Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

COPY

October 24, 1980

Director, Nuclear Reactor Regulation
Att Mr Dennis M Crutchfield, Chief
Operating Reactors Branch No 5
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 -
BIG ROCK POINT PLANT - VENTILATION
VALVE QUALIFICATION PROGRAM FOR
CONTAINMENT PURGING AND VENTING
DURING NORMAL OPERATION

NRC letter dated September 27, 1979 requested Consumers Power Company to commit to implement a valve qualification program on an expedited basis and provided guidelines to be used as the basis for the qualification program. Consumers Power Company inadvertently failed to respond to the Commission's letter but did proceed with the requested valve qualification program at that time.

The Big Rock Point containment design requires frequent personnel entries during operation to conduct activities as specified in our submittal dated December 17, 1979. Therefore, the ventilation system was designed for continuous ventilation to provide the containment atmospheric control necessary for personnel entry during operation. Continuous ventilation results in the ventilation valves being open during reactor operation and subjects them to the possibility of DBA-LOCA forces being dynamically applied during required closure. The original purchase specifications for the ventilation valves only included static differential pressure requirements; therefore, valve qualification for dynamic closure as requested by NRC letter dated September 27, 1979 was required.

Big Rock Point's containment ventilation system uses two types of valves for containment isolation and vacuum relief functions. Butterfly and swing-check valves manufactured by Allis-Chalmers and Atwood-Morrill, respectively are provided for both the inlet and exhaust penetrations of the ventilation system. The butterfly valves (CV 4095 and CV 4097) function as primary isolation valves during accident conditions with containment isolation redundancy provided by the swing-check valves (CV 4094 and CV 4096). The attached drawing, number 0740G40125 Rev. R, shows the system configuration with the isolation valves exterior to the containment structure.

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Consumers Power Company contracted both Allis-Chalmers and Atwood-Morrill (supplemented by MPR Associates) to perform analyses of their respective valves. The following considerations were made in the analyses:

1) Both types of valves use valve operators that open with air pressure and close by use of a spring internal to the operator. Therefore, valve closure during accident conditions has an increasing rate of closure due to the spring force and ΔP across the valve.

2) The flow direction during accident conditions thru the valves is such that closure is added. In the case of the butterfly valves, a slight tilt of the disc in the direction of closure is required to assure closure in the correct direction.

3) Each valve analysis considers failure in the open position of the other valve in the train as the worst case for valve closure (ie, this assumption provides maximum ΔP across the valve being analyzed).

4) Operator pilot air is vented outside of containment; therefore, containment back pressure effects on the operators are not applicable.

5) Valve closure is dependent on spring force and not air actuators; therefore, no accumulators are used in the system.

6) Torque limiting devices are not used on the valve operators.

7) The effect of piping systems was modeled by Allis-Chalmers for butterfly valves for their bench testing program. This data was then applied to the Big Rock Point butterfly valves assuming the full containment accident pressure acts on the valves. In analyzing the swing-check valves, MPR Associates modeled the Big Rock Point piping system in order to generate the closing velocity of the disc during the DBA-LOCA.

8) The effect of butterfly valve disc and shaft orientation to the fluid egressing from the containment was addressed in the Allis-Chalmers bench testing program.

Allis-Chalmers demonstrated the operability of the butterfly valves by performing a bench testing program on a similarly designed valve and extrapolating the data to the Big Rock Point valves. Results of the bench testing program were provided by Allis-Chalmers report VER-0209, dated December 17, 1979. Extrapolation of this data to the Big Rock Point valves was provided by Allis-Chalmers letter to Consumers Power Company dated March 14, 1980 which recommended an opening angle of between 80° - 85° for CV-4095 (replacement valve) and 75° for CV-4097 (original valve) due to shaft torque limitations. Therefore, as reported in update to LER 79-028 dated August 4, 1980, the two butterfly valves have been mechanically restricted to an opening angle of 75° to assure operability during DBA-LOCA conditions.

Atwood-Morrill and MPR Associates Inc were contracted during November 1979 to perform an expedited qualification program for the swing-check valves. MPR performed an analysis to develop the maximum disc closing velocity under DBA-LOCA conditions. This analysis resulted in the identification of an overpressure condition in the air operator resulting from the rapid closure of the valve. This condition was identified by LER 80-013 dated May 23, 1980. Calculations were performed by MPR to determine an acceptable opening (15°) for the valve and modifications to the air operator which would make full opening of the valve acceptable. The valve was mechanically limited to the interim opening criteria until modifications to the air operator cylinder could be made. Revision 1 to MPR report MPR-644, dated June 1980 provides the results of their original analysis and the additional analyses to determine acceptable interim opening and the effect of the modified air operator cylinder (increased volume by three (3) inch extension of cylinder). Concurrently with the MPR effort, Atwood-Morrill developed the maximum closing velocity that the valve and operator could withstand. This effort was subcontracted by Atwood-Morrill to John Henry Associates, Inc. The analysis identified the same overpressure condition in the air operator and developed a maximum acceptable disc closing velocity that was greater than the maximum disc closing velocity calculated by MPR indicating that structural integrity of the valve was assured during DBA-LOCA conditions. Technical review of Atwood-Morrill/John Henry Associates analysis has revealed areas in their analysis that required additional work, specifically the plastic deformation noted in the disc and disc arm. This additional work is currently proceeding with completion anticipated by March, 1980. It should be noted that MPR and Atwood-Morrill/John Henry Associates do not expect the additional analyses to disclose any additional problems with respect to valve integrity.

The current opening positions for the butterfly and swing-check valves are 75° (full open - 90°) and 45° (full open - 45°) respectively as reported in the update to LER's 79-028 and 80-013 dated August 4, 1980

As requested by the staff, Consumers Power Company is sending six (6) copies of each of the following documents considered to be in final form to the Director, Nuclear Reactor Regulation with this submittal:

1) Allis-Chalmers Report VER-0209, "Test Report on an Allis-Chalmers 6" STREAMSEAL Butterfly Valve in Air concerning Nuclear Containment Isolation Valves", dated December 19, 1979.

2) Allis-Chalmers (Kopey) to Consumers Power Company (Monshor and Hartman), letter dated March 14, 1980.

3) MPR Associates, Inc Report MPR-644 Revision 1, "Big Rock Point Nuclear Power Plant- Disc Impact Velocity For Containment Ventilation System Check Valve Closure", dated February 1980 and Revised June 1980.

Upon completion of the additional analyses for the swing-check valves, the revised Atwood-Morrill/John Henry Associates Inc analysis will be submitted for the staff's review.

David P Hoffman (Signed)

David P Hoffman
Nuclear Licensing Administrator

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

Attachment

ALLIS-CHALMERS
BOX M-93 • YORK, PENNSYLVANIA 17405/717-848-1126

YORK PLANT
VALVE DIVISION

pg. 1 of 6

March 14, 1980

Larry Monshor and C. J. Hartman
Consumers Power Co.
Big Rock Point Nuclear Plant
Charlevoix, MI 49720

SUBJECT: Allis-Chalmers Containment Purge Valves

REFERENCE: Consumers Power P.O. 60904-Q

Gentlemen:

Thank you for your purchase order.

Included with this letter are two sets of documentation. The notebook details the overall test program and with the aid of the charts and graphs one should be able to predict the dynamic torque of any similarly constructed Allis-Chalmers valve.

The other package, which is four pages long, specifically addresses your valves, and a closer look will show that we have modified our initial recommendations.

Briefly, here's what the data shows.

CV-4095

Originally we recommended that this valve be limited to 45° open because at this angle the dynamic torque begins to exceed the operator output torque. Nothing has changed in this regard, however a more detailed analysis of the test data shows that during a DBE, the fluid flow through the line will by itself tend to close the valve. The effect is so pronounced that an opening angle of between 80°-85° is now acceptable.

At these angles, the dynamic torque even though beyond the capabilities of the operator in magnitide, will actually cause the valve to close faster during a DBE than if the line velocity were zero. Nowhere do the dynamic torques exceed operator rated capacity. (Operator structural integrity is not a factor).

5/pmm/0524

CV-4097

This valve as previously recommended should be limited to 75° open because of shaft torque limitations.

We sincerely hope that these new results will help your containment purging problems.

As always, please call me if you have any questions.

Sincerely,

Theodore Kopey, Jr.

Theodore Kopey, Jr.
Application Engineer

TK/pmm

cc: John Popa, Consumers Power
Larry Retters, Consumers Power
Frank Anderson, A-C York

5/pmm/7864

CUSTOMER: CONSUMERS POWER / BIG ROCK PT.

DATE: 3-13-80

SHEET OF

SUBJECT: OPERATING TORQUES - VALVE CV 4095 - TORQUE - EXHAUST

PRELIM.

FINAL ✓

DRAWING NUMBER

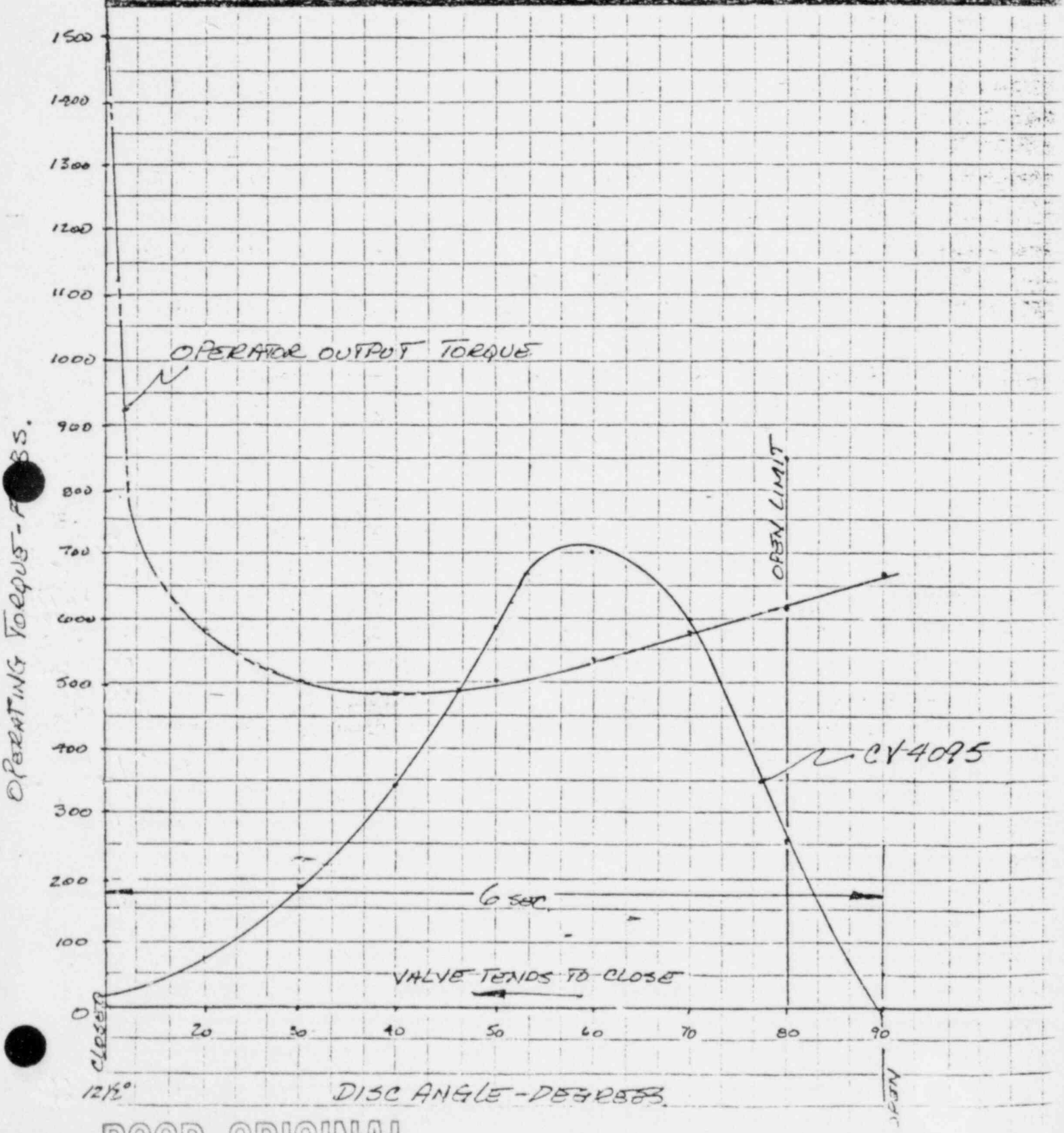
LITHO IN U.S.A. - A-C

ENGINEERING CALCULATION SHEET

ALLIS-CHALMERS

FORM 6715-1

CALCULATED BY: P.R. SCHWARZ
R. Gridus 3/13/80



CUSTOMER: CONSUMERS POWER | DATE: 1-4-80 | SHEET 1 OF 2

SUBJECT: BIG ROCK POINT. | PRELIM. | FINAL X

DRAWING NUMBER

ENGINEERING CALCULATION SHEET

LITHO IN U.S.A.-A-C

ALLIS-CHALMERS FORM 6715-1

CALCULATED BY: R.J. 3/13 P. SCHWARZ

VALVE NO. CV 4095 - 24" BFV - EXHAUST.

$t/d = .125$

"GADEN - TYPE A · 77½°

SHAFT, IN PLANE

SHAFT ϕ - 2.25"

SHAFT CAP: 1550 #.

ΔP_{MAX} = 23.3 PSIG.

°OPEN	ΔP	C_v	T_d #	T_o #	T_{od} #	OPER CAP. #
90	3.95	—	288			665
80	7.45	4.75	283	-30	253	620
70	11.85	6.80	642	-46	596	573
60	15.55	6.12	761	-61	700	532
50	18.55	4.46	662	-73.3	589	502
OPER. 45° LIMIT						
40	20.35	2.60	423	-80.4	343	488
30	21.20	1.58	268	-84.0	184	500
20	21.90	.86	151	-84.0	67	578
12½ - CLOSED.	--					+1644
10	21.90	.58	102	-84.0	18	
0	21.90					

CUSTOMER: CONSUMERS POWER / BIG ROCK POINT | DATE: 3-15-80 | SHEET OF

SUBJECT: OPERATING TORQUES - VALVE CV4097 FORGE INLET | PRELIM. | FINAL ✓

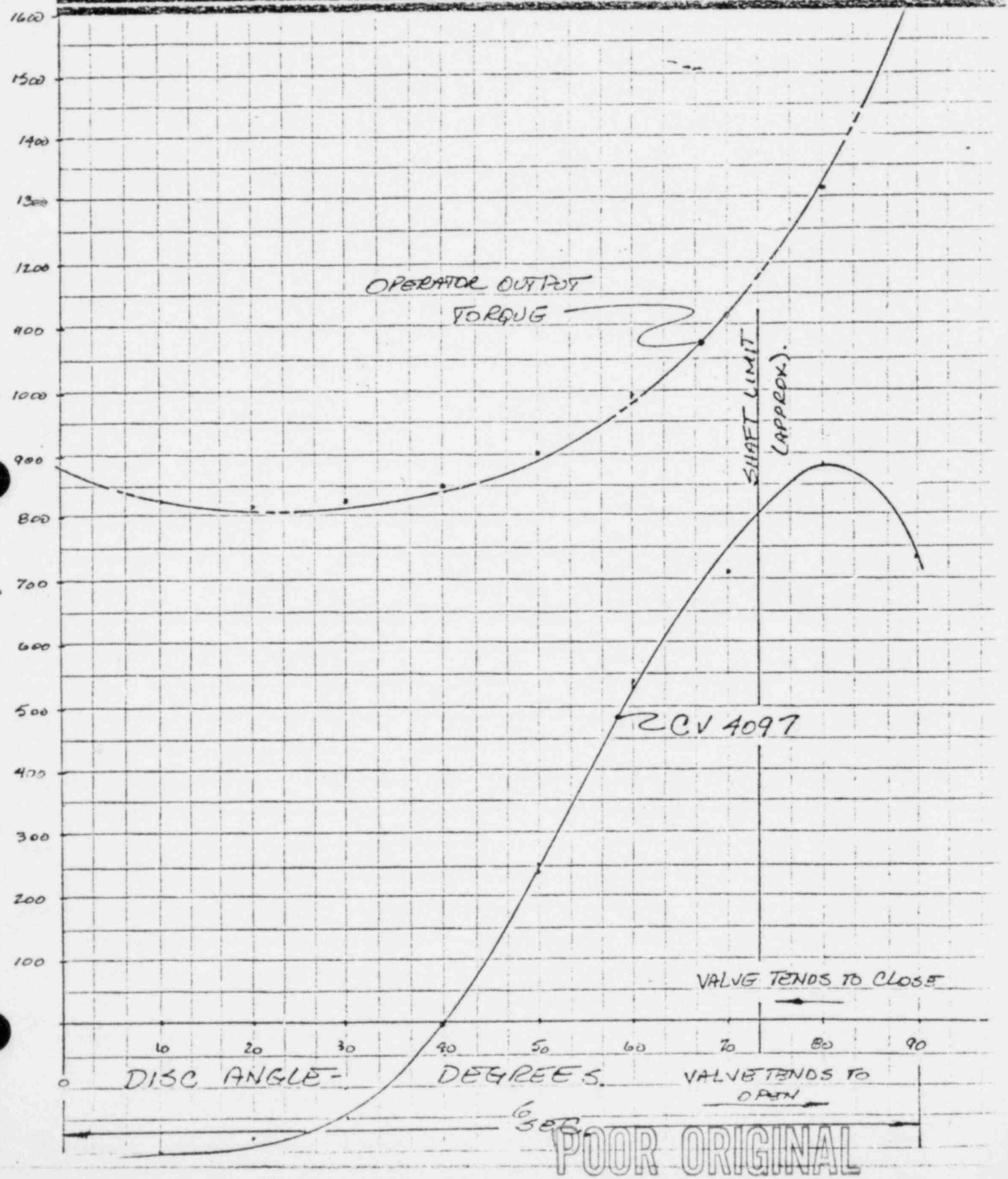
DRAWING NUMBER

LITHO IN U.S.A. - A-C

ENGINEERING CALCULATION SHEET

ALLIS-CHALMERS FORM 6715-1

CALCULATED BY: P.R. SCHWARZ
R. Zickus 3/13/80



6 SEC

CUSTOMER: CONSUMERS POWER | DATE: 1-4-80 | SHEET 2 OF 2

SUBJECT: BIG ROCK POINT | PRELIM. | FINAL

DRAWING NUMBER

LITHO IN U.S.A.—A-C

ENGINEERING CALCULATION SHEET

ALLIS-CHALMERS FORM 6715-1

CALCULATED BY: P. SCHWARZ RJS 3/13

NO* 4097-

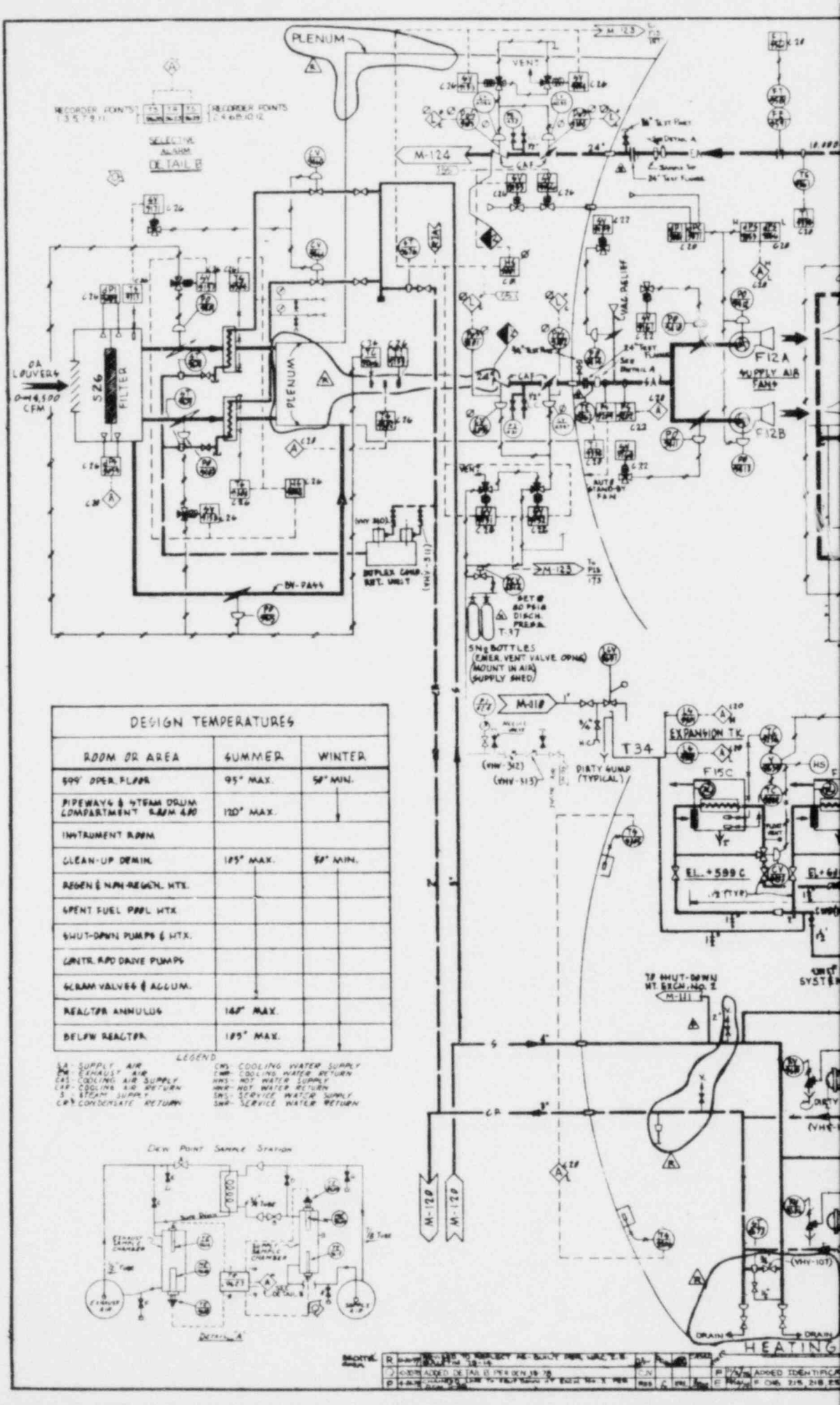
t/d = .125 OFFSET DISC - TEST #26.

SHAFT IN PLANE SHAFT CAP: 720 '#.

SHAFT ϕ - 1.75"

°OPEN	ΔP	C_T	Td '#	T_b '#	T_d '#	OPER CAP. '#
90	3.95	23.6	746	-15.6	730	1652
80	7.45	15.1	900	-29.4	871	1319
70	11.85	8.0	758	-46.8	711	1117
60	15.55	4.75	591	-61.4	530	988
50	18.55	2.15	319	-73.8	245	905
40	20.35	.45	74	-80.4	-6.4	854
30	21.20	-.37	-63	-83.7	-147	826
20	21.90	-.51	-89	-86.5	-176	816
10	21.90	-.69	-121	-86.5	-208	820
0	21.90	-1.6	-280	-86.5	-367	

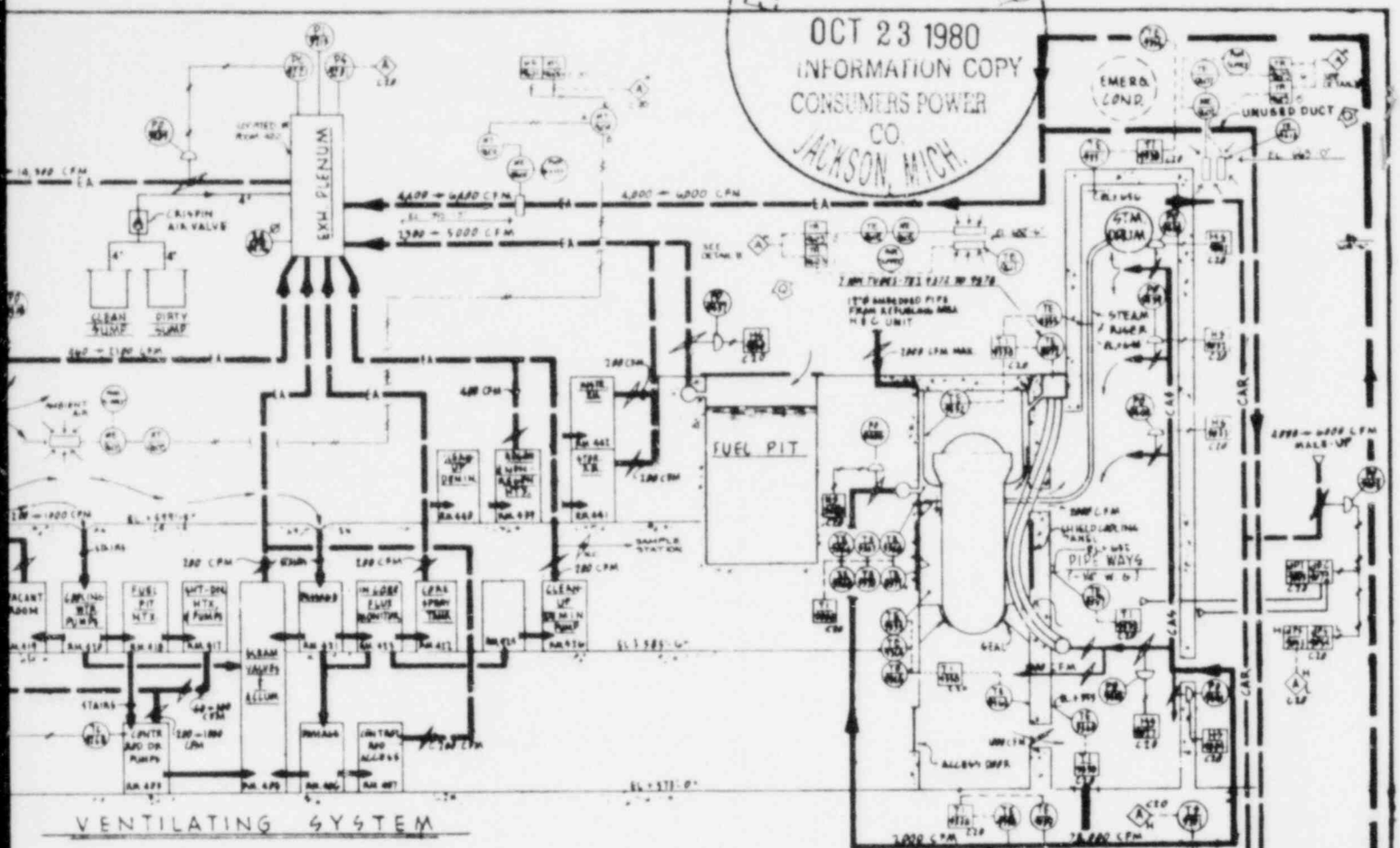
SHAFT ?

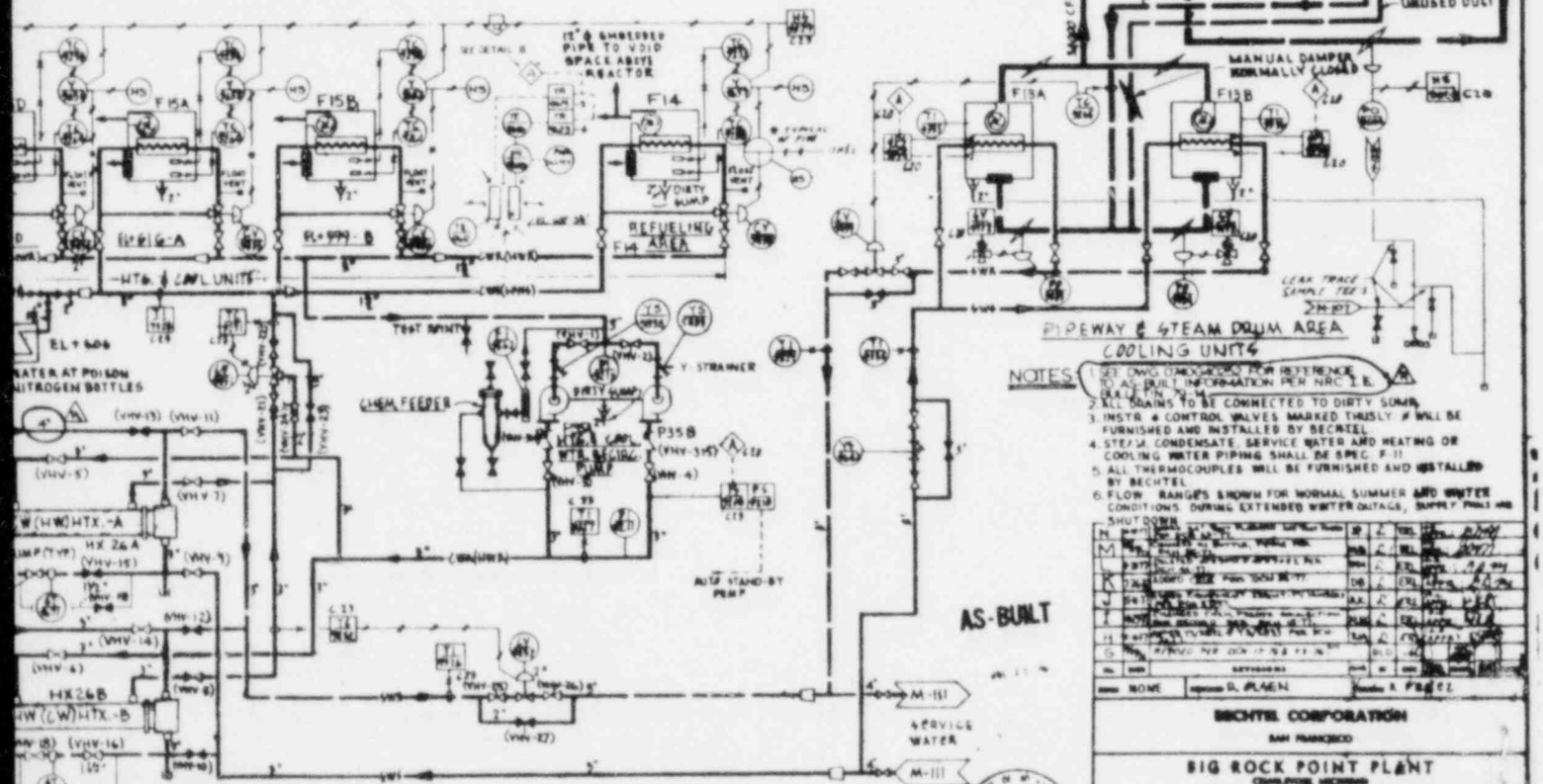


DESIGN TEMPERATURES		
ROOM OR AREA	SUMMER	WINTER
599' OPER. FLOOR	95° MAX.	50° MIN.
PIPEWAYS & STEAM DRUM COMPARTMENT ELEV. 630	120° MAX.	
INSTRUMENT ROOM		
CLEAN-UP DEMIN.	105° MAX.	50° MIN.
REGEN & NON-REGEN. HTX.		
SPENT FUEL POOL HTX.		
SHUT-DOWN PUMPS & HTX.		
CONTR. ROD DRIVE PUMPS		
SCRAM VALVES & ACCUM.		
REACTOR ANNULUS	160° MAX.	
BELOW REACTOR	105° MAX.	

LEGEND

SA: SUPPLY AIR
EA: EXHAUST AIR
CAS: COOLING AIR SUPPLY
CAR: COOLING AIR RETURN
S: STEAM SUPPLY
CR: CONDENSATE RETURN
CWS: COOLING WATER SUPPLY
CWR: COOLING WATER RETURN
HWS: HOT WATER SUPPLY
HWR: HOT WATER RETURN
SWS: SERVICE WATER SUPPLY
SWR: SERVICE WATER RETURN





NOTES
1. SEE DWG G-190-2003 FOR REFERENCE TO AS-BUILT INFORMATION PER NRC I.E. BULLETIN 79-14.
2. ALL DRAINS TO BE CONNECTED TO DIRTY SUMP.
3. INSTR. & CONTROL VALVES MARKED THUSLY # WILL BE FURNISHED AND INSTALLED BY BECHTEL.
4. STEAM, CONDENSATE, SERVICE WATER AND HEATING OR COOLING WATER PIPING SHALL BE SPEC. F-11.
5. ALL THERMOCOUPLES WILL BE FURNISHED AND INSTALLED BY BECHTEL.
6. FLOW RANGES SHOWN FOR NORMAL SUMMER AND WINTER CONDITIONS DURING EXTENDED WINTER OUTAGE, SUMPLY PUMPS ARE SHUT DOWN.

NO.	REVISION	BY	CHK	APP	DATE
N					
M					
K					
J					
H					
G					

NO.	REVISION	BY	CHK	APP	DATE
C	REVISED PER FIELD CHANGES				
B	REVISED TO DATE				
A	PER DWG # CHANGES				

APPROVED
FOR CONSTRUCTION

& COOLING SYSTEM PIPING

BECHTEL CORPORATION
SAN FRANCISCO

BIG ROCK POINT PLANT
CHARLEVOIX, MICHIGAN
CONSUMERS POWER COMPANY

REACTOR BUILDING
VENTILATING, HEATING & COOLING SYSTEM
P & I DIAGRAMS

BECHTEL	3159	M-128	R

8010290287