

SPG Dry Cooling

ACC Commissioning & Critical Spares

ACC User's Group 2026 Annual Conference - Clarksville, TN

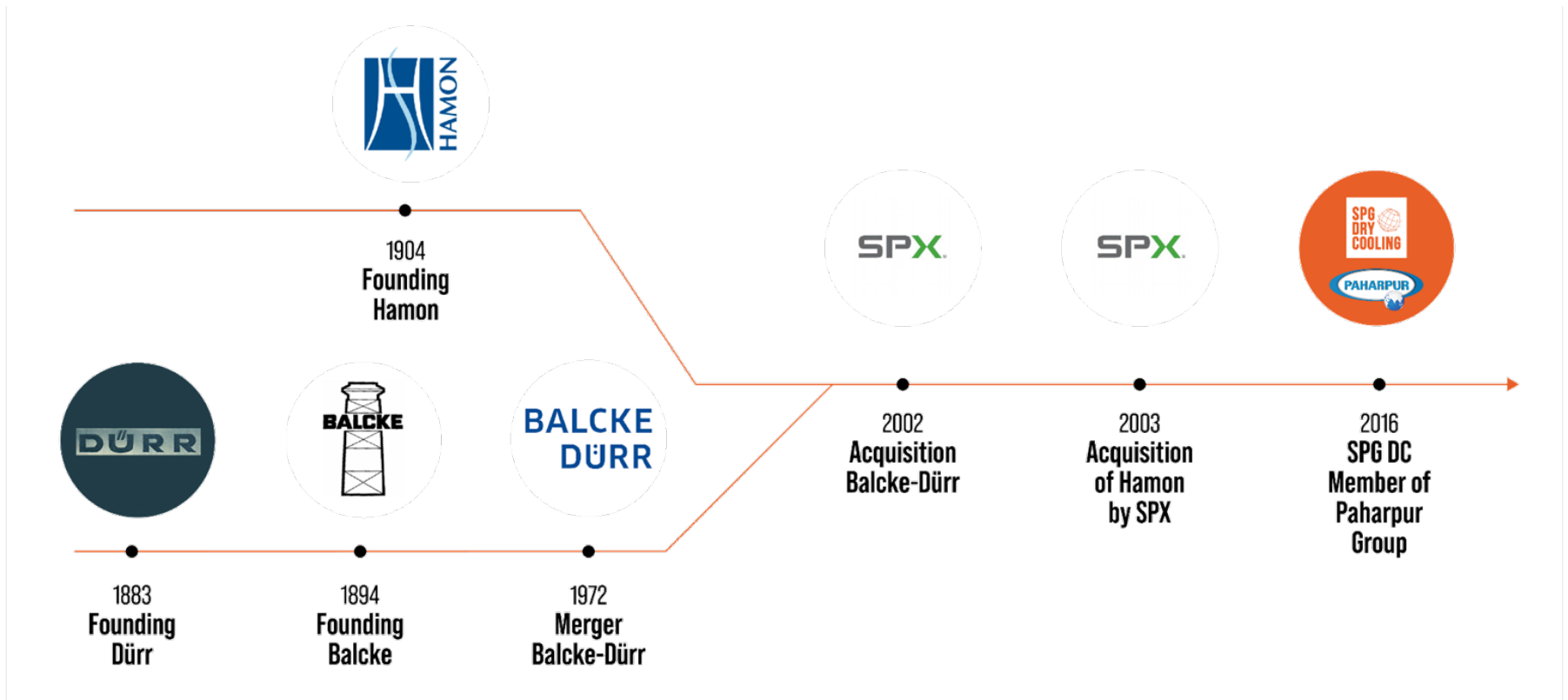
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Agenda

1. Introduction to SPG
2. Commissioning Check List Overview
3. Functional Description & Fan Step Logic
4. Critical Spare Parts
5. ACC Maintenance Items

Introduction to SPG

SPG Dry Cooling History 1883 - Present





ACC – CUMBERLAND CITY – 1,450 MW – TENNESSEE
Combined Cycle Power Plant



Commissioning Check List

Commissioning Check List

 SPG DRY COOLING		AIR COOLED CONDENSER - ACC COMMISSIONING CHECK LIS			
Customer :		Date : 18 August 2025			
Plant :		Doc. Nr. :			
SPG Ref. Nr. :		Rev. : A			
AIR COOLED CONDENSER COMMISSIONING CHECK LIST  SPG Ref. Nr.:					
-	06/05/24	First issue	PLER	MS	GO
REV.	DATE	REVIEW	ISSUED	APPROVED	RELEASED

- Provided to EPC

Commissioning Check List – Mechanical Equipment

Pressure Test

Fan & Motor

- Fan motor power consumption test
- Fan pitch angle setting
- Motor, fan, and gearbox re-torque verification after run-in period (24 hours)
- Motor-to-gearbox coupling alignment check (close-coupled / driveshaft)
- VFD commissioning and operational verification (if applicable)

Commissioning Check List - Gearboxes

- Flushing of gearbox preservation oil
- Addition of OEM-specified operating oil
- Greasing of low-speed shaft (LSS)
- Mounting bolt torques, LLS verticality
- Vibration sensor/switch setup
- Verification of:
 - Oil Pressure, Flow, & Level switch
 - Temperature Probe (RTD)
 - Oil pump
 - Oil heater

Commissioning Check List – Steam Isolation Valves (SIV)

- SIV operation and seating verification
 - Inspection using feeler gauges to confirm proper sealing
- Actuator & Gearbox testing
- Zero and span calibration



Commissioning Check List – I & C

Calibration and Functional Checks

- Instrument zero and span verification
- Pressure transmitter calibration and redundancy verification
- Temperature transmitter calibration

Level Instrumentation

- Drain pot level transmitters
- Condensate tank level transmitters

Commissioning Check List – Structural & Ducting

- Inspection and cleaning of:
 - Turbine Exhaust Duct (TED)
 - Risers
 - Steam ducts / Condensate ducts
- Verify sliding plates are free for thermal expansion and contraction
- Confirm shipping restraints/brackets have been removed

Commissioning Check List – Steam Jet Air Ejector (SJAE)

Equipment

- Holding, Hogging, and DA SJAE operational testing
- Steam blow completion verification
- Steam trap(s) functional testing

Valves & Instrumentation

- Flow meter operation (RheoVac)
- Instrumentation calibration & functionality
- Vacuum isolation valves seating and operation
- Steam isolation valve operation

Motive Steam

- Verify motive steam Temperature & Pressure within OEM specification

Commissioning Check List – Liquid Ring Vacuum Pump (LRVP)

Motor

- DE and NDE bearing greasing
- Excessive vibration & noise
- Bearing temperature verification
- E-stop functionality test

Gearbox & Pump

- Lubrication inspection
- Preservation oil flush
- Alignment verification of all components
- Instrumentation and valve function checks
- Seal water level and flow verification
- Gland packing leakage rate adjustment (if applicable)
- Plate heat exchanger performance verification (ΔT)
- Removal of temporary suction-side filter after first week of operation

Commissioning Check List – Cleaning System

- Cleaning system is typically one of the final items to be shipped/installed
- Installation verification, water and power, blow out lines
- Operational testing and training
- Cleaning performed prior to performance test (potential ~17% performance impact)

Functional Description & Fan Step Logic

Functional Description

			
	Project		Functional Description
	Client		
	Plant		
	Location		Sheet 1 of 64

FUNCTIONAL DESCRIPTION

FOR

AIR COOLED CONDENSER

REV.	DATE	REVIEW	ISSUED	APPROVED	STATUS
-	11/11/2022	Initial Release	GDU	JNE	FC
A	12/17/2022	Miscellaneous revisions	GDU	JNE	FA
B	08/22/2023	Miscellaneous revisions	GDU	JNE	FA
C	10/17/2023	Miscellaneous revisions	GDU	JNE	FA
D	02/16/2024	Update Section 4.1.1.4	GDU	JNE	CFC
E	04/24/2024	Update Section 4.1.1.4, 4.5.11 & 5.5.1	RTD		

LEGEND:

- FI = FOR INFORMATION
- FC = FOR COMMENTS
- FA = FOR APPROVAL
- PREL = PRELIMINARY
- CFC = CERTIFIED FOR CONSTRUCTION
- ASB = AS BUILT

- ACC Theory of Operation
 - Equipment Tag List
- ST Alarm, Bypass, & Trip set points
 - Back pressure, Temperature
- Fan Motor Alarm & Trip set points
 - Vibration
- Alarm Levels:
 - Condensate Tank Level HH / LL
 - Drain Pot HH
 - Condensate Tank Heater On/Off
 - LRVP Separator Tank Levels
- Fan Control Steps
 - Freeze Protection Logic

Fan Step Control

Client
Location
Document

Document Reference
Project Nr

FAN CONTROL STEPS

Step	Street 1 FAN-01					Street 2 FAN-02					Street 3 (*) FAN-03					Street 4 (*) FAN-04					Steam Isolation valve			Step
	1A	1B	1C	1D	1E	2A	2B	2C	2D	2E	3A	3B	3C	3D	3E	4A	4B	4C	4D	4E	01-MOV ACC121	01-MOV ACC122	01-MOV ACC123	
00 ^{1,2}	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	open	open	open	00 ^{1,2}
0 ¹	n	n	n	n	n	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	closed	closed	closed	0 ¹
1	n	1/2	n	n	n	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	closed	closed	closed	1
2	n	1/2	n	1/2	n	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	closed	closed	closed	2
3	n	1/2	n	n	n	0	0	0	0	0	n	1/2	n	n	n	0	0	0	0	0	closed	open	closed	3
4	n	1/2	n	n	n	0	0	0	0	0	n	1/2	n	1/2	n	0	0	0	0	0	closed	open	closed	4
5	n	1/2	n	1/2	n	0	0	0	0	0	n	1/2	n	1/2	n	0	0	0	0	0	closed	open	closed	5
6	n	1/2	n	1/2	n	0	0	0	0	0	n	1/2	n	n	n	n	1/2	n	n	n	closed	open	open	6
7	n	1/2	n	1/2	n	0	0	0	0	0	n	1/2	n	n	n	n	n	1/2	n	1/2	closed	open	open	7
8	n	1/2	n	1/2	n	0	0	0	0	0	n	1/2	n	1/2	n	n	n	1/2	n	1/2	closed	open	open	8
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12	n	1/2	n	1/2	n	n	1/2	1/2	1/2	n	n	1/2	1/2	1/2	n	n	n	1/2	n	1/2	open	open	open	12
13	n	1/2	1/2	1/2	n	n	1/2	1/2	1/2	n	n	1/2	1/2	1/2	n	n	n	1/2	1/2	1/2	open	open	open	13
14	n	1/2	1/2	1/2	n	n	1/2	1/2	1/2	1/2	n	1/2	1/2	1/2	1/2	n	n	1/2	1/2	1/2	open	open	open	14
15	n	1/2	1/2	1/2	1/2	n	1/2	1/2	1/2	1/2	n	1/2	1/2	1/2	1/2	n	n	1/2	1/2	1/2	open	open	open	15
16	n	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	n	n	1/2	1/2	1/2	open	open	open	16
17	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	open	open	open	17
18	1/2	1/2	1/2	1/2	1/2	1/2	1	1/2	1/2	1/2	1/2	1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	open	open	open	18
19	1/2	1	1/2	1/2	1/2	1/2	1	1/2	1/2	1/2	1/2	1	1/2	1/2	1/2	1/2	1	1/2	1/2	1/2	open	open	open	19
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22	1/2	1	1/2	1	1/2	1	1	1/2	1	1/2	1	1	1/2	1	1/2	1/2	1	1/2	1	1/2	open	open	open	22
23	1	1	1/2	1	1/2	1	1	1/2	1	1/2	1	1	1/2	1	1/2	1	1	1/2	1	1/2	open	open	open	23
24	1	1	1/2	1	1/2	1	1	1	1	1/2	1	1	1	1	1/2	1	1	1/2	1	1/2	open	open	open	24
25	1	1	1	1	1	1/2	1	1	1	1	1	1	1	1	1/2	1	1	1	1	1/2	open	open	open	25
26	1	1	1	1	1	1/2	1	1	1	1	1	1	1	1	1	1	1	1	1	1/2	open	open	open	26
27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	open	open	open	27

LEGEND

0 = Isolated

n = Natural Convection

1/2 = Motor at 1/2 speed

1 = Motor at full speed

1: Step 00 to be applied during hogging at all ambient conditions

2: For non-freezing conditions (Air temperature > -3 °C), start with step 00 then steps 9 to 27

3: Steps 0 to 12 to be applied during freezing conditions (air temperature < -3 °C)

4: Steps 18 to 27 are only available for air temperature > 10 °C

Remark : (*) Street 1 : no isolation valve

Revision	-	A	B	C	D	E
Date	22-May-23					
Issued	GDA					
Approved	CBR					
Released	JNE					
Status	PRF					

Recommendations

- VFDs
- Weather Station
 - Wind speed and direction
 - Temperature
- Saturation Temperature Indication on ACC DCS Screen
- Operator training after start-up, in the fall
 - Freeze protection
- RheoVac Air In-leakage Monitor
 - Water vapor to air mass ratio (m_{wv}/m_a); Vacuum quality
 - Air In-leakage (All non-condensables)
 - Total mass flow (SJAЕ)
 - Total volumetric flow (LRVP)
- Clean after handover from EPC



ACC Critical Spares

Critical Spare Parts – 25 Cell ACC

Rupture Discs, QTY = Total + 2

- Maintain total installed quantity + 2 spare sets
- Include 2 gaskets per rupture disc

Complete Spare Fan Assembly, QTY = 2

- Fan blades (full set)
- Hub
- Coupling Flange
- Mounting hardware

Spare Coupling Flanges QTY = 2

- Gearbox low-speed shaft (LSS) coupling flanges
- Recommended due to removal/installation difficulty during gearbox replacements

Complete Gearbox Assembly, QTY = 2

- Oil Pump, QTY = 2
- Seal Kit, QTY = 2
- Motor to Gearbox coupling, QTY = 5
 - Close-coupled configuration
 - Driveshaft configuration

Critical Spare Parts – 25 Cell ACC

Instrumentation

- Vibration Sensors/Switches, QTY = 2
- Vibration Sensor Transmitters, QTY = 2
- Pressure Transmitter, QTY = 3
- Temperature Transmitter, QTY = 2

Steam Jet Air Ejector (SJAE)

- Steam trap rebuild kits, QTY = 2
- Steam chest gasket set, QTY = 1

Liquid Ring Vacuum Pump (LRVP)

- Mechanical seal kit (if applicable), QTY = 1
- Bearings, gasket, o-ring kit, QTY = 1

Spare Fan Motor, QTY = 1

Steam Isolation Valve (SIV)

- Complete set of shaft seals, QTY = 1



Critical Spare Parts

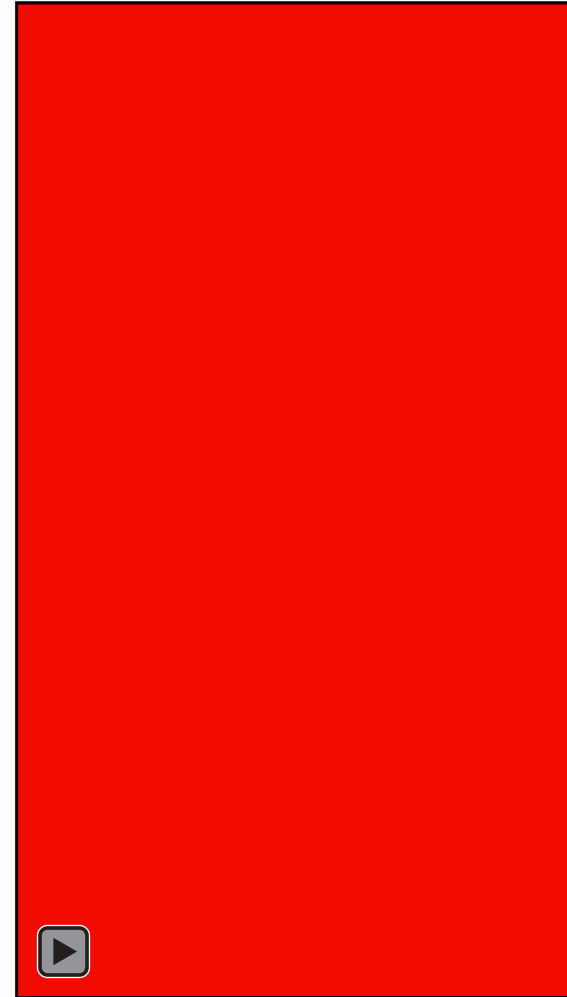
Recommended Stocking Philosophy

Maintain sufficient inventory to support:

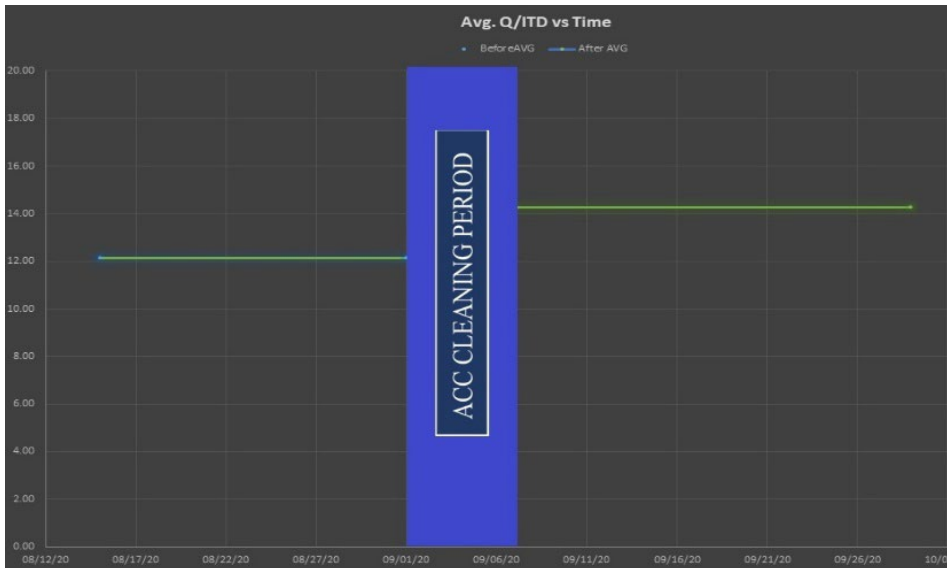
- Forced outage response time
- Planned gearbox maintenance programs
- Instrumentation failures
- Vacuum equipment maintenance
- Vacuum envelope repairs
 - Rupture Discs
 - Manway gaskets
 - RTV and Foil Tape
- **Long lead time equipment replacement**

ACC Maintenance Items

Cleaning System – A Frame Application



Cleaning – When and How Often?



- ACC Commissioned January 2019 (PJM Market)
- Cleaned September 2019
- 17% Performance Improvement
- 0.7 inHG on 85°F Back Pressure Decrease (Improvement)
- < 30 Day ROI

Cleaning – When and How Often?



Construction foulants (dirt)
removed during initial cleaning

Helium Leak Detection

Vacuum Decay Test Failure = Vacuum equipment not functioning correctly and/or leaks present in vacuum envelope.

Helium is sprayed around potential leak areas and the magnitude is detected downstream by a mass spectrometer.

The entire ACC vacuum envelope is inspected.

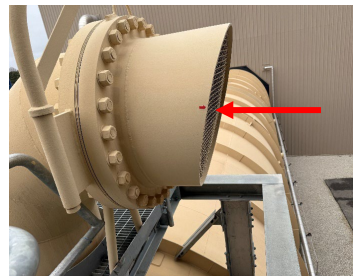
Typical leak locations include:
LP turbine hood, Expansion joints, TED, Rupture discs, MOVs, Deaerator tank, SJAE, CCM & SDM



Bundle Inspection



Vacuum Pump Iso Valve



Rupture Disc



LP Hood Manway

IR Thermal Imaging

IR Camera Thermal Imaging is a valuable tool for getting insight of how well air is being removed from your ACC bundles. Proper air removal is key to heat transfer efficiency. SPG provides this service with every helium leak detection.



Small amount of air. Good finish



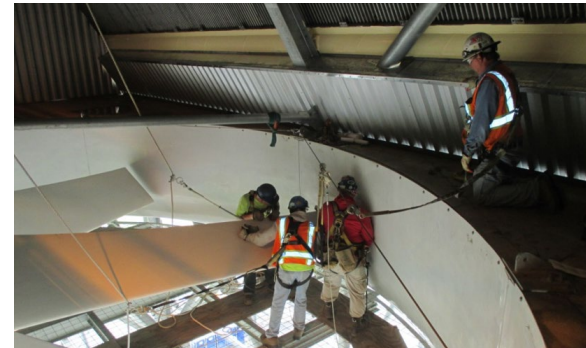
Large amount of air

Air Moving Equipment Inspections – Yearly

Rotating equipment, fan, gearbox, motor should be inspected at least once a year

Torque checks to OEM Specification

- Motor to gearbox bolts
- Gearbox to fan bridge bolts
- Gearbox to fan hub bolts
- Fan hub to fan blade clamp bolts



Fan blade tracking, clearances (fan stack), pitch angle, cleanliness and condition

Gearbox oil sampling/change, grease, oil pressure switch, breather & vibration switches

Motor grease (DE & NDE)



Other Inspections

Condensate & Drain Pot Pump inspections

- Bearings
- Seals

Instrumentation – Periodic inspection and calibration

- Pressure transmitters and indicators
- Temperature transmitters and indicators

Steam Jet Air Ejector (SJAE)

- Inner/After Condenser ΔT
- Condenser steam trap(s)

Liquid Ring Vacuum Pump (LRVP)

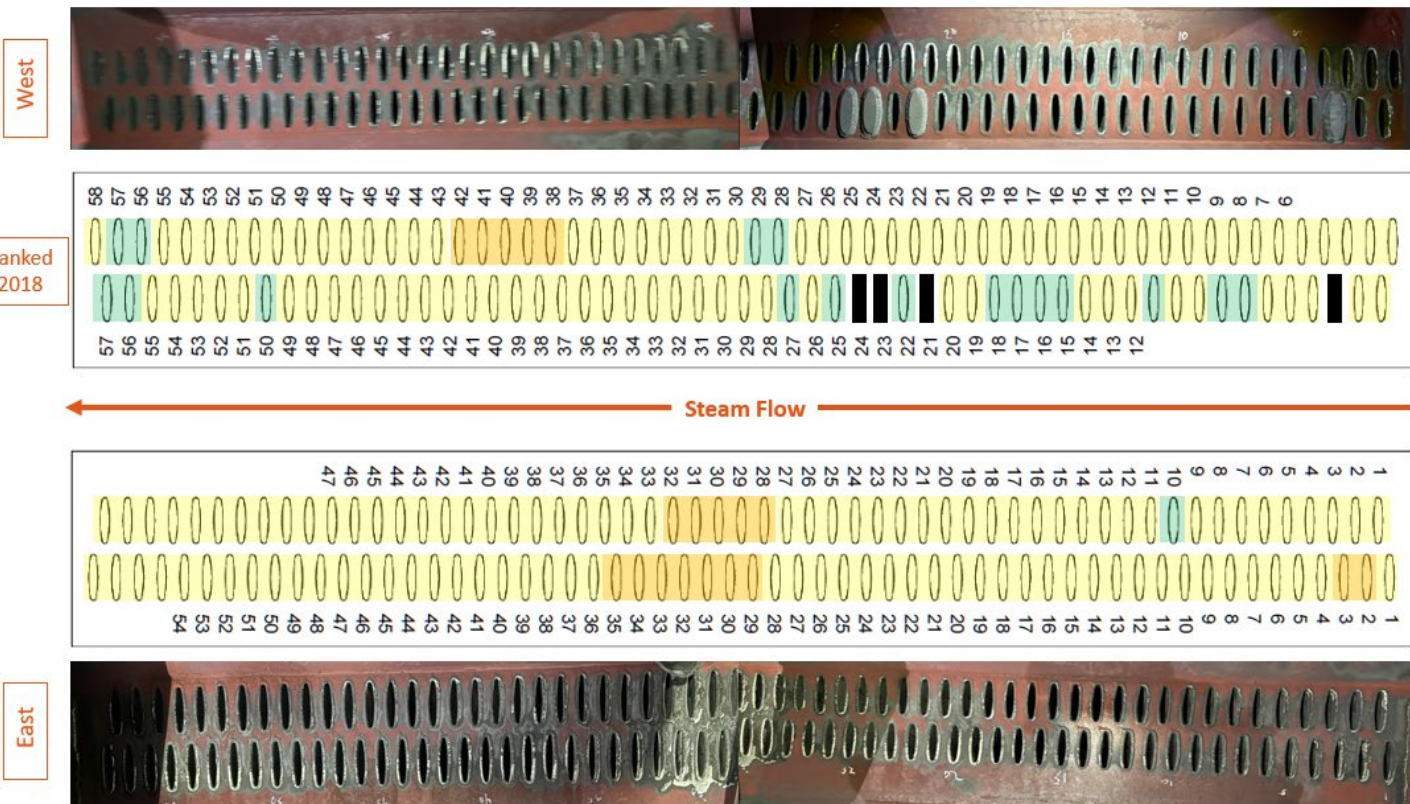
- Bearing packing leak rate (if applicable)
- Excessive noise, cavitation
- HE cleanliness, ΔT

Flow Accelerated Corrosion (FAC)



Flow Accelerated Corrosion (FAC)

Street 1, Bay K11, Bundle 2



TUBE SHEET STATUS

Recommended Tools

- IR Thermal Camera, Drone
 - IR Thermometer
- Acoustical Camera
 - Leak detection



Thank you!

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