WesDyne International, LLC

Turbine Generator Inspection Capabilities

WESDYNE
INTERNATIONAL
A Westinghouse Electric Company

WESDYNE – A HISTORY

WesDyne's Turbine Generator headquarters is located at the Waltz Mill site in Madison, Pennslyvania (USA)

WesDyne International, LLC, a subsidiary of Westinghouse Electric Company, was formed in 1994 when the nondestructive examination (NDE) branch of Westinghouse's Power Generation Services Division (PGSD) and Dynacon Systems Inc. merged to create one company specializing in nondestructive examinations. Prior to the merge, both Westinghouse and Dynacon had considerable experience with turbine generator inspections.

In 1975, Westinghouse (PGSD) began conducting NDE field service operations on turbine and generator components. The initial Westinghouse turbine / generator inspection capabilities included general NDE, rotor bore eddy current and ultrasonic testing, manual low pressure disc inspection, manual ultrasonic testing of retaining rings, manual inspection of main steam inlet features, and conventional ultrasonic testing of blade attachments. In the mid 1980s, Westinghouse established a select technical group to focus on specialty, high-end examinations, providing support to individual service lines.

Dynacon Systems Inc. was established in 1980 and specialized in surveillance systems built around radar detection algorithms. In 1987, Dynacon entered the automated turbine / generator market providing automated rotor bore, turbine disc and retaining ring inspections. As a non-original equipment manufacturer (non-OEM), Dynacon inspected all turbine manufacturers' equipment rather than specializing on one manufacturer. In 1988, Dynacon was acquired by Westinghouse to support its nuclear field services business. Dynacon Systems Inc. operated as a Westinghouse subsidiary until 1994 when WesDyne International was formed.

Turbine rotor

The merging of Westinghouse PGSD and Dynacon Systems Inc. into one group gave WesDyne a vast knowledge and experience base. The combination of resources, in turn, led to an increased focus on technological development and research unmatched in the industry, including development of automated inspection processes and analysis capabilities.

In the early 2000s, WesDyne developed and qualified phased array ultrasonic testing processes, techniques, and procedures for various tangential and axial entry blade attachment geometries. These geometries include dovetail, inverted fir tree for tangential entry and steeple, and ball and shank for axial entry.

WesDyne also has patented phased array inspection processes for inspection of main steam inlet feature components.

INSPECTION CAPABILITIES

WesDyne provides a broad range of inspection capabilities, from general non-destructive examinations to specialized component inspections. We offer a full complement of inspection techniques, including conventional and phased array ultrasonic testing (PAUT), dye penetrant (PT), magnetic particle (MT), visual (VT), computed radiography (RT) and eddy current testing (ET).

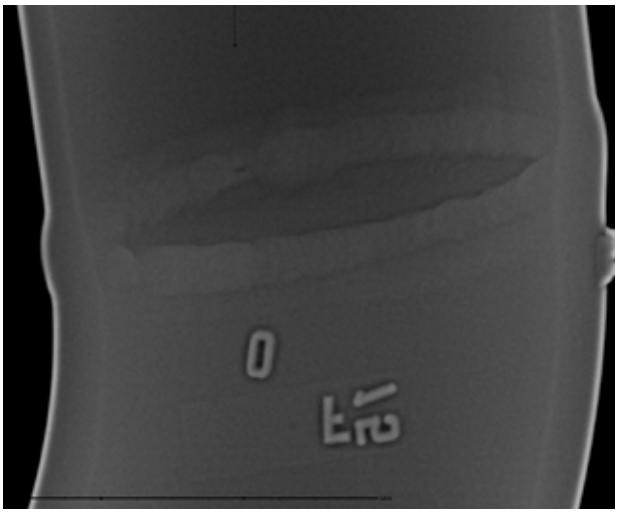
Our procedures are tailored to detect the various service- induced flaws that are common to each particular component.

Benefits

- Ability to inspect multiple OEM configurations
- Experienced personnel with in-depth knowledge of components and flaw trends
- Capacity to support both nuclear and non-nuclear inspections involving small or large outage scopes

Dye penetrant inspection of valve seat

Remote visual inspection



Computed radiographic image of a typical weld

WesDyne's broad experience base and technical expertise allows us to provide a comprehensive portfolio of inspection services designed to meet numerous inspection needs for all turbine / generator manufacturers.

OEM	General NDE	Retaining Ring (1)	Remote Visual	Rotor Bore	Disc (1)	Rotor Blade Attachments (2)	Main Steam Inlet Features (2)	Generator Slots (2)
Alstom / ABB	✓	✓	✓	✓	✓	✓ Steeples	N/A	
Allis-Chalmers	✓	✓	✓	✓	✓		N/A	
Elliott	✓	✓	✓	✓		✓ Fir Tree	N/A	
General Electric	✓	✓	✓	✓	✓	✓ Dovetails	N/A	✓
Hitachi	✓	✓	✓	✓	✓	✓ Dovetails	N/A	✓
Mitsubishi	✓	✓	✓	✓	✓	✓ Steeples	N/A	✓
Parsons	✓	✓	✓	✓	✓	✓ Fir Tree	N/A	
Rolls Royce (Combustion Engineering)	✓	✓		✓	✓	✓ Steeples	N/A	
Siemens / Westinghouse	✓	✓	✓	✓	✓	✓ Steeples	✓	✓
Toshiba	✓	✓	✓	✓	✓	✓ Dovetails Steeples	N/A	✓

(1) Manual or automated examinations
(2) Phased array ultrasonic testing application

ROTOR BORE INSPECTION

WesDyne has the capability to provide comprehensive rotor bore inspection services on turbine generators up to 50 feet long, with bore diameters ranging from 2.4 to 24 inches and including bottle and step bores. Rotor bore inspection services capabilities include visual examination of the bore inside diameter; creep detection on high pressure and reheat rotors; automated, computer-controlled eddy current and ultrasonic testing; and magnetic particle testing, as required. Ultrasonic test (UT) capabilities include circumferential shear, axial shear and 0˚ longitudinal wave techniques, as required.

The WesDyne rotor bore process specialist oversees the entire inspection process, including bore plug removal, bore surface preparation, inspection, and installation of the replacement bore plug.

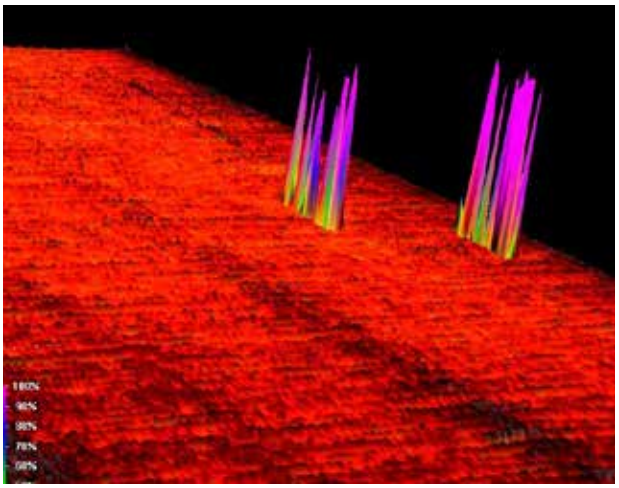
Benefits

- Ultrasonic and eddy current inspection conducted simultaneously, eliminating the need for magnetic particle testing (MT)
- Inspections can be completed in as few as four shifts
- In-house personnel complete all preparations, inspections and analyses
- Integrated engineering evaluation and all-in-one data evaluation

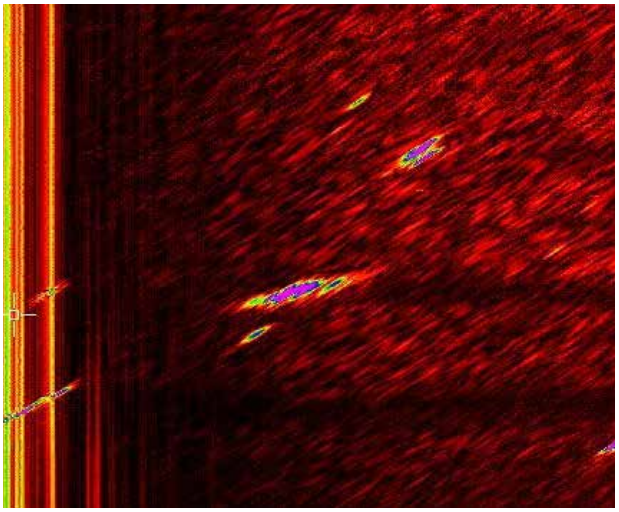
Experience

- WesDyne has performed more than 1,000 rotor bore inspections at more than 300 sites worldwide
- WesDyne rotor bore process specialists have an average of 15 years of inspection experience

WesDyne rotor bore scanner



Surface connected indications detected with eddy current



Surface and subsurface indications detected with ultrasonic testing

LOW-PRESSURE TURBINE DISC INSPECTION

Qualified on full-scale mockups of multiple OEMs

Automated disc inspection platform

WesDyne provides manual and automated UT inspections on low-pressure turbine disc bores and inter-disc button drives for multiple OEMs. The automated examination process targets the disc bores, keyways, or peg / button drive holes. Versatile tooling configurations allow inspections to be tailored to meet specific customer needs while minimizing plant support.

Benefits

- In-house engineering assessment services can be provided
- Flexible inspection techniques that minimize plant support requirements
- With the ability to perform inspections in-situ or out-of-frame, disassembly efforts can be reduced.

Experience

- WesDyne has inspected more than 1,500 discs on more than 250 different rotors. This experience, coupled with the baseline Westinghouse design information, provides WesDyne with unmatched industry qualifications to perform high-quality, reliable disc inspections.

TECHNOLOGY TIMELINE

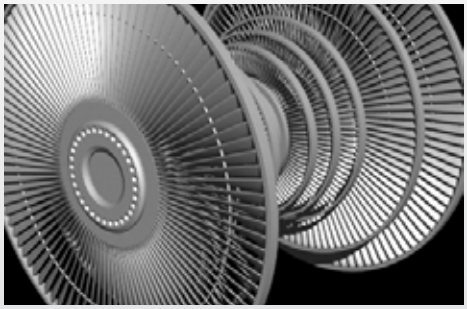
In the 1970s, Westinghouse began conducting non-destructive examination services on turbine and generator components…

For nearly two decades, Westinghouse exclusively performed in-service and new construction services at Westinghouse nuclear facilities worldwide…

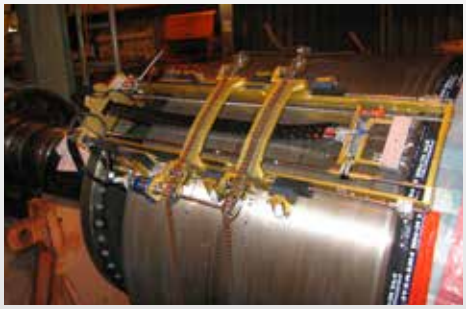
In 1985, Dynacon Systems began performing automated inspections on turbine/generator equipment including rotor bore, retaining ring, turbine discs and dovetail blade attachments. Shortly after, Westinghouse acquired Dynacon Systems...

1970 1980 1990

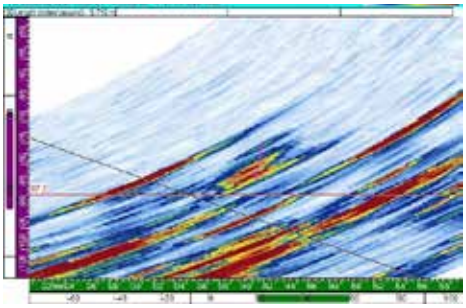
The initial Westinghouse turbine / generator inspection services portfolio included rotor bore examination, disc inspection, retaining ring inspection, inspection of main steam inlet features, inspection of blade attachments and general NDE…



In the mid 1980s, Westinghouse established a select technical group to focus on specialty, high-end examinations, providing support to individual regions…



In 1994, WesDyne was formed by combining all Westinghouse NDE groups with Dynacon Systems. Merging into a single NDE group gave WesDyne a vast knowledge and experience base on Westinghouse and non-Westinghouse OEM equipment…



In the early 2000s, WesDyne began development and qualification of phased array ultrasonic testing procedures and techniques for various blade attachment geometries. WesDyne's initial phased array application was for tangential entry dovetails…

Patented phased array inspection process for inspection of main steam inlet features components and phased array application for tangential entry inverted fir tree blade attachment geometry…

Phased array inspection process developed and qualified for inspection of Westinghouse turbine generator tooth tops and General Electric turbine generator slots…

2000

2010 Beyond

Phased array procedures and techniques continued with axial entry steeples relative to basic shape and then additional configuration geometries…

Began remote turbine entry for visual examinations. Qualified inspection technique for all straddle tangential mount design blade roots and phased array application for axial entry ball and shank blade attachment geometry…

Developed in-situ automated disc inspection examination capabilities for all OEM rotors. Button drive examination process developed for a customer-specific application…

PHASED ARRAY OF TANGENTIAL ENTRY BLADE ATTACHMENTS

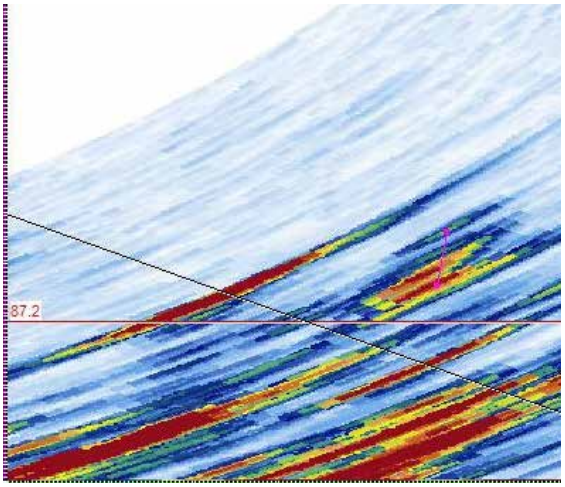
WesDyne developed a means to examine critical areas of the wheel dovetail region using linear phased array ultrasonic testing technology without the need to remove the blades from the rotor. One entire side of a wheel dovetail can be inspected as a single scan from the opposite side of the wheel. This inspection can be applied to steam turbine designs from Alstom, General Electric, Hitachi and Toshiba. Our technology also allows us to inspect inverted fir tree attachments (Parsons style) as well as the attachment areas of GE/Hitachi/Toshiba style straddle mount blades.

The traditional delivery system is a fixed position stand that deploys PAUT probes from the disc surface. Fixed position delivery systems require that the disc (or rotor) be rotated by means of power rollers, placement in a lathe, or turning gear modifications. This type of examination is typically conducted with the rotor out of frame. It can also be conducted with the rotor in-situ provided that the top half of the rotor can be fully exposed.

Benefits

- Reduces disassembly and inspection time versus magnetic particle testing
- Provides better detectability when compared to magnetic particle testing
- Provides demonstrated, accurate flaw detection at 0.005” and flaw depth sizing at 0.040”
- Characterize indications
- Can be performed simultaneously with other inspections
- Most data can be collected in one shift

Tangential entry blade attachments



Data display of an indication on the middle hook showing measurable depth of 0.26”

Cross section of tangential entry “dovetail” showing intergranular stress corrosion cracking

PHASED ARRAY OF AXIAL ENTRY BLADE ATTACHMENTS

WesDyne developed a means to examine the axial entry steeple blade attachments using phased array UT without the need to remove the blades from the rotor. Using multidirectional beam sweeping of the blade attachment, with linear and matrix array probes, flaws can be detected and sized for both length and depth. A flaw's orientation can also be determined. This inspection can be applied to steam and combustion turbines from virtually all OEMs.

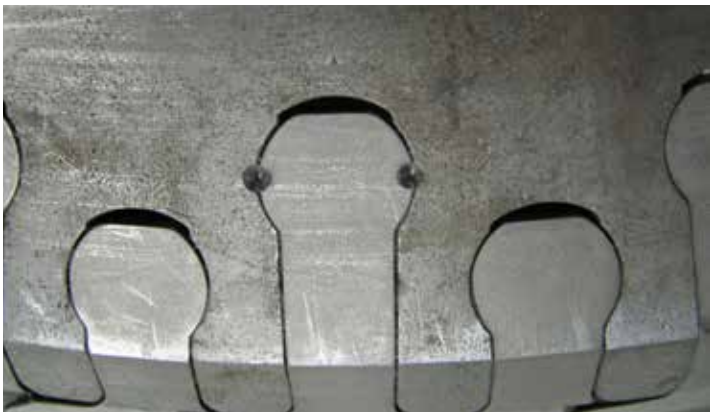
The traditional delivery system is a fixed position stand that deploys PAUT probes from the disc surface. Fixed position delivery systems require that the disc (or rotor) be rotated by means of power rollers, placement in a lathe, or turning gear modifications. This type of examination is typically conducted with the rotor out of frame. It can also be conducted with the rotor in-situ provided that the top half of the rotor can be fully exposed.

Benefits

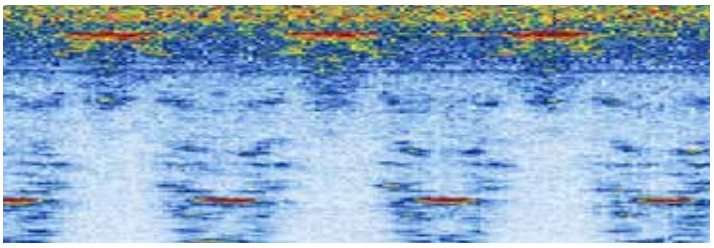
- Reduced inspection time
- Ability to monitor crack growth
- Blade attachment removal is not required
- Better detectability than magnetic particle testing
- Demonstrated flaw detection at 0.010" and flaw depth sizing at 0.040"

Experience

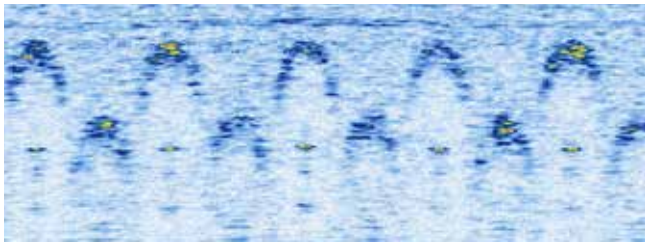
WesDyne continues to lead the way with an experience base for blade attachment inspection that is unmatched in the industry. WesDyne was first to automate the recording and processing of conventional wheel dovetail ultrasonic data in 1984.



DeLaval style ball and shank blade attachment



Data display for DeLaval style ball and shank blade attachment



Data display for axial style blade attachment

Axial style blade attachment

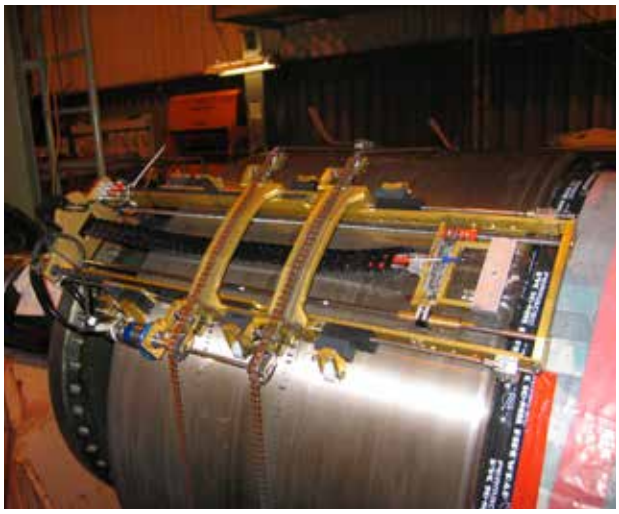
RETAINING RING INSPECTION

With nearly four decades of experience, WesDyne provides automated ultrasonic and eddy current testing techniques for retaining ring inspections of multiple OEMs. Inspections are conducted on 18Mn-5Cr, 18Mn-18Cr and magnetic alloy materials using both manual and automated inspection techniques. The inspection techniques are performed simultaneously from the outside diameter surface of the retaining ring. Ultrasonic testing interrogates the inside diameter surface while eddy current testing interrogates the outside diameter surface. Our automated inspection scanner is designed to fit in a gap as small as 1.6 inches (40.65 mm), and our inspection can be performed with the rotor in-situ or out of frame.

A remote visual examination is conducted on accessible areas beneath the retaining ring to identify general conditions such as moisture exposure, corrosion damage, foreign material, local overheating and / or arcing, material migrations, and broken insulation.

Benefits

- Simultaneous performance of ET on the outer diameter and UT on the inner diameter provides a shorter inspection time
- Special inspection techniques are used to identify and discriminate bore cracks from spurious noise signals and signals caused by ring geometry
- Demonstrated flaw detection as small as 0.010” and sizing to 0.030”
- In-situ inspection capabilities eliminate the need to remove the rotor, thereby minimizing inspection shifts and risk of damage
- Engineering assessment services are available to determine inspection intervals



WesDyne’s automated retaining ring scanner

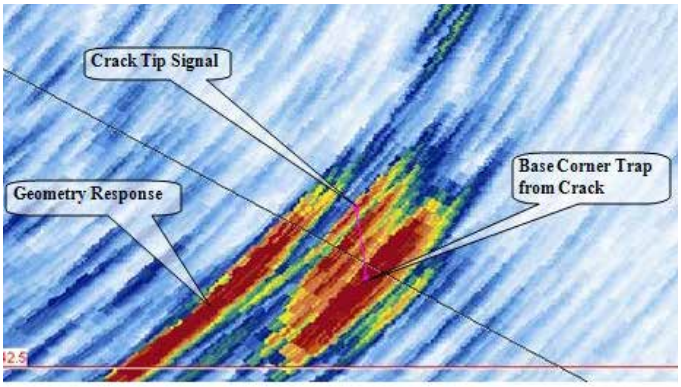
PHASED ARRAY INLET FEATURES

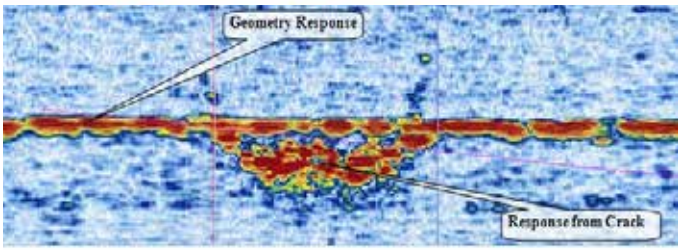
WesDyne provides phased array ultrasonic testing and visual inspection services for examination of the high-pressure nozzle chamber neck weld area as an alternative to the OEM-recommended inspections of Westinghouse high-pressure turbines.

Benefits

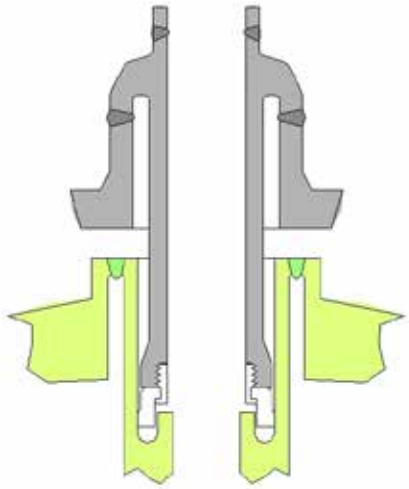
- Phased array procedure allows for a reduced inspection time compared to conventional inspection methods
- Inspection results are more accurate than with conventional methods, eliminating premature replacement of inlet sleeves
- Detection of flaws as small as .015” deep and sizing of flaws as small as .040” deep
- Inspection of modified units with piston seal rings is possible
- No surface preparation, sand blasting or site support required, minimizing plant outage impact
- An engineering evaluation on all flaws can be provided
- Machining repairs of the inlet sleeves can be monitored without disassembling the HP turbine

Inlet sleeve scanner shown in position on the upper half HP shell





B-Scan view showing Crack Length



Main steam inlet sleeve and nozzle chamber weld

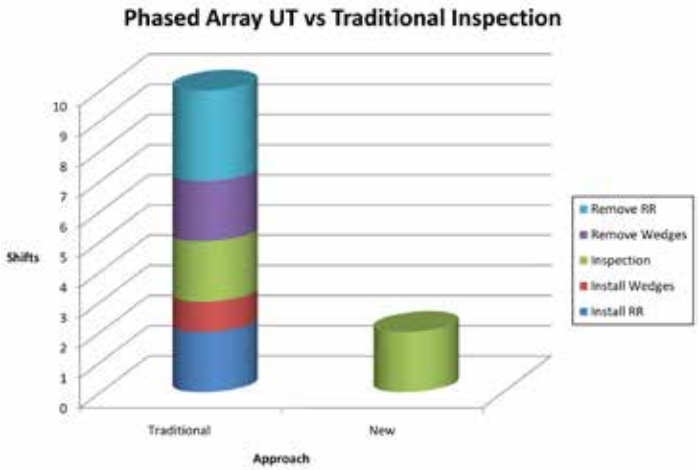
Manipulator for nozzle chamber weld

GENERATOR SLOT DOVETAILS

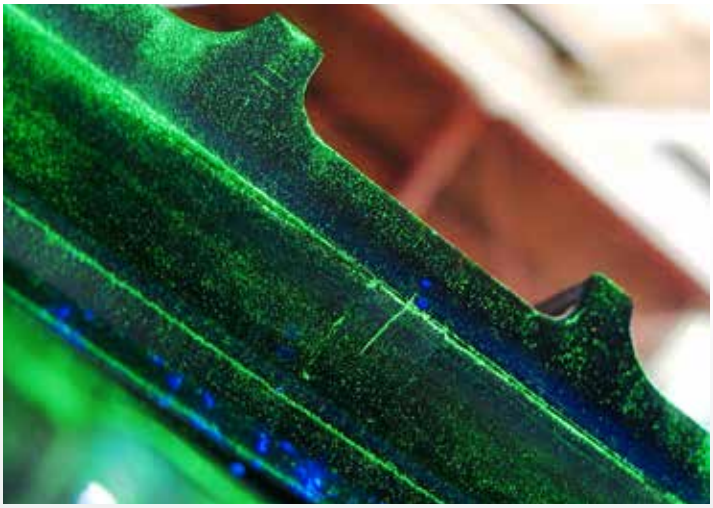
The WesDyne generator slot dovetail examination provides a viable inspection alternative to the requirements of GE TIL-1292. WesDyne uses phased array UT methods to inspect the load-bearing surfaces of the slot dovetails on GE, Toshiba, and Hitachi designed two- and four-pole generators for flaws located at the wedge-butt interfaces. Our technique allows detection of flaws at depths <0.005" and depth sizing down to 0.030".

Benefits

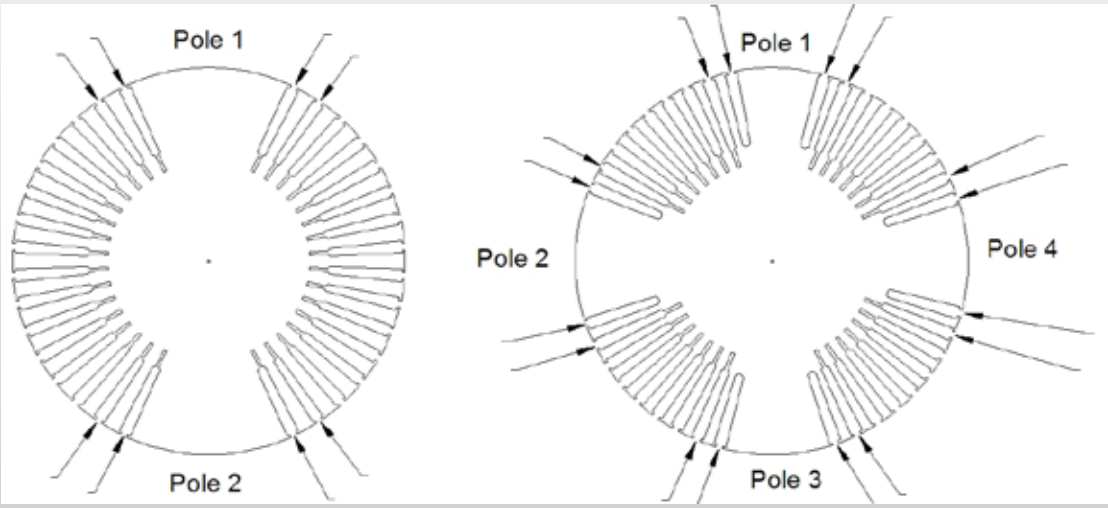
- No surface preparation required
- No wedge removal required
- Flaws are both detected and sized for depth
- Since installation and removal of the retaining rings and wedges are not required, WesDyne's process provides a significant reduction in overall inspection time over the traditional approach



Note: Excludes time to remove and install rotor



Slot dovetail indication



Typical location of steel wedges on two- and four-pole generators

SUMMARY

As a provider of non-destructive examination products and services for nearly four decades, WesDyne has in-depth knowledge and experience in the turbine generator industry. As a developer of inspection techniques, WesDyne fully understands the capabilities and limitations of these inspection methods. Our headquarters hosts a wide variety of mockups reflecting various OEM components, which allow personnel to demonstrate and qualify processes and create a solid technical base.

WesDyne's commitment to customer values has driven our initiatives for safety, quality and price competitiveness. For more information about WesDyne inspection services, call 724-722-5250.