

DICOM Correction Item

Correction Number		CP-165
Log Summary: Icon Image Sequence for Composite Image IODs		
Type of Modification	Name of Standard	
Addition	PS 3.3, 3.5 – 2000	
<p>Rationale for Correction</p> <p>The DICOM Standard defines an Icon Image Sequence which can be present in a DICOMDIR file on media. This Sequence contains the image stamps of the images stored on this specific media. But it doesn't say anything about if this sequence is also allowed inside the images (on this media or transferred via network). The compression of icons was never considered when the compressed transfer syntaxes were defined.</p> <p>Also when storing the Image Stamp inside a composite image we run into a problem regarding compression. Part 5 states that in case of compression all DICOM tags (7FE0,0010) have to be compressed with the algorithm defined in the Transfer Syntax. This implies that the Icon Image Sequence should also contain compressed pixel data. From our point of view this is not intended as the Icon Image is pretty small and its quality should not be further reduced especially in case of JPEG lossy compression.</p> <p>Three alternative solutions are possible:</p> <ol style="list-style-type: none"> 1) Same Transfer Syntax for the Icon Image Sequence as the Image Pixel Data (e.g. compressed), 2) Exempt Icon Image Sequences from compression, 3) Allow pixel data to be either compressed or uncompressed within embedded sequences. <p>Alternative 1 is not attractive since icons must always be compressed. Alternative 2 is problematic since it would invalidate existing images with compressed embedded icons. Alternative 3 offers the most flexible approach and is detailed below.</p>		
Sections of documents affected		
PS 3.3 Section C.7.6.1, PS 3.5 Section A.		
Correction Wording:		

Amend the following entry in Section C.7.6.1 General Image Module Table C7-7 GENERAL IMAGE MODULE ATTRIBUTES in PS 3.3

Attribute Name	Tag	Type	Attribute Description
Icon Image Sequence	(0088,0200)	3	This icon image is representative of the Image.
> Image Pixel Module			See C.7.6.1.1.6 for further explanation.

Amend the following sub-section in Section C.7.6.1.1 General Image Attributes Description in PS 3.3

C.7.6.1.1.6 Icon Image Sequence

An Icon Image may be used as a key representative of an Image. It is defined as a Sequence which contains a single Item encapsulating the Data Set made of the Data Elements of the Icon Image. The Data Elements are defined by the Image Pixel Module (see Section C.7.6.3). The restrictions defined in Section F.7 shall apply.

Amend the following exception note in Section A.4 TRANSFER SYNTAXES FOR ENCAPSULATION OF ENCODED PIXEL DATA in PS 3.5.

A.4 TRANSFER SYNTAXES FOR ENCAPSULATION OF ENCODED PIXEL DATA

These Transfer Syntaxes apply to the encoding of the entire DICOM Data Set, even though the image Pixel Data (7FE0,0010) portion of the DICOM Data Set is the only portion that is encoded by an encapsulated format. This implies that when a DICOM Message is being encoded according to an encapsulation Transfer Syntax the following requirements shall be met:

- a) The Data Elements contained in the Data Set structure shall be encoded with Explicit VR (with a VR Field) as specified in Section 7.1.2.
- b) The encoding of the overall Data Set structure (Data Element Tags, Value Length, etc.) shall be in Little Endian as specified in Section 7.3.
- c) The encoding of the Data Elements of the Data Set shall be as follows according to their Value Representations:
 - For all Value Representations defined in this part of the DICOM Standard, except for the Value Representations OB and OW, the encoding shall be in Little Endian as specified in Section 7.3.
 - For the Value Representations OB and OW, the encoding shall meet the following specification depending on the Data Element Tag:
 - Data Element (7FE0,0010) Pixel Data **may be encapsulated or native.**

It shall be encapsulated if present in the top-level Data Set (i.e. not nested within a Sequence Data Element).

Note: The distinction between fixed value length (native) and undefined value length (encapsulated) is present so that the top level data set Pixel Data can be compressed (and hence encapsulated), but the Pixel Data within an Icon Image Sequence may or may not be compressed.

If native, it shall have a defined Value Length, and be encoded as follows:

- **where Bits Allocated (0028,0100) has a value greater than 8 shall have Value Representation OW and shall be encoded in Little Endian;**
- **where Bits Allocated (0028,0100) has a value less than or equal to 8 shall have the Value Representation OB or OW and shall be encoded in Little Endian.**

Note: That is, as if the transfer syntax were Explicit VR Little Endian.

If encapsulated, it has the Value Representation OB and is a sequence of bytes resulting from one of the encoding processes. It contains the encoded pixel data

stream fragmented into one or more Item(s). This Pixel Data Stream may represent a Single or Multi-frame Image. See Tables A.4-1 and A.4-2:

- The Length of the Data Element (7FE0,0010) shall be set to the Value for Undefined Length (FFFFFFFFH).
- Each Data Stream Fragment encoded according to the specific encoding process shall be encapsulated as a DICOM Item with a specific Data Element Tag of Value (FFFE,E000). The Item Tag is followed by a 4 byte Item Length field encoding the explicit number of bytes of the Item.
- All items containing an encoded fragment shall be made of an even number of bytes greater or equal to two. The last fragment of a frame may be padded, if necessary, to meet the sequence item format requirements of the DICOM Standard.

- Notes: 1. Any necessary padding may be added in the JPEG compressed data stream as per ISO 10918-1 such that the End of Image (EOI) marker ends on an even byte boundary, or may be appended after the EOI marker, depending on the implementation.
2. ISO 10918-1 defines the ability to add any number of padding bytes FFH before any marker (all of which also begin with FFH). It is strongly recommended that FFH padding bytes not be added before the Start of Image (SOI) marker.

- The first Item in the Sequence of Items before the encoded Pixel Data Stream shall be a Basic Offset Table item. The Basic Offset Table Item Value, however, is not required to be present:
 - When the Item Value is not present, the Item Length shall be zero (00000000H) (see Table A.4-1).
 - When the Item Value is present, the Basic Offset Table Item Value shall contain concatenated 32-bit unsigned integer values that are byte offsets to the first byte of the Item Tag of the first fragment for each frame in the Sequence of Items. These offsets are measured from the first byte of the first Item Tag following the Basic Offset Table item (See Table A.4-2).

Note: For a Multi-Frame Image containing only one frame or a Single Frame Image, the Basic Offset Table Item Value may be present or not. If present it will contain a single 00000000H value.

- This Sequence of Items is terminated by a Sequence Delimiter Item with the Tag (FFFE,E0DD) and an Item Length Field of Value (00000000H) (i.e., no Value Field shall be present).