



# BOILER GENERATING BANK INSPECTIONS







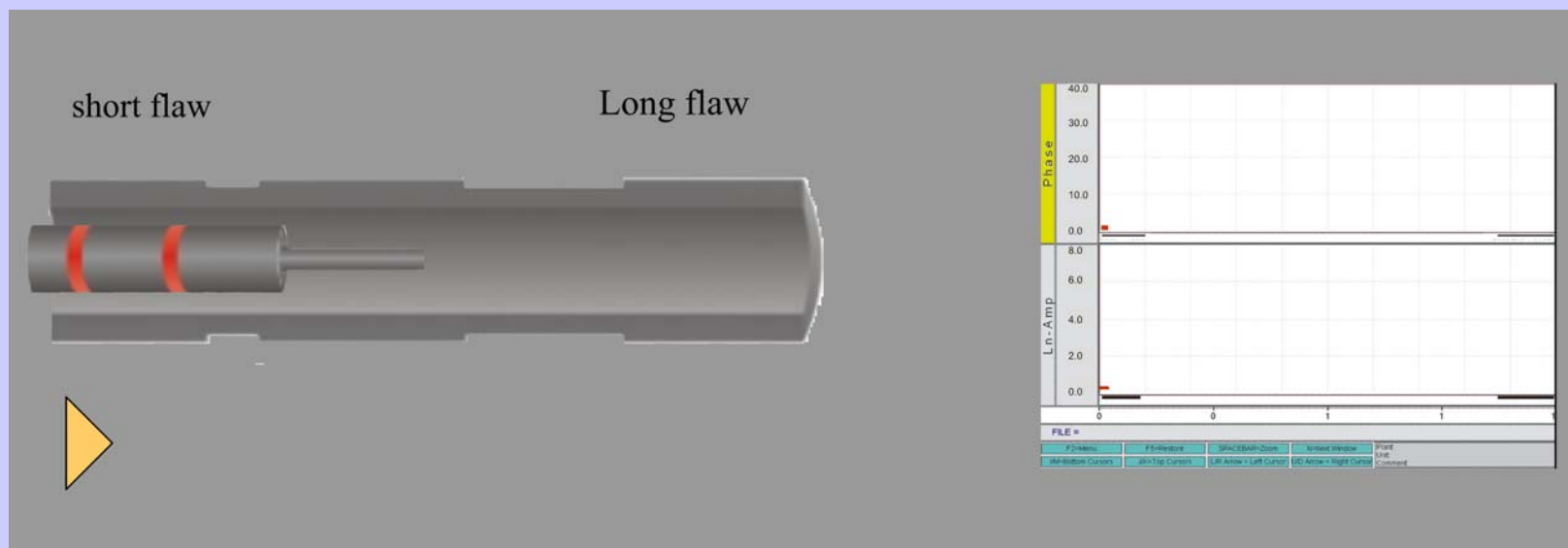
# **POSSIBLE INSPECTION TECHNOLOGIES**

- **STANDARD ULTRASONIC THICKNESS TESTING**
- **MAGNETIC PARTICLE INSPECTION OF SEAM WELDS**
- **RADIOGRAPHY**
- **REMOTE FIELD ELECTROMAGNETIC TECHNIQUE (RFET)**
- **IRIS**



# Remote Field Electromagnetic Technique (RFET)

***The electromagnetic field generated by the Exciter coil travels through the tube material and is sensed by the Receiver coil placed at a distance 3 times the diameter. Any change in the tube wall thickness will cause a change in the field which in turn changes the phase and amplitude. This change in phase & amplitude can be used to quantify the wall loss.***

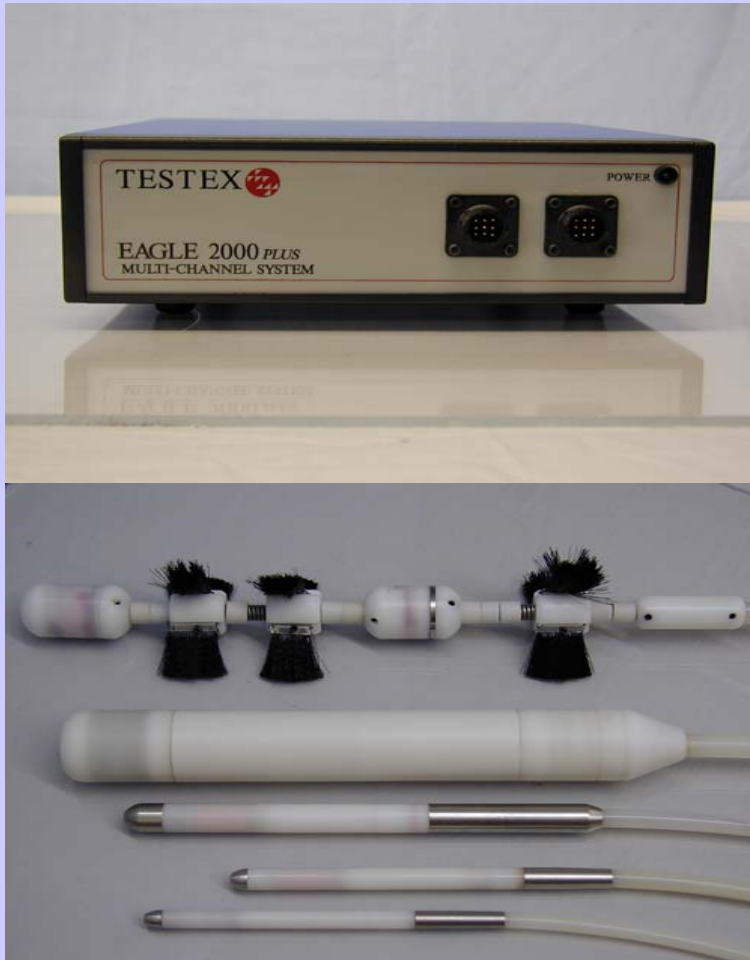




# ***Carbon Steel Tube Inspection Using Remote Field Electromagnetic Technique***

## **Eagle 2000 Plus System**

- ***Single/ Multi-channel System: Up to 8 Channels for tube inspection***
- ***300 to 350 tubes can be inspected in a 10 hour shift***
- ***Special Flexible Probes for boiler drum to drum tubes inspection***
- ***Flexible probe sizes can be built to inspect generating bank tubes ranging in size from 1" OD to 3.5" OD.***





# ***Carbon Steel Tube Inspection Using Remote Field Electromagnetic Technique***

## ***Remote Field Electromagnetic Technique (RFET)***

- ***Inspects Ferrous Tubes such as Carbon Steel***
- ***Highly sensitive to volumetric defects***
- ***Equally sensitive to ID and OD defects however they cannot be differentiated.***
- ***60-75% Fill Factor probes can be used for inspection***
- ***Minimal Preparation is required***
- ***Defects under Tube-sheet cannot be detected***
- ***Need access to the ID of the tubes through the steam drum and mud drum***
- ***Can employ 2 teams at the same time to double productivity***



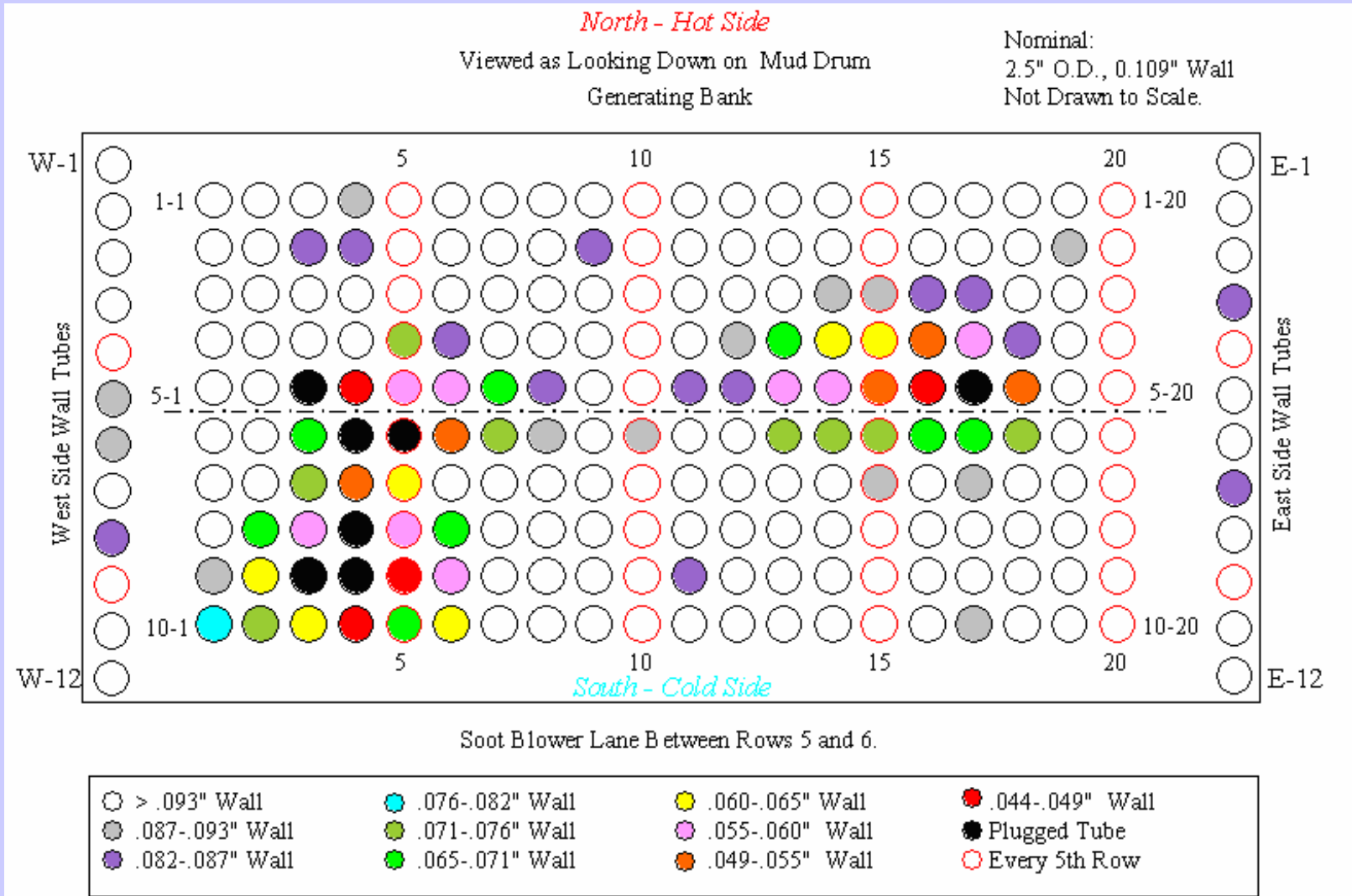
# **COMMON DEFECTS FOUND IN GENERATING BANK TUBES**

- **GENERAL WALL LOSSES**
- **SOOT BLOWER EROSION**
- **FLUE GAS EROSION**
- **PITTING**
- **CRACKING**



# Bank Boiler Tube Inspection Using Remote Field Electromagnetic Technique

Tube Sheet showing color coded wall losses.





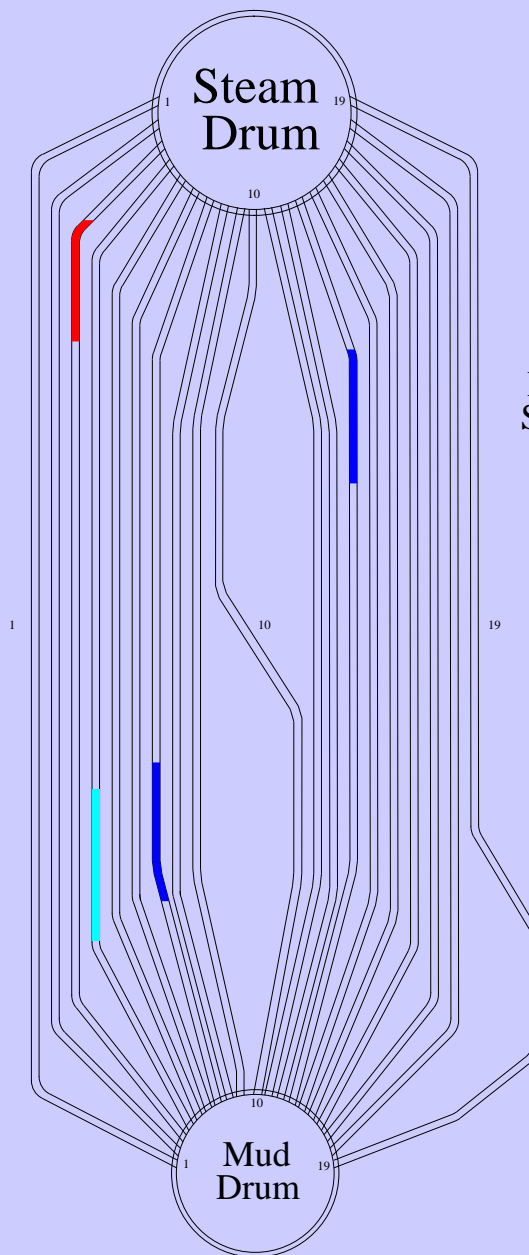


*Color Coded Side Elevation Diagram showing the location of the thinning.*

Cold Side

Hot Side

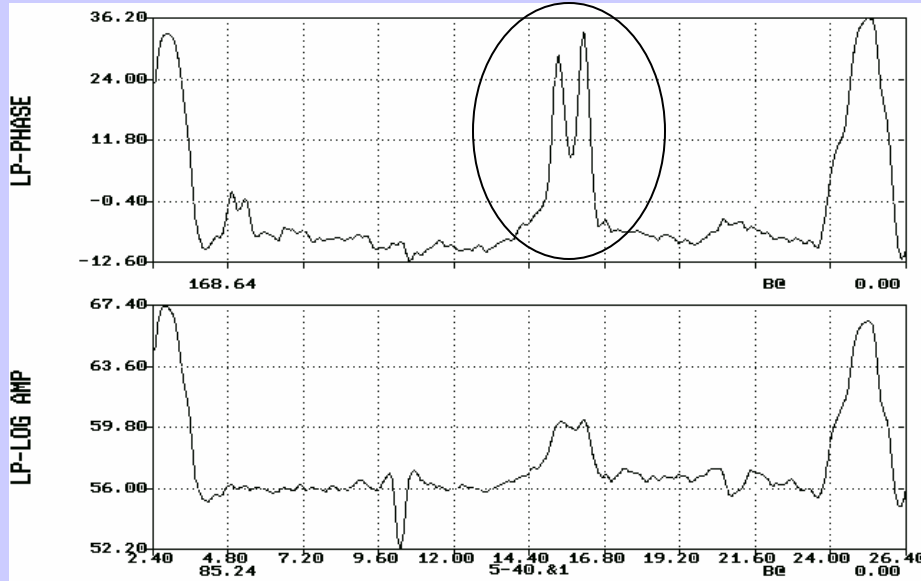
Legend	
○	>0.153" Wall Remaining
●	0.144"-0.153" Wall Remaining
●	0.135"-0.144" Wall Remaining
●	0.126"-0.135" Wall Remaining
●	0.117"-0.126" Wall Remaining
●	0.108"-0.117" Wall Remaining
●	0.099"-0.108" Wall Remaining
●	0.090"-0.099" Wall Remaining
●	0.081"-0.090" Wall Remaining
●	0.072"-0.081" Wall Remaining
●	< 0.072" Wall Remaining
●	Plugged



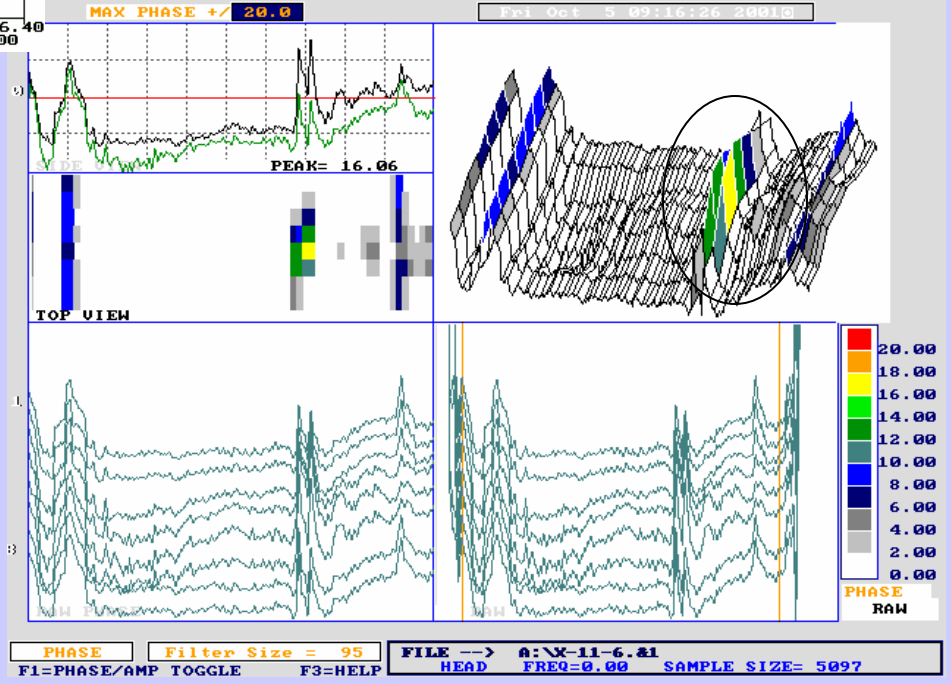
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# Boiler Tube Inspection Using Remote Field Electromagnetic Technique

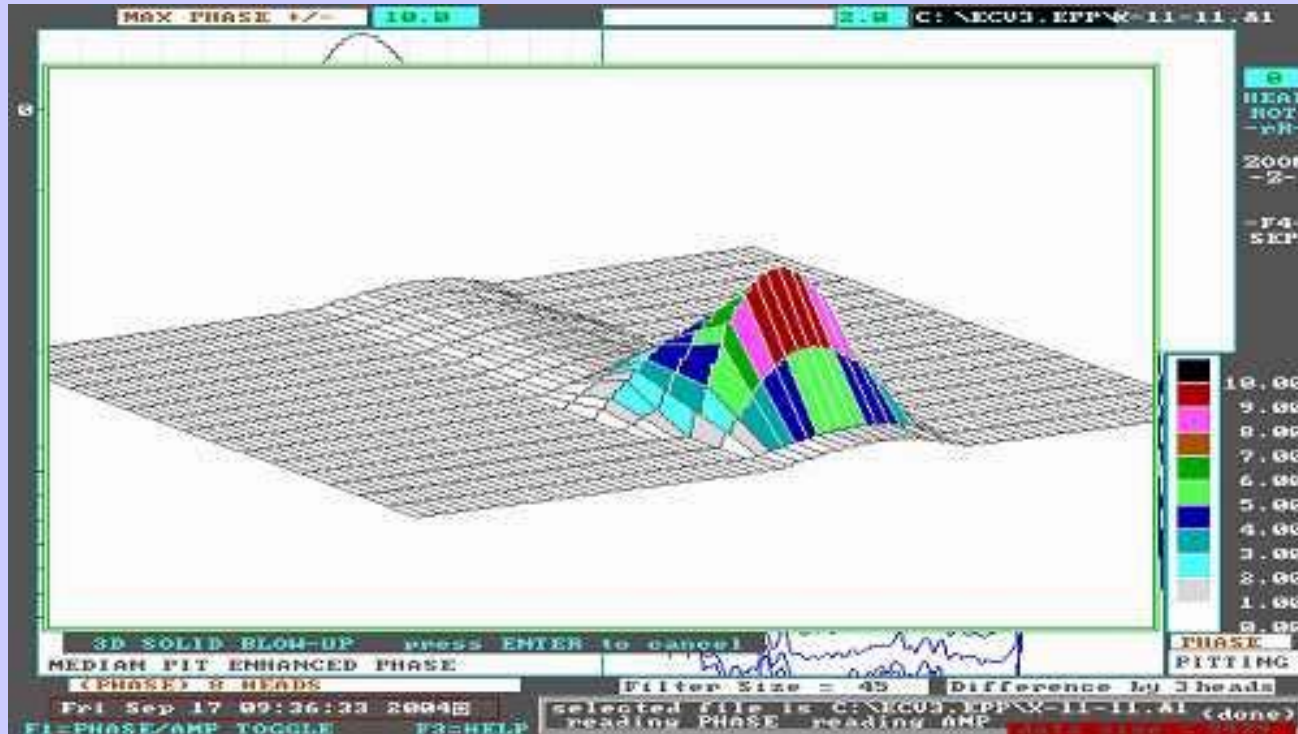


Single Channel and Multichannel Data showing 65-70% localized wall loss.





# *Bank Boiler Tube Inspection Using Remote Field Electromagnetic Technique*



Example of ID pit found with Multichannel RFET Probe found between the mud drum and the mud drum bend.  
Carbon Steel 2.5" O.D., 0.165" tube swaged to 2" O.D.



# Details Needed for Successful Inspection

- Tube Dimensions
- Any Available Drawings
- Failure History
- Repair History
- Scaffolding Plans
- Available Time for Inspection



# **GENERATING BANK INSPECTION CONCLUSIONS**

- **CAN INSPECT APPROXIMATELY 350 TUBES PER TEAM PER SHIFT**
- **ABLE TO DETERMINE CONDITION OF TUBE WITHIN THE BANK**
- **LOCATIONS AND SEVERITY OF DEFECTS REPORTED**
- **PRELIMINARY REPORT ISSUED HOURS AFTER COMPLETION OF INSPECTION**
- **ABLE TO REACT ON RESULTS TO PLUG TUBES AND/OR REPAIR THINNED AREAS**
- **ALLOWS PLANNING FOR FUTURE RETUBING FORECASTING**

