Part 21 (PAR) Event # 50299

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County:		**License #:**	
State: KS			
NRC Notified by: MELANIE DIRKS		**Notifications:** MEL GRAY	R1DO
HQ Ops Officer: STEVE SANDIN		RANDY MUSSER	R2DO
Emergency Class: NON EMERGENCY		STEVE ORTH	R3DO
10 CFR Section:		GEOFFREY MILLER	R4DO
21.21(d)(3)(i) DEFECTS AND NONCOMPLIANCE		NRR PART 21	EMAIL

PART 21 REPORT - POTENTIALLY DEFECTIVE PRESSURE & TEMPERATURE SWITCHES

The following information was originally received in NRC Region IV on July 16, 2014 via email. Relevant portions of the submittal are provided below without graphs, tables or pictures.

"SOR is a supplier of basic components to the nuclear power industry. The components of concern for this notification are SOR nuclear qualified Pressure and Temperature switches with TA housings manufactured from 2004 through 2009.

"The defect being reported is a potential out of tolerance condition concerning the machined sealing surface for an environmental seal on the SOR nuclear TA housing. Other switches with a similar defect have the potential to not meet their intended safety function.

"Summary: SOR Inc. began a 10CFR21 evaluation on 6/4/14 upon receipt of three SOR pressure switches, model number 5TA-B45-U8-C1A-JJTTNQ (SN's 041100627, 041100628, and 041100629). These were returned from Entergy Nuclear Vermont Yankee (VY) due to inspections which questioned the suitability of the sealing surfaces on the face of the housings where the cover O-ring seals.

"The product evaluation was concluded on 6/24/14 and it was determined that this issue is a reportable defect as defined by 10CFR Part 21. If the switch housing has an inadequate machined sealing surface, the potential exists for steam permeation into the switch housing during accident conditions. This could result in an increase in set point as well as allow moisture into the housing potentially causing electrical consequences such as current leakage or a short. It is anticipated that the above noted condition represents a small percentage of the total number of housings from this batch of castings. Also, the potential risk is thought to be small due to a second redundant seal on the cover. This condition is being reported as a conservative measure.

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"Evaluation: There are 2 (redundant) environmental seals on the cover of the nuclear TA housing. One O-ring seals on the undercut of the cover threads (151 O-ring). This seal is not in question and is not part of this evaluation. The other O-ring seals between the face of the enclosure and the O-ring groove on the cover (042 O-ring). This is the seal that is the subject of this evaluation.

"Redundant O-ring seals are used on the SOR 'TA' cover to minimize steam permeation into the housing during LOCA or HELB conditions. The consequences of permeation are that it can result in an increase in the set point and also allow moisture into the housing which could have electrical consequences. The returned switches have a suspect sealing surface on the face of the housing where one of the two O-rings (the 042 O-ring) is intended to seal. For the purposes of this Part 21 evaluation, consideration needs to be given to whether this suspect sealing surface could result in increased permeation into the switch enclosure.

"Switches #041100627 and 041100628 both have an area on the face of the housing where the casting did not have sufficient material for cleanup when the housing was machined. This area was characterized by use of the SOR CMM and measuring the area where the O-ring is expected to seal.

"Switch #041100629 was different from #041100627 and 041100628 in that it had one small indentation in the sealing surface which was immeasurable but does not meet surface finish requirements.

"The TA housings on the returned switches are clearly out of tolerance. It is SOR's position that the environmental seals on any switch with a similar defect has the potential to not meet its' intended safety function. . .

"Evaluation of Previous Shipments: SOR has validated shipments for a quantity of 56 pressure and temperature switches with the subject TA housing.

"Potentially affected customers/utilities include: TVA/Watts Bar, TVA/Browns Ferry, TVA/Sequoyah, Entergy Nuclear/Vermont Yankee, Entergy Operations/River Bend, Southern California Edison, Third Qinshan Nuclear/QSNPP-3-A (TQNPC), Fairbanks Morse Engine, STP Nuclear Operating Co., Hydro Quebec /Gentilly II, Progress Energy/Shearon Harris, Control Components Inc./Korea Hydro Nuclear Shin-Kori & Wolsong, Control Components Inc./KHPN Shin Kori 3 & 4, Korea Hydro & Nuclear/KHPN Yonggwang NPP #5, Konan Engineering/Yonggwang Nuclear, and First Energy/Davis-Besse Nuclear. (Total Potentially Affected = 56.

"Root Cause: The returned TA housing castings did not meet print and therefore did not allow enough material for cleanup of the machined sealing surface.

"Permanent Corrective Action: SOR internal documentation is being changed to require 100% inspection of the raw casting height. Also, the 1/8 [inch] minimum finish dimension is being added to the housing machining drawings.

"Action by Nuclear Power Plant: SOR recommends that the application for each switch noted in the above table be reviewed to determine if it is being used in a LOCA or HELB application. If so, SOR recommends an inspection to visually check for an adequate sealing surface of the housing . This inspection is also recommended for switches that have not yet been installed. The minimum required sealing surface is 1/8 [inch] (0.125 [inch]). After inspection, all units should have the 042 and 151 O-rings replaced if the units do not exhibit the deviation.

"SOR will send replacement O-rings at no charge upon request. If units are found that do not meet the acceptance criteria, they will be replaced free of charge by SOR. Contact SOR Director of Customer Service, Greg Barber for the replacements:

"Greg Barber
"913-956-3059
"gbarber@sorinc.com"

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MEASUREMENT AND CONTROL

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July 16, 2014

SUBJECT: Notification of Defect

SOR is a supplier of basic components to the nuclear power industry. The components of concern for this notification are SOR nuclear qualified Pressure and Temperature switches with TA housings manufactured from 2004 through 2009.

The defect being reported is a potential out of tolerance condition concerning the machined sealing surface for an environmental seal on the SOR nuclear TA housing. Other switches with a similar defect have the potential to not meet their intended safety function.

The attached report describes the defect, recommended actions, evaluation of previous shipments and permanent corrective action taken.

Regards,

Melanie Dirks
Director of Quality
SOR Inc.

Scope:

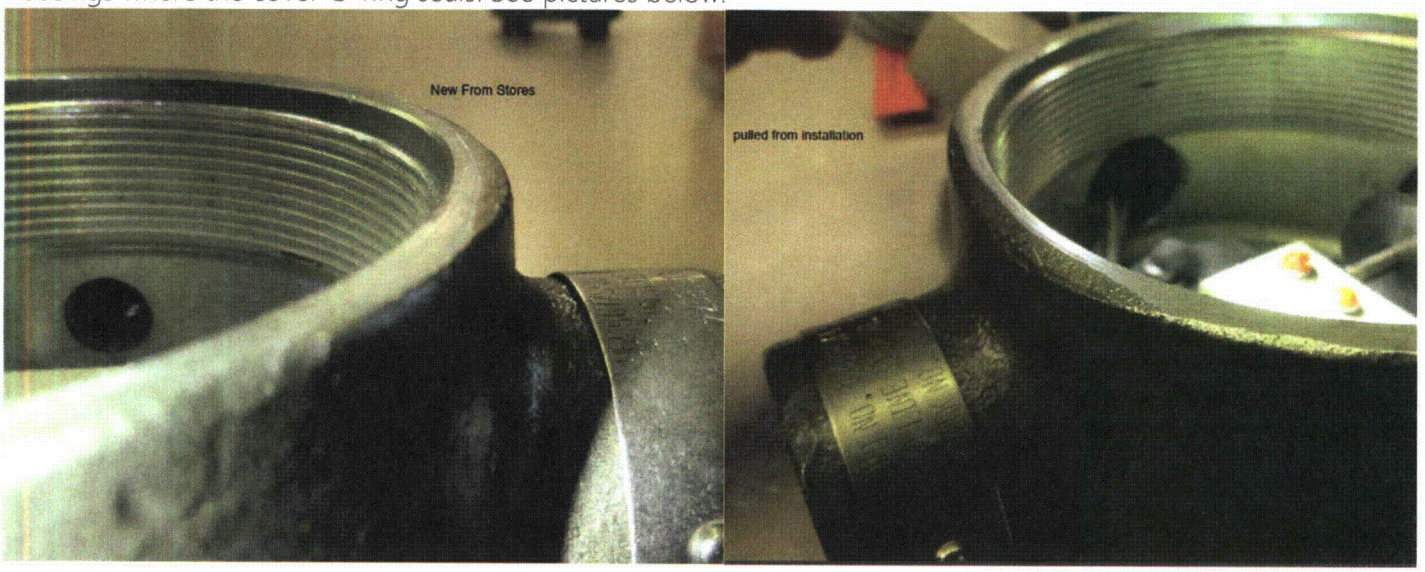
Nuclear Pressure and Temperature switches manufactured between 2004 and 2009: The relevant models are designated by a "TA" in the second position of the model number string (Housing designator) and by a "NQ" at the end of the model number (Accessory designator). See model string below:

XXX TA - XX XXX – XX – XXX - XX XX NQ
1 2 3 4 5 6 7 8 9

1= Sensor designator
2= Housing designator – Only "TA" is affected
3= Switch designator
4= Range designator
5= Diaphragm designator
6= Process connection designator
7= Accessory (optional)
8= Accessory (optional)
9= Accessory designator – Only "NQ" is affected

Summary:

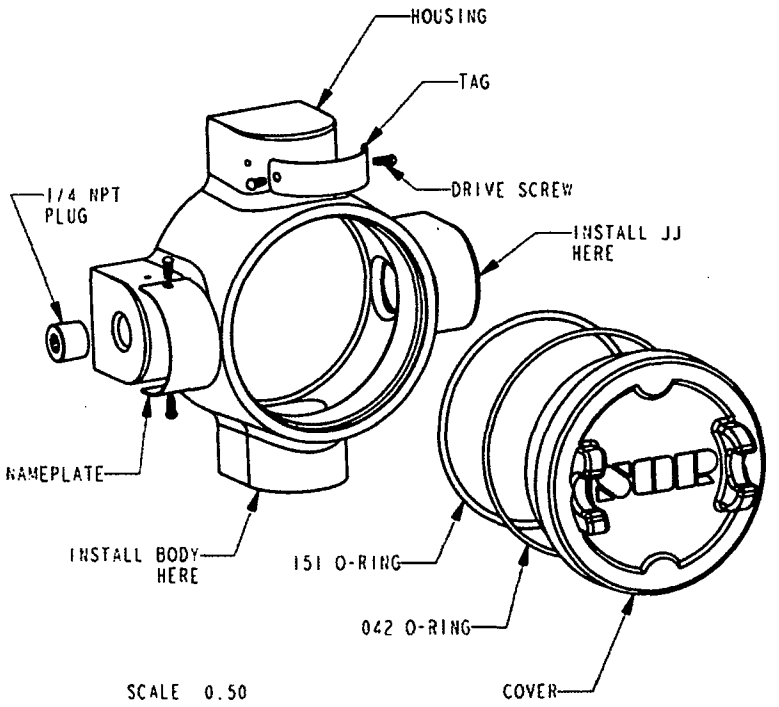
SOR Inc. began a 10CFR21 evaluation on 6/4/14 upon receipt of three SOR pressure switches, model number 5TA-B45-U8-C1A-JJTTNQ (SN's 041100627, 041100628, and 041100629). These were returned from Entergy Nuclear Vermont Yankee (VY) due to inspections which questioned the suitability of the sealing surfaces on the face of the housings where the cover O-ring seals. See pictures below.



The product evaluation was concluded on 6/24/14 and it was determined that this issue is a reportable defect as defined by 10CFR Part 21. If the switch housing has an inadequate machined sealing surface, the potential exists for steam permeation into the switch housing during accident conditions. This could result in an increase in set point as well as allow moisture into the housing potentially causing electrical consequences such as current leakage or a short. It is anticipated that the above noted condition represents a small percentage of the total number of housings from this batch of castings. Also, the potential risk is thought to be small due to a second redundant seal on the cover. This condition is being reported as a conservative measure.

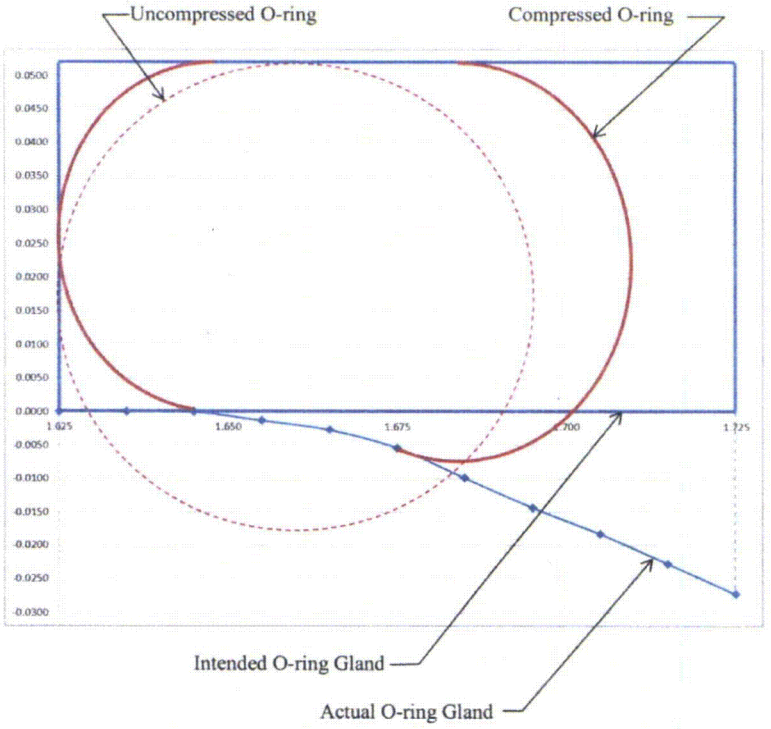
Evaluation:

There are 2 (redundant) environmental seals on the cover of the nuclear TA housing. One O-ring seals on the undercut of the cover threads (151 O-ring). This seal is not in question and is not part of this evaluation. The other O-ring seals between the face of the enclosure and the O-ring groove on the cover (042 O-ring). This is the seal that is the subject of this evaluation. See illustration below.

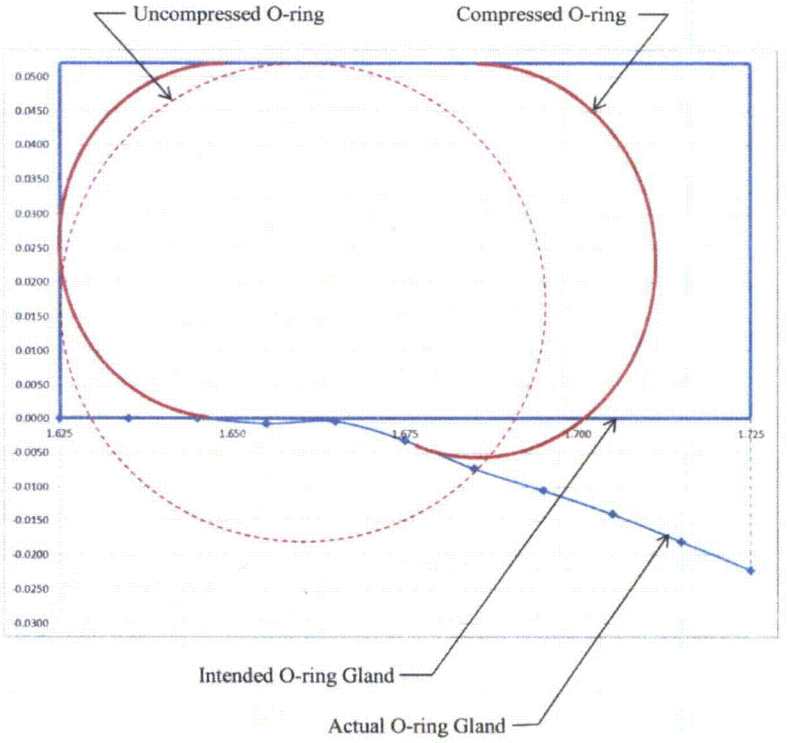


Redundant O-ring seals are used on the SOR "TA" cover to minimize steam permeation into the housing during LOCA or HELB conditions. The consequences of permeation are that it can result in an increase in the set point and also allow moisture into the housing which could have electrical consequences. The returned switches have a suspect sealing surface on the face of the housing where one of the two O-rings (the 042 O-ring) is intended to seal. For the purposes of this Part 21 evaluation, consideration needs to be given to whether this suspect sealing surface could result in increased permeation into the switch enclosure.

Switches #041100627 and 041100628 both have an area on the face of the housing where the casting did not have sufficient material for cleanup when the housing was machined. This area was characterized by use of the SOR CMM and measuring the area where the O-ring is expected to seal. The graphs below represent the worst case measurements taken on Serial #041100627 and 041100628. The "1.625" on the X axis represents the radius to the inside of the O-ring seal gland. Eleven measurements were taken at 0.010" increments. The Y axis represents the deviation from the machined surface on the face of the housing. The O-ring groove is 0.104" wide X 0.052+/-0.002" deep. The 042 O-ring has a 0.070" diameter cross section and will be a snug fit on the ID of the groove. From the illustration below, it can be seen that approximately 50% of the O-ring groove will have less than the intended compression. While the O-ring may be suitable with less compression, it was not qualified this way.



S/N 041100627
(Approximately to scale)



S/N 041100628
(Approximately to scale)

Switch #041100629 was different from #041100627 and 041100628 in that it had one small indentation in the sealing surface which was immeasurable but does not meet surface finish requirements.

The TA housings on the returned switches are clearly out of tolerance. It is SOR's position that the environmental seals on any switch with a similar defect has the potential to not meet its' intended safety function. There must be at least 1/8" of machined sealing surface on the housing as measured from the 3-5/32" diameter counter-bore to ensure an adequate seal.

Evaluation of Previous Shipments:

SOR has validated shipments for a quantity of 56 pressure and temperature switches with the subject TA housing. The table listed below provides the total potentially affected and their shipment history.

Date Shipped	Customer, Utility Name & Purchase Order Number	Quantity	Serial Numbers	SOR Model Number	SOR SO
8/23/04	Tennessee Valley Authority Watts Bar 00037620	2	40604704, 40604705	201TA-B125-U9-C7A-JJTTNQ	422041-1
8/23/04	Tennessee Valley Authority Watts Bar 00037620	3	40604706, 40604707, 40604708	201TA-BB125-U9-C7A-JJTTNQ	422041-2
6/5/06	Tennessee Valley Authority Watts Bar, 00001682.REL.00693	1	60511049	201TA-B125-U9-C7A-JJTTNQ	455055-1
5/17/05	Tennessee Valley Authority Browns Ferry, 614317	1	50207568	201TA-B125-U9-C7A-JJTTNQ	433824-1
3/16/06	Tennessee Valley Authority Sequoyah Nuclear Plant 00001682.REV003.REL.00614	5	51206511, 51206512, 60109536, 60109537, 60109538	9TA-BB5-U8-C1A-JJTTNQ	448080-1
5/14/07	Tennessee Valley Authority Sequoyah Nuclear Plant 0001682.REL.00815	1	70304432	9TA-BB5-U1-C1A-JJTTNQ	468864-1
10/1/07	Tennessee Valley Authority Sequoyah Nuclear Plant 00063289	5	70701763, 70701764, 70701765, 70701766, 70701767	201TA-B125-U9-C7A-JJTTNQ	474034-1
2/1/05	Entergy Nuclear Vermont Yankee VY018974	5	41100625, 41100626, 41100627, 41100628, 41100629	5TA-B45-U8-C1A-JJTTNQ	428483-1
4/4/05	Entergy Nuclear Vermont Yankee VY019418	2	50202265, 50202266	29TA-B45-U1-C1A-JJTTNQ	432798-1
8/26/08	Entergy Nuclear Vermont Yankee 10202738	4	80709351, 80709352, 80709353, 80709354	29TA-B45-U1-C1A-JJTTNQ	492310-1
9/1/09	Entergy Nuclear Vermont Yankee 10242835	1	90606577	12TA-B45-U8-C1A-JJTTNQ	506962-1

Date Shipped	Customer, PO & Utility Name	Quantity	Serial Numbers	SOR Model Number	SOR SO
2/14/10 10/13/10	Entergy Operations, Inc. River Bend 10258267	1	91101205	20XTA-BB125-U9-C7A-TTNQ	512576-2 30190
1/27/06	Southern California Edison 6G216003	1	50806569	201TA-W125-U9-C7A-JJTTNQ	442181-1
5/19/06	Southern California Edison 6L236024	1	60400344	201TA-W125-U9-C7A-JJTTNQX	452775-1
5/4/07	Third Qinshan Nuclear QSNPP-3-A (TQNPC) 2007-SOR-1	2	70203416, 70203417	6TA-B5-U8-C1A-JJRRTTNQ	467009-1
7/19/07	Fairbanks Morse Engine FAIRBANKS.MORSE.SAMPLE	1	70704378	201TA-B125-U9-C7A-JJTTNQ	474450-1
1/8/08	Fairbanks Morse Engine 1099787REV1	2	71205152, 71205153	201TA-B125-U9-C7A-JJTTNQ	481832-1
11/19/07	STP Nuclear Operating Co Stock Code 501-74266 90296	2	70709479, 70709480	6TA-B3-U8-C1A-JJTTNQ	475156-1
12/5/07	Hydro Quebec Gentilly II 4502016557	3	70808012, 70808013, 70808014	4TA-B4-U8-C1A-JJTTNQ	476320-1
10/6/08	Progress Energy Shearon Harris Nuclear Plant 00389275.REV001	2	80707379, 80707380	6TA-B5-U8-C1A-JJTTNQ	492020-1
8/11/08	Control Components Inc. Korea Hydro Nuclear Shin-Kori & Wolsong 603876	4	80200099, 80200100, 80200101, 80200102	6TA-BB5-U8-C1A-JJTTNQ	483633-1
12/8/08	Control Components Inc. KHPN Shin Kori 3 & 4 604751	4	81005472, 81005473, 81005474, 81005475	6TA-BB5-U8-C1A-JJTTNQ	496234-1
2/27/09	Korea Hydro & Nuclear Yonggwang NPP #5 Y080660651	1	81204791	6TA-BB5-U8-C1A-JJTTNQ	498838-1
10/27/08	Konan Engineering Yonggwang Nuclear KPOS-080828	1	80810115	6TA-BB5-U8-C1A-JJTTNQ	493782-1
2/2/09	First Energy Davis-Besse Nuclear 45288635	1	81202736	201TA-BB125-U9-C7A-JJTTNQ	498532-1
Total Potentially Affected		56			

Root Cause:

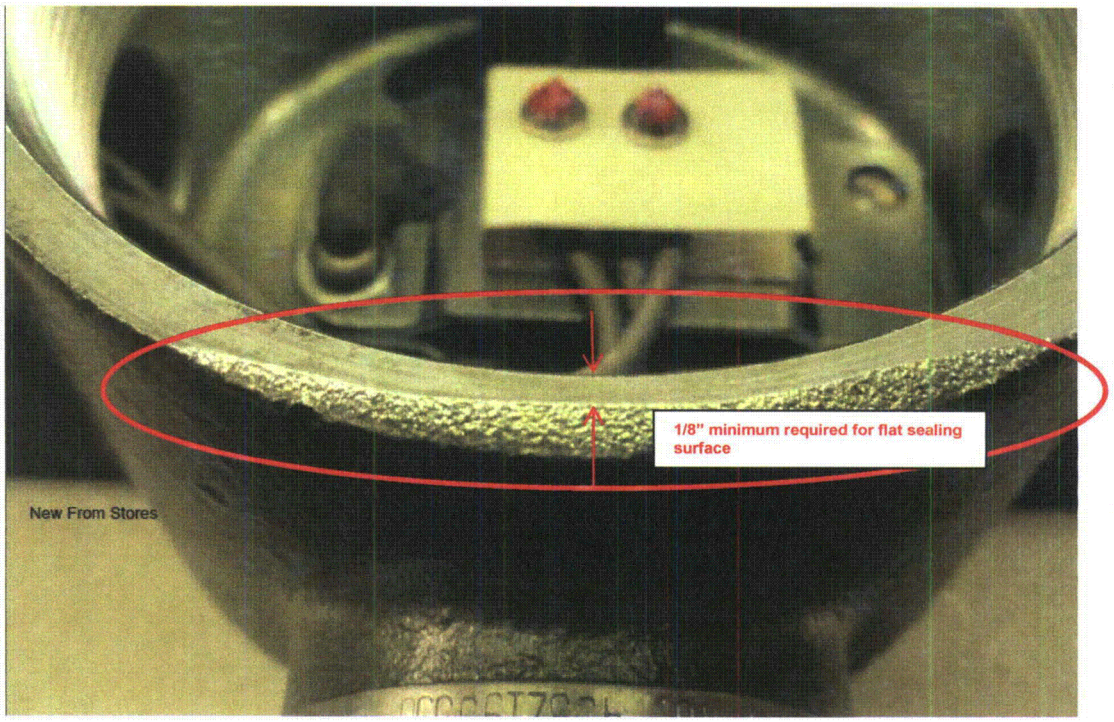
The returned TA housing castings did not meet print and therefore did not allow enough material for cleanup of the machined sealing surface.

Permanent Corrective Action:

SOR internal documentation is being changed to require 100% inspection of the raw casting height. Also, the 1/8" minimum finish dimension is being added to the housing machining drawings.

Action by Nuclear Power Plant:

SOR recommends that the application for each switch noted in the above table be reviewed to determine if it is being used in a LOCA or HELB application. If so, SOR recommends an inspection to visually check for an adequate sealing surface of the housing (reference picture below). This inspection is also recommended for switches that have not yet been installed. The minimum required sealing surface is 1/8" (0.125"). After inspection, all units should have the 042 and 151 O-rings replaced if the units do not exhibit the deviation.



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