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Inspection of Pipe Welds Using the Radiogrphy Method with the Double Wall Double Image Technique

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Abstrak

Inspection of 90^0 angle pipe welds using the Radiography method with an Ir.192 source with a capacity of 150 Curie while operating 56 curies using the Double Wall Double Image Technique Case study at (PT. XXX). Errors and inaccuracies in timing result in the resulting image being damaged, not meeting radiographic film acceptance quality standards. irradiation (exposure time). The purpose of this paper is to be able to calculate the exposure time using computation, and to know the type of defects in the welding and there are significant undercutting defects that require repair or re-welding and are declared rejected by the radiographer. The results of the exposure time calculation between the calculations of several processes have a relatively large time difference, this is because they do not follow the curve value. In the end it can be concluded from the results of the film is very influential on the exposure time. Based on this, the resulting software can be declared in accordance with field conditions

Keyword: Air Dryer, Teknik Double Wall Double Image, Camera Gamma Sumber Radiasi Ir-192, Undercutting.

1. Introduction

Air dryer is a tool that serves to remove the water content in the compressor (compressed air)[1]. Before the air is utilized for use, the air must be dried first so that corrosion does not occur in the compressor and prevents clogging of nozzles, needles and others. The working principle of the air dryer is that the air leaving the dryer will be heated by the air leaving the compressor, entering through an air heat exchanger to prevent condensation from occurring in the pipeline. Therefore inspection is often carried out with the radiography method on the bend pipe[2].

The radiography method is an inspection method that utilizes radiation beams originating from the emission of nuclear isotope radiation from Ir 192 which is placed in a radiography camera[3][4]. The radiation energy is then transferred into a film image through an exposure process for a certain time. The irradiated film is then carried out by an image forming process (processing film) so that all indications contained in the material can be produced properly.

In accordance with ASME code section V, the implementation of radiography is generally known by several methods, one of which is the Double Wall Double Image (DWDI)[5], the application of the radiographic test technique depends on the dimensions and shape of the object to be inspected. for example pipe diameter smaller than 3.5 inches.

For the DWDI technique, several main parameters that influence the production of good radiographic image quality include time accuracy and good chemical processing, accurate irradiation. these parameters are related to one another. Of these parameters, determining the accurate irradiation time is a critical parameter in the implementation of radiography tests. Errors and inaccuracies in timing result in the resulting image being damaged and not meeting radiography film reception quality standards. In the field, the determination of test time is still done manually based on monographs with poor accuracy. These monographs are usually issued by film manufacturers used such as AGFA and others. The use of monographs often causes the results of this radiography test to fail (rework) to the detriment of the company and the industry where the test is carried out.

Several studies have been carried out[6][7][8], Kusuma, et al., conducted research on Analysis of Variations in Welding Currents and Solvent A-TIG (Activated-Tungsten Inert Gas) Material SA 240 Type 304 Against Radiography, Hardness and Metallography, the results showed that the results of radiography film interpretation found defects incomplete penetration and porosity[9]. Yusmawati, et al, conducted research on theoretical review of welding inspection results on gas cooler tube joints, the results of the tests conducted showed that the composition, ferrite content, tensile and bending strength were still within the specified value limits[10].

2. Research Methods

3.1 Inspected materials

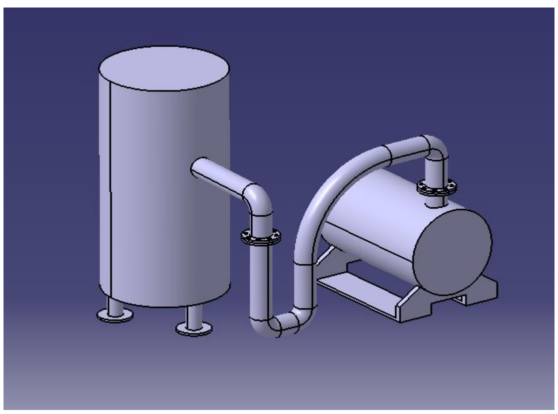


Fig 2. Pipe installation

a. Calculation of Camera Capacity

The type of radiation source used for the radiographic test at PT. XXX is Ir 192. with a half-life of 74 days which emits gamma X-rays covered by a gamma camera with type B(U) CDN /2086/B (U)-96 weighing 22 kg using a shield. The reduced uranium content is 2, 71 mm for the Ir-192 source. This material also has the ability to absorb very high radiation emissions when compared to other materials such as lead (Pb). In Indonesia, the use of gamma sources above one hundred curries is not recommended. However, in a high-tech country like Japan, sourcing activities can reach more than one hundred curries because they are superior in terms of security technology. When it was used to inspect a 900 angle bend at PT.XXX on July 17, 2016, the Ir-192 source, of course, had decayed so that the magnitude was smaller than its original activity. On that date, source activity was approximately 56 Ci. Theoretically, the calculation of the activity decay is as follows: The decay time is 65 days. The theoretical calculations are as follows:

$$A = Ao \, . \, e^{(\ln 2/t\ paroh).t}$$

$$A = 91.^{(-0,693/74).65}$$

Fig 3. Pipe Joints 1

Fig 4. Pipe Joints 2

$$A = 91 \ . \ 0,61$$

$$A = 55,51 \text{ Ci}$$

b. Exposure Time Calculation

- Formulas manually

SFD curve = 610 mm
E based on curves = 183,06 Ci.minute
Thick 2 las =2(5,49+2) =15 mm

$$t = \left(\frac{SFD}{SFD\ kurva}\right)^2 . \frac{E}{A}$$

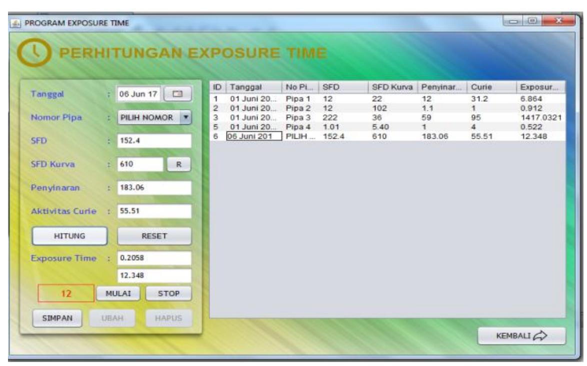
$$t = \left(\frac{152,4}{610}\right)^2 . \frac{183,06}{55,51}$$

$$t = 0,06 \ . \ 3$$

$$t = 0,2 \text{ minute}$$

$$t = 12 \text{ secon}$$

- Formulas using computation



c. *Sensitivity*

At all film positions, the pin wires appear 4 pieces with the smallest diameter of 0.016 inches. So the sensitivity is

$$S = \frac{\Phi(diameterkawatterkecil)inchi}{x(tebalmaterial)inchi} \, . \, 100\ \%$$

$$S = \frac{0,016}{0,216} \,.\, 100\ \% = 7,4\ \%$$

In general, the actual density value is not included in the radiographic report, but only in the range of 2-4. When using a densitometer, as long as the white part of the film is not less than 2 and the black part of the film is not more than 4, then the film is worthy of interpretation. If the client in question feels that the film is too dark or too light, then the radiographer shows the density value.

Table 1. Comparison of Determination of Exposure Time Using Manual Formulas Using Computing.

Use		**Information**
Formula in the Field	**Computing**	
• The formula used is too complicated so that the operator spends a lot of time in the calculations • Calculation results are less accurate and precise. • In this calculation a lot of time is wasted. • The operator re-enters the data in a month • Must be careful in calculating the formula. • Users have expertise in formula calculations.	• Facilitate the operator in using calculations through computation • Accurate, precise calculation results. • Facilitate the operator in certain conditions in the field. • Makes it easier for the operator to input data because it is stored automatically per/month. • Computational programmed calculation process. • Users (users) do not have to have special skills in using this calculation.	Calculation of Exposure Time

3 Results and Discussion

The results of the film that has been radiographed for a pipe with a bend angle of 900 at the air dryer at PT. XXX can be seen in figure 4.9.

Fig.

Fig 6. Film result

Based on the Fig 6, it can be seen that in the top position of the rear weld there is significant undercutting so that it needs repair or re-welding and is declared rejected by the interpreter. As shown in Fig. 7.

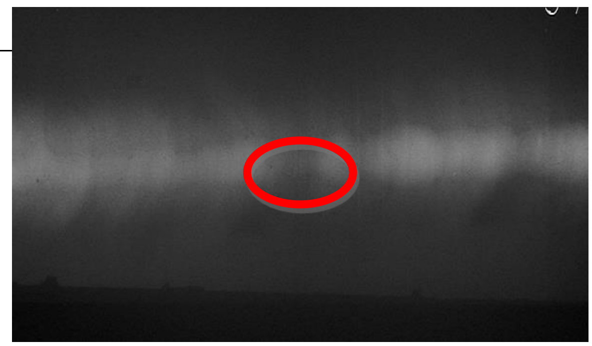


Fig. 7a. Undercutting

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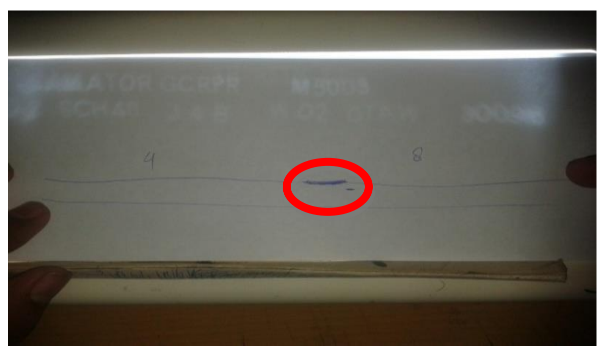

Fig. 7b. Undercutting

4. Conclusion

Based on the ASME standard section V article 2.T-271, for pipe inspection, the nominal OD is greater than 3.5 inches, the DWSI technique is used, the nominal OD is smaller than 3.5 inches, the DWDI technique is used, while the SWSI technique is used for plates. In inspection of pipe welds with a bend angle of 900 on the air dryer using the radiographic method with the double wall double image technique, the conclusions are as follows: Comparing manual calculations with computational calculations, shows that calculations using computation are more accurate and precise than using manual calculations. Can know the types of causes of material damage / defects, namely undercutting. Based on the ASME V article 2 standard, the sensitivity does not meet the requirements, which is above 2% due to errors in using IQI.

In radiography, the reality in the field is sometimes different from the existing theory. Different operational standards, unsupportive material conditions in the field and costs are the main factors influencing these differences. In the industrial world all these factors are taken into account because they affect productivity.

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