Frozen Process Plan

MacLean Power Systems
Frozen Process Plan
3.5" Extruded Line Posts
May 3, 2013

Background:
On April 23rd, 2013 all prototype tests were complete and passed for the 3.5" extruded line post insulator manufactured by MacLean Power Systems. These tests were performed in accordance with ANSI C29.17.

From the start of the project, the 3.5" insulators initially passed tensile load, housing tracking and erosion and dye penetration. There were some issues with a supplier that caused Core time-load to be repeated. In addition, there were some supplier, test set-up and manufacturing inconsistencies that caused the test on interfaces on connection of end fittings to be repeated. All of the tests have performed at Powertech Labs and have passed.

1. Section 7.1 – Tests on interfaces and connection of end fitting (See Appendix A)
2. Section 7.2.1 – Core time-load test (See Appendix B)
3. Section 7.2.2 – Tensile load test (See Appendix C)
4. Section 7.3 – Housing tracking and erosion test (See Appendix D)
5. Section 7.3.2 – Ageing or Weathering test (See Appendix E)
6. Section 7.4.1 – Dye Penetration test (See Appendix F)
7. Section 7.4.2 – Water Diffusion test (See Appendix G)

Root Cause Analysis:
Due to the past issues above, MacLean Power Systems conducted a multi-day Root Cause Analysis resulting in a design of experiments matrix for the samples manufactured for Tests on interfaces and connection of end fittings. This RCA steps were necessary to handle the manufacturing inconsistencies that were present in previous tests. Through the RCA, the three major undesirable outcomes that have been experienced are:

1. Sheath to Rod Mating
2. Shed to Sheath Mating
3. Rod Imperfections

Two different RCAs were produced for the first two undesirable outcomes. The items in green were determined to be controlled by our process. The items in red were identified as requiring additional investigation and control of the parameters.

Figure 1 shows the RCA analysis and breakdown of sheath to rod mating. The surface finish, storage/handling and extrusion screw RPM were identified as requiring additional investigation. Through this investigation, the extrusion screw RPM settings were found to be controlled by the machine set-up instructions that are in place. The storage/handling issues were identified as an improvement area but did not lead to the mating issue. However, the surface finish imperfections were identified as having a direct correlation to the mating and were included in the DOE.

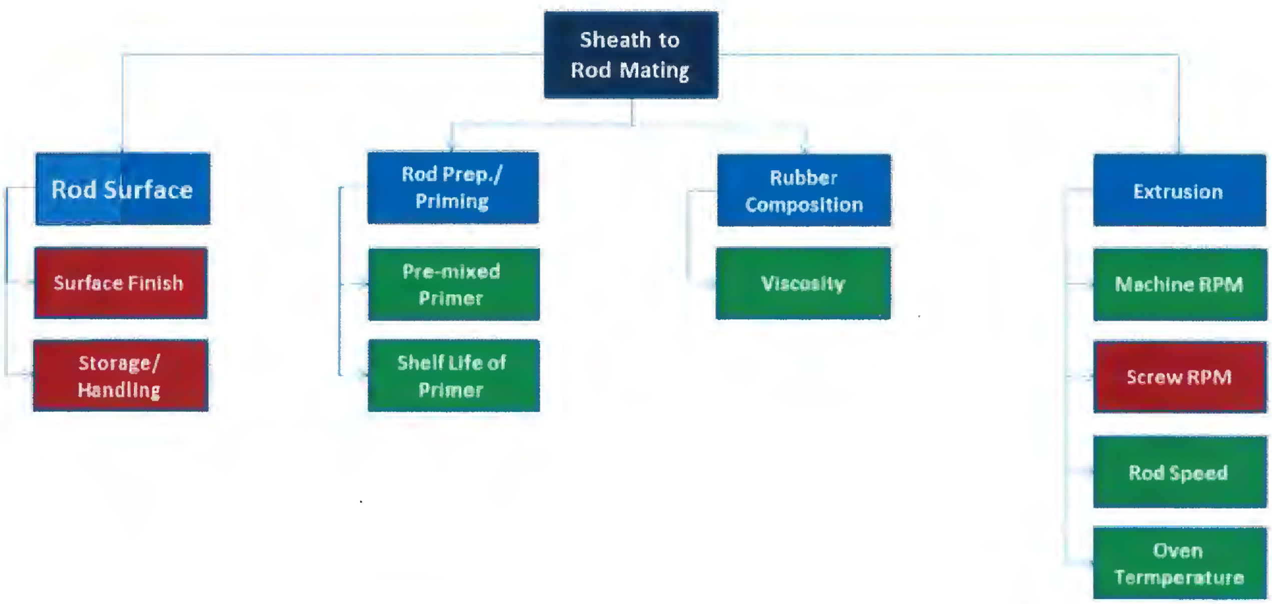

Figure 1: RCA for Sheath to Rod Mating

Figure 2 shows the RCA analysis and breakdown of shed to sheath mating. The surface finishes of the sheds were found to be a problem during earlier stages of testing. The supplier is abrading all sheds. The rod-shed turbulence parameters were an unknown and therefore, included in some samples created in the DOE. The paste removal with alcohol were identified as having a direct contribution to this mating issue and were changed for all samples on the DOE.

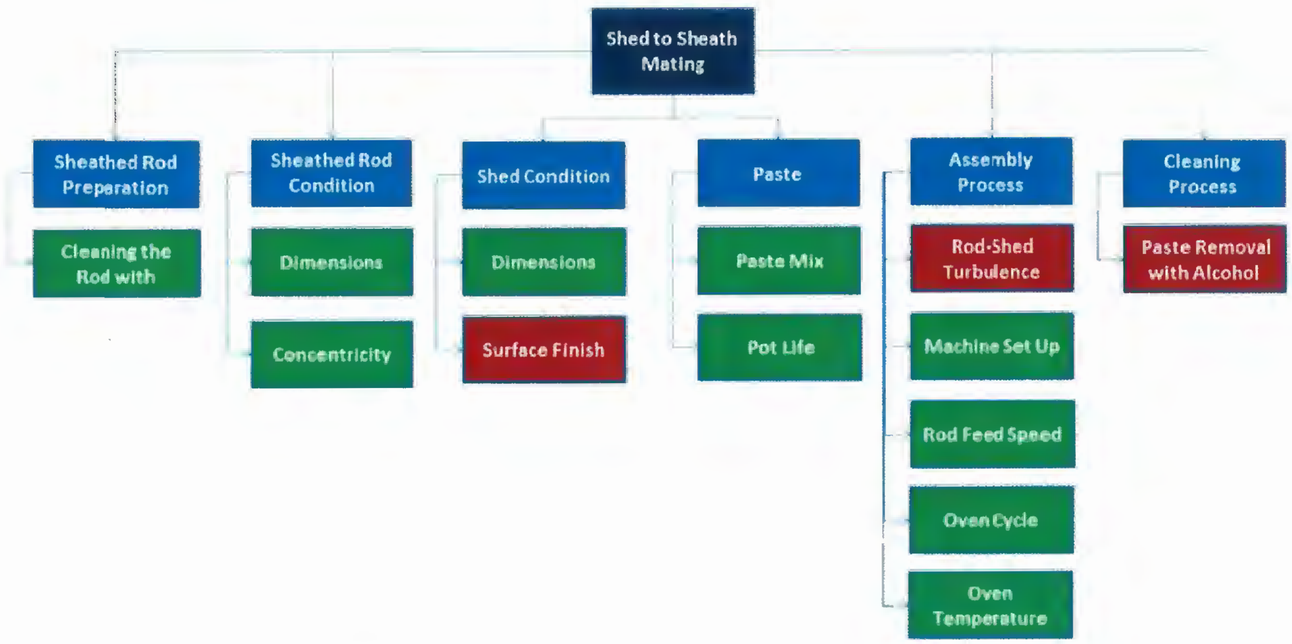

Figure 2: RCA for Shed to Sheath Mating

MPS has been working closely with the 3.5" rod supplier to identify the imperfections that caused the issues with the Core time-load test. It has been isolated to two lots and an RCA is in process by the vendor.

Design of Experiments:
Table 1 is the matrix used to create samples for the latest round of testing at Powertech. This takes into the account the three parameters: rod abrasion, no alcohol during cleaning, rod-shed turbulence and eliminating the first/last rod from extrusion.

Table 1: Design of Experiments – Sample Matrix

3.5" Insulator Trial Matrix						
Sample #	Rod Abraded	No Alcohol	Extra 20" at Rod Shed	Dye Penetration Test	Sent For Testing Y/N	Why?
1-1	Y	Y		Y	No	First Rod
1-2	Y	Y		Y	No	First Rod
2-1	Y	Y		Y	Yes	
2-2	Y	Y		Y	Yes	
3-1	Y	Y		Y	Yes	
3-2	Y	Y		Y	Yes	
4-1	Y	Y		Y	Yes	
4-2	Y	Y	Y	Y	Yes	
5-1	Y	Y		Y	Yes	
5-2	Y	Y	Y	Y	Yes	
6-1	Y	Y		Y	Yes	
6-2	Y	Y	Y	Y	Yes	
7-1	Y	Y		Y	Yes	
7-2	Y	Y	Y	Y	Yes	
8-1	Y	Y		Y	Yes	
8-2	Y	Y		Y	Yes	
9-1	Y	Y		Y	Yes	
9-2	Y	Y		Y	Yes	
10-1	Y	Y		Y	No	Glue - Cosmetic
10-2	Y	Y		Y	Yes	
11-1	Y	Y		Y	Yes	
11-2	Y	Y		Y	Yes	
12-1	Y	Y		Y	No	Glue - Cosmetic
12-2	Y	Y		Y	Yes	
13-1	Y	Y		Y	No	Last Rod
13-2	Y	Y		Y	No	Last Rod

Testing:
The units used for testing that passed steep front testing were manufactured using three of the four characteristics identified in the matrix.

1. Rod Abrasion
2. No Alcohol used during cleaning
3. Eliminating the first and last rod from extrusion

Production:
In order to ensure that all 3.5” extruded line posts are manufactured the same way as testing, the process has been frozen; instructions and processes have been implemented to ensure the repeatability of the production process.

Figure 3 shows an abbreviated version of the MPS Value Stream Map. The steps in the process are identified with changes or no changes. The full value stream map identifies tact time, inventory, manning, etc.

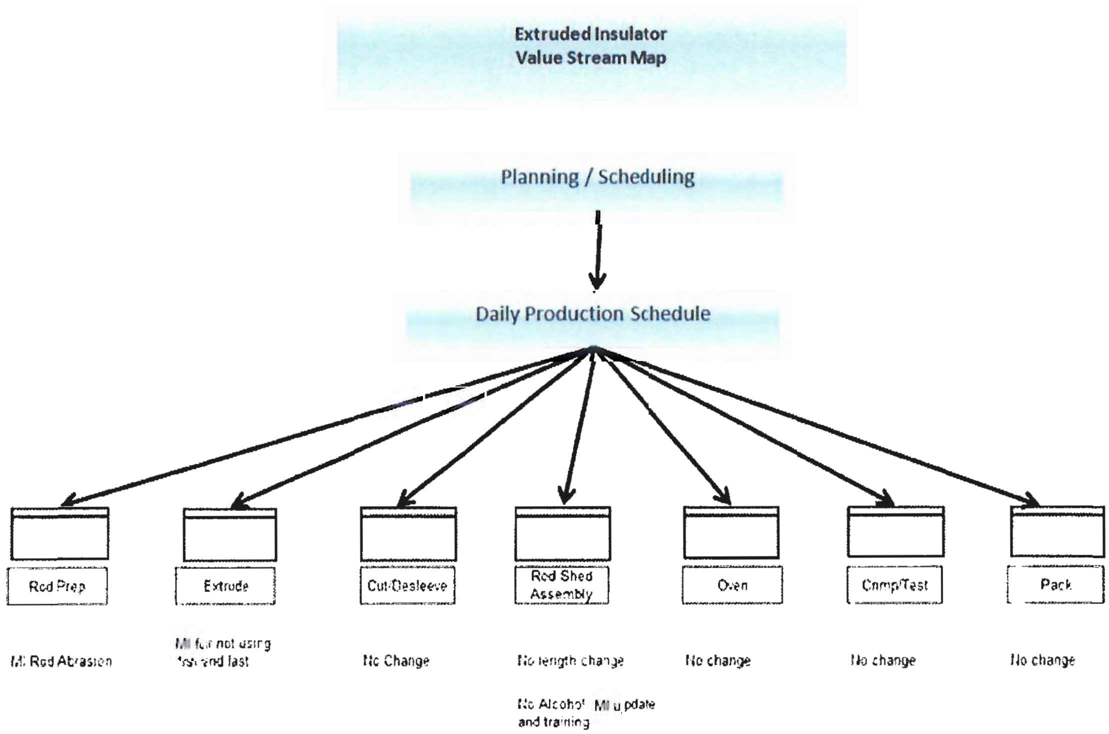

Figure 3: Abbreviated Value Stream Map

Prior to entering the value stream, there are two material checks that are implemented regarding rod inspection and shed inspection. The rod inspection will include a mix of water diffusion, dye penetration, gauging and visual checks. This will ensure that any quality imperfections delivered by our supplier will never make it through MPS production. The shed inspection will include visual as well as dimensional checks to ensure the same thing.

Rod abrasion has been implemented in the rod preparation step of MPS production for 3.5" extruded line posts. There is a MI (Manufacturing Instruction) in place that details the required steps. Additionally, MPS investigated the need for rod abrasion on all extruded products. The finish on the rod produced by the in house production facility is rougher than that of the finish of the rod produced by the supplier thus requiring the need for abrasion of the 3.5" and not across all product lines.

For the extrusion step of the manufacturing process, MPS will not be using the first and last rod extruded for 3.5". The MI has been updated to reflect this change in process.

There were no changes to the cut and desleeve step of the manufacturing process.

For rod shed, there were the initial thoughts that there were rod-shed turbulence influences and this affected the bonding of the sheds at the far end of the insulator. Four samples were made that had an additional 20 inches for this rod-shed turbulence influence, samples 4-2, 5-2, 6-2 and 7-2 (See Table 1). These samples were not used in electrical testing and therefore, the additional 20 inches will not be added in the manufacturing process. The samples that passed steep front were 3-2, 12-2, 3-1 and 7-1 was used as a reference sample (See Appendix A).

The alcohol steps were removed from the cleaning process for the samples that passed the electrical testing therefore; the MI has been updated to reflect this change in process. Due to this change, there may be some excess paste left on the insulators. This paste is purely cosmetic and does not affect the performance of the insulators. Figure 4 shows several pictures of the insulators that passed steep front with this cosmetic issue.

Figure 4: Extra paste on insulators

The remaining steps of the manufacturing process including oven bake, crimp, test and pack were not changed in any way.

Conclusion:
The changes in the manufacturing process include rod abrasion, omitting the first/last rod of extrusion and elimination of alcohol during rod shed. Manufacturing Instructions have been updated for all these process changes. This ensures the repeatability of the process throughout the production of any 3.5" extruded line post insulators.

Appendix A

Tests on interfaces and connection of end fittings

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"TESTS ON INTERFACES AND CONNECTION OF END FITTINGS" TEST REPORT ON 3.5" DIAMETER COMPOSITE LINE POST INSULATOR

Client: Maclean Power Systems, 7801 Park Place Road, York, SC, USA, 29745-0949

Test Date: 3 - 14 April 2013 | **Project:** 80021827

Sample Data:
Manufacturer: Maclean Power Systems
Description: Post Insulator
Rod Diameter: 3.5"
PTL Sample No: 1137-1 (3-2), 1137-2 (12-2), 1137-3 (3-1) and 1137-7 (7-1, reference sample) Note: the numbers in parentheses are Maclean Power Systems numbers.
The tested insulators are shown in Figure 1 & 2.

Test Witnesses: Shane Nazworth, Maclean Power Systems, Russell S. Hall, CenterPoint Energy

Test Standard: ANSI C29.17-2002: "American National Standard for Insulators – Composite Line-Post Type", Clause 7.1.

Test Procedure:

1. *Test Specimens:* Four sample insulators were subjected to the routine tensile load of 50% of the specified tensile load for 10 seconds.
2. *Thermal Mechanical Test:* Three insulators were submitted to a mechanical load of 3,789 lbs (50% of the SCL of 7,578) in two opposite directions while also, simultaneously, subjected to two 24-hour temperature cycles. Each 24-hour cycle started with one heating period of +50 ± 5 °K, followed by one cooling period of -35 ± 5 °K. The duration of the two temperature levels was at least 8 hours. The load was applied perpendicularly to the insulators' axis at the normal hardware attachment point. The direction of the cantilever load applied to the specimens was reversed once after the first 24-hour temperature cycle when the chamber temperature reached room temperature.
3. *Water Penetration Test:* The three test insulators were immersed for 42 hours in boiling de-ionized water with 0.1% by weight of NaCl. At the end of boiling, the insulators remained in the water until the water cooled to 50°C ± 5C. The water was maintained at this temperature until the verification tests were started.
4. *Verification Tests:* The following verification tests were completed within 48 hours after removing the samples from the water:

   Visual examination: No cracks or crazing of the shed or housing are permitted.

   Steep-front Impulse voltage test: Each sample was subjected to 25 positive and 25 negative steep-front impulses of at least 1000 kV/µs. Each impulse shall cause an external flashover. There shall be no punctures.

   Power frequency voltage test: The shank temperature of the samples was measured. The power frequency flashover voltage was determined by averaging five flashover voltages on each sample, including the reference sample. The samples and the reference sample were continuously subjected to 80% of the reference flashover voltage for 30 minutes.

   The temperature of the housing between the sheds of each sample and of the reference sample was measured at three places immediately after the removal of the test voltage. The flashover voltage of each sample shall be at least 90% of the reference insulator. No puncture shall occur. The maximum temperature rise of the shank of each sample insulator shall be not more than 20°C above ambient.

Test Results: The insulators passed the test with no cracks or crazing of the shed or housing. The insulators passed the steep front tests. The flashover voltage of the test samples was at least 90% of the reference sample and the temperature rise during the 30 minute test was less than 20°C above ambient. Tables 1 & 2 give the test result details. The insulators meet the test requirements.

Remarks: The insulators **passed** the "Tests on Interfaces and Connection of End Fittings" in accordance with the requirements of ANSI C29.17-2002: "American National Standard for Insulators – Composite Line-Post Type", Clause 7.1.

Tested by:

B. Kitson
Senior Technician, High Voltage Laboratory

Prepared by:

30 April/13

A.J. Vandermaar, P. Eng.
Manager, High Voltage Laboratory

Figure 1 – Reference Insulator

Figure 2: Tested Insulators after Boiling

Table 1 – Flashover Test Results

Test Date: 14 April 2013

Atmospheric Conditions: BP – 756.2 mm Hg, T_{dry} –20.2 °C, RH – 30.6 %

The following flashover values were obtained:

Insulator	Uncorrected flashover values (kV_{rms})	Uncorrected flashover average (kV_{rms})	Corrected* flashover value (kV_{rms})	Flashover relative to Reference (%) (min 90 %)
1137-1	382, 378, 385, 386, 386	384	415	98%
1137-2	366, 365, 384, 359, 381	371	401	95%
1137-3	385, 386, 377, 383, 379	382	413	98%
1137-7 reference sample	394, 392, 394, 394, 394	391	423	NA

* - corrected to standard atmospheric conditions

Table 2 – Temperature Rise

Test Date: 14 April 2013

Each insulator was subjected for 30 minutes to 80% of the reference sample flashover value (80% x 394 kV = 315 kV). The measured temperatures were as follows:

Insulator	Pre-test shank temp (°C)		Post-test shank temp (°C)		Change (°C) (max 20 °C)
1137-1	Top	19.9	Top	20.3	0.4
	Middle	19.3	Middle	19.9	0.6
	Bottom	19.1	Bottom	19.0	-0.1
1137-2	Top	20.9	Top	21.0	0.1
	Middle	20.3	Middle	20.2	-0.1
	Bottom	20.2	Bottom	20.1	-0.1
1137-3	Top	21.6	Top	20.5	-1.1
	Middle	19.3	Middle	19.4	0.1
	Bottom	19.1	Bottom	19.2	0.1
1137-7 reference sample	Top	20.3	Top	20.6	-0.3
	Middle	19.3	Middle	20.1	0.8
	Bottom	19.3	Bottom	20.0	0.7

Appendix B

Core time-load test

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CORE TIME-LOAD TEST REPORT ON 3.5" DIAMETER COMPOSITE LINE POST INSULATOR

Client:	Maclean Power Systems, 7801 Park Place Road, York, SC, USA, 29745-0949	
Test Date:	18 April - 23 April 2013	**Project:** 80021827

Sample Data:

Manufacturer: Maclean Power Systems
Description: Post Insulator
Sample No: 1137-8 (2-2), 1137-9 (5-2), 1137-10 (4-1) Note: the numbers in parentheses are Maclean Power Systems numbers.

Test Standard: ANSI C29.17-2002: "American National Standard for Insulators – Composite Line-Post Type", Clause 7.2.1.

Test Procedure:

Core Time Load Test: Three insulators were submitted were gradually loaded to 40% of the SCL (40% of 7,578 = 3,131 lbs) at a temperature of 20°C ± 10°C. The load was applied to the insulator at the conductor position, approximately perpendicular to the intended orientation of the conductor and approximately perpendicular to the core of the insulator. The load was maintained for 96 hours.

Visual Examination: After removal of the load, the base end fitting was visually inspected for cracks or permanent deformation. All threaded connections must be intact and usable.

Dissection and Dye Penetration: Each insulator was cut at 90° to the axis of the core and about 50 mm from the base end fitting, them the base end fitting was cut longitudinally into two halves in the plane of the previously applied cantilever load. The cut surfaces were smoothed by means of a fine abrasive cloth (grain size 180).

The cut halves were visually inspected for cracks and delamination. The presence of cracks or delamination in the fiberglass rod constitutes failure.

A dye penetration test was performed on the cut surfaces in accordance with ISO 3452 to reveal cracks. The presence of cracks or delamination in the fiberglass rod constitutes failure.

Test Results: The insulators passed the test with no cracks or permanent deformation on the base end fitting. All connections were intact and usable. Two of the insulators passed the dye penetration test. Figure 1 to 3 shows the insulators cut ends. The insulators **passed** the test requirements.

Remarks: The insulators **passed** the "Core Time-Load Test" in accordance with the requirements of ANSI C29.17-2002: "American National Standard for Insulators – Composite Line-Post Type", Clause 7.2.1.

Tested by:

for

A. Hall
Materials Tester

Prepared by:

PROFESSIONAL
PROVINCE OF
A.J. VANDERMAAR
BRITISH COLUMBIA

30 April / 13

A.J. Vandermaar, P. Eng.
Manager, High Voltage Laboratory

Figure 1: Dye Penetration Test – Sample 1137-8

Figure 2: Dye Penetration Test Pass – Samples Sample 1137-9

Figure 3: Dye Penetration Test Pass – Sample 1137-10

Appendix C

Tensile load test

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TENSILE LOAD TEST REPORT ON 3.5" DIAMETER COMPOSITE POST INSULATOR

Client:	Maclean Power Systems, 7801 Park Place Road, York, SC, USA, 29745-0949		
Test Date:	23 April 2013	**Project:**	80021827

Sample Data:

Manufacturer: Maclean Power Systems
Description: Post Insulator
Rod Diameter: 3.5"
PTL Sample No: 1137-12 (6-2), 1120-13 (8-2) and 1137-14 (9-1) Note: the numbers in parentheses are Maclean Power Systems numbers.
The test setup is shown in Figure 1.

Test Standard: ANSI C29.17-2002: "American National Standard For Insulators – Composite-Line Post Type", Clause 7.2.2.

Test Procedure:

Three insulators with standard end fittings were tested. Each insulator was testing by applying a tensile load individually in line with the axis of the core of the insulator. The load was increased rapidly but smoothly from zero to approximately 11,250 lbs (75 % of STL load of 15,000 lbs). The load was then gradually increased in a time between 30 s and 90 s until the STL of 15,000 lbs was reached. The load was maintained for the remainder of the 90 s. After 90 s the load was released.

The test is regarded as passed if there is no evidence of pull out of the core from the end fittings or breakage of the end fitting.

Test Results: There was no evidence of pull out of the core from the end fittings or breakage of the end fitting on the three insulators.

Remarks: The composite post insulator **passed** the Tensile Load Test in accordance with ANSI C29.17-2002, Clause 7.2.2

Tested by:

R. Trip
Senior Project Specialist

Reviewed by:

PROFESSIONAL PROVINCE OF A. J. VANDERMAAR BRITISH COLUMBIA ENGINEER

30 April /13

A.J. Vandermaar, P. Eng.
Manager, High Voltage Laboratory

Figure 1: Tensile Test Setup

Appendix D

Housing tracking and erosion test

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COMPOSITE POST INSULATOR 1000 HOUR TRACKING AND EROSION (SALT FOG) TEST REPORT

Client: Maclean Power Systems, 7801 Park Place Road, York, SC, USA, 29745-0949

Test Date: 19 June, 2012 to 9 August, 2012 | **Project:** 80021827

Sample Data:
Manufacturer: Maclean Power Systems
Description: Post Insulator
PTL Sample No: 1077-1C, 1077-2C

Test Standard: ANSI C29.17-2002: "American National Standard for Insulators – Composite Line-Post Type", Clause 7.3, "Housing tracking and erosion tests".

Test Procedure:

The two samples were tested as follows:

Sample 1077-1C was mounted horizontally in the fog chamber. Sample 1077-2C was mounted vertically. Clearances of >200 mm were maintained between the samples and form the samples to the chamber walls, floor and ceiling. The chamber volume was 6.64 m^3. The water was doped with 10 kg/m^3 NaCl and the flow rate to the fog nozzles was measured to be 2.7 l/hour.

The two test insulators were energized at 18.4 kV (635 mm leakage distance/34.6) while subjected to a salt fog atmosphere. A current trip on each sample was set to 1 A_{rms}. The samples pass the test if they withstand the test conditions for 1000 hrs and experience no more than three over current trips, no tracking, no weather shed punctures and no erosion to the core.

Test Results: Figure 1 shows the insulators after the tracking and erosion test. There was no tracking, no erosion to the core and no sheds were punctured. The insulators met the test requirements.

Remarks: The insulators **passed** the 1000 hour tracking and erosion test in accordance with the requirement of ANSI C29.17-21, Clause 7.3, "Housing tracking and erosion tests".

Tested by:

for

R. Urrutia
Technical Assistant

Prepared by:

14 Nov/12

A.J. Vandermaar, P. Eng.
Manager, High Voltage Laboratory

Figure 1: Insulator Samples after Testing – left sample, horizontal, right sample vertical

Appendix E

Ageing or Weathering test

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AGING OR WEATHERING TEST REPORT

Client:	Maclean Power Systems, 7801 Park Place Road, York, SC, USA, 29745-0949		
Test Date:	25 June 2012 to 7 August 2012	**Project:**	80021827
Sample Data: Manufacturer: Tested Samples:	 Maclean Power Systems Three new specimens of shed and housing materials.		
Test Standards:	ANSI C29.17-2002: "American National Standard for Insulators – Composite Line-Post Type", Clause 7.3.2, "Aging or weathering test".		
Test Procedure:	Three new specimens of the shed and sheath material and one new shed specimen with markings was subjected to a 1000 h UV light testing using the fluorescent UV method: ASTM G 53.		
Test Evaluation:	The samples shall show no indication of cracking or crazing after one thousand hours.		
Test Results:	The tested samples had no surface cracking, or crazing. Figure 1 shows the tested samples at the completion of the test.		
Remarks:	The insulators **passed** with the requirements of ANSI C29.17-2002, Clause 7.3.2.		

Tested by:

Brian Kitson
Senior Technician

Prepared by:

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Manager, High Voltage Laboratory

Figure 1 – Test Samples after 1000 Hours Aging

Appendix F

Dye Penetration test

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DYE PENETRATION TEST REPORT ON 3.5" DIAMETER COMPOSITE POST INSULATOR

Client:	Maclean Power Systems, 7801 Park Place Road, York, SC, USA, 29745-0949		
Test Date:	19-21 April 2013	**Project:**	80021827

Sample Data:
Manufacturer: Maclean Power Systems
Description: Post Insulator
Rod Diameter: 3.5"
PTL Sample No: 1137-11 (5-1) Note: the number in parentheses is the Maclean Power Systems number.

Test Standard: ANSI C29.17-2002: "American National Standard For Insulators – Composite-Line Post Type", Clause 7.4.1.

Test Procedure:

Specimens Preparation: Ten specimens were cut from the tested insulator. The housing material was not removed from the core. The cuts were made at 90° to the axis of the core using a diamond-coated circular saw blade under running cold water. The cut surfaces were smoothed by means of fine abrasive cloth (grain size 180). The length of the specimens was 10 ± 0.5 mm. A thin bead of clear silicon rubber was applied to the circumference of each test specimen to prevent rising of dye along the external surface of the specimen.

Dye Penetration Test: The specimens were placed (with fibres in vertical position) on a layer of glass balls (2 mm diameter) in a glass vessel. A dye, 1% methyl alcohol solution of red Fuchsin was poured into the vessel with its level 2-3 mm above the glass balls. The time taken for dye to rise by capillarity through the specimens shall be greater than 15 minutes.

Test Results: No dye penetration through any of the ten tested specimens was observed within 15 minutes. The photographs of the tested specimens are shown in Figures 1 to 5.

Remarks: The composite post insulator **passed** the Dye Penetration Test in accordance with ANSI C29.17-2002, Clause 7.4.1.

Tested by:

B. Kitson
Senior Technician, High Voltage Laboratory

Reviewed by:

30 April /13

A. J. VANDERMAAR

A.J. Vandermaar, P. Eng.
Manager, High Voltage Laboratory

Figure 1: Dye Penetration Test on Specimens 1 and 2

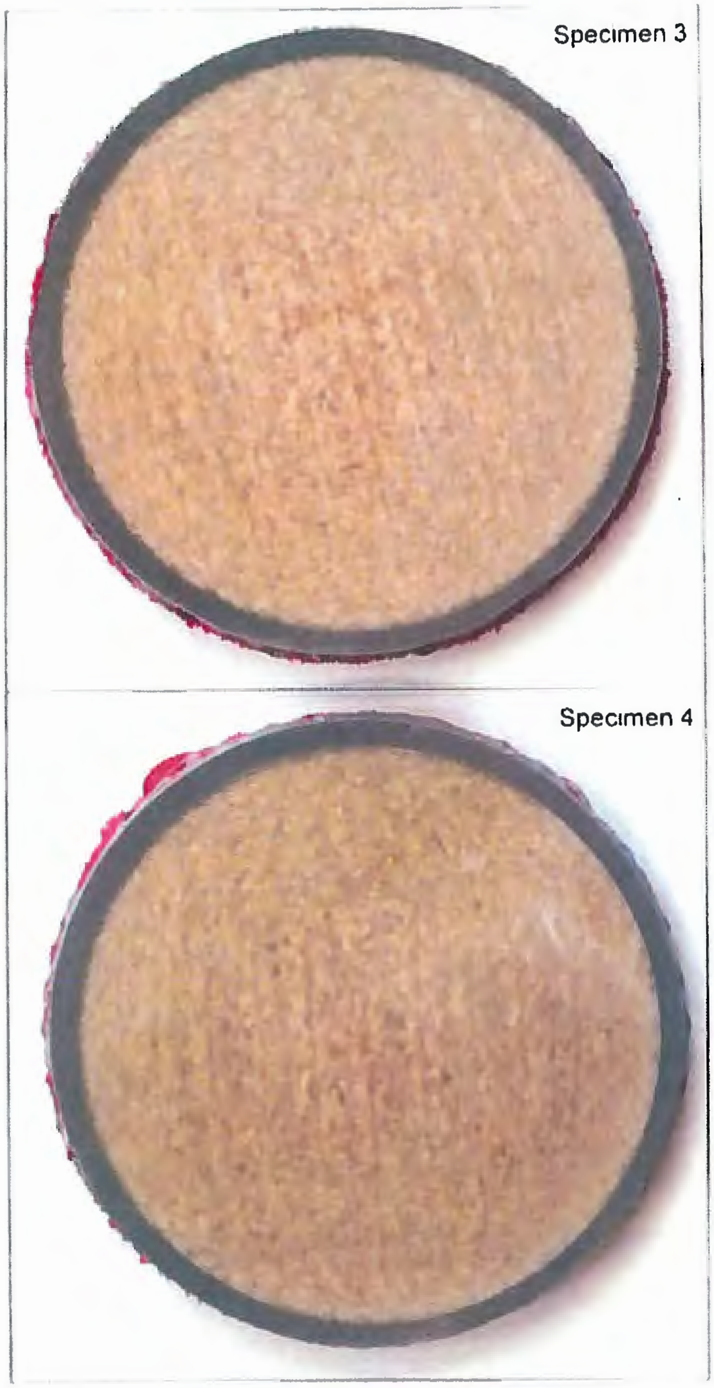

Figure 2: Dye Penetration Test on Specimens 3 and 4

Dye Penetration Test on McLean Power Systems Line Post Insulators

Proj 80021827-27(E1B)   Post Insulator rod diameter 3 5   21 April 2013

Figure 3: Dye Penetration Test on Specimens 5 and 6

Dye Penetration Test on McLean Power Systems Line Post Insulators

Proj 80021827-27(E1B) Post Insulator rod diameter 3 5" 21 April 2013

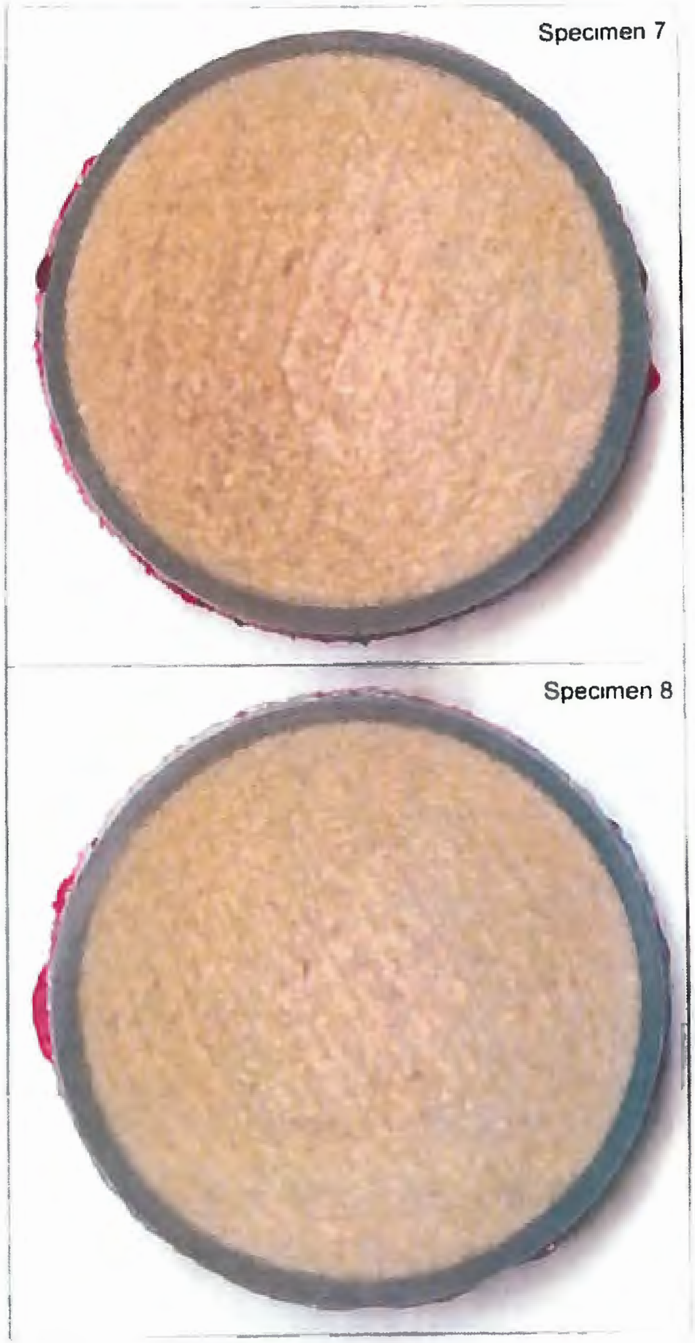

Figure 4: Dye Penetration Test on Specimens 7 and 8

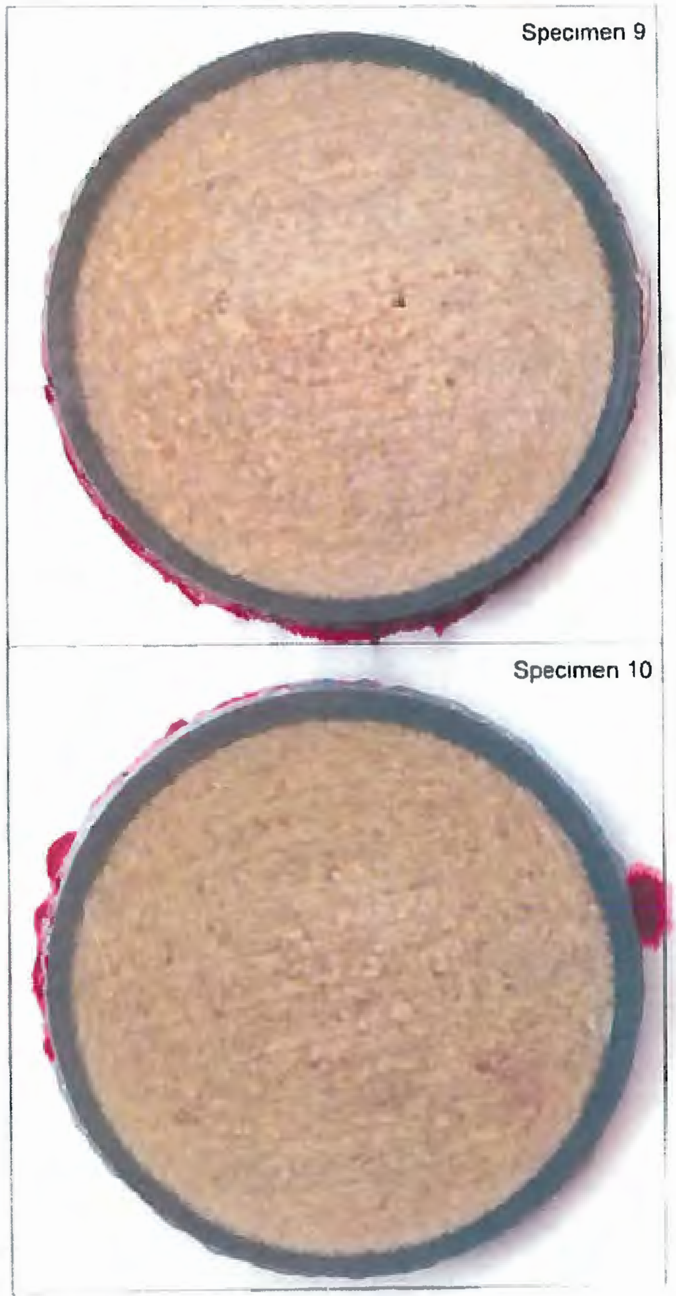

Figure 5: Dye Penetration Test on Specimens 9 and 10

Appendix G

Water Diffusion test

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WATER DIFFUSION TEST REPORT
ON 3.5" DIAMETER COMPOSITE POST INSULATOR

Client:	Maclean Power Systems, 7801 Park Place Road, York, SC, USA, 29745-0949		
Test Date:	19-23 April 2013	**Project:**	80021827

Sample Data:

Manufacturer:	Maclean Power Systems
Description:	Post Insulator
Rod diameter:	3.5"
PTL Sample No: 1137-11 (5-1)	Note: the number in parentheses is the Maclean Power Systems number.

Test Standard: ANSI C29.17-2002: "American National Standard For Insulators – Composite-Line Post", Clause 7.4.2.

Atmospheric Conditions:

Verification test date:	23 April 2013
Temperature:	21.8 °C
Relative humidity:	29.2%
Barometric pressure:	764.9 mmHg

Test Procedure:

Pre-stressing: Six specimens were cut from the tested insulator. The housing material was not removed from the core. The cuts were made at 90° to the axis of the core using a diamond-coated circular saw blade under running cold water. The cut surfaces were smoothed by means of fine abrasive cloth (grain size 180). The length of the specimens was 30 ± 0.5 mm. The specimens were then boiled for 100 hours in a solution of 0.1% by weight NaCl in deionised water. The specimens were then moved to a container with tap water at ambient temperature for 30 minutes prior to testing.

Water Diffusion Test: Immediately before the voltage test the specimens were removed from the glass container and their surfaces dried with filter paper. Each specimen was placed between the test electrodes. The test voltage was increased at rate of approximately 1 kV_{rms}/sec up to 12 kV_{rms}, kept at this level for one minute and then decreased to zero. The maximum leakage currents for each specimen are given in Table 1.

Test Results: All six specimens (Specimens I to VI) **passed** the test with a leakage current below the allowable current of 1 mA_{rms} and no external flashover was observed. The detailed test results are shown on Page 2.

Remarks: The composite post insulator **passed** the Water Diffusion Test.

Tested by:

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Prepared by:

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30 April /13

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Table 1 – Leakage Currents at 12 kV_{rms}

Specimen	I	II	III	IV	V	VI
Withstood 12 kV_{rms} for one minute	Yes	Yes	Yes	Yes	Yes	Yes
Leakage current (μA_{rms})	169	167	168	161	161	164

Frozen Process Plan Follow-Up

MacLean Power Systems
Frozen Process Plan - Follow-ups
3.5" Extruded Line Posts
May 17, 2013

Background:
On May 3rd, 2013 MacLean Power Systems presented a Frozen Process Plan for 3.5" Extruded Line Posts to CenterPoint. From that document, additional explanations arose. This document is meant to capture those questions and answers.

Questions and Answers
Q: On page 4:

- You mention that two insulators weren't included due to cosmetic issues relating to the glue. What was wrong with them precisely? How is that determined? Will this inspection process be continued along with exclusion?

A: There was cosmetic glue on the units. At the time of the samples being manufactured, MPS did not know if excessive paste had any influence on the results of steep front testing. It was discovered during testing at Powertech that excessive paste does not influence the testing. Therefore, this step, eliminating units with excessive glue, will not be continued for production. Figure 1 shows excessive paste on insulators that passed testing.

Figure 4: Extra paste on insulators

Q: On page 5:

- Exactly how often is the rod inspection performed and what exactly is done?

A: Rod inspection is a 3 part process including dye penetration, water diffusion and dimensional checks. The dye penetration and water diffusion occur on every lot that is received from our supplier. The gauging is performed on every rod to ensure dimensional compliance.

Q: On page 6:

- How often is the shed inspection performed and what exactly is checked?
- Does MPS spec a surface finish or roughness? What is that spec?
- Can we see the Manufacturing Instruction?
- Is that the full length of rod or just the first and last insulator length of rod that will be excluded from production? What is the raw rod length?

A: Shed inspection is performed on every lot. A random sampling is taken from the lot to dimensionally inspect the sheds. For surface roughness, a visual check is performed. The roughness degree does not have an influence as long as the abrasion as occurred. MPS does not perform the abrasion in house; therefore there is no manufacturing instruction. The full length of the rod for the first and last will be excluded from production, not just the first and last insulator. The length of the rod varies depending on the part number but is a minimum of 10 feet. Depending on the insulator cut length, multiple units can be produced from one extruded rod.

Q: On page 7:

- Bake details need to be included.
- CNP would like a step by step process of insulator production. Literally:
  - Step 1: Buy rod from vendor
  - Step 2: Buy shed from vendor
  - Step 3: Inspect rod with these specific methods
  - Step 4: Inspect shed with these specific methods
  - Step 5: Extrude sheath onto rod with these specific methods
  - Etc.

A: Post insulators are baked for 5 hours at 240 degrees Fahrenheit.

The steps of the manufacturing process are as follows:

1. Buy components from vendors (rod, rubber, sheds, end fitting and bases)
2. Rod receiving inspection including dye penetration, water diffusion, and dimensional check. The sample size is statistically significant determined by QII-216 based on AQL and lot size.
3. For rubber, the certifications are reviewed. In addition, MPS verifies that the lot codes match the paperwork.
4. Shed receiving inspection including dimensional and visual checks for abrasion. The sample size is statistically significant determined by QII-216 based on AQL and lot size

5. End fitting receiving inspection includes dimension, galvanization and workmanship. There is an RICP for each end fitting. The appropriate RICP is noted on the drawing. End fittings are included on the skip lot program so every delivery may not require inspection.
6. Base receiving inspection includes dimensions, hole placement and galvanization. The appropriate RICP is noted on the drawing. Bases are included on the skip lot program so every delivery may not be inspected.
7. Clean the rod with MI-9000 and then extrude the sheath onto the rod with MI-3008.
8. Cut and desleeve the units with the following manufacturing instructions:
   a. MI-3034 Rod Cut Extrusion
   b. MI-3221 Post Desleever
9. Rod shed assembly with the following manufacturing instructions:
   a. MI-0022 for Cross Linking Paste Prep
   b. MI-0054 for Laser Shed Marker
   c. MI-3024 Post Rod Shed
10. Bake the units with the following manufacturing instructions, MI 1140.
11. Sand the rod with MI-9007.
12. End fittings are crimped using MI-3200/2192.
13. Test the insulators using MI-1219.
14. Packing and used of the foam machine is instructed in MI-0053.

Frozen Process Plan Follow-Up – Rev B

MacLean Power Systems
Frozen Process Plan - Follow-ups
Revision B
3.5" Extruded Line Posts
June 17, 2013

Background:
On May 17th, 2013 MacLean Power Systems presented a follow- up to the Frozen Process Plan for 3.5" Extruded Line Posts to CenterPoint. From that document, there was additional clarification needed. This is revision B of that document.

Questions and Answers
Q: On page 4:

- You mention that two insulators weren't included due to cosmetic issues relating to the glue. What was wrong with them precisely? How is that determined? Will this inspection process be continued along with exclusion?

A: These units were merely an overage and there was nothing wrong with the units that would have prevented them from being tested.

Q: On page 5:

- Exactly how often is the rod inspection performed and what exactly is done?

A: Rod inspection is a 3 part process including dye penetration, water diffusion and dimensional checks. The dye penetration and water diffusion occur on every lot that is received from our supplier. The gauging is performed on every rod to ensure dimensional compliance. The Quality Inspection (QII-216) details out the statistical sampling technique. This includes the sample size versus lot size, frequency, etc.

Q: On page 6:

- How often is the shed inspection performed and what exactly is checked?
- Does MPS spec a surface finish or roughness? What is that spec?
- Can we see the Manufacturing Instruction?
- Is that the full length of rod or just the first and last insulator length of rod that will be excluded from production? What is the raw rod length?

A: Shed inspection is performed on every lot. A random sampling is taken from the lot to dimensionally inspect the sheds (reference QII-216). For surface roughness of the shed, a visual check is performed. As opposed to determining a sample size by lot size, sample size is independent of lot size. The percentage is a result of the sampling plan. This provides you, the customer, with equal or greater protection with less inspection than established plans in ANSI Z1.4. The roughness degree does not have an influence as long as the abrasion as occurred. MPS does not perform the abrasion in house; therefore there is no manufacturing instruction. Figure 1 depicts two different sheds where the sanding step has not occurred and Figure 2 depicts two different sheds after sanding. They were pulled out of the Receiving Inspection for ease of reference.

Figure 1: Sheds where sanding has not occurred.

Figure 2: Sanded Sheds

The full length of the rod for the first and last will be excluded from production, not just the first and last insulator. The length of the rod varies depending on the part number but is a minimum of 10 feet. For your unit, we extrude a 168" long rod that is then cut into two units that are 76" long with a drop. Depending on the insulator cut length, multiple units can be produced from one extruded rod, in this case, two. The rod is abraded using 180 grit sand paper with the machine. The MI for the step of the production process is MI-1040.

Q: On page 7:

- Bake details need to be included.
- CNP would like a step by step process of insulator production. Literally:
    - Step 1: Buy rod from vendor
    - Step 2: Buy shed from vendor
    - Step 3: Inspect rod with these specific methods
    - Step 4: Inspect shed with these specific methods
    - Step 5: Extrude sheath onto rod with these specific methods
    - Etc.

A: Post insulators are baked for 5 hours at 240 degrees Fahrenheit.

The steps of the manufacturing process are as follows:

1. Buy components from vendors (rod, rubber, sheds, end fitting and bases)
2. Rod receiving inspection including dye penetration, water diffusion, and dimensional check. The sample size is statistically significant determined by QII-216 based on AQL and lot size.
3. For rubber, the certifications are reviewed. In addition, MPS verifies that the lot codes match the paperwork.
4. Shed receiving inspection including dimensional and visual checks for abrasion. The sample size is statistically significant determined by QII-216 based on AQL and lot size
5. End fitting receiving inspection includes dimension, galvanization and workmanship. There is an RICP for each end fitting. The appropriate RICP is noted on the drawing. End fittings are included on the skip lot program so every delivery may not require inspection.
6. Base receiving inspection includes dimensions, hole placement and galvanization. The appropriate RICP is noted on the drawing. Bases are included on the skip lot program so every delivery may not be inspected.
7. Abrade the rod with MI-1040.
8. Clean the rod with MI-9000 and then extrude the sheath onto the rod with MI-3008.
9. Cut and desleeve the units with the following manufacturing instructions:
    a. MI-3034 Rod Cut Extrusion
    b. MI-3221 Post Desleever
10. Rod shed assembly with the following manufacturing instructions:
    a. MI-0022 for Cross Linking Paste Prep
    b. MI-0054 for Laser Shed Marker
    c. MI-3024 Post Rod Shed
11. Bake the units with the following manufacturing instructions, MI 1140.

12. Sand the rod with MI-9007.
13. End fittings are crimped using MI-3200/2192.
14. Test the insulators using MI-1219.
15. Packing and used of the foam machine is instructed in MI-0053.

Receiving Sampling Plan

Statistical Sampling Techniques at MPS

SAMPLING PRINCIPLES:

1.0 Purpose
This procedure describes the use of sampling techniques that are used for Receiving Inspection.

2.0 Scope

- This procedure applies to statistical sampling activities used at MacLean Power Systems in association with the documented control plans.
- This procedure may identify specific AQL's and sample plans for a particular product type (example, end fittings).

3.0 References

- ANSI / ASQC Z1.4 — Sampling Procedures and Tables for Inspection by Attributes.
- ANSI / ASQC Z1.9 — Sampling Procedures and Tables for Inspection by Variables and Percent Nonconforming
- MIL-HDBK-30 — Guide for Sampling Inspection
- Guide to Acceptance Sampling - Software is available to calculate attributes and variables sampling plans.
- **Refer to Attachment 1 - End Fitting Sample Requirements**

4.0 Definitions

A. AQL (**Acceptable Quality Level**) - This is the maximum percent defective that is considered satisfactory as a process average. The AQL represents a level of quality that the sampling plan routinely accepts. It is generally taken at the 95% confidence level. The 5% probability of rejection at the AQL is called the producers risk. It is the probability of falsely rejecting a good lot.

B. LTPD (**Lot Tolerance Percent Defective**) - This represents a level of quality that the sampling plan routinely rejects. It is generally taken at the 10% confidence level. The 10% probability of acceptance at the LTPD is called the consumers risks. It is the probability of a bad lot being falsely accepted. Generally it is preferred to have this number between 5% - 10% for the percent defective.

C. Example: If a characteristic is defined to comply with an AQL = 1.0, it can be said that the sample size is statistically established to assure that there is a 95% chance of accepting the lot provided the lot quality is not worse than 1%. If the LTPD = 7.5%, this means that there is only a 10% chance that the lot could be 7.5% bad and we would accept the lot. The AQL & LTPD are used to establish confidence levels for a sampling plan.

D. OC Curve (**Operating Characteristic Curve**) - An OC curve is a plot of process or lot quality versus the probability of acceptance. The OC curve summarizes the protection provided by the sampling plan. From the OC curve one can determine what quality lots are routinely released and routinely rejected.

E. **Sample size** - one or more units selected at random from the lot without regard to their quality.

F. **Attribute** - This refers to qualitative information concerning the conformance to requirements. Attribute sampling plans only require go / no-go information.

G. **Variable** - this refers to quantitative values from actual measurements typically produced from micrometers, calipers, and other indication gage types.

H. **Defect** - A characteristic of a part that does not conform to specifications.

5.0 General Requirements

A. Attribute sampling Plan - ANSI / ASQC Z1.4 - 1993
This standard provides sampling procedures and tables for inspection by attributes, which directly correspond to Mil-Std-105E. This military standard is obsolete.

B. Variable sampling Plan - ANSI / ASQC Z1.9 - 1993
This standard provides sampling procedures and tables for inspection by variables for percent defective which corresponds directly to Mil-Std-414. This military standard is obsolete.

C. Parts procured from suppliers will have a Receiving Inspection Control Plans (RICP) generated. The RICP will identify the sample size, accept and reject numbers. In some cases only an AQL will be identified on the RICP, and then the sample size is to be determined by using this QII to satisfy the RICP requirements along with meeting the AQL.

D. As a general guideline sampling plans are established at a Pa = .95 (probability of acceptance).

E. Sample Selection - It is important to pick samples in a random manner. This means to select parts that exhibit the entire lot. Sample parts are to be taken from numerous boxes that are representative of the lot quality.

F. If a sampling plan is not economically satisfactory then it should be changed.

G. Sampling plans may not directly relate to those identified in the ANSI standards. The sampling plans may be established by calculating the appropriate sample size along with the related accept and reject numbers to comply with the AQL.

H. Sample size is independent of the lot size. When the sample size is small compared to the lot size, the protection afforded by the acceptance sampling is not effected by the lot size. It is solely the result of the sample size and the accept number. This fact surprises many. They mistakenly believe that it is the percentage of the lot sampled that determines the protection and this is not the case. The protection is almost exclusively a result of the sampling plan used. The single sampling **plan n=50 and a=1** offers the same protection for a lot of **100,000 units (.05% inspected)** as it does for **a lot of 500 units (10% inspected).**

I. **C = 0 Sampling Plans** - These sampling plans are designed to provide equal or greater consumer protection with less inspection than the established sampling plans in ANSI Z1.4. When nonconformances are detected the lot is put on NMR for review and disposition. The lot is not rejected meaning returned to the supplier until analyzed. These sampling plans are generally used as a screening or monitoring mechanism to determine if product is fit for use.

6.0. Attribute Sampling

A. **Types of sampling plans**
- **Single sample plan**
- **Double sample plan**

B. To perform an attribute sampling plan the following items must be indicated.
Sample Size = N
Accept number = A
Reject number = R

C. It is very important that the sample is taken randomly. This means parts are to be picked through out all boxes or containers. Selectively picking parts that represent a condition is not acceptable.

D. **Single Sample Plan Example:**
RICP or this procedure will identify the following
N = 15
A = 0
R = 1

- This expression is read as the sample size is 15 pcs.
- We accept the lots if zero items are found nonconforming for the desired characteristic.
- We reject the lot if one item is found to be nonconforming.
- You are required to inspect all 15 samples for the identified characteristic.
- If they are all acceptable, then the lot is accepted.

E. Double Sample Plan Example:

RICP or this procedure will identify the following:
First sample: N=10, A=0, R=2
Second sample: N=20, A=1, R=2

Note - Total of 30 pieces will be inspected if both first and second samples are performed. 10 pieces are inspected, and then another 20 pieces are inspected.

The sampling procedure is interpreted as follows:

- **Verify the first 10 pieces to the identified characteristic.**
- **If zero defects are found, then accept the lot.**
- **If one part is found with a defect then the second sample of 20 pieces is inspected.**
- **If 2 pieces are found defective the lot is rejected and the second sample is not performed.**

1. **When inspecting the second sample of 20 pieces there is only the one defective unit allowed from the first inspection.**
2. **So the 20 pieces can not have any more additional defects with this sample plan.**
3. **If an additional defective part is found, then this means that there are 2 defective units and the lot is rejected and placed on NMR for disposition.**

7.0 Variable Sampling

A. **Types of variable sampling plans**
   - **Standard Deviation method (Unknown)**
   - **Range method**

B. This type of data must be a numerical value it is also expressed as quantitative data.

C. Variable sample plans calculate the average or mean of the data along with the standard deviation from the data taken.

D. To perform a variables sampling plan the following items must be identified.
Sample size = **N**

Constant (Acceptance region) = **K**

Upper Spec Limit = **USL**

Lower Spec Limit = **LSL**

E The procedure to accept or reject a lot is based on the specification limits. **Reference the following table to calculate the acceptance criteria.**

Standard Deviation	Specification Limits	Acceptance Criteria
Unknown	Lower Only	LSL + K(S) = Xbar
Unknown	Upper Only	Xbar = USL - K(S)
Unknown	Upper & Lower	LSL + K(S) = Xbar = USL - K(S)

F. **Variable sample plan example 1 - Typical for Surface Finish**

N	=	**10**
K	=	**1.55**
USL	=	**400**
LSL	=	**175**
AQL	=	**1.0**

❖ Start by selecting the sample at random. In this case 10 pieces are selected. Measure each of the units for the desired characteristic. Using these measurements calculate the sample mean and the standard deviation.

Readings:

	Far End	Near End	Sum	Sum / 2 AVG.	
1.	270	300	570	285	
2.	250	280	530	265	LSL = 175
3.	275	290	565	282.5	USL = 400
4.	325	250	575	287.5	Xbar = 273.2
5.	297	225	522	261	S = 60.93
6.	408	418	826	413	LSL + K x (S) = Xbar = USL - K x (S)
7.	170	160	330	165	175 + 1.55 x (60.93) = 273.2 = 400 - 1.55 x (60.93)
8.	268	292	560	280	175 + 94.4 = 277.3 = 400 - 94.4
9.	235	148	483	241.5	269.4 = 277.3 = 305.5
10.	275	228	503	251.5	Conditions are met, the lot is accepted.

G. **Variable sample plan example 2**
The data has been excluded from this example to demonstrate the calculations only.

N	=	**20**
K	=	**2.0**
USL	=	**140**
LSL	=	**120**
Xbar	=	**124.07**
S	=	**2.15**

Acceptance Limits are:

LSL + K x (S) = Xbar = USL - K x (S)

120 + 2.0 x (2.15) = 124.07 = 140 - 2.0 x (2.15)

120 + 4.3 = 124.07 = 140 - 4.3

124.3 = 124.07 = 135.7

Since the mean does not satisfy these conditions, the lot is rejected.

Attachment 1: End Fitting Sample Requirements

Critical Characteristics	AQL Required	Sample First Lot Received	AQL / LTPD	Continuous Sample After First Lot	AQL / LTPD	Use this column if a problem is found with Continuous sample	AQL / LTPD
Galvanizing	1.5	N=26, Ac=1, R=2	1.12 / 11.61	N=13, A=0 R=2 N=26, A=1 R=2	1.5 / 17.5	N/A	
Ball Gages	1.5	N=26, Ac=0, R=1		N=13, A=0 R=1		N/A	
Socket Gages	1.5	N=26, Ac=0, R=1		N=13, A=0 R=1		N/A	
I.D. of E/F	1.0	N=30, Ac=1, R=2	1.44 / 14.68	N=15, A=0 R=1 N=30, A=1 R=2	1.2 / 14.8	N/A	
Hole Depth	1.0 Frgd 2.5 Cast	N=30, Ac=1, R=2 N=30, Ac=1, R=2	1.44 / 14.68 1.44 / 14.68	N=15, A=0 R=1 N=20, A=1 R=2 N=15, A=0 R=1 N=20, A=1 R=2	1.2 / 14.8 2.6 / 27.0	N/A	
Runout Forgings Runout Castings	1.0 Frgd 4.0 Cast	N=25, Ac=1, R=2 N=32, Ac=3, R=4	1.44 / 14.68 4.38 / 19.69	N=10, K=1.55 (Variable Sampling Plan) Use all 20 readings N=10, K=1.10 (Variable Sampling Plan) Use all 20 readings	1.0 / 18.4 4.0 / 29.0	N=20, K= 1.7 (Test additional 10 pcs) (Use all 40 sample readings) N=20, K=1.25	1.17 / 10.98 4.15 / 19.77
Surface Finish & Grooves	1.0	N=20, Ac=0, R=1	.25 / 10.87	Attributes Double sample Plan N=10, A=0 R=2 Variable Sampling Plan N=10, K=1.55 Check supplier sheets Use all 20 readings	.51 / 20.5 1.0 / 18.4	Attribute Double sample Plan 20, A=1 R=2 (Total 30 pcs) Variable Plan N=10, K=1.7 (Total 20 pcs) Use all 40 sample readings	1.6 / 11.8 1.17 / 10.98
Chamfer	4.0	N=20, Ac=2, R=3	4.21 / 24.47	N=10, Ac= 0, R=3	4.0 / 24.7	Second Sample N=12, A=2 R=3	4.0/24.7
Cotter Pin Hole	1.5	N=26, Ac=1, R=2	1.44 / 14.68	N=13,A=0 R=2 N=13 A=1 R=2	1.5 / 17.5	N/A	
Porosity	4.0	N=20, Ac=2, R=3	4.21 / 24.67	N=10, A=0 R=3 N=10 A=2 R=3	4.0 / 24.7	N/A	
Cast Holes	2.5	N=20, Ac=1, R=2	1.44 / 14.68	N=8, A=0 R=2 N=8, A=1 R=2	2.6 / 27.0	N/A	
Tapped Holes	2.5	N=20, Ac=1, R=2	1.44 / 14.68	N=8, A=0 R=2 N=8, A=1 R=2	2.6 / 27.0	N/A	
Workmanship	4.0	N=20, Ac=2, R=3	4.21 / 24.67	N=10, A=0 R=3 N=10, A=2 R=3	4.0 / 24.7	N/A	

Receiving Inspection Control Plans

RECEIVING INSPECTION CONTROL PLAN

PART NUMBERS: 2377-241	**DESCRIPTION:** 3.5" Fiberglass Rod
DRWG No.: YCP-0022-RI	**REV.** A / 08-06-13 **ECO.** 00452 **SHEET** 1 **OF** 2

QUALITY CHARACTERISTICS	ZONE	SAMPLE	A/R	EQUIPMENT	VERIFICATION PROCEDURES/COMMENTS
C-1) Material Certification	—	Per Lot	—	Visual	CERTIFICATION REQUIRED FOR EACH LOT OF MATERIAL. VERIFY THAT THE FOLLOWING VALUES ARE WITHIN THE RANGE SPECIFIED ON THE DRAWING: 1. GLASS CONTENT 2. TEMPERATURE WITHSTAND 3. O.D. SIZE 4. CAPILLARY ABSORPTION
C-2) Water Diffusion		SEE TABLE ON PAGE 2		SEND TO NEWBERRY	SEND SAMPLE TO NEWBERRY TO VERIFY COMPLIANCE WITH WATER DIFFUSION TESTS.
C-3) Dye Penetration		SEE TABLE ON PAGE 2		FUSCHIA DYE/ GLASS BEADS, DISH	PERFORM DYE PENETRATION PER ANSI C29.17. THE 30MM PUCKS ARE PLACED IN FUSCHIA DYE FOR 15 MINUTES WITH NO DYE WICKING THROUGH THE ROD.

RECEIVING INSPECTION CONTROL PLAN

PART NUMBERS: 2377-241	**DESCRIPTION**: 3.5" Fiberglass Rod
DRWG: YCP-0022-RI	**REV.** A /08-06-13 **ECO.** 00452 **SHEET** 2 **OF** 2

TABLE 1: RECEIVING SAMPLING PLAN

CRITICAL CHARACTERISTIC	AQL REQUIRED	SAMPLE FIRST LOT RECEIVED	AQL/LTPD	CONTINUOUS SAMPLE AFTER FIRST LOT	AQL/LTPD
C-2) Water Diffusion	1.5	N=2, Ac=0, R=1		N=2, Ac=0, R=1	
C-3) Dye Penetrâtion	1.5	N=2, Ac=0, R=1		N=2, Ac=0, R=1	

FOR THE FULL DESCRIPTION AND INFORMATION BEHIND THE RECEIVING SAMPLING PLAN, PLEASE REFERENCE QII-216.

RECEIVING INSPECTION CONTROL PLAN

PART NUMBERS: REFER TO DRAWING FOR PART NUMBER.	**DESCRIPTION**: 3.5" SHED CONTROL PLAN
DRWG: YCP-0023-RI	**REV.** A /08-06-13 **ECO. 00452** **SHEET** 1 **OF** 2

QUALITY CHARACTERISTICS	SAMPLE	A/R	EQUIPMENT	VERIFICATION PROCEDURES/COMMENTS
C-1) DIMENSIONAL CHECK			VISUAL	A CHECK OF EVERY CAVITY FOR DIMENSION OF FINISHED PARTS SHALL BE PERFORMED BY THE SUPPLIER IF THE SUPPLIER MODIFIES THE TOOL OR CHANGES MATERIAL.
C-2) WORKMANSHIP CRITERIA	SEE TABLE ON PAGE 2	0/1	VISUAL	INSPECTION TO BE PERFORMED ACCORDING TO QII-1210. THIS INCLUDES EXAMINATION FOR POROSITY, PIGMENTATION, FLASH, UNCURES, BACK RIND, AND CONTAMINATION.
C-3) WORKMANSHIP CRITERIA - SANDING	SEE TABLE ON PAGE 2	0/1	VISUAL	INSPECT SHED FOR SANDING ON THE INNER DIAMETER OF THE SHED.
C-4) SHED HEIGHT	SEE TABLE ON PAGE 2	0/1	CALIPERS	VERFIY DIMENSION PER PRINT
C-5) OVERALL WIDTH	SEE TABLE ON PAGE 2	0/1	CALIPERS	VERFIY DIMENSION PER PRINT
C-6) INNER TOP DIMENSION	SEE TABLE ON PAGE 2	0/1	CALIPERS	VERFIY DIMENSION PER PRINT
C-7) INNER BOTTOM DIMENSION	SEE TABLE ON PAGE 2	0/1	CALIPERS	VERFIY DIMENSION PER PRINT

RECEIVING INSPECTION CONTROL PLAN

PART NUMBERS: 1108-035

DESCRIPTION: 3.5"SHED CONTROL PLAN

DRWG: YCP-0023-RI

REV. A /08-06-13 **ECO. 7453** **SHEET** 2 **OF** 2

TABLE 1: RECEIVING SAMPLING PLAN

CRITICAL CHARACTERISTIC	AQL REQUIRED	SAMPLE FIRST LOT RECEIVED	AQL/LTPD	CONTINUOUS SAMPLE AFTER FIRST LOT	AQL/LTPD
C-2) WORKMANSHIP CRITERIA	4.0	N=20, Ac=2, R=3	4.21/24.67	N=10, Ac=0, R=3 N=10, Ac=2, R=3	4.0/24.7
C-3) WORKMANSHIP CRITERIA - SANDING	4.0	N=20, Ac=2, R=3	4.21/24.67	N=10, Ac=0, R=3 N=10, Ac=2, R=3	4.0/24.7
C-4) SHED HEIGHT	1.0	N=30, Ac=1, R=2	1.44/14.68	N=15, Ac=0, R=1 N=30, Ac=1, R=2	1.2/14.8
C-5) OVERALL WIDTH	1.0	N=30, Ac=1, R=2	1.44/14.68	N=15, Ac=0, R=1 N=30, Ac=1, R=2	1.2/14.8
C-6) INNER TOP DIMENSION	1.0	N=30, Ac=1, R=2	1.44/14.68	N=15, Ac=0, R=1 N=30, Ac=1, R=2	1.2/14.8
C-7) INNER BOTTOM DIMENSION	1.0	N=30, Ac=1, R=2	1.44/14.68	N=15, Ac=0, R=1 N=30, Ac=1, R=2	1.2/14.8

FOR THE FULL DESCRIPTION AND INFORMATION BEHIND THE RECEIVING SAMPLING PLAN, PLEASE REFERENCE QII-216.