Is It Hot in Here?

Significant Recovery Opportunities with Boiler Failures

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Water boiler failures provide significant recovery opportunities. By understanding how these relatively simple systems work, one can realize that recovery potential and identify the probable failures modes, skillfully directing the recovery investigation, and asserting the proper legal theories that afford recovery. Steam and energy-generating boilers date back to the late 1700s and early 1800s with the development of kettle-type boilers. As mechanical capabilities and technology advanced, steam/energy generation sky-rocketed.

Recovery opportunities for boiler failures are numerous given the sheer quantity of boilers operating in the field. As of 2005, there were up to 162,000 boilers in manufacturing, lodging, and industrial applications. Commercial properties in the U.S. host over 581,000 boilers. Major steam-generating industries, such as food, paper, chemicals, refining, and energy are home to 71 percent of the boiler units and 82 percent of the boiler capacity. There are relatively few kinds of power-producing boilers. Water tube boilers and fire tube boilers are the predominant types. Each has numerous subset variations. Water tube boilers, the primary focus here, are the most common boilers.

How They Work

Water tube boilers are relatively simple. Most consist of a pair of drums, tubing, and a heat source. One upper drum for steam collection, and one lower drum for water heating. The drums are connected with tubes, primarily downcomer and riser tubes. A system of burners heats the water in the lower drum, which produces steam that naturally flows to the upper drum. The upper drum facilitates steam and water separation with the water stored below the steam. The water that collects in the upper drum is then fed back into the lower drum at hotter temperatures, continuing the cycle of convectional water flow in the system. Heat can also be applied to the tubing and there are several other variations, but recovery avenues following failure events are applicable throughout a majority of water-tube boilers.

Commercial and industrial water-tube boilers have different applications that power a wide variety of business. Commercial water-tube boilers generally generate steam for hot water utility or comfort applications. A significant portion of hotels and office buildings use water-tube boilers for heating and water boiling. Hospitals and medical facilities tend to use water-boilers for sterilization, humidification, and dietary cleanliness. Industrial water-tube boilers generate energy and facilitate industrial applications. Some commercial applications will require higher pressures and larger quantities of steam generation, as well as higher energy/heat inputs from external heating sources. For example, companies that generate ethanol or natural energy and by-products rely on water-tube boilers for their production processes.

Recovery Opportunities

Water-tube boilers are large steel and alloy machines that manipulate heavy pressures and temperatures that can exceed 1,800 degrees Fahrenheit. Because strength of steel drops exponentially at temperatures over 800 degrees, numerous issues can affect a boiler's operation, resulting in catastrophic failure.

Low water conditions — Most boilers do not use pumps to push water through the system. Instead, they allow and rely on natural circulation of water through the tubes. Constantly flowing water, at proper levels, removes heat from the tubes. As the water temperature rises in the upper boiler steam drum, sufficient heat is eventually generated and steam forms. Cold water is then fed into boiler, replaces the water that rose, creating the natural circulation.

Low water conditions usually occur when diminished amounts of cold water enter the system to replace the water lost to generated steam. Without sufficient amounts of cold water, the low water condition can melt or otherwise severely damage the steel tubing. Several common causes of low water conditions include trip switch failure, control valve failure, feedwater pump failure, and sudden changes in the steam load. Trip switches are an inexpensive preventative measure to avoid boiler damage due to low water conditions. These easy-to-install switches will shut off a boiler when low water conditions occur. Newer boilers tend to contain these switches and industry standards typically promote their installation in older boiler systems.

Poor water/chemical treatment — The water running through a boiler system is supposed to be treated. Proper treatment protects the boiler tubing from two basic issues — minimizing solid deposits and preventing corrosion. When the water is vaporized to steam, there are solids that are left behind. Most boilers operate at adequately low pressures to allow for the use of simple treatment procedures. Solids can also be removed through the use of blow-down procedures and the assistance of trained chemical treatment providers. Although the amount of solids in the water and their density vary, untreated water accelerates a reduction in efficiency.

Given the need for efficient water circulation to maintain the temperature of a boiler's steel tubing, deposit buildup reduces the ability to keep temperatures at optimal levels by reducing the efficiency of water circulation. Eventually, if the water is left untreated and deposits accumulate, the result is overheating and eventual blowout. Proper chemical treatment of the water reduces the solid deposits to acceptable levels. Generally, the greater the operating pressure and running temperatures, the more closely water treatment must be monitored and properly maintained.

Improper warm-up — When external corporate stresses and production requirements are high, extreme over emphasis on expediting boiler operations may result in an initial failure at warm-up. Poor or rushed warm-up is one of the most severe hardships that a boiler can undergo. The boiler's startup cycle, operation, and turn-off put serious strain on numerous joints. Parts of the boiler, operate at different pressures at different times. All of these materials change temperatures while warming up and cooling down at different times in the warm-up process. Speeding through start-up procedures subjects the boiler components to fatigue and high localized pressures, resulting in acute failures.

Steam blanketing — Steam blanketing affects and damages boiler tubing during normal operation. When the water circulation occurs naturally, as it does in most water-tube boilers, gravity generates proper velocity through the tubes. Improper angling of the tubing, usually due to a design and/or manufacturing defect, decrease water velocity and in turn, may cause stratification.

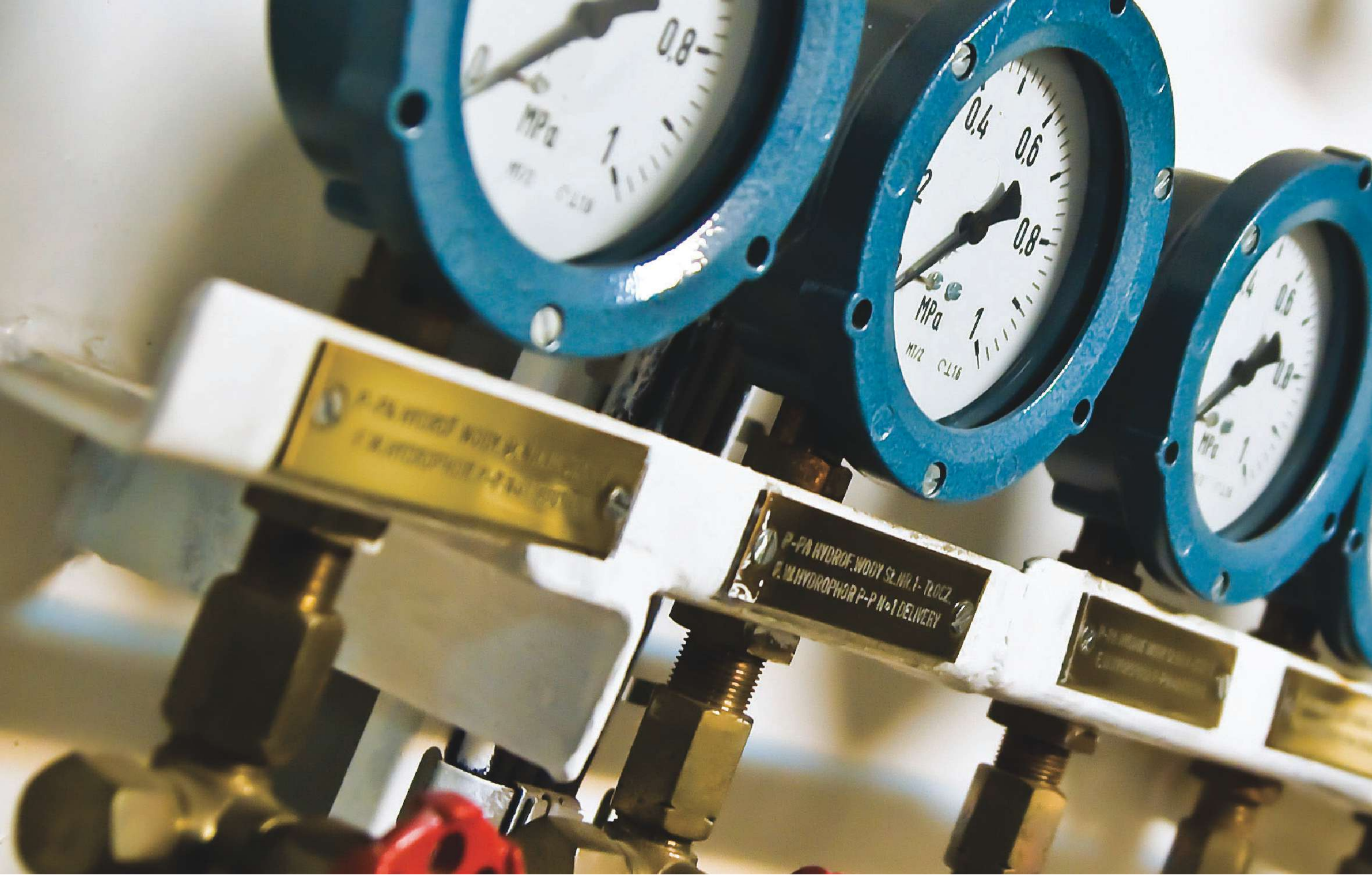
Stratification — Stratification is the result of decreased water velocity that is insufficient to separate steam from water. Stratification creates the steam blanket, which is the two-phase (water/steam) shift within the tubing that increased localized heating. The ultra-high heat wears out the steel in the tubing, eventually causing a rupture. Steam blanketing can be identified under metallurgical examination. The affected tubes will show noticeable thinning around the steam blanketed area.

Corrosion — Dissolved oxygen in boiler water can cause serious corrosive damage throughout the system when it attaches to the walls of metal piping, causing rust. Steel is always susceptible to water's corrosive properties. Water-tube boilers are equipped with deaerating systems, which remove oxygen and other dissolved gases from feed-water as it is entering a water-tube boiler. Corrosion is the reversion of steel to its ore form and can affect a boiler in various ways. From localized destruction of tubing, to large-scale impact of the steel drum, corrosion can come from several sources.

Generally, corrosion originates from improper water deaeration. Corrosion control processes include proper deaeration, pH level maintenance, deposit control, and reduction of stresses through recommended operational practices.

Recovery Investigation

The initial phase of a boiler failure investigation often requires retention of forensic experts, such as mechanical engineers, metallurgists, water treatment experts, and boiler specialists. Then, heavy photographic documentation of the



boiler, the surrounding areas, and the relevant documentation should be gathered. Afterwards, a forensic, expert-driven onsite investigation is usually necessary. Onsite investigations can provide experts with information that is critical to the overall recovery investigation.

During the initial phase of the boiler failure investigation, it is important to gather accurate information that will assist the forensic experts in their investigation. There are several pieces of information that will be critical to the investigation into the origin and cause of the failure, as well as the eventual legal strategy regarding potential recovery. Initially, it is important to gather as much accurate information regarding the incident as possible. This information includes:

- Witness information.
- Surveillance camera footage.
- Pre-programmed controls and operational protocols and data.
- Plant processes and operations (including equipment changes or modifications).
- Water treatment records.
- A large number of high-quality digital photographs of the incident scene.
- Identification of the persons most knowledgeable on the boiler design/ installation/commissioning/operation.
- Identification of any entities that or individuals who might have potentially caused or contributed to the failure.
- Electronic data (protocol or process data) on the subject boiler system during the period of interest.
- Contracts, agreements, and documentation for purchase, installation, commissioning, maintenance, and/or modifications of the subject boiler systems and water treatment services.

During the investigation, the experts should aim to understand how the failure occurred and the contributing dynamics.

Recovery Theories

Boiler Manufacturer/Designer — Design defects should be considered when a boiler component is involved in a failure. Small deviations, such as tube angling, porosity of the steel, and thickness of components, can have detrimental impacts on a boiler's operation. Generally, two types of design defects exist in boilers – ones that directly cause harm and ones that make harm from other sources more likely. The two most common tests used to determine whether a design defect was present are the consumer expectation test and the risk utility test. Under the consumer expectation test, courts determine whether the product was defective to a degree not ordinarily contemplated by the reasonable consumer. Under the risk utility test, courts determine whether the probability of failure and harm posed by the product outweighs the benefits associated with its use.

Manufacturing defects occur when the product is manufactured in a way that departs from its intended design or

specifications. No matter how careful the manufacturer was when designing the product, choosing materials, creating the assembly line, and issuing quality assurance, the manufacturer still could be liable for deviations that injure consumers. However, manufacturing defects can be difficult to establish. A plaintiff must show that the claimed defect was outside the product's design specifications.

Water Chemical Treatment Servicer — Water chemical treatment services should be considered. The water chemistry servicer should follow express manufacturing protocols and have a plan to avoid unnecessary fluctuations in circulation and composition of the water. Failures resulting from sludge, waste, or corrosion can be placed on the shoulders of water chemical treatment servicers.

Installer & Maintenance Provider — A retained maintenance provider is also a potential recovery avenue. National Fire Protection Association (NFPA) 85 establishes safe installation, operation, maintenance and training procedures for installers and servicers. NFPA 85 contributes to operating safety and prevents failures in boiler fire systems. Forensic experts should be well-versed in NFPA 85.

Inspecting Entity — When boilers suffer from minor failures, inspecting entities are sometimes retained to determine the cause of the breakdown. These entities must provide clear inspection scopes in written reports that define their respective examination and recommendations. If there is a future failure and a forensic examination reveals that the previous inspecting entity failed to identify existing problems or failed to recommend proper and corrective actions, liability could exist. Statements from the inspecting entity could establish a basis for recovery. Claims generally available include negligence, negligent misrepresentation, breach of contract, and breach of implied and express warranties.

Implied and Express Warranties — The implied warranty of fitness relies on the intentional representations upon which a buyer relies. To establish this claim, the buyer has expressly or impliedly informed the seller of a particular purpose for which the product is required and has relied on the seller's skill or judgment in selecting or furnishing a product to satisfy that purpose.

The implied warranty of merchantability certifies to a buyer that the goods are fit to sell. "Fit to sell" just means that the product is reasonably fit for its foreseeable, ordinary purpose within the customer's reasonable expectations. An express warranty is any affirmation of fact or promise, relating to the goods, that the seller makes to the buyer and that becomes part of the basis for the bargain. A particularly sensitive arena, for potential liability, is created in statements made in advertisements, brochures, sales pitches, and instruction manuals. Even vague statements could be construed as express warranties, if a reasonable buyer would consider them in purchasing the product. Unlike implied warranties, express warranties cannot be disclaimed.

Successful Recovery

There are hundreds of thousands active commercial water boilers powering a massive variety of industry. From hospitals, hotels, and industrial settings, boiler failures can shutter critical services in the sector. The key to a successful recovery pursuit is having the right team of professionals in place. The investigation and any recovery litigation must be based on good working knowledge of water boilers, credible evidence, and forensic work-up. The investigation should be effective, efficient, and strategic. A focused, thorough forensic investigation affords the potential for maximizing significant boiler recovery opportunities. LM

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