Fermilab

Particle Physics Division

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Mechanical Department Engineering Note

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Title: **NuMI Target Hall Air Cooling system Specification for Chilled Coolant Pumping System**
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RFQ Version

NuMI Target Hall Air Cooling System
Specification for Chilled Coolant Pumping System
#MD-ENG-052

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1.0 Scope

1.1 The purpose of this pumping system is to circulate chilled coolant in a closed loop system. An atmospheric expansion tank is installed on the pump suction header.

1.2 The pumping system shall be a complete, packaged unit. Components shall be mounted on one base/skid.

1.3 Fermilab will set the unit, and connect it to the process piping and to the electrical power system. Fermilab will install wiring to the terminal strip(s) provided in the enclosure on the pumping system for the remote control signals.

1.4 The pumping system shall be designed according to vendor standard practices. Vendor is encouraged to propose alternatives to specified requirements.

1.5 The pumps and all structural steel shall be painted.

1.6 Vendor technical and cost-saving suggestions are welcome.

1.7 Quantity: One pumping system.

2.0 Pump

2.1	Number of pumps	Two. One pump online, other pump is 100% backup
2.2	Chilled coolant	75% water, 25% propylene glycol by volume with industrial corrosion inhibitors
2.3	Chilled coolant temperature	30 °F at pump suction
2.4	Chilled coolant density	64.4 Lbm/ft^3
2.5	Chilled coolant viscosity	6 centipoise
2.6	Flow rate per pump	110 USGPM
2.7	Pump differential head	325 feet
2.8	Pump shut-in head	375 feet maximum

2.9 The pump shall be suitable for pumping a chilled fluid.

2.10 The unit will be installed indoors. The indoor temperature range is 50 to 80 °F and the relative humidity is 50 to 90%.

3.0 Electrical Power System

3.1 Fermilab will provide 480 VAC, 3 phase, 60 Hz electrical power to the power enclosure mounted on the skid. This is the only power source for the pumping system. Fermilab will provide and install the breaker for this circuit in the Fermilab distribution panel.

3.2 Vendor shall design and provide the electrical power system for the pumping system. It shall comply with the NEC and NEMA, be housed in NEMA Type 4 enclosure, and include:

3.2.1 NOTE: This list only contains specific items, not all items, that shall be included in the power system that is designed by the vendor.

3.2.2 Fused main disconnect.

3.2.3 Transformer for control power.

3.2.4 Main fuses.

3.2.5 Transformer primary and secondary fuses.

3.2.6 Electronic soft starter for each pump motor.

3.2.7 Bimetallic thermal overload relays with manual reset for each starter.

3.2.8 Set of normally open contacts on the starter that close when the starter engages. Fermilab will apply 120 VAC to the contacts to generate a remote control signal.

4.0 Control System

4.1 Vendor shall design and provide the control system for the pumping system. It shall comply with the NEC and NEMA, be housed in NEMA Type 4 enclosure, and include:

4.1.1 NOTE: This list only contains specific items, not all items, that shall be included in the control system that is designed by the vendor.

4.1.2 Control system voltage shall be 120 VAC.

4.1.3 Local/Remote switch for each pump to block/activate remote start signals and remote stop signals.

4.1.4 Normally open, momentary contact local start button for each pump.

4.1.5 To remotely start a pump: A time delay relay with a set of normally open contacts in parallel with each pump local start button. This relay will be energized with a 120 VAC remote control signal. The time delay relay contacts shall close long enough to start the pump and then open. The time delay relay shall reset when the control signal terminates.

4.1.6 Normally closed, momentary break local stop button for each pump. Each local stop button shall stop its pump in both Local and Remote operation modes.

4.1.7 To remotely stop a pump: A control relay with a set of normally closed contacts in series with the contacts on the remote start, time-delay relay for the pump. This relay will be energized with a 120 VAC remote control signal.

4.1.8 Press-to-test, red "ON" light for each pump.

4.1.9 Press-to-test, green "OFF" light for each pump.

4.1.10 Hour meter for each pump.

4.1.11 An electrical interlock that prevents the other pump from starting after one of the pumps is running.

4.1.12 A normally closed temperature switch with adjustable set point to shutdown the pumps if chilled coolant temperature exceeds 90 °F. The switch shall be installed in the common discharge header.

4.1.13 An internal, normally closed temperature switch in each pump motor to shutdown the pump if the motor overheats.

4.1.14 A current indicating meter with two adjustable switches for each pump to shutdown the pump on either high or low current. Low current shutdown shall be bypassed for starting.

4.1.15 A button to reset automatic shutdowns for each pump.

4.1.16 For each pump, a current switch with a set of normally open contacts that make when the pump motor is energized. 120 VAC will be applied to the contacts to obtain "PUMP ON" signal for remote monitoring.

4.1.17 The buttons, lights and current meters shall be mounted in the door of the control enclosure.

5.0 Piping

5.1 Both pumps shall discharge into a common header mounted on the base/skid. Discharge header is $2^1/_2$ inch nominal copper tubing.

5.2 Both pumps shall take suction from a common header mounted on the base/skid. Suction header is $2^1/_2$ inch nominal copper tubing.

5.3 Both headers and the line to and from each pump shall be Type K copper tubing. Phosphorous bearing silver brazing alloy, such as Silfos, shall be used to make the joints. Brazing alloy shall be selected to give the lines a minimum allowable operating pressure of 200 psig at 100 °F.

5.4 Threaded pump connections shall be made with o-ring unions so pumps can be removed without disturbing the piping.

5.5 A three-piece, full port, suction ball valve shall be provided for each pump.

5.6 A three-piece, full port, discharge ball valve shall be provided for each pump.

5.7 Ball valve body material: bronze or stainless steel.

5.8 Ball valve ball material: stainless steel.

5.9 Stem and ball seal material: UHMWPE.

5.10 A low-leakage check valve shall be provided in the discharge line from each pump.

6.0 Instrumentation

6.1 A pressure gauge shall be installed in the common discharge header. A ball valve with threaded ends shall isolate the gauge from the process line.

6.2 A differential pressure gauge shall be installed across the suction and discharge headers. A ball valve with threaded ends shall isolate the gauge from the process lines. This gauge can share the process tap used by the discharge pressure gauge.

6.3 A temperature switch shall be installed in the common discharge header. The switch shall be used in the control system as specified in Section 4.0.

6.4 A temperature indicator shall be installed in the common discharge header.

6.5 If a gauge is installed less than 4 feet above the floor, it shall be tilted to make it easy to read.

7.0 Motor

7.1 Motor shall have TEFC enclosure.

7.2 Motor shall have an internal, normally closed temperature switch that opens when internal motor temperature exceeds manufacturer's preset limit. The switch shall be used in the control system as specified in Section 4.0.

7.3 Motor shall have EPACT efficiency.

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8.0 Pumping System Layout

8.1 The pumping system shall be no higher than 75 inches and no wider than 66 inches.

8.2 The pumping system shall be laid out as shown in Figure #1.

9.0 Insulation

9.1 The pumps and process piping shall be insulated with closed cell, elastomeric insulation made specifically for HVAC chilled water systems, such as Armaflex or equal.

10.0 Delivery

10.1 Pumping system shall be shipped 6 to 8 weeks ARO.

10.2 Order to be placed by August 13, 2004 if budget restrictions are not imposed.

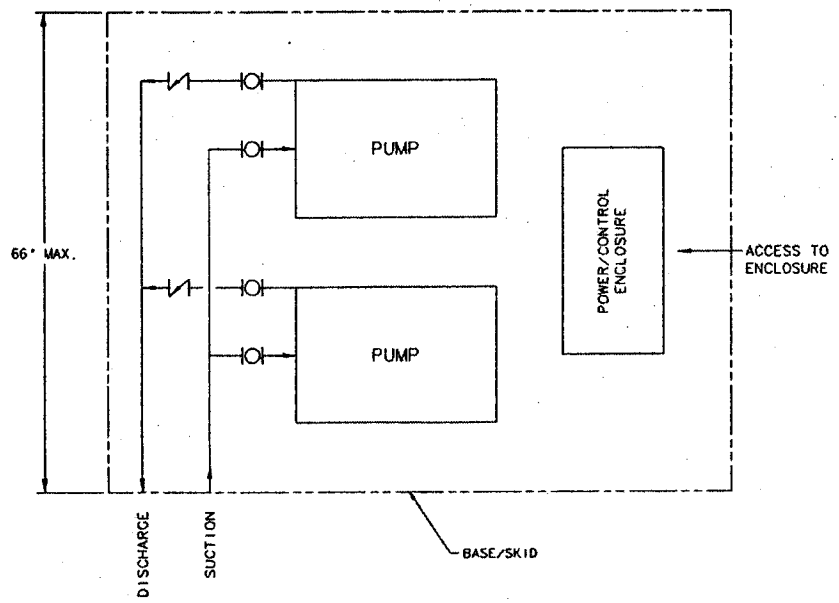

Figure 1. Pumping System Layout