CALCULATION
ED-Q2268-87324
480V Reactor MOV Board 2C
w/All Attachments

TSD-EQ-

CALCULATION COVER SHEET

TITLE THERM[illegible]VERLOAD HEATER CALCULATIONS - 480V [illegible]TOR MOV BD 2C	PL[illegible]T 2-WP-12
PREPARING ORGANIZATION: EBASCO	KEY NOUNS (Consult RIMS DESCRIPTORS LIST): THERMAL OVERLOAD CALCULATION
BRANCH/PROJECT IDENTIFIERS: ED-Q2268-87324	Each time these calculations are issued, preparers must ensure that the original (R0) RIMS accession number is filled in.
APPLICABLE DESIGN DOCUMENT(S): AS REFERENCED	SAR SECTION(S): N/A; UNID SYSTEM(S): 268

Rev	(for RIMS' use)	RIMS accession number
R0	8804110066	B22 '880331 109
R L		B22 '88 0815 102
R _		
R _		

Revision 0	R1	R2	R3
ECN No. (or indicate Not Applicable): E-2-P7010	DCN H1239 RA		
Prepared: Dan J. Amaty 3/16/88	8-1-88 Jeffrey P. Mellen		
Checked: [illegible] (EHAM) 3-17-88	8-1-88 Rowan Kobbe		
Reviewed: [illegible] 3/22/88	4-1-88 [illegible]		
Approved: [illegible]	[illegible]		
Date: 3/22/88	5/11/88		
List all pages added by this revision.	4A, 5A, 6A 7A, 8A		
List all pages deleted by this revision.	4, 5, 6, 7, 8		
List all pages changed by this revision.	AS NOTED		

Safety-related? Yes ☒ No ☐

Statement of Problem:

THERMAL OVERLOAD HEATERS (TOL) AT BFNP WERE, NOT PREVIOUSLY DOCUMENTED.

THIS CALCULATION DETERMINES THE DESIGN AND EVALUATES THE INSTALLED TOL HEATERS PER REQUIREMENTS OF NRC IEB 87031.

Abstract

These calculations contain an unverified assumption(s) that must be verified later. Yes ☐ No ☒

CLASSIFICATION

ESSENTIAL DIRECT DESIGN INPUT | R1

[illegible]

[illegible]

☐ Microfilm and store calculations in RIMS Service Center.

☐ Microfilm and return calculations to: Calculation File Room Microfilm instructions ☐

Address: EC 2FN

CULATION NO: ED-Q2268-87324

Title: ERMAL OVERLOAD HEATER CALCULATIONS-480V REACTOR MOV BD 2C

REVISION LOG

Revision No.	DESCRIPTION OF REVISION	Date Approved
0	THIS CALCULATION VOIDS AND SUPERSEDES CALCULATION NO BFEP-E1-86062 RIMS-B22-870504 104 AND ALL REVISIONS THERETO.	
1	REVISED HEATER SIZES BASED ON CLARIFICATION OF G.E. INSTRUCTIONS.	8/11/88

PREP. JPM 1.88
CHECK RKS 88 REV.1

TABLE OF CONTENTS

This Sheet Added by Rev. 1

1.0 GENERAL

1.1 Purpose

The purpose of this calculation is to establish the requirements and guidelines to evaluate, verify, control and retain engineering calculations for thermal overload relay (TOL) selection.

1.2 Scope

The scope of this calculation is to determine the design for TOL heater sizes and settings and to evaluate the installed TOL heaters for continuous duty motors and motor operated valve motors powered from the Motor Control Centers (MCC) required for Unit 2 restart at Browns Ferry Nuclear Plant utilizing QIR-EED-87031 design criteria. (Ref. #5)

2.0 CRITERIA

The manufacturer's recommendations are used in the selection of overload heaters. The overload heater sizes and settings will be in accordance with the design criteria in QIR-EEB-87031. R1

2.1 Continuous Duty Motors

Following is the process to be used in the selection of thermal overload heaters for continuous duty motors: R1

2.1.1 The walkdown input data for the motor nameplate and motor control center will be recorded and used to perform the calculations. (Ref. #3)

2.1.2 Temperature Correction Factor

Manufacturer's recommendations shall be followed when non-accident ambient temperatures of the motor and motor control centers are within 18°C of each other. If the temperature difference is higher, the full load current shall be multiplied by temperature correction factor before selecting the overload heater. (Ref. #5)

The temperature correction factor is the ratio of motor ambient temperature correction factor and overload heater ambient temperature correction factor. (Ref. #5)

2.1.3 Designed thermal overload heaters are sized as follows:

a) The service factor is determined from the walkdown input data. From Ref. #1 sh. 1, the derating factor is selected and the motor nameplate full load current is multiplied by the derating factor to determine the maximum full load current to be used in the heater table. (Ref. #1 sh. 8)

b) The heater catalog number is selected for the starter NEMA size and maximum full load current calculated in Item 2.1.3 a. If the maximum full load current does not match the heater table, use the next larger maximum motor full load current and adjust the percent setting of the overload relay as required.

c) The degree of protection provided by the overload heater is evaluated by multiplying the maximum motor full load current given in the heater table by 125% and dividing by the motor nameplate full load current. (Ref. #9)

d) This value is then compared to the design criteria for acceptance. (Ref. #5)

2.1.4 The installed thermal overload heaters are evaluated as follows:

The maximum motor full load current given in the table is multiplied by 125% and by the percent setting of the overload relay. This value is the trip current of the overload heater. The trip current of the heater is then divided by the nameplate full load current of the motor to determine the percent protection. (Ref. #9) This value is then compared to the design criteria for acceptance. (Ref. #5)

2.1.5 Section 4 of the calculation sheet makes the recommendation to either leave the installed heater and adjust setting as necessary or to replace with the thermal overload heater sized in section 2 of the calculation sheet.

2.2 Motor Operated Valve Motors

The following procedures are to be used for motor operated valve motors:

2.2.1 The walkdown input data for the motor nameplate and motor control center will be recorded and used to perform the calculations. (Ref. #3)

This Sheet Added by Rev. 1

2.1.3 Thermal overload heaters for continuous duty motors are sized as follows:

a) The service factor is determined from the walkdown input data. Multiply the motor nameplate full load current by the service factor derating factor to determine the current to be used when selecting a heater from the heater table. (Ref. #1 Sh. 8)

b) The heater is selected from the heater table for the starter size it will be used with. The heater minimum current must be equal to or greater than the motor full load current calculated in Item 2.1.3 a above.

c) Heater minimum current is determined from the heater tables by the method described in G.E. "Application Tips" dated March 11, 1983 No. 001.

d) The degree of protection provided by the overload heater is evaluated by multiplying the heater minimum current by 1.25 and dividing by the motor nameplate full load current. (Ref. #9) R1

e) This value is then compared to the design criteria for acceptance. (Ref. #5)

2.1.4 Acceptability of existing thermal overload heaters will be determined using the method described in 2.1.3 above and based on the following:

a) Heaters will be selected based on an overload relay setting of 100%.

b) Existing heaters will be reset or replaced as required.

2.2 Motor Operated Valve Motors

Following is the process to be used in the selection of thermal overload heaters for motor operated valve motors:

2.2.1 The walkdown input data for the motor nameplate and motor control center will be recorded and used to perform the calculations. (Ref. #3)

2.2.2 Designed thermal overload heaters are sized as follows:

Using the time-current curve for the overload relay (Ref. # 1 Shts 5 through 7) locate the 15 second point and determine the current rating multiple for the particular zone of curve selected. Locked rotor current is divided by the current rating multiple to calculate the trip current. Divide trip current by factor of 1.25 to determine the heater selection current. (Ref. #9)

2.2.3 The heater catalog number is selected for the starter NEMA size and the heater selection current from heater selection table (Ref. #1, Sh. 8). If the heater selection current does not match the heater table, use the next larger maximum heater selection current. This value is the maximum full load current of the heater (Im).

2.2.4 The overload heater trip current (It) is calculated by multiplying maximum motor full load current (Im) by factor of 1.25 and the percent setting of the overload relay. (Ref. #9)

2.2.5 Determine the tripping time of the heater at 100% Full Load Current (FLC), 200% FLC and Locked Rotor Current/Amps (LRA) by dividing these values by the tripping current for each value. The percent values obtained shall be compared to the time vs current curves giving time in seconds. The heater tripping zones are given in Ref. #1 Shts 2, 3, & 4 and time-current curves are given in Ref # 1 Shts 5, 6, & 7. If the trip time does not fall within the acceptance criteria, then overload relay setting shall be adjusted to bring the trip time with the acceptance criteria outlined in QIR EEA 87[illegible] (Ref. #5)

2.2.6 Installed thermal overload heaters are evaluated as follows:

The heater catalog number is located in the heater selection table (Ref. #1 Sh. 8) for the proper size NEMA starter. The maximum motor full load current is located opposite the catalog number. After determining the maximum motor full load current follow steps 2.2.4 and 2.2.5 above to determine the tripping time of the overload heater for 100% FLC, 200% FLC and LRA.

2.2.7 Section 5 of the calculation sheet makes the recommendation either to leave the installed heater and adjust the setting as necessary or to replace thermal overload heater with the one sized in Section 3 of the calculation sheet.

2.2.8 If the Locked Rotor Current/Amps (LRA) is to be determined from the NEC code letter, select the value from Sec. 3.6 NEC Table 430.7 (b) and multiply by the motor rated horsepower. The KVA value obtained is divided by the square root of three and the motor rated voltage to determine the motor Locked Rotor Current/Amps (LRA).

SUPERSEDED BY PAGE 6A OF 11

This Sheet Added by Rev. 1

2.2.2 Thermal overload heaters for motor operated valves are sized as follows:

a) Using the time-current curve for the overload relay (Ref. #1 Shts. 5-7) locate the 15 second point and determine the current rating multiple for the particular zone of curve selected. Locked rotor current is divided by the current rating multiple to calculate the trip current. Divide trip current by factor of 1.25 to determine the heater selection current. (Ref. #9)

b) The heater is selected for the starter size it will be used with. The heater selected should have minimum current rating equal to or less than the current calculated in 2.2.2a above.

c) The overload ~~heater~~ RELAY trip current (It) is calculated by multiplying heater minimum current (Im) by factor of 1.25. (Ref. #9)

d) Determine the tripping time of the heater at 100% Full Load Current (FLC), 200% FLC and Locked Rotor Current by dividing these values by the tripping current. The percent values obtained shall be used to determine the maximum and minimum trip times from the heater curve operating band and recorded on the calculation worksheet. The heater tripping zones and time-current curves are given in TVA memorandum dated March 2, 1987 (RIMS B72 870302 013). The values obtained will then be compared to the criteria outlined in QIR-EEB-87031 to verify the acceptability of heater selected. (Ref. #5) R1

2.2.3 Acceptability of existing thermal overload heaters will be determined using the method described in 2.2.2 above and based on the following:

a) Heaters will be selected based on an overload relay setting of 100%.

b) Existing heaters will be reset or replaced as required.

2.2.4 If the Locked Rotor Current/Amps (LRA) is to be determined from the NEC code letter, select the maximum value from Sec. 3.6 NEC Table 430-7(b) and multiply by the motor rated horsepower. The KVA value obtained is divided by the square root of three and the motor rated voltage to determine the motor Locked Rotor Current.

2.2.5 For cases where the 200% FLC criteria stated in QIR-EEB-87031 is not met, acceptability of the selected heater is proven by demonstrating that full load current can be carried for at least the motor duty cycle which is greater than 2 times the valve stroke time. This meets the alternate criteria stated in the QIR.

3.0 CODES AND STANDARDS

3.1 National Electric Code - NFPA 70-1987, 430-32 & 430-34 for Continuous Duty Motors.

3.2 IEEE Transactions - Vol. PAS-100, No. 1, Jan. 1981, Pg. 43, Motor Overload Protection for Motors on Motor-Operated Valves.

3.3 National Electrical Manufacturers Association (NEMA) - Standards.

3.4 American National Standard for Electrical Power Systems and Equipment - Voltage Rating (60 Hz) ANSI C84.1 - 1982.

3.5 National Electrical Code - NFPA 70-1987, 430-110 (C3).

3.6 National Electrical Code - NFPA 70-1987, Tab 430-7 (b).

4.0 ASSUMPTIONS

4.1 Assumptions will be made for the required data to perform the calculations where the walkdown input data is not available. Assumptions shall be noted in the calculation sheets based on the following documentation:

a) TVA's design approved drawings and EQP walkdown input data
b) Manufacturer's published data
c) By similarity among motors with same characteristics (e.g. used for alike functions, same size MOV operator, same horsepower, purchased on same contract).
d) Vendor drawings.

4.2 Locked rotor current for small motors below 1/2 HP that are not listed in the reference tables will be six (6) times full load current (NFPA 70-1987, 430-110 (C3)).

4.3 Continuous duty motors will be considered to be a Design B, Class B Insulation, 40°C Rise, NEC Code C, continuous duty and a Service Factor of 1 unless stated otherwise in the walkdown input data (Ref. #3).

4.4 The ambient temperature differential is assumed to be less than 15°C for all continuous duty motors where the average ambient temperature does not exceed 40°C.

5.0 DESIGN INPUT DATA

Ref. #1 Technical Justification - Thermal Overload Heaters (RIMS B22 870302 013).

Att. A: General Electric publications for CR124 overload relays and heaters applications, sheets 1 through 8.

This Sheet Added by Rev. 1

3.0 CODES AND STANDARDS

3.1 National Electric Code - NFPA 70-1987, 430-32 & 430-34 for Continuous Duty Motors.

3.2 IEEE Transactions - Vol. PAS-100, No. 1, Jan. 1981, Pg. 43, Motor Overload Protection for Motors on Motor-Operated Valves.

3.3 National Electrical Manufacturers Association (NEMA) - Standards.

3.4 American National Standard for Electrical Power Systems and Equipment - Voltage Rating (60 Hz) ANSI C84.1 1982.

3.5 National Electrical Code - NFPA 70-1987, 430-110 (C3).

3.6 National Electrical Code - NFPA 70-1987, Tab 430-7 (b).

4.0 ASSUMPTIONS

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a) TVA's design approved drawings and EQP walkdown input data
b) Manufacturer's published data
c) By similarity among motors with same characteristics (e.g. used for alike functions, same size MOV operator, same horsepower, purchased on same contract).
d) Vendor drawings.

4.2 Motor data may be obtained from TVA Design Guide DS-E2.4.6 if unavailable from walkdown data or through assumptions described in 4.1 above.

4.3 Continuous duty motors will be considered to be a Design B, Class B Insulation, 40°C Rise, NEC Code C, continuous duty and a Service Factor of 1 unless stated otherwise in the walkdown input data. (Ref. #3)

4.4 The ambient temperature differential is assumed to be less than 18°C for all equipment where the average ambient temperature does not exceed 40°C.

5.0 DESIGN INPUT DATA

Ref. #1 Technical Justification - Thermal Overload Heaters (RIMS B22 870302 013).

Att. A: General Electric publications for CR124 overload relays and heaters applications, sheets 1 through 8.

Sheet 1 - How to use heater tables.

Sheet 2 - Overload relay heater tripping zones for open relay-open starter or enclosed starter-sizes 00, 0, 1, 2, and 5 - Drawing #231HA165-3.

PREPARED [illegible] 8-1-88
CHECKED [illegible] 8-1-88 REV. 1

Sheet 1 - How to use heater tables.

Sheet 2 - Overload relay heater tripping zones for open relay-open starter or enclosed starter-sizes 00, 0, 1, 2, And 5 - Drawing #231HA165 - 3.

Sheet 3 - Overload heaters tripping zones for open and enclosed size 4 starters - Drawing #515A296 - 1.

Sheet 4 - Overload relay heaters tripping zones for size 3 starters - Drawing #K-9770791 - 1.

Sheet 5 - Time-Current characteristics curves for series 00, 0, 1, 2, and 5 starter overload heaters - Drawing #231HA165-2. Read with sheet #2 listed above.

Sheet 6 - Time-Current characteristics curves for size 3 starter overload heaters - Drawing #K-9770790-1. Read with sheet #4 listed above

Sheet 7 - Time-Current characteristics curves for size 4 starter overload heaters - Drawing #55-172381-1. Use with sheet # 3 listed above.

Sheet 8 - Overload heater selection table extracted from instruction manual GEH-2614C.

Att. B: General Electric approximate motor full load current ratings for motors from 1/4 HP to 400 HP. Sheet 1 of 1.

Ref. #2 Rotork Controls Inc. Publication AF2/01 (4/1983) - Rotork & 7874305 480V Motor Data for Motor Operated Valves (55C 01057 D, K -01-02-01) Page D-03.

Ref. #3 Walkdown Info Data - Motor & Motor Control Centers (QIRF0P86023, QIRF0P87005, QIRF0P87035, QIRF0P87096 & MD-1105).

Ref. #4 General Electric letter for sizing Thermal Overload Heaters (RIMS NZ7 870123 702).

Ref. #5 QIR Database QIR EFH 87031 (RIMS N43 870203 903).

Ref. #6 Mechanical Valve Motor Operator tabulation drawings (47A3[illegible] Series).

Ref. #7 American National Standard for Electrical Power Systems and Equipment - Voltage Ratings (60 Hz) ANSI C84.1 1982, Page 10.

Ref. #8 Environmental drawings (47A22[illegible] Series).

Ref. #9 General Electric Publication - Instructions, Installation and Maintenance of 7700 Line Motor Control Center GEH-2614C, Contract 4[illegible]/162.

SUPERSEDED BY PAGE 8A OF 11

This Sheet Added by Rev. 1

Sheet 3 - Overload heaters tripping zones for open and enclosed size 4 starters - Drawing #545A296-1.

Sheet 4 - Overload relay heaters tripping zones for size 3 starters - Drawing #K-9770791-1.

Sheet 5 - Time-Current characteristics curves for series 00, 0, 1, 2, and 5 starter overload heaters - Drawing 231HA165-2. Read with sheet #2 listed above.

Sheet 6 - Time-Current characteristics curves for size 3 starter overload heaters - Drawing #K-9770790-1. Read with sheet #4 listed above

Sheet 7 - Time-Current characteristics curves for size 4 starter overload heaters - Drawing #55-172381-1. Use with sheet # 3 listed above.

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Att. B: General Electric approximate motor full load current ratings for motors from 1/4 HP to 400 HP. Sheet 1 of 1.

Ref. #2 Rotork Controls Inc. Publication AE2/01 (4/1983) - Rotork # 7874305 480V Motor data for Motor Operated Valves (55C 01057 D, K -01-08-01) Pg. 5 D-03.

Ref. #3 Walkdown Input Data - Motor & Motor Control Centers (QIREQP86073, QIREQP87005, QIREQP87085, QIREQP87096 & WD-1184)

Ref. #4 General Electric letter for sizing Thermal Overload Heaters (RIMS B22 870126 702).

Ref. #5 QIR Release QIR EEB 87031 (RIMS 343 870203 903), Supplemented by Memorandum (Guha to ~~Reletrin~~ Rainsley RIMS B22 88012 011. R1

Ref. #6 Mechanical Valve Motor Operator tabulation drawings (47A368 Series).

Ref. #7 American National Standard for Electrical Power Systems and Equipment - Voltage Ratings (60 Hz) ANSI C84.1 1982, Page 10.

Ref. #8 Environmental drawings (47W225 Series).

Ref. #9 General Electric Publication - Instructions, Installation and Maintenance of 7700 Line Motor Control Center GEH-2614F, Contract #824182.

Ref. #10 General Electric "Application Tips" dated 3/11/83, no. 001 GE General Purpose Control Department.

Ref. #11 TVA Electrical Design Guide DG-E2.4.6 Rev 0 R1

5.0 CALCULATIONS

The calculation for TOL Heaters are prepared on individual set of sheets as identified in the calculation index and contain the following:

a. Walkdown Input Data

b. Manufacturers Data

c. Definitions

d. Acceptance Limits

e. Calculations

f. Design of Overload Heaters

g. Evaluation of Installed Overload Heaters

h. Comments

7.0 SUMMARY OF CALCULATION RESULTS

480V Reactor MCC B4 3C

30 MCC Compartments have been evaluated in this calculation.

30 Individual TOL Heater calculations prepared.

± 2 Installed TOL Heater sizes and settings have been determined acceptable.

± 3 Installed TOL Heater sizes have been determined acceptable but require resetting.

± 25 Installed TOL Heater sizes have been determined unacceptable and require replacing and setting.

0 TOL Heater calculations have unverified assumptions.

R1

9.0 CONCLUSIONS

All thermal overload (TOL) heaters required for Unit 2 restart have been designed and the installed TOL heaters have been evaluated for compliance with the CIP ECG 87031 design criteria. The evaluation of the installed TOL heaters has determined:

9.1 Acceptable - Use as is.

The following Motor Control Center (MCC) compartment heater sizes and settings have been determined acceptable:

Compt. No.

~~12~~ 7A
~~41~~ 8B
~~42~~
~~7A~~
~~11C~~

R1

9.2 Acceptable - Reset.

The following Motor Control Center (MCC) compartment heater sizes have been determined acceptable but require resetting.

~~12~~
~~3C~~
7F
~~4C~~
~~4A~~
~~5A~~
~~6A~~
~~6C~~
~~6E~~
~~7L~~
~~7A~~
~~7B~~
~~8A~~
8C
~~8B~~
~~8D~~
~~11L~~
11C

R1

3.3 Unacceptable - Replace.

The following Motor Control Center (MCC) compartment heater sizes and settings have been determined unacceptable:

Comp. No.

4E	1A	5C	8E
5E	1D	6B	9B
9E	3C	6C	11A
R6A	4A	6E	
R6E	4B	7B	
R8B	4C	7C	
R3F	5B	7E	
R11A			

R1

4.0 REFERENCES

4.1 Company Procedure

E-30-TVA-PFIP - Preparation, Review and Approval of Calculations for Browns Ferry Nuclear Plant.

E-76-TVA-PFIP - Procedure for Design Verification for Nuclear Power Plants

E-77-TVA-PFIP - Procedure for Identifying, Selecting and Documenting Design Inputs for Nuclear Power Plants.

E-7-TVA-PFNP - Processing Drawings for Review and Approval.

I-S-TVA-PFIP - Site Document Control.

PJ-1-TVA-PFIP - Project Filing System.

4.2 TVA Procedure

BFEP-PI-87-29 - Procedure for Assignment of Document Numbers.

NEP 3.1 Calculations

NEP 5.1 Design Output

NEP 5.2 Review

4.3 TVA Calculation

Electrical Equipment Required to Support Unit 2 Restart

BLSS 883 860206 012.

CALCULATION NO. ED-C2268-37724 SHEET 1.0 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 8/16/88

BOARD REF 480V REACTOR MOV 1B TC COMPILED BY DLC DATE 8/16/88

UNIT 1 2 CHECKED BY TMG DATE 8/17/88

CALCULATION INDEX SHEET REV. 1 PREPARED JPM 8-1-88
CHECKED RK 8-1-88

Item No.	Comp. No.	Description	Tag No.	Data Sheet #	Rev. Code
1	-	Calculation Index Sheet		1.0 -	A1
2	1A	Drywell Blower 2A-5		2.1- 2.3	A1
3	1D	Recirc MG Set Oil Pmp 2A-3		3.1- 3.3	A1
4	3C	CRD Return Isol Vlv	FCV-85-84	4.1- 4.3	A1
5	3E	CRD Wtr Pressure Control Vlv	FCV-85-21	5.1- 5.3	A1
6	4A	RB CCW Seal Wtr Collec & Transfer Pmp		6.1- 6.3	A1
7	4B	RB Equip Drain Sump Pmp 2A		7.1- 7.3	A1
8	4C	RECI M. Header Sectionalizing Vlv	FCV-67-21	8.1- 8.3	A1
9	4E	CRD Wtr Pressure Control Vlv	FCV-85-27	9.1- 9.3	A1
10	5A	Bus Heat Exch Alt Clr & Hyd Clg Wtr Vlv	FCV-24-25	10.1-10.3	A1
11	5C	CCW Spare Pmp Suction Vlv	FCV-70-67	11.1-11.3	A1
12	5E	CRD Pmp A Suct Isol Vlv	FCV-03-09	12.1-12.3	A1
13	6B	Stator Liquid Clg Wtr Shutoff MOV	FCV-21-41	13.1-13.3	A1
14	6C	CCW Spare Pump Disch Vlv	FCV-70-66	14.1-14.3	A1
15	6E	Main Stm Line Drain Vlv	FCV-01-58	15.1-15.3	A1
16	7A	RB Floor Drain Sump Pmp 2A		16.1-16.3	A1
17	7B	Precooler Liquid Clg Wtr Shutoff MOV	FCV-24-57	17.1-17.3	A1
18	7C	RWCU Blowdown MOV	FCV-69-14	18.1-18.3	A1
19	7E	RWCU Filter & Demin Sys Bypass MOV	FCV-69-08	19.1-19.3	A1
20	8B	Turb Oil EHC Fluid Clg Wtr Shutoff MOV	FCV-24-69	20.1-20.3	A1
21	8C	RWCU Drain to Radwaste MOV	FCV-69-17	21.1-21.3	A1
22	8E	RWCU Restrict Orifice Bypass MOV	FCV-69-18	22.1-22.3	A1
23	9B	Main Stm Line Drain MOV	FCV-01-57	23.1-23.3	A1
24	9E	Main Stm Line to Condenser MOV	FCV-01-59	24.1-24.3	A1
25	11A	Drywell Blower 2B-5		25.1-25.3	A1
26	11C	CRD Wtr Transfer MOV	2-FCV-85-09	26.1-26.3	A1
27	P6A	Recirc Header Equalizer MOV	FCV-68-33	27.1-27.3	A1
28	P6E	Recirc Pmp 2B Suction MOV	FCV-68-77	28.1-28.3	A1
29	P8B	Recirc Pmp 2A Suction Valve	FCV-68-01	29.1-29.3	A1
30	P8E	Recirc Header Equalizer Valve	FCV-68-35	30.1-30.3	A1
31	P11A	RSC Water Head Tank Pmp 2A		31.1-31.3	A1

F

CALCULATION NO. ED-Q2268-87324 SHEET 2.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD. 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 4582299-6 REV. 0 CHECKED BY TMS DATE 3/17/88

COMP # 1A EQUIP REF. DRYWELL BLOWER 2A-5

REV. 1 PREPARED: JPM 8-1-88

CONTINUOUS DUTY MOTORS CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR106E0 SIZE 3

O/L RELAY TYPE CR124 HEATER SIZE CR123E48.78 SETTING 100 ΦA
110 ΦC

MOTOR NAMEPLATE DATA:

H.P. 40 (2) VOLTS 460 (2) FLC 52 (3) PHASE 3 (2) INS. CLASS B (1) NEC CODE G (2)

DUTY CONT (1) S.F. 1.0 (1) TEMP RISE 60 (2) DEG C. AMBIENT TEMP -- DEC C

(1)(2)(3) SEE SH. 3.3

AMBIENT TEMPERATURE: (REF #8)

MOTOR AMBIENT TEMP 42 DEG C

STARTER AMBIENT TEMP ≤ 40 DEG C

EQUIP. LOCATED IN PORTION OF REACTOR BLDG. WHICH IS NOT PART OF HARSH ENVIRONMENT PER DWGS 45N803-8 REV. 5 & 47W225-102 REV. 1

MANUFACTURER'S DATA:

O/L FACTOR (D.F.) (REF # 1 - SH. 1) 0.9 TEMP CORRECTION FACTOR (TCF --)

HEATER TABLE: (REF #1 SH. 8)

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT / MINIMUM

I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # / RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

D.F. -- MOTOR DERATING FACTOR BASED ON MOTOR SERVICE FACTOR. (REF #1 SH 1)

I(n) -- MOTOR NAMEPLATE FULL LOAD CURRENT OR ADJUSTED MOTOR FULL LOAD CURRENT

~~I* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

R1

ACCEPTANCE LIMITS:

%PROTECTION FROM 115% TO 130% (REF #5)

OVERLOAD HEATERS RANGE FROM 85% to 115%

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

CALCULATION NO. ED-Q2268-87324 SHEET 2.2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 9/16/88

BOARD REF 480V REACTOR MOV 50 2C COMPUTED BY DJH DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 1A EQUIP REF. DRYWELL BLOWER 2A-5

REV. 1 | PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

2. MOTOR OVERLOAD HEATER SELECTION

(A) CALCULATION OF HEATER SIZE (REF #5)
I(n)xD.F. = (USE D.F. PER REF #1 SH 1)

52 I(n)x 0.9 D.F. = 46.8 AMPS

CATALOG HEATER SIZE ~~CR123 F56.73~~ 51 ~~F61.48~~ F65.88

I(m)= ~~47.0~~ 51 ~~47.1~~ 50.2

(B) CALCULATION FOR OVERLOAD HEATER SETTING:
CALCULATE % PROTECTION USING HEATER SETTING OF 100%

~~47.0~~ 51 ~~47.1~~ 50.2 I(m) x 1.25 X 100 %* / 52 I (n) = ~~113~~ 121 %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

✓ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.

~~✓ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.~~

~~% * = [% PROTECTION x I(n)] / [I(m) x 1.25]~~

~~105 % * = 2/3 PROT. x 52/47.0 x 1.25; 2/3 PROT. = 113%~~

~~% * =~~

~~IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.~~

~~NO - THE OVERLOAD HEATER HAS BEEN IMPROPERLY SIZED.~~

3. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 2B?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 2B?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 4.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 4.

✓ NO - REPLACE HEATER - PROCEED TO SECTION 5.4 ~~PROCEED WITH FOLLOWING~~ JPM 1/11/89 ~~CR123F46.73~~ ~~I(m)=46.9~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 46.9 I(m) x 1.25 x 100 %* = 58.63 AMPS~~

CALCULATION NO. ED-Q2268-87324 SHEET 2.3 OF 3.1

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 9/14/88

BOARD REF 230V REACTOR MOV BD 2C COMPUTED BY DJA DATE 3/16/89

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMB DATE 3/17/89

COMP # 1A EQUIP REF. DRYWELL BLOWER 2A-S

REV. 1 PREPARED: [illegible] 9-1-88

CHECKED: [illegible] 9-1-88

EVALUATION OF INSTALLED OVERLOAD HEATER PROTECTION.

% PROTECTION = I(t) / I(n) x 100

~~53.63~~ I(t) / 52 I(n) x 100 = 103 %

~~DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?~~

~~_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE~~

~~_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.~~

~~% = [% PROTECTION x I (n)] / [I(n) x 1.25]~~

~~% = % PROT. x 52 / 46.9 x 1.25, % PROT. = 119 %~~

~~IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

~~_____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 2B.~~

4. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE ~~F51.48~~ F65.88 CR123 ~~F48.78~~

OVERLOAD HEATER SETTING ~~115%~~ 100 %

5. COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 115%~~

(1) ASSUMPTION PER SECT. 4.3

(2) INFORMATION BASED ON WALKDOWN DATA WD-1105

(3) ASSUMPTION PER NEC ARTICLE 430, TABLE 430-150

REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE

R1

R1

CALCULATION NO. ED-Q2268-87324 SHEET 3 OF 31
THERMAL OVERLOAD HEATER CALCULATION REV. 5 DATE 3/16/88
BOARD REF 480V REACTOR MOV BD-2C COMPUTED BY [illegible] DATE 3/16/88
UNIT # 2 DWG. NO. 4582299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88
COMP # 1D EQUIP. REF. RECIRCULATION MG SET OIL PUMP 1A-3
REV. 1 TARGET: Mon 9-1-88
CONTINUOUS DUTY MOTORS CHECKED: TK 9-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109ED SIZE 4
O/L RELAY TYPE CR124 HEATER SIZE CR123FT7.28 SETTING 115 %

MOTOR NAMEPLATE DATA:

H.P. 60 VOLTS 460 FLC 76.5 PHASE 3 INS. CLASS B NEC CODE G
DUTY Cont S.F. 1.0 TEMP RISE 40 (1) DEG C. AMBIENT TEMP 40 DEG C

AMBIENT TEMPERATURE: (REF #8) (1) SEE SH. 3.3

MOTOR AMBIENT TEMP ≤ 40 DEG C
STARTER AMBIENT TEMP ≤ 40 DEG C

EQUIP. LOCATED IN PORTION OF REACTOR BLDG WHICH IS NOT PART OF HARSH ENVIRONMENT PER DWGS 47W200-2 REV. 6 & 47W225-119 REV. 1

MANUFACTURER'S DATA:
O/L FACTOR (D.F.) (REF# 1 - SH. 1) 0.9 TEMP CORRECTION FACTOR (TCF -)
HEATER TABLE: (REF #1 - SH. 8)

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~/~~ MINIMUM
I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP
1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT
D.F. -- MOTOR DERATING FACTOR BASED ON MOTOR SERVICE FACTOR. (REF #1 SH 1)
I(n) -- MOTOR NAMEPLATE FULL LOAD CURRENT OR ADJUSTED MOTOR FULL LOAD CURRENT
~~I* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

R1

ACCEPTANCE LIMITS:

%PROTECTION FROM 115 % TO 130 % (REF #5)
OVERLOAD HEATERS RANGE FROM 85% to 115%

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO
IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

0051T

CALCULATION NO. ED-Q2268-87324 SHEET 3 .2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD. 2C COMPUTED BY DLL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2209-6 SH. 2 CHECKED BY [illegible] DATE 3/17/88

COMP # 1D EQUIP REF. RECIRCULATION MG SET OIL PUMP 2A-3

REV. 1 PREPARED: JPN 5-1-88

CHECKED: JRK 5-1-88

2. MOTOR OVERLOAD HEATER SELECTION

(A) CALCULATION OF HEATER SIZE (REF #5)
I(n)xD.F. = (USE D.F. PER REF #1 SH 1)

76.5 I(n)x 0.9 D.F. = 68.85 AMPS

F91.48

CATALOG HEATER SIZE CR123 ~~F84.88~~

I(m)= 73.1

R1

(B) CALCULATION FOR OVERLOAD HEATER SETTING:
CALCULATE % PROTECTION USING HEATER SETTING OF 100%

73.1 I(m) x 1.25 x 100 %* / 76.5 I (n) = 119 %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

__✓__ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.

_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.
% * = [% PROTECTION x I(n)] / [I(m) x 1.25]
% * =
% * =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?
_____ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.
_____ NO - THE OVERLOAD HEATER HAS BEEN IMPROPERLY SIZED.

3. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER
IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 2B?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 2B?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 4.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 4.

REPLACE HEATER

__✓__ NO - ~~PROCEED WITH FOLLOWING~~ PROCEED TO SECTION 4

~~CR123F77.83~~
~~I(m)= 67.8~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~
~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~
~~I(t) = 67.8 I(m) x 1.25 x 115 %* = 97.46 AMPS~~

R1

0051T

CALCULATION NO. ED-Q2266-87324 SHEET 3.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD. 2C COMPUTED BY DKL DATE 3/16/88

UNIT # 2 DWG. NO. 4582299-6 SH 1.0 CHECKED BY MHS DATE 3/17/88

COMP # 1D EQUIP REF. RECIRCULATION MG SET OIL PUMP 2A-3

REV. 1 PREPARED: JRM 8-1-88

CHECKED: RK 8-1-88

EVALUATION OF INSTALLED OVERLOAD HEATER PROTECTION.

% PROTECTION = I(t) / I(n) x 100

~~97.46~~ I(t) / ~~76.5~~ I(n) x 100 = ~~107~~ %

~~DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?~~

~~/~~ ~~YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE.~~

_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.

%* = [% PROTECTION x I (n)] / [I(m) x 1.25]

%* =

%* =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

_____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 2B.

4. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 F91.4B ~~F77.8B~~

OVERLOAD HEATER SETTING ~~+5%~~ 100%

5. COMMENTS: ~~THE INSTALLED HEATERS SETTINGS ARE~~ ~~ACCEPTABLE~~

(1) ASSUMPTION REFER TO SECT. 4.3

REPLACE INSTALLED TOL HEATERS AS SHOWN ABOVE

R1

R1

CALCULATION NO. 5[illegible]-Q2268-87324 SHEET 4.1 OF 31
THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 5/16/88
BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJQ DATE 5/16/88
UNIT # 2 DWG. NO. 4SB2299-6 REV. 0 CHECKED BY TMB DATE 5/17/88
COMP # 3C EQUIP REF. CRD RETUCN ISOLATION VALVE FCV-85-33
MOTOR OPERATED VALVE MOTORS

REV. 1 PREPARED: JPM 8-1-88
CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1
O/L RELAY TYPE CR124 HEATER SIZE CR123C1.96A SETTING 130 % OF FLA
85% OF FLC

MOTOR NAMEPLATE DATA: (1)

STARTING TORQUE 10 (3) ft# RPM 1700 DUTY 15 min.S.F. -
H.P. .66 (2) VOLTS 460 FLC 2.3 LRA 11.4 (3) PHASE 3 INS. CLASS -
NEC CODE LETTER - TEMP RISE 75 deg C.

(1) see SH. 4.3
(2) see SH. 4.3
(3) see SH. 4.3

MANUFACTURER'S DATA:
HEATER TABLE: REF # 1-SH.8
TIME .VS. CURRENT CURVE: REF # 1.SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~MAXIMUM~~ MINIMUM SAM 7/12/88
I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP
1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT
I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT
~~I* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. 30-82268-87324 SHEET 2 OF

THERMAL OVERLOAD HEATER CALCULATION REV. 2

BOARD REF 43aV [illegible] ACTOR MOV 50 2C COMPUTED BY [illegible]

UNIT 1-2 DWG. NO. 4682299-6 REV. 6 CHECKED BY [illegible]

COMP 1-3C EQUIP. REF. CRD RETURN ISOLATION VALVE FCV-85-50

REV. 1 PREPARED: [illegible] 3-1-88

CHECKED: [illegible] 3-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) = _____

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ___/___ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x _____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1 SH.5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 11.9/6.25 = 1.90

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.90/1.25 = 1.52 AMPS

CATALOG HEATER SIZE ~~CR123 C1.84A~~ C1.84A

I(m) ~~1.56~~ 1.48 ZONE B

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x I* = ~~1.56~~ / 1.48 x 1.25 x 100%

I(t) = ~~1.95~~ 1.85 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:

(2.3 I(n) / ~~1.95~~ 1.85 I(t)) x 100 = ~~116~~ / 124 % (TRIP TIME) ~~2033 300~~ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 2.3 I(n) / ~~1.95~~ 1.85 I(t)) x 100 = ~~236~~ / 249 % ~~70 92~~ / 62 - 80 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(11.9 MTR LRA / ~~1.95~~ 1.85 I(t)) x 100 = ~~610~~ / 643 % ~~9.7 - 14.5~~ / 9.6 - 14.5 SECS

R1

CALCULATION NO. ED-Q2268-37324 SHEET 4 .3 OF 5

THERMAL OVERLOAD HEATER CALCULATION FOR MOV BD 3C REV. 0

BOARD REF 480V COMPUTED BY DLL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 3C EQUIP REF. CRD RETURN ISOLATION VALVE FCV-69-16

REV.1 PREPARED: JPM 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS? CHECKED: PAC 8-1-88

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓~~ ~~NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 1.56 x 1.25 x 95%~~
~~I(t) = 1.85 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(2.3 I(a) / 1.85 I(t)) x 100 = 124 % [illegible] SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 2.3 I(a)/ 1.85 I(t)) x 100 = 249 % [illegible] SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(11.9 MTR LRA/ 1.85 I(t)) x 100 = 643 % 16 [illegible] SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓~~ ~~YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) BASED ON WALKDOWN DATA OF EQUIPMENT CONNECTED TO 480V REACTOR MOV BD. 3C COMPT. 3C. ASSUMPTION LIKE FUNCTION.
(2) ASSUMPTION PER ONELINE DIAG. DWG NO 45N751-5 REV 21
(3) ASSUMPTION PER DWG. VPF 2547-36-3 (SIMILAR CKT LOAD CURRENT & HP, GE TAG = 12-56 FCV-69-16)

R1

00502

CALCULATION NO. ED-G2268-87584 SHEET 4 OF 5

THERMAL OVERLOAD \TER CALCULATION REV. 0 DATE 8/10/88

BOARD REF 480V \CTOR MOV BD 2C COMPUTED BY DJL DATE 8/12/88

UNIT # 2 DWG. NO. 4E82259.6 REV. 0 CHECKED BY THB DATE 8/17/88

COMP # 3C EQUIP REF. CRD RETURN ISOLATION VALVE TCV-99-50

REV. 1 | PREPARED: RM 8-1-88

CHECKED: THB 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

/ NO - REPLACE HEATER - PROCEED TO SECTION 5

~~NO - PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 1.75 I(m) x 1.25 x 1.00 %*~~

~~I(t) = 2.19 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(8.3 I(a) / 2.19 I(t)) x 100 = 105 % 92 - 115 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 8.3 I(a) / 2.19 I(t)) x 100 = 210 % 92 - 115 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(11.9 MTR LRA/ 2.19 I(t)) x 100 = 543 % 13.8 - SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~/ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = 1.75 x 1.25 x 85 %~~

~~I(t) = 1.86 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(8.3 I(a) / 1.86 I(t)) x 100 = 124 % 92 - 115 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 8.3 I(a) / 1.86 I(t)) x 100 = 247 % 92 - SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(11.9 MTR LRA/ 1.86 I(t)) x 100 = 640 % 13.8 - SECS~~

R1

CALCULATION NO. 25-32223-87324 SHEET 4.5 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V [illegible]ACTOR MOV BD. 3C COMPUTED BY DJH 3/16/88

UNIT # 2 DWG. NO. 45B7279-6 REV. 0 CHECKED BY TMB 3/16/88

COMP # 3C EQUIP REF. CRD RETURN ISOLATION VALVE FCV-85-20 3/17/88

REV.1 PREPARED: DJH 5-1-88

CHECKED: TMB 5-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

~~✓ YES — THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

~~✓ NO — THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C1.95A~~ C1.84A

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATER TO 95%~~

REPLACE HEATERS AS SHOWN ABOVE

R

CALCULATION NO. [illegible]-0226B-87324 SHEET 5.1 of 31
THERMAL OVERLOAD [illegible]ATER CALCULATION REV. 0 DATE 3/16/88
BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DVL DATE 3/16/88
UNIT # 2 DWG. NO. 45B2299.6 REV. 0 CHECKED BY [illegible] DATE 3/17/88
COMP # 3E EQUIP REF. CCW WATER PRESSURE CONTROL VALVE PCV-85-23
MOTOR OPERATED VALVE MOTORS REV.1
PREPARED: JPM 8-1-88
CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE - MODEL - CR109C0 SIZE 1
O/L RELAY TYPE CR124 HEATER SIZE CR123C0.96A SETTING 100% OA
95% OC

MOTOR NAMEPLATE DATA:

STARTING TORQUE 2 ft# RPM 850 DUTY 15 min.S.F. -
H.P. - VOLTS 460 FLC .45 LRA 1.46 (1) PHASE 3 INS. CLASS B
NEC CODE LETTER - TEMP RISE 75 deg C.

(1) SEE SH. 5.3

MANUFACTURER'S DATA:
HEATER TABLE: REF # 1-SH.8
TIME .VS. CURRENT CURVE: REF# 1-SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT / ~~MAXIMUM~~ MINIMUM JPM 7/12/88
I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP
1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT
I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT
~~% -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. [illegible]-Q2268-87324 SHEET 5 .2 OF 31

THERMAL OVERLOA[illegible]TER CALCULATION REV. 0 [illegible]TE 3/16/88

BOARD REF 4300 REACTOR AUX. BD 2C COMPUTED BY DJS [illegible]TE 3/16/88

UNIT # 2 DWG. NO. 4582299-6 REV. 0 CHECKED BY TLH DATE 3/17/88

COMP # 3N EQUIP REF. CRD WATER PRESSURE CONTROL VALVE PCV-85-23

REV. 1 PREPARED: DJS 8-1-88

CHECKED: RK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (____ HP x _____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1 SH. 5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 5.1

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 1.48/5.1 = .29

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = .29/1.25 = .23 AMPS

CATALOG HEATER SIZE CR123E0.36A * ZONE A

I(n) ~~0.31~~ 0.29

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(n) x 1.25 x %* = ~~0.31~~ x 1.25 x 100%

I(t) = ~~0.29~~ 0.36 AMPS 0.29

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(.45 I(n) / ~~0.29~~ 0.36 I(t)) x 100 = ~~115~~ 125 % ~~0152~~ 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x .45 I(n) / ~~0.29~~ 0.36 I(t)) x 100 = ~~231~~ 250 % ~~52-64~~ 41-61 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(1.48 MTR LRA/ ~~0.29~~ 0.36 I(t)) x 100 = ~~379~~ 411 % ~~155-95~~ 13.5 - ~~40~~ 22 SECS 3pm 8-1-88

R1

* NOTE: THIS IS THE SMALLEST HEATER SIZE AVAILABLE AND IS THEREFORE ACCEPTABLE PER CIRCLE 87031

0050P

CALCULATION NO. [illegible]-Q2268-87324 SHEET 5.3 OF 31

THERMAL OVERLOAD [illegible]ATER CALCULATION REV. 0 DATE 2/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJA DATE 3/16/88

UNIT # 2 DWG. NO. 4582299.6 REV.0 CHECKED BY [illegible] DATE 3/17/88

COMP # BE EQUIP REF. CRD WATER PRESSURE CONTROL VALVE PCV-85-23

REV.1 PREPARED: JPM 8-1-88 CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 0.31 x 1.25 x 95%~~
~~I(t) = 9.98 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ (TRIP TIME)
~~(1.45 I(a) / 2.33 I(t)) x 100 = 136 % 0432.700 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 1.45 I(a)/ 9.98 I(t)) x 100 = 279 % 30-50 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(4.4 MTR LRA/ 0.93 I(t)) x 100 = 448 % 4.5 - 6.5 SECS~~ *

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIRPEB07031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER VENDOR DATA PROVIDED IN EBASCO LETTER TO LIMITORQUE DATED MARCH 18, 1988

~~* ACCEPTABLE PER QIRPEB07031 (REV 5) RIMS = B49 870203 903~~

0050P

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

✓ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

✓ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

_____ NO - PROCEED WITH FOLLOWING

EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT

I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = _____ I(m) x 1.25 x _____ %*
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

_____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5

_____ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS

I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = I(m) x 1.25 x %* = _____ x 1.25 x _____
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

CALCULATION NO. EC-G2268-37374 SHEET 5.5 OF 81

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD. 2C COMPUTED BY DAG DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 3E EQUIP REF. CRD WATER PRESS REG CONTROL VALVE PCV-85-23

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

~~✓ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

_____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123C0.36A

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: RESET THE INSTALLED TOL HEATERS TO ~~95%~~ 100%.

CALCULATION NO. ED-G2268-87324 SHEET 6.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V RECTOR MOV BD 2C COMPUTED BY DLH DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 R#0 CHECKED BY JMB DATE 3/17/88

COMP # 4A EQUIP REF. RBCCW SEAL WTR COLLECTION & TRANSFER PUMP

REV.1 PREPARED: JJM 8-1-88

CONTINUOUS DUTY MOTORS CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR106C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.31A SETTING 100%

MOTOR NAMEPLATE DATA:

H.P. 1/2 VOLTS 460 FLC 1.1 PHASE 3 INS. CLASS B NEC CODE K

DUTY CONT S.F. 1.25 TEMP RISE - DEG C. AMBIENT TEMP 40 DEC C

AMBIENT TEMPERATURE: (REF #8)

MOTOR AMBIENT TEMP ≤ 40 DEG C

STARTER AMBIENT TEMP ≤ 40 DEG C

EQUIP. LOCATED IN PORTION OF REACTOR BLDG. WHICH IS NOT PART OF HARSH ENVIRONMENT PER DWGS 47W404-19 REV. 1 & 47W225-110 REV. 1

MANUFACTURER'S DATA:

O/L FACTOR (D.F.) (REF# 1-SH.1) : TEMP CORRECTION FACTOR (TCF -)

HEATER TABLE: (REF #1 -SH.B)

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~MAXIMUM~~ MINIMUM JJM 7/13/88

I (a) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

D.F. -- MOTOR DERATING FACTOR BASED ON MOTOR SERVICE FACTOR. (REF #1 SH 1)

I(n) -- MOTOR NAMEPLATE FULL LOAD CURRENT OR ADJUSTED MOTOR FULL LOAD CURRENT

~~%~~ -- ~~PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

%PROTECTION FROM 125% TO 140% (REF #5)

OVERLOAD HEATERS RANGE FROM 85% to 115%

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

CALCULATION NO. ED-Q2265-8731C
THERMAL OVERLOAD HEATER CALCULATION
SHEET 6 .2 OF 31
REV- 0 DATE 2/16/87
BOARD REF 480V RECTOR MOV BD 2C COMPUTED BY DJA DATE 2/16/87
UNIT # 2 DWG. NO. 45B2299-4 REV 6 CHECKED BY TMB DATE 3/17/88
COMP # 2A EQUIP REF. 2B CCW SEAL WTR COLLECTION TRANSFER VLV
REV. 1 PREPARED: JPM 8-1-88
CHECKED: RK 8-1-88

2. MOTOR OVERLOAD HEATER SELECTION

(A) CALCULATION OF HEATER SIZE (REF #5)
I(n)xD.F. = (USE D.F. PER REF #1 SH 1)

1.1 I(n)x 1 D.F. = 1.1 AMPS

CATALOG HEATER SIZE ~~CR123 C1.31A~~ C1.48A
I(m)= ~~1.18~~ 1.19

(B) CALCULATION FOR OVERLOAD HEATER SETTING:
CALCULATE % PROTECTION USING HEATER SETTING OF 100%

~~1.18~~ 1.19 I(m) x 1.25 X 100 %* / 1.1 I (n) = ~~124~~ 135 %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

✓ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.

_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.
% * = [% PROTECTION x I(n)] / [I(m) x 1.25]
% * =
% * =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?
_____ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.
_____ NO - THE OVERLOAD HEATER HAS BEEN IMPROPERLY SIZED.

3. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER
IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 2B?

~~✓~~ ~~YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 2B?~~

~~✓~~ ~~YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 4.~~

~~NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, YIELD TO RESET SETTING. PROCEED TO SECTION 4.~~

REPLACE HEATER - PROCEED TO SECTION 4

✓ NO - ~~PROCEED WITH FOLLOWING~~

EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT
I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = _____ I(m) x 1.25 x _____ %* = _____ AMPS

0051T

CALCULATION NO. ED-02268-87324 SHEET 6.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 9/14/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJA DATE 3/16/88

UNIT # 2 DWG. NO. 4583299-6 REV 0 CHECKED BY JTE DATE 3/17/88

COMP # 1A EQUIP REF. RBCCW SEAL WTR COLLECTION TANK 2-1

REV.1 PREPARED: JPM 8-1-88

CHECKED: JRK 8-1-88

EVALUATION OF INSTALLED OVERLOAD HEATER PROTECTION.

% PROTECTION = I(t) / I(n) x 100

_____ I(t) / _____ I(n) x 100 = _____ %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE.

_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.

%* = [% PROTECTION x I (n)] / [I(m) x 1.25]

%* =

%* =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

_____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 2B.

4. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C-3~~ C1.48A

OVERLOAD HEATER SETTING 100%

5. COMMENTS: ~~THE INSTALLED T.O.L. HEATERS & SETTINGS ARE ACCEPTABLE.~~ R1

REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE.

CALCULATION NO. CD-Q2268-87324 — SHEET 7.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION — REV. 0 — DATE 3/16/88

BOARD REF 480V REACTOR BLDG BD 2C — COMPUTED BY DJK — DATE 3/16/88

UNIT # 2 — DWG. NO. 45B2222 SH 3 REV 0 — CHECKED BY TKE — DATE 3/17/88

COMP # 4B — EQUIP REF: REACTOR BLDG EQUIP DRAIN SUMP PUMP 2A

REV. 1 — DRAWN: JPM 7-1-88

CONTINUOUS DUTY MOTORS — CHECKED: VR 7-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123C10.4B SETTING 105%

MOTOR NAMEPLATE DATA:

H.P. 7.5 VOLTS 440 FLC 10.6 PHASE 3 INS. CLASS B (1) NEC CODE G

DUTY CONT S.F. 1.0 TEMP RISE 55 DEG C. AMBIENT TEMP — DEG C

(1) SEE SH. 7.3

AMBIENT TEMPERATURE: (REF #8)

EQUIP. LOCATED IN PORTION OF REACTOR BLDG. WHICH IS NOT PART OF HARSH ENVIRONMENT PER DWGS. 4E-M100-Y REV. A & E47W225-103 REV. 1

MOTOR AMBIENT TEMP ≤ 40 DEG C

STARTER AMBIENT TEMP ≤ 40 DEG C

MANUFACTURER'S DATA:

O/L FACTOR (D.F.) (REF# 1.5H.1) 0.9 TEMP CORRECTION FACTOR (TCF —)

HEATER TABLE: (REF #1 SH. 2)

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT / MINIMUM

I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

D.F. -- MOTOR DERATING FACTOR BASED ON MOTOR SERVICE FACTOR. (REF #1 SH 2)

I(n) -- MOTOR NAMEPLATE FULL LOAD CURRENT OR ADJUSTED MOTOR FULL LOAD CURRENT

~~I% -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

%PROTECTION FROM 115% TO 130% (REF #5)

OVERLOAD HEATERS RANGE FROM 85% to 115%

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ✓ YES ____ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

$$I\ (adjusted) = \frac{440 \times 10.6}{460} = 10.13$$

FOR THIS CALCULATION I (n) = I ADJUSTED = 10.13 AMPS

0051T

CALCULATION NO. ED-Q2268-87324 SHEET 7 .2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV CHECKED BY TMS DATE 3/17/88

COMP # 43 EQUIP REF. REACT 2-[illegible] = 3 [illegible] DRAIN = [illegible]

REV. 1 PREPARED: JPM 3-17-88

CHECKED: DRR 3-17-88

2. MOTOR OVERLOAD HEATER SELECTION

(A) CALCULATION OF HEATER SIZE (REF #5)
I(n)xD.F. = (USE D.F. PER REF #1 SH 1)

10.13 I(n)x 0.9 D.F. = 9.12 AMPS

CATALOG HEATER SIZE CR123 ~~CH33~~ C12.5B

I(m)= ~~9.99~~ 10.0

(B) CALCULATE PROTECTION USING HEATER SETTING OF 100%

~~9.99~~ / 10.0 I(m) x 1.25 X 100 %* / 10.13 : I(n) = 123. %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

/ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.

___ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.
% * = [% PROTECTION x I(n)] / [I(m) x 1.25]
% * =
% * =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?
___ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.
___ NO - THE OVERLOAD HEATER HAS BEEN IMPROPERLY SIZED.

3. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER
IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 2B?

___ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 2B?
___ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 4.

__ __ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 4.

/ NO - REPLACE HEATER ~~PROCEED WITH FOLLOWING~~ PROCEED TO SECTION 4 ~~CR123C12.5B~~ ~~I(m) = 9.99~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~
~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~
~~I(t) = 9.99 I(m) x 1.25 x 1.15 %* = 13.0 AMPS~~

R

R1

CALCULATION NO. ED-Q2265-37824 SHEET 7.3 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2225D-6 SH 1 CHECKED BY THB DATE 3/17/88

COMP # 4B EQUIP REF. REACTOR BLDG EQUIP DESIGN CRITERIA 2A

REV.1 PREPARED: DJL 4-1-88

CHECKED: DJL 4-1-88

EVALUATION OF INSTALLED OVERLOAD HEATER PROTECTION.

% PROTECTION = I(t) / I(n) x 100

~~13.0~~ I(t) / ~~10.13~~ I(n) x 100 = ~~128~~ %

~~DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?~~

~~✓~~ YES - ~~THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE.~~

_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.

%* = [% PROTECTION x I (n)] / [I(n) x 1.25]

%* =

%* =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

_____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 2B.

4. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C10.4B~~ C12.5B

OVERLOAD HEATER SETTING ~~115%~~ 100%

5. COMMENTS: ~~THE INSTALLED TOL HEATERS SETTINGS ARE ACCEPTABLE~~

(1) ASSUMPTION, REFER TO SECT. 4.3

REPLACE INSTALLED TOL HEATERS AS SHOWN ABOVE.

R

R1

CALCULATION NO. [illegible]-Q2265-87[illegible]4 SHEET 3 .1 OF 21

THERMAL OVERLOAD [illegible]TER CALCULATION REV. 0 DATE 3/16/88

BOARD REF # 480V [illegible]AL[illegible] MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45[illegible]SE-1 REV. 0 CHECKED BY TMH DATE 3/17/88

COMP # 2C EQUIP. REF. 2ECW N-3ADEC SECTIONALIZING VALVE FCV-67-21

MOTOR OPERATED VALVE MOTORS

REV. 1 PREPARED: JDL 9-1-88

CHECKED: TRK 9-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C0.71A SETTING 94%

MOTOR NAMEPLATE DATA:

STARTING TORQUE 5 (1) ft# RPM 1725 DUTY 15 min. S.F. -

H.P. .333 (1) VOLTS 460 FLC .95 LRA 5.1 (1) PHASE 3 INS. CLASS B

NEC CODE LETTER - TEMP RISE 75 deg C.

(1) SEE SH. 3.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1-SH.3

TIME .VS. CURRENT CURVE: REF# 1-SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~MINIMUM~~

I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~I* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

R

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 11 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. FD-Q2263-87304 SHEET 3 .2 OF 31

THERMAL OVERLOA[illegible]TER CALCULATION REV. 0 E 3/14/88

BOARD REF 480V ACTUV MOV 63 2C COMPUTED BY D/A .E 3/14/88

UNIT 1 2 DWG. NO. 45B2[illegible] REV. 0 CHECKED BY TMB DATE 3/17/88

COMP 1 4C EQUIP REF. 2SLN A.F.W. AD SECTIONALIZING VALVE FCV-67-21

REV.1 PREPARED: JLM 8-1-88

CHECKED: RK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ___/___ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___HP x _____KVA/HP x 1000) / (1.73 x 460)

LRA = _____AMPS

3. SELECTION MOTOR OVERLOAD HEATER.

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-5145) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 5.1/6.25 = .82

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = .82/1.25 = .66 AMPS

CATALOG HEATER SIZE CR123C0.78A

I(m) ~~.79~~ 0.63 'B' ZONE

B. DETERMINE RELAY ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = .79/0.63 x 1.25 x 100%

I(t) = ~~.99~~ 0.79 AMPS

C. DETERMINE TRIP TIMES FOR:

		(TRIP TIME)
100% MOTOR FLC TO HEATER CURRENT BASE: (.95 I(n) / ~~.79~~ 0.79 I(t)) x 100 =	~~119~~ 120 %	~~over 900~~ SECS
200% MOTOR FLC TO HEATER CURRENT BASE: (2x .95 I(n) / ~~.79~~ 0.79 I(t)) x 100 =	~~240~~ 241 %	~~60-105~~ 66-88 SECS
LOCKED ROTOR AMPS TO HEATER CURRENT BASE: (5.1 MTR LRA/ ~~.79~~ 0.79 I(t)) x 100 =	~~593~~ 646 %	~~11.2-11.6~~ 9.8-14.5 SECS

R1

0050P

CALCULATION NO. [illegible] SHEET 8.3 OF [illegible]

THERMAL OVERLOAD [illegible] TER CALCULATION REV. 0 3/16/88

BOARD REF 4307 [illegible] COMPUTED BY DJA 3/16/88

UNIT # 2 DWG. NO. 4587250.6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 2C EQUIP REF. E-CW 1 HEADER SECTIONALIZING VALVE E-CW-V-21

REV.1 PREPARED: JDA 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS? CHECKED: RK 8-1-88

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x %~~ = [illegible] x 1.25 x 95%

~~I(t) = .88 AMPS~~

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIMES)

~~(1.05 I(a) / .88 I(t)) x 100 = 119 % 200 SECS~~

200% MOTOR FLC TO HEATER CURRENT BASE

~~(2x .95 I(a)/ .88 I(t)) x 100 = 232 % 24 SECS~~

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

~~(5.1 MTR LRA/ .88 I(t)) x 100 = 622 % 4 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIRE88087031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS ① ASSUMPTION PER PHILADELPHIA GEAR CORP DWG NO 15-477-3292-3 & 47A368-67-2 REV. D

R1

CALCULATION NO. [illegible] SHEET 8 .4 OF 31
THERMAL OVERLOAD HEATER CALCULATION REV. 3 E 5/14/88
BOARD REF. [illegible] COMPUTED BY DJA E 3/14/88
UNIT 3 DWG. NO. 45B2233-6 REV. 0 CHECKED BY TMS DATE 3/17/88
COMP # [illegible] EQUIP REF. HEDER 4, HEADER SECTIONALIZING VALVE FCV-67-21
REV.1 PREPARED JPM 8-1-88
CHECKED TRK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

REPLACE HEATER - PROCEED TO SECTION 5

✓ NO - ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 1.02 I(m) x 1.25 x .98 %*~~

~~I(t) = .76 AMPS~~

~~CR 2346 2.21A~~
~~2-wire 6.2~~
~~B-Bond~~

~~100% MOTOR PLC TO HEATER CURRENT BASE:~~

~~(.95 I(m) / .76 I(t)) x 100 = 125 % (TRIP TIME) SECS~~

~~200% MOTOR PLC TO HEATER CURRENT BASE:~~

~~(2 x .95 I(m) / .76 I(t)) x 100 = 250 % 61.93 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(5.1 MTR LRA / .76 I(t)) x 100 = 671 % 9.8 +3 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

_____ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

✓ ~~NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = .82 x 1.25 x 105 %~~

~~I(t) = .81 AMPS~~

~~100% MOTOR PLC TO HEATER CURRENT BASE:~~

~~(.95 I(m) / .81 I(t)) x 100 = 117 % (TRIP TIME) SECS~~

~~200% MOTOR PLC TO HEATER CURRENT BASE:~~

~~(2 x .95 I(m) / .81 I(t)) x 100 = 235 % 72.94 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(5.1 MTR LRA / .81 I(t)) x 100 = 630 % 10.4 +5 SECS~~

R

CALCULATION NO. EDG2868-87884 SHEET 3.5 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0 5/14/88

BOARD REF 480V REACTOR MOV BD 6C COMPUTED BY DJA 5/14/88

UNIT # 2 DWG. NO. 2562630, Sh 1, Rev 6 CHECKED BY TAE DATE 5/17/88

COMP # 4C EQUIP REF. HEGW V-HEADER SECTIONALIZING VALVE ECV-87-C1

REV. 1 PREPARED: JPM 8-1-88

CHECKED: JRK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

✓ ~~YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

✓ ~~NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123C0.78A ~~CR123C0.71A~~

OVERLOAD HEATER SETTING ~~105%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 105%.~~ REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE.

R

CALCULATION NO. Q2268-87324 SHEET 9.1 of 31
THERMAL OVERLOAD WATER CALCULATION REV. 0
BOARD REF 480V REACTOR MOV 3D 2C COMPUTED BY DJK DATE 3/14/88
UNIT # 2 DWG. NO. 4582299-6 REL.0 CHECKED BY TMF DATE 5/17/88
COMP # 4E EQUIP REF. CRD WATER PRESSURE CONTROL VALVE PCV-85-27

MOTOR OPERATED VALVE MOTORS REV.1

PREPARED: JPM 8-1-88
CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1
O/L RELAY TYPE CR124 HEATER SIZE CR129C0.60A SETTING 110 OA
127 OC

MOTOR NAMEPLATE DATA:

STARTING TORQUE 2 ft# RPM 850 DUTY 15 min.S.F. -
H.P. - VOLTS 460 FLC .45 LRA 1.48 ① PHASE 3 INS. CLASS B
NEC CODE LETTER - TEMP RISE 75 deg C.

① SEE SH. 9.3

MANUFACTURER'S DATA:
HEATER TABLE: REF # 1-SH.3
TIME .VS. CURRENT CURVE: REF# 1-SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT, MINIMUM
I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP
1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT
I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT
~~%* ---------- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

R

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. [illegible]-22268-87324 SHEET 9 .2 OF 41

THERMAL OVERLOAD [illegible]ATER CALCULATION REV. 0 DATE 9/14/88

BOARD REF 480V REACTOR MOV BD. 2C COMPUTED BY DJA DATE 3/10/88

UNIT # 2 DWG. NO. 45B2299-16 REV. 0 CHECKED BY TAE DATE 3/17/88

COMP # 43 EQUIP REF. CRD WATER PRESSURE CONTROL VALVE PCV-85-27

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___HP x ____KVA/HP x 1000) / (1.73 x 460)

LRA = _____AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SH 5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 5.1

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 1.48/5.1 = 0.29

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 0.29 / 1.25 = 0.23 AMPS

CATALOG HEATER SIZE CR123 C0.36A ZONE A

I(m) ~~0.34~~ 0.29

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~0.34~~ x 1.25 x 100%

I(t) = ~~0.38~~ 0.36 AMPS 0.29

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(0.45 I(n) / ~~0.38~~ 0.36 I(t)) x 100 = ~~115~~ 125 % ~~282 900~~ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x0.45 I(n) / ~~0.38~~ 0.36 I(t)) x 100 = ~~221~~ 250 % ~~50.74~~ 41-61 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(1.48 MTR LRA/ ~~0.38~~ 0.36 I(t)) x 100 = ~~577~~ 411 % ~~15.5-85~~ 13.5-16 SECS

JPM 8-1-88

NOTE: THIS IS THE SMALLEST HEATER SIZE AVAILABLE AND IS THEREFORE ACCEPTABLE PER O.I 688 87081

R1

0050P

CALCULATION NO. [illegible]-Q2268-87324 SHEET 9 .3 31

THERMAL OVERLOAD ATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 450 REACTOR MOV BD 2C COMPUTED BY DJC DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMA DATE 3/17/88

COMP # 4E EQUIP. REF. CRD WATER PRESSURE CONTROL VALVE PCV-85-27

REV. 1 PREPARED: JPM 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS? CHECKED: RK 8-1-88

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 0.31 x 1.25 x 85% I(t) = 0.33 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~
~~(0.45 I(a) / 0.33 I(t)) x 100 = 136 % 200-300 SECS~~ R

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 0.45 I(a) / 0.33 I(t)) x 100 = 273 % 50-90 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(1.68 MTR LRA / 0.33 I(t)) x 100 = 509 % 5-11.5 SECS~~ *

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

_____ NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.

COMMENTS (1) ASSUMPTION PER VENDOR DATA PROVIDED IN EBASCO LETTER TO LIMITORQUE DATED MARCH 18, 1988

~~* ACCEPTABLE PER QIREEB-87031 (REF. 5)~~ R
~~RIMS = 343 870203 903~~

0050P

CALCULATION NO. C D-Q2268-87324 SHEET 9.4 OF 31
THERMAL OVERLO[illegible]ATER CALCULATION REV. 0 TE 3/16/88
BOARD REF 4804 REACTOR MOV BD 2C COMPUTED BY DJG ATE 3/16/88
UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88
COMP # 4E EQUIP REF. CRD WATER PRESSURE CONTROL VALVE PCV-85-27
REV. 1 | PREPARED: JPM 8-1-88
(CHECKED): RK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

✓ NO - REPLACE HEATER - PROCEED TO SECTION 5 ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~
~~I(t) = 0.52 I(m) x 1.25 x 105 %*~~
~~I(t) = 0.66 AMPS~~

~~ER-23E0.60A~~
~~I(m) = 0.52~~
~~ZONE A~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(0.45 I(n) / 0.66 I(t)) x 100 = 68 % OVER 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~
~~(2 x 0.45 I(n) / 0.66 I(t)) x 100 = 136 % OVER 900 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(1.48 MTR LRA/ 0.66 I(t)) x 100 = 224 % 54-78 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

_____ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

✓ ~~NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~
~~I(t) = I(m) x 1.25 x %* = 0.52 x 1.25 x 95%~~
~~I(t) = 0.55 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(0.45 I(n) / 0.55 I(t)) x 100 = 82 % OVER 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~
~~(2 x 0.45 I(n) / 0.55 I(t)) x 100 = 164 % OVER 900 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(1.48 MTR LRA/ 0.55 I(t)) x 100 = 269 % 53-59 SECS~~

R1

CALCULATION NO. ED-Q2268-87324 SHEET 9.5 / 31

THERMAL OVERLO[illegible]ATER CALCULATION REV. 0 [illegible]TE 3/16/88

BOARD REF 480[illegible] .EACTOR MOV BD 2C COMPUTED BY DLU DATE 3/16/88

UNIT # DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 4E EQUIP REF. CRD WATER PRESSURE CONTROL VALVE PCV-85-27

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

__✓__ ~~NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123C 0.36A

OVERLOAD HEATER SETTING ~~85%~~ 100%

COMMENTS: REPLACE THE INSTALLED TOL HEATERS WITH THOSE SHOWN ABOVE.

CALCULATION NO. ED-0226F-37324 | SHEET 10.1 of 31
THERMAL OVERLO[illegible]ATER CALCULATION | REV. 0 | DATE 3/16/88
BOARD REF 480 [illegible]FACTOR MOV BD 2 | COMPUTED BY DJU | DATE 3/16/88
UNIT # 2 | DWG. NO. 4CB22299.6 REV. 0 | CHECKED BY JTHS | DATE 3/17/88
COMP # 5B | EQUIP REF. BJS HT. EXCH. FLT. CLR & HYDR CLG. WTR. SHUTOFF MOV FCV-24-25

MOTOR OPERATED VALVE MOTORS

REV. 1 | PREPARED: JPM 8-1-88
CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1
O/L RELAY TYPE CR124 HEATER SIZE CR123 C0.394 SETTING 100% OA
95% OC

MOTOR NAMEPLATE DATA:

STARTING TORQUE 2 ft# RPM 1725 DUTY 15 min. S.F. —
H.P. 133 (1) VOLTS 440 FLC 7 LRA 2.6 (1) PHASE 3 INS. CLASS B (1)
NEC CODE LETTER — TEMP RISE 75 deg C.

(1) SEE SH. 10.3

MANUFACTURER'S DATA:
HEATER TABLE: REF # 1 - SH. 8
TIME .VS. CURRENT CURVE: REF# 1 - SH. 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~/~~ MINIMUM
I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP
1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT
I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT
~~%* ---- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

R

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. ED-Q2264-87324 SHEET 10.2 OF [illegible]

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V MOTOR CONTROL CENTER 2C COMPUTED BY [illegible] DATE 3/11/88

UNIT # 2 DWG. NO. 4582299-6 REV. 0 CHECKED BY [illegible] DATE 3/11/88

COMP # 5B EQUIP REF. BUS HT. EXCH., ALT. CLR. & HYDR. CLG. WTR. SUPPLY MOV FCV-24-25

REV. 1 PREPARED: [illegible] 4-1-88

CHECKED: [illegible] 4-4-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED / YES ____ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

$$I\ (adjusted) = \frac{440 \times .7}{460} = .67$$

FOR THIS CALCULATION I (n) = I ADJUSTED = .67 AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES / NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (____ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = ____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-9H.5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE ~~5.1~~ 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 2.6/~~5.1~~ 6.25 = ~~.51~~ .42

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD ~~HEATER~~ RELAY

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = ~~.51~~ .42/1.25 = ~~.41~~ .34 AMPS

CATALOG HEATER SIZE ~~CR123C0.46A~~ CR123C0.39A

I(m) ~~.43~~ ~~0.39~~ 0.32 SPM 7/13/88

'J' ZONE 'B'

B. DETERMINE ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~.43~~ / ~~0.39~~ SPM 7/13/88 x 1.25 x 100%

I(t) = ~~.54~~ AMPS SPM 7/13/88 ~~0.49~~ 0.40 0.32

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(.67 I(n) / ~~.54~~ SPM 7/13/88 ~~0.49~~ 0.40 I(t)) x 100 = ~~124~~ / ~~137~~ SPM 7/13/88 167 % OVER 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x .67 I(n) / ~~.54~~ SPM 7/13/88 ~~0.49~~ 0.40 I(t)) x 100 = ~~248~~ / ~~273~~ SPM 7/13/88 335 % ~~41 - 46~~ / ~~32 - 50~~ SPM 7/13/88 46 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(2.6 MTR LRA / ~~.54~~ SPM 7/13/88 ~~0.49~~ 0.40 I(t)) x 100 = ~~481~~ / ~~531~~ SPM 7/13/88 650 % ~~10 - 16.5~~ / ~~8.8 - 14~~ 9.7 SECS

R1

0050P

CALCULATION NO. ED-92263-37524 SHEET 10.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480 FACTOR MOV BD 2C COMPUTED BY DJA DATE 3/16/88

UNIT # 2 DWG. NO. 45B2279-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 5B EQUIP REF. 3V54 HT. EXCH. ALT CLR. & HYD. CLG. WTR SHUTOFF MOV FCV 24-25

REV. 1 PREPARED: JPM 7-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~/ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = .43 x 1.25 x 95%~~
~~I(t) = .51 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~
~~(.67 I(a) / .51 I(t)) x 100 = 131 % over 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x .67 I(a)/ .51 I(t)) x 100 = 262 % 37-55 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(8.6 MTR LRA/ .51 I(t)) x 100 = 510 % 9.2-15 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER CRANE TELEDYNE DWG. NR T-12942-3 ISSUED UNDER CONTRACT # 70C55-92272-1 & 47A368-24.2 REV. 0. THE FULL LOAD CURRENT SHOWN ON THE VENDOR DWG. IS LESS THAN THAT GIVEN IN THE WALKDOWN DATA; THEREFORE, USE OF THE LOCKED ROTOR CURRENT FROM THE VENDOR DRAWING IN THIS CALCULATION WILL BE CONSERVATIVE.

0050P

CALCULATION NO. ED-02268-37324 SHEET 10.4 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 TE 3/16/88

BOARD REF 480 REACTOR MOV BD 2C COMPUTED BY DJC DATE 3/17/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 5B EQUIP REF. 3,5 HT. EXCH. A,T. CLR. & HYDR. CLG. WTR. SUPPLY MOV FCV-24-25

REV. 1 PREPARED: JPM 8-1-88

CHECKED: D RK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

✓ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

✓ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

~~REPLACE HEATER - PROCEED TO SECTION 5~~ JPM 7/13/88

~~✓ NO - PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = .34 I(m) x 1.25 x 100 %*~~

~~I(t) = .43 AMPS~~

~~ER-23 60.39A~~

~~I(m) .34~~

~~B above~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(.67 I(n) / .43 I(t)) x 100 = 156 % over 100 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .67 I(n) / .43 I(t)) x 100 = 312 % 28-55 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(2.6 MTR LRA/ .43 I(t)) x 100 = 605 % 11-19 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~_____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~✓ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(n) x 1.25 x %* = .34 x 1.25 x 95%~~

~~I(t) = .40 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(.67 I(n) / .40 I(t)) x 100 = 168 % over 100 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .67 I(n) / .40 I(t)) x 100 = 335 % 32-47 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(6.4 MTR LRA/ .40 I(t)) x 100 = 650 % 9.6-14.2 SECS~~

R1

CALCULATION NO. ED-Q2265-8752.4 SHEET 10.5 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/14/88

BOARD REF 480 REACTOR MOV BD 2C COMPUTED BY [illegible] DATE 3/14/88

UNIT # 2 DWG. NO. 45B2259-6 REV. 0 CHECKED BY [illegible] DATE 3/16/88

COMP # 53 EQUIP REF. BUS HT EXCH. ALT. CLR & HYDR. CLG. WTR. SHUTOFF MOV FCV-24-25

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

✓ ~~✓ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~ DO NOT DELETE JPM 7/13/88

~~✓~~ ~~NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C0.48A~~ ~~C0.39A~~ C0.39A JPM 7/13/88

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 95%.~~

~~REPLACE THE INSTALLED TOL HEATERS~~ JPM 7/13/88

~~AS SHOWN ABOVE~~ JPM 7/13/88

RESET THE INSTALLED TOL HEATERS TO 100%

CALCULATION NO. EC-Q2268-87324 SHEET 11.1 [illegible]

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD. 2C COMPUTED BY DAL DATE 3/16/88

UNIT # 2 DWG. NO. 2E6721299-6 REV. 7 CHECKED BY THB DATE 3/17/88

COMP # 5C EQUIP REF. CLOSED COOLING WATER SPARE PUMP SUCTION VALVE MOTOR OPERATED VALVE MOTORS

REV. 1 PREPARED: JPM 4-1-88 ECN-70557

CHECKED: RK 4-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.09A SETTING 100%

MOTOR NAMEPLATE DATA:

STARTING TORQUE 120 (1) ft# RPM 29 DUTY 15 min. S.F. —

H.P. 0.6 (1) VOLTS 460 FLC 2.1 (1) LRA 7.8 (1) PHASE 3 INS. CLASS —

NEC CODE LETTER — TEMP RISE — deg C.

(1) SEE SH. 1.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1. SH. 8

TIME .VS. CURRENT CURVE: REF# 1. SH. 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT / MINIMUM

I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # / RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~%* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR. NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. ED-Q2269-3732 | SHEET 11 OF
THERMAL OVERLOAD WATER CALCULATION | REV. 0
BOARD REF 490 REACTOR MOV BD 2C | COMPUTED BY DAL | DATE 3/24/88
UNIT 1 2 | DWG. NO. 45B2299-6 REV. 0 | CHECKED BY TMB | DATE 3/24/88
COMP 1 5C | EQUIP REF. CLOSED COOLING WATER SPARE PUMP DISCH VALVE

CALCULATIONS: REV.1 PREPARED: DAL 8-1-88 CHECKED: TMB 8-1-88

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ___ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:
LRA = (___ HP x ____ KVA/HP x 1000) / (1.73 x 460)
LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1.5M.5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.
RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 7.8/6.25 = 1.25

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD ~~HEATER~~ RELAY
HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.25/1.25 = 1.0 AMPS
CATALOG HEATER SIZE CR123 C1.18A ZONE 5
I(m) ~~1.04~~ 0.95

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~1.04~~ 0.95 x 1.25 x 100%
I(t) = ~~1.30~~ 1.19 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:
(2.1 I(n) / ~~1.30~~ 1.19 I(t)) x 100 = ~~108~~ 176 % (TRIP TIME) ~~30-120~~ OVER 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2x 2.1 I(n) / ~~1.30~~ 1.19 I(t)) x 100 = ~~323~~ 353 % ~~35-60~~ 29-42 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(7.8 MTR LRA/ ~~1.30~~ 1.19 I(t)) x 100 = ~~600~~ 655 % ~~11-20~~ 9.5-14.0 SECS

R1

0050P

CALCULATION NO. ED-Q2269-97326 SHEET 11.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 8/16/88

BOARD REF 43C REACTOR MOV BD 2C COMPUTED BY DJA DATE 8/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMS DATE 8/17/88

COMP # SC EQUIP REF. CLOSED COOLING WATER SPARE PUMP SUCTION VALVE FCV-70-67

REV.1

PREPARED: JPM 8-1-88

CHECKED: JPK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING TF TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(m) x 1.25 x % = 1.04 x 1.25 x 95%~~

~~I(t) = 1.24 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2.1 I(m) / 1.24 I(t)) x 100 = 169 % OVER 140 SECS~~ (TRIP TIME)

~~200% MOTOR FLC TO HEATER CURRENT BASE~~

~~(2x 2.1 I(m)/ 1.24 I(t)) x 100 = 339 % 22.45 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(7.8 MTR LRA/ 1.24 I(t)) x 100 = 629 % 10.8-15 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER REF. #2 - ROTORK CONTROLS INC BASED ON SPEED OF 29 RPM

0050P

CALCULATION NO. ED-02268-873C4		SHEET 11.4 OF 31	
THERMAL OVERLOAD HEATER CALCULATION		REV. 0	DATE 3/10/88
BOARD REF 480 ACTOR MOV BD 2C	COMPUTED BY DJL		DATE 3/14/88
UNIT # 2	DWG. NO. 45R2299-6 REV. 0	CHECKED BY [illegible]	DATE 3/17/88
COMP # 5C	EQUIP REF. CLOSED COOLING WATER SPARE PUMP SUCTION VALVE		

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

REV. 1 FCV-70-27 PREPARED: JPM 8-1- CHECKED: RK 8-1-

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

/ NO - REPLACE HEATER - PROCEED TO SECTION 5

~~NO - PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = .94 I(m) x 1.25 x 100 %*~~

~~I(t) = 1.18 AMPS~~

~~62+23 C+0.5 A~~

~~I(m) = .94~~

~~3-2-0-5~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(8.1 I(n) / 1.18 I(t)) x 100 = 178 % (TRIP TIME) 125-160 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 8.1 I(n) / 1.18 I(t)) x 100 = 356 % 89-42 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(7.6 MTR LRA/ 1.18 I(t)) x 100 = 661 % 9.4-13.8 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~_____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~/ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = .94 x 1.25 x 105 %~~

~~I(t) = 1.23 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(8.1 I(n) / 1.23 I(t)) x 100 = 171 % (TRIP TIME) over 140 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 8.1 I(n) / 1.23 I(t)) x 100 = 341 % 32-45 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(7.6 MTR LRA/ 1.23 I(t)) x 100 = 534 % 10-14.5 SECS~~

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE? REV. 1

PREPARED: FCV 7-84 8-1-88
CHECKED: RK 8-1-88

~~✓ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

~~✓ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C1.09A~~ C 1.18A

OVERLOAD HEATER SETTING ~~105%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 105%~~
REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE.

CALCULATION NO. 50-Q2263-37326 SHEET 1.1 OF
THERMAL OVERLOAD HEATER CALCULATION REV. 0
BOARD REF 480V FACTOR MOV FED 20 — COMPUTED BY DJL DATE 2/10/88
UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMS DATE 4/7/88
COMP # 5E EQUIP REF. CRD UNIT 2 SECTION ISOLATION VALVE FCV-85-65
MOTOR OPERATED VALVE MOTORS REV. 1
PREPARED: DJM 3-1-88
CHECKED: TMS 3-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR3720 SIZE
O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.31A SETTING 85% OR 100% OR

MOTOR NAMEPLATE DATA:

STARTING TORQUE 5 ft# RPM 1725 DUTY 15 min. S.F. —
H.P. .333 (1) VOLTS 460 FLC .95 LRA 5.1 PHASE 3 INS. CLASS B
NEC CODE LETTER — TEMP RISE 75 deg C.
(1) SIZE OF .33 B

MANUFACTURER'S DATA:
HEATER TABLE: REF # 1-SH 8
TIME .VS. CURRENT CURVE: REF# 1-SH 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~/~~ MINIMUM
I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG ~~/~~ RELAY TRIP
1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT
I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT
~~%* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. ED-Q1226A-37224 SHEET 12.2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 7/14/88

BOARD REF 4A3 REACTOR MOV SD 2C COMPUTED BY DLQ DATE 7/14/88

UNIT # 2 DWG. NO. 4E22299-6 REV. 0 CHECKED BY THB DATE 7/27/88

COMP # 5E EQUIP REF. CRD PUMP A SUCTION ISOLATION VALVE FCV 85-65

REV. 1 PREPARED: DLQ 8-1-88

CHECKED: THB 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ___ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ___ YES ___/___ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x ___ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SH 5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 5.1/6.25 = .82

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD ~~HEATER~~ RELAY

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = .82/1.25 = .66 AMPS

CATALOG HEATER SIZE CR123C0.79A 3 ZONE

I(m) ~~0.69~~ 0.63

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~0.69~~ / 0.63 x 1.25 x 100%

I(t) = ~~0.86~~ / 0.79 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:

(.95 I(n) / ~~0.86~~ / 0.79 I(t)) x 100 = ~~110~~ / 120 % (TRIP TIME) ~~0.28~~ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x .95 I(n) / ~~0.86~~ / 0.79 I(t)) x 100 = ~~220~~ / 241 % ~~50 - 105~~ / 66 - 88 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(5.1 MTR LRA/ ~~0.86~~ / 0.79 I(t)) x 100 = ~~593~~ / 646 % ~~11.3 - 17.5~~ / 9.8 - 14.5 SECS

0050P

CALCULATION NO. ED-Q2268-9724 SHEET 12.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/14/88

BOARD REF 43 REACTOR MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45R2299-6 REV. 0 CHECKED BY TMS DATE 3/17/88

COMP # 5E EQUIP REF. CRD PUMP A SUCTION ISOLATION VALVE FCV-85-65

REV. 1 PREPARED: JAM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓~~ ~~NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = .69 x 1.25 x 95%~~
~~I(t) = .82 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~
~~(.95 I(a) / .82 I(t)) x 100 = 116 % OVER 300 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x .95 I(a)/ .82 I(t)) x 100 = 232 % 74-96 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(5.1 MTR LRA/ .82 I(t)) x 100 = 622 % 10.5-15.3 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓~~ ~~YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION BASED ON COMPARISON OF ELEC. CHARACTERISTICS OF FCV-67-21 COMPT. 4C, AND DWG. 15-477-3292-3.

0050P

CALCULATION NO. ED-Q2268-87324 SHEET 12.4 OF 41

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480 REACTOR MOV 3D 2C COMPUTED BY D.L.L DATE 3/16/88

UNIT # 2 DWG. NO. 45B2297-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 5E EQUIP REF. CRD PUMP A SUCTION ISOLATION VALVE FCV-85-65

REV. 1 PREPARED: JRM 4-1-88

CHECKED: JRK 4-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SITTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

✓ NO - REPLACE HEATER - PROCEED TO SECTION 5 ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 1.45 I(m) x 1.25 x 100 %*~~

~~I(t) = 1.45 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(.95 I(n) / 1.45 I(t)) x 100 = 64 % (TRIP TIME) SEC~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .95 I(n) / 1.45 I(t)) x 100 = 128 % SEC~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(5.1 MTR LRA/ 1.45 I(t)) x 100 = 345 % SEC~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~✓ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = 1.45 x 1.25 x 85%~~

~~I(t) = 1.25 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(.95 I(n) / 1.25 I(t)) x 100 = 74 % (TRIP TIME) SEC~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .95 I(n) / 1.25 I(t)) x 100 = 152 % SEC~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(5.1 MTR LRA/ 1.25 I(t)) x 100 = 408 % SEC~~

CALCULATION NO. ED-G2203-57324 SHEET 12.5 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 TE 3/16/88

BOARD REF 430 REACTOR MOV BD 2C COMPUTED BY DJL TE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY MAB DATE 3/22/88

COMP # 5E EQUIP REF. CRD PUMP A SUCTION ISOLATION VALVE FCV-85-65

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

~~✓ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 C0.78A

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: REPLACE THE INSTALLED TOL HEATERS WITH THOSE SHOWN ABOVE.

CALCULATION NO. EC-[illegible]-37324 SHEET-13.1 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480 FACTOR MOV-FCV-24 COMPUTED BY DJA DATE 3/16/88

UNIT # 2 DWG. NO. 45E2299-6 REV. 0 CHECKED BY TMS DATE 3/17/88

COMP # 63 EQUIP REF. STATE LIQUID COOLING WATER SHUTOFF MOV FCV-24-41

MOTOR OPERATED VALVE MOTORS REV. 1

PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C0.29A SETTING 115%

MOTOR NAMEPLATE DATA:

STARTING TORQUE 2 ft# RPM 1725. DUTY 15. min.S.F. —

H.P. .133 (1) VOLTS 440 FLC .7 LRA 2.6 (1) PHASE 3 INS. CLASS B (1)

NEC CODE LETTER — TEMP RISE 75. deg C.

(1) SEE SH. 13.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1-SH. 8

TIME .VS. CURRENT CURVE: REF# 1. SH. 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~/~~ MINIMUM

I (a) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~** -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. ED-Q2268-37324 SHEET 15.2 0

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480 REACTOR MOV BD. 2C COMPUTED BY DLC DATE 3/14/84

UNIT 2 DWG. NO. 45B2299-6 R31.0 CHECKED BY TWB DATE 3/17/84

COMP # 63 EQUIP REF. STATOR LIQUID COOLING WATER SHUTOFF VLV. FCV-26-61

REV. 1 PREPARED: DLC 3-1-88

CHECKED: TWB 3-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ✓ YES ____ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

$$I\ (adjusted) = \frac{440 \times .7}{460} = .67$$

FOR THIS CALCULATION I (n) = I ADJUSTED = .67 AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (____ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = ____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SK-5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE ~~5.1~~ 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = $2.6/\frac{5.1}{6.25} = \frac{5.1}{.42}$

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = ~~5.1~~ .42 / 1.25 = ~~.34~~ AMPS

CATALOG HEATER SIZE CR123C~~.49~~A C0.39A

I(m) ~~.43~~ ~~0.39~~ 0.32 3/17/88 JDm

RELAY

B. DETERMINE ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~.43~~ x 1.25 x 100%

I(t) = ~~.54~~ AMPS ~~0.39~~ 3/17/88 JDm

~~3/17/88 JDm~~ ~~0.49~~ 0.40 0.32

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(.67 I(n) / ~~.54~~ 3/17/88 JDm ~~0.49~~ I(t)) x 100 = ~~.94~~ ~~.37~~ 3/17/88 JDm % OVER 900 SECS

0.40

200% MOTOR FLC TO HEATER CURRENT BASE: 168

(2x .67 I(n) / ~~.54~~ 3/17/88 JDm ~~0.49~~ I(t)) x 100 = ~~.99~~ ~~2.73~~ 3/17/88 JDm % ~~41.60~~ 32 - 60 3/17/88 JDm SECS

0.40 46

LOCKED ROTOR AMPS TO HEATER CURRENT BASE: 335

(2.6 MTR LRA / ~~.54~~ 3/17/88 JDm ~~0.49~~ I(t)) x 100 = ~~454~~ ~~5.31~~ 3/17/88 JDm % ~~10-16~~ ~~8.6~~ 9.7 SECS

0.40 650

0050P

CALCULATION NO. ED-Q2268-B7324 SHEET 13.1 OF 51

THERMAL OVERLOAD WATER CALCULATION REV. 0 DATE 8/10/88

BOARD REF 4B04 FACTOR MOV 30 2C COMPUTED BY D.A. DATE 8/10/88

UNIT # 2 DWG. NO. 45B2299.6 REV. 0 CHECKED BY TMB DATE 8/17/88

COMP # 68 EQUIP REF. SIMPK LIQUID COOLING WATER SHUTOFF VALVE FCV-24-41

REV.1 PREPARED: GMM 8-1-88

CHECKED: TMB 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(m) x 1.25 x % = .43 x 1.25 x 95% = .51 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ (PREVIOUS)

~~(.67 I(n) / .51 I(t)) x 100 = 131 : [illegible] TCCS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~

~~(2x .67 I(n)/ .51 I(t)) x 100 = 262 : [illegible] TCCS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(2.0 MTR LRA/ .51 I(t)) x 100 = 510 : [illegible] TCCS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIRE88031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER CRANE TELEDYNE DWG. NO. T-12942-3 ISSUED UNDER CONTRACT # 70-55-92272-1 & 47A368-24-2 REV. 0. THE FULL LOAD CURRENT SHOWN ON THE VENDOR DWG IS LESS THAN THAT GIVEN IN THE WALKDOWN DATA; THEREFORE, USE OF THE LOCKED ROTOR CURRENT FROM THE VENDOR DRAWING IN THIS CALCULATION WILL BE CONSERVATIVE.

0050P

CALCULATION NO. EC-G2268-87324 SHEET 13.4 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/16/88

BOARD REF 480V MOTOR MOV BD 2C COMPUTED BY D.U. E 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY JMS DATE 3/17/88

COMP # 6B EQUIP REF. STATOR LIQUID COOLING WATER SHUTOFF MOV FCV-24-41

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

✓ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

✓ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

~~REPLACE HEATER PROCEED TO SECTION 5~~ JPM 7/13/88

~~✓ NO - PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = .34 I(m) x 1.25 x 115 %*~~

~~I(t) = .49 AMPS~~

~~ER-23-00.39A~~
~~E(m) = .34~~
~~B-2002~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(.67 I(a) / .49 I(t)) x 100 = 137 % 0002.900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .67 I(a) / .49 I(t)) x 100 = 273 % 50.67 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(2.6 MTR LRA/ .49 I(t)) x 100 = 531 % 14.81 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

____ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~✓ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(c) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = .34 x 1.25 x 95%~~

~~I(t) = .40 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(.67 I(a) / .40 I(t)) x 100 = 168 % 0002.40 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .67 I(a) / .40 I(t)) x 100 = 335 % 38.47 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(2.6 MTR LRA/ .40 I(t)) x 100 = 650 % 9.6-14.8 SECS~~

R

CALCULATION NO. ED-32263-97E24 SHEET 13.5 OF 5

THERMAL OVERLOA[D] WATER CALCULATION REV. 2 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299.6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 6B EQUIP REF. STATOR LIQUID COOLING WATER SHUTOFF MOV FCV-24-41

REVISED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

JPM 7-1-88

~~✓~~ ~~YES — THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~ ~~DO NOT REJECT~~ JPM 7/13/88

~~✓~~ ~~NO — THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C0.48A~~ ~~C0.39A~~ C0.39

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 95%~~

~~REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE~~ JPM 7/13/88 JPM 7/13/88

RESET THE INSTALLED TOL HEATERS TO 100%

0050P

CALCULATION NO. EDG-Q2268-87302 SHEET 14.1 of 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/16/88

BOARD REF # 80X HEATER MOV 1-2 2C COMPUTED BY DJA DATE 3/16/88

UNIT # 2 DWG. NO. 25B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 6C EQUIP REF. CLOSED CLG WTR SPARE PUMP DISCH. VLV. FCV-70-68

MOTOR OPERATED VALVE MOTORS REV. 1

PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109 C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.09A SETTING 100%

MOTOR NAMEPLATE DATA:

STARTING TORQUE 120 (1) ft# RPM 29 DUTY 15 min.S.F. —

H.P. 0.6 (1) VOLTS 460 FLC 2.1 (1) LRA 7.3 (1) PHASE 3 INS. CLASS —

NEC CODE LETTER — TEMP RISE — deg C.

(1) SEE SH. 14.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1. SH. 8

TIME .VS. CURRENT CURVE: REF # 1-SH. 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~MAXIMUM~~ MINIMUM

I (n) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~% -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. EDQ2268-87324 SHEET 14.2 1

THERMAL OVERLOAD HEATER CALCULATION REV. 0 RE 3/16/88

BOARD REF 480V MOTOR ACTUATOR MOV.SD 2C COMPUTED BY DJL DATE 3/16/88

UNIT 0 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP 0 GE EQUIP REF. CLOSED CLG. WTR. SPARE PUMP DISCH. VLV. FCV-70-68

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ___/___ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x ___ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1.5W 5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 7.8/6.25 = 1.25

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.25/1.25 = 1.0 AMPS

CATALOG HEATER SIZE CR123 C1.19A

I(m) ~~1.19~~ 0.95 'B' Zone

B. DETERMINE RELAY ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~1.04~~ / 0.95 x 1.25 x 100%

I(t) = ~~1.30~~ 1.19 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:

(2.1 I(n) / ~~1.20~~ 1.19 I(t)) x 100 = ~~168~~ 176 % ~~110-140~~ OVER 900 SECS (TRIP TIME)

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 2.1 I(n) / ~~1.30~~ 1.19 I(t)) x 100 = ~~323~~ 353 % ~~25-50~~ 29-42 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(7.8 MTR LRA/ ~~1.30~~ 1.19 I(t)) x 100 = ~~600~~ 655 % ~~11-15~~ 9.5-14.0 SECS

0050P

CALCULATION NO. EC-G1268-87324 SHEET 4.3 07
THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88
BOARD REF 480V MOTOR CONTROL BD 2C COMPUTED BY DJL DATE 3/16/88
UNIT # 2 DWG. NO. 1582299.6 REV. 0 CHECKED BY TMS DATE 3/16/88
COMP # 6C EQUIP REF. CLOSED CLG. WTR. SPARE PUMP DISCH. V.V. FCV-70-6

REV. 1
PREPARED: JPM 8-1-88
CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x %* = 1.04 x 1.25 x 95 %~~
~~I(t) = 1.24 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~
~~(2.1 I(a) / 1.24 I(t)) x 100 = 169 : 292.40 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 2.1 I(a)/ 1.24 I(t)) x 100 = 339 : 92.45 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(7.3 MTR LRA/ 1.24 I(t)) x 100 = 589 : 19.15 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO CIRCEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER REF #2 ROTORK CONTROLS INC BASED ON SPEED OF 29 RPM

0050P

CALCULATION NO. ED-92268-37324 SHEET 14.4 REV. 0

THERMAL OVERLOAD HEATER CALCULATION

BOARD REF 480 FACTOR MAN BD. 2C COMPUTED BY DJL DATE 3/14/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TJA DATE 3/17/88

COMP # 6C EQUIP REF. CLOSED CLG WTR SPACE PUMP DISCH. V.V. FCV-70-68

REV. 1 PREPARED: DJM 8-1-88

CHECKED: TJA 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

REPLACE HEATER - PROCEED TO SECTION 5

✓ NO - ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = .94 I(m) x 1.25 x .00 %*~~

~~I(t) = 1.18 AMPS~~

~~I(m) = 1.4~~

~~3 Zone~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2.1 I(a) / 1.18 I(t)) x 100 = 178 % 125 SECS~~ (TRIP TIME)

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 2.1 I(a) / 1.18 I(t)) x 100 = 356 % 29.4 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(7.8 MTR LRA / 1.18 I(t)) x 100 = 661 % 9.4 13.3 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

____ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

✓ ~~NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = .94 x 1.25 x 105%~~

~~I(t) = 1.23 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2.1 I(a) / 1.23 I(t)) x 100 = 171 % 0VER 14.2 SECS~~ (TRIP TIME)

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 2.1 I(a) / 1.23 I(t)) x 100 = 341 % 36.4 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(7.8 MTR LRA / 1.23 I(t)) x 100 = 634 % 10.14 SECS~~

CALCULATION NO. ED-G2268-3734 SHEET 14.5 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0 ≡ 3/16/88

BOARD REF 480V ACTIVE MAV BD COMPUTED BY DJA .E 3/16/88

UNIT # 2 DWG. NO. 45B2299-2 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # GC EQUIP REF. CLOSED CLG WTR SPARE PUMP DISCH V/V, FCV-72-68

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN TLE OVERLOAD HEATER RANGE?

~~✓ YES — THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

JPM 7-31-88 ~~✓ NO — THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C1.09A~~ C1.18A

OVERLOAD HEATER SETTING ~~105%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 105%~~

REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE

CALCULATION NO. SD-G2268-87324 SHEET 15.1 REV. 0

THERMAL OVERLOAD HEATER CALCULATION

BOARD REF 480V MOTOR CONTROL CENTER 2C COMPUTED BY D.L DATE 3/14/88

UNIT # 2 DWG. NO. 4582299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 6E EQUIP REF. MAIN STEAM LINE DRAIN VALVE FCV-1-6A

MOTOR OPERATED VALVE MOTORS

REV.1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR123 HEATER SIZE CR123C1.34A SETTING 90 98 QA QC

MOTOR NAMEPLATE DATA:

STARTING TORQUE 7.5 ft# RPM 1700 DUTY 15 min.S.F. —

H.P. 0.5 ① VOLTS 460 FLC 2.3 LRA 10.9 ① PHASE 3 INS. CLASS —

NEC CODE LETTER — TEMP RISE 75 deg C.

① SEE SH.15.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1 - SH.8

TIME .VS. CURRENT CURVE: REF# 1 - SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~/~~ MINIMUM

I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~I* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. ED-[illegible]-87824 SHEET 15.2 of 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/14/88

BOARD REF 4301 REACTOR MOV BD. 3C COMPUTED BY DLA DATE 3/14/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 6E EQUIP REF. MAIN STEAM LINE DRAIN VALVE FCV-1-59

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 9-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SU.S) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 10.9/6.25 = 1.74

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.74/1.25 = 1.40 AMPS

CATALOG HEATER SIZE CR123 C1.63A 'B' ZONE

I(m) ~~1.47~~ 1.31

RELAY

B. DETERMINE ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~1.47~~ / 1.31 x 1.25 x 100%

I(t) = ~~1.84~~ 1.64 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:

(2.3 I(n) / ~~1.84~~ 1.64 I(t)) x 100 = ___ % (TRIP TIME) OVER 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 2.3 I(n) / ~~1.84~~ 1.64 I(t)) x 100 = ~~250~~ 280 % ~~42.82~~ 47-65 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(10.9 MTR LRA/ ~~1.84~~ 1.64 I(t)) x 100 = ~~592~~ 665 % ~~11.5-17~~ 9.2-13.5 SECS

R

0050P

CALCULATION NO. ED-Q2268-3754 SHEET 15.3

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480 FACTOR MAV ED 2C COMPUTED BY DJK DATE 2/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 2/17/88

COMP # 02E EQUIP REF. MAIN STEAM LINE DRAIN VALVE F.C.V. 1-55

REV. 1 PREPARED: DJK 3-1-88

CHECKED: PJK 3-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(n) x 1.25 x ** = 1.47 x 1.25 x 95%~~
~~I(t) = 1.75 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(2.3 I(n) / 1.75 I(t)) x 100 = 131 % SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 2.3 I(n)/ 1.75 I(t)) x 100 = 263 % SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(10.9 MTR LRA/ 1.75 I(t)) x 100 = 623 % SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREED87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS ① ASSUMPTION PER PHILADELPHIA GEAR W27 DWG ENTITLED "LIMITORQUE MASTER CERTIFICATION II" STATION 1, 2 & 3 REV. E & DWG 47A365-1-2 REV. 3

0050P

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

/ NO - REPLACE HEATER - PROCEED TO SECTION 5

~~NO - PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~
~~I(t) = 1.56 I(m) x 1.25 x 98 %*~~
~~I(t) = 1.91 AMPS~~

~~ER-23 E1.54A~~
~~EW = 1.56~~
~~B-E0007~~

~~100% MOTOR PLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(2.3 I(n) / 1.91 I(t)) x 100 = 120 % ONE = 200 SECS~~

~~200% MOTOR PLC TO HEATER CURRENT BASE:~~
~~(2 x 2.3 I(n) / 1.91 I(t)) x 100 = 241 % 66 - 35 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(0.9 MTR LRA/ 1.91 I(t)) x 100 = 571 % 10.2 - 18 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~_____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~/ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~
~~I(t) = I(m) x 1.25 x %* = 1.56 x 1.25 x 90%~~
~~I(t) = 1.76 AMPS~~

~~100% MOTOR PLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(2.3 I(n) / 1.76 I(t)) x 100 = 131 % ONE = 200 SECS~~

~~200% MOTOR PLC TO HEATER CURRENT BASE:~~
~~(2 x 2.3 I(n) / 1.76 I(t)) x 100 = 261 % 55 - 74 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(0.9 MTR LRA/ 1.76 I(t)) x 100 = 619 % 10.5 - 15.2 SECS~~

CALCULATION NO. ED-G3265-87226 SHEET 15.5 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 8/16/88

BOARD REF 480 FACTOR MAY BD 2C COMPUTED BY DLC DATE 8/16/88

UNIT # 2 DWG. NO. 4E23299-6 REV. 0 CHECKED BY [illegible] DATE 8/17/88

COMP # 6E EQUIP REF. MAIN STEAM LINE DRAIN VALVE FCV-1-56

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

~~✓ YES — THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

JPM 8-1-88

~~✓ NO — THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C1.84A~~ C1.63A

OVERLOAD HEATER SETTING ~~90%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 90%~~ REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE.

CALCULATION NO. ED-G2268-87324 SHEET 16.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 8/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DVL DATE 8/16/88

UNIT # 2 DWG. NO. 4582299.6 REV. 0 CHECKED BY JMB DATE 8/17/88

COMP # 7A EQUIP REF. REACTOR BLDG. FLOOR DRAIN SUMP PUMP 2A

REV. 1 PREPARED: JPM 8-1-88

~~CONTINUOUS DUTY MOTORS~~ CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR106C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123C12.58 SETTING 100%

MOTOR NAMEPLATE DATA:

H.P. 7.5 VOLTS 440 FLC 10.6 PHASE 3 INS. CLASS B (1) NEC CODE G

DUTY CONT S.F. 1.0 TEMP RISE 55 DEG C. AMBIENT TEMP — DEC C

(1) SEE SH. 16.3

AMBIENT TEMPERATURE: (REF #8)

MOTOR AMBIENT TEMP ≤ 40 DEG C

STARTER AMBIENT TEMP ≤ 40 DEG C

EQUIP LOCATED IN PORTION OF REACTOR BLDG. WHICH IS NOT PART OF HARSH ENVIRONMENT PER DWGS 47W200-7 REV. A & 47W225-103 REV. 1

MANUFACTURER'S DATA:

O/L FACTOR (D.F.) (REF# 1-SH.1) 0.9 TEMP CORRECTION FACTOR (TCF -)

HEATER TABLE: (REF #1 -SH.8)

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

D.F. -- MOTOR DERATING FACTOR BASED ON MOTOR SERVICE FACTOR. (REF #1 SH 1)

I(n) -- MOTOR NAMEPLATE FULL LOAD CURRENT OR ADJUSTED MOTOR FULL LOAD CURRENT

~~%A -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

%PROTECTION FROM 115% TO 130% (REF #5)

OVERLOAD HEATERS RANGE FROM 85% to 115%

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ✓ YES ____ NO

IF YES;

$$I\,(\text{adjusted}) = \frac{V\,(\text{nameplate})}{V\,(\text{operating})} \times I\,(\text{nameplate})$$

$$I\,(\text{adjusted}) = \frac{440 \times 10.6}{460} = 10.13$$

FOR THIS CALCULATION I (n) = I ADJUSTED = 10.13 AMPS

0051T

CALCULATION NO. ED-G7268-87324 SHEET 16.2 OF [illegible]

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE [illegible]

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DLL DATE [illegible]

UNIT # 2 DWG. NO. 45E2299-6 REV. 0 CHECKED BY [illegible] DATE [illegible]

COMP # 7A EQUIP REF. REACTOR BLDG FLOOR DRAIN SUMP [illegible] 7A

REV. 1 PREPARED: JPM [illegible]

CHECKED: RK [illegible]

2. MOTOR OVERLOAD HEATER SELECTION

(A) CALCULATION OF HEATER SIZE (REF #5)
I(n)x D.F. = (USE D.F. PER REF #1 SH 1)

10.13 I(n)x 0.9 D.F. = 9.12 AMPS

CATALOG HEATER SIZE C12.5B ~~CR123 C11.38~~

I(m)= ~~9.99~~ 10.0

(B) CALCULATION FOR OVERLOAD HEATER SETTING:
CALCULATE % PROTECTION USING HEATER SETTING OF 100%

~~9.99~~ / 10.0 I(m) x 1.25 X 100 %* / 10.13 I(n) = 123 %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

✓ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.

_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.
% * = [% PROTECTION x I(n)] / [I(m) x 1.25]
% * =
% * =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?
_____ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.
_____ NO - THE OVERLOAD HEATER HAS BEEN IMPROPERLY SIZED.

3. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER
IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 2B?

✓ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 2B?

✓ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 4.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE. FIELD TO RESET SETTING. PROCEED TO SECTION 4.

~~✓ NO - PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~
~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~
~~I(t) = 10.0 I(m) x 1.25 x 90 %* = 13.62 AMPS~~

CALCULATION NO. ED-Q2268-9736C | SHEET 16.3 OF 21

THERMAL OVERLOAD HEATER CALCULATION | REV 0 | DATE 3/10/88

BOARD REF 480V REACTOR MOV 5D 2C | COMPUTED BY DLL | DATE 3/10/88

UNIT # 2 | DWG. NO. 45E2250-6 REV 0 | CHECKED BY TAB | DATE 3/10/88

COMP # 7A | EQUIP REF. REACTOR BLDG FLOOR DRAIN SUMP PUMP "A"

REV.1 | PREPARED: DLL 5-1-88

EVALUATION OF INSTALLED OVERLOAD HEATER PROTECTION. | CHECKED: TAB 5-1-88

% PROTECTION = I(t) / I(n) x 100

~~13.42~~ I(t) / ~~10.13~~ I(n) x 100 = ~~135~~ %

~~DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?~~

~~____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE.~~

~~__✓__ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.~~

~~I* = [% PROTECTION x I (n)] / [I(m) x 1.25]~~

~~90 I* = % PROT x 10.13 / 10.9 x 1.25; % PROT = 121%~~

~~I* =~~

~~IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

~~____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 2B.~~

4. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123C12.5B

OVERLOAD HEATER SETTING ~~90%~~ 100%

5. COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 90%~~

① ASSUMPTION, REFER TO SECT. 4.3

THE INSTALLED TOL HEATERS SETTINGS ARE ACCEPTABLE.

CALCULATION NO. ED-[illegible]-97326 SHEET 17.1 OF [illegible]

THERMAL OVERLOAD [illegible]TER CALCULATION REV. 0

BOARD REF 43[illegible] [illegible]ACTOR MOV 30 QC COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 4532999.6 R21.0 CHECKED BY TMS DATE 3/17/88

COMP # 78 EQUIP REF. PRECOOLER 1,2,3,D COOLING WATER SHUTOFF VLVS M1.24-57

MOTOR OPERATED VALVE MOTORS REV.1

PREPARED: DJM 3-1-88

CHECKED: DJL 3-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109GR SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C0.39A SETTING 90% 0A
100% DC

MOTOR NAMEPLATE DATA:

STARTING TORQUE 2 ft# RPM 1725 DUTY 15 min.S.F. —

H.P. .133 (1) VOLTS 440 FLC .7 LRA 2.6 (1) PHASE 3 INS. CLASS B (1)

NEC CODE LETTER — TEMP RISE 75 deg C.

(1) SEE S4.17.2

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1-SH.8

TIME .VS. CURRENT CURVE: REF# 1-SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~/~~ MINIMUM

I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~S.F. -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 4 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. [illegible] SHEET 17.2 OF [illegible]

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 4350 ACT-2 MOV 30 2C. COMPUTED BY DJA DATE 3/16/88

UNIT # 2 DWG. NO. 4582299.6 REV.0 CHECKED BY [illegible] DATE 3/17/88

COMP # 7B EQUIP REF. RCP Cooler Liquid Cooling Water Shut-off MOV FCV-24-57

REV. 1 PREPARED: RPM 8-1-88

CHECKED: RR 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED / YES ____ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

$$I\ (adjusted) = \frac{440 \times .7}{460} = .67$$

FOR THIS CALCULATION I (n) = I ADJUSTED = .67 AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES / NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (____ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = ____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SH.8) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE ~~5.1~~ 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = $\frac{2.6}{\cancel{5.1}\ 6.25} = \frac{\cancel{.51}}{0.42}$

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = [illegible]/1.25 = [illegible] AMPS

CATALOG HEATER SIZE ~~CR123C0-43A~~ CR123C0-39A W Code S

I(m) ~~.43~~ ~~0.34~~ 0.32 3/17/88

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x I% = ~~.43~~ / ~~0.34~~ 0.32 x 1.25 x 100%

I(t) = ~~.54~~ 0.40 AMPS 3/17/88

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(.67 I(n) / ~~.54~~ ~~0.43~~ 0.40 I(t)) x 100 = ~~134~~ ~~137~~ 168 % OVER 300 SECS 3/17/88

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x .67 I(n) / ~~.54~~ ~~0.34~~ 0.40 I(t)) x 100 = ~~244~~ ~~272~~ 335 % ~~41-60~~ 32 ~~50~~ 40 SECS 3/17/88

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(2.6 MTR LRA / ~~.54~~ ~~0.43~~ 0.40 I(t)) x 100 = ~~481~~ ~~531~~ 650 % ~~8.0-14.0~~ 9.7 SECS 3/17/88

0050P

CALCULATION NO. ED-02268-37324 SHEET 17.3 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V ACTUR MOV 3D 2G COMPUTED BY DJL DATE 8/11/88

UNIT # 2 DWG. NO. 25B2299.6 REV. 0 CHECKED BY THS DATE 8/17/88

COMP # 7B EQUIP REF. PCA COOLER LIQUID COOLING WATER SHUTOFF VLV FCV-1-24-57

REV. 1

PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(m) x 1.25 x % = .43 x 1.25 x 95% = .51 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~

~~(.67 I(n) / .51 I(t)) x 100 = 131 : over 300 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~

~~(2x .67 I(n)/ .51 I(t)) x 100 = 262 : 37.55 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(8.6 MTR LRA/ .51 I(t)) x 100 = 5.13 : 9.8-15 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREPD87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS ① ASSUMPTION PER CRANE TELEDYNE DWG. NO T-12942-3 ISSUED UNDER CONTRACT # 70C55.92272-1 & 47A368-24-2 REV. 0. THE FULL LOAD CURRENT SHOWN ON THE VENDOR DWG IS LESS THAN THAT GIVEN IN THE WALKDOWN DATA, THEREFORE, USE OF THE LOCKED ROTOR CURRENT FROM THE VENDOR DRAWING IN THIS CALCULATION WILL BE CONSERVATIVE

CALCULATION NO. ED-02268-8736 | SHEET 17.4 OF 21
THERMAL OVERLOAD HEATER CALCULATION | REV. 2 | 9/14/88
BOARD REF 430 MOTOR MOV BD. 2C | COMPUTED BY DJL | 9/14/88
UNIT # 2 | DWG. NO. 45B2299-6 REV. 0 | CHECKED BY [illegible] | DATE 9/17/88
COMP # 7B | EQUIP REF. PRECOOLER LIQUID COOLING WATER SHUTOFF MOV FCV-24-57

REVISED: JPM 8-1-88
CHECKED: RK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER — REV.1

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

✓ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

✓ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

~~REPLACE HEATER - PROCEED TO SECTION 5~~ JPM 7/19/88

✓ NO - ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = .34 I(m) x 1.25 x 1.20 %*~~

~~I(t) = .49 AMPS~~

~~6.2+83 60.99A~~
~~E(m) = .34~~
~~B' 2.0.5~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(.37 I(m) / .49 I(t)) x 100 = 1.20 % 20.40 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .37 I(m) / .49 I(t)) x 100 = 9.8 % 28.55 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(2.6 MTR LRA/ .49 I(t)) x 100 = 1205 % 11 - 16 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

_____ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

✓ ~~NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = .34 x 1.25 x 95%~~

~~I(t) = .40 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(.67 I(m) / .40 I(t)) x 100 = 1.68 % over 140 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .67 I(m) / .40 I(t)) x 100 = 335 % 20.47 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(2.6 MTR LRA/ .40 I(t)) x 100 = 650 % 9.6 14.2 SECS~~

CALCULATION NO. ED-22869-87224 SHEET 17.5 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V [illegible] CTR MOV BD 2C COMPUTED BY DLL 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 4/17/88

COMP # 7B EQUIP REF. 2CC600 LEC LIQUID COOLING WATER SUPPLY TO MOV FCV-26-57

REV 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

JM 7-13-88

~~✓~~ ~~YES — THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~ ~~DO NOT DELETE~~ JPM 7/13/88

~~✓~~ ~~NO — THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE ~~CO.48A~~ CR123 ~~CO.39A~~ CO.39A

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 95%.~~

~~REPLACE THE INSTALLED TOL HEATERS~~ JPM 7/13/88

~~AS SHOWN ABOVE~~ JPM 7/13/88

RESET THE INSTALLED TOL HEATERS TO 100%

CALCULATION NO. ED-Q2265-3736 | SHEET 13.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION | REV. 0

BOARD REF 480V ACTIVE MOV BD 2C | COMPUTED BY DJL DATE 3/16/88

UNIT # 2 | DWG. NO. 45B2299.6 REV 0 | CHECKED BY TMS DATE 3/17/88

COMP # 7C | EQUIP REF. RNCU BLOWDOWN MOV FCV-69-16

MOTOR OPERATED VALVE MOTORS

REV.1 | PREPARED: JPM 8-1-88 | CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1.

O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.63A SETTING 100%.

MOTOR NAMEPLATE DATA:

STARTING TORQUE 10. ft# RPM 1700. DUTY 15. min.S.F. —

H.P. .66 (1) VOLTS 460 FLC 2.1 LRA 11.9 (1) PHASE 3. INS. CLASS B.

NEC CODE LETTER — TEMP RISE 75. deg C.

(1) See ¶4.18.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1-514.3

TIME .VS. CURRENT CURVE: REF# 1-514.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (n) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~I* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. ED-G2268-3736 SHEET 18.2 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/14/51

BOARD REF 480 FACTOR MOV BD 3C COMPUTED BY DJL DATE 3/16/51

UNIT 1 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP 1 7C EQUIP REF. RWCU BLOWDOWN MOV FCV-69-6

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (____ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SH 5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 11.9/6.25 = 1.90

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.90/1.25 = 1.52 AMPS

CATALOG HEATER SIZE CR123 C1.84A

I(m) ~~1.56~~ 1.48 3 Zone

B. DETERMINE RELAY ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~1.56~~ / 1.48 x 1.25 x 100%

I(t) = ~~1.95~~ / 1.85 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(2.1 I(n) / ~~1.95~~ / 1.85 I(t)) x 100 = ~~108~~ / 114 % ~~over 900~~ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 2.1 I(n) / ~~1.95~~ / 1.85 I(t)) x 100 = ~~215~~ / 227 % ~~80-100~~ / 78-100 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(11.9 MTR LRA/ ~~1.95~~ / 1.85 I(t)) x 100 = ~~610~~ / 643 % ~~10.7-15.8~~ / 9.8-14.5 SECS

CALCULATION NO. ED-Q2263-47506 SHEET 18.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/16/88

BOARD REF 480V REACTOR MAN BD 2C COMPUTED BY DJH E 3/16/88

UNIT 1 2 DWG. NO. 4522299-6 REV. 0 CHECKED BY TMS DATE 3/17/88

COMP 1 76 EQUIP REF. RWCU BLOWDOWN MOV FCV 69-16

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS? REV.1 PREPARED: JPM 8-1-88 CHECKED: RK 8-1-88

___✓___ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

___✓___ ~~NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 1.56 x 1.25 x 95%~~
~~I(t) = 1.85 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~
~~(8.1 I(a) / 1.95 I(t)) x 100 = 111 % 21.2 300 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 8.1 I(a)/ 1.95 I(t)) x 100 = 207 % 76 - 100 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(11.9 MTR LRA/ 1.95 I(t)) x 100 = 643 % 10 - 14.1 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

___✓___ ~~YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

_____ ~~NO REFER TO QIRBEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER DWGS VPF 2547-36-3E 47A368-69-2 REV. 2.

0050P

CALCULATION NO. HED-[illegible] SHEET 13.4 OF [illegible]

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 430 REACTOR MOV 30 VC COMPUTED BY DLW DATE 9/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 9/16/88

COMP # 7C EQUIP REF. RWCU BLOW DOWN MOV FCV-69-16

REV. 1 PREPARED: DLW 9-1-88

CHECKED: VRK 9-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

REPLACE HEATER - PROCEED TO SECTION 5

✓ NO - ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 1.47 I(m) x 1.25 x 1.00 %*~~

~~I(t) = 1.84 AMPS~~

~~GR 2366 - 5A~~

~~I(m) = 1.47~~

~~3 Secs~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(6.1 I(n) / 1.84 I(t)) x 100 = 114 % 3 Secs~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 6.1 I(n) / 1.84 I(t)) x 100 = 229 % 7 Secs~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(11.9 MTR LRA/ 1.84 I(t)) x 100 = 647 % 9.7 - 14.5 Secs~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

✓ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

_____ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS

I(t) = I(m) x 1.25 x %* = TRIP AMPS

I(t) = I(m) x 1.25 x %* = _____ x 1.25 x _____ _____

I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(_____ MTR LRA/ _____ I(t)) x 100 = _____ % _____ SECS

CALCULATION NO. ED-G0268-87324 SHEET 15 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V ACTOR MOV SD 2C COMPUTED BY DJL 3/14/88

UNIT # 2 DWG. NO. 2523299-6 REV. 0 CHECKED BY [illegible] 3/17/88

COMP # 7C EQUIP REF. RWCU Blow Down MOV FCV-69-16

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

JPM 7-31-88

✓ NO ~~THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 C1.84A ~~C1.63A~~

OVERLOAD HEATER SETTING 100%

COMMENTS: ~~THE INSTALLED TOL HEATERS SETTINGS ARE ACCEPTABLE~~

REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE.

CALCULATION NO. EDC-CA2207-37826 SHEET 19.1 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 4537 FACTOR MOV 8D 2E COMPUTED BY D.U DATE 8/16/91

UNIT # 2 LWG. NO. 25B2299.6 REV. 0 CHECKED BY TMB DATE 8/17/91

COMP # 7E EQUIP REF. RWCU FILTER D2 SMIN SYS. BY-PASS MOV F.P. 69-5

MOTOR OPERATED VALVE MOTORS

REV. 1

PREPARED: JPM 8-1-88

CHECKED: TMB 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123C1.63A SETTING 95% 98% 100% 96

MOTOR NAMEPLATE DATA:

STARTING TORQUE 7.5 ft# RPM 1720 DUTY 15 min.S.F. -

H.P. .5 (1) VOLTS 460 FLC 2.1 LRA 11.9 (1) PHASE 3 INS. CLASS B

NEC CODE LETTER - TEMP RISE 75 deg C.

(1) SEE SH.19.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1-SH.8

TIME .VS. CURRENT CURVE: REF# 1-SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~P.U. -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. EL-3CC28-37424 SHEET 19.2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/16/88

BOARD REF 4R24 ACTUATOR MOV FCV 67-5 COMPUTED BY DJL E 3/16/88

UNIT # - 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMS DATE 3/17/88

COMP # - 73 EQUIP REF. RWCU FILTER & DEMIN SYS. BYPASS MOV FCV-67-5

REV. 1 PREPARED: JPM 8-1-88

CHECKED: JPK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (____ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1.4H.5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 11.9 / 6.25 = 1.90

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.90/1.25 = 1.52 AMPS

CATALOG HEATER SIZE CR123 C1.84A

I(m) ~~1.36~~ 1.48 'B' Zone

B. DETERMINE RELAY ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x ~~1*~~ = ~~1.36~~ / 1.48 x 1.25 x 100%

I(t) = ~~1.85~~ 1.85 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:

(2.1 I(n) / ~~1.85~~ 1.85 I(t)) x 100 = ~~108~~ 114 % (TRIP TIME) OVER 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 2.1 I(n) / ~~1.85~~ 1.85 I(t)) x 100 = ~~215~~ 227 % ~~50 110~~ 76 - 98 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(11.9 MTR LRA / ~~1.85~~ 1.85 I(t)) x 100 = ~~610~~ 643 % ~~107 16.3~~ 9.8 - 14.3 SECS

CALCULATION NO. EC-02265-47524 SHEET 19.3 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0 3/16/88

BOARD REF 480V ACTOR MOV HD 2C COMPUTED BY DKA 3/14/88

UNIT # - 2 DWG. NO. 45B2299.6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 73 EQUIP REF. RWCU FILTER & DEMIN SYS. BY-PASS MOV FCV-69-3

REVN

PREPARED: DKA 3-1-88

CHECKED: DKA 3-1-88

.. ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.

I(t) = I(a) x 1.25 x % = 1.56 x 1.25 x 95%

I(t) = 1.85 AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIMES)

(2.1 I(a) / 1.85 I(t)) x 100 = 114 % 2 TO 6 SECS

200% MOTOR FLC TO HEATER CURRENT BASE

(2x 2.1 I(a)/ 1.85 I(t)) x 100 = 227 % 7½ 10 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(11.9 MTR LRA/ 1.85 I(t)) x 100 = 643 % 6 [illegible] 6 SECS

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

____ NO REFER TO QIRE8B87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.

COMMENTS (1) ASSUMPTION PER DWGS UPF# 2547-36-3 &

47A365-69-2 REV. 2

0050P

CALCULATION NO. ED-Q2764-3706 SHEET 19.4 OF 31

THERMAL OVERLOAD [illegible]TER CALCULATION REV. 0

BOARD REF 480V [illegible]ACTOR M:V SD 2C COMPUTED BY DJA DATE 3/10/82

UNIT # 2 DWG. NO. 25B2259-2 REV. 0 CHECKED BY JHB DATE 3/10/82

COMP # 7E EQUIP REF. RWCU FILTER & DEMIN SYS BYPASS M:V FCV-69-8

REVISED: DJA 2-1-88 REV. 1

CHECKED: JPK 2-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

✓ NO - ~~PROCEED WITH FOLLOWING~~ REPLACE HEATER - PROCEED TO SECTION 5

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x T* = TRIP AMPS~~

~~I(t) = 1.47 I(a) x 1.25 x 1.00 T*~~

~~I(t) = 1.84 AMPS~~

~~CR-283-1.05A~~

~~B-20.5~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ (TRIP TIME)

~~(2.1 I(n) / 1.84 I(t)) x 100 = 114 % 1122 221 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 2.1 I(n) / 1.84 I(t)) x 100 = 223 % 76-14.2 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(11.9 MTR LRA/ 1.84 I(t)) x 100 = 647 % 9.8-11.4 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~✓ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

_____ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS

I(t) = I(m) x 1.25 x T* = TRIP AMPS

I(t) = I(m) x 1.25 x T* = _____ x 1.25 x _____

I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

CALCULATION NO. ED-72263-57524 SHEET 19.5 OF 54

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 490V REACTOR MOV BD 2C COMPUTED BY D&L DATE 5/16/88

UNIT # 2 DWG. NO. 25B2299-6 REV. 0 CHECKED BY TMB DATE 5/17/88

COMP # 7E EQUIP REF. RVICU FILTER & DEMIN SYS. BYPASS MOV 2-CU-69-A

REVIEWED: JLM 5-16-88

CHECKED: DRE 5-16-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

JLM 5-16-88

✓ NO - ~~THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C1.69A~~ C1.84A

OVERLOAD HEATER SETTING 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 100%.~~ REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE

0050P

CALCULATION NO. EDG-CALC-3-37824 SHEET 20.1 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF # 33V HEATER MAY BE SE... COMPUTED BY DJJ DATE 9/18/88

UNIT # 2 DWG. NO. 4E8E2299-6-R31.0 CHECKED BY TWB DATE 9/17/88

COMP # 3B EQUIP. REF. TURBINE BLDG CLOSED COOLING WTR. SHUTOFF VLV. TCV-14-65

MOTOR OPERATED VALVE MOTORS REV.1

PREPARED: JJM 9-1-88

CHECKED: TWB 9-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C0.39A SETTING 100%

MOTOR NAMEPLATE DATA:

STARTING TORQUE 2 ft# RPM 1725 DUTY 15 min.S.F. -

H.P. .133 (1) VOLTS 440 FLC .7 LRA 2.6 (1) PHASE 3 INS. CLASS B (1)

NEC CODE LETTER - TEMP RISE 75 deg C.

(1) SEE 54.00.2

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1-SH. 8

TIME .VS. CURRENT CURVE: REF # 1. SH. 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~% -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 11 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. EP-Q2268-97324 SHEET 20.2 OF 91

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V MOTOR MCC 2C COMPUTED BY DJJ DATE 8/24/88

UNIT # 2 DWG. NO. 1582299.6 REV 2 CHECKED BY TMS DATE 8/29/88

COMP # 2B EQUIP REF. TURBINE BLG & BLG FLUID CLG WTR SUPPLY MOV #2-24-25

REV. 1 PREPARED: JPA 2-1-89

CHECKED: DJ 2-1-89

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ✓ YES ____ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

$$I\ (adjusted) = \frac{440 \times .7}{460} = .67$$

FOR THIS CALCULATION I (n) = I ADJUSTED = .67 AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (____HP x ____KVA/HP x 1000) / (1.73 x 460)

LRA = ____AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-54.5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE ~~5.1~~ 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = $2.6 / \underset{6.25}{\cancel{5.1}} = \underset{0.42}{\cancel{.51}}$

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = ~~.51~~ / 1.25 = ~~.41~~ AMPS

CATALOG HEATER SIZE CR123 G0.48A C0.39A ~~.48~~ ~~0.39~~ 0.32 ~~1~~ 3 ONE

I(m)

RELAY

B. DETERMINE ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x I* = ~~.43~~ x 1.25 x 100 %

I(t) = ~~.54~~ AMPS ~~0.37~~ 3sm 7/19/88 ~~0.48~~ 0.40 0.32

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(.67 I(n) / ~~.54~~ I(t)) x 100 = ~~124~~ % OVER 900 SECS

~~0.44~~ 0.40 ~~137~~ 168

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x .67 I(n) / ~~.54~~ I(t)) x 100 = ~~248~~ % ~~41.60~~ SECS

~~0.44~~ 0.40 ~~275~~ 33 - ~~50~~ 46

LOCKED ROTOR AMPS TO HEATER CURRENT BASE: 335

(2.6 MTR LRA/ ~~.54~~ I(t)) x 100 = ~~481~~ % ~~10.16.5~~ SECS

~~0.44~~ 0.40 ~~530~~ 650 ~~9.5~~ - 14.0 9.7

0050P

CALCULATION NO. ED-92269-878:4 SHEET 20.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 3/14/95

BOARD REF 480V MOTOR MOV SD 8C COMPUTED BY DJA 3/14/95

UNIT # 2 DWG. NO. 25B2299.6 REV 0 CHECKED BY TMB DATE 3/19/95

COMP # 8B EQUIP REF. TERRY TURBINE AUX FEED PUMP MOV FCV-25-65

REV.1 PREPARED: JPM 8 1-98

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS? CHECKED: RK 8 1-98

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = .43 x 1.25 x 95%~~
~~I(t) = .51 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~
~~(.67 I(a) / .51 I(t)) x 100 = 131 : 9.8 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x .67 I(a)/ .51 I(t)) x 100 = 262 : 37.5 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(2.5 MTR LRA/ .51 I(t)) x 100 = 510 : 9.8 - 15 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO OVREE87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER CRANE TELEDYNE DWG. NO T-12942-3 ISSUED UNDER CONTRACT # 70655-92272-1 & 47A369-24-2 REV. 0. THE FULL LOAD CURRENT SHOWN ON THE VENDOR DWG IS LESS THAN THAT GIVEN IN THE WALKDOWN DATA; THEREFORE, USE OF THE LOCKED ROTOR CURRENT FROM THE VENDOR DRAWING IN THIS CALCULATION WILL BE CONSERVATIVE.

0050P

CALCULATION NO. ED-Q2265-B7504 SHEET 20.4 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 3/16/88

BOARD REF 480V ACTOR MOV SD 26 COMPUTED BY DLA 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 93 EQUIP REF. TURBINE BLDG ENG EL. 565 CLG. WTR. SHUTOFF MOV FCV-24-65

REV. 1 PREPARED: JPM 8-1-88 CHECKED: JRK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

✓ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

✓ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

~~REPLACE HEATER - PROCEED TO SECTION 5~~ JPM 7/13/88

~~✓ NO - PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(a) x 1.25 x %* = TRIP AMPS~~

~~I(t) = .34 I(a) x 1.25 x 1.00 %*~~

~~I(t) = .43 AMPS~~

~~CR-23 60.5 DA~~

~~I(a) = .34~~

~~'B' Coil~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(.67 I(a) / .43 I(t)) x 100 = 156 % OVER .40 SECS~~ (TRIP TIME)

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .67 I(a) / .43 I(t)) x 100 = 310 % 33.55 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(2.6 MTR LRA / .43 I(t)) x 100 = 605 % 11.10 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~✓ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(a) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(a) x 1.25 x %* .34 x 1.25 x 95%~~

~~I(t) = .40 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(.67 I(a) / .40 I(t)) x 100 = 116 % OVER .40 SECS~~ (TRIP TIME)

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x .67 I(a) / .40 I(t)) x 100 = 335 % 22.47 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(2.6 MTR LRA / .40 I(t)) x 100 = 650 % 3.5-4.0 SECS~~

CALCULATION NO. ED-G2268-87324 SHEET 2.5 OF [illegible]

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480 V ACTOR MOV BD 2C COMPUTED BY DLU DATE 3/16/88

UNIT # 2 E.C.N. NO. 4582299.6 REV. 0 CHECKED BY TMK DATE 4/15/88

COMP # B13 EQUIP REF. TURBINE BUILDING FLUID COOLING WATER ISOLATION MOV FCV-22-6

REV.1 | UPDATED: JMA 7-1-88
CHECKED: TMK 7-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

JMA 7-1-88

X ~~—✓—~~ YES - ~~THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~ ~~DATE~~ JMA 7/1/88

—✓— NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~E0.48A~~ JMA 7/1/88 ~~E0.99A~~ C0.39A

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATER TO 95%~~

~~REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE~~ JMA 7/1/88 JMA 7/1/88

THE INSTALLED TOL HEATERS AND SETTING ARE ACCEPTABLE.

0050P

CALCULATION NO. ED-G2263-37324 SHEET 21.1 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V ACTOR MOV BD 2C COMPUTED BY DJU DATE 3/16/88

UNIT # 2 DWG. NO. 4583299-6 REV. 0 CHECKED BY TAR DATE 3/17/88

COMP # 8C EQUIP REF. RWCU DRAIN TO RADWASTE MOV MCV-69-17

MOTOR OPERATED VALVE MOTORS REV.1

PREPARED: JPM 8-1-88

CHECKED: RRK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.84A SETTING 100% OA
95% OL

MOTOR NAMEPLATE DATA:

STARTING TORQUE 10 ft# RPM 1700 DUTY 15 min.S.F. —

H.P. .66 (1) VOLTS 460 FLC 2.1 LRA 11.9 (1) PHASE 3 INS. CLASS B

NEC CODE LETTER — TEMP RISE 75 deg C.

(1) SEE SH.21.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1: SH.8

TIME .VS. CURRENT CURVE: REF# 1 - SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~%* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. SD-27268-37324 SHEET 21.2 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/14/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJL E 3/14/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMP 3/17/88

COMP # 2C EQUIP REF. RWCU DRAIN TO RADWASTE MOV FCV-69-17

REV 1 PREPARED: DJL 3-1-88

CHECKED: TMP 3-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x ___ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SH 5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 11.9/6.25 = 1.90

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.90/1.25 = 1.52 AMPS

CATALOG HEATER SIZE CR123 C1.54A

I(m) ~~1.56~~ 1.48

B. DETERMINE RELAY ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~1.56~~ x 1.25 x 100 %

I(t) = ~~1.95~~ 1.85 AMPS 1.48

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(2.1 I(n) / ~~1.95~~ 1.85 I(t)) x 100 = ~~108~~ 114 % OVER 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 2.1 I(n) / ~~1.95~~ 1.85 I(t)) x 100 = ~~215~~ 227 % ~~86-110~~ 78-105 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(11.9 MTR LRA/ ~~1.95~~ 1.85 I(t)) x 100 = ~~640~~ 643 % ~~10.7-15.3~~ 9.8-14.5 SECS

0050P

CALCULATION NO. ED-Q2269-STS:C — SHEET 21.3 OF 51

THERMAL OVERLOAD HEATER CALCULATION — REV. 0 — DATE 3/16/88

BOARD REF 480V REACTOR MOV 3D 2C — COMPUTED BY DJU — DATE 3/16/88

UNIT # 2 — DWG. NO. 45B2299-6 REV. 0 — CHECKED BY TAB — DATE 3/17/88

COMP # 8C — EQUIP REF. RWCU DRAIN TO CADWASTE MOV FCV-69-17

REV. 1 — PREPARED: JPM 8-1-88 — CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 1.56 x 1.25 x 90%~~
~~I(t) = 1.85 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ (TRIP TIME)
~~(2.1 I(a) / 1.85 I(t)) x 100 = 114 % TRIP 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 2.1 I(a)/ 1.85 I(t)) x 100 = 227 % 70-100 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(11.9 MTR LRA/ 1.85 I(t)) x 100 = 643 % 10 - 14.4 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE ERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER DWGS VPF# 2547-36-3 & 47A368-69-2 REV. 2

0050P

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER
IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

/ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

/ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

_____ NO - PROCEED WITH FOLLOWING

EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT
I(c) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = _____ I(m) x 1.25 x _____ %*
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

_____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5

_____ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS

I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = I(m) x 1.25 x %* = _____ x 1.25 x _____
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

CALCULATION NO. EC-3226-87324 SHEET 21.5 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJG DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TAB DATE 3/17/88

COMP # 2C EQUIP REF. RWCU DRAIN TO RADWASTE MOV FCV-69-17

REV.1 PREPARED: JJM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

JJM 7-30-88

~~✓ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

_____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 Cl. 84A

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: RESET THE INSTALLED TOL HEATERS TO ~~95%~~ 100%

0050P

CALCULATION NO. EC-0226G-07524 SHEET EC.1 OF 21

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/10/88

BOARD REF 480V MOTOR CONTROL CENTER 1AM 2D-2C COMPUTED BY DLW E 3/10/88

UNIT # 2 DWG. NO. 45B2299.6 REV. 0 CHECKED BY JMS DATE 3/17/88

COMP # AE EQUIP REF. RWCU RESTRICTING ORIFICE BY PASS MOV. FCV-69-12

MOTOR OPERATED VALVE MOTORS REV. 1

PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.63A SETTING 100% @ A
105% @ C

MOTOR NAMEPLATE DATA:

STARTING TORQUE 7.5 ft# RPM 1700 DUTY 15 min.S.F. -

H.P. .5 (1) VOLTS 460 FLC 2.1 LRA 11.9 (1) PHASE 3 INS. CLASS B

NEC CODE LETTER - TEMP RISE 75 deg C.

(1) See SH. 22.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1 - SH. 8

TIME .VS. CURRENT CURVE: REF# 1 - SH. 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~** -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER-UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. ED-92268-87SC | SHEET 2 OF 31
THERMAL OVERLOAD HEATER CALCULATION | REV. 0 | DATE 3/10/88
BOARD REF 480V REACTOR MOV BD 2C | COMPUTED BY DJL | DATE 3/14/88
UNIT 1 2 | DWG. NO. 45B2295-6 REV. 0 | CHECKED BY JRK | DATE 3/17/88
COMP # 8E | EQUIP REF. RWCU RESTRICTING ORIFICE BY PASS MOV-FCV-69-1A

REV. 1 | REVISED: JPM 8-1-88 | CHECKED: JRK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) = _____

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:
LRA = (___ HP x ____ KVA/HP x 1000) / (1.73 x 460)
LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.
RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 11.9/6.25 = 1.90

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER
HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.90/1.25 = 1.52 AMPS
CATALOG HEATER SIZE ~~CR123 C1.84A~~ 'B' ZONE
I(m) ~~1.56~~ 1.48

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~1.56~~ / 1.48 x 1.25 x 100%
I(t) = ~~1.95~~ / 1.85 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:
(2.1 I(n) / ~~1.95~~ / 1.85 I(t)) x 100 = ~~108~~ / 114 % (TRIP TIME) ~~2 TO 900~~ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2x 2.1 I(n) / ~~1.95~~ / 1.85 I(t)) x 100 = ~~215~~ / 227 % ~~60-110~~ / 78-100 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(11.9 MTR LRA/ ~~1.95~~ / 1.85 I(t)) x 100 = ~~610~~ / 643 % ~~9.7-15.8~~ / 9.8-14.5 SECS

R

0050P

CALCULATION NO. ED-Q2268-87[illegible]4 SHEET 23.3 OF 31

THERMAL OVERLOAD[illegible]\TER CALCULATION REV. 0 E 3/16/88

BOARD REF 480V ACTOR MOV [illegible] COMPUTED BY DJH E 3/16/88

UNIT 1 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP 1 A 2 EQUIP REF. RWCU RESTRICTING ORIFICE BY-PASS MOV-PCV-69-14

REV.1 PREPARED: JPM 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS? CHECKED: JRK 8-1-88

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO RING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(m) x 1.25 x %* = 1.56 x 1.25 x 95%~~
~~I(t) = 1.85 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~
~~(2.1 I(n) / 1.85 I(t)) x 100 = 114 % 27 = 2 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 2.1 I(n)/ 1.85 I(t)) x 100 = 227 % 9 - 100 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(11.9 MTR LRA/ 1.85 I(t)) x 100 = 643 % 9.9 - 14.4 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB07031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER DWGS VPF 2517.36.3 & 47A368-69.2 REV.2

0050P

CALCULATION NO. ED-02268-07324 SHEET 22.4 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/14/88

BOARD REF 480V CT32 MCV 32 2C COMPUTED BY DJL E 3/16/88

UNIT # 2 DWG. NO. M-12299-6 REV.0 CHECKED BY [illegible] DATE 3/17/88

COMP # BE EQUIP REF. RWCU RESTRICTING ORIFICE BY-PASS MOV. PCV. 69.1C

REV.1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

REPLACE HEATER - PROCEED TO SECTION 5

/ NO - ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 1.47 I(m) x 1.25 x 100 %*~~

~~I(t) = 1.84 AMPS~~

ER183 C1.63A

~~I(m) = 1.47~~

~~3 Ø 3 WIRE~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(8.1 I(n) / 1.84 I(t)) x 100 = 114 %~~ ~~(TRIP TIME)~~ ~~SEE 200~~ ~~SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 8.1 I(n) / 1.84 I(t)) x 100 = 228 %~~ ~~76-100~~ ~~SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(11.9 MTR LRA/ 1.84 I(t)) x 100 = 647 %~~ ~~9.8-14.4~~ ~~SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~/ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~_____ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

I(t) = I(m) x 1.25 x %* = TRIP AMPS

I(t) = I(m) x 1.25 x %* = _____ x 1.25 x _____

I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE:

(_____ I(n) / _____ I(t)) x 100 = _____ % _____ (TRIP TIME) SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(_____ MTR LRA/ _____ I(t)) x 100 = _____ % _____ SECS

CALCULATION NO. ED-G2268-87324 SHEET 22.5 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0 PCR 244614

BOARD REF 480V TOR MOV BD 2C COMPUTED BY DKR 244614

UNIT # 2 DWG. NO. 25B2299-6 REV. 0 CHECKED BY TMS DCN 5171QP

COMP # 8E EQUIP REF. 2WCV RESTRICTING ORIFICE BY-PASS MOV. PCV-1-3-14

REV.1 PREPARED: JPM 8-1-88

CHECKED: JPR 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

~~✓ NO — THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

SIA 7-30-88

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE C 1.84A ~~CR123 C1.63A~~

OVERLOAD HEATER SETTING 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 100%~~

REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE

CALCULATION NO. ED-Q2268-9732 4 SHEET 23.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/16/88

BOARD REF 480V MOTOR MOV BD 2C COMPUTED BY DJW E 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 98 EQUIP REF. MAIN STEAM LINE DRAIN MOV FCV-1-58

MOTOR OPERATED VALVE MOTORS REV. 1

PREPARED: JPM 3-1-88

CHECKED: TMB 3-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR105C SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.84A SETTING 100%

MOTOR NAMEPLATE DATA:

STARTING TORQUE 7.5 ft# RPM 1700 DUTY 15 min. S.F. —

H.P. 0.5 (1) VOLTS 460 FLC 2.3 LRA 10.9 (1) PHASE 3 INS. CLASS —

NEC CODE LETTER — TEMP RISE 75 deg C.

(1) SEE SH. 23.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1-SH.8

TIME .VS. CURRENT CURVE: REF # 1-SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~%* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. ED-Q2268-57324 SHEET 25.2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 4SOV ACTOR MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45R2299-6 REV. 0 CHECKED BY TMS DATE 3/17/88

COMP # 98 EQUIP REF. MAIN STEAM LINE DRAIN MOV FCV-1-57

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-54 5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 10.9/6.25 = 1.74

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT,~~ SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 1.74 / 1.25 = 1.40 AMPS

CATALOG HEATER SIZE CR123 C1.63A 'B' ZONE

I(m) ~~1.47~~ 1.31

B. DETERMINE RELAY ~~HEATER~~ TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~1.47~~ x 1.25 x 100%

I(t) = ~~1.84~~ 1.64 AMPS 1.31

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:

(2.3 I(n) / ~~1.84~~ 1.64 I(t)) x 100 = ~~125~~ 140 % (TRIP TIME) over 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 2.3 I(n) / ~~1.84~~ 1.64 I(t)) x 100 = ~~250~~ 280 % ~~42-32~~ 47-65 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(10.9 MTR LRA/ ~~1.84~~ 1.64 I(t)) x 100 = ~~578~~ 665 % ~~11.5-17~~ 9.3-13.5 SECS

R

CALCULATION NO. ED-G226B-87324 SHEET 23.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V MOTOR CTR MCC 2D COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 4583299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 9B EQUIP DEP. MAIN STEAM LINE DRAIN MOV FCV-1-57

REVISED: JDM 8-1-88

CHECKED: JRK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(m) x 1.25 x %~~ = 1.47 x 1.25 x 95% = 1.75 AMPS

~~100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)~~

~~(2.3 I(n) / 1.75 I(t)) x 100 = 131 % over 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~

~~(2x 2.3 I(n) / 1.75 I(t)) x 100 = 263 % 59.74 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(10.9 MTR LRA / 1.75 I(t)) x 100 = 623 % 10.3 - 15.2 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION PER PHILADELPHIA GEAR CORP DWG ENTITLED "LIMITORQUE MASTER CERTIFICATION I" STATION 1,2 & 3 REV. E & DWG. 47A363-1-2 REV. 3

0050P

CALCULATION NO. ED-G2268-87324 SHEET 13.4 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V MOTOR MCC ED 2C COMPUTED BY D.H.B. DATE 2/16/88

UNIT # 2 DWG. NO. 4EB2299.6 R31.0 CHECKED BY [illegible] DATE 2/17/88

COMP # 9B EQUIP REF. MAIN STEAM LINE ISOLATION MOV FCV-1-57

REVISION 1 BY [illegible] 2-1-88

REVISION 2 BY [illegible] 2-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

REPLACE HEATER - PROCEED TO SECTION 5

✓ NO - ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 1.56 I(m) x 1.25 x 100 %*~~

~~I(t) = 1.95 AMPS~~

~~(TRIP TIME)~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2.3 I(n) / 1.95 I(t)) x 100 = 1.3 % SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 2.3 I(n) / 1.95 I(t)) x 100 = 236 % 70.0 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(10.9 MTR LRA/ 1.95 I(t)) x 100 = 559 % 12.4 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

_____ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

✓ ~~NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = 1.56 x 1.25 x 90 %~~

~~I(t) = 1.76 AMPS~~

~~(TRIP TIME)~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2.3 I(n) / 1.76 I(t)) x 100 = 1.3 % SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 2.3 I(n) / 1.76 I(t)) x 100 = 261 % 70.0 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(10.9 MTR LRA/ 1.76 I(t)) x 100 = 619 % 12.4 SECS~~

CALCULATION NO. ED-02268-07324 SHEET 23.5 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V MCC MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2255-6 231.0 CHECKED BY THB DATE 3/17/88

COMP # 9B EQUIP REF. MAIN STEAM LINE DRAIN MOV FCV-1-57

REV.1 ENGR'D: [illegible] 5-1-88

CHECKED: [illegible] 5-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

~~✓ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

JJ 7-30-88

✓ NO - ~~THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE C1.63A CR123 ~~C1.84A~~

OVERLOAD HEATER SETTING ~~90%~~ 100%

COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 90%~~

REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE

0050P

CALCULATION NO. FP Q2268-87324 SHEET 24.1 OF 71

THERMAL OVERLOAD HEATER CALCULATION REV. 0 3/16/88

BOARD REF 480V REACTOR MOV 50 2C COMPUTED BY [illegible] 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 9E EQUIP REF. MAIN STEAM LINE DRAIN TO CONDENSER MOV - 1FCV-1-59

MOTOR OPERATED VALVE MOTORS

REV. 1 TRENHEM: JPM 8-1-88

CHECKED: JRK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C1.18A SETTING 100%

MOTOR NAMEPLATE DATA: (1)

STARTING TORQUE 5 ft# RPM 1800 DUTY - min.S.F. -

H.P. .33 VOLTS 440 FLC 0.9 LRA 4.57 PHASE - INS. CLASS -

NEC CODE LETTER - TEMP RISE - deg C.

(1) See SH. 24.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1 - SH. 8

TIME .VS. CURRENT CURVE: REF# 1 SH. 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~%* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. ED-Q 2268-87?24 SHEET 24.2 OF 31

THERMAL OVERLOAD [illegible]ER CALCULATION REV. 0 3/16/88

BOARD REF 480V [illegible]CTOR MOV 30, 2C COMPUTED BY DJA 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 9E EQUIP REF. MAIN STEAM LINE DRAIN TO CONDENSER MOV-

CALCULATIONS:

REV. 1 PREPARED: JPM 5-1-88 CV

CHECKED: RK 5-1-88

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED / YES ____ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

$$I\ (adjusted) = \frac{440 \times 0.9}{460} = 0.86$$

FOR THIS CALCULATION I (n) = I ADJUSTED = 0.86 AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES / NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (____ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = ____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1.SH.5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 4.87/6.25 = 0.78

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT,~~ SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 0.78/1.25 = 0.62 AMPS

CATALOG HEATER SIZE CR 123 ~~C0.71A~~ ~~0.78A~~ ~~C0.71A~~ ZONE 'B'

I(m) ~~0.68~~ ~~0.63~~ 0.57

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x % = ~~0.63~~ ~~0.71~~ 0.57 x 1.25 x 100%

I(t) = ~~0.78~~ ~~0.79~~ ~~0.73~~ 0.71 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(0.86 I(n) / ~~0.78~~ ~~0.79~~ 0.71 I(t)) x 100 = ~~110~~ ~~109~~ 121 % over 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 0.86 I(n) / ~~0.78~~ ~~0.79~~ 0.71 I(t)) x 100 = ~~220~~ ~~220+0~~ % ~~82-105~~ ~~82-105~~ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE: 242 67 - 88

(4.87 MTR LRA/ ~~0.78~~ ~~0.79~~ 0.71 I(t)) x 100 = ~~624~~ ~~616~~ 686 % ~~10.4-15.6~~ ~~10.5-15.6~~ 9.0 - 13.0 SECS

0050P

CALCULATION NO. ED-92268-87324 SHEET 24.3 OF 31
THERMAL OVERLOAD HEATER CALCULATION REV. 0
BOARD REF 480V MOTOR MOV BD 2C COMPUTED BY DLA 3/16/88
UNIT 1 2 DWG. NO. 45B22994 REV. 0 CHECKED BY TJE DATE 3/17/88
COMP 1-9E EQUIP REF. MAIN STEAM LINE DRAIN TO CONDENSER MOV-FCV-1-59

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

_____ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.

I(t) = I(m) x 1.25 x %* = _____ x 1.25 x _____
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE
(2x _____ I(n)/ _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/ _____ I(t)) x 100 = _____ % _____ SECS

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

_____ NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.

COMMENTS _____

(1) ASSUMPTION PER PHILA. GEAR CORP. DWG ENTITLED "LIMITORQUE MASTER CERTIFICATION I, STATION #1, #2, #3" REV. E (CONTRACT # 68-91062) & 47A368-1-2 REV. 3, BASED ON SERIAL NUMBER & ORDER NUMBER GIVEN IN THE WALKDOWN DATA.

0050P

CALCULATION NO. ED-Q2268-87324 SHEET 24.4 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 25B2299-6 REV. 0 CHECKED BY TJS DATE 3/17/88

COMP # 9E EQUIP REF. MAIN STEAM LINE DRAIN TO CONDENSER MOV-

REV. 1 PREPARED: JDM 8-1-88 CV-1-59

CHECKED: RK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

/ NO - REPLACE HEATER - PROCEED TO SECTION 5

~~____ NO - PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 1.04 I(m) x 1.25 x 100% %*~~

~~I(t) = 1.3 AMPS~~

~~GR 23 C 1.18A~~

~~I(m) = 1.04~~

~~ZONE B~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(0.86 I(n) / 1.3 I(t)) x 100 = 66 % OVER 300 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 0.86 I(n) / 1.3 I(t)) x 100 = 132 % OVER 300 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(4.87 MTR LRA / 1.3 I(t)) x 100 = 375 % 26-33 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~/ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = 1.04 x 1.25 x 85%~~

~~I(t) = 1.11 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(0.86 I(n) / 1.11 I(t)) x 100 = 77 % OVER 300 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 0.86 I(n) / 1.11 I(t)) x 100 = 155 % OVER 140 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(4.87 MTR LRA / 1.11 I(t)) x 100 = 439 % 19.2-28.8 SECS~~

CALCULATION NO. ED-Q2268-87324 SHEET 24.5 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V MOTOR MOV BD 2C COMPUTED BY DLU DATE 2/26/88

UNIT # 2 DWG. NO. 4532299.6 REV. 0 CHECKED BY [illegible] DATE 2/27/88

COMP # 9E EQUIP REF. MAIN STEAM LINE DRAIN TO CONDENSER MOV-FCV-1-59

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE? REV.1

PREPARED: JPM 3-1-88

CHECKED: RJC 3-1-88

___ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

_/_ ~~NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~C0.70A~~ 7.30.88 JPM ~~C0.71A~~ C0.71A R

OVERLOAD HEATER SETTING 100%

COMMENTS: REPLACE THE INSTALLED TOL HEATERS WITH THOSE SHOWN ABOVE.

0050P

CALCULATION NO. ED-Q2268-87324 SHEET 25.1 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJU DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 11A EQUIP REF. DRYWELL BLOWER 2B-5

CONTINUOUS DUTY MOTORS (REV.) PREPARED: JRM 5-1-88 CHECKED: RA 5-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR106E0 (2) SIZE 3

O/L RELAY TYPE CR124 HEATER SIZE CR123 E4F.7B SETTING 100%

MOTOR NAMEPLATE DATA:

H.P. 40 (2) VOLTS 460 (2) FLC 52 (3) PHASE 3 (2) INS. CLASS B (1) NEC CODE G (2)

DUTY CONT (1) S.F. 1.0 (1) TEMP RISE 60 (2) DEG C. AMBIENT TEMP — DEG C

(1) (2) (3) - SEE SH. 25.3

AMBIENT TEMPERATURE: (REF #8)

EQUIP. LOCATED IN PORTION OF REACTOR BLDG. WHICH IS NOT PART OF HARSH ENVIRONMENT PER DWG. 45N803-8 REV. 5 & 47W225-102 REV. 1

MOTOR AMBIENT TEMP 42 DEG C

STARTER AMBIENT TEMP ≤ 40 DEG C

MANUFACTUKER'S DATA:

O/L FACTOR (D.F.) (REF# 1-SH. 1) 0.9 TEMP CORRECTION FACTOR (TCF —)

HEATER TABLE: (REF #1 SH. 3)

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~/~~ MINIMUM

I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG √RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM~~ TRIP CURRENT

D.F. -- MOTOR DERATING FACTOR BASED ON MOTOR SERVICE FACTOR. (REF #1 SH 1)

I(n) -- MOTOR NAMEPLATE FULL LOAD CURRENT OR ADJUSTED MOTOR FULL LOAD CURRENT

~~%* — PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

%PROTECTION FROM 115% TO 130% (REF #5)

OVERLOAD HEATERS RANGE FROM 85% to 115%

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\,(\text{adjusted}) = \frac{V\,(\text{nameplate})}{V\,(\text{operating})} \times I\,(\text{nameplate})$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

0051T

CALCULATION NO. ED-Q2268-87324 SHEET 25.2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/10/88

BOARD REF 480V REACTOR MOV 50 2C COMPUTED BY DJA DATE 3/10/88

UNIT # 2 DWG. NO 4582299-6 REV 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 11A EQUIP REF. DRYWELL BLOWER 2B-5

REV. 1 PREPARED: JPM 8-1-88

CHECKED: ORK 8-1-88

2. MOTOR OVERLOAD HEATER SELECTION

(A) CALCULATION OF HEATER SIZE (REF #5)
I(n)xD.F. = (USE D.F. PER REF #1 SH 1)

52 I(n)x 0.9 D.F. = 46.8 AMPS

CATALOG HEATER SIZE CR123 ~~F56.78~~ F65.8B

I(m)= ~~47.0~~ / 50.2

(B) CALCULATION FOR OVERLOAD HEATER SETTING:
CALCULATE % PROTECTION USING HEATER SETTING OF 100%

~~47.0~~ / 50.2 I(m) x 1.25 X 100 %* / 52 I (n) = ~~119~~ / 121 %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

✓ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.

~~✓ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.~~

~~% * = [% PROTECTION x I(n)] / [I(m) x 1.25]~~

~~105 % * = % PROT. x 52 / 47.0 x 1.25, % PROT. = 119%~~

~~% * =~~

~~IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.~~

~~NO - THE OVERLOAD HEATER HAS BEEN IMPROPERLY SIZED.~~

3. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER
IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 2B?

YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 2B?

YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 4.

NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 4.

✓ NO - ~~PROCEED WITH FOLLOWING~~ REPLACE HEATER
PROCEED TO SECTION 4

CR123 ~~F47.7B~~ F48.9

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x % * = TRIP AMPS~~

~~I(t) = 47.9 I(m) x 1.25 x 100 %* = 59.85 AMPS~~

0051T

CALCULATION NO. ED-Q2268-87324 SHEET 25.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJA DATE 3/16/88

UNIT # 2 DWG. NO 45B2299-6 REV. 0 CHECKED BY THE DATE 3/17/88

COMP # 11A EQUIP REF. DRYWELL BLOWER 2B-S

REV.1 REVISED: JPM 8-1-88
CHECKED: ORK 8-1-88

EVALUATION OF INSTALLED OVERLOAD HEATER PROTECTION.

% PROTECTION = I(t) / I(n) x 100

~~53.63~~ I(t) / 52 I(n) x 100 = 103 %

~~DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?~~

~~____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE.~~

~~✓ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.~~

~~%* = [% PROTECTION x I (n)] / [I(m) x 1.25]~~

~~115 %* = 103% PROT x 52 / 42.9 x 1.25 ; % PROT. = 119%~~

~~%* =~~

~~IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

~~✓ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 2B.~~

4. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 ~~F46.75~~ F65.88

OVERLOAD HEATER SETTING ~~115%~~ 100%

5. COMMENTS: ~~RESET THE INSTALLED TOL HEATERS TO 115%~~, REPLACE THE INSTALLED TOL HEATERS AS SHOWN ABOVE

(1) ASSUMPTION PER SECT. 4.3

(2) ASSUMPTION BASED ON COMPARISON TO SIMILAR EQUIP. CONNECTED TO COMPT. 1A

(3) ASSUMPTION PER NEC ARTICLE 430 TABLE 430.150

(4) MCC WALKDOWN DATA INDICATES AN INVALID MODEL NR. ASSUMPTION - MODEL NR IS SAME AS COMPT. 1A WHICH HAS SIMILAR EQUIP. CONNECTED TO IT.

0051T

CALCULATION NO. ED-Q226B-57304 SHEET 26.2 OF 51

THERMAL OVERLOAD WATER CALCULATION REV. 0 TE 3/16/88

BOARD REF 480V ACTOR MOV BD 2C COMPUTED BY DLA TE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REL.0 CHECKED BY TMS DATE 3/17/88

COMP # 11C EQUIP REF. CRD WATER TRANSFER M-V-2-EC1-B5-2B

REV.1 PREPARED: JDM 8-1-88

CHECKED: RK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) = ____

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ___/___ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SH.5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 5.1/6.25 = .82

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = .82/1.25 = .66 AMPS

CATALOG HEATER SIZE CR123 C0.78A

I(m) ~~.69~~ 0.63 'B' ZONE

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

$I(t) = I(m) \times 1.25 \times \%^* = \frac{0.63}{\cancel{0.69}} \times 1.25 \times 100\%$

I(t) = ~~.86~~ 0.79 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:

(.95 I(n) / ~~.86~~ 0.79 I(t)) x 100 = ~~110~~ 120 % (TRIP TIME) ~~OVER 900~~ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x .95 I(n) / ~~.86~~ 0.79 I(t)) x 100 = ~~220~~ 241 % ~~90-105~~ 67-78 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(5.1 MTR LRA/ ~~.69~~ 0.79 I(t)) x 100 = ~~593~~ 646 % ~~11.3-16.5~~ 9.8-14.5 SECS

R1

CALCULATION NO. EC-Q2268-87324 SHEET 24.3 OF 24

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DLC DATE 3/16/88

UNIT # 2 DWG. NO. 45B2292-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 11C EQUIP. REP. WATER TRANSFER MOV-2-FCV-67-8B

REV. 1 DESIGNED BY DLC 3-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS? CHECKED BY [illegible] 3-1-88

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(m) x 1.25 x % = 0.69 x 1.25 x 95 %~~
~~I(t) = .82 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE: TRIP TIMES~~
~~(.95 I(m) / .82 I(t)) x 100 = [illegible] % [illegible] SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~
~~(2x .95 I(m)/ .82 I(t)) x 100 = [illegible] % [illegible] SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(5.1 MTR LRA/ .82 I(t)) x 100 = [illegible] % [illegible] SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION BASED ON COMPARISON OF ELEC. CHARACTERISTICS OF FCV-67-21 CONTT. 4C, AND DWG. 15-477-3292-3

0030P

CALCULATION NO. ED-2268-87324 SHEET 5.4 OF 31
THERMAL OVERLOAD WATER CALCULATION REV. 0 DATE 3/16/88
BOARD REF 480V REACTOR MOV B1D 2C COMPUTED BY DKA DATE 3/16/88
UNIT # 2 DWG. NO. 45B2295-6 REV. 0 CHECKED BY MB DATE 3/17/88
COMP # 11C EQUIP REF. WATER TRANSFER MOV-3, FCV-85-53
REV.1 PREPARED: JPM 8-1-88
CHECKED: DRK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

✓ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

~~✓ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.~~

✓ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

R1

____ NO - PROCEED WITH FOLLOWING

EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT

I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = _____ I(m) x 1.25 x _____ %*
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

_____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5

_____ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS

I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = I(m) x 1.25 x %* = _____ x 1.25 x _____
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

CALCULATION NO. ED-G2268-87324 SHEET 20.5 OF 51

THERMAL OVERLOAD TER CALCULATION REV. 2 E 3/16/88

BOARD REF 480V FACTOR MOV 80 2C COMPUTED BY D.L.L E 3/16/88

UNIT # 2 DWG. NO. 4SB2299-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # 11C EQUIP REF. WATER TRANSFER MOV-3-FCV-63-88

REV. 1 DESIGNED: JPM 8-1-88

CHECKED: JRK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

JM 7-30-88

~~✓ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.~~

_____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 C0.78A

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: ~~THE INSTALLED TOL HEATERS & SETTINGS ARE ACCEPTABLE.~~

RESET THE INSTALLED TOL HEATERS TO 100%

CALCULATION NO. ED-Q2268-37??? SHEET 27.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V ... COMPUTED BY DJU DATE 3/16/88

UNIT # 2 DWG. NO. 45B... CHECKED BY FHB DATE 3/17/88

COMP # R6A EQUIP REF. ... EQUALIZER MOV FCV-63-...

MOTOR OPERATED VALVE MOTORS

REV. 1 | PREPARED: JDM 8-1-88
CHECKED: VRK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL ... SIZE 1
O/L RELAY TYPE CR124 HEATER SIZE CR123 C...B SETTING 100%

MOTOR NAMEPLATE DATA:

STARTING TORQUE 60 ft# RPM 3500 DUTY 15 min.S.F. —
H.P. 8 VOLTS 460 FLC 11.2 LRA ... (1) PHASE 3 (1) INS. CLASS H
NEC CODE LETTER — TEMP RISE 115 deg C.

(1) SEE SH 27.3

MANUFACTURER'S DATA:
HEATER TABLE: REF # 1-SH.8
TIME .VS. CURRENT CURVE: REF# 1-SH.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT — MINIMUM
I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP
1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM~~ TRIP CURRENT
I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT
~~%* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: ≥ 2 MINUTES AND ≤ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: ≥ 10 SECONDS AND ≤ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

CALCULATION NO. ED-G2268-87324 SHEET 27.2 OF 41

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJL DATE 3/10/88

UNIT # 2 DWG NO. 4582299-6 REV. 0 CHECKED BY JAMS DATE 3/10/88

COMP # RGA EQUIP REF. RECIRC. HEADER EQUALIZING MOV 2-641-33

REV. 1 UPDATED: JAM 5-1-88

CHECKED: ER 5-4-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ___/___ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x _____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF Sht 5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 91.6/6.25 = 14.7

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 14.7/1.25 = 11.8 AMPS

CATALOG HEATER SIZE CR123C13.78

I(n) ~~12.0~~ 11.0

ZONE B

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(n) x 1.25 x %* = ~~12.0~~ / 11.0 x 1.25 x 100 %

I(t) = ~~15.0~~ 13.8 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:

(11.2 I(n) / ~~15.0~~ 13.8 I(t)) x 100 = ~~75~~ 81 % (TRIP TIME) over 300 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 11.2 I(n) / ~~15.0~~ 13.8 I(t)) x 100 = ~~149~~ 162 % over ~~120~~ 120 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(91.6 MTR LRA / ~~15.0~~ 13.8 I(t)) x 100 = ~~611~~ 664 % ~~10.7 - 12.5~~ 9.4 - 13.5 SECS

R

0050P

CALCULATION NO. ED-02262-37314 SHEET 27.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0

BOARD REF 480V [illegible] MOV 80 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299.6 REV. 0 CHECKED BY THB DATE 3/17/88

COMP # R6A EQUIP REF. RECIRC HEADER EQUALIZER MOV FCV-68-33

REV. 1 CLEARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 12.9 x 1.25 x 95%~~
~~I(t) = 14.25 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(11.2 I(a) / 14.25 I(t)) x 100 = 79 % OVER 300 SECS~~ R1

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 11.2 I(a)/ 14.25 I(t)) x 100 = 157 % OVER 40 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(91.6 MTR LRA/ 14.25 I(t)) x 100 = 643 % 9.9 - 14.5 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIRBEP87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION BASED ON DATA FOR 60 FT, 3600 RPM MOTOR ON DWG. VPF-24K6-20-3

0050P

CALCULATION NO. ED-22269-87524 SHEET 27.4 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY D.L. DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY [illegible] DATE 3/17/88

COMP # 26A EQUIP REF. RECIRC. HEADER EQUALIZER MOV FCV-68-33

REV 1 PREPARED: JPM 8-1-88

CHECKED: ORK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

/ NO - REPLACE HEATER - PROCEED TO SECTION 5 ~~PROCEED WITH FOLLOWING~~ ~~GROUP C: 5.0B~~ ~~I(m) = 5.8~~ ~~B Zone~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 5.8 I(m) x 1.25 x 100 %*~~

~~I(t) = 9.75 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(11.2 I(n) / 9.75 I(t)) x 100 = 57 % over 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 11.2 I(n) / 9.75 I(t)) x 100 = 113 % over 900 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(91.6 MTR LRA/ 9.75 I(t)) x 100 = 464 % 17.5 - 21 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

_____ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~✓~~ ~~NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = 6.9 x 1.25 x 85%~~

~~I(t) = 12.79 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(11.2 I(n) / 12.79 I(t)) x 100 = 87 % over 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 11.2 I(n) / 12.79 I(t)) x 100 = 133 % over 900 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(91.6 MTR LRA/ 12.79 I(t)) x 100 = 546 % 13.5 10.5 SECS~~

REV. 1
CHECKED: JPM 8-1-88
CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

~~____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123C13.7B

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: REPLACE THE INSTALLED TOL HEATERS WITH THOSE SHOWN ABOVE

CALCULATION NO. EQ-Q2[illegible]B-3731C SHEET 28.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/16/88

BOARD REF # 30[illegible] FACTOR MOV BD 2C COMPUTED BY DJW E 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY JMB DATE 3/17/88

COMP # 26E EQUIP REF. RECIRC PUMP 2B SUCTION MOV FCV 68-77

MOTOR OPERATED VALVE MOTORS REV. 1

PREPARED: JPM 8-1-88

CHECKED: JRK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR1080 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123 C14.0B SETTING 85% 100%.

MOTOR NAMEPLATE DATA:

STARTING TORQUE 60 (1) ft# RPM 3500 DUTY 15 min.S.F. —

H.P. 3 VOLTS 460 FLC 11.2 LRA 91.6 (2) PHASE 3 INS. CLASS H

NEC CODE LETTER — TEMP RISE 115 deg C.

(1) SEE SH. 28.3

(2) SEE SH. 28.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1. SH. 8

TIME .VS. CURRENT CURVE: REF# 1. SH. 5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~MAXIMUM~~ MINIMUM

I (m) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM~~ TRIP CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~%* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. ED-G2268-87324 SHEET 25.2 OF

THERMAL OVERLOAD TER CALCULATION REV. 0

BOARD REF 480V MTR MOV 3D 2C COMPUTED BY DJH

UNIT 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY

COMP RGE EQUIP REF. RECIRC. PUMP 2B SUCTION MOV FCV-23-77

REV. 1 RETYPED: JM 5-1-88

CHECKED: JR 5-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ___/___ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:

LRA = (___ HP x ____ KVA/HP x 1000) / (1.73 x 460)

LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-SM-5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.

RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 91.6/6.25 = 14.7

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER

HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 14.7/1.25 = 11.8 AMPS

CATALOG HEATER SIZE CR123 C13.7B

I(m) ~~+8.0~~ 11.0 ZONE 3

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x %* = ~~+8.0~~ / 11.0 x 1.25 x 100%

I(t) = ~~+5.0~~ 13.8 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)

(11.8 I(n) / ~~+5.0~~ 13.8 I(t)) x 100 = ~~75~~ 81 % OVER ~~900~~ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:

(2x 11.8 I(n) / ~~+5.0~~ 13.8 I(t)) x 100 = ~~+9~~ 162 % OVER ~~+6~~ 12c SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:

(91.6 MTR LRA/ ~~+5.0~~ 13.8 I(t)) x 100 = ~~+11~~ 664 % ~~+0.7 +5.4~~ 9.4 - 13.5 SECS

R1

0050P

CALCULATION NO. ED-Q2263-57324 SHEET 23.3 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/16/88

BOARD REF 480V REACTOR MOV FCV 2C COMPUTED BY DJA E 3/16/88

UNIT # 2 DWG. NO. 4SB2299-6 REV. 0 CHECKED BY TMS DATE 3/17/88

COMP # RGE EQUIP REF. RECIRC. PUMP 2B SUCTION MOV FCV-68-77

REV. 1 REVIEWED: JPM 8-1-88

CHECKED: RK 8-1-88

A. ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 12.0 x 1.25 x 95%~~
~~I(t) = 14.25 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(11.2 I(a) / 14.25 I(t)) x 100 = 78.6 % SIZE 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 11.2 I(a)/ 14.25 I(t)) x 100 = 157 % OVER 140 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(91.6 MTR LRA/ 14.25 I(t)) x 100 = 643 % 6.3 - 16.5 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION BASED ON COMPARISON OF ELEC. CHARACTERISTICS TO FCV-68-33 (COMPT. R16A)

(2) ASSUMPTION BASED ON DATA FOR 60 FT., 3600 RPM MOTOR ON DWG VPF-2486-20-3

R

0050P

CALCULATION NO. 23-G-2268-87324 SHEET 23.4 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480 REACTOR MOV 3D 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # R6E EQUIP REF. RECIRC PUMP 2B SUCTION MOV HCV-68A-77

REV. 1 | RETYPED: JPM 8-1-88 | CHECKED: JRK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

REPLACE HEATER · PROCEED TO SECTION 5

✓ NO - ~~PROCEED WITH FOLLOWING~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x T* = TRIP AMPS~~

~~I(t) = 15.8 I(m) x 1.25 x 100 T*~~

~~I(t) = 19.75 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(11.2 I(a) / 19.75 I(t)) x 100 = 57 : 0100 300 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 11.2 I(a) / 19.75 I(t)) x 100 = 113 : 0100 300 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(91.6 MTR LRA/ 19.75 I(t)) x 100 = 464 : 17.5 - 36 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

____ ~~YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

✓ ~~NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x T* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x T* = 15.8 x 1.25 x 85%~~

~~I(t) = 16.79 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~

~~(11.2 I(a) / 16.79 I(t)) x 100 = 67 : 0100 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 11.2 I(a) / 16.79 I(t)) x 100 = 133 : 0100 900 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(91.6 MTR LRA/ 16.79 I(t)) x 100 = 546 : 12.5 - 19.5 SECS~~

CALCULATION NO. ED-C2263-57544 SHEET 5.3 OF 8

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 48 FACTOR MOV FSD 2C COMPUTED BY DLH DATE 3/16/88

UNIT # 2 E.G. NO. 45B2299-1 REV. 0 CHECKED BY TMB DATE 3/17/88

COMP # R6E EQUIP REF. RECIRC. PUMP 2B SUCTION MOV FCV-68-77

REVIEWED: JIM 8-1-88

CHECKED: JRK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

_/_ ~~NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~ R

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123C13.7B

OVERLOAD HEATER SETTING ~~95%~~ 100% R

COMMENTS: REPLACE THE INSTALLED TOL HEATERS WITH THOSE SHOWN ABOVE.

0050P

CALCULATION NO. ED-Q1233-3726 SHEET 29.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF # [illegible] FACTOR MAN 50 EC COMPUTED BY DLA DATE 3/16/88

UNIT # 2 DWG. NO. 4582299-6 REV. 0 CHECKED BY RJB DATE 3/17/88

COMP # RBB EQUIP REF. RECIRC. PUMP 2A SUCTION VALVE EQUIP. 62.1

MOTOR OPERATED VALVE MOTORS

REV. 1 RECALCULATED: DLA 3-1-88

CHECKED: DRR 3-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR105 ED SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123C13.78 (3) SETTING 100% (3)

MOTOR NAMEPLATE DATA:

STARTING TORQUE 60 (1) ft# RPM 3500 DUTY 15 min. S.F. —

H.P. 8 VOLTS 460 FLC 11.2 LRA 91.6 (2) PHASE 3 INS. CLASS —

NEC CODE LETTER — TEMP RISE 115 deg C.

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1 - SH. 8

TIME .VS. CURRENT CURVE: REF# 1 - SH. 5

(1) SEE SH. 29.3

(2) SEE SH. 29.3

(3) SEE SH. 29.3

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG RELAY TRIP

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM TRIP~~ CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~% -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 3 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREEB87031 FOR INSTRUCTIONS.

0050P

CALCULATION NO. ED-Q2263-E7326 SHEET 29.2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 E 3/16/88

BOARD REF 480 V REACTOR MOV 1SD 2C COMPUTED BY DJL E 3/16/88

UNIT # 2 DWG. NO. 2E-22299-6 REV. 0 CHECKED BY JMS DATE 3/17/88

COMP # R3B EQUIP REF. ELECTRIC PUMP 2A SUCTION VALVE FCV-68-1

REV. 1 | REVIEWED: JLM 5-1-88
CHECKED: RK 5-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ✓ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:
LRA = (____ HP x ____ KVA/HP x 1000) / (1.73 x 460)
LRA = _____ AMPS

3. SELECTION MOTOR OVERLOAD HEATER

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1-5W-5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.
RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 91.6/6.25 = 14.7

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT~~, SELECT OVERLOAD HEATER
HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 14.7/1.25 = 11.8 AMPS
CATALOG HEATER SIZE CR123C13.7B
I(n) ~~10.0~~ 11.0 ZONE 8

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(n) x 1.25 x %* = ~~10.0~~ / 11.0 x 1.25 x 100%
I(t) = ~~15.0~~ 13.8 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE:
(11.2 I(n) / ~~15.0~~ 13.8 I(t)) x 100 = ~~75~~ 81 % (TRIP TIME) OVER 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2x 11.2 I(n) / ~~15.0~~ 13.8 I(t)) x 100 = ~~149~~ 162 % OVER ~~120~~ 120 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(91.6 MTR LRA / ~~15.0~~ 13.8 I(t)) x 100 = ~~611~~ 664 % ~~10.7-15.8~~ 9.4-13.5 SECS

R1

CALCULATION NO. ~~EDG2268-87524~~ SHEET 29.3 OF 31

THERMAL OVERLOAD ~~HEATER CALCULATION~~ REV. 0 E 3/16/88

BOARD REF 4~~50~~ ~~EALTER MOV 150 2C~~ COMPUTED BY DJL E 3/16/88

UNIT # 2 DWG. NO. 4583299-6 REV. 0 CHECKED BY MJB DATE 3/17/88

COMP # R33 EQUIP REF. RECIRC PUMP 2A SUCTION VALVE FCV-68-1

REV. 1 DERIVED: JPM 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS? CHECKED: RK 8-1-88

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 12.0 x 1.25 x 95%~~
~~I(t) = 14.25 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(11.2 I(a) / 14.25 I(t)) x 100 = 78.6 % OVER 200 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 11.2 I(a)/ 14.25 I(t)) x 100 = 157 % OVER 140 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(91.6 MTR LRA/ 14.25 I(t)) x 100 = 643 % 9.5 - 14.5 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIREEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION BASED ON COMPARISON OF ELEC CHARECTERISTICS TO FCV-68-33 COMPT. R6A

(2) ASSUMPTION BASED ON DATA FOR 60 FT#, 3600 RPM MOTOR ON DWG VPF-2486-20-3

(3) DESIGNED TO L HEATER SIZE USED DUE TO LACK OF MCC WALKDOWN DATA.

R1

REW | ACCEPTED: JPM 8-1-88
CHECKED: JRK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

JPM 7/12/88
✓ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

JPM 7/12/88
✓ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

REPLACE HEATERS
✓ NO - ~~PROCEED WITH FOLLOWING~~ (3) SEE SH. 29.3
PROCEED TO SECTION 5

R1

R1

EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT

I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = _____ I(m) x 1.25 x _____ %*
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

_____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5

_____ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS

I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = I(m) x 1.25 x %* = _____ x 1.25 x _____
I(t) = _____ AMPS

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(_____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2 x _____ I(n) / _____ I(t)) x 100 = _____ % _____ SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(_____ MTR LRA/_____ I(t)) x 100 = _____ % _____ SECS

CALCULATION NO. ED-G226 B-97324 SHEET - 7.5 OF 51

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480 [redacted] REACTOR MOV 3D 2C COMPUTED BY DLA DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TAB DATE 3/17/88

COMP # RBB EQUIP REF. RECIRC. PUMP 2A SUCTION VALVE FCV-68-1

REV.1 PREPARED: JPM 8-1-88
CHECKED: JRK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

JPM 8-1-88

____ ~~NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE C2123 C13.7B

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: REPLACE THE INSTALLED TOL HEATERS & SETTINGS WITH THE DESIGNED HEATERS & SETTING SHOWN ABOVE.

R

CALCULATION NO. ED-G2268-87324 SHEET 30.1 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480V ACTOR MOV BD 2C COMPUTED BY DJA DATE 3/16/88

UNIT # 2 DWG. NO. 4E32299-6 REV.0 CHECKED BY TMB DATE 3/17/88

COMP # 23E EQUIP REF. RECIRC. HEADER EQUALIZER VALVE FCV-68-35

MOTOR OPERATED VALVE MOTORS REV.1

PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR109C0 SIZE 1

O/L RELAY TYPE CR124 HEATER SIZE CR123.C18.08 SETTING 100%

MOTOR NAMEPLATE DATA:

STARTING TORQUE 60. ft# RPM 3500. DUTY 15. min.S.F. -

H.P. 8. VOLTS 460. FLC 11.2 LRA 91.6 (1) PHASE 3 (1) INS. CLASS 14.

NEC CODE LETTER — TEMP RISE 115. deg C.

(1) see s4.30.3

MANUFACTURER'S DATA:

HEATER TABLE: REF # 1-S4.8

TIME .VS. CURRENT CURVE: REF# 1-S4.5

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT

I (m) -- ~~MAXIMUM FULL LOAD~~ MINIMUM CURRENT CORRESPONDING TO THE HEATER CATALOG # RELAY

1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM~~ TRIP CURRENT

I (n) -- MOTOR NAMEPLATE FULL LOAD CURRENT

~~%* -- PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

ACCEPTANCE LIMITS:

OVERLOAD HEATER SETTING RANGE FROM 85% to 115%

OVERLOAD HEATERS SHALL BE SELECTED TO TRIP AS FOLLOWS:

MOTOR NAMEPLATE FULL-LOAD CURRENT TIMES SERVICE FACTOR: NOT LESS THAN THE MOTOR DUTY RATING (15 MINUTE TYPICAL) EXCEPT AS NOTED BELOW.

200% OF MOTOR NAMEPLATE FULL-LOAD CURRENT: $\geq$ 2 MINUTES AND $\leq$ 8 MINUTES

MOTOR NAMEPLATE LOCKED ROTOR CURRENT: $\geq$ 10 SECONDS AND $\leq$ 15 SECONDS WITH 15 SECONDS BEING PREFERABLE.

NOTE: IF THE ABOVE SELECTION CRITERIA CANNOT BE SATISFIED FOR A UNIQUE APPLICATION, REFER TO QIREFB87031 FOR INSTRUCTIONS.

CALCULATION NO. E7-9[illegible]-873[illegible] SHEET 50.2 OF 81

THERMAL OVERLOAD HEATER CALCULATION REV. 0 TE 3/16/88

BOARD REF 450 FACTOR MOT BD 2C COMPUTED BY DJA TE 3/16/88

UNIT # 2 DWG. NO. 4582299-6 REV. 0 CHECKED BY TMS DATE 3/17/88

COMP # R3E EQUIP REF. CIRC. HEADER EQUALIZER VALVE FCV-68-35

REV. 1 | COMPUTED: JPM 8-1-88
CHECKED: RK 8-1-88

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ___/___ NO

IF YES;

$$I\ (adjusted) = \frac{V\ (nameplate)}{V\ (operating)} \times I\ (nameplate)$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

2. LOCKED ROTOR CURRENT CALCULATION REQUIRED ____ YES ___/___ NO

IF YES;

CALCULATION FOR LRA USING CODE LETTER:
LRA = (___HP x ____KVA/HP x 1000) / (1.73 x 460)
LRA = _____AMPS

3. SELECTION MOTOR OVERLOAD HEATER.

A. USING THE OVERLOAD RELAY TIME-CURRENT CURVE (REF 1.5M.5) LOCATE THE 15 SECOND POINT AND DETERMINE THE CURRENT RATING MULTIPLE.
RECORD VALUE 6.25

TRIP CURRENT = (LRA) / (MULTIPLE OF CURRENT RATING)

TRIP CURRENT = 91.6/6.25 = 14.7

USING THE ABOVE TRIP CURRENT ~~AS THE MAXIMUM CURRENT,~~ SELECT OVERLOAD HEATER
HEATER SELECTION CURRENT = TRIP CURRENT/1.25 = 14.7/1.25 = 11.8 AMPS
CATALOG HEATER SIZE CR123 C13.7B
I(m) ~~12.0~~ 11.0

B. DETERMINE ~~HEATER~~ RELAY TRIP CURRENT WITH PERCENT SETTING AT 100%

I(t) = I(m) x 1.25 x ~~%~~ = ~~12.0~~ / 11.0 x 1.25 x 100%
I(t) = ~~15.0~~ / 13.8 AMPS

C. DETERMINE TRIP TIMES FOR:

100% MOTOR FLC TO HEATER CURRENT BASE: (TRIP TIME)
(11.2 I(n) / ~~15.0~~ / 13.8 I(t)) x 100 = ~~75~~ / 81 % OVER 900 SECS

200% MOTOR FLC TO HEATER CURRENT BASE:
(2x 11.2 I(n) / ~~15.0~~ / 13.8 I(t)) x 100 = ~~149~~ / 162 % OVER ~~110~~ 120 SECS

LOCKED ROTOR AMPS TO HEATER CURRENT BASE:
(91.6 MTR LRA / ~~15.0~~ / 13.8 I(t)) x 100 = ~~611~~ / 664 % ~~10.7-15.9~~ / 9.4 - 13.5 SECS

R1

CALCULATION NO. ED-G2269-87324 SHEET No. 3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480 ACTOR MOV BD 2C COMPUTED BY DJL DATE 3/16/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 9 CHECKED BY THS DATE 3/17/88

COMP # 23E EQUIP REF. RECIRC HEADER EQUALIZER VALVE FCV-68-35

REV.1 PLOTTED: JLM 8-1-88

CHECKED: JRK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?

✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.

~~✓ NO DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS.~~

~~I(t) = I(a) x 1.25 x % = 12.0 x 1.25 x 95%~~
~~I(t) = 14.25 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~ ~~(TRIP TIME)~~
~~(11.2 I(a) / 14.25 I(t)) x 100 = 78.6 % over 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE~~
~~(2x 11.2 I(a)/ 14.25 I(t)) x 100 = 157 % 540 to 140 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~
~~(91.6 MTR LRA/ 14.25 I(t)) x 100 = 643 % 9.8 to 14.5 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?~~

~~✓ YES THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 4.~~

~~NO REFER TO QIRBEB87031 FOR INSTRUCTIONS CONCERNING ACCEPTANCE CRITERIA.~~

COMMENTS (1) ASSUMPTION BASED ON DATA FOR 60 FT-#, 3600 RPM MOTOR ON DWG VPF-2486-20-3

CALCULATION NO. ED-Q2268-87324 SHEET 30.4 OF 31

THERMAL OVERLOA[illegible]ATER CALCULATION REV. 0 [illegible]TE 3/16/88

BOARD REF 480 [illegible]EACTOR MOV BD 2C COMPUTED BY DJL [illegible].E 3/16/88

UNIT 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY TAB DATE 3/17/88

COMP # RBE EQUIP REF. RECIRC HEADER EQUALIZER VALVE FCV-68-35

REV. 1 | CALCULATED: JPM 8-1-88

CHECKED: JRK 8-1-88

4. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER

IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 3?

____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 3?

~~__YES~~ - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 5.

____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 5.

/ NO - REPLACE HEATER - PROCEED TO SECTION 5 ~~PROCEED WITH FOLLOWING~~ ~~E=8.23 E=8.00 I(m)=15.8 Close~~

~~EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = 15.8 I(m) x 1.25 x 100 %*~~

~~I(t) = 19.75 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(11.2 I(m) / 19.75 I(t)) x 100 = 57 % (TRIP TIME) over 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 11.2 I(m) / 19.75 I(t)) x 100 = 113 % over 900 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(91.6 MTR LRA / 19.75 I(t)) x 100 = 464 % 17.5-26 SECS~~

~~ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS?~~

~~____ YES - THE OVERLOAD HEATER SIZE AND TRIP SETTING HAVE BEEN PROPERLY SELECTED PROCEED TO SECTION 5~~

~~/ NO - DETERMINE IF PERCENT SETTING CAN BE ADJUSTED TO BRING THE TRIP TIMES WITH THE ACCEPTANCE LIMITS~~

~~I(t) = I(m) x 1.25 x %* = TRIP AMPS~~

~~I(t) = I(m) x 1.25 x %* = 15.8 x 1.25 x 85%~~

~~I(t) = 16.79 AMPS~~

~~100% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(11.2 I(m) / 16.79 I(t)) x 100 = 67 % (TRIP TIME) over 900 SECS~~

~~200% MOTOR FLC TO HEATER CURRENT BASE:~~

~~(2 x 11.2 I(m) / 16.79 I(t)) x 100 = 133 % over 900 SECS~~

~~LOCKED ROTOR AMPS TO HEATER CURRENT BASE:~~

~~(91.6 MTR LRA / 16.79 I(t)) x 100 = 546 % 13.5-19.5 SECS~~

CALCULATION NO. ED-G2263-87324 SHEET 30.5 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 3/16/88

BOARD REF 480 [redacted] MOV 80 2C COMPUTED BY DLA DATE 3/16/88

UNIT # 2 DWG. NO. 4583229-6 REV. 0 CHECKED BY MB DATE 3/17/88

COMP # RSE EQUIP REF. RECIRC. HEADER EQUALIZER VALVE FCV-68-35

REV. 1 | PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

ARE ALL TRIP TIMES WITHIN THE ACCEPTANCE LIMITS AND IS PERCENT SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

JJF 8/1/88

__✓__ ~~NO — THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 3.~~

5. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123C13.7B

OVERLOAD HEATER SETTING ~~95%~~ 100%

COMMENTS: REPLACE THE INSTALLED TOL HEATERS WITH THOSE SHOWN ABOVE

0050P

CALCULATION NO. ED-G2268-87324 SHEET 31.1 OF 31
THERMAL OVERLOAD HEATER CALCULATION REV. 0 DATE 8/16/88
BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJL DATE 8/16/88
UNIT # 2 DWG. NO. 45B2295-6 R1.0 CHECKED BY TMS DATE 8/17/88
COMP # R11A EQUIP REF. PSC WATER HEAD TANK PUMP 2A.
REV.1 CONTINUOUS DUTY MOTORS
REVIEWED: JPM 8-1-88
CHECKED: RK 8-1-88

WALKDOWN INPUT DATA: (REF # 3)

MOTOR CONTROL CENTER DATA:

STARTER MFGR. GE MODEL CR106C0 SIZE 1 (1)
O/L RELAY TYPE CR124 HEATER SIZE CR123C7.78A (2) SETTING 100% (2)

MOTOR NAMEPLATE DATA:

H.P. 5 · VOLTS 460 · FLC 6.9 · PHASE 3 · INS. CLASS B · NEC CODE J ·
DUTY CONT · S.F. 1.15 · TEMP RISE — DEG C. AMBIENT TEMP 65 · DEC C

(1) SEE SH. 31.3
(2) SEE SH. 31.3

AMBIENT TEMPERATURE: (REF #8)

MOTOR AMBIENT TEMP ≤ 40 DEG C
STARTER AMBIENT TEMP ≤ 40 DEG C

EQUIP. LOCATED IN PORTION OF REACTOR BLDG. WHICH IS NOT PART OF HARSH ENVIRONMENT PER DWGS 45N2750-21 REV. 5 & 47W225-103 REV. 1

MANUFACTURER'S DATA:
O/L FACTOR (D.F.) (REF# 1 · SH. 1) 1 TEMP CORRECTION FACTOR (TCF —)
HEATER TABLE: (REF #1 SH. 5)

DEFINITIONS

I (t) -- ~~HEATER~~ RELAY TRIP CURRENT ~~-~~ MINIMUM
I (n) -- ~~MAXIMUM FULL LOAD~~ CURRENT CORRESPONDING TO THE HEATER CATALOG # ~~RELAY~~
1.25 -- GENERAL ELECTRIC'S MULTIPLYING FACTOR FOR ESTABLISHING ~~MAXIMUM~~ TRIP CURRENT
D.F. -- MOTOR DERATING FACTOR BASED ON MOTOR SERVICE FACTOR. (REF #1 SH 1)
~~I(n) -- MOTOR NAMEPLATE FULL LOAD CURRENT OR ADJUSTED MOTOR FULL LOAD CURRENT~~
~~%~~ -- ~~PERCENT SETTING OF THE OVERLOAD HEATER, EXPRESSED IN PER UNIT (P.U.)~~

DO NOT DELETE

ACCEPTANCE LIMITS:

%PROTECTION FROM 125 % TO 140 % (REF #5)
OVERLOAD HEATERS RANGE FROM 85% to 115%

CALCULATIONS:

1. MOTOR FULL LOAD CURRENT ADJUSTMENT REQUIRED ____ YES ✓ NO
IF YES;

$$I\,(\text{adjusted}) = \frac{V\,(\text{nameplate})}{V\,(\text{operating})} \times I\,(\text{nameplate})$$

I (adjusted) =

FOR THIS CALCULATION I (n) = I ADJUSTED = _____ AMPS

0051T

CALCULATION NO. ED-G226B-37324 SHEET 31.2 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/14/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DJA DATE 3/14/88

UNIT # 2 DWG. NO. 45B2299-6 REV. 0 CHECKED BY THB DATE 3/17/88

COMP # R11A EQUIP REF. PSC WATER HEAD TANK PUMP 2A

REV. 1 PREPARED: JIM 8-1-88

CHECKED: RK 8-1-88

2. MOTOR OVERLOAD HEATER SELECTION

(A) CALCULATION OF HEATER SIZE (REF #5)
I(n)xD.F. = (USE D.F. PER REF #1 SH 1)

6.9 I(n)x 1 D.F. = 6.9 AMPS

CATALOG HEATER SIZE CR123 ~~C77A~~ C8.67A

I(m)= ~~6.92~~ 6.93

(B) CALCULATION FOR OVERLOAD HEATER SETTING:
CALCULATE % PROTECTION USING HEATER SETTING OF 100%

$\frac{6.92}{6.93}$ I(m) x 1.25 X 100 %* / 6.9 I (n) = $\frac{125}{126}$ %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

✓ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.

_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.
% * = [% PROTECTION x I(n)] / [I(m) x 1.25]
% * =
% * =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?
_____ YES - THE OVERLOAD HEATER SIZE AND SETTING HAVE BEEN PROPERLY SELECTED.
_____ NO - THE OVERLOAD HEATER HAS BEEN IMPROPERLY SIZED.

3. EVALUATION OF INSTALLED MOTOR OVERLOAD HEATER
IS THE HEATER SIZE THE SAME AS CALCULATED IN SECTION 2B?

_____ YES - IS THE HEATER SETTING THE SAME AS CALCULATED IN SECTION 2B?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE. PROCEED TO SECTION 4.

_____ NO - THE INSTALLED OVERLOAD HEATER SIZE IS ACCEPTABLE, FIELD TO RESET SETTING. PROCEED TO SECTION 4.

✓ NO - ~~PROCEED WITH FOLLOWING~~ REPLACE HEATER (2) SEE SH. 31.3 ~~PROCEED TO SECTION 4~~

EVALUATION OF INSTALLED OVERLOAD HEATER TRIP CURRENT
I(t) = I(m) x 1.25 x %* = TRIP AMPS
I(t) = _____ I(m) x 1.25 x _____ %* = _____ AMPS

0051T

CALCULATION NO. ED-G2243-37324 SHEET 31.3 OF 31

THERMAL OVERLOAD HEATER CALCULATION REV 0 DATE 3/16/88

BOARD REF 480V REACTOR MOV BD 2C COMPUTED BY DLA DATE 3/16/88

UNIT # 2 DWG. NO. 45B2209-6 Rev. 0 CHECKED BY TWB DATE 3/17/88

COMP # R11A EQUIP REF. 2SC WATER HEAD TANK PUMP 2A

REV. 1 PREPARED: JPM 8-1-88

CHECKED: RK 8-1-88

EVALUATION OF INSTALLED OVERLOAD HEATER PROTECTION.

% PROTECTION = I(t) / I(n) x 100

_____ I(t) / _____ I(n) x 100 = _____ %

DOES THE % PROTECTION FALL WITHIN THE ACCEPTANCE LIMITS?

_____ YES - THE INSTALLED OVERLOAD HEATER SIZE AND SETTING ARE ACCEPTABLE.

_____ NO - DETERMINE HEATER SETTING TO MEET THE % PROTECTION ACCEPTANCE CRITERIA BY USING THE CLOSEST ACCEPTANCE LIMIT VALUE.

%* = [% PROTECTION x I (n)] / [I(m) x 1.25]

%* =

%* =

IS % SETTING WITHIN THE OVERLOAD HEATER RANGE?

_____ YES - THE INSTALLED OVERLOAD HEATER SHALL BE RESET TO THIS VALUE.

_____ NO - THE INSTALLED OVERLOAD HEATER WAS INCORRECTLY SIZED AND SHALL BE REPLACED WITH THE ONE SELECTED IN SECTION 2B.

4. THIS CALCULATION HAS VERIFIED THAT THE SIZE AND SETTING OF THE OVERLOAD HEATER HAVE BEEN CORRECTLY DETERMINED TO BE:

OVERLOAD HEATER SIZE CR123 C8.67A ~~C7.78A~~ R1

OVERLOAD HEATER SETTING 100 %

5. COMMENTS: REPLACE INSTALLED TOL HEATERS WITH THE DESIGNED TOL HEATERS & SETTINGS SHOWN ABOVE

(1) ASSUMPTION PER REF #1 SH. 5

(2) DESIGNED HEATER SIZE & SETTING USED DUE TO LACK OF MCC WALKDOWN DATA.

TV-72164A
TSD-E034

EBASCO SERVICES INC
CONTROL OF CALCULATION AND CHECK LIST
(CCCL) Sheet 1 of 2

ED-72168-87324

NO	TASK	TASK PERFORMED	LEAD ENGINEER OR DESIGNEE
1	Assign Calculation Preparer	Name: DAN J AMATO DJA 3/14/88	AL LANE 3/14/88
2	Advise preparer to follow technical direction provided by discipline branch (guides, standards, instructions, procedures etc) during pre-preparation of calculation.	YES DJA 3/14/88	YES ASL 3/14/88
3	Enter calculation identifier/ title into calculation log.	YES DJA 3/14/88	YES ASL 3/14/88
4	Assign calculation verifier.	Name: TRILOCHAN H. BHATT THB 3/17/88	
5	Is Interface review required?	a) If "NO" Explain: No input from other disciplines required, No impact to other disciplines.	
	Yes or (NO) DJA 3/14/88 THB 3/17/88	b) If "YES", with whom?	
6	Does the calculation contain unverified assumptions?	Yes (NO) DJA 3/14/88 THB 3/17/88	
7	Was computer program used in performing calculation?	If "YES" Yes (NO) DJA 3/14/88 THB 3/17/88	
		If "YES" answer questions below:	
7.1	If "YES" is code verified, documented and controlled in accordance with Ebasco Procedure A-30.	Controlled User's Manual No. N/A	
7.2	Was the calculation verified independent of unverified code.	If "YES" Evidence: N/A	
		If "NO" Resolve: N/A	
7.3	Is software version, computer input and computer output documented?	Evidence: N/A	

SL184

TV-72164A
TSD-E034

EBASCO SERVICES INC
CONTROL OF CALCULATION AND CHECK LIST
(CCCL) Page 2 of 2

ED-Q2268-87324

ITEM NO	ITEM	YES OR NA PREPARER	YES OR NA VERIFIER
8	Is the problem stated clearly and completely?	YES DJD 3/10/88	YES, TWG 3/17/88
9	Is design input clearly identified and complete?	YES DJD 3/10/88	YES TWG 3/17/88
10	Are references correctly listed?	YES DJD 3/10/88	YES TWG 3/17/88
11	Are formula and equation, defined and referenced with the exception of AISC or Blodgett?	YES DJD 3/10/88	YES TWG 3/17/88
12	Is conclusion statement added, clear and correct?	YES DJD 3/10/88	YES TWG 3/17/88
13	Is the drawing revision number identified in the calculation?	YES DJD 3/10/88	YES TWG 3/17/88
14	Are all comments by the checker incorporated or otherwise reconciled?	YES DJD 3/10/88	YES TWG 3/17/88
15	Are all attachments identified and labeled?	YES DJD 3/10/88	YES TWG 3/17/88
16	Are superceded original calculations marked superceded, or made part of historical copy?	N/A DJD 3/10/88	N/A TWG 3/17/88
17	Are all calculation sheets initialed and dated by preparer and verifier?	YES DJD 3/10/88	YES TWG 3/17/88
18	Are all calculation sheets and attachments arranged properly?	YES DJD 3/10/88	YES TWG 3/17/88
19	Is the calculation log properly filled out?	YES DJD 3/10/88	YES TWG 3/17/88
20	Is the cover sheet properly filled out?	YES DJD 3/10/88	YES TWG 3/17/88
21	Is construction and operation experiences considered?	N/A DJD 3/10/88	N/A TWG 3/17/88
22	Are appropriate calculation methods used?	YES DJD 3/10/88	YES TWG 3/17/88
23	Is output verified to be reasonable compared to inputs?	YES DJD 3/10/88	YES TWG 3/17/88
24	Is adequate system performance, safety margins, etc considered?	YES DJD 3/10/88	YES TWG 3/17/88
25	Are unverified assumptions that require subsequent verification, identified?	YES DJD 3/10/88	YES TWG 3/17/88

EL184

DRAWINGS
480V REACTOR MOV Board 2A
DCA- H1239-003, -004, -005, -006
480 V REACTOR MOV BOARD 2C
DCA- H1239-011, -012, -013
480V SHUTDOWN AUX POWER
45N 779-2, -3, -6, -7, -14, -15, 16, -17

BROWNS FERRY NUCLEAR PLANT — DISCIPLINE: ELECTRICAL

DRAWING CHANGE AUTHORIZATION

ECN — DCN H1239
REVISION — REVISION A
SH #: 21 OF 68

	COMP NO	MANUFACTURER R000	STARTER MODEL NO.	STARTER SIZE	O/L HEATER ELEMENT NUMBER	O/O SETTING AØ	O/O SETTING BØ	O/O SETTING CØ
▲	1A	GE	CR109SO(F)	1	CR123C9.55A	100		100
▲	1A	GE	CR109SO(S)	1	CR123C3.26A	100		100
▲	1D	GE	CR109CO	1	CR123C18.0B	100		100
▲	1D	GE	CR106CO	1	CR123C18.0B	100		100
▲	1D	GE	CR106CO	1	CR123C18.0B	100		100
▲	2B	GE	CR109EO	3	CR123F31.4B	100		100
▲	4A	GE	CR106CO	1	CR123C7.78A	100		100
▲	4B	GE	CR109CO	1	CR123C7.18A	100		100
▲	4C	GE	CR109CO	1	CR123C2.68A	100		100
▲	4E	GE	CR106CO	1	CR123C5.92A	100		100
▲	5C	GE	CR109CO	1	CR123C2.68A	100		100
▲	5E	GE	CR106CO	1	CR123C5.92A	100		100
▲	6A	GE	CR106CO	1	CR123C8.67A	100		100
▲	6C	GE	CR109CO	1	CR123C3.26A	100		100

R000 R000 R000 R000 R000

480V REACTOR MOV BD 2A

NOTES

3. ▲ - DENOTES MCC COMP. NO. DESIGN VERIFIED FOR UNIT 2 RESTART.

Q

REV.		DRAFTED BY	CHECKED BY
000	REVISED: REPLACED HEATER ELEMENTS & ADJUSTED SETTING AS NOTED. ADDED: NOTE 3. SUPERCEDES DCA-E-2-P7010-003-REV000	Harshad P. Panchal	John P. Timmerman

THIS CHANGE IS ☒ SAFETY RELATED ☐ NOT RELATED TO NUCLEAR SAFETY

BASE DRAWING	REV.	DCA NUMBER	REV.
2-45E2299-2	000	DCA-H1239-003	000

BROWNS FERRY NUCLEAR PLANT — DISCIPLINE: ELECTRIC

DRAWING CHANGE AUTHORIZATION

ECN — DCN H1239
REVISION — REVISION 1
SH # : 22 OF GE

	COMP NO	MANUFACTURER	STARTER MODEL NO.	STARTER SIZE	O/L HEATER ELEMENT NUMBER	O/O SETTING AØ	O/O SETTING BØ	O/O SETTING CØ
R000	6E	GE	CR109CO	1	CR123C1.63A	100		100
	7B	GE	CR106CO	1	CR123C3.67A	100	100	100
	7C	GE	CR109CO	1	CR123C3.26A	100		100
	7E	GE	CR109CO	1	CR123C1.63A	100		100
	8C	GE	CR109CO	1	CR123C3.67A	100		100
	9B2	GE	CR109CO	1	CR123C1.18A	100		100
	9D	GE	CR109CO	1	CR123C1.18A	100		100
	9E	GE	CR109CO	1	CR123C1.18A	100		100
	10A	GE	CR109FO	4	CR123F91.4B	100		100
	10A	GE	CR106CO	1	CR123C3.01A	100		100
	11A	GE	CR106CO	1	CR123C3.67A	100		100
	11B	GE	CR109CO	1	CR123C1.63A	100		100
	11C	GE	CR109CO	1	CR123C5.92A	100		100
	12B	GE	CR109CO	1	CR123C1.63A	100		100

R000 R000 R000

480V REACTOR MOV BD 2A

Q

REV.		DRAFTED BY	CHECKED BY
000	REVISED: REPLACED HEATER ELEMENTS & ADJUSTED SETTING AS NOTED SUPERCEDES DCA-E-2-P7010-002 & 013 REV 000	Howard P Pinchel	John P Timmerman

THIS CHANGE IS ☒ SAFETY RELATED ☐ NOT RELATED TO NUCLEAR SAFETY

BASE DRAWING	REV.	DCA NUMBER	REV.
2-45B2299-2	000	DCA-H1239-004	000

BROWNS FERRY NUCLEAR PLANT

DISCIPLINE: ELECTRICAL

DRAWING CHANGE AUTHORIZATION

ECN — DCN H1239

REVISION — REVISION A

SH # : 23 OF 68

R000

COMP NO	MANUFACTURER	STARTER MODEL NO.	STARTER SIZE	O/L HEATER ELEMENT NUMBER	O/O SETTING AØ	O/O SETTING BØ	O/O SETTING CØ
12E	GE	CR109C0	1	CR123C1.84A	100		100
14A	GE	CR106C0	1	CR123C3.01A	100		100
14E	GE	CR109C0	1	CR123C1.84A	100		100
16A	GE	CR109C0	1	CR123C0.78A	100		100
16E	GE	CR109C0	1	CR123C3.26A	100		100
17A	GE	CR106E0	3	CR123F65.8B	100		100
17C	GE	CR109C0	1	CR123C4.19A	100		100
17E	GE	CR109C0	1	CR123C10.4B	100		100
18A	GE	CR106E0	3	CR123F65.8B	100		100
18C	GE	CR109C0	1	CR123C4.19A	100		100

R000

R000

R000

480V REACTOR MOV BD 2A

Q

REV.		DRAFTED BY	CHECKED BY
000	REVISED: REPLACED HEATER ELEMENTS & ADJUSTED SETTING AS NOTED SUPERCEDES DCA-E-2-P7010-013 REV 000	Harshad P. Patel	Jean P. Trompeter

THIS CHANGE IS ☒ SAFETY RELATED ☐ NOT RELATED TO NUCLEAR SAFETY.

BASE DRAWING	REV	DCA NUMBER	REV.
2-45B2299-2	000	DCA-H1239-005	000

BROWNS FERRY NUCLEAR PLANT — DISCIPLINE: ELECTRICAL

CHANGE AUTHORIZATION

ECN — — DCN 41239
REVISION — — REVISION A
SH # : 24 OF 66

R00C

	COMP NO	MANUFACTURER	STARTER MODEL NO.	STARTER SIZE	O/L HEATER ELEMENT NUMBER	O/O SETTING AØ	O/O SETTING BØ	O/O SETTING CØ
▲	18E	GE	CR109CO	1	CR123C5.92A	100		100
▲	19A	GE	CR109CO	1	CR123C0.71A	100	100	100
▲	R9A	GE	CR106CO	1	CR123C8.67A	100		100
▲	R9B	GE	CR106CO	1	CR123C8.67A	100		100
▲	R9C2	GE	CR106CO	1	CR123C1.09A	100		100
▲	R9E	GE	CR106CO	1	CR123C0.87A	100		100
▲	R10F	GE	CR106CO	1	C123C3.79A	100		100

R000

480V REACTOR MOV BD 2A

R000

NOTES

2. ▲ - DENOTES MCC COMP. NO. DESIGN VERIFIED FOR UNIT 2 RESTART.

Q

REV.		DRAFTED BY	CHECKED BY
000	REVISED: REPLACED HEATER ELEMENTS & ADJUSTED SETTING AS NOTED. ADDED: NOTE 2. SUPERCEDES DCA-E-2-P7010-003-REV 000	Harshad P. Pandit	Jerry P. Tennessee

THIS CHANGE IS ☒ SAFETY RELATED ☐ NOT RELATED TO NUCLEAR SAFETY

BASE DRAWING	REV.	DCA NUMBER	REV.
2-45B2299-3	000	DCA-41239-006	000

BROWNS FERRY NUCLEAR PLANT — DISCIPLINE: ELECTRICAL

DRAWING CHANGE AUTHORIZATION

ECN — DCN H1239
REVISION — REVISION A
SH # : 29 OF 65

COMP NO	MANUFACTURER	STARTER MODEL NO.	STARTER SIZE	O/L HEATER ELEMENT NUMBER	O/O SETTING AØ	O/O SETTING BØ	O/O SETTING CØ
1A	GE	CR106EO	3	CR123F65.8B	100		100
1D	GE	CR109FO	4	CR123F91.4B	100		100
3C	GE	CR109CO	1	CR123C1.84A	100		100
3E	GE	CR109CO	1	CR123C0.36A	100		100
4A	GE	CR106CO	1	CR123C7.48A	100		100
4B	GE	CR109CO	1	CR123C12.5B	100		100
4C	GE	CR109CO	1	CR123C0.78A	100		100
4E	GE	CR109CO	1	CR123C0.36A	100		100
5B	GE	CR109CO	1	CR123C0.39A	100		100
5C	GE	CR109CO	1	CR123C1.18A	100		100
5E	GE	CR109CO	1	CR123C0.78A	100		100
6B	GE	CR109CO	1	CR123C0.39A	100		100
6C	GE	CR109CO	1	CR123C1.18A	100		100
6E	GE	CR109CO	1	CR123C1.63A	100		100

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480V REACTOR MOV BD 2C

NOTES

3. ▲ - DENOTES MCC COMP. NO. DESIGN VERIFIED FOR UNIT 2 RESTART.

Q

REV.		DRAFTED BY	CHECKED BY
000	REVISED: REPLACED HEATER ELEMENTS & ADJUSTED SETTING AS NOTED, ADDED: NOTE 3 SUPERCEDES DCA-E-2-P7010-006, REV 000	Harshad P Raval	John P. Tomaszewski

THIS CHANGE IS ☒ SAFETY RELATED ☐ NOT RELATED TO NUCLEAR SAFETY

BASE DRAWING	REV.	DCA NUMBER	REV.
2-45B2299-6	000	DCA-H1239-011	000

BROWNS FERRY NUCLEAR PLANT — DISCIPLINE: ELECTRICAL

DRAWING CHANGE AUTHORIZATION — ECN — DCN H-1239; REVISION — REVISION A; SH #: 30 OF 68

	COMP NO	MANUFACTURER	STARTER MODEL NO.	STARTER SIZE	O/L HEATER ELEMENT NUMBER	O/O SETTING A∅	O/O SETTING B∅	O/O SETTING C∅
▲	7A	GE	CR106C0	1	CR123C12.5B	100		100
▲	7B	GE	CR109C0	1	CR123C0.35A	100		100
▲	7C	GE	CR109C0	1	CR123C1.84A	100		100
▲	7E	GE	CR109C0	1	CR123C1.84A	100		100
▲	8B	GE	CR109C0	1	CR123C0.39A	100		100
▲	8C	GE	CR109C0	1	CR123C1.84A	100		100
▲	8E	GE	CR109C0	1	CR123C1.84A	100		100
▲	9B	GE	CR109C0	1	CR123C1.63A	100		100
▲	9E	GE	CR109C0	1	CR123C0.71A	100		100
▲	11A	GE	CR106E0	3	CR123F65.8B	100		100
▲	11C	GE	CR109C0	1	CR123C0.78A	100		100
▲	R6A	GE	CR109C0	1	CR123C13.7B	100		100
▲	R6E	GE	CR109C0	1	CR123C13.7B	100		100
▲	R8B	GE	CR109C0	1	CR123C13.7B	100		100

R000 — R000 — R000

480V REACTOR MOV BD 2C

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REV.		DRAFTED BY	CHECKED BY
000	REVISED: REPLACED HEATER ELEMENTS & ADJUSTED SETTING AS NOTED. SUPERCEDES DCA-E-2-P7010-006&015 REV 000	Harshad P. Pandit	John P. Tomaszewski

THIS CHANGE IS ☒ SAFETY RELATED ☐ NOT RELATED TO NUCLEAR SAFETY

BASE DRAWING	REV.	DCA NUMBER	REV.
2-45B2299-6	000	DCA-H1239-012	000

BROWNS FERRY NUCLEAR PLANT | DISCIPLINE: ELECTRICAL

DRAWING CHANGE AUTHORIZATION | ECN — | DCN H1239 | REVISION — | REVISION A | SH #: 31 | OF 68

COMP NO	MANUFACTURER	STARTER		O/L HEATER ELEMENT				
		MODEL NO.	SIZE	NUMBER	O/O SETTING			
					AØ	BØ	CØ	
▲ R8E	GE	CR109C0	1	CR123C13.7B	100		100	R000
▲ R11A	GE	CR106C0	1	CR123C8.67A	100		100	

480V REACTOR MOV BD 2C

Q

000	REVISED: REPLACED HEATER ELEMENTS & ADJUSTED SETTING AS NOTED. SUPERCEDES DCA-E-2-P7010-015 REV 000	Hoshad P. Pavel	John P. Tomaszewski
REV.		DRAFTED BY	CHECKED BY

THIS CHANGE IS ☒ SAFETY RELATED ☐ NOT RELATED TO NUCLEAR SAFETY

BASE DRAWING	REV.	DCA NUMBER	REV.
2-45B2299-6	000	DCA-H1239-013	000

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