

Published 23 October 2023

Subscriptions and technical questions: optics.innventia@ri.se

Internet: <https://www.ri.se/en/services/optical-reference-standards-ir3>

ISO reference standards

We provide ISO reference standards of level 3 (IR3) for calibration of optical instruments. Non-fluorescent standards are used for the calibration of the reflectance factor scale and the fluorescent standards are used for adjusting the UV level in the instrument to D65 and/or C conditions. The standards are issued around the 15th of each month.

The non-fluorescent IR3 standards are calibrated in a Konica Minolta CM-3630 and the fluorescent IR3 standards are calibrated in a Technidyne Color Touch 2. These reference instruments are calibrated in relation to the perfect reflecting diffuser (IR1) by means of a transfer standard of ISO level 2 (IR2) calibrated at the NRC, Ottawa, Canada. The fluorescent reference standards are calibrated in relation to a fluorescent IR2 also calibrated at the NRC, Ottawa.

All reference standards are prepared with a sample port area/view area of 34/30. Each standard consists of an opaque pad of paper of size 72 mm × 140 mm. **The assigned values apply only to the top sheet of the complete paper pad.**

Non-fluorescent standards are provided in accordance with ISO 2469 *Paper, board and pulps – Measurement of diffuse radiance factor* and ISO 22754 *Pulp and paper – Determination of the effective residual ink concentration (ERIC number) by infrared reflectance measurement*. Note that for a non-fluorescent material, the radiance factor is usually referred to as the reflectance factor. Fluorescent standards are provided in accordance with ISO 2470-1 *Paper, board and pulps – Measurement of diffuse blue reflectance factor – Part 1: Indoor daylight conditions (ISO brightness)* and ISO 11475 *Paper and board – Determination of CIE whiteness, D65/10 degrees (outdoor daylight)*.

IR3 type D – spectral reflectance factor for spectrophotometers

Type D standards are intended for spectrophotometers such as the Datacolor Elrepho 2000, 3000 Series or 450, Lorentzen&Wettre Elrepho, Technidyne Color Touch and Minolta CM-3630. Spectral reflectance factor values are assigned for wavelengths between 400 and 700 nm at 20 nm and/or 10 nm intervals. These values must be entered into the instrument before the reference standard is used for calibration purposes.

For most instruments, data at 20 nm intervals are sufficient. The 20 nm data are reported on the data label (front side) attached to the standard and on the calibration certificate, while the 10 nm data are reported on the calibration certificate only. The Optical Calibration Laboratory is accredited for both 10 and 20 nm data. 20 nm data are obtained by conversion from 10 nm data.

On the backside of the data label several check values are reported, see Table 1, page 4.

The material in type D standards is non-fluorescent and has been specially chosen because of its insensitivity to UV radiation. Calibration can therefore be performed with any UV setting, for example UV(D65), UV(C) or UV excluded.

IR3 type DX – spectral reflectance factor for spectrophotometers with extended wavelength range

Type DX standards are intended for spectrophotometers having an extended wavelength range. These standards are made of the same paper as type D standards and have assigned spectral reflectance factor values for wavelengths between 360 nm and 740 nm.

On the backside of the data label several check values are reported, see Table 1, page 4.

IR3 type DE – spectral reflectance factor for spectrophotometers with ERIC measurement option

Type DE standards are intended for spectrophotometers equipped with a reflectance measurement channel at 950 nm. These standards are the same as type D, but with the R950 value (the reflectance factor at 950 nm) also assigned. Measurements at 950 nm are used for the determination of the effective residual ink concentration number, the ERIC number, of de-inked, recycled pulp and of sheets of machine-made paper made from recycled pulp.

On the backside of the data label several check values are reported, see Table 1, page 4.

IR3 type F – fluorescent standards for illuminant D65

Type F fluorescent standards have an assigned CIE whiteness ($D_{65}/10^\circ$) value, for the UV filter in the spectrophotometer to be adjusted so that the illumination corresponds to illuminant D65. The instrument must first be calibrated with a non-fluorescent standard, e.g. IR3 type D or DX. The whiteness of the fluorescent standard should then be measured, and the UV filter adjusted until the correct value is obtained.

On the backside of the data label several approximate values are reported, see Table 1, page 4.

IR3 type B – fluorescent standards for illuminant C

Type B fluorescent standards have an assigned ISO brightness R_{457} (illuminant C) value, for the UV filter in the spectrophotometer to be adjusted so that the illumination corresponds to illuminant C. The instrument must first be calibrated with a non-fluorescent standard, e.g. IR3 type D or DX. The brightness of the fluorescent standard should then be measured, and the UV filter adjusted until the correct value is obtained.

On the backside of the data label several approximate values are reported, see Table 1, page 4.

IR3 type FB – combined fluorescent standards for illuminants D65 and C

Type FB standards are a combination of type F and B standards. Each standard has two assigned values, a CIE whiteness value for the adjustment to illuminant D65 and an ISO brightness value for the adjustment to illuminant C.

On the backside of the data label several approximate values are reported, see Table 1, page 4.

IR3 type Zxx – for filter instruments Zeiss Elrepho and Technidyne micro-TB-1C

Type Z standards are intended for filter instruments. Each standard has assigned R_x , R_y , R_z and R_{457} values for calibration of the corresponding filters in these instruments. Type Z standards are available at 6 different reflectance levels, having nominal R_{457} values of 90%, 80%, 70%, 60%, 50% and 20% – Z90, Z80, Z70, Z60, Z50 and Z20. See Table 2, page 5.

IR3 type Exx – for Elrephomat

Type E standards are intended for the Elrephomat instrument. Each standard has assigned R_x , R_y and R_z values for calibration of the corresponding filters in this instrument, relating to illuminants D65, C and A. The standard also has an assigned ISO brightness R_{457} value. Type E standards are available at 6 different reflectance levels, having nominal R_{457} values of 90%, 80%, 70%, 60%, 50% and 20% – E90, E80, E70, E60, E50 and E20. See Table 2, page 5.

List of Reference Standards

The reported physical and colorimetric quantities of the different standards issued by the Optical Calibration Laboratory are listed in Table 1 and Table 2 below.

Table 1: Physical and colorimetric quantities for type D, DX, DE, F, B and FB

IR3 Type	Description	D Non-fluor. 85%<R<97% 400–700nm	DX Non-fluor. 85%<R<97% 360–740nm	DE Non-fluor. 85%<R<97% 400–700nm and 950nm	F Fluor. $W \approx 152$	B Fluor. $R_{457} \approx 101\%$	FB Fluor. As F and B
	$R(\lambda)$	•	•	•			
C/2°	X	o	o	o		o	o
	Y	o	o	o		o	o
	Z	o	o	o		o	o
	R_x	•	•	•		o	o
	R_y	•	•	•		o	o
	R_z	•	•	•		o	o
	R_{457}	•	•	•		•	•
	R_{457F}					o	o
	R_{950}			•			
	L^*	o	o	o			
	a^*	o	o	o			
	b^*	o	o	o			
	W					o	o
	T_W					o	o
	W_F					o	o
D65/10°	X	o	o	o	o		o
	Y	o	o	o	o		o
	Z	o	o	o	o		o
	R_x	o	o	o	o		o
	R_y	o	o	o	o		o
	R_z	o	o	o	o		o
	R_{457}				o		o
	L^*	o	o	o			
	a^*	o	o	o			
	b^*	o	o	o			
	W				•		•
	T_W				o		o
	W_F				o		o

• = accredited values according to the ISO standards

o = check values

Table 2: Physical and colorimetric quantities for type Z90 – Z20 and type E90 – E20

IR3 Type	Description	Z90	Z80	Z70	Z60	Z50	Z20	E90	E80	E70	E60	E50	E20
		Non-fluor. R457~90%	Non-fluor. R457~80%	Non-fluor. R457~70%	Non-fluor. R457~60%	Non-fluor. R457~50%	Non-fluor. R457~20%	Non-fluor. R457~90%	Non-fluor. R457~80%	Non-fluor. R457~70%	Non-fluor. R457~60%	Non-fluor. R457~50%	Non-fluor. R457~20%
C/2°	R_x	•	•	•	•	•	•	•	•	•	•	•	•
	R_y	•	•	•	•	•	•	•	•	•	•	•	•
	R_z	•	•	•	•	•	•	•	•	•	•	•	•
	R_{457}	•	•	•	•	•	•	•	•	•	•	•	•
A/2°	R_x							o	o	o	o	o	o
	R_y							o	o	o	o	o	o
	R_z							o	o	o	o	o	o
D65/10°	R_x							o	o	o	o	o	o
	R_y							o	o	o	o	o	o
	R_z							o	o	o	o	o	o

• = accredited values according to the ISO standards

o = check values

Price List published 23 October 2023

Single orders and subscriptions for the year 2024 will be based on this price list.

IR3 type	For calibration of	Price each (SEK)		
		>10	>5	5 or less
D	Spectral reflectance factor 400–700 nm ¹⁾	1 625	1 825	2 390
DX	Spectral reflectance factor 360–740 nm ¹⁾	1 915	2 135	2 820
Zxx	Reflectance factors for filter instruments ¹⁾	975	1090	1365
Exx	Reflectance factors for filter instruments ¹⁾	1240	1390	1800
DE	Spectral reflectance factor 400–700 nm and 950 nm ^{1) 2)}	1 915	2 135	2 820
F	CIE whiteness ³⁾	1 625	1 825	2 390
B	ISO brightness ⁴⁾	1 625	1 825	2 390
FB	Combination of F and B ^{3) 4)}	2 335	2 605	3 385

¹⁾ ISO 2469 | ²⁾ ISO 22754 | ³⁾ ISO 11475 | ⁴⁾ ISO 2470-1

The quantity discounts are only applicable for each type of standard separately when they have the same consignee and are invoiced jointly. The Type Z90, Z80, Z70, Z60, Z50 and Z20 standards are different types of standards in this respect and so are E90, E80, E70, E60, E50 and E20.

There is an expedite fee of 500 SEK for an immediate delivery, that is a delivery in between our regular mid-month dispatches.

The standard shipment method is air mail/surface mail (regular post), free of charge.

Additional fee for delivery with courier: 2400 SEK/delivery.

Additional fee for delivery as registered letter: 250 SEK/delivery.

Sales Terms and Conditions

Detailed general terms are found in the documents *Optical Calibration Laboratory – Sales Terms and Conditions* and *RISE General Terms and Conditions*. A few details are, however, worth mentioning here.

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Annual subscriptions are intended for laboratories who want deliveries of reference standards according to an agreed schedule. Subscriptions are accepted for a one-year period and the subscription fee must be paid in full and in advance. A subscription is automatically renewed without change of content after one year unless a change or cancellation notice is sent in writing. A cancellation notice or notice of changes to a current subscription shall be made at least **two months** before the new subscription period starts.

All invoices are payable within 30 days both for single and subscription orders. The invoices are sent as soon as an order is placed to new customers and for single orders. For continued subscription a new invoice for the subsequent year is due for payment in the beginning of the subscription period.

Any defective reference standard will be replaced free of charge.

Li Yang

Technical Manager

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