Cryo Utilities Room Cooling System

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D-Zero Engineering Note #3740.510.EN-203

Approved: _____

A handwritten signature in cursive script, appearing to read "Kelly Dixon", is written over a horizontal line.

Many of the mechanical equipment failures at the Laboratory are due to the loss of cooling water. In order to insure the proper operating temperatures and to increase the reliability of the mechanical equipment in the D0 Cryo Utilities Room it is necessary to provide an independent liquid cooling system. To this end, an enclosed glycol/water cooling system which transfers heat from two vane-type vacuum pumps and an air compressor to the outside air has been installed in the Cryo Utilities Room.

System Selection

From the appended list it can be seen that only the Thermal Precision PFC-121-D and Ingersoll-Rand WAC 16 deserve closer investigation based on price. The disadvantages of the WAC 16 are that: it runs a little warmer, it requires more valving to properly install a backup pump, inlet and outlet piping are not included, and temperature and pressure indicators are not included. Its only advantage is that it is \$818 cheaper than the PFC-121-D. The advantages of the PFC-121-D are that: it has automatic pump switching during shutdown, it has a temperature regulator on one fan control, it has a switch which indicates proper operation, has a sight glass on the expansion tank, and comes with an ASME approved expansion tank and relief valve. For these reasons the Thermal Precision PFC-121-D was chosen.

System Details

In the past, we have always found the pond water to be muddy and to sometimes contain rocks of greater than 1/2 inch diameter. Thus a system completely dependent on the pond water from the accelerator was deemed unacceptable. A closed system was selected based on its ability to greatly improve reliability, while remaining economical. It is charged with a 50/50 glycol/water mixture capable of withstanding outside temperatures down to -33 °F. The fluid will be circulated by a totally enclosed air cooled Thermal Precision PFC-121-D pump. The system will be on emergency power and an automatically controlled backup pump, identical to the primary, is available should the main pump fail. The fan unit is used as a primary cooler and the trim cooler cools the fluid further on extremely hot days. The trim cooler has also been sized to cool the system in the event of a total shutdown provided that the pond water supply has adequate pressure. Due to a broken filter, we found it necessary to install a strainer in the pond water supply line. The expansion tank separates air bubbles, ensures a net positive suction head, protects against surges and over pressurization of the system, and allows

Status

All piping has been installed, flushed, charged with the glycol/water mix, and hydrostatically tested to 55 psi. The condition of all pumps and flow conditions will be recorded at the PLC. It has been decided not to include the regulator valve in the pond water return line. This valve was designated by the manufacturer to reduce the amount of water flowing through the trim cooler. This is not necessary in our application. There is some concern that the cooling fluid may cool the mechanical equipment too much when they are not operating or during very cold days. This issue will be addressed and the conclusion appended to this engineering note.

July 12, 1988

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Enclosed Water Cooler

	Pioneer	Thermal Precision	Ingersoll-Rand (YAC)	Airtek
make	AS219Y	PFC-121-D	WAC 16	SF2060
fan unit model no.	KFH200	05036		XF060xx
trim cooler model no.				
fan unit dims. (in.)	82x19x39	69x39x41	62x62x26.5	64x36x80
pump skid dims.	NA	42x30x53	NA	NA
inlet temp. (deg. F)	120	120	140	≤120
outlet temp. (deg. F)	95	95	115	≤95
ambient temp. (deg. F)	80	80	90	80
capacity BTU/hr**	113,000	115,000	117,000	120,000
t.c. capacity BTU/hr**	>115,000	>115,000	>115,000	>115,000
no. fans (hp)	3(1/4)	2(1/2)	1(3/4)	1(2)
pump hp	1 1/2	1	1 1/2	1 1/2
duplex available?	yes*	yes*	yes*	yes*
backup pump isolable?	yes	yes	no	yes
auto switching?	yes*	yes	yes*	yes*
pump failure readout?	yes*	yes	yes	yes*
fan voltage	230/1/60	110/1/60	230/1/60	230 or 460
pump voltage	115 or 230/1Ø	460/3/60	230/1/60	230 or 460
fan starter	NEMA 1	NEMA 3R	NEMA 4	NEMA 4*
pump starter	NEMA 1	NEMA 4	NEMA 4	NEMA 4*
pipng included?	yes	yes	no	yes
regulating valve?	no*	no	yes*	yes
expansion tank?	yes	yes	yes	yes
e.t. relief valve?	yes	yes	yes	on piping
e.t. sight glass?	no*	yes	no	no
e.t. purge?	yes	yes	yes	yes
fans cycle?	yes*	yes	yes	no
fan direction	Y(H)	H	Y	Y
flow switch	press. switch*	yes	yes*	yes*
help set up?	yes	yes	yes	yes
distributor	Cochran Comp.	manufacturer	I-R Air Center	Cochran Comp.
sales person	Robert Barnes	Craig Smith	Steve Stearn	Robert Barnes
telephone number	312-345-0225	716-823-3921	312-530-3800	312-345-0225
price with options (\$)	9,635	7,042	6,224	10,120

* indicates an optional item

** using a 40% glycol mix

Cryo Utility Room Cooling System

DRY FLUID COOLER

Water - An Endangered National Resource

Droughts in the Midwest. Bans on lawn sprinkling in the East. Lowering water tables nation-wide. These are all symptoms of our dwindling natural water resources. The end result? An ever-rising price to use and dispose of water.

If you are operating water-cooled equipment in your plant, you are faced with:

- increasing water costs
- sewage discharge taxes
- tightening government regulations
- discharge regulation compliance costs
- scaling and corrosion problems

The Alternative? A THERMAL PRECISION Packaged Fluid Cooler.

A sealed, pressurized recirculating cooling system consisting of an air-cooled fan-coil unit coupled to a pump station/control module, the Thermal Precision Fluid Cooler is THE answer to your water usage dilemma.

Engineered to match your heat load, the Thermal Precision Fluid Cooler utilizes a continuously circulating water/glycol solution to cool your equipment. This mixture in turn is cooled by ambient air passing over the fan coil unit.

The completely sealed system eliminates scale and corrosion build-up in piping and equipment by eliminating entrained oxygen in the system. The glycol mixture contains corrosion inhibitors for further protection.

As a complete package, the Thermal Precision Fluid Cooler is easily installed at your site. We offer either one complete module for outdoor mountings, or as two separate modules, enabling you to install the pump/control module inside and remote mount the air-cooled heat exchanger outdoors.

Compared to water and sewage expenses, the costs to operate the Thermal Precision Fluid Cooler is miniscule. And through the use of our standard fan cycling sequence control, we make it even more efficient.

Got a critical application which cannot afford to shut down due to lack of cooling water flow? Specify the Thermal Precision Fluid Cooler with optional dual pump arrangement. With this option we provide a manual lead pump selector switch, a pump failure alarm light with remote alarm contacts, automatic switch over to lag pump and warning light advising that a switch-over has occurred.

For difficult temperature situations, or under high ambient conditions, we offer optional trim cooler packages, complete with thermostatic mixing valves. Or, if you prefer, we can provide the Thermal Precision system with evaporative coolers rather than dry fan-coil units.

Feature

Benefit

1.) Closed air cooled system	No water costs
No sewage cost
No chemical treatment
2.) Glycol system	No scale or corrosion
No freeze up
3.) Complete package	Low installation cost
4.) Fan cycling	Low operating cost

Payback — The Bottom Line

Economic payback on your investment in Thermal Precision equipment is rapid. Directly related to your water and sewer costs, it is easily calculated.

For Example, A heat source using 30 gpm of water, 24 hours per day, 7 days per week with water and sewage costs of \$2.00 per 1000 gallons = 365 days x 24 hrs x 60 minutes x 30 gpm x \$0.002 per gallon = \$31,536.00 per year of water & sewage charges. When compared to the price of a Thermal Precision Fluid Cooler including installation and annual operating cost, you will find payback will occur within as little as 6 months.

Our representative will be pleased to prepare a payback analysis for your specific applications or:

Calculate Your Own Payback

	GPM	X Days Worked Per Year	X Hours Worked Per Day	X 60 (Minutes)	X Water & Sewage Cost Per Gallon	= Annual Water & Sewage Cost
Your				60		
Application				60		

Dry Fluid Cooler Selection

Fluid Out - To Heat Load Degrees F				105								
Fluid In - From Heat Load Degrees F				125								
% Glycol				20			30 - 40			50		
Ambient Degrees F				90	95	100	90	95	100	90	95	100
HP	MBH	GPM ¹	PUMP ²	PFC MODEL								
20	55	5	1	116	116	121	116	117	117	116	117	123
25	70	7	1	117	117	123	117	117	121	117	121	125
30	85	8	1	121	121	123	121	121	123	121	123	125
40	110	11	1	121	123	134	121	123	134	121	125	134
50	140	14	1	123	125	137	123	134	137	125	134	137
60	170	17	2	125	134	225	125	134	225	125	134	225
75	210	21	2	134	137	227	134	137	227	134	137	227
100	280	28	2	137	227	231	137	229	234	225	229	237
125	350	35	2	227	231	237	227	231	326	227	231	326
150	420	42	3	229	237	326	231	237	328	229	237	328
200	560	56	3	234	325	331	237	326	333	237	328	333
250	700	70	3	325	328	336	326	328	336	326	331	339
300	840	84	5	328	331	339	328	333	342	328	333	342
350	980	98	5	328	333	342	331	336	342	333	336	342
400	1120	112	5	333	336	342	333	339	345	333	339	345
500	1400	140	7.5	336	342	361	339	342	361	339	342	361
600	1680	168	7.5	342	342	361	342	345	364	342	361	364

1. Flows are basis water and will increase with glycol concentration.
2. Pump selection based on 100 PDF. Refer to Selection Manual for proper sizing.

Flow Schematic

Standard Equipment

- Heat Exchanger Coils
- Direct drive fans (Series 100 & 200)
- Belt drive fans (Series 300)
- Thermal overload protection
- Fan cycling controls (Multi-fan units only)
- NEMA 3R control panels
- Unit cabinets fabricated of either heavy gauge corrosion-resistant aluminum or galvanized steel
- All legs of galvanized steel
- Fans dynamically & statically balanced
- Fan guards of heavy gauge close mesh steel wire
- Pre-piped and pre-wired to single point connections

- Pump Station (simplex or duplex)
- Close coupled centrifugal pump(s) with mechanical seal
- Pump discharge check valve(s)
- Suction and discharge isolation and flow control valves
- Flow switch
- Pressure and temperature gauges
- Expansion/fill tank with air purge line, safety valve, isolation valve and fluid level sight glass
- Fabricated steel base plate
- Pre-piped and pre-wired to single point connection

- Pump Station (con't)
- NEMA 4 control enclosure, housing:
 - Full voltage magnetic motor starters
 - 120 volt control transformer (fused)
 - Hand-off-auto selector switch
 - Power-on light
 - Pump run light(s)
 - Pump failure lights with contacts for remote alarm
 - Terminal strip for connection to heat exchangers coil controls

Optional

- Dual Pump
- Thermostatic Mixing Valves
- Trim Coolers
- Water Make Up System
- Remote Control Panels
- Nema, 12, 4x, 7
- TEFC Motors
- Audible Alarm
- Evaporative Coolers
- Heat Recovery Units
- Custom Packaging

Specifications subject to change without notice.

PFC Cooler

MODEL (PFC)	L	W	H	WT. (LBS.)	MODEL (PFC)	L	W	H	WT. (LBS.)	MODEL (PFC)	L	W	H	WT. (LBS.)
114	39.312	39.062	41.25	200	227	119.75	44.562	50	570	328	121	85.875	62.5	1610
116	39.312	39.062	41.25	225	229	119.75	44.562	50	590	331	176	85.875	62.5	2110
117	39.312	39.062	41.25	245	231	174.75	44.562	50	840	333	176	85.875	62.5	2380
121	69.312	39.062	41.25	300	234	174.75	44.562	50	850	336	176	85.875	62.5	2460
123	69.312	39.062	41.25	340	237	174.75	44.562	50	880	339	176	85.875	62.5	2580
125	69.312	39.062	41.25	380	322	121	85.875	62.5	1280	342	231	85.875	62.5	3370
134	99.312	39.062	41.25	500	324	121	85.875	62.5	1340	345	231	85.875	62.5	3450
137	99.312	39.062	41.25	550	325	121	85.875	62.5	1370	361	341	85.875	62.5	4995
225	119.75	44.562	50	560	326	121	85.875	62.5	1540	364	341	85.875	62.5	5115

Simplex Pump Package

MODEL (HP)	L	W	H	WT. (LBS.)
1	42	24	53	450
2	42	24	53	465
3	48	28	53	500
5	48	28	53	520
7.5	62	30	63.5	660
10	62	30	63.5	690
15	62	30	63.5	850

Duplex Pump Package

MODEL (HP)	L	W	H	WT. (LBS.)
1	42	30	53	560
2	42	30	53	575
3	48	36	53	730
5	48	36	53	760
7.5	62	40	63.5	1200
10	62	40	63.5	1310
15	62	40	63.5	1500

All Dimensions Are In Inches

THERMAL PRECISION

3 Bradford St. Buffalo, N.Y. 14210 716/823-3921

SB-DFC/12-87/NPC-1M

Close-Coupled Centrifugal Pumps

Performance Curve

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SECTION 1

MODEL

GL642

METERS FEET

05036	3'-5"					
06024	2'-					
06036	3'-					
06048	4'-5 1/8"	57/16"	1"	1/2"	2"	19/16"
06060	5'-5 1/8"					
08024	2'-6 5/8"					
08036	3'-6 5/8"					
08048	4'-6 5/8"	7 1/16"	1 13/16"	1/2"	2 1/2"	2 1/4"
08060	5'-6 5/8"					
08072	6'-6 5/8"

*Note: The vent and drain bosses on the in/out bonnet will not be drilled or tapped unless specifically requested.

4 PASS

Size	M	N	P	R N.P.T.	S N.P.T.	T
03014	1'-5 1/8"	39/16"	3/8"	3/8"	3/4"	1"
03024	2'-3 1/8"					
04014	1'-5 7/8"					
04024	2'-3 7/8"	47/16"	5/8"	3/8"	3/4"	1 1/4"
04036	3'-3 7/8"					
05014	1'-6 13/16"					
05024	2'-4 13/16"	4 13/16"	3/4"	3/8"	1"	1 11/16"
05036	3'-4 13/16"					
06024	2'-5 1/8"					
06036	3'-5 1/8"	57/16"	1"	1/2"	1 1/2"	2"
06048	4'-5 1/8"					
06060	5'-5 1/8"					
08024	2'-6 5/8"					
08036	3'-6 5/8"					
08048	4'-6 5/8"	7 1/16"	1 13/16"	1/2"	2"	2 1/2"
08060	5'-6 5/8"					
08072	6'-6 5/8"

*Note: The vent and drain bosses on the in/out bonnet will not be drilled or tapped unless specifically requested.

Size	M	N	P	R N.P.T.	S N.P.T.	T
03014	3 1/4"	4 1/2"	10"	2 5/16"	1'-4 3/8"	2 3/4"
03024			1'-8"		2'-2 3/8"	4 1/2"
04014			9"		1'-4 5/8"	1 5/8"
04024	4 1/4"	6"	1'-7"	3 1/8"	2'-2 5/8"	7/16" Dia.
04036			2'-7"		3'-2 5/8"	1/4"
05014			9"		1'-5 1/8"	1 3/4"
05024	5 1/4"	6 3/4"	1'-7"	3 7/16"	2'-3 1/8"	1/2" x 3/4"
05036			2'-7"		3'-3 1/8"	1/4"
06024			1'-6 1/4"		2'-3 1/8"	
06036	6 1/4"	7 3/4"	2'-6 1/4"	4 1/16"	3'-3 1/8"	1/2" x 3/4"
06048			3'-6 1/4"		4'-3 1/8"	3/8"
06060			4'-6 1/4"		5'-3 1/8"	2"
08024			1'-5"		2'-3 1/2"	
08036			2'-5"		3'-3 1/2"	
08048	8 5/8"	10 1/2"	3'-5"	5 7/16"	4'-3 1/2"	5/8" x 7/8"
08060			4'-5"		5'-3 1/2"	3/8"
08072			5'-5"		6'-3 1/2"	3"