

State Energy Inspection Services Standard Operating Procedure: Special End Area	Instruction #	Manual
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1.0 Scope

Special End Area (SEA) examination is performed to provide the inspection and testing coverage necessary on the end portions of tubulars not covered during Electromagnetic or Ultrasonic testing. The coverage for this examination is 18 inches from each end including pin and coupling threads. Special End Area examination consists of the following inspection and testing methods.

- a) Visual thread inspection
- b) White light inspection
- c) Magnetic particle testing of the external and internal surfaces utilizing either wet fluorescent particle or the dry method

1.1 For visual thread evaluation performed during SEA, reference State Energy's SOP 11.0.

1.2 For evaluation of tube imperfections found during SEA, reference State Energy's SOP 2.0.

2.0 Personnel Qualifications

2.1 Personnel performing this procedure shall be classified as a minimum, Level I Inspector

2.2 Level I inspectors shall be under the supervision of an on-site Level II or Level III supervisor.

2.3 Personnel performing SEA inspection must be able to distinguish J2 letters at 12 inches on a Jaeger eye chart and have no color vision impairment.

3.0 Reference Documents

3.1 The following documents are referenced in preparation of this procedure and should be available on the job site location.

- ✓ API RP5A5
- ✓ API 5CT
- ✓ API 5L
- ✓ API 5D
- ✓ Customer Specification, as applicable

4.0 Definitions

4.1 Reference RP 5A5 for definitions of wording used in this procedure.

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5.0 Equipment

- 5.1 Equipment required to perform SEA inspection as applicable, is as follows:
- a) Magnetizing equipment for circular magnetization
 - b) Magnetization equipment for longitudinal magnetization
 - d) Magnaflux 14a magnetic particles or equivalent
 - e) Magnaflux WA-20b water conditioner or equivalent
 - f) Magnetometer, hand held
 - e) Magnetic field penetrometer or Burmah Castorl Strip
 - g) Black light inspection lamps
 - h) AWS 86 magnetic particles or equivalent. Particles shall be of a color that will provide a high contrast between the particles and the surface being inspected
 - i) Tools for imperfection evaluation of the threads and tube body
 - j) White light
 - k) Light meter

6.0 Surface Preparations of the Pipe Ends

- 6.1 Thread protectors, if applicable, shall be removed and set aside for cleaning before re-application.
- 6.2 All inspection surface areas, including threads shall be cleaned to insure removal of dirt, grease, thread lubricants, scale, excess paint, sticky coating or other contaminants which could interfere with the movement of magnetic particles used in the inspection. Use varsol or other non-oily, quick dry, high flash point solvent to clean with. Do not ever use diesel.
- 6.3 Any original mill varnish or coating thickness exceeding .031" should be removed, since this could prevent movement of particles to an imperfection.
- 6.4 All seal rings must be removed before cleaning the threaded area of modified couplings.
- 6.5 Once protectors are removed from connections, care shall be exercised when handling for protection of the exposed threads.

7.0 Magnetization Technique

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7.1 Circumferential magnetic field for longitudinal discontinuities is to be performed prior to the longitudinal magnetic field is applied.

7.2 Longitudinal magnetic field for transverse discontinuities is to be performed after the circumferential magnetic field.

7.3 Circumferential Magnetic Field

- a) The technique for introduction of the magnetic field shall be via an insulated centralized conducting rod and a half wave, full wave, battery pack or a capacitor discharge unit for inducing the current. The current unit should have a pulse duration greater than 40 milliseconds with 400 amps per inch of OD pipe size. Each length of pipe shall be pulsed a minimum of 2 times. See table '5-1' for current requirements.
- b) Do not drape shooting cables over joints, which have already been magnetized. This may change the field strength and/or direction.
- c) The Magnetic field is to be verified on first five joints to be inspected and approximately every twenty-five joints thereafter with a penetrometer or castrol strip. A particle build up parallel to the pipe axis should be visible on the penetrometer. Take the magnetic field reading on the OD of the pipe approximately 12 inched from the end. Take care that no residual magnetism remains in the penetrometer from previous inspections.
- d) If any length fails to indicate a sufficient magnetic field and direction, it is good practice to verify the direction and strength of the magnetic field in each length. Increase the number of pulses applied to each length and verify the field before continuing.

Note: In some cases on pipe that is concentric or ERW pipe it is hard to get an magnetic field indication on a penetrometer or castrol strip due to the non flux leakage of a true circumferential field. Care should be taken when indicating a field.
- e) Magnetize only the amount of pipe that you expect to complete in any one-work day. Any pipe left on the rack longer than 4 hours before inspection must be re-magnetized unless it can be demonstrated with the use of a penetrometer or castrol strip that a sufficient magnetic field is still present.

7.4 Longitudinal Magnetic Field

- a) The technique for introduction of the magnetic field shall be via a DC power supply and coil with the coil energized while the coil is completely over the end to be inspected at a distance of approximately 12 inches at centerline of the coil.

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- b) The current for longitudinal magnetization of pipe ends is the amount that will produce a minimum residual field of 50 gauss using a magnetometer and will not cause clumping of the particles on the pipe ends.
- c) If excessive powder furring/clumping occurs at the ends of the tube or powder mobility is hampered, re-magnetize the pipe ends at a lower setting.
- d) The Magnetic field is to be verified on first five joints inspected and approximately every twenty-five joints thereafter with a magnetometer. Also a particle build up perpendicular to the pipe axis must be visible on the penetrometer or castrol strip. Take the magnetic field reading as far as you can practically reach in the ID of the pipe. Take care that no residual magnetism remains in the penetrometer from previous inspections.
- e) If any length fails to indicate a sufficient magnetic field and direction, it is good practice to verify the direction and strength of the magnetic field in each length. Increase the number of amp turns applied to each length and verify the field before continuing.
- f) Magnetize only the amount of pipe that you expect to complete in any one-work day. Any pipe left on the rack longer than 4 hours before inspection must be re-magnetized unless it can be demonstrated with the use of a magnetic field penetrometer or castrol strip that a sufficient magnetic field is still present.
- g) Any pipe that will not be followed by full-length body inspection that utilizes a demagnetize system after SEA inspection shall be demagnetized. The residual magnetism should be lowered to 5 gauss or less as indicated with a magnetometer.

8.0 Procedure “Wet Method”

8.1 Lighting

- a) Black light intensity should be checked at the beginning of the job and after every 4-6 hours of operation, start or end of shift and any time the power is interrupted. Warm the bulb for at least 5 minutes prior to the intensity test. The reading must be at least 1000 $\mu\text{w}/\text{CM}^2$ at the normal inspection distance.
- b) Insure there are no cracks in the filter lenses. This could allow harmful light rays to escape. Replace any cracked filter lenses or lenses that are cloudy due to excessive use or light intensity drop. The bulbs will also drop in intensity over time.
- c) White light for visual inspection of the pipe surfaces and threads shall have a measured intensity not less than 50 foot candles at the inspection surface.

8.2 Bath Preparation

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- a) Water shall be used for particle solution; adequate surfactants must be included to insure good watability of the final mixed solution.
- b) Mix the proper amount of particles in a container of water to create slurry. When thoroughly mixed, slowly add the slurry to the clean bath while agitating.
- c) Allow the bath to agitate for 15 minuets prior to taking a settling test. Leave the dispensing hose open during this time.
- d) The settling test consists of a 100 ML centrifuge tube and stand. Fill the centrifuge tube to the 100 ML line, place the tube in the stand and allow settling for 30 minuets.
- e) The volume of particles will settle to the bottom of the tube. The bath is properly mixed if the particle concentration is between .2% to .4% by volume. Less than a .2% volume will cause loss of sensitivity and greater than a .4% volume could cause increase background color and mask indications.
- f) If particle concentration is found to be less than .2% at any time, all lengths inspected since the last acceptable settling test was taken must be re-inspected.
- g) Settling tests should be taken prior to start of job, every 4-6 hours, start or end of a shift, any time maintenance of bath and at the completion of the job.
- h) The bath should be drained and cleaned periodically to remove contamination and excess dye removed from the particles by agitation of the bath.

8.3 Inspection Procedure

- a) Apply a sequential number near the coupling end of each length.
- b) Prepare the ends to be inspected per 5.0 above to a distance of at least 24 inches from each end.
- c) Pass a central conductor rod through the pipe as stated in 6.1 above.
- d) A white light inspection of the threads and tube internal and external areas is to be performed either before or after the black light inspection.
- e) Apply the bath solution to both the internal and external surface of the pipe while rolling to ensure complete coverage to a distance of 24 inches.
- f) Slowly roll each length 1-1/2 revolutions while observing the external surfaces using the black light lenses as parallel to the surface as possible.
- g) Slowly roll each length 1-1/2 more revolutions while observing the internal surfaces using the black light as close to the ID as possible.
- h) Mark any indication observed and evaluate all indications.
- i) Establish a longitudinal field as stated in 6.2 above.
- j) Reapply the bath solution to both the internal and external surface of the pipe while rolling to ensure complete coverage.
- k) Slowly roll each length 1-1/2 revolutions while observing the external surfaces using the black light as parallel to the surface as possible.

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- l) Slowly roll each length 1-1/2 more revolutions while observing the internal surfaces using the black light as close to the ID as possible.
- m) Mark any indication observed and evaluate all indications.
- n) Evaluate all indications in accordance with Xtreme SOP 2.0.

9.0 Procedure “Dry Method”

9.1 White light for visual inspection of the pipe surfaces and threads shall have a measured intensity not less than 50 foot candles at the inspection surface.

9.2 Inspection Procedure

- a) Apply a sequential number near the coupling end of each length.
- b) Prepare the ends to be inspected per 5.0 above to a distance of at least 24 inches from each end.
- c) Pass a central conductor rod through the pipe as stated in 6.1 above.
- d) A white light inspection of the threads is to be performed either before or after the particle inspection.
- e) Apply an even bead of magnetic particles to the ID of the pipe to 24 inches.
- f) Slowly roll the pipe 1-1/2 revolutions while applying magnetic particles to the external surface in a light mist cloud.
- g) Slowly roll the pipe 1-1/2 more revolutions while observing the ID surface using the magnetic particles already applied.
- h) Mark any indication observed and evaluate all indications.
- i) Establish a longitudinal field as stated in 6.2 above.
- j) Reapply magnetic particles to the ID if necessary.
- k) Slowly roll the pipe 1-1/2 revolutions while applying magnetic particles to the external surface in a light mist cloud.
- l) Slowly roll the pipe 1-1/2 more revolutions while observing the ID surface using the magnetic particles already applied.
- m) Mark any indication observed and evaluate all indications.
- n) Evaluate all indications in accordance with State Energy’s SOP 2.0.

10.0 Post Inspection Requirements

- 10.1 For the Dry method, blow all iron powder and other residue completely from both the ID and OD of the pipe with hi pressure air.
- 10.2 If Wet Magnetic Particle is used, all solution shall be rinsed with water from and near the threads and blown with hi pressure air.

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- 10.3 When blowing inspection powder, take particular care to clean the threads thoroughly.
- 10.4 Apply the proper thread compound as noted on the Work Order instructions of all exposed threads. Coverage must be complete over the entire threaded area. Do not thin any pipe thread compound. In cold weather, it may be easier if warmed before applied.
- 10.5 Clean thread protectors are to be applied wrench tight and fully engaged.

11.0 Records

- 11.1 Confirm the final count, tallies, rejects, good joints, and total joints are correctly reflected in the record.
- 11.2 Confirm all joints have been banded and stenciled properly.
- 11.3 Records of Thread Gage are to be kept for a minimum of 5 years.

Table 5-1

<i>Pipe OD</i>	<i>Current-Min. (Amps)</i>	<i>No of Pulses-Min.</i>
2-3/8"	950	2
2-7/8"	1150	2
3-1/2"	1400	2
4"	1600	2
4-1/2"	1800	2
5"	2000	2
5-1/2"	2200	2
6-5/8"	2650	2
7"	2800	2
7-5/8"	3050	2
8-5/8"	3450	2
9-5/8"	3850	2
9-3/4"	3900	2
9-7/8"	3950	2
10-3/4"	4300	2
11-3/4"	4700	2
12-3/4"	5100	2

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13-3/8"	5350	2
13-5/8"	5450	2
16"	6400	2
18-5/8"	7450	2
20"	8000	2