

DCU FURNACE TROUBLESHOOTING: “HIGH TUBE METAL TEMPERATURE”

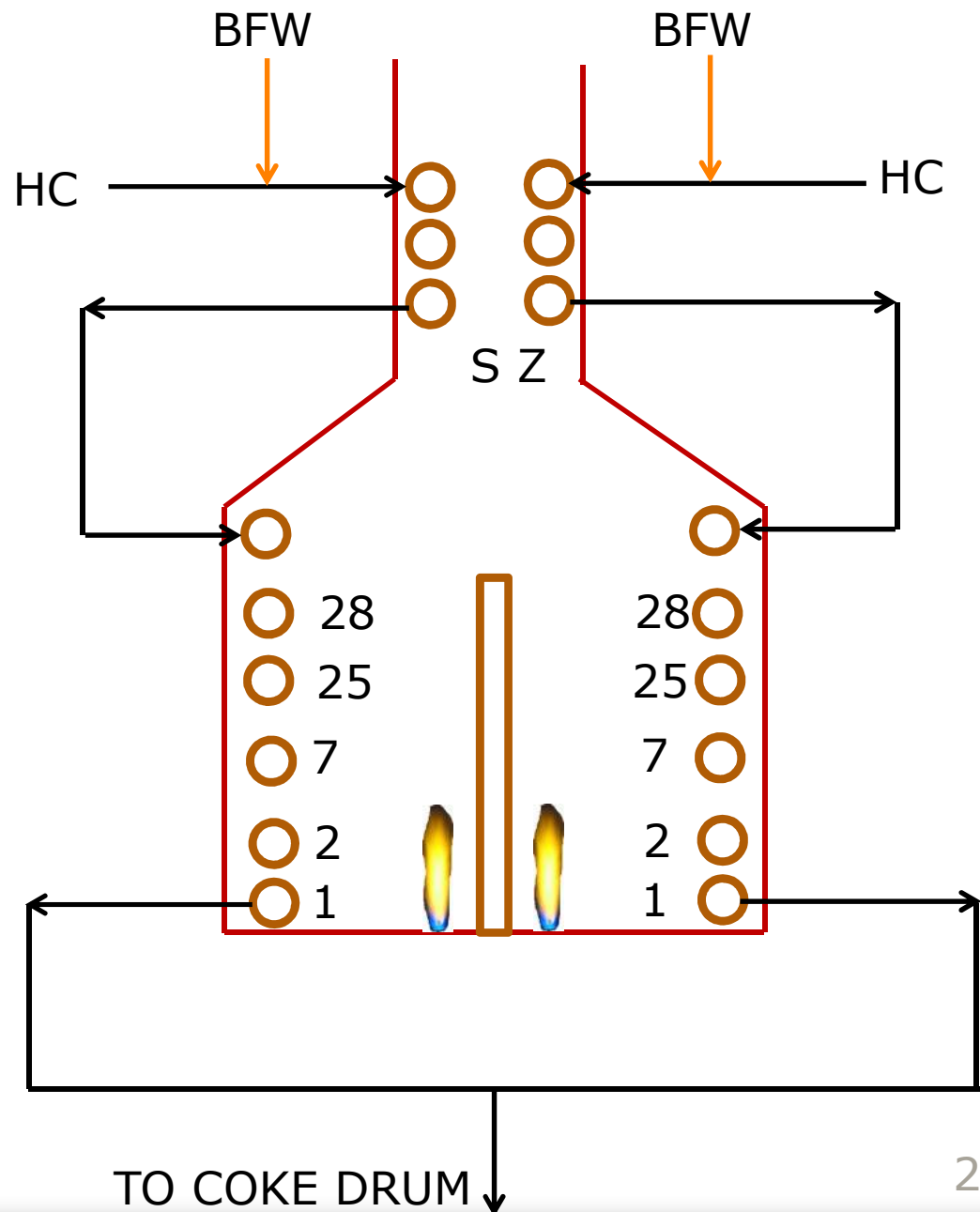
C K SINHA

Senior Manager Technical Services,
sinhack@indianoil.in



FURNACE OVERVIEW

- ❑ 2 - Pass Bottom Fired Natural draft Furnace
- ❑ Design Fired duty- 8.16 Gcal/hr
- ❑ Low Nox flat flame burner
- ❑ Total 36 no of tubes in radiation section
- ❑ Tube metal T t'couple on tube no 1,2,7,25,28 & shock zone (SZ) tube



PROBLEM

- ❑ Rise in tube metal temperature (TMT) in short time
- ❑ No on-line spalling facility
- ❑ Frequent SAD
- ❑ Frequent DCU outage
- ❑ Reduction in Refinery Profit



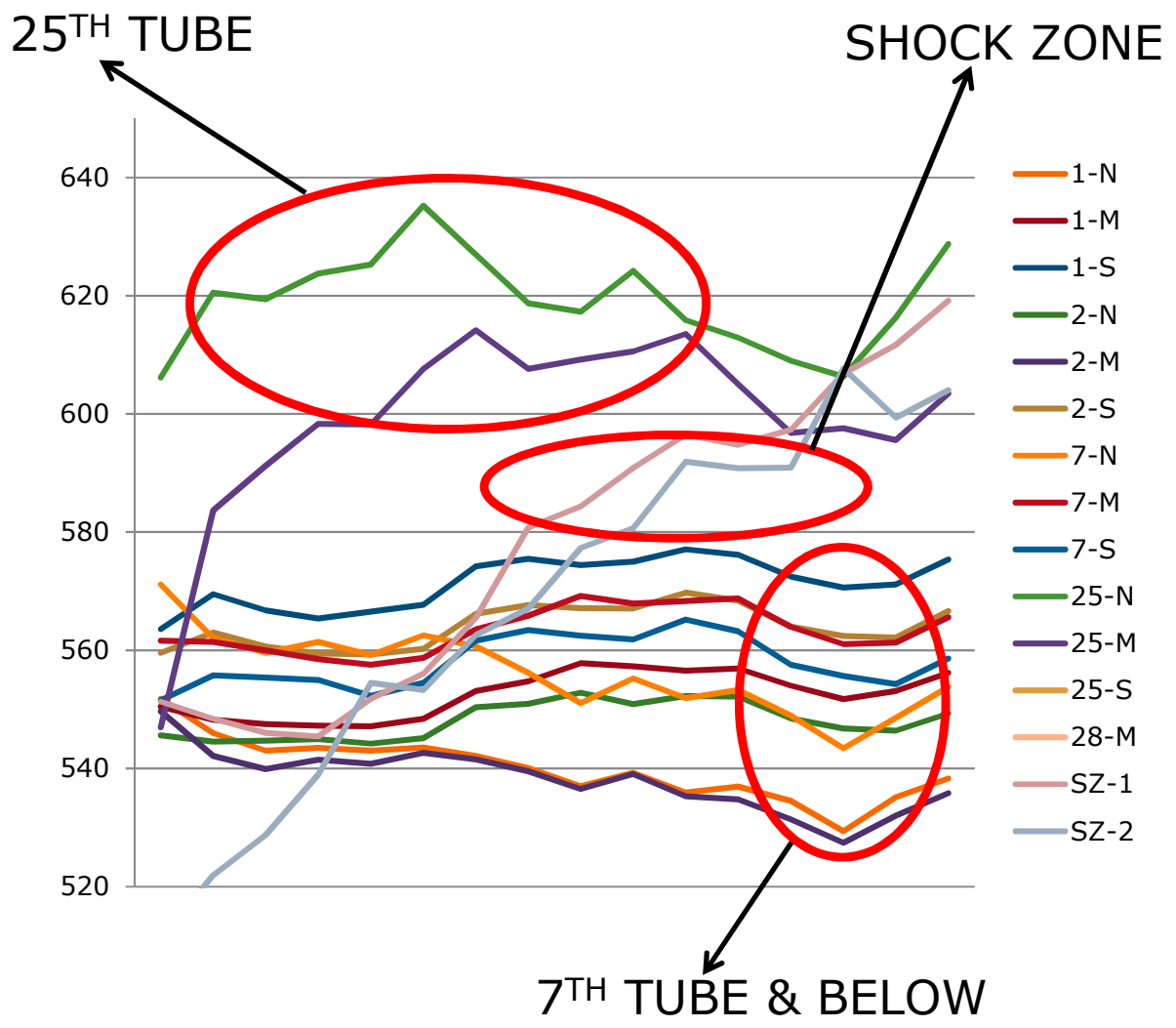


Problem Analysis

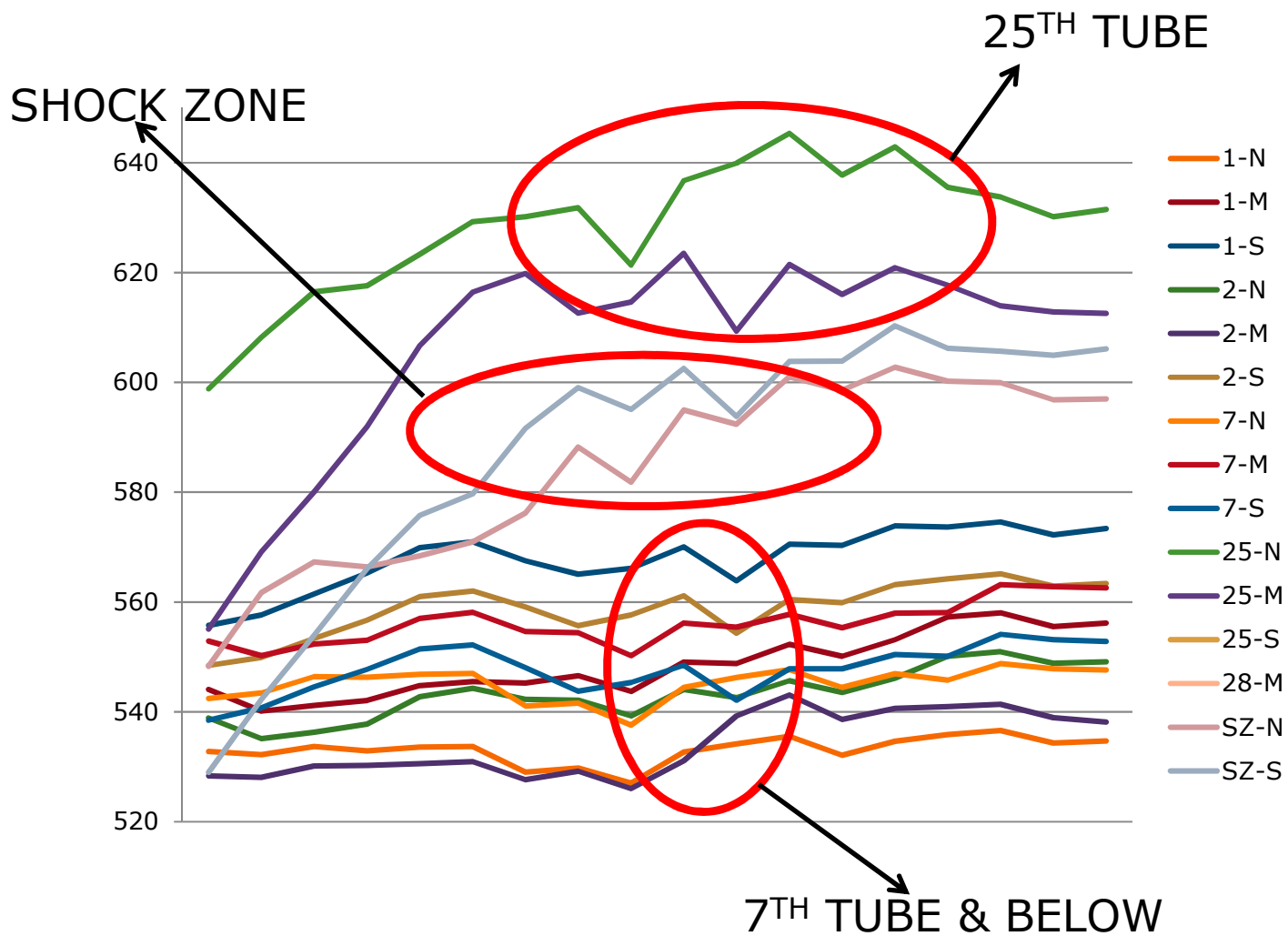
FIELD CHECKS

- CROSS CHECKING OF TMT BY THERMOGRAPHY
- FEED PROPERTY , FG PROPERTY
- CONTAMINATION OF FEED WITH RESIDUE
- FURNACE FEED PUMP SUCTION STRAINER
- START-UP CIRCULATION PUMP SUCTION STRAINER
- TRAMP AIR
- FIRED DUTY

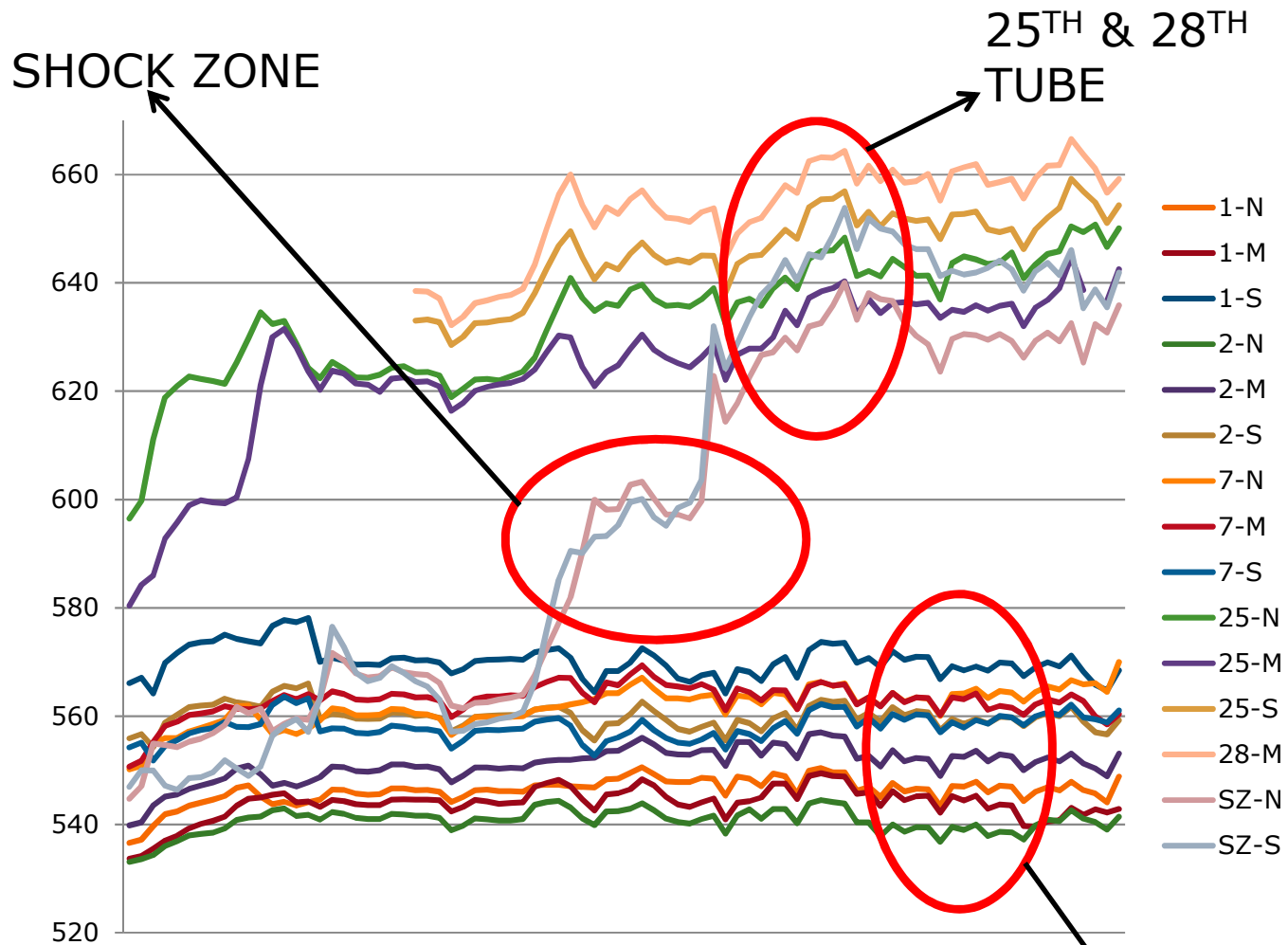
TMT TREND OF PAST RUN-1



TMT TREND OF PAST RUN-2



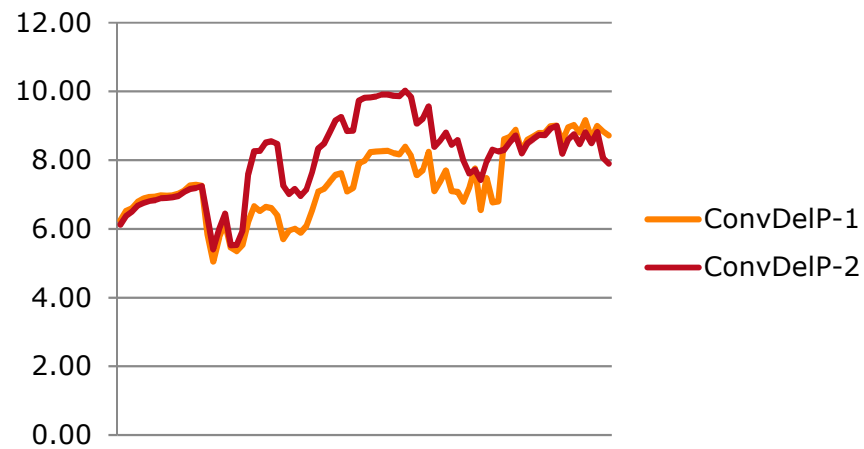
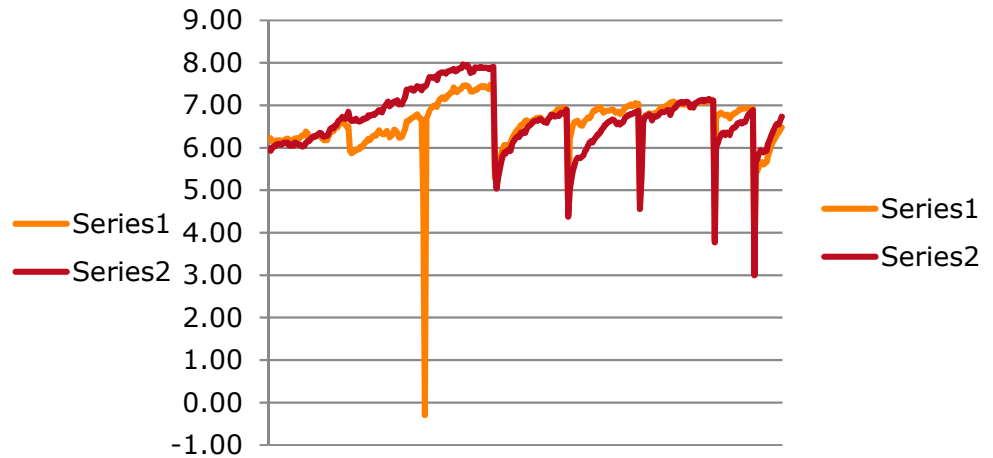
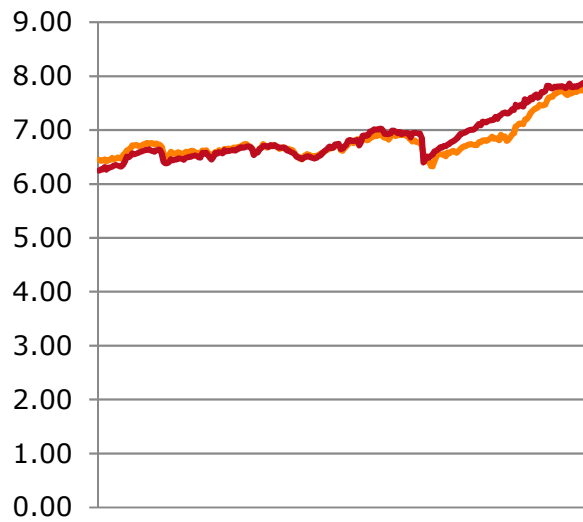
TMT TREND OF PAST RUN-3



***One additional t'couple installed on 25th in Middle position and on 28th in Middle position**

7TH TUBE & BELOW

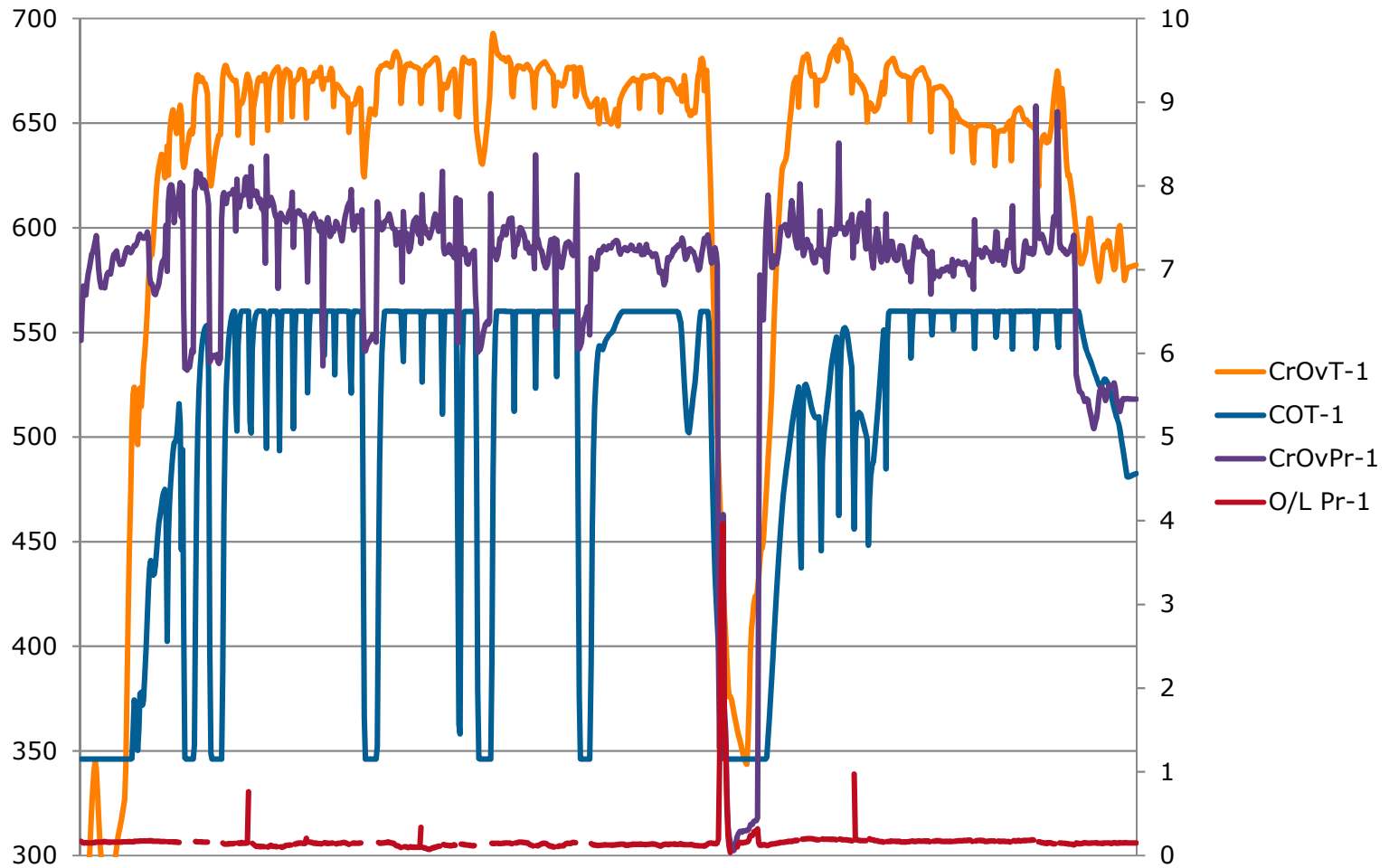
CONVECTION COIL PRESSURE DROP



OPERATING CONDITIONS

- ❑ HC flow 29 m³/hr
- ❑ BFW to convection coil flow rate 0.32 m³/hr
- ❑ CIT- 325°C , COT- 492.5°C
- ❑ Furnace draft- 7 mmWC
- ❑ O₂ analyzer reading- 8 vol%
- ❑ Convection O/L T- 433°C
- ❑ Stack T- 230°C
- ❑ Flue gas T at arch- 740°C
- ❑ Flue gas T at floor-620°C
- ❑ Fuel Gas flow- 560 kg/hr

PROCESS TEMPERATURE DURING SAD WITH SAME DRAFT AND O2 IN FLUE GAS



OBSERVATIONS

- ❑ HIGH DRAFT, HIGH EXCESS AIR, HIGH TMT IN SHOCK ZONE & RADIANT TOP ZONE
- ❑ HIGH HEAT TRANSFER IN CONVECTION TUBES
- ❑ HIGH RADIATION INLET TEMP
- ❑ CONVECTION COIL FOULING
- ❑ HIGH AMOUNT OF HEAT AVAILABLE IN RADIATION TOP ZONE
- ❑ COKE FORMATION IN RADIATION TOP ZONE AT FAST RATE
- ❑ COKE LAYER IN 25TH & 28TH TUBE
- ❑ TUBE 1 & 2 VERY CLEAN

- Reduce the draft in the furnace box to shift the heat transfer to radiation bottom

- Increase the HC velocity at the radiation inlet to slow down coke layer formation in radiation top tubes



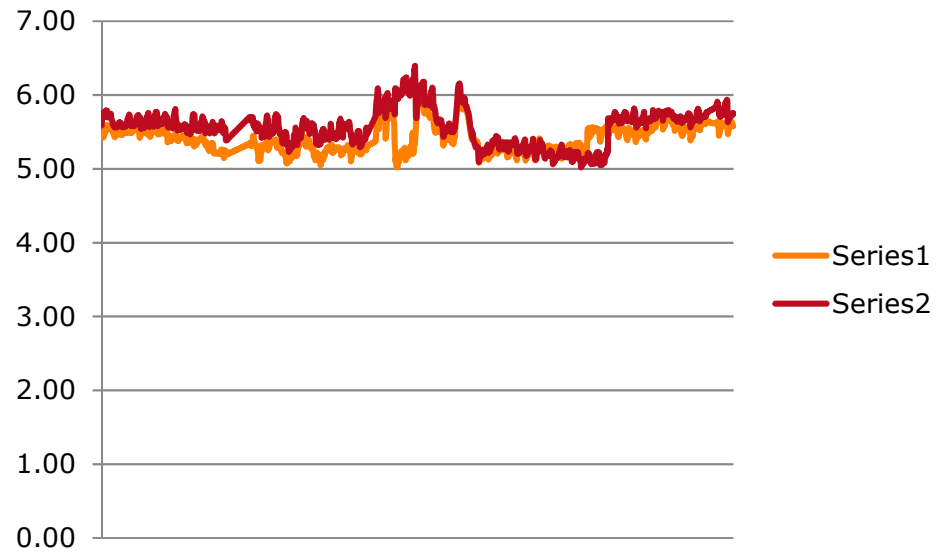
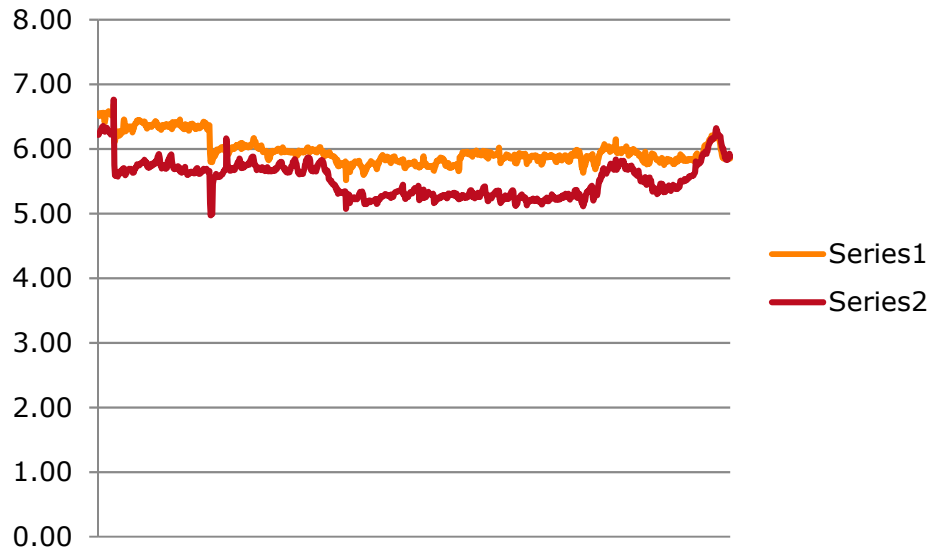
NEW OPERATING CONDITION

- ❑ HC flow 29 m³/hr/pass
- ❑ BFW to convection coil flow rate 0.32 m³/hr/pass
- ❑ **BFW to radiation I/L coil flow rate 0.2 m³/hr/pass**
- ❑ CIT- 325°C , COT- 495°C
- ❑ Convection O/L T- 420°C
- ❑ **Furnace draft- 2.3 mmWC**
- ❑ O₂ analyzer reading- 3.2 vol%
- ❑ Stack T- 210°C
- ❑ Flue gas T at arch- 730°C
- ❑ Flue gas T at floor-620°C
- ❑ Fuel Gas flow- 530 kg/hr

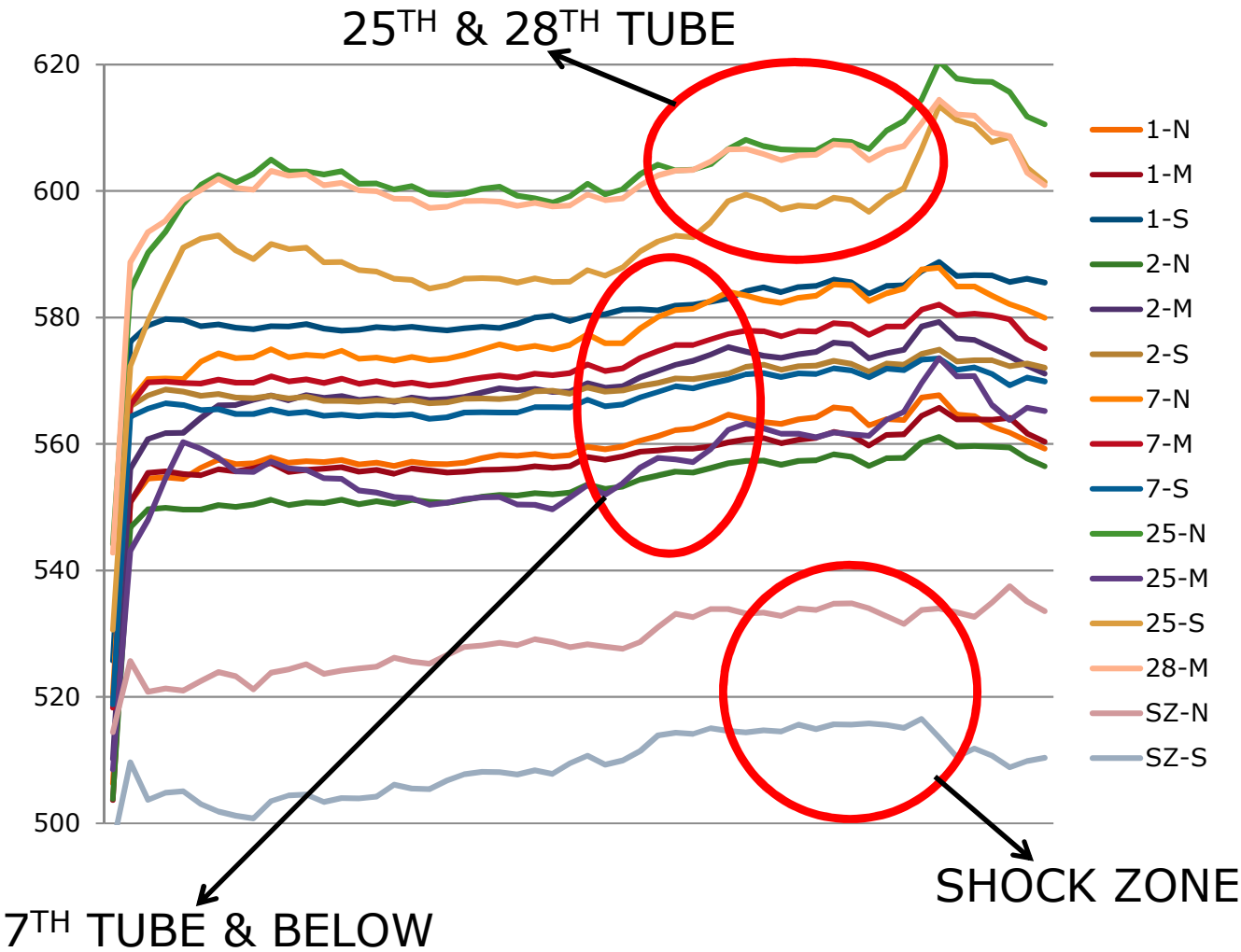


RESULTS

CONVECTION COIL PRESSURE DROP



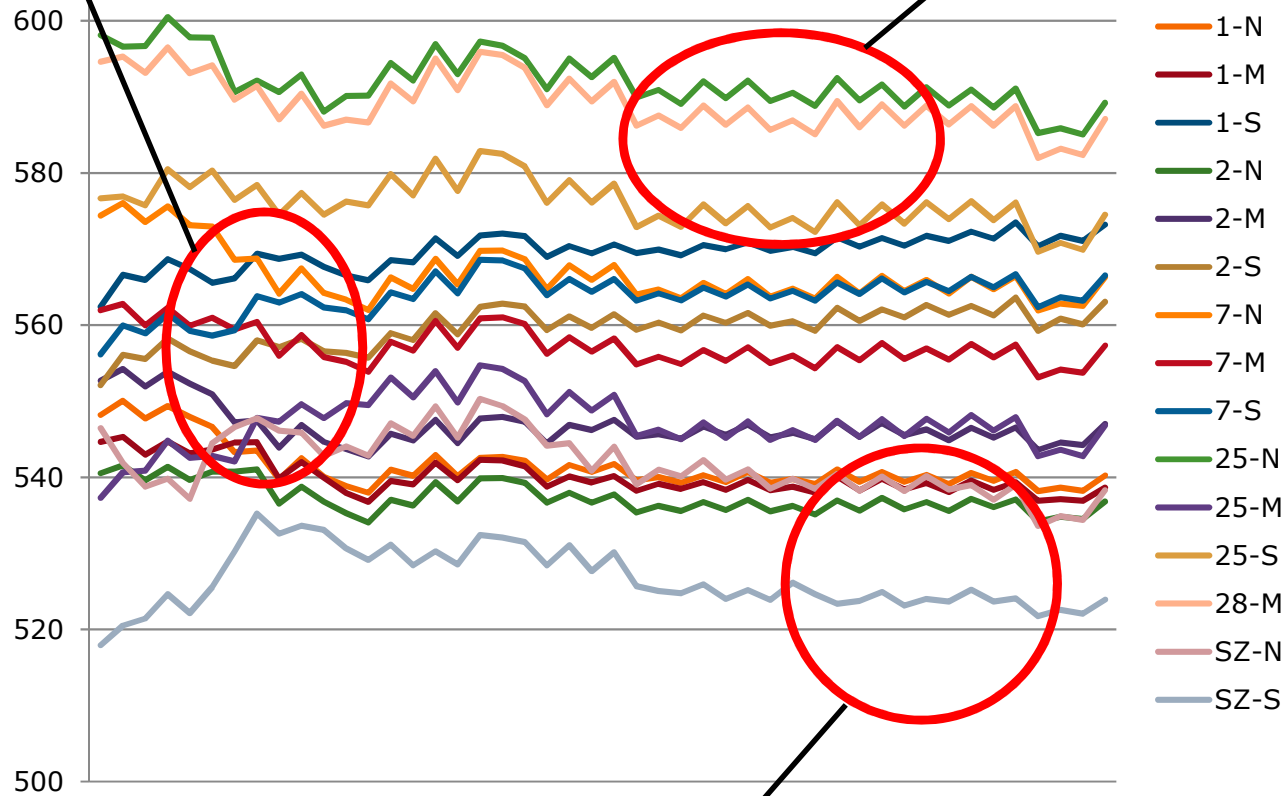
NEW TMT TREND RUN-1



NEW TMT TREND RUN-2

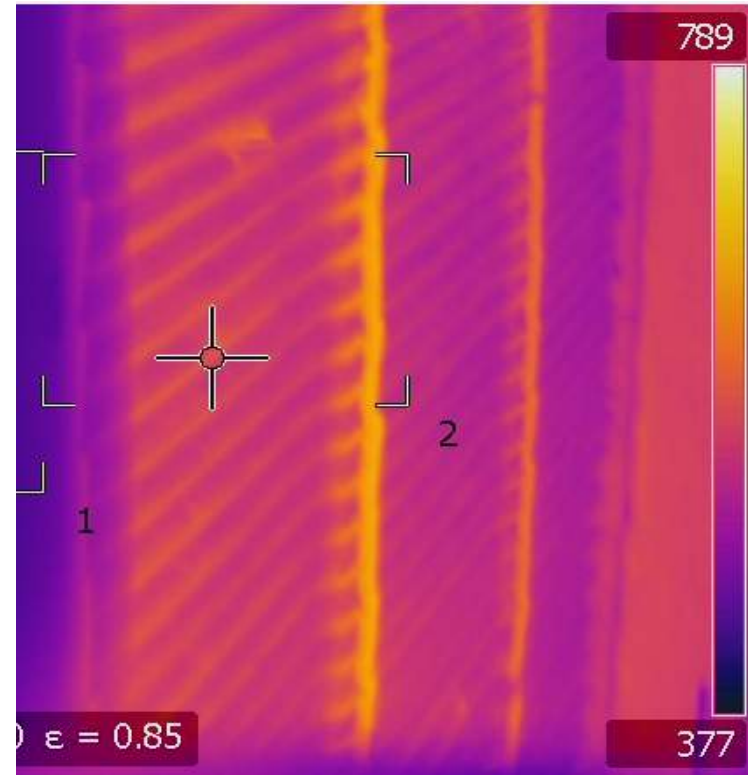
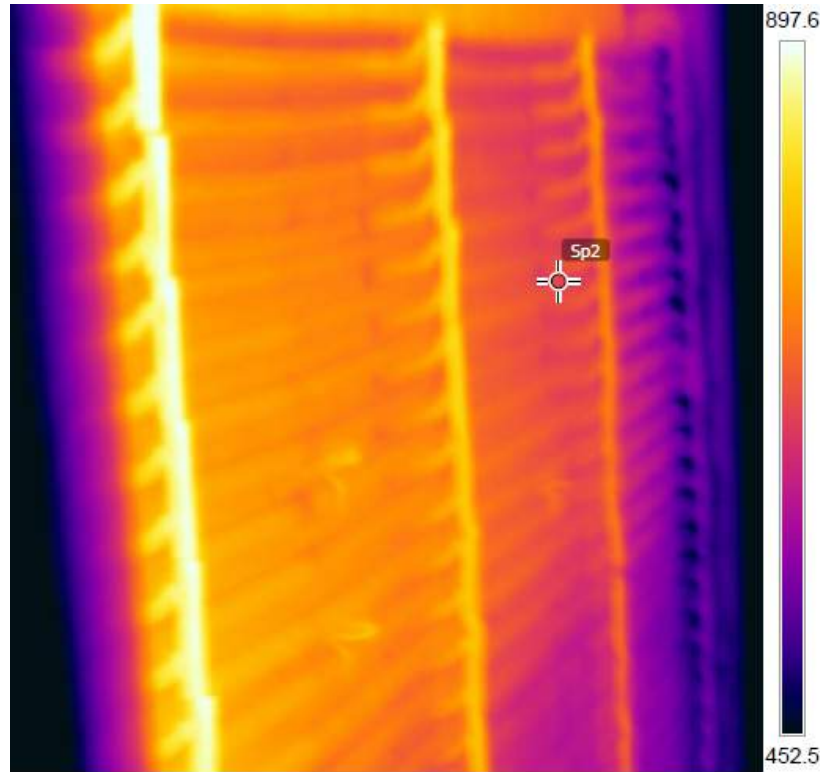
7TH TUBE & BELOW

25TH & 28TH TUBE



SHOCK ZONE

BEFORE



AFTER



