

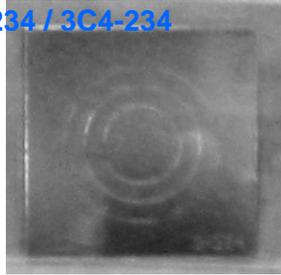
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QQI'S (Quantitative Quality Indicators)

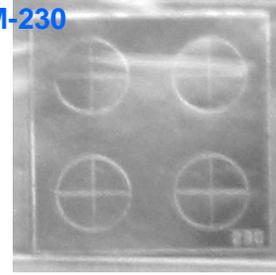
CX-230 / 430



3C2-234 / 3C4-234



CM-230



Operating Instructions

Introduction

QQI's are artificially flawed low carbon steel specimens that are used in magnetic particle inspection (MPI). They are used to establish, and assuring, the proper magnetic field is achieved to produce indications of flaws in ferromagnetic parts. It must be emphasized that QQI's are themselves flawed parts, so that when they are placed in an appropriate magnetic field, indications will appear when magnetic particles are applied. QQI's are manufactured strictly in accordance with applicable AMS specification.

Physical Characteristics

All QQI's are nominally $\frac{3}{4}$ " square. The miniature configuration (CM-230) are intended to be cut into individual specimens for application in small radii and tight places. The 3 concentric circles, have depths of 40% in the inner circle, 30%, 20% on the outer circle. Use of the 3 Circle types will effectively pinpoint applicable current density to produce optimal indications. The typical 30% depth of indications. on all other QQI's. is usually sufficient to indicate a Hall Effect Gauss Meter reading of 30 when such a reading is required by specification.

How to Apply

The hermetically sealed package should be left in place until ready for use. The low carbon steel (AISI 1005) will readily corrode in typical plant or laboratory environments. All QQI's are coated with an inert material, approximately 0.005 mm thick, that should be removed before application. The coating appears to have a pinkish cast under black light, but will not interfere with indications forming.

It is strongly recommended that once opened QQI's be stored in a solvent, such as isopropyl Alcohol. If being applied to a workpiece with Anaerobic Adhesive (Super / Crazy Glue), both the part and QQI must be clean and dry before application.

The QQI selected must be placed in intimate contact with and flaw side next to the part to be evaluated. QQI's must be securely fastened, on all four sides, so that inspection media can not gain access in the bond line. A part, with affixed QQI's', can be used for process control for monitoring adequate light, contrast, bath concentration, and other inspection attributes.

For singular and repetitive use, a single-sided cellophane tape applied to all four sides of

the QQI. This tape should have the following properties; good adhesion to steel, impervious to the bath carrier being used, clear and non-fluorescent, and readily available in ¼" or ½" widths. Suggested tapes are; Scotch brand 191, 471, or 600 series. Should the tape become loose, allowing particles and bath to enter the QQI should be carefully removed. The back of the QQI and the part surface should be thoroughly cleaned and the QQI re-applied.

Observation and Evaluation

The circle and cross configuration will indicate fields in any direction if all other requirements are met. Particle content meeting AMS specifications must be between 0.15mm and 0.25mm in a Centrifuge Tube, and the UV light level at 2500 mw/cm² on the surface. The flaw depth is maintained to a tolerance of <0.5 micron.

With a QQI appropriately placed in points of high stress concentration or expected locations of flaws, the magnetizing apparatus should be incrementally moved from a minimal level upward until the indication is readily observed. If the direction of field is applied in a longitudinal mode, the cross will be preferentially indicated in a vertical direction and the circle will show in the direction of the field applied. A distortion would indicate that the field is distorted.

For an indication of an adequate circular field, the reverse of the above will be true. If a measurement of Gauss is required a Hall Effect probe should be placed at the point of the QQI's attachment. Reading should be taken at the same position. The fact that these readings are not truly Gauss measurements is not consequential.

Due to the very low retentivity and high permeability of QQI's, they cannot be used for indicating residual fields in setting up procedures. Procedures should be set with for the continuous method, and then with a slight increase in magnetizing strength, depending upon the type of steel.

Longitudinal Field Generation

When a field flow (yoke) means of longitudinal magnetization is employed, it is desirable to place a QQI at the center of an elongated part. When using either an AC or HWDC magnetizing force, the useable field will diminish over the length of the part. When using a coil, a QQI's mounted along the length of a part will readily show the degree to which the field diminishes as the distance from the edge of the coil is increased.

In the case of hand held yokes, the field distribution, and direction, between the poles is readily shown by applying particle on a white piece of paper on a non-magnetic surface. While testing, indications formed on a QQI will show to which angle the yoke must be changed to achieve 100% surface coverage. This use of QQI's is very useful when testing parts with drastic changes in shape.

Multi-Directional Magnetization

Multi-Directional Magnetization must be treated separately in order to achieve its perceived performance. Machines with this capability should have the longitudinal and circular fields determined separately. It is essential that fields be balanced in all directions. QQI's are essential to assure this balance. When one direction tends to

overpower the other, the result will be uni-directional magnetization, thus defeating any performance gains.

QQI's should be appropriately placed with one direction on the selector at zero, the amperage increased incrementally until satisfactory indications appear with this direction. A record of the amperage must be kept as field is incrementally increased, until an adequate indication is produced in other direction. The selector switch on the power source is then turned to MD and energized. If the entire circle on the QQIs shows adequate indications, the inspection can be performed. If there are any changes to the part or it is mounted differently in the machine, this verification must be repeated. If parts to be tested have varying levels of residual magnetization, the inspection procedure should require demagnetization before inspection is performed.