Base Load Power Hub (BLPH)

Radiographic Examination Procedure – Structure

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Table of contents

1	INTRODUCTION	5
1.1	PROJECT OVERVIEW	5
1.1.1	Project Location	5
1.1.2	Project Concept	6
2	DOCUMENT SCOPE	8
2.1	REFERENCES (Applicable edition)	8
2.2	DEFINITIONS AND ABBREVIATIONS	8
3	PERSONNEL QUALIFICATION	9
4	SURFACE PREPARATION	9
5	RADIATION SOURCE	9
6	CALIBRATIONS	10
7	FILM SYSTEM AND METAL SCREEN	10
8	BACKSCATTERED RADIATION	11
9	PENETRAMETERS (IQI)	11
10	IDENTIFICATION SYSTEM	12
11	RADIOGRAPHIC TECHNIQUE	12
11.1	SINGLE WALL TECHNIQUE	13
11.2	SINGLE WALL TECHNIQUE	13
12	SOURCE TO OBJECT DISTANCE	13
13	FILM DENSITY	14
14	IQI SENSITIVITY	14
15	FILM STORAGE	14
16	FILM DEVELOPMENT	15
17	ACCEPTANCE CRITERIA	15
18	WELD REPAIR	21
19	EXAMINATION REPORT	21
20	ATTACHMENT	22

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List of Figures

Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map 5
Figure 2 - Wind Park Details 6
Figure 3 – BLPH Concept 6

List of tables

Table 1 - Reference Documents 8
Table 2 - Definitions and Abbreviations 8

List of Attachments

Attachment 1 – Maximum permissible voltage
Attachment 2 – Radiographic techniques
Attachment 3 – Minimum number of exposures (Class B)
Attachment 4 – Ug Nomogram
Attachment 5 – IQI Selection
Attachment 6 – IQI Size
Attachment 7 – Examination Report

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

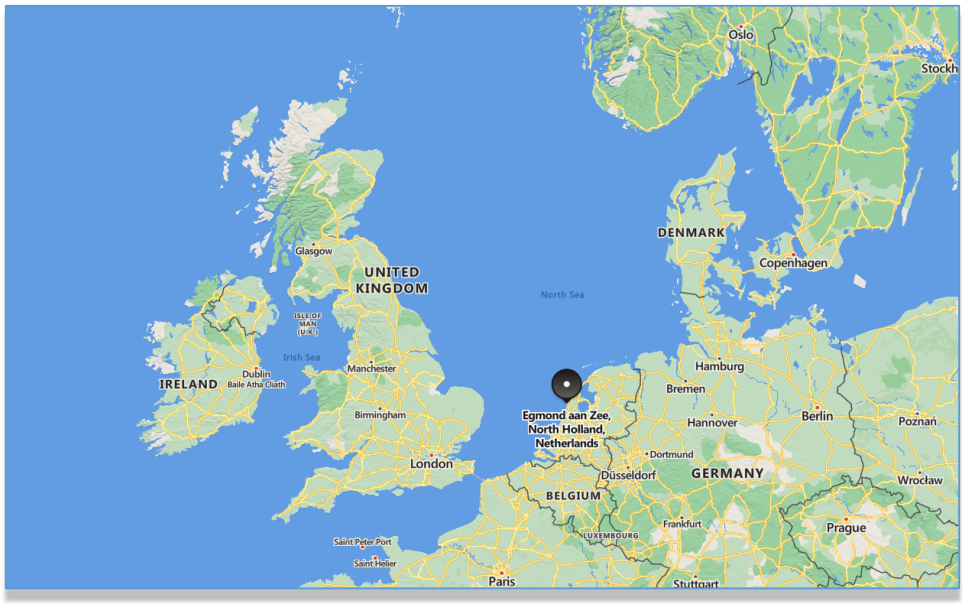


Figure 1 HOLLANDSE KUST NOORD WIND PARK Location Map

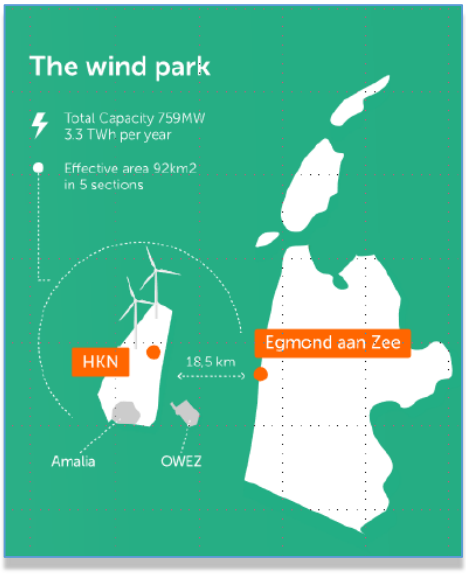


Figure 2 - Wind Park Details

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

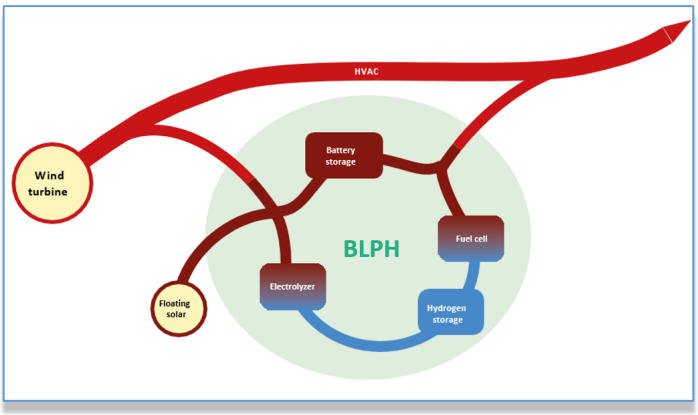


Figure 3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

2 DOCUMENT SCOPE

This procedure specifies the requirements for the execution, examination and evaluation of radiographic films obtained by x-rays or γ-rays (shall be subject to company approval) on welded joint in carbon steel.
The procedure is applicable limited to structural Scope of Work.
NDT shall not be carried out until at least 48 hours have elapsed following completion of welding.
As per company specification 123A90-DDL-ST-SP-90019 the radiographic examination shall be in accordance with ISO 17636-1

2.1 REFERENCES (Applicable edition)

Doc. No.	Description
123A90-DDL-ST-SP-90019	Structural Fabrication Specification
EEMUA_158	Construction Specification for fixed offshore structures
UNI EN ISO 17636-1	Non-destructive testing of welds – Radiographic testing part 1 – X and Gamma ray techniques with film.
ISO 10675-1	Non-destructive testing of welds – Acceptance levels for radiographic testing – Part 1: Steel,nickel,titatium and their alloys
ISO 19232-1	Non-destructive testing -- Image quality of radiographs -- Part 1: Determination of the image quality value using wire-type image quality indicators
ISO 11699-1	Non-destructive testing – Industrial radiographic film – Part . Classification of film systems for industrial radiography
ISO 9712	Non-destructive testing — Qualification and certification of NDT personnel

Table 1 - Reference Documents

2.2 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project
NDT:	Non Destructive test

Table 2 - Definitions and Abbreviations

3 PERSONNEL QUALIFICATION

Personnel performing and evaluating Radiographic examinations shall be qualified and certified minimum as Level II in accordance with ISO 9712.

The personnel shall have an annual near vision acuity test, with correction if necessary, and shall be able to read the 1st line of a JAEGER STANDARD chart at not less than 300 mm. For color contrast differentiation and shades of grey, the test may be conducted upon initial certification and at one-year intervals.

Operators/Interpreters shall have passed an eyesight acuity test according to ISO 9712 within the previous 12 months.

4 SURFACE PREPARATION

All welds shall be 100% visually examined and accepted in accordance with the Project requirements before testing.

Excessive surface irregularities, nicks, slag and weld ripples, etc. that could mask or be confused with discontinuities shall be removed by grinding or other suitable means in according with manufacturing specifications.

5 RADIATION SOURCE

To maintain a good flaw sensitivity, the X-ray tube voltage should be as low as possible. When using X-radiations, the maximum voltage used shall be selected according to the graph in attachment 1.

Gamma radiation sources may be used as Ir 192 isotope for thickness ranges as following indicated:

(Note that by agreement between the contracting parties the value for Ir192 may further be reduced to 10 mm and for Se75 to 5 mm.)

Radiation Source	**Penetration Thickness w (mm) - Class B**
X-rays equipment energy up to 0.5 MeV	$1 \leq w \leq 50$
Ir 192	$20 \leq w \leq 90$

6 CALIBRATIONS

Manufacturer's or Supplier's publications documenting actual source size and decay curves shall be available.

X-Ray equipment in new conditions shall be calibrated by the Equipment Manufacturer for the verification of the focal spot size and in accordance with the calibration program established by the society performing NDT.

7 FILM SYSTEM AND METAL SCREEN

<table>
<tr><th rowspan="2">Radiation source</th><th rowspan="2">Penetrated thickness
w</th><th colspan="2">Film system class[a]</th><th colspan="2">Type and thickness of metal screens</th></tr>
<tr><th>Class A</th><th>Class B</th><th>Class A</th><th>Class B</th></tr>
<tr><td>X-ray potentials
≤ 100 kV</td><td rowspan="3"></td><td rowspan="3">C5</td><td rowspan="2">C3</td><td colspan="2">None or up to 0,03 mm front and back screens of lead</td></tr>
<tr><td>X-ray potentials
> 100 kV to 150 kV</td><td colspan="2">Up to 0,15 mm front and back screens of lead</td></tr>
<tr><td>X-ray potentials
> 150 kV to 250 kV</td><td>C4</td><td colspan="2">0,02 mm to 0,15 mm front and back screens of lead</td></tr>
<tr><td rowspan="2">X-ray potentials
> 250 kV to 500 kV</td><td>w ≤ 50 mm</td><td rowspan="2">C5</td><td>C4</td><td colspan="2">0,02 mm to 0,2 mm front and back screens of lead</td></tr>
<tr><td>w > 50 mm</td><td>C5</td><td colspan="2">0,1 mm to 0,2 mm front screen of lead[b]
0,02 mm to 0,2 mm back screen of lead[b]</td></tr>
<tr><td>Ir 192</td><td></td><td>C5</td><td>C4</td><td>0,02 mm to 0,2 mm front screen of lead</td><td>0,1 mm to 0,2 mm front screen of lead[b]
0,02 mm to 0,2 mm back screens of lead</td></tr>
</table>

[a] Better film system classes may also be used.

[b] Ready-packed films with a front screen of up to 0,03 mm may be used if an additional lead screen of 0,1 mm is placed between the object and the film.

[c] In class A, 0,5 mm to 2 mm screens of lead may also be used.

[d] In class A, lead screens 0,5 mm to 1,0 mm may be used by agreement between the contracting parties.

[e] Tungsten screens may be used by agreement.

8 BACKSCATTERED RADIATION

A lead symbol "B" with minimum dimensions of 10 mm in height and 1.5 mm in thickness shall be attached to the back of each film holder.

If a light image of the "B" appears on a darker background of the radiograph, protection from backscatter is insufficient and the radiograph shall be considered unacceptable.

A dark image of the "B" on a lighter background or invisibility of the same is not cause for rejection.

9 PENETRAMETERS (IQI)

The RTs will be performed with a technique that obtains a sufficient sensitivity in order to detect the image of the penetrameter (IQI) and the wire specified, for a continuous length of at least 10 mm in a section of uniform optical density, being essential indices of the radiograph quality.

On the radiograph will be applied numbers and identification letters in lead.

Will be used wires IQI standard UNI EN ISO 19232-1.

The size of the wire and IQI chosen are specified in the tables in Annex 2 to the technique with single and double wall (class A).

IQI material will be selected from the same group of the base material or of a material with an absorption of radiation is less than the material to be radiographed.

IQI be placed on the source side in the central part of the area to be examined and perpendicular to the weld, except when the hand positioning is prevented by inaccessibility on the source side.

In this case it should be positioned on the film side in contact with the part to be examined and it must have a lead letter "F" in the adjacent area or on the same IQI without it masks the essential thread.

In the case where Ir 192 sources are used, IQI values may be accepted by agreement of contracting parties as follows:

Double wall, double image techniques, class B:

10 mm < w ≤25 mm: 1 wire or step hole value less far Ir 192;

5mm < w ≤12mm: 1 wire or step hole value less for Se75

Single wall single image and double wall single image techniques, class B:

10mm< w ≤40 mm: 1 wire value less for Ir 192.

5mm < w ≤20mm: 1 wire value less for Se 75.

10 IDENTIFICATION SYSTEM

Lead letters or numbers of location markers shall be placed directly on the part and their location shall be marked on the surface of the part being radiographed to allow accurate location of a radiograph to the part of interest and demonstrate complete coverage of the region being examined.

Location markers shall be permanently stenciled on the part radiographed and/or reported on a radiographic map.

When metric markers strip is used, the start point, and progression direction shall be identified and applied directly on the part when 100% coverage is required.

Where the radiograph doesn't show the weld (smooth grinding), markers shall be placed on either side of the weld.

When radiographing an area with two or more separate films, the films shall overlap sufficiently to ensure the complete coverage.

This shall be verified by markers on the surface of the object which will appear on each film.

Location marks shall be placed on the object being inspected not on film holder/cassette.

On each film shall be permanently marked the following information:

- Project Nr
- Item Nr
- Weld Nr
- Date of radiograph execution

Flash marking on film can be perform when agreed with Company's representative.

Films carried out after "repair" shall have a marking "**R**" and the eventual repair number

Films carried out after "repeat confirmation defect" shall have a marking "**RXX**"

Films carried out after "repeat" shall have a marking symbol "**RR**"

Films carried out on reweld after cutting shall have marking "**C**"

11 RADIOGRAPHIC TECHNIQUE

Radiographic arrangements shall be in conformance to ISO 17636-1 as per Attachment 2. By agreement between parties' other arrangements can be used.

An adequate number of exposures shall be made to demonstrate that the required coverage is obtained as per Attachment 3.

11.1 SINGLE WALL TECHNIQUE

In the single-wall technique, the radiation passes through only one wall of the weld, which is viewed for acceptance on the radiograph (Attachment 2).

For Single Wall-Single Image technique the IQI sensitivity for source side IQI shall be in accordance with ISO 17636.

11.2 SINGLE WALL TECHNIQUE

In the double-wall technique, the radiation passes through two walls of the weld (Attachment 2).

A. Double Wall–Single Image (DWSI): For welds in components, a technique may be used in which the radiation passes through two walls and only the weld of the film side wall is viewed for acceptance on the radiograph. When complete coverage is required for circumferential welds, a minimum of 3 exposures taken 120 deg. to each other shall be made.

B. Double Wall-Double Image (DWDI): For welds in components having outside diameter less than 100 mm, nominal thickness less than 8 mm or weld width less than D/4, a technique may be used in which the radiation passes through two walls and the weld or material in both walls is viewed for acceptance on the same radiograph. Two 90° displaced images are sufficient if t/De ≤ 0,12, otherwise three images are needed. The distance between the two projected weld images shall be about one weld width. The radiation beam may be offset from the plane of the weld at an angle sufficient to separate the images of the source side and film side portions of the welds so that there is no overlap of the areas to be interpreted and at least the weld width. When complete coverage is required, a minimum of two exposures taken 90° to each other shall be made for each joint. Additional exposures shall be made if the required radiographic coverage cannot be obtained.

12 SOURCE TO OBJECT DISTANCE

The minimum distance between source and object to be examined in order to limit the geometric unsharpness is chosen according to the nomogram as per Attachment 4.

The nomogram is based on the focal spot size and object to film distance and in function of class quality.

The geometrical unsharpness shall not exceed 0.25 mm.

13 FILM DENSITY

The exposure conditions should be such that the minimum optical density of the radiograph in the area examinaed shall be for Class B ≥ 2,3.

For composite viewing of multiple film exposures, each film of the composite set shall be a minimum density of 1.3.

A tolerance of ± 0.1 in density is allowed for variations between densitometer readings suitable calibrated electronic densitometer shall be available during evaluation of films. Film density shall be checked with a calibrated transmission type densitometer.

Densitometers shall be calibrated at least every 90 days during use as follows:

A national standard step tablet or a step wedge calibration film, traceable to a national standard step tablet and having at least five steps with neutral densities from at least 1.0 through 4.0, shall be used.

The step wedge calibration film shall have been verified within the last year by comparison with a national standard step tablet unless, prior to first use, it was maintained in the original light-tight and waterproof sealed package as supplied by the manufacturer. Step wedge calibration films may be used without verification for one year upon opening, provided it is within the manufacturer's stated shelf life.

The densitometer manufacturer's step-by-step instructions for the operation of the densitometer shall be followed.

The density steps closest to 1.0, 2.0, 3.0, and 4.0 on the national standard step tablet or step wedge calibration film shall be read.

The densitometer is acceptable if the density reading do not vary by more than ±0.05 density units from the actual density stated on the national standard step tablet or step wedge calibration film.

14 IQI SENSITIVITY

Radiography shall be performed by a technique that allow sufficient sensitivity to display the essential wire of a Wire IQI as per Attachment 5.

Sensitivities for source-side IQIs shall, for both single wall and double wall techniques, be in accordance with ISO17636-1, Class B.

The radiograph shall also display the IQI identifying numbers and letters.

If the essential wire doesn't show on any film in a multiple film technique, but do show in composite film viewing, interpretation shall be permitted only by composite film viewing.

15 FILM STORAGE

Radiographic film and reports shall be properly stored and retained for minimum 5 years.
Radiographs shall be stored in suitable boxes in sequence with the weld numbering.
Radiographs of rejected welds, repairs and re-shoots shall be stored together.

Radiographs storage temperature should be between 40°F (4.4°C) and 75°F (24°C) at a relative humidity range of 30 to 60 %.

16 FILM DEVELOPMENT

Radiographs will be developed using an automatic method.

Chemicals change log shall be maintained.

All radiographs shall be free from artifacts, blemishes, scratch-es, etc., which might hinder future interpretations.

After processing, the radiographs shall not contain a greater concentration of residual thiosulphate than specified in ISO 11699-2. An analysis shall be performed on 5% of all production radiographs.

17 ACCEPTANCE CRITERIA

The acceptance criteria shall be in accordance with ISO 10675-1 Level 1.

Internal indications in butt welds

No.	Type of internal imperfections in accordance with ISO 6520-1	Acceptance Levels 1
1	Cracks (100)	Not permitted
2a	Porosity and gas pores (2012,2011) Single layer	A< 1% d≤ 0,2s, max.3mm L=100mm
2b	Porosity and gas pores (2012,2011) Multy layer	A< 2% d≤ 0,2s, max.3mm L=100mm
3b	Clustered (localized) porosity (2013)	$d_A \leq w_p/2$, max.15mm L=100mm
4	Linear porosity (2014)	l ≤ s, max.25mm d≤ 0,2s, max.2mm L=100mm
5d	Elongated cavities (2015) and wormholes (2016)	h < 0,2s, max.2mm ∑l≤s, max.25mm L=100mm
6e	Shrinkage cavity (202) (other than crater pipes)	Not permitted
7	Crater pipe (2024)	Not permitted

8d	Slag inclusion (301) Flux inclusions (302) and oxide inclusion (303)	h < 0,2s, max.2mm ∑l≤s, max.25mm L=100mm
9	Metallic inclusion (304) (other than coper)	l≤0,2s, max.2mm
10	Copper inclusions (3042)	Not permitted
11e	Lack of fusion (401)	Not permitted
12e	Lack of penetration (402)	Not permitted

Surface imperfections

13	Crater cracks (104)	Not permitted
14a	Undercut,continues and intermittet (5011,5012) t>3mm	Smooth transition is required. h≤0,05t, max.0,5mm
14b	Undercut,continues and intermittet (5011,5012) 0,5mm≤ t≤3mm	Smooth transition is required. Not permitted
15a	Shrinkage groove (root undercut 5013) t>3mm	Smooth transition is required. l≤25mm, h≤0,05t, max.0,5mm
15b	Shrinkage groove (root undercut 5013) 0,5mm≤ t≤3mm	Smooth transition is required. Not permitted
16a	Excess penetration (504) 0,5mm≤ t≤3mm 0,5mm≤ t≤3mm	h≤1mm + 0,1b
16b	Excess penetration (504) t>3mm	h≤1mm + 0,2b max.3mm
17	Stray arc (601)	Not permitted
19a	Root concavity (515) 0,5mm≤ s≤3mm	Not permitted

19b	Root concavity (515) s>3mm	l≤25mm, h≤0,05t, max.0,5mm
20	Poor restart (517) s≥0,5mm	Not permitted
21a	Sagging (509) Incompletely filled groove(511) 0,5mm≤ s≤3mm	Not permitted
21b	Sagging (509) Incompletely filled groove(511) s>3mm	l≤25mm, h≤0,05t, max.0,5mm
22a	Linear misalignement (507) 0,5mm≤ s≤3mm	h≤0,2mm + 0,1t
22b	Linear misalignement, longitudinal welds (507) s>3mm	h≤0,1 t, max.3mm
22c	Linear misalignement, circumferential welds (507) s≥0,5mm	h≤0,1 t, max.5mm

Determination of area percentage (%) of imperfections

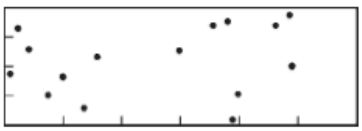


Figure B.1 — A = 1 %

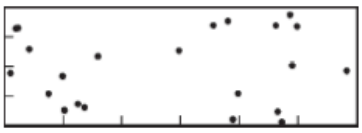


Figure B.2 — A = 1,5 %

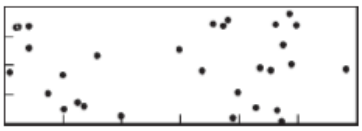


Figure B.3 — A = 2 %

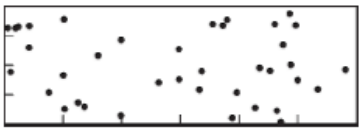


Figure B.4 — A = 2,5 %

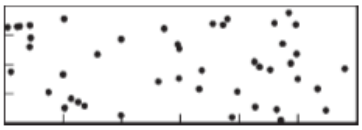


Figure B.5 — A = 3 %

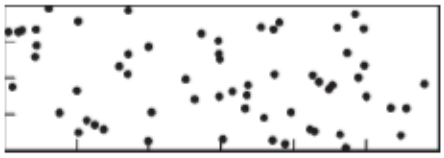


Figure B.6 — A = 4 %

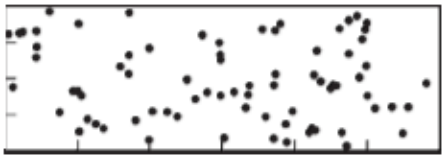


Figure B.7 — A = 5 %

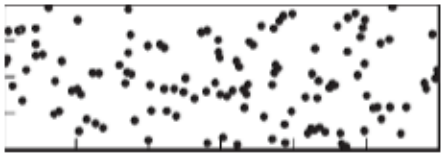


Figure B.8 — A =8 %

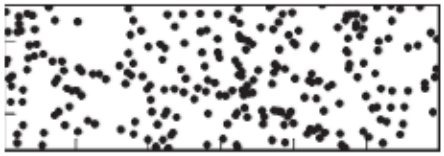


Figure B.9 — A = 16 %

Calculation of the sum of acceptable areas

C.1 Clustered porosity

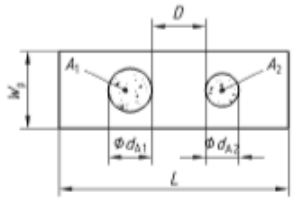


Figure C.1 — Clustered porosity, $D > d_{A2}$

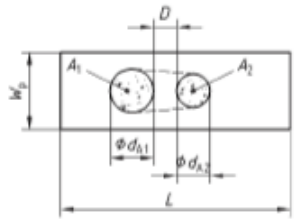


Figure C.2 — Clustered porosity, $D < d_{A2}$

The sum of the different pore envelop areas ($A_1 + A_2$ ...) related to the evaluation area, $L \times w_p$ (see Figure C.1), shall be calculated.

If D is less than d_{A1} or d_{A2}, whatever is smaller, an envelope surrounding the porosity areas, $A_1 + A_2$, shall be considered as one area of imperfection (see Figure C.2).

C.2 Linear porosity

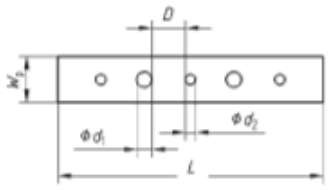


Figure C.3 — Linear porosity, $D > d_2$

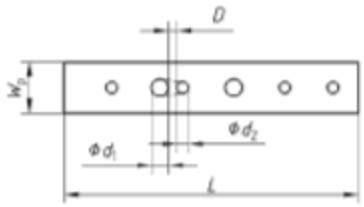


Figure C.4 — Linear porosity, $D < d_2$

The sum of the different pore areas related to the evaluation area, $L \times w_p$ (see Figure C.3), shall be calculated.

If D is smaller than the smaller diameter of one of the neighbouring pores, the full connected area of the two pores shall be taken into the sum of imperfections (see Figure C.4).

C.3 Elongated cavities and wormholes

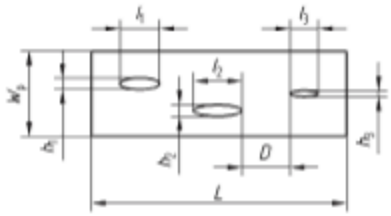


Figure C.5 — Elongated cavities and wormholes, $D > l_3$

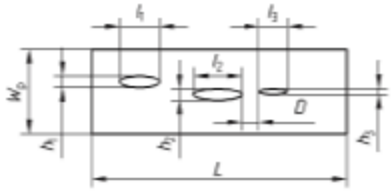


Figure C.6 — Elongated cavities and wormholes, $D < l_3$

The sum of the length of indications, Σl, shall be determined for each testing length, L (see Figure C.5).

If D is smaller than the shorter length of one of the neighbouring imperfections, the full connection of the two imperfections is to be taken into the sum of imperfections (see Figure C.6).

18 WELD REPAIR

All unacceptable indications shall be removed. Where welding repair is required, the repair area, including 50 mm on either side, shall be re-examined for external defects prior to welding. Welding repairs (or replaced welds) shall be examined with the same methods prescribed for the original weld.

19 EXAMINATION REPORT

All NDT shall be documented, and all reports shall be generated by database.

The documentation shall include as minimum the following information:

a) Job identification;
b) Item and weld number;
c) Radiographic testing procedure including acceptance criteria;
d) Isotope or XR identification Activity;
e) Isotope or max XR intensity Voltage used
f) Effective focal spot size;
g) Unsharpness geometry
h) Film brand and screen (thickness, dimension, material for the filter and film)
i) Number of exposures;
j) Base material type and thickness;
k) Exposure time and source to film distance;
l) Single or double wall exposure;
m) Single or double wall viewing.
n) Type and position of IQI;
o) Film development: manual or automatic;
p) Test results, density
q) WPS identification

20 ATTACHMENT

Attachment 1 – Maximum permissible voltage

Attachment 2 – Radiographic techniques

Attachment 3 – Minimum number of exposures (Class B)

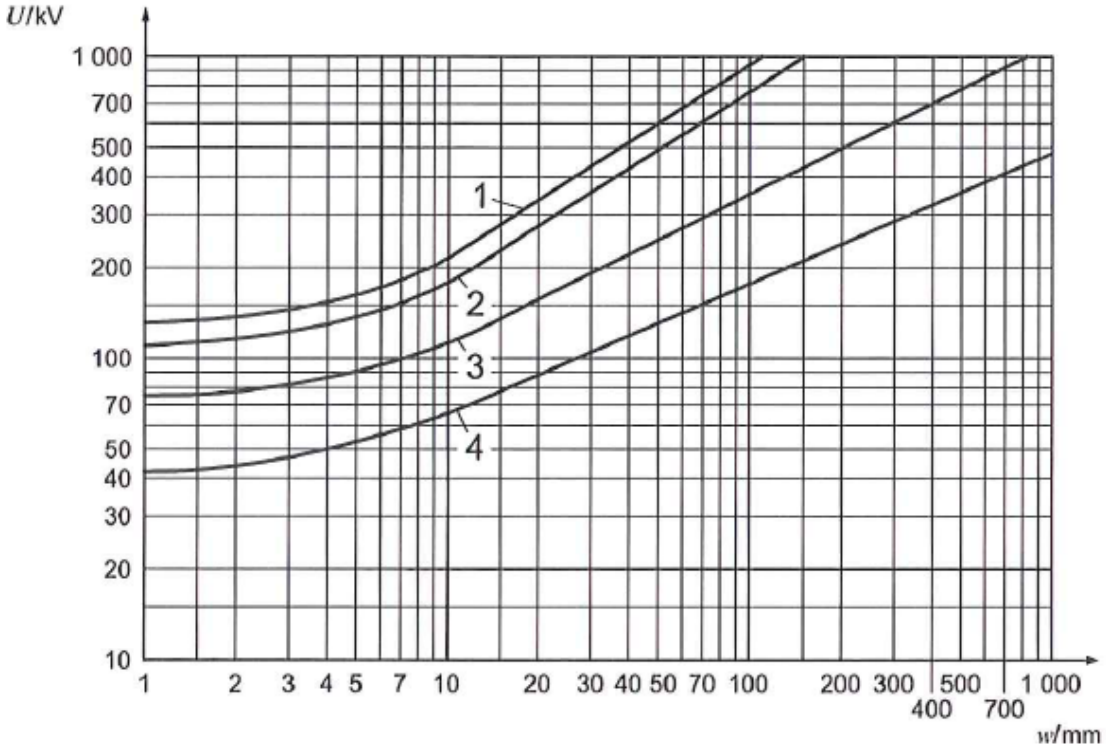
Attachment 4 – Ug Nomogram

Attachment 5 – IQI Selection

Attachment 7 – Examination Report

ATTACHMENT 1 – MAXIMUM PERMISSIBLE VOLTAGE

Maximum X-ray voltage for X-ray devices up to 1 000 kV as a function of penetrated thickness and material.

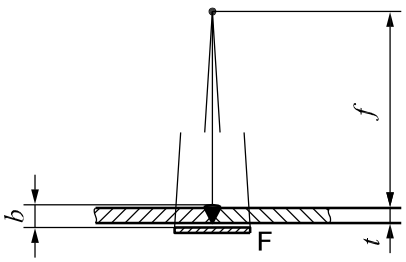


Key

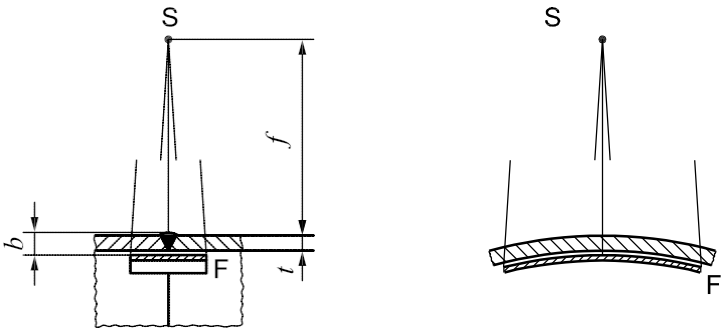
U	X-ray voltage	1	copper and nickel and alloys
w	penetrated thickness	2	steel
		3	titanium and alloys
		4	aluminium and alloys

ATTACHMENT 2 – RADIOGRAPHIC TECHNIQUES

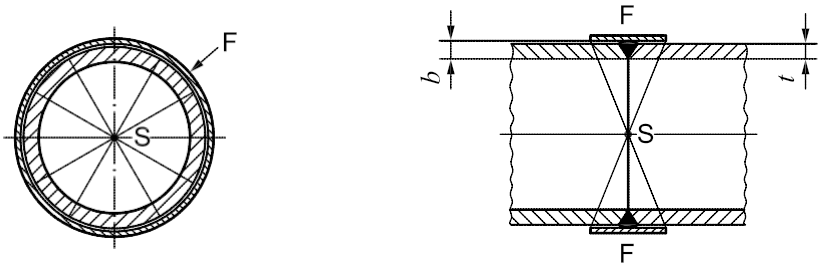
- Radiation source located in front of the object and with the film at the opposite side. Test arrangement for plane welds and single wall penetration



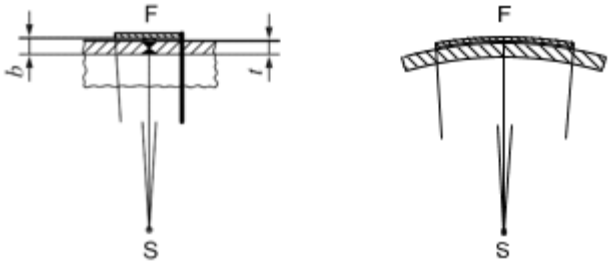
- Radiation source located outside the object and film inside



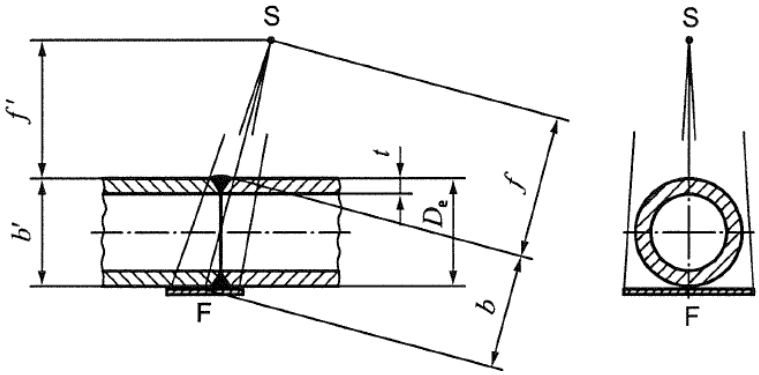
- Radiation source centrally located inside the object and with the film outside



- Radiation source located off-centre inside the object and film outside



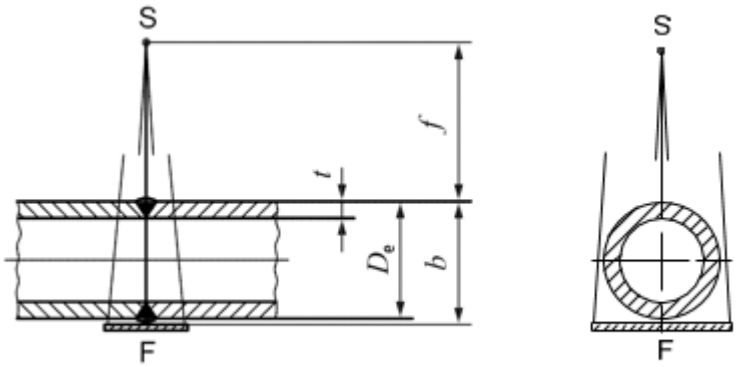
- Elliptic technique



NOTE: The source-to-object distance can be calculated by the perpendicular distance *f'*, calculated from *b'*.

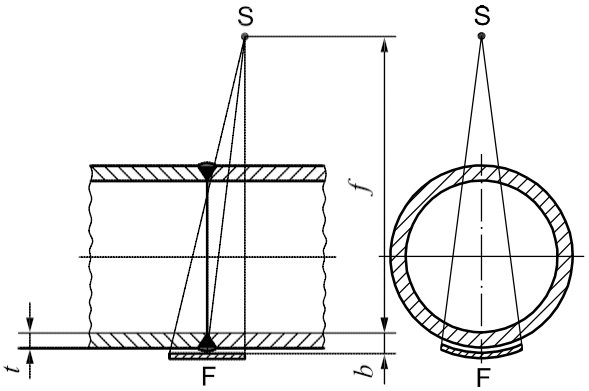
Test arrangement for double wall penetration double image of curved objects for evaluation of both walls (source and film outside of the test object).

- Perpendicular technique

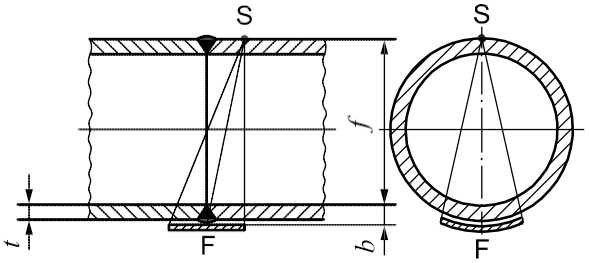


Test arrangement for double wall penetration double image of curved objects for evaluation of both walls (source and film outside of the test object)

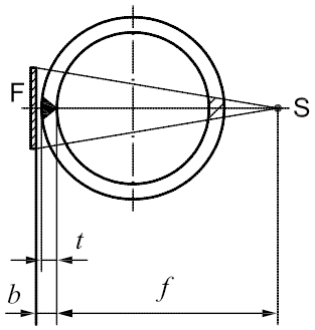
Radiation source located outside the object and film on the other side



Test arrangement for double wall penetration single image of curved objects for evaluation of the wall next to the film with the IQI placed close to the film

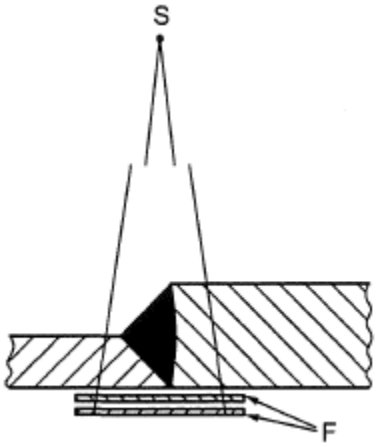


Test arrangement for double wall penetration single image



Test arrangement for double wall penetration single image of longitudinal welds

- Technique for different material thicknesses



Multi-film technique

ATTACHMENT 3 – MINIMUM NUMBER OF EXPOSURES (CLASS B)

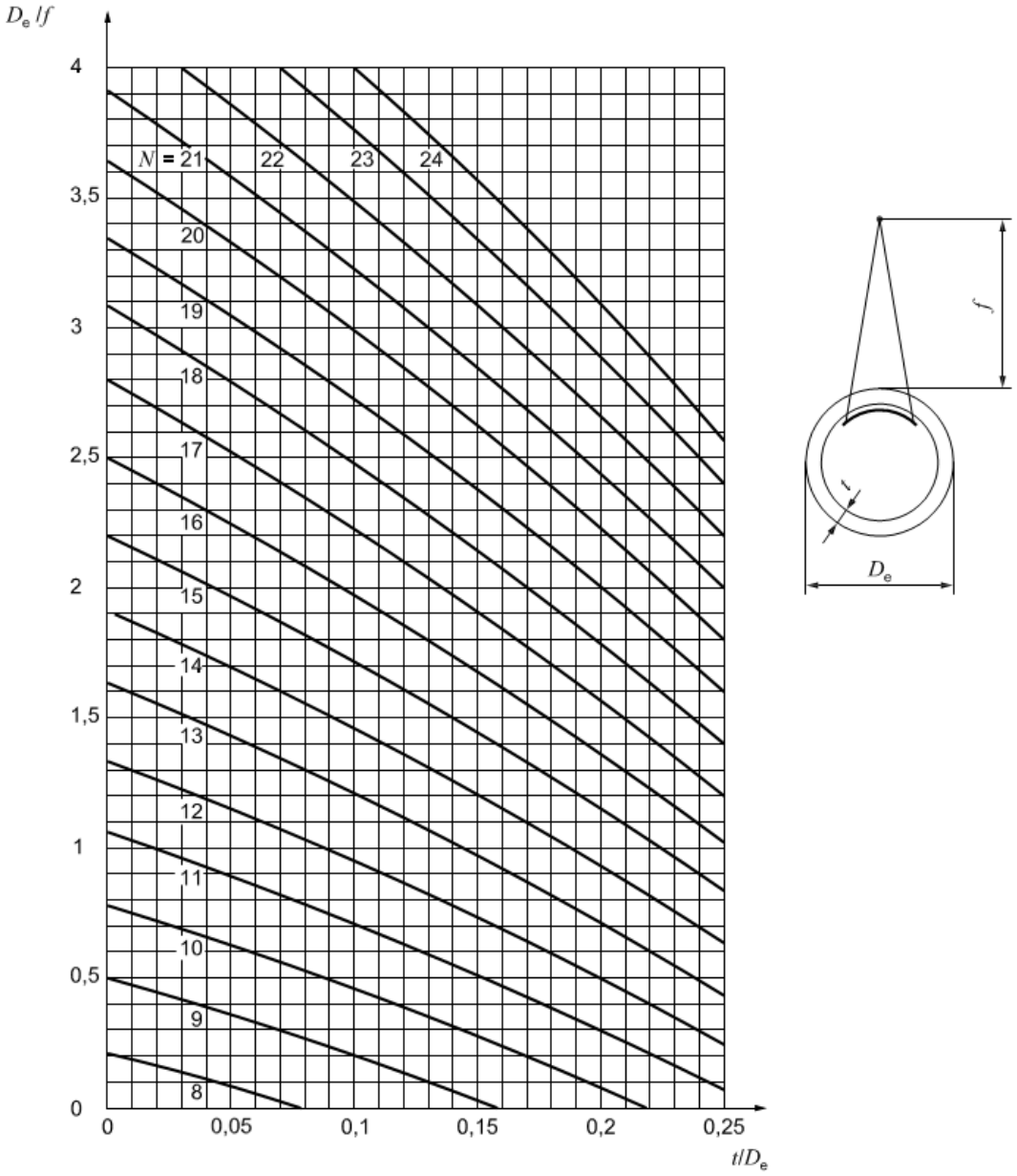
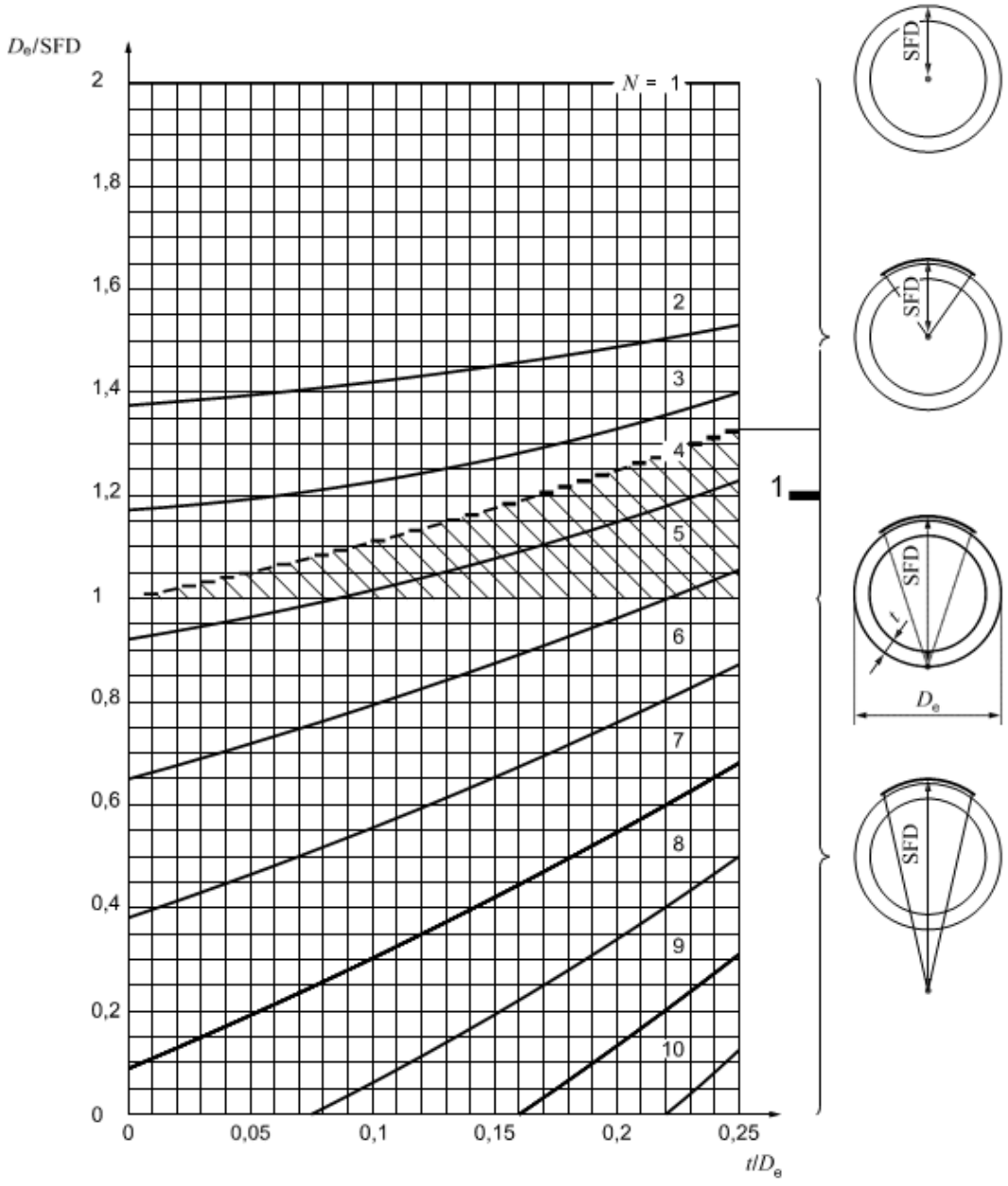


Figure A.1 – Minimum number of exposures *N* for single wall penetration with source outside, with a maximum permissible increase in penetrated thickness D*t*/*t* due to inclined penetration in the areas to be evaluated of 10 % (class B), as a function of ratios t/D_e and D_e/f.

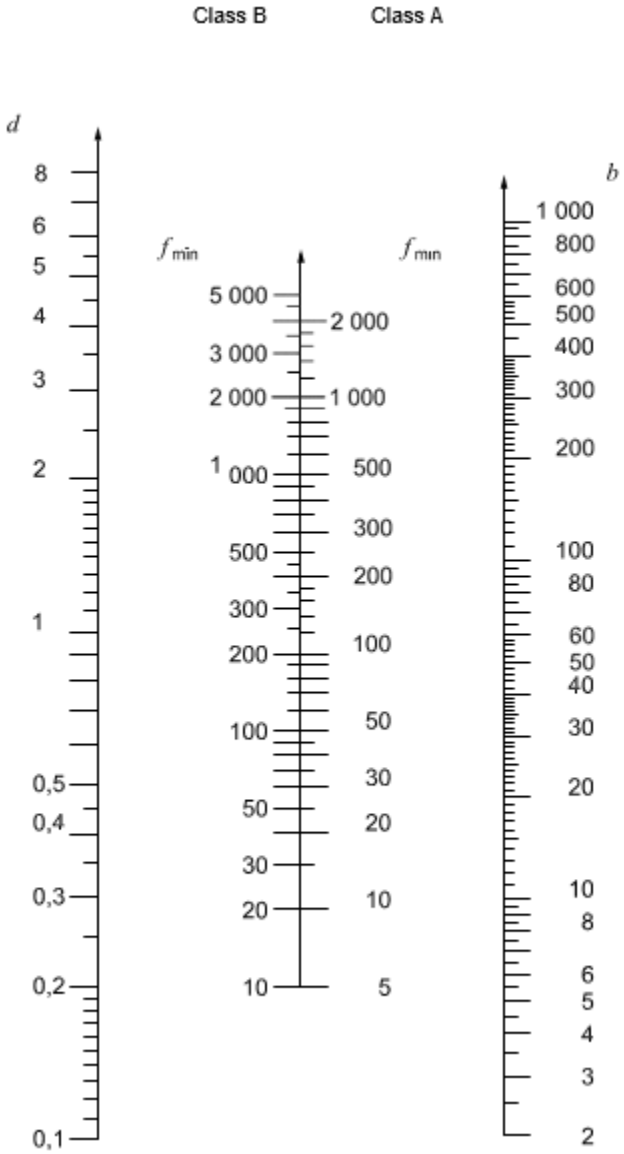


Key

1 inside pipe wall (not accessible)

Figure A.2 – Minimum number of exposures *N* for off-centre penetration with source inside and for double wall penetration, with a maximum permissible increase in penetrated thickness D*t*/*t* due to inclined penetration in the areas to be evaluated of 10 % (class B), as a function of ratios t/D_e and D_e/SFD

ATTACHMENT 4 – UG MONOGRAM



Nomogram for the determination of minimum source-to-object distance f_{min} in relation to object-to-film distance *b* and the source size *d*.

ATTACHMENT 5 – IQI SELECTION

Table 1: Wire numbers, diameters and limit deviations (Dimensions in millimetres)

Image Quality Indicator Including				Wire		
W1	W6	W10	W13	Wire Number	Nominal wire	Tolerances
x				W1	3,20	±0,03
x				W2	2,50	
x				W3	2,00	
x				W4	1,60	±0,02
x				W5	1,25	
x	x			W6	1,00	
x	x			W7	0,80	
	x			W8	0,63	
	x			W9	0,50	±0,01
	x	x		W10	0,40	
	x	x		W11	0,32	
	x	x		W12	0,25	
		x	x	W13	0,20	
		x	x	W14	0,16	
		x	x	W15	0,12	±0,005
		x	x	W16	0,10	
			x	W17	0,08	
			x	W18	0,06	
			x	W19	0,05	

Table 2 — Types of IQI and wire materials used for selected groups of materials

Image quality indicator	Wire number	Wire material	Suitable for test- the following materials
W 1 CU W 6 CU W 10 CU W 13 CU	W 1 to W 7 W 6 to W 12 W 10 to W 16	Copper	Copper, zinc, tin and their alloys
W 1 FE W 6 FE W 10 FE W 13 FE	W 1 to W 7 W 6 to W 12 W 10 to W 16	Steel (low alloyed)	Ferrous materials
W 1 TI W 6 TI W 10 TI W 13 TI	W 1 to W 7 W 6 to W 12 W 10 to W 16	Titanium	Titanium and their alloys
W 1 AL W 6 AL W 10 AL W 13 AL	W 1 to W 7 W 6 to W 12 W 10 to W 16	Aluminium	Aluminium and their alloys

ATTACHMENT 6 – IQI SIZE

Single-wall technique; IQI on source side

Table B.3 — Wire IQI

Image quality class B				
Nominal thickness *t* mm				IQI value
		to	1,5	W 19
above	1,5	to	2,5	W 18
above	2,5	to	4	W 17
above	4	to	6	W 16
above	6	to	8	W 15
above	8	to	12	W 14
above	12	to	20	W 13
above	20	to	30	W 12
above	30	to	35	W 11
above	35	to	45	W 10
above	45	to	65	W 9
above	65	to	120	W 8
above	120	to	200	W 7
above	200	to	350	W 6
above	350			W 5

Double-wall technique; double image; IQI on source side

Table B.7 — Wire IQI

Image quality class B				
Penetrated thickness w mm				IQI value
		to	1,5	W 19
above	1,5	to	2,5	W 18
above	2,5	to	4	W 17
above	4	to	6	W 16
above	6	to	8	W 15
above	8	to	15	W 14
above	15	to	25	W 13
above	25	to	38	W 12
above	38	to	45	W 11
above	45	to	55	W 10
above	55	to	70	W 9
above	70	to	100	W 8
above	100	to	170	W 7
above	170	to	250	W 6
above	250			W 5

Double-wall technique; single or double image; IQI on film side

Table B.11 — Wire IQI

Image quality class B Penetrated thickness w mm				IQI value
		to	1,5	W 19
above	1,5	to	2,5	W 18
above	2,5	to	4	W 17
above	4	to	6	W 16
above	6	to	12	W 15
above	12	to	18	W 14
above	18	to	30	W 13
above	30	to	45	W 12
above	45	to	55	W 11
above	55	to	70	W 10
above	70	to	100	W 9
above	100	to	180	W 8
above	180	to	300	W 7
above	300			W 6

ATTACHMENT 7 – EXAMINATION REPORT

ROSETTI MARINO

NDT ACTIVITIES - TEST REPORT

RAPPORTO DI ESAME RADIOGRAFICO
RADIOGRAPHIC TEST REPORT

DATA RAPPORTO Report Date

FOGLIO / sheet n° 1 of 1

COMMESSA Job	PROGETTO Project	CLIENTE Client	NUMERO ORDINE Order number	DISCIPLINA Discipline

WPS	TECNICA SALD. Welding Process	CODICE SPECIFICA Standard Code	CODICE PROCEDURA Procedure code	ISTRUZ. DI LAVORO RT RT Work Instruction
			Rev.	Rev.

CRITERIO DI ACCETTABILITA Acceptance criteria	INSPECTION TEST PLAN ITP	FASE ITP ITP Phase
	Rev.	

FASE DEL CONTROLLO Examination Phase	MATERIALE Material	TRATTAMENTO TERMICO Post Weld Heat Treatment
		☐ PRIMA del TT Before PWHT ☐ DOPO TT After PWHT ☐ NON APPLICAB. Not Applicable

RADIOGRAPHIC TECHNIQUE DETAILS

Sorgente / Source	I.Q.I. Tipo / I.Q.I. Type	I.Q.I. Sensibilità richiesta / I.Q.I. Required Sensitivity	I.Q.I. Posizione / I.Q.I. Location

Unità / Unit	Tipo Film + Marca / Film type + Brand	Pellicole per cassetta (Nr) Films box	Schermi di rinforzo (mm) Intensifying screens Front-Back	Sviluppo / Development

Energia+Corrente / Energy+Current Attività /Activity	Nr. Films / Films Nr.	Tecnica radiografica Radiographic techniques	Densità film / Film density	Penombra Ug (mm) Unsharpness geom. Ug	Data esposizione Exposure date

Macchia Focale (mm) Focal Spot	Distanza sorgente-oggetto (mm) Distance Source-Object	Distanza lato sorgente oggetto-pellicola (mm) Distance from Source side object to film	Distanza focal (mm) Focal distance	Tempo di esposiz. Exposure time	No. di esposizioni Nr. of exposures

OGGETTO CONTROLLATO / Tested object

COMPONENTE / Item

RAPP. Report	SALD Weld	DISEGNO Drawing	Fg Sh	MARCA Mark	CIANF. Bevel	DIMENSIONE Dimension	Sp. Thk (mm)	POS. Film pos.	INDICAZIONI Indications	ESITO Result	SALDATORI Welders

NOTE / Remarks

TECNICO CND Livello 2 NDT Technician Level 2	CONTROLLO QUALITA' QC Supervisor	ISPETTORE CONTRATTISTA Contractor Repr.	ISPETTORE CLIENTE Company Repr.	ISPETTORE TERZA PARTE Third Party Inspector
Company: Operator:				