B.1 Design Specification

The details of the design change are specified below:

B.2 Scope Description

The scope of this Engineering Change is to identify the number and the sequence of tendons to detension to allow removal and repair of the delaminated section of the containment wall under EC 75219. These tendons to be detensioned are in addition to the 10 vertical and 17 hoop tendons removed to accommodate the creation of the SGR access opening (Ref. EC 63016).

Removed Tendons associated with SGR Opening - identification Numbers

34V8 thru 34V17 (10 verticals)

53H27 thru 53H35 and 42H27 thru 42H34 (17 hoops)

Tendons to be Detensioned under this EC are identified in Attachment Z09R

In order to access the tendons inside the Auxiliary Building, which contains the Spent Fuel Pool and its associated decay heat removal systems, portions of the roof over the Auxiliary Building between Buttresses 5 and 6 are to be modified to provide hydraulic ram access for tendon detensioning.

This EC will remove a roof section at the 200'- 4" elevation of the Fuel Handling Building (approx. 180 ft^2) to facilitate detensioning tendons at buttress # 6. At the 167'-6" elevation of the Auxiliary Building a section of the roof (approx. 81 ft^2) will be removed to facilitate detensioning of tendons at RB buttress # 5. This EC will evaluate how these openings will affect the Auxiliary Building Air Handling Systems when roof sections are removed.

This EC will be implemented while the Plant is in a "No-Mode" condition.

B.3 References

1. Industry Standards:

   1.1. ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWA, IWE, and IWL of the 2001 edition through the 2003 Addenda, as amended by 10CFR50.55a.
   1.2. ASME Boiler and Pressure Vessel Code, Section III, Division 2, Code for Concrete Containments, 2001 edition through the 2003 Addenda
   1.3. ANSI N45.2.11-1974, Quality Assurance Requirements for the Design of Nuclear Power Plants
   1.4. ASME Boiler & Pressure Vessel Code, Section VIII, Unfired Pressure Vessels, 1965 Ed
   1.5. ASME Boiler & Pressure Vessel Code, Section III, Nuclear Vessels, 1965 Ed
   1.6. ASME Boiler and Pressure Vessel Code, Section III, Division 2, Appendix F, Rules for Evaluation of Service Loadings with Level D Service Limits, 1995 Ed
   1.7. ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection NE, 1995 Ed
   1.8. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, as contained in the Ninth Edition of the AISC Manual of Steel Construction.

1.9. ACI 318-63, Building Code Requirements for Structural Concrete and Commentary
1.10. NUREG-0612, Control of Heavy Loads at Nuclear Power Plants.

2. Design Basis Documents:

2.1. DBD11, Design Basis Document for the Containment, Revision 7 (Tab 1/1)
2.2. DBD13, Design Basis Document for Major Class I Structures, Revision 5 (Tab 1/3)
2.3. EDBD Tab 8/7 Revision 14, Titled "Auxiliary Building Air Handling System"

3. Specifications:

3.1. SP-5209, Revision 0, CR-3 Seismic Qualification
3.2. RO 3040, Requirement Outline, Pre-stressing System Tendon Conduit, Date 06/12/1970
3.3. SP-5583, Dated 09/18/1968, Specification, Tendon and Associated Conduit, RB
3.4. GAI Specification SP-5844, Dated 10/21/1970, Specification, Installation of Pre-stressing System Tendon Conduit and Embedded anchorage
3.5. GAI Specification SP-5646, Fabrication and Delivery of Reinforcing Steel, Dated 04/25/1969

4. Drawings:

4.1. 421-043, Revision 7, RB Equipment Access Shield Structure
4.2. 421-031, Revision 4, RB Exterior Wall – Concrete Outline
4.3. 421-032, Revision 8, RB Stretch-Out of Exterior Wall Buttress #2, #3, #4 and #5
4.4. 421-033, Revision 8, RB Stretch-Out of Exterior Wall Buttress #5, #6, #1 and #2
4.5. 421-036, Revision 10, RB Exterior Wall – Sections and Details
4.6. 421-039, Revision 5, RB Exterior Wall – Equipment Access Opening Reinforcement Details
4.7. 421-041, Revision 5, RB Ring Girder – Concrete Outline – Plan And Sections
4.8. 421-001, Revision 4, RB Tendon Access Gallery – Plan, Sections and Details
4.9. Prescon Drawings Series 5EX7-003, (CR3 Dwg Key #S-26 series and S1542 thru S1596)
4.10. 5EX7-003-A-01, Revision 3, (Dwg key #S-000031)–Prescon Corp tendon fabrication
4.11. 5EX7-003-A-02, Revision 0, (Dwg key #S-000032)
4.12. 5EX7-003-A-03, Revision 5, (Dwg key #S-000195)
4.13. 5EX7-003-A-04, Revision 5, (Dwg key #S-001527)
4.14. 5EX7-003-A-07, Revision 2, (Dwg key #S-001528)
4.15. 5EX7-003-A-08, Revision 3, (Dwg key #S-001529)
4.16. 5EX7-003-A-09, Revision 5, (Dwg key #S-001530)
4.17. 5EX7-003-A-09A, Revision 5, (Dwg key #S-001531)
4.18. 5EX7-003-A-09C, Revision A, (Dwg key #S-001532)
4.19. 5EX7-003-A-09D, Revision 1, (Dwg key #S-001533)
4.20. 5EX7-003-P-16, Revision 1, (Dwg key #S-001569)
4.21. 5EX7-003-P-19, Revision 0, (Dwg key #S-001572)
4.22. 5EX7-003-P-22, Revision 1, (Dwg key #S-001575)
4.23. 5EX7-003-P-28, Revision 1, (Dwg key #S-001581)
4.24. 421-346, Revision 0, Reactor Bldg Temporary Access Opening for SGR – Load Combinations.
4.25. 421-347, Revision 0, Reactor Bldg Temporary Access Opening for SGR – Vertical & Horizontal Tendon Positions.

4.26. 421-348, Revision 0, Reactor Bldg Temporary Access Opening for SGR – Demolition Sheet 1 of 2
4.27. 421-349, Revision 0, Reactor Bldg Temporary Access Opening for SGR – Demolition Sheet 2 of 2
4.28. S-502-036, Revision 2, Miscellaneous Security Barriers (tendon access hatch cover).
4.29. FD-302-751 Sheet 1 of 1, Revision 62, Titled "RB, Fuel Handling Area and Auxiliary Bldg Air Handling".
4.30. FD-302-752 Sheet 1 of 1, Revision 36, Titled "Auxiliary Building and Fuel Handling Area".
4.31. L-001-023 Sheet 1 of 1, Revision 25, Titled "Layout Plan Above Reactor, Auxiliary and Intermediate Building Elev. 143 ft ".
4.32. L-001-032 Sheet 1 of 1, Revision 29, Titled "Layout Plan above RB Operating floor Elev 160' and Aux. Bldg 162 ft".
4.33. BS-311-715 Revision 27, Titled "Auxiliary Building – South End Plan @ El. 143 ft".
4.34. BS-311-716 Revision 23, Titled "Auxiliary Building & Control Complex Plan at Floor El. 143 ft and 145 ft – 8 inches"
4.35. BS-311-718 Revision 30, Titled "Auxiliary Building & Control Complex Plan at Floor 162 ft and 164 ft"
4.36. A-101-111 Revision 13, Titled "Architectural Roof Plan and Sections".

5. Calculations:

5.1 S10-0004 Tendon Detensioning Calculation – (MPR;0102-0135-06)
5.2 S09-0055 - Reinforcement Ratio and Effective Modulus of Elasticity-- (MPR;0102-0135-01)
5.3 S09-0056 - Concrete Modulus of Elasticity and Minimum Compressive Strength-- (MPR;0102-0135-02)
5.4 S10-0001 - Tendon Tension Calculation-- (MPR;0102-0135-03)
5.5 S10-0002 - Finite Element Model Description-- (MPR;0102-0135-04)
5.6 S10-0003 - Conduit Local Stress Analysis-- (MPR;0102-0135-05)
5.7 S10-0005 - Bending/Tension Interaction Diagrams for Selected Sections-- (MPR;0102-0135-07)
5.8 S10-0006 - Seismic, Wind, and Tornado Evaluation and Delamination Depth Evaluation for Detensioned State-- (MPR;0102-0135-08)
5.9 Holding point for PII Calculation (See Caveat)
5.10 Calculation H70-0001 Revision 0, Titled "Air Handling Calculations"

6. Nuclear Generating Group (NGG) Procedures:

6.1 EGR-NGGC-0003, Rev. 10, "Design Review Requirements"
6.2 EGR-NGGC-0005, Rev. 29, "Engineering Change"
6.3 EGR-NGGC-0011, Rev. 13, "Engineering Product Quality"
6.4 MNT-NGGC-0004, Rev. 11, "Scaffolding Control"
6.5 EGR-NGGC-0015, Rev. 3, "Containment Inspection Program"
6.6 NUA-NGGC-1530, Revision 13, "Quality Assurance Hold Point Procedure".
6.7 SAF-NGGC-2172, Revision 9, "Industrial Safety".
6.8 FIR-NGGC-0003, Revision 4, "Hot Work Permit"
6.9 CHE-NGGC-0045, Chemical Control Program.

7 Plant Procedures:

7.1 A1-1803, Revision 21, "Safety Standards for Ladders & Scaffolds"
7.2 AI-1000, Revision 42, "HOUSEKEEPING/MATERIAL CONDITION PROGRAM"
7.3 AI-2200, Revision 13, GUIDELINES FOR HANDLING USE AND CONTROL OF TRANSIENT COMBUSTIBLES
7.4 ISI, Rev 3, "In-service Inspection Program/Containment Inspection Program - IWE/IWL"
7.5 P-182, Revision 16, Reactor Building Structural Integrity Tendon Surveillance Program.
7.6 AI-1801, Revision 15, Heat Stress Management.
7.7 AI-1803, Revision 21, Safety Standards for Ladders & Scaffolds.
7.8 AI-1816, Revision2, Industrial Safety Signs and Tags.
7.9 AI-2210, Revision 11, Fire watch Program
7.10 MP-804, Revision 10, Concrete Anchor Bolt Installation
7.11 EM-220, Revision 36, Violent Weather
7.12 Station Fire Protection Plan (FPP, Revision 25)
7.13 EVC-SUBS-00016, Revision 7, Hazardous Waste Management
7.14 OP-409, Revision 75, Plant Ventilation System
7.15 SP-300, Revision 220,Operating Daily Surveillance Log
7.16 PT-407C, Revision 0, Reactor Building Containment Tendon Detensioning, Retensioning, Replacement, Examination and Testing

8. Plant Change Documents:

8.1 EC 63016, Revision 31, "Containment Opening"
8.2 EC 63020, Revision 07, "Outside Erection Crane & Inside Auxiliary Crane"
8.3 EC 63021, Revision 11, "Temporary Material and Personnel Hoist Outside RB"
8.4 EC 63022, Revision 31, "Steam Generator Rigging and Transport"
8.5 EC 74801, Revision 8, "Containment Structure – Extent of Condition Core Bores"
8.6 EC 75219, Revision 0, "Reactor Building Delamination Repair Phase 3 – Concrete Removal (In Development)
8.7 EC 75220, Revision 0, "Reactor Building Delamination Repair Phase 4 – Concrete Placement (In Development)
8.8 EC 75221, Revision 0, "Reactor Building Delamination Repair Phase 5 – Retention/Test (In Development)
8.9 EC 70377, Temporary Power Outside Containment for SGR.
8.10 EC-ED 0068398, NUREG-0612 Justification for Tendon Testing Over Spent Fuel Pool.
8.11 EC 75000, CR3 Reactor Building Delamination Repair

9. Regulatory Documents:

9.1 FSAR, Revision 31.3
9.2 Improved Technical Specifications (Through Amendment 235and Improved Technical Specifications Bases Revision 81)

10. Other References:

10.1 AR 00358724, Exposed Cracks During Hydro-Demolition.
10.2 AR00364707, 50.59 Screen for EC 75000
10.3 AR00376765, 50.59 Screen for EC 75218

10.4 SAF-SUBS-00029, Rev. 3, "General Machine Guarding"
10.5 SAF-SUBS-00030, Rev. 3, "Hand and Power Tool Safety"
10.6 SAF-NGGC-2172, Rev. 12, "Industrial Safety"
10.7 Precision Surveillance Corporation (PSC) Manual "Post Tensioning System Field and Quality Control Procedure Manual", Part of PT-407C.
10.8 Containment Liner IWE Repair Plan for the Crystal River Unit 3 Steam Generator Replacement Modification and Delamination Repair. (Attachment Z21R0).
10.9 Containment IWL Repair Plan for the Crystal River Unit 3 Steam Generator Replacement Modification and Delamination Repair. (Attachment Z20R0).
10.10 EVC-SUBS-00107, Waste Vendor Program.
10.11 EVC-CRNF-00002, Crystal River Nuclear Plant Site-Specific Environmental Policies, Permits, Registrations, Certifications and Plans.

B.4 Design Inputs

Following is a list of applicable *design inputs* specified to meet the requirements of ANSI N45.2.11.

B.4.1 Basic Functions of Each Structure, System and Component:
Reactor Building Containment Structure:

The containment is a Class I Structure as described in the FSAR Sections 5.1.1.1 and 5.2.1 and the Design Basis Document for the Containment, (Ref. 2.1, Tab 1/1). However, the Containment Building is not required to be operational while the reactor is defueled. Also there are no Technical Specification Actions requiring Containment closure while defueled.

This EC will remove a section of Auxiliary Building and Spent Fuel Pool area roof to facilitate detensioning of tendons at RB buttress No. 5 (column 305/304B and L/M) and No. 6 (column 305/304B and column I). Removal of sections of the Auxiliary Building and Spent Fuel Pool area roof will breech the boundary of the following Auxiliary building air handling systems:

- Auxiliary Building Supply System (AH-XD)
- Fuel Handling Area Supply System (AH-XE)
- Spent Fuel Pit Supply System (AH-XH)
- Auxiliary and Fuel Building Exhaust System (AH-XJ)

The functions of these systems is to provided filtered, conditioned air to the Auxiliary Building and control/limit the release of radioactivity to the environment by maintaining a slight negative pressure within the buildings.

Basis:
Design Basis Document for the Containment (Ref. 2.1, Tab 1/1),
ITS Sections 3.6.1 and 3.9.5
FSAR Sections 5.1 and 5.2
DBD Tab 1/3
EDBD Tab 8/7
Attachment Z28R0

B.4.2. Performance Requirements such as Capacity, Rating, and System Output:

The reactor containment building is a Class I Structure designed as a passive barrier that is required to maintain its structural integrity during a design basis accident and for all normal and accident load cases and load combination, however, since the reactor is defueled through the detensioning process and the plant is in No Mode, design bases requirements are not applicable.

Auxiliary Building Air Handling System:

Supply Systems: (139,029 CFM total, 96,974 CFM from the AH-XD system and 30,000 CFM from the AH-XE system, 12,055 CFM from the AH-XH system)

The Auxiliary Building Supply System (AH-XD) provides 48,487 CFM/fan (AHF-11A/B, 50% capacity) of outside filtered air (AHF-8) to the Auxiliary Building which is the required differential CFM between the supply and exhaust to maintain a slightly negative building pressure and provide the desired number of Aux. Building air changes (5-6 per hour). From the total flow rate of 96,974 CFM, a flow rate of 17,514 CFM is directed to the 143' operating floor area through dampers AHMD-36/37/38.
The fans and filter are located on the 143' elevation where the (1) roof panel is being removed.

The Fuel Handling Area Supply System (AH-XE) provides 30,000 CFM (AHF-10) of outside filtered (AHFL-9) air to the fuel pool area which is the required differential CFM between the supply and exhaust to maintain a slightly negative building pressure. The system in located on the 164 elevation.

The Spent Fuel Pit Supply System (AH-XH) provides 12,055 CFM (AHF-23A or AHF-23B) of fuel handling area air across the spent fuel pit. This flow ensures that the supplied air travels over the complete pool area to capture all gases released by the spent fuel. The air that travels across the pool is then captured by the Auxiliary Building and Fuel Handling Exhaust System (AH-XJ).

Exhaust System: (156,680 CFM / 141,012 CFM min)
The Auxiliary Building and Fuel Handling Exhaust System (AH-XJ) exhausts 78,340 CFM/fan (AHF-14A/B/C/D, two fans in operation) of Auxiliary Building air through filters (AHF-2A/B/C/D) to the outside. The minimum flow rate is 141,012 CFM. The fans and filter are located on the 143' elevation where the (1) roof panel is being removed.

Basis:

Design Basis Document for the Containment, (Ref. 2.1, Tab 1/1)
FSAR, Section 5.2.1
EDBD Tab 8/7.
Dwg FD-302-751
Dwg BS-311-715

B.4.3. Codes, Standards, and Regulatory Requirements:

The post tensioned, reinforced concrete reactor containment building is designated as a Class I Structure (FSAR Section 5.1.1.1 and Ref. 2.1) and by definition is therefore nuclear safety-related. Its design and construction predated the establishment of a

concrete pressure vessel code. The primary design code for the concrete, tendons and steel reinforcement was ACI 318-63, Parts IV-B and Part V. The tendons conformed to the applicable portions of ASTM A421-65 for low relaxation wire (FSAR Section 5.2.2.3.2). The liner plate conformed in all respects to the applicable Sections of ASA N 6.2-1965 "Safety Standard for Design, Fabrication and Maintenance of Steel Containment Structures for Stationary Nuclear Power Reactors". However, while defueled the containment building is not required to be operational.
Requirements impacting the roof of the Aux Building are addressed under Attachment Z18R0.

Auxiliary Building Air Handling System:
Maintain a negative pressure in the Auxiliary Building utilizing the supply fans and two of the four exhaust fans during normal operation. In addition one of two spent fuel pit supply fans operate.

During an emergency or fuel handling accident, the supply fans automatically stop and the exhaust fans continue to operate.

Basis: Design Basis Document for the Containment, (Ref. 2.1, Tab 1/1)
FSAR revision 31.3
EDBD Tab 8/7.
Attachment Z18R0

B.4.4 Design Conditions such as Pressure, Temperature, Fluid Chemistry and Voltage:

Most design conditions do not exist since the building is not operational.

Auxiliary Building Air Handling Systems:
The Auxiliary and Spent Fuel Building pressure must be maintained at a negative pressure (0.05 to 0.125 inches of water)

Basis: EDBD Tab 8/7

B.4.5 Loads such as Seismic, Wind, Thermal, and Dynamic:

Loads to be considered in verifying the structural integrity of the containment building include forces resulting from natural phenomena such as earthquake, tornado, wind, and hurricane. There will be material dead loads, live loads and forces during tendon detensioning but the loads resulting from operations will not exist during this process.
Requirements impacting the roof of the Aux Building are addressed under Attachment Z18R0.

Basis: Design Basis Document for the Containment Building, (Ref. 2.1, Tab 1/1),
ACI 318-63, Parts IV-B and Part V
Attachment Z18R0

B.4.6 Environmental Conditions:

Tendon grease disposal:
It is estimated that approximately (100 gal/vertical tendon, 20 gal/horizontal tendon) 100 drums (5,500 gallons) of waste tendon grease will be generated as a result of this

modification. Waste tendon grease shall be drummed, labeled, temporarily stored, and disposed, in accordance with regulatory requirements and PEF policies and procedures.

The Auxiliary Building Air Handling Systems maintain the building above 55° F for freeze protection and personnel comfort, and under 122° F to maintain electrical equipment qualification temperatures.

Basis: EDBD Tab 8/7.

B.4.7 Interface Requirements:

B.4.7.1 EC 63016, Containment Opening
B.4.7.2 EC 74801, Containment Structure – Extent of Condition Core Bores
B.4.7.3 EC 75219, Reactor Building Delamination Repair Phase 3 – Concrete Removal (In Development)
B.4.7.4 EC 75220, Reactor Building Delamination Repair Phase 4 – Concrete Replacement (In Development)
B.4.7.5 EC 75221, Reactor Building Delamination Repair Phase 5 – Retension/Test (In Development)
EC 63020, Outside Erection Crane & Inside Auxiliary Crane
EC 63021, Temporary Material and Personnel Hoist Outside RB
EC 63022, Steam Generator Rigging and Transport
EC 70377, Temporary Power Outside Containment for SGR

Auxiliary Building Air Handling Systems:

The Aux. Building Air handling supply systems (AH-XE/XH/XD) provide filtered/heated air to the Auxiliary and Fuel handling buildings which is removed by the Aux. Building Air handling exhaust system (AH-XJ) at a slightly higher flow rate. This increase in exhaust flow rate maintains the buildings negative pressure.

Basis: NCR 358724
EDBD Tab 8/7

B.4.8 Material Requirements:

All materials used in the restoration of the Aux. Bld. roof access opening must be compatible with the existing materials and meet or exceed the original material requirements.

Basis: S-521-102
S-522-003

B.4.9 Mechanical Requirements

Maintain the buildings negative pressure range and environmental conditions identified in sections B.4.4 and B.4.6 respectively.

Basis: EDBD Tab 8/7

B.4.10 Structural Requirements:

This EC provides for detensioning a number of Tendons on the Reactor Building exterior wall for additional stress relief around the Containment Opening. There is a high probability that detensioning will create a crack originating in both the bottom and top of the Containment opening. This will be caused, in part, by the lack of reinforcing and thinning in this part of the wall. Cracking is also expected at the base of buttresses 3 and 4 from high stress concentrations. No damage is predicted in other parts of the containment shell or building components as a result of this modification. Extensive detensioning is required to allow as close to maximum retensioning in the repaired section as possible.
Aux. Building structural requirements are covered under attachment Z18R0.

Basis: Design Basis Document for the Containment, (Ref. 2.1, Tab 1/1, Ref. 10.9)
FSAR Sections 5.1 through 5.2

B.4.11. Hydraulic Requirements:

Not Applicable

B.4.12 Chemistry Requirements:

Tendon grease disposal:
It is estimated that approximately (100 gal/vertical tendon, 20 gal/horizontal tendon) 100 drums (5,500 gallons) of waste tendon grease will be generated as a result of this modification. Correct handling and disposal is required.

B.4.13 Electrical Requirements:

Not Applicable

B.4.14 Layout and Arrangement Requirements:

Detensioning of tendons shall only be performed during the no mode condition so as to maintain the plant in a safe condition.

Basis: Scope of EC

B.4.15 Operational Requirements Under Various Conditions:

Detensioning of tendons shall only be performed during the no mode condition so as to maintain the plant in a safe condition.

Basis: Scope of EC

B.4.16 Instrument and Control Requirements:

Auxiliary Building Air Handling Systems:
Negative air pressure is required in the Aux. Building

Basis: EDBD Tab 8/7.
SP-300

B.4.17 Access and Administrative Control for Plant Security:

Access to the Tendon Gallery may require security controls. Plant Security controls shall be maintained during this activity. Security shall be notified 24hrs in advance prior to breeching any Protected Area (PA) or Vital Area (VA) boundary to include roofs. Security posting will be required prior to actual breeching activity and will remain in place until breech is properly secured.

B.4.18 Redundancy, Diversity, and Separation Requirements of Structures, Systems, and Components:

Not Applicable

B.4.19 Failure Effects on Requirements of Structures, Systems, and Components:

While defueled, the partially detensioned containment could possibly pose a threat to the adjacent Auxiliary Building (due to the presence of the spent fuel pools), during a seismic or tornado event (II/I relationship).

Basis: DBD I/I

B.4.20 Test Requirements:

During the detensioning process, strain gauges and acoustic emission sensors shall be monitored as defined in Section E, the testing section.

B.4.21 Accessibility, Maintenance, Repair, and ISI Requirements:

Not Applicable

B.4.22 Personnel Requirements and Limitations:

A number of infrequently performed and quite complex construction work activities are involved in detensioning the tendons. Personnel performing these activities will be trained and qualified in performing them.

Basis: N/A

B.4.23 Transportability Requirements:

All rigging, lifting and material handling activities will comply with Procedure MNT-NGGC-0021, (Rigging, Lifting and Material Handling Program) and MNT-NGGC-0005, (Control of Rigging and Temporary Loads). There are a number of lifts associated with this EC and they must be evaluated to ensure they can be done safely and not impact any safety related SSC in the area.

Basis: MNT-NGGC-0021
MNT-NGGC-0005

B.4.24 Fire Protection or Resistance Requirements:

The only identified flammable material involved in this EC is the tendon grease.

All welding, cutting, or burning shall be per FIR-NGGC-0003, "Hot Work Permit".

Determination of fire loading shall be per FIR-NGGC-0004, "Determination of Combustible Loading and Equivalent Fire Severity".

All transient combustibles shall be controlled per AI-2200, "Guidelines for Handling, Use and Control of Transient Combustibles".

For administrative and technical guidance for the development and operation of the Fire Watch Program at CR-3 refer to AI-2210, "Fire Watch Program".
Pre-Fire Plan as applicable.

There is no adverse impact with Station compliance with "Appendix R" to 10CFR50.

Basis: FIR-NGGC-0003
FIR-NGGC-0004
AI-2200
AI-2210
AI-2205E
Station Fire Protection Plan (FPP, Rev.25)

B.4.25 Handling, Storage, and Shipping Requirements:

Materials procured for this EC shall be handled, stored and shipped per the requirements of MCP-NGGC-0402 "Material Management (Storage, Issue and Maintenance)" and ANSI N45.2.2 – 1972 "Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Stations". FSAR Table 1-3 "Crystal River Unit 3 Quality Program Commitments".

- Replacement shims, anchor heads, caps (cans) and grease and grease end cap gaskets.
- 55 gallon drums.

Basis: MCP-NGGC-0402 (Ref. 6.13)
ANSI N45.2.2 – 1972 (Ref. 1.15)
FSAR Table 1-3

B.4.26 Other Requirements to Prevent Undue Risk to the Health and Safety of the Public:

There will be no fuel handling during the time the Aux. Bld/Spent Fuel Pool roof is open and Tendon equipment is being used.

B.4.27 Materials, Processes, Parts, and Equipment Suitability for Application:

All materials used in the restoration of the temporary access Opening must be compatible with the existing materials and meet or exceed the original material requirements.

B.4.28 Safety Requirements for Preventing Personnel Injury:

The detensioning process should utilize properly qualified mobile or suspended platforms and/or scaffolding as required.

Proper consideration shall be made of the requirements for fall protection and of the dangers involved in working at heights. Work will be performed under SGT management applying their safety procedure. Their safety procedure is listed under their QA rules and regulations.

Pre-Job briefs shall incorporate any relevant OE prior to commencing work in the field. Consideration must be given to the dangers associated with utilizing detensioning and hydraulic equipment.

Basis: OSHA requirements
SAF-NGGC-2172, "Industrial Safety"
AI-1803, "Safety Standards for Ladders & Scaffolds"

B.4.29 Circuits for systems with Improved Technical Specifications testing requirements:

Not Applicable

B.4.30 Emergency Diesel Generator Loading Impact Assessment:

Not Applicable

B.5 Assumptions

Assumptions included in the development of this engineering change include: None.

B.6 Evaluation

B.6.1 Basic Functions of Each Structure, System, and Component:

The CR3 Reactor Building Containment Structure is similar in design to the containment buildings for the Three Mile Island Nuclear Station Unit 1, the Turkey Point Plant, the Palisades Plant, the Point Beach Plant, and the Oconee Nuclear Station.

The containment is a concrete structure with a cylindrical wall, a flat foundation mat, and a shallow dome roof. The foundation slab is reinforced with conventional mild-steel reinforcing. The cylinder wall is prestressed with a post-tensioning system in the vertical and horizontal directions. The dome roof is prestressed utilizing a three-way post-tensioning system. The inside surface of the reactor building is lined with a carbon steel liner to ensure a high degree of leak tightness during operating and accident conditions. Nominal liner plate thickness is 3/8 inch for the cylinder and dome and 1/4 inch for the base.

The foundation mat is bearing on competent bearing material and is 12-½ feet thick with a 2 feet thick concrete slab above the bottom liner plate. The cylinder portion has an inside diameter of 130 feet, wall thickness of 3 feet 6 inches, and a height of 157 feet

from the top of the foundation mat to the spring line. The shallow dome roof has a large radius of 110 feet, a transition radius of 20 feet 6 inches, and a thickness of 3 feet. The containment has been designed to limit the leakage rate to 0.25% by weight of contained atmosphere in 24 hours at the design pressure and temperature.

Per Section 5.2 of the FSAR and Ref. 2.1 the design of the containment building is based on:

- The containment of radioactive material which might be released from the core following a Design Basis Loss-Of-Coolant-Accident (LOCA).
- Temperature and pressure generated from the LOCA, i.e. 281 degrees F and 55 psig. The design pressure is 55 psig but the DBA pressure is 54.2 psig (Ref. FSAR Section 14.2.2.5.9 and TS B 3.6.1.
- Operational and Safe Shutdown Earthquakes
- Severe weather phenomena, i.e. hurricane winds, tornado and tornado missile

The Aux building design is based on housing safety related and radioactive containment systems including the spent fuel system. Refer to Attachment Z18R0.

Auxiliary Building Air Handling Systems:

System functions identified section B.4.1are critical during normal operation and emergency conditions. These functions will continue to be maintained during the identified detensioning (plant in no mode condition) in order to maintain their capabilities with a full load of fuel in the fuel pool and radiation sources in the Auxiliary Building. The operation of Auxiliary Building exhaust fans (AHF-14A/B/C/D) and minimizing building opening when the identified roof sections are removed are critical to maintaining a negative pressure in the Auxiliary Building and Fuel Handling area.

B.6.2 Performance Requirements such as Capacity, Rating, and System Output:

Containment
During No Mode there are no TS requirements for containment integrity or TS Actions that require containment closure. Therefore, performance requirements are not applicable.

Auxiliary Building Air Handling System:
The Auxiliary Building Exhaust System (AH-XJ) performance as well as the Spent Fuel Pit Supply system (AH-XH) will be maintained during the detensioning activity (with the roof sections removed) to maintain negative building pressure and to prevent the release of radioactivity from the Auxiliary Building and Fuel Pool area.

The Fuel Handling Area Supply System (AH-XE) and the Auxiliary Building Supply System (AH-XD) performance will decrease to maintain the design functions of the AH-XH and AH-XJ systems. This direction is similar to emergency conditions.

Basis: OP-0409

B.6.3 Codes, Standards, and Regulatory Requirements:

Containment:

During No Mode there are no TS requirements for containment integrity or TS Actions that require containment closure, therefore, design basis loads and load combinations are not applicable. However, the containment still meets the intent of ACI 318-63, Parts IV-B and Part V while defueled, as documented in calculation S10-0004 (MPR detensioning calc).

Auxiliary Building:
Refer to Attachment Z18R0

Auxiliary Building Air Handling Systems:
To satisfy regulatory requirements identified in section B.4.3, the Auxiliary Building and Fuel Building exhaust system (AH-XJ) and Spent Fuel Pit Supply System (AH-XH) will be maintained to assure system functions identified in section B.4.1.

Basis: OP-0409

B.6.4 Design Conditions Such as Pressure, Temperature, Fluid Chemistry, and Voltage:

Auxiliary building Air Handling Systems:
The buildings will be maintained at a negative pressure as identified in section B.4.4.

The negative pressure identified is maintained with the new fuel hatch on the Fuel handling deck open (360 ft^2, 10' x 36' by field walkdown). Therefore, the negative pressure should be able to be maintained in the Auxiliary Building and Fuel Handling Building if both roof openings (261ft^2) are removed.

However, temporary radiation monitoring equipment should be staged in the area of the open roof section to provide identification of a release should Air Handling equipment become unable to maintain building conditions or fail.

B.6.5 Loads such as Seismic, Wind, Thermal, and Dynamic:

Containment Building:
The dead load of the containment shell, dome, liner plate and base mat has been accounted for through element self weight in the finite element models and associated ANSYS models as evaluated in Section B.6.10.

Wind Loads:
While defueled there are no TS requirements for containment integrity or TS Actions that require containment closure, therefore, design basis wind loads are not applicable. While the containment is defueled and partially detensioned it could possibly pose a II/I hazard to the adjacent Auxiliary Building due to the presence of the spent fuel pools.
Hurricane wind loads are enveloped by Tornado Wind load which is addressed below.

Tornado Wind Loads:
While defueled there are no TS requirements for containment integrity or TS Actions that require containment closure. Therefore, design basis requirements for Tornado Load are not applicable. However, while the containment is defueled and partially detensioned it

could possibly pose a II/I (collapse) hazard to the adjacent Auxiliary Building due to the presence of the spent fuel pools. Accordingly, MPR calculation 0102-0135-08 has conservatively evaluated the partially detensioned containment shell for design basis tornado wind loads, with the delaminated concrete removed, for a tornado wind velocity of 300 mph and an external pressure drop of 3 psig (Ref. 2.1, 5.7 & Section 5.2.1.2.6 of the FSAR, Ref. 9. 1) for a potential collapse of the containment structure.

Seismic Loads:
The appropriate seismic loads have been applied to the containment ANSYS finite element model generated by MPR and evaluated in MPR Calculation 0102-0135-08.

Per the Containment DBD (Ref. 2.1), and Section 5.2.1.2.9 of the FSAR (Ref. 9.1), the design basis seismic parameters are as follows:

- Operating Basis Earthquake (OBE)
  - 0.05 g, maximum horizontal ground motion acceleration
  - 0.033, 0.033g, maximum vertical ground motion acceleration
- Safe Shutdown Earthquake (SSE)
  - 0.1 g, 0.1 g maximum horizontal ground motion acceleration
  - 0.067, 0.067 g, maximum vertical ground motion acceleration

While defueled there are no TS requirements for containment integrity or TS Actions that require containment closure. However, while the containment is defueled and partially detensioned it could possibly pose a seismic II/I hazard to the adjacent Auxiliary Building due to the presence of the spent fuel pools. MPR evaluated the effects of seismic loads on the partially detensioned containment shell with the delaminated concrete removed and concluded that the containment shell had sufficient strength to preclude any possible collapse mechanism.

Reduced Prestress After Detensioning
Calculation S10-0004 has evaluated the containment shell for reduced prestress while defueled for 150 hoop and 32 vertical tendons detensioned (which includes the 17 hoops and 10 verticals that were previously removed during SGR). The expected prestress during this time has been determined based on an effective prestress considering all losses due to concrete shrinkage, concrete creep, steel wire relaxation and elastic shortening of the concrete (Ref. Calc. S10-0001).
Hoop and vertical tendon forces are modeled explicitly in the ANSYS finite element model.

Per Ref. 2.1 and Calculation S80-0002 (Ref. 5.5) the initial and minimum required vertical and hoop tendon forces at the end of plant life are as follows:

- The Guaranteed Ultimate Tensile Strength (GUTS) = 2335 Kips/tendon (A = 9.723 in^2, fu = 240 ksi).
- The initial prestress = 80% GUTS = 1867 kips/tendon
- The lock-off prestress = 70% GUTS = 1635 kips/tendon (168 ksi)
- Minimum required prestress in a vertical tendon at 40 years = 1149 kips (mean anchorage force)) – Ref. 2.1
- Minimum required prestress in a horizontal tendon at 40 years = 1252 kips (mean anchorage force)) – Ref. 2.1

Thermal Loads:

The effects of thermal loads on the containment shell while detensioned have been evaluated for the following three items:

- Thermal loads due to restrained expansion of containment liner
- Axial (average cross-sectional) temperature within the concrete
- Temperature gradient through the thickness of the concrete sections

The thermal gradient across the containment shell will be managed (during and after detensioning) by operation so as to maintain the temperature Delta across the shell as close to zero as possible. Refer to Section B.6.10 for Temperature Monitoring Requirements. Calculation S10-0004 conservatively considered a 10° F gradient through the wall.

Polar Crane Loads:

The partially detensioned containment shell, with the delaminated concrete removed, has been evaluated by MPR (Refer to Calc. S10-0004) for the dead weight of the polar crane only.
The polar crane cannot be used for any lifts prior to the repaired concrete being sufficiently cured and supporting analysis from MPR is completed (Refer to EC 75221).

Auxiliary Building:
Refer to Attachment Z18R0

Pressure Loads:
While defueled there are no accident pressure loads that need be evaluated.

B.6.6 Environmental Conditions:

Plastic sheeting is be taped to the tendons gallery floor and side walls to contain any grease spills when detensioning or removing tendons.

Storm drains in the area must also be protected from grease spills.

Auxiliary Building Air Handling Systems:

Section B.4.6 identifies that the Auxiliary Building and Fuel Handing Air are to be maintained above 55 °F for freeze protection and personnel comfort, and under 122 °F to maintain equipment qualification temperatures.

In the no mode condition, the 122 °F temperature is not a concern. However, with cold outside air conditions the 55 °F internal building conditions could be a challenge.

To prevent freezing conditions inside the Auxiliary Building and Fuel Handling Building the following conditions should exist:

- A negative building pressure is to be maintained as well as one train of the Auxiliary Building Supply System (AH-XD) is to be running. This condition/alignment prevents ex-filtration of heated air from occurring at the removed roof openings and provides the ability to heat supply air using electric heating coils AHHE-2A or AHHE-2B (inlet of AHF-11A/B).
- Stage portable heaters in the area of the openings.

If the Auxiliary Building or Fuel Handling building approaches 45° F all roof opening should be temporarily closed and Auxiliary Building Air Handling Systems should be allowed to re-establish building temperature above 55° F.

B.6.7 Interface Requirements

MPR Associates: Responsible for the structural analysis of the containment shell resulting from the creation and restoration of the delaminated containment shell. Through their analysis they identify the detensioning sequence that will be applied prior to removal of the delaminated concrete. The detensioning of additional tendons symmetrically around the building will ensure the new concrete will be sufficiently prestressed when the tendons are retensioned to produce design basis strengths and will behave as originally designed.

SGT: Responsible for tendon work platforms and other hardware associated with detensioning, removal, reinstallation and pre-stressing of the tendons. SGT will provide supervisory personnel to oversee all activities related to detensioning, removing, reinstalling, retensioning and inspecting all affected tendons. They are also responsible for providing work packages and will generally work to Precision Surveillance Corporations standards and procedures. These procedures were used by Progress Energy on previous tendon work.

Auxiliary Building Air Handling Systems:
This section identifies actions required to maintain the subject system in compliance with identified design requirements identified in section B.4 of this design input.

1. A negative pressure in the Auxiliary Buildings and Fuel Handling Building maintained between 0.05 to 0.125 inches of water as read by AH-349-DPI. OP-409 is to be utilized to maintain Auxiliary Building Air Handling System alignments required to maintain these conditions. Temporary Radiation monitoring equipment should be staged in area of the openings to provide identification of a release should Air Handling equipment become unable to maintain building conditions or fail. Roof openings are to be temporarily closed if conditions cannot be maintained.
2. The Auxiliary Building and Fuel Handling building shall be maintained above 45 °F with the roof opening removed and below 122 def F. OP-409 is to be utilized to maintain Auxiliary Building Air Handling System alignments required to maintain these conditions. To prevent freezing conditions, one train of the Auxiliary Building System (AH-XD) is to be running to provide the ability to heat supply air using electric heating coils AHHE-2A or AHHE-2B. Stage portable heaters in the area of the openings to assists HVAC if required. Roof openings are to be temporarily closed if conditions cannot be maintained.
3. The Auxiliary Building and Fuel Building Exhaust System (AH-XJ) shall maintain two fans (AHF-14A/B/C/D) in operation at all times.
4. The Spent Fuel Pit Supply System (AH-XH) shall maintain one fan (AHF-23A or AHF-23B) in operation at all times.
5. All building opening in the fuel handling area (with the exception of the opening required for the detensioning equipment) shall be closed (new fuel access hatch,etc.)
6. No fuel movement shall be in progress during the time the roof is open.

B.6.8 Material Requirements

As noted in B.4.8 all materials used in the restoration of the temporary Aux. Bld. roof access opening must be compatible with the existing materials and meet or exceed the original material requirements.

Basis: S-521-102
S-522-003

B.6.9 Mechanical Requirements:

Maintain the buildings negative pressure range and environmental conditions identified in sections B.4.4 and B.4.6 respectively.

B.6.10 Structural Requirements:

Containment Building:

Unit Weight (density) of Existing Containment Shell Concrete

The purpose of this evaluation is to determine the density of the existing CR3 containment shell concrete based on information gathered from original construction concrete pour cards and supported by a limited number of recent core bore test results. The average density will be used as an input to MPR Associates calculations that evaluate the delaminated containment shell, including the detensioning and retensioning calculations.

Core Bore Results:

S&MEs core bore test results for bulk wet and dry densities (Attachment Z25R0) are shown in TABLE 1. Note that the bulk dry and wet density's listed in S&ME's test reports are based on a multiple of the specific weight of water and must be multiplied by 62.416 (lbs/ft^3). Refer to EC 74801 for core bore locations.

Note: The wet density test results will best represent the actual in-situ concrete density as it exists today.

TABLE 1

	Core #16	Core #40-2	Core #40-3	Core #60-1	Core #60-2	Core #63	Core #65	Core #66	Average All	Average w/o #60
Bulk density dry (lbs/ft^3)	136.07	134.2	134.82	132.32	131.7	135.44	133.57	134.82	134.12	134.82
Bulk density wet (lbs/ft^3)	144.81	142.93	144.18	140.44	140.44	144.18	142.93	143.56	142.93	143.77

Original Construction Records:

There were four mixes used for the construction of the containment walls; DM-5, DM-5-mod, 727550-2 and 727550-2-mod (Refer to Attachment Z24R0 which contains pour card records for all pours between buttress's 1 and 6 and buttress's 3 and 4, and are a good representation of

pours made for all of containment). Of these four pours, DM-5-mod and 727550-2-mod were the primary mixes used in the containment walls. Both DM-5-mod and 727550-2-mod had slightly lower W/C ratios compared to DM-5 and 727550-2.

(i) 727550-2-mod was used exclusively for the dome, and also at the ring girder, equipment hatch, and generally for higher elevations of the containment wall.
(ii) DM-5-mod was used generally for the lower elevations of the containment walls.

Refer to Attachment Z23R0 for pour location drawings between buttresses 1 & 6 and 3 & 4.
The mix proportions for both DM-5-mod and 727550-2-mod are listed in Table 2 (Refer to Attachment Z24R0)

TABLE 2

	Mix DM-5 (M)	Mix 727550-2 (M)	UNITS
Design Strength f'c	5000	5000	psi
Cement	682	752	lbs/cu. yd
Coarse Aggregate	1800	1800	lbs/cu. yd
Fine Aggregate	1100	1060	lbs/cu. yd
Admix Daratard	21	23	oz/cu. yd
Admix Darex	5	4.5	oz/cu. yd
Water	276	286	lbs/cu. yd
W/C ratio	0.41	0.38	N/A
Unit Weight	143	144.4	lbs/cu. ft.

Conclusion:
Based on an average bulk wet density of 143.77 lbs/ft^3 from Table 1, and unit weights of 143 and 144.4 lbs/ft^3 for each mix from Table 2, an average unit weight of 144 lbs/ft^3 will be used for the density of the existing concrete in the containment shell including the dome.

Description of Calculations Supporting Partial Detensioning of the Containment

Calculation S09-0055 (MPR Calculation #0102-0135-01) Reinforcement Ratio and Effective Modulus of Elasticity:
The purpose of this calculation is to determine an equivalent modulus of elasticity (E_{equiv}) at several sections of interest based on the weighted area of both the reinforcement and concrete and compare the results to the un-weighted Ec. Several sections of the containment shell were chosen as being of particular interest due to their location and reinforcement ratio. The following primary equations were used in this evaluation:
$Ec = 33 \times w_c^{1.5} \times (f'c)^{0.5}$ (ACI 318-63 Section 1102)
$w_c = 144$ pcf (Existing concrete density – Refer to Section B.6.10)
$f'c = 5000$ psi (FSAR, Section 5)
$E_{equiv} = [E_c \times A_c + E_s \times A_s] / (A_c + A_s)$
* The E_{equiv} thus determined for each section will be reviewed for possible inclusion in the MPR ANSYS FEM for both the detensioning and re-tensioning calculations.

Calculation S09-0056 (MPR Calculation #0102-0135-02) Concrete Modulus of Elasticity and Minimum Compressive Strength:
This calculation determines the concrete elastic modulus and specified concrete compressive strength for the new and existing concrete for the containment shell. The calculated values for E will be used in the ANSYS model to accurately reflect section stiffness, and the values

determined for compressive strength will be the basis for determining the compressive and tension allowable stresses.
The elastic modulus for the old concrete for all phases of the repair thru end of life is based on the original design basis specified strength of 5000 psi. As described in calculation S09-0056, Section 6.1 test results from several cores from the containment indicate an elastic modulus of 3.29E6 ksi. The calculated modulus based on f'_c= 6720 (see below) is 4.67E6 ksi. Based on these two extremes (3.29E6 - 4.67E6) the chosen value of 4.01E6 based on an f'_c = 5000psi is reasonable.
The elastic modulus of the new concrete is based on the 5 and 28 day specified compressive strength of 6000 and 7000 psi respectfully.

$E_{\text{original concrete}} = 33 \times w_c^{1.5} \times (f'_c)^{0.5}$
$= 33 \times 144^{1.5} \times (5000)^{0.5}$
$= \underline{4.03\ E3\ ksi}$

$E_{\text{new concrete}} = 33 \times 151^{1.5} \times (7000)^{0.5}$
$= \underline{5.12\ E3\ ksi}$

The compressive strength of the existing concrete during detensioning used for calculating the allowable strength is $f'_{c\ repair}$ = 6720 psi. This value was chosen to best represent the strength of the existing concrete based on the conclusion of calculation S-00-0047, and supported by the results of a limited number of core bores (Ref. Attachment Z30R0, Z31R0) taken around the SGR access opening which indicated an average f'c = 7390 psi, thus validating the use of f'_c = 6720 psi.
The specified compressive strength of the existing concrete for the design basis retensioning calculation thru end of life $f'_{c\ design\ basis}$ = 5000 psi which is the original design basis specified strength per the FSAR, Section 5.0.
The compressive strength of the new concrete is 6000 and 7000 psi at 5 and 28 days. However, currently for the design basis calculations (specifically the retensioning calculation) the specified compressive strength is set at the design basis value of f'c =5000 psi as reported in the FSAR.

Calculation S10-0001 (MPR Calculation #0102-0135-03) Tendon Tension Calculation:
The purpose of this calculation is to determine the dome, hoop and vertical tendon tension immediately following completion of the Steam Generator Replacement Project and at 60 years (end of plant life) for both original tendons (not affected by the containment repair) and for tendons affected by the repair . Tendon losses for concrete creep, concrete elastic shortening, concrete shrinkage and steel relaxation of tendon wires were calculated for each time period and subtracted from the initial prestress of 70% GUTS.
Calculation S10-0004 (MPR Calculation #0102-0135-06) Tendon Detensioning Calculation:
The purpose of this calculation is to identify the optimum number of hoop and vertical tendons to detension that will result in ensuring that sufficient prestress is restored to the new concrete, including the access opening after retensioning. To evaluate the stress condition of the containment shell for both detensioning and retensioning an ANSYS FEM has been created by MPR that explicitly models the vertical, hoop and dome tendons. The calculation establishes a tendon detensioning sequence that will be completed prior to removal of the delaminated concrete that is primarily based on the original tendon tensioning sequence.
Note that the tendon detensioning sequence was evaluated in ANSYS for 9 intermediate steps in order to establish if an intermediate state of stress exists during detensioning that is worse than the state prior to or after final detensioning. The calculation concluded that the detensioning sequence is acceptable.
Individual tendon forces were input to the model based on losses at the time of the Steam Generator Replacement outage and at the end of 60 year life (Refer to calculation S10-0001 for determination of tendon forces).
Two load cases were evaluated for the detensioned containment:

(i) Dead Load + Reduced Prestress
(ii) Dead Load + Reduced Prestress + Thermal (10 degrees F gradient)

Note that the dead weight of the polar crane located over the access opening was included in "Dead Load".
The acceptance criteria for concrete tensile membrane stresses under factored loads is $3\sqrt{f'c}$ and $6\sqrt{f'c}$ for membrane + bending stresses, including stresses from thermal (Ref. 2.1, based on $f'_c = 6720$ psi)(Ref. Calc. s09-0056 & s-00-0047) Applicable for detensioning calculation only.
Reduced prestress is based on a total of 150 hoop and 32 vertical tendons detensioned and/or removed per Attachment Z09R0.

Note that vertical tendons 34V8 thru 34V17 were removed during the SGR outage.

The temperature inside containment during detensioning will be controlled by Operations so that the delta between the inside and outside temperatures are maintained as close to zero as possible based on a 7 day rolling average. Calculation S10-0004 conservatively considered a 10 degree F temperature gradient through the thickness of the wall.
While the containment is defueled and partially detensioned it could possibly pose a II/I hazard (collapse) to the adjacent Auxiliary Building due to the presence of the spent fuel pools. MPR calculation 0102-0135-08 has evaluated the effects of both seismic and tornado wind loads on the partially detensioned containment shell with the delaminated concrete removed and concluded that the containment shell has sufficient strength to preclude any possible collapse mechanism.
The stress analysis results for the detensioned containment shell identified several locations that exceeded the design basis acceptance criteria for load cases with and without thermal. For areas that contain reinforcement, the results were compared to standard load/moment interaction diagrams that were developed in Calculation S10-0005 and only one location, at the bottom of buttress #3, under dead load, prestress and operating thermal had stresses that exceeded the ultimate capacity of the section (Refer to Section B.6.10 of this EC for an evaluation of this limiting stress condition). The unreinforced concrete wall around the SGR access opening has membrane and membrane plus bending tensile stresses that exceed the acceptance criteria for cases with and without operating thermal loads. The calculation concluded that cracking in these areas was expected (Refer to Section B.6.10 of this EC for an evaluation of the extent of cracking).
Calculation S10-0004 performed a non-design basis review of the containment shell stresses after retensioning for the following two design basis load cases:

(i) 0.95D + Fa + 1.5P + Ta
(ii) 0.95D + Fa + 1.0P + Ta

Ta = accident temperature = 281 degrees F
P = accident pressure = 55 psi
The calculation concluded that tensile stresses exceeded the acceptance criteria for concrete membrane stress under factored loads of $3\sqrt{f'c}$ and $6\sqrt{f'c}$ for membrane + bending stresses, including stresses from thermal, at the boundary of the SGR access opening and in some of the surrounding areas.

Tendons to be detensioned or removed
Tendon removal due to potential damage to flexible conduit will be addressed in EC75219.

Temperature Monitoring Requirements:

Calculation S10-0004 has included a 10 degree F thermal gradient in the ANSYS FEM when evaluating the containment shell for reduced prestress.

The surface temperature of the liner plate will be measured using thermocouples (or similar devices that can measure surface temperature) attached to the surface of the liner plate at a minimum of two representative locations. Similar devices will be attached to the inside surface of existing core bores located in the general vicinity of buttresses 3 and 4 as required to obtain representative internal concrete temperatures. These devices will be placed so that they can measure internal bore surface temperature at 3 approximate depths; 4" inside the core bore, at mid-point and at the base of the core bore or at least 12". The temperature measuring instruments for the various depths may be combined in a single core bore or spread among adjacent core bores as determined practical during installation. Once mounted, the core bore should be plugged with at least 2"-3" of insulating material at the outer face. In addition, two thermocouples will record ambient air temperature outside containment. The temperature devices shall be capable of recording temperatures at a sampling frequency of at least once every 10 minutes. If capability exists, the temperatures will be made available on the CR3 business network for display on OSI PI.
At a minimum during de-tensioning, the rolling 7 day average temperature will be trended and recorded for the inner liner surface and 4" concrete depth (in PI if available). It is desired to have indication from all devices in PI. The seven day average is listed because of the latent affect that temperature has on a 42" thick (or 32" thick after delaminated concrete is removed) concrete wall.

Thermal measuring devices are not attached to the outside face of the containment wall since un-conservatively high temperatures would be recorded if the measurements were taken at the surface of the containment wall due to solar radiation, i.e. the surface temperature is directly affected by the sun and would not be representative of the average temperature 2"-3" inside the wall. This effect can be seen in the temperature monitoring results contained in Attachment Z29R0.

The thermal gradient that will be managed will be the difference between the average of the two thermocouples attached to the liner and the average of the two thermocouples 4 inches from the face of the outside containment wall inside the core bores. Operations will use the RB ventilation cooling, heating and purge system per OP-417 making daily adjustments as required to maintain the delta as close to zero as possible based on a 7 day rolling average. The limit on the ambient temperature inside containment is 60 degrees. If the delta between the thermocouples inside containment and 4 inches from outside face of containment inside the core bores reaches 8 degrees F, engineering will evaluate if additional actions need to be taken outside containment by SGT to increase the concrete temperature. These actions may include tents, blankets, heaters, and moisture. Based on a review of the stresses in the unreinforced section of concrete during the detensioned condition, the extent of protection outside containment is expected to be limited to an area about 10 feet beyond the perimeter of the steam generator opening.
Summary: Temperature gradient (4 inches subsurface to inner liner) will be managed as close to zero as practical based on a seven day rolling average. When the thermal gradient reaches 8 degrees F, an evaluation will be made by engineering with the intent of determining if forecasted temperatures could result in a sustained temperature gradient greater than 10 degrees F. If such a gradient is judged possible then appropriate actions will be taken. The action is to preclude a temperature gradient of 10 degrees taken as a 7 day rolling average.

Design Basis Condition Assessment

Design basis stresses were evaluated in Calculation S10-0004 to assess the effectiveness of proposed detensioning. Numerous options were considered leading to a final scope and sequence as described in S10-0004. Stresses were assessed for each option by consideration of two load cases. The following discussion addresses load cases evaluated, resulting exceedences of acceptance criteria and expected resolutions.
In calculation S10-0004, limiting load cases are described. The most limiting factored load case AND the most limiting design load case are selected and evaluated further because these two cases have different acceptance criteria. The Return to Service time frame is evaluated because tendon forces are higher and could be most damaging under design loads. The End of Life condition is evaluated because tendon forces will have relaxed the greatest thereby providing the least protection for the structure for accident loading. Other load cases were considered that include seismic and wind but were shown to not control because the contribution from accident pressure is so high.
Conditions listed below are the only overstresses that remain in S10-0004.

	LC	Dir	Return to Service	End of Life
1	1.0P	Vert		M ID 5-17/0
2	1.0P	Vert	M ID 6-12/0	M ID 6-42/0
3	1.0P	Hoop	M ID 16-8/0	M ID 16-39/0
4	1.5P	Vert	M ID 5-222/212	M ID 5-255/212
5	1.5P	Vert	M ID 6-237/212	M ID 6-268/212
6	1.5P	Vert	M+B ID 6-453/424	M+B ID 6-478/424
7	1.5P	Hoop	M+B ID 12-513/424	M+B ID 12-590/424
8	1.5P	Hoop	M ID 16-235/212	M ID 16-267/212
9	1.5P	Hoop	M+B ID 16-438/424	M+B ID 16-464/424
10	1.5P	Hoop		M+B ID 14-448/424
11	1.5P	Hoop		M+B ID 17-435/424

Where, by example, 16-8/0 indicates that Section 16 has 8 psi membrane stress and ID indicates that the inner surface is more highly stressed. The allowable stress for this condition is 0 psi.

Section 5 is the new plug at the bottom.
Section 6 is the 42 inch thick wall below the plug.
Section 12 is the wall below the SGR opening.
Section 14 is in near the top of the new plug.
Section 16 is the bottom surface of the plug.

Section 17 is the top surface of the new plug.

Vertical membrane stress issues can be accepted by further averaging of stresses in the horizontal plane through and below the restored opening. Additionally, the increased stiffness of the equipment hatch will offset some of these tensile stresses. Vertical membrane plus bending stresses in Section 6 can be accepted by use of higher allowable stress for the existing concrete (~465 psi). There may also be a need to reassess end-of-life tendon forces at some point in the future. Section 12 has membrane plus bending stress on the inner surface that exceeds the allowable. However, increasing the stiffness of the plug transfers more moment to the plug. This will reduce the hoop direction bending below the plug. The membrane stress issue for Section 16 is also improved by stiffening the plug. For membrane plus bending at Section 14 and 16, the allowable stress is actually higher because the new concrete has specified strength of 7000 psi. The new allowable is $6(7000)^{0.5} = 502$ psi.

Predicted Localized Concrete Cracking due to Detensioning

While the containment is defueled there are no Tech Spec requirements for containment integrity or that require containment closure. Therefore, the design basis acceptance criteria for concrete tension and compression may be exceeded (posing a possible commercial risk only). Any cracks that may occur in the containment shell (as identified below) will be mapped in EC 75219 and evaluated and repaired accordingly in EC 75220.

Results from the MPR ANSYS analysis for the detensioned containment shell (Calculation S10-0004) indicate that there are a limited number of locations along the top and bottom of the SGR access opening where tensile stresses in the concrete due to membrane and membrane plus bending exceed the acceptance criteria for cases with and without operating thermal loads, and which exceed the expected cracking strength of the concrete.

The cracking strength of the existing concrete is based on an evaluation by WJE Engineers (Attachment Z32) of a limited number of direct tension and cracking tensile strength tests on cores taken from the area along the bottom and sides of the SGR access opening. Based on WJE's evaluation the predicted tensile stress, beyond which the concrete is expected to crack, for both membrane and membrane plus bending tensile stress is 600 psi.

Two load cases were evaluated in the ANSYS model; limiting section stresses due to (i) the detensioned state without operating thermal analysis and (ii) the detensioned state with an operating thermal gradient of 10 degrees F. Resulting stresses were evaluated at several locations of interest on the containment shell, each location being assigned a "Section" number as shown in Attachment Z32, pages 2 and 3. Note that results are symmetrical about the centerline of the opening.

Results for Load Case (i) (without thermal):
Results indicate that hoop tensile membrane stress exceeds the cracking limit of 600 psi at one location only (Section 9) along the bottom of the access opening (Attachment Z32). Since a membrane stress represents an average stress across a section, then the high tensile membrane stress that occurs at Section 9 may occur across the full thickness of the wall and is indicative of a probable through wall vertical crack (extending from the outside face of containment to the liner plate). The crack may propagate vertically until it reaches a compression zone which per Attachment Z32, page 6 is about 8'-6" below the bottom of the opening.

Additionally, hoop tensile stresses due to hoop membrane plus bending exceed 600 psi at two locations (in addition to Section 9); Section 5 along the top and Section 7 along the bottom of the opening. Vertical cracking at these two locations is possible, initiating at the inside face of the containment wall and extending across the full thickness of the wall. Similar to the crack at Section 9, cracks at Sections 5 and 7 may extend for several feet either above (Section 5) or below (Section 7) the opening. These stresses are very small compared to steels yield values, therefore no problems are predicted for the liner.

Results for Load Case (ii) – (with thermal):
Inclusion of the operating thermal gradient across the containment shell does not change any of the conclusions made for load case (i).

Results for Load Case (i) – (without thermal) at Buttress #3 and 4:

Calculation S10-0005 created a standard Force-Moment interaction diagram (as described in the Commentary to Chapter 19 of ACI 318-63) that is specific for the reinforced concrete section at the bottom of buttress 3 and 4, and is a representation of all combinations of axial load and moment strengths for that particular cross-section. The force and moment generated at the base of the buttress was plotted on the interaction diagram and found to be acceptable (Refer to Calculation S10-0004 for plot). The interaction diagrams are based on a cracked section and strain compatibility between the concrete (and steel reinforcement) in the compression zone and the steel reinforcement in the tension zone (outside face of the buttress). Since the outside face at the bottom of the buttress is in tension, a horizontal crack may occur. The tension reinforcement provided on the outside face will limit the width and depth of any crack.

The moment at the bottom of the buttress is a result of detensioning and is primarily a function of the resulting forces exerted by hoop tendons just above the base, any crack that develops at this location will result in the partial redistribution of this moment.

Results for Load Case (ii) - (with thermal) at Buttress #3 and 4:
Calculation S10-0004 conservatively considered a 10 degree F thermal gradient across the thickness of the wall. It should be noted that the thermal gradient is going to be managed by Operations (Refer to Section B.6.10) so as to maintain the delta in temperature across the wall to as close as zero as possible. Also note that the bottom of the buttress is approximately 25' below grade and not very susceptible to ambient temperature changes above grade.
The results indicate that including the thermal gradient has increased the bending moment at the base of the buttress by approximately 24%. However, since thermal moments are self relieving through cracking of the section, and since the section already cracks under prestress loads, the thermal moment will either not develop or if it does it will diminish upon the onset of cracking.

Conclusion:
If cracks do occur around the SGR access opening (Sections 5, 7 and 9) and at the bottom of buttress 3 and 4, as previously described, they will be mapped in EC 75219 Concrete Removal.

Cracks will be evaluated and repaired as required in EC 75220 Concrete Placement.

Aux. Building is Addressed in Appendix Z18R0

B.6. 11 Hydraulic Requirements:

There is no evaluation required for this Design Input.

B.6.12 Chemistry Requirements:

Chemical requirements are itemized under NGG Procedures: CHE-NGGC-0045, Chemical Control Program.

B.6.13 Electrical Requirements:

There is no evaluation required for this Design Input.

B.6.14 Layout and Arrangement Requirements:

There is no evaluation required for this Design Input.

B.6.15 Operational Requirements Under Various Conditions:

As stated in the design input, the work shall only commence during no mode conditions. This will to minimize potential adverse impact to the structure. No other evaluation is required.

B.6.16 Instrument and Control Requirements:

Auxiliary Building Air Handling Systems:
AH-349-DPI is utilized to determine if a system negative pressure is maintained within the Fuel Handling and Auxiliary Building.

Basis: EDBD Tab 8/7.
SP-300

B.6.17 Access and Administrative Control for Plant Security:

Access to the Tendon Gallery requires security controls as listed in B.4.17.

B.6.18 Redundancy, Diversity, and Separation Requirements of Structures, Systems, and Components:

There is no evaluation required for this Design Input.

B.6.19 Failure Effects on Requirements of Structures, Systems, and Components:

Containment has been analyzed by MPR at its free standing state to be able to maintain its structural integrity. Also based on the evaluation in B.6.5, the adjacent Auxiliary Building will remain unaffected as a result of the cuts as the critical slab sections are stable for the applicable loading conditions. Subsequent interfacing ECs will restore the containment to meet its design base requirements.

Basis: Calc S10-0006

B.6.20 Test Requirements:

Radial strain gauges and acoustic emission monitoring will be utilized to protect the non-delaminated portions of the containment structure from having any damage created in these areas during the detensioning process.

Radial strain gauges have been installed previously in locations where the first tendon will be detensioned and where the first tendon above the SGR opening will be detensioned. The radial strain gauges will provide localized strain and stress indications that would indicate the concrete is approaching its ultimate load. Locations of strain gauges can be found in L:\Shared\CR3 Containment\CONDITION ASSESSMENT Files\Strain Gage Data & Photos.

Acoustic emission arrays will be set up across the area where the first tendon will be detensioned and where the first tendon will be detensioned next to a tendon that is already detensioned. Additional wide area acoustic emission sensors will be installed around the outer surface of the non-delaminated portions of the containment structure and on the containment dome. The acoustic arrays are capable of pinpointing where any forms of cracking or delamination are occurring during the detensioning process in those areas. The wide area monitors are able to determine whether cracking or delamination is occurring in others sections of the containment structure.

Acoustic emissions were chosen for monitoring the vast majority of the containment structure because of how localized the strain gauge indications would be. It would not be feasible to install strain gauges all around the containment building as the strain gauges are required to be installed inside an 8" core bore whereas the acoustic emissions sensors are mounted on the outer surface of the containment structure.

By using the radial strain gauges and acoustic emission monitoring; if any form of cracking or delamination were to happen in a non-delaminated area, it will be detected early enough to keep it localized to a small area where it could then be evaluated.

Strain Gauges
Strain gauges will be monitored during the detensioning process of the containment building. 0.1% strain from the strain gauges will provide an acceptable monitoring margin to use during detensioning. This is based on the following:

- Ultimate strain of concrete is 0.3%.
- 5000 psi concrete (tested higher)
- The current state of the concrete has a load of approximately 1500 psi hoop stress and 900 psi vertical stress. (Principal stress of 1750 psi)

The 0.1% additional strain would result in the total strain of the concrete approaching 0.2% total strain. If strain gauges indicate an increase of 0.1% strain, detensioning work will be immediately stopped and the area evaluated prior to proceeding with additional work.

0.1% strain corresponds to 1000 micro-strain.

Acoustic Emissions
Acoustic Emissions sensors will be monitored during the detensioning process of the containment building. Monitoring will be performed under the guidance of trained, experienced individuals. Any indications or pre-cursers of new cracking or new delamination outside of the original delamination area during detensioning will trigger an

immediate stop of detensioning work. A review of this additional cracking must be evaluated prior to proceeding with additional work. Locations of acoustic sensors are identified in Attachment Z33R0.

B.6.21 Accessibility, Maintenance, Repair, and ISI Requirements:

There is no evaluation required for this Design Input.

B.6.22 Personnel Requirements and Limitations:

A number of infrequently performed and quite complex construction work activities are involved in detensioning the tendons. Personnel performing these activities will be trained and qualified in performing them. Pre-job briefs will ensure a safe work environment is maintained.

B.6.23 Transportability Requirements:

All rigging, lifting and material handling activities will comply with Procedure MNT-NGGC-0021, (Rigging, Lifting and Material Handling Program) and MNT-NGGC-0005, (Control of Rigging and Temporary Loads). There are a number of lifts associated with this EC and they must be evaluated to ensure they can be done safely and not impact any safety related SSC in the area.

Basis: MNT-NGGC-0021
MNT-NGGC-0005

B.6.24 Fire Protection or Resistance Requirements:

The only identified flammable material involved in this EC is the tendon grease. However, creation of the temporary access opening involves flame cutting.

All welding, cutting, or burning shall be per FIR-NGGC-0003, "Hot Work Permit".

Determination of fire loading shall be per FIR-NGGC-0004, "Determination of Combustible Loading and Equivalent Fire Severity".

All transient combustibles shall be controlled per AI-2200, "Guidelines for Handling, Use and Control of Transient Combustibles".

For administrative and technical guidance for the development and operation of the Fire Watch Program at CR-3 refer to AI-2210, "Fire Watch Program".
Pre-Fire Plan as applicable.

There is no adverse impact with Station compliance with "Appendix R" to 10CFR50.

Basis: FIR-NGGC-0003
FIR-NGGC-0004
AI-2200
AI-2210
AI-2205E
Station Fire Protection Plan (FPP, Rev.25)

B.6.25 Handling, Storage, and Shipping Requirements:

Tendon grease Handling and disposal:
Waste grease is managed in accordance with EVC-SUBS-00107, Waste Vendor Program. The grease may have to be waste profiled (chemical profiling) before disposal. It will be tested by RP before release. Storage of grease is limited on the spent fuel floor to 220 Gal.

B.6.26 Other Requirements to Prevent Undue Risk to the Health and Safety of the Public:

There is no evaluation required for this Design Input.

B.6.27 Materials, Processes, Parts, and Equipment Suitability for Application:

As noted in B.4.27 all materials used in the restoration of the temporary access opening must be compatible with the existing materials and meet or exceed the original material requirements.

B.6.28 Safety Requirements for Preventing Personnel Injury:

The detensioning process will utilize properly qualified mobile or suspended platforms. These units will be new and designed specifically for this application.

B.6.29 (CR3) Circuits for systems with Improved Technical Specifications testing requirements:

There is no evaluation required for this Design Input.

B.6.30 (CR3) Emergency Diesel Generator Loading Impact Assessment:

There is no evaluation required for this Design Input.

B.7 Interfaces

Interfaces are as follows:

Progress Energy EC Project Team and Interfaces

- T. K. McEwan – Responsible Engineer, CR3 Containment Design Team
- C. Glenn Pugh – Responsible Engineer, CR3 Containment Design Team
- Ron Knott – CR3 Containment Design Base Analysis Team
- John Holliday – CR3 Containment Design Base Analysis Team
- Emin Ortalan- CR3 Containment Design Team Supervisor
- Paul Fagan – CR3 Containment Design Team Superintendent
- Charles Williams – CR3 Containment Root Cause Analysis Team Lead
- Sid Powell – CR3 Licensing
- Keith Allen – CR3 Design Superintendent
- Rick Portmann – CR3 Containment IWE/IWL Program Owner
- Rick Pepin - CR3 Repair Implementation and Maintenance Lead
- Ron Tyrie- CR3 Operations

- Rick Curry- CR3 Procurement and M&CS
- Bryant Akins- ALARA and Radiation Protection
- Ron Johnson- Environmental Protection
- Jeff Finnell- CR3 Welding Engineer
- Al Koralewski- CR3 security
- Joe Lese- Design Verification
- J.M. Livingston, Mechanical Design Engineering
- Dan Caraballo, HVAC Systems
- Scott Stewart, Containment Systems

B.8 Quality Class Determination

Quality class of individual components and materials required for this EC are as follows:

1. The containment building is a **Class I Structure (Safety Related)** as described in the FSAR Sections 5.1.1.1 and 5.2.1 and the Design Basis Document for the Containment, (Ref. 2.1, Tab 1/1). The primary function of the reactor containment building and its steel liner is to house the primary nuclear system and to provide biological shielding from the fission products that could become airborne under accident conditions.
2. Tendons, tendon anchorage including stressing washers, shims and tendon grease are all **Safety Related.** These items ensure the structural integrity of the containment building.
3. All Auxiliary Building Air Handling Systems identified (AH-XD/XE/XH/XJ) are non-safety systems.
4. The Aux. building is a Class 3 Structure.

Therefore, because the majority of the work on this EC is on 1 and 2 above, the overall quality classification of this EC shall be Safety Related.

C.1 Document/Drawing and Equipment Database Mark-Ups

Controlled documents requiring revision are listed on the EC Affected Document List (ADL). Drawings required for turnover are designated with the "OpSVc" flag on the ADL. Document changes may be indicated by document mark-ups or by "Description Of Change" provided in the tables below.

Changes to the Equipment database which are under PassPort revision tracking and control are listed on the EC Affected Equipment List (AEL). Pending changes under revision tracking and control are specified using minor revisions to each item on the AEL. Mark-ups of pending changes are not required since the PassPort pending change information is captured by the EC Package Print report.

A summary of changes to controlled documents, the equipment database, or other changes can be provided in this section.

C.2 Updates of Controlled Documents/Drawings

Either reference to drawing mark-ups or descriptions of changes to affected controlled documents can be given below. All affected controlled documents should be listed on the ADL.

Doc. Type	Document Number	Sht	Description Of Change or Reference to Mark-Up
			NONE

Pages may be added to this file (Ctrl-Enter), or EC Folder Utilities may be used to add a (11x8.5 or 17x11) page as required to hold any electronic or scanned mark-up. Alternately, electronic mark-ups may be added to the EC Folder as separate files (C01R0, etc).

C.3 Other Required Updates

Other required updates which do not affect controlled documents (e.g. Training, Operators Aids) can be described below:

Item	Description Of Change or Reference to Mark-Up	Rq'd for T/O?	AR Number?
	NONE		

C.4 Equipment Parameter Notes

CAUTION

Parameter Notes are placed under Revision Tracking & Control beginning with the V10.0.4 upgrade of PassPort (installed on December 10, 2006). Prior to V10.0.4, special rules were required for processing EDB Parameter Notes. Prior to V10.0.4, since parameter notes are not part of the EC PassPort report which becomes a QA record, a parameter note with a pending change should be captured in the table below to preserve the QA record. Changes to parameter notes created after V10.0.4 should be processed in the same manner as any other EDB change under Revision Tracking & Control, and are not required to be captured in the table below.

(Select Table/Select/Table, copy Ctrl-C, and paste Ctrl-V the following table as many times as necessary.)

U	System	Tag # or Equipment #	Parameter
Pending Minor Revision			

C.5 Equipment Document References

Equipment document references in the Equipment database are not under PassPort revision tracking and control. They should be listed below (Title is optional):

Unit	System	Tag # or Equipment #			
Doc. Type	Sub-Type	Document Number	Sht	Add or Delete	Title

D.1 Installation Package

1.1 This EC describes the work to detension tendons in the Containment wall per the sequence detailed in Calculations by MPR (Ref.Z09R0). The details listed below should be used for planning *work packages*.

Precautions Required in Work Preperations:

Caveat: Performance Improvement International (PII) is running a confirmation analysis of the number and the sequence of tendons to detention as determined by MPR in their calculations. When PII confirms that the design as documented in this EC is acceptable for detensioning the tendons in the order MPR has determined, the detensioning work can proceed. MPR analyses has already been owner accepted by CR3. This caveat is to limit the start of detensioning the tendons in the field until the final owner's acceptance of the PII analysis by CR3. Also PNSC approval is required prior to start of detensioning the first tendon. All other support work to detension tendons such as setting the platforms and preparing the Auxiliary building roof, etc can proceed.

Polar crane will NOT be operated during the time of detensioned state until an analysis is performed by MPR determining when it can be put back into service.

All Heavy lifts shall follow the safe load paths documented in EC 63020. This EC installed the Manitowoc 2250 crane. EC 63020 contains references to load drop analysis and safe load path sketches that bound the anticipated activities required to be completed for this EC. Preparation of the work packages that utilize the 2250 mobile crane shall include reference to the safe load path sketches contained in EC 63020. In general, the following load paths are pre-approved for all lifts in No-Mode conditions.

- Movement of tendon work platforms and USF's are controlled by safe load sketch 63016-SK-S0001.
- Movement of concrete repair reinforcement mats and concrete formwork are controlled by safe load sketch 63016-SK-S003 and 63016-SK-S004.
- General lifts (less than 10,000 pounds) to support EC 75000, 75218, 75219, 75220, and 75221 are limited to the following safe load paths:
    - For any lifts higher than 70', load must first be taken over the containment hatch enclosure and then raised to final height (Refer to Sketch 63020-SK-S007).
    - Lifted load may be moved over the Intermediate building without restrictions
    - Lifted loads to be moved over the Auxiliary building (south of Buttress 5) cannot exceed a distance of 10' beyond the outer radius of containment.
    - Any loads that are to go over the Auxiliary Building shall come up from above the equipment hatch enclosure and rotate East over the containment roof first. In other words, no loads are allowed to swing over the Auxiliary Building roof.
    - No loads can be lifted over the seawater room roof as shown on Safe Load Path Sketches 63016-SK-0001, -0003, or -0004.
    - The Crane may be moved closer to the equipment hatch enclosure in order to reach the north side of containment.
- The hook and rigging of the 2250 mobile crane is considered a heavy load even without a lifted load. The spent fuel building has not been qualified for any load drop. **Therefore, there are no allowed lifts over the Spent Fuel building**

between Buttresses 5 and 6. For use of the tendon platforms and tendon rams between buttresses 5 and 6 refer to EC/ED 68398.

Preparation of Auxiliary Building Air Handlings Systems: To be established prior to detensioning activity.

This section identifies actions required to maintain the subject system in compliance with identified design requirements identified in section B.4 of this design input.

1. A negative pressure in the Auxiliary Buildings and Fuel Handling Building maintained between 0.05 to 0.125 inches of water as read by AH-349-DPI. OP-409 is to be utilized to maintain Auxiliary Building Air Handling System alignments required to maintain these conditions. Temporary Radiation monitoring equipment should be staged (setpoints established by HP) in area of the openings to provide identification of a release should Air Handling equipment becomes unable to maintain building conditions or fail. Roof openings are to be temporarily closed if conditions cannot be maintained.
2. The Auxiliary Building and Fuel Handling building shall be maintained above 45 °F with the roof opening removed and below 122 def F. OP-409 is to be utilized to maintain Auxiliary Building Air Handling System alignments required to maintain these conditions. To prevent freezing conditions, one train of the Auxiliary Building System (AH-XD) is to be running to provide the ability to heat supply air using electric heating coils AHHE-2A or AHHE-2B. Stage portable heaters in the area of the openings to assist HVAC if required. Roof openings are to be temporarily closed if conditions cannot be maintained.
3. The Auxiliary Building and Fuel Building Exhaust System (AH-XJ) shall maintain two fans (AHF-14A/B/C/D) in operation at all times.
4. The Spent Fuel Pit Supply System (AH-XH) shall maintain one fan (AHF-23A or AHF-23B) in operation at all times.
5. All building opening in the fuel handling area (with the exception of the opening required for the detensioning equipment) shall be closed (new fuel access hatch,etc.)
6. No fuel movement shall be in progress during this evolution.

Preparation required before detensioning:

1. Access to tendon platform #5 (gray platform) at the ladder needs to be provided. It is currently land locked by the power feeds to the roof and the duct work.
2. Remove both coiling platforms and their associated upper support frames (USF). These are to be stored along with the removed platforms for reuse when the Containment shell is retensioned.
3. The safe load path for the crane installs/moves of the platforms and upper support frames (USF) can be found on sketches " G01R5 Safe load path 63016-SK-S001" and "G02R5 Safe load path 63016-SK-S002" in EC 63016.
4. Determine most efficient means to move all six tendon platforms for de-tensioning effort. Consider if 12 jib arms/12 platform and 12 hydraulic rams is a viable option.
5. Provide a PO and specification for the six vertical tendons (34V10 thru 34V15) that are being prepared for shipment to PSC to be refurbished for potential reuse in another location.

6. Erect a protective temporary wall per FME Plant Procedures. Wall shall be from floor to ceiling to protect the spent fuel pool from foreign material and enclose the hydraulic lift platform service elevator path.
7. Before removing Fuel Pool Roof Section at EL.200'-4", replace floor plugs in AB level 162'.
8. Remove Fuel Pool Roof Section at EL.200'-4" south side of buttress #6, AZ 300 degrees. (Ref. Z18R0)
   a. Remove the roof's membrane, insulation, decking, and structural steel as shown on attachmentsZ12R0 and Z13R0. This will allow platform and hydraulic ram access to the tendons with the platform.
   b. Install a temporary curb around the opening.
   c. Install a weather cover over the opening, allowing access for the hoist and hydraulic stressing ram. The weather cover will be mounted on a wheeled/track system to facilitate easy removal and placement.
   d. When the roof is removed the following tendons will accessible 62H32@B6, 62H31@B6, 62H30@B6, 62H29@B6, 62H28@B6, 62H27@B6, 62H26@B6, 62H25@B6, 62H24@B6, and 62H23@B6. (10 total)
9. Remove Auxiliary Building Roof section at EL.167'-6" north side of buttress #5, AZ 240 degrees. (Ref. Z18R0)
   a. Install scaffolding from the floor at EL 143'-0" to access all of the vertical tendons on the north side of Buttress #5. The ram will be lowered through the roof utilizing the hoist mounted to the upper support frame. (Note: the scaffolding must be removable since the ram will need to be moved up and down to access various tendons at this buttress)
   b. Remove the roof's membrane, insulation, decking, and structural steel as shown on attachment Z14R0 and Z15R0.
   c. Install a temporary curb around the opening
   d. Install a weather cover over the opening, allowing access for the hoist cable and hydraulic stressing ram. This cover will be removable through use of the hoist cable.
   e. When the roof cover is removed the following tendons will be accessible 53H22@B5, 53H21@B5, 53H20@B5, 53H19@B5, 53H18@B5, 53H17@B5. (6 total)
10. Mock-ups and associated training of craft for complex work activities required for detensioning tendons.
11. Staging tendon upper support frames onto the Reactor Building roof and attaching the tendon work platforms.
12. Partial degreasing of 22 vertical tendons.
13. Tendon anchorage inspections per ASME Section XI, Subsection IWL.
14. Install four radial strain gauges in core location 104. One will be outside of the horizontal tendon plane, one will be inside of the horizontal tendon plane, and two will be installed in the plane of the horizontal tendons.
15. Strain gauges will be monitored per the Test Monitoring Activities listed in Section E.
16. Install an acoustic emission monitoring array from Buttress 4 to Buttress 5 between elevations 150 and 160.
17. Install single point acoustic emission sensors in panels H, K, N, Q, T, and W in bays 12, 23, 45, and 61. Install single point acoustic emission sensors in panels H, K, and N in bay 56.

Additionally install single point acoustic emission sensors at azimuth 270, elevations 175', 185', and 195'.

18. Each work platform, suspended from an USF will be load tested to 125% of its rated load (Refer to Section E.1.1 for test requirements).

19. In the event of violent weather (as described below) all work platforms shall be lowered to the ground or the Intermediate Building roof or secured adequately (Refer to plant procedure EM-220, Violent Weather, Enclosure 2, Checklist 12 for additional information):

    a. Tornado Watch: Alerts an area of the possibility of a tornado and usually lasts for 2 to 4 hours.

    b. Tornado Warning: Issued when a tornado has been sighted in the area.

    c. Whenever winds exceed 30 mph

Hurricane and Tropical Storm Watch and Warning (in accordance with the EM-220 Violent Weather Committee instructions)

D.2 Detensioning Documents, Inspections, Holds, and Clearances

2.1 Tendon Anchorage Inspection

Anchorage components can be cleaned and required visual inspections performed (per ASME Section XI, subsection IWL) in preparation for each tendon to be detensioned. Any questionable deficiencies should be referred to the IWE/IWL Responsible Engineer.

2. 2 Tendon Detensioning

Communication between each of the two teams responsible for detensioning each of the tendons must be established before powering up each hydraulic system. Each team is to follow the detensioning procedure as written without deviation. If there is any disruption in the process, both teams must shut down, place the systems in a safe condition and notify the shift Engineer. Detensioning will be sequenced per the detail in MPR's calculation. All tendons identified at each hoop elevation must be detensioned before starting to detension the next designated level.

2.3 Acoustic Monitoring will be in accordance with Attachment Z33.

D.3 Label Requests

Labels requiring change as a result of this EC include:
NONE

D.4 EC Parts List

Parts or other materials required by this EC will be supplied under Work Orders from **SGT**.

Progress Energy

memo

Date: January 28, 2010
DE10-0013

To: DRB Members

From: Emin Ortalan, Supervisor
Design Engineering

Subject: Final Design Review Board for EC 75218
Detensioning the Containment

Quorum Members

Chairperson:	Emin Ortalan	Maintenance:	Rick Pepin
Operations:	Ron Tyrie	Outage & Scheduling:	Mark Whiting

Final Design Review Board (DRB) for the subject design change package (EC) was held Wednesday, January 27, 2010. The final EC product was discussed with no follow-up comment from the Quorum Members and the EC was approved for installation with the unanimous vote of the members.

Additional Attendees:

Paul Fagan	Louis Lake	Clift Pompee
John Holliday	Craig Miller	Ken McEwan
Ron Knott	Bill Bayrd	Todd Petro
Rick Portmann	Jacob Sistrunk	Guy McCallum
Don Dyksterhouse	Larry Davis	Sean Clifton
Steve Cahill	Sid Powell	James Nevill
Keith Allen	Joe Lese	

NGG
Think Fleet

E.1 Testing Requirements

Unique Prerequisites, Precautions, Limitations, Initial Conditions, and Outage Requirements:

Test and Acceptance Criteria:

Design Input/ Parameter/ Function	Test Procedure Or Method	Acceptance Criteria	Required for T/O Y/N?
E.1.1 Perform tendon work platform proof load test (any mode).	Test per MNT-NGGC-0022	1. Rated capacity of large tendon work platform (nominal 10'x20') is 22,000 lbs. Load test to 125% of rated capacity = 27,500 lbs. 2. Rated capacity of small tendon work platform (8'x10') is 4000 lbs. Load test to 125% of rated capacity = 5000 lbs. 3. Rated capacity of small tendon work platform (8'x6'') is 4000 lbs. Load test to 125% of rated capacity = 5000 lbs. Progress Energy is responsible for providing test weights. Each platform will be tested after it has been attached to its respective upper support frame (USF) directly above the equipment hatch shield structure, and prior to the USF (and attached platform) being staged at their respective buttress	N
E.1.2 DELETED			
E.1.3 Impulse response and/or impact echo testing in the following locations: Bays 12, 23, 45, and 61 in panels K, N, Q, T, and W. Bay 56 in panels K and N. In 160' elevation of Auxiliary Building in general area that was impulse response tested previously. On dome between azimuth 115-180. (Area on dome was previously tested and grid is already laid out). Other locations may be tested at the	following detensioning	PT-407T	N

discretion of the responsible engineer or his designees. **Testing in bays 23 and 45 must be complete prior to any form of hydrodemolition due to interference issues with the technology.**			
E.1.4 Perform boroscopic inspections of all core locations outside of the original delamination area (including dome). **Cores located in bay 34 must be completed prior to concrete removal.**	following detensioning	PT-407T	N
E.1.5 Tendon Anchorage Inspections	ASME Section XI, Subsection IWL.	ASME Section XI, Subsection IWL.	N

Monitoring Activities:

Monitoring Method	Locations	Actions	Duration
E.2.1 Strain gauges	Radial strain gauges in core locations 30 and 104.	Any strain from the radial strain gauges that exceed 1000 micro strain will require work to be held until engineering has been able to evaluate the core location.	During initial detensioning of the first 3 tendon sets in sequence and periodically thereafter (weekly).
E.2.2 Acoustic Emissions	1. Array from buttress 4 to buttress 5 between elevation 150' to 160'. Array from buttress 2 to buttress 3 between elevation 185' to 195'. 2. Single point monitors around the outer containment surface (31 in total including 4 on dome). 3.Locations of acoustic sensors	Acoustics will be monitored under the guidance of the MISTRAS Group, INC. An approximate 5-10 minute hold may be required during initial detensioning to adjust frequency filters on equipment.	1. During initial detensioning of the first 8 tendon sets in sequence. 2. Periodic monitoring throughout detensioning (daily)

	are identified in Attachment Z33R0.		

Strain gauges will be monitored weekly due to the localized location of the strain gauges. Acoustic emissions will be monitored daily since they will be covering the entire area being detensioned.

F.1 Turnover/Closeout Summary

Turnover Summary

Turnover to operations is not required on completion of this EC. Continuation of this work can be found in EC75219 and EC75220.

Closeout Summary

Close out will be at the end of the project

Catalog and Bill of Materials Impact

BOM Manufacturer:	Model:	Version:		
Manufacturer's Part Number	Catalog ID	Add or Delete	Q Status	Proposed Stocking Quantity

G.1 Installation Sketches

N/A

Sketch Number	Sht	Rev		Title
SK-				
SK-				
SK-				
SK-				
SK-				
SK-				
SK-				

H.1 Risk Management

Scope of Work:

The repairs to the delaminated containment wall will be implemented in a multi-phased approach. The first phase will cut stress release lines into the affected region to prevent crack propagation while detensioning tendons to allow removal of the delaminated area. This EC is the second phase in this process and provides the total number and the sequence of tendons to detension without causing further damage to the concrete containment structure.
A Finite Element Analysis model has been generated by MPR Associates Inc. to study the integrity of the overall containment structure and to confirm that by following a specific detensioning sequence containment structural integrity will be maintained. This risk matrix will be updated as necessary to identify additional risks that may be determined as a result of the detensioning phase of the work.

Risk Critical Evolution(s) and Associated Risk Parameter(s):

Risk critical evolutions will be isolated and applied to the second phase as follows:

Containment Detensioning
Overall containment structural integrity shall be maintained. Evaluation must show that there will be no additional degradation to the containment structure as a result of detensioning.

Risk Assessment:	Risk Screen Level:
Probability: ☉ 1 ☐ 2 ☐ 3	☉ H ☐ M ☐ L
Consequence: ☉ 1 ☐ 2 ☐ 3	

Basis for Probability and Consequence:

Significant Consequence level (1) is determined based on potential functional failure of the containment structure. Probability of error is determined Moderate (1) since the plant experienced a failure due to combination of activities that took place during the Steam Generator replacement, one of which was detensioning tendons similar to what this EC will accomplish. The analyses being performed to prevent further damage to the containment structure is highly complex with some of the independent verification analyses can be considered as first time application.
As a result this EC (detensioning additional tendons) is screened as high risk in accordance with EGR-NGGC-0011.

Risk Response Planning

Risk Parameter:	Risk Response:	Risk Response Action:
Tendon Detensioning :	☐ Avoidance ☐ Acceptance ☒ Mitigation	Previous Experience: The vendor responsible for physical tendon detensioning activity is PSC. They have done this work exclusively for many years and were retained to perform all tendon work during R16. They will be supplying the equipment and highly experienced supervisory personnel to oversee all aspects of the job under management of the general contractor SGT. Pre-Operational Training: Mock-ups will be constructed prior to work starting to train craft in executing complex activities included in the tendon detensioning. Additional training subjects will be included such as re-tensioning, tendon re-installation and tendon grinding. This training is to be done in a safe and expeditious manner. Engineering Oversight: MPR will be providing analysis to identify critical tendons population to detension and the sequence to execute it. This input will be reviewed both internally and externally by the root cause team to further ensure that no additional damage will be encountered. These tendons will be carefully detensioned while strain gauges are being monitored for critical readings. These detensioning instructions will be cross checked by the Root Cause Team, Performance Improvement International, knowledgeable field engineering personnel and 3rd party engineering reviewers. Containment structure will be monitored by strain gauges, Acoustics and Concrete internal temperature will be monitored with differential

		temperature monitors
Personnel Safety	☐ Avoidance ☐ Acceptance ☒ Mitigation	Pre-Job Briefs - must emphasize the dangers of working at heights. Personnel access to the tendon work platforms must be limited to those individuals that have a need to actually be on the platforms. The pre-job brief should also emphasize the potential danger from dropped objects, especially considering the heights involved when working on the containment building roof or suspended on the work platforms. Adherence to Vendor Procedures and Training - familiarity with SGT work procedures is critical. Sufficient pre-outage training of the craft that will be involved in tendon work activities is required. Due to the possibility of elevated temperatures during portions of this modification, personnel are to be trained in the hazards of heat stress. Adherence to CR3 Procedures - All work performed relating to this EC will be in accordance with SAF-NGGC-2172, "Industrial Safety". All appropriate safety equipment is to be employed during the performance of this modification (e.g. eye, face, hearing, hand, foot protection, fall prevention / protection, respirators). Personnel working on scaffolding must be familiar with the requirements for working at heights. All work controlled areas will be marked and tagged per AI-1816, "Industrial Safety Signs and Tags".

H.2 Validation Plan

Product/EC Stage	Process/Tool	Outsourced EC[1, 2, 3] ☐	Internal EC[1, 2, 3] ☑	All other Engr Products[3] ☐	To Be Implemented?[4]
At Initiation	Validation Plan	R	R	O	☑
	Risk Determination	R	R	O	☑
	Risk Response Planning	R[7]	R[7]	O	☑
	Project kick-off meeting	X	O	O	☑
	Pre-job briefing	R	R	NA	☑
	Formation of an EC Team	X[5]	X[5]	NA	☑
	Scheduling/Work Management	X	X	O	☑
Development Phase	In-process review – 0% Design Challenge	X	X	O	Waived
	In-process review – 30% Design Challenge	X	X[5]	O	Waived
	In-process review – 70% Design Challenge	X	X[5]	O	☑
	In-process review – Final Design Challenge	X	X	O	Waived
	Source review	O	NA	NA	☐
	Owner review	X	NA	NA	☐
	Error Prevention Tools (STAR, SAFE, OAQ-3, etc)	O	O	O	☑
	Design Review Board – Conceptual	X	X	O	Waived
	Design Review Board - Final	X	X	O	☑
	Engineering change checklist	R	R	O	☑
	Outsource management checklist	R	O	O	☐
	Procurement vendor oversight checklist	O	O	O	☐
	Supervisor EC Approval Checklist	R	R	NA	☑
	EC Implementation Checklist	O	O	NA	☑
Post Implementation	Post-job briefing[6]	X	X	O	☑
	Post-job critique[6]	O	O	O	☐

Risk Level[4]: ◉ H ○ M ○ L

Waiver Basis:

The nature of the detensioning work is routine in nature as the crew conducting the work are well trained and experienced. However, the consequences of an improper number and sequence of detensioning tendons may have major operational impacts.
Conceptual DRBs is waived for this work since all the work scope and analytical details will have been created by collaborative outputs from MPR, PII and PE's Root Cause Team.
A 0%, 30% and 100% Design Challenge will not be convened for the same reason as listed for the Waived DRB's. The 70% design challenge will be convened to inform all parties of the final recommended number and sequence of tendons to be detensioned. This review will cover the proposed methods and provide parties with a chance to reflect and comment on potential impacts.

Notes:
1. Required use of processes/tools per this procedure apply to PCHG-DESG, PCHG-ALTR and TCHG-DESG ECs (except child ECs) only. These tools are optional for all other EC types
2. Outsourced ECs are ECs which are developed by vendors. Internal ECs are ECs developed in-house.
3. O – Optional, X – Required (unless waived and waiver basis documented), R - Required.
4. Design Superintendent approval is required for ECs screened as high risk or for waiving DRB not previously waived for this application.
5. No EC team was formed since work will be based on analysis and advice from MPR, PII and SGT. All provide advanced technical expertise.
6. Initiate an NTM for scheduling purposes when the validation plan is approved.
7. For ECs determined to be medium or high risk level.

H.3 Reviewer Comments

Select, copy, and paste the table below into a WORD file and e-mail message to reviewers. Select (Table/Select/Table), copy (Ctrl-C) and paste (Ctrl-V) tables from reviewer's responses below. Have reviewer sign EC milestone when comments are resolved.

Discipline/Program Review	Scope of Review		
Operations	70% design review		
Reviewer	**Discipline**	**Date**	**Turnover Required?**
Ron Tyrie	Operations SRO	01/06/10	No

Item	Comment	Resolution
1	B – page 4, NGG references – add reference to FIR-NGGC-0003, Hot Work Permit	Reference added.
2	B – page 4, Plant references – typo "SP-300" not "P-300"	Corrected
3	B – page 8, 19 – Add "no mode" to MODE 5 and 6	Only changed on page 9.
4	B – page 9, 28 – Should this be project safety or site safety?	Not found
5	B – page 13 design cond. Should the RB failure reference losing one of three fission product barriers which could lead to exceeding postulated off-site dose during a design basis event.	This section to be deleted since no fuel will be stored in the RB during detensioning.
6	B – page 14, 5.d – update for 152 tendons	Number no longer listed
7	B – page 22, 5i – need to true up with thermal analysis being performed for PE. Goal is to ensure the numbers may shift (downward) but with gradient temperature control, the results remain valid	Thermal analysis is to be supported in evaluation section.
8	B – page 25, 5.k polar crane load assumptions may not be valid with delam and detensioning	Section has been modified since review
9	D – page 4 – revise for number of tendons	All affected tendons were eliminated and this section completely revised.
10	50.59 section 3 11a – suggest text of "could be affected" vice "will be performed"	Adopted

11	50.59 be sure to reference the FSAR section 5.4.3.2.2.b for the temporary openings which gives no credit to the roof except for seismic – with the beams removed this should be addressed.	Addressed By Mr. Sid Powell in his rewrite of the 50.59 section.
12	E – Why list the post-tensioning and testing here? I would reference that EC and let it go at that.	"post-tensioning" will be deleted from this section and a total review of all testing will be undertaken before issuing this EC.

Discipline/Program Review	Scope of Review		
ISI	70% design review		
Reviewer	**Discipline**	**Date**	**Turnover Required?**
R. Portmann	ISI – IWE/IWL	1/7/10	No

Item	Comment	Resolution
1	Sect. A, page 5 – Remove Tendon's 51H18 and 62H18 from the scope.	Removed.
2	Sect. A, page 5 – Correct the referenced attachment for "All additional tendon detensioning shall follow procedures detailed in SGT Procedures (Attachment Z01) on Degreasing and Ram Tendon Detensioning" as attachment Z01 is for drawing 425-004--SH-001.	Corrected
3	Sect. B, page 1 – Capitalize the word "Identification" in the 2 below listed headings: "Removed Tendons in the Opening - identification Numbers" & Additional Tendons to be Detensioned (Ref. Z09R0) - identification Numbers.	Corrected
4	Sect. B, page 1 – Remove Tendon's 51H18 and 62H18 from the scope.	Removed
5	Sect. B, page 5 – Add the IWE and IWL Repair/Replacement Plans to "Other References"	Added
6	Sect. B, page 11 – Have we concluded that the calcs listed in para. B.6.1 are still valid? ("These evaluations are documented in Calculations S06-0002 thru S06-0007, S07-0003 and S09-0025") [Also note that these are referenced through-out this EC]	New Calculations will be x-referenced
7	Sect. B, page 11 – Have we concluded that the statement listed in para. B.6.1.2 is still valid? ("However, containment still meets the applicable requirements of ACI 318-63, Parts IV-B and Part V while defueled as documented in calculation S06-0005.")	To be reviewed with JH
8	Sect. B, page 11 – References an attachment that is not located in this EC.	Most of these sections have been

	"Also, refer to Attachment Z30 for an evaluation of the resulting....."	completely modified. This ref. deleted.
9	Sect. B, page 15 thru 17 (Para. 5-d (i), (ii), (iii) – Are the results and calculations discussed still valid?	No, most have been deleted.
10	Sect. B, page 19 thru 21 (Para. 5-i) – Are the results and calculations discussed still valid?	Sections have been edited.
11	Sect. B, page 21 (Para. 5-j) – Need to reference the EC Attachment or Calculation number this will fall under.	Reference added.
12	Sect. D, page 1, item 5 – References an incorrect attachment. Need to add the attachment and correct the reference. ("Erect a temporary wall per attached sketch in Z14R0. Wall shall be from floor to ceiling to protect the spent fuel pool from foreign material and enclose the hydraulic lift plateform service elevator path")	Corrected
13	Sect. D, page 1, item D1.1.1.6 & .7 – Suggest deleting the sentence. ("This cover will be lockable for long term security")	Deleted
14	Sect. D, page 2, item D1.1.1.11 & .13 – Same requirement listed twice.	Deleted
15	Sect. D, page 2, item D1.1.1.14 – Do we want to list tendon sheath cutting and removal as part of this EC? (If we need to do this it should be part of EC 75219)	Item deleted
16	Sect. D, page 2, item D1.1.1.15 & follow on paragraphs ("Prior to Detensioning") – Are we doing any Core Bores under this EC? There is an existing EC for Core-Bores	Check with Sean on Boring vs. Monitoring
17	Sect. D, page 3, Material and Equipment Requirements: Item 1 – Suggest deleting most of this sentence. Just leave it as "Six platforms required total." [Sizes and colors may be different]	Sentence edited.
18	Sect. D, page 3, Item 9 – Delete the last sentence, no need to direct craft work in the EC. ("The jib arm assemblies will be needed for access to the tendons in the building. (51H18@B5, 62H18@B6, 42H1@B4, 42H2@B4, 53H1@B5, 53H2@B5, 64H2@B6, 64H3@B6, 64H4@B6, 13H2@B1, 13H3@B1, 13H4@B1, 42H1@B2, 42H2@B2, 53H1@B3,	All of this is deleted.

	53H2@B3, 13H2@B3, 13H3@B3, 13H4@B3, 64H2@B4, 64H2@B4, 64H4@B4) (22 total).")	
19	Sect. D.4, page 5, EC Parts List – Sketches and attachments are listed in the description section, but not listed in the attachment. Add the attachment items and correct the reference numbers	Most Items deleted.
20	Sect.E – Most all of these items can be eliminated from this section. Inspections identified in Sect. D were the tendon Anchorage, boroscope inspections, IR testing, and proof load testing of the USF's.	Section completely modified.

Discipline/Program Review	Scope of Review		
Fire Protection	70% Design review		
Reviewer	**Discipline**	**Date**	**Turnover Required?**
R J Marckese	Fire Protection	1/7/10	N
Item	**Comment**	**Resolution**	
1	Reference Hot Work Procedure FIR-NGGC-0003 for any cutting	Complied	
2	Reference AI-604 for Lay Down requirements	Corrected	
3	Provide an instruction in Installation section to follow transient combustible and hot work procedures as needed.	Complied	
4	Limit the amount of stored grease on the Spent Fuel floor to 220Gals..	See procedure in B.6.6	
5			

Discipline/Program Review	Scope of Review		
Security	70% Design Review		
Reviewer	**Discipline**	**Date**	**Turnover Required?**
Al Koralewski	Security	1/8/10	N
Item	**Comment**	**Resolution**	
1	Section B.4 missing Layout and Arrangement Requirements (if required) Section is missing #11	It is there now	
2	Section B.4.17 add; Plant Security controls shall be maintained during this activity. Security shall be notified 24hrs in advance prior to breeching any Protected Area (PA) or Vital Area (VA) boundary to include roofs. Security posting will be required prior to actual breeching activity and will remain in place until breech is properly secured.	Added	

Discipline/Program Review		Scope of Review	
ISI		100% Design Review	
Reviewer	**Discipline**	**Date**	**Turnover Required?**
R. Portmann	ISI – IWE/IWL	1/12/10	No

Item	Comment	Resolution
1	Section A Contents: Need to update the folder file contents, Z20 is "IWE R-R Plan_R3", Z21 is "IWL R-R Plan_R4", Z17 will be "Calculation S10-0004 – Tendon Detensioning Calculation" (When approved).	Corrected
2	Section A Contents: Page 5, Delete "(Ref. 10.8)" ["Tendon detensioning shall follow procedures detailed in SGT Procedures (Ref. 10.8)….."]	Deleted
3	Section B Design: Need to update reference 5.1 when the MPR calc 0102-0135-06 is approved and becomes "Calculation S10-0004 – Tendon Detensioning Calculation"	Completed
4	Section B Design: Pages 15 & 16 discusses the period of reduced prestress during detensioning, within these paragraphs is a discussion "The reduced prestress during this time has been calculated by MPR. The expected prestress during this time will be determined based on the average effective prestress considering all losses due to concrete shrinkage, concrete creep, steel relaxation, and elastic shortening of the concrete." Is there a calculation that MPR performed that should be referenced here? The discussion follows on with " ➢ Prestress Force in Existing Tendons (not removed/de-tensioned) – During SGR: Per pages Section 4.2.1 of Ref. 5.9 (Calc S06-0004) and Ref. 5.23 (G/C Calc #1.01.19, the projected tendon forces at end of the SGR outage are: Is this section (and calc S06-0004) still valid?	Yes. This is in the S10-0006 Calc., however, this reference to "prestress during detensioning" has been deleted. This also has been deleted.
5	Section B Design: B.6.10 – Test	

	Requirements, Acoustic Emission, should we label this as "if installed" ?	This has been changed to and is not listed anymore.
6	Section E Testing: Need to add, Tendon anchorage inspections per ASME Section XI, Subsection IWL.	Added
7	Section E Testing: E.1.3 and E.1.4 should state that this testing is to start following the detensioning of the tendons.	Added
8	Section E Testing: E.2.2 - Acoustic Emission, should we label this as "if installed" ?	Has been accepted.
9	Section D, Item #5 – Correct the spelling of platform	Corrected
10	Section D, Item #7a – Suggest to reword to "Install scaffolding from the floor at EL 143'-0" to access all of the vertical tendons on the north side of Buttress #5" (in lieu of to the underside of the roof)	Corrected
11	Section D, Item #12 – Delete this item as the sump work may not be needed or should be in EC 75219.	Deleted
12	Section D, Boxed item referencing PSC Manual – Delete this box/reference as the PSC Manual is now under SGT's QA Program and work instructions.	SGT is going to use the PSC manual as a reference for developing their Work Orders.
13	Section D, Materials and Equipment Section, Item #1 – Delete the second sentence in differentiating platform colors, not needed in the EC	Just to make sure it gets done I have left it in.
14	Section D, Materials and Equipment Section, Item #4 – Change "will" to "may" as taller cans may not be required.	Adopted
15	Section D – Install, need to add a discussion on the safe load path for the crane for platform installs/moves and reference EC 63016, sketches " G01R5 Safe load path 63016-SK-S001" and "G02R5 Safe load path 63016-SK-S002"	Added to "Preparation required before detensioning" Section.
16	EC Attachments: Need to update" Z17R0-MPR Detensioning Calc 0102-0135-06.pdf" when it becomes "Calculation S10-0004 – Tendon Detensioning Calculation".	Changed Number in Title

Discipline/Program Review	Scope of Review
Licensing	100% Design Review

Reviewer	Discipline	Date	Turnover Required?
Sid Powell		1/12/10	

Item	Comment	Resolution
1	EC 63020 should be referenced in B.3.8 for use of the Mobile Crane and its safe load paths	Added
2	B.3.9the Tech Specs are currently amended thru amendment 235 and the Bases revision is 81	Corrected
3	B.4.7 – EC 63020 should be included for the Mobile crane, safe load paths, and load drop analysis	Added
4	Page 20 – the AR for the risk assessments is 373964	Added to X-REF.

Discipline/Program Review	Scope of Review
CRT Implementor	100% Design Review

Reviewer	Discipline	Date	Turnover Required?
M. Anderson	Nuclear Projects	1/12/10	

Item	Comment	Resolution
1	B.2. Scope description needs SGR EC # for removed tendons listed.	Included
2	B.4.16 first sentence spelling "required = require"	Editing removed sentence.
3	B.4.20 "monitored" identifies what action, when.	Monitoring is defined in detail in the Section E, the Testing Section identified in Section B.4.20
4	B.4.24 The "only" flammable material = The only identified flammable material	Corrected
5	B.4.26 The "Site Safety" department = The "SGT Safety" must reference the SGT safety procedure.	SGT safety procedure added to description.
6	Page 17, Temperature gradient not greater than 5 degrees is unachievable. Work will never begin.	A temp. gradient of 5° F is achievable. The temperature is measured by thermocouples inside each face of the concrete wall. Because the thermal conductivity of concrete is low, temperature changes of the inside & outside air have little time impact in changing the delta of the concrete wall temperature. Care must be taken, but we will have enough control of the inside temperature to follow the thermal gradient. By the time we get to detensioning, the average outside

		temperature should have increase substantially giving us better control.
7.	B.6.10 Is 1000 micro strain acceptable by what standards, are the instruments calibrated, how often.	This is based on calculations regarding the existing strain and the strain gages have been in use on the building for some time. They are used by a number of testing labs and are considered a standard for measuring strain in working concrete. I can get you references if you want them. The calibration methods are standard and will be applied here before starting new locations before detensioning. Recalibration is usually only done once a year on continually operating systems.
8	B.6.10 What is the purpose of Acoustic Emissions? What is the testing criteria?	We will use Acoustic Emissions as a backup test system. The people who will deploy this system claim the array of pickup points will triangulate and locate sources of sound events. These events indicate sources of micro-cracks that are precursors to the start of a major crack. High densities of these events indicate that detensioning should be stopped pending further investigation at the site of the source of these events..
9	Installation package page 1, remove 1,2,4,5,6c,7a,8,10. Not required in EC	Comment noted
10	Installation, remove "Material & Equip. Required Section, page 3	Helps the planner
11	Page 4, "Tendon Detensioning" remove the word "timed"	Corrected
12	"Testing" E.1.1 platform testing has been completed by PSC and they will provide CFC which is acceptable	4 new platforms are to be supplied along with 4 new upper support frames. These are to be re-proof loaded after installation.
13	Aux Bldg & Spent Fuel Pool roofs have a vacuum under them, how are we placing a temporary roof on safely with a vacuum pulling it down, and how do we remove the temporary roof with a vacuum holding it down.	These temporary roofs will not be sealed around the edges making them easy to slide off the opened areas.
14	No hidden hold points to stop scheduled work will be acceptable.	I'm not aware of a hidden hold point.

Discipline/Program Review	Scope of Review		
Procurement Engineering	Procurement Engineering review of EC 75218		
Reviewer	**Discipline**	**Date**	**Turnover Required?**
Rick Curry	Mechanical	1/7/10	

Item	Comment	Resolution
1	Need to add Procurement Engineering as a Milestone signoff.	Added Comment to resolution – I reviewed the milestones and I do not see Procurement Engineering as a milestone. I added it again. I don't know now how we lost the old one?
2	Section A00R0, subsection A.5, paragraph 2) Detensioning of Tendons, page 4 of 6; "PII" is not defined – what type of calculation is this?	PII is the name of a company. It has been defined in the Caveat in A.3 on Page 2. Comment to resolution – Thanks.
3	Section B.6.8, Material Requirements states: "As noted in B.4.8 all materials used in the restoration of the temporary access Opening must be compatible with the existing materials and meet or exceed the original material requirements." Section B.4.8, Material Requirements states "Not applicable". Since there are material requirements, this section needs to be revised. Same comment for section B.4.27, Materials, Processes, Parts, and Equipment Suitability for Application.	These sections redefined and edited. Comment to resolution – I have reviewed these sections again and with the exception of renumbering some of the sections, I see no change and still have the same comments. Corrected properly this time!
4	What happened to item 4 of the parts list: "Head, Anchor, Tendon, ASTM A514, Type Q, (163 Wire Stressing Washer), Cat ID no. 9220184437? Unless it is specified in another EC, it needs to be added back in the parts list.	Added back in. Comment to resolution – I have reviewed Section D.4 and now the parts list is gone and a statement "Parts or other materials required by this EC will be supplied under Work Orders from **SGT**." replaces it. We have Cat IDs set up for these items and quantities in stock. Are we going to trash these items in stock and SGT is going to buy their own or is SGT going to use the parts that we have in stock? If SGT is going to use them, then the parts list needs to go back in the EC and the current statement would stay in but would read "Additional parts or other materials required by this EC will be supplied under Work Orders from **SGT**.". SGT cannot be responsible for procuring parts that we

		have already procured. I have been told that SGT will use the parts from our stock and I am to leave the parts list out of the EC.
5	The quantity for the Grease Cap Gaskets, Cat ID no. 9220159636 has changed from 100 to 35. Is 35 the correct quantity?	Changed again to 370. Comment to resolution – See comment no. 4 above.

Discipline/Program Review	Scope of Review
Systems Engineering	Ventilation Concerns based on being briefed on work scope

Reviewer	Discipline	Date	Turnover Required?
Daniel Caraballo	HVAC / Mechanical	1/13/10	

Item	Comment	Resolution
1	Ensure this EC considers: Currently at the Refuel Floor AB 162' the floor plugs are not in place (just in front of AHF-10). These need to be put back in place prior to removing any roof sections to assist local area dP control.	Instruction included in section D of EC on Page 2, Item 7.
2	Ensure this EC considers: AHF-10 should be turned off while work is in progress to assist dP control such that air flow is from potentially clean to potentially contaminated.	This should be covered under section title "Preparation of Auxiliary Building Air Handlings Systems" In Section D of EC.
3	Ensure this EC considers: Be mindful that without AHF-10 running (it has electric heat to keep temperature above 55°F) if outside temperatures drop that the area will be very cold for personnel.	This is addressed under section title "Preparation of Auxiliary Building Air Handlings Systems" In Section D of EC.
4	Ensure this EC considers: Work must stop and roof must be covered if for any reason AB Exhaust Fans AHF-14A/B/C/D are shut down either for other work or if they trip/fail.	Again covered under section title "Preparation of Auxiliary Building Air Handlings Systems" In Section D of EC.

Discipline/Program Review	Scope of Review
Maintenance	Maintenance impact, field impact

Reviewer	Discipline	Date	Turnover Required?
Pepin	Mechanical	01/11/2010	Yes

Item	Comment	Resolution
1	Platform inspections should be done per MNT-NGGC-0022, I would invoke a requirement to load test per MNT-NGGC-0022 and that is all	Added to Section E.1.1 Testing
2	Safe Load paths for equipment and materials working the roof is not in this EC. There are not sufficient details in the Maxim Crane EC to get materials to the	Covered under EC 63020

	area. We either work that EC or denote a path in this EC. Don't care which. This is critical for Spent Fuel roof and AB roof.	
3	Material and equipment section is too detailed on what is required for each tendon. If we have a breakdown we may end up with some other configuration.	Deleted from Section D.

Discipline/Program Review	Scope of Review
Mechanical/HVAC	HVAC Review

Reviewer	Discipline	Date	Turnover Required?
Tom Worthington	Mechanical Design	1-12-10	N

Item	Comment	Resolution
1	B.6.6 The requirement to close the roof opening at 45°F. Does this mean the roof has to be installed or will a temporary cover suffice? If temporary covering is acceptable, then a statement like "...all roof openings should be temporarily closed..."	Revised section B.6.6, B.6.8 and D.1 to identify temporarily closed.
2	Is the use of portable heaters acceptable to assist in maintaining temperature?	Yes. Portable heaters are acceptable to maintain the identified minimum temperature. Revised section B.6.6 and D.1.
3	B.6.8 "...above 45 def F with..." should be 45°F.	Revised.
4	B.7 does not include Mark Livingston's name as an interface and yet he was.	Added
4a	There is no proposed roof opening size. Opening size is required for evaluation.	Attachments Z12 (dwg S-521-102) and Z14 (dwg S-522-003, S-522-012) identify the openings to be made in the Fuel Handling and Auxiliary Buildings respectively. The sizes are approximately: - Fuel Handling Area: (10'6" x 17'= 180 ft²) per att. Z12. - Auxiliary Bldg Area: ([5' x 12.5'] + [6'x3'] = 81 ft²) Added to section B.2.
5	There is no evaluation demonstrating that the proposed openings will allow maintenance of the required negative pressure by the exhaust fans. The exhaust fans can maintain negative pressure (DBD) with the new fuel shipping opening open (known). How	The new fuel hatch was measured at approximately 10' x 36' (360 ft²). With only one roof openings removed at once, closure of the new fuel opening on the Fuel Handling deck will allow the Auxiliary and Fuel Handling Exhaust

	does this relate to the size of the openings being considered?	system (AH-XJ) to maintain a negative pressure. Added evaluation in section B.6.4. and B.6.8.
6	Do both openings have to be made at the same time? This may be limited by what the capability of the exhaust fans are compared to the stack/chimney effect of the openings in the roof and the resulting infiltration.	The RE has identified that one opening will be removed at a time. This has been added to section B.6.8 and to D.1.
7	Wind is not considered in the evaluation of the opening area and the required negative pressure in the Aux Building.	Yes, it is not considered. However, added statement in installation instructions to establish HVAC requirements prior to detensioning activity. It this time, actions will be taken if wind is a factor. Also, identified that heaters and rad monitors are to be staged to address conditions not evaluated.
8	Restrict the new fuel opening to be closed during the time the roof holes are open.	Previously identified. Incorporated into section B.6.8 and D.1.
9	If negative pressure cannot be maintained, is it permissible to have the openings in the roof if temporary local rad monitoring is installed?	A temporary monitor will be staged. However, the roof opening will be closed should setpoints be exceeded. Added statement to section B.6.4, B.6.8 and D.1.

Discipline/Program Review	Scope of Review
Containment System Engineer	100% design review

Reviewer	Discipline	Date	Turnover Required?
S. Stewart	NSS Systems	1/19/10	N

Item	Comment	Resolution
1	When sections of the FH building roof are removed, how will debris, rainwater, etc be prevented from impacting equipment below?	Special plug is being fabricated to close the opening when not in use. When it rains, they will shut down the work on tendons and close up the openings in the roof.
2	Section B.4.24 – States "The only identified flammable material involved in this EC is the tendon grease. However, creation of the temporary access opening involves flame cutting." Does this mean we need to be concerned about the grease catching fire? Not clear how these two sentences go together.	No flame cutting will be done while cleaning grease or before the tendon caps are removed. Cutting holes in the roof will be done before any tendon work is done.
3	Section B.6.5, Thermal Loads – States the temperature differential across the	A great deal of discussion has gone on about this subject, however the thermal

	containment wall will be controlled to be no more than 5 Deg F. This appears to be difficult to maintain given that the outside temperature will change throughout the day depending on if raining, sunny, etc. What do we do if the 5 degrees is exceeded?	conductivity of concrete is so low that it takes days to see a difference in temperature in only 2 or 3 inches deep in the wall. Thermocouple will be installed 2-3 inches deep into the concrete. It can be shown that constant 20° differential through the wall will take a week to migrate to just to the center. Control of the inside temperature is thought to have enough impact to control the through wall temperature differential. Also max limit is 10F
4	Section B.6.6 & B.6.7 – Says that the Aux and FH buildings are to be maintained above 55 deg F. Why then is it okay to not take any actions until the temperatures drop to 45 Deg F? Shouldn't there be actions to prevent getting below 55 Deg F?	55F is for personnel comfort and 45F is for Freeze protection
5	Section B, Page 21 of 26 – Typo? Symitrically	Corrected
6	Section B.6.10 (Temperature Monitoring Requirements) – Suggest using more than just one thermocouple to measure the temperature since one T/C could fail or be inaccurate	Thermocouples will have redundancy both inside and outside and spares to replace any failed ones
7	Section E – Should the temperature monitoring of the RB inside and outside be on the "Test Monitoring Activities" list?	This is not as a test function. They will be used as monitoring only.

Installation					Design			
Item No.	Qty/ Units	PO Number	PE Request	Catalog ID	Description (If available, include Manufacturer, Model, and Version)	Spec or CGI	Q Status	
							Buy	Use
1	9000/ Gallons	Contract no. 270269		9220198981	Visconorust 2090-P4 Grease - Supplied by SGT/PSC		QL-1	QL-1
2	35/ Each	Contract no. 270269		9220159631	Grease Cap Gaskets - Supplied by SGT/PSC Gasket, Cap, End, 15-3/8" x I.D. x 16-5/8" O.D. x 5/8" thick, Neoprene or Nitrile Base Rubber, 60 Durometer Hardness, lower vertical tendon. Refer to Prescon drawing 5EX7-003A-A-9C, Rev. A for lower vertical gasket. (Also refer to sketch in Attachment Z19)		QL-4	QL-4
3	35/ Each	Contract no. 270269		9220159636	Grease Cap Gaskets - Supplied by SGT/PSC Gasket, Cap, End, 14-1/2" x I.D. x 15-1/2" O.D. x 1/2" thick, Neoprene or Nitrile Base Rubber, 60 Durometer Hardness, hoop, dome and upper tendon caps. Refer to Prescon drawing 5EX7-003A-A-9D, Rev. A. (Also refer to sketch in Attachment Z19)		QL-4	QL-4
4	100/ Each				55 gallon steel drums.		QL-4	QL-4
5	25/ Each			9220185112	Can, (Cap), Grease, for the Vertical Tendons in accordance with drawing no. 5EX7-003A-A-9D, rev. 1 with the exception that the height is to be changed from 24" to 27".		QL-4	QL-4
6	20/ Each				1/2"diameter Hilti Kwik Bolt 3 anchor bolts produced from AISI 316 Stainless Steel with a minimum embedment of 3 1/2" (KB3 316SS ½ x 5 ½"). Required for tendon access gallery hatch cover.		QL-1	QL-1
7	29/ Each	Contract no. 270269		9220184437	Head, Anchor, Tendon, ASTM A514, Type Q, (163 Wire Stressing Washer). Refer to Attachment Z19R0 for details, PSC drawing CR-N1009-502 (163 Wire Stressing Washer) - Supplied by SGT/PSC.		QL-1	QL-1

Deleted: 0001430382

Deleted: 8

Comment: The Cat ID for item 1 was changed because the Cat ID currently specified is for gallons and the Cat ID deleted is for 55 gallon drum containers.

Installation					Design			
Item No.	Qty/ Units	PO Number	PE Request	Catalog ID	Description (If available, include Manufacturer, Model, and Version)	Spec or CGI	Q Status	
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3	35/ Each	Contract no. 270269		9220159636	Grease Cap Gaskets - Supplied by SGT/PSC Gasket, Cap, End, 14-1/2" x I.D. x 15-1/2" O.D. x 1/2" thick, Neoprene or Nitrile Base Rubber, 60 Durometer Hardness, hoop, dome and upper tendon caps. Refer to Prescon drawing 5EX7-003A-A-9D, Rev. A. (Also refer to sketch in Attachment Z19)		QL-4	QL-4
4	100/ Each				55 gallon steel drums.		QL-4	QL-4
5	25/ Each			9220185112	Can, (Cap), Grease, for the Vertical Tendons in accordance with drawing no. 5EX7-003A-A-9D, rev. 1 with the exception that the height is to be changed from 24" to 27".		QL-4	QL-4
6	20/ Each				1/2"diameter Hilti Kwik Bolt 3 anchor bolts produced from AISI 316 Stainless Steel with a minimum embedment of 3 1/2" (KB3 316SS ½ x 5 ½"). Required for tendon access gallery hatch cover.		QL-1	QL-1
7	29/ Each	Contract no. 270269		9220184437	Head, Anchor, Tendon, ASTM A514, Type Q, (163 Wire Stressing Washer). Refer to Attachment Z19R0 for details, PSC drawing CR-N1009-502 (163 Wire Stressing Washer) - Supplied by SGT/PSC.		QL-1	QL-1

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Comment: The Cat ID for item 1 was changed because the Cat ID currently specified is for gallons and the Cat ID deleted is for 55 gallon drum containers.

Discipline/Program Review	Scope of Review		
Civil/Structural	70% Design Review		
Reviewer	**Discipline**	**Date**	**Turnover Required?**
John Holliday		01/12/10	No

Item	Comment	Resolution
1	Section A.5, page 5: 5th paragraph that describes that sections of the roof must be removed identifies tendons 51H17 thru 51H22. This is incorrect; the tendons under the AB roof are 53H17 thru 53H22.	Corrected
2	Section B.2: Last paragraph states that "This EC will remove a roof section at the 200'-4" elevation of the auxiliary building to facilitate.....and at the 167'-6" elevation of the *Spent Fuel Pool Building"*. Change to "This EC will remove a roof section at *El.* 200'-4" of the *Fuel Handling Building* to facilitate..... and at El. 167'-6" of the Auxiliary Building".	Corrected
3	Section B.3, Item 5.1 (Calculations): Add calculation number S10-0004 for MPR detensioning calc.	Added
4	Section B.4: Item B.4.14 should be "Layout and Arrangement Requirements". Revise remaining section numbers accordingly, i.e. B.4.15 should be "Operational Requirements Under Various Conditions"	Revised
5	Section B.4.22: first paragraph, delete "However, creation of the temporary access opening involves flame cutting".	Deleted
6	Section B.4.22: Delete sentence "Coatings must comply with FIR-NGGC-0004.	Deleted
7.	B.4.23: Refer to similar section in EC 63016 and cut and paste relevant sections. There are handling and storage requirements for the new tendons, grease, shim plates, end cans, etc that must be addressed.	Revised
8.	B.6.1: Delete in its entirety the 5th paragraph that starts "MPR and PII have..." and replace with "However, while defueled there are not TS LCOs	Revised

	requiring containment integrity or TS Actions applicable to the defueled containment.	
9.	Section B.6.2: Add a heading for "Containment" and state "During No Mode there are no TS requirements for containment integrity or TS Actions that require containment closure, Therefore performance requirements are not applicable.	Completed
10.	B.6.3 Codes: Add a heading for "Containment". Add the following…. "During No Mode there are no TS requirements for containment integrity or TS Actions that require containment closure, therefore, design basis loads and load combinations are not applicable. However, the containment still meets the intent of ACI 318-63, Parts IV-B and Part V while defueled, as documented in calculation S09-0004 (MPR detensioning calc).	Completed
11.	B.6.5: The first paragraph should state "*The dead load* of the containment….". Also change AHSYS runs to *ANSYS models.* Delete "per Ref. Z11R0" and replace with *"as evaluated in Section B.6.10".* I recommend that you move the whole section that addresses "Unit Weight" to Section B.6.10 (Structural). Delete the reference to Attachment Z11R0 and delete remove from Attachments. In the last sentence directly above TABLE 2, change Attachment Z23R0 to Z24R0.	Completed Unit Wt. Moved & references moved Table 2 is in Section 10 & attachment # changed.
12.	Wind Loads: Delete whole section. Add…,"While defueled there are no TS requirements for containment integrity or TS Actions that require containment closure, therefore, design basis wind loads are not applicable. While the containment is defueled and partially detensioned it could possibly pose a II/I hazard to the adjacent Auxiliary Building due to the presence of the spent fuel pools.	Changed

	Hurricane wind loads are enveloped by Tornado Wind load which is addressed below.	
13.	Add section for Seismic Loads. Add the following: The appropriate seismic loads have been applied to the containment ANSYS finite element model generated by MPR and evaluated in MPR Calculation 0102-0135-08. Per the Containment DBD (Ref. 2.1), and Section 5.2.1.2.9 of the FSAR (Ref. 9.1), the design basis seismic parameters are as follows: • Operating Basis Earthquake (OBE) 0.05 g, maximum horizontal ground motion acceleration 0.033g, maximum vertical ground motion acceleration • Safe Shutdown Earthquake (SSE) 0.1 g maximum horizontal ground motion acceleration 0.067 g, maximum vertical ground motion acceleration While defueled there are no TS requirements for containment integrity or TS Actions that require containment closure. However, while the containment is defueled and partially detensioned it could possibly pose a seismic II/I hazard to the adjacent Auxiliary Building due to the presence of the spent fuel pools. MPR evaluated the effects of seismic loads on the partially detensioned containment shell with the delaminated concrete removed and concluded that the containment shell had sufficient strength to preclude any possible collapse mechanism.	All of this changed in section 6.5
14.	Add section for Tornado Wind. Add the following:	

	While defueled there are no TS requirements for containment integrity or TS Actions that require containment closure. Therefore, design basis requirements for Tornado Load are not applicable. However, while the containment is defueled and partially detensioned it could possibly pose a II/I (collapse) hazard to the adjacent Auxiliary Building due to the presence of the spent fuel pools. Accordingly, MPR calculation 0102-0135-08 has conservatively evaluated the partially detensioned containment shell for design basis tornado wind loads, with the delaminated concrete removed, for a tornado wind velocity of 300 mph and an external pressure drop of 3 psig (Ref. 2.1, 5.7 & Section 5.2.1.2.6 of the FSAR (Ref. 9.1 for a potential collapse	Added to Section 6.5
15.	Change section heading "Reduced Prestress During Detensioning" to "*Reduced Prestress after Detensioning*", then delete the whole description that follows this heading and replace with: "Calculation S10-0004 has evaluated the containment shell for reduced prestress while defueled for 150 hoop and 32 vertical tendons detensioned (which includes the 17 hoops and 10 verticals that were previously removed during SGR). The expected prestress during this time has been determined based on an effective prestress considering all losses due to concrete shrinkage, concrete creep, steel wire relaxation and elastic shortening of the concrete (Ref. Calc. S10-0001). Hoop and vertical tendon forces are modeled explicitly in the ANSYS finite element model. Per Ref. 2.1 and Calculation S80-0002 (Ref. 5.5) the initial and minimum required vertical and hoop tendon forces at the end of plant life are as follows:	Changed in Section 6.5 Changed

	• The Guaranteed Ultimate Tensile Strength (GUTS) = 2335 Kips/tendon (A = 9.723 in^2; fu = 240 ksi). • The initial prestress = 80% GUTS = 1867 kips/tendon • The lock-off prestress = 70% GUTS = 1635 kips/tendon (168 ksi) • Minimum required prestress in a vertical tendon at 40 years = 1149 kips (mean anchorage force) – Ref. 2.1 • Minimum required prestress in a horizontal tendon at 40 years = 1252 kips (mean anchorage force) – Ref. 2.1 Tendon forces input to the ANSYS model are based on the initial lock-off force =1635 kips – calculated losses.	Changed
16	Delete the whole section that address friction losses. This section is only pertinent to the retensioning calculation.	Deleted
17	B.6.5: After the sentence that ends "vary from outside temperature by more than 5 degrees F" add a new sentence that states: "*Refer to Section B.6.10 for Temperature Monitoring Requirements*".	Sentence added
18.	Polar Crane Load: Revise to state that: "The partially detensioned containment shell, with the delaminated concrete removed, has been evaluated by MPR (Refer to Calc. S10-0004) for the dead weight of the polar crane only. The polar crane cannot be used for any lifts prior to the repaired concrete being sufficiently cured (Refer to EC 75220)	Revised
19.	Add a section, Pressure Loads. State that while defueled there are no accident pressure loads that need be evaluated.	Added
20.	The numbering system in Section B.6 must reflect the same numbering system and Section headings as in B.4.	Revised
21.	B.6.7: Change from "Structural Requirements" to "Interface Requirements" (Refer to comment #20	Revised

	above). Similar to EC 63016 Section B.6.7 add limited description of interface EC's and list of interface vendors. Note that PSC not SGT provides all equipment and oversight for tendon related work	SGT will have full management control and run RSC under their QA program.
22.	B.6.8 should be "Material Requirements".	Changed
23.	B.6.9 should be "Mechanical Requirements". State that there are none for detensioning.	Changed
24.	B.6.10 should be "Structural Requirements". Suggest adding sub-heading such as: "Description of Calculations Supporting Partial Detensioning of the containment"	Added
25.	B.6.10, Calculation S10-0004: Revise the section that states that "the risk posed from the occurrence of a tornado or earthquake has been assessed in Maintenance Risk Assessment XXXXXXXXXXX, both quantitatively and qualitatively and found to be acceptable, thus eliminating both earthquake and tornado loads from consideration during this time period" to "while the containment is defueled and partially detensioned it could possibly pose a seismic II/I hazard to the adjacent Auxiliary Building due to the presence of the spent fuel pools. MPR calculation 0102-0135-08 has evaluated the effects of both seismic and tornado wind loads on the partially detensioned containment shell with the delaminated concrete removed and concluded that the containment shell has sufficient strength to preclude any possible collapse mechanism".	Section updated and changed from this section. Changed
26.	B.6.10, Calculation S10-0004: Delete the last two sentences that refer to thermal	Sentences deleted

	gradient and to stresses that exceed the acceptance criteria.	
27.	B.6.10, Calculation S10-0004: The section that addresses tensile strength of the in-situ concrete states "*based on Attachment xxxxx, the tensile strength of the in-situ-concrete.....).* Identify an Attachment number and place the Report from WJE Associates in that attachment. I will forward the report to you.	Delete this Comment....no longer applicable. OK. Ignored
28.	B.6.10, As noted in comment #11 include in Section B.6.10 the discussion about concrete unit weight.	Now included.
29.	B.6.10: Identify which tendons have to be detensioned and removed. Describe why certain tendons have to be removed (flexible conduit). Describe method of tendon removal (Refer to EC 63016). Add that they have to be tagged for future identification and how they are to be stored. Add precautions for tendon removal (burred ends of tendon wires getting jammed in anchor head). What are the requirements for refurbishing these tendons for re-use? Are we going to re-use them or replace them with new tendons?	The assumption is flexible conduit will not be damaged. Removal of tendons will be done under EC75220, If required.
30	B.6.10: Add a new section heading "Temperature Monitoring Requirements" Add the following discussion: Calculation S10-0004 has included a 10 degree F thermal gradient in the ANSYS FEM when evaluating the containment shell for reduced prestress The surface temperature of the liner plate will be continually monitored thru thermocouples (or similar devices that can measure surface temperature) attached to the surface of the liner plate at a minimum of two representative locations. Similar devices will be attached to the inside surface of at least two existing core bores located in the general vicinity of	Added Added Added

	buttresses 3 and 4. These devices will be placed so that they can measure the surface temperature at 3 approximate locations; 4" inside the core bore, at mid-point and at the base of the core bore. Once mounted, the core bore should be plugged with approximately 2"-3" of polystyrene at the outer face. In addition, two thermocouples will record ambient air temperature outside containment. The rolling 7 day average temperature changes will be recorded for all devices in PI. The seven day average is listed because of the latent affect that temperature has on a 42" thick (or 32" thick after delaminated concrete is removed) concrete wall. Thermal measuring devices are not attached to the outside face of the containment wall since un-conservatively high temperatures would be recorded if the measurements were taken at the surface of the containment wall due to solar radiation, i.e. the surface temperature is directly affected by the sun and would not be representative of the average temperature 2"-3" inside the wall. This effect can be seen in the temperature monitoring results contained in Attachment XXXXXX. The thermal gradient that will be managed will be the difference between the average of the two thermocouples attached to the liner and the average of the two thermocouples 4 inches from the face of the outside containment wall inside the core bores. Operations will use the purge system per OP-417 to maintain the delta as close to zero as possible based on a 7 day rolling average. The limit on the ambient temperature inside containment is 60 degrees. If the delta between the thermocouples inside containment and 4 inches from outside face of containment inside the core bores reaches 8 degrees F,	ADDED all

	engineering will evaluate if additional actions need to be taken outside containment by SGT to increase the concrete temperature. These actions may include tents, blankets, heaters, and moisture. Based on a review of the stresses in the unreinforced section of concrete during the detensioned condition, the extent of protection outside containment is expected to be limited to an area about 10 feet beyond the perimeter of the steam generator opening. Summary: Temperature gradient will be continuously managed as close to zero as practical based on a seven day rolling average. When the thermal gradient reaches 8 degrees F, an evaluation will be made by engineering with the intent of determining if forecasted temperatures could result in a sustained temperature gradient greater than 10 degrees F. If such a gradient is judged possible then appropriate actions will be taken. . The action is to preclude a temperature gradient of 10 degrees.	ADDED ALL
31.	Address removal of structural members from AB SF building roof. Is there any effect on the structural qualification of the roofs?	Detail addressed in Attachment Z18
32.	What are the requirements and safe load paths for moving tendon platforms and other tendon related equipment to and from the RB roof? Include safe load path drawings as Attachments to the EC. May want to add that we are removing the two coiler platforms including the USFs and replacing with a total of 4 new small platforms.	Included in Section D
33.	Add Sections B.6.11 "Hydraulic Requirements". None for detensioning.	Included
34.	Add Sections B.6.12 thru B.6.30 per procedure.	Added
35.	B.6.17: Does security have to post a 24 hour guard at the AB and Fuel Handling	Apparently, They have reviewed this and are making appropriate plans.

	Building roofs after a portion of these roofs have been removed?	
36.	B.6.24: Has the plant fire protection group reviewed the acceptability of cutting a hole in the AB and Fuel handling building roof? Does the temporary wall erected in the Fuel Handling Building impact fire loading (is it even a concern?)	Yes. New wall does not seem to be a concern.
37.	All Attachments must have each page numbered and EC number identified. Refer to EC 63016 for guidance.	All changes made for final review.
38.	Section D00: Preparation required before detensioning: #2: What safe load path does removal of the coiler platform/USFs require? How are the work platforms going to be physically removed (there is no chipping platform on which to place the platforms and hook them up to the crane). #12: Sump pumps do not have to be disabled. Baricade around sumps as was done during SGR. Bechtel provided pumps linked to the grease barrels from which they pumped excess water. Discuss with Leon Gagne (Operations and Rich Ionelli (was Bechtel may now be with SGT). Add that plastic sheeting will be taped to the tendons gallery floor and side walls to contain any grease spills. Add that any storm drains in the area will be protected from grease spills.	Safe work paths are defined in attachments Z27 and Z28. These details are to be looked after by SGT and will be done under W.O. etc. etc.
39.	Section B.6.10, new heading: <u>Predicted Localized Concrete Cracking due to Detensioning</u> While the containment is defueled there are no Tech Spec requirements for containment integrity or that require containment closure. Therefore, the design basis acceptance criteria for concrete tension and compression may be	Added

	exceeded (posing a possible commercial risk only). Results from the MPR ANSYS analysis for the detensioned containment shell (Calculation S10-0004) indicate that there are a limited number of locations along the top and bottom of the SGR access opening where tensile stresses in the concrete due to membrane and membrane plus bending exceed the acceptance criteria for cases with and without operating thermal loads, and which exceed the expected cracking strength of the concrete. The cracking strength of the existing concrete is based on an evaluation by WJE Engineers (Attachment Z32) of a limited number of direct tension and cracking tensile strength tests on cores taken from the area along the bottom and sides of the SGR access opening. Based on WJE's evaluation the predicted tensile stress, beyond which the concrete is expected to crack, for both membrane and membrane plus bending tensile stress is 600 psi. Two load cases were evaluated in the ANSYS model; limiting section stresses due to (i) the detensioned state without operating thermal analysis and (ii) the detensioned state with an operating thermal gradient of 10 degrees F. Resulting stresses were evaluated at several locations of interest on the containment shell, each location being assigned a "Section" number as shown in Attachment 32, pages 2 and 3. Note that results are symmetrical about the centerline of the opening. Results for (i): Results indicate that hoop tensile membrane stress exceeds the cracking	Added

	limit of 600 psi at one location only (Section 9) along the bottom of the access opening (Attachment Z32). Since a membrane stress represents an average stress across a section, then the high tensile membrane stress that occurs at Section 9 may occur across the full width of the wall and is indicative of a probable through wall vertical crack extending from the outside face of containment to the liner plate. The crack may propagate vertically until it reaches a compression zone which per Attachment Z32, page 6 is about 8'-6" below the bottom of the opening. Additionally, hoop tensile stresses due to hoop membrane plus bending exceed 600 psi at two locations (in addition to Section 9); one along the top and one along the bottom of the opening. Vertical cracking at these two locations is possible, initiating at the inside face of the containment wall and extending to the outer face, due to the presence of the tension field that exists across the full width of the wall. Since these cracks are caused by a combination of membrane plus bending stresses the length of the cracks may be shorter than the cracks caused by membrane tensile stress only. <u>Results for (ii):</u> Inclusion of the operating thermal gradient across the containment shell does not change any of the conclusions in (i) <u>Results for (i) and (ii) at Buttress #3 and 4:</u> Section 12 at the bottom of buttress 3 and 4 is in compression for vertical membrane stress only, however, when bending is included the resulting vertical tensile stress at the outside face of the buttress (compression inside face) exceeds the cracking limit of 600 psi and a horizontal	Added

	crack may occur at the base of the buttress. The depth of this crack is limited due to the distribution of tensile and compressive stresses through the section (based on the depth of the neutral axis). The reason for this high stress is the high restraint provided at the interface between the bottom outside face of the buttress and the foundation. If cracking does occur, this restraint is eliminated and the moment should be relieved and no further impact to the containment shell should occur. Conclusion: If cracks do occur at the limited locations previously identified in (i) they will be identified and mapped in EC 75219 Concrete Removal. Cracks will be repaired in EC 75220 Concrete Placement.	Added
40.	Add IWL requirements for measuring grease drained from tendons. Refer to EC 63016 page 94.	

Discipline/Program Review	Scope of Review
Final DRB	DRB meeting

			Turnover Required?

Item	Comment	Resolution
1	NONE	
2		
3		
4		
5		

I.1 Design Verification

Design Verification Review	☑	Engineering Review	☐	Owner's Review	☐
Design Review	☑	Scope of Review			
Alternate Calculation	☐	Review of engineering change package for technical adequacy and procedural compliance.			
Qualification Testing	☐				
Special Engineering Review	☐				

Reviewer	Discipline	Date
Joe A. Lese	Structural	1/13/2010

Item	Comment	Resolution
1	There are 3 items in the master folder that prevent the macro from being run as they are compatible from a format perspective. Z24, the draft 50.59, and Z08 need to be either removed, spared, or changed to meet format requirements.	Draft 50.59 and Z08 deleted. Z 24 formatted.
2	In the Table Of Contents (TOC), file Z11 exists. There are no page numbers shown and it is a blank when opened (i.e. no header or footer with relevant information).	Z11 has been populated and properly formatted.
3	File Z24 has no page numbers on the TOC.	Z 24 formatted.
4	All of the associated EC's (not just 75000) should be listed on the xref panel in PASSPORT (i.e. 75219, 75220, 75221, and 74801)	Complete
5	Every sheet should have the EC number, file #, page # on it for identification purposes. The following do NOT have that: Z09, B00 (page 1), C00 (no EC#). Also, it would be wise to N/A those sections in C00 so it is obvious that they were considered. Also, this applies to D00 (page 5 has no EC#), G00 (no EC #), and Z00 (no EC#).	All these have been corrected.
6	Is Attachment 'A' (File Z00) a spare? It has nothing in it and it is not identified as a spare on the TOC.	Erased
7	Headers and footers with relevant information (EC#, page #, file #, and PCHG-DESG nomenclature) are missing from many of the attachments, namely: Z01, Z02, Z03, Z04, Z05, Z06, Z07, Z09, Z10, Z11 (has EC # only), Z12, Z13, Z14, Z15, Z17 (need latest version of calc after comments have been incorporated), Z18, Z19, Z20, Z21, Z23, and Z25. By contrast, Z16 has the info.	Review of Z attachments reworked with headers and footers.

8	After all comments are incorporated, re-run the macro so that your page numbers in the TOC are correct or inspect them manually and change the page x of x nomenclature as needed.	Done
9	The Problem Statement of A.4 has too much solution information in it. It should strictly be a problem statement.	Rewritten
10	Calculations 5.1 and 5.2 (item 5) referenced on page 3 of B00 need to be identified.	5.1 identified, 5.2 should be identified on Fri. before issuing
11	Attachment "xxx" as identified on page 18 of 22 of B00 in section B.6.7 needs to be identified.	Ref. completed to Z11Ro.
12	There are 4 instances of "XXXXX" called out on page 20 of 22 of Section B00 in B.6.7 that need to be clarified.	Section edited to remove the "XXXX" references by Mr. J. Holliday
13	There is no D.2 section as stated in the TOC. I believe you can get rid of the existing D.2.3 nomenclature and make D.2 start where you describe Preparation Required Before Detensioning on page 1 of 5 of D00.	D.2.3 deleted and replaced with D.2
14	It does not appear that attachments Z12,Z13, Z14, and Z15 provide enough detail such that the field will know exactly what steel needs to be removed from the Auxiliary Building roof sections. Attachment Z18 provides better detail.	Work orders are to be reviewed by design engineers from roofing contractor. They will specify details.
15	Exactly where is the tendon detensioning sequence called out in the Installation Instructions? Z09 provides the spread sheet but I cannot find any specific installation instructions for a planner who will put together a work package that conveys the critical information regarding the sequence of tendons to be detensioned as provided in the MPR calculation..	The written detail instructions have been purposely left out until all calculations confirm procedures to be used.
16	Remove the draft 50.59 file/section as it has no relevance to the package and prevents the macro from being run.	Deleted from folder
17	Put an "N/A" in Section G.1 so that it is clear no sketches exist.	Complete
18	In Section J00, checklists J.2, J.3, J.4, and J5 are not filled out. This is identified as a high risk evolution per your Validation Plan and leaving them blank causes confusion.	Complete

19	Attachment A (File Z00) has no EC # on it. Even if you leave it in as a blank, it should be noted as such and update the TOC accordingly.	Deleted
20	You have "flip-flopped" Z20 and Z21. The TOC shows them as one thing, but in actuality, they are reversed when you open the files.	Corrected
Note: The Lead Reviewer signature on the EC DV milestone panel signifies that a lead review has been performed in accordance with EGR-NGGC-0003 and that errors/deficiencies (for all reviews performed) have been resolved and included in the EC package.		

J.1 Engineering Pre-Job Briefing

Responsible Engineer: T. K. McEwan Date: 12/22/09

Job Objectives: *(Clearly define the task and what the task entails (scope). Discuss how the scope of the task was validated.)*

All work described in this EC is in support of Detensioning of the listed Tendons. (Listed in A.5) Scope is defined by MPR calculations and cross checked/confirmed by PII and the Root Cause Team.

Job Expectations: *(Clearly define Roles and Responsibilities (performer, preparer, checker, independence of verifier, project coordinator, corporate, Non Station Personnel, etc.).*

T. K. McEwan will act as Responsible Engineer for this EC. Precision Surveillance Corporation personnel will detension the listed tendons per the sequence defined in Section A. They will be managed by SGT and progress will be monitored through careful observations and by tracking strain gage readings. The result of each tendons release will be documented and reviewed by those responsible for overseeing the calculations to confirm expected results. Careful interface and oversight by RE and Supervision will be required since this EC will also involve many consultants, contractors, and in-housing engineering staff. Other plant personnel from the Root Cause team, Maintenance, Radiation Protection, etc will have an opportunity to review and comment on the EC package.

Other Expectations include:

- Perform evaluations and analysis of acceptable detensioning options.
- Follow applicable procedures.
- Maintain communication with assigned personnel.
- Review and incorporate applicable OE.
- Effectively communicate issues that impact success of product or established schedule.
- Notify supervision if conditions change that alter the scope of this pre-job brief or the validation planning. Maintain focus on risk planning established in validation plan.
- Target date for EC approval to meet project schedule needs.

Skill Sets Required (including impacted organization reviewers): *(Review personnel qualifications. Establish appropriate mentoring and oversight if appropriate.)*

This is a civil/structural design modification. Civil/Structural design engineer qualifications are required. All anticipated personnel assigned to this modification are experienced and do not require mentoring. Monitoring documenting detail output readings of Tendon tension forces will be the responsibility of PSC personnel. Tracking and documenting strain gage output will be by Progress engineering's group. Interpertation of the data will be by representatives from MPR, Pii, and the root cause team.

Specific skill set requirements include:

- Knowledge of Field and Quality control procedures for tendon detensioning/retensioning.
- Knowledge of CR3 Design and Licensing Basis
- Knowledge of finite element plate and beam analysis, and seismic analysis techniques.
- Coordination with team members to evaluate ongoing activities
- Remain cognizant of plant personnel safety during tendon detensioning..
- Knowledge of heavy load lifting activities

Error Precursors (TWIN analysis)			
Task Demands	*Work Environment*	*Individual Capabilities*	*Human Nature*
☑ Time/Schedule Pressure	☑ Distractions	☐ Unfamiliarity with task	☐ Stress – Work/ Home
☐ High Workload	☐ Changes from routine	☐ Lack of knowledge	☐ Health patterns
☐ Multiple simultaneous tasks	☐ Confusing displays/Controls	☐ New techniques not used before	☐ Assumptions
☐ Repetitive actions/monotony	☐ Workarounds/OOS equipment	☐ Lack of proficiency	☐ Complacence
☑ Unrecoverable / Irreversible actions	☐ Hidden system responses	☐ Unsystematic problem solving skills	☐ Overconfidence
☑ Interpretation requirements	☐ Unexpected equip conditions	☐ "Unsafe" attitude for critical tasks	☑ Mind Set
☐ Unclear goals, roles, responsibilities	☐ Adverse physical conditions	☐ Illness/ Fatigue/ General Health	☐ Inaccurate risk perceptions
☐ Lack of/or unclear standards	☐ Vague or incorrect guidance		☐ Mental shortcuts
☐ Activity inputs inadequate			☐ Limited short term memory
			☐ Apparent emotional health
			☐ First day back from days off
			☑ First time evolution

Error Prevention Techniques	
☑ Self Check / STAR	☑ Checklists
☑ Peer Check	☐ 5 Step Problem Solving Process
☐ OAQ-3 Pass (Att. 13)	☑ Communication
☐ Mentoring	☐ Task Planning Review
☑ Procedure adherence	☐ Tests
☑ Reviews	☐ SAFER
☐ Time out	

Prioritization/Budget Required ☐ Yes ☑ No

☐ Sponsor identified	☐ Parts identified
☐ Project prioritized & budgeted	☐ Elements for estimate identified
☐ Capital/ O&M	
☐ Maintenance to implement	
☐ Contractor to implement	

Additional Checklist Items

Roles/Responsibilities/Reviews

- [x] Work assignment made, roles defined, key interfaces identified
- [x] Required internal reviews (including an independent verifier), Required third party reviews
- [x] Expectations and makeup of EC Teams and DRB
- [x] Individual accountability made clear

Plant Interface

- [x] Plant Walkdown needs
- [x] ALARA
- [x] Personal safety (heat stress, electrical, safety equipment)
- [x] Review plant scheduling and plant interface considerations

Product Quality Considerations

- [x] Risk management worksheet and Validation plan completed, mitigating strategies discussed
- [x] Utilize the Product Quality Checklists
- [x] Formalized design inputs (for Outsourced products and vendor supplied inputs)
- [ ] Need for a formal FMEA
- [ ] For digital upgrades, consider EGR-NGGC-0157 requirements
- [x] Design basis and margin considerations identified
- [ ] Validating assumptions

Human Performance Tools

- [x] Lessons learned / OE items – Include feedback on recent product quality concerns from CAP roll-up, EPR, EC, Team implementation roll-up and EC reviews [Significant NCR 105197]
  - For EC (Permanent Design/Commercial Change, Alternate Replacements and Temporary Design/Commercial Change) reviews: Review the last 6 months of NCRs related to Engineering Change by running a text search report using "Engineering Change" or "EC."
- [ ] Methods of communicating and coordinating actions
- [x] Emphasis on doing the job right vs. schedule

Miscellaneous

- [ ] Review appropriate programs/ procedures to be used
- [ ] Schedule of milestones (design inputs, reviews, etc.)
- [x] Implementation of work management tool to schedule reviews
- [ ] Implementation of project management tools (including need for a project plan) per NGGM-PM-0018

Comments:

J.2 Engineering Change Checklist

The following engineering change checklists address the design specification, administrative items, implementation, and testing. Use this checklist to ensure all important aspects of the engineering change have been captured.

	Administrative/PASSPORT Considerations	Y	NA
1	Problem statement is adequately documented in the Contents section of the EC.	☑	☐
2	Solution statement is adequately documented in the Contents section of the EC. Options are evaluated and the reasons for selection and elimination have been provided.	☑	☐
3	The history/root cause of the issue that has necessitated the EC has been provided. Applicable NCRs and OE have been incorporated.	☑	☐
4	EC Team members are listed in the Contents section. An NIT SME has been included on the EC team for plant	☑	☐

	Administrative/PASSPORT Considerations	Y	NA
	digital SSC-related products.		
5	If EC is a Commercial Change, the Commercial Change Screening Criteria (Attachment 1 of EGR-NGGC-0005) has been completed.	☐	☑
6	The revision levels of applicable documents utilized to develop the EC have been verified.	☐	☑
7	The accuracy of the Table of Contents has been verified. Ensure page numbers in the Table of Contents match the page numbers in the sections.	☑	☐
8	"Track changes", if used, has been set to display revision bars only.	☐	☑
9	Validation plan is included in the review section of the EC package (if required).	☑	☐
10	DRB comments/resolutions are included in the review section of the EC package	☑	☐
11	All information is legible so that QA records can be made.	☑	☐
12	EGR-NGGC-0005, Attachment 7 screening criteria has been used to determine required reviews.	☑	☐
13	The required discipline inputs and outputs have been design verified or engineering reviewed as required. Lead reviews and concurrent reviews have been completed.	☑	☐
14	The applicable Discipline, Program, and 50.59 reviewers are qualified in PQD.	☑	☐
15	If EC is a Master, the Master EC field is checked. If EC is a Child, Child is in the KW4 field and the Master EC is on the Xref panel.	☐	☑
16	For concurrent modifications, the Adv Wk Appvd field is checked.	☐	☑
17	"Cavet Outst" field is checked if caveats or exclusions (future details, missing documentation, vendor outputs, etc.) are identified in the scope of the EC.	☑	☐
18	ADL is complete. All affected documents are included. Reviewed field is checked. If a Turnover is required to Operations, the "Ops Svc" field is checked for each document that is required to be updated prior to turnover. Compare ADL to Section C (Markup) to ensure affected document lists match.	☐	☑
19	For temporary changes, the appropriate incorporation code has been identified for documents on the ADL.	☐	☑
20	AEL is complete. All affected tags are included. Minor revisions have been initiated and reviewed.	☐	☑
21	Reason for Revision attribute has been added and completed if EC is being revised	☐	☑
22	"VALIDATION PLAN APPROVED" and "50.59 APPROVED AND ON XREF" attributes have been added and completed if applicable. Document Validation Plan approvals in notes.	☑	☐
23	The correct quality class has been included on the Attributes Panel in accordance with EDB and the Quality Classification of Section B.	☑	☐
24	Turnover to Operations is checked Y or N on the Attributes panel (and agrees with Turnover/Closeout Summary and Testing requirements).	☑	☐
25	All required reviews and approval signoffs have been included on the Milestone Panel.	☑	☐
26	For EC's that require turnover, the 'RE T/O RELEASE' and 'OPS T/O ACCEPT' milestones are included. These milestones are not included for EC's not requiring turnover (including Master EC's). The 'DOC REV RELEASE' milestone is not included for Master EC's.	☐	☑
27	For Child EC's, the NO50.59 IMPACT1 and NO50.59 IMPACT2 milestones are included.	☐	☑
28	Work Orders (required for turnover), Action Requests (NCR, OPEX, REG, NTM, etc.) are included in the Xref Panel. Delete Work Package and Work Request references. Ensure no WO tasks are on Xref panel for Master EC's.	☑	☐
29	An NTM AR has been initiated if a post-job briefing and/or post-job critique has been specified on the validation plan	☑	☐
30	A.1.1. The basis for the initial risk level has been re-evaluated during the Engineering product development process when new information is available, and for modified or new scope.	☑	☐

	Design Section	Y	NA
1	Design Specification scope is clearly defined with specific detail and for software applications meets EGR-NGGC-0157 requirements. Caveats or exclusions that will be included in a future EC revision (e.g. future details, missing documentation, vendor outputs, etc.) are identified.	☑	☐
2	Codes, specifications and standards applicable to the design are consistent with the plant commitments (e.g. UFSAR).	☑	☐
3	All design inputs identified in EGR-NGGC-0005, Attachment 2 and EGR-NGGC-0157, Attachment 6 have been reviewed for applicability.	☑	☐
4	Design inputs indicate the basis and source of each input.	☑	☐
5	Design inputs are in accordance with the sources identified in Attachment 2 of EGR-NGGC-0005.	☑	☐
6	Design inputs clearly address required operating conditions for equipment (normal, transient, and accidents) and the expected performance requirements under these conditions.	☑	☐
7	Interfaces with other SSCs are clearly identified in design inputs.	☑	☐
8	All assumptions are clearly identified and bases for assumptions (or method of validation) are provided.	☐	☑
9	Evaluation considers and dispositions each identified design input. Evaluations are provided in the "Evaluation" section, and not in the "Design Inputs" section.	☑	☐
10	Impacts on PSA modes, assumptions and success criteria are identified.	☐	☑
11	Relative internal (plant specific) and external (nuclear and non-nuclear) operating experience is considered in the design and is evaluated.	☑	☐
12	Evaluation includes a failure modes and effect discussion for new and modified equipment.	☐	☑
13	Evaluation identifies changes to margins and considers mitigation for reduced margins.	☑	☐
14	Evaluation considers in-process Engineering Changes to interfacing SSCs. Potential impacts based on possible cumulative effects are evaluated. Required sequencing of implementation and document updates is considered.	☐	☑
15	Vendor-supplied technical data has been validated against design inputs.	☑	☐
16	Individuals/Vendors who provided input (excluding EC Team members) are identified in the Interfaces section.	☑	☐
17	The applicable quality classifications are identified based on EC scope and boundaries are established.	☑	☐
18	Constructability walkdowns have been completed, if possible, to verify actual plant configuration and constructability of the design. Where constructability walkdowns are not possible, the modification clearly identifies the possible risk that field changes based on actual as-builts may be required.	☑	☐
19	Modifications that involve interface agreements have responsibilities (including engineer of record) and testing requirements defined by responsible groups.	☑	☐
20	The impact to Preventive Maintenance program has been considered and reviewed. This includes: • establishing or revising the scope of PM activities, including material requirement changes (Note: Model Work Order may have staged Material Requests that require revision) (PM Planner) • establishing or revising the frequency of PM performance (System Engineer or Program Engineer) • planning to reset schedule for PM performance based on modification activities (PM Program Manager)	☐	☑
21	Software and databases used meet the benchmarking and verification procedural requirements.	☑	☐
22	Increased rigor used when modifying daisy-chained electrical circuits. (CAPR 292232)	☐	☑
23	Wire segment numbers are changed wherever a discontinuity is introduced or recognized within a control circuit. (CAPR 292232)	☐	☑

	Document/Database Impact Considerations	Y	NA
1	Design record document (Drawings, Calculations, DBD's, Specifications, etc.) impacts have been identified.	☑	☐

	Document/Database Impact Considerations	Y	NA
2	Non-Design record document (POM Procedures, System Descriptions, Operator Aids, etc.) impacts have been identified.	☐	☑
3	Vendor Manual changes for addition or deletion of information have been identified.	☐	☑
4	EDB change information is clearly identified. Review EDB requirements for affected or new equipment tags and ensure Maintenance Rule and ZTEF codes have been entered. Minimum required data fields for new equipment tags have been included per EGR-NGGC-0012. A Manufacturer Model Version (MMV) has been identified for any procured component subject to maintenance. For calibrated devices, setpoint parameters have been identified. If installing new equipment, consider if an EDB tag number(s) should be assigned. Ensure software components receive EDB tag numbers, when required by EGR-NGGC-0157.	☐	☑
5	Electrical cable management impact has been identified and input provided by the cable management coordinator if wires, cables or conduits are added, removed or spared.	☐	☑
6	The applicable load lists in Operations procedures are considered for impact if adding, removing, or modifying electrical characteristics of a component fed from an electrical panel, bus or MCC.	☐	☑
7	Markups are provided for each impacted document or a precise description of the impact to each document is provided. Consider preparation of a sketch list to aid in document update, particularly for large projects and when multiple sketches impact the same drawing.	☐	☑
8	Other tracking items (PMR AR's, NTM AR's, etc.) are identified.	☐	☑
9	If the EC is a Master, no minor revisions are created.	☐	☑
10	Changes potentially impacting a regulatory commitment (BNP RRIL, RG 1.97, EP, ISI, ASSD, SBO, T/S, etc.) are adequately reviewed for updating of the calibration program (Ref. BNP procedure ENP-33.4) [BNP only]	☐	☑

	Implementation Section	Y	NA
1	A succinct description of the EC implementation instructions has been included in the "Installation" section.	☑	☐
2	The Precautions and Limitations applicable to the instructions are included. Caveats or exclusions that will be included in a future EC revision (e.g. future details, missing documentation, vendor outputs, etc.) are identified.	☑	☐
3	Implementation instructions have been written to ensure that design requirements are achieved and maintained throughout implementation.	☑	☐
4	The installation instructions clearly identify ALL installation sketches to be used and, encompass the entire installation scope of the mod. For software components, installation instructions are provided.	☑	☐
5	For concurrent modifications, the requirements of EGR-NGGC-0005, Attachment 3 have been met.	☑	☐
6	For temporary changes, requirements for temporary change tagging have been developed and documented.	☐	☑
7	For temporary changes, an expiration date has been established and specific removal requirements have been considered and documented.	☐	☑
8	The EC Parts List includes the necessary parts for the design, including software components.	☐	☑
9	The "Use" column of the EC Parts List is filled in correctly for the quality class of parts to be used in the design.	☐	☑
10	Elimination of inventory has been considered, including budget impact.	☐	☑
11	QC Holdpoints currently not included in existing procedures needed for implementation of the EC are identified. Refer to NUA-NGGC-1530.	☐	☑
12	For ECs requiring turnover, a request for the planner to initiate an AD type Work Order Task has been included in the instructions [BNP only]	☐	☑
13	A Turnover/Closeout Summary is included that identifies: • (for Master ECs) Scope of Child ECs including identification of affected SSCs and boundaries • Known activities to be verified in the turnover process, specifically, required Operations and Maintenance training	☐	☑

Implementation Section		Y	NA
	• Identification of post-turnover testing requirements • Justification if no turnover is required • Identification of known exceptions and caveats for turnover • Identification of closure activities and schedule • Identification of any tracking mechanisms for turnover or closeout activities • Spare parts are identified and M&CS notified		

	Testing Considerations	Y	NA
1	It has been verified that the test will demonstrate satisfaction of all performance criteria, including software functions, of the modification in addition to verifying the operability of the affected components and systems.	☑	☐
2	It has been verified that the modification will be tested in all its operating configurations. It has been verified that the test determines the modification has not adversely affected the unmodified portions of the component or system.	☑	☐
3	A.1.2. It has been verified that the proposed test demonstrates proper functioning of the component or systems over its entire range of operation and can be performed under both current and anticipated plant conditions.	☐	☑
4	The test should verify that any substituted components or equivalency engineering was accurate and complete.	☐	☑
5	It has been verified that modifications to redundant equipment and components are tested identically and that subsequent testing receive the same level of review, verification, and validation as the initial test.	☐	☑
6	If the proposed test will cause plant parameters to change, it has been verified that all administrative and operating requirements are met for the anticipated changes.	☐	☑
7	Responsibility and authority to intervene or terminate the test if problems are encountered during testing have been established and communicated.	☐	☑
8	The test termination criteria are specified. It has been verified that the test termination criteria do not conflict with guidance contained in normal, off-normal, or emergency operating procedures. Methods for resolving discrepancies have been identified.	☐	☑
9	It has been verified and documented that any procedure or document referenced by the test procedure is the most current revision.	☐	☑
10	Consideration has been giving to whether or not this test is an infrequently performed test or evolution or requires heightened level of awareness procedures. The basis for this determination has been developed and documented. [BNP - 0PLP-017, CR3 – AI-550, HNP – PLP-100, RNP – PLP-037]	☐	☑
11	If senior managers are required to be present during the test, the appropriate managers and their responsibilities have been identified.	☐	☑
12	It has been verified that station personnel required to conduct the test are trained and qualified to perform the test.	☐	☑
13	Post modification testing includes plant mode required for testing and any special requirements.	☐	☑
14	Electrical and I&C post modification testing is specified per EGR-NGGC-0155.	☐	☑
15	If an SSC has been disturbed and then returned to original state, appropriate testing is specified.	☐	☑
16	If separate testing is performed on different portions of the affected SSCs (e.g., an electrical circuit), the overall test plan ensures that no portions of affected SSCs that are required to be tested are omitted.	☐	☑
17	Plant digital SSC-related testing has been implemented per criteria in EGR-NGGC-0157. Software functionality has been validated prior to installation using test systems, simulations, or mockups.	☐	☑
18	A special procedure has been developed for PMT if an adequate procedure does not currently exist.	☐	☑

	Testing Considerations	Y	NA
19	Post modification testing includes design parameter/function to be tested and acceptance criteria.	☐	☑
20	Failure modes and effects analysis results are used as input to modification test planning and software validations.	☐	☑

J.3 Outsourced Product Quality Management Checklist

The following checklist should be used to ensure proper vendor product quality oversight.

	Outsourced Product Quality Management Considerations	Y	NA
1	The supplier/manufacturer has been contacted to identify what changes have been made since the original equipment was installed, or they are aware of any concerns for the application(s).	☐	☑
2	Critical characteristics for the application(s) have been determined.	☐	☑
3	If there is a repair/procurement specification, it is adequate to ensure the supplier meets product quality expectations and it is current. If there is no repair/procurement specification, it has been determined how procurement/repair requirements will be captured in the Purchase Order.	☐	☑
4	There has been adequate communication with the supplier/manufacturer to ensure the supplier/manufacturer understands our requirements and expectations (e.g., scope, deliverables) for adherence to them, and to ensure they are sensitive to past problems/OE related to the component.	☐	☑
5	The outsourced organization has addressed SQA and digital design criteria per EGR-NGGC-0157.	☐	☑
6	A review has been performed to determine if operating or maintenance procedures related to the item contain information such as settings or tolerances. If yes, a review of supplier procedures may be needed.	☐	☑
7	The level of outsourced organization acceptance testing is prudent. Consider supplier performance history and Progress Energy experience with supplier, shop/factory testing capabilities and experience, whether the production schedule is rushed or not, use of a third party for testing, internal/external OE.	☐	☑
8	Receipt inspections and testing specified are prudent.	☐	☑
9	The level of outsourced organization oversight/surveillance is prudent. Consider supplier performance history and Progress Energy experience with supplier, supplier procedure reviews, shop/factory tests, critical steps, and milestones that should be witnessed and by whom, source review of vendor technical documentation, whether the production schedule is rushed or not, use of third parties for sub-components, services or testing, internal/external OE.	☐	☑
10	The procedures/processes/tools (including software) being used by the outsourced organization are acceptable and is there a good understanding of these procedures/processes/tools within Progress Energy. The vendor is using Progress Energy approved software.	☐	☑
11	There is a good understanding of the outsourced organization's modification process (including corrective action program, intrusiveness of reviews, and use of error prevention tools). If necessary interview of project personnel has been conducted.	☐	☑
12	If process weaknesses are identified (e.g., specific areas where the outsourced organization's process or expectations may not be as strong as Progress Energy), areas to focus on have been discussed with the vendor.	☐	☑
13	If the outsourced organization is using Progress Energy's procedures to develop the modification, the outsourced organization has a clear understanding of the scope, deliverables, our process, review cycle, and expectations. This has been factored in to the contract.	☐	☑
14	Key contacts on each side have been identified to ensure clear communication.	☐	☑
15	Design inputs have been transmitted in a formal manner.	☐	☑
16	The outsourced organization understands margins that Progress Energy wants to maintain. Known future degradation impacts on margin have been addressed.	☐	☑
17	Scope or direction changes are formally approved. The outsourced organization does not change direction based on informal direction from plant personnel.	☐	☑
18	A vendor quality management plan is developed for high risk/critical/safety related component fabrications.	☐	☑

J.4 QAQ-3 Pass Method for Review

This method should be used in instances where the product involves complex design or technical evaluations affecting risk significant components.

1	**Overview**	P P A T	☑ Purpose of the document ☑ Purpose & scope of review & verification ☑ Acceptance criteria ☑ General theme

2	**Assessing Critical Areas**	L A D R	☑ Critical logics ☑ Critical assumptions ☑ Critical supporting data ☑ Critical results

3	**QV & V**	Q V V	☑ Qualification: reliability and accuracy of source ☑ Validation: internal consistency check (sanity check) ☑ Verification (if necessary): independent data/analysis/ calculation/ assumptions

1st Pass: Read document for general overview (PPAT).

2nd Pass: Highlight and label critical logics, assumptions, supporting data, and results.

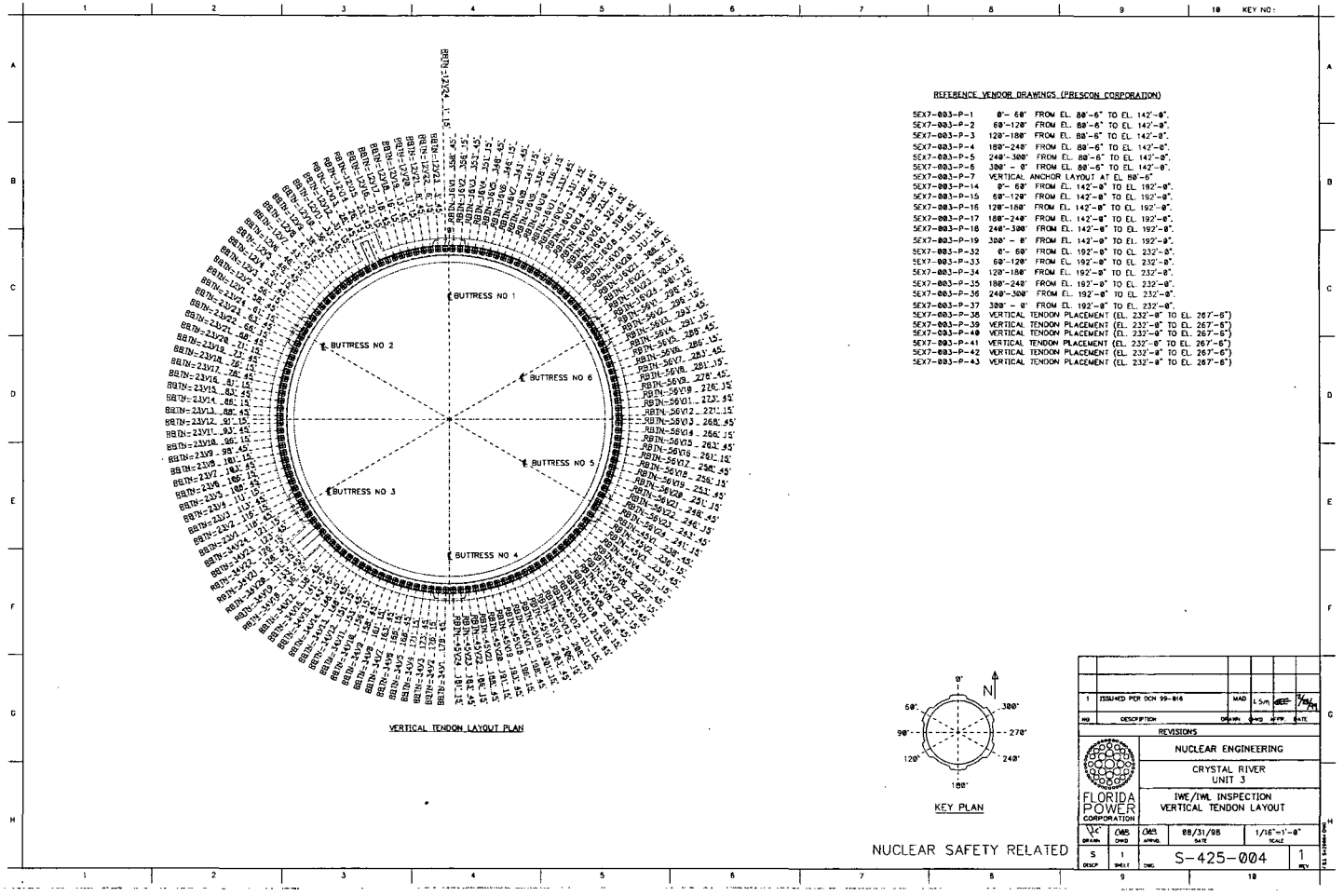
3rd Pass: QV&V each critical logic, assumption, supporting data, and result; note problems and inconsistencies.

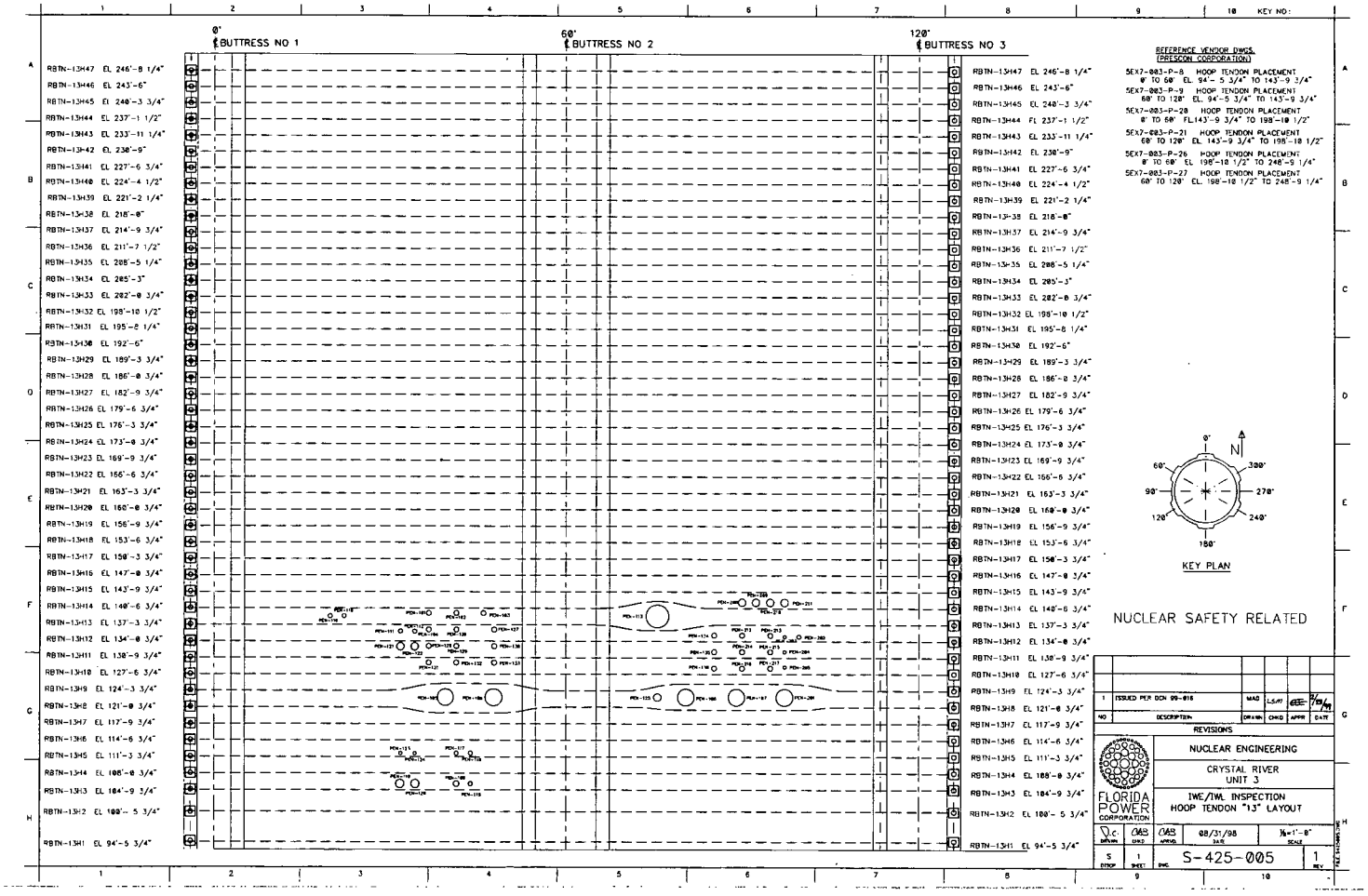
Preparer: T. K. McEwan	Reviewer:

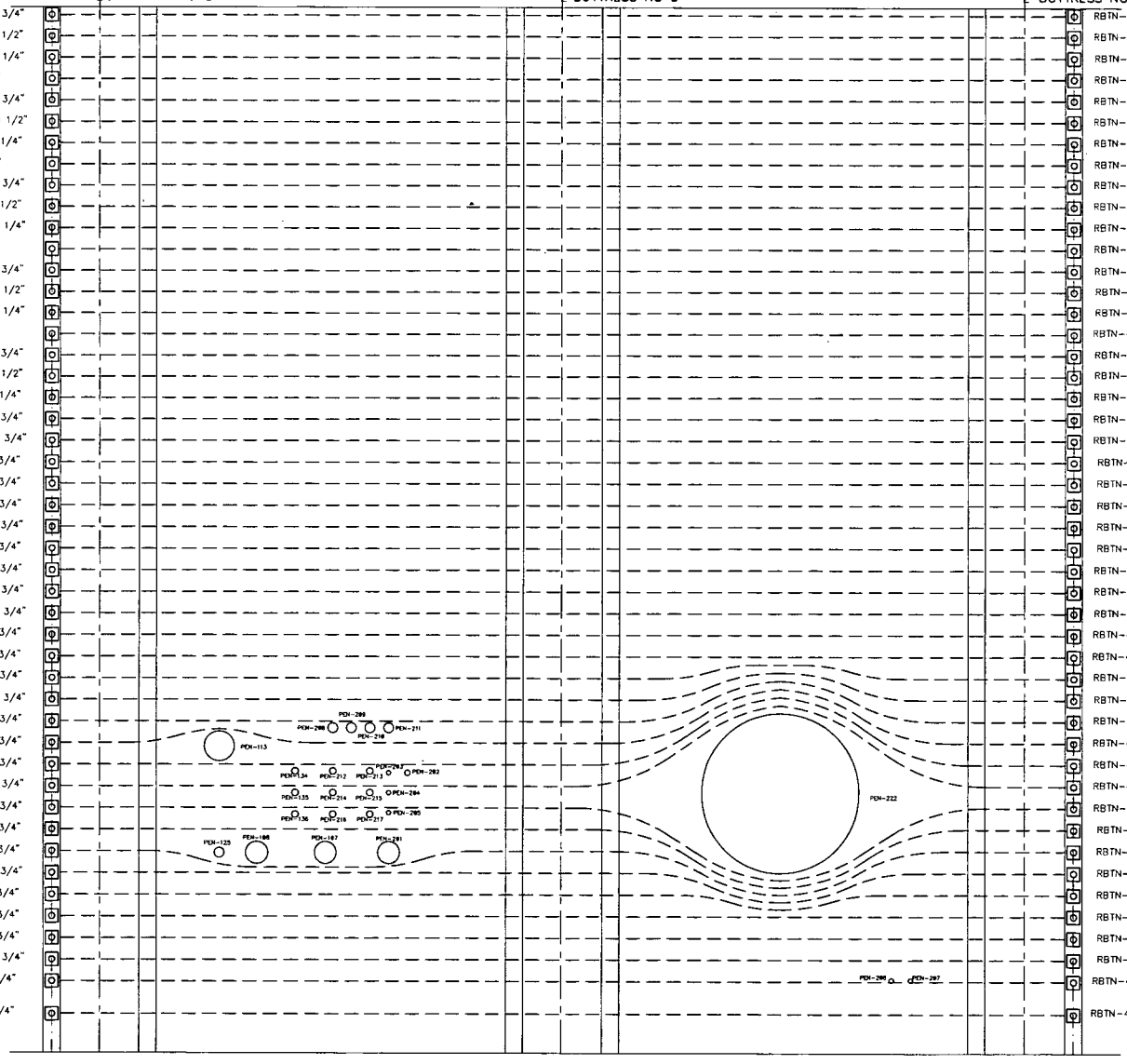
J.5 Procurement Vendor Oversight Checklist

This checklist should be used to identify potential areas of risk and determine appropriate actions to minimize any risks identified.

	Procurement Vendor Oversight Considerations	Y	NA
1	Affected item on the Single Point Vulnerability List.	☐	☐
2	Affected item is a critical component.	☐	☐
3	The procurement activity is an error-likely situation (e.g., rush order, one-time order, new equipment, etc.).	☐	☐
4	Operating Experience (internal or external, 10 CFR 21 reports) issues have been identified for this procurement activity.	☐	☐
5	The equipment or service is being supplied by someone other than the Original Equipment Manufacturer (OEM) or Original Equipment Supplier (OES).	☐	☐
6	OEM/OES is subcontracting the work.	☐	☐
7	Reverse engineering activities have been used to develop design/configuration information.	☐	☐
8	ASME XI applies.	☐	☐
9	For new or customized equipment design, the need for reliability testing has been evaluated.	☐	☐
10	Physical changes have been implemented since the original equipment was installed. The vendor has this information.	☐	☐
11	Compensatory measures have been included in the procurement documents to minimize risk.	☐	☐
12	There is a need for enhanced vendor oversight at the vendor's and/or sub-vendor's facility or on-site based on the following: ❖ Credible failure modes and critical characteristics ❖ OE ❖ Equipment is new or customized design ❖ Supplier performance ❖ Critical manufacturing, repair/refurbishment and/or testing milestones ❖ Special processes (e.g., NDE, welding, coating) ❖ Documentation requirements (drawings, procedures, etc.) ❖ Station schedule ❖ In-house expertise, use of third party	☐	☐
13	There is a need for mock-up testing.	☐	☐
14	Vendor assumptions have been validated.	☐	☐


KEY NO:
BUTTRESS NO 1
BUTTRESS NO 2
BUTTRESS NO 3
BUTTRESS NO 4
BUTTRESS NO 5
BUTTRESS NO 6
VERTICAL TENDON LAYOUT PLAN
REFERENCE VENDOR DRAWINGS (PRESCON CORPORATION)
5EX7-003-P-1 0°- 60° FROM EL. 88'-6" TO EL. 142'-0".
5EX7-003-P-2 60°-120° FROM EL. 88'-6" TO EL. 142'-0".
5EX7-003-P-3 120°-180° FROM EL. 88'-6" TO EL. 142'-0".
5EX7-003-P-4 180°-240° FROM EL. 88'-6" TO EL. 142'-0".
5EX7-003-P-5 240°-300° FROM EL. 88'-6" TO EL. 142'-0".
5EX7-003-P-6 300° - 0° FROM EL. 88'-6" TO EL. 142'-0".
5EX7-003-P-7 VERTICAL ANCHOR LAYOUT AT EL 88'-6"
5EX7-003-P-14 0°- 60° FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-15 60°-120° FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-16 120°-180° FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-17 180°-240° FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-18 240°-300° FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-19 300° - 0° FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-32 0°- 60° FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-33 60°-120° FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-34 120°-180° FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-35 180°-240° FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-36 240°-300° FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-37 300° - 0° FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-38 VERTICAL TENDON PLACEMENT (EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-39 VERTICAL TENDON PLACEMENT (EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-40 VERTICAL TENDON PLACEMENT (EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-41 VERTICAL TENDON PLACEMENT (EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-42 VERTICAL TENDON PLACEMENT (EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-43 VERTICAL TENDON PLACEMENT (EL. 232'-0" TO EL. 267'-6")
N
0°
30°
60°
90°
120°
180°
240°
270°
KEY PLAN
NUCLEAR SAFETY RELATED
1 ISSUED PER DCN 99-816 MAD
REVISIONS
NUCLEAR ENGINEERING
CRYSTAL RIVER UNIT 3
IWE/IWL INSPECTION VERTICAL TENDON LAYOUT
FLORIDA POWER CORPORATION
08/31/98
1/16"=1'-0"
S-425-004
1


0° ℄ BUTTRESS NO 1
60° ℄ BUTTRESS NO 2
120° ℄ BUTTRESS NO 3
KEY NO:
REFERENCE VENDOR DWGS. (PRESCON CORPORATION)
5EX7-003-P-8 HOOP TENDON PLACEMENT 0° TO 60° EL 94'- 5 3/4" TO 143'-9 3/4"
5EX7-003-P-9 HOOP TENDON PLACEMENT 60° TO 120° EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-20 HOOP TENDON PLACEMENT 0° TO 60° FL143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-21 HOOP TENDON PLACEMENT 60° TO 120° EL 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-26 HOOP TENDON PLACEMENT 0° TO 60° EL 198'-10 1/2" TO 248'-9 1/4"
5EX7-003-P-27 HOOP TENDON PLACEMENT 60° TO 120° EL. 198'-10 1/2" TO 248'-9 1/4"
KEY PLAN
NUCLEAR SAFETY RELATED
REVISIONS
NUCLEAR ENGINEERING
CRYSTAL RIVER UNIT 3
IWE/IWL INSPECTION HOOP TENDON "13" LAYOUT
FLORIDA POWER CORPORATION
08/31/98
1/8"=1'-0"
S-425-005



REFERENCE VENDOR DWGS.
(PRESCON CORPORATION)

5EX7-003-P-9 HOOP TENDON PLACEMENT
60° TO 120° EL. 94'-5 3/4" TO 143'-9 3/4"

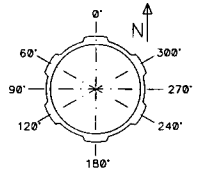
5EX7-003-P-10 HOOP TENDON PLACEMENT
120° TO 180° EL. 94'-5 3/4" TO 143'-9 3/4"

5EX7-003-P-21 HOOP TENDON PLACEMENT
60° TO 120° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003-P-22 HOOP TENDON PLACEMENT
120° TO 180° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003-P-27 HOOP TENDON PLACEMENT
60° TO 120° EL. 198'-10 1/2" TO 248'-9 1/4"

5EX7-003-P-28 HOOP TENDON PLACEMENT
120° TO 180° EL. 198'-10 1/2" TO 248'-9 1/4"



KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR.	DATE
1	ISSUED PER DCN 99-016	MAD	LSM	[illegible]	8/19/99

REVISIONS

FLORIDA POWER CORPORATION

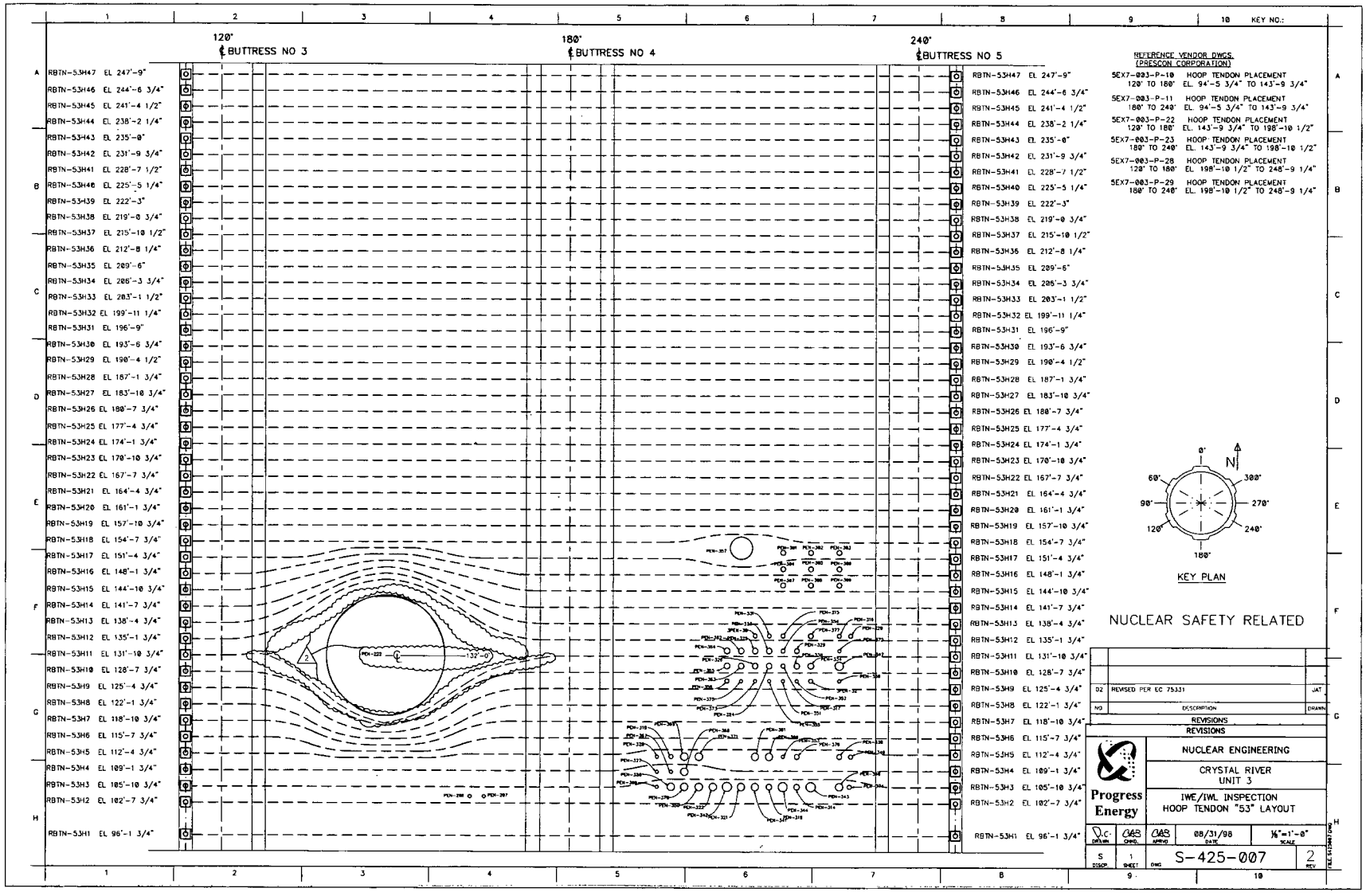
NUCLEAR ENGINEERING

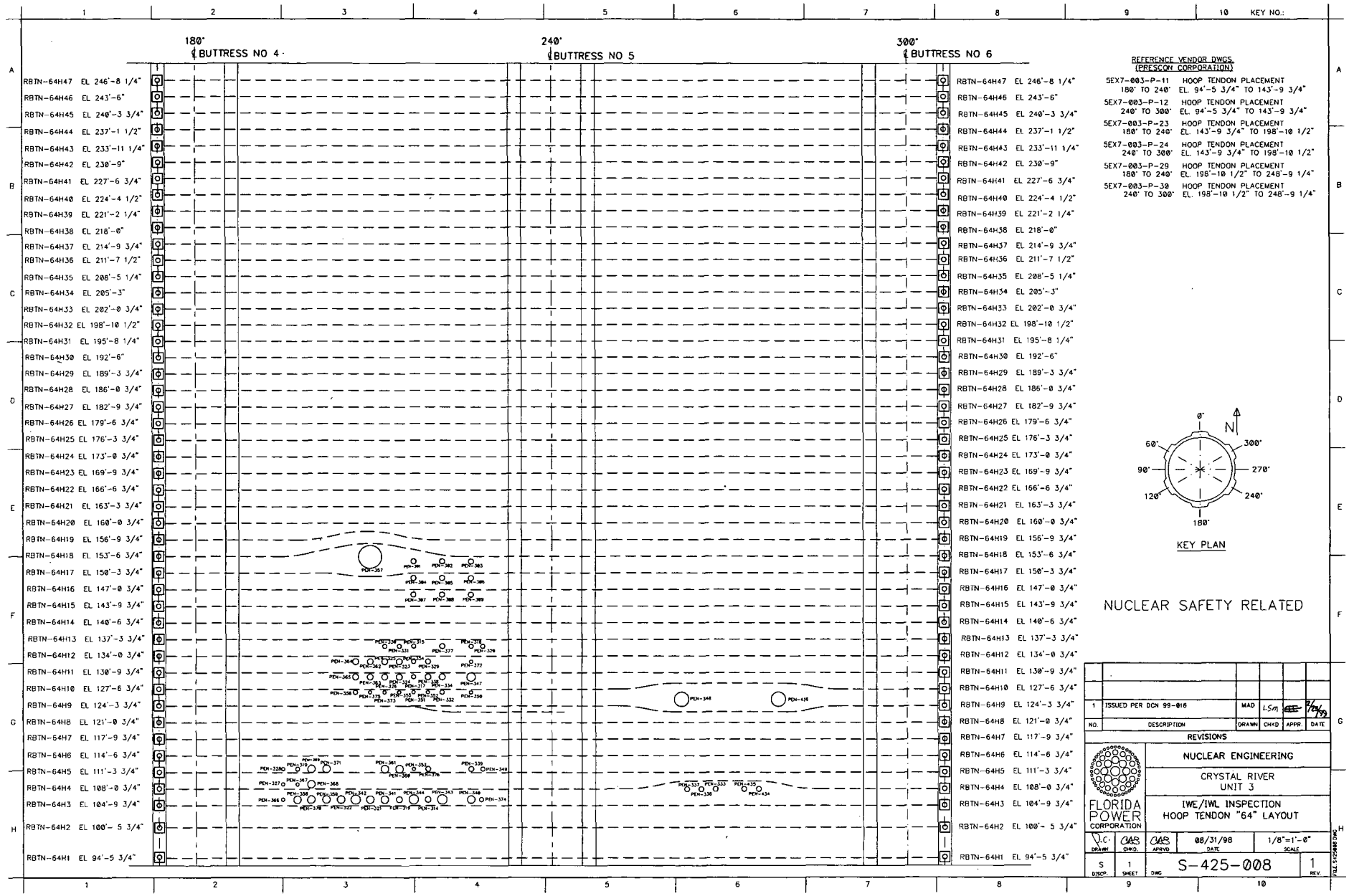
CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION
HOOP TENDON "42" LAYOUT

D.C. DRAWN	CAS CHKD.	CAS APRVD.	08/31/98 DATE	1/16"=1'-0" SCALE
S DISCP.	1 SHEET	DWG S-425-006		1 REV.

FILE S4S425 DWG


120° ℄ BUTTRESS NO 3
180° ℄ BUTTRESS NO 4
240° ℄ BUTTRESS NO 5
KEY NO.:
REFERENCE VENDOR DWGS. (PRESCON CORPORATION)
5EX7-003-P-10 HOOP TENDON PLACEMENT 120° TO 180° EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-11 HOOP TENDON PLACEMENT 180° TO 240° EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-22 HOOP TENDON PLACEMENT 120° TO 180° EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-23 HOOP TENDON PLACEMENT 180° TO 240° EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-28 HOOP TENDON PLACEMENT 120° TO 180° EL. 198'-10 1/2" TO 248'-9 1/4"
5EX7-003-P-29 HOOP TENDON PLACEMENT 180° TO 240° EL. 198'-10 1/2" TO 248'-9 1/4"
KEY PLAN
NUCLEAR SAFETY RELATED
REVISIONS
02 REVISED PER EC 75331 JAT
NO DESCRIPTION DRAWN
NUCLEAR ENGINEERING
CRYSTAL RIVER UNIT 3
IWE/IWL INSPECTION HOOP TENDON "53" LAYOUT
Progress Energy
08/31/98
1/8"=1'-0"
S-425-007
2



REFERENCE VENDOR DWGS. (PRESCON CORPORATION)

5EX7-003-P-11	180° TO 240°	HOOP TENDON PLACEMENT EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-12	240° TO 300°	HOOP TENDON PLACEMENT EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-23	180° TO 240°	HOOP TENDON PLACEMENT EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-24	240° TO 300°	HOOP TENDON PLACEMENT EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-29	180° TO 240°	HOOP TENDON PLACEMENT EL. 198'-10 1/2" TO 248'-9 1/4"
5EX7-003-P-30	240° TO 300°	HOOP TENDON PLACEMENT EL. 198'-10 1/2" TO 248'-9 1/4"

KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR.	DATE
1	ISSUED PER DCN 99-016	MAD	LSM	[illegible]	8/24/99

REVISIONS

FLORIDA POWER CORPORATION

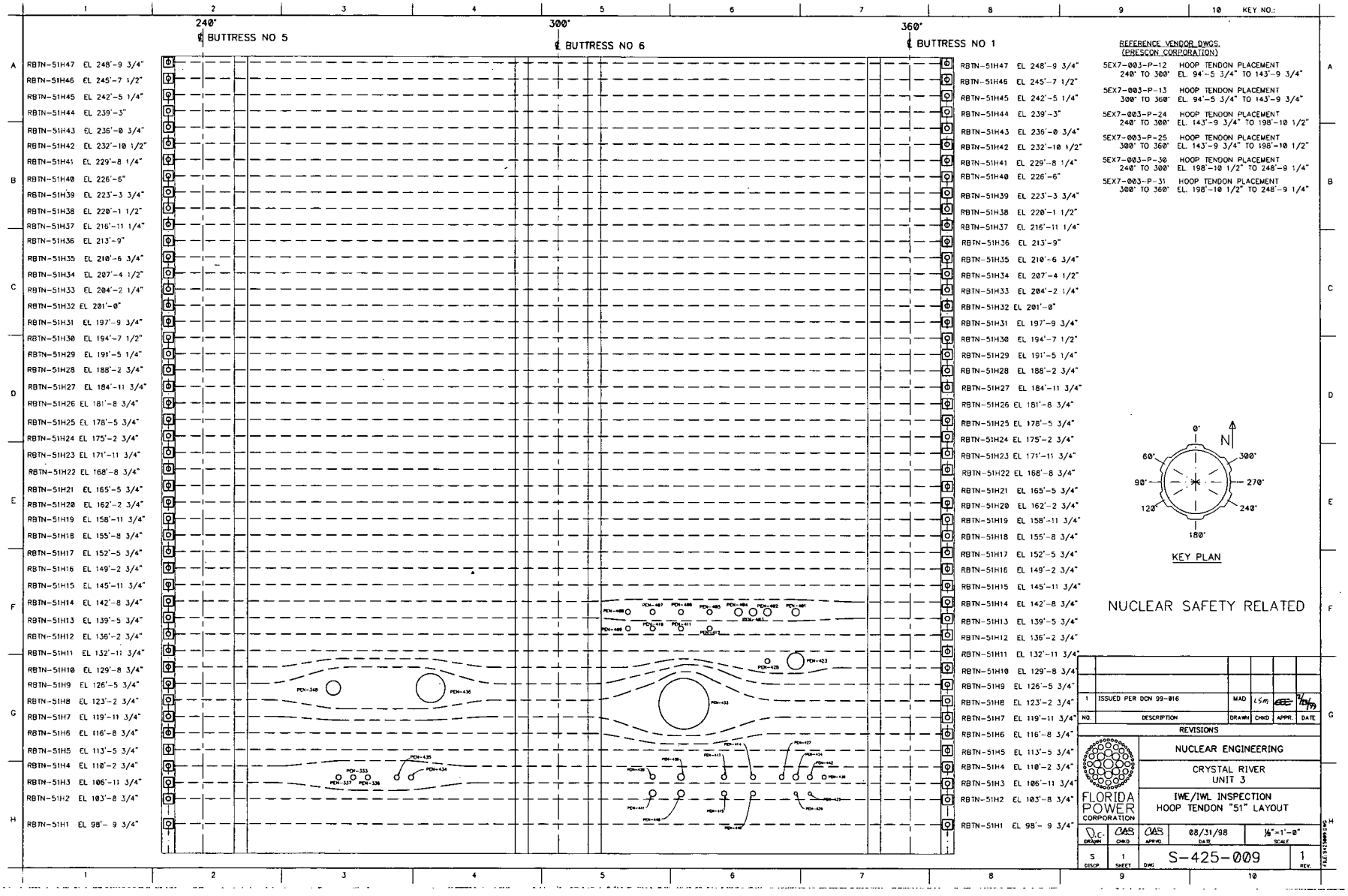
NUCLEAR ENGINEERING

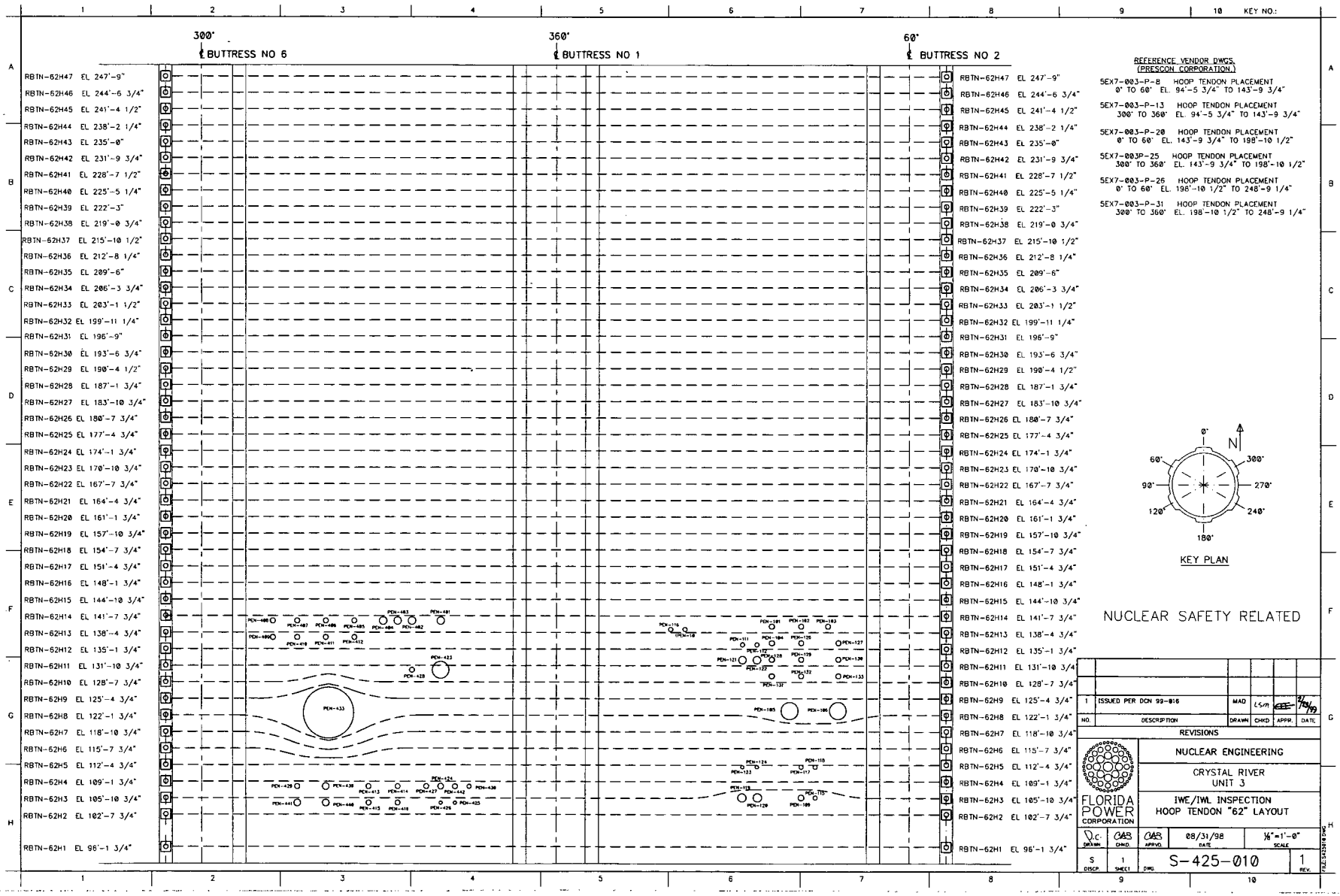
CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION HOOP TENDON "64" LAYOUT

DRAWN	CHKD	APPRVD	DATE	SCALE
J.C.	CAS	CAS	08/31/98	1/8"=1'-0"

DISCP.	SHEET	DWG	REV.
S	1	S-425-008	1


240°
℄ BUTTRESS NO 5
300°
℄ BUTTRESS NO 6
360°
℄ BUTTRESS NO 1
RBTN-51H47 EL 248'-9 3/4"
RBTN-51H46 EL 245'-7 1/2"
RBTN-51H45 EL 242'-5 1/4"
RBTN-51H44 EL 239'-3"
RBTN-51H43 EL 236'-0 3/4"
RBTN-51H42 EL 232'-10 1/2"
RBTN-51H41 EL 229'-8 1/4"
RBTN-51H40 EL 226'-6"
RBTN-51H39 EL 223'-3 3/4"
RBTN-51H38 EL 220'-1 1/2"
RBTN-51H37 EL 216'-11 1/4"
RBTN-51H36 EL 213'-9"
RBTN-51H35 EL 210'-6 3/4"
RBTN-51H34 EL 207'-4 1/2"
RBTN-51H33 EL 204'-2 1/4"
RBTN-51H32 EL 201'-0"
RBTN-51H31 EL 197'-9 3/4"
RBTN-51H30 EL 194'-7 1/2"
RBTN-51H29 EL 191'-5 1/4"
RBTN-51H28 EL 188'-2 3/4"
RBTN-51H27 EL 184'-11 3/4"
RBTN-51H26 EL 181'-8 3/4"
RBTN-51H25 EL 178'-5 3/4"
RBTN-51H24 EL 175'-2 3/4"
RBTN-51H23 EL 171'-11 3/4"
RBTN-51H22 EL 168'-8 3/4"
RBTN-51H21 EL 165'-5 3/4"
RBTN-51H20 EL 162'-2 3/4"
RBTN-51H19 EL 158'-11 3/4"
RBTN-51H18 EL 155'-8 3/4"
RBTN-51H17 EL 152'-5 3/4"
RBTN-51H16 EL 149'-2 3/4"
RBTN-51H15 EL 145'-11 3/4"
RBTN-51H14 EL 142'-8 3/4"
RBTN-51H13 EL 139'-5 3/4"
RBTN-51H12 EL 136'-2 3/4"
RBTN-51H11 EL 132'-11 3/4"
RBTN-51H10 EL 129'-8 3/4"
RBTN-51H9 EL 126'-5 3/4"
RBTN-51H8 EL 123'-2 3/4"
RBTN-51H7 EL 119'-11 3/4"
RBTN-51H6 EL 116'-8 3/4"
RBTN-51H5 EL 113'-5 3/4"
RBTN-51H4 EL 110'-2 3/4"
RBTN-51H3 EL 106'-11 3/4"
RBTN-51H2 EL 103'-8 3/4"
RBTN-51H1 EL 98'- 9 3/4"
REFERENCE VENDOR DWGS.
(PRESCON CORPORATION)
5EX7-003-P-12 HOOP TENDON PLACEMENT 240° TO 300° EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-13 HOOP TENDON PLACEMENT 300° TO 360° EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-24 HOOP TENDON PLACEMENT 240° TO 300° EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-25 HOOP TENDON PLACEMENT 300° TO 360° EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-30 HOOP TENDON PLACEMENT 240° TO 300° EL. 198'-10 1/2" TO 248'-9 1/4"
5EX7-003-P-31 HOOP TENDON PLACEMENT 300° TO 360° EL. 198'-10 1/2" TO 248'-9 1/4"
0°
60°
90°
120°
180°
240°
270°
300°
N
KEY PLAN
NUCLEAR SAFETY RELATED
1 ISSUED PER DCN 99-816 MAD
NO. DESCRIPTION DRAWN CHKD APPR. DATE
REVISIONS
NUCLEAR ENGINEERING
CRYSTAL RIVER UNIT 3
IWE/IWL INSPECTION HOOP TENDON "51" LAYOUT
FLORIDA POWER CORPORATION
08/31/98
1/8"=1'-0"
S-425-009
1



REFERENCE VENDOR DWGS.
(PRESCON CORPORATION.)

5EX7-003-P-8 HOOP TENDON PLACEMENT
0° TO 60° EL. 94'-5 3/4" TO 143'-9 3/4"

5EX7-003-P-13 HOOP TENDON PLACEMENT
300° TO 360° EL. 94'-5 3/4" TO 143'-9 3/4"

5EX7-003-P-20 HOOP TENDON PLACEMENT
0° TO 60° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003P-25 HOOP TENDON PLACEMENT
300° TO 360° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003-P-26 HOOP TENDON PLACEMENT
0° TO 60° EL. 196'-10 1/2" TO 248'-9 1/4"

5EX7-003-P-31 HOOP TENDON PLACEMENT
300° TO 360° EL. 198'-10 1/2" TO 248'-9 1/4"

KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR.	DATE
1	ISSUED PER DCN 98-816	MAD	LSM	[illegible]	8/31/98

REVISIONS

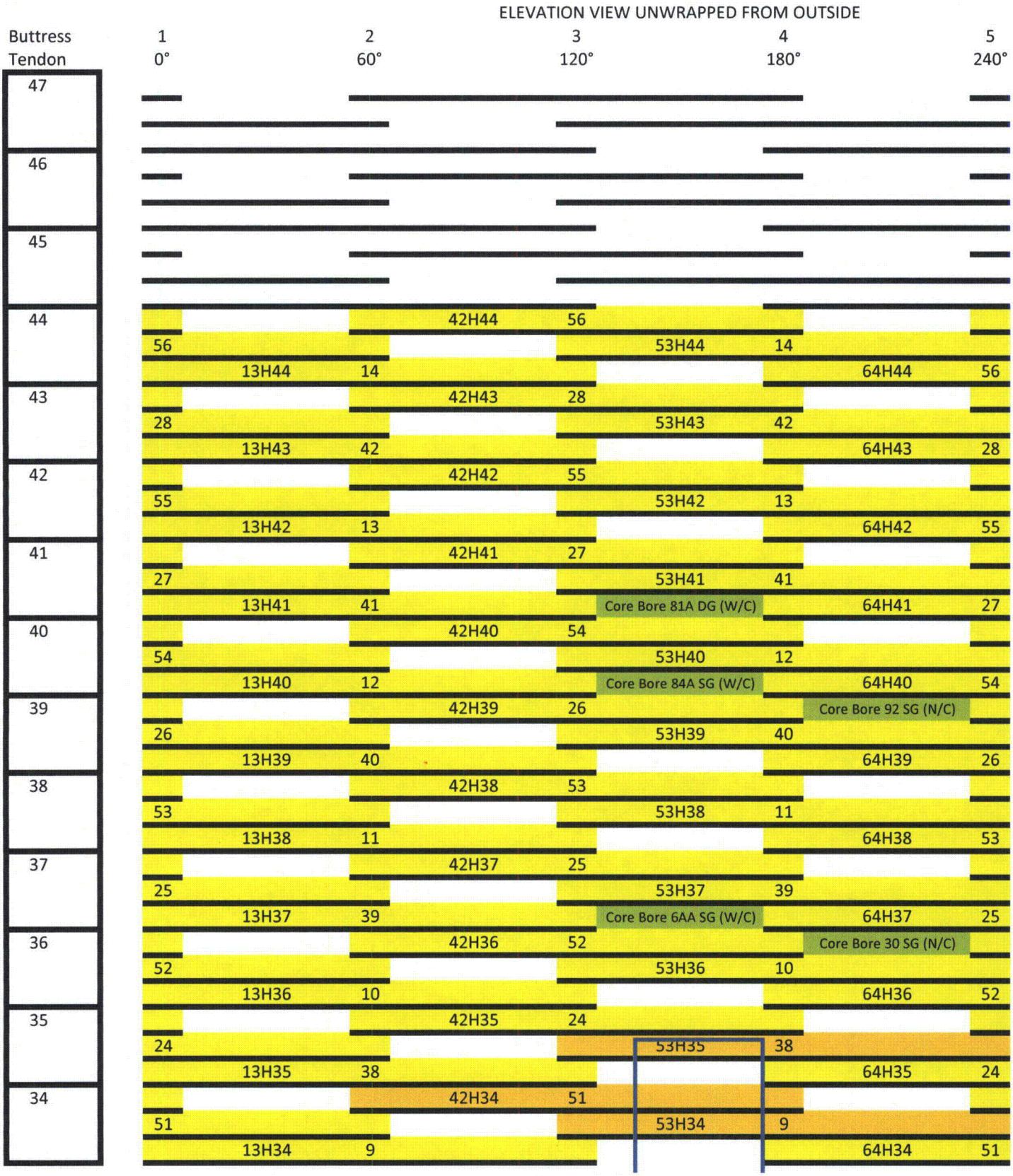
FLORIDA POWER CORPORATION

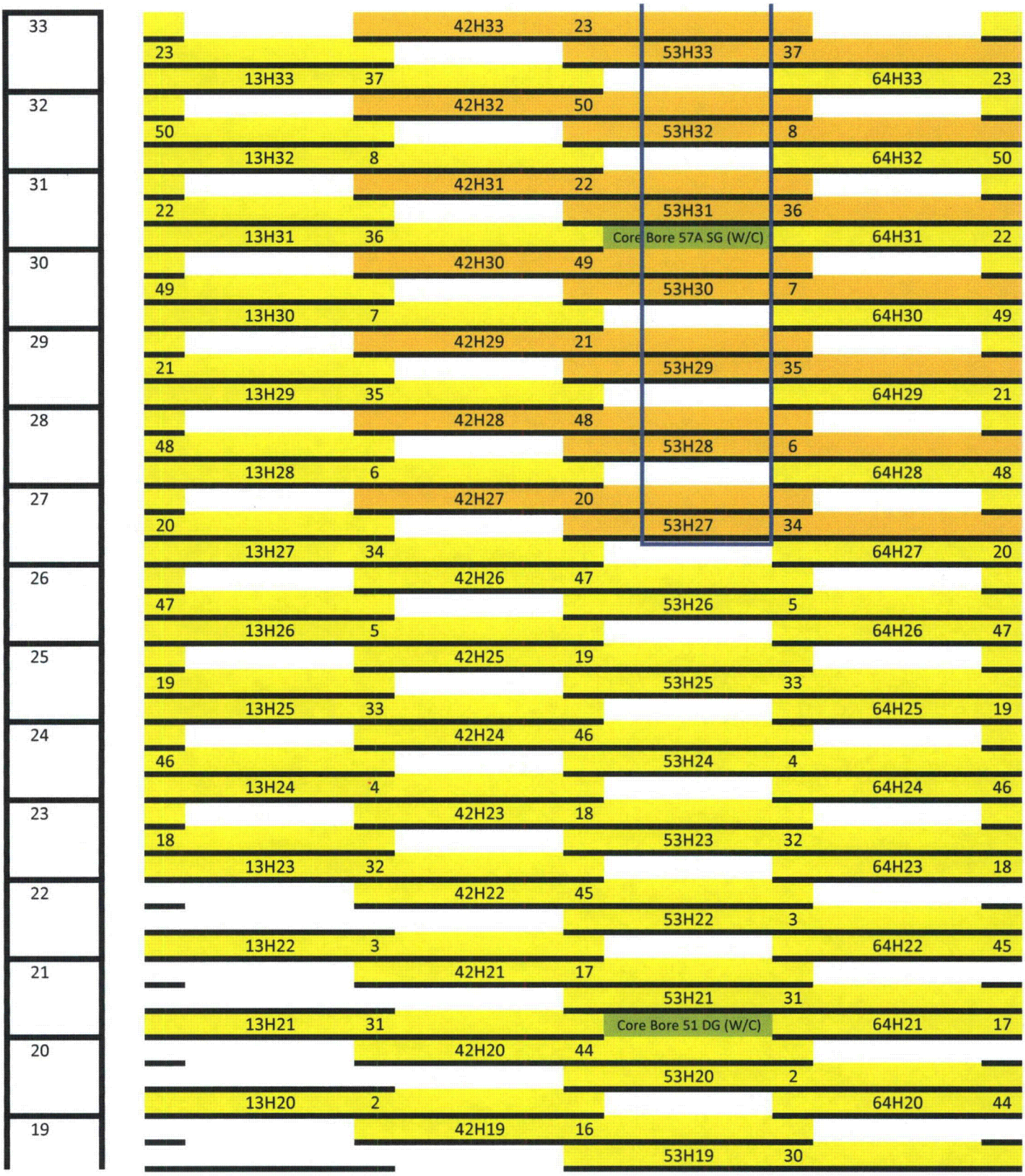
NUCLEAR ENGINEERING

CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION
HOOP TENDON "62" LAYOUT

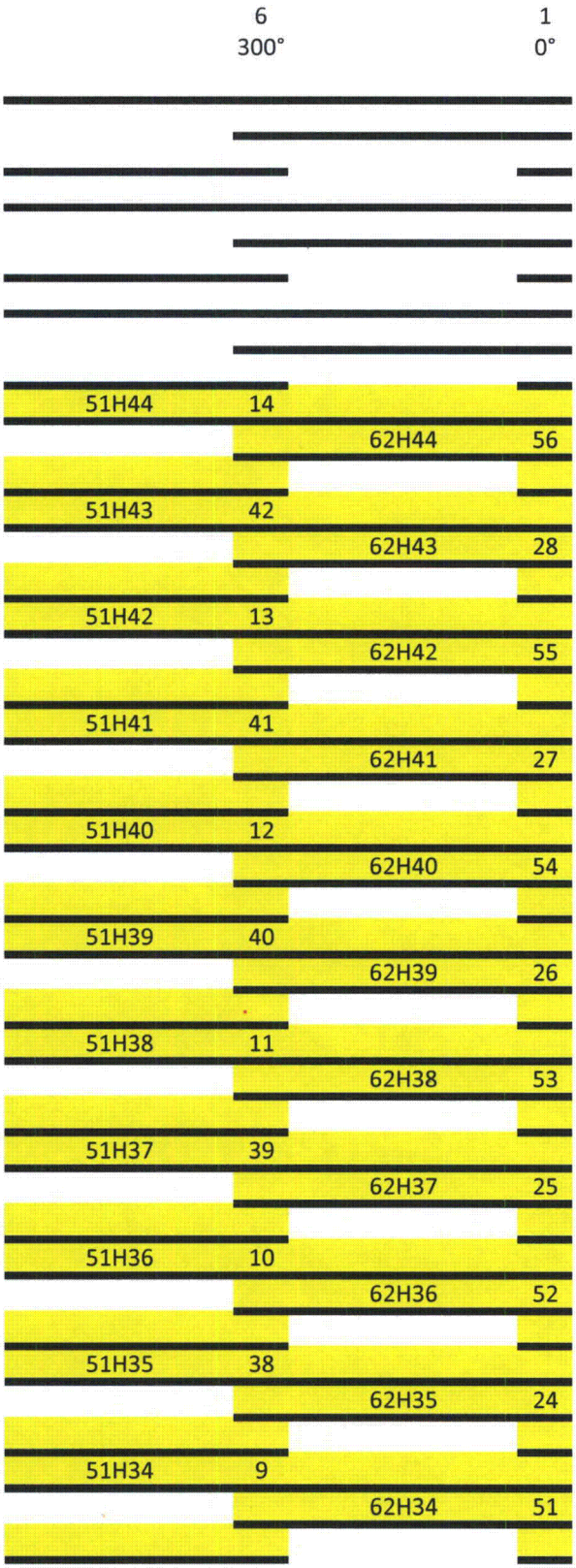
D.C. DRAWN	CAB CHKD	CAB APPVD	08/31/98 DATE	1/8"=1'-0" SCALE
S DISCP	1 SHEET	DWG	S-425-010	1 REV.


ELEVATION VIEW UNWRAPPED FROM OUTSIDE
Buttress
Tendon
1
0°
2
60°
3
120°
4
180°
5
240°
47
46
45
44
42H44
56
56
53H44
14
13H44
14
64H44
56
43
42H43
28
28
53H43
42
13H43
42
64H43
28
42
42H42
55
55
53H42
13
13H42
13
64H42
55
41
42H41
27
27
53H41
41
13H41
41
Core Bore 81A DG (W/C)
64H41
27
40
42H40
54
54
53H40
12
13H40
12
Core Bore 84A SG (W/C)
64H40
54
39
42H39
26
Core Bore 92 SG (N/C)
26
53H39
40
13H39
40
64H39
26
38
42H38
53
53
53H38
11
13H38
11
64H38
53
37
42H37
25
25
53H37
39
13H37
39
Core Bore 6AA SG (W/C)
64H37
25
36
42H36
52
Core Bore 30 SG (N/C)
52
53H36
10
13H36
10
64H36
52
35
42H35
24
24
53H35
38
13H35
38
64H35
24
34
42H34
51
51
53H34
9
13H34
9
64H34
51


33
42H33 23
23
53H33 37
13H33 37
64H33 23
32
42H32 50
50
53H32 8
13H32 8
64H32 50
31
42H31 22
22
53H31 36
13H31 36
Core Bore 57A SG (W/C)
64H31 22
30
42H30 49
49
53H30 7
13H30 7
64H30 49
29
42H29 21
21
53H29 35
13H29 35
64H29 21
28
42H28 48
48
53H28 6
13H28 6
64H28 48
27
42H27 20
20
53H27 34
13H27 34
64H27 20
26
42H26 47
47
53H26 5
13H26 5
64H26 47
25
42H25 19
19
53H25 33
13H25 33
64H25 19
24
42H24 46
46
53H24 4
13H24 4
64H24 46
23
42H23 18
18
53H23 32
13H23 32
64H23 18
22
42H22 45
53H22 3
13H22 3
64H22 45
21
42H21 17
53H21 31
13H21 31
Core Bore 51 DG (W/C)
64H21 17
20
42H20 44
53H20 2
13H20 2
64H20 44
19
42H19 16
53H19 30


18
42H18 43
53H18 1
17
42H17 15
53H17 29
16
15
14
13
12
11
10
9
8
7
6
5
4


3
2
1



Legend

Tendon to be detensioned with sequence. 23

Tendon currently detensioned sequence irrelevant. 9

CORE BORE - GAUGE LOCATIONS

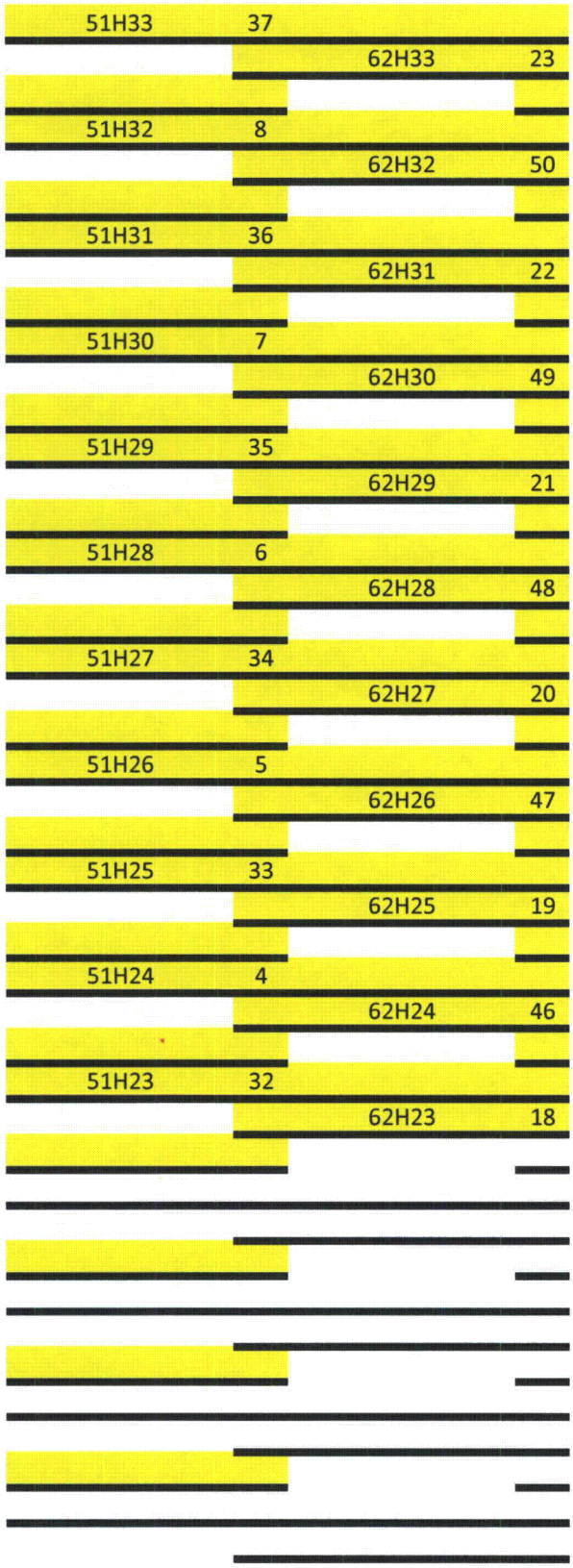
Vert. Tendon to the Right ----------

Vert. Tendon to the Left ---------- ---v

Horiz. Tendon Below ---------- ---v

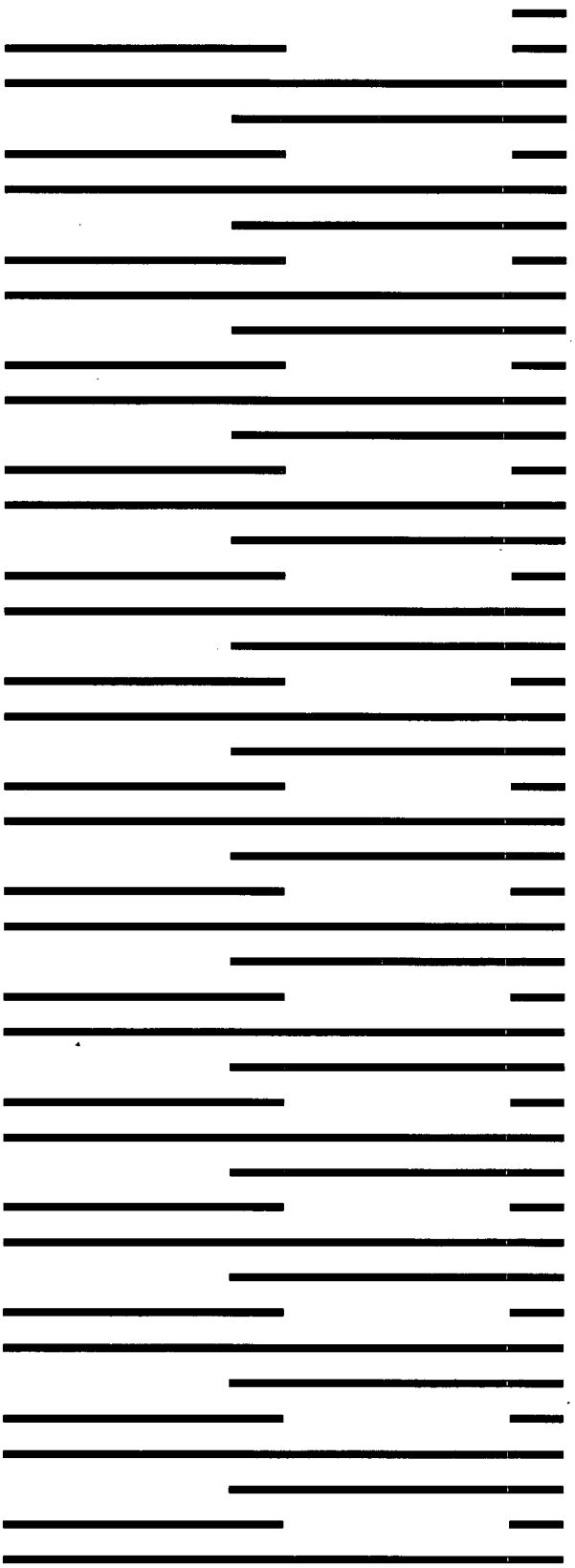
Horiz. Tendon Above ---v

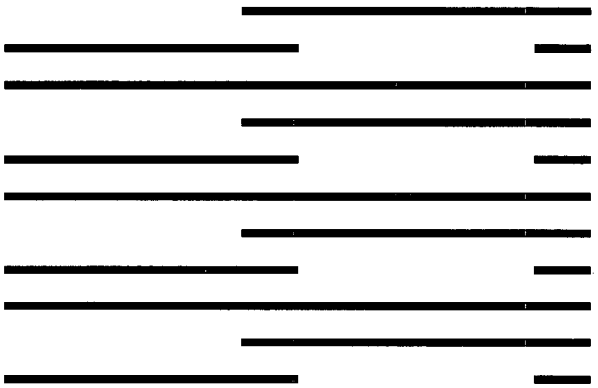
Removed Tendon			
N/A - Adjacent Tendon Not Detensioned			
Core Bore 81A DG (W/C) 227.67', 156.72°	53H41	42H40	34V10
Core Bore 84A SG (W/C) 224.67', 164.12°	53H40	42H39	34V07
Core Bore 92 SG (N/C) 223.83', 192.03°	64H40	53H39	45V20
Core Bore 6AA SG (W/C) 214.67', 137.19°	53H37	42H36	34V18
Core Bore 30 SG (N/C) 213.92', 208.08°	64H37	53H36	45V14



Core Bore 57A SG (W/C) 195.58', 164.05° 53H31 42H30 34V07

Core Bore 51 DG (W/C) 162.29', 169.14° 53H21 42H20 34V05





DETENSIONING SEQUENCE - CASE 10 [1-22-10] (By Sequence)

	Seq. Seq.	Tendon Tendon	Tendon Tendon	Tendon Tendon
	1	35H18		
	2	13H20	35H20	
	3	13H22	35H22	
	4	13H24	35H24	51H24
	5	13H26	35H26	51H26
	6	13H28	35H28	51H28
	7	13H30	35H30	51H30
	8	13H32	35H32	51H32
	9	13H34	35H34	51H34
	10	13H36	35H36	51H36
	11	13H38	35H38	51H38
	12	13H40	35H40	51H40
	13	13H42	35H42	51H42
---v	14	13H44	35H44	51H44
	15	42H17		
	16	42H19		
	17	42H21	64H21	
	18	42H23	62H23	64H23
	19	42H25	62H25	64H25
34V09	20	62H27	42H27	64H27
	21	62H29	42H29	64H29
	22	62H31	42H31	64H31
34V06	23	62H33	42H33	64H33
45V19	24	42H35	62H35	64H35
	25	42H37	62H37	64H37
	26	42H39	62H39	64H39
	27	42H41	62H41	64H41
	28	42H43	62H43	64H43
	V-1	34V18	34V07	
	V-2	34V20	34V05	
	V-3	34V22	34V03	
34V17	V-4	34V24	34V01	
45V13	V-5	23V02	45V23	
	V-6	23V04	45V21	
	29	35H17		
	30	35H19		
	31	13H21	35H21	
	32	13H23	35H23	51H23
	33	13H25	35H25	51H25
	34	13H27	35H27	51H27
	35	13H29	35H29	51H29

	36	13H31	35H31	51H31
	37	13H33	35H33	51H33
	38	13H35	35H35	51H35
	39	13H37	35H37	51H37
	40	13H39	35H39	51H39
	41	13H41	35H41	51H41
	42	13H43	35H43	51H43
	V-7	34V19	34V06	
34V06	V-8	34V21	34V04	
	V-9	34V23	34V02	
	V-10	23V01	45V24	
	V-11	23V03	45V22	
	43	42H18		
	44	42H20	64H20	
	45	42H22	64H22	
	46	42H24	62H24	64H24
	47	42H26	62H26	64H26
	48	62H28	42H28	64H28
	49	62H30	42H30	64H30
	50	62H32	42H32	64H32
	51	62H34	42H34	64H34
	52	42H36	62H36	64H36
	53	42H38	62H38	64H38
	54	42H40	62H40	64H40
	55	42H42	62H42	64H42
	56	42H44	62H44	64H44

Adjacent to a Core Bore Gauge Location			
N/A - Adjacent Tendon Not Detensioned			
Removed Tendon			
42H20		34V04	
42H30	Removed	34V05	
42H36		34V06	
42H39		34V07	
42H40		34V09	Removed
53H21		34V10	Removed
53H31	Removed	34V17	Removed
53H36		34V18	

34V04

53H37		45V13	N/A
53H39		45V14	N/A
53H40		45V19	N/A
53H41		45V20	N/A
64H37			
64H40			

Currently Removed Vertical Tendons	
34V08	34V13
34V09	34V14
34V10	34V15
34V11	34V16
34V12	34V17

ATTACHMENT 7
Sheet 1 of 29

EC Screening Criteria

EC 75218 Rev 1 1/6/10

NOTE:	Screening questions are provided to assist the **Responsible Engineer** in identifying potential impacts to plant programs, engineering disciplines, and plant customers. This screening is used to determine the need for EC Team formation and membership, obtain design inputs and/or evaluation inputs and determine reviews required for ECs. Depending on the complexity of the EC, this screening criteria may need to be reviewed several times during the EC development. Conservatively answer the screening questions early in the EC development to ensure that potentially impacted discipline/program/customers are contacted. Subsequent contact with the discipline/program/customer may identify that the area is NOT impacted.

NOTE:	**For design modifications (PCHG-DESG, PCHG-ALTR, and TCHG-DESG), special emphasis is placed on screening categories which have a history of missed review. These screening categories are designated below with a "Yes" in the Validate column. The RE should validate any decision not to include these categories in the EC review milestones by contacting the appropriate reviewer. The RE may waive the validation if the Responsible Supervisor concurs that a review is not required. Validation of reviews for an EC revision is only required when the revision includes a change in the EC scope of work.**

Screening Category	Validate	Notes	Sheet
Mechanical Design Discipline	Y	HVAC	3
Electrical Design Discipline			4
Instrumentation and Controls (I&C) Design Discipline			5
Civil/Structural/Seismic Design Discipline	Y		5
Materials Design Discipline			6
Welding Discipline	Y		6
System Engineer	Y	Con't of HVAC	7
Inservice Inspection ~~(ISI)~~/Inservice Testing (IST)/Appendix J (WE/IW)	Y		8
Safe Shutdown In Case Of Fire [HNP][BNP][RNP]	~~Yes~~	NO	9
Appendix R [CR3]	~~Yes~~	NO	9
Fire Protection Program	Yes		10
Nuclear Fuels			11
OPL-3 [BNP]			11
Plant Parameters Document (PPD) [HNP, RNP]			13
Safety Analysis Input Document (SAID) [CR3]			13
Environmental Qualification Program (10CFR50.49)			14
Human Factors Program			14
Regulatory Guide 1.97 Program			15
Flow Accelerated Corrosion Program			15
Check Valve Program			15
Motor/Air Operated Valve Program			15
Station Blackout Program [HNP]			16
Station Blackout Program [BNP]			16
Station Blackout Program [RNP]			17
Station Blackout Program [CR3]			18
Maintenance Rule Program			18
Preventive Maintenance Program			19
Equipment Data Base			19
Probabilistic Safety Assessment (PSA) Model			19
Radioactive Waste Compliance [HNP]			20
Protective Coatings Program			20

ATTACHMENT 7
Sheet 2 of 29
EC Screening Criteria
EC75218

Screening Category	Validate	Notes	Sheet
Transmission Engineering Design			20
Radiological Dose Consequences			21
Fatigue Monitoring Program			21
License Renewal (10 CFR 54.37(b)) [RNP]			21
Cooling Water Reliability Program			21
Major Projects (CR3)			22
Buried Pipe Reliability Program			22
ALARA	Y		22
Security (10CFR50.54P)	Yes		22
Emergency Plan (10CFR50.54Q)	~~Yes~~	NO	23
Simulator Training			23
Operations Training			24
Technical Training			24
Information Technology			24
Decommissioning (10CFR50.75)			24
Scram Frequency Reduction [BNP,HNP]			25
Mechanical Maintenance			25
Electrical/I&C Maintenance			25
Environmental & Radiation Control (E&RC)	~~Yes~~	NO	25
Chemistry			26
Environmental Permitting			26
Installer SGT	Y		26
Planner	Y		27
Operations	Y		27
Material & Contract Services (M&CS, Procurement Engineering			27
Plant Services Group [RNP]/Plant Support Group [BNP]			27
Licensing/Regulatory Programs			28
PNSC Review Required Prior to Implementation			28
NAS Review Required Prior to Approval/Implementation			29

Unit Weight (density) of Existing Containment Shell Concrete

The purpose of this evaluation is to determine the density of the existing CR3 containment shell concrete based on information gathered from original construction concrete pour cards and supported by a limited number of recent core bore test results. The average density will be used as an input to MPR Associates calculations that evaluate the delaminated containment shell, including the detensioning and retensioning calculations.

Core Bore Results:

S&MEs core bore test results for bulk wet and dry densities (Attachment Z25R0) are shown in TABLE 1. Note that the bulk dry and wet density's listed in S&ME's test reports are based on a multiple of the specific weight of water and must be multiplied by 62.416 (lbs/ft^3). Refer to EC 74801 for core bore locations.

Note: The wet density test results will best represent the actual in-situ concrete density as it exists today.

TABLE 1

	Core #16	Core #40-2	Core #40-3	Core #60-1	Core #60-2	Core #63	Core #65	Core #66	Average All	Average w/o #60
Bulk density dry (lbs/ft^3)	136.07	134.2	134.82	132.32	131.7	135.44	133.57	134.82	134.12	134.82
Bulk density wet (lbs/ft^3)	144.81	142.93	144.18	140.44	140.44	144.18	142.93	143.56	142.93	143.77

Original Construction Records:

There were four mixes used for the construction of the containment walls; DM-5, DM-5-mod, 727550-2 and 727550-2-mod (Refer to Attachment Z24R0 which contains pour card records for all pours between buttress's 1 and 6 and buttress's 3 and 4, and are a good representation of pours made for all of containment). Of these four pours, DM-5-mod and 727550-2-mod were the primary mixes used in the containment walls. Both DM-5-mod and 727550-2-mod had slightly lower W/C ratios compared to DM-5 and 727550-2.

(i) 727550-2-mod was used exclusively for the dome, and also at the ring girder, equipment hatch, and generally for higher elevations of the containment wall.
(ii) DM-5-mod was used generally for the lower elevations of the containment walls.

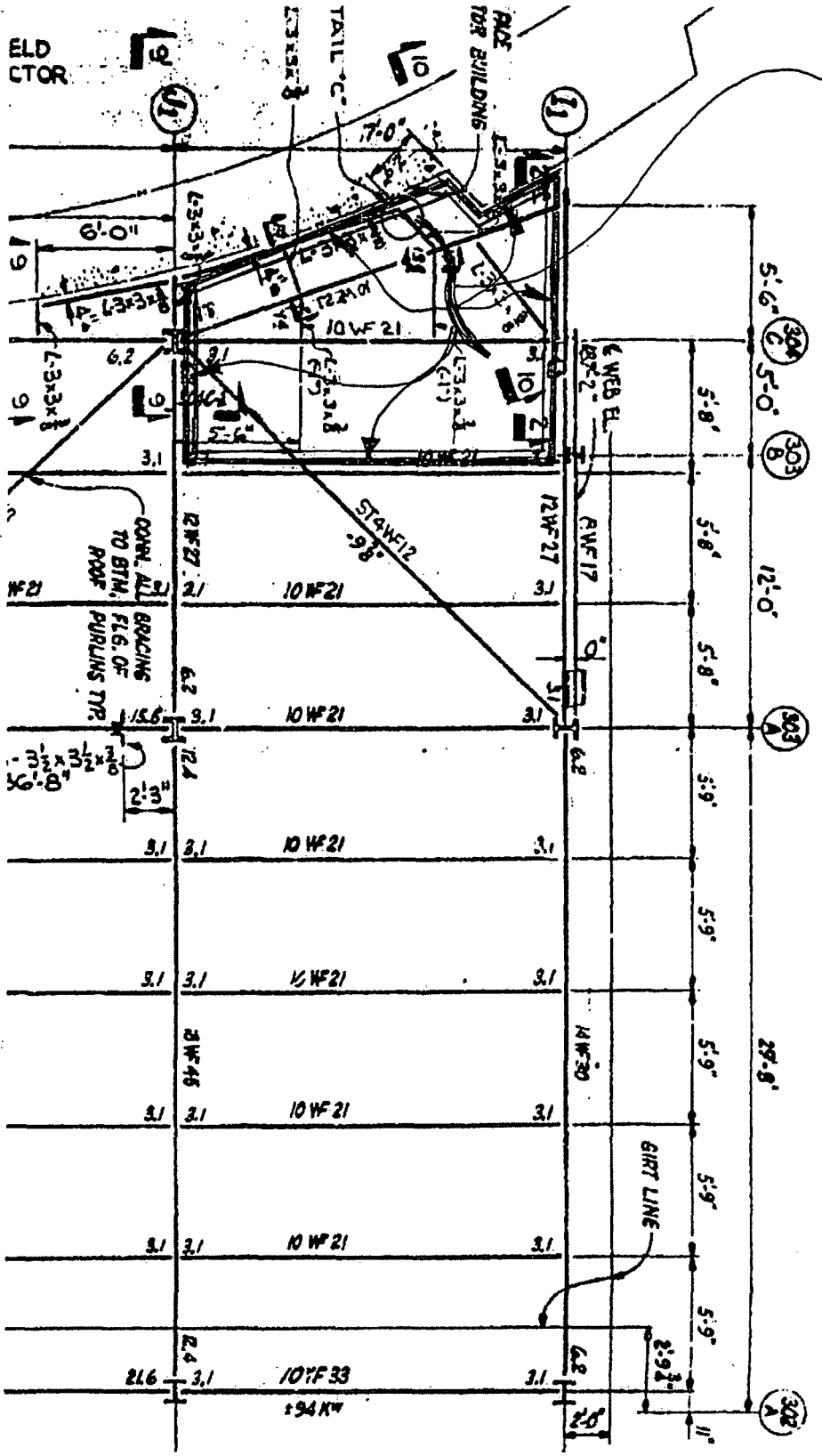
Refer to Attachment Z23R0 for pour location drawings between buttresses 1 & 6 and 3 & 4.
The mix proportions for both DM-5-mod and 727550-2-mod are listed in Table 3 (Refer to Attachment Z23R0)

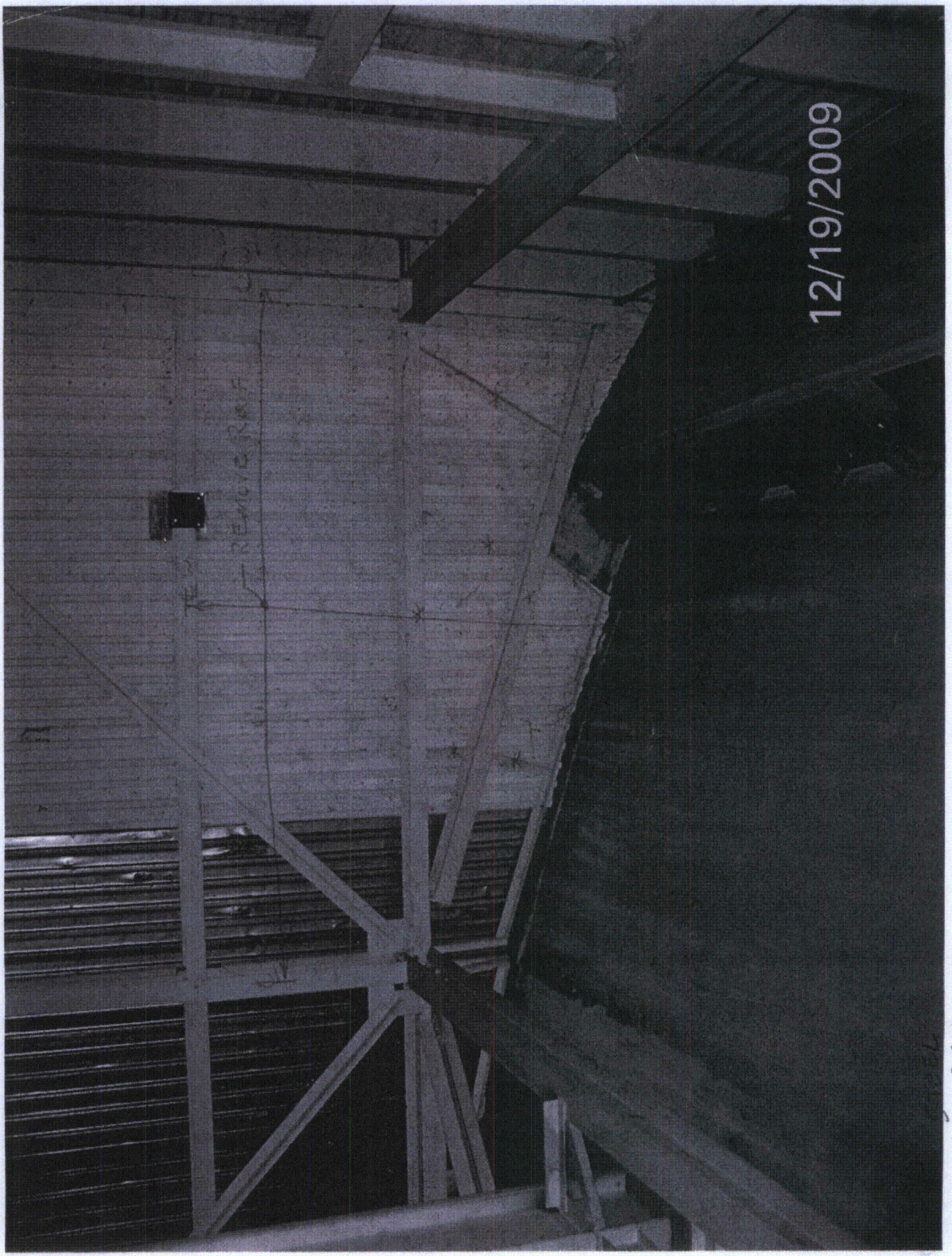
TABLE 2

	Mix DM-5 (M)	Mix 727550-2 (M)	UNITS
Design Strength f'c	5000	5000	psi
Cement	682	752	lbs/cu. yd
Coarse Aggregate	1800	1800	lbs/cu. yd
Fine Aggregate	1100	1060	lbs/cu. yd
Admix Daratard	21	23	oz/cu. yd
Admix Darex	5	4.5	oz/cu. yd
Water	276	286	lbs/cu. yd
W/C ratio	0.41	0.38	N/A
Unit Weight	143	144.4	lbs/cu. ft.

Conclusion:

Based on an average bulk wet density of 143.77 lbs/ft^3 from Table 1, and unit weights of 143 and 144.4 lbs/ft^3 for each mix from Table 2, an average unit weight of 144 lbs/ft^3 will be used for the density of the existing concrete in the containment shell including the dome.


ROOF REMOVAL AREA
AUX. BUILDING NORTH STEEL FRAMING
ROOF STEEL
ROOF ELEVATION 200'-4"
S-521-102
ELD CTOR
FACE OF BUILDING
TAIL "C"
6'-0"
10 WF 21
12 WF 27
10 WF 21
12 WF 27
8 WF 17
ST 4 WF 12
10 WF 21
10 WF 21
8 WF 48
10 WF 21
14 WF 30
10 WF 21
10 WF 21
10 WF 33
194 KW
CONN. ALL BRACING TO BTM. FLG. OF PURLINS TYP.
5'-6"
5'-0"
12'-0"
29'-8"
5'-8"
5'-9"
BIRT LINE
11"

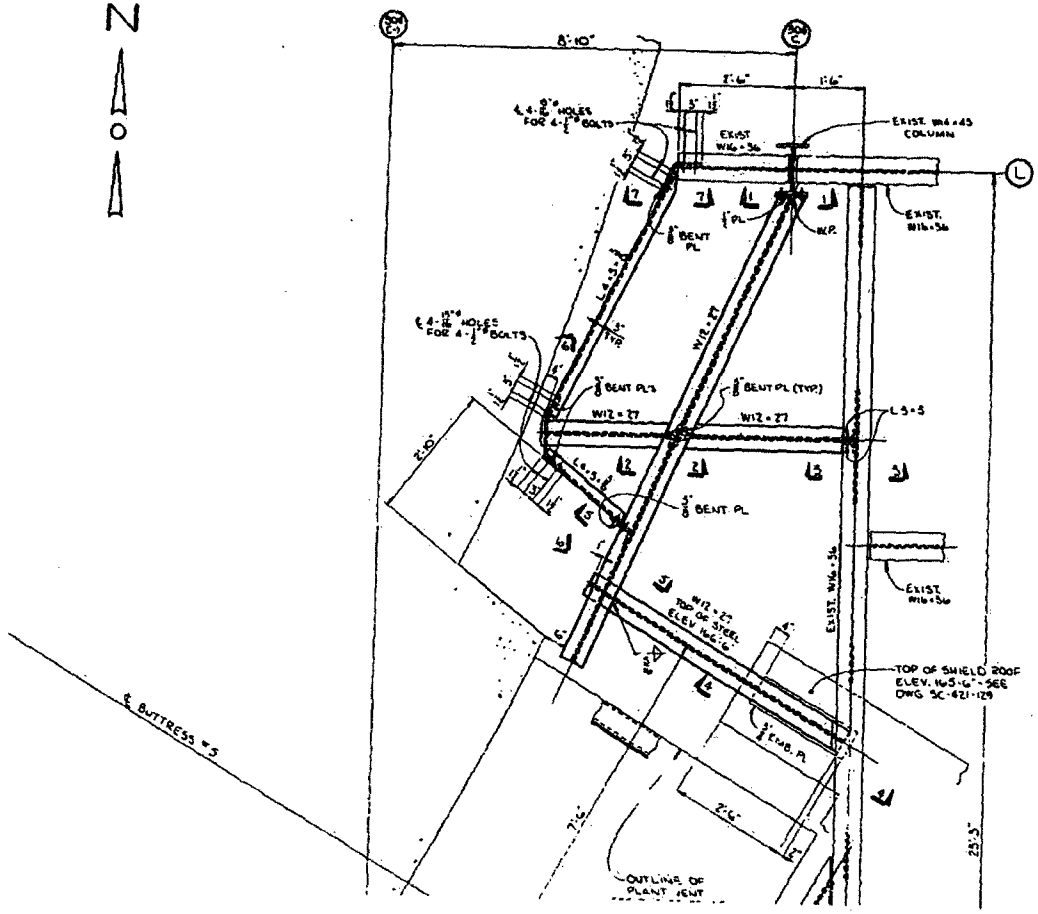

12/19/2009

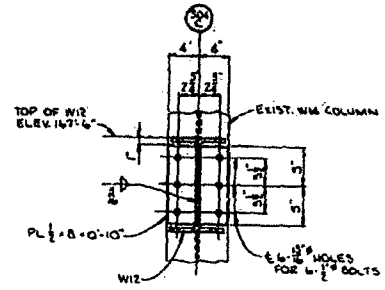
Engineering Change

AUX. BUILDING SOUTH

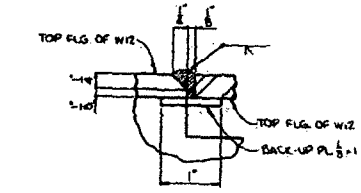
MISC. STEEL - ROOF STEEL FRAMING

ELEV. 167'-6" @ BUTTRESS #5

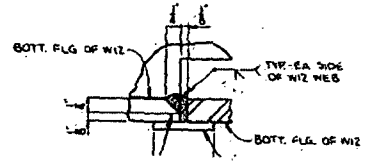




SECTION 1-1



DETAIL "A" (AS SHOWN)
DETAIL "B" (OPP. HAND)



S-522-003

PCHG-DESG

Z14


* REMOVE STEEL
12/01/2009

This attachment provides a holding place for the Precision Surveillance Corporations (PSC) information on the tendon work platforms and lift systems. The majority of this information was originally included in EC 63016. This earlier information has been edited to be specific for detensioning under EC 75218 while the plant is in No-Mode conditions. This EC attachment contains several Sub-Attachments as follows:

- Attachment "A": PSC Field and Quality Control Manual, 137 pages
- Attachment "B": PSC Platform Calculation CR-N1013-100, 219 pages
- Attachment "C": Contract Amendment for new Platforms, 5 pages

Detensioning and retensioning the tendons involves components (tendons, bolts, stressing washers, etc) that are stressed to very high levels through the use of high pressure hydraulic rams. Additionally, the majority of this work is done on either work platforms suspended from the top of the containment roof or from the roof itself. All work activities associated with the tendons will be controlled by CR3 work orders that incorporated Precision Surveillance Corporations (PSC) Field and Quality Control procedures (See Attachment "A" of this document). PSC has done similar work on several steam generator replacement projects, as well as being the primary provider of services related to Plant Tendon Surveillance Programs for the majority of post-tensioned containment buildings in the United States. Their previous experience and proven work procedures are the industry norm and should provide reasonable assurance that all tendon related work will be done in a safe and efficient manner. The Site Safety department must ensure that proper and sufficient consideration is made of the requirements for fall protection and of the dangers involved in working at heights.

EC 63016 used 4 work platforms that are suspended from the Upper Support Frames (USF) on the containment roof rail system. These platforms and USFs are designed for all relevant loads and load combinations to ensure that they cannot fall and damage safety related components below. Refer to Attachment "B" of this document for PSC design calculations (as prepared for EC 63016) and sketches for the tendon work platforms and upper support frames.

Each USF supports a tendon work platform with four independent drive cables and four independent safety cables each. PSC has qualified all USFs (with platforms attached) for dead, live, hurricane, and seismic loads (See Attachment B). These calculations have also verified that the USFs have sufficient strength to resist tornado wind loads and cannot break apart during a tornado and become a source of missiles. The tie-downs that this calculation specifies ensure that the USFs cannot slide off the RB roof as a result of any of these loads.

As stated above the four platforms (2 - nominal 8'x10' platforms and 2 – nominal 10'x20' platforms) that were originally procured for EC 63016 will be supplemented with four additional

platforms and USFs as documented in Attachment "C" of this document. These four new platforms will be smaller than those procured for EC 63016. The calculations for the larger platforms are therefore bounding and considered acceptable for the newer platforms.

EC 63016 originally documented using the platforms and USFs during various plant modes and how the various lifting would be arranged to protect safety related equipment. The new platforms will be similarly controlled to avoid interaction with safety related equipment.

In the event of violent weather (as described below) all work platforms will be lowered to the ground and secured:

- Tornado Watch: Alerts an area of the possibility of a tornado and usually lasts for 2 to 4 hours.
- Tornado Warning: Issued when a tornado has been sighted in the area.
- Whenever winds exceed 30 mph
- Hurricane and Tropical Storm Watch and Warning (in accordance with the EM-220 Violent Weather Committee instructions)

Prior to the issuance of EC 64487 the Spent Fuel Pool (SFP) was covered by metal missile shields which were analyzed and accepted as providing adequate missile protection of the fuel, including dropping the approximately 8500# hydraulic tendon testing jack/ram. EC 64487 however justified the removal of these missile shields. Consequently, EC/ED 68398 was issued to provide the NUREG-0612 justification for tendon surveillance testing over the SFPs without the missile shields installed. This EC-ED evaluated staging an 8'x10' work platform at either buttress number 5 or 6 and the potential for dropping the hydraulic ram onto the fuel pools. The EC/ED concluded that the USF is designed for hurricane winds, seismic forces and the full dead & live loads of the platform and that a sufficiently large distance separated the work platforms from the edge of the fuel pools. Additionally, the USFs have been qualified for hurricane and tornado winds and seismic loads while they are moving along the rail system. Based on these conclusions, moving the work platform past the spent fuel pool and staging it at buttress #5 is acceptable during any Mode.

The remaining nominal 10'x20' is also evaluated and qualified the USF/platform configuration for both seismic and hurricane/tornado wind forces.

NOTE: It is acceptable to store tools, gang boxes and other miscellaneous equipment required to support tendon related activities on the platforms, while the platforms are being moved around the RB roof to either their temporary storage location on the IB roof or while they are being staged at buttress numbers 4 and 5, based on the following:

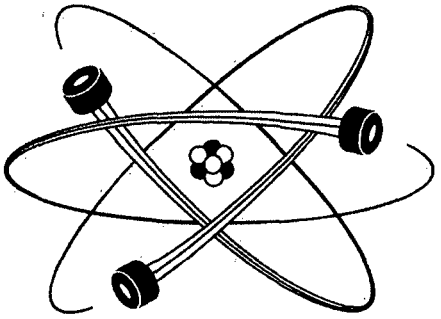
1. All items must be secured so that they cannot fall off the platforms. This restriction also applies during adverse weather conditions.

The maximum weight of an individual item is limited to 200 lbs to ensure no damage to the IB roof or the seawater room roof. Based on a maximum fall height of 130', final velocity would be approximately 62 mph, with the missiles resulting kinetic energy (KE) equal to 26,285 ft-lbs. By comparison, per FSAR, Section 5.2.1.2.6 the KE generated by a 10' long 3 inch diameter schedule 40 pipe is 25,300 ft-lbs and maximum penetration is 0.3 inches. The maximum additional load to the platforms during resulting from storing small tools, etc is 500 lbs. (limited by the allowable live load to the IB roof).

The Upper Support Frames and platforms are proof load tested to 125% of their rated load capacity by PSC prior to their shipment to the site. After assembly at the site, each platform is to be functionally tested at 125% of their rated capacity through the full range of movements expected. See Testing.Section of EC 63016 for test procedure.

Note that the USFs and associated equipment must be stored, while on the containment roof, in a secure manner for adverse weather conditions. Refer to site procedure EM-220, Violent Weather for additional guidance.

Attachment "A"
PSC Field and Quality Control Manual



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CONTROLLED MANUAL NO: N1013-

POST TENSIONING SYSTEM
FIELD AND QUALITY CONTROL PROCEDURE MANUAL

FOR

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

CONTAINMENT BUILDING TENDON INSTALLATION

REVISION	0	AUGUST 29, 2008
REVISION	1	JUNE 24, 2009
REVISION	2	AUGUST 19, 2009
REVISION	3	SEPTEMBER 16, 2009

Gerald Bussone	*QA MANAGER*	*09/16/09*
Prepared by	Title	Date
Approved by	*PROJECT MANAGER, P.E.*	*09/16/09*
	Title	Date
Approved by	*PRESIDENT*	*09/16/09*
	Title	Date

FIELD AND QUALITY CONTROL PROCEDURE MANUAL
ACKNOWLEDGEMENT OF RECEIPT FORM
August 29, 2008
Page 1 of 1
Revision 0
Revision 2. 8/19/2009
Revision 3. 9/16/2009

This page shall be removed, and mailed or faxed to:

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Quality Assurance
3468 Watling Street
East Chicago, IN 46312

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Field and Quality Control Procedure Manual	
Issue Date	08-29-08
Revision	3 09-16-09

PSC
Precision Surveillance Corporation

FIELD AND QUALITY CONTROL PROCEDURE MANUAL
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August 29, 2008
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PSC
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FIELD AND QUALITY CONTROL PROCEDURE MANUAL
INDEX STATUS SHEET
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B.H. Mach/Oper. Qual Sht.	1	0	08-29-08		
Buttonhead Spec. Sheet		0	08-29-08		
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Data Sheet F&Q 15.0 A	1	0	08-29-08		
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Sketch Sheet F&Q 15.1	1	0	08-29-08		
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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

DEFINITIONS

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

ACTIVE CORROSION: Corrosion on a component that exhibits metal loss that has occurred since fabrication or construction, and/or exhibits pitting visible to the naked eye. Active corrosion usually is a reddish/rust color.

ANCHORAGE (Stressing Washer): The round machined components at the end of each end of the tendon through which tendon wires are passed.

BEARING PLATE (Baseplate, Trumplate): The steel plate at the end of the tendon, embedded in the concrete. The tendon is passed through the hole in the plate and the anchorhead bears against the plate or shim which in turn transfers the load to the concrete.

BROKEN WIRE: A wire within a tendon assembly that is broken and not capable of accepting prestressed load. Wires that excessively protrude from the anchorage components are suspected to be broken.

BUTTONHEAD: The end of the tendon wire that was mechanically deformed during construction, which seats on each anchorage.

CORROSION PROTECTION MEDIUM (Grease, Casing Filler): Grease injected into tendon duct and anchorage cans for corrosion protection. Also referred to as grease or sheathing filler grease.

EFFECTIVE WIRE: Tendon wire capable of maintaining required post tensioned force.

ELONGATION: The distance a tendon/wire stretches while under stress.

FEELER GAUGE METHOD: The method used to determine lift off during a test that utilizes the placement of feeler gauges within the anchorage components while the tendon is under jack/ram load.

FIELD END: The end of the tendon on which buttonheads are formed after the tendon is installed. The field end usually does not have a bushing.

FREE WATER: Any quantity of water collected from a tendon grease can, anchorage components, shim gaps, or tendon duct.

GREASE CAP: Steel container bolted to the bearing plate or anchorhead. A grease can encases the anchorage assembly to provide permanent corrosion protection.

GUARANTEED MINIMUM ULTIMATE TENSILE STRENGTH (GUTS): The tensile strength of the tendon assembly based upon the tensile strength of the wire used in construction and the quantity of effective wires. The minimum Guaranteed Ultimate Tensile Strength of 7 mm (0.27559") diameter wire is 240,000 pounds per square inch or 14,316 pounds.

JACK (Ram): A cylindrical, hydraulic device used to stress the tendon. Also referred to as a "Ram".

JACK CHAIR: That device attached to the front of the ram and bears against the bearing plate, which provides the lift height for the tendon as it is being stressed.

LIFT OFF FORCE: The actual force or pressure required to lift the anchor head off the tendon anchorage assembly shim stack.

LOCK OFF FORCE: The final seating force of a tendon after tensioning during construction or retensioning thereafter.

MINIMUM DESIGN FORCE (kips): The minimum acceptable average prestress force for a tendon or group of tendons to maintain the design basis of the containment structure. For Crystal River Unit 3 the force levels for this average prestress condition are 1215 kips for the dome tendon group, 1149 kips for the vertical tendon group, and 1252 kips for the hoop tendon group.

MISSING WIRE: A wire that is identified as missing from the tendon.

MONITORING OF FORCE: That series of operations that determine the force or prestress remaining in the tendon.

NET DUCT VOLUME: The volume within a tendon duct that is capable of being filled with corrosion protection medium. This is the gross duct volume minus the volume taken by the tendon wires and components.

OVERSTRESS FORCE: The maximum force that can be applied to a tendon during lift off testing and retensioning. This force is 80% of the tendon's ultimate tensile strength. For wire specification ASTM A421, 80% of the minimum Guaranteed Ultimate Tensile Strength of the wire is 11,452 pounds for each 7 mm diameter wire.

POST TENSIONING: A method of prestressing concrete in which the tendons are tensioned after the concrete has cured.

PREDICTED FORCE: The precalculated force (in kips) based upon the measurement of the prestressing forces during installation minus the losses in prestressing forces that were predicted to have occurred since that time because of material and structural characteristics. This is the calculated minimum force that should be required to achieve lift off. This value is the acceptance criteria for measuring pre stress forces. The as found value should be equal to or exceed this value.

PRETENSIONING FORCE: The force achieved during retensioning where the slack and mechanical clearances have been removed.

PROTRUDING OR UNSEATED WIRE: A wire within a tendon assembly that is extending beyond a tendon anchorage after stressing and is not seated against the anchorage. The wire must be evaluated.

PUMP: A mechanical device used to pump hydraulic fluid into the jack and apply the force required to stress the tendon.

RAM: Synonym for Jack. (See Jack)

SHEATHING (Conduit, Duct): The thin-walled tubular steel used for creating a void in the concrete through which the tendon is passed. (Also referred to as : duct, conduit.)

SHIM STACK: A series of steel shims installed between the anchor head and bearing plate so that the desired prestress force is obtained.

SHOP END: The end of a tendon on which the buttonheads are formed prior to installation. These buttonheads are formed in a shop environment and not in the field.

STRESSING: Connecting the ram to the tendon and pulling until a predetermined force and elongation is achieved.

STRESSING ADAPTOR (Coupler): That threaded device attached to the pull-rod of the ram, which couples with the anchorhead to be stressed. This may be for internal or external threaded anchorheads.

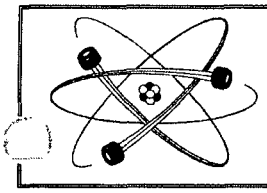
TENDON: A separate continuous multiwire tensioned element anchored at both ends to an end anchorage assembly. An assembly of prestressing steel and anchorage components which imparts prestressing forces to concrete.

TENDON END ANCHORAGE ASSEMBLY: That portion of the tendon which extends beyond the bearing plate while in a stressed condition which consists of the bearing plate, shim stack, anchor head and wire.

TENDON TYPE: A tendon type is defined by its geometry and position in the containment structure; e.g., horizontal (hoop), vertical, and dome.

TENDON LOCATION NUMBER: The identity of a tendon with regard to it's location in the structure.

WIRE: 7 mm diameter wire manufactured to ASTM A421.



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

PERSONNEL SAFETY

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 The purpose of this document is to create awareness for those safety considerations that must be observed by those personnel working around or directly involved in Post Tensioning System operations.

2.0 GENERAL

2.1 All personnel directly involved with the Post-Tensioning System operations SHALL be made aware of the magnitude of the working forces and safety requirements for the various operations.

3.0 SAFETY

3.1 WIRE

3.1.1 The wire used for fabricating the tendons has a minimum breaking strength of 240,000 pounds per square inch. This means that each 7mm diameter wire is capable of withstanding a minimum breaking load of 14,316 pounds per wire. Multiply this by the number of wires in a tendon and you are dealing with forces in excess of 2 million pounds for a 163 wire tendon.

- CAUTION: Never connect a welding ground, perform welding on, or strike an arc near a stressed tendon.

- CAUTION: Never apply an open flame to the button heads, the wires or anchorages of a stressed tendon. (Unless the tendon end is being Plasma Cut)

- CAUTION: Never strike the button heads, the wires or the anchorheads of a stressed tendon with a hammer or any other metal object.

3.1.2 The above actions could cause a button head or wire to fail. During tendon tensile testing, broken wires or button heads have been observed to penetrate hard lumber in excess or 4 inches in thickness, about the equivalent of a .32 caliber bullet.

3.2 STRESSING OPERATIONS

3.2.1 During de-tensioning or stressing operations the following cautions SHALL be observed.

- CAUTION: Never exceed the overstress force or pressure - 80% of tendon GUTS for a 163 wire tendon (or 11.452 kips per effective wire).

- CAUTION: DO NOT stand behind the jack when it is under load.

- CAUTION: Keep fingers out of any pinch areas.

- CAUTION: Be alert during shim placement and removal.

3.3 STRESSING ADAPTOR (COUPLER)

3.3.1 Prior to applying ANY FORCE to the tendon, the stressing adaptor, coupler, must be fully engaged with the anchorage to be stressed or de-tensioned.

- CAUTION: Ensure the stressing adaptor (coupler) is fully engaged with the anchorage before applying any load, regardless of how small that load might be.

3.4 GREASING OPERATIONS

3.4.1 During greasing operations the grease may be pumped under pressure and may have temperatures in excess of 150°F and injury could occur through carelessness. It is therefore essential to avoid direct contact with the hot grease and to make sure all connections are secure. Exercise caution when climbing tendon buttress and gallery ladders. The potential for slippery surfaces created by grease on shoes exists. Ladder rung, etc. shall be wiped clean if coated in grease.

3.4.2 During heating of grease be aware that belt heaters are hot and could cause injury if touched. It is also essential to ensure that no flammable materials are allowed to touch belt heaters when in operation.

3.4.3 Belt heaters draw large amounts of current, ensure that power supply and any extension cords used are suitable for the power requirements.

3.4.4 CAUTION: During greasing, be aware that the grease is HOT and may be pumped under pressure.

3.5 CONSTRUCTION SAFETY

- CAUTION: DO NOT stand under loads while stationary or during hoisting.

- CAUTION: DO NOT permit others to stand under loads.

- CAUTION: DO NOT throw or drop object from the scaffold.

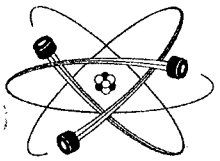
3.5.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well being of the other trades and personnel in the area must be observed, especially during hoisting operations.

3.5.2 All CR03 Accident Prevention Procedures SHALL be rigidly adhered to, to the total satisfaction of the site safety department.

3.5.3 Some work may be near plant equipment required for safe shutdown and/or may cause shutdown if plant equipment is damaged. Use special care therefore when suspending or moving detensioning rams or other heavy surveillance equipment.

3.5.4 If required notify the site safety organization to obtain air samples in the tendon gallery prior to entry into the gallery. Enter gallery only upon site safety approval.

3.5.5 If there are any doubts or questions concerning a point of operation or safety, refer to the Construction Supervisor before starting that operation or proceeding any further. Refer to the Quality Control personnel any questions about quality before starting operations or proceeding any further.



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

PURPOSE

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
~~Approved by~~	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 The purpose of this Field and Quality Control Manual is to provide those procedures that will be necessary to perform the required vertical and horizontal Post Tensioning System Tendon work during the Steam Generator Replacement Project at Crystal River Unit 3.

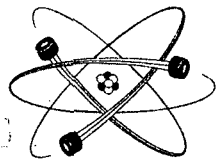
1.2 These procedures shall be used for the required Field Operations and Inspections of selected Vertical and Horizontal Tendons of CR03 as shown in PSC Procedure F&Q 2.0 or as determined by owner approved Work Package.

1.3 In addition, each procedure provides as necessary, the reporting responsibilities for notification of unacceptable conditions that may have been detected as a result of the Field Operations or Inspections.

1.4 This Field and Quality Control Manual has been developed in accordance with owner requirements.

1.5 The instructions provided in this Field and Quality Control Manual contain instructions on construction methods and good practices and quality inspection requirements to perform work on post tensioned tendons. The Quality Control Documentation (QCD) instructions are quality inspection points, hold points and/or documentation points required to control critical activities. Work shall not progress through these points without a release from the Inspector or Field Engineer as outlined in the QCD. Data Sheets are provided within each F&Q document where QCD activities require written authorization or collection of critical data. At no time will these QCD activities be deviated from with out prior authorization by owner.

1.6 The methods and practices other than QCD's contain construction related activities which may vary depending upon field conditions. In the event that one of these methods or practices is required to be performed out of sequence or in a different manner, variations require prior written authorization by owner.



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

SCOPE

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 GENERAL:

1.1 A construction opening is required in the containment wall for the Crystal River Unit 3 (CR03) Steam Generator Replacement Project. In order to accomplish this task a total of 65 tendons will have to be removed or fully de-tensioned as determined by the owner.
The services to be provided are applicable to Crystal River Unit 3.

1.2 Generally, the scope of the work involves:

1.2.1 Plasma cut de-tension and removal of selected Vertical Tendons.

1.2.2 Plasma cut de-tension and removal of selected Horizontal Tendons.

1.2.3 After completion of all generator moving activities fully ram de-tension selected Vertical and Horizontal Tendons.

1.2.4 Installation of new Vertical and Horizontal Tendons for those removed.

1.2.5 Once released by Owner re-stress all replaced new Vertical and Horizontal Tendons and the Vertical and Horizontal Tendons fully de-tensioned.

1.2.6 Install replacement tendon grease.

2.0 SCOPE:

2.1 There are 10 Vertical Tendons and 17 Horizontal Tendons to be removed and replaced with new tendons.

2.2 There are 20 Vertical Tendons and 18 Horizontal Tendons to be fully de-tensioned.

2.3 Removal Tendons

Vertical Tendon No.		Horizontal Tendon No.		Horizontal Tendon No.
34V8		42H27		53H27
34V9		42H28		53H28
34V10		42H29		53H29
34V11		42H30		53H30
34V12		42H31		53H31
34V13		42H32		53H32
34V14		42H33		53H33
34V15		42H34		53H34
34V16				53H35
34V17				

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2.4 Detension Tendons

Vertical Tendon No.	Vertical Tendon No.	[redacted]	Horizontal Tendon No.	Horizontal Tendon No.
45V22	34V18		42H22	
45V23	34V19		42H23	53H23
45V24	34V20		42H24	53H24
34V1	34V21		42H25	53H25
34V2	34V22		42H26	53H26
34V3	34V23			
34V4	34V24		42H35	
34V5	23V1		42H36	53H36
34V6	23V2		42H37	53H37
34V7	23V3		42H38	53H38
			42H39	53H39

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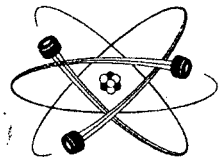

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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

RECEIVING, HANDLING AND STORAGE

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the receiving, storage and handling of materials and quality control inspections/data recording for the vertical and horizontal tendon work during the Steam Generator Replacement Project at Crystal River unit 3.

2.0 SCOPE

2.1 Equipment and material shall be received by owner, unloaded by owner and stored at an area at the jobsite as designated. Material must be released by owner prior to shipment and receipt inspected by owner.

2.2 The materials shall be received, stored and handled in accordance with ANSI N45.2.2. All instrumentation shall be classified Level B. Sheathing filler material, replacement tendon shipping containers, removed tendons and anchor heads and shims shall be Level C. All other materials and equipment shall be Level D. Owner will establish and maintain appropriate storage areas and levels while onsite.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

3.2 Owner Quality Control Personnel to perform all inspections and data recording.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

4.2 Owner Quality Control Personnel shall be qualified to a minimum of Level II capability in accordance with the requirements of ANSI N45.2.6.

5.0 EQUIPMENT

5.1 Cranes, forklifts as needed.

5.2 Miscellaneous shackles, slings, etc.

6.0 PRECAUTIONS

6.1 Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

CAUTION

DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING. DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 All Quality Control Documentation (QCD) points noted in this procedure are HOLD POINTS. The work shall not progress past or through a QCD without a verbal release from the Inspector.

CAUTION: Never connect a welding ground, perform welding on, or strike an arc near a stressed tendon.

8.0 PREREQUISITES

8.1 None.

9.0 PROCEDURE

9.1 RECEIVING

9.1.1 QCD - Notification - Unload material using appropriate equipment, slings, chains, etc. for the type of material received.

9.2 STORAGE AND HANDLING GREASE (SHEATHING FILLER)

9.2.1 QCD - Notification - Grease (sheathing filler) when received in bulk tanker trucks shall be offloaded into onsite storage tank provided by PSC. During offloading two one quart samples of the grease shall be obtained by the Owner Inspector identified and turned over for testing if needed.

9.2.1.1 The temperature in the storage tank can be maintained up to 250^0F while product is being actively used, and dropped down to 150^0F or heat turned off when product will not be used at Owner Supervision's determination. Product in the tank must be above the coils when the heat is turned off so the product can be easily reheated, otherwise new hot material may have to be added to get the system activated to heat up. Temperature of product should not exceed 250^0F during storage.

9.2.1.2 Grease from the storage tank may be transferred to 55 gal. drums or other containers for possible hand pumping and pouring of grease into some of the tendon void ends. If this is done containers should be clean (free of dirt, debris, water and any other possible source on contamination) and be protected from the elements after filling to prevent contamination by chlorides, sulfides, nitrates, and water.

9.2.2 If drums of grease are received they shall be stored on dunnage in a well drained area and be covered with plastic or tarps to protect them from the environment.

9.3 STORAGE AND HANDLING INSTRUMENTATION

9.3.1 All instrumentation except hydraulic rams when not in use shall be stored in tool trailers or indoor office space to protect from environmental and possible accidental damage.

9.3.1.1 The hydraulic rams when not in use may be stored on dunnage and placed to prevent accidental damage.

9.4 STORAGE AND HANDLING TENDONS, ANCHOR HEADS AND SHIMS

9.4.1 Tendons and anchorage hardware when removed from the containment shall be stored at the jobsite until scrapped or shipped offsite in accordance with the requirements of Owners applicable procedures.

9.4.1.1 Minimum storage for new material at the jobsite is to be in a well drained area with the items placed on pallets, racks or in boxes or on dunnage and covered to provide protection from the weather and possible contamination including exposure to direct sunlight.

9.4.1.2 All material will be handled using appropriate equipment, slings, chains, etc. to prevent damage or contamination.

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the Owner Quality Control Inspector on Data Sheet F&Q 3.0 or, Data Sheet F&Q 3.0A attached to this procedure or Owner Receipt/Storage Inspection Forms.

11.0 QUALITY CONTROL

11.1 For materials received, a preliminary visual inspection or examination shall be performed prior to unloading or placing into storage to determine if any damage occurred during shipping. Observations for unusual conditions shall include:

11.1.1 Fire - Charred paper, wood or paint indicating exposure to fire or high temperature.

11.1.2 Excessive Exposure - Weather-beaten, frayed, rusted, or stained containers indicating prolonged exposure during transit.

11.1.3 Environmental Damage - Water or oil marks, damp conditions, dirty areas, or salt film (indicating exposure to sea water or winter road salt chemicals).

11.1.4 Tie Down Failure - Shifted, broken, loose or twisted shipping ties, and worn material under ties, indicating improper blocking and tie down during shipment.

11.1.5 Rough Handling - Splintered, torn, or crushed containers indicating improper handling.

11.2 Any deficiencies found as a result of the inspections above will be immediately recorded on Receipt/Storage Inspection Forms. At the jobsite it will not be necessary to open any containers unless shipping damage is evident.

11.2.1 Receiving Inspections will be documented by the Inspector on Receipt/Storage Inspection Forms.

11.3 Once a tendon or anchorage hardware storage container is opened the visible areas of the tendon or anchorage hardware will be inspected for damage and corrosion condition per attached Specification EW101 Evaluative Criteria and results documented on Data Sheet F&Q 3.0A.

11.3.1 Anchor heads, bushing and shims will be checked for obvious damage and any deficiencies found as a result of inspection will be immediately corrected or appropriate corrective action proposed.

11.4 After storage inspection, bare metal areas of tendons if in evidence are to be coated with corrosion protection grease (1601 Amber or 2090P-4 or Owner approved equivalent).

11.5 Results of inspections are to be documented on Receipt/Storage Inspection Forms.

12.0 NOTIFICATION

12.1 Work shall not proceed beyond a QCD point, until Quality Control Inspector is notified.

12.2 Owner is to be notified of any reject conditions.

13.0 ATTACHMENTS

13.1 Data Sheet F&Q 3.0

13.2 Data Sheet F&Q 3.0A

13.3 Specification EW101 Evaluative Criteria

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RECEIVING INSPECTION DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

DATE OF RECEIVING INSPECTION: _____

MATERIAL RECEIVED	CONDITION ON RECEIPT		
TENDON IDENTIFICATION:	**ACCEPT**	**HOLD**	**REJECT**
ANCHORAGE HARDWARE:			

IF MATERIAL IS FOUND DAMAGED OR REQUIRES RECONDITIONING, STATE THE PROBLEM BELOW AND CORRECTIVE ACTION PERFORMED.

_____

_____

_____

_____

Q.C. INSPECTOR SIGNOFF: _____ **LEVEL:** _____ **DATE:** _____
Q.C. REVIEW: _____ **LEVEL:** _____ **DATE:** _____

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STORAGE INSPECTION DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

DATE OF STORAGE INSPECTION: _____

MATERIAL INSPECTED	CONDITION		
TENDON IDENTIFICATION:	**ACCEPT**	**HOLD**	**REJECT**
ANCHORAGE HARDWARE:			

IF MATERIAL IS FOUND DAMAGED OR REQUIRES RECONDITIONING, STATE THE PROBLEM BELOW AND CORRECTIVE ACTION PERFORMED.

_____

_____

_____

_____

Q.C. INSPECTOR SIGNOFF: _____ **LEVEL:** _____ **DATE:** _____
Q.C. REVIEW: _____ LEVEL: _____ DATE: _____

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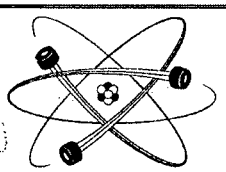

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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

EQUIPMENT PROOF TEST

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the proof testing of tensioning equipment and quality control inspections/data recording for the vertical and horizontal tendon work during the Steam Generator Replacement Project for Crystal River Unit 3. The proof-test shall demonstrate that the equipment functions safely under the most severe anticipated field conditions, and under maximum possible load, eccentricity, and misalignment.

2.0 SCOPE

2.1 Each set of tensioning equipment shall be proof tested and after proof testing shall be inspected prior to delivery to the jobsite.

2.2 Owner should be notified 14 days prior to the test so that they have the option to witness the test.

3.0 RESPONSIBILITY

3.1 Precision Surveillance Corporation Shop Personnel shall be responsible for the physical activities associated with this procedure.

3.2 Precision Surveillance Corporation, Quality Control or Engineering Personnel to perform all inspections and data recording.

4.0 QUALIFICATIONS

4.1 Precision Surveillance Corporation Shop Personnel shall be fit by skill, training and/or experience to perform these duties.

4.2 Precision Surveillance Corporation Quality Control Personnel shall be qualified to a minimum Level II capability in accordance with the requirements of ANSI N45.2.6.

4.3 Precision Surveillance Corporation Engineering Personnel shall have a four year degree from an accredited institution.

5.0 EQUIPMENT

5.1 Ram Calibration Stand

5.2 Hydraulic Pump

5.3 Hydraulic Ram with jack chair, pullrod with nut, and rod adaptor.

5.4 Hydraulic Pressure Gauge.

5.5 Miscellaneous hoses and connections.

6.0 PRECAUTIONS

6.1 Respect for the safety and well being of other personnel in the area must be observed.

6.2 Prior to applying any force to the tensioning equipment assure that all load bearing threaded connections are fully engaged.

6.3 During proof testing the following cautions shall be observed.

CAUTION

DO NOT STAND BEHIND THE RAM WHEN IT IS UNDER LOAD

KEEP FINGERS OUT OF ANY PINCH AREAS

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 All Quality Control Documentation (QCD) points noted in this procedure are HOLD POINTS. The work shall not progress past or through a QCD without a verbal release from the Inspector or Engineer.

8.0 PREREQUISITES

8.1 Owner should have been notified 14 days prior to the test so that they have the option to witness the test.

8.2 Prior to performing this proof-test the tensioning equipment will have been calibrated in accordance with PSC Procedure QA 12.8.G-W.

9.0 PROCEDURE

9.1 **QCD**-HOLD POINT- Set up the ram assembly so that the ram is out of alignment with the test stand by 3/16". (The test may also be performed by butting two ram assemblies together and obtaining the 3/16" misalignment in this way two ram assemblies are tested at the same time.)

9.1.1 This eccentric position of the ram is the maximum that can occur in the field when the ram is positioned on the tendon bearing plate.

9.2 **QCD**-HOLD POINT- The ram will be pressurized to a force of 1979KIPS and held at that force for approximately 5 seconds.

9.2.1 This 1979 KIPS is 106 percent of the maximum working load of 1867 KIPS for a 163 wire tendon.

9.3 **QCD**-HOLD POINT- While at maximum pressure, from a safe vantage point, inspect ram for hydraulic fluid leaks.

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9.4 **QCD**-HOLD POINT- After testing the ram shall be removed from the test stand or from the other ram and all components visually inspected for damage or defects.

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the PSC Quality Control Inspector or Engineer on Data Sheet F&Q 3.1 attached to this procedure.

11.0 QUALITY CONTROL

11.1 Document date of proof test.

11.2 Document acceptance of 3/16" eccentric alignment.

11.3 Document acceptance of 1979 KIPS force being held for 5 seconds.

11.4 Document no hydraulic fluid leaks at pressure.

11.5 Document the identity number of the ram, stressing rod, pull rod, pull rod nut and jack chair as applicable being proof tested.

11.6 Document the acceptance of visual examinations after proof test.

12.0 NOTIFICATION

12.1 PSC Quality Control Inspector or Engineer must be notified prior to working through a QCD-HOLD POINT.

13.0 ATTACHMENTS

13.1 Data Sheet F&Q 3.1

PSC PROCEDURE F&Q 3.1
EQUIPMENT PROOF TEST
DATA SHEET F&Q 3.1
August 29, 2008
Page 1 of 1
Revision 0

TENSIONING EQUIPMENT PROOF TEST DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3

STEAM GENERATOR REPLACEMENT PROJECT

DATE OF PROOF TEST: _____

(9.1) 3/16" ECCENTRIC ALIGNMENT: ☐ ACCEPTABLE

(9.2) 1979 KIPS HELD FOR 5 SECONDS: ☐ ACCEPTABLE

(9.3) NO OBSERVABLE HYDRAULIC FLUID LEAKS: ☐ ACCEPTABLE

RESULTS OF VISUAL INSPECTION

RAM IDENTITY NO. _____ ☐ ACCEPTABLE

STRESSING ROD IDENTITY NO. _____ ☐ ACCEPTABLE

PULL ROD IDENTITY NO. _____ ☐ ACCEPTABLE

PULL ROD NUT IDENTIY NO. _____ ☐ ACCEPTABLE

JACK CHAIR IDENTITY NO. _____ ☐ ACCEPTABLE

QC INSP.
or ENGINEER SIGNOFF _____ LEVEL _____ DATE _____

QC REVIEW _____ LEVEL _____ DATE _____

109 F&Q3.1.CR3.SGR

Precision Surveillance Corporation

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

TENDON INITIAL DEGREASING AND CAP REMOVAL

Gerald Brussone	*QA MANAGER*	*08/19/09*
Prepared by	Title	Date
	PROJECT MANAGER, P.E.	*08/19/09*
Approved by	Title	Date
	PRESIDENT	*08/19/09*
Approved by	Title	Date

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1.0 PURPOSE

1.1 This procedure will establish the requirements for the initial degreasing of tendons and quality control inspections/data recording during grease cap removal at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project. △1

2.0 SCOPE

2.1 The tendons to be initially degreased to the extent possible before tendon work begins are those vertical tendons to be removed, and vertical tendons to be de-tensioned but not removed as specified in PSC Procedure F&Q 2.0 or Owner Work Package. However, only tendons being detensioned and NOT removed, both vertical and horizontal, shall have grease quantity capture recorded for evaluation against replaced quantities. △1

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

5.0 EQUIPMENT

5.1 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, etc.

5.2 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

5.3 Device to depress end cap check valve.

5.4 A source of dry air (if required).

5.5 Air hose and fittings (if required).

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

6.2 A tendon grease cap weighs in excess of 100 pounds and may contain about 100 pounds of grease. Be prepared to support this weight when the grease cap is unbolted and removed. △1

110 F&Q5.0.CR3.SGR

6.3 The sheathing filler (grease) may be in liquid, gel or solid form. Tendons in the area of steam or feed penetrations in operating plants, may contain hot grease and some caution should be exercised.

6.4 Spilled grease from hoses and voids could be a slipping safety hazard, during all operations it should be cleaned up and placed in waste drums.

CAUTION NEVER STRIKE THE BUTTONHEADS, THE WIRES, OR THE ANCHORAGES OF A STRESSED TENDON WITH A HAMMER OR ANY OTHER OBJECT UNLESS AUTHORIZED.

HAVE SUFFICIENT QUANTITIES OR SIZES OF CONTAINERS ON HAND TO CATCH THE GREASE, AS IT MAY FALL FROM THE TENDON VOID, ANCHORAGE OR GREASE CAP.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 None.

8.0 PREREQUISITES

8.1 Assure this tendon is scheduled to have its grease removed.

9.0 PROCEDURE

9.1 INITIAL VERTICAL TENDON DEGREASING

9.1.1 In the tendon gallery locate the grease cap of the tendon to be degreased, place visqueen on the floor and up the walls to desired height and secure with tape.

9.1.2 Place an empty 55 gallon drum under the cap.

9.1.3 Remove the plug from the grease cap and attach device to depress end cap check valve. Have the plug from the top grease cap removed to allow the tendon to gravity drain. At the field superintendent's option for those tendons being removed the grease cap in the gallery may be removed to assist draining.

9.1.4 Note for those tendons not to be removed and replaced care should be taken to prevent rain or contamination from entering the cap while the plug is removed.

9.1.5 Full drums are replaced with another empty drum until the tendon is drained.

9.1.6 If it is determined that enough of the grease has not been removed by gravity draining an air hose may be attached to the top grease cap inlet and air pressure (not to exceed 100 psig) may be used to further degrease the tendon void. Be sure that adequate communication is provided at each end of the tendon so that each crew will know what actions are taking place.

9.1.7 Replace the grease cap plugs on both ends of the tendon after the tendon is degreased and identify on each grease cap that the tendon has been degreased.

9.1.8 On tendons to be removed bottom anchorages can be covered with a bag for protection instead of replacing the cap.

9.1.9 Remove waste grease drums for disposal offsite in accordance with the requirements of Owners applicable procedures and clean up any spilled grease.

10.0 REMOVAL OF GREASE CAP (VERTICAL OR HOOP)

10.1 Position platforms, if required, at the end of the tendon to have the cap removed.

10.2 Place a container and/or a protective cover under the tendon grease cap to protect adjacent areas from dripping grease.

10.3 Remove the bulk filler plug from the tendon end cap and depress the check valve to allow any excess pressure and/or bulk filler grease to escape. Reinstall plug after depressurization.

10.4 Remove the three (3) nuts and washers holding the end cap to the bearing plate ensuring that the end cap is fully supported as the nuts are being removed.

△1

10.5 Carefully, remove the grease cap to prevent any foreign matter from dropping into the grease in that cap. Remove the three 3/4" x 4-1/2" studs.

10.6 Clean and collect the grease from the grease cap.

10.7 For detensioned and not removed tendons only, determine the amount of grease that may have been lost during removal of the grease cap, plus the amount of grease removed from the anchorage during cleaning and record on Data Sheet F&Q 5.0.

11.0 DOCUMENTATION

11.1 The items requiring documentation in this procedure shall be documented by the assigned field construction person of the working crew on Data Sheet F&Q 5.0 attached to this procedure or the documentation provided in the Owner Work Package.

12.0 QUALITY CONTROL

12.1 None.

13.0 NOTIFICATION

13.1 Owner Field Supervision to be notified if any problems are encountered during the degreasing operations.

14.0 ATTACHMENTS

14.1 Data Sheet F&Q 5.0.

110 F&Q5.0.CR3.SGR

PSC PROCEDURE F&Q 5.0
TENDON INITIAL DEGREASING AND CAP REMOVAL
DATA SHEET F&Q 5.0
August 29, 2008
Page 1 of 1
Revision 0
Revision 1 6/24/2009

GREASE REMOVAL DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____

END IDENTIFICATION: _____ QUANTITY REMOVED: _____ GAL.

END IDENTIFICATION: _____ QUANTITY REMOVED: _____ GAL.

DATE: _____

1 SUPERINTENDENT (OR) CIVIL FIELD ENGINEER: _____

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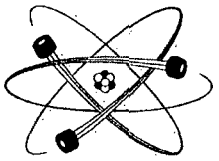

PSC
Precision Surveillance Corporation

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

TENDON DETENSIONING/REMOVAL FOR POSSIBLE REUSE

Gerald Brussani	*QA MANAGER*	*09/16/09*
Prepared by	Title	Date
	PROJECT MANAGER, P.E.	*09/16/09*
Approved by	Title	Date
Paul C. Lieb	*PRESIDENT*	*09/16/09*
Approved by	Title	Date

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1.0 PURPOSE

1.1 This procedure will establish the requirements for hydraulic ram de-tensioning and removal of tendons for possible reuse at Crystal River Unit 3 during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The vertical tendons to be de-tensioned by hydraulic ram and removed shall be as specified in Owner Work Package. Vertical tendons shall be de-tensioned from the top end as specified in the Owner Work Package.

2.2 Prior to de-tensioning a tendon a full visual inspection shall be performed on each tendon end and documented per PSC Procedure F&Q 15.1 and F&Q 15.2 or on Owner Work Package documentation.

2.3 The de-tensioning sequence shall be as specified on the Owner Work Package.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities and recording of documentation associated with this procedure.

4.0 QUALIFICATIONS

4.1 Owner Construction Personnel shall be fit by skill, training and experience to perform these duties and PSC tendon training program.

5.0 EQUIPMENT

5.1 Hydraulic ram (calibrated) and pump with appropriate hoses and fittings.

5.2 Hydraulic pressure gauge (calibrated).

5.3 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, etc.

5.4 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

CAUTION

DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.

DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

DO NOT THROW OR DROP OBJECTS.

6.2 The wire used for the tendons has a minimum breaking strength of 240,000 pounds per square inch. This means that each 7mm diameter wire is capable of withstanding a minimum breaking load of 14,317 pounds. Multiply this by 163 wires in a tendon and you are dealing with forces in excess of two million pounds per tendon.

CAUTION

(When using rams or on a tendon not being removed.)

NEVER CONNECT A WELDING GROUND, PERFORM WELDING ON, OR STRIKE AN ARC NEAR A STRESSED TENDON.

NEVER APPLY AN OPEN FLAME TO THE BUTTONHEADS, THE WIRES OR ANCHORAGES OF A STRESSED TENDON.

NEVER STRIKE THE BUTTONHEADS, THE WIRES OR THE ANCHORAGES OF A STRESSED TENDON WITH A HAMMER OR ANY OTHER METAL OBJECT.

6.3 Prior to applying ANY FORCE to the tendon, the stressing coupler must be fully engaged with the anchorage to be de-tensioned. Also check that the locking bolts on stressing rod (top part of two piece stressing rod) and coupler are present and fastened.

CAUTION

BE SURE THE STRESSING ROD IS FULLY ENGAGED WITH THE ANCHORAGE BEFORE APPLYING ANY LOAD, REGARDLESS OF HOW SMALL THAT LOAD MIGHT BE.

6.4 During de-tensioning operations the following cautions shall be observed.

CAUTION

NEVER EXCEED THE OVERSTRESS FORCE OR PRESSURE - 80% (1867 kips for a 163 wire tendon) or 11.46 kips FOR THE AMOUNT OF EFFECTIVE WIRES IN A TENDON.

DO NOT STAND BEHIND THE JACK WHEN IT IS UNDER LOAD.

KEEP HANDS AND FINGERS OUT OF ANY PINCH AREAS.

BE ALERT DURING SHIM PLACEMENT AND REMOVAL.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 HOLD POINT - Prior to de-tensioning a tendon the tendon owner inspector is to be notified to perform visual inspections and document IAW PSC Procedure F&Q 15.1 and 15.2.

8.0 PREREQUISITES

8.1 Prior to removing tendon grease will be drained.

8.2 Perform visual inspections IAW PSC Procedure F&Q 15.1 and F&Q 15.2.

8.3 Record on Data Sheet F&Q 6.0 or Owner Work Package documentation the information required for tendon number, tendon end and date of de-tensioning.

9.0 PROCEDURE

9.1 If not previously done, remove the grease cap or end protection from the end being de-tensioned.

9.2 ANCHORAGE CLEANUP

9.2.1 Grease shall be removed from the tendon end using clean non-metallic devices. Bristle brushes and rags with suitable quantities of Viscosity Oil, Viscor Industrial No. 16A solvent or Owner approved solvent to dilute and wash away the grease may also be required. This cleanup must be sufficient to permit engagement of the anchorage threads with the stressing rod threads.

9.3 TENDON DE-TENSIONING

9.3.1 HOLD POINT - Prior to de-tensioning a tendon a full visual inspection shall be performed on each tendon end and documented per PSC Procedure F&Q 15.1 and F&Q 15.2 or on Owner Work Package documentation.

9.3.1.1 De-tensioning of vertical tendons shall be performed on the top end as specified in Owner Work Package.

9.3.1.2 Align the ram stressing rod with the anchorage and the jack chair with the bearing plate. Ensure that the ram is in alignment within 1/8 inch. Record on Data Sheet F&Q 6.0 or Owner Work Package documentation the ram and gauge identification.

9.3.1.2.1 The stressing rod and coupler is now screwed onto the anchorage. (Rotate rod counter clockwise several revolutions to align threads, then clockwise to attach).

CAUTION

VERIFY RAM WILL NOT LOAD SUPPORT RIGGING WHEN PRESSURIZING RAM.

9.3.1.3 Before de-tensioning be sure opposite end of tendon is clear and not being worked on. Pressurize the ram until the shims under the anchorage become loose and can be removed.

9.3.1.3.1 NOTE: A tendon shall never be stressed beyond 80% of the Minimum Guaranteed Ultimate Tensile Strength (GUTS) of the effective wires in that tendon. A 163 wire tendon shall not exceed a force of 1867 kips. For a tendon with missing wires, the maximum tensile force shall be reduced accordingly by 11.46 kips/wire.

9.3.1.4 Remove all shims from between the anchorage and bearing plate. Reduce the ram pressure until the load is reduced to zero.

9.3.1.5 Set the anchorhead down on one 3" pair of shims.

9.3.1.6 The ram shall be uncoupled from the anchorage.

9.4 TENDON END CUTTING

9.4.1 On the top end bolt the pulling plate to the anchor head.

9.4.2 If lower anchorage is not loose couple pulling plate to coiler or crane, lift anchor head to allow removal of shims then lower tendon into void.

9.4.3 With all shims removed in the gallery and adequate tendon length exposed push gallery anchor head up to bearing plate exposing approximately 2 feet of wire.

9.4.4 Cut off buttonheads with hand grinder right behind the buttonheads ensuring a clean square cut.

9.4.5 Remove anchor head.

9.5 TENDON LENGTH VERIFICATION

9.5.1 Lift tendon with coiler or crane and place on 3" pair of shims.

9.5.2 Remove pulling plate.

9.5.3 Locate any outside wire and pry up to allow attachment of tendon wire puller (figure 1.0).

9.5.4 Pull the wire completely through the tendon duct.

9.5.4.1 After pulling, the entire length of the tendon wire shall be visually inspected for pitting, corrosion, or other signs of deterioration and evaluated in accordance with Specification EW101 in PSC Procedure F&Q 13.0. Solvent cleaning may be performed to facilitate cleaning before inspection.

9.5.4.1.1 Document the Category of Corrosion rating on Data Sheet 6.1, for every 10 feet of length.

9.5.4.1.2 If the Category of Corrosion has progressed beyond Condition "C" as defined in Specification EW101, Progress Energy Engineering shall be notified for disposition.

9.5.4.2 After the tendon wire has been pulled through, it shall be measured for length.

9.5.4.2.1 Document the total length of wire on Data Sheet 6.1.

9.5.4.3 After the tendon wire has been pulled, it may be cleaned of excess grease and coiled into coil form of approximately five-foot diameter. Secure the coil from unwinding.

9.6 TENDON REMOVAL

9.6.1 Re-attach pulling plate on anchor head.

9.6.2 For vertical tendon attach 5/16 inch cable only to cut end to facilitate cleaning at a latter date. Alternatively, a cable can be dropped down the void for cleaning after tendon removal at Owner Field Construction Personnel discretion.

9.6.3 Expand the coiler hub and attach the cable from the field coiler to the tendon end anchor head plate, bolt and apply a light tension on the cable with the coiler.

9.6.4 Coil the tendon placing a ¾" band approximately every 5' to ensure wires remain in a manageable bundle.

9.6.5 Coil the tendon on the coiler, using extra care as the anchor head enters the coiler. Place two bands on the tendon anchor head after the first revolution. After, band the tendon coils in the coiler for every new loop of the tendon as it is coiled (stagger the placement of the banding). The closer to the end of the tendon the more banding of the coils are needed in the coiler.

9.6.6 Carefully coil the tendon to ensure no crimped or bent wires.

9.6.7 Field Engineer to inspect tendon as it is removed for corrosion, water or other deleterious conditions.

9.6.8 Reverse the operation of the coiler and retract the hub to loosen the pulling cable and detach the pulling cable from the tendon end.

9.6.9 Hoist the tendon out of the uncoiler, wrap in plastic and lower it to the ground for storage.

9.6.10 If the tendon voids are to be cleaned at this time refer to PSC Procedure F&Q 11.0, if not protect the void end.

9.6.11 Since these tendon ends will have further work performed on them at a later date, the following methods of tendon end protection shall be used. The tendon end may be covered with a plastic bag or sheeting and taped to provide protection from the elements, or the grease cap may be replaced using the old gaskets.

9.6.12 Shims removed from a tendon shall be kept in matched pairs and protected from the elements by covering with plastic or placing in a temporary storage container until sent to storage.

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the Superintendent or Field Engineer on Data Sheet F&Q 6.0 and F&Q 6.1 attached to this procedure or Work Package documentation.

11.0 QUALITY CONTROL

11.1 None.

12.0 NOTIFICATION

12.1 Owner Site Shift Superintendent shall be notified of any problems encountered.

13.0 ATTACHMENTS

13.1 Data Sheet F&Q 6.0.

13.2 Data Sheet F&Q 6.0A.

13.3 Figure 1.0 – Tendon Wire Puller

RAM TENDON DETENSIONING DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____ TENDON END _____

DATE OF DETENSIONING: _____

ANCHORAGE ID/HEAT CODE: _____

NUMBER OF EFFECTIVE BUTTONHEADS: _____

RAM ID _____

GAUGE ID _____

De-tensioning Sequence Verification: _____

SUPERINTENDENT (OR) CIVIL FIELD ENGINEER: _____

PSC PROCEDURE F&Q 6.0
TENDON DETENSIONING/REMOVAL FOR POSSIBLE REUSE
DATA SHEET F&Q 6.0A
September 16, 2009
Page 1 of 1
Revision 0

Project: CRYSTAL RIVER UNIT 3 – SGR

Tendon No.: _____ Tendon End: _____

Removal Date: _____ Inspection Date: _____

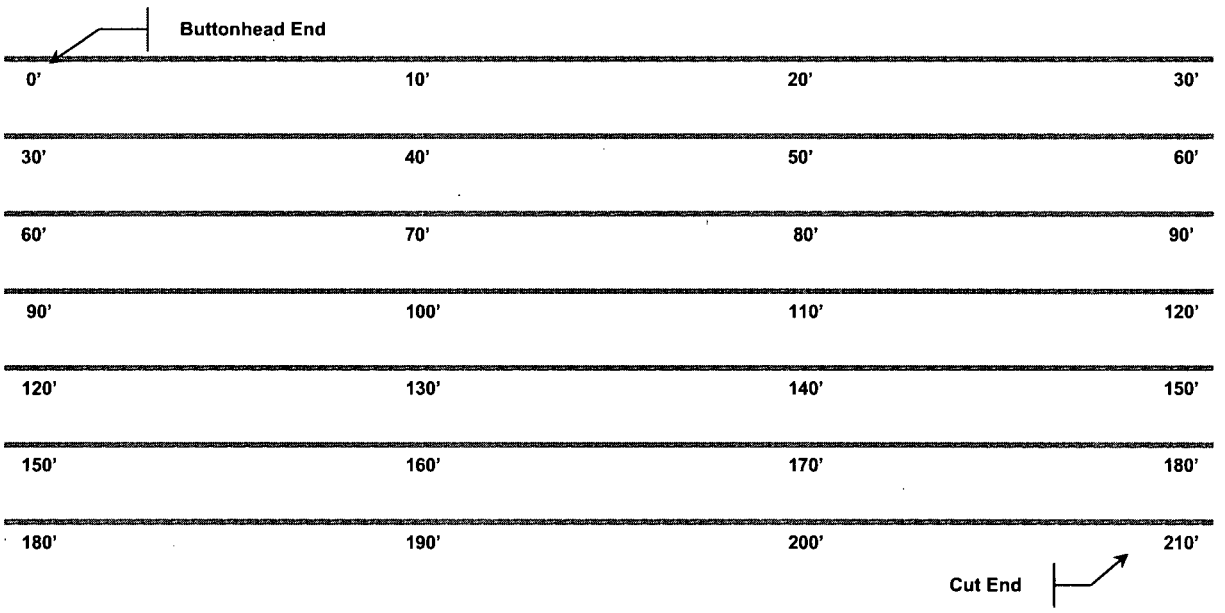
WIRE REMOVAL INSPECTION

CORROSION INSPECTION @ LENGTH INTERVALS

(8.5.4.1) Document the Corrosion Category for each 10' of wire in the increments below. Use Categories described in EW101.

(8.5.4.2) For Corrosion Levels D and E notification required. Req'd: ☐ NO ☐ YES _____

(8.5.4.3.1) Document the total length of the wire on the diagram below. Completed: ☐ NO ☐ YES



COMMENTS _____

CIVIL FIELD ENGINEER: _____ DATE: _____

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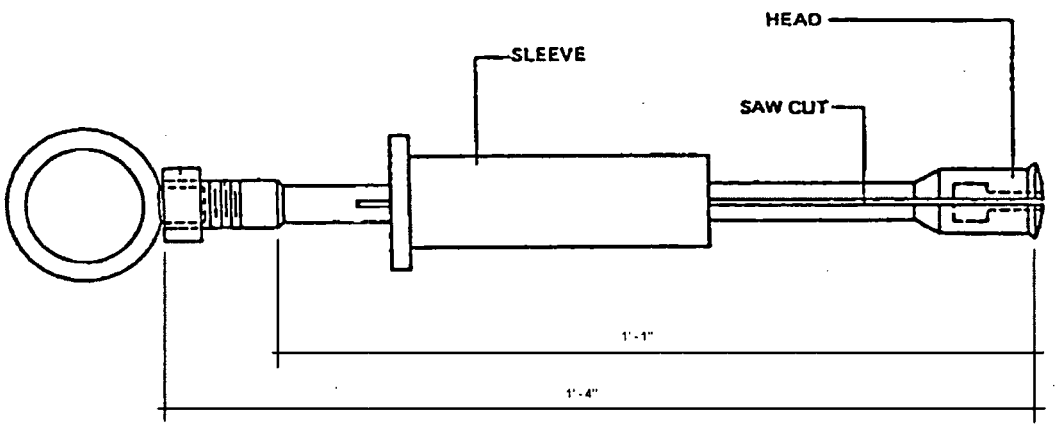
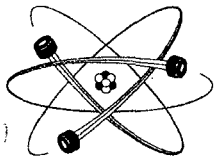
Figure 1.0 – Tendon Wire Puller

Figure 1.0 is a represented sample of a wire puller and is not a quality controlled device. The actual wire puller may vary somewhat from this configuration.





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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

PLASMA CUTTING TENDON DETENSIONING

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for plasma cutting de-tensioning of tendons at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The tendons to be de-tensioned by plasma cutting shall be as specified in PSC Procedure F&Q 2.0 or Owner Work Package.

2.2 The de-tensioning sequence shall be as specified in Owner Work Package.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities and recording of documentation associated with this procedure.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

5.0 EQUIPMENT

5.1 Plasma cutting equipment.

5.2 Shim, anchor head and button head catcher.

5.3 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, etc.

5.4 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

6.2 During plasma cutting operations, care should be taken to wear prescribed protective equipment such as proper eye protection, gloves, and to avoid burns from the plasma cutting and electrical shock.

6.3 Grease is flammable, during plasma cutting operations all Fire Watch restrictions and precautions are to be followed.

6.4 During plasma cutting operations, at the end of the tendon being cut a shim and button head catcher is to be in place as directed by the Owner Site Shift Superintendent to catch any projectile button heads.

6.5 On the opposite end of a tendon end that is being plasma cut care should be taken when the grease cap is removed as it could contain loose shims which could fall when the cap is removed.

CAUTION

DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.

DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

DO NOT THROW OR DROP OBJECTS.

DURING PLASMA CUTTING WEAR PROTECTIVE EQUIPMENT, AVOID BURNS AND ELECTRICAL SHOCK.

6.6 The wire used for the tendons has a minimum breaking strength of 240,000 pounds per square inch. This means that each 7mm diameter wire is capable of withstanding a minimum breaking load of 14,317 pounds. Multiply this by 163 wires in a tendon and you are dealing with forces in excess of two million pounds per tendon.

CAUTION

(When plasma cutting on a tendon to be removed and scrapped)

NEVER CONNECT A WELDING GROUND, PERFORM WELDING ON, OR STRIKE AN ARC NEAR A STRESSED TENDON WHICH IS NOT BEING SCRAPPED.

NEVER APPLY AN OPEN FLAME TO THE BUTTONHEADS, THE WIRES OR ANCHORAGES OF A STRESSED TENDON EXCEPT FOR THE END OF THE TENDONS THAT ARE TO BE PLASMA CUT AND SCRAPPED.

NEVER STRIKE THE BUTTONHEADS, THE WIRES OR THE ANCHORAGES OF A STRESSED TENDON WITH A HAMMER OR ANY OTHER METAL OBJECT.

6.7 The above actions could cause a button head or wire to fail. During tendon tensile testing, broken wires or button heads have been observed to penetrate hard lumber in excess of 4 inches in thickness, about the equivalent of a .32 caliber bullet.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 There are no Quality Control Documentation (QCD) points or HOLD POINTS in this procedure.

8.0 PREREQUISITES

8.1 Prior to removing a grease cap/tendon end protection assure that the proper tendon is being worked on.

8.2 Prior to de-tensioning vertical tendons that are to be removed from the void, grease is to have been drained and or blown from the tendon.

8.3 On the opposite end of the tendon to be plasma cut the grease cap is to be removed. The grease cleaned out of the cap and from around the anchorage and shims. A keeper plate is installed to the anchor head to hold the button heads in place during plasma cutting. The grease cap is replaced and tightened down. Care should be taken when this grease cap is removed after plasma cutting as it could contain loose shims which could fall when the cap is removed.

9.0 PROCEDURE

9.1 If not previously done, remove the grease cap or end protection from the end being de-tensioned.

9.2 ANCHORAGE CLEANUP

9.2.1 Grease shall be removed from the tendon end. Bristle brushes and rags with suitable quantities of Viscosity Oil, Viscor Industrial No. 16A solvent or Owner approved equivalent to dilute and wash away the grease may also be required. This cleanup must be sufficient to permit plasma cutting of button heads as verified by Superintendent.

9.3 TENDON DE-TENSIONING

9.3.1 During plasma cutting the grease cap at the other end not being cut is to remain on. The button heads of the tendon are to be plasma cut one at a time, if possible, until all the button heads are cut.

9.4 TENDON SHIM PROTECTION

9.4.1 Shims removed from a tendon shall be kept in matched pairs and protected from the elements by covering with plastic or placing in a temporary storage container until sent to storage.

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the assigned field construction person of the working crew on Data Sheet F&Q 8.0 attached to this procedure or as required by Owner Work Package.

11.0 QUALITY CONTROL

11.1 There is no quality control inspection or documentation required by this procedure.

12.0 NOTIFICATION

12.1 Owner Shift Superintendent shall be notified if there are any problems encountered with the plasma cutting operations.

13.0 ATTACHMENTS

13.1 Data Sheet F&Q 8.0.

PSC PROCEDURE F&Q 8.0
PLASMA CUTTING TENDON DETENSIONING
DATA SHEET F&Q 8.0
August 29, 2008
Page 1 of 1
Revision 0
Revision 1. 6/24/2009

PLASMA CUTTING TENDON DETENSIONING DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

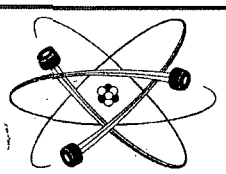
TENDON NO.: _____

DATE OF DETENSIONING: _____

De-tensioning Sequence Verification: _____

1 SUPERINTENDENT (OR) CIVIL FIELD ENGINEER: _____

111 F&Q8.0.CR3.SGR



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

RAM TENDON DETENSIONING

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for hydraulic ram de-tensioning of tendons and de-tensioning documentation at Crystal River Unit 3 for tendon work during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The tendons to be de-tensioned by hydraulic ram shall be as specified in Owner Work Package. Tendons can be de-tensioned from both ends or can be de-tensioned from one end as specified in the Owner Work Package.

2.2 Prior to de-tensioning a tendon the anchor head, shims, bearing plate and button heads are to be visually inspected and documented per PSC Procedure F&Q 15.1 or on Owner Work Package documentation.

2.3 The de-tensioning sequence shall be as specified on the Owner Work Package.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities and recording of documentation associated with this procedure.

4.0 QUALIFICATIONS

4.1 Owner Construction Personnel shall be fit by skill, training and experience to perform these duties and PSC tendon training program.

5.0 EQUIPMENT

5.1 Hydraulic ram (calibrated) and pump with appropriate hoses and fittings.

5.2 Hydraulic pressure gauge (calibrated).

5.3 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, etc.

5.4 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

CAUTION

DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.

DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

DO NOT THROW OR DROP OBJECTS.

6.2 The wire used for the tendons has a minimum breaking strength of 240,000 pounds per square inch. This means that each 7mm diameter wire is capable of withstanding a minimum breaking load of 14,317 pounds. Multiply this by 163 wires in a tendon and you are dealing with forces in excess of two million pounds per tendon.

CAUTION

(When using rams or on a tendon not being removed.)

NEVER CONNECT A WELDING GROUND, PERFORM WELDING ON, OR STRIKE AN ARC NEAR A STRESSED TENDON.

NEVER APPLY AN OPEN FLAME TO THE BUTTONHEADS, THE WIRES OR ANCHORAGES OF A STRESSED TENDON.

NEVER STRIKE THE BUTTONHEADS, THE WIRES OR THE ANCHORAGES OF A STRESSED TENDON WITH A HAMMER OR ANY OTHER METAL OBJECT.

6.3 Prior to applying ANY FORCE to the tendon, the stressing coupler must be fully engaged with the anchorage to be de-tensioned. Also check that the locking bolts on stressing rod (top part of two piece stressing rod) and coupler are present and fastened.

CAUTION

BE SURE THE STRESSING ROD IS FULLY ENGAGED WITH THE ANCHORAGE BEFORE APPLYING ANY LOAD, REGARDLESS OF HOW SMALL THAT LOAD MIGHT BE.

6.4 During de-tensioning operations the following cautions shall be observed.

CAUTION

NEVER EXCEED THE OVERSTRESS FORCE OR PRESSURE - 80% (1867 kips for a 163 wire tendon) or 11.46 kips FOR THE AMOUNT OF EFFECTIVE WIRES IN A TENDON.

DO NOT STAND BEHIND THE JACK WHEN IT IS UNDER LOAD.

KEEP HANDS AND FINGERS OUT OF ANY PINCH AREAS.

BE ALERT DURING SHIM PLACEMENT AND REMOVAL.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 HOLD POINT - Prior to de-tensioning a tendon Owner Inspector to be notified to perform a visual inspection and documentation of the anchor head, shims, bearing plate and button heads per PSC Procedure F&Q 15.1.

8.0 PREREQUISITES

8.1 Prior to removing a grease cap/tendon end protection or placing the jack on a tendon assure that proper tendon is being worked on. Record on Data Sheet F&Q 8.1 or Owner Work Package documentation the information required for tendon number, tendon end and date of de-tensioning.

8.2 The tendon anchorage end should be visually inspected per PSC Procedure F&Q 15.1 prior to de-tensioning.

9.0 PROCEDURE

9.1 If not previously done, remove the grease cap or end protection from the end being de-tensioned.

9.2 ANCHORAGE CLEANUP

9.2.1 Grease shall be removed from the tendon end using clean non-metallic devices. Bristle brushes and rags with suitable quantities of Viscosity Oil, Viscor Industrial No. 16A solvent or Owner approved solvent to dilute and wash away the grease may also be required. This cleanup must be sufficient to permit engagement of the anchorage threads with the stressing rod threads. Record on Data Sheet F&Q 8.1 the anchorage heat codes and amount of effective wires/button heads on tendon end.

9.3 TENDON DE-TENSIONING

9.3.1 HOLD POINT - Prior to de-tensioning a tendon Owner Inspector to be notified to perform a visual inspection and documentation of the anchor head, and for vertical tendons the bottom end plates, shims, bearing plate and button heads per PSC Procedure F&Q 15.1.

9.3.1.1 De-tensioning of tendons can be performed on both ends of the tendon in a simultaneous and controlled manner or on one tendon end for a vertical tendon as specified in Owner Work Package.

9.3.1.2 Align the ram stressing rod with the anchorage and the jack chair with the bearing plate. Ensure that the ram is in alignment within 1/8 inch. Record on Data Sheet F&Q 8.1 or Owner Work Package documentation the ram and gauge identification.

9.3.1.2.1 The stressing rod and coupler is now screwed onto the anchorage. (Rotate rod counter clockwise several revolutions to align threads, then clockwise to attach).

CAUTION

VERIFY RAM WILL NOT LOAD SUPPORT RIGGING WHEN PRESSURIZING RAM.

9.3.1.3 Before de-tensioning be sure opposite end of tendon is not being worked on. If opposite end of tendon is being worked on, coordinate with the opposite crew and continue. Pressurize the ram until the shims under the anchorage become loose and can be removed.

9.3.1.3.1 NOTE: A tendon shall never be stressed beyond 80% of the Minimum Guaranteed Ultimate Tensile Strength (GUTS) of the effective wires in that tendon. A 163 wire tendon shall not exceed a force of 1867 kips. For a tendon with missing wires, the maximum tensile force shall be reduced accordingly by 11.46 kips/wire.

9.3.1.4 Remove all shims from between the anchorage and bearing plate. Reduce the ram pressure until the load is reduced to zero. The ram shall be uncoupled from the anchorage.

9.4 TENDON END PROTECTION

9.4.1 Since these tendon ends will have further work performed on them at a later date, the following methods of tendon end protection shall be used. The tendon end may be covered with a plastic bag or sheeting and taped to provide protection from the elements, or the grease cap may be replaced using the old gaskets.

9.4.2 Shims removed from a tendon shall be kept in matched pairs and protected from the elements by covering with plastic or placing in a temporary storage container until sent to storage.

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the assigned field construction person of the working crew on Data Sheet F&Q 8.1 attached to this procedure or Work Package documentation.

11.0 QUALITY CONTROL

11.1 There is no quality control inspection or documentation required by this procedure.

12.0 NOTIFICATION

12.1 Owner Site Shift Superintendent shall be notified of any problems encountered.

13.0 ATTACHMENTS

13.1 Data Sheet F&Q 8.1.

112 F&Q8.1.CR3.SGR

PSC PROCEDURE F&Q 8.1
RAM TENDON DETENSIONING
DATA SHEET F&Q 8.1
August 29, 2008
Page 1 of 1
Revision 0
Revision 1. 6/24/2009

RAM TENDON DETENSIONING DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____ TENDON END _____

DATE OF DETENSIONING: _____

1 ANCHORAGE ID/HEAT CODE: _____

NUMBER OF EFFECTIVE BUTTONHEADS: _____

RAM ID _____

GAUGE ID _____

De-tensioning Sequence Verification: _____

1 SUPERINTENDENT (OR) CIVIL FIELD ENGINEER: _____

112 F&Q8.1.CR3.SGR

Precision Surveillance Corporation

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

TENDON REMOVAL

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the removal of tendons from tendon voids at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The tendons to be removed from the tendon voids shall be as specified in the Owner Work Package. Vertical Tendons shall be removed from the top, horizontal tendons shall be removed from the buttress as per the Owner Work Package.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

5.0 EQUIPMENT

5.1 Tendon Field Coiler.

5.2 Cleaning waffle, splice chucks and cables.

5.3 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, banders and banding materials, etc.

5.4 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations. The area in the tendon gallery where a tendon is being removed from the void is to be roped off and personnel are to be kept away from that area during tendon removal.

CAUTION: DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.

DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

DO NOT THROW OR DROP OBJECTS.

STAY AWAY FROM THE AREA IN THE TENDON GALLERY WHILE A TENDON IS BEING REMOVED

6.2 Use care when coiling the tendon, it tends to be quite springy and can cause injury if not properly restrained.

6.3 Waste grease from the voids could be a slipping safety hazard, during all operations it should be cleaned up and placed in waste drums.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 There are no Quality Control Documentation (QCD) points or HOLD POINTS in this procedure.

8.0 PREREQUISITES

8.1 Prior to implementing this procedure the field anchor head cut off operations on the tendon must have been performed as per PSC Procedure F&Q 8.0. If shims have not been removed from under a anchor head they are to be removed, kept in matched pairs and protected from the elements by covering with plastic or placing in a temporary storage container until sent to storage.

9.0 PROCEDURE

9.1 TENDON REMOVAL

9.1.1 Remove tendon end protection from each end of the tendon.

9.1.2 On the cut end of the horizontal tendon attach a minimum 5/16 inch cable with a void cleaning waffle to one of the cut wires using a wire/cable chuck. This cable will be pulled into the tendon void as the tendon is removed and may be left in the void for later use or removed. The cleaning waffle will remove all excess grease from the void.

9.1.3 The trumplet will have excess grease removed after tendon removal with manual degreasing devices.

9.1.4 For vertical tendon attach 5/16 inch cable only to cut end to facilitate cleaning at a latter date. If used, secure cable to top bearing plate. Alternatively, a cable can be dropped down the void for cleaning after tendon removal at Owner Field Construction Personnel discretion.

9.1.5 Expand the coiler hub and attach the cable from the field coiler to the tendon end anchor head plate, bolt and apply a light tension on the cable with the coiler.

9.1.6 Coil the tendon on the coiler, using extra care as the anchor head enters the coiler. Place two bands on the tendon anchor head after the first revolution. After, band the tendon coils in the coiler for every new loop of the tendon as it is coiled (stagger the placement of the banding). The closer to the end of the tendon the more banding of the coils are needed in the coiler.

9.1.7 Detach the waffle cleaner or 5/16 inch cable, if present, from the wire at the cut end of the tendon and secure the cable.

9.1.8 Reverse the operation of the coiler and retract the hub to loosen the pulling cable and detach the pulling cable from the tendon end.

9.1.9 Hoist the tendon out of the uncoiler, wrap in plastic and lower it to the ground for storage and subsequent scraping.

9.1.10 If the tendon voids are to be cleaned at this time refer to PSC Procedure F&Q 11.0, if not protect the void end as per Section 9.2 of this Procedure.

9.2 VOID END PROTECTION

9.2.1 After the tendon is removed from the void, the tendon void end may be covered with plywood or by attaching a temporary bearing plate cover to the bearing plate, or the grease cap may be replaced using the old gaskets to provide the voids protection from the elements.

10.0 DOCUMENTATION

10.1 There is no documentation required by this procedure.

11.0 QUALITY CONTROL

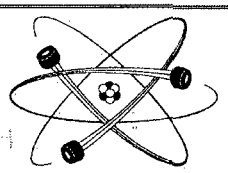
11.1 There is no quality control inspection or documentation required by this procedure.

12.0 NOTIFICATION

12.1 Owner Site Shift Superintendent or Field Engineer shall be notified if any areas of rust, water coating, damage or other types of deterioration are found on tendon wires.

13.0 ATTACHMENTS

13.1 None.



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

TENDON VOID CLEANING

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the cleaning of tendon voids at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The tendon voids to be cleaned of excess grease are for those tendons that have been removed and are to be replaced as specified in the Owner Work Package.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

5.0 EQUIPMENT

5.1 Lengths of 5/16" minimum cable.

5.2 Cleaning Waffles: A void cleaning device with attachment eyes on each end to accommodate the 5/16" minimum cable.

5.3 Walkie-Talkies: Or field phones for communications from one end of the void to the other.

5.4 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

CAUTION

DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.

DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

DO NOT THROW OR DROP OBJECTS.

6.2 Waste grease from the voids could be a slipping safety hazard, during all operations it should be cleaned up and placed in waste drums.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 There are no Quality Control Documentation (QCD) points or HOLD POINTS in this procedure.

8.0 PREREQUISITES

8.1 Prior to implementing this procedure the Tendon must have been removed from the void as per PSC Procedure F&Q 10.0.

8.2 Adequate communication must be maintained between both ends of the tendon void.

9.0 PROCEDURE

9.1 Remove tendon end protection from each end of the tendon sheath.

9.2 At the top end of the vertical tendon sheath or one end of the horizontal tendon sheath attach one end of a cleaning waffle to the 5/16" minimum cable that was left in the void from tendon removal. All connections between the cables and the cleaning waffle shall be made in a streamline fashion so that it does not pose a snagging hazard to the sheathing material.

9.3 Pull the 5/16" minimum cable into the void until another 5/16" minimum cable can be attached to the other end of the cleaning waffle. At this point there should be two 5/16" minimum cables attached to the cleaning waffle.

9.4 From the bottom end of the vertical tendon sheath or the other end of the horizontal tendon sheath pull the 5/16" minimum cable until the cleaning waffle is reached and disconnected and the remaining cable is removed from the sheath, clean up excess grease removed. Manually clean trumpet area of excess grease.

9.5 CAUTION: If the cleaning waffle becomes blocked in the void during cleaning of tendon voids and are not able to be pulled back by hand with the 5/16" minimum cable the Owner Site Shift Superintendent shall be notified for determination of additional action.

9.6 Once the cleaning is completed the tendon void ends will be protected by applying a temporary cover or grease cap attached to the bearing plate.

10.0 DOCUMENTATION

10.1 There is no documentation required by this procedure.

11.0 QUALITY CONTROL

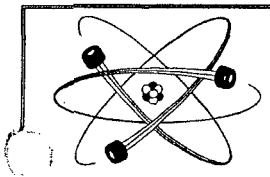
11.1 There is no quality control inspection or documentation required by this procedure.

12.0 NOTIFICATION

12.1 Owner Site Shift Superintendent shall be notified when there is any blockage in the tendon void preventing the cleaning waffle from being pulled through the sheathing.

13.0 ATTACHMENTS

13.1 None



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CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

TENDON INSTALLATION

Prepared by	*QA MANAGER* Title	*06/24/09* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*06/24/09* Date
~~Approved by~~	*PRESIDENT* Title	*06/24/09* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the installation of tendons and quality control inspections/data recording at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The tendons to be installed are those removed from the tendon voids as specified in the Owner Work Package. Vertical Tendons shall be installed from the top, horizontal tendons shall be installed from the buttress as per the Owner Work Package

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

3.2 Owner Quality Control Personnel to perform all inspections and data recording.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

4.2 Owner Quality Control Personnel shall be qualified to a minimum of Level II capability in accordance with the requirements of ANSI N45.2.6.

5.0 EQUIPMENT

5.1 Tendon Field Coiler, tendon puller (tugger).

5.2 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, etc.

5.3 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

5.4 Walkie-Talkies: Or field phones for communications from one end of the void to the other.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

CAUTION

DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.

DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

DO NOT THROW OR DROP OBJECTS.

6.2 Use care when uncoiling the tendon and installing it in the void. The tendon has considerable spring force and must be prevented from uncoiling violently.

6.3 If tendon becomes stuck do not exceed a pulling force of 35,000 lbs. on the tendon tugger.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 All Quality Control Documentation (QCD) points noted in this procedure are HOLD POINTS.

8.0 PREREQUISITES

8.1 Tendon void cleaning has been performed per PSC Procedure F&Q 11.0.

8.2 Verify sheathing is installed and braced to accept loads imposed during installation.

8.3 Verify correct tendon has been selected for installation into the selected tendon void.

9.0 PROCEDURE

9.1 If the pulling device, which is used to control the twists in the tendon and to assist with tendon insertion was not applied during storage, it will now be attached using the following steps:

9.1.1 Approximately the first three to four feet of the free end of the tendon will be solvent cleaned with Viscosity Oil, Viscor Industrial No. 16A solvent or Owner approved equivalent to remove the grease compound. This will allow placement of the grip assist material and placement of the Kellum's Grip.

9.1.2 About three to four feet of the tendon will be wrapped with a grip assisting material such as strips of rubber and tape, that will enhance the gripping properties of the Kellum's Grip. A nose cone will be added over the taped end, with a Kellum's Grip placed over the nose cone and grip assist material, and secured with tape, wire, or bands. This encasement shall be installed in a streamline fashion with no sharp edges, abrupt changes in geometry, etc.

9.1.3 Attach the pull back eyebolt to the shop anchor head if required.

9.2 Hoist the tendon with one sling and place it in the uncoiler.

9.2.1 With the tendon in the uncoiler, align the free end of the tendon with the exit/feed opening of the uncoiler. The uncoiler will provide the control for uncoiling and placing the tendon into the tendon void.

9.2.2 The pull back eyebolt is secured to the spindle of the uncoiler. This will keep the shop anchor head securely out of the way during uncoiling.

9.2.3 Expand the coiler hub and install the tendon retention braces.

9.2.4 At any time prior to pulling in the tendon a tendon puller, also called a "tugger" may be attached to the bearing plate at the pulling end of the tendon void or a puller cable may be positioned at this end. Tendon feed-in guide rolls may be attached to the bearing plate at the feed-in end of the tendon void.

9.2.5 A length of 1/4 inch wire or trailer cable will be placed in the void to use as a "messenger" through the sheath and hook up the tendon puller cable. Pull back the cable with the wire or cable and once out at the feed-in end, hook up the cable to the tendon.

9.2.6 The outer bands holding the tendon in a coil shape can now be cut. Do not cut all coil holding bands. Do not cut the bands holding the wires in a bundle. Coil bands are cut to free up the coil as the tendon is being pulled into the void.

9.2.7 Gradually rotate the uncoiler while placing the tendon into the void with the tendon puller cable.

9.2.7.1 Regulate the speed of the uncoiler while maintaining communications with the placing crews at each end of the tendon void, so that the bands holding the wire in a bundle can be cut and removed just before entering the tendon void. The remaining coil holding bands will be cut as the tendon is being placed.

9.2.8 If the tendon is to be button headed at a later time, be certain the protective cap or plate over the shop anchor head is still in position. At this time, place the tendon such that the free wire end is protruding approximately 3 to 4 feet beyond the face of the bearing plate. The threaded bolt/eye bolt inserted onto the shop anchor head is used to guide the shop anchor head into the trumpet.

9.2.9 The grip assisting material and kellum's grip and nose cone may be removed at this time or later before button heading.

9.2.10 If button heading is not to be performed at this time, the following methods of tendon end protection may be used on the ends at the discretion of the Owner Site Superintendent. The tendon end may be covered with a plastic bag or sheeting and taped to provide protection from the elements, or the grease cap may be replaced using the old gasket.

115 F&Q13.0.CR3.SGT

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the Owner Quality Control Inspector on Data Sheet F&Q 13.0 attached to this procedure or on documentation provided in Work Packages.

11.0 QUALITY CONTROL

11.1 **QCD** - Inspector to document on Data Sheet F&Q 13.0 the information required for tendon number and date of installation.

11.2 **QCD** - During tendon installation, as it is being pulled into the void, the Inspector shall inspect the visible portion of the tendon wires for corrosion condition observing the requirements of attached Specification EW101 - Evaluative Criteria and document the wire condition rating.

11.3 Any other damage or adverse conditions noted by the Inspector are to be noted in the comments area of Data Sheet F&Q 13.0 or on documentation provided in Owner Work Packages.

12.0 ATTACHMENTS

12.1 Data Sheet F&Q 13.0

12.2 Specification EW101 - Evaluative Criteria

115 F&Q13.0.CR3.SGT

TENDON INSTALLATION DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON LOCATION NO.: _____

TENDON IDENTIFICATION NO. (FROM TAG)_____

WIRE CORROSION CONDITION: A or B or C or D or E
(CIRCLE ONE)

COMMENTS:_____

_____

_____

_____

QC INSP. SIGNOFF_____LEVEL_____ DATE_____

QC REVIEW_____LEVEL_____ DATE_____

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SPECIFICATION EW101 - EVALUATIVE CRITERIA

The following criteria shall be used for evaluation during visual inspection of tendon wire. Wire in Condition Rating A, B or C is considered acceptable. Owner shall be notified of any evaluation classified as either "D" or "E". Sandpaper cleaning, as noted below, is only a means of evaluating the true condition of the wire and will be done only at the discretion and approval of the Quality Control Inspector.

1. A = EXCELLENT CONDITION

   Bright, uniformly colored wire; no foreign matter, visible rust or pitting. No cleaning for inspection is required. Two heavy passes with 100 grit sandpaper to bright metal.

2. B = GOOD CONDITION

   Partial loss of color; little foreign matter and a small quantity of light rust may be present; no pitting. The oxide coat will be more discernable when viewed parallel to the length of the wire. Rag wipe cleaning may be required for inspection. Five heavy passes with 100 grit sandpaper to bright metal. NOTE: ANY FOREIGN MATTER OR LIGHT RUST FOUND IS TO BE REMOVED.

3. C = FAIR CONDITION

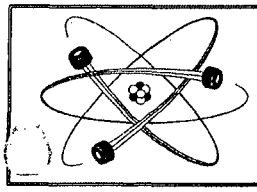
   Major loss of color; some foreign matter and a large quantity of light rust may be present; no pitting. Rag cleaning or steel wool may be required for inspection. Ten heavy passes with 100 grit sandpaper to bright metal. NOTE: ANY FOREIGN MATTER OR LIGHT RUST FOUND IS TO BE REMOVED.

4. D = UNUSABLE CONDITION

   Almost total loss of color; much foreign matter and small quantities of heavy rust in the form of red oxide dust; no pitting. Rag wiping, steel wool and sandpaper cleaning will be required for inspection. Twenty heavy passes with 100 grit sandpaper to bright metal.

5. E = REJECTED CONDITION

   Area of hard, crusty, scaly red oxide, when cleaned show definite signs of pitting. Pits are defined as indentations of a depth of 1/64" or deeper and a minimum of 1/32" in diameter. Anytime pitting is in evidence, the material shall be graded as rejected. Thirty or more passes with 100 grit sandpaper to bright metal.



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

TENDON FIELD ANCHOR HEAD AND BUTTONHEADING APPLICATION

J Bussone	*QA MANAGER*	*06/24/09*
Prepared by	Title	Date
	PROJECT MANAGER, P.E.	*06/24/09*
Approved by	Title	Date
	PRESIDENT	*06/24/09*
~~Approved by~~	Title	Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the application of field anchor heads to tendons and field buttonheading of the tendons along with quality control inspections/data recording at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The tendons to have the field anchor head and buttonheads applied shall be for those tendons removed as specified in the Work Package. Vertical Tendons shall have the button heads and anchor head applied to the bottom (tendon gallery) end of the tendon wires. Horizontal tendons shall have the button heads and field anchor head applied at the buttress as per the Work Package.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

3.2 Owner Quality Control Personnel to perform all inspections and data recording.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

4.2 Owner Quality Control Personnel shall be qualified to a minimum of Level II capability in accordance with the requirements of ANSI N45.2.6.

5.0 EQUIPMENT

5.1 B-End Device.

5.2 Tendon Field Button header.

5.3 Button head GO, No-Go Gauge, Feeler Gauges, Optical Comparator, Eccentricity Gauge.

5.4 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, etc.

5.5 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

CAUTION

DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.

DO NOT PERMIT OTHERS TO STAND UNDER LOADS.

DO NOT THROW OR DROP OBJECTS.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 All Quality Control Documentation (QCD) points noted in this procedure are HOLD POINTS.

8.0 PREREQUISITES

8.1 The tendon will have been installed in the void.

9.0 PROCEDURE

9.1 APPLYING ANCHORHEAD

9.1.1 Prepare the field end by removing any protective coverings or pulling devices.

9.1.2 Make sure the end of the tendon protrudes beyond the bearing plate about 3-4 feet.

9.1.3 If needed, clean the individual wires with #16A Solvent or Owner approved equivalent about 18 inches from the end.

9.1.4 Position the anchor head into the tendon button heading frame or holder making sure the buttonhead bearing side of the anchor head faces away from the bearing plate.

9.1.5 With the anchor head properly placed in the holder, run it back toward the bearing plate until the wire ends would extend about 2 inches into the anchor head.

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9.1.6 Place each wire into the anchor head by slightly bowing it and allowing it to snap into the wire hole. Place the bottom wires of the tendon into the lower quadrant holes of the anchor head, keeping the wires as parallel as possible to prevent wire crossing. Do not miss holes while placing the wires, as it will be very difficult to place a missed wire in the center wire holes when all the surrounding holes are filled.

9.1.6.1 If a hole is missed, it may be necessary to remove some placed wires to allow placement of the missed wires.

9.1.7 After all the wires are placed, push the anchor head back towards the bearing plate to allow free wire length for buttonheading operations. The tendon is now ready to be buttonheaded.

9.2 BUTTONHEADING MACHINE and OPERATOR QUALIFICATION

9.2.1 Prior to forming any buttonheads on a tendon, the buttonhead machine and operator will be tested for the ability to form acceptable buttonheads, observing the requirements of this procedure.

9.2.2 As a minimum, the machine shall be qualified whenever another machine is substituted; whenever the machine has had mechanical repairs or parts replacement that would influence the forming of the buttonhead; or whenever the machine is determined to be responsible for forming unacceptable buttonheads.

9.2.3 Each machine or operator qualification shall be by forming buttonheads on each end of three sample wires about 12 inches in length.

9.2.4 **QCD** Notification - The buttonheads shall be inspected for acceptability observing the requirements of PSC Buttonhead Specification BHCR3, seen attached to this Procedure. The buttonhead diameter shall be checked with a Go No-Go Gauge or micrometer, with visual inspection for splits and eccentricity. If the visually inspected buttonheads appear to exceed the acceptance criteria, they shall be mechanically checked with the appropriate gauge for the suspect deficiency.

9.2.5 If all the buttonheads are acceptable, that machine and operator is therefore qualified for the forming of buttonheads.

9.2.6 Machines that do not form acceptable buttonheads, excluding problems with the wire, shall not be used in the forming of buttonheads until that machine is repaired and qualified or replaced by a qualified machine. Operators that do not form acceptable buttonheads shall not form buttonheads in production until qualified.

9.2.7 The qualification of each machine and operator tested shall be documented on the Buttonheading Machine Qualification Sheet by the QC Inspector.

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9.3 FIELD BUTTONHEADING

9.3.1 Be sure the wire ends are clean and dry. Remove any built-up corrosion protection material from approximately the first 12 inches of the wire.

9.3.2 Set up the buttonheader and pump for access to the tendon to be buttonheaded. Generally, if the buttonheader is suspended from an overhead support and at the level of the tendon end, it can be swung back and forth with relative ease.

9.3.3 Buttonhead each wire in the tendon by sliding the wire into the buttonheader. Push the buttonheader against the wire until the wire is seated all the way into the header against the heading die. Be sure the wire is centered in the jaws of the header. Actuate the header and form a buttonhead on each wire.

9.3.3.1 During the course of the button heading operations the production person forming the button heads shall make the following checks:

9.3.3.1.1 100% of the buttonheads should be visually checked for splits and eccentricity.

9.3.3.1.1.1 Buttonheads that appear to have large splits, or appear to be eccentric will be tagged with a piece of tape wrapping for further evaluation by the QC Inspector at a later time. If a total of 4 button heads are tagged for large splits or eccentric heads, the buttonheading operation on the tendon will stop and the Owner Site Superintendent, QC Inspector, and Field Engineer is to be notified.

9.3.3.1.2 As work progresses a random sampling 10% diameter check of the buttonheads shall be performed, using the Go No-Go Gauge.

9.3.3.1.2.1 If a buttonhead is found unacceptable it will be tagged with a piece of tape wrapping for further evaluation by the QC Inspector at a later time. The production person forming the buttonheads should check the next 5 buttonheads formed using the Go No-Go Gauge and if 2 of them are unacceptable, the buttonheading operation on the tendon will stop and the Owner Site Superintendent and QC Inspector is to be notified.

9.3.3.2 Based on the above inspections:

9.3.3.2.1 For three or less rejectable buttonheads, the tendon will be considered acceptable for stressing operations.

9.3.3.2.2 For number of rejectable buttonheads greater than three rejected button heads shall be cut off and re-buttonheaded.

9.3.3.2.3 If four or more buttonheads are rejected after re-buttonheading in step 9.3.3.2.2, all 163 buttonheads shall be cut off and re-buttonheaded.

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9.3.3.2.4 When less than all 163 wires are to be cut, each wire shall not be shortened by more than 3/4", measured from the outer end of the button head, unless approved by Responsible Engineer.

9.3.3.2.5 Individual buttonhead wires may be cut off more than once if the total shortening, relative to the length of the majority of wires, is not more than 3/4".

9.4 **QCD**-Notification-REGREASING THE SHOP HEAD

9.4.1 After the buttonheading and the QC Inspector's buttonhead inspection is completed smear on or brush on a light coating of grease onto the wires so the wires are greased inside the anchor head holes. Retract the field applied anchor head away from the bearing plate seating as many of the buttonheads as possible.

9.4.1.1 Smear on or brush a light coating of grease onto the button heads, wires and anchorage.

9.4.2 If re-stressing of the tendon is not to be performed at this time, the following methods of tendon end protection must be used on the ends at the discretion of the Owner Site Superintendent. The tendon end must be covered with a plastic bag or sheeting and taped to provide protection from the elements, or the grease cap may be replaced using the old gaskets.

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the Owner Quality Control Inspector on Data Sheet F&Q 14.0 attached to this procedure or documentation provided in the Work Package.

11.0 QUALITY CONTROL

11.1 Inspector to document on Data Sheet F&Q 14.0 or documentation provided in the Work Package the information required for tendon number, field anchor head identification and date of buttonheading.

11.2 The Inspector will check buttonheads formed during Buttonheading Machine and Operator Qualification and document on Buttonheading Machine Qualification Sheet or documentation provided in the Work Package.

11.3 After buttonheading is complete and before the field anchor head is pulled back the following buttonhead inspection are to be performed by the Inspector and documented on Data Sheet F&Q 14.0 or documentation provided in the Work Package.

11.3.1 100% of the buttonheads shall be visually checked for splits and eccentricity.

11.3.1.1 Buttonheads that appear to be at or near the limiting criteria for splits and/or eccentricity, will be further evaluated for acceptability by using the appropriate mechanical gauging device.

11.3.2 A random sampling 10% check of the buttonheads should be performed, using the Go No-Go Gauge.

11.3.2.1 If a buttonhead is found unacceptable, all adjacent buttonheads, those surrounding the unacceptable head, will be checked. This secondary check will not be counted as part of the 10% check. If no additional unacceptable heads are found, that tendon will be accepted. If one or more additional heads are found to be unacceptable, 100% of the buttonheads on that tendon will be checked.

11.3.2.2 Buttonheads that do not pass the Go portion of the Go No-Go Gauge and where splits are in evidence, may be further evaluated by visually examining or physically measuring the split to verify that it does not exceed the acceptance criteria of BHCR3. If the split is within the parameters of BHCR3, then the button head will be measured with a micrometer or caliper at a point perpendicular to the split. This measurement will not exceed 0.475 of an inch.

11.3.2.2.1 The geometric function of an acceptable size split on a button head, near or at the 0.475 of an inch limit, will have a tendency to elongate the button head, so that it might not pass through the Go portion of the Go No-Go Gauge.

11.3.2.3 Double buttonheads are acceptable provided they pass the Go No-Go Gauge for size conformity and visual check for splits and eccentricity. All double headed buttonheads should be checked as noted above and will not be counted as part of the normal 10% check.

11.3.3 A minimum of 5 buttonheads shall be checked for eccentricity with the appropriate mechanical device to the acceptance criteria stated in BHCR3. Buttonheads outside the acceptable tolerance shall be marked as rejectable with tape and evaluated per Section 12.3.

11.3.4 Whenever a "secondary check" or 100% check for buttonhead size has been performed it will be noted as "secondary check" or "100% check" in the comments area of Data Sheet F&Q 14.0.

12.0 NOTIFICATION

12.1 Owner Site Superintendent and QC Inspector to be notified if splits or unacceptable sized buttonheads are encountered as defined in sections 9.3.3.1.1.1 and 9.3.3.1.2.1.

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12.2 Owner to be notified for disposition if 4 or more buttonheads on a tendon are found to be reject during QC Inspector's buttonhead inspection.

13.0 ATTACHMENTS

13.1 Data Sheet F&Q 14.0.

13.2 Buttonheading Machine/Operator Qualification Sheet.

13.3 Button head Specification BHCR3.

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TENDON BUTTON HEADING DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____ FIELD HEAD (END PLATE) ID: _____

DATE OF BUTTON HEADING: _____

BUTTON HEADING MACHINE NO.: _____

MACHINE OPERATOR QUALIFIED?: _____

INSPECTIONS	ACCEPTABLE (CHECK)	REJECTABLE
GO, NO-GO	(OK) _____	_____
SPLITS	(OK) _____	_____
ECCENTRICITY	(OK) _____	_____
TOTAL UNACCEPTABLE HEADS		_____

QC GAUGES USED:

GO, NO-GO _____ Recal. Date_____

ECCENTRICITY_____ Recal. Date_____

FEELER GAUGE OR OPTICAL COMPARATOR_____ Recal. Date_____

COMMENTS_____

_____

_____

QC INSP. SIGNOFF _____ LEVEL _____ DATE _____

QC REVIEW _____ LEVEL _____ DATE _____

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BUTTON HEADING MACHINE/OPERATOR QUALIFICATION SHEET

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

BUTTON HEADING MACHINE ID: _____

DATE: _____

SHIFT: _____

OPERATOR: _____

INSPECTOR: _____

INSPECTION CHECKS:

Indicated in-tolerance dimension by check mark.

	Wire #1	Wire #2	Wire #3
1. Head diameter:	_____	_____	_____
2. Head height:	_____	_____	_____
3. Head eccentricity:	_____	_____	_____
4. Split/Crack criteria:	_____	_____	_____

Remarks of general appearance check (Visual):

_____
_____
_____
_____
_____

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BUTTON HEAD SPECIFICATION BHCR3

The following describes the characteristics and acceptance criteria that have been established for Buttonheads. This procedure is based on Inryco Button head Specification BH102.

1. INTRODUCTION:

   The ultimate strength of wires with upset button heads, as used for the Post Tensioning method, depends on the following factors:

   - Hardness of the anchor head
   - Dimensions of borehole in the anchor head
   - Button head dimensions
   - Button head eccentricity

   For button heads on stress relieved wire corresponding to ASTM A421 Type BA, to 0.2756 inch diameter, to develop the ultimate strength of wire, the following standards must be met:

2. Dimensions of Wire Hole

   For the most effective performance of the button head, the bore through the base material must be .286" to .300". The corners at the button head bearing surface will be broken to .015" chamfer + .010", - .005".

3. Button head Dimensions

   4.1. Diameter: 0.410 inch minimum to 0.450 inch maximum

4. Button head Defects

   5.1. Fissures in Button heads

   5.1.1. Splits are defined as fissures with their larger dimension oriented within +/- 50^0 to the wire axis. Split width is the dimension perpendicular to larger dimension.

   a. Maximum split width allowed for any one split: 0.060 inches.

   b. A button head may have several splits, maximum 4 per buttonhead.

   c. Button heads with splits which bisect the button head shall be rejected.

   d. Splits shall not intersect.

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5. Eccentricity of Button heads

Button head eccentricity is defined as a lack of alignment between the axis of the button head with the axis of the wire.

Maximum allowable eccentricity: 0.010 inches.

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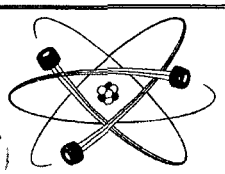

PSC
Precision Surveillance Corporation

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

TENDON RESTRESSING

Prepared by	*QA MANAGER* Title	*06/24/09* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*06/24/09* Date
Approved by	*PRESIDENT* Title	*06/24/09* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the re-stressing of tendons and quality control inspections/data recording at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

2.0 SCOPE

2.1 The tendons to be re-stressed are those new tendons installed to replace those removed from the tendon voids and those de-tensioned but not removed as specified in the Work Package. Vertical tendon stressing shall be performed from the top of the containment. Horizontal tendon stressing shall be performed from both ends.

2.2 The re-stressing sequence shall be as specified in Work Package.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

3.2 Owner Quality Control Personnel to perform all inspections and data recording.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

4.2 Owner Quality Control Personnel shall be qualified to a minimum of Level II capability in accordance with the requirements of ANSI N45.2.6.

5.0 EQUIPMENT

5.1 Hydraulic ram (calibrated) and pump with appropriate hoses and fittings.

5.2 Hydraulic pressure gauge (calibrated).

5.3 O.030" feeler gauges or shim stock.

5.4 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, etc.

5.5 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

> CAUTION
>
> DO NOT STAND UNDER LOADS WHILE STATIONARY OR DURING HOISTING.
>
> DO NOT PERMIT OTHERS TO STAND UNDER LOADS.
>
> DO NOT THROW OR DROP OBJECTS.

6.2 The wire used for the tendons has a minimum breaking strength of 240,000 pounds per square inch. This means that each 7mm diameter wire is capable of withstanding a minimum breaking load of 14,317 pounds. Multiply this by 163 wires in a tendon and you are dealing with forces in excess of two million pounds per tendon.

> CAUTION
>
> NEVER CONNECT A WELDING GROUND, PERFORM WELDING ON, OR STRIKE AN ARC NEAR A STRESSED TENDON.
>
> NEVER APPLY AN OPEN FLAME TO THE BUTTONHEADS, THE WIRES OR ANCHORAGES OF A STRESSED TENDON.
>
> NEVER STRIKE THE BUTTONHEADS, THE WIRES OR THE ANCHORAGES OF A STRESSED TENDON WITH A HAMMER OR ANY OTHER METAL OBJECT.

6.3 Prior to applying ANY FORCE to the tendon, the stressing rod and coupler must be fully engaged with the anchorage.

> CAUTION
>
> BE SURE THE STRESSING ROD IS FULLY ENGAGED WITH THE ANCHORAGE BEFORE APPLYING ANY LOAD, REGARDLESS OF HOW SMALL THAT LOAD MIGHT BE.

6.4 During stressing operations the following cautions shall be observed.

CAUTION

NEVER EXCEED THE OVERSTRESS FORCE OR PRESSURE - 80% (1867 kips for a 163 wire tendon) or 11.46 kips FOR THE AMOUNT OF EFFECTIVE WIRES IN A TENDON.

DO NOT STAND BEHIND THE JACK WHEN IT IS UNDER LOAD.

KEEP FINGERS OUT OF ANY PINCH AREAS.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

△1 7.1 All Quality Control Documentation (QCD) points noted in this procedure are HOLD POINTS.

8.0 PREREQUISITES

8.1 For tendons with 162, 161 or 160 effective wires, the force as shown on Work Package shall be prorated as follows:

8.1.1 Number of EFFECTIVE WIRES divided by 163 STANDARD times Pre-Tensioning Force (PTF) equals Prorated Pre-Tensioning Force

8.1.2 Number of EFFECTIVE WIRES divided by 163 STANDARD times Overstress Force (OSF) equals Prorated Overstress Force

8.1.3 Number of EFFECTIVE WIRES divided by 163 STANDARD times Lock-Off Force equals Prorated Lock-Off Force.

9.0 PROCEDURE

9.1 Remove tendon end protection.

9.2 **QCD** - Notification - Grease shall be removed from the tendon end using clean non-metallic devices. Bristle brushes and rags with suitable quantities of Viscosity Oil, Viscor Industrial No. 16A solvent or Owner approved equivalent to dilute and wash away the grease may also be required. This cleanup must be sufficient to permit engagement of the anchorage threads with the stressing rod threads.

9.3 Align the jack coupler with the anchorage and the jack chair with the bearing plate.

9.4 The coupler is pressed against the anchorage and is now screwed onto the anchorage. (Rotate coupler or rod counter clockwise several revolutions to align threads, then clockwise to attach).

9.5 Approximately equalize the anchor head distance from the bearing plate on both ends of a horizontal tendon, adjust anchor head location if necessary.

9.6 NOTE: Vertical tendons are only stressed from one end, from the top of the containment.

9.7 **QCD** - HOLD POINT - Rams shall be pressurized to a Pre-tensioning Force (PTF), that force necessary to bring the tendon into a lightly stressed condition to remove slack and seat the button heads. This force establishes the base for Elongation Measurement. This force shall be shown on Work Package to remove slack from the tendon. Record pressure and elongation. (NOTE: The elongation can be measured with the bearing plate and anchor head as a reference point. The methodology to be used is to select a reference based on field conditions.)

9.7.1 Verify that the equipment and tendon are stable. Verify that anchor heads are parallel to the base plates to within +/- 1/8 inches and that all button heads are seated properly. For this and following steps the stressing crews shall be in continuous contact during the performance of the work.

9.7.2 Ram pressures shall be maintained within 1,000 psi of each other. At final lock-off values the ends of double end stressed tendons should be adjusted if needed to be so that gap between bearing plate and anchor head at each end be within 1 inch of each other.

9.8 **QCD** - HOLD POINT - Rams shall be pressurized to the Overstress Force (OSF) shown on Owner Work Package unless a prorated Overstress Force is required by section 8.1, hold for 1 minute verifying that all load induced movements have ceased, record pressure and elongation.

9.8.1 If it is necessary to go beyond the maximum travel of the ram, fill the space between the bearing plate and anchor head with shims, transfer load to shims, lower piston to bottom of travel, screw jack rod nut down tight against piston, then continue to stress.

9.9 Compare measured elongation to the target value listed in the Owner Work Package. If the measured value deviates from the target value by more than $\pm$10% the tendon can be de-stressed and restressed starting from zero pressure follow the instructions in Steps 9.7 and 9.8 as applicable.

9.9.1 If measured elongation deviates from the target value by more than 10%, reduce jacking force to zero and repeat instructions in Sections 9.7 and 9.8 above. However, do not re-stress the tendon more than twice following the initial trial unless directed to do so by Owner Engineering. If elongation within the plus or minus 10% acceptance range is not achieved after three trials, notify Owner Engineering.

9.10 Shim Placement:

9.10.1 At any point prior to or during stressing, the field crew will prepare shim stacks of uniform thickness, so that when the shims are placed, there will not be more than a 1/16 inch height differential between the total of each shim stack. The largest shim should be against the bearing plate with the next largest shim thickness against the anchor head bearing face, unless approved otherwise by Owner Engineering.

9.11 Reduce pressure on the ram to a few hundred psi above lock-off (seating) point.

9.11.1 The shims will be placed between the bearing plate and anchor head in matched diametrically opposite pairs. The shim gap will be filled to the nearest 1/8" increment. While the shims are being placed, the gap between shims shall be minimized and in no case shall exceed a space of 1/4 inch for the first shims in direct contact with the anchor head and 1/2 inch for the remaining shims in the stack.

9.11.1.1 Shims are to be installed in tight alignment so as not to interfere with installation of the grease caps.

9.11.2 Insert a feeler gauge or shim stock of 0.030 inches in thickness into each shim stack at two points located approximately 180 degrees apart and approximately centered.

9.11.3 De-pressurize the ram to set the anchor head onto the shims. It shall not be necessary to return to zero gauge pressure but at least 2000 psi below anticipated liftoff on the gauge with a minimum of 1500psig.

9.11.4 No portion of the bearing surface of the anchor head shall overhang the shim stack.

9.12 **QCD** - HOLD POINT - To assure that the correct forces have been applied to the tendon, lift-off stress measurement will now be performed. NOTE: This may be performed independently of the other end.

9.12.1 Gradually pressurize the ram while pulling the feeler gauges. The point at which the second feeler gauge becomes loose is the lift-off stress.

9.12.2 Repeat Sections 9.11.3 through 9.12.1 until 3 consecutive lift-offs have been taken. These lift-offs shall be within 40 kips of each other. If this is not achieved the feeler gauges may be repositioned and the lift-offs repeated until 3 consecutive results fall within the range criteria.

9.12.3 If the average of the three lift-offs are within the minus (-)0% and plus (+)4% range of the final calculated values provided in Owner Work Package, the tendon re-stressing is now complete. Readings falling outside the range shall be adjusted by adding or removing shims. If, after adjustment trying the minimum available shim sizes, readings still fall outside the acceptable range it shall be reported to Owner.

9.12.4 The ram force shall be reduced to zero. The ram shall be uncoupled from the anchorage.

9.13 At this time perform detailed visual inspection of as left anchorage per PSC Procedure F&Q 15.1. If inspection is not to be performed at this time anchorage shall be smeared with a light coating of grease and protected.

9.13.1 If final installation of the grease cap is to be performed refer to PSC Procedure F&Q 16.0.

9.13.2 The following methods of tendon end protection may be used at the discretion of the Owner Site Superintendent. The tendon end may be covered with a plastic bag or sheeting and taped to provide protection from the elements, or the grease cap may be replaced using the old gaskets.

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the Owner Quality Control Inspector on Data Sheet F&Q 15.0 or Data Sheet F&Q 15.0A (both attached to this procedure) or Owner Work Package Documentation. After the tendon has been re-stressed the amount of seated button heads, are to be inspected and recorded on data sheet F&Q 15.0.

11.0 QUALITY CONTROL

11.1 Inspector to document on Data Sheet F&Q 15.0 or Owner Work Package Documentation the information required for tendon number, tendon end and date of stressing.

11.2 Document the ram and gauge identification.

11.3 Note: The following are instructions for PSC F&Q 15.0 Data Sheet Documentation.

11.4 Document on Line 1 of Data Sheet F&Q 15.0 the calculated pressure. Document on Line 1.1 the actual pressure and elongation at PTF.

11.5 Document on Line 2 of Data Sheet F&Q 15.0 the calculated pressure. Document on Line 2.1 the actual pressure and elongation at OSF.

11.6 Document on Line 3 of Data Sheet F&Q 15.0 the calculated elongation. Document on Line 3.1 the actual measured elongation (Line 2.1 minus Line 1.1).

11.7 The Total measured elongation for the tendon shall be within plus or minus 10% of calculated values.

11.8 Document on Line 4 of Data Sheet F&Q 15.0 the calculated lift-off.

11.9 Document on Data Sheet F&Q 15.0A the pressure for the second shim stock to become loose for each Lift-Off and average the readings as required on the Data Sheet.

11.10 Transfer the Averaged Lift-Off reading from Data Sheet F&Q 15.0A to Line 4.1 of Data Sheet F&Q 15.0.

11.11 The lift-offs shall be within the minus (-)0 and plus (+)4 percentage ranges of the final calculated values provided.

11.12 Document on Line 5 of Data Sheet F&Q 15.0 the actual shims installed.

11.13 Document on Line 6 the number of seated button heads after stressing.

11.14 Document on Line 7 of Data Sheet F&Q 15.0 the anchor head identification.

12.0 NOTIFICATION

12.1 Owner is to be notified if elongation is not within the plus or minus 10% after three attempts at elongation or if the lock-offs are not within the minus (-)0 and plus (+)4 percentage ranges, of the values provided.

13.0 ATTACHMENTS

13.1 Data Sheet F&Q 15.0

13.2 Data Sheet F&Q 15.0A

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PSC PROCEDURE F&Q 15.0
TENDON RESTRESSING
DATA SHEET F&Q 15.0
August 29, 2008
Page 1 of 1
Revision 0

TENDON STRESSING DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____ **CIRCLE ONE: Removed & Replaced Tendon or Restress Only Tendon**

CIRCLE ONE: Single End Stress Tendon or Double End Stress Tendon

 # EFFECTIVE WIRES: _____ **DO NOT EXCEED: 80% OF GUTS:** _____ **KIPS**

STRESSING SEQUENCE VERIFIED: _____

	TENDON END: _____			TENDON END: _____		
	RAM NO.: _____ RAM AREA: _____ K = _____			RAM NO.: _____ RAM AREA: _____ K = _____		
	GAUGE NO.: _____			GAUGE NO.: _____		
	KIPS	PSI	ELONGATION	KIPS	PSI	ELONGATION
1.0 CALCULATED (PTF)						
1.1 ACTUAL (PTF)						
2.0 CALCULATED (OSF)						
2.1. ACTUAL (OSF)						
3.0 CALCULATED ELONGATION OVER (PTF)						
3.1. ACTUAL MEASURED ELONGATION (2.1 MINUS 1.1) (+/-10% of calculated elongation)						
3.2. TOTAL TENDON ELONGATION						
4.0 CALCULATED LIFT-OFF						
4.1. ACTUAL LIFT-OFF (-,+% of calculated lift-off)						
ACTUAL LIFT-OFF in kips (1/2 sum of individual forces)						
5.0 ACTUAL SHIMS INSTALLED						
6. # seated Buttonheads after stressing:						
7.	ANCHOR HEAD ID _____			ANCHOR HEAD ID _____		

$$PSI = \frac{(KIPS - K) \times 1000}{RAM\ AREA} \qquad KIPS = \frac{RAM\ AREA \times PSI}{1000} + K$$

COMMENTS: _____

QC INSP. SIGNOFF: _____ **LEVEL:** _____ **DATE:** _____

QC REVIEW: _____ **LEVEL:** _____ **DATE:** _____

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TENDON STRESSING DOCUMENTATION

TENDON LOCK-OFF STRESS MEASUREMENT DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____ **TENDON END:** _____

RAM NO.: _____ **GAUGE NO.:** _____

RAM AREA: _____ **K =** _____

MEASUREMENT #	Gauge Pressure (PSI) Feeler Gauge Withdrawal	Average Pressure/ Force (kips) [Ave of Measurements 1,2,3]
	2nd. Gauge	
1		
2		
3		
		_____PSI/_____KIPS

PSI = $\frac{(KIPS - K) \times 1000}{RAM\ AREA}$ **KIPS** = $\frac{RAM\ AREA \times PSI}{1000} + K$

COMMENTS_____

_____

_____

QC INSP. SIGNOFF_____**LEVEL**_____**DATE**_____

QC REVIEW_____**LEVEL**_____**DATE**_____

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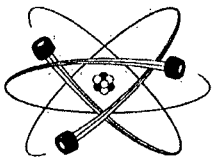


PSC
Precision Surveillance Corporation

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

ANCHORAGE INSPECTION OF STRESSED TENDON

Gerald Bussone	*LEVEL II Q.C.*	*09/16/09*
Prepared by	Title	Date
	PROJECT MANAGER, P.E.	*09/16/09*
Approved by	Title	Date
Paul C. Smith	*PRESIDENT*	*09/16/09*
Approved by	Title	Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for a detailed visual inspection of the anchor head, shims, bearing plate and wire button heads on each end of a tendon at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

1.2 Inspection shall be performed in accordance with the requirements of 2001 Edition and 2003 Addenda of the ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWL.

1.3 A detailed visual inspection is to be performed prior to de-tensioning for those tendons to be de-tensioned but not removed as specified in the Work Package.

1.4 Also a detailed visual inspection is to be performed on those re-stressed new tendons installed to replace those removed from the tendon voids and those de-tensioned but not removed as specified in the Work Package.

2.0 RESPONSIBILITY

2.1 Owner Quality Control Personnel to perform all inspections and data recording.

3.0 QUALIFICATIONS

3.1 The inspector performing this inspection is to be qualified as a Level II per PSC Procedure or as qualified by Progress Energy.

4.0 EQUIPMENT

4.1 Magnifying Glass with suitable illumination.

4.2 Optical Comparator with 0.005 inch (min.) Measuring Reticle.

4.3 Steel Ruler.

4.4 Light Meter.

5.0 QUALITY CONTROL

5.1 All Quality Control Documentation (QCD) points noted in this procedure are Hold Points. The work shall not progress past or through a QCD without a verbal release from the Inspector. The required information or evaluative data shall be documented on Data Sheet F&Q 15.1 or Work Package Documentation.

6.0 PRECAUTIONS

6.1 CAUTION - NEVER STRIKE THE BUTTON HEADS, THE WIRES OR THE ANCHOR HEAD OF A STRESSED TENDON WITH A HAMMER OR ANY OTHER METAL OBJECT.

6.2 CAUTION - IF AT ANY TIME A CRACKED OR BROKEN ANCHOR HEAD IS DETECTED AS A RESULT OF INSPECTION, ALL WORK SHALL STOP. ALL PERSONNEL SHALL BE MOVED AWAY FROM THAT AREA AND THE OWNER CONSTRUCTION SUPERVISOR SHALL BE NOTIFIED. THE WORK AND/OR INSPECTIONS SHALL CONTINUE ONLY AFTER A SAFETY EVALUATION HAS BEEN MADE AND ONLY AT THE DIRECTION AND CONTROL OF THE OWNER CONSTRUCTION SUPERVISOR.

7.0 PREREQUISITES

7.1 The tendon will be in a stressed condition.

7.2 The anchor head, shims, bearing plate and wire button heads are to be cleaned to permit inspection.

8.0 ANCHORAGE INSPECTION

8.1 The tendon anchorage, including the anchor head, bearing plate, stressing shims and button heads of all selected tendons shall be visually inspected for signs of corrosion, cracks, missing wires, broken/damaged or protruding wires and malformed button heads.

8.2 These inspections are to be performed with light conditions supplemented by auxiliary light sources if needed to attain a minimum illumination level of 50 foot-candles (fc) as verified by a light meter provided by owner. The light meter ID with its calibration due date and a description of any auxiliary lighting used is to be documented on Data Sheet F&Q 15.1 or Work Package Documentation.

8.3 CORROSION INSPECTION

8.3.1 BUTTON HEADS

8.3.1.1 The Category of Corrosion that could be seen on Button heads or Tendon Wire will be described in PSC Specification EW101 of PSC Procedure F&Q 13.0. As the tendon is still in a stressed condition, there will not be much area to review for Category of Corrosion, therefore only the exposed, visible portions of the button heads shall be evaluated.

8.3.1.1.1 **QCD**- Document the Category of Corrosion of the Button heads on Data Sheet F&Q 15.1 or Work Package Documentation.

8.3.2 ANCHOR HEAD, SHIMS, BEARING PLATE

8.3.2.1 The Category of Corrosion that could be seen on Anchor Head, Shims, or Bearing Plates will be described in PSC Specification EW101 of PSC Procedure F&Q 13.0. As the tendon is still in a stressed condition, the areas to be reviewed will be somewhat limited, therefore only the exposed, visible portions of the anchor head, shims and bearing plate shall be evaluated.

8.3.2.1.1 **QCD**- Document the Category of Corrosion of each item on Data Sheet F&Q 15.1 or Work Package Documentation.

8.3.3 CRACKS

8.3.3.1 The Anchor Head, Shims and Bearing Plates shall be visually inspected for signs of Cracks.

8.3.3.1.1 **QCD**- If there are no signs of Cracks present, "None" shall be entered into the "Cracks" area of Data Sheet F&Q 15.1 or Work Package Documentation for each item as it occurs.

8.3.3.1.2 QCD- If signs of Cracks are present in any item, regardless of size, the crack shall be sketched on Sketch Sheet F&Q 15.1 or Work Package Documentation and identified with a Sketch Number, which shall be entered into the "Cracks" area of Data Sheet F&Q 15.1 or Work Package Documentation.

8.3.4 BUTTON HEAD PHYSICAL INSPECTION

8.3.4.1 While the tendon is in a Stressed Condition, it shall be necessary to inspect the button heads/wires for those button heads/wires that may be missing, damaged or protruding/unseated. The button heads shall be inspected for obvious gross deficiencies as part of the Off-size Button head Inspection.

8.3.4.2 All conditions for button heads and wires, whether missing or defective, shall be documented.

8.3.4.3 Wire and button heads shall be inspected for the following information and documented by the appropriate code on Data Sheet F&Q 15.1 or Work Package Documentation. The circle represents the button head location on the anchor head. To correctly orient the button head on the anchorage, it shall be necessary to accurately locate the anchorage Heat or Code Number on the Anchorage Sketch with respect to the hole pattern alignment, on Data Sheet F&Q 15.1 or Work Package Documentation.

8.3.4.3.1 = Off-size button head

8.3.4.3.1.1 Malformed button heads shall be documented as Off-size button heads, with no other distinguishing Category Codes.

8.3.4.3.2 = Protruding/Unseated Wire/Button head.

8.3.4.3.2.1 Place an arrow pointing at the protruding button head, with the distance of protrusion above the other button heads at the tail end and in such a location so as not to obscure information.

8.3.4.3.3 Ø= Broken/Missing Wire/Button head

8.3.4.3.3.1 This code shall be used to identify occurrences for this inspection. See section 8.3.4.3.5 for Code if wire is removed.

8.3.4.3.4 ● = Previously Identified As Missing; whether a result of a previous inspection or as a result of the installation.

8.3.4.3.5 Ø = A discontinuous wire that was removed during this inspection and previously identified as Broken/Missing.

8.3.4.4 **QCD-** Document the Button head Inspection on the Sketch shown on Data Sheet F&Q 15.1 or Work Package Documentation in accordance with the Button head Code shown of Data Sheet F&Q 15.1 or Work Package Documentation.

8.3.4.5 **QCD-** Document the Anchor Head ID and Heat Number Code Identification Number for each anchorage component on Data Sheet F&Q 15.1 or Work Package Documentation.

8.3.4.6 IF any missing, broken and/or damaged wires are detected, THEN check the installation records, i.e., the button heading records, stressing records or reports, to determine if the missing, broken, and/or damaged wires were previously noted.

9.0 NOTIFICATION

9.1 Owner should be formally notified when each one or more of the following conditions are detected as a result of the inspection of a tendon. Notification should be by a nonconformance report or a formal letter.

9.1.1 CATEGORY OF CORROSION D, or E - when detected for Button heads or Wires, Owner should be notified.

9.1.2 CATEGORY OF CORROSION D, or E - when detected for Anchor Heads, Shims, or Bearing plates, Owner should be notified.

9.1.3 CRACKS - no matter how small, when detected for Anchor Heads, Shims and/or Bearing Plates, Owner should be notified.

9.1.4 OFFSIZE BUTTON HEADS - when detected for Button heads, document on Data Sheet F&Q 15.1A or 15.1B as applicable or Work Package Documentation.

9.1.5 PROTRUDING WIRES - when detected for Button head/Wires the quantity and length of protrusion of each Button head shall be reported and Owner should be notified.

9.1.6 MISSING OR BROKEN WIRES/BUTTON HEADS - when detected and not previously documented, Owner should be notified.

10.0 DOCUMENTATION

10.1 The items in this procedure requiring documentation shall be documented on Data Sheet F&Q 15.1 or Work Package Documentation.

10.2 The Data Sheet references the applicable section number of the procedure for each QCD point.

10.3 Sketch Sheet F&Q 15.1 or Work Package Documentation accompanies this procedure and shall be filled in for the required information if applicable.

11.0 ATTACHMENTS

11.1 DATA SHEET F&Q 15.1

11.2 SKETCH SHEET F&Q 15.1

PSC PROCEDURE F&Q 15.1
ANCHORAGE INSPECTION
DATA SHEET F&Q 15.1
August 29, 2008
Page 1 of 1
Revision 0
Revision 1. 6/24/2009

Project: CRYSTAL RIVER UNIT 3 – SGR M&TE:
ITEM: ID: DUE:
Tendon No.: Tendon End: ITEM: ID: DUE:
ITEM: ID: DUE:

ANCHORAGE INSPECTION CRITERIA

☐ As-Found ☐ Post Re-Tensioning — Q.C. Signoff

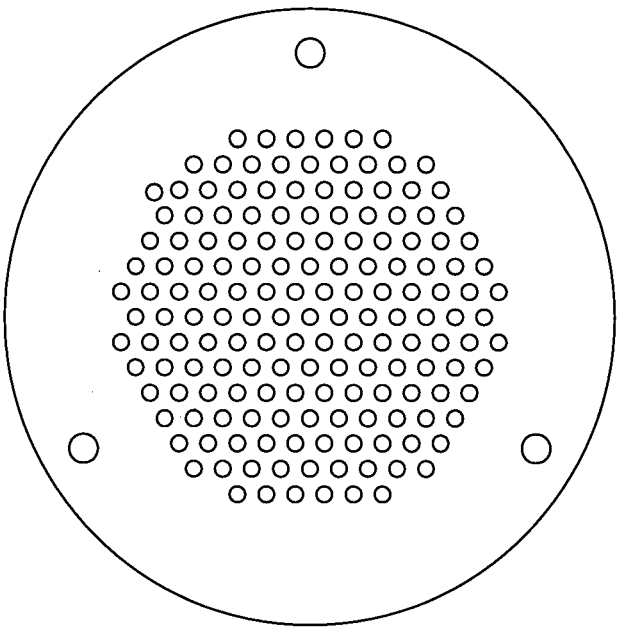
CORROSION & CRACK INSPECTION

(8.3.1.1.1) Buttonheads	Level: (1)	(8.3.3.1.1) Cracks	☐ Yes (2)	☐ No	
(8.3.2.1.1) Anchorhead	Level: (1)	(8.3.3.1.1) Cracks	☐ Yes (2)	☐ No	
(8.3.2.1.1) Shims	Level: (1)	(8.3.3.1.1) Cracks	☐ Yes (2)	☐ No	
(8.3.2.1.1) Bearing Plate	Level: (1)	(8.3.3.1.1) Cracks	☐ Yes (2)	☐ No	

(1) – Corrosion Levels of "D" and "E" required an NCR.
(2) – Compose a sketch of the cracks on Sketch Sheet 8.0 and initiate an NCR.

8.3.4.4 - BUTTONHEAD INSPECTION

◗	Offsize (Malformed)
▬	Protruding/unseated wire/buttonheads.
Ø	Broken/missing wire/buttonheads.
●	Previously identified as missing
☒	Discontinuous – removed



(8.3.4.5)Anchorhead I.D. _____
Located on Sketch: ☐ Yes ☐ No
(8.3.4.5) Heat Code _____
Located on Sketch: ☐ Yes ☐ No

Offsize Buttonhead Totals _____

Missing Buttonheads: ☐ Yes ☐ No; Quantity: _____
Protruding BH: _____ Missing BH: _____ Total (Protruding+Missing): _____
Total # of Effective Buttonheads Seated: _____

Overall Results ☐ Acceptable ☐ Un-Acceptable Owner Notified NCR#: _____

QC Reviewed: _____ Level: _____ Date: _____

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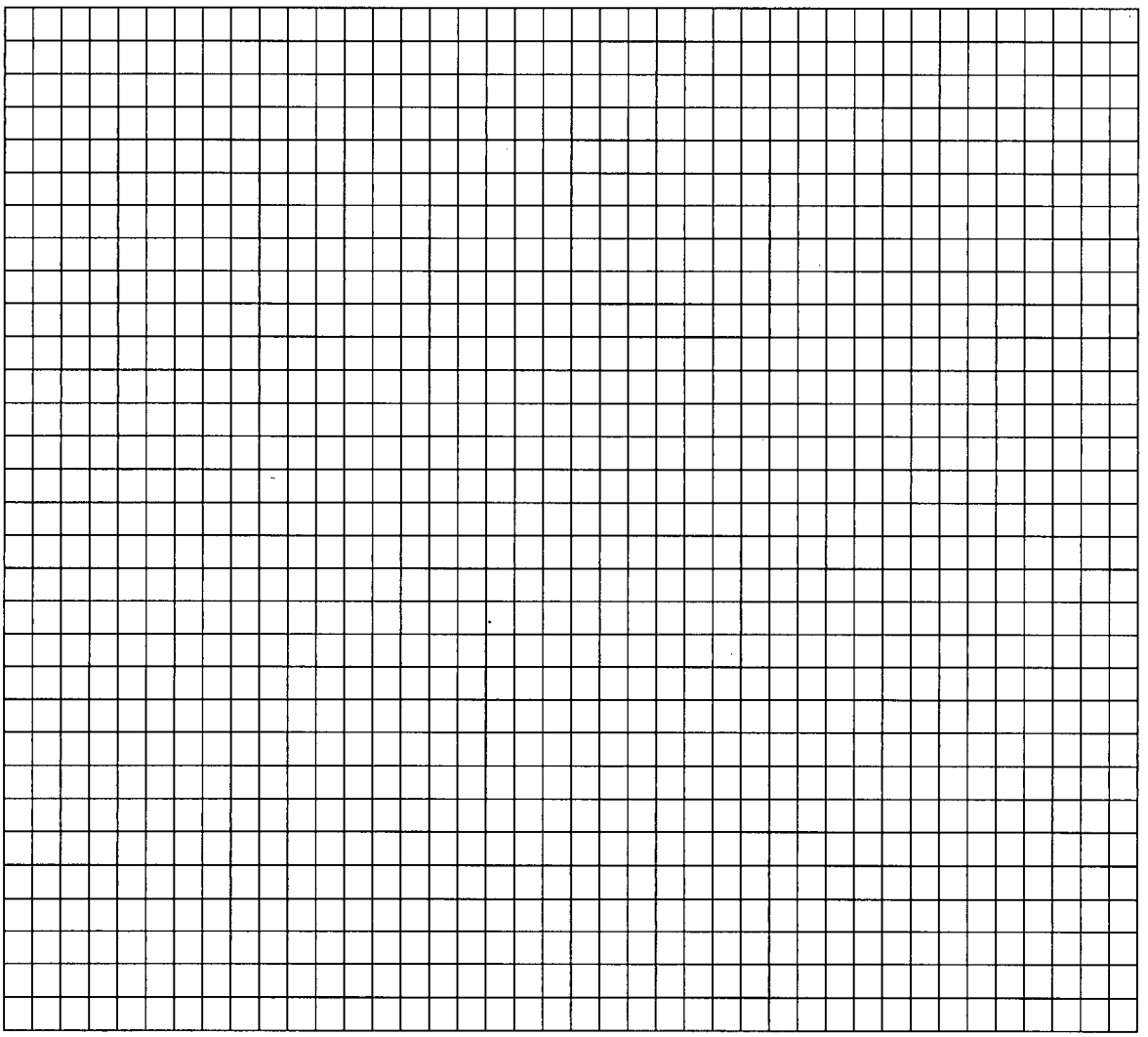
PSC PROCEDURE F&Q 15.1
ANCHORAGE INSPECTION
SKETCH SHEET F&Q 15.1
August 29, 2008
Page 1 of 1
Revision 0

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____ TENDON END/BUTTRESS No: _____

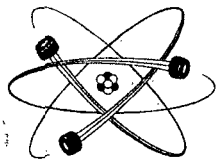
Sketch each crack as it appears in the Anchorage, Shims or Bearing Plate. Identify each item by name; apply the heat code identification if available and locate that identification on the sketch. Use as many Sketch Sheets as necessary being sure to list the page number below and to apply a Sketch Number to each item with cracks.



Inspected By: _____ Date: _____

Reviewed By: _____ Date: _____

118 F&Q15.1.CR3.SGR.REV 1.doc



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

BEARING PLATE CONCRETE INSPECTION

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for a detailed visual inspection of the concrete around/adjoining each end of a tendon prior to detensioning and after re-stressing the tendon at Crystal River Unit 3 for the vertical and horizontal tendon work during the Steam Generator Replacement Project.

1.2 Inspection shall be performed in accordance with the requirements of 2001 Edition and 2003 Addenda of the ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWL.

1.3 The tendons to have a detailed visual inspection performed on them are those new tendons installed to replace those removed from the tendon voids and those de-tensioned but not removed as specified in the Work Package.

2.0 RESPONSIBILITY

2.1 Owner Quality Control Personnel to perform all inspections and data recording.

3.0 QUALIFICATIONS

3.1 The inspector performing this inspection is to be qualified as a Level II per PSC Procedure or as approved by the Owner's IWL Responsible Engineer, or by an IWL Responsible Engineer accepted by the Owner.

4.0 EQUIPMENT

4.1 Optical Comparator with 0.005 inch (min.) Measuring Reticle.

4.2 Feeler Gauges.

4.3 Steel Ruler.

4.4 Light Meter.

5.0 QUALITY CONTROL

5.1 There are no hold points for this operation. Quality Control Inspectors shall perform the inspections that are described in this procedure and document those results on Data Sheet F&Q 15.2 or Work Package Documentation.

6.0 PREREQUISITES

6.1 The tendon will be in a stressed condition.

6.2 The Grease Cap may or may not have been installed.

6.3 The tendon may or may not have been re-greased.

7.0 CONCRETE INSPECTION

7.1 The concrete adjoining the bearing plate (within 2 feet of the edge of the bearing plate, unless 2 feet is not accomplished due to bearing plate location) of each selected tendon shall be inspected for cracks or any other abnormal material behavior.

7.2 This inspection is to be performed with light conditions supplemented by auxiliary light sources if needed to attain a minimum illumination level of 50 foot-candles (fc) as verified by a light meter. The light meter ID with its calibration due date and a description of any auxiliary lighting used is to be documented on Data Sheet F&Q 15.2 or Work Package Documentation.

7.2.1 **QCD-** Any crack that is 0.010" in width or wider shall be documented on Data Sheet F&Q 15.2 or Work Package Documentation.

7.2.1.1 The full length and width of each crack shall be documented as well as sketching the crack pattern.

8.0 NOTIFICATION - UNACCEPTABLE CONDITIONS

8.1 Owner should be notified when any crack width or gaps greater than 0.010" in width are detected.

9.0 DOCUMENTATION

9.1 Data Sheet F&Q 15.2 or Work Package Documentation shall be used for documenting the requirements of this inspection.

10.0 ATTACHMENTS

10.1 Data Sheet F&Q 15.2.

119 F&Q15.2.CR3.SGR

PSC PROCEDURE F&Q 15.2
BEARING PLATE CONCRETE INSPECTION
DATA SHEET F&Q 15.2
August 29, 2008
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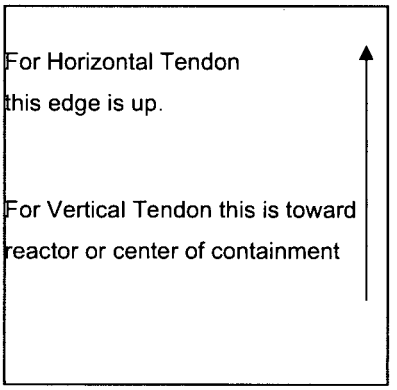
Revision 0
Revision 1. 6/24/2009

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____ ☐ As-Found ☐ Post Re-Tensioning

TENDON END: _____ BEARING PLATE I.D. NO.: _____

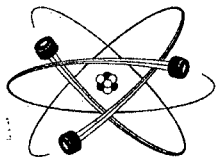
The bearing plate shall be oriented as shown below. Place the location of the bearing plate identification on the sketch below. Sketch all visible concrete cracks and/or other abnormal indications.



For above inspection:
Light Conditions 50fc or greater? circle one: YES or NO
Light Meter ID: _____ Date due calibration: _____
Auxiliary Light Source used? Describe: _____
Q.C. Signoff _____ Level _____ Date _____

Q.C. Review _____ Level _____ Date_____

119 F&Q15.2.CR3.SGR



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

GREASE CAP REPLACEMENT

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the final placement of grease caps after all other work has been completed (except re-greasing) for the vertical and horizontal tendon work during the Steam Generator Replacement Project at Crystal River Unit 3.

2.0 SCOPE

2.1 This procedure applies to those new tendons installed to replace those removed from the tendon voids and those de-tensioned but not removed as specified in the Work Package. This procedure may also be used for any other tendon as needed by Owner.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities and recording of documentation associated with this procedure.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

5.0 EQUIPMENT

5.1 Miscellaneous Tools, wrenches, ratchets, sockets, etc.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations.

6.2 Be prepared to support the weight of the grease cap.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 There are no Quality Control Documentation (QCD) points or HOLD POINTS in this procedure.

8.0 PREREQUISITES

8.1 All other work has been completed on this tendon with the exception of Grease Replacement.

9.0 GREASE CAP REPLACEMENT

9.1 Only minor cleaning and brushing may be necessary to prepare the bearing plate and grease cap for remounting to the bearing plate.

9.2 Inspect and prepare bearing plate surface by cleaning with rags and solvent. If detrimental foreign matter such as mill scale, rust, and dirt is detected on the gasket bearing surface of the plate, and power tool cleaning is required, then:

9.2.1 Make suitable provisions to protect the tendon wires and anchor head threads from accidental rubbing, cutting, or scratching by coming into contact with the power tool's rotating wire brushes and/or abrasive disks. Sheet metal shrouds around the tendon and end anchorage may be necessary.

9.2.1.1 Take precautions to keep dirt and other foreign material out of the tendon, and from the inside of the trumpet and conduit.

9.2.2 Power tools should remove loose mill scale, loose rust, loose or flaking paint, etc. Surfaces must be clean and smooth but not necessarily burnished after using power tools.

9.2.2.1 Remove sharp edges, and smooth down remaining mill scale to a "feather-edge".

9.3 At the discretion of the Owner's Representative fill scratches, nicks, and other sharp depressions in the gasket bearing surface with nonmetallic epoxy, such as "Belzona" epoxy. Use of epoxy shall be according to manufacture's application instructions.

9.3.1 Smooth out epoxy to prevent grease leakage under the gasket.

9.4 Remove all dust and loose matter from the vicinity of the tendon and entrance to the trumpet.

9.5 Clean any foreign material from the three threaded bearing plate grease can mounting holes.

9.6 Smear, swab or brush a coating of grease over all the exposed portions of the anchor head, bearing plate, shims, buttonheads and wires.

9.7 A 3/4" thread chaser or tap may be required to clear the threads of the bearing plate's grease cap mounting holes so that the mounting studs can be sufficiently tightened to bottom in the threaded holes.

9.8 Thread the three 3/4" studs in the three mounting holes of the bearing plate.

9.9 Clean and dry the flange and gasket sealing surface of the grease cap.

9.10 With the grease cap on end, apply adhesive to the grease cap gasket flange groove, in such quantity so as to hold the gasket in position. Place the gasket onto the groove and allow it to dry for a few minutes. Pliobond or a similar industrial adhesive shall be used for gluing. Water soluble adhesives shall not be used.

9.10.1 New gaskets shall be used in the final placement of the grease cap. Old or used gaskets may be used during temporary placement of the grease caps.

9.11 Lift the grease cap and slide it onto the three mounting studs. For Hoop tendons the grease cap shall be placed so that the bushing (inlet, outlet) is oriented in its highest altitude or toward the top of the containment.

9.12 Be sure the gasket is in the groove of the flange and is seated against the bearing plate. Install the three washers and the three nuts to the mounting studs.

9.13 Tighten each nut with a wrench, equalizing the load on each nut as well as possible. Tighten each nut in a gradual and even manner to allow the gasket to deform evenly until compressed and snug tight.

9.14 If new studs, nuts, and washers are used, or grease caps and/or bearing plates are scratched, then the exposed surfaces shall be touched up with Carbo Zinc 11 (or approved equal) per the manufacture's application instructions.

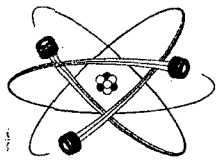
9.15 The replacement is now complete and regreasing can be performed observing the requirements of PSC Procedure F&Q 17.0.

10.0 DOCUMENTATION

10.1 None required.

11.0 ATTACHMENTS

11.1 None



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PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
FIELD AND QUALITY CONTROL PROCEDURE

GREASE REPLACEMENT

Prepared by	*LEVEL II Q.C.*	*08/29/08*
	Title	Date
Approved by	*PROJECT MANAGER, P.E.*	*08/29/08*
	Title	Date
Approved by	*PRESIDENT*	*08/29/08*
	Title	Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for the replacement of grease (sheathing filler) into the voids of tendons after all other work has been completed for the vertical and horizontal tendon work during the Steam Generator Replacement Project at Crystal River Unit 3.

2.0 SCOPE

2.1 This procedure applies to those new tendons installed to replace those removed from the tendon voids and those de-tensioned but not removed as specified in the Work Package. This procedure may also be used for any other tendon as needed by Owner.

3.0 RESPONSIBILITY

3.1 Owner Field Construction Personnel shall be responsible for the physical activities associated with this procedure.

3.2 Owner Quality Control Personnel to perform all inspections and data recording.

4.0 QUALIFICATIONS

4.1 Owner Field Construction Personnel shall be fit by skill, training and/or experience to perform these duties.

4.2 Owner Quality Control Personnel shall be qualified to a minimum of Level II capability in accordance with the requirements of ANSI N45.2.6.

5.0 EQUIPMENT

5.1 Grease heating and storage system

5.2 Grease pumping system, miscellaneous grease hoses and fittings.

5.3 Y-Devices

5.4 Thermometers

5.5 Miscellaneous Tools, wrenches, ratchets, sockets, shackles, come-alongs, etc.

5.6 Plastic bags, plastic sheeting (Visqueen), rags, buckets or drums for waste grease.

6.0 PRECAUTIONS

6.1 As in other heavy construction, care should be exercised while working from scaffolds, platforms, ladders, high or restricted access locations. Respect for the safety and well-being of the other trades and personnel in the area must be observed, especially during hoisting operations. When grease is under pressure, personnel will wear face shields, coveralls, and gloves if within 10 (ten) feet of the process.

6.2 During Grease Replacement, the grease may be pumped under pressure with an exit temperature of 140^0F or higher. It is therefore essential to avoid direct contact with the hot grease and to make sure all connections are secure.

CAUTION

DURING GREASING THE GREASE IS HOT AND MAY BE PUMPED UNDER PRESSURE. ALL FITTINGS AND FIXTURES THROUGHOUT THE SYSTEM WILL BE HOT AND COULD CAUSE INJURY.

6.3 Spilled grease from hoses and voids could be a slipping safety hazard, during all operations it should be cleaned up and placed in waste drums.

6.4 Pumping of grease should be stopped immediately if it is suspected or known that the grease is going somewhere else besides the immediate tendon void.

7.0 QUALITY CONTROL DOCUMENTATION AND HOLD POINTS

7.1 All Quality Control Documentation (QCD) points noted in this procedure are Hold Points. The work shall not progress past or through a QCD without a verbal release from the Inspector.

8.0 PREREQUISITES

8.1 All other work has been completed on this tendon and the grease caps have been installed.

9.0 PROCEDURE

9.1 COMPLETE TENDON VOID REFILLING

9.1.1 The pumping pressure for complete tendon void refilling shall not exceed 100 psig at the point of installation for hoop tendons and 150 psig for vertical tendons.

9.1.1.1 Notification - Remove grease cap pipe plug from each end of the tendon and attach to the operating shaft of the Y-device. The Y-device will be similar as seen in Sketch 8-1.

9.1.2 Connect the Y-device to the tendon end grease cap filler bushing on each end of the tendon, at outlet end push Y-device plunger in to open internal valve.

9.1.2.1 The Y-device at the pumping end (inlet end) to have grease hose attached, the Y-device at the opposite end (outlet end) to have waste line attached.

9.1.3 A grease control station shall be set up near the tendons to be filled and a communications network established so that the personnel at the furthest end of the tendon to be filled, will be able to communicate with the crew leader or control station attendant.

9.1.4 CAUTION: Operation of the system pressurizes the grease lines. Assure proper PPE. Re-check Y-plunger has opened the internal valve on the outlet by listening or feeling for air exiting during initial operation.

9.1.5 The grease will be pumped through the void at a temperature of 220^0 to 260^0F at the point of injection until it exits from the waste line and emerges clean and essentially free of air bubbles.

9.1.5.1 QCD – Exit grease verified free of air bubbles onto Data Sheet F&Q 17.0 or Work Package Documentation.

9.1.5.2 QCD – Exit grease temperature (140^0F minimum) and M&TE data onto Data Sheet F&Q 17.0 or Work Package Documentation.

9.1.6 Shut valve on the Y-device and when greasing is complete tighten grease cap pipe plug (the plug threads when replaced shall have an Owner approved thread sealant applied) and remove the Y-device.

9.1.7 During tendon grease replacement, if the condition develops where there is no grease exiting the Outflow from the Opposite End of a Horizontal Tendon, or the Top End of a Vertical Tendon, Stop Work, notify the Owner for additional direction.

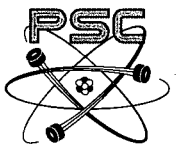
9.1.8 Clean-up any grease spillage and greasing is now complete on this tendon. Vented, spilled or waste grease shall not be reused.

9.1.8.1 QCD - The amount of grease pumped into the tendon less any vented, waste or spillage to be recorded by the Inspector onto Data Sheet F&Q 17.0 or Work Package Documentation.

10.0 DOCUMENTATION

10.1 The items requiring documentation in this procedure shall be documented by the Owner Quality Control Inspector on Data Sheet F&Q 17.0 or Work Package Documentation.

121 F&Q17.0.CR3.SGR



11.0 QUALITY CONTROL

11.1 Inspector to document on Data Sheet F&Q 17.0 or Work Package Documentation the information required for unit number, tendon number and date of greasing.

11.2 Document that the exiting grease is clean and does not have air bubbles greater than 1/4 inch in diameter.

11.3 Document the amount of grease pumped into the tendon less any vented, waste or spillage.

11.4 Verify and document that no grease are leaking from the caps, that they are leak tight.

12.0 NOTIFICATION

12.1 Work shall not proceed beyond a QCD, until Quality Control Inspector is notified.

13.0 ATTACHMENTS

13.1 Data Sheet F&Q 17.0

13.2 Sketch 8-1

121 F&Q17.0.CR3.SGR

TENDON GREASE REPLACEMENT DOCUMENTATION

PROJECT: CRYSTAL RIVER UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

TENDON NO.: _____

DATE OF GREASING: _____

EXIT GREASE CLEAN AND FREE OF AIR BUBBLES (Check) _____

GREASE TEMPERATURE
(At exit/outlet end) _____ ^{0}F Thermometer I.D. _____ Recal. Date _____
(140^0F minimum)

AMOUNT OF GREASE PUMPED INTO TENDON (less waste and spillage): _____GAL.

CAPS LEAK TIGHT (Check) Pumping End _____ Exit/Outlet End _____

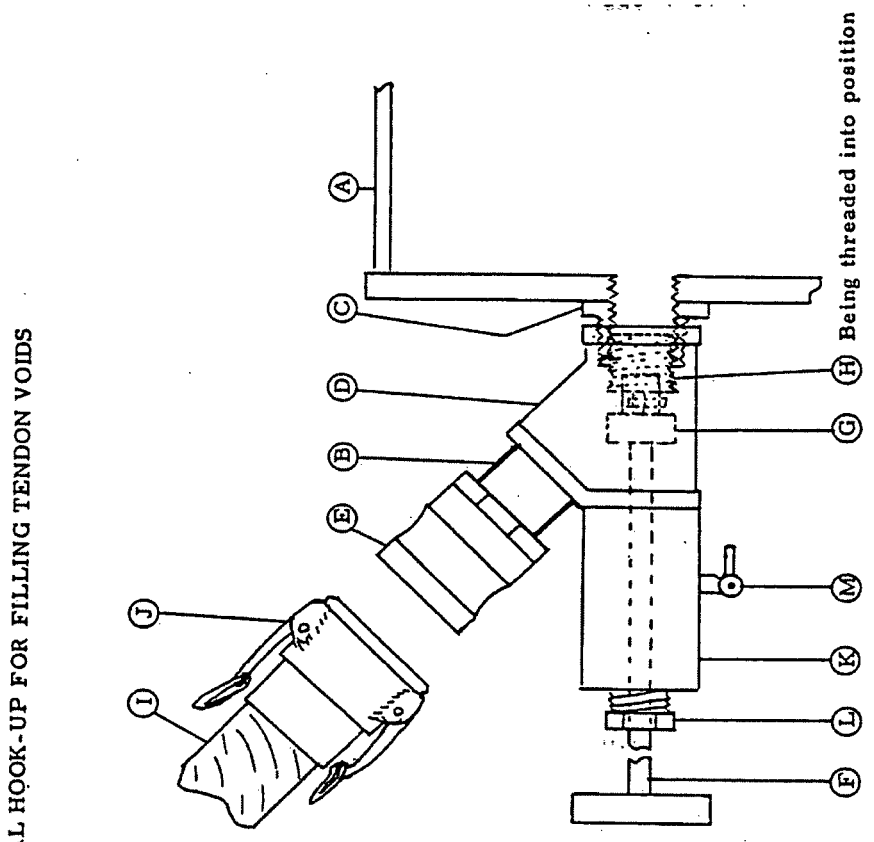
COMMENTS:
_____
_____
_____
_____

Q.C. INSPECTOR SIGNOFF: _____ LEVEL: _____ DATE: _____
_____

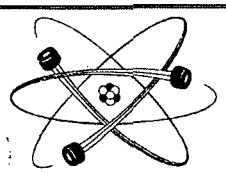
Q.C. REVIEW: _____ LEVEL: _____ DATE: _____

121 F&Q17.0.CR3.SGR

Sketch 8-1. – PSC "Y-Device"



121 F&Q17.0.CR3.SGR



PSC
Precision Surveillance Corporation

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
QUALITY ASSURANCE PROCEDURE

CALIBRATION OF MEASURING AND TEST EQUIPMENT

Prepared by	*LEVEL II Q.C.* Title	*08/29/08* Date
Approved by	*PROJECT MANAGER, P.E.* Title	*08/29/08* Date
Approved by	*PRESIDENT* Title	*08/29/08* Date

1.0 PURPOSE

1.1 This procedure will establish the requirements for calibration of the Quality Control Test and Measuring Equipment to be used for inspection, testing and evaluation, during field operation of the Post-Tensioning System Tendons.

2.0 CONTROLS

2.1 All calibrated test and measuring equipment shall be controlled for issue by the PSC Quality Control or Quality Assurance Section. The area of issue shall be indicated on the calibration records. The calibration records shall be maintained by the PSC Quality Control or Quality Assurance Section.

2.2 PSC Quality Control personnel shall maintain a file or list of in-service devices requiring calibration, and periodically review those records to prevent any lapse in calibration.

2.3 The Quality Assurance Section shall review calibration records during audits of that operation being audited.

2.4 All calibrated equipment shall be documented and identified by a label, tag, or log sheet indicating the status of calibration. The control device shall identify the equipment, the date of calibration, date due for recalibration and the signature or initials of the person performing or verifying the calibration.

2.5 The identification control of the calibrated equipment shall be of such a nature so that the specific traceability of that device will not be lost; usually engraved or marked with a Quality Control code number.

2.6 Any calibrated device that has been damaged, adjusted or repaired before the recalibration due date, shall be recalibrated before initial use, to assure the prescribed accuracy.

2.7 There is no intent to apply calibration requirements on those devices such as rulers, tapelines, levels, etc. where normal commercial practices provide adequate accuracy, or where there is no need for accuracy.

2.8 Procedures shall be provided for the calibration of special testing, measuring, inspection devices or other equipment requiring calibration and shall be controlled by the Quality Assurance Section or included in the Quality Manual for the project.

2.9 The Rams which have been used for Monitoring Force, De-tensioning or Re-tensioning operations for the Post-Tensioning System Tendons shall be verified for calibrated status after the completion of the work.

2.10 The documents for the calibration of Rams prior to starting the work and after completing the work shall be transmitted to Progress Energy per the requirements of the contract documents.

2.11 Equipment used to measure tendon force shall be calibrated prior to performing post-tensioning operations and within 3 months following completion of post-tensioning operations. Accuracy of the calibration shall be within 1.5% of the specified minimum ultimate strength of the tendon. If the calibration results following post-tensioning operations differ by more than the specified accuracy tolerance from the pretest calibrations, the accuracy of the post-tensioning operations shall be evaluated.

3.0 OUT OF CALIBRATION

3.1 Devices out of calibration shall be processed as non-conformances. Devices out of calibration that are determined to have an adverse effect on quality shall have copies of that nonconformance report submitted to PSC Executive Management for review, and comments where applicable.

3.1.1 Nonconformance Reports shall be drafted, submitted and distributed in accordance with the requirements of Progress Energy Procedures.

3.2 Instruments that are found to be out of calibration shall be re-calibrated and a comparison made of the results of the new calibration and the out-of-calibration variance, if any. If no significant variation exists, the instrument shall be put back into service. In the event that a discrepancy exists, then the Engineering and/or Quality Assurance and Quality Control Sections shall make an evaluation of the discrepancy and the possible effect on the items processed with the out-of-calibration device, with regard to quality, accuracy or reliability. If it is determined that a serious problem exists, then the Quality Assurance Section shall determine what items checked with the out-of-calibration device shall be rechecked with an effective calibrated device.

3.3 Instruments that are found to be in excess of the required accuracy or tolerance band after being returned from Field Service, shall be controlled with Nonconformance Reports as required of Sections 3.1 and 3.2 of this Procedure.

4.0 TOOL AND GAUGE CONTROL

4.1 The calibration standards used to calibrate measuring and test equipment shall be traceable to the National Institute of Standards and Technology (NIST) formerly National Bureau of Standards (NBS) and shall be controlled to an accuracy not to exceed a limit of 0.25% of the tolerance of the equipment being calibrated or the smallest used division of that instrument's scale, unless otherwise limited by "State-of-the Art" conditions. Pressure Gauges used for Post-Tensioning System operations shall be excluded from this requirement and shall be defined for accuracy in separate procedures.

4.1.1 For example, a micrometer that has a smallest scale reading of 0.001" shall be calibrated with a standard or device that has been calibrated to an accuracy of 0.00025" or less.

4.2 All measuring and test equipment used for Quality Control Inspections shall have subdivisions or increments for measurements that are equal to or smaller than the tolerance of the parameter being measured.

4.2.1 For example, a part needs to be controlled to a dimension of 9.365" with a tolerance of plus or minus 0.001". It would therefore be acceptable to perform that measurement with a device that is capable of measuring to 0.001" or smaller.

4.3 Calibrated Devices may be extended for the stated period of frequency, where that device has been calibrated and placed into storage, rather than into service. The original frequency period stated in Section 5.2, Equipment List, shall always be observed.

5.0 EQUIPMENT

5.1 The Equipment List shown in Section 5.2 of this Procedure contains those devices that are required for field operations or are used to calibrate devices that will be used during the field operations. The required accuracy and frequency of calibration are stated for each device. It should be noted that the accuracy requirement is meant to be the tolerance band to which the device is being calibrated and not the original accuracy or the accuracy between calibration frequencies.

5.1.1 The term "DISS" in the Accuracy Column is defined as "Division of that Instrument's Smallest Scale".

5.1.2 Where an asterisk "*" follows the accuracy dimension, this is meant to be that the dimension shown shall be verified with a Micrometer that reads to 0.0001".

5.1.3 The procedures that are used to calibrate the various types of equipment, gauges or instruments used during the field operations, will accompany this procedure in the Field Quality Control Manual. These procedures provide information relative to the calibration of each device and may be used for purposes of calibrating these devices in the field, should that become necessary.

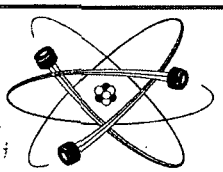
5.2 EQUIPMENT LIST

DEVICE	FREQUENCY	ACCURACY
Load Cell (3000 Kips) Load Cell (Approx. 50 Kips) Rams/Jacks (Stressing, Testing, etc.	5 Years 8 Years Beginning & End (B & E) of Project	± .1% Entire System ± .1% Entire System Calculated to within ± 0.01" for Ram Area
Dead Weight Tester Heise Digital Gauge	5 Years 3 Years	± 0.10% ± 0.10%
Pressure Gauge-Master (1/4%) Pressure Gauge-Stressing (1/4%) Pressure Gauges (1/2%) (Not used for Stressing)	B & E of Project B & E of Project 1 Year	± 30 psi ± 30 psi of Heise ± 55 psi of Heise
Micrometer Micrometer-Checking Bar Standard	6 months	± 1 DISS ± 0.0001"
Thickness (Feeler) Gauge Under 0.005" 0.005" and Over (* Verified with a 0.0001" micrometer)	 6 months 6 months	 ± 0.0005"* ± 0.0010"
Steel Ruler Steel Tapeline Thermometer	1 Year 1 Year 1 Year	± 0.0100" ± 1/16"/100' of lgth. ± 1 DISS
Optical Comparator (0.005")	1 Year	± 0.0010"
Dial Indicator	1 Year	± 1 DISS

6.0 DOCUMENTATION

6.1.1 The various types of documents generated for calibration and/or status of calibrations will be described in the General Procedures for Calibration or contained within that procedure for a particular device. Others may be added as the need arises. Quality Control personnel shall prepare or assist in the preparation of these records. A copy of the calibration record shall accompany the calibrated device to the field.

122 QA10.0.CR3.SGR



PSC
Precision Surveillance Corporation

PROGRESS ENERGY FLORIDA, INC.
CRYSTAL RIVER NUCLEAR UNIT 3
STEAM GENERATOR REPLACEMENT PROJECT

PRECISION SURVEILLANCE CORPORATION
QUALITY ASSURANCE PROCEDURE

VERIFICATION OF CALIBRATED STATUS OF HYDRAULIC PRESSURE GAUGES

Prepared by	*LEVEL II Q.C.*	*08/29/08*
	Title	Date
Approved by	*PROJECT MANAGER, P.E.*	*08/29/08*
	Title	Date
Approved by	*PRESIDENT*	*08/29/08*
	Title	Date

1.0 FIELD VERIFICATION OF PRESSURE GAUGES

1.1 The following procedure shall be used to verify the calibration of hydraulic pressure gauges during field operations. These gauges may be used in stressing operations with the rams or other devices that require a measure of accuracy to produce quality results. Frequency and Accuracy of Calibration shall be controlled as stated in Section 5.2 of Procedure QA 10.0 Equipment List.

2.0 GENERAL

2.1 Prior to being used for any work, all gauges shall be calibrated with the use of a Dead Weight Tester or the Heise Digital electronic pressure indicator.

2.2 In addition to the pressure gauges used during the field operations, one gauge, designated as the Master Gauge or a Heise Digital Gauge, shall be set aside for purposes of Calibration Verification during the process of the work. Prior to use the Master Gauge or Heise Digital Gauge used for Calibration Verification shall have been calibrated with a dead weight tester traceable to NIST.

2.3 Owner Quality Control personnel shall maintain the controls for distribution and recall of each Pressure Gauge being used on site.

2.4 A Pressure Gauge may be verified for calibration or accuracy at shorter frequencies than stated in Section 5.2 of Procedure QA 10.0. It is important that verification be performed any time that the gauge has been damaged, subjected to some physical abuse or there is some reason to suspect its accuracy.

2.5 Pressure Gauges used for De-tensioning or Re-tensioning (Stressing) tendons of Post-Tensioning Tendon Systems of Nuclear Power Plants, shall be Verified for Calibrated status at least once a day during the operational use of those gauges.

3.0 VERIFICATION OF CALIBRATION

3.1 Clean and remove any dirt, grease or residue that could affect the accuracy of the calibration or use of the pressure gauge.

3.2 At the option of the Owner Quality Control Section it shall be acceptable to use a Heise Digital Pressure Indicating Gauge for Calibration Verification of Pressure Gauges, rather than a Master Gauge.

3.3 Attach the Pressure Gauge to the Calibration Pump of the Heise Indicator or Master Gauge.

3.4 Close the back pressure valves before pressurizing the system.

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3.5 Increase the hydraulic pressure to the point of the desired reading on the Pressure Gauge, usually 1,000 psi plus or minus 100 psi increments. Take a reading of the Pressure Gauge and the Heise Indicator and document both on the Pressure Gauge Calibration Form.

3.6 MASTER GAUGE (1/4% Accuracy)

3.6.1 Where a Master gauge is used for verification of calibration, the master gauge and field gauge to be calibrated shall be connected to a common line (manifold) on a hydraulic pump. The pump shall be pressurized in no greater than 1,000 psi increments, plus or minus 100 psi, to the highest overstress pressure that shall be encountered during stressing activities; for example, 7,600 psi overstress will require calibration on that gauge to at least 7,600 psi. It shall be acceptable to go to 8,000 psi.

3.6.2 The accuracy of a gauge verified in this manner shall be acceptable, if it reads to within 50 psi of any reading on the Master Gauge.

3.7 HEISE DIGITAL GAUGE

3.7.1 A Pressure Gauge may be verified for calibration by connecting that gauge and the Heise Digital Gauge to a common line, which is in turn connected to a hydraulic pump and pressurized to the same values noted in 3.6.1 above.

3.7.2 The verification accuracy of that Pressure Gauge shall be acceptable if it reads to within 30 psi of the Heise Digital Gauge reading for a 1/4 percent accuracy gauge or 55 psi for 1/2 percent accuracy gauge. As a 1/2 percent gauge cannot be accurately interpolated to increments of 5 psi it will be acceptable to take the reading to some point equal to or above 50 psi but not to exceed 60 psi.

3.7.3 Pressure Gauges with an accuracy of 1/2 percent or greater shall not be used for Monitoring Force, De-tensioning or Re-tensioning operations of the Post-Tensioning Tendon System.

3.8 With the Verification and Documentation of the Pressure Gauge being acceptable, the pump and gauge shall be depressurized and prepared for disassembly.

4.0 UNACCEPTABLE CONDITIONS

4.1 If a Pressure Gauge fails to meet the accuracy requirements of Section 3.6.2 or 3.7.2 after being used for Stressing or De-tensioning operations, it shall be necessary to contact the Client and draft a Nonconformance Report in accordance with the PSC requirements, to control that Gauge and any Tendons worked with that Gauge.

123 QA10.1.CR3.SGR

4.1.1 Any Pressure Gauge not capable of meeting the stated accuracy requirements of Section 3.6.2 or 3.7.2 for the method of calibration being used shall be returned to the PSC shop for adjustment or repair. Any repaired or adjusted Gauge shall be recalibrated before use.

4.1.2 ZERO ALIGNMENT (Zero Beating)

4.1.2.1 On occasion, the Pressure Gauge Indicating Needle may not be in precise alignment with the Zero mark on the Gauge Face, necessitating realignment. Before calibration the needle is to be realigned to the zero mark, with the realignment completed the Verification shall be performed and documented.

5.0 ACCURACY VARIATIONS

5.1 Even though Pressure Gauges that have been calibrated or verified for calibration, variations in excess of the requirements of Sections 3.6.2 and 3.7.2 may be detected between calibrations or verifications. In an effort to explain and control this deficiency, this Section shall be reviewed before the Verification of any Pressure Gauges.

5.1.1 The accuracy of the calibration of Pressure Gauges or the verification of calibration is highly dependent on the accuracy of the reading of the location of the Pressure Indicating Needle on the Gauge Face. While there is an attempt to precisely align the needle with the Gauge Face Indicating Line, it is nearly impossible to maintain that control. In an effort to explain any variations that could be noted between calibrations or verifications, it is recommended that a notation be added to the Calibration Document to signify that the intended increment was not precisely obtained. At that increment it would be noted that the value actually achieved was plus or minus an extrapolated pressure noted during the calibration.

5.1.1.1 For example: If the target increment on the gauge Face was intended to be 2,000 psi and the Indicating Needle was somewhat over the 2,000 psi line, perhaps enough to interpret as 10 psi, the notation on the Calibration Record would read: 2,000 psi +10

5.1.1.2 The requirements for Stressing or De-tensioning Tendons do not require the Pressure to be read any finer than 10 psi during the Inspections. The Hydraulic Ram Calibration Procedure takes the reading error into account for Stressing or De-tensioning along with any other errors that may occur as a result of calibration or gauge reading, thereby maintaining the accuracy or integrity of the work being performed. It is therefore necessary to document any minor variations during calibration or verification activities, so as to maintain the integrity of the accuracy of the Pressure Gauges.

6.0 DOCUMENTATION

6.1 A gauge Calibration Record form shall be prepared for each gauge being calibrated or verified. All pertinent information as required by the form shall be posted during calibration or verification.

6.2 Calibration or verification documents shall be retained in the appropriate jobsite Quality file.

7.0 ATTACHMENTS

7.1 Gauge Calibration Record Form

123 QA10.1.CR3.SGR

PSC PROCEDURE QA10.1
GAUGE CALIBRATION RECORD FORM
August 29, 2008
Page 1 of 1
Revision 0

Project: CRYSTAL RIVER UNIT 3 – SGR Job # _____

GAUGE CALIBRATION VERIFICATION RECORD

DATE CHECKED _____
GAUGE I.D. _____
MASTER GAUGE I.D. _____
REMARKS _____

MASTER GAUGE (PSI)	JACK GAUGE (PSI)

Project: CRYSTAL RIVER UNIT 3 – SGR Job # _____

GAUGE CALIBRATION VERIFICATION RECORD

DATE CHECKED _____
GAUGE I.D. _____
MASTER GAUGE I.D. _____
REMARKS _____

MASTER GAUGE (PSI)	JACK GAUGE (PSI)

123 QA10.1.CR3.SGR

ATTACHMENT 3
Sheet 1 of 1

Record of Concurrent Review

Document PSC TENDON FAB MANUEL Revision Ø

☐ Design Verification Review ☐ Engineering Review ☒ Owner's Review
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☒ Special Engineering Review: Engineering

John Holliday / JOHN HOLLIDAY CIVIL 4/15/08
Concurrent Reviewer (print/sign) Discipline Date

Item No.	Deficiency	Resolution
	NONE	

FORM EGR-NGGC-0003-3-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

ATTACHMENT 3
Sheet 1 of 1

Record of Concurrent Review

Document PSC TENDON FABRICATED MANUAL **Revision** Ø

☐ **Design Verification Review** ☐ **Engineering Review** ☒ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☐ **Special Engineering Review**

WILLIAM J. NIELSEN/	SCE PROJ. QA	4/21/08
Concurrent Reviewer (print/sign)	**Discipline**	**Date**

Item No.	Deficiency	Resolution
	No Comments	

FORM EGR-NGGC-0003-3-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

ATTACHMENT 3
Sheet 1 of 1

Record of Concurrent Review

Document **Revision**

☐ **Design Verification Review** ☐ **Engineering Review** ☒ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☒ **Special Engineering Review:** **Engineering**

John Holliday / JOHN HOLLIDAY CIVIL / 4/15/08

Concurrent Reviewer (print/sign) **Discipline** **Date**

Item No.	Deficiency	Resolution
	NONE	

FORM EGR-NGGC-0003-3-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

ATTACHMENT 3
Sheet 1 of 1

Record of Concurrent Review

Document Post Tentioning System Fabrication Manual **Revision** 0

☐ **Design Verification Review** ☐ **Engineering Review** ☐ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☒ **Special Engineering Review** Procurement Engineering

Concurrent Reviewer (print/sign)	Discipline	Date
Andy Harmon / Andy Harmon	M&CS	7/2/08

Item No.	Deficiency	Resolution
1	Our approved suppliers list (ASL) requires, " Materials provided under this Purchase Order/Service Contract shall be from subsuppliers of PSC who have been qualified through an on-site audit which verified 10CFR50 App. B Compliance". This does not appear in any of the specs. One spec is for non domestic material, which will likely mean their subsupplier will not have a 10CFR50 App. B QA program.	All material commercial graded dedicated by PSC. Vendor E&Q notified of ASL restriction disparity by procurement engineering.

FORM EGR-NGGC-0003-3-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

ATTACHMENT 3
Sheet 1 of 1

Record of Concurrent Review

Design : 1009-TFAB TENDON FABRICATION MANUAL **Revision 0**

☐ **Design Verification Review** ☐ **Engineering Review** ☒ **Owner's Review**
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Testing

☒ **Special Engineering Review** **Contract Administration Review; no comments**

DEBBIE HANNA / DEBBIE Hanna	CONTRACT ADMIN	1/31/08
Concurrent Reviewer (print/sign)	**Discipline**	**Date**

Item No.	1/31/08	Resolution
	NO COMMENTS	

FORM EGR-NGGC-0003-3-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

ATTACHMENT 3
Sheet 1 of 1

Record of Concurrent Review

Document 1009 - TFA13 Revision 0

☐ Design Verification Review ☐ Engineering Review ☒ Owner's Review
☐ Design Review
☐ Alternate Calculation
☐ Qualification Testing

☐ Special Engineering Review

Concurrent Reviewer (print/sign)	Discipline	Date
Jon Burchett Jon Burchett	CO/TM	1/30/2008

Item No.	Deficiency	Resolution
	NONE	

FORM EGR-NGGC-0003-3-10
This form is a QA Record when completed and included with a completed design package. Owner's Reviews may be processed as stand alone QA records when Owner's Review is completed.

Attachment "B"
PSC Calculation CR-N1013-100

DOCUMENT COVER SHEET

Document No: CR-N1013-100

Title: CRYSTAL RIVER UNIT 3: TENDON ACCESS EQUIPMENT DESIGN

0	INITIAL ISSUE	*B.GIOMETTI*	*09/08/08*	*C.E.COX, P.E.*	*09/08/08*		
REV NO	**DESCRIPTION OF REVISION**	**By**	**Date**	**Checked**	**Date**	**By**	**Date**
		PSC SIGN OFF				**APPROVED**	

REVISIONS

TABLE OF CONTENTS

1.0 PURPOSE

1.1 DOCUMENT PURPOSE

1.1.1 Precision Surveillance Corp. (PSC) will provide an access system consisting of work platforms suspended from Upper Support Frames (USF) for the removal and installation of tendons during the Crystal River Unit 3 Steam Generator Replacement Project. The access system will consist of four Work Platform/Upper Support Frame combinations to allow for the simultaneous access to all four of the affected buttresses.

1.1.2 The purpose of this document is to provide the necessary setup information and design loading calculations for the access system. These calculations will provide the necessary confidence level that the entire access system will be able to adequately resist all the loadings imposed upon it. These forces will consist of forces generated from vertical working load conditions as well as wind and seismic lateral forces. The forces will be combined in accordance with ASCE/SEI 7-05 – Minimum Design Loads for Buildings and Other Structures [Reference 2.1.1] in order to form the design loading conditions. Lateral loading is limited to only the Upper Support Frames, as the effects of lateral loads on the work platforms are negligible due to their pendulum style support.

1.1.3 All design modeling and calculation for this calculation has been performed using RISA 3D Version 7.1. RISA-3D calculates the stresses in each member, with respect to the member size and designation, and checks them against the allowable stresses defined in the applicable code. All of the members for the USF and work platform have been designed in accordance with AISC 9th Edition ASD [Reference 2.1.2] and ASME A120.1-2006 [Reference 2.1.3].

2.0 REFERENCES

2.1 REFERENCE DOCUMENTS

2.1.1 ASCE Standard ASCE/SEI 7-05 – Minimum Design Loads for Buildings and Other Structures

2.1.2 AISC Manual of Steel Construction – Allowable Stress Design, 9th Edition.

2.1.3 ASME Standard A120.1-2006 – Safety Requirements for Powered Platforms for Building Maintenance

2.1.4 OSHA Standards for the Construction Industry, 29 CFR Part 1926, Current Edition.

2.1.5 CR-N1013-101, CR03 – BT2-60° & BT5-240° Upper Support Frame Set Position Design, Revision 0

2.1.6 CR-N1013-102, CR03 – BT2-60° & BT5-240° Work Platforms Design, Revision 0

2.1.7 CR-N1013-103, CR03 – BT3-120° & BT4-180° Upper Support Frame Set Position Design, Revision 0

2.1.8 CR-N1013-104, CR03 – BT3-120° Work Platform Design, Revision 0

2.1.9 CR-N1013-105, CR03 – BT4-180° Work Platform Design, Revision 0

2.1.10 CR-N1013-106, CR03 – Vertical Tendon Coiler Platform Design, Revision 0

2.1.11 E-GEN-501, Upper Support Frame Tie Down, Revision 0

2.1.12 Crystal River Unit 3 Design Basis Document, Revision 5

2.1.13 SP-5209 CR-3 Seismic Qualification, Revision 0

2.2 REFERENCE DRAWINGS

2.2.1 SC – 421 – 041 Reactor Building Ring Girder Concrete Outline – Plan and Sections

3.0 EQUIPMENT ARRANGEMENT

3.1 BACKGROUND

3.1.1 Before concrete can be removed for the containment opening, all the tendons traversing the opening must be detensioned and removed. There are 10 vertical tendons and 17 hoop tendons that must be removed.

3.1.1.1 There are two groups of hoop tendons that cross the area of the containment opening, tendons from Buttress 3 (BT3) to Buttress 5 (BT5) and tendons from Buttress 4 (BT4) to Buttress 2 (BT2). Both of these groups will be cut from the buttress furthest from the construction opening (BT 2 and BT5) and then removed and coiled from the buttresses closest to the opening (BT3 and BT4).

3.1.1.2 All of the vertical tendons traversing the containment opening will be detensioned from the bottom end and then removed and coiled at the top of the containment dome.

3.1.2 In addition, the tendons adjacent to the opening must also be detensioned, but will remain in the concrete. There are approximately 16* vertical tendons and 7 hoop tendons adjacent to the opening which must be detensioned. The vertical tendons will be detensioned from the top end only, while the hoop tendons will be detensioned from both corresponding buttresses simultaneously.

3.1.3 Once all the scheduled tasks are completed and the materials form the containment opening have been replaced, the 10 vertical and 17 hoop tendons will be replaced using newly fabricated tendons. Once the tendons are installed, all detensioned tendons (new and existing) will be retensioned. The vertical tendons will be retensioned from the top only and the hoop tendons will be retensioned simultaneously from both ends; except for restricted conditions which may mandate tensioning from only one end.

3.2 GENERAL ARRANGEMENT

3.2.1 The system used to access the hoop tendons will consist of four work platforms suspended from Upper Support Frames (hereafter referred to as USFs) which will be attached to the dome rails of the Unit 3 Reactor Building. Large USFs and work platforms capable of supporting the equipment necessary for coiling a tendon will be placed at each of the buttresses where tendons will be removed (BT3 and BT4). Smaller USFs and work platforms which only need to support detensioning and stressing activities will be placed at the other two buttresses (BT2 and BT5).

3.2.2 Vertical tendons will be removed from a coiler placed on top of the containment dome rails. The coiler will be located on a platform capable of supporting the equipment and a tendon. The coiler platform will provide the necessary configuration and mobility to allow the vertical tendon coiler to be optimally positioned in an efficient manner.

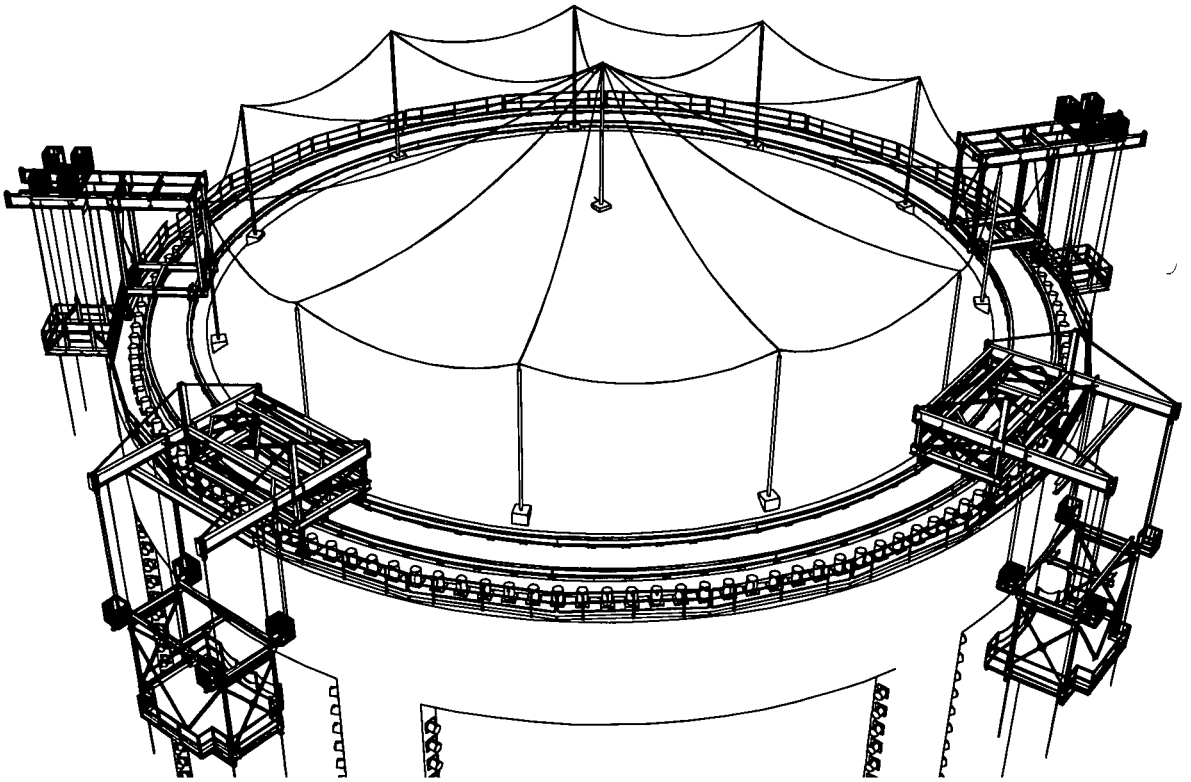
3.2.3 All of the USFs and platforms have been given a specific designation to identify each piece of equipment throughout this calculation. The designation includes the buttress it will be located at as well as that buttress's azimuth. Table 3-1 shows all of the designations as well as a short description identifying the differences between each location.

Table 3-1: USF and Platform Designation

Designation (Location)	Description
DOME Coiler Platform	Coiler Platform for access to vertical Tendons
BT2-60° USF & Work Platform (BT2)	Small USF with Standard 8' X 10' Work Platform
BT5-240° USF & Work Platform (BT5)	Small USF with Standard 8' X 10' Work Platform
BT3-120° USF & Work Platform (BT3)	Large USF with Standard 20' X 10'-9" Work Platform
BT4-180° USF & Work Platform (BT4)	Large USF with Modified 18' X 14'-4" Work Platform

* Approximate number, final quantities will be determined by CR3 Engineering

FIGURE 3-1: TENDON ACCESS EQUIPMENT ARRANGEMENT



3.3 DETAILED ARRANGEMENT

3.3.1 All of the work platforms will be raised and lowered by either Tractel XE2050P or Tractel XE1020P drive units. Depending on which size motors are used on the corresponding platforms, a block and tackle system will be employed. Single-part, 2-part or 4-part lines will be used in order to keep the motors running within their limits when the corresponding loads are applied.

3.3.1.1 The XE2050P Tractel units have a man-riding capacity of 4 kips each. The drive cables for the XE2050P consist of 9/16" diameter wire rope. The 9/16" steel cable has a minimum breaking strength of 35.3 kips. This means in this configuration, the support cables have a safety factor of 8.83.

3.3.1.2 The XE1020P Tractel units have a man-riding capacity of 2.2 kips each. The drive cables for the XE1020P consist of 3/8" diameter wire rope. The 3/8" steel cable has a minimum breaking strength of 15 kips, which yields a safety factor of 6.82.

3.3.2 In addition to the drive cable system, all of the work platforms will have a secondary set of independent safety cables. In all cases the safety cables will consist of 9/16" diameter wire rope and a minimum safety factor of at least 5 to 1 will be provided over the operating weight for the platform.

3.3.3 Spider basket(s) may be hung from any of the USFs to facilitate the transportation of personnel and material/tooling between the work platform and the containment dome or ground. One spider basket has a dead weight of 250 lbs. and a capacity of 1,000 lbs. Each spider basket setup will exert a maximum of 1,250 lbs. of force on the USF when installed.

3.3.4 BT2-60° & BT5-240° Upper Support Frames

3.3.4.1 The Tractel drive units on the BT2-60° and BT5-240° Upper Support Frames will be arranged on a separate assembly unit, which will attach to the top flanges of the USF. This allows for the placement of the basket in an optimal location for the work being performed. The entire assembly, including framing, motors, and 200 feet of drive/safety cable, will weigh a maximum of 4.4kips.The BT2-60° and BT5-240° USFs general arrangement are shown in Figure 3-2 and Figure 3-3 shows their general dimensions.

3.3.4.2 During tendon stressing operations, a hydraulic ram will be supported from a 5-ton capacity (10 kip working load) electric hoist. The hoist itself weighs 1.8 kips. In this configuration the maximum load the hoist will exert on the USF is 11.8 kips.

FIGURE 3-2: BT2-60° & BT5-240° UPPER SUPPORT FRAMES

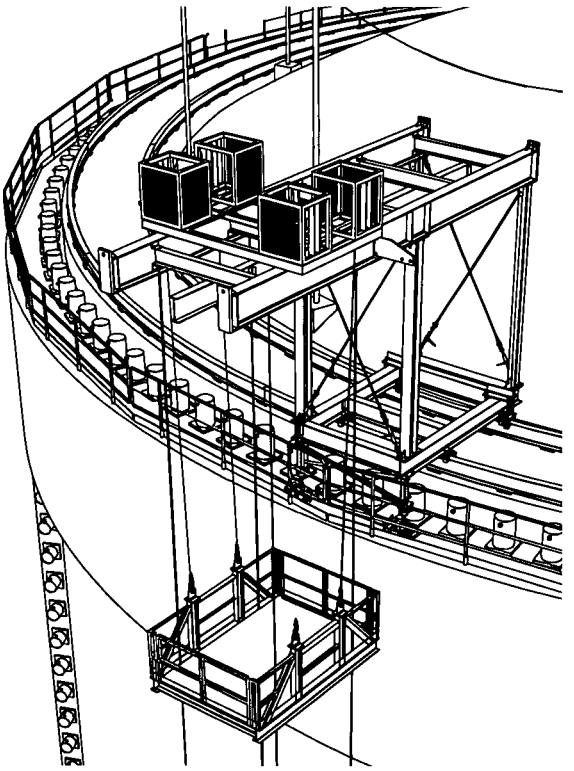
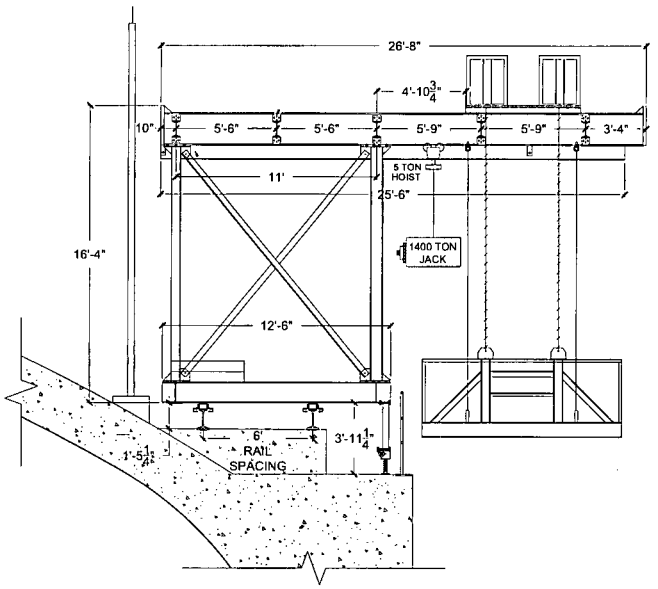


FIGURE 3-3: BT2-60° & BT5-240° UPPER SUPPORT FRAMES



3.3.4.3 The counterweight used to resist overturning for this USF consists of 30 kips of steel plate, located at the rear end of the USF. The counterweights will be located on the base of the frame as shown in Figure 3-3. In addition to counterweight, the USF will be tied down to the containment rails using PSC custom tie downs similar to those shown in Reference 2.1.11. The tie downs will be designed and tested for a maximum force of 40 kips each in the same manner shown. The total hold-down force for this frame will be 120 kips {30+45+45 = 120 kips}.

3.3.5 BT2-60° & BT5-240° Work Platforms

3.3.5.1 The work platforms located at Buttress 2 (60° azimuth) and Buttress 5 (240° azimuth) are standard 8' X 10' PSC Work Platforms. All of the dead and live loads that will be exerted on the work platforms are summarized in Table 3-2 below.

Table 3-2 : Detailed Loads for BT2-60° & BT5-240° Work Platform					
Load Description	**Class**	**Unit Weight**	**Quantity**	**Total Weight**	**Class Totals**
Platform Self-Weight	DL	3,850 lbs.	1	3,850 lbs.	3,850 lbs.
Personnel	LL	250 lbs.	4	1,000 lbs.	1,850 lbs.
New/Scrap Grease Drum	LL	500 lbs.	1	500 lbs.	
Shims	LL	100 lbs.	1	100 lbs.	
Tools	LL	250 lbs.	1	250 lbs.	
Hydraulic Ram Pump	OL3	750 lbs.	1	750 lbs.	750 lbs.
				Total Weight =	6,450 lbs.

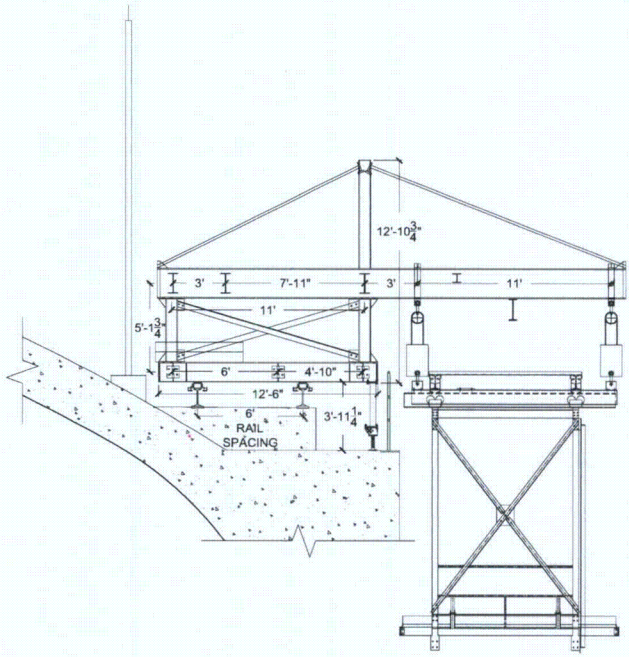
3.3.6 BT3-120° & BT4-180° Upper Support Frames

3.3.6.1 The Tractel drive units on the BT3-120° and BT4-180° Upper Support Frames will be hung directly from the outriggers of the USF. In this configuration, the total load from the motors, drive cables, and safety cables does not exceed 4.0 kips.

3.3.6.2 During all tendon removal/replacement and stressing operations the loads from all equipment on the work platforms will be transferred to the USF through the drive cable system.

3.3.6.3 The counterweight used to resist overturning for this USF will total 54.0 kips and be located on the support beams at the rear of the USF. The counterweights will be located on the base of the frame as shown in Figure 3-3. In addition to counterweight, the USF will be tied down to the containment rails using PSC custom tie downs similar to those shown in Reference 2.1.11. The tie downs will be designed and tested for a maximum force of 40 kips each in the same manner shown. The total hold-down force for this frame will be 144 kips {$54^K + 45^K + 45^K = 144$ kips}.

FIGURE 3-4 : BT3-120° & BT4-180° UPPER SUPPORT FRAMES



3.3.6.4 The BT3-120° and BT4-180° Upper Support Frames dimensions are shown in Figure 3-4 and the general arrangement for the frames and work platforms are shown in Figure 3-5.

3.3.7 BT5-260° & BT6-320° Work Platforms

3.3.7.1 During tendon removal and replacement operations, the BT3-120° and BT4-180° Work Platforms will be setup with a tendon coiler being powered by a hydraulic pump. When tendons are being stressed, a hydraulic ram will be installed on the platform monorail and run with a hydraulic pump. All of the equipment from these setups will be supported directly by the work platforms. The weights of each setup, as well as the dead and live loads for the work platforms are listed below in Table 3-3. It should be noted that the Coiler Setup and Stressing Setup cannot be used simultaneously.

3.3.7.2 The minor differences in size of the two work platforms is due to the BT4-180° Work Platform needing to be narrower to clear possible interferences. The general loads listed below are the same for both work platforms, however the actual application of the design loads will vary due to the configuration differences.

FIGURE 3-5 : BT3-120° & BT4-180° UPPER SUPPORT FRAMES

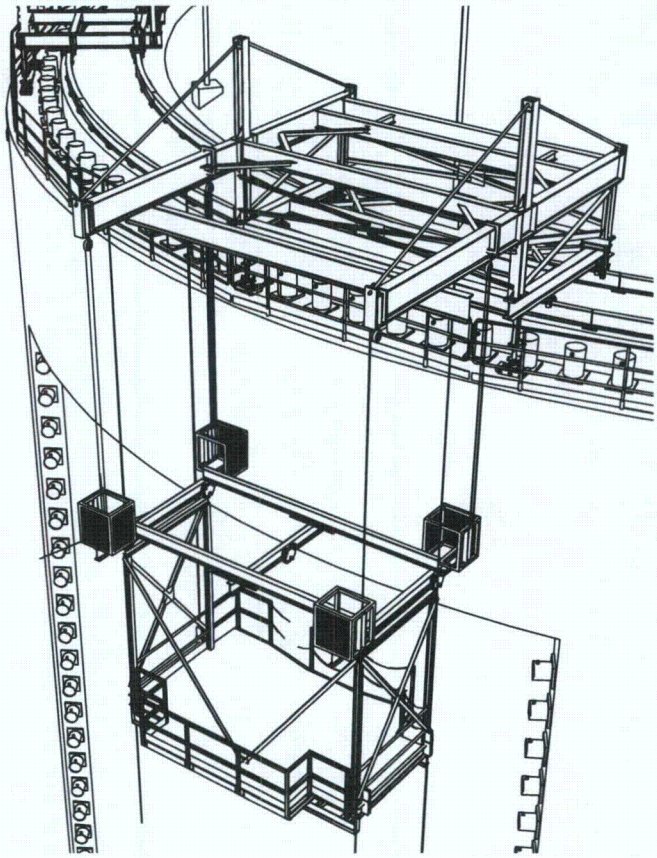


Table 3-3: Detailed Loads for BT3-120° & BT4-180° Work Platforms					
Load Description	**Class**	**Unit Weight**	**Quantity**	**Total Weight**	**Class Totals**
Platform Self-Weight	DL	15,000 lbs.	1	15,000 lbs.	15,000 lbs.
Personnel	LL	250 lbs.	8	2,000 lbs.	3,700 lbs.
New/Scrap Grease Drum	LL	500 lbs.	2	1,000 lbs.	
Shims	LL	200 lbs.	1	200 lbs.	
Tools	LL	500 lbs.	1	500 lbs.	
Coiler	OL4	8,500 lbs.	1	8,500 lbs.	15,500 lbs.
Tendon	OL4	6,000 lbs.	1	6,000 lbs.	
Hydraulic Pump	OL4	1,000 lbs.	1	1,000 lbs.	
Hydraulic Ram	OL5 / 6	10,000 lbs.	1	10,000 lbs.	10,750 lbs.
Hydraulic Pump	OL5 / 6	750 lbs.	1	750 lbs.	
NOTE The Coiler Setup and Stressing Setup cannot be used simultaneously		Total Weight with Coiler Setup =			34,200 lbs.
		Total Weight with Stressing (Ram) Setup =			29,450 lbs.

4.0 DESIGN LOADS

4.1 WORK PLATFORM DESIGN LOADS

4.1.1 In Table 4-1 through Table 4-3 below, the weights outlined in the previous section have been converted to the design loading and applied to the models in RISA 3D. All of the loads have been applied as either joint, linear distributed, or area distributed in order to best reflect the physical nature of the loads.

Table 4-1 : Design Loads Used in ihe BT2-60° & BT5-240° Work Platform Analysis

Load Description	Class	Weight	Quantity of Loads Applied in RISA	Magnitude of Loads Applied in RISA	Comments
Platform Dead Load	DL	3,850 lbs	76.245 sq. ft.	50.50 psf	
Platform Live Load	LL	1,850 lbs	76.245 sq. ft.	24.26 psf	
Hydraulic Pump	OL3	750 lbs	1	750 lbs	OL = Other Load
5:1 Platform Live Load	LLS	9,250 lbs	76.245 sq. ft.	121.32 psf	LLS = Live Load Special

Table 4-2: Design Loads Used in the BT3-120° Work Platform Analysis

Load Description	Class	Weight	Quantity of Loads	Magnitude of Loads	Comments
Platform Dead Load	DL	15,000 lbs.	231.16 sq. ft.	64.89 psf	
Platform Live Load	LL	3,700 lbs.	231.16 sq. ft.	16.00 psf	
Coiler/Tendon/Pump	OL4	15,500 lbs.	48.0 sq. ft.	322.92 psf	OL = Other Load
Hydraulic Ram/Pump	OL5 / 6	10,750 lbs.	1	10,750 lbs.	OL = Other Load
5:1 Platform Live Load	LLS	18,500 lbs.	231.16 sq. ft.	80.03 psf	LLS = Live Load Special

Table 4-3: Design Loads Used in the BT4-180° Work Platform Analysis

Load Description	Class	Weight	Quantity of Loads	Magnitude of Loads	Comments
Platform Dead Load	DL	15,000 lbs.	220.74 sq. ft.	67.95 psf	
Platform Live Load	LL	3,700 lbs.	220.74 sq. ft.	16.76 psf	
Coiler/Tendon/Pump	OL4	15,500 lbs.	48.0 sq. ft.	322.92 psf	OL = Other Load
Hydraulic Ram/Pump	OL5 / 6	10,750 lbs.	1	10,750 lbs.	OL = Other Load
5:1 Platform Live Load	LLS	18,500 lbs.	220.74 sq. ft.	83.81 psf	LLS = Live Load Special

* Areas are calculated from RISA 3D and AutoCAD

4.2 Upper Support Frame Design Loads

4.2.1 In Table 4-4 and Table 4-5 below, the design loads are converted from their stated weights or calculated values to the actual design loads applied to the USF models in RISA 3D. The DL, LL, and OL values from the corresponding work platforms are taken from Table 3-2 and Table 3-3 above, the corresponding equipment weights from Section 3.3, and the lateral design forces calculated in Section 5.0.

4.2.2 It should be noted that the dead loads of the USFs themselves are not included in the tables because RISA 3D calculates the weight of all members based on their sizes and lengths.

Table 4-4: Design Loads Used in the BT2-60° & BT5-240° USF Analysis

Load Description	Class	Load Magnitude	Quantity of Loads in RISA	Magnitude of Loads in RISA	Comments
Platform Dead	DL	3.85^K	4	0.96^K	
Platform Live	LL	1.85^K	4	0.46^K	
Tractel Support Basket	DL	4.4^K	4	1.1^K	
Steel Counterweight	DL	30.0^K	2	15.0^K	
Trolley/Hoist	OL1 / 2	11.8^K	1	11.8^K	OL = Other Load
Hydraulic Pump (in platform)	OL3	0.75^K	4	0.19^K	OL = Other Load
Spider Basket	LL	1.25^K	1	1.25^K	
300mph Wind X-Dir ($W_{\perp}$)	WLX	16.24^K	43.36 ft.	0.375k/ft.	
300mph Wind Z-Dir ($W_{//}$)	WLZ	27.76^K	67.7 ft.	0.410 k/ft.	
Horiz. Earthquake ($EQ_{\perp}$)	ELX	88.99^K	8	7.42^K	
Horiz. Earthquake ($EQ_{//}$)	ELZ	36.25^K	8	4.53^K	
Vertical Earthquake	ELY	9.05^K	8	1.13^K	

Table 4-5: Design Loads Used in the BT3-120° & BT4-180° USF Analysis

Load Description	Class	Load Magnitude	Quantity of Loads in RISA	Magnitude of Loads in RISA	Comments
Platform Dead	DL	15.0^K	4	3.75^K	
Platform Live	LL	3.7^K	4	0.925^K	
Coiler/Tendon/Pump	OL4	15.5^K	4	3.875^K	OL = Other Load
Hydraulic Ram/Pump	OL5	10.75^K	4	2.69^K	OL = Other Load
Tractel Motors/Cables	DL	4.0^K	4	1.0^K	
Spider Baskets	LL	2.5^K	2	1.25^K	
Counterweight	DL	54.0^K	8	6.75^K	
300mph Wind X-Dir ($W_{\perp}$)	WLX	31.03^K	47.41 ft.	0.656 k/ft.	
300mph Wind Z-Dir ($W_{//}$)	WLZ	25.27^K	46.60 ft.	0.542 k/ft.	
Horiz. Earthquake ($EQ_{\perp}$)	ELX	161.16^K	8	20.15^K	
Horiz. Earthquake ($EQ_{//}$)	ELZ	61.99^K	8	7.75^K	
Vertical Earthquake	ELY	16.38^K	8	2.05^K	

NOTE D.L. of the USF is automatically calculated from member sizes by RISA

5.0 LATERAL LOADS

5.1 TWO- PERCENT OPERATING WEIGHT

5.1.1 Two-Percent (2%) of each USF's operating weight has been calculated and added to the wind load to account for any accidental lateral loading in addition to that already calculated. The respective weights are calculated below in Table 5-1.

Table 5-1: 2% Operating Weight Tabulation

Description	BT2-60° & BT5-240°	BT3-120° & BT4-180°
USF Dead Load (DL)*	12.0 kips	18.0 kips
Platform Dead Load (DL)	3.85 kips	15.0 kips
Platform Live Load (LL)	2.60 kips	3.7 kips
Coiler/Tendon/Pump (LL)	-	15.5 kips
Hoist w/ Hydraulic Ram (LL)	11.8 kips	-
Tractel Motors (DL)	4.4 kips	4.0 kips
Spider Basket(s) (LL)	1.25 kips	2.5 kips
Counterweight (DL)	30.0 kips	54.0 kips
Total Dead Load	*50.25 kips*	*91.00 kips*
Total Live Load	*15.65 kips*	*21.70 kips*
Total Operating Weight	**65.90 kips**	**112.70 kips**
2% of Operating Weight	**1.32 kips**	**2.25 kips**

* USF Dead Loads are calculated from RISA 3D

5.2 WIND LOADING

5.2.1 The wind loading for each USF has been calculated in two directions for a 300 mph tornado wind speed, which has a design pressure of 230.22 psf, as well as a 179 mph hurricane wind speed, which has a design pressure of 81.792psf, both in accordance with Reference 2.1.12. The Projected Area Method has been used to calculate the Design Wind Loads. The wind loads are applied as distributed loads perpendicular to containment (radial) and parallel to the containment building (tangential) in order to ensure each structure's ability to withstand these forces. The wind loadings are evaluated under working conditions. The dimensions used for calculating the design wind loads are tabulated in Table 5-2.

Table 5-2: USF Wind Loading Dimensions

BT2-60° & BT5-240°			BT3-120° & BT4-180°		
Dimension	Parallel to Containment (tangential)	Perpendicular to Containment (radial)	Dimension	Parallel to Containment (tangential)	Perpendicular to Containment (radial)
Projected Area (A_p)	115 sq. ft.	65 sq. ft.	Projected Area (A_p)	100 sq. ft.	125 sq. ft.
Length that Wind Load is Applied in RISA (L_w)	67.70 ft.	43.36 ft.	Length that Wind Load is Applied in RISA (L_w)	46.60 ft.	47.41 ft.
* Areas and Lengths calculated from RISA 3D and AutoCAD					

5.2.2 BT2-60° & BT5-240° USF Wind Loading

5.2.2.1.1 Design Tornado Wind Load applied parallel to containment (W_{II}):

$$F = P \cdot A_p$$

$$F_{II} = (230.22)(115) = 26475.3lb. = 26.48^{K} + 1.32^{K} = \mathbf{27.79^{K}} \quad \therefore \mathbf{GOVERNS}$$

Distributed Load Applied in RISA: $W_{II} = \frac{F}{L_w} = \frac{27.79}{67.70} = \mathbf{0.410\ ^{k}/_{ft}}$

5.2.2.1.2 Design Hurricane Wind Load applied parallel to containment (W_{II}):

$$F = P \cdot A_p$$

$$F_{II} = (81.792)(115) = 9406.08lb. = 9.41^{K} + 1.32^{K} = \mathbf{10.73^{K}}$$

5.2.2.1.3 Design Tornado Wind Load applied perpendicular to containment ($W_{\perp}$):

$$F = P \cdot A_p$$

$$F_{\perp} = (230.22)(65) = 14964.3lb. = 14.96^{K} + 1.32^{K} = \mathbf{16.28^{K}} \quad \therefore \mathbf{GOVERNS}$$

Distributed Load Applied in RISA: $W_{\perp} = \frac{F}{L_w} = \frac{16.28}{43.36} = \mathbf{0.375\ ^{k}/_{ft}}$

5.2.2.1.4 Design Hurricane Wind Load applied perpendicular to containment ($W_{\perp}$):

$$F = P \cdot A_p$$

$$F_{\perp} = (81.792)(65) = 5316.48lb. = 5.32^{K} + 1.32^{K} = \mathbf{6.64^{K}}$$

5.2.3 BT3-120° & BT4-180° USF Wind Loading

5.2.3.1.1 Design Tornado Wind Load applied parallel to containment (W_{II}):

$$F = P \cdot A_p$$

$$F_{II} = (230.22)(100) = 23022lb. = 23.02^{K} + 2.25^{K} = \mathbf{25.27^{K}} \quad \therefore \mathbf{GOVERNS}$$

Distributed Load Applied in RISA: $W_{II} = \frac{F}{L_w} = \frac{25.27}{46.60} = \mathbf{0.542\ ^{k}/_{ft}}$

5.2.3.1.2 Design Hurricane Wind Load applied parallel to containment (W_{II}):

$$F = P \cdot A_p$$

$$F_{II} = (81.792)(100) = 8179.2lb. = 8.18^{K} + 2.25^{K} = \mathbf{10.43^{K}}$$

5.2.3.1.3 Design Tornado Wind Load applied perpendicular to containment ($W_{\perp}$):

$$F = P \cdot A_p$$

$$F_{\perp} = (230.22)(125) = 28777.5lb. = 28.78^{K} + 2.25^{K} = \mathbf{31.03^{K}} \quad \therefore \mathbf{GOVERNS}$$

Distributed Load Applied in RISA: $W_{\perp} = \frac{F}{L_w} = \frac{31.03}{47.41} = \mathbf{0.655\ ^{k}/_{ft}}$

5.2.3.1.4 Design Hurricane Wind Load applied perpendicular to containment ($W_{\perp}$):

$$F = P \cdot A_p$$

$$F_{\perp} = (81.792)(125) = 10224lb. = 10.22^{K} + 2.25^{K} = \mathbf{12.47^{K}}$$

5.3 SEISMIC LOADING

5.3.1 The seismic design loads have been calculated from design accelerations obtained from the response spectra provided at various elevations. The response spectra and necessary guidance have been taken from Reference 2.1.13. Acceleration values have been obtained for both Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) levels.

5.3.2 For both horizontal and vertical accelerations, the SSE values are equal to two (2) times the OBE values for the respective direction. In an effort to maintain simplicity and conservatism, the peaks of all response spectra involved have been used rather than the values corresponding with the periods of the Upper Support Frames.

5.3.3 Vertical accelerations are calculated as two thirds (2/3) the horizontal ground response spectra. A value of 2% of critical damping has been used in selecting the peak acceleration. The note from Section 5.1.1 of Reference 2.1.13 references Section 5.4.5.2 of the CR-3 FSAR which addresses the fact that thick vertical walls do not amplify the seismic response therefore the ground acceleration may be used. Table 5-3 outlines the calculation of the vertical accelerations.

Table 5-3: USF Vertical Seismic Loading

		BT2-60° & BT5-240°	BT3-120° & BT4-180°
USF Dead Weight		50.25 kips	91.00 kips
OBE	Horizontal Ground Acceleration (Ref. 2.1.13 Attachment "E", Fig. 22)	0.09g	0.09g
	Force	4.52 kips	8.19 kips
SSE	Acceleration (2 x OBE)	0.18g	0.18g
	Design Load	**9.05 kips**	**16.38 kips**

5.3.4 When calculating the horizontal accelerations the following steps were taken in order to achieve more realistic accelerations when considering the amplification due to the equipment sitting on top of the reactor containment building.

5.3.4.1 Because the only data available for the 270' elevation (Reference 2.1.13, Attachment "E", Figure 5) was at 1/2% of critical damping, the ground response spectra was used to calculate the estimated accelerations at 270' for damping values of 1%, 2% and 5% as well. This estimation was achieved by using the same ratio on the ground between damping values at the 270' elevation. A frequency of 4.4 Hz was used for this comparison since that is the peak of the Reactor Building Shell response spectra at 270' elevation. Table 5-4 shows the calculation of accelerations at various % damping values.

Table 5-4: Floor Response Spectra at Elev. 270'

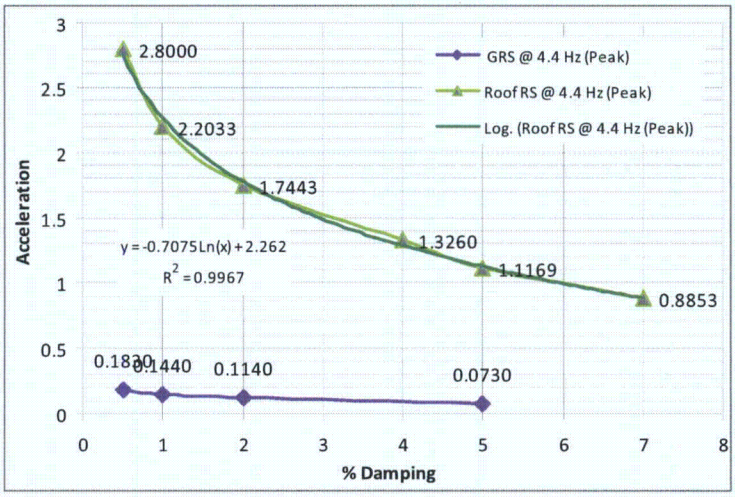
% Damping	GRS Acceleration (@ 4.4 Hz)	Ratio	270' Roof Acceleration (@ 4.4 Hz)
0.5	0.183	-	2.8
1	0.144	$\frac{0.144}{0.183}(2.8)$	2.2033
2	0.114	$\frac{0.114}{0.183}(2.8)$	1.7443
5	0.073	$\frac{0.073}{0.183}(2.8)$	1.1169

5.3.4.2 According to Section 5.2.2 of Reference 2.1.13, a value of 4% of critical damping for OBE and 7% for SSE is most realistic when designing bolted steel structures. Linear interpolation was used to calculate the OBE acceleration value on the roof at 4% of critical damping.

$$OBE = y_0 + (x - x_0)\frac{y_1 - y_0}{x_1 - x_0} = 1.7443 + (4-2)\frac{1.1169 - 1.7443}{5-2} = \mathbf{1.326g}$$

5.3.4.3 In order to estimate the acceleration value at 7% of damping, a trend line was best fit to the other data points in order to obtain a conservative value. Using linear extrapolation would have yielding a value that was too low due to the downward trending of the data points. Figure 5-1 shows the actual and estimated values as well as the equation of the trend line used to calculate the acceleration at 7% damping.

FIGURE 5-1: RESPONSE SPECTRA EVALUATION



5.3.4.4 The equation from the trend line was used to calculate the SSE acceleration value at 7% of critical damping and Table 5-5 shows the design forces which were calculated from these acceleration values.

$$SSE = 0.7075Ln(x) + 2.262 = 0.7075Ln(7) + 2.262 = 0.8853g \times 2 = \mathbf{1.771g}$$

Table 5-5: USF Horizontal Seismic Loading

		BT2-60° & BT5-240°	BT3-120° & BT4-180°
USF Dead Weight		50.25 kips	91.00 kips
OBE	Acceleration (4%)	1.326g	1.326g
	Force	66.63 kips	120.67 kips
SSE	Acceleration (7% x 2)	1.771g	1.771g
	Design Load	**88.99 kips**	**161.16 kips**

5.3.4.5 Only the perpendicular (radial) direction of the USFs is evaluated for the full design load, the parallel (tangential) direction will never see the entire load due to the fact that the frames will just roll back and forth in place. Because of this, the frames were designed for the load which would be needed to break the static friction and start the frames moving. A coefficient of friction of 0.55 was used.

$$ELZ_{BT2-60\&BT5-240} = 65.9 \cdot 0.55 = \mathbf{36.25^K} \qquad ELZ_{BT3-120\&BT4-180} = 112.7 \cdot 0.55 = \mathbf{61.99^K}$$