RESULTS

Table 1 lists the Test run giving the type of test and type of wire sample used. Tables 2 to 5 are summaries of the results of each of the test. Appendix A has a detailed description for each of the individual tests.

Table 1. List of Tests and types of wire used.

Test Number	Test Type	Sample Wire Type
Preliminary Test 1	Wet Arc Tracking	BMS-W42/1/1-20
Preliminary Test 2	Wet Arc Tracking	BMS-W42/1/1-20
Test 1	Wet Arc Tracking	BMS-W42A/8/1-20
Test 2	Wet Arc Tracking	BMS-W42A/8/1-20
Test 3	Wet Arc Tracking	BMS-W42/1/1-20
Test 4	Wet Arc Tracking	Mil-W-81381/12-20
Test 5	Wet Arc Tracking	Mil-W-81381/12-20
Test 6	Wet Arc Tracking	BMS-W42A/8/1-20
Test 7	Wet Arc Tracking	BMS-W42A/8/1-20
Test 8	Metal Shavings Short Circuit	BMS-W42A/8/1-16
Test 9	Metal Shavings Short Circuit	BMS-W42A/8/1-16
Test 10	Metal Shavings Short Circuit	BMS-W42A/8/1-16
Test 11	Metal Shavings Short Circuit	BMS-W42A/8/1-16
Test 12	Metal Shavings Short Circuit	BMS-W42/1/1-20
Test 13	Metal Shavings Short Circuit	BMS-W42/1/1-20
Test 14	Metal Shavings Short Circuit	BMS-W42A/8/1-20
Test 15	Metal Shavings Short Circuit	BMS-W42A/8/1-20
Test 16	Metal Shavings Abrasion (90 °)	BMS-W42A/8/1-20
Test 17	Metal Shavings Abrasion (long.)	BMS-W42/1/1-20
Test 18	Metal Shavings Abrasion (long.)	BMS-W42/1/1-20
Test 19	Metal Shavings Abrasion (long.)	BMS-W42/1/1-20
Test 20	Metal Shavings Abrasion (long.)	BMS-W42/1/1-20

Table 2. Summary of Wet Arc Tracking Results: Grouped according to wire type

Wire Spec	Test #	Electrolyte	Duration	Qualitative Description	# Circuit Breakers Tripped	# of Wires that Failed Wet Dielectric Test	Length of Damage/ Char Build up
W 42A/8/1-20	Test 1	1% NaCl	20 min.	Some intense flashing	0	2 of 5	1/2"
W 42A/8/1-20	Test 2	1% NaCl	25 min.	Some intense flashing	0	2 of 5	5/8"
W 42A/8/1-20	Test 6	Lav. Water	10 min.	Some intense flashing	0	2 of 5	1/4"
W 42A/8/1-20	Test 7	Lav. Water	16 min.	Some intense flashing	0	0 of 5	3/8"
W 42/1/1-20	Pre Test A	1% NaCl	5 min	Some intense flashing	0	NA	1/2"
W 42/1/1-20	Pre Test B	1% NaCl	<1/2 min	Some intense flashing	0	NA	1/4"
W 42/1/1-20	Test 3	1% NaCl	~3 min	Strong Arcing	1 (reset then 3)	5 of 5	1/2"
Mil-W-81381	Test 4	1% NaCl	~1.5 min.	Strong Arcing	3 (reset)	4 of 5	2"
Mil-W-81381	Test 5	1% NaCl	< ½ min.	Strong Arcing	3 (no reset)	3 of 5	7/8"

Note: The insulation thickness for W42A/8/1-20 wire is ~11 mils and for W42/1/1-20 is ~7 mils but in both cases the primary insulation is an aliphatic polyimide (Poly X). The Mil-W-81381/12-20 has an insulation thickness of 8 to 9 mils.

Table 3. Summary of Metal Shavings Short Circuit Test: Grouped according to wire type

Wire Spec	Test #	Shaving Material	Shaving Cross section (Mils)	Circuit Breaker/Circuit Resistor	Qualitative Description	# Circuit Breakers Tripped	# of Wires that Failed Wet Dielectric Test	Length of Damage/ Char Build up
W 42A/8/1-16	Test 8	Steel	110 X 9	7.5 Amp/ 1 Ω	Short Flash	0	0 of 5	0"
W 42A/8/1-16	Test 9	Steel	65 X 28	15 Amp/ 0.5 Ω	Intense Flash	0	5 of 5	1.5"
W 42A/8/1-16	Test 10	Steel	48 X 26	15 Amp/ 0.5 Ω	Short Flash	0	2 of 5	1/8"
W 42A/8/1-16	Test 11	Al 7075	120 X 6	15 Amp/ 0.5 Ω	Short Flash	0	0 of 5	0"
W 42/1/1-20	Test 12	Steel	51 X 10	7.5 Amp/ 1 Ω	Short Flash	0	1 of 5	1/4"
W 42/1/1-20	Test 13	Al 7075	50 X 8	7.5 Amp/ 1 Ω	Short Flash	0	0 of 5	0"
W 42A/8/1-20	Test 14	Steel	52 X 9	7.5 Amp/ 1 Ω	Short Flash	0	0 of 5	0"
W 42A/8/1-20	Test 15	Al 7075	70 X 8	7.5 Amp/ 1 Ω	Short Flash	0	0 of 5	0"

Table 4. Summary of Metal Shavings Abrasion Test: 90° (Right Angle)

Wire Spec	Test #	Shaving Material	Shaving Cross section (Mils)	Duration	Qualitative Description	# Circuit Breakers Tripped	# of Wires that Failed Wet Dielectric Test	Insulation Damage
W 42A/8/1-20	Test 16A	Steel	41 X 26	19.25 hours	No Flash	0	1 of 7	Moderate damage to PolyX Flexing broke 1 wire
W 42A/8/1-20	Test 16B	Al 7075	42 X 30	19.25 hours	No Flash	0	2 of 7	Moderate damage to Topcoat Flexing broke/cracked 2 wires

Table 5. Summary of Metal Shavings Abrasion Test: Longitudinal

Wire Spec	Test #	Shaving Material	Shaving Cross section (Mils)	Duration	Qualitative Description	# Circuit Breakers Tripped	# of Wires that Failed Wet Dielectric Test	Insulation Damage
W 42/1/1-20	Test 17	Steel	~40 X 25	1+ hours	Small Flash	0	2 of 8	Cuts in Poly X to the conductor
W 42/1/1-20	Test 19	Steel	49 X 18	4 hours	No Flash	0	2 of 8	Cuts in Poly X to the conductor
W 42/1/1-20	Test 18	Al 7075	48 X 26	~15 minute	No Flash	0	0 of 8	Abrasion of Topcoat
W 42/1/1-20	Test 20	Al 7075	120 X 6	4 hours	No Flash	0	0 of 8	Abrasion of Topcoat

APPENDIX A: Description of Individual Test Results

Wet Arc Tracking Tests

Preliminary Tests A & B

Wet Arc Tracking
Bundle: Seven wires (6 over 1) of BMS 42/1/1-20 specification, 15 inches in length.
Electrolyte: 1% saline solution @ 100mg/minute
Circuit Resistance: 1 Ohm
Generator: 3 phase, 400Hz, 120 line to neutral (208 line to line), 10 kVA.
Length of tests: 5 minutes (Test A) and ½ minute (Test B)

Observation	Preliminary Test A	Preliminary Test B
Visible scintillation	Yes	Yes
Flash	Yes	Yes
Strong Arcing	No	Approaching
Circuit Breakers Tripped	No	No
Damage Length	1/2"	1/4"
Number of Wires Failing Wet Dielectric Test	–	–

Both tests gave similar results although preliminary test A was run for 5 minutes and preliminary test B was run for only ½ of a minute. Both began scintillations almost immediately and soon developed flashing type events.

In test A the sample was very active for the first minute or so and then had periods of dormancy interrupted by short spurts of activity. Examination of the bundle shows damage and char for about ½ an inch around the pre-damaged cuts. Also, about 3/8 of the conductors of the top two wires had been eroded away (Figure 18).

The bundle in test B experienced a period of intense activity within the first 30 seconds approaching strong arcing with 20+ cycles of continuous arcing (Figure 19). This period included current peaks of 75 Amperes and over 350 joules of electrical energy was dissipated in the event. The sample was then removed and examined. There was about a 1/4 inch of damage and char build up around the cut in the insulation, but both conductors were still intact.

No circuit breaker tripped in either test.