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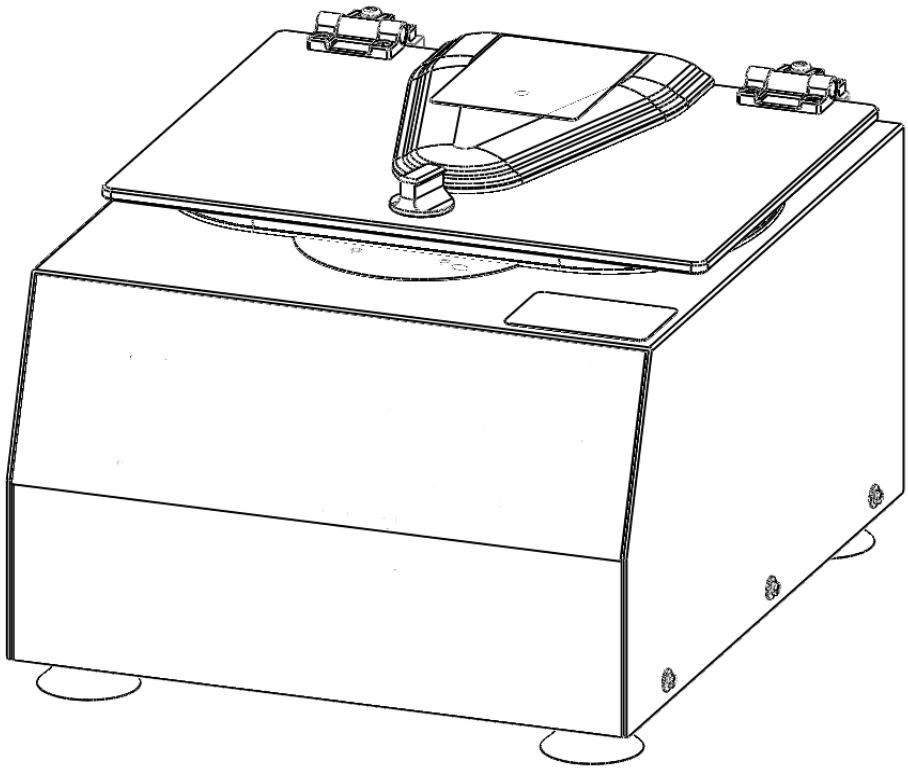
# Service Manual

## Model 853VES Centrifuge



## CONTENTS

# 1 PREFACE

1.1 The purpose of this manual is to provide the service technician with information for troubleshooting, testing, and repair of laboratory centrifuge model 853VES. Only qualified technically trained personnel should attempt any of the servicing described in this document. Failure to follow the procedures in this document may result in personal injury or instrument damage. The Drucker Company will not be held liable for any injury or damage as a result of improper servicing.

1.2 Information contained within this manual is subject to change without notice.

# 2 INTENDED USE

2.1 Model 853VES is a general purpose laboratory centrifuge, intended for sample separation.

# 3 GENERAL DESCRIPTION OF MAJOR COMPONENTS

3.1 Motor: Brushless DC Motor

3.2 Printed Circuit Board: The PCB is the microcontroller based control center of the centrifuge. All control signals are generated in the PCB.

3.3 Lid Locking Tray Assembly: The lid tray assembly contains a solenoid and limit switch that are used to determine the state of the lid (Open or Closed) and to keep the lid locked during centrifugation cycles.

3.4 Rotor: The centrifuge rotor is the main component that spins in the centrifuge. The rotor is loaded with tube holders, and the samples are placed into the tube holders for processing.

# 4 WARRRANTY INFORMATION

4.1 The Drucker Company warrants its centrifuges to be free from defects in workmanship and parts for two years.

# 5 SPECIFICATIONS

| | 12-Place Horizontal Rotor (7786024) | 12-Place Performance Plus Rotor (7786010) |
|---|---|---|
| Maximum Speed | 4000 rpm | 5000 rpm |
| Maximum RCF | 2900 xg | 3750 xg |
| Maximum Capacity | Twelve 17x125mm Tubes | Twelve 17x100mm Tubes |
| Dimensions (in) | 9.0 (H) x 12.5 (W) x 14.75 (L) | 9.0 (H) x 12.5 (W) x 14.75 (L) |
| Environmental Operating Range | 2-40 deg C | 2-40 deg C |
| Typical Noise Level (At Maximum Speed) | < 70 dB A | < 70 dB A |
| Electrical Ratings | | |
| 115VAC Version | 115VAC (+/- 10V) | 115VAC (+/- 10V) |
| 230VAC Version | 230VAC (+/- 20V) | 230VAC (+/- 20V) |

# 6 TROUBLESHOOTING

| PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| The lid does not open. | No Power | Check removable line cord |
| | No Power | Check circuit breaker on underside of centrifuge. |
| | No Power | Check wall outlet |
| | Lid knob is ajar | Rotate the lid knob fully clockwise before pressing the 'OPEN' button |
| | Lid lock is active (Unlock timed out) | Press the 'OPEN' button to de-activate the lid |
| | Lid tray is unplugged from PCB or defective | Requires service |
| | PCB is damaged | Requires service |
| | | To gain access to the rotor - Remove the 'OPEN/CLOSE' sticker and slide the lid latch lever toward the front of the centrifuge. This will unlock the lid. |

| PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Excessive vibration | Rotor improperly loaded | Load equally filled tubes symmetrically in the rotor. All carriers and/or tube holders must be present in the rotor, whether loaded, or empty. |
| | Debris lodged within the rotor or tube carriers | Carefully inspect all rotor pockets, tube holders and crevasses for debris. |
| | Centrifuge housing is loose | Requires service |
| | Missing/damaged feet | Requires service |
| | Motor failure | Requires service |
| | Rotor damaged | Replacement required |

| PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Rotor does not spin | No Power | Check removable line cord |
| | No Power | Check circuit breaker on underside of centrifuge. |
| | No Power | Check wall outlet |
| | Lid not properly latched | Press down firmly on lid and rotate lid knob clockwise until the 'LATCHED' light illuminates. |
| | Internal connection failure | Requires service |
| | PCB failure | Requires service |
| | Motor Failure | Requires service |

| PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Clicking noise during braking | Rotor is loose | Tighten rotor screw per section 7-2 |

| PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Whistling noise while running | Debris in air intake / exhaust ports | Remove power before clearing debris. |
| | Gasket failure | Requires service |

| PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Error message is displayed | | |
| 'OVRSPD' | Rotor speed is too great - Internal error | Service required |
| 'SPEED' | Rotor Speed is under set speed for too long. | Check power supply |
| | Rotor Speed is under set speed for too long. | Check rotor – Missing carriers can reduce rotor speed in some models. All carriers must be installed whether full or empty. |
| | Rotor Speed is under set speed for too long. | Check the lid and guard bowl gaskets. Voids in the rotor chamber gaskets change the airflow, resulting in increased stress on the motor drive. |
| | Rotor speed is over set speed for too long | Service required |
| 'BALANC' | Rotor improperly loaded | Load equally filled tubes symmetrically in the rotor. All carriers and/or tube holders must be present in the rotor, whether loaded, or empty. |
| | Debris lodged within the rotor or tube carriers | Carefully inspect all rotor pockets, tube holders and crevasses for debris. |
| | Rotor damaged | Replacement required |
| 'ROTOR' | Software selection of rotor is unknown | Service Required – Call Drucker technical service. |

# 7 SERVICE INSTRUCTIONS

## 7.1 Cleaning

a) The cabinet, rotor top and accessories shall be thoroughly cleaned using soap and water, isopropyl alcohol, or a mild bleach solution.

b) Under no circumstances should any of the following be used: Fully/Partially Halogenated Hydrocarbons, Ketones and Esters.

c) Use of any chemicals not prescribed by the manufacturer may cause damage to the rotor and tube carriers / holders and shall not be used.

## 7.2 Removing the Rotor

a) Use a 5/32” hex key to loosen the center rotor screw (turn counter-clockwise).

b) Lift the rotor straight up and out of the rotor chamber.

c) To install the rotor, reverse steps A and B above. Take care to align the hub spines and/or shaft cross pin with the rotor hub. Tighten the rotor screw by hand until snug. Complete the installation by tightening the screw an additional ¼ turn.

## 7.3 Maintaining the Rotor

a) Keep the rotor clean, any corrosive materials must not be allowed contact with the rotor and should be cleaned immediately.

b) The rotor should be checked periodically for signs of wear.

c) Remove the rotor from service if any of the following are found: cracks, deep scratches, corrosion or discoloring.

## 7.4 Rotor Screw

a) If the rotor screw needs to be tightened, use a 5/32” hex key and tighten it by hand until snug, continuing an additional ¼ turn to achieve sufficient torque.

## 7.5 Speed Calibration

a) Check the centrifuge speed periodically, we recommend every two years.

b) Important: When verifying rotor speed, make certain that all carriers are installed in the rotor.

c) No calibration adjustment of speed can be made, only a verification of rotor speed.

## 7.6 Line Leakage

a) Check the centrifuge’s line leakage periodically, we recommend every two years.

b) All Drucker centrifuges currently manufactured are classified as “laboratory equipment”, per the requirements of UL 61010-1 Electrical Equipment for Measurement, Control and Laboratory Use; Part 1: General Requirements. This standard specifies that the maximum current levels between any accessible parts are as follows:

c) In normal condition the maximum current flow between accessible parts is 0.5mA RMS for sinusoidal waveforms, 0.7mA peak for non-sinusoidal waveforms or mixed frequencies, or 2mA DC.

d) In single fault condition the maximum current flow between accessible parts is 3.5mA RMS for sinusoidal waveforms, 5mA peak for non-sinusoidal waveforms or mixed frequencies, or 15mA DC.

7.7 Ground continuity

a) Check the centrifuge's ground continuity periodically, we recommend every two years.

b) Disconnect the manufacturer's supplied power cord from the power supply.

c) Measure the resistance between the ground tab of the line cord and an exposed, clean, unpainted metal surface contiguous to the chassis main frame.

d) The maximum acceptable ground resistance is 0.1 Ohms.

7.8 Removing the Cabinet (Upper Housing)

a) There are eight screws that fasten the centrifuge cabinet to the base.

b) Begin by unplugging the centrifuge, and waiting 10 minutes for internal voltages to dissipate.

c) Use a #2 Phillips screwdriver to remove the cabinet screws (three on left and right sides, two in the rear)

d) The cabinet control panel is attached to the base internally with cable harnesses. Be careful not to stress the cables when removing the cabinet.

e) Stand directly in front of the centrifuge and lift the cabinet straight up and off the base, setting it down on its right side.

f) Gently remove the power supply and motor harnesses from the PCB.

a) Use a Volt meter to measure the DC voltage across the power supply capacitor.

**IMPORTANT: Do not continue until the voltage is below 0.5 V DC. See fig 4**


Fig 4

b) Once the voltage is below 0.5 V DC short the capacitor with a screwdriver. See fig 5

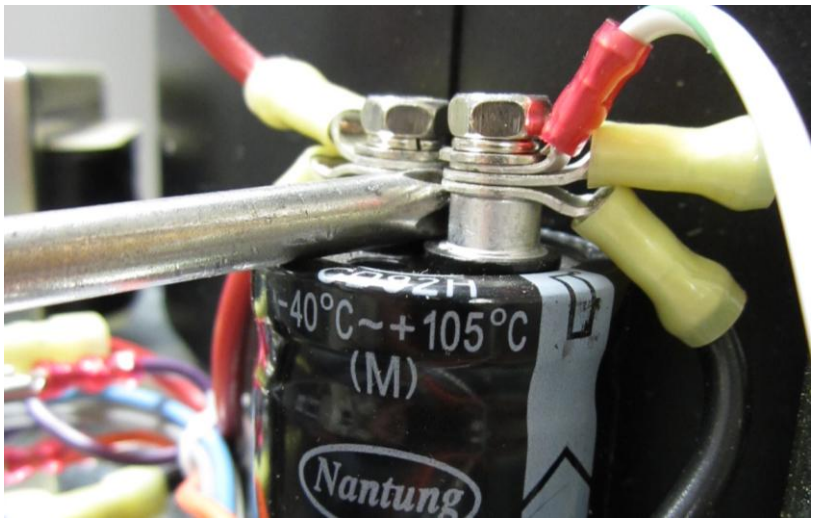



Fig 5

c) Service may continue once the capacitor is drained.

## 7.9 Replacing the Lid Tray Assembly

a) The lid tray assembly is accessible once the cabinet has been removed.

b) Gently remove the lid tray wire harness from the PCB.

c) The lid tray assembly is held in place with two #6 Nylok nuts. Use a 5/16” nut driver to remove the nuts. The tray will slide off the threaded studs.

d) Early models used a plastic spacer between the tray assembly and the metal cabinet. A spacer is no longer needed. **IMPORTANT: Remove any plastic spacer that may be present.**

e) To install the lid tray, slide it onto the studs, and secure it with two #6 Nylok nuts, hand tight.

f) Complete the installation by gently plugging the wire harness into the PCB header ‘J4’. The header and connector are keyed for proper orientation.

## 7.10 Replacing the PCB

a) The PCB is accessible once the cabinet has been removed. Make certain that all wire harnesses have been disconnected. Use standard precautions for handling static sensitive components.

b) The PCB is held in place with nine #6 Nylok nuts and plastic insulator washers. Use a 5/16” nut driver to remove the nuts. The PCB and washers are now free to slide off the threaded studs.

c) Beneath the PCB are seven plastic standoffs. If they are crushed, replace them before reassembly.

d) To install the PCB, make certain that seven plastic standoffs and two rubber spacers are present on the control panel studs.

e) Slide the board onto the studs

f) Install seven plastic washers onto the studs securing the circuit card.

g) Install two conventional #6 washers onto the heat sink studs.

h) Important: Secure the heat sink side of the PCB first, and tighten the Nylok nuts until the stud protrudes past the Nylok Nut by only one thread.

i) Important: over tightening the PCB nuts will cause malfunction – Each nut sets the height of a separate control panel switch. Too low, and they cannot be actuated, too high and they jam against the front panel label, and are always in the 'ON' state.

j) The remaining 7 nuts should be tightened only until the buttons on the control panel click when pressed – do not over tighten. Each nut sets the height of a separate control panel button. Tighten each nut a ¼ turn in succession, trying each corresponding button as you go.

k) Once each control panel button clicks when pressed, installation is complete.

**IMPORTANT: Do not connect the power supply to the PCB yet. Follow the instructions in section 6.13**

7.11 Removing the motor

a) Remove the cabinet assembly by following 6.8

b) Cut and remove all wire harness zip ties.

c) Flip the base assembly up-side down and remove the three exhaust air channel screws with a #2 Phillips driver.

d) Set the exhaust cover aside

e) The guard bowl is held in place with six #8 screws. Remove them with a #2 Phillips driver.

f) Lift the base assembly off of the guard bowl and set it aside.

g) Flip the guard bowl.

h) The motor is held in place with 4 #8 Nylok nuts. Remove them with an 11/32" nut driver.

i) Slide the motor and motor gasket out of the guard bowl's motor well.

7.12 Replacing the motor

a) Make certain that a new gasket is used when installing a motor.

b) Locate the seam on the inside of the guard bowl wall.

c) Position the motor so its wires exit approx 180 deg away from the guard bowl seam.

d) Install the motor and gasket into the guard bowl with the wire harness positioned as described above.

e) Drive 4 #8 Nylok nuts onto the motor studs with an 11/32” nut driver.

f) Turn the guard bowl assembly upside down with the guard bowl seam facing you.

g) Place the base assembly (with transformers facing you) onto the guard bowl.

**h) IMPORTANT: Make certain that no wires are pinched between the guard bowl and base!**

**i) IMPORTANT: Tuck a portion of the motor wire harness into the rectangular cutout in the base. See fig 1.**

Figure 1

**j) IMPORTANT: Make certain that the base assembly wires are routed between the base and the threaded screw inserts. See fig 2.**

Figure 2

k) Fasten the guard bowl to the base with six each #8 screw, washer and lock washers.

l) Install the exhaust air cover with 3 each #8 screw, washer and lock washers. Make certain that the motor wire harness is contained within the cover's wire channel. See fig 3.

Fig 3

m) Replace the zip tie removed in 6.11

n) The lower assembly is complete.

7.13 Power Connections and Final Assembly

**IMPORTANT: These steps must be followed to avoid personal harm and to avoid damaging the PCB.**

d) Make certain that the lower assembly has been unplugged from the mains supply for at least 10 minutes.

e) Use a Volt meter to measure the DC voltage across the power supply capacitor.

**IMPORTANT: Do not continue until the voltage is below 0.5 V DC. See fig 4**


Fig 4

f) Once the voltage is below 0.5 V DC short the capacitor with a screwdriver. See fig 5

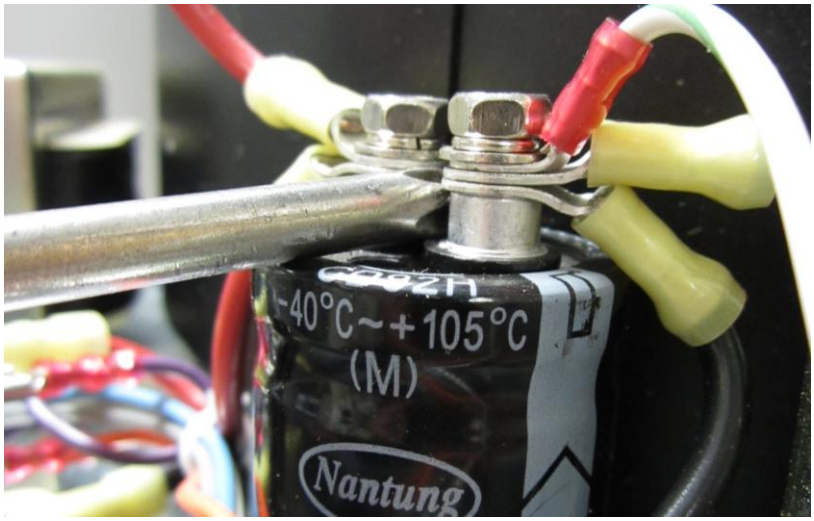



Fig 5

g) Connect the power leads to the PCB. The positive lead (red) goes to ‘J10’ Negative (black) lead goes to ‘J11’

h) Connect the two motor connectors to ‘J2’ and ‘J12’ on the PCB.

**IMPORTANT: Remove the screwdriver before continuing**

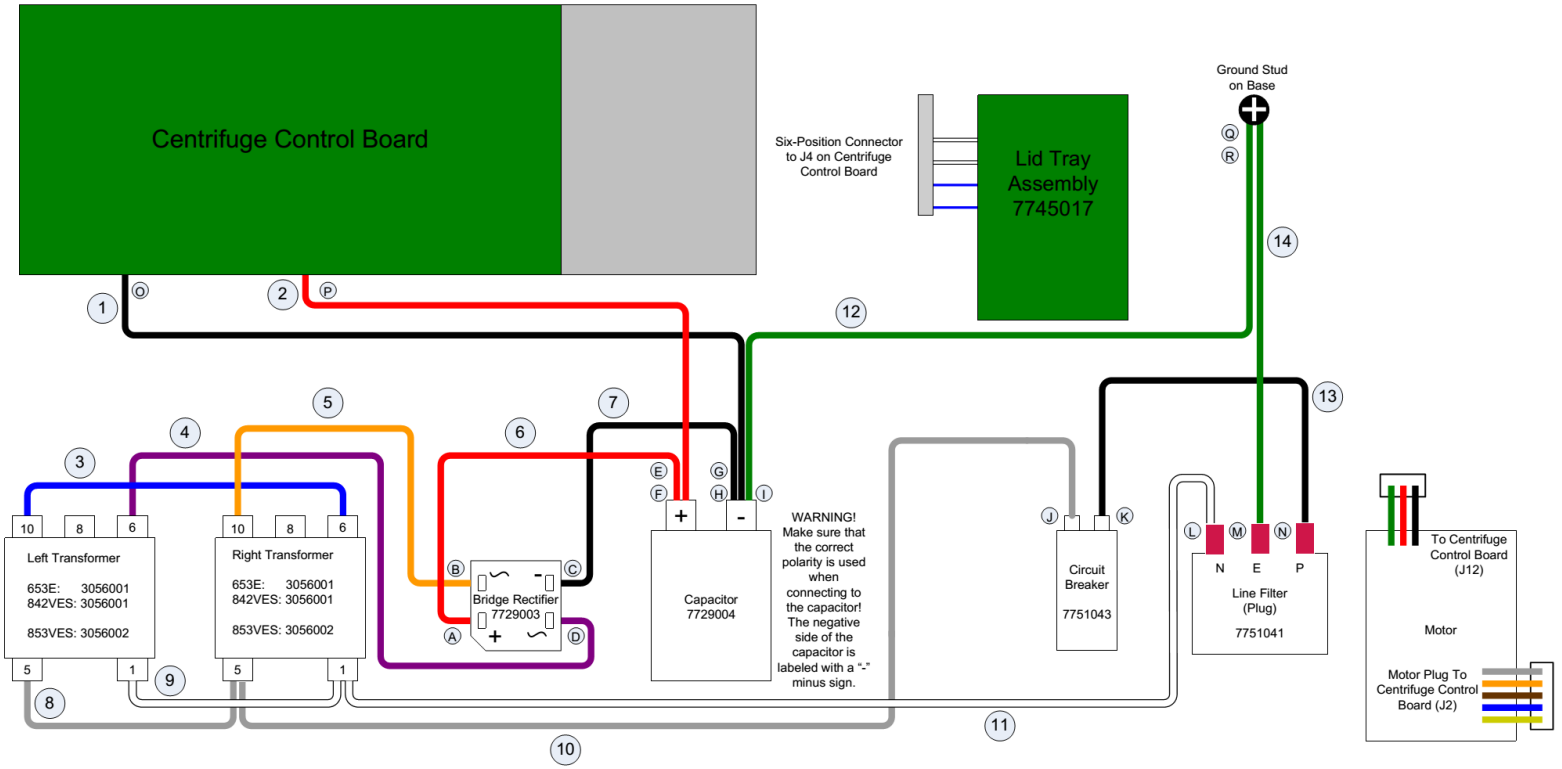
i) Carefully place the cabinet onto the base taking care not to pinch any wires between the two.

j) Complete the assembly by replacing the eight #8 screws, washers and lock washers with a #2 Phillips driver.

# 8 WIRING DIAGRAM (115V MODELS)

**WIRE IDENTIFICATION: TYPE AND LENGTH:**
1. 03-1-0005-0031 – 14 INCH
2. 03-1-0005-0032 – 14 INCH
3. 03-1-0005-0025 – 16 INCH
4. 03-1-0005-0065 – 8 INCH
5. 03-1-0005-0064 – 11 INCH
6. 03-1-0005-0032 – 4 INCH
7. 03-1-0005-0031 – 6 INCH
8. 03-1-0005-0030 – 14 INCH
9. 03-1-0005-0029 – 20 INCH
10. 03-1-0005-0030 – 20 INCH
11. 03-1-0005-0029 – 20 INCH
12. 03-1-0005-0028 – 19 INCH
13. 03-1-0005-0024 – 6 INCH
14. 03-1-0005-0028 – 6 INCH

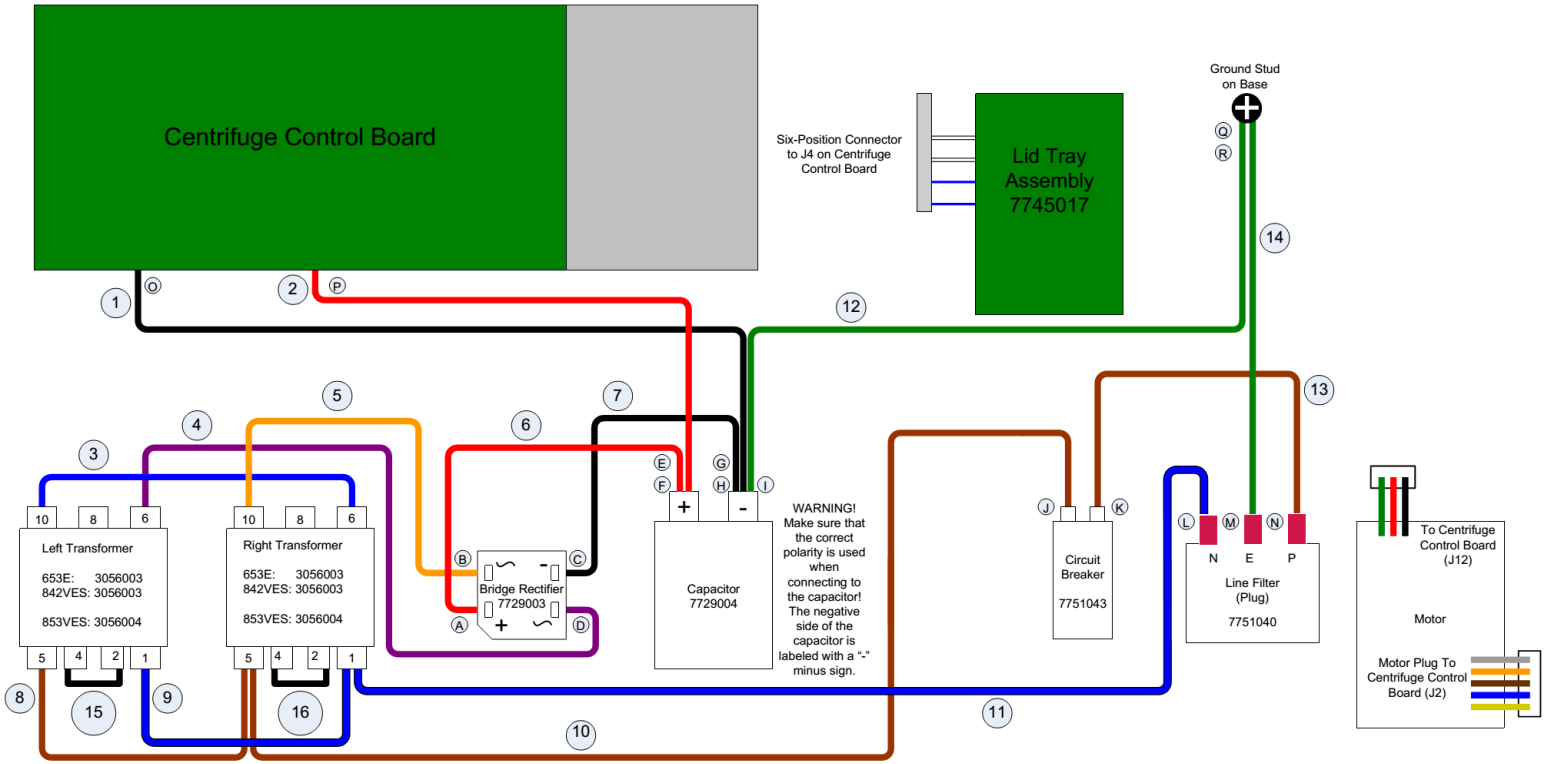
**CONNECTOR IDENTIFICATION:**
A. DISCONNECT, .25", FEMALE, YELLOW (3081016)
B. DISCONNECT, .125", FEMALE, RED (3081010)
C. DISCONNECT, .25", FEMALE, YELLOW (3081016)
D. DISCONNECT, .125", FEMALE, RED (3081010)
E. TERMINAL, RING, 12-10 AWG (3081011)
F. TERMINAL, RING, 12-10 AWG (3081011)
G. TERMINAL, RING, 12-10 AWG (3081011)
H. TERMINAL, RING, 12-10 AWG (3081011)
I. CONN RING TERM #6 14-16 AWG (03-1-0005-0017)
J. DISCONNECT, .25", FEMALE, RED (3081002)
K. DISCONNECT, .25", FEMALE, RED (3081002)
L. DISCONNECT, .25", FEMALE, YELLOW (3081016)
M. DISCONNECT, .25", FEMALE, RED (3081002)
N. DISCONNECT, .25", FEMALE, RED (3081002)
O. DISCONNECT, .25", FEMALE, YELLOW (3081016)
P. DISCONNECT, .25", FEMALE, YELLOW (3081016)
Q. CONN RING TERM #6 14-16 AWG (03-1-0005-0017)
R. CONN RING TERM #6 14-16 AWG (03-1-0005-0017)



# 9 WIRING DIAGRAM (230V MODELS)

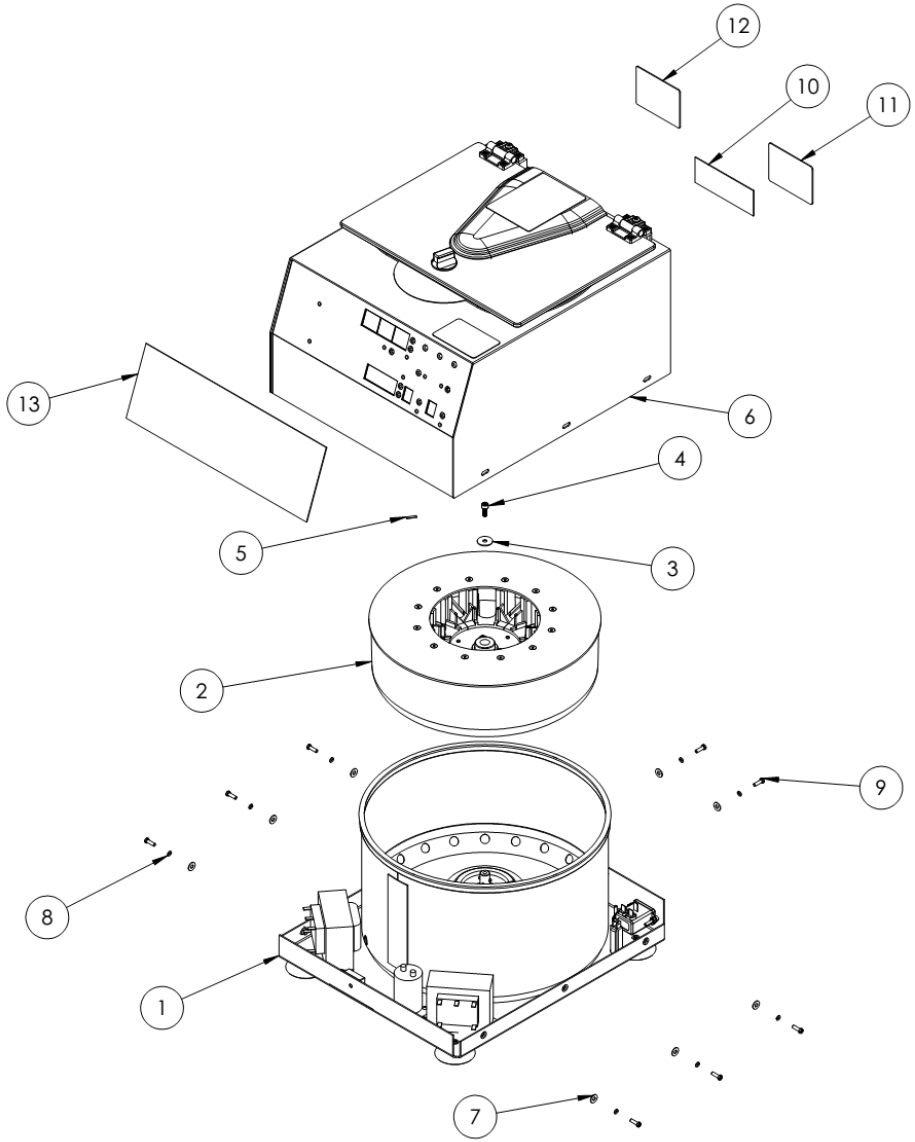
**WIRE IDENTIFICATION: TYPE AND LENGTH:**
1. 03-1-0005-0031 – 14 INCH
2. 03-1-0005-0032 – 14 INCH
3. 03-1-0005-0025 – 16 INCH
4. 03-1-0005-0065 – 8 INCH
5. 03-1-0005-0064 – 11 INCH
6. 03-1-0005-0032 – 4 INCH
7. 03-1-0005-0031 – 6 INCH
8. 03-1-0005-0037 – 14 INCH
9. 03-1-0005-0036 – 20 INCH
10. 03-1-0005-0037 – 20 INCH
11. 03-1-0005-0036 – 20 INCH
12. 03-1-0005-0028 – 19 INCH
13. 03-1-0005-0037 – 6 INCH
14. 03-1-0005-0028 – 6 INCH
15. 03-1-0005-0033 – 2 INCH
16. 03-1-0005-0033 – 2 INCH

**CONNECTOR IDENTIFICATION:**
A. DISCONNECT, .25", FEMALE, YELLOW (3081016)
B. DISCONNECT, .125", FEMALE, RED (3081010)
C. DISCONNECT, .25", FEMALE, YELLOW (3081016)
D. DISCONNECT, .125", FEMALE, RED (3081010)
E. TERMINAL, RING, 12-10 AWG (3081011)
F. TERMINAL, RING, 12-10 AWG (3081011)
G. TERMINAL, RING, 12-10 AWG (3081011)
H. TERMINAL, RING, 12-10 AWG (3081011)
I. CONN RING TERM #6 14-16 AWG (03-1-0005-0017)
J. DISCONNECT, .25", FEMALE, RED (3081002)
K. DISCONNECT, .25", FEMALE, RED (3081002)
L. DISCONNECT, .25", FEMALE, RED (3081002)
M. DISCONNECT, .25", FEMALE, RED (3081002)
N. DISCONNECT, .25", FEMALE, RED (3081002)
O. DISCONNECT, .25", FEMALE, YELLOW (3081016)
P. DISCONNECT, .25", FEMALE, YELLOW (3081016)
Q. CONN RING TERM #6 14-16 AWG (03-1-0005-0017)
R. CONN RING TERM #6 14-16 AWG (03-1-0005-0017)



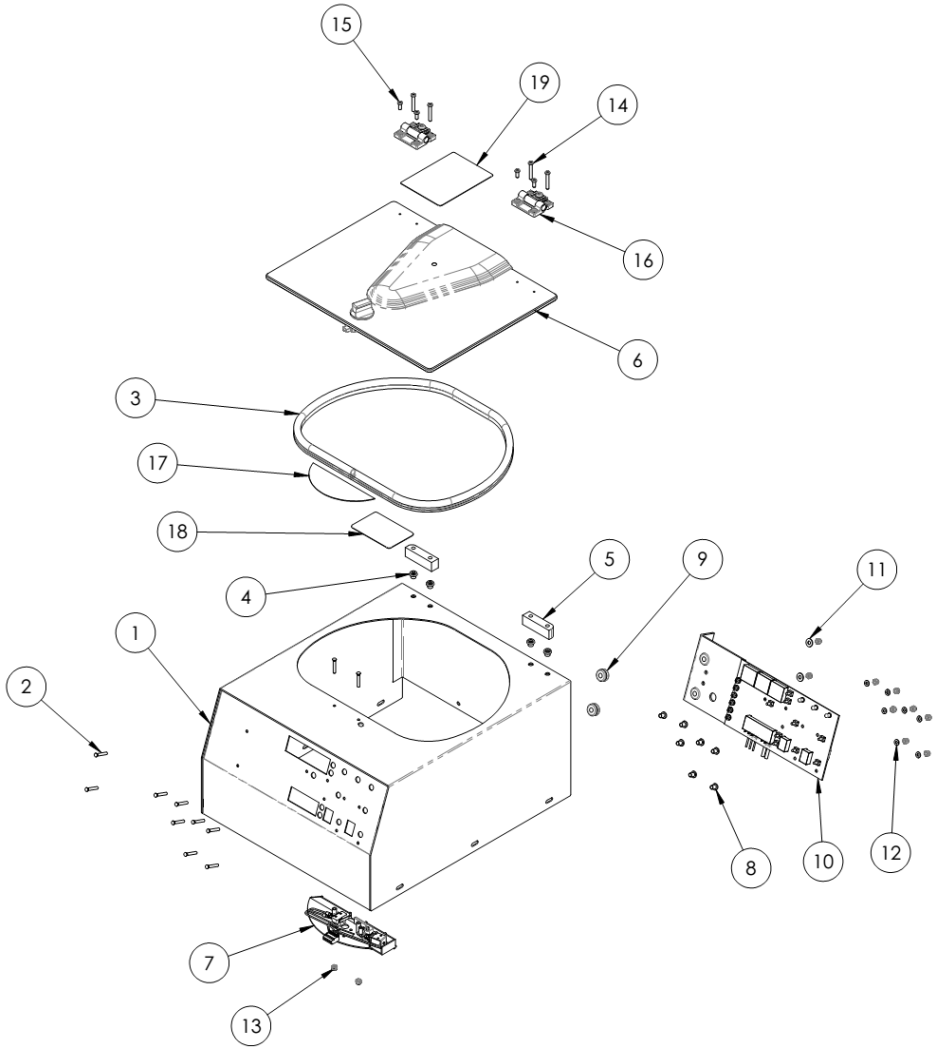
# 10 FINAL CENTRIFUGE ASSEMBLY

| ITEM NO. | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | OEM SPECIFIC | 853VES BASE ASSEMBLY | 1 |
| 2 | 7786010 | 853VES PERFORMANCE PLUS ROTOR ASSEMBLY | 1 |
| 3 | 3033016 | WASHER | 1 |
| 4 | 3012033 | SCREW, 10-32 X 1/2, SHCS | 1 |
| 5 | 3000002 | TAPE, REFLECTIVE, RPM CHECK | 1 |
| 6 | OEM SPECIFIC | 853VES CABINET & LID ASSEMBLY | 1 |
| 7 | 3033003 | WASHER #8, FLAT, SILVER | 8 |
| 8 | 3033001 | #8 SPLIT LOCK WASHER | 8 |
| 9 | 3012007 | SCREW, PHILLIPS, 8-32, 0.50 LONG | 8 |
| 10 | 7724026 | SERIAL NUMBER | 1 |
| 11 | OEM SPECIFIC | FACTORY CALIBRATION LABEL | 1 |
| 12 | OEM SPECIFIC | CARRIER REPLACEMENT LABEL | 1 |
| 13 | OEM SPECIFIC | 853VES FRONT PANEL LABEL | 1 |



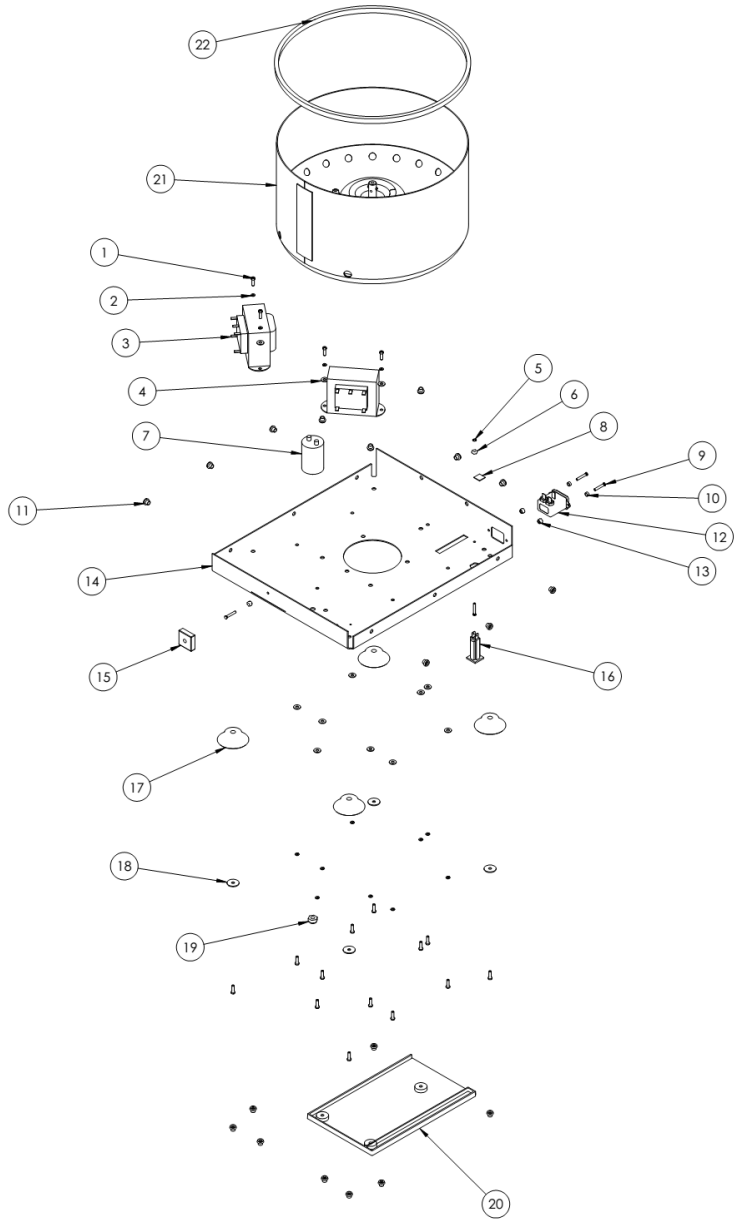
# 11 CABINET ASSEMBLY

| ITEM NO. | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | 7710182 | 853VES CABINET, POWDER COATED | 1 |
| 2 | 3051001 | STUD, 6-32 x 7/8 | 11 |
| 3 | 7732018 | MOTOR WELL GASKET | 1 |
| 4 | 3023001 | NUT INSERT, 8-32 THREAD | 4 |
| 5 | 7713003 | HINGE SPACER | 2 |
| 6 | 02-002-1-0006 | 853VES LID ASSEMBLY | 1 |
| 7 | 7745017 | 642/755 LID TRAY ASSEMBLY | 1 |
| 8 | 3003002 | STANDOFF, .320 x .203, 642 BOARD MOUNT | 7 |
| 9 | 7728102 | 755 GROMMET, HEAT SINK MOUNT | 2 |
| 10 | 7717041 | VES PCB ASSEMBLY | 1 |
| 11 | 3033003 | WASHER #8, FLAT, SILVER | 2 |
| 12 | 3033002 | WASHER, # 6 FLAT NYLON, WHITE | 7 |
| 13 | 3022002 | NUT, 6.32, NYLOK, SILVER | 11 |
| 14 | 3012009 | SCREW, 8.32 x 1.00, PAN HEAD, PHILLIPS, SILVER | 4 |
| 15 | 3012004 | SCREW, #6 x .375, PH/PHIL, SELF TAP, BLUNT, SILVER | 4 |
| 16 | 7724071 | FRICTION HINGE | 2 |
| 17 | OEM SPECIFIC | LABEL, OPEN/CLOSE | 1 |
| 18 | OEM SPECIFIC | UNLOCKING INSTRUCTION LABEL | 1 |
| 19 | OEM SPECIFIC | LABEL, STOP | 1 |



# 12 LOWER ASSEMBLY

| ITEM NO. | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | 3012007 | SCREW, PHILLIPS, 8-32, 0.50 LONG | 17 |
| 2 | 3033001 | #8 SPLIT LOCK WASHER | 13 |
| *3 | *3056002 | *853VES TRANSFORMER, 115V to 16V | 2 |
| **3 | **3056004 | **853VES TRANSFORMER, 230V to 16V | 2 |
| 4 | 3033003 | WASHER #8, FLAT, SILVER | 13 |
| 5 | 3033005 | WASHER, #6, INTERNAL TOOTH | 1 |
| 6 | 3021001 | NUT, 6-32 HEX SILVER | 1 |
| 7 | 7729004 | 853VES/853VES/755VES POWER SUPPLY CAPACITOR | 1 |
| 8 | 7724002 | LABEL, GROUND | 1 |
| 9 | 3051001 | STUD, 6-32 x 7/8 | 4 |
| 10 | 3003007 | SPACER, LINE FILTER, ALUMINUM | 2 |
| 11 | 3023001 | NUT INSERT, 8-32 THREAD | 19 |
| *12 | *7751041 | *LINE FILTER | 1 |
| **12 | **7751042 | **LINE FILTER 230V | 1 |
| 13 | 3022002 | NUT, 6.32, NYLOK, SILVER | 3 |
| 14 | 7710183 | 653/853 CENTRIFUGE BASE | 1 |
| 15 | 7729003 | 853VES/853VES/755VES BRIDGE RECTIFIER | 1 |
| 16 | 7751043 | BREAKER, 4A | 1 |
| 17 | 7724177 | SUCTION FOOT, BLACK NITRILE | 4 |
| 18 | 3033015 | FENDER WASHER | 4 |
| 19 | 3022005 | NUT, M8, NYLOK, SILVER | 1 |
| 20 | 7713027 | 614/642/643/755 EXHAUST AIR DEFLECTOR | 1 |
| 21 | 7710344 | GUARD BOWL/MOTOR MOUNT ASSEMBLY | 1 |
| 22 | 7732019 | ALL MODELS GASKET, ROTOR CHAMBER | 1 |

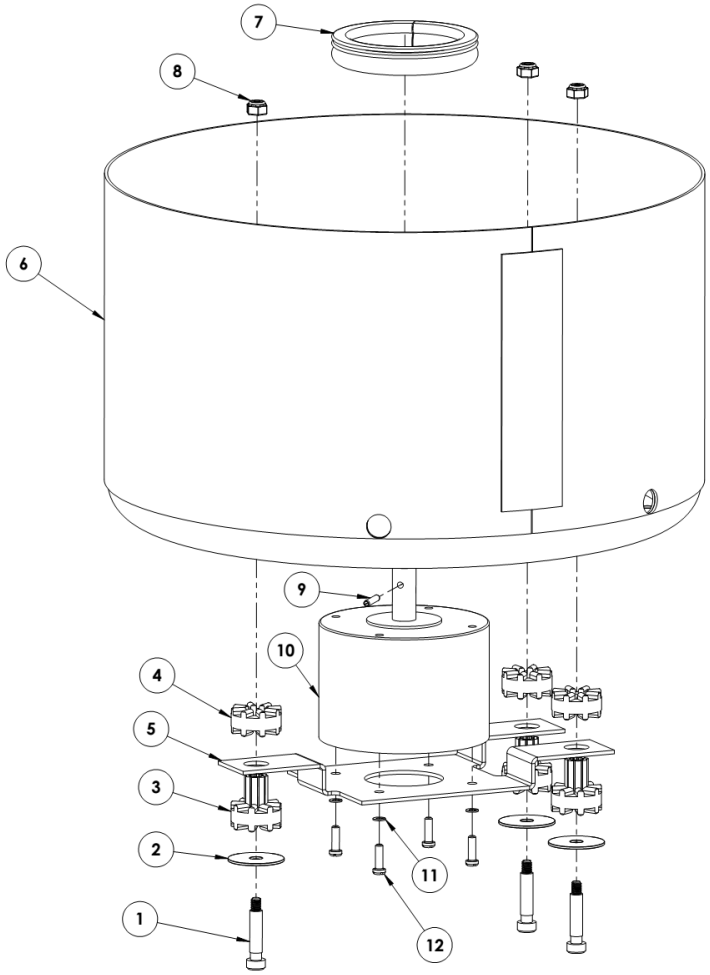



* ONLY USED IN 115V CENTRIFUGES

** ONLY USED IN 230V CENTRIFUGES

# 13 GUARD BOWL ASSEMBLY

| ITEM NO. | PART NUMBER | DESCRIPTION | QTY |
|---|---|---|---|
| 1 | 3012031 | SHOULDER BOLT, SOCKET HEAD, 10/32, 1.0" LONG | 3 |
| 2 | 3033019 | FENDER WASHER, 1.00" OD 17/64" ID 0.048 THK | 3 |
| 3 | 7710346 | ELASTOMER BUSHING | 3 |
| 4 | 7710347 | ELASTOMER GROMMET | 3 |
| 5 | 7710345 | SUSPENSION MOTOR MOUNT PLATE | 1 |
| 6 | 7710352 | 853 GUARD BOWL ASSEMBLY FOR MOTOR MOUNT | 1 |
| 7 | 7732018 | MOTOR WELL GASKET | 1 |
| 8 | 3022004 | 10/32 NYLOCK NUT | 3 |
| 9 | 3062003 | 1/8 x 5/8 ROLL PIN | 1 |
| 10 | 7735016 | 755/853 BLDC MOTOR | 1 |
| 11 | 3033001 | #8 SPLIT LOCK WASHER | 4 |
| 12 | 3012007 | SCREW, PHILLIPS, 8-32, 0.50 LONG | 4 |



# 14 REVISION HISTORY

| Revision # | Date | Details of Change |
|---|---|---|
| Original | 07/07/2013 | Original Issue - DR-2958. |
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