INTERNATIONAL STANDARD

ISO 12639

First edition
1998-10-01

Graphic technology — Prepress digital data exchange — Tag image file format for image technology (TIFF/IT)

Technologie graphique — Échange de données numériques de préimpression — Format de fichier d'image d'étiquette pour la technologie d'image

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Reference number
ISO 12639:1998(E)

Contents

Page

© ISO 1998

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet iso@iso.ch

Printed in Switzerland

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 12639 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

Annexes A to I of this International Standard are for information only.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Introduction

This International Standard was prepared by Working Group 2 (Prepress data exchange) of ISO/TC 130, *Graphic technology*, and is based on American National Standard IT8.8-1993, *Graphic technology — Prepress digital data exchange — Tag image file format for image technology (TIFF/IT).*

The technical content of this International Standard enables the interchange of various types of rasterised colour and monochrome image data files among electronic, digital systems used in prepress image processing, graphic arts design and related document creation and production operations. This International Standard is intended for use as a media-independent means for such interchange, thus is applicable to facilitate interchange through a variety of mechanisms such as, though not limited to, network, magnetic and optical media.

The image data types supported by this International Standard include those specified in ISO 10755:1992, ISO 10756:1993, ISO 10759:1993 (Colour Picture Data, Colour Line Art Data, and Monochrome Image Data) and also specified in ANSI IT8.8-1993.

This International Standard, though based on ANSI IT8.8-1993, goes further to specify a second, more constrained, level of conformity called Profile 1 (P1) for each image data type. The P1 formats for CT (Colour Picture), MP (Monochrome Picture), and BP (Binary Picture) files are compatible with the popular TIFF 6.0 files for CMYK (Separated) Images, Monochrome Images and Bilevel Images respectively. The P1 formats for HC (High Resolution Continuous Tone), LW (Line Art) and BL (Binary Line Art), though not compatible with TIFF 6.0, are designed to be easier to implement within desktop systems by limiting the range of options and selections. These Profile 1 formats allow for a broader usage of this International Standard by allowing conformance to a simplified, restricted subset of functionality supported by many popular application software systems used in the prepress, graphic arts document processing and computer graphics and imaging industries.

In support of backward compatibility, the IT8Header field provides the ability to include, in TIFF/IT, unmodified headers (appended by an ASCII "null" at the end of the character string) from ISO 10755, ISO 10756 and ISO 10759. This may be particularly useful if a file is being transported from one ISO 10755, ISO 10756, or ISO 10759 environment to another via TIFF/IT. TIFF/IT readers are not required to interpret and use the contents of the IT8Header field.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Graphic technology — Prepress digital data exchange — Tag image file format for image technology (TIFF/IT)

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

1 Scope

This International Standard specifies a media-independent means for prepress electronic data exchange. This International Standard defines image file formats for encoding colour continuous tone picture images, colour line art images, high resolution continuous tone images, monochrome continuous tone picture images, binary picture images, and binary line art images.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 646:1991, *Information technology — ISO 7-bit coded character set for information interchange.*

ISO 3166:1993, *Codes for the representation of names of countries.*

ISO 10755:1992, *Graphic technology — Prepress digital data exchange — Colour picture data on magnetic tape.*

ISO 10756:1994, *Graphic technology — Prepress digital data exchange — Colour line art data on magnetic tape.*

ISO 10759:1994, *Graphic technology — Prepress digital data exchange — Monochrome image data on magnetic tape.*

ISO 12641:1997, *Graphic technology — Prepress digital data exchange — Colour targets for input scanner calibration.*

ISO 12642:1996, *Graphic technology — Prepress digital data exchange — Input data for characterization of 4 - colour process printing.*

ANSI CGATS.15:___ [1)], *Graphic technology — Prepress digital data exchange — Three-component color data definitions.*

TIFF, Revision 6.0 Final: Aldus Corporation (now Adobe Systems Incorporated), June 3, 1992.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 big-endian (byte-ordering): Method for arranging the sequence of the bytes within a SHORT or LONG from the most significant to the least significant byte, as the byte address increases.

3.2 little-endian (byte-ordering): Method for arranging the sequence of the bytes within a SHORT or LONG from the least significant to the most significant byte, as the byte address increases.

3.3 offset: Address within a TIFF/IT file, relative to byte zero of the file.

3.4 offset value: SHORT or LONG value within a TIFF/IT file, containing the offset of a data element.

1) To be published.

3.5 pixel: A picture element, the smallest single building block of a picture containing colour identification and size (when used to describe dimensions relating to the picture resolution, as in pixels per inch).

3.6 printing tone value; printing dot value (of a data set): Number, recorded as data in the computer, corresponding to the percentage area on a printing forme that is intended to accept ink for transfer to the final sheet.

NOTE 1 This corresponds to the tone value of a half-tone film. The light end of the final reproduction scale (highlights) will have values approaching 0% (or often in computer files, 0) and the dark cnd of the scale (shadows) will have values approaching 100% (or often in computer files, 255).

3.7 reader: An application, system or subsystem that accepts a file as its input and performs a level of processing on that file that, at the minimum, accepts or rejects the file based on predetermined criteria and, if accepted, passes the file to the next stage of processing.

3.8 run length encoding: Data encoding method in which a sequence of data items, which may include many adjacent repetitions of the same value, is represented by a sequence of ordered pairs, each consisting of a value and a repeat count.

NOTE 2 Run length encoding may result in data compression.

3.9 separations: Individual planes of data that correspond to each of the single colours to be used in the rendering process. For "process" colours these are cyan (C), magenta (M), yellow (Y), and black (K). Additional separations are often required for spot or speciality colours or for imagewise finishing treatments such as varnish.

3.10 string: Serial sequence of characters, bytes, integers, etc.

3.11 TIFF/IT field, TIFF field: A one-dimensional array of values (though most are a single-entry array) having an associated count.

NOTE 3 An array is identified by a Field name, a Tag number, and a Field type.

3.12 TIFF/IT tag: A unique numeric identifier for each entry in the TIFF/IT file.

3.13 transparent colour: Attribute that signifies that the underlying image (if any) shows through.

NOTE 4 A clear run is where no colour is present and the underlying image (if any) shows through. The colour "white" signifies that no underlying image should show through, only the underlying substrate (paper). The "transparent" attribute may be applied to any or all separations of a pixel run or a palette colour in a LW, HC, BL or BP file.

3.14 trapping: Technique for modifying colour separations to account for dimensional variations in the printing process by overprinting in selected colours at the boundaries between colours which might inadvertently be left uncoloured by normal errors in printing press registration.

3.15 word-aligned: Sequence of bytes beginning at an even offset.

3.16 writer: An application, system or subsystem that generates a file based on predetermined criteria and prepares the file for output.

4 Notations, symbols, abbreviations and field types

4.1 Notations

All numeric values in this International Standard are expressed in decimal notation, unless otherwise indicated. A letter "h" is suffixed to indicate a hexadecimal value. Literal strings are denoted in this International Standard by enclosing them in single quotation marks. In the descriptions of file parameters, field names from ISO 10755, ISO 10756, and ISO 10759 are enclosed in brackets.

Preferred values in TIFF/IT fields are preceded by "=" and enclosed in parentheses, for example "(=5)". Preferred values are those values which are required to be accepted and recognized by a compliant application or reader. A compliant application or writer may write values other than preferred values but the reader is not required to accept or recognize the value. It is left to the discretion of the reader.

Required values in TIFF/IT fields are preceded by "=" but not enclosed in parentheses, for example "=5". Required values are those values which are required to be written by a compliant application or writer and are required to be accepted and recognized by a compliant application or reader.

Default values, if specified, are preceded by "Default =" or "d=", for example "Default = 0,255". In some tables, default values are indicated in a "default value" column. The reader shall assume the default value if no value is written by the writer in the default-specified field. Because the default values shown for all "TIFF" tag numbers are those specified for TIFF files, they may not be valid for the particular TIFF/IT file type. In all such cases, a mandatory field value or values is specified.

NOTE 5 When an entry is made in a "default value" column it might reference a TIFF 6.0 default value that may not be a valid value for the particular TIFF/IT file type. This is usually

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

indicated by entry of a mandatory field value or values in the tables.

Classification marks used in clause 7 are defined as follows:

m Mandatory (Absolute Requirement) field
The writer is required to include mandatory fields. The reader is required to read and process the field. The reader is allowed to reject those files where mandatory fields are omitted.

opt, o Optional field
The writer may include or omit optional fields. The reader is not required to read or process optional fields.

d Default field
The writer may include or omit default fields. The reader shall assume the default value for the field if the field is omitted. The reader is required to read and process the field when it contains any required or preferred values.

These classifications may vary by file type, and are discussed further in clause 7.

Image File Directory (IFD) entries are identified by a field name of one or more words, written with initial capital letters, and no internal spaces (e.g. "PageName").

4.2 Symbols and abbreviations

The following symbols and abbreviations are used within this International Standard with the meanings indicated:

BL binary line art (or run length encoded bitmap) image or file

BP binary picture (or byte-packed bitmap) image or file

CEPS Colour Electronic Prepress System

CT colour continuous tone picture image or file

DDES Digital Data Exchange Specification

DTP Desktop Publishing

HC high resolution continuous tone (colour) image or file

IFD image file directory

LW colour line art (or line work) image or file

MP monochrome continuous tone picture image or file

P1 Profile 1

TIFF Tag Image File Format , Version 6.0, Aldus Corporation.

TIFF/IT TIFF for image technology

NOTE 6 For character strings, it is recommended that only character values 32-126 be used and to assume letters A-Z and a-z have the same significance respectively.

4.3 Field types

The field types used in this International Standard are as follows:

ASCII: A field type consisting of a byte containing a graphic character code from ISO 646. The last character in an ASCII string shall be a "null" (character 0/0).

BYTE: A field type consisting of an 8-bit unsigned binary integer.

LONG: A field type consisting of a 32-bit unsigned binary integer.

RATIONAL: A field type consisting of two LONGs, the first representing the numerator of a fraction and the second its denominator.

SHORT: A field type consisting of a 16-bit unsigned binary integer.

5 Conformance

This International Standard has two levels of conformance: TIFF/IT (also referred to as full TIFF/IT) conformance and TIFF/IT-P1 conformance. Both conformance levels are intended to support a media-independent means for the exchange of various images used in the prepress, printing, graphic arts, and information processing fields. TIFF/IT-P1 conformance provides a minimized set of options to permit simpler implementation and compatibility, where possible (for CT, BP, and MP files), with commonly available TIFF 6.0 readers and writers. TIFF/IT-P1 is intended for use where the full set of TIFF/IT options is not required.

Only TIFF/IT fields defined in this International Standard need to be written, recognized and interpreted by conforming implementations. TIFF fields that are unclassified or not referred to in this International Standard are not required to be supported for an implementation to conform to this International Standard. If an unsupported field is read, processing of that field is at the discretion of the reader. The reader shall follow the strategy described

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

in TIFF and attempt to process the file while ignoring unsupported fields. (See annex I.)

This International Standard specifies conforming TIFF/IT and/or TIFF/IT-P1 files for specific image data types. Files for each specific image data type that conform to the requirements of this International Standard shall be considered conforming TIFF/IT and/or TIFF/IT-P1 files for the specific image data type. Readers that accept and process these files shall be considered conforming TIFF/IT or TIFF/IT-P1 readers for the specific image data types. Writers that generate and output these files shall be considered conforming TIFF/IT or TIFF/IT-P1 writers for the specific image data types. Where requirements of this International Standard and TIFF 6.0 are in conflict, this International Standard shall take precedence.

5.1 Image file type identification

TIFF/IT provides the ability to represent the data structure of a wide range of printing and graphic arts images. The identification of the individual image file types is as follows (see annex E):

TIFF/IT-CT	colour continuous tone picture image data
TIFF/IT-LW	colour line art image data
TIFF/IT-HC	high resolution continuous tone image data
TIFF/IT-MP	monochrome continuous tone picture image data
TIFF/IT-BP	binary picture image data
TIFF/IT-BL	binary line art image data

5.2 TIFF/IT conformance

For conformance to this International Standard, all image file types do not have to be implemented. Each image file type described in clause 7 may be individually implemented. Files, readers or writers may be identified as conforming for either all image file types or specifically identified image file types.

Conformance with TIFF/IT requires implementation of the requirements for all image file types as described in clause 7. Conformance with a specific image file type or types requires identification of the specific image file type using the identification defined in 5.1 (e.g. TIFF/IT-CT).

5.3 TIFF/IT-P1 conformance

TIFF/IT-P1 conformance provides an ability to represent the data structure of various images in as simple and straightforward a way as possible in order to support image file exchange with prepress, printing, graphic arts, and information processing systems and applications. TIFF/IT-P1 is a subset of TIFF/IT.

Conformance with TIFF/IT-P1 requires implementation of the requirements for all image file types as described in clause 7. Conformance with a specific image file type or types requires identification of the specific image file type using the identification defined in 5.1 with the designation "/P1" appended (e.g. TIFF/IT-CT/P1).

5.4 Conformance identification

Conformance with the provisions of this International Standard shall be identified individually for files, readers, and writers. The accepted terminology shall be the image file type followed by the designation "file", "reader", or "writer" (e.g. TIFF/IT writer, TIFF/IT-CT/P1 reader, TIFF/IT-LW file).

6 Image data type description

6.1 Colour continuous tone picture image (CT) data

A colour continuous tone picture image (CT) is a rectangular array of pixels (picture elements). A pixel is represented by a set of values corresponding to its colour components.

NOTE 7 Pixels typically consist of four bytes, representing cyan (C), magenta (M), yellow (Y), and black (K) process colours.

6.2 Colour line art (LW) image data

A colour line art or line work (LW) image is a rectangular array of pixels. Each pixel is one of a limited number of colours. The colours are defined in a palette table which specifies the values of the colour separation components for each entry in the palette. Line work images have areas of many pixels of the same palette entry. Run length encoding techniques are used. Underlying images may be made visible by the use of a transparent colour capability. Colour line art images are normally of higher resolution than colour continuous tone picture images (CT).

6.3 High resolution continuous tone (HC) image data

A high resolution continuous tone (HC) image is a rectangular array of pixels. A pixel is represented by a set of values corresponding to its colour components. It is typically at the higher resolution of colour line art. It is also characterized by a transparent colour capability and run length encoded similar to colour line art. It does not use a palette table and as such does not have the same limited colour representation of colour line art. High resolution continuous tone images are typically used to define the edges between merged colour continuous tone picture images, and between colour line art and colour continuous tone picture images.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

NOTE 8 Annex A describes the relationship between CT, LW, and HC images. Annex D describes an additional data type called Final Page (FP) which describes a completed page.

6.4 Monochrome and binary images

In addition to the colour formats specified in 6.1, 6.2, and 6.3, monochrome continuous tone and binary DDES images are also supported. These images are similar to their colour counterparts, except that their formats take advantage of the reduced amount of data associated with monochrome (single colour) and binary images.

6.4.1 Monochrome continuous tone picture image (MP) data

A monochrome continuous tone picture image (MP) consists of a rectangular array of pixels. Each pixel is represented by a single byte value indicating the varying intensity of the single image colour at that pixel location. The intended effect is to reproduce the monochrome continuous tone picture using various levels of the specified image colour.

The monochrome continuous tone picture format is similar to, though not identical to, a monochrome version of the colour continuous tone picture format with a single colour per pixel and is therefore not interleaved.

6.4.2 Binary picture image (BP) data

A binary picture image (BP) consists of a rectangular array of pixels. Each pixel is represented by a single bit value indicating that the pixel location is to be part of the background (bit value 0) or part of the image (bit value 1) for that pixel location. The bits are ordered left to right within the byte; i.e. the most significant bit first. A background and a foreground colour may each be specified.

6.4.3 Binary line art image (BL) data

A binary line art image (BL) consists of a rectangular array of pixels. Each pixel is represented by a single value which is encoded as a sequence of pairs of background and image colours.

The binary line art image is further characterized by having continuous areas of many pixels of image and background colour. Run length encoding techniques are used.

7 Requirements

The format of the TIFF/IT and TIFF/IT-P1 image data files and the specific requirements for each of the individual image file types follow. See annex F for examples of the structure of these files.

7.1 Structure of TIFF/IT file

This International Standard incorporates the notation and structure as defined in TIFF 6.0 Sections 1 and 2. In addition, those TIFF tags identified but not defined in this International Standard shall be as defined in TIFF 6.0. Where requirements of this International Standard and TIFF 6.0 are in conflict, this International Standard shall take precedence.

7.1.1 Overview

A TIFF/IT file conveys image data for a single image or a set of related images. The TIFF/IT structure includes a short header, one or more Image File Directories (IFD), and the image data associated with the IFDs. Image parameters are encoded in tagged fields in the IFD. Fields that are not used to describe an image are omitted from its IFD. Each field is identified by its tag value rather than its position in the directory entry.

7.1.2 Header

A TIFF/IT file begins with an eight-byte image file header.

Bytes 0-1: The pair of bytes at offset 0 of the file contains the ISO 646 characters "II" (4949h) or "MM" (4D4Dh). "II" signifies that the file is stored in little-endian byte order. "MM" signifies that the file is stored in big-endian byte order. A writer may write either of the two byte orders. A reader shall interpret both byte orders.

NOTE 9 In normal TIFF usage, this parameter applies to all data within headers , directories, and image data. In this International Standard, certain 16-bit fields in the image data have a fixed "big-endian" byte order which will be defined with the specific image data types in clause 7.3 through 7.8.

Bytes 2-3: The pair of bytes (SHORT) at offset 2 contains the constant 42 (2Ah).

Bytes 4-7: The four bytes (LONG) at offset 4 contain the offset of the first IFD of the file. The directory is required to begin on a word-aligned boundary.

7.1.3 Image subfiles

A TIFF/IT file contains one or more subfiles, each representing a single image which may be among a set of related images in the same TIFF/IT file. Each subfile consists of an Image File Directory (IFD) together with one or more referenced word-aligned sequences containing image data.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

7.1.4 IFD (Image File Directory)

Each IFD is located at an arbitrary word-aligned offset within the file. The IFDs are forward-chained together. An IFD consists of a two-byte count of the quantity of IFD entries within it, one or more IFD entries sorted in ascending order of tag number, and a four-byte offset to the next IFD in the chain (zero in the case of the last IFD in the file). Each IFD entry is a 12-byte field, describing a one-parameter field that defines an attribute of the file.

7.1.5 IFD entry

Each IFD entry consists of a SHORT (two-byte) tag number identifying the field, a SHORT (two-byte) data type identifying the field type, a LONG (four-byte) count, and a LONG (four-byte) offset value. The offset value shall be an even number since the value is expected to be on a 16-bit word boundary.

The field type codes are:

1	BYTE
2	ASCII
3	SHORT
4	LONG
5	RATIONAL

The count determines the number of data elements in the value. The count of an ASCII string entry shall be the number of characters (bytes) in the string, including the terminating null character.

NOTE 10 In the case of an ASCII string, the ISO 10755, ISO 10756, and ISO 10759 headers do not have a terminating null, and so these field sizes are one less than a corresponding TIFF/IT count with the appended null character.

The data value associated with an IFD entry is stored directly in the offset value field of the IFD entry, if its type and count combine to indicate a length of four bytes or less. Otherwise, the offset value field of the IFD entry contains the offset of a referenced, word-aligned sequence that contains the indicated count of data elements.

7.1.6 Image data

Image data is stored in one or more word-aligned sequences. The array of pixels making up the image may be divided into strips. Each strip of an image, except possibly the last strip, contains the number of rows specified in the RowsPerStrip field (tag 278, SHORT or LONG, default FFFFFFFFh). If RowsPerStrip equals or exceeds ImageLength, as is the default, then the entire image is contained within a single strip. Each strip is held in a single word-aligned sequence of data.

The offsets of the word-aligned sequences containing the image data for each strip are contained in the data values of the mandatory StripOffsets field (tag 273, LONG or SHORT, count = StripsPerImage) .

The StripByteCounts field (tag 279, LONG or SHORT, Count = StripsPerImage) specifies the number of bytes for each strip.

The structure of a TIFF/IT file containing a single image subfile is shown in figure 1.

7.2 General parameters

This subclause describes, in general terms, each of the fields used in TIFF/IT files. For usage specific to an image file type (i.e. CT, LW, HC, MP, BP, and BL) see the subclause appropriate to that file type. Annex H provides an alphabetical listing of TIFF/IT fields.

7.2.1 Job identification

The job and picture name of the image are described by the document name (DocumentName) and image description (ImageDescription) fields. The page name (PageName) field may also be used. Annex H contains an alphabetical list of TIFF/IT fields.

269	DocumentName	ASCII [Job Name]
270	ImageDescription	ASCII [Picture Name, Image Name]
285	PageName	ASCII

The originator of the image may be identified, and a copyright statement may be included using the Artist and Copyright fields, respectively.

315	Artist	ASCII
33432	Copyright	ASCII

7.2.2 System identification

The following fields may be used to describe system data relating to the image:

271	Make	ASCII [Vendor Name]
272	Model	ASCII
305	Software	ASCII [Program Name]
306	DateTime	ASCII
316	HostComputer	ASCII
34016	Site	ASCII [Site Name]
34018	IT8Header	ASCII

It is recommended to include the three-character country code from ISO 3166 as the last three characters, before the terminating "null" character, of the Make field, to identify the country of registry of the vendor name.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

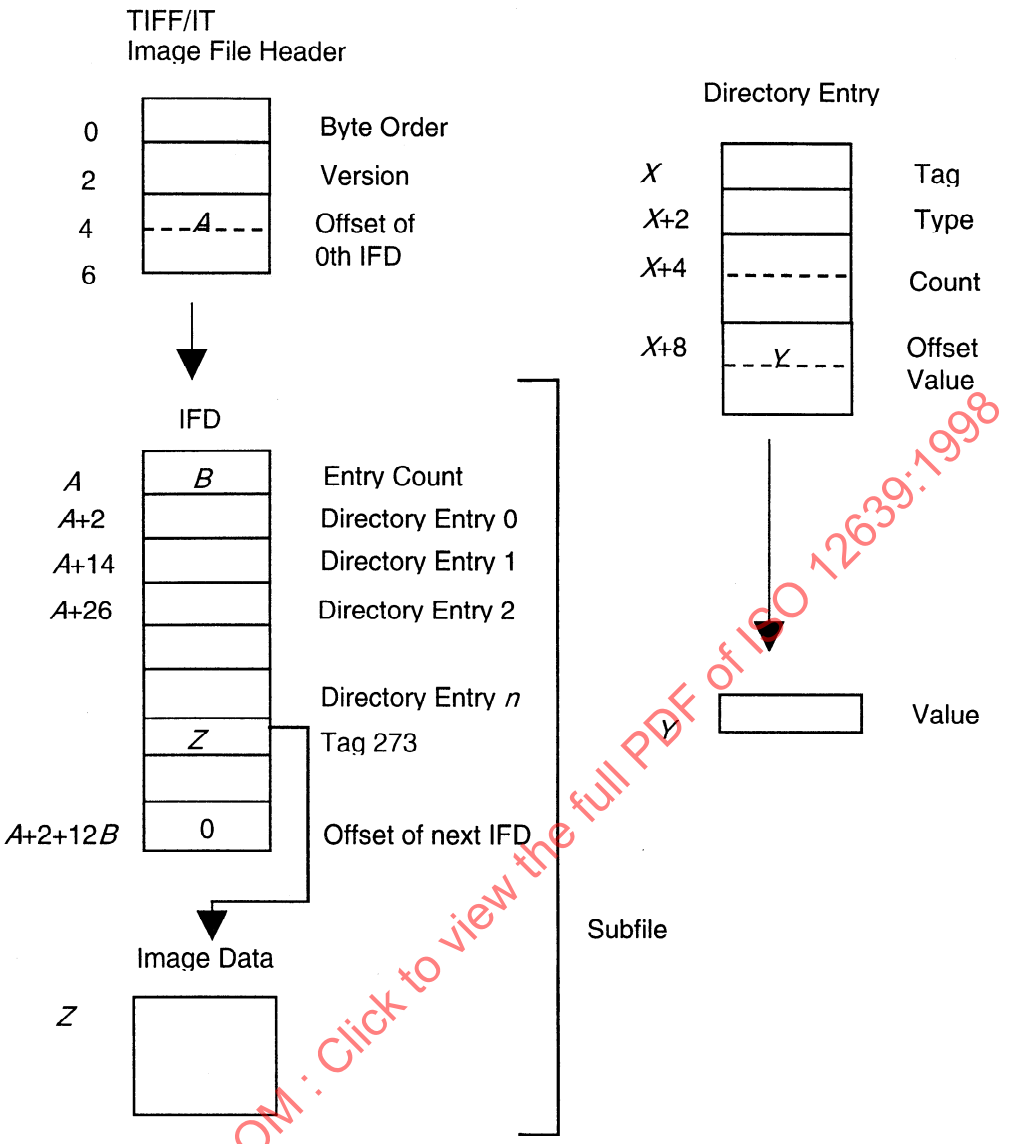

Figure 1 — Structure of TIFF/IT file for single image subfile (single strip)

The Site field allows the identity of the location at which the image was digitized (or encoded into TIFF/IT) to be included with the file.

NOTE 11 The IT8Header field provides the ability to include unmodified headers (appended by an ASCII "null" at the end of the character string) from ISO 10755, ISO 10756, and ISO 10759 in the TIFF/IT files. This may be particularly useful if a file is being transported from one ISO 10755, ISO 10756, or ISO 10759 environment to another via TIFF/IT. TIFF/IT readers are not required to interpret and use the contents of the IT8Header field.

7.2.3 Image size and orientation

Image size and orientation are defined by three fields. One field specifies the width of an image, another specifies the length of the image, and the third specifies the orientation of the scan lines with respect to the image content as viewed by the end user.

256	ImageWidth	SHORT or LONG [pixels per line]
257	ImageLength	SHORT or LONG [lines in image]
274	Orientation	SHORT

Basic orientations are specified as follows (see figure 2):

1 = Load from top left, horizontally (default)
the 0th row represents the visual top of the image, and the 0th column represents the visual left-hand side.

5 = Load from top left, vertically
the 0th row represents the visual left-hand side of the image, and the 0th column represents the visual top.

4 = Load from bottom left, horizontally
the 0th row represents the visual bottom of the image,

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

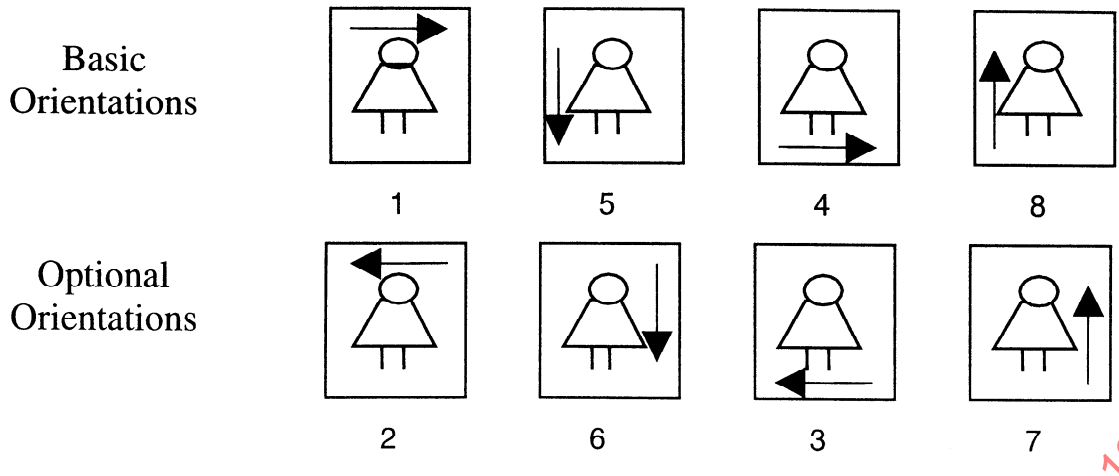

Figure 2 — Relationship between first line of data, image orientation, and orientation code.

and the 0th column represents the visual left-hand side.

8 = Load from bottom left, vertically
the 0th row represents the visual left-hand side of the image, and the 0th column represents the visual bottom.

Conformance to this International Standard requires that at least one basic orientation be written and all four basic orientations be read.

Optional orientations are specified as follows (see figure 2):

2 = Load from top right, horizontally
the 0th row represents the visual top of the image, and the 0th column represents the right-hand side.

6 = Load from top right, vertically
the 0th row represents the visual right-hand side of the image, and the 0th column represents the visual top.

3 = Load from bottom right, horizontally
the 0th row represents the visual bottom of the image, and the 0th column represents the visual right-hand side.

7 = Load from bottom right, vertically
the 0th row represents the visual right-hand side of the image, and the 0th column represents the visual bottom.

NOTE 12 ISO 10755, ISO 10756, and ISO 10759 made provision for unknown orientations; TIFF/IT does not.

NOTE 13 The size, resolution, and orientation fields interact to describe the size and orientation of the logical image in the data stream. The ImageWidth (pixels per scanline) and ImageLength (scanlines in image) fields refer to the sequence of pixels in the data stream and not the logical image itself. The TIFF and TIFF/IT term "Width" ("length of line" in ISO 10755, ISO 10756, or ISO 10759) refers to the dimension of the image represented by the first line of pixels in the data stream. The TIFF and TIFF/IT term "Length" ("breadth of area" in ISO 10755, ISO 10756, or ISO 10759) refers to the dimension of the image represented by the number of lines in the data stream. For example, orientations "1" and "4" define "Width" as the horizontal axis of the logical image, and "Length" as the vertical axis. Orientations "5" and "8" define "Width" as the vertical axis and "Length" as the horizontal axis.

7.2.4 Image resolution

282	XResolution	RATIONAL [resolution of line]
283	YResolution	RATIONAL [resolution of breadth]
296	ResolutionUnit	SHORT

The resolution (number of pixels per ResolutionUnit) may be specified in both the Width (line) and Length (breadth) directions. The values for ResolutionUnit for TIFF/IT and TIFF/IT-P1 conformity levels shall be centimetres represented by value 3 and inches represented by value 2 (default value) in field 296. The other value recognized by TIFF, but not by TIFF/IT, is 1, meaning no absolute unit of measurement is specified.

Pixels do not need to be square in size. To properly size an image, the resolution of both axes must be considered. The necessary information is provided by the resolution specifications for each axis, and the number of pixels for each axis. From this, the size of each axis may be determined by dividing the number of pixels by the resolution.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 1 — Encoding of data format

File Type	SamplesPerPixel	BitsPerSample	Compression	PlanarConfiguration
Colour continuous tone picture (CT) - pixel interleaved	1-16	8, 8, ...	1 or 32895	1
Colour continuous tone picture (CT) - line interleaved	1-16	8, 8, ...	1 or 32895	32768
Colour continuous tone picture (CT) - colour interleaved	1-16	8, 8, ...	1 or 32895	2
Colour line art (LW)	1	8	32896	omit, not used
High resolution continuous tone (HC)	2 -16 even values only	8, 8, ...	32897	1
Monochrome continuous tone picture (MP)	1	8	1 or 32895	omit, not used
Binary picture (BP)	1	1	1	omit, not used
Binary line art (BL)	1	1	32898	omit, not used

7.2.5 Data format

The data format parameters describe the style and order of the data stream. A number of TIFF/IT fields are used to encode them.

254 NewSubfileType LONG

NewSubfileType is a general indication of the kind of data contained in the subfile. The value is made up of 32 flag bits. Unused bits shall be 0. Bit 0 is the low-order bit.

258 BitsPerSample SHORT
259 Compression SHORT
277 SamplesPerPixel SHORT
284 PlanarConfiguration SHORT

The fields SamplesPerPixel and BitsPerSample determine the number of samples (separations, colours) and their size. This information, with that provided in the fields Compression and PlanarConfiguration, determine the format of the data in the file. The count of BitsPerSample data elements shall equal the value of the SamplesPerPixel fields.

If the value of Compression is the default value of "1", there is no compression. (The BP data format packs data into bytes as tightly as possible, with no unused bits except at the end of a row.) The other TIFF/IT values of the compression indicate:

— the use of RasterPadding in the CT or MP format (value 32895)
— the run length encoding scheme for the LW format (value 32896)
— the run length encoding scheme for the HC format (value 32897)
— the run length encoding scheme for the BL format (value 32898)

PlanarConfiguration distinguishes between CT formats that are pixel (sometimes referred to as "chunky"), line or colour (i.e. colour plane or separation) interleaved, by values 1, 32768, and 2 respectively. The value defaults to 1, and the field may be omitted when SamplesPerPixel equals 1.

Table 1 summarizes how the data formats for the different file types are encoded by these TIFF/IT fields.

34019 RasterPadding SHORT

The RasterPadding field allows each line of colour or interleaved colours to be padded to a 1-, 2-, 4-, 512-, or 1024-byte boundary.

0 = byte raster (default value) — pad to 1 byte
1 = word raster — pad to 2 bytes
2 = long word raster — pad to 4 bytes
9 = sector raster — pad to 512 bytes
10 = long sector raster — pad to 1024 bytes

When applied to line interleaved data, this field relates to each line of colour, rather than to each line of pixels. The value of the field is the power of two corresponding to the padding length (in bytes).

Two additional fields are required for the TIFF/IT-LW line art files. They describe the number of bits required to describe short and long runs. See the individual file type for more information.

34020 BitsPerRunLength SHORT (default = 8)
34021 BitsPerExtendedRunLength SHORT (default = 16)

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

The HC file has specific usages which determine the type of information contained within the file. HCUsage is an indicator of the type of information contained within the HC file.

34030 HCUsage LONG

The bits of HCUsage indicate the type of information contained in the HC file. If all bits are 0, or the field is not present, the information type is unknown. Each bit indicates a type of information which may be coded in the file, the bits are not mutually exclusive since an HC file may contain both contone and line art information:

bit 0: 1 means the file contains high resolution CT contone information
bit 1: 1 means the file contains line art (line work) information
bit 2: 1 means the file contains trapping information
bit 3-31: Reserved, must contain zeroes

7.2.6 File format

Many prepress applications use only one strip in the TIFF/IT formats. In these cases, there will be only one strip offset and byte count, and the RowsPerStrip field may be omitted. In other cases, the usage of StripOffsets, RowsPerStrip, and StripByteCounts fields are as described in TIFF 6.0, Part 1: Baseline.

273	StripOffsets	LONG or SHORT
278	RowsPerStrip	LONG or SHORT
279	StripByteCounts	LONG or SHORT

See 7.1.6 for the use of these parameters.

7.2.7 Colour specification

The primary colour space for this International Standard is CMYK, with other colour spaces provided for as described below. The parameters for specifying the colour space are:

— the number of colour separations,
— the colour sequence,
— the colour values.

7.2.7.1 Number of colour separations

Images for printing are typically represented by the four separations of process colour inks, in either CMYK or YMCK order. Optionally, one to sixteen separations with varied sequences can be described as specified in 7.2.7.2. SamplesPerPixel specifies the number of separations except for the line art (LW) file type. For LW, the number of separations is specified as the number of colour entries specified in the ColorSequence field.

7.2.7.2 Colour sequence

262	PhotometricInterpretation	SHORT (=5 for separations)
34017	ColorSequence	ASCII [Sequence of Colours]

Value 5 for PhotometricInterpretation for CT, LW, and HC images signifies separated image file data in the sequence CMYK, or a separated image file data in other colours or sequences if modified by other fields. Values 0 and 1 are used for MP, BP, and BL images.

This International Standard provides for two basic colour sequences describing four-colour separations. These basic colour sequences are specified by values "CMYK" and "YMCK" in the ColorSequence field.

To specify optional colours or colour sequences in this International Standard, the following entries in the ColorSequence field may be used in any sequence (colour entries may be repeated for additional separations of the same colour):

"Y" "M" "C" "K"	= Yellow, magenta, cyan, and black inks
"R" "G" "B"	= Red, green, blue light intensity
"U" "V" "L"	= CIE 1976 projective u', v', and photopic luminance (Y)
"1" to "9"	= User-definable colours or separations; such as pink, varnish, etc.
"Q"	= Present in the data stream but ignored

The use of ColorSequence for RGB images is discouraged. The TIFF 6.0 specification, Section 6: RGB Full Colour Images, should be used unless TIFF/IT specific features and functionality is required for RGB images.

NOTE 14 The "Sequence of Colours" field in ISO 10755, ISO 10756, and ISO 10759 is fixed-length and space-padded; the TIFF/IT ColorSequence field is variable-length and null-terminated.

NOTE 15 Other colour sequences for red, green, blue are unlikely to bc found. UVL is also unlikely to be found. They are retained only for backward compatibility with ISO 10755 and ISO 10756. A future revision of this International Standard is likely to include an encoding for the CIELAB and CIEXYZ colour representations.

PhotometricInterpretation values of "0" and "1" shall bc used for MP, BP, and BL images. Value of "0" means "WhiteIsZero" (0 is imaged as white) and value of "1" means "BlackIsZero" (0 is imaged as black). In TIFF/IT, the value "0" is recommended for MP, BP, and BL images. In TIFF/IT, MP, BP, and BL images, the terms white and black in WhiteIsZero and BlackIsZero should be replaced with BackgroundColor and ImageColor (foreground

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

colour) for proper interpretation.

332	InkSet	SHORT	
334	NumberOfInks	SHORT	(Default=4)

InkSet and NumberOfInks are optional fields. An InkSet value of 1 specifies that CMYK inks are to be used in the CMYK colour sequence. An InkSet value of 2 specifies that the inkset and/or colour sequence is other than that specified by an InkSet value of 1 (i.e. not CMYK). If this field is to be used, it must not conflict with any other fields used. NumberOfInks value specifies the number of inks or separations used and is usually equal to SamplesPerPixel but may be equal to the number of colours specified in the ColorSequence field.

7.2.7.3 Colour values

336	DotRange	BYTE or SHORT (0% dot, 100% dot)

For separated images, the scaling of the colour values shall be linear with respect to printing dot value. The colour values are unsigned, and any values from 0 through 255 may be used. The relationship between DotRange values and colour values (step size, direction of slope, and intercept) shall be at the discretion of the originator of the file, but shall be identical for all colour separations in one file. The DotRange field is used to describe these values. The count for the number of values of the DotRange field in TIFF/IT shall be 2, one value for 0% printing dot value and one value for 100% printing dot value. Default values are 0 and $2^{BitsPerSample}$ -1 (with a maximum of 255) for 0% and 100% printing dot value, respectively.

NOTE 16 TIFF 6.0 permits using either the same or different DotRange values for each separation. For simplicity, TIFF/IT requires that the same DotRange values be used for all separations of a file.

Figure 3 describes further the colour values for the case where the 0% printing dot value is the colour value 20 and the 100% printing dot value is the colour value 220.

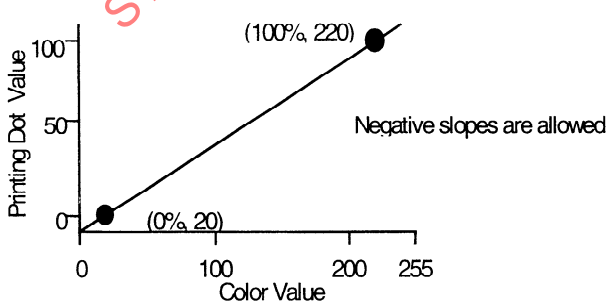

Figure 3 — Printing dot value vs colour value

It is possible that the colour values of the pixels (i.e. the values in the data stream) can fall above or below the values specified for 0% dot and 100% dot. In this case, it is at the discretion of the reader to either accept or truncate the data.

NOTE 17 For example, where the value for 0% dot is 20 and the data value is 15, the resulting data value after transfer could be 20 or 15 at the discretion of the reader.

34029	ColorCharacterization	ASCII

The colour values of separated, RGB or other colour images may be further characterized by the use of data tables as specified in ISO 12641 and ISO 12642. These ASCII data tables may be carried with the image file they describe by use of the ColorCharacterization field. For further details, see ISO 12641 and ISO 12642. ANSI CGATS.15 prescribes preferred definitions for three-component colour spaces and encoding. If these preferred colour definitions are used, this field shall contain a named colour definition as described in ANSI CGATS.15 (see annex B).

34022	ColorTable	BYTE

In LW images, colour values are specified by encoding them in a colour palette table. The colour palette table is the value of the TIFF/IT ColorTable field (see 7.4).

34025	ImageColorValue	BYTE
34026	BackgroundColorValue	BYTE

The pixels (bits) in a BP and BL image denote either a foreground or background colour. The fields ImageColorValue and BackgroundColorValue denote the value of the image and background colour respectively.

34027	PixelIntensityRange	BYTE (minimum, maximum intensity)

The pixels in an MP image denote intensities of a particular colour. The colour is defined by the ImageColorValue field. Similar to the DotRange field, percent intensity may be mapped into two-byte values as indicated by the field PixelIntensityRange. Default values are 0 and $2^{BitsPerSample}$ - 1, for 0% and 100% intensity respectively (See 7.6).

34028	TransparencyIndicator	BYTE

TransparencyIndicator is used as a transparency indicator for HC files. Value "0", the default, signifies that transparency is not used. Value "1" signifies that transparency is used and may be found, encoded as described in 7.5. Other values are not supported. The field is not used for other file types. Transparency is encoded in the colour table for LW files, and in the image and background colour indicator fields for BP and BL files.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

7.2.8 Image and background colour indicators

34023 ImageColorIndicator BYTE
34024 BackgroundColorIndicator BYTE

The data stream for binary images (BP and BL) functions as a switch between foreground and background colours. The ImageColorIndicator field indicates whether or not the particular image or foreground colour is encoded in the binary image (along with information about transparency) or in the monochrome continuous tone picture image (where no background colour exists). The BackgroundColorIndicator field indicates the same information about the background colour (MP images do not specify any background colour). The values of these fields indicate the nature of the image and background colour definitions, where:

"0" = image/background colour not defined (default value)
"1" = image/background colour defined
"2" = full transparency, image/background colour not defined

Full transparency means that an underlying image, if any, will show through completely in the transparent areas.

Systems that do not choose to specify any image or background colour specification may indicate this by the default value "0" in the foreground and background colour indicators. In this case, the significance of image and/or background colour is at the discretion of the reader.

7.2.9 Fields in TIFF/IT tag number order

7.2.9.1 Traditional TIFF fields

Table 2 shows the traditional TIFF (TIFF 6.0) field usage as generally applied to TIFF/IT files. Only the TIFF fields specifically used in TIFF/IT are listed (unused fields, reserved fields, and fields that are not applicable are not listed). For usage in specific file types (CT, LW, HC, MP, BP, BL), see the subclause for that file type (see annex C).

7.2.9.2 Additional TIFF/IT fields

In addition to the traditional TIFF field, TIFF/IT requires fields to hold specific TIFF/IT capabilities. Twenty (20) private tags from 34016 through 34035 are specifically allocated for TIFF/IT use. Table 3 specifies these TIFF/IT fields. For usage in specific file types (CT, LW, HC, MP, BP, BL) see the subclause for that file type.

7.3 Colour continuous tone picture (CT) file

7.3.1 TIFF/IT-CT and TIFF/IT-CT/P1

TIFF/IT-CT makes use of all the features and functionality supported by the TIFF and TIFF/IT fields appropriate to colour continuous tone picture images. TIFF/IT-CT/P1 limits the field values to either the default value, a single value or a small choice of values. TIFF/IT-CT/P1 also limits the usage of optional fields to the minimum required for reasonable interchange.

TIFF/IT-CT/P1 is a simplified image file format profile for colour continuous tone picture image (CT) data and can be considered a constrained subset of TIFF/IT-CT. TIFF/IT-CT/P1 files can be read by typical TIFF 6.0 readers and be written by typical TIFF 6.0 writers that conform to TIFF 6.0, Section 16: CMYK Images.

7.3.2 Data structure

There are three formats for describing the pixel structure of colour continuous tone picture file data: pixel interleaving (also called chunky format), line interleaving (also called row interleaving), and colour interleaving (also called planar format).

A TIFF/IT-CT writer shall write in any one of the formats and a TIFF/IT-CT reader shall read all three of the formats. A TIFF/IT-CT/P1 file is constrained to only the pixel interleaved format.

In TIFF/IT-CT, to insure compatibility with some machines and applications that require data to be written to 16-bit word boundaries, there should be an even number of bytes written per line. Therefore, if the number of bytes per line is odd, there would be one fill byte at the end of each line. In this case, field 34019 (RasterPadding) with value 1 indicates the value of the padding to the word boundary (word aligned), and value 32895 for field 259 (Compression) indicates the presence of such padding. TIFF/IT-CT/P1 does not permit the use of value 32895 for field 259 (Compression) to indicate the use of raster padding nor does it permit the use of field 34019 (RasterPadding).

7.3.2.1 Pixel interleaving

Pixel interleaved data consists of a row of contiguous colour pixels which form a line of image, with a sequence of these lines extending across the image. The order of components within the pixel is defined by PhotometricInterpretation or ColorSequence.

7.3.2.2 Line interleaving

Line interleaved data consists of one line of a colour, followed by a line of the next colour for that same row of

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 2 — Traditional TIFF fields

Tag No.	Field name	Data type	Remarks
254	NewSubfileType	LONG	(=0)
256	ImageWidth	LONG or SHORT	Baseline TIFF required field [pixels per line]
257	ImageLength	LONG or SHORT	Baseline TIFF required field [lines in image]
258	BitsPerSample	SHORT	See specific file type
259	Compression	SHORT	See specific file type
262	PhotometricInterpretation	SHORT	See specific file type
269	DocumentName	ASCII	Optional field [Job Name]
270	ImageDescription	ASCII	Optional field [Picture Name, Image Name]
271	Make	ASCII	Optional field [Vendor Name]
272	Model	ASCII	Optional field
273	StripOffsets	LONG or SHORT	Baseline TIFF required field (only one value, if only one strip)
274	Orientation	SHORT	(=1, =4, =5, and =8) optional values are 2, 3, 6, and 7
277	SamplesPerPixel	SHORT	See specific file type
278	RowsPerStrip	LONG or SHORT	Omit field to take default value if whole image is in one strip
279	StripByteCounts	LONG or SHORT	Baseline TIFF required field (only one value, if only one strip)
282	XResolution	RATIONAL	Baseline TIFF required field [resolution of line] (from pixel to pixel within line)
283	YResolution	RATIONAL	Baseline TIFF required field [resolution of breadth] (from line to line within image)
284	PlanarConfiguration	SHORT	See specific file type
285	PageName	ASCII	Optional
296	ResolutionUnit	SHORT	Baseline TIFF required field
305	Software	ASCII	Optional [Program Name]
306	DateTime	ASCII	Optional
315	Artist	ASCII	Optional
316	HostComputer	ASCII	Optional
332	InkSet	SHORT	See specific file type
334	NumberOfInks	SHORT	See specific file type
336	DotRange	BYTE or SHORT	[0% and 100% dot sample values]
33432	Copyright	ASCII	Optional

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 3 — Additional TIFF/IT fields

Tag No.	Field name	Data type	Remarks
34016	Site	ASCII	[Site name]
34017	ColorSequence	ASCII	[Sequence of colours], Default= 'CMYK' for 4-colour files for compatibility with PhotometricInterpretation Value=5
34018	IT8Header	ASCII	The entire DDES header sequence, if available, may be stored here to speed processing.
34019	RasterPadding	SHORT	ISO 10755 CT and ISO 10759 BP files are padded to 2-byte boundaries. Therefore, ISO 10755 and ISO 10759 files shall use the appropriate raster padding value as indicated within the specific file (1, 2, 9 or 10). Other CT and MP files may also use 0 to indicate that no raster padding is used. Default=0
34020	BitsPerRunLength	SHORT	See specific file type
34021	BitsPerExtendedRunLength	SHORT	See specific file type
34022	ColorTable	BYTE	Count=([Last Valid Color]+1) × 20 bytes. This is the entire ISO 10756 colour palette table, up to and including the [Last Valid Color] entry unmodified. See 7.4.2.1.
34023	ImageColorIndicator	BYTE	See specific file type
34024	BackgroundColorIndicator	BYTE	See specific file type
34025	ImageColorValue	BYTE	See specific file type
34026	BackgroundColorValue	BYTE	See specific file type
34027	PixelIntensityRange	BYTE	See specific file type
34028	TransparencyIndicator	BYTE	See specific file type
34029	ColorCharacterization	ASCII	As specified in ISO 12641, ISO 12642, and ANSI CGATS.15 as appropriate
34030	HCUsage	LONG	Type of information in HC file
34031	Reserved for future TIFF/IT use		
34032	Reserved for future TIFF/IT use		
34033	Reserved for future TIFF/IT use		
34034	Reserved for future TIFF/IT use		
34035	Reserved for future TIFF/IT use		

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

pixels ("n" lines of "m" colour separations). The sequence of colours for each line is defined by PhotometricInterpretation or ColorSequence.

7.3.2.3 Colour interleaving

Colour interleaved data consists of all lines of one colour, followed by all lines of the next colour ("n" images of "m" separations). The order of planes of colour is defined by PhotometricInterpretation or ColorSequence.

7.3.2.4 Samples per pixel

Both TIFF/IT-CT and TIFF/IT-CT/P1 readers shall be capable of reading and processing CT files with four samples per pixel. Other values are optional for TIFF/IT-CT, but are not permitted for TIFF/IT-CT/P1.

Both TIFF/IT-CT and TIFF/IT-CT/P1 writers shall be capable of writing CT files with four samples per pixel. Other values are optional for TIFF/IT-CT, but are not permitted for TIFF/IT-CT/P1.

7.3.2.5 Colour sequences

For pixel interleaving data format of TIFF/IT-CT either the YMCK or the CMYK order of pixels shall be written and both the YMCK or the CMYK order shall be read. For TIFF/IT-CT/P1 only the CMYK order of pixels shall be written and read.

For line interleaving data format of TIFF/IT-CT only the CMYK order is required to be written and read.

Optional colour sequences for TIFF/IT-CT are defined in 7.2.7.2.

7.3.3 TIFF/IT-CT and TIFF/IT-CT/P1 encoding

Field usage for TIFF/IT-CT and TIFF/IT-CT/P1 data is as shown in table 4. The names in brackets correspond to ISO 10755 fields. Annex F shows examples of the encoding of these file types.

7.4 Colour line art (LW) file

7.4.1 TIFF/IT-LW and TIFF/IT-LW/P1

TIFF/IT-LW makes use of all the features and functionality supported by the TIFF and TIFF/IT fields appropriate to line art images. TIFF/IT-LW/P1 limits the field values to either the default value, a single value or a small choice of values. TIFF/IT-LW/P1 also limits the usage of optional fields to the minimum required for reasonable interchange.

TIFF/IT-LW/P1 is a simplified image file format profile for line art (LW) image data and can be considered a constrained subset of TIFF/IT-LW specifically intended for simpler implementation. Neither TIFF/IT-LW nor TIFF/IT-LW/P1 files are readable by typical TIFF 6.0 readers and neither can be written by typical TIFF 6.0 writers because of the mandatory use of TIFF/IT-specific fields and values and non-traditional interpretations of other TIFF 6.0 fields and values (e.g., compression by mandatory run length encoding). Filters may be written for DTP and other applications which are desired to read and write TIFF/IT-LW and TIFF/IT-LW/P1 files. As a simplified profile, the filters for TIFF/IT-LW/P1 are simpler to implement than for TIFF/IT-LW.

7.4.2 Data structure

Colour line art data consists of an image file of one or more blocks of run length encoded pixel data describing the colour line art image and a colour table (in the IFD) which defines the colour values for the colour numbers. It is similar to binary line art data with the addition of a colour table for colour specification.

7.4.2.1 Colour table

The colour table defines the relationship between the colour numbers assigned to pixels in the image file and the four-colour separation colour description in CMYK, YMCK or optional colour sequences (if other than CMYK or YMCK, or if other than four separations). The table consists of from 1 to 256 twenty-byte entries each describing a colour number, a discrete colour description, and a transparency switch. The colour number is used to link run lengths in the data with specific colour and transparency values.

The colour table is organized as follows:

Table Entry	Colour Number	Description of Use
1	0	reserved for transparency
2-256	1	discrete colour descriptions

Colour number "0" (zero) is always a transparent colour.

Each colour number shall be in ascending sequence from 0 through 255, and in its proper location in the colour table; i.e. colour number 1 is the second entry, colour number 10 is the eleventh entry, etc. Colour numbers that are not used shall be zero filled from bytes 0 through 19 within their entry locations. The highest colour number used is the LastValidColour.

Each entry in the colour table is a 20-byte sequence of binary numbers which indicates the colour and transparency of the run length. There are two formats for the table entries, a basic format describing CMYK or YMCK colour parameters and an optional format for describing optional colour sequences as specified in 7.2.7.2. Figure 4 shows the basic format and figure 5 shows the optional format.

7.4.2.2 Transparent colours

Colour number 0 and the value hex "FF" in byte 3 of colour numbers 1 through 256 are reserved to signify a fully transparent colour using the basic format. The value hex "FF" shall be loaded in colour number 0 when colour number 0 is used. Any colour values in bytes 4 through 19 which are flagged as transparent or unused separations are reserved for vendor-specific (system) use and treated as non-printing.

The values hex "F1" to hex "FE" in byte 3 of the basicformat colour table for colour numbers 1 through 255 signify that one or more of the defined separations will be transparent. The bit mask defined by the value specified defines which separations are transparent according to the colour sequence specified, such that the least significant bit of the defined bit mask corresponds to the first separation defined by the colour sequence.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 4 — TIFF/IT-CT and TIFF/IT-CT/P1 field usage

Field Name	Tag No.	Data type	Count	Default value	TIFF/IT-CT	TIFF/IT-CT/P1	Remarks
NewSubfileType	254	LONG	1	0	d(=0)	d=0	
ImageWidth	256	SHORT/LONG	1	none	m	m	[pixels per line]
ImageLength	257	SHORT/LONG	1	none	m	m	[lines per image]
BitsPerSample	258	SHORT	NOTE 1	1	m(=8,8,8,8)	m=8,8,8,8	
Compression	259	SHORT	1	1	d=1, =32895	d=1	
PhotometricInterpretation	262	SHORT	1	none	m=5	m=5	
DocumentName	269	ASCII	NOTE 2	none	optional	not used	[job name]
ImageDescription	270	ASCII	NOTE 2	none	optional	optional	[picture name]
Make	271	ASCII	NOTE 2	none	optional	optional	[vendor name]
Model	272	ASCII	NOTE 2	none	optional	not used	
StripOffsets	273	SHORT/LONG	NOTE 3	none	m	m	pointer to image data
Orientation	274	SHORT	1	1	d(=1, =4, =5, =8)	d=1	
SamplesPerPixel	277	SHORT	1	1	m(=4)	m=4	[no. of separations]
RowsPerStrip	278	SHORT/LONG	1	FFFFFFFFh	d	d	NOTE 5
StripByteCounts	279	SHORT/LONG	NOTE 3	none	m	m	
XResolution	282	RATIONAL	1	none	m	m	[res. of line]
YResolution	283	RATIONAL	1	none	m	m	[res. of breadth]
PlanarConfiguration	284	SHORT	1	1	d=1, =2, =32768	d=1	
PageName	285	ASCII	NOTE 2	none	optional	not used	
ResolutionUnit	296	SHORT	1	2	d(=2, =3)	d=2, =3	
Software	305	ASCII	NOTE 2	none	optional	optional	[program name]
DateTime	306	ASCII	NOTE 4	none	optional	optional	
Artist	315	ASCII	NOTE 2	none	optional	optional	
HostComputer	316	ASCII	NOTE 2	none	optional	not used	
InkSet	332	SHORT	1	1	optional (NOTE 7)	d=1	
NumberOfInks	334	SHORT	1	4	optional (NOTE 8)	d=4	
DotRange	336	BYTE/SHORT	2	0,255	d	d=0,255	
Copyright	33432	ASCII	NOTE 2	none	optional	optional	
Site	34016	ASCII	NOTE 2	none	optional	not used	[site name]
ColorSequence	34017	ASCII	NOTE 2	CMYK	d(=CMYK,=YMCK)	not used	[sequence of colors]
IT8Header	34018	ASCII	NOTE 2	none	optional	not used	
RasterPadding	34019	SHORT	1	0	NOTE 6	not used	
ColorCharacterization	34029	ASCII	NOTE 2	none	optional	optional	NOTE 9

1 SamplesPerPixel.
2 The number of characters (bytes) in the string including the terminating null.
3 If PlanarConfiguration is equal to 1 or 32768, use StripsPerImage.
If PlanarConfiguration is equal to 2, use SamplesPerPixel x StripsPerImage.
StripsPerImage=INTEGER((ImageLength+RowsPerStrip-1)/RowsPerStrip), where INTEGER(x) is the integer value of x (i.e. INTEGER (2.9) = 2).
4 20 characters in the format YYYY:MM:DD HH:MM:SS indicating Year, Month, Day, space, Hour, Minute, Second, null.
5 The default value FFFFFFFFh means that the entire image is contained in a single strip.
6 If RasterPadding is used in CT format, then the Compression value must be specified as 32895. Values of 0, 1, 2, 9, 10 are the allowed values of RasterPadding.
7 If InkSet tag is used, it shall have a value of 1, if ColorSequence tag value is the default value of "CMYK", otherwise it shall have the value of 2.
8 If NumberOfInks tag is used it must have the same value as the value of SamplesPerPixel.
9 ISO 12641, ISO 12642, ASCII data tables, or named colour definition as described in ANSI/CGATS.15.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Byte	Bit 7 6 5 4 3 2 1 0
0	Reserved for future use
1	Colour Number, see NOTE 1
2	< 1 1 1 1 1 1 1 1 >
3	< 1 1 1 1 > < see NOTE 2 >
4 5 6 7	Values for basic colour sequences defined in 7.2.7.2 (CMYK or YMCK)
8 : 19	Not used in basic LW colour table

1 The colour number shall be a binary value from 0 through 255, representing colour numbers 0 through 255.

2 Bits 4 through 7 shall be set to binary "1". Bits 0 through 3 are used as transparency indicators to indicate which separations, if any, are transparent. See 7.4.2.1 for the order of separations. A binary "1" indicates that the flagged separations are transparent, such that for colour numbers 1 through 255:

0000	signifies non-transparent colour
0001	
:	signifies that one or more of the defined
:	separations will be transparent
1110	
1111	signifies that all separations are transparent

Figure 4 — Basic LW colour table entry

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Bit / Byte	7 6 5 4 3 2 1 0
0	Reserved for future use
1	Colour Number, see NOTE 1
2	Transparency indicator for optional separations, see Note 2
3	< 1 1 1 1 > < see NOTE 2 >
4 : : 19	Values for optional colour sequences defined in 7.2.7.2 and are identical to the order as specified in the ColorSequence field.

1 The colour number shall be a binary value from 0 through 255, representing colour numbers 0 through 255.

2 Bits 0 through 15 (bits 0 through 7 of bytes 2 and 3) shall be used as transparency indicators to indicate which separations, if any, are transparent. See 7.4.2.2 for the order of separations. A binary "1" shall indicate that the flagged separation is transparent such that for colour numbers 1 through 255:

BYTE	---2---		---3---		
	7	0	7	0	
BIT	15	8	7	0	
	0000	0000	0000	0000	signifies non-transparent colour
	0000	0000	0000	0001	signifies that one or more
	:	:	:	:	of the defined separations
	1111	1111	1111	1110	will be transparent
	1111	1111	1111	1111	signifies that all separations are transparent

Figure 5 — Optional LW colour table entry

NOTE 18 For example:
- the value F1 (bit mask: 1111 0001) signifies that "Y" would be transparent where the colour sequence is "YMCK".
- the value F6 (bit mask: 1111 0110) signifies that the second and third separations are transparent, or "M" and "Y" where the colour sequence is "CMYK".

Likewise, optionally formatted separations are provided for using bytes 2 and 3, with the value hex "0000" indicating that all separations are non-transparent colours, the value hex "FFFF" indicating that all separations are transparent, and the values hex "0001" to hex "FFFE" indicating various combinations in between. Transparency indicators for any unused separations should be set to binary one.

7.4.2.3 Basic run length encoding structure

There are two basic formats for encoding run lengths: a short form (16 bits long) for encoding run lengths up to 255 pixels long, and a long form (32 bits long) for encoding run lengths up to 65535 pixels long. Both forms may be freely mixed within a file, as the long form is encoded as a special case of the short form. Writers are required to write the short form. There is no requirement to write both forms, since long runs may be encoded by repetitions of the short form. However, readers shall be capable of reading both forms.

Each line of data (whose orientation to the image is defined according to 7.2.3) is initiated by two zero bytes and terminated by two zero bytes.

NOTE 19 Two adjacent zero bytes may also occur within the encoding of a line, so this occurrence should not be used as a means of detecting an end of line.

If the number of pixels in an encoded line does not equal the declared number of pixels per line of the image, or the number of encoded lines of data does not equal the declared number of lines in the image, an error exists and continued processing is left to the discretion of the processing system.

Run lengths of zero are specifically excluded as valid run length entries for either the long form or the short form since this would conflict with other indicators.

7.4.2.3.1 Short form encoding structure

The short form consists of a two-byte entry, with the first eight bits a binary number representing the colour number in the colour table with a value from 0 through 255, and the second eight bits a binary number representing the run length from 1 through 255 as follows:

byte:	0	1
value:	colour#	run length

7.4.2.3.2 Long form encoding structure

The long form consists of a four-byte entry, with the first eight bits a binary number representing the colour number in the colour table with a value from 0 through 255, and the second eight bits shall be always equal to 0 to signify the long form. The next 16 bits are a binary number representing the run length from 1 through 65535. In the event the long form is used to encode a run length of less than 256, byte 2 shall be binary zero, and the run length shall be contained in byte 3. This byte ordering corresponds to the big-endian ("MM") byte order, regardless of the ordering used in TIFF/IT directories (IFD). The long form looks as follows:

byte:	0	1	2 and 3
value:	colour#	0	run length

7.4.2.3.3 Basic line repeat code

This International Standard does not permit the use of line repeat codes.

NOTE 20 ANSI IT8.8 and ISO 10756 permit line repeat encoding to further compress line art files.

7.4.2.4 Optional run length encoding structure

This International Standard does not permit run length encoding structures other than the short and long structures specified in 7.4.2.3.1 and 7.4.2.3.2.

NOTE 21 ANSI IT8.8 and ISO 10756 permit optional run length encoding structures.

7.4.3 TIFF/IT-LW and TIFF/IT-LW/P1 encoding

Field usage for TIFF/IT-LW and TIFF/IT-LW/P1 data is as shown in table 5. The names in brackets correspond to ISO 10756 fields.

7.5 High resolution continuous tone (HC) file

7.5.1 TIFF/IT-HC and TIFF/IT-HC/P1

TIFF/IT-HC makes use of all the features and functionality supported by the TIFF and TIFF/IT fields appropriate to high resolution continuous tone images. TIFF/IT-HC/P1 limits the field values to either the default value, a single value or a small choice of values. TIFF/IT-HC/P1 also limits the usage of optional fields to the minimum required for reasonable interchange.

TIFF/IT-HC/P1 is a simplified image file format profile for high resolution continuous tone (HC) image data and can be considered a constrained subset of TIFF/IT-HC specifically intended for simpler implementation. Neither

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 5 — TIFF/IT-LW and TIFF/IT-LW/P1 field usage

Field Name	Tag No.	Data type	Count	Default value	TIFF/IT-LW	TIFF/IT-LW/P1	Remarks
NewSubfileType	254	LONG	1	0	d(=0)	d=0	
ImageWidth	256	SHORT/LONG	1	none	m	m	[pixels per line]
ImageLength	257	SHORT/LONG	1	none	m	m	[lines per image]
BitsPerSample	258	SHORT	1	1	m=8	m=8	
Compression	259	SHORT	1	1	m=32896	m=32896	
PhotometricInterpretation	262	SHORT	1	none	m=5	m=5	
DocumentName	269	ASCII	NOTE 1	none	optional	not used	[job name]
ImageDescription	270	ASCII	NOTE 1	none	optional	optional	[picture name]
Make	271	ASCII	NOTE 1	none	optional	optional	[vendor name]
Model	272	ASCII	NOTE 1	none	optional	not used	
StripOffsets	273	SHORT/LONG	NOTE 2	none	m	m	pointer to image data
Orientation	274	SHORT	1	1	d(=1, =4, =5, =8)	d=1	
SamplesPerPixel	277	SHORT	1	1	d=1	d=1	[no. of separations]
RowsPerStrip	278	SHORT/LONG	1	FFFFFFFFh	d	d	NOTE 5
StripByteCounts	279	SHORT/LONG	NOTE 2	none	m	m	
XResolution	282	RATIONAL	1	none	m	m	[res. of line]
YResolution	283	RATIONAL	1	none	m	m	[res. of breadth]
PageName	285	ASCII	NOTE 1	none	optional	not used	
ResolutionUnit	296	SHORT	1	2	d(=2, =3)	d=2, =3	
Software	305	ASCII	NOTE 1	none	optional	optional	[program name]
DateTime	306	ASCII	NOTE 3	none	optional	optional	
Artist	315	ASCII	NOTE 1	none	optional	optional	
HostComputer	316	ASCII	NOTE 1	none	optional	not used	
InkSet	332	SHORT	1	1	optional (NOTE 7)	d=1	
NumberOfInks	334	SHORT	1	4	optional (NOTE 8)	d=4	
DotRange	336	BYTE/SHORT	2	0,255	d	d=0,255	
Copyright	33432	ASCII	NOTE 1	none	optional	optional	
Site	34016	ASCII	NOTE 1	none	optional	not used	[site name]
ColorSequence	34017	ASCII	NOTE 1	CMYK	d(=CMYK, =YMCK)	not used	[sequence of colors]
IT8Header	34018	ASCII	NOTE 1	none	optional	not used	
BitsPerRunLength	34020	SHORT	1	8	d=8	d=8	
BitsPerExtendedRunLength	34021	SHORT	1	16	d=16	d=16	
ColorTable	34022	BYTE	NOTE 4	none	m	m	
ColorCharacterization	34029	ASCII	NOTE 1	none	optional	optional	NOTE 6

1 The number of characters (bytes) in the string including the terminating null.
2 StripsPerImage = INTEGER((ImageLength+RowsPerStrip-1)/RowsPerStrip), where INTEGER(x) is the integer value of x (i.e. INTEGER(2.9)=2).
3 20 characters in the format YYYY:MM:DD HH:MM:SS indicating Year, Month, Day, space, Hour, Minute, Second, null.
4 ([LastValidColor] + 1) × 20.
5 The default value FFFFFFFFh means that the entire image is contained in a single strip.
6 ISO 12641, ISO 12642 ASCII data tables or named colour definition as described in ANSI/CGATS.15.
7 If InkSet tag is used, it shall have a value of 1, if ColorSequence tag value is default vallue of "CMYK", otherwise it shall have the value of 2.
8 If NumberOfInks tag is used it must have as its value the number of separations specified in ColorSequence or, if ColorSequence is not used, the value of "4" which is the default value of the field.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

TIFF/IT-HC nor TIFF/IT-HC/P1 files are readable by typical TIFF 6.0 readers and neither can be written by typical TIFF 6.0 writers because of the mandatory use of TIFF/IT-specific fields and values and non-traditional interpretations of other TIFF 6.0 fields and values (e.g., compression by mandatory run length encoding). Filters may be written for DTP and other applications which are desired to read and write TIFF/IT-HC and TIFF/IT-HC/P1 files. As a simplified profile, the filters for TIFF/IT-HC/P1 are simpler to implement than for TIFF/IT-HC.

7.5.2 Data structure

High resolution continuous tone data consist of an image file of one or more blocks of run length encoded pixel data. The number of lines is defined in the ImageLength field. Each line is made up of pixel runs and starts and ends with a blank pixel run (all zero bytes). Each pixel run is made up of two components: a run length followed by a colour value. The run length is a 16-bit integer as defined in 7.4.2.3.2. The big-endian byte order is used regardless of the order used in the TIFF/IT directories (IFD). The sum of the run lengths in the line shall be the value found in ImageWidth. Run lengths shall not cross line boundaries. The colour value is defined by the values of SamplesPerPixel, BitsPerSample, ColorSequence and DotRange in the same manner that CT colour values are specified except that a special case of colour value is reserved for a transparent colour, if used.

TIFF/IT field 34028 is used as the transparency indicator. If transparency is used, colour values of zero become a special case, and signify transparency in that separation of the high resolution continuous tone (HC) data. Transparency indicates that the underlying colour picture separation value is used.

If transparency is used, then colour values of 0 shall indicate transparency for the separation to which they refer. When the writer uses "0" internally as a data value and also uses transparency (field 34028 with value "1"), both data values "0" and "1" are transferred as "1" and the reader shall treat this data as "0". If more or fewer than four colours are required, then SamplesPerPixel may take other even-numbered values (2, 6, 8...).

NOTE 22 For example, pixel runs for four-separation colours are coded with six bytes each, two bytes for the run length followed by four bytes for the separation values. In this case, each line begins and ends with six zero bytes.

If the separations are CMYK, the encoding is:

Byte	Value
0 and 1	run length
2	cyan colour value
3	magenta colour value
4	yellow colour value
5	black colour value

NOTE 23 This format is not included in ISO 10755, ISO 10756 or ISO 10759.

7.5.3 TIFF/IT-HC and TIFF/IT-HC/P1 encoding

Field usage for TIFF/IT-HC and TIFF/IT-HC/P1 data is as shown in table 6. The names in brackets may correspond to ISO 10755/10756/10759 fields for CT and LW data.

7.6 Monochrome continuous tone picture (MP) file

7.6.1 TIFF/IT-MP and TIFF/IT-MP/P1

TIFF/IT-MP makes use of all the features and functionality supported by the TIFF and TIFF/IT fields appropriate to monochrome continuous tone picture images. TIFF/IT-MP/P1 limits the field values to either the default value, a single value or a small choice of values. TIFF/IT-MP/P1 also limits the usage of optional fields to the minimum required for reasonable interchange.

TIFF/IT-MP/P1 is a simplified image file format profile for monochrome continuous tone picture image (MP) data and can be considered a constrained subset of TIFF/IT-MP specifically intended for simpler implementation. TIFF/IT-MP/P1 files can be read by typical TIFF 6.0 readers and be written by typical TIFF 6.0 writers. TIFF/IT-MP/P1 files will be recognized by baseline TIFF 6.0 readers as Grayscale Images as described in Section 4 of the TIFF 6.0 specification. As such, all reference to colour specifications will be lost since those fields describing colour are not recognized by a baseline TIFF 6.0 reader.

7.6.2 Data structure

7.6.2.1 Image colour values

The image colour values for a pixel are obtained by combining the colour values for each of the colour components with the pixel intensity values in the data stream. This applies to foreground colours only. Monochrome continuous tone pictures do not have background colour specifications. The scaling of these intensity values is linear with respect to printing dot percent. The bytes for pixel data values are unsigned, and any values from 0 through 255 may be found. The relationship between the colour value parameters and the intensity value (step size, direction of slope, and intercept) is linear, and determined by the originator of the file. It is defined by expressing the data values corresponding to 0% intensity and 100% intensity in PixelIntensityRange.

7.6.2.2 Image colour indicators

For monochrome continuous tone pictures, the image colour indicator (ImageColorIndicator) shall be "0" or "1".

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 6 — TIFF/IT-HC and TIFF/IT-HC/P1 field usage

Field Name	Tag No.	Data type	Count	Default value	TIFF/IT-HC	TIFF/IT-HC/P1	Remarks
NewSubfileType	254	LONG	1	0	d(=0)	d=0	
ImageWidth	256	SHORT/LONG	1	none	m	m	[pixels per line]
ImageLength	257	SHORT/LONG	1	none	m	m	[lines per image]
BitsPerSample	258	SHORT	NOTE 1	1	m(=8,8,8,8)	m=8,8,8,8	
Compression	259	SHORT	1	1	m =32895	m =32895	
PhotometricInterpretation	262	SHORT	1	none	m=5	m=5	
DocumentName	269	ASCII	NOTE 2	none	optional	not used	[job name]
ImageDescription	270	ASCII	NOTE 2	none	optional	optional	[picture name]
Make	271	ASCII	NOTE 2	none	optional	optional	[vendor name]
Model	272	ASCII	NOTE 2	none	optional	not used	
StripOffsets	273	SHORT/LONG	NOTE 3	none	m	m	pointer to image data
Orientation	274	SHORT	1	1	d(=1, =4, =5, =8)	d=1	
SamplesPerPixel	277	SHORT	1	1	m(=4)	m=4	[no. of separations]
RowsPerStrip	278	SHORT/LONG	1	FFFFFFFFh	d	d	NOTE 5
StripByteCounts	279	SHORT/LONG	NOTE 3	none	m	m	
XResolution	282	RATIONAL	1	none	m	m	[res. of line]
YResolution	283	RATIONAL	1	none	m	m	[res. of breadth]
PlanarConfiguration	284	SHORT	1	1	d=1	d=1	
PageName	285	ASCII	NOTE 2	none	optional	not used	
ResolutionUnit	296	SHORT	1	2	d(=2, =3)	d=2, =3	
Software	305	ASCII	NOTE 2	none	optional	optional	[program name]
DateTime	306	ASCII	NOTE 4	none	optional	optional	
Artist	315	ASCII	NOTE 2	none	optional	optional	
HostComputer	316	ASCII	NOTE 2	none	optional	not used	
InkSet	332	SHORT	1	1	optional (NOTE 6)	d=1	
NumberOfInks	334	SHORT	1	4	optional (NOTE 7)	d=4	
DotRange	336	BYTE/SHORT	2	0,255	d	d=0,255	
Copyright	33432	ASCII	NOTE 2	none	optional	optional	
Site	34016	ASCII	NOTE 2	none	optional	not used	[site name]
ColorSequence	34017	ASCII	NOTE 2	CMYK	d(=CMYK,=YMCK)	not used	[sequence of colors]
TransparencyIndicator	34028	BYTE	1	0	d=0, =1	d=0, =1	
ColorCharacterization	34029	ASCII	NOTE 2	none	optional	optional	NOTES 8 and 9
HCUsage	34030	LONG	1	0	d(NOTE 9)	d(NOTE 9)	

1 SamplesPerPixel.
2 The number of characters (bytes) in the string including the terminating null.
3 StripsPerImage = INTEGER((ImageLength+RowsPerStrip-1)/RowsPerStrip), where INTEGER(*x*) is the integer value of *x* (i.e. INTEGER(2.9)=2).
4 20 characters in the format YYYY:MM:DD HH:MM:SS indicating Year, Month, Day, space, Hour, Minute, Second, null.
5 The default value FFFFFFFFh means that the entire image is contained in a single strip.
6 If InkSet tag is used, it shall have a value of 1, if ColorSequence tag value is the default value of "CMYK", otherwise it shall have the value of 2.
7 If NumberOfInks tag is used, it must have the same value as the value of SamplesPerPixel.
8 ISO 12641, ISO 12642, ASCII data tables, or named colour definition as described in ANSI/CGATS.15
9 The bits of HCUsage indicate the type of information contained in the HC file. If all bits are 0, or the field is not present, the information type is unknown. Each bit indicates a type of information which may be coded in the file (see 7.2.5).

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Applications that do not specify any image colour may indicate this by putting the value "0" in the ImageColorIndicator field. In this case, the significance of image colour is at the discretion of the reader.

NOTE 24 In this case, though the originator of the file defines the conversion from pixel intensity values to percent intensity values by specifying the PixelIntensityRange field, the originator does not define the conversion from the percent intensity values to printing dot percent values.

Applications that specify an image colour shall indicate this by putting the value "1" in the ImageColorIndicator field. In this case, ImageColorValue shall contain the values of the colour components for the image colour, specified in the sequence as defined in ColorSequence. These colour values apply to the image colour when printed at 100% intensity for monochrome continuous tone pictures.

Annex G illustrates the relationships between pixel data values, intensity values, image colour values, and dot percent.

7.6.3 TIFF/IT-MP and TIFF/IT-MP/P1 encoding

Field usage for TIFF/IT-MP and TIFF/IT-MP/P1 data is as shown in table 7. The names in brackets correspond to ISO 10759 fields.

7.7 Binary picture (BP) file

7.7.1 TIFF/IT-BP and TIFF/IT-BP/P1

TIFF/IT-BP makes use of all the features and functionality supported by the TIFF and TIFF/IT fields appropriate to binary picture images. TIFF/IT-BP/P1 limits the field values to either the default value, a single value or a small choice of values. TIFF/IT-BP/P1 also limits the usage of optional fields to the minimum required for reasonable interchange.

TIFF/IT-BP/P1 is a simplified image file format profile for binary picture (BP) image data and can be considered a constrained subset of TIFF/IT-BP specifically intended for simpler implementation. TIFF/IT-BP/P1 files can be read by typical TIFF 6.0 readers and be written by typical TIFF 6.0 writers. TIFF/IT-BP/P1 files will be recognized by baseline TIFF 6.0 readers as Bilevel Images as described by Section 3 of the TIFF 6.0 specification. As such, all reference to colour specifications will be lost since those fields describing colour are not recognized by a baseline TIFF 6.0 reader.

7.7.2 Data structure

For binary pictures, ImageColorValue and BackgroundColorValue may contain the values of the colour components for the image (foreground) and background colour, specified in the sequence as defined in ColorSequence. These colour values apply to the solid image and background colours for binary pictures.

The data stream indicates which of the colours, foreground and background, will print. The bits in the data stream function as a switch between the image colour and the background colour. Bitmap fill order is from most significant bit to least significant bit within the byte, the default TIFF fill order. ImageColorIndicator and BackgroundColorIndicator field values shall be used to indicate when, if, and how image and background colours are used, including the use of transparency (see 7.2.8). An example of this data encoding is shown in annex G.

7.7.3 TIFF/IT-BP and TIFF/IT-BP/P1 encoding

Field usage for TIFF/IT-BP and TIFF/IT-BP/P1 data is as shown in table 8. The names in brackets correspond to ISO 10759 fields.

7.8 Binary line art (BL) file

7.8.1 TIFF/IT-BL and TIFF/IT-BL/P1

TIFF/IT-BL makes use of all the features and functionality supported by the TIFF and TIFF/IT fields appropriate to binary line art images. TIFF/IT-BL/P1 limits the field values to either the default value, a single value or a small choice of values. TIFF/IT-BL/P1 also limits the usage of optional fields to the minimum required for reasonable interchange.

TIFF/IT-BL/P1 is a simplified image file format profile for binary line art (BL) image data and can be considered a constrained subset of TIFF/IT-BL specifically intended for simpler implementation. Neither TIFF/IT-BL nor TIFF/IT-BL/P1 files are readable by typical TIFF 6.0 readers and neither can be written by typical TIFF 6.0 writers because of the mandatory use of TIFF/IT-specific fields and values, and non-traditional interpretations of other TIFF 6.0 fields and values (e.g., compression by mandatory run length encoding). Filters may be written for DTP and other applications which are desired to read and write TIFF/IT-BL and TIFF/IT-BL/P1 files. As a simplified profile, the filters for TIFF/IT-BL/P1 are simpler to implement than for TIFF/IT-BL.

7.8.2 Data structure

Each line of data shall be encoded as a sequence of pairs of background and image run lengths. Each new scan line shall start with a background run. In the case where a continuous background or an image section of a scan line has to be encoded by more than one run length pair, a zero run length of the "opposite" colour shall be inserted.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 7 — TIFF/IT-MP and TIFF/IT-MP/P1 field usage

Field name	Tag No.	Data type	Count	Default value	TIFF/IT-MP	TIFF/IT-MP/P1	Remarks
NewSubfileType	254	LONG	1	0	d(=0)	d=0	
ImageWidth	256	SHORT/LONG	1	none	m	m	[pixels per line]
ImageLength	257	SHORT/LONG	1	none	m	m	[lines per image]
BitsPerSample	258	SHORT	1	1	m(=8)	m=8	
Compression	259	SHORT	1	1	d=1, =32895	d=1	
PhotometricInterpretation	262	SHORT	1	none	m(=0) (NOTE 7)	m=0	
DocumentName	269	ASCII	NOTE 1	none	optional	not used	[job name]
ImageDescription	270	ASCII	NOTE 1	none	optional	optional	[picture name]
Make	271	ASCII	NOTE 1	none	optional	optional	[vendor name]
Model	272	ASCII	NOTE 1	none	optional	not used	
StripOffsets	273	SHORT/LONG	NOTE 2	none	m	m	pointer to image data
Orientation	274	SHORT	1	1	d(=1, =4, =5, =8)	d=1	
SamplesPerPixel	277	SHORT	1	1	d=1	d=1	[no. of separations]
RowsPerStrip	278	SHORT/LONG	1	FFFFFFFFh	d	d	NOTE 5
StripByteCounts	279	SHORT/LONG	NOTE 2	none	m	m	
XResolution	282	RATIONAL	1	none	m	m	[res. of line]
YResolution	283	RATIONAL	1	none	m	m	[res. of breadth]
PageName	285	ASCII	NOTE 1	none	optional	not used	
ResolutionUnit	296	SHORT	1	2	d(=2, =3)	d=2, =3	
Software	305	ASCII	NOTE 1	none	optional	optional	[program name]
DateTime	306	ASCII	NOTE 3	none	optional	optional	
Artist	315	ASCII	NOTE 1	none	optional	optional	
HostComputer	316	ASCII	NOTE 1	none	optional	not used	
DotRange	336	BYTE/SHORT	2	0,255	d	d=0,255	
Copyright	33432	ASCII	NOTE 1	none	optional	optional	
Site	34016	ASCII	NOTE 1	none	optional	not used	[site name]
ColorSequence	34017	ASCII	NOTE 1	CMYK	d(=CMYK, =YMCK)	not used	[sequence of colors]
IT8Header	34018	ASCII	NOTE 1	none	optional	not used	
RasterPadding	34019	SHORT	1	0	NOTE 6	not used	
ImageColorIndicator	34023	BYTE	1	0	d=0, =1	d=0, =1	NOTE 9
ImageColorValue	34025	BYTE	NOTE 4	none	NOTE 7, 8	NOTE 7,	
PixelIntensityRange	34027	BYTE	2	NOTE 10	d (NOTE 7)	d=0,255	
ColorCharacterization	34029	ASCII	NOTE 1	none	optional	optional	NOTE 9

1 The number of characters (bytes) in the string including the terminating null.
2 StripsPerImage=INTEGER((ImageLength+RowsPerStrip-1)/RowsPerStrip), where INTEGER(x) is the integer value of x (i.e. INTEGER (2.9)=2).
3 20 characters in the format YYYY:MM:DD HH:MM:SS indicating Year, Month, Day, space, Hour, Minute, Second, null.
4 One byte for each colour indicated in ColorSequence (count of one less than count of ColorSequence).
5 The default value FFFFFFFFh means that the entire image is contained in a single strip.
6 If RasterPadding is used in MP format, then Compression value must be specified as 32895. Values of 0, 1, 2, 9, 10 are the allowed values of RasterPadding.
7 If PhotometricInterpretation value is 0, pixel values of 0 are imaged as white (background), pixel values of $2^{BitsPerSample}$-1 are imaged as maximum density image colour, as specified by ImageColorIndicator, ImageColorValue, and PixelIntesityRange tag values.
If PhotometricInterpretation value is 1, pixel values of $2^{BitsPerSample}$-1 are imaged as white (background), pixel values of 0 are imaged as maximum density image colour (i.e. the image is reversed from the interpretation of PhotometricInterpretation value of 0).
8 If ImageColorIndicator value is 1, ImageColorValue is mandatory. If ImageColorIndicator value is 0, ImageColorValue is not used.
9 ISO 12641, ISO 12642, ASCII data tables, or named colour definition as described in ANSI/CGATS.15
10 0 and $2^{BitsPerSample}$ -1 for 0% and 100% intensity respectively.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 8 — TIFF/IT-BP and TIFF/IT-BP/P1 Field usage

Field name	Tag No.	Data type	Count	Default value	TIFF/IT-BP	TIFF/IT-BP/P1	Remarks
NewSubfileType	254	LONG	1	0	d(=0)	d=0	
ImageWidth	256	SHORT/LONG	1	none	m	m	[pixels per line]
ImageLength	257	SHORT/LONG	1	none	m	m	[lines per image]
BitsPerSample	258	SHORT	1	1	d=1	d=1	
Compression	259	SHORT	1	1	d=1	d=1	
PhotometricInterpretation	262	SHORT	1	none	m(=0) NOTE 6	m=0	
DocumentName	269	ASCII	NOTE 1	none	optional	not used	[job name]
ImageDescription	270	ASCII	NOTE 1	none	optional	optional	[picture name]
Make	271	ASCII	NOTE 1	none	optional	optional	[vendor name]
Model	272	ASCII	NOTE 1	none	optional	not used	
StripOffsets	273	SHORT/LONG	NOTE 2	none	m	m	pointer to image data
Orientation	274	SHORT	1	1	d(=1, =4, =5, =8)	d=1	
SamplesPerPixel	277	SHORT	1	1	d=1	d=1	[no. of separations]
RowsPerStrip	278	SHORT/LONG	1	FFFFFFFFh	d	d	NOTE 5
StripByteCounts	279	SHORT/LONG	NOTE 2	none	m	m	
XResolution	282	RATIONAL	1	none	m	m	[res. of line]
YResolution	283	RATIONAL	1	none	m	m	[res. of breadth]
PageName	285	ASCII	NOTE 1	none	optional	not used	
ResolutionUnit	296	SHORT	1	2	d(=2, =3)	d=2, =3	
Software	305	ASCII	NOTE 1	none	optional	optional	[program name]
DateTime	306	ASCII	NOTE 3	none	optional	optional	
Artist	315	ASCII	NOTE 1	none	optional	optional	
HostComputer	316	ASCII	NOTE 1	none	optional	not used	
DotRange	336	BYTE/SHORT	2	0,255	d	d=0,255	
Copyright	33432	ASCII	NOTE 1	none	optional	optional	
Site	34016	ASCII	NOTE 1	none	optional	not used	[site name]
ColorSequence	34017	ASCII	NOTE 1	CMYK	d(=CMYK, =YMCK)	not used	[sequence of colors]
IT8Header	34018	ASCII	NOTE 1	none	optional	not used	
ImageColorIndicator	34023	BYTE	1	0	d=0, =1, =2	d=0, =1, =2	NOTE 7
BackgroundColorIndicator	34024	BYTE	1	0	d=0, =1, =2	d=0, =1, =2	NOTE 7
ImageColorValue	34025	BYTE	NOTE 4	none	NOTE 6, 7	NOTE 7, 8	
BackgroundColorValue	34026	BYTE	NOTE 4	none	NOTE 6, 7	NOTE 7, 8	
ColorCharacterization	34029	ASCII	NOTE 1	none	optional	optional	NOTE 8

1 The number of characters (bytes) in the string including the terminating null.
2 StripsPerImage=INTEGER((ImageLength+RowsPerStrip-1)/RowsPerStrip), where INTEGER(x) is the integer value of x (i.e. INTEGER (2.9)=2)
3 20 characters in the format YYYY:MM:DD HH:MM:SS indicating Year, Month, Day, space, Hour, Minute, Second, null.
4 One byte for each colour indicated in ColorSequence (count of one less than count of ColorSequence).
5 The default value FFFFFFFFh means that the entire image is contained in a single strip.
6 If PhotometricInterpretation value is 0, pixel values of 0 are imaged as background and pixel values of 1 are imaged as image, as specified by imageColorIndicator, BackgroundColorIndicator, ImageColorValue, and BackgoundColorValue. If PhotometricInterpretation value is 1, pixel values of 1 are imaged as background and pixel values of 0 are imaged as image (i.e. the image is reversed from the interpretation of PhotometricInterpretation value of 0).
7 If ImageColorIndicator value is 1, ImageColorValue is mandatory; otherwise, ImageColorValue is not used.
If BackgroundColorIndicator value is 1, BackgroundColorValue is mandatory; otherwise, BackgroundColorValue is not used.
8 ISO 12641, ISO 12642, ASCII data tables, or named colour definition as described in ANSI/CGATS.15.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

For binary line art, the data stream indicates which of the colours, foreground or background, will print. The decoded run lengths of the data stream function as a switch between the image (foreground) colour and the background colour. An example of this data encoding is shown in annex G.

7.8.2.1 Run length encoding structure

There are two basic formats for encoding run lengths. The short form (8 bits long) is used for encoding run lengths up to 254 pixels long, and the long format (24 bits long) for encoding run lengths up to 65535 pixels long. Both forms may be combined within a single background/image run length pair, and may be freely mixed within a file, as the long form is encoded as a special case of the short form. Writers are required to write the short form. There is no requirement to write both forms, since long runs may be encoded with repetitions of the short form. Readers shall be capable of reading both forms.

The short form consists of a single-byte entry representing a binary number signifying the run length from 0 through 254 as follows:

Byte:	0
Value:	run length (0 through 254)

The value 0 indicates an "empty" run; two successive zero bytes are not allowed within a scan line, as this would conflict with other indicators.

The long form consists of a three-byte entry, with the first eight bits a binary number always equal to 255 to signify the long form. The next 16 bits are a binary number representing the run length from 1 through 65535. In the event the long form is used to encode a run length of less than 256, byte 1 will be binary zero, and the run length will be found in byte 2. The long form looks as follows:

Byte:	0	1 and 2
Value:	255	run length (0 through 65535)

Each line of data is initiated by two zero bytes and terminated by two zero bytes.

NOTE 25 Two adjacent zero bytes may also occur within the encoding of a line, so this occurrence should not be used as a means of detecting an end of line.

If the number of pixels in an encoded line does not equal the declared number of pixels per line of the image, or the number of encoded lines does not equal the declared number of lines in the image, an error exists and continued processing is left to the discretion of the processing system.

If an image and/or background colour is specified, the image colour value for a pixel is obtained by using the alternating sequence of the run lengths as a switch between the background colour and the image colour, as defined in ImageColorValue and BackgroundColorValue, starting with background colour at the beginning of each scan line.

7.8.2.2 Line repeat code

This International Standard does not permit the use of line repeat codes.

NOTE 26 ANSI Standard IT8.8 and ISO 10759 permit the use of line repeat codes to further compress binary line art files.

7.8.3 TIFF/IT-BL and TIFF/IT-BL/P1 encoding

Field usage for TIFF/IT-BL and TIFF/IT-BL/P1 data is as shown in table 9. The names in brackets correspond to ISO 10759 fields.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table 9 — TIFF/IT-BL and TIFF/IT-BL/P1 field usage

Field name	Tag No.	Data type	Count	Default value	TIFF/IT-BL	IFF/IT-BL/P1	Remarks
NewSubfileType	254	LONG	1	0	d(=0)	d=0	
ImageWidth	256	SHORT/LONG	1	none	m	m	[pixels per line]
ImageLength	257	SHORT/LONG	1	none	m	m	[lines per image]
BitsPerSample	258	SHORT	1	1	d=1	d=1	
Compression	259	SHORT	1	1	m=32898	m=32898	
PhotometricInterpretation	262	SHORT	1	none	m=0, =1 (NOTE 6)	m=0	
DocumentName	269	ASCII	NOTE 1	none	optional	not used	[job name]
ImageDescription	270	ASCII	NOTE 1	none	optional	optional	[picture name]
Make	271	ASCII	NOTE 1	none	optional	optional	[vendor name]
Model	272	ASCII	NOTE 1	none	optional	not used	
StripOffsets	273	SHORT/LONG	NOTE 2	none	m	m	pointer to image data
Orientation	274	SHORT	1	1	d(=1, =4, =5, =8)	d=1	
SamplesPerPixel	277	SHORT	1	1	d=1	d=1	[no. of separations]
RowsPerStrip	278	SHORT/LONG	1	FFFFFFFFh	d	d	NOTE 5
StripByteCounts	279	SHORT/LONG	NOTE 2	none	m	m	
XResolution	282	RATIONAL	1	none	m	m	[res. of line]
YResolution	283	RATIONAL	1	none	m	m	[res. of breadth]
PageName	285	ASCII	NOTE 1	none	optional	not used	
ResolutionUnit	296	SHORT	1	2	d(=2, =3)	d=2, =3	
Software	305	ASCII	NOTE 1	none	optional	optional	[program name]
DateTime	306	ASCII	NOTE 3	none	optional	optional	
Artist	315	ASCII	NOTE 1	none	optional	optional	
HostComputer	316	ASCII	NOTE 1	none	optional	not used	
DotRange	336	BYTE/SHORT	2	0,255	d	d=0,255	
Copyright	33432	ASCII	NOTE 1	none	optional	optional	
Site	34016	ASCII	NOTE 1	none	optional	not used	[site name]
ColorSequence	34017	ASCII	NOTE 1	CMYK	d(=CMYK, =YMCK)	not used	[sequence of colors]
IT8Header	34018	ASCII	NOTE 1	none	optional	not used	
ImageColorIndicator	34023	BYTE	1	0	d=0, =1, =2	d=0, =1, =2	NOTE 8
BackgroundColorIndicator	34024	BYTE	1	0	d=0, =1, =2	d=0, =1, =2	NOTE 8
ImageColorValue	34025	BYTE	NOTE 4	none	NOTE 6, 7	NOTE 6, 7	
BackgroundColorValue	34026	BYTE	NOTE 4	none	NOTE 6, 7	NOTE 6, 7	
ColorCharacterization	34029	ASCII	NOTE 1	none	optional	optional	NOTE 8

1 The number of characters (bytes) in the string including the terminating null.
2 StripsPerImage=INTEGER((ImageLength+RowsPerStrip-1)/RowsPerStrip), where INTEGER(x) is the integer value of x (i.e. INTEGER (2.9)=2).
3 20 characters in the format YYYY:MM:DD HH:MM:SS indicating Year, Month, Day, space, Hour, Minute, Second, null.
4 One byte for each colour indicated in ColorSequence (count of one less than count of ColorSequence).
5 The default value FFFFFFFFh means that the entire image is contained in a single strip.
6 If PhotometricInterpretation value is 0, pixel values of 0 are imaged as background and pixel values of 1 are imaged as image, as specified by ImageColorIndicator, BackgroundColorIndicator, ImageColorValue, and BackgoundColorValue. If PhotometricInterpretation value is 1, pixel values of 1 are imaged as background and pixel values of 0 are imaged as image (i.e. the image is reversed from the interpretation of PhotometricInterpretation value of 0).
7 If ImageColorIndicator value is 1, ImageColorValue is mandatory; otherwise, ImageColorValue is not used.
If BackgroundColorIndicator value is 1, BackgroundColorValue is mandatory; otherwise, BackgroundColorValue is not used.
8 ISO 12641, ISO 12642, ASCII data tables, or named colour definition as described in ANSI/CGATS.15.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Annex A
(informative)

Relationship between image types on a colour page

A page generally consists of CT and LW areas. The CT areas are typically scanned images or colour gradations ("vignettes", "degrades") and the LW areas are typically text, rules, logotypes, etc.

The LW data needs to be at a high resolution (typically more than 35 pixels per mm) to avoid the appearance of jagged edges where there is high colour contrast; e.g., black letters on white paper. The CT data typically has less colour contrast between adjacent pixels because of the sampling techniques used in scanning images and the response of the eye. Hence the spatial resolution, and with it the volume of data, can be reduced; typically, fewer than 25 pixels per mm are used. Each processing and output system will have its own restrictions on CT and LW resolutions, and the relationship between them.

Typically, both CT and LW pixels are square, the ratio between their linear resolutions is a small integer, and they are positioned such that the LW grid appears to subdivide the CT grid, each having edges coincident with the axes of the imaging area.

LW data is considered to take precedence over CT data, as if layered over it. The combination of LW and CT on the page is achieved by using two special colours in the LW palette: "white" and "transparent". White (0% in all separations) is conceptually a solid colour like any other in the LW palette, and thus "knocks out" any underlying CT data, in this case ensuring that no ink is printed and the bare substrate (paper) is seen. Transparent is a special indication which may apply to any or all separations of the palette colour. It has the effect of making the LW transparent in that separation, allowing the underlying CT to show through.

The above description of resolution suggests that the CT resolution is lower than the LW resolution. While this is true within the image, it is not always true of the edges of CT features. Where a shape has a sloping or curved edge it may be necessary or desirable to "cut into" CT pixels at LW resolution. The HC data format provides a method for doing this.

The HC file is at the same resolution as the LW file, and is also run-length encoded, but each run has its colour specified by a full CMYK or other colour value, instead of a palette reference. By this means, the limit on the number of palette colours is removed. Another way of looking at the HC data is to consider it as a higher resolution continuous tone (CT) file in which each pixel is accompanied by a repeat count. The HC file may have the same concept of "transparency" as the LW file, but uses colour byte values of zero to indicate it. The HC file is considered as lying between the LW and CT files in the imaging model. It is possible to carry the line art data in the HC file and omit the LW file if this is desired. However, this may lead to an increase in file size owing to the less compact encoding (six bytes per run instead of two or four). If there are fewer than 255 colours in the line art, the LW format will produce a smaller file.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Annex B
(informative)

Colour values

This International Standard provides a method of transferring images destined for print using the four-colour printing process. These images can originate from a wide variety of sources, and may be transferred at any point in the production process. Therefore, this International Standard does not attempt to specify the final printed result, but to define the components of the image (sometimes referred to as a "bag of pixels") and its current parameters, such as size, resolution, colour saturation, etc. This does not imply that these parameters, and the specific colour values assumed by their definition, will remain unchanged prior to the printing process.

The relative colour values of the pixels represent the colour of the image at the time it was written in the TIFF/IT format. Relative colour values may be changed as the image passes from stage to stage in the production process. After scanning, they represent the scanned colour percentages; after colour correction they represent the corrected colour percentages; etc. They may represent a target value for dots on film for either lithographic or gravure printing, or the final dot value printed on paper after dot gain, or any of a number of other representations of the printing process. The current generation of data exchange standards makes no assumptions about what the value represents, but does provide a vehicle for transferring the values. It is necessary to understand where the image is in the printing process, and how it was created, to understand what the dot percent represents in absolute terms, and this can only be done with information from the originator of the image. The various parts of ISO 12641, ISO 12642, and ANSI CGATS.15 address this issue, and the field ColorCharacterization is provided to carry calibration data as specified in them.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Annex C
(informative)

The Tag Image File Format and TIFF/IT

The Tag Image File Format (TIFF) was created by Aldus and is currently defined and maintained by Adobe Systems, Incorporated. It is intended to provide "a rich environment within which the interchange of image data between application programs can be accomplished."

The format is extensible. Arrangements are available both to define private fields, and to define private enumerated values for existing fields. The tag values for private fields and the values for existing fields are made available by Adobe. It is essential not to select arbitrary tag numbers for private fields, since they might conflict with other use of the same numbers. Tag numbers 34016 through 34035, along with the additional enumerated values for Compression and PlanarConfiguration referred to in this International Standard, were formally assigned to the ANSI IT8 Committee.

ANSI IT8.1, IT8.2, and IT8.5 (which correspond to ISO 10755, ISO 10756, and ISO 10759, respectively) relate specifically to the ANSI X3.27 format for files on magnetic tape and, as such, have characteristics inappropriate for other media. TIFF/IT provides a mechanism for encoding ANSI IT8.1, IT8.2, and IT8.5 data in a media-independent manner. Existing TIFF fields and enumerated values are used wherever possible, and new ones are specified where necessary. Newly defined fields have default values that do not cause any variation in the significance of existing fields. By this means, if the default value applies, the new field can be omitted and the file may be compatible with existing TIFF readers (this is possible for CT, BP, and MP data formats only).

This concept is intended to allow existing TIFF writers to generate files in these formats wherever the data is compatible, and to reduce the amount of modification to existing TIFF software needed when enhancement is undertaken. In particular, TIFF 6.0, Section 16: CMYK Images, conforms to this International Standard.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Annex D
(informative)

Final page (FP) file format

D.1 TIFF/IT-FP and TIFF/IT-FP/P1

Typically, a final page, ready for exposure on an output recorder, consists of more than one of the CT, LW, and HC raster formats described in this International Standard. TIFF/IT-FP provides a mechanism for associating image files of the different types which make up a final page.

It is assumed that, for each image type, the page assembly processes have combined all the page input components of that data type into one output file: the single component image file of that data type for the page.

The component image files of a final page may be of either TIFF/IT conformance level or TIFF/IT-P1 conformance level. The final page is considered to be TIFF/IT-P1 conformant only if all of its component files are TIFF/IT-P1 conformant and its own fields are TIFF/IT-FP/P1 conformant as specified in D.2.5.

D.2 Data structure

D.2.1 Component image files

A final page consists of from two to four files: The FP file which describes the page and an optional component image file for each of CT, LW, and HC file types.

As a simple step toward data volume reduction, each component image need not extend to the page boundaries, but may be the minimum rectangle which can contain all its elements, correctly positioned. The component images shall not extend beyond the page boundaries by more than a fractional pixel. Optional offset dimensions are used to correctly position the component files within the page area (see figure D.1).

In areas of the final page where more than one component file is present, the ordering shall be LW over HC over CT, with transparency allowing lower layers to show through where present.

Any area of the final page which does not contain image data is considered to be a non-printing area.

All component files in a final page must have the same values for Orientation and ResolutionUnit as the FP file. If HC and LW files exist in the same final page, they must have the same values for XResolution and YResolution.

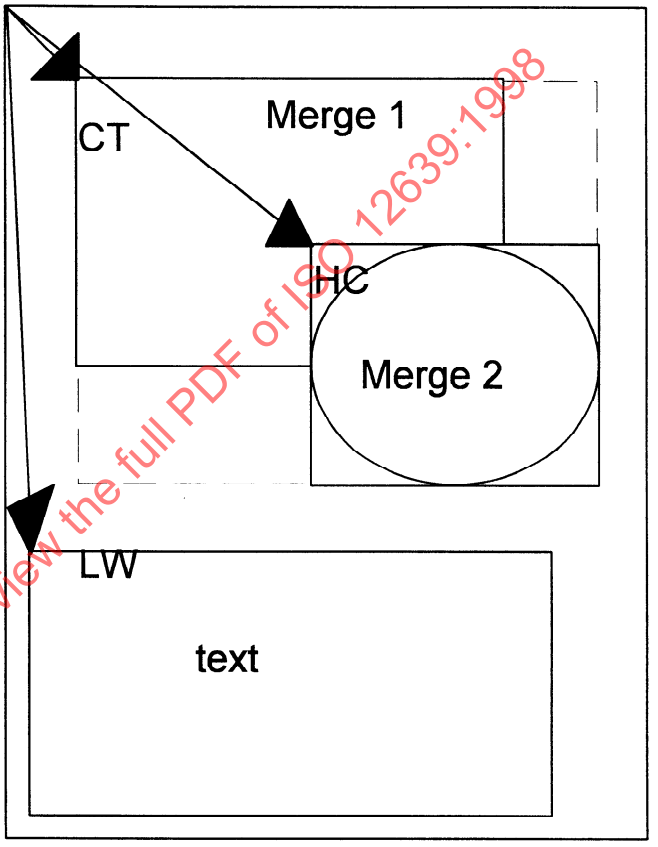

Figure D.1 — Sample FP file

D.2.2 FP file structure

The FP file uses the TIFF subfile structure (see figure D.2). An FP file consists of from two to four Image File Directories (IFDs), one for the FP itself and one for each of the CT, LW, and HC component images which may be present. The FP IFD is the 0th IFD. The component images' IFDs can appear in any sequence.

The component images' IFDs are copies of the IFDs of the actual component files, except as detailed in D.2.5.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

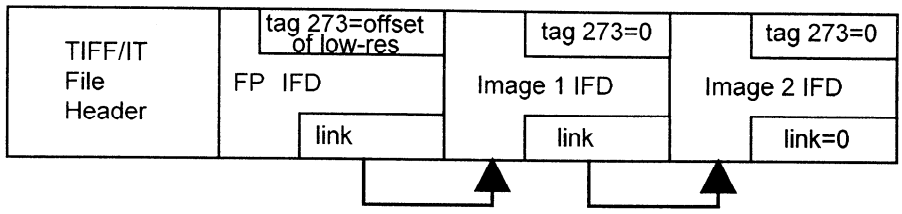

Figure D.2 — Example of FP file with subfile structure for an FP with two component files

The component images' IFDs are included to assure that the processing system has all the information necessary to process the FP file without having to actually access the component files until they are needed.

Only the component images' IFDs are included in the FP file, not their image data. Their StripOffset fields are therefore zero.

The final page (0th) IFD does contain "image" data, in keeping with TIFF 6.0 requirements and to allow positioning the FP file using page make-up applications. This data may be a low-resolution rendering of the page, but may be any other image, including white space, at the discretion of the writer. The image size in pixels in each dimension divided by the resolution in that direction must give the exact actual page size in the appropriate resolution units. The image data may be TIFF 6.0 Bilevel, Grayscale, RGB, or CMYK, using the tags specified in D.2.6.

NOTE 27 Although the 0th IFD is TIFF 6.0-compliant, the FP file itself is not, because the subsequent IFDs do not include image data.

D.2.3 Referencing component image files

The ImageDescription field in each component image's IFD in the FP file must contain the actual name of the component image file at creation time. Because files may be renamed after creation, particularly if they are exchanged between heterogeneous operating systems, the actual file name should also be included in the ImageDescription field of each component image file. (See table D.1.)

This usage is in contrast to the usage in individual image files, where the field is optional and descriptive and its meaning is the same as the ISO 10755, ISO 10756, and ISO 10759 picture name field.

NOTE 28 While it is recommended that the ImageDescription field in each component file contain its file name, this may not always be possible if the final page is created separately from its components. Changing the IFD of a file being included in a final page may not be feasible, such as when the FP file is being added to a write-once medium which already contains some or all of the component files.

D.2.4 Page positions of component image files

The position of each component image on the page is specified by the XPosition and YPosition fields in its IFD in the FP file. If these fields are not included for a component, the component is assumed to be positioned at the top left corner of the page. The XPosition and YPosition fields may also be set in the actual component image files, but there they are informational only. All processing is to be performed according to the fields within the IFDs in the FP file.

D.2.5 Component image IFD encoding

Additional field usage for component images' IFD fields for inclusion in TIFF/IT-FP and TIFF/IT-FP/P1 is as shown in table D.2. These fields are in addition to the fields defined in the appropriate subclause in this International Standard for the component files. For fields which appear in both places, the usage within the FP file is as shown in table D.2.

D.2.6 TIFF/IT-FP and TIFF/IT-FP/P1 encoding

General field usage for TIFF/IT-FP and TIFF/IT-FP/P1 final page (0th) IFD is as shown in table D.4. Table D.3 defines field usage for those fields which depend on the encoding of the low-resolution image data.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table D.1 — ImageDescription field usage in component image files of a final page

Field name	Tag No.	Data type	Count	Default value	TIFF/IT-FP	TIFF/IT-FP/P1	Remarks
ImageDescription	270	ASCII	NOTE 1	none	NOTE 2	NOTE 2	

1 The number of characters (bytes) in the string including the terminating null.
2 In an image file which is a component of a final page, ImageDescription shall contain the name of the component file at the time the final page is created, unless the usage is not reasonably possible. For example, if the medium is write-once, this usage is not required. Use facilitates identifying the file in case of a subsequent renaming. (Optional and descriptive only in an individual image file.)

Table D.2 — TIFF/IT-FP and TIFF/IT-FP/P1 component image IFD field usage

Field name	Tag No.	Data type	Count	Default value	TIFF/IT-FP	TIFF/IT-FP/P1	Remarks
ImageDescription	270	ASCII	NOTE 1	none	m (NOTE 2)	m (NOTE 2)	
StripOffsets	273	SHORT/LONG	1	none	m=0	m=0	no image data
XPosition	286	RATIONAL	1	0	d	d	NOTE 3
YPosition	287	RATIONAL	1	0	d	d	NOTE 4

1 The number of characters (bytes) in the string including the terminating null.
2 ImageDescription contains the actual name of the component image file as created.
3 XPosition is the offset of the left side of the image from the left side of the page, in positive ResolutionUnits.
4 YPosition is the offset of the top of the image from the top of the page, in positive ResolutionUnits.

Table D.3 — TIFF/IT-FP 0th IFD field usage for various low-resolution image data encodings

Field name	Tag No.	Data type	Count	Default value	Bilevel	Grayscale	RGB	CMYK
BitsPerSample	258	SHORT	NOTE 1	1	not used	m=4, =8	m=8,8,8	m=8,8,8,8
PhotometricInterpretation	262	SHORT	1	none	m (NOTE 2)	m (NOTE 2)	m=2	m=5
SamplesPerPixel	277	SHORT	1	1	not used	not used	m=3	m=4
InkSet	332	SHORT	1	1	not used	not used	not used	d=1
NumberOfInks	334	SHORT	1	4	not used	not used	not used	d=4
DotRange	336	BYTE/SHORT	2	0,255	not used	not used	not used	d=0,255

1 SamplesPerPixel
2 0=WhiteIsZero, 1=BlackIsZero

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Table D.4 — TIFF/IT-FP and TIFF/IT-FP/P1 0th IFD field usage

Field name	Tag No.	Data type	Count	Default value	TIFF/IT-FP	TIFF/IT-FP/P1	Remarks
NewSubfileType	254	LONG	1	0	m=bit 3=1	m=bit 3=1	NOTE 1
ImageWidth	256	SHORT/LONG	1	none	m (NOTE 2)	m (NOTE 2)	[pixels per line]
ImageLength	257	SHORT/LONG	1	none	m (NOTE 3)	m (NOTE 3)	[lines per image]
Compression	259	SHORT	1	1	d=1	d=1	
DocumentName	269	ASCII	NOTE 4	none	optional	not used	[job name]
ImageDescription	270	ASCII	NOTE 4	none	m (NOTE 5)	m (NOTE 5)	FP file name
Make	271	ASCII	NOTE 4	none	optional	optional	[vendor name]
Model	272	ASCII	NOTE 4	none	optional	not used	
StripOffsets	273	SHORT/LONG	NOTE 6	none	m	m	
Orientation	274	SHORT	1	1	d(=1, =4, =5, =8)	d=1	
RowsPerStrip	278	SHORT/LONG	1	FFFFFFFFh	d	d	NOTE 7
StripByteCounts	279	SHORT/LONG	NOTE 6	none	m	m	
XResolution	282	RATIONAL	1	none	m (NOTE 2)	m (NOTE 2)	[res. of line]
YResolution	283	RATIONAL	1	none	m (NOTE 3)	m (NOTE 3)	[res. of breadth]
PlanarConfiguration	284	SHORT	1	1	d=1	d=1 (NOTE 8)	
PageName	285	ASCII	NOTE 4	none	optional	not used	
ResolutionUnit	296	SHORT	1	2	d(=2, =3)	d=2, =3	
Software	305	ASCII	NOTE 4	none	optional	optional	[program name]
DateTime	306	ASCII	NOTE 9	none	optional	optional	
Artist	315	ASCII	NOTE 4	none	optional	optional	
HostComputer	316	ASCII	NOTE 4	none	optional	not used	
Copyright	33432	ASCII	NOTE 4	none	optional	optional	
Site	34016	ASCII	NOTE 4	none	optional	not used	[site name]

1 Bit 3 of NewSubfileType has been allocated to uniquely identify TIFF/IT-FP files. The least significant bit is bit 0.
2 Any value of XResolution may be used such that ImageWidth divided by XResolution equals the exact actual page width in ResolutionUnits.
3 Any value of YResolution may be used such that ImageLength divided by YResolution equals the exact actual page length in ResolutionUnits.
4 The number of characters (bytes) in the string including the terminating null.
5 The name of the FP file at creation time, in order to facilitate identifying it in case of a subsequent rename.
6 StripsPerImage.
7 The default value FFFFFFFFh is effectively infinite, meaning that the entire image is contained in a single strip.
8 Only pixel interleave ("chunky" format) is allowed in keeping with Baseline TIFF requirements.
9 20 characters in the format YYYY:MM:DD HH:MM:SS indicating Year, Month, Day, space, Hour, Minute, Second, null.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998

Annex E
(informative)

Identification and determination procedures

E.1 Procedure for determination of TIFF/IT file type

The following logic can be used to determine the file type of a TIFF/IT file:

```
if SubfileType is = 1 or is non-existent then
        if Compression = 1 or 32895 then
                if PhotometricInterpretation = 5 then
                        if PlanarConfiguration = 1 then          type is CT with pixel interleaving
                        if PlanarConfiguration = 32768 then      type is CT with line interleaving
                        if PlanarConfiguration = 2 then          type is CT with colour interleaving
                if PhotometricInterpretation = 0 or 1 then
                        if BitsPerSample = 1 then                type is BP
                        if BitsPerSample > 1 then                type is MP
        if Compression = 32896 then                              type is LW
        if Compression = 32897 then                              type is HC
        if Compression = 32898 then                              type is BL
        if bit3 of NewSubfileType = 1 then                       type is FP
```

E.2 Procedure for identifying the component image files of a final page

The component images' ImageDescription fields in their IFDs in the FP file contain the names of the component image files at the time the final page was created. The ImageDescription field in each component image file should also contain this name, but may not in certain cases (see D.2.3). Files may be renamed, however, after the final page is created. In particular, renaming may be done automatically when files are exchanged between operating systems with differing file naming rules.

The Inter-Company File Exchange Network (IFEN) specification defines files which may, in some cases, partially comply with this International Standard. A reader application could be designed to process both TIFF/IT and IFEN final pages. In IFEN, however, file names are not explicitly coded within the files. All files of an IFEN final page, including the FP file, have the same base file name with a three-character extension specifying the file type (.ICT for IFEN CT, .ILW for IFEN LW, .IHC for IFEN HC, and .IFP for IFEN FP).

The following algorithm can be used to locate the component files of a final page, given the FP file:

```
FileName = component image's ImageDescription field from its IFD in the FP file, if present

if ImageDescription exists but the file "FileName" does not exist it is possibly renamed or IFEN
        search all TIFF/IT files for a file of the correct type with ImageDescription = FileName

if file not found, or no ImageDescription in IFD it is possibly IFEN
        FileName = FP base file name with IFEN extension ('.ICT', '.ILW', '.IHC')
        if the file "FileName" does not exist
                error, or allow manual file name specification
```

If the reader application supports IFEN files, it may be more efficient to test for IFEN file naming first if the FP file's name includes the IFEN FP file extension.

STANDARDSISO.COM : Click to view the full PDF of ISO 12639:1998