

ICS 17.180
CCS A 60

JJG

**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

JJG 2028-2021

**Verification Scheme of Measuring Instruments for Diffuse
Transmission Visual Density(Black and White Density)
(English Translation)**

Issued on: December 8, 2021

Implemented on: June 8, 2022

Issued by: State Administration for Market Regulation

Table of Contents

Introduction (II)

1 Scope(1)

2 Measurement basis(1)

3 Metrics(2)

4 Working Measuring Instruments(3)

5 Diagram of the calibration system for diffuse transmission visual density (black and white density) measuring instruments (3)

4 Working Measuring Instruments(3)

5 Diagram of the calibration system for diffuse transmission visual density (black and white density) measuring instruments (3)

Introduction

JJF1001 "General Metrology Terms and Definitions", JJF1032 "Terms and Definitions of Optical Radiation Metrology", JJF1059.1 "Evaluation and Expression of Measurement Uncertainty" and JJF1104 "Rules for Compiling Tables of National Metrology Verification System" Together they constitute the basic series of specifications that support the revision of the verification system tables:

This verification system table replaces JJG 2028-1989: Compared with JJG 2028-1989, except for editorial modifications, the main technical changes are as follows:

- Modified the description and indicators of the national benchmark for diffuse transmission visual density (see 2.1);
- Modified the indicators of the diffuse transmission visual density work benchmark (see 3.1);
- Increased the description and indicators of the diffuse transmission visual density standard device (see 3.2);
- Modify the description about the standard density sheet (see 3.3, 3:4, 3:5);
- Deleted the related content of optical wedge density;
- Modified the diffuse transmission visual density (black and white density) measuring instrument verification system diagram (see Chapter 5):

The previous version releases of this verification system table are as follows:

---JJG 2028-1989:

Diffuse transmission visual density (black and white density) Measuring Instrument Verification System Table

1 Scope

This verification system table is applicable to the verification of optical transmission density measuring instruments: It specifies the diffuse transmission visual density state the purpose of the benchmark, the complete set of basic measuring instruments included in the benchmark, the metrological parameters of the benchmark and the use of the working benchmark, Standard procedure for transmitting the value of a transmission density unit to a working measuring instrument, specifying its uncertainty and basic verification method law etc:

The verification system is composed of three parts: measuring reference instruments, measuring standard instruments and working measuring instruments:

Spectral conditions and geometric conditions of measuring instruments at all levels shall comply with GB/T 11501-2008 "Photographic Densitometer Part 3: Spectral Conditions", GB/T 11500-2008 "Photographic Density Measurement Part 2: Transmission Density Degree of geometric conditions "requirements:

2 Measurement basis

2.1 National benchmark for diffuse transmission visual density

2.1.1 National benchmark for diffuse transmission visual density is a device to reproduce diffuse transmission visual density: optical density the spectrum-corrected photodetector directly reads the transmitted luminous flux of the sample and the measured luminous flux when the sample moves out of the sampling hole of the measuring device the amount is then calculated according to the definition of transmission density [Equation (1)]:

$$DT = \lg(1/\tau) \quad (1)$$

Among them, DT is the optical density; τ is the transmission factor, which is defined as the difference between the luminous flux ϕ_{τ} passing through the sample and the sample measured from the ratio of the measured aperture flux ϕ_{ij} after the sampling aperture of the instrument leaves, that is, $\tau = \phi_{\tau} / \phi_{ij}$ (2) Then there are:

$DT = \lg(\phi_{ij} / \phi_{\tau})$ (3) Optical density is a dimensionless quantity with a unit of 1: The measurement spectral condition of the national benchmark is the incidence of the lighting system the spectral function should be the function SH specified in GB/T 11501-2008; the spectral function of the detection system should be VT: country the measurement geometry of the home benchmark is an integrating sphere plus opal glass lighting, and a 9° cone angle for collection: So this spectral condition and the functional representation of the geometric conditions should be DT (90° opalescent glass; SH≤10°; VT): This optical

density is called diffuse Transmission visual density: The sampling hole diameter of the reference device is 4mm: Its schematic diagram is shown in Figure 1:

2.1.2 The incident lighting system of the national benchmark is realized by the light source system with the fiber optic hemispherical transmitter as the core, mainly including tungsten halogen lamps, axicon ellipsoid mirrors, fiber optic hemispherical emitters, and opal glass: Its diffuse transmission coefficient reaches 0.945, in the reflection factor of opal glass at 550nm wavelength is 0.55:

2.1.3 The detection system consists of a lens group designed using the imaging principle, a silicon photodiode with a $V(\lambda)$ correction filter, and a picoammeter, the nonlinearity is 1:002 in the range of $(4 \times 10^{-6} \sim 1 \times 10^{-12})A$:

2.1.4 The optical density measurement resolution of the whole system is 0.001, and the expanded uncertainty is $U=0.003$ (0