

SHMS Magnet High Current Test Procedure

Revision D
Sept 26, 2016

Purpose: Commissioning and acceptance test for the SHMS magnets to 100% of the peak operating current required for running experiments with the SHMS at 11 GeV/c operation. The procedure will test and verify the PSU, dump circuit and magnet at various current excitations, by exercising the magnet at ever increasing currents, using slow ramp up and discharges and fast discharges.

Equipment:

Isolation transformer

Chart Recorders

Battery powered DC calibrated voltage source

Pre-test Verification:

Magnet should be at cryogenic temperature, Full of Helium and LN2 and regulating its liquid level.

Initial quench detector calibration, no current and low current magnet tests shall have been successfully completed.

Magnet pre-run check out list is to be completed.

Warning signs for high magnetic fields shall be posted.

Protective panels around DC bus leads on CCR shall be in place.

Procedure:

Fast Discharge = FD

Quench Detector = QD

Power Supply Unit = PSU

Maximum Operating Parameter = MOP (Not 110% test condition)

Turn on PSU and set upper current limit to 110% of peak operational current, both hardware and software limits. Set PSU ramp rate to 1.8A/sec.

Record magnet, PSU and dump resistor parameters throughout the test. Note any abnormal behavior or trend.

At the 5% test point, test and verify the functionality of the polarity switch.

Magnet testing will occur at the following six current setting:

1. 500Amps or 5% of operational stored energy, whichever is less.
2. Followed by 25%, 50%, 75 and 100% of the MOP stored energy.
3. Test current = 110% of the MOP current for Q2Q3 and 103 % for the Dipole

Repeat the following sequence of steps for each excitation current:

Set output current of PSU to current setting. Do not turn on PSU mains at this time. Verify that current lead coolant mass flow tracks with the set current parameter.

Turn on PSU mains to magnet.

Ramp magnet to test point current.

Note ramp time and PSU ready status.

Let magnet soak at current for 15 minutes*.

Ramp the magnet down 100A from test set point and let it settle.

Ramp current back up to test point.

Note any ringing or drift of PSU, voltages or support links.

Let magnet set at current for 1 minute.

Perform a fast discharge of the magnet.

Note magnet temperatures, pressure and voltages.

Reset interlocks and turn PSU mains back on.

Re-power magnet to test current and let it stabilize.

Ramp magnet to zero by a slow discharge interlock.

Continue to next excitation step and repeat sequence of test.

*Increase the soak time from 15 minutes to 1 hour for the 110% current excitation.

The quench detector (QD) may require re-balancing, thresholds raised or dwell time increased if noisy signals result in nuisance false interlocks being generated. If the QD requires adjustment, the test point at the time of adjustment shall be repeated. Record threshold voltage and dwell times.

The ramp rate of the PSU may be decreased if the PSU's output voltage approaches its maximum output voltage.

Notable parameters to trend and/or record:

- Magnet coil voltages.

- Dump resistor temperature after a fast discharge.

- Voltage drop across current leads.

- PSU output voltage.

- Strain gauges on support links.

- LCW temperature.

- Cryogenic valves changes.

- Helium pressure and temperatures during a fast discharge.

Table 1 SHMS Dipole High Current Test

% Iop	Itest Amps	Stored Energy	CL Mass flow	PSU Output Voltage	PSU Ramp Rate	Dump Resistor Temp (after FD)	Helium Pressure (after FD)	Magnet Temp (after FD)
	Amps	MJoules	SLPM	Volts	A/sec	C	ATM	K
0	0	0	138					
10	345	0.16	144					
25	863	1.00	154					
50	1725	4.00	170					
75	2588	9.00	186					
100	3450	16.0	201					
103	3554	17.0	203					

Table 2 SHMS Q2/Q3 High Current Test

% Iop	Current	Stored Energy (SE) % of MOP	CL Mass flow Setting	PSU Output Voltage	PSU Ramp Rate	Dump Resistor Temperature (after FD)	Helium Pressure (after FD)	Magnet Temperature (after FD)
	Amps	MJoules	SLPM He gas	Volts	A/sec	C	ATM	K
0	0	0	138					
10	366	0.10	145					
25	915	0.63	155					
50	1830	2.50	172					
75	2745	5.63	189					
100	3660	10.0	205					
109	4000	12.0	212					

Test Operators:

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____