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Third edition

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Information technology — High efficiency coding and media delivery in heterogeneous environments —

Part 12:  
Image File Format

Technologies de l'information — Codage à haute efficacité et livraison des medias dans des environnements hétérogènes —

Partie 12: Format de fichier d'image

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Contents Page

Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This third edition cancels and replaces the second edition (ISO/IEC 23008-12:2022), which has been technically revised.

The main changes are as follows:

— clarification on the signalling of colour information in image items;

— support for the signalling of camera intrinsic and extrinsic matrices;

— support for progressive decoding, rendering and refinement;

— support for region annotations for image sequence or video track;

— support for renderable text items.

A list of all parts in the ISO/IEC 23008 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](https://www.iso.org/members.html) and [www.iec.ch/national-committees](http://www.iec.ch/national-committees).

Introduction

The Image File Format is designed to enable the interchange of images and image sequences, as well as their associated metadata. It forms part of a family of specifications that are box-structured, and is built using tools defined in the ISO base media file format. This document specifies both structural brands that can be used with any codec and brands specific to High Efficiency Video Coding (HEVC). The file format specified in this document is referred to as the High Efficiency Image File Format (HEIF). It is suggested that HEIF be pronounced "heaff" (like heath with an ff ending). When the requirements of the HEVC-specific brands are applied, the file format can be referred to as the HEVC Image File Format.

This document is organized as follows:

Clause 5 specifies general requirements on files and file readers conforming to the Image File Format.

Clause 6 specifies the file structures for the storage of a single image and an image collection. Additionally, general requirements that shall be supported in all files using the Image File Format for the storage of a single image or an image collection are specified.

Clause 7 specifies the file structures for the storage of image sequences. Additionally, general requirements that shall be supported in all files using the Image File Format for the storage of image sequences are specified.

Clause 8 specifies the metadata structures for a single image, an image collection, and image sequences.

Clause 9 specifies enhancements to the ISO base media file format.

Clause 10 specifies structural brands for a single image and an image collection, as well as image sequences. Requirements on both files and file readers are specified.

Clause 11 specifies tools to associate annotations, e.g. metadata or images with one or more regions of an image or an image sequence.

Annex A specifies the format for storing Exif, XMP, and MPEG-7 metadata in files conforming to the Image File Format.

Annex B specifies the format for encapsulating HEVC-coded images, image collections, and image sequences according to the Image File Format. Annex B also specifies HEVC-specific brands for a single image and an image collection as well as image sequences. Requirements on both files and file readers are specified.

Annex C and Annex D specify the MIME type registration for a single image or an image collection, and image sequences, respectively, for the structural and HEVC-specific brands.

Annex E specifies the format for encapsulating AVC-coded images, image collections, and image sequences according to the Image File Format.

Annex F and Annex G specify the MIME type registration for a single image or an image collection, and image sequences, respectively, for the AVC-specific brands.

Annex H specifies the format for encapsulating JPEG-coded images, image collections, and image sequences according to the Image File Format.

Annex I contains guidelines on defining new image formats and brands.

Annex J contains informative examples of single image and image collection file structures conforming to the Image File Format.

Annex K provides examples of content encoding, file structures and player operations for progressive rendering, progressive decoding and progressive refinement with the Image File Format .

Annex L specifies the format for encapsulating VVC-coded images, image collections, and image sequences according to the Image File Format. Annex L also specifies VVC-specific brands for a single image and an image collection as well as image sequences. Requirements on both files and file readers are specified.

Annex M specifies the format for encapsulating EVC-coded images, image collections, and image sequences according to the Image File Format. Annex M also specifies EVC-specific brands for a single image and an image collection as well as image sequences. Requirements on both files and file readers are specified.

Annex N contains considerations on privacy and security relating to the use of the Image File Format.

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Editors note: This document is currently written in the amendment style. Once HEIF 3ed AMD1 and AMD2 are more stable it will be converted to a full integrated edition. At that point I will also correct formatting and ToC.

## Clause 3.1

*Add the following term*

3.1.xx  
**crop-rotate-mirror grid derived image item***derived image item* (3.1.8) of type 'grid' that is not associated with any other types of e*ssential item properties* (3.1.12) than 'colr', 'irot', 'clap', and 'imir'

## Clause 6.3

*Add the following before the last paragraph in clause 6.3:*

Auxiliary image item associations are not carried over from the input image items to the derived image item.

NOTE Alpha auxiliary image item associations themselves are not carried over from the input image items to the derived image item, but the transparency data is forwarded from the input image items to the derived image item as an alpha channel. See 6.9.1.

## Clause 6.5.6.1

*Append the following note*

NOTE Clause 6.9.1 contains constraints on the value of channel\_idc for alpha planes.

## Clause 6.6

*Add the following at the end of subclause 6.6.2.1 Identity derivation:*

NOTE Alpha information is carried over from the input image to the output of the 'iden' derived image item as a channel, whether originally stored as a dedicated channel or as a separate alpha auxiliary item.

*Add the following at the end of subclause 6.6.2.2.1 Image overlay derivation definition:*

If present, the normalized values of the alpha planes of the input image items of a 'iovl' derived image item shall be used as the *α* variable in the formulas defined in 6.9.1 when iteratively overlaying each input image into the canvas. The alpha plane of an input image may be stored as a channel in the same input image item, or as an alpha auxiliary image item associated with that input image item.

The output of a 'iovl' derived image item is opaque and does not carry transparency information if the A value of the canvas\_fill\_value is equal to 65535 (fully opaque). Otherwise, the output of a 'iovl' derived image item may be transparent or opaque, and carries transparency information coming from a combination of the alpha planes of the input image items and the A value of the canvas\_fill\_value.

NOTE An alpha auxiliary item can be associated with a 'iovl' derived image item only if the A value of the canvas\_fill\_value is equal to 65535. See 6.9.1.

*Replace the canvas\_fill\_value semantics in subclause 6.6.2.2.3 with the following:*

canvas\_fill\_value indicates the pixel value per channel used as the base color and transparency values of the canvas, before any layering of input images occurs. The fill values are specified as R, G, B, and A, in this order corresponding to loop counter j equal to 0, 1, 2, and 3, respectively. The R, G, and B values are specified in the same RGB color space as the first input image item (e.g. same ICC profile, or same ColorPrimaries and TransferCoefficients; ignoring MatrixCoefficients and VideoFullRangeFlag), ranging from 0 to 65535. The A value is a linear opacity value ranging from 0 (fully transparent) to 65535 (fully opaque). The R, G, and B values are not pre-multiplied by the A value.

*Add the following at the end of subclause 6.6.2.3.1 Image grid derivation definition:*

NOTE If any, alpha information is carried over as a channel from the input images to the output of the 'grid' derived image item, whether stored as dedicated channels in the input images or as separate alpha auxiliary items associated with the input images.

*Add the following at the end of subclause 6.6.2.4.1 Tone-map derivation definition:*

Only color data (luma/chroma) shall be tone-mapped. The other channels from the base input image, such as alpha and depth, shall be carried over without transformation to the 'tmap' derived image item output.

NOTE Depth auxiliary image item associations are not carried over from input items to the 'tmap' derived item.

The gain map input image should only carry color planes. The other channels from the gain map input image, such as alpha and depth, shall be ignored in the context of the tone-mapping operation and not carried over to the 'tmap' derived image item output.

## Clause 6.8.11

*Add the following subclause 6.8.11*

#### 6.8.11 Session entity group

The session entity group ('sess') indicates a set of entities that belong to a session.

All image items (potentially in multiple files) sharing the same session\_ID belong to the same session.

NOTE Example use cases are multiple files captured from different angles of an object, or the same scene or photographic event captured with multiple cameras or settings.

If two or more image items belonging to different files share the same session\_ID and are associated with CameraExtrinsicMatrixProperty boxes containing the same coordinate system identifier they shall share the same global coordinate system rather than having local coordinate systems per file.

The CreationTimeProperty item property should be used to signal the capture time of the image items associated with a specific session\_ID.

## Clause 6.9.1

*Add the following note after the first paragraph:*

NOTE The use of CICP in "CICP-compliant" is for historical reasons and has no impact.

*Add the following text after the paragraph starting with "* *Alpha planes should be encoded in monochrome":*

If a PixelInformationProperty with (px\_flags & 1) equal to 1 is associated with an image item describing a CICP-compliant alpha plane, one (and only one) component shall have a channel\_idc set to 5 (alpha).

*Add the following at the end of subclause 6.9.1:*

The formulas above should be performed in the same linear RGB color space. Prior to applying the formulas above, *m* and *vi* should have been converted from their original color space to the same linear RGB color space, and *vu* may be converted from that linear RGB color space to another color space if necessary. If the master image is pre-multiplied in gamma RGB space, the pre-multiplication of *m* should be undone before converting it to linear RGB. An item reference (respectively track reference) of type 'prem' from the master image item (respectively master image sequence track) to the auxiliary image item (respectively auxiliary image sequence track) should be assumed to signal that the master image is pre-multiplied by the alpha value in gamma RGB space.

NOTE 1 The common behaviour of not converting from gamma-encoded RGB to linear RGB before alpha compositing is acknowledged. It is encouraged to correct these layering inaccuracies on a best effort basis, as it could imply parsing and applying CICP values or ICC profiles.

NOTE 2 If compositing is performed in gamma-encoded RGB and the RGB values are pre-multiplied in gamma-encoded RGB, there is no need to undo the pre-multiplication. Moreover, if the values are not pre-multiplied, then compositing in RGB or in YUV is equivalent.

Unless opaque or absent, the alpha plane of the visual context is updated by performing the following operation for each co-located pixel of the master image and the visual context:

*αu* = *α* + *αi* × (1 − *α*)

where

*αu* is the value of the alpha plane of a pixel in the updated visual context,

*α* is an alpha plane value as described above, and

*αi* is the value of the alpha plane of a pixel in the visual context given as input to the process.

The visual context value *vi* and the updated visual context value *vu* are pre-multiplied by alpha values *αi* and *αu*, respectively.

NOTE The non-pre-multiplied updated visual context value is .

Alpha planes from alpha auxiliary image items and alpha auxiliary tracks shall be processed as if that alpha plane was instead a dedicated channel in the output master image.

NOTE This means alpha auxiliary items associated with input items of a derived item are applied or carried over to the output of that derived item.

NOTE Transformative properties associated with the master image item do not apply to its associated alpha auxiliary image item. The carried over alpha plane is considered present in the output image only once the transformative properties were applied to the master image item.

Alpha auxiliary image items and alpha auxiliary tracks should not be associated with image items and tracks already possessing transparency data. The first alpha channel in increasing component order takes precedence if there are multiple transparency data planes. The other transparency data planes are ignored.

## Clause 6.9.1

*Add the following at the end of subclause 6.9.2 CICP-compliant depth map:*

Depth information from depth auxiliary image items and depth auxiliary tracks shall be processed as complimentary side data linked only to the explicitly associated image item, and not considered as a dedicated channel in the master image.

NOTE This means depth auxiliary items associated with input items of a derived item are NOT carried over to the output of that derived item. However, a depth channel is forwarded from an input item to the derived item output.

## Clause B.4.1.2

*Replace the following text*

* The item is a crop-rotate-mirror derived image item, and the source image item of the item is either a crop-rotate-mirror derived image item or a coded image item that is present in the file and conforms to the 'heic' brand as specified in B.4.1.1.

*With*

* The item is a crop-rotate-mirror derived image item or a crop-rotate-mirror grid derived image item and any input image of any operation used to derive the item only consists of a crop-rotate-mirror derived image item, a crop-rotate-mirror grid derived image item or a coded image item present in the file that conform to the 'heic' brand as specified in B.4.1.1.

*Do the same replacement in the corresponding constraint for the 'heix' brand*