

	PER CO #15650	Tech RN	Approved By D.PFOSI	Effective Date 1-10-08	Document No. 166320	Revision A
	Originator BRIAN CORNELIUS	Checked By W.MUDGE		Page 1 of 39	Reference QTP-311-40	Class 40

SUBJECT: **HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST
QUALIFICATION**

TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
1.0	PURPOSE:.....	2
2.0	MATERIALS NEEDED:.....	2
3.0	REFERENCE DOCUMENT:.....	3
4.0	DOCUMENTATION:.....	4
5.0	TEST PREPARATION:.....	6
6.0	PRESSURE VESSEL ASSEMBLY PROCEDURE:.....	8
7.0	ASSEMBLED PRESSURE VESSEL TEST PREPARATION:.....	19
8.0	TEST PROCEDURE:.....	22
9.0	DISASSEMBLY AND INSPECTION:.....	35
APPENDIX A:		39

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 2 of 39	Reference QTP-311-40	Class 40

1.0 **PURPOSE:**

THE PURPOSE OF THIS PROCEDURE IS TO QUALIFY THE HIGH POWER NAUTILUS ELECTRICAL STEMS WHILE UNDER MULTIPLE MODES OF STRESS IN AN ACCELERATED LIFE CONDITION. TEN HIGH POWER NAUTILUS PLUG PINS WILL BE EXPOSED TO 15,000 PSI DIFFERENTIAL PRESSURE WHILE THE PIN IS STRAINED IN A CANTILEVER DEFLECTION MODE. ADDITIONALLY, THE PIN WILL BE CONTINUOUSLY EXPOSED TO 20,000 VDC (PIN TO GROUND) WHILE CURRENT LEAKAGE IS MONITORED. THE TEST WILL BE CONDUCTED AT 45°C TO ACCELERATE THE TEST LIFE EXPOSURE. THE STRAIN IMPARTED TO THE PIN FROM THE PRESSURE VESSEL/FIXTURE DESIGN REPRESENTS A VALUE HIGHER THAN WHAT THE PIN WOULD EXPERIENCE WITH WORST CASE TOLERANCE STACK-UP AND CONNECTOR MISALIGNMENT DURING CONNECTOR MATING. THE FIXTURE (P/N 1050436, DRAWING REV. B) IMPARTS A 0.060 INCH CANTILEVER STYLE DEFLECTION ON THE PIN WHICH RESULTS IN A MAXIMUM STRAIN OF 3%.

2.0 **MATERIALS NEEDED:**

- **D/N 10637** (SOP-021-39) STANDARD PRACTICE FOR CONNECTOR TERMINATING
- **D/N 75879** (SOP-085-39) DIGITAL IMAGE NAMING CONVENTION PROCEDURE
- **D/N 50166** (EHS.3-23) HIGH VOLTAGE TESTING SAFETY
- **P/N 1050436** (HPR-245-01) HP PLUG PIN PRESSURE TEST FIXTURE WITH ASSOCIATED COMPONENTS (DRAWING REVISION B)
- **P/N 1047261** (HPR-244-01) HP PLUG PIN, QTY OF 10
- **P/N 1049499** (HPR-203-01) HP PIN PLUG SEAL, QTY OF 10
- **P/N 1007564** (EXCEPTION: MADE FROM OD1037) (FPB-036-04, OD1037) OD 1037 GLAND SEAL, QTY OF 10
- **P/N 1050439** (HPR-245-01-3) PEEK OFFSET JIG, QTY OF 10
- **P/N 1050251** (HPR-237-04) BOOT SEAL, QTY OF 10
- **P/N 1049549** (HPR-221-04) MODULE BLADDERS , MINIMUM QTY OF 2
- COTTON SWABS
- DC4 DOW CORNING DIELECTRIC LUBRICANT
- DIGITAL CAMERA
- ELECTRICAL TESTING FACILITIES AND ASSOCIATED EQUIPMENT (HIGH DC VOLTAGE TESTING)
- ISOPROPYL ALCOHOL
- MEG-OHM METER
- MICROSCOPE WITH CAMERA
- NANOAMP TESTING EQUIPMENT CAPABLE OF MAINTAINING 20,000 +500/-0 VDC
- HIPOT CAPABLE OF MAINTAINING 20,000 +500/-0 VDC
- PRESSURE TESTING FACILITIES CAPABLE OF WITHSTANDING 15 KPSI AT 45 °C

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 3 of 39	Reference QTP-311-40	Class 40

CAUTION: THIS QUALIFICATION TESTING REQUIRES THE USE OF HIGH POWER ELECTRICAL EQUIPMENT AND HIGH PRESSURE. USE CAUTION TO PREVENT PERSONAL INJURY OR DEATH. ADVISE SUPERVISOR OR SAFETY COMMITTEE MEMBER OF ANY CONCERNS BEFORE STARTING TESTS. MAINTAIN SAFETY PRACTICES PER D/N 50166.

NOTE: DIGITAL PHOTOGRAPHS SHOULD BE TAKEN THROUGHOUT THE QUALIFICATION TESTING TO ASSIST IN DOCUMENTING THE SET-UP, ACTIONS AND RESULTS. THE MINIMUM REQUIRED PHOTOS ARE IDENTIFIED IN THE PROCEDURE.

NOTE: ALL ELECTRONIC DATA INCLUDING PHOTOGRAPHS, COMPUTER GATHERED DATA, ETC. SHOULD BE COPIED TO AN ELECTRONIC STORAGE DEVICE (DISK), LABELED AND INSERTED INTO THE APPROPRIATE SECTION SLEEVE WHEN THAT PARTICULAR SECTION IS COMPLETED.

3.0 REFERENCE DOCUMENT:

- **D/N 161589** (HPR-244-04) HIGH POWER PLUG ELECTRICAL STEM DETAIL DRAWING
- **D/N 161774** (HPR-245-01) HP PLUG PIN PRESSURE TEST FIXTURE ASSEMBLY DRAWING
- **D/N 135594** (ENG-727-20) INVESTIGATION SUMMARY REPORT

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 4 of 39	Reference QTP-311-40	Class 40

4.0 **DOCUMENTATION:**

NOTE: IF FAILING READINGS ARE TAKEN OR ANY DAMAGE IS NOTED AT ANY TIME DURING TESTING, INITIATE A DISCREPANCY REPORT (DR), CONTACT ENGINEERING WITH THE DR NUMBER AND ATTACH A COPY OF THE DISPOSITIONED DR TO THE SHOP PACK FOR RETENTION.

4.1 REVIEW THE QUALITY PLAN (IF PRESENT) TO DETERMINE ENGINEERING WITNESS AND HOLD POINTS. IF ENGINEERING WITNESS OR HOLD IS REQUIRED, ADVISE THE PROJECT ENGINEER OF THE ESTIMATED STARTING DATE VIA E-MAIL. ATTACH A COPY OF THE E-MAIL TO THIS DOCUMENT. ATTACH TEMPORARY MARKERS TO THIS PROCEDURE FOR ANY STEPS THAT HAVE BEEN IDENTIFIED AS HOLD POINTS. THESE STEPS ARE NOT TO BE PERFORMED WITHOUT ENGINEERING APPROVAL. OBTAIN A COPY OF THE QUALITY PLAN (IF PRESENT) AND ATTACH TO THIS TEST PROCEDURE.

OPERATOR INITIALS: _____ DATE: _____

4.2 RECORD ALL OF THE INFORMATION REQUESTED BELOW FOR ALL OF THE EQUIPMENT, COMPONENTS AND DOCUMENTS USED IN THIS QUALIFICATION. INCLUDE ALL ASSEMBLY AND COMPONENT LEVEL DRAWINGS AND ATTACH ALL INSPECTION DOCUMENTS.

JOB NUMBER (IF APPLICABLE): _____

QUALITY PLAN DOCUMENT NUMBER (IF PRESENT): _____

PROJECT ENGINEER: _____

DOCUMENTS

DOCUMENT NO.	REFERENCE NO.	DESCRIPTION	REVISION
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

TECHNICIANS (PRINT): _____ ; _____

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 5 of 39	Reference QTP-311-40	Class 40

- 4.3 ATTACH ALL DOCUMENTS TO THIS TEST PROCEDURE, INCLUDING RELEVANT INFORMATION FROM THE LOWER LEVEL ASSEMBLIES FOR COMPLETENESS. ALSO, OBTAIN AND ATTACH A PRINTED COPY OF THE ASSEMBLY PARTS LIST AND RECORD THE REVISION OF EACH PART USED.

OPERATOR INITIALS: _____ DATE: _____

- 4.4 QUALITY ENGINEERING TO ENSURE THIS SECTION IS COMPLETE, INCLUDING ALL TEST RESULTS, PHOTOGRAPHS AND REFERENCE INFORMATION. ENSURE ALL ARE LABELED AND ATTACHED. ALL ELECTRONIC DATA SHALL BE COPIED AND THE STORAGE DEVICE (DISK) SHALL BE APPROPRIATELY PLACED WITHIN THIS SECTION OF THE PROCEDURE.

OPERATOR INITIALS: _____ DATE: _____

QUALITY ENGINEER: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 6 of 39	Reference QTP-311-40	Class 40

5.0 **TEST PREPARATION:**

NOTE: FAILURE TO COMPLETELY FILL OUT ALL PAPERWORK PERTAINING TO THE BUILD AND QUALIFICATION OF THIS UNIT WILL VOID THIS QUALIFICATION TEST.

- 5.1 RECORD THE MATERIALS REQUISITION (MR) NUMBER(S) (IF APPLICABLE) ASSOCIATED WITH THE PROCUREMENT OF ANY PARTS REQUIRED FOR THIS TESTING.

MR NUMBER(S) : _____

OPERATOR INITIALS: _____ DATE: _____

- 5.2 IF NOT ALREADY DONE, OBTAIN ALL MATERIALS (I.E. PROCEDURES, DRAWINGS, PARTS, EQUIPMENT, TOOLS ETC.) REQUIRED TO COMPLETE THE FOLLOWING TESTING.

OPERATOR INITIALS: _____ DATE: _____

- 5.3 MARK ALL OF THE PINS USING A PERMANENT MARKING METHOD ON A PORTION OF THE PIN THAT WILL NOT INTERFERE WITH TESTING.

NOTE: IF ANY IDENTIFICATION NUMBERS FADE DURING TESTING, RE-APPLY THEM TO MAINTAIN TRACEABILITY.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 7 of 39	Reference QTP-311-40	Class 40

5.4 INSPECT THE PINS FOR SIGNS OF DAMAGE PRIOR TO BEGINNING TESTING. PHOTOGRAPH ANY DEFECTS/ABNORMALITIES. MARK ALL PHOTOS WITH THE DATE, TIME, QUALIFICATION D/N, STEP NUMBER AND TECHNICIAN NAME. LOG PHOTOS PER **D/N 75879** (SOP-085-39), **OR EQUIVALENT DOCUMENTATION METHOD**. ATTACH ALL PHOTOS TO THIS DOCUMENT. ENSURE THE MAGNIFICATION USED FOR EACH PHOTOGRAPH IS RECORDED IN THE TITLE (IF APPLICABLE). ENSURE THIS SECTION IS COMPLETED PRIOR TO PROCEEDING TO THE NEXT SECTION.

NOTE: THROUGHOUT THE TESTING, ENSURE THAT ALL PHOTOS ARE GIVEN AN APPROPRIATE DESCRIPTIVE LABEL AND ARE ATTACHED (ELECTRONIC AND COLOR HARD COPIES) TO THE SECTION OF THIS TEST PROCEDURE TO WHICH THAT PHOTO RELATES. A PHOTOGRAPHIC RECORD OF ALL TEST SET-UPS IS REQUIRED.

COMMENTS:

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 8 of 39	Reference QTP-311-40	Class 40

6.0 **PRESSURE VESSEL ASSEMBLY PROCEDURE:**

NOTE: THESE PINS WILL BE TESTED WITH HIGH VOLTAGE AND HIGH PRESSURE. PLEASE EXERCISE EXTREME CAUTION DURING OPERATION TO ENSURE SAFETY AND PROTECT EQUIPMENT.

NOTE: IF FAILING READINGS ARE TAKEN OR ANY DAMAGE IS NOTED AT ANY TIME DURING TESTING, CONTACT ENGINEERING, INITIATE A DISCREPANCY REPORT, RECORD THE DR NUMBER AND ATTACH A COPY OF THE DISPOSITIONED DR TO THIS DOCUMENT FOR RETENTION. PHOTOGRAPH ANY SIGNS OF DAMAGE.

- 6.1 RECORD THE NAME OF ALL OPERATORS AND OBSERVERS INVOLVED WITH THIS TEST.

OPERATOR/OBSERVER NAME(S) : _____ ;

DATE: _____

- 6.2 RECORD THE TYPE, ODI ID NUMBER, LAST CALIBRATION DATE AND NEXT CALIBRATION DATE INFORMATION FOR ANY TEST EQUIPMENT USED.

TABLE 1 - COMPOSITE TEST CALIBRATION INFORMATION			
EQUIPMENT TYPE	ODI ID NUMBER	LAST CALIBRATION DATE	NEXT CALIBRATION DATE

OPERATOR INITIALS: _____ DATE: _____

- 6.3 PHOTOGRAPH TEST SET-UP AND RELATED PORTIONS OF THE TEST DURING PROCEDURES PER **D/N 75879 (SOP-085-39), OR EQUIVALENT DOCUMENTATION METHOD**. LABEL AND ATTACH THE PHOTOGRAPHS TO THIS DOCUMENT.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 9 of 39	Reference QTP-311-40	Class 40

6.4 ENSURE THAT ALL REQUIRED INFORMATION HAS BEEN RECORDED REGARDING THE TEST EQUIPMENT AND TEST ARTICLES.

OPERATOR INITIALS: _____ DATE: _____

6.5 OBTAIN THE FOLLOWING COMPONENTS:

TABLE 2 - COMPONENTS REQUIRED FOR COMPOSITE PIN TESTING			
PART NUMBER	REFERENCE NUMBER	DESCRIPTION	QUANTITY REQUIRED
1047261	HPR-244-01	HIGH POWER PLUG ELECTRICAL STEM	10
1050436	HPR-245-01	HP PLUG PIN PRESSURE TEST FIXTURE WITH ASSOCIATED COMPONENTS	10

**NOTE: ALL ELECTRICAL STEMS AND RUBBER PARTS MUST BE
NEW/UNUSED.**

OPERATOR INITIALS: _____ DATE: _____

6.6 ENSURE THAT THE 10 HP PLUG PINS (P/N 1047261) ARE CLEANED THOROUGHLY BY WIPING THE SURFACE USING ALCOHOL AND A CLEAN LINTFREE CLOTH. ENSURE ALL CLEAN PINS ARE CONTAINED IN A CLEAN, COVERED CONTAINER SO THAT NO AIRBORNE PARTICULATE SETTLES ON THEM.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: **HIGH POWER NAUTILUS ELECTRICAL
STEM COMPOSITE TEST
QUALIFICATION**

Effective Date

1-10-08

Document No.

166320

Revision

A

Page

10 of 39

Reference

QTP-311-40

Class

40

- 6.7 OBTAIN TWO CLEAN MODULE BLADDERS (P/N 1049549). PERFORM AN IR TEST ON EACH PIN AT 10 KVDC FOR 10 MINUTE DWELLS. THIS TEST IS TO BE DONE BY WATERBLOCKING THE ENDS OF THE PINS AND SUBMERGING THEM IN A WATER BATH AS SEEN IN FIGURE 1. RECORD THE RESULTS IN TABLE 3. PASS ≥ 100 G Ω .

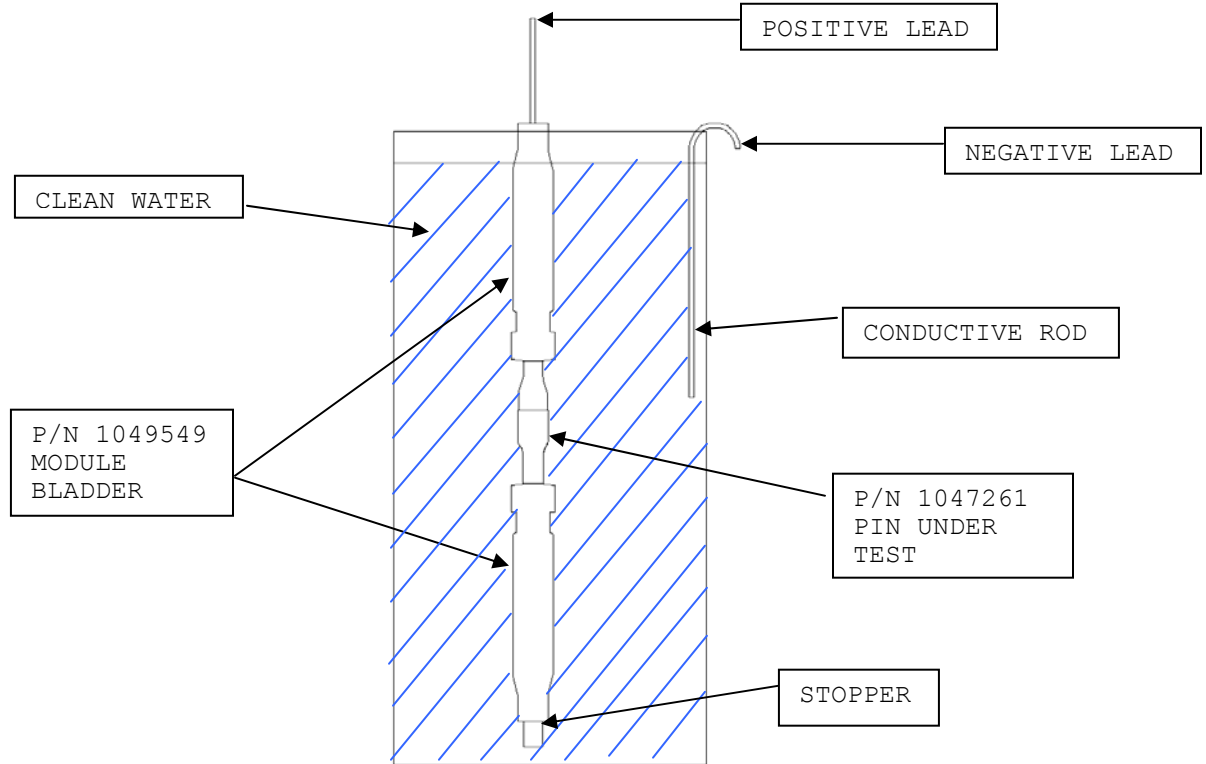


FIGURE 1: INSULATION RESISTANCE TEST SET-UP

TABLE 3 - PRESSURE TEST BASELINE INSULATION RESISTANCE			
PIN NUMBER	INSULATION RESISTANCE (G Ω)	CHECK ONE	
		PASS	FAIL
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

OPERATOR INITIALS: _____ DATE: _____

UNCONTROLLED COPY - FOR INFORMATION ONLY, WILL NOT BE KEPT UP TO DATE.
"COMPANY CONFIDENTIAL"

SUBJECT: **HIGH POWER NAUTILUS ELECTRICAL
STEM COMPOSITE TEST
QUALIFICATION**

Effective Date

1-10-08

Document No.

166320

Revision

A

Page

11 of 39

Reference

QTP-311-40

Class

40

- 6.8 CLEAN ALL PRESSURE VESSEL CAPS AND PRESSURE VESSEL BODIES BY THOROUGHLY WIPING THESE COMPONENTS WITH ALCOHOL AND A CLEAN LINT FREE CLOTH. ENSURE THAT THE COMPONENTS ARE DRY BEFORE ASSEMBLY.

OPERATOR INITIALS: _____ DATE: _____

- 6.9 NUMBER EACH PRESSURE VESSEL BODY 1 - 10. LABEL EACH PRESSURE VESSEL CAP 1 - 10. PAIR UP THE CORRESPONDING PRESSURE VESSEL CAPS AND BODIES (CAP 1 WITH BODY 1, CAP 2 WITH BODY 2, ETC.). REFER TO FIGURE 2 IF IT IS UNCLEAR AS TO WHICH COMPONENT IS THE PRESSURE VESSEL CAP AND WHICH COMPONENT IS THE PRESSURE VESSEL BODY.

OPERATOR INITIALS: _____ DATE: _____

- 6.10 INSTALL EACH VESSEL CAP INTO ITS CORRESPONDING VESSEL BODY UNTIL IT IS FULLY SEATED. REFER TO FIGURE 2 FOR GUIDANCE TO ENSURE PROPER SEATING.

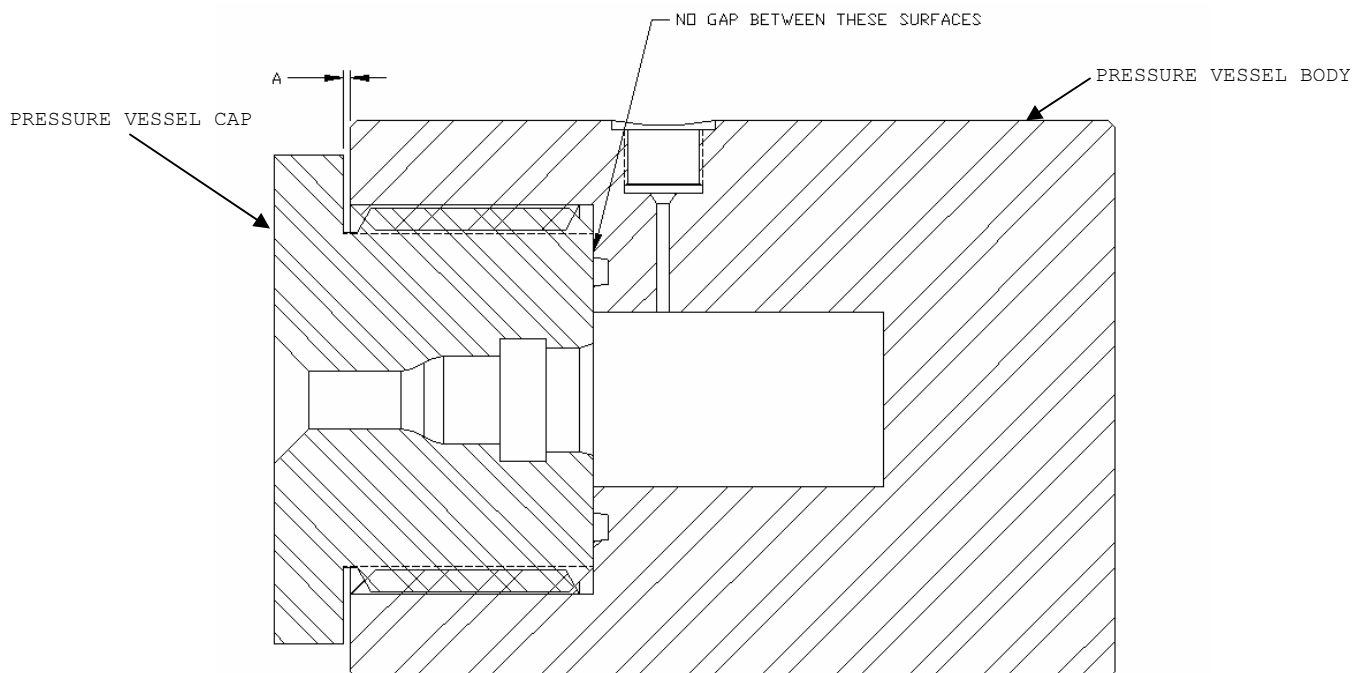


FIGURE 2: VESSEL CAP INSTALLED INTO VESSEL BODY

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 12 of 39	Reference QTP-311-40	Class 40

- 6.11 USING A MEASURING DEVICE SUCH AS A VERIFIED PIN GAGE, DETERMINE THE DISTANCE OF GAP "A" (SEE FIGURE 1) ON EACH OF THE 10 ASSEMBLED VESSEL CAP/BODIES TO THE NEAREST THOUSANDTHS OF AN INCH. RECORD THE VALUES IN TABLE 4 BELOW.

TABLE 4 - GAP "A" VALUES FOR THE ASSEMBLED VESSEL CAPS AND BODIES	
VESSEL CAP/BODY NUMBER	GAP "A" MEASUREMENT (X.XXX INCH)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

OPERATOR INITIALS: _____ DATE: _____

- 6.12 DISASSEMBLE EACH CAP FROM ITS VESSEL BODY. ENSURE THAT EACH CAP REMAINS WITH ITS CORRELATING BODY THROUGHOUT THE PRESSURE VESSEL ASSEMBLY PROCESS.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: **HIGH POWER NAUTILUS ELECTRICAL
STEM COMPOSITE TEST
QUALIFICATION**

Effective Date

1-10-08

Document No.

166320

Revision

A

Page

13 of 39

Reference

QTP-311-40

Class

40

6.13 REFER TO FIGURE 3 FOR GUIDANCE WHEN ASSEMBLING THE PRESSURE VESSEL.

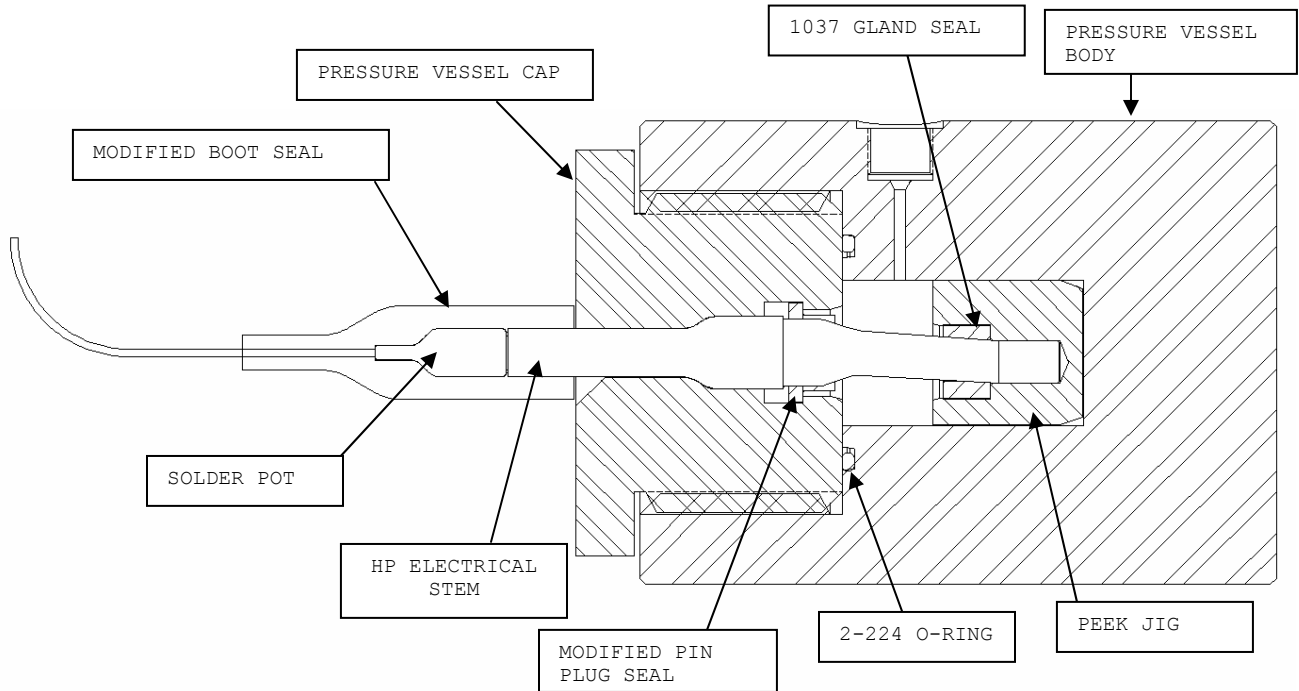


FIGURE 3: FULLY ASSEMBLED PRESSURE VESSEL TEST SET-UP

6.14 OBTAIN P/N 1049499 HP PIN PLUG SEAL. CAREFULLY AND CLEANLY CUT THROUGH THE CROSS SECTION OF THE SEAL APPROXIMATELY 0.4 INCH AWAY FROM THE END WITH THE LARGER OUTSIDE DIAMETER. REFER TO FIGURE 4 BELOW FOR GUIDANCE. REPEAT THIS PROCESS FOR A TOTAL OF 10 PIN SEALS.

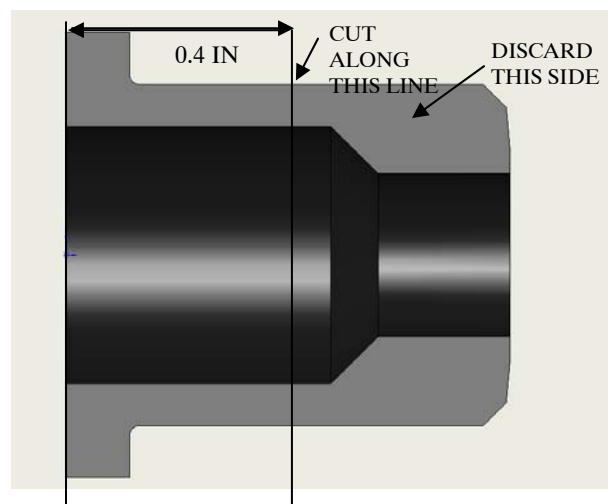


FIGURE 4: HP PLUG PIN SEAL CUTTING DIAGRAM

OPERATOR INITIALS: _____ DATE: _____

UNCONTROLLED COPY - FOR INFORMATION ONLY, WILL NOT BE KEPT UP TO DATE.

"COMPANY CONFIDENTIAL"

SUBJECT: **HIGH POWER NAUTILUS ELECTRICAL
STEM COMPOSITE TEST
QUALIFICATION**

Effective Date

1-10-08

Document No.

166320

Revision

A

Page

14 of 39

Reference

QTP-311-40

Class

40

- 6.15 OBTAIN P/N 1050251 BOOT SEAL. CUT 0.5 ± 0.025 INCH OFF BY COMPLETELY CUTTING THROUGH THE CROSS-SECTION OF THE SOLDER POT SIDE (LARGER DIAMETER SIDE) OF THE BOOT SEAL. REFER TO FIGURE 5 FOR GUIDANCE. REPEAT THIS PROCESS FOR A TOTAL OF 10 BOOT SEALS.

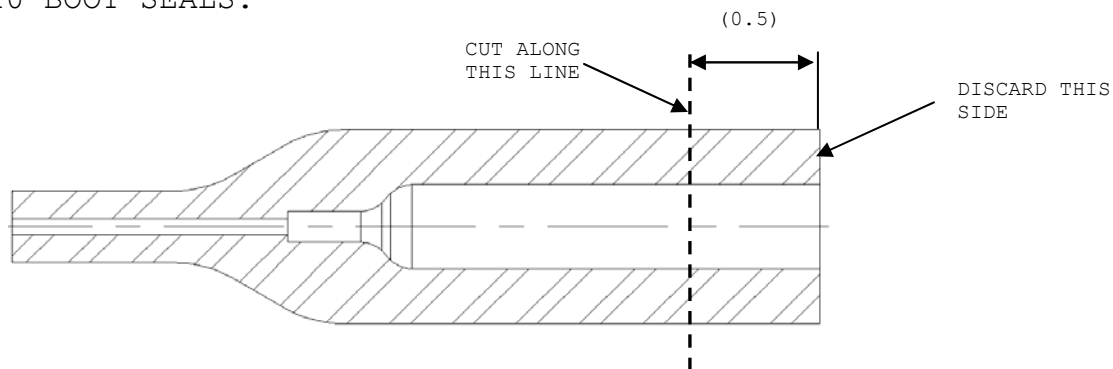


FIGURE 5: DIMENSIONS FOR MODIFIED BOOT SEAL

OPERATOR INITIALS: _____ DATE: _____

- 6.16 ULTRASONICALLY CLEAN THE FOLLOWING COMPONENTS IN A FRESH ALCONOX SOLUTION BATH FOR 30 +5/-0 MINUTES. RINSE THE COMPONENTS IN DISTILLED WATER AND DRY THEM WITH NEW, LINT FREE KIMWIPES.

TABLE 5 - COMPONENTS THAT REQUIRE ULTRASONIC CLEANING		
PART NUMBER	DESCRIPTION	QUANTITY
MODIFIED 1049499	HP PIN PLUG SEAL (MODIFIED/CUT)	10
OD1037 1007564	OD 1037 GLAND SEAL	10
1050439	PEEK OFFSET JIG	10
MODIFIED 1050251	BOOT SEAL (MODIFIED/CUT)	10

OPERATOR INITIALS: _____ DATE: _____

- 6.17 IF TEST LEADS (WIRE IFS P/N 1034781) ARE NOT ALREADY SOLDERED TO P/N 1050130 SOLDER POTS AND READY FOR TEST, CLEAN THE TEST LEAD ENDS WITH ALCOHOL AND SOLDER THE WIRE LEADS (P/N 1034781) TO P/N 1050130 PER THE GENERAL REQUIREMENTS OF **D/N 10637** (SOP-021-39).

OPERATOR INITIALS: _____ DATE: _____

- 6.18 THREAD THE SOLDER POT INTO THE THREADED PORTION OF THE STEM HAND TIGHT.

OPERATOR INITIALS: _____ DATE: _____

UNCONTROLLED COPY - FOR INFORMATION ONLY. WILL NOT BE KEPT UP TO DATE.
"COMPANY CONFIDENTIAL"

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 15 of 39	Reference QTP-311-40	Class 40

6.19 LIGHTLY LUBRICATE THE INSIDE AND OUTSIDE SURFACES OF THE CLEAN, MODIFIED HP PIN PLUG SEAL.

OPERATOR INITIALS: _____ DATE: _____

6.20 ENSURE THAT THE BORE OF THE PRESSURE VESSEL END CAP P/N 1050438 IS CLEAN. LIGHTLY LUBRICATE THE BORE OF THE PRESSURE VESSEL END CAP IN THE AREA WHERE THE MODIFIED PLUG PIN SEAL WILL BE INSTALLED.

OPERATOR INITIALS: _____ DATE: _____

6.21 CAREFULLY INSTALL THE MODIFIED HP PIN PLUG SEAL INTO THE PRESSURE VESSEL END CAP BORE AND ENSURE THAT IT SEATS PROPERLY IN THE BORE RECESS.

OPERATOR INITIALS: _____ DATE: _____

6.22 INSTALL THE CLEAN HP PIN INTO THE PRESSURE VESSEL CAP UNTIL IT IS FULLY SEATED. ENSURE THAT THE HP PIN SEAL IS INSTALLED ON THE PIN WITHIN THE VESSEL CAP.

OPERATOR INITIALS: _____ DATE: _____

6.23 OBTAIN ONE CLEAN OD1037 GLAND SEAL (SAME AS P/N 1007564, EXCEPT MADE WITH OD1037) AND ONE CLEAN PEEK PIN OFFSET JIG P/N 1050439. LUBRICATE AND INSTALL THE OD1037 GLAND SEAL, ENSURING IT IS PROPERLY SEATED IN THE JIG.

OPERATOR INITIALS: _____ DATE: _____

6.24 INSTALL THE PEEK JIG/PIN SUBASSEMBLY ONTO THE PIN CONTACT END WITH THE PIN INSTALLED IN THE VESSEL CAP.

OPERATOR INITIALS: _____ DATE: _____

6.25 ENSURE THAT THE O-RING GROOVE FOR THE PRESSURE VESSEL BODY IS CLEAN AND FREE OF DEBRIS. CLEAN AND LIGHTLY LUBRICATE THE 2-224 O-RING AND INSTALL IT INTO THE PRESSURE VESSEL O-RING GROOVE.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 16 of 39	Reference QTP-311-40	Class 40

6.26 ENSURE THAT THE SEALING FACE (BOTTOM SURFACE) OF THE PRESSURE VESSEL CAP IS CLEAN AND FREE OF DEFECTS. INSTALL THE PRESSURE VESSEL CAP SUBASSEMBLY (WITH PIN/PEEK JIG/PIN SEAL/GLAND SEAL) INTO THE PRESSURE VESSEL BODY UNTIL IT SEATS COMPLETELY, ENSURING THAT THE O-RING IS PROPERLY COMPRESSED.

NOTE: THERE MAY BE SIGNIFICANT TORQUE REQUIRED TO INSTALL THE CAP INTO THE VESSEL BODY. THIS IS DUE TO THE REACTION FORCES OF THE PIN BEING BENT AS IT IS BEING INSTALLED INTO THE PEEK OFFSET JIG WITHIN THE PRESSURE VESSEL ASSEMBLY. IF THERE ARE ANY SUDDEN UNUSUAL NOISES OR SUDDEN INCREASE IN RESISTANCE, STOP AND CONTACT ENGINEERING IMMEDIATELY.

OPERATOR INITIALS:_____ DATE:_____

6.27 LUBRICATE ONE CLEAN, MODIFIED P/N 1050251 BOOT SEAL AND SLIDE IT DOWN OVER THE SOLDER POT UNTIL IT IS FULLY SEATED ON THE PIN.

OPERATOR INITIALS:_____ DATE:_____

6.28 REPEAT STEPS 6.17 THROUGH 6.27 FOR ALL TEN PRESSURE VESSEL ASSEMBLIES.

OPERATOR INITIALS:_____ DATE:_____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 17 of 39	Reference QTP-311-40	Class 40

6.29 MEASURE GAP "A" AS DEPICTED IN FIGURE 1 (STEP 6.8) FOR EACH PRESSURE ASSEMBLY, USING THE SAME MEASUREMENT METHOD AND INSTRUMENT (S) AS WAS USED IN STEP 6.9. RECORD THE VALUES TO THE NEAREST THOUSANDTHS OF AN INCH IN TABLE 6. THE VALUES MUST BE WITHIN ± 0.005 INCH OF THE VALUES IN TABLE 4 FOR THE CORRESPONDING PAIR.

NOTE: IF A PRESSURE VESSEL DOES NOT MEET THE ± 0.005 INCH CRITERIA, TIGHTEN THE CAP FURTHER ONTO THE VESSEL BODY UNTIL THE CRITERIA IS MET. IF EXCESSIVE TORQUE IS EXPERIENCED WHILE NOT BEING ABLE TO MEET THE CRITERIA, CONTACT ENGINEERING FOR FURTHER GUIDANCE.

TABLE 6 - GAP "A" VALUES FOR THE ASSEMBLED PRESSURE VESSEL ASSEMBLIES			
VESSEL CAP/BODY NUMBER	GAP "A" MEASUREMENT ON ASSEMBLY (X.XXX INCH)	TABLE 4 VALUES (STEP 6.9) (X.XXX INCH)	DIFFERENCE (X.XXX INCH)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

OPERATOR INITIALS: _____ DATE: _____

6.30 OBTAIN A MEGGER CAPABLE OF SUPPLYING 10,000 VDC. ENSURE THAT THE MEGGER'S CALIBRATION INFORMATION IS RECORDED IN TABLE 1. ATTACH THE MEGGER POSITIVE TEST LEAD TO THE STEM TO BE TESTED AND GROUND THE PRESSURE VESSEL THAT THE STEM IS IN. TAKE AN INSULATION RESISTANCE READING AFTER APPLYING 10,000 VDC FOR 1 MINUTE ON THE STEM AND RECORD THE RESULT IN TABLE 7.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 18 of 39	Reference QTP-311-40	Class 40

6.31 REPEAT STEP 6.30 FOR THE OTHER 9 STEMS, RECORDING THE RESULTS IN TABLE 7.

PASS $\geq 100G\Omega$

TABLE 7 - IR PRIOR TO INSTALLATION INTO THE THERMAL CHAMBER			
		CHECK ONE	
PIN NUMBER	INSULATION RESISTANCE (G Ω)	PASS	FAIL
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 19 of 39	Reference QTP-311-40	Class 40

7.0 **ASSEMBLED PRESSURE VESSEL TEST PREPARATION:**

NOTE: IF FAILING READINGS ARE TAKEN OR ANY DAMAGE IS NOTED AT ANY TIME DURING TESTING, CONTACT ENGINEERING, INITIATE A DISCREPANCY REPORT, RECORD THE DR NUMBER AND ATTACH A COPY OF THE DISPOSITIONED DR TO THIS DOCUMENT FOR RETENTION. PHOTOGRAPH ANY SIGNS OF DAMAGE.

NOTE: IF ANY DAMAGE IS NOTED AT ANY TIME DURING TESTING, CONTACT ENGINEERING, INITIATE A DISCREPANCY REPORT, RECORD THE DR NUMBER AND ATTACH A COPY OF THE DISPOSITIONED DR TO THIS DOCUMENT FOR RETENTION. PHOTOGRAPH ANY SIGNS OF DAMAGE.

NOTE: A CHART RECORDER OR EQUIVALENT MEANS OF DATA ACQUISITION SHALL BE USED TO RECORD PRESSURE AND TIME AS A MINIMUM DURING ALL RELEVANT TESTING. THE CHART RECORDER OR EQUIVALENT SHALL BEAR A VALID CALIBRATION CERTIFICATE. THE ACCURACY OF THE DATA ACQUISITION SYSTEM SHALL BE WITHIN $\pm 1\%$.

7.1 INSTALL ALL ASSEMBLED PRESSURE VESSELS INTO A SUITABLE THERMAL CHAMBER(S) THAT CAN MAINTAIN $45 \pm 2^\circ\text{C}$ FOR EXTENDED PERIODS OF TIME.

OPERATOR INITIALS: _____ DATE: _____

7.2 INSTALL HIGH PRESSURE PIPING (WITH A MINIMUM WORKING PRESSURE OF 15,000 PSI AT 45°C) TO THE PRESSURE VESSELS AND MANAGE OUT THROUGH THE SIDE OF THE THERMAL CHAMBER.

OPERATOR INITIALS: _____ DATE: _____

7.3 MANAGE ALL HIGH PRESSURE LINES TO A MANIFOLD SYSTEM (WITH A MINIMUM WORKING PRESSURE OF 15,000 PSI) SO THAT THEY CAN BE CONTROLLED AND MONITORED BY ONE PRESSURE SOURCE. ENSURE THAT THE LINES HAVE A MEANS OF SAFELY VENTING THE SYSTEM PRESSURE.

OPERATOR INITIALS: _____ DATE: _____

7.4 MANAGE ALL WIRES OUT THROUGH THE SIDE OF THE THERMAL CHAMBER, ENSURING THAT THEY DO NOT GET NICKED OR CUT WHILE MANAGING THEM.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: **HIGH POWER NAUTILUS ELECTRICAL
STEM COMPOSITE TEST
QUALIFICATION**

Effective Date

1-10-08

Document No.

166320

Revision

A

Page

20 of 39

Reference

QTP-311-40

Class

40

7.5 ATTACH THE MEGGER TEST LEAD TO THE STEM 1 TEST LEAD AND GROUND THE MEGGER TO THE HIGH PRESSURE TUBING OR OTHER METAL COMPONENT TO GROUND THE SYSTEM. REFER TO FIGURE 6 FOR ADDITIONAL GUIDANCE.

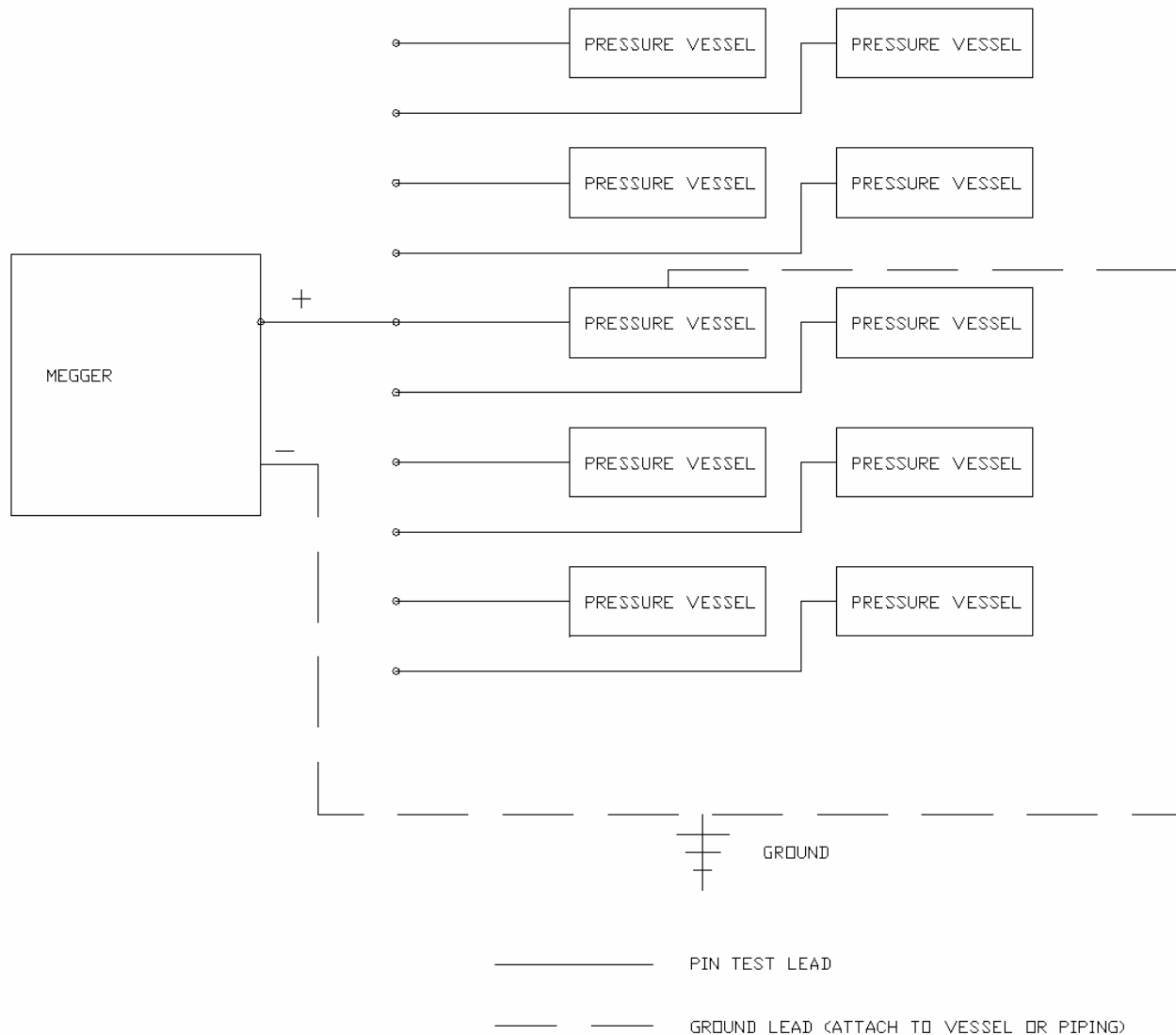


FIGURE 6: TYPICAL TEST CONFIGURATION FOR INSULATION RESISTANCE TESTING

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 21 of 39	Reference QTP-311-40	Class 40

7.6 TAKE AN INSULATION RESISTANCE READING AT 10,000 VDC. RECORD THE READING AFTER A ONE MINUTE DWELL HAS ELAPSED. RECORD THE RESULTS IN TABLE 8.

OPERATOR INITIALS: _____ DATE: _____

7.7 REPEAT STEPS 7.5 AND 7.6 FOR THE OTHER 9 STEMS TO ENSURE ALL STEMS ARE WELL INSULATED WITHIN THE TEST ASSEMBLIES, RECORDING VALUES IN TABLE 8.

PASS $\geq 100G\Omega$

TABLE 8 - IR AS INSTALLED			
		CHECK ONE	
PIN NUMBER	INSULATION RESISTANCE (G Ω)	PASS	FAIL
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 22 of 39	Reference QTP-311-40	Class 40

8.0 TEST PROCEDURE:

CAUTION: THE NEXT STEPS WILL REQUIRE THE USE OF HIGH PRESSURE WHICH CAN CAUSE SERIOUS RISKS TO PERSONNEL AND DAMAGE TO TEST EQUIPMENT, IF NOT SET-UP PROPERLY. PLEASE EXERCISE EXTREME CAUTION DURING OPERATION TO ENSURE PERSONNEL SAFETY AND TO PROTECT EQUIPMENT.

NOTE: THESE PINS WILL BE TESTED WITH HIGH VOLTAGE AND HIGH PRESSURE. PLEASE EXERCISE EXTREME CAUTION DURING OPERATION TO ENSURE SAFETY AND PROTECT EQUIPMENT. REFER TO D/N 50166 FOR HIGH VOLTAGE SAFETY.

8.1 FILL THE SYSTEM WITH A TAP WATER SOURCE AND VENT ALL AIR FROM THE SYSTEM.

OPERATOR INITIALS: _____ DATE: _____

8.2 REPEAT STEPS 7.5 THROUGH 7.6 FOR ALL OF THE STEMS, RECORDING THE VALUES IN TABLE 9.

PASS $\geq 100G\Omega$

TABLE 9 - BASELINE IR WITH SYSTEM FILLED			
		CHECK ONE	
PIN NUMBER	INSULATION RESISTANCE (G Ω)	PASS	FAIL
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

OPERATOR INITIALS: _____ DATE: _____

8.3 TIE ALL WIRES TOGETHER SO THAT THEY ARE PARALLEL AND CAN ALL BE SUPPLIED WITH ELECTRICAL POWER FROM ONE SOURCE.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: **HIGH POWER NAUTILUS ELECTRICAL
STEM COMPOSITE TEST
QUALIFICATION**

Effective Date

1-10-08

Document No.

166320

Revision

A

Page

23 of 39

Reference

QTP-311-40

Class

40

- 8.4 OBTAIN A HIPOT CAPABLE OF MAINTAINING 20,000 VDC FOR EXTENDED PERIODS OF TIME AND HAS A LEAKAGE CURRENT GAUGE. ENSURE THAT THE HIPOT'S CALIBRATION INFORMATION IS RECORDED IN TABLE 1.

OPERATOR INITIALS: _____ DATE: _____

- 8.5 CONNECT THE TEST LEAD OF THE HIPOT TO THE JUNCTION OF THE PIN TEST LEADS. CONNECT THE GROUND LEAD OF THE HIPOT TO THE HIGH PRESSURE METAL TUBING. ENSURE THAT ALL PRESSURE VESSELS ARE GROUNDED TO THE GROUND WIRE. REFER TO FIGURE 7 FOR ADDITIONAL GUIDANCE.

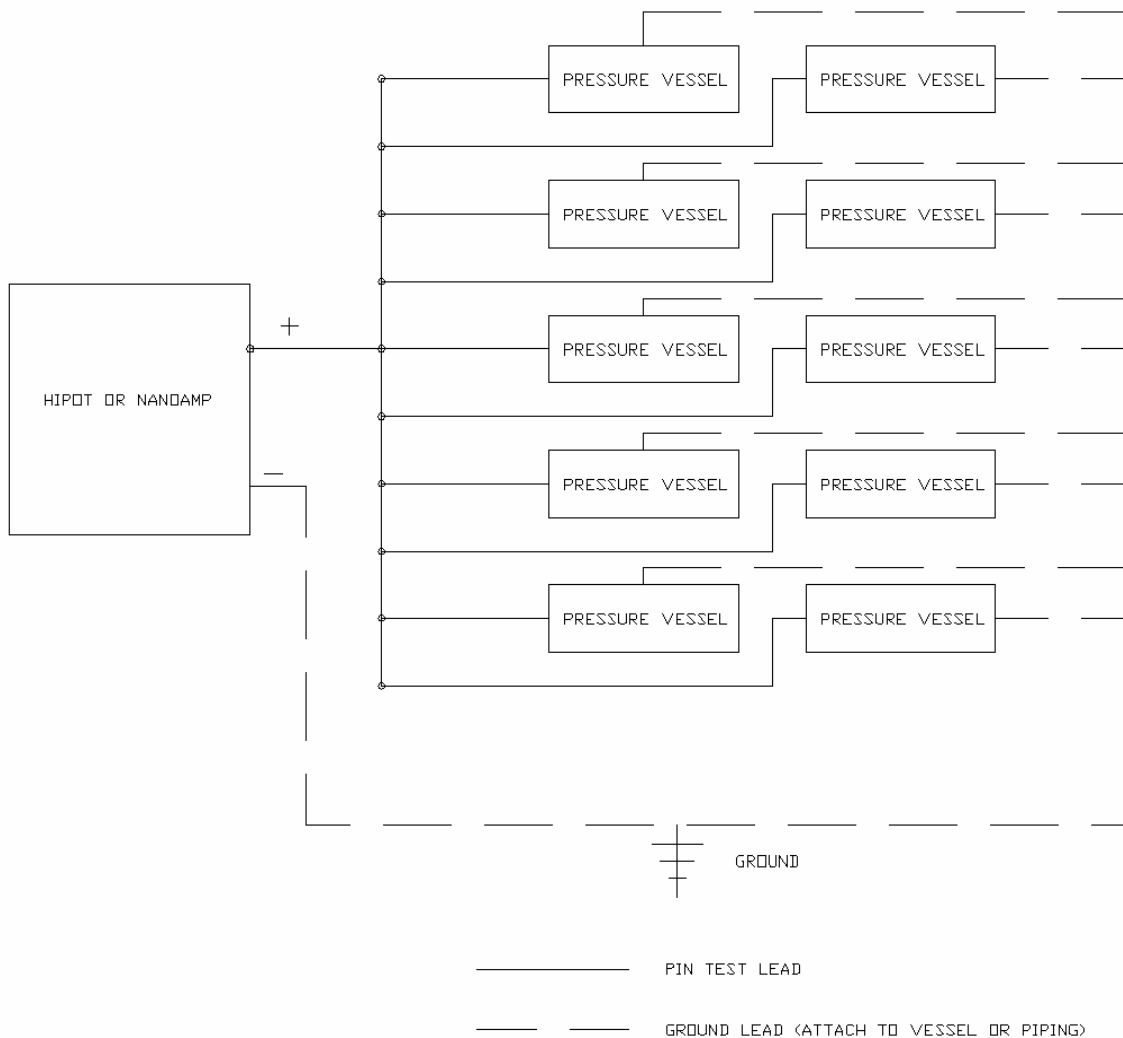


FIGURE 7: TEST CONFIGURATION FOR HIPOT OR NANOAMP TESTING

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 24 of 39	Reference QTP-311-40	Class 40

- 8.6 USING LAB SAFETY PRACTICES, ENERGIZE THE DC HIPOT. RAMP THE VOLTAGE UP TO 20,000 +500/-0 VDC AT APPROXIMATELY 20,000 VDC/MINUTE. ALLOW THE UNIT TO DWELL AT 20,000 +500/-0 VDC FOR TWO MINUTES AND THEN RECORD THE LEAKAGE CURRENT.

LEAKAGE CURRENT: _____

OPERATOR INITIALS: _____ DATE: _____

- 8.7 DE-ENERGIZE THE 20,000 VDC HIPOT AND ENSURE THAT THE SYSTEM IS DISCHARGED TO GROUND (VIA A CONDUCTIVE CONNECTION BETWEEN THE VESSEL/TUBING AND GROUND). DISCONNECT THE POSITIVE AND NEGATIVE LEADS FROM THE SYSTEM.

OPERATOR INITIALS: _____ DATE: _____

- 8.8 OBTAIN THE NANOAMP. ENSURE THAT THE NANOAMP'S CALIBRATION INFORMATION IS RECORDED IN TABLE 1. CONNECT THE TEST LEAD OF THE NANOAMP TO THE JUNCTION OF THE PIN TEST LEADS. CONNECT THE GROUND LEAD OF THE NANOAMP TO THE HIGH PRESSURE METAL TUBING.

OPERATOR INITIALS: _____ DATE: _____

- 8.9 USING LAB SAFETY PRACTICES, ENERGIZE THE NANOAMP. RAMP THE VOLTAGE UP TO 20,000 +500/-0 VDC AT APPROXIMATELY 20,000 VDC/MINUTE. ALLOW THE UNIT TO DWELL AT 20,000 +500/-0 VDC FOR TWO MINUTES AND THEN RECORD THE LEAKAGE CURRENT.

LEAKAGE CURRENT: _____

OPERATOR INITIALS: _____ DATE: _____

- 8.10 DE-ENERGIZE THE NANOAMP AND ENSURE THAT THE SYSTEM IS DISCHARGED TO GROUND (VIA A CONDUCTIVE CONNECTION BETWEEN THE VESSEL/TUBING AND GROUND). DISCONNECT THE POSITIVE AND NEGATIVE LEADS FROM THE SYSTEM.

OPERATOR INITIALS: _____ DATE: _____

- 8.11 ENSURE THAT THE SYSTEM IS IN A FILLED, VENTED STATUS.

OPERATOR INITIALS: _____ DATE: _____

- 8.12 BEGIN DATA ACQUISITION RECORDING ON THE SYSTEM PRESSURE AND TEMPERATURE.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 25 of 39	Reference QTP-311-40	Class 40

8.13 TURN ON THE THERMAL CHAMBER AND SET THE TEMPERATURE TO $45\pm 2^{\circ}\text{C}$.

OPERATOR INITIALS: _____ DATE: _____

8.14 ALLOW THE SYSTEM TO SOAK AT $45\pm 2^{\circ}\text{C}$ FOR A MINIMUM OF 8 HOURS BEFORE PROCEEDING.

OPERATOR INITIALS: _____ DATE: _____

8.15 SEPARATE THE PIN TEST LEADS THAT WERE TIED TOGETHER IN PARALLEL.

OPERATOR INITIALS: _____ DATE: _____

8.16 ATTACH THE MEGGER TEST LEAD TO THE STEM 1 TEST LEAD AND GROUND THE MEGGER TO THE HIGH PRESSURE TUBING OR OTHER METAL COMPONENT TO GROUND THE SYSTEM. REFER TO FIGURE 5 FOR SET-UP GUIDANCE.

OPERATOR INITIALS: _____ DATE: _____

8.17 TAKE AN INSULATION RESISTANCE READING AT 10,000 VDC. RECORD THE READING AFTER A ONE MINUTE DWELL HAS ELAPSED. RECORD THE RESULTS IN TABLE 10, ALONG WITH THE CHAMBER TEMPERATURE.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 26 of 39	Reference QTP-311-40	Class 40

8.18 REPEAT STEPS 8.16 AND 8.17 FOR THE OTHER 9 STEMS TO ENSURE ALL STEMS ARE WELL INSULATED WITHIN THE TEST ASSEMBLIES. RECORD ALL VALUES IN TABLE 10.

PASS $\geq 100G\Omega$

CHAMBER TEMPERATURE ($^{\circ}C$): _____

TABLE 10 - IR AT ELEVATED TEMPERATURE			
		CHECK ONE	
PIN NUMBER	INSULATION RESISTANCE ($G\Omega$)	PASS	FAIL
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

OPERATOR INITIALS: _____ DATE: _____

8.19 CLOSE THE SYSTEM VENT PATH.

OPERATOR INITIALS: _____ DATE: _____

NOTE: IF, AT ANY TIME DURING PRESSURIZATION OR PRESSURE SOAK OF THE SYSTEM, THERE IS ANY CONCERN FOR SAFETY OF THE OPERATOR OR EQUIPMENT, IMMEDIATELY VENT THE SYSTEM AND CONTACT THE ENGINEERING DEPARTMENT.

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 27 of 39	Reference QTP-311-40	Class 40

8.20 INCREASE THE PRESSURE OF THE VESSELS TO 500 ± 100 PSI. HOLD PRESSURE AT 500 ± 100 PSI AND PERFORM A THOROUGH VISUAL INSPECTION OF ALL VESSELS AND CONNECTED EQUIPMENT TO ENSURE THAT THERE ARE NO LEAKS. COMMENT ON THE STATUS OF THE SYSTEM IN THE PROVIDED SPACE BELOW:

COMMENTS: _____

INSPECTION RESULT (CIRCLE RESULT): PASS / FAIL
 PASS CRITERIA IS NO LEAKS

OPERATOR INITIALS: _____ DATE: _____

8.21 INCREASE THE PRESSURE OF THE VESSELS TO 5000 ± 100 PSI. HOLD PRESSURE AT 5000 ± 100 PSI FOR A MINIMUM OF 5 MINUTES. WHERE ACCESSABLE, OBSERVE FOR SIGNS OF LEAKAGE (SUCH AS THE PUMP WORKING EXCESSIVELY TO MAINTAIN PRESSURE). COMMENT ON THE STATUS OF THE SYSTEM IN THE PROVIDED SPACE BELOW:

COMMENTS: _____

RESULT (CIRCLE RESULT): PASS / FAIL
 PASS CRITERIA IS NO LEAKS

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 28 of 39	Reference QTP-311-40	Class 40

8.22 INCREASE THE PRESSURE OF THE VESSELS TO 10,000 ± 100 PSI. HOLD PRESSURE AT 10,000 ± 100 PSI FOR A MINIMUM OF 5 MINUTES. WHERE ACCESSIBLE, OBSERVE FOR SIGNS OF LEAKAGE (SUCH AS THE PUMP WORKING EXCESSIVELY TO MAINTAIN PRESSURE). COMMENT ON THE STATUS OF THE SYSTEM IN THE PROVIDED SPACE BELOW:

COMMENTS: _____

RESULT (CIRCLE RESULT): PASS / FAIL
 PASS CRITERIA IS NO LEAKS

OPERATOR INITIALS: _____ DATE: _____

8.23 ONCE THE SYSTEM IS VERIFIED TO BE LEAK FREE, PRESSURIZE THE SYSTEM TO 15,000 +100/-0 PSI AT A RATE OF APPROXIMATELY 500 PSI/MINUTE.

OPERATOR INITIALS: _____ DATE: _____

8.24 ATTACH THE MEGGER TEST LEAD TO THE STEM 1 TEST LEAD AND GROUND THE MEGGER TO THE HIGH PRESSURE TUBING OR OTHER METAL COMPONENT TO GROUND THE SYSTEM.

OPERATOR INITIALS: _____ DATE: _____

8.25 TAKE AN INSULATION RESISTANCE READING AT 10,000 VDC. RECORD THE READING AFTER A ONE MINUTE DWELL HAS ELAPSED. RECORD THE RESULTS IN TABLE 11, ALONG WITH THE CHAMBER TEMPERATURE.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 29 of 39	Reference QTP-311-40	Class 40

8.26 REPEAT STEPS 8.21 AND 8.22 FOR THE OTHER 9 STEMS TO ENSURE ALL STEMS ARE WELL INSULATED WITHIN THE TEST ASSEMBLIES. RECORD ALL RESULTS IN TABLE 11.

CHAMBER TEMPERATURE (°C): _____

TEST SYSTEM PRESSURE (PSI): _____

PASS ≥ 100GΩ

TABLE 11 - INITIAL IR AT TEST PRESSURE AND TEMPERATURE			
		CHECK ONE	
PIN NUMBER	INSULATION RESISTANCE (GΩ)	PASS	FAIL
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

OPERATOR INITIALS: _____ DATE: _____

8.27 DISCONNECT THE POSITIVE AND NEGATIVE MEGGER LEADS FROM THE SYSTEM.

8.28 TIE ALL WIRES TOGETHER SO THAT THEY ARE PARALLEL AND CAN ALL BE SUPPLIED WITH ELECTRICAL POWER FROM ONE SOURCE.

OPERATOR INITIALS: _____ DATE: _____

8.29 CONNECT THE TEST LEAD OF THE NANOAMP TO THE JUNCTION OF THE PIN TEST LEADS. CONNECT THE GROUND LEAD OF THE NANOAMP TO THE HIGH PRESSURE METAL TUBING.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 30 of 39	Reference QTP-311-40	Class 40

8.30 USING LAB SAFETY PRACTICES, ENERGIZE THE NANOAMP. RAMP THE VOLTAGE UP TO 20,000 +500/-0 VDC AT APPROXIMATELY 20,000 VDC/MINUTE. ALLOW THE UNIT TO DWELL AT 20,000 +500/-0 VDC FOR TWO MINUTES AND THEN RECORD THE LEAKAGE CURRENT.

LEAKAGE CURRENT:_____

OPERATOR INITIALS:_____ DATE:_____

8.31 DE-ENERGIZE THE NANOAMP AND ENSURE THAT THE SYSTEM IS DISCHARGED TO GROUND (VIA A CONDUCTIVE CONNECTION BETWEEN THE VESSEL/TUBING AND GROUND). DISCONNECT THE POSITIVE AND NEGATIVE LEADS FROM THE SYSTEM.

OPERATOR INITIALS:_____ DATE:_____

8.32 CONNECT THE TEST LEAD OF THE HIPOT (CAPABLE OF MAINTAINING 20,000 VDC FOR EXTENDED PERIODS OF TIME AND HAS A LEAKAGE CURRENT GAGE) TO THE JUNCTION OF THE PIN TEST LEADS. CONNECT THE GROUND LEAD OF THE HIPOT TO THE HIGH PRESSURE METAL TUBING.

OPERATOR INITIALS:_____ DATE:_____

8.33 USING LAB SAFETY PRACTICES, ENERGIZE THE DC HIPOT. RAMP THE VOLTAGE UP TO 20,000 +500/-0 VDC AT APPROXIMATELY 20,000 VDC/MINUTE. ALLOW THE UNIT TO DWELL AT 20,000 +500/-0 VDC FOR TWO MINUTES AND THEN RECORD THE LEAKAGE CURRENT.

LEAKAGE CURRENT:_____

OPERATOR INITIALS:_____ DATE:_____

8.34 AT A MINIMUM, TAKE READINGS ON THE LEAKAGE CURRENT ONCE A DAY, EXCLUDING WEEKENDS AND HOLIDAYS. THE READINGS WILL BE RECORDED ON THE TABLE IN APPENDIX A. COPY THE APPENDIX A TABLE AS MUCH AS NECESSARY TO ADEQUATELY CAPTURE THE INFORMATION.

OPERATOR INITIALS:_____ DATE:_____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 31 of 39	Reference QTP-311-40	Class 40

8.35 AT A MINIMUM, TAKE LEAKAGE CURRENT READINGS ON THE SYSTEM USING THE NANOAMP WEEKLY. THESE READINGS WILL BE TAKEN AS THEY WERE IN STEPS 8.28 THROUGH 8.30. RECORD THESE VALUES IN THE APPROPRIATE LOCATION ON THE TABLE IN APPENDIX A. AFTER THESE READINGS ARE TAKEN, ENSURE THAT THE HIPOT IS RECONNECTED TO THE SYSTEM PER STEP 8.31 AND THE SYSTEM CONDITIONS RE-ESTABLISHED PER STEP 8.36.

NOTE: AT ANYTIME, IF THERE IS A NOTICEABLE CHANGE IN THE SYSTEM PARAMETERS (LEAKAGE CURRENT, PRESSURE, ETC.), IMMEDIATELY CONTACT ENGINEERING FOR CONSULTATION.

OPERATOR INITIALS: _____ DATE: _____

8.36 SHOULD THERE BE A FAILURE AT ANY TIME DURING TESTING, ANNOTATE THE FAILURE MODE IN THE COMMENTS SECTION AT THE BOTTOM OF THE TABLE IN APPENDIX A.

OPERATOR INITIALS: _____ DATE: _____

8.37 ALLOW THE SYSTEM TO REMAIN IN THE FOLLOWING CONDITIONS UNTIL TOLD OTHERWISE BY ENGINEERING.

SYSTEM PRESSURE: 15,000 +100/-0 PSI

SYSTEM TEMPERATURE: 45±2°C

APPLIED VOLTAGE: 20,000 +500/-0 VDC

DURATION OF TEST: LONG TERM - ENGINEER WILL NOTIFY WHEN TO STOP TEST.

OPERATOR INITIALS: _____ DATE: _____

8.38 ONCE THE ENGINEER HAS PROVIDED THE PERMISSION TO STOP THE TEST, TAKE A FINAL LEAKAGE CURRENT READING ON THE PINS. RECORD THIS FINAL VALUE, ALONG WITH THE DATE, TIME, PRESSURE, TEMPERATURE AND TEST VOLTAGE IN TABLE 12.

TABLE 12 - FINAL PRESSURIZED, HIGH TEMPERATURE RESULTS	
DATE/TIME:	
PARAMETER	RESULT
TEST VOLTAGE (VDC)	
OBSERVED LEAKAGE CURRENT FROM THE HIPOT (nA)	
OBSERVED LEAKAGE CURRENT FROM THE NANOAMP (nA)	
TEST PRESSURE (PSI)	
THERMAL CHAMBER TEMPERATURE (°C)	

OPERATOR INITIALS: _____ DATE: _____

UNCONTROLLED COPY - FOR INFORMATION ONLY. WILL NOT BE KEPT UP TO DATE.

"COMPANY CONFIDENTIAL"

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 32 of 39	Reference QTP-311-40	Class 40

8.39 DE-ENERGIZE THE HIPOT. VENT THE SYSTEM PRESSURE TO AMBIENT PRESSURE AT A DEPRESSURIZATION RATE OF APPROXIMATELY 500 PSI/MINUTE.

OPERATOR INITIALS: _____ DATE: _____

8.40 LEAVING THE PRESSURE VESSEL VENTED, REDUCE THE THERMAL CHAMBER TEMPERATURE TO AMBIENT TEMPERATURE (25±5°C). ALLOW THE ASSEMBLY TO REMAIN AT THIS TEMPERATURE FOR A MINIMUM OF 8 HOURS.

OPERATOR INITIALS: _____ DATE: _____

8.41 AT AMBIENT TEST CONDITIONS, USING LAB SAFETY PRACTICES, ENERGIZE THE DC HIPOT. RAMP THE VOLTAGE UP TO 20,000 +500/-0 VDC AT APPROXIMATELY 20,000 VDC/MINUTE. ALLOW THE UNIT TO DWELL AT 20,000 +500/-0 VDC FOR TWO MINUTES AND THEN RECORD THE LEAKAGE CURRENT.

LEAKAGE CURRENT: _____

OPERATOR INITIALS: _____ DATE: _____

8.42 DE-ENERGIZE THE 20,000 VDC HIPOT AND ENSURE THAT THE SYSTEM IS DISCHARGED TO GROUND (VIA A CONDUCTIVE CONNECTION BETWEEN THE VESSEL/TUBING AND GROUND). DISCONNECT THE POSITIVE AND NEGATIVE LEADS FROM THE SYSTEM.

OPERATOR INITIALS: _____ DATE: _____

8.43 CONNECT THE TEST LEAD OF THE NANOAMP TO THE JUNCTION OF THE PIN TEST LEADS. CONNECT THE GROUND LEAD OF THE NANOAMP TO THE HIGH PRESSURE METAL TUBING.

OPERATOR INITIALS: _____ DATE: _____

8.44 USING LAB SAFETY PRACTICES, ENERGIZE THE NANOAMP. RAMP THE VOLTAGE UP TO 20,000 +500/-0 VDC AT APPROXIMATELY 20,000 VDC/MINUTE. ALLOW THE UNIT TO DWELL AT 20,000 +500/-0 VDC FOR TWO MINUTES AND THEN RECORD THE LEAKAGE CURRENT.

LEAKAGE CURRENT: _____

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 33 of 39	Reference QTP-311-40	Class 40

8.45 DE-ENERGIZE THE NANOAMP AND ENSURE THAT THE SYSTEM IS DISCHARGED TO GROUND (VIA A CONDUCTIVE CONNECTION BETWEEN THE VESSEL/TUBING AND GROUND). DISCONNECT THE POSITIVE AND NEGATIVE LEADS FROM THE SYSTEM.

OPERATOR INITIALS: _____ DATE: _____

8.46 SEPARATE THE PIN TEST LEADS THAT WERE TIED TOGETHER IN PARALLEL FOR THE HIGH VOLTAGE/LEAKAGE CURRENT PORTION OF THE TEST.

OPERATOR INITIALS: _____ DATE: _____

8.47 ATTACH THE MEGGER TEST LEAD TO THE STEM 1 TEST LEAD AND GROUND THE MEGGER TO THE HIGH PRESSURE TUBING OR OTHER METAL COMPONENT TO GROUND THE SYSTEM.

OPERATOR INITIALS: _____ DATE: _____

8.48 TAKE AN INSULATION RESISTANCE READING AT 10,000 VDC. RECORD THE READING AFTER A ONE MINUTE DWELL HAS ELAPSED. RECORD THE RESULTS IN TABLE 13, ALONG WITH THE CHAMBER TEMPERATURE.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 34 of 39	Reference QTP-311-40	Class 40

8.49 REPEAT STEPS 8.44 AND 8.45 FOR THE OTHER 9 STEMS TO ENSURE ALL STEMS ARE WELL INSULATED WITHIN THE TEST ASSEMBLIES. RECORD ALL VALUES IN TABLE 13.

CHAMBER TEMPERATURE (°C) : _____

PASS ≥ 100GΩ

TABLE 13 - IR AT ELEVATED TEMPERATURE			
		CHECK ONE	
PIN NUMBER	INSULATION RESISTANCE (GΩ)	PASS	FAIL
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 35 of 39	Reference QTP-311-40	Class 40

9.0 **DISASSEMBLY AND INSPECTION:**

- 9.1 DRAIN THE SYSTEM AND REMOVE THE PRESSURE VESSELS FROM THE THERMAL CHAMBER.

OPERATOR INITIALS: _____ DATE: _____

- 9.2 REQUEST THE PRESENCE OF THE PROJECT ENGINEER TO WITNESS DISASSEMBLY AND INSPECTION BEFORE PROCEEDING ANY FURTHER IN THE PROCEDURE. THE OPERATOR AND THE ENGINEER MUST SIGN THIS STEP TO VALIDATE THAT THE ENGINEER HAS BEEN NOTIFIED.

OPERATOR INITIALS: _____ DATE: _____

ENGINEER: _____ DATE: _____

- 9.3 OBTAIN PRESSURE VESSEL 1.

OPERATOR INITIALS: _____ DATE: _____

- 9.4 REMOVE THE PRESSURE VESSEL CAP (WITH PIN AND MODIFIED HP PIN STILL INSTALLED) FROM THE PRESSURE VESSEL BODY.

OPERATOR INITIALS: _____ DATE: _____

- 9.5 CAREFULLY REMOVE THE PIN FROM THE VESSEL CAP AND SET ASIDE FOR FURTHER INSPECTION.

OPERATOR INITIALS: _____ DATE: _____

- 9.6 REMOVE THE MODIFIED HP PIN SEAL FROM THE VESSEL CAP AND SET IT ASIDE FOR FURTHER INSPECTION.

OPERATOR INITIALS: _____ DATE: _____

- 9.7 OBTAIN THE PIN THAT WAS SET ASIDE IN STEP 9.5 AND CAREFULLY INSPECT THE PIN UNDER A MICROSCOPE. INSPECT FOR AND NOTE ANY DISCREPANCIES SUCH AS ARC TRACKING, PIN HOLES, CRACK INITIATION AND PROPAGATION DUE TO CANTILEVER STRAIN OR HYDROSTATIC PRESSURE, EXTRUSION DUE TO HYDROSTATIC PRESSURE, ETC.). PHOTOGRAPH THE PART, PARTICULARLY THE AREAS THAT WOULD BE EXPOSED TO THE HIGHEST ELECTRICAL OR MECHANICAL STRAIN. PROVIDE ANY COMMENTS CONCERNING THIS INSPECTION IN THE COLUMN TITLED "PIN COMMENTS" ON TABLE 14.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 36 of 39	Reference QTP-311-40	Class 40

9.8 OBTAIN THE MODIFIED HP PIN SEAL THAT WAS SET ASIDE IN STEP 9.5 AND CAREFULLY INSPECT THE SEAL UNDER A MICROSCOPE. INSPECT FOR AND NOTE ANY DISCREPANCIES SUCH AS ARC TRACKING, PIN HOLES, TEAR INITIATION AND EXTRUSION DUE TO HYDROSTATIC PRESSURE, PERMANENT SET DUE TO BEING INSTALLED AT HIGH PRESSURE AND ELEVATED TEMPERATURE FOR LONG PERIODS OF TIME, ETC.). PHOTOGRAPH THE PART, PARTICULARLY THE AREAS THAT WOULD BE EXPOSED TO THE HIGHEST ELECTRICAL OR MECHANICAL STRAIN. PROVIDE ANY COMMENTS CONCERNING THIS INSPECTION IN THE COLUMN TITLED "HP PIN SEAL COMMENTS" ON TABLE 14.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 37 of 39	Reference QTP-311-40	Class 40

9.9 REPEAT STEPS 9.7 THROUGH 9.8 FOR THE OTHER 9 PINS, RECORDING ALL INSPECTION COMMENTS IN TABLE 14.

TABLE 14 - POST TEST COMPONENT INSPECTION COMMENTS		
PIN	PIN COMMENTS	HP PIN SEAL COMMENTS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 38 of 39	Reference QTP-311-40	Class 40

9.10 PERFORM AN ALCOHOL SWAB TEST ON EACH PIN TO VERIFY EACH PIN PERFORMS WELL ELECTRICALLY BEFORE ASSEMBLY. PERFORM THIS TEST AT 5,000 VDC, SWABBING THE ENTIRE AREA OF THE ULTEM WITH ALCOHOL TO WITHIN 0.5 INCH OF THE PIN CONTACT OR SOLDER POT CONTACT AREA. RECORD THE RESULTS IN TABLE 15.

TABLE 15 - POST-TEST ALCOHOL SWAB TEST OF PINS		
PIN NUMBER	CIRCLE ONE	COMMENTS
1	PASS / FAIL	
2	PASS / FAIL	
3	PASS / FAIL	
4	PASS / FAIL	
5	PASS / FAIL	
6	PASS / FAIL	
7	PASS / FAIL	
8	PASS / FAIL	
9	PASS / FAIL	
10	PASS / FAIL	

PASS $\geq$ 100G Ω

OPERATOR INITIALS: _____ DATE: _____

9.11 LABEL A CLEAN BAG WITH THE PIN NUMBER AND PLACE THE PARTS INTO THE BAG.

OPERATOR INITIALS: _____ DATE: _____

9.12 SUBMIT THE BAGS TO ENGINEERING FOR FURTHER EVALUATION.

OPERATOR INITIALS: _____ DATE: _____

SUBJECT: HIGH POWER NAUTILUS ELECTRICAL STEM COMPOSITE TEST QUALIFICATION	Effective Date 1-10-08	Document No. 166320	Revision A
	Page 39 of 39	Reference QTP-311-40	Class 40

APPENDIX A:

DATE	TIME	SYSTEM PRESSURE (PSI)	CHAMBER TEMP. (°C)	HIPOT LEAKAGE CURRENT (nA)	NANOAMP LEAKAGE CURRENT (nA)	OPERATORS INITIALS

COMMENTS: