



AES

American Efficiency Services
The Efficiency Experts

SAFELY PROVIDING SERVICES
& PRODUCTS TO OPTIMIZE
OPERATIONAL EFFICIENCY

*Serving the Power Generation,
Process, & Industrial Markets*

AmericanEfficiency.com

877-816-9081 (Toll Free) | 410-489-0613 (Local) | info@americanefficiency.com

- Company started November 1, 2001
- Impeccable safety record
- Pre-shift and Mid-shift briefings conducted
- Annual OSHA safety training administered
- Full time, background checked, drug tested, and safety trained employees
- All employees are safety professionals cross trained in all service areas offered

Our mission is to work for the success of the Industries we serve by providing our customers with Safe, Efficient, Responsive and Reliable Services that best satisfy their needs.

Our primary vision is to provide our customers with the competitive advantage they desire within their specific markets. Our services are designed so that we become part of our customer's team working towards excellence.



Mission/Vision Statement

Safety

We believe safety is our LIFE work, while inspection and cleaning is our "9 to 5" job. Although there are times we seem to "live in the office and plants", the reality is we will spend most of our life off the work site. We aspire to have our safety culture be alive in our lives 24 hours a day.

All AES personnel complete the 30-hour OSHA training during their first week of employment, and complete a 10-hour OSHA refresher course annually. We are proud to report that our three year running RIR and DART are 0.

And while work quality and image is of utmost importance to each of our employees, our focus is on the most important aspect of our lives: family. All of the employees of AES work to provide a better life for ourselves and our families; and realize that to work unsafely jeopardizes so much, most of all health and enjoyment of family.



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Electromagnetic Testing

With our top-of-the-line equipment and highly trained work force, American Efficiency Services (AES) advanced non-destructive testing services stand ready to meet your most challenging inspection requirements.

AES specializes in Electromagnetic Testing, which utilizes electromagnetic induction to assess the condition of conductive material like heat exchanger tubing, piping, vessels, and turbine blades.

AES is a leader

Heat Exchangers

Electromagnetic testing is often used to inspect condenser and heat exchanger tubing. AES will provide the proper electromagnetic testing technique to meet your needs based on tube design, tube material, and the type of damage mechanisms present

Eddy Current Testing employs a bobbin probe on non-ferrous tubing like stainless steel. This technique works well to provide flaw detection, as well as characterization of defects like pitting, cracking, fretting, and erosion. AES uses high speed probe pushers to reduce worker fatigue, ensure data consistency and improve production. Our pushers use precise encoders to obtain the most accurate record of defect locations and their extent.



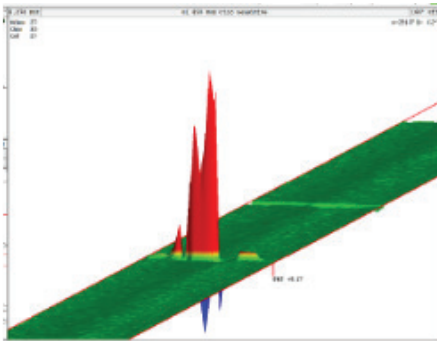
Electromagnetic Testing (cont.)

AES also offers **Eddy Current Array** inspections which allow us to detect defects previously impossible to find with conventional bobbin eddy current. This technology uncovers defects near or under support structures like circumferential cracking. Additionally, eddy current array provides a better understanding as to the extent of damage in areas with fretting and better resolution in areas with multiple defects like pitting.

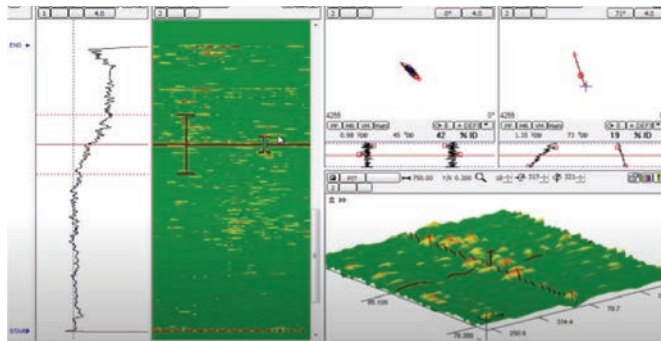
Remote Field Testing is utilized to inspect ferromagnetic tubing materials like carbon steel. This technique is sensitive to wall loss thickness changes and is equally sensitive to the inside and outside diameter of the tube. Like eddy current testing, AES can employ a probe pusher to obtain better quality data and a controlled inspection speed to improve detection and sizing of defects.

Near Field Testing is utilized to inspect air cooled heat exchangers with large aluminum fins often called fin-fan tubes. NFT is specifically suited to detecting corrosion, erosion, and pitting inside carbon steel tubing. NFT is perfect for fin-fan tube heat exchangers because eddy currents do not go through the wall of the tube. NFT is also much more sensitive to defects close to structures such as support plates and tube sheets.

AES can also provide near field array testing which can detect inside diameter (ID) pitting, internal cracking at the tube sheets, internal erosion, and wall loss. It also provides better resolution when multiple defects are found close together such as inside diameter pit clusters.



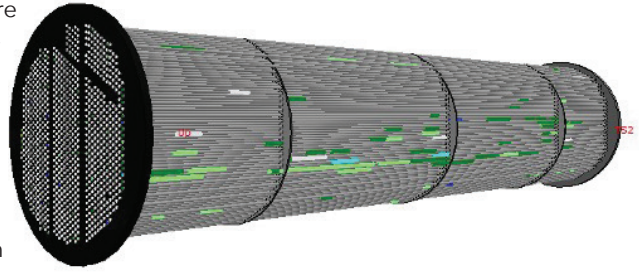
Depiction of circumferential crack in 304 SS tubing identified using the Eddy Current Array technique.



Example of pitting in Carbon Steel Fin-Fan tubing identified using the Near Field Array technique.

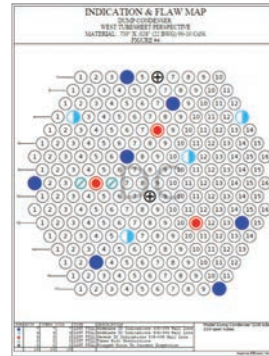
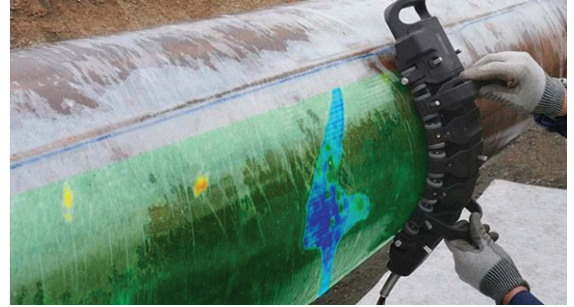
Electromagnetic Testing (cont.)

Our state-of-the-art reporting software provides faster and more complete results. In most cases AES can provide detailed information well beyond just simple wall loss or remaining wall information to help you understand the condition of your heat exchanger tubes. Report information is stored into our database for future comparison and trending purposes. Upon request, our reporting programs can provide our customers with 3D modeling of their heat exchanger. These 3D models can be inserted into a PDF report without the need for special software to view or rotate the model.



Surface Eddy Current

AES utilizes the most advanced tools and techniques to provide high quality inspections for surface applications for both ferrous and non ferrous metals. Conventional NDT methods like Penetrant or Magnetic Partical testing require costly, time consuming paint removal and surface preparation before inspection. AES utilizes techniques which in most cases eliminate the need for extensive surface preparation. Surface eddy current also has the advantage of flaw depth measurements with the data recorded for future review.



*AES Indication/
Flaw Map*

Expansion Joint

Replacement & Repair

American Efficiency Services (AES) has long provided replacement and repair services for steam inlet expansion joints. Whether a traditional flat belt or our state-of-the-art **S-Flex®** and **S-Flex II®**, we are known for our experienced project management and uncompromising commitment to safety. Our quality inspection, repair, and replacement processes include:

- Documenting all “as found” conditions internally and externally, with photographs, prior to removing any hardware and the expansion joint itself
- Carefully match marking all removed components to ensure there are no mistakes made during the reinstallation process
- Thoroughly cleaning all surface areas, stud threads, and steam shields to ensure components are free of debris prior to the installation of the new expansion joint
- Inspecting all studs, clamping bars, and steam shields to identify damaged or degraded materials that require replacement
- Identifying any replacements and/or repairs necessary and advising plant personnel early in the process
- Measuring around the periphery every 10 feet to identify any possible misalignment and document its location
- Conducting a final torque verification of all bolts once the new expansion joint is in place and vulcanized
- Performing an off-line helium inspection of the expansion joint after all hardware is installed to ensure there are no gross breaches between the expansion joint hardware and the expansion joint itself
- Providing a detailed final report, with photographs, that describes the entire project in detail, noting all anomalies identified, as well as the “as left” conditions

Replacement & Repair



Helium Leak Detection



Heat Exchanger Tube Inspection

If a heat exchanger tube leak is contaminating the system it needs to be identified quickly and with accuracy. Most tube inspections are conducted with the system on-line and the tube bundle drained. In this condition the water leak has been converted to an air leak and the same procedure for an air leak is conducted. Advantages to using AES's tube inspection services:

- Can be conducted with the unit on-line
- Only tubes leaking are plugged
- If the leak is a tube to tube sheet or plug leak these are easily identified
- If a manned entry is not possible while the unit is on-line a partial entry can be conducted (call for specific procedure)
- If the system cannot be inspected on-line AES has other procedures to identify the leakage (call for specific procedures)

Pressure / Vacuum Inspections

Any system operating under a positive or negative pressure (vacuum) can use AES's helium leak detection to identify leaks. If the system operates with a positive pressure, helium is added to the system and AES inspectors identify the areas helium is escaping with the use of our helium mass spectrometers. If the system operates under a negative pressure (vacuum), AES's helium mass spectrometer samples the system's off-gas while an inspector applies helium to all components under vacuum.



Air Inleakage

Any system experiencing elevated off-gas, back pressure and/or dissolved oxygen should have an inspection conducted to identify all sources of leakage. There are three primary reasons for conducting an inspection:

1. Routine inspections to understand where potential failures will occur and to maintain an efficiently operating system
2. Prior to an outage so components in need of repair are addressed and scheduled accordingly and again after the outage to ensure all repairs were successful
3. Emergency inspections due to a catastrophic failure or because the air inleakage has exceeded the air removal systems' capabilities, degrading efficiency

Electrical Generator Inspection

AES is capable of inspecting the hydrogen system of an electrical generator on or off-line by introducing a small amount of helium to the system. Once inoculated, an inspector will cover the entire system to identify where the helium is escaping the system. There are four main reasons for conducting an electrical generator inspection:

1. To ensure excessive pockets of hydrogen are not allowed to build up in any area
2. Routine inspection to understand where failures have occurred and to maintain an efficiently operating generator
3. Prior to an outage so components in need of repair are addressed accordingly and then again after an outage to ensure all repairs were properly conducted
4. Emergency inspection due to a catastrophic failure and the hydrogen loss exceeded the machines recommended amount

AES | American Efficiency Services
AN ISO 9001 CERTIFIED COMPANY

LEAK # _____

Description of LEAK: _____

LEAK SIZE: _____

Date: _____ **Initials:** _____

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AES Leak Tag

Helium Leak Detection (cont.)

Reporting

All of AES's inspections are completed with the submission of a detailed report identifying all areas of leakage and suggested repairs, temporary and permanent. These reports should be filed with the customer within a 24-hour period. All leaks are also tagged with an AES Leak Tag that corresponds to the leak in the report so there is no confusion once the crew leaves site.

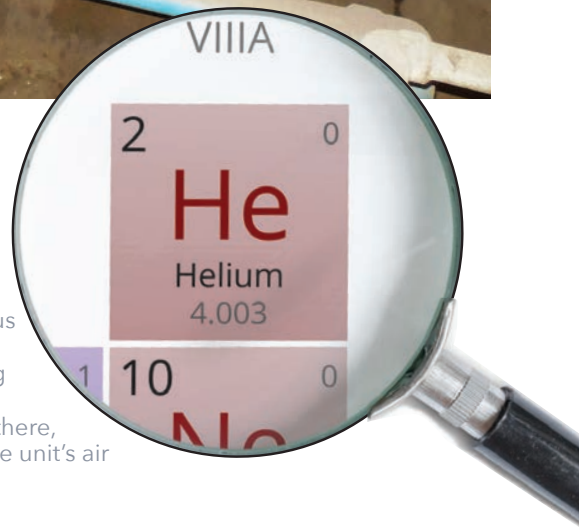
Systems Typically Inspected

- Turbines and Condensers
- Heat Exchangers
- Generators
- Vacuum Towers
- Pipe Lines
- Boiler Duct



Why Helium?

When Helium is applied to various components of a Turbine and/or Condenser system, the leaking component will allow helium to enter the steam space and from there, the helium will be removed by the unit's air removal system.



Tube Cleaning

AES is dedicated to not only cleaning your tubes during the current project but establishing a program that can be managed for years to come. Our philosophy is to bring the condenser to your desk through project updates and detailed reporting.

We have conducted condenser / heat exchanger cleanings on systems as small as 20 tubes to main condensers having greater than 60,000 tubes. These projects have been conducted in electrical generating facilities (fossil and nuclear), petrochemical, medical waste, mining and other industrial facilities. Each system can provide its own unique challenges so we are equipped to combat each with a dozen different cleaners.



Five distinguishing factors separate AES's tube cleaning from our competition:

1. **Safety** – a dedicated Safety/Documentation Manager is assigned to all tube cleaning projects
 - o Ensures that the facility and AES's programs are complied with properly and merged as one
 - o This individual will be responsible for but not limited to; pre-shift safety brief, mid-shift safety brief, JHA, confined spaces and continual surveillance of the work area
 - o Communicates directly with plant safety and management
2. **Deposit Sampling** – during the cleaning a deposit sample will be collected directly from the tubes
 - o Allows AES to offer fact based recommendations for future cleanings
 - o Provides valuable insight to uncover and correct the root cause of the deposition



Before

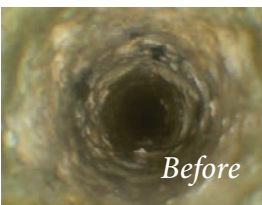


After



Tube Cleaning (cont.)

3. **Draft Reporting** - AES will submit a draft report prior to the crew leaving your job site that will:
 - o Identify the conditions existing in the condenser tubes before and after cleaning, using detailed internal photographs
 - o Identify, with photos, the waterbox and tube sheet conditions, before and after the cleaning, concentrating on corrosion, deposition, anode conditions and any unique findings
 - o Provide tube measurements and tube bundle diagrams
4. **Strategic Alliance** - we have a partnership with a specialized consulting company that has been solving difficult water and steam chemistry problems for over 40 years.
5. **Final Report** - The report will include a breakdown of the major elements, the root cause of the deposition, conclusions and recommendations for corrective actions.



Chemical Cleaning



Condenser/Heat Exchanger efficiency is critical in many system processes. AES offers Chemical Cleaning (Condenser/Heat Exchanger Descaling), a highly impactful cleaning approach for a variety of heat exchangers.

- Can be used exclusively for cleaning or used in combination with mechanical cleaning methods
- Utilizes safe, yet powerful, acids to quickly free the fouling bond matrix and/or dissolve calcium, limescale, rust, lithium carbonate and other types of deposits from passages in water-cooled or heated equipment



Perfect candidates for a chemical cleaning:

- Plate & Frame (no disassembly required)
- Main Condensers
- Auxiliary Condenser
- Heat Exchangers
- Chillers
- Evaporator Condensers
- Cooling Towers

Have a system with hard deposits? Just provide us a sample and we'll begin the analysis process.



We exclusively feature the ScaleBreak® line from Goodway Technologies, which is safe for use on a wide variety of metals, plastics and rubber while quickly helping to improve the operating efficiency and extend the life of your equipment.

- Advanced formulas offer incredible performance and protection
- Fortified with powerful low foaming, wetting, penetrating agents and superior corrosion inhibitors
- Allows for powerful cleaning on scale and other deposits, without the high corrosion rates associated with simple acids
- Comprehensive system review conducted to ensure the chemical cleaning can be delivered safely with high operational integrity

Condenser Retubing



American Efficiency Services has assembled a team of condenser experts with hundreds of years of combined experience specializing in a wide range of retubing services and capabilities. Our unique approach employs seamless processes that effectively manage all aspects of condenser design, operation, and maintenance.

The AES retubing team is comprised of individuals experienced in providing full-scope, turnkey condenser retubing utilizing its innovative equipment and tooling, products, and services for condensers and heat exchangers. Retubing projects consist of many layers of work tasks and activities, sequenced in accordance with our proven approaches ensuring that complex projects are performed safely, and delivered with quality work-manship, on time, and within budget. With experience in the retubing of all combinations and types of tube and tube sheet materials, including titanium and Sea-Cure®, you can be assured we have the working knowledge of the characteristics, idiosyncrasies, and inherent challenges that accompany every retubing project. This experience also gives us a unique perspective in developing technical approaches tailored to fit each plant's design.

Whether you are looking for expert technical advice and state-of-the-art tooling and equipment or a full scope, turnkey retubing contractor, we have the team with the knowledge to assist you in:

- Project Planning & Procedure Development
- Tube Joint Strength Testing
- Uplift and Vibration Analyses
- Sample Tube Removal
- Tube/Tube Sheet Plugging
- Tube Slewing
- Tube Procurement
- Coating Tube Sheets & Waterboxes
- Interference Removal/Reinstallation
- Waterbox/Waterbox Cover Removal/Reinstallation
- Tube Sheet Replacement
- Tube Removal/Tube Installation
- Tube Sheet Serrating
- Tube Expansion
- Tube Staking
- Tube-to-Tube Sheet Welding
- Design & Installation of Cathodic Protection Systems
- Tube Sheet Stress Analysis

We Can Help?

Are you experiencing a high rate of tube failures?
Is your condenser or heat exchanger more than 10% plugged? Do you need to change tube materials due to environmental regulations?

Give us a call and let us put our retubing experience to work for you!



Condenser Services

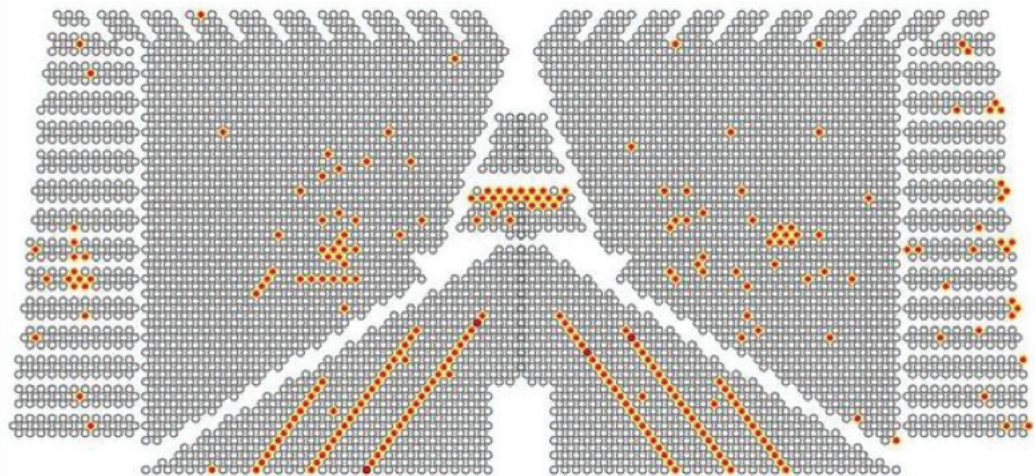
Tube Plugging/Tube Plug Removal/Tube Removal

Over time plug integrity can become an issue and they begin to leak. AES has pulled old plugs from condensers/heat exchangers and replaced them with new plugs to ensure a leak free environment during operation. The tube bundle is mapped of all plugs prior to the extraction and then updated after the new plugs are inserted. During most of these projects many tubes are identified as having a plug on one side but not the other. All of these tubes have plugs inserted on both ends.

During condenser tube inspections and cleaning, a tube plug or tube extraction may be recommended to understand the failure mechanism, confirm eddy current data, and/or to obtain a visual inspection on the condition of the condenser tubes. Since the waterboxes remain in place during these minimal extractions, a procedure is implemented to remove the tube in a controlled manner, so the tube can be placed in the same order once in a controlled area. Once any defects are identified it will be possible to trend if the failures/defects are distributed randomly throughout the tube bundle or if a specific pattern exists.

Once the tube(s) are extracted, a tube sheet plug is inserted into the blank tube sheet holes to ensure there is no cooling water contamination during operation. Since tubes should only be pulled from the condenser off-line, AES can have a helium inspection crew on-site during unit start up to inspect any areas that have had tubes pulled to ensure the plugging is leak free.

AES creates tube bundle maps (see pictured below) of all tubes currently plugged during our tube cleaning projects and can be contracted to provide mapping independently of other projects.



Understanding where your failures/defects have occurred and having the ability to trend them can prove to be a valuable tool for efficient and economical outage decisions

Boiler Duct Inspections

AES conducts several Boiler Duct Inspections a year identifying sources of leakage that are compromising the unit's efficiency. Obtaining a sample from the systems discharge AES then applies helium to the duct work, expansion joints, manways and all other components under vacuum.

The benefits of the inspection include: reducing the potential for elevated load on the ID fans, reducing the temperature of the SCR's, and assisting in maintaining an efficient boiler.

Boroscope Inspections

AES provides a crew with a boroscope capable of capturing images and video of spaces not accessible to man. Our boroscope is capable of looking inside piping, heater chambers, and other tight areas to conduct visual inspections and assess the need for maintenance or other corrective actions.

AES crews have also been deployed for the specific purpose of evaluating the internals of critical systems for foreign material that could damage a system during start-up and/or operation. The removal of foreign material prior to start-up can save the facility millions of dollars. A complete report of the procedure conducted on the specific system, findings, photographs, and video are all compiled in a final report. The report allows the customer to assess their system so outage planning and proper repairs can be made efficiently.

Steam Inlet Expansion Joints

American Efficiency Services (AES) has long provided replacement and repair services for steam inlet expansion joints. Known for our experienced project management and uncompromising commitment to safety, we have expanded our service line into the manufacturing of our innovative **S-Flex**® Steam Inlet Expansion Joint and **S-Flex II**® System (the same "S" shaped designs as previously pioneered and patented by Bob Hahn).

S-Flex®

S-Flex® - designed to replace existing, aging, and inferior rubber "dog bone" type expansion joints. The **S-Flex**® steam inlet expansion joint provides the following advantages over a traditional straight belt:

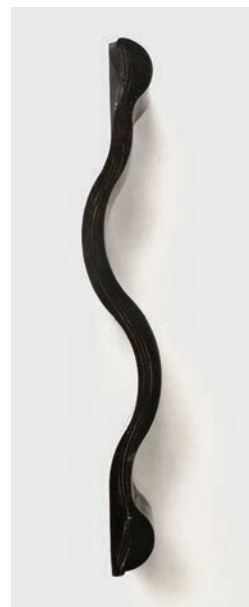
- Expansion or compression during installation to account for the potential misalignment of the receiving bars without compromising its integrity or life span
- Elimination of the need to keep belts of different heights on the shelf in the event the size ordered does not fit
- Extended life by allowing expansion and contraction of the expansion joint during plant cycling
- Ease of installation and the transition of corners without buckling or bulging
- Additional barriers to air in-leakage as a result of the unique 3-ply construction of the expansion joint consisting of multi-filament polyester fabric plies, skim coated with rubber, which ensures superior bonding



S-Flex II®

S-Flex II® - initially designed for use by condenser OEM's, the **S-Flex II**® has become the industry standard in steam inlet expansion joint systems for new condenser construction.

- The **S-Flex II**® system is also an affordable alternative for replacing an existing failed metal bellows type system or rubber "U" joint design.
- No matter your application, the **S-Flex II**® rubber steam inlet expansion joint system is custom engineered and designed for each specific application and will accommodate any unique challenges.
- The **S-Flex II**® rubber steam inlet expansion joint system uses the same proven construction and advantages of the "S" shape design as the original **S-Flex II**®. By removing one side of the bulb (making one side flat), we increased the surface area to be sealed thereby improving the overall sealing capability and further reducing the susceptibility of air in-leakage.



Anti-Vibration Tube Stakes

Cradle-Lock®

American Efficiency Services (AES) offers its Cradle-Lock® Tube Stakes (the same anti-vibration designs as pioneered and patented by Bob Hahn) that eliminate vibration. Since November of 1988, millions of these stakes have been installed around the world in hundreds of operating condensers and heat exchangers. We have a proven record of success in staking condensers and heat exchangers of all makes and tubesheet configurations using our designs for straight, back-to-back, beam stake, and spring stakes. There has not been one reported tube failure as a result of vibration where these stakes have been installed.

Tube damage as a result of vibration occurs when high-velocity steam travels through the tube bundle. Whether by design, a change of tube materials, or the result of a power uprate, the tubes are susceptible to all types of flow-induced vibration mechanisms. Most commonly, failures occur as a result of mid-span collision or circumferential fracture at the tube sheet or support plates. Tube vibration, if left unresolved, may result in catastrophic tube failures and the subsequent unplanned shutdown of the unit.



Consider Cradle-Lock® Stakes:

- To eliminate tube damage when increased steam flows are introduced or when retubing with thinner-wall tubes such as Titanium, Sea-Cure®, AL-6XN, or other exotic alloys as a result of vibration.
- To accommodate excessive support plate spacing, especially if the condenser was fabricated prior to 1977, preceding HEI support plate specifications.
- As part of a power uprate project, to protect tube bundles against higher steam velocities.

Technical Advantages of Cradle-Lock® Stakes:

- Unlike other clip or "locking" stakes fabricated from a flattened stainless steel tube, all AES Cradle-Lock® stakes are custom-engineered and fabricated of 304 stainless steel using precision dies to precisely mimic the tube pitch and spacing characteristics of your condenser or heat exchanger.
- The indentations (dimples) are what sets our design apart from the rest, providing an interference fit that locks the stakes and tubes into a single vibration-free unit.
- The Cradle-Lock® design "cradles" the tube on both sides of the stake which prevents horizontal vibration and limits vertical movement.
- Our stakes "cradle" the tube throughout the surface area of each indentation, greatly increasing the contact area between the tube and the stake. Conventional stakes offer only one point of contact and allow the tube to move up and down its length.
- Cradle-Lock® stakes are easier to install as they virtually eliminate the necessity of wiring, bolting, bands, or other parts.



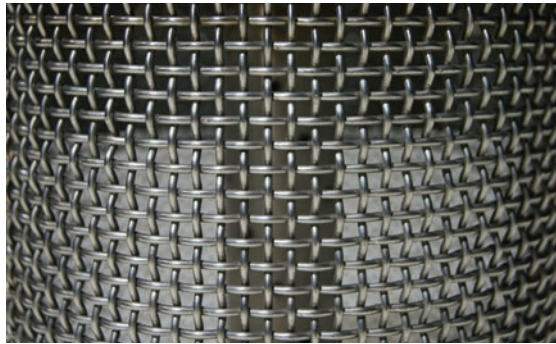
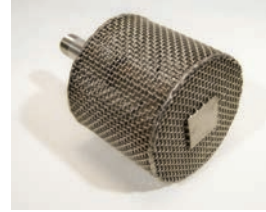
We Can Help!

Considering a retubing? We can perform a vibration analysis to ascertain if your new tubes will be susceptible to vibration damage. Experiencing failures and uncertain if these are due to vibration? We can perform an inspection of your tube bundle.

Stainless Steel Basket Tips

The turbulent steam exiting the exhaust at high velocities can adversely affect static pressure readings if critical instrumentation is not adequately protected. Pressure sensing devices are typically located above the condenser tube bundle and below the turbine exhaust. Basket tip assemblies are the most commonly used components to protect instrumentation from the influences of high-velocity steam and to ensure readings are accurate.

- American Efficiency Services' (AES) basket tip assemblies are manufactured of heavy-duty stainless steel and designed in accordance with the most recent ASME Standard (ASME PTC-12.2-1998), performance monitoring, and test codes.
- Our basket tips are drilled with 1/8" holes in accordance with the updated standard.
- AES maintains an inventory with a plain connection intended for field welding, and an NPT threaded (3/4") connection for an existing threaded pipe. AES can even custom design connections to meet your exact requirements.
- We offer replacement basket tip assemblies at a reduced cost and lead-time compared to the OEM condenser manufacturers.



Need Help!

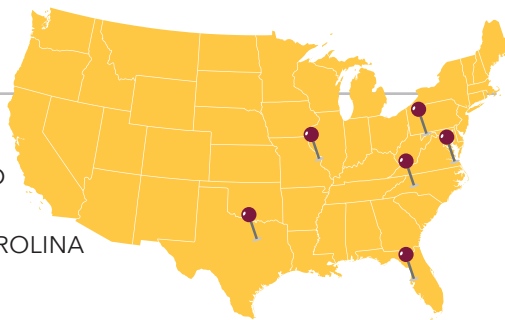
Don't know the condition of your basket tips? AES can perform an internal inspection during your next outage. And, while we're in there, we can also assess the condition of other components, including the steam inlet expansion joint, tubes and tube bundle, baffle connections, steam spargers, general steam space, etc.





📍 Six regional offices to serve you quickly and cost effectively.

- TAMPA, FLORIDA
- CUMBERLAND, MARYLAND
- ST. LOUIS, MISSOURI
- MORGANTON, NORTH CAROLINA
- IRVING, TEXAS
- NORFOLK, VIRGINIA



For more information or to have AES service your facility call our toll free number or visit our website listed below.

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