer edges is approximately 29 ± 0.5 mm.



3. **Black gaskets:** All four fasteners are fully tightened when the distance between gap between the magnet flange and the elbow flange as follows:



Type A: 30.5mm to 31.5mm
Type B: 33.5mm to 34.5mm
Type C: 28.5mm to 29.5mm

- For Type "A" elbows, the gap is 31mm +/- 0.5mm.
- For Type "B" elbows, the gap is 34mm +/- 0.5mm.
- For Type "C" elbows, the gap is 29mm +/- 0.5mm.

NOTE

Always replace black gaskets with seal assemblies when you change burst disks.

Type "A"
4K magnets
three mounting-screw slots and five mounting-screw holes

Type "B"
4K magnets
seven mounting-screw slots and nine mounting-screw holes

Type "C"
10K magnets
four mounting-screw holes

3.5 Check helium venting system outlet (SAFETY)

Do a check to see if the helium vent pipe outlet, or the area around it, has changed.

Systems installations after … must send pictures from the helium venting system outlet before receiving a release key for the system.

3.5.1 If the system is released after this date:

Find the photographs of the helium vent pipe that were made during the installation.

Note: These photographs are stored in the system record, and copies are also stored by the local Q&R person.

Scenario 1: If the situation has not changed since installation of the system, the result of the test is passed.

Scenario 2: If the situation has changed with respect to the photographs or no pictures from the installation are available, the result of the test is failed.

Actions:

- Create a test remark for the customer in your PM report. Tell the customer that this test has failed because the helium vent pipe outlet has changed or is unclear w.r.t. the original installation photographs.
- Pictures of the new situation must be made and send to local site planning for evaluation and approval.
- When site planning approved the new situation, the photographs must be stored in the system record, and copies are also stored by the local Q&R person. Make a note in the system record that these photographs are made after installation and that they are used for approval by site planning.

3.5.2 If the system is released before this date:

Look if approved photographs of the helium vent pipe that were made during the installation.

Note: These pictures are stored in the system record, and copies are also stored by the local Q&R person.

- If photographs are made, stored and approved by site planning, go to scenario 3.
- If no photographs are stored, go to scenario 4.

Scenario 3: If the situation has not changed w.r.t. the approved photographs of the system, the result of the test is passed.

Scenario 4: If the situation has changed w.r.t. the approved photographs or no photographs from the installation are available, the result of the test is failed.

Actions:

- Create a test remark for the customer in your PM report. Tell the customer that this test has failed because the helium vent pipe outlet has changed or is unclear w.r.t. the original installation photographs that are approved (by site planning) during an earlier PM visit.
- Photographs of the new situation must be made and send to local site planning for evaluation and approval.
- When site planning approved the new situation, the photographs must be stored in the system record, and copies are also stored by the local Q&R person. Make a note in the system record that these photographs are made after installation and that they are used for approval by site planning.

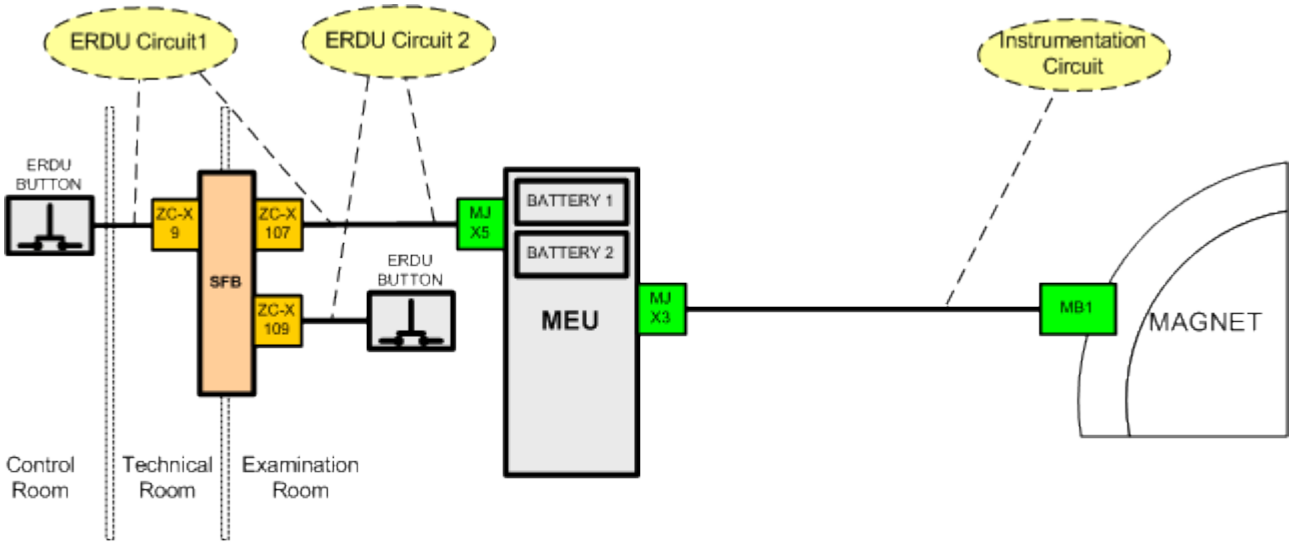
3.6 ERDU test magnet ON (SAFETY)

3.6.1 For systems with a MEU

CAUTION

Do not disconnect ZC-X107 due to risk of quenching the magnet

1. Disconnect the cable at **ZC-X 109**. See the figure that follows.



Note for HFO Magnets

SFB — **SFB** is named **FFC**

ZC-X — Connector label **ZCF-X 203** instead of **ZC-X 9**
Connector label **ZCF-X 211** instead of **ZC-X 107**
Connector label **ZCF-X 213** instead of **ZC-X 109**

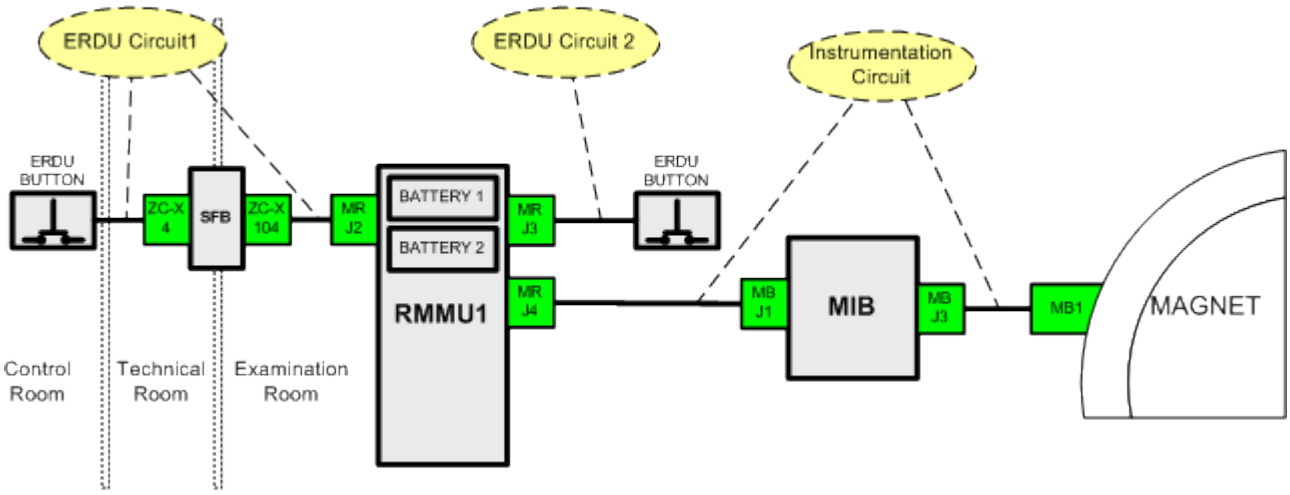
2. When the cable is disconnected, make sure that a buzzer sounds.
3. Re-connect the cable when you hear the buzzer.

WARNING

Make sure that you immediately re-connect the cable after disconnecting.
A disconnected cable will disable the functioning of an ERDU button.

3.6.2 For systems with a RMMU1

1. Disconnect the cable at **ZC-X104**. See the figure that follows.



2. When the cable is disconnected, make sure that a buzzer sounds.

   a) If the buzzer does not sound when ZC-X104 is disconnected it is possible that an incorrect version of cable **MRJ2 - ZC-X104** is installed. The 12nc of the incorrect cable version is: 4522 131 6749.x.

   b) Replace cable MRJ2 - ZC-X104 with the latest correct version.
   The 12nc of the correct cable is: 4522 132 5551.x.

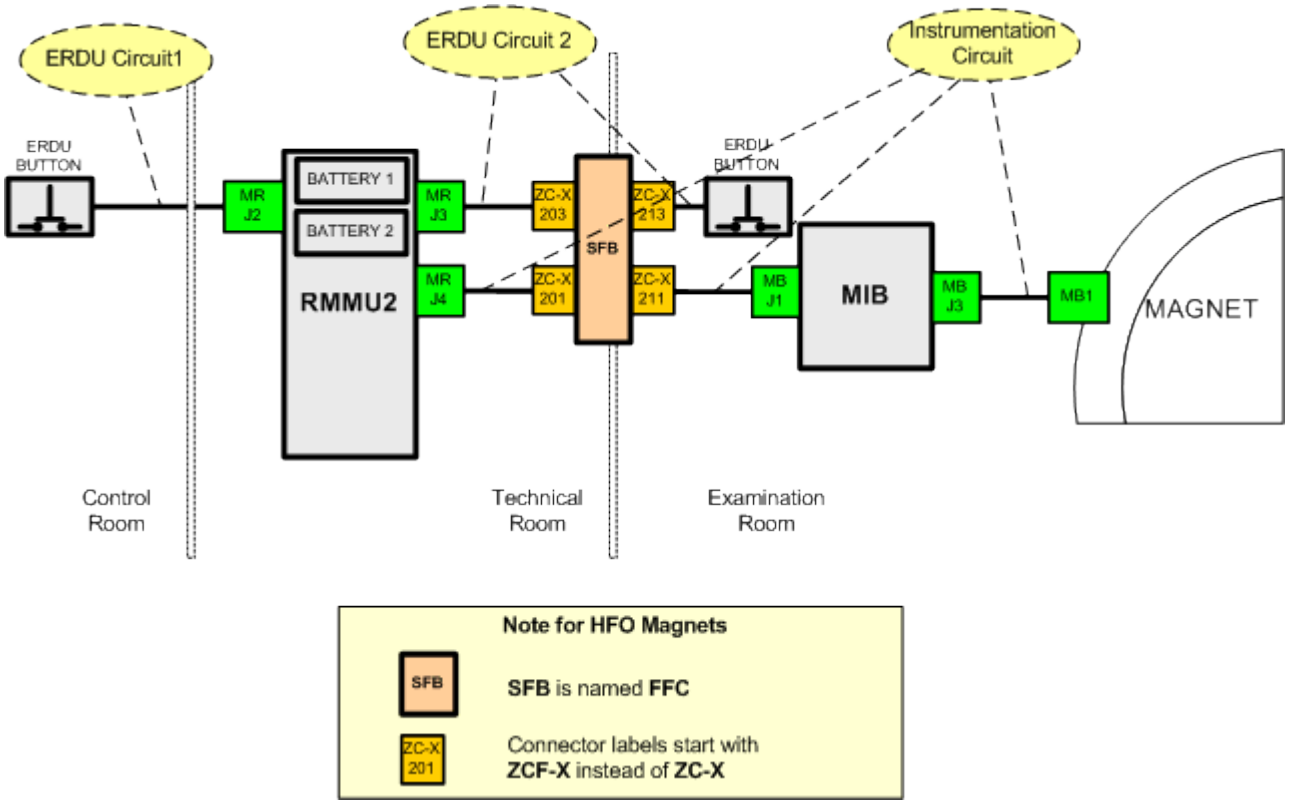
3. Re-connect cable when you hear the buzzer.

WARNING

Make sure that you immediately re-connect the cable after disconnecting.
A disconnected cable will disable the functioning of an ERDU button.

3.6.3 For systems with a RMMU-2

1. Disconnect the cable at **ZC-X213**. See the figure that follows.



2. When the cable is disconnected, make sure that a buzzer sounds.
3. Re-connect the cable when you hear the buzzer.

WARNING

Make sure that you immediately re-connect the cable after disconnecting.
A disconnected cable will disable the functioning of an ERDU button.

3.7 Check helium over-pressure detection circuit [4K only] (SAFETY)

1. Disconnect the helium gas line at the MEU, **or** at the RMMU.
   - The MEU is located on the magnet. See Figure 2.
   - The RMMU is located in the technical room on the wall. See Figure 3.

Figure 2 - MEU (on magnet)

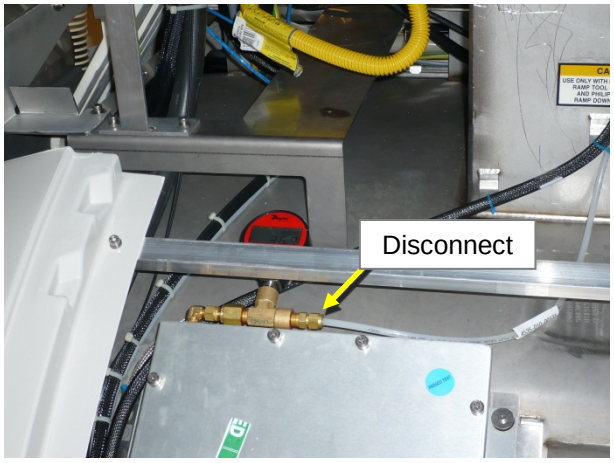
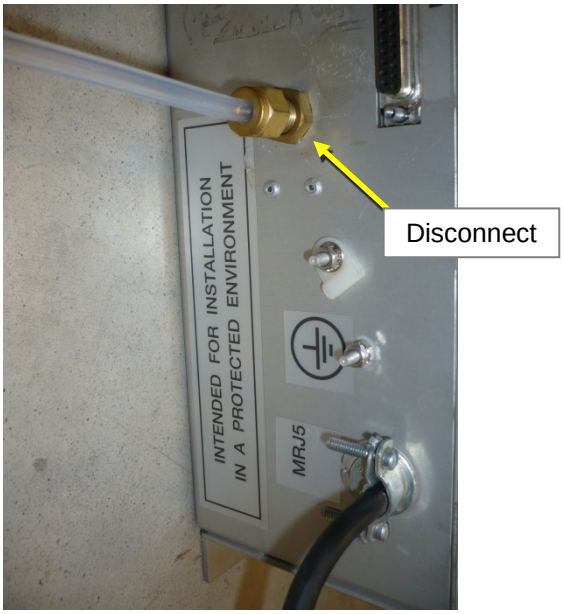


Figure 3 – RMMU (on tech room wall)



2. Listen if the cold head stops within 1 minute.
3. If the cold head stops within 1 minute the test is passed go to step 4, else continue fault finding.
4. Reconnect the helium gas line at the RMMU or MEU.
5. Make sure that the cold head starts within 1 minute.

3.8 Installation of the ERDU button cover + label (0.5 hour for 1 engineer)

Materials:

459801042301: ERDU-BUTTON COVER			
12 NC	**Description**	**Qty**	**UoM**
459801042311	ERDU-BUTTON COVER HOUSING	2	pcs
459801042321	ERDU-BUTTON COVER LID	2	pcs
459801162571	Emergency Magnet Off user information	1	pcs
459801162641	Installation of the ERDU button cover	1	pcs

Label Set (Country specific)			
12 NC	**Description**	**Qty**	**UoM**
Country Specific	LABEL SET ERDU BUTTON	2	pcs

Tools & test Equipment:

Tools	Tool Code / 12 NC
Tool kit, standard	TC129

Installation:

1. Unpack the box.
   Check the delivered parts for completeness and condition. Refer to chapter 1.3 for details.
   Make sure that the cover lid opens as shown in Figure 3. If needed, change the position of the lid on the housing.

2. Remove the current label of each ERDU. (See Figure 1)

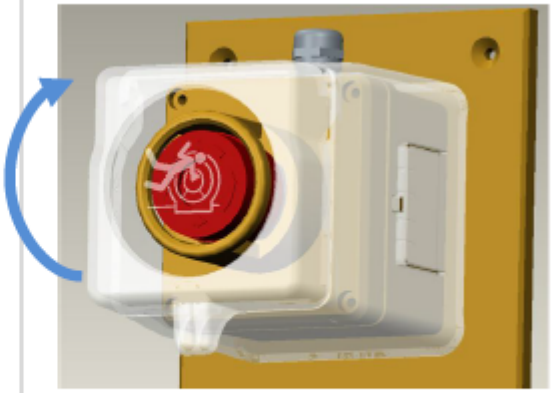
Figure 1. Example of Current label

Do not clean the surface and apply the new delivered label in the appropriate language on the yellow plate of the ERDU switch.
Depending on the location of the label, align the label with the chamfer on bottom or on the top of the yellow plate.

Make sure the text on the label is clearly visible.

3. Write with a permanent marker the telephone number of the Philips Service organization in the field 'Otherwise' on the label. (See Figure 2)

Figure 2. New label

4. Carefully slide the cover over each ERDU button until it locks. (See Figure 3).	**Figure 3. ERDU Switch with housing** 
5. Explain the functional changes to the customer as described in supplied document 459801162571 "Emergency Magnet Off user information".	

PM manual

Section 8 - Patient support MT

1 INTRODUCTION

- This PM section provides an overview of the Planned Maintenance (PM) program for:
  - Subsystem: **Patient support MT**
- Tools and materials that are required for the procedures described here can be found in the Material List section of this PM manual.

2 WHAT'S NEW

This section describes the updates made in the document.

Revision	
DMR132750_R00	▪ Modular structure
DMR132750_R01	▪ Added Multiva to title (PM manual compatible with Multiva) ▪ Added UIM/UIH (for Multiva) next to PICU
DMR179418_R00	▪ Table top inspection (MR00119440) Added inspection procedure ▪ Updated procedure inspection trolley wheels.
DMR179418_R01	▪ Added Omniva to title
DMR211947_R00	▪ New DMR number. Changes: 3.1 Patient support checks Intera and Intera Achieva , 3.1.1 Explanation of controls on the magnet and patient support , 3.1.2 Preparation , 3.1.10 Cleaning of grease pollution , 3.3 Trolley
DMR211947_R01	▪ Revision update, clerical changes
DMR211947_R02	▪ Changed Title
DMR211947_R03	▪ Added: 3.1.6 Check emergency stop button AM3
DMR211947_R04	▪ The emergency stop circuit test will stop the table movement instead of the scan.

3 PROCEDURES

3.1 Patient support checks Intera, Intera Achieva, Multiva

3.1.1 Explanation of controls on the magnet and patient support

3.1.1.1 PICU /UIM controls

Icon	Function
	**Manual mode** Use to toggle between the motorized mode and the manual mode, the LED on the left of the button indicates if the table is in manual mode.
	**Travel to scan plane (TTS)** In the TTS mode the reference point moves to the iso-center.
	**Tumble switch** Push the Tumble switch up for the up or in movement of the tabletop, and push the switch down for the out or down movement.
 or STOP	**Emergency stop** Stops all table movements. Press the **Manual mode** button to reset.
	**Resume** Resets the table-top after an emergency stop.
 or Start scan	**Start scan / Pause scan** Starts or pauses the scan.

or Stop scan	**Stop scan** Stops the scan.
	Light visor Switches on crossed laser lines indicating the reference point.
or	**Talk** Activates patient intercom.
	Bore light Increases / decreases bore light intensity.
	Patient ventilation Increases / decreases patient ventilation air-flow.
	Music volume Increases / decreases patient audio volume.

3.1.1.2 Table top release buttons

For safety reasons the patient support is equipped with a table-top release handle/button at both sides of the stretcher.

When activated, this handle/button immediately releases the table-top and enables manual movement of the table-top. The LED of the manual mode will start flashing.

When the table-top is released with the table-top release handle/button, all other functions of the patient support are disabled. This includes the vertical movement, the horizontal stop etc.

To re-enable the motorized movement after pressing the TTR buttons perform the next action.

NT/Intera:

1. Press the same TTR button again to re-enable motorized movement

Achieva / Multiva:

1. Press any TTR button again to re-enable motorized movement.

Initialization of the horizontal position system is necessary after using the table-top release handle/button.

Figure 1 – NT & Intera

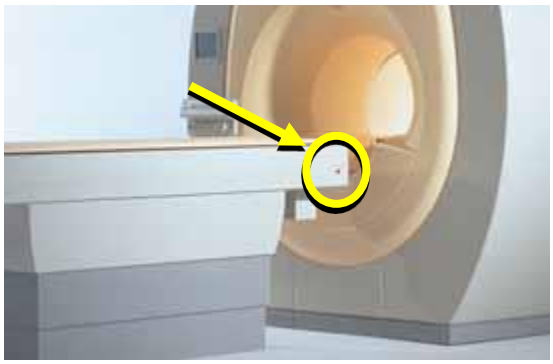


Figure 2 – Achieva/Multiva

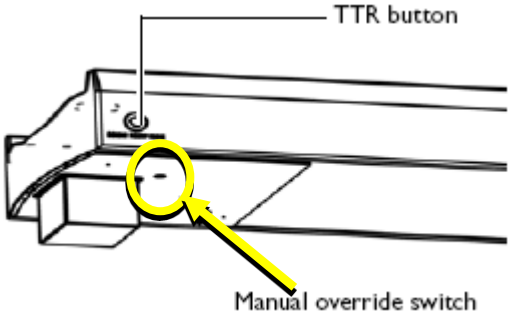
3.1.1.3 Manual override switch

If the control electronics breaks down, it is still possible to initiate the vertical movement for the **upwards direction only** and bringing the table in the highest position.

The manual override switch is accessible by the operator, without having to remove any cover. The override switch is located at the front side of the patient support underneath the stretcher.

When using the override switch, the vertical movement will stop in the upmost position.
In this way it is possible for the operator to continue using the system.

Figure 3 – Manual override switch



3.1.2 Preparation

1. Position the head coil with a 3 liter bottle lengthwise on the tabletop.
2. Move the head coil to the iso-center using the **Travel to scan-plane** button.

3.1.3 Testing the stop function on the operator console (SAFETY)

1. Login: MRService + password
2. Select: **"Application software"** in the MR Boot Configuration Manager and press **"Start".**
3. Select: Register a **dummy patient**
4. Select: **PHILIPS tab**
5. Select: **Phantom studies**
6. Select: **PIQT;** when a QHG is not available, select sense Head 8 coil.
7. Drag: **QA1** to the left scanning area
8. Select: **Geo#** and delete this field.
9. Select: **Start Scan**
10. After the preparation phase, the scanner starts its sequence. Select after a while the <STOP SCAN> function. The scan must stop.

3.1.4 Testing the stop scan buttons on the magnet (SAFETY)

1. Select the just stopped QA1 scan, R-mouse click, Copy and Paste it into the scanning area.
2. D-click: **QA1** to modify it.
3. Select: **Parameter editor** TAB.
4. Select: **Dyn/ang** TAB.
5. Set: **Manual Star**t to **yes**
6. Select: **Proceed**
7. Select: **Start Scan**
8. The preparation phase starts. Wait for the message: “Select **Proceed**, or press **Start Scan** at the magnet to (re)start scan”.
9. Go inside the RF room, close the door, and start the scan with the **Start Scan** button on the PICU/UIM/UIH. Stop the scan after a while by pressing the **Stop Scan** button on the PICU/UIM/UIH. The scan must stop.
10. Select: **Start Scan**
11. Select: **Proceed** to select the stopped scan. The preparation phase starts.

12. Wait for the message: Select **Proceed**, or press **Start Scan** at the magnet to (re)start scan.
13. Go inside the RF room, close the door, and start the scan with the **Start Scan** button on the rear side of the magnet. Stop after a while the scan by pressing the **Stop Scan** button on the rear side of the magnet. The scan must stop.

3.1.5 Check the emergency stop circuit (SAFETY)

1. Select the just stopped QA1 scan, R-mouse click, Copy and Paste it into the scanning area.
2. D-click: **QA1** to modify it.
3. Select: **Parameter editor** TAB.
4. Select: **Dyn/ang** TAB.
5. Set: **Manual Start** to **yes**
6. Select: **Proceed**
7. Select: **Start Scan**
8. The preparation phase starts. Wait for the message: “Select **Proceed**, or press **Start Scan** at the magnet to (re)start scan”.
9. Go inside the RF room, close the door, and start the scan with the **Start Scan** button on the PICU/UIM/UIH.
10. Press the red **Emergency STOP** button on the PICU/UIM/UIH.
    - Know that the scan will not stop when you press the Emergency STOP button.
11. Check that the tabletop moves freely without friction after you have pressed the Emergency STOP button.

3.1.6 Check emergency stop button AM3 (SAFETY)

1. Make sure the patient support is fully outwards
2. Move the table top with the tumble switch inwards. While the table top is moving, ask another person to press the red emergency stop button on the Audio Module 3 (AM3).
3. Table movement should stop immediately.
4. Press the reset button on the UIM/SCU.

3.1.7 Check the tabletop release button (SAFETY)

1. The tabletop release buttons are located on the patient support left and right side.
2. Check that the tabletop can be moved freely without friction after activating the left tabletop release button.
3. Repeat this for the right tabletop release button.
4. Press the reset button to release the stop function.

3.1.8 Testing the stop function finger protection plate (SAFETY)

1. Move the table outwards by activating the tumble switch.
2. While the table is moving out, activate the finger protection plate.
3. The table movement must stop. The motor for the horizontal movement must stop immediately.
4. Move the table downwards by pressing the same knob.
5. During the downwards movement press against the finger protection plate
6. Check that the table movement stops.

3.1.9 Check the tabletop MANUAL function

1. Check that the tabletop of the patient support can be moved horizontally without friction after activating the MANUAL button on the control panel (PICU/UIM/UIH).
2. Press the MANUAL button again to release the manual function.

3.1.10 Check the patient alarm (SAFETY)

3.1.10.1 Check the software nurse call

1. Go inside the examination room and close the RF door
2. Connect the nurse call and pinch the ball
3. Check if you hear the acoustic alarm inside the examination room
4. Go to the operator console and check if the light on the audio module flashes

3.1.10.2 Check the hard-wired nurse call

1. Disable the patcom process by running: **permproc stop patcom**
2. Go inside the examination room and leave the RF door open
3. Pinch the ball of the nurse call
4. Check if you hear the acoustic alarm outside the examination room
5. Enable the patcom process by running: **permproc start patcom**

3.1.11 Cleaning of grease pollution

On some parts of the horizontal driving mechanism, grease is applied. This grease is especially present in the driving tooth wheel area. Grease and dust can be concentrated in this area. The tooth rack can carry the grease/dust over the whole table stretcher and bridge section.
Use cleaning agent to clean the horizontal driving mechanism, table stretcher and bridge section.

Do this inspection 1 time per year.

Required tools:

- 3mm non-magnetic hex-key.

Required materials:

- Molub-alloy grease
- Loctite 243

1. Remove the table-top from the patient support.
2. Do a visual inspection for the presence of dirt and grease in the area of the driving tooth-wheel and on the stretcher and bridge section surfaces.
3. If you find more than a usual amount of dirt, clean the contaminated areas and surfaces. Use a general purpose cleaning agent.
4. If you find a large amount of dirt underneath the tooth-wheel, it is recommended that to remove the tooth-wheel and clean this area. If you decide to clean this area, do the steps that follow.

WARNING

The washer holding the tooth-wheel and the spring are magnetic and can be attracted into the magnet-bore during the (dis)assembly procedure.

a) Remove the screw and washer that attach the tooth-wheel.

b) Carefully slide the tooth-wheel of the axis. Take care to prevent the spring being attracted to the magnet.

c) Remove the spring.

d) Clean the spring, the tooth-wheel, and the axis.

e) Apply molub-alloy grease to:

- the axis
- the inner surface of the tooth-wheel
- the top and bottom of the spring

NOTE

Make sure that grease does not go into the screw hole that is used to attach the tooth-wheel.

f) Apply a small amount of Loctite onto the thread of the screw.

g) Assemble all the parts.

3.1.12 Check patient comfort lights

1. Check the proper functioning of the bore lights.
2. Replace defective lights.

3.1.13 Check patient support cooling fans

1. Move the patient support in the upper position.
2. Remove the bottom covers, if not already done. Take care not to disconnect the tacho connector on the horizontal motor unit during removal of the covers.
3. Make sure that the control unit fan is running.
4. Make sure that the fan of the power supply unit works. If a fan does not work properly, replace it.
5. Install the covers.

3.1.14 Check table top for damage and loose glass-fibers

1. Move the table-top out of the magnet bore and remove all mattresses.
2. Visually inspect the upper surface of the table-top on damage such as loose glass-fibers and damaged top-coat.
   No loose glass-fibers are allowed.

3. If loose fibers are found, remove the table top and move it out of the examination room.
4. Carefully remove the loose fibers, do not remove the loose fibers by pulling but cut-off the loose fibers.
5. Make sure the repaired surface is smooth.
6. Clean and Touch-up the repaired surface using the right paint, refer to eSPF.

7. Install the table-top.

3.2 Patient support checks AD5 SA Tilt I/T table (Interventional systems)

3.2.1 Quick functional check

1. Move the control knob down.
2. The tabletop is moving down.
3. Move the table height control knob up.
4. The tabletop is moving up.
5. Release the tabletop brakes and move the tabletop through all the horizontal plane positions.
6. Dock the AD5 tabletop I/T to the MR patient support.
7. Move the tabletop from AD5 towards the MR system and back again. Check that the tooth rack is picked up from the MR patient support and that the tooth rack remains on the MR patient support after moving the tabletop onto the AD5 table.

3.2.2 Remove covers

1. Move the tabletop to the highest position.
2. Power OFF the system.
3. Remove the rear covers.

3.2.3 Mechanical check (SAFETY)

1. Check that the table base mounting bolts are secured.
2. Check that the gas spring is positioned correctly.
3. Check if all cables are locked.
4. Check if no cables are damaged.
5. Check if the brake gap is < 0.5 mm.
   If it is wider than 0.5 mm, adjust it to 0.2 mm (+ 0.2 mm/- 0.0 mm)
6. Check (visually) that the MR table top I/T locks correctly to the AD5 table, also check this with the AD5 in tilted mode with a load (average patient weight) on the MR tabletop I/T.

3.2.4 Cleaning and lubrication of tabletop

1. Clean the running surfaces of the AD5 tabletop with a dry cloth.

CAUTION

Do not lubricate the running surface of the tabletop.

2. Clean the brake strips with a dry cloth.
3. If necessary, grease the running surface of the vertical guides with Tribol Molub Alloy 823-2-FM.
4. Oil the running surface of the transversal guides lightly with Tribol 772.
5. Oil the rod of the table height drive lightly with Tribol 772.

3.2.5 Electrical checks (SAFETY)

1. Switch the system on.

2. Move the table height control knob up.
   The tabletop is moved to the highest position.
3. Measure the maximum height.
4. Check if the distance between the limit switch and the activator is approximately 5 mm.
5. Move the control knob down.
   The tabletop is moved to the lowest position.
6. Measure the minimum height. The travel distance (maximum height - minimum height) is 280 mm.
7. The distance between the limit switch and the activator is approximately 5 mm.
8. Check that the table height movement is stopped when the limit switches are activated.
9. Check that the tabletop brakes function properly.

3.2.6 Pivot (Option)

1. Clean the running surface of the friction with dry-cleaning naphta.
2. Check if the friction of the arret assy. is 70 - 90 N, measured at 1500 mm from the centre of the pivot.
3. When out of tolerance adjust the friction, the friction unit is mounted inside the base on the right side.

3.2.7 Mount the covers

1. Mount all covers.
2. Clean the covers with spray cleaner.
3. Paint scratches with touch-up paint.

3.2.8 Functional check

1. Move the table up and down. No unusual noises should be heard.
2. Move the tabletop through all the horizontal plane positions. It must run smoothly without unusual noises.
3. Dock the table to the MR Patient support; it must dock smoothly without unusual noises.

3.3 Trolley wheels inspection

Figure 4 – Location of bolt

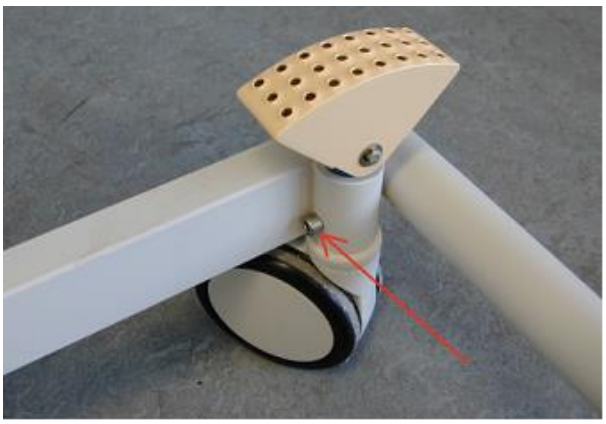
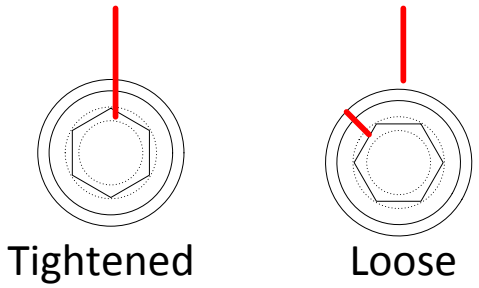


Figure 5 – Example of a mark



1. Do a check to find if there are marks (thin lines) on the bolts securing the four wheels of the trolley. See Figure 5.
   a) If there are marks, and the marks are **not** aligned to each other (see Figure 5), the bolt is loose. Continue with step 2.
   b) If there are no marks, do a check on the bolts to find if they are loose.
      - If the bolts are loose continue with step 2.
      - If the bolts are tight continue with step 5.
   c) If there are marks, and the marks are aligned to each other (see Figure 5), the bolt is tight. There is no further action required.
2. Remove the loose bolt and clean it.
3. Apply Loctite 243 to the thread of the bolt.
4. Install the bolt.
5. Make new marks. Use a permanent marker or some paint.

PHILIPS

Healthcare, MRI

PM manual

Section 9 - System measurements and adjustments

1 INTRODUCTION

This Planned Maintenance (PM) section gives the system measurements and adjustments for Intera, Achieva and Multiva systems that are configured with either CDAS or DDAS.

2 WHAT'S NEW

Revision	
DMR132751_R00	▪ Modular structure of the PM document ▪ Reference is made to the service application for performance of measurements and adjustments, instead of listing these here.
DMR132751_R01	▪ Updated procedure: 3.1 Run the PM software tests. ▪ Updated CSIP labeling
DMR132751_R02	▪ Added Multiva to title
DMR180902_R00	▪ Initial version. This will replace all previous versions of CH9 – System Measurements and adjustments. Applicable for all R1-R3 and R5 systems. ▪ Removed 3.2 High Order Shim calibration, this is already listed in the service application under PM procedures. ▪ 3.2 Artifact measurements: added here, Moved from CH2 ▪ 3.3 Spike test batch: added here, Moved from CH2 ▪ 3.4 Spurious noise test batch: added here, Moved from CH2 ▪ Periodic image quality test (PIQT): updated and relocated ▪ Appendix A: Export of image data to DICOM files: added
DMR180902_R01	▪ Updated: 3.3.1 General spike information ▪ Updated: 3.3.4 Running the spike test batch
DMR180902_R02	▪ Added Omniva to title
DMR211948_R00	▪ New DMR number. Removed: 3.2 Artifact measurements. Updated: 3.2 Coil and spike analysis , 3.3.2 Running the spurious noise test batch , 3.4 Periodic image quality test (PIQT). Added: 3.2 VSWR procedures. Updated: 3.1 Run the PM software tests.
DMR211948_R01	▪ Revision update, clerical changes
DMR211948_R02	▪ PM improvements. ▪ Updated to include PSC service application (R5.1.10 / R3.2.10), DDAS. ▪ Removed: Appendix A.
DMR211948_R03	▪ Updated: 3.3 Use analyzer.
DMR211948_R04	▪ Updated: 3.3 Use analyzer.
DMR211948_R05	▪ Added spike analysis procedure ▪ Updated: 3.3 Use analyzer
DMR211948_R06	▪ Updated: Chapter 3.5 RF spurious test batch
DMR211948_R07	▪ CSIP changes
DMR211948_R08	▪ Add chapter “Check bodycoil transmit characteristics” ▪ Remove reference to SPD Image Quality

3 PROCEDURES

3.1 Run the PM software tests

1. Refer to the Timetable in section 13 to find which tests you must do.
2. To start any of the tests shown in the timetable, open the service application and then:

   If the installed software version has a PM menu with PM sessions (PM sessions one to six):

   a) Go to the **first** PM session.

   b) If your current PM session is not the first, you can find all of the tests under the first PM session.

   If the installed software version has a PM menu without PM sessions:

   a) All of the tests are listed alphabetically under the PM menu.

3. The preferred order of execution for these tests is shown in the Timetable in section 13.

NOTE

Detailed instructions on how to perform the tests are given by the service application.

3.2 Check Body coil transmit characteristics

At this time, it is assumed that the service application has been started.

3.2.1 3.0T single-transmit (X) systems ≤ R3 (Check 50 Ohm load)

Tools/equipment:

Digital Volt Meter (DVM).

Procedure:

WARNING

Switch off the power to the RF amplifier.

1. Disconnect cable MGB-X2 at the hybrid box. This cable is connected to the 50 Ohm body coil load.
2. Use a DVM to measure the resistance between shielding and center pin on plug MGB-X2 of the disconnected cable.
3. The measured resistance should be 50 Ohm +/- 1 Ohm.
4. When finished, reconnect cable MGB-X2 to the hybrid box.
5. Switch on the power to the RF-amplifier.

3.2.2 3.0T single-transmit (X) systems ≥ R5 (Orthogonality check)

1. Do the following test: **Diagnostic procedures > RF > RF-coils > Body coil TX Char (I)**
2. The testresult must have the status PASSED.

3.3 Check VSWR

3.3.1 1.5T and XR systems

1. Select one of the following procedures based on the software release:

Release	Procedure
R1.x and R2.1.x	**Diagnostic procedures > RF > RF-amp > VSWR QBC**
R2.6.x	**Diagnostic procedures > RF > RF-amp > VSWR Body Coil**
R3.x <R3.2.10	**Diagnostic procedures > RF > RF-amp > VSWR Body Coil TX1**
R3.x ≥R3.2.10	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1**
R4.x <R4.1.9	**Diagnostic procedures > RF > RF Coils > VSWR Body Coil TX1**
R4.x ≥R4.1.9	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1**
R5.x <R5.1.9	**Diagnostic procedures > RF > RF Coils > VSWR Body Coil TX1**
R5.x ≥R5.1.9	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1**

2. The measurement should meet the following specification: **VSWR value <1.5**

3.3.2 3.0T single-transmit (X) systems

1. Select one of the following procedures based on the software release:

Release	Procedure
R1.x and R2.1.x	**Diagnostic procedures > RF > RF-amp > VSWR QBC**
R2.6.x	**Diagnostic procedures > RF > RF-amp > VSWR Body Coil**
R3.x <R3.2.10	**Diagnostic procedures > RF > RF-amp > VSWR Body Coil TX1**
R3.x ≥R3.2.10	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1**
R4.x <R4.1.9	**Diagnostic procedures > RF > RF Coils > VSWR Body Coil TX1**
R4.x ≥R4.1.9	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1**
R5.x <R5.1.9	**Diagnostic procedures > RF > RF Coils > VSWR Body Coil TX1**
R5.x ≥R5.1.9	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1**

2. The measurement should meet the following specification: **VSWR value <1.5**

3.3.3 3.0T Multi-Transmit (TX) systems

1. Select one of the following procedures based on the software release:

Release	Procedure
R3.x <R3.2.10	**Diagnostic procedures > RF > RF-amp > VSWR Body Coil TX1** and **Diagnostic procedures > RF > RF-amp > VSWR Body Coil TX2**
R3.x ≥R3.2.10	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1** and **Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX2**
R4.x <R4.1.9	**Diagnostic procedures > RF > RF Coils > VSWR Body Coil TX1** and **Diagnostic procedures > RF > RF Coils > VSWR Body Coil TX2**
R4.x ≥R4.1.9	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1** and **Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX2**
R5.x <R5.1.9	**Diagnostic procedures > RF > RF Coils > VSWR Body Coil TX1** and **Diagnostic procedures > RF > RF Coils > VSWR Body Coil TX2**
R5.x ≥R5.1.9	**Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX1** and **Corrective Maintenance > Diagnostics > RF > RF Coils > VSWR Body Coil TX2**

2. Both measurements must meet the following specification: **VSWR value < 5.0**

3.4 Use analyzer

NOTE

- The goal of using the analyzer is for spike analysis, to ensure system performance.
- If you are not authorized to use the analyzer, refer to chapter 3.5 for an alternative method.

3.4.1 General information

- The presence of spikes in a system can be checked using the data in the system log files using the **RF Coil Analyzer**, or its successor, the **MR System Inspector** (in this procedure the term “analyzer tool” is used, to cover either the RF coil analyzer or the MR System Inspector).
- The performance of RF-Coils can also be analyzed in this way.
- Make sure that you have installed the latest version of the analyzer tool that is available on InCenter.

3.4.2 Collect log files [Remote]

1. Go to PRS portal
2. Enter the system reference number in the search box that is in the top right corner of your window.
3. Select ‘enter’ or select the ‘search button’.
4. Select: **Applications** window > **Device** tab > **Telnet SSH2**. The Telnet credentials are pre-filled.
5. Select: **Ok**
6. In the session window, type: **CMD** and select ‘enter’
7. Type: **G:** and select ‘enter’
8. Type: **cd log** and select ‘enter’
9. Zip the log files of the last two weeks by typing: **zip xxx.zip logfile.log**, where:
   xxx.zip: the name of the targeted zip file
   Logfile.log: the log files that you want to add to the zip file.

NOTE

To add multiple logfiles to the targeted zipfile:

1. Add the names of all required logfiles after the command zip xxx.zip.
2. Separate the names of the logfiles with a space.

10. In PRS portal, select: **Applications** window > **Device** tab > **Secure FTP (Passive)**. The Telnet credentials are pre-filled
11. Select: **Ok**
12. Go to: **G:\Log**
13. Go to: **xxx.zip** file
14. Copy the file to the desired location on a local computer.
15. When the **xxx.zip** file is successfully copied to the local drive and it is not required anymore on the host computer, remove the **xxx.zip** file from the host computer.
16. Go to chapter 3.4.4 and continue.

3.4.3 Collect log files [If not remote]

1. Connect the USB memory stick to the host computer.
2. Zip the log files of the last two weeks.
3. Copy the .zip file to the USB memory stick.
4. Remove the USB memory stick from the host computer.
5. Connect the USB memory stick to a local computer.
6. Go to chapter 3.4.4 and continue.

3.4.4 Use analyzer

1. Make sure that the latest version of the analyzer tool is installed on your laptop.
   a) go to: **InCenter -> Service -> Products & Solutions -> Magnetic Resonance -> MR Download Area -> General Download Area**
   b) If necessary, download and install the latest version of the tool.
2. Start the analyzer tool.
3. Follow the instructions on the screen.
4. Go to: **File** > **Open** > **xxx.zip** file and load the file.
   – Use the data of recent log files for the PM and not (necessarily) the data of log files related to complaints.
   – The analyzer tool does a check to find if enough log files are available in the **xxx.zip** file to give a reliable result.
   – The analyzer tool shows per item tab if a service action is necessary.
5. Go to the tab QPI to check that spikes in the system are within acceptable limits.
6. Does the analyzer tool show that a service action is necessary?
   – **Yes:** Investigate the results and when required, plan a separate corrective action to solve these issues. Read the Help of the tool for detailed information. Go to step 7 and continue.
   – **No:** Go to step 7 and continue.
7. Check all other tabs of the analyzer.
8. Does the analyzer tool show that a service action is necessary?
   – **Yes:** Investigate the results and when required, plan a separate corrective action to solve these issues. Read the Help of the tool for detailed information. Go to chapter 3.6 and continue.
   – **No:** Go to chapter 3.6 and continue.

3.5 Spike analysis

1. Select relevant logfiles (Logfile format: logYYYYMMDD*.log)
2. Check the found QPI values in these files. The value must be: **<1**.
3. When one or more QPI values are higher than 1, the cause must be found and the problem must be solved.

3.6 RF spurious test batch

3.6.1 Introduction

Spurious noises are radio frequencies not deliberately created or transmitted by the MRI system. A harmonic or other signal outside the MRI system is considered as RF spurious.

Depending on the intensity and the number of RF spurious signals, the effects in the reconstructed image vary from reduction in the signal to noise ratio to lines or bands in the image.

Perform the RF spurious test batch to measure if the RF spurious level of the system is within acceptable limits. This test performs a number of scans. Perform a visual check after the scans.

3.6.2 Running the RF spurious test batch

1. Turn on all equipment that can be used in the patient room during scanning for this system (like injectors, monitors etc.) as they can be a source for RF spurious.
2. Login under **MRService** and open the **Batch Interpreter**:

   For ≤ R3:

   a) Select: **Application Software** in the MR Boot Configuration Manager

   b) Select: **Start**

   c) Select: **System > Advanced tools > Scan Utilities > enter service mode > Batch Interpreter**

   d) Continue at step 3.

   For R5.x < R5.3:

   a) Select: **Start > MR Applications > Service Tools > Batch Interpreter**

   b) Continue at step 3.

   For R5.x ≥ R5.3.0 and R5.1.530, R6.0.530, R3.2.530:

   a) Select: **Planned Maintenance > Planned maintenance > Batch Interpreter**

   b) Continue at step **Error! Reference source not found.**.

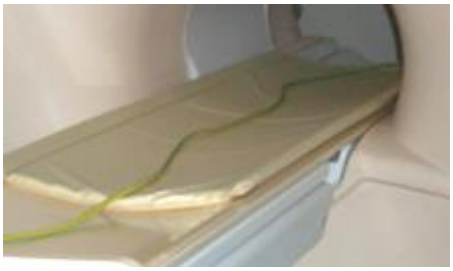
For all releases:

3. Select: '**Click here to select one**' in the Batch Interpreter window
4. Go to: **c:\nmr\gyroscan\testbatch**
5. Select:
   - For a 1.5 T system: **pbsviq_spurious_t15_180hz.acq**
   - For a 3.0T system: **pbsviq_spurious_t30_180hz_qbc.acq**
6. Select: **Open**
7. Select:  to start the batch processing
8. Follow the instructions on the screen.

The result of the **PREPARATION** should look like shown in Figure 1.

9. Select: **Proceed**.
10. Wait until the batch scanning completes and the text appears: '**Batch execution completed successfully'**.
11. **Exit** and close the Batch Interpreter window.

Figure 1 – Wire in bore



3.6.3 Analyzing the RF spurious test batch

1. Select: **Application Software** in the MR Boot Configuration Manager
2. Select: **Start**
3. Select:
   - For ≤ R3:
     Select: **Patients > Review**
   - For R5:
     Select: **Patients > Open for review**
4. Select in the **View Exam** window:
   - For a 1.5T system: **Spur T15 180 Hz/px**
   - For a 3.0T system: **Spur T30 180 Hz/px**
5. Select: **Proceed**
6. Follow the workflow in the table that follows, start at cell 1.

1

- Are lines, dots and / or other irregularities visible in the images?

No ►

2

- Are the Window Width (WW) approximately 1200, and the Window Level (WL) approximately 600 (or higher)?

Yes ►

3

- No RF spurious is present.
- Continue with the PIQT test in chapter 3.7.

No ▼

4

- Wide band RF spurious is present.
- The cause must be found and the problem must be solved.
- Repeat the RF spurious test batch when the problem is solved

Yes ▼

5

- Small band RF spurious is present.
- The cause must be found and the problem must be solved. Repeat the RF spurious test batch when the problem is solved

3.7 Periodic image quality test (PIQT) (SAFETY)

- At the start of a PM session PIQT data is gathered to use as a reference PIQT in the PM procedure.
  - For this, recent PIQT results that are already present can be used when available, see chapter 3.7.1.
  - If no recent PIQT results are present they have to be generated, see chapter 3.7.2.
- At the end of a PM session PIQT data is generated to indicate the end status of the MRI system, see chapter 3.7.3.
- 'Recent PIQT results' data is defined as data that is not older than 31 days.

3.7.1 Use of recent PIQT scans

1. Start RADAR.
2. In the textbox **SNR or City**, enter the SRN of the MRI system.
3. Select: **search** or select "enter".
4. Select: **System info** > **Specification information** > **Specification index**. A table appears:
   - If in the column PIQT no number is filled in (empty) or the number is not **0**, then the PIQT scan is not available or out of spec. In that case, check PIQT on site. Continue at chapter 3.7.2.
   - If in the column PIQT the number is 0, then a PIQT scan is available and in spec. Continue at step 5.
5. Click on the **0**. A window appears with a graph with 1 or more blue dots.
6. Check: Is the most recent dot on a date not longer than 31 days ago?
   - **Yes**: The PIQT is OK and can be used as reference PIQT for the PM.
   - **No**: Go to chapter 3.7.2 and continue.

3.7.2 Running PIQT scans

1. Login under **MRService**
2. Activate service level 1 or higher
3. Select: **Application Software** in the MR Boot Configuration Manager
4. Select: **Start**
5. Select:
   - For ≤ R3:
     Select: **SPT icon**
   - For R5:
     Select: **System** > **SPT…**

For all releases:

6. Select: **BatchView** tab
7. Expand: **Batch Files** folder
8. Expand: **PIQT** folder
9. Select: batch **piqt** in this folder
10. Right-click on **piqt**
11. Select: **Run Batch**
12. Follow the instruction on the screen about the coil and phantom positioning.
    Accurate phantom and coil positioning is important for good measurement results.

13. Select: **Proceed**
14. Wait until the batch scanning completes and the text appears: '**Batch execution completed successfully'**.
15. Select: **OK**
16. **Exit** and close the **Batch Interpreter** window.

3.7.3 Generating a report for the PIQT results

1. Select: **Application Software** in the MR Boot Configuration Manager
2. Select: **Start**
3. Select:
   - For ≤ R3:
     Select: **SPT icon**
   - For R5:
     Select: **System** > **SPT…**

For all releases:

4. Select: **ImageView** tab
5. Select: patient **PIQT**
6. Right-click on patient name **PIQT**
7. Select: **Generate Reports**
8. In the 'SPT report selection' window, select:

- Section **All Sections**
- Range **With Spec**
- Range **Latest**

9. Select: **OK** to display the PIQT results.
10. Make sure that all values are within specifications, and do a check on the images.

3.7.4 Marking PIQT scans as reference specifications

- **Only do this section if the SENSE head 8ch coil is used as system coil**.
- Do not do this section if the Quad head coil, T/R head coil or HST HeadSpine16 coil is used as system coil.)

During the weekly Quality Assurance (QA) PIQT scans the user can with the aid of the reference specifications compare the results with the PIQT results found during the system installation or during the last planned maintenance. When reference specifications are created the results of the PIQT scans are compared with the normal specifications and with the reference specifications. An “error” indication will be displayed in case a specification is not met.

To generate the reference specification service level 2 must have been activated.

1. Select: **Application Software** in the MR Boot Configuration Manager
2. Select: **Start**
3. Select:
   - For ≤ R3:
     Select: **SPT icon**
   - For R5:
     Select: **System** > **SPT…**

For all releases:

4. Select: **ImageView** tab
5. Select: patient **PIQT**
6. Right-click on patient name **PIQT**.
7. Select: **Mark as reference**
   A list of marked scans is displayed.
8. Make sure that all scans/slices are included in the list.
9. Close: Marking as reference window.
10. Select: **Tools > Overview ref scans**
11. Make sure that the previous marked scans are on the list.
12. Close: **Overview reference scans window**.
13. Select: **Tools > Generate ref specs**
    The reference specifications are generated and when done a message appears.
14. Select: **OK**
15. Generate a report again and verify that the applied verification files include the newly made reference specifications, for example: SR: t15r4v1l1_4_l1_nt_ref.spec.
16. Select: **Proceed** in SPT
17. Follow the instructions on the screen and start the execution of the performance tests.

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Section 10 - Operators console and viewing

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) program for all Intera / Achieva / Multiva / Ingenia operators console and viewing.

2 WHAT'S NEW

Revision	
DMR194533_Rev00	▪ Moved DVD PC ▪ Moved EWS ▪ Fans of the EWS computer, DVD-PC, and MO drive (already covered by various internal cleaning sections. ▪ Moved External MO Drive cleaning
DMR211949_R00	▪ New DMR number. ▪ Removed: 3.2 Check of hardcopy functionality , 3.4 Physiology battery replacement. ▪ Changes: 3.1 Monitor calibrations for OCD/EWS (Optional) , 3.1.1 Adding a new display (R≥3.2.1 and / or EWS only) , 3.1.2 Monitor calibration (R≥3.2.1 and / or EWS only) , 3.1.3 Monitor calibration (R1 and R2) , 3.4 Testing the audio communication
DMR211949_R01	▪ Revision update (no change)
DMR211949_R02	▪ Added: 3.2 Monitor adjustments for OCD [Intera BDAS systems])

3 PROCEDURES

Power OFF the MR console computer, EWS computer, DVD-PC and external MO drive (if applicable).

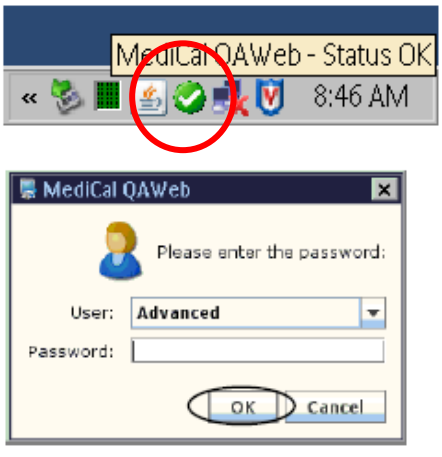
3.1 Monitor calibrations (Optional)

Depending on the type of operator console display present, refer to the following document for the monitor adjustment.

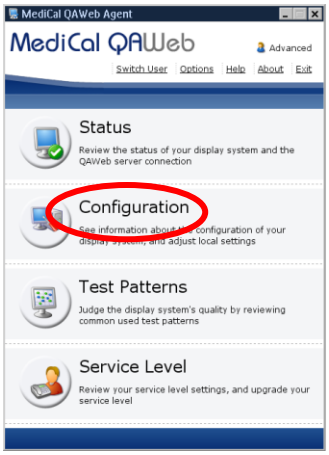
- For R3: Wide Screen OCD (refer to SIM).
- For EWS: 19", 23" or 24" (refer to EWS SIM) (Software Installation Manual)).

3.1.1 Adding a new display (R≥3.2.1 and / or EWS only)

1. Login on system as:
   MRService + <password>
2. Open QAWeb
3. Switch user if logged in as Guest:
4. User: **Advanced**
5. Password: **advanced**

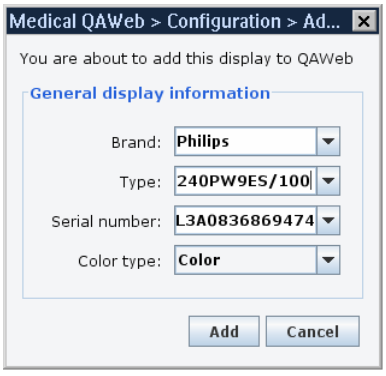


6. Select: **Configuration**



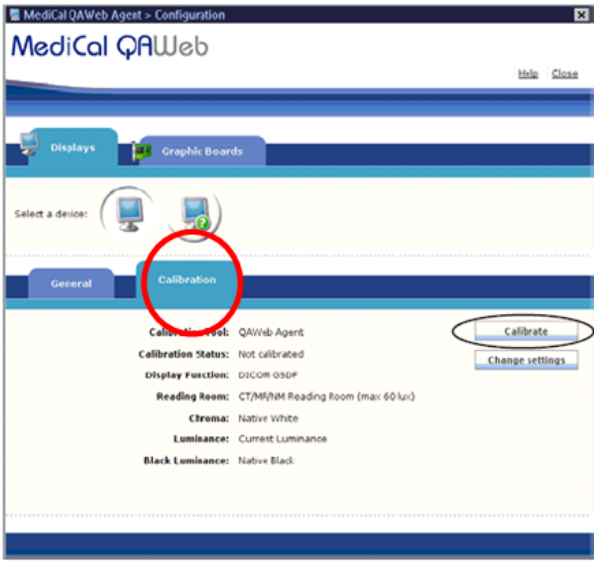
7. Identify the current display.

8. Press: **Add display**
9. If general display information appears press **Add**



3.1.2 Monitor calibration (R≥3.2.1 and / or EWS only)

1. Login on system as:
   MRService + <password>
2. Open QAWeb
3. Switch user if logged in as Guest:
   User: **Advanced**
   Password: **advanced**
4. Open tab **Calibration**
5. Connect Barco optical sensor to USB port

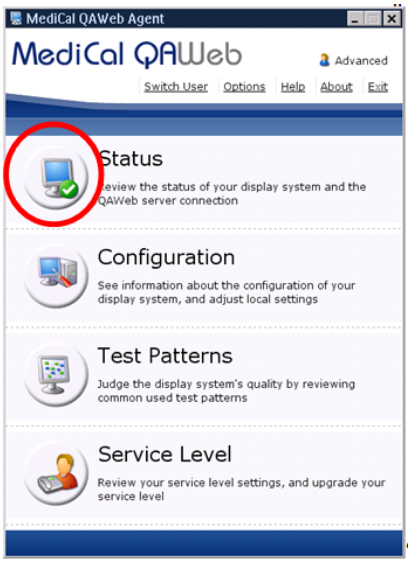


NOTE

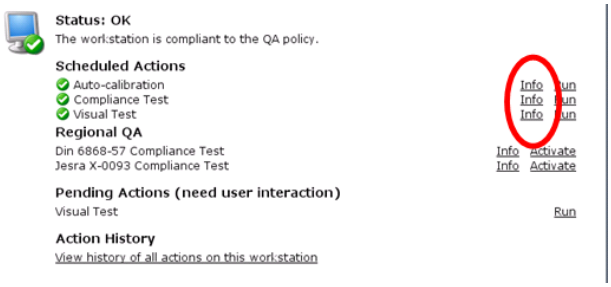
If sensor is connected for the first time it will be recognized as new hardware, refer to SIM for installation procedure.

6. Click: **Calibrate**
7. Follow instructions displayed on screen.

8. If a status report is required continue with the next steps:
9. Select: **Status**

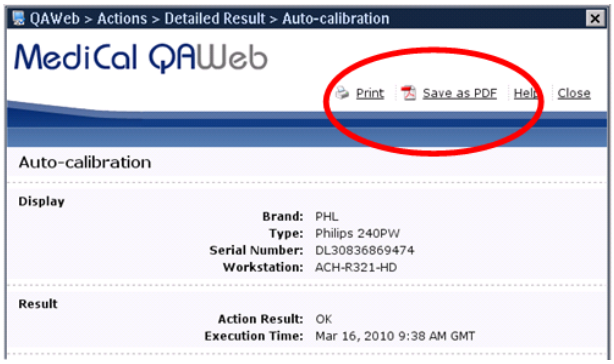


10. Select the link **Info** behind the applicable test e.g. autoCalibration test.



11. Select: **View Detailed Result**

12. Generate report in the preferred format.
13. Close the QAWeb application.



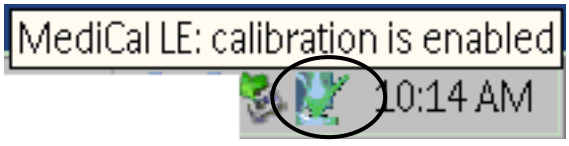
3.1.3 Monitor calibration (R1 and R2)

Systems on software release R1.x and R2.x must be calibrated according the standard DICOM grey value curve, identical with the calibration done on ViewForum displays.
For this calibration a Barco MediCal LE calibration tool must be used that can be part of the upgrade package and can be found in the tool catalogue -> Barco calibration tool..

Procedure:

1. Calibrate the OCD using the delivered Barco MediCal LE calibration tool to the standard DICOM curve according SIM section operator console calibration:
2. After calibration the calibration procedure can be disabled and enabled again by clicking the right mouse button on the MediCal LE icon at the right bottom of the screen

Figure 1 – MediCal LE icon



3.2 Monitor adjustments for OCD [Intera BDAS systems]

Depending on the type of operator console display present, refer to the following documents for the monitor adjustment.

20" OCD 6202 SPD:
http://incenter.medical.philips.com/doclib/getDoc.aspx?func=ll&objId=297192&objAction=browsemaster

20" OCD 6203 SPD:
http://incenter.medical.philips.com/doclib/getDoc.aspx?func=ll&objId=360012&objAction=Open

18" OCD option:
http://incenter.medical.philips.com/doclib/getDoc.aspx?func=ll&objId=295765&objAction=Open

19" OCD option:
http://incenter.medical.philips.com/doclib/getDoc.aspx?func=ll&objId=863877&objAction=browsemaster

3.2.1 Barco MediCal LE calibration (DICOM)

- Systems on software release R11.x, R12.x and R1.x and higher must be calibrated according the standard DICOM grey value curve, identical with the calibration done on ViewForum displays.
- For this calibration a Barco MediCal LE calibration tool must be used that can be part of the upgrade package and can be found in the tool catalogue -> Barco calibration tool..

Procedure:

1. Calibrate the OCD using the delivered Barco MediCal LE calibration tool to the standard DICOM curve according SIM section operator console calibration.
2. After calibration the calibration procedure can be disabled and enabled again by clicking the right mouse button on the MediCal LE icon at the right bottom of the screen.

Figure 2 – MediCal LE icon

3.3 Interactive display I/T (only for interventional systems)

3.3.1 Mechanical maintenance

1. Remove the two cover plates of the ceiling carriage and of the rotating part. Remove the cover plates of the ceiling carriage by removing the Allen head screws which are screwed in from underneath. The covers can then simply be lifted from the Allen head screws screwed in at the side.
2. Remove dust and any metal grindings from the rails with a dry and soft lint-free cloth soaked with degreasing agent.
3. Check the outside of the bearings with degreasing agent.
4. Check that all the bearings run easily and if necessary, lubricate with a drop of Tribol 772. Do not use contact spray for this.
5. Clean the blank part of the gas spring and oil lightly with Tribol 772.
6. If necessary, remove any grindings present on the inside of the covers.

3.3.2 Ceiling carriage

1. Both bearings of each bearing pair should rotate when traveling. If one of the bearings of a bearing pair is obstructed, it should still be possible to move the ceiling carriage. If this is the case, all 6 bearing pairs are set correctly.

2. Check if the monitor suspension starts to move by itself in one of the possible positions (caused by the weight of the cables). The cause of this is the lack of a device, which, by means of friction, ensures that movement is only possible when a certain force is exceeded. The most obvious means of achieving this is to set two of the bearings tightly.

3.3.3 Ceiling carriage limit stops (SAFETY)

1. Check that the limit stops to the limit in the ceiling rails are present and attached securely. Also, check the condition of the rubber buffers.
2. Check that all the bearings run easily and if this is not the case , grease them with a drop of Tribol 772 oil. Do not grease the rail.
3. Check the condition of the cables and check that they run properly. Correct if necessary.
4. Fit the covers again, and clean if necessary with general cleaning agent.

3.3.4 Functional checks

1. Check that the height movement can be set to all possible positions without too much difficulty and that it remains in position each time.
2. Check that the longitudinal movement in the rails can be set to all positions and that the monitor suspension remains in position each time.
3. Check that the rotation movement in the ceiling carriage can be moved from stop to stop without too much force and that the monitor arm remains in position in each direction.
4. Check that the monitor itself can be rotated from stop to stop and that it remains in position each time.
5. Check that the image screen can be set to various viewing angles and that it remains in position each time.

3.4 Cleaning the mouse, keyboard and monitor of Host and EWS

1. Open the mouse at the bottom and remove the mouse ball (only applicable for PS/2 mouse).
2. Clean the mouse ball with some water.
3. Do not use alcohol since this can damage the rubber ball.
4. The mouse contacts cannot be cleaned.
5. Check the connection cable of the mouse.
6. If the cable is damaged, replace the mouse.
7. Check the mouse pad for dirt and damage, clean if necessary. If damaged, replace the mouse pad.
8. Clean the keyboard.
9. Clean the monitor

3.5 Check the audio communication

1. Put a music source near the microphone of the audio module.
2. Press **Talk** button
3. Make sure the music is heard on the ceiling speakers, or audio headset.
4. Put the music source near the microphone on the magnet.
5. Press listen to patient on the audio module.
6. Make sure the music is heard on the audio module.

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Section 11 - Software

1 INTRODUCTION

This PM section provides an overview of the Planned Maintenance (PM) for software. This section applies to R1 up to including R5. The procedures mentioned in this chapter apply to all releases, unless stated differently.

2 WHAT'S NEW

Revision	
DMR177239_R00	Initial version: This document is meant for all SW releases R1-R5. Replacing the older release specific PM software documents. Important changes made: ▪ Combined earlier release software procedures with R5. ▪ Moved: Install Service Packs and Security Fixes: to the system level chapter. ▪ Updated: 3.1 Clean up disks ▪ Deleted: check/run cleanup services ▪ Updated: 3.4 Remote Services Network test ▪ Deleted: FSF session and Philips Service Agent test on MR console, ▪ Updated: 3.5 Site hardware configuration 'as maintained' on MR console ▪ Do only if not on PRS. ▪ Removed check if “AsMaintained application” is installed (from 1.8.1SP5 and 2.1.5SP5 the as maintained script is standard installed) ▪ Moved 3.6.1 Backup MR console and 3.6.2 Backup EWS computer to the end of this chapter
DMR177239_R01	▪ Updated: 3.4 Remote Services Network test, Added click sequence for ≤R4
DMR211950_R00	▪ New DMR number. Removed: 3.3 Check statistical logging on MR console , 3.4 Remote Services Network test , 3.6.2 Backup EWS computer. Updated: 3.1 Clean up disks.
DMR211950_R01	▪ Revision update, Added export config header.
DMR211950_R02	▪ Added: 3.1.1 Procedure for ≤ Release 9 systems ▪ Updated: 3.3 Site hardware configuration 'as maintained' on MR console (if not on PRS.
DMR211950_R03	▪ Updated: 3.1.2 Procedure for ≥ Release 10 systems.
DMR211950_R04	▪ Updated: chapter 3.1.2 Procedure
DMR211950_R05	▪ Update chapter 3.3 for windows 10 systems only

3 PROCEDURES

3.1 Clean up disks

3.1.1 Procedure for ≤ Release 9 systems

The application software will run slowly if you do not make a cleanup according to the frequency mentioned in the timetable.

CAUTION

Be sure you are the only user on the system when doing a cleanup of the directories.
Detached processes will be stopped by this procedure.

1. Ask the customer if all patient examinations on the data disk can be deleted. Deleting them will improve the performance of the system.
   a) Delete all patients with use of the Admin menus under.
   b) Logout from (system exit).
2. Login: **GYROTOOL**
3. Select: **2** Daily cleanup tool
4. Enter **Y** on the following questions:
   - Are you the only one running ?
   - Perform cleanup ?

- Perform optimize ?
- Perform cleanup optimized indexed files ?
- Press <RETURN> to exit Daily ?

5. Press **<RETURN>**
6. Select: **1** Exit From Gyrotool
7. Make sure you are the only user on the system and login under SYSTEM.
8. Select: **6** System management
9. Select: **10** Repair disk device(s)
10. Select: **1** Exit
11. Select: **1** Exit to DCL
12. Enter: **up**
13. Enter: **purge/log [...]*.***
14. Enter: **mrmenu**
15. Enter: **2** logout
16. Login: **GYRORESTART**

3.1.2 Procedure for ≥ Release 10 systems

To clean up the FTP partition, do the procedure that follows:

1. Do a check to see how much free disk space there is on the partition.
   c) If there is <15% free space, do the disk clean-up.
   d) If there is >15% free space, go to the next chapter
2. Press Ctrl+Alt+Delete
3. Login: **MRService** + password
4. Start Windows Explorer
5. Select FTP (E:) partition
6. Look in folders **Service**, **FPR** and **UrgentFixFolder** to find any files that can be deleted.
   – Do not delete **Blackbox*.*** files if you find them.
7. Look in folders **DICOM**, **Export** and see if the customer should cleanup these folders.
   – For **DICOM** folder cleanup, use the application software.
   – For **Export** folder cleanup, use Windows Explorer.

3.2 Disk defragmentation

- **Find the version of Windows installed on the system:**
  – If **Windows 7** is installed, **do not** do this procedure. Go to the next chapter.
  – If **Windows XP** is installed, check the fragmentation status of the systems and data disk. Do the steps that follow:

1. Press **Windows** button on your keyboard
2. Select: **(All)Programs > Accessories > System Tools > Disk Defragmenter**
3. Select: **Disk Volume** e.g. **Site (G:)**
4. Select: **Analyze**(Disk)
5. Select: **View Report**
6. Select: **Defragment** if the system gives the advice to defragment the partition.
7. Select: **Disk Volume C:** and repeat steps 4-6

3.3 Site hardware configuration 'as maintained' on MR console [if not on PRS]

NOTE

If the system is on PRS then this step is not required.

The following action will allow the entire MR organization having an up-to-date installed base configuration database, enabling better FCO roll out, correct Upgrade Packages, etc.

NOTE

From R12 onwards the **AsMaintained** script is present in the software and the installation step to install this application is not required.

Step (A) To check if the "AsMaintained application" is installed.

1. GoTo menu:
2. **Start -> MR Applications-> Service Tools-> AsMaintained**
   - If AsMaintained is NOT present, continue with step-B
   - If AsMaintained IS present, continue with step-C

Step (B) To install the AsMaintained script

1. Access InCenter
2. Select **Service > Products & Solutions > Magnetic Resonance**
3. From MR Links, select: ***MR Download Area***
4. Select: ***General download area***
5. Download '***MR_asmaintained_V*.zip***'
6. Logon user: ***MRService*** + ***<****password****>***
7. Copy the ZIP file to the "**E:\Service**" folder (from USB Memory stick, secure-FTP connection or CD/DVD)
8. Select ***E:\Service\MR_asmaintained_V*.zip***
9. Click right mouse button and select **Extract Here**
10. Install as maintained by double clicking **E:\Service\'installasmaintained.bat'** file

Step (C) To run the AsMaintained script

1. Click: **Start** > **MR Applications** > **Service Tools** > **AsMaintained**.
2. A script will run in a dos window
3. After running the script the browser window appears.
4. The script data is stored at **E:\service\asmaintained\ system_dataxxxxx. xml**.
   (where **xxxx** is date/time tag)
5. Locate the script data file and email it to: as.maintained@philips.com

Step (D) for Windows 10 systems only

1. Click: :  **> Service Application > Configuration > System Information > System About > AsMaintained**
2. A script will run in a dos window
3. After running the script the browser window appears.
4. The script data is stored at **E:\service\asmaintained\ system_dataxxxxx. xml**. (where **xxxx** is date/time tag)
5. Locate the script data file and email it to: as.maintained@philips.com

3.4 Back-up MR Console

Refer to the Software Installation Manual (SIM) of the applicable SW release for the backup procedure.

3.5 Export config MR console

Refer to the Software Installation Manual (SIM) of the applicable SW release for export config procedure.

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Section 12 - Material list Intera / Achieva

1 INTRODUCTION

This section lists the various replacement parts and special tools that are needed for each step in a planned maintenance visit. The list of these materials and tools is the 'material list'. This list refers to the various modules of the PM manual. Only reference is made to the required tools that are not standard required. The following tools/materials are always needed:

- TC030 (ESD protective kit) present on site
- TC129 (Standard toolkit)
- TC130 (Non-magnetic toolset)
- Cable binders

Materials for all possible configurations covered by this manual are listed here. Please make sure that only suitable parts are ordered for the configuration on which you will be doing PM. Furthermore, parts indicated for a PM period may not necessarily be used. Some parts will be replaced based on their condition assed at the customer site.

2 WHAT'S NEW

Revision	Reason for change
DMR194828_R00	▪ Added Headbands (FRU, Headband, Black, 4-pack and FRU, Headband, NVA, 2-pack) ▪ Added materials for Glycol level measurement ▪ Corrected leakage current measurements: Only needed in visit 4
DMR211954_R00	▪ New DMR number. Added materials for 'Check patient comfort lights' ▪ Removed Check headbands on headsets, Physiology battery replacement
DMR211954_R01	▪ Revision update, Removed 9240 300 17100, Philips Halogen Dichroic 20W-12V (obsolete), added 2422 076 01205 USB 2 to RS232 converter
DMR211954_R02	▪ Added leak check. ▪ Check operating hours of S23 RF-amplifier tubes
DMR211954_R03	▪ Added: Shock indicator 100 G ▪ Added: ODU Extractor and Guiding Pins Kit ▪ Added: QCH-kit 1.5T and 3.0T
DMR211954_R04	▪ Textual update: Glycol concentration measurement ▪ Changed interval for glycol concentration measurement for LCC and Neslab
DMR211954_R05	▪ Installation of the ERDU button cover + label ▪ Added appendix

3 MATERIAL LIST

PM module name:	11/12NC or TC code	Tool/material name	PM Period			
			1	2	3	4
2. System Level			**1**	**2**	**3**	**4**
*Firmware check S30	2422 076 01205 Local Local Downloadable via InCenter Downloadable via InCenter	USB 2.0 to RS232 Converter Null modem cable female/female 9-pins Gender changer sub-D male/male 9 pins -MKS S30 Firmware IOP Rev. I installation document (DMR144941)	x	x	x	x
Visual inspection	1322 054 11156	Touch up paint mushroom 40383	x	x	x	x
Dust filter and fans CDAS	4522 150 3428 4522 150 3427 4522 150 3429	CDAS Fan filter CDAS (3x) Fan unit FAN (out of CDAS Fan unit)	x		x	
Dust filter BE-misc box	4522 150 2404	Dust filter set (5 pieces) (for BE-misc box)		x		x
Dust filter and fan patient ventilation	4522 150 2202	Air filter pat. ventilation unit or SFB pat. Ventilation	x	x	x	x
Dust filters RF amplifier	4522 150 3322 4522 150 3158 4522 150 3157 4522 150 3346 4522 150 3345	Dust filter S23, S24 Dust filter PS-deck S26A Dust filter RF-deck S26A Dust filter PS-deck S26B Dust filter RF-deck S26B	x		x	
Dust filters gradient system	 4522 150 2366 4522 150 1477	Copley 274: four fan filter PDU fan filter		x		x
Check shock indicator(s) RF-coil(s)	4553 000 7141.x	Shock indicator 100 G	x	x	x	x
*Install ODU Extractor and Guiding Pins Kit	4553-000-73671	ODU Extractor and Guiding Pins Kit	x	x	x	x
*Install quick change head on PICU socket	4553-000-71681	1.5T QCH kit	x	x	x	x
*Install quick change head on PICU socket	4553-000-71691	3.0T QCH kit	x	x	x	x
Check operating hours of S23 RF-amplifier tubes	4522 150 1144x 4522 150 2050x Local	IPA tube PA tube Printed tube admin log and plastic pouch.	x	x	x	x

*one-time activity only and can be performed in any visit.

PM module name:	11/12NC or TC code	Tool/material name	PM Period			
			1	2	3	4

3. Mains distribution			1	2	3	4
Earth bonding test	TC025 -or- TC378	Earth bonding tester -or- Gossen Earth Bond Electrical Safety Tester Kit	x			
Leakage current measurements	TC012 -or- TC378	HIOKI clamp-on leak tester -or- Gossen Earth Bond Electrical Safety Tester Kit	x			

4. Gradient System			1	2	3	4
Check gradient connections	TC188	Non-magnetic torque wrench	x		x	

5. Liquid cooling			1	2	3	4
LCC2x systems						
Glycol concentration measurement	4598 004 9920x TC647 Local *1322 530 3150x	Glycol content indicator Small cup *DOWTHERM SR1 PACKED	x			
LCC and Neslab systems						
Glycol concentration measurement	4598 004 9920x TC647 Local 1322 530 3150x	Glycol content indicator Small cup DOWTHERM SR1 PACKED	x		x	
All liquid cooling systems						
Flushing the gradient coil	9896 030 22501 only for USA and Canada 9896 030 22491 rest of the world Local	GRAD COIL KIT NX1106 & AZ8104 (biocide/inhibitor) GRAD COIL KIT NX1164 & AZ8104 30 liter distilled water *40 liter distilled water	x			

*Make sure that there is additional Dowtherm SR1 mixture available on site, in case the cooling loop needs to be re-pressurized.

6. Refrigeration system			1	2	3	4
Check for leaks (only for 10K)	4522 150 12481	Gas leak detector ('snoop')	x	x	x	x

PM module name:	11/12NC or TC code	Tool/material name	PM Period			
			1	2	3	4

7. Magnet system			1	2	3	4
Installation ERDU-Button Cover + LABEL SET ERDU BUTTON	459801042301 Country Specific (See appendix)	Installation ERDU-Button Cover + label set ERDU button	x	x	x	x

8. Patient support			1	2	3	4
Check patient comfort lights	9240 512 17100 4598 001 08101	HALOGEN LAMP (12V20W) INTERA WA lampset and screw driver	x	x	x	x
Cleaning and lubrication	1322 521 64901 1322 523 46402	Tribol Molub Alloy 823-2-FM Tribol 772 oil	x		x	
Trolley wheels inspection	1311 504 84101	Loctite 243	x		x	

10. Operators consoles & viewing			1	2	3	4
Monitoring calibration	TC010	Barco calibration sensor		x		x
Interactive display I/T (only for interventional systems)	1322 523 46402 1311 504 84101	Tribol 772 oil Loctite 243	x		x	

11. Software			1	2	3	4
Backup procedure MR console and EWS	Please check the DVD+RW Media compatibility list	Medical grade DVD +RW	x	x	x	x

12. Appendix

Country	Label nr	Label description	Comment
All Other countries	459801193621	ERDU LABEL SET EN (ENGLISH)	
Albania	459801196831	ERDU LABEL SET AL (ALBANIAN)	
Argentina	459801193631	ERDU LABEL SET ES (SPANISH)	
Australia	459801193621	ERDU LABEL SET EN (ENGLISH)	
Austria	459801193611	ERDU LABEL SET DE (GERMAN)	
Azerbaijan	459801193751	ERDU LABEL SET RU (RUSSIAN)	English also allowed
Bangladesh	459801193621	ERDU LABEL SET EN (ENGLISH)	
Belarus	459801193751	ERDU LABEL SET RU (RUSSIAN)	English also allowed
Belgium	459801193501	ERDU LSET NL-FR-DE (NED. FRENCH GERM.)	
Bolivia	459801193631	ERDU LABEL SET ES (SPANISH)	
Bosnia	459801193551	ERDU LABEL SET EN SR (ENGLISH SERBAIN)	Preferred
	459801193421	ERDU LABEL SET SR (SERBIAN)	
Botswana	459801193621	ERDU LABEL SET EN (ENGLISH)	
Brazil	459801193391	ERDU LABEL SET BR (BRAZILIAN PORTUGESE)	
Bulgaria	459801193771	ERDU LABEL SET BG (BULGARIAN)	
Burkina Faso	459801193411	ERDU LABEL SET FR (FRENCH)	
Canada	459801193651	ERDU LABEL SET EN FR (ENGLISH FRENCH)	
Chile	459801193631	ERDU LABEL SET ES (SPANISH)	English also allowed
Colombia	459801193631	ERDU LABEL SET ES (SPANISH)	
Costa Rica	459801193631	ERDU LABEL SET ES (SPANISH)	
Croatia	459801193441	ERDU LABEL SET HR (CROATIAN)	English also allowed
Czech Republic	459801193591	ERDU LABEL SET CS (CZECH)	
Denmark	459801193601	ERDU LABEL SET DA (DANISH)	
Ecuador	459801193631	ERDU LABEL SET ES (SPANISH)	
Egypt	459801193621	ERDU LABEL SET EN (ENGLISH)	
Estonia	459801193641	ERDU LABEL SET ET (ESTONIA)	
Finland	459801193431	ERDU LABEL SET FI VS (FINNISH SWEDISH)	
France	459801193411	ERDU LABEL SET FR (FRENCH)	
Georgia	459801193751	ERDU LABEL SET RU (RUSSIAN)	English also allowed
Germany	459801193611	ERDU LABEL SET DE (GERMAN)	
Greece	459801193661	ERDU LABEL SET GRE (GREEK)	English also allowed
Hong Kong	459801193621	ERDU LABEL SET EN (ENGLISH)	
Hungary	459801193671	ERDU LABEL SET HU (HUNGARIAN)	
India	459801193621	ERDU LABEL SET EN (ENGLISH)	
Indonesia	459801193451	ERDU LABEL SET ID (INDONESIAN) (BAHASA)	
Iran	459801193621	ERDU LABEL SET EN (ENGLISH)	
Ireland	459801193621	ERDU LABEL SET EN (ENGLISH)	
Israel	459801193621	ERDU LABEL SET EN (ENGLISH)	
Italy	459801193681	ERDU LABEL SET IT (ITALIAN)	
Japan	459801193691	ERDU LABEL SET JA (JAPANESE)	
Jordania	459801193621	ERDU LABEL SET EN (ENGLISH)	
Kazakhstan	459801193471	ERDU LABEL SET KK (KAZAKH)	
Kenia	459801193621	ERDU LABEL SET EN (ENGLISH)	
Korea, South	459801193481	ERDU LABEL SET KR (KORIAN)	English also allowed
Kuwait	459801193621	ERDU LABEL SET EN (ENGLISH)	
Latvia	459801193711	ERDU LABEL SET LV (LATVIA)	English also allowed
Lebanon	459801193621	ERDU LABEL SET EN (ENGLISH)	
Libia	459801193621	ERDU LABEL SET EN (ENGLISH)	

Lithuania	459801193701	ERDU LABEL SET LT (LITHANIAN)	
Luxembourg	459801193611	ERDU LABEL SET DE (GERMAN)	
	459801193411	ERDU LABEL SET FR (FRENCH)	
Macedonia	459801193491	ERDU LABEL SET MK (MACEDONIAN)	
Malaysia	459801193621	ERDU LABEL SET EN (ENGLISH)	
Mexico	459801193631	ERDU LABEL SET ES (SPANISH)	
Nepal	459801193621	ERDU LABEL SET EN (ENGLISH)	
Netherlands	459801193721	ERDU LABEL SET NL (DUTCH)	English also allowed
New Zealand	459801193621	ERDU LABEL SET EN (ENGLISH)	
Norway	459801193731	ERDU LABEL SET NO (NORWEGIAN)	
Oman	459801193621	ERDU LABEL SET EN (ENGLISH)	
Pakistan	459801193621	ERDU LABEL SET EN (ENGLISH)	
Palestine	459801193621	ERDU LABEL SET EN (ENGLISH)	
Panama	459801193631	ERDU LABEL SET ES (SPANISH)	
People's Republic of China	459801193571	ERDU L SET ZH SIMP (CHINESE SIMPLIFIED)	
Peru	459801193631	ERDU LABEL SET ES (SPANISH)	
Philippines	459801193621	ERDU LABEL SET EN (ENGLISH)	
Poland	459801193511	ERDU LABEL SET PL (POLISH)	
Portugal	459801193741	ERDU LABEL SET PT (PORTUGUESE)	
Republic of South Africa	459801193621	ERDU LABEL SET EN (ENGLISH)	
Romania	459801193521	ERDU LABEL SET RO (ROMANIAN)	
Russian Federation	459801193751	ERDU LABEL SET RU (RUSSIAN)	English also allowed
Saudi Arabia	459801193621	ERDU LABEL SET EN (ENGLISH)	
Singapore	459801193621	ERDU LABEL SET EN (ENGLISH)	
Slovakia	459801193541	ERDU LABEL SET SK (SLOVAK)	
Slovenia	459801193531	ERDU LABEL SET SI (SLOVENE)	
Spain	459801193631	ERDU LABEL SET ES (SPANISH)	
Sweden	459801193761	ERDU LABEL SET SV (SWEDISH)	
Switzerland	459801193461	ERDU L SET IT-FR-DE ITALIAN FRENCH GERM.	
Syria	459801193621	ERDU LABEL SET EN (ENGLISH)	
Taiwan	459801193381	ERDU LABEL SET ZH (CHINESE TRADITIONAL)	
Thailand	459801193621	ERDU LABEL SET EN (ENGLISH)	
Tunisia	459801193411	ERDU LABEL SET FR (FRENCH)	English also allowed
Turkey	459801193561	ERDU LABEL SET TR (TURKISH)	
Ukraine	459801193581	ERDU LABEL SET UK (UKRAINIAN)	
United Arab Emirates	459801193621	ERDU LABEL SET EN (ENGLISH)	
United Kingdom	459801193621	ERDU LABEL SET EN (ENGLISH)	
United States	459801193621	ERDU LABEL SET EN (ENGLISH)	
	459801193401	ERDU LABEL SET EN ES (ENGLISH SPANISH)	
Venezuela	459801193631	ERDU LABEL SET ES (SPANISH)	English also allowed
Vietnam	459801193621	ERDU LABEL SET EN (ENGLISH)	

PHILIPS

Healthcare, MRI

PM manual

Timetable Intera / Achieva

1 INTRODUCTION

1.1 Purpose of the timetable

This section provides the time table for Intera / Achieva systems. The purpose is to prescribe how often to perform PM tasks and in which visit. The order of tasks and the way tasks are clustered in visits are optimized for workflow. Depending on the actual situation on site the optimal workflow can be different.

The time table includes the following columns:

Column name:	Description of column:
Subsystem/Module	This provides the name of the subsystem where the PM task applies to. In case the PA tool is used to record the result, this name corresponds to the module name in the PA tool where this tasks can be found
Task	Name of the PM task
Location	Can be either one of the following: ▪ **On site**: task can be executed on site ▪ **Remote**: task can be executed remote ▪ **Remote monitoring**: if the system is on RADAR and there is a local agreement for remote surveillance of the system then this task can be skipped.
Execution	Can be either one of the following: ▪ **Mandatory**: This task needs to be done always, when prescribed in the visit. You can handover the system if any mandatory task is out of specification, but you should plan a corrective action. ▪ **Mandatory (Safety)**: This task needs to be done always, when prescribed in the visit and is performed for safety reasons. You must not handover the system if any safety task is out of specification. ▪ **Optional**: This task can be skipped depending on local and/or customer agreements ▪ **Workflow Step**: This task is mentioned as workflow step,
Recording input	Possible outcomes of the PM task
Spec	Acceptable values of the outcome of the PM task
Configuration	Describes the configuration in which this task needs to be executed.
1,2,3,4	Represent the PM visit number: ▪ All the visits should be performed in 2 years. In each visits' column, a time estimate in minutes represents that the task in that row needs to be executed and what the expected time needed for the task is. ▪ If a column contains "n.a." this means that the task does not need to be performed in that visit.

1.2 Document history

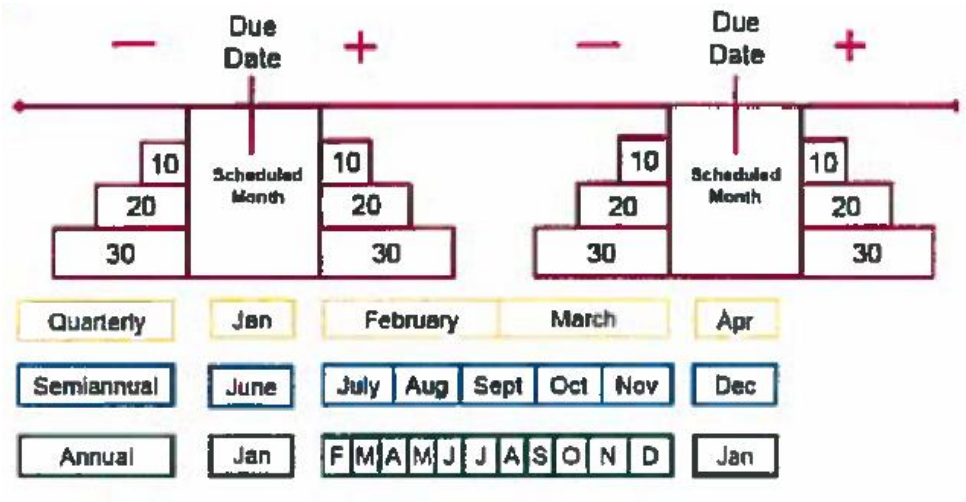
Revision	Date	Reason for changes
00	2014-07-03	▪ First issue
01	2014-07-11	▪ Clerical changes in durations
02	2014-07-14	▪ Textual changes in introduction section
03	2015-01-16	▪ Updated guidelines on execution of PM tasks ▪ Added RF tube operating hours estimation for S23 ▪ Updated earth bonding measurements
04	2015-11-04	▪ Added: Use analyzer
05	2015-11-19	▪ Added tolerance around PM intervals ▪ Added: Install ODU Extractor and Guiding Pins Kit ▪ Added: Install quick change head on PICU socket
06	2016-04-04	▪ Update: Check door switch ▪ Changed interval for glycol concentration measurement for LCC and Neslab
07	09-Sep-2016	▪ Installation of the ERBU-button cover + label
08	25-Nov-2016	▪ Update: PM Optimized Work Flow Time Table
09	06-FEB-2018	▪ Add chapter "Check bodycoil transmit characteristics"

1.3 Tolerance around PM intervals

PM tasks should be done within the following period around the month of the actual due date:

- 3 month interval: +/- 10 days
- 6 month interval: +/- 20 days
- 12 month (or greater) interval: +/- 30 days

Figure 1 Due date and tolerated deviations around the due date's month



2 TIMETABLE

Subsystem / Module	Task	Location	Execution	Recording input	Spec	Configuration	1	2	3	4
-	Log in to MR service	On site	Workflow Step	-	-	All	3	3	3	3
System level	Visual inspection	On site	Mandatory	Pass/Fail	Pass	All	10	10	10	10
System level	Check RF coils	On site	Mandatory (Safety)	Pass/Fail	Pass	All	n.a.	15	n.a.	15
System level	Check -5V PS FEPSU	On site	Mandatory	Pass/Fail	Pass	All	n.a.	5	n.a.	5
System level	Check RF-enclosure	On site	Mandatory	Pass/Fail	Pass	All	10	10	10	10
Magnet System	Check seals quench buttons	On site	Mandatory	Pass/Fail	Pass	Not for ERDU buttons with a key	1	1	1	1
Magnet System	Check helium vent pipe outlet	On site	Mandatory (Safety)	Pass/Fail	Pass	All	n.a.	15	n.a.	15
Patient Support MT	Check table top for damage and loose glass fibers	On site	Mandatory	Pass/Fail	Pass	All	10	10	10	10
System level	Check SPT Spec files	On site / Remote	Mandatory	Pass/Fail	Pass	All	11	11	11	11
System level	Check door switch	On site	Mandatory (Safety)	Pass/Fail/Form signed	Pass / Form signed	All	5	n.a.	5	n.a.
Patient Support MT	Test stop scan buttons on the magnet	On site	Mandatory (Safety)	Pass/Fail	Pass	All	5	5	5	5
Patient Support MT	Test stop function on operator console	On site	Mandatory (Safety)	Pass/Fail	Pass	All	2	2	2	2
System level	PIQT	On site / Remote	Mandatory (Safety)	Pass/Fail	Pass	All	15	15	15	15
System measurements & Adjustments 1.5T System measurements & Adjustments 3.0T	Use analyzer	On site / Remote	Mandatory	Pass/Fail	Pass	All	5	5	5	5
Refrigerator system HC-8E1	Check boil off	On site / Remote monitoring	Mandatory	Pass/Fail	Pass	10K Magnets only	n.a.	10	n.a.	10
Refrigerator system CSW-71 Refrigerator system F-50	Check cryogenic performance	On site / Remote monitoring	Mandatory	Pass/Fail	Pass	4K Magnets only	15	15	15	15
System level	Check site condition (Temp and Humidity)	On site / Remote	Mandatory	Pass/Fail	Pass	All	10	10	10	10
System level	Dust filter BE-misc box	On site	Mandatory	Clean - Filter Reused Clean - Filter Cleaned Clean - Filter Replaced Intermediate - Filter Reused Intermediate - Filter Cleaned Intermediate - Filter Replaced Dirty - Filter Reused Dirty - Filter Cleaned Dirty - Filter Replaced	Clean - Filter Reused Clean - Filter Cleaned Clean - Filter Replaced Intermediate - Filter Replaced Dirty - Filter Replaced	All	n.a.	5	n.a.	5

System level	External Host Computer Cleaning	On site	Mandatory	Pass/Fail	Pass	All	n.a.	5	n.a.	n.a.
System level	Internal Host Computer Cleaning	On site	Mandatory	Pass/Fail	Pass	All	n.a.	n.a.	n.a.	30
System level	Internal cleaning External MO drive	On site	Mandatory	Pass/Fail	Pass	MO drive option only	n.a.	2	n.a.	2
System level	Internal DVD-PC cleaning	On site	Mandatory	Pass/Fail	Pass	DVD PC option only	n.a.	n.a.	n.a.	5
Software	Clean up disks	On site	Mandatory	Pass/Fail	Pass	All	1	1	1	1
Software	Disk defragmentation	On site	Mandatory	Pass/Fail	Pass	Windows XP only	2	2	2	2
Gradient System 274/271/281	Door interlocks Gradient amplifier	On site	Mandatory (Safety)	Pass/Fail	Pass	274 / 271 / 281	n.a.	5	n.a.	5
Gradient System 274/271/281	Dust filter and fan gradient system	On site	Mandatory	Pass/Fail	Pass	274 / 271 / 281	n.a.	2	n.a.	2
-	Power off the RF amplifier and Gradient	On site	Workflow Step	-	-	All	1	1	1	1
-	Remove covers in Exam Room	On site	Workflow Step	-	-	All	20	n.a.	20	n.a.
System level	Check for dust in hybrid box and QBC	On site	Mandatory	Pass/Fail	Pass	All	n.a.	n.a.	45	n.a.
System level	Dust filter SFB	On site	Mandatory	Clean - Filter Reused Clean - Filter Cleaned Clean - Filter Replaced Intermediate - Filter Reused Intermediate - Filter Cleaned Intermediate - Filter Replaced Dirty - Filter Reused Dirty - Filter Cleaned Dirty - Filter Replaced	Clean - Filter Reused Clean - Filter Cleaned Clean - Filter Replaced Intermediate - Filter Replaced Dirty - Filter Replaced	SFB dust filter config only	10	10	10	10
Magnet System	Waterdrain	On site	Mandatory (Safety)	Pass/Fail	Pass	All	2	n.a.	2	n.a.
Gradient System 274/271/281	Check gradient coil connections	On site	Mandatory (Safety)	Pass/Fail	Pass	All	15	n.a.	15	n.a.
Magnet System	ERDU - Magnet Field On	On site	Mandatory (Safety)	Pass/Fail	Pass	All	n.a.	n.a.	5	n.a.
Magnet System	Check DPS	On site	Mandatory (Safety)	Pass/Fail	Pass	4K only	n.a.	n.a.	5	n.a.
Electrical safety Intera Achieva Multiva	Earth bonding: Exam Room	On site	Mandatory (Safety)	-	-	All	15	n.a.	n.a.	n.a.
Electrical safety Intera Achieva Multiva	SFB - Magnet	On site	Mandatory (Safety)	value (mOhm)	< 30 mOhm	(i)MDU(E) systems				
Electrical safety Intera Achieva Multiva	SFB - Magnet	On site	Mandatory (Safety)	value (mOhm)	< 50 mOhm	GMDU systems				
Electrical safety Intera Achieva Multiva	SFB or Magnet - ERD	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	ERD only				
Electrical safety Intera Achieva Multiva	SFB or Magnet - Patient table	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	SFB or Magnet - PFEI	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	SFB or Magnet - PHD	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	PHD only				
Electrical safety Intera Achieva Multiva	SFB or Magnet - RMMU	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	RMMU only				

Electrical safety Intera Achieva Multiva	SFB or Magnet – Host/Host-recon computer Chassis	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	SFB or Magnet - PE of OEC (Console)	On site	Mandatory (Safety)	-	< 50 mOhm	All				
Electrical safety Intera Achieva Multiva	SFB or Magnet - PE of SSC (Console)	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Service Storage Cabinet only				
Electrical safety Intera Achieva Multiva	Earth bonding: Tech Room	On site	Mandatory (Safety)	value (mOhm)	-		15	n.a.	n.a.	n.a.
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - ACC Cabinet	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	ACC only				
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - ACC Front cover	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	ACC only				
Electrical safety Intera Achieva Multiva	GMDU or SFB - AIBO	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	DACC with AIBO only				
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - CDAS	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	CDAS only				
Electrical safety Intera Achieva Multiva	GMDU or SFB - Circulator	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Multi Transmit aircooled RF amp only				
Electrical safety Intera Achieva Multiva	MDU or SFB - Cryo Compressor	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU or SFB - DACC Cabinet	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - DACC Front cover	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU - GMDU (door)	On site	Mandatory (Safety)	value (mOhm)	< 50 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU or SFB - Grad Amp Cabinet	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU or SFB - Grad Amp Front cover	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	All				
Electrical safety Intera Achieva Multiva	MDU or SFB - Grad Amp1 Cabinet	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	MDU or SFB - Grad Amp1 Front cover	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	All				
Electrical safety Intera Achieva Multiva	MDU or SFB - Grad Amp2 Cabinet	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Dual Gradient amp only				
Electrical safety Intera Achieva Multiva	MDU or SFB - Grad Amp2 Front cover	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	Dual Gradient amp only				
Electrical safety Intera Achieva Multiva	iMDU or SFB - Gradient switch	On site	Mandatory (Safety)	-	< 100 mOhm	Dual Gradient amp 274 271 281 only				
Electrical safety Intera Achieva Multiva	iMDU or SFB - Gradient switch door	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	Dual Gradient amp 274 271 281 only				
Electrical safety Intera Achieva Multiva	MDU or SFB - Heat exchanger Grad Amp.	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Neslab III only				
Electrical safety Intera Achieva Multiva	MDU or SFB - Heat exchanger Grad Coil.	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Eaton Williams only				
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - HOS	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	3.0T only				
Electrical safety Intera Achieva Multiva	GMDU or SFB - IGC1	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	C78x only				
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - LCC Cabinet	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	LCC, LCC2, LCC2A, LCC2B only				

Electrical safety Intera Achieva Multiva	MDU or SFB - LCC Cabinet door	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	LCC, LCC2, LCC2A, LCC2B only				
Electrical safety Intera Achieva Multiva	MDU or SFB - LCC Cover electronic box	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	LCC, LCC2, LCC2A, LCC2B only				
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - DACC Mains Inlet Unit	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU or SFB - ACC Mains Inlet Unit	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	ACC only				
Electrical safety Intera Achieva Multiva	MDU - MDU (door)	On site	Mandatory (Safety)	value (mOhm)	< 50 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU or SFB - MN RF	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Multi Nuclei only				
Electrical safety Intera Achieva Multiva	MDU or SFB - MN RFA	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Multi Nuclei only				
Electrical safety Intera Achieva Multiva	MDU or SFB - NTDAC/DACC Cabinet	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	SFB - Pat. Vent Cabinet	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Separate PVU only				
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - MN PMU	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Multi Nuclei only				
Electrical safety Intera Achieva Multiva	(G)MDU or SFB - Reconstructor chassis	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	Stand alone reconstructor only				
Electrical safety Intera Achieva Multiva	(G)MDU – RF-enclosure	On site	Mandatory (Safety)	value (mOhm)	< 30 mOhm	All				
Electrical safety Intera Achieva Multiva	MDU or SFB - RFA	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU or SFB - RFA or WCRFA	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU or SFB - RFA2	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	Multi Transmit aircooled RF amp only				
Electrical safety Intera Achieva Multiva	(G)MDU - SFB	On site	Mandatory (Safety)	value (mOhm)	< 30 mOhm	All				
Electrical safety Intera Achieva Multiva	GMDU or SFB - Ethernet Switch DACC	On site	Mandatory (Safety)	value (mOhm)	< 150 mOhm	All				
Electrical safety Intera Achieva Multiva	MDU - Transformer	On site	Mandatory (Safety)	value (mOhm)	< 100 mOhm	MDU 480V/60Hz only				
Electrical safety Intera Achieva Multiva	GMDU - Transformer inside the GMDU	On site	Mandatory (Safety)	value (mOhm)	< 50 mOhm	gMDU 480V/60Hz only				
Electrical safety Intera Achieva Multiva	Leakage current (transformer output)	On site	Mandatory (Safety)	value (mA)	< 11 mA	gMDU 480V/60Hz only	10	n.a.	n.a.	n.a.
Electrical safety Intera Achieva Multiva	Leakage current (system input)	On site	Mandatory (Safety)	value (mA)	< 11 mA	All	5	n.a.	n.a.	n.a.
Refrigerator system HC-8E1	Check for leaks	On site	Mandatory	Pass/Fail	Pass	10K Magnets only	10	n.a.	10	n.a.
Magnet System	Check helium vent pipe bolts	On site	Mandatory	Pass/Fail	Pass	All	n.a.	n.a.	5	n.a.
Magnet System	Installation of the ERBU-button cover + label	On Site	Mandatory	Exchanged Yes / No	Yes	All ERDU buttons installed from 2004	30	30	30	30
I/T display	Ceiling carriage	On site	Mandatory	Pass/Fail	Pass	I/T display only	10	n.a.	10	n.a.
I/T display	Ceiling carriage limit stops	On site	Mandatory (Safety)	Pass/Fail	Pass	I/T display only	10	n.a.	10	n.a.
I/T display	Functional checks	On site	Mandatory	Pass/Fail	Pass	I/T display only	10	n.a.	10	n.a.
AD5 SA Tilt I/T table	Quick functional check	On site	Mandatory	Pass/Fail	Pass	AD5 SA Tilt I/T table	5	n.a.	5	n.a.
AD5 SA Tilt I/T table	Mechanical check	On site	Mandatory (Safety)	Pass/Fail	Pass	AD5 SA Tilt I/T table	10	n.a.	10	n.a.
AD5 SA Tilt I/T table	Cleaning and lubrication	On site	Mandatory	Pass/Fail	Pass	AD5 SA Tilt I/T table	10	n.a.	10	n.a.
AD5 SA Tilt I/T table	Electrical checks	On site	Mandatory (Safety)	Pass/Fail	Pass	AD5 SA Tilt I/T table	5	n.a.	5	n.a.

AD5 SA Tilt I/T table	Pivot	On site	Mandatory	Pass/Fail	Pass	AD5 SA Tilt I/T table	10	n.a.	10	n.a.
AD5 SA Tilt I/T table	Functional check	On site	Mandatory	Pass/Fail	Pass	AD5 SA Tilt I/T table	5	n.a.	5	n.a.
-	Put back Covers - Exam Room	On site	Workflow Step	-	-	All	20	n.a.	20	n.a.
Patient Support MT	Check the tabletop release button	On site	Mandatory (Safety)	Pass/Fail	Pass	All	2	n.a.	2	n.a.
Patient Support MT	Check patient comfort lights	On site	Mandatory	Pass/Fail	Pass	All	5	5	5	5
Patient Support MT	Check emergency stop circuit	On site	Mandatory (Safety)	Pass/Fail	Pass	All	1	1	1	1
Patient Support MT	Check emergency stop button AM3	On site	Mandatory (Safety)	Pass/Fail	Pass	AM3 only	1	1	1	1
Patient Support MT	Test stop function finger protection plate	On site	Mandatory (Safety)	Pass/Fail	Pass	All	1	1	1	1
Patient Support MT	Check the table top manual function	On site	Mandatory	Pass/Fail	Pass	All	2	n.a.	2	n.a.
Patient Support MT	Check the patient alarm	On site	Mandatory (Safety)	Pass/Fail	Pass	All	3	3	3	3
Operator Console & Viewing	Check the audio communication	On site	Optional	-	-	All	10	10	10	10
System level	RF Tube operating hours estimation	On site	Mandatory	value (hours) (IPA tube)	≤ 18000 hours (IPA tube)	S23 only	5	5	5	5
				value (hours) (PA tube 1)	≤ 18000 hours (PA tube 1)					
				value (hours) (PA tube 2)	≤ 18000 hours (PA tube 2)					
-	Turn on Gradient and RF Amplifier	On site	Workflow Step	-	-	All	1	1	1	1
System measurements & Adjustments 1.5T	PFEI peripheral test	On site	Mandatory	Pass/Fail	Pass	All	1	1	1	1
System measurements & Adjustments 3.0T										
System measurements & Adjustments 3.0T	Check bodycoil transmit characteristics	On Site	Mandatory (Safety)	Pass/Fail	Pass	3.0T single-transmit systems only	10	10	10	10
System measurements & Adjustments 1.5T	Check VSWR	On site	Mandatory	Pass/Fail	Pass	All	n.a.	4	n.a.	4
System measurements & Adjustments 3.0T										
System measurements & Adjustments 3.0T	RF amp controlloop calibration	On site	Mandatory	Pass/Fail	Pass	3T Solid Sate RF amplifiers only	n.a.	2	n.a.	2
System measurements & Adjustments 1.5T	RF amp TX1 PMU test body coil	On site	Mandatory (Safety)	Pass/Fail	Pass	All	7	7	7	7
System measurements & Adjustments 3.0T										
System measurements & Adjustments 3.0T	RF amp TX2 PMU test body coil	On site	Mandatory (Safety)	Pass/Fail	Pass	Multitransmit only	7	7	7	7
System measurements & Adjustments 1.5T	Max kW calibration body coil	On site	Mandatory	Pass/Fail	Pass	All	n.a.	1	n.a.	1
System measurements & Adjustments 3.0T										
System measurements & Adjustments 3.0T	MN RF amp PMU test	On site	Mandatory (Safety)	Pass/Fail	Pass	Multi nuclei only	7	7	7	7
System measurements & Adjustments 3.0T	MN max KW calibration	On site	Mandatory	Pass/Fail	Pass	Multi nuclei only	n.a.	1	n.a.	1
System measurements & Adjustments 3.0T	Multitransmit RF calibration	On site	Mandatory	Pass/Fail	Pass	Multitransmit only	n.a.	5	n.a.	5
System measurements & Adjustments 1.5T	F0 determination	On site	Mandatory	Pass/Fail	Pass	All	n.a.	2	n.a.	2
System measurements & Adjustments 3.0T										
System measurements & Adjustments 1.5T	RF power ref. cal. Body coil	On site	Mandatory	Pass/Fail	Pass	All	n.a.	1	n.a.	1
System measurements & Adjustments 3.0T										

System measurements & Adjustments 1.5T	Pickup coil tripl.cal.body coil	On site	Mandatory	Pass/Fail	Pass	All	n.a.	1	n.a.	1
System measurements & Adjustments 3.0T										
System measurements & Adjustments 3.0T	Max kW calibration TR-Head coil	On site	Mandatory	Pass/Fail	Pass	Option for 3.0T only	n.a.	5	n.a.	5
System measurements & Adjustments 3.0T	RF power ref. cal. TR-Head coil	On site	Mandatory	Pass/Fail	Pass	Option for 3.0T only	n.a.	3	n.a.	3
System measurements & Adjustments 3.0T	Pickup coil tr.cal TR-Head coil	On site	Mandatory	Pass/Fail	Pass	Option for 3.0T only	n.a.	2	n.a.	2
System measurements & Adjustments 1.5T	Max kW calibration H-Head coil	On site	Mandatory	Pass/Fail	Pass	Option for 1.5T only	n.a.	5	n.a.	5
System measurements & Adjustments 1.5T	RF power ref. cal. H-Head coil	On site	Mandatory	Pass/Fail	Pass	Option for 1.5T only	n.a.	5	n.a.	5
System measurements & Adjustments 3.0T	Max kW calibration TR-Knee coil	On site	Mandatory	Pass/Fail	Pass	Option for 3.0T only	n.a.	5	n.a.	5
System measurements & Adjustments 3.0T	RF power ref. cal. TR-Knee coil	On site	Mandatory	Pass/Fail	Pass	Option for 3.0T only	n.a.	5	n.a.	5
System measurements & Adjustments 3.0T	Pickup coil tr.cal TR-Knee coil	On site	Mandatory	Pass/Fail	Pass	Option for 3.0T only	n.a.	2	n.a.	2
System measurements & Adjustments 1.5T	Spurious noise test batch	On site	Mandatory	Pass/Fail	Pass	All	n.a.	15	n.a.	15
System measurements & Adjustments 3.0T										
Patient Support MT	Check patient support cooling fans	On site	Mandatory	Pass/Fail	Pass	All	10	n.a.	10	n.a.
Patient Support MT	Cleaning of grease pollution	On site	Mandatory	Pass/Fail	Pass	All	10	n.a.	10	n.a.
Patient Support MT	Trolley wheels inspection	On site	Mandatory	Pass/Fail	Pass	Trolley option only	5	n.a.	5	n.a.
System measurements & Adjustments 1.5T	LCC pressure sensors overview	On site	Mandatory	Pass/Fail	Pass	LCC, LCC2, LCC2A, LCC2B only	2	2	2	2
System measurements & Adjustments 3.0T										
System level	Dust filter CDAS	On site	Mandatory	Clean - Filter Reused	Clean - Filter Reused	All	5	n.a.	5	n.a.
				Clean - Filter Cleaned	Clean - Filter Cleaned					
				Clean - Filter Replaced	Clean - Filter Replaced					
				Intermediate - Filter Reused						
				Intermediate - Filter Cleaned	Intermediate - Filter Cleaned					
				Intermediate - Filter Replaced	Intermediate - Filter Replaced					
				Dirty - Filter Reused						
				Dirty - Filter Cleaned						
				Dirty - Filter Replaced	Dirty - Filter Replaced					
System level	Dust filter and fan RF amplifier	On site	Mandatory	Pass/Fail	Pass	S23 and S26B only	2	n.a.	2	n.a.
System level	Dust filter PVU	On site	Mandatory	Clean - Filter Reused	Clean - Filter Reused	PVU only	2	2	2	2
				Clean - Filter Cleaned	Clean - Filter Cleaned					
				Clean - Filter Replaced	Clean - Filter Replaced					
				Intermediate - Filter Reused						
				Intermediate - Filter Cleaned						
				Intermediate - Filter Replaced	Intermediate - Filter Replaced					
				Dirty - Filter Reused						
				Dirty - Filter Cleaned						
				Dirty - Filter Replaced	Dirty - Filter Replaced					
System level	External Reconstructor Cleaning	On site	Mandatory	Pass/Fail	Pass	All	5	n.a.	n.a.	n.a.

System level	Internal Reconstructor Cleaning	On site	Mandatory	Pass/Fail	Pass	All	n.a.	n.a.	30	n.a.
Liquid cooling Neslab	Check of the primary water hoses	On site	Mandatory	Pass/Fail	Pass	All	3	n.a.	3	n.a.
Liquid cooling Eaton Williams										
Liquid cooling LCC										
Liquid cooling LCC2(A)										
Liquid cooling LCC2B										
Liquid cooling LCC2(A)	Glycol concentration measurement	On site	Mandatory	Low	In Spec	LCC2, LCC2A, LCC2B only	5	n.a.	n.a.	n.a.
Liquid cooling LCC2B				In Spec						
				High						
Liquid cooling Neslab	Glycol concentration measurement	On site	Mandatory	Low	In Spec	Neslab, LCC only	5	n.a.	5	n.a.
Liquid cooling LCC				In Spec						
				High						
Liquid cooling LCC2(A)	Re-pressurize GC and GA cooling loops	On site	Mandatory	Pass/Fail	Pass	LCC2, LCC2A, LCC2B only	25	n.a.	n.a.	n.a.
Liquid cooling LCC2B										
Liquid cooling LCC2(A)	Check fill pressure	On site / Remote monitoring	Mandatory	Pass/Fail	Pass	LCC2, LCC2A, LCC2B only	2	2	2	2
Liquid cooling LCC2B										
Refrigerator system CSW-71	Check pressure of the compressor	On site	Mandatory	Pass/Fail	Pass	All	2	2	2	2
Refrigerator system F-50										
Refrigerator system HC-8E1										
Refrigerator system CSW-71	Check water flow	On site	Mandatory	Pass/Fail	Pass	All	3	3	3	3
Refrigerator system F-50										
Refrigerator system HC-8E1										
Liquid cooling Neslab	Check of the coolant level	On site	Mandatory	Pass/Fail	Pass	Neslab, Eaton Williams, LCC only	5	5	5	5
Liquid cooling Eaton Williams										
Liquid cooling LCC										
Liquid cooling LCC	Cleaning the secondary GC and GA filter.	On site	Mandatory	Pass/Fail	Pass	LCC only	n.a.	n.a.	15	n.a.
Liquid cooling Eaton Williams	Flush gradient coil water cooling system	On site	Mandatory	Pass/Fail	Pass	Eaton Williams, LCC, LCC2, LCC2A, LCC2B only	n.a.	n.a.	60	n.a.
Liquid cooling LCC										
Liquid cooling LCC2(A)										
Liquid cooling LCC2B										
Liquid cooling LCC2(A)	Clean the primary strainer (filter)	On site	Mandatory	Pass/Fail	Pass	LCC2, LCC2A, LCC2B only	15	n.a.	n.a.	n.a.
Liquid cooling LCC2B										
System level	Check gradient airflow circuit	On site	Mandatory (Safety)	Pass/Fail	Pass	All	5	n.a.	n.a.	n.a.
Gradient System 274/271/281	Grad Coil temp sensors detection circuit	On site	Mandatory (Safety)	Pass/Fail	Pass	All	n.a.	5	n.a.	5
Gradient system 78x										
Liquid cooling Neslab	Check of the heat exchanger interlock(s)	On site	Mandatory (Safety)	Pass/Fail	Pass	All	5	n.a.	5	n.a.
Liquid cooling Eaton Williams										
Liquid cooling LCC										

Liquid cooling LCC2(A)										
Liquid cooling LCC2B										
Software	Config. As maintained	On site	Mandatory	Pass/Fail	Pass	if not on PRS	n.a.	15	n.a.	15
Operator Console & Viewing	Monitor calibration	On site	Optional	-	-	All	n.a.	10	n.a.	10
System measurements & Adjustments 1.5T	PIQT	On site	Mandatory (Safety)	Pass/Fail	Pass	All	15	15	15	15
System measurements & Adjustments 3.0T										
Software	Export config MR console	On site	Mandatory	Pass/Fail	Pass	All	5	5	5	5
Software	Back-up MR console	On site	Mandatory	Pass/Fail	Pass	All	n.a.	15	n.a.	15
Operator Console & Viewing	Cleaning the mouse, keyboard and monitor of Host and EWS	On site	Optional	-	-	All	2	2	2	2
-	Pack up tools	On site	Workflow Step	-	-	All	5	5	5	5
-	Check and clean covers	On site	Workflow Step	-	-	All	5	5	5	5
-	Check paperwork / administration	On site	Workflow Step	-	-	All	5	5	5	5
-	Logoff MR Service - Reboot - Logon MRUser - do a quick bottle scan	On site	Workflow Step	-	-	All	10	10	10	10
						total minutes:	559	436	624	466
						total hours:	9,3	7,3	10,4	7,8

2.1 Optimized parallel work flow visit 1: Intera / Achieva

New Sequence #	Critical Path	Parallel Path	Remote	Uncommon Options	Subsystem/Module	Task	Location	Execution	Configuration	Visit 1 [Minutes]
1	3				-	Log in to MR service	On site	Workflow Step	All	3
2	10				System level	Visual inspection	On site	Mandatory	All	10
3	10				System level	Check RF-enclosure	On site	Mandatory	All	10
4	10				Patient Support MT	Check table top for damage and loose glass fibers	On site	Mandatory	All	10
5	15		15		System level	PIQT	On site / Remote	Mandatory (Safety)	All	15
5,1		1			Magnet System	Check seals quench buttons	On site	Mandatory	Not for ERDU buttons with a key	1
5,2		11	11		System level	Check SPT Spec files	On site / Remote	Mandatory	All	11
5,3		5	5		System measurements & Adjustments	Use analyzer	On site / Remote	Mandatory	All	5
5,4	15		15		Refrigerator system	Check cryogenic performance	On site / Remote monitoring	Mandatory	4K Magnets only	15
5,5		10	10		System level	Check site condition (Temp and Humidity)	On site / Remote	Mandatory	All	10
6	5				Patient Support MT	Check patient comfort lights	On site	Mandatory	All	5
7	3				Patient Support MT	Check the patient alarm	On site	Mandatory (Safety)	All	3
8	10				Operator Console & Viewing	Check the audio communication	On site	Optional	All	10
9	5				System level	Check door switch	On site	Mandatory (Safety)	All	5
10	5				Patient Support MT	Test stop scan buttons on the magnet	On site	Mandatory (Safety)	All	5
11	2				Patient Support MT	Test stop function on operator console	On site	Mandatory (Safety)	All	2
12	5				System level	Check gradient airflow circuit	On site	Mandatory (Safety)	All	5
13	2				Patient Support MT	Check the tabletop release button	On site	Mandatory (Safety)	All	2
14	1				Patient Support MT	Check emergency stop circuit	On site	Mandatory (Safety)	All	1
15	1				Patient Support MT	Check emergency stop button AM3	On site	Mandatory (Safety)	AM3 only	1
16	1				Patient Support MT	Test stop function finger protection plate	On site	Mandatory (Safety)	All	1
17	2				Patient Support MT	Check the table top manual function	On site	Mandatory	All	2
18	1				System measurements & Adjustments	PFEI peripheral test	On site	Mandatory	All	1
19	7				System measurements & Adjustments	RF amp TX1 PMU test body coil	On site	Mandatory (Safety)	All	7
19,1		5			System level	Dust filter CDAS	On site	Mandatory	All	5
19,2		2			System level	Dust filter and fan RF amplifier	On site	Mandatory	S23 and S26B only	2
19,3		2			System level	Dust filter PVU	On site	Mandatory	PVU only	2
19,4		5			System level	External Reconstructor Cleaning	On site	Mandatory	All	5
20	7				System measurements & Adjustments 3.0T	RF amp TX2 PMU test body coil	On site	Mandatory (Safety)	Multitransmit only	7
21	7				System measurements & Adjustments 3.0T	MN RF amp PMU test	On site	Mandatory (Safety)	Multi nuclei only	7

22	2		2		Liquid cooling LCC2(A) or LCC2B	Check fill pressure	On site / Remote monitoring	Mandatory	LCC2, LCC2A, LCC2B only	2
23	1				-	Power off the RF amplifier and Gradient	On site	Workflow Step	All	1
24	20				-	Remove covers in Exam Room	On site	Workflow Step	All	20
25	10				System level	Dust filter SFB	On site	Mandatory	SFB dust filter config only	10
26	2				Magnet System	Waterdrain	On site	Mandatory (Safety)	All	2
27	15				Gradient System 274/271/281	Check gradient coil connections	On site	Mandatory (Safety)	All	15
28	15				Electrical safety Intera Achieva Multiva	Earth bonding: Exam Room	On site	Mandatory (Safety)	All	15
29	15				Electrical safety Intera Achieva Multiva	Earth bonding: Tech Room	On site	Mandatory (Safety)		15
30	10				Electrical safety Intera Achieva Multiva	Leakage current (transformer output)	On site	Mandatory (Safety)	gMDU 480V/60Hz only	10
31	5				Electrical safety Intera Achieva Multiva	Leakage current (system input)	On site	Mandatory (Safety)	All	5
32	10				Refrigerator system HC-8E1	Check for leaks	On site	Mandatory	10K Magnets only	10
33				15	I/T display	Mechanical maintenance	On site	Mandatory	I/T display only	15
34				10	I/T display	Ceiling carriage	On site	Mandatory	I/T display only	10
35				10	I/T display	Ceiling carriage limit stops	On site	Mandatory (Safety)	I/T display only	10
36				10	I/T display	Functional checks	On site	Mandatory	I/T display only	10
37				5	AD5 SA Tilt I/T table	Quick functional check	On site	Mandatory	AD5 SA Tilt I/T table	5
38				10	AD5 SA Tilt I/T table	Mechanical check	On site	Mandatory (Safety)	AD5 SA Tilt I/T table	10
39				10	AD5 SA Tilt I/T table	Cleaning and lubrication	On site	Mandatory	AD5 SA Tilt I/T table	10
40				5	AD5 SA Tilt I/T table	Electrical checks	On site	Mandatory (Safety)	AD5 SA Tilt I/T table	5
41				10	AD5 SA Tilt I/T table	Pivot	On site	Mandatory	AD5 SA Tilt I/T table	10
42				5	AD5 SA Tilt I/T table	Functional check	On site	Mandatory	AD5 SA Tilt I/T table	5
43	10				Patient Support MT	Check patient support cooling fans	On site	Mandatory	All	10
44	10				Patient Support MT	Cleaning of grease pollution	On site	Mandatory	All	10
45	5				Patient Support MT	Trolley wheels inspection	On site	Mandatory	Trolley option only	5
46	20				-	Put back Covers - Exam Room	On site	Workflow Step	All	20
47	1				-	Turn on Gradient and RF Amplifier	On site	Workflow Step	All	1
50	3				Liquid cooling	Check of the primary water hoses	On site	Mandatory	All	3
51	5				Liquid cooling LCC2(A) or LCC2B	Glycol concentration measurement	On site	Mandatory	LCC2, LCC2A, LCC2B only	5
51,1	0				Liquid cooling	Glycol concentration measurement	On site	Mandatory	Neslab, LCC only	5
52	25				Liquid cooling LCC2(A)	Re-pressurize GC and GA cooling loops	On site	Mandatory	LCC2, LCC2A, LCC2B only	25
53	2				System measurements & Adjustments	LCC pressure sensors overview	On site	Mandatory	LCC, LCC2, LCC2A, LCC2B only	2
54	2				Refrigerator system	Check pressure of the compressor	On site	Mandatory	All	2
55	3				Refrigerator system	Check water flow	On site	Mandatory	All	3
56	5				Liquid cooling	Check of the coolant level	On site	Mandatory	Neslab, Eaton Williams, LCC only	5
57	15				Liquid cooling LCC2(A) or LCC2B	Clean the primary strainer (filter)	On site	Mandatory	LCC2, LCC2A, LCC2B only	15
58	5				Liquid cooling	Check of the heat exchanger interlock(s)	On site	Mandatory (Safety)	All	5
59	5				Software	Export config MR console	On site	Mandatory	All	5
62	5				System level	RF Tube operating hours estimation	On site	Mandatory	S23 only	5
63	1				Software	Clean up disks	On site	Mandatory	All	1

64	2				Software	Disk defragmentation	On site	Mandatory	Windows XP only	2
65	10				-	Logoff MR Service - Reboot - Logon MRUser - do a quick bottle scan	On site	Workflow Step	All	10
65,1		2			Operator Console & Viewing	Cleaning the mouse, keyboard and monitor of Host and EWS	On site	Optional	All	2
65,2		5			-	Check and clean covers	On site	Workflow Step	All	5
66	15				System measurements & Adjustments 1.5T / 3.0T	PIQT	On site	Mandatory (Safety)	All	15
66,1		5			-	Pack up tools	On site	Workflow Step	All	5
67	5				-	Check paperwork / administration	On site	Workflow Step	All	5
total minutes:	**386**	**53**	58	90						534
total hours:	6,4		5,5							8,9

2.2 Optimized parallel work flow visit 2: Intera / Achieva 1.5T

Original Sequence #	New Sequence #	Critical Path	Parallel Path	Remote	Uncommon Options	Subsystem/Module	Task	Location	Execution	Configuration	Visit 2 [Minutes]
1	1	3				-	Log in to MR service	On site	Workflow Step	All	3
2	2	10				System level	Visual inspection	On site	Mandatory	All	10
5	3	10				System level	Check RF-enclosure	On site	Mandatory	All	10
8	4	10				Patient Support MT	Check table top for damage and loose glass fibers	On site	Mandatory	All	10
12	5	15		15		System level	PIQT	On site / Remote	Mandatory (Safety)	All	15
6	5,1		1			Magnet System	Check seals quench buttons	On site	Mandatory	Not for ERDU buttons with a key	1
9	5,2		11	11		System level	Check SPT Spec files	On site / Remote	Mandatory	All	11
13	5,3		5	5		System measurements & Adjustments	Use analyzer	On site / Remote	Mandatory	All	5
15	5,4	15		15		Refrigerator system	Check cryogenic performance	On site / Remote monitoring	Mandatory	4K Magnets only	15
14	5,5			0		Refrigerator system HC-8E1	Check boil off	On site / Remote monitoring	Mandatory	10K Magnets only	10
16	5,6		10	10		System level	Check site condition (Temp and Humidity)	On site / Remote	Mandatory	All	10
3	6	15				System level	Check RF coils	On site	Mandatory (Safety)	All	15
4	7	5				System level	Check -5V PS FEPSU	On site	Mandatory	All	5
10	8	5				Patient Support MT	Test stop scan buttons on the magnet	On site	Mandatory (Safety)	All	5
11	9	2				Patient Support MT	Test stop function on operator console	On site	Mandatory (Safety)	All	2
22	10	5				Gradient System 274/271/281	Door interlocks Gradient amplifier	On site	Mandatory (Safety)	274 / 271 / 281	5
50	11	5				Gradient System	Grad Coil temp sensors detection circuit	On site	Mandatory (Safety)	All	5
26	12	5				Patient Support MT	Check patient comfort lights	On site	Mandatory	All	5
27	13	1				Patient Support MT	Check emergency stop circuit	On site	Mandatory (Safety)	All	1
28	14	1				Patient Support MT	Check emergency stop button AM3	On site	Mandatory (Safety)	AM3 only	1
29	15	1				Patient Support MT	Test stop function finger protection plate	On site	Mandatory (Safety)	All	1
30	16	3				Patient Support MT	Check the patient alarm	On site	Mandatory (Safety)	All	3
43	17	15				System measurements & Adjustments	Spurious noise test batch	On site	Mandatory	All	15
17	17,1		5			System level	Dust filter BE-misc box	On site	Mandatory	All	5
18	17,2		5			System level	External Host Computer Cleaning	On site	Mandatory	All	5
19	17,3				2	System level	Internal cleaning External MO drive	On site	Mandatory	MO drive option only	2
31	18	10				Operator Console & Viewing	Check the audio communication	On site	Optional	All	10
32	19	5				System level	RF Tube operating hours estimation	On site	Mandatory	S23 only	5
34	20	1				System measurements & Adjustments	PFEI peripheral test	On site	Mandatory	All	1

35	21	4				System measurements & Adjustments	Check VSWR	On site	Mandatory	All	4
36	22	7				System measurements & Adjustments	RF amp TX1 PMU test body coil	On site	Mandatory (Safety)	All	7
45	22,1		2			System level	Dust filter PVU	On site	Mandatory	PVU only	2
47	22,2		2			Refrigerator system	Check pressure of the compressor	On site	Mandatory	All	2
48	22,3		3			Refrigerator system	Check water flow	On site	Mandatory	All	3
37	24	1				System measurements & Adjustments	Max kW calibration body coil	On site	Mandatory	All	1
38	25	2				System measurements & Adjustments	F0 determination	On site	Mandatory	All	2
39	26	1				System measurements & Adjustments	RF power ref. cal. Body coil	On site	Mandatory	All	1
40	27	1				System measurements & Adjustments	Pickup coil tripl.cal.body coil	On site	Mandatory	All	1
41	28	0			5	System measurements & Adjustments 1.5T	Max kW calibration H-Head coil	On site	Mandatory	Option for 1.5T only	5
42	29	0			5	System measurements & Adjustments 1.5T	RF power ref. cal. H-Head coil	On site	Mandatory	Option for 1.5T only	5
20	30	1				Software	Clean up disks	On site	Mandatory	All	1
21	31	2				Software	Disk defragmentation	On site	Mandatory	Windows XP only	2
24	32	1				-	Power off the RF amplifier and Gradient	On site	Workflow Step	All	1
25	33	10				System level	Dust filter SFB	On site	Mandatory	SFB dust filter config only	10
23	34	2				Gradient System 274/271/281	Dust filter and fan gradient system	On site	Mandatory	274 / 271 / 281	2
33	35	1				-	Turn on Gradient and RF Amplifier	On site	Workflow Step	All	1
49	36	5				Liquid cooling	Check of the coolant level	On site	Mandatory	Neslab, Eaton Williams, LCC only	5
44	37	2				System measurements & Adjustments	LCC pressure sensors overview	On site	Mandatory	LCC, LCC2, LCC2A, LCC2B only	2
46	37,1		2	2		Liquid cooling LCC2(A) or LCC2B	Check fill pressure	On site / Remote monitoring	Mandatory	LCC2, LCC2A, LCC2B only	2
51	38	15				Software	Config. As maintained	On site	Mandatory	if not on PRS	15
54	39	5				Software	Export config MR console	On site	Mandatory	All	5
55	40	15				Software	Back-up MR console	On site	Mandatory	All	15
7	40,1		15			Magnet System	Check helium vent pipe outlet	On site	Mandatory (Safety)	All	15
60	41	10				-	Logoff MR Service - Reboot - Logon MRUser - do a quick bottle scan	On site	Workflow Step	All	10
56	41,1		2			Operator Console & Viewing	Cleaning the mouse, keyboard and monitor of Host and EWS	On site	Optional	All	2
53	42	15				System measurements & Adjustments	PIQT	On site	Mandatory (Safety)	All	15
52	42,1		10			Operator Console & Viewing	Monitor calibration	On site	Optional	All	10
58	43	5				-	Check and clean covers	On site	Workflow Step	All	5
57	44		5			-	Pack up tools	On site	Workflow Step	All	5
59	45	5				-	Check paperwork / administration	On site	Workflow Step	All	5
	total minutes:	**252**	**78**	**58**	**12**						352
	total hours:	4,2		3,2							5,9

2.3 Optimized parallel work flow visit 2: Intera / Achieva 3.0T

Original Sequence #	New Sequence #	Critical Path	Parallel Path	Remote	Uncommon Options	Subsystem/Module	Task	Location	Execution	Configuration	Visit 2 [Minutes]
1	1	3				-	Log in to MR service	On site	Workflow Step	All	3
2	2	10				System level	Visual inspection	On site	Mandatory	All	10
5	3	10				System level	Check RF-enclosure	On site	Mandatory	All	10
8	4	10				Patient Support MT	Check table top for damage and loose glass fibers	On site	Mandatory	All	10
12	5	15				System level	PIQT	On site / Remote	Mandatory (Safety)	All	15
6	5,1		1			Magnet System	Check seals quench buttons	On site	Mandatory	Not for ERDU buttons with a key	1
9	5,2		11	11		System level	Check SPT Spec files	On site / Remote	Mandatory	All	11
13	5,3		5	5		System measurements & Adjustments	Use analyzer	On site / Remote	Mandatory	All	5
15	5,4	15		15		Refrigerator system	Check cryogenic performance	On site / Remote monitoring	Mandatory	4K Magnets only	15
14	5,5			0		Refrigerator system HC-8E1	Check boil off	On site / Remote monitoring	Mandatory	10K Magnets only	10
16	5,6		10	10		System level	Check site condition (Temp and Humidity)	On site / Remote	Mandatory	All	10
3	6	15				System level	Check RF coils	On site	Mandatory (Safety)	All	15
4	7	5				System level	Check -5V PS FEPSU	On site	Mandatory	All	5
10	8	5				Patient Support MT	Test stop scan buttons on the magnet	On site	Mandatory (Safety)	All	5
11	9	2				Patient Support MT	Test stop function on operator console	On site	Mandatory (Safety)	All	2
22	10	5				Gradient System 274/271/281	Door interlocks Gradient amplifier	On site	Mandatory (Safety)	274 / 271 / 281	5
59	11	5				Gradient System	Grad Coil temp sensors detection circuit	On site	Mandatory (Safety)	All	5
26	12	5				Patient Support MT	Check patient comfort lights	On site	Mandatory	All	5
27	13	1				Patient Support MT	Check emergency stop circuit	On site	Mandatory (Safety)	All	1
28	14	1				Patient Support MT	Check emergency stop button AM3	On site	Mandatory (Safety)	AM3 only	1
29	15	1				Patient Support MT	Test stop function finger protection plate	On site	Mandatory (Safety)	All	1
30	16	3				Patient Support MT	Check the patient alarm	On site	Mandatory (Safety)	All	3
52	17	15				System measurements & Adjustments	Spurious noise test batch	On site	Mandatory	All	15
17	17,1		5			System level	Dust filter BE-misc box	On site	Mandatory	All	5
18	17,2		5			System level	External Host Computer Cleaning	On site	Mandatory	All	5
19	17,3				2	System level	Internal cleaning External MO drive	On site	Mandatory	MO drive option only	2
31	18	10				Operator Console & Viewing	Check the audio communication	On site	Optional	All	10
32	19	5				System level	RF Tube operating hours estimation	On site	Mandatory	S23 only	5
34	20	1				System measurements & Adjustments	PFEI peripheral test	On site	Mandatory	All	1

35	21	4				System measurements & Adjustments	Check VSWR	On site	Mandatory	All	4
36	22	2				System measurements & Adjustments 3.0T	RF amp controlloop calibration	On site	Mandatory	3T Solid Sate RF amplifiers only	2
37	23	7				System measurements & Adjustments	RF amp TX1 PMU test body coil	On site	Mandatory (Safety)	All	7
54	23,1		2			System level	Dust filter PVU	On site	Mandatory	PVU only	2
56	23,2		2			Refrigerator system	Check pressure of the compressor	On site	Mandatory	All	2
57	23,3		3			Refrigerator system	Check water flow	On site	Mandatory	All	3
38	24	7				System measurements & Adjustments 3.0T	RF amp TX2 PMU test body coil	On site	Mandatory (Safety)	Multitransmit only	7
39	25	1				System measurements & Adjustments	Max kW calibration body coil	On site	Mandatory	All	1
40	26				7	System measurements & Adjustments 3.0T	MN RF amp PMU test	On site	Mandatory (Safety)	Multi nuclei only	7
41	27				1	System measurements & Adjustments 3.0T	MN max KW calibration	On site	Mandatory	Multi nuclei only	1
42	28	5				System measurements & Adjustments 3.0T	Multitransmit RF calibration	On site	Mandatory	Multitransmit only	5
43	29	2				System measurements & Adjustments	F0 determination	On site	Mandatory	All	2
44	30	1				System measurements & Adjustments	RF power ref. cal. Body coil	On site	Mandatory	All	1
45	31	1				System measurements & Adjustments	Pickup coil tripl.cal.body coil	On site	Mandatory	All	1
46	32	5				System measurements & Adjustments 3.0T	Max kW calibration TR-Head coil	On site	Mandatory	Option for 3.0T only	5
47	33	3				System measurements & Adjustments 3.0T	RF power ref. cal. TR-Head coil	On site	Mandatory	Option for 3.0T only	3
48	34	2				System measurements & Adjustments 3.0T	Pickup coil tr.cal TR-Head coil	On site	Mandatory	Option for 3.0T only	2
49	35	5				System measurements & Adjustments 3.0T	Max kW calibration TR-Knee coil	On site	Mandatory	Option for 3.0T only	5
50	36	5				System measurements & Adjustments 3.0T	RF power ref. cal. TR-Knee coil	On site	Mandatory	Option for 3.0T only	5
51	37	2				System measurements & Adjustments 3.0T	Pickup coil tr.cal TR-Knee coil	On site	Mandatory	Option for 3.0T only	2
20	38	1				Software	Clean up disks	On site	Mandatory	All	1
21	39	2				Software	Disk defragmentation	On site	Mandatory	Windows XP only	2
24	40	1				-	Power off the RF amplifier and Gradient	On site	Workflow Step	All	1
23	41	2				Gradient System 274/271/281	Dust filter and fan gradient system	On site	Mandatory	274 / 271 / 281	2
25	42	10				System level	Dust filter SFB	On site	Mandatory	SFB dust filter config only	10
33	43	1				-	Turn on Gradient and RF Amplifier	On site	Workflow Step	All	1
58	44	5				Liquid cooling	Check of the coolant level	On site	Mandatory	Neslab, Eaton Williams, LCC only	5
53	45	2				System measurements & Adjustments	LCC pressure sensors overview	On site	Mandatory	LCC, LCC2, LCC2A, LCC2B only	2
55	45,1			2		Liquid cooling LCC2(A) or LCC2B	Check fill pressure	On site / Remote monitoring	Mandatory	LCC2, LCC2A, LCC2B only	2
60	46	15				Software	Config. As maintained	On site	Mandatory	if not on PRS	15
63	47	5				Software	Export config MR console	On site	Mandatory	All	5

64	48	15				Software	Back-up MR console	On site	Mandatory	All	15
7	48,1		15			Magnet System	Check helium vent pipe outlet	On site	Mandatory (Safety)	All	15
69	49	10				-	Logoff MR Service - Reboot - Logon MRUser - do a quick bottle scan	On site	Workflow Step	All	10
65	49,1		2			Operator Console & Viewing	Cleaning the mouse, keyboard and monitor of Host and EWS	On site	Optional	All	2
62	50	15				System measurements & Adjustments	PIQT	On site	Mandatory (Safety)	All	15
61	50,1		10			Operator Console & Viewing	Monitor calibration	On site	Optional	All	10
67	51	5				-	Check and clean covers	On site	Workflow Step	All	5
66	52		5			-	Pack up tools	On site	Workflow Step	All	5
68	53	5				-	Check paperwork / administration	On site	Workflow Step	All	5
	total minutes:	**288**	**76**	**43**	**10**						386
	total hours:	4,8		4,1							6,4

2.4 Optimized parallel work flow visit 3: Intera / Achieva

Original Sequence #	New Sequence #	Critical Path	Parallel Path	Remote	Uncommon Options	Subsystem/Module	Task	Location	Execution	Configuration	Visit 3 [Minutes]
1	1	3				-	Log in to MR service	On site	Workflow Step	All	3
2	2	10				System level	Visual inspection	On site	Mandatory	All	10
3	3	10				System level	Check RF-enclosure	On site	Mandatory	All	10
5	4	10				Patient Support MT	Check table top for damage and loose glass fibers	On site	Mandatory	All	10
10	5	15				System level	PIQT	On site / Remote	Mandatory (Safety)	All	15
4	5,1	1	1			Magnet System	Check seals quench buttons	On site	Mandatory	Not for ERDU buttons with a key	1
6	5,2		11	11		System level	Check SPT Spec files	On site / Remote	Mandatory	All	11
11	5,3		5	5		System measurements & Adjustments	Use analyzer	On site / Remote	Mandatory	All	5
12	5,4	15		15		Refrigerator system	Check cryogenic performance	On site / Remote monitoring	Mandatory	4K Magnets only	15
13	5,6		10	10		System level	Check site condition (Temp and Humidity)	On site / Remote	Mandatory	All	10
38	6	5				Patient Support MT	Check patient comfort lights	On site	Mandatory	All	5
43	7	3				Patient Support MT	Check the patient alarm	On site	Mandatory (Safety)	All	3
44	8	10				Operator Console & Viewing	Check the audio communication	On site	Optional	All	10
7	9	5				System level	Check door switch	On site	Mandatory (Safety)	All	5
8	10	5				Patient Support MT	Test stop scan buttons on the magnet	On site	Mandatory (Safety)	All	5
9	11	2				Patient Support MT	Test stop function on operator console	On site	Mandatory (Safety)	All	2
67	12	5				Liquid cooling	Check of the heat exchanger interlock(s)	On site	Mandatory (Safety)	All	5
37	13	2				Patient Support MT	Check the tabletop release button	On site	Mandatory (Safety)	All	2
39	14	1				Patient Support MT	Check emergency stop circuit	On site	Mandatory (Safety)	All	1
40	15	1				Patient Support MT	Check emergency stop button AM3	On site	Mandatory (Safety)	AM3 only	1
41	16	1				Patient Support MT	Test stop function finger protection plate	On site	Mandatory (Safety)	All	1
42	17	2				Patient Support MT	Check the table top manual function	On site	Mandatory	All	2
47	18	1				System measurements & Adjustments	PFEI peripheral test	On site	Mandatory	All	1
48	19	7				System measurements & Adjustments	RF amp TX1 PMU test body coil	On site	Mandatory (Safety)	All	7
55	19,1		5			System level	Dust filter CDAS	On site	Mandatory	All	5
56	19,2		2			System level	Dust filter and fan RF amplifier	On site	Mandatory	S23 and S26B only	2
57	19,3		2			System level	Dust filter PVU	On site	Mandatory	PVU only	2
49	20	7				System measurements & Adjustments 3.0T	RF amp TX2 PMU test body coil	On site	Mandatory (Safety)	Multitransmit only	7
50	21				7	System measurements & Adjustments 3.0T	MN RF amp PMU test	On site	Mandatory (Safety)	Multi nuclei only	7

61	22	2		2		Liquid cooling LCC2(A) or LCC2B	Check fill pressure	On site / Remote monitoring	Mandatory	LCC2, LCC2A, LCC2B only	2
16	23	1				-	Power off the RF amplifier and Gradient	On site	Workflow Step	All	1
17	24	20				-	Remove covers in Exam Room	On site	Workflow Step	All	20
18	25	45				System level	Check for dust in hybrid box and QBC	On site	Mandatory	All	45
19	26	10				System level	Dust filter SFB	On site	Mandatory	SFB dust filter config only	10
20	27	2				Magnet System	Waterdrain	On site	Mandatory (Safety)	All	2
21	28	15				Gradient System 274/271/281	Check gradient coil connections	On site	Mandatory (Safety)	All	15
22	29	5				Magnet System	ERDU - Magnet Field On	On site	Mandatory (Safety)	All	5
23	30	5				Magnet System	Check DPS	On site	Mandatory (Safety)	4K only	5
24	31	10				Refrigerator system HC-8E1	Check for leaks	On site	Mandatory	10K Magnets only	10
25	32	5				Magnet System	Check helium vent pipe bolts	On site	Mandatory	All	5
26	33				15	I/T display	Mechanical maintenance	On site	Mandatory	I/T display only	15
27	34				10	I/T display	Ceiling carriage	On site	Mandatory	I/T display only	10
28	35				10	I/T display	Ceiling carriage limit stops	On site	Mandatory (Safety)	I/T display only	10
29	36				10	I/T display	Functional checks	On site	Mandatory	I/T display only	10
30	37				5	AD5 SA Tilt I/T table	Quick functional check	On site	Mandatory	AD5 SA Tilt I/T table	5
31	38				10	AD5 SA Tilt I/T table	Mechanical check	On site	Mandatory (Safety)	AD5 SA Tilt I/T table	10
32	39				10	AD5 SA Tilt I/T table	Cleaning and lubrication	On site	Mandatory	AD5 SA Tilt I/T table	10
33	40				5	AD5 SA Tilt I/T table	Electrical checks	On site	Mandatory (Safety)	AD5 SA Tilt I/T table	5
34	41				10	AD5 SA Tilt I/T table	Pivot	On site	Mandatory	AD5 SA Tilt I/T table	10
35	42				5	AD5 SA Tilt I/T table	Functional check	On site	Mandatory	AD5 SA Tilt I/T table	5
51	43	10				Patient Support MT	Check patient support cooling fans	On site	Mandatory	All	10
52	44	10				Patient Support MT	Cleaning of grease pollution	On site	Mandatory	All	10
65	45	15				Liquid cooling LCC	Cleaning the secondary GC and GA filter	On site	Mandatory	LCC only	15
66	46	60				Liquid cooling	Flush gradient coil water cooling system	On site	Mandatory	Eaton Williams, LCC, LCC2, LCC2A, LCC2B only	60
59	46,1		3			Liquid cooling	Check of the primary water hoses	On site	Mandatory	All	3
62	46,2		2			Refrigerator system	Check pressure of the compressor	On site	Mandatory	All	2
63	46,3		3			Refrigerator system	Check water flow	On site	Mandatory	All	3
69	46,4		5			Software	Export config MR console	On site	Mandatory	All	5
64	47	5				Liquid cooling	Check of the coolant level	On site	Mandatory	Neslab, Eaton Williams, LCC only	5
60	48	5				Liquid cooling	Glycol concentration measurement	On site	Mandatory	Neslab, LCC only	5
36	49	20				-	Put back Covers - Exam Room	On site	Workflow Step	All	20
58	50	30				System level	Internal Reconstructor Cleaning	On site	Mandatory	All	30
14	50,1		1			Software	Clean up disks	On site	Mandatory	All	1
15	50,2		2			Software	Disk defragmentation	On site	Mandatory	Windows XP only	2
46	51	1				-	Turn on Gradient and RF Amplifier	On site	Workflow Step	All	1
45	52	5				System level	RF Tube operating hours estimation	On site	Mandatory	S23 only	5
54	53	2				System measurements & Adjustments	LCC pressure sensors overview	On site	Mandatory	LCC, LCC2, LCC2A, LCC2B only	2

74	54	10				-	Logoff MR Service - Reboot - Logon MRUser - do a quick bottle scan	On site	Workflow Step	All	10
70	55	2				Operator Console & Viewing	Cleaning the mouse, keyboard and monitor of Host and EWS	On site	Optional	All	2
68	56	15				System measurements & Adjustments	PIQT	On site	Mandatory (Safety)	All	15
53	56,1		5			Patient Support MT	Trolley wheels inspection	On site	Mandatory	Trolley option only	5
72	57	5				-	Check and clean covers	On site	Workflow Step	All	5
71	58		5			-	Pack up tools	On site	Workflow Step	All	5
73	59	5				-	Check paperwork / administration	On site	Workflow Step	All	5
	total minutes:	**441**	**62**	**43**	**97**						599
	total hours:	7,4		6,6							10,0

2.5 Optimized parallel work flow visit 4: Intera / Achieva 1.5T

Original Sequence #	New Sequence #	Critical Path	Parallel Path	Remote	Uncommon Options	Subsystem/Module	Task	Location	Execution	Configuration	Visit 4 [Minutes]
1	1	3				-	Log in to MR service	On site	Workflow Step	All	3
2	2	10				System level	Visual inspection	On site	Mandatory	All	10
5	3	10				System level	Check RF-enclosure	On site	Mandatory	All	10
8	4	10				Patient Support MT	Check table top for damage and loose glass fibers	On site	Mandatory	All	10
12	5	15				System level	PIQT	On site / Remote	Mandatory (Safety)	All	15
6	5,1		1			Magnet System	Check seals quench buttons	On site	Mandatory	Not for ERDU buttons with a key	1
9	5,2		11	11		System level	Check SPT Spec files	On site / Remote	Mandatory	All	11
13	5,3		5	5		System measurements & Adjustments	Use analyzer	On site / Remote	Mandatory	All	5
15	5,4	15		15		Refrigerator system	Check cryogenic performance	On site / Remote monitoring	Mandatory	4K Magnets only	15
14	5,5		0	0		Refrigerator system HC-8E1	Check boil off	On site / Remote monitoring	Mandatory	10K Magnets only	10
17	5,6		10	10		System level	Check site condition (Temp and Humidity)	On site / Remote	Mandatory	All	10
3	6	15				System level	Check RF coils	On site	Mandatory (Safety)	All	15
4	7	5				System level	Check -5V PS FEPSU	On site	Mandatory	All	5
10	8	5				Patient Support MT	Test stop scan buttons on the magnet	On site	Mandatory (Safety)	All	5
11	9	2				Patient Support MT	Test stop function on operator console	On site	Mandatory (Safety)	All	2
24	10	5				Gradient System 274/271/281	Door interlocks Gradient amplifier	On site	Mandatory (Safety)	274 / 271 / 281	5
52	11	5				Gradient System	Grad Coil temp sensors detection circuit	On site	Mandatory (Safety)	All	5
28	12	5				Patient Support MT	Check patient comfort lights	On site	Mandatory	All	5
29	13	1				Patient Support MT	Check emergency stop circuit	On site	Mandatory (Safety)	All	1
30	14	1				Patient Support MT	Check emergency stop button AM3	On site	Mandatory (Safety)	AM3 only	1
31	15	1				Patient Support MT	Test stop function finger protection plate	On site	Mandatory (Safety)	All	1
32	16	3				Patient Support MT	Check the patient alarm	On site	Mandatory (Safety)	All	3
45	17	15				System measurements & Adjustments	Spurious noise test batch	On site	Mandatory	All	15
18	17,1		5			System level	Dust filter BE-misc box	On site	Mandatory	All	5
20	17,2				2	System level	Internal cleaning External MO drive	On site	Mandatory	MO drive option only	2
33	18	10				Operator Console & Viewing	Check the audio communication	On site	Optional	All	10
34	19	5				System level	RF Tube operating hours estimation	On site	Mandatory	S23 only	5
36	20	1				System measurements & Adjustments	PFEI peripheral test	On site	Mandatory	All	1

37	21	4				System measurements & Adjustments	Check VSWR	On site	Mandatory	All	4
38	22	7				System measurements & Adjustments	RF amp TX1 PMU test body coil	On site	Mandatory (Safety)	All	7
47	22,1		2			System level	Dust filter PVU	On site	Mandatory	PVU only	2
49	22,2		2			Refrigerator system	Check pressure of the compressor	On site	Mandatory	All	2
50	22,3		3			Refrigerator system	Check water flow	On site	Mandatory	All	3
39	24	1				System measurements & Adjustments 1.5T	Max kW calibration body coil	On site	Mandatory	All	1
40	25	2				System measurements & Adjustments	F0 determination	On site	Mandatory	All	2
41	26	1				System measurements & Adjustments	RF power ref. cal. Body coil	On site	Mandatory	All	1
42	27	1				System measurements & Adjustments	Pickup coil tripl.cal.body coil	On site	Mandatory	All	1
43	28				5	System measurements & Adjustments 1.5T	Max kW calibration H-Head coil	On site	Mandatory	Option for 1.5T only	5
44	29				5	System measurements & Adjustments 1.5T	RF power ref. cal. H-Head coil	On site	Mandatory	Option for 1.5T only	5
22	30	1				Software	Clean up disks	On site	Mandatory	All	1
23	31	2				Software	Disk defragmentation	On site	Mandatory	Windows XP only	2
26	32	1				-	Power off the RF amplifier and Gradient	On site	Workflow Step	All	1
27	33	10				System level	Dust filter SFB	On site	Mandatory	SFB dust filter config only	10
25	34	2				Gradient System 274/271/281	Dust filter and fan gradient system	On site	Mandatory	274 / 271 / 281	2
35	35	1				-	Turn on Gradient and RF Amplifier	On site	Workflow Step	All	1
51	36	5				Liquid cooling	Check of the coolant level	On site	Mandatory	Neslab, Eaton Williams, LCC only	5
46	37	2				System measurements & Adjustments	LCC pressure sensors overview	On site	Mandatory	LCC, LCC2, LCC2A, LCC2B only	2
48	37,1		2	2		Liquid cooling	Check fill pressure	On site / Remote monitoring	Mandatory	LCC2, LCC2A, LCC2B only	2
53	38	15				Software	Config. As maintained	On site	Mandatory	if not on PRS	15
56	39	5				Software	Export config MR console	On site	Mandatory	All	5
57	40	15				Software	Back-up MR console	On site	Mandatory	All	15
7	40,1		15			Magnet System	Check helium vent pipe outlet	On site	Mandatory (Safety)	All	15
21	41	5				System level	Internal DVD-PC cleaning	On site	Mandatory	DVD PC option only	5
62	42	10				-	Logoff MR Service - Reboot - Logon MRUser - do a quick bottle scan	On site	Workflow Step	All	10
19	43	30				System level	Internal Host Computer Cleaning	On site	Mandatory	All	30
58	43,1		2			Operator Console & Viewing	Cleaning the mouse, keyboard and monitor of Host and EWS	On site	Optional	All	2
55	44	15				System measurements & Adjustments	PIQT	On site	Mandatory (Safety)	All	15
54	44,1		10			Operator Console & Viewing	Monitor calibration	On site	Optional	All	10
60	45	5				-	Check and clean covers	On site	Workflow Step	All	5
59	46		5			-	Pack up tools	On site	Workflow Step	All	5
61	47	5				-	Check paperwork / administration	On site	Workflow Step	All	5
	total minutes:	**287**	**73**	**43**	**12**						382
	total hours:	4,8		4,1							6,4

2.6 Optimized parallel work flow visit 4: Intera / Achieva 3.0T

Original Sequence #	New Sequence #	Critical Path	Parallel Path	Remote	Uncommon Options	Subsystem/Module	Task	Location	Execution	Configuration	Visit 4 [Minutes]
1	1	3				-	Log in to MR service	On site	Workflow Step	All	3
2	2	10				System level	Visual inspection	On site	Mandatory	All	10
5	3	10				System level	Check RF-enclosure	On site	Mandatory	All	10
8	4	10				Patient Support MT	Check table top for damage and loose glass fibers	On site	Mandatory	All	10
12	5	15				System level	PIQT	On site / Remote	Mandatory (Safety)	All	15
6	5,1		1			Magnet System	Check seals quench buttons	On site	Mandatory	Not for ERDU buttons with a key	1
9	5,2		11	11		System level	Check SPT Spec files	On site / Remote	Mandatory	All	11
13	5,3		5	5		System measurements & Adjustments	Use analyzer	On site / Remote	Mandatory	All	5
15	5,4	15		15		Refrigerator system	Check cryogenic performance	On site / Remote monitoring	Mandatory	4K Magnets only	15
14	5,5		0	0		Refrigerator system HC-8E1	Check boil off	On site / Remote monitoring	Mandatory	10K Magnets only	10
17	5,6		10	10		System level	Check site condition (Temp and Humidity)	On site / Remote	Mandatory	All	10
3	6	15				System level	Check RF coils	On site	Mandatory (Safety)	All	15
4	7	5				System level	Check -5V PS FEPSU	On site	Mandatory	All	5
10	8	5				Patient Support MT	Test stop scan buttons on the magnet	On site	Mandatory (Safety)	All	5
11	9	2				Patient Support MT	Test stop function on operator console	On site	Mandatory (Safety)	All	2
24	10	5				Gradient System 274/271/281	Door interlocks Gradient amplifier	On site	Mandatory (Safety)	274 / 271 / 281	5
61	11	5				Gradient System	Grad Coil temp sensors detection circuit	On site	Mandatory (Safety)	All	5
28	12	5				Patient Support MT	Check patient comfort lights	On site	Mandatory	All	5
29	13	1				Patient Support MT	Check emergency stop circuit	On site	Mandatory (Safety)	All	1
30	14	1				Patient Support MT	Check emergency stop button AM3	On site	Mandatory (Safety)	AM3 only	1
31	15	1				Patient Support MT	Test stop function finger protection plate	On site	Mandatory (Safety)	All	1
32	16	3				Patient Support MT	Check the patient alarm	On site	Mandatory (Safety)	All	3
54	17	15				System measurements & Adjustments	Spurious noise test batch	On site	Mandatory	All	15
18	17,1		5			System level	Dust filter BE-misc box	On site	Mandatory	All	5
20	17,2				2	System level	Internal cleaning External MO drive	On site	Mandatory	MO drive option only	2
33	18	10				Operator Console & Viewing	Check the audio communication	On site	Optional	All	10
34	19	5				System level	RF Tube operating hours estimation	On site	Mandatory	S23 only	5
36	20	1				System measurements & Adjustments	PFEI peripheral test	On site	Mandatory	All	1
37	21	4				System measurements & Adjustments	Check VSWR	On site	Mandatory	All	4

38	22	2				System measurements & Adjustments 3.0T	RF amp controlloop calibration	On site	Mandatory	3T Solid Sate RF amplifiers only	2
39	23	7				System measurements & Adjustments	RF amp TX1 PMU test body coil	On site	Mandatory (Safety)	All	7
56	23,1		2			System level	Dust filter PVU	On site	Mandatory	PVU only	2
58	23,2		2			Refrigerator system	Check pressure of the compressor	On site	Mandatory	All	2
59	23,3		3			Refrigerator system	Check water flow	On site	Mandatory	All	3
40	24	7				System measurements & Adjustments 3.0T	RF amp TX2 PMU test body coil	On site	Mandatory (Safety)	Multitransmit only	7
41	25	1				System measurements & Adjustments 1.5T	Max kW calibration body coil	On site	Mandatory	All	1
42	26				7	System measurements & Adjustments 3.0T	MN RF amp PMU test	On site	Mandatory (Safety)	Multi nuclei only	7
43	27				1	System measurements & Adjustments 3.0T	MN max KW calibration	On site	Mandatory	Multi nuclei only	1
44	28	5				System measurements & Adjustments 3.0T	Multitransmit RF calibration	On site	Mandatory	Multitransmit only	5
45	29	2				System measurements & Adjustments	F0 determination	On site	Mandatory	All	2
46	30	1				System measurements & Adjustments	RF power ref. cal. Body coil	On site	Mandatory	All	1
47	31	1				System measurements & Adjustments	Pickup coil tripl.cal.body coil	On site	Mandatory	All	1
48	32	5				System measurements & Adjustments 3.0T	Max kW calibration TR-Head coil	On site	Mandatory	Option for 3.0T only	5
49	33	3				System measurements & Adjustments 3.0T	RF power ref. cal. TR-Head coil	On site	Mandatory	Option for 3.0T only	3
50	34	2				System measurements & Adjustments 3.0T	Pickup coil tr.cal TR-Head coil	On site	Mandatory	Option for 3.0T only	2
51	35	5				System measurements & Adjustments 3.0T	Max kW calibration TR-Knee coil	On site	Mandatory	Option for 3.0T only	5
52	36	5				System measurements & Adjustments 3.0T	RF power ref. cal. TR-Knee coil	On site	Mandatory	Option for 3.0T only	5
53	37	2				System measurements & Adjustments 3.0T	Pickup coil tr.cal TR-Knee coil	On site	Mandatory	Option for 3.0T only	2
22	38	1				Software	Clean up disks	On site	Mandatory	All	1
23	39	2				Software	Disk defragmentation	On site	Mandatory	Windows XP only	2
26	40	1				-	Power off the RF amplifier and Gradient	On site	Workflow Step	All	1
25	41	2				Gradient System 274/271/281	Dust filter and fan gradient system	On site	Mandatory	274 / 271 / 281	2
27	42	10				System level	Dust filter SFB	On site	Mandatory	SFB dust filter config only	10
35	43	1				-	Turn on Gradient and RF Amplifier	On site	Workflow Step	All	1
60	44	5				Liquid cooling	Check of the coolant level	On site	Mandatory	Neslab, Eaton Williams, LCC only	5
55	45	2				System measurements & Adjustments	LCC pressure sensors overview	On site	Mandatory	LCC, LCC2, LCC2A, LCC2B only	2
57	45,1			2		Liquid cooling	Check fill pressure	On site / Remote monitoring	Mandatory	LCC2, LCC2A, LCC2B only	2
62	46	15				Software	Config. As maintained	On site	Mandatory	if not on PRS	15
65	47	5				Software	Export config MR console	On site	Mandatory	All	5
66	48	15				Software	Back-up MR console	On site	Mandatory	All	15

7	48,1		15			Magnet System	Check helium vent pipe outlet	On site	Mandatory (Safety)	All	15
21	49	5				System level	Internal DVD-PC cleaning	On site	Mandatory	DVD PC option only	5
71	50	10				-	Logoff MR Service - Reboot - Logon MRUser - do a quick bottle scan	On site	Workflow Step	All	10
19	51	30				System level	Internal Host Computer Cleaning	On site	Mandatory	All	30
67	51,1		2			Operator Console & Viewing	Cleaning the mouse, keyboard and monitor of Host and EWS	On site	Optional	All	2
64	52	15				System measurements & Adjustments	PIQT	On site	Mandatory (Safety)	All	15
63	52,1		10			Operator Console & Viewing	Monitor calibration	On site	Optional	All	10
69	53	5				-	Check and clean covers	On site	Workflow Step	All	5
68	54		5			-	Pack up tools	On site	Workflow Step	All	5
70	55	5				-	Check paperwork / administration	On site	Workflow Step	All	5
	total minutes:	**323**	**71**	**43**	**10**						416
	total hours:	5,4		4,7							6,9