

Basketed Element

Manufacturing Process and Quality Assurance

Our facility and machinery are continuously updated to assure our products will be the highest quality in the industry. These technological upgrades allow Paragon to produce with maximum efficiency and achieve short turnaround at low cost to the customer.

All phases of our manufacturing process are performed in accordance with ISO 9001 procedures. Manufacturing begins with our engineering department where:



Step 1	Step 2	Step 3	Step 4	Step 5
Each order receives an individual engineering review	Detailed manufacturing drawings are produced for each basket to conform with the customer's specific requirements	Approval drawings are sent to the customer to verify conformance with the customer's specifications	Mill certifications are established and obtained for all of the steel used to manufacture the basket element.	Material quantities are calculated and inventories are reserved to meet the production schedule

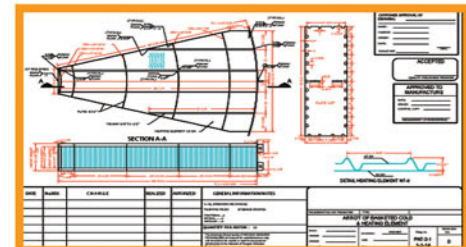


Paragon's production department works in conjunction with the engineering department and reserves resources to assure that the order will be manufactured and shipped to meet the customer's schedule. This process includes advance scheduling of machinery, manpower, materials and transport requirements.

The quality control department continually engages in proactive checks of machinery, workmanship, product dimensions and materials so that quality issues can be prevented, not just corrected. Quality monitoring is performed by Paragon's highly trained and well staffed quality assurance department.

Paragon provides a basket arrangement drawing and production drawings of the individual baskets to the customer in an Auto-Cad format prior to shipment. All baskets are labeled so they can be easily identified at the job site. Each basket is coated with sealant to prevent corrosion, placed on a pallet and wrapped in plastic to maintain its integrity during transportation and short-term storage after delivery.

Paragon's unparalleled technical knowledge/support, manufacturing, and field services provide the unique capability of working with customers to improve power plant performance and reliability in the most cost effective ways.



THE PARAGON PERFORMANCE SOLUTION

Airheater

DuraFlex Circumferential/Bypass Seals
The DuraFlex high-performance circumferential and bypass seals use a patented revolutionary interlocking design. This technique reduces the air gaps normally found in other circumferential or bypass sealing systems. The seals are designed to flex during rotor movement – preventing wear on the sealing rings.

DuraMax Radial Seals
DuraMax seals incorporate a unique, self-adjusting bellows that ensures positive contact with the sealing surfaces. The rugged construction of the seal guarantees that they will withstand erosion, corrosion and soot blowing. When sealing edge wear does occur, they can be reset, rather than replaced, reducing maintenance costs.

Basketed Element
The element comes in a variety of engineered configurations which the company manufactures to extremely tight tolerances. The manufacturing plant is ISO 9001 certified, which further assures product quality. Our engineering department analyzes every order to assure our customers achieve optimum performance and satisfaction.

Paragon's focus is placed on product engineering and manufacturing processes to ensure the highest quality, and the most efficient manufacturing process possible while delivering a high level of product features.



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Basketed Element

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The airheater is a rotary regenerative heat exchanger in which gases and air pass through a slowly rotating cylinder filled with heat transfer surfaces (basketed element). The gases heat the rotating element which in turn preheat the air before it enters the boiler.

Heat Recovery

In the airheater there is a heat recovery cycle. The continuously rotating cylinder, called the rotor is packed with thousands of square feet of specially formed sheets of heat transferable surface (heating element). As the rotor revolves (at 1 to 3 RPM's), waste heat is absorbed from the hot gas and passes through one half of the structure. This accumulated heat is released to the incoming air as the same surface passes through the other half of the structure. Thus resulting in a continuous heat transfer cycle, the element are alternately exposed to the outgoing gas and incoming air streams.



Heating Element

Paragon offers a full range of heating element surface configurations for both Ljungström® and Rothemüle™ airheaters. To assure optimum performance and life under a variety of plant environments, we use steel manufactured under the latest ASME standards – A1008 carbon steel and A606-04 for low alloy steel with enhanced corrosion resistance. Paragon provides mill certifications for all steel used to manufacture our element. The basketed element is built to the tightest tolerances in the industry. We manufacture each element sheet to precise geometric configurations and lengths to assure maximum heat transfer and airheater efficiency.

Recent changes to plants including the addition of SCR's and the conversion to PRB coal, have placed new emphasis on airheater element performance. The correct element configuration, material, thickness and rigid manufacturing quality control processes are vital to the performance of the unit. In addition to providing the best material and manufacturing quality in the industry, Paragon's proprietary heat transfer surface, ACE (Advanced Clear Element) provides the optimum gas flow dynamics to inhibit fouling and enhance cleanability, while providing improved heat transfer characteristics needed in today's environments.



Element Materials

Paragon can provide several high quality steels for use in airheater element. All steels used by Paragon conform to ASTM specifications and mill certifications are provided to our customers with each order.

Carbon Steel

Paragon supplies only ASTM 1008 steel whenever carbon steel element is specified. Steels conforming to the ASTM 1008 specification contain significant amounts of manganese, which, when combined with carbon, provides the steel with greater strength and more resistance to corrosion than mild grades of carbon steel.

Steels with Enhanced Corrosion Resistance

The Cor-Ten, ASTM A606-04 standard covers High Strength, Low Alloy (HSLA) steels with enhanced corrosion resistance. The corrosion resistance of these steels is measured and established using the ASTM G 101-04 standard (Standard Guide for Estimating the Corrosion Resistance of Low-Alloy Steels) and a corrosion index is established for each steel that corresponds to the material's resistance to material loss in corrosive environments. Based on the G101 standard, all ASTM A606-04 steels must have a minimum Corrosion Index (CI) of 6.0 (whereas most carbon steels have a CI of approximately 1.0).

Paragon can supply two different types of ASTM A606-04 steel:

- ASTM A606-04 Type 2 is a High Strength, Low Alloy (HSLA) steel with Enhanced Corrosion Resistance with a corrosion index (CI) of 6.0.
- ASTM A606-04 Type 4 is a High Strength Low Alloy (HSLA) steel similar to Type 2 but with additional Chromium and Nickel alloying elements that establish a corrosion index (CI) of 8.0.



NOTE: In recent years, some materials used for airheater element have been described as "LACR" or "Low Alloy Corrosion Resistant." These designations are essentially meaningless as they do not fall under any ASTM standard nor the standards of any other government agency. Metallurgists consider these terms to be both ambiguous and irrelevant as there is no minimum alloy requirement or corrosion resistance standard associated with these descriptions.

Steels which conform to the ASTM A606-04 standard must meet specific chemistry requirements and must have an established Corrosion Index established by the G101-04 standard. Such steels are correctly identified in the steel industry as High Strength Low Alloy steels with Enhanced Corrosion Resistance.

THE AIRHEATER PERFORMANCE EXPERTS

Element Types

ACE - 8 Series

The ACE (Advanced Clear Element) design is the optimum solution for most air heater element problems in today's power plant environment. ACE element not only provides a lower pressure drop than other available element, but its unobstructed flow pattern greatly reduces plugging from ash and ABS, and enables the element to be easily cleaned throughout its entire depth with normal soot blowing. The non-fouling and clean-ability attributes of ACE element are far superior to the DU7™, DN7™, and DL7 element.

DU Series

The DU (Double Undulated) Series of hot and intermediate layer element has been the mainstay of the industry for many years. Paragon produces the full array of DU element including the standard DU 2.9-2.5 as well as the less common DU 3.4-2.3 and the newer, DU7™ element. The common characteristic of DU element is the alternating stacking of "Undulated" element sheets with sheets that contain both undulations and notches. The increasing number designations represent the increase in spacing between adjacent sheets.

DN Series

The DN (Double Notched) series of element profiles (ranging from DN2.9 to DN7) offer reduced fouling and better clean-ability when compared with the equivalent DU elements, while maintaining similar pressure drop and heat transfer characteristics. Unlike DU, DN element contains notches as well as undulations on all of the element sheets.

DL Series (Loose packed)

The DL (DN Loose Pack) series of element profiles offers enhanced cleanability with coals such as PBR that tend to produce "soft" ash deposits in the airheater. The configuration of DL element is identical to that of DN; however the element are stacked loosely within the baskets allowing them to move back and forth up to one inch during soot blowing. This movement allows soft ash deposits to work their way through, and out of the airheater. DL element profiles can only be used in airheaters with vertical shafts.

FNC

FNC (Flat Notched Crossed) element has higher thermal performance and lower pressure drop than standard DU element. It is mainly used in low fouling applications such as oil and gas since it is extremely difficult to clean. With the advent of SCR systems that can produce ABS fouling, FNC element is often replaced with easier to clean element configurations.

NF Series

NF (notched flat) element has been a mainstay for cold end element for many years. Although relatively low in thermal efficiency, its wide open configuration (axial oriented Notched sheet followed by a Flat sheet) makes NF element ideal for the cold end of coal fired units where condensation combines with ash resulting in plugging and corrosion. The most common configurations of NF element are NF6 which has large, open spaced notches and is ideal for high ash coals and NF3.5 for low fouling fuels with high acid dew points. NF element is usually provided in the thicker 18 gauge steel for increased life, and because of the corrosive environment in the cold end, Paragon produces NF element using High Strength Low Alloy (HSLA) steel with Enhanced Corrosion Resistance in conformance with the ASTM A606-04 standard.

NU Series

NU (Notched Undulated) is similar to NF but contains an undulated sheet in place of the flat sheet used in NF. NU has better heat transfer characteristics than NF and can be used on cold end applications where the potential for plugging is low.

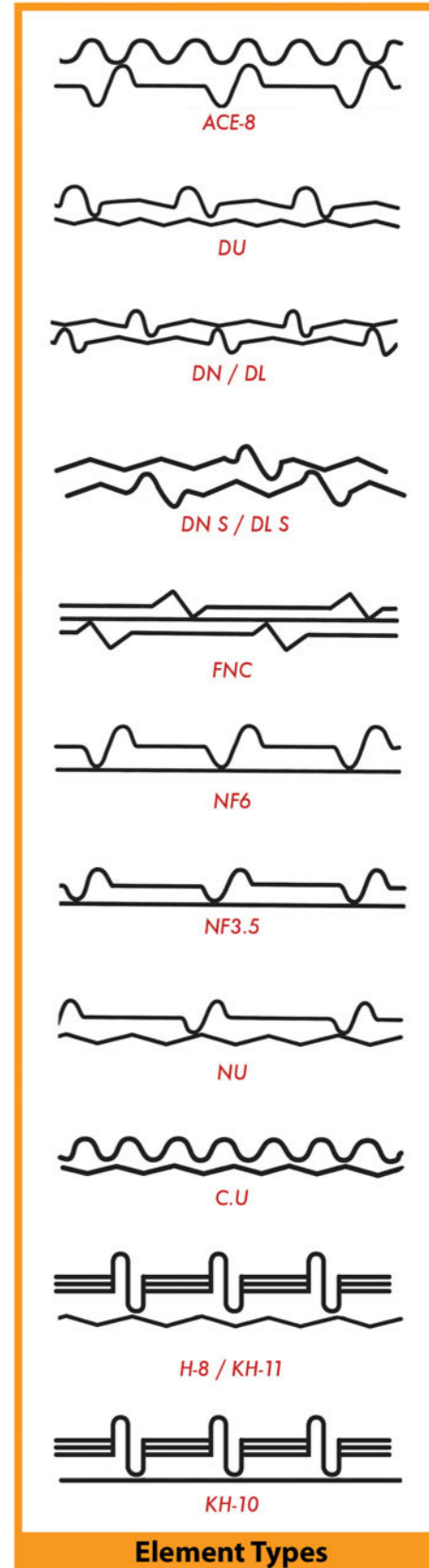
CU Series

CU (Corrugated Undulated) profiles are typically used only in natural gas fired units. CU is a compact, exceptionally high thermal efficiency element but with correspondingly high pressure drop characteristics as well. This element is most suitable when used with the low density flue gasses produced when firing natural gas.

ROTHEMÜLE™ AIRHEATER ELEMENT

Regenerative airheaters manufactured under the Rothemüle™ license employ a stationary rotor and use a unique element design which includes an embossed pattern in addition to notched and undulated patterns in order to achieve its unique performance characteristics. Paragon is the only company in North America that manufactures the actual Rothemüle element configurations, H-8, KH-10 and KH-11.

Rothemüle™ is a trademark of its respective company. Ljungström® is a registered trademark of ABB Air Preheater, Inc.



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