Certificate No.: 146884-06152009

## Summary of Enclosed Documents

R-Tech Dental of Minnesotta
Michael Wiltrout


Your instrument has passed several strict tests and has been approved for delivery. Enclosed you will find detailed documents for your instrument.

## Service Activity:

Upgraded base to ver 5.05 , upgraded external detector to ver 5.03 , Calibrated and Verified

## Recommended calibration interval for this instrument is 12 months that begins on the date of receipt by the customer.

Due to the different transportation methods and local customs (i.e. delivery channel), you may have received an instrument with a calibration certificate that is several weeks old. Our past experience indicates the calibration of this product is not affected by storage prior to its initial receipt by the customer. Important consideration should be given as to when the instrument is put into service and the manufacture recommended calibration interval.

## Arrival Check

## Unfors Xi R/F

R-Tech Dental of Minnesotta
Michael Wiltrout

| Mate of Arrival Check: | $06-15-09$ | Model: | RF |
| :--- | :---: | :--- | :---: |
| Product: | Unfors Xi External Detector | Serial Number: | 146884 |

## Measurement details

| kVp |  | Total Filtration $=2.5 \mathrm{~mm} \mathrm{Al}$ |  |  |
| :---: | :---: | :---: | :---: | :---: |
| RFF Low |  |  |  |  |
| Generator settings |  | Measurements |  |  |
| Set KVp | Set mA | Ref. kVp | XikV | $\begin{gathered} \text { spec. } 2 \% \\ \text { Deviation (\%) } \end{gathered}$ |
| 49 | 100 | 49,6 | 49,9 | 0,7\% |
| 70 | 50 | 70,5 | 71,4 | 1,2\% |
| 99 | 25 | 99,7 | 99,8 | 0,1\% |
| 145 | 25 | 145,7 | 145,9 | 0,1\% |


| Total Filtration $=2.5 \mathrm{~mm} \mathrm{Al}$ |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| R/F High |  |  |  |  |
| Generator settings |  | Measurements |  |  |
| Set kVp | Set mA | Ref. kV p | Xi kVp | $\begin{gathered} \text { spec. } 2 \% \\ \text { Deviation (\%) } \\ \hline \end{gathered}$ |
| 49 | 250 | 49,6 | 49,6 | 0,1\% |
| 70 | 100 | 70,5 | 70,9 | 0,6\% |
| 99 | 32 | 99,7 | 99,3 | -0,4\% |
| 145 | 25 | 145,7 | 146,1 | 0,2\% |


| Dose |  |  | Total Filltration $=2.5 \mathrm{~mm} \mathrm{Al}$ |  |
| :---: | :---: | :---: | :---: | :---: |
| R/F Low |  |  |  |  |
| Generator settings |  | Measurements |  |  |
| Set kVp | Set mAs | Ref. Dose $\mu \mathrm{Gy}$ | $\begin{gathered} \begin{array}{c} \mathrm{Xi}_{\mathrm{i} \text { dose }} \\ \mu G G \end{array} \end{gathered}$ | $\begin{array}{\|c\|} \hline \text { spec. 5\% } \\ \text { Deviation (\%) } \end{array}$ |
| 49 | 32 | 220,4 | 221,8 | 0,7\% |
| 70 | 16 | 237,4 | 238,9 | 0,7\% |
| 99 | 8 | 223,9 | 223,1 | -0,3\% |
| 145 | 8 | 434,5 | 425,0 | -2,2\% |


| Total Filtration $=2.5 \mathrm{~mm} \mathrm{Al}$ |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| R/F High |  |  |  |  |
| Generator settings |  | Measurements |  |  |
| Set kVp | Set mAs | $\begin{gathered} \text { Ref. Dose } \\ \text { HGy } \end{gathered}$ | $\begin{gathered} \begin{array}{c} x_{i} \text { dose } \\ \mu G y \end{array} \end{gathered}$ | $\begin{gathered} \text { spec. } 5 \% \\ \text { Deviation (\%) } \\ \hline \end{gathered}$ |
| 49 | 80 | 7346 | 7366 | 0,3\% |
| 70 | 32 | 6317 | 6313 | -0,1\% |
| 99 | 10 | 3847 | 3800 | -1,2\% |
| 145 | 8 | 5630 | 5478 | -2,7\% |

Time
Total Filltration $=2.5 \mathrm{~mm} \mathrm{Al}$

| RIF High |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Generator settings |  | Measurements |  |  |
| Set kVp | Set ms | $\begin{gathered} \text { Ref. Time } \\ \text { ms } \end{gathered}$ | $\begin{gathered} \hline \text { Xi Time } \\ \mathrm{ms} \end{gathered}$ | spec. 0.5\% <br> Deviation (\%) |
| 70 | 320 | 320,0 | 320,6 | 0,2\% |

## Certificate of Calibration Unfors Xi R/F

R-Tech Dental of Minnesotta
Michael Wiltrout

| Date of Calibration: | $06-15-09$ | Product: | Unfors Xi External Detector |
| :--- | :---: | :--- | :---: |
| Serial Number: | 146884 | Model: | RF |

## Measurement details

| kVp |  | Total Filtration $=2.5 \mathrm{~mm}$ Al |  |  |
| :---: | :---: | :---: | :---: | :---: |
| R/F Low |  |  |  |  |
| Generator settings |  | Measurements |  |  |
| Set KVp | Set mA | Ref. $\mathrm{kV} \mathrm{p}_{\mathrm{p}}$ | XikV | spec. $2 \%$ Deviation (\%) |
| 49 | 100 | 49.3 | 49,2 | -0,3\% |
| 70 | 50 | 70,5 | 70,5 | 0,0\% |
| 99 | 25 | 99,8 | 98,9 | -0,9\% |
| 145 | 25 | 146,0 | 146,4 | 0,2\% |
| Active Compensation |  | Total Filtration $=2.5+10 \mathrm{~mm} \mathrm{Al}$ |  |  |
| 80 | 50 | 80,6 | 81,8 | 1,5\% |


| Total Filtration $=2.5 \mathrm{~mm}$ Al |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| R/F High |  |  |  |  |  |
| Generator settings | Measurements |  |  |  |  |
| Set kVp | Set mA | Ref. kVp | Xi kVp | spec. $2 \%$ <br> Deviation $(\%)$ |  |
| 49 | 250 | 49,3 | 49,6 | $0,4 \%$ |  |
| 70 | 100 | 70,5 | 70,5 | $0,0 \%$ |  |
| 99 | 32 | 99,8 | 99,5 | $-0,3 \%$ |  |
| 145 | 25 | 146,0 | 147,1 | $0,8 \%$ |  |
| Total Filtration $=2.5+10 \mathrm{~mm} \mathrm{Al}$ |  |  |  |  |  |
| Active Compensation |  |  |  |  |  |
| 80 | 64 | 80,6 | 81,2 | $0,8 \%$ |  |



| Total Filtration $=2.5 \mathrm{~mm} \mathrm{Al}$ |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| R/F High |  |  |  |  |
| Generator settings |  | Measurements |  |  |
| Set kVp | Set mAs | $\begin{gathered} \text { Ref. Dose } \\ \text { HGy } \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { Xi dose } \\ \mu \mathrm{Gy} \end{gathered}$ | $\begin{gathered} \text { spec. 5\% } \\ \text { Deviation (\%) } \\ \hline \end{gathered}$ |
| 49 | 80 | 8387 | 8397 | 0,1\% |
| 70 | 32 | 7257 | 7259 | 0,0\% |
| 99 | 10 | 4408 | 4389 | -0,4\% |
| 145 | 8 | 6335 | 6335 | 0,0\% |
| Active Compensation |  | Total Filtration $=2.5+10 \mathrm{~mm} \mathrm{Al}$ |  |  |
| 80 | 20 | 1045 | 1043 | -0,2\% |

HVL

| HVL |  |  | Total Filtration $=2.5 \mathrm{~mm} \mathrm{Al}$ |  |
| :---: | :---: | :---: | :---: | :---: |
| RIFLow |  |  |  |  |
| Generator settings |  | Measurements |  |  |
| Set kVp | Set mAs | Ref. HVL | Xi HVL | $\begin{gathered} \hline \text { spec. 10\% } \\ \text { Deviation (\%) } \\ \hline \end{gathered}$ |
| 70 | 16 | 2,48 | 2,56 | 3,2\% |


| Total Filtration $=2.5 \mathrm{~mm} \mathrm{Al}$ |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | R/F High |
| Generator settings | Measurements |  |  |  |  |  |
| Set kVp | Set mAs | Ref. HVL | Xi HVL | spec. $10 \%$ <br> Deviation (\%) |  |  |
| 70 | 32 | 2,48 | 2,54 | $2,4 \%$ |  |  |

Time

| Total Filtration $=2.5 \mathrm{~mm} \mathrm{Al}$ |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | RIF High |  |
| Generator settings |  | Measurements |  |  |
| Set kVp | Set ms | Ref. Time <br> ms | Xi Time <br> ms | spec. $0.5 \%$ <br> Deviation $(\%)$ |
| 70 | 320 | 321,0 | 320,7 | $-0,1 \%$ |

Certificate No.: 14688406152009

## Calibration Equipment

R-Tech Dental of Minnesota
Michael Without

| Date of Calibrations): | $06-15-09$ | Model: | RF |
| :---: | :---: | :---: | :---: |
| Product: | Unfors Xi External Detector | Serial Number: | 146884 |

The listed equipment below were used as main references for the calibration

|  | RIF | RIF | RIF |  |
| :---: | :---: | :---: | :---: | :---: |
| GENERATOR | CPI INDIGO 100 | Calibration |  |  |
| WAVEFORM TYPE | HF | HDICO 100 |  |  |
| ANODEIFILTER | $W / 2.5 \mathrm{~mm}$ Al | $W / 2.5 \mathrm{~mm} \mathrm{Al}$ |  |  |
| FIELD SIZE | $10 \times 10 \mathrm{~cm}$ | $10 \times 10 \mathrm{~cm}$ |  |  |
| FDR | RFF Low: $200 / 100 \mathrm{~cm}$ <br> R/F High: 50 cm | R/F Low: $200 / 100 \mathrm{~cm}$ <br> R/F High: 50 cm |  |  |



The expanded uncertainties of measurement for the Unfors Xi are:
$2 \%$ for $k \vee p \quad 0.5 \%$ for exposure time $5 \%$ for Dose

## Calibration condition:

The expanded uncertainty is stated as the combined uncertainty of measurement multiplied by the coverage factor $k=2$, which assuming a normal distribution has a coverage probability

Ambient temperature: $22^{\circ} \mathrm{C} \pm 3^{\circ} \mathrm{C}$ Relative humidity: $50 \% \pm 10 \%$

All reference systems are calibrated once a year. $k V$ systems are calibrated by the Swedish National Testing and Research institute and are
traceable to PTB. All dose systems are calibrated by PTB and are traceable to NIST on available beam qualities. NIST does not currently
have traceable dose standards for the W/Rh. Mo/Rh ( 2 mmAl ), Rh/Al and MolAl beam qualities. Unfors instruments certifies the W/Rh, Mo/Rh,
Rh/Al, Rh/Rh and MolAl (if applicable) beam quality measurements, made with this Unfors Xi, to be accurate within its published
Rh/Al, Rh/Rh a
specifications.
Unfors $X i$ is calibrated according to FDA MQSA requirements.
Unfors calibration procedure: "Procedure calibration and verification Xi RF detector" and "Procedure calibration
and verification Xi Mam, MPro, WAI detector" in applicable parts
Tested by: Joe H

Certified by:


UNFORS INSTRUMENTS Inc.
48 Anderson Avenue, Suite 1, New Milford, CT 06776 Phone: (860) 355-2588. FAX: (860) 350-2664 service@unfors.com. www.unfors.com

## Summary of Enclosed Documents

| Product: | Unfors Xi Base Unit w/ mAs |
| :--- | :---: |
| Model: | mAs |
| Serial Number: | 147404 |

mAs Calibration Certificate: $\quad$ Date: $06-15-09$
Calibration Equipment List

R-Tech Dental on Minnesota Michael Wiltrout Calibration Equipment List

Your instrument has passed several strict tests and has been approved for delivery. Enclosed you will find detailed documents for your instrument.

## Service Activity:

Calibrated and verified

Recommended calibration interval for this instrument is 12 months that begins on the date of receipt by the customer.
Due to the different transportation methods and local customs (i.e. delivery channel), you may have received an instrument with a calibration certificate that is several weeks old. Our past experience indicates the calibration of this product is not affected by storage prior to its initial receipt by the customer. Important consideration should be given as to when the instrument is put into service and the manufacture recommended calibration interval.

## Certificate of Calibration

R-Tech Dental on Minnesota
Michael Wiltrout

| Serial number: | 147404 | Product: | Unfors Xi Base Unit w/ mAs |
| :--- | :---: | :--- | :---: |
| Date of calibration: | $6-15-09$ | Model: | mAs |

## Measurement details

| mA |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Nominal Settings |  |  |  |  |  | Measured Data |  |  |
| Current <br> $(\mathrm{mA})$ | Exposure <br> Time (s) | Ref. Current <br> $(\mathrm{mA})$ | Xi Current <br> $(\mathrm{mA})$ | spec. 1.0\% <br> Deviation (\%) |  |  |  |  |
| 1,2 | 6 | 1,2 | 1,2 | $0,7 \%$ |  |  |  |  |
| 20 | 6 | 20,0 | 20,0 | $0,0 \%$ |  |  |  |  |


| mAs. |  |  |
| :---: | :---: | :---: |
|  | Measured Data |  |
| Reference mAs <br> (mAs) | Xi mAs <br> (mAs) | spec. $1.0 \%$ <br> Deviation (\%) |
| 200 | 200,9 | $0,5 \%$ |

## Calibration Equipment

R-Tech Dental on Minnesota
Michael Wiltrout

| Date of calibration: | 6-15-09 | Model: |  |
| :--- | :---: | :--- | :---: |
| Product: | Unfors Xi Base Unit w/ mAs | Serial no: | 147404 |

The listed equipment below were used as main references for the calibration

| eference Equipment |  | Callbration Date |
| :---: | :---: | :---: |
| $\qquad$ | Unfors mAs Box S/N: 114 | 04-21-09 |
| REFERENCE SYSTEM mA | Fluke 189 S/N: 92180049 | 01-08-09 |

The expanded uncertainties of measurement for the Unfors Xi Base Unit w/mAs are:
$0.1 \%$ for $m A s \quad 0.15 \%$ for $m A$

The expanded uncertainty is stated as the combined uncertainty of measurement multiplied by the coverage factork=2, which assuming a normal distribution has a coverage probability of $95 \%$ (Guide to Uncertainty of Measurements, ISO, 1995).

All reference systems are calibrated once a year. The mA system is tested by Fluke and tracable to NIST. The mAs system is tested by Bodycote Metech accredit by SWEDAC.

## Calibration condition:

Ambient temperature: $72^{\circ} \mathrm{F} \pm 3^{\circ} \mathrm{F}$
Relative humidity: $50 \% \pm 10 \%$

Tested by:

Certified by:


UNFORS INSTRUMENTS Inc.

