**This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.本国际标准是根据世界贸易组织技术性贸易壁垒（TBT）委员会发布的《关于制定国际标准、指南和建议的原则的决定》中确定的国际公认的标准化原则制定的。**

# Designation: E1390 − 21名称： E1390 - 21

**Standard Specification for用于**

Illuminators Used for Viewing Industrial Radiographs1用于观察工业射线照片的照明器标准规范1

This standard is issued under the fixed designation E1390; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (s) indicates an editorial change since the last revision or reapproval.本标准以固定编号 E1390 发布；紧跟编号之后的数字表示最初通过的年份，如果是修订，则表示最后一次修订的年份。 括号中的数字表示最近一次重新批准的年份。 上标ε（s）表示上次修订或重新批准后的编辑改动。

## Scope范围

* 1. The function of the illuminator is to provide sufficient illumination and viewing capabilities for the purpose of iden- tification and interpretation of radiographic images. This speci- fication provides the recommended minimum requirements for industrial radiographic illuminators used for viewing industrial radiographic films using transmitted light sources.照明器的功能是提供足够的照明和观察能力，以便识别和判读射线图像。 本规范为使用透射光源观察工业射线胶片的工业射线照度计提供了建议的最低要求。
	2. The illuminator has to ensure the same safety for personnel, or users of any electric apparatus, as specified by electrical standards applicable in the country in which the illuminator is used.照度计必须确保人员或任何电气设备用户的安全，与使用照度计的国家所适用的电气标准规定的安全相同。
	3. Units—The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.单位--以国际单位制单位表示的数值应视为标准数值。 SI 单位后括号内的数值仅供参考，不视为标准值。
	4. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appro- priate safety, health, and environmental practices and deter- mine the applicability of regulatory limitations prior to use.本标准无意解决与使用本标准有关的所有安全问题（如有）。 本标准的使用者有责任在使用前制定适当的安全、健康和环保措施，并确定法规限制的适用性。*
	5. *This international standard was developed in accor- dance with internationally recognized principles on standard- ization established in the Decision on Principles for the Development of International Standards, Guides and Recom- mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.本国际标准是根据世界贸易组织技术性贸易壁垒（TBT）委员会发布的《关于制定国际 标准、指南和建议的原则的决定》中规定的国际公认的标准化原则制定的。*

## Referenced Documents参考文件

* 1. *ASTM Standards:2美国材料与试验协会标准：2*

E1316 Terminology for Nondestructive ExaminationsE1316 无损检测术语表

## Terminology术语

* 1. *Definitions:定义：*

1 This specification is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.01 on Radiology (X and Gamma) Method.1 本规范由 ASTM 无损检测 E07 委员会管辖，并由放射学（X 和伽马）方法 E07.01 小组委员会直接负责。

Current edition approved Nov. 1, 2021. Published November 2021. Originally approved in 1990. Last previous edition approved in 2016 as E1390 – 12(2016). DOI: 10.1520/E1390-21.当前版本于 2021 年 11 月 1 日批准。 2021 年 11 月出版。 最初于 1990 年批准。 上一版于 2016 年批准，编号为 E1390 - 12(2016)。 DOI：10.1520/E1390-21。

2 For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard’s Document Summary page on the ASTM website.2 有关参考的 ASTM 标准，请访问 ASTM 网站 www.astm.org，或联系 ASTM 客户服务部门 service@astm.org。 有关 ASTM 标准卷年鉴信息，请参阅 ASTM 网站上的标准文件摘要页面。

* + 1. diffusing screen, n—the screen that scatters the light such that the light appears the same brightness from any viewing angle.扩散屏（diffusing screen），n-散射光的屏，使光在任何视角下都呈现相同的亮度。
		2. viewing screen, n—the port through which the light is projected.观察屏，n--光线投射的端口。
	1. For additional definitions of terms used in this specification, see Terminology E1316.有关本规范所用术语的其他定义，请参阅术语 E1316。

## Ordering Information订购信息

* 1. This specification is intended to be used by the manu- facturers and purchasers of radiographic illuminators. Requirements, if imposed on manufacturers, should be estab- lished by contractual agreement or appropriate purchase docu- ment.本规范供射线照相照明器的制造商和采购商使用。 如果对制造商有要求，应通过合同协议或适当的采购文件来确定。

## Materials and Manufacture材料和制造

* 1. General—The illuminator shall consist of a housing with one or more of the sides containing a viewing screen illuminated from the inside of the housing. The viewing screen may also be the diffusing screen. There shall be thermal protection to prevent overheating, and subsequent damage to the radiographs placed on the viewing screen. The housing or system may or may not require ventilation. A rheostat or suitable electrical circuit shall be provided to vary the light intensity.一般--照明器应由一个外壳组成，外壳的一个或多个侧面装有从外壳内部照亮的观察屏。 观察屏也可以是扩散屏。 必须有热保护装置，以防止过热，进而损坏放在观察屏上的射线照片。 机壳或系统可能需要通风，也可能不需要。 应提供一个变阻器或适当的电路来改变光强度。

## Physical Properties物理特性

* 1. General—The illuminator shall be manufactured of materials deemed suitable to withstand the environmental conditions encountered under normal operating conditions.一般 - 照明器的制造材料应能承受正常工作条件下所遇到的环境条件。
	2. Viewing Screen—The viewing screen shall be easy to clean and made of material which is resistant to scratches. The size of the screen shall allow the user to view the radiograph without excessive glare. If the illuminator is to be used for viewing radiographs of various sizes, masks of various sizes and configurations should be provided. Alternately, an adjust- able aperture may be used.观察屏--观察屏应易于清洁，并由不易划伤的材料制成。 屏幕的尺寸应能让用户在观看射线照片时不会过度刺眼。 如果照明器用于观察各种尺寸的射线照片，则应提供各种尺寸和配置的遮光罩。 也可以使用可调节的光圈。
	3. Color of Light—The color of the light used to illuminate the radiograph shall be white, that is, color temperature between 5000 and 6250 °K. However, illuminators using non-white or “colored” light may be used if they have been recommended by the film manufacturers.光的颜色-用于照射射线照片的光的颜色应为白色，即色温在 5000 至 6250 °K 之间。 但是，如果胶片生产商推荐使用非白色或 "彩色 "光源，也可以使用。

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* 1. Diffusing Screen—If the illuminator has a diffusing screen, the light shall be sufficiently divergent in accordance with 7.2.漫射屏--如果照明器有漫射屏，则光线应充分发散，符合 7.2 的规定。
	2. Housing—The external housing shall be constructed in such a manner that no disturbing light hinders the viewing of the radiographs.外壳-外部外壳的构造不得妨碍观察射线照片。
	3. Anti-Glare Device—The illuminator shall be fitted with an anti-glare switch or device that minimizes the probability of the operator being subjected to excessive glare when the radiograph is removed. This switch or device may be manual or automatic.防眩装置--照相机须装有防眩开关或装置，以尽量减少操作者在取下射线照片时受到过度强光照射的可能性。 这种开关或装置可以是手动或自动的。
	4. Illuminators Used for Viewing “Wet” Radiographs— Illuminators manufactured for use in viewing “wet” radio- graphs shall be manufactured to prevent the penetration of liquid into internal electrical components in such a manner that safe operation of the unit would be compromised.用于观察 "湿 "射线照片的照明器--用于观察 "湿 "射线照片的照明器在制造时应防止液体渗入内部电气元件，以免影响设备的安全运行。

## Performance Requirements性能要求

* 1. Maximum Luminance Output—The luminance of the transmitted light shall not be less than 30 candelas per square metre for radiographs with optical densities equal to or less than 2.5 and not less than 10 candelas per square metre for radiographs with optical densities greater than 2.5.最大亮度输出-对于光密度等于或小于 2.5 的射线照片，透射光的亮度不得小于每平方米 30 烛光；对于光密度大于 2.5 的射线照片，透射光的亮度不得小于每平方米 10 烛光。
	2. Divergence and Diffusion of Light—If the illuminator has a diffusing screen, the light shall be sufficiently divergent so that both eyes of the observer receive rays from all parts of the screen. The divergence factor shall exceed 0.7.光的发散和扩散--如果照明器有一个扩散屏，则光线必须有足够的发散，以便观察者的双眼都能接收到来自屏幕所有部分的光线。 发散系数应超过 0.7。
	3. The viewing screen shall be uniformly illuminated with the uniformity factor δ being higher than 0.5.观察屏应均匀发光，均匀系数 δ 应大于 0.5。
	4. Appropriate precautions shall be taken by the manufac- turer to ensure that temperature of the housing does not exceed 60 °C (140 °F) at the usual contact surfaces after 1 h of operation at a 50 % duty cycle.制造商应采取适当的预防措施，确保在 50 % 的工作周期下工作 1 小时后，外壳通常接触面的温度不超过 60 °C (140 °F)。
	5. A radiograph having an optical density of 2.0 when placed onto the illuminator viewing surface shall not warp or curl after 1 min of continuous viewing time and 1 h of operation of the illuminator at a 50 % duty cycle.光密度为 2.0 的射线照片放置在照度计观察面上，经过 1 分钟的连续观察和照度计以 50 % 的占空比工作 1 小时后，不得翘曲或卷曲。

## Scope范围

* 1. The following tests shall be utilized to verify the performance requirements specified in 7.1 through 7.3 of this specification.以下测试用于验证本规范 7.1 至 7.3 中规定的性能要求。
		1. Maximum illuminator luminance shall be determined using a calibrated photometer placed at the center of the viewing surface, and shall be measured in accordance with the directions specified by the photometer’s manufacturer.最大照明器亮度应使用校准过的光度计测定，光度计应放置在观察表面的中心，并按照光度计制造商规定的方向进行测量。
		2. Maximum illuminator luminance measurements are to take place in a room with less than 20 lux (approximately 2 footcandles) of background light. Light escaping from the illuminator even when the viewing screen is completely masked shall not affect the measurements.最大照明器亮度测量应在背景光低于 20 勒克斯（约 2 英尺烛光）的房间内进行。 即使观察屏被完全遮住，从照明器漏出的光也不应影响测量。
	2. Divergence and Diffusion of Light—If the illuminator has a diffusing screen, the light shall be sufficiently divergent so that both eyes of the observer receive rays from all parts of the screen. The divergence factor shall exceed 0.7.光的发散和扩散--如果照明器有一个扩散屏，则光线应具有足够的发散性，以便观察者的双眼都能接收到来自屏幕所有部分的光线。 发散系数应超过 0.7。
		1. The luminance shall be measured on a semi-circle, the center of which is center of the screen.亮度应在以屏幕中心为圆心的半圆上测量。
		2. The diameter of the circle is approximately the same as the maximum dimension of the screen (the diagonal). The radius of this semi-circle should be at least 25 cm (10 in.).半圆的直径与屏幕的最大尺寸（对角线）大致相同。 半圆的半径至少应为 25 厘米（10 英寸）。
		3. The luminance is measured with the aid of an appro- priate luminance photometer whose sensitive surface is tangent to the curve of the circle (see Fig. 1). These measurements shall be made at angles of 5° (L5), 20° (L20), and 45° (L45) relative to the normal (L0) to the diffusing screen. The divergence factor, σ’, shall be calculated according to the following equation:使用合适的亮度光度计测量亮度，光度计的敏感面与圆的曲线相切（见图 1）。 这些测量应在相对于扩散屏法线（L0）的 5°（L5）、20°（L20）和 45°（L45）角处进行。 发散因子 σ' 应按下式计算：

σ’ 5 L451L20σ' 5 L451L20

2 L5

* 1. The viewing screen shall be uniformly illuminated with the uniformity factor δ being higher than 0.5, and calculated in the following manner:观察屏应均匀照明，均匀系数 δ 应大于 0.5，并按以下方式计算：
		1. The measurements shall be made with the aid of an illumination photometer or other suitable instrument.应借助照明光度计或其他合适的仪器进行测量。
		2. If the screen is rectangular, it shall be divided into squares, each side of the squares measuring 3.5 cm, the luminance of each being measured separately. If the screen is circular, the same basic procedure shall be followed. In both cases, the network of the squares shall be so arranged that the middle square is centered in the middle of the screen.如果屏幕是长方形的，则应将其划分为正方形，每个正方形的边长为 3.5 厘米，分别测量每个正方形的亮度。 如果屏幕是圆形的，则应遵循相同的基本程序。 在这两种情况下，方格网的排列应使中间方格位于屏幕中央。
		3. The average of the four highest and the average of the four lowest results shall be found, which give the average arithmetical values of the luminance Lmax and Lmin . The uniformity factor g shall then be calculated according to the formula:应找出四个最高结果的平均值和四个最低结果的平均值，即亮度 Lmax 和 Lmin 的平均算术值。 然后根据公式计算均匀度系数 g：

*δ 5 Lmin*

*Lmax*

## Certification认证

* 1. The manufacturer is responsible for certifying that the illuminator conforms to the requirements of this specification prior to shipping to customer.在向客户发货之前，制造商有责任证明照明器具符合本规范的要求。
	2. At the request of the customer, the manufacturer of the illuminator shall provide a written statement indicating confor- mance to the requirements of this specification and test results if requested.应客户要求，照明器具制造商应提供一份书面声明，说明其符合本规范的要求，并应要求提供测试结果。



**FIG. 1 Measurement Angles of Diversion and Dispersion of Light图 1 光的发散和散射测量角度**

## Product Marking产品标记

* 1. Each illuminator will have the following information permanently affixed by the manufacturer:每台照明器具上都有制造商永久性粘贴的以下信息：
		1. Nominal operating voltage or permissible voltage range.额定工作电压或允许电压范围。
		2. Nominal line frequency or permissible frequency range.额定线路频率或允许的频率范围。
		3. Whether direct, alternating current, or both may be used.是否可以使用直流电、交流电或两者兼用。
		4. Whether designed for use with “wet” film viewing.是否设计用于 "湿 "膜观察。
		5. Nominal power consumption.标称耗电量。
		6. Maximum brightness in candelas per square metre as calculated during factory acceptance tests.出厂验收测试时计算的每平方米最大亮度（烛光）。
		7. Lamp type.灯泡类型。

## Packaging and Package Marking包装和包装标记

* 1. Each illuminator will be provided with operating instructions that address the following:每台照明器都将附有操作说明，其中包括以下内容：
		1. Safety precautions to be expected during the normal operating conditions.正常工作条件下的安全注意事项。
		2. Operating conditions.操作条件。
		3. Instructions for mounting and replacements of lamps and screens.灯泡和屏幕的安装和更换说明。
		4. Care and recommended maintenance procedures.保养和建议的维护程序。
		5. Replacement lamp and screen identification and sup- plier contact information.更换灯管和屏幕的标识以及供应商的联系信息。

## Quality Assurance质量保证

* 1. The manufacturer is responsible for testing and certi- fying that the illuminator conforms to the requirements of this specification prior to shipping to customer.制造商负责在向客户发货前测试并证明照明器符合本规范的要求。

## Keywords关键字

* 1. illuminator; luminance; radiograph照明器；亮度；射线照相

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