DEC 8 1992

Docket No. 50-155

Consumers Power Company
ATTN: Mr. William L. Beckman
Plant Manager
Big Rock Point Nuclear Plant
10269 US 31 North
Charlevoix, MI 49720

Dear Mr. Beckman:

SUBJECT: NOTICE OF VIOLATION AND NOTICE OF DEVIATION
(NRC INSPECTION REPORT NO. 50-155/92019(DRS))

This will acknowledge receipt of your letters dated November 17 and November 24, 1992, in response to our letter dated October 30, 1992, transmitting a Notice of Violation and a Notice of Deviation associated with Inspection Report No. 50-155/92019(DRS). This report summarized the results of the electrical distribution system functional inspection (EDSFI) at your Big Rock Point Nuclear Power Plant. We have reviewed your corrective actions and have no further questions at this time. These corrective actions will be examined during future inspections.

In addition, you requested in your letter dated November 24, 1992, an extension to December 31, 1992, to respond to the open and unresolved items addressed in Inspection Report No. 50-155/92019. We consider your request to be reasonable and grant you this extension.

Sincerely,

ORIGINAL SIGNED BY GEOFFREY C. WRIGHT (for)

H. J. Miller, Director
Division of Reactor Safety

See Attached Distribution

SEE PREVIOUS CONCURRENCE PAGE

RIII	RIII	RIII	RIII	RIII	RIII
Butler/jk	Phillips	Gardner	Ring	Martin	Miller
12/07/92	12/ /92	12/ /92	12/ /92	12/8/92	12/8/92

9212140130 921208
PDR ADOCK 05000155
G PDR

IE01

Docket No. 50-155

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ATTN: Mr. William L. Beckman
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Charlevoix, MI 49720

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H. J. Miller, Director
Division of Reactor Safety

See Attached Distribution

RIII	RIII	RIII	RIII	RIII	RIII
Butler/jk	Phillips	Gardner	Ring	Martin	Miller
12/07/92	12/08/92	12/08/92	12/8/92	12/ /92	12/ /92

Distribution

cc: David P. Hoffman. Vice
President - Nuclear Operations

cc w/ltrs dtd 11/17/92
and 11/24/92:
DCD/DCB(RIDS)
OC/LFDCB
Resident Inspector, RIII
James R. Padgett, Michigan
Public Service Commission
Michigan Department of
Public Health
L. Olshan, LPM, NRR
E. Imbro, NRR
Palisades SRI
W. Hodges, Region I
J. Durr, Region I
A. Gibson, Region II
C. Julian, Region II
S. Collins, Region IV
T. Stetka, Region IV
K. Perkins, Region V
L. Miller, Region V

Consumers Power
POWERING MICHIGAN'S PROGRESS

William L Beckman
Plant Manager

Big Rock Point Nuclear Plant, 10269 US-31 North, Charlevoix, MI 49720

November 17, 1992

Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 - BIG ROCK POINT - REPLY TO A NOTICE OF VIOLATION (NRC INSPECTION REPORT 50-155/92-019)

Enclosed is the reply to a Notice of Violation described in the Nuclear Regulatory Commission Inspection Report 50-155/92-019 dated October 30, 1992.

William L Beckman (Signed)

William L Beckman
Plant Manager

CC: Administrator, Region III, USNRC
NRC Resident Inspector - Big Rock Point

ATTACHMENT

NOV 23 1992

ATTACHMENT

Consumers Power Company
Big Rock Point Plant
Docket 50-155

RESPONSE TO NOTICE OF VIOLATION
NRC INSPECTION REPORT 92-019

RESPONSE TO NOTICE OF VIOLATION 92-019

VIOLATION

10 CFR 50, Appendix B, Criterion XI, requires a test program be established to assure that all testing required to demonstrate that components will perform satisfactorily in service is documented and evaluated.

Contrary to the above, from October 25, 1990 through September 2, 1992, the Licensee failed to conduct post modification testing of facility change FC-670 to demonstrate that relays "T" and "CR5", in the EDG (Emergency Diesel Generator) control logic, performed satisfactorily.

REASON FOR THE VIOLATION

During a special NRC Electrical Distribution System Functional Inspection (EDSFI), a potential problem concerning post modification test documentation for Facility Change 670 was identified on September 2, 1992. The documentation did not provide conclusive evidence that the entire 24 Vdc EDG circuit logic in question was tested.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

The EDG was declared inoperable at 1530 the same day (the facility was in the COLD SHUTDOWN condition, and the 46 kV transmission was available as per Technical Specifications). A test was performed shortly thereafter to verify the operation of relays "T" (trouble relay) and "CR5" (auxiliary trouble relay), which are located in the EDG electrical scheme (reference Maintenance Order 92-EPS-0200). The relays were verified to be operable, and the EDG was declared operable at 1848.

ACTIONS TAKEN TO PREVENT RECURRENCE

By mid-1993, the Administrative procedures and related training courses governing the modification process will be reviewed to determine if additional directions or training is required for post-modification testing activities.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

The facility has been in full compliance since September 2, 1992 per the successful testing of the EDG circuit described above.

Consumers Power
POWERING MICHIGAN'S PROGRESS

Big Rock Point Nuclear Plant, 10269 US-31 North, Charlevoix, MI 49720

William L Beckman
Plant Manager

November 24, 1992

Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 - BIG ROCK POINT - REPLY TO A NOTICE OF DEVIATION (NRC INSPECTION REPORT 92-019)

Enclosed is the reply to a Notice of Deviation described in the Nuclear Regulatory Commission Inspection Report 50-155/92-019 dated October 30, 1992. Previously on November 17, 1992, a reply to the Notice of Violation described in the same NRC Inspection Report was submitted to the NRC. This latest submittal completes the requirements to respond to the Notices enclosed in the Inspection Report dated October 30, 1992.

In addition, the Inspection Report addressed a number of open and unresolved items, and a request was made to address each of these items along with the reply to the Notices. After a preliminary review of these items, additional time is requested to submit a response. The coordination between on-site and off-site groups to address these items lends a factor of delay that must be managed.

We therefore respectfully request an extension to the 31st of December, 1992, to respond completely to the open and unresolved items addressed in the NRC Inspection Report described above.

William L Beckman (Signed)

William L Beckman
Plant Manager

CC: Administrator, Region III, USNRC
NRC Resident Inspector - Big Rock Point

ATTACHMENTS

NOV 3 0 1992

9212010352
34pp.

ATTACHMENT

Consumers Power Company
Big Rock Point Plant
Docket 50-155

RESPONSE TO NOTICE OF DEVIATION
NRC INSPECTION REPORT 92-019

November 24, 1992

DEVIATION

Consumers Power Company, by letter to the NRC dated March 31, 1983, "Big Rock Point Plant - SEP Topic IX-5, Ventilation Systems," committed to install a ventilation system to assure that adequate ventilation was provided in the emergency diesel generator (EDG) room.

Contrary to the above, due to an error in calculation EA-FC-544-01-02, dated November 24, 1982, the installed ventilation system was undersized and did not assure adequate ventilation of the emergency diesel generator room with the EDG running.

REASON FOR THE DEVIATION

The calculation used for "Q" (flow, cfm) on page 8 of 9 in EA-FC-544-01-02 used an additional factor of 1hr/60min. This additional conversion factor was an oversight and should not have been used. The use of the additional conversion factor renders the numerical conclusion in the engineering analysis inadequate.

CORRECTIVE ACTION TAKEN AND RESULTS ACHIEVED

Corrective Action

A re-evaluation for fan sizing has been performed in EA-RFI-CG-34-01 (attached). An additional evaluation has also been performed to address the capacity available from alternate ventilation sources for the emergency diesel generator room as provided in the Big Rock Point Plant, System Operating Procedure (SOP) 25, "Heating and Ventilation System".

Summary of Results Achieved

The existing exhaust fan will be replaced with a wall exhaust fan that will meet the flow requirements necessary to assure adequate ventilation.

It should also be noted that even though the existing exhaust fan is undersized, the capacity provided by alternate ventilation is more than adequate to provide the necessary ventilation for the EDG.

ACTIONS TAKEN TO AVOID FURTHER DEVIATIONS

Calculational errors are anticipated to be corrected via the technical review process. This incident is an isolated occurrence, and the likelihood of repeating this error is very small.

DATE WHEN CORRECTIVE ACTION WILL BE COMPLETED

The corrective action will be completed by the end of the 1993 Refueling Outage.

ATTACHMENT

Consumers Power Company
Big Rock Point Plant
Docket 50-155

RESPONSE TO NOTICE OF DEVIATION
NRC INSPECTION REPORT 92-019

EA-RFI-CG-34-01

November 24, 1992

BIG ROCK POINT NUCLEAR PLANT
ENGINEERING ANALYSIS WORK SHEET

EA-RFI-CG-34-01
SHEET 1 OF 25

TITLE: EMERGENCY DIESEL GENERATOR (EDG) ROOM RE-EVALUATION FOR EXHAUST FAN SIZING AND TOTAL AVAILABLE VENTILATION USING ALTERNATE VENTILATION AS STATED IN SYSTEM OPERATING PROCEDURE (SOP) - 25 "HEATING AND VENTILATION SYSTEM"

INITIATION AND REVIEW

REV #	DESCRIPTION	INITIATED		REVIEW METHOD ( )			TECHNICAL REVIEW	
		BY	DATE	ALT CALC	DET RVW	QUAL TEST	BY	DATE
0	ORIGINAL ISSUE	2S	9/15/92		✓		[signature]	9/15/92

OBJECTIVE

This evaluation is being performed to correct the numerical errors noticed regarding the adequacy of the emergency diesel generator room exhaust fan sizing as identified by the USNRC, Electrical Distribution System Functional Inspection (EDSFI) at the Big Rock Point Plant, via Request For Information (RFI) Number CG-34, dated August 31, 1992. In addition, an evaluation will also be done to address the capacity available from alternate ventilation for the emergency diesel generator room as provided in the Big Rock Point Plant, System Operating Procedure (SOP)-25.

REFERENCES

1. Facility Change - 544, Emergency Diesel Generator Room Ventilation
2. Consumers Power Letter to USNRC, Dated June 11, 1982
3. USNRC Letter to Consumers Power, Dated October 12, 1982
4. Big Rock Point Alarm Procedure, ALP 1.12
5. Big Rock Point System Operating Procedure, SOP-25

6. USNRC Request For Information, RFI No. BS-04

7. USNRC Request For Information, RFI No. CG-04

8. USNRC Request For Information, RFI No. CG-10

9. USNRC Request For Information, RFI No. CG-11

10. ASHRAE Handbook, 1981 Fundamentals

11. Big Rock Point Maintenance Order No. 83-EPS-0217

ATTACHMENTS

1. Telecon, dated September 3, 1992, from TSikavitsas to DPiellegata, Michigan Tractor & Machinery Co., Caterpillar Dealer

2. Catalog cut-sheet for Dynamaster Fan, Model FQ16H4

3. Telecon, dated September 9, 1992, from TSikavitsas to DKahlbaum, CPCo Environmental Department

ASSUMPTIONS

1. Below is the original design basis for the Emergency Diesel Generator Room thermostatic controlled ventilation system as evaluated in Facility Change (FC) - 544 (Reference 1).

   " The failure of the Emergency Diesel Generator (EDG) ventilation system will not jeopardize the ability of the EDG's operability. From an evaluation by Consumers Power Company for SEP Topic IX-5, for Big Rock Point (Reference 3), it was determined that the heat rise from the EDG will not impair its operation. The recommendation is to establish a procedure in (Vol 3, i.e. SOP's) to provide adequate ventilation by means of opening the access doors to the room. In addition, the NRC evaluation (Reference 4) also states that a procedure be established to provide adequate ventilation for the room if the EDG is required to operate for extended duration. Our main commitment to the NRC is to p vide procedural control for ventilating the room.

   The installation of a thermostatic controlled vent system is to help alleviate subsequent operator action and also alleviate the placement of additional security personnel.

   Procedures will be drafted (Reference 5) to assure that the vent system activates (at its set-point) automatically. However, if it does not activate automatically by making of the thermostat, manual activation is provided. In addition, if the

vent syst[illegible] becomes completely disabled than operator action will be t[illegible] open doors to the room and security will be posted.

The E[illegible] has a passive ventilation system and the addition of a thermostatic controlled vent system is merely to aid in venting the room adequately."

2. From Reference 6 and Reference 12, it has been stated that the EDG ventilation is non-safety-related (NSR) and non-Q-classified. The basis for this conclusion is based on the fact that failure of the thermostatically-controlled ventilation system will not render the EDG inoperable since alternate ventilation is provided by opening of the room doors.

   The original analysis in Reference 1 did not consider the ventilating capacity of the open doors. Access heat removal capacity provided by this alternate ventilating means will be evaluated to substantiate procedural compliance.

3. EA-FC-544-01-02 did not take credit for insulation provided on the EDG steel exhaust piping and muffler. The heat gain assumed from an exposed EDG exhaust system piping is overly conservative. This evaluation will consider the use of the calcium silicate insulation provided in determining heat gain for the EDG room.

4. Values for heat (BTU/hr) radiated by the diesel engine and heat dissipated (BTU/hr) by the generator were obtained from Caterpillar Dealer for the D-343 generator. See Attachment 1.

5. EA-[illegible]-544-01-02 did not consider combustion air intake flow requirements. Intake flow requirements (cfm) would help in removing heat from the room. This re-evaluation will consider the significant contribution that intake flow provides for heat removal. Intake air will use a 10° F temperature difference.

6. Summer conditions will be considered for heat loss and average wind velocities for alternate ventilation method.

7. EDG Room inside temperature estimated at 140°F with outside temperature at 85°F.

8. The value for the air inlet velocity coefficient for effective opening in determining alternate ventilation flow will be assumed to be at 0.4.

9. The west wall of the EDG room is the division between it and the screenhouse pump room. Inside temperature for the pump room will also be assumed to be at 85°F.

10. In determining heat gain to the EDG room through the exhaust system insulation, inside room air temp will be assumed to be at [illegible]0°F. This will give a higher value for heat gain.

CALCULATION - EXHAUST FAN SIZING AND AND ALTERNATE VENTILATION FLOW

NOMENCLATURE

A AREA, SQ FT
C COEFFICIENT, 1.1
C CONDUCTANCE, BTU/HR/SQ FT/DEG F
Δt INDOOR-OUTDOOR TEMP DIFFERENCE, °F
H_{L_N} HEAT LOSS THRU A PARTICULAR AREA, BTU/HR

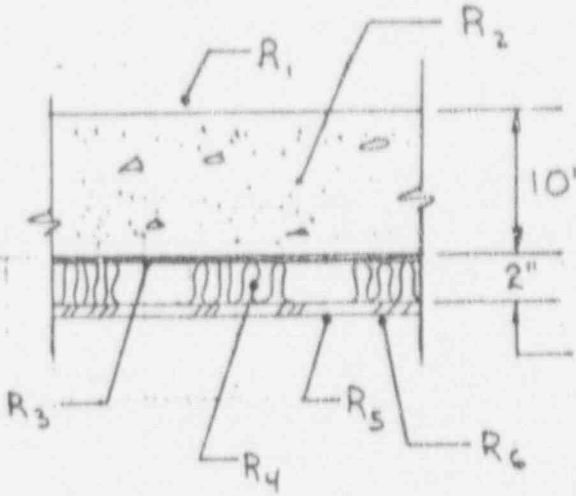
H_{G_T} HEAT GAINED, BTU/HR

H_R HEAT TO BE REMOVED, BTU/HR

H_{L_T} TOTAL HEAT LOSS, BTU/HR

Q FLOW, CFM
ρ AIR DENSITY, .0745 LBM/FT³
v AIR VELOCITY, FT/SEC
C_v AIR VELOCITY DIRECTIONAL COEFFICIENT, 0.4
U OVERALL COEFFICIENT, BTU/HR-°F-FT²
R THERMAL RESISTANCE, HR-FT²-°F/BTU
K CONDUCTIVITY, BTU/HR-°F/IN THICKNESS

WALL, FLOOR AND CEILING DETAILS FOR DETERMINING U-FACTOR



REF. DWG 07-0620037

WALL DETAIL-TYP FOR NORTH, SOUTH & EAST

FROM REF 10, CHT 23

R_1 = OUTSIDE AIR FILM = .17

R_2 = CONCRETE = .83

R_3 = 15# FELT = .12

R_4 = 2" RIGID BOARD INSULATION = 8.00

R_5 = 1/4" A.C.B = .06

R_6 = INSIDE AIR FILM = .61

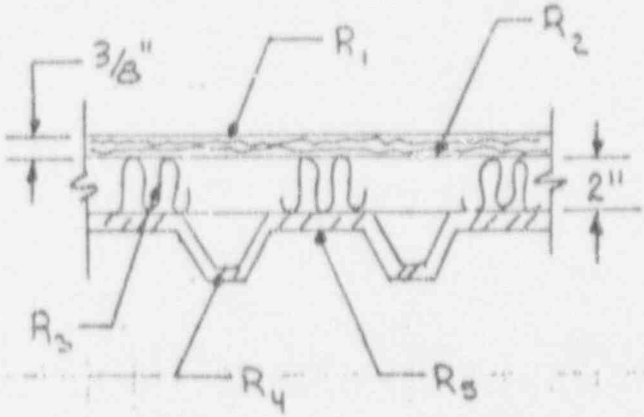
$$R_T = R_1 + R_2 + R_3 + R_4 + R_5 + R_6$$

$$= .17 + .83 + .12 + 8.00 + .06 + .61$$

$$R_T = 9.79 \text{ HR-FT}^2\text{-°F/BTU}$$

$$U = 1/R = 1/9.79$$

$$U = .102 \text{ BTU/HR-°F-FT}^2$$



REF DWG 0740G20037

CEILING DETAIL

FROM REF 10, CHPT 22

R_1 = OUTSIDE AIR FILM
= .17

R_2 = 3/8" BUILD-UP ROOF
= .33

R_3 = RIGID BOARD INSUL
= 5.88

R_4 = STEEL DECK
= 0.0

R_5 = INSIDE AIR FILM
= .61

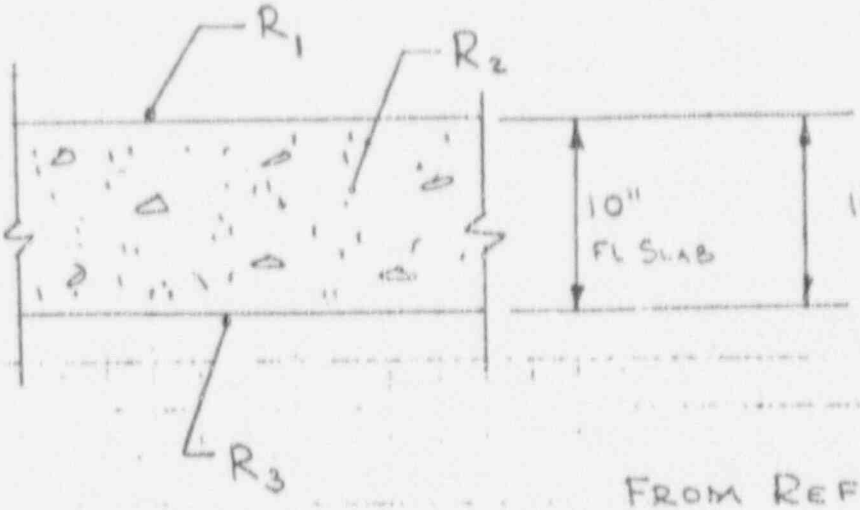
$R_T = R_1 + R_2 + R_3 + R_4 + R_5$

$= .17 + .33 + 5.88 + 0 + .61$

$R_T = 6.99$ HR - FT²-°F/BTU

$U = 1/R_T = 1/6.99$

$U = .143$ BTU/HR - °F - FT²



MAIN FLOOR AND WEST WALL DETAIL

REF DWG 0740G20035

FROM REF 10, CHPT 23

R_1 = INSIDE AIR FILM = .61

R_2 = STONE AGG CONCRETE = .83 @10" & 1.12 @14"

R_3' = OUTSIDE AIR FILM = .17 FOR FLOOR

R_3 = INSIDE AIR FILM P.R. = .61 WEST WALL

$R_{T(FLOOR)} = R_1 + R_2 + R_3$

$= .61 + .83 + .17$

$R_{T(F)} = 1.61$ HR-FT²-°F/BTU

$U_{(F)} = 1/R_T = 1/1.61$

$U_F = .62$ BTU/HR-°F-FT²

$R_{T(WALL)} = .61 + 1.12 + .61$

$R_{T(W)} = 2.34$

$U_{(W)} = 1/R_T = 1/2.34$

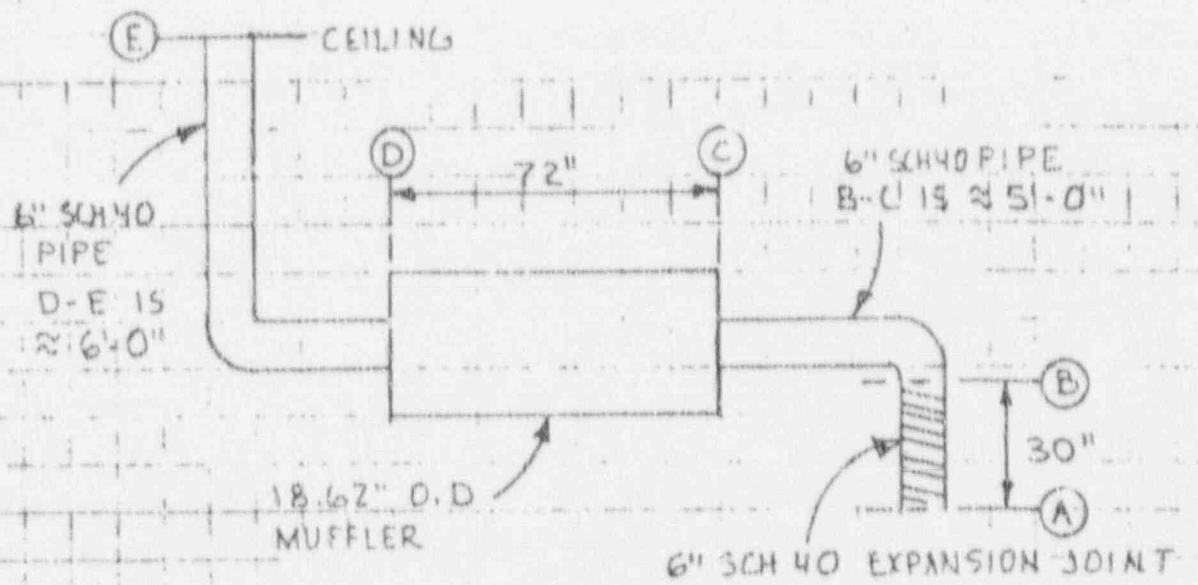
$U_{(W)} = .43$ BTU/HR-°F-FT²

HEAT GAIN IN EDG ROOM

ENGINE = 1750 BTU/MIN X 60MIN/HR
= 105,000 BTU/HR ATTACHMENT-1

GENERATOR = 906 BTU/MIN X 60MIN/HR
= 54,360 BTU/HR ATTACHMENT-1

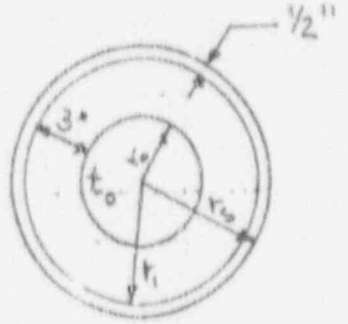
EXHAUST SYSTEM



INSULATION

A-B NONE EXPANSION JOINT IS EXPOSED

B-E 3" CALCIUM SILICATE BLOCK WITH 1/2" MINERAL FIBER CEMENT WITH HYDRAULIC BINDER - MANVILLE THER-MO-12



6" SCH 40 PIPE
W/ INSULATION

6" SCH 40 PIPE O.D = 6.625"

r_o = 3.31"

r_1 = 3.31" + 3" = 6.31"

r_s = 6.31" + 1/2" = 6.81"

t_o = EXHAUST TEMP = 810°F
FROM ATTACHMENT -1

t_a = 80°F ASSUMED INSIDE TEMP

R_s = .5 REF 10, CHT 23

6" PIPE HEAT GAIN

ASSUME MEAN TEMP OF SILICATE ≅ 450° F
ASSUME MEAN TEMP OF CEMENT ≅ 200° F

FROM REF 10, TABLE 3B, PG 23.19 k_1 = .5, k_2 = .8

$$q_s = \frac{t_o - t_a}{[r_s \log_e (r_1/r_o)]/k_1 + [r_s \log_e r_s/r_1]/k_2 + R_s}$$

REF 10
CHT 27
EQ-12

$$q_s = \frac{810-80}{\left[6.81 \log_e (6.31/3.31)\right]/.5 + \left[6.81 \log_e (6.81/6.31)\right]/.8 + .5}$$

$$q_s = \frac{730}{8.79 + .65 + .5} = \frac{730}{9.94} = 73.4 \text{ BTU/HR-FT}^2$$

FROM REF 10, CHPT 23, FIG. 6, $R_s \cong .6$

MEAN TEMP OF CALCIUM SILICATE IS;

$$t_a - \frac{\left\{\left[r_s \log_e (r_1/r_0)\right]/k_1\right\}/2}{9.94} \times \Delta T$$

$$810 - \left(\frac{4.395}{9.94}\right)(730)$$

$$T_{MEAN_{SILICATE}} = 487.2° F$$

MEAN TEMP OF CEMENT IS;

$$t_a - \frac{\left\{\left\{\left[r_s \log_e (r_1/r_0)\right]/k_1\right\}/2 + \left\{\left[r_s \log_e (r_s/r_1)\right]/k_2\right\}\right\}}{9.94} \times \Delta T$$

$810 - 9.12/9.94\ (730)$

$T_{MEAN_{CEMENT}} = 140°F$

FROM REF 10, CHPT 23, TABLE 3B

@ 487.2°F $k_1 = .506$
@ 140 °F $k_2 = .77$

RE-CALCULATE USING NEW K_1, K_2 & R_S VALUE

$$q_s = \frac{730}{4.39/.506 + .52/.77 + .6} = 73.4\ BTU/HR\text{-}FT^2$$

K_1, K_2 & R_S WILL NOT CHANGE AT 73.4 BTU/HR-FT² THUS THIS IS FINAL q_s ∴ $q_0 = q_s(r_s/r_0)$ REF 10, CHT 23 EQ-13

$$q_0 = 73.4\ (6.81/3.31) = 151\ BTU/HR \cdot FT^2$$

TRIBUTARY LENGTH OF 6" PIPE IS ≅ 11 FEET

$C = 2\pi r / 12 = 1.734$ FT

SURFACE AREA = C X 11' = 1.734 X 11

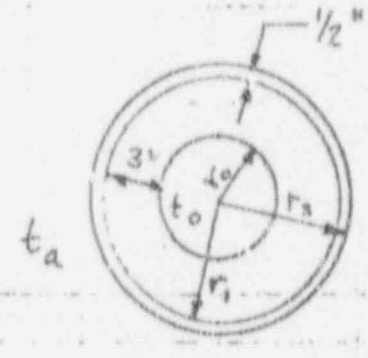
$A = 19.1$ FT²

HEAT GAIN

$q = 151$ BTU/HR-FT² x 19.1 FT²

$q_{\text{EXHAUST PIPE}} = 2884$ BTU/HR

18.62" MUFFLER HEAT GAIN



18.62" O.D MUFFLER

$r_0 = 18.62"/2 = 9.31"$

$r_1 = 9.31 + 3" = 12.31"$

$r_3 = 12.31" + 1/2" = 12.81"$

$t_0 = 810°F$

$t_a = 80°F$

ASSUME $K_1 = .5$, $K_2 = .8$ & $R_s = .5$

$$q_s = \frac{810-80}{\left[12.81\left(\log_e \frac{12.31}{9.31}\right)\right]/.5 + \left[12.81\left(\log_e \frac{12.81}{12.31}\right)\right]/.8 + .5}$$

$$q_s = \frac{730}{7.14 + .64 + .5} = \frac{730}{8.28}$$

$q = 88.2$ BTU/HR-FT^2

FROM REF 10, CHPT 23, FIG 6 $R_s = .58$

MEAN TEMP FOR CALCIUM SILICATE IS;

$$810 - \frac{3.57}{8.28}(730) = 495°F$$

MEAN TEMP FOR CEMENT IS;

$$810 - \frac{7.46}{8.28}(730) = 153°F$$

FROM REF 10, CHPT 23, TABLE 3B

$K_1 = .52$ $K_2 = .78$

RECALCULATE FOR q_s

$$q_s = \frac{730}{\frac{3.57}{.52} + \frac{.51}{.78} + .58} = \frac{730}{8.1}$$

$q_s = 90.12$ BTU/HR-FT^2

FROM REF 10, CHPT 23, FIG 6, $R_s = .57$

MEAN TEMP FOR CALCIUM SILICATE IS;

$810 - {3.44}/{8.1}(730) = 500°F$

MEAN TEMP FOR CEMENT IS;

$810 - {7.2}/{8.1}(730) = 161°F$

K_1, K_2 & R_S WILL NOT CHANGE

AT $q_s = 90.12$ BTU/HR-FT²

THEREFORE FINAL q_s

$q_0 = q_s(r_s/r_o) = 90.12(12.81/9.31)$

$q_0 = 124$ BTU/HR-FT²

TRIBUTARY AREA OF MUFFLER SECTION

$C = \pi d / 12 \text{ IN/FT} = 18.62(\pi)/12 = 4.87$ FT

$L = 72" = 6$ FT

$A = 6 \times 4.87 = 29.22$ FT²

$q = 124$ BTU/HR-FT² $\times 29.22$ FT²

$q = 3624$ BTU/HR.

HEAT GAIN FROM EXPANSION JOINT

$q = AU\Delta t$ $\Delta t = 730°F$

$U = 1/R_s$ R_s = AIR FILM ≈ .6

$U = 1/.6 = 1.67$

TRIBUTARY AREA OF EXPANSION JOINT

$C = \pi d / 12\ IN/FT = \pi(6.625)/12 = 1.73\ FT$

$L = 30'' / 12\ IN/FT = 2.5\ FT$

$A = 2.5 \times 1.73 = 4.36\ FT^2$

$q = (4.36)(1.6)(730) = 5316\ BTU/HR$

TOTAL HEAT GAIN IN EDG ROOM

$H_{GT} = 105,000 + 54,360 + 2884 + 3624 + 5316$

$H_{GT} = 171,184$ BTU/HR + 25% CONTIGENCY

$H_{GT} = 213,980$ BTU/HR

DETERMINE HEAT LOSS

WEST WALL

$H_L = AU\Delta t$

$A = 420\ FT^2$ DWG 0740G20035
$U = .43\ BTU/HR\text{-}°F\text{-}FT^2$
$\Delta t = (140-85) = 55°F$

$H_{L_{WW}} = 420(.43)(55)$

$H_{L_{WW}} = 9933\ BTU/HR$

CEILING & ROOF DECK

$H_{L_{RD}} = AU\Delta t$

$A = 373\ FT^2$ DWG 0740G20035
$U = .143\ BTU/HR\text{-}°F\text{-}FT^2$
$\Delta t = 55°F$

$H_{L_{RD}} = 373(.143)55$

$H_{L_{RD}} = 2933\ BTU/HR$

MAIN FLOOR

$H_{L_F} = AU \Delta t$

$A = 373\ FT^2$ — DWG 0740G20035

$U = .62\ BTU/HR\text{-}°F\text{-}FT^2$

$\Delta t = 55°F$

$H_{L_F} = 373(.62)(55)$

$H_{L_F} = 12,719\ BTU/HR$

NORTH WALL

$H_{L_{NW}} = AU \Delta t$

$A = 150\ FT^2$ — DWG 0740G20035

$U = .102\ BTU/HR\text{-}°F\text{-}FT^2$

$\Delta t = 55°F$

$H_{L_{NW}} = 150(.102)55$

$H_{L_{NW}} = 842\ BTU/HR$

SOUTH WALL

$H_{L_{SW}} = AU\Delta t$

$A = 136\ FT^2$ — DWG 0740G 20035

$U = .102\ BTU/HR\text{-}°F\text{-}FT^2$

$\Delta t = 55°F$

$H_{L_{SW}} = 136(.102)55$

$H_{L_{SW}} = 763\ BTU/HR$

EAST WALL

$H_{L_{EW}} = AU\Delta t$

$A = 420\ FT^2$ — DWG 0740G 20035

$U = .102\ BTU/HR\text{-}°F\text{-}FT^2$

$\Delta t = 55°F$

$H_{L_{EW}} = 420(.102)55$

$H_{L_{EW}} = 2356\ BTU/HR$

NORTH DOOR

$H_{L_{ND}} = AU\Delta t$

A = 24.25 FT² — DWG 0740G20035
U = .47 (STEEL DOOR SOLID CORE) — REF 10, PG 23.29
Δt = 55°F

$H_{L_{ND}} = 24.25\,(.47)\,55$

$H_{L_{ND}} = 627$ BTU/HR

SOUTH DOOR

$H_{L_{SD}} = AU\Delta t$

A = 39 FT² — DWG 0740G20035
U = .47 BTU/HR-°F-FT²
(STEEL DOUBLE DOOR)
Δt = 55°F

$H_{L_{SD}} = 39\,(.47)\,55$

$H_{L_{SD}} = 1008$ BTU/HR

COMBUSTION AIR INTAKE

$Q = 695\ FT^3/MIN$ COMBUST AIR-INTAKE ATTACHMENT-1

$$Q = \frac{H_{L_{CA}}}{60\, C_p\, \rho\, (\Delta t)}$$ REF 10, CHPT 22 EQ-6

$C_p = .245$ BTU/LB
$\rho = .0745$ LB/FT^3
$60 =$ MIN/HR
} = 1.1

$\Delta t = 10°F$ A- INTAKE ASSUMPTION - 5

$H_{L_{CA}} = Q\,(1.1)\,(\Delta t)$

$H_{L_{CA}} = 695\,(1.1)\,(10)$

$H_{L_{CA}} = 7{,}645$ BTU/HR

$H_{L_T} = \Sigma H_{L_N}$

$= [9933 + 2933 + 12{,}719 + 842 + 763 + 2356 + 627 + 1008 + 7{,}645]$

$H_{L_T} = 38{,}826$ BTU/HR

REQUIRED AIR FLOW

$$Q = H_R / 60 C_p \rho (t_i - t_o)$$ REF 10, CHP 22 EQ-8

$$H_R = H_{GT} - H_{LT}$$
$$= 213,980 - 38,826$$

$$H_R = \text{175,154} \quad \text{(167,852 BTU/HR struck through)}$$

$$Q = \frac{175,154 \text{ BTU/HR}}{60 \frac{MIN}{HR} (.245 \text{ BTU}/_{LB\text{-}°F})(.0745 \frac{LB}{FT^3})(55°F)}$$

$$Q = 2908 \text{ CFM}$$

IN ORDER TO AVOID HAVING TO INCREASE THE EXISTING VENT OPENING IN THE N.E CORNER OF THE ROOM, THE VENT FAN SIZE WILL BE LIMITED TO THE EXISTING 18" SQ OPENING. FROM ATTACHMENT-2 THE FAN THAT WOULD PROVIDE THE REQUIRED FLOW OF 2908 CFM IS A DYNAMASTER FAN MODEL FQ16H.4, WITH A CAPACITY OF 3710 CFM.

EVALUATION OF ALTERNATE VENTILATION PROVIDED BY OPENING DOORS

The existing ventilation fan (F-32) is undersized due to the numerical error in EA-FC-544-01-02. However, the EDG room is provided with a room high temperature alarm via temperature switch TS-9701. The switch is located on the side of the north end panel of control cabinet C-18. It will activate at 115°F and rising, and annunciate in the control room (Reference 4). Local indication is also provided.

If the EDG is run for extended periods with the ventilation fan running and room temperature increasing, TS-9701 will activate and operators will be required to respond. The operator response is to open the doors as required by Reference 5.

ALTERNATE VENTILATION FLOW

$Q = C_V \times A \times V$ — REF 10, CHPT 22, EQ-9

C_V = EFFECTIVENESS OF OPENING COEFFICIENT
= .4 - See Assumption 8

A = DOOR OPENING (3'- 4 1/2" x 7'- 2 1/2")
= 24.25 SQ FT

V = WIND VELOCITY — REF ATTACHMENT - 3
= 12.6 MPH (1109 FT/MIN)

NOTE: The above referenced equation is used in designing natural ventilation systems. It is also used to determine the air forced through openings due to wind. Summer wind velocities will be used since they tend to be lower than the other seasons. From Reference 10, the average seasonal wind velocity is often reduced by a factor of 2. Since the extended use of the EDG has a low probability, in our application we will take full credit of average summer wind velocities.

$Q = C_V \times A \times V$

$= .4 \times 24.25$ sq ft $\times 1109$ ft/min

$Q = 10{,}757$ CFM

ELECTRICAL EVALUATION FOR PROPOSED FAN REPLACEMENT

1. LOADS ON THE SECONDARY SIDE OF THE TRANSFORMER

   A. 3/4 HP, 120 VAC, SINGLE PHASE MOTOR - FROM NEC ARTICLE 430, TABLE 430-148, USE 13.8 AMPS

   B. DAMPER MOTOR, 120 VAC, SINGLE PHASE, INRUSH 75 VA, HOLDING 25 VA, USE 75 VA (UNCHANGED FROM ORIGINAL LOADS)

2. FIND REQUIRED KVA FOR SIZING TRANSFORMER:

$$KVA = \frac{A \times V}{1000}$$

$$3/4\ HP\ MOTOR = \frac{13.8 \times 120}{1000} = 1.65\ KVA \quad SAY\ 1.7\ KVA$$

$$DAMPER\ MOTOR = \frac{75\ VA}{1000} = .075\ KVA$$

TOTAL KVA = 1.7 + .075 = 2.0 KVA

3. FUSE SELECTION - BASED ON NEC ARTICLE 450-3(b)(2)

SECONDARY SIDE FUSE SHALL NOT EXCEED 125% OF RATED TRANSFORMER SECONDARY CURRENT.

I_2 = 2 KVA / 120 V = 16.66 AMPS

125% x 16.66 = 20.8 AMPS THEREFOR USE 20 AMP FUSE

PRIMARY SIDE NOT TO EXCEED 250%

I_1 = 2 KVA / 480 V = 4.17 AMP

4.17 x 250% = 10.42 AMP THEREFOR USE 10 AMP FUSE

See Figure - 1 for a diagram depicting the above changes

RECOMMENDATIONS

Since the original calculation for exhaust fan sizing is inadequate, it is being recommended that the existing exhaust fan be replaced with a fan having a capacity as stated in this re-evaluation.

From inspection of existing design documents, this could be accomplished with minimal impact on the existing installed system.

The following would require upgrading.

1. Replace existing exhaust Fan (F-32), with a 3/4 hp, 120 vac, 1 phase, 3710 cfm wall exhaust fan. See Attachment 2.

2. The primary side fuse protection (2 amp) to the control transformer would have to be increased. The preliminary indication would be to use a 10 amp fuse. The fuse block is rated at 30 amp and does not require changing. See EA-RFI-CG-34-01, page 24.

3. The existing 1.0 kva transformer would require upgrading to a 2.0 kva 480/120 vac. See EA-RFI-CG-34-01, page 24.

4. The secondary side fuse protection (6 amp at 120vac) would have to be increased to at least 20 amp. The existing fuse block has capacity to 30 amp and is adequate. See EA-RFI-CG-34-01, page 24.

5. The existing power and control wiring has ample capacity to accommodate the new fan and existing motor damper and does not need to be replaced.

6. Revise SOP-25, Section 6.6 and 6.6.1 to more accurately clarify the intent of the alternate ventilation for the EDG Room.

Along with the changes recommended above, it should be noted even though the existing exhaust fan is undersized, the capacity provided by the alternate ventilation has more than adequate capacity to provide the necessary ventilation for the EDG.

TELEPHONE LOG

NAME T. Sikavitsas

DATE September 3, 1992

TIME 10:15 AM

(TO)/FROM D. Piellegata PHONE 313-347-7050

OF Michigan Tractor & Machinery Co (Caterpillar Dealer)

CITY-STATE Novi, Michigan

PERTINENT INFORMATION Requested Information Regarding Heat Radiated From D-343 Diesel Generator Set. Request From Mr. Piellegata The Following:

1. Heat Radiated From Engine
   Response — 1750 BTU/MIN
2. Heat Dissipated From Generator
   Response — 906 BTU/MIN
3. Exhaust Gas Temperature
   Response — 810°F
4. Combustion Air Intake Required
   Response — 696 CFM

All The Above Figures Are Based On Full Load

A TTACHMENT 2 1/3

DynaMaster Fans

High capacity fans for low or high pressure ventilating requirements.

TWO DESIGNS TO FIT ALL INDUSTRIAL OR COMMERCIAL APPLICATIONS

Recommended for use in:

foundries	libraries
garages	lobbies
laboratories	restaurants
paper mills	banks
breweries	schools
packing plants	locker rooms
factories	offices
equipment rooms	hallways
hospitals	bowling alleys
shops	gyms
kitchens	auditoriums
chapels	shopping malls
exercise rooms	stores

FN FANS

These fans are designed to operate at up to 1" static pressure with capacities to 35,930 CFM. Available in 9 sizes, 14" thru 48" these heavy duty fans are designed for industrial type applications where extra strength and durability are desired.

Fan panels are constructed of steel and range from 18 to 14 gauge.

Aluminum blade thickness is from .080 to .125.

HIGH PRESSURE PROPELLERS

For increased pressure requirements FN propellers, depending on size and horsepower, have four or six, tapered, circular-arc airfoil blades. Standard construction is all welded heavy duty aluminum that is precision balanced. Non-overloading design prevents motor overload when operated within cataloged static pressure ranges. Optional steel prop is available for all FN fans, except size 48".

FQ FANS

These fans are designed to operate more quietly than conventional propeller fans and are recommended for ventilating applications desiring less fan noise.

Available in 10 sizes, 9" thru 36" with a maximum capacity of 17,800 CFM.

Fan panels are constructed of steel and range from 18 to 16 gauge.

Aluminum blade thickness is from .050 to .125.

ADVANCED PROPELLER DESIGN

These propellers feature an advanced tear-drop shape blade designed for exceptionally low noise level performance.

Aluminum blades are fastened to a formed steel hub with heavy duty oversize rivets. Propeller is precision balanced for smooth vibrationless operation.

The swept-back tear drop blade shape with its aerodynamic leading edge propels the air through the streamlined orifice with a minimum of air turbulence.

FQ not available with steel propeller.

CERTIFIED RATINGS FOR SOUND AND AIR

Acme Engineering and Manufacturing Corporation certifies that the Dynamaster fans shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests made made in accordance with AMCA Standard 210 and AMCA Standard 300 and comply with the requirements of the AMCA Certified Ratings Program.

Performance shown is for units without ducts.

The sound power level ratings shown are in decibels referred to 10^{-12} watt. The sound ratings shown were obtained in accordance with AMCA Standard 300 test setup No. 2-C. The sound power A weighted levels Lw (A) were calculated in accordance with AMCA Standard 301. Values shown are the sound power levels at the fan inlet, A weighted. The loudness values in sones at a distance of 5 feet were calculated in accordance with AMCA Standard 301.

THREE DIFFERENT FORMS OF CERTIFIED SOUND RATINGS

The application of sound ratings to various fan installations produce different sound rating requirements. Also, some engineers have preferences for the type of sound rating they want to use. For these reasons, Acme has provided three different sound rating values for the noise produced by each fan. They are shown in the following values.

DECIBELS – this is the sound power level in decibels (db) for each of the 8 octave bands to the reference power of 10^{-12} watt.

Lw (A) – is an A weighted sound power level in decibels.

SONES – is a single number sound rating value.

This complete certified sound rating data is available in Bulletin 54.

Most Acme Dynamasters are listed by the Canadian Standards Association Testing Laboratory as approved.

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918 682-7791

Attachment – 2 2/3

DynaMaster Performance

Performance is for units without ducts.

FAN MODEL	RPM	TIP SPEED FPM	HP	SONES	CFM vs STATIC PRESSURE .000''	.100''	.125''	.250''	.375''	.500''	.625''	.750''	.875''	1.000''	* MAX BHP	FAN SHIP WT.	TYPE SHUTTER
FQ09LO	1600	3435	1/20	8	450	356										15	Std.
FQ09HI	1650	3780	1/10	10	500	410	385								.170	15	Std.
FQ108LO	1500	3925	1/20	6	620	530	505									17	Std.
FQ108HI	1650	4320	1/10	6	688	600	580								.1120	17	Std.
FQ1210LO	980	3030	1/20	4	870	645	565								.027	27	Std.
FQ1210HI	1060	3280	1/20	4	940	750	685								.034	27	Std.
FQ129LO	1350	4180	1/6	5	1200	1075	1030								.069	27	Std.
FQ129HI	1550	4795	1/6	6	1380	1280	1245	1030							.105	27	Std.
FQ1204	1760	5445	1/4	8	1565	1475	1450	1295	1090						.158	29	Std.
FQ1408	1150	4150	1/6	7	1625	1440	1375								.100	32	Std.
FQ14F4	1760	6295	1/3	14	2460	2360	2350	2170	1940						.263	36	Hvy.
FN14D4	1760	6450	1/6	14	1880	1780	1750	1600	1430						.108	52	Std.
FN14E4	1780	6450	1/3	14	2160	2050	2020	1850	1640	1300	985	780			.300	35	Std.
FQ1606	1160	4800	1/4	8	2180	2020	1960	1620							.148	37	Std.
FQ16F4-2	1760	7280	1/4	16	2580	2490	2450	2320	2150	1850					.290	40	Std.
FQ16H4	1760	7280	3/4	17	3710	3600	3570	3430	3240	3010	2770				.585	40	Hvy.
FN16F4	1760	7370	1/4	17	3200	3080	2980	2740	2480	2170	1500	1390			.293	36	Std.
FQ18H6	1160	5505	1/4	8	3210	2960	2890	2500							.253	40	Std.
FQ1908	1180	5605	1/2	12	4030	3720	3640	3300	2730						.470	48	Hvy.
FQ19H4	1760	8350	3/4	17	4870	4720	4670	4450	4220	3950	3700	3360			.870	48	Hvy.
FN18G4	1760	8290	3/4	21	4170	4000	3960	3760	3520	3250	2960	2620	2040		.571	33	Std.
FQ21G6-2	1160	6325	1/2	13	5250	5020	4950	4550	4080						.610	83	Hvy.
FQ21K4	1760	9585	1½	24	6750	6570	6530	6300	6050	5780	5490	5180	4700		1.510	81	Hvy.
FN21J4	1760	9670	1	30	6530	6150	6100	5680	5600	5320	5020	4580	4290	3800	1.089	98	Hvy.
FN21K4	1760	9670	1½	30	8150	7930	7980	7590	7250	6880	6440	5840			1.712	82	Hvy.
FQ24F8	860	5430	1/2	10	5550	5110	4990	4200							.389	93	Std.
FQ24G6	1160	7325	3/4	14	7140	6820	6750	6250	5660	4850					.882	93	Hvy.
FQ24J6	1160	7290	1	23	8150	7750	7650	7080	6360						.980	121	Hvy.
FN24J4	1760	11050	1	39	6420	6220	6180	5860	5700	5450	5170	4670	4530	4180	1.070	85	Hvy.
FN24L4	1760	11050	2	40	9590	9400	9360	9110	8870	8590	8210	7960	7800	7200	2.100	99	Hvy.
FQ30H8	860	6700	3/4	18	8960	8310	8150	7330	6380						.830	132	Std.
FQ30K8	860	6730	1½	14	11600	10870	10800	9950	9000						1.370	158	Hvy.
FQ30M6	1160	9035	3	21	15100	14880	14570	13880	13330	12610	11900	11130			3.000	174	Hvy.
FN30L6	1160	9110	2	30	12450	12100	12000	11500	10900	10300	9580	8720	7780	6600	1.96	175	Hvy.
FN30M6	1160	9110	3	31	16040	15600	15420	14750	14000	13150	12050				3.03	215	Hvy.
FQ36K8	860	8020	1½	21	14450	13800	13620	12580	11570						1.640	197	Hvy.
FQ36L8	860	8020	2	22	17800	17000	16800	15800	14700	13300					2.420	203	Hvy.
FN36K8	860	8100	1½	27	13160	12850	12520	11800	10950	9900	8500	6600	5290	4000	1.68	198	Std.
FN36L6	1160	10930	2	43	14280	13920	13820	13300	12700	12050	11400	10700	10000		2.25	204	Hvy.
FN36M6	1160	10930	3	43	17740	17350	17270	16780	16200	15600	15000	14300			3.14	244	Hvy.
FN42K8	860	9456	1½	32	17560	16700	16340	14970							1.80	212	Std.
FN42L8	860	9456	2	35	19400	18600	18220	16980							2.26	222	Hvy.
FN42M8	860	9456	3	43	22320	21650	21450	20480	19000	16250					3.45	290	Hvy.
FN48K8	860	10800	1½	36	17120	15900	15530	13950	12400	10540	9025	7420	6000	4300	1.71	223	Std.
FN48L8	860	10800	2	38	19340	18200	17930	16650	15050	13380	11630	9900	8240	6840	2.19	233	Std.
FN48M8	860	10800	3	41	22400	21600	21440	20380	18940	17170	15280	13110	11285	10090	3.01	241	Hvy.

Model numbers shown are for Exhaust Fans with standard direction of air flow (motor on intake side of propeller.) To order Supply Fans with direction of air flow reversed (motor on discharge side of propeller) add letter "R" to end of model number.

[illegible]

*The brake horsepower capability of a fan motor is dependent on the degree of cooling the motor receives from the moving air stream over the motor. The motor loading beyond the motor name plate rating on Acme built fans does not overheat the motor and is within NEMA recommended limits. It is therefore not detrimental to the motor and is economically desirable.

ATTACHMENT 2 4/3

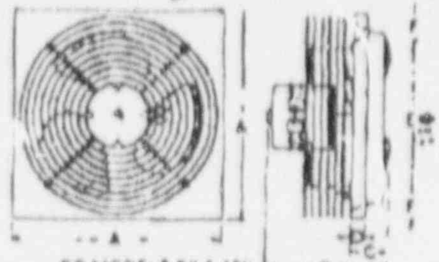
Dimensional Information

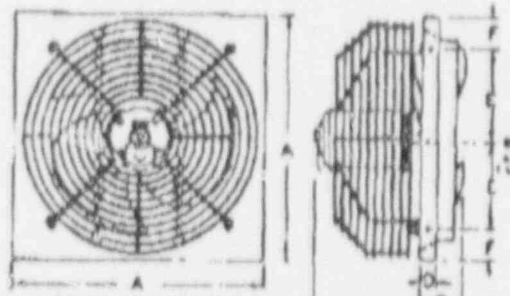
DIMENSIONS FOR EXHAUST FANS

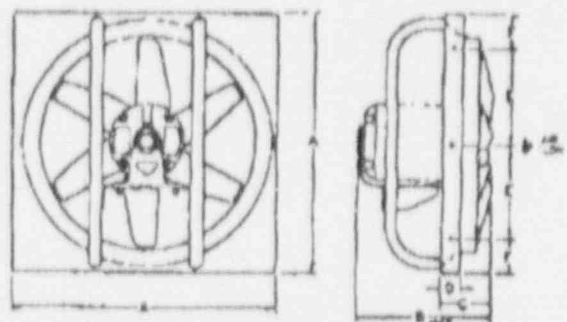
FAN SIZE	A	B MAX	C	D	E■	F	METAL GAUGES ORIFICE	METAL GAUGES BLADES
FO9	12"	5½"	1½"	1½"	8"	2"	18	.060"
FO10	14"	7"	3"	1½"	10"	2"	18	.050"
FO12	16"	13½"	4"	1½"	10"	3"	18	.063"
FO14	18"	16"	4½"	1½"	10"	4"	18	.080"
FN14	18"	11"	3½"	1½"	10"	4"	18	.080"
FO16	21"	15¼"	5"	1½"	8"	2½"	18	.080"
FN16	21"	12"	4"	1½"	8"	2½"	18	.080"
FO18	23"	19"	6½"	1½"	9"	2½"	18	.080"
FN18	23"	13"	4½"	1½"	9"	2½"	18	.080"
FO21	26½"	17½"	6"	1½"	10"	3½"	18	.080"
FN21	26½"	16"	5"	1½"	10"	3½"	16	.080"
FO24	30"	20"	6½"	1½"	8"	3"	16	.080"
FN24	30"	17½"	8"	1½"	8"	3"	16	.125"
FO30	37½"	22½"	7½"	1½"	10"	3½"	16	.125"
FN30	37½"	20"	8"	1½"	10"	3½"	16	.125"
FO36	45"	24½"	8"	1½"	12"	4½"	16	.125"
FN36	45"	20"	9"	1½"	12"	4½"	16	.125"
FN42	60"	24"	2½"	3 1/16"	15"	7½"	14	.125"
FN48	64"	25½"	3"	3 1/16"	16"	8"	14	.125"

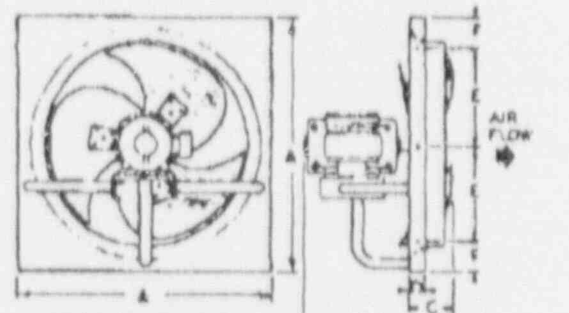
DIMENSIONS FOR SUPPLY FANS

FAN SIZE	A	B MAX	C	D	E■	F	METAL GAUGES ORIFICE	METAL GAUGES BLADES
FO12	16"	14½"	2½"	1½"	10"	3"	18	.063"
FO14	18"	16½"	3½"	1½"	10"	4"	18	.080"
FN14	18"	13½"	1½"	1½"	10"	4"	18	.080"
FO16	21"	20"	4½"	1½"	8"	2½"	18	.080"
FN16	21"	17"	1½"	1½"	8"	2½"	18	.080"
FO18	23"	[illegible]	4"	1¼"	9"	2½"	18	.080"
FN18	23"	19"	1½"	1½"	9"	2½"	18	.080"
FO21	26½"	22"	2½"	1½"	10"	3½"	16	.080"
FN21	26½"	22"	1½"	1½"	10"	3½"	16	.080"
FO24	30"	21"	1½"	1½"	8"	3"	16	.080"
FN24	30"	25"	1½"	1½"	8"	3"	16	.125"
FO30	37½"	25"	4½"	1½"	10"	3½"	16	.125"
FN30	37½"	30"	1½"	1½"	10"	3½"	16	.125"
FO36	45"	25½"	5"	1½"	12"	4½"	16	.125"
FN36	45"	30"	1½"	1½"	12"	4½"	16	.125"
FN42	60"	30½"	2"	3 1/16"	15"	7½"	14	.125"
FN48	64"	32½"	2½"	3 1/16"	18"	8"	14	.125"

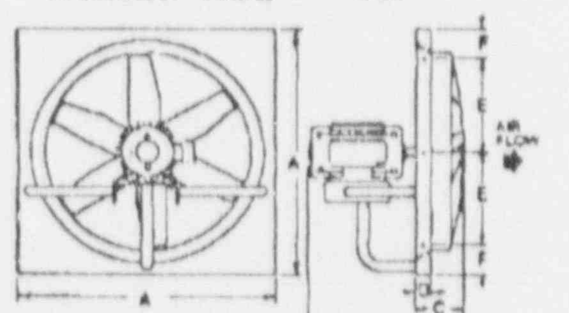

FO MODELS 9" & 10"


FO MODELS 12" THRU 18"
(Back Guard optional)


FN MODELS 14" THRU 18"

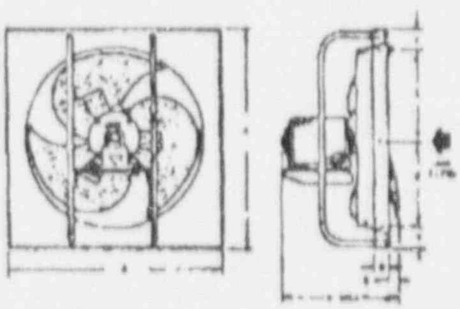


FO MODELS 21" THRU 36"

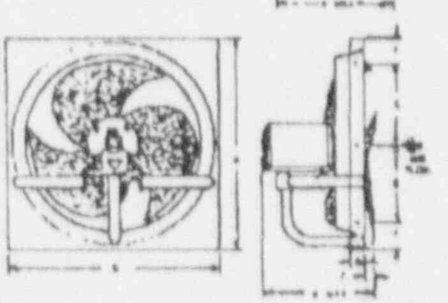


FN MODELS 21" THRU 48"

SUPPLY MODELS FO12" THRU 18" AND FN14" THRU 18"



SUPPLY MODELS FO21" THRU 36" AND FN21" THRU 48"



These are typical drawings for dimensional purposes only, which are correct within limits suitable for normal installation requirements and do not necessarily show actual construction.

■ FO9 thru FN14 - 2 Holes. FO16 thru FN21 - 3 Holes. FO24 thru FN48 - 4 Holes

ATTACHMENT-3 1/1

TELEPHONE LOG

NAME T. SIKAVITSAS

DATE SEPTEMBER, 8, & 9, 1992

TIME 9:10 AM

(TO)/FROM D. KAHLBAUM PHONE 517-788-1934

OF CPCo ENVIRONMENTAL DEPARTMENT

CITY-STATE JACKSON, MI

PERTINENT INFORMATION REQUESTED INFORMATION FROM MR KAHLBAUM REGARDING THE SEASONAL AND ANNUAL WIND SPEEDS RECORDED FOR BRP. THE FOLLOWING DATA PROVIDED FROM MR KAHLBAUM IS ACTUAL DATA FROM THE BRP-SITE FROM 1985 TRHU 1991. THE DATA IS IN AVERAGE SPEED/SEASON FROM THE YEARS OF DATA STATED ABOVE

AVG WINTER	AVG SPRING	AVG SUM	AVG FALL
18.6 M/HR	14.7 M/HR	12.6 M/HR	17.4 M/HR

AND AVG ANNUAL 15.8 M/HR