RADIATION PROTECTION REPORT

For the University Hospitals of Derby and Burton NHS Foundation Trust

MOBILE IMAGE INTENSIFIER (Routine Survey)		
Location: Pulvertaft Hand Centre Level 2 King's Treatment Centre Royal Derby Hospital	Date of Survey: 10/09/2019	
Manufacturer: Hologic	Model: Fluoroscan Insight FD	
	X-ray tube	**Image Intensifier**
Type:	PXS11-100-35-ROHS	CMOS Detector
Serial Number:	22158	11793
Hospital Asset Number:	602680	
Copies sent to:	Sarah Balmforth, Matron, Pulvertaft Hand Centre (EC)(Recs) Christine Parker, Hand Unit Co-ordinator (EC) Clinical Engineering, Royal Derby Hospital (EC) Radiology Physics File Copy (EC)	

Summary

This initial survey of equipment performance and safety features was undertaken by Radiology Physics.

The requisite equipment and safety features, such as failsafe exposure switch and a password operated interlock, were present and operational.

During the survey we were unable to locate some of the required radiation safety documentation and as such the following are subject to recommendation:

- Working instructions – The current working instructions should be located and reviewed. If there are currently no working instructions for this equipment then a new document should be created. If required, the working instructions applicable to the Fluoroscan units in the Hand Unit on Level 3 may be used as a template. It is suggested that any new copies of the working instructions are placed directly on the Fluoroscan unit where they are clearly visible to any individuals present during operation of the unit.
- Equipment folder - This folder is used to collate the radiation safety documentation (unless such documents are stored digitally) and routinely contains:
    - Handover record. This document is used to ensure that equipment is safely accepted back into clinical use following any service or repair work, as stipulated in *HSE Guidance Note PM77*.
    - Service/Survey history
    - A completed risk assessment

With this system it is possible to achieve a focus to patient skin distance of less than 30cm. This is the minimum permissible separation as stated in IPEM's Medical and Dental Guidelines. As a physical spacer, sometimes used on larger fluoroscopy systems, would be impractical for this unit a statement in the working instructions relating to this is an acceptable solution.

Both the fluoroscopic input dose rates and patient skin dose rates were assessed using a calibrated dose meter and appropriate phantoms (1mm Cu and 19mm Al. respectively) and using a combination of field sizes and dose rate settings. All results were found to be comparable with other flat panel Fluoroscan units tested by Radiology Physics and are therefore acceptable. The results obtained during this survey will form the baseline values for use in any future surveys.

Fluoroscopic image quality was assessed for threshold contrast, noise, contrast loss, and limiting spatial resolution; all results were found to be consistent with those obtained for other flat panel Fluoroscan units and are therefore satisfactory.

The calibration of the unit's DAP meter was assessed and was found to be within the required ±20% tolerance and therefore satisfactory.

Recommendations

R1. The working instructions for this unit should be located and reviewed where necessary. If no working instructions are currently in place for this unit then a new document should be created. The working instructions should be clearly displayed on the unit where they can be viewed by the operators.

R2. An equipment folder should be made available which contains the following documents:

- Equipment handover form.
- Service/Survey history
- A completed risk assessment

Results

The following items were checked for compliance with the *Ionising Radiations Regulations (2017), Guidance Notes (2002)* and Nationally agreed safety standards. Non-compliance is indicated with a × and the reader is referred to the relevant recommendation.

Environmental Protection			
Item	**Reference**	**Compliance**	**Rec.**
Key switch / password interlock	GN 4.30	✓	
Fail safe exposure switch	GN 4.27	✓	
Mains on indicator/meters functioning	GN 4.22	✓	
Controls and indicators clearly labelled	GN 4.24	✓	
Visible /audible exposure warning	GN 4.22	✓	
Foot switch cannot expose inadvertently	GN 4.29	✓	
Indicator for accumulated fluoroscopy exposure, resolution of 0.1min or better	GN 4.32	✓	
Independent resettable alarm sounds after 5 min accumulated fluoroscopy exposure	GN 4.32	✓	
DAP meters fitted	GN 4.37	✓	
Focal spot position marked	GN 4.7	✓	
Total filtration labelled	GN 4.10	✓	
Working Instructions present	GN 1.59	×	**C1; R1**
Local rules available	GN 1.65	✓	
Prior risk assessment left with user	GN 1.18	✓	
Equipment log book present	GN 3.32	✓	
Equipment handover form present	HSE (PM 77 p.26)	×	**C2; R2**
Appropriate dose reduction features available, ie LIH, pulsed, fluoro grab, cine loop, variable frame rates, kV/mA curves.	GN 4.17	✓	
Minimum focal spot to skin distance greater than 30cm	GN 3.85	×	**C3**

C1. We were unable to locate a copy of the working instructions at the time of the survey.

C2. We were unable to locate an equipment handover form during the survey.

C3. The minimum achievable focus to patient skin distance for this Fluoroscan unit is less than the required 30cm as stated in the *Medical and Dental Guidance Notes*.

DAP Performance / Calibration			
Tolerance	**Unit indicated DAP ($cGy.cm^2$)**	**Physics measured DAP ($mGy.cm^2$)**	**Result**
Error indicated/measured <20% at 80 kV 10x10cm field	20.15	199	+1% **Pass**

Fluoroscopic Input Dose Rates IPEM 91 FLU 07				
Field Size	**Dose Setting Programme**	**Baseline (µGy/sec)**	**Measured (µGy/sec)**	**Result**
6”	Auto kV/mA 0.5mmCu additional filtration	**Baseline established**	1.46	**Acceptable C4**
4”	Auto kV/mA 0.5mmCu additional filtration	**Baseline established**	1.39	**Acceptable C4**
6”	Auto IQ 0.5mmCu additional filtration	**Baseline established**	2.20	**Acceptable C4**
4”	Auto IQ 0.5mmCu additional filtration	**Baseline established**	2.30	**Acceptable C4**
6”	Auto kV/mA 1mmCu additional filtration	**Baseline established**	1.07	**Acceptable C4**
4”	Auto kV/mA 1mmCu additional filtration	**Baseline established**	1.01	**Acceptable C4**
6”	Auto IQ 1mmCu additional filtration	**Baseline established**	1.73	**Acceptable C4**
4”	Auto IQ 1mmCu additional filtration	**Baseline established**	1.83	**Acceptable C4**
Filter used: 0.5mmCu / 1mmCu		**FID = 44cm**		
Tolerance Remedial: baseline ±25%, Suspension: baseline ±50%				

C4. The results obtained for input dose rates were comparable to other Fluoroscan Insight FD units tested by Radiology Physics and are therefore considered acceptable. The results obtained during this survey will form baseline values which are to be used as a reference in future surveys.

Fluoroscopic Skin Dose Rates Local Tolerance						
Field Size	**Dose Setting Programme**	**Baseline (mGy/min)**	**kV**	**mA**	**Measured (mGy/min)**	**Result**
6”	Auto kV/mA	**Baseline established**	63	0.082	1.27	**Acceptable; C5**
4”	Auto kV/mA	**Baseline established**	62	0.081	1.19	**Acceptable; C5**
6”	Auto IQ	**Baseline established**	65	0.101	1.66	**Acceptable; C5**
4”	Auto IQ	**Baseline established**	66	0.101	1.69	**Acceptable; C5**
Phantom: 19mm Al.					**FSD = 42 cm**	
Local tolerance for 37mmAl **Remedial: >10mGy/min (Full field) or Baseline ±25%** **Mag field sizes: >2 times Full field or Baseline ±25%** **Suspension: >100mGy/min or Baseline ±50%**						

C5. The results obtained for patient skin dose rates were comparable to other Fluoroscan Insight FD units tested by Radiology Physics and are therefore considered acceptable. The results obtained during this survey will form baseline values which are to be used as a reference in future surveys.

Fluoroscopic Performance				
Test	**Field Size**	**Tolerance**	**Measured**	**Comment**
Local/Leeds TO Imaged Field Size	6”	**Remedial** 0.85 x nominal *Full field: 14.5 x 11.4cm* *Limited field: 11.2 x 11.2cm*	14.5 x 11.2cm **(0.98 of nominal)**	**Pass**
	4”		10.7 x 10.8cm **(0.96 of nominal)**	**Pass**
IPEM 91 FLU 11 Uniformity of Focus	6”	Visual inspection Mesh used:MS4	No artefacts visible	**Pass**
IPEM 32 Part II 2.2.2 Limiting Spatial Resolution	6”	**Remedial** Baseline <2 groups **Baselines:** *Baselines Established*	19.5 groups **(4.25lp/mm)**	**Acceptable C6**
	4”		19.5 groups **(4.25lp/mm)**	**Acceptable C6**
IPEM 32 Part II 2.2.3 Threshold Contrast N3	6”	**Remedial** Baseline < 2 discs **Baseline** *Baseline Established*	15 discs @ 69kV using 1mm Cu (1.55% contrast)	**Acceptable C6**
IPEM 91 FLU 10 Threshold Contrast TO 10	6”	**Remedial** Quality Index< 0.9	Quality Index: 1.00	**Pass**

C6. The image quality results were comparable to other Fluoroscan Insight FD units tested by Radiology Physics and are therefore considered to be acceptable. The results obtained during this survey will form baseline values which are to be used as a reference in future surveys.