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Graphic technology — Prepress data exchange — Tone adjustment curves exchange

bsi.

National foreword

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The committee responsible for this document is ISO/TC 130, *Graphic technology*.

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Introduction

The aim of this International Standard is to define a simple format to exchange data of Tone Adjustment Curves (also called transfer functions and plate curves) between applications including, but not limited to, colour management, calibration and raster image processor systems.

In many cases, it is useful to be able to provide calibration data for printing plates in a standard form to ensure easy and accurate exchange of data. Graphic arts raster image processor vendors all provide support for printing plate calibration and adjustment of tone curves for digital presses using essentially the same data, however, each uses a proprietary format. One consequence of this is that companies providing tools to support print certification need to provide support for many different file formats. Increasingly, the importance of calibration is being recognized by printers who wish to provide a single, often centralized, solution for calibration and in this context it is becoming increasingly difficult to keep up with the many different formats in use.

TC 130 experts know of no commercial reason for each vendor to adopt a different standard and believe that if there was an ISO standard format, this would be likely to be adopted by the industry. This International Standard aims to define the minimum set of data required by all of today's applications and provide a format that is easily extensible so that additional metadata can be included when agreed on between the parties.

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Graphic technology — Prepress data exchange — Tone adjustment curves exchange

1 Scope

This International Standard specifies a simple extensible format for the exchange of tone adjustment curves between applications including but not limited to colour management, calibration and raster image processor systems.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Namespaces in XML 1.0 (Third Edition), W3C (World Wide Web Consortium) Recommendation 8 December 2009[1)]

XML Schema Part 2: Datatypes (Second Edition), W3C (World Wide Web Consortium) Recommendation 28 October 2004[2)]

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
transfer curve
curve that defines the relationship between input code values and output values, imaged or printed

4 Symbols and abbreviated terms

4.1 Text styles

The following documentation conventions are used.

Names of XML elements are shown in bold type, for example **TransferCurve**.

Names of XML attributes are shown in italics, for example *SpotColorName*.

4.2 Data types

All datatypes used in this International Standard are as defined by XML Schema Part 2: Datatypes.

1) Available at http://www.w3.org/TR/REC-xml-names/. [Accessed 21st December 2015].

2) Available at http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/. [Accessed 21st December 2015].

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5 Requirements

5.1 XML Namespace

This International Standard relies on XML to ensure clear communication of metadata. It is very likely that different systems will want to add elements and attributes whose intended use falls outside of this specification.

Extension of this sort is well supported by XML and the following rules apply.

— All elements and attributes defined by this International Standard shall use the namespace 'http://www.npes.org/schema/ISO18620/'.

— Vendor-specific attributes and elements may be included and when included shall be defined in a vendor-specific namespace as described in "Namespaces in XML 1.0".

— Compliant reader applications may safely ignore vendor specific attributes and elements. These attributes and elements may enable additional functionality in closed environments but shall not change the base functionality as defined in elements and attributes defined in this International Standard.

Such proprietary elements and attributes are out of the scope of this International Standard.

5.2 File structure

5.2.1 General

The file is intended to contain a single set of transfer curves comprising one or more transfer curves. A schema is provided in Annex A for information.

The first line of the file shall be as follows:

<?xml version="1.0" encoding="UTF-8"?>

5.2.2 TransferCurveSet

A single **TransferCurveSet** element shall be included and shall be as shown in Table 1.

Table 1 — TransferCurveSet element

Name	Cardinality[a]	Data type	Description
xmlns	Required	anyURI	The namespace shall be declared in accordance with *Namespaces in XML1.0 (Third Edition), Clause 3* and shall be 'http://www.npes.org/schema/ISO18620/'.
Creator	Optional	string	Describes the creator of the document. This is usually the name and version of the authoring application used.
CreationDate	Optional	dateTime	The date and time when the file was created.
OperatorName	Optional	string	Describes the operator who created the file.
PressName	Optional	string	The name used to describe the press for which the data has been created.
MediaName	Optional	string	The name used to describe the media for which the data has been created

[a] Cardinality: unless otherwise specified, only a single instance of each element or attribute may be included.

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Table 1 *(continued)*

Name	Cardinality[a]	Data type	Description
Side	Optional	enumeration	The side of the sheet for which the data has been created. One of Front or Back. Note that this attribute should be omitted if the data applies to both sides of the sheet.
MeasurementFile	Optional (more than one may be provided)	anyURI	URI providing the location of one or more measurement file(s) from which the data has been derived. Note that there is no convention specified for the URI or for the content of the files.
TransferCurveSetID	Optional	NMTOKEN	TransferCurveSet identifier. The value selected for this ID should be agreed between stakeholders.
FormPreparationDetails	Optional	element	Provides details of any specific form preparation configuration, for example, the screening family, gravure engraving parameters, flexo anilox lpi, etc. to which the data relates. This information is likely to be vendor-specific.
PrintingCondition	Optional (unless match a standard printing condition)	element	Metadata describing the printing condition that this adjustment applies to. This shall be included when the TransferCurveSet is being used to match a standard printing condition.
TransferCurve	Required (more than one may be provided)	element	Transfer curve element for a single colorant.

[a] Cardinality: unless otherwise specified, only a single instance of each element or attribute may be included.

5.2.3 FormPreparationDetails

The **FormPreparationDetails** element may be included and when included shall be as shown in Table 2. When included, it provides details of any specific form preparation configuration, for example, the screening family, gravure engraving parameters, flexo anilox lpi, etc. to which the data relates. This information is likely to be vendor-specific.

Table 2 — FormPreparationDetails element

Name	Cardinality	Data type	Description
Description	Required	string	Human readable description of the key form preparation parameters. This string should be suitable for presentation on a user interface.
NOTE This element can be used to provide additional details about the form preparation in a more structured way than can be achieved using a simple text description. The way in which this is done is outside of the scope of this International Standard.			

5.2.4 PrintingCondition

The **PrintingCondition** element may be included and when included shall be as shown in Table 3. When included, this information identifies the printing condition used and allows the user to check that the adjustment meets the intended aims.

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Table 3 — PrintingCondition element

Name	Cardinality	Data type	Description
PrintingConditionID	Optional	String	The name of the printing condition. When used, this shall be the reference name indicated in the ICC CMYK Characterisation Data registry or the name of an unregistered standard printing condition agreed between the parties. This shall be included when the TransferCurveSet is being used to match a standard printing condition.
NOTE It is anticipated that, for some cases, structured data about the printing condition may be required such as solid ink measurement data and this kind of information needs to be included as part of this element.			

5.2.5 TransferCurve

The **TransferCurveSet** shall include at least one TransferCurve and may include a **TransferCurve** for each separation to be adjusted and shall be as shown in Table 4.

A **TransferCurve** with *Separation* = 'Default' (a default transfer curve) shall apply to all separations for which no **TransferCurve** has been explicitly included.

If no **TransferCurve** curve is present for a given separation and no default transfer curve is present, the file shall be read as not providing any information regarding adjustment of that separation.

Table 4 — TransferCurve element

Name	Cardinality	Data type	Description
Separation	Required	string	Name of the colour separation. May be one of the following: 'Cyan', 'Magenta', 'Yellow', 'Black', 'Default' or a name agreed by all stakeholders in the print production process.
TransferCurveID	Optional	NMTOKEN	TransferCurve identifier. The value selected for this ID should be agreed between stakeholders.
PrintingUnitNumber	Optional	integer	The number of the printing unit. The number 1 represents the first printing unit. PrintingUnitNumber shall not be present when Separation='Default'.
Curve	Required	Whitespace-separated list of an even number of doubles	A set of XY coordinates in the range 0,0 to 1,0 of a transfer curve where 0,0 indicates a 0% tone (no coverage) and 1,0 represents a 100% tone (full coverage). The set of coordinates shall include a point with x value of 0,0 and a point with an x value of 1,0. XY coordinates shall be ordered such that successive X values in the Curve list shall be equal to or greater than previous X values. The curve shall be 'increasing' or 'decreasing' as follows: For an 'increasing' curve, successive Y values in the Curve list shall be equal to or greater than previous Y values and For a 'decreasing' curve, successive Y values in the Curve list shall be less than or equal to previous Y values. As this International Standard does not specify how intermediate values are to be calculated, sufficient points shall be included to avoid artefacts such as Mach banding.

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5.3 Interpretation of TransferCurve

The **TransferCurve** is a list of x y pairs defining a function which should be applied to document colour separations as part of the rendering process or after the document has been rendered but before the document is printed or printing plates are made. The x of each pair represents a document colour separation value and the y of each pair represents its mapped value.

5.4 Examples

5.4.1 Example 1

The following example code specifies no adjustment to the Black, a 10% cutback to Cyan, and a more complex curve for all other colours as shown in Figure 1.

```
<?xml version="1.0" encoding="UTF-8"?>
<TransferCurveSet xmlns="http://www.npes.org/schema/ISO18620/"
                  Creator="My Press Calibration Software"
                  CreationDate="2013-04-09T17:08:30-05:00"
                  OperatorName="Samuel Adams"
                  PressName="My Printing Press"
                  MediaName="Standard Coated paper"
                  Side="Front"
                  MeasurementFile="<URL>"
                  TransferCurveSetID="CRD-24-3">
        <FormPreparationDetails Description="Euclidean screen"/>
        <PrintingCondition PrintingConditionID="Fogra39"/>
        <TransferCurve Separation="Cyan"
                       TransferCurveID="C123456"
                       PrintingUnitNumber="1"
                       Curve="0.0 0.0 0.5 0.4 1.0 1.0" />
        <TransferCurve Separation="Black"
                       TransferCurveID="K654321"
                       PrintingUnitNumber="2"
                       Curve="0.0 0.0 1.0 1.0" />
        <TransferCurve Separation="Default"
                      TransferCurveID="D123"
                       Curve="0.0 0.0 0.1 0.2 0.5 0.6 0.8 0.9 1.0 1.0" />
</TransferCurveSet>
```

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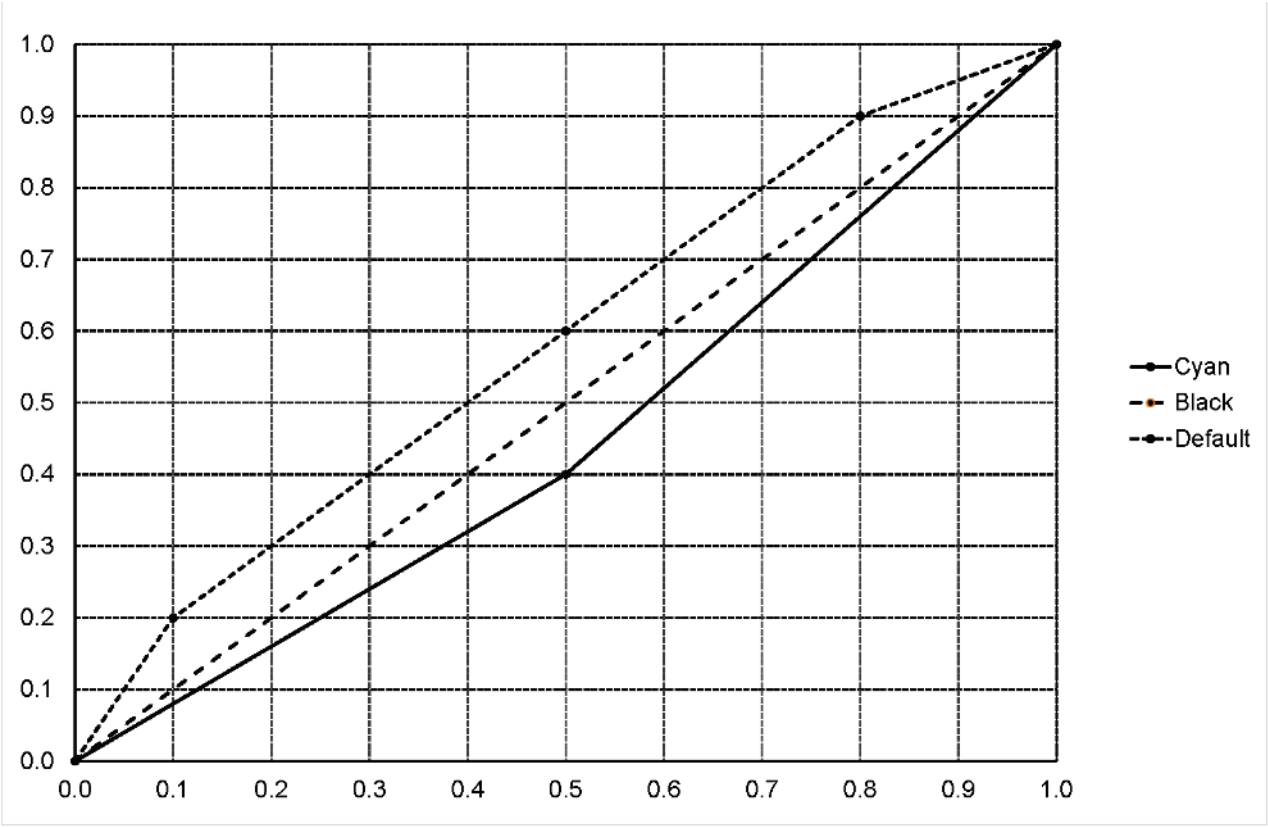

Figure 1 — Example curves

5.4.2 Example 2

The following example specifies a jump discontinuity, sometimes referred to as a “flexo bump”, of 0,07, by including two successive points with the same X coordinate (0). This curve is applied to all separations. This is a practice often found in the flexographic printing community. The resulting curve is illustrated in Figure 2.

```
<?xml version="1.0" encoding="UTF-8"?>
<TransferCurveSet xmlns="http://www.npes.org/schema/ISO18620/"
                  Creator="My Flexo Curve Tool"
                  CreationDate="2014-10-09T17:08:30-05:00"
                  OperatorName="Samuel Adams"
                  PressName="My Printing Press"
                  MediaName="Poly Plastic"
                  Side="Front"
                  MeasurementFile="<URL>"
                  TransferCurveSetID="CRD-24-3">
        <FormPreparationDetails Description="Round dots screen"/>
        <PrintingCondition PrintingConditionID="CRPC-5"/>
        <TransferCurve Separation="Default"
                     TransferCurveID="D123"
                      Curve="0.0 0.0 0.004 0.0 0.004 0.1 1.0 1.0"/>
</TransferCurveSet>
```


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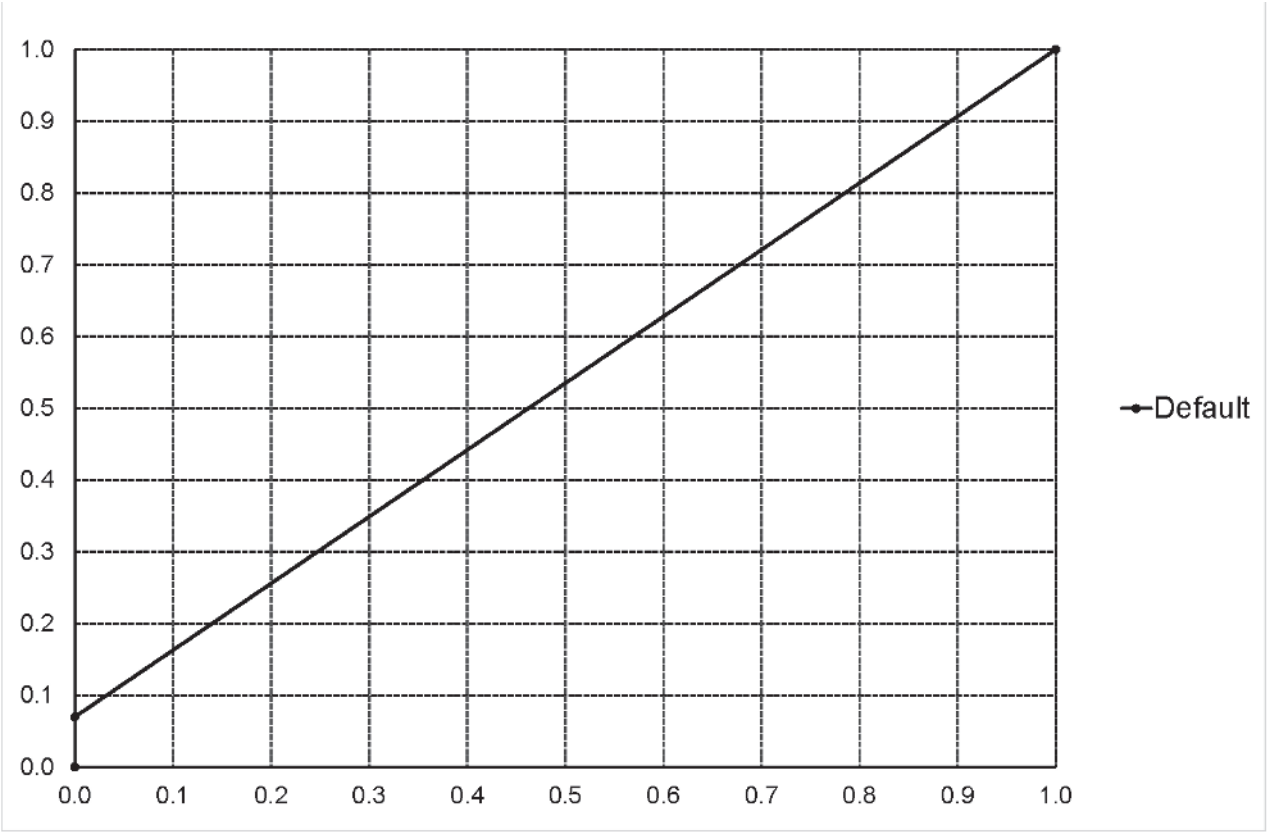

Figure 2 — Example default curve

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Annex A
(informative)

Schema

The following schema for Tone Adjustment Curves may be used to check syntax and conformance.

```
<xs:schema attributeFormDefault="unqualified"
           elementFormDefault="qualified"
           targetNamespace="http://www.npes.org/schema/ISO18620/"
           xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="TransferCurveSet">
    <xs:complexType>
      <xs:attribute type="xs:string" name="Creator" use="optional"/>
      <xs:attribute type="xs:dateTime" name="CreationDate" use="optional"/>
      <xs:attribute type="xs:string" name="OperatorName" use="optional"/>
      <xs:attribute type="xs:string" name="PressName" use="optional"/>
      <xs:attribute type="xs:string" name="MediaName" use="optional"/>
      <xs:attribute type="xs:string" name="TransferCurveSetID"
                    use="optional"/>
      <xs:attribute name="Side" use="optional">
        <xs:simpleType>
          <xs:restriction base="xs:string">
            <xs:enumeration value="Front" />
            <xs:enumeration value="Back" />
          </xs:restriction>
        </xs:simpleType>
      </xs:attribute>
      <xs:attribute type="xs:anyURI" name="MeasurementFile" use="optional"/>
      <xs:sequence>
        <xs:element name="FormPreparationDetails"
                    maxOccurs="1"
                    minOccurs="0">
          <xs:complexType>
            <xs:simpleContent>
              <xs:extension base="xs:string">
                <xs:attribute type="xs:string"
                              name="Description"
                              use="required"/>
              </xs:extension>
            </xs:simpleContent>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
      <xs:sequence>
        <xs:element name="PrintingCondition"
                    maxOccurs="1"
                    minOccurs="0">
          <xs:complexType>
            <xs:simpleContent>
              <xs:extension base="xs:string">
                <xs:attribute type="xs:string"
                              name="PrintingConditionID"
                              use="optional"/>
              </xs:extension>
            </xs:simpleContent>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
      <xs:sequence>
        <xs:element name="TransferCurve"
                    maxOccurs="unbounded"
                    minOccurs="1">
          <xs:complexType>
            <xs:simpleContent>
```


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```
              <xs:extension base="xs:string">
                <xs:attribute type="xs:string"
                              name="Separation"
                              use="required"/>
                <xs:attribute type="xs:NMTOKEN"
                              name="TransferCurveID"
                              use="optional"/>
                <xs:attribute type="xs:integer"
                              name="PrintingUnitNumber"
                              use="optional"/>
                <xs:attribute type="xs:string"
                              name="Curve"
                              use="required"/>
              </xs:extension>
            </xs:simpleContent>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
      <xs:sequence>
        <xs:element name="NativePressResponse"
                    maxOccurs="unbounded"
                    minOccurs="0">
          <Comment>This element when present may contain proprietary elements and
attributes</Comment>
      </xs:sequence>
      <xs:sequence>
        <xs:element name="CalibratedPressResponse"
                    maxOccurs="unbounded"
                    minOccurs="0">
          <Comment>This element when present may contain proprietary elements and
attributes</Comment>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

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Bibliography

[1] ISO 14977, *Information technology — Syntactic metalanguage — Extended BNF*

[2] *Tone curve Exchange Data* (TED), 1.0, 4th June 2009, David Harris, Esko Artwork

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