

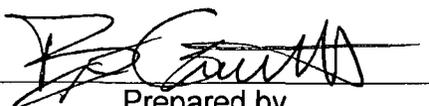
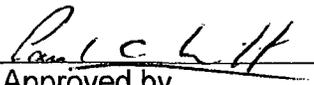
PSC
Precision Surveillance Corporation

PSC PROCEDURE SQ 12.1
GREASE REPLACEMENT
September 21, 2007
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Revision 0

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
30TH YEAR - 8TH PERIOD
CONTAINMENT BUILDING TENDON SURVEILLANCE

PRECISION SURVEILLANCE CORPORATION
IN-SERVICE INSPECTION
QUALITY CONTROL PROCEDURE

GREASE REPLACEMENT

 Prepared by	LEVEL II Q.C. Title	09/21/07 Date
 Approved by	PROJECT MANAGER, P.E. Title	09/21/07 Date
 Approved by	PRESIDENT Title	09/21/07 Date



1.0 PURPOSE

- 1.1 This procedure will establish the requirements for the Replacement of Grease in the tendon duct after visual inspection and evaluation of Post-Tensioning System Tendons during In-Service Inspections (surveillance) of Progress Energy Florida's Crystal River Unit 3.

2.0 SCOPE

- 2.1 This procedure is intended to provide the Grease Replacement requirements for the wire post-tensioning system. This procedure requires that all tendons which had grease caps removed and replaced shall be full of grease at the end of the surveillance.

3.0 RESPONSIBILITY

- 3.1 As stated in PSC Procedure QA 4.0.

4.0 QUALIFICATIONS

- 4.1 As stated in PSC Procedure QA 4.1.

5.0 EQUIPMENT

- 5.1 The gauges and test equipment necessary for the Quality Control activities will be itemized in PSC Procedure SQ 4.0.

6.0 QUALITY CONTROL

- 6.1 This procedure contains **HOLD POINTS**. The work shall not progress past or through a **HOLD POINT** without a sign-off from the QC Inspector. All Quality Control Documentation (**QCD**) points shall only require documentation of information or evaluation data. The sign-off's and required information or evaluation data shall be documented on Data Sheet 12.1. It shall be necessary to acquire the Total Grease Loss for the tendon from the Data Sheets 6.0 of PSC Procedure SQ 6.0 for each end.

7.0 PRECAUTIONS

- 7.1 During Grease Replacement, the grease may be pumped under pressure with an inlet end temperature of 130°F to 210°F. It is therefore essential to avoid direct contact with the hot grease and to make sure all connections are secure.

- CAUTION - DURING GREASING, BE AWARE THAT THE GREASE IS HOT AND MAY BE PUMPED UNDER PRESSURE.



8.0 PREREQUISITES

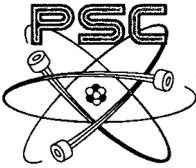
- 8.1 All Inspections will be complete.
- 8.2 The tendon will be in a stressed condition.
- 8.3 The Grease Cap shall be ready to be installed or has been installed.
- 8.4 **QCD** – Enter the quantity of Total Grease Loss from Data Sheet 6.0 for this end of the tendon.
- 8.5 **QCD** – Enter the quantity of Total Grease Loss from Data Sheet 6.0 for the other end of the tendon.
- 8.6 **QCD** – Enter any Estimated Grease Loss that may have occurred as a result of Leaks from the Grease Cap or Gasket since the original installation or previous surveillance for this end of the tendon.
- 8.7 **QCD** – Enter the Estimated Grease Loss that may have resulted from Leakage from the Grease Cap or Gasket since the original installation or previous surveillance for the other end of the tendon.
- 8.8 Calculate the TOTAL TENDON GREASE LOSS by adding the 8.4 + 8.5 + 8.6 + 8.7.
- 8.8.1 **QCD** – Document the TOTAL TENDON GREASE LOSS on Data Sheet 12.1.
- 8.9 **QCD** – Document the ambient temperature near the tendon, and Thermometer Identification and Recalibration Date.
- 8.10 **QCD** – Document the date of grease cap removal shown on Data Sheet 6.0 of PSC Procedure SQ 6.0 for this tendon. Document the date of grease replacement and calculate the Elapsed Time.

9.0 CONTROLS FOR REFILLING THE TENDON VOID

- 9.1 The replacement of grease shall be performed prior to demobilization of the tendon surveillance equipment and personnel, provided that the tendon anchorages have been lightly coated with grease and grease can properly installed.
- 9.2 Hoop or Dome Tendon
- 9.2.1 Where less than 10 gallons of grease has been lost from the tendon void (duct). Each end will be hand pumped or poured with hot grease until full.
- 9.2.2 Where more than 10 gallons of grease has been lost from the tendon void (duct). The tendon will be pressure pumped with hot grease from one end until it exits the Opposite End.



- 9.2.2.1 Where there is no grease Exiting Outflow from the Opposite End of a Hoop or Dome Tendon, it shall be necessary to hand pump or pour hot grease into the Opposite End grease cap until full.
- 9.3 Vertical Tendon
- 9.3.1 Where less than 10 gallons of grease has been lost from the tendon void (duct) at the lower end. Hot grease will be poured or hand pumped into the top end until full.
- 9.3.2 Where more than 10 gallons of grease has been lost from the tendon void (duct) at the lower end. The tendon will pressure pumped with hot grease from the bottom end until it exits the Top End.
- 9.3.2.1 Where there is no grease Exiting Outflow from the Top End of a Vertical Tendon, it shall be necessary to pour or hand pump hot grease into the Top End grease can until grease reaches the level of the inlet on the side of the cap.
- 9.4 The grease in the drum shall be pumped at a minimum temperature of 130°F and not be permitted to exceed a maximum temperature of 210°F at any time during pumping.
- 9.5 The pressure required for pressure pumping hot grease into the tendon in an effort to have the grease exit the Opposite End of the tendon shall not exceed 55 psig at the filler end for hoop and dome tendons and 125 psig for the lower end of a vertical tendon. The pressure for hand pumping hot grease into the upper end grease cap of a vertical tendon shall not exceed 55 psig.
- 9.6 Pumping shall be stopped immediately if it is suspected or known that the grease is going somewhere else besides the immediate tendon void.
- 9.7 Notify CR3ENG when the absolute difference between the amount of grease removed and the amount of grease replaced is equal to or greater than 10% of the net duct volume for a given tendon. Continue grease replacement up to 20 gallons under CR3ENG approval. Use extreme care over 20 gallons, considering the possibility of grease leakage somewhere in the system.
- 9.8 MEASUREMENT OF GREASE REPLACEMENT
- 9.8.1 The grease may be in a large storage container or in 55-gallon drums. The large storage container shall have an automatic thermostat control for temperature, while drum heaters shall be used to heat the grease in drums.
- 9.8.2 The grease shall be monitored for quantity by a volume gauge at the pumping mechanism or by measuring the quantity of grease remaining in the drum or by measuring the drum to determine the quantity that has been pumped out.



- 9.8.3 To provide a grease volume number in gallons based on a standard 55 gallon drum, divide the 55 gallons by the usable height of the drum (31 inches). This provides a figure of 1.77 gallons per inch of drum height. Note that a typical 55 gallon drum is 34 inches high, but based on actual observation, grease shrinkage and the depressed lid take up 3 inches of height.
- 9.8.4 Take a measurement of the height of the grease in the drum with a clean measuring device before installing any grease. It will be acceptable to take the measurement from the top of the grease in the drum to the top edge of the drum.
- 9.8.4.1 **HOLD POINT** – Document the grease height dimension to the nearest 1/8 of an inch.
- 9.8.5 Take a measurement of the height of the grease in the drum after installing the grease.
- 9.8.5.1 **HOLD POINT** – Document the final grease height dimension to the nearest 1/8 of an inch.
- 9.8.5.2 **QCD** – Calculate and document the Total Quantity of grease replaced into the cap to the nearest 1/4 gallon.
- 9.8.5.2.1 *EXAMPLE:* If the initial grease height was 25-1/2" and the final grease height was 6-1/4", this is a 19-1/4" reduction multiplied by 1.77 gallons per inch which equals 34.1 gallons pumped in.

$$(25 \frac{1}{2}'' - 6 \frac{1}{4}'') \times 1.77 = 34.1 \text{Gal}$$

9.9 MEASUREMENT OF GREASE WASTE

- 9.9.1 When it becomes necessary to determine the volume of grease that was pumped into the tendon void, it will be necessary to subtract the waste grease outflow, spillage, grease remaining in the pump-in hose, grease remaining in the waste line hose from the grease volume that was pumped from the drum into that tendon.
- 9.9.2 If the waste grease is pumped into a 55 gallon drum, then each inch of drum height will equal to 1.77 gallons.
- 9.9.3 The standard grease filling hoses have an internal diameter of 1-1/2". The formula for volume of a cylinder measured in inches is $\pi(3.1416) \times r^2 \times L$ (in inches) divided by 231 cubic inches per gallon. Therefore, each 12" of this hose would contain 0.092 gallons. The same volume formula would apply to determine the capacity of other types of cylindrical containers; buckets, cans, etc.



9.9.4 Smaller containers should be evaluated for size to determine the capacity. These types of containers would only require a simple estimate for the waste grease contained therein.

9.9.5 Before pumping any waste grease into a container, always verify the quantity within that container before pumping.

10.0 GREASE REPLACEMENT

10.1 The Grease Replacements described in this Procedure are for one end of a tendon. The terms Tendon Void, Tendon Conduit, and Tendon Duct are synonymous.

10.2 HAND PUMPING AND/OR POURING

10.2.1 Where less than 10 gallons of grease has been lost from the tendon void (duct), each end will be hand pumped or poured until full.

10.2.2 Where less than 10 gallons of grease has been lost from the tendon void (duct) at the lower end of a vertical tendon, the Top End of will be poured or hand pumped to replace the grease.

10.2.3 Remove the grease cap plug, attach the "Y-Device" shown in Sketch 8.1 or a similar device. Grease is to be hand pumped/poured in at a minimum temperature of 130°F, but no greater than 210°F.

10.2.4 Remove the "Y-Device" reinstall the grease cap plug.

10.2.5 **QCD** – Verify no grease is leaking.

10.2.6 Repeat sections 10.1.1 and 10.1.3 for the other end of a hoop or dome tendon.

10.2.7 **QCD** – Document the quantity of hot grease Hand Pumped into this end grease cap.

10.2.8 **QCD** – Document the quantity of hot grease Hand Pumped into the other end grease cap.



10.3 PRESSURE PUMPING

- 10.3.1 Where more than 10 gallons of grease has been lost from the tendon void (duct), or more than 5 gallons from either end of a hoop or dome tendon the tendon will be pressure pumped from one end until it exits the Opposite End.
- 10.3.2 Where more than 10 gallons of grease has been lost from the tendon void (duct) at the lower end of a vertical tendon the tendon will be pressure pumped from the Lower End until it exits the Top End.
- 10.3.3 Remove the grease cap plug, attach the "Y-Device" or a similar device and pump hose to the end of the grease cap to be pumped into. Connect the waste outflow hose to the opposite end of the tendon. Be sure to have a suitable quantity of waste containers on hand to collect the waste.
- 10.3.4 Be sure that adequate communication is provided at each end of the tendon so that the crew at each end of the tendon will know what actions are taking place.
- 10.3.5 Pressure pump grease in with a pressure not to exceed 55 psig at the Filler End for hoop and dome tendons and 125 psig for the Lower End of a vertical tendon, at a minimum temperature of 130°F, but no greater than 210°F.
- 10.3.6 If the grease exits the Opposite End of a hoop or dome tendon or Top End of a vertical tendon grease pumping shall continue until a minimum of 1 gallon of clean grease has exited from the opposite end.
- 10.3.6.1 Where there is no grease Exiting Outflow from the Opposite End of a hoop or dome tendon or Top End of a vertical tendon it shall be necessary to hand pump or pour hot grease into the Opposite End of a hoop or dome tendon or Top End of a vertical tendon grease cap until full.
- 10.3.7 **QCD** – Document the quantity of hot grease Pressure Pumped into this grease cap. Also document the Thermometer Identification, Recalibration Date and the temperature of the grease pumped in.
- 10.3.8 **QCD** – Document the quantities of Exiting Outflow Grease, if any. Refer to Section 9.9 of this procedure for explanation on calculating exiting outflow grease.
- 10.3.9 **QCD** – Document the QUANTITY REPLACED by Hand Pumping or pouring from the other end of the tendon, if applicable.
- 10.3.10 **QCD** – Calculate the TOTAL TENDON QUANTITY REPLACED by adding the quantities of grease replaced by Hand Pumping (10.2.6 and 10.2.7 or 10.3.9) to the quantity of grease Pressure Pumped (10.3.7) minus the quantity of Exiting Outflow Grease (10.3.8).



- 10.3.11 **QCD** – Compare the TOTAL TENDON QUANTITY REPLACED to the TOTAL TENDON GREASE LOSS. Calculate the percent difference by the following formula:

$$\frac{[\text{TOTAL TENDON QUANTITY REPLACED (10.3.10)}] - [\text{TOTAL TENDON GREASE LOSS (8.8.1)}]}{\text{NET VOLUME TENDON VOID (SQ 12.2)}} \times 100\%$$

11.0 OTHER CONTROLS

- 11.1 Verify that no grease is leaking. If there is some leakage, the deficiency shall be corrected and cleanup performed.
- 11.2 **HOLD POINT** – Document the acceptance of leak tightness.
- 11.3 **HOLD POINT** – Document the acceptability of the refilling. An acceptable refilling is one in which the percent difference from Section 10.3.11 of this procedure does not exceed 10% and there are no leaks.
- 11.4 **QCD** – Document any comments of unusual occurrences or references that could assist in evaluating the refill or for future surveillances.

12.0 NOTIFICATION

- 12.1 If the absolute difference between the amount of grease removed from the tendon and the amount of grease replaced exceeds 10% of the net duct volume, it shall be necessary to notify CR03ENG with a nonconformance report.

13.0 DOCUMENTATION

- 13.1 The items requiring documentation shall be documented on Data Sheet 12.1.
- 13.2 Some information shall be posted from Data Sheet 6.0 of PSC Procedure SQ 6.0 onto Data Sheet 12.1.
- 13.3 The Data Sheet references the applicable Section or Step number of the procedure for each **QCD** or **HOLD POINT**.

14.0 ATTACHMENTS

- 14.1 Figure 1.0 – PSC “Y” Device
- 14.2 Data Sheet 12.1



Figure 1.0 - PSC "Y-Device"

TYPICAL HOOK-UP FOR FILLING TENDON VOIDS

- A - Grease Can Body
- B - Pipe
- C - Grease Can Filler Bushing
- D - Y-Device Body
- E - Male Quick Coupler
- F - Operating Shaft & Handle
- G - Square Male Pipe Plug Wrench
- H - Pipe Plug
- I - Casing Filler Hose
- J - Female Quick Coupler
- K - Packing Box
- L - Packing Box Gland
- M - Relief Valve - Optional

