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Graphic technology — Exchange format for colour and process control data using XML or ASCII text

Technologie graphique — Format d'échange pour les données de couleur et de contrôle de procédé en utilisant du texte XML ou ASCII

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition cancels and replaces the first edition (ISO 28178:2009), which has been technically revised.

The main changes are as follows:

— in 4.2.3.21, an additional tag to remove ambiguity with respect to the printing sequence and the sequence of tabulating data in particular to ease the data exchange for multi-colour printing has been added;

— in 4.1.2.1, additional guidance on the use of delimiters, such as point and comma, as well as the plausibility of the sample ID usage have been provided.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is intended to support all existing and future graphic arts standards that require the exchange of measured, computed, or process control data and the associated metadata necessary for its proper interpretation.

The following requirements were identified when reviewing the needs of such a format:

— applications based on the existing ASCII formats must not be made obsolete;

— data must be in a form that is both human-readable (once the digital file has been displayed using standard editors, or file readers) and machine-readable;

— data must be readable by automated programs to extract the necessary information;

— data files must be extensible by end users in such a way as to allow additional information to be included without breaking automated readers of the file;

— data files must be capable of being created by automated programs;

— the format must allow multiple language representation of data.

The file formats chosen to accomplish this task are a combination of XML and extensions of the existing ASCII keyword-value file format, coupled with the necessary tools to allow appropriate conversions to and from XML from ASCII keyword-value files. However, either the XML file format or the ASCII keyword-value file format can be used independently.

These formats make use of predefined XML tags and ASCII keywords. Values are associated with the tags and keywords and remain in effect until another instance of the tag or keyword. Provision is made to allow the use of data tables and to separately define the format within data tables. Multiple occurrences of such data tables within a single file are also permitted. User-defined tags and keywords are also allowed.

NOTE During the 2021 review process, it was noted that the XML format is not widely used and that its specification in this document is insufficiently precise to ensure reliable exchange of data.

Graphic technology — Exchange format for colour and process control data using XML or ASCII text

1 Scope

This document defines an exchange format for colour and process control data (and the associated metadata necessary for its proper interpretation) in electronic form using either XML or ASCII formatted data files. This exchange format maintains human readability of the data as well as enabling machine readability. It includes a series of predefined tags and keywords, and provides extensibility through provision for the dynamic definition of additional tags and keywords as necessary. It is focused primarily on spectral measurement data, colorimetric data, and densitometric data.

This document is intended to be used in conjunction with other standards that will define the required data, and tags or keywords for specific data exchange applications.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
data format identifier
predefined set of characters, without intervening spaces, forming a unique word that is used to identify the presence of a defined item of data in a subsequent data table

3.2
keyword
predefined set of characters, without intervening spaces, forming a unique word that is used to identify the presence of a defined item of information

3.3
schema
XML document that, following the rules established by the World Wide Web Consortium, defines the structure of a class of xml documents

3.4
value
information immediately following a *keyword* (3.2) that represents the data content or "value" associated with that keyword

4 Requirements

4.1 General description of a conforming file

4.1.1 XML format

This file format is an XML format that complies with Extensible Markup Language (XML) 1.0.[46] The format makes use of predefined tags that identify information commonly used to describe graphic arts samples. In addition, users of this format are allowed to define tags to tailor the format to their specific needs according to the rules of XML namespace.

The data file is divided into two sections.

The preamble is the first section. This section provides general information and describes the conditions under which data was collected. The preamble tag is iso28178.preamble. Tags used in the preamble are listed in 4.2.

The data section is the second section, which is further divided into two parts. The first part of the data section provides the information that describes the type and location of the table contents; the second section contains the data values.

The schema associated with the XML format defined in this document is contained in file iso28178_data.xsd (available at: https://standards.iso.org/iso/28178/ed-2/en/), which is an essential normative part of this document. This document also provides structural XML tags that are needed for the proper specification of an XML document instance.

NOTE See Annex A for a discussion on the need and application of the XML data reporting format.

4.1.2 ASCII format

4.1.2.1 General

This file format is an ASCII format keyword-value file. It makes use of predefined keywords and data tables. Values are associated with the keyword that precedes them and remain in effect until another instance of the keyword-value pair. Data values are delimited by the BEGIN_DATA and END_DATA keywords.

Keywords and values, as well as fields within data tables, are separated by white space. Valid white space characters are space (position 2/0 of ISO/IEC 646), carriage return (position 0/13 of ISO/IEC 646), newline (position 0/10 of ISO/IEC 646), and tab (position 0/9 of ISO/IEC 646). Keywords may be separated from values using any valid white space character. Only the space and tab may precede a keyword on a line. Comments are preceded by a single comment character (a single character keyword). The comment character is the "#" (position 2/3 of ISO/IEC 646) symbol. Comments may begin any place on a line, and are terminated by a newline or carriage return character.

NOTE The default separator for exporting data from spreadsheet applications in many regions is a comma and not a white space character. Conforming files can be created by changing this default to a tab character and by using the full point character as the decimal separator.

4.1.2.2 Exchanged data file structure

A file containing measurement data would normally be structured as shown in Figure 1. This structure allows multiple tables of data within a single exchange file.

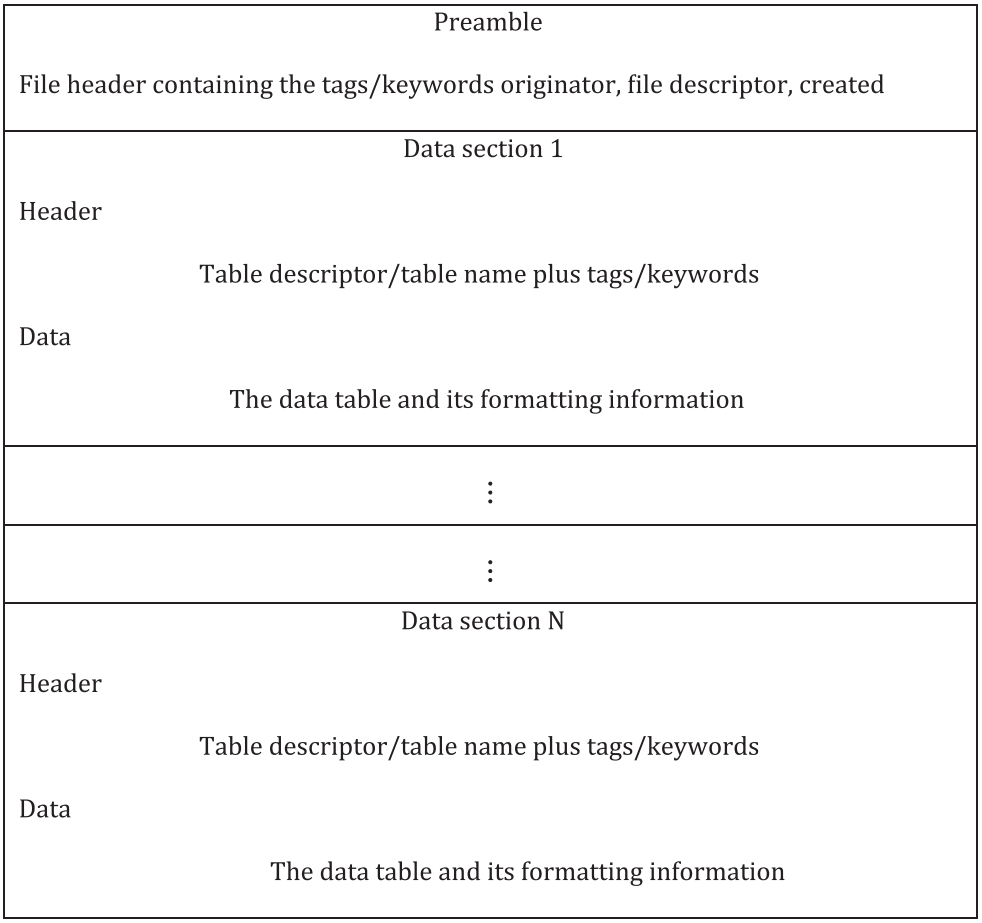

Figure 1 — File structure

4.2 Tags and keywords

4.2.1 General

Most tags and keywords may appear in the file in any order, and may appear multiple times within the file. Values associated with tags and keywords that appear more than once shall be replaced by successive instances except for KEYWORD, COMPUTATIONAL_PARAMETER, and WEIGHTING_FUNCTION. Tags and keywords that describe data tables, however, shall be defined before the data table. Table 1 lists these tags and keywords. These tags are described in greater detail in this subclause.

Table 1 — XML tags and ASCII keywords that appear in a defined order

Function	XML tag	ASCII keyword
data table width	<number_of_fields>	NUMBER_OF_FIELDS
data format delimiters	<data_format>	BEGIN_DATA_FORMAT END_DATA_FORMAT
data table length	<number_of_sets>	NUMBER_OF_SETS
data table delimiters	<table>	BEGIN_DATA END_DATA

Data format delimiters shall be preceded by a data table width tag or keyword. Data table delimiters shall be preceded by a data table length tag or keyword. In the ASCII format, BEGIN_/END_ keywords begin and end the data format or table data. In the XML format, tags have parameters and/or values and

a standard syntax is used; e.g. <data_format> data format identifiers </data_format>. Values for tags and keywords that describe data tables shall be specified for each data table in the file; i.e. inheritance of these values is not permitted.

ASCII tags and keywords may be composed of any combination of the following: upper case letters; digits 0 through 9; and ASCII characters $ (position 2/4 of ISO/IEC 646), % (position 2/5 of ISO/IEC 646), & (position 2/6 of ISO/IEC 646), - (position 2/13 of ISO/IEC 646), / (position 2/15 of ISO/IEC 646), _ (position 5/15 of ISO/IEC 646). By convention all XML tags are lower case.

In the ASCII format, unless used as part of a data format definition, keywords should not be preceded on a line by other than white space. Unless otherwise noted, each keyword has a character string value associated with it. All character string values shall be enclosed in quotes, regardless of whether there is white space contained within the string. Enclosed in quotes means beginning and ending the character string with the " symbol (position 2/2 of ISO/IEC 646). The " symbol itself is represented within a string as "" as in the C language syntax.

NOTE The default behaviour of applications writing '.csv' files results in additional quotation marks being added to files, for example "FILE_DESCRIPTOR ""12642-3 Target definition""", which means that such files do not conform with this requirement.

For XML tag/keyword entries the form is <xml-tag>value</xml-tag>. If attribute names are provided in the XML section of a definition, the information is represented in the XML-formatted data as XML attribute using the form <xml-tag attribute-name="value" …>.

The value associated with keywords NUMBER_OF_FIELDS and NUMBER_OF_SETS shall be an integer. These values should not be enclosed in quotes.

Format and table delimiters do not have explicit values associated with them but rather enclose either the data format definition or table data.

The separation between the integer and the fractional part of a given number should be a "full point" for all entries.

See Annex B for examples of the use of each tag and keyword shown in 4.2.2 and 4.2.3.

4.2.2 Required preamble tags and keywords

4.2.2.1 General

Certain tags and keywords are required as part of each file, while others are optional depending upon the data to be included. All keywords shall occur before the BEGIN_DATA_FORMAT keyword and the sequence order for required tags and keywords shall follow the order shown in 4.2.2.2 through 4.2.2.9.

The STANDARD, ORIGINATOR, FILE_DESCRIPTOR and CREATED tags/keywords may occur only once within a file.

The first line in the ASCII format should be ISO 28178. The use of this identifier indicates that the data contained in the file adheres to this document. This information is represented in the XML format with the <standard> tag. See 4.2.2.2.

NOTE Strings are widely used including "ECI2002", "CGATS17", "CGATS.17", "ISO 12642-2". These files often conform to this document with the exception of this identifier.

4.2.2.2 Standard

The use of this identifier indicates that the data contained in the file adheres to the indicated standard.

Format	Tag/Keyword	Attribute	Data type
XML	<standard>		String

NOTE There is no ASCII keyword for this because in the ASCII format this information is carried in the first line of the file.

4.2.2.3 Originator

Identifies the specific system, organization or individual that created the data file.

Format	Tag/Keyword	Attribute	Data type
XML	<originator>		String
ASCII	ORIGINATOR		String

4.2.2.4 File descriptor

Describes the purpose or contents of the data file.

Format	Tag/Keyword	Attribute	Data type
XML	<file_descriptor>		String
ASCII	FILE_DESCRIPTOR		String

4.2.2.5 Created

Indicates the creation date of the data file. The recommended form for this date is CCYY-MM-DDThh:mm:ss[Z | +/-hh:mm].

Format	Tag/Keyword	Attribute	Data type
XML	<created>		String
		date	String
ASCII	CREATED		String

4.2.2.6 Number of fields

Number of fields (data format identifiers) that are included in the data format definition that follows.

Format	Tag/Keyword	Attribute	Data type
XML	<number_of_fields>		Integer
ASCII	NUMBER_OF_FIELDS		Integer

4.2.2.7 Data format

Marks the beginning and end of a data format definition. END_DATA_FORMAT shall be preceded by BEGIN_DATA_FORMAT. See 4.3.4 for information on the data that would be included between these tags/keywords.

Format	Tag/Keyword	Attribute	Data type
XML	<data_format>		NA
ASCII	BEGIN_DATA_FORMAT		
	END_DATA_FORMAT		

4.2.2.8 Number of sets of data

Number of repetitions or sets of data, i.e. the number of rows in the data table. The associated value is an integer.

Format	Tag/Keyword	Attribute	Data type
XML	<number_of_sets>		Integer
ASCII	NUMBER_OF_SETS		Integer

4.2.2.9 Data table

Marks the beginning and end of a data table.

Format	Tag/Keyword	Attribute	Data type
XML	<table>		NA
ASCII	BEGIN_DATA		
	END_DATA		

4.2.3 Optional tags and keywords

4.2.3.1 General

Certain additional general tags and keywords are optional and may be used as needed. The currently defined optional tags and keywords are defined in 4.2.3.2 to 4.2.3.19. The optional tags and keywords shall occur after the CREATED tag/keyword and before the NUMBER_OF_FIELDS tag/keyword.

4.2.3.2 Comment

Comments are ignored by automated readers. In the XML syntax, all characters within the <comment> </comment> tags are ignored. In the ASCII syntax, all characters between the comment keyword and the end of line indicator are ignored. End of line is indicated by either carriage return or newline. Comments indicate to users that the information that follows is of informative interest. Comments need not be enclosed in quotes. Comments may occur anywhere except within a table.

Format	Tag/Keyword	Attribute	Data type
XML	<comment>		String
ASCII	#		String

4.2.3.3 Instrumentation

Used to report the specific instrumentation used (e.g. manufacturer, model number and serial number, etc.) to generate the data reported. This data will often provide more information about the particular data collected than an extensive list of specific details. This is particularly important for spectral data or data derived from spectrophotometry.

Format	Tag/Keyword	Attribute	Data type
XML	<instrumentation>		String
		manufacturer	String
		model	String
		serial_number	String
ASCII	INSTRUMENTATION		String

4.2.3.4 Measurement geometry

The type of measurement, either reflection or transmission, should be indicated along with details of the geometry and the aperture size and shape. For example, for transmission measurements it is important to identify 0/diffuse, diffuse/0, opal or integrating sphere, etc. For reflection measurements it is important to identify 0/45, 45/0, sphere (specular included or excluded), etc.

Format	Tag/Keyword	Attribute	Data type
XML	<measurement_geometry>		String
ASCII	MEASUREMENT_GEOMETRY		String

4.2.3.5 Measurement source

Illumination (e.g. incandescent, daylight, colour temperature, etc.) used during spectral measurement. This data helps provide a guide to the potential for issues of paper fluorescence, etc.

Format	Tag/Keyword	Attribute	Data type
XML	<measurement_source>		String
ASCII	MEASUREMENT_SOURCE		String

4.2.3.6 Filter

Identifies the use of physical filter(s) during measurement. This is typically used to denote the use of filters such as none, D65, Red, Green or Blue.

Format	Tag/Keyword	Attribute	Data type
XML	<filter>		String
ASCII	FILTER		String

4.2.3.7 Polarization

Identifies the use of a physical polarization filter during measurement. Allowed values are "yes", “none” or “na”.

Format	Tag/Keyword	Attribute	Data type
XML	<polarization>		String
ASCII	POLARIZATION		String

4.2.3.8 Weighting function

Indicates such functions as: the CIE standard observer functions used in the calculation of various data parameters (2 degree and 10 degree); CIE standard illuminant functions used in the calculation of various data parameters (e.g. D50, D65, etc.); density status response; etc. If used, there shall be at least one name-value pair following the WEIGHTING_ FUNCTION tag/keyword. The first attribute in the set shall be "name" and shall identify the particular parameter used. The second shall be "value" and shall provide the value associated with that name. For ASCII data a string containing the Name and Value attribute pairs shall follow the weighting function keyword. A semi-colon shall be used to separate attribute pairs from each other, and within the attribute the name and value shall be separated by a comma.

Format	Tag/Keyword	Attribute	Data type
XML	<weighting_function>		String
		name	String
		value	String
ASCII	WEIGHTING_FUNCTION		String

4.2.3.9 Computational parameter

Parameter that is used in computing a value from measured data. Name is the name of the calculation, parameter is the name of the parameter used in the calculation, and value is the value of the parameter.

Format	Tag/Keyword	Attribute	Data type
XML	<computational_parameter>		NA
		name	String
		parameter	String
		value	String
ASCII	COMPUTATIONAL_PARAMETER	String	

4.2.3.10 Sample backing

Identifies the backing material used behind the sample during measurement. Allowed values are “black”, “white”, “self” or “na”.

Format	Tag/Keyword	Attribute	Data type
XML	<sample_backing>		String
ASCII	SAMPLE_BACKING		String

4.2.3.11 Manufacturer

Indicates the manufacturer of the sample from which the data was measured.

Format	Tag/Keyword	Attribute	Data type
XML	<manufacturer>		String
ASCII	MANUFACTURER		String

4.2.3.12 Material

Identifies the material or substrate on which the target was produced, using a code identifying the material.

Format	Tag/Keyword	Attribute	Data type
XML	<material>		String
ASCII	MATERIAL		String

4.2.3.13 Target type

Identifies the type of target being measured, e.g. IT8.7/1, IT8.7/3, user-defined, etc.

Format	Tag/Keyword	Attribute	Data type
XML	<target_type>		String
ASCII	TARGET_TYPE		String

4.2.3.14 Colorant(s)

Identifies the colorant(s) used in creating the target.

Format	Tag/Keyword	Attribute	Data type
XML	<colorant>		String
ASCII	COLORANT		String

4.2.3.15 Production date

Identifies year and month of production of the target in the form yyyy:mm.

Format	Tag/Keyword	Attribute	Data type
XML	<prod_date>		String
		year	String
		month	String
ASCII	PROD_DATE		String

4.2.3.16 Print conditions

Used to define the characteristics of the printed sheet being reported. Where standard conditions have been defined (e.g. SWOP at nominal) named conditions may suffice. Otherwise, detailed information shall be provided.

Format	Tag/Keyword	Attribute	Data type
XML	<print_conditions>		String
ASCII	PRINT_CONDITIONS		String

4.2.3.17 Serial number

Uniquely identifies physical samples.

Format	Tag/Keyword	Attribute	Data type
XML	<serial>		String
ASCII	SERIAL		String

4.2.3.18 Process colour identification

Uniquely identifies colour and sequence of data columns associated with the numerical values assigned to each process colour set.

Format	Tag/Keyword	Attribute	Data type
XML	<processcolor_id>		
		colors_in_set	Integer
		color_number	Integer
		color	String
ASCII	PROCESSCOLOR_ID		String

Where the data format identifier PCm_n is used, a process colour tag/keyword (<processcolor_id>, PROCESSCOLOR_ID) shall be included for each process colour used. The value *m* represents the number of colours in the process colour set. The value *n* is used to identify the individual colour within the process colour set and is assigned according to the order of columns in the data block.

4.2.3.19 Spot colour identification

Uniquely identifies colour associated with the numerical value assigned to each spot colour (or line colour).

Format	Tag/Keyword	Attribute	Data type
XML	<spot_id>		
		number	Integer
		color	String
ASCII	SPOT_ID		String

Where the data format identifiers SPOT_1 through SPOT_n are used, a spot colour tag/keyword (<spotid>, SPOTID) shall be included for each spot colour used.

4.2.3.20 Copyright

Identifies any specific copyright information associated with the file.

Format	Tag/Keyword	Attribute	Data type
XML	<copyright>		String
ASCII	COPYRIGHT		String

Where no copyright is associated with a file and it can be freely used without restriction, creators of the file should note that fact.

4.2.3.21 Printing order

Identifies the order of laydown (sequence of printing) for the PCm_n and/or SPOT_s and/or CMYK_x data columns in the data format, by listing the number of laydown in the order of those data columns.

Format	Tag/Keyword	Attribute	Data type
XML	<printing_order>		String
ASCII	PRINTING_ORDER		String

NOTE 1 This numbering can also be applied for the common non-standard usage of mCLR_n data columns.

NOTE 2 The special string value "n/a" can be used to specify a printing system without inherent sequence, like multi-pass inkjet printing.

4.2.3.22 Spectral range

Identifies the unit of absolute spectral quantities, or the encoding of relative spectral quantities, which can be given as a percentage or as a fractional number.

Format	Tag/Keyword	Attribute	Data type
XML	<spectral_range>		String
ASCII	SPECTRAL_RANGE		String

The value shall be "100" for percentage values, "1" for fractional data or a unit for absolute data such as "$W/m^2/nm$".

4.2.4 User-defined tags and keywords

Declares a user-defined tag or keyword. This is primarily intended for vendor-specific information, but can also be used as a mechanism to add new keywords in the future without breaking automated readers in existence prior to tag/keyword revision. See Annex D for an example of use of user-defined keywords.

User-defined tags and keywords do not take effect until they are defined and remain in effect for the rest of the file. Automated readers may ignore user- or vendor-defined keywords, and associated values, that they do not recognize.

In the XML syntax, the value associated with the user-defined tag may be set using the value attribute or by enclosing the value within <keyword> </keyword> tags. The data type is set using the data_type attribute, which may have the following values: R for decimal values, I for integer values and CS for string values.

In the ASCII syntax, the value associated with KEYWORD is the name of keyword being defined. The name value shall be an alphanumeric value without white space. The user-defined keyword value shall be set using normal keyword-value pair syntax; i.e. KEYWORD "name of user-defined keyword".

Format	Tag/Keyword	Attribute	Data type
XML	<keyword>		String
		name	String

		value	String
		data_type	String
		comment	String
ASCII	KEYWORD		String

NOTE In the XML format, if the user-defined keyword is to be used as a data format identifier, the value attribute is not included in the initial definition. In the ASCII format, if the user defined Keyword is not used as a data format identifier but in the header, the user defined keyword is required to be repeated followed by its value.

4.2.5 Data format identifier

Declares a new data format identifier to be defined from this point forward.

Format	Tag/Keyword	Attribute	Data type
XML	<data_format_identifier>		NA
		name	String
ASCII	DATA_FORMAT_IDENTIFIER		String

4.3 Data tables

4.3.1 General

The file structure of this document provides support for both single and multiple data sets (data formats and data table delimiters) to be contained within a single file. When multiple data sets are contained within a file, these data sets may be one of the following: multiple data sets using the same data format, multiple data sets using the same header information, or multiple data sets that are unrelated to each other but are contained in the same file. In any case, data table formatting tags or keywords shall be specified for each data table.

NOTE As specified in 4.2.2.1, the STANDARD, ORIGINATOR, FILE_DESCRIPTOR and CREATED tags/keywords can occur only once within a file.

4.3.2 Table descriptor

Describes the purpose or contents of a data table.

Format	Tag/Keyword	Attribute	Data type
XML	<table_descriptor>		String
ASCII	TABLE_DESCRIPTOR		String

4.3.3 Table name

Provides a short name for a data table.

Format	Tag/Keyword	Attribute	Data type
XML	<table_name>		String
ASCII	TABLE_NAME		String

4.3.4 Data format identifiers

4.3.4.1 General

Data format identifiers describe the meaning of each field of data within a set. See examples in Annex C. Data formats shall be composed of identifiers listed in 4.3.4, or data format identifiers defined by the user using the <data_format_identifier> tag or DATA_FORMAT_IDENTIFIER keyword. Unknown entries in the data format definition will be read, but may be ignored by automated readers. Data format identifiers shall be uppercase. The data type associated with each data format is assumed to be decimal (R) unless separately defined as integer (I) or character string (CS). In ASCII files character string data shall be enclosed in quotes except in the case of SAMPLE_ID or SAMPLE_NO where the quotes are not required if the sample identifier does not contain white space. The Sample ID (CS) entries shall reflect integer values.

In ASCII files where multiple data format identifiers appear they may be entered either on individual lines or on single lines separated with white space characters as specified in 4.1.2.

A data format remains in effect until the next data format is encountered.

4.3.4.2 Defined data format identifiers

The following are the currently defined data format identifiers:

SAMPLE_ID (CS)	—	Sample identifier as defined in ISO 12642-1 or ISO 12642-2
SAMPLE_NO (CS)	—	Sample sequential number assigned based on read order or other user defined criteria.
STRING (CS)	—	Identifies label, or other non-machine readable value. Value shall begin and end with a " symbol.
CMYK_C	—	Cyan component of CMYK data expressed as a percentage
CMYK_M	—	Magenta component of CMYK data expressed as a percentage
CMYK_Y	—	Yellow component of CMYK data expressed as a percentage
CMYK_K	—	Black component of CMYK data expressed as a percentage
PC*m_n*	—	Data associated with the process colour identified in tag/keyword Process colour identification (4.2.3.18), expressed as a percentage. The value *m* represents the number of colours in the process colour set. The value *n* is used to identify the individual colour within the process colour set and is assigned according to the order of columns in the data block.
SPOT_*n*	—	Data associated with the spot colour *n* identified in tag/keyword Spot colour identification (4.2.3.19), expressed as a percentage, where *n* is a numerical value
D_RED	—	Red filter density
D_GREEN	—	Green filter density
D_BLUE	—	Blue filter density
D_VIS	—	Visual filter density
D_MAJOR_FILTER	—	Major filter density
RGB_R	—	Red component of RGB data expressed as a code value in the range 0-255

RGB_G	—	Green component of RGB data expressed as a code value in the range 0-255
RGB_B	—	Blue component of RGB data expressed as a code value in the range 0-255
SPECTRAL_lambda	—	Data associated with the reflectance/transmittance values at wavelength lambda (e.g. 380, 390, …, 730: 36 columns).
SPECTRAL_PCT	—	Percentage reflectance/transmittance
SPECTRAL_DEC	—	Reflectance/transmittance
XYZ_X	—	X component of tristimulus data
XYZ_Y	—	Y component of tristimulus data
XYZ_Z	—	Z component of tristimulus data
XYY_X	—	x component of chromaticity data
XYY_Y	—	y component of chromaticity data
XYY_CAPY	—	Y component of tristimulus data
LAB_L	—	L* component of CIELAB data[1]
LAB_A	—	a* component of CIELAB data
LAB_B	—	b* component of CIELAB data
LAB_C	—	C^*_{ab} component of CIELAB data
LAB_H	—	h_{ab} component of CIELAB data
LAB_DE	—	CIE ΔE^*_{ab}
LAB_DE_94	—	CIE ΔE using CIE DE 94
LAB_DE_CMC	—	ΔE using CMC
LAB_DE_2000	—	CIE ΔE using CIEDE2000[2]
MEAN_DE	—	Mean ΔE^*_{ab} (LAB_DE) of samples compared to batch average (used for data files for ANSI IT8.7/1 and ANSI IT8.7/2 targets)
STDEV_X	—	Standard deviation of X (tristimulus data)
STDEV_Y	—	Standard deviation of Y (tristimulus data)
STDEV_Z	—	Standard deviation of Z (tristimulus data)
STDEV_L	—	Standard deviation of L*
STDEV_A	—	Standard deviation of a*
STDEV_B	—	Standard deviation of b*
CHI_SQD_PAR	—	Average of the standard deviations of L*, a* or b*

A data format identifier shall occur only once per data format specification.

NOTE In addition to SPECTRAL_lambda, many existing files and software packages use the shorter notation NM_lambda or R_lambda.

4.3.4.3 Usage

4.3.4.3.1 XML format

The data format is contained within <data_format> tags and shall be preceded by the <number_of_fields> tag. Each data field shall be described individually using the parameterized <field_info> tag. The number of <field_info> tags shall equal the value of the <number_of_fields> tag.

Parameters of the tag are:

Format	Tag/Keyword	Attribute	Data type
XML	<field_info>		
		pos	string
		name	string
		col_name	string

The following example illustrates the syntax.

Example

<number_of_fields> integer value </number_of_fields>

<data_format>

<field_info pos=”position” name=”data format identifier” col_name=”column header” />

…

<field_info pos=”position” name=”data format identifier” col_name=”column header” />

</data_format>

4.3.4.3.2 ASCII format

The data format shall be contained within BEGIN_/END_DATA_FORMAT keywords and shall be preceded by the NUMBER_OF_FIELDS keyword. Each data field shall be described individually by using data format identifiers. The number of data format identifiers shall equal the value of the NUMBER_OF_FIELDS keyword.

ASCII formatted data tables shall be represented using the syntax

NUMBER_OF_FIELDS

BEGIN_DATA_FORMAT

Data format identifier

…

Data format identifier

END_DATA_FORMAT

4.3.5 Table data

4.3.5.1 General

Subclauses 4.3.5.2 and 4.3.5.3 describe how a table is constructed in the XML format and the ASCII format, respectively.

The number of data points for each row of the table shall be equal to the NUMBER_OF_FIELDS as defined in 4.2.2.6. The number of rows in the table shall be equal to the NUMBER_OF_SETS as defined in 4.2.2.8.

Each "set of data" within a given table should be related directly to a specific sample area.

4.3.5.2 XML format

The XML formatted data tables shall be represented as illustrated in the following:

<number_of_sets> integer value </number_of_sets>

<table>

<tr>

<td> field value </td>

…

<td> field value </td>

</tr>

…

<tr>

<td> field value </td>

…

<td> field value </td>

</tr>

</table>

4.3.5.3 ASCII format

ASCII formatted data tables shall be represented using the syntax:

NUMBER_OF_SETS

BEGIN_DATA

…

END_DATA

Annex A
(informative)

Advantages of an XML data reporting format

A.1 General

XML has become the lingua franca for data that is being exchanged. Therefore, there is an assumption that the implementers of this document have a working knowledge of XML or access to appropriate resources. In addition to multiple books on XML and its related standard, current information can be obtained at http://www.w3.org, the group that maintains the XML standard. There are also numerous other web sites with information about XML and its various parts.

The general XML environment consists of three sections:

— document descriptions,

— tools, and

— documents.

A.2 Document descriptions

The XML environment for this document requires both well-formed and valid documents. To this end, a schema is provided. The schema provides the definition of a properly created document. This definition or rule set indicates what information is to be within the document and in what order the information should appear. There is also information about the mandatory or optional use of information and how many times any particular piece of information may appear. The schema provides the information needed to allow a processing application to confirm that all documents meet the rules of XML and this document.

A.3 Tools

Because of the significant interest in using XML for information exchange, a number of tools have been developed. There are two tools of particular interest to implementers of this document. The first is an XSLT processor[7]. The other is an XML DOM.

XSLT is the formatting and conversion language developed for XML. The XSLT processor uses a set of transformation rules along with a source document and a document definition to create a new document. The new document can either be an XML file or an alternate file format. A XSLT transformation document is provided. It will support the transformation of a valid, well-formed XML document which is in accordance with this document into an ASCII document in compliance with this document.

The XML DOM is software that provides a programmatic interface between an XML document and an application program. Versions of XML DOM software are available for most programming and operating system environments.

A.4 Documents

The documents are the most important part of XML. An XML document can be represented as a file, a stream between applications, or a presentation on a screen. The XML document is required to conform to the rules of XML to be well formed. An XML document that is in conformance with this document is also required to confirm the schema (iso28178_data.xsd which is available at: https://standards.iso

.org/iso/28178/ed-2/en/) in order to be valid. A number of sample XML documents are provided in Annex C along with the equivalent documents in ASCII format.

Annex B
(informative)

Tag and keyword examples

B.1 General

Each line of information shown in Table B.1 is independent of any other line and will not collapse into a meaningful single file based on this document.

Where there is more than one row in columns 3 and 4 corresponding to a single row in columns 1 and 2, these are independent examples.

Table B.1 — Examples of using keywords and tags

Section	Reported data	ASCII	XML
4.2.2.2	Standard	ISO28178	<standard>ISO28178</standard>
4.2.2.3	Originator	ORIGINATOR "XYZ Printing Company"	<originator>XYZ Printing Company</originator>
4.2.2.4	Descriptor	FILE_DESCRIPTOR "IT8.7/1 Data Files, 4x5 inch"	<file_descriptor>IT8.7/1 Data Files, 4x5 inch</ file_descriptor>
		FILE_DESCRIPTOR "Average colorimetric Data"	<file_descriptor>Average Colorimetric Data</ file_descriptor>
		FILE_DESCRIPTOR "IT8.7/3 Average Colorimetric Data"	<file_descriptor> standard_ identifier="IT8.7/3"> Average Colorimetric Data</ file_descriptor>
4.2.2.5	Created	CREATED "JUNE 28, 2001"	<created>2001-06-28</created>
		CREATED "March 28, 2003"	<created>2003-03-28</created>
4.2.2.6	Number of fields	NUMBER_OF_FIELDS 12	<number_of_fields>12</number_of_fields>
		NUMBER_OF_FIELDS 8	<number_of_fields>8</number_of_fields>

Table B.1 *(continued)*

Section	Reported data	ASCII	XML
4.2.2.7	Data format	BEGIN_DATA_FORMAT SAMPLE_ID … STDEV_L END_DATA_FORMAT	<data_format> <field_info pos="1" name="SAMPLE_ID" col_name="ID"/> … <field_info pos="12" name="STDEV_L" col_name="S_L"/> </data_format>
		BEGIN_DATA_FORMAT SAMPLE_ID CMYK_C CMYK_M CMYK_Y CMYK_K LAB_L LAB_A LAB_B END_DATA_FORMAT	<data_format> <field_info pos="1" name="SAMPLE_ID" col_name="ID"/> <field_info pos="2" name="CMYK_C" col_name="Cyan"/> <field_info pos="3" name="CMYK_M" col_name="Magenta"/> <field_info pos="4" name="CMYK_Y" col_name="Yellow"/> <field_info pos="5" name="CMYK_K" col_name="Black"/> <field_info pos="6" name="LAB_L" col_name="L*"/> <field_info pos="7" name="LAB_A" col_name="a*"/> <field_info pos="8" name="LAB_B" col_name="b*"/> </data_format>
4.2.2.8	Number of sets of data	NUMBER_OF_SETS 264	<number_of_sets>264</number_of_sets>
		NUMBER_OF_SETS 928	<number_of_sets>928</number_of_sets>

Table B.1 *(continued)*

Section	Reported data	ASCII	XML
4.2.2.9	Data table	BEGIN_DATA A01 2.48 1.99 1.42 15.42 12.19 2.53 0.07 0.05 0.05 0.47 0.30 ⋮ Dmax 0.08 0.08 0.06 0.71 0.18 0.20 0.00 0.00 0.00 0.05 0.03 END_DATA	<table> <tr><td>A01</td><td>2.48</td><td>1.99</td><td>1.42</td><td>15.42</td><td>12.19</td><td>2.53</td><td>0.07</td><td>0.05</td><td>0.05</td><td>0.47</td><td>0.30</td></tr> … <tr><td>Dmax</td><td>0.08</td><td>0.08</td><td>0.06</td><td>0.71</td><td>0.18</td><td>0.20</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.05</td><td>0.03</td></tr> </table>
		BEGIN_DATA 1 100 0 0 0 57.69 -39.82 -46.40 ⋮ 928 100 100 100 80 11.36 -0.76 0.31 END_DATA	<table> <tr><td>1</td><td>100</td><td>0</td><td>0</td><td>0</td><td>57.69</td><td>-39.82</td><td>-46.40</td></tr> … <tr><td>928</td><td>100</td><td>100</td><td>100</td><td>80</td><td>11.36</td><td>-0.76</td><td>0.31</td></tr> <table>
4.2.3.2	Comment	# It should be noted that all transmittance data is based on an opal reference as defined in ISO 5-2 and identified in ISO 13655.	<comment>It should be noted that all transmittance data is based on an opal reference as defined in ISO 5-2 and identified in ISO 13655.</comment>
		# Extracted from CGATS_SC4 work	<comment>Extracted from CGATS_SC4 work</comment>
4.2.3.3	Instrumentation	INSTRUMENTATION "XYZ Company, Model 2A, SN 123456"	<instrumentation manufacturer="XYZ Company" model="Model 2A" serial_number="SN 123456"></instrumentation>

Table B.1 *(continued)*

Section	Reported data	ASCII	XML
4.2.3.4	Measurement Geometry	MEASUREMENT_GEOMETRY "0/45"	<measurement_geometry>0/45</measurement_geometry>
		MEASUREMENT_GEOMETRY "sphere (specular included)"	<measurement_geometry>sphere (specular included)</measurement_geometry>
4.2.3.5	Measurement Source	MEASUREMENT_SOURCE "A"	<measurement_source>A</measurement_source>
4.2.3.6	Filter	FILTER "no"	<filter>no</filter>
		FILTER "uv"	<filter>uv</filter>
4.2.3.7	Polarization	POLARIZATION "no"	<polarization>no</polarization>
4.2.3.8	Weighting function	WEIGHTING_FUNCTION "ILLUMINANT, D50"	<weighting_function name="illuminant" value="d50"/>
		WEIGHTING_FUNCTION "OBSERVER, 2 degree"	<weighting_function name="observer" value="2 degree"/>
4.2.3.9	Computational parameter	COMPUTATIONAL_PARAMETER "CIE94,c,0.5"	<computational_parameter name="CIE94" parameter="c" value="0.5"/>
4.2.3.10	Sample backing	SAMPLE_BACKING "black"	<sample_backing>black</sample_backing>
4.2.3.11	Manufacturer	MANUFACTURER "XYZ Company"	<manufacturer>XYZ Company</manufacturer>
4.2.3.12	Material	MATERIAL "Film Product Family"	<material>Film Product Family</material>
4.2.3.13	Target type	TARGET_TYPE "IT8.7/1"	<target_type>IT8.7/1</target_type>
4.2.3.14	Colorant(s)	COLORANT "Cyan 2241"	<colorant>Cyan 2241</colorant>
4.2.3.15	Production date	PROD_DATE "2001:06"	<prod_date>2001:06</prod_date>
4.2.3.16	Print conditions	PRINT_CONDITIONS "Test 2224"	<print_conditions>Test 2224</print_conditions>
4.2.3.17	Serial number	SERIAL "2001:06 BATCH AVERAGE DATA"	<serial>2001:06 BATCH AVERAGE DATA</serial>
4.2.3.18	Process colour identifier	PROCESSCOLOR_ID "4 1 cyan"	<processcolor_id colors_in_set="4" color_number="1" color="cyan"/>
4.2.3.19	Spot colour identifier	SPOT_ID "1 Reflex Blue"	<spot_id number="1" color="Reflex Blue"/>
4.2.3.20	Copyright	COPYRIGHT "Data may be used freely without restriction"	<copyright>Data may be used freely without restriction</copyright>
4.2.3.20	Printing order	PRINTING_ORDER "4 3 2 1"	<printing_order>4 3 2 1</printing_order>

Table B.1 *(continued)*

Section	Reported data	ASCII	XML
4.2.4	User defined tags and keywords	KEYWORD "MEAN_DE" # Mean Delta E of samples compared to batch average MEAN_DE 1.05	<keyword name="MEAN_DE" value="1.05" data_type="R" comment="Mean Delta E of samples compared to batch average"/>
		KEYWORD "PrintingDate (CS) # Date sample was printed PrintingDate "June 6, 2006"	<keyword name="PrintingDate" value="2006-06-06" data_type="CS" comment="Date sample was printed"/>
4.2.5	Data format identifier	DATA_FORMAT_IDENTIFIER "D_RED"	<data_format_identifier name="d_red"/>
4.3.2	Table descriptor	TABLE_DESCRIPTOR "This is a test table"	<table_descriptor>This is a test table</table_descriptor>
4.3.3	Table name	TABLE_NAME "Test Table"	<table_name>Test Table</test_table>

Annex C
(informative)

Sample files

C.1 General

The following sample files are provided to demonstrate the use and flexibility of this data format approach. See also the example files given in https://standards.iso.org/iso/28178/ed-2/en/.

C.2 Sample files

Table C.1 shows an example of a calibration data file in both ASCII and XML used to report XYZ calibration data for an IT8.7/1 target.

Table C.2 shows an example of a data file in both ASCII and XML used to report XYZ measurements from a printed sheet of an IT8.7/3 Basic Data Set.

Table C.3 shows an example of a data file in both ASCII and XML used to report CIELAB data for the GATF/SWOP run bars on a printed sheet.

Table C.1 — Example of XYZ calibration data for an IT8.7/1 target

ASCII	XML
ISO28178 ORIGINATOR "Company L" FILE_DESCRIPTOR "XYZ calibration data" CREATED "December 6, 1992" MANUFACTURER "Z Film Company" TARGET_TYPE "IT8.7/1" PROD_DATE "1992:09" SERIAL "1234" # Caution this serial number may be questionable the operator had difficulty in reading this value due to a label stuck on top MATERIAL "XYZ Chrome" NUMBER_OF_FIELDS 4 BEGIN_DATA_FORMAT SAMPLE_ID XYZ_X XYZ_Y XYZ_Z END_DATA_FORMAT NUMBER_OF_SETS 178 BEGIN_DATA A1 2.27 1.91 1.34 A2 4.16 2.99 1.84 ... GS22 .21 .22 .18 END_DATA	<?xml version="1.0" encoding="UTF-8"?> <iso28178 std_version="1.0" schema_version="1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:iso28178="https://www.iso.org/iso28178/1.0" xmlns="https://www.iso.org/iso28178/1.0" xsi:schemaLocation="https://www.iso.org/iso28178/1.0 iso28178_data.xsd"> <iso28178.preamble> <standard>ISO28178</standard> <originator>Company L</originator> <file_descriptor>XYZ calibration data</file_descriptor> <created date="1992-12-06">December 6, 1992</created> </iso28178.preamble> <iso28178.data_section> <iso28178.data_section_header> <manufacturer>Z Film Company</manufacturer> <target_type>IT8.7/1</target_type> <prod_date year="1992" month="09">1992:09</prod_date> <serial comment=" Caution this serial number may be questionable the operator had difficulty in reading this value due to a label stuck on top">1234</serial> <material>XYZ Chrome</material> </iso28178.data_section_header> <iso28178.data_section_data> <number_of_fields>4</number_of_fields> <data_format> <field_info pos="1" name="SAMPLE_ID"/> <field_info pos="2" name="XYZ_X"/> <field_info pos="3" name="XYZ_Y"/> <field_info pos="4" name="XYZ_Z"/> </data_format> <number_of_sets>178</number_of_sets> <table> <tr><td>A1</td><td>2.27</td><td>1.91</td><td>1.34</td></tr> <tr><td>A2</td><td>4.16</td><td>2.99</td><td>1.84</td></tr> <!-- ... --> <tr><td>GS22</td><td>.21</td><td>.22</td><td>.18</td></tr> </table> </iso28178.data_section_data> </iso28178.data_section> </iso28178>

Table C.2 — Example of XYZ measurements from a printed sheet for an IT8.7/3 target

ASCII	XML
ISO28178 ORIGINATOR "XYZ Printing Company" FILE_DESCRIPTOR "Results of Oct 17, 1991 printing test" CREATED "December 6, 1991" TARGET_TYPE "IT8.7/3" INSTRUMENTATION "GTO Spectro, Model 5" MEASUREMENT_SOURCE "Unknown" PRINT_CONDITIONS "SWOP aim test using basic data set" KEYWORD "SAMPLE_LOC" #Patch location in printing form NUMBER_OF_FIELDS 5 BEGIN_DATA_FORMAT SAMPLE_ID SAMPLE_LOC XYZ_X XYZ_Y XYZ_Z END_DATA_FORMAT NUMBER_OF_SETS 182 BEGIN_DATA 1 A1 15.85 24.00 45.01 2 A2 29.74 15.45 14.11 ... 182 N13 9.87 8.81 4.79 END_DATA	<?xml version="1.0" encoding="UTF-8"?> <iso28178 std_version="1.0" schema_version="1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:iso28178="https://www.iso.org/iso28178/1.0" xmlns="https://www.iso.org/iso28178/1.0" xsi:schemaLocation="https://www.iso.org/iso28178/1.0 iso28178_data.xsd"> <iso28178.preamble> <standard>ISO28178</standard> <originator>XYZ Printing Company</originator> <file_descriptor>Results of Oct 17, 1991 printing test</file_descriptor> <created date="1991-12-06">December 6, 1991</created> </iso28178.preamble> <iso28178.data_section> <iso28178.data_section_header> <target_type>IT8.7/3</target_type> <instrumentation manufacturer="GTO Spectro" model="Model 5">GTO Spectro, Model 5</instrumentation> <measurement_source>Unknown</measurement_source> <print_conditions>SWOP aim test using basic data set</print_conditions> <keyword name="SAMPLE_LOC" comment="Patch location in printing form"/> </iso28178.data_section_header> <iso28178.data_section_data> <number_of_fields>5</number_of_fields> <data_format> <field_info pos="1" name="SAMPLE_ID"/> <field_info pos="2" name="SAMPLE_LOC"/> <field_info pos="3" name="XYZ_X"/> <field_info pos="4" name="XYZ_Y"/> <field_info pos="5" name="XYZ_Z"/> </data_format> <number_of_sets>182</number_of_sets> <table> <tr><td>1</td><td>A1</td><td>15.85</td><td>24.00</td> <td>45.01</td></tr> <tr><td>2</td><td>A2</td><td>29.74</td><td>15.45</td> <td>14.11</td> </tr> <!-- ... --> <tr><td>182</td><td>N13</td><td>9.87</td><td>8.81</td> <td>4.79</td></tr> </table> </iso28178.data_section_data> </iso28178.data_section> </iso28178>

Table C.3 — Example of CIELAB data for the GATF/SWOP run bars on a printed sheet

ASCII	XML
ISO28178 ORIGINATOR "XYZ Printing Company" FILE_DESCRIPTOR "Results of Oct 17, 1991 printing test, GATF/SWOP Control Bar Data" CREATED "December 6, 1991" INSTRUMENTATION "GTO Spectro, Model 5" MEASUREMENT_SOURCE "D50" POLARIZATION "no" PRINT_CONDITIONS "SWOP test using RGB inks at aim density" SAMPLE_BACKING "Black" NUMBER_OF_FIELDS 5 BEGIN_DATA_FORMAT STRING STRING LAB_L LAB_A LAB_B END_DATA_FORMAT NUMBER_OF_SETS 9 BEGIN_DATA "5th group" "Cyan Solid" 56.08 -36.84 - 39.12 "5th group" "Mag Solid" 69.55 -3.68 29.75 "5th group" "Yel Solid" 84.19 -5.79 83.93 "5th group" "K Solid" 20.72 1.22 1.28 "5th group" Paper 88.06 0.15 4.23 "5th group" "Cyan 50" 70.86 -17.90 -18.90 "5th group" "Mag 50" 65.23 34.19 -3.13	<?xml version="1.0" encoding="UTF-8"?> <iso28178 std_version="1.0" schema_version="1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:iso28178="https://www.iso.org/iso28178/1.0" xmlns="https://www.iso.org/iso28178/1.0" xsi:schemaLocation="https://www.iso.org/iso28178/1.0 iso28178_data.xsd"> <iso28178.preamble> <standard>ISOS28178</standard> <originator>XYZ Printing Company</originator> <file_descriptor>Results of Oct 17, 1991 printing test, GATF/SWOP Control Bar Data</file_descriptor> <created date="1991-12-06">December 6, 1991</created> </iso28178.preamble> <iso28178.data_section> <iso28178.data_section_header> <instrumentation manufacturer="GTO Spectro" model="Model 5">GTO Spectro, Model 5</instrumentation> <measurement_source>D50</measurement_source> <polarization>no</polarization> <print_conditions>SWOP test using RGB inks at aim density</print_conditions> <sample_backing>Black</sample_backing> </iso28178.data_section_header> <iso28178.data_section_data> <number_of_fields>5</number_of_fields> <data_format> <field_info pos="1" name="STRING"/> <field_info pos="2" name="STRING"/> <field_info pos="3" name="LAB_L"/> <field_info pos="4" name="LAB_A"/> <field_info pos="5" name="LAB_B"/> </data_format>

Table C.3 *(continued)*

ASCII	XML
"5th group" "Yel 50" 85.75 -4.34 44.24 "5th group" "K 50" 57.81 -0.18 1.08 END_DATA	<number_of_sets>9</number_of_sets> <table> <tr><td>5th group</td><td>Cyan solid</td><td>56.08</td> <td>-36.84</td><td>-39.12</td></tr> <tr><td>5th group</td><td>Mag Solid</td><td>69.55</td> <td>-3.68</td><td>29.75</td></tr> <tr><td>5th group</td><td>Yel Solid</td><td>84.19</td> <td>-5.79</td><td>83.93</td></tr> <tr><td>5th group</td><td>K Solid</td><td>20.72</td> <td>1.22</td><td>1.28</td></tr> <tr><td>5th group</td><td>Paper</td><td>88.06</td> <td>0.15</td><td>4.23</td></tr> <tr><td>5th group</td><td>Cyan 50</td><td>70.86</td> <td>-17.90</td><td>-18.90</td></tr> <tr><td>5th group</td><td>Mag 50</td><td>65.23</td> <td>34.19</td><td>-3.13</td></tr> <tr> <td>5th group</td><td>Yel 50</td><td>85.75</td> <td>-4.34</td><td>44.24</td></tr> <tr><td>5th group</td><td>K 50</td><td>57.81</td> <td>-0.18</td><td>1.08</td></tr> </table> </iso28178.data_section_data> </iso28178.data_section> </iso28178>

Table C.4 — Example of mixed process and spot colour data with printing order

ASCII
PROCESSCOLOR_ID "3 1 Cyan"
PROCESSCOLOR_ID "3 2 Magenta"
PROCESSCOLOR_ID "3 3 Yellow"
SPOT_ID "1 Reflex Blue"
column sequence is Cyan, Magenta, Yellow, Reflex Blue
PRINTING_ORDER "2 3 4 1"
laydown order is Reflex Blue, Cyan, Magenta, Yellow
i.e. first relevant column PC3_1 = Cyan is printed as second ink "2",
second relevant column PC3_2 = Magenta is printed as third ink "3",
third relevant column PC3_3 = Yellow is printed as fourth ink "4",
fourth relevant column SPOT_1 = Reflex Blue is printed as first ink "1".
BEGIN_DATA_FORMAT
SAMPLE_ID SAMPLE_NAME PC3_1 PC3_2 PC3_3 SPOT_1 LAB_L LAB_A LAB_B
END_DATA_FORMAT

Annex D
(informative)

Example of use of user-defined keywords

D.1 General

Subclause 4.2.4 outlines the notation of user-defined tags and keywords. The following sample files employ a series of unique tags or keywords describing the positioning of an instrument read head in relationship to the area of measurement. This example reports the positioning of multiple samples taken over a small area in a manner consistent with an automated scanning device reading multiple spots along a colour control bar.

D.2 Sample files

The following sample files contain 3 user-defined keywords: Sample_Loc, (the sample identification) and X_Loc and Y_Loc for measurement positioning in millimetres from the left edge and bottom edge respectively. The following sample files are incomplete and are included here only to demonstrate the use of the user-defined tags and keyword identifiers. For sample files that are complete, refer to Annex C.

Table D.1 — Example of multiple density patch measurements from a printed sheet for a custom target

ASCII	XML
ISO28178 ORIGINATOR "XYZ Printing Company" FILE_DESCRIPTOR "Results of Oct 20, 2003 average printing test" CREATED "October, 22 2003" INSTRUMENTATION "XY Spectro, Model 1" MEASUREMENT_SOURCE "Unknown" PRINT_CONDITIONS "House SID aim test using tiered color bar" KEYWORD "SAMPLE_LOC" # Patch location in ink zone of printing form KEYWORD "X_LOC" # distance of measurement center from left sheet edge in mm KEYWORD "Y_LOC" # distance of measurement center from bottom sheet edge in mm SAMPLE_BACKING "Black" NUMBER_OF_FIELDS 8 BEGIN_DATA_FORMAT SAMPLE_ID SAMPLE_LOC X_LOC Y_LOC D_RED D_GREEN D_BLUE D_VIS END_DATA_FORMAT NUMBER_OF_SETS 182 BEGIN_DATA 1 C1 25.4 5.0 1.13 0.400.23 0.68 1 C2 27.4 5.0 1.12 0.400.23 0.68 3 M1 30.4 5.0 0.26 1.220.64 0.59 ... 182 K13 910.0 5.0 1.41 1.46 1.44 1.47 END_DATA	<?xml version="1.0" encoding="UTF-8"?> <iso28178 std_version="1.0" schema_version="1.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:iso28178="https://www.iso.org/iso28178/1.0" xmlns="https://www.iso.org/iso28178/1.0" xsi:schemaLocation="https://www.iso.org/iso28178/1.0 iso28178_data.xsd"> <iso28178.preamble> <standard>ISO28178</standard> <originator>XYZ Printing Company</originator> <file_descriptor> Results of Oct 20, 2003 average printing test </file_descriptor> <created date="2003-10-22">October, 22 2003</created> </iso28178.preamble> <iso28178.data_section> <iso28178.data_section_header> <instrumentation manufacturer="XY Spectro" model="Model 1">XY Spectro, Model 1</instrumentation> <measurement_source>Unknown</measurement_source> <print_conditions>House SID aim test using tiered color bar </print_conditions> <keyword name="SAMPLE_LOC" comment="Patch location in ink zone of printing form"/> <keyword name="X_LOC" comment="distance of measurement center from left sheet edge in mm"/> <keyword name="Y_LOC" comment="distance of measurement center from bottom sheet edge in mm"/> <sample_backing>Black</sample_backing> </iso28178.data_section_header> <iso28178.data_section_data>

Table D.1 *(continued)*

ASCII	XML
	<number_of_fields>8</number_of_fields> <data_format> <field_info pos="1" name="SAMPLE_ID"/> <field_info pos="2" name="SAMPLE_LOC"/> <field_info pos="3" name="X_LOC"/> <field_info pos="4" name="Y_LOC"/> <field_info pos="5" name="D_RED" col_name="Red filter density"/> <field_info pos="6" name="D_GREEN" col_name="Green filter density"/> <field_info pos="7" name="D_BLUE" col_name="Blue filter density"/> <field_info pos="8" name="D_VIS" col_name="Visual filter density"/> </data_format> <number_of_sets>182</number_of_sets> <table> <tr><td>1</td><td>C1</td><td>25.4</td><td>5.0</td> <td>1.13</td><td>0.40</td><td>0.23</td><td>0.68</td></tr> <tr><td>1</td><td>C2</td><td>27.4</td><td>5.0</td> <td>1.12</td><td>0.40</td><td>0.23</td><td>0.68</td></tr> <tr><td>1</td><td>m1</td><td>30.4</td><td>5.0</td> <td>0.26</td><td>1.22</td><td>0.64</td><td>0.59</td></tr> <!-- ... --> <tr><td>182</td><td>k13</td><td>910.0</td><td>5.0</td> <td>1.41</td><td>1.46</td><td>1.44</td><td>1.47</td></tr> </table> </iso28178.data_section_data> </iso28178.data_section> </iso28178>

D.3 Sample file 1

Table D.2 shows an example of a calibration data file in both ASCII and AMPAC used to report XYZ calibration data for an IT8.7/1 target.

NOTE ISO/TR 16044 (Database AMPAC) has been withdrawn and AMPAC is no longer widely used. These tables show the relationship between the elements of the AMPAC data format and the corresponding ASCII format elements and so enable legacy AMPAC files to be updated.

Table D.2 — Example of XYZ calibration data for an IT8.7/1 target

ASCII	AMPAC
ISO 28178	AMPAC Ver.01.00 ; utf-8
ORIGINATOR "Company L"	Company_L ; XYZ_calibration_data ; 11 ; 0.0.2.0 ; Standard ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; ISOS28178.
FILE_DESCRIPTOR "XYZ calibration data"	Company_L ; XYZ_calibration_data ; 11 ; 0.0.2.0 ; Descriptor ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; XYZ calibration data
CREATED "December 6, 1992"	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.120 ; ; 0 ; ; DAY( ) ; 3 ; ; ; 1 ; 1992-12-06
MANUFACTURER "Z Film Company"	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.164 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; Z Film Company
PROD_DATE "1992:09"	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.130 ; ; 0 ; ; DAY( ) ; 3 ; ; ; 1 ; 1992-09
SERIAL "1234"	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.134 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; 1234
# Caution this serial number may be questionable the operator had difficulty in reading this value due to a label stuck on top	Company_L ; XYZ_calibration_data ; 11 ; 0.0.2.0:14.2.12.134 ; Comment ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; Caution this serial number may be questionable the operator had difficulty in reading this value due to a label stuck on top
MATERIAL "XYZ Chrome"	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.128 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; XYZ Chrome
NUMBER_OF_FIELDS 4	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.138 ; ; 0 ; ; VI( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 1 ; 4
BEGIN_DATA_FORMAT	
SAMPLE_ID XYZ_X XYZ_Y XYZ_Z	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.168 ; ; 0 ; ; CH( ) ; 3 ; ; ; 4 ; SAMPLE_ID, XYZ_X, XYZ_Y, XYZ_Z
END_DATA_FORMAT	
NUMBER_OF_SETS 178	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.136 ; ; 0 ; ; VI( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 1 ; 178
BEGI N_DATA	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.166 ; ; 2 ; 14.2.12.124 , 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 9 ; 1, 3,
A1 2.27 1.91 1.34	A1, XYZ_X, XYZ_Y, XYZ_Z, 2.27, 1.91, 1.34
	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.166 ; ; 2 ; 14.2.12.124 , 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 9 ; 1, 3,
A2 4.16 2.99 1.84	A2, XYZ_X, XYZ_Y, XYZ_Z, 4.16, 2.99, 1.84
	Company_L ; XYZ_calibration_data ; 11 ; 14.2.12.166 ; ; 2 ; 14.2.12.124 , 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 9 ; 1, 3,
...	...
GS22 0.21 0.22 0.18	GS22, XYZ_X, XYZ_Y, XYZ_Z, 0.21, 0.22, 0.18
END_DATA	End of data

D.4 Sample file 2

Table D.3 shows an example of a data file in both ASCII and AMPAC used to report XYZ measurements from a printed sheet of an IT8.7/3 Basic Data Set.

Table D.3 — Example of XYZ measurements from a printed sheet for an IT8.7/3 target

ASCII	AMPAC
ISO 28178	AMPAC Ver.01.00 ; utf-8
ORIGINATOR "XYZ Printing Company"	XYZ_Printing_Company ; test_data ; 11 ; 0.0.2.0 ; Standard ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; IAO28178.
FILE_DESCRIPTOR "Results of Oct 17, 1991 printing test"	XYZ_Printing_Company ; test_data ; 11 ; 0.0.2.0 ; Descriptor ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; Results of Oct 17 1991 printing test
CREATED "December 6, 1991"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.120 ; ; 0 ; ; DAY( ) ; 3 ; ; ; 1 ; 1991-12-06
INSTRUMENTATION "GTO Spectro, Model 5"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.98 ; ; 0 ; ; CH( ) ; 3 ; ; ; 2 ; GTO Spectro , Model 5
MEASUREMENT_SOURCE "Unknown"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.8 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; Unknown
PRINT_CONDITIONS "SWOP aim test using basic data set"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.118 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; SWOP aim test using basic data set
KEYWORD "SAMPLE_LOC"	XYZ_Printing_Company ; test_data ; 10 ; 0.0.0.0:14.2.12.1 ; ; 0 ; ; TPNE( ) ; 3 ; ; ; 4 ; Printing process, Process management, Quality control, SAMPLE_LOC
#Patch location in printing form	XYZ_Printing_Company ; test_data ; 10 ; 0.0.2.0:14.2.12.1 ; comment ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; Patch location in printing form
NUMBER_OF_FIELDS 5	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.138 ; ; 0 ; ; VI( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 1 ; 5
BEGIN_DATA_FORMAT	
SAMPLE_ID SAMPLE_LOC XYZ_X XYZ_Y XYZ_Z	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.168 ; ; 0 ; ; CH( ) ; 3 ; ; ; 5 ; SAMPLE_ID, SAMPLE_LOC, XYZ_X, XYZ_Y, XYZ_Z
END_DATA_FORMAT	
NUMBER_OF_SETS 182	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.136 ; ; 0 ; ; VI( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 1 ; 182
BEGIN_DATA	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 2 ; 14.2.12.124 , 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 11 ; 1, 4,
1 A1 15.85 24.00 45.01	1, SAMPLE_LOC, XYZ_X, XYZ_Y, XYZ_Z, A1, 15.85, 24.00, 45.01
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 2 ; 14.2.12.124 , 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 11 ; 1, 4,
2 A2 29.74 15.45 14.11	2, SAMPLE_LOC, XYZ_X, XYZ_Y, XYZ_Z, A2, 29.74, 15.45, 14.11
...	...
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 2 ; 14.2.12.124 , 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 11 ; 1, 4,
182 N13 9.87 8.81 4.79	182, SAMPLE_LOC, XYZ_X, XYZ_Y, XYZ_Z, N13, 9.87, 8.81, 4.79
END_DATA	End of data

D.5 Sample file 3

Table D.4 shows an example of a data file in both ASCII and AMPAC used to report CIELAB data for the GATF/SWOP run bars on a printed sheet.

Table D.4 — Example of CIELAB data for the GATF/SWOP run bars on a printed sheet

ASCII	AMPAC
ISO 28178	AMPAC Ver.01.00 ; utf-8
ORIGINATOR "XYZ Printing Company"	XYZ_Printing_Company ; test_data ; 11 ; 0.0.2.0 ; Standard ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; ISO28178.
FILE_DESCRIPTOR "Results of Oct 17, 1991 printing test, GATF/SWOP Control Bar Data"	XYZ_Printing_Company ; test_data ; 11 ; 0.0.2.0 ; Descriptor ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; Results of Oct 17 1991 printing test GATF/SWOP Control Bar Data
CREATED "December 6, 1991"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.120 ; ; 0 ; ; DAY( ) ; 3 ; ; ; 1 ; 1991-12-06
INSTRUMENTATION "GTO Spectro, Model 5"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.98 ; ; 0 ; ; CH( ) ; 3 ; ; ; 2 ; GTO Spectro , Model 5
MEASUREMENT_SOURCE "D50"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.8 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; D50
POLARIZATION "no"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.172 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; no
PRINT_CONDITIONS "SWOP test using RGB inks at aim density"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.118 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; SWOP test using RGB inks at aim density
SAMPLE_BACKING "Black"	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.96 ; ; 0 ; ; CH( ) ; 3 ; ; ; 1 ; Black
NUMBER_OF_FIELDS 5	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.138 ; ; 0 ; ; VI( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 1 ; 5
BEGIN_DATA_FORMAT	
STRING STRING LAB_L LAB_A LAB_B	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.168 ; ; 0 ; ; CH( ) ; 3 ; ; ; 5 ; STRING, STRING, LAB_L, LAB_A, LAB_B
END_DATA_FORMAT	
NUMBER_OF_SETS 9	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.136 ; ; 0 ; ; VI( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 1 ; 9
BEGIN_DATA	
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 12 ; 1, 5,
"5th group" "Cyan Solid" 56.08 -36.84 -39.12	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, Cyan Solid, 56.08, -36.84, -39.12
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 12 ; 1, 5,
"5th group" "Mag Solid" 69.55 -3.68 29.75	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, Mag Solid, 69.55, -3.68, 29.75
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 12 ; 1, 5,
"5th group" "Yel Solid" 84.19 -5.79 83.93	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, Yel Solid, 84.19, -5.79, 83.93
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 12 ; 1, 5,
"5th group" "K Solid" 20.72 1.22 1.28	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, K Solid, 20.72, 1.22, 1.28
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0 ; 12 ; 1, 5,

Table D.4 *(continued)*

ASCII	AMPAC
"5th group" “Paper” 88.06 0.15 4.23	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, Paper, 88.06, 0.15, 4.23
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0,0 ; 12 ; 1, 5,
"5th group" "Cyan 50" 70.86 -17.90 -18.90	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, Cyan 50, 70.86, -17.90, -18.90
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0,0 ; 12 ; 1, 5,
"5th group" "Mag 50" 65.23 34.19 -3.13	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, Mag 50, 65.23, 34.19, -3.13
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0,0 ; 12 ; 1, 5,
"5th group" "Yel 50" 85.75 -4.34 44.24	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, Yel 50, 85.75, -4.34, 44.24
	XYZ_Printing_Company ; test_data ; 11 ; 14.2.12.166 ; ; 1 ; 14.2.12.168 ; TR( ) ; 1 ; ; 0,0,0,0,0,0,0,0 ; 12 ; 1, 5,
"5th group" "K 50" 57.81 -0.18 1.08	STRING, STRING, LAB_L, LAB_A, LAB_B, 5th group, K 50, 57.81, -0.18, 1.08
END_DATA	End of data

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