Cryogenic Summary - Testing D1L101 in MAGCOOL

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- Difference between D1L101 & D1L105
- Magnet Temperature and Heat Load
- Tests Performed
- Results
- Problem Encountered
- Lead Precooling
- Summary

Difference between Testing D1L101 and D1L105

- D1L105
  - Use standard warm bore for RHIC magnet
  - Insufficient super-insulation around magnet end volume
- D1L101
  - Improve super-insulation around magnet end volume
  - Use thermal strip to heat station outer wall of warm bore with 4.5 K cooling

Magnet Temperature and Heat Load

- Magnet Temperature
  - ~ 0.05 K Lower for D1L101 with warm bore evacuated or opened
- Heat Load
  - Appears lower for D1L101
- Effect of bore tube on temperature at MAGCOOL Return Header
  - Increased by ~ 0.4 K (bore tube open compared with evacuated)
  - Unable to determine accurately
  - Seems the same between D1L101 and D1L105

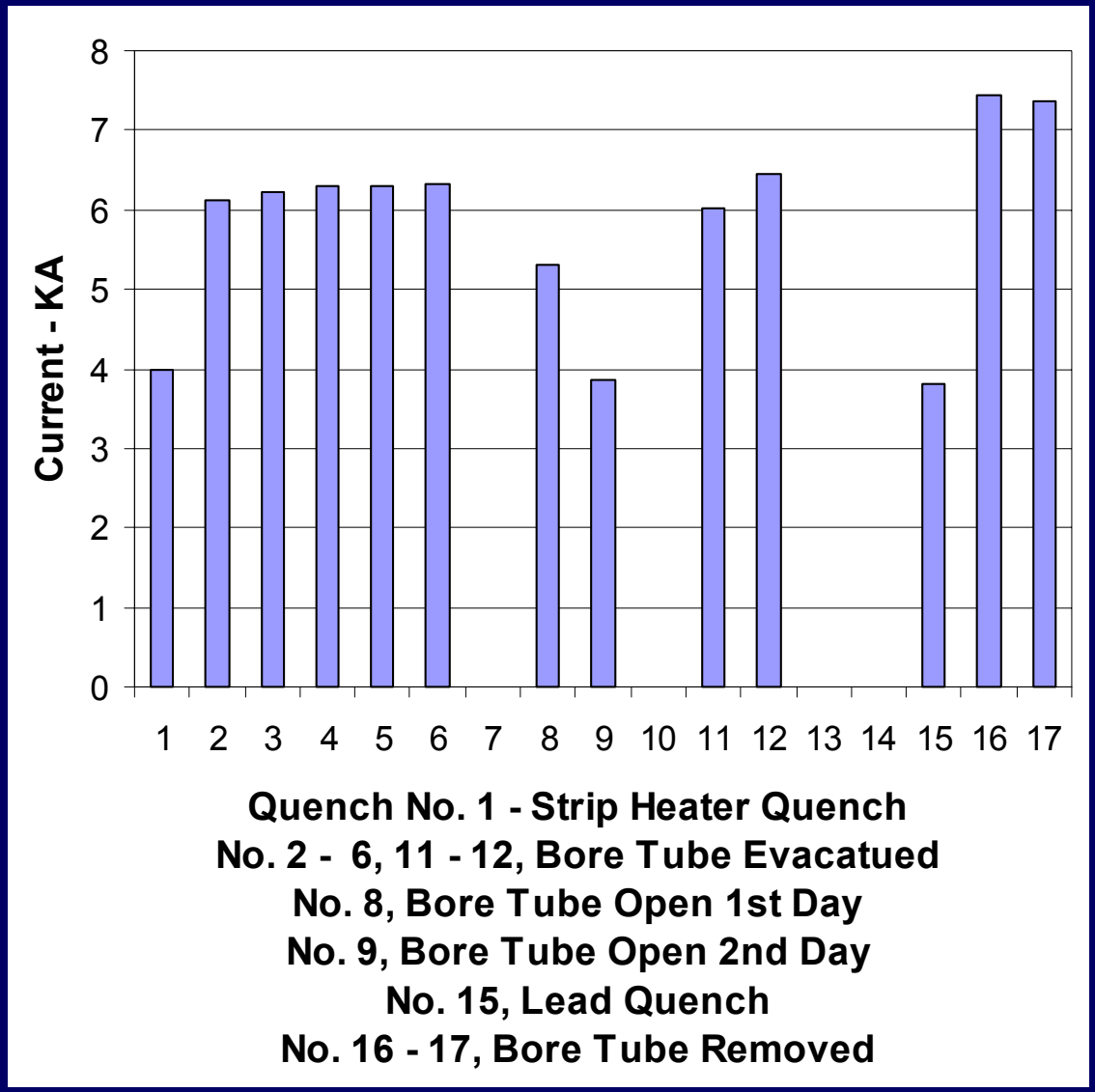
Tests Performed

- Warm Bore Tube Evacuated
  - Eight Quenches
- Warm Bore Tube Opened
  - Two Quenches
- Warm Bore Tube Removed
  - Two Quenches

Four groups of tests

- December 12 - 13, 2001
  - Warm bore tube inserted and evacuated
  - Strip heater and natural quenches
- December 13 - 14, 2001
  - Warm bore tube and measuring coil inserted
  - Natural quenches
- December 17, 2001
  - Warm bore tube evacuated
  - Natural quench and 1 hour at 5500 A
- January 18, 2002
  - Warm bore tube removed
  - Ramping 5 times to 7000 A, two Natural quenches

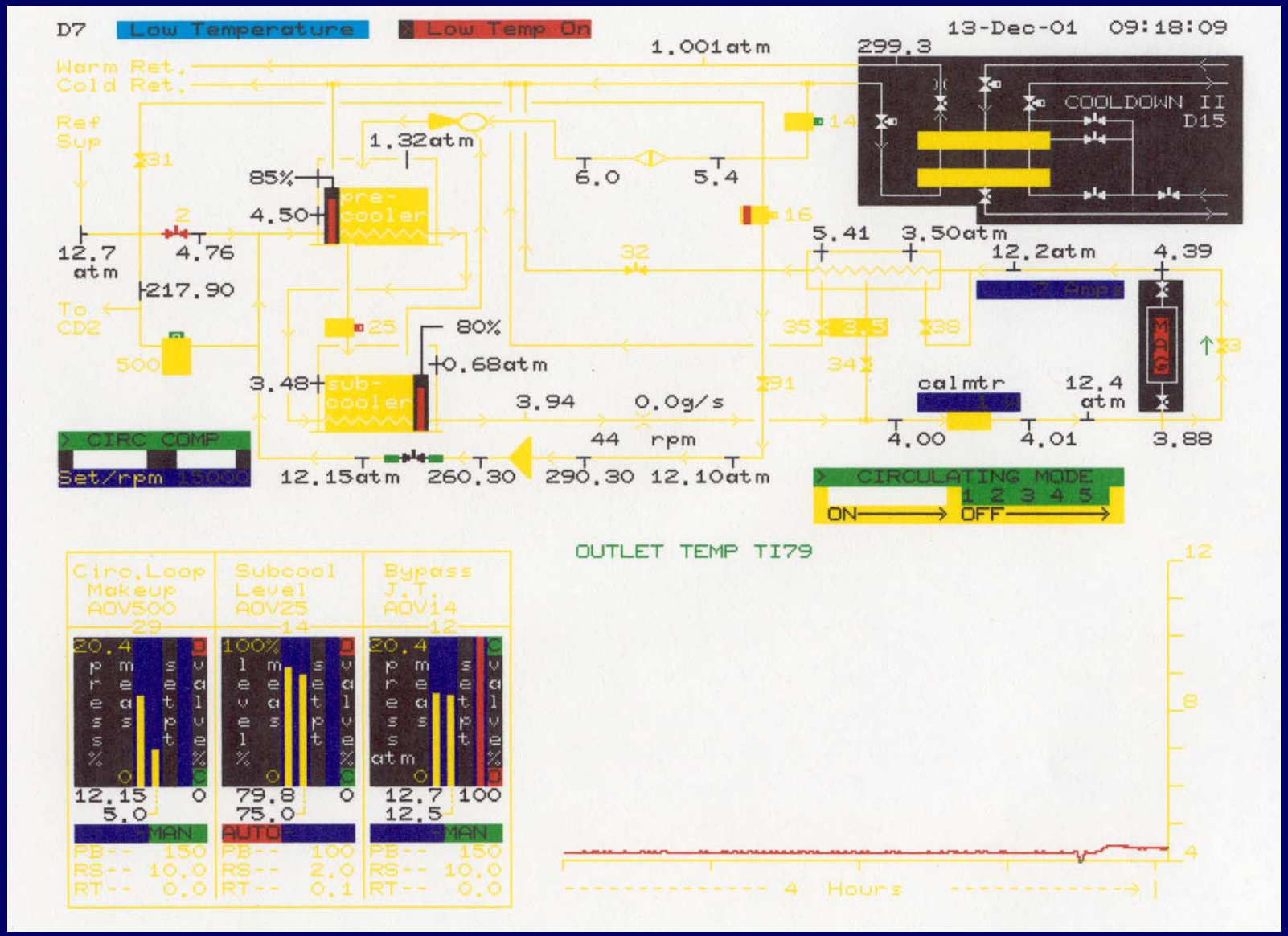
Quench Current for D1L101



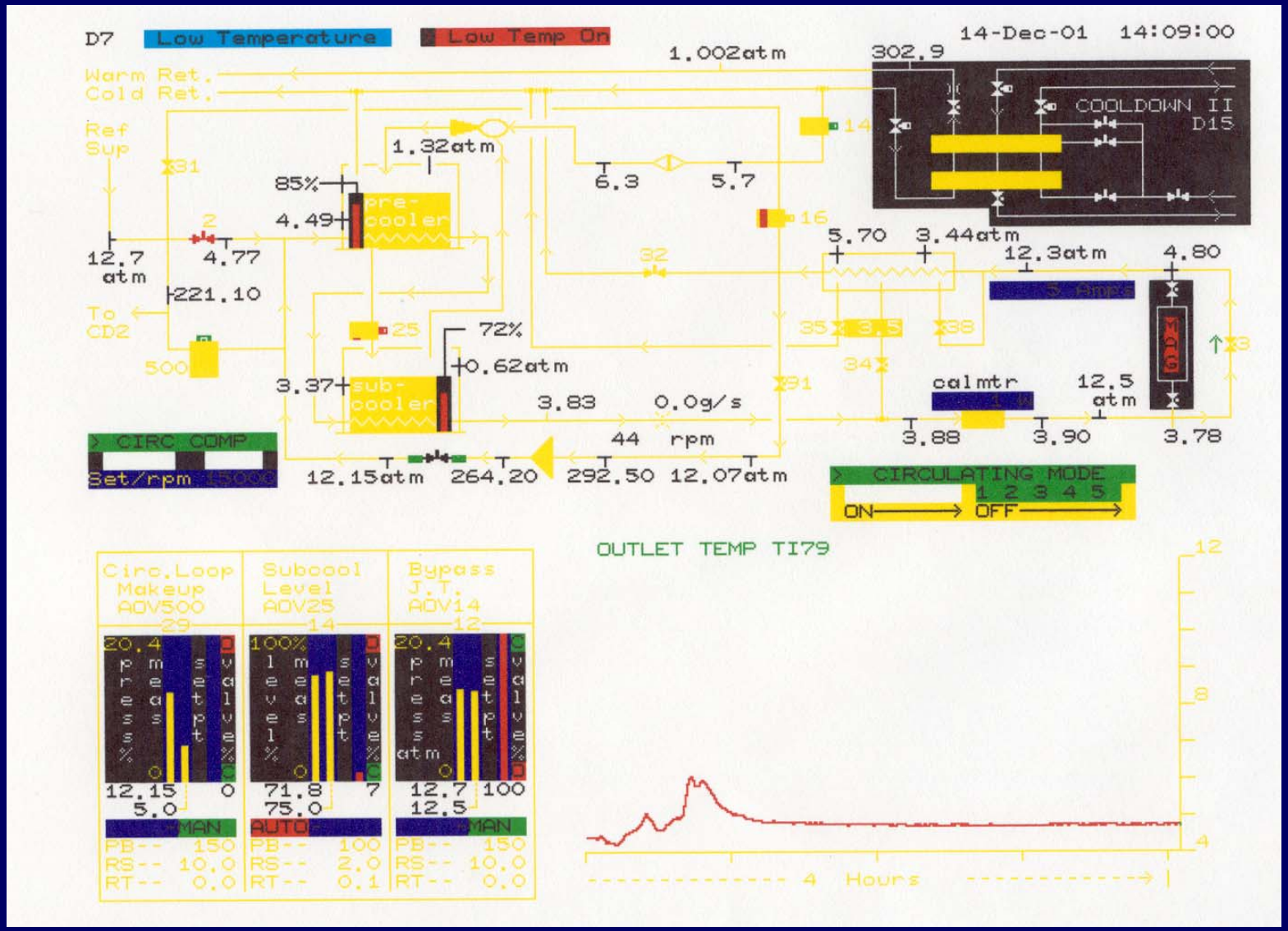
Main Results

- Temperature and heat load in D1L101 are slightly lower than D1L105
- With warm bore inserted, quench current for D1L101 is not higher than D1L105 especially with warm bore open
- With warm bore removed, quench current ~ 7400A

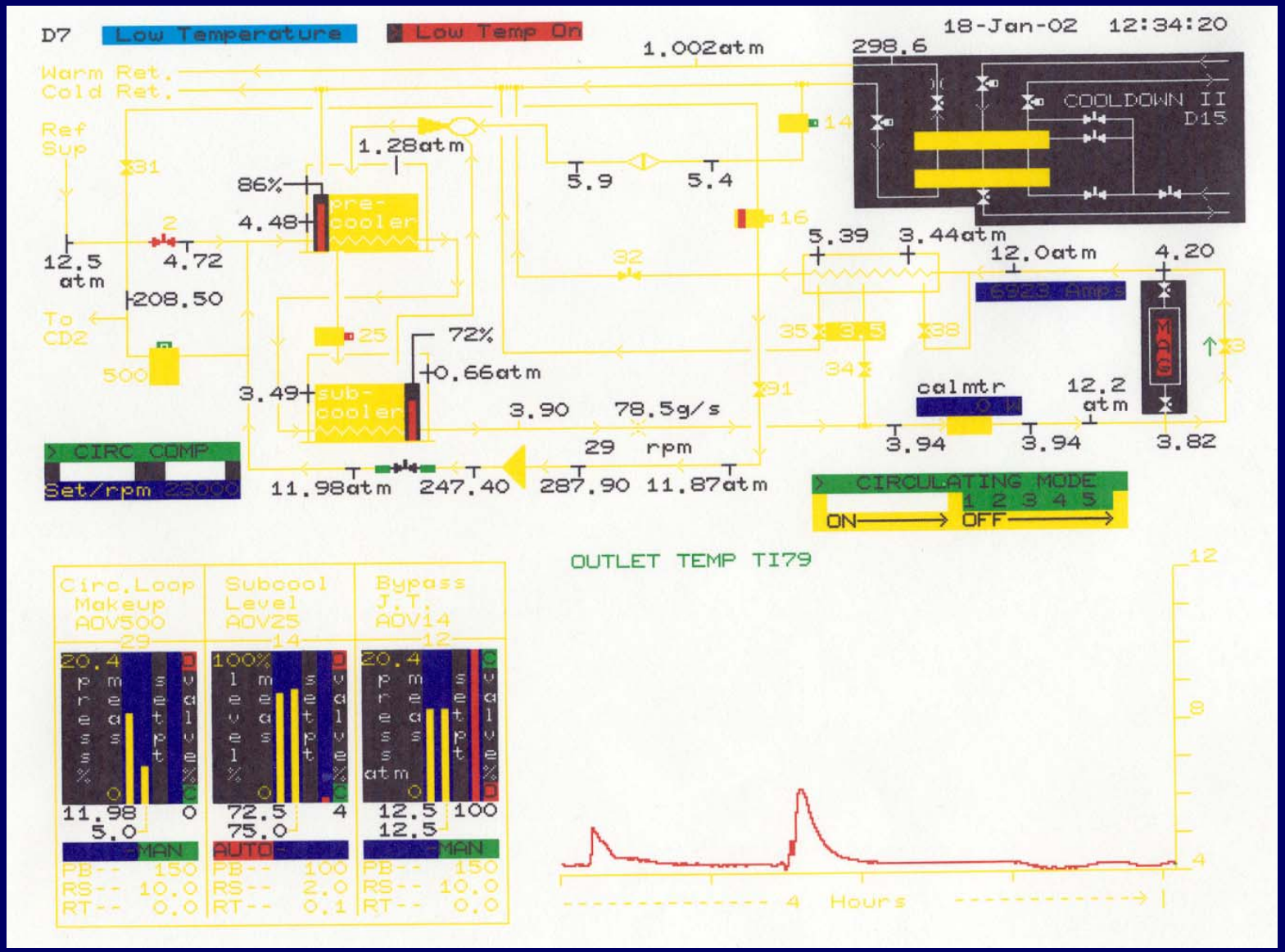
Typical operating condition D1L101 - warm bore evacuated



Typical operating condition D1L101 - warm bore open



Condition of D1L101 at 7000 A - warm bore removed



Problem Encountered

- Automatic pressure controller on the helium refrigerator failed, operate manually
  - No problem for test
  - Unable to obtain meaningful peak loop pressure and temperature due to uncontrolled venting
- Current Lead Insulator too cold and leak - one incident
  - Suspect precool flow was set too large or too long
  - Re-commissioned after insulator warmup and lead checked, no problem

Problem Encountered - continue

- On 1/17/02, a by-pass valve on MAGCOOL was left open by unknown reason. Thus the magnet appears very warm when MAGCOOL reached operating temperature. A 1000 Ampere shutoff was performed and found lead flow control inadequate.
- On 1/18, the by-pass valve is closed and cryogenic system becomes normal. Lead pot is colder than previous experience (T11 & T12 ~ 5.3 & 7.3 K). Try ramping without lead precooling, Lead quenched at 3800 A. No problem was observed for the next two quenches using lead precooling.

Lead Precooling Requirement

- Past experience - temperature at bottom of lead below 5.3 K to avoid quench

- For D1L105 lead ~ 6 and 11 K (.049 g/s flow)
  - Need lead precooling
- For D1L101 with bore tube evacuated ~ 5.25 K (.060 g/s Tare flow)
  - No precooling
- For D1L101 with bore tube open ~ 6 and 11 K (.049 g/s Tare flow)
  - Need lead precooling

Precooling 7500 A Lead

- When temperature at the bottom of the lead > 5.3 K
- Switch Flow Controller to MANUAL
- Increase lead flow from 0.049 g/s to ~ 0.1g/s.
- Watch lead temperature
- As soon as lead reach 5.3 K,
  - Switch Flow Controller back to AUTO
  - At the same time, start ramping

Summary

- Heat load in D1L101 is reduced by improving thermal insulation
- Warm bore tube was heat stationed
- Temperature of D1L101 is slightly less than D1L105
- Quench current for D1L101 is not higher than D1L105, especially with warm bore open
- Current lead insulator freeze in one incident
- Lead re-commissioned without problem
- Warm bore is undergoing 2nd design modification
- Without warm bore, ramp D1L101 to 7000 Amp five times
- Operated at 7000 A and Quenched at ~ 7400 A. Without bore tube, 2nd quench is slightly lower than 1st quench due to .046 K higher temperature.