

CTB Information

Title				Beam Quality Guidelines for High Energy Clinac Systems			
DWG Number		100044339		CTB		GE-681	
Complaint No.		N/A		Est. Labor Hrs		N/A	
Purpose		Provide guidelines to perform various beam quality tests after completion of service repair work.					
Product Code(s) Affected		Product Code: H14, H27, H29, HCX, H08, H81, H54, H56, HEC Product Name: High Energy Clinac, OBI, PV, MLC, ICVI					
Prerequisites		None					
AN UPDATE TO THIS CTB MAY BE AVAILABLE ON MY.VARIAN.COM							

Tools Information

Tools and Equip	N/A
Reference Documents	CP-12459 PNL-FSN: Unexpected 6MV Beam Output Variation (available at myvarian.com)
Modification Overview	This document is provided for information purposes only.

Order Kit Information

Order Number	Description
100044339-01	N/A
Order From:	<input type="checkbox"/> CSS Logistics <input type="checkbox"/> MY.VARIAN.COM <input checked="" type="checkbox"/> Not Applicable

Revision Information

REV	DATE	AUTHOR NAME	DESCRIPTION OF CHANGE	FILE NAME
O	16 Oct 2018	Jeff Taylor	Table 1: Added checkmark for "Verify Output vs Gantry Rotation" test requirement for "Ion Chamber Removal/Reinstallation (same chamber)" row per CP-2018- 03452.	CTB-GE-681-O.docx
N	12 Apr 2018	Jeff Taylor	Page 3: Added WARNING note. Page 6: Added new Note 10. Table 1: Clarified Yield Monitor energies. Table 2: Added new rows 2.8 & 2.9 and related columns for isocenter adjustments. Table 3: Added NOTE 10 to rows 3.8 - 3.10. Added new row 3.12 for ICVI Mount. Table 4: Minor text edit in row 3 and column 5 for clarity.	CTB-GE-681-N.docx

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GENERAL INFORMATION

Read this entire document, carefully reviewing all instructions.

PERFORMANCE CHECK

Complete a thorough performance verification before disassembling and modifying any system. Make a note of any operational discrepancies.

SAFETY PROCEDURES

Become familiar with Customer Support Service's safety policies before working on Oncology Systems Products. Ensure compliance with CSS's safety practices and procedures while performing this modification. Refer to the Product Users' Manual for safety instructions.

CONTACT INFORMATION

If there are any questions, issues, or concerns contact Varian at 1.888.VARIAN.5 (1.888.827.4265) or go to <http://my.varian.com> and click on **Contact Us**.

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1. CUSTOMER DOCUMENTATION

This document and the latest version of the instructions for user are available for download at <https://my.varian.com>.

This CTB includes new information not available in other Varian documents. Please advise the appropriate personnel working in your radiotherapy department of the content of this CTB and place a copy of this CTB with the user manuals for the affected Varian Product.



Note

This document is not all-inclusive and beam quality tests may also be required for other part replacements, alignments, adjustments and upgrades that are not listed.

It is the responsibility of all Varian LINAC users to understand and practice these guidelines.



WARNING

The Integrated Collimator Verification and Interlock (ICVI) beam quality guidelines (listed in Table 3) are critical to safety.



CAUTION

It is the responsibility of the person performing maintenance to notify the department responsible person when performing any of the following adjustments that could affect patient treatment:

- Any adjustment or repair listed in the following tables that require beam verification (light field vs. X-ray coincidence, beam energy, beam symmetry, or dosimetry calibration)
- Light field, crosshair or rangefinder adjustments
- Patient setup adjustments (lasers, position readouts, front pointers, etc.)
- Accessory adjustments or replacements (wedges, applicators, accessory mount, etc.)
- MLC leaf alignments
- OBI or CBCT Image calibration or E-arm mechanical realignment



CAUTION

Test requirements preceded with the term **[QA]** are standard beam quality assurance checks to ensure patient safety. The customer is ultimately responsible for all QA tests and accepts the responsibility to perform the required QA tests before resuming patient treatments.

BEAM RULES TO REMEMBER

- **ALWAYS** request assistance with beam alignment when in doubt or not properly trained.
- **ALWAYS** investigate beam quality (energy, symmetry & flatness) when dose cal shifts of > 2% occur. Refer to CP-12459 PNL-FSN: Unexpected 6MV Beam Output Variations if the dose cal shifts only in the 6MV energy.
- **NEVER** close steering servo switches on B15, B16, B19 or B20 while beamed on in the x-ray modes.
- **NEVER** adjust the Energy Switch with the steering servos closed.
- **NEVER** make large sudden steering pot or balance pot adjustments with the steering servos closed.
- **NEVER** override the following interlocks without authorization from Varian: **VAC1, KSOL, KFIL, HVOC, MOD, CTRL, FLOW** (*FLOW can be overridden for no longer than 30 seconds to measure the klystron filament socket voltage*).
- **ALWAYS** beam on in Clinical Mode (after completing any service work) before leaving site to verify Clinical Mode is operational.
- **ALWAYS** verify beam symmetry and dose calibration if a > 10% **unexplainable** dose rate change occurs in 6MV. This could be an indication of potential target damage and should be investigated per the instructions in CP-12459 PNL-FSN: Unexpected 6MV Beam Output Variation.
- **ALWAYS** verify beam symmetry before initiating auto-calibration on the Steering Interlock (SI) boards.
- **ALWAYS** record the final parameter values after making any adjustments on Program PCBs (excluding small GUN I or RFDR adjustments).
- **ALWAYS** verify correct dose rate tuning after any service or repairs related to beam generation or beam performance.
- **ALWAYS** immediately beam off if any X-ray energy exhibits an unexplainable loss of dose rate. See following NOTICE.

NOTICE

Catastrophic damage can occur to the BMAG if the beam is steered at a severe angle into the walls of the vacuum chamber. A severe angle could result from a large angle steering adjustment, an angle steering circuit failure, or a 'latched' angle servo, and is noticeable due to a very large or complete loss of dose rate. Within a few seconds, the beam could burn a hole through the BMAG vacuum chamber, resulting in a VAC1 interlock. This damage has only occurred in high gun current energies (6 – 10X). There have been no reported cases of damage in 15 – 20X or the electron energies. When troubleshooting severe dose rate problems, turn OFF all four steering servos and troubleshoot in any electron energy (if possible), or reduce the dose rate to RR2 if you have to troubleshoot in a photon energy.

NOTICE

NEVER beam-on when the integrity of the vacuum system is unknown. Severe arcing and RF window damage may occur if RF power is applied into a guide that is not under vacuum.

TABLE NOTES

NOTE 1

Steering current values for BUN R/T, ANG R/T & POS R/T for each energy are displayed in the second column on the *Display> Analog > Machine* screen. These values indicate the amount of current passing through each of the steering coil pairs and are displayed in amperes (e.g., 0.12 = 120 mA). During clinical operation, with the steering servos closed (working), these closed-loop values represent the amount of current required in each coil pair to provide the correct beam trajectory, which results in good beam position and beam angle at the patient plane.

If “known-good” closed-loop steering current values are available (or can be acquired) for each energy before the maintenance, then these values can be used to compare with the final values after the maintenance.

“Known-good” values can be obtained just before the maintenance (preferred method) or from the **FIXED** mode runs on a previous Morning Checkout printout (when the machine was good).

However, the gantry, collimator and jaws must be in the same positions for both the “before” and “after” steering values because different positions will result in different values.

If the steering current values after the maintenance are the same (within ± 0.01) as the ‘known-good’ reference values, then the beam trajectory will be very similar to the original trajectory, and beam symmetry may be within $\pm 2\%$ of the original symmetry. In the following tables, if the **Verify Closed-Loop Steering Current** box is marked and the **Beam Profile Scans Required** box is not marked, it is only necessary for the customer to perform their normal beam quality QA tests. But...

...if ANG R/T or POS R/T steering current values change by > 0.01 , then full beam profile symmetry must be verified and may require adjustment before resuming patient treatment.

...if POS R/T steering current values change by > 0.01 , then Light Field vs. X-ray coincidence must also be verified and may require adjustment before resuming patient treatment.

When observing steering current values, also check the ANG R/T and POS R/T steering current values during gantry rotation to determine if the steering amplifier output current is reaching the pre-programmed current limits at any angle. These current values should slowly and constantly change during gantry rotation when the steering servos are closed (working). If the steering current limit values (listed below) occur at any gantry angle, then the current limit has been reached and steering corrections will cease. If this happens, corrective action is required.

BUN R/T $I_{LIM} = \pm 1.5$ A (all energies)

POS R/T $I_{LIM} = \pm 2.2$ A (all energies)

ANG R $I_{LIM} = \pm 0.25$ A (4X, 6X, 6SRS); ± 0.65 A (8X); ± 1.5 A (10-20X, 4e-16e); ± 2.2 A (18e-22e)

ANG T $I_{LIM} = \pm 0.22$ A (4X); ± 0.35 A (6X, 6SRS); ± 0.65 A (8X); ± 1.00 A (10-20X, 4e-22e)

NOTE 2

Output vs. Gantry rotation is a ‘catch-all’ type test that can identify beam steering and symmetry problems, beam steering current limit issues, EXQ interlocks, and dose rate stability with rotation. If any problems are observed, corrective action is required.

NOTE 3

Beam output energy can be verified via three methods.

1. Depth of ionization (DOI) scans can be run in a water tank.
2. Percent Depth Dose (PDD) checks can be made by the physicist (using a water scanning tank or solid water).
3. Dmax Diagonal “Horn” scans can be run in a water tank or with a beam array device. The flatness of these “horn” scans is much more sensitive to an energy change than a DOI or PDD scan. Horn scans are also a very good test to verify if the DOI or PDD scan results are accurate because any probe depth errors for these scans will significantly affect the results, whereas probe depth is not as critical for horn scans because they are run at Dmax depth.

NOTE 4	<p>Beam profile scans in a water tank are required for the following major repairs:</p> <ul style="list-style-type: none"> • BMAG, or BMAG coil(s) replacement • New energy addition or flattening filter replacement <p>However, a beam array device can be used for all other repairs if all of the following conditions exist:</p> <ul style="list-style-type: none"> • Energy measurements are not required; or will be confirmed via Dmax diagonal profiles; or will be performed with solid water. • The beam array device includes at least 20 ion chambers per plane and can verify large field (≥ 30 cm) and small field (10 cm) beam symmetry (such as the Sun Nuclear IC Profiler). • The beam array device is calibrated and the profile results are confirmed as trustworthy (when using a customer device); or if using a Varian provided Sun Nuclear IC Profiler, reference profiles can be collected before the maintenance and compared to the “after maintenance” profile results. <p>General Rules:</p> <ol style="list-style-type: none"> 1. If using a beam array device and the system is operational, always collect beam reference data with the beam array device before performing the maintenance. 2. If a beam array device is not available, all profiles must be verified after the maintenance using a water tank scanning system.
NOTE 5	<p>When replacing the Accelerator Solenoid power supply, the beam quality will remain unchanged if the following conditions are true. If not true, then adjust the power supply output to make these conditions true.</p> <ul style="list-style-type: none"> • The final SOL I meter value on the <i>Display > Analog > Machine</i> screen matches the original value for each energy within ± 0.5. • The accelerator solenoid coil voltage measurements at Sled Patch Panel TB3 and TB4 (with HiX selected) match the original recorded parameter values within ± 2 V.
NOTE 6	<p>Beam energy will remain unchanged if both of the following conditions are true, and beam energy verification is not required. If not true, then the beam energy must be verified.</p> <ul style="list-style-type: none"> • The final BMAG I or BMAG V meter value on the <i>Display > Analog > Machine</i> screen matches the original value for each energy within ± 0.03 (BMAG I) or ± 0.06 (BMAG V). • The voltage drop across BMAG fuses F1 and F2 (with HiX selected) match the original recorded parameter value within ± 0.05 V.
NOTE 7	<p>When replacing a failed Beam Position Servo PCB or cardrack Program PCB, accurately set all pots to original board values (via voltage measurements or pot resistance measurements).</p>
NOTE 8	<p>When replacing Beam Position Servo PCBs (not resulting from an energy change upgrade), verify that the values for R38, R47, R48 & R49 match the original PCB resistor values.</p>
NOTE 9	<p>This test only applies to the B15 Symmetry Monitor & Dose Rate Integrator PCB. If replacing B16, it is only necessary to adjust the linearity pot so the MU2 count does not ramp up.</p> <ul style="list-style-type: none"> • Linearity pot R38 will affect all standard energies, so dose reproducibility vs. dose rate should be checked in both standard photon energies, and the low and high electron energies. • Linearity pot R89 only affects the FFF energy so dose reproducibility vs. dose rate should be checked in the FFF energy only. <p>Refer to the machine acceptance documents for linearity specifications.</p>
NOTE 10	<p>Any adjustments to the interface mount rear retainer or accessory mount latches could affect the tilt of the electron applicators. Therefore, beam symmetry for the electron energies must be checked, unless the applicator tilt changed < 1 mm.</p>

Table 1: Beam Quality Guidelines for Part Replacements & Alignments – High Energy Clinac

<p>This table provides the minimum test requirements, in sequential order, that are required after completing a specific maintenance task.</p> <p>Tests with the QA icon are standard quality assurance tests (per AAPM guidelines). The customer is ultimately responsible for all QA tests. These tests can be performed with the assistance of the Varian service representative, or the customer can elect to perform these tests on their own.</p> <p>If a Varian Customer Support Representative (CSR) was involved with these repairs, then that CSR is required to enter the following comment in the work order / FSR to define the customer's responsibilities.</p> <p>“Completed necessary beam quality tests and alignments per TT-GE-00668, and informed customer to perform required beam QA tests per CTB-GE-681 before starting treatments.”</p> <p>Varian employees are not authorized to adjust the dose calibration potentiometer (MU1) without customer approval and guidance.</p>																	Verify Unserved Dose Rate		Verify Beam Steering Apertures (for Buncher & Position steering)	Verify Closed-Loop Steering Current Values (ANG R/T & POS R/T) NOTE 1	Verify Output vs. Gantry Rotation NOTE 2	QA Verify Light Field Alignment	QA Verify Light Field vs. X-ray Coincidence	QA Verify Beam Energy NOTE 3	Verify Servo Calibration (servo-cal)	QA Verify Beam Symmetry NOTE 4 (Customer QA device or 2-pt. check)	QA Beam Profile Scans Required (large field and 10 x 10 cm field) NOTE 4	Steering Interlock PCB Auto-Cal (required if ANG or POS Balance pots adjusted)	Run PMP Clinical Test Patient (Morning Checkout can be used if PMP is NA)	QA Verify Dose Calibration	Establish Yield Monitor Baseline (6X/6XSRS/6XFFF)	QA Verify Winston-Lutz Accuracy (FBIa option only)
1.1	Guide Replacement	●	●		●			●			●	●	●	●	●	●	●															
1.2	BMAG Replacement or Mechanical Alignment	●	●		●			●			●	●	●	●	●	●	●															
1.3	Target Replacement (requirements for photons only)	●						●			●	●	●	●	●	●																
1.4	Target Realignment (requirements for photons only)	●						●			●	●	●	●	●																	
1.5	Electron Gun Replacement	●		●	●					●			●	●	●																	
1.6	Energy Switch Replacement (requirements for LoX only)	●	●		●			●			●	●	●	●	●	●																
1.7	Energy Switch Realignment (> 5 lines on dial) (LoX only)	●		●	●					●			●	●	●	●																
1.8	Accelerator Solenoid Alignment or Phase Config Change	●	●		●			●			●	●	●	●	●	●																
1.9	Accelerator Solenoid P/S Replacement NOTE 5	●		●						●			●	●	●																	
1.10	BMAG P/S or BMAG Cable Replacement NOTE 6	●		●				●		●			●	●	●																	
1.11	BMAG Coil Replacement or BMAG Field Strip	●			●			●			●	●	●	●	●	●																
1.12	3-IN-1 P/S Replacement NOTE 5 & 6	●		●				●		●			●	●	●																	
1.13	New Energy Addition (requirements for new energy only)	●	●		●			●	●		●	●	●	●	●																	
1.14	Ion Chamber Removal/Reinstallation (same chamber)	●		●	●						●	●	●	●	●	●																
1.15	Ion Chamber Replacement	●		●	●				●		●	●	●	●	●	●																
1.16	Ion Chamber Coax Cable Replacement	●		●	●						●	●	●	●	●	●																

Table 2: Beam Quality Guidelines for Part Replacements & Alignments – High Energy Clinac (continued)

<p>This table provides the minimum test requirements, in sequential order, that are required after completing a specific maintenance task.</p> <p>Tests with the QA icon are standard quality assurance tests (per AAPM guidelines). The customer is ultimately responsible for all QA tests. These tests can be performed with the assistance of the Varian service representative, or the customer can elect to perform these tests on their own.</p> <p>If a Varian Customer Support Representative (CSR) was involved with these repairs, then that CSR is required to enter the following comment in the work order / FSR to define the customer's responsibilities.</p> <p>“Completed necessary beam quality tests and alignments per TT-GE-00668, and informed customer to perform required beam QA tests per CTB-GE-681 before starting treatments.”</p> <p>Varian employees are not authorized to adjust the dose calibration potentiometer (MU1) without customer approval and guidance.</p>		Verify Unserved Dose Rate	●	●	Verify Closed-Loop Steering Current Values (ANG R/T & POS R/T) NOTE 1	Verify Output vs. Gantry Rotation NOTE 2	Verify Wall Laser Alignment	Verify Couch LAT and LNG PROs	Calibrate Axis PRO and Verify PRO/SPRO Displayed Raw Scale Values are Opposite Polarity	QA Verify Beam Energy NOTE 3	QA Verify Beam Symmetry NOTE 4 (Customer QA device or 2-pt. check)	QA Beam Profile Scans Required (large field and 10 x 10 cm field) NOTE 4	Steering Interlock PCB Auto-Cal (required if ANG or POS Balance pots adjusted)	Run PMP Clinical Test Patient (Morning Checkout can be used if PMP is NA)	Verify IsoCal (PV and OBI if option installed)	QA Verify Winston-Lutz Accuracy (FBIa option only)	QA Verify Dose Calibration	
		2.1	15V Console P/S or ±15V P/S Fuse Replacement (refer to STB-CN-236)	●	●	●						●			●			●
		2.2	Klystron or Klystron Solenoid Replacement	●											●			●
		2.3	Gun High Voltage Adjustment (> 10% change)	●											●			●
		2.4	Foil/ Filter Installation or Realignment	●			●				●		●		●			●
		2.5	Carousel Pin Replacement or Realignment	●	●		●					●			●			●
		2.6	Gantry Head Tilt Realignment	●						●			●		●	●	●	●
		2.7	PRO or SPRO Potentiometer or Readout Harness Replacement							●								
		2.8	Stand Isocenter Realignment						●								●	●
		2.9	Couch Turntable Isocenter Realignment						●								●	●

Table 3: Beam Quality Guidelines for Collimator Part Replacements & Alignments – High Energy Clinac

<p>This table provides the minimum test requirements, in sequential order, that are required after completing a specific maintenance task.</p> <p>Tests with the QA icon are standard quality assurance tests (per AAPM guidelines). The customer is ultimately responsible for all QA tests. These tests can be performed with the assistance of the Varian service representative, or the customer can elect to perform these tests on their own.</p> <p>If a Varian Customer Support Representative (CSR) was involved with these repairs, then that CSR is required to enter the following comment in the work order / FSR to define the customer's responsibilities.</p> <p>“Completed necessary beam quality tests and alignments per TT-GE-00668, and informed customer to perform required beam QA tests per CTB-GE-681 before starting treatments.”</p> <p>Varian employees are not authorized to adjust the dose calibration potentiometer (MU1) without customer approval and guidance.</p>		QA Verify Light Field Alignment	QA Verify Crosshair Alignment	Verify ICVI Mount Keyed to Interface Mount Clamp Plate	Verify Attachment of ICVI Mount to Interface Mount	Verify Attachment of Accessory Mount to Interface Mount	QA Verify Alignment of ICVI Mount to Collimator Axis	QA Verify Light Field vs. X-ray Coincidence	QA Verify MLC Leaf Alignment (visual check on graph paper only)	QA Verify Jaw PRO Calibration	QA Verify Collimator PRO Calibration	QA Verify Collimator Spoke Shot	QA Verify Beam Symmetry NOTE 4 (Customer QA device or 2-pt. check)	QA Beam Profile Scans Required (large field and 10 x 10 cm field) NOTE 4	Steering Interlock PCB Auto-Cal (required if ANG or POS Balance pots adjusted)	Run PMP Clinical Test Patient (Morning Checkout can be used if PMP is NA)	QA Verify Winston-Lutz Accuracy (FBI/A option only)	QA Verify Dose Calibration
		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3.1	Collimator Replacement	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3.2	Collimator Lift & Reinstallation (same collimator)										●					●	●	●
3.3	Crosshair Replacement or Realignment	●	●						●	●								
3.4	Mirror Removal or Replacement	●	●					●	●							●		
3.5	Light Field Lamp Replacement	●	●															
3.6	Light Field Lamp Realignment	●	●					●	●	●								
3.7	X or Y Jaw Maintenance (that affects jaw tilt or position)									●				●	●			●
3.8	Interface Mount Replacement NOTE 10	●	●	●	●	●	●											
3.9	Interface Mount Retainer Pin Replacement or Adjustment NOTE 10							●	●	●	●	●	●					
3.10	Interface Mount Latch Adjustment NOTE 10							●	●	●	●	●	●					
3.11	Electron Applicator Replacement (applies to e-modes only)																	●
3.12	ICVI Mount Conical Seat Assembly and Shroud/Pillar Assembly Removal or Adjustment													●	●			

Table 4: Beam Quality Guidelines for Printed Circuit Board Replacements – High Energy Clinac

<p>This table provides the minimum test requirements, in sequential order, that are required after completing a specific maintenance task.</p> <p>Tests with the QA icon are standard quality assurance tests (per AAPM guidelines). The customer is ultimately responsible for all QA tests. These tests can be performed with the assistance of the Varian service representative, or the customer can elect to perform these tests on their own.</p> <p>If a Varian Customer Support Representative (CSR) was involved with these repairs, then that CSR is required to enter the following comment in the work order / FSR to define the customer's responsibilities.</p> <p>“Completed necessary beam quality tests and alignments per TT-GE-00668, and informed customer to perform required beam QA tests per CTB-GE-681 before starting treatments.”</p> <p>Varian employees are not authorized to adjust the dose calibration potentiometer (MU1) without customer approval and guidance.</p>	Verify Carousel Port Positioning	Verify Unserved Dose Rate	Verify Servo Calibration (servo-cal) NOTE 7	Verify Servo Loop Gain NOTE 8	Verify Closed-Loop Steering Current Values (ANG R/T & POS R/T) NOTE 1	Verify Output vs. Gantry Rotation NOTE 2	QA Verify Light Field vs. X-ray Coincidence	QA Verify BMAG Values NOTE 6	QA Verify Beam Symmetry NOTE 4 (Customer QA device or 2 pt. check)	QA Beam Profile Scans Required (large field and 10 x 10 cm field) NOTE 4	Steering Interlock PCB Auto-Cal (required if ANG or POS Balance pots adjusted)	Run PMP Clinical Test Patient (Morning Checkout can be used if PMP is NA)	Verify Dose Reproducibility with Dose Rate NOTE 9	QA Verify Dose Calibration	Verify Beam Gating for MLC, PV and RPM Gating
4.1	Beam Position Servo PCB Replacement	●	●	●		●	●			●	●	●		●	
4.2	Symmetry Monitor & Dose Rate Integrator PCB Replacement	●								●	●	●	●	●	
4.3	Steering Interlock PCB Replacement (Angle SI board)	●			●						●	●			
4.4	Steering Interlock PCB Replacement (Position SI board)	●			●		●				●	●			
4.5	Cardrack Program PCB Replacement (with all programming pots set to original PCB values) (applies to affected energy only)	●	●	●	●	●				●	●	●		●	
4.6	PFN Servo PCB Replacement (same type PFN Servo PCB)	●										●			
4.7	Dual Cardrack Backplane PCB Replacement	●			●	●			●			●		●	
4.8	Console Backplane PCB Replacement	●			●	●			●			●		●	
4.9	PWM PCB Replacement (excluding XA4 PWM PCB)	●			●				●			●			
4.10	Auxiliary Electronics Backplane PCB Replacement	●			●			●				●			
4.11	Stand Motherboard PCB Replacement	●										●			
4.12	Carrousel/Mode/BMAG PCB Replacement	●	●		●			●	●			●		●	
4.13	Gun Driver PCB Replacement (any PCB)	●										●			
4.14	Beam Hold Interface PCB or Gating Interface PCB Replacement														●

Table 5: Beam Quality Requirements for Potentiometer Adjustments – High Energy Clinac

<p>This table provides the minimum test requirements, in sequential order, that are required after completing a specific maintenance task.</p> <p>Tests with the QA icon are standard quality assurance tests (per AAPM guidelines). The customer is ultimately responsible for all QA tests. These tests can be performed with the assistance of the Varian service representative, or the customer can elect to perform these tests on their own.</p> <p>If a Varian Customer Support Representative (CSR) was involved with these repairs, then that CSR is required to enter the following comment in the work order / FSR to define the customer's responsibilities.</p> <p>“Completed necessary beam quality tests and alignments per TT-GE-00668, and informed customer to perform required beam QA tests per CTB-GE-681 before starting treatments.”</p> <p>Varian employees are not authorized to adjust the dose calibration potentiometer (MU1) without customer approval and guidance.</p>												Verify Unserved Dose Rate	Verify Closed-Loop Steering Current Values (ANG R/T & POS R/T) NOTE 1	Verify Output vs. Gantry Rotation NOTE 2	QA Verify L/F vs. X-Ray Coincidence	QA Verify Beam Energy NOTE 3	QA Verify Beam Symmetry NOTE 4 (Customer QA device or 2 pt. check)	QA Beam Profile Scans Required (large field and 10 x 10 cm field) NOTE 4	Steering Interlock PCB Auto-Cal (required if ANG or POS Balance pots adjusted)	Verify Dose Reproducibility with Dose Rate NOTE 9	QA Verify Dose Calibration	Establish Yield Monitor Baseline (6X, 6XSRS, 6XFFF)
5.1	GUN I Programming Pot (resulting in > 10% dose rate change)	●				● ¹				●												
5.2	BUN R/T Programming Pots (> 0.5 V change)	●	●																			
5.3	ANG R/T Programming Pots (> 1 V change)	●	●																			
5.4	POS R/T Programming Pots (> 1 V change)	●	●																			
5.5	SOL I Programming Pot (> 5 change on analog meter display)	●	●																			
5.6	ANG R/T BAL Pots (any amount of adjustment)	●	●				●	●														
5.7	POS R/T BAL Pots (any amount of adjustment)	●	●	●			●	●														
5.8	BMAG Programming Pots (> 1% shunt voltage change)	●	●		●		●	●		●	●											
5.9	B15 Symmetry Monitor & Dose Rate Integrator Linearity Pot (R38 or R89)	●							●	●	●											

¹ Beam symmetry verification is only required for the 6MV energy. An unexplainable unserved dose rate change in 6MV could be an early indication of target damage and should be investigated by Varian.

Table 6: Beam Quality Guidelines for MLC Maintenance

This table provides the minimum test requirements, in sequential order, that are required after completing a specific maintenance task.

Tests with the **QA** icon are standard quality assurance tests (per AAPM guidelines). The customer is ultimately responsible for all QA tests. These tests can be performed with the assistance of the Varian service representative, or the customer can elect to perform these tests on their own.

If a Varian Customer Support Representative (CSR) was involved with these repairs, then that CSR is required to enter the following comment in the work order / FSR to define the customer's responsibilities.

“Completed necessary beam quality tests and alignments per TT-GE-00668, and informed customer to perform required beam QA tests per CTB-GE-681 before starting treatments.”

		MLC Initialization Required	Adjust / Optimize IR Beam	Verify Leaf Alignment Files are Restored (V7+ requires SysOffset.txt and *.taln files) (V6.8 requires mlxcval.txt file)	Verify Leaf Touch Test Results (V7+ only) (Perform Leaf Alignment if any leaf reports a minimum or maximum gap > 0.20 mm)	QA Verify Leaf Alignment (V6.8 only) (visual check on graph paper)	Perform Leaf Alignment (with alignment bar) CUSTOMER MUST BE NOTIFIED!	QA Verify Interleaf Leakage (PV imaging analysis can be used)	QA Verify Dosimetric Leaf Gap (DLG) (Customer test if previously measured)
6.1	Leaf Drive Component Replacement (motor, screw, nut)	●							
6.2	Carriage Softpot or Leaf SFB Actuator Replacement	●			●	●			
6.3	MLC Power Supply Adjustments	●			●	●			
6.4	MLC Power Supply Replacement (after setting +5V & +15V motor power)	●			●	●			
6.5	Power Distribution PCB Replacement	●							
6.6	Head Transceiver or Motor Driver PCB Replacement	●							
6.7	LED Emitter or Optical Receiver PCB Replacement	●	●				●		
6.8	Leaf Removal and Cleaning (individual leaves)	●							
6.9	Leaf & Carriage Removal and Cleaning/Lubrication (all leaves and carriage)	●			●				
6.10	Carriage Drive Assembly Replacement	●	●				●		
6.11	MLC Controller Replacement	●			●				
6.12	MLC Workstation Replacement	●		●	●				●
6.13	Leaf Swap (swapping leaves with same leaf type in same carriage)	●			●			●	
6.14	Leaf Replacement with a New Leaf	●			●			●	
6.15	Carriage Removal and Reinstallation	●							
6.16	Carriage Replacement	●					●	●	●

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Table 7: Beam Quality Guidelines for OBI and PV System Maintenance

This table provides the minimum test requirements, in sequential order, that are required after completing a specific maintenance task.

Tests with the **QA** icon are standard quality assurance tests (per AAPM guidelines). The customer is ultimately responsible for all QA tests. These tests can be performed with the assistance of the Varian service representative, or the customer can elect to perform these tests on their own.

If a Varian Customer Support Representative (CSR) was involved with these repairs, then that CSR is required to enter the following comment in the work order / FSR to define the customer's responsibilities.

“Completed necessary beam quality tests and alignments per TT-GE-00668, and informed customer to perform required beam QA tests per CTB-GE-681 before starting treatments.”

	X-ray Tube Alignment	IDU ISO Calibration	QA KVD Imager Center Pixel Alignment Accuracy	OBI Image Calibration	CBCT Image Calibration	PV Image Calibration	QA IsoCal Verification (if IsoCal option is included); otherwise kV or MV Isocenter Verification	Portal Dosimetry Calibration
7.1	X-Ray Tube Replacement	●	●	●	●		●	●
7.2	PaxScan Panel Replacement		●	●	●		●	
7.3	IDU Panel Replacement					●	●	●
7.4	DU Replacement					●		●
7.5	MV/KV Arm Axis PRO Encoder Replacement or Adjustment						●	
7.6	OBI KVS IDU ISO Calibration (changes > 1 mm)		●				●	
7.7	OBI KVD IDU ISO Calibration (changes > 1 mm)		●				●	
7.8	MVD IDU ISO Calibration (changes > 1 mm)						●	

Varian CSR does not perform clinical PD calibration

Bill Of Materials					
			-01	Part Number	Description
			-	-	N/A
				Drawing or Document Number	Other Documents Included
			-	-	N/A



Document Signing Page

This document has been reviewed and electronically signed by the following people:

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