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<b>Eddy Current Test Management System</b>			

## 1、 Purpose

Standardize the operation requirements of the company for eddy current testing Ensure the stability and standardization of eddy current testing procedures.

## 2、 Scope of application

This standard is applicable to eddy current testing of welded pipes produced according to ASTM A249/A249M, ASTM A269 and GB/T 12770, GB/T12771, GB/T245930 and other specifications. The specific flaw detection methods are as follows:

Product Standard	Method of Flaw Detection
GB/T 12770	GB/T 7735
GB/T 12771	
GB/T24593	
ASTM A249/A249M	ASTM A/ASME SA1016/ASTM E426/ASME SE426
ASTMA269	

Remark: The following is an abbreviation for the standard of flaw detection with the US standard and the national standard.


## 3、 Relative Files

- A) GB/T 7735
- B) ASTM A/ASME SA1016
- C) ASTM E426/ASME SE426
- D) Management Program Recording
- E) Inspection and experiment management program

## 4、 Management Duty

**4.1** The quality insurance department is responsible for formulating this management system.

**4.2** The quality department is responsible for the implementation of eddy current testing operations in accordance with this management.

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## 5、 Process Control

### 5.1 Personnel qualification

Detectors should pass qualifications in accordance with ISO9712 or SNT-TC-1A or other similar standards. NDE personnel shall be assessed and qualified according to the provisions of “Eddy Current Test Qualification Assessment System” from Jiangsu TSC Tube.

### 5.2 Equipment Request

#### 5.2.1 Flaw detection equipment

The flaw detection equipment shall be equipped with a probe, a filter circuit, a modulation circuit, a magnetic saturation device, and a signal display device.

#### 5.2.2 Probe requirements

##### 5.2.2.1 National Standard

The appropriate excitation coil frequency should be chosen to ensure adequate penetration and good signal-to-noise ratio.

##### 5.2.2.2 American Standard

The appropriate excitation coil frequency should be chosen to ensure adequate penetration and good signal-to-noise ratio. Excitation coil frequency can not exceed the following requirements:

- 1) Wall thickness of steel pipe < 1.3mm, not exceed 100kHz;
- 2) 1.3mm  $\leq$  Wall thickness of steel pipe < 3.8mm, not exceed 50kHz;
- 3) Wall thickness of steel pipe  $\geq$  3.8mm, not exceed 10kHz

### 5.3 Sample tube requirements

5.3.1 The steel pipe of the comparative sample shall be the same as the nominal size of the steel pipe to be inspected, similar in chemical composition, surface state, heat treatment state, or have similar electromagnetic characteristics.



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5.3.2 The comparison sample tube should be straight, the surface is not stained with foreign matter, and there is no defect affecting the calibration.

5.3.3 Compare the artificial defect shape of the sample tube

5.3.3.1 The artificial defect shape of the national standard contrast sample tube is a through hole

5.3.3.2 The artificial defect shape of the American standard contrast sample tube is through hole or lateral groove

5.3.4 Compare sample tubes of manual defect size and quantity requirements

5.3.4.1 National Standard

A) Sample tube artificial defect using drilling. There should be 5 round holes drilled on the manifold, and the round hole should penetrate the wall thickness of the manifold

B) The three holes in the middle of the penetrating probe sample tube should be spaced  $120^\circ$  apart from each other in the circumferential direction, and the longitudinal interval should be no less than 200mm to obtain a clearly identifiable signal, and one hole must be on the weld.

C) The fan probe only needs to drill an empty hole in the weld.

D) In addition, the end is drilled through the hole at a distance of less than 200 mm from both ends to check the end effect. The hole should completely penetrate the wall thickness of the steel pipe, and care should be taken to avoid deformation of the pipe and the hole when drilling.

E) When wall thickness of steel pipe  $\leq 3\text{mm}$ , through hole diameter is 1.20mm (but when out diameter  $\geq 51\text{mm}$ , through hole diameter is 1.60mm)

F) When wall thickness of steel pipe  $> 3\text{mm}$ , through hole diameter is 1.60mm (but when out diameter  $\geq 51\text{mm}$ , through hole diameter is 1.60mm)

G) If the customer requests, the size of the hole is determined according to the result agreed by the customer.

5.3.4.2 American Standard

A) The diameter of the hole must not exceed 0.8mm



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B) Drill at least 3 through the probe hole, so that the holes are evenly distributed in the circumferential direction of the manifold, and the longitudinal spacing is far enough to avoid mutual interference. One of the holes must be on the weld

C) The fan probe drills a hole in the weld

D) In addition, drill a space at the position of the 200mm weld at both ends of the sample tube to check the end effect.

### 5.4 Flaw detection requirements

#### 5.4.1 Non-ferromagnetic material eddy current testing equipment calibration requirements

5.4.1.1 According to the material, state and specifications of the incoming product, select the correct sample tube to debug the equipment.

5.4.1.2 Select instrument, detection frequency, detection speed, coil or probe, circuit design, phase identification, and other circuits.

5.4.1.3 The device is used to verify the device so that the artificial defect produces a clearly identifiable signal.

The amplitude of these signals is applied to set the alarm level. The minimum signal amplitude obtained from each hole in the manifold is applied to the set alarm level

5.4.1.4 During calibration, the relative movement speed between the sample tube and the detection coil should be consistent with that of normal flaw detection, and the same equipment parameters such as frequency, sensitivity, phase angle, filter parameters, magnetic saturation strength, etc. should be used.

5.4.1.5 A dedicated fistula should be used to measure the end effect, with a series of artificial defects near one or both ends of the fistula. The test tube is passed through the inspection system at the product inspection speed. If artificial defects are only present at one end of the fistula, the fistula should be passed back and forth through the detection system. If the order is required, the length of the end non-explorable area shall be reported to the buyer.

(Applicable to national standard)



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### 5.4.2 Ferromagnetic material eddy current testing equipment calibration requirements

5.4.2.1 Selected instrument, detection frequency, detection speed, coil or probe arrangement, magnetic saturation device, phase discriminator and other circuits.

5.4.2.2 Adjust the magnetic field strength of the magnetic saturation device so that the sample tube can obtain the proper degree of magnetization in the pipe fitting according to the following two requirements to ensure smooth detection.


1) Adjust the sensitivity of the system so that the manifold does not cause excessive "noise" when it is not detected by an external magnetic field. This state is characterized by repeated alarms by the instrument when the total length of the pipe is exceeded.

2) Repeated detection of the manifold to increase the magnetizing current or magnetic field until the "noise" obtained by further increasing the magnetic field strength is not further reduced.

5.4.2.3 The device is tuned to achieve the best signal-to-noise ratio with the lowest sensitivity required to reliably detect artificial defects in the fistula. The parameter settings (like the detection speed) at the time of device verification must be the same as when the product is inspected.

5.4.2.4 When the 6.3.2.3 is performed, or as a separate operation, the manifold is rotated in 90° or 120° increments to determine the “electrical center” position of the detection coil. Mechanically adjusting the position of the tubes in the coil to obtain approximately equal responses from artificial defects, regardless of their circumferential position

5.4.2.5 A dedicated helium tube should be used to measure the end non-explorable area, with a series of artificial defects near one or both ends of the fistula. When the artificial defect is only close to one end of the tube, the tube can be passed through the detection system twice, once with one end with several artificial defects as the front end, and the range of the end non-explorable area is from the front end of the tube to the detected end. The area with the first artificial defect that responds uniformly; the other is the end with several artificial defects as the tail end,

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and the range of the end non-explorable area refers to the last artificial defect detected from the uniform response to the tube The area at the end.

5.4.3 The equipment calibration shall be carried out before and after the replacement of the product. The intermediate flaw detection process shall be commissioned at least 4 times. The equipment shall be commissioned after replacement of the settings or operation personnel, equipment maintenance, power failure and abnormality of the equipment. The sample tube debug signal to noise ratio is at least 3:1. The artificial injury signal echo amplitude is at least 50% of the screen height. If the defect echo signal is reduced by 3dB after the last commissioning, the equipment shall be re-verified, and the steel pipe tested after the last calibration shall be re-inspected after the equipment is correctly set.

## 5.5 Result determination and processing

5.5.1 When the steel pipe generates a signal lower than the alarm level, it shall be judged as qualified

5.5.2 When the steel pipe produces a signal equal to or higher than the alarm level, the steel pipe should be judged to be suspicious, or choose to re-inspect


5.5.3 If the steel pipe does not produce a signal equal to or higher than the alarm level when re-inspection, it is judged as qualified. If a signal equal to or higher than the alarm level is still generated, it is considered suspicious.

5.5.4 For suspicious steel pipes, one or more of the following measures shall be taken in accordance with product standards:

A) Grinding suspicious places. If the wall thickness is still within the tolerance range after grinding, it should be re-tested according to the previous method. If no signal equal to or higher than the alarm level is generated, it is judged as qualified. Suspicious places can be checked and accepted by buyers and sellers, and other non-destructive testing techniques and methods are used for testing.

B) Remove the suspicious part. The manufacturer must ensure that all suspicious parts are removed

C) Suspicious pipe is judged to be unqualified

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5.5.5 The non-explorable area at both ends of the steel pipe must be cut at least 200mm

### 5.6 Report

After each batch of steel pipes is inspected, the corresponding original records shall be made, and the inspection report shall be issued according to the customer's requirements. The inspection report format shall be in the eddy current inspection report, and the report shall be issued by personnel with Class II or above.

Made By		Approved By		Date	
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