4 ASSOCIATED MATERIALS

		FORM NO.
4.1	CH-68 Grey Track Resistant High Density Polyethylene	N/A
4.2	28 Threaded Cores	N/A
4.3	Electric Unscrewing Device	N/A
4.4	Grinding Tool	N/A
4.5	Airseal	N/A
4.6	X-Ray Inspection of Molded Insulators	QC 044
4.7	Molding Room Process Controls	SLP 014
4.8	Box Selection and Pallet Layout	W 076
4.9	Operator Shift Work Sheet	W 078
4.10	Insulator Rotation	W 080
4.11	Nonconforming Molded and Accessory Products	QC 045
4.12	Clippers and Knife	N/A

5 PROCEDURE

5.1 **Processing:** Verify core I.D. is the correct Hendrix Insulator thread Form/Type needed by Referring to the tables below:

- **HPI-15 & HPI-35 – Standard Threads:**

Hendrix thread form/type	ID number
Standard ANSI 1.0" thread	-01
Standard ANSI 1 3/8" thread (2 airseal)	-02
Australian Metric - Pattern "C" thread	-03
Norwegian/Scandinavian Metric thread	-04
Bosnian Metric thread	-05
United Kingdom Metric thread	-06

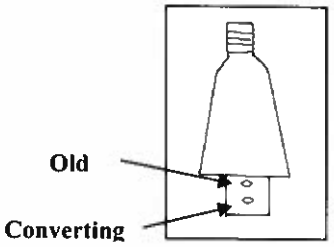
- **HPI-25 - Mold #3:**

Convertible Mold Form/Type	ID Number
Convertible Core	-01
Convertible Core (2 airseal)	-02

5.1.1 Hang one core on each protruding pin in each cavity of the mold. Note: Visually check to ensure the cores are firmly in place.

- **Old Insulator Mold**: Use the hole closest to the threaded end of the core.

- **Converting Insulator Mold**: The core will only fit in the mold using the bottom hole.



5.1.2 Once mold opens:

5.1.2.1 Open door.

5.1.2.2 Clip gates off each part.

5.1.2.3 Remove parts from mold.

5.1.3 Reload empty cores into mold repeating steps 5.1.3 thru 5.1.4.3.

5.1.4 Recheck gates to ensure they are clipped as close to part as possible.

5.1.5 Follow Insulator rotation procedure (W 080).

5.1.6 Parts from rotation: Unscrew each core by placing it in the unscrewing device.

5.1.7 **Airseal:** Use the airseal chart, posted at each line, for airseal requirement. Note: The Standard 3/8" large core requires two pieces of airseal.

5.1.8 Grind gate on top of the insulator flush to the surface of the insulator head using a grinding tool. Note: Do not over grind or gouge top of the insulator saddle.

5.2 **Quality Checks:** Perform quality checks on each molded product paying special attention to:

5.2.1 **Contaminant Inspection:** Visually inspect molded part for any foreign material.

5.2.2 **Cosmetic Inspection:** Visually inspect molded part for wrinkles, bubbles, flashing, evidence of short shot, and the depth of the knockout location.

5.2.3 **Date Pin Inspection:** Visually inspect molded part to ensure that the correct year is molded into the part.

5.2.4 **Thread Inspection:** Visually inspect the bottom of the molded insulator thread cavity for proper thread formation and for any molded imperfections.

5.2.5 **X-Ray Inspection:** Determine if any voids are present by placing the insulator inside the X-ray machine and examining both sides of the insulator (re: QC 044) a minimum of one shot per shift. During machine set-up a void free process must be obtained in order to accept the machine set-up and begin the run.

5.2.5.1 If voids are found, continue to X-ray until no voids are present. If problem persists, notify Process Engineer or Accessory Products Operation Manager.

5.3 **Inspection Failures:** Follow QC 045.

5.4 **Packaging:** Package per W 076.

5.5 **Records:** Complete Operator Shift Work Sheet (W 078).

6 ASSESSMENT AREAS (POSSIBLE)

6.1 Select 2 – 3 pallets at random and verify packaging requirements.

6.2 Select 2 – 3 pallets (manufactured on different shifts) and verify that quality checks were performed.

7 PASS/FAIL CRITERIA

7.1 **Contaminant Inspection:** PASS: No evidence of any dirty material, i.e. specks not found.

7.2 **Cosmetic Inspection:** PASS:

- Bubbles, wrinkles or flashing are not conspicuous.
- The part is completely molded with no evidence of a short shot.
- Knockout location depths are minimal.

7.3 **Date Pin Inspection:** PASS: The year that is molded into the part is the same year for which it is molded.

7.4 **Thread Inspection:** PASS: Thread is formed properly and no mold imperfections.

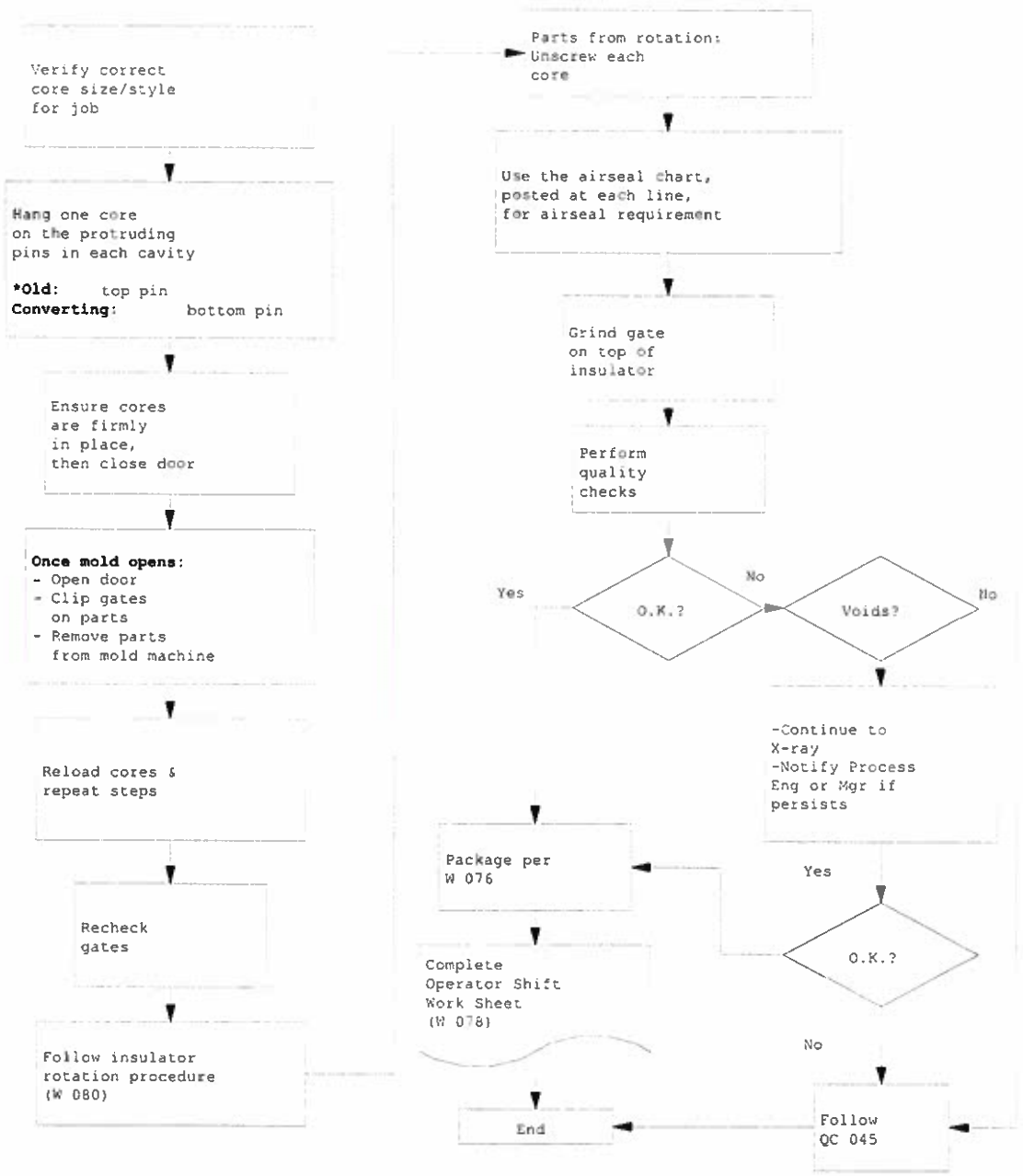
7.5 **X-Ray Inspection:** PASS: Voids are not present.

8 AUTHORIZATION LIST

8.1 Operation Manager Molded Products
8.2 Molded Process Engineer
8.3 Quality Manager

TIE TOP INSULATOR FAMILY

Processing



REVISION RECORD: W 097 (Formally M-019)

Distribution:	**Date Added**
• Master Copy (book #529)	9/27/95
• G:\ISO9002\masterworkinst\w097.doc	1/27/98
• Molding Room Training Book (509)	5/11/06
Obsolete distribution:	***Date obsolete***
• *Molding Room W/I book*	*9/27/95*
• *Master Copy*	*9/27/95*

Rev #	Dated	Revision description	Date Dist.
M-019			
0	11/17/92	Initial Release	11/17/92
1	12/2/92	Unavailable	12/2/92
W 097		Revision numbers to follow M-019	
2	9/27/95	a) Procedures revised & added quality checks & failure info. b) 6,7,8 & flowchart added	9/27/95
3	1/12/96	a) 3.3 revised & 3.6 added b) 4.2 revised & 4.14 added c) 5.2.1.3 revised to once per shift d) 8.3 added e) 5.1.11 notation added f) 4.15 added g) 5.2.2 & 7.2 flashing added	1/12/96
4	3/26/96	a) 5.2.3 revised b) 5.2.3.1 added	3/26/96
	1/27/98	Converted from SmartII to Word 6.0 No functional changes made	
5	5/11/98	a) 3.7 added visual standards b) 5.2 added compare to visual standards c) 8.2 revised to Aerial Process Engineers d) 3.1 added picture of HPI-15	5/12/98
6	6/29/98	a) 5.2 revised to "consult as needed"	6/30/98
7	6/24/99	a) 3.5 Void – added "…during x-ray exam b) 3.7 short shot & 3.8 knockout location definition added c) 5.2.2 revised to add short shot & knockout location quality inspections d) 5.2.3 added date pin quality inspections a) 5.2.4 added thread quality inspections a) 7.2 revised to add short shot & knockout inspections pass/fail criteria g) 7.3 added date pin pass/fail criteria h) 7.4 added thread pass/fail criteria a) 8.2 revised to Aerial Process Engineer j) 5.2 revised visual standards for each part instead of just HPI-35	6/24/99

REVISION RECORD: **W 097**

Rev #	Dated	Revision description	Date Dist.
8	12/21/99	a) 5.1.10 added notation re: Australian metric large cores – 1 airseal	12/21/99
9	11/03/00	a)Added 5.1.1 and table b)Changed "pins" to "cavities" on the heading in old 5.1.1 (now is 5.1.2)	11/6/00
10	5/9/02	a) 4.5, 4.6, 4.8, 5.1.8, 5.1.10 & 5.2.5.1 removed b) 4.13 removed "tank" c) 5.1.4.3, 5.1.7 rewrote d) 5.1.4.2 revised wording e) 5.1.5 # revised f) 5.1.11 removed "tamp down using…." g) 8.1 title revised	5/22/02
11	5/21/03	a) Subject, 1, 3.1, 5.1.2, & 5.2 added "HPI-25J & HPI-35J"	5/29/03
12	11/24/03	a) 5.2.5 revised to "a minimum of one shot per shift" and "a void free process" instead of "4 consecutive void free shots"	11/24/03
13	6/9/04	a) 3.9 & 5.2 Removed reference to "visual standard" b) 5.2.5.1 Added "If voids found…"	6/9/04
14	9/27/04	a) Subject revised document name b) 1 Purpose, Definition & 5.1.2 added HPI-15FX	9/27/04
15	5/18/05	a) 5.1.2.1 identified as "old mold" b) 5.1.2.2 added "New mold" c) 5.1.8 added "parts from rotation" d) 5.1.9 added "press into place" e) 5.19.1, 5.1.9.2 & 5.1.9.3 directions separated	5/25/05
16	6/29/06	a) 5.1 Tables rewritten b) 5.1.1 added bullet definitions & diagram c) 5.1.7 rewrote airseal requirements d) 5.2.3 & 7.3 removed reference to "month"	7/10/06
17	9/14/06	a) 4.11 added "Molded" b) 8.1 & 8.2 revised Titles	9/21/06

Environmental Stress Cracking Test
Black High Density Polyethylene
(per ASTM D 1693)

Abstract
The purpose of this test was to evaluate the Black High Density Polyethylene insulation used for the outer layer of our cable constructions.

Procedure
75 mil plaque samples were prepared from pellets. Tests were conducted following condition B of the specification.

Equipment
VWR Scientific oven set at 50 ° C for 48 hours and a test solution composed of 10% Igepal and 90% water.

Results
10 of the 10 samples tested passed with no cracking present.
Base Resin Lot: CL171219A1
Color Black masterbatch Lot: 3692696

Conclusion
Test results indicate that the material examined has environmental stress crack resistance. No cracking was observed.

Tested by: Gary Grenier
Title: Aerial Operations Manager
Date: 5/1/2008

HENDRIX

Environmental Stress Cracking Test
Gray High Density Polyethylene
(per ASTM D 1693)

Abstract
The purpose of this test was to evaluate the Gray High Density Polyethylene insulation used for the outer layer of our cable constructions.

Procedure
75 mil plaque samples were prepared from pellets. Tests were conducted following condition B of the specification.

Equipment
VWR Scientific oven set at 50° C for 48 hours and a test solution composed of 10% Igepal and 90% water.

Results
10 of the 10 samples tested passed with no cracking present.
Base Resin Lot: CL171219A1
Color Gray masterbatch Lot: 3801801

Conclusion
Test results indicate that the material examined has environmental stress crack resistance.

Tested by: Gary Grenier
Title: Aerial Operations Manager
Date: 5/1/2008

Date - Physical	Inspector- Physical	Part Numb	MPS Number	MPS number is not required (auto updated)
5/1/2008	G. Grenier	BAS-24F	1026	

PO Number	Supplier Name	CTR	Visual Inspection	Yes = Pass
14735	PGM	Yes	Yes	No = Fail

Dim A	Dim B	Dim C	Dim D

Dim E	Dim F	Dim G	Dim H

Dim Y	Dim Z	Hyperlink

Comments **Enter Cavity number if applicable**

Checked part for good color dispersion, straightness, fill, knockout indents. fit between forks for attachment to spacer.

Report

169 -Ciento sesenta y nueve -

Part Number	LINEDUC-BL	MPS Number	811	CTR	☐ Check if received		
PO Number	11490	Supplier Name	Scandia	Qty Received	4857	Sample Size	3

TEST RESULTS DATA ENTRY

PHYSICAL PROPERTIES

	Vertical Load (Lbs)	Horizontal Load (Lbs)
Top Arm	0	0
Middle Arm	0	0
Bottom Arm	0	0
Side Phase	0	

	Tensile Strength	Elongation
1st test	0	0
After 168 hrs	0	0

CRITICAL FEATURES/DIMENSIONS

Fraction	Decimal Equivalent
1/32	0.03125
1/16	0.0625
3/16	0.1875
1/8	0.125
1/4	0.250
3/8	0.375
1/2	0.500
5/8	0.625
3/4	0.750
7/8	0.750
13/16	0.8125

Enter values in decimals

A1	0	G	0
B1	0	H	0
C	0	Z	0
D	0	Y	0
E	0	A2	0
F	0	A3	0
B2	0	A4	0
B3	0	B4	0

ACCEPTANCE INSPECTION

Visual Inspection: Pass? Yes

Comments

Report

Inspector Gary Grenier

Quality Measurement Data Sheet

Customer:	Hendrix	Purchase Order Number : 014735	Part Description & Rev:	See below

BAS-24F Anti-sway Bracket - Rev. 0

			Start-up		Shut-down	
		Date	7/24/07			
		Time	1pm			
	Loc	Int.	A.I			
Hole Diameter .562"	A	cav1	0.56			
		cav2	0.56			
USL 0.593						
LSL 0.531			0.560	0.000	0.000	0.000
Hole Location .657"	B	cav1	0.676			
		cav2	0.676			
USL 0.688						
LSL 0.626			0.676	0.000	0.000	0.000
Min Opening .750"	C	cav1	0.652			
		cav2	0.654			
USL 0.750						
LSL 0.658			0.653	0.000	0.000	0.000
Hole Location 0.614	D	cav1	0.645			
		cav2	0.645			
USL 0.6[illegible]5						
LSL 0.5[illegible]3			0.645	0.000	0.000	0.000

P	F	F	F
P	F	F	F
P	F	F	F
P	F	F	F
P	F	F	F
P	F	F	F
P	F	F	F
P	F	F	F

Clevis Pin for Anti-sway Brackets - Rev. 1

			Start-up		Shut-down	
		Date	7/24/07			
		Time	1pm			
	Loc	Int.	A.I			
Pin Diameter .484"	A	cav1	0.480			
		cav2	0.483			
USL 0.515						
LSL 0.453			0.482	0.000	0.000	0.000
Length 1.687	B	cav1	1.660			
		cav2	1.657			
USL 1.718						
LSL 1.656			1.659	0.000	0.000	0.000
Stop Height 0.625	C	cav1	0.618			
		cav2	0.621			
USL 0.656						
LSL 0.594			0.620	0.000	0.000	0.000

P	F	F	F
P	F	F	F
P	F	F	F
P	F	F	F
P	F	F	F
P	F	F	F

Ciento setenta y uno - 171

PLASTICS TECHNOLOGY LABORATORIES, INC.

Testing	:	Environmental Stress-Cracking of Ethylene Plastics
Test Method	:	ASTM D1693-01 per ASTM D1248-02, Section 11.1.8.3 - **Modified ****
Project Number	:	P20051652 Purchase Order # : 8258
Customer	:	Hendrix Wire & Cable, Inc.
Attention	:	Gary Grenier
Analyst	:	S. Polastri
Date	:	September 30, 2005

Material	:	**High Density Polyethylene**
Sample Preparation	:	Plaques tested as received from customer - conditioning time waived**
Specimen Preparation	:	ESCR specimens were die cut and nicked by PTLI
Reagent	:	Igepal CO-630
Reagent Strength	:	10% by volume
Test Condition	:	B
Notch Depth	:	0.012 - 0.015 in.
Bath Temperature	:	50°C
Test Duration	:	**48 Hours**

Sample ID	:	**Gray High Density Polyethylene**
% Sample Failure at Test Duration	:	0 48 Hours

Plastics Technology Laboratories, Inc. reports are issued for the exclusive use of the clients to whom they are addressed. No quotations from reports or use of the Plastics Technology Laboratories, Inc. name is permitted except as expressly authorized in writing. Letters and reports apply only to the specific materials, products or processes tested, examined or surveyed and are not necessarily indicative of the qualities of apparently identical or similar materials, products or processes. The liability of Plastics Technology Laboratories, Inc. with respect to services rendered shall be limited to the amount of compensation paid for such services and not include any consequential damages.

50 Pearl Street, Pittsfield, MA 01201
Phone (413) 499-0983, Fax 499-2339
http://www.ptli.com

PLASTICS TECHNOLOGY LABORATORIES, INC.

Testing	:	Environmental Stress-Cracking of Ethylene Plastics
Test Method	:	ASTM D1693-01 per ASTM D1248-02, Section 11.1.8.3 - **Modified ****
Project Number	:	P20051652 Purchase Order # : B258
Customer	:	Hendrix Wire & Cable, Inc.
Attention	:	Gary Grenier
Analyst	:	S. Polastri
Date	:	September 30, 2005

Material	:	**High Density Polyethylene**
Sample Preparation	:	Plaques tested as received from customer - conditioning time waived**
Specimen Preparation	:	ESCR specimens were die cut and nicked by PTLI
Reagent	:	Igepal CO-630
Reagent Strength	:	10% by volume
Test Condition	:	B
Notch Depth	:	0.012 - 0.015 in.
Bath Temperature	:	50°C
Test Duration	:	48 Hours

Sample ID	:	**Gray High Density Polyethylene**
% Sample Failure at Test Duration	:	0 48 Hours

Plastics Technology Laboratories, Inc. reports are issued for the exclusive use of the clients to whom they are addressed. No quotations from reports or use of the Plastics Technology Laboratories, Inc. name is permitted except as expressly authorized in writing. Letters and reports apply only to the specific materials, products or processes tested, examined or surveyed and are not necessarily indicative of the qualities of apparently identical or similar materials, products or processes. The liability of Plastics Technology Laboratories, Inc. with respect to services rendered shall be limited to the amount of consideration paid for such services and not include any consequential damages.

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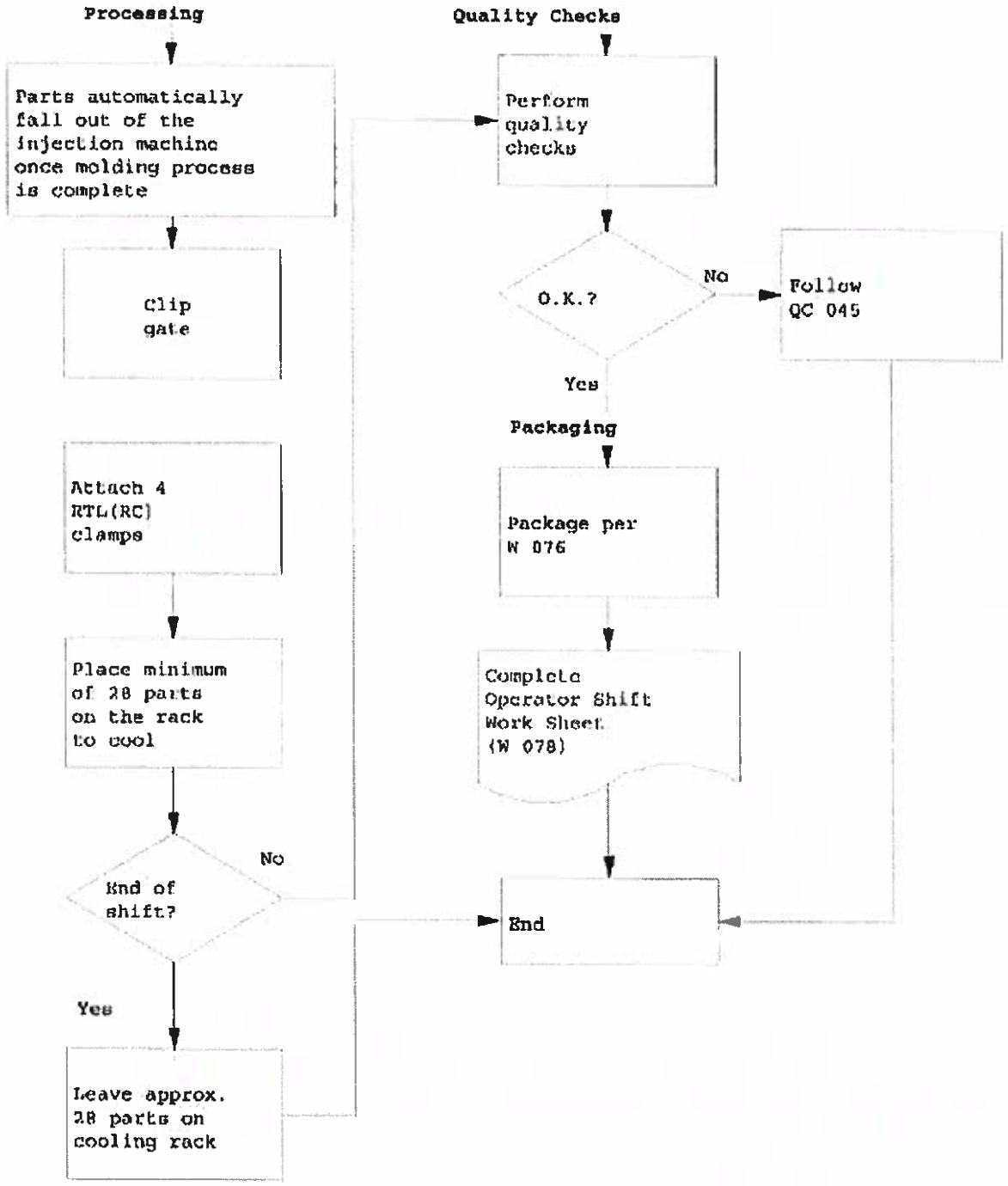
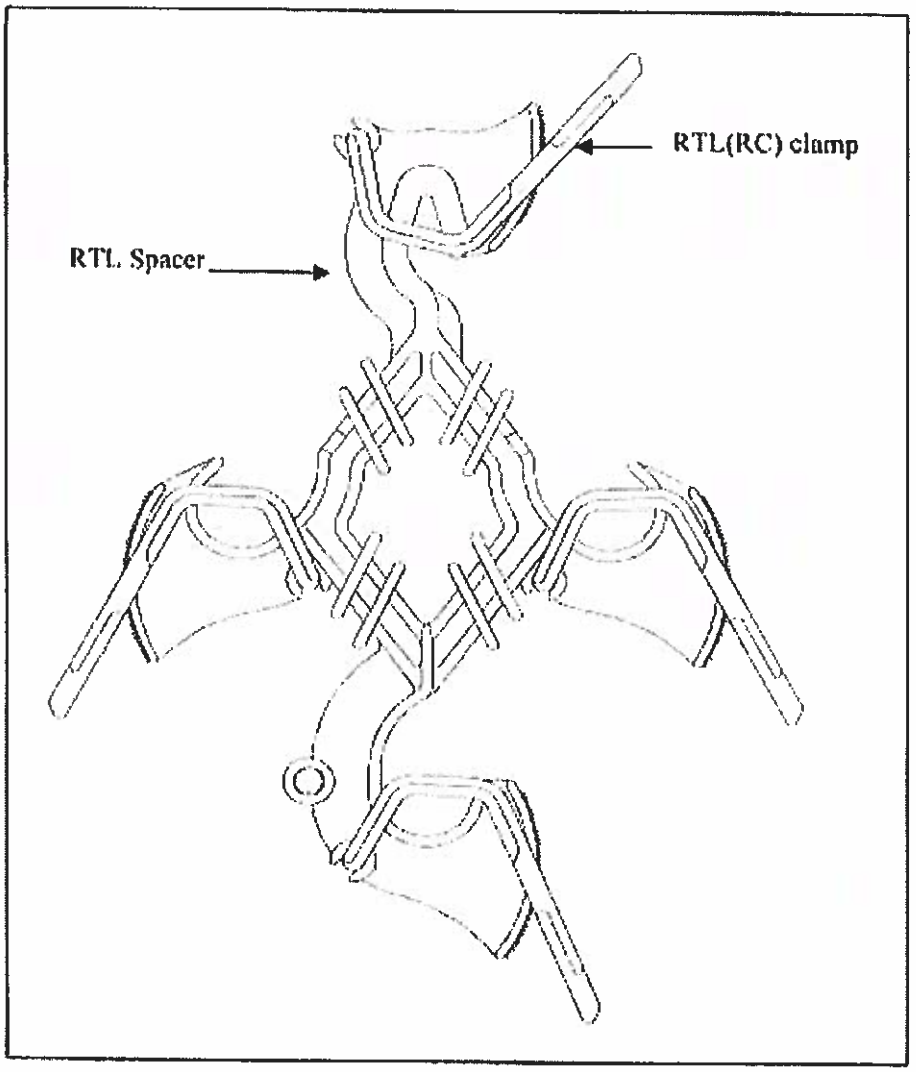
http://www.ptli.com

RTL SPACERS


Processing
Parts automatically fall out of the injection machine once molding process is complete
Clip gate
Attach 4 RTL(RC) clamps
Place minimum of 28 parts on the rack to cool
End of shift?
No
Yes
Leave approx. 28 parts on cooling rack
Quality Checks
Perform quality checks
O.K.?
No
Follow QC 045
Yes
Packaging
Package per W 076
Complete Operator Shift Work Sheet (W 078)
End

ATTACHMENT A

RTL Spacer Assembly Drawing



5.2.1.2. **Cosmetic Inspection:** Visually inspect part for wrinkles, bubbles, flashing, evidence of short shot, and the depth of the knockout location.

5.2.1.3. **Date Pin Inspection:** Visually inspect part to ensure that the correct month and year is molded into the part.

5.3. Inspection Failure: Reference Nonconforming Accessory Products (QC 045).

5.4. Packaging: Package according to W 076.

5.5. Records: Complete Operator Shift Work Sheet (W 078).

6. ASSESSMENT AREAS (POSSIBLE)

6.1. Select 2 - 3 pallets of spacers at random and verify packaging requirements.

6.2. Select 2 - 3 boxes of spacers and verify that each part has clamps attached.

7. PASS/FAIL CRITERIA

7.1. Contaminant Inspection: PASS: No evidence of any dirty material, i.e. black specks are not found.

7.2. Cosmetic Inspection: PASS:
- Bubbles, wrinkles or flashing are not conspicuous.
- The part is completely molded with no evidence of a short shot.
- Knockout location depths are minimal.

7.3. Date Pin Inspection: PASS The month and year which is molded into the part is the same month and year for which it is molded.

8. AUTHORIZATION LIST

8.1. Aerial Operations Manager
8.2. Aerial Process Engineer
8.3. Product Design Engineer
8.4. Applications Engineer
8.5. Quality Manager

4. ASSOCIATED MATERIALS	FORM NO.
4.1. CH-68 Grey Track Resistant High Density Polyethylene	N/A
4.2. Cooling Fans (2)	N/A
4.3. Clippers and Knife	N/A
4.4. Appropriate RTL (RC) Ringless Clamp	N/A
4.5. Molding Room Process Controls	SLP 014
4.6. Box Selection and Pallet Layout	W 076
4.7. Operator Shift Work Sheet	W 078
4.8. Nonconforming Accessory Products	QC 045
4.9.RTL Spacer Assembly Drawing	Attachment A

5. PROCEDURE

5.1. Processing:

5.1.1. Parts automatically fall out of the injection machine once molding process is complete.

5.1.2. Clip gate.

5.1.3. **RTL (RC) clamp required.** Attach four RTL (RC) to the part by slipping clamps over ratchet lock. Note: Do not engage clamps in the ratchet lock.

5.1.4. Place a minimum of 28 parts on the rack to cool. Note: Use a rotating system.

5.1.4.1. Approximately 28 parts are to be left on the cooling rack at the end of each shift during the manufacturing cycle of the product.

5.2. Quality Checks: Perform quality checks on each molded product assembled. Consult the manufactured RTL to the visual standard RTL as needed, paying special attention to:

5.2.1. **Molding Process:** Compare the manufactured RTL to the RTL visual standard, paying special attention to:

5.2.1.1. **Contaminant Inspection:** Visually inspect part for any foreign material.

Written By: Mold Room Team
Prepared By: KEF
Approved By: G.Grenier
Signature:

No: W 237 Rev: 2
Page: 1 of 5
Approval Date: 10/15/01

SUBJECT: RTL-15, RTL-46, and RTL-P SPACERS

1. PURPOSE

To provide instructions and quality tests for the making of all RTL spacers.

2. APPLICATION

This procedure applies to all Molding Room Operators.

3. DEFINITIONS

3.1. RTL-15, RTL-46 and RTL-P Spacers:

RTL-15 shown

Hendrix spacer features the open diamond design and is rated for 5,000 through 46,000 volts. It is designed for hot line work and the messenger and conductors are secured by clamps.

3.2. Gate: The path plastic material flows in a mold prior to filling the part cavity.

3.3. Contaminant: Any material that is not homogeneous, (part of and completely mixed into the polyethylene material). Contaminants may be solid and appear opaque or darker against the polyethylene background.

3.4. Void: A circular or oval space or bubbles in the material. Voids can appear to be clear and when smaller may appear dark during x-ray examination.

3.5. Flashing: Excess material on the edge of the part.

3.6. Short Shot: The part has not completely formed.

3.7. Knockout Locations: Indents on the part where the ejector pins have released it from the mold. Note: Indent depth should be minimal.

3.8. Visual Standard: A sample of the product or a similar product.

DC Resistance Test
(per NEMA WC 5 – 87, Section 2.5.1)

Conductor: 70 mm²

Abstract:

The purpose of this test report is to verify the capability of the cable to meet or exceed the specification requirements.

Procedure:

Various stranded conductors were tested using standard test equipment.

Equipment:

Biddle Model 217001 or 247002

Results:

The value below has been corrected to 20° C.

Reel tested: LN7DZD02

Conductor Gauge	***Measured Resistance*** *(ohms-km)*	*Maximum*
70 mm ²	.409	.43

Tested by: Tim Caswell

Title: Technical Assistant to QC Manager

Date: 4/30/2008

P15

CABLE TECHNOLOGY LABORATORIES, INC

690 Jersey Avenue — P.O. Box 707 — Fax: (732) 846-55:
New Brunswick, N.J. 08903 Tel: (732) 846-31:
(732) 846-3220

December 1, 2005

Mr. Gary Grenier
Aerial Process Engineer
Hendrix
53 Old Wilton Road
Milford, NH 03055-3119

Report No. 05-113-10

RE: LIQUID-CONTAMINANT, INCLINED-PLANE TRACKING

Cable Technology Laboratories has performed Liquid-Contaminant, Inclined-Plane Tracking and Erosion test on the compound identified by Hendrix as: Black High Density Polyethylene.

The test was performed fully in accordance with ASTM D 2303 Standard Method. The contaminant solution had a resistivity of 400 Ωcm at 24 °C and its rate of application was 0.15 ml/min. A constant ac voltage of 2500 V was applied between electrodes. None of the samples failed during testing.

The test results are given in the following table.

Specimen Designation	Average Thickness (mils)	Time Under Test (hour)	Results	Observations
A	122	33	Pass	Minimal tracking
B	122	25	Pass	Minimal tracking
C	118	25	Pass	Minimal tracking
D	115	43	Pass	Minimal tracking
E	123	43	Pass	Minimal tracking

The minimum required number of hours to pass was 25 hours.

The column headed "Time Under Test (hour)" indicates the number of hours after which the test was terminated.

Tests supervised and reported by

Roger Fontazyn

CABLE TECHNOLOGY LABORATORIES, INC.

690 Jersey Avenue — P.O. Box 707 — Fax: (732) 846-563
New Brunswick, N.J 08903 Tel: (732) 846-313
(732) 846-3220

December 1, 2005

Mr. Gary Grenier
Aerial Process Engineer
Hendrix
53 Old Wilton Road
Milford, NH 03055-3119

Report No. 05-113-12

RE: LIQUID-CONTAMINANT, INCLINED-PLANE TRACKING

Cable Technology Laboratories has performed Liquid-Contaminant, Inclined-Plane Tracking and Erosion test on the compound identified by Hendrix as: Gray Blend High Density Polyethylene.

The test was performed fully in accordance with ASTM D 2303 Standard Method. The contaminant solution had a resistivity of 400 Ωcm at 24 °C and its rate of application was 0.15 ml/min. A constant ac voltage of 2500 V was applied between electrodes. None of the samples failed during testing.

The test results are given in the following table.

Specimen Designation	Average Thickness (mils)	Time Under Test (hour)	Results	Observations
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B	122	25	Pass	Minimal tracking
C	118	25	Pass	Minimal tracking
D	115	43	Pass	Minimal tracking
E	123	43	Pass	Minimal tracking

The minimum required number of hours to pass was 25 hours.

The column headed "Time Under Test (hour)" indicates the number of hours after which the test was terminated.

Tests supervised and reported by

Bogdan Fryszczyn
VP Research

P15

CABLE TECHNOLOGY LABORATORIES, INC

690 Jersey Avenue — P.O. Box 707 — Fax: (732) 846-55:
New Brunswick, N.J. 08903 Tel: (732) 846-31:
(732) 846-3220

December 1, 2005

Mr. Gary Grenier
Aerial Process Engineer
Hendrix
53 Old Wilton Road
Milford, NH 03055-3119

Report No. 05-113-10

RE: LIQUID-CONTAMINANT, INCLINED-PLANE TRACKING

Cable Technology Laboratories has performed Liquid-Contaminant, Inclined-Plane Tracking and Erosion test on the compound identified by Hendrix as: Black High Density Polyethylene.

The test was performed fully in accordance with ASTM D 2303 Standard Method. The contaminant solution had a resistivity of 400 Ωcm at 24 °C and its rate of application was 0.15 ml/min. A constant ac voltage of 2500 V was applied between electrodes. None of the samples failed during testing.

The test results are given in the following table.

Specimen Designation	Average Thickness (mils)	Time Under Test (hour)	Results	Observations
A	122	33	Pass	Minimal tracking
B	122	25	Pass	Minimal tracking
C	118	25	Pass	Minimal tracking
D	115	43	Pass	Minimal tracking
E	123	43	Pass	Minimal tracking

The minimum required number of hours to pass was 25 hours.

The column headed "Time Under Test (hour)" indicates the number of hours after which the test was terminated.

Tests supervised and reported by

Roger Fontaydos

Ciudad Fontaydos -

CABLE TECHNOLOGY LABORATORIES, INC.

690 Jersey Avenue — P.O. Box 707 — Fax: (732) 846-563
New Brunswick, N.J. 08903 Tel: (732) 846-313
(732) 846-3220

December 1, 2005

Mr. Gary Grenier
Aerial Process Engineer
Hendrix
53 Old Wilton Road
Milford, NH 03055-3119

Report No. 05-113-12

RE: LIQUID-CONTAMINANT, INCLINED-PLANE TRACKING

Cable Technology Laboratories has performed Liquid-Contaminant, Inclined-Plane Tracking and Erosion test on the compound identified by Hendrix as: Gray Blend High Density Polyethylene.

The test was performed fully in accordance with ASTM D 2303 Standard Method. The contaminant solution had a resistivity of 400 Ωcm at 24 °C and its rate of application was 0.15 ml/min. A constant ac voltage of 2500 V was applied between electrodes. None of the samples failed during testing.

The test results are given in the following table.

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Tests supervised and reported by

Bogdan Fryszczyn
VP Research

Ciento ochenta y tres -

DC Resistance Test
(per NEMA WC 5 – 87, Section 2.5.1)

Conductor: 185 mm²

Abstract:

The purpose of this test report is to verify the capability of the cable to meet or exceed the specification requirements.

Procedure:

Various stranded conductors were tested using standard test equipment.

Equipment:

Biddle Model 217001 or 247002

Results:

Corrected to 20° C

Reel Tested: LN7DZQ05

Conductor Gauge	***Measured Resistance (ohms-km)***	*Maximum*
185 mm ²	.1596	.164

Tested by: Tim Caswell

Title: Technical Assistant to QC Manager

Date: 4/30/2008

Test Report
Liquid Contaminant, Inclined-PlaneTracking and Erosion Test Report
(Per ASTM D 2303)

Abstract
The purpose of this test is to demonstrate the Resistance to Tracking of the Gray High Density Polyethylene (GHDPE) material which is used in an outdoor application. This is determined by measuring the material's "Time to Track" in an Incline Plane test fixture.

Procedure

Five (5), 125 mil thick plaque specimen were produced and tested as specified by the ASTM standard. Continuous voltage was applied for the duration of the test. The test was stopped at 1500 minutes.

Incline Plane Testing was performed in accordance to ASTM D 2303 specifications, "Time to Track Method". Specific test settings were; Voltage = 2.5 kV, Resistance = 10 k-ohms, Contaminant Flow Rate = .15 ml/min.

Equipment

Beckman Industrial Test Unit.

Model Number TERT 1A-10

Serial Number 41978

Calibrated: 6/19/2007 and is due 6/19/2008

Results

Material	Blend No.	*Specimen No.*	*Time Under Test*
Hendrix Gray	3689366	1	1540
		2	1540
		3	1540
		4	1540
		5	1540
		Average	1540

Note: No tracking, melting, or burning was present on any of the test specimens.
Hendrix Requirement: The test average must be 1500 minutes or greater with no tracking, melting, or burning present.

Conclusion
Results are stable through 1500 minutes of track testing.

Tested by: Chris Asselin

Reported by: Gary Grenier

Aerial Operations Manager

Reported: December 11, 2007

Test Report
Liquid Contaminant, Inclined-PlaneTracking and Erosion Test Report
(Per ASTM D 2303)

Abstract
The purpose of this test is to demonstrate the Resistance to Tracking of the Gray High Density Polyethylene (GHDPE) material which is used in an outdoor application. This is determined by measuring the material's "Time to Track" in an Incline Plane test fixture.

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		5	1540
		Average	1540

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Conclusion
Results are stable through 1500 minutes of track testing.

Tested by: Chris Asselin

Reported by: Gary Grenier

Aerial Operations Manager

Reported: December 11, 2007

SUBJECT: INSULATOR PUNCH-OUT TEST (PIN TYPE)

1. PURPOSE

To test the A.C. withstand performance of finished product insulators.

2. APPLICATION

This procedure applies to quality control personnel and process engineers performing insulator punch-out testing in the 300kv test area. A basic knowledge of the test area and related safety is necessary.

3. DEFINITION

3.1.Average: Total of all punch-out values divided by number of samples.
3.2.H.V.: High voltage.
3.3.A.C.: Alternating current.

4. ASSOCIATED MATERIALS

	FORM NO.
4.1.ANSI C29.1 (Latest revision)	N/A
4.2. Rags (cleaning oil off insulators)	N/A
4.3.QC Testing of HPI Insulators Work Sheet	QRQ001F
4.4. Insulator Punch-out Database G:\Qualityr\Insulator Punchout.mdb	
4.5. Calibrated "Memory" Meter	N/A

5. PROCEDURE

5.1. Place the high voltage buss bar between the top of the H.V. bushing on the 300kv transformer and the insulator assembly suspended from the lab roof.

5.1.1. Move the oil filled insulator breakdown tank into place. Center the tank under the H.V. buss bar with sufficient distance from grounded objects in order to avoid H.V. flashover to ground.

5.1.2. A length of plastic pipe is used as an insulator and support for the connection to the H.V. as follows:

5.1.2.1 At one end of the pipe place an insulator pin so the threads are inside the tube.

5.1.2.2 Connect with a covered wire to the insulator pin and exit the wire through the other end of the pipe. Note: This is where the wire is bared and the connection to the H.V. occurs.

5.1.3. Screw a test insulator onto the pin. From the opposite end of plastic insulator pipe, pull the H.V. lead, forcing the insulator tight onto end of the plastic insulator pipe.

5.1.4. Place the inverted insulator onto the grounding bar in the oil tank. Note: Be sure the insulator saddle is properly positioned on the ground bar.

5.1.5. Attach the H.V. lead to the H.V. buss bar. Center the insulator in the tank to avoid internal flashover.

5.1.6. Recheck all grounding. Note: Tank grounding bar, tank stand, and opposite end of main ground lead at the ground rod.

5.2. Set the "rate of rise" on control unit to 50% of the dial range.

5.2.1. Observe and record voltage using the calibrated "memory" meter (left side meter).

5.2.2. Apply the H.V. rise to 80Kv.

5.2.3. At 80kv, while continuing voltage increase, turn "rate of rise" to 0.0% and continue until punch out occurs. NOTE: This raises voltage to approximately 10 kV in 15 seconds.

5.2.4. Record kV value on the work sheet (QRQ001F).

5.3. Ground the tank and the H.V. bar with the ground stick.

5.3.1. Remove the insulator (with rags).

5.3.2. Check the location of the failure.

5.4. Record the failure location on the work sheet (QRQ001F).

5.4.1. When testing is complete, enter all test results into the database (**Insulator Punchout.mdb**)

5.4.2. Notify Operations Manager Mold Products and Mold Process Engineer of the test results.

5.5. Dispose of the insulator in the trash.

5.6. Failures:

5.6.1. If the first group of insulators fail, the criteria: Test twelve more insulators (if available for testing).

5.6.2. If the second group of insulators fail, the criteria: Notify either the Quality Manager or Mold Process Engineer.

6. ASSESSMENT AREAS (POSSIBLE)

6.1. Observe testing.

6.2. Verify quality records.

7. PASS/FAIL CRITERIA

7.1.Incoming Inspection: PASS: The average puncture value must meet or exceed the Hendrix requirement and the required percent variation must be less than 15%.

Insulator	Hendrix Requirement Average Puncture Value
HPI15F	205 Kv

7.2.Qualification/Evaluation: No pass/fail associated with this procedure. However if the value listed below is not met, follow step 7.3. Minimum allowable mean puncture value listed below:

Insulator	Mean Puncture Value
HPI15F	205 Kv

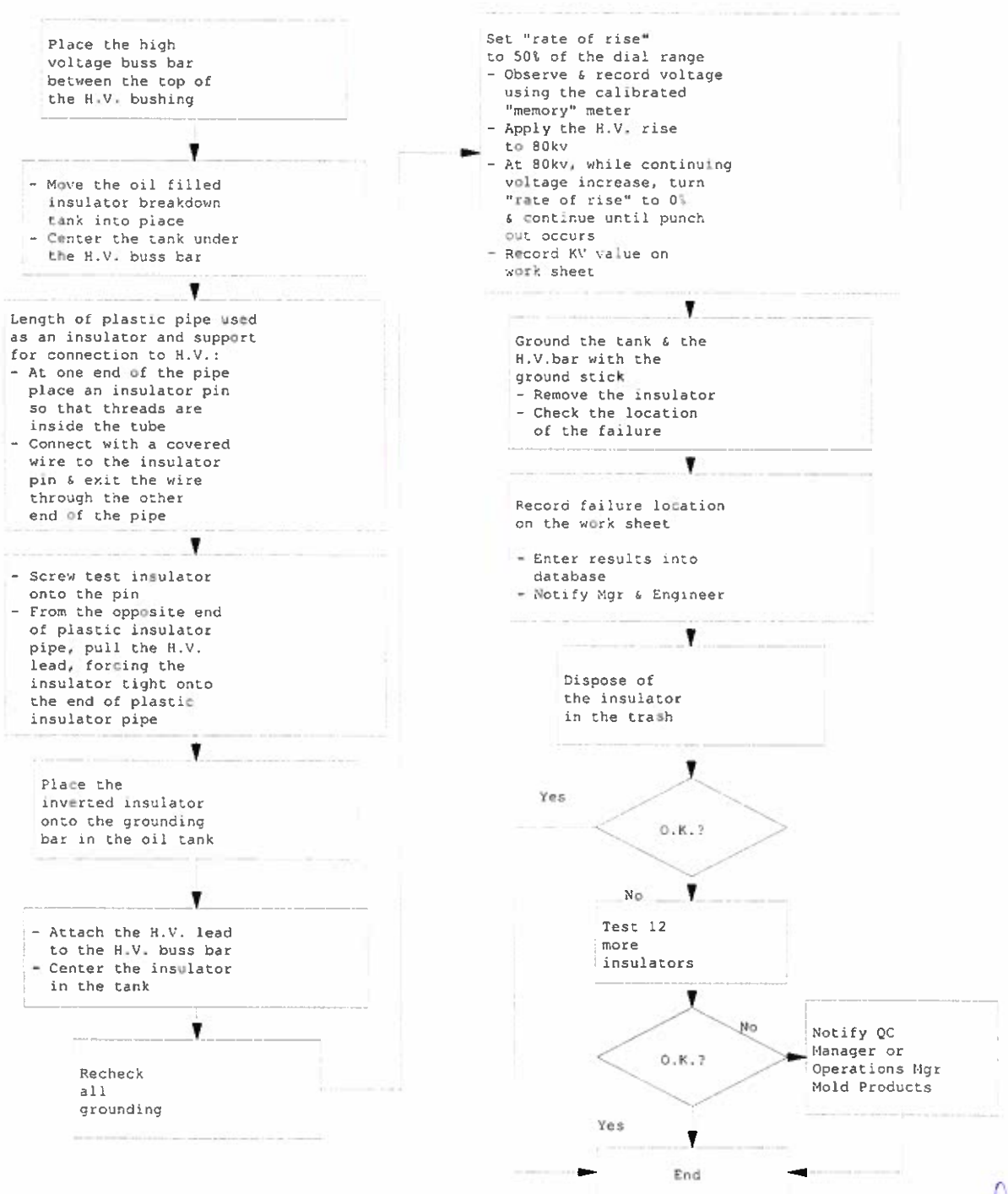
Required average percent of variation is 15% maximum

7.3.FAIL: If the minimum mean puncture value does not meet the stated value, notify the Quality Manager or the Mold Process Engineer.

8. AUTHORIZATION LIST

8.1. Quality Manager
8.2. Operations Manager Mold Products
8.3. Mold Process Engineer

INSULATOR PUNCH-OUT TEST (PIN TYPE)



mw

REVISION RECORD: QRQ 001

(Originally QCP 010)

Distribution List	**Date Added**
• Master Book (301)	2/1/95
• G:\ISO9002\MasterQRQ\QRQ001	12/31/97

Obsolete list	***Date Obsolete***
• ***Rev 0:*** *File, SOP Book, SOP Committee*	*9/11/90*
• ***Rev 0:*** *M.Spector, T.Wilson, R&D, (2) E-Test J.McAuliffe, (2) P-test, C.Richardson, R.Bristol*	*2/1/95*
• *E-Test Work Instruction Book (519)*	*1/31/01*
• *E-Test Work Instruction Book (520)*	*1/31/01*
• *Physical Test (209)*	*1/22/03*
• *Outside Training Room (304)*	*3/2/05*

Rev #	**Rev Date**	**Description of Revision**	**Date Dist**
QCP 010			
0	5/1/90	Initial Release	5/1/90
	9/11/90	Re-typed (no revisions)	9/11/90
QRQ 001		Revision numbers to follow QCP 010	
1	2/1/95	a) Document number revised b) 6,7,8 & flowchart added	2/1/95
2	4/22/96	a) 4.4 revised b) 5.4 revised c) 8 Authorization List revised d) 4.5 added e) 5.5 added	4/22/96
3	7/23/96	a) 1 Purpose revised b) 5 Procedure revised c) 7.1 pass/fail revised d) 8.3 title revised & 8.4 deleted	7/23/96
4	10/30/96	a) 4.5 added b) 5.2.1 & 5.2.4 added c) 5.4 revised & 5.4.1 added d) 7.1 revised table e) 7.2 deleted	10/30/96
	12/31/97	Converted from SMARTII to Word 6.0 No functional changes made	
5	5/28/98	a) 1 Purpose revised b) 3.2 & 3.3 deleted c) 5.4.3 added Aerial Process Engineer d) 7 Pass/Fail revised e) 8.3 revised to Aerial Process Engineer	5/28/98
6	6/21/99	a) 7.1 revised to "Qualification/Evaluation" b) 7.2 Incoming inspection added	6/21/99
7	4/19/00	a) 1 Purpose revised (base resin) b)3.3 added	4/20/00
8	11/5/02	a) 5.4.3 revised Distribute to titles b) 5.6.2 & 7.3 removed "control" c) 7.1 reworded d) 8.1 & 8.2 revised titles	11/18/02

REVISION RECORD: QRQ 001

Rev #	Rev Date	Description of Revision	Date Dist
9	1/25/05	a) 1 removed "and base resin…" b) 5.4.1 added "excel" c) 5.4.2 added "log book" d) 5.4.3 removed "file, QC Mgr & Direct of Tech"	1/25/05
10	3/30/06	a) 2 Application added process engineer b) 7.1 added "meet or" c) 7.2 removed ref to all other insulator types d) 7.3 added "min mean puncture"	4/7/06
11	11/14/06	a) 4.6 & 5.4.2 revised log book name b) 5.4.3, 5.6.2, 7.3, 8.2 & 8.3 revised titles	12/7/06
12	1/12/07	a) 4.4 revised Database name b) 4.6 & 5.4.2 removed Log Book c) 5.4.1 removed reference to excel file d) 5.4.3 reworded	1/30/07
13	4/5/07	a) 4.1 added latest rev b) 5.2.3 added Note c) 5.2.4 & 5.4.1 added worksheet & database names	4/17/07

HPI INSULATOR PUNCH-OUT

Base Resin or Masterbatch	Compound Lot #

Insulator	Neck Type	Pin Size	Produced Date	Rating
HPI 25		1		25

TEST DATA

TEST NUMBER	KV @ PUNCTURE	INSULATOR WEIGHT (GRAMS)	PUNCH OUT
TEST #1	235		T
TEST #2	220		N
TEST #3	235		N
TEST #4			
TEST #5			
TEST #6			
TEST #7			
TEST #8			
TEST #9			
TEST #10			
TEST #11			
TEST #12			

Number Teste	Max % Avg Variation	Percent Avg Variation	REQUIRED MEAN AVG Mean
	0		0

Comments	Attachments:
Tested for GCG / Anda	

Test Date	Approved	Tested By
5/1/2008		t caswell

Ing. GERARD [illegible]
Director [illegible]

Form ORO001F 11/16/06 rmw

HENDRIX

Environmental Stress Cracking Test
Gray High Density Polyethylene
(per ASTM D 1693)

Abstract
The purpose of this test was to evaluate the Gray High Density Polyethylene insulation used for the outer layer of our cable constructions.

Procedure
75 mil plaque samples were prepared from pellets. Tests were conducted following condition B of the specification.

Equipment
VWR Scientific oven set at 50° C for 48 hours and a test solution composed of 10% Igepal and 90% water.

Results
10 of the 10 samples tested passed with no cracking.
Color Gray masterbatch Lot: 3689366

Conclusion
Test results indicate that the material examined has environmental stress crack resistance.

Tested by: Paul Taraszuk and Gary Grenier
Reported by: Gary Grenier
Aerial Operations Manager
Date: December 11, 2007

HENDRIX

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Gray High Density Polyethylene
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Reported by: Gary Grenier
Aerial Operations Manager
Date: December 11, 2007

Puncture Test
Per ANSI C29.1
for
Class 55-5
HPI 25 F Neck, 1" Thread

Objective
To meet requirements found in ANSI C29.1-1988, section 4.11.

Test Location
Testing was performed at Hendrix Wire & Cable Co.

Test Procedure
Each of 3 insulators was mounted onto a 7" long, 1" diameter thread. The pin was connected to the end of covered cable. The insulator was immersed in an insulating oil bath. A grounded 1" diameter copper bar traveled horizontally through the bath. The top insulator position rested on the bar. The other end of the covered cable was connected to high voltage to complete the circuit.
High voltage was applied at a rate of approximately 10 kV/15seconds until failure.

Equipment
Manufacturer: Hipotronics AC Dielectric Test Set
Model: 7300-100
Serial Number: 731-7701

Results
235 kV, location Top
220 kV, location Neck
235 kV, location Neck

Note: Only 3 insulators were available from available inventory.
Tested by: Tim Caswell
Reported by: Gary Grenier

Date: 5/1/2008

Operator Shift Worksheet

Operator: Joe Date: 7-30-06 Machine Hours: 12 Part: RTL-45 SANDE
Mold Number:

Circle One: Shift: 1, 2, (3) Material Handling: Box, (Silo)
Machine: 350, 400, 500A, 500B, 500C, (700)
Material: (CH68 Grey) CH68 Regrind, Other:
Downtime: Reason for downtime: MELAN. COVERED BARREL

Type of Examination	Number Failed
Start-up:	
X-Ray (voids): N/A	
Cosmetic:	
Contamination:	
Other: STUCK	1
Total parts produced: 177	Total Parts Rejected: 1

Operator Comments:
+3
168
6
177
FULL 24
BOX 25

Operator Approval: JOE

Operator: Colette Date: 7/31/06 Machine Hours: 7½ Part: RTL-45 SANDE
Mold Number:

Circle One: Shift: (1) 2, 3 Material Handling: Box, (Silo)
Machine: 350, 400, 500A, 500B, 500C, (700)
Material: (CH68 Grey) CH68 Regrind, Other:
Downtime: 1½hr. Reason for downtime: (Leak Valve)

Type of Examination	Number Failed
Start-up:	
X-Ray (voids) N/A	
Cosmetic:	
Contamination:	
Other:	
Total parts produced: 116	Total Parts Rejected: 0

Operator Comments: *USE PACKING SHEET
1 PER BOX
+1
112
113
+3 Lot #12
116

Operator Approval: CDE

Operator: Diego Date: 7.31.06 Machine Hours: 8 Part: RTL-45 SANDE
Mold Number:

Circle One: Shift: 1, (2) 3 Material Handling: Box, (Silo)
Machine: 350, 400, 500A, 500B, 500C, (700)
Material: (CH68 Grey) CH68 Regrind, Other:
Downtime: Reason for downtime:

Type of Examination	Number Failed
Start-up:	
X-Ray (voids): N/A	
Cosmetic:	
Contamination:	
Other:	
Total parts produced: 122	Total Parts Rejected: 0

Operator Comments: *1 packing slip per box
+4
112 16 Boxes
6 Box #7
122

Operator Approval: DAN

Test Report
U-Bend

Abstract

The purpose of the testing was to meet or exceed the ANSI requirement of 125 v/mil for 6 hours.

Procedure

A cable sample was bent around a mandrel which was 8x the diameter of the cable and secured in that position. The bent cable was placed on a grounded metal plate. The conductor was exposed on the two cable ends and attached to high voltage. High voltage was applied at 31 kV for 6 hours.

Specification

ANSI Standard Number S-61-402

Cable Description

Reel Number	*Conductor*
LN7DZD21	70 mm^2 Aluminum, compact
LN7DZQ94	185 mm^2 Aluminum, compact

Results

The cable tested meets the requirements of ANSI S-61-402.

Tested and reported by: Gary Grenier

Operations Manager

Date: 5/1/2008

HENDRIX

Test Report
Tensile & Elongation
Conductor Shield

Abstract
The purpose of this test is to measure the material strength of Natural Semiconducting High Density Polyethylene Insulation material used for the conductor shield portion of the aerial cable design.

Tensile Testing Procedure
Samples were produced from materials used in the production of the customers product. .075" thick tensile bars were die cut and tested per ASTM D 638, except a tensile width of .100" was used. Samples were pulled at a rate of 2" / minute until failure.

Results

Blend	*Sample*	*Tensile (psi)*	*(MPa)*	*Elongation (%)*
CR17110911	1	2350	16.20	390
	2	2450	16.90	430
	3	2475	17.07	380
	Average	2425	16.72	400

ANDE Requirement: 9.65 Mpa Tensile and 200 % Elongation
Hendrix Requirement: 1400 psi (19.31 MPa) Tensile and 200 % Elongation

Conclusion
Test results meet and exceed both the ANDE and Hendrix requirement.

Tested by: Gary Grenier

Signature:

Title: Aerial Operations Manager

Date: 5/1/2008