Dominion Nuclear Connecticut, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
Web Address: www.dom.com

Dominion®

July 2, 2013

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Serial No.	13-228A
NSSL/MAE	R0
Docket No.	50-423
License No.	NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3
SUPPLEMENT TO LICENSE AMENDMENT REQUEST FOR CHANGES TO TECHNICAL SPECIFICATION 3/4.7.5, "ULTIMATE HEAT SINK"

By letter dated May 3, 2013, Dominion Nuclear Connecticut, Inc. (DNC) submitted a license amendment request (LAR) for Millstone Power Station Unit 3 (MPS3). The proposed amendment would modify Technical Specification (TS) 3/4.7.5, "Ultimate Heat Sink," to increase the current ultimate heat sink (UHS) water temperature limit from 75°F to 80°F and change the TS Action to state, "With the ultimate heat sink water temperature greater than 80°F, be in HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours." DNC requested approval of the LAR by May 5, 2014 with implementation within 60 days of issuance.

In a letter dated June 26, 2013, the NRC provided DNC an opportunity to supplement the LAR identified above. During a clarification call between the NRC and DNC on June 20, 2013, DNC agreed to provide the information to the NRC by July 3, 2013.

Enclosure 1 provides DNC's response to the NRC's request. The associated detailed information requested by the NRC is provided in Enclosures 2 and 3.

If you have any questions or require additional information, please contact Wanda Craft at (804) 273-4687.

Sincerely,

David A. Heacock,
President and Chief Nuclear Officer

VICKI L. HULL
Notary Public
Commonwealth of Virginia
140542
My Commission Expires May 31, 2014

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by David A. Heacock, who is President and Chief Nuclear Officer of Dominion Nuclear Connecticut, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 2nd day of July, 2013.

My Commission Expires: 5-31-14

Vicki L. Hull
Notary Public

Commitments made in this letter: None

A001
NRR

Enclosures:

1. Supplement to License Amendment Request for Changes to Technical Specifications 3/4.7.5, "Ultimate Heat Sink."
2. DNC Response for Items A1 through A10
3. DNC Response for Item B

cc: U.S. Nuclear Regulatory Commission
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NRC Senior Resident Inspector
Millstone Power Station

Director, Radiation Division
Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

ENCLOSURE 1

SUPPLEMENT TO LICENSE AMENDMENT REQUEST FOR CHANGES TO TECHNICAL SPECIFICATIONS 3/4.7.5, "ULTIMATE HEAT SINK"

Dominion Nuclear Connecticut, Inc.
Millstone Power Station Unit 3

By letter dated May 3, 2013, Dominion Nuclear Connecticut, Inc. (DNC) submitted a license amendment request (LAR) for Millstone Power Station Unit 3 (MPS3). The proposed amendment would modify Technical Specification (TS) 3/4.7.5, "Ultimate Heat Sink," to increase the current ultimate heat sink (UHS) water temperature limit from 75°F to 80°F and change the TS Action to state, "With the ultimate heat sink water temperature greater than 80°F, be in HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours."

In a letter dated June 26, 2013, the NRC provided DNC an opportunity to supplement the LAR identified above. The NRC requested;

A) The following information for each safety related heat exchanger cooled by service water:

1) Design heat load
2) Design fouling factor
3) As-tested fouling factor
4) Tube plug allowance
5) Actual number of plugged tubes
6) Calculated heat removal capability
7) Design minimum flow rate
8) Actual flow rate
9) Vendor supplied heat exchanger specification sheet
10) Description of Generic Letter 89-13 testing/cleaning program for each heat exchanger.

B) An 18 x 24 size piping and instrumentation diagram of service water system, and

C) A statement as to whether or not the increase in service water temperature from 75 °F to 80 °F will result in a derating of the emergency diesel generators.

DNC Response (Items A1 through A10)

The requested information for items A1 through A10 identified above in support of operation at a UHS of 80°F, are provided in Enclosure 2 for the following service water cooled, safety-related, heat exchangers:

- Reactor Plant Component Cooling Water Heat Exchangers (3CCP*E1A, 3CCP*E1B, 3CCP*E1C)
- Charging Pump Coolers (3CCE*E1A, 3CCE*E1B)
- Safety Injection Pump Coolers (3CCI*E1A, 3CCI*E1B)
- Emergency Diesel Generator Heat Exchangers (3EGS*E1A/E2A, 3EGS*E1B/E2B)
- Control Building Chiller Heat Exchangers (3HVK*CHL1A, 3HVK*CHL1B)
- ESF Air Conditioning Unit Heat Exchangers (3HVQ*ACUS1A, 3HVQ*ACUS1B, 3HVQ*ACUS2A, 3HVQ*ACUS2B)
- MCC/Rod Control Air Conditioning Unit Heat Exchangers (3HVR*ACU1A, 3HVR*ACU1B)
- Recirculation Spray Heat Exchangers (3RSS*E1A, 3RSS*E1B, 3RSS*E1C, 3RSS*E1D)

Physical plant changes have been implemented following the UHS license amendment submittal to correct HVR booster pump (flow) performance deficiencies identified in the submittal (LAR Commitment 13). The corrective actions entailed a change to a flow restricting orifice size in the Service Water to HVR piping subsystem. This change corrected the HVR booster pump flow deficiency and also resulted in small changes to the delivered flow calculated to some of the other heat exchangers in the SW system. Any information provided in this response which is different from the values provided in the UHS license amendment submittal dated May, 3, 2013, are flagged to indicate the value which has been updated to address the recent restricting orifice change. Note that the tabulation of actual flows in the May 3 submittal only identifies the lower of the two trains' flow. In this submittal, both trains' flowrate are identified. These are not flagged as changes.

DNC Response (Item B)

A 17 x 22 size piping and instrumentation diagram of the MPS3 service water system is provided in Enclosure 3 as Drawing No. 25212-26933.

DNC Response (Item C)

The increase in service water temperature from 75°F to 80°F does not require derating of the MPS3 emergency diesel generators.

ENCLOSURE 2

DNC Response for Items A1 through A10

Dominion Nuclear Connecticut, Inc.
Millstone Power Station Unit 3

Reactor Plant Component Cooling Water Heat Exchangers			
Item	**3CCP*E1A**	**3CCP*E1B**	**3CCP*E1C**
A1) Design heat load	117.8 E+6 Btu/hr	117.8 E+6 Btu/hr	117.8 E+6 Btu/hr
A2) Design fouling factor**	0.001609	0.001609	0.001609
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	10% (114 of 1148 Tubes)	10% (114 of 1148 Tubes)	10% (114 of 1148 Tubes)
A5) Actual number of plugged tubes	63	79	88
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	LOP(1) - 3634 gpm SIS(2) - 2139 gpm SGCS(3) - 7388 gpm	LOP - 3634 gpm SIS - 2139 gpm SGCS - 7388 gpm	SGCS – 7388 gpm
A8) Actual flow rate	LOP – 7637(4) gpm SIS - 6378(4) gpm SGCS - 7623(4) gpm	LOP - 7661(4) gpm SIS - 6207(4) gpm SGCS - 7646(4) gpm	SGCS – 7412 gpm
A9) Vendor supplied specification sheet	See Figure 1	See Figure 1	See Figure 1
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.
(1) LOP: Loss of Power.
(2) SIS: Safety Injection Signal.
(3) SGCS: Safety Grade Cold Shutdown.
(4) Updated value.

Figure 1

CCP

447 446

3-5

95-052 R2C2
P. 22

TECHNICAL DATA FURNISHED BY BIDDER/SELLER
STONE & WEBSTER ENGINEERING CORPORATION
TUBULAR HEAT EXCHANGER DATA

1	Customer	Northeast Utilities Service Company	
2	Project and Location	Millstone Nuclear Power Station- Unit 3	Date 4-7-73 ROS
3	Service	Reactor Plant Component Cooling Heat Exchangers	Mark No. 3CCP-E1A
4	Mfr's Size	49=504 Mfr's Type TEMA CGN	Installation - Horiz. B,C
5		3 Batteries Each Consisting of 1 Parallel Banks of 1 Shells in Series	
6		Sq. ft. per Shell 1 Shells per Battery 12625 Sq. ft. per Battery Gross	
7		PERFORMANCE OF ONE BATTERY	

		SHELL SIDE	TUBE SIDE
9	Fluid Circulated	Component Cooling Water	Service Water
10	Total Fluid Entering	MW 4,050,000 lb/hr	MW 4,000,000 lb/hr
11	Vapor	MW lb/hr	MW lb/hr
12	Liquid	MW 4,050,000 lb/hr	MW 4,000,000 lb/hr
13	Steam	lb/hr	lb/hr
14	Noncondensables	MW lb/hr	MW lb/hr
15	Liquid: Density & Viscosity	lb/cu ft at F& CP at F	lb/cu ft at F& CP at F
16	Liquid: Sp. Ht. & Bubble Point	at F& F	at F& F
17	Liquid: Therm. Conductivity	BTU/hr (ft²)(F/ft) at F	BTU/hr (ft²)(F/ft) at F
18	Vapor: Therm. Cond. & Viscosity	BTU/hr (ft²)(F/ft) & CP at F	BTU/hr (ft²)(F/ft) & CP at F
19	Vapor: Sp. Ht. & Dew Point	at F& F	at F& F
20	Fluid Vap. & Cond.	MW lb/hr	MW lb/hr
21	Steam Cond.	lb/hr	lb/hr
22	Latent Heat	BTU/lb at F	BTU/lb at F
23	Temp. In & Out	113.8 F& 95 F	75 F& 94 F
24	Operating Pressure	115 psig at inlet	65 psig at inlet
25	No. Passes & Velocity	Split Flow & 5.5 Avg. ft/sec	2 & 7 ft/sec
26	Pressure Drop	Max. 15 psi Calc. 15 psi	Max. 20 psi Calc. 10 psi
27	Sensible Heat BTU/hr	76,000,000	76,000,000
	Latent BTU/hr		
30			
31	Total Duty BTU/hr	76,000,000 ✓	76,000,000
32	Film Rates & Fouling Factors	ho 1370 fo .0005	hi 1300 fi .001
33	LMTD 19.9 TD corr. 19.2	Overall: Clean 608 Service 318	Surface: Calculated 12,480 sq ft Supplied 12,480 sq ft
34	0.969 = F	CONSTRUCTION	UA = 3.96 x 10⁶
35	Pressure: Design & Test	150 psig 225 psig	100 psig 150 psig
36	Design Temp.	200 F	200 F
37	Tubes: No. per Shell 1148	Length 42' x 1" ODX	18 AVG BWG Pitch 5/16 △
38	Materials: Tubes	90-10 Cu-Ni Shell Carbon Steel	49" ID Thickness 1/2
39	Channel	Monel Gasket Compressed Asbestos	Channel Cover Car. St./Monel Ovly.
40	Shell Cover	--- Gasket ---	Gasket
41	Tube Sheets: Stationary	Car. St./Monel Overlay " Thick	Floating " Thick
42	Cross Baffles	Carbon Steel 3/4 " Thick Type Seg.	No. 22 % Cut 45 Spacing 22.8"
43	Long Baffles	Carbon Steel 1/4 " Thick	Type Long No. 1
44	Tube Supports	Carbon Steel 5/8 " Thick	Type Full Support Spacing
45	Corrosion Allowance: Shell Side	1/8 "Tube Side None	Stress Relieved (SR) Radiographed (XR)
46	Code Requirements	ASME III, Cl. 3 TEMA Class R Weights: Each Shell 61,800 lb Bundle Only --- lb	Full of Water 98,500 lb

	Nozzles	Shell: No. Size & Rating	Tube: No. Size & Rating
48	Inlet	24", 150# R.F.	24", 150# R.F.
49	Outlet	24", 150# R.F.	24", 150# R.F.
50	Drain	3/4" soc.wld. coup.	3/4"soc. wld. coup.
51	Vent	(full) - 3000psi	(full) - 3000psi
52	Vent	" " "	" " "

53 Remarks: Design shall be satisfactory
54 for continuous operation with
55 35F inlet tube side and 150F
inlet shell side.

Sketch

Notes:

1. Overall length = 48' 0"
2. Distribution belt provided.

60 Revisions 1. 2. 3.

Charging Pump Coolers		
Item	**3CCE*E1A**	**3CCE*E1B**
A1) Design heat load	81,100 Btu/hr	81,100 Btu/hr
A2) Design fouling factor**	0.00654 hr-ft^2-°F/Btu	0.00654 hr-ft^2-°F/Btu
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	0%, Total Number of Tubes 1	0%, Total Number of Tubes 1
A5) Actual number of plugged tubes	N/A	N/A
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	31.2 gpm	31.2 gpm
A8) Actual flow rate	40.8 gpm	44.2 gpm
A9) Vendor supplied specification sheet	N/A(1)	N/A(1)
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.
(1) Heat exchanger was specially manufactured on site.

Safety Injection Pump Coolers		
Item	**3CCI*E1A**	**3CCI*E1B**
A1) Design heat load	27,850 Btu/hr	27,850 Btu/hr
A2) Design fouling factor**	0.00256 hr-ft^2-°F/Btu	0.00256 hr-ft^2-°F/Btu
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	0%, Total Number of Tubes 1	0%, Total Number of Tubes 1
A5) Actual number of plugged tubes	N/A	N/A
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	19.62(2) gpm	19.62(2) gpm
A8) Actual flow rate	22.7 gpm	27.2 gpm
A9) Vendor supplied specification sheet	N/A(1)	N/A(1)
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.
(1) Heat exchanger was specially manufactured on site.
(2) Updated value.

Emergency Diesel Generator Heat Exchangers		
Design Parameter	**3EGS*E1A/E1B**	**3EGS*E2A/E2B**
A1) Design heat load	4,210,000[(1)] Btu/hr	8,445,000 Btu/hr
A2) Design fouling factor**	0.000959 hr-ft^2-°F/Btu	0.000959 hr-ft^2-°F/Btu
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	5.0 % (16 Tubes)	5.0 % (16 Tubes)
A5) Actual number of plugged tubes	0 Tubes	0 Tubes
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	1444 gpm	1444 gpm
A8) Actual flow rate	1738 gpm	1714 gpm
A9) Vendor supplied specification sheet	See Figure 2 (a)	See Figure 2 (b)
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.

(1) This is the required heat load for the intercooler heat exchanger (3EGS*E1A/E1B).. Since the jacket water cooler (3EGS*E2A/E2B) is more limiting, and the heat exchangers are in series, at the jacket water cooler required flow, the intercooler heat load is 4,725,000 Btu/hr. This design minimum flow rate is based on the jacket water cooler..

Figure 2 (a)

AMERICAN STANDARD
HEAT TRANSFER DIVISION
BUFFALO, N.Y. 14240

11 907 209 JO 12179 SPEC 2447.300-241 MILLSTONE NUCLEAR POWER STATION UNIT #3 NORTHEAST UTILITIES SERVICE Co

HEAT EXCHANGER SPECIFICATION SHEET

1			JOB NO.	B221661-0
2	CUSTOMER	Cole Industries Inc	REFERENCE NO.	Y3-030-US
3	ADDRESS		INQUIRY NO.	7-20006
4	PLANT LOCATION		DATE	7/28/75
5	SERVICE OF UNIT	Intercooler Water Cooler	ITEM NO.	01 - 14 cyl.
6	SIZE 17180 CPT	TYPE Packed Head (HORIZ.) (VERT.)	CONNECTED IN	
7	SQ. FT. SURF./UNIT (GROSS) (EFF.) 736	SHELLS/UNIT One	SQ. FT. SURF./SHELL (GROSS) (EFF.)	736
8	PERFORMANCE OF ONE UNIT			
9		SHELL SIDE		TUBE SIDE
10	FLUID CIRCULATED	WATER		WATER
11	TOTAL FLUID ENTERING	800 GPM		1900 GPM
12	VAPOR			
13	LIQUID			
14	STEAM			
15	NON-CONDENSABLES			
16	FLUID VAPORIZED OR CONDENSED			
17	STEAM CONDENSED			
18	GRAVITY			
19	VISCOSITY			
20	MOLECULAR WEIGHT			
21	SPECIFIC HEAT		BTU/LB-°F	BTU/LB
22	THERMAL CONDUCTIVITY		BTU/HR-FT-°F	BTU/HR-FT
23	LATENT HEAT		BTU/LB	BTU/L
24	TEMPERATURE IN	105.8	°F	60
25	TEMPERATURE OUT	95	°F	64.6
26	OPERATING PRESSURE		PSIG	
27	NO. PASSES PER SHELL	1		1
28	VELOCITY		FT/SEC	7.3 FT/S
29	PRESSURE DROP	3.8	PSI	3.1
30	FOULING RESISTANCE (MIN.)	Total .0015		
31	HEAT EXCHANGED-BTU/HR	4,338,055	MTD CORRECTED-°F	17.9
32	TRANSFER RATE-SERVICE	329	CLEAN	
33	CONSTRUCTION OF ONE SHELL			
34	DESIGN PRESSURE	150	PSI	150
35	TEST PRESSURE	225	PSI	225
36	DESIGN TEMPERATURE	200	°F	200
37	TUBES 90/10	NO. 250 ** OD. 3/4 BWG. 18	LENGTH 15	PITCH 15/16
38	SHELL Steel	I.D. O.D.	SHELL COVER	(INTEG) (REM.)
39	CHANNEL OR BONNET 90/10		CHANNEL COVER	90/10 lined
40	TUBESHEET-STATIONARY 90/10		TUBESHEET-FLOATING	90/10
41	BAFFLES-CROSS Steel	TYPE Segmental	FLOATING HEAD COVER	
42	BAFFLES-LONG	TYPE	IMPINGEMENT PROTECTION	
43	TUBE SUPPORTS			
44	TUBE TO TUBESHEET JOINT			
45	GASKETS			
46	CONNECTIONS-SHELL SIDE	IN 6" on Dome OUT 6" on Dome	RATING	150
47	CHANNEL SIDE	IN 8" OUT 8"	RATING	150
48	CORROSION ALLOWANCE-SHELL SIDE		TUBE SIDE	
49	CODE REQUIREMENTS	ASME SECTION III - Class 3	TEMA CLASS	R
50	WEIGHTS-EACH SHELL 3780#	BUNDLE 2160#	FULL OF WATER	5255#
51	NOTE: INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)			
52	REMARKS.			

5-049-17-160-001
EQUIP.ID 3EGS*EG-A/B Unit has zincs *

12179-2447-300.241-069

NO.	DATE	REVISIONS	BY	CHK	APP	APP
F	5-19-11	INCORP. DCN DM3-01-0365-00 PER DUR 11-800084	MKN	MP	-	MP
E	2-15-06	INCORP. DCN DM3-00-0520-05	JCV	WBZ	-	ASK
D	9-15-04	INCORP. DCN DM3-00-0365-00 & DM3-00-0462-01	RL	MP	-	DED

* ZINCS OPTIONAL
** ACTUAL NUMBER OF TUBES IS 258. ORIGINAL VALUE OF 250 TUBES REMAINS VALID FOR HEAT EXCHANGER ANALYSIS.

CAD
NOTE: MANUAL REVISIONS TO THIS DOCUMENT WHEN AS-BUILT ARE PROHIBITED.

25212-39241 SH. 69

Figure 2 (b)

3EGS*E2A/B

AMERICAN STANDARD
HEAT TRANSFER DIVISION
BUFFALO, N.Y. 14240

11 907208

J.O. # 12179
SPEC. 2447.300.241
MILLSTONE NUCLEAR POWER STA UNIT #3
NORTHEAST UTILITIES SERVICE CO.

HEAT EXCHANGER SPECIFICATION SHEET

1			JOB NO.	B-271681-0
2	CUSTOMER	COLT INDUSTRIES INC	REFERENCE NO.	Y3-030-US
3	ADDRESS		INQUIRY NO.	7-20006
4	PLANT LOCATION		DATE	7/28/75
5	SERVICE OF UNIT	JACKET WATER COOLER	ITEM NO.	02- 14 Cyl.
6	SIZE	19093 CPT TYPE Packed Head (HORIZ.)(VERT.)	CONNECTED IN	
7	SQ. FT. SURF./UNIT (GROSS)(EFF.)	489 SHELLS/UNIT One	SQ. FT. SURF./SHELL (GROSS)(EFF.)	489

	PERFORMANCE OF ONE UNIT			
9		SHELL SIDE		TUBE SIDE
10	FLUID CIRCULATED	WATER		WATER
11	TOTAL FLUID ENTERING	913 GPM		1900 GPM
12	VAPOR			
13	LIQUID			
14	STEAM			
15	NON-CONDENSABLES			
16	FLUID VAPORIZED OR CONDENSED			
17	STEAM CONDENSED			
18	GRAVITY			
19	VISCOSITY			
20	MOLECULAR WEIGHT			
21	SPECIFIC HEAT		BTU/LB-°F	BTU/LB-
22	THERMAL CONDUCTIVITY		BTU/HR-FT-°F	BTU/HR-FT-
23	LATENT HEAT		BTU/LB	BTU/
24	TEMPERATURE IN	155	°F	84.6
25	TEMPERATURE OUT	136.5	°F	93.5
26	OPERATING PRESSURE		PSIG	PS
27	NO. PASSES PER SHELL	One		One
28	VELOCITY		FT/SEC	6 FT/S
29	PRESSURE DROP	4.0	PSI	1.3
30	FOULING RESISTANCE (MIN.)	Total .0015		
31	HEAT EXCHANGED-BTU/HR	8,419,000	MTD CORRECTED-°F	52.4
32	TRANSFER RATE-SERVICE	328	CLEAN	

	CONSTRUCTION OF ONE SHELL			
34	DESIGN PRESSURE	150	PSI	150
35	TEST PRESSURE	225	PSI	225
36	DESIGN TEMPERATURE	200	°F	200

37	TUBES 90/10 NO. 322** O.D. 3/4 BWG. 18 LENGTH 8 PITCH 15/16 Δ	
38	SHELL Steel I.D. O.D.	SHELL COVER (INTEG.)(REMOV.)
39	CHANNEL ~~XXXXXXXX~~ 90/10	CHANNEL COVER Steel 90/10 lined
40	TUBESHEET-STATIONARY 90/10	TUBESHEET-FLOATING 90/10
41	BAFFLES-CROSS Steel TYPE Segmental	FLOATING HEAD COVER
42	BAFFLES-LONG TYPE	IMPINGEMENT PROTECTION
43	TUBE SUPPORTS	
44	TUBE TO TUBESHEET JOINT	
45	GASKETS	
46	CONNECTIONS-SHELL SIDE IN 6" on Dome OUT 6" on Dome	RATING 150
47	CHANNEL SIDE IN 8" OUT 8"	RATING 150
48	CORROSION ALLOWANCE-SHELL SIDE	TUBE SIDE
49	CODE REQUIREMENTS ASME SECTION III - Class 3	TEMA CLASS R
50	WEIGHTS-EACH SHELL 2350# BUNDLE 1625#	FULL OF WATER 3205#
51	NOTE: INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)	
52	REMARKS: UNIT HAS ZINCS * 5-049-19-093-001	

FORM 150-3 N.Y. REVISED 1-70

12179-2447.300-241-067

NO.	DATE	REVISIONS	BY	CHK	APP	APP
E	5-19-11	INCORP DCN DM3-01-0365-00 PER DUR 11-800084	MKN	MP	-	MP
D	2-15-06	INCORP. DCN DM3-00-0520-05	JCV	WBZ	-	ASK
C	9-15-04	INCORP. DCN DM3-00-0365-00	RL	MP	-	DED

* ZINCS OPTIONAL

** ACTUAL NUMBER OF TUBES IS 324. ORIGINAL VALUE OF 322 TUBES REMAINS VALID FOR HEAT EXCHANGER ANALYSIS.

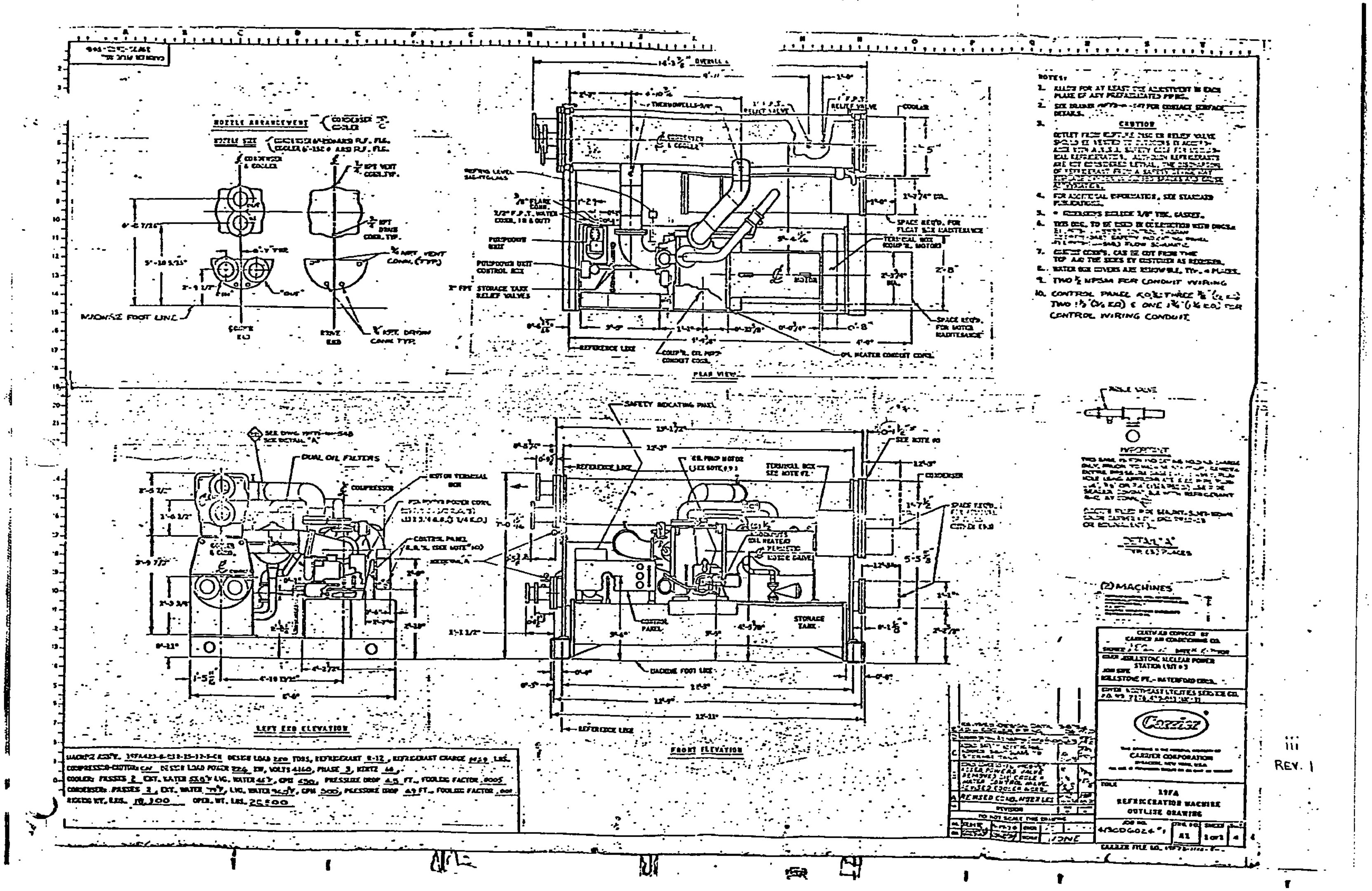
CAD
NOTE: MANUAL REVISIONS TO THIS DOCUMENT WHEN AS-BUILT ARE PROHIBITED.

25212-39241 SH. 67

Control Building Chiller Heat Exchangers		
Item	**3HVK*CHL1A**	**3HVK*CHL1B**
A1) Design heat load	2,800,000 Btu/hr	2,800,000 Btu/hr
A2) Design fouling factor**	0.00461291 hr-ft^2-°F/Btu	0.00461291 hr-ft^2-°F/Btu
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	15.0% of 240 Tubes	15.0% of 240 Tubes
A5) Actual number of plugged tubes	22 Tubes	18 Tubes
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	303 gpm	303 gpm
A8) Actual flow rate	315 gpm	329 gpm
A9) Vendor supplied specification sheet	See Figure 3	See Figure 3
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.

Figure 3



ESF Air Conditioning Unit Heat Exchangers		
Item	**3HVQ*ACUS1A**	**3HVQ*ACUS1B**
A1) Design heat load	360,600 Btu/hr	360,600 Btu/hr
A2) Design fouling factor**	0.00244395 hr-ft^2-°F/Btu	0.00244395 hr-ft^2-°F/Btu
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	10.0% of 106 Tubes	10.0% of 106 Tubes
A5) Actual number of plugged tubes	0 Tubes	2 Tubes
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	25.0 gpm	25.0 gpm
A8) Actual flow rate	29.6 gpm	25.2 gpm
A9) Vendor supplied specification sheet	See Figure 4	See Figure 4
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.

Figure 4

Vacuum and Heat Transfer

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Page 7 of 8

EXCHANGER SPECIFICATION SHEET

1		EG NO. 160CIN75R3
2	CUSTOMER CVI CORP.	JOB NO. 29066 M
3	USER NORTHEAST NUCLEAR ENERGY CO.	CUST. NO. 80-0113
4	PLANT LOCATION MILLSTONE III NUCLEAR POWER PLANT	DATE 11-20-79
5	SERVICE OF UNIT R-22 CONDENSER	ITEM NO. ----
6	SIZE 10" x 11' TYPE BEM	POSITION - HORIZ. ~~VERT.~~
7	SURF./UNIT 635 SQ. FT. SHELLS/UNIT ONE	SURF./SHELL 635 SQ. FT.
8	NO. OF UNITS FOUR (4) SHELL ARRANGEMENT ---	ENGR. SPN

PERFORMANCE OF ONE UNIT

9	FLUID ALLOCATION		SHELL SIDE		TUBE SIDE	
10	FLUID CIRCULATED		R-22		WATER	
11	TOTAL FLUID ENTERING	#/HR.	5760		32500	
12			IN	OUT	IN	OUT
13	VAPOR	#/HR.	5760	---	---	---
14	LIQUID	#/HR.	---	---	32500	32500
15	STEAM	#/HR.	---	---	---	---
16	NONCONDENSABLES	#/HR.	---	---	---	---
17	FLUID ~~VAPORIZED OR~~ CONDENSED	#/HR.	---	5760	---	---
18	STEAM CONDENSED	#/HR.	---	---	---	---
19	GRAVITY - LIQUID		---	---	---	---
20	VISCOSITY - LIQUID		---	---	---	---
21	MOLECULAR WEIGHT - VAPORS		86.5	86.5	---	---
22	MOLECULAR WEIGHT - NON - CONDENSIBLES		---	---	---	---
23	SPECIFIC HEAT	BTU/#/°F	---	---	---	---
24	THERMAL CONDUCTIVITY		---	---	---	---
25	LATENT HEAT		---	---	---	---
26	TEMPERATURE (COND. 105 ° F.)	°F	155	95	80	95.7
27	INLET PRESSURE PSIG		215		110	
28	NUMBER OF PASSES	PER SHELL	ONE		TWO	
29	VELOCITY	FT./SEC.	---		3.0	
30	PRESSURE DROP - ALLOW/CALC	PSI	4 / 4		6 / 3	
31	FOULING RESISTANCE		---		.001	

32 HEAT EXCHANGED 510,000 BTU/HR; MTD (CORRECTED) 18 °F

33 TRANSFER RATE SERVICE 45 CLEAN --- BTU/HR SQ.FT.°F

CONSTRUCTION OF ONE SHELL

			SHELL SIDE	TUBE SIDE
34			SHELL SIDE	TUBE SIDE
35	DESIGN/TEST PRESSURE PSIG		300 / 450	150 / 225
36	DESIGN TEMPERATURE °F		200	200
37	CORROSION ALLOWANCE IN		.063"	.003"
38	CONNECTIONS	IN	1-1/4"NPT	2"-150#R.F.
39	SIZE &	OUT	1-1/4"NPT	2"-150#R.F.
40	RATING		---	---

SKETCH (BUNDLE NOZZLE ORIENT.)

ORIENTATION PER DRAWING NU-C-1056-1

41 TUBE NO. 106 OD 5/8" IN. THK(MIN ~~AVG~~) .049 IN. LENGTH 11'-0"

42 TUBE MATERIAL (~~WLD~~/SMLS) SB-359 90/10 CuNi PITCH 25/32" IN. ← 30

43 SHELL SA-106 Gr.B ID. -- OD. 10" IN. | SHELL COVER --- (INTEG.) (REMOV.)

44 [redacted] BONNET SB-402 90/10 Cu-Ni ** | CHANNEL COVER ---

45 TUBESHEET - STATIONARY SB-171 90/10 Cu-Ni | TUBESHEET - FLOATING ---

46 FLOATING HEAD COVER --- | IMPINGEMENT PROTECTION SA-240 TP 304

47 BAFFLES - CROSS SA-285 Gr.C TYPE Segmental % CUT 20% SPACING 4" (4)

48 BAFFLES - LONG SA-285 Gr. C Subcooling Weir TUBE SUPPORTS SA-285 Gr. C

49 TUBE SHEET JOINTS - SHELL Welded CHANNEL Flanged TUBES Expanded

50 GASKETS - SHELL None FLOATING HEAD ---- CHANNEL Neoprene

51 CODE REQUIREMENTS ASME Section III Class 3 (Tubeside) * TEMA CLASS R

52 WEIGHTS/SHELL - SHIPPING 1200 FLOODED 1660 LBS.

53 REMARKS: *ASME Section VIII Div. 1 (Shellside) 1974 Edition - S74 Ad[illegible]

55 **Flanges are SB-402 90/10 Cu-Ni Plate Type

ESF Air Conditioning Unit Heat Exchangers		
Item	**3HVQ*ACUS2A**	**3HVQ*ACUS2B**
A1) Design heat load	396,400 Btu/hr	396,400 Btu/hr
A2) Design fouling factor**	0.00211819 hr-ft^2-°F/Btu	0.00211819 hr-ft^2-°F/Btu
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	10.0% of 106 Tubes	10.0% of 106 Tubes
A5) Actual number of plugged tubes	0 Tubes	0 Tubes
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	33.2 gpm	33.2 gpm
A8) Actual flow rate	35.7 gpm	35.5 gpm
A9) Vendor supplied specification sheet	See Figure 4	See Figure 4
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.

MCC/Rod Control Air Conditioning Unit Heat Exchangers		
Item	**3HVR*ACU1A**	**3HVR*ACU1B**
A1) Design heat load	560,700 Btu/hr (DBA(1)) 507,000 Btu/hr (BTP CMEB 9.5-1(2))	560,700 Btu/hr (DBA) 507,000 Btu/hr (BTP CMEB 9.5-1(2))
A2) Design fouling factor**	0.016642 hr-ft^2-°F/Btu	0.016642 hr-ft^2-°F/Btu
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	5.5 % (3 of 54 Tubes per Row – 4 Rows)	5.5 % (3 of 54 Tubes per Row – 4 Rows)
A5) Actual number of plugged tubes	2	2
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	BTP CMEB 9.5-1 - 75 gpm All Others - 122 gpm	BTP CMEB 9.5-1 - 75 gpm All Others - 122 gpm
A8) Actual flow rate	BTP CMEB 9.5-1 – 96(3) gpm All Others - 140(3) gpm	BTP CMEB 9.5-1 - 100(3) gpm All Others - 134(3) gpm
A9) Vendor supplied specification sheet	See Figure 5	See Figure 5
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.
(1) DBA: Design Basis Accident.
(2) BTP CMEB 9.5-1: Fire protection guidelines, Branch Technical Position CMEB 9.5-1. These are conditions during a postulated fire that disables the associated booster pump.
(3) Updated value.

Figure 5 – Page 1

Attachment No. 1 NNECO Calculation No. 90-069-01131M3, Rev. 1

(3HVR*ACU1A/B) 31

SELECTION OF AEROFIN AIR-COOLING COILS OPTIM Rev H 06/01/94

Job Name : MILLSTONE
Quote Number : NO TUBES PLUGGED
System Id :
Date : 10/18/94

Coil Information

Coil Type : R
Fin Material : Copper
Coil Circuit : FULL
Tube Size : 5/8" x 0.049" wall

Number In Face	Tube Face	Casing Height	Nominal Tube Length	Fins/ Inch	Rows	Dry Wt lbs
2	27	43.0"	96.0"	8.50	4	1079

System Face Area : 49.51 sq ft

Performance

Air Side

Elevation :	0 ft
Standard Pressure :	29.92 in Hg
Standard Airflow :	26000 cfm
Standard Face Velocity :	525 fpm
Entering Dry Bulb Temperature :	120.0 F
Entering Wet Bulb Temperature :	91.0 F
Leaving Dry Bulb Temperature :	100.7 F
Leaving Wet Bulb Temperature :	87.3 F
Sensible Heat Load :	568.0 MBH
Total Heat Load :	568.0 MBH
Outside Surface Fouling :	0.00000 hr-ft^2-F/Btu

Fluid Side

Fluid :	SEA WATER
Entering Temperature :	75.0 F
Leaving Temperature :	96.4 F
Flow Rate :	55.0 gpm
Tube Velocity :	1.5 fps
Inside Surface Fouling :	0.00200 hr-ft^2-F/Btu

Losses

Air Friction :	0.30 in wg
Fluid Pressure Drop :	~~1.4~~ 1.5 ft wg

Notes
Non standard tube face; special pricing/lead time required.
Coil weight shown is for one coil.
Fluid properties: SG= 1.025 VI= 0.850 CP= 0.940 TK= 0.340.

PAGE 4 OF 11

Proto-Power Calc: 99-114
Attachment: A
Rev: A Page 2 of 4

Figure 5 – Page 2

3HVR*ACU1A/B 32

PROTO-POWER CORPORATION

591 POQUONNOCK ROAD
GROTON, CT 06340
(860) 446-9725

TELEPHONE MEMORANDUM

DATE OF CALL: 9/16/99 **TIME OF CALL:** ~11:00 AM

PERSON CALLING: Merid Above
Proto-Power
860-446-9725

PERSON CALLED: Brian Elliott
Aerofin Corp.
804-528-6208

SUBJECT: Millstone Unit 3 MCC Control Rod Area AC unit (3HVR*ACU1A/B)

COMMENTS:
Called Aerofin Corporation (Manufacturer of Subject Air Coil unit) to obtain missing physical information. Namely,

The coil's Fin Thickness, Fin Height, and Longitudinal and Transverse tube pitches.

Mr. Elliott provided me with the following information.

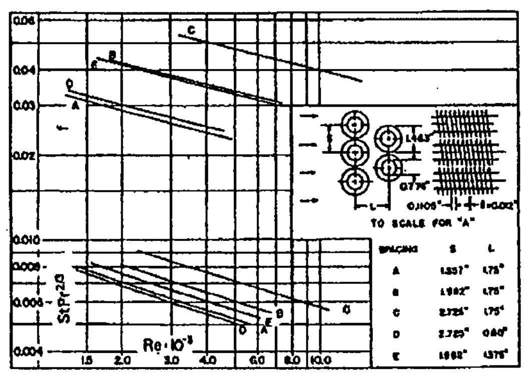
Fin Thickness: 0.012"
Fin Height: 3/8" above tube outer surface
Transverse Tube Pitch: 1 25/64".

In addition, he mentioned that the tubes are arranged in an equilateral triangle configuration and that the longitudinal pitch can be derived from the geometry.

Figure 5 – Page 3

3HVC*ACUIA(B) 33

Fig. 10-89 Finned circular tubes, surface CF-9.05–3/4J. *(Data of Jameson.)*



Tube outside diameter = 0.774 in = 19.66×10^{-3} m
Fin pitch = 9.05 per in = 356 per m
Fin thickness = 0.012 in = 0.305×10^{-3} m
Fin area/total area = 0.917

	A	*B*	*C*	*D*	*E*
Flow passage hydraulic diameter, $4r_h$ =	0.01681	0.02685	0.0445	0.01587	0.02108 ft
=	5.131×10^{-3}	8.179×10^{-3}	13.59×10^{-3}	4.846×10^{-3}	6.426×10^{-3} m
Free-flow area/frontal area, σ =	0.455	0.572	0.688	0.537	0.572
Heat transfer area/total volume, α =	108	85.1	61.9	135	108 ft^2/ft^3
=	354	279	203	443	354 m^2/m^3

Note: Minimum free-flow area in all cases occurs in the spaces transverse to the flow, except for *D*, in which the minimum area is in the diagonals.

90-069-01131M3 Rev. 2
Proto-Power Calc: 99-114
Attachment: A
Rev: A Page 4 of 4

Recirculation Spray Heat Exchangers				
Design Parameter	**3RSS*E1A**	**3RSS*E1B**	**3RSS*E1C**	**3RSS*E1D**
A1) Design heat load[(1)]	184,534,533 Btu/hr	184,534,533 Btu/hr	184,534,533 Btu/hr	184,534,533 Btu/hr
A2) Design fouling factor** (shell/tube side)	0.0010 hr-ft^2-°F/Btu	0.0010 hr-ft^2-°F/Btu	0.0010 hr-ft^2-°F/Btu	0.0010 hr-ft^2-°F/Btu
A3) As-tested fouling factor	See Item 5 of Attachment 2	See Item 5 of Attachment 2	See Item 5 of Attachment 2	See Item 5 of Attachment 2
A4) Tube plug allowance	69 (5%) of 1380	69 (5%) of 1380	69 (5%) of 1380	69 (5%) of 1380
A5) Actual number of plugged tubes	3	3	6	3
A6) Calculated heat removal capability	See Attachment 1	See Attachment 1	See Attachment 1	See Attachment 1
A7) Design minimum flow rate	5400 gpm	5400 gpm	5400 gpm	5400 gpm
A8) Actual flow rate	5493[(2)] gpm	5753[(2)] gpm	5479[(2)] gpm	5641[(2)] gpm
A9) Vendor supplied specification sheet	See Figure 6	See Figure 6	See Figure 6	See Figure 6
A10) Description of Generic Letter 89-13 testing/cleaning program	See Attachment 2	See Attachment 2	See Attachment 2	See Attachment 2

** This is the total fouling factor used in the analysis of record to determine required service water flow rate.

(1) Design heat load data comes directly from the heat exchanger vendor data sheet. Actual heat transfer values based on Loss of Coolant Accident (LOCA) conditions with 80°F service water temperature vary with time based on containment sump temperature and therefore, were not specifically documented within design bases analysis documents. These calculations were done using the NRC-approved GOTHIC methodology.

(2) Updated value.

Figure 6

3-6

TECHNICAL DATA FURNISHED BY BIDDER/SELLER
STONE & WEBSTER ENGINEERING CORPORATION
TUBULAR HEAT EXCHANGER DATA

Client Northeast Utilities Service Company
Project and Location Millstone Nuclear Power Station - Unit 3 — Date 11/4/76 BKAK
Service Containment Recirculation Coolers — Mark No. 3RSS-E1A/B/C/D
Mfr's Size 36 - 432 — Mfr's Type — Installation - Horiz. ☐ -Vert. ☒
4 Batteries Each Consisting of 1 Parallel Banks of 1 Shells in Series
8082 Sq. ft. per Shell 1 Shells per Battery 8082 Sq. ft. per Battery

PERFORMANCE OF ONE BATTERY

	SHELL SIDE	TUBE SIDE
Fluid Circulated	Recirculated Water	Service Water
Total Fluid Entering	MW 1,932,299 lb/hr	MW 3,244,278 lb/hr
Vapor	MW lb/hr	MW lb/hr
Liquid	MW 1,932,299 lb/hr	MW 3,244,278 lb/hr
Steam	lb/hr	lb/hr
Noncondensables	MW lb/hr	MW lb/hr
Liquid: Density & Viscosity	lb/cu ft at F & CP at F	lb/cu ft at F & CP at F
Liquid: Sp. Ht. & Bubble Point	at F & F	at F & F
Liquid: Therm. Conductivity	BTU/hr (ft²)(F/ft) at F	BTU/hr (ft²)(F/ft) at F
Vapor: Therm. Cond. & Viscosity	BTU/hr (ft²)(F/ft) & CP at F	BTU/hr (ft²)(F/ft) & CP at F
Vapor: Sp. Ht. & Dew Point	at F & F	at F & F
Fluid Vap. & Cond.	MW lb/hr	MW lb/hr
Steam Cond.	lb/hr	lb/hr
Latent Heat	BTU/lb at F	BTU/lb at F
Temp. In & Out	201.5 F & 106.0 F	75 F & 131.88 F
Operating Pressure	100 - 160 psig at inlet	65 psig at inlet
No. Passes & Velocity	1 & 5.02(6.41)** ft/sec	1 & 7.0 (7.44) *** ft/sec
Pressure Drop	Max. 25 psi Calc. 23.5 (36.8)**	Max. 15 psi Calc. 8.0(9.5)*** psi
Sensible Heat BTU/hr	184,534,533	184,534,533
Latent Heat BTU/hr		
Total Duty BTU/hr	184,534,533	184,534,533
Film Rates & Fouling Factors	h_o 1751 r_o .0005	h_i 1751 r_i

LMTD 47.8 MTD corr. 47.8 Overall Rate: Clean 629 Service 478 Surface: Calculated 7740 sq. ft. Supplied 8082 sq. ft.

CONSTRUCTION

Pressure: Design & Test Full Vac. & 300 psig — 450 psig — 100 psig — 150 psig
Design Temp. 235 F — 200 F
Tubes: No. per Shell 1380 Length 36'-0" " X 5/8 " ODX 18 BWG ave/min Pitch .8125 " ▲ ☐ ◇
Materials: Tubes 70-30 CuNi - SB111 Shell Type 304 Stainless Steel, SA240 36" ID Thickness 0.375 "
Channel 90-10 CuNi - SB402 Gasket Compressed Asbestos Channel Cover Carbon Steel Line with 90-10 CuNi-SB402
Shell Cover Gasket ~~Floating Head~~ Expansion Joint Gasket N.R.
Tube Sheets: Stationary Monel-SB127-400 Hot Rolled Thk 1 3/8 Floating " Thick
Cross Baffles Type 304 S.S. " Thick Type D'ble Seg No. 28 % Cut NA Spacing 14 1/4"
Long Baffles Type 304 S.S. " Thick Type No.
Tube Supports " Thick Type Imping Spacing
Corrosion Allowance: Shell Side None " Tube Side None Stress Relieved (SR) Radiographed (XR) ☐
Code Requirements ASME III* TEMA Class R Weights: Each Shell 27,000 lb Bundle Only lb Full of Water 45,000 lb

Nozzles	Shell: No. Size & Rating	Tube: No. Size & Rating
Inlet	16"-300psig-RF Flg	18"-150 psig-RF.Flg
Outlet	16"-300psig-R.F.Flg	18"-150 psigR.F.Flg
Drain	1"-SW Coup-3,000psi	3/4"-SW Coup-3,000 psi
Vent	1/4"-NPT in T.S.	3/4"-SW Coup.-3,000 psi
Drain	1/4"-NPT in T.S.	

Sketch

NOTES:

1. J. Oat Job No. J-2227-1, A-D

Remarks: * Shell side-Class 2, Tube side-Class 3
**At 5,000 gpm
***At 7,000 gpm

Revi. ons. 1. KAK 11/4/76 3.

ATTACHMENT 1

CALCULATED HEAT REMOVAL CAPABILITY

**Dominion Nuclear Connecticut, Inc.
Millstone Power Station Unit 3**

Calculated Heat Removal Capability

Service water cooled heat exchanger calculations (using Proto-HX™) use the design heat load (or an assumed heat load greater than the design) and fouling factor, the heat exchanger characteristics (geometry, tube plugging limits, materials, etc.), process side parameters, and temperature of the sea water to determine the required seawater flow rate. The service water system flow calculation (using Proto-flo™) then determines the available flow. There is no separate calculation of heat removal capability – it's presented as the same as the design heat load. The difference between the required flow and the available flow demonstrates the margin. Additionally, margin also exists in the difference between the actual number of tubes plugged and the number of tubes assumed plugged (plugging allowance) and the difference between the actual service water pump performance and the assumed degraded pump in the flow analysis. While these numbers can change over time, they are monitored to ensure that equipment is repaired or replaced before system margin is challenged.

For Plant Component Cooling Water (CCP), heat removal capability depends on the system alignment under consideration. From a safety standpoint, the most limiting system alignment is a safety grade cold shutdown (SGCS). It is limiting because it has the least amount of associated flow margin with respect to the other CCP flow alignments.

Heat removal capability is calculated as a function of various parameters. To name a few, it is a function of CCP temperature limitations, time to cold shutdown requirements, CCP flow rates, service water (SW) flow rates, and is a function of time due to decay heat removal.

SGCS which involves CCP and the residual heat removal system is analyzed using calculation specific code and is analyzed in time steps. For each time step, various parameters of interest, many of which are interdependent and must be solved simultaneously/iteratively for each time step, are calculated. Among those parameters is the CCP heat removal capability, which varies over time.

The SGCS analysis is defined as the limiting CCP heat exchanger heat transfer case because it has the highest safety-related component heat load and the lowest margin between minimum required and available SW flow. The SGCS analysis is a transient analysis that models multiple systems to simulate the plant cooldown process. The SGCS analysis uses a representative fixed CCP heat exchanger proportionality constant (UA) and a 7388-gpm SW flow rate to simulate the plant cooldown process. The representative UA value is 3.93×10^6 (BTU/hr-°F) and this UA is determined in a supporting CCP heat exchanger heat transfer calculation. SGCS analysis cases have a peak 117.8×10^6 BTU/hr CCP heat exchanger heat removal rate and this peak occurs when the CCP heat exchanger shell side inlet temperature is 142.4°F. This heat removal rate is reported as the CCP heat exchanger "design heat load" in Enclosure 2.

ATTACHMENT 2

DESCRIPTION OF GENERIC LETTER 89-13 TESTING/CLEANING PROGRAM

Dominion Nuclear Connecticut, Inc.
Millstone Power Station Unit 3

Description of Generic Letter (GL) 89-13 Testing/Cleaning Program

GL 89-13 Elements

Five items were required by GL 89-13. They are summarized below:

1) Implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. This program includes:

    a. Inspect the intake structure for macrofouling due to organisms, sediment and corrosion. Remove fouling accumulations.
    b. Continuously chlorinate the service water (SW) system.
    c. Flush and flow test infrequently used cooling loops and fill stagnant loops with chlorinated water prior to layup.

2) Conduct thermal performance testing of safety related heat exchangers to verify design heat transfer capability.

3) Perform routine inspection and maintenance on piping and components to ensure that corrosion, erosion, protective coating failure, silting and biofouling cannot degrade the performance of safety related systems cooled by service water. This program should include:

    a. Remove excessive accumulations of biofouling agents, corrosion products and silt.
    b. Repair defective coatings and corroded service water system piping and components that could adversely affect a safety related function.

4) Confirm the service water system will perform its intended function per the licensing basis for the plant.

5) Confirm that maintenance practices, operating and emergency procedures and training that involve the service water system are adequate to ensure that safety related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively.

Dominion Nuclear Connecticut Response

Millstone Unit 3 complies with GL 89-13 as follows. Note that item numbers below correspond to the requirements of GL 89-13 listed above.

Item 1:

a. The intake structure is inspected annually using divers and videotape during the annual intake bay outages in the winter.
b. The Service Water system is chlorinated by injecting hypochlorite immediately downstream of the strainer of the running SW pump.
c. The infrequently used cooling loops in the SW system are the supply lines to the four Containment Recirculation Spray (RSS) heat exchangers which are normally maintained dry, the SW piping to the diesel heat exchangers, and the SW piping to the engineered safety feature (ESF) Air Conditioning Unit Heat Exchangers (HVQ) heat exchangers. Service Water is flushed through the RSS heat exchangers twice per year, followed by a fresh water flush and then drained. The diesel heat exchangers get chlorinated water continuously via a flow orifice which allows flow around a normally closed isolation valve and they are tested weekly at full flow for macrofouling. Service Water to the HVQ is flowed once per day for 15 minutes via the bypass outlet valve in order to maintain chlorinated water in the heat exchangers and each of these heat exchangers is subject to a weekly macrofouling surveillance. Layup of heat exchangers and stagnant piping requires components to be placed in fresh water layup if they are idle for greater than three days. Removing the salt water significantly reduces the possibility of fouling and thus additional chlorination is not needed.

Item 2:

Thermal performance testing of heat exchangers has been conducted per NRC commitments made in NU letter B17205 of May 6, 1998 (Reference 1) as modified by Northeast Utilities (NU) letter B18331 of February 28, 2001 (Reference 2). Millstone Power Station Unit 3 committed to the NRC (in letter B17205) to develop and implement a heat exchanger testing program to satisfy Item 2 of GL 89-13. This testing program required three baseline thermal performance tests and periodic retests be done on each safety related SW-cooled heat exchanger except the four RSS heat exchangers. The RSS heat exchangers are maintained dry and are flushed with fresh water after surveillances which flow salt water through the tubes. These actions prevent fouling. In 2001, attempts to test Reactor Plant Component Cooling Water (CCP) heat exchangers were discontinued due to impracticality of obtaining meaningful test data. Commitments related to CCP heat exchanger testing were cancelled by NU Letter B18331 of February 28, 2001. For the other safety related heat exchangers, baseline thermal performance tests were used to establish a cleaning frequency that ensures that microfouling will not proceed to a point that exceeds the assumptions in the heat exchanger analyses. Subsequent testing has confirmed that this cleaning frequency remains adequate to maintain required heat transfer capability. For the CCP heat exchangers, an annual cleaning frequency was established. The cleaning frequency has subsequently been changed to twice per year to prolong heat exchanger life (silt accumulation was found to increase the rate of tube pitting).

Item 3:

Inspection and maintenance of SW system components includes direct visual examination of accessible piping and heat exchangers, inspection by remote camera of piping, components and heat exchangers (as needed), cleaning and eddy current testing of heat exchangers, and ultrasonic testing to determine wall thickness of susceptible piping. The results of the inspections determine the necessary maintenance on the affected components so that the safety related function of the Service Water system is maintained.

Item 4:

The ability of the SW system to perform as licensed has been confirmed and reported in NU letter B14643 of November 5, 1993 (Reference 3). Regular maintenance of the heat exchangers, as well as control over design changes (including analyses and tests to verify the design) ensure that the system will continue to perform as licensed.

Item 5:

Maintenance practices, procedures, and training have been confirmed to adequately ensure that Service Water cooled equipment will perform as designed and that operators will operate the equipment effectively to maintain the safety related function of the system.

The thermal performance tests described in item 2 above were used to determine a rate of change of fouling factor with respect to time to determine the adequacy of the cleaning frequency. Therefore, there is no direct correlation between the tested and the design fouling factors. The tested fouling factor is extrapolated to the end of the cleaning interval to demonstrate that the fouling factor remains less than the design.

References:

1. M. L. Bowling to NRC, "Millstone Station, Unit No. 3, Service Water System – Generic Letter 89-13 (TAC No. 74027), May 6, 1998.
2. R. P. Necci to NRC, "Millstone Nuclear Power Station, Unit No. 3, Commitment Changes Associated with Service Water System – Generic Letter 89-13 (TAC No. 74027), February 28, 2001 (ML010660034).
3. J. F. Opeka to NRC, "Millstone Nuclear Power Station, Unit No. 3, Service Water System-Generic Letter 89-13 (TAC No. 74027), November 5, 1993.

ENCLOSURE 3

DNC Response for Item B

Dominion Nuclear Connecticut, Inc.
Millstone Power Station Unit

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