

**Government of India**  
**Atomic Energy Regulatory Board**  
**Radiological Safety Division**  
**Niyamak Bhavan, Anushaktinagar,**  
**Mumbai-400094**

**FORMAT FOR QUALITY ASSURANCE TEST FOR DIAGNOSTIC X-RAY EQUIPMENT**  
*(Applicable for Radiography/Radiography&Fluoroscopy/C-Arm/InterventionalRadiology Equipment)*

*(Periodic Quality Assurance shall be carried out at least once in two years and also after any repairs having radiation safety implications)*

**A. DETAILS OF THE DIAGNOSTIC X-RAY EQUIPMENT**

1	Name of the Institution and City	
2	Type of Equipment	
3	Model Name	
4	Name of the Manufacturer	
5	Name(s) of Person(s) testing the equipment and Name of Supplier/Service Agency	
6	Dates and Duration of the Tests	

**B. SUMMARY OF RADIATION SAFETY PERFORMANCE TEST REPORT:**

Sr. No.	Parameters Tested	Specified Values	Measured Values	Tolerance	Remarks
1	Congruence of radiation and optical field	Measurement at 60 kV		Tolerance : $I X I + I X' I \leq 2\% \text{ of FFD}$ $I Y I + I Y' I \leq 2\% \text{ of FFD}$	
2	Central Beam Alignment	Measurement at 60 kV		Central Beam Alignment $< 1.5^0$	
3	Effective focal spot measurement FFD= 60 cm			Tolerance : 1. + 0.5 f for $f < 0.8 \text{ mm}$ 2. + 0.4 f for $0.8 \leq f \leq 1.5 \text{ mm}$ 3. + 0.3 f for $f > 1.5 \text{ mm}$	
4	Accuracy of Operating Potential (kV)	(last value maximum kV)		$\pm 5 \text{ kV}$	
5	Accuracy of Irradiation Time(sec.)			% Error $< 10 \%$	
6	Total filtration	Measurement at maximum kV		Tolerance : 1.5 mm Al for $kV \leq 70$ 2.0 mm Al for $70 < kV \leq 100$ 2.5 mm Al for $kV > 100$	
7	Linearity of mA/mAs loading Stations			CoL $<0.1$	

8	Consistency of radiation output			CoV $\leq$ 0.05	
9	Low contrast resolution	Measurement shall be done on each mode of Image Intensifier		3.0 mm hole pattern must be resolved	
10	High contrast resolution	Measurement shall be done on each mode of Image Intensifier		1.5 lp/mm pattern must be resolved	
11	Exposure Rate at Tabletop	Applicable Fluoroscopy Mode		Tolerance : 1. Exposure Rate without AEC mode $\leq$ 5 cGy/Min 2. Exposure Rate with AEC mode $\leq$ 10 cGy/Min	
12	Radiation leakage level at 1m from tube housing and Collimator (Pl. mention values separately)	Measurement at Maximum kVp and corresponding tube current		Tube Leakage < 1 mGy in one hour	

Note:

1. Tests as mentioned in Sr. No. 1,2,3 are not applicable for C-Arm/Interventional Radiology Equipment.
2. Tests as mentioned in Sr. No. 9,10,11 are not applicable for only radiography mode of x-ray equipment.

I hereby undertake that all the information provided above is correct and in accordance with the detailed Quality Assurance Report enclosed herewith.

Place:

Date:

Signature:

Name of the Service Engineer:

Name of Supplier/Service Agency:

Seal of Supplier/Service Agency:

#Signature of Institution's Representative:

Name of Institution:

Seal of the Institution:

# Quality Assurance Tests Report shall be signed by Institution's Representative and duly stamped by the User's Institution.

# 1. CONGRUENCE OF RADIATION & OPTICAL FIELD

Operating parameters:

FFD (cm)	100	kV	60	mAs	
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Shift in the edges of the radiation field				
Dimensions (cm)	Observed shift	% of FFD	Tolerance	Remark
I X I + I X' I			2 % of FFD	
I Y I + I Y' I			2 % of FFD	

# 2. CENTRAL BEAM ALIGNMENT

Operating parameters:

FFD (cm)	100	kV	60	mAs	
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Observe the images of the two steel balls on the radiograph and evaluate tilt in the central beam.		
Observed tilt		Remark
Tolerance: Central Beam Alignment <math>< 1.5^\circ</math>		

# 3. EFFECTIVE FOCAL SPOT MEASUREMENT

FFD (cm)	60
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	Stated value of Focal Spot Size (mm x mm)	Measured value of Focal Spot Size (mm x mm)	Tolerance: 1. + 0.5 f for $f < 0.8$ mm 2. + 0.4 f for $0.8 \leq f \leq 1.5$ mm 3. + 0.3 f for $f > 1.5$ mm
Large Focus			
Small Focus			

# 4. ACCURACY OF OPERATING POTENTIAL

# 5. ACCURACY OF IRRADIATION TIME

# 6. TOTAL FILTRATION

FFD (cm)	100
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Applied kVp	Set time (s)	Measured values								
		mA stations								
		Minimum mA station		Routinely used mA station		Maximum mA station		Average kVp	Average Time (s)	Remarks
		kVp	Time (s)	kVp	Time (s)	kVp	Time (s)			
Max. kVp										

Tolerance for kVp :  $\pm 5$  kV  
Tolerance for Timer : % Error:  $\pm 10$  %  
Total Filtration (measurement at maximum kVp) : ..... mm of Al  
Tolerance for Total Filtration: 1.5 mm Al for kV  $\leq$  70, 2.0 mm Al for kV  $\leq$  100, 2.5 mm Al for kV  $>$  100

### 7. LINEARITY OF ( mA/mAs) LOADING STATIONS

Operating parameters:

FFD (cm)	100	kV		Time (s)	
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mA applied	Radiation Output ( $\mu$ Gy)			Average Output	$\mu$ Gy /mAs ( X )	Coefficient of Linearity (CoL)	Remarks
	Reading 1	Reading 2	Reading 3	( $\mu$ Gy)			

Tolerance: COL  $<$  0.1

### 8. OUTPUT CONSISTANCY

FFD (cm)	100
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Applied kV	mAs	Radiation Output ( $\mu$ Gy)					Average (X)	Coefficient of Variation (CoV)	Remarks
		1	2	3	4	5			

Tolerance : CoV  $<$  0.05

### 9. LOW CONTRAST SENSITIVITY:

Diameter of the smallest size hole clearly resolved on the monitor	
Recommended performance standard	3.0 mm hole pattern must be resolved

### 10. HIGH CONTRAST SENSITIVITY

Bar strips resolved on the monitor (lp/mm)	
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Recommended performance standard	1.5 lp/mm pattern must be resolved
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### 11. EXPOSURE RATE AT TABLE TOP

Distance from Focus to Table top	Applied kV	Applied mA	Exposure rate at table top (cGy/Min)	Remarks
Tolerance : 1. Exposure Rate without AEC mode $\leq 5$ cGy/Min 2. Exposure Rate with AEC mode $\leq 10$ cGy/Min <i>Minimum focus to table top distance shall be 30 cm for fluoroscopy</i>				

### 12. TUBE HOUSING LEAKAGE

Operating parameters:

FDD (cm)	100	kVp	(Max)	mA		Time(s)	$\approx 1$ sec
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Location (at 1.0 m from the focus)	Exposure level (mR/hr)					Result
	Left	Right	Front	Back	Top	
Tube						
Collimator						
Tolerance: Maximum leakage radiation level at 1 meter from the focus should be $\leq 1$ mGy (114 mR) in one hour.						

Work load 180 mAmin in one hr

$$\text{Max leakage} = \frac{180 \text{ mAmin in 1 hr} \times \text{Max Exposure level (mR/hr)}}{60 \times \text{mA used for measurement}}$$

Maximum radiation leakage from tube housing = ----- mR in one hour  
 Maximum radiation leakage from tube collimator = ----- mR in one hour

### Details of Radiation Protection Survey of the installation

Date of radiation protection survey:

Whether radiation survey meter used for the survey has valid calibration certificate: Yes/No

Equipment Setting:-

Applied Current (mA):

Applied Voltage (kV):

Exposure time(s):

Workload:

Provide the measured maximum radiation levels (mR/hr) at different locations

Location	Max. Radiation level (mR/hr)

Control console(Operator Position)	
Outside patient entrance door	
Behind Windows (if applicable)	
Patient Waiting Area	

$$\text{Maximum Radiation level/week (mR/wk)} = \frac{\text{----- mAmin/week} \times \text{----Max. radiation level (mR/hr)}}{60 \times \text{-----mA used for measurement}}$$

Permissible limit

For location of Radiation Worker: 20 mSv in a year (40 mR/week)

For Location of Member of Public: 1 mSv in a year (2mR/week)