Duray® V2

DC X-Ray Unit

Instruction For Use

Beyes CANADA

Dear Customer,

thank you for purchasing the Duray V2 intraoral X-ray equipment for dental radiography.

Please, before taking X-rays of patients, get familiar with this radiographic system and follow the operating instructions given and the applicable radiation protection regulations.

Graphic symbols

Caution	Type B applied part	Switch OFF
Notice	Non-ionizing electromagnetic radiation	Switch ON
Follow operating instructions	Small focal spot	System ready
Operating instruction	Inherent filtration	L Mains phase 1 live
Separate Collection, Do Not Dispose	Irradiation light on hand-switch	N Mains neutral
Temperature limitation	Irradiation light on control panel	N* Mains phase 2
Date of manufacture	Exposure release	Protective earth (PE)
Manufacturer	Earth	

Chemical Film	Phosphor plate	Digital sensor
MENU key	Increment	Decrement
kV level selection	Child build	Adult build
Upper Incisor	Upper cuspid/premolar	Upper molar
Occlusal	Premolar crowns	Molar crowns
Lower Incisor	Lower cuspid/premolar	Lower molar

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1. INTRODUCTION

1.1 Foreword

Congratulations

Duray V2, state of the art in the field of dental radiology, is a medical device which will assist you in your profession day after day, performing consistently for many years.

The unit is manufactured under a Quality Control System which grants full compliance to specifications

1.2 General information

Intended use

The medical device Duray V2 is an intraoral X-ray equipment designed to fulfil the needs for high resolution radiography of the dental anatomy structures in order to diagnose and monitor dental diseases or developments in the maxillo-facial regions.

Contraindications

There are no contraindications to the use of the equipment within the intended scope other than those related to exposure of the patient to ionizing radiation, which should be limited to the maximum.

Features

Duray V2 features a power of 490 W radiation power on an extra fine focus size 0.4, allowing to expose at 60 or 70 kV and 7 mA, from 0.01 s to 3.2 s (i.e. 0.07 to 22.4 mAs), according to R20 scale (20 steps each decade). Optional items are the rectangular beam limiting device to size 2 Adult and to size 0 Pedo, and a cone extension to reach 30 cm (12") source-skin distance (SSD).

It is quite important to use an extra fine focus (focal spot) size 0.4 to fully exploit the high resolution features of new imaging detectors, above all when working according to paralleling technique at 20 cm (8") source-skin distance (SSD) with the receptor hold by a position indicating device (PID), situation in which image magnification is introduced.

Useful life

The expected useful life of Duray V2 is exceeding 10 years of normal use and, in this regard, a schedule prospect is provided to monitor the preventive maintenance up to 20 years.

Operator's Skills

To have knowledge of:

- X-ray equipment and radiation protection,
- Radiographic techniques for dental radiology
- Patient management.
- Basic knowledge of English language.

Temperature

The recommended room temperature to be in the range from 10°C to 40 °C (from 50 °F - 104 °F) …

Configuration

The systems Duray V2 are available for wall mounting or as mobile solution.

Installation

The system requires assembly and installation as described in the Service and Installation manual provided.

Trouble free

Use the system only if no malfunction is detected upon use, otherwise put it out of service and call the authorized technician for repair.

Documentation

The accompanying documents supplied with the system include the following documents which are integral parts of the product:

- Duray V2 Operating Instructions
- Duray V2 Service and Installation Manual.

1.3 Equipment Classification

CE

Duray V2 is a Class IIb medical device
(rule 10, annex IX, European Council Directive 93/42/EEC and Directive 2007/47/EC)

IEC

Duray V2 is a Class I equipment (where the accessible parts of metal are protectively earthed), with type B applied part (being it the plastic rim of the x-ray output window on the tube-head).

US FDA

Duray V2 is a Class II medical device equipment (21 CFR 872-1800).

2. SAFETY ASPECTS

2.1 Obligations of the User

It is the responsibility of the User:

Instructions

- To follow instructions and recommendations contained in this Operating Instructions.

Maintenance

- To maintain the equipment in compliance by following the manufacturer's recommended maintenance instructions.
- Neither the inspection nor the service is part of the equipment warranty.

Liability

- Failure to observe the maintenance instructions given relieves the manufacturer or his agent from any responsibility for injury, damage or non-conformities that may derive there from.

Report to Health Authority

- To report promptly to the Health Authority in charge and to the Manufacturer or to its Agent any accident involving this medical device or any alteration in features and/or performances which could cause death, injuries or health hazard to patient and/or operator.
  Important information to be gathered and to be included in the report to the Manufacturer are the type and serial numbers of the involved items which can be retrieved from the technical labels.

2.2 Warning

Proper installation

Risk of malfunction due to wrong installation.

Use the system only after proper assembly and installation as per manufacturer's instructions. Medical electrical equipment need special precautions regarding electromagnetic compatibility (EMC) and need to be installed and put into service according to the EMC information provided.

Proper maintenance

Risk of malfunction due to incorrect maintenance.

For preventive maintenance follow the instructions of the manufacturer.

It is requested not to replace fuses on the unit if defective.

In case of a need to replace the power cord, or to perform other activities related to preventive or corrective maintenance, only qualified and authorized technicians must be involved.

No modifications

Risk of performance degradation.

No modification to this medical device is allowed.

Electrical safety

Risk of electrical shock.

To avoid the risk of electric shock, this equipment must only be connected to a mains supply with protective earth, using a plug only on the mobile version.

Ionizing radiation

Risk of exposure to ionizing radiation.

X-ray equipment produce ionizing radiation that may be harmful if not properly controlled. The equipment must be operated by trained personnel only, in accordance with the existing laws.

Electromagnetic compatibility

Risk of electromagnetic interference.

Use of accessories, transducers and cables other than those specified or provided by Beyes could result in increased electromagnetic emissions or decreased electromagnetic immunity of the Duray V2 and result in improper operation.

In the following table a list of the interface cables of the equipment is provided:

Designation of interface cables	Code
Hand switch spiral cable, 3 m, unshielded	Part of 76 560 20019
Cable folding arm XDC	76 560 90002
3-wire AWG18, shielded (12 m)	Part of 76 560 90003
3-wire AWG18, unshielded (12 m)	Part of 76 560 90003
1-wire AWG13, green yellow (12 m)	Part of 76 560 90003

Use of the Duray V2 adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, the Duray V2 and the other equipment should be observed to verify that they are operating normally. The presence of electromagnetic disturbances may degrade the diagnostic performance of the equipment (e.g. exam interruption, presence of artifacts, etc.). The need of repetition of an X-Ray exam must be justified for each patient in order to demonstrate that the benefits outweigh the risks.

The functionality of implanted systems such as cardiac pacemakers or cochlear implants can be affected by the electromagnetic fields. Make sure that the patient does not have such implants and do not expose unless immunity to electromagnetic fields is granted.

Portable and mobile Radio Frequency communications equipment can affect medical electrical equipment like Duray V2. Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closed than 30 cm (12 inches) to any part of the Duray V2, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.

2.3 Recommendations

Training

Risk of improper use.

The system must be operated only by properly trained personnel.

Ambient

Risk of malfunction.

Do not switch unit on until room temperature is in the normal range.

Hygiene

Risk of infection.

Take proper measures avoid cross-contamination among patients, operators and other persons.

Electrical

Risk of electrical shock.

Trained and qualified service technicians only are authorized to remove covers and have access to power circuits.

Power supply lines must comply with safety legislation and have ground terminals for protective earth connection.

Switch the equipment OFF and disconnect it from line voltage supply (with the room switch) before cleaning or disinfecting the unit.

Dust and liquids

Risk of corrosion.

Enclosures are class IP00 and do not offer protection against dust and liquids.

Mechanical

Risk of break or block of movements.

Check regularly, as per recommended maintenance schedule, the status of supports and arms of the suspension system, in case having necessary maintenance performed by a service technician.

Explosion

Risk of explosion.

The equipment cannot be used in presence of flammable gases or vapours

Radiation

Risk of exposure to ionizing radiation

The statutory radiation protection equipment must be used for patient and operator, and the patient safety during operation has to be ensured by the operator.

The X-ray equipment must not be left unattended.

In case of intensive use of the equipment by the same operator, exceeding the average number of 100 exposures per day, it is recommended the operator to adopt a radiation protection device, such as wearing 0.25 mm lead equivalent apron, or to protect behind a suitable barrier. This not to exceed an additional radiation dose of 1 mSv per year, on top of an absorbed dose of about 3 mSv per year of natural radiation.
For the computation of the amount of scattered and leakage radiation absorbed by the operator at 2 m distance from the patient, outside of the primary beam of radiation, consider that it equals about 1/40000 of the direct radiation at 20 cm.

Environment

Risk of pollution.

The equipment contains components which must be disposed-of following the law.

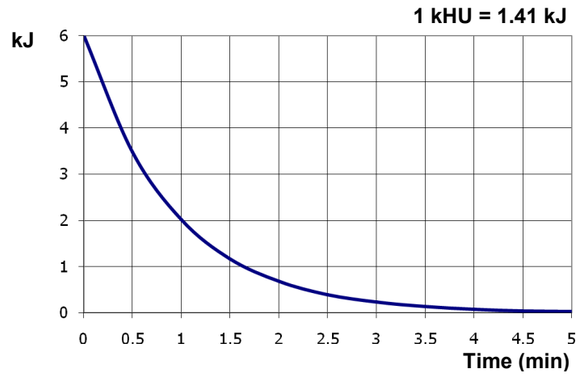
3. TECHNICAL DESCRIPTION

3.1 Technical Data

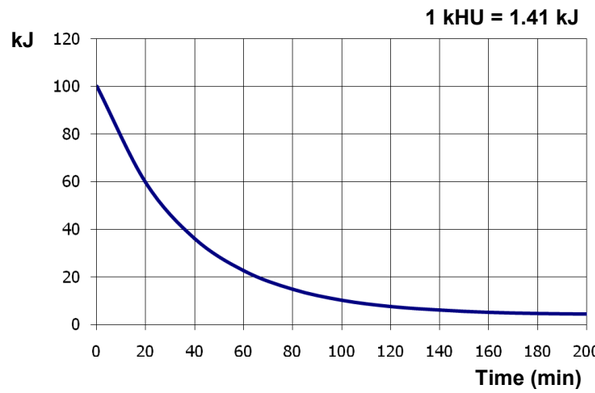
Power supply	Nominal Line Voltage	110-127 V ± 10%, 220-240 V ± 10%
	Line Frequency	50 /60 Hz
	Maximum Line Current	8 A at 110-127 V, 5 A at 220-240 V
	Permissible apparent impedance of supply mains	≤ 0.5 Ohm at 110-127 V, ≤ 1.0 Ohm at 220-240 V
	Line voltage regulation for maximum line current:	2.6 % at 120 V, 1.3 % at 240 V (maximum voltage drop 3.0 V)
	Line fuses	T 8AL, 250 V (time lag) at 110-127 V, T 5AH, 250 V (time lag) at 220-240 V second fuse available for two phases supply or for non-permanent connection to mains with plug
	Power input upon radiation	1.1 kVA at 220-240 V, 0.95 kVA at 110-127 V
	Power input standby mode	< 6 VA
Performance	Mode of operation	Continuous
	Nominal Duty Cycle	1/20, 4 s minimum waiting time
	Irradiation time	0.01–3.2 s ± 5% + 1 ms, R20 scale
	Tube Voltage	60 or70 kV ± 5% selectable
	Tube Current	7 mA ± 10%
	High-voltage waveform	High Frequency DC, residual ripple ≤ 4 kV
	Frequency HV generator	70 kHz
	Source Skin Distance (SSD)	20 cm (8”), optional 30 cm (12”)
	Radiation output field	Section < 6.0 cm (2 ⅜”)
	Circular BLD	Circular field: diameter 5.8 cm (2 ¼”), 26.4 cm^2 area at 20 cm SSD, eccentricity < 10%.
	Rectangular BLD size 2	Field 3.2 x 4.4 cm (1 ¼” x 1 ¾”) for Adult image receptor, 14 cm^2 area at 20 cm SSD.
	Rectangular BLD size 0	Field 2.2 x 3.2 cm ((⅞” x 1 ¼”) for Pedo image receptor, 7 cm^2 area at 20 cm SSD.
Wall suspension	Arm Length	Short (S): 30 cm /11 ¾”, Medium (M): 60 cm /23 ⅝”, Long (L): 80 cm /31 ½”, Extra Long (XL) 100 cm /39 ⅜”
	Useful Reach SSD 20 cm	143 cm /56 ¼” with Short (S) arm 173 cm /68 ⅛” with Medium (M) arm 193 cm /76” with Long (L) arm 213 cm /83 ⅞” with Extra Long (XL) arm
Radiation quality	First half value layer	≥ 2.3 mm Al at 70 kV
	Dose yield at 60 kV	8.4 mGy/s ±20%, 1.2 mGy/mAs ±20% at 20 cm (8”) from source
	Dose yield at 70 kV	11.2 mGy/s ±20%, 1.6 mGy/mAs ±20% at 20 cm (8”) from source
	Loading factors for leakage radiation	0.33 mA at 70 kV
	Radiation leakage	< 0.25 mGy/h at 1 m (< 28.75 mR/h at 1 m)
	Focal spot mark	Dot embossed on plastic covers of tube-head
X-ray Insert	Tube model	OX/70-G4 by Skan-X (formerly C.E.I.)
	Anode material	Tungsten/Wolframium
	Anode angle	≤ 16°
	Focal Spot	0.4 (IEC 60336: 1995)
	Nominal continuous power	110 W
Transport and storage	Temperature, transport	From -20°C to +50°C (from -4°F to 122°F)
	Relative humidity, transport	From 10 to 90%
	Pressure, transport	from 500 to 1060 hPa
Operation	Temperature, operation	From 10 to 40 °C (from 50°F to 104°F)
	Relative humidity, operation	From 30 to 75%
	Pressure, operation	From 700 to 1060 hPa

3.2 Cooling Diagrams

X-ray Tube
Cooling Curve



Tube Head
Cooling curve



3.3 Standards and Approvals

Original Language

The original language of the Operating Instructions is English.

Duray V2 bears the CE mark – IMQ Notified Body - in accordance with the provisions of the European Council Directive 93/42/EEC relating to Medical Devices, and subsequent amendments and integrations of which in the Directive 2007/47/EC of the European Parliament and of the Council.

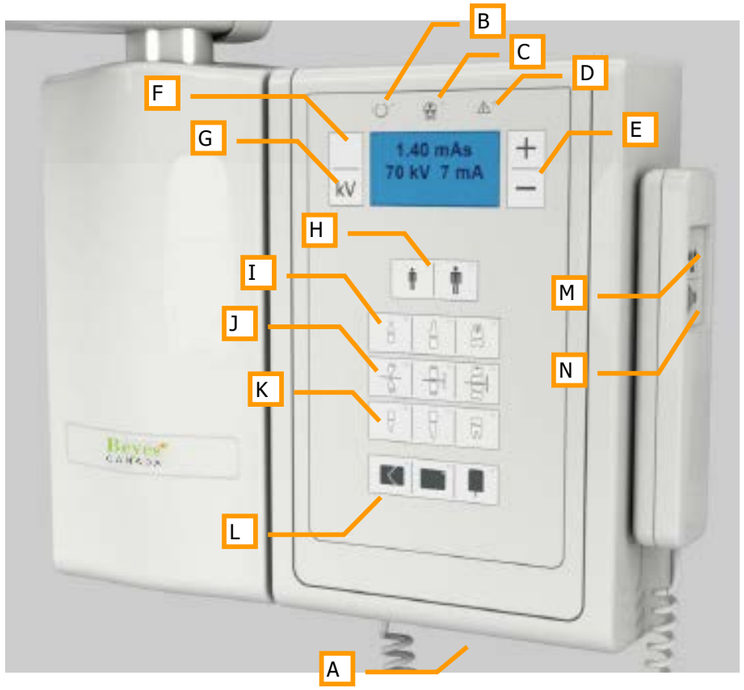
International standards

Duray V2 X-ray equipment for dental intra-oral radiography is in accordance with the following international standards, among others:

- IEC 60601-1: 2005 + AMD1: 2012.
- IEC 60601-1-2: 2014.
- IEC 60601-1-3:2008 + AMD1: 2013.
- IEC 60601-1-6: 2010 + AMD1: 2013.
- IEC 60601-2-65: 2012 + AMD1: 2017.
- IEC 62366-1: 2015.
- IEC 60336: 2005.
- IEC 62304: 2006.

4. CONTROLS AND FUNCTIONALITY

4.1 Operating elements



	A	Mains line ON/OFF switch
	B	GREEN light for system READY
	C	YELLOW light upon IRRADIATION (X-ray source assembly, emitting)
	D	RED light for alarm or error
+ −	E	PLUS and MINUS keys to change the exposure value
	F	MENU key
kV	G	Key for kV level selection to 60 or 70 kV
	H	Keys for patient build selection CHILD or ADULT
	I	Keys for selection in maxillary region: upper INCISOR, CUSPID /PREMOLAR, MOLAR
	J	Keys for selection of occlusal regions: OCCLUSAL UPPER/LOWER ARCH, OCCLUSAL PREMOLAR CROWNS, OCCLUSAL MOLAR CROWNS
	K	Keys for selection in mandibular region: lower INCISOR, CUSPID /PREMOLAR, MOLAR
	L	Keys for selection of image receptor: CHEMICAL FILM (traditional), PHOSPHOR PLATE, DIGITAL SENSOR
	M	YELLOW light upon IRRADIATION (same as C)
	N	X-ray EXPOSURE release button (radiographic control)

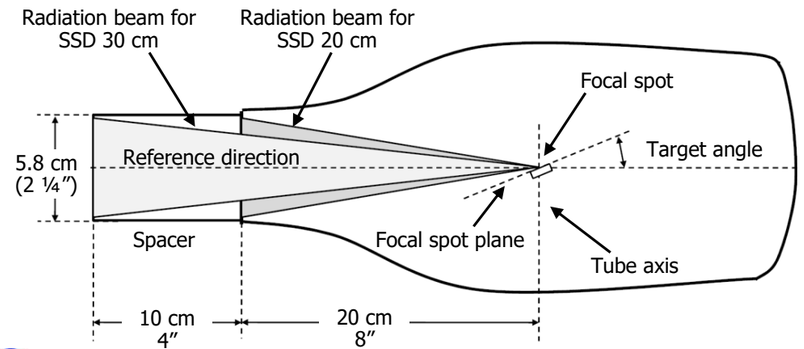
4.2 Display structure

The background coloured light of the display reflects the status of the unit.

Background colour	Status
Blue	Ready for radiation
Yellow	Irradiation
Red	Error /Alarm

4.3 The geometry of X-ray tube-head

X-ray tube-head
side view,
scissor arm joint side



Note. The position of the focal spot is marked on the outside of the tube-head with a dot embossed on the top and bottom covers.

4.4 Accessories

The accessories here listed may be not included in the scope of the supply.

Standard cone

The basic radiographic system allows to operate at 20 cm (8") source-skin distance (SSD) with circular radiation beam.

Cone extension
to operate
at 30 cm (12")

A 10 cm (4") cone extension to reach 30 cm (12") SSD is available as an option, featuring circular output field with a diameter of 5.8 cm (2 ¼").

Limiting rectangular
diaphragm
for film size 2

A rectangular diaphragm for X-ray beam limitation to 3.2 x 4.4 cm (1 ¼" x 1 ¾") for film size 2 (Adult) is available as an option:

Limiting rectangular
diaphragm
for film size 0

A rectangular diaphragm for X-ray beam limitation to 2.2 x 3.2cm ((⅞" x 1 ¼") for film size 0 (Pedo) is available as an option:

4.5 Range of exposure times

Values in s or mAs

The exposure table in s and in mAs (current time product) at 7 mA comprises 51 steps from 0.01 to 3.2 s (i.e. from 0.07 to 22.4 mAs) according to the R20 scale (20 steps per decade, doubling the value every 6 steps forward, halving it every 6 steps backward).

Exposure table

s	mAs	s	mAs	s	mAs
0.010	0.070	0.071	0.500	0.500	3.500
0.011	0.080	0.080	0.560	0.560	4.000
0.012	0.090	0.090	0.630	0.630	4.480
0.014	0.100	0.100	0.700	0.710	5.000
0.016	0.110	0.110	0.800	0.800	5.600
0.018	0.125	0.125	0.880	0.900	6.300
0.020	0.140	0.140	1.000	1.000	7.000
0.022	0.160	0.160	1.120	1.100	8.000
0.025	0.175	0.180	1.250	1.250	8.750
0.028	0.200	0.200	1.400	1.400	10.00
0.032	0.220	0.220	1.600	1.600	11.20
0.036	0.250	0.250	1.750	1.800	12.50
0.040	0.280	0.280	2.000	2.000	14.00
0.045	0.320	0.320	2.240	2.200	16.00
0.050	0.360	0.360	2.500	2.500	17.50
0.056	0.400	0.400	2.800	2.800	20.00
0.063	0.440	0.450	3.200	3.200	22.40

4.6 Exposure index of image receptors

Load the exposure indexes for the available image receptors before using the unit if they are different from the factory values.

EXP INDEX	REF
0.160	E/6
0.180	
0.200	E/5
0.220	
0.250	E/4
0.280	
0.320	
0.360	
0.400	
0.450	
0.500	E/2
0.560	
0.630	
0.710	
0.800	F
0.900	
1.000	E
1.100	
1.250	
1.400	
1.600	
1.800	
2.000	D
2.200	
2.500	

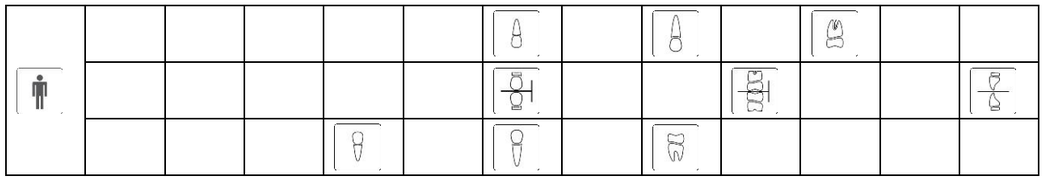
- Exposure index 1 corresponds to image receptor type E which is taken as a reference of exposure dose. Ektaspeed Plus by Kodak and (new) Dentus M2 Comfort by Agfa are a type E films.
- For image receptors type D which require twice the dose of image receptor type E, increase the exposure index of 6 steps, which doubles the exposure index to 2. Kodak Ultraspeed and Agfa Dentus M2 are type D image receptors.
- Kodak Insight is a type F film which requires less dose than E type receptor and is assigned the exposure index of 0.8.
- Digital sensor requiring half the dose of an E type image receptor have an exposure index of 0.5 (E/2).
- Duray sensor is assigned an exposure index of 0.32.
- Duray Elite is assigned an exposure index of 0.45.

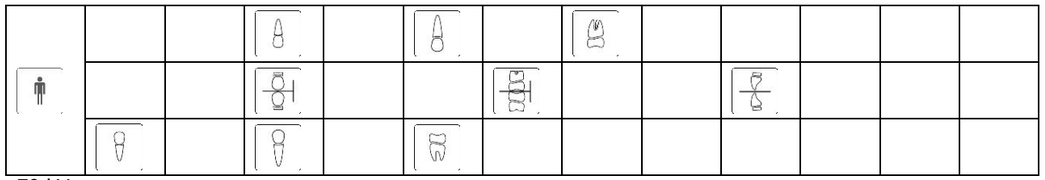
4.7 Sensitivity class D receptors

Class D image receptors

Recommended pre-programmed exposure values in mAs (current by time product) or in s (time) for sensitivity class D receptors used at 20 cm (8") or at 30 cm (12") Source to skin distance (SSD).

Sensitivity class D image receptor - SSD 20 cm (8")





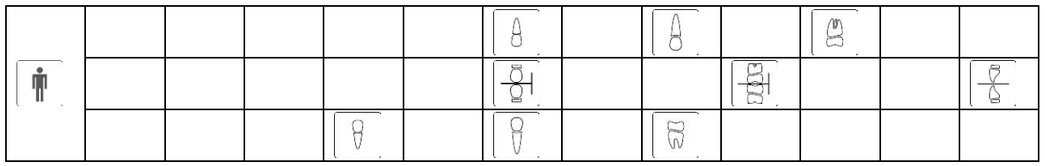
70 kV

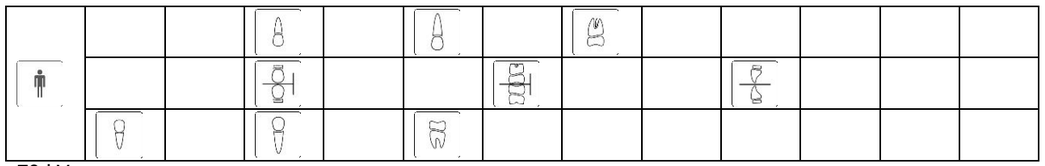
s	0.125	0.140	0.160	0.180	0.200	0.220	0.250	0.280	0.320	0.360	0.400	0.450
mAs	0.88	1.00	1.12	1.25	1.40	1.60	1.75	2.00	2.24	2.50	2.80	3.20

60 kV

s	0.180	0.200	0.220	0.250	0.280	0.320	0.360	0.400	0.450	0.500	0.560	0.630
mAs	1.25	1.40	1.60	1.75	2.00	2.24	2.50	2.80	3.20	3.50	4.00	4.48

Sensitivity class D image receptor - SSD 30 cm (12")





70 kV

s	0.250	0.280	0.320	0.360	0.400	0.450	0.500	0.560	0.630	0.710	0.800	0.900
mAs	1.75	2.00	2.24	2.50	2.80	3.20	3.50	4.00	4.48	5.00	5.60	6.30

60 kV

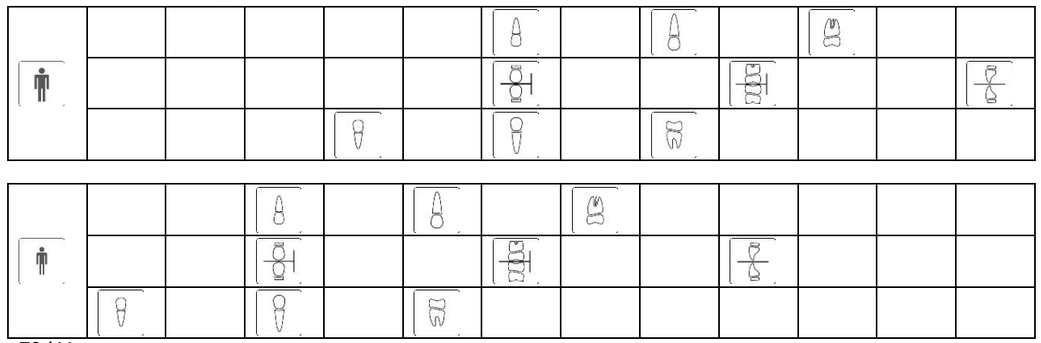
s	0.360	0.400	0.450	0.500	0.560	0.630	0.710	0.800	0.900	1.000	1.100	1.250
mAs	2.50	2.80	3.20	3.50	4.00	4.48	5.00	5.60	6.30	7.00	8.00	8.75

4.8 Sensitivity class E receptors

Class E image receptors

Recommended pre-programmed exposure values in mAs (current by time product) or in s (time) for sensitivity class E receptors used at 20 cm (8") or at 30 cm (12") Source to skin distance (SSD).

Sensitivity class E image receptor - SSD 20 cm (8")



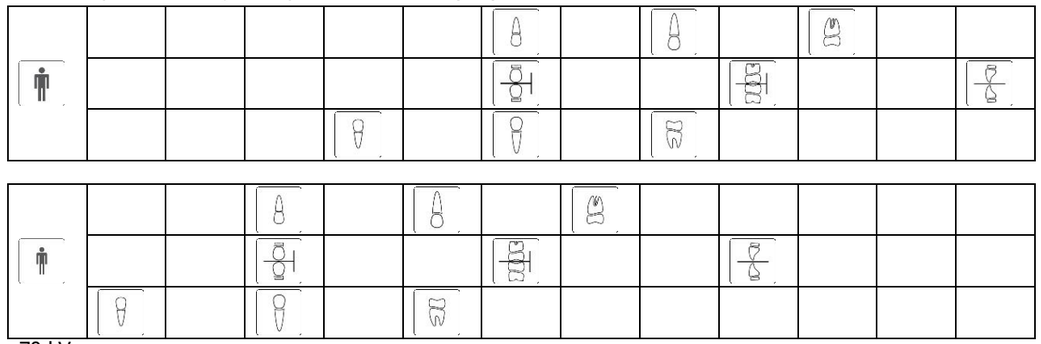
70 kV

s	0.063	0.071	0.080	0.090	0.100	0.110	0.125	0.140	0.160	0.180	0.200	0.220
mAs	0.44	0.50	0.56	0.63	0.70	0.80	0.88	1.00	1.12	1.25	1.40	1.60

60 kV

s	0.090	0.100	0.110	0.125	0.140	0.160	0.180	0.200	0.220	0.250	0.280	0.320
mAs	0.63	0.70	0.80	0.88	1.00	1.12	1.25	1.40	1.60	1.75	2.00	2.24

Sensitivity class E image receptor - SSD 30 cm (12")



70 kV

s	0.125	0.140	0.160	0.180	0.200	0.220	0.250	0.280	0.320	0.360	0.400	0.450
mAs	0.88	1.00	1.12	1.25	1.40	1.60	1.75	2.00	2.24	2.50	2.80	3.20

60 kV

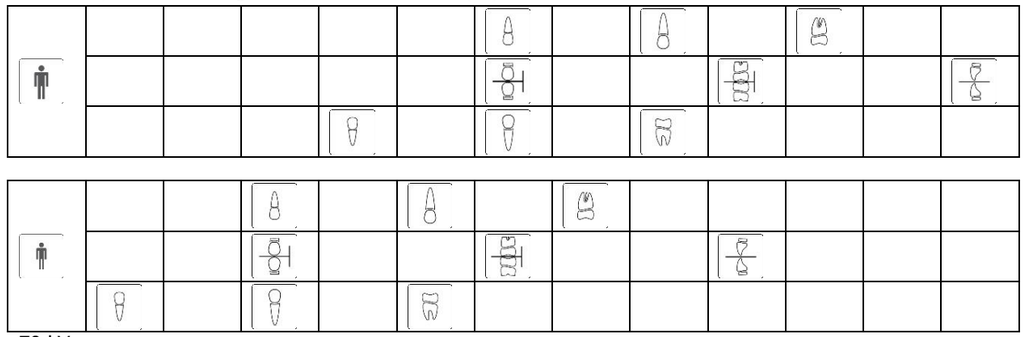
s	0.180	0.200	0.220	0.250	0.280	0.320	0.360	0.400	0.450	0.500	0.560	0.630
mAs	1.25	1.40	1.60	1.75	2.00	2.24	2.50	2.80	3.20	3.50	4.00	4.48

4.9 Sensitivity class E/2 receptors

Class E/2 image receptors

Recommended pre-programmed exposure values in mAs (current by time product) or in s (time) for sensitivity class E receptors used at 20 cm (8") or at 30 cm (12") Source to skin distance (SSD).

Sensitivity class E/2 image receptor - SSD 20 cm (8")



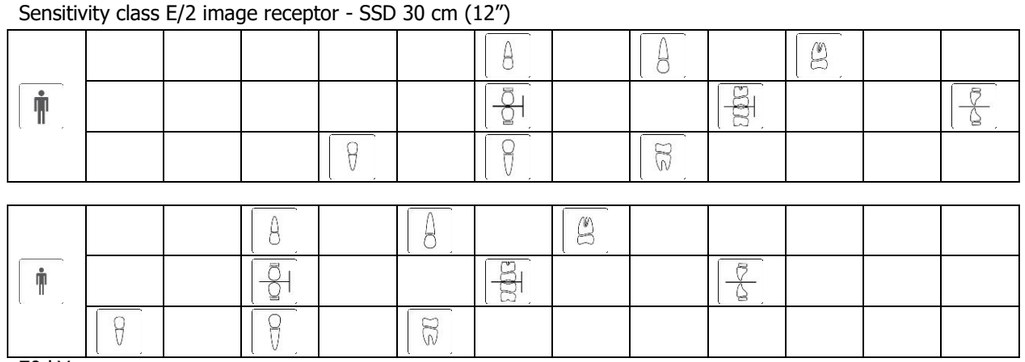
70 kV

s	0.032	0.036	0.040	0.045	0.050	0.056	0.063	0.071	0.080	0.090	0.100	0.110
mAs	0.22	0.250	0.280	0.320	0.360	0.400	0.440	0.500	0.560	0.630	0.700	0.800

60 kV

s	0.045	0.050	0.056	0.063	0.710	0.800	0.900	0.100	0.110	0.125	0.140	0.160
mAs	0.32	0.360	0.400	0.440	0.500	0.560	0.630	0.700	0.800	0.880	1.000	1.120

Sensitivity class E/2 image receptor - SSD 30 cm (12")



70 kV

s	0.063	0.071	0.080	0.090	0.100	0.110	0.125	0.140	0.160	0.180	0.200	0.220
mAs	0.44	0.50	0.56	0.63	0.70	0.80	0.88	1.00	1.12	1.25	1.40	1.60

60 kV

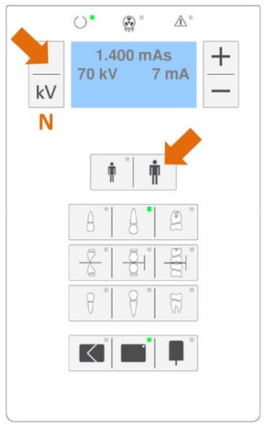
s	0.090	0.100	0.110	0.125	0.140	0.160	0.180	0.200	0.220	0.250	0.280	0.320
mAs	0.63	0.70	0.80	0.88	1.00	1.12	1.25	1.40	1.60	1.75	2.00	2.24

5. OPERATION

5.1 Configuring the System

Turn the system ON with the switch below the unit to operate and turn it OFF at the end.

5.1.1 Setting system parameters



The User Menu is available for configuration of the system parameters listed below.

- Activate it by pressing at the same time the two keys

  MENU [ ] and ADULT [ ].
  The parameter shown can then be programmed.
- Press the kV key [kV] to go to the NEXT step of the configuration menu.
- Press the hand switch push button to exit from the User Menu.

mAs or s — Unit of measure of the technique factor on display:
- s (factory default)
- mAs

Cone length (SSD)
- 20 cm (8”) (factory default).
- 30 cm (12”) with use of 10 cm (4”) cone extension.

BLD shape
- Circular beam limiting device (BLD) 5.8 cm (2 ¼”) diameter (factory default)
- Rectangular size 2 Adult (3.2x4.4 cm, 1 ¼” x 1 ¾”).
- Rectangular size 0 Pedo (2.2 x 3.2 cm, (⅞” x 1 ¼”).

Film sensitivity — Exposure index of chemical film in the range from 0.16 to 2.5.
Factory default at 2.0. Typical values for chemical films are:
- 0.8 for film class F.
- 1.0 for film class E.
- 2.0 for film class D.

Phosphor plate sensitivity — Exposure index of phosphor plate in use, with selectable values from 0.16 to 2.5.
Factory default at 1.0. Typical values for phosphor plates from 0.5 to 2.

Digital sensor sensitivity — Exposure index of digital sensor in use, with selectable values from 0.16 to 2.5.
Factory default at 0.5. Typical values for digital sensors from 0.25 to 1.

DAP on display — Dose area product (DAP) display presentation setting:
- OFF: no presentation of DAP value with exposure factors (factory default)
- ON: the DAP value is presented with the exposure factors.

Demo mode — Demo mode setting:
- OFF: for normal use with X-ray emission (factory default).
- ON: demo mode with no X-ray emission and DEMO flag on display.

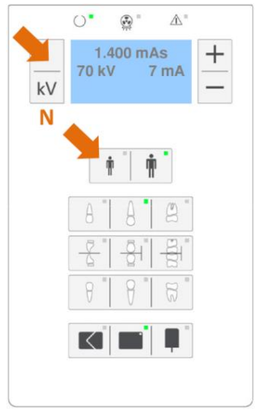
Display contrast — Character contrast level on the display settable in the range from 5 to 63.

Language — Selectable among: English, Italiano, Español, Français, Português, Deutsch.

Default factory setting — Reset parameters to factory settings:
- Press the EXPOSURE release button to restore the parameters and then:
  - Press the same EXPOSURE release button to exit.
  - Press the kV key [kV] to go to the next step in the menu.

Beyes

5.1.2 Checking system parameters and current DAP values



A command sequence is available to display the system parameters as configured and the matrix of the 6 DAP values.

- Activate the presentation of configured parameters by pressing at the same time the two keys

  MENU [ ] and CHILD [ ].
- Two pages are shown in sequence on the display:
  - A page with the exposure indexes set for the imaging receptors.
  - A page with DAP values and other configuration data.
- The change to the next page is done with the kV key [kV].
- The exit is done by pressing the X-ray push button.

Exposure indexes set
- Exposure indexes of the 3 types of imaging receptors as loaded:
  - Chemical film.
  - Phosphor plate.
  - Digital sensor.

DAP matrix — This function replaces the DAP table consultation in the manual.

- The 6 possible DAP values for the current technique factors are made available for quick retrieval of the correct number in case of temporary change of the working set-up, due to a different working distance or a different BLD shape from the configured ones.

  The 6 possible values depend on the 2 working distances and on the 3 BLD shapes.

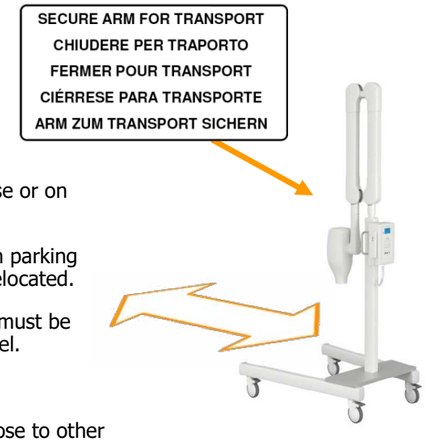
  The actual SSD distance and the BLD shape configured are enhanced and the corresponding DAP value reported in brackets.

  The page thus includes:
  - Current exposure parameters: mAs /s, kV, mA
  - Unit of measure of DAP and of SSD distance
  - Icons of the 3 BLD shapes
  - DAP values at 20 cm (8”) SSD for 3 possible BLD shapes;
  - DAP values at 30 cm (12”) SSD for 3 possible BLD shapes

5.2 Preparing for the exposure

5.2.1 Moving the mobile unit

Use the handles to bring the unit in place and block it for stability by pushing down the flaps of brakes on wheels.



⚠ Risk of overbalancing.

ⓘ Do not step on the plate at the base or on legs.

ⓘ The folding arm has to be closed in parking position every time the mobile unit is relocated.

ⓘ The mobile unit for transportation must be pushed or pulled facing the control panel.

⚠ Risk of EMC interference.

ⓘ The unit has not to be activated close to other equipment which could disturb it or which could be disturbed. Instructions are reported in the "Electromagnetic Compatibility" section in the following.

5.2.2 Selecting cone and collimator

SSD

The unit can be set to work (and has to be configured as such):

- at 20 cm (8") SSD or
- at 30 cm (12") with proper 10 cm (4") extension.

⚠ Risk of wrong DAP due to inconsistent configuration. ⓘ Upon changing SSD, upgrade system parameters through the User Menu.

BLD

The beam limiting device (BLD) can be (and has to be configured as such):

- circular 5.8 cm (2 ¼") diameter, or
- rectangular 3.2 x 4.4 cm (1 ¼" x 1 ¾") for size 2 Adult image receptor, or
- rectangular 2.2 x 3.2 cm ((⅞" x 1 ¼") for size 0 Pedo image receptor.

⚠ Risk of wrong DAP due to inconsistent configuration. ⓘ Upon changing BLD, upgrade system parameters through the User Menu.

5.2.3 Switching the unit ON

Turn unit ON

The switch is below the control panel.

Change it from position O pressed (OFF) to position I pressed (ON).

- The unit is supplied and a self test is run.
- None of the keys on the control panel nor the X-ray release hand-switch must be pressed during this phase.
- Once the initialization is terminated in about 10 seconds, the background light of the display changes to blue and the green light at top on the control panel turns ON continuously to indicate that the unit is READY for radiation.
- The most recent exposure parameters used are proposed.

Initialization error

In case an ERROR is detected the relevant message is generated.

- The background light of the display changes to red and the red light on the control panel (point C) turns ON continuously to indicate abnormal condition.
- The unit is thus NOT READY for operation.
- Do consult the section ERROR MESSAGES to handle the situation.
- If the error condition cannot be recovered put the system DOWN and call a service engineer to repair it.

5.3 Positioning the tube-head assembly

Hygiene

⚠ Risk of cross contamination. ⓘ The operator must follow a protocol covering all the phases from preparation to exposure and processing in order to maintain the aseptic chain.

ⓘ Always protect the rim of the spacer /collimator (applied part) with proper hygienic barrier.

Preparation

Have the patient seated and remove any provisional object in the mouth which may affect image quality.

⚠ Risk of over exposure of the patient to ionizing radiation.

ⓘ It is recommended to adopt a shielding apron with thyroid collar, at least featuring 0.25 lead equivalence and avoid, as much as possible, involving the patient for holding with fingers the image receptor during X-ray.

Image receptor

Position the image receptor in the anatomical area of interest and orientate the tube-head accordingly.

ⓘ Avoid touching the patient while holding the tube-head.

Parallel technique

Whenever possible use the parallel technique with the following set-up:

- 30 cm (12") SSD to reduce magnification and distortion.
- Rectangular BLD fitting the actual size of the image receptor.
- Proper holder to keep the image receptor in place. Some of the most common include XCP (extension cone paralleling) with localizing rings.

⚠ Risk of partial exposure.

ⓘ Rotate the rectangular BLD around the X-RAY BEAM AXIS to fit the actual orientation of the imaging receptor.

⚠ Risk of wrong DAP due to inconsistent configuration .

ⓘ Upon changing BLD, upgrade system parameters through the User Menu.

The indicated DAP value has in case to be corrected through consultation of the DAP tables in this manual or by displaying the 6 DAP matrix as part of system parameters.

Bisecting technique

In case bisecting technique is used, just position the image receptor where required paying attention then to orientate the tube-head according to the bisecting angle.

The bisecting angle technique is of value when the paralleling technique cannot be utilized.

Horizontal angulations

Position horizontally for a proper representation of teeth, namely the interproximal areas in bitewing exposures.

Vertical angulations (tilting angle)

Depending on the area to be exposed the X-ray source has to be orientated around its horizontal axis to meet approximately the indicated angles with the occlusal plane. Fine adjustment to be done in case with the XCP aiming ring.

Upper jaw (maxillary)	Molars	+ 35°
	Cuspids /Premolars	+ 45°
	Incisors (anteriors)	+ 55°
	Bite wings	+ 10°
Lower jaw (mandibular)	Bite wings	0
	Incisors (anteriors)	- 20°
	Cuspids/Premolars	- 10°
	Molars	- 05°

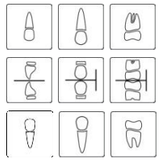
Movement

⚠ Risk of motion blur. ⓘ Keep the rim of the spacer /collimator (applied part) in touch with the XCP ring of the imaging receptor's holder or with the patient to prevent blur.

5.4 Setting exposure parameters

5.4.1 Selecting the anatomical region

Press the key corresponding to the desired anatomical region to automatically set the exposure value, in relation to type of receptor, kV value, patient build, and working distance (SSD). The selection is indicated by the green light on the icon.



Keys for selection of areas in maxillary region:
upper INCISOR, CUSPID /PREMOLAR, MOLAR

Keys for selection of occlusal areas:
UPPER/LOWER ARCH, PREMOLAR CROWNS, MOLAR CROWNS

Keys for selection of areas in mandibular region:
lower INCISOR, CUSPID /PREMOLAR, MOLAR

The exposure value for the selected anatomical region considering the configured system parameters (SSD and exposure index) appears on the display.

At bottom, if DAP presentation is selected, the corresponding DAP value depending on the declared working parameters (SSD and BLD shape)

Manual mode

The selected exposure value in s or mAs can be corrected by acting on the PLUS or MINUS keys to respectively increase or decrease the proposed value.

By doing so the green light on the anatomical region selected is turned OFF, the user having entered free settings in manual mode.

5.4.2 Selecting type of receptor

Press the key corresponding to the image receptor to be used.

A green light close to the symbol indicates selection.

For proper use the applicable exposure index should have been loaded before.

In case the stored value has to be changed go back to the User Menu in the system configuration section.

Film — Select this icon if the imaging receptor is a film (for chemical processing).

Phosphor plate — Select this icon if the imaging receptor is a phosphor plate.

Digital sensor — Select this icon if the imaging receptor is a digital sensor.

5.4.3 Selecting kV value

kV

Press the kV key to alternatively change the value displayed to 60 or 70 kV.

At 60 kV radiographs are produced with higher contrast than at 70 kV. At 70 kV the X-ray beam is more penetrating than at 60 kV.

5.4.4 Selecting build of patient

Press this key to select small patient (CHILD).

Press this key to select large patient (ADULT).

5.4.5 Plus /Minus keys

Press this key to increase the exposure time in s or the corresponding current-time product in mAs until the desired value is reached.

Press this key to decrease the exposure time in s or the corresponding current-time product in mAs until the desired value is reached.

5.5 Releasing the exposure

Check the exposure values on the display.

Checking the system parameters

By pressing MENU and CHILD keys at the same time it is activated the function to display the system parameters currently configured:

- The exposure index of each image receptor,
- The SSD declared as of 20 cm /8" o of 30 cm/12"),
- BLD shape being circular, rectangular size 2 Adult, or rectangular size 0 Pedo

Refer to section 5.1.2, Checking system parameters and current DAP , for more details.

Door closed

Close the surgery door if a door switch is installed.

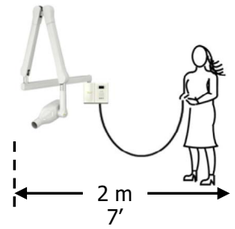
Patient still

Recommend the patient to stay still.

Operator's protection by distance

Risk of operator exposure to radiation if close to patient.

Hold the exposure hand-switch and move at least at 2 m (6.7') from the patient, out of the path of the X-ray beam, to protect against stray and leakage radiation.



Irradiation

Press the exposure pushbutton and keep it pressed until the yellow light and the buzzer are switched OFF to indicate termination of the exposure (irradiation).

The exposure yellow light and the sound of the buzzer indicate X-ray emission.

Premature termination

Risk of greater exposure of patient to radiation.

Do release the exposure button before due time only in case of need: the radiation emission is immediately terminated and the relevant alarm generated.

If termination occurs during filament heating no irradiation occurred and the image receptor has not been exposed.

Processing

Once radiation is terminated, hook back the exposure hand-switch and process the image receptor exposed.

Error or alarm

In case an error or an alarm condition occurs it is signalled by the red light and by an error code on the display of the control panel.

Cool down

After each exposure the device handles the cool-down period according to the duty cycle stated, with a minimum waiting time of 3 seconds.

During waiting time for cool-down the system is inhibited and the green light at top of the control panel keeps blinking.

At the end of the waiting time for cool-down the green light stops blinking and illuminates continuously to indicate system ready.

DAP

If DAP presentation is selected, the DAP value corresponding to the exposure and system parameters declared (SSD and BLD shape) is shown in the display at bottom.

DAP matrix

The user function available to display the system parameters and the DAP matrix can be used to verify, on one side, the actual system configuration declared and, on the other side, to quickly retrieve the correct DAP value in case of temporary change of the working set-up, with SSD or BLD shape different from what actually configured.

5.6 Switching the unit off

Turn unit OFF

If the system is not going to be used it can be switched OFF.

The ON /OFF switch is below the control panel.

Change it from position I pressed (ON) to position O pressed (OFF).

6. DOSE AREA PRODUCT (DAP)

DAP tables

The two tables in the last pages contain the DAP values for SSD of 20 cm (8") or of 30 cm (12") for each exposure condition at 60 or 70 kV.

DAP values computation

The DAP values are obtained with the dose of radiation in microGy produced at the indicated kV level and provided at the indicated distance multiplied by the area in square meters of the actual output window, being that circular or rectangular for film of size 2 or rectangular for film of size 0.

DAP on display

Please note that DAP values are also available on display:

- The actual DAP value corresponding to the selected technique factors (kV, mA, s or mAs) and to the configured parameters (SSD, exposure index of imaging receptor) is shown at bottom on the display provided DAP presentation has been selected.
- The DAP matrix with the set of 6 values corresponding to the selected technique factors is shown as second page of the user function to display the system parameters.

Unit of measure

The DAP values are expressed in microGy m^2 (µGy m^2).

Tolerance

A tolerance of 20% has to be considered to compensate for measuring errors as well as for system and instrument variations.

7. CARE OF THE SURFACES

7.1 Cleaning

⚠ Risk of electrical shock. ⓘ Always disconnect the system from the mains (turning OFF the main switch in the room) before cleaning it.

⚠ Risk of corrosion. ⓘ Do not spill any liquids into the equipment.

- Use a mild soap to remove fingerprints or other traces of dirt being careful not to let liquid substances penetrate the machine.
- The plastic covers can be cleaned with a soft cloth and a mild detergent.

7.2 Disinfecting

⚠ Risk of electrical shock. ⓘ Always disconnect the system from the mains (turning OFF the main switch in the room) before disinfecting it.

⚠ Risk of corrosion.

ⓘ Do not spill any liquids into the equipment.

ⓘ Do not use solvents or corrosive substances

The parts that come into contact with the patient must be cleaned after each use with a detergent (for example, a 2% ammonia solution) and then disinfected.

8. INSPECTION AND MAINTENANCE

Inspection and preventive maintenance must be performed at regular intervals to protect the safety and health of patients, users and third parties.

Preventive and corrective maintenance must be performed by skilled and trained and authorized personnel.

Inspection

It is recommended that the inspection to the medical device Duray V2 unit be performed every year by the user, or by other person charged, to verify the following aspects:

- Availability of manuals.
- Absence of mechanical damages.
- Presence and legibility of labels.
- Proper working of pushbuttons on control panel.
- Proper working of light indicators on control panel.
- Proper working of light and sound indicators upon irradiation.
- Proper working of volunteer termination of irradiation (dead-man functionality).

Preventive Maintenance

It is recommended that, in addition to the yearly inspections scheduled, preventive maintenance to the medical device Duray V2 be performed by a service technician after 4, 7, 10 years from the date of installation and then every two years to cover the following aspects:

- Movement of mechanical parts.
- Tight connection of green-yellow wires at protective earth (PE) points.
- Accuracy of anode voltage.
- Accuracy of anode current.
- Accuracy of exposure time.
- Adequacy of irradiation level.

Instruction

To perform inspection and preventive or corrective maintenance follow the instructions provided in the Service and Installation manual.

Original parts

When components affecting safe operation of the system become defective, they must be replaced with original ones.

Service report

When maintenance work is performed to the unit it is recommended that the technician engaged prepares a report with details of the activity performed, the list of parts replaced, if any, the changes to the system parameters, when done, in addition to the name and address of the customer and of the service company involved, eventually completing with date and signature.

9. ELECTROMAGNETIC COMPATIBILITY

9.1 Electromagnetic Emissions

The Duray V2 is suitable for use in the specified electromagnetic environment. The purchaser or user of the Duray V2 has to assure that it is used in an electromagnetic environment as described below.

Emission Test	Compliance	Electromagnetic environment
RF emissions CISPR 11	Group 1	This Duray V2 uses RF energy only for its internal function. Therefore, the RF emission is very low and not likely to cause any interference in nearby electronic equipment.
	Class B	This Duray V2 is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Complies	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	
RF emissions CISPR 11	Group 1	

9.2 Electromagnetic Immunity

The Duray V2 is suitable for use in the specified electromagnetic environment. The purchaser or user of the Duray V2 has to assure that it is used in an electromagnetic environment as described below.

Immunity test	EN 60601-1-2 test level	Compliance level	Electromagnetic environment
Electrostatic discharge (ESD) IEC 61000-4-2	8 kV contact 2/4/8/15 kV air	IEC 60601-1-2 Test level	Floors should be wood. Concrete or ceramic tile. If floors are covered with synthetic material. The relative humidity should be at least 30%.
Radiated electromagnetic field IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz	IEC 60601-1-2 Test level	Portable and mobile RF communications equipment should be used no closer to any part of the Duray V2 including cables. Minimum distance 30 cm
Electrical fast transient/burst IEC 61000-4-4	2 kV for power supply lines 1 kV for input/output lines > 3 m	IEC 60601-1-2 Test level	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	0.5/1 kV differential mode 0.5/1/2 kV common mode	IEC 60601-1-2 Test level	Mains power quality should be that of a typical commercial or hospital environment.
Conducted disturbances induced by RF fields IEC 61000-4-6	3 V 150 kHz to 80 MHz	IEC 60601-1-2 Test level	Portable and mobile RF communications equipment should be used no closer to any part of the Duray V2 including cables. Minimum distance 30 cm
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	0% Un for 0.5 cycle 0 % Un for 1 cycle 70 % Un for 25 cycles 0 % Un for 5 s	IEC 60601-1-2 Test level	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Duray V2 requires continued operation during power mains interruptions. It is recommended that the Duray V2 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30 A/m	IEC 60601-1-2 Test level	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

10. DISPOSING OF OBSOLETE EQUIPMENT

A radiological system is made of different materials which include many kinds of metals (iron, aluminium, lead, copper and others), plastic materials, electronic components and dielectric oil in the tank of the X-ray tube.

The "crossed-out wheeled bin" symbol on the product indicates that the product at the end of its useful life must not be disposed of as unsorted municipal waste but has to be collected separately and delivered to specialized operators for recycling or disposal of waste of electrical and electronic equipment (WEEE), in compliance with existing laws.

By doing in this way possible negative effects on human health and environment are prevented, and recycling of the component materials is promoted.

Penalties are applicable to illicit disposal.

Beyes and its local Dealers commit to fulfil obligations related to the management of WEEE of professional nature, according to the provisions of the European directives 2002/96/EC and 2003/108/EC.

11. ERROR MESSAGES

In order to possibly resume the normal activity once an error has been detected it is required that the message generated be acknowledged either by pressing and releasing the X-ray pushbutton or by switching the unit OFF and ON again.

Code	Cause	Remedy
E01	X-ray push button pressed	Try again and call for technical service if persisting
E08	Exposure stopped by the operator	Try again
E09	Exposure stopped by the back-up timer	Turn system OFF and call for technical service
E13	Filament supply error	Turn system OFF and call for technical service
E14	Keyboard communication error	Check the connection cable form keyboard to CPU
E15	High Voltage regulation error	Turn system OFF and call for technical service
E16	RS485 communication error	Try again and call for technical service if persisting
E17	Door open	Remove the cause and try again
E18	EEPROM error	Try again and call for technical service if persisting
E19	Incongruent configuration	Try again and call for technical service if persisting
E20	System locked with key	Unlock the system with the key switch

Duray V2 DAP Table
[µGy m^2]

60 kV			SSD 20 cm (8")		70 kV		
Circular diameter 5.8 cm	Rectang. Size 2 Adult	Rectang. Size 0 Child	s	mAs	Circular diameter 5.8 cm	Rectang. Size 2 Adult	Rectang. Size 0 Child
0.27	0.14	0.07	0.010	0.070	0.32	0.17	0.09
0.31	0.16	0.08	0.011	0.080	0.37	0.20	0.10
0.34	0.18	0.09	0.012	0.090	0.42	0.22	0.11
0.38	0.20	0.10	0.014	0.100	0.46	0.25	0.12
0.42	0.22	0.11	0.016	0.110	0.51	0.27	0.13
0.48	0.25	0.13	0.018	0.125	0.58	0.31	0.15
0.54	0.28	0.14	0.020	0.140	0.65	0.34	0.17
0.61	0.32	0.16	0.022	0.160	0.74	0.39	0.20
0.67	0.36	0.18	0.025	0.175	0.81	0.43	0.21
0.77	0.41	0.20	0.028	0.200	0.92	0.49	0.25
0.84	0.45	0.22	0.032	0.220	1.02	0.54	0.27
0.96	0.51	0.25	0.036	0.250	1.16	0.61	0.31
1.07	0.57	0.28	0.040	0.280	1.29	0.69	0.34
1.22	0.65	0.32	0.045	0.320	1.48	0.78	0.39
1.38	0.73	0.37	0.050	0.360	1.66	0.88	0.44
1.53	0.81	0.41	0.056	0.400	1.85	0.98	0.49
1.68	0.89	0.45	0.063	0.440	2.03	1.08	0.54
1.91	1.02	0.51	0.071	0.500	2.31	1.23	0.61
2.14	1.14	0.57	0.080	0.560	2.59	1.37	0.69
2.41	1.28	0.64	0.090	0.630	2.91	1.54	0.77
2.68	1.42	0.71	0.100	0.700	3.23	1.72	0.86
3.06	1.62	0.81	0.110	0.800	3.70	1.96	0.98
3.37	1.79	0.89	0.125	0.880	4.07	2.16	1.08
3.83	2.03	1.02	0.140	1.000	4.62	2.45	1.23
4.29	2.27	1.14	0.160	1.120	5.17	2.74	1.37
4.79	2.54	1.27	0.180	1.250	5.78	3.06	1.53
5.36	2.84	1.42	0.200	1.400	6.47	3.43	1.72
6.12	3.25	1.62	0.220	1.600	7.39	3.92	1.96
6.70	3.55	1.78	0.250	1.750	8.09	4.29	2.14
7.66	4.06	2.03	0.280	2.000	9.24	4.90	2.45
8.57	4.55	2.27	0.320	2.240	10.3	5.49	2.74
9.57	5.08	2.54	0.360	2.500	11.6	6.13	3.06
10.7	5.68	2.84	0.400	2.800	12.9	6.86	3.43
12.2	6.50	3.25	0.450	3.200	14.8	7.84	3.92
13.4	7.11	3.55	0.500	3.500	16.2	8.58	4.29
15.3	8.12	4.06	0.560	4.000	18.5	9.80	4.90
17.1	9.09	4.55	0.630	4.480	20.7	10.98	5.49
19.1	10.2	5.08	0.710	5.000	23.1	12.25	6.13
21.4	11.4	5.68	0.800	5.600	25.9	13.72	6.86
24.1	12.8	6.39	0.900	6.300	29.1	15.44	7.72
26.8	14.2	7.11	1.000	7.000	32.3	17.15	8.58
30.6	16.2	8.12	1.100	8.000	37.0	19.60	9.80
33.5	17.8	8.88	1.250	8.750	40.4	21.44	10.7
38.3	20.3	10.2	1.400	10.00	46.2	24.50	12.3
42.9	22.7	11.4	1.600	11.20	51.7	27.44	13.7
47.9	25.4	12.7	1.800	12.50	57.8	30.63	15.3
53.6	28.4	14.2	2.000	14.00	64.7	34.30	17.2
61.2	32.5	16.2	2.200	16.00	73.9	39.20	19.6
67.0	35.5	17.8	2.500	17.50	80.9	42.88	21.4
76.6	40.6	20.3	2.800	20.00	92.4	49.00	24.5
85.7	45.5	22.7	3.200	22.40	103	54.88	27.4

Duray V2 DAP Table
[µGy m^2]

60 kV			SSD 30 cm (12")		70 kV		
Circular diameter 5.8 cm	Rectang Size 2 Adult	Rectang. Size 0 Child	s	mAs	Circular diameter 5.8 cm	Rectang Size 2 Adult	Rectang. Size 0 Child
0.12	0.06	0.03	0.010	0.070	0.14	0.08	0.04
0.14	0.07	0.04	0.011	0.080	0.16	0.09	0.04
0.15	0.08	0.04	0.012	0.090	0.18	0.10	0.05
0.17	0.09	0.05	0.014	0.100	0.21	0.11	0.05
0.19	0.10	0.05	0.016	0.110	0.23	0.12	0.06
0.21	0.11	0.06	0.018	0.125	0.26	0.14	0.07
0.24	0.13	0.06	0.020	0.140	0.29	0.15	0.08
0.27	0.14	0.07	0.022	0.160	0.33	0.17	0.09
0.30	0.16	0.08	0.025	0.175	0.36	0.19	0.10
0.34	0.18	0.09	0.028	0.200	0.41	0.22	0.11
0.37	0.20	0.10	0.032	0.220	0.45	0.24	0.12
0.43	0.23	0.11	0.036	0.250	0.51	0.27	0.14
0.48	0.25	0.13	0.040	0.280	0.57	0.30	0.15
0.54	0.29	0.14	0.045	0.320	0.66	0.35	0.17
0.61	0.32	0.16	0.050	0.360	0.74	0.39	0.20
0.68	0.36	0.18	0.056	0.400	0.82	0.44	0.22
0.75	0.40	0.20	0.063	0.440	0.90	0.48	0.24
0.85	0.45	0.23	0.071	0.500	1.03	0.54	0.27
0.95	0.51	0.25	0.080	0.560	1.15	0.61	0.30
1.07	0.57	0.28	0.090	0.630	1.29	0.69	0.34
1.19	0.63	0.32	0.100	0.700	1.44	0.76	0.38
1.36	0.72	0.36	0.110	0.800	1.64	0.87	0.44
1.50	0.79	0.40	0.125	0.880	1.81	0.96	0.48
1.70	0.90	0.45	0.140	1.000	2.05	1.09	0.54
1.91	1.01	0.51	0.160	1.120	2.30	1.22	0.61
2.13	1.13	0.56	0.180	1.250	2.57	1.36	0.68
2.38	1.26	0.63	0.200	1.400	2.87	1.52	0.76
2.72	1.44	0.72	0.220	1.600	3.29	1.74	0.87
2.98	1.58	0.79	0.250	1.750	3.59	1.91	0.95
3.40	1.80	0.90	0.280	2.000	4.11	2.18	1.09
3.81	2.02	1.01	0.320	2.240	4.60	2.44	1.22
4.25	2.26	1.13	0.360	2.500	5.13	2.72	1.36
4.76	2.53	1.26	0.400	2.800	5.75	3.05	1.52
5.44	2.89	1.44	0.450	3.200	6.57	3.48	1.74
5.95	3.16	1.58	0.500	3.500	7.19	3.81	1.91
6.81	3.61	1.80	0.560	4.000	8.21	4.36	2.18
7.62	4.04	2.02	0.630	4.480	9.20	4.88	2.44
8.51	4.51	2.26	0.710	5.000	10.3	5.44	2.72
9.53	5.05	2.53	0.800	5.600	11.5	6.10	3.05
10.7	5.68	2.84	0.900	6.300	12.9	6.86	3.43
11.9	6.32	3.16	1.000	7.000	14.4	7.62	3.81
13.6	7.22	3.61	1.100	8.000	16.4	8.71	4.36
14.9	7.89	3.95	1.250	8.750	18.0	9.53	4.76
17.0	9.02	4.51	1.400	10.00	20.5	10.9	5.44
19.1	10.1	5.05	1.600	11.20	23.0	12.2	6.10
21.3	11.3	5.64	1.800	12.50	25.7	13.6	6.81
23.8	12.6	6.32	2.000	14.00	28.7	15.2	7.62
27.2	14.4	7.22	2.200	16.00	32.9	17.4	8.71
29.8	15.8	7.89	2.500	17.50	35.9	19.1	9.53
34.0	18.0	9.02	2.800	20.00	41.1	21.8	10.9
38.1	20.2	10.1	3.200	22.40	46.0	24.4	12.2

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