



INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 947

RECOMMENDED PRACTICE FOR RADIOGRAPHIC INSPECTION
OF CIRCUMFERENTIAL FUSION WELDED BUTT JOINTS IN STEEL PIPES
UP TO 50 mm (2 in) WALL THICKNESS

1st EDITION

January 1969

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BRIEF HISTORY

The ISO Recommendation R 947, *Recommended practice for radiographic inspection of circumferential fusion welded butt joints in steel pipes up to 50 mm (2 in) wall thickness*, was drawn up by Technical Committee ISO/TC 44, *Welding*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question led to the adoption of a Draft ISO Recommendation.

In April 1967, this Draft ISO Recommendation (No. 1167) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Ireland	South Africa, Rep. of
Austria	Israel	Spain
Belgium	Japan	Sweden
Canada	Korea, Rep. of	Switzerland
Czechoslovakia	Netherlands	Turkey
Denmark	New Zealand	United Kingdom
Finland	Norway	U.S.A.
France	Poland	U.S.S.R.
Greece	Portugal	Yugoslavia
India	Romania	

One Member Body opposed the approval of the Draft :

Germany

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in January 1969, to accept it as an ISO RECOMMENDATION.

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INTRODUCTION

The increasing use of X-rays and gamma-rays for the examination of welded joints has made it desirable to issue ISO Recommendations of a general character giving guidance on the application of these methods in order to attain satisfactory sensitivity in the test itself.

In the present state of knowledge of radiographic inspection of welds, it is undesirable to impose strict rules to be followed in order to obtain the best results; the final result depends upon many variables, for example, the characteristics of the equipment and radioactive source, the characteristics of films and screens, and the characteristics and accessibility of welds.

However, it is possible, within certain limits, to assess the radiographic quality by means of such devices as image quality indicators (I.Q.I.), which are specified in ISO Recommendation R 1027, *Radiographic image quality indicators – Principles and identification*.

NOTE. — The shape, size and accessibility of the objects considered here may necessitate differences in the positioning, in relation to the welded joint being examined, of the X-ray equipment (or gamma-ray sources) and of the films. These points are described in section 6.

1. SCOPE

This ISO Recommendation provides general guidance on the techniques of weld radiography with the object of enabling satisfactory results to be obtained and it enunciates some rules which are based on generally accepted practice and the fundamental theory of the subject.

2. FIELD OF APPLICATION

This ISO Recommendation relates to the radiographic examination of circumferential fusion welded butt joints in steel pipes* up to 50 mm (2 in) wall thickness.

It should not be regarded as giving acceptance standards for joints and is concerned only with radiography as such.

3. DEFINITIONS

Definitions of the principal terms concerning radiographic techniques used in this ISO Recommendation are given in an Appendix, separately published under the title *Explanations on the significance of the principal radiographic terms used in ISO Recommendations concerning welding*.

* Besides its conventional meaning, the word "pipe" as used in this ISO Recommendation should be understood to cover other cylindrical bodies, such as tubes, penstocks, boiler drums, pressure vessels, etc.

4. CLASSIFICATION OF RADIOGRAPHIC TECHNIQUES

The examination techniques are divided into the following three classes :

- Class A : general technique for X-ray examination;
- Class B : more sensitive X-ray technique;
- Class C : general technique for gamma-ray examination.

4.1 Class A

Most cases, in particular where mild or low alloy steel is concerned, are covered by the correct use of the technique given for Class A.

4.2 Class B

Class B (high-sensitivity X-ray examination) is intended only for more important and difficult cases or where the Class A technique is unlikely to reveal the imperfections sought. It is a technique in which only fine-grain films and lead screens are used; it therefore requires longer exposure times and, on occasions, the use of equipment capable of giving voltages higher than those required for Class A.

4.3 Class C

With regard to Class C (gamma-ray examination) it is to be noted that the detectability of imperfections obtainable even with the best gamma-ray technique is always inferior to that obtainable with the Class A technique. The use of gamma-rays should, therefore, be limited as far as possible to cases in which the shape, the thickness or the accessibility of the weld renders X-ray inspection impossible. It should be mentioned in the test report that gamma-rays have been used and full details of the source should be given. (See section 7.)

It should also be noted that the known disadvantage of the Class C technique (low contrast) is sometimes offset by the fact that the small size of the radioactive sources allows of their being placed on the axis of the pipe to be examined, thus ensuring the best geometrical conditions while avoiding, in many instances, the disadvantages arising from the double wall techniques.

5. GENERAL

5.1 Protection

Exposure of any part of the human body to X-rays or gamma-rays can be highly injurious to health. It is therefore essential that, wherever X-ray equipment or radioactive sources are in use, adequate precautions should be taken to protect the radiographer and any other person in the vicinity.

Safety precautions to be taken against X-rays and gamma-rays are those in force in each country.*

5.2 Surface preparation

In order to obtain the best flaw sensitivity, it is always advisable to remove surface imperfections before taking radiographs.

In general, surface preparation may not be necessary for radiography, but where surface irregularities might cause difficulty in detecting internal imperfections, the surface should be ground smooth.

5.3 Location of the weld in the radiograph

Markers, usually in the form of lead arrows or other symbols, should be placed alongside the weld on each side of it, so that the position of the weld can be identified on the radiograph. This may not be necessary if the reinforcement is retained.

5.4 Identification of radiographs

Lead letters or symbols should be affixed to each section of the weld being radiographed. The images of these letters should appear in the radiograph to ensure unequivocal identification of the section.

* In default of such regulations, reference should be made to the latest Recommendations of the International Commission on Radiological Protection.