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June 10, 1987

US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Dear Sirs:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Filter Canister Media Modification

In an effort to reduce the potential for clogging of the filter canister filter elements, the pore size of the filter bundle in some of the filter canisters has been increased from 0.5 microns nominal (2 microns absolute) to 16 microns nominal (25 microns absolute). The new filter elements will be installed in filter canisters and will be used in a manner identical to the previous design.

Attached for the information of the NRC TMICPD is an evaluation which demonstrates that the safety aspects of the canisters containing the new filter media are bounded by previous structure and criticality safety analyses.

Sincerely,

F. R. Standerfer
Director, TMI-2

FRS/RDW/eml

Attachment

cc: Regional Administrator, Region 1 - W. T. Russell
Director, TMI-2 Cleanup Project Directorate - Dr. W. D. Travers

A001
1/1

EVALUATION OF THE FILTER CANISTER MEDIA MODIFICATION

In an effort to reduce the potential for clogging of the filter canister filter elements, the pore size of the filter bundle in some of the filter canisters has been increased from 0.5 microns nominal (2 microns absolute) to 16 microns nominal (25 microns absolute). The new media is similar to that previously utilized in that it is comprised of sintered stainless steel. The new media also is designed to allow backflushing at higher pressure differentials (a maximum of 25 psid). The new filter elements will be installed in the filter canisters and will be used in a manner identical to those currently in-service. As a result of the change in the design of the filter media, it was found that the overall filter bundle weight increased slightly. The below evaluation demonstrates that the safety aspects of canisters containing the new filter media are bounded by previous structural and criticality safety analyses.

To ensure that the structural analyses performed for the previous filter media are conservative when applied to the new media, a series of bench tests were performed by Babcock and Wilcox (B&W) (Attachment 2) to assess the load carrying capability of the new elements. In these tests, new production filter elements were subjected to a series of axial and lateral forces. The load carrying capability and overall element deflections resulting from these forces were then compared to similar tests performed on the original filter elements. This comparison showed that the axial and lateral load carrying capabilities of the new elements exceeded those of the earlier design. Additionally, the deflections resulting from the applied loads were less than those experienced earlier. Thus, GPU Nuclear concludes that the previous structural analyses are bounding when applied to the new filter elements.

Regarding previously performed criticality analyses, it is noteworthy that the only change to the internals of the filter canister is the change in the filter media design. As previously described, the filter bundle with the new media design is slightly heavier than the previous bundle. This increase, resulting from an increase in the quantity of stainless steel within the canister, should result in a greater neutron poisoning effect. This conclusion is based on previous canister evaluations which have shown that an increase in stainless steel within a canister will result in a lower neutron multiplication (k_{eff}). Therefore, GPU Nuclear concludes that, in the normal configuration, canisters employing the new media will have a k_{eff} less than that calculated for the original media design.

In the design accident configuration, the internals of the filter canister are deflected to one side as a result of the dropping of the canister. The increase in the canister k_{eff} as a result of this deflection has been shown to increase with increasing deflection. Attachment 2 indicates that the new elements have greater load carrying capabilities; therefore, less deflection will result. Thus, the potential increase in k_{eff}, resulting from the design accident, will be bounded by that expected for the original filter media design.

Based on the results reported in Attachment 2, GPU Nuclear has determined that the new filter media will have no adverse impact on existing analyses. Therefore, the normal and accident k_{eff}'s for the filter canisters as calculated for the original filter design (i.e., 0.839 and 0.892 respectively) are bounding for filter canisters containing the new filter media (i.e., 16 micron nominal). This modification will be addressed in the next annual update to the Defueling Canister Technical Evaluation Report.

ATTACHMENT 2
4410-87-L-0092
18 Pages

TMI-2 CANISTER FILTER ELEMENT EVALUATION
(REVISED FILTER MEDIA)

B&W DOCUMENT NO. 77-1168130-00

Published: June 3, 1987

Prepared for
GPU Nuclear Corporation

Babcock & Wilcox Company
Nuclear Power Division
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TMI-2 CANISTER FILTER ELEMENT EVALUATION
(REVISED FILTER MEDIA)
77-1168130-00

Prepared by: H D Ross 6/2/87
H. D. Ross, B&W — Date

Approved by: E J McGuinn 6/2/87
E. J. McGuinn, Senior Engineer, B&W — Date

Approved by: P.C. Childress 6/2/87
P. C. Childress, Project Manager, B&W — Date

CONTENTS

1. SUMMARY/CONCLUSIONS

B&W has evaluated the adequacy of GPUN's new canister filter module with regards to the existing criticality and structural analysis used in licensing.

The results of bench tests indicate that the axial and lateral load carrying capability of the new module exceeds that of the previous module. Also, the deformations under load are less. The margins of safety under accident condition shipping loads are 423% for a 100g lateral load and 72% for a 40g axial load.

Based on these results, the new module design will have no adverse impact on existing analyses.

2. BACKGROUND

GPUN has revised the performance specification of their canister filter media from .1 micron nominal to .16 micron nominal in an effort to improve the canister's total flow capacity. Their vendor, Pall Trinity Corporation, has changed the details of element construction to allow the revised performance levels to be met. The original filter element was an important structural contributor in determining the accident geometry of the canister internals for criticality evaluation; bench tests showing the element's structural performance were a crucial part of the evidence leading to NRC licensing. It is important to ensure that the use of the new element does not invalidate the conclusions of existing canister criticality and structural analyses.

Bench tests run on the previous production filter modules indicated that an axial force of 3450 pounds was needed to initiate buckling. The total axial deflection at that load was 0.045 inches and the plastic set, after the load was removed, was 0.020 inches. The module tested was not mounted on the center core tube which would have increased its rigidity. The lateral crush test performed on two modules compressed against each other with their endcaps offset yielded a load of 2290 pounds and a total overlap of nearly 0.5 inch. At that point, the center tube, were it in place, would have started picking up the load and increased the crush resistance.

3. EVALUATION

Bench tests were performed on the four canister filter modules supplied by GPUN. Test tests were carried out at the B&W Commercial Nuclear Fuel Plant using the same equipment and method of testing as in previous module tests by B&W.

Two tests were performed. In the first test, the module was placed axially in a Baldwin machine and incremental compression loads were applied until buckling seemed to initiate. The test was then terminated. Deflection measurements reported in Tables 1 and 2 were recorded at each load step. Two modules were tested in this manner. In the second test, two modules were positioned laterally against each other with their endcaps in-line. The modules were then incrementally compressed up to a load of 1500 pounds. Deflection measurements reported in Table 3 were recorded at each load step. The modules were then offset the width of an endcap and again incrementally compressed against each other until the deflection became non-linear. The test was then terminated. Deflection measurements reported in Table 4 were recorded at each load step.

Pictures were taken of the modules. Figures 1-7 show the modules before and after tests.

4. RESULTS

The new modules proved to be superior to the original module both in load carrying capability and in overall deformation under load.

In the axial test on two modules, loads of 4300 and 4040 pounds resulted in deflections of 0.045 and 0.0485 inches, respectively. Both modules had a permanent set of 0.023 inches. These values compare to 3450 pounds, 0.045 inches, and 0.020 inches, respectively, as reported for the original module. In the lateral test with the endcap in-line, the deflection was 0.0185 inches for the 1500 pound applied load and the permanent set was 0.014 inches. The endcap in-line test was not performed on the original module. In the lateral test with endcaps offset, the maximum load and deflection was 2800 pounds and 0.117 inches. These values compare to 2290 pounds and 0.405 inches reported for the original module. The figure on page 15 shows three pleats of the filter media under the endcap to be crushed. This was the only damage to the module.

The recorded load/deflections for the axial and lateral tests are given in the tables on pages 5-11.

The test results yield large margins of safety for the accident condition shipping loads. Based on a payload of 1000 pounds at a lateral load of 100g's being evenly distributed on the 187 modules (17 elements, 11 modules/element), the load per module is 535 pounds and the margin of safety is 423%. With the 1000 payload and a 40g axial load evenly distributed to 17 elements, the load per module of 2353 pounds would result in a margin of safety of 72%.

FORM NO: QC-R-102

C. N. F. P.

Approved By: VRe

Date: 5-4-82

THE BABCOCK & WILCOX CO.

QUALITY CONTROL SECTION

MISCELLANEOUS INSPECTION REPORT

PAGE ___ OF ___

LYNCHBURG, VA.

DWG. NO. SPEC. INSTR.

SPEC. NO. N/A

JOB NO. SC-1525

PROC. NO. SPEC. INSTR.

1R AXIAL TEST

PART NAME: FILTER CANISTER ELEMENT

TABLE 1

LOAD (LBS)	DEFLECTION (IN)		LOAD (LBS)	DEFLECTION (IN)		LOAD (LBS)	DEFLECTION (IN)
0	0		1800	.011		3600	.025
100	.0015		1900	.0115		3700	.028
200	.003		2000	.012		3800	.030
300	.0035		2100	.0125		3900	.0345
400	.0045		2200	.013		4000	.037
500	.005		2300	.0135		4100	.039
600	.006		2400	.014		4150	.040
700	.0065		2500	.0145		4200	.041
800	.007		2600	.015		4250	.0425
900	.0075		2700	.016		4300	.045
1000	.008		2800	.0165			
1100	.008		2900	.017			
1200	.0085		3000	.018			
1300	.009		3100	.019			
1400	.0095		3200	.020			
1500	.010		3300	.0205			
1600	.010		3400	.022			
1700	.0105		3500	.023			

INSPECTED BY: R E Davidson DATE: 5-20-82 RELEASED BY: ________ DATE: ________

FORM NO: QC-R-102

C. N. F. P.

Approved By: [illegible]

Date: 5-4-82

THE BABCOCK & WILCOX CO.

QUALITY CONTROL SECTION

MISCELLANEOUS INSPECTION REPORT

PAGE ___ OF ___

LYNCHBURG, VA.

DWG. NO. SPEC. INSTR.

SPEC. NO. N/A

JOB NO. SC.1526

PROC. NO. SPEC INSTR

2A AXIAL TEST

PART NAME: FILTER CANISTER ELEMENT

TABLE 2

LOAD (LBS)	DEFLECTION (IN)		LOAD (LBS)	DEFLECTION (IN)		LOAD (LBS)	DEFLECTION (IN)
0	0		1800	.016		3600	.0365
100	.005		1900	.016		3700	.039
200	.007		2000	.017		3800	.0405
300	MISSED		2100	.0175		3900	.0425
400	.0085		2200	.018		4000	.045
500	.009		2300	.0185		4040	.0485
600	.010		2400	.019			
700	.0105		2500	.020			
800	.011		2600	.0205			
900	.0115		2700	.021			
1000	.012		2800	.022			
1100	.0125		2900	.023			
1200	.013		3000	.024			
1300	.0135		3100	.0255			
1400	.014		3200	.027			
1500	.0145		3300	.0285			
1600	.015		3400	.0305			
1700	.015		3500	.034			

INSPECTED BY: R E [illegible] DATE: 5-20-82 RELEASED BY: ___________ DATE: _______

FORM NO: QC-R-102 THE BABCOCK & WILCOX CO. PAGE ___ OF ___

C. N. F. P. QUALITY CONTROL SECTION LYNCHBURG, VA.

Approved By: [signature]

Date: 3-4-82 MISCELLANEOUS INSPECTION REPORT

DWG. NO. SPEC. INSTR.

SPEC. NO. N/A

JOB NO. SC 1525

PROC. NO. SPEC. INSTR.

(AGAINST EACH OTHER) LATERAL TEST

PART NAME: FILTER CANISTER ELEMENT

TABLE 3

LOAD (LBS)	DEFLECTION (IN)						
0	0						
100	.0045						
200	.0065						
300	.0075						
400	.0085						
500	.0095						
600	.0105						
700	.012						
800	.013						
900	.014						
1000	.015						
1100	.0155						
1200	.0165						
1300	.0175						
1400	.018						
1500	.0185						

INSPECTED BY: [signature] DATE: 5-20-82 RELEASED BY: ________ DATE: ______

FORM NO: QC-R-102 THE BABCOCK & WILCOX CO. PAGE ___ OF ___

C. N. F. P. QUALITY CONTROL SECTION LYNCHBURG, VA.

Approved By: [illegible]

Date: 5-4-82 MISCELLANEOUS INSPECTION REPORT

DWG. NO. SPEC. INSTR.

SPEC. NO. N/A

JOB NO. SC-1525

PROC. NO. SPEC. INSTR.

3rd (OFFSET) LATERAL TEST

PART NAME: FILTER CANISTER ELEMENT

TABLE 4

LOAD (LBS)	DEFLECTION (IN)		LOAD (LBS)	DEFLECTION (IN)			
0	0		1800	MISSED			
100	.007		1900	.050			
200	.0095		2000	.054			
300	.0105		2100	.057			
400	.012		2200	.060			
500	.0125		2300	.063			
600	.0135		2400	.066			
700	.0145		2500	.077			
800	.016		2600	.108			
900	.018		2700	.112			
1000	.0195		2800	.117			
1100	.021						
1200	.027						
1300	.029						
1400	.0315						
1500	.034						
1600	.037						
1700	.0415						

INSPECTED BY: [illegible] DATE: 5-20-82 RELEASED BY: ___________ DATE: ______

FORM NO.: QC-R-102

THE BABCOCK & WILCOX COMPANY
COMMERCIAL NUCLEAR FUEL PLANT — LYNCBBURG, VIRGINIA
QUALITY ASSURANCE SECTION

APPROVED BY: CW
DATE: 1/12/87

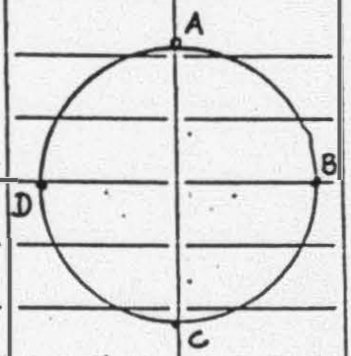
MISCELLANEOUS INSPECTION REPORT

DWG. NO.: Special Instruct
SPEC. NO.: N/A
JOB NO.: SC-1525
PROC. NO.: Special Instruct

PART NAME: FILTER CANISTER ELEMENT

AXIAL TEST

TABLE 5



FREE HEIGHT BEFORE TEST

S/N	A	B	C	D
1A	11.2265	11.2346	11.2247	11.2178
2A	11.2128	11.2158	11.2082	11.2061

FREE HEIGHT AFTER TEST

S/N	A	B	C	D
1A	11.2019	11.2097	11.2034	11.1954
2A	11.1871	11.1944	11.1864	11.1809

Plastic Set

1A	.0246	.0249	.0213	.0224
		Δ avg	= .0233"	
2A	.0257	.0214	.0218	.0252
		Δ avg	= .0235"	

INSPECTED BY: LE DATE: 5/20/87 RELEASED BY: DATE:

FORM NO.: QC-R-102 PAGE 1 OF 1

THE BABCOCK & WILCOX COMPANY
COMMERCIAL NUCLEAR FUEL PLANT LYNCHBURG, VIRGINIA
QUALITY ASSURANCE SECTION

APPROVED BY: B.W.
DATE: 1/12/87

MISCELLANEOUS INSPECTION REPORT

DWG. NO.: Special Instruct.
SPEC. NO.: N/A
JOB NO.: SC-1525
PROC. NO.: Special Instruct.

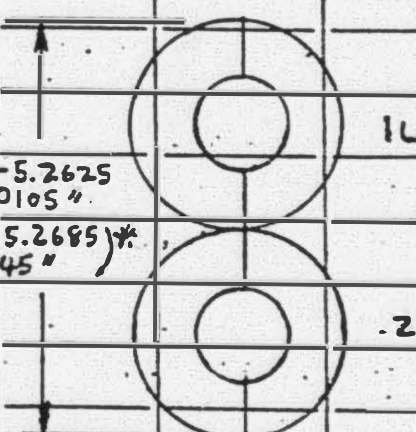
PART NAME: FILTER CANISTER ELEMENT (BEFORE) LATERAL TEST

TABLE 6

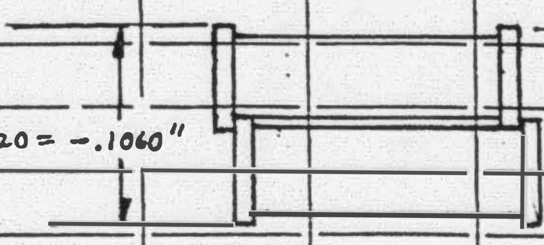
S/N	ACROSS SCRIBE LINE DIA. A	OPPOSITE END	DIA. B	OPPOSITE END
1L	2.6320	2.6335	2.6340	2.6355
2L	2.6330	2.6350	2.6330	2.6350

S/N	ACROSS BOTH SCRIBE LINES DIA. A		OPPOSITE END
1L & 2L	5.2625		5.2685

S/N	OFFSET DIA.		OPPOSITE END
1L & 2L	5.1520		5.1460



5.2520 - 5.2625 = -.0105"
(5.2540 - 5.2685)* = -.0145"



5.0460 - 5.1520 = -.1060"

5.0220 - 5.1460 = -.1240"

* Parenthesis is opposite end

INSPECTED BY: KE DATE: 5/20/87 RELEASED BY: ________ DATE: ________

FORM NO.: QC-R-102

THE BABCOCK & WILCOX COMPANY
COMMERCIAL NUCLEAR FUEL PLANT — LYNCHBURG, VIRGINIA
QUALITY ASSURANCE SECTION

APPROVED BY: BW
DATE: 1/12/87

MISCELLANEOUS INSPECTION REPORT

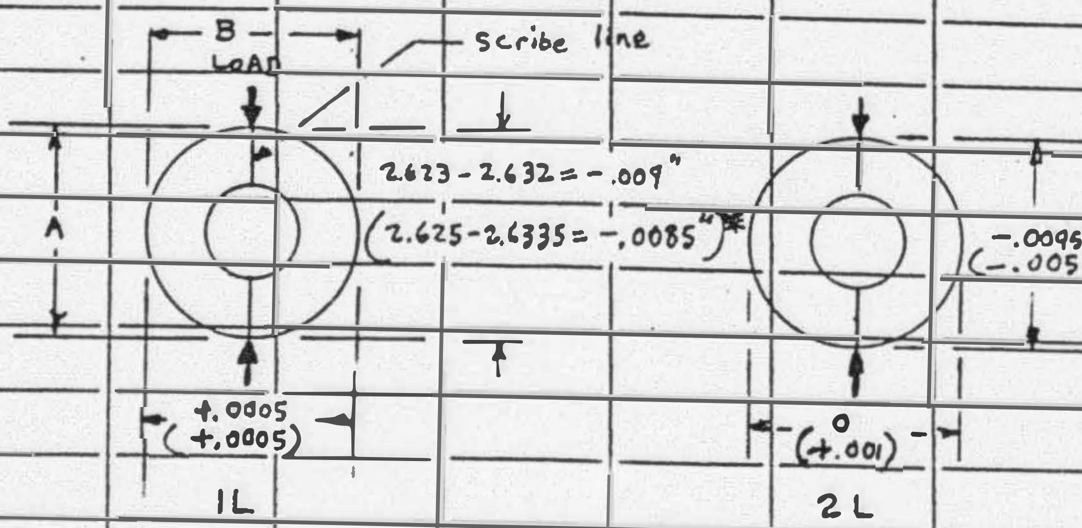
DWG. NO.: Special Instruct.
SPEC. NO.: N/A
JOB NO.: SC-1525
PROC. NO.: Special Instruct

PART NAME: FILTER CANISTER ELEMENT (AFTER)

LATERAL TEST

TABLE 7

S/N	ACROSS SCRIBE LINE DIA. A	OPPOSITE END	DIA. B	OPPOSITE END
1L	2.6230	2.6250	2.6345	2.6360
2L	2.6235	2.6300	2.6330	2.6360
S/N	OFFSET DIA.		OFFSET OPPOSITE END	
1L & 2L	5.0460		5.0220 ~~5.0050~~	
S/N	ACROSS BOTH SCRIBE LINES DIA. A		ACROSS BOTH SCRIBE LINES DIA. B	
1L & 2L	5.2520		5.2540	



* Parenthesis is opposite end

INSPECTED BY: ME DATE: 5/20/87 RELEASED BY: ________ DATE: ________

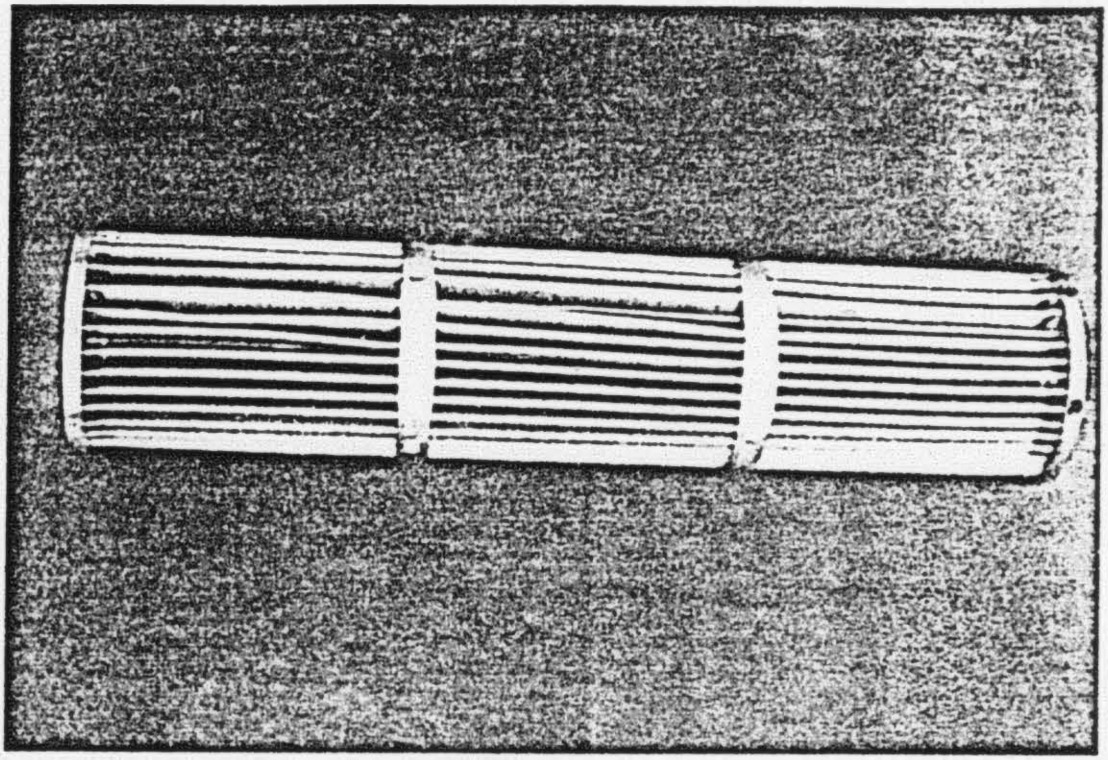


FIGURE 1 TYPICAL FILTER MODULE
BEFORE TEST

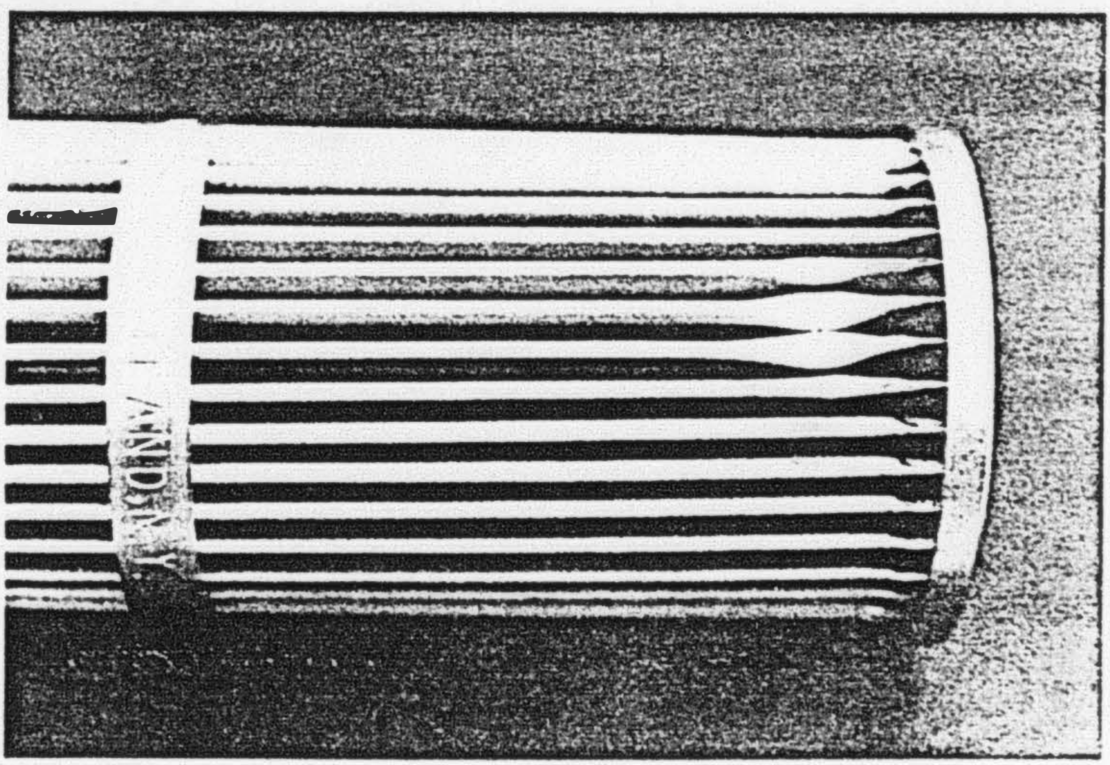


FIGURE 2 CLOSEUP OF FILTER MODULE
BEFORE TEST

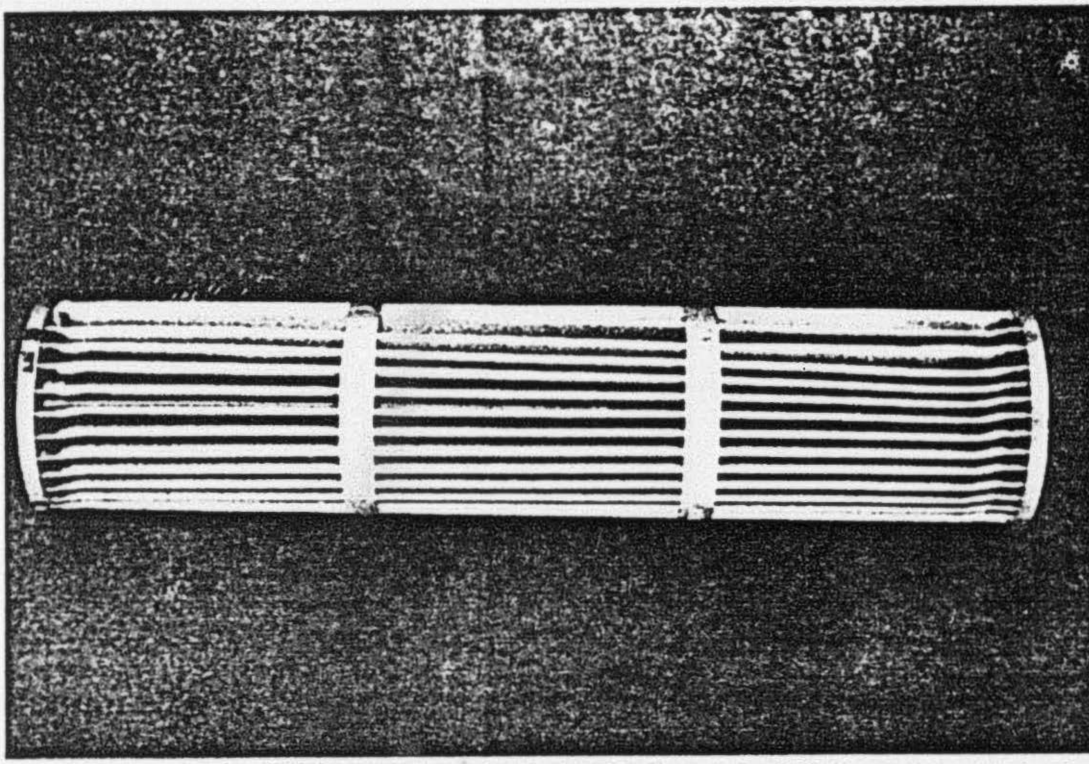


FIGURE 3 FILTER MODULE 2A AFTER
4040 POUND AXIAL TEST

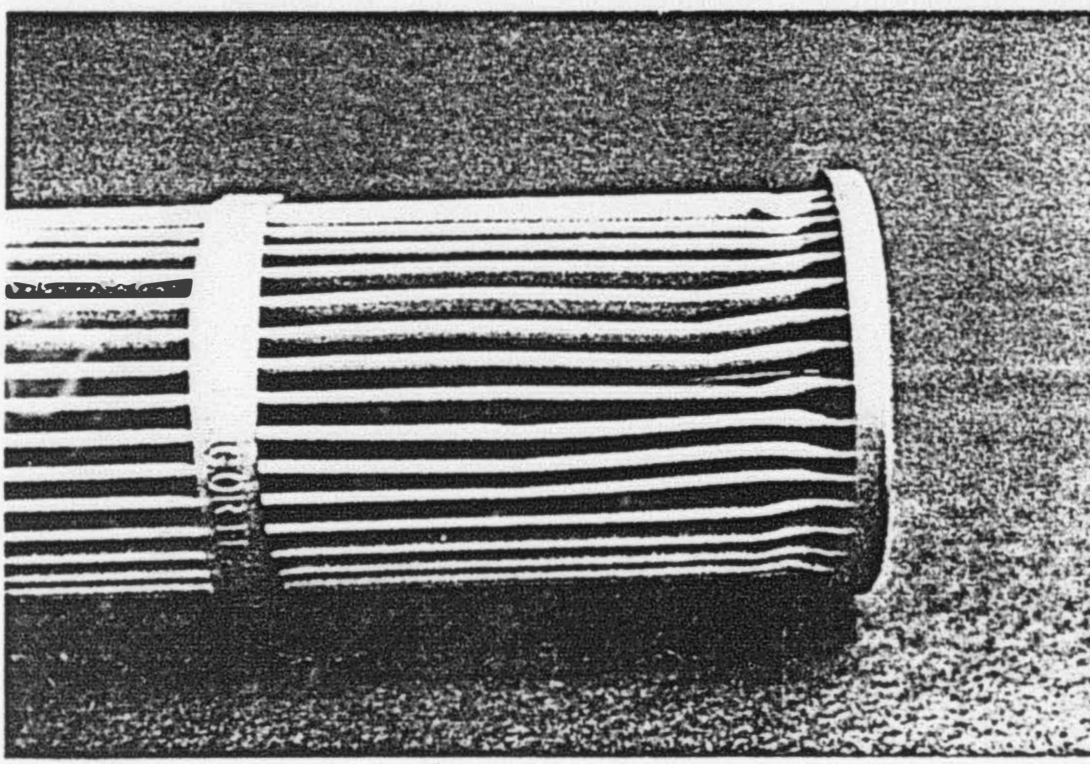


FIGURE 4 CLOSEUP OF FILTER MODULE 1A AFTER
4300 POUND AXIAL TEST

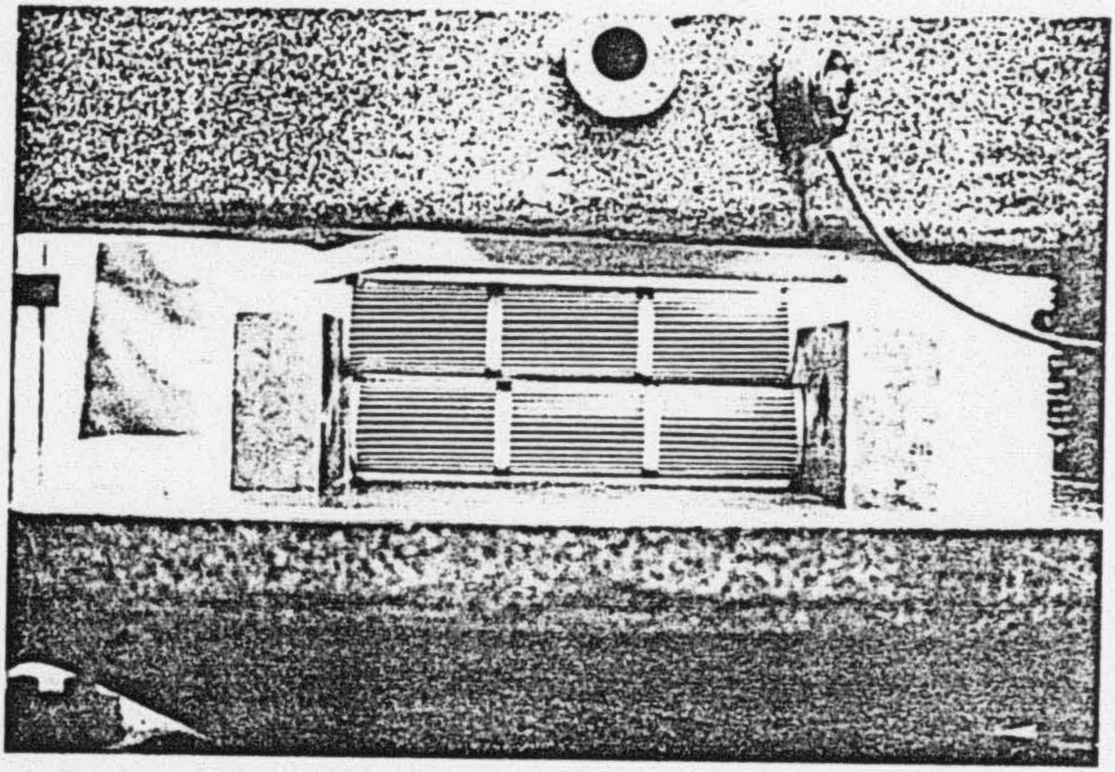


FIGURE 5 FILTER MODULES IN LATERAL CRUSH TEST

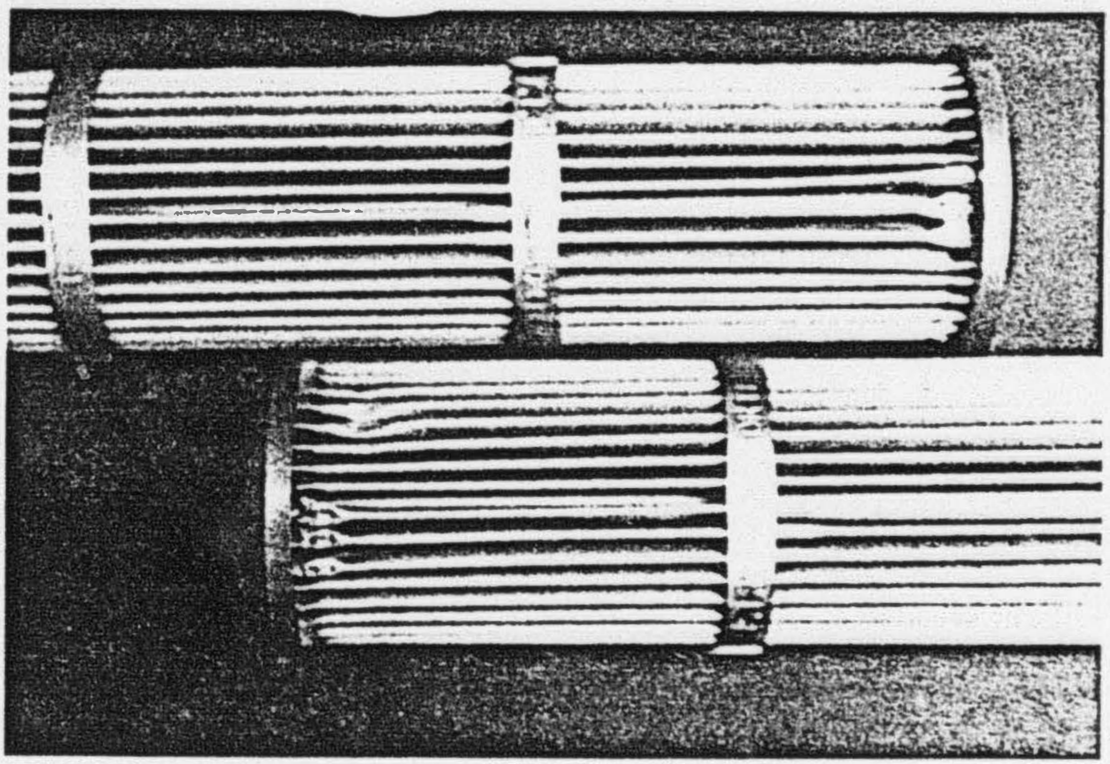


FIGURE 6 CLOSEUP OF FILTER MODULES AFTER LATERAL CRUSH TEST OF 2800 POUNDS

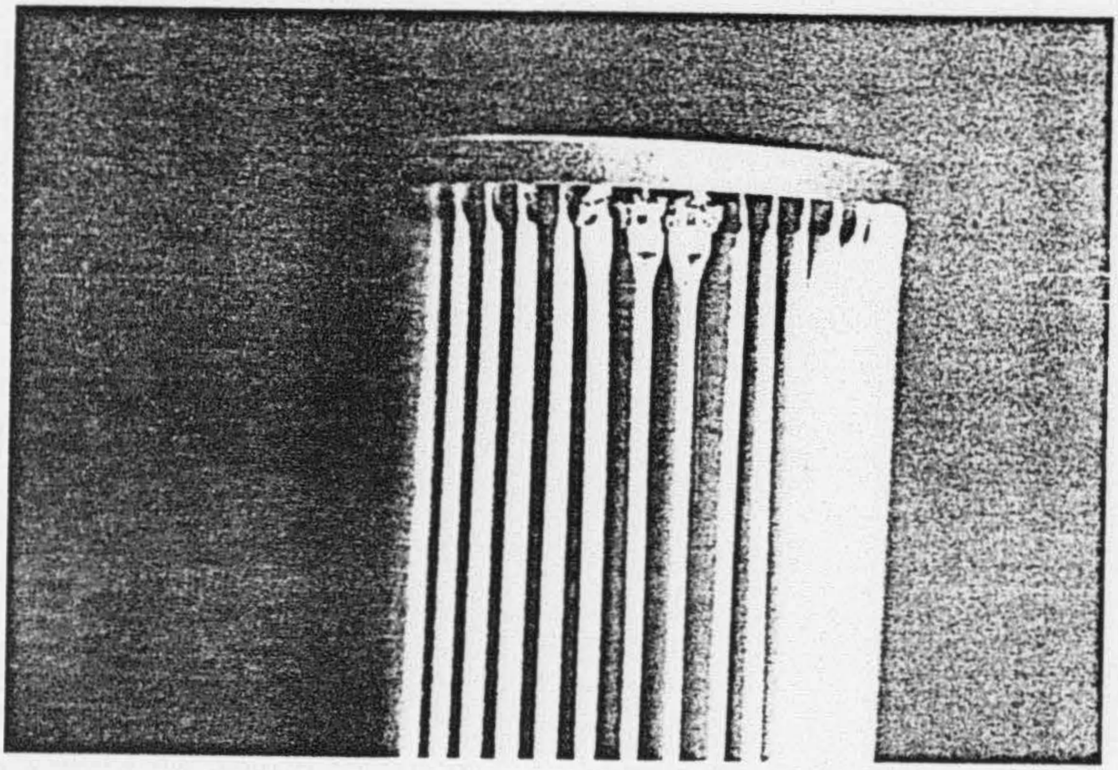


FIGURE 7 CLOSEUP OF FILTER MODULE AFTER LATERAL CRUSH TEST OF 2800 POUNDS