

# Yellowstone ACC Rebundle Project

Presented at the ACC Users Group Annual Conference  
San Diego, CA – September 22 – 25, 2014

By:



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## **YELLOWSTONE POWER PLANT AIR COOLED CONDENSER**

Owner: Yellowstone Energy Limited  
Partnership (YELP) & Billings Generation Inc.

Operator: Rosebud Operating Services, Inc.

Owner's Engineer: Burns Engineering  
Services, Inc.

Original ACC OEM: Zurn Balcke-Durr



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## **Yellowstone Power Plant Air Cooled Condenser**

- Located in Billings, Montana,
- 70 MW (Gross) Cogeneration Plant, Petroleum Coke Fired,
- Process Steam Supplied to the Exxon-Mobil Refinery,
- Air Cooled Condenser, 10 Fan Cells with 26' Diameter Fans,
- 3 Row Galvanized Steel Elliptical Fin Tube Heat Exchangers,
- Commissioned in 1995.



Frozen Tube Damage

**2011 YELP Presentation at the ACCUG  
Conference Noted:**

- Frozen Tube Damage
- Debris Trapped Behind Support Beams
- Tube Holes at Tube/Header Connections
- Severe Debris Build Up on Tube Fins
- Debris consists of Cottonwood Tree Pollen, Coke, Dust, and Flyash

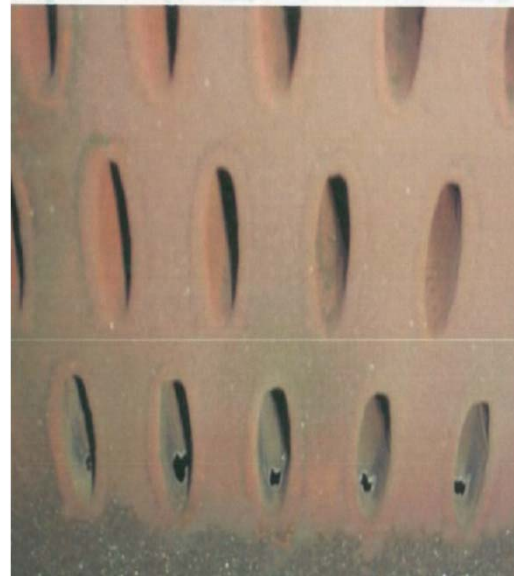


Corrosion Build-up Behind Support Beam

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Tube Holes at Tube/Header Connections



Severe Debris Build Up on Tube Fins

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### **YELP Rebundle Project Technical Requirements:**

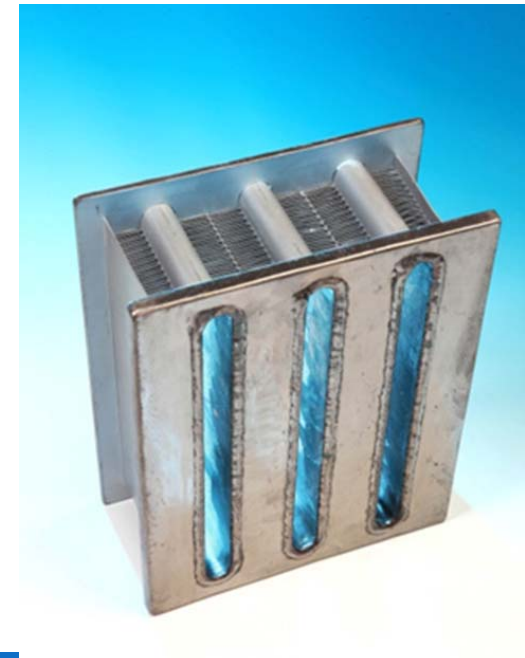
- Single Row Finned Tube Heat Exchanger Design
- New Design to be Compatible with Existing ACC Geometry & Equip
- Operable with Proven Freeze Protection System to -30°F





## ALEX® Heat Exchanger Bundles: Single Row, Carbon Steel, Aluminum Fin

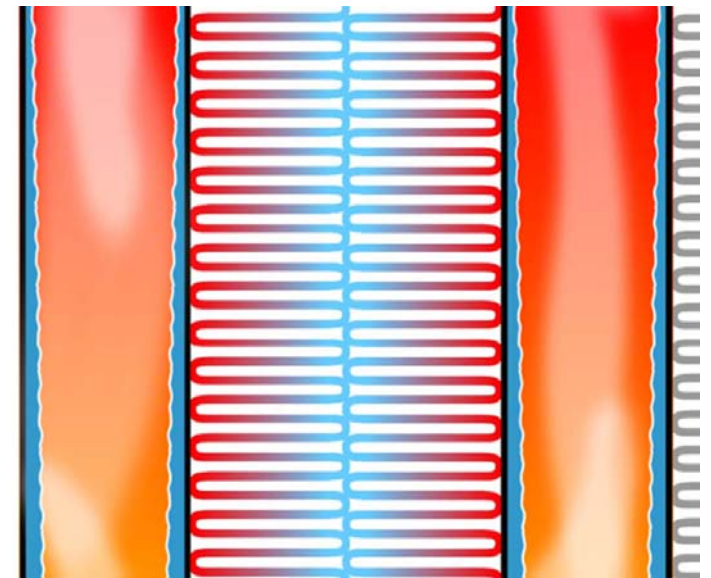
- Manufactured Exclusively in GEA Owned and Controlled Factories
- Lightweight Heat Exchanger with High Structural Rigidity
- Factory Vacuum Test Performed on Entire Bundle; not Individual Tubes
- Straight-through Fins Offer Superior Cleanability (high pressure water spray)





## Freeze Protection Improvements:

- Single row tube design inherently more freeze resistant than multi-row tube designs.
- Prior to rebundle, no control logic was being utilized contributing to the widespread freeze damage.
- Control logic to prevent freezing of the ACC down to  $-30^{\circ}\text{F}$ .
- This logic has proven successful in numerous ACC installations around the world including Canada, Alaska and Siberia.



ALEX<sup>®</sup> Heat Exchanger Bundles Delivered And Preassembled Into Four Bundle Subassemblies.





ALEX<sup>®</sup> Finned Tube Heat Exchanger Bundles were preassembled and stored on a temporary frame, sized to the actual ACC Dimensions.



Pre-Outage activities were utilized where possible to reduce outage duration.





First Steam Riser Duct Elbow  
being removed.





Existing Finned Tube Heat Exchanger bundles being removed.



The existing Fan Deck was modified and new slide bars were installed. New cell partition walls were installed to accommodate the revised bundle pitch angle.



The new ALEX<sup>®</sup> Fin Tubed Heat Exchanger Bundles installed.



Air Removal Pipe headers welded to the Dephlegmator cells.





New Steam Distribution Duct sections.



Wind wall installation.





The existing Steam Distribution  
Duct Elbow was reused with new  
Expansion Joints.



The newly rebundled YELP ACC awaiting the final piece of wind wall metal siding.



**Rebundle Project Results**

	ZBD Original Design	Pre Outage Test 4/15/14	Rebundle Guarantee/Comparable*	Post Outage Performance Test 9/15/14
Turbine Exhaust Steam Flow (Lbs/Hr)	463,700	480,570	523,677/481,800	
Dry Bulb Temperature	83°F	52.5°F	83°F	
Turbine Back Pressure (Inches HgA)	7.5	6.45	8.41/7.5	
ACC Thermal Performance	100%	65% **	100%/103.8%***	109.3%****

\* Comparable value selected at same ambient temperature and turbine backpressure. Under similar ambient conditions and backpressure, the rebundled ACC has a calculated design improvement in steam flow of ~3.8%

\*\* Not a Code Test, Estimated Performance based on Data from Plant Instrumentation and the ZBD Original Design Performance Curves

\*\*\* Rebundle Design Heat Load Capacity exceeds the Original OEM Design by 3.8 %

\*\*\*\* ACC performs 9.3% above the design, in terms of steam flow admittance



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- Preassembly & Installation Duration - 3 months
  - All Material Delivery and Installation on Schedule
  - Effort Completed on Budget
  - Zero Recordable Incidents
  - New ALEX<sup>®</sup> Design Provides More Generating Capacity for Life of the Plant
  - ACC Performance Test Result: 109.3 % of Current Contract Guarantee