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The Scourge of the Integral Economizer

My introduction to the North American boiler market was in 1992 with my acceptance of a Sales Engineering position with a US economizer manufacturer. This was a watershed period for the market as high-value-added economizers were beginning to gain acceptance. High value-added economizers are defined primarily as featuring easily replaceable tubes and ability to supply the heat exchanger in corrosion resistant materials such as stainless steel providing better longevity, greater applicational use, higher energy recoveries, and ease of inexpensive maintenance.

Boiler economizers at that time were akin to snake oil and was perhaps one of the most challenging products to promote in a boiler room. This was because of the multitude of failed economizers, abandoned and bypassed, impossible to economically repair or replace. Boiler economizer design was nearly unchanged throughout the second half of the 20th century. Industrial boiler economizers were nothing more than scaled down versions of the units installed on extremely large industrial and utility boilers. The problem however was smaller boilers do not necessarily receive the same level of preventive maintenance and attention to water chemistry as their larger brethren yet were supplied with the same carbon steel boiler tubes. Unknown to those small boiler owners that wanted to improve the efficiency of their boilers was these economizers were almost impossible to economically repair should tube leaks develop. Dissolved oxygen is the nemesis of any carbon steel boiler tube which prohibited economizers being installed on any non-deaerated boiler feedwater system which become less common down the boiler capacities scale. Compounding the problems was the development of the even cheaper "coiled economizer" in which helically coiled tubes were nested inside of each other. The nature of the construction meant repair of those nested tube elements was for all practical purposes impossible and were rightfully referred to as "throw-away" designs. It had gotten to a point where economizer manufacturers would actually promote internal bypass dampers as an advantage should the economizer fail once installed. It was very difficult to sell a replacement economizer to the owner of an abandoned "throw-away" economizer.

The industry was fortunate to have visionaries that recognized industrial boiler economizer design needed to make a generational change. This led to the development of the aforementioned high-value-added generation of economizers. By the start of the 21st century something amazing had happened; US industrial boiler owners began to reconsider economizers. A new generation of manufactures had proven that serviceable economizers provided with corrosion resistant materials could provide an exceptional return on investment and long service life.

I started my own economizer manufacturing business in 2005 as I saw the opportunity for a second-generation of high-value added economizers expanding on those first visionary concepts by integrating modern methods of optimized computerized design and manufacturing. These advancements ushered in the advancement of new multi-stage condensing technologies enabling boiler owners to achieve operating efficiencies which were unimaginable even twenty years prior. Carbon steel economizer tubes are the ideal "canary in the coal mine" shielding the boiler tubes by absorbing the brunt of corrosion resulting from oxygenated water. These economizer tubes elements can be easily and inexpensively replaced compared to the boiler tubes. Since this style of economizer are almost always located above the boiler, they are easily accessible and feature removable panels to provide full and unrestricted access to the heat exchanger for routine maintenance. This arrangement also serves to ensure no condensation, leaking tubes, or rain can make its way into the boiler. Integral economizers are limited to sensible heat recovery applications only since condensing into a firebox is unwise.

Integral economizers, primarily the domain of firetube boilers, seek to cram a small economizer into the smoke box in the boiler prior to the exhaust gas outlet. This location makes inspection difficult and routine maintenance and accessibility nearly impossible. Nearly all integral economizers are supplied in carbon steel leaving them susceptible to the same potential for dissolved oxygen pitting that resulted in hundreds if not thousands of economizers to be abandoned in place just a generation ago and without the advantage of easily replaceable tubes just one leak away from abandonment. As a Professional Engineer that earned an USCG Unlimited Steam and Motor Vessel Engineering Officer's license 30 years ago that has since built a successful career in the industrial boiler market, I am very experienced with the design and operation of boilers. I state this to qualify my opinion that the safety aspects of placing a heat exchanger almost assured to experience leakage during its operational life in close proximity to the boiler tube sheet should be very concerning. There is a potential for catastrophic failure resulting from either corrosion or the thermal shock that would arise from the relatively cold economizer leak coming in contact a firetube boiler tubesheet. Common sense would seem to dictate placing a device inside of the smoke box with a high likely hood of failure in its operational life that has the ability to flood the fire side of the boiler in the event of a failure does not represent sound engineering practice. At least the throw-away designs of the past included internal bypass arrangements to allow the continued operation of the boiler with a failed economizer and were located outside of the boiler to allow for replacement; integral economizers are substantially more difficult to pull out of the firebox of a boiler when they inevitably experience a leak.

It is because I experienced the worst of the industry 30 years ago that I am so concerned with the rise of the current trend towards integral economizers. The common phase "Those that do not study the past are doomed to repeat it" has never been more accurate than in how it applies to the integral economizer. That any engineer or owner would consider a return to the era of economizers that are nearly impossible to repair or offer minuscule gains in efficiency compared to modern designs is difficult to comprehend.

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