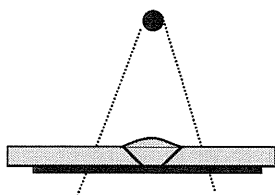


Single Wall Exposure Method

Procedure RT-0016
Technique 1

Procedure Used	RT0016	Technique Description	General Single Wall exposure
Applicable specifications	ASME Sect V, CSA Z662, and CSA W59		
Material	P1 – P5	Thickness Range	2.0 mm – 160 mm
Joint Type	Butt Weld		

DRAWING OF TECHNIQUE



- Source of Radiation
- Film
- ▬ Material wall
- ⋯ Beam direction

Beam Angle: 90° Perpendicular to weld

PARAMETERS

Source Type	IR 192	Source size	< 5.0 mm	Thickness range	2mm – 70mm
Source Type	Co 60	Source size	< 7.0 mm	Thickness range	25mm – 160mm
Strength	Min 15 Ci	Exposure	As required	SFD	Calculate Ug
Technique	Single Wall	Viewing	Single Wall	# of Exposures	n/a
Calculated Ug Factor	< 0.020"		Max Allowable Ug Factor	< 0.020"	
Intensifying Screens	Lead	Tk. Front	0.005"	Tk Back	0.010"
Film Designation	Class I or II	Brand	Agfa or Kodak	No./ Cassette	1 (one)
Penetrameter Type	ASTM wire or ASME Hole		Designation #	As per referenced code.	
Essential Sensitivity	As per code		Placement	Sourceside unless inaccessible	
Penetrameters per Film	CSA codes - 2 (middle/end) ASME codes - 1		Per Weld	2 per exposure 1 per exposure	
Comparator Shims per Film	1 (CSA Z662 only)		Per Weld	1 per exposure	
Shim Used	Only ASME hole penetrameters		Thickness	0.062" each	
Location Marker Type	Lead #		Metric <input type="checkbox"/>	Imperial <input type="checkbox"/>	
Location Marker Placement	On part		Source side when accessible Filmside is only allowed when source to material distance equals the radius of component.		
Density	2 to 4.0 H&D		Area Taken	Through Weld	
Additional Information	<ul style="list-style-type: none"> Must meet the UG factor with SFD 				
Identification on film	<ul style="list-style-type: none"> As per specification - Lead Numbers or Flash 				

PROCESSING AND STORAGE OF FILM

Method	Manual	Developing Time	5 minutes	Temperature	68°F
Fixing time	3 minutes	Washing Time	20 minutes	Drying Temp	150° F
Storage of Finished Radiographs	Placed in interleaves and film envelope				

All processing and storage in accordance with ASME SE999.

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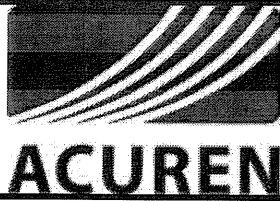
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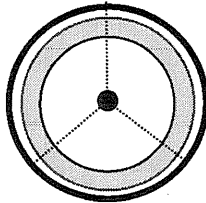


Single Wall Panoramic Exposure Method

Procedure RT-0016
Technique 2

Procedure Used	RT0016	Technique Description	Single Wall Panoramic Exposure
Applicable specifications	ASME Sect V, CSA Z662, and CSA W59		
Material	P1 – P5	Thickness Range	2.0 mm – 160 mm
Joint Type	Butt Weld		

DRAWING OF TECHNIQUE



- Source of Radiation
- Film
- Pipe wall
- Beam direction

Beam Angle: 90° Perpendicular to weld

PARAMETERS

Source Type	IR 192	Source size	< 5.0 mm	Thickness range	2mm – 70mm
Source Type	Co 60	Source size	< 7.0 mm	Thickness range	25mm – 160mm
Strength	Min 15 Ci	Exposure	As required	SFD	0.5 dia must meet Ug
Technique	Single Wall	Viewing	Single Wall	# of Exposures	3 to 4
Calculated Ug Factor	< 0.020"		Max Allowable Ug Factor	0.020"	
Intensifying Screens	Lead	Tk. Front	0.005"	Tk Back	0.010"
Film Designation	Class I or II	Brand	Agfa or Kodak	No./ Cassette	1 (one)
Penetrameter Type	ASTM wire or ASME Hole		Designation #	As per referenced code.	
Essential Sensitivity	As per code		Placement	Source side only when accessible	
Penetrameters per Film	N/A		Per Weld	3 @ 120° apart	
Comparator Shims per Film	1 (CSA only)		Per Weld	3 @ 120° apart	
Shim Used	Only ASME hole penetrameters		Thickness	0.062" each	
Location Marker Type	Lead #		Metric <input type="checkbox"/>	Imperial <input type="checkbox"/>	
Location Marker Placement	On part		Source side <input type="checkbox"/>	Film side <input checked="" type="checkbox"/>	
Density	2 to 4.0 H&D		Area Taken	Through Weld	
Additional Information	<ul style="list-style-type: none"> Must meet the UG factor with SFD 				
Identification on film	<ul style="list-style-type: none"> As per specification - Lead Numbers or Flash 				

PROCESSING AND STORAGE OF FILM

Method	Manual	Developing Time	5 minutes	Temperature	68°F
Fixing time	3 minutes	Washing Time	20 minutes	Drying Temp	150° F
Storage of Finished Radiographs	Placed in interleaves and film envelope				

All processing and storage in accordance with ASME SE-999.

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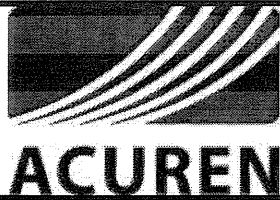
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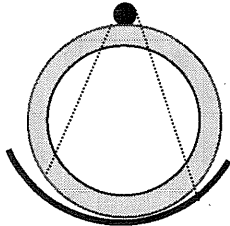


Double Wall Exposure Method

Procedure RT-0016
Technique 3

Procedure Used	RT0016	Technique Description	Double Wall Exposure
Applicable specifications	ASME Sect V, CSA Z662, and CSA W59		
Material	P1 – P5	Thickness Range	2.0 mm – 70 mm
Joint Type	Butt Weld		

DRAWING OF TECHNIQUE



- Source of Radiation
- Film
- ▬ Pipe wall
- ⋯ Beam direction

Beam Angle: 90° Perpendicular to weld

PARAMETERS

Source Type	IR 192	Source size	< 5.0 mm	Thickness range	2mm – 70mm
Source Type	Co 60	Source size	< 7.0 mm	Thickness range	25mm – 70 mm
Strength	Min 15 Ci	Exposure	As required	SFD	Pipe Diameter
Technique	Double Wall	Viewing	Single Wall	# of Exposures	3 to 4
Calculated Ug Factor	< 0.020"		Max Allowable Ug Factor		0.020"
Intensifying Screens	Lead	Tk. Front	0.005"	Tk Back	0.010"
Film Designation	Class I or II	Brand	Agfa or Kodak	No./ Cassette	1 (one)
Penetrameter Type	ASTM wire or ASME Hole		Designation #	As per referenced code.	
Essential Sensitivity	As per code		Placement	As per referenced code	
Penetrameters per Film	1		Per Weld	1 / exposure	
Comparator Shims per Film	1 (CSA only)		Per Weld	1 / exposure	
Shim Used	Only ASME hole penetrameters		Thickness	0.062" each	
Location Marker Type	Lead #		Metric <input type="checkbox"/>	Imperial <input type="checkbox"/>	
Location Marker Placement	On part		Source side <input type="checkbox"/>	Film side <input checked="" type="checkbox"/>	
Density	2 to 4.0 H&D		Area Taken	Through Weld	
Additional Information	<ul style="list-style-type: none"> Must meet the UG factor with SFD 				
Identification on film	<ul style="list-style-type: none"> As per specification - Lead Numbers or Flash 				

PROCESSING AND STORAGE OF FILM

Method	Manual	Developing Time	5 minutes	Temperature	68°F
Fixing time	3 minutes	Washing Time	20 minutes	Drying Temp	150° F
Storage of Finished Radiographs	Placed in interleaves and film envelope				

All processing and storage in accordance with ASME SE-999.

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Elliptical Exposure Method

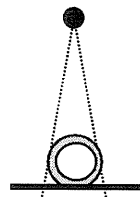
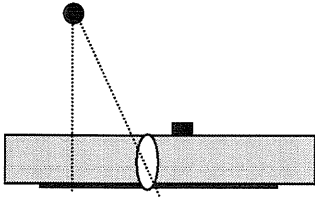
Procedure RT-0016
Technique 4

Procedure Used	RT0016	Technique Description	Elliptical Exposure
Applicable specifications	ASME Sect V, CSA Z662, and CSA W59		
Material	P1 – P5	Thickness Range	5.0 mm – 25 mm
Joint Type	Butt Weld		

DRAWING OF TECHNIQUE

A&B - 30° offset

A & B - 90°



- Source of Radiation
- Film
- Pipe wall
- Beam direction

Beam Angle: 90° Perpendicular to weld

PARAMETERS

Source Type	IR 192	Source size	< 5.0 mm	Thickness range	2mm – 25 mm
Strength	Min 15 Ci	Exposure ci/sec	As required	SFD	10X dia. minimum
Technique	Double Wall	Viewing	Double Wall	# of Exposures	2
Calculated Ug Factor	< 0.020"		Max Allowable Ug Factor		0.020"
Intensifying Screens	Lead	Tk. Front	0.005"	Tk Back	0.010"
Film Designation	Class I or II	Brand	Agfa or Kodak	No./ Cassette	1 (one)
Penetrameter Type	ASTM wire or ASME Hole		Designation #	As per referenced code.	
Essential Sensitivity	As per code		Placement	Source Side	
Penetrameters per Film	1		Per Weld	2 @ 90° apart	
Comparator Shims per Film	1 (CSA only)		Per Weld	2 @ 90° apart	
Shim Used	Only ASME hole penetrameters		Thickness	0.062" each	
Location Marker Type	Lead #		Metric <input type="checkbox"/>	Imperial <input type="checkbox"/>	
Location Marker Placement	On part		Source side <input type="checkbox"/>	Film side <input checked="" type="checkbox"/>	
Density	2 to 4.0 H&D		Area Taken	Through Weld	
Additional Information	<ul style="list-style-type: none"> Must meet the Ug factor with SFD 				
Identification on film	<ul style="list-style-type: none"> As per specification - Lead Numbers or Flash 				

PROCESSING AND STORAGE OF FILM

Method	Manual	Developing Time	5 minutes	Temperature	68°F
Fixing time	3 minutes	Washing Time	20 minutes	Drying Temp	150°F
Storage of Finished Radiographs	Placed in interleaves and film envelope				

All processing and storage in accordance with ASME SE-999.

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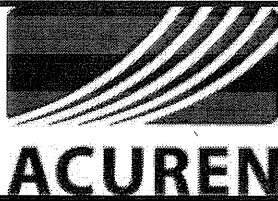
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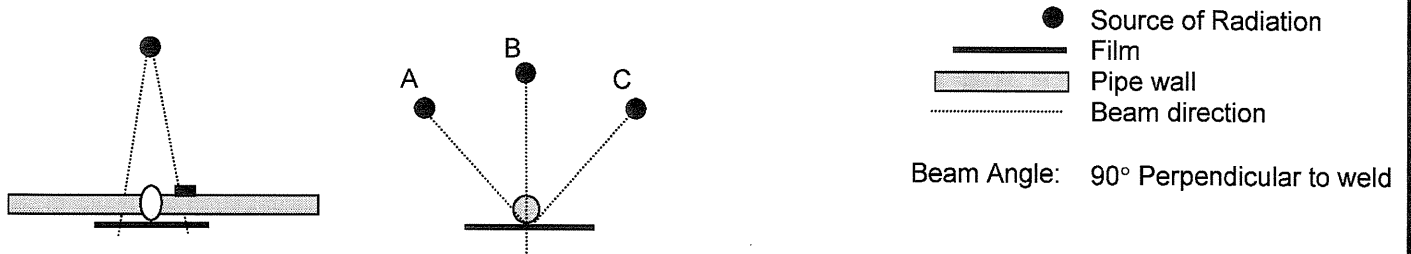


Superimposed Exposure Method

Procedure RT-0016
Technique 5

Procedure Used	RT0016	Technique Description	Superimposed Exposure
Applicable specifications	ASME Sect V, CSA Z662, and CSA W59		
Material	P1 – P5	Thickness Range	5.0 mm – 25 mm
Joint Type	Butt Weld		

DRAWING OF TECHNIQUE



PARAMETERS

Source Type	IR 192	Source size	< 5.0 mm	Thickness range	2mm – 25 mm
Strength	Min 15 Ci	Exposure ci/sec	As required	SFD	10X dia. minimum
Technique	Double Wall	Viewing	Double Wall	# of Exposures	3
Calculated Ug Factor	< 0.020"		Max Allowable Ug Factor	0.020"	
Intensifying Screens	Lead	Tk. Front	0.005"	Tk Back	0.010"
Film Designation	Class I or II	Brand	Agfa or Kodak	No./ Cassette	1 (one)
Penetrator Type	ASTM wire or ASME Hole		Designation #	As per referenced code.	
Essential Sensitivity	As per code		Placement	Source Side	
Penetrators per Film	1		Per Weld	1	
Comparator Shims per Film	1 (CSA only)		Per Weld	3 @ 45° angle between	
Shim Used	Only ASME hole penetrators		Thickness	0.062" each	
Location Marker Type	Lead # A, B, C		Metric <input checked="" type="checkbox"/>	Imperial <input type="checkbox"/>	
Location Marker Placement	On part		Source side <input checked="" type="checkbox"/>	Film side <input type="checkbox"/>	
Density	2 to 4.0 H&D		Area Taken	Through Weld	
Additional Information	<ul style="list-style-type: none"> Must meet the UG factor with SFD 				
Identification on film	<ul style="list-style-type: none"> As per specification - Lead Numbers or Flash 				

PROCESSING AND STORAGE OF FILM

Method	Manual	Developing Time	5 minutes	Temperature	68°F
Fixing time	3 minutes	Washing Time	20 minutes	Drying Temp	150° F
Storage of Finished Radiographs	Placed in interleaves and film envelope				

All processing and storage in accordance with ASME SE-999.

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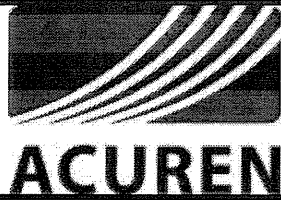
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Elliptical / Contact Exposure Method

Procedure RT-0016
Technique 6

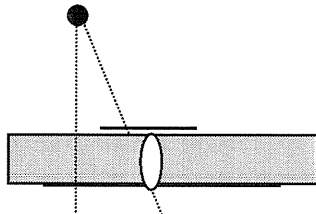
Procedure Used	RT0016	Technique Description	Elliptical/ Contact Exposure
Applicable specifications	ASME Sect V, CSA Z662, and CSA W59		
Material	P1 – P5	Thickness Range	2.0 mm – 25 mm
Joint Type	Butt Weld		

DRAWING OF TECHNIQUE

A - 30° offset

2 Contact exposures

One each side B & C



- Source of Radiation
- Film
- ▬ Pipe wall
- ⋯ Beam direction

Beam Angle: 90° Perpendicular to weld

PARAMETERS

Source Type	IR 192	Source size	< 5.0 mm	Thickness range	2mm – 25 mm
Strength	Min 15 Ci	Exposure ci/sec	As required	SFD	10X dia. For A Pipe dia. For B&C
Technique	Double Wall	Viewing	Double Wall	# of Exposures	3
Calculated Ug Factor	< 0.020"		Max Allowable Ug Factor		0.020"
Intensifying Screens	Lead	Tk. Front	0.005"	Tk Back	0.010"
Film Designation	Class I or II	Brand	Agfa or Kodak	No./ Cassette	1 (one)
Penetrameter Type	ASTM wire or ASME Hole		Designation #	As per ASME V Art 2 table T-276	
Essential Sensitivity	2T		Placement	Source side when accessible	
Penetrameters per Film	1		Per Weld	1	
Comparator Shims per Film	N/A		Per Weld	N/A	
Shim Used	N/A		Thickness	N/A	
Location Marker Type	Lead # A, B, C		Metric <input checked="" type="checkbox"/>	Imperial <input type="checkbox"/>	
Location Marker Placement	On part		Source side <input checked="" type="checkbox"/>	Film side <input checked="" type="checkbox"/> for B & C	
Density	2 to 4.0 H&D		Area Taken	Through Weld	
Additional Information	<ul style="list-style-type: none"> Minimum offset at 30° for Exposure A (must ellipse). Contact shots for B & C are opposite sides of tangents. SFD at diameter of weld. 				
Identification on film	<ul style="list-style-type: none"> As per specification - Lead Numbers or Flash. 				

PROCESSING AND STORAGE OF FILM

Method	Manual	Developing Time	5 minutes	Temperature	68°F
Fixing time	3 minutes	Washing Time	20 minutes	Drying Temp	150° F
Storage of Finished Radiographs	Placed in interleaves and film envelope				

All processing and storage in accordance with ASME SE-999.

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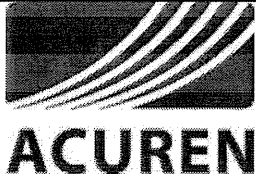
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WALL THICKNESS EVALUATION WITH RADIOGRAPHY

Procedure RT-0016
Technique 7

Procedure Used	RT-0016		
Technique Description	Calculation of wall thickness with shadow shot radiography		
Applicable Specification	Providing information for client evaluation		
Material	Ferrous and Non ferrous	Weld Types	N/A
Method	Projection of wall thickness to large format film.		
Equipment:	<ul style="list-style-type: none"> • Flat 14" x 17" or larger film holder with proper straps to secure film to part. • Cobalt 60, Iridium 192, or X-Ray may be used to produce acceptable results. Choice is dependent upon the thickness range, and/or location or the component. • Jig for positioning source and holding in stable position during exposure. • Film cassettes of appropriate size to provide coverage • Film • Penetrameters • Tungsten collimator • High intensity viewer. • Single edge razor blade for removing emulsion. • Standard block of known thickness or diameter. 		
Planning	<ol style="list-style-type: none"> 1. Discuss the orientation with the client to ensure the desired positioning of the test is relative to the evaluation for traceability. This is normally in the horizontal or vertical position to determine corrosion or pitting in a selected area. (See figure 1) 2. In most situations the exposure will only be in one direction at 90 degrees to the part, and utilize only one exposure per location. Verify with client. 3. Select the film speed based on what the client's expectations are. Best industry practice is to select a fast film with lower contrast and higher grain to meet the productivity needs. The sensitivity provided is high due to the greater source to film distance (SFD). 4. When requested by the client a standard may be used as a comparison tool to provided accuracy of the calculations. 5. The set-up and technical information in the datasheet (Table 1) attached will provide best quality results. 		

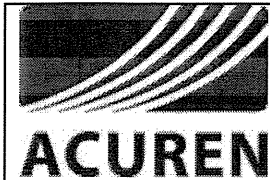
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WALL THICKNESS EVALUATION WITH RADIOGRAPHY

Procedure RT-0016
Technique 7

General set up procedure	<ol style="list-style-type: none">1. Set-up the jig and collimator in exposure position.2. Perform a test pocket dosimeter shot on opposite side of the part to determine exposure time.3. Position an attenuative material approximately 1 inch x 3 inches to block out radiation in the top left hand corner of the film. This is for the Flash ID.4. Position the film on the part 90 degrees perpendicular to the source position.<ul style="list-style-type: none">• Ensure that the film remains flat and is not curved. Measure from both sides of the edge of the film to ensure distance is equal.• Take care to prevent pressure marks due to handling and positioning the film.• If a physical standard is used for comparison, position at the same distance where measurements will be compared. See technique drawing.• It is critical to record and report orientation of the radiograph. (See figure 1.)5. Take precautions to prevent movement of all equipment and film.6. Project source and expose film for pre-determined time7. Process film.
Methods of determining the wall thickness	<ol style="list-style-type: none">1. <u>Projected comparison</u><ul style="list-style-type: none">• Formulas$\text{Actual wall thickness} = \frac{\text{Known outside diameter} \times \text{Projected wall thickness}}{\text{Projected outside diameter}}$<p>Or</p><p>Projected OD/Actual OD = Ratio, (then with this ratio):</p>$\text{Actual wall} = \text{ratio} \times \text{projected wall}$



WALL THICKNESS EVALUATION WITH RADIOGRAPHY

Procedure RT-0016
Technique 7

Evaluation	<p>Client is normally responsible for evaluation of the results.</p> <p>Acuren will provide calculations in accordance with this technique when requested by the client.</p> <p><u>Recommendations to assist in the evaluation</u></p> <ul style="list-style-type: none"> • If range of the radiographic density is high in the area of interest, a good practice is to remove the emulsion from one side of the film with a single edge razor blade. This allows a reduction in the density and permits easier measurement from the edges of the projected wall thickness. • Swab the area of measurement with a damp cloth to soften the emulsion. • Once the emulsion is softened, position flat against the viewer and scrape the emulsion <u>only from the outer wall</u> with a smooth angular motion.
Reporting	<p><u>Identification on the radiograph.</u></p> <ul style="list-style-type: none"> • Flash or lead numbers providing the Acuren name or logo, client name, ID number, date, part or line number. Best practice is with the flash in the top left hand corner utilizing a lead block or other similar material positioned during exposure to white out the area for the flash. This provides a small detailed identification of the identification. <p><u>Data to be Recorded on Acuren Report Form (s)</u></p> <ul style="list-style-type: none"> • As per RT-0016

Lead #	Designation
T	Top
N	North
E	East
W	West
S	South

Film &
Lead #
positions

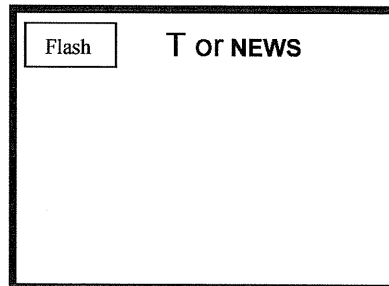


Figure 1

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WALL THICKNESS EVALUATION WITH RADIOGRAPHY

Procedure RT-0016
Technique 7

Table 1

Procedure Used		RT0016			
Technique Description		Wall thickness evaluation with radiography			
Applicable specifications		ASME Sect V, Article 2			
Material	N/A	Thickness Range	2.0 mm – 160 mm		
Joint Type	N/A				
Drawing:					
		Beam Angle: 90 degrees Perpendicular to weld Penetrimeter in contact film side			
Parameters					
Source Type	IR 192	Source size	< 5.0 mm	Thickness range	2.0 mm – 70 mm
Source Type	Co 60	Source size	< 7.0 mm	Thickness range	25 mm – 160 mm
Strength	Min 30 Ci preferred.	Exposure	As required	SFD	7 x diameter
Technique	Single Wall	Viewing	Single Wall	# of Exposures	1
Calculated Ug Factor	N/A	Max Allowable Ug Factor	N/A		
Intensifying Screens	Lead	Thk Front	.005"	Thk Back	.010"
Film Designation	Class II preference	Brand	Agfa D7 or Kodak AA	# Per Cassette	1 (one)
Penetrimeter Type	ASTM wire or ASME Hole	Designation #	Use ASME Specification based on single wall thickness.		
Essential Sensitivity	N/A	Placement	Film side		
Penetrimeters per Film	1				
Comparator Standard	1	Location	As per figure 1		
Shim Used	None	Thickness	N/a		
Location Marker Type	Lead #				
Location Marker Placement	On part	Source side	<input type="checkbox"/>	Film side	<input checked="" type="checkbox"/>
Density	1.2 to 2.0 H&D	Area Taken	Through double wall area		
Additional Information	<ul style="list-style-type: none"> Density specified above is not critical. 				
Identification on film	<ul style="list-style-type: none"> Lead Numbers or Flash – Top left corner or Top center of wall area. 				
Processing and Storage of Film					
Method	Manual	Developing Time	5 minutes	Temperature	68°
Fixing time	3 minutes	Washing Time	20 minutes	Drying Temp	150°F
Storage of Finished Radiographs		Placed in interleaves and film envelope			

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