Sara Sae **OPERATING PROCEDURE**

| Procedure No. |
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| SES 26-703 |

Title

## RADIOGRAPHIC INSPECTION, GENERAL

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| | | | | Revision Description | Release Date | Rev. |

Written By

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## 1.0 PURPOSE

To provide a detailed procedure for the inspection of parts using Radiographic (RT) Examination.

## 2.0 APPLICABILITY

The requirements of this procedure are directive in nature to all personnel:

2.1 Defining design requirements for Radiographic Examination.

2.2 The performance of Radiographic Examination for purposes of final product acceptance.


## 3.0 REFERENCE DOCUMENTS

3.1 SARA SAE Quality Assurance Manual

3.2 SDP-27-009, "Control of Nonconforming Products"

3.3 American Society of Mechanical Engineers (ASME)

3.3.1 Section V - "Nondestructive Testing"

3.3.2 Section VIII, Division 1 - "Rules for Construction of Pressure Vessels"

3.4 American Petroleum Institute (API)

3.4.1 Specification 6A – "Specification for Wellhead and Christmas Tree Equipment"

3.4.2 Specification 16A - "Specification for Drill Through Equipment"

3.4.3 Specification 8A – "Specification for Drilling and Production Hoisting Equipment"

3.4.4 Specification 8C – "Specification for Drilling and Production Hoisting Equipment (PSL-1 and PSL-2)"

(R) 3.4.5 Specification 16D – "Control Systems for Drilling Well Control Equipment"

(R) 3.4.6 Specification 16C – "Specification for Choke and Kill Systems"

3.5 American Society for Testing and Materials (ASTM)

3.5.1 E 94 "Standard Guide for Radiographic Testing"

3.5.2 E 142 "Standard Method for Controlling Quality of Radiographic Testing"

3.5.3 E 747 "Standard Test Method for Controlling Quality of Radiographic Examination Using Wire Penetrameters"

3.6 American Welding Society (AWS)

3.6.1 D1.1 – "Structural Welding Code"

3.7 American Society of Nondestructive Testing (ASNT)

3.7.1 Publication SNT-TC-1A – "Recommended Practice for Qualification and Certification of Personnel in Nondestructive Testing"

## 4.0 GENERAL

Radiographic Inspection is an approved volumetric nondestructive testing method for detecting discontinuities in ferrous and nonferrous materials. The intent of this procedure is to provide the required controls for the use of Radiographic Inspection.

## 5.0 RESPONSIBILITY

5.1 Design Engineering is responsible for including this procedure as a design requirement when Radiographic Examination is specified on product drawings. This requirement is effective with the original release of this procedure.

5.2 Manufacturing Engineering is responsible for including this procedure as a requirement on Process Routers in accordance with design requirements.

5.3 Quality Control is responsible for initiating subcontractor Purchase Orders for Radiographic Examination per the design requirements and this procedure.

(R) - Indicates revised item

5.4 The subcontractor supplying nondestructive testing services is responsible for compliance to the purchase order requirements and the requirements of this procedure.

5.5 The NDE Level III is responsible for approving Radiographic Examination Procedures.

## 6.0 METHODS

### 6.1 General

6.1.1 Radiographic Examination is performed where specified by the applicable Engineering drawing, Quality Assurance Plan, or Nonconformance Report disposition.

6.1.2 The following requirements apply to subcontractor RT personnel:

6.1.2.1 Technicians' qualifications shall be approved by the Level III and provided to the SARA SAE file in the Quality Records Department.

(R) 6.1.2.2 Technicians performing and/or interpreting RT examination for final product acceptance purposes shall be certified in accordance with the requirements of ASNT SNT-TC-1A - NDT Level II or III - RT minimum.

6.1.2.3 All subcontract RT examinations shall be accompanied by a report of Nondestructive Testing listing acceptance criteria and status.

6.1.3 RT Examination Subcontract Purchase Orders shall specify the SARA SAE part number, work order number, serial number, and applicable Examination Procedure/Acceptance Criteria

### 6.2 RADIOGRAPHIC EXAMINATION PROCEDURES/ACCEPTANCE CRITERIA

6.2.1 General

6.2.1.1 RADIOGRAPHIC EXAMINATION FOR FINAL ACCEPTANCE SHALL BE PERFORMED AFTER ALL WELDING, HEAT TREATMENT/POSTWELD (STRESS RELIEF) HEAT TREATMENT, AND MACHINING OPERATIONS ARE COMPLETED WITH THE FOLLOWING EXCEPTION:

EXCEPTION - API 6A, PSL 3 AND 4 BODY, BONNET, AND END AND OUTLET CONNECTION BASE MATERIAL VOLUMETRIC EXAMINATION SHALL BE PERFORMED AFTER HEAT TREATMENT FOR MECHANICAL PROPERTIES (EXCLUSIVE OF STRESS RELIEF TREATMENTS) AND PRIOR TO MACHINING OPERATIONS THAT LIMIT EFFECTIVE INTERPRETATION OF THE EXAMINATION.

6.2.1.2 Paragraphs 6.2.2 through 6.2.4 describe the various types of RT examination procedures required on SARA SAE products. Accompanying this description is a listing of the acceptance criteria for the examination procedure.

6.2.1.3 RT subcontractors must use the examination method and acceptance criteria in performing the examination.

6.2.2 Radiographic Examination of ASME Boiler and Pressure Vessel Code Section VIII Division 1 Welds

Radiographic Examination Procedure:

100% Examination of Welds - The procedures specified in the ASME Boiler and Pressure Vessel (B&PV) Code Section VIII, Division 1, Para. UW-11 and UW-51 shall be followed. The radiographic techniques shall be according to the ASME Boiler and Pressure Vessel Code Section V, Article 2.


Acceptance Criteria:

The ASME B&PV Code Section VIII, Division 1, Para. UW-51.

Spot Radiographic Examination of Welds - The procedures specified in the ASME B&PV Code Section VIII, Division 1, para. UW-11 and UW-52 shall be followed. The Radiographic

techniques shall be according to the ASME B&PV Code Section V, Article 2.

Acceptance Criteria:

The ASME B&PV Code Section VIII, Division 1, Para. UW-52.

6.2.3 Radiographic Examination of Castings

Radiographic Examination Procedure:

The procedures specified in the ASME Boiler and Pressure Vessel Code Section VIII, Division 1, Appendix 7 shall be followed. The radiographic techniques shall also be according to the ASME Boiler and Pressure Vessel Code, Section V, Articles 1 and 3.

Acceptance Criteria:

The ASME B&PV Code, Section VIII, Appendix 7, Para's. 7-3(a)(1) or 7-3(b)(3).

(R) 6.2.4 Radiographic Examination of API 6A, PSL 3 and 4 Body, Bonnet and End and Outlet Connection Base Material (hot worked or casting); API 6A, PSL 2 and 3 Pressure Boundary Welds; API 16A Pressure Boundary Welds.

Radiographic Examination Procedure

API 6A, PSL 2 and 3 and API 16A Pressure Boundary welds - 100% Radiographic Examination required.

API 6A, PSL 3 and 4 Body, Bonnet and End and Outlet Base Material - As far as practical, the entire volume of these parts shall be radiographically examined.

The procedures specified in ASTM E-94, to a minimum equivalent sensitivity of 2%, shall be followed.

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Both x-ray and gamma ray radiation sources are acceptable within the inherent thickness range limitations of each. Real imaging and recording enhancement methods may be used when the manufacturer has documented proof that these methods will result in a minimum equivalent sensitivity of 2%.

Wire type image quality indicators are acceptable for use in accordance with ASTM E-747.

Acceptance Criteria:

API 6A, PSL 3 base metal - API 6A, Para. 605.2c(14).
API 6A, PSL 4 base metal - API 6A, Para's. 605.2c(14) and 605.2d(11).

API 6A PSL 2 and 3 pressure boundary welds - API 6A, Para. 605.2b(14).

API 16A pressure boundary welds - API 16A, Section VI E1.14.2.2.

(R) 6.2.5 Radiographic Examination of Structural Material and Structural Welds

Radiographic Examination Procedure:
The procedures specified in the American Welding Society Specification AWS D1.1, Section 6, Part A and Part B shall be followed.

Acceptance Criteria:

AWS D1.1, Section 8, Para's. 8.15.1, 8.15.2, and 8.15.3.

6.3 Data Reporting

6.3.1 Radiographs of the examined area(s) shall be provided. A setup Information and Grading Sheet shall accompany all radiographs to aid in film interpretation.

6.3.1.1 The Information and Grading Sheet shall include the following:

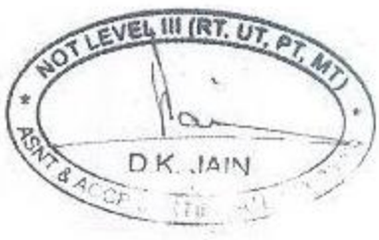
A. Number of films

B. Type and thickness of seam

C. System identification

D. Location markers

E. Radiographic examination procedure used



F. Technique used

G. Acceptance criteria used

H. Accept/reject information

I. Date

J. Part number

K. Serial number

L. Work order (if applicable)

M. Name of Level II or III Technician performing and grading the Radiographic Examination

6.3.2 Radiographic subcontractor acceptance of the examined area(s) as shown on the Information and Grading Sheet shall be used as final acceptance by SARA SAE QC.

6.3.3 SARA SAE QC.acceptance of the Radiographic Inspection shall be documented by entering an inspection stamp impression and date on the appropriate Router operation.

6.3.4 Nonconforming parts shall be reported on an NCR in accordance withSARA SAE SDP-27-009The report shall include an exact description of the nonconformance.

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# RADIOGRAPHY EXAMINATION TECHNIQUE SHEET

SHEET NO. :
DATE :
PAGE # 1 OF 1

| | |
|---|---|
| CLIENT : | INSPECTION AUTHORITY : |
| W.O. NO. / JOB NO. : | DRG. NO. : |
| PART NO. / JOINT NO. : | PROCEDURE NO. / REV. NO. : |
| MATERIAL SPEC. : | THICKNESS + REINFORCEMENT: |
| TECHNIQUE STD. : ASME SECTION V | OUTSIDE DIAMETER : |
| ACCEPTANCE STD. : | |

**RADIOGRAPHY EQUIPMENT & MATERIALS :**

| | | |
|---|---|---|
| SOURCE TYPE Ir 192<br>X Ray Voltage KV | SOURCE ACTIVITY / Current | SOURCE SIZE / FOCAL SPOT SIZE / 1.5mm X 1.5mm |
| RADIOGRAPHY FILM | MAKE | BRAND |
| IQI | TYPE : | DESIGNATION : |
| LEAD INTENSIFYING SCREEN | FRONT 0.10mm | BACK 0.10 mm / 0.15 mm |

**RADIOGRAPHIC QUALITY REQUIREMENTS :**

| | | |
|---|---|---|
| QUALITY LEVEL : As per T-276 | Maximum Permissible Ug 0.51mm / | DESITY 2.0 to 3.5 |

| | | | | |
|---|---|---|---|---|
| IQI PLACEMENT | ☐ | SOURCE SIDE | ☐ | FILM SIDE |
| LOCATION MARKER PLACEMENT | ☐ | SOURCE SIDE | ☐ | FILM SIDE |

**RADIOGRAPHY TECHNIQUE DETAILS :**

| | | | | |
|---|---|---|---|---|
| EXPOSUCRE TECHNIQUE | ☐ | SINGLE WALL | ☐ | DOUBLE WALL |
| VIEWING : | ☐ | SINGLE WALL | ☐ | DOUBLE WALL |

| | |
|---|---|
| RCE TO OBJECT DISTANCE | EXPOUSRE TIME |
| OBJECT TO FILM DISTANCE | ACTUAL Ug |
| NO. OF FILM PER CASSETTE | FILM SIZE |

## SHOOTING SKETCH

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|---|---|
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