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QUALITY CONTROL DEPARTMENT

LIQUID PENETRANT EXAMINATION PROCEDURE

Procedure No: ADSD 0340
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APPROVAL DATE	APPROVED BY	NDT LEVEL-III
	BUREAU VERITAS, NOIDA	R.N. Tripathi 91503

BUREAU VERITAS (INDIA) PRIVATE LIMITED * SURVEYOR DELHI

REVISION No.	DATE	REVIEWED BY	REVISION DETAILS
0	23.11.07	DGM (Q / P&D)	Original Issue

PREPARED BY	VERIFIED BY	REVIEWED BY
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ASNT LEVEL II		
NAME & DESIGNATION	NAME & DESIGNATION	

1. SCOPE

This procedure is applicable for Liquid Penetrant Examination of ferrous and non ferrous materials. The examination is limited to detection of discontinuities which are open to the surface.

The procedure is well suited for the detection of discontinuities like surface cracks, laps, seams, pin holes, porosity, shrinkage area, lamination, cold shuts and lack of fusion in welds.

2. TECHNIQUE

Solvent removable visible penetrant shall be used.

3. REFERENCE

ASME Sec. V Article 6
ASTM E 165, ASME Sec. VIII Div. – 1
ASME Sec. II Part A, SA 613 & SA 614
ASME Sec. III Sub Section NC

4. NDT PERSONNEL

The test shall be carried out by trained/ ASNT LEVEL-I and Interpretation shall be done by ASNT LEVEL-II personnel.

5. PT MATERIALS

(a) Cleaner - PC-21 or PC – 21 A or PC – 120
(b) Penetrant – PP 15, or PP-15 A or PP-110
(c) Developer - PD – 31 or PD – 31 A or PD 130 B

} P. Met make or NPCIL approved product for Nuclear jobs.

5.1. M/s ITW Signode, Hyderabad make chemicals
5.2 Other approved chemicals
5.3 Intermixing of family of LP materials is prohibited.

6. CONTROL OF CONTAMINANTS

Certification of contaminant content for all liquid penetrant materials used on nickel base alloys, austenitic stainless steels and titanium shall be obtained.

These certificates shall include manufacturer's batch number and test results in accordance with following:

When examining nickel base alloys, Sulphur content shall not exceed 1% of the residue by weight

When examining Austenitic Stainless Steel or Titanium, Chlorine and Fluorine content shall

not exceed 1% by weight.

7. SURFACE PREPARATION

The surface being inspected shall be machined, smooth and free from dirt, oil, grease, rust, etc. in order to avoid confusion with imperfections.

The test surface shall be free from irregularities that could mask the indications due to discontinuities.

After cleaning, test surface shall be wiped with lint free cloth and cleaner,

Drying of the surfaces to be examined shall be accomplished by normal evaporation.

The temperature of the penetrant and the surface of the object to be tested shall be neither below 10°C nor above 52°C throughout the examination period.

8. EXAMINATION PROCESS

Penetrant Application:

Penetrant shall be applied over examination surface by brushing

Penetration Time:

Penetrant shall be allowed to remain over test surface for at least 15 minutes (dwell time)

Excess Penetrant Removal:

After dwell time, the excess penetrant shall be removed by wiping with a lint free cloth. Repeat the operation until most traces of penetrant have been removed. The remaining traces shall be removed by lightly wiping the surface with lint free cloth moistened with solvent. To minimize removal of penetrant from discontinuities, care shall be taken to avoid the excess use of solvent. **Flushing the surface with solvent, following the application of penetrant and prior to developing, is prohibited.**

Drying After Excess Penetrant Removal:

The surface shall be dried by normal evaporation.

Developing:

Developer shall be applied as soon as possible after penetrant removed and surface has dried but shall not exceed five minutes from time of penetrant removal.

Developer Application:

Non-aqueous developer shall be applied to dry surface.
A thin and uniform coating of Developer shall be applied over examination surface by spraying.

9. INSPECTION

After application of developer, the test surface shall be closely observed for appearance of any indication.
Inspection shall be performed under white light. The minimum light intensity at the test surface shall be 1000 lux.
Mirror/Magnifying Lens may be used to facilitate the inspection.
Developing time for final interpretation begins immediately as soon as developer coating is dry.
The test surface shall be kept under observation for 10 minutes

10. RELEVANT INDICATIONS

(i) Relevant indications are those having major dimension greater than 1.6 mm.
(ii) Linear indication are those indications in which length is more than 3 times the width.
(iii) A rounded indication is one of the circular or elliptical shape with the length equal to or less than 3 times the width.

11. CHARACTERIZATION OF INDICATIONS

Close observation of the formation of indications during application of developer may assist in characterizing and determining the extent of the indications.

12. ACCEPTANCE STANDARD FOR CASTINGS

As per ASME Sec. VIII Div.1 , Appendix - 7

Surface indications determined by liquid penetrant examination are unacceptable if they exceed the following limits.

(a) All cracks and hot tears
(b) Any group of more than six linear indications other than those in (a) above in any rectangular area of 38mm x 150 mm or less or any circular area having a diameter of 88mm or less, these areas being taken in the most unfavorable location relative to the indications being evaluated.
(c) Other linear indications more than 6 mm long for thickness upto 19 mm. Inclusive, more than one third of the thickness in length for thickness from 19 mm to 57 mm. And more than 19 mm long for thickness over 57 mm.
(d) All indications of non- linear imperfection which have any dimension exceeding 5 mm.

13. ACCEPTANCE STANDARD FOR FORGINGS, ROLLED BARS AND WELDS

As per ASME Sec.VIII Div.-1 , Appendix – 8

All surfaces to be examined shall be free of .....

(a) Relevant linear indications
(b) Relevant rounded indications greater than 5 mm
(c) Four or more relevant rounded indication in a line separated by 1.6mm or less (edge to edge)

14. ACCEPTANCE STANDARDS FOR NUCLEAR ITEMS

14.1. Acceptance Standards for base metal forgings and bars

As per ASME Sec. III NC –2546.3

(a) Only indications with major dimensions greater than 1.6 mm shall be considered relevant .
(b) The relevant indication (i) through (iv) below are unacceptable.

(i) Any linear indications greater than 1.6mm long for material less than 16 mm thick, greater than 3.2mm long for material from 16 mm thick to under 50 mm thick and 4.8 mm long for material 51 mm thick and greater.
(ii) Rounded indications with dimensions greater than 3.2 mm for thicknesses less than 16 mm and greater than 4.8 mm for thicknesses 16 mm and greater.
(iii) Four or more indications in a line separated by 1.6 mm or less edge to edge
(iv) Ten or more indications in any 3870mm^2 of area whose major dimensions is not more than 152 mm with the dimensions taken in the most unfavorable location relative to the indications being evaluated.

14.2. Acceptance Standards for Castings

As per SA 613 and ASME Sec.III NC-2576.C

(a) Only indications with major dimensions greater than 1.6 mm shall be considered relevant .
(b) The relevant indication (i) through (iv) below are unacceptable.

(i) Any linear indications greater than 1.6mm long for material less than 16 mm thick, greater than 3.2mm long for material from 16 mm thick to under 50 mm thick and 4.8 mm long for material 51 mm thick and greater.
(II) Rounded indications with dimensions greater than 3.2 mm for thicknesses less than 16 mm and greater than 4.8 mm for thicknesses 16 mm and greater.
(iii) Four or more indications in a line separated by 1.6 mm or less edge to edge
(v) Ten or more indications in any 3870mm^2 of area whose major dimensions is not more than 152 mm with the dimensions taken in the most unfavorable location relative to the indications being evaluated.

14.3. Acceptance Standards for Welds

As per ASME Sec.III nC – 5352

(a) Only imperfections producing indications with major dimensions greater than 1.6 mm shall be considered relevant imperfections.
(b) Imperfections producing the following indications are unacceptable
(i) Any cracks or linear indications
(ii) Rounded indications with dimensions greater than 4.8mm

(iii) Four or more rounded indications in a line separated by 1.6 mm or less edge to edge

(iv) Ten or more rounded indications in any 3870mm^2 of surface, with the major dimensions of this area not to exceed 152 mm, with the area taken in the most unfavorable location relative to the indications being evaluated.

14.4. **Acceptance Standards for Bolts, Stud and Nuts greater than 25 mm Nominal bolts size**

As per SA - 614

(i) Linear non axial indications are unacceptable

(ii) Linear axial indications greater than 25 mm long is unacceptable

15. REPAIR REQUIREMENTS

Any indication which is believed to be non relevant shall be regarded as an imperfection unless it is shown by re-examination by the same method or by the use of other NDT method or by surface conditioning that no unacceptable imperfection is present.

Unacceptable imperfection shall be removed or reduced to an imperfection of acceptable size and re-examination made to assure complete removal or reduction to acceptable size.

16. POST CLEANING

Surface examined shall be cleaned thoroughly with dry cotton or clothes.

17. EXAMINATION REPORT

Certificate of penetrant test shall, at least, cover following information's: -

(I) Manufacturer

(ii) Job, drg. no., denomination, serial no. of the job.

(iii) Customer - Inspection authority

(iv) Stage of Inspection

(v) Operating condition such as
- Product used for the test
- Present condition of the surface
- Dwell time (penetrant time of application)
- Developing time

(vi) Result of the examination

(vii) Signature of the operator or level II personnel

18. REPORT FORMAT

The reporting of the test result shall be made on as per format given in Annexure-I

ANNEXURE-1

CUSTOMER;	**BHARAT PUMPS & COMPRESSORS LTD.** RECORD OF NON DESTRUCTIVE EXAMINATION	F- 44003 F -02 Ref.. No. Date

Reference :

Sales Order No	Name of Article	Material	Identification	Heat No	Qty	Drg..No.	Specification

Dye Penetrant Examination		**Magnetic Particle Examination**		Ultrasonic Examination		Sketch / Remarks
Inspection Stage.		Inspection Stage		Inspection Stage.		
Area Examined		Area Examined		Area Examined		
Penetrant.		Surface Condition		Surface Condition		
Cleaner		Apparatus		Apparatus		
Developer		Magnetizing Method		Method		
Dwell Time		Powder		Probe Dia-& Freq.		
Examination Temp.		Magnetizing Current		Couplant		
Result		Magnetizing Time		Gain / Reject / Damp		Date of Examination
		Result		Pulse Height		DY.MGR. QC / Witnessed by
				Result		