

2004 Fermilab Fall Shutdown P-Bar Water Issues

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I was assigned to Frank Schneider, who works within the Accelerator Division Water Group. Frank would educate me with issues pertaining to water flow cooling at the P-Bar facility. Also during the shutdown period, water issues in the Pre-Vault Stub Room would be addressed.

Week one was primarily used to familiarize and understand the tasks Frank and I were charged with. Operation of equipment as well as an overview of safety issues was presented by Frank. Once the equipment was positioned into place, “hands-on” examples to further enforce instructions given by Frank were reviewed.

Work began with Frank and I removing water hoses from magnets, which were slated for new magnet stands. These magnets were “blown-out” to prevent water from becoming stagnant within the magnet. With the completion of this task, I began “Header Flushing” as Frank began replacing water hoses, which presented a reliability hazard, in his opinion. As I understood the process of header flushing, I decided that I would use a higher water pressure than the “house pressure” in an attempt to flush each sector as thoroughly as possible. This also included cycling the power several times during the flush period to entice particle contamination to become dislodged by surging high pressure water and remove itself from the sector currently being flushed. I also kept note of any reduction in particle count as water in this closed-loop system passed through the filter. Water leaks were also noted and would be addressed at a later date.

The Header Flushing closed-loop system consisted of first closing the LCW (Low Conductivity Water) supply at the header. At one end of the sector being flushed, a jumper hose was attached between the LCW supply line and LCW return line. At the other end of the sector, the LCW supply line and LCW return line were connected to a portable water pump. The pump was connected in series to a filtration system and a Forward Scatter Turbidimeter. The Turbidimeter reads particle count based on a pre-selected scale. A series of pressure gauges at the water pump input and output stages, along with a pressure gauge at the filter, permitted me to maintain a desired water pressure. Obviously, a water leak within the closed-loop system would allow the water pressure to drop. Water was added from the LCW header supply valve as necessary during the flushing period.

After header flushing ran for about two minutes I felt water flow had stabilized within the system and I noted the reading on the Turbidimeter. This reading would become the high particle contamination reference point. As flushing progressed ran during the day, I noted the reduction in the particle count. I cycled the power several times during the

flushing period to “disturb” the water and dislodge any particle contamination trapped within a magnet. Before ending the flush, another reading was noted on the Turbidimeter and this would be the low particle contamination reference point. The closed-loop system was then broken down and removed from the sector. The header sector was returned to its original state and an information tag placed on the LCW header supply valve noting the date of the flush. I repeated this procedure at each LCW header sector. What I determined as I flushed each sector was that on average, I noted a 20% drop in particle contamination count at the end of a header flush. Each header flush ran for six hours.

Addressing water leaks started as Frank and I began connecting water hoses to the magnets with the new stands first. Further inspection of hose condition at each sector followed with new hoses being added as needed. After all the hoses were once again connected and water turned on, I, several times during the week inspected each magnet for water leaks. A spreadsheet was developed noting the corrective measure taken with respect to water leaks. Frank determined what corrective measure needed to be taken to stop the leaks. Some minor leaks I corrected, others, Frank resolved. Water leak inspections occurred throughout the shutdown period every few days.

The large dipole magnets in sectors 40-50 were prepped for a “bake-out.” Magnets that had an internal leak are noted in the spreadsheet. The bake-out was completed while I was away by Frank.

About mid-shutdown, Frank was now pulling “T’s” for the Large Quad Magnet (D4Q4A & D4Q4B) installation. I was asked to locate hoses that had the older brass fittings. The locations are noted on the spreadsheet. As time permitted, Frank began replacing these older hoses with a stainless steel style after completing pulling “T’s”. Approximately 152 hoses were replaced overall during the shutdown for various reasons.

Hoses were also made and installed in the Pre-Vault Stub Room. I failed to note the magnet locations. A call from the Control Room concerning a major water leak at the Pre-Vault Stub Room lead to repacking a leaky ball valve and replacing gaskets on a water hose. Apparently, electricians working in the area tried to stop a minor leak...thereby causing a major leak, then left. Surveyors called the leak into the Control Room and stated what had occurred. Several weeks later Frank would replace the ball valve. Also, Frank and I provided new water hoses to a power supply shunt, which was to become operational.

Frank was then charged with installing water flow meters in the P-Bar facility. The water flow meters are located at Cable Tray D-403-3, D-203-1 and D203-3 respectively. As Frank was performing this work, Inpeng Samayavong and I began brazing the last of the magnet water leaks. Again, information on which magnets were brazed is noted on the spreadsheet. One magnet water leak will not be corrected by brazing. It was decided that the leak was so minor and the risk of doing damage to the magnet would be much greater. The leak, located at D3Q17 will be monitored at this point.

Frank is now connecting water flow cooling hoses to power supplies at the AP0 Target Hall, AP30 and AP50 locations as I prepare this report. The last task will be to survey all hoses and debris brought up for radioactive contamination, along with all equipment brought into the P-Bar facility. Once this is satisfied and the equipment is returned to its proper place and the debris is disposed of, the removal of our LOTO locks shall signal the completion of the tasks Frank and I were charged with during the shutdown.

This report is being presented from information provided to me by Frank and my notes between August through November 2004.

P-Bar Water Leaks
11/16/2004

Date	Location	Inspected by	Problem	Resolution	Corrected by	Date
9/10/2004	A6B7	Albert	hose leak	replaced hose	Frank	9/16/2004
9/10/2004	A5S7	Albert	manifold leak, needs to be brazed	brazed leak/new fittings	Frank	9/16/2006
9/10/2004	A1Q14	Albert	shunt leak	replaced shunt	shunt personal	9/13/2004
9/10/2004	TQ6	Albert	hose to manifold leak	replaced hose	Frank	9/17/2004
9/10/2004	TQ4	Albert	1. hose to manifold leak	replaced hose	Frank	9/17/2004
			2. Copper line overhead leak	tightened connector	Frank	9/17/2004
9/10/2004	D5SF15	Albert	hose too short or manifold leak	replaced hose/brazed manifold	Frank	9/16/2004
9/10/2004	D:QS304	Albert	Supply hose to shunt	re-seated hose	Albert	9/20/2004
9/10/2004	D5Q6	Frank	bubble on hose	replaced hose	Frank	9/24/2004
9/10/2004	D2Q5	Frank	bubble on hose	replaced hose	Frank	9/24/2004
9/15/2004	A1Q10	Albert	hose seeping (1/2") black	replaced hose	Albert	10/6/2004
9/15/2004	D3B13	Albert	manifold leak, needs to be brazed	brazed leak	Samayavong	11/8/2004
9/15/2004	A6Q9	Albert	lower water tube from magnet leak	tightened connector	Frank	9/16/2004
9/16/2004	D6Q11		backside leak upper manifold	tightened connector	Frank	9/20/2004
9/21/2004	AARF4	Frank	hose leak inside cavity	tightened connector	RF Person	9/22/2004
9/22/2004	D:QS509	Albert	hose with brass fitting	replaced hose	Frank	9/22/2004
9/22/2004	D:QS502	Albert	hose with brass fitting	replaced hose	Frank	9/22/2004
9/22/2004	D:QS402	Albert	hose with brass fitting	replaced hose	Frank	9/22/2004
9/22/2004	D:QS403	Albert	hose with brass fitting	replaced hose	Frank	9/22/2004
9/22/2004	D:QS406	Albert	hose with brass fitting	replaced hose	Frank	9/22/2004
9/22/2004	D4B11	Albert	hose with brass fitting	replaced hose	Frank	9/22/2004
9/24/2004	D5Q6	Albert	1/4" black hoses leaking (2)	replaced hoses	Frank	9/27/2004
9/24/2004	D4SD10	Albert	copper line leak, needs to be brazed	brazed leak	Samayavong	11/8/2004
9/24/2004	A4B10	Frank	lower fitting leak, black hose	replaced hose	Albert	10/6/2004
9/27/2004	A3Q13	Albert	hose leak	tightened connector	Albert	10/6/2004
9/27/2004	EQ6	Albert	hose with brass fitting			
9/27/2004	D1Q8	Albert	hose with brass fitting			
9/27/2004	D1B7	Albert	hose with brass fitting			
9/27/2004	D6B7	Albert	hose with brass fitting			
9/27/2004	D6Q9	Albert	hose with brass fitting			
9/27/2004	D6Q10	Albert	hose with brass fitting			
9/27/2004	D6Q11	Albert	hose with brass fitting			
9/27/2004	D6Q12	Albert	hose with brass fitting			
9/27/2004	D6Q13	Albert	hose with brass fitting			

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9/27/2004	SMA107	Albert	hose with brass fitting			
9/27/2004	A6S10	Albert	hose with brass fitting			
		Albert	sub-room 40-1 hose with brass fitting			
10/6/2004	A3B7	Albert	prepared magnet for bake-out	no leak	Albert	10/6/2004
10/6/2004	A3B8	Albert	prepared magnet for bake-out	major leak within magnet	Albert	10/6/2004
10/6/2004	A3B9	Albert	prepared magnet for bake-out	no leak	Albert	10/6/2004
10/6/2004	A3B10	Albert	prepared magnet for bake-out	no leak	Albert	10/6/2004
10/7/2004	A4B10	Albert	prepared magnet for bake-out	minor leak within magnet	Albert	10/7/2004
10/7/2004	A4B9	Albert	prepared magnet for bake-out	minor leak within magnet	Albert	10/7/2004
10/7/2004	A4B8	Albert	prepared magnet for bake-out	no leak	Albert	10/7/2004
10/7/2004	A4B7	Albert	prepared magnet for bake-out	not equipped for bake-out	Albert	10/7/2004
10/7/2004	A4B3	Albert	prepared magnet for bake-out	not equipped for bake-out	Albert	10/7/2004
10/19/2004	D2SD10	Albert	lower tube needs to be brazed	brazed leak	Samayavong	11/8/2004
10/19/2004	D2SD14	Albert	hose leak	tightened connector	Frank	10/19/2004
10/19/2004	D1Q17	Albert	hose leak	replaced 1/4" black hose	Albert	10/29/2004
10/19/2004	A5Q10	Albert	hose leak	replaced 3/8" black hose	Albert	10/29/2004
10/20/2004	DQS317	Albert	shunt leaking	replaced shunt	shunt person	11/1/2004
10/20/2004	DQS319	Albert	SS line leaking	replaced tube	Frank	10/28/2004
10/25/2004	D5SD19	Albert	hose leak	tightened hose	Albert	10/28/2004
10/28/2004	D5Q12	Albert	connected hoses	no leaks	Albert	10/28/2004
10/28/2004	D5Q17	Albert	hose leak	replaced 1/4" black hose	Albert	11/2/2004
10/28/2004	D6Q17	Albert	connected hoses	no leaks	Albert	10/28/2004
10/28/2004	D6SD19	Albert	hose leak	tightened hose	Albert	10/28/2004
10/28/2004	Q417	Albert	replaced all & connected hoses	no leaks	Albert	10/28/2004
10/28/2004	D5Q4	Albert	hose leak	tightened hose	Albert	10/28/2004
10/28/2004	A2B9	Albert	3/8" black hose weeping	replaced 3/8" black hose	Albert	10/28/2004
10/28/2004	D2Q13	Albert	1/4" black hose kinked	replaced hose	Albert	10/29/2004
10/28/2004	A2Q2	Albert	1/4" black hose leaking	replaced hose	Albert	10/29/2004
10/28/2004	D3Q5	Albert	1/4" black hose binding	replaced hose	Albert	10/29/2004
10/28/2004	D4SF16	Albert	hose leak	tightened hose	Albert	10/29/2004
10/28/2004	DQS415	Albert	upper shunt hose leaking	tightened hose	Albert	10/29/2004
10/28/2004	D6SF19	Albert	hose leak	tightened hose	Albert	10/29/2004
11/1/2004	D1SD9	Albert	copper line needs to be brazed	brazed leak	Samayavong	11/8/2004
11/1/2004	D1SF18	Albert	brass tube needs to be brazed	brazed leak	Samayavong	11/8/2004

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11/1/2004	D3SD12	Albert	lower SS tube needs to be brazed	brazed leak	Samayavong	11/8/2004
11/3/2004	D5SF16	Albert	hose leak	tightened hose	Frank	11/3/2004
11/8/2004	D6SD13	Albert	minor leak needs to be brazed	brazed tube	Samayavong	11/8/2004
11/12/2004	D2Q3	Albert	SS tubing leak... bumped into	tightened hose	Frank	11/12/2004