

UNCONTROLLED COPY

WASHINGTON PUBLIC POWER SUPPLY SYSTEM  
Verified Prior To Use PLANT PROCEDURES MANUAL

Verified By \_\_\_\_\_ Date \_\_\_\_\_ WNP-2

Verified By \_\_\_\_\_ Date \_\_\_\_\_

PROCEDURE NUMBER

APPROVED

DATE

\*10.3.5

12/17/81

VOLUME NAME

10

MAINTENANCE PROGRAMS AND PROCEDURES

SECTION

10.3

REACTOR VESSEL SERVICING

TITLE

\*10.3.5

REACTOR VESSEL HEAD REMOVAL AND REPLACEMENT

10.3.5.1 Purpose

The purpose of this procedure is to detail the steps in tensioning and untensioning the vessel head studs as well as the head removal and replacement in sequence with the tensioning procedure. Incidental to this procedure is the installation and removal of the refueling cattle-chute.

10.3.5.2 References

- A. Safe Load Path - RPV Head, Exhibit 10.3.5A
- B. GE, Vessel Flange Bolting Print 105D4615
- C. GE, Head Strongback Head Lifting Fixture Print 767E187
- D. GE, Nuclear Boiler Equipment Operation and Maintenance Instruction, GEK71311, CVI-02-02-01, Sheet 8
- E. Chicago Bridge and Iron Company Reactor Vessel Instruction Manual, CVI 2-02B13-06, Sheet 150

10.3.5.3 Prerequisites

- A. Reactor in shutdown mode.
- B. Reactor vessel pressure at atmospheric and temperature maintained below 200°F.
- C. Check with the shift supervisor to make certain water in the reactor vessel is at the proper level.
- D. Reactor vessel cavity shield blocks removed.
- E. Drywell head removed.

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-1 of 16

ENCLOSURE 3

210190582 821004  
PDR ADDCK 05000397  
E PDR



- F. Reactor vessel head insulation package removed.
- G. Water tight seal covers installed on drywell ventilation duct openings.
- H. Reactor vessel cavity drained of water.
- I. Work Request approved by Shift Supervisor in accordance with PPM 1.3.7.
- J. Clearance Order approved in accordance with PPM 1.3.8.
- K. RWP in accordance with PPM 11.2.8.
- L. Reactor building crane checked out per PPM 10.4.1.
- M. Reactor vessel head lifting fixture EPN NSSE-EQ-15 and Cattle Chute Slings EPN \_\_\_\_\_ checked out and found operable.
- N. Stud tensioners and pumps given preoutage PM.

#### 10.3.5.4 Precautions

- A. Notification of the Control Room when tensioning operation commences and is completed to assure temperature requirements for this procedure. The head temperature must be maintained above 70°F.
- B. Vessel stud elongation holes must be void of moisture and dirt.
- C. While tensioners are in operation, all personnel shall keep clear of stud tensioner heads.
- D. While hoisting stud tensioners and/or threading tensioners onto vessel studs, be careful of damage to stud threads.
- E. Stud thread protectors shall always be in place except during stud tensioning operation or while studs are being cleaned, lubricated or removed for inspection.
- F. Prior to head removal and all the time the head is removed, all small tools and equipment shall be sufficiently secured to prevent falling into the vessel per PPM 1.3.18.
- G. The flange protectors shall always be in place while the head is removed except when the in-vessel staging tracks are mounted.
- H. The reactor vessel head and cattle chute shall be moved per the path shown on Exhibit 10.3.5A.

I. *Note: Any Deviation From the prescribed load path shall be marked upon the load path drawing (exhibit 10.3.5A) and shall be reviewed and approved by the shift manager or his designee. Documentation and Plant operating committee approval shall be handled in accordance with PPM 1.2.4.*

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-2 of 16

#### 10.3.5.5 Materials, Tools and Equipment

##### A. Spare Parts

1. At least one set of vessel 'O' rings
2. Three vessel studs and nuts
3. Recommended spares for stud tensioners
4. Recommended spares for stud tensioners pumps

##### B. Special Tools and Fixtures

1. Head stud and nut rack
2. Vessel nut handling tool
3. Stud handling tool
4. Complete set of thread protectors
5. Stud running air motors
6. Set of flange protectors
7. 12" machinist level
8. Complete set of stud elongation rods
9. Dial depth indicator
10. Head temperature measuring instrumentation

##### C. Regular Tools and Fixtures

1. Reactor building crane
2. Head lifting fixture - EPN NSSE-EQ-15
3. Stud tensioning carousel
4. Set of 4 stud tensioners
5. Tensioning pump
6. Flexible hose for head evacuation to the off-gas system
7. Refueling "cattle-chute"
8. Head stud guide pins
9. Lanyards for small tools..

##### D. Materials

1. Supply of lint free rags
2. WPPSS approved cleaning fluid - Isopropanol or Methonal Alcohol
3. Six cans each of Fel-Pro C-5A, Never-Seez compound or equivalent

#### 10.3.5.6 Procedure

##### A. Vessel Head Stud Untensioning

1. Using reactor building crane auxiliary hook place stud tensioner carousel with tensioners and manifolds, onto vessel head.
2. Connect and check out operation of tensioner hydraulic pumps.
3. Remove stud protective covers and store along outer periphery of reactor cavity.
4. Contact control room to monitor head flange temperature. Must remain above 70°F while tensioning is being performed.

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-3 of 16



5. For four tensioners two cycle procedure, use the following pattern sequence:

<u>Operation</u>	<u>Tensioner Number</u>			
	#1	#2	#3	#4
<u>Stud Numbers</u>				
1	1	20	39	58
2	13	32	51	70
3	5	24	43	62
4	17	36	55	74
5	9	28	47	66
6	3	22	41	60
7	15	34	53	72
8	7	26	45	64
9	19	38	57	76
10	11	30	49	68
11	2	21	40	59
12	14	33	52	71
13	6	25	44	63
14	18	37	56	75
15	10	29	48	67
16	4	23	42	61
17	12	31	50	69
18	8	27	46	65
19	16	35	54	73

NOTE: This sequence is shown pictorially on Exhibit 10.3.5B.

B. Connecting the tensioners to studs:

1. The tensioners should be lowered simultaneously, or individually, each tensioner being guided by an operator. The tensioner should go down over the stud and nut until the base rests on the flange.
2. Turn the drive handle on the side of the tensioner until the driving teeth of the drive plate match up with the slots of the nuts, the drive plate will drop into place and be ready for turning the nut.
3. Push down on the puller bar by pushing down on the hand wheel and feel for the thread engagement between the puller bar socket and the stud.
4. After the threads have engaged, screw on the puller bar until the tensioner holding nut bottoms on the tensioner spherical washers.
5. Back off the puller bar about 1/2 to 1 turn.
6. Step back to signal that unit is ready for tensioning.

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-4 of 16

7. When this operation has been performed on all of the tensioners, they are ready to be pressurized.
8. Close tensioner bypass valves. Position control valve to tensioning "Position to Start Tensioner Pump". Continue pumping until nuts at each tensioner are free to rotate (maximum hyd. press. should be approximately 8000 PSIG for operations 11-10 and 8600 PSIG for operations 11-19.) Position control valve to "Neutral" and signal that pump is at pressure.
9. Turn drive handle on side of tensioner 5 turns counter clockwise (1 turn of nut) and step back to signify operation is complete.
10. Crack the pressure relief valve and lower hydraulic pressure to 4500 PSIG (operations 1-10) or 4730 PSIG (operations 11-19) and signal that pump is at pressure.
11. Turn drive handle clockwise until stud nut is snug against vessel flange and step back to signify operation is completed.
12. Position the control valve to "release" position and allow hydraulic pressure to decrease to "0" PSIG.

NOTE: Leave control valve in release during positioning of tensioners to next position.

13. Disengage tensioners from studs by turning handwheel counter clockwise. Hoist tensioners free from studs and index to next position.
14. Repeat steps 5 thru 13 until all nuts (operations 1 thru 19) have been released to the intermediate tension.
15. Index back to position 1 and engage tensioners onto studs per step 5.
16. Position control valve to "tensioning" and increase hydraulic pressure until all nuts are free. (Approximately 6800 PSIG for operation 1-10 and 8800 PSIG for operations 11-19) position control valve to "Neutral."
17. Loosen the stud nuts by turning the drive handle counter clockwise 10 full turns (2 nut turns).
18. Open the pressure relief valve and lower pressure to "0" PSIG. Position control valve to "Release."
19. Disengage tensioners from studs and index to next position and engage tensioners onto studs per step 5.
20. Repeat steps 16 thru 19 until all nuts have been loosened (operations 1-19).



21. Check to see that all nuts are free. Transfer carousel, tensioners and pumps to storage.
22. Place nut and washer storage racks in vessel cavity. Proceed with nut removal by use of nut threading tool. Place nut and washer in the rack, making sure both pieces are kept in sets and in sequence. When completed, transfer racks to refueling floor for storage.
23. Replace all stud protectors, except at positions #1, #25 and #50 for head/stud guide caps and selected studs to be removed for inspection.
24. Install the three head/stud guide caps.
25. Remove three or four studs for refueling passageway, using stud handling fixture. Check to see that studs are correctly identified for vessel position.
26. Remove other selected studs as specified by engineering for periodic surveillance testing. Check to see that studs are correctly identified for respective vessel position.
27. Transfer studs in stud rack to refuel floor for storage or testing.

C. Vessel Head Removal

1. Transfer vessel head lifting fixture and attach to head.

NOTE: Make certain crane hook is properly mated to strong back pins and locking pins are in place.

2. Carefully hoist head approximately 1" until it is free of the flange. Continuously monitor the crane load cell for overloading, (RPV maximum weight is 186,700#). Check for head level, clearance and uniform loading, adjust turn-buckles as needed.

NOTE: Check with operations to make certain the RPV head has been evacuated of noncondensable gases that could go airborne and contaminate the 606 level. Have Health Physics check when vessel head has been lifted approximately 1" to see if further evacuation is needed through the head vent. *Check the load path shown on Exhibit 10.3.5 A to make certain it is free of all obstacles.*

3. When the head is cleared for removal, remove filter (if installed) and hoist head free. Hoist and transfer head to its storage pedestals. Release head lifting fixture from crane hook. *VIA THE SAFE LOAD PATH ON EXHIBIT 10.3.5 A.*
4. Install vessel flange protectors and vessel stud hole protectors in void areas.

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-6 of 16

D. "Cattle-Chute" Installation

1. After the fuel pool shield blocks have been removed per PPM 10.3.2, in preparation for the refueling operation, rig the "Cattle-Chute" for hoisting. Hoist and move to vessel cavity.
2. Guide and set cattle-chute so that one end is protruding into fuel pool canal and the other end overhanging the vessel flange. Remove rigging.

E. "Cattle-Chute" Removal

1. Attach hoisting rigging. Hoist and transfer chute to storage position on refueling floor. Release hoisting rigging.
2. Upon completion, fuel pool shield blocks may be reinstalled.

F. Vessel Head Replacement

1. Remove old "O" rings and collect all clips and retaining rings. Clean head flange and "O" ring grooves with isopropyl or methyl alcohol to level "B" cleanliness.

CAUTION: Do not touch "O" rings with bare hands, use cotton gloves. Support uniformly with at least 6 people.

2. Install new set of "O" rings into head grooves and attach retaining clips.

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

3. Clean and lubricate all vessel studs and nuts with Fel-Pro-C-5A, "Nickel Never-Seez" compound or equivalent.

NOTE: All one product should be used at one refueling.

4. Install vessel studs previously removed for inspection. Tighten in place by use of stud wrench. Make sure studs are returned to their specific location.

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

5. Remove vessel flange protectors. Clean flange with isopropyl or methyl alcohol to level "B" cleanliness. Do not use a metal cleaning device on flange surfaces.

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

6. Attach vessel head lifting fixture to the vessel head. Hoist head free and check for level and uniform loading.

7. *check the load path on Exhibit 10.3.5A to make certain*

PROCEDURE NUMBER

10.3.5

REVISION NUMBER

0

PAGE NUMBER

10.3.5-7 of 16

*it is free of all obstacles.*

- via the safe load path on exhibit 10.3.51*
7. Transfer head to vessel cavity. Check out head orientation. Slowly lower head over guide pins and studs until it sits firmly on vessel flange. Release head lifting fixture and transfer to storage location.

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

8. Remove stud protectors and store in cavity outer periphery. Remove and store vessel head guide caps.
9. Transfer nut and washer racks to cavity floor. Assemble washers and nuts to their respective studs. Washers shall have rounded side up. With nut turning device, run nuts down to within 1/4" of flange. Return nut and washer racks to storage.

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

10. Attach head and flange temperature instrumentation. Vessel stud tensioning cannot start until the head is above 70°F.

G. Vessel Head Stud Tensioning

1. Place stud tensioner lifting rig with tensioners and manifolds onto the auxiliary hook.
2. Remove cap screws and thoroughly clean each stud elongation measuring hole and install respective measuring pins in each stud. Allow sufficient time for measuring pins to assume related stud temperature. Should generally take about one hour.
3. Connect and check out tensioner hydraulic pump/pumps.
4. Contact control room to monitor head and flange temperature. Temperature must remain above 70°F while tensioning is being performed.
5. Using a dial depth indicator, take and record on data sheet 10.3.5.C two complete initial sets of stud measurements. If there is more than 0.005" difference between the two readings, then sufficient time has not been allowed for temperature changes. Use the final set of readings for eventual computation.

\_\_\_\_\_  
Inspector

\_\_\_\_\_  
Date

6. For four tensioner 3 cycle procedure, use the following pattern of sequencing:

<u>Operation</u>	<u>Tensioner Number</u>			
	#1	#2	#3	#4
1	1	20	39	58
2	13	32	51	70
3	5	24	43	62
4	17	36	55	74
5	9	28	47	66
6	3	22	41	60
7	15	34	53	72
8	7	26	45	64
9	19	38	57	76
10	11	30	49	68
11	2	21	40	59
12	14	33	52	71
13	6	25	44	63
14	18	37	56	75
15	10	29	48	67
16	4	23	42	61
17	12	31	50	69
18	8	27	46	65
19	16	35	54	73

7. Position the Stud Tensioner Over Studs 1, 20, 39 and 58 (Operation 1)
- The tensioners should be lowered simultaneously, or individually, each tensioner being guided by an operator. The tensioner should go down over the stud and nut until the base rests on the flange.
  - Turn the drive handle on the side of the tension until the driving teeth of the drive plate match up with the slots of the nuts, the drive plate will drop into place and be ready for turning the nut.
  - Push down on the puller bar by pushing down on the hand wheel and feel for the thread engagement between the puller bar socket and the stud.
  - After the threads have engaged, screw on the puller bar until the tensioner holding nut bottoms on the tensioner spherical washers.
  - Back off the puller bar about 1/2 to 1 full turns and step back to indicate completion of operation.
  - When this operation has been performed on all of the tensioners, they are ready to be pressurized.

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-9 of 16

8. Close tensioner bypass valves. Position control valve to "Tensioning" position to start tensioner pump. Continue pumping until hydraulic pressure reaches 3600 PSIG. Position control valve to "Neutral". Signal this step is complete.
9. Turn drive handle on side of tensioner clockwise until nuts are seated against head flange and step back.
10. Position control valve to "release" and allow pressure to decrease to zero.

NOTE: Leave control valve in release during position of tensioners.

11. Disengage tensioners from studs by turning handwhell counter clockwise and step back. Hoist tensioners free from studs and index to next position in the sequence.
12. Repeat steps 7 thru 11 for operations 2 thru 19.
13. Index the tensioners to positions for operation 1.
14. Repeat steps 7 thru 11 for operations 1 thru 19 using the following pressures in step 8 of this section.

Operation 1 thru 7	7370 PSIG
Operation 8 thru 13	7035 PSIG
Operation 14 thru 19	6700 PSIG

15. Repeat steps 7 thru 11 for operations 1 thru 10 using the following pressures in step 8 of this section.

Operation 1 thru 10	7775 PSIG
Operation 11 thru 19	7400 PSIG

16. Disengage tensioners from studs and lift to provide access to studs for elongation measurements.
17. Take with a dial depth indicator and record on data sheet (Exhibit 10.3.5.C) a complete set of studs end to extensometer rod measurements. Record the difference between the final measurement and the initial measurement (taken in step 5) on the Stud Tensioning Record (Exhibit 10.3.5.C) for each stud.

NOTE: The required elongation is ".052 to .062"-any studs with less elongation must be retensioned.

18. Retension all studs not meeting the elongation requirements using the same sequence as before and using the pressures of step 15.
19. Measure the retensioned studs and record the readings on the data sheet.

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-10 of 16

NOTE: Any studs that do not meet the elongation requirements must be retensioned until they do.

20. When completed, remove stud measuring pins and cap stud holes. Store measuring pins.

21. Remove, dismantle and store stud tensioning equipment.

10.3.5.7 Documentation

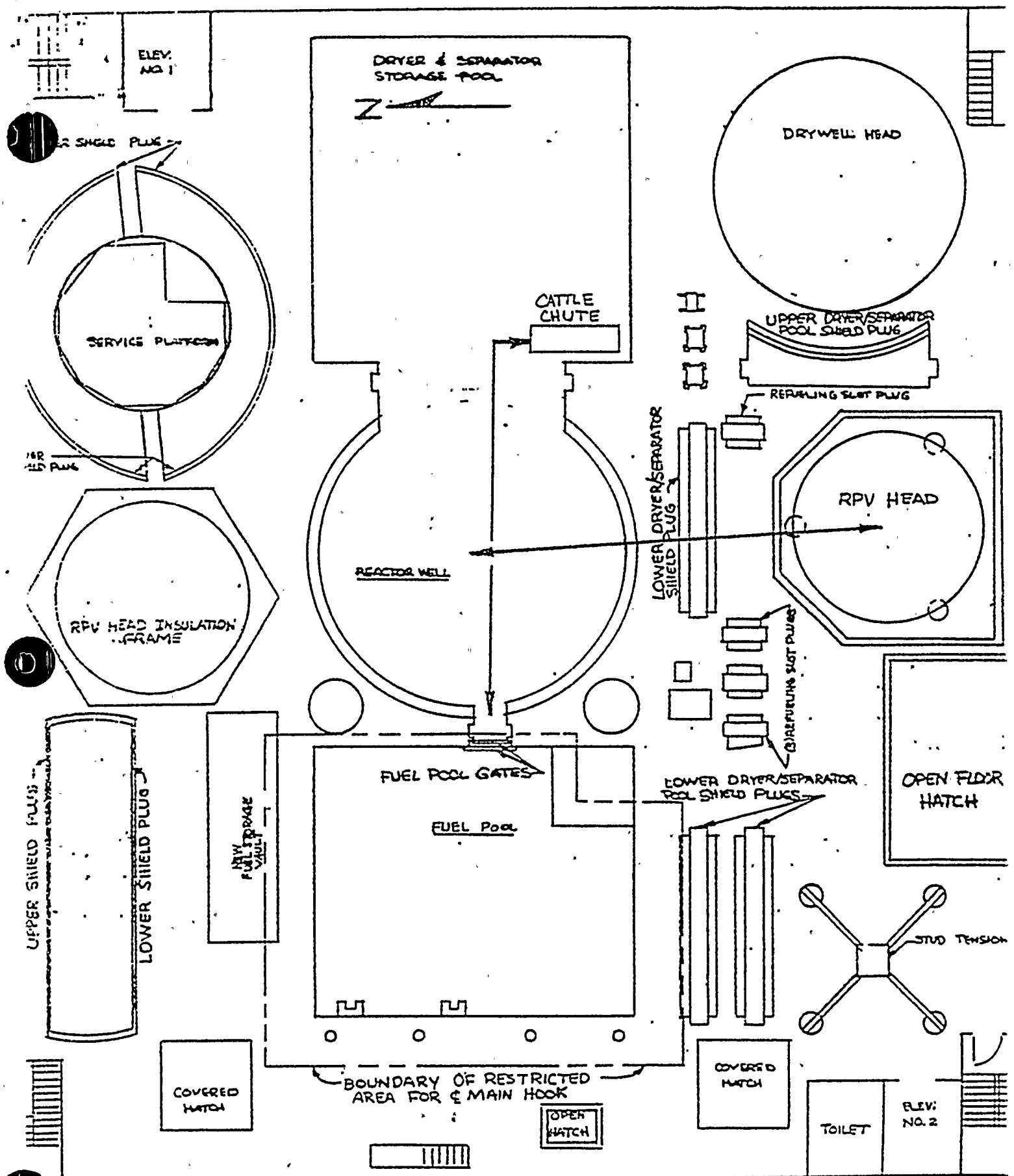
- A. Complete signatures of this procedure as specified in the body of this procedure.
- B. Enter data in Stud Tensioning Record (Exhibit 10.3.5.C).
- C. When work activity as specified on Work Request is completed, attach this signed procedure and record sheet to the respective Work Request.
- D. Return Work Request to the Shift Supervisor as per PPM 1.3.7.
- F. File completed work request in the equipment history folder.

10.3.5.8 Attachments

Exhibit 10.3.5.A through 10.3.5.C

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-11 of 16





SAFE LOAD PATH - RPV HEAD  
EXHIBIT 10.3.5A

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-12 of 16



# STUD TENSIONING AND UNBOLTING SEQUENCE

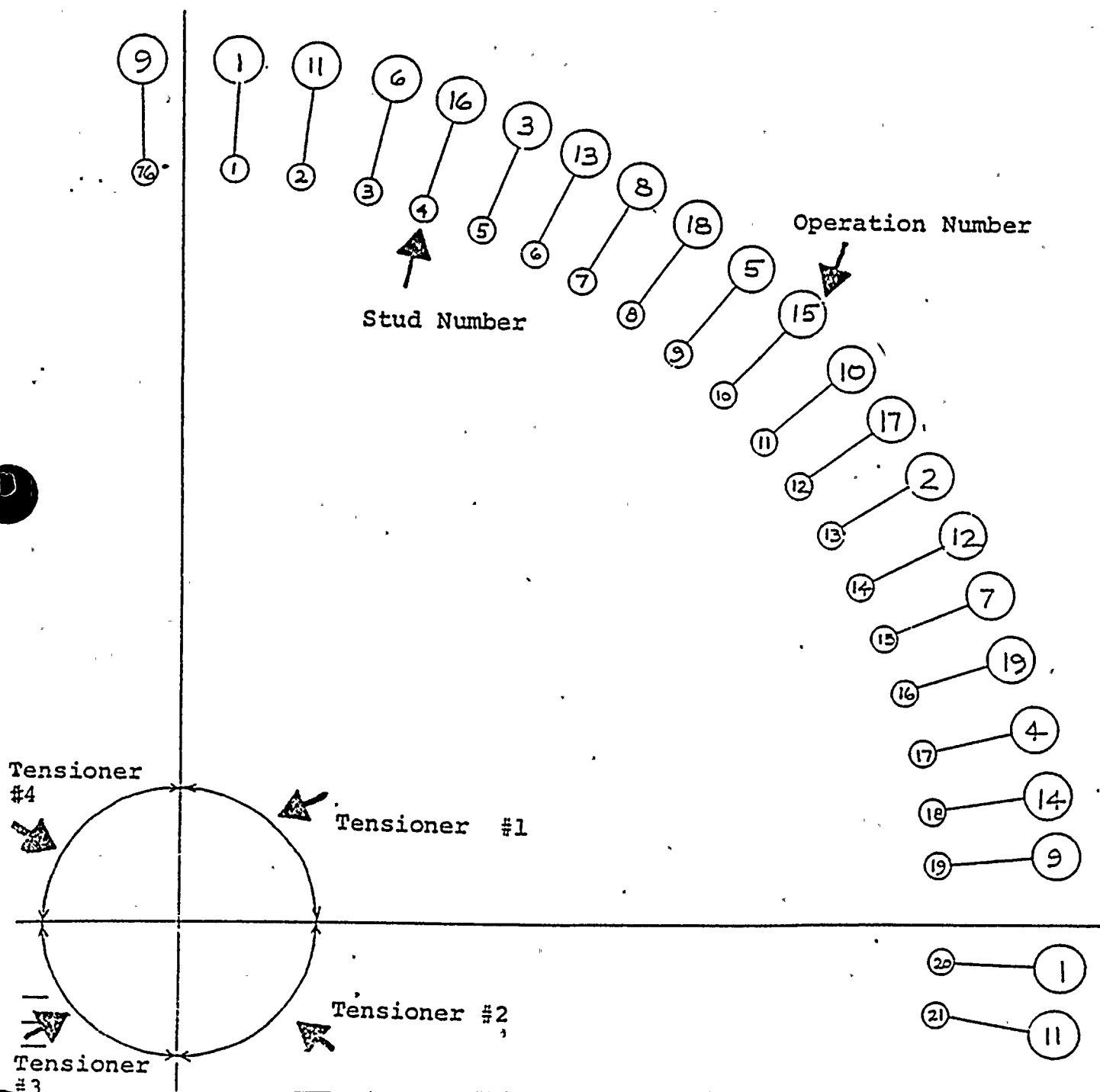


EXHIBIT 10.3.5B

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-13 of 16

# STUD TENSIONING RECORD

STUD TEMP. \_\_\_\_\_ CLOSURE FLG. TEMP. \_\_\_\_\_

VERIFIED BY: \_\_\_\_\_  
Inspector Date

STUD NO.	NO-LOAD ELONG. READ. 1 1a   1b	LOADED ELONG. READ. 2	STUD ELONG. 2 - 1	TRIM ELONG. READ. 3	STUD ELONG. 3 - 1
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					

EXHIBIT 10.3.5.C

PROCEDURE NUMBER	REVISION NUMBER	PAGE NUMBER
10.3.5	0	10.3.5-14 of 16

# STUD TENSIONING RECORD (cont'd)

STUD NO.	NO-LOAD ELONG. READ.		LOADED ELONG. READ. 2	STUD ELONG. 2 - 1	TRIM ELONG. READ. 3	STUD ELONG. 3 - 1
	1					
	1a	1b				
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						

EXHIBIT 10.3.5.C



## STUD TENSIONING RECORD (cont'd)

STUD NO.	NO-LOAD ELONG. READ.		LOADED ELONG. READ.	STUD ELONG.	TRIM ELONG. READ.	STUD ELONG.
	1 1a	1b	2	2 - 1	3	3 - 1
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						

EXHIBIT 10.3.5.C