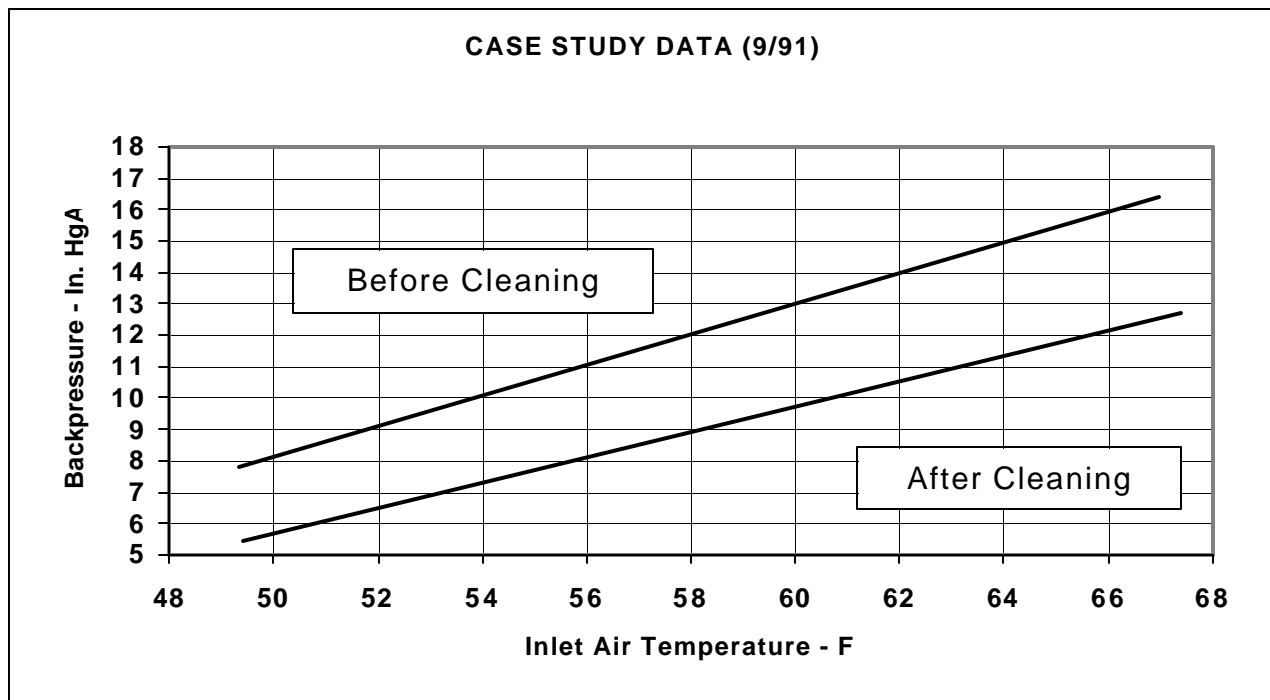


Semi-Automatic Fin Tube Cleaning System

History:

- In the early 1990's, GEA recognized the importance for fin tube cleaning.
- Early case studies proved that dramatic increases in ACC performance were achieved following a high-pressure cleaning, as shown in the below actual data from a plant:



- To support plant operations and allow for improved plant performance, GEA Power Cooling, Inc. designed and fabricated our first fin tube cleaning system in 1993.
- Since 1993, GEA Power Cooling, Inc. has supplied over 30 FTCS to various customers.

Design:

- **GEA has updated each component of the FTCS to achieve improvements in reliability, ease of use, and ease of installation. Component improvements include, but are not limited to:**
 - Lower and improved carriage weight distribution resulting in an easily movable library ladder style carriage.
 - Only requires one portable control box and one gear-motor assembly for an entire ACC.
 - Available in 9gpm or 18gpm, both at 2000psig
 - Easily adaptable to air removal interference (as shown in figure 1) on older ACCs

- **A comparison of the designs follows:**

OLD DESIGN (PRIOR TO 2002)	COMMENTS FROM THE FIELD	NEW DESIGN (AVAILABLE TODAY)
<ul style="list-style-type: none"> ➤ Utilized the fin tube bundles for support (traveled up the tube bundle sidewalls) 	<p>“Cleaning unit gets stuck on the tube bundle because the bundle sidewalls and the cleaning frame do not have the same tolerances.”</p>	<p>The fin tube cleaning system no longer utilizes the tube bundle sidewalls. The cleaning head utilizes its own separate support assembly, thus eliminating any cleaning frame hold-up or binding.</p>
<ul style="list-style-type: none"> ➤ Total weight of cleaning frame and motor assembly over 250 pounds 	<p>“The equipment is far too heavy”</p>	<p>The weight of the FTCS has been reduced dramatically. Many small design changes have attributed to this reduction, but some of the key reasons are: updated carriage design, reduction of gear-motor size, and updated control logic. The weight of the heaviest movable item on the current system is well below 40 pounds.</p>
<ul style="list-style-type: none"> ➤ Dimensions of the cleaning frame close to 34” x 105” and the motor was ¾ hp 	<p>“The equipment is too bulky and too difficult to move from bay to bay”</p>	<p>The size and “bulkiness” of the FTCS has substantially reduced. Carriage assembly is 24’ x 4.5’ for 18gpm size and 24’ x 3.5’ for 9gpm size.</p>

- The cleaning system restores performance of the ACC

“The cleaning system works great, but it would be better if it were easier to use.”

The cleaning system is still very effective, cleaning the tube bundles in a thorough and efficient manner. However, due to all of the design modifications, the FTCS is easier to use, safer, and even less expensive.

Upon request, GEA can provide specific details regarding a possible fin tube cleaning system installation.

Operation & Performance:

- High-pressure water is **systematically** and **uniformly** applied over a section of the fin tube bundle face area. Such an approach ensures a complete and thorough cleaning, which cannot be matched by using a conventional fire hose or hand wand.
- The system is extremely lightweight and is easily maneuvered along the condenser row on a library ladder style carriage (Figures 1 and 2). Every effort has been made to place the majority of the carriage weight at the bottom of the carriage resulting in an easily pushed carriage along the lower transfer rail.
- All components required to move between the sides of a row have been made as light as possible and are easily portable. Only the control box (approx 12 lbs), gear-motor (approx 15lbs) and the proximity sensor are required to move between the sides of the 18gpm system. The 9gpm system includes a portable pump that can be moved on the walkway around and between the ACC rows.
- Updated control logic automatically cycles the cleaning head up and down the bundle requiring only movement of the carriage down the row.
- By mounting a spring tensioned hose reel on each carriage, only a minimal amount of hose is required to move between the sides of each row. Each side of each row is equipped with a carriage, upper and lower transfer rails, hose reel, belt driven cleaning head, and linear actuator.
- FTCS effectively cleans both types of GEA’s fin tube bundles. GEA has field verified the performance of the FTCS for our A-tube, which utilizes two rows of tubes, and our Alex tube, which utilizes a single row of tubes. Tube bundle design and manufacture do not limit the ability of the FTCS to return performance of the ACC back to its design point.
- Two systems are available to fit the needs of large and small ACCs, a 9gpm unit and an 18gpm. Both systems operate at 2000psig. The only difference between options is the size of the portable high-pressure pump and connections between the pump and cleaning head assembly.
- Using an engineered cleaning system will provide for a more effective cleaning of the ACC, thus increasing the performance of the equipment and allowing for more power generation.

- **The new cleaning system is “operator friendly”. Such supporting characteristics are:**
 - Lightweight
 - Portable high pressure pump, gear-motor, and control box
 - All operator actions take place at the fan deck level...no need to traverse up the tube bundle face
 - Safe
 - Reduced size
 - Reduced weight
 - Improved design
 - Semi-automatic operation and control
 - Integrated human machine interface on portable control box
 - Convenient piping risers and quick release fittings from grade to the fan deck level.
 - No longer supported by the tube bundle sidewall...no more time delays associated with equipment binding
 - Flawless integration into existing ACC units, even with protruding air removal lines, as shown in figure 1.

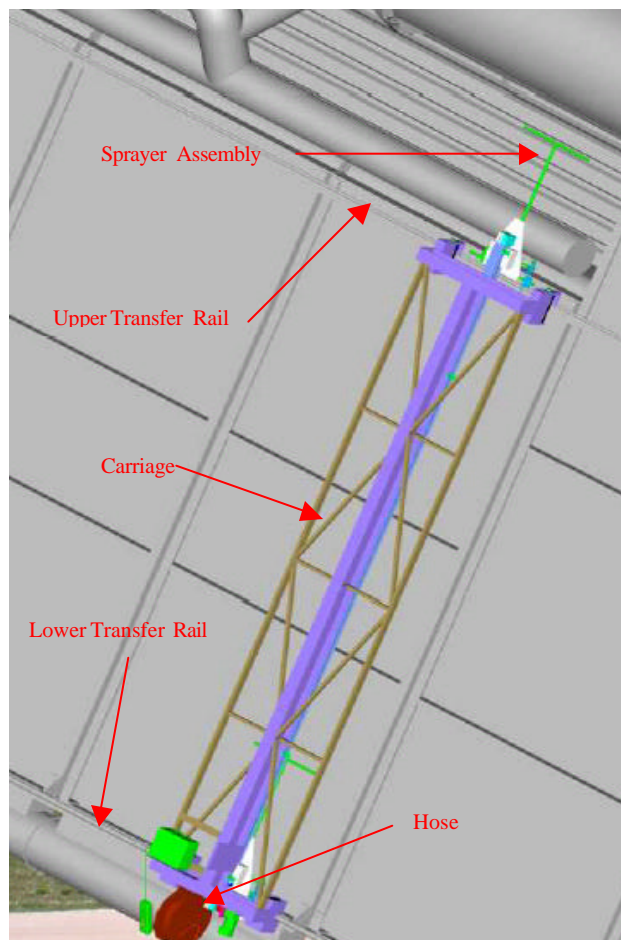


Figure 1 Basic Fin Tube Cleaning System

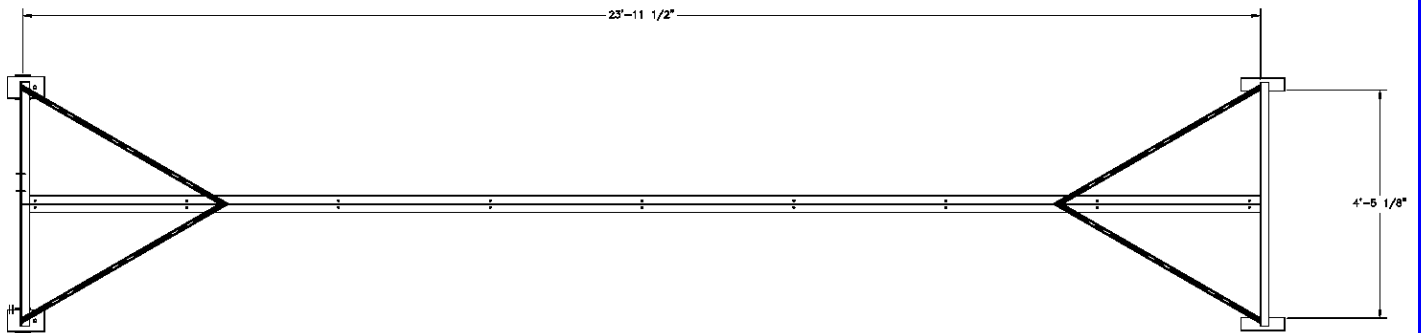


Figure 2 Basic Revised Carriage Design

- The payback for the investment costs of the FTCS is usually one year or less, depending on the condition of the ACC and the frequency of use. The thorough cleaning achieved with GEA's FTCS typically increases the airflow through the ACC by more than 35%. Such an increase in airflow can result in backpressure reductions of 1" HgA or more.

Results:

- The use of GEA's FTCS has consistently provided positive results in terms of an increase in ACC performance and subsequently, an increase in plant power generation capacity. Below are a few case studies:

CASE STUDY:

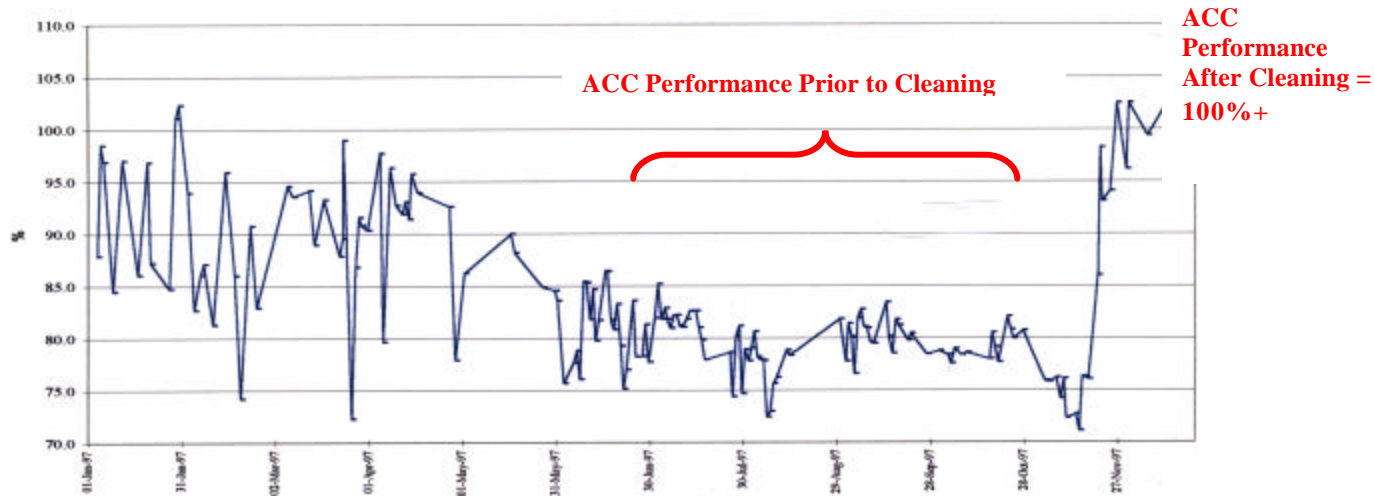


← Dirty Fin Tube Bundle



High-pressure Water Wash
from GEA's FTCS





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