

RECOMMENDATIONS

COMMISSION RECOMMENDATION (EU) 2022/1341

of 23 June 2022

on voluntary performance requirements for X-ray equipment used in public spaces (outside aviation)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 292 thereof,

Whereas:

- (1) Except for the field of civil aviation, Union law does not provide, at present, for harmonised performance requirements for X-ray equipment used for detection in public spaces. Such requirements differ between Member States, leading to uneven and not always sufficiently high levels of protection of the general public against security threats. Terrorists and other criminals may exploit the resulting vulnerabilities, including to stage attacks or conduct other criminal activities in Member States with a lower level of security in public spaces.
- (2) Terrorist attacks committed across the Union in recent years have predominantly taken place in public spaces, targeting members of the general public. In order to contribute to a sufficiently high level of protection against terrorist attacks and security threats in public spaces across the Union, voluntary performance requirements for X-ray equipment should be set out at Union level.
- (3) The detection equipment, including X-ray equipment, used in the field of civil aviation is subject to detailed requirements laid down in Commission Implementing Decision C(2015) 8005 ⁽¹⁾. Those requirements are well defined and offer a high and consistent level of protection in the field of civil aviation security. Therefore, that field should not be covered by this Recommendation. In addition, in the interest of clarity, it should be clarified that this Recommendation is without prejudice to acts of Union law regulating safety aspects of X-ray equipment.
- (4) In the Counter-Terrorism Agenda for the EU ⁽²⁾, the Commission committed to support the development of voluntary requirements for detection technologies to ensure that they detect the security threats they need to detect, while preserving the mobility of people. In pursuit of this commitment, the Commission established the Technical Working Group on detection performance requirements, composed of Member State experts, manufacturers and officials from a number of Commission services, and asked it to assist in developing voluntary performance requirements for X-ray equipment at Union level. This Recommendation, and in particular the voluntary requirements contained therein relating to product documentation and X-ray performance, is based on the preparatory work conducted by this working group.
- (5) The voluntary performance requirements contained in this Recommendation should be used by Member States in public procurement of X-ray equipment intended to be used for security-threat detection in public spaces.

⁽¹⁾ Commission Implementing Decision C(2015) 8005 laying down detailed measures for the implementation of the common basic standards on aviation security containing information, as referred to in point (a) of Article 18 of Regulation (EC) No 300/2008.

⁽²⁾ Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. A Counter-Terrorism Agenda for the EU: Anticipate, Prevent, Protect, Respond COM(2020) 795 final.

- (6) This Recommendation, which has no binding force, should not be understood as requiring the Member States to procure or use certain particular X-ray equipment for security-threat detection in public spaces. The decisions on which equipment to procure or use in a given public space should continue to be taken exclusively by Member States, in accordance with Union law. This Recommendation should rather aim to promote the use of the voluntary performance requirements contained in this Recommendation in the context of Member States' procurement activities to contribute to achieving an equivalent and high level of security-threat detection performance by X-ray equipment used by Member States' authorities in public spaces across the Union.
- (7) The voluntary performance requirements contained in this Recommendation should not be understood as being intended to replace national performance standards for X-ray equipment, where such national standards exist. In particular, Member States should remain free to apply, in accordance with Union law, more stringent performance requirements for X-ray equipment used to detect security threats in public spaces.
- (8) This Recommendation should indirectly incentivise manufacturers to comply with the requirements in future production of X-ray equipment. Member States should therefore require in the procurement document for the X-ray equipment to be used for security-threat detection in public spaces that the tenderers include in the tender the product documentation and declaration of conformity based on the manufacturer's own methodology to demonstrate the conformity of the X-ray equipment with the voluntary performance requirements contained in this Recommendation.
- (9) The use of X-ray equipment in public spaces may pose challenges from the viewpoint of the rights to protection of privacy and personal data. It is of crucial importance in relation to all activities connected to the use of the X-ray equipment at issue, including the procurement and operation of the equipment and any subsequent processing activities, to limit the intrusiveness as much as possible and, in any event, to act in compliance with the relevant acts of Union law, in particular Regulation (EU) 2016/679 of the European Parliament and of the Council ⁽³⁾, Directive (EU) 2016/680 of the European Parliament and of the Council ⁽⁴⁾ and the Charter of Fundamental Rights of the European Union.
- (10) Bearing in mind in particular the relevant technological developments in the area of security-threat detection, the voluntary performance requirements for X-ray equipment contained in this Recommendation should be subject to review and adjustments where necessary. The Commission, with the assistance of the technical working group on detection performance requirements, will therefore closely follow technological and other relevant developments and regularly assess the need for adjustments of this Recommendation.
- (11) In the interest of effectiveness and transparency, Member States should be encouraged to give effect to this Recommendation and submit a report on their implementing measures to the Commission within a reasonable timeframe.
- (12) On the basis of those reports and any other relevant information, the Commission will, after a suitable time period, assess the progress made in giving effect to this Recommendation, with a view, inter alia, to assessing whether Union legal acts with binding force on this subject matter are necessary,

⁽³⁾ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (OJ L 119, 4.5.2016, p. 1).

⁽⁴⁾ Directive (EU) 2016/680 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, and on the free movement of such data, and repealing Council Framework Decision 2008/977/JHA (OJ L 119, 4.5.2016, p. 89).

HAS ADOPTED THIS RECOMMENDATION:

1. For the purposes of this Recommendation, the following definitions apply:
 - (a) 'X-ray equipment' means radiographic X-ray scanners used for physical controls aimed at security-threat detection, in which a pseudo-colour image is generated based on measured changes of X-ray radiation that passes through scanned items of interest;
 - (b) 'security-threat detection' means the determination of the presence or absence of one or more substances or objects of interest which may be used to cause security threats, such as explosives, dangerous chemicals, firearms or sharp objects;
 - (c) 'performance requirements' mean the technical specifications to be met by X-ray equipment intended to ensure that the equipment adequately performs its security-threat detection functions;
 - (d) 'product documentation' means the documentation, in paper or electronic form, accompanying the X-ray equipment;
 - (e) 'public spaces' mean any physical place that is accessible to the public, regardless of whether certain conditions for access may apply.
2. Member States should require in the procurement document for X-ray equipment to be used for security threat detection in public spaces that the tenderer include in the tender the product documentation set out in point 1 of the Annex.
3. Member States should ensure that the X-ray equipment they procure for the use of security-threat detection in public spaces comply with the performance requirements set out in point 2 of the Annex, except when acting in the field of civil aviation.
4. Member States should require in the procurement document for X-ray equipment to be used for security-threat detection in public spaces that the tenderer include in the tender a declaration of conformity with the performance requirements that is issued by the manufacturer, based on the manufacturer's own methodology.
5. By 23 June 2023, Member States should take the necessary measures, in accordance with Union law, to give effect to this Recommendation.
6. Member States should report to the Commission on their implementing measures by 23 December 2023.

Done at Brussels, 23 June 2022.

For the Commission
Ylva JOHANSSON
Member of the Commission

ANNEX

Product Documentation and X-ray Performance Requirements***Terms and Definitions***

For the purposes of this Annex, the following terms and definitions should apply:

- (1) 'Concept of operations (CONOPS)': document describing the equipment characteristics and correct operating procedure(s);
- (2) 'Dark alarm': visual indication presented to the operator when X-ray equipment cannot fully penetrate a scanned item (also known as 'shield alarm' or 'dark alarm');
- (3) 'Dual energy': the exploitation of the energy-dependent attenuation of X-rays in different materials to estimate the effective atomic number of scanned materials, typically employed to discriminate between organic and inorganic material;
- (4) 'Dual view': X-ray equipment where X-ray detection is implemented at two different angles of at least 60° and no more than 90° rotation to give two simultaneous views of scanned objects;
- (5) 'Edge enhancement': an image-processing filter that enhances the edge contrast of an image in an attempt to improve its apparent sharpness;
- (6) 'Effective atomic number': real (non-integer) number describing a hypothetical single element that would exhibit very similar X-ray attenuation as the scanned object comprising different elements;
- (7) 'Inorganic material': in the context of X-ray security screening, a material with an effective atomic number greater than 10;
- (8) 'Multi view': X-ray equipment where X-ray detection is implemented at different angles to give different simultaneous views of scanned objects;
- (9) 'Organic material': in the context of X-ray security screening, a material with an effective atomic number less than 10;
- (10) 'Threat image projection (TIP)': a software function used in X-ray screening to merge a pre-recorded scan of a threat item with an operational scan to create a realistic combined image that is presented to the operator in near real-time.

1. Product Documentation

The X-ray equipment to be used for security-threat detection in public spaces should be supplied together with documentation (in paper and/or electronic form) that contains the following information:

1.1. Physical dimensions of equipment

- overall dimension should be expressed as length (L) x width (W) x height (H) in millimetres (mm);
- tunnel size should be expressed as length (L) x width (W) in mm;
- the maximum object size that can be scanned should be expressed as length (L) x width (W) in mm;
- the maximum conveyor load should be evenly distributed and expressed in kilograms (kg);
- the conveyor height (H) should be expressed in mm.

1.2. Weight of equipment

The overall weight of the X-ray equipment should be expressed in kilograms (kg). The equipment weight should only consider the X-ray hardware and not include additional elements, such as a conveyor belt.

1.3. **Throughput**

The throughput should be expressed as conveyor speed in meter per second (m/s).

1.4. **Power supply and consumption**

- the power supply of the X-ray equipment should be expressed in voltage of alternating current (VAC) with a tolerance of $\pm 10\%$;
- power consumption should be expressed in kilovolt-ampere (kVA).

1.5. **X-ray generator**

- the number of generators should be indicated (e.g. single, dual, multi);
- the anode voltage should be expressed in kilovolt (kV);
- the beam current should be expressed in milliampere (mA);
- the cooling system should be described (e.g., sealed oil bath with forced air).

1.6. **IP rating**

The IP rating according to IEC 60529 should be reported.

1.7. **Operating environment**

- operating temperature should be expressed in degree Celsius ($^{\circ}\text{C}$);
- storage temperature should be expressed in degree Celsius ($^{\circ}\text{C}$);
- humidity should be expressed in range in % (non-condensing).

1.8. **System of conveyance**

It should be indicated if the equipment includes a system of conveyance.

1.9. **Threat image projection**

It should be indicated if the system is able to provide threat image projection (TIP) functionality.

1.10. **Requirements for CE marking**

The equipment should be provided with all relevant documentation to demonstrate compliance with the requirements laid down in the applicable EU legislation that would allow affixing the CE marking. It should be the responsibility of manufacturers to determine which rules apply for their products. Relevant provisions can include, for example:

- Directive 2006/42/EC on machinery
- Directive 2014/35/EU on low voltage
- Directive 2014/30/EU on electromagnetic compatibility

1.11. **Radiation leakage**

Equipment should be provided with a declaration signed by a legal representative of the manufacturer that it meets all requirements for occupational and public exposure to ionising radiation in accordance with Council Directive 2013/59/Euratom on basic safety standards for protection against the dangers arising from exposure to ionising radiation.

1.12. **Operating instructions (concept of operations)**

The system should be provided with operating instructions, also referred to as concept of operations (CONOPS).

2. X-ray Performance Requirements

The X-ray equipment to be used for security-threat detection in public spaces should meet the following performance requirements:

2.1. Image enhancement functions

The X-ray equipment should have the following functions to enhance the image deployed on the screen:

- the capability of at least two times zoom on any part of the image;
- video inversion so as to be able to display a monochrome image with white displayed as black, and black displayed as white;
- an edge-enhancement feature.

Any selected function should reset automatically when the next screened object is shown to the operator.

2.2. Dark alarms

The X-ray equipment should generate dark alarms when scanned objects cannot be fully penetrated by X-ray.

2.3. Colour mapping behaviour

The X-ray equipment should differentiate between inorganic and organic materials by displaying them in different colours. The X-ray equipment should have the following image functions to differentiate between inorganic and organic materials:

- inorganic function to highlight inorganic materials.
- organic function to highlight organic materials.

The colour mapping behaviour specifications that the X-ray equipment should meet is indicated in Table 2.1.

Table 2.1

Colour mapping behaviour

Effective atomic number of material	no image function enabled	organic function enabled	inorganic function enabled
$0 < Z_{\text{eff}} \leq 10$	orange	orange	none
$10 < Z_{\text{eff}} \leq 17$	green	orange	blue/green
$Z_{\text{eff}} > 17$	blue	none	blue

When organic and inorganic material are stacked on top of each other, the X-ray equipment should display the organic material when the organic function is enabled, as indicated in Table 2.2.

Table 2.2

Colour mapping behaviour (stacked organic/inorganic)

Effective atomic number of material	no image function enabled	organic function enabled	inorganic function enabled
organic material under aluminium plate	green	orange	blue/green
organic material under steel plate	blue	orange	blue

2.4. Image quality tests

The image quality tests for the X-ray equipment should be performed by using the human perception (HP) test piece described in the following international standard:

- ASTM F792-17e1, Standard Practice for Evaluating the Imaging Performance of Security X-Ray Systems, ASTM International, West Conshohocken, PA, 2017, www.astm.org

The image quality of the X-ray equipment should be assessed by using the following nine tests:

2.4.1. Test 1: wire display

- the ability of an X-ray equipment to display images that can be used by an operator to identify metal wires.

2.4.2. Test 2: useful penetration

- the ability of an X-ray equipment to produce an image that allows for the detection, by an operator or algorithm, of wires that are hidden by different thicknesses of blocking material.

2.4.3. Test 3: spatial resolution

- the ability of an X-ray equipment to display closely spaced, high-contrast items as separate.

2.4.4. Test 4: simple penetration

- the ability of an X-ray equipment to display images that can be used by an operator to identify lead numerals that would otherwise be hidden by steel blocking material.

2.4.5. Test 5: thin organic imaging

- the ability of an X-ray equipment to display images that can be used by an operator to identify thin pieces of organic material.

2.4.6. Test 6: steel contrast sensitivity

- the ability of an X-ray equipment to display images that can be used by an operator to identify shallow circular recesses in steel.

2.4.7. Test 7: materials discrimination

- the ability of an X-ray equipment to display images that can be used by an operator to discriminate between materials with different effective atomic numbers.

2.4.8. Test 8: materials classification

- the ability of an X-ray equipment to display images that can be used by an operator to consistently identify a particular material over a range of different thicknesses.

2.4.9. Test 9: organic differentiation

- the ability of an X-ray equipment to display images that can be used by an operator to differentiate between organic materials of different effective atomic numbers.

2.5. Image quality thresholds

With reference to the human perception (HP) test piece in ASTM F792-17e1, the minimum thresholds for each image quality test should be as described in Table 2.3 below. To qualify for a specific standard, the X-ray equipment should reach the respective minimum thresholds for all image quality tests.

Table 2.3

Thresholds for image quality

	Image quality Test	Standard 1	Standard 2
1	wire display: wire thickness in air	AWG 30 (0,255 mm)	AWG 34 (0,160 mm)
2	useful penetration: wire thickness under aluminium (Al) of specified thickness	AWG 24 (0,511 mm) behind 16 mm Al	AWG 24 (0,511 mm) behind 20 mm Al & AWG 30 (0,255 mm) behind 12 mm Al
3	spatial resolution: perpendicular line-pair gauges (4 slots, horizontal & vertical, in 1018, 1010 or 1008 steel)	2 mm wide slots with 2mm spacing	1,5 mm wide slots with 1,5 mm spacing
4	simple penetration: lead numerals (thickness $3,0 \pm 0,2$ mm) attached to steel of specified thickness;	24 mm thick steel	28 mm thick steel
5	thin organic imaging: steps in polyoxymethylene with thicknesses of 0,25, 0,5, 1, 2 and 5 mm. Each step has holes of 2, 5 and 10 mm diameter.	4 holes visible *	7 holes visible *
6	steel contrast sensitivity: steel steps with thicknesses of 0,5, 1, 2, and 5 mm. Each step has holes of 2, 5 and 10 mm, all of depth 0,1 mm.	4 holes visible *	7 holes visible *
7	materials discrimination: a grid of square attenuators (varying amounts of steel & plastic varying effective atomic number and attenuation **).	hues of 10 neighbouring squares can be differentiated	hues of 12 neighbouring squares can be differentiated
8	materials classification: a test that the system consistently identifies a given material over a range of thicknesses **.	4 columns are classified as the same material per column	6 columns are classified as the same material per column
9	organic differentiation: the observer records if he/she perceives a difference in hue between four different squares **.	squares 1 through 4 displayed as organic material	squares 1 through 4 displayed as organic material

* A hole is considered visible if it at least half of its area or edge can be discerned.

** See ASTM F792-17e1 for a more detailed description of the human perception test piece.