SAE INTERNATIONAL

AEROSPACE RECOMMENDED PRACTICE	ARP4402™	REV. A
	Issued 1992-04 Revised 2020-09 Reaffirmed 2024-09 Superseding ARP4402	

(R) Eddy Current Inspection of Open Fastener Holes in Aluminum Aircraft Structure

RATIONALE

ARP4402A results from a Five-Year Review and update of this specification.

ARP4402A has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

1.1 Purpose

This SAE Aerospace Recommended Practice establishes the requirements and procedures for eddy current inspection of open fastener holes in aluminum aircraft structures.

1.2 Application

This process has been used typically by maintenance and overhaul facilities personnel to inspect aluminum aircraft structures for service-induced cracks, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 AIA Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS-410 Nondestructive Testing Personnel Qualification and Certification

2.2 ASNT Publications

Available from American Society for Nondestructive Testing, 1711 Arlingate Lane, Columbus, OH 43228-0518.

SNT-TC-1A Recommended Practice, Personnel Qualification and Certification in Nondestructive Testing

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/ARP4402A/

2.3 Airlines for America (A4A) Publications

Available from Airlines for America (A4A), 1301 Pennsylvania Avenue, NW, Suite 1100, Washington, DC 20004, Tel: 202-626-4000, www.airlines.org.

Spec 105 Guidelines for Training and Qualifying Personnel in Nondestructive Testing

3. TECHNICAL REQUIREMENTS

3.1 Equipment

Instrument/probe combinations shall be capable of meeting the standardization requirements of 3.5.

3.1.1 Eddy Current Instruments

3.1.1.1 Instruments shall be capable of displaying both of the following signal response displays simultaneously:

3.1.1.1.1 Impedance (Y/X)

3.1.1.1.1.1 Eddy current instruments display eddy current information using a two-dimensional impedance plane display. The impedance plane refers to an orthogonal display of both the inductive reactance and resistance components of the complex impedance of the eddy current probe (Figures 1 through 3).

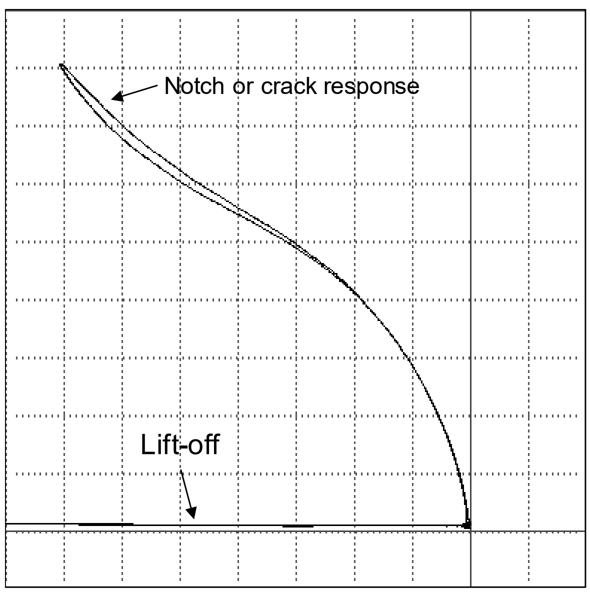


Figure 1 - Eddy current impedance plane – non-filtered absolute display

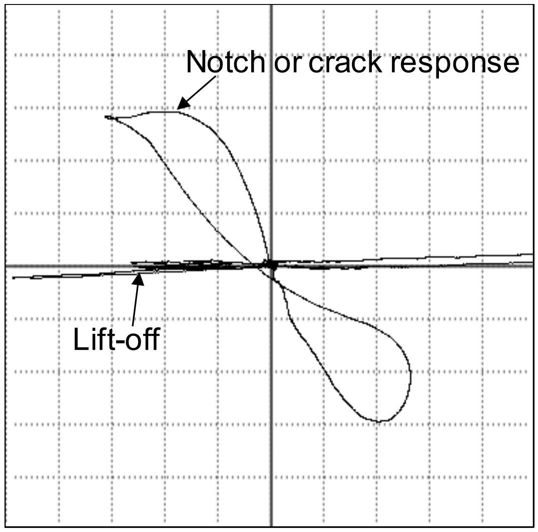


Figure 2 - Eddy current impedance plane – filtered absolute display

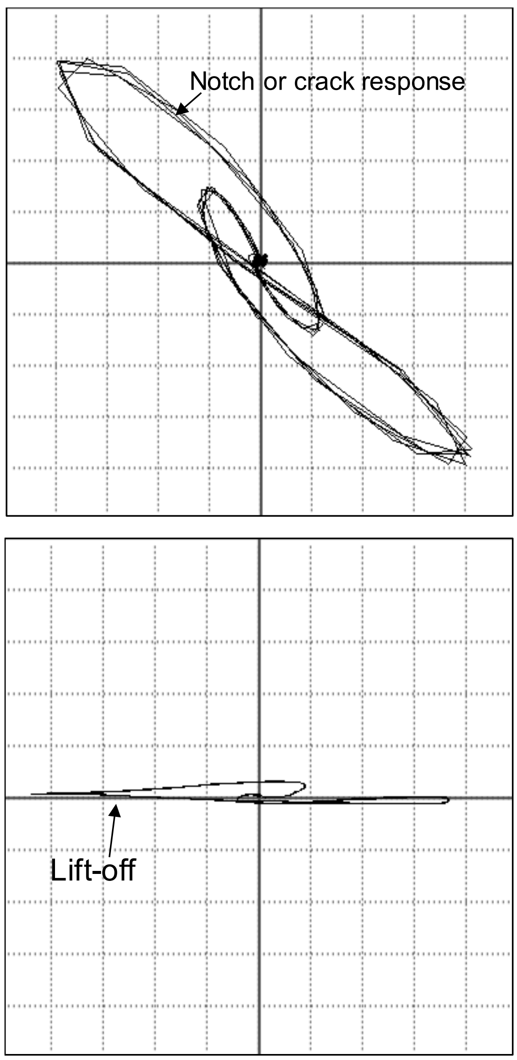


Figure 3 - Eddy current impedance plane – filtered differential display

3.1.1.1.2 Sweep (Y/T)

3.1.1.1.2.1 Sweep displays show the vertical component of the eddy current impedance plane signal as a function of time. The horizontal axis displays the clock position of a single rotation of the probe in the hole. The clock position is the location of an indication around the circumference of the hole and can be configured to any location across the horizontal axis during standardization. Figure 4 shows an example where a crack or notch has been configured to be displayed at approximately 6 o'clock (180 degrees) and the corresponding signal produced in the sweep display, but other configurations are possible and acceptable.

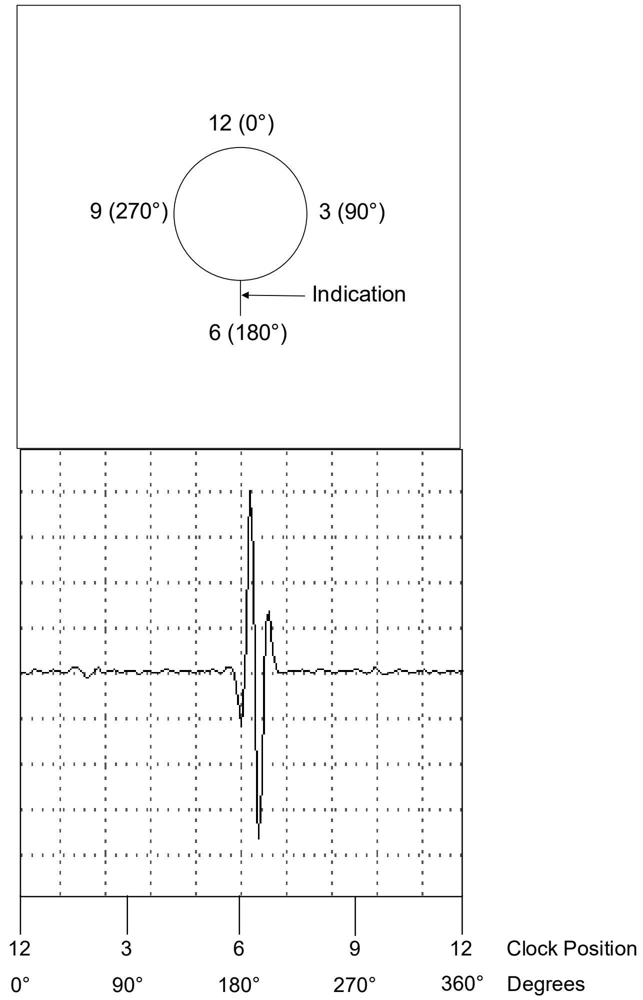


Figure 4 - Sweep display signal of hole with an indication at 6 o'clock (180 degrees)

3.1.1.2 The impedance and sweep displays can be used simultaneously (Figure 5). This display style is recommended because it is helpful when there are multiple indications at different positions around a hole. An inspector can use the sweep display to identify the clock position of each indication and the corresponding signal on the impedance plane to determine if the signal is in phase with a crack signal or whether the signal is produced from another anomaly (lift-off, hole damage, etc.). Figure 5 shows an example of a signal produced by two indications. Indication A is located at 9 o'clock (270 degrees) and has a large signal response. Indication B is located at 3 o'clock (90 degrees) and has a smaller signal response.

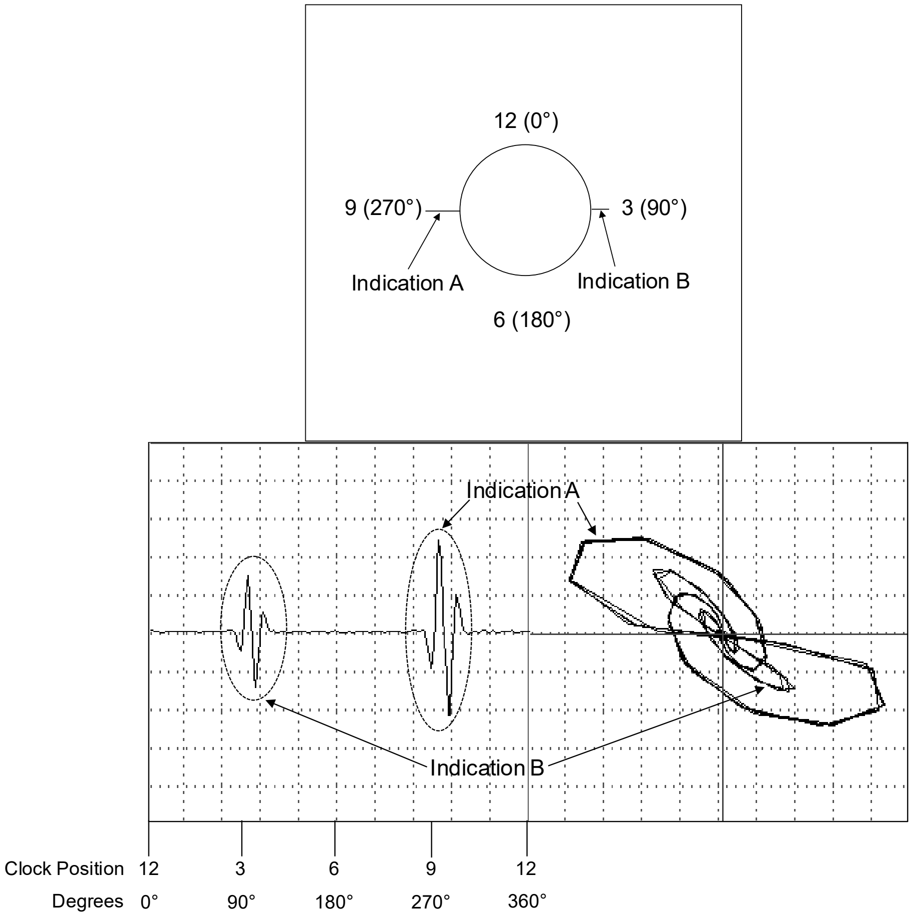


Figure 5 - Simultaneous use of impedance plane and sweep displays

3.1.1.3 Instruments typically shall be capable of operating between 100 KHz and 500 KHz. Instruments may be operated at other frequencies if the requirements of 3.5 are met.

3.1.1.4 Instruments shall be equipped with an audible and/or visual alarm system.

3.1.1.5 Filters

3.1.1.5.1 Electronic filters are often useful for reducing noise or spurious geometric signals and improving the signal to noise ratio of an inspection. Some inspections may be dependent upon the use of appropriate filters for their success. Such requirements shall be specified in the appropriate inspection procedure. Three general types of filters are described as follows:

3.1.1.5.1.1 High Pass Filters (HPF) – Eliminates or reduces the amplitude of signals which have a frequency below the frequency setting of the filter.

3.1.1.5.1.2 Low Pass Filters (LPF) – Eliminates or reduces the amplitude of signals which have a frequency above the frequency setting of the filter.

3.1.1.5.1.3 Band Pass Filters – A combination of a high pass and a low pass filter which acts to eliminate or reduce the amplitude of signals which have a frequency above or below the frequency settings of the filter.

3.1.1.5.2 Filter Setting and Flaw Frequency Calculations

The optimal signal response is dependent on the filter settings. Filter frequencies are related to the speed at which the coil passes over the flaw and the duration the coil is sensing the flaw and registering a response. This flaw frequency is measured in Hz and is different than test/oscillator frequency, which is typically measured in kHz or MHz. The flaw frequency can be calculated if the effective coil diameter (D_{eff}) and coil surface scan speed are known by using the following equation:

$$Flaw\ Frequency = \frac{Surface\ Scan\ Speed}{D_{eff}}$$

The coil surface scan speed can be approximated using the following equation:

$$Surface\ Scan\ Speed = \pi(Scanner\ RPM)\left(\frac{2\pi}{60\ seconds}\right)(Probe\ Diameter)$$

Scanner RPM can be controlled with the use of a rotary scanner.

For a shielded coil, the effective coil diameter (D_{eff}) can be estimated as the coil diameter. For unshielded coils, D_{eff} can be estimated using the following equation:

$$D_{eff} = \frac{26}{\sqrt{\sigma \mu_r f}}$$

where:

σ = conductivity in %IACS of the material being tested

μ_r = relative permeability (1 for nonmagnetic materials)

f = test/oscillator frequency in Hertz

3.1.1.5.3 Flaw Frequency Example

Figure 6 provides calculated flaw frequencies for a typical 0.0625 inch diameter shielded coil at various scanner RPM and probe diameters.

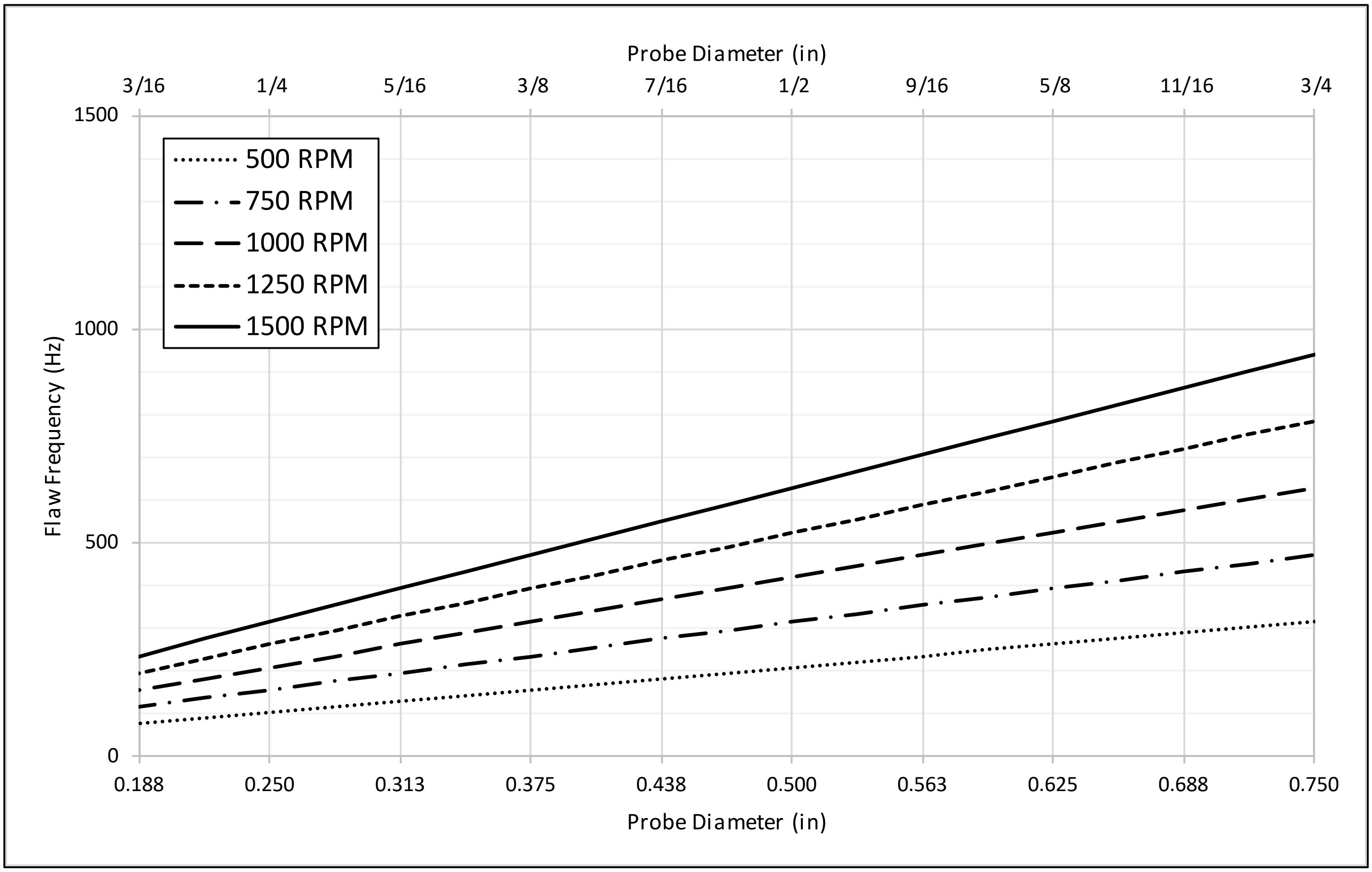


Figure 6 - Flaw frequencies for various scanner rpm for a range of probe diameters

3.1.1.5.4 Filter Setting Example

Table 1 provides calculated surface speeds and flaw frequencies for a typical 0.0625 inch diameter shielded coil at 1500 rpm and various probe diameters.

Table 1 - Flaw frequency example values for 1500 rpm

Probe Diameter (in)		Surface Speed (in/s)	Flaw Frequency (Hz)
0.156	5/32	12	196
0.188	3/16	15	236
0.219	7/32	17	275
0.250	1/4	20	314
0.281	9/32	22	353
0.313	5/16	25	393
0.344	11/32	27	432
0.375	3/8	29	471
0.406	13/32	32	511
0.438	7/16	34	550
0.469	15/32	37	589
0.500	1/2	39	628
0.531	17/32	42	668
0.563	9/16	44	707
0.594	19/32	47	746
0.625	5/8	49	785
0.656	21/32	52	825
0.688	11/16	54	864
0.719	23/32	56	903
0.750	3/4	59	942

Although Table 1 identifies the optimum inspection frequency at 1500 rpm, filters must be selected to allow a range of frequencies to pass. Since filter design varies with instrument model and effective coil size can vary with probe types, filter ranges should be verified experimentally by evaluating the amplitude and symmetry of the signal response for a particular Scanner RPM and probe diameters.

Figure 7 illustrates the flaw frequencies from Table 1 with proposed high and low pass filters from Table 2 for different probe diameters for this example.

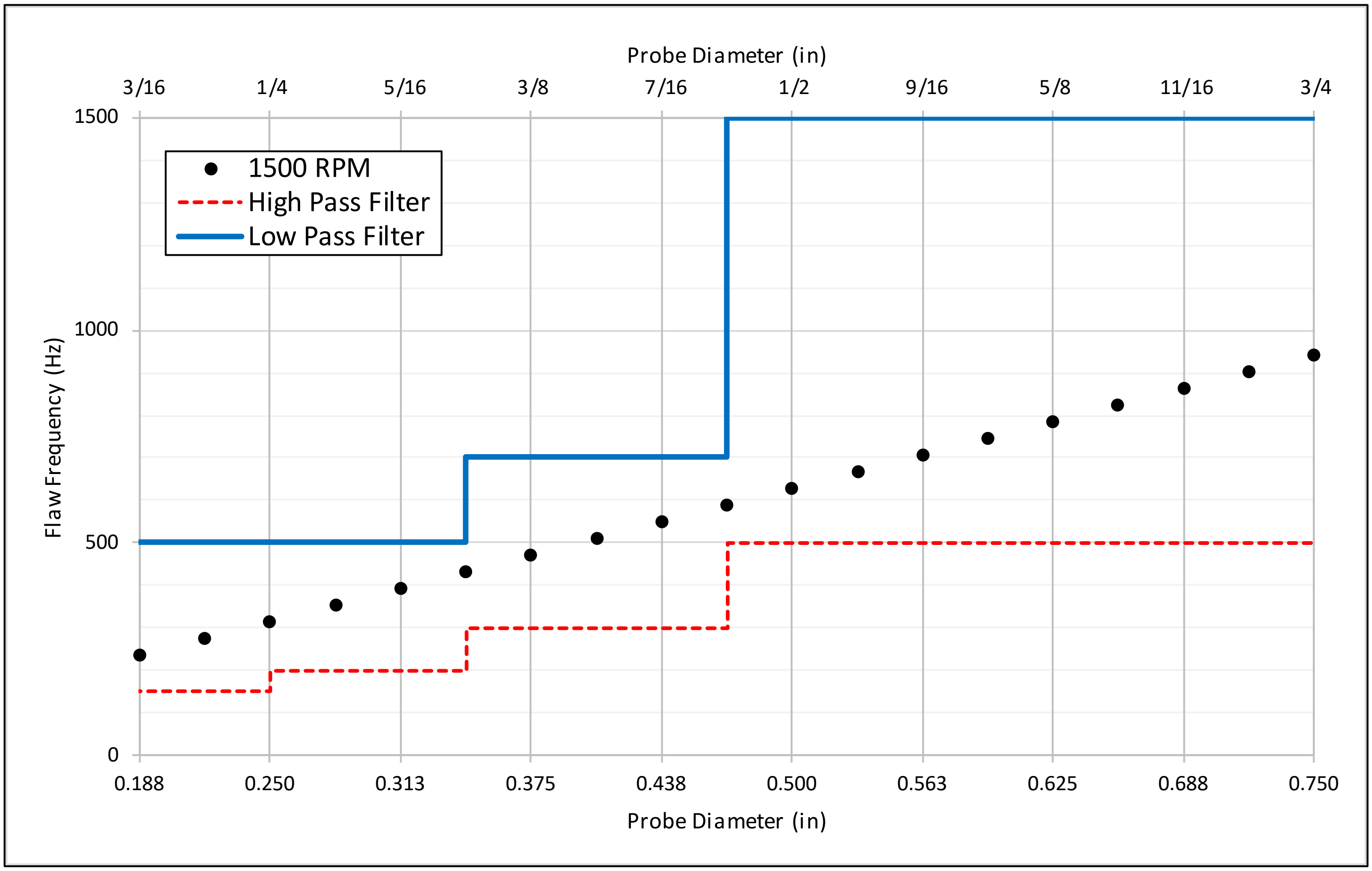


Figure 7 - Flaw frequencies with high and low pass filters for 1500 rpm

Table 2 - Flaw frequencies with high and low pass filters at 1500 rpm

Probe Diameter (in)		Flaw Frequency (Hz)	HPF	LPF
0.156	5/32	196	150	500
0.188	3/16	236	150	500
0.219	7/32	275	150	500
0.250	1/4	314	200	500
0.281	9/32	353	200	500
0.313	5/16	393	200	500
0.344	11/32	432	300	700
0.375	3/8	471	300	700
0.406	13/32	511	300	700
0.438	7/16	550	300	700
0.469	15/32	589	500	1500
0.500	1/2	628	500	1500
0.531	17/32	668	500	1500
0.563	9/16	707	500	1500
0.594	19/32	746	500	1500
0.625	5/8	785	500	1500
0.656	21/32	825	500	1500
0.688	11/16	864	500	1500
0.719	23/32	903	500	1500
0.750	3/4	942	500	1500

3.1.2 Voltage Regulators

For other than battery-powered instruments, a voltage regulator shall be used on the power source if instrument internal voltage regulators are not adequate to prevent a signal variation of 20% or more.

3.1.3 Probes

3.1.3.1 The probe diameter shall be determined by the diameter of the inspection hole and the ability of the probe to maintain compliance with the inspection surface at all times during the inspection. Probes which operate with a gap between the probe and inspection surface are not recommended (Figure 8) unless an allowable gap size is specified by the appropriate inspection procedure.

3.1.3.1.1 Variable diameter (slotted) probes (Figure 9) are recommended to improve compliance and shall be selected so a slight interference fit exists between the hole and probe. The use of shims (foam, etc.) may also be used to expand the probe further and help maintain compliance.

3.1.3.1.2 Fixed diameter probes (Figure 9) are not recommended, but may be used if an allowable gap size (Figure 8) between the probe diameter and the inspection hole is specified by the appropriate inspection procedure. The gap size between the inspection hole diameter and the probe outer diameter shall not exceed the value specified by the appropriate inspection procedure.

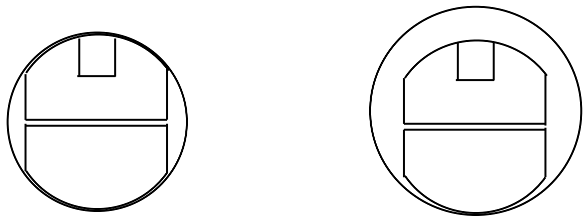


Figure 8 - Recommended and not recommended probe contact in hole

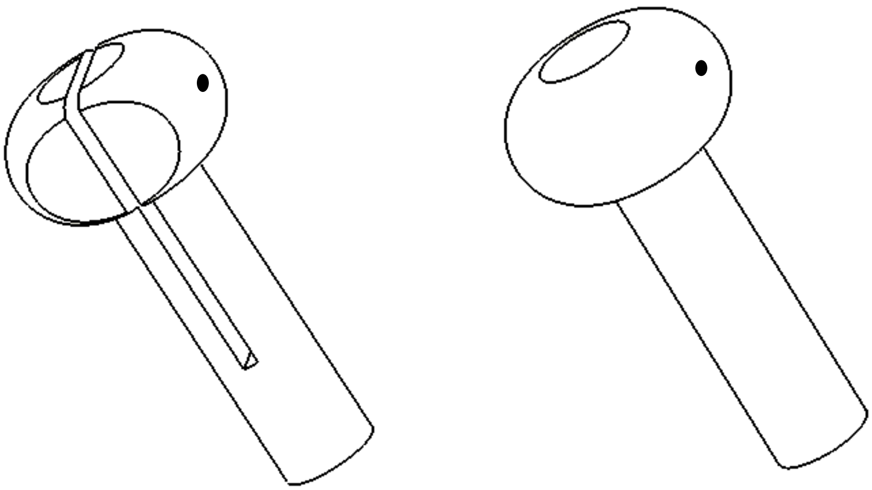


Figure 9 - Variable and fixed diameter probes

3.1.3.2 Probes typically shall be capable of operating between 100 KHz and 500 KHz. Probes may be used at other frequencies if the requirements of 3.5 are met.

3.1.3.3 Probes shall be marked with the operating frequency or frequency range.

3.1.3.4 The impedance of probes and adaptors shall match the instrument being used.

3.1.3.5 Probe connectors and adaptors shall match the instrument being used.

3.1.3.6 Probes may have an absolute (single coil), differential (dual coil), reflection (driver-pickup), or hybrid coil configuration.

3.1.3.6.1 Absolute coils (Figure 10) use one coil as both the driver coil and sensing coil. Absolute coils often have a ferrite core to improve the path of the eddy currents into the material inspected.

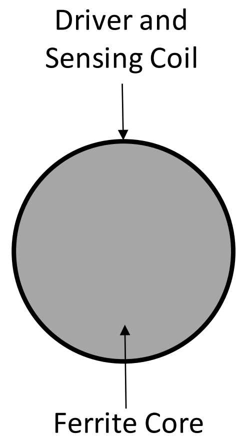


Figure 10 - Absolute eddy current coil

3.1.3.6.2 Differential coils (Figure 11) consist of two or more coils. Each coil acts as both a driver coil and sensing coil. Any change detected by one coil but not the other will result in a signal.

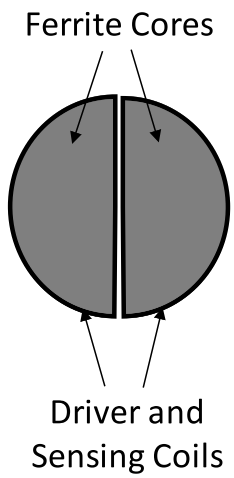


Figure 11 - Differential eddy current coils

3.1.3.6.3 Reflection coils (Figure 12) consist of two or more coils. A driver coil imparts the eddy currents into the material and the sensing coil(s) detect the resulting field.

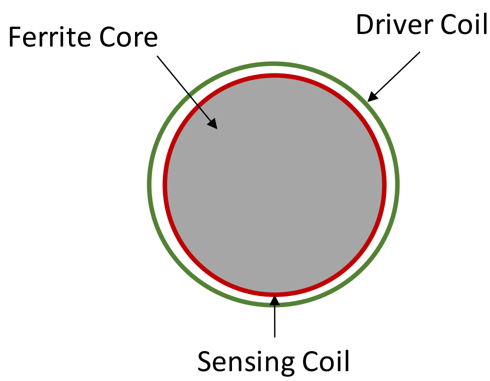


Figure 12 - Reflection eddy current coils

3.1.3.6.4 Hybrid coils consist of a combination of absolute, differential, or reflection coils. A common (and highly recommended) probe for eddy current inspection of circular holes is the reflection differential hybrid combination (Figure 13). The driver coil imparts the eddy currents into the material and the differential sensing coils detect the resulting field. Any change detected by one sensing coil, but not the other will result in a signal.

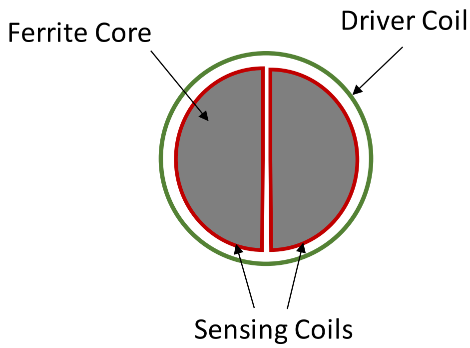


Figure 13 - Hybrid (reflection and differential) eddy current coils

3.1.3.7 Probes may be shielded or unshielded.

3.1.3.8 Probes shall not give interfering responses from handling pressures, manipulation, or normal operating pressure variations on the sensing coil which cause the signal-to-noise ratio to be less than 3:1.

3.1.3.9 Multiple probe housing types are available, such as housings which contact the entire circumference of the hole or only partially contact the circumference (Figure 14). Partial circumferential contact probes are preferred because they minimize friction while maintaining probe compliance to the inspection surface.

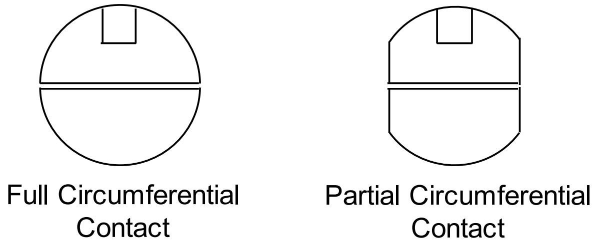


Figure 14 - Typical eddy current probe housings

3.1.4 Probe Collars

Probe collars shall be used to ensure uniform depth of rotation and to aid in reducing lift-off effects when using manual probes. Collars are typically not practical with rotary scanners.

3.1.5 Rotary Scanners

Eddy current inspections of holes are greatly facilitated by the use of a rotary scanner to rotate the probe at a selectable RPM. Rotary scanners are strongly recommended over manual scanners because they can reduce the time required to perform an inspection, ensure complete coverage of the hole inside diameter is achieved, and significantly improve capability (i.e. probability of detection). Before using a rotary scanner, the user shall verify that the rotational and axial indexing speeds are appropriate for the inspection procedure.

3.1.5.1 Fixed Insertion (Helical)

Scanning units that drive a probe in a helical pattern through the length of an inspection hole. The rotation pitch and probe revolution speed may be adjustable or nonadjustable.

3.1.5.2 Free Insertion

Scanning units that rotate a probe at an adjustable or nonadjustable revolution speed.

3.1.5.3 Free Revolution

Scanners typically shall rotate at a speed greater than 500 rpm. Slower speeds may be used if the requirements of 3.5 are met.

3.1.6 Reference Standards

3.1.6.1 Reference standards shall be used to establish equipment sensitivity prior to performing an inspection.

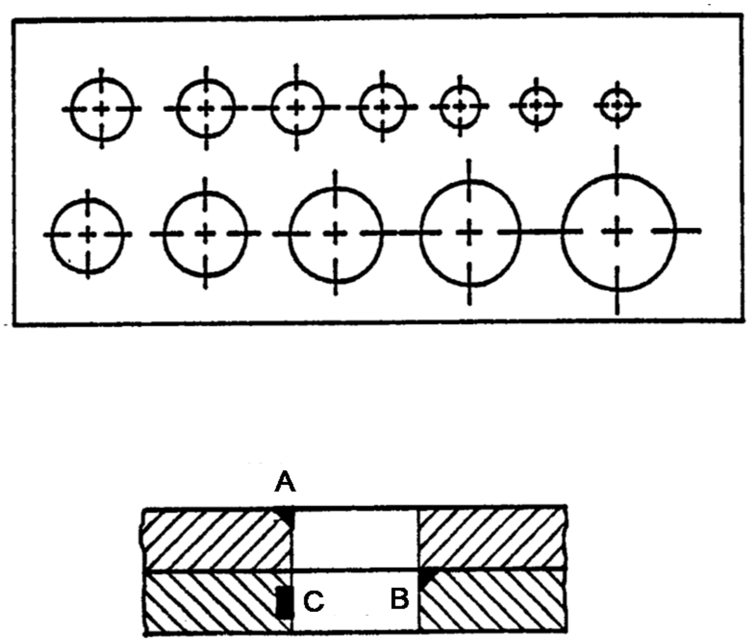
3.1.6.2 Reference standards to be used shall be agreed upon by purchaser and the cognizant quality assurance activity.

3.1.6.3 The reference standard to be used shall be specified in the applicable detailed written procedure.

3.1.6.4 The conductivity of the reference standard shall match the conductivity of the part to be inspected within ±15% International Annealed Copper Standard (IACS) (±8.7 MS/m).

3.1.6.5 The finish of the reference standard hole shall be 63 RHR or better.

3.1.6.6 Reference standards shall meet the requirements of Figure 15 unless otherwise specified by purchaser, engineering drawing, or cognizant quality assurance activity.



TYPICAL AL HOLES

NOTES:

All dimensions in inches (millimeters in parentheses)
Tolerances: X.XXX ± 0.001 (± 0.025)
Notch Width: 0.004 ± 0.001 (0.102 ± 0.025)

A – EDM Corner Notch – 0.030 (0.76) long x 0.030 (0.76) deep
B – EDM Interface Notch – 0.030 (0.76) long x 0.030 (0.76) deep
C – In-Hole Notch – 0.060 (1.52) long x 0.030 (0.76) deep

Figure 15 - Typical reference standard

3.1.7 Recording Devices

When used, recording devices shall be compatible with the instrument and be capable of presenting a permanent copy of the instrument signal response display.

3.2 Personnel Qualification

3.2.1 Personnel performing open fastener hole eddy current inspections shall be qualified in accordance with Spec 105; SNT-TC-1A; NAS 410; or a program approved by the local regulatory agency.

3.3 Written Procedure Requirements

Eddy current open hole inspections shall be done in accordance with this procedure or a detailed written procedure specified to the component being inspected.

3.3.1 Procedures shall comply with the general requirements of this document and shall provide all of the specific information required to set up and standardize the equipment and perform the tests.

3.3.2 Each procedure shall be verified and approved by a Level III personnel.

3.3.3 Each procedure shall include not less than the following information:

3.3.3.1 A specific description of the hole configuration (including layer material stack up) to be inspected, the alloy type, and the potential crack location and orientation, if known.

3.3.3.2 The required eddy current instrument, probes, fixturing equipment, scanner requirements, reference standards (including standardization notch dimensions and alloy type), standardization amplitude, filter settings, RPM, and test/oscillator frequency.

3.3.3.3 The manufacturer and identification number of the required equipment.

3.3.3.4 Rejection and noise (vertical and horizontal) thresholds.

3.3.3.5 Standardization check intervals (time or number of holes) and acceptable standard signal range.

3.3.4 A copy of each applicable procedure shall be readily available to purchaser, upon request, for reference and use.

3.4 Preparation for Inspection

3.4.1 Identify the location, number, and size of the holes to be inspected.

3.4.2 Clean loose dirt, paint, or sealant from the inside of the hole, and when a probe collar is used, from around the outer edge of the hole.

3.4.3 Visually inspect all applicable holes for conditions that could interfere with the inspection such as burrs, galling, corrosion, out-of-round conditions, cracks, or offset at component interfaces.

3.4.3.1 Holes having the above conditions may require a cleanup ream, flex hone, or other disposition. Contact engineering for corrective action.

3.4.3.2 Borescopes, endoscopes, or other optical aids may be used to enhance the visual inspection.

3.4.3.3 A record or map may be made indicating which holes require or have received rework.

3.4.4 Select the probe(s) to fit the holes to be inspected per 3.1.3.1.

3.4.4.1 To protect the probe from wear, nonconductive tape may be applied over the probe coil. The tape may require replacement occasionally during the inspection.

3.4.4.1.1 The nonconductive tape over the probe coil shall be no thicker than 0.005 inch (0.13 mm).

3.4.4.1.2 The probe diameter with tape applied shall meet the requirements of 3.1.3.1.

3.4.5 Select the reference standard(s) to match the holes to be inspected per 3.1.6.

3.4.6 Except for battery-powered instruments, electrically ground the instrument during operation.

3.4.7 Locate inspection equipment not less than 10 feet (3 m) from any items that generate a large magnetic field, such as large motors, generators, transformers, or power lines.

3.5 Instrument Standardization

3.5.1 Set the instrument test/oscillator frequency (typical operating frequencies are between 100 KHz and 500 KHz, but other frequencies may be used if the requirements of 3.5 are met), filter settings, and RPM.

3.5.2 Attach nonconductive tape to the probe as selected per 3.4.4.1.

3.5.3 Balance the instrument in accordance with the manufacturer's instructions, or specific operating procedures along with the following steps:

3.5.3.1 For an absolute coil, insert the probe into the reference standard hole away from any reference notches and from outer and faying surfaces. Balance the probe once it is in place.

3.5.3.2 For differential and hybrid (reflection and differential) coils, balance the probe while holding it still in air.

3.5.4 Set the position of the balance point as follows:

3.5.4.1 Impedance Display Instruments

3.5.4.1.1 When using an absolute coil probe, use the vertical and horizontal position controls to set the balance signal to the center of the lower right hand quadrant of the screen. See Figure 16.

3.5.4.1.2 When using a differential or hybrid (reflection and differential) coil probe, use the vertical and horizontal position controls to set the balance signal to the center of the screen. See Figure 17.

3.5.4.2 Sweep Display Instruments

3.5.4.2.1 Use the vertical position control to set the balance signal to the middle of the screen (Figure 18).

3.5.5 Adjust the lift-off (phase) as follows:

3.5.5.1 Impedance Display Instruments

3.5.5.1.1 When using an absolute coil probe, adjust the phase control to obtain a horizontal deflection from the balance point to the left across the screen when probe sensing coil is lifted slightly off the standard. See Figure 16.

3.5.5.1.2 When using a differential or hybrid (reflection and differential), adjust the phase control to obtain a horizontal deflection form the balance point to the left and right across the screen while the probe is rotating and in contact with a flat area of the reference standard away from any edges or reference notches. See Figure 17.

3.5.6 Adjust the sensitivity as follows:

3.5.6.1 Impedance Plane Instruments

3.5.6.1.1 Adjust the probe coil depth in the reference standard hole to the same depth as the reference notch.

3.5.6.1.2 Rotate the probe in the hole until the coil scans over the reference notch and maximize the signal from the reference notch.

3.5.6.1.3 Adjust the horizontal gain and vertical gain independently to obtain the signal for the reference notch.

3.5.6.1.3.1 When using an absolute coil probe, the signal shall be 80% full screen height (FSH). See Figure 16.

3.5.6.1.3.2 When using a differential or hybrid (reflection and differential), the signal shall be 80% full screen width (FSW) and 80% FSH signal. The angle between the lift-off line and the reference notch signal should be 45 degrees. See Figures 17.

3.5.6.1.4 The signal-to-noise ratio shall be at least 3:1.

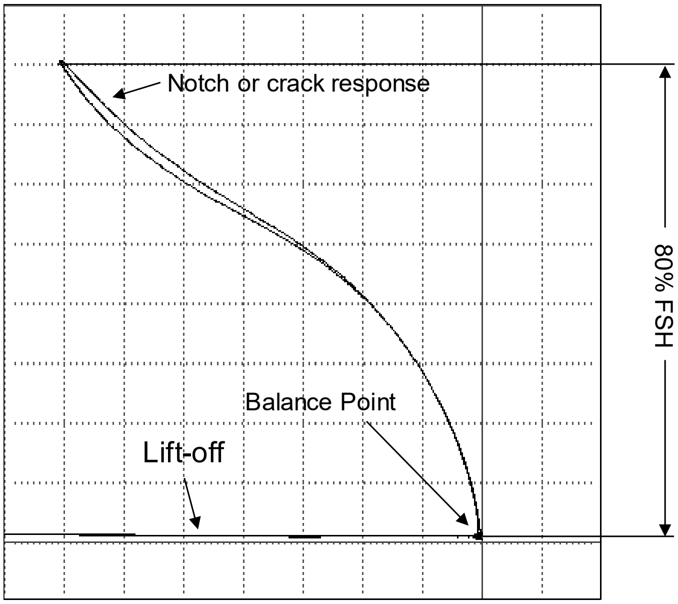


Figure 16 - Impedance plane display standardization signal for absolute coil

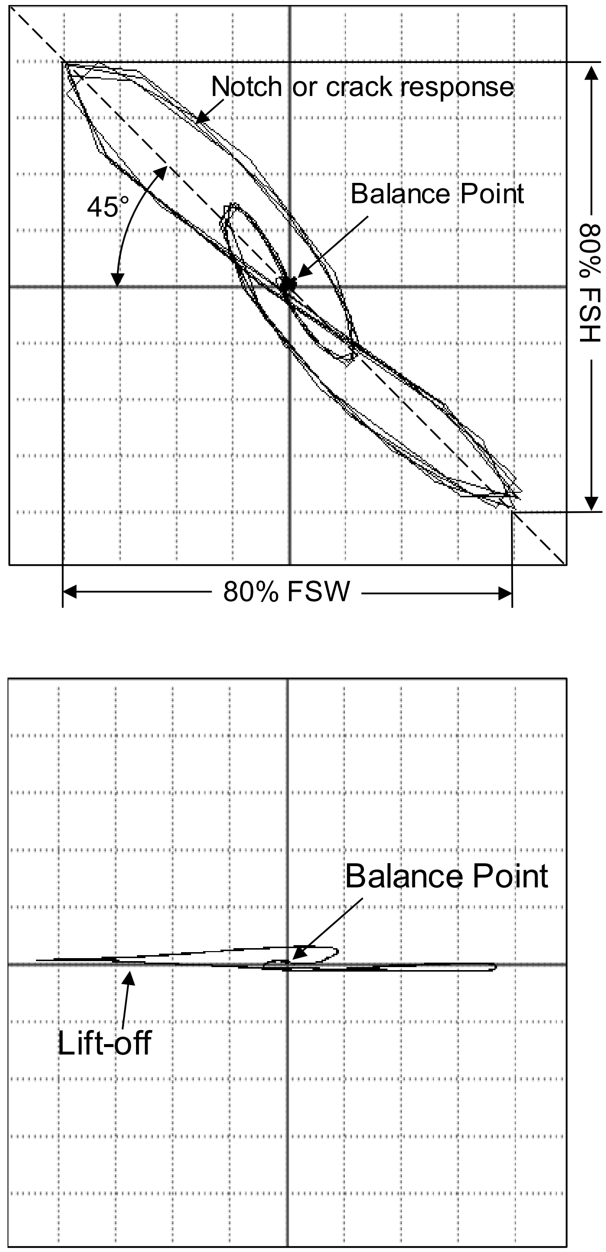


Figure 17 - Impedance plan display standardization signal for differential or hybrid coil

3.5.6.2 Sweep Display Instruments

3.5.6.2.1 Index the rotating probe through the reference standard hole.

3.5.6.2.2 Obtain the maximum signal from the reference notch by adjusting the probe depth in the hole.

3.5.6.2.3 Adjust the sensitivity to obtain an 80% peak-to-peak (PTP) from the reference notch. See Figure 18.

3.5.6.2.4 The signal-to-noise ratio shall be at least 3:1.

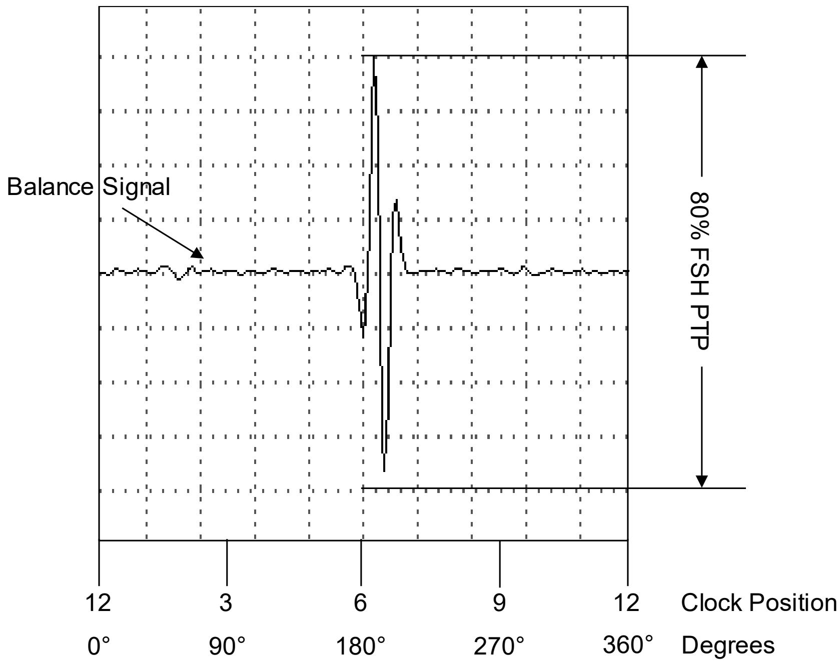


Figure 18 - Sweep display reference notch standardization signal

3.5.7 When instruments are equipped with an alarm, set the audible/visual alarm to respond to 50% of the reference notch amplitude.

3.5.8 Recheck the balance and lift-off. If adjustments are made, recheck the sensitivity per 3.5.6.

3.5.9 Determine the maximum probe rotation or index speed as follows:

3.5.9.1 Manual Scan

3.5.9.1.1 Perform instrument standardization starting at 3.5.

3.5.9.1.2 Adjust the probe coil depth in the hole to obtain the maximum signal from the reference notch.

3.5.9.1.3 Rotate the probe across the reference standard notch and note the index speed when the response begins to fall just below the standardization response. This is the maximum probe index speed.

3.5.9.2 Rotary Scan

3.5.9.2.1 Perform instrument standardization starting at 3.5.

3.5.9.2.2 Adjust the probe coil depth in the hole to obtain the maximum signal from the reference notch.

3.5.9.2.3 Insert the rotating probe into the reference hole and note the index speed when the response falls just below the standardization response. This is the maximum probe index speed.

3.6 Inspection Procedure

3.6.1 Prepare for inspection per 3.4.

3.6.2 Perform instrument standardization per 3.5.

3.6.3 Place the probe in the inspection hole.

3.6.3.1 Expand variable diameter probes by placing rubber, paper, foam, etc., in the slot to obtain the fit noted in 3.1.3.1.

3.6.4 Check the balance and lift-off. If necessary, readjust on the part. Do not readjust the sensitivity.

3.6.5 Scan the entire circumference of all inspection holes.

3.6.5.1 Manual Scan

3.6.5.1.1 Scanning shall be conducted in either one-half or one revolution intervals. If suspect areas are noted near the ends of scans, these areas shall be retested using other scans such that the suspect area is located in the middle portion of the scan.

3.6.5.1.2 Unless otherwise specified in the written procedure or instructions, incremental depths shall be such that the Figure 15 mid-hole reference notch, 0.060 inch (1.52 mm) in length and hole edge notches 0.030 inch (0.76 mm) in length, are detected with a signal amplitude that is at least 50% of the reference notch standardization response.

3.6.5.1.2.1 Readjust balance and lift-off, as necessary.

3.6.5.2 Automated Scan

3.6.5.2.1 Insert the rotating probe into the inspection hole, and feed the probe through the length of the hole.

3.6.5.2.2 Instrument/probe filtering shall be such that little or no signal interference is received from hole edges or interfaces. If the filter setting is changed, perform standardization again per 3.5 using new filter setting.

3.6.6 Commonly encountered structural configurations may require the following scanning techniques:

3.6.6.1 Same Diameter Holes

Holes, edges of holes, or interfaces of holes that have the same diameter may be inspected together before inspecting other portions of the holes.

3.6.6.2 Countersink

When inspecting from the countersunk side of holes, the edge crack inspection shall start at the intersection between the end of the countersink and the straight portion of the hole.

3.6.6.3 Members Less Than 0.125 inch (3.18 mm) in Thickness

3.6.6.3.1 Automated Inspection

Automated inspection is recommended for members under 0.125 inch (3.18 mm) in thickness and is performed per 3.5.10.2.

3.6.6.3.2 Manual Inspection

If necessary to manually inspect members under 0.125 inch (3.18 mm) in thickness, identify the proper probe depth with a centering technique. The eddy current probe shall be moved slowly in the hole through the member and the instrument readout shall be observed for equal deflections from both edges. Locate the probe at a position halfway between these deflection points and scan thin member for cracks.

3.6.6.3.2.1 Periodically check the instrument/probe standardization responses. Standardization should be checked at least every 30 minutes when defect indications are observed and after tape replacement. If any response is found to be unsatisfactory (per the inspection procedure), standardize again per 3.5.6.1 and reinspect all areas inspected since the last standardization check.

3.6.6.3.2.2 Do not exceed the maximum manual probe rotation speed as established in 3.5.10.1, or the automated probe insertion speed as established in 3.5.10.2, as applicable.

3.6.6.3.2.3 Note all locations where a signal response comparable to the response from the reference notch is obtained.

3.7 Disposition

3.7.1 The presence of a potential defect condition is indicated by a rapid response similar in appearance to the reference standard notch response. Check standardization, if necessary, to compare the defect response to the response from the equivalent reference standard notch. Comparison of the defect response to the reference standard notch response should be accomplished at the same scanning speed.

3.7.1.1 A response greater than 50% of and in phase on the impedance display with the reference notch response indicates the presence of a crack.

3.7.1.2 Questionable indications, or indications showing less than 50% of the reference notch response may indicate a defect condition. The following may be used to enhance defect determination.

3.7.1.2.1 Teflon tape placed over the sensing coil or on the probe shank opposite the sensing coil may improve the signal-to-noise ratio. Standardize again when tape is added or removed from the probe coil.

3.7.1.2.2 The crack sensing distance traveled by the eddy current probe when crossing a suspected crack should be equal to the sensing distance traveled when crossing the reference standard notch.

3.7.1.2.3 Nonconductive coatings on the internal hole surface may reduce the amplitude of the crack signal. Request removal of the coating and reinspect.

3.7.1.2.4 A cleanup ream to obtain a hole inspection surface of RHR 125, or better, may be required when excessive surface noise masks or interferes with interpretation of inspection results.

3.7.2 An eddy current inspection shall be performed after each increase in hole diameter when the fastener hole has been reamed for crack removal. Standardize again, as necessary. Each ream shall increase the diameter of the fastener hole by at least one-half of the standardization reference notch depth.

3.7.2.1 Once a crack cannot be found after reaming, an insurance cut should be performed. The oversize ream size of the insurance cut is specified by the appropriate inspection procedure.

4. RESPONSIBILITY FOR INSPECTION

The inspection source shall be responsible for performing all required tests and identifying the parts inspected and accepted.

4.1 Reports

As required by purchaser.

5. NOTES

5.1 The instrument, cables, and probes shall be checked for correct function at regular intervals, as noted in required specifications or established by usage.

5.2 Reference standard dimensions, including hole sizes, conductivity, and notch dimensions, shall be measured and documented. Reference standards shall be certified when required by purchaser.

5.3 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

5.4 Revision Indicator

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

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