



AKER KVAERNER CHEMETICS



Modular – Radial Flow Exchanger

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Agenda



- Introduction to Aker Kvaerner Chemetics
- Radial Flow Gas/Gas Exchangers (General)
- Recent Large Projects
- Development of Modular Radial Flow Gas/Gas Exchangers (patent pending)

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Introduction to Chemetics

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Chemetics THE BEGINNING



- Late 60's - R & D Division of C.I.L. (C.I.L. Operating Acid Plants)
- Chemetics H₂SO₄ Innovations:
 - Early 70's - Annodically protected Acid Coolers
 - Late 70's - Radial Flow Gas/Gas Exchangers
 - Early 80's - Stainless Steel Converter
 - Early 80's - SARAMET
- 1982 - First Complete H₂SO₄ Plant
- 2005 - >30 plants, 300 - 4400 MTPD

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Chemetics' Capabilities



Headquarters - Chemetics Vancouver Office (200 People)

- Research & Development
- Multi-Discipline Engineering
- Project Engineering and Management
- Proprietary Equipment Design & Fabrication
- Hazard and Operability Studies
- Construction Services
- Commissioning
- Technical Services

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Chemetics Equipment Division, Toronto



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A leading global provider of engineering and construction services, technology products and integrated solutions



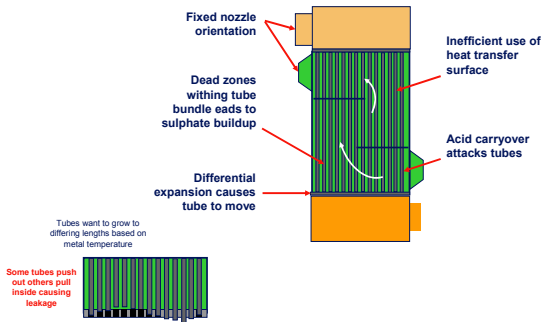
- Norwegian company, headquarters in Oslo
- Annual revenues of approximately 4.5 billion USD
- 22,000 people employed world-wide
- Offices and operations in more than 30 countries
- > 200 in Brazil (offices in Belo Horizonte, Rio, Curitiba)

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Radial Flow Heat Exchangers

Conventional Heat Exchanger



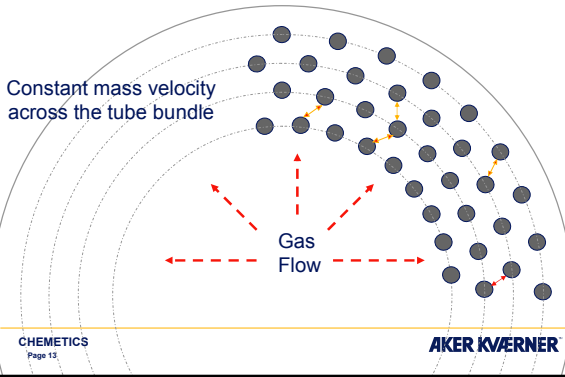
Classical Heat Exchanger



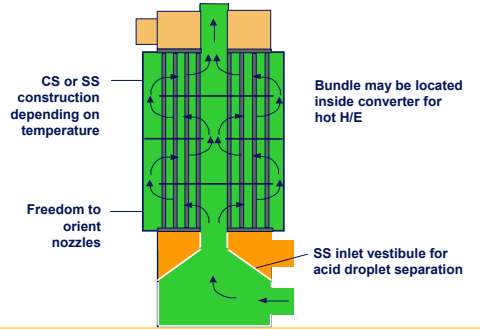
Acid attack and sulphate buildup in Inlet Gas region blocking flow area



CHEMETICS Proprietary Heat Exchanger



Radial Flow Gas/Gas Heat Exchanger



Radial Flow Gas/Gas Heat Exchanger



Inco Exchanger, Sudbury (2003)



Thai Copper Exchanger



Ready for shipment from CED plant Toronto Canada.

Sasal Agri Exchanger (2002)



All stainless Reheat Exchanger installed at Sasol Agri., (South Africa) July 2002 during phase 2 of acid plant retrofit

Radial Flow Heat Exchanger



Features & Benefits

- Optimum heat transfer efficiency
 - Design can be optimized for balance between Heat Transfer Rate and Pressure Drop
- High integrity mechanical design
 - Minimal differential stresses across tubesheet and between tubes and shell

» Over 300 in service «

Radial Flow Heat Exchanger



Remaining Potential Problem

- For large plants, shipping of fully assembled exchanger can be problematic:
 - If there are shipping constraints (tunnels, etc), may be impossible to ship;
 - If it can be shipped, bulk freight is generally expensive compared to containerization.

For Instance.....WMC, Australia



Radial Flow Heat Exchanger



Solution: Field Erect Exchanger

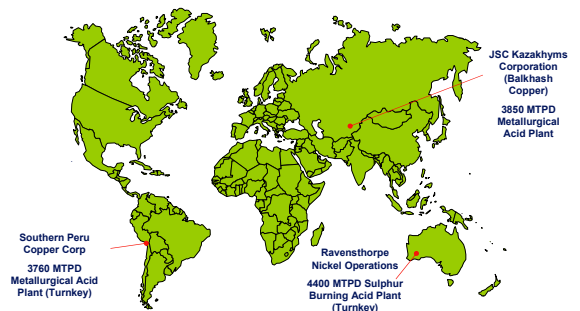
- Disadvantages:
 - High Construction costs;
 - Longer Construction Schedule;
 - Potentially lower quality control on welds.

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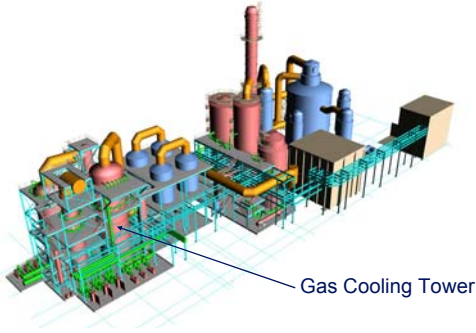


Recent Major Projects

Chemetics Contracts (May-Aug 2004)



SPCC Plant (3D Model View)



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SPCC Vessel



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SPCC Site, Sept 2005



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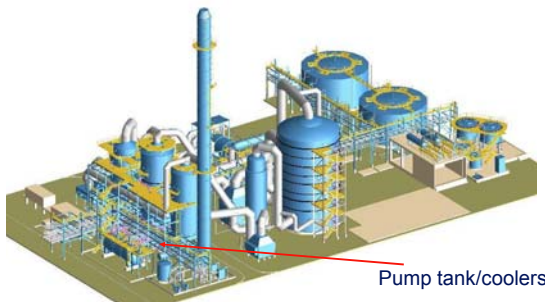
SPCC SARAMET™ Pipe Distributor



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Ravensthorpe Plant (3D Model View)



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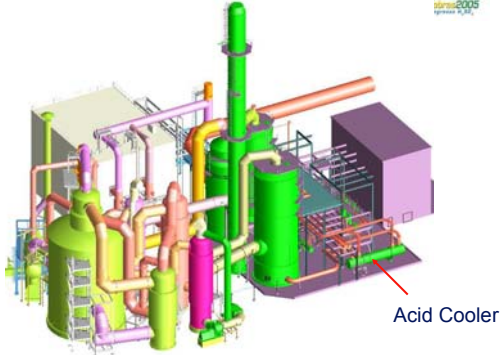
Ravensthorpe Site (Sept 2005)



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Balkhash Plant (3D Model View)



Acid Cooler, Balkhash Copper (2005)



Balkhash Copper - Location



Balkhash Copper Smelter

Balkhash Acid Plant



Challenges:

- Very large acid plant (3850 MTPD, single line);
- Very remote location;
- Lack of skilled construction labour (particularly for Stainless Steel welding);
- Rail only practical means of transport;
- Major transport constraints: 3.5m x 3.5m:
 - Wet ESP's (shells);
 - FRP vessels;
 - **Gas/Gas Exchangers (largest 6m diameter).**

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Modular Radial Flow Exchangers

Modular Radial Flow Exchanger



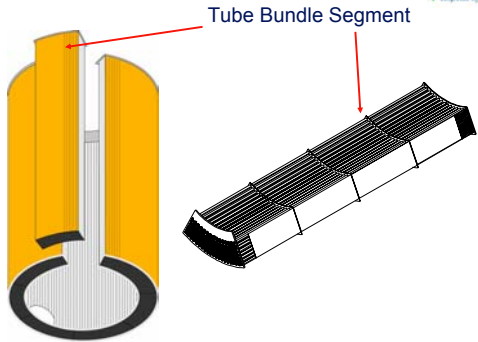
Challenge:

- Find an economic means of modularizing radial flow gas/gas exchangers so that they can be shipped in standard containers;
- Maintain shop quality of critical welds;
- Minimize site installation cost;

Solution:

- **"Orange Segment" approach;**

Modular Radial Flow Exchanger



Modular Radial Flow Exchanger



Advantages

- Segments can be containerized to reduce freight costs;
- All critical tube to tubesheet welds carried out in the fabrication facility to insure high quality;
- Minimizes field site labour and construction schedule compared to complete field erection;
- Overall “turnkey” cost of exchanger is lower (depending on site specifics);

PATENT PENDING

Exchanger Segment Loading



Exchanger Segment Loading



Exchanger Segment Loading



Modular Radial Flow Exchanger



Conclusions

- The Modular Radial Flow Exchanger now offers owners the advantages of radial flow exchangers:
 - Superior performance (lower pressure drop);
 - Lower maintenance cost;
- coupled with the opportunity to reduce the total freight and construction costs, while maintaining high quality;
- The Modular Radial Flow Exchanger is particularly well suited to remote plant locations;
 - The design should also be considered for retrofits to reduce the cost and schedule impact;



THANK YOU!