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TRANSPORTADORA DE GAS DEL PERU

CAMISEA NATURAL GAS AND NGL TRANSPORTATION SYSTEM

TECHINT COMPAÑÍA TÉCNICA INTERNACIONAL

TECHINT
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AREA

RADIOGRAPHY

MATERIAL SPECIFICATION

2794-L-SP-00037		0
ESC. S/E	JOB: E100-50113	REVISION

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0.0 PURPOSE

This specification establishes the general guidelines for pipe weld radiographic test through the use of x-rays or gamma rays, to assure a proper radiographic quality.

1.0- SCOPE

This specification shall cover all pipeline and piping welds under inspection with the following general conditions of acceptance and refusal of welds stated in API 1104.

2.0- REFERENCE STANDARDS

Radiographic tests performed on welds along Pipeline and Facilities construction must fulfill the specification requirements and those of the codes and standards mentioned below. Unless otherwise indicated, the latest issues of such codes and standards shall apply:

- ASME B 31.8 / B 31.4
- API Std. 1104
- ASNT-TC-1ª / ASNT CP 189
- ASME E 747

3.0- WELDS TO BE TESTED

3.1 On line welds:

♦ Owner Inspector shall choose the welds to be radiographed, however the percentage stipulated must be completed during that day.

♦ All pipeline welds must be radiographied at 100%. Radiographic examination of piping welds for facilities shall be done in accordance with the project piping Specs.

3.1.3 One hundred percent (100%) of tie-ins and special works must be tested, including but not limited to roads, rivers, railways, third party crossings and previously repaired welds.

3.2 Radiographic tests will be performed on the whole circumferential welding, in compliance with API Standard 1104, Section 8. Whenever it is not possible to perform radiographic tests due to weld geometry, control of welds shall be carried out through other non-destructive methods (magnetic particle testing, liquid penetrant testing, ultrasonic testing, hydraulic test, etc.). The alternative methods shall be in accordance with written procedures and must be previously approved by Owner

o The radiographic image shall be interpreted in accordance with the Acceptance standards established in applicable code

3.4 Owner Inspector must be able to control all radiographs. For such reason, all exposed films must be made available to him.

3.5 Any repairs made will be at the Supplier's expense.

3.6 A radiographer (at least Level II) shall interpret the radiographs corresponding to production welds, once the films are completely dry.

3.7 All radiographs not fulfilling the specification requirements, regarding image quality, shall be retaken. Such condition must be indicated in the gamma ray testing report (GTR).

3.8 The weld surface to be radiographically tested must be free from irregularities on both sides of the weld, in order to achieve a correct interpretation of the radiographs. If necessary, all buckling and irregularities will be eliminated, so as to avoid the concealment of any defects.

3.9 The transition of the metal deposited by welding on the base metal surface must be done softly, so that no notch defects are produced.

4.0- RADIOGRAPHIC EQUIPMENT

The Contractor shall have the following minimum necessary equipment and material at the site to achieve the perfect execution of production weld radiographic tasks.

4.1 The Contractor may use X rays or gamma rays for radiographic equipment.

4.1.1 Gamma ray :
Source : Iridium 192
Strength of Source : minimum ------ 15 curies
maximum------ 110 curies

External equipment or internal equipment (crawlers) may be used.

4.1.2 X ray :
If X ray crawler is used, the exposure voltage shall be according to pipe thickness, and shall be advised in a Specific Radiographic Procedure.

4.2 The Contractor shall have at the site the mobile units for radiography processing and interpretation. All equipment used for the performance of radiographic activities, film processing, interpretation, etc. must be in perfect operating condition. Any element not complying with production requirements will be replaced.

4.3 Radiographic Film and processing material

4.3.1 The film to be used must be extra fine grain Class 1, or fine grain Class 2 as needed. The films must be fresh and be within the life term specified by the manufacturer.

4.3.2 The films must be rollpack type or similar.

- Whenever more than one film is used to inspect a weld, adjacent films shall overlap in order to assure continuity of control along the whole circumferential seam in such a way to ensure that no part of the weld has been omitted. Film overlap should not be less than 2".

- Development processing materials shall be those recommended by a film Manufacturer

4.4 Intensifying screens

Minimum 20-μm thick lead intensifying screens will be used with gamma rays (Ir-192).

Lead screens must be kept free from scratches, wrinkles, pitting and oxide particles.

4.5 Image Quality Indicators (IQI)

4.5.1 IQI ASTM E 747 shall be used as indicated in API Standard 1104 for pipeline or in accordance with ASME V for piping.

4.5.2 Whichever the type of IQI used, the radiographic technique must detect the defects having a depth equal to 2% (vertical sensitivity) and a width of 4% (lateral sensitivity) of the total radiographed thickness.

4.5.3 The IQIs shall be in direct contact with the pipe, and the number of IQIs to be placed shall be in accordance with API Standard 1104, Section 8 for pipeline or in accordance with ASME V for piping.

4.6 Film density

4.6.1 Radiographic images shall not be less than 1,8 through the maximum thickness weld portion and not should it exceed 3.5 through the base metal (through small localized areas may have up to maximum densities shall not exceed 4,2).

4.6.2 The Radiographic Contractor shall have a densitometer with a valid crosschecking certificate at each work spread, to control the exposed film density.

4.7 Darkroom

4.7.1 The Contractor shall have a room to carry out all film processing, development, fixing, washing and drying operations, as well as sorting thereof prior to interpretation.

4.7.2 Such darkroom shall at least:

- Prevent light from entering the room.
- Have adequate ventilation and heating.
- Be a dry place.
- Have necessary water and electric power supply.
- Have two separate lighting systems: a white light system and a system of lamps with adequate filters.
- Have the necessary elements to enable exposed film processing and drying.

5.0- RADIOGRAPHERS

5.1 All personnel performing radiographic tests or interpreting the films under this Specification shall be qualified and authorized as established in ASNT-TC-1A and this Specification. The Contractor shall submit the radiographer’s personal background together with a qualifying certificate to Techint S.A. prior to the commencement of production activities.

5.2 Only Level II and III radiographers shall interpret the radiographic images.

5.3 Level I radiographers shall only perform the assembly of the radiographic installation, make the exposures or process films under the supervision of a Level II or higher technician.

5.4 Techint must send to **Owner**, the qualifying certificate of each of the radiographers prior to starting any production radiography.

♦ The qualification record of each radiographer must be complete. It must include the name of the authorized entity participating in such qualification and a description of all the procedures for which it has been approved.

♦ Such certificate shall be valid for 3 years.

5.5 Personnel Re-qualification

5.5.1 Qualification records that are incomplete, illegible or somehow questionable, re-qualification of the radiographer shall be requested.

5.5.2 If there are any reasons to question the abilities of any of the radiographers, re-qualification thereof may be requested.

6.0- RADIOGRAPHIC PROCEDURE

6.1 The Contractor must comply with the Radiographic Specification to be used at the site and issue a **Specific Radiographic Procedure (SRP)** for each diameter, thickness and technique, for approval. By mutual agreement it will be decided whether the procedure qualification shall be performed on a test weld or a production weld.

6.2 If the **SPR** is qualified on a test weld, the pipe must have the same size and wall thickness than the one to be used for production welds. Besides, the material should have similar radiographic characteristics.

6.3 Field qualification shall require at least 3 radiographs being taken of the test weld. IQIs placed on both the source side and the film side shall be used. Each IQI shall be identified and they must be located at 1” from the film edge. Both IQIs must have the required sensitivity. Weld defects shall be recorded in a gamma ray test report. Upon test completion, the Inspector shall determine whether the procedure is satisfactory.

6.4 The Specific Radiographic Procedure shall be re-qualified if there have been any changes to:

- The type of joint.
- The radiation source.
- The pipe diameter, if such change amounts to twice or half the qualified size.
- The source angle (by more than 15 degrees).

- The pipe thickness, if such change amounts to twice or half the qualified size.
- The film type.
- Intensifying screens.

6.5 If the image of one of the IQIs is not clear enough or the radiographs are not within the acceptable density range or they are not in full accordance with this Specification, the Specific Radiographic Procedure shall not be qualified. Upon the execution of the necessary adjustments, the procedure qualification shall be repeated.

6.6 Exposed Film Identification

6.6.1 Exposed films shall be clearly identified by the use of lead numbers and letters.

6.6.2 The films of each weld must show the welder's number, the job number, date when the radiograph was taken, the pipe diameter, weld number and the pipeline section identification.

6.6.3 The Radiographer Contractor shall mark **"0"** and the **weld number** on the pipe with indelible paint.

♦ Films shall be identified as indicated in Work Instruction 2794 L-ME-00004

7.0- FILM PROCESSING

7.1 Films shall be stored in a cool and dry place.

7.2 Enough water and chemicals shall be provided so as to keep the film clarity.

7.3 The materials and equipment used for film handling and developing, including cleaning, shall be subjected to the inspector's approval.

7.4 Either automatic or manual film processing may be used. If automatic processing is used, manual processing should also be available.

o Film processing shall be carried out preferably in tanks, where the films placed in their respective film holders may be introduced vertically or by means of automatic processors.

7.6 The development bath temperature must be controlled to assure it is within the values recommended for the type of film used.

7.7 The water supply necessary to carry out the final wash must be enough to enable quick performance of such task. If washing is done in tanks, it will be necessary to renew the water continuously so as to drag out the chemicals coming from the fixing bath and thus prevent washing bath contamination.

7.8 Films shall be preferably dried with dust-free hot air or automatic dryers.

7.9 Film defects

7.9.1 Films must be free of any defects which might detrimentally affect the correct interpretation of radiographs.

7.9.2 Films shall not be fit for interpretation when one of the following defects are detected:

- Fogged parts.
- Scratched parts.
- Fading due to defective fixing or washing.
- Points or stains caused by water drops.
- Damaged emulsion due to film friction.
- Folds, scratches or any other type of marks.

7.9.3 Radiographs rejected due to the abovementioned defects shall be repeated.

7.10 FILM VIEWING EQUIPMENT (Iluminator)

A iluminator shall be available for radiograph reading and interpretation. Its variable high intensity type must enable the viewing of film densities within the specified ranges, making the observation of the radiographic image easy.

8.0- PRODUCTION RADIOGRAPHY

8.1 Radiographic interpretation shall be carried out in accordance with the acceptance standards established in the applicable code. The Inspector shall reject any radiographs not complying with the requirements of the abovementioned standard and those of this Specification.

8.2 The following, among others, shall be grounds for rejection:

- Alteration of identification.
- Incomplete coverage of the circumferential seam.
- Improper density.
- Lead letter which darken the weld area.
- Fog, processing stains, scratches or any other factor detrimentally affecting the correct weld evaluation.

8.3 All defects detected shall be reported to the Inspector well in advance in order to enable the corresponding repairs and further control before the pipe is lowered into the trench.

8.4 Each radiographic interpretation shall be recorded in a standard form, which shall become a part of the final site documents.

8.5 Radiographs taken of repairs shall be identified with letter “R”, so that they can be differentiated from the originals.

8.6 The final interpretation of radiographs shall include verification of their density and definition.

8.7 The Radiography Contractor shall submit Techint SACI a written report with the final results of the radiographic inspection of welds, together with the radiographs taken.

8.8 According to the needs arising from the work performed, a partial report will be made on a daily basis and submitted to Owner Representative and Contractor. However, upon completion of work, a final report shall be issued. Such report shall include all data appearing on partial reports.

8.9 All reports made shall be clear and legible, and shall contain all of the following:

- Indication of the radiographed joint or area and Welder number.
- Interpretation of radiographs, stating the type of defects observed and whether the radiograph might be rejected due to such defects.
- Code or standard used for inspection.
- Radiation source used.
- Size of gamma radiation source.
- Focus-film distance.
- Brand, type and size of film used.
- Material specification.
- Acceptance standard.
- Pipe diameter and thickness.

8.10 The final authority in determining the defects detected throughout the weld radiographic control shall be the Radiography Level II or III.

9.0- SAFETY CONDITIONS

9.1 Radiography experts and any other personnel involved in radiographic activities shall carry a dosimetric film and a pocket dosimeter. Care shall be taken to prevent personal radiation from exceeding the limits established by the regulations in force.

9.2 A Geiger meter shall be available for all gamma ray or X ray equipment.

- When gamma ray source is not being used, it shall be kept in a metallic locked container with radiactive signs, fixed outside the mobile darkroom unit. Access shall be permitted to radiography personnel only.

- It is the Radiography Contractor's responsibility to prevent unauthorized people from entering the radiographic test areas.

- The Radiography Contractor shall have an **Emergency Procedure** for accidents occurred during the performance of radiographic tests. A copy of such procedure shall be delivered to Techint SACI prior to the initiation of radiographic activities.

- Signs as flashing lights, flags, etc will be established at safe intervals to warn all personnel when radiography is in progress.

- *ACCEPTANCE CRITERIUM AND TEST FOR RADIOGRAPHIC EVALUATION*

- Standards as per API 1104 September 1999 edition for pipeline

- ASME code B31.8/ B31.4/ B31.3 as applicable for piping

- *ANNEX Specific Radiographic Procedure (SRP)*