

DICOM Correction Item

Correction Number		CP-270
Log Summary: Add Contributing Equipment Sequence		
Type of Modification	Name of Standard	
Addition	PS 3.3 2000	
<p>Rationale for Correction</p> <p>This CP addresses 2 separate, but related, problem scenarios (there were originally 2 separate CPs which have been merged into this CP):</p> <p><i>Problem Scenario 1:</i></p> <p>The Equipment Module describes its attributes in relation to the equipment that produced the digital images (e.g. Institution Department Name, Manufacturer's Model Name, or Software Versions). The meaning of "produced" in this context is ambiguous and has been interpreted in different ways (device which originally created the information from which this instance is derived, or device which creates this instance). The conditions under which a post-processing application considers itself to be a "producer" of images can vary considerably (e.g. MPR, Virtual Endoscopy, Image Fusion).</p> <p>The DICOM Composite Instance IOD Model (Part 3, A.1.2) specifies that one piece of Equipment creates 1-n Series containing 1-n Composite Instances.</p> <p>Existing post-processing applications generally fill Equipment Module attributes in one of 2 ways when creating derived images:</p> <ol style="list-style-type: none"> 1. Equipment identification from the original images are copied (incompatible with the IOD Model) 2. Equipment identification of the device running the post-processing application are inserted (compatible with the IOD Model) <p>In the first case, information about the post-processing application does not get recorded. In the second case, information about the original acquisition device is lost. Information about the original acquisition device is important since it can affect interpretation (e.g. Manufacture's Model Name to easily distinguish high-end from low-end devices) and is often displayed as annotative text.</p> <p>Flexibility is required since:</p> <ol style="list-style-type: none"> a) Multiple Acquisition devices may have contributed to the produced images (e.g. Image Fusion). b) Some devices (e.g. Film Digitizers or Video Capture) may not have access to information about the original acquisition device. <p><i>Problem Scenario 2:</i></p> <p>It is common in the field to have certain attributes in the SOP Instance modified by the equipment other than the original producer of such SOP Instance, without changing that SOP Instance UID. Examples are QA Stations, integration "black boxes", archives, etc.</p> <p>Unfortunately, there is no provision in the standard that would allow the equipment that makes modifications to include its identification into the object, and more often than not, it would replace information in the General Equipment Module. Thus, the knowledge of the original creator of the object is being lost.</p> <p><i>Proposed Solution:</i></p> <p>It is proposed to add a sequence to the SOP Common Module where information about the Contributing Equipment can be recorded. The reason for the equipment reference is identified via a coded entry.</p> <p>Also, correct the descriptions of attributes in the Module to refer to composite instances rather than digital images.</p>		

Spatial Resolution	(0018,1050)	3	The inherent limiting resolution in mm of the acquisition equipment for high contrast objects for the data gathering and reconstruction technique chosen. If variable across the images of the series, the value at the image center.
Date of Last Calibration	(0018,1200)	3	Date when the image acquisition device calibration was last changed in any way. Multiple entries may be used for additional calibrations at other times. See C.7.5.1.1.1 for further explanation.
Time of Last Calibration	(0018,1201)	3	Time when the image acquisition device calibration was last changed in any way. Multiple entries may be used. See C.7.5.1.1.1 for further explanation.
Pixel Padding Value	(0028,0120)	3	Value of pixels added to non-rectangular image to pad to rectangular format. See C.7.5.1.1.2 for further explanation. Note: The Value Representation of this Attribute is determined by the value of Pixel Representation (0028,0103).

2 **C.7.5.1.1 General Equipment Attribute Descriptions**

C.7.5.1.1.1 Date Of Last Calibration, Time Of Last Calibration

4 Date of Last Calibration (0018,1200) and Time of Last Calibration (0018,1201) are used to
 6 convey the date and time of calibration. The Attribute Date of Last Calibration (0018,1200)
 8 may be supported alone, however, Time of Last Calibration (0018,1201) Attribute has no
 meaning unless Attribute Date of Last Calibration (0018,1200) is also supported. The order
 for each Attribute shall be from the oldest date/time to the most recent date/time. When the
 Attributes are both supported they shall be provided as pairs.

10 **C.7.5.1.1.2 Pixel Padding Value**

Pixel Padding Value (0028,0120) is used to pad non-rectangular images to rectangular
 12 format. The native format of some images is not rectangular. It is common for devices with this
 14 format to pad the images to the rectangular format required by the DICOM Standard with a
 specific pixel value that is not contained in the native image. This attribute specifies the value
 of this padding value.

- 16 Notes: 1. When the relationship between pixel value and X-Ray Intensity is unknown, it is
 recommended that the following values be used to pad with black:
 18 0 if Photometric Interpretation (0028,0004) is MONOCHROME2.
 $2^{\text{BitsStored}} - 1$ if Photometric Interpretation (0028,0004) is MONOCHROME1.
 20 2. When the relationship between pixel value and X-Ray Intensity is known (for example as
 defined by Pixel Intensity Relationship (0028,1040) and Pixel Intensity relationship Sign
 22 (0028,1041)), it is recommended that a value equivalent to air be used.

24 **When modifying equipment changes the pixel padding value in the image, it shall change the value of Pixel Padding Value (0028,0120).**

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Item 2: Add the following rows to PS 3.3, Section C.12.1 SOP Common Module, Table C.12-1 SOP Common Module Attributes

28 **Table C.12-1
SOP COMMON MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
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Contributing Equipment Sequence	(0018,A001)	3	Sequence of Items containing descriptive attributes of related equipment which has contributed to the acquisition, creation or modification of the composite instance. One or more Items may be included in this Sequence. See C.12.1.1.4 for further explanation.
>Purpose of Reference Code Sequence	(0040,A170)	1	Describes the purpose for which the related equipment is being referenced. See C.12.1.1.4 for further explanation.
>>Include 'Code Sequence Macro' Table 8.8-1			Defined Context ID 7005.
>Manufacturer	(0008,0070)	1	Manufacturer of the equipment that contributed to the composite instance.
>Institution Name	(0008,0080)	3	Institution where the equipment that contributed to the composite instance is located.
>Institution Address	(0008,0081)	3	Address of the institution where the equipment that contributed to the composite instance is located.
>Station Name	(0008,1010)	3	User defined name identifying the machine that contributed to the composite instance.
>Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment that contributed to the composite instance is located.
>Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name of the equipment that contributed to the composite instance.
>Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that contributed to the composite instance.
>Software Versions	(0018,1020)	3	Manufacturer's designation of software version of the equipment that contributed to the composite instance.
>Spatial Resolution	(0018,1050)	3	The inherent limiting resolution in mm of the acquisition equipment for high contrast objects for the data gathering and reconstruction technique chosen. If variable across the images of the series, the value at the image center.

>Date of Last Calibration	(0018,1200)	3	Date when the image acquisition device calibration was last changed in any way. Multiple entries may be used for additional calibrations at other times. See C.7.5.1.1.1 for further explanation.
>Time of Last Calibration	(0018,1201)	3	Time when the image acquisition device calibration was last changed in any way. Multiple entries may be used. See C.7.5.1.1.1 for further explanation.
>Contribution DateTime	(0018,A002)	3	The Date & Time when the equipment contributed to the composite instance.
>Contribution Description	(0018,A003)	3	Description of the contribution the equipment made to the composite instance.
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Item 3: Add the following sub-section to PS 3.3, Section C.12.1.1 SOP Common Attribute Descriptions

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C.12.1.1.4 Contributing Equipment Sequence

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Contributing Equipment Sequence (0018,A001) allows equipment to be described which has contributed towards the creation of the composite instance. The general class of contribution is denoted via a coded entry within the Purpose of Reference Code Sequence (0040,A170).

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Notes: 1. For example, a post-processing application creating DERIVED images from ORIGINAL images would place its own identification within the Equipment Module and identify the original acquisition equipment as an Item within the Contributing Equipment Sequence (0018,A001). Here, the value of the Purpose of Reference Code Sequence (0040,A170) within the Item would be (109101, DCM, "Acquisition Equipment"). Image display applications wishing to annotate images with information related to the acquisition environment would prefer to extract such details from the Contributing Equipment Sequence rather than the Equipment Module.

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2. For example, an image fusion application would place its own identification within the Equipment Module and identify each of the original acquisition equipment as separate Items within the Contributing Equipment Sequence (0018,A001). Here, the value of the Purpose of Reference Code Sequence (0040,A170) within each Item would be (109101, DCM, "Acquisition Equipment").

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3. For example, a post-processing application creating DERIVED images from other DERIVED images would place its own identification within the Equipment Module and add the source equipment as an additional Item within the Contributing Equipment Sequence (0018,A001). Here, the value of the Purpose of Reference Code Sequence (0040,A170) within the Item would be (109102, DCM, "Processing Equipment").

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4. For example, a gateway device that coerces attributes of existing composite instances (without creating new composite instances) would retain information about the creating equipment within the Equipment Module and provide its own identification as an Item within the Contributing Equipment Sequence (0018,A001). Here, the value of the

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2 Purpose of Reference Code Sequence (0040,A170) within the Item would be (109103, DCM, "Modifying Equipment").

4 Item 4: Add the following lines in Section 6 of PS 3.6

Tag	Name	VR	VM
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(0018,A001)	Contributing Equipment Sequence	SQ	1
(0018,A002)	Contribution DateTime	DT	1
(0018,A003)	Contribution Description	ST	1
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Item 5: Add new Context Group to Annex B of PS 3.16

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CID 7005

CONTRIBUTING EQUIPMENT PURPOSES OF REFERENCE

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Type: Extensible
Version: 20030108

<u>Coding Scheme Designator (0008,0102)</u>	<u>Code Value (0008,0100)</u>	<u>Code Meaning (0008,0104)</u>
<u>DCM</u>	<u>109101</u>	<u>Acquisition Equipment</u>
<u>DCM</u>	<u>109102</u>	<u>Processing Equipment</u>
<u>DCM</u>	<u>109103</u>	<u>Modifying Equipment</u>

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Item 6: Add new DCM Code Definitions to Annex D of PS 3.16

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DICOM Code Definitions (Coding Scheme Designator "DCM" Coding Scheme Version "01")

<u>Code Value</u>	<u>Code Meaning</u>	<u>Definition</u>
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<u>109101</u>	<u>Acquisition Equipment</u>	<u>Equipment that originally acquired the data stored within composite instances. For example, a CT, MR or Ultrasound modality.</u>
<u>109102</u>	<u>Processing Equipment</u>	<u>Equipment that has processed composite instances to create new composite instances. For example, a 3D Workstation.</u>

109103	Modifying Equipment	Equipment that has modified existing composite instances (without creating new composite instances). For example, a QA Station or Archive.
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