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# Arizona Nuclear Power Project

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September 30, 1985  
ANPP-33604-TDS/TPS

REGION V I&F

U. S. Nuclear Regulatory Commission  
Region V  
1450 Maria Lane - Suite 210  
Walnut Creek, CA 94596-5368

Attention: Mr. D. F. Kirsch, Acting Director  
Division of Reactor Safety and Projects

Subject: Final Report - DER 85-20  
A 50.55(e) Reportable Condition Relating  
to Broken Diesel Generator Rocker Arm  
File: 85-019-026; D.4.33.2

Reference: A) Telephone Conversation between R. C. Sorensen and  
P. J. Coffin on May 28, 1985.  
B) ANPP-32907, dated June 26, 1985 (Interim Report)  
C) ANPP-33358, dated September 9, 1985 (Time Extension)

Dear Sir:

Attached is our final written report of the Reportable Deficiency under 10CFR50.55(e), referenced above. The 10CFR21 Evaluation is also included with this report.

Very truly yours,

E. E. Van Brunt, Jr.  
Executive Vice President  
Project Director

EEVB/TPS/plk

Attachment

cc: See Page Two

8510220474 850930  
PDR ADOCK 05000528  
S PDR

11 IE-27

Mr. D. F. Kirsch  
DER 85-20  
ANPP-33604-TDS/TPS  
September 30, 1985

cc: Richard DeYoung, Director  
Office of Inspection and Enforcement  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

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FINAL REPORT - DER 85-20  
DEFICIENCY EVALUATION 50.55(e)  
ARIZONA NUCLEAR POWER PROJECT (ANPP)  
PVNGS UNITS 1, 2, 3

I. Description of Deficiency

A broken rocker arm assembly was discovered on the right bank intake valves for the number five cylinder on Unit 2 Emergency Diesel Generator, (D/G) Train B. This condition was identified during investigation to determine the source of a sharp metallic noise coming from the rocker cover assembly when the diesel received a stop signal and was coasting down.

The D/G is tag no. 2MDGBH01 supplied by Cooper Energy Services (CES).

EVALUATION

The diesel generator (D/G) provides emergency power to equipment required for safe plant shutdown in the event of loss of preferred power. Two D/G sets (Train A and Train B) are provided per plant.

The intake rocker arm is an internal component of the diesel engine responsible for opening and closing the intake valves for its respective cylinder. This is accomplished as follows:

One end of a push rod has a roller attached to it which rides on a cam of the rotating cam shaft. As the high spot on the cam (the lobe) rotates around to the push rod, the push rod rises in its guide. The other end of the push rod rests in a seat in the rocker arm (See Figure 1). The rising action forces the inlet valves seated opposite the push rod down to the open position. As the lobe passes, the push rod comes down and the valves return to the closed position.

The investigation disclosed that the rocker arm on the #5 cylinder on the right bank was split open along the entire length of the arm. NCR MC-2695 documents this finding. Continued use of the D/G with the damaged rocker arm would have initially affected performance in that the intake and exhaust valves for that cylinder would not have operated. With further use, the rocker arm may have split in two and jammed nearby components causing more extensive damage to the push rod, valves, and piston in that cylinder.

The damaged rocker arm was returned to CES for metallurgical analysis to determine the cause of failure. The resulting CES Report (Reference 2) stated the following:

- (1) A scuffed area on the spherical push rod seat indicates that the push rod was loose and impacting on the side of the seat rather than sliding smoothly in the seat.

- (2) The details of the properties found in the rocker arm are reported on the Data Sheet in Reference 2 and no gross casting defects were found in the fracture surface which confirms that the rocker arm was cast to the C-B Specification M-40N.
- (3) A tensile test bar machined from the seat area had a tensile strength of 41,000 psi. This value exceeds the requirements for a separately cast test bar even without factoring in the effect of section thickness.

This concludes that the design and fabrication of the rocker arm was satisfactory. The root cause of the failure of the rocker arm was due to improper adjustment of the push rod clearances. This caused the push rod to hammer against the push rod seat eventually breaking the rocker arm. The failure is mechanical and is considered an isolated occurrence since, per Reference 2 and 3, the material and casting were not found to be deficient and proper tappet adjustment will preclude recurrence. Project records show that no clearance adjustments were made to the push rods after the D/G was delivered to the jobsite.

#### VI. Analysis of Safety Implications

Continued use of the D/G with the damaged rocker arm would have at least affected system performance by reducing the number of operable combustion cylinders from 20 to 19. In the worst case, the piston could have been damaged causing damage to the engine rendering the system inoperable.

Based on the above, this condition is evaluated as reportable under the requirements of 10CFR50.55(e), since if this condition were to remain uncorrected it would represent a significant safety condition.

This project also has evaluated this condition as reportable under 10CFR21.21(b)(3). This report addresses the reporting requirements of the regulation with the exception of subpart (vi), regarding the number and location of such components supplied to other facilities.

#### III. Corrective Action

The broken rocker arm was replaced with a new rocker arm under Start-up Work Authorization No. 16632. To preclude future failures, tappet clearances will be adjusted at eighteen month intervals as required by Diesel Generator Engine Inspection Procedure No. 31ST-9DG01. Section 11 of the CES Instruction Manual (Document M018-388) details the procedure for valve tappet adjustment. The above test procedure will be performed on the Unit 2 and 3 D/G prior to entry into Mode 6 as required by the Technical Specification. Unit 1 was inspected under 31ST-9DG01 prior to

Mr. D. F. Kirsch

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entry into Mode 6 and will be reinspected at the next regularly scheduled interval.

REFERENCE

- (1) NCR MG-2695
- (2) CES Laboratory Report #763, Bechtel log M018-524
- (3) CES Letter No. 506

43% COTTON FIBER

100% COTTON FIBER

50% COTTON FIBER

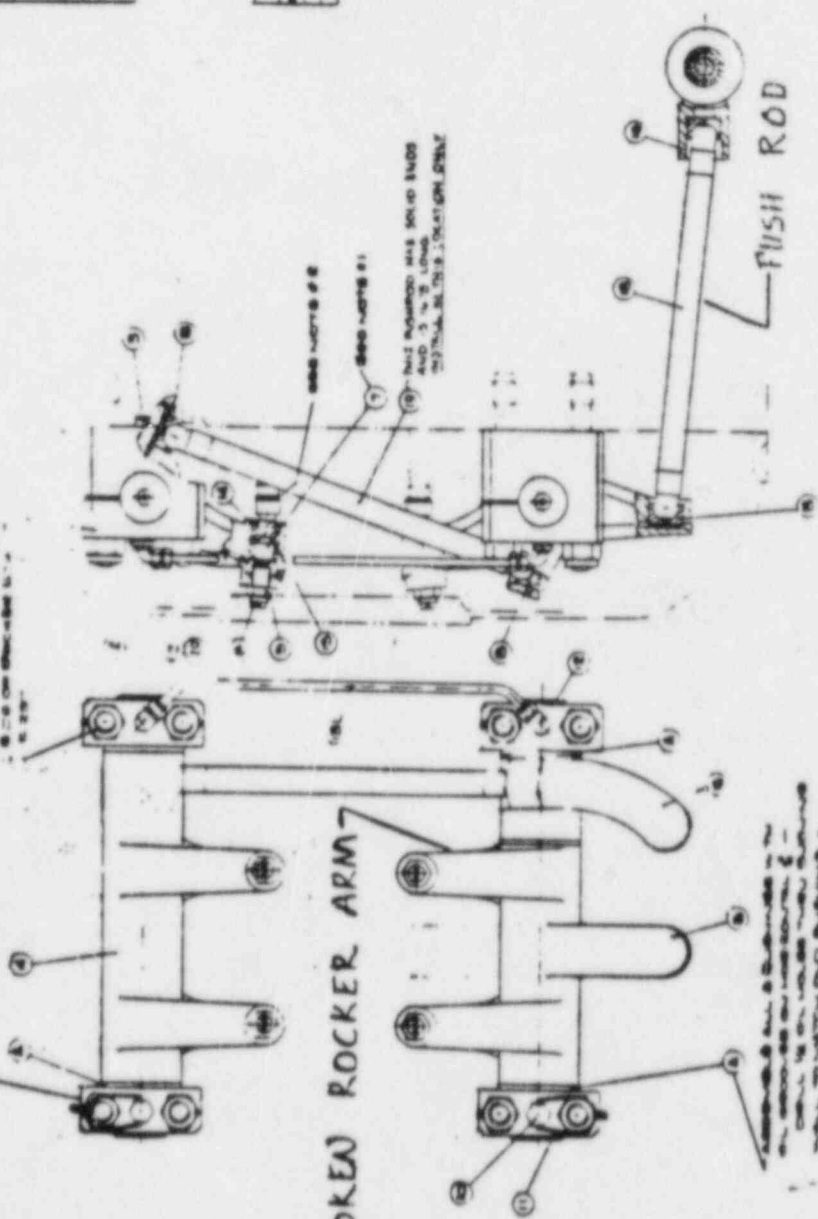


# FIGURE 1

ROCKET STRAP TO BE REMOVED  
AND 5/8" TUBULAR CLEARANCE

TUBULAR TO BE 5/8" LONG  
AND 5/8" DIA. MIN. DIA.  
AND 5/8" DIA. MIN. DIA.  
AND 5/8" DIA. MIN. DIA.

BROKEN ROCKER ARM



ASSEMBLED ALL 3 SUBASSEMBLY  
IN THE ORDER SHOWN IN THE  
DRAWING. THE ORDER SHOWN  
IS: 1. MAIN BODY, 2. MAIN  
BODY TO MAIN BODY SUBASSEMBLY  
CHECK TO SEE THAT ALL BOLTS ARE  
TIGHTENED SUBASSEMBLY IS IN PLACE

PUSH ROD

THIS PUSHER HAS SOLID END  
AND 5/8" LONG  
TUBULAR IN THE CENTER ON DRIVE

SEE NOTE #2  
SEE NOTE #1

| ITEM | QTY | DESCRIPTION            | UNIT | REMARKS |
|------|-----|------------------------|------|---------|
| 1    | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 2    | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 3    | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 4    | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 5    | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 6    | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 7    | 1   | ROCKET STRAP (REMOVED) | EA   |         |
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| 11   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 12   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 13   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 14   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 15   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 16   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 17   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 18   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 19   | 1   | ROCKET STRAP (REMOVED) | EA   |         |
| 20   | 1   | ROCKET STRAP (REMOVED) | EA   |         |

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| 20   | 1   | ROCKET STRAP (REMOVED) | EA   |         |

ITEM 10 SEE DRAWING

NOTE #1 - MAINLY UNDESIRABLE VALUE  
NOTE #2 - UNDESIRABLE VALUE  
NOTE #3 - UNDESIRABLE VALUE  
NOTE #4 - UNDESIRABLE VALUE  
NOTE #5 - UNDESIRABLE VALUE  
NOTE #6 - UNDESIRABLE VALUE  
NOTE #7 - UNDESIRABLE VALUE  
NOTE #8 - UNDESIRABLE VALUE  
NOTE #9 - UNDESIRABLE VALUE  
NOTE #10 - UNDESIRABLE VALUE  
NOTE #11 - UNDESIRABLE VALUE  
NOTE #12 - UNDESIRABLE VALUE  
NOTE #13 - UNDESIRABLE VALUE  
NOTE #14 - UNDESIRABLE VALUE  
NOTE #15 - UNDESIRABLE VALUE  
NOTE #16 - UNDESIRABLE VALUE  
NOTE #17 - UNDESIRABLE VALUE  
NOTE #18 - UNDESIRABLE VALUE  
NOTE #19 - UNDESIRABLE VALUE  
NOTE #20 - UNDESIRABLE VALUE

| ITEM | QTY | DESCRIPTION            | UNIT | REMARKS |
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INSPECT AT ASSEMBLY PER DEP-18-11

NUCLEAR STABILITY

FIRE EXTINGUISHER WITH  
5/8" CARTRIDGE

