

**QUALITY ASSURANCE PLAN**


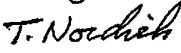

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### 1. SCOPE

This Instruction describes techniques for Liquid Penetrant Examination (PT)

PT is a non-destructive method for detecting cracks, cold laps and other discontinuities, at the surface, in ferromagnetic and non-ferromagnetic materials.

### 2. PERSONNEL REQUIREMENTS

Personnel, performing examination according to this procedure, shall be authorized by NTO N-025 level 3 responsible, and qualified according to EN 473/NORDTEST level 2 or equivalent.

Personnel responsible for NDT activities shall be qualified according to EN 473/NORDTEST, level 3.

### 3. EQUIPMENT REQUIREMENTS

This procedure is valid for the following penetrant products or equivalent:

- Cleaner: Bycotest C 5 or C10
- Penetrant: Bycotest RP 20. (Colour-water washable)
- Penetrant: Bycotest RP 20 LT (Colour- solvent removable/water washable, low temperature.)
- Developer: Bycotest D 30A

Cleaner (C5/C10 or equals) shall be used when pre-cleaning the examination area and also for removal of excess penetrant. The penetrant and cleaner may be in spray cans or tins.

The developer shall be in spray form.

Penetrant products shall be certified with regard to chemical content according to ASME V, Article 6.

### 4. RESTRICTIONS AND CHEMICAL BLENDING

Penetrant examination shall be carried out with products of the same manufacturer. Other products may destroy/reduce the effectiveness of the process.

When examining nickel (alloys), austenitic stainless steels or titanium, the content of sulphur, chlorine or fluorine shall not exceed 1% each.

Examination according to this procedure shall be performed within instructions given by manufacturer on the cans.

If the temperature of the test piece is below 16 °C, a propane flame or electrical heat equipment may heat the surface, to max 52 °C. In that case examination shall be performed immediately after.

When the temperature is low for long periods (ex. winter), low temperature penetrant, RP 20 LT or equal, shall be used. Instructions given on the can shall be followed.

### 5. SURFACE PREPARATION

HAZ (HAZ = Heat Affected Zone = 6mm) + an area of 25 mm each side of the weld, or the test area, shall be cleaned and free from grease, oil, rust or other pollutants that may interfere with the penetrant process.

The test object shall be examined from all accessible surfaces.

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Cleaner (Bycotest C5/C10 or equivalent) shall always be applied to the surface, for example to remove thin layers of grease/oil. Leave it to work for 2 - 3 min. and clean with special lint free paper or cloth. Repeat until the surface is truly clean. Grinding or other machining may be necessary but shall be avoided as far as possible since defect openings on the surface may become covered/closed as a result.

### 6. DRYING OF SURFACE

The area to be examined shall be completely dry before the penetrant is applied. Warm air may be used, i.e. hair-dryer. The test object temperature when drying shall not exceed 52 °C.

### 7. APPLICATION OF PENETRANT - TECHNIQUES

The penetrant may be applied by spraying or brush stroke, and with following combinations as shown in table below.

Technique No.	Cleaner	Penetrant	Developer
N	C5/C10	RP20	D30A
LT	C5/C10	RP20LT	D30A

Equivalent products may be used.

Operator shall ensure that the testing area is complete covered by the Penetrant. The penetration time shall be according to instructions given by the Manufacturer. Maximum penetration time is 1 hour.

#### 7.1 PENETRANT LOW TEMPERATURE TEST

ASME Comparator block shall be used in the following way:

1. Perform a test in area "A" on the comparator block in the temperature range 16 - 35 °C using RP 20 LT penetrant or equal
2. After performed test, the area "A" to be carefully covered by transparent tape
3. Bring the block and the penetrant materials to the area where the testing shall be performed
4. Wait at least 30 minutes until the comparator block and the penetrant materials have achieved the same temperature as the test object
5. Perform a test on area "B" using the penetration time (minimum) as given in Section 7 and developing time as described in Section 11
6. If the test results in area "B" deviates from the test result in area "A" the penetrant and developer have less sensitivity and should not be used without acceptance by the Client.

### 8. REMOVAL OF EXCESS PENETRANT

The surface shall be free of all excess penetrant when the penetration has elapsed time.

Cleaning shall be gently, as this may also remove the penetrant from defects. When all surface penetrant is removed the cleaning shall be terminated.

Excessive penetrant shall be removed according to instructions given by the Manufacturer. A lint free cloth/paper shall be used.

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When solvent is used, the cloth/paper shall be moistened with the solvent and the surface cleaned. Repeat with clean cloths/paper until the surface is clean.

NOTE! The solvent MUST NOT be sprayed or applied directly on to the surface. This may cause removal of the penetrant from the defects.

### 9. DRYING AND APPLICATION OF DEVELOPER

Before applying the developer, after cleaning process, the test surface shall be dried. Care must be taken since excessive drying may destroy the process. Warm air, using a hair-dryer may be applied. The object must not be heated too above 52 °C. Natural evaporation may be utilized.

*NOTE! As soon as the surface is dry the developer shall be applied.*

Developer, Bycotest D-30A or equal, in spray-form require that the spray-can has to be agitated well so the developer powder evenly is distributed in the carrier fluid.

The spray-can shall be hold in a distance of 30 cm from the test surface and be applied in an even, thin layer. The test surface shall be seen through the developer layer.

### 10. DEVELOPING AND INSPECTION

As soon as the developer is dry, the developing process will start. Inspection may be performed in natural daylight or artificial light. The light conditions in the inspection area shall have an intensity of minimum 500 lux.

### 11. EVALUATION OF INDICATIONS

True defect type is difficult to decide if the penetrant bleeds excessively. Therefore the viewing shall start immediately after applying the developer. Final viewing shall be performed after a developing time in 20 minutes, or 30 minutes if the temperature is below 0 °C.

If the operator is in doubt if the indication is a relevant defect, the penetrant examination procedure shall be complete repeated.

*Only indications with dimensions greater than 2,0 mm shall be considered as relevant. An indication of any imperfection may be larger than the imperfection that causes it.*

*However, the size of the indication (after 20 or 30 minutes) is the basis for acceptance evaluation.*

### 12. REPORTING SYSTEM

A report shall be made after examination. If no reportable defects the PT operator may date and sign for acceptance of the actual weld in the weld log only, if approved by Client.

In case of reportable defects, the report shall describe where the examination is performed, and gives a clear and exact description of reportable defects.

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Examination reports of weld repairs shall be documented using the same report number as the original using the suffix R1, R2 etc. which refer to the number of repairs.

Defect types shall be defined when possible.

### 13. ACCEPTANCE CRITERIA

Basically acceptance standards are a matter of agreement between the manufacturer and the purchaser. Some relevant Design Codes & Mandatory Appendices are listed in Chapter 14 - Reference Standards .

### 14. REFERENCE STANDARDS

Some relevant standards:

- NORSOK
- DnV – Rules for Design, Construction and Inspection of Offshore Structures
- DnV – Mobile Offshore Units
- DnV – Lifting Appliances
- DnV – Submarine Pipeline Systems
- ASME B 31.3 – Chemical Plant and Petroleum Refinery Piping
- PD5500 – Specification for Unfired Fusion Welded Pressure Vessels
- ASME – Boiler and Pressure Vessel Code, Section V
- ASME - Boiler and Pressure Vessel Code, Section VIII
- NS-ISO 10042 – Arc-welded joints in aluminum and its weld able alloys – Guidance on quality levels for imperfections
- NS-ISO 5817 – Quality levels for weld imperfections
- EN 12062 – Non-destructive examination of welds – General rules for metallic materials
- NS-EN 571-1 – Non-destructive testing - Penetrant testing - Part 1: General principles
- NS-EN 1289 – Non-destructive examination of welds - Penetrant testing of welds - Acceptance levels
- prEN-ISO 12706 – Terminology
- NS-ISO 6520 – Classification of imperfections in metallic fusion welds, with explanations
- NS-EN 13445 – Unfired Pressure Vessels Part 5 – Inspection and testing

### 15. ANNEX

Annex 1

Report form.

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### Annex 1

#### Aker Inspection and Consulting **LIQUID PENETRANT TESTING** PRØVING MED PENETRERENDE VÆSKE

CLIENT / KUNDE		AIC O.NO	REPORT NO./RAPPORT NR.	PAGE / SIDE 1 OF / AV
MANUFACTURER / PRODUENT		PLACE OF WORK / KONTROLLSTED		OPERATOR / OPERATØR
OBJECT / KONTROLL AV			DATE OF TESTING / KONTROLLDATO	
			EXTENT OF TESTING / KONTROLLOMFANG	
DRAWING NO./ TEGNING NR.			REV.	CLIENT NO / KUNDE NR
INSTRUCTION REFERENCE / INSTRUKS REFERANSE		ACCEPTANCE STANDARD / AKSEPTSTANDARD		
MATERIAL TYPE / MATERIALTYPE	SURFACE / OVERFLATE	TEST STANDARD / KONTROLLSTANDARD	GROOVE / FLUGE GEOMETRI	WELDING PROCESS / SVESSEPROSSESS
PENETRANT TYPE / PENETRANTTYPE		FLUORESCENT / FLUORESCERENDE <input type="checkbox"/> YES / JA <input type="checkbox"/> NO / NEI		APPLICATION METHOD / PAFØRINGSMETODE
PENETRANT REMOVER / PENETRANTFJERNER <input type="checkbox"/> WATER / VANN		<input type="checkbox"/> EMULSIFIER / EMULGATOR		<input type="checkbox"/> SOLVENT / LØSNINGSMIDDEL
DEVELOPER / FREMKALLER				
<input type="checkbox"/> 1. DRY POWDER / TØRRPULVER		<input type="checkbox"/> 3. SUSPENSION IN WATER / OPPSLEMME I VANN		
<input type="checkbox"/> 2. SOLUTION IN WATER / OPPLØST I VANN		<input type="checkbox"/> 4. POWDER IN VOLATILE SOLVENT / PULVER I FLYKTIG VÆSKE		
PENETRATION TIME / PENETRERINGSTID MIN.		DEVELOPING TEST TIME / FREMKALLINGSTID MIN.		OBJECT TEMPERATURE / OBJEKTTEMPERATUR °C
TEST RESULTS - REMARKS / RESULTATER - BEMERKNINGER				
REPAIRS MARKED ON / REPARASJONER AVMERKET PÅ <input type="checkbox"/> OBJECT / OBJEKT <input type="checkbox"/> SKETCH / SKISSE			OPERATOR CERTIFICATE NO. / OPERATØRBEFÆT NR.	
APPROVED / GODKJENT  SIGN		APPROVED / GODKJENT  SIGN		OPERATOR / OPERATØR  SIGN

**AKER KVÆRNER**