Non Distructive Test

QUALITY DETAIL PROCEDURE

STANDARD NON-DESTRUCTIVE EXAMINATION PROCEDURE (UT, RT, MT, PT)

This NDT Procedure consists of Four Parts:

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PART A -ULTRASONIC EXAMINATION

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1.0 SCOPE

This procedure establishes the requirement for pulse echo ultrasonic examination to evaluate full penetration welds in valves. The general requirement will be conditional to examination of all welds whilst specific changes may be deemed necessary to suit particular dimension, geometry and material of specific welds.

2.0 REFERENCE

ASME Section V : 2004 Edition.
ASME B31.3 : 2004 Edition , 2003 Addendum.
ASTM A 435 : Lamination Check – 2002 Edition.

3.0 SAFETY PRECAUTION AND HAZARD IDENTIFICATION

All Personnel performing UT Shall be fully aware of the potential site working hazard and take the necessary safety precaution during the time and inspection. E.g. Working at height, confine spaces, etc.

4.0 PERSONNEL QUALIFICATION

Ultrasonic Inspector shall be qualified to the following:
Personnel having PCN / CSWIP Level II shall be engaged on the job.

5.0 EQUIPMENT REQUIREMENT

5.1 The examination shall be conducted with an ultrasonic pulse reflection system generating frequencies covering the nominal range of 1 MHz to 5 MHz with a rectified ‘A’ scan display. Such equipment includes the Krautkramer USK 7.

5.2 The ultrasonic pulse-echo instrument shall provide linear vertical presentation within +/- 5% of the full screen height for 20% to 80% of the full screen height (base line to maximum calibrated screen height). The screen height linearity shall be measured and recorded as per procedure set out in Appendix 1.

5.3 The ultrasonic pulse echo instrument shall utilize an amplitude control accurate over its useful range to ± 20% of the nominal amplitude ratio, to allow measurement of indication beyond the linear range of the vertical display on the screen. The amplitude control linearity shall be measured and recorded as per procedure set out in Appendix 2.

5.4 The pulse-echo instrument shall be calibrated weekly and the calibration results filed using the format shown in Appendix 5. The equipment shall be serviced with respect to its service manual at least once a year.

Equipment shall be checked at the beginning and end of each examination, when examination personnel are exchanged or at anytime when malfunctioning suspected.

5.5 Frequency of straight beam probes shall be between 1 MHz
to 5 MHz, with diameters 10mm to 25mm size. A4MHz 20mm diameter probe shall normally be used.

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5.6 For angle probes, frequencies of 2 MHz to 4 MHz with crystal size of approximately 20mm shall normally be used. Exit point and exact angle of beam propagation of each individual probe shall be checked and marked before commencement of a test. Type of probes used shall include Krautkramer MWB series.

6.0 GENERAL EXAMINATION REQUIREMENT

6.1 Examination Coverage

The area to be tested shall be examined by moving the search unit over the examination surface so as to scan the entire examination volume. As a minimum, each pass of search unit shall overlap a minimum of 10% the transducer dimension perpendicular to the direction of the scan.

6.2 Rate of Search Unit Movement

The rate of search unit movement shall not exceed 6 in/sec (153mm/sec) unless calibration is verified at scanning speed.

6.3 Scanning Sensitivity Level

Scanning shall be performed at a gain setting at least two times the reference level. During scanning, only the gain or attenuator controls will be adjusted. Any adjustment of the other controls shall require recalibration.

6.4 Transducer Scanning Pattern

The examination volume shall be scanned with angle beam probes directed both at right angles to the weld axis and along the weld axis. In order to detect all possible defects, the following scanning pattern shall be utilized as much as weld and test specimen configuration would permit.

6.4.1 Transverse Motion

This movement is necessary to examine the complete cross section of the weld and heat affected zone. The extent of such movement is normally equal to the skip distance.

6.4.2 Lateral Motion

This movement should be made to scan the specified length of the welded joint. This is combined with the traversing motion so that each successive probe displacement has an overlap dimension not less than that stated in 5.1 above.

6.4.3 Swiveling Motion

During the movement both towards and away from the welded joint the probe shall be done at an angle not exceeding 15 degrees from the weld axis from both directions and sides of the weld.

6.4.4 Transverse Scanning

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On cases where transverse defects in the weld is to be detected, scanning shall be done at an angle not exceeding 15 degrees from the weld axis from both directions and sides of the weld.

Alternatively, the weld surface may be dressed flush with the parent metal and a transverse scan be performed over the weld surface along the weld axis.

6.5 Transfer Correction

In the event calibration is not performed on an off-cut of the component to be tested, it will be deemed necessary to determine the difference in gain setting necessary to compensate for transfer loss. This can be obtained from the amplitude difference between the signals obtained from the edge of the calibration block and from the edge of the component with similar thickness.

7.0 BASIC CALIBRATION BLOCK

7.1

Calibration Block Material

The basic calibration block shall be a section of product form of the same nominal size, schedule, heat treatment of material specification or equivalent P-Number groupings as one of the materials being examined. The block size and reflector locations shall be adequate to perform calibration for the beam angles used. For calibration blocks for dissimilar metal welds, the material selection shall be used on the side of the weld from which the examination will be conducted.

If examination will be conducted from both sides, calibration reflectors shall be conducted from both sides, calibration reflectors shall be provided in both materials. Where two or more base material thickness are involved, the calibration block thickness shall be determined by the average thickness shall be determined by the average thickness of the weld.

7.2 Clad

Where the component materials are cladded, the block shall be cladded by the same method as the production part.

7.3 Surface Finish

The finish on the surface of the block shall be representative of the surface on the components.

7.4 Block Quality

The calibration block material shall be completely examined with a straight beam search unit. Areas that contain indication exceeding the remaining back reflection shall be excluded from the beam paths required to reach the various calibration reflectors.

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7.5 Basic Calibration Reflectors

The calibration block and reflector configurations shall be as specified in T441.1.1 in Article 4 and T542.2.1 in Article 5 of ASME V (2004), according to their thickness and diameter (in the case of pipe) as stated. Additional reflectors may be installed; these reflectors shall not interfere with establishing the primary reference.

7.6 Materials with diameters greater than 508mm

For examination of materials where the examination surface diameter is greater than 508mm, a block of essentially the same curvature, or alternatively a flat basic calibration block, shall be used.

7.7 Material with diameters less than 508mm.

The basic calibration block shall be curved for materials with diameters 20” and less. A single curved basic calibration block may be used to calibrate the examination on surfaces in the range of curvature from 0.9 to 1.5 times the basic calibration block diameter.

8.0 SYSTEM CALIBRATION AND CALIBRATION CONFIRMATION

8.1 System Calibration

Calibration shall include the complete ultrasonic examination system. The original calibration shall be performed on the basic calibration blocks as per ASME Section V, Article 4, Appendix B.

8.2 Calibration Check

Calibration check shall be performed before commencement of a test. When any part of the examination system is changed, a calibration check shall be made on the basic calibration block to verify any change of values.

Such changes may include:

1. Changes of transducer or cable
2. Change of power source
3. Manipulation of on/off switch
4. Manipulation of any other settings on the equipment with exception to the gain setting.

8.3 Sweep Range Correction

If a point on the DAC curve has moved on the sweep line more that 10% of the sweep reading or 5% of full sweep, whichever is greater, the sweep range calibration shall be noted and corrected. All recorded indications since the last valid calibration check shall be re-examined with corrected calibration and their values shall be changed on the data sheets.

8.4 DAC Correction

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If a point on the DAC curve has decreased 20% or 2 Db of its amplitude, all data sheets since the last calibration check shall be marked void. A new calibration shall be made and recorded and the area covered by the voided data shall be re-examined. If any point of the DAC curve has increased more than 20% or 2 Db of its amplitude all recorded indications since the last valid calibration and their values shall be changed on the data sheets.

9.0 EXAMINATION OF WELDS

9.1 Surface Preparation

The base metal on each side of the weld shall be free of weld spatter, surface irregularities or foreign matter that might interfere with the examination.

9.2 Straight Beam Scanning

Straight beam scanning of the adjacent base metal shall be performed to detect reflectors that may lie in the horizontal plane parallel to the scanning surface. Locations and area of such reflectors shall be recorded and evaluated for acceptance and rejection accordingly.

9.3 Angle Beam Scanning

Angle beam scanning shall be directed at approximate right angles to the weld axis from two directions where possible. The search unit shall be manipulated so that the ultrasonic energy passes through the required volumes of weld and adjacent base metal.

Scanning shall be performed at a gain setting at least two times the primary reference level. Evaluation shall be performed with respect to the primary reference level. Transducers angle include 45, 60, 70 degrees. A minimum of three angle probes are to be used for each examination in addition to the zero degree probe on parent metal. (where specimen thickness allows).

9.4 Butt Welds

Scanning of butt welds should be done within half skip and full distance. In the case of curve surfaces, the effect of curvature should be taken into consideration in locating echo origin.

9.5 Nozzle Welds (Full Penetration)

Nozzle orientation and weld configuration should be studied to understand the shift in echoes due to change on geometry . Test should be performed from more than one scanning face if possible. In the case of large diameter nozzles, scan should be performed also from the nozzle internal.

9.6 Evaluation

Any imperfection which causes an indication in excess of 20% DAC shall be investigated to the extent that it can be evaluated in terms of the acceptance
– rejection standard of the relevant code section.

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10.0 COUPLANT

Grease, light oil or cellulose paste shall be used as couplant. The couplant used shall not be injurious to the material to be tested or disturb post scanning surface treatment. The same couplant shall be used for sensitivity calibration and production test.

11.0 DEFECT SIZING (LENGTH)

All reflections from weld defects will be maximized from all angles to find the best angle which is compatible to the defect orientation. The defect echo will be adjusted to the screen's graticule. The defect echo will be adjusted to the screen's graticule height and sized in the following manner:

11.1 Compressional Wave

The 6 Db drop method shall be used for sizing large defects. Small defects shall be expressed as a percentage amplitude of the back wall echo.

11.2 Shearwave

The 6 Db drop method shall be used for sizing large defects lengths whilst the 20 Db drop method may be used for sizing small defects. For sizing defect height, the 20 Db drop method or the maximum amplitude technique may be used.

12.0 ACCEPTANCE CRITERIA

The acceptance / rejection criteria shall be as per Appendix 9 of ASME VIII Div. 1 / ASME B31.3 for Piping, 2004 Edition, ASTM A 435 for Lamination Check - 2002 Edition.

13.0 REPORTING

13.1 All tests performed shall be recorded in proper reports with the following information included :

i. Project Title

ii. Weld Identification and Spool No and Line No

iii. Weld Geometry

iv. Ultrasonic Procedure No.

v. Specification for Acceptance

vi. Equipment Used

vii. Frequency Range

viii. Couplant

ix. Basic Calibration Blocks

x. Result of Test

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xi. Name and Signature

xii. Date of Test

xiii. Material Tested (Type).

13.2 Any defects found shall be recorded with the following information included :

i. Location of Defect

ii. Size of Defect

iii. Defect Type Assessment

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PART B RADIOGRAPHIC EXAMINATION

PROCEDURE FOR RADIOGRAPHIC EXAMINATION OF WELDS TABLE OF CONTENTS

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1.0 SCOPE

This procedure establishes the requirement, techniques and processes for quality radiographic examination on welds of plates, beams, turbulars and pipes. It is applicable to radiographic examination using Ir-192 Isotope on various grades of steel, cooper and nickel alloy's piping.

Amendments may be made to this general procedure to meet special requirements specifically. Such amendments, if any, shall receive the prior consent of client.

2.0 REFERENCE

ASME Section V : 2004 Edition ASME / ANSI 31.3 : 2004 Edition

THE ATOMIC ENERGY LICENSING ACT 1984 (ACT304)

3.0 SAFETY PRECAUTION AND HAZARD IDENTIFICATION

All personnel performing Radiographic Testing will be fully aware of the potential hazard of radiation and requirement of safe working practices. Also shall ensure that radiation level shall be maintained is low as reasonably achievable to prevent overdose & radiation. Radiation protection requirement set forth by the Atomic Energy Licensing Board shall be observed. Radiographic Testing personnel must be certified to Atomic Energy Licensing Board requirements.

4.0 PERSONNEL QUALIFICATIONS

PT. XXXXX's Quality Assurance Department (QAD) shall use qualified NDT subcontractor to perform the Gamma ray Radiographic Testing (RT).

All RT Personnel with the exceptions of assistants shall be qualified to ASNT Level II certified by ASNT Level III as per Contractor's Written Practice and MLVK Level I or equivalent in Industrial Radiography. They shall be registered with Atomic Energy Licensing Board (AELB) of Malaysia.
Radiography Film Interpreters shall posses a valid PCN / CSWIP 3.4 Level II Certificate.

5.0 EQUIPMENT

5.1 Type of Radiating Source

Iridium 192 Gamma isotope will be used. Container for the isotope shall be Tech-Ops 660 or equivalent model with remote control winder. Curie strength of isotope shall normally not exceed 50 curies.

5.2 Film Selection

Radiographs shall be made using Type 1 or 2 films or equivalent. Examples of these film types are :

i. Type 1 film (Agfa Gevaert D4, Kodak MS 125)

ii. Type 2 film (Agfa Gevaert D7, Kodak AA)

All films shall be stored in a cool clean storage area where they will not be exposed to heat, light or radiation. The pre-exposure fog of the film shall not be greater than 0.3 density. Where PWHT is required, Type 1 film shall be used prior to PWHT and after PWHT.

Radiographic film for Duplex Stainless Steel shall be as per ASTM E94, Type I.

5.3 Intensifying Screens

Lead intensifying screens of 0.125mm thickness shall be placed on the front and back of the films in close contact. Screens shall be free of dents, scratches, dirt and other foreign materials.

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6.0 PENETRAMETER

6.1 Penetrameter (I.O.I)

Standard penetrameter or DIN wire type penetrameter) shall be used. The IQI material shall either be the similar material to the component to be radiographer or belonging to a similar material group or belonging to a similar material grouping.

6.2 Placement of Penetrameters

Penetrameters shall normally be placed on the source side. In the case when this is not possible due to inaccessibility, the penetrameter may be placed on the film side with a lead letter 'F'at least as high as the penetrameter identification number shall be placed adjacent to or on the penetrameter, but shall not mask the essential wire to denote this change. A procedure test will be performed to determine the equivalent penetrameter to be visible at the required sensitivity. The thinnest wire shall be placed within 25mm of the edge of the diagnostic film length.

6.3 For materials of equal thickness and transition thickness, two (2) penetrameter shall be used for welds ten (10) inches and greater in length and one penetrameter for welds less than ten (10) inches in length (Refer to Appendix 2. Fig. 1 & Fig. 3). For single wall single image (Panoramic) exposure, four penetrameters equally spaced shall be placed on the source side.

7.0 FILM IDENTIFICATION

PT. XXXX shall incorporate radiographic film identification as follows :

a. Client:
b. Project
c. Contract No.
d. Spool indicate spool number as per No.requested
e. Weld Identification: Indicate weld number as per requested
f. Identification of repair: R1 or R2 for repair, RS for reshoot joints, RW for rewelded joints, etc .
g. Date of Exposure: date radiographic taken.
h. Penetrameters : to indicate the density of the films
i. Welder Identification : indicate welder number as per requested.
j. Material Thickness : indicate thk of material as per requested.

Refer to Appendix C Figure 1 for radiography identification (layout and description) These identifications shall not obscure the area of interest.

8.0 QUALITY OF RADIOGRAPHY

8.1 All radiographs shall be free from mechanical, chemical or other blemishes to the extent that they mask or be confused with the image of any discontinuity in the area of interest of the object being radiograph. Such blemishes include but not limited to :

a. fogging;
b. water marks, streaks or chemical stains;
c. scratches, finger marks, crimps, dirtiness, static marks or tears;
d. loss of detail due to poor screen to film contact;
e. false indication due to defective screens.

8.2 Back Scatter

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When radiography is carried out in a direction which may create back scattering (e.g. film placed between source and concrete floor) lead sheets may be placed behind the film cassette to reduce or cut off such scatter. A lead letter 'B', 1/16" thickness by ½" height will be placed on the back of the film cassette.
If the lead letter "B" appears on the radiograph as a lighter image than the background, protection from back scatter is insufficient. A new exposure shall be taken with additional backings.

8.4 Geometrical Unsharpness

Sufficient source to object distance shall be maintained in order that geometrical unsharpness shall not exceed 0.02 inch for object thickness of 2 inch and below.

8.5 Density

The minimum and maximum transmitted film density at the area of interest for single film viewing shall be 2.0 and 4.0 H & D respectively. Density is measured either by comparison with a calibrated densitometer or a calibrated density strip.

8.6 Sensitivity

A radiographic technique of sufficient sensitivity shall be used as to produce a basic quality level that shall be no less than 2% as based on material section thickness. However for material of thinner material, such as copper, stainless steel, duplex shall be established if the sensitivity level exceeds as stated in ASME Section V (2004), Table T. 276.

8.7 Location Marker

Location Marker shall be placed on the part. Their location shall be permanently marked on the surface of the part to be radiographer.

8.8 Contrast

The contrast of radiograph shall be to acceptable level as not to reduce the quality and maintain the required sensitivity and density.

9.0 FILM PROCESSING

Manual processing shall be used. Films shall be processed to a quality whereby they remain to be interpretable for at least 5 years under normal storage condition.

9.1 Developing

Films will be placed in hangers and immersed in developer solution with constant agitation for even development time should be adjusted accordingly. Film shall be developed for a minimum of 5 min and a maximum of 8 minutes in the developer at 20°c or per manufacturer's recommendation.

9.2 Stop Bath or Rinse

After development is completed, the films shall be immersed in stop bath or rinsed in clean running water to stop the activity of the developer.

9.3 Fixing

Fixing shall be done for at least twice the clearing time but not more than 15 minutes in fresh fixer.

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9.4 Washing

Washing shall be done with constant flow of clean water. Rate of water flow shall be approximately 5 to 6 times the volume of water tank per hour.

Washing time shall be minimum 10 minutes. Dilution or mixture of chemicals shall be in accordance to that recommended by the chemical manufacturer.

9.5 Drying of Films

i. Care shall be taken to avoid causing any mechanical damage to the emulsion and prevent causing marks from uneven drying.

ii. Drying shall be carried out in a normal dust free room.

iii. Other method of drying can also be achieved (rapid drying) by placing the film in a special cabinet, in which, a constant stream of hot air is forced over both sides of the film.

iv. Once drying has commenced the films shall not be removed from the cabinet until it is completed dry.

v. Drying time shall vary with the drying temperature of the film drying cabinet.

vi. Hypo thiotest to be carried out weekly and recorded.

10.0 RADIOGRAPHIC TECHNIQUE

10.1 Single Wall Single Image (SWSI)

This is the preferred method whenever possible. However, it requires that both side of the weld or component be accessible, with the source placed on one side and the film in close contact on the other side.

In the case when the inside of a pipe is accessible, with the source placed on one side and the film in close contact on the other side.

10.2 Double Wall Double Image (DWDI)

This technique is limited to pipe weld up to 3” O.D. or less in nominal outside diameter. The radiation beam will offset from plane or weld in order to separate the images of welds. At least two films must be taken, at 90º to the other, for each joint. Superimpose technique shall be applied if unable to perform elliptical shots.

10.3 Double Wall single Image (DWSI)

This method is recommended for pipe welds greater than 3” nominal diameter. The radiation passes through two walls but only the image of the wall close to the film is projected. Sufficient number of exposures will be taken to cover the entire weld or component.

11.0 INTERPRETATION

11.1 Viewing of Radiography

The processed radiographs shall be interpreted and evaluated by a qualified radiography interpreter and to be random reviewed by Client. Viewing shall be done on the radiograph film using film viewers. The film viewer shall provide

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sufficient light for viewing the essential penetrameter image and all pertinent details of a radiograph with a density of 2.0 to 3.5 H & D.

12.0 ACCEPTANCE CRITERIA

Accept / Reject Criteria shall be in accordance to Chapter VI, Section 344.5 of ASME / ANSI B31.3, 2004, Table 341.3.2 Severe cyclic condition.

13.0 REPORTING

Radiographic examination report shall be issued

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PART C

MAGNETIC PARTICLE EXAMINATION

PROCEDURE FOR MAGNETIC PARTICLE EXAMINATION OF WELDS TABLE OF CONTENTS

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1.0 SCOPE

This procedure establishes the method and process for magnetic particle inspection using a magnetic yoke for the defection of discontinuities on or near surface of ferromagnetic material.

2.0 REFERENCE

ASME Section V (2004) ASME / ANSI 31.3 (2004)

3.0 SAFETY PRECAUTION AND HAZARD IDENTIFICATION

Personnel performing MPI shall take necessary safety precautionary measures and be fully aware of potential site working hazards eq. Electricity leakage, confine space, electroulation.

4.0 QUALIFICATION OF PERSONNEL

Personnel performing the magnetic particle inspection shall be trained and certified to NDT Level II in Magnetic Particle Inspection in accordance with an approved company written practice established in compliance with ASNT's SNT-TC-1A (Personnel Qualification and Certification in Non Destructive Testing).

In addition, the above personnel are required to undergo an eye examination for visual acuity and as a minimum be able to read at least the Jaeger J2 Chart.

5.0 MAGNETIZING APPARATUS

An AC Yoke or permanent Magnetic Yoke unit shall be used to produce a magnetic field strength sufficient to reveal all objectionable defects. The AC Yoke shall have a lifting power of not less than 10 lbs (4.5 kg) for a maximum pole spacing of 6.5 ins. (165 mm) or less. The Permanent Yoke shall have a lifting power of not less than
40 lbs (18 kg) for a maximum pole spacing of 8 ins (200 mm) or less. The magnetizing force of yokes shall be checked at least once a year, or whenever a yoke has been damaged. If a yoke has not been in use for a year or more, a check shall be done prior to first use.

Refer to Appendix 2 of this section for the procedure to check the magnetizing force of yokes. Use of permanent magnet shall be limited to areas where the use of AC Yoke is not practical.

6.0 DETECTING MEDIUM

Premix Black Magnetic Ink having a concentration of not less than 0.8% and not more than 3.2% by volume shall be used. The particles shall not be toxic and shall be free from substances like rust, grease and dirt. The wet powder method shall be applicable up to a maximum temperature of 135ºF.

Type of premix magnetic ink used shall include Ardrox or Magnaflux brands. When aerosol spray us used, care should be taken to ensure sufficient ventilation at the location of test and no naked flame is close by.

Dry incon powder may be used where temperature of parts to be tested is higher than 130ºF but lower than 600ºF.

7.0 CONTRAST AID

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When test is performed on a surface which may not provide sufficient color contrast to the magnetic ink used, a contrast aid in the form of a thin white adherent paint coating may be applied to the metal surface. This coating thickness shall not exceed 20 microns.

8.0 FIELD INTENSITY INDICATOR

A Burmah 'Castrol' Field Intensity Indicator shall be used to indicate that sufficient field intensity has been applied.

Sufficient field intensity would be indicated by the detection of the three lines artificial defect in the indicators.

9.0 SURFACE CONDITION

Surface of the ferro-magnetic material to be tested and all adjacent areas within at least 1 inch shall be dry and free from rust, oil, grease, paint or any other material that may hinder the movement of iron powder or the interpretation of result indications. Welded surface should be free of flux covering. Light grinding may be necessary to remove very rough weld surface which may give rise to spurious indications.

Primed surfaces shall be tested only if the paint forms a thin coherent coating, tightly adhering to the surface and not thicker than 20 microns.

10.0 ELECTRICAL SAFETY

AC Yoke equipment shall be subjected to EPMI approval and shall be properly earthed. Current supply shall be fitted with an earth-leakage current circuit breaker. The circuit shall trip with a leakage current to earth of not more than 10 mA.

11.0 TEST TECHNIQUE

10.1 Use of AC Yoke - Magnetic Flow Technique

The use of the magnetic Yoke favours the detection of flaws where the major axis lies transverse to the line joining the pole pieces of the Yoke. As such, two magnetizing application, each being at right angle to the other, should be applied over the same area. When an indication is found, a third application should be made at an axis where maximum indication is obtained.

12.0 TEST PROCEDURE (YOKE METHOD)

12.1 Wet Method

12.1.1 Clean and dry area of test free from rust, oil, grease or any other material that may obstruct movement of iron particles or impair result interpretation. Grind lightly if necessary.

12.1.2 Apply thin coat of white contrast paint on area of test. Allow the paint to dry.

12.1.3 Place yoke on the area of test in a direction where a second application at 90º to this first axis is possible. Ensure good contact of yoke to the test piece. Switch on current flow.

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12.1.4 Apply magnetic ink either through aerosol (wet method) onto area where magnetic field has been induced, with the current still on.

12.1.5 Observe for indications formed by the iron powder.

12.1.6 Cut off current flow before removing the yoke.

12.1.7 Repeat step 11.1.3 to 11.1.6 at an axis perpendicular to first test.

12.1.8 When an indication is found, perform step 11.1.3 to 11.1.6 at an axis perpendicular to the axis of the indication in order to obtain maximum sensitivity.

12.1.9 If in doubt, step 11.1.3 to 11.1.6 should be repeated, and the indication reevaluated until a result can be obtained.

12.1.10 Repeat step 11.1.3 to 11.1.7 over the entire area of test. Maintain an overlap of approximately 50mm to ensure 100% coverage of area of test.

12.1.11 Remove remaining solvent after test.

12.1.12 Record flaw indications, found with respect to their location, size and type.

12.2 Dry Method

12..2.1 Clean and dry area of test free from rust, oil, grease or any other material that may obstruct movement of iron particles or impair result interpretation. Grind lightly if necessary.

12.2.2 Place Yoke on the area of test in a direction where a second application at 90º to this first axis is possible. Ensure good contact of Yoke to the test place. Switch on current flow.

12.2.3 Apply fine magnetic powder onto area where magnetic field has been induced, with the current still on.

12.2.4 Observe for indications formed by the iron powder.

12.2.5 Mark Off defect location with the magnetic field still induced.

12.2.6 Cut off current flow before removing the Yoke.

12.2.7 Repeat step 11.2.2 to 11.2.6 at an axis perpendicular to first test.

13.0 ACCEPTANCE CRITERIA

Accept / Reject Criteria shall be in accordance to Appendix 6, ASME VIII Div.1 2001, 2004 Addendum / ASME B31.3 2004 for Piping.

14.0 REPORTING

All tests carried out shall be reported in a format that contains the following information:

i. Job Identification.
ii. Date of Test.

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iii. Type of Equipment Used.
iv. Type of Technique Applied.
v. Identification of Weld/Component.
vi. Type of Magnetizing Current.
vii. Consumable Used.
viii. Result Interpretation.
ix. Description of Flaw Detected, if any.
x. Name and Signature of Tester.

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PART D

DYE PENETRANT EXAMINATION

PROCEDURE FOR DYE PENETRANT EXAMINATION OF WELDS TABLE OF CONTENTS

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1.0 SCOPE

This procedure establishes the requirements for liquid penetrant examination of weldment on plates and pipes of ferrous and non-ferrous materials using solvent removal dye.

2.0 REFERENCE

ASME Section. V (2004) ASME/ ANSI 31.3 (2004)

3.0 SAFETY PRECAUTION AND HAZARD IDENTIFICATION

Personnel performing Dye Penetrant Testing shall take necessary safety precautionary measures and be fully aware of potentials site working hazards during the time of inspection ex. Working in confine space, heights, etc.

4.0 QUALIFICATION OF PERSONNEL

Non-Destructive Testing Personnel shall be qualified and certified to NDT Level II in accordance with an approved Written Practice established in compliance with ASNT's SNT-TC-1A (Personnel Qualification and Certification in Non-Destructive Testing). Or CSWIP/PCN Level II shall be acceptance.

5.0 GENERAL REQUIREMENTS

5.1 Surface Condition

Surface condition shall be as weld, as rolled, cast, or as forged condition. However, surface preparation by grinding or machining may be necessary when surface irregularities might mask the indication of unacceptable discontinuities. Or otherwise interfere with effectiveness of the examination. Temperature of test surfaces shall not be lower than 16ºC.

5.2 Pre-Cleaning of Parts and Materials

The success of any penetrant inspection is greatly dependent upon the surface and the discontinuity being free of any contaminant that might interfere with the penetrant process. All surfaces to be inspected and all adjacent areas within at least 1 inch must be cleaned and dried before the penetrant is being applied. The surface must be free of any rust, scale, welding flux, spatter, grease, paint, oily films and dirt.

5.3 Drying

All surfaces tested shall be subjected to drying period after pre-cleaning. Liquid residue that may hinder the entrances of penetrant shall be removed either warming the surface with forced hot air, exposure to ambient temperature or wiped the surface with a clean, dry cloth or absorbent paper prior to carrying out inspection.

Surface temperature of surface or material shall not exceed 52ºC prior to application of penetrant.

5.4 Penetrant Application

Penetrant shall cover the entire surface under inspection. Proper ventilation is important when using aerosol spray type.

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Penetrant dwell time shall be as recommended by manufacturer, normally not less than 5 minutes to a maximum of 20 minutes.

Penetrant dwell time for other materials not stated by manufacturer shall have to comply to ASME Section V, SE-165, Table 2 for recommended dwell time. In any case, penetrant should not be allowed to dry-up during dwell time.

5.5 Solvent Application

Solvent shall be used for the removal of penetrant by wiping with a lint-free material. Flushing the surface with solvent following the application of penetrant and prior to developing is prohibited. Allow surface solvent to evaporate before applying developer.

5.6 Developer Application

An even developing film shall cover the entire surface under inspection. Minimum distance to produce such film shall be at least 12 inches away from surface of inspection. The length of time for the developer to remain on the surface of interest should be at least 7 minutes. If bleed out does not alter the inspection results, development period of over 30 minutes are permitted.

5.7 Post Cleaning

Post cleaning is necessary where residual penetrant and developer promotes corrosion or interfere with other processes.

6.0 TEST PROCEDURE

6.1 Surface Preparation

Ensure that surface of interest to be tested is free of paint, grease, oil, dust, lint, scales and spatters.

Grinding and machining may be applied only when surface irregularities might mask indication of unacceptable discontinuities.

6.2 Testing Media

Solvent removable system consisting of the following shall be used (aerosol spray type). Samples of Brands.

A1 Magnaflux RPC Cleaner/Removal A2 Magnaflux RP Penetrant
A3 Magnaflux RPD Developer OR
B1 Ardrox - Tracer-Tech D495A Developer

B2 Ardrox - Tracer-Tech P300A Red Dye Penetrant B3 Ardrox -Tracer-Tech K410C Penetrant Remover or equivalently fit for use brands.

6.3 Penetrant Application

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Apply the penetrant to the entire surface to be inspected. Allow a minimum dwelling time of 5 minutes and to a maximum of 20 minutes.

6.4 Solvent Application

Clean lint-free material wets with solvent shall be used to remove the penetrant. Care should be taken not to apply solvent too extensively. Direct spraying of solvent to remove penetrant is not to be practised.

6.5 Developer Application

Allow solvent to dry before applying developer. Direct the developer at approximately 12 inches away from the surface to be inspected and apply only a thin and even film. Mark all defect indication.

7.0 INSPECTION

Inspection shall be done while applying the developer. Final interpretation shall be made after allowing the penetrant to bleed out for 7 minutes to 30 minutes. Longer periods acceptable if the surface to be examined is not altered by the bleed out. If the surface to be examined is so large as to preclude complete examination within the prescribed time, then only portions of the surface shall be examined at any one time.

8.0 INTERPRETATION

Interpretation shall be made at intervals during the 'bleed out' process so that the large indication may be viewed before excessive diffusion occurs.

Localized surface irregularities such as machining marks or other surface irregularities may also produce indication. Such indications shall not be treated as non-relevant until and unless proven to be one.

9.0 EVALUATION OF INDICATION

Relevant indications are those, which result from mechanical discontinuities.

a. Linear indication is those indications in which the length is more than three times the width. Only indications with major dimensions greater

b. Rounded indications or indications, which are circular or elliptical with the length less than three times the width.

c. Any questionable or doubtful indications shall be retested to verify whether or not actual defects are present.

d. Localised surface imperfection, such as may occur from machining marks. Surface conditions, or an incomplete bond between base metal and cladding, may produce similar indications which are nor relevant to the detection of unacceptable discontinuities.

10.0 ACCEPTANCE CRITERIA

The Acceptance / Rejection Criteria shall be in accordance with Appendix 8, ASME VIII Div.1 ASME B31.3 (2004) for Piping.

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11.0 REPORTING

All tests carried out shall be reported in a Format

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