DELTA ELECTRIC

MOTORS

October 23, 2012

Washington State Ferries
2901 3rd Ave, Suite 500
Seattle, WA 98121-3014

Attn: Scott Mullen – mullans@wsdot.wa.gov
Bruce Cooper – cooperb@wsdot.wa.gov

RE: M/V Walla Walla Inspection, PO#S122-0528, Findings Report

Findings Report

Condition found on all commutators:

-Uneven discoloration was found on all bars and on complete surface of commuter. One cause of this is atmospheric condition. Moisture and vapors introduced thru cooling and ventilation can cause enough contamination needed to produce heavy destructive film on commutator, a very low amount is needed. The most common cause is Sulfur (3 parts per million). That would be sufficient enough to cause heavy film and discoloration of copper similar of the type of markings you have on these commutators. The source of sulfur comes from vehicle exhaust thru ventilation. Another source of discoloration is uneven spring pressure. Uneven spring pressure will disturb the amount of load per brushes causing change in temperature between brushes that contribute to discoloration of commutator bars.

-Excessive dust was found in all motor. Excessive dust, in this case carbon, is produced by self seating of brushes. Excessive carbon dust causes the brushes to ride on the dust, disturbing surface contact between the brush and commutator surface causing unbalanced load between brushes.

2141 West Valley Hwy North
Auburn, WA 98001
(253) 833-1572 Fax (253) 833-7521

Recommendations:

-Use self cleaning brushes. These would be specific brushes for your application and it would need to be engineered. We use Daniel Perkins of Perkins Power Products, representative of Helwig Carbon brushes for our special brush needs.

- Replace and seat brushes 100% of surface on all brushes at one time, not the current system of 32 brushes at a time, every other month. Replacing all brushes at one time will take care of uneven spring tension caused by varying brush lengths and it will allow 100% contact on the commutator.

If you would like any additional information or explanation, please contact us to schedule a meeting in person.

Sincerely,

Antonio Vacca

Michael DiPietro

Delta Electric Motors, Inc.
2141 West Valley Hwy N
Auburn, WA 98001
Ph: 253-833-1572
FX: 253-833-7521

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Since 1976

MOTORS

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Delta Electric Motors, Inc.
2141 W Valley Hwy N
Auburn, WA 98001
(253) 833-1572 Fax (253) 833-7521

Date 10-5-2012

Delta Job# 10953

Motor # 222033-2B
End#1

Shunt Coils

CE			OCE		
1	.305"	+.004"	1	.305"	+.002"
2	.310"	+.009"	2	.305"	+.002"
3	.295"	-.006"	3	.295"	-.007"
4	.290"	-.011"	4	.290"	-.012"
5	.290"	-.011"	5	.290"	-.012"
6	.290"	-.011"	6	.290"	-.012"
7	.295"	-.007	7	.295"	-.007"
8	.310"	+.009"	8	.310"	+.008"
9	.312"	+.011"	9	.312"	+.010"
10	.310"	+.009"	10	.315"	+.013"
11	.305"	+.004"	11	.325"	+.023"
12	.305"	+.004"	12	.300"	-.002
Nom	.301"		Nom	.302"	

Shunt: All in Tollerance, OK.

Interpoles

CE			OCE		
A	.300"	.000"	A	.312"	+.010"
B	.310"	+.010"	B	.310"	+.008"
C	.285"	-.015"	C	.285"	-.017"
D	.290"	-.010"	D	.290"	-.012"
E	.285"	-.015"	E	.285"	+.017"
F	.295"	-.005"	F	.285"	+.017"
G	.295"	-.005"	G	.290"	-.012"
H	.312"	+.012"	H	.310"	+.008"
I	.310"	+.010"	I	.313"	+.011"
J	.305"	+.005"	J	.305"	+.003"
K	.310"	+.010"	K	.330"	+.028"
L	.305"	.005"	L	.320"	+.018"
Nom	.300"		Nom	.302"	

A	Top	.306"	J	Left side	.305"
G	Bottom	.293"	D	Right side	.290"

Interpoles CE OK, all within Tollerence.
Interpoles OCE OK, K is over very little. All the rest are OK.

DELTA ELECTRIC MOTORS

Delta Electric Motors, Inc.
2141 W Valley Hwy N
Auburn, WA 98001
(253) 833-1572 Fax (253) 833-7521

Date 10-5-2012

Delta Job# 10953

Motor # 222033-1A

Arm#1	1	2	3	4	5	6	7	8
Brushes Lbs R	2.5	3	3	2.5	2.5	2	4	4
Brushes Lbs L	2	2.5	2	3	2.5	2.5	3.5	3
Brush Box Distance	.090"	.080"	.080"	.080"	.080"	.080"	.090"	.080"

Arm#2	1	2	3	4	5	6	7	8
Brushes Lbs R	3	3	3	4	3	3	3	3.5
Brushes Lbs L	4	3.5	3	2.5	3	3	3	3.5
Brush Box Distance	.090"	.090"	.090"	.090"	.090"	.090"	.090"	.090"

Arm#3	1	2	3	4	5	6	7	8
Brushes Lbs R	3.5	3	3	2.5	3.5	3.5	2.5	2.5
Brushes Lbs L	2.5	2.5	3.5	3	3.5	3	2.5	3
Brush Box Distance	.090"	.090"	.090"	.090"	.090"	.090"	.090"	.090"

Arm#4	1	2	3	4	5	6	7	8
Brushes Lbs R	3	2.5	2.5	3	3.5	2.5	3	3.5
Brushes Lbs L	3	2.5	2	3	3	3	2.5	3
Brush Box Distance	.090"	.090"	.090"	.090"	.090"	.090"	.090"	.090"

Arm#5	1	2	3	4	5	6	7	8
Brushes Lbs R	2.5	2.5	2.5	2.5	3	3.5	3.5	3.5
Brushes Lbs L	2	2.5	3	2.5	3	2.5	3	2.5
Brush Box Distance	.120"	.100"	.100"	.100"	.100"	.100"	.100"	.090"

Arm#6	1	2	3	4	5	6	7	8
Brushes Lbs R	2.5	2.5	2.5	3	3.5	3	2.5	3
Brushes Lbs L	2	2	3.5	3	2.5	3.5	2.5	3
Brush Box Distance	.110"	.100"	.100"	.090"	.090"	.090"	.090"	.090"

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Date 10-5-2012

Delta Job# 10953

Motor # 222033-1A

Arm#7	1	2	3	4	5	6	7	8
Brushes Lbs R	2.5	3	3	3	3	2	3	2.5
Brushes Lbs L	2.5	2	3	2.5	3	2.5	3	2
Brush Box Distance	.110"	.110"	.090"	.090"	.090"	.090"	.090"	.110"

Arm#8	1	2	3	4	5	6	7	8
Brushes Lbs R	2.5	3	2.5	2.5	3.5	4	3	3
Brushes Lbs L	2.5	3	2.5	3	3	2.5	3	3.5
Brush Box Distance	.100"	.090"	.090"	.090"	.090"	.090"	.090"	.090"

Arm#9	1	2	3	4	5	6	7	8
Brushes Lbs R	3	2	2	3	3	2.5	2	3
Brushes Lbs L	3.5	3	3	3	3	3	2.5	3.5
Brush Box Distance	.090"	.090"	.090"	.090"	.090"	.090"	.090"	.090"

Arm#10	1	2	3	4	5	6	7	8
Brushes Lbs R	3.5	2.5	3	3.5	3.5	3	3	3
Brushes Lbs L	2.5	3	3.5	3	3	3	2	2.5
Brush Box Distance	.100"	.100"	.100"	.100"	.100"	.100"	.100"	.100"

Arm#11	1	2	3	4	5	6	7	8
Brushes Lbs R	3	3	2.5	2.5	3	3.5	3	3
Brushes Lbs L	3	3	3	3	3	3	4	4.5
Brush Box Distance	.090"	.090"	.090"	.090"	.090"	.090"	.090"	.090"

Arm#12	1	2	3	4	5	6	7	8
Brushes Lbs R	3	3.5	2	2.5	2	3	3.5	2.5
Brushes Lbs L	3.5	3	2.5	3.5	2.5	2.5	3	2.5
Brush Box Distance	.100"	.090"	.090"	.090"	.090"	.090"	.090"	.090"

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Date 10-5-2012

Delta Job# 10953

Motor # 222033-1A

Brush spring pressure is all within 2 lbs to 5 lbs

Brush distance to commutator

Arm 1	OK
Arm 2	OK
Arm 3	OK
Arm 4	OK
Arm 5	Box #1 .120" too high. The rest are within tollerance.
Arm 6	Box #1 .110" too high. The rest are within tollerance.
Arm 7	Box #1 #2 and #8 too high. The rest are within tollerance.
Arm 8	OK
Arm 9	OK
Arm 10	OK
Arm 11	OK
Arm 12	OK

ARM Spacing

Brush Arm #	
1-2	283mm
2-3	280mm
3-4	282mm
4-5	283mm
5-6	281mm
6-7	282mm
7-8	282mm
8-9	281mm
9-10	282mm
10-11	283mm
11-12	283mm
12-1	283mm

All in Tollerance

All arm and coil numbers are clockwise facing commutator

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Date 10-5-2012

Delta Job# 10953

Motor # 222033-1A
End#1

Shunt Coils

CE			OCE		
1	.300"	-.001"	1	.302"	+.002"
2	.295"	-.006"	2	.305"	+.005"
3	.307"	+.006"	3	.312"	+.012"
4	.310"	+.009"	4	.305"	+.005"
5	.305"	+.004"	5	.295"	-.005"
6	.290"	-.011"	6	.285"	-.015"
7	.290"	-.011"	7	.290"	-.010"
8	.300"	-.001"	8	.300"	+.000"
9	.305"	+.004"	9	.305"	+.005"
10	.300"	-.001"	10	.310"	+.010"
11	.310"	+.009"	11	.300"	+.000"
12	.300"	-.001"	12	.300"	+.000"
Nom	.301"		Nom	.300"	

Shunt: All in Tollerance, excellent.

Interpoles

CE			OCE		
A	.312"	+.012"	A	.310"	+.007"
B	.290"	-.010"	B	.315"	+.012"
C	.305"	+.005"	C	.312"	+.009"
D	.310"	+.010"	D	.310"	+.007"
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F	.290"	-.010"	F	.290"	-.013"
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J	.313"	+.013"	J	.310"	+.007"
K	.305"	+.005"	K	.305"	+.002"
L	.290"	-.010"	L	.295"	-.008"
Nom	.300"		Nom	.303"	

A	Top	.311"	J	Left side	.312"
G	Bottom	.295"	D	Right side	.310"

Interpoles All within Tollerence, Excellent

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10/5/2012
Delta Job# 10953

Nameplate Data
PM# 1 end #1

Motor # 222033-1A EN 222033

Type MCF12 HP 4250 RPM 180

Volts 750 Amps 4510 Wound Shunt

Class F Insulation 50 degrees C ambient 75 degrees C Rise TH

Exitation Separate Volt 180 Amps 94.1 DC

Ventilation 25000 CFM 4.5 In WSP

Date March 2003

Enclosure ESV IP44

End #1

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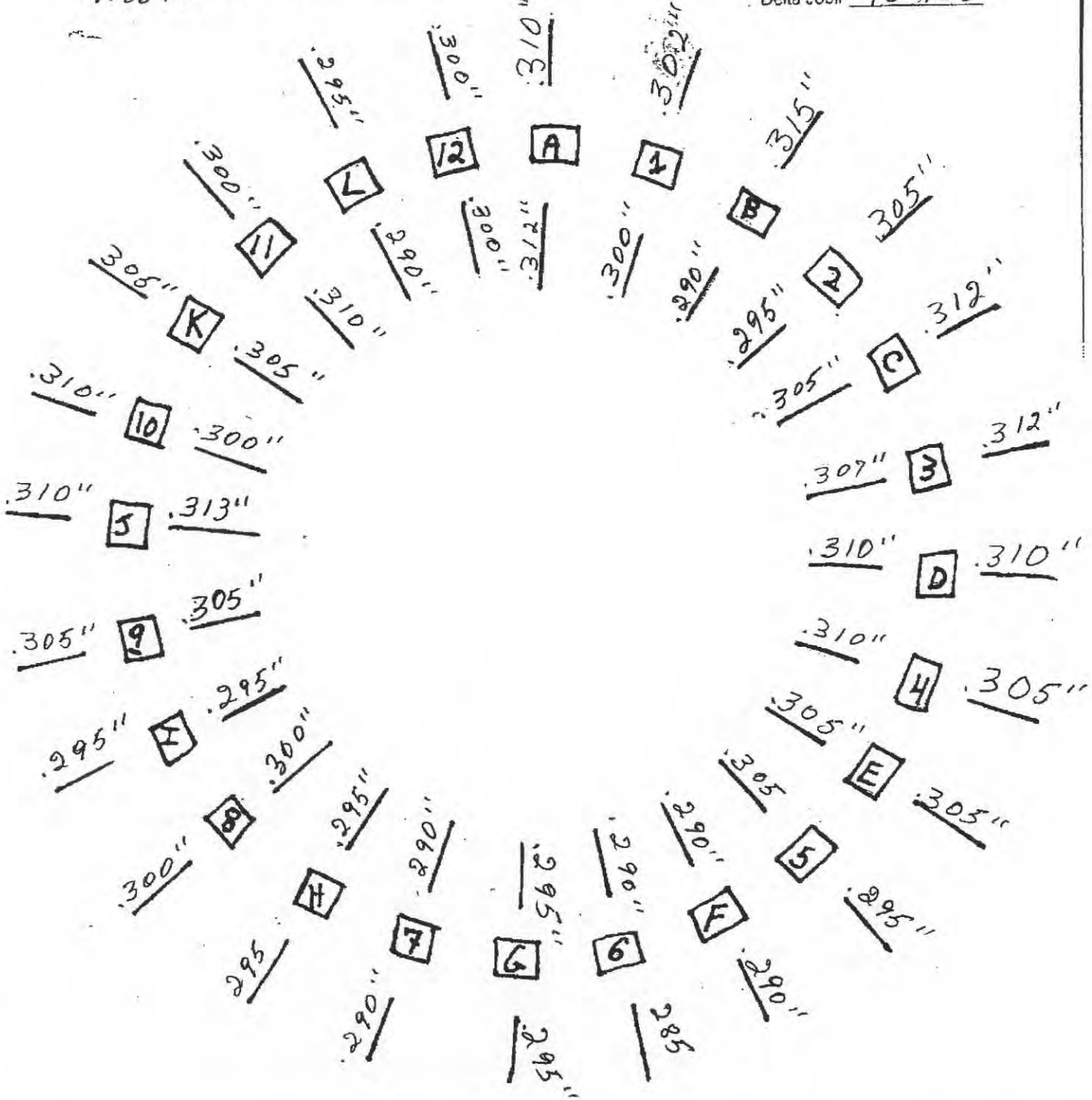
(253) 833-1572 Fax (253) 833-7521

Motor S# 222033-1 (A)

Date 10-9-12

Delta Job# 10-953



End #1

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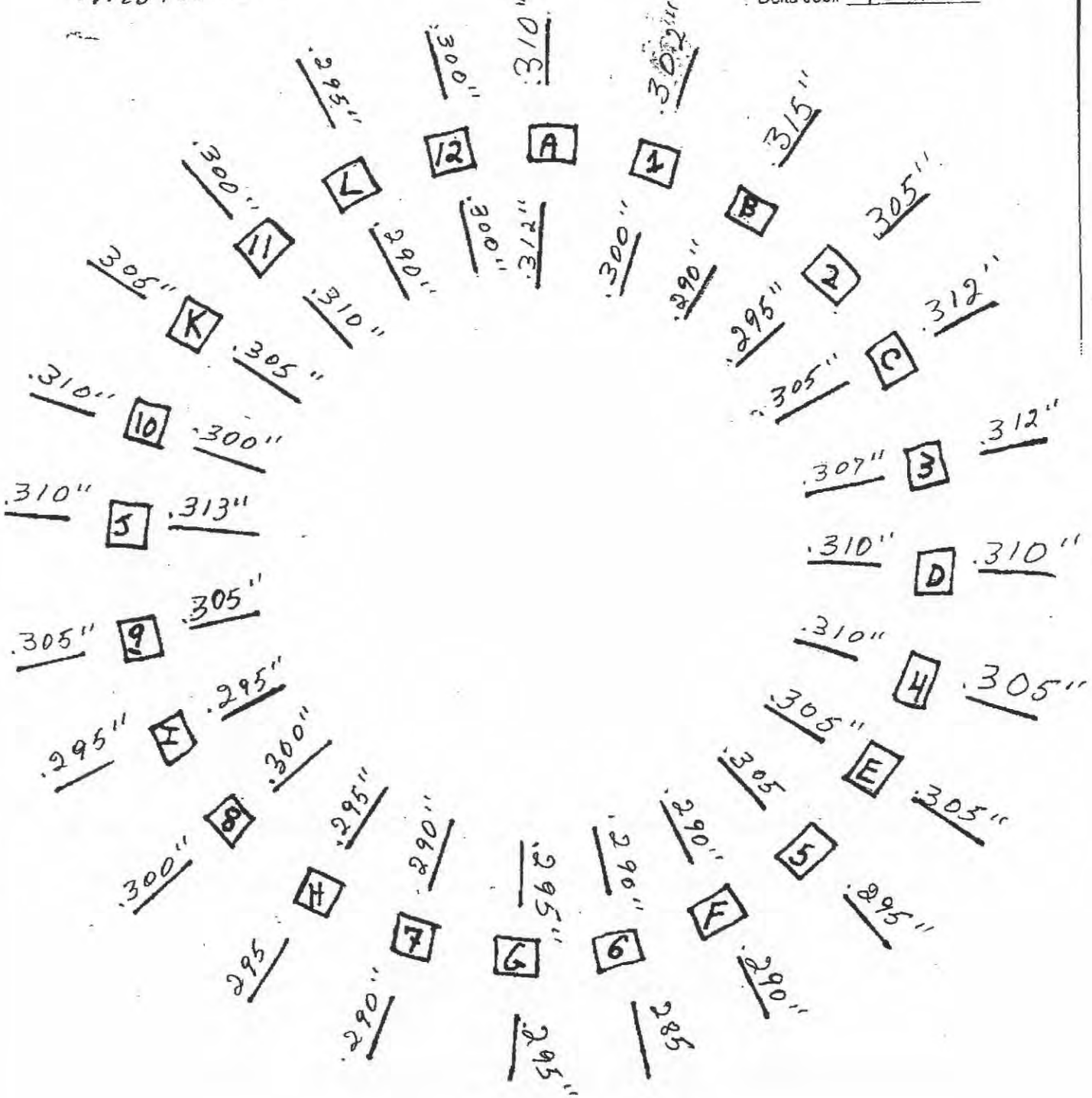
Motor S# 222033-1 (A)

Date 10-9-12

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