rotork

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10CFR21 REPORT

Report To: NRC Operations Centre
By Fax: 301 816 5151

By Mail: NRC Document Control Desk
US Nuclear Regulatory Commission
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Rockville, MD 20852-2738

Report Filed By: Rotork Controls Inc.
675 Mile Crossing Blvd
Rochester NY 14624

Date of Report: June 10, 2002

Originated By: Karen Black
Quality Manager

Approved By: Bob Arnold
President

Signed K. C. Black

Date June 10, 2002

Signed

Date June 10, 2002

1.0 Basic Component Affected

Rotork NA1 type Electric Valve Actuators fitted with an Add-on-Pak 1 (AOP1) Assembly, manufactured between 1978 (post 78 build) and October 2001, that have a safety function and are used for *end of travel indication.* If used for mid travel indication, with the switches are set to trip in the range of 7.5% to 92.5% of set travel, then the function of the AOP will not be affected. This range depends on the gear ratio within the AOP1 and could increase to 3.7% to 96.3% as indicated in Attachment A.

The basic control of the Rotork NA1 type actuator is through the torque switch and end of position switches (three for the close direction and three for the open direction) that are present in the main switch mechanism. This is described in Rotork publication AE1/4. The AOP1 is an optional assembly, fitted with either six or twelve switches, whose design is best suited for use in mid travel i.e. for indication and for torque switch bypass.

Rotork NA4, NA5, NA1E and NAE5 type Electric Valve Actuators are not affected.

2.0 Nature of the Defect and Associated Safety Hazard

It has recently been identified that the moulded (PPS) components within the AOP1 assembly have a low level of crystallinity and it cannot be confirmed that they are to the same specification as those originally tested and qualified at Wyle in 1978 (refer test report 43979-1 Rev A).

The AOP1 components have been supplied by the same sub-contractor for many years and record's go back to the mid 80's. The sub-contractor does not anneal the components and the tool is not heated hence the components have a low level of crystallinity. The WYLE test monitored the trip point of the AOP1 switches through out the qualification program and was reported to be acceptable. This would imply that either that the AOP1 components tested were annealed or, more probable, that the thermal aging process during the test program annealed the components. An annealing process was added to the AOP1 components in October 2001 to preclude recurrence of this condition.

Recent testing has revealed that moulded PPS AOP1 components with a low level of crystallinity could distort in extreme circumstances, causing the switches to reset or fail to operate. For the distortion to occur, the following conditions must exist simultaneously:

1. The actuator is held in the fully open or closed condition and the AOP1 is set within zero and a minimum of 3.5% of end of travel, maximum 7.5% of end of travel. This is dependent on the gear ratio as detailed in Attachment A.

2. The AOP1 components reach temperatures above 80°C (176°F) and are maintained at this temperature for more than 10 minutes.

Affect on Functionality

- Prior to reaching 80°C (176°F) and for a period of 10 minutes at this temperature, the AOP1 will function correctly regardless of the valve position and the trip position of each switch.

- If the AOP1 switches are set to trip in mid travel and are in this state when exposed to 80°C (176°F) for a period of 10 minutes or more, there is no effect on function. The PPS components may distort but the trip point for the switches and the indication will not change.

Attachment 2 details typical scenarios and the corresponding affect this condition will have on AOP1 function.

3.0 Date of Discovery

April 15, 2002

4.0 Number and Location of Components (Valve Actuators) Affected

NA4 and NA5 type Electric Valve Actuators have a maximum ambient temperature rating of 70C (160F) and are not affected.

NA1 type Electric Valve Actuators have the same ambient temperature rating but can be subject to a loss of coolant accident (LOCA) and are required to operate after this event. The condition reported will only affect Valve Actuators in plant locations where

- the LOCA and Operational temperature specifications, as defined in the Design Basis Document for each facility and location, exceed 80°C (176°F) and
- the AOP1 fitted was manufactured between 1978 and October 2001 and
- the AOPI is exposed to the two conditions outlined in section 2.0.

5.0 Corrective Action

This condition can be corrected without removing the actuator from service, or the AOP1 from the actuator, by annealing "in situ" as documented in Rotork procedure NEP01. Alternatively the AOP1 can be removed from the actuator and annealed as a separate assembly as documented in Rotork Procedure NEP03. The effect on Qualified Life of the annealing process is documented in Rotork procedure ER244.

The documents referenced above are enclosed in the FedEx package sent June 10, 2002.

6.0 Recommended Actions

Each utility must assess whether there are any NA1 actuators installed, fitted with an AOP1 manufactured between 1978 and October 2001, with a safety function and used in the end of travel position, that could be exposed to the two conditions described in section 2, and whether AOP1 malfunction would compromise plant operation.

Please report the results of this assessment to Karen Black in writing who will contact you to establish the rework schedule.

Attachment A

Ref. ER250
Issue 2
Date 6/6/02

NUCLEAR NA1 AOP. % CHANGE IN SWITCH TRIP POSITION.

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		Actuator output turns range using 'LOW' limit switch ratio																							
Actuator	L/S RATIO	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
7NA1 to 16NA1	3.125	1.16	1.25	1.26	1.55	1.56	1.90	1.91	2.35	2.36	2.55	2.56	3.15	3.16	3.95	3.96	4.75	4.85	5.20	5.25	6.40	6.45	8.00	8.10	9.60
Camshaft movement Degree		89.09	96.00	96.77	119.04	119.81	145.92	146.69	180.48	89.50	96.70	97.08	119.46	119.84	149.80	150.18	180.13	90.82	97.38	98.31	119.85	120.78	149.81	151.68	179.77
% Change		7.48	6.94	6.88	5.59	5.56	4.56	4.54	3.69	7.44	6.89	6.86	5.58	5.56	4.45	4.43	3.70	7.33	6.84	6.77	5.56	5.51	4.45	4.39	3.70
30NA1 to 90NA1	5	1.88	2.00	2.01	2.50	2.51	3.00	3.01	3.75	3.81	4.10	4.11	5.10	5.11	6.10	6.11	7.60	7.71	8.30	8.35	10.25	10.26	12.50	12.51	15.50
Camshaft movement Degree		90.24	96.00	96.48	120.00	120.48	144.00	144.48	180.00	90.30	97.18	97.42	120.88	121.12	144.58	144.82	180.13	90.24	97.14	97.73	119.96	120.08	146.30	146.41	181.41
% Change		7.38	6.94	6.90	5.55	5.53	4.63	4.61	3.70	7.38	6.85	6.84	5.51	5.50	4.61	4.60	3.70	7.38	6.86	6.81	5.55	5.55	4.55	4.55	3.67
Potentiometer Gear No. Teeth		26		32		40		48		26		32		40		48		26		32		40		48	
Number of gear clusters 21337		0								2								4							
Number os spacers 21338		5								4								3							

		Actuator output turns range using 'LOW' limit switch ratio																							
Actuator	L/S RATIO	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
7NA1 to 16NA1	3.125	9.80	10.50	10.55	13.00	13.10	16.00	16.10	19.50	19.55	21.00	21.10	26.00	26.10	33.00	33.10	40.00	40.10	43.00	43.10	53.00	53.10	66.00	66.10	80.00
Camshaft movement Degree		90.62	97.09	97.55	120.21	121.13	147.95	148.87	180.31	89.26	95.89	96.34	118.72	119.17	150.68	151.13	182.64	90.41	96.95	97.18	119.50	119.72	148.81	149.03	180.37
% Change		7.35	6.86	6.83	5.54	5.50	4.50	4.47	3.69	7.46	6.95	6.91	5.61	5.59	4.42	4.41	3.65	7.37	6.87	6.85	5.57	5.56	4.48	4.47	3.69
30NA1 to 90NA1	5	15.56	16.80	16.85	20.75	20.80	26.00	26.10	31.00	31.60	34.00	34.10	42.00	42.10	52.00	52.10	63.00	64.10	69.00	69.10	85.00	85.10	105.00	105.10	127.00
Camshaft movement Degree		89.93	97.09	97.38	119.92	120.21	150.26	150.84	179.16	90.18	97.03	97.31	119.86	120.14	148.39	148.68	179.79	90.33	97.23	97.37	119.78	119.92	147.96	148.10	178.96
% Change		7.41	6.86	6.84	5.55	5.54	4.43	4.42	3.72	7.39	6.86	6.84	5.56	5.54	4.49	4.48	3.70	7.37	6.85	6.84	5.56	5.55	4.50	4.50	3.72
Potentiometer Gear No. Teeth		26		32		40		48		26		32		40		48		26		32		40		48	
Number of gear clusters 21337		6								8								10							
Number of spacers 21338		2								1								0							

This sheet is based on NA1 gear selection chart 40064 issue 101.(POST 1978 NA1)

% Change is derived assuming maximum deformation of the Ryton AOP1 cam resulting in a 6.66 degree change in switch trip position.

Example - 7NA1 with 10 actuator output turns
3.125 : 1 'Low' limit switch ratio will use 6 gears (37/26 teeth) & 2 spacers.
% change in switch trip position 7.35% - 6.86%.

Ref. ER250
Issue 2
Date 6/6/02

NUCLEAR NA1 AOP. % CHANGE IN SWITCH TRIP POSITION.

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Actuator	L/S RATIO	Actuator output turns using 'MEDIUM/HIGH' limit switch ratio																							
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
7NA1/11NA1	8.333	3.09	3.33	3.36	4.13	4.16	5.07	5.09	6.27	6.29	6.80	6.83	8.40	8.43	10.53	10.56	12.67	12.93	13.87	14.00	17.07	17.20	21.33	21.60	25.60
Camshaft movement Degree		89.00	95.91	96.77	118.95	119.81	146.02	146.60	180.58	89.45	96.71	97.13	119.46	119.89	149.76	150.18	180.19	90.80	97.40	98.32	119.88	120.79	149.79	151.69	179.76
% Change		7.48	6.94	6.88	5.60	5.56	4.56	4.54	3.69	7.45	6.89	6.86	5.57	5.56	4.45	4.43	3.70	7.33	6.84	6.77	5.56	5.51	4.45	4.39	3.70
14NA1/16NA1	15	5.57	6.00	6.05	7.44	7.49	9.12	9.17	11.28	11.33	12.24	12.29	15.12	15.17	18.96	19.01	22.80	23.28	24.96	25.20	30.72	30.96	38.40	38.88	46.08
Camshaft movement Degree		89.12	96.00	96.80	119.04	119.84	145.92	146.72	180.48	89.51	96.70	97.10	119.46	119.85	149.80	150.19	180.13	90.82	97.38	98.31	119.85	120.78	149.81	151.68	179.77
% Change		7.47	6.94	6.88	5.59	5.56	4.56	4.54	3.69	7.44	6.89	6.86	5.58	5.56	4.45	4.43	3.70	7.33	6.84	6.77	5.56	5.51	4.45	4.39	3.70
30NA1/40NA1	20	7.52	8.00	8.04	10.00	10.04	12.00	12.04	15.00	15.24	16.40	16.44	20.40	20.44	24.40	24.44	30.40	30.84	33.20	33.40	41.00	41.04	50.00	50.04	62.00
Camshaft movement Degree		90.24	96.00	96.48	120.00	120.48	144.00	144.48	180.00	90.30	97.18	97.42	120.88	121.12	144.58	144.82	180.13	90.24	97.14	97.73	119.96	120.08	146.30	146.41	181.41
% Change		7.38	6.94	6.90	5.55	5.53	4.63	4.61	3.70	7.38	6.85	6.84	5.51	5.50	4.61	4.60	3.70	7.38	6.86	6.81	5.55	5.55	4.55	4.55	3.67
70NA1/90NA1	25	9.40	10.00	10.05	12.50	12.55	15.00	15.05	18.75	19.05	20.50	20.55	25.50	25.55	30.50	30.55	38.00	38.55	41.50	41.75	51.25	51.30	62.50	62.55	77.50
Camshaft movement Degree		90.24	96.00	96.48	120.00	120.48	144.00	144.48	180.00	90.30	97.18	97.42	120.88	121.12	144.58	144.82	180.13	90.24	97.14	97.73	119.96	120.08	146.30	146.41	181.41
% Change		7.38	6.94	6.90	5.55	5.53	4.63	4.61	3.70	7.38	6.85	6.84	5.51	5.50	4.61	4.60	3.70	7.38	6.86	6.81	5.55	5.55	4.55	4.55	3.67
Potentiometer Gear No. Teeth		26		32		40		48		26		32		40		48		26		32		40		48	
Number of gear clusters 21337		0								2								4							
Number os spacers 21338		5								4								3							

Actuator	L/S RATIO	Actuator output turns using 'MEDIUM/HIGH' limit switch ratio																							
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
7NA1/11NA1	8.333	26.13	28.00	28.13	34.67	34.93	42.66	42.93	52.00	52.13	56.00	56.26	69.33	69.60	88.00	88.26	106.66	106.93	114.66	114.93	141.33	141.59	175.99	176.26	213.32
Camshaft movement Degree		90.61	97.10	97.55	120.22	121.13	147.93	148.87	180.32	89.26	95.89	96.33	118.71	119.18	150.68	151.13	182.64	90.41	96.95	97.18	119.50	119.72	148.80	149.03	180.37
% Change		7.35	6.86	6.83	5.54	5.50	4.50	4.47	3.69	7.46	6.95	6.91	5.61	5.59	4.42	4.41	3.65	7.37	6.87	6.85	5.57	5.56	4.48	4.47	3.69
14NA1/16NA1	15	47.04	50.40	50.64	62.40	62.88	76.80	77.28	93.60	93.84	100.80	101.28	124.80	125.28	156.68	156.88	192.00	192.48	206.40	206.88	254.40	254.88	316.80	317.28	384.00
Camshaft movement Degree		90.62	97.09	97.55	120.21	121.13	147.95	148.87	180.31	89.26	95.89	96.34	118.72	119.17	150.94	151.13	182.64	90.41	96.95	97.18	119.50	119.72	148.81	149.03	180.37
% Change		7.35	6.86	6.83	5.54	5.50	4.50	4.47	3.69	7.46	6.95	6.91	5.61	5.59	4.41	4.41	3.65	7.37	6.87	6.85	5.57	5.56	4.48	4.47	3.69
30NA1/40NA1	20	62.24	67.20	67.40	83.00	83.20	104.00	104.40	124.00	126.40	136.00	136.40	168.00	168.40	208.00	208.40	252.00	256.40	276.00	276.40	340.00	340.40	420.00	420.40	508.00
Camshaft movement Degree		89.93	97.09	97.38	119.92	120.21	150.26	150.84	179.16	90.18	97.03	97.31	119.86	120.14	148.39	148.68	179.79	90.33	97.23	97.37	119.78	119.92	147.96	148.10	178.96
% Change		7.41	6.86	6.84	5.55	5.54	4.43	4.42	3.72	7.39	6.86	6.84	5.56	5.54	4.49	4.48	3.70	7.37	6.85	6.84	5.56	5.55	4.50	4.50	3.72
70NA1/90NA1	25	77.80	84.00	84.25	103.75	104.00	130.00	130.50	155.00	158.00	170.00	170.50	210.00	210.50	260.00	260.50	315.00	320.50	345.00	345.50	425.00	425.50	525.00	525.50	635.00
	33			127.10	137.28	137.28	171.60	172.26	204.60	208.50	224.40	225.00	277.20	277.86	343.20	343.86	415.80	423.00	455.40	456.00	561.00	561.66	693.00	693.66	838.20
Camshaft movement Degree		89.93	97.09	97.38	119.92	120.21	150.26	150.84	179.16	90.18	97.03	97.31	119.86	120.14	148.39	148.68	179.79	90.33	97.23	97.37	119.78	119.92	147.96	148.10	178.96
% Change		7.41	6.86	6.84	5.55	5.54	4.43	4.42	3.72	7.39	6.86	6.84	5.56	5.54	4.49	4.48	3.70	7.37	6.85	6.84	5.56	5.55	4.50	4.50	3.72
Potentiometer Gear No. Teeth		26		32		40		48		26		32		40		48		26		32		40		48	
Number of gear clusters 21337		6								8								10							
Number of spacers 21338		2								1								0							

This sheet is based on NA1 gear selection chart 40064 issue 101.(POST 1978 NA1)

% Change is derived assuming maximum deformation of the Ryton AOP1 cam resulting in a 6.66 degree change in switch trip position.

Ref. ER250
Issue 2
Date 6/6/02

NUCLEAR NA1/NA1E AOP. % CHANGE IN SWITCH TRIP POSITION.

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		Actuator output turns range using 'LOW' limit switch ratio																							
Actuator	L/S RATIO	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
7NA1 to 16NA1	3.125	1.16	1.25	1.26	1.55	1.56	1.90	1.91	2.35	2.36	2.55	2.56	3.15	3.16	3.95	3.96	4.75	4.85	5.20	5.25	6.40	6.45	8.00	8.10	9.60
Camshaft movement Degree		89.09	96.00	96.77	119.04	119.81	145.92	146.69	180.48	89.50	96.70	97.08	119.46	119.84	149.80	150.18	180.13	90.82	97.38	98.31	119.85	120.78	149.81	151.68	179.77
% Change		7.48	6.94	6.88	5.59	5.56	4.56	4.54	3.69	7.44	6.89	6.86	5.58	5.56	4.45	4.43	3.70	7.33	6.84	6.77	5.56	5.51	4.45	4.39	3.70
30NA1 to 90NA1	5	1.88	2.00	2.01	2.50	2.51	3.00	3.01	3.75	3.81	4.10	4.11	5.10	5.11	6.10	6.11	7.60	7.71	8.30	8.35	10.25	10.26	12.50	12.51	15.50
Camshaft movement Degree		90.24	96.00	96.48	120.00	120.48	144.00	144.48	180.00	90.30	97.18	97.42	120.88	121.12	144.58	144.82	180.13	90.24	97.14	97.73	119.96	120.08	146.30	146.41	181.41
% Change		7.38	6.94	6.90	5.55	5.53	4.63	4.61	3.70	7.38	6.85	6.84	5.51	5.50	4.61	4.60	3.70	7.38	6.86	6.81	5.55	5.55	4.55	4.55	3.67
Potentiometer Gear No. Teeth		26		32		40		48		26		32		40		48		26		32		40		48	
Number of gear clusters 44190		0								1								3							
Number os spacers 21338		5								4								3							
Drive gear 44191		0								1								1							

		Actuator output turns range using 'LOW' limit switch ratio																							
Actuator	L/S RATIO	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
7NA1 to 16NA1	3.125	9.80	10.50	10.55	13.00	13.10	16.00	16.10	19.50	19.55	21.00	21.10	26.00	26.10	33.00	33.10	40.00	40.10	43.00	43.10	53.00	53.10	66.00	66.10	80.00
Camshaft movement Degree		90.62	97.09	97.55	120.21	121.13	147.95	148.87	180.31	89.26	95.89	96.34	118.72	119.17	150.68	151.13	182.64	90.41	96.95	97.18	119.50	119.72	148.81	149.03	180.37
% Change		7.35	6.86	6.83	5.54	5.50	4.50	4.47	3.69	7.46	6.95	6.91	5.61	5.59	4.42	4.41	3.65	7.37	6.87	6.85	5.57	5.56	4.48	4.47	3.69
30NA1 to 90NA1	5	15.56	16.80	16.85	20.75	20.80	26.00	26.10	31.00	31.60	34.00	34.10	42.00	42.10	52.00	52.10	63.00	64.10	69.00	69.10	85.00	85.10	105.00	105.10	127.00
Camshaft movement Degree		89.93	97.09	97.38	119.92	120.21	150.26	150.84	179.16	90.18	97.03	97.31	119.86	120.14	148.39	148.68	179.79	90.33	97.23	97.37	119.78	119.92	147.96	148.10	178.96
% Change		7.41	6.86	6.84	5.55	5.54	4.43	4.42	3.72	7.39	6.86	6.84	5.56	5.54	4.49	4.48	3.70	7.37	6.85	6.84	5.56	5.55	4.50	4.50	3.72
Potentiometer Gear No. Teeth		26		32		40		48		26		32		40		48		26		32		40		48	
Number of gear clusters 44190		5								7								9							
Number of spacers 21338		2								1								0							
Drive Gear 44191		1								1								1							

This sheet is based on NA1 gear selection chart 40064 issue 2.

% Change is derived assuming maximum deformation of the Ryton AOP1 cam resulting in a 6.66 degree change in switch trip position.

Example - 7NA1 with 10 actuator output turns
3.125 : 1 'Low' limit switch ratio will use 6 gears (5 x 44190 + 1 x 44191) & 2 spacers.
% change in switch trip position 7.35% - 6.86%.

06/10/02 12:01 ☎716 328 5848 →→→ NRC OPS CTR HOO 006/008

Ref. ER250
Issue 2
Date 6/6/02

NUCLEAR NA1/NA1E AOP. % CHANGE IN SWITCH TRIP POSITION.

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Actuator output turns using 'MEDIUM/HIGH' limit switch ratio

Actuator	US RATIO	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
7NA1/11NA1	8.333	3.09	3.33	3.36	4.13	4.16	5.07	5.09	6.27	6.29	6.80	6.83	8.40	8.43	10.53	10.56	12.67	12.93	13.87	14.00	17.07	17.20	21.33	21.60	25
Camshaft movement Degree		89.00	95.91	96.77	118.95	119.81	146.02	146.60	180.58	89.45	96.71	97.13	119.46	119.89	149.76	150.18	180.19	90.80	97.40	98.32	119.88	120.79	149.79	151.69	175
% Change		7.48	6.94	6.88	5.60	5.56	4.56	4.54	3.69	7.45	6.89	6.86	5.57	5.56	4.45	4.43	3.70	7.33	6.84	6.77	5.56	5.51	4.45	4.39	[illegible]
14NA1/16NA1	15	5.57	6.00	6.05	7.44	7.49	9.12	9.17	11.28	11.33	12.24	12.29	15.12	15.17	18.96	19.01	22.80	23.28	24.96	25.20	30.72	30.96	38.40	38.88	46
Camshaft movement Degree		89.12	96.00	96.80	119.04	119.84	145.92	146.72	180.48	89.51	96.70	97.10	119.46	119.85	149.80	150.19	180.13	90.82	97.38	98.31	119.85	120.78	149.81	151.68	175
% Change		7.47	6.94	6.88	5.59	5.56	4.56	4.54	3.69	7.44	6.89	6.86	5.58	5.56	4.45	4.43	3.70	7.33	6.84	6.77	5.56	5.51	4.45	4.39	[illegible]
30NA1/40NA1	20	7.52	8.00	8.04	10.00	10.04	12.00	12.04	15.00	15.24	16.40	16.44	20.40	20.44	24.40	24.44	30.40	30.84	33.20	33.40	41.00	41.04	50.00	50.04	62
Camshaft movement Degree		90.24	96.00	96.48	120.00	120.48	144.00	144.48	180.00	90.30	97.18	97.42	120.88	121.12	144.58	144.82	180.13	90.24	97.14	97.73	119.96	120.08	146.30	146.41	18
% Change		7.38	6.94	6.90	5.55	5.53	4.63	4.61	3.70	7.38	6.85	6.84	5.51	5.50	4.61	4.60	3.70	7.38	6.86	6.81	5.55	5.55	4.55	4.55	[illegible]
70NA1/90NA1	25	9.40	10.00	10.05	12.50	12.55	15.00	15.05	18.75	19.05	20.50	20.55	25.50	25.55	30.50	30.55	38.00	38.55	41.50	41.75	51.25	51.30	62.50	62.55	7
Camshaft movement Degree		90.24	96.00	96.48	120.00	120.48	144.00	144.48	180.00	90.30	97.18	97.42	120.88	121.12	144.58	144.82	180.13	90.24	97.14	97.73	119.96	120.08	146.30	146.41	18
% Change		7.38	6.94	6.90	5.55	5.53	4.63	4.61	3.70	7.38	6.85	6.84	5.51	5.50	4.61	4.60	3.70	7.38	6.86	6.81	5.55	5.55	4.55	4.55	[illegible]
Potentiometer Gear No. Teeth		26		32		40		48		25		32		40		48		26		32		40		48	
Number of gear clusters 44190		0								1								3							
Number os spacers 21338		5								4								3							
Drive gear 44191		0								1								1							

Actuator output turns using 'MEDIUM/HIGH' limit switch ratio

Actuator	US RATIO	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
7NA1/11NA1	8.333	26.13	28.00	28.13	34.67	34.93	42.66	42.93	52.00	52.13	56.00	56.26	69.33	69.60	88.00	88.26	106.66	106.93	114.66	114.93	141.33	141.59	175.99	176.26	21
Camshaft movement Degree		90.61	97.10	97.55	120.22	121.13	147.93	148.87	180.32	89.26	95.89	96.33	118.71	119.18	150.68	151.13	182.64	90.41	96.95	97.18	119.50	119.72	148.80	149.03	18
% Change		7.35	6.86	6.83	5.54	5.50	4.50	4.47	3.69	7.46	6.95	6.91	5.61	5.59	4.42	4.41	3.65	7.37	6.87	6.85	5.57	5.56	4.48	4.47	
14NA1/16NA1	15	47.04	50.40	50.64	62.40	62.88	76.80	77.28	93.60	93.84	100.80	101.28	124.80	125.28	158.68	158.88	192.00	192.48	206.40	206.88	254.40	254.88	316.80	317.28	38
Camshaft movement Degree		90.62	97.09	97.55	120.21	121.13	147.95	148.87	180.31	89.26	95.89	96.34	118.72	119.17	150.94	151.13	182.64	90.41	96.95	97.18	119.50	119.72	148.81	149.03	18
% Change		7.35	6.86	6.83	5.54	5.50	4.50	4.47	3.69	7.46	6.95	6.91	5.61	5.59	4.41	4.41	3.65	7.37	6.87	6.85	5.57	5.56	4.48	4.47	
30NA1/40NA1	20	62.24	67.20	67.40	83.00	83.20	104.00	104.40	124.00	126.40	136.00	136.40	168.00	168.40	208.00	208.40	252.00	256.40	276.00	276.40	340.00	340.40	420.00	420.40	50
Camshaft movement Degree		89.93	97.09	97.38	119.92	120.21	150.26	150.84	179.16	90.18	97.03	97.31	119.86	120.14	148.39	148.68	179.79	90.33	97.23	97.37	119.78	119.92	147.96	148.10	17
% Change		7.41	6.86	6.84	5.55	5.54	4.43	4.42	3.72	7.39	6.86	6.84	5.56	5.54	4.49	4.48	3.70	7.37	6.85	6.84	5.56	5.55	4.50	4.50	
70NA1/90NA1	25	77.80	84.00	84.25	103.75	104.00	130.00	130.50	155.00	158.00	170.00	170.50	210.00	210.50	260.00	260.50	315.00	320.50	345.00	345.50	425.00	425.50	525.00	525.50	63
	33			127.10	137.28	137.28	171.60	172.26	204.60	208.50	224.40	225.00	277.20	277.86	343.20	343.86	415.80	423.00	455.40	456.00	561.00	561.66	693.00	693.66	83
Camshaft movement Degree		89.93	97.09	97.38	119.92	120.21	150.26	150.84	179.16	90.18	97.03	97.31	119.86	120.14	148.39	148.68	179.79	90.33	97.23	97.37	119.78	119.92	147.96	148.10	17
% Change		7.41	6.86	6.84	5.55	5.54	4.43	4.42	3.72	7.39	6.86	6.84	5.56	5.54	4.49	4.48	3.70	7.37	6.85	6.84	5.56	5.55	4.50	4.50	
Potentiometer Gear No. Teeth		26		32		40		48		26		32		40		48		26		32		40		48	
Number of gear clusters 44190		5								7								9							
Number of spacers 21338		2								1								0							
Drive Gear 44191		1								1								1							

This sheet is based on NA1 gear selection chart 40064 issue 2.

% Change is derived assuming maximum deformation of the Ryton AOP1 cam resulting in a 6.66 degree change in switch trip position.

Attachment B
POSSIBLE AFFECT ON FUNCTIONALITY

Before reaching 80°C (176°F)		After reaching and being held at 80°C (176°F) for more than 10 minutes	
Valve Position	**AOP1 switch trip position**	**Open/Close Action**	**Affected on Function**
CLOSE	Mid Travel*	Open On Limit OR Open On Torque	No affect
OPEN	Mid Travel*	Close On Limit OR Close On Torque	No affect
CLOSE	End of Travel	Open On Limit OR Open On Torque	AOP switches may reset or fail to operate
OPEN	End of Travel	Close On Limit OR Close On Torque	AOP1 switches may reset or fail to operate

* Mid Travel – within range of 7.5% to 92.5% of travel (worst case) dependent on the AOP gear ratio refer Attachment A
** End of Travel - within 3.7% to 7.5% of end of travel position dependent on the AOP gear ratio refer Attachment A

General Information or Other (PAR) Event # 38975

Rep Org: ROTORK CONTROLS, INC	**Notification Date / Time:** 06/10/2002 13:11 (EDT)
Supplier: ROTORK CONTROLS, INC	**Event Date / Time:** 06/10/2002 (EDT)
	Last Modification: 06/10/2002
Region: 1	**Docket #:**
City: ROCHESTER	**Agreement State:** Yes
County:	**License #:**
State: NY	
NRC Notified by: KAREN BLACK	**Notifications:** VERN HODGE NRR
HQ Ops Officer: RICH LAURA	
Emergency Class: NON EMERGENCY	
10 CFR Section:	
21.21 UNSPECIFIED PARAGRAPH	

PART 21 ON ROTORK NA1 ACTUATOR

The name of the manufacturer is Rotork Controls, Inc. The defective components the Rotork NA1 type electric Valve Actuators fitted with an Add-on-Pak 1 (AOP1) Assembly which was manufactured between 1978 and October 2001 and have a safety function used for end of travel indication. The problem is that moulded components within the AOP1 assembly cannot be confirmed to the same specifications as those originally tested and qualified at Wyle in 1978. No list of affected plants was available at this time.

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