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Doc No. & Version	Doc 31388 V1	System Engineer	Recommended	Zaki Petersen		TRAVAUX Engineering Services
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Inductor Divert Coil Specification

Inter Business / Departmental Interface Approvals of Procedure:

Department	Name	Signature	Date of Approval
1.			
2.			
3.			
4.			
5.			

PROCESS REFERENCE: S30.00.10

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1. Introduction and Scope

This Specification outlines the Requirement for Inductor Divert Coils as Required for 5M2A and 10M5 Motor Coaches.

2. Drawings and Documentation

2.1 General Specification

- The Field shunt type SH116Z is used to weaken the field strength of the motors by diverting current from the main-field windings, thus obtain higher speeds for given armature curent. The Diverter is displayed in Figure 1.

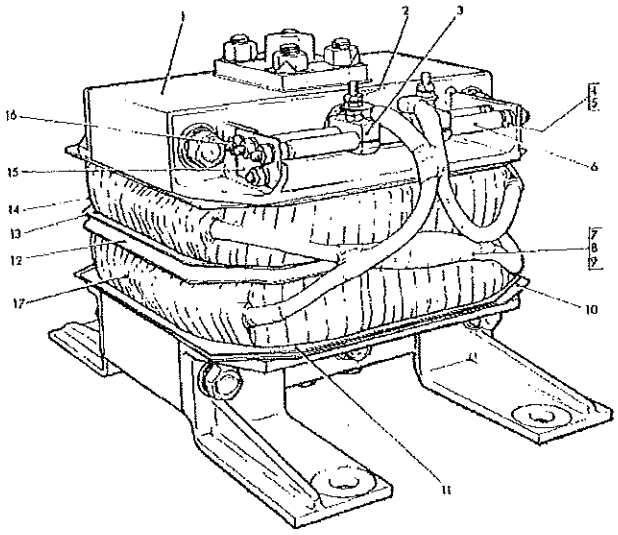

Figure 1

1. Core
2. Hex locknut
3. Terminal Clamp
4. Hex nut
5. Spring Washer
6. Insulated support rod
7. Hex Bolt
8. Spring washer
9. Hex nut
10. Insulating coil washer
11. Coil support washer
12. Coil Spacer
13. Coil Spring
14. Top Coil
15. Clamping Plate
16. Hex Bolt

17. Bottom Coil

Table 1: Inductive Diverter Properties

Number of coils per Inductive Divert	2
Turns per coil	140.5 in two layers
Type of bare conductor	Copper C101 grade (Superceded by BS1432)
Cross section of bare conductor	23.62 x 1,02mm
Type of winding	strap on the flat
Resistance Value of 2 Coils at 20 °C	0.22 ohm
Total Impedance at 50 hz	48 ohm
Overall Dimensions of Inductor Diverter (Length x Breadth x Width)	559 x 377 x 376 mm
Minimum 5000 V Meggar Ohm Reading	200Mohm

2.2 Coil Construction

As per Figure 1 , item 14 and 17. An inductive diverter consits of 2 identical coils seperated by a coil spacer.

Each Coil consists of 2 layers . And each layer consists of 70.25 turns of copper bar (23.62 x 1.02mm). Individual Coil construction is depicted below.

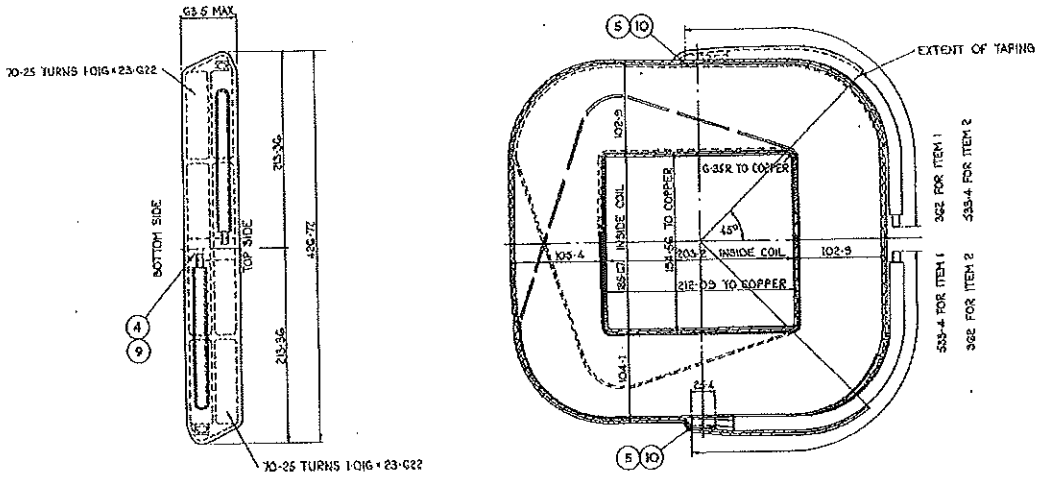

Figure 2 : Side and Top View of an individual TOP/BOTTOM Coil

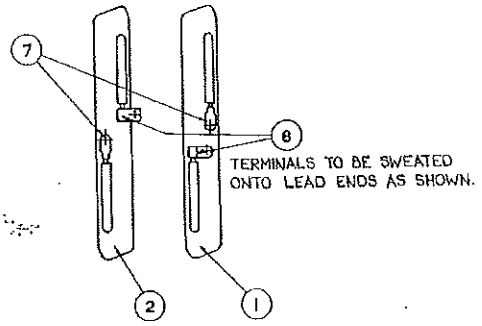

Figure 3: Connection of Top and Bottom Coil

Table 2: Bill of Quantities for Coil

item	Name	Qauntity per assembly	Material	Specification	Length	Additional Notes
1	Top Coil (Figure 3)	1	-			
2	Bottom Coil (Figure 3)	1	-			
3	Coil Layers	4	Copper	Copper C101 grade (Superceded by BS1432)	±77.2 m	
4	Connector Strips	2	Copper	Copper C101 grade (Superceded by BS1432)	±0.127m Long	
5	Connectors (Bent to suit)	4	Copper	Copper C101 grade (Superceded by BS1432)	Width-23.62mm Length-80mm Thickness-1.02mm	
6	Tinned Flexible Cable	1		$25mm^2$	1.826m long	3300V insulatted Stranding, Rope stranded
7	Terminals	2	Copper	Copper C101	25mm 10mm	
8	Brazing Strips	2	Brazing Alloy	(.12 x 50.8) mm	±47.24mm	3000V applicable
9	Brazing strips	4	Brazing alloy	(.12x 50.8)mm	±25.4mm	3000V

2.3 Coil Insulation Instruction

- Overall Insulation Resistance should remain above 200Mohm throughout a lifespan of 5 Years. Maximum Dimensions as shown in Figure 2.

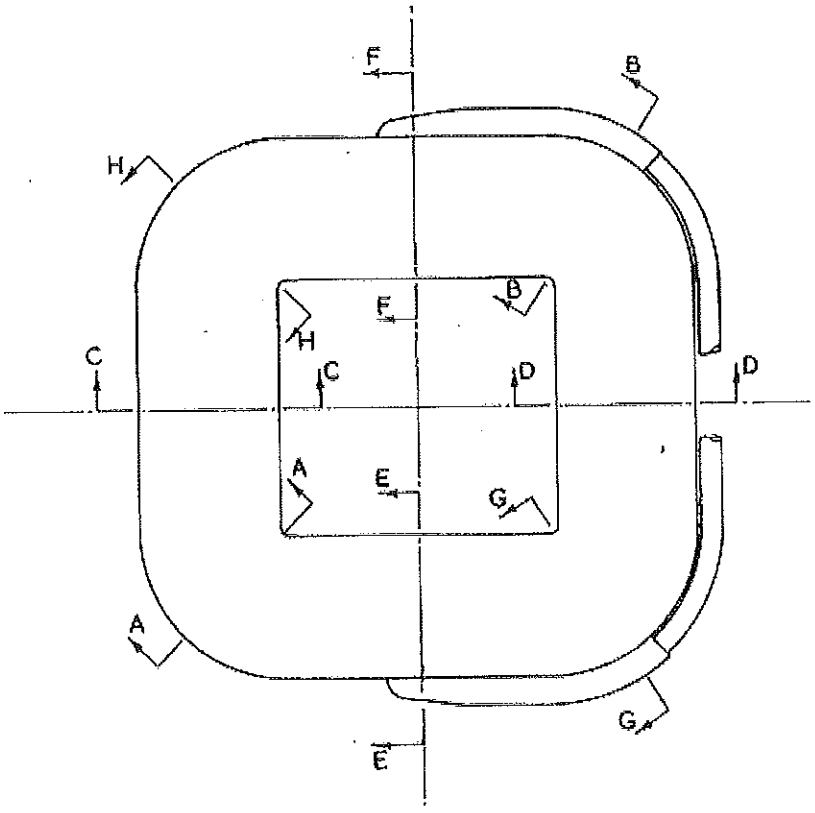

Figure 4: Primary Insulation section view

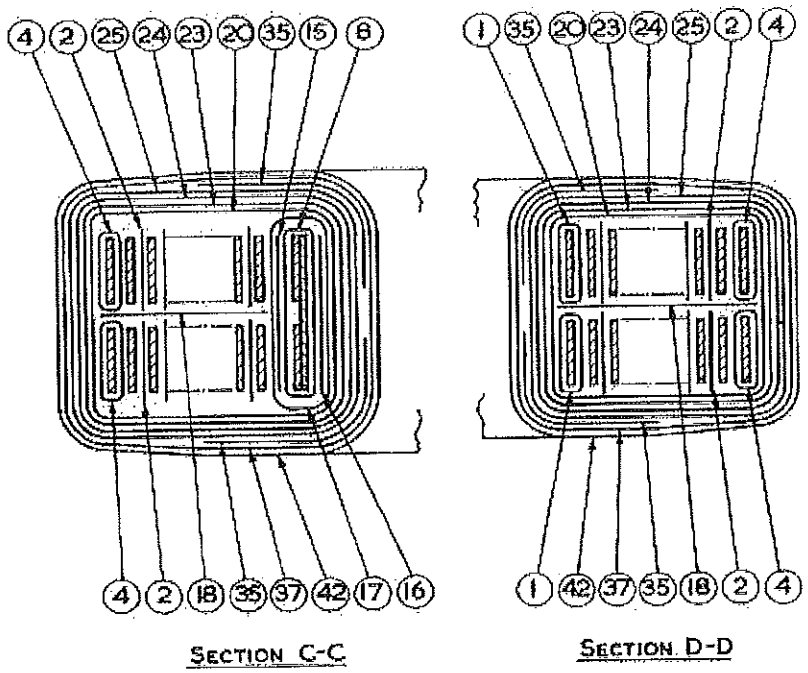

Figure 5: C & D Insulation Section view

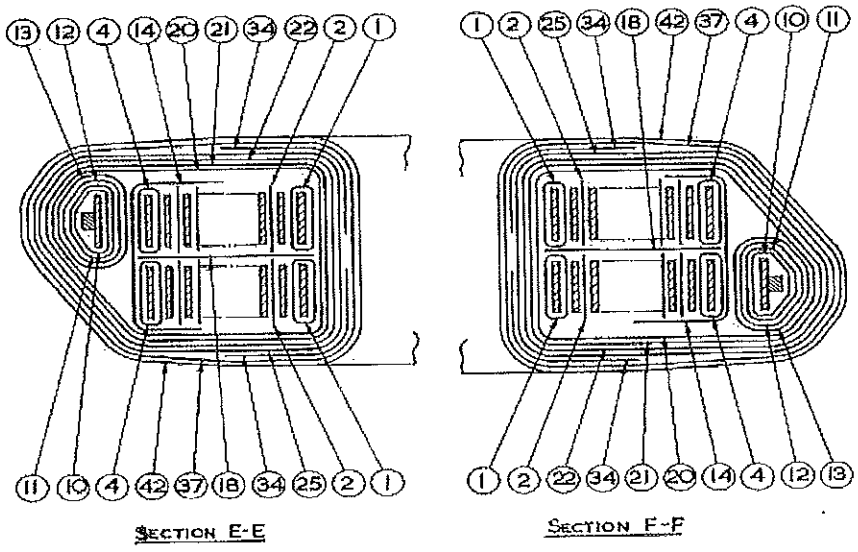

Figure 6 ; E & F Insulation Section View

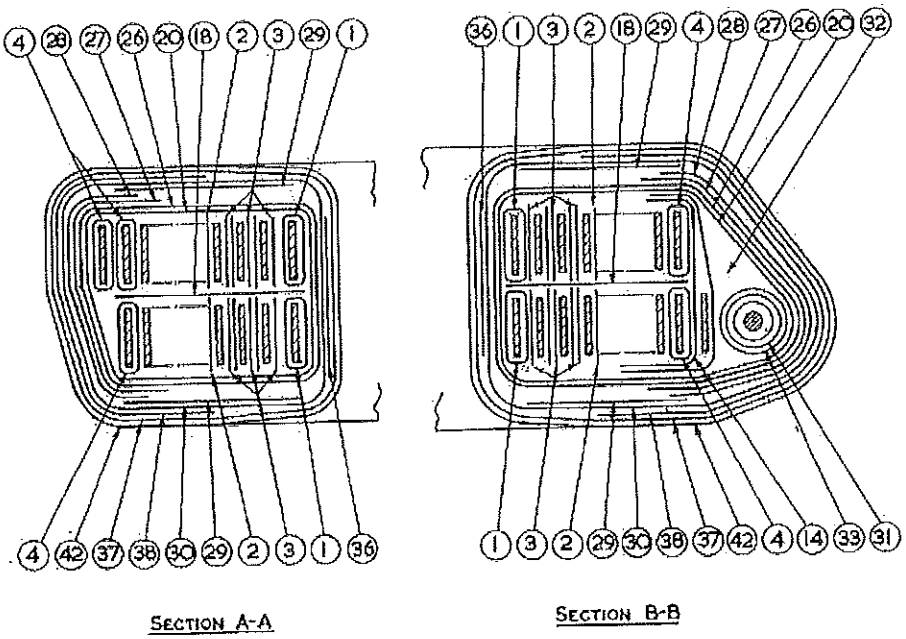

Figure 7: A & B insulation section view

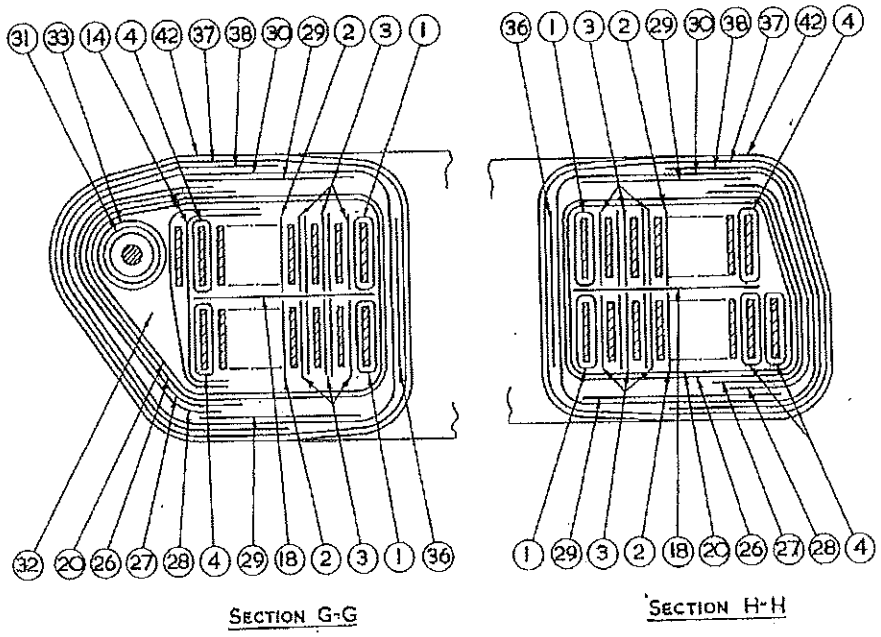

Figure 8 : G & H insulation section View

Table 3: Winding process

Item	Name	Length / Qauntity per assembly	Material/Spec	Description/Size	Size	Remarks
1	First turn during winding	12 metres	Glass Tape	0.13 x 25mm		1 layer with ½ lap
2	Insulate between turns when winding	305 metres	Nomex Type 410	0.1x 26mm		2 layers
3	Reinforce First four turns at each corner	24	Nomex Type 410	0.1 x 26mm	76mm long	
4	Tape last turn during winding	23 metres	Glass Tape	0.1 x 19mm		1 layer ½ lap
5	Tie Up end turns when winding	3m	Cotton tape	0.18 x 25mm		If Reqd
6	Tie up sections after winding	10m	Cotton Tape	0.18 x 25 mm		If Reqd
7	Tie up Coil when joining	5m	Cotton Tape	0.18 x 25mm		If Reqd
8	Tape inside joints and connections	1m	Kapton / polyimide tape	0.07 x 9.5mm		
9	Tape recess on cable	4m	Glass tape	0.23 x 25mm		
10	Insulate tail strap and joint	2	Phlogoplite – grade Mica sheet	Sheet 0.23 mm thick	95 x 95 mm	

11	Insulate tail strap and joint	2	Phlogoplite - grade Mica sheet	Sheet 0.23mm thick	64x 381 mm	
12	Tape tail strap and cable joint	6m	Mica Tape	0.14 x 25mm		3 layers ½ lap
13	Tape tail strap and cable joint	8m	Glass Tape	0.23 x 25mm		1 layer ½ lap
14	Seperate tail strap from coil	2	Nomex Type 410	Sheet 0.23 mm thick	152 x 508 mm	
15	Protect Inside joint from coil	2	Nomex Type 410	Sheet 0.23 mm thick	29 x 127 mm	
16	Insulate inside joint	2	Nomex Type 410	Sheet 0.23mm thick	76 x 102mm	
17	Tape inside joint	6m 3m 3m	-1st layer Kapton Tape -2nd Layer Mica Tape -3rd Layer Glass Tape	-0.07 x 9.5mm -0.14 x 25mm 0.23 x 25mm		2 layer ½ lap 1 layer ½ lap 1 layer ½ lap
18	Washers between sections	2	Nomex or Nomex mica	Sheet 0.76 thick	382x 400mm	Cut to template
20	Tape coil	28m	Mica Tape	0.14 x 25mm		
27	Reinforce corners(outside)	4	Nomex	Sheet 0.20 thick	191 x 204mm	
29	Reinforce corners (Top and Bottom)	8	Nomex	Sheet 0.3 thick	137 x 156mm	Cut to template
30	Bind Items 27,28,29	23m	Glass Tape	0.13 x 25mm		Staggered/Skeleton tape
31	Jacket on cables	2		Sheet 0.15 mm thick	137 x 156mm	Cut to template

32	Pack around cables	As reqd	non setting and jointing compound			
33	Tape Jacket to cable	7m	Mica tape	0.14 x 25mm		1 layer 1/2 lap
36	Inside corner protection	4	Nomex	Sheet 0.76mm thick	25 x 44mm	
40	Apply stripping tape	28m	Glass Tape	0.18 x 38 mm		Temporary/ Skeleton Tape
41	Treat coil	VPI Process using EPOXYLITE TSA 220FM IMPREGNATING RESIN or better.Followed by a baking process.				
42	Tape coil	+- 25 m +-20 m	- 1st Mica Tape layer - 2nd Glass Tape layer	0.14 x 25mm 0.13 x 25 mm		1 ½ lap 1 ½ lap
43	Treat Coil	VPI Process using EPOXYLITE TSA 220FM IMPREGNATING RESIN or better.Followed by a baking process.				

Please Note :

Where applicable only the following High Quality materials are to be utilised or equivalent.

Material	Specification or Equivalent materials
Mica Tape	Electrical Insulation tape High absorbent mica tape paper based uncalcined muscovite reinforced on one side with glass cloth COMPLIES TO IEC 371-2 THICKNESS NOMINAL :0.14MM ; WIDTH 25MM Product Name: 366.88 SAMICAPOR OR EQUIVALENT
Glass Tape	E22 Electrical Grade glass yarn Class H THICKNESS NOMINAL :0.13MM ; 0.18MM;0.23MM

	WIDTH 25MM Specification BS 3779 (1985)
Nomex	Type 410 or equivalent
Resin	EPOXYLITE TSA 220FM IMPREGNATING RESIN or equivalent
Non-setting and jointing Compound	-Temperature range from -50°C to 250°C -Pressure range of 0 – 35Bar - easy to break and clean -Non setting -Non hardening -Thermal resistance -Vibration resistance -used of contraction of joints Product name: Henley Insulating Compound or Equivalent

Coil Winding procedure Disclaimer:

Due to the fact that it is not possible to check final coils for consistency with the above winding process. This is is only a guideline to how Coils are wound within PRASA technical department.

Coils are however required to carry a guarantee of 5 years whereby insulation is gauranteed to not breakdown or lower below a value of 200 Mohm .

2.3 Quality Control Documents

Each coil To be supplied with Qaulity Control Documentation with all relevant details as stated below or a better in-house process:

	Job Number:_____	QA Surname and Initials: _____	
No.	DESCRIPTION	SPECIFICATION	QA Remarks
1	Verification of conductor sizing and grade	-Copper C101 grade -Conductor	

		Width 23.62 mm -Conductor Thickness 1,02mm	
2	Wind/Form the coil	as per procedure in table 3	
3	Specify Winding Tension		
4	Inspect terminals :	-No Cracks -Uniform Weld -No inclusions	
5	VPI process	Pre and Post VPI Inspection incl. Resistance ,Impedance and Insulation Resistance	
6	Resistance Test per Coil	-0,11 Ohm ± 5 %	
7	Impedance of Coil at 50 HZ	2 coils @ 48 Ohm	
8	Meggar Test	5000V for 1 minute Min 200 Mohm	
9	Mechanical Inspection		
	9.1 Using Small hammer ,tap bands to see if they are tight		
	9.2 Inspect band for cracks	Not wider than 0.5mm	
	9.3 Inspect bands for cracks longer than pole pitch		
	9.4 No gaps between sleeves		
	9.5 no gaps between turns		
	9.6 Dimensional Tolerances of completed Coil after VPI	Thickness : ±31.75mm	

		Outside : ±426.72 by 426.72mm Inside Coil dimension: ± 203.2 mm by 185.67mm	

3. Packaging and transportation

The following to be complied with :

-Coil to be supplied in boxes with appropriate protective material to prevent any damage during transit

-Coils which are damaged or contains missing items on arrival will be at the liability of the contractor and will need to be replaced accordingly.

All items to be delivered to Salt River Metrorail Goods Receiving Terminal at Rolling Stock, Cape Town.

4. Markings

-Coil Identity number as below to be stencilled on each supplied coil.

ID – 5M/10M – (Sequence of supplied COILS) – (Manufacture date -yyyymmdd)

Eg. ID- 5M/10M- 001- 20190821

Stencilling to be done in such a way which does not compromise the coil or insulation.

5. Final Inspection and Acceptance

Coils will first be subjected through an internal Quality Check before being accepted.

An NCR (Non-Conformance Report) process will be initiated should a coil not meet the requirements

6. Guarantee

Should Coils fail pre-maturely inside the warranty period of 5 years, A Joint investigation between PRASA and tenderer will be held to ascertain the cause of failure. Should inferior Coils supplied be the cause of failure, Tenderer will be held accountable for all damages and replacement of parts or complete Inductor Divert units should it be warranted. And should re-occurring faults occur. The decision will be left with PRASA Maintenance Engineering Manager with regard to the termination and/or penalties of the contract.