S02.1 Scope

This procedure is for the examination of ferromagnetic surface and near surface indications in stressed areas of welds, drilling or production equipment, or as a prove up technique. Both wet and dry particle techniques are discussed. Wet fluorescent magnetic particle inspection (MT) is also known as “Blacklight inspection”. The black light shall operate only in the UV-A part of the light spectrum.

S02.2 Relevant Standards and Documentation

The latest editions of the following:

- ASTM E 709
- ASTM E 1444
- API RP 7G
- API RP 5A5
- API 8C

S02.3 Equipment

S02.3.1 General Requirements

02.3.1.1 AC Yoke: AC yokes are used for prove up with either dry or wet particles. The yoke shall be capable of lifting a 10-lb. steel test mass and bear a re-calibration certificate (see Quality manual).

02.3.1.2 Coil: When a coil is to be used, it shall be supplied with DC, or rectified AC (Half-wave or full wave) from a source with a peak-reading ammeter (so that the ampere-turns can be calculated). The number of turns shall be securely attached to the coil.

02.3.1.3: Inspection Area for coils: The inspection area shall be limited to half of the coil diameter up to 9" on each side of the DC coil.

02.3.1.4 Field Indicator: Type G castrol strips shall be used to test for the presence of magnetic field in the part. The strip shall be held on the part at least once per ten areas inspected. In use, a magnetic particle indication shall be visible on all 3 slots in the strip. The customer may require other forms of field indicator.

02.3.1.5: Black and White Light Meter: An in-recalibration black (UVA)/white light meter shall be used to control (a) the minimum UVA light intensity at the inspection surface, and (b) the maximum white light in the inspection area. See below.

02.3.1.6 Cleaning materials: Cleaning of the part shall be performed using appropriate methods, depending upon the end use of the product. In the case of threads, only soft wheels may be used. The area to be inspected shall be free of grease and scale or other surface contaminant. All paint shall be removed from the area to be inspected.
02.2.1.7 **Colored paints**: Use to determine whether a part is acceptable or repairable or reject. If inspection is not to be performed to API standards where color coding had been defined, customer should supply his/her color coding requirement during “Contract review”.

**S02.3.2 Dry Particle Inspection**

02.3.2.1 **Minimum Light Level**: The minimum ambient white (daylight, or indoor facility) light intensity at the inspection surface shall be 500 lux (50 ft-candles).

02.3.2.2 **Contrast**: Dry Particles with high contrast from the surface to be inspected, and meeting the requirements of API RP 5A5 shall be used, and dispensed from an approved powder bulb.

**S02.3.3 Wet Fluorescent Particle Inspection**

02.3.3.1 **UVA Lamp**: UVA (Black) light bulbs must be mercury vapor bulb of minimum wattage 100 W, with minimum intensity acceptable at a distance of 15 inches must be 2000 microwatts/cm². Allow sufficient time (e.g. 10 minutes) for bulbs to warm up to provide full intensity.

02.3.3.2 **Suspension fluid** shall be a solvent with low sulfur content, Safety clean, Varsol, No 1 grade kerosene, and other comparable solutions may be used. Gasoline or diesel shall not be used. Water may be substituted on customer request. Surface tension reducers shall be added to water solutions.

02.3.3.3 **Particle Concentration**: Wet fluorescent particle strength shall range from a minimum of 0.1 to 0.4 ml/100 ml of solution, measured utilizing a centrifuge tube. Particle concentration shall be checked prior to the commencement of a job, and at least every 8 hours thereafter. The settling flask shall be maintained in an area free of magnetic fields.

02.3.3.4 **Darkened Area**: This can be a black light tent, or a cape + a matt black cloth on the floor. *Capes where reflected sunlight (from the ground) should be discouraged.* The latter is discouraged. The white light intensity in the viewing area shall not be more than 2 ft-candles (20 lux). The eye must be dark-adapted for several (at least 5) minutes before attempting to perform WFMT.

**S02.4 Procedures**

02.4.1 **Settling Test**: Make up the solution. Fill the settling flask immediately prior to the start of the job.

02.4.2 **Preparation**: All surfaces to be inspected shall be thoroughly cleaned of any elements which could hinder a quality inspection. This may involve filing or grinding. In the case of the roots of threads in RSCs, use only soft wheels, to avoid the danger of removing metal, and covering the mouths of tight cracks.

04.4.3 **Magnetization**: The parts to be inspected shall be magnetized using a continuous longitudinal DC magnetic field.
02.4.4 **Presence of Sufficient Field:** A Castrol strip shall be used to verify the presence of an acceptable surface field magnetic strength and direction. Where many parts of the same dimensions are required to be inspected, use of the Castrol strip may be restricted to one in 5 components.

02.4.5 **Particle application:** Generously apply the magnetic solution to areas to be inspected while the coil is active. Allow several seconds for the particles to be drawn to any the MFL fields of any imperfections and defects.

02.4.6 **Visual Inspection:** Carefully examine the area in a darkened state (either a black light tent, or under a cape, with the inspector looking at about 45 degrees to the horizontal). Particular attention should be paid to the area of the last engaged threads because this is the area where the majority of the stress is concentrated.

02.4.7 **Mirrors:** All areas where accumulation of particles occur shall be rolled at least twice, and inspected. A magnifying glass shall be used on pin ends, and a dentist’s mirror shall be used on box end threads.

02.4.8 Any indications which cannot be lightly buffed and proved up shall be rejected and marked for repair. Grinding out cracks is not permitted.

02.4.9 All RSC connections shall be inspected over the entire surface of the connection over the box threads and the ID of the pin.

**S02.5 Visible Magnetic Ink Inspection**

02.5.1 Magnetic ink inspection shall be performed with the use of an AC yoke to create a variable surface field strength; A dry white flat background contrast shall be provided using a very thin layer of contrast aerosol paint. The particle suspension shall be prepared according to recommendation or pre-mixed aerosol cans.

02.5.2 Any indication shall be proved up with a buffing wheel, and reapplication of the test. Any cracks are cause for rejection.

02.5.3 API or customer specification shall apply for acceptance and rejection criteria.

**S02.6 Dry Particle Inspection**

02.6.1 **Contrast:** Dry Particles with high contrast from the surface to be inspected, and meeting the requirements of API RP 5A5 shall be used.

02.6.2 **Inspection Area:** When a yoke is used, the inspection of the area is a ring in the central region between the legs of the yoke.

02.6.3 **Inspection:** All inspection areas shall be inspected (a) with the legs of the yoke in contact with the
article under inspection, and (b) at least two angles, roughly 90 deg apart.

Note: When attempting dry particle inspection in an active coil field, particles will “fur” out along emergent lines of MFL, and could obscure indications.

S02.7 Wet Fluorescent Particle Inspection (WFMT).

S02.7.1 Activation of MFL: When using a coil, the largest MFL from tight imperfections occurs when the coil field is ON. Inspection can also be performed in the resulting residual induction, but the indication from very tight cracks at the roots of threads may be more difficult to see.

S02.7.2 Use of Field Indicator: Once the magnetization level has been determined from the customer’s magnetization requirement(s) [These may be different from API or other written standards, since there are very many requirements in existence], the ability of that field strength to produce an indication on a field indicator must be verified.

S02.7.3 Concentration: Record the solution concentration on the inspection form.

S02.7.4 Solution/Ink: Solution must be sprayed slowly and indications given time to form. Allow the solution to run slowly over the inspection area so that the MFL from imperfections/defects can attract and hold particles out of the solution.

S02.7.5 Thread Roots: UVA shall be directed downwards into thread roots, either directly or using a mirror. As part of the set-up procedure, check the intensity at the inspected surface using a UVA meter, and note the distance of the UVA lamp from the work surface. While cracks can appear anywhere on RSCs, pay particular attention to the last engaged thread area, especially on connections showing thread stretch.

S02.7.6 Rejection Criteria: Any indication that can not be lightly buffed out or otherwise proved up shall be marked for repair. (Some such indications may arise from small metal burrs at thread roots.) However, if cracks are found, they shall not be ground. All cracks in thread roots indicate that the metal has completely fatigued and is to be rejected.

S02.7.7 Marking of Rejects: Follow the appropriate color coding

S02.8 Records

02.8.1 Inspection records: A record of the inspection(s) shall be completely filled in, reviewed by an appropriate person, and provided to the client. As a minimum this report shall contain at least the following information.

A. Customer name and P.O. number,  
B. Date of inspection,  
C. Description of parts  
D. Inspection tolerances used, if any,  
E. Service performed,  
F. Inspection report number  
G. Inspector’s certification level in MT  
H. Summary of inspection results:
   1. Inspection Unit numbers and inspector’s signature. Initials not acceptable.  
   2. Inspector’s certification level in MT  
   3. Findings, including sketches, photos (if any).
F. SOP(s) used.
G. Location of Inspection.

02.8.2: **Record Keeping:** Records of this inspection shall be retained for a period of 5 years (see Quality Manual). Records may be either in paper form or digital.