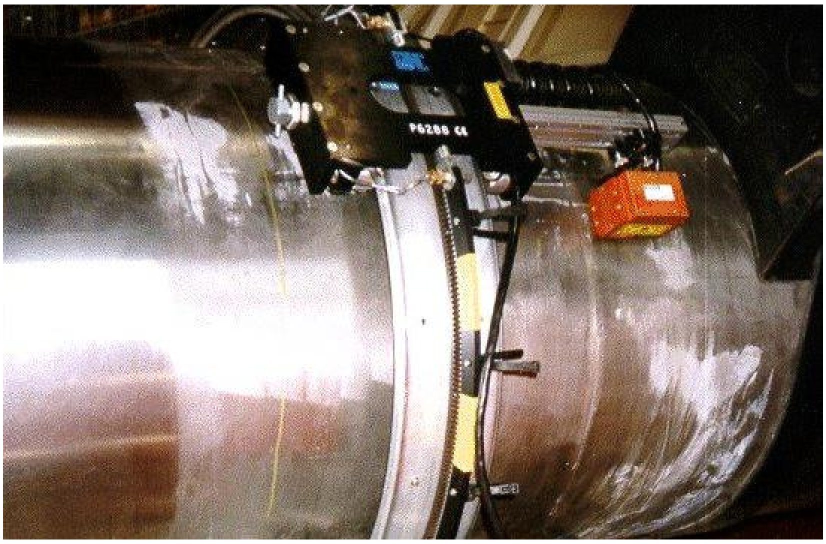
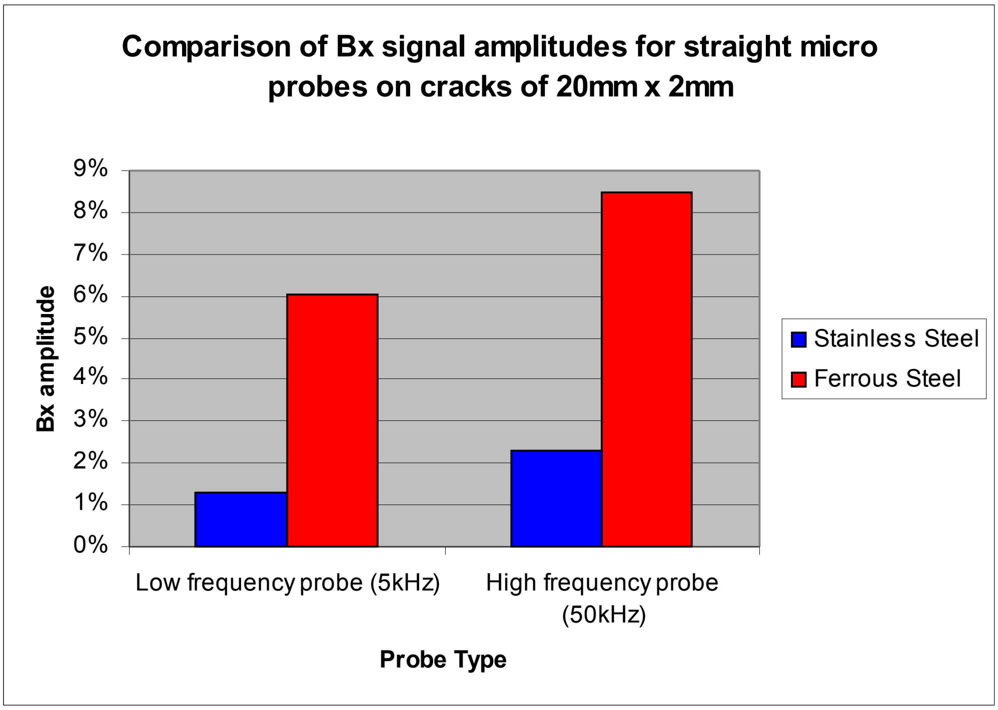
# ACFM ON NON-FERROUS METALS



The ACFM technique can be used to detect and size defects in non-ferrous metals, but users familiar with its application on ferrous steels should be aware of some significant differences.

The a.c. skin effect means that the currents induced in the ACFM technique are confined to a thin layer at the surface so that only defects lying within this layer can perturb the current and thus be detected. The thickness of this layer (the so-called "skin depth") is inversely proportional to the square root of the magnetic permeability of the metal so is much smaller for ferritic steel than for non-ferrous metals. This means that surface-breaking defects in non-ferrous metals generally perturb less of the current flow than equivalent defects in ferrous metals, so sensitivity to small defects is reduced (see graph on reverse). However, the larger skin depth in non-ferrous metals also opens up the possibility of detecting defects that do not break the top surface.

For detection of surface-breaking defects in non-ferrous metals, use of a high frequency probe is recommended. These reduce the skin depth compared to standard 5kHz probes, and thus increase the sensitivity to small defects (see graph on reverse and separate datasheet on high frequency probes).




Increase in sensitivity with frequency for both ferrous and stainless steel

The theoretical model used to calculate defect depth in the ACFM software only applies to ferrous steel, so depth sizing of defects in non-ferrous metals uses a factory-set calibration. TSC supplies a configuration for use on stainless steel which is calibrated on a characterised fatigue crack. This avoids calibration on slots which are known to give different results due to induction effects. Configurations for other non-ferrous metals can be supplied on request.

Surface-breaking defects give much larger and "sharper" signals than sub-surface defects, but it is possible to detect sub-surface defects in non-ferrous metals if they perturb a significant portion of the current flow. For this to be the case, a defect must extend to within about half a skin depth of the top surface, and have a through thickness height of at least half a skin depth. For this reason, standard low frequency probes should be used if sub-surface defect detection is required. The skin depth in low conductivity metals (such as stainless steel, titanium, nickel alloys, bronzes etc.) is around 5-8mm at 5kHz, whereas the skin depth in low conductivity metals (such as aluminium, copper and tungsten) is around 1-2mm. The signal from a sub-surface defect depends on the relative sizes of the remaining ligament and the defect length, but usually results in an upward-moving Bx.

It should also be noted that volumetric defects, such as corrosion pitting or porosity, give much weaker signals than planar defects, so it is not recommended that ACFM be used to detect sub-surface porosity.

*Due to our policy of continual improvement, specifications are subject to change without prior notification. For critical applications, please contact TSC before ordering.*

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