

U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
REGION IV

Report No. 99900061/79-02

Program No. 51300

Company: Velan Engineering Ltd.
2125 Ward Avenue
Montreal, Quebec, H4M 1T6, Canada

Inspection
Conducted: October 18, 1979

Inspector: W. D. Kelley for 11/28
Wm. D. Kelley, Contractor Inspector
Components Section I
Vendor Inspection Branch
Date

Approved by: D. E. Whitesell for 11/28
D. E. Whitesell, Chief
Components Section I
Vendor Inspection Branch
Date

Summary

Inspection on October 18, 1979 (99900061/79-02)

Areas Inspected: Implementation of 10 CFR 50, Appendix B and applicable codes and standards including, vendor's corrective action on identified problems of cracked hardfacing of gate valve disc and sheared pin of swing check valve. The inspection involved six (6) inspector-hours on site by one (1) NRC inspector.

Results: In the one (1) area inspected, no deviations or unresolved items were identified.

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DETAILSA. Persons ContactedVelan Engineering, Ltd. (VEL)

*J. M. Farrell, Corporate Manager of Engineering
A. Nartini, QA Administrator

*Denotes these person who attended the Exit Interview (See paragraph D)

B. General Review of Vendor's Activities

1. There has been no change of the status of the ASME Certificate of Authorization, the authorized inspection agency, or the authorized nuclear inspector as reported in Report Number 99900061/79-01.
2. VEL is doing all the design, design drawings, design reports and stress analyses for the orders placed at Velan Valve Corporation (VVC), Burlington, Vermont.
3. VEL is manufacturing all of its nuclear valve orders for the United States market at the VVC plant in Burlington, Vermont.

C. Follow-Up of Reported Deficiencies1. Cracked Hardfacing of Gate Valve Wedgesa. Background Information

On July 17, 1979, the Tennessee Valley Authority (TVA), phoned NRC-IE-R11, to report that during the inspection of the safety injection system at Sequoyah Plant 1, cracks had been identified in the hardfacing wedges in two gate valves located in the accumulator charging line. The valves had been manufactured by Velan Engineering Ltd. (VEL).

b. Objectives

The objectives of this area of the inspection were to ascertain whether this problem might be generic to plants other than Sequoyah, and whether the safety significance had been evaluated to determine whether the defect was reportable under 10 CFR 21.

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c. Method of Accomplishment

The foregoing objectives were accomplished by:

(1) Review of the customer's procurement documents as follows:

- (a) Purchase Order Number 54-CAK-91710BN, dated December 23, 1969.
- (b) Equipment Specification Number G676258, "Motor Operated Valves," dated May 23, 1966; Revision 1, dated October 23, 1968.
- (c) Quality Assurance Specification Number QC-S1, dated January 2, 1970.

To ascertain the number, sizes, quality class of the valves, and the design criteria i.e. pressure, temperature, materials, and governing codes and standards specified in the procurement documents.

- (2) Review of VEL's PO Number 3383, to verify whether all of the pertinent quality requirements of the customer's procurement documents had been included.
- (3) Review of VEL's Safety Report issued in June 1973, directing the attention of not only its customers, but the nuclear industry, to the fact that fast closing valve operators, have the potential to damage valve parts and the valve operator by overstresses generated by stalled motor torque due to the time delay between tripping the switch and motor shutoff. Revision 1, dated October 1973, included VEL's Test Report Number RD-014/1, "Strain Gage Test on 1" - 1500# BB Gate Valve Wedge" which demonstrated that repeated over torquing the valve wedge results in cracking the stellite surface.
- (4) Review of VEL Engineering Calculations No. RD-115, Revision 0; "Evaluation Report - 8 inch and 10 inch Wedges" for Pacific Gas and Electric, Diablo Canyon.
- (5) Review of VEL Engineering Calculations - "Cast Wedges" dated January 9, 1973.
- (6) VEL Engineering Calculations, "Forged Wedges 10", dated August 1, 1978.
- (7) Inspected the photomicrograph of a CF8 Stainless Steel Wedge, hardfaced with stellite No. 6; and

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- (8) Discussions with the cognizant managers concerning the following information:
- (a) Evaluation of the cause.
 - (b) The corrective action taken and/or proposed.
 - (c) The generic aspects of the problem.
 - (d) Evaluation of the safety significance under 10 CFR 21.

d. Findings

It appears that the VEL motor operated valves were designed and manufactured in compliance with the customer's purchase order and design specification. However, the sizing and selection of the valve actuator was done before the effects of stalled motor torque and fast closing speeds were known.

Early in 1973, VEL's management became concerned regarding the increasing reports of plants shutting down due to valve problems, and also pressures coming from its engineering department relative to the lack of certain technical information concerning the actual torque and forces generated by fast acting operators with motors capable of functioning at 70% rated power. These concerns prompted VEL into publishing a Safety Report covering its concerns and the lack of technical information to enable the appropriate engineers to select actuators the best suited for the valves' specified function.

One of the major concerns of VEL was the ever increasing demands by its customer for faster closing speeds, and actuator motors suitable for low voltage operation (70%). To provide adequate technical information VEL performed a series of tests which not only provided pertinent technical information, but also confirmed VEL's concerns that the speed vs. torque thrust could overstress valve and operator parts to destruction.

From the results of these tests together with updated information from Limitorque Corp. (LC) who also had been performing research and development testing, VEL revised its Safety Report to include several of its test results, in October 1973. The revised Safety Report was issued to all of its nuclear customers, and the nuclear industry as a whole.

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The test results together with the calculations enabled VEL determine that the hardface cracking problem only existed in 8 and 10 inch gate valves, with cast steel wedges, and a specified closure time of ten seconds or less.

e. Generic Impact

Most valves order prior to 1971 were specified to meet the requirements of ASA 16.5. In many instances the customer's PO covered valves for several facilities, and VEL was not provided with any shipping instructions until the valves were inspected and accepted by the customer. At which time the customer signed the Quality Release Forms (QRF) and identified the facility to which the valves identified there on were to be shipped. QRF was then filed under the serial number(s) of the valve(s) identified on the QRF.

The retrieval of QRF for the valves purchased by the customer's PO number 54-CAK-91710BN indicates that the only 8 and 10 inch cast wedge gate valves with a specified closure time of 10 seconds or less was shipped to the Sequoyah Nuclear Plant, and Diablo Canyon Plant.

f. Corrective Action

It appears that VEL initiated its initial corrective action in October 1973, with the issuance of its Safety Report to all of its customers, concerning the potential damage to valve and actuator parts due to overstressing that can be generated by the stalled motor torque of high speed actuators. The Safety Report also provided specific instructions concerning the precautions the customer should follow to negate or minimize these potential dangers.

The cast steel wedges in the 8 and 10 inch valves with specified closure time of 10 seconds or less, supplied in compliance with PO No. 54-CAK-91710BN, has been replaced by VEL, with forged steel wedges of a heavier design.

Since 1973 additional technical information concerning the magnitude of stalled motor torque, the lag time between the switch disconnect and motor drop-out, the relation of the actuator's efficiency to RPM output, and new torque sensors and compensating units have been developed to absorb the torque and reduce the resulting stresses. Also the new information provides the design engineer with more reliable and precise data which enables him to more accurately

evaluate the actual stress that will be imposed on various parts of the valve to determine the adequacy of the design to resist those stresses. It also provides better and more reliable information to size and select actuators with motors and gearing most suitable for its function with minimum adverse operating effects.

2. Sheared Pin on Valve Disc

a. Background Information

NRC RII received a letter from the Tennessee Valley Authority dated December 29, 1978 that reported during refueling outage on Browns Ferry Nuclear Plant, Unit 1, the 10 inch, 150 pound carbon steel swing check valve 1-71-580 in the RCIC system failed the local leak rate test. During the maintenance inspection the valve was found in an open position due to the pin shearing on the valve disc. A new pin and disc were installed and the valve passed the leak test satisfactorily.

TVA stated in their report that this was the first failure of this nature and they considered it an isolated case and planned no recurrence control action.

b. Objective

The objective of this area of the inspection was to ascertain:

- (1) Whether the vendor had evaluated the cause of pin failure on the valve disc and had evaluated the safety significance of the problem in conformance with their procedure for evaluating the reportability of defects in accordance with 10 CFR 21. Also,
- (2) The generic implications of this problem, and
- (3) Whether the corrective action that was taken, or to be taken, is appropriate.

c. Method of Accomplishment

The foregoing objectives were accomplished by a discussion with the corporate manager of engineering at the VEL corporate office at Montreal, Quebec, Canada, on October 18, 1979, and by a telephone conference on October 26, 1979.

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d. Findings

- (1) From the discussions with the corporate manager of engineering, the following was determined.
 - (a) The pin referenced in the TVA report is actually part of the cast steel disc.
 - (b) TVA is performing an analysis of the system to determine the safety significance of the valve failure and to verify what the dynamic impact loading on the disc would be when the steam flow opens the valve.
 - (c) VEL is performing a stress analysis to determine the system fluid velocity necessary for disc pin failure.
 - (d) TVA is retaining the disc parts; therefore, VEL is unable to perform an examination of the parts to ascertain the nature and/or cause of the pin failure.
- (2) Within this area of the inspection no deviations or unresolved items were identified.

e. Generic Impact

The generic impact cannot be determined until the TVA and VEL analysis are completed and compared with the results of the examination of the failed parts.

f. Corrective Action

The corrective action will be reviewed on a subsequent inspection after the TVA and VEL analysis are complete and compared with results of the examination of the failed parts.

D. Exit Interview

At the conclusion of the special inspection on October 18, 1979, the inspector met with the company's management, identified in paragraph A, for the purpose of informing as to the results of the inspection. During this meeting management was informed no deviations or unresolved items were identified.

The company's management acknowledged the inspector's statement and had no comments.

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