STEAM GENERATOR TUBE INSPECTION DISCUSSION DURING PALISADES 2015 (RF24) OUTAGE (Preliminary Information)

Currently Palisades is ~ 80% through the base scope eddy current inspection and starting the special interest as of 10/1/2015 at ~ 1200 hours

1. Discuss any trends in the amount of primary-to-secondary leakage observed during the recently completed cycle.

Refer to attached Primary to Secondary Leak Rate for Operational Cycle 24 Primary to Secondary Leak Rate graph. Leakage has been minimal all cycle.

2. Discuss whether any secondary side pressure tests were performed during the outage and the associated results.

No secondary side pressure tests are planned for the 2015 refueling outage (RF24).

3. **Discuss any exceptions taken to the industry guidelines.**

In cycle (22) Palisades submitted a deviation to the NRC: Technical Justification Supporting Deviation from the EPRI Appendix I ETSS for ODSCC Sizing

Palisades will deviate from the "needed" requirement to use an approved Examination Technique Specification Sheet (ETSS) contained in The “EPRI PWR Steam Generator Examination Guidelines – Revision 7”, Section 6.2 for ODSCC sizing. Palisades will instead use a modified ETSS for ODSCC. The modified ETSS will be identical to the ETSS approved per Appendix I of the examination guidelines with the exception that only the sub-set of data from CE plants will be used instead of the combined fleet data set used in the approved ETSS.

A comprehensive review of axial ODSCC in Palisades steam generators shows that Appendix I28432 over sizes maximum depth values for axial ODSCC at Palisades. There is a reasonable basis to submit a deviation request for maximum depth sizing of axial ODSCC indications at Palisades. The request is relatively modest since it uses the Combustion Engineering (CE) subset of the well vetted data of Appendix I28432. The regression slope and standard error of regression are retained. Only the intercept parameter is changed. This provides an across the board reduction of NDE maximum depth sizing of 11.23 %TW. This will lead to about a 1000 psi increase in calculated condition monitoring burst pressures and much better matching of projected and measured NDE maximum depths.

The deviation was implemented in the 2012 (1R22) refueling outage steam generator inspection for the remaining life of the existing Palisade steam generators.

4. For each steam generator, provide a description of the inspections performed including the areas examined and the probes used (e.g., dents/dings, sleeves, expansion-transition, U-bends with a rotating probe), the scope of the inspection (e.g., 100% of dents/dings greater than 5 volts and a 20% sample between 2 and 5 volts), and the expansion criteria.

- Full length ECT bobbin coil examination of all in-service tubes (except row 1, 2, and 3 U-bends) in both SGs.

ECT +Point™ coil examinations (both SGs):

- 100% of rows 1, 2, and 3 U-bends.
- 100% of hot leg from TTS + 3" to a minimum of 13.5" below the bottom of the expansion transition.
- 100% of free span dings >5V between TSH and TSC.
- 100% of >2V dents at egg crate, diagonal bar, and vertical strap intersections between TSH and TSC.
- 25% of historical %TW calls at diagonal bars and vertical straps
- 100% of historical TRA indications
- The outer 3 peripheral tubes at the cold leg from TTS+3" to TTS-2" for detection of possible loose parts or wear signals.
- The periphery region is defined to be the outer three (3) tubes exposed to the annulus, all tubes in rows 1 through 4, and the inner three (3) tubes around the stay cylinder region.

The expansion criteria for each degradation is attached to the back in tables 9-1 through 9-4.

5. For each area examined (e.g., tube supports, dent/dings, sleeves, etc), provide a summary of the number of indications identified to-date of each degradation mode (e.g., number of circumferential primary water stress corrosion cracking indications at the expansion transition). For the most significant indications in each area, provide an estimate of the severity of the indication (e.g., provide the voltage, depth, and length of the indication). In particular, address whether tube integrity (structural and accident induced leakage integrity) was maintained during the previous operating cycle. In addition, discuss whether any location exhibited a degradation mode that had not previously been observed at this location at this unit (e.g., observed circumferential primary water stress corrosion cracking at the expansion transition for the first time at this unit).

As of 10/1/2015 @ 1200 hours

SG	Location	Type	Number Indications	Number Tubes	Integrity Acceptable
A	TSH	Axial ODSCC	6	6	YES*
A	TSH	Axial PWSCC	0	0	N/A
A	TSH	Circ PWSCC	0	0	N/A
A	TSH	Circ ODSCC	1	1	YES*
A	TSH	Volumetric	2	2	YES*
A	TEC to TEH	Wear > 40	0	0	N/A
B	TSH	Axial ODSCC	4	4	YES*
B	TSH	Axial PWSCC	0	0	N/A
B	TSH	Circ PWSCC	0	0	N/A
B	TSH	Circ ODSCC	0	0	N/A
B	TSH	Volumetric	0	0	N/A
B	TEH to TEC	Wear > 40	0	0	N/A
A	Tube Supports	Axial ODSCC	0	0	N/A
A	Freespan	Axial ODSCC	0	0	N/A
B	Tube Supports	Axial ODSCC	0	0	N/A
B	Freespan	Axial ODSCC	0	0	N/A

*Expectation based on voltage and sizing performed to date

SG A

- 6 OD SAIs, all at TTS sludge pile on hot side (TSH+0.3” to 1.16”) (see plot)
- 1 OD SCI, at TSH

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    - 0.83 V
    - Max circumferential extent 0.38” (62 degrees)
    - Max depth 83 %TW
    - Not structurally challenging
    - No depth profile sizing yet
- 2 foreign object wear flaws (SVIs)
    - No sizing yet.
    - We will attempt to remove the object, and then size them.

SG B

- 4 OD SAIs, all at TTS sludge pile on hot side (TSH+0.43” to 1.27”)
    - Voltages are less limiting than the 3 largest in SG A.
    - No sizing yet.
- No foreign object wear

Both SGs – Support Structure Wear

- No plugging expected
- Average growth rate is essentially zero
- 95/50 growth rate is ~3 %TW/EFPY

Freespan

There is no free span repairable indications reported to date.

U-Bends

There are no U-bend repairable indications reported to date.

6. Describe repair/plugging plans.

Currently there are **9** potential tubes requiring tube plugging in SG E-50A and **4** potential tubes in SG E-50B.

All stress corrosion cracking (SCC) indications will be plugged. Any circumferential SCC indications near the top-of-tubesheet (TTS) will be stabilized and plugged. C* depth is applicable to the HL

All wear indications (at support structures) greater than or equal to 40%TW will be plugged.

7. Describe in-situ pressure test and tube pull plans and results (as applicable and if available).

Based on the available data to date, no tubes will require in-situ pressure testing.

8. Discuss the following regarding loose parts:

What inspections are performed to detect loose parts?

The hot leg top of tube sheet (TTS) region is inspected with +Pt up to 3 inches above TTS. A similar inspection is performed for the cold leg TTS region (3 tubes deep along periphery and tube lane. Foreign object search and retrieval (FOSAR) is performed for the periphery, tube lane annulus, and stay cavity areas.

A description of any loose parts detected and their location within the SG

As of 10/1/2015 at 1200 hours, the following are the number of potential loose parts identified with the plus point inspection:

E-50A	192 PLP Calls in 131 Tube Locations
E-50B	102 PLP Calls in 76 Tube Locations

The majority of the indications is historical and has not changed. Visual inspection with FOSAR has been completed in SGB. Anticipate FOSAR in SGA on 10/2/2015

If the loose parts were removed from the SG

SG E-50A

It is anticipated that FOSAR will start in SG E-50A on 10/2/2015.

SG E-50B

The visual inspection will be performed around the periphery of both the hot leg and cold leg and along both sides of the tube lane approximately 3 tubes deep. Several locations were identified and visually inspected. There were a few new parts identified from last outage. Most were identified as demister wire/sludge. One location in SGB CL was determined to be a sludge rock. An attempt to remove it was unsuccessful.

Indications of tube damage associated with the loose parts

Currently there is 1 location in SGA that has wear associated with the part. An attempt will be made to remove the parts and retest with a volumetric standard. If unable to remove, the affected tube and surrounding tubes will be removed from service.

9. Discuss the scope and results of any secondary side inspection and maintenance activities (e.g., in-bundle visual inspections, feedring inspections, sludge lancing, assessment deposit loading, etc).

Sludge lancing was not performed.

There is an ISI inspection (WO-384812) in E-50A which is being supported by the SG Project. This inspection is not part of the SGMP inspections.

10. Discuss any unexpected or unusual results.

An attempt was made to run one of the analysis systems in auto for the tube sheet region. Based on the manual analysis and IQDA inspections, it appears that the Auto system missed an axial crack at the sludge pile. The crack is ~ 0.8 volts. It is still being sized. The auto systems was adjusted to find this type of flaw but manual analysis of the remaining tubes and those affected by the auto analysis is being performed instead.

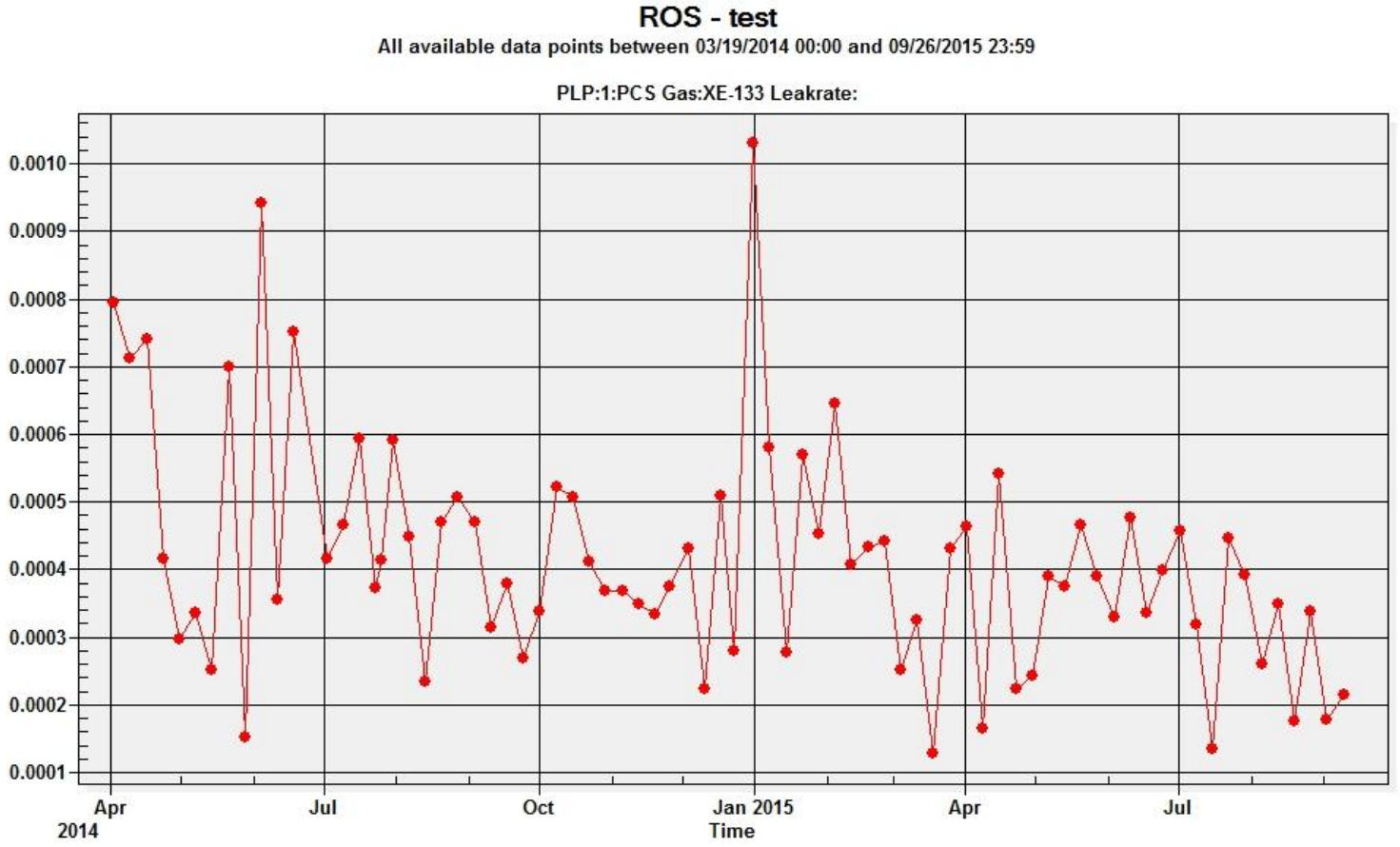
Currently there are no other unexpected or unusual results. There are no tubes that have failed the screening criteria requiring in-situ pressure testing

11. Provide the schedule for steam generator-related activities during the remainder of the current outage.

Once the remainder of the base – bobbin and top of tube sheet, are complete, the special interest test will be performed.

Anticipate complete ECT on 10/4/2015
Anticipate complete repair on 10/6/2015
Anticipate closeout on 10/7/2015
Nozzle dam removal and manway installation on 10/7/2015

The following is the Primary to Secondary Leak Trend for the Last Fuel Cycle
Note: Units in Gallons per Minutes



The following is a trend of the Main Condenser Off-Gas Rad-Monitor in GPD

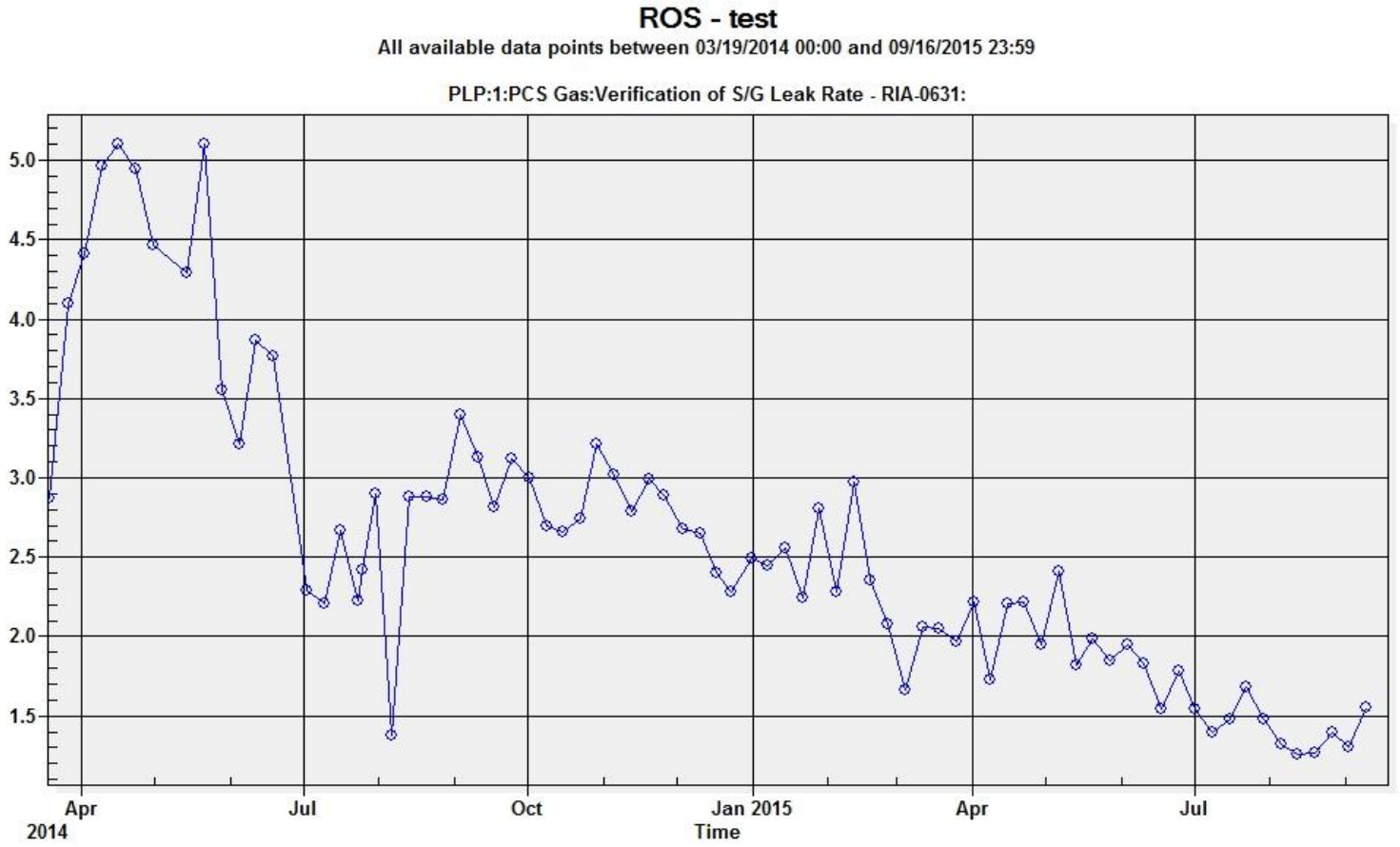


Table 9-1: Inspection Scope Summary – Wear

Damage Mech.	Location	E/P D/S	Probe / ETSS	Scope	Expansion / Comments
Wear	Eggcrates DB/VS	E/D/S	Bobbin / 96004.1	100% bobbin except row 1-3 u-bends.	+Point all new wear, all wear ≥40%TW, all bobbin I-codes
		E/D/S	+Point 10908.4	100% +Point row 1-3 u-bends.	
		P(SCC)/ D	+Point / (see SCC sections)	+Point all eggcrate wear, and 25% of DB/VS wear not previously inspected, in order to detect any SCC coincident with wear.	If SCC is coincident with significant DB/VS wear, then +Point all DB/VS wear in the affected SG. In-situ testing will be required per CDME-07-119
	Dented VS/DB (≤ 5Vpp)	E/D	Bobbin / 96004.1	100% bobbin except row 1-3 u-bends. Identifies coincident wear and denting (see [3.e])	+Point all bobbin I-codes and all bobbin indications of coincident wear and denting
		E/D/S	+Point 10908.4	100% +Point row 1-3 u-bends, plus all bobbin indications of coincident wear and denting. (see CDME-07-119)	
	Dented VS/DB (> 5Vpp)	E/D/S	+Point 10908.4	Apply this technique to all VS/DB dents >5Vpp reported by bobbin probe to ensure detection and sizing of wear (see CDME-07-119)	If wear cannot be sized (depth or voltage), then in-situ testing will be required
	Tube to Tube Contact Wear	E/D/S	Bobbin / 13091.1	100% bobbin except row 1-3 u-bends.	+Point all new wear, +Point all bobbin I-Codes
		E/D/S	+Point 13901.1	+Point row 1-3 u-bends. +Point highest eggcrate through the square bend for the tubes surrounding R99 C140 in SGB	
	Loose Part Wear	E/D	Bobbin / 27091.2	100% bobbin and FOSAR both SGs.	+Point all bounding tubes with loose part wear or loose part indication or visually detected loose part
		E/D/S	+Point 27901-27907 10908.4	27901 thru 27907 when loose part not present (CMOA) 10908.4 when loose part present (CM)	

Table 9-2: Inspection Scope Summary – Axial ODSCC/PWSCC

Damage Mech.	Location	E/P D/S	Probe / ETSS	Scope	Expansion / Comments
Axial ODSCC	Non-dented and ≤ 2Vpp Dented Eggcrates DB/VS Freespan	E/D	Bobbin / I28413	100% bobbin except row 1-3 u-bends.	+Point all bobbin I-Codes
		E/D	+Point / I28425	+Point inspection of all bobbin I-Codes for ODSCC detection	
		E/S	+Point / I28432	+Point depth and length sizing of detected ODSCC	
	+Point Row 1-3 U-bends	P/D/S	+Point / 10411.1	100% +Point row 1-3 u-bends.	+Point sizing of any low row indications.
	Freespan Ding ≤ 5Vpp	E/D	Bobbin / 24013.1	100% bobbin except row 1-3 u-bends.	+Point all bobbin I-Codes
		E/D/S	+Point / 22401.1	+Point inspection of bobbin I-Codes at dinged freespan locations for ODSCC detection, and length sizing of detected ODSCC.	
	Freespan Ding >5Vpp Dented >2Vpp Eggcrates DB/VS	E/D/S	+Point / 22401.1	+Point inspection to detect and length size axial ODSCC at dinged and dented locations.	
	Sludge Pile and Exp Transition	E/D	+Point / I28424	+Point 100% H/L TTS +3" to 13.5" below the bottom of the expansion transition; +Point inspection of cold leg bobbin I-Codes	+Point 100% of region in affected SG; ensure 20% inspected in the other SG
		E/S	+Point / I28431	+Point inspection for depth and length sizing of detected Axial ODSCC indications at the sludge pile and expansion transitions.	
Axial PWSCC	Row 1-3 U-bends	E/D/S	+Point / (MR) 96511.2	100% +Point Row 1-3 u-bends	If SCC is detected in row 3, then inspect all u-bends in row 4 of the affected SG, and 20% of row 4 in the unaffected SG.
		E/D/S	+Point / (HF) 99997.2		
	Dented Eggcrates DB/VS Dinged Freespan	P/D/S	+Point / 96703.1	+Point all >2Vpp dents at structures and dings >5Vpp in freespan; +Point inspection of bobbin I-Codes	If an indication is detected, then a scope expansion will be determined based on the dent voltage and significance of the indication.
	Tubesheet and Exp Transition	E/D/S	+Point / 20511.1	+Point 100% H/L TTS +3" to 13.5" below the bottom of the expansion transition; +Point inspection of cold leg bobbin I-Codes	+Point 100% of region in affected SG; ensure 20% inspected in the other SG

Table 9-3: Inspection Scope Summary – Circumferential ODSCC/PWSCC

Damage Mech.	Location	E/P D/S	Probe / ETSS	Scope	Expansion / Comments
Circ ODSCC	Row 1-3 U-bends	P/D/S	+Point / 22842.1 & 21410.1	100% +Point row 1-3 u-bends	If SCC is detected in row 3, then inspect all u-bends in row 4 of the affected SG, and 20% of row 4 in the unaffected SG
	Dented Eggcrates DB/VS Dinged Freespan	P/D/S	+Point / 22842.1 & 21410.1	+Point all >2Vpp dents at structures and dings >5Vpp in freespan; +Point inspection of bobbin I-Codes;	If an indication is detected, then a scope expansion will be determined based on the dent voltage and significance of the circumferential indication
	TTS and Expansion Transition	E/D/S	+Point / 21410.1	+Point 100% H/L TTS +3" to 13.5" below the bottom of the expansion transition; +Point inspection of cold leg bobbin I-Codes	+Point 100% of region in affected SG; ensure 20% inspected in the other SG
	Expansion Transition	E/S	+Point / EPRI TR-107197-P1	Sizing of circumferential indications per EPRI TR-107197-P1	
Circ PWSCC	Row 1-3 U-bends	P/D	+Point (MR) / 96511.2	100% +Point row 1-3 u-bends	If SCC is detected in row 3, then inspect all u-bends in row 4 of the affected SG, and 20% of row 4 in the unaffected SG
		P/D	+Point (HF) / 99997.2		
	Dented Eggcrates DB/VS. Dinged Freespan	P/D	+Point / I11524	+Point all >2Vpp dents at structures and dings >5Vpp in freespan; +Point inspection of bobbin I-Codes	If an indication is detected, then a scope expansion will be determined based on the dent voltage and significance of the circumferential indication
		P/S	+Point / 96701.1	Sizing of circumferential PWSCC	
	Row 1-3 U-bends	P/D	+Point / I11524	100% +Point row 1-3 u-bends	If SCC is detected in row 3, then inspect all u-bends in row 4 of the affected SG, and 20% of row 4 in the unaffected SG
		P/S	+Point / 20510.1	Sizing of u-bend circumferential PWSCC	
	TTS and Exp Transition	E/D	+Point / I11524	+Point 100% H/L TTS +3" to 13.5" below the bottom of the expansion transition; +Point inspection of cold leg bobbin I-Codes	+Point 100% of region in affected SG; ensure 20% inspected in the other SG
		E/D/S	+Point / 96701.1		

Table 9-4: Inspection Scope Summary – Pitting

Damage Mech.	Location	E/P D/S	Probe / ETSS	Scope	Expansion / Comments
Pitting	Sludge Pile	P/D	Bobbin / 96005.2	100% bobbin exam of the region	+Point all bobbin I-Codes
		P/S	+Point / 21998.1	+Point sizing of detected pitting	