

OPERATING INSTRUCTIONS

QQI™

Introduction:

QQI™s are artificially flowed low carbon steel (AISI 1005) specimens that are used in magnetic particle inspection (MPI) for establishing and assuring proper field direction and magnitude required to produce satisfactory indications of flaws or anomalies in ferromagnetic parts and structures. It must be emphasized that QQI™s are in themselves flawed parts, so that even when placed on another substrate such as wood, or even in air, when magnetic particles are applied, indications of the flaws will be noted, in the presence of a field of sufficient magnitude. An example might be placing shim in between poles of an electromagnet. These are manufactured strictly in accordance with applicable AMS specification of mild low carbon steel (AISI 1005). The specification, SAE/AMS, number AS 5371 is the governing specification for these standards.

Physical Characteristics:

All QQI™s are nominally 3/4" square. The miniature configurations are intended to be cut into individual specimens for application in small radii and tight spaces. The 3 concentric circle configuration, have a depth of 40% 30% and 20% respectively from outer to inner circle. While the 30% depth is aimed at approximately 30 Gauss, this configuration will assist in applicable current density to produce optimum indications.

How to Apply:

The hermetically sealed package should be left intact until ready to use. Such low carbon steel will corrode in typical plant atmosphere. The manufacturing process consists of differential chemical etch and it was found that leaving the inert photoresist left in place protects parts from corrosion. It is necessary to remove before use with a suitable solvent in which they may also be retained. Solvent used in liquid penetrant testing seems to be satisfactory. A check with plant safety will be desirable. Part and shim must be clean and dry before application.

The QQI selected must be placed in intimate contact, flaw down, in intimate contact with part being investigated. Either it must be securely fastened on all four sides or, possibly use of a very strong adhesive if the part is to be used as a sample part for training purposes or as a specimen in lieu of a flawed part itself. If the inspection vehicle should enter the "sealed" standard, it must be removed carefully and reapplied. When using as a process control part, be sure that the permanent glue does not in any way cover a portion of the QQI. This would also be applicable when left in place in preventive maintenance applications. Clear and non-fluorescent tape, readily available in 1/4" or 1/2" widths: Suggested tapes that have been used: Scotch brand, 191, 471, or a 600 series.

Observation and Evaluation:

The circle & cross configuration will indicate if all other requirements are met. Particle content for these particles meeting AMS specifications, must be between .15mm and .25mm on a settling test (See ASTM E-1444a) with minimum "blacklight" level of 2500 mw/cm². At the part surface. The QQIs are placed in points of high stress concentration or expected locations of, or service induced flaws. The 100 micron thickness are not applicable to curved or convoluted surfaces.

The control on the magnetic apparatus should be incrementally moved from a minimum level upward until the first indication is noted. Of course, when held in position a longitudinal mode will indicate the vertical indication and, conversely, the horizontal direction with circular mode. The QQI must be used to establish a balanced field in an MDM (multi-directional) application.

On equipment employing electronic firing a blown module will be indicated with a grossly distorted field indication. If a numerical level for quantification of field intensity, or a gauss reading is needed, a Hall Effect Probe should be placed at the point of QQI attachment, or some location which can be readily repeated. The fact that such readings are not truly Gauss measurements is not consequential, and type of meter employed should be noted, as models differ, but for repetitive measurements, meters should be re-calibrated at periodic intervals, i.e., quarterly.

While the indicating bath, either oil or water, can be easily washed away, they are usually that one field measurement followed by the second, the entire circular field should be shown. In incrementally increasing field strength, one must carefully rub the surface of the QQI with a finger as potentiometer readings are increased. Because of very low retentivity, and high permeability of the shims, they cannot be used for setting up procedures using the residual method.

Longitudinal Field Generation

When a Field Flow (yoke) means of longitudinal magnetization is employed, the shim should be placed near the center of the elongated part. When using either an AC or HWDC current for magnetization a consistent field in non-existent beyond 40" in length. When using a rail mounted coil, QQIs placed at intervals along the length of such a part, will show the degradation of field as distance from coil edge is increased.

Multi-Directional Magnetization (MDM)

Because MDM usage is rising as more realize that purchase of such equipment can usually be justified on the basis of in excess of 60% saving in inspection times, with a measurable enhancement in flaw finding capability. But the field directions must be determined separately. It is essential that fields be balanced. (i.e., full circle indicated). No other satisfactory means is known for achieving this. One direction may overwhelm another, and it becomes uni-directional (initially this was in widespread usage prior to electronic firing, but with a patented method)

So QQIs should be appropriately placed with one direction set on zero, amperage increased incrementally until satisfactory indication is shown on all. A record is made. The QQIs are very carefully cleaned, part is energized again in other direction desired. Then the selector switch is turned to MD and energized; If the entire circle is shown proceed unless a distortion of the circle is noted, in which case, either a "blown module exists or you must repeat the procedure. Some use a gauss meter for control purposes, even though readings are meaningless, but should be repetitive. Some large power packs claiming to be MDMs, they switch mechanically, and do essentially satisfactory on rough surfaces where particles are held mechanically.

Re-use of QQIs:

If a razor blade is carefully inserted at point of adhesion, they may be used several times, so long as they are not distorted so as to prevent intimate contact with the part.