



American National Standard for Financial Services

ANSI X9.100-181-2014 (R2021)

TIFF Image Format for Image Exchange



Developed by
Accredited Standards Committee X9, Incorporated
Financial Industry Standards

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Foreword

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Introduction

The purpose of this standard is to provide the financial industry with a defined specific implementation of a TIFF (Tagged Image File Format) structure necessary to support proper electronic check exchange (ECE) without the need of special agreements. This standard was determined to be necessary to define the minimum TIFF fields and their allowed values for image exchange. The standard allows development of accepted methods and procedures to accommodate any identified key non-conformances. JPEG (grayscale) compressions may be addressed in a separate standard to be developed in the future.

The latest revision for clarifies certain points and places the restriction on the *StripByteCounts* (Tag 279) within Table 1 to avoid any confusion about the requirement. Other minor changes were made improve clarity, update references, and to reflect X9 organizational changes.

Suggestions for the improvement or revision of this standard are welcome. They should be sent to the X9 Committee Secretariat, Accredited Standards Committee X9, Inc., Financial Industry Standards, 275 West Street, Suite 107, Annapolis, MD 21401

This standard was processed and approved for submittal to ANSI by the Accredited Standards Committee on Financial Services, X9. Committee approval of the standard does not necessarily imply that all the committee members voted for its approval.

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 Janet Busch, Managing Director

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Hewlett Packard.....	Susan Langford
IBM Corporation.....	Todd Arnold

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Independent Community Bankers of America	Cary Whaley
Ingenico.....	Rob Martin
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J.P. Morgan Chase.....	Roy DeCicco
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Office of Financial Research, U.S. Treasury Department.....	Con Crowley
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Vantiv LLC.....	Patty Walters
VeriFone, Inc.	Dave Faoro
VerifyValid	Paul Doyle
VISA	Kim Wagner
Wells Fargo Bank	Mark Tiggas

At the time this standard was approved, the X9AB Payments Subcommittee had the following members:

- Daniel Welch, X9AB Chairman
- Jackie Pagán, X9AB Vice Chairman
- Alan Thiemann, X9AB Vice Chairman
- John McCleary, X9AB Vice Chairman

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Representative

All My Papers	Ray Higgins
All My Papers	Larry Krummel
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American Bankers Association	Steve Kenneally
American Bankers Association	C. Diane Poole
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American Express Company	Eric Eldridge
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American Express Company	Vicky Sammons
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AQ2 Technologies LLC.....	Shawn Box
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BancTec, Inc.....	David Hunt
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Bank of America	Colleen Powers
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Bank of America	Matthew Sharp
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Bank of America	David Uitermarkt
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Bank of New York Mellon	Bryan Kirkpatrick
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CDP, Inc.	Johnny Sena
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Conexus, Inc.	Linda Toth
Deluxe Corporation.....	Angela Hendershott
Deluxe Corporation.....	Margiore Romay
Deluxe Corporation.....	Jeannette VanDenberg
Deluxe Corporation.....	Andy Vo
Diebold, Inc.....	Bruce Chapa
Diebold, Inc.....	Kelly Patenaude
Discover Financial Services.....	Gordon Searle
Discover Financial Services.....	Brenda Tobias
Discover Financial Services.....	Michelle Zhang
ECCHO	Ellen Heffner
ECCHO	Phyllis Meyerson
Etegrity L.L.C.....	Penny Tisdale
Federal Reserve Bank.....	Mary Hughes
Federal Reserve Bank.....	Kathleen Jacob
Federal Reserve Bank.....	Mark Kielman
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J.P. Morgan Chase.....	Edward Koslow
J.P. Morgan Chase.....	Jackie Pagan
Key Bank	James Sokal
MagTek, Inc.....	Jeff Duncan
MAXIMUS, Inc.....	Peter Relich
NACHA The Electronic Payments Association	Robert Unger
National Security Agency	Paul Timmel
Navy Federal Credit Union	Kim Engman

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Navy Federal Credit Union	Jezreel Espeleta
Navy Federal Credit Union	April Haynes
Navy Federal Credit Union	Jimmy Jones
Navy Federal Credit Union	Dana Majors
Navy Federal Credit Union	Tynika Wilson
NCR Corporation	David Norris
NCR Corporation	Ron Rogers
NCR Corporation	Jamie Rossignoli
NCR Corporation	Steve Stevens
Paychex Inc	Carl Tinch
RDM Corporation	Bill Faulkner
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Relyco Sales Inc	Michael Steinberg
Rosetta Technologies	Jim Walling
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Solutran	Cindy Neiderhiser
Solutran	Deb Niles
Solutran	Carmen R. Nordstrand
Solutran	Holly Umhoefer
Source Technologies	Wally Burlingham
Source Technologies	Chuck Freeman
Standard Register Company	Melissa Kirk
SWIFT/Pan Americas	Jean-Marie Eloy
SWIFT/Pan Americas	James Wills
Symcor Inc	Hiren Joshi
Symcor Inc	Brian Salway
TECSEC Incorporated	Ed Scheidt
Texas DSHS WIC EBT	Duane Grabarschick
Texas DSHS WIC EBT	John Hannemann
Texas DSHS WIC EBT	Brian Whitfield
The Clearing House	Henry Farrar
Troy Group, Inc	Michael Riley
U.S. Bank	Michelle Copher
U.S. Bank	Tim Dawe
U.S. Bank	Gina Hebner
U.S. Bank	Scott LaPlante
U.S. Bank	Maureen Latendresse
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USDA Food and Nutrition Service	Kathy Ottobre
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VeriFone, Inc	Brad McGuinness
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VerifyValid	John FitzPatrick
Viewpointe	Richard Luchak
VISA	John Aafedt
VISA	Brian Hamilton
VISA	Glenn Powell
Wells Fargo Bank	William Davis
Wells Fargo Bank	Jeff Harmon
Wells Fargo Bank	Ann Kirk

Wells Fargo Bank	Garrett Macey
Wells Fargo Bank	Alan Nguyen
Wells Fargo Bank	John Quinn
Wells Fargo Bank	Mark Schaffer
Wells Fargo Bank	Mark Tiggas
Wincor Nixdorf Inc	Scott Waldrop
Wyoming Department of Health WIC Program	Tina Fearneyhough
Wyoming Department of Health WIC Program	Melissa Sosa
Wyoming Department of Health WIC Program	David Spindler
Xerox Services LLC	Julie Alyea
Xerox Services LLC	Frank Bov
Xerox Services LLC	William Kelly
Xerox Services LLC	Chad Main
Xerox Services LLC	Kirk Norsworthy

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Working Group **X9AB6** on **Electronic Exchange of Check and Image Data** which developed this standard had the following participants:

Steve Gibson-Saxty, Chair, FIS/Endpoint Exchange

Organization Represented	Representative
Bank of America	Welch, Daniel
ECCHO	Meyerson, Phyllis
Federal Reserve Bank.....	Kielman, Mark
J.P. Morgan Chase & Co.....	Pagán, Jackie
FIS/Endpoint Exchange.....	Gibson-Saxty, Stephen
Symcor Inc.	Joshi, Hiren
Symcor Inc.	Salway, Brian
Viewpointe.....	Luchak, Richard
NCR.....	Rossignoli, Jamie
Wells Fargo Bank	Harmon, Jeff

This document cancels and replaces ANS X9.100-181-2010, *TIFF Image Format for Image Exchange*.

American National Standard for Financial Services— TIFF Image Format for Financial Image Exchange

1 Purpose

The ANSI X9.100-187 standard, as well as other standards, defines TIFF 6.0 as an image format scheme that will support interoperability for check image exchange processing between financial institutions without the need of special agreement. Although TIFF is a defined specification, it is very flexible and is designed to accommodate a variety of uses. In addition, some TIFF field values can have different interpretations. Therefore, this flexibility can cause some TIFF readers, internal TIFF editors and image applications to experience problems when they encounter a condition which they are not designed to handle. Many TIFF readers in use in the financial industry do not support all interpretations of TIFF generated by the diverse range of check image capture devices and software platforms.

In addition, as automated recognition and quality analysis becomes more common throughout the industry, some variations such as upside down or reversed image video can cause failures within these processes as well as printing and viewing concerns. As many new scanning devices and applications are being developed for check imaging, a central purpose of this standard is to provide guidance to the financial industry by defining the most commonly supported and least problematic uses of TIFF fields and their values for the exchange of images within the financial industry.

2 Scope

The scope of this standard is to define specific TIFF fields and parameters for check image exchange and the allowable values for those parameters. This standard will only address the use of G4 bilevel image (black/white) compressions within the TIFF 6.0 structure.

A “least common denominator” approach was used to identify the fields that everyone should read and the required or allowable values for these fields that everyone will be expected to support. To accomplish interoperability, some of the fields and values are more restrictive compared to what is being generated in today’s environment. In addition, this standard clarified areas that have been interpreted in different ways.

This standard will not address changing the industry TIFF (Tagged Image File Format) revision 6.0 (final June 3, 1992) specification owned by Adobe Systems Inc. as it is used for a wider variety of industry uses. Also, JPEG (grayscale) compressions will be addressed in a separate standard to be developed in the future.

3 Normative References

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

ANSI X9.100-187, *Electronic Exchange of Check and Image Data*

ANSI X9.100-181-2014

CCITT Recommendation T.6 (CCITT, Geneva: 1988), *Facsimile Coding Schemes and Coding Control Functions for Group 4 Facsimile Apparatus*

ITU-T Recommendation T.6, *Facsimile Coding Schemes and Coding Control Functions for Group 4 Facsimile Apparatus*

Regulation CC (12 CFR part 229), *Availability of Funds and Collection of Checks*

TIFF™ Revision 6.0 (June 3, 1992)

4 Terms and Definitions

The defining standard is listed in parentheses after each term.

4.1 bilevel (ANSI X9.100-181)

A bilevel image contains two colors – black and white. Also known and referenced as a bitonal image.

4.2 CCITT Group 4 (G4) (ANSI X9.100-181)

CCITT T.6 bilevel encoding as specified in section 2 of CCITT Recommendation T.6: “Facsimile coding schemes and coding control functions for Group 4 facsimile apparatus.” Consultative Committee International Telephone and Telegraph (CCITT, Geneva: 1988). ITU-T supersedes CCITT.

4.3 exchange file (ANSI X9.100-181)

A file containing data and associated images organized in a structure suitable for exchange of value between Depository Financial Institutions. (Example is ANSI X9.100-187 exchange file standards).

4.4 image file (ANSI X9.100-181)

The data set representing a single image view formatted in accordance with the TIFF 6.0 standard. The image file may be a stand-alone file (.TIF extension) or embedded within an exchange file “(e.g. within Image View Data Record (Type 52) Image Data Field (Field 19) in ANSI X9.100-187 exchange file).

4.5 image file directory (IFD) (ANSI X9.100-181)

An image file directory contains tag information about the image, as well as pointers to the actual image data. There must be at least 1 IFD in a TIFF file and each IFD must have at least one entry.

4.6 lossless compression algorithm (ANSI X9.100-181)

Lossless compression algorithm is a class of algorithm that allows the exact original image to be reconstructed from the compressed image data. Lossless compression is used when it is important that the original image and image reconstructed from the compressed image data be identical, or when no assumption can be made on whether certain deviation is uncritical.

4.7 optional TIFF fields (ANSI X9.100-181)

These are TIFF fields that are not required to be present in order to process the image. If not present the default value shall be assumed.

4.8 photometric interpretation (ANSI X9.100-181)

A bilevel image contains two colors – black and white. TIFF allows an application to write out bilevel data in either a white-is-zero or black-is-zero format. The field that records this information is called photometric interpretation. Also known as the color space of the image data.

4.9 TIFF (Tagged Image File Format) (ANSI X9.100-181)

A tag-based file format for storing and interchanging raster images.

4.10 TIFF field (ANSI X9.100-181)

A TIFF field is a logical entity consisting of TIFF tag and its value. This logical concept is implemented as an IFD Entry, plus the actual value if it doesn't fit into the value/offset part, the last 4 bytes of the IFD Entry. The terms TIFF field and IFD entry are interchangeable in most contexts.

5 Overview

In order to promote efficient interoperable check image exchange among institutions, restrictions and additional requirements and definitions are needed to specify TIFF fields that shall be used or may be used, and the allowable type, counts and values for those fields. In addition, values that can be generated with different techniques or conventions need to be clearly and unambiguously specified. A "least common denominator" approach is used to identify the fields that everyone should be able to read and the required or allowable type, counts and values for these fields that everyone is expected to support.

To accomplish the desired level of interoperability, these fields and values will necessarily have to be more restrictive compared to what is being generated in today's environment. This will promote a more efficient exchange and as more players get involved and volumes increase, the industry will be moved to an environment where there will be less variation. Less variation will protect exchange partners that have always expected certain TIFF format conventions from being surprised when a new player comes on board and starts using an unconventional field, or field value, that is allowed within the overall TIFF specifications.

TIFF wrapped G4 is an "encoding" of the actual image. Since G4 is a lossless compression algorithm, when performed properly the encoding of an image can be altered without changing the information content of the underlying image. Converting the encoding of an image is a normal occurrence in the processing of an image and does not alter the information content of the image, and as such this process can be performed to make an image conform to the specification.

6 TIFF Wrapped (G4) Bilevel Images

This standard is specifically addressing G4 bilevel Images and defines a subset of the TIFF 6.0 specifications and, when followed, will produce TIFF image files compliant with those specifications. The following general TIFF 6.0 specifications are retained without restrictions and are listed here to emphasize their importance in creating standard compliant TIFF files. The following TIFF 6.0 requirements shall be met:

- ❑ TIFF files begin with an 8-byte image file header that points to an image file directory (IFD). An image file directory contains information about the image, as well as pointers to the image data.
- ❑ All entries in an IFD (also called TIFF fields) shall be sorted in ascending order by Tag number.
- ❑ An IFD shall be included only once for a single image. Duplicate or Multiple IFDs shall not be allowed.

- ❑ Each TIFF field has an associated field type, e.g., SHORT, LONG. The TIFF standard allows for more than one type for some fields. The TIFF specifications explicitly state which field types are valid for each TIFF field. Only the specified field types shall be used. All valid field types are supported by this standard.
- ❑ Each TIFF field has an associated count and a value/offset. The actual syntax of the value is determined by the field type and the count. The proper, defined syntax shall be used. In accordance with the TIFF 6.0 specification, the Value Offset shall contain the value instead of pointing to the value if and only if the value fits into 4-bytes. If the value is shorter than 4 bytes, it is left justified within the 4 bytes Value Offset, i.e., stored in the lower numbered bytes. Whether the value fits within 4 bytes is determined by the field type and count of the field.
- ❑ Some TIFF fields are mandatory (Table 1), while others are optional (Table 2). These optional TIFF fields have a default value specified by the TIFF standard and TIFF file readers are instructed to use the default value whenever such a TIFF field is absent. If these optional fields are present the value specified shall be the same as the default value.
- ❑ TIFF image files shall be syntactically correct and properly formed in accordance with the TIFF 6.0 specification unless otherwise specified within this standard.

6.1 End-of-Facsimile-Block (EOFB) Requirements

The End-of-Facsimile-Block (EOFB) is mandatory for Image Exchange. Per TIFF 6.0 specification, each image shall be terminated with a valid EOFB. EOFB is a required structural edit within the image that determines if the image is correct in order to ensure downstream processing (i.e. image archive) will happen properly.

- ❑ Each G4 compressed image strip shall be terminated by a 24-bit EOFB code. The EOFB sequence is defined in the TIFF 6.0 Specification.
- ❑ Per TIFF 6.0 Specification -
 - The EOFB sequence is immediately followed by enough 0-bit padding to fit the entire stream into a sequence of 8-bit bytes.
 - TIFF readers will operate most smoothly by always ignoring bits beyond the EOFB. Some writers may produce additional bytes of pad bits beyond the byte containing the final bit of the EOFB. Robust readers will not be disturbed by this prospect.

7 Requirements for Image Exchange

The following general restrictions to the TIFF 6.0 standard are introduced by this standard in defining the Requirements for check image exchange.

- ❑ **Byte Order** shall be least significant byte to the most significant byte. This is called *little-endian* byte order. The little-endian byte order is specified by the first two bytes in a TIFF 6.0 image file header as: "II" (4949.H).
- ❑ **Images shall be single page.** Each TIFF image file shall contain a single image view. Thus each TIFF image file shall contain only one IFD (Image File Directory).
- ❑ **Images shall be single strip.** RowsPerStrip (278) fields shall have a value greater than or equal to the value of the field ImageLength (257).
- ❑ **Compression shall be Group 4 Fax.**
- ❑ **Valid EOFB shall be present.**
- ❑ **Photometric Interpretation shall be 0**

- ❑ **Image Orientation shall be 1.** The 0th row represents the visual top of the image, and the 0th column represents the visual left-hand side.
- ❑ **XResolution and YResolution shall be the same and resolve to a value of 200 or 240.** If the denominator is greater than 1, the ratio shall resolve to a value of 200 or 240, (e.g., $800/4=200$).
- ❑ **Table 1 lists baseline Bilevel TIFF 6.0 fields that shall be present along with their approved value .**
- ❑ **Table 2 lists additional TIFF 6.0 TIFF fields, which if present, shall have an approved value as specified in Table 2.**

Tables 1 and 2 specify the subset of TIFF 6.0 fields that have restrictions specified on values that are required by this standard. These specified values shall be used for creating black/white (Group 4) TIFF image files for check image exchange.

Variances when images do not meet Table 1 or Table 2 standards are not allowed.

In order to create maximum compatibility with TIFF readers commonly used in the financial industry, financial industry TIFF writers shall only use these fields and their defined values and conditions when creating image views for exchange in ANSI X9.100-187 or other similar exchange files. Conversely, financial industry TIFF readers shall support as a minimum the fields and values specified by these requirements in order to achieve maximum interoperability across diverse platforms. All tag numbers and related values are expressed in decimal notation.

Any Image that does not meet the requirements for image exchange may, at their discretion, be rejected by the receiving institution.

Table 1 - Required TIFF Fields

Tag Name	Tag Number	Type	Approved Defined Value(s)	Comment
ImageWidth	256	SHORT or LONG	Shall be greater than zero	See Note 1
ImageLength	257	SHORT or LONG	Shall be greater than zero	Shall be less than or equal to the value of the "RowsPerStrip" field. Note 1, Note 2
Compression	259	SHORT	4	Group 4 Fax – T.6
Photometric Interpretation	262	SHORT	0	WhiteIsZero - 0 is imaged as white and 1 is imaged as black.
StripOffsets	273	SHORT or LONG	Shall be greater than zero	This array shall have only one entry. See Note 1, Note 2
RowsPerStrip	278	SHORT or LONG	Shall be greater than zero	Shall be greater than or equal to the value of the "ImageLength" field. See Note 1, Note 2
StripByteCounts	279	LONG OR SHORT	Shall be greater than zero and shall not be greater than 200,000	This array shall have only one entry. See Note 1, Note 2
XResolution	282	RATIONAL	Shall resolve to 200 or 240	See Note 3
YResolution	283	RATIONAL	Shall resolve to 200 or 240	See Note 3

Note 1. This value shall be a valid value as defined in TIFF 6.0 for this field. It shall also comply with any restriction specified by this Standard.

Note 2. All image views shall be represented as a single strip.

Note 3. XResolution and YResolution fields shall have the same resolved values.

Table 2 - Optional TIFF Fields

Tag Name	Tag Number	Type	Approved Defined Value(s)	Comments
NewSubfileType	254	LONG	0	Single image per TIFF file.
BitsPerSample	258	SHORT	1	Bilevel image
Thresholding	263	SHORT	1	No dithering or half toning has been applied to image data
FillOrder	266	SHORT	1	This indicates that the first sequential bit of the binary string of encoded data is found in the high-order bit of the first octet of the stored byte sequence. The high-order bit of the first compression code is stored in the high-order bit of the first byte, the next-highest bit of the first compression code is stored in the next-highest bit of the first byte, and so on
Orientation	274	SHORT	1	The 0th row represents the visual top of the image, and the 0th column represents the visual left-hand side.
SamplesPerPixel	277	SHORT	1	
PlanarConfiguration	284	SHORT	1	
T6Options	293	LONG	0	Values for T6Options other than zero (0) are not allowed since not all G4 decompressors would be able to handle T.6-Encoding options (specifically uncompressed mode).
ResolutionUnit	296	SHORT	2	Inch

8 Private and Additional TIFF Tags

8.1 Private TIFF Tag Definition

The TIFF 6.0 specification defines Private Tags as being any tag numbered 32768 or higher.

8.2 Additional TIFF Tags Definition

Additional TIFF Tags are any TIFF 6.0 documented TIFF Tags not listed in Table 1 or 2.

8.3 Usage

Private and Additional Tags shall be syntactically correct as documented in the TIFF 6.0 specification. Additional TIFF Tags shall not conflict with any Bilevel baseline TIFF Tags. Any Private and Additional Tags may be ignored by the receiver and are not required to be maintained with the image.