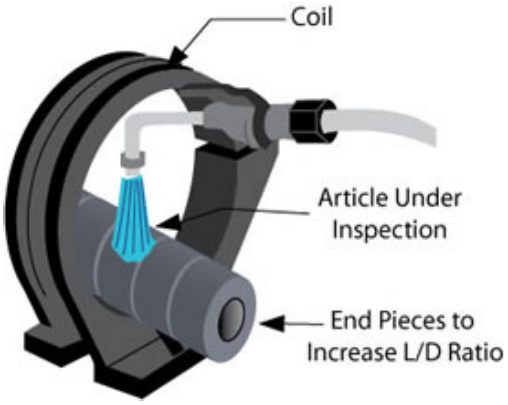
Length to Diameter Ratio

When establishing a longitudinal magnetic field in component using a coil or cable wrap, the ratio of its length (in the direction of the desired field) to its diameter or thickness must be taken into consideration. If the length dimension is not significantly larger than the diameter or thickness dimension, it is virtually impossible to establish a field strength strong enough to produce an indication. An L/D ratio of at least two is usually required.

The formula for determining the necessary current levels presented in the appendix of ASTM 1444 are only useful if the L/D ratio is greater than two and less than 15. Don't forget that the formula only provide an estimate of the necessary current strength and this strength must be confirmed in other ways. The preferred method is to examine parts having known or artificial discontinuities of similar type and size, and in the location of the targeted flaws; or by using quantitative quality indicator (notched) shims. A second method is to use gaussmetter with a tangential field Hall effect probe to measure the field strength, which must be in the range of 30 to 60 G.

Use of End Pieces

If the component does not meet the minimum L/D ratio requirement, end pieces may be used to essentially lengthen the component. The end pieces must be the same diameter or thickness of the the component under test and must made of ferromagnetic material. Sometime it is possible to stack multiple parts end to end to increase the L/D ratio. The parts must butt fairly tightly together as shown in the image.



The urge to inspect the entire length of butted parts at one time must be resisted. This is urge is especially strong when using a central conductor with wet-horizontal equipment to inspect components such as nuts. To increase the efficiency of the inspection, a number of nuts are often placed on a central conductor and a circular magnetic field is established in the parts all at once. This is perfectly acceptable when inspecting the components with a

circular magnetic field. . However, when switching to a longitudinal field, it is very tempting to simply slide the coil out so that it is centered on the stack of nuts, which are left in place on the central conductor. This is unacceptable technique for a couple of reasons. First, remember that the effective field extends a distance on either side of the coil center approximately equal to the radius of the coil. Parts outside of the effective distance will not receive adequate magnetization. The parts will need to be repositioned in the coil in order to examine the entire length of the stack. An overlap area of about ten percent of the effective magnetic field is required by most specifications. Additionally, if the central conductor is left clamped in the stocks, the parts will be at the center of the coil where the field strength is the weakest. The parts should be placed at the inside edge of the coil for best results.

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