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John C. Brons
Executive Vice President
Nuclear Generation

January 19, 1989
IPN-89-006

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

Subject: Indian Point 3 Nuclear Power Plant
Docket No. 50-286
Turbine Disc Inspection

References:

1. Letter from Mr. J. C. Brons to the NRC, dated June 3, 1988 entitled: "Turbine Disc Inspection."
2. Letter from Mr. J. D. Neighbors to Mr. J. C. Brons, dated February 25, 1987.
3. Letter from Mr. J. C. Brons to Mr. S. A. Varga, dated May 9, 1986 entitled: "Turbine Disc Inspection Schedule."
4. Letter from Mr. J. C. Brons to Mr. S. A. Varga, dated October 31, 1986 entitled: "Turbine Disc Inspection Schedule."
5. Letter from Mr. J. Kern (Westinghouse) to Mr. K. Chapple (NYPA), dated November 22, 1988, entitled: "Low Pressure Turbine Rotors Heavy Disc Inspection Interval."

Dear Sir:

References 3 and 4 requested an extension of the Indian Point 3 (IP-3) turbine disc inspection schedule to an interval equivalent to five years of turbine operation. Reference 2 concluded, based on the information presented in References 3 and 4 that inspection intervals of three years for low pressure turbine rotors LP-1 and LP-3 and five years for low pressure turbine rotor LP-2 were appropriate. Reference 1 provided the latest information regarding the low pressure turbines' probability of missile generation (P1 values). The purpose of this letter is to request relief from inspecting low pressure turbine rotors LP-1 and LP-3 prior to the Cycle 7/8 Refueling Outage.

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1/1

The NRC approved turbine system reliability criteria was provided in Reference 2. This criteria states that if Pl is greater than 10^{-5} but less than 10^{-4}, the turbine may be kept in service until the next scheduled outage. During the outage the licensee is to take action to reduce Pl to meet the appropriate criterion of Pl less than 10^{-5} before returning the turbine to service. Reference 1 included a graphical representation of the Pl values for low pressure turbine rotors LP-1, LP-2 and LP-3. For convenience this graph is included as Attachment I. The graph shows that Pl will not exceed 10^{-5} until after approximately two (2) years and two (2) months of operation for LP-1 and LP-3 and after approximately four (4) years and two (2) months of operation for LP-2. Pl will not exceed 10^{-4} until after approximately five (5) years and three (3) months of operation for LP-2 and approximately three (3) years and three (3) months of operation for LP-1 and LP-3.

Attachment II is a time sequence which shows preliminary dates for upcoming IP-3 outages as well as the dates when the turbine system reliability criteria will be exceeded. This time sequence begins at the start-up date for Cycle 5/6 and ends at the date when Pl for LP-1 and LP-3 exceed 10^{-4}. This time sequence shows that LP-1 and LP-3 will exceed 10^{-5} approximately April, 1990 (two years and two months of operation after the start of Cycle 5/6). Therefore, in accordance with the turbine system reliability criteria the turbine may be kept in service until the next scheduled outage, at which time the Authority is to take action to reduce Pl to meet the at least 10^{-5} before returning the turbine to service.

The Authority has tentatively scheduled a two week maintenance outage to commence approximately February 1, 1990. Since this is a tentative date, it is possible that this maintenance outage may be moved or delayed until after April, 1990. If that were to occur, the Authority would be required to inspect LP-1 and LP-3 during this short maintenance outage in accordance with the turbine reliability criteria.

The Authority is requesting relief from inspecting LP-1 and LP-3 during this maintenance outage. The purpose of the short maintenance outage is to perform necessary maintenance and repair activities to ensure the availability of IP-3 throughout the summer peak, not to embark on major modifications and/or inspections. Inspection of LP-1 and LP-3 is a major project and would substantially increase the length of the maintenance outage. Granting the requested relief will provide the Authority the flexibility to schedule the maintenance outage as necessary and would negate the potential for "emergency" submittals.

The Authority has information from Westinghouse concerning the heavy disc and key plate design which is installed in the low pressure turbines at IP-3. Since 1981, there has been approximately 3 million hours of operating experience with the heavy disc design. Of the 598 discs which have been supplied, 172 have been ultrasonically inspected and to date, there have been no cracks found in any of the discs. The longest period of operation for one of the discs which was inspected was approximately 42,000 hours. In general, the Westinghouse information indicates that the heavy disc design reduced nominal bore stresses to 85% of those in the light disc. Yield strengthes of the redesigned heavy disc were also reduced to 80% of the light discs. Peak stresses at the disc bore were further reduced by eliminating the stress concentration associated with the round keyway and utlizing a new attachment system consisting of keying plates, circular spacers, dowel pins and drive keys. Specifically, for IP-3, the yield stresses went from 159.0 KSI with the light disc design to 128.5 KSI in the heavy disc design. Reference 5, which contains additional details, is included as Attachment III.

One factor influencing stress corrosion cracking (SCC) is the environment. A corrosive chemical environment accelerates SCC. Since 1984, the Authority has made numerous modifications to improve the secondary side chemistry of IP-3. Modifications affecting chemistry included a new titanium condenser, retubed moisture separator reheaters, the addition of a full flow condensate polisher, new feedwater heaters, the addition of blowdown recovery system and ultrafiltration and deaeration of makeup water. The results of these modifications have been a dramatic improvement in chemistry at IP-3. On the average steam generator blowdown chloride level has decreased from 70 ppb to 3 ppb. In addition, steam generator cation conductivity has decreased from a typical value of 2.0 umho/cm from 1976 to 1984 to an average value of 0.155 umho/cm from 1985 to 1988.

Impurity carryover in the steam is a function of steam generator bulk water chemistry. The improvements in steam generator chemistry has resulted in purer steam which provides an improved environment in the turbine. Therefore, as a result of these improvements coupled with the heavy disc design, the two major contributors to SCC have been significantly reduced.

It should also be noted that a deterministic analysis of the low pressure turbines shows that Disc No. 1 is the limiting disc. If Disc No. 1 is ignored in the deterministic analysis, an inspection interval of five (5) years results for LP-1, LP-2 and LP-3. Based on a probabilistic analysis (References (1), (2), (3) and (4)), the probability of Disc No. 1 generating a

missile is zero. Therefore, it can be concluded that Disc No. 1 is not the limiting disc since it is not possible for it to become a missile.

During the Cycle 7/8 Refueling Outage the Authority is planning on a complete replacement of all three low pressure turbines (LP-1 and LP-2 and LP-3) with a welded disc rotor. If the Authority cannot replace the low pressure turbines, we will perform a complete inspection of all three.

The Authority believes the information provided in this letter shows that not inspecting LP-1 and LP-3 during a short maintenance outage, after the P1 values exceed 10^{-5}, will not reduce the margin of safety with regard to the operation of IP-3. In accordance with the NRC approved turbine system reliability criteria if we did not have this short maintenance outage scheduled, IP-3 could operate until the Cycle 7/8 Refueling Outage since P1 doesn't exceed 10^{-4} until May 1991.

Should you or your staff have any questions regarding this matter, please contact Mr. P. Kokolakis of my staff.

Very truly yours,

John C. Brons
Executive Vice President
Nuclear Generation

cc: Mr. Joseph D. Neighbors, Senior Project Manager
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Division of Reactor Projects - I/II
U.S. Nuclear Regulatory Commission
Mail Stop 14B2
Washington, D.C. 20555

Resident Inspector's Office
Indian Point Unit 3
U.S. Nuclear Regulatory Commission
P.O. Box 337
Buchanan, NY 10511

U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

ATTACHMENT II TO IPN-89-006
TIME SEQUENCE

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

TIME SEQUENCE

DATE	DESCRIPTION
9/5/87	Start Of Cycle 5/6
9/88	One Year Since LP-1, LP-2 And LP-3 Inspection
2/4/89	Start Of Cycle 6/7 Refueling Outage (approx. 4 mos. in duration)
6/4/89	Start Of Cycle 6/7
1/90	Two Years Since LP-1, LP-2 And LP-3 Inspection
2/1/90	Start Of A Two Week Maintenance Outage
2/15/90	Startup From Maintenance Outage
4/90	LP-1 And LP-3 Pl Values Exceed 10^{-5}
10/1/90	Start Of Cycle 7/8 Refueling Outage
1/9	Three Years Since LP-1, LP-2, And LP-3 Inspection
5/91	LP-1 and LP-3 Pl Values Exceed 10^{-4}

ATTACHMENT III TO IPN-89- 006
WESTINGHOUSE INFORMATION ON
HEAVY DISC AND KEY PLATE DESIGN

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

Westinghouse
Electric Corporation

75 Holly Hill Lane
Box 7250
Greenwich Connecticut 06830
(203) 629 3369

November 22, 1988

Mr. K. R. Chapple
New York Power Authority
123 Main Street
White Plains, New York 10503

SUBJECT: INDIAN POINT UNIT 3
LOW PRESSURE TURBINE ROTORS
HEAVY DISC INSPECTION INTERVAL

Dear Ken:

This letter is provided in response to your request for information regarding Westinghouse experience with the heavy disc and key plate design low pressure turbine rotors throughout the industry and with those of similar design to the rotors currently operating at Indian Point Unit 3.

Westinghouse has supplied a total of 598 heavy discs with key plates worldwide. Some of these discs were provided as spares and therefore have yet to be put into service. The spare discs account for approximately 17 of the 598 heavy discs. The first heavy disc was manufactured in 1980 and placed in service in 1981. Attachment 1 shows a year by year breakdown of how many heavy discs were placed in service through 1987. Since 1981 there has been approximately 3,000,000 hours of operating experience with the heavy disc design. Of the 598 discs which have been supplied, 172 heavy discs with key plates have been ultrasonically inspected and, to date, there have been no cracks found in any of the discs. The longest period of operation for one of the discs which was inspected was approximately 42,000 hours. This data is summarized in Attachment 1 and a rotor inspection schedule, by year, is shown in Attachment 2. Attachment 3 is a list of units of similar design and vintage to those currently operating at Indian Point Unit 3 which have inspected their heavy discs with key plate design without finding cracks or distress.

Attachment 4 is a chart which shows the history of disc inspections in terms of at what yield strength and temperature allbore and keyway indications have been found in the light discs. The red boxes drawn on the graph indicate the design region of the heavy discs with key plates. The heavy disc design reduced nominal bore stresses to 85% of those in the light disc. Yield strengthes of the redesigned heavy disc were also reduced to 80% of the light discs. Peak

stresses at the disc bore were further reduced by eliminating the stress concentration associated with the round keyway and utilizing a new attachment system consisting of keying plates, circular spacers, dowel pins and drive keys.

This new configuration is depicted in Attachment 5.

In the case of Indian Point Unit 3 (disc test number TN12448), the yield stresses went from 159.0 KSI with the light disc design to 128.5 KSI in the heavy disc design.

If you have any questions or require further information, please call.

Very truly yours:

John G. Kern
Special Sales Representative

cc: E. Heina Orlando
C. Boyd Orlando
M. Flandermeyer Greenwich
L. Hoffmann Greenwich

HEAVY DISC AND KEY PLATE HISTORY

IN SERVICE DATE (NUMBER OF ROTORS)

1981	1982	1983	1984	1985	1986	1987	TOTAL
11	13	12	11	9	12	14	72

SHIPPED (BUT NOT IN SERVICE) 17

TOTAL 99

REFURBISHED ROTORS	61
NEW ROTORS	38
TOTAL DISCS	598
DISCS INSPECTED	172
LONGEST RUNNING INSPECTED ROTOR	42,000 HOURS
CRACKS AND/OR DISTRESS FOUND	0

Attachment 1

HEAVY DISC AND KEY PLATE ROTOR INSPECTION SCHEDULE

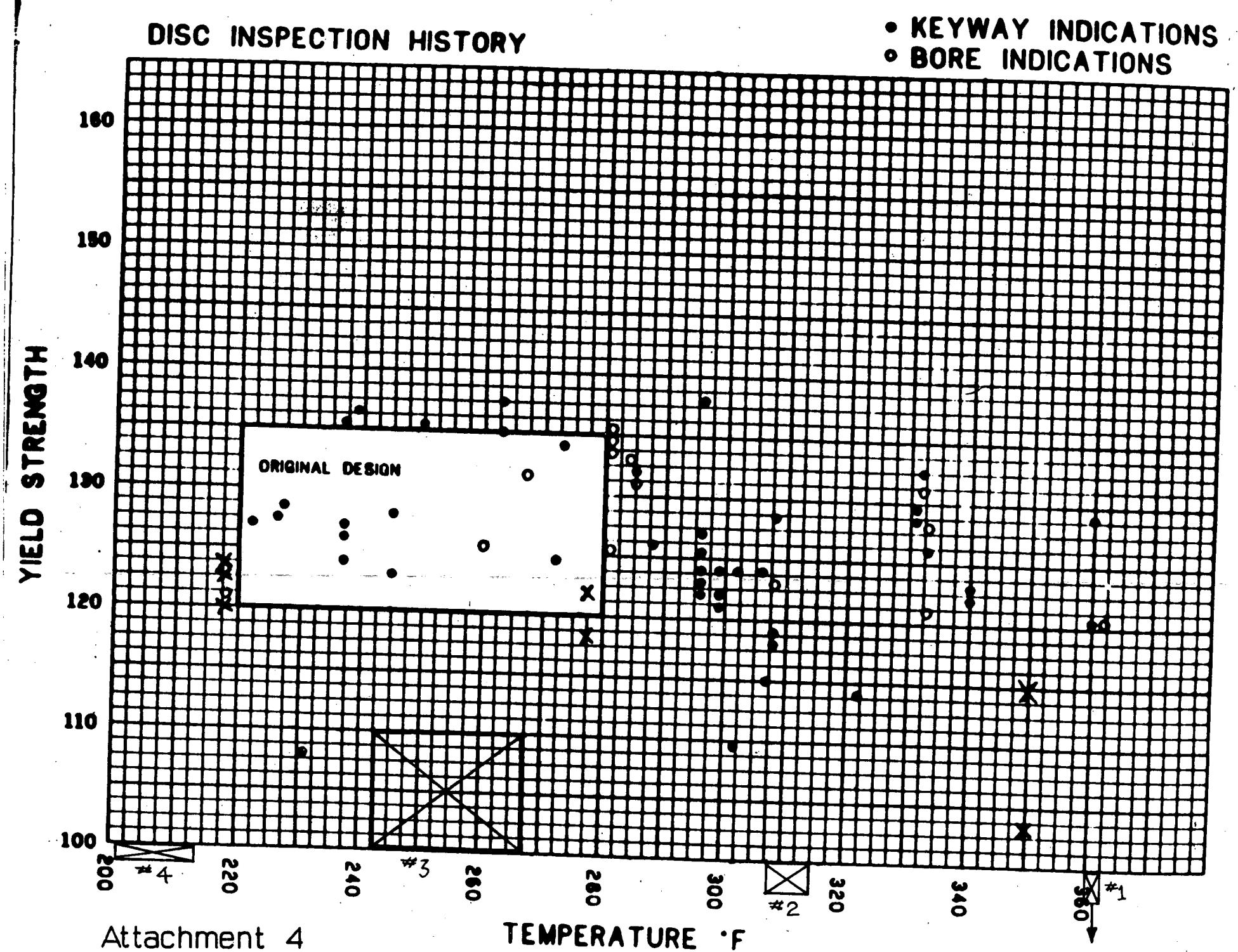
	BB81	BB281	BB80	TOTAL
1983	2	0	0	2
1984	3	2	0	5
1985	2	0	0	2
1986	3	0	0	3
1987	6	2	3	11
1988	3	1	0	4
1989	1	7	2	10
1990	10	4	1	15
1991	1	4	2	7
TOTAL	31	20	8	59

Attachment 2

HEAVY DISC AND KEY PLATE INSPECTION HISTORY

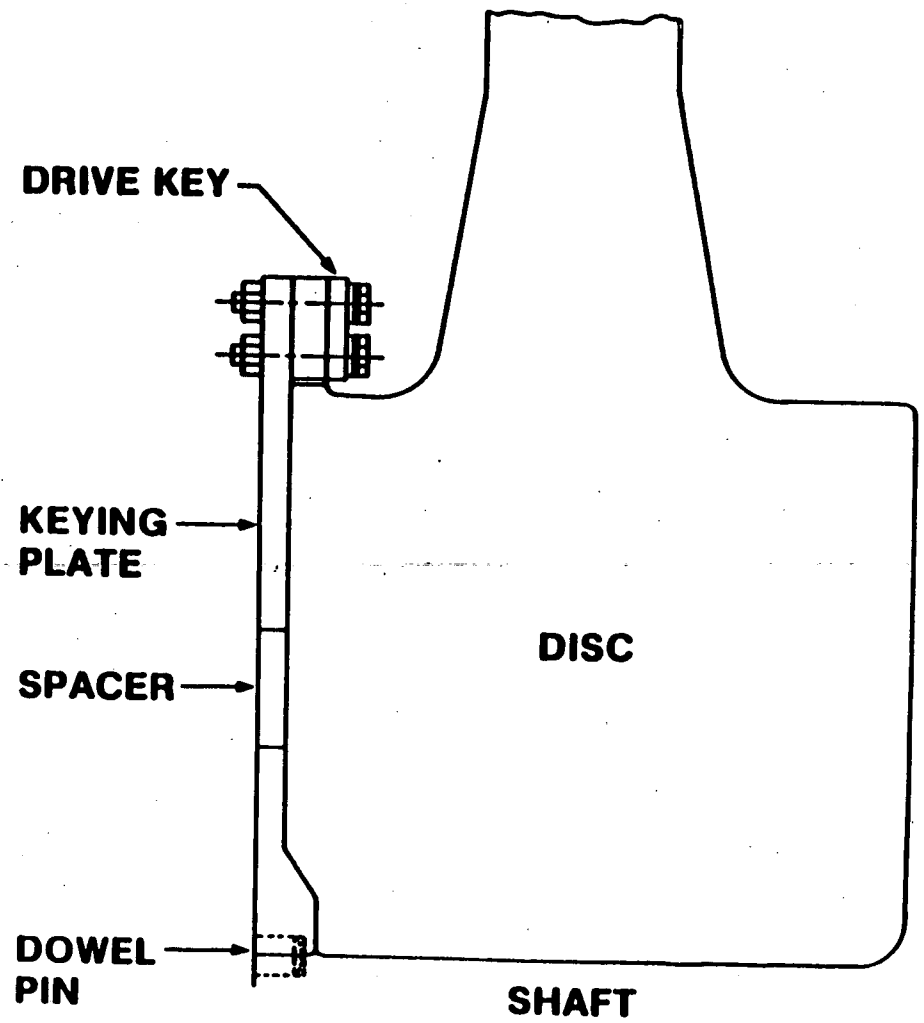
DATE	UNIT	BB	MONTHS
8/84	CONNECTICUT YANKEE	81	12
2/83	CONNECTICUT YANKEE	81	15
2/86	CONNECTICUT YANKEE	81	50
2/86	CONNECTICUT YANKEE	81	35
6/84	INDIAN POINT 2	81	36
6/84	INDIAN POINT 2	81	18
2/83	SURRY	81	17
8/86	COOPER	81	29
4/87	MAINE YANKEE	81	56
4/87	POINT BEACH	80	51
4/87	POINT BEACH	80	51
4/87	KEWAUNEE	80	50
1/87	FARLEY	281	36
1/87	FARLEY	281	36
8/24	NORTH ANNA	281	13
8/84	NORTH ANNA	281	13

Attachment 3



Attachment 4

HEAVY DISC AND KEYPLATE



Attachment 5