



# CAN-RT-14P001 REVISION 05

## RADIOGRAPHIC EXAMINATION



ASME V, ARTICLE 2

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**Notes:** This document was renamed from AGI RT 01 to CAN-RT-14P001 and may also be used when AGI RT 01 is referenced.

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**QUALITY "EVERY CLIENT, EVERYWHERE, EVERY DAY"**

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## CAN-RT-14P001 REVISION 05

Radiographic Examination (ASME V, Article 2)

November 15, 2013

Revision Summary		
Revision No.	Date	Description
00	---	First revision.
01	December 01, 2011	Changes made to language throughout to clarify and ensure compliance with the standard.
02	July 01, 2012	Document and references renamed. Corrected wording in 6.5.
03	June 06, 2013	Updated document format.
04	August 09, 2013	Regenerated document due to problems with PDF conversion of scanned tables. No technical changes.
05	November 15, 2013	Updated for ASME V 2013. Revised 2.0, 3.0, 4.0, and 8.0. Updated document tables and corrected figure references in Appendices.



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**1.0 SCOPE**

This procedure provides instruction to Acuren technicians performing radiographic examination in accordance with ASME Section V, Article 2. It is to be applied when that standard is referenced and may also be used when no inspection protocol is specified.

**2.0 REFERENCES**

- 2.1 Acuren Radiation Safety Management System
- 2.2 Acuren Safety Management System
- 2.3 ASME Section V (2013) Article 2 and 22 (SE 747, SE 1025)
- 2.4 CAN-CP-02P001 Acuren Canada SNT-TC-1A Written Practice

**3.0 PERSONNEL**

Radiography shall be carried out by certified personnel with the responsibilities listed below. RT Level II or III personnel as described shall be certified to the requirements of the Acuren written practice CAN-CP-02P001. Note: Certain codes or standards may require the use of additional or alternate certification schemes.

- 3.1 An exposure device or x-ray tube must only be operated by a Certified Exposure Device Operator (CEDO) or an EDO trainee under the direct supervision of a CEDO. Radiographic inspections must be performed as per the Acuren RSMS.
- 3.2 An RT Level II or III technician shall carry out final interpretation and sign the report.
- 3.3 An RT Level III technician shall approve new or revised techniques and procedures.

**4.0 SAFETY**

- 4.1 Personnel shall;
  - 4.1.1 comply with the requirements of the Acuren Radiation Safety Management System and Acuren Safety Management System.
  - 4.1.2 follow all Client and project specific safety requirements.
- 4.2 All personnel carrying out radiographic inspections, are responsible for the safety of others working near the area of radiation. Protection and monitoring shall comply with government and CNSC requirements.

**5.0 EQUIPMENT AND MATERIALS**

- 5.1 Radiographic Energy
  - 5.1.1 Types

The energy source may be either X-ray or gamma ray that can achieve the density and IQI image requirements of this procedure. X-ray generators used by Acuren (Canada) have a maximum output of 350KV.

**5.1.2 Source (Focal Spot) Size**

- a) Source size varies with the isotope type and strength. Maximum isotope dimensions are 3.5mm for Selenium, 5.0mm for Iridium 192 and 7.0mm for Cobalt 60. Use the actual sizes provided on the manufacturer supplied decay charts that accompany the source for reporting and for "F" when calculating geometric unsharpness (6.12).
- b) Focal spot varies with each x-ray generator. The focal spot or target size is indicated on the tube head. Use this figure indicated for reporting and for "F" when calculating geometric unsharpness.

**5.2 Radiographic Film**

Common types of industrial radiographic film in use at Acuren are listed below. Alternate types or alternate manufacturers may be used with approval of a Level III. The signature of a Level III on the final report is considered approval. Type and size are dependent upon application and may vary but density and sensitivity requirements must be met.

FILM TYPES					
Agfa	Class*	Kodak	Class*	Fuji	Class*
Structurix D2	Special	DR50	---	---	---
Structurix D3	I	M100	I	IX 50	I
Structurix D4	I	MX125	---	---	---
Structurix D5	I	T200	I	IX 80	I
Structurix D7	II	AA400	II	IX 100	II

\*Refers to the manufacturers supplied class rating of the film per ISO 11699-1.

Film shall be of sufficient length and width to allow a minimum of 25 mm of overlap on consecutive circumferential exposures and a minimum of 20 mm coverage on either side of the weld where configuration permits.

**5.3 Radiographic Screens**

Screens are not required but lead or lead foil screens may be used. Typical configuration is 0.127mm (0.005") front and 0.254mm (0.010") back. Screens shall be free of dirt, oxidization and surface anomalies.

**5.4 Image Quality Indicators (IQI)**

Only IQI's meeting the requirements of SE1025 (hole type) or SE-747(wire type) are to be used. Acuren supplies IQI's meeting these requirements as per the following IQI tables.

**Table T-233.1**  
**Hole-Type IQI Designation, Thickness, and Hole Diameters**

IQI Designation	IQI Thickness, in. (mm)	1T Hole Diameter, in. (mm)	2T Hole Diameter, in. (mm)	4T Hole Diameter, in. (mm)
5	0.005 (0.13)	0.010 (0.25)	0.020 (0.51)	0.040 (1.02)
7	0.0075 (0.19)	0.010 (0.25)	0.020 (0.51)	0.040 (1.02)
10	0.010 (0.25)	0.010 (0.25)	0.020 (0.51)	0.040 (1.02)
12	0.0125 (0.32)	0.0125 (0.32)	0.025 (0.64)	0.050 (1.27)
15	0.015 (0.38)	0.015 (0.38)	0.030 (0.76)	0.060 (1.52)
17	0.0175 (0.44)	0.0175 (0.44)	0.035 (0.89)	0.070 (1.78)
20	0.020 (0.51)	0.020 (0.51)	0.040 (1.02)	0.080 (2.03)
25	0.025 (0.64)	0.025 (0.64)	0.050 (1.27)	0.100 (2.54)
30	0.030 (0.76)	0.030 (0.76)	0.060 (1.52)	0.120 (3.05)
35	0.035 (0.89)	0.035 (0.89)	0.070 (1.78)	0.140 (3.56)
40	0.040 (1.02)	0.040 (1.02)	0.080 (2.03)	0.160 (4.06)
45	0.045 (1.14)	0.045 (1.14)	0.090 (2.29)	0.180 (4.57)
50	0.050 (1.27)	0.050 (1.27)	0.100 (2.54)	0.200 (5.08)
60	0.060 (1.52)	0.060 (1.52)	0.120 (3.05)	0.240 (6.10)
70	0.070 (1.78)	0.070 (1.78)	0.140 (3.56)	0.280 (7.11)
80	0.080 (2.03)	0.080 (2.03)	0.160 (4.06)	0.320 (8.13)
100	0.100 (2.54)	0.100 (2.54)	0.200 (5.08)	0.400 (10.16)
120	0.120 (3.05)	0.120 (3.05)	0.240 (6.10)	0.480 (12.19)
140	0.140 (3.56)	0.140 (3.56)	0.280 (7.11)	0.560 (14.22)
160	0.160 (4.06)	0.160 (4.06)	0.320 (8.13)	0.640 (16.26)
200	0.200 (5.08)	0.200 (5.08)	0.400 (10.16)	...
240	0.240 (6.10)	0.240 (6.10)	0.480 (12.19)	...
280	0.280 (7.11)	0.280 (7.11)	0.560 (14.22)	...

**Table T-233.2**  
**Wire IQI Designation, Wire Diameter, and Wire Identity**

Set A			Set B		
Wire Diameter, in.	Wire (mm)	Wire Identity	Wire Diameter, in.	Wire (mm)	Wire Identity
0.0032	(0.08)	1	0.010	(0.25)	6
0.004	(0.10)	2	0.013	(0.33)	7
0.005	(0.13)	3	0.016	(0.41)	8
0.0063	(0.16)	4	0.020	(0.51)	9
0.008	(0.20)	5	0.025	(0.64)	10
0.010	(0.25)	6	0.032	(0.81)	11
Set C			Set D		
Wire Diameter, in.	Wire (mm)	Wire Identity	Wire Diameter, in.	Wire (mm)	Wire Identity
0.032	(0.81)	11	0.100	(2.54)	16
0.040	(1.02)	12	0.126	(3.20)	17
0.050	(1.27)	13	0.160	(4.06)	18
0.063	(1.60)	14	0.200	(5.08)	19
0.080	(2.03)	15	0.250	(6.35)	20
0.100	(2.54)	16	0.320	(8.13)	21

**5.5 Viewing Facilities**

Viewing facilities shall provide subdued background lighting of an intensity that will not cause reflections, shadows or glare on the radiograph that interfere with the interpretation process. The viewer shall have a variable light source sufficient for the essential IQI hole or designated wire to be visible for the specified density range. Viewing conditions shall be such that light from around the outer edge of the radiograph or coming through low-density portions of the radiograph does not interfere with interpretation.

**5.6 Densitometers and Step Wedge Comparators**

Densitometers shall be calibrated every 90 days in accordance with CAN-CAL-02P001.

Density of the radiograph shall be determined using either a step wedge (density strip) that has been verified within the previous 12 months or a calibrated densitometer.

5.6.1 Step wedge comparison strips must have a minimum of five steps with densities from at least 1.0 to 4.0. It may be purchased with verification to a national standard by the manufacturer. Alternatively it may be verified with a calibrated densitometer. When verified with a densitometer the step wedge film is acceptable if the density readings do not vary by more than  $\pm 0.1$  density units from the calibrated strip.

5.6.2 When densitometers are used they must be checked against the calibrated density strip at the beginning of each shift, after eight hours of continuous use, or change of apertures. Allow the densitometer to warm up for five minutes. Zero the instrument. Take four readings at the control strip densities nearest to 1.0, 2.0, 3.0 and 4.0. Results must be  $\pm 0.05$ . Results of this verification need not be recorded.

**5.7 Documentation**

Each technician shall have access to current versions of; this procedure, the Acuren Code Acceptance Extracts, an Acuren supplied report form and a copy of a work order or call sheet where applicable (see 6.0).

**6.0 EXAMINATION**

Client information and specific examination requirements including acceptance criteria shall be provided to the technician in the form of a Work Order (Call Sheet) prior to the start of examination. On projects where work orders are not issued detailed instructions shall be provided to the technician by the project supervisor, preferably in writing.

**6.1 Radiographic Technique**

Whenever practical a single-wall exposure technique shall be used. When this is not practical a double-wall technique shall be used. Technique numbers referred to are located in Appendix 2. An adequate number of exposures shall be made to demonstrate that the required coverage has been obtained.

**6.1.1 Single-Wall Techniques with Single Wall Viewing**

The radiation passes through only one wall of the weld or material and one wall is viewed (Techniques 1, 2 and 3)

#### 6.1.2 Double Wall Techniques

When configuration does not allow single wall technique a double wall technique is required. These techniques describe the minimum number of exposures, however additional exposures may be required to demonstrate that the required coverage has been obtained.

##### a) Double-Wall with Single Wall Viewing

Radiation passes through two walls and only the weld or material on the film side is viewed. When complete coverage is required for circumferential welds or materials take three exposures at 120 degrees to each other (Techniques 4 and 5).

##### b) Double-Wall Technique with Double Wall Viewing

For materials and welds in components 89 mm (3.5 inches) or less in nominal outside diameter these techniques may be used where the radiation passes through two walls and the weld or material in both walls is viewed. Only source side IQI's shall be used.

Technique 6 - for welds the radiation beam is offset from the plane of the weld at an angle sufficient to separate the images of the source-side and film-side portions of the weld so that there is no overlap of the areas to be interpreted. When complete coverage is required a minimum of two exposures at 90 degrees to each other shall be taken.

Technique 7 – as an alternate for technique 6 the weld may be radiographed with the radiation beam positioned so that the images of both walls are superimposed. When complete coverage is required a minimum of three exposures taken at either 60 or 120 degrees to each other are required.

#### 6.2 Surface Preparation

The finished surface of all butt-welded joints may be flush with the base material or may have reasonably uniform crowns with reinforcement not to exceed that in the referencing Code Section.

If surface irregularities mask or interfere with interpretation of any discontinuity on the radiograph, it may be necessary to remove the weld ripples or weld surface irregularities on both the inside (where accessible) and outside any suitable process to such a degree that the images of surface irregularities cannot mask or be confused with the image of any discontinuity..



**6.3 Film Identification**

- 6.3.1 It is preferred that radiographic identification be a radiographic image using either lead or flash. Where errors or omissions are made, alternate means of permanent marking (indelible marker) are permissible.
- 6.3.2 Minimum identification requires Manufacturer (generally the client) name and the date along with unique identifiers such as contract, component, weld (as per the chart below) or part number.
- 6.3.3 In the absence of specific client requirements use the following identification for welds.

WELD TYPE	IDENTIFICATION
Pipe	X1
Vessel – circumferential	C1
Vessel – longitudinal seam	L1
Vessel – man way	M1
Spot radiograph	S1
Spot radiograph – tracer	S1T1

- 6.3.4 Repairs are identified using the original identification with R1, R2 added as applicable.
- 6.3.5 Welds that have been removed or "cut out" shall be marked with the suffix CO.

**6.4 Location Markers**

Location markers must be placed on the part not on the film cassette. Their locations shall be marked on the part or on a map permitting the area of interest on the radiograph to be traceable to its location on the part. Where multiple films are required, the next film in a series must show the last location marker on the preceding film. See Figure T-275 for sketches of placement as described below.

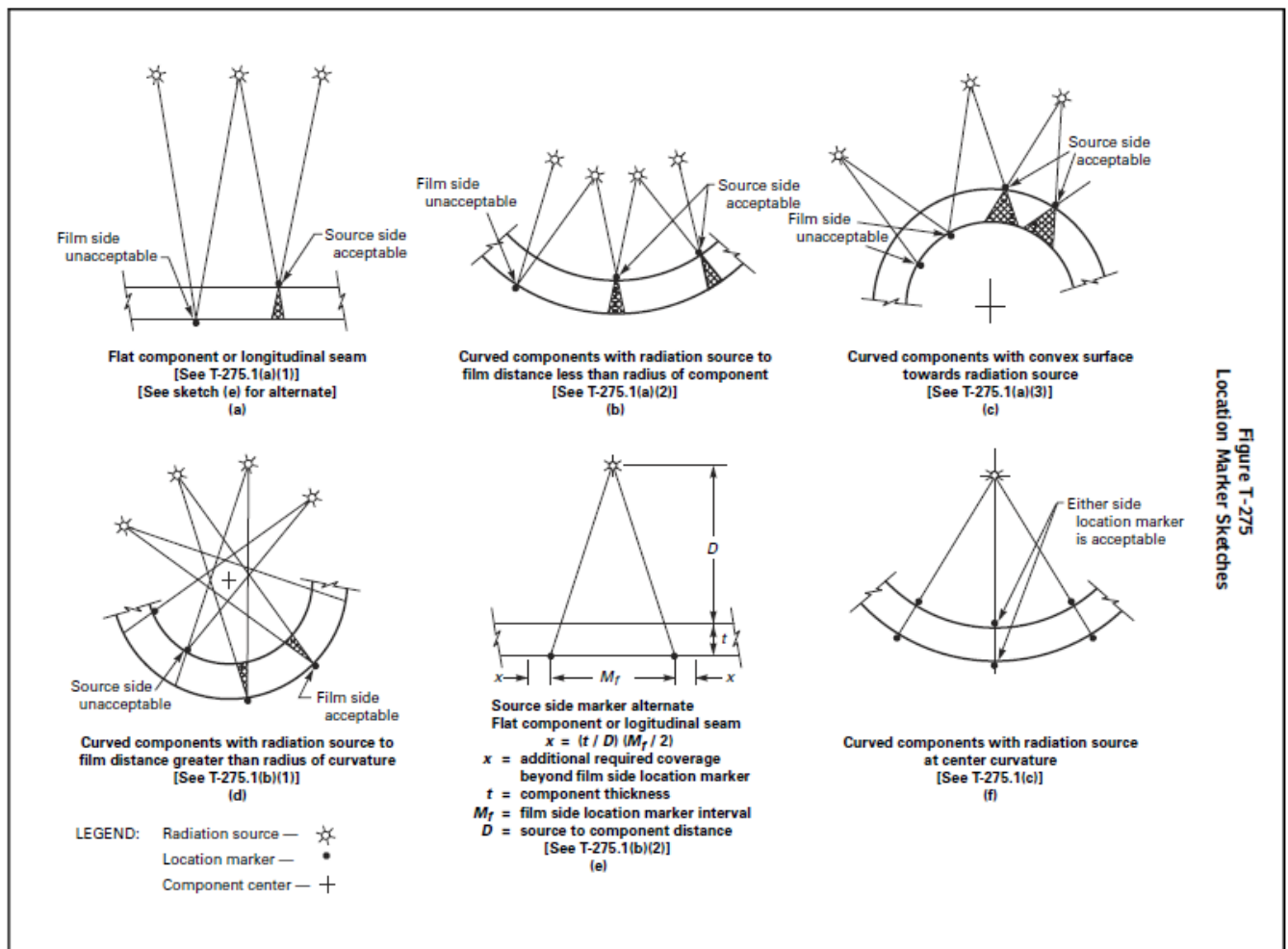
**6.4.1 Single Wall Viewing****a) Source Side Markers**

Place markers on source side when radiographing:

- Flat components or longitudinal joints in cylindrical or conical components.
- Curved or spherical components whose concave side is toward the source and when the source-to-material distance is less than the inside radius of the component.
- Curved or spherical components whose convex side is toward the source.

**b) Film Side Markers**

- Place location markers on film side when radiographing curved or spherical components whose concave side is toward the source and when the source-to-material distance is greater than that of the inside radius.
  - As an alternate to source side placement in a) markers may be placed film side when the radiograph shows coverage beyond the location makers to the extent indicated in Figure T-275 (e) and the alternate is documented on the report.
- c) Either side markers
- Location markers may be placed on either the source side or film side when radiographing either curved or spherical components whose concave side is toward the source and the “source to material” distance equals the inside radius of the component.
- 6.4.2 Double Wall Viewing
- At least one location marker shall be placed adjacent to the weld or on the material in the area of interest for each radiograph.
- 6.4.3 Where accessibility prevents placement of markers per 6.4.1a) and 6.4.1b), then a dimensioned map showing actual marker placement shall be made to indicate that full coverage has been achieved. Provide the map with the radiographs and report.



## 6.5 Image Quality Indicator (IQI) Selection

For welds with reinforcement, the thickness on which the IQI is based is the nominal single-wall thickness plus the estimated reinforcement not to exceed the maximum permitted by the referencing code section (it does not need to be measured).

For welds without reinforcement, the thickness on which the IQI is based is the nominal single wall thickness. Backing rings are not considered as part of the weld thickness.

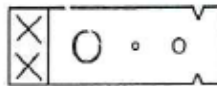
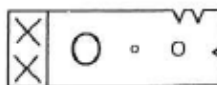
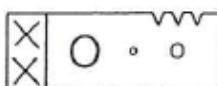
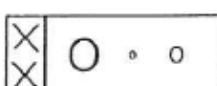
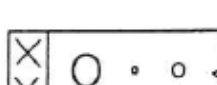
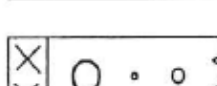
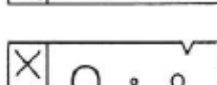
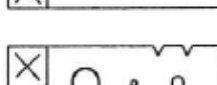
\*Reinforcement limits are provided in the Acuren Code Acceptance Extracts.

### 6.5.1 QI size and sensitivity is determined by Table T-276.

Table T-276 IQI Selection						
Nominal Single-Wall Material Thickness Range, in. (mm)	IQI					
	Source Side			Film Side		
	Hole-Type Designation	Essential Hole	Wire-Type Essential Wire	Hole-Type Designation	Essential Hole	Wire-Type Essential Wire
Up to 0.25, incl. (6.4)	12	2T	5	10	2T	4
Over 0.25 through 0.375 (6.4 through 9.5)	15	2T	6	12	2T	5
Over 0.375 through 0.50 (9.5 through 12.7)	17	2T	7	15	2T	6
Over 0.50 through 0.75 (12.7 through 19.0)	20	2T	8	17	2T	7
Over 0.75 through 1.00 (19.0 through 25.4)	25	2T	9	20	2T	8
Over 1.00 through 1.50 (25.4 through 38.1)	30	2T	10	25	2T	9
Over 1.50 through 2.00 (38.1 through 50.8)	35	2T	11	30	2T	10
Over 2.00 through 2.50 (50.8 through 63.5)	40	2T	12	35	2T	11
Over 2.50 through 4.00 (63.5 through 101.6)	50	2T	13	40	2T	12
Over 4.00 through 6.00 (101.6 through 152.4)	60	2T	14	50	2T	13
Over 6.00 through 8.00 (152.4 through 203.2)	80	2T	16	60	2T	14
Over 8.00 through 10.00 (203.2 through 254.0)	100	2T	17	80	2T	16
Over 10.00 through 12.00 (254.0 through 304.8)	120	2T	18	100	2T	17
Over 12.00 through 16.00 (304.8 through 406.4)	160	2T	20	120	2T	18
Over 16.00 through 20.00 (406.4 through 508.0)	200	2T	21	160	2T	20

#### 6.5.2 IQI Material

IQI's may be from either the same alloy material group or grade as identified in SE-1025 (hole type) or SE-747 (wire type), as applicable, or from an alloy material group or grade with less radiation absorption than the material being radiographed. The excerpt from SE-1025 provided below lists materials in increasing order of radiographic absorption.

Group 03 IQI for Magnesium	
Group 02 IQI for Aluminum	
Group 01 IQI for Titanium	
Group 1 IQI for Carbon Alloy and Stainless Steel	
Group 2 IQI for Aluminum Bronze	
Group 3 IQI for Nickel-Chromium-Iron	
Group 4 IQI for Nickel-Copper (70-30)	
Group 5 IQI for Tin Bronze	

- 6.5.3 A thicker or thinner or thicker hole-type IQI than the required IQI may be substituted, provided an equivalent or better IQI sensitivity as listed in Table T-183 is achieved and all other requirements for radiography are met. Equivalent IQI sensitivity is shown in ant row of the table which contains the required IQI and hole. Better IQI sensitivity is shown in any row of the table which is above the equivalent sensitivity row. If the required IQI and hole are not represented in the table the next thinner IQI row form the table may be used to establish equivalent IQI sensitivity.

Table T-283 Equivalent Hole-Type IQI Sensitivity		
Hole-Type Designation	Equivalent Hole-Type Designations	
27 Hole	17 Hole	47 Hole
10	15	5
12	17	7
15	20	10
17	25	12
20	30	15
25	35	17
30	40	20
35	50	25
40	60	30
50	70	35
60	80	40
80	120	60
100	140	70
120	160	80
160	240	120
200	280	140

#### 6.6 Dissimilar Materials or Filler Metal

On welds where the weld material has a radiation attenuation factor differing from the base material, the IQI shall be based upon the weld metal. If density limits per 6.11.1 cannot be achieved at the weld and base metal interface with one IQI, a second IQI selected for the base material shall be added.

#### 6.7 Placement of IQI's

Source side IQI's shall be used except for conditions listed in 6.7.2

6.7.1 Where it is not practical to place the IQI on the part or weld, they may be placed on separate blocks made of the same or radiographically similar materials.

- a) The IQI of the source side of the block shall be placed no closer to the film than the source side of the part.
- b) The block shall be placed as close as possible to the part.
- c) When hole type IQI's are used the block dimensions shall be large enough to ensure that three sides of the IQI will be visible on the radiograph.

6.7.2 Where hand placement of the IQI on the source side of the part being examined is not possible the IQI shall be placed on the film side. Place a lead letter "F" adjacent to, or on the IQI but not masking the essential hole when hole type IQI's are used.

#### 6.7.3 IQI Placement for Welds

- a) Hole Type – Placed adjacent to the weld.

- b) Wire Type – Placed on the weld so that the length of the wires is perpendicular to the length of the weld.

In either case the IQI identification or the lead letter "F", if used, shall not be in the area of interest except where geometric configuration makes it impractical.

- 6.7.4 When hole type IQ's are selected, shims may be used to compensate for material thickness greater than the parent metal or to compensate for the total material thickness when the IQI cannot be placed on the material being radiographed.

- a) For welds, place a shim of radiographically similar material between the part and IQI such that the radiographic density throughout the area of interest is no more than minus 15% from (lighter than) the density through the IQI adjacent to the essential hole. Shims shall exceed the IQI dimension such that the outline of at least three sides of the IQI, are visible on the radiograph.

- 6.7.5 IQI Placement for Other than Welds

When placing IQI's on materials other than welds the IQI, the IQI identification and the letter "F", if used, may be placed in the area of interest.

- 6.7.6 Number of IQI's

- a) When multiple IQI's are used per 6.11.2 one shall be representative of the lightest area of interest and the other for the darkest. The intervening densities shall be considered as having acceptable density.
- b) Where multiple film holders are used for an exposure, at least one IQI image shall appear on each radiograph except as outlined in the special cases detailed in Appendix 1.

- 6.8 Backscatter Radiation

A lead letter "B" 13mm high and 1.5mm thick shall be attached to the back of each film holder during each exposure to determine if backscatter radiation is exposing the film.

- 6.9 Direction of Radiation

The central beam of radiation should be centred on the area of interest whenever practical.

- 6.10 Film Processing

Film processing is normally manual. Where automatic processors are used a local procedure based upon the manufacturers requirements shall be in place.

Guideline for manual film processing is included in Appendix 3.

- 6.11 Radiographic Density

6.11.1 Density is measured through the radiographic image of the body of the hole-type IQI or adjacent to the designated wire of a wire IQI. The density in the area of interest shall be:

- a) Minimum of 1.8 for single wall viewing for an X-ray, and a minimum of 2.0 for a gamma ray source.
- b) Minimum of 1.3 for composite viewing of multiple exposures.
- c) Maximum of 4.0 for either single or composite viewing.

A tolerance of 0.05 is allowed for variations in densitometer readings

6.11.2 Variation

Density of the radiograph must be within the ranges stated in 6.11.1 but density in the area of interest cannot vary by more than minus 15% or plus 30% from the density throughout the body of the hole-type IQI adjacent to the essential hole or adjacent to the designated wire of a wire IQI.

When these limits are exceeded then the radiograph shall be retaken adding an additional IQI or IQI's for each exceptional area or areas.

When calculating the allowable variation in density the calculation may be rounded to the nearest .1 within the range specified in 6.11.1.

6.12 Geometric unsharpness of the radiographs shall be determined in accordance with:

$$U_g = Fd/D$$

Where:

$U_g$  = Geometric unsharpness

$F$  = Source size: the maximum projected dimension of the radiating source (or effective focal spot) in the plane perpendicular to the distance  $D$  from the weld or object being radiographed. Dimensions are provided on the decay chart for isotopes or on the x-ray equipment/manual.

$D$  = Distance from source of radiation to weld or object being radiographed.

$d$  = Distance from source side of weld or object being radiographed to the film.

Recommended maximum  $U_g$  values are listed below.

MATERIAL THICKNESS (MM)	$U_g$ (MM)
50 or less	0.51
50-75	0.76
75-100	1.02
100 or greater	1.78

6.13 Quality of Radiographs

6.13.1 Radiographs shall be free from false indications, mechanical, chemical, or other blemishes to the extent that they will not mask or be confused with the image of any discontinuity in the area of interest.



6.13.2 If a light image of the "B" appears on a darker background of the radiograph, protection against backscatter is insufficient and the radiograph will be considered unacceptable. A dark letter "B" is not cause for rejection.

#### 6.14 QI Sensitivity

6.14.1 Radiography shall be performed with a technique of sufficient sensitivity to display the designated hole IQI image and the essential hole, or the essential wire of a wire IQI. The radiographs shall also display the IQI identifying numbers and letters. If the designated hole IQI image and essential hole, or essential wire, do not show on any film in multiple film technique but do show in composite film viewing, interpretation shall be permitted only by composite film viewing.

6.14.2 If a thinner or thicker hole type IQI is used the equivalent IQI sensitivity chart in 6.5.3 may be applied.

#### 6.15 Marking

Increments corresponding to the location markers and direction of travel shall be marked on the part with a permanent marker. Alternatively a map may be used as per 6.4.

## 7.0 ACCEPTANCE CRITERIA

Radiographs shall be interpreted in accordance with the acceptance criteria as specified by the client and provided to the radiographer in the Acuren Code Acceptance Extracts.

In absence of a specification, all indications are to be reported with no acceptance or rejection.

## 8.0 REPORTS

Radiographic reports shall include the following fields at a minimum.

Date of Examination	Radiation Source (X-Ray or Isotope)
Client information	Curies or KV
Work Location	Focal Spot/Source Size (F)
Acuren Job Number	OFD (Object to Film Distance)(d)
Procedure / Technique and Rev	SOD (Source to Object Distance) (D)
Weld or Component Identification	Listing of Each Radiographic Location
Reinforcement Thickness	Discontinuity Types and Location
Material Type and Thickness	Acceptance Standard
Pipe Diameter (when applicable)	Accept/Reject
Film Manufacture and Designation	Technician- Signature/Certification
Number of Exposures	Client Signature (when possible)
Number of Film Per Cassette	

8.1 Complete all fields of the supplied Acuren report form. State N/A for not applicable when the field does not apply.



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- 8.2 Ensure that the acceptance standard field is completed in full, including the standard, relevant section or clause (when applicable), and the date or revision status.
- 8.3 Attach a copy of a dimensional map for location of marker placement if requested.
- 8.4 Report all material or weld discontinuities and disposition per the specified acceptance criteria. Record indications observed on the radiograph as follows:
  - 8.4.1 Acceptable indications - note the indication type (e.g. slag) but the size and location are not required.
  - 8.4.2 Rejectable Indications – note the type, location and size {(e.g. slag at 1-6 cm (2 cm long))}.
- 8.5 Where no acceptance criteria are specified report all discontinuities without disposition.
- 8.6 Records of the interpretation and the radiographs shall be provided to the client. Acuren shall not be responsible for storage of these items after completion of the project.

**APPENDIX 1: IQI SPECIAL CASES**

When multiple film holders are used for an exposure at least one IQI image shall appear on each radiograph except as allowed per ASME Section V, Article 2T-277.2 (b) and Nonmandatory Appendix D provided below.

**T-277.2***(b) Special Cases*

(1) For cylindrical components where the source is placed on the axis of the component for a single exposure, at least three IQI's, spaced approximately 120 degrees apart, are required under the following conditions:

(a) When the complete circumference is radiographed using one or more film holders, or;

(b) When a section or sections of the circumference, where the length between the ends of the outermost sections span 240 or more deg, is radiographed using one or more film holders. Additional film locations may be required to obtain necessary IQI spacing.

(2) For cylindrical components where the source is placed on the axis of the component for a single exposure, at least three IQIs, with one placed at each end of the span of the circumference radiographed and one in the approximate center of the span, are required under the following conditions:

(a) When a section of the circumference, the length of which is greater than 120 deg and less than 240 deg, is radiographed using just one film holder, or;

(b) When a section or sections of the circumference, where the length between the ends of the outermost sections span less than 240 deg, is radiographed using more than one film holder.

(3) In (1) and (2) above, where sections of longitudinal welds adjoining the circumferential weld are radiographed simultaneously with the circumferential weld, an additional IQI shall be placed on each longitudinal weld at the end of the section most remote from the junction with the circumferential weld being radiographed.

(4) For spherical components where the source is placed at the center of the component for a single exposure, at least three IQIs, spaced approximately 120 deg apart, are required under the following conditions:

(a) When a complete circumference is radiographed using one or more film holders, or;

(b) When a section or sections of a circumference, where the length between the ends of the outermost sections span 240 or more deg, is radiographed using one or more film holders. Additional film locations may be required to obtain necessary IQI spacing.

(5) For spherical components where the source is placed at the center of the component for a single exposure, at least three IQIs, with one placed at each end of the radiographed span of the circumference radiographed and one in the approximate center of the span, are required under the following conditions:

(a) When a section of a circumference, the length of which is greater than 120 deg and less than 240 deg, is radiographed using just one film holder, or;

(b) When a section or sections of a circumference, where the length between the ends of the outermost sections span less than 240 deg is radiographed using more than one film holder.

(6) In (4) and (5) above, where other welds are radiographed simultaneously with the circumferential weld, one additional IQI shall be placed on each other weld.

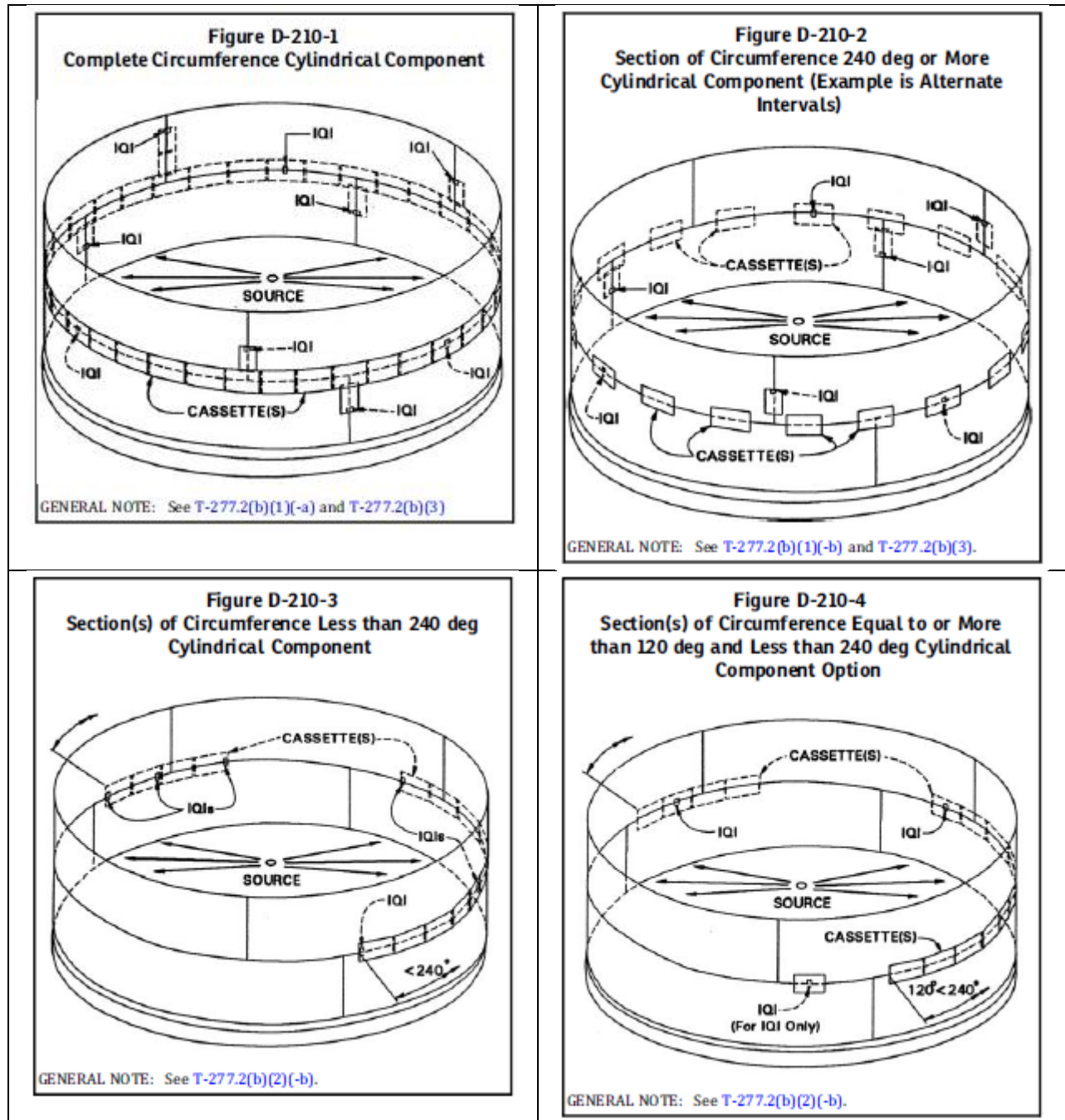
(7) For segments of a flat or curved (i.e., ellipsoidal, torispherical, toriconical, elliptical, etc.) component where the source is placed perpendicular to the center of a length of weld for a single exposure when using more than three film holders, at least three IQIs, one placed at each end of the radiographed span and one in the approximate center of the span, are required.

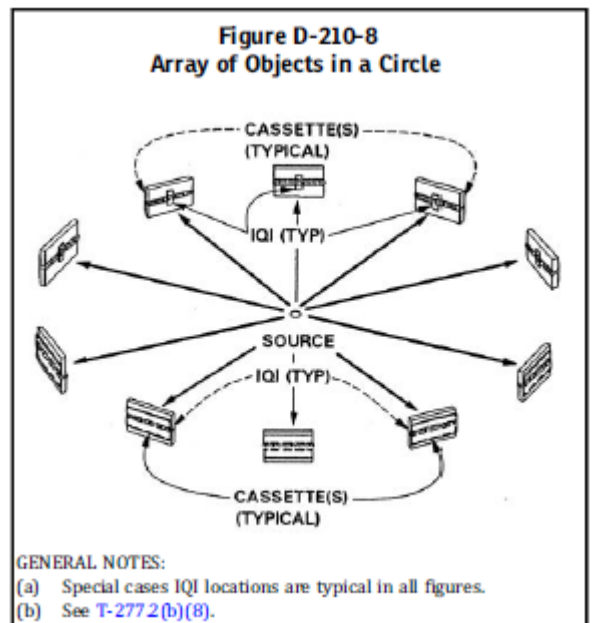
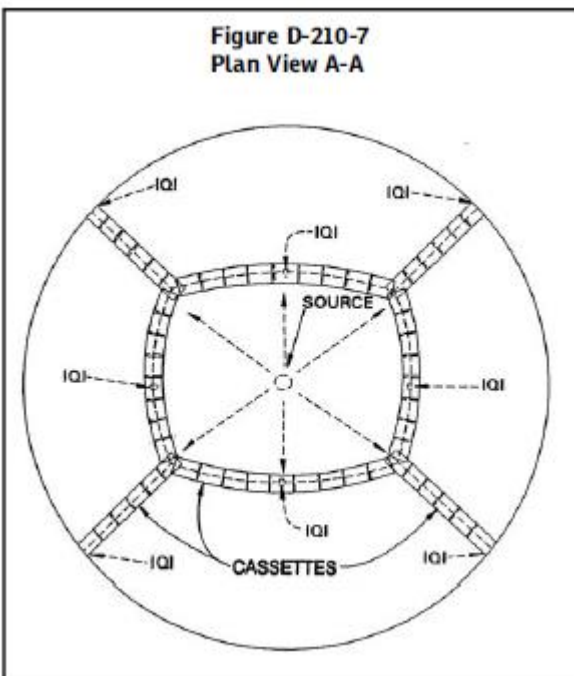
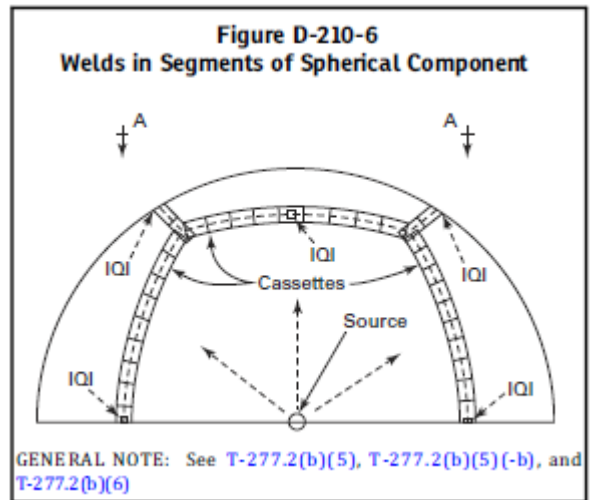
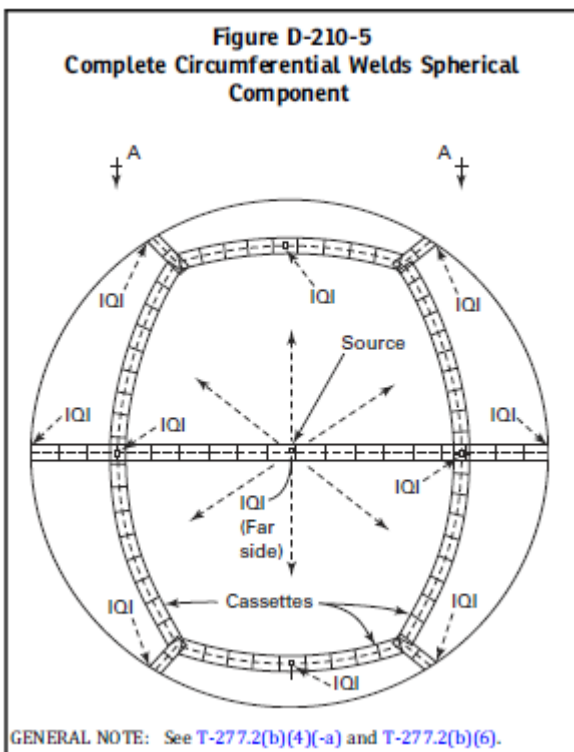
(8) When an array of components in a circle is radiographed, at least one IQI shall show on each component image.

(9) In order to maintain the continuity of records involving subsequent exposures, all radiographs exhibiting IQIs that qualify the techniques permitted in accordance with (1) through (7) above shall be retained.

**ASME Non-mandatory APPENDIX D — NUMBER OF IQIs (SPECIAL CASES) D-210 SCOPE**

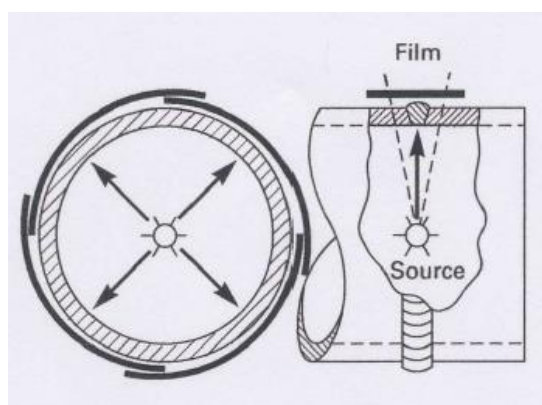
The figures in this Appendix illustrate examples of the number and placement of IQIs that may be used in the special cases described in T-277.2(b). These figures are not intended to cover all configurations or applications of production radiography.



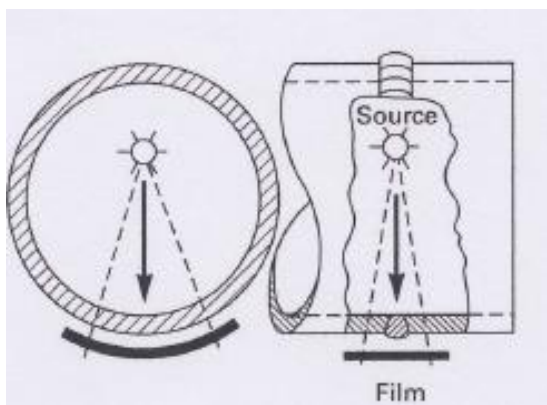


**APPENDIX 2: TECHNIQUES**

<b>TECHNIQUE 1</b>		
<b>SINGLE WALL TECHNIQUE WITH SINGLE WALL VIEWING (SW-SWV)</b>		
IQI Selection	IQI Placement	Location Marker Placement
6.5 and 6.5.1(Table T-276)	Source Side (6.7) or if not possible Film Side (6.7.2) with F	Either Side 6.4.1c) or 6.4.3
Source-Weld-Film Arrangement		

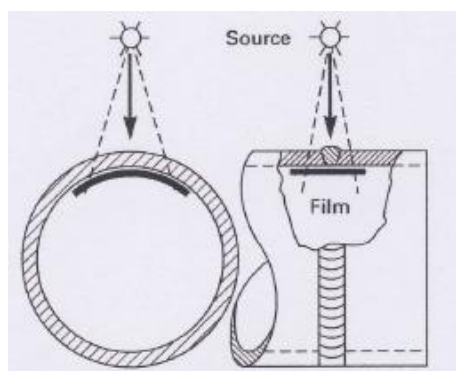


<b>TECHNIQUE 2</b>		
<b>SINGLE WALL TECHNIQUE WITH SINGLE WALL VIEWING (SW-SWV)</b>		
IQI Selection	IQI Placement	Location Marker Placement
6.5 and 6.5.1(Table T-276)	Source Side (6.7) or if not possible Film Side (6.7.2) with F	Film Side 6.4.1b)
Source-Weld-Film Arrangement		



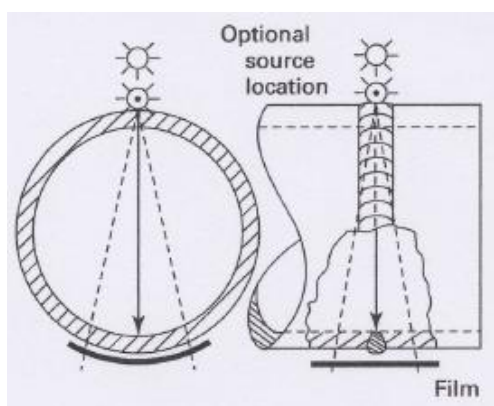


<b>TECHNIQUE 3</b> <b>SINGLE WALL WITH SINGLE WALL VIEWING (SW-SWV)</b>		
IQI Selection	IQI Placement	Location Marker Placement
6.5 and 6.5.1(Table T-276)	Source Side (6.7) or if not possible Film Side (6.7.2) with F	Either Side 6.4.1c) or 6.4.3
Source-Weld-Film Arrangement		

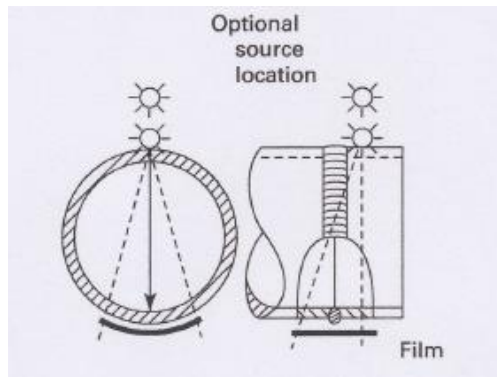


The illustration depicts piping but this technique is also valid for flat plate or longitudinal seams

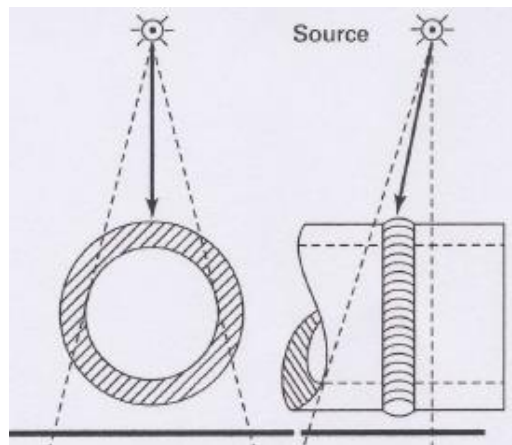
<b>TECHNIQUE 4</b> <b>DOUBLE WALL WITH SINGLE WALL VIEWING (DW-SWV)</b> Minimum 3 exposures at 120 degrees		
IQI Selection	IQI Placement	Location Marker Placement
6.5 and 6.5.1(Table T-276)	Source Side (6.7) or if not possible Film Side (6.7.2) with F	Film Side 6.4.1b)
Source-Weld-Film Arrangement		



<b>TECHNIQUE 5</b> <b>DOUBLE WALL WITH SINGLE WALL VIEWING (DW-SWV)</b> Minimum 3 exposures at 120 degrees		
IQI Selection	IQI Placement	Location Marker Placement
6.5 and 6.5.1(Table T-276)	Source Side (6.7) or if not possible Film Side (6.7.2) with F	Film Side 6.4.1b)
Source-Weld-Film Arrangement		

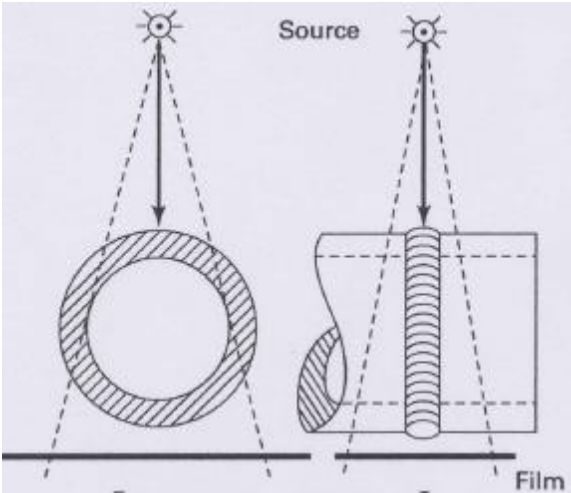


<b>TECHNIQUE 6</b> <b>DOUBLE WALL TECHNIQUE WITH DOUBLE WALL VIEWING (DW-DWV)</b> Minimum 2 exposures at 90 degrees		
IQI Selection	IQI Placement	Location Marker Placement
6.5 and 6.5.1(Table T-276)	Source Side (6.7) or if not possible Film Side (6.7.2) with F	Either Side 6.4.2
Source-Weld-Film Arrangement		





<b>TECHNIQUE 7</b> <b>DOUBLE WALL TECHNIQUE WITH DOUBLE WALL VIEWING (DW-DWV)</b> <b>Minimum 3 exposures at 60 or 120 90 degrees</b>		
IQI Selection	IQI Placement	Location Marker Placement
6.5 and 6.5.1(Table T-276)	Source Side (6.7)	Either Side 6.4.2
Source-Weld-Film Arrangement		



### **APPENDIX 3: MANUAL FILM PROCESSING**

#### **Chemistry**

- a) The requirement for changing chemistry varies due to time, the amount of film being processed, temperature fluctuations, environmental conditions, average film density and others. Change chemistry:
  - a. whenever film artifacts that could be attributed to exhausted chemistry are present on the radiograph
  - b. if it is over three months old
  - c. when fixer clearing time exceeds 5 minutes
  - d. wash water should be changed weekly - more often when in frequent use.
- b) Replenish developer and fixer solutions with replenishment solutions to keep both the level and activity constant.

#### **Mixing Chemistry**

- a) Ensure that the tanks are clean prior to replacing chemistry.
- b) Mix replacement chemistry as per the directions provided on the packaging.
- c) Mix replenishment chemistry as per the directions provided on the packaging. Note that replenishment is a stronger than original concentration. Addition of original strength developer or fixer does not produce the desired regenerating effect.

#### **Processing**

- a) Stir the chemistry prior to processing film.
- b) Process per standard time and temperature per the attached chart.

#### **Developing**

- a) Do not adjust developing time ("sight develop") to account for improper exposure times.
- b) Start development timing as soon as the hanger is placed in the tank.
- c) Obtain even development by tapping the hanger to dislodge air bubbles then agitate for approximately 15 seconds. Continue to agitate both horizontally and vertically for a few seconds each minute of developing time. Removing the hanger and allowing it to drain from one corner for a few seconds is also recommended.
- d) Upon completion of development drain the hanger over the developer tank and place into the stop bath.

#### **Stop Bath**

- a) Immerse and agitate for 30 to 60 seconds.
- b) Upon completion drain the hanger over the stop tank and place into the fixer.

#### **Fixing**

- a) Tap and agitate when first immersed and continue to agitate for a few seconds each 2 minutes in the fixer solution.
- b) Total fixing time is a minimum of twice the clearing time. Maximum time should be 15 minutes.
- c) Upon completion drain the hanger over the fixer tank and place into the wash.

#### **Washing**

- a) Ensure that the wash level is sufficient to cover the top bar of the hanger.
- b) Rinse for a minimum of 30 minutes in fresh wash water.

#### **Drying**

- a) Place the hangers in a forced air dryer or allow drying in ambient air.

