

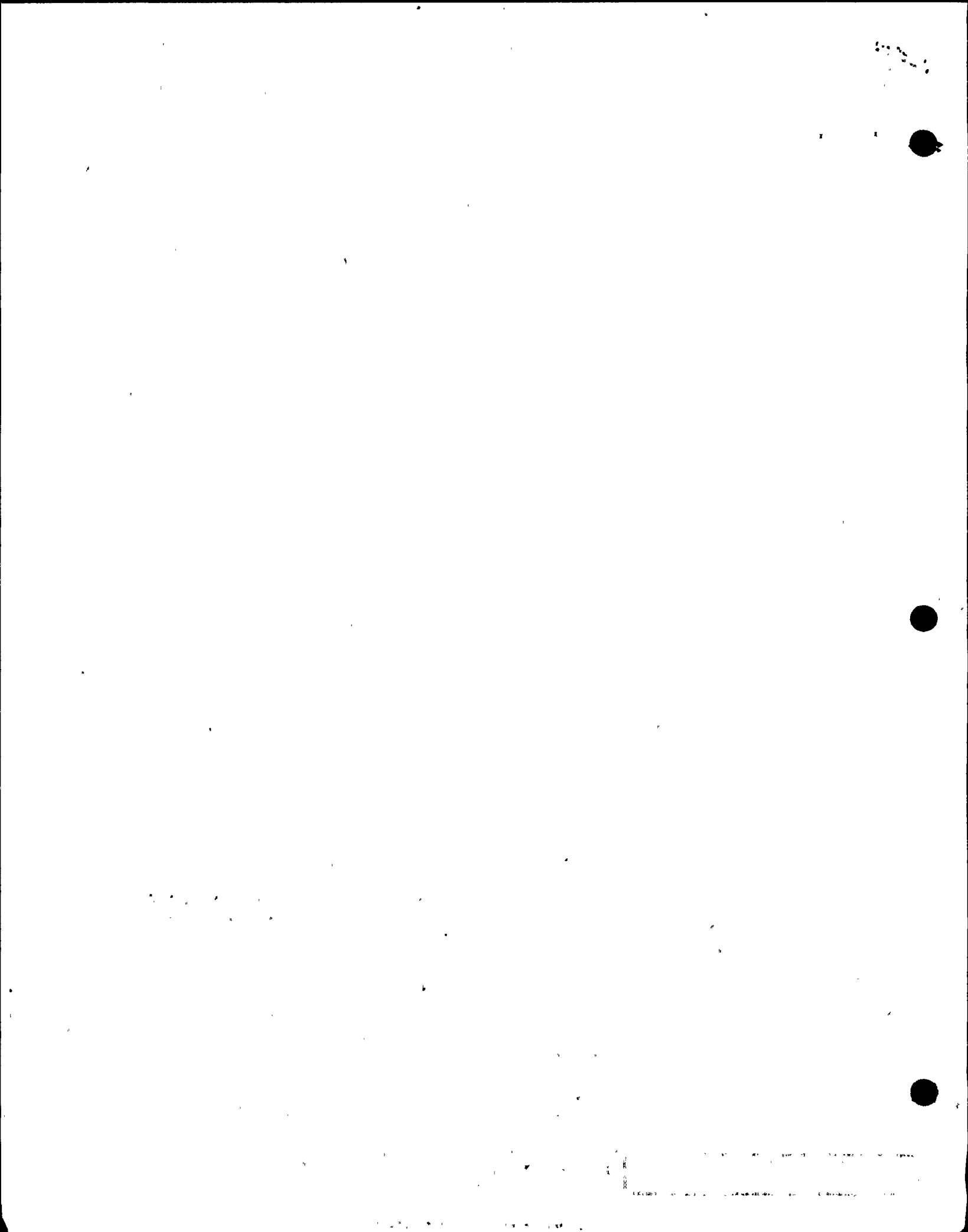
LIQUID PENETRANT EXAMINATION PROCEDURE

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT, UNIT 1

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Project Application 5530 - ISI	Prepared By S. Foote	Date 7/29/80
APPROVALS		
TITLE/DEPT.	SIGNATURE	DATE
LP Level III	<i>F. T. Carr</i> F. T. Carr	7/31/80
Mgr. Field Operations	<i>M. C. Stamm</i> M. C. Stamm	8/4/80
Project Manager	<i>G. M. Griffiths</i> G. M. Griffiths	8.5.80
Q. A. Manager	<i>V. J. Potent</i> V. J. Potent	8/7/80
NMPC - QC Operations	<i>Larry R. Leskiw</i>	2/26/81
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 8301040638 821230 PDR ADOCK 05000220 P PDR </div>		



October 26, 1982

Date

ISI FIELD CHANGE AUTHORIZATION

Document Title LIQUID PENETRANT EXAMINATION Document No. 80A2819 Rev. 1
PROCEDURE

Field Change No. FC-1 Originator M. Stamm

Description of Field Change:

Change Para 8.2 (8.2.1) Table for Penetration Time (Dwell) to read:

<u>Penetrant</u>	<u>Penetration Time (Dwell)</u>
Water-washable	min. 30 minutes-max. 60 minutes
Solvent-removable	min. 20 minutes-max. 60 minutes

Reason for Change:

To show minimum to maximum dwell times.

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Approvals:

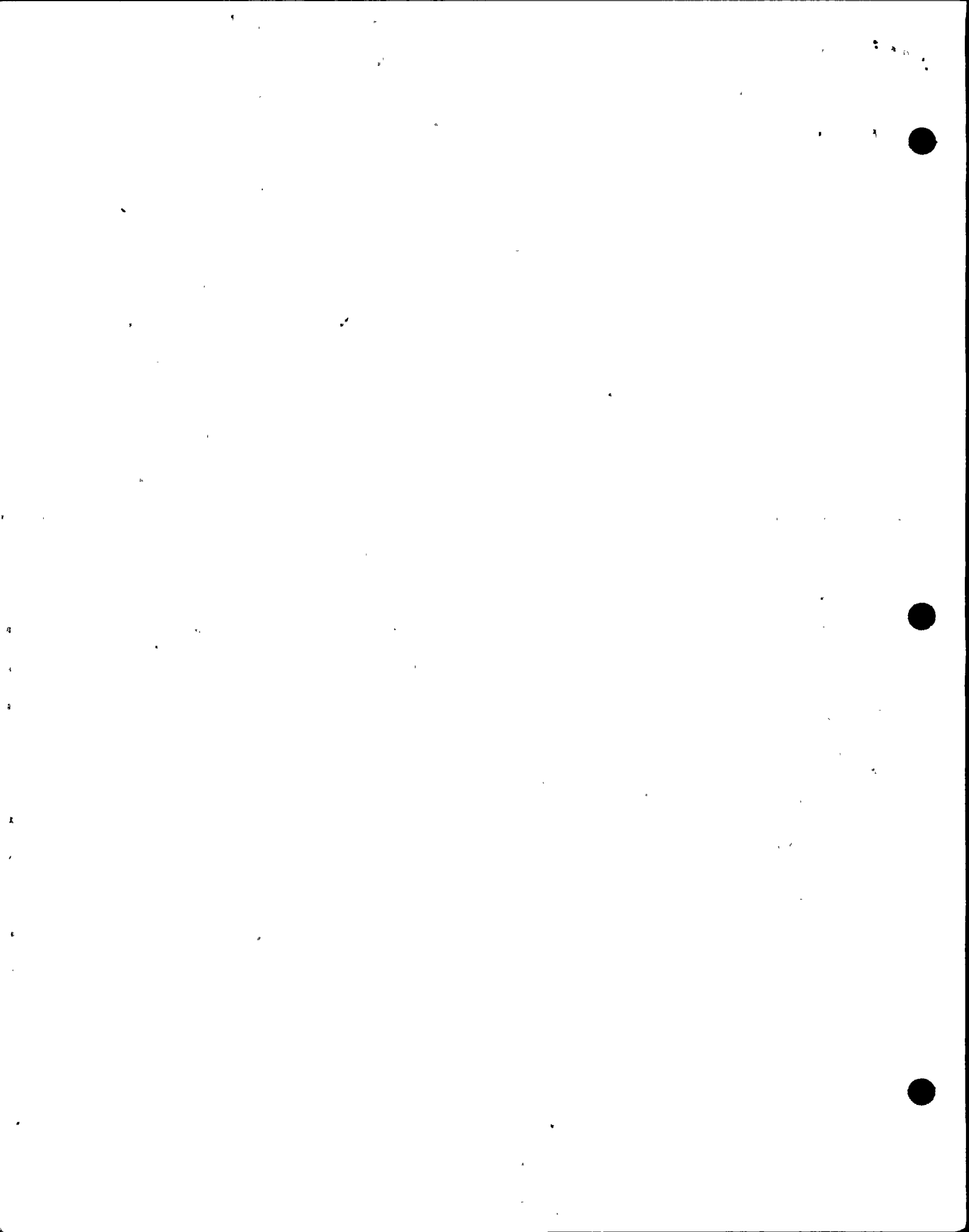
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NMPC

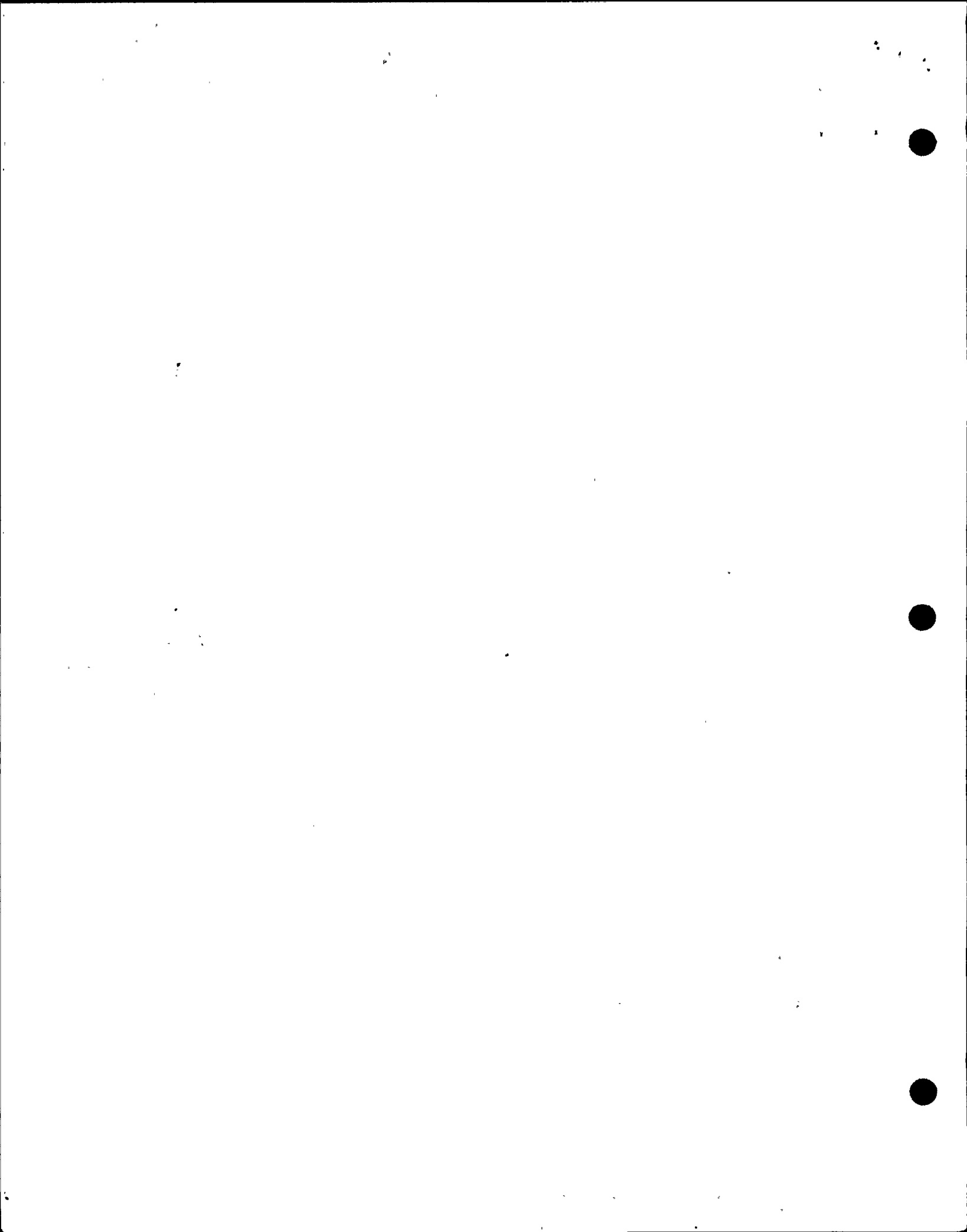
[Signature]
Gary R. Leskier

10/26/82
10/26/82

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Note: A copy of this authorization shall be attached to the affected document until a subsequent revision incorporates the field change.






LIQUID PENETRANT EXAMINATION PROCEDURE

1. SCOPE

1.1 INTENT

1.1.1 This procedure shall be followed for liquid penetrant examination of nuclear reactor systems or components as required by ASME Boiler and Pressure Vessel Code, Section XI. Rules for Inservice Inspection of Nuclear Power Plant components, 1974 Edition to and including Summer 1975 Addenda. The method described herein is to be used for the detection of discontinuities open to the surface. This procedure supercedes 80A2310 (NIP 528) of the Inservice Inspection Program Plan. 

1.1.2 This procedure may be used on-ferrous and non-ferrous materials but shall not be utilized for surface examinations of porous materials.

1.2 TYPES OF EXAMINATIONS

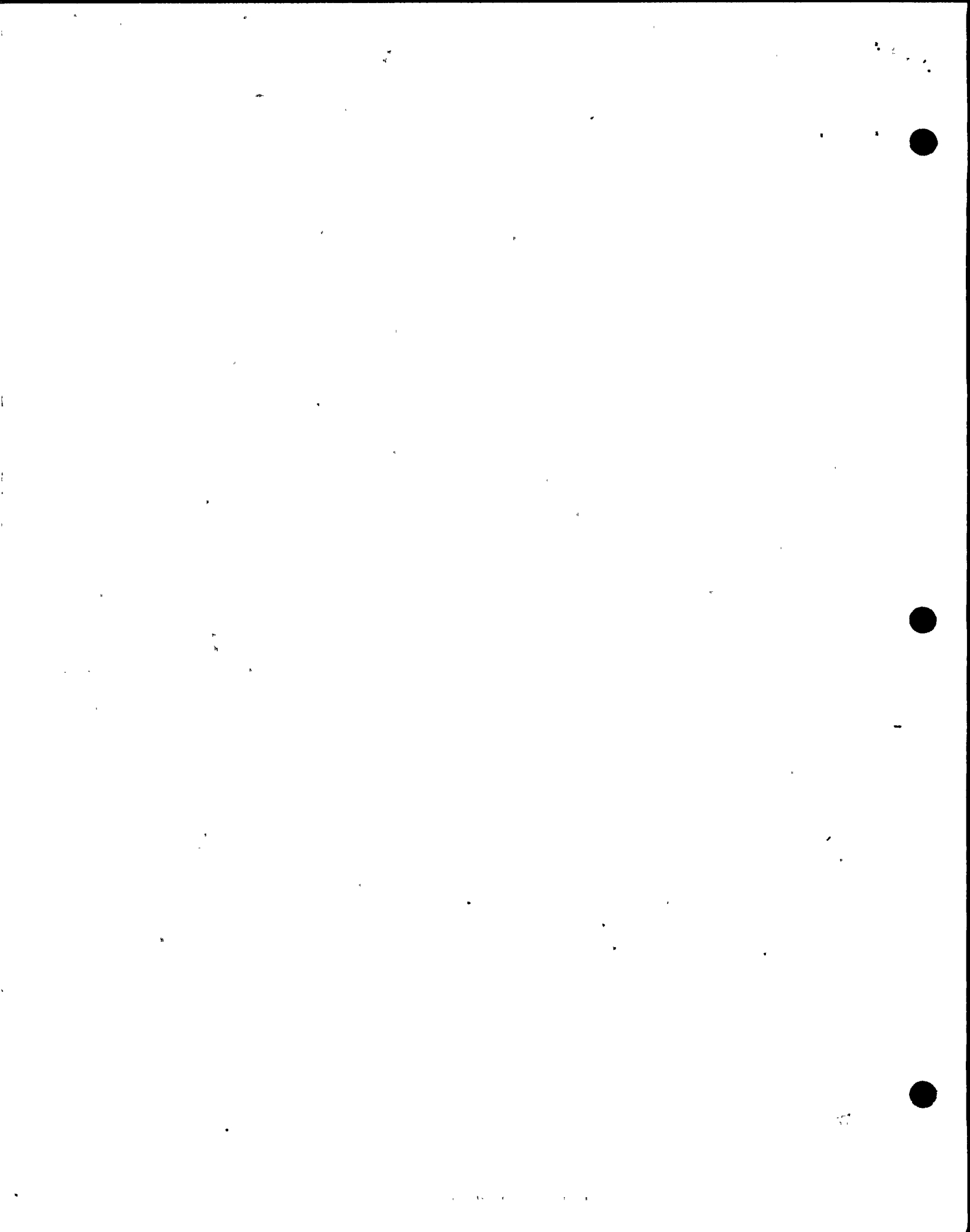
Either a color-contrast or fluorescent penetrant method may be used. This procedure covers water washable and solvent removable methods only.

1.3 TIME OF EXAMINATION

This procedure shall govern the inservice examinations and reexamination after repairs of piping systems and components as required by the ASME Boiler and Pressure Vessel Code, Section XI.

2. REFERENCES

- 2.1 ASME Boiler and Pressure Vessel Code, Sections III, V, and XI 1974 Edition to and including Summer 1975 Addenda.
- 2.2 The American Society for Nondestructive Testing, Recommended Practice for Nondestructive Testing Personnel Qualification and Certification, SNT-TC-1A, 1975 Edition.
- 2.3 NES Document 80A9068: "Procedure for the Qualification and Certification of Nondestructive Examination Personnel" (latest revision).



3. PROCEDURE COMPLIANCE

The examination procedures described in this document comply with Section XI of the ASME Boiler and Pressure Vessel Code.

4. PERSONNEL CERTIFICATION

4.1 PERSONNEL CERTIFICATION REQUIREMENTS

- 4.1.1 Each person performing liquid penetrant examination governed by this procedure shall be certified in accordance with the documents referenced in paragraphs 2.1, 2.2, 2.3.
- 4.1.2 Interpretation of examination results shall be performed by personnel with a minimum qualification of Level II Examiner in the Nondestructive Examination Method described in the procedure.

4.2 PERSONNEL

- 4.2.1 Records of personnel qualification shall be maintained by the Examination Contractor.
- 4.2.2 A copy of each examiner's certification summary and a current eye test, as required by SNT-TC-1A, shall be filed with permanent examination records, with a copy submitted to the Plant Owner, or his Agent, prior to performing examinations per this procedure.

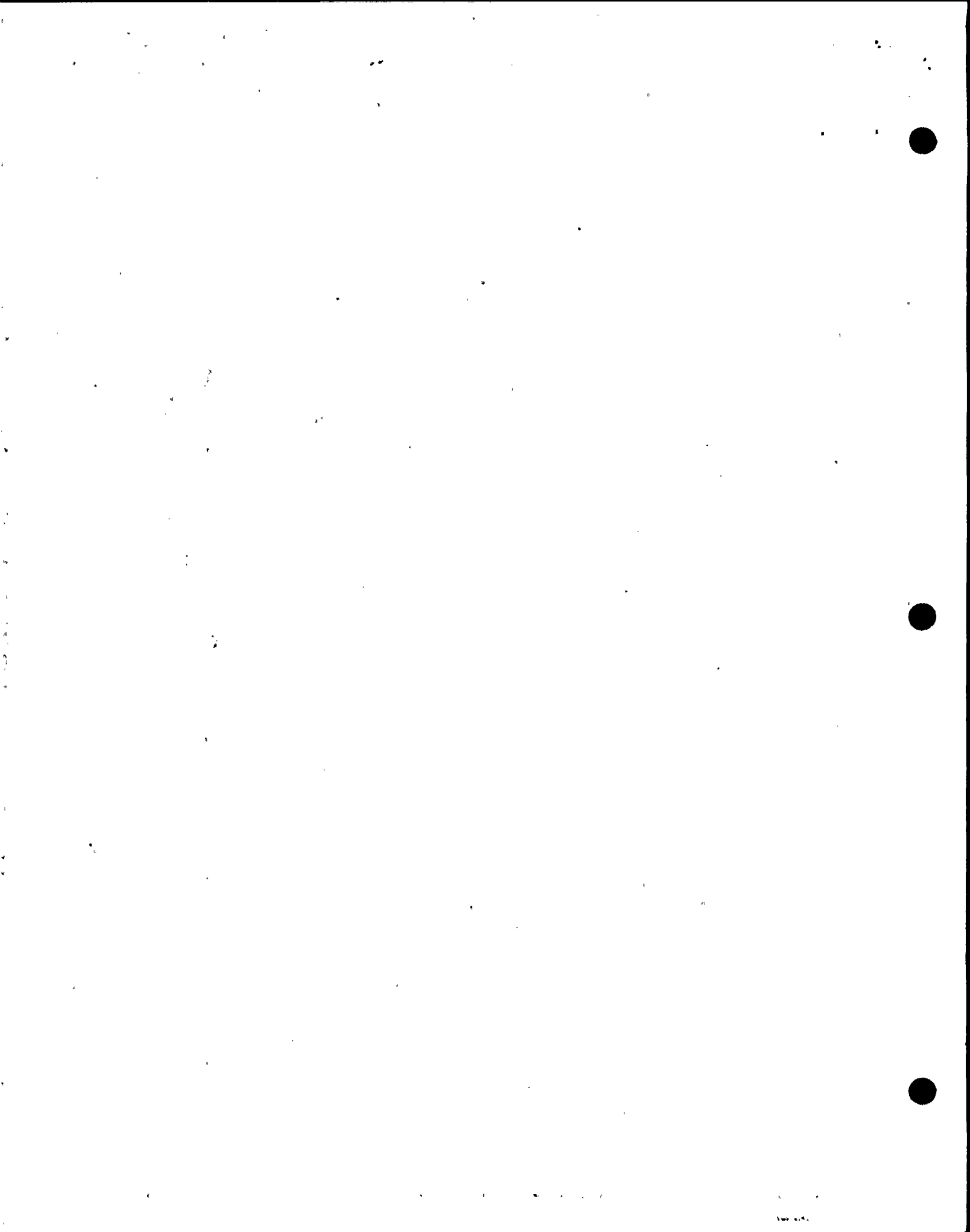
5. EXAMINATION REQUIREMENTS

5.1 SURFACE PREPARATION

All surfaces of the component or part to be examined by the liquid penetrant examination method and all adjacent areas within 1 inch must be dry and free of weld spatter, scale, grease, paint, oily films, dirt and other extraneous matter that would obscure surface openings or otherwise interfere with the examination. Components or parts must have a surface finish which will permit proper interpretation of developed indications. The surface shall be even with no abrupt ridges or valleys. In general, satisfactory results may be obtained when the surface is in the as-welded, as-rolled, as-cast, or as-formed condition; however, in some cases surface preparation by grinding or machining, may be necessary when surface irregularities would otherwise mask the indications of unacceptable discontinuities. Wire brushing shall be accomplished after grinding to ensure removal of all foreign material from the surface.

- 5.2 Caution: Blasting with shot or dull sand may peen discontinuities at the surface and shall not be used.





5.3 EXAMINATION AREA IDENTIFICATION

Each examination area shall be located or identified on the appropriate weld map, isometric, system boundary diagram, or planned schedule table.

5.4 EXAMINATION COVERAGE

The intent of this procedure is to provide maximum examination coverage of the systems in areas identified in Tables IWB-2500 and IWC-2520 of Section XI of the ASME Boiler and Pressure Vessel Code.

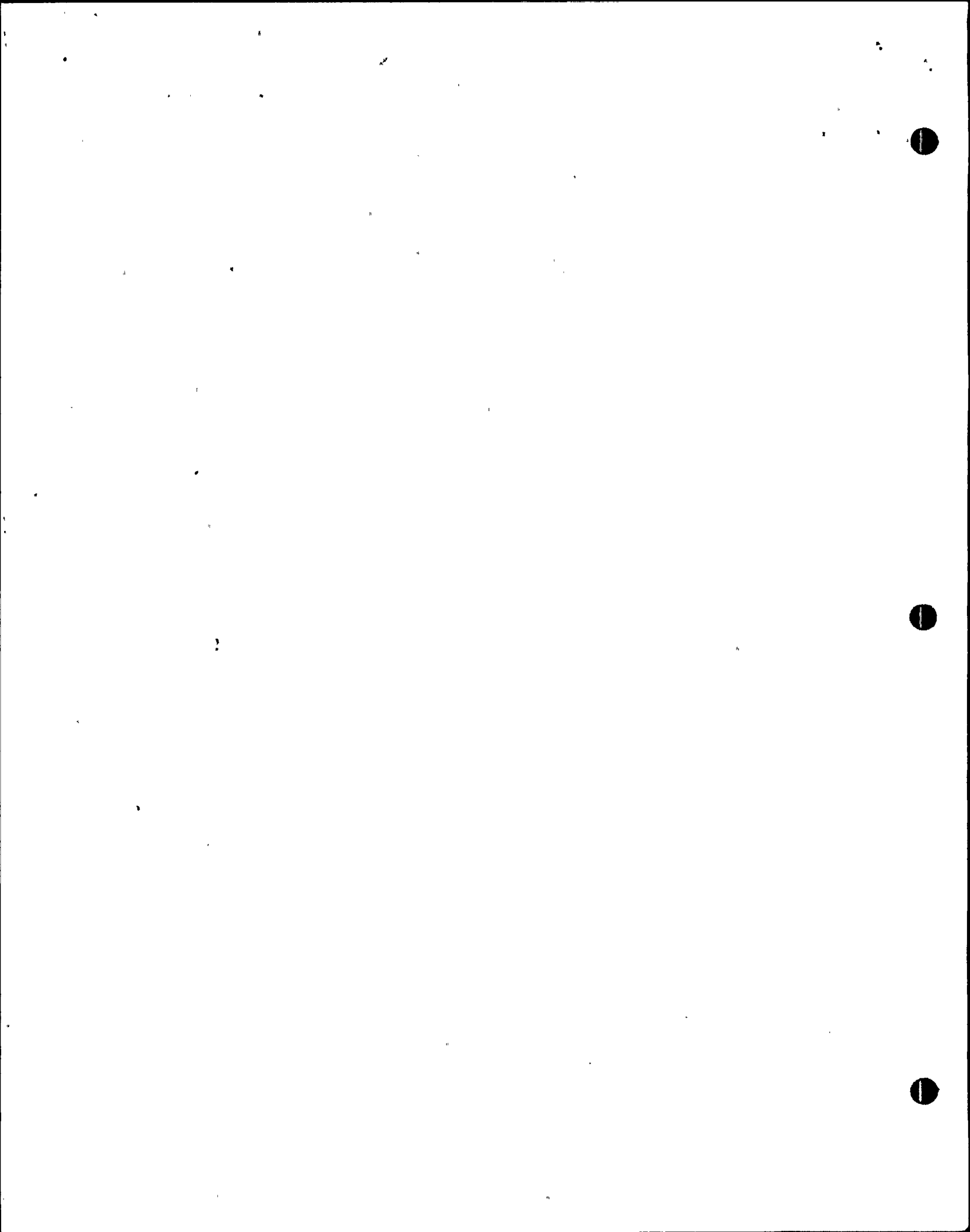
6. EQUIPMENT REQUIREMENTS

6.1 EXAMINATION CONTRACTOR'S EQUIPMENT

6.1.1 The following test equipment, or its equivalent, shall be provided and/or utilized by the Examination Contractor as required for examinations:

1. Cleaning agent such as isopropyl alcohol or penetrant cleaner
2. Visible dye penetrant or fluorescent penetrant
3. Remover
4. Developer
5. Clean rags or cloth or absorbent paper (lint free)
6. Mirror
7. Portable light source(s)
8. Camera (as required)
9. Low-power magnifying lens (as required)
10. Black light source (if fluorescent penetrant is used)
11. Light meter (as required)
12. Thermometer with a range of 50°F to 140°F
13. Timer or watch
14. Hot air gun (as required).





6.1.2 For visible dye examinations, a light source shall be used and shall be sufficient to obtain good definition and contrast at the surface of the object being examined. Color of the light source may be white (incandescent) or any other which will produce the desired definition and contrast. In all cases, light position, direction, and distance shall be adjusted to the best angle for viewing the component being examined. Where feasible, it shall be moved to various positions during the examination so that the light will fall on the component from a number of directions to improve the interpretation of conditions which may be present. In addition, the level of illumination shall be adjusted by changing the distance or the intensity so that the best visual contrast is obtained.

6.2 PLANT OWNER'S EQUIPMENT

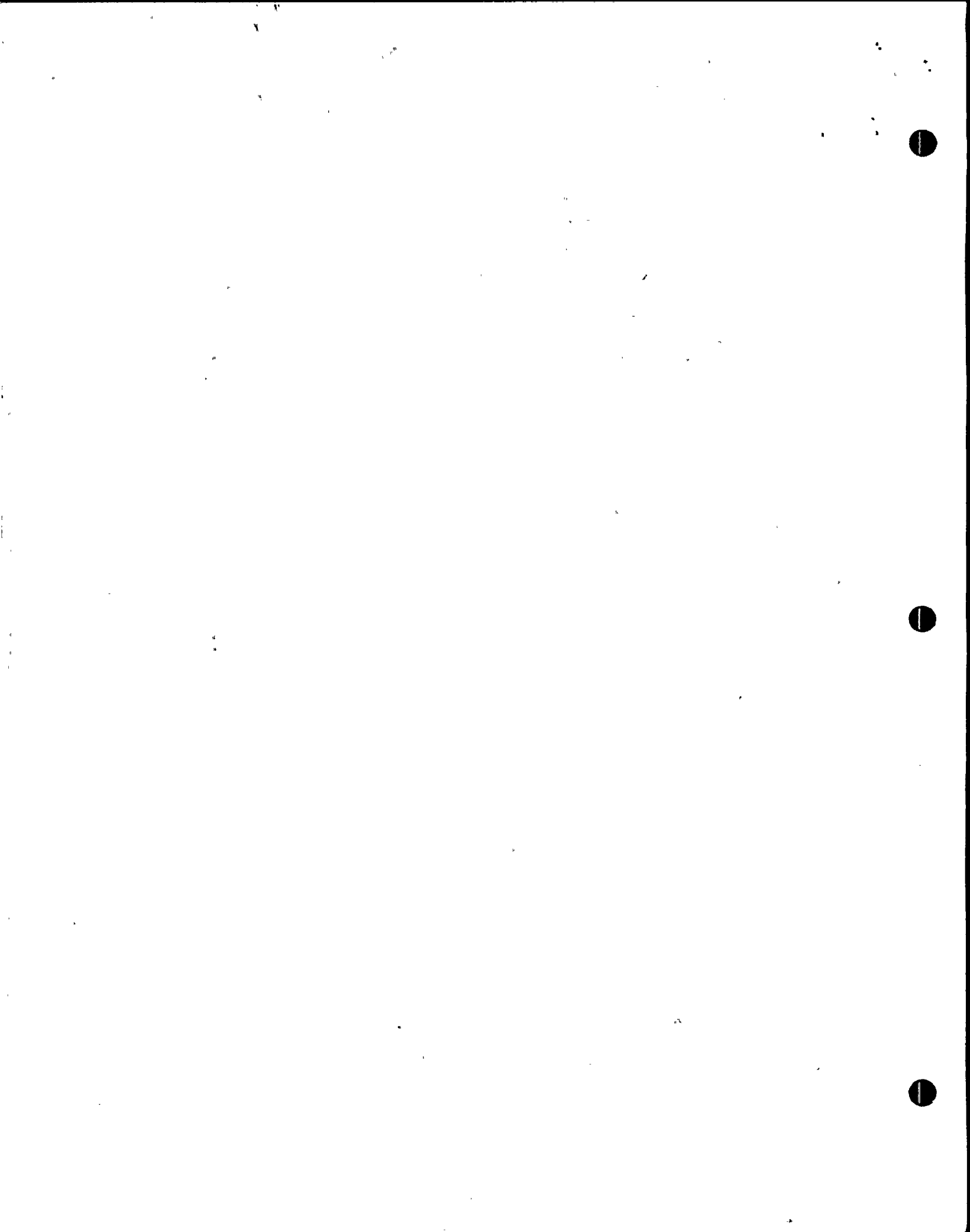
The Plant Owner, or his Agent, shall provide the following service facilities and equipment as required:

1. Scaffolding
2. Water, air, and electricity (110 volts, 50-60 Hz)
3. Adequate temporary lighting
4. Moving or lifting devices
5. Radiation monitoring equipment
6. Radiation shielding
7. Anti-contamination clothing
8. Personnel decontamination facilities
9. Test surface preparation
10. Post-examination cleanup of test area
11. Decontamination of the test area, where required.

7. PRECAUTIONS AND PREREQUISITES

7.1 MATERIAL ANALYSIS

7.1.1 The penetrant, cleaning agents, and developer materials shall be analyzed for sulfur content and total halogens in accordance with ASTM D-129-64 Test for Sulfur in Petroleum Products by the Bomb Method, and ASTM D-808-63, Test for Chlorine in New and Used Petroleum Products (Bomb Method). The residual amounts of total sulfur or halogens shall not exceed 1% by weight. The Examination Contractor shall obtain certification of these tests for each penetrant material used, giving batch numbers and test results. These records shall be maintained in accordance with Section 10 of this procedure.



7.1.2 The brand name and type of penetrant to be used is "Spot-Check", Type SKL-S by Magnaflux Corporation. The material shall be in the form of spray or bulk. Equivalent material may be used subject to the approval of the examination contractor, plant owner, and inspector.

7.1.3 Intermixing of penetrant materials (penetrant, remover and developer) from different family groups is not permitted.

7.2 EXAMINATION CONDITIONS

7.2.1 Fluorescent penetrant examination shall not immediately follow a color-contrast penetrant examination.

7.2.2 Examinations will not be conducted near open flames, welding, or burning.

7.2.3 Smoking within 20 feet of the examination area is not permitted.

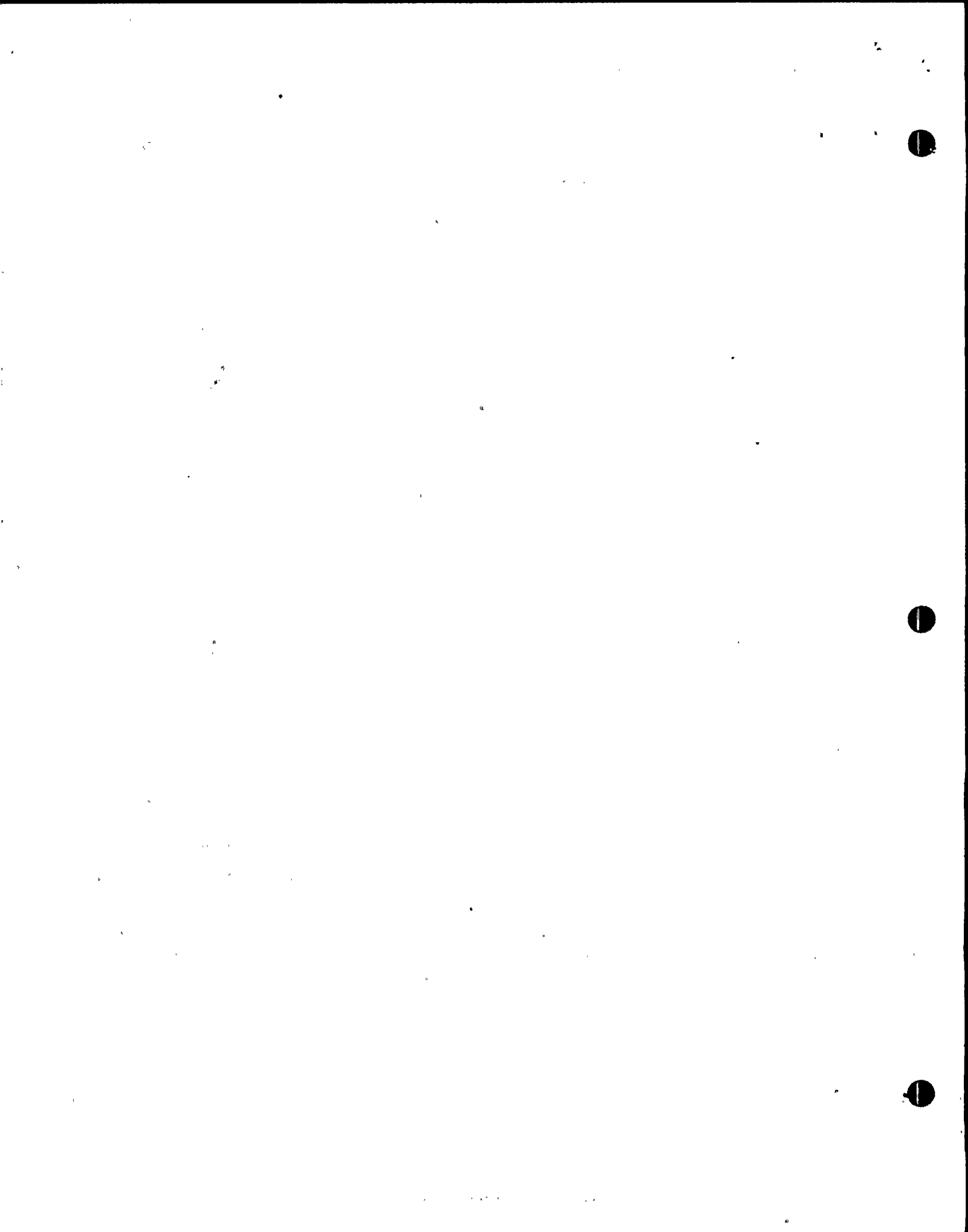
7.2.4 Examinations will be conducted only under conditions allowing sufficient ventilation to prevent explosions or toxic inhalation.

7.3 EXAMINATION TEMPERATURES

7.3.1 As a standard technique, the temperature of the surface to be examined shall not be below 60°F nor above 125°F throughout the examination period. Local heating or cooling is permitted, provided temperatures remain in the range of 60-125°F during the examination.

7.3.2 When it is not practical to make a liquid penetrant examination at a minimum temperature of 60°F, the following technique shall be used:

1. Using a comparator block as described in ASME Section V, paragraph T-622, allow the block and all liquid penetrant materials to cool to the proposed temperature (40°F min).
2. At the proposed temperature, examine area "B" on the comparator block with the technique in accordance with Section 9 of this procedure.
3. The comparator block shall then be allowed to warm to a temperature of 60°F and area "A" of the comparator block shall be examined strictly in accordance with Section 8 of this procedure.
4. The crack indications shall be compared between areas "A" and "B". If the indications obtained under the proposed reduced temperature are essentially the same as those obtained under normal temperatures, examination at the lower temperature shall be considered equivalent.
5. The above shall be demonstrated to the satisfaction of the Authorized Nuclear Inspector.
6. This procedure shall then be qualified for that temperature range verified.



8. EXAMINATION PROCEDURE

8.1 PREEXAMINATION CLEANING

8.1.2 Immediately prior to the examination, all surfaces to be examined and all adjacent areas within one inch shall be cleaned by heavy swabbing with clean cloths or absorbent paper saturated with a cleaning agent. The excess cleaning agent shall then be removed using clean, dry cloths, or absorbent paper.

8.1.3 The surfaces to be examined must be completely dried prior to application of the penetrant. A minimum of five minutes waiting time shall be observed prior to application of the penetrant. The drying may be accomplished by normal evaporation or with forced hot air, if necessary, provided the temperatures remain in the range of 60 to 125°F during the examination. The solvent acts as a penetrant and must be allowed to evaporate from all discontinuities.

8.2 PENETRANT APPLICATION AND REMOVAL

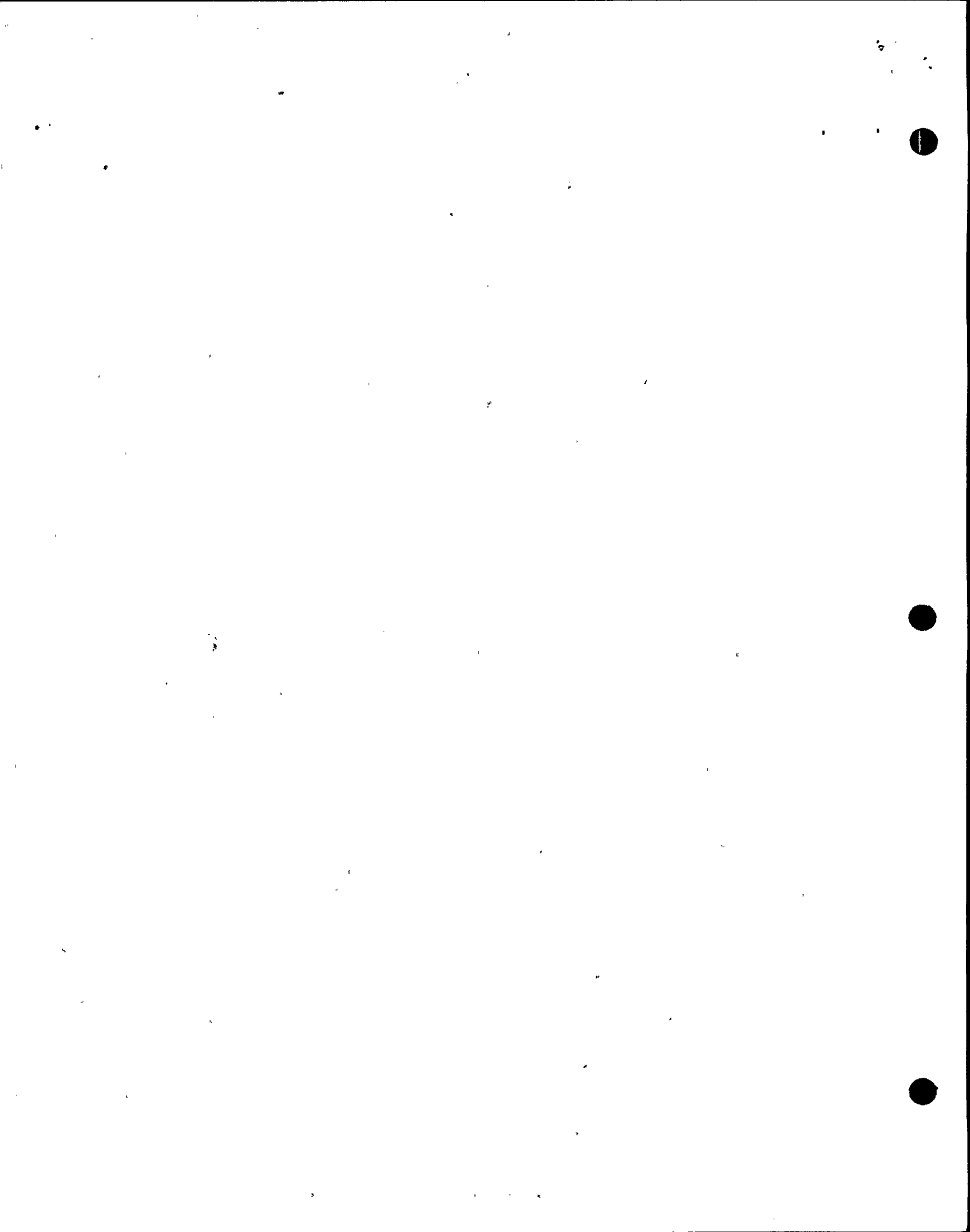
8.2.1 After the surface has dried, it shall be thoroughly and uniformly coated with penetrant by spraying, dipping, or brushing. The surface shall be kept wetted during the entire application time.

<u>Penetrant</u>	<u>Penetration Time (Dwell)</u>
Water-washable	30 minutes
Solvent-removable	20 minutes

1. If the penetrant does not wet the surface but tends to pull away, leaving local islands of unwet surfaces or if the penetrant is allowed to become dry or tacky, the surface shall be re-cleaned in accordance with Section 9.1 and the procedure shall be repeated.
2. If the penetrant is applied by spraying using a compressed air type apparatus, filters shall be placed at the air inlet to preclude contamination of the penetrant from oil, water and/or dirt sediment that may have collected in the lines.

8.2.2 After the penetration time specified in 9.2.1 has elapsed, any penetrant remaining on the surface shall be removed as stipulated below. Insufficient removal will leave a background which will interfere with subsequent indication of defects. Care shall be exercised to limit the removal of penetrant from any discontinuity to as little as possible.

1. With water-washable penetrants, excess penetrant shall be removed with a water spray or a clean cloth saturated with "approved" water. Water pressures over 50 psi or water temperatures over 110°F shall not be employed.



2. With solvent removable penetrants, excess penetrant shall be removed by using clean, dry cloths or absorbent paper. The operation should be repeated until most traces of penetrant have been removed. A clean, dry cloth or absorbent paper shall then be moistened with solvent and the surface shall be wiped lightly until all remaining traces of excess penetrant have been removed. Care shall be employed not to use an excess of the solvent in order to avoid removing penetrant from discontinuities. Flushing the surface with solvent or spraying cleaner directly on the surface is prohibited.

8.2.3 DRYING BEFORE APPLICATION OF DEVELOPER

1. If the water-washable method is employed, the surface should be dry before application of the developer. Drying shall be accomplished by blotting with absorbent paper or clean cloths or by circulating warm air provided the temperature of the surface is not raised above 125°F.
2. With the solvent-removable method, drying shall be accomplished by allowing a minimum of five (5) minutes for normal evaporation.

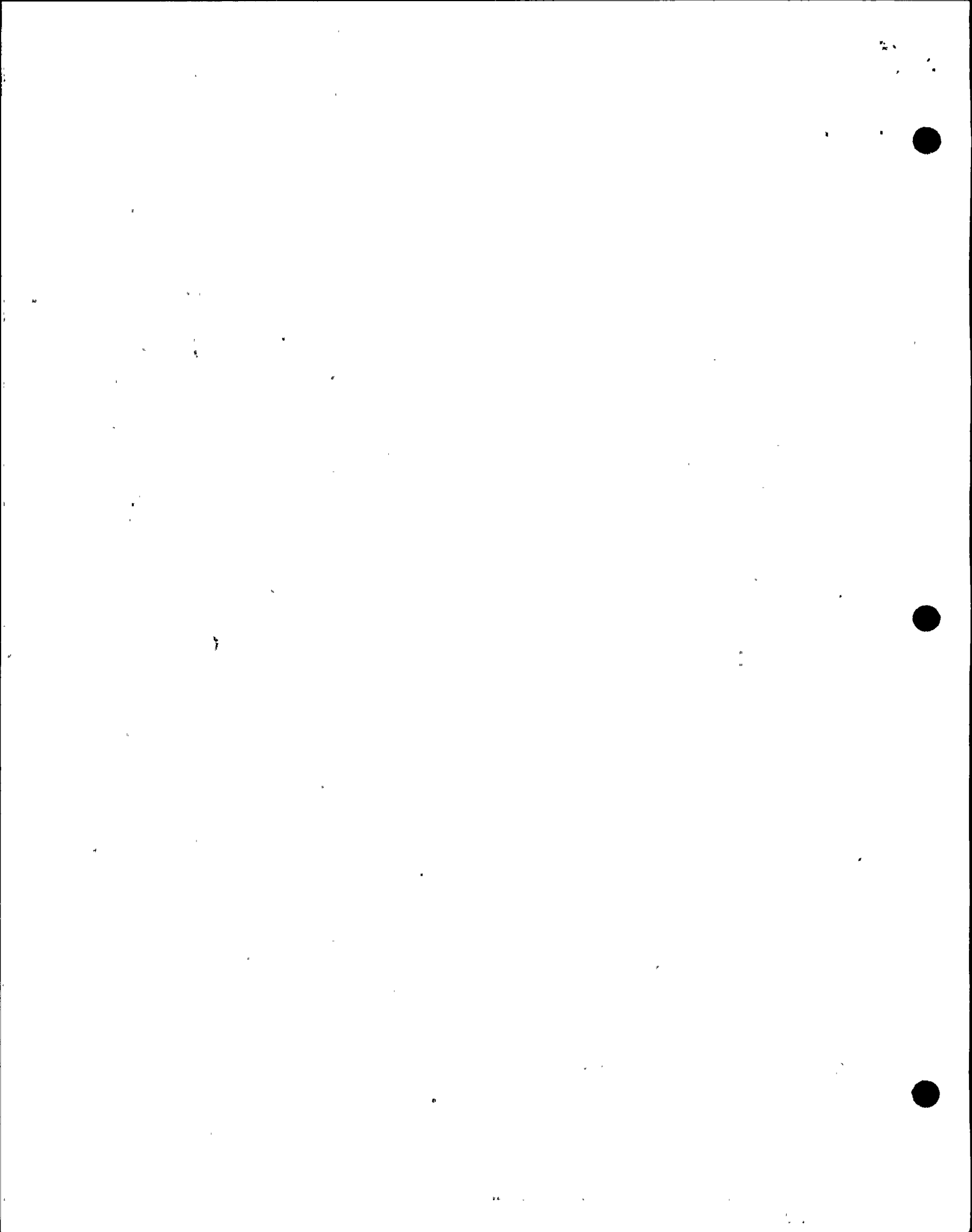
8.3 DEVELOPING

8.3.1 The developer shall be applied immediately after the drying operation is complete. There are two types of developer, dry and liquid, either of which may be used with fluorescent penetrants. With color-contrast penetrants, only the liquid developer is permitted. The minimum development time shall be no less than 7 minutes nor more than 30 minutes.

8.3.2 The dry developer shall be a powder, applied by a soft brush, a hand powder bulb or powder gun. Other means more suitable to the size and geometry of the specimen may be used, provided the powder is evenly dusted over the entire surface being examined.

8.3.3 Liquid Developer

The liquid developer is a suspension, or solution, of powder in water or a volatile solvent and shall be applied by spraying at a sufficient distance to achieve a thin coating over the surface being examined. Insufficient coatings may not be adequate to draw the dye out of the discontinuities. Conversely, excessive coatings of developer may result in pooling and may mask indications. Prior to applying the liquid developer to the surface, the developer must be thoroughly agitated to ensure that the particles in suspension are dispersed. Where a water suspension developer is used, drying time may be decreased by the use of warm air, provided the temperature of the specimen is not raised above 125°F. Developer must be thoroughly dry before interpretation.



8.4 OBSERVATION OF RESULTS

8.4.1 General

The true size and type of discontinuity are difficult to appraise if the dye diffuses excessively in the developer. Consequently, it is good practice to observe the surface during the application of the developer in order to detect the nature of certain indications which might tend to bleed-out profusely. Final interpretation, however, shall be made after allowing the penetrant to bleed-out for a minimum of 7 minutes to a maximum of 30 minutes. If the surface is sufficiently large to preclude complete examination within the prescribed time, only portions of the surface shall be examined at any one time.

8.4.2 Nature of Indications with Color-Contrast Penetrants

With color-contrast penetrants, the developer forms a more or less uniform white coating. Surface discontinuities are indicated by bleeding-out of the penetrant which is normally a deep red color. Indications with a light pink color may indicate excessive cleaning. Inadequate cleaning may leave excessive background, making interpretation difficult. Adequate illumination is required to ensure adequate sensitivity in the examination.

8.4.3 Nature of Indications with Fluorescent Penetrants

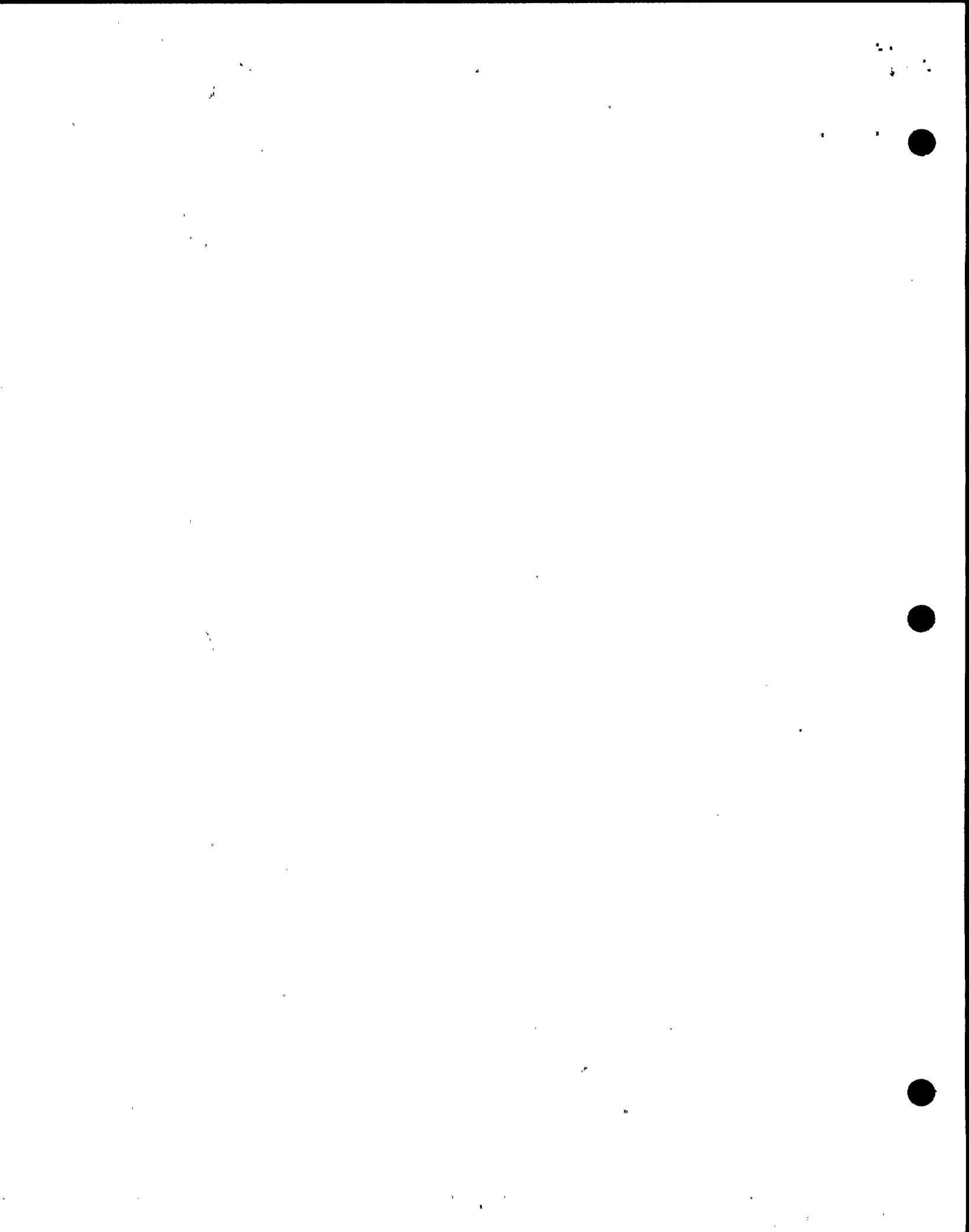
With fluorescent penetrants, the indications are essentially the same as for color-contrast penetrants, but the examination is conducted in a darkened area using filtered "black light". The intensity of illumination at the examination surface shall be 90 ft-candles measured with a Weston 703 Type III meter (or equivalent). The black light shall emit ultraviolet radiation of a wavelength within the range of 3300 to 3900 angstrom units. The bulbs shall be allowed to warm up for a minimum of 5 minutes prior to its use in the examination. The intensity of the black light at the surface under examination shall be determined at least once every 8 hours and whenever the work location is changed.

8.4.4 Evaluation of Results

Evaluation of results shall be in accordance with Section 9 of this procedure.

8.5 POST-EXAMINATION CLEANUP

Remove developer with cleaner and or solvents recommended in this procedure, using as many clean cloths or absorbent paper towels as necessary.




9. EVALUATION CRITERIA

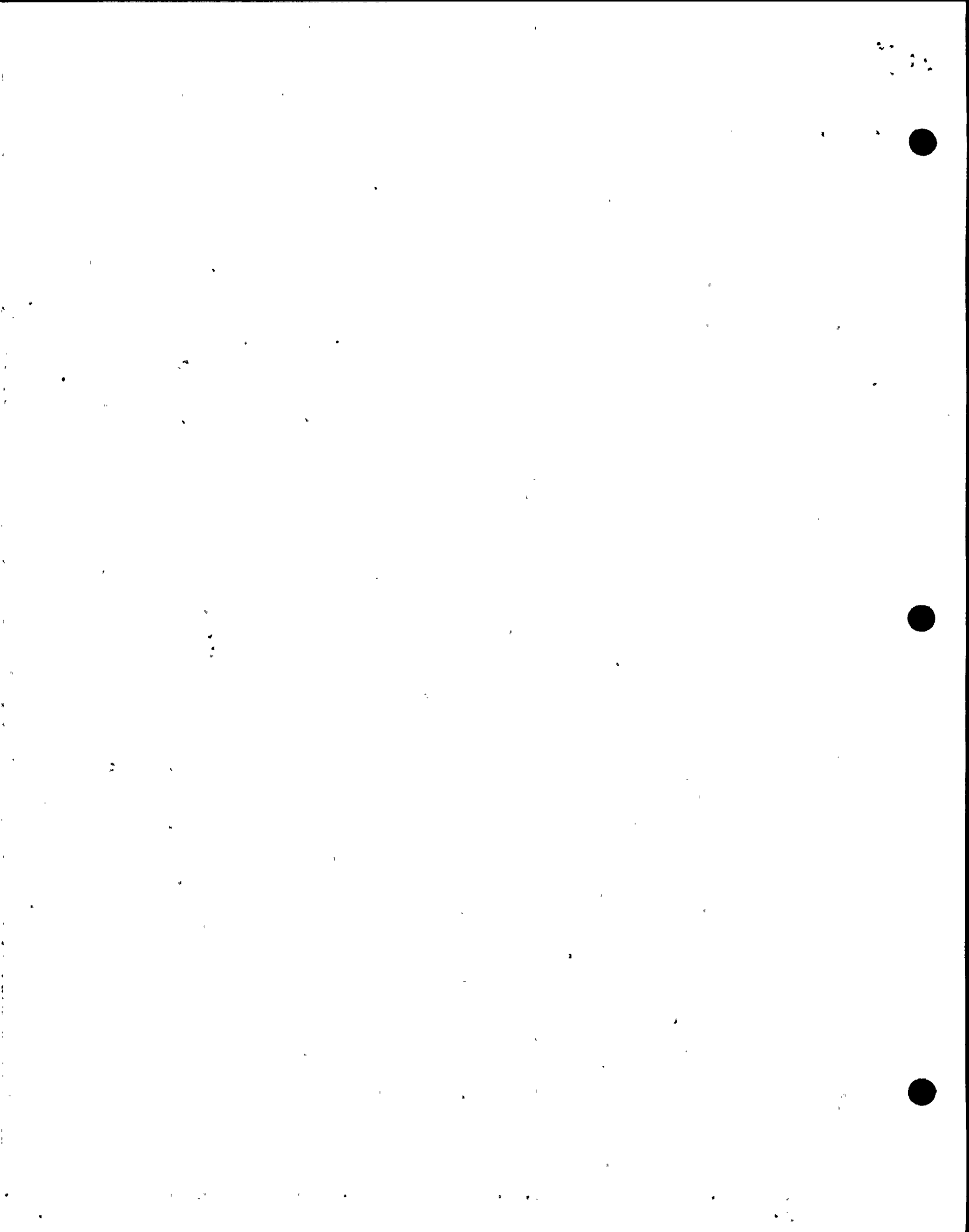
9.1 RECORDING OF INDICATIONS

All indications shall be reported and detailed on the data sheet (Figure 1) and shall contain the following information:

1. Date of examination
2. Identification and signature of examiner
3. Identification of item examined
4. Brand name and specific type (number and/or letter designation of penetrant, penetrant remover and developer, and batch number)
5. Cleaning materials used and time allowed for drying for pre-examination cleaning
6. The length of time that the penetrant remains on the surface
7. The length of developing time before evaluation
8. Photographs that may have been used to assist in evaluation
9. All indications described with respect to a convenient datum point on the object being examined
10. Other information as required.

9.2 EVALUATION OF INDICATIONS

- 9.2.1 All indications shall be evaluated in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, and Section III (paragraphs NC-2546 and NC-5350). 
- 9.2.2 Any indication that is believed to be nonrelevant shall be regarded as an unacceptable surface defect and shall be reexamined to verify whether actual defects are present. Surface conditioning may precede the reexamination. Nonrelevant indications and broad areas of pigmentation which would mask defects are unacceptable.
- 9.2.3 Results of this evaluation shall be reported to the Plant Owner, or his agent, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section XI.
- 9.2.4 Only indications whose major dimensions are greater than 1/16 inch shall be considered relevant. For weld material the following indications are not acceptable:
 1. Cracks or other linear indications



2. Rounded indications greater than 3/16 inch in maximum dimension
3. Four or more indications in a line separated by 1/16 inch or less, edge to edge.
4. Ten or more rounded indications within a 6 square inch area whose major dimension is not to exceed six inches, with the area defined in the least favorable location with respect to the indications being evaluated.

NOTE: Linear indications are those indications in which the length is more than three times the width. Rounded indications are circular to elliptical with length less than 3 times the width.

9.2.5 Bolts and bolting material shall have no linear axial defects greater than one inch on bolting over one inch, and all linear nonaxial defects are unacceptable.

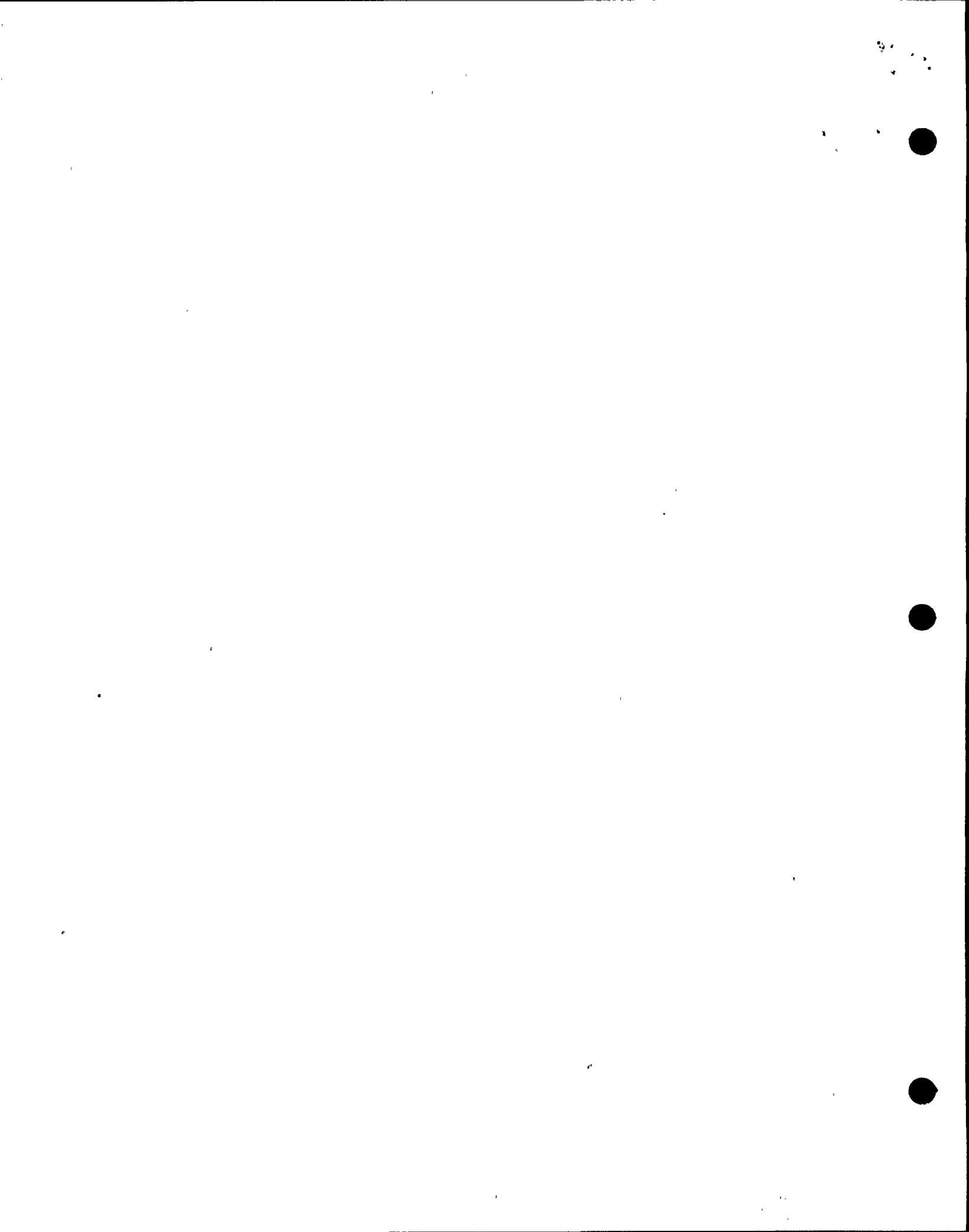
9.2.6 Forging/Safe Ends

1. Only indications with major dimensions greater than 1/16 inch shall be considered relevant.
2. The following relevant indications are unacceptable:
 - A. Any linear indications greater than 1/16 inch long for materials less than 5/8 inch thick, greater than 1/8 inch long for materials from 5/8 inch thick to under 2 inches thick, and 3/16 inch long for materials 2 inches thick and greater;
 - B. Rounded indications with dimensions greater than 1/8 inch for thicknesses less than 5/8 inch and greater than 3/16 inch for thicknesses 5/8 inch and greater;
 - C. Four or more indications in a line separated by 1/16 inch or less, edge to edge;
 - D. Ten or more indications in any six (6) square inches of area whose major dimension is no more than six (6) inches with the dimensions taken in the most unfavorable locations relative to the indications being evaluated.

10. EXAMINATION RECORDS

10.1 CERTIFICATION OF RECORDS

Data sheets shall be numbered 2819-1, 2819-2, 2819-3, etc., completed and signed by the examiner immediately upon completion of the examination(s).



10.2 FILING OF RECORDS

- 10.2.1 NES shall be responsible for submitting to the Plant Owner, or his agent, a complete set of examination records, including certification of personnel qualifications with current eye test in accordance with paragraph 4.2.2.
- 10.2.2 Permanent records shall be maintained by the owner-operator for the life of the components.

11. EXAMINER'S CRITIQUE

11.1 PROCEDURE CORRECTIONS AND ADDITIONS

- 11.1.1 All procedure corrections and/or additions required during the examination shall be made in accordance with the requirements of the NES QA Plan 81A0405.
- 11.1.2 The examiner shall contact the NMPC representative on site to initiate all such changes. All changes shall be documented in the record of revisions section of this procedure.

11.2 CRITIQUE REPORT

Upon completion of the examinations, NES shall submit a written report to the Plant Owner, or his agent, listing pertinent information for future examinations such as procedure additions, corrections and revisions, or unique problems or action to be taken.

