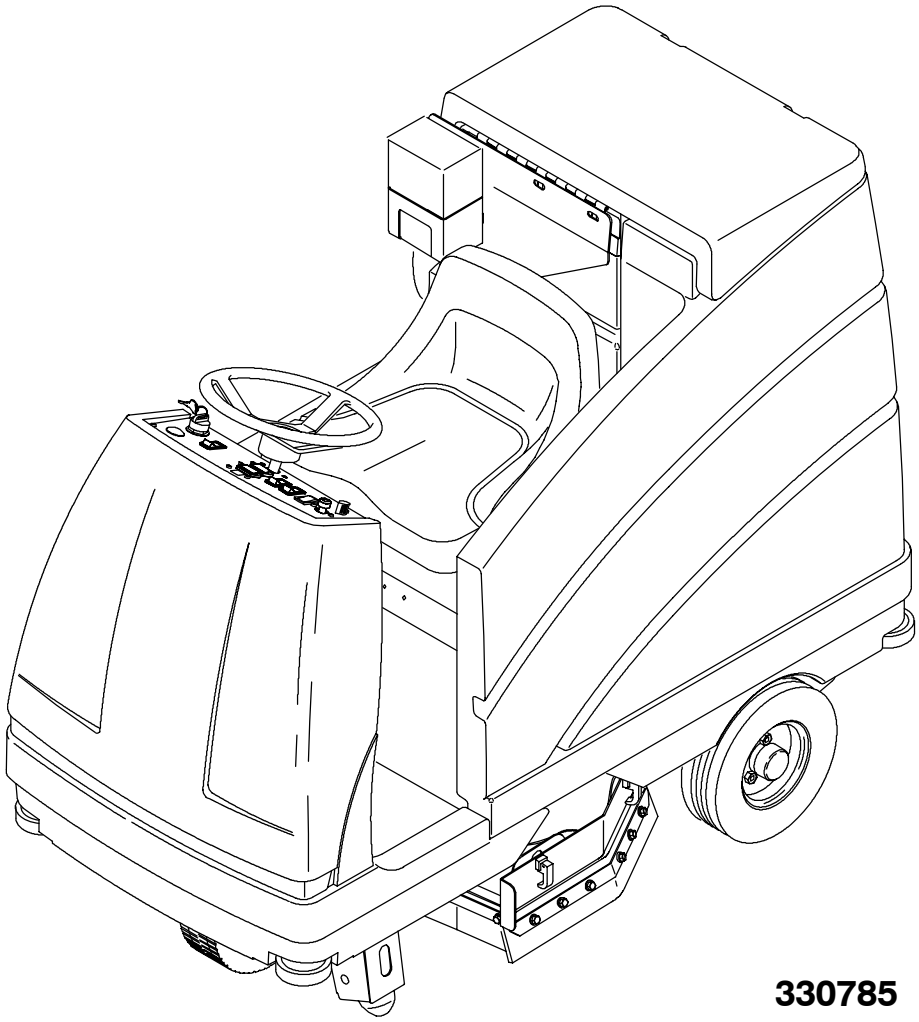
TENNANT

7080

Service Information

F.a.S.T.™
Foam Scrubbing Technology
Patents Pending

The safe scrubbing alternative ™



330785
Rev. 00

This manual provides service information for the TENNANT Model 7080.

This machine will provide excellent service. However, the best results will be obtained at minimum costs if:

- The machine is operated with reasonable care.
- The machine is maintained regularly – per the maintenance instructions provided.
- The machine is maintained with TENNANT supplied or equivalent parts.

Manual Number – 330785

Revision: 00

Published: 6–05

7080

ELECTRICAL

Troubleshooting Information

BEFORE CONDUCTING TESTS:

*** Read and Follow ALL Safety Warnings and Precautions in Operator's Manual**

*** Always use an ESD (Electrostatic Discharge) strap when working near the Control Board**

*** Be cautious when working near Control Board – *Battery voltage is always present, even with Key OFF***

*** Always unplug Battery Connector when removing or replacing components**

DURING TESTS:

*** Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action**

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

2005.05.11 7080ETI REV 00

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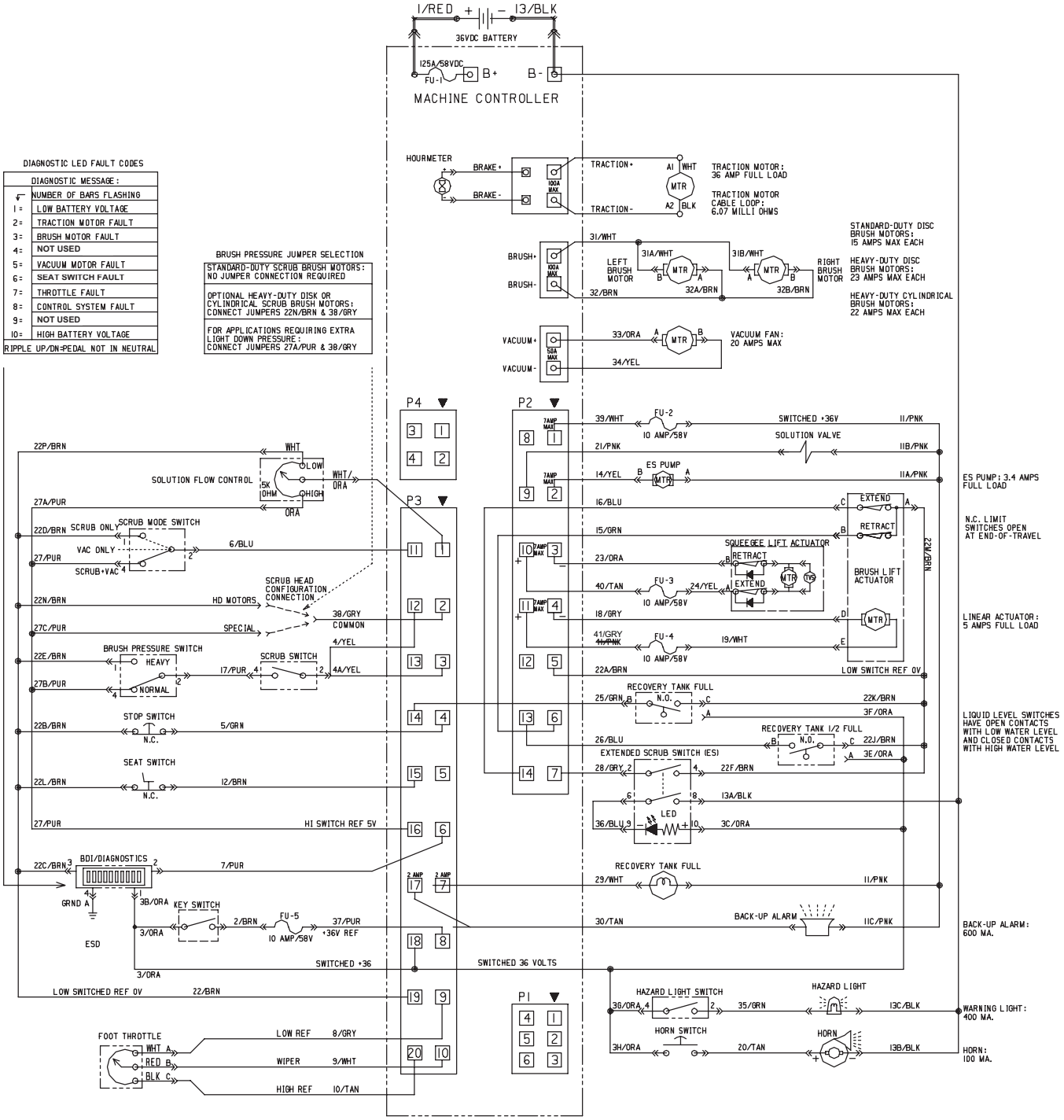
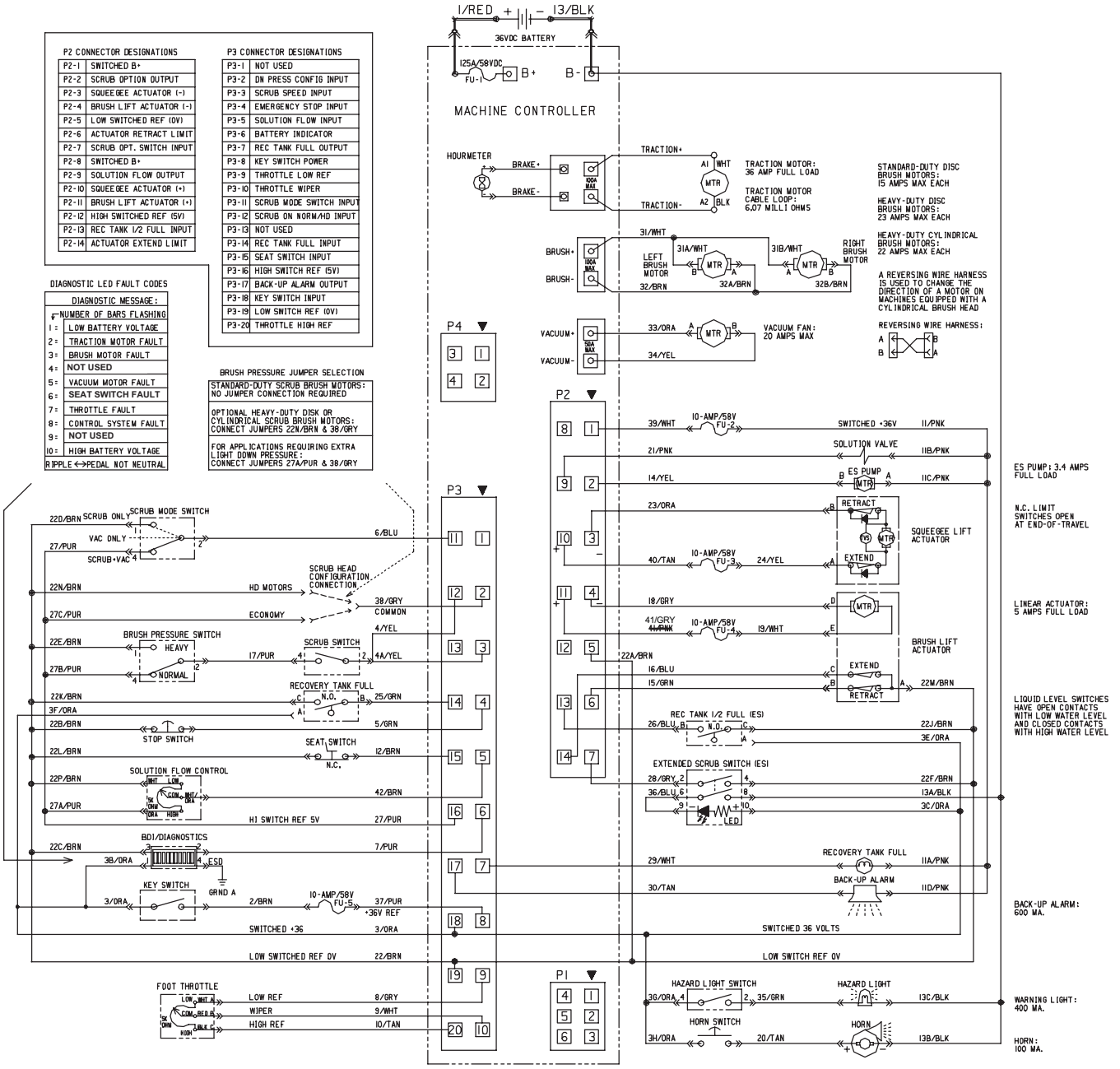
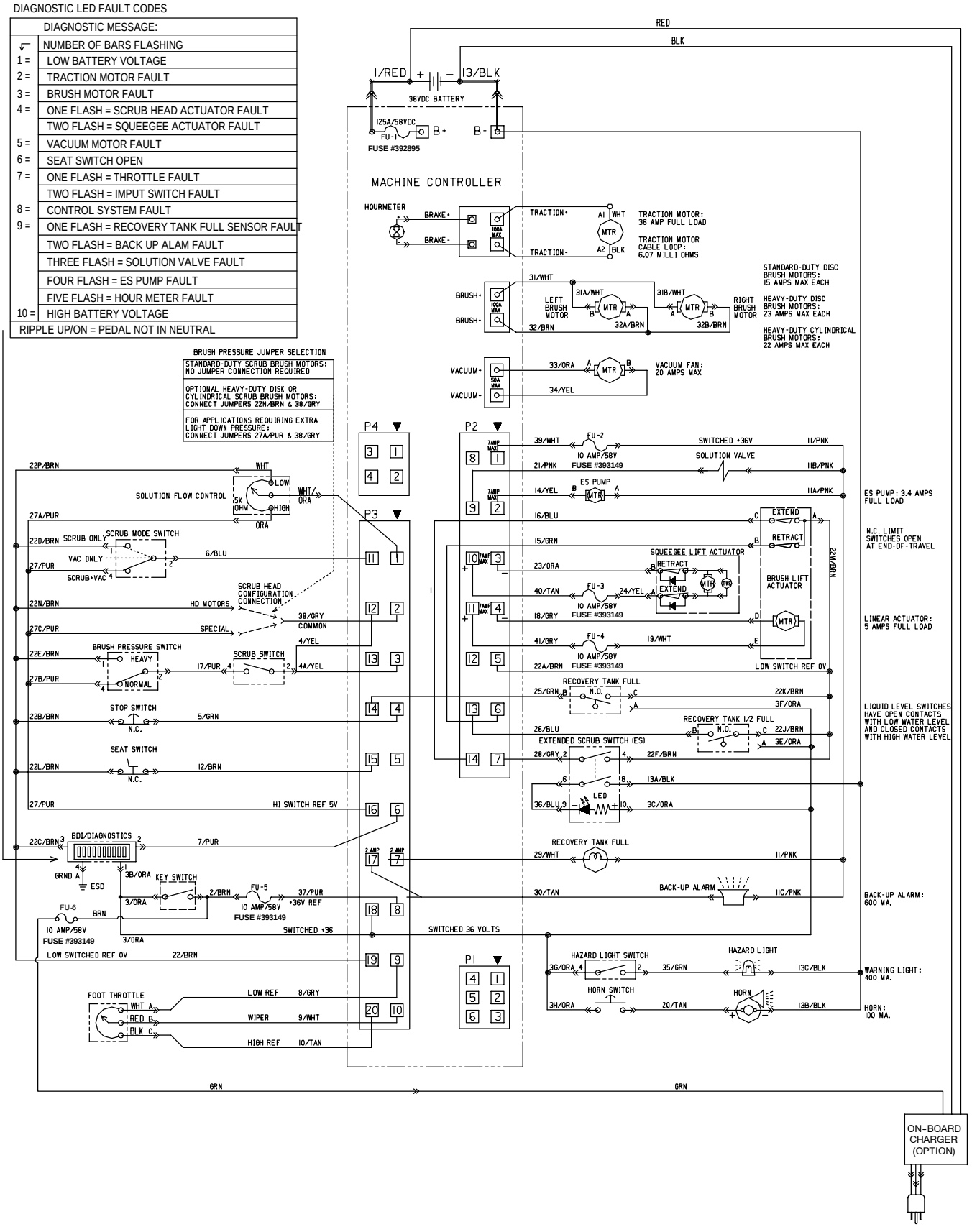
7080 Electrical Schematic (00000000-10143032)

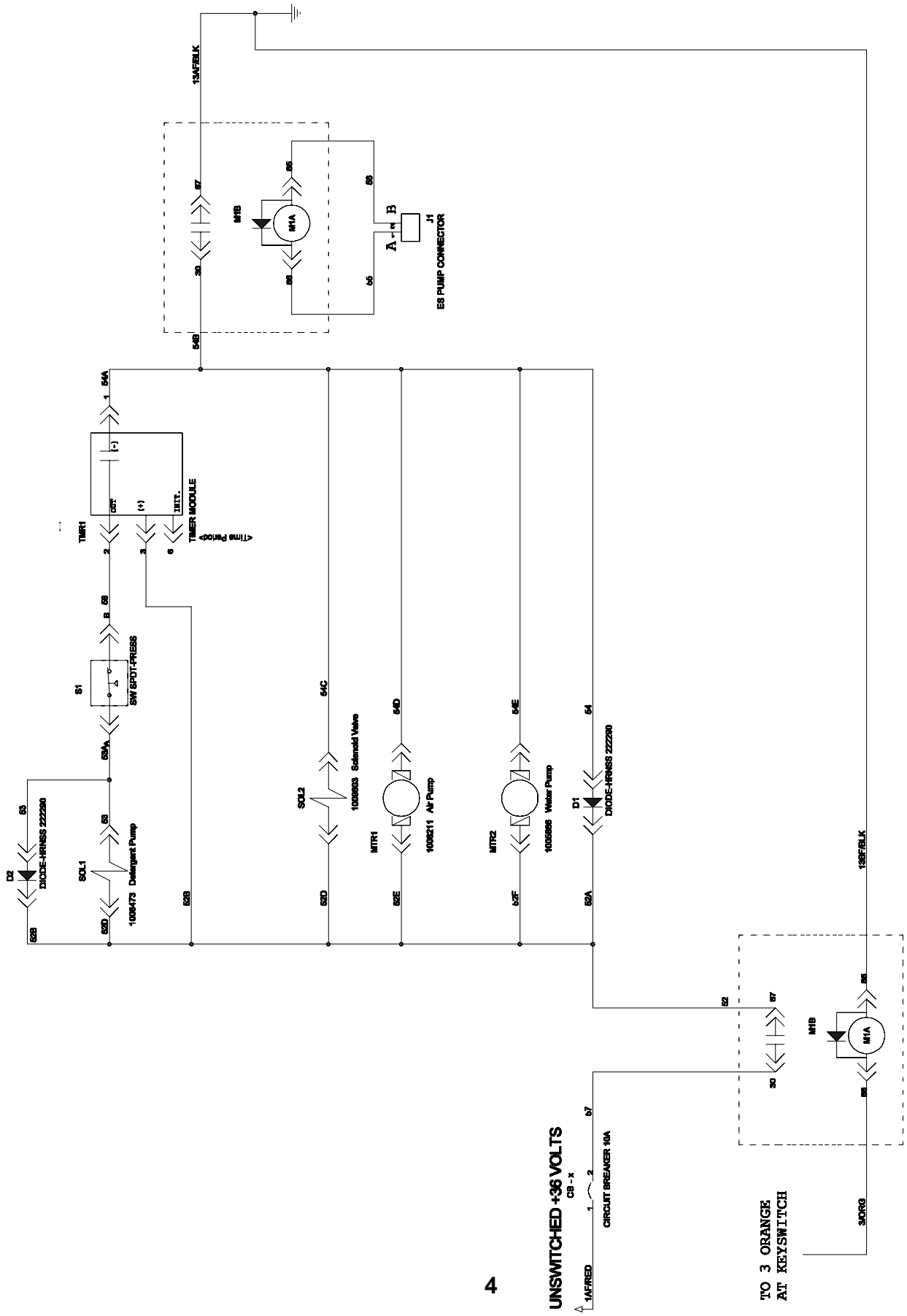


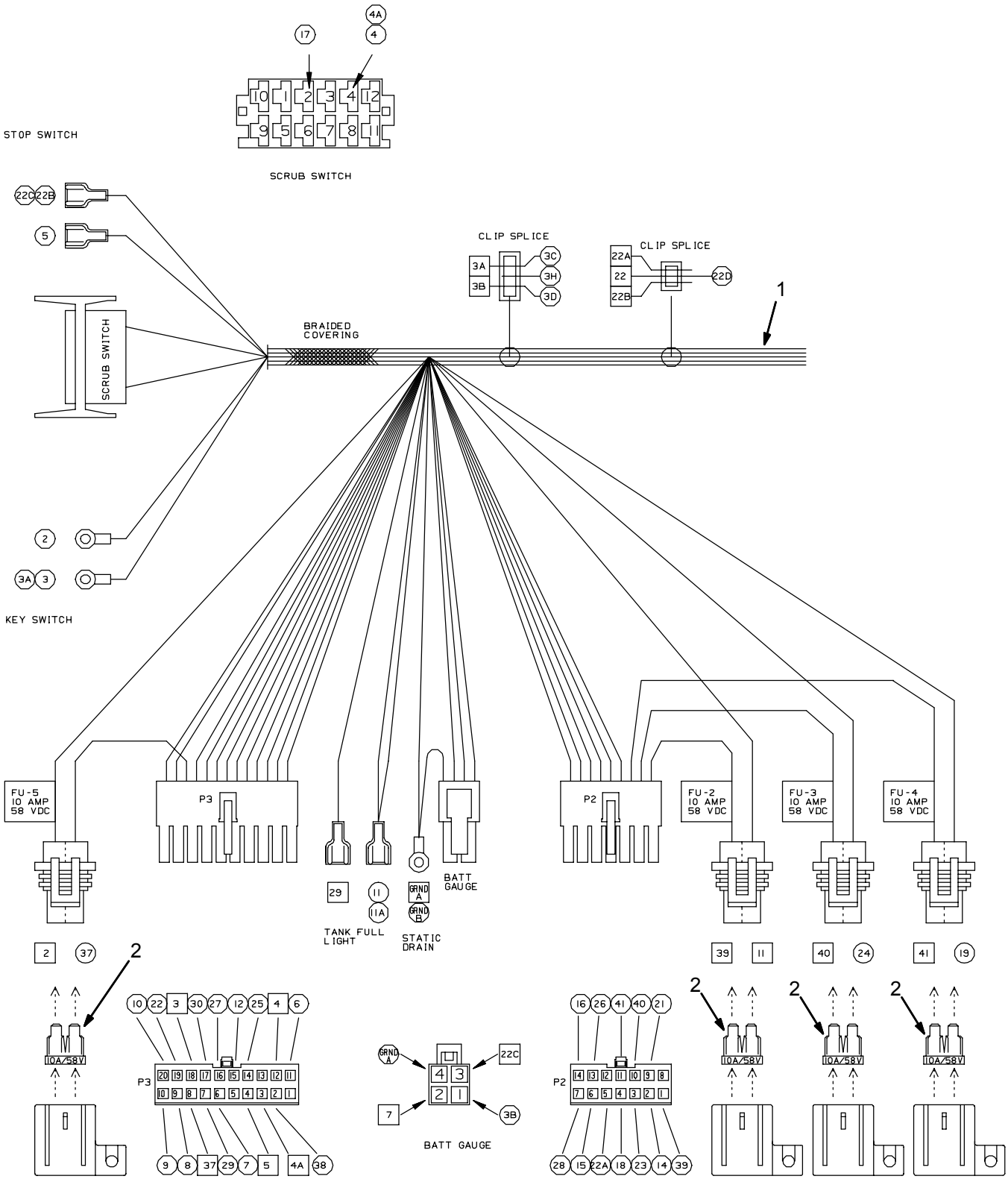
7080 Electrical Schematic (10143033-)

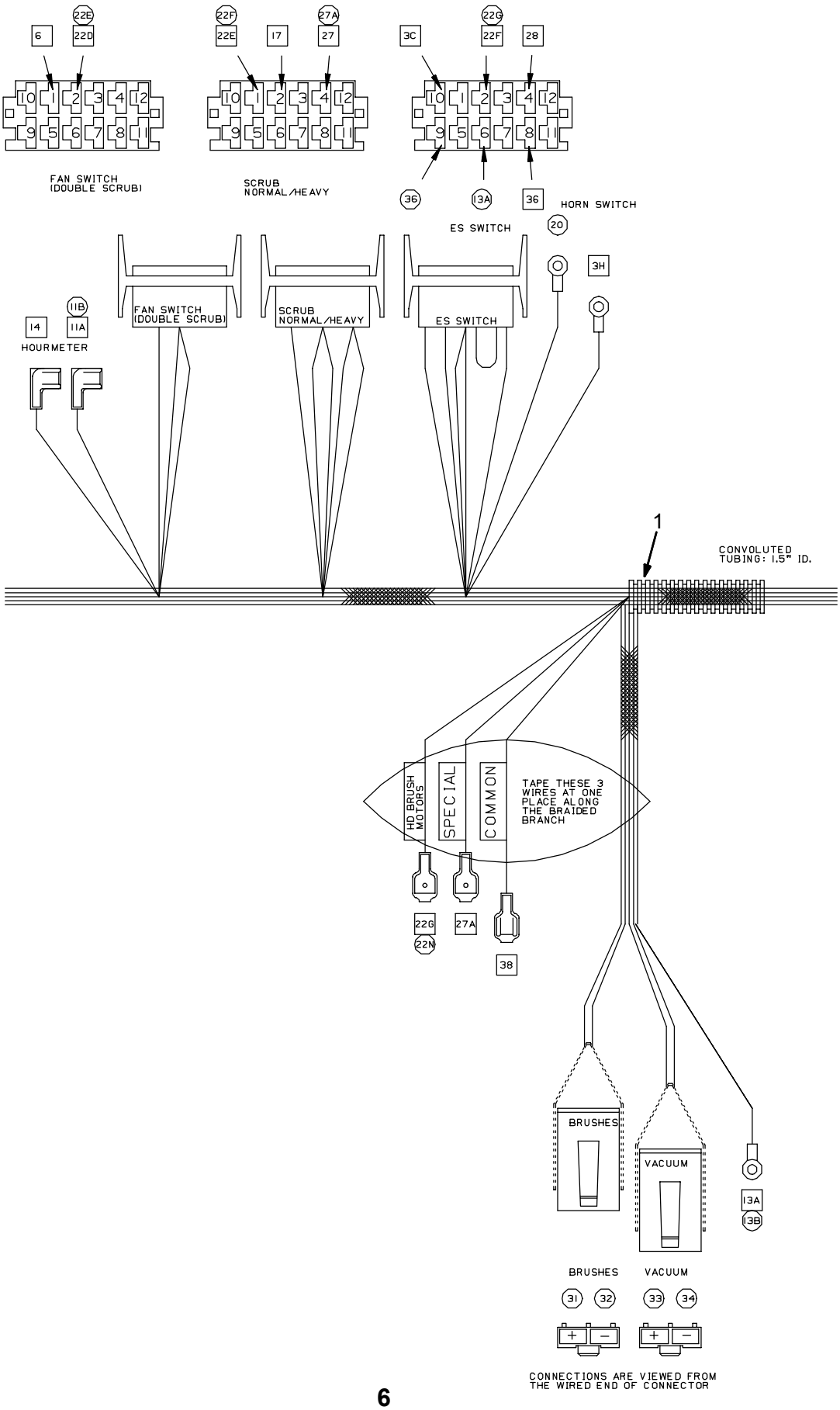


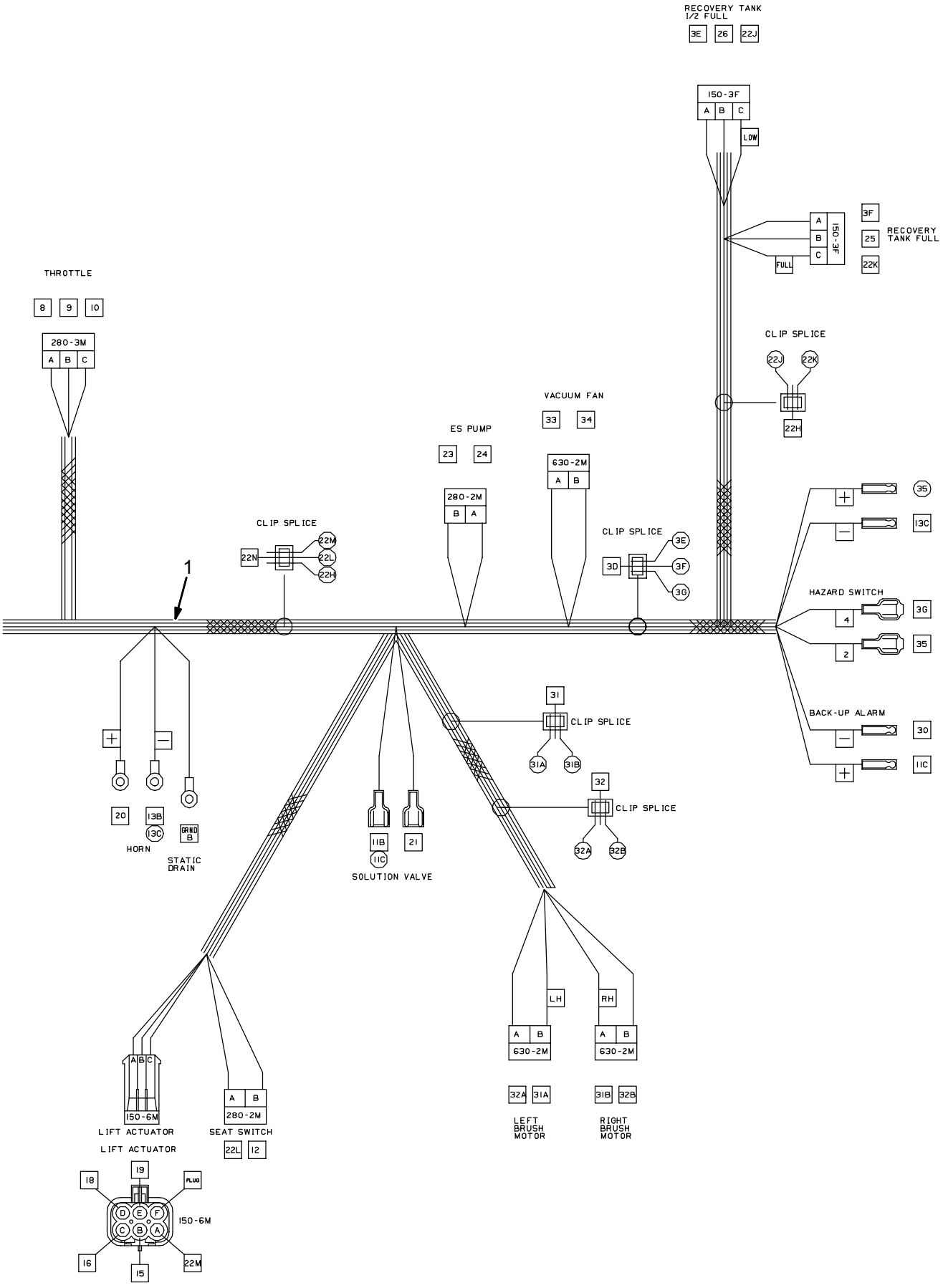
7080 Electrical Schematic for Models with Optional On-board Charger

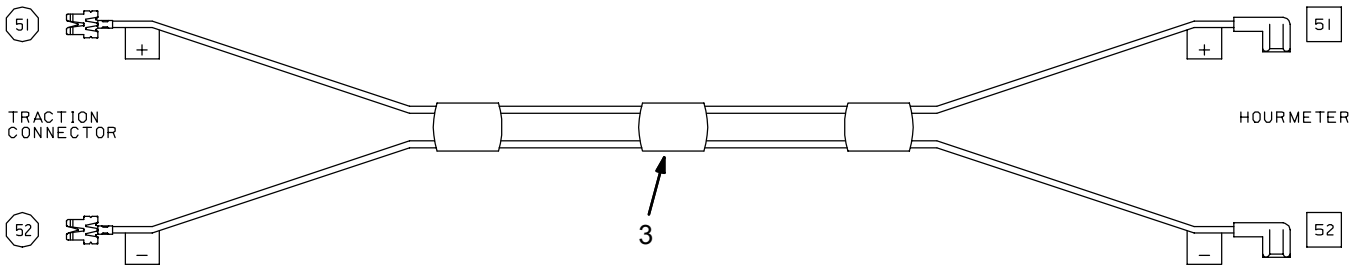


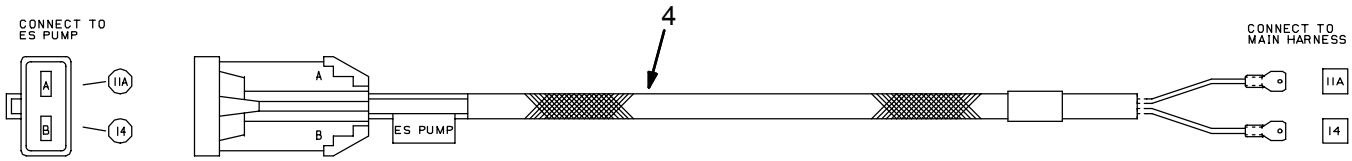

UNSWITCHED +36 VOLTS
CB - x
CIRCUIT BREAKER 10A
1AF/RED
TO 3 ORANGE
AT KEYSWITCH
3/ORG
13BF/BLK
13AF/BLK
M1B
M1A
ES PUMP CONNECTOR
J1
TIMER MODULE
TMR1
SW SPDT-PRESS
S1
Detergent Pump
SOL1
1006473
DIODE-HRNSS 222290
D2
Solenoid Valve
SOL2
1005803
Air Pump
MTR1
1006211
Water Pump
MTR2
1005866
D1
DIODE-HRNSS 222290

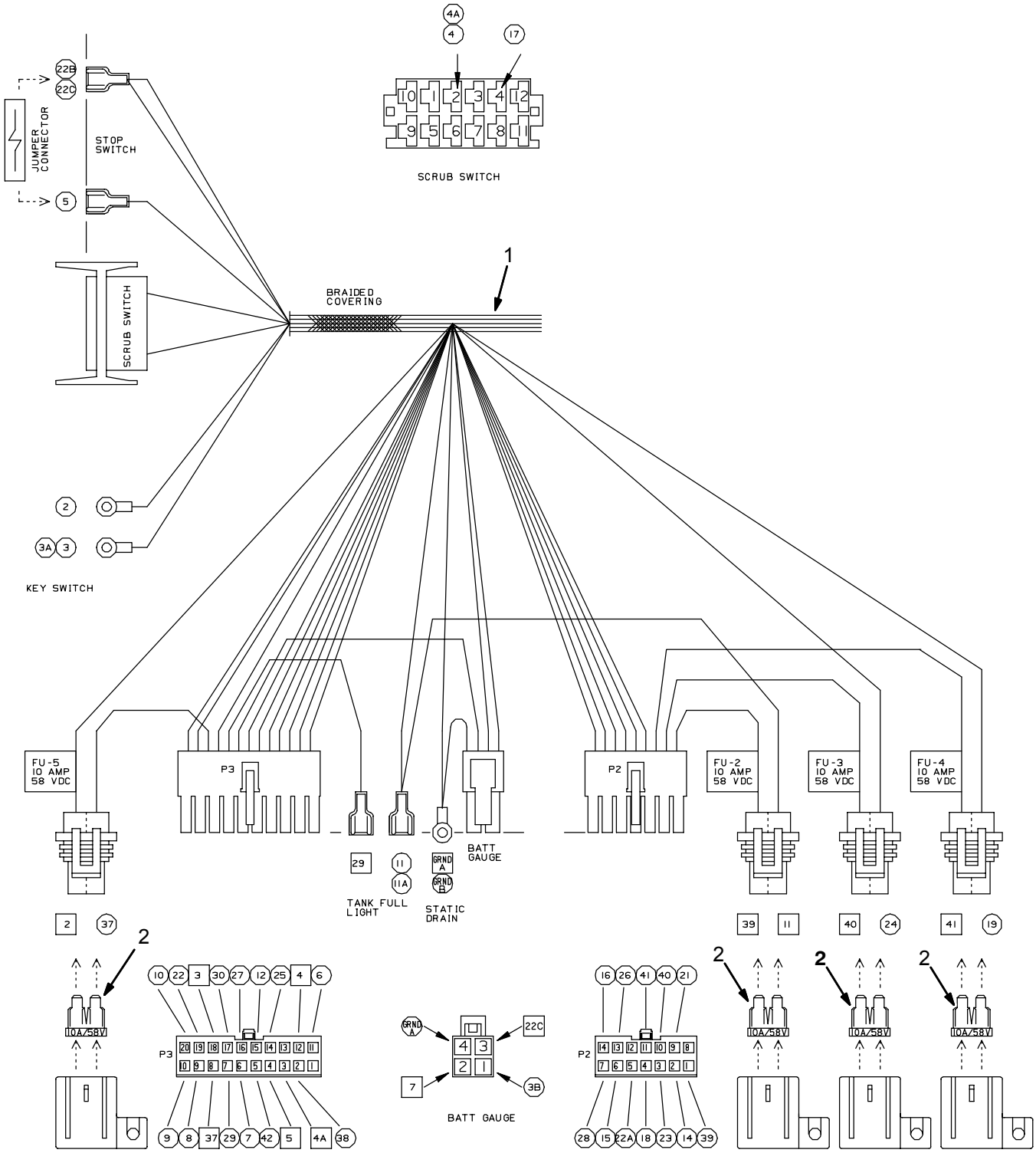

STOP SWITCH
SCRUB SWITCH
CLIP SPLICE
CLIP SPLICE
BRAIDED COVERING
SCRUB SWITCH
KEY SWITCH
FU-5 10 AMP 58 VDC
P3
P2
FU-2 10 AMP 58 VDC
FU-3 10 AMP 58 VDC
FU-4 10 AMP 58 VDC
BATT GAUGE
TANK FULL LIGHT
STATIC DRAIN
10A/58V
BATT GAUGE

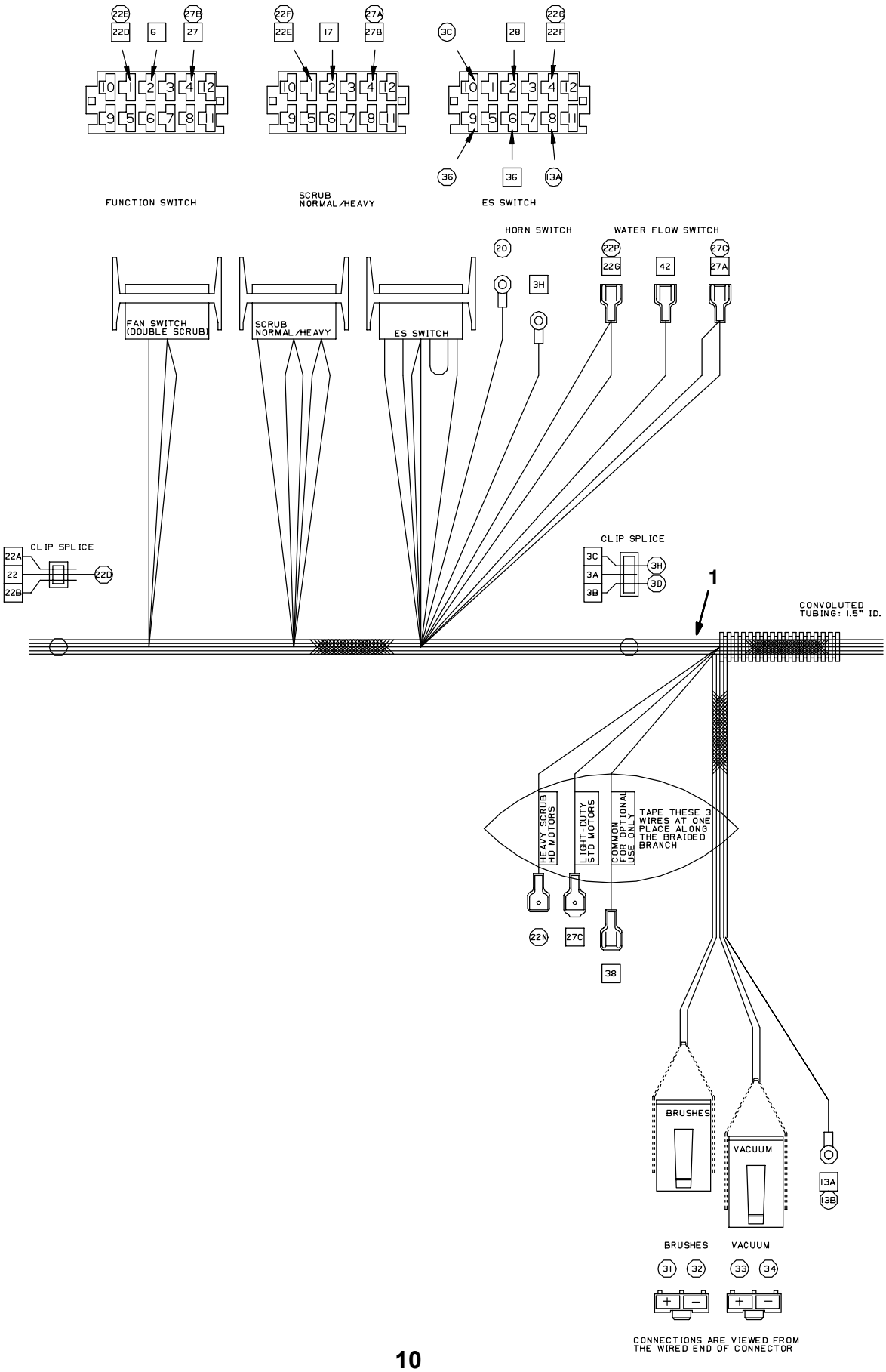

6
22E
22D
FAN SWITCH
(DOUBLE SCRUB)
22F
22E
17
27A
27
SCRUB
NORMAL/HEAVY
3C
22G
22F
28
36
13A
36
ES SWITCH
HORN SWITCH
20
3H
FAN SWITCH
(DOUBLE SCRUB)
SCRUB
NORMAL/HEAVY
ES SWITCH
14
11B
11A
HOURMETER
1
CONVOLUTED
TUBING: 1.5" ID.
HD BRUSH
MOTORS
SPECIAL
COMMON
TAPE THESE 3
WIRES AT ONE
PLACE ALONG
THE BRAIDED
BRANCH
22G
22N
27A
38
BRUSHES
VACUUM
13A
13B
BRUSHES
VACUUM
31
32
33
34
CONNECTIONS ARE VIEWED FROM
THE WIRED END OF CONNECTOR

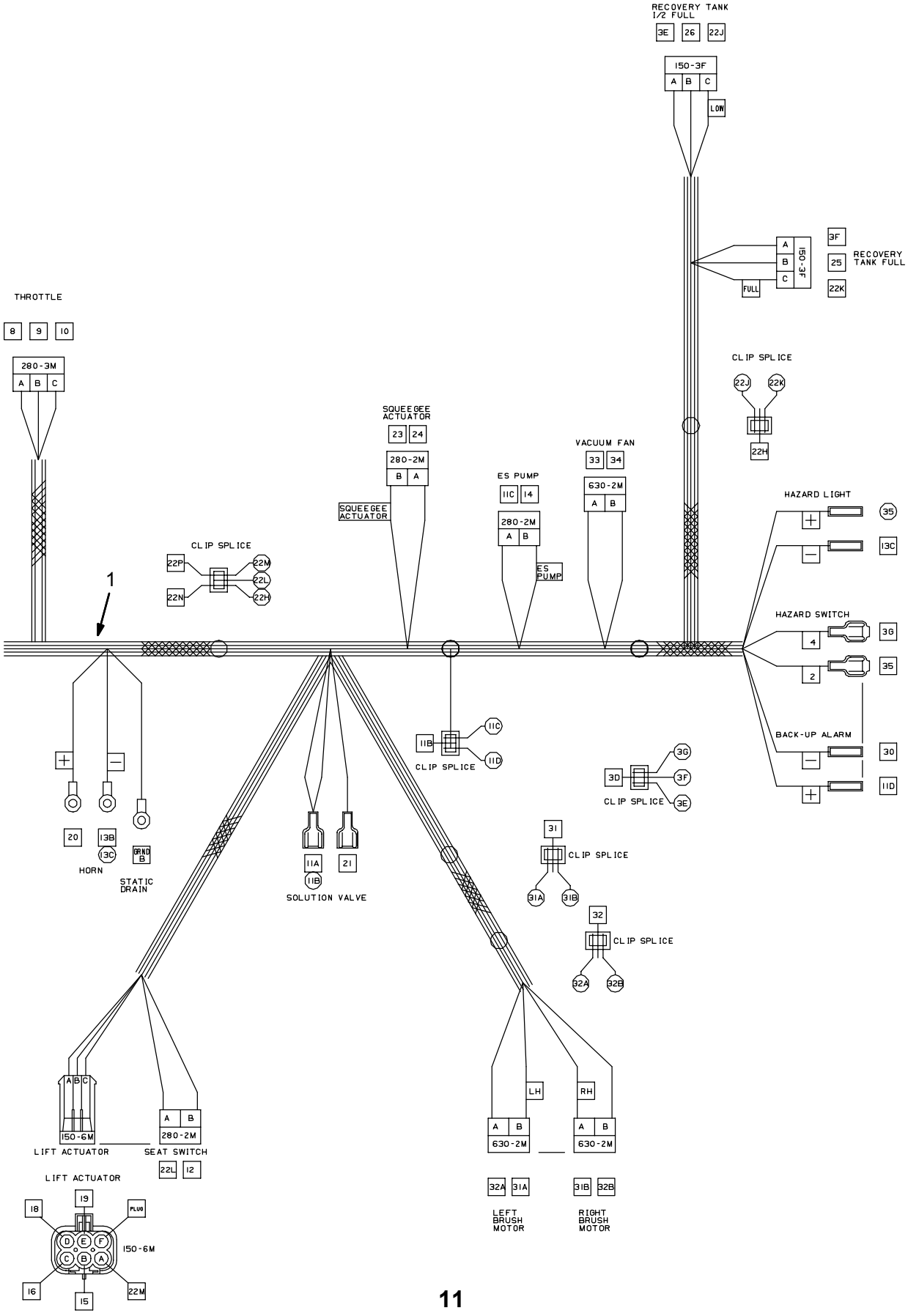

RECOVERY TANK 1/2 FULL
3E
26
22J
150-3F
A
B
C
LOW
FULL
3F
25
22K
RECOVERY TANK FULL
THROTTLE
8
9
10
280-3M
CLIP SPLICE
22J
22K
22H
VACUUM FAN
33
34
ES PUMP
23
24
280-2M
630-2M
CLIP SPLICE
22N
22M
22L
22H
3D
3E
3F
3G
1
35
13C
HAZARD SWITCH
4
2
30
11C
BACK-UP ALARM
31
CLIP SPLICE
31A
31B
32
32A
32B
20
13B
13C
GRND B
HORN
STATIC DRAIN
11B
21
SOLUTION VALVE
LH
RH
150-6M
LIFT ACTUATOR
280-2M
SEAT SWITCH
22L
12
19
18
16
15
22M
PLUG
D
E
F
C
B
A

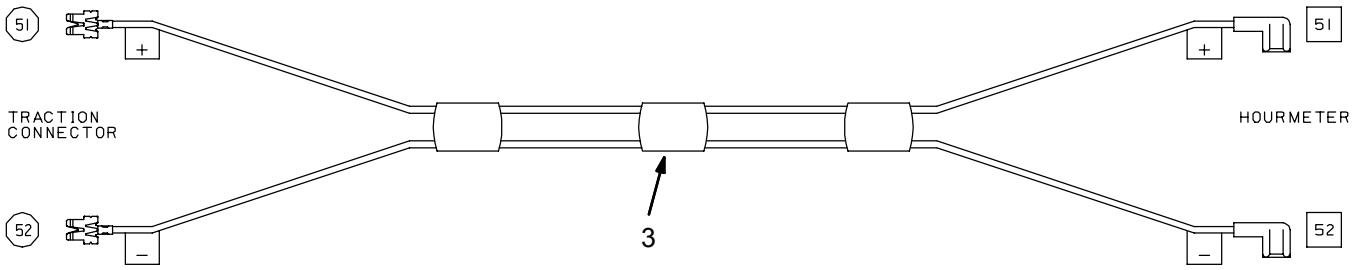

51
+
TRACTION
CONNECTOR
52
-
3
51
+
HOURMETER
52
-

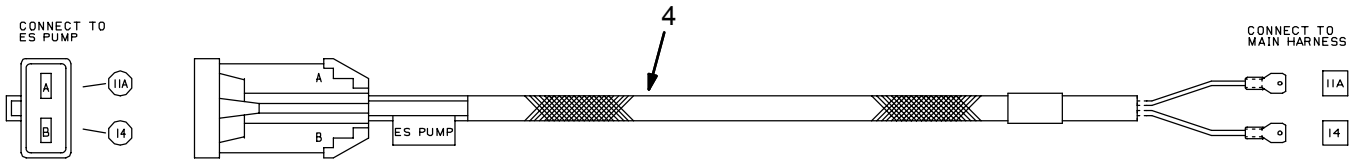

CONNECT TO
ES PUMP
A
B
11A
14
4
A
B
ES PUMP
CONNECT TO
MAIN HARNESS
11A
14

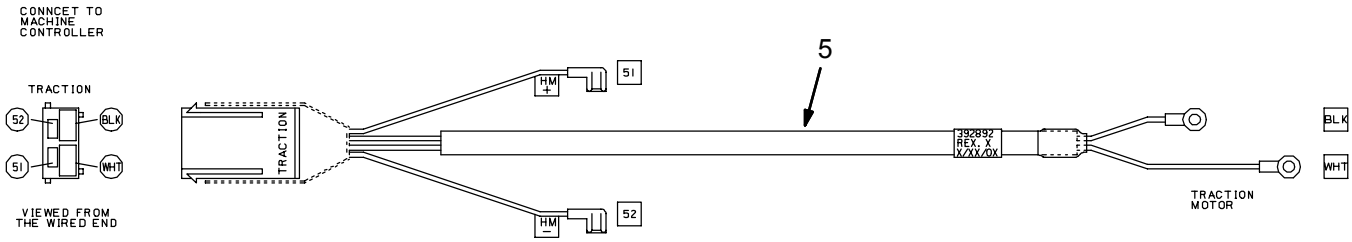

4A
4
17
SCRUB SWITCH
22B
22C
JUMPER CONNECTOR
STOP SWITCH
5
SCRUB SWITCH
1
BRAIDED COVERING
2
3A
3
KEY SWITCH
FU-5 10 AMP 58 VDC
P3
P2
FU-2 10 AMP 58 VDC
FU-3 10 AMP 58 VDC
FU-4 10 AMP 58 VDC
29
11
11A
GRND A
GRND
BATT GAUGE
TANK FULL LIGHT
STATIC DRAIN
2
37
39
11
40
24
41
19
2
10A/58V
P3
GRND A
22C
7
3B
BATT GAUGE
P2
2
2
2
10A/58V
10A/58V
10A/58V

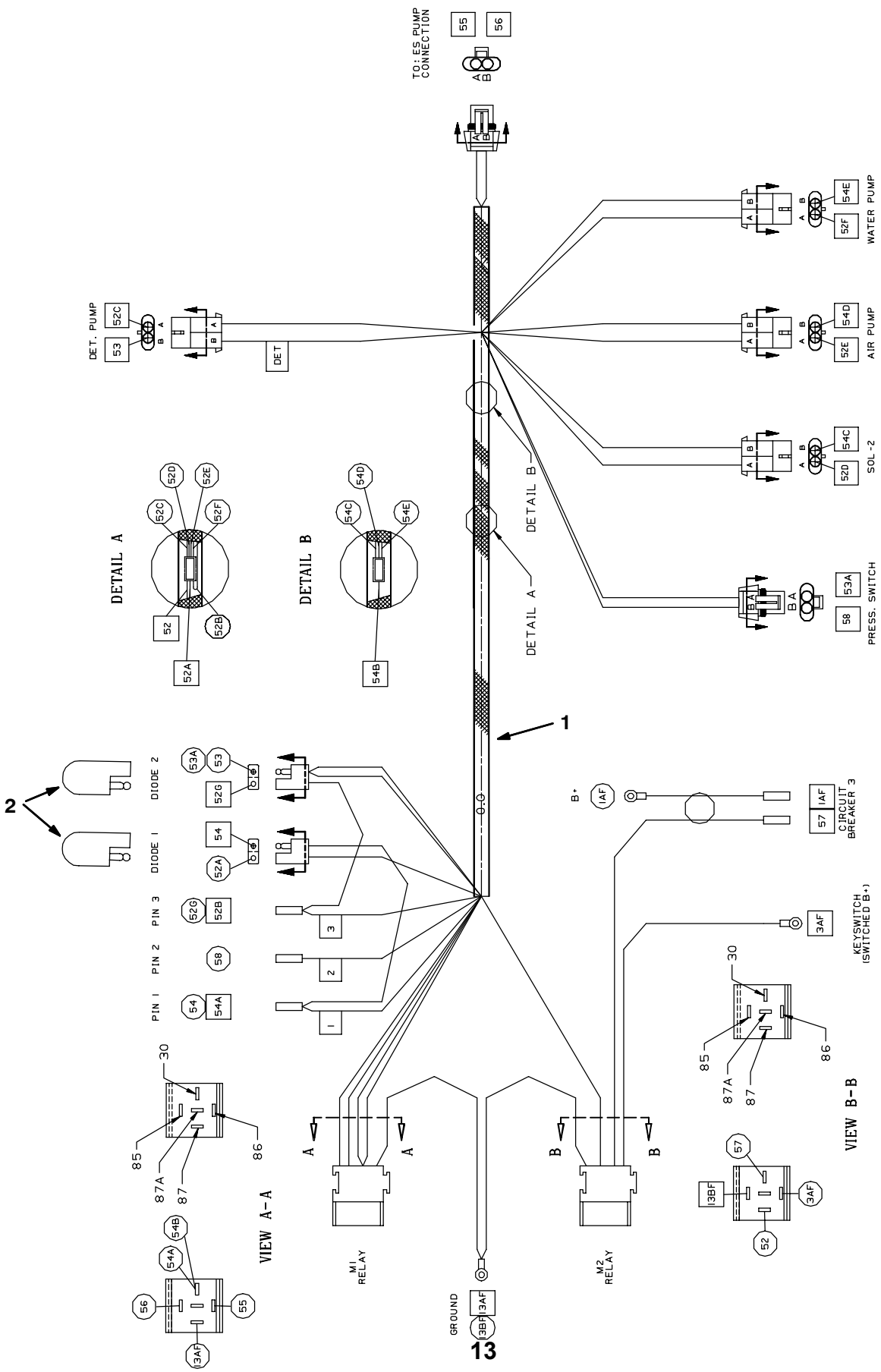

FUNCTION SWITCH
SCRUB NORMAL/HEAVY
ES SWITCH
HORN SWITCH
WATER FLOW SWITCH
FAN SWITCH (DOUBLE SCRUB)
SCRUB NORMAL/HEAVY
ES SWITCH
CLIP SPLICE
CLIP SPLICE
1
CONVOLUTED TUBING: 1.5" ID.
HEAVY SCRUB HD MOTORS
LIGHT-DUTY STD MOTORS
COMMON FOR OPTIONAL USE ONLY
TAPE THESE 3 WIRES AT ONE PLACE ALONG THE BRAIDED BRANCH
BRUSHES
VACUUM
BRUSHES
VACUUM
CONNECTIONS ARE VIEWED FROM THE WIRED END OF CONNECTOR

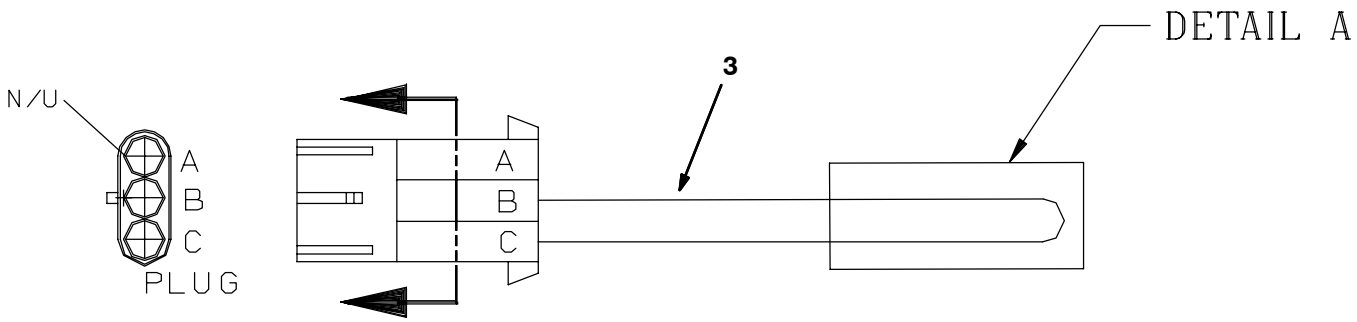

RECOVERY TANK 1/2 FULL
3E 26 22J
150-3F
A B C
LOW
A B C 150-3F
FULL
3F
25
22K
RECOVERY TANK FULL
THROTTLE
8 9 10
280-3M
A B C
CLIP SPLICE
22J 22K
22H
SQUEEGEE ACTUATOR
23 24
280-2M
B A
SQUEEGEE ACTUATOR
VACUUM FAN
33 34
630-2M
A B
ES PUMP
11C 14
280-2M
A B
ES PUMP
HAZARD LIGHT
35
13C
CLIP SPLICE
22P 22M 22L 22N 22H
1
HAZARD SWITCH
4 2
3G
35
BACK-UP ALARM
30
11D
11B
CLIP SPLICE
11C 11D
3D
CLIP SPLICE
3G 3F 3E
20 13B 13C
GRND B
HORN
STATIC DRAIN
11A 21 11B
SOLUTION VALVE
31
CLIP SPLICE
31A 31B
32
CLIP SPLICE
32A 32B
A B C
150-6M
LIFT ACTUATOR
A B
280-2M
SEAT SWITCH
22L 12
LIFT ACTUATOR
19
18
PLUG
D E F
C B A
150-6M
16
15
22M
LH
RH
A B
630-2M
A B
630-2M
32A 31A
31B 32B
LEFT BRUSH MOTOR
RIGHT BRUSH MOTOR

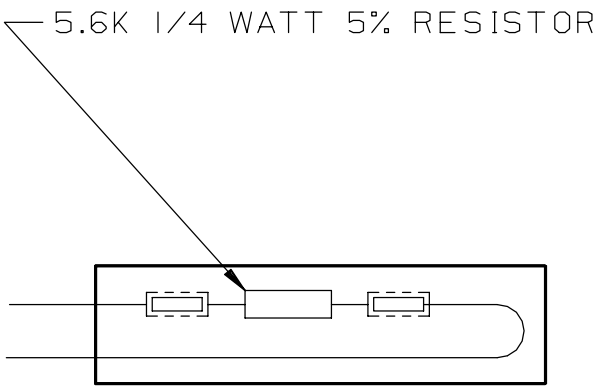

51
+
TRACTION
CONNECTOR
52
–
3
51
+
HOURMETER
52
–


CONNECT TO
ES PUMP
A
B
11A
14
4
A
B
ES PUMP
CONNECT TO
MAIN HARNESS
11A
14


CONNCET TO
MACHINE
CONTROLLER
TRACTION
52
BLK
51
WHT
VIEWED FROM
THE WIRED END
TRACTION
HM
+
51
HM
–
52
5
J92892
REV. X
XXX/XX
BLK
WHT
TRACTION
MOTOR


TO: ES PUMP CONNECTION
55
56
WATER PUMP
52F
54E
AIR PUMP
52E
54D
SOL - 2
52D
54C
PRESS. SWITCH
58
53A
DET. PUMP
53
52C
DET
DETAIL A
DETAIL B
52
52A
52B
52C
52D
52E
52F
54B
54C
54D
54E
1
2
DIODE 2
DIODE 1
PIN 3
PIN 2
PIN 1
53
53A
52G
54
54A
52A
52B
58
3
2
1
0.8
B+
1AF
57
CIRCUIT BREAKER 3
3AF
KEYSWITCH (SWITCHED B+)
30
85
86
87
87A
VIEW A-A
VIEW B-B
M1 RELAY
M2 RELAY
GROUND
13BF
13AF
A
B

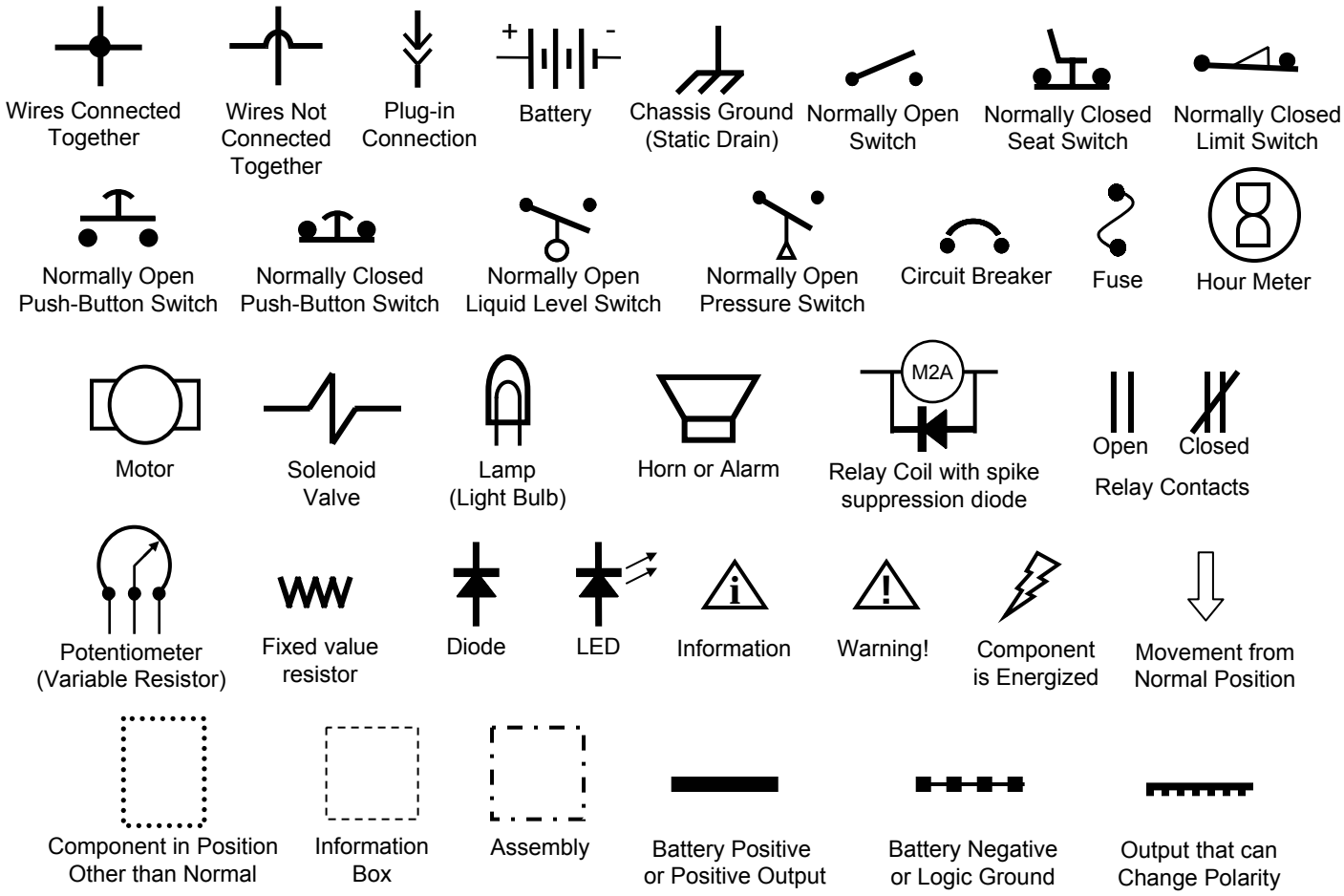




DETAIL A

Commonly Used Electrical Symbols & Terms

NOTE: The term “NORMALLY” refers to the component’s “at rest” or “de-energized” position



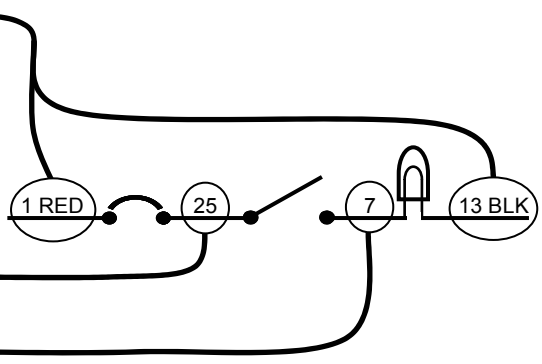
Terms & Abbreviations

BDI – Battery Discharge Indicator
LED – Light Emitting Diode
PWM (Pulse Width Modulation) – A method of using controlled on/off times to regulate the voltage and current supplied to an electrical device

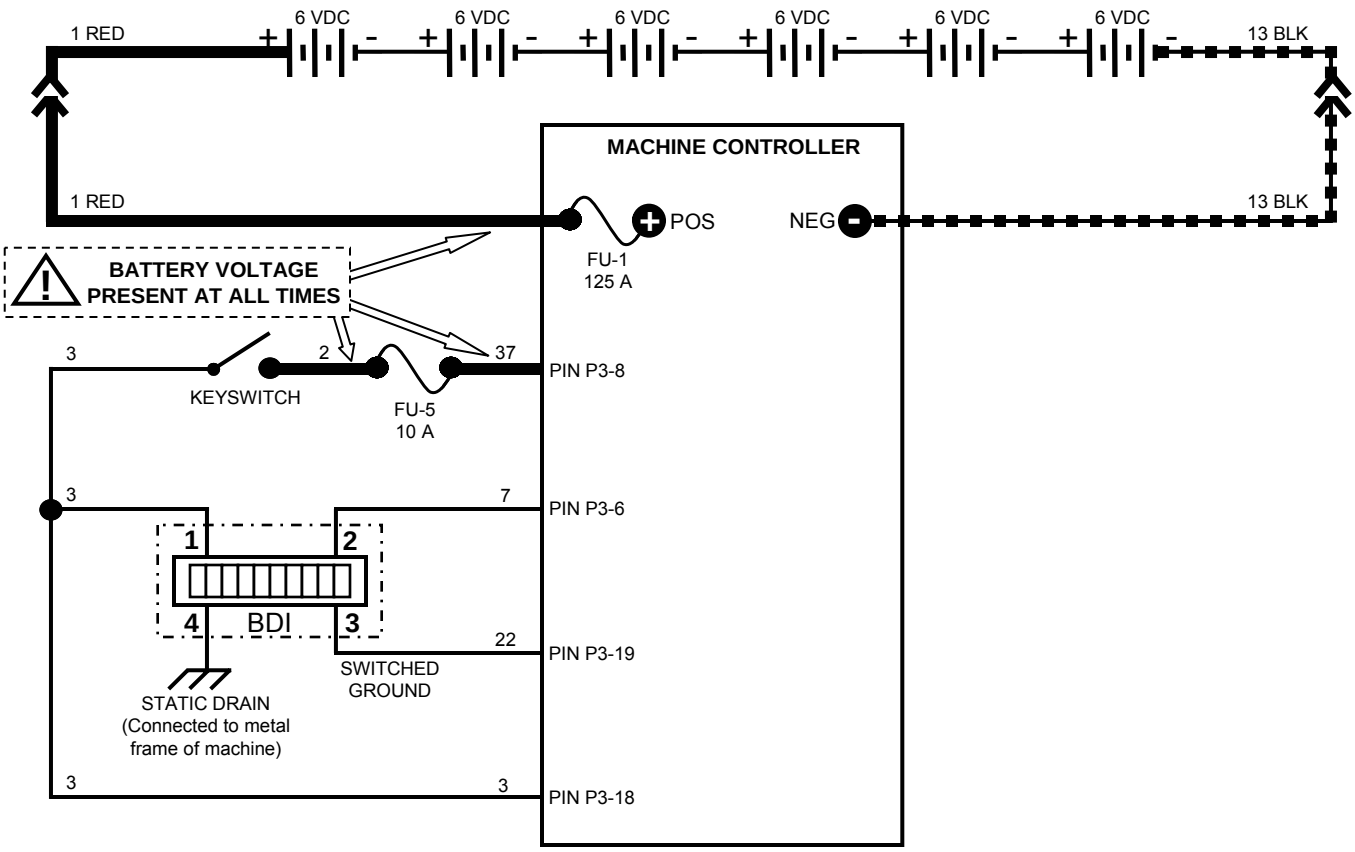
Example of Wiring Numbers & Colors:

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White



7080 - Key OFF

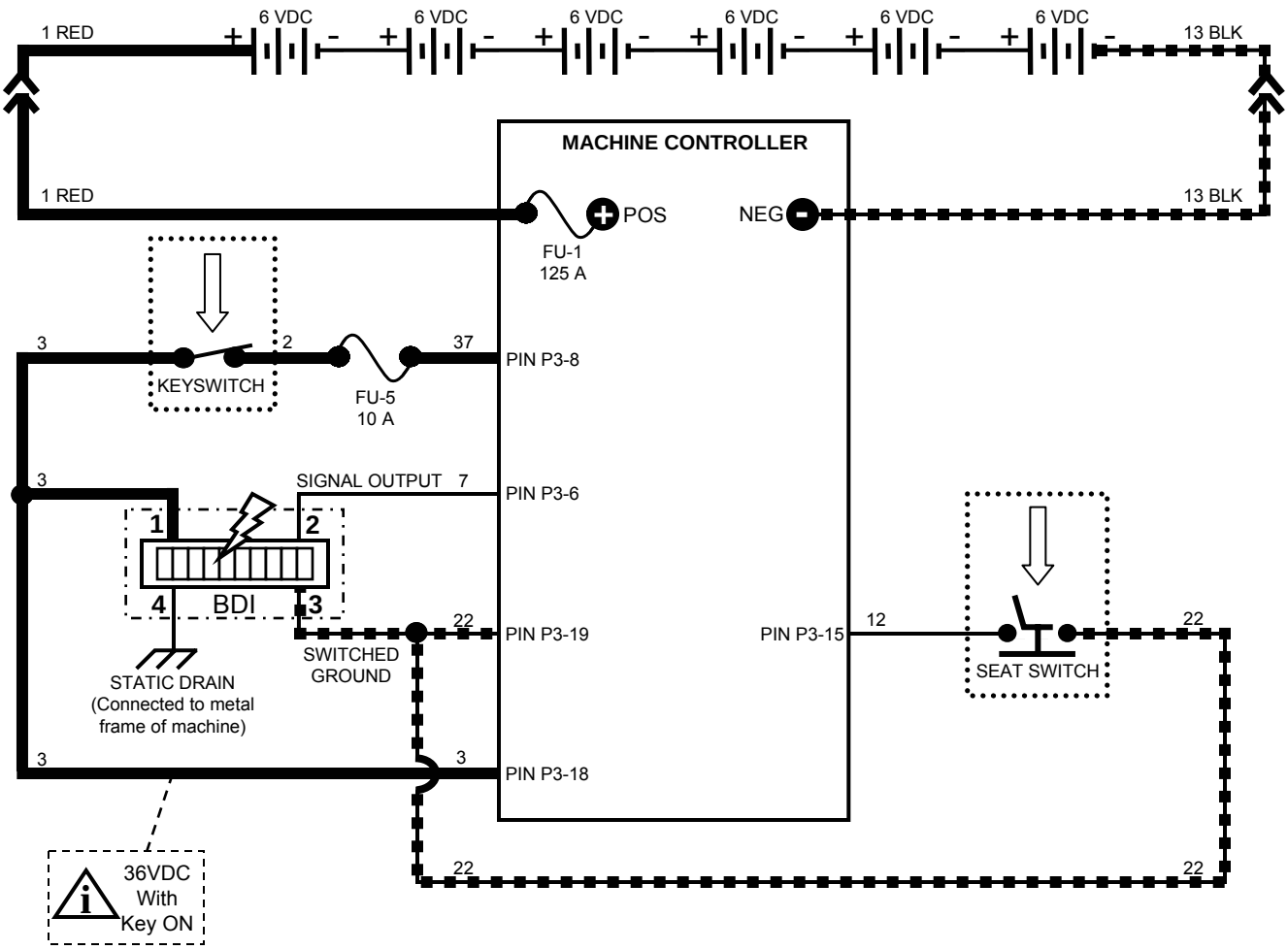


Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Be cautious when working near Control Board –
Battery voltage is always present, even with Key OFF

7080 - Key ON, Operator on Seat

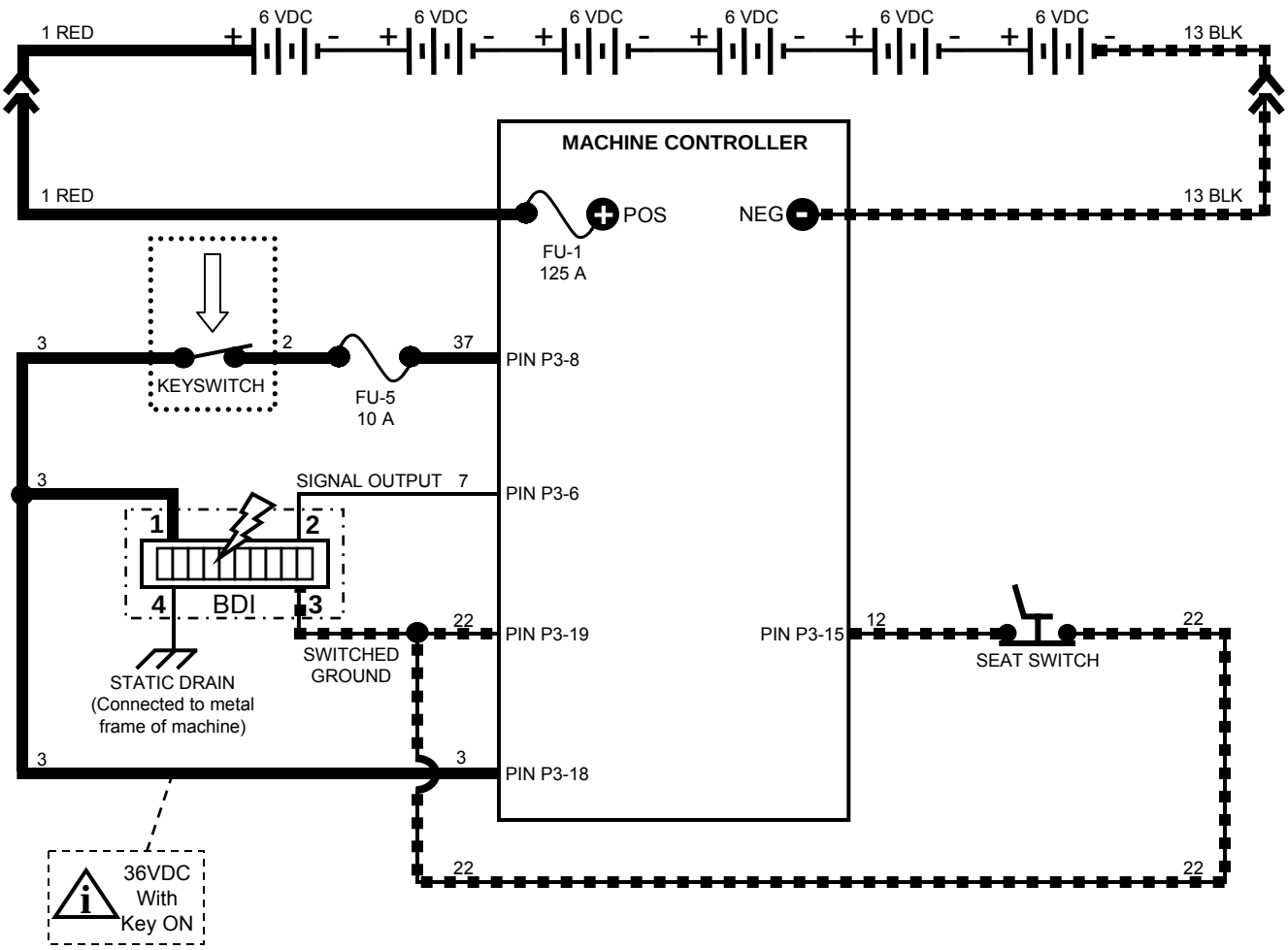


Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

BDI should display the state of charge of the batteries if no faults are found; Refer to Machine Controller troubleshooting if BDI LED's are flashing

7080 - Key ON, Operator NOT on Seat



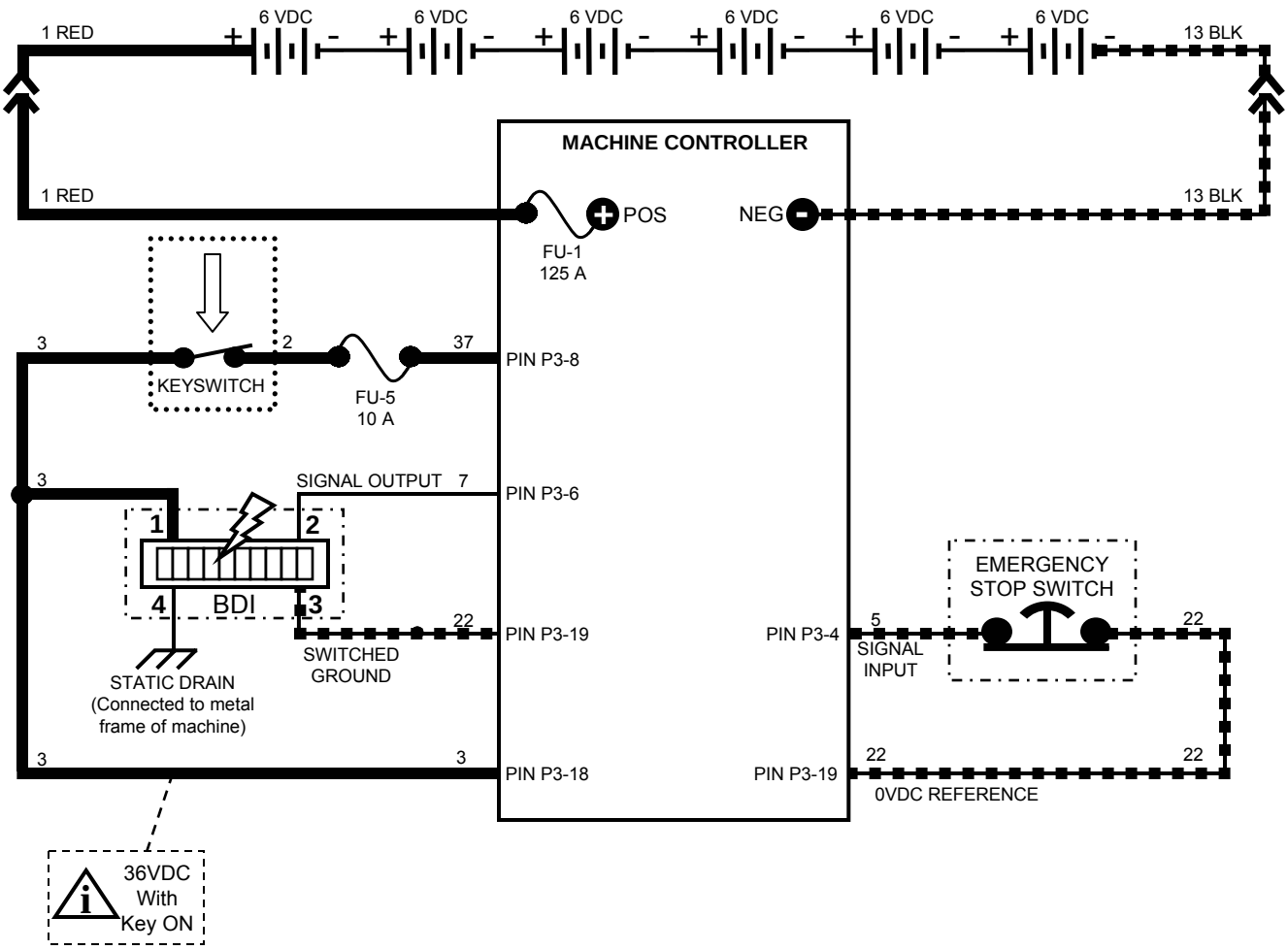
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

BDI should display 6 rapidly flashing LED's, indicating that the operator is not sitting on seat; Refer to Machine Controller troubleshooting for more information

7080– Emergency Stop Switch

CONDITIONS: **Key ON**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Emergency Stop Switch is normally closed; Activating the Emergency Stop Switch opens the switch and removes the 0VDC reference voltage to PIN P3-4

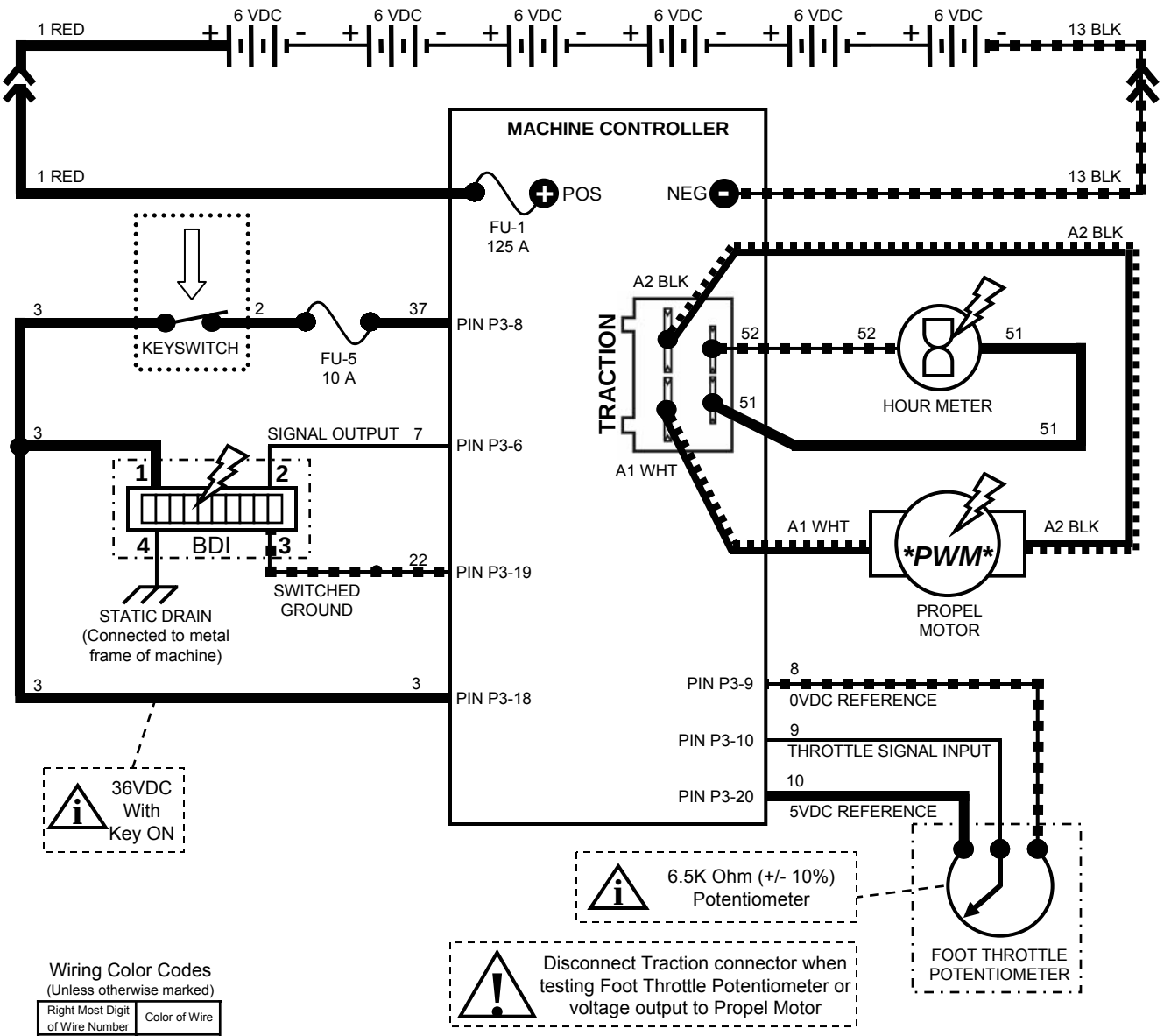
Machine will function normally if a 0VDC reference voltage is sensed at pin P3-4

All machine functions will shut off if no reference voltage is sensed at pin P3-4

If the Emergency Stop Switch has been activated, the BDI should display 8 rapidly flashing LED's; Refer to Machine Controller troubleshooting for more information

7080 – Propel System

CONDITIONS: **Key ON, operator on seat & travel (forward or reverse)**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Typical Propel Motor Current Draw: 1 to 25 Amps in motion, higher at start-up

Maximum NO-LOAD current: 6 Amps (wheel raised off floor)

Maximum current allowed to Propel Motor by controller: 63 Amps

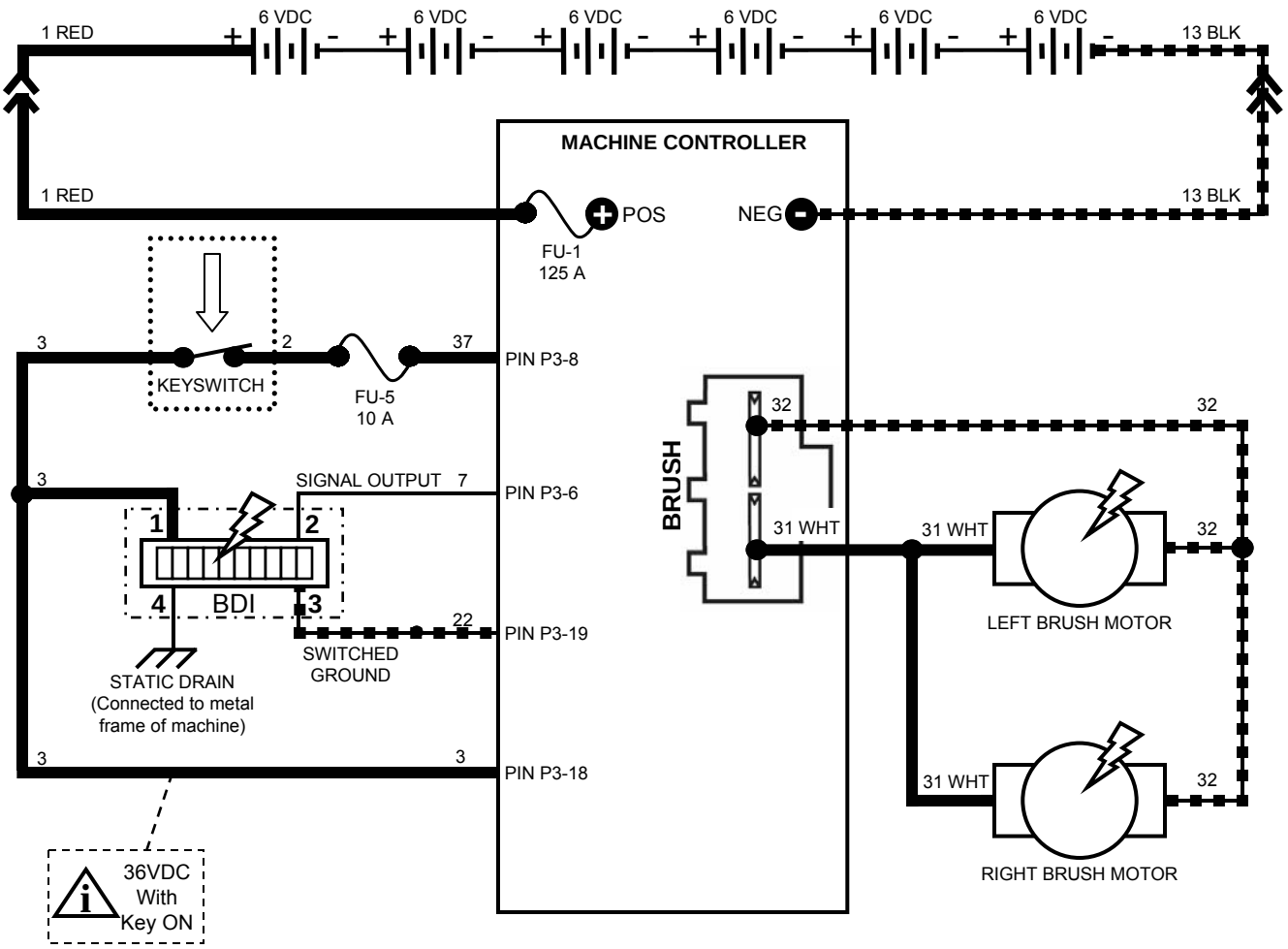
Propel Motor Voltage: 0 to 36 VDC - FORWARD
0 to approx. 27 VDC - REVERSE

Propel Motor is controlled by PWM (Pulse Width Modulation)

Throttle Signal Input will vary from approximately 0 to 5VDC as propel pedal is moved from full forward to full reverse, with neutral being approximately 2.5VDC

7080 – Scrub Brush Motors

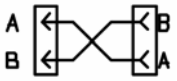
CONDITIONS: **Key ON, operator on seat, forward travel, One Step switch ON, scrub mode switch in "scrub only" or "scrub & vacuum" position**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

REVERSING WIRE HARNESS FOR CYLINDRICAL SCRUB HEAD – LOCATED AT & CONNECTED TO REAR SCRUB BRUSH MOTOR



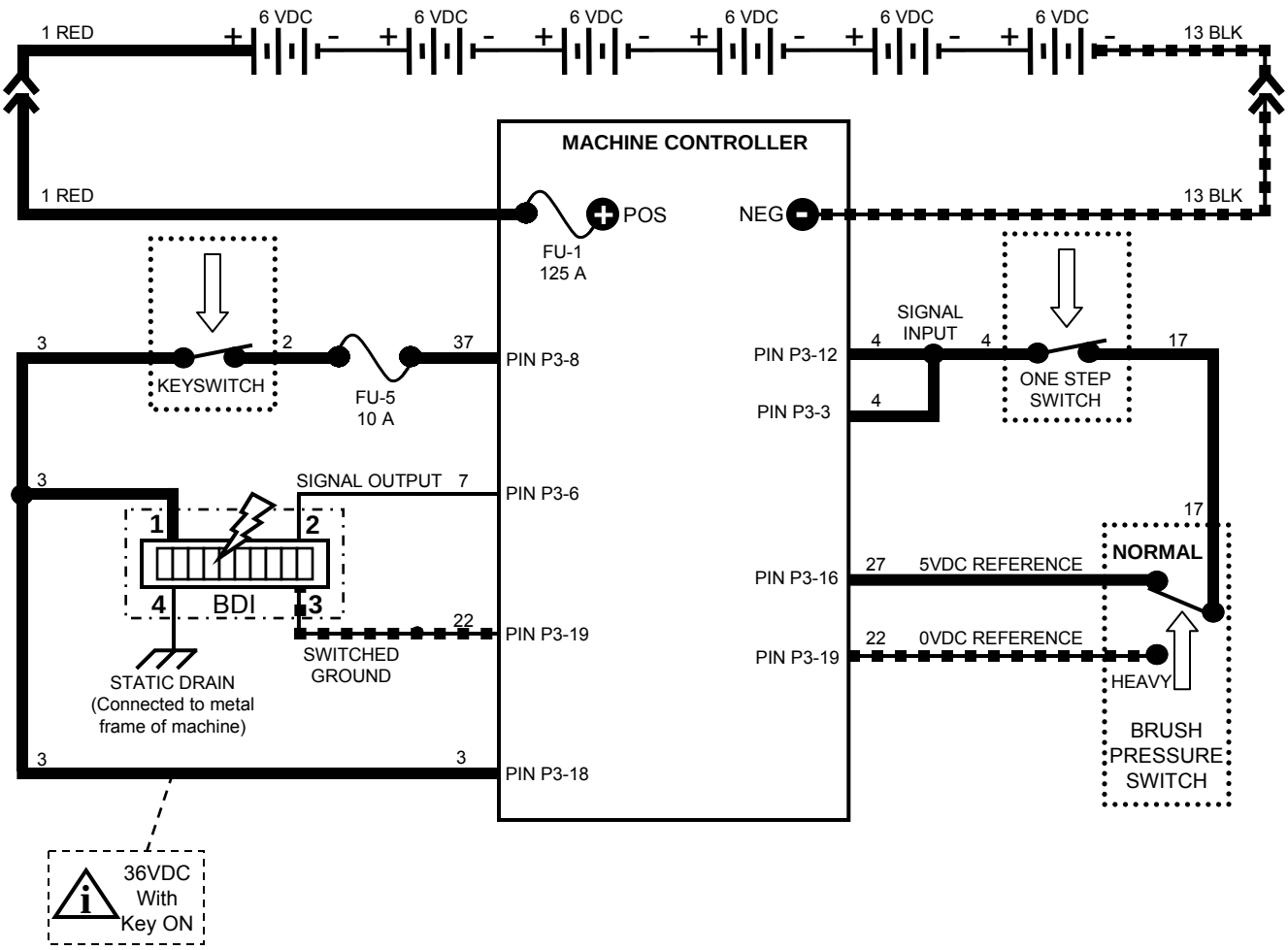
Maximum Brush Motor Current Draw:

Standard-duty DISC brush motors – 15 Amps Maximum EACH
Heavy-duty DISC brush motors – 23 Amps Maximum EACH
CYLINDRICAL brush motors – 22 Amps Maximum EACH

A reversing wire harness is used to change the direction of one motor on machines equipped with a CYLINDRICAL scrub head (see diagram above)

7080 – Scrub & Brush Pressure Switches (Normal Brush Pressure)

CONDITIONS: **Key ON, operator on seat, forward travel, One Step switch ON, scrub mode switch in "scrub only" or "scrub & vacuum" position**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

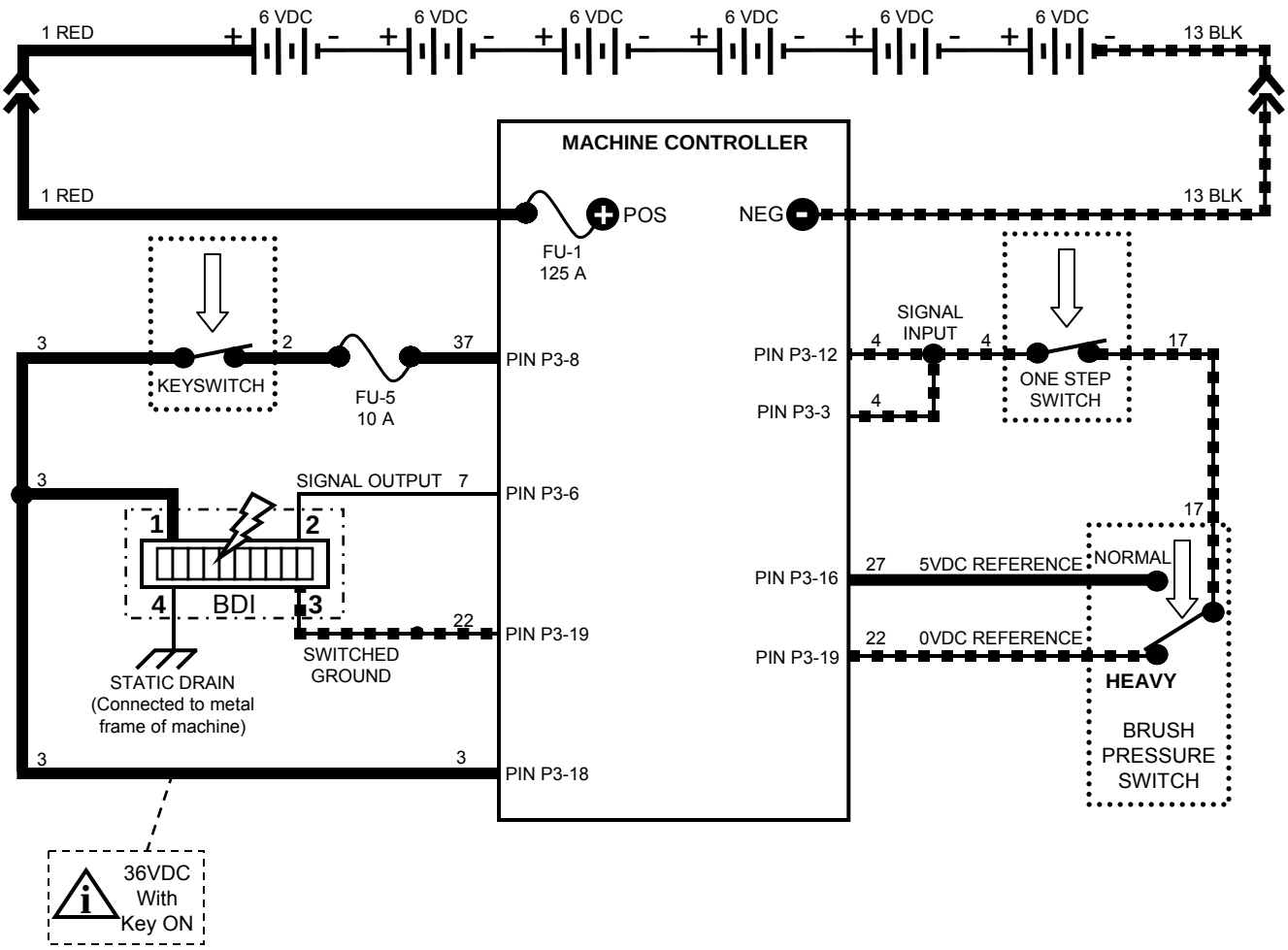
Normal brush pressure will be applied if a 5VDC reference voltage is sensed at pins P3-12 and P3-3

Heavy brush pressure will be applied if a 0VDC reference voltage is sensed at pins P3-12 and P3-3

Scrub Functions will be disabled if NO reference voltage is sensed at pins P3-12 and P3-3

7080 – Scrub & Brush Pressure Switches (Heavy Brush Pressure)

CONDITIONS: **Key ON, operator on seat, forward travel, One Step switch ON, scrub mode switch in "scrub only" or "scrub & vacuum" position**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

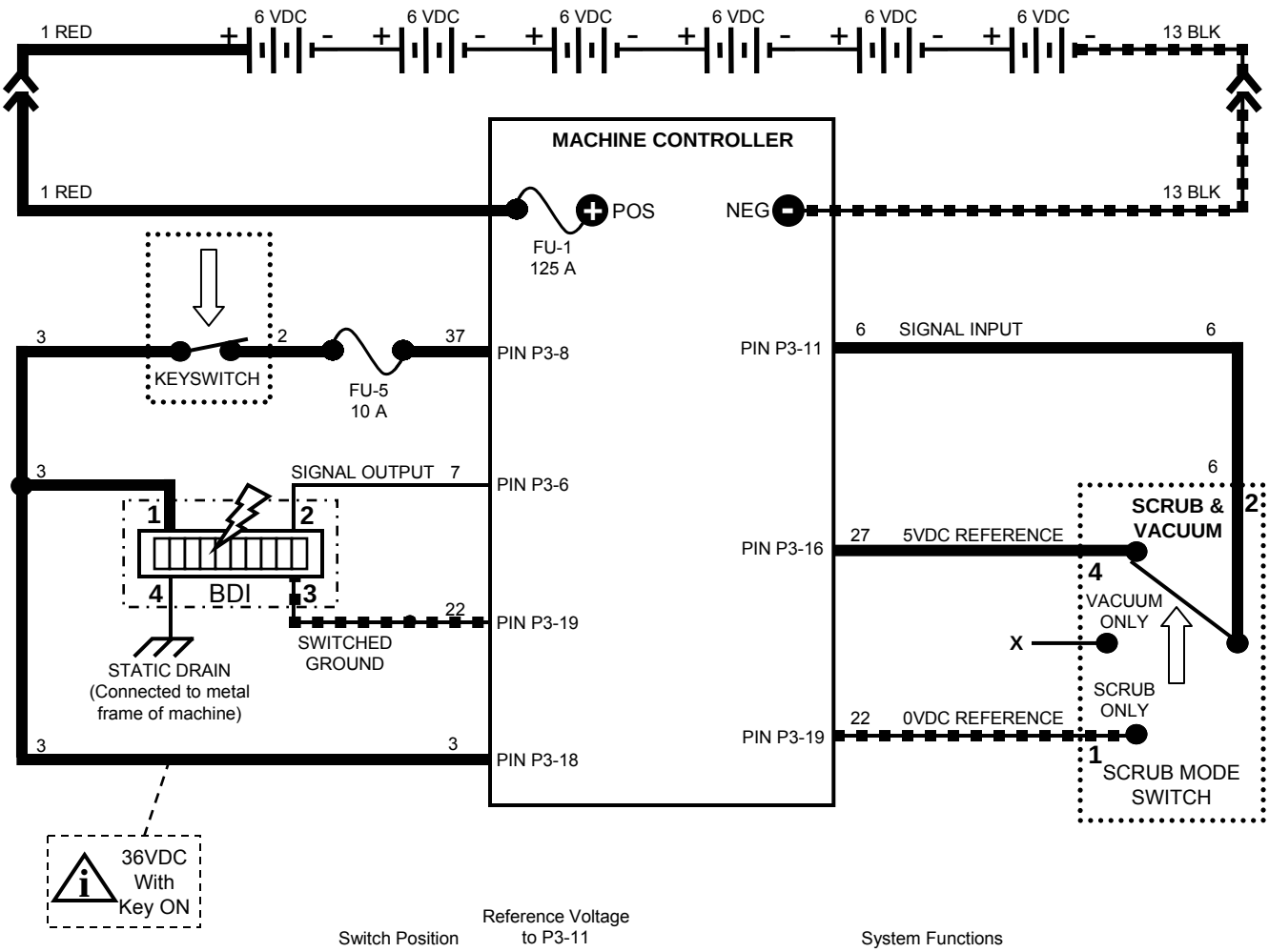
Normal brush pressure will be applied if a 5VDC reference voltage is sensed at pins P3-12 and P3-3

Heavy brush pressure will be applied if a 0VDC reference voltage is sensed at pins P3-12 and P3-3

Scrub Functions will be disabled if NO reference voltage is sensed at pins P3-12 and P3-3

7080 – Scrub Mode Switch (Scrub & Vacuum)

CONDITIONS: **Key ON, operator on seat, forward travel, One Step switch ON**



Switch Position	Reference Voltage to P3-11	System Functions
Scrub & Vacuum	5VDC	All scrub, vacuum, & squeegee operations
Vacuum Only	NONE	Vacuum & Squeegee operations only – No scrubbing
Scrub Only	0VDC	Scrub operations only – No vacuum or squeegee operations

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

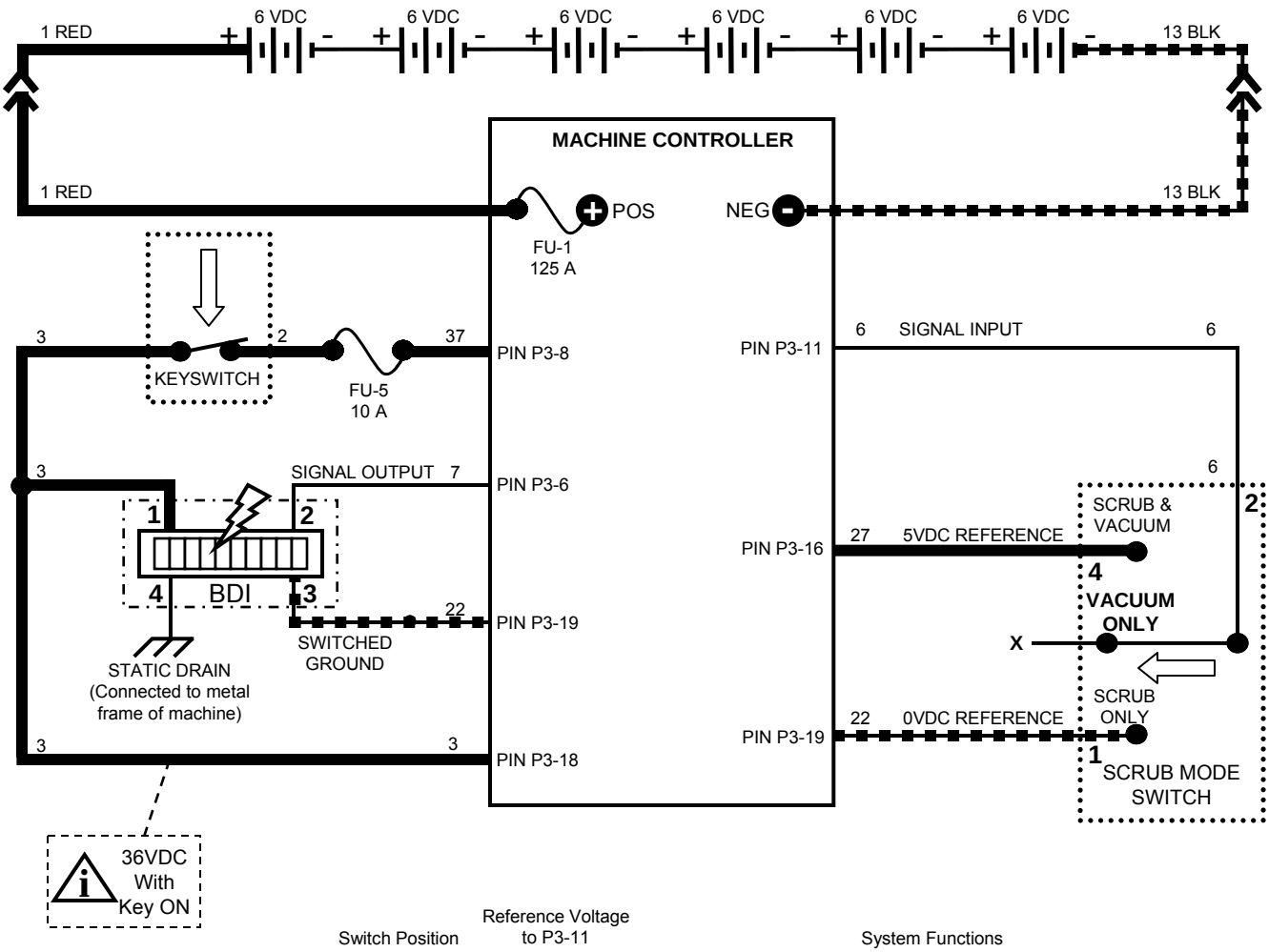
Scrub system and Vacuum/Squeegee system will operate if a 5VDC reference voltage is sensed at pin P3-11

Vacuum/Squeegee system ONLY will operate if NO reference voltage is sensed at pin P3-11 (Default state)

Scrub system ONLY will operate if a 0VDC reference voltage is sensed at pin P3-11

7080 – Scrub Mode Switch (Vacuum Only)

CONDITIONS: **Key ON, operator on seat, forward travel, One Step switch ON**



Switch Position	Reference Voltage to P3-11	System Functions
Scrub & Vacuum	5VDC	All scrub, vacuum, & squeegee operations
Vacuum Only	NONE	Vacuum & Squeegee operations only – No scrubbing
Scrub Only	0VDC	Scrub operations only – No vacuum or squeegee operations

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

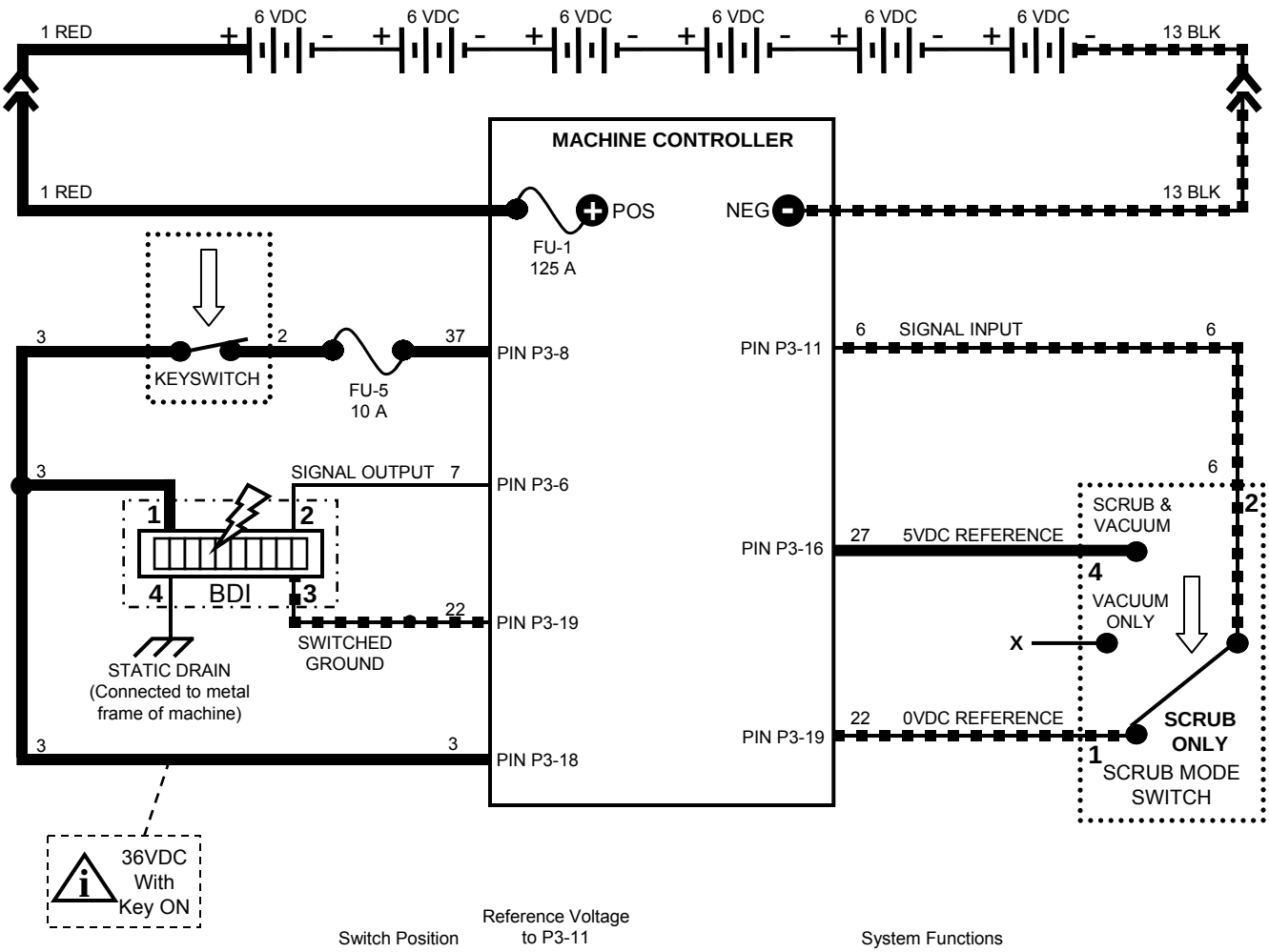
Scrub system and Vacuum/Squeegee system will operate if a 5VDC reference voltage is sensed at pin P3-11

Vacuum/Squeegee system ONLY will operate if NO reference voltage is sensed at pin P3-11 (Default state)

Scrub system ONLY will operate if a 0VDC reference voltage is sensed at pin P3-11

7080 – Scrub Mode Switch (Scrub Only)

CONDITIONS: **Key ON, operator on seat, forward travel, One Step switch ON**



Switch Position	Reference Voltage to P3-11	System Functions
Scrub & Vacuum	5VDC	All scrub, vacuum, & squeegee operations
Vacuum Only	NONE	Vacuum & Squeegee operations only – No scrubbing
Scrub Only	0VDC	Scrub operations only – No vacuum or squeegee operations

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

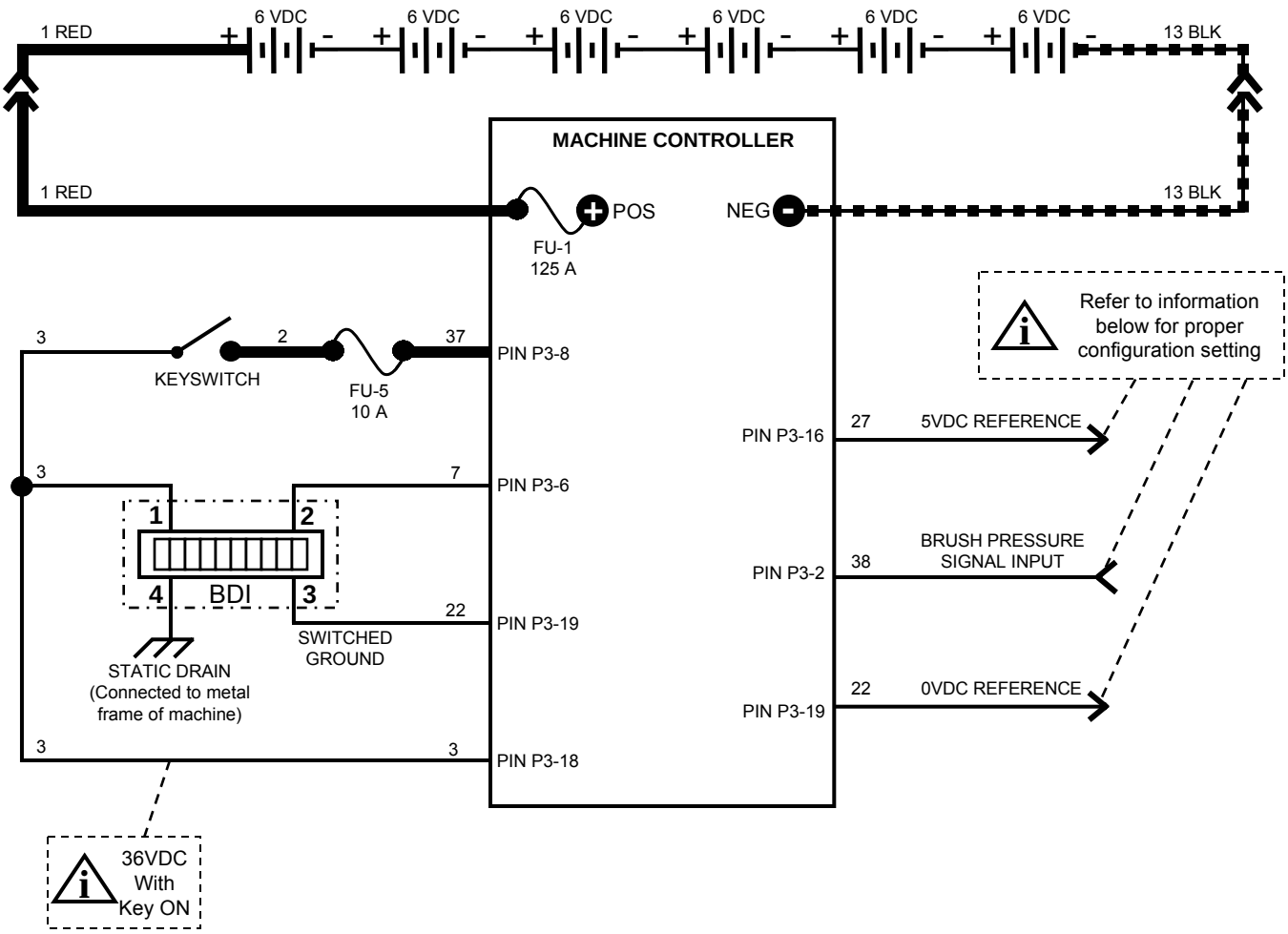
Scrub system and Vacuum/Squeegee system will operate if a 5VDC reference voltage is sensed at pin P3-11

Vacuum/Squeegee system ONLY will operate if NO reference voltage is sensed at pin P3-11 (Default state)

Scrub system ONLY will operate if a 0VDC reference voltage is sensed at pin P3-11

7080 – Scrub Head Configuration Connection

CONDITIONS: **Key OFF to change configuration setting**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Configuration Settings:

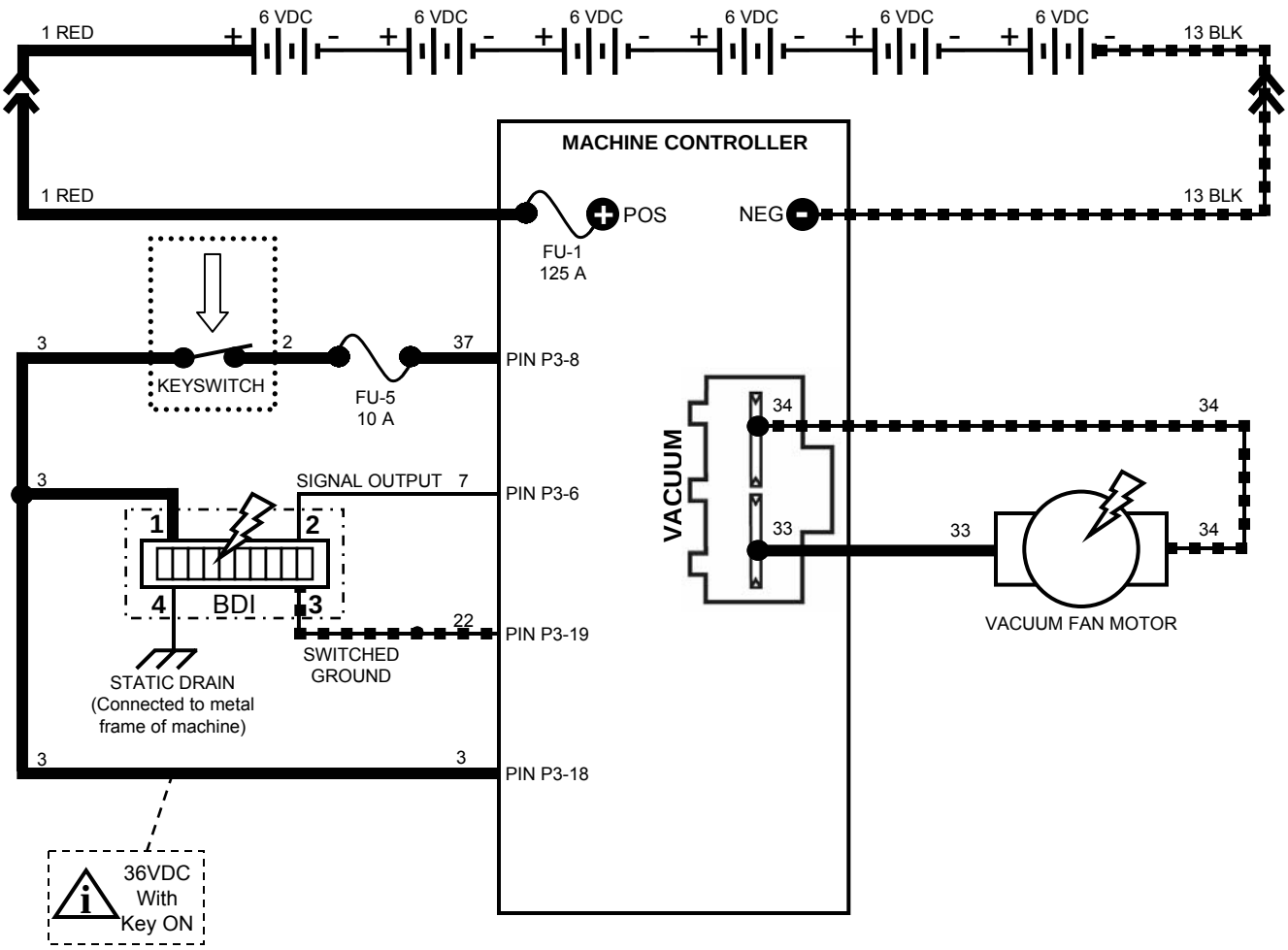
For Standard-duty DISC scrub brush motors:
MAKE NO CONNECTIONS

For CYLINDRICAL or Heavy-duty DISC scrub brush motors:
CONNECT WIRES 22 & 38 (0VDC reference & signal input)

For applications requiring EXTRA-LIGHT down pressure:
CONNECT WIRES 27 & 38 (5VDC reference & signal input)

7080 – Vacuum Fan Motor

CONDITIONS: **Key ON, operator on seat, One Step switch ON, scrub mode switch in "vacuum only" or "scrub & vacuum" position**



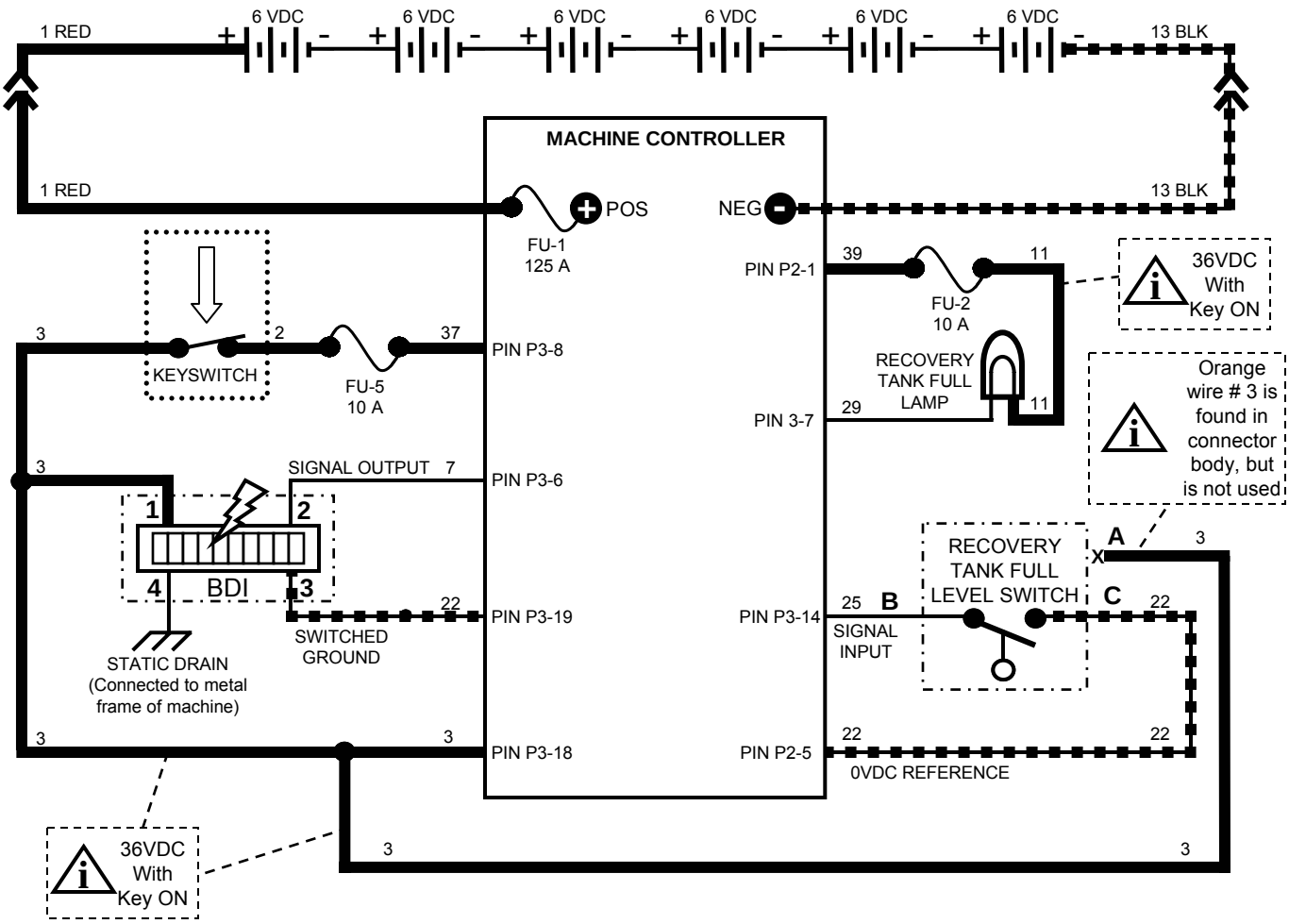
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Maximum Vacuum Fan Motor Current Draw: 20 Amps
Typical Vacuum Fan Motor Current Draw: 16 to 18 Amps

7080 – Recovery Tank Full Level Switch

CONDITIONS: **Key ON**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Recovery Tank Full Switch ***closes*** when recovery tank is full

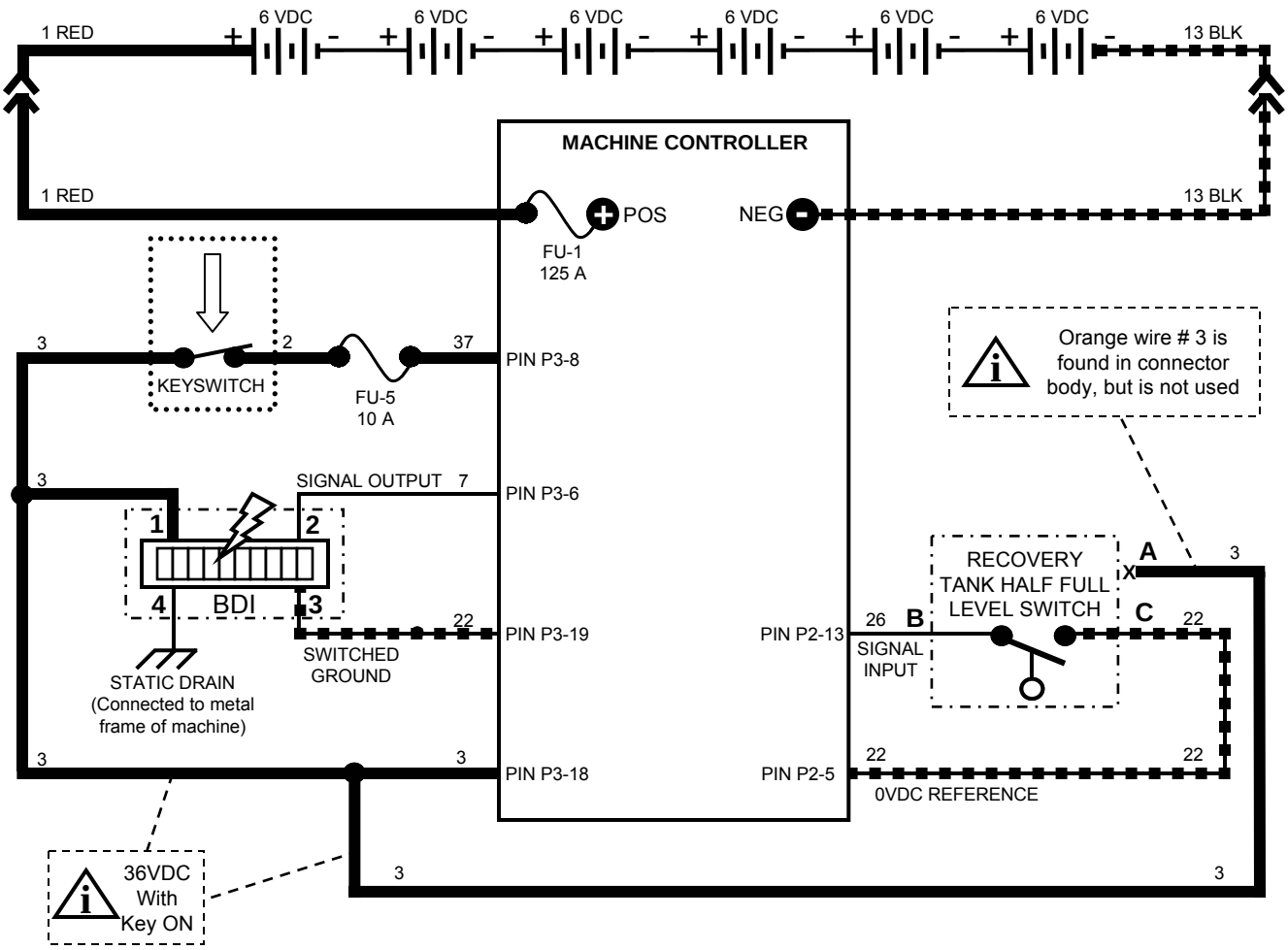
Recovery Tank Full Lamp is lit when recovery tank is full

Recovery Tank Full Switch is in the OPEN position with low or empty tank

Recovery Tank Full Switch is in the CLOSED position with full tank

7080– Recovery Tank Half Full Level Switch (ES Only)

CONDITIONS: **Key ON**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Recovery Tank Half Full Switch ***closes*** when recovery tank is half full or higher

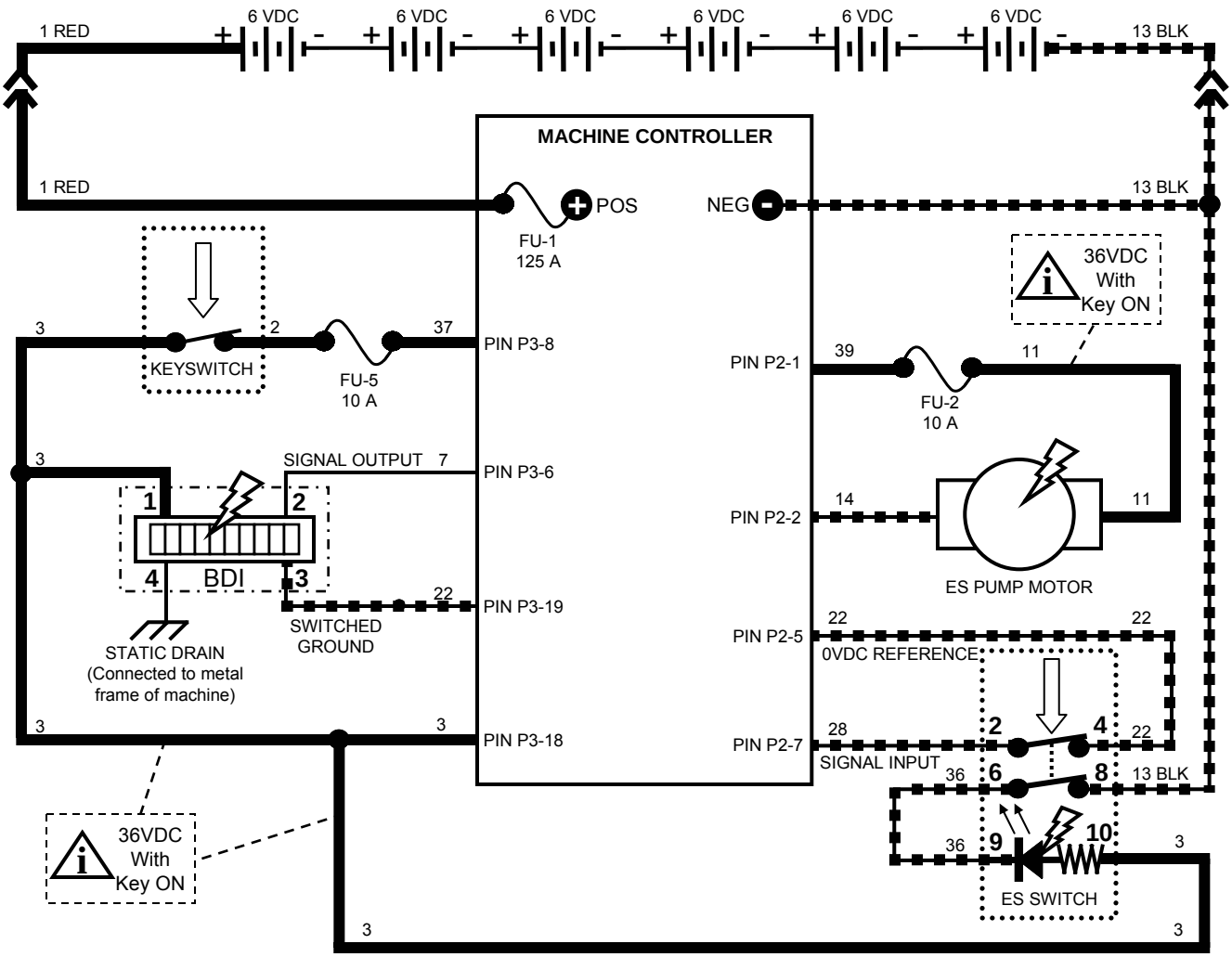
Recovery Tank Half Full Level Switch is in the OPEN position with low or empty tank

Recovery Tank Half Full Level Switch is in the CLOSED position with at least a half full tank

If wire # 26 (PIN P2-13) is grounded or shorted to the 0VDC reference, the Machine Controller will assume the ES system is installed and the recovery tank is at least half full

7080 – Extended Scrub (ES) System

CONDITIONS: **Key ON, operator on seat, recovery tank at least half full**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

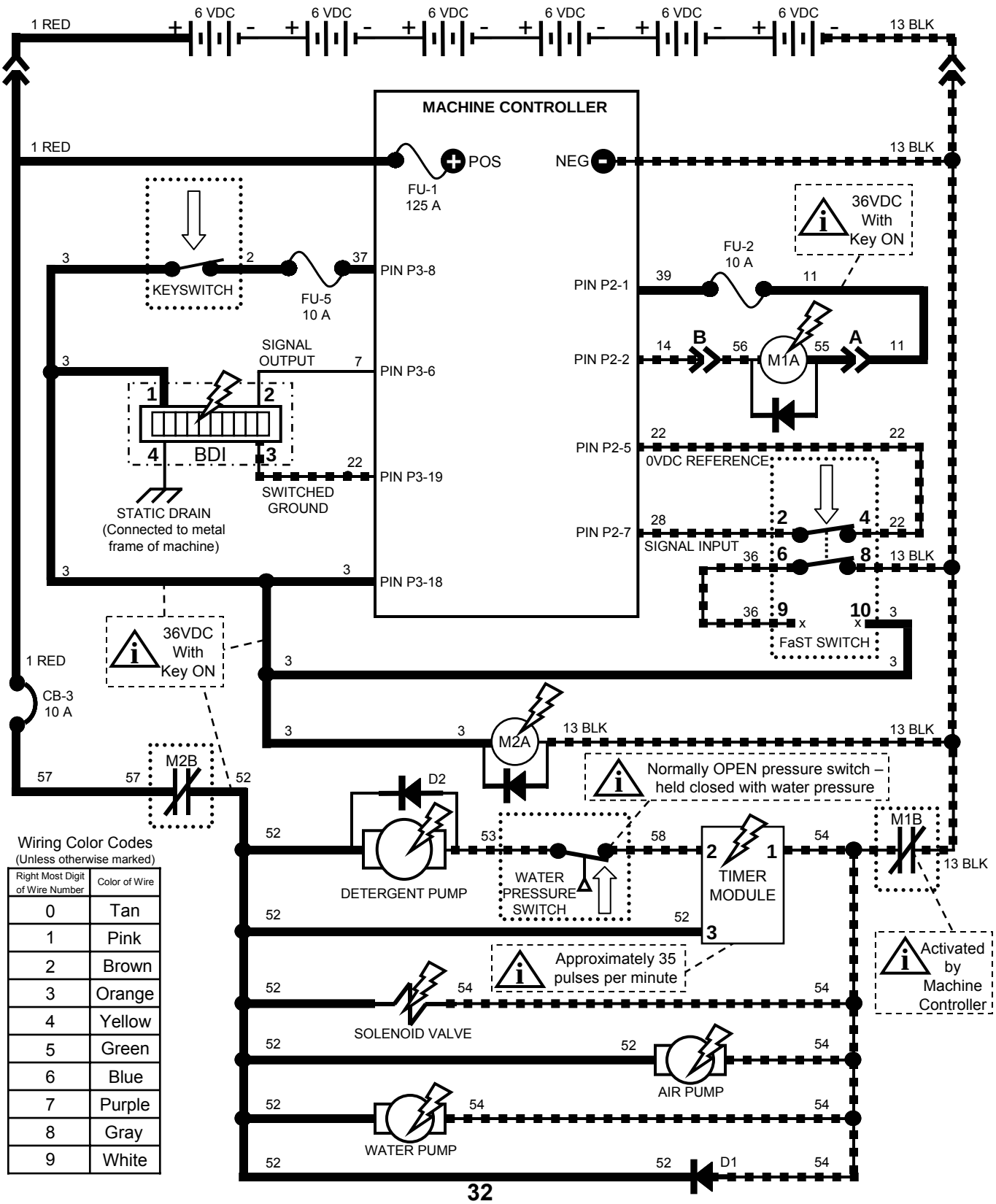
Recovery Tank must be at least half full for ES pump to operate

ES system will be active anytime ES Switch is ON, regardless if scrub system is ON or not

ES Pump current draw: 3.4 Amps at full load

7080 – FaST System

CONDITIONS: **Key ON, operator on seat, forward travel, scrub system active**

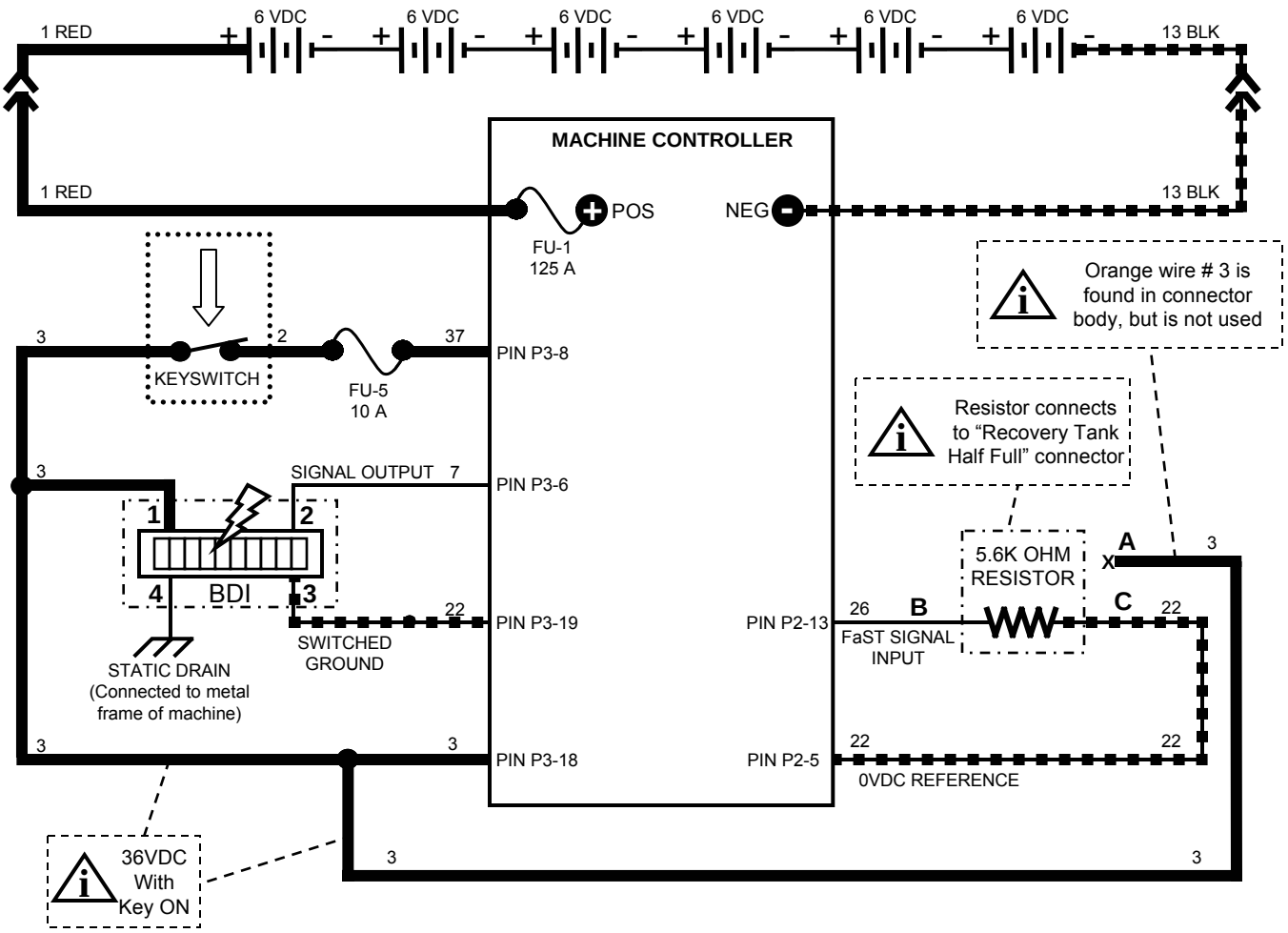


Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

7080 – Signal Resistor (FaST Only)

CONDITIONS: **Key ON**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

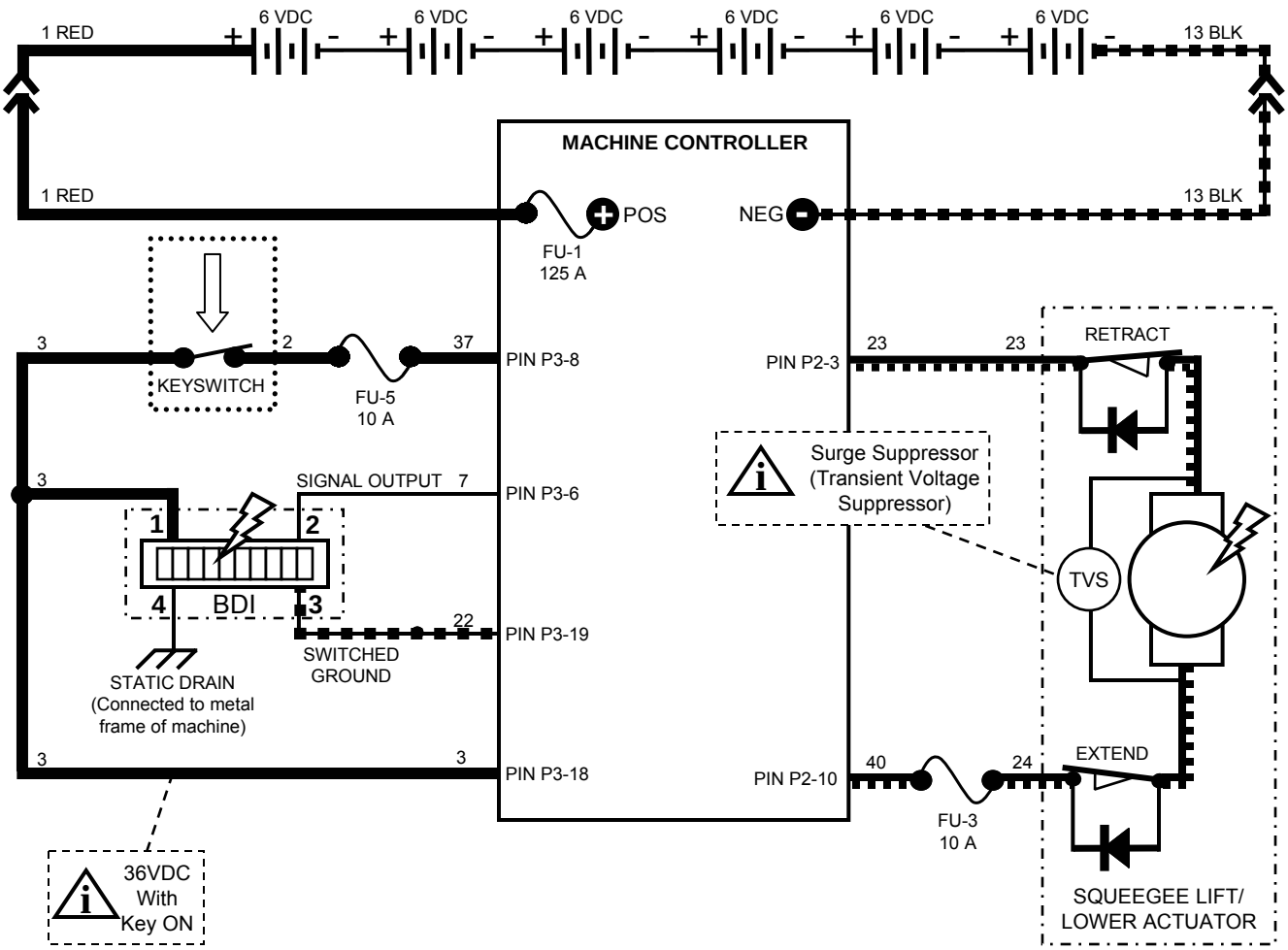
The 5.6K Ohm resistor connected as shown above will tell the Machine Controller that the FaST system is installed

If the 5.6K Ohm resistor is not installed, the Machine Controller will assume there is no FaST system installed and the recovery tank is not at least half full

If wire # 26 (PIN P2-13) is grounded or shorted to the 0VDC reference, the Machine Controller will assume the ES system is installed and the recovery tank is at least half full

7080 – Squeegee Actuator

CONDITIONS: **Key ON, operator on seat, engage or disengage One Step switch with Vacuum Fan active**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Squeegee Actuator limit switches are both normally closed, and the respective switch will open at the end-of-travel when extending or retracting

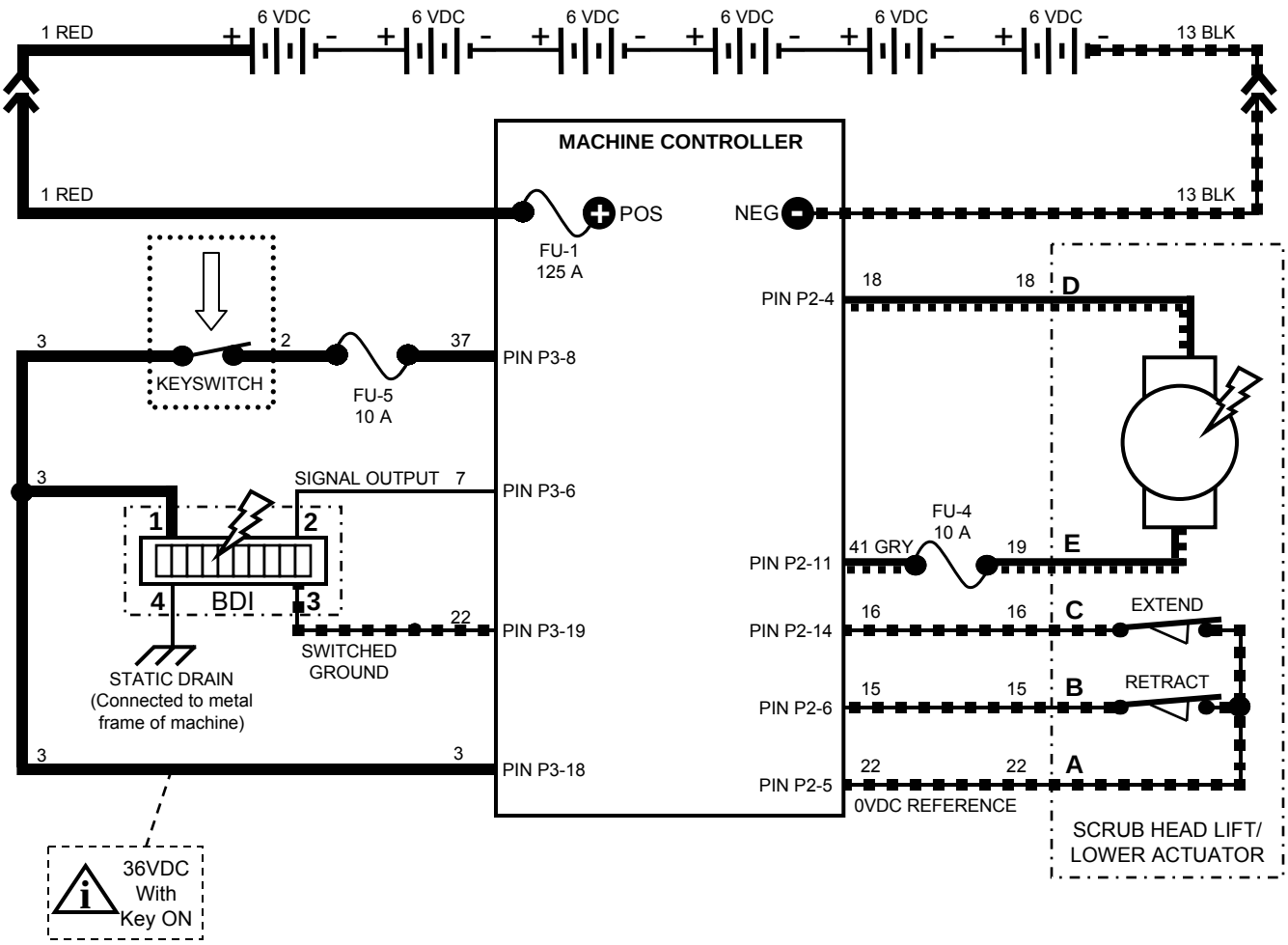
Both limit switches will be closed during actuator travel

Diodes are used to allow current flow around the open switch at the beginning of actuator movement (until switch closes)

Squeegee Actuator current draw: 5.0 Amps at full load

7080 – Scrub Head Actuator

CONDITIONS: **Key ON, operator on seat, engage or disengage One Step switch with scrub system active**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Scrub Head Actuator limit switches are both normally closed, and the respective switch will open at the end-of-travel when extending or retracting

Machine controller will turn OFF Scrub Head Actuator when either PIN P2-14 or P2-6 no longer receives the 0VDC reference signal

Both limit switches will be closed during actuator travel

Scrub Head Actuator current draw: 5.0 Amps at full load

7080 –Scrub Head Actuator Removal & Installation

DESCRIPTION:

Instructions to remove and reinstall the scrub head lift actuator on the model 7080

SPECIAL TOOLS / CONSIDERATIONS: None

(Estimated time to complete: 1 hour)

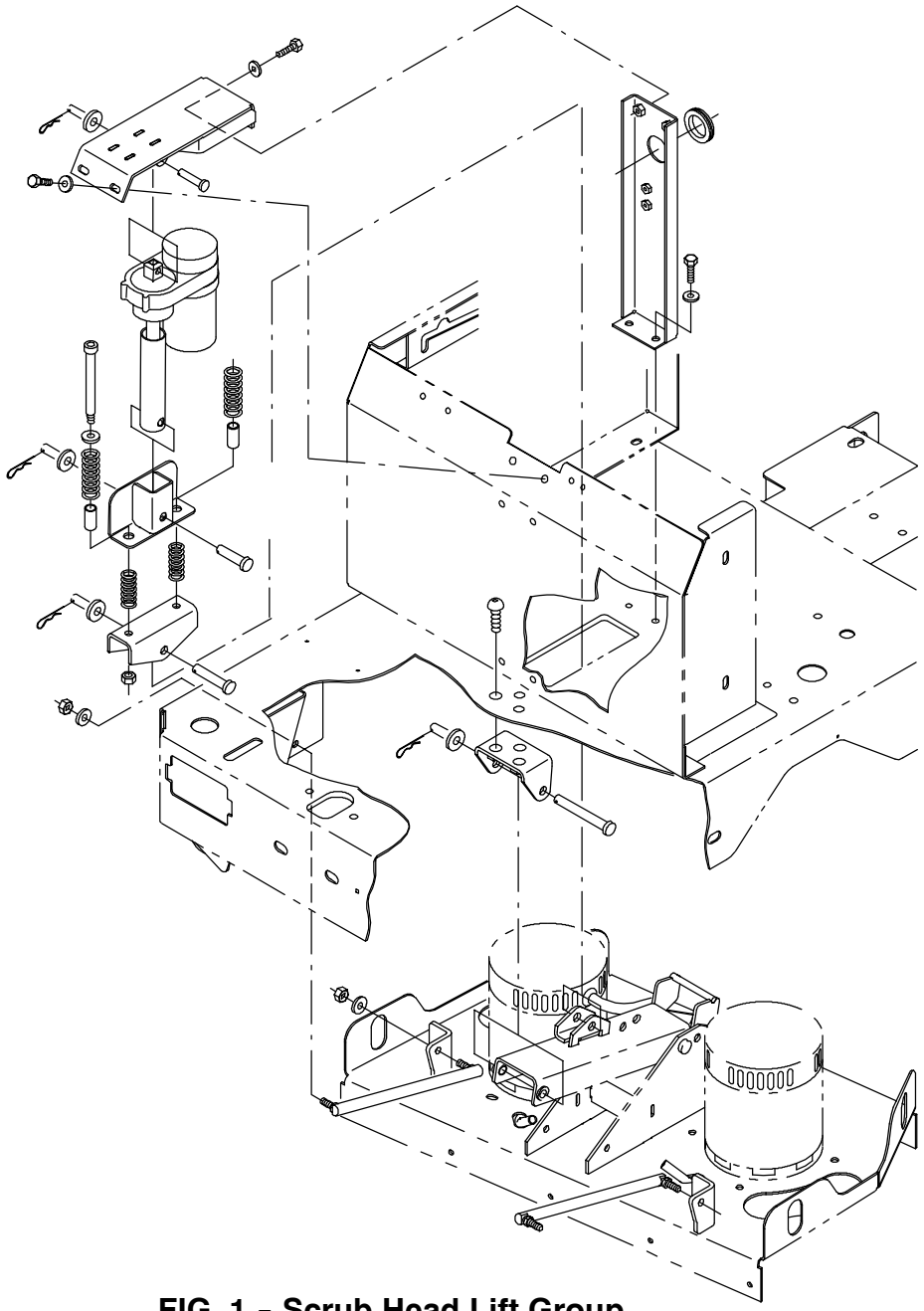
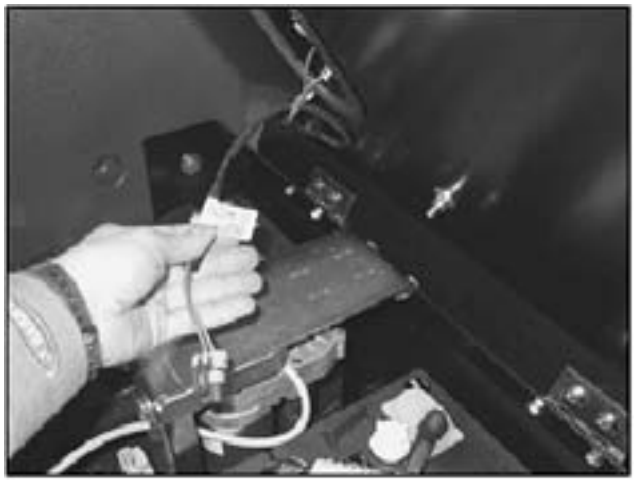


FIG. 1 - Scrub Head Lift Group

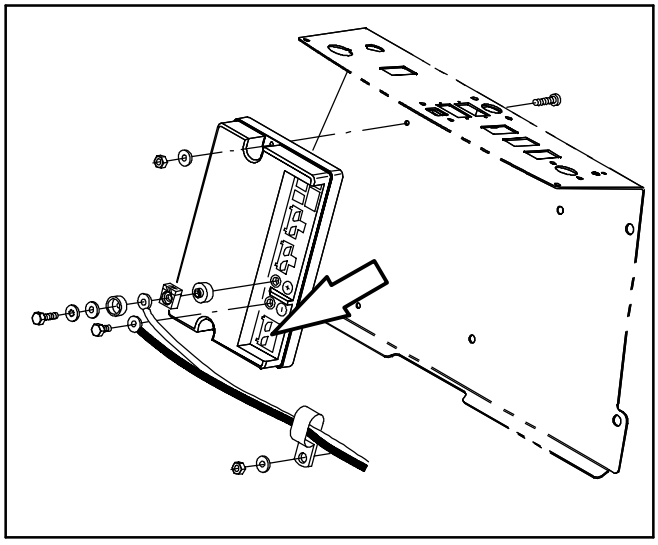
7080 –Scrub Head Actuator Removal & Installation

Removal:

1. Unplug the seat switch.



2. Unplug the traction plug from the P&G controller.



3. Remove the scrub brushes or pad drivers.

4. Loosen the four bolts holding actuator plate.

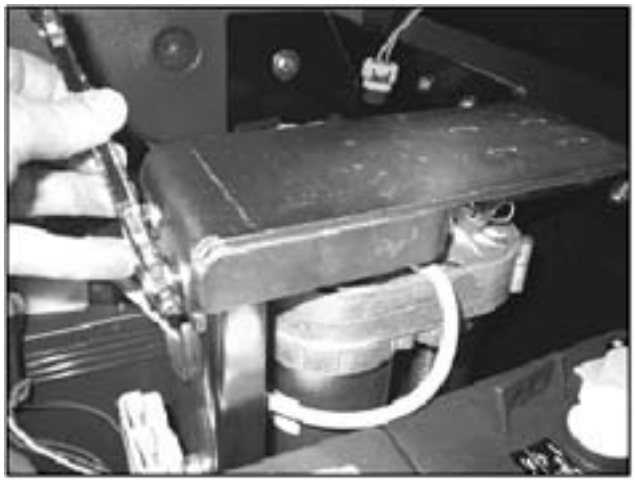
5. Put the vacuum fan/squeegee switch into the vacuum off position. Put the one-step (scrub) switch into the on position.

6. Turn the key switch on and activate the pedal in the forward direction. The scrub deck will begin to lower and the brush motors will turn on.

7080 –Scrub Head Actuator Removal & Installation

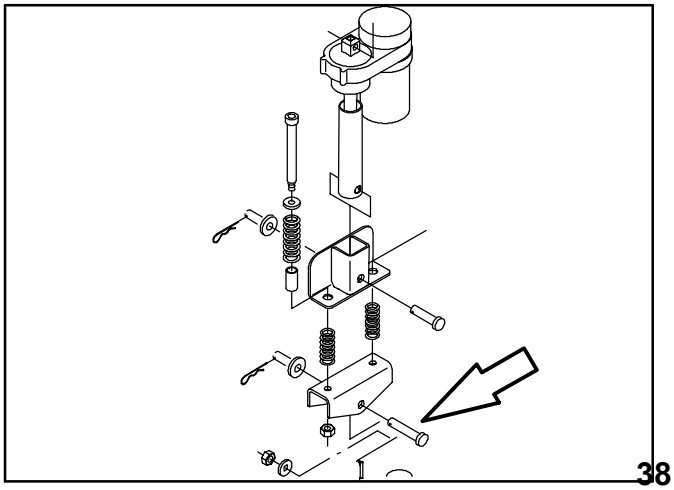
7. When the scrub deck makes contact with the floor and begins to raise the actuator plate, turn the power off at the key switch or by using the power kill switch.

8. Remove the four bolts holding the plate in place.



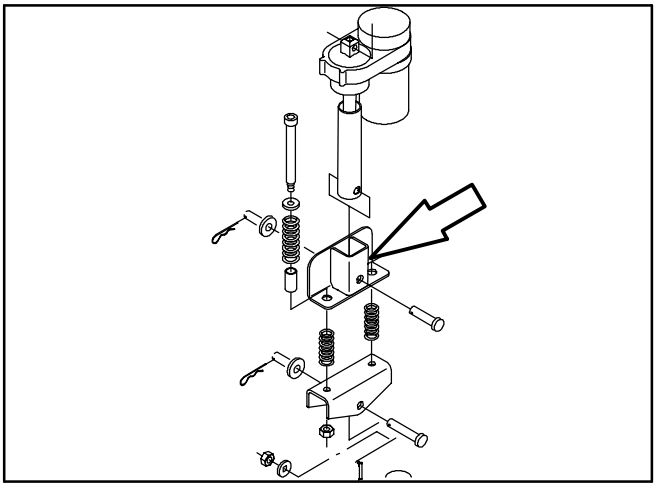
9. Power on and activate forward propel until the actuator reaches full extension, then power off.

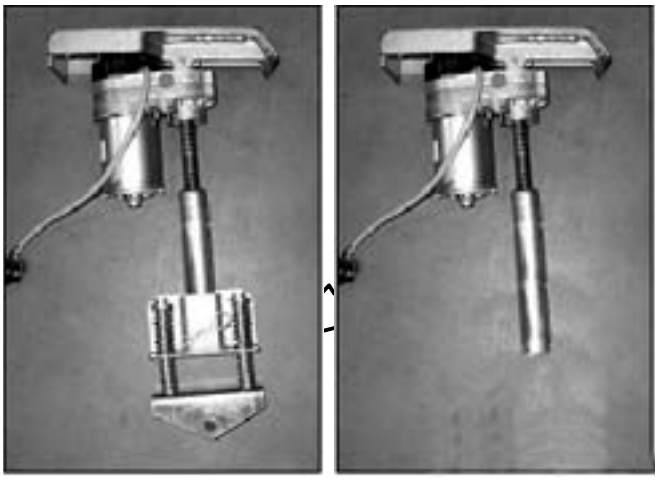
10. Remove the clevis pin at the lower channel.



11. Unplug the actuator and lift out the assembly.

12. Remove the lower bracket assembly.



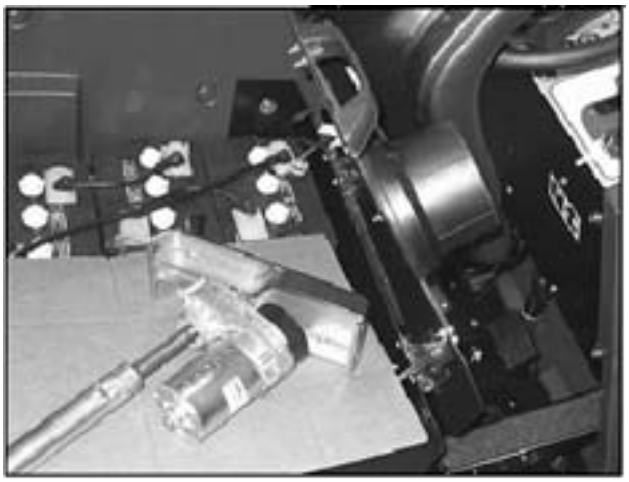


7080 –Scrub Head Actuator Removal & Installation

Installation:

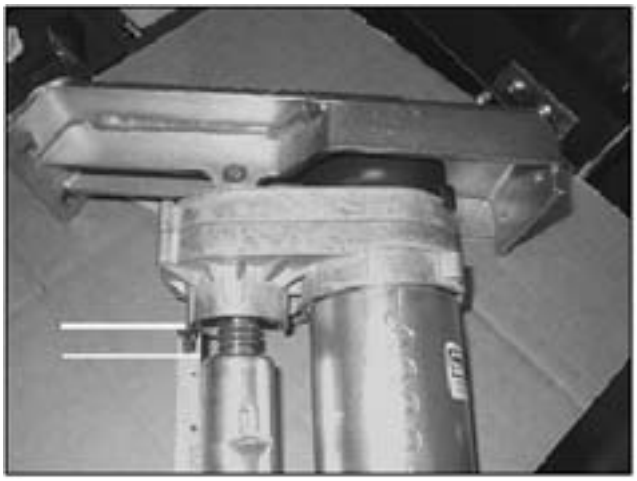
13. Lay some cardboard or other non–conductive material across the batteries and lay the actuator assembly down on it.

⚠ FOR SAFETY: To prevent shock or sparks, do not lay actuator or metal tools on battery cables.

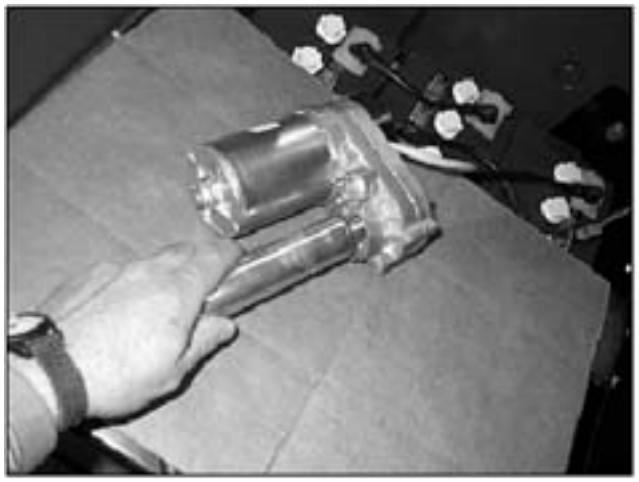


14. Plug the actuator into the harness, power on and allow the actuator to turn freely until the upper limit switch in the actuator opens and turns the motor off.

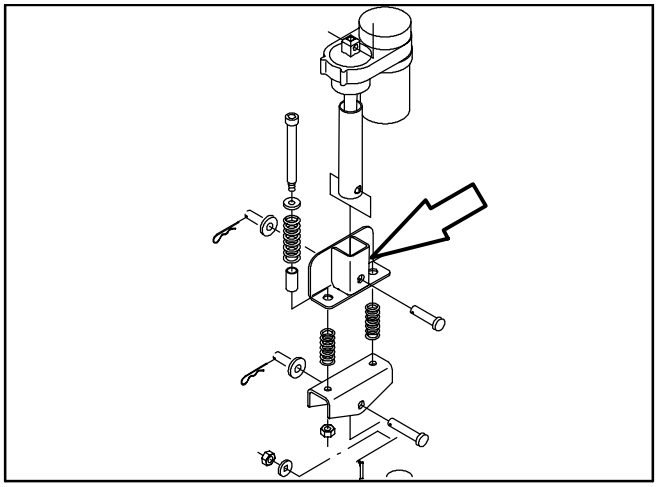
15. Power off. Turn the tube by hand until the gap between the gear–box and tube is 11 mm (7/16 in).



16. Hold onto the tube, power on, activate forward propel until the actuator reaches full extension, then power off. HOLD ON TO THE TUBE ALL THE WAY. If it slips, repeat steps 13 & 14.

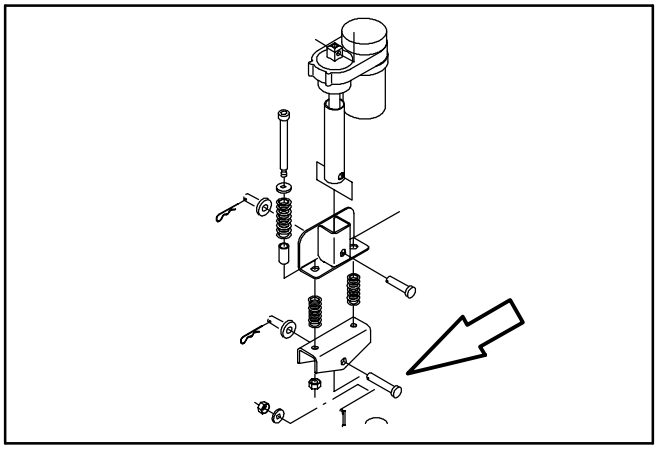


17. Unplug the actuator and reinstall the lower bracket



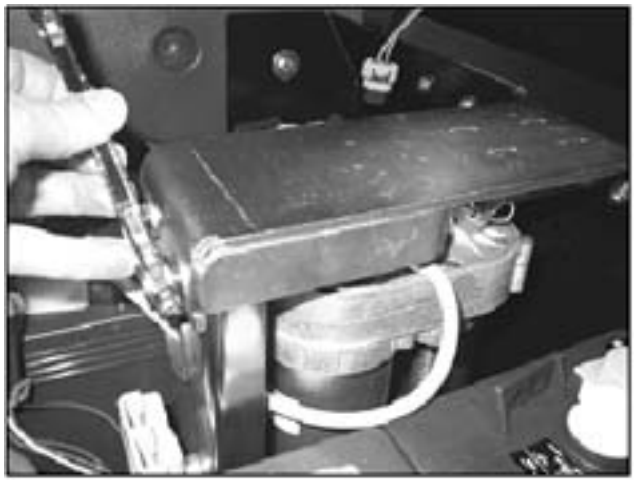
18. Remove the cardboard and place the actuator back into position.

19. Connect the actuator to the machine by installing the lower clevis pin.



7080 –Scrub Head Actuator Removal & Installation

20. Start the two rear bolts into the actuator plate.



21. Power on, and allow the actuator to retract and pull the upper plate into position.

⚠ FOR SAFETY: Keep hands clear of pinch points while retracting actuator.

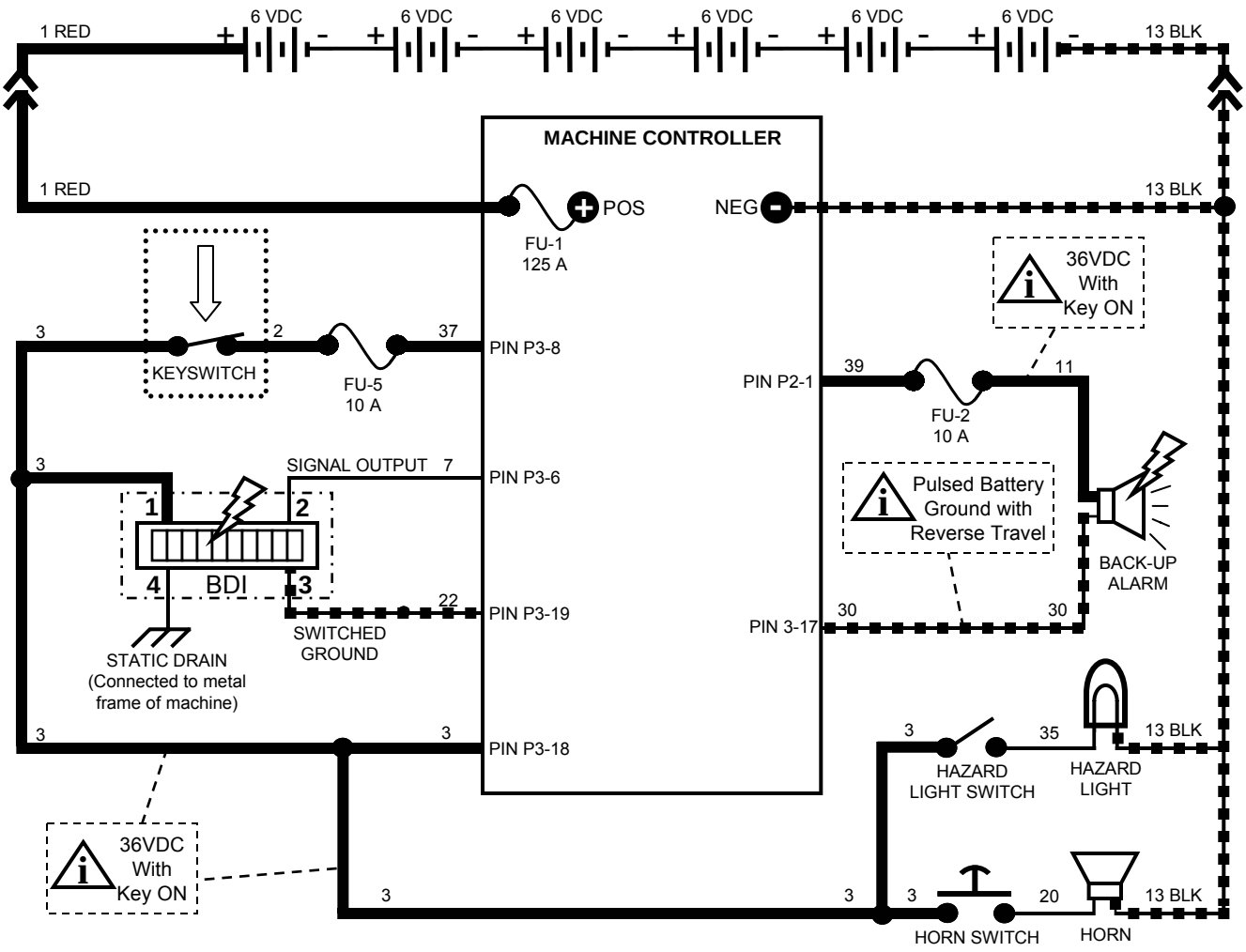
22. Install and tighten all four plate bolts and plug in the actuator.

23. Plug in the seat switch and the traction plug.

24. Install scrub brushes or pad drivers.

7080 – Horn, Back-up Alarm & Hazard Light Systems

CONDITIONS: **Key ON, operator on seat & reverse travel (for back-up alarm)**



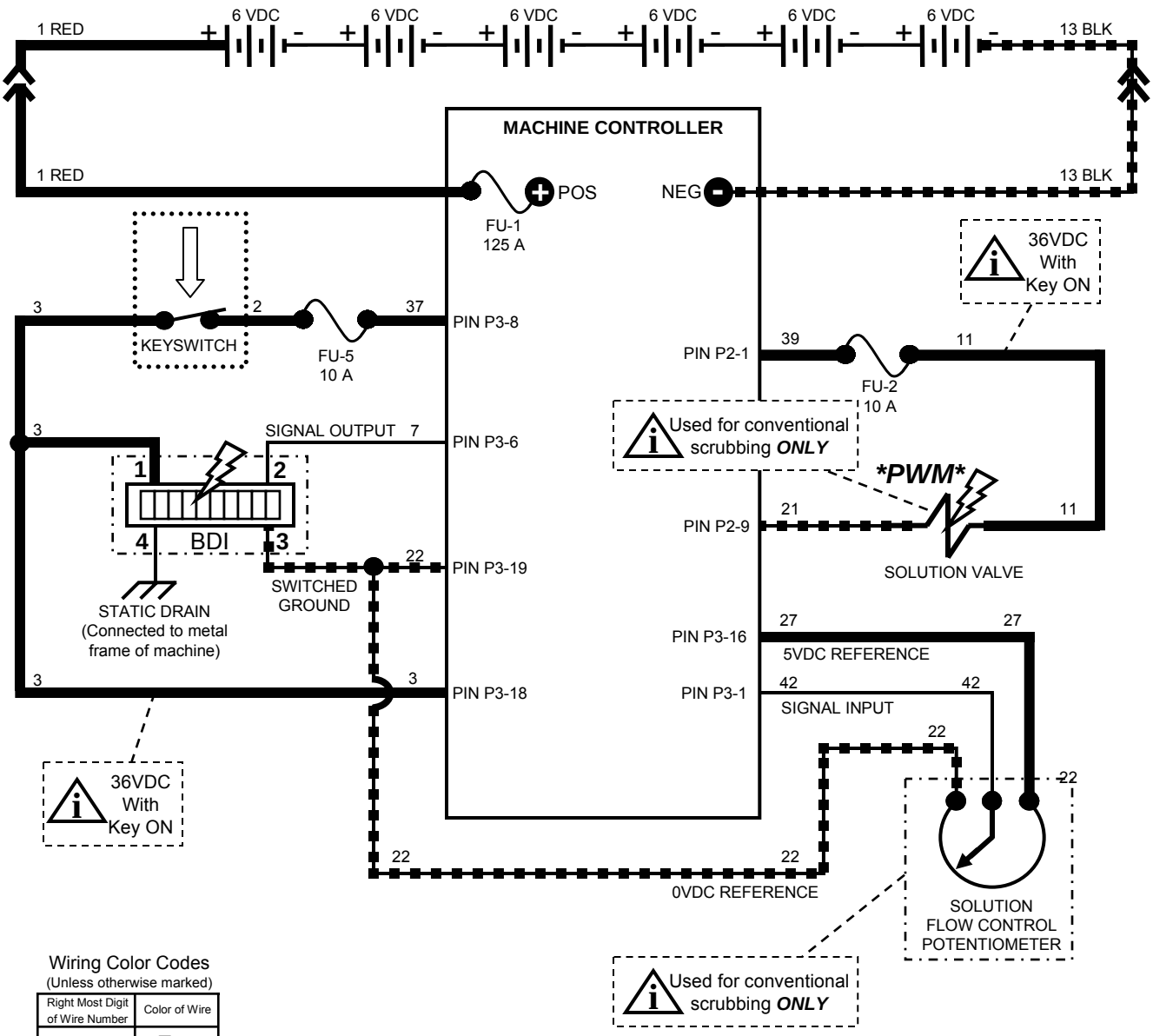
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Back-up Alarm sounds only during reverse travel

7080 – Solution Flow Control (00000000-10143032)

CONDITIONS: **Key ON, operator on seat, forward travel, One Step switch ON, scrub mode switch in "scrub only" or "scrub & vacuum" position**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Not all machines use electronic Solution Flow Control – some machines use a mechanical device to control the amount of solution applied to the floor

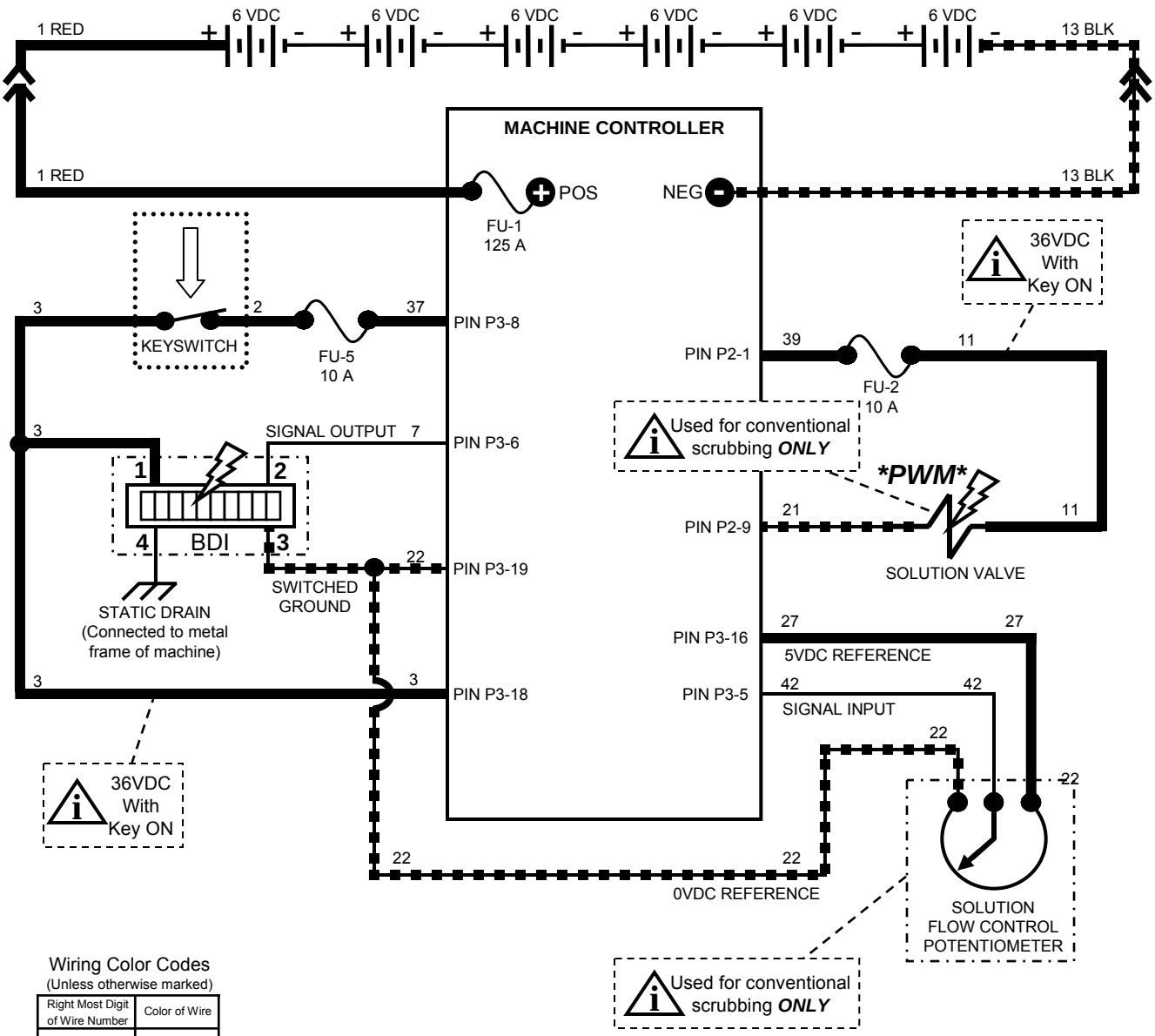
If electronic Solution Flow Control is used, the Solution Valve is controlled by Pulse Width Modulation

The Solution Valve and Solution Flow Control Potentiometer is used only during conventional scrubbing – they are NOT used during FaST scrubbing

Typical Solution Valve current draw: 0.3 to 0.5 Amps

7080 – Solution Flow Control (10143033-)

CONDITIONS: **Key ON, operator on seat, forward travel, One Step switch ON, scrub mode switch in "scrub only" or "scrub & vacuum" position**



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Not all machines use electronic Solution Flow Control – some machines use a mechanical device to control the amount of solution applied to the floor

If electronic Solution Flow Control is used, the Solution Valve is controlled by Pulse Width Modulation

The Solution Valve and Solution Flow Control Potentiometer is used only during conventional scrubbing – they are NOT used during FaST scrubbing

Typical Solution Valve current draw: 0.3 to 0.5 Amps

7080 – Fuses & Circuit Breaker

Fuses

fuse #	rating	circuit protected	location
FU-1	125 Amps	Machine Controller	On Machine Controller where Battery (+) cable attaches
FU-2	10 Amps	Solution Valve; ES Pump; Recovery Tank Full Lamp; Back-up Alarm	Near the two multi-pin connectors on the Machine Controller
FU-3	10 Amps	Squeegee Lift Actuator	
FU-4	10 Amps	Scrub Head Actuator	
FU-5	10 Amps	Key Switch; BDI; Machine Controller	

Circuit Breaker

circuit breaker #	rating	circuit protected	location
CB-3	10 Amps	FaST Detergent, Air, & Water Pumps; FaST Solenoid Valve; FaST Timer Module	On the lower part of the operator console

Troubleshooting Guide for the PG Drives “Trio” Controller

This guide was prepared to help you diagnose and repair the machine controller. It is recommended that you begin your troubleshooting at the **START** point on page 2. The following chart lists the contents of this troubleshooting guide

page	description
2	START point for troubleshooting
3	TEST 1: Scrubbing Functions Troubleshooting
4	Covers the following functions:
5	Scrub brush motors, scrub head and squeegee actuators, and vacuum fan
6	TEST 2: Other Systems Troubleshooting
7	Covers the following functions:
8	ES system, recovery tank full light, horn, & solution flow control (if electrically controlled)
9	TEST 3: Propelling Troubleshooting
10	Covers traction motor and foot throttle
11	TRIO pin configurations diagram
12	TRIO connectors P2 & P3 pin inputs and outputs charts
13	TRIO battery cable connections diagram
14	TRIO BDI charts & diagrams

Controller System Troubleshooting

Safety & Test Requirements:
Disconnect traction motor plug on Trio
Drive wheel off ground, back wheels blocked
Key switch "on" & unplug seat switch

TRIO Controller Notes
Controller will be referred to as "TRIO"
"BDI" is Battery Discharge Indicator
Be sure to have adequate battery charge

Disconnect traction motor plug from Trio before conducting these tests!

START

With key on, do any BDI segments light up?

Yes

No

Note: For information on the Trio pin configurations, go to pages 11 & 12

Note: Refer to diagram on page 14

Note: Refer to Page 13, Figure 1

What is BDI status?

Steady or flashing segments

Segments "rippling" up and down

With meter leads on the Trio's battery cable bolts, is battery voltage measured?

Yes

No

What system is not working properly?

Propel system

Go to **TEST 3** Page 9

With key on or off, is there battery voltage at Trio connector P3 pin# 8?

Note: Refer to Page 13, Figure 2

Other systems

Scrubbing system

Go to **TEST 2** Page 6

Note: Refer to diagram on page 14

With key on, is there battery voltage at BDI pin# 1?

With meter leads on the battery cable ends at the Trio, is battery voltage measured?

Go to **TEST 1** Page 3

With key off, is there continuity between BDI pin# 3 & Trio connector P3 pin# 19?

Reset or replace emergency stop switch, check all fuses, check all wiring connections, recheck fuses & wiring, replace Trio if needed

Replace main fuse on Trio at B+ connection

Replace BDI

With key off, is there continuity between BDI pin# 2 & Trio connector P3 pin# 6?

Check/replace Fuse# 5 (10 amps), check/replace ignition switch

Verify problem is repaired - retest from **START**

Repair or replace battery cables, charge or replace batteries

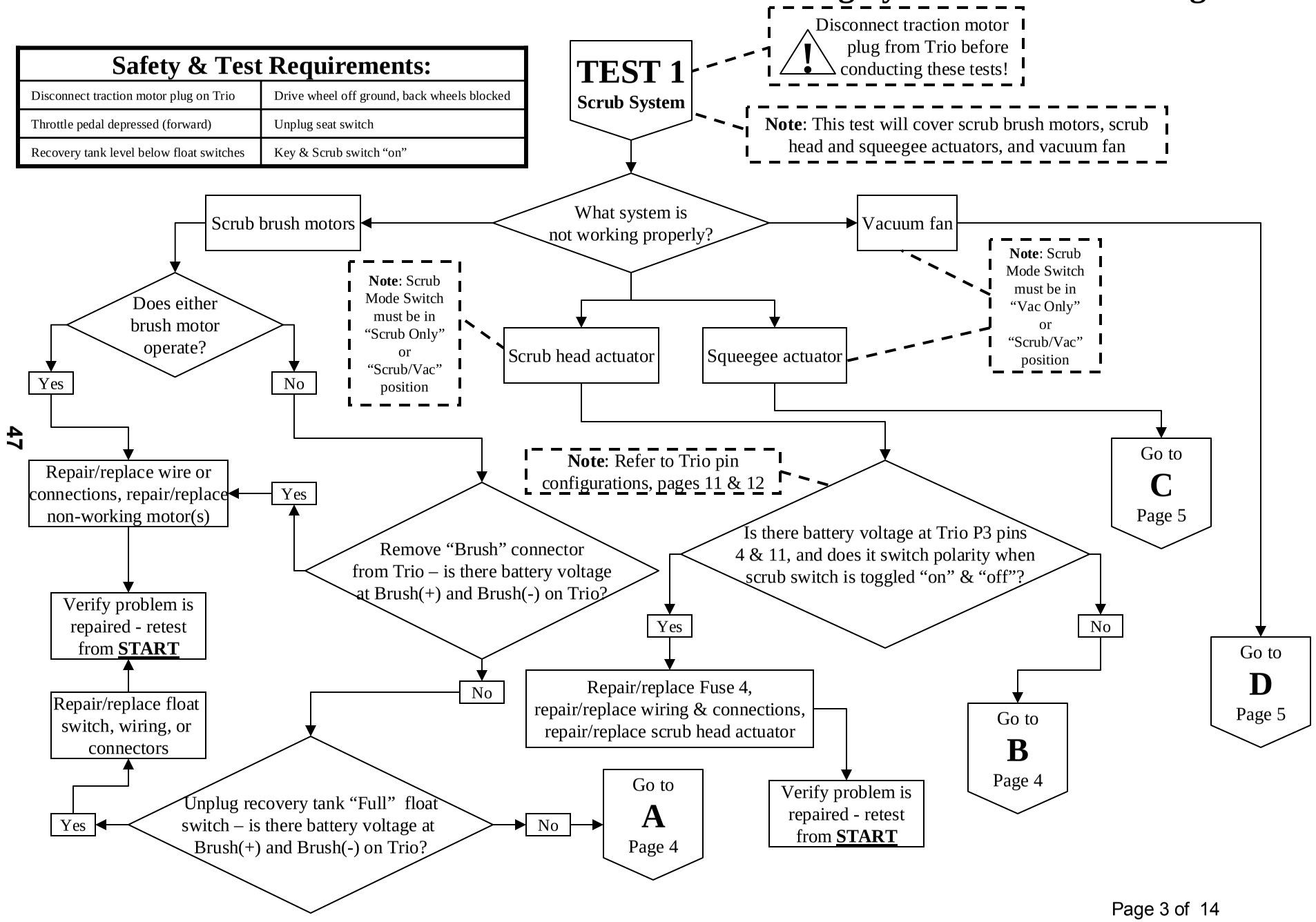
Verify problem is repaired - retest from **START**

Repair/replace wire or connections

Verify problem is repaired - retest from **START**

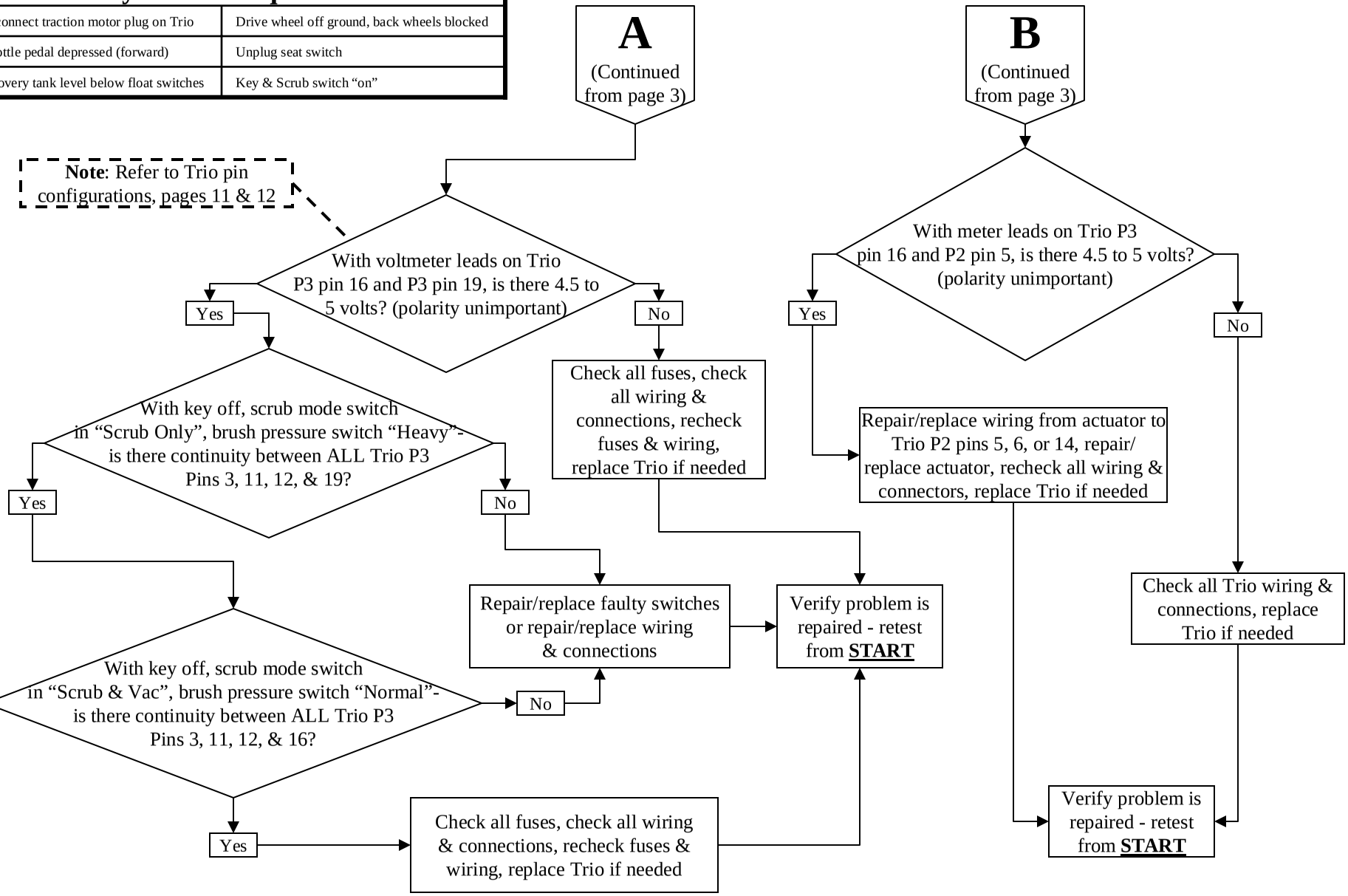
Scrubbing System Troubleshooting

Safety & Test Requirements:	
Disconnect traction motor plug on Trio	Drive wheel off ground, back wheels blocked
Throttle pedal depressed (forward)	Unplug seat switch
Recovery tank level below float switches	Key & Scrub switch "on"



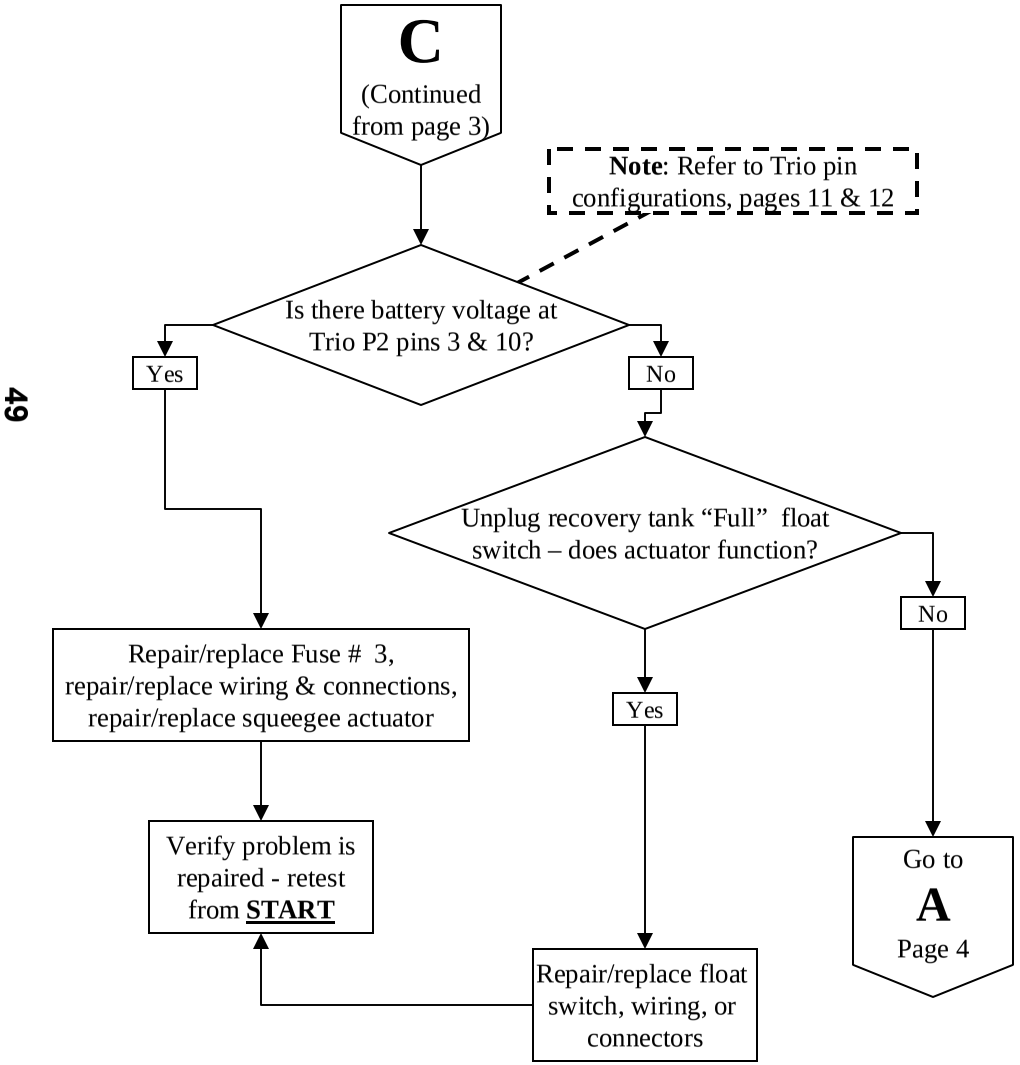
Scrubbing System Troubleshooting

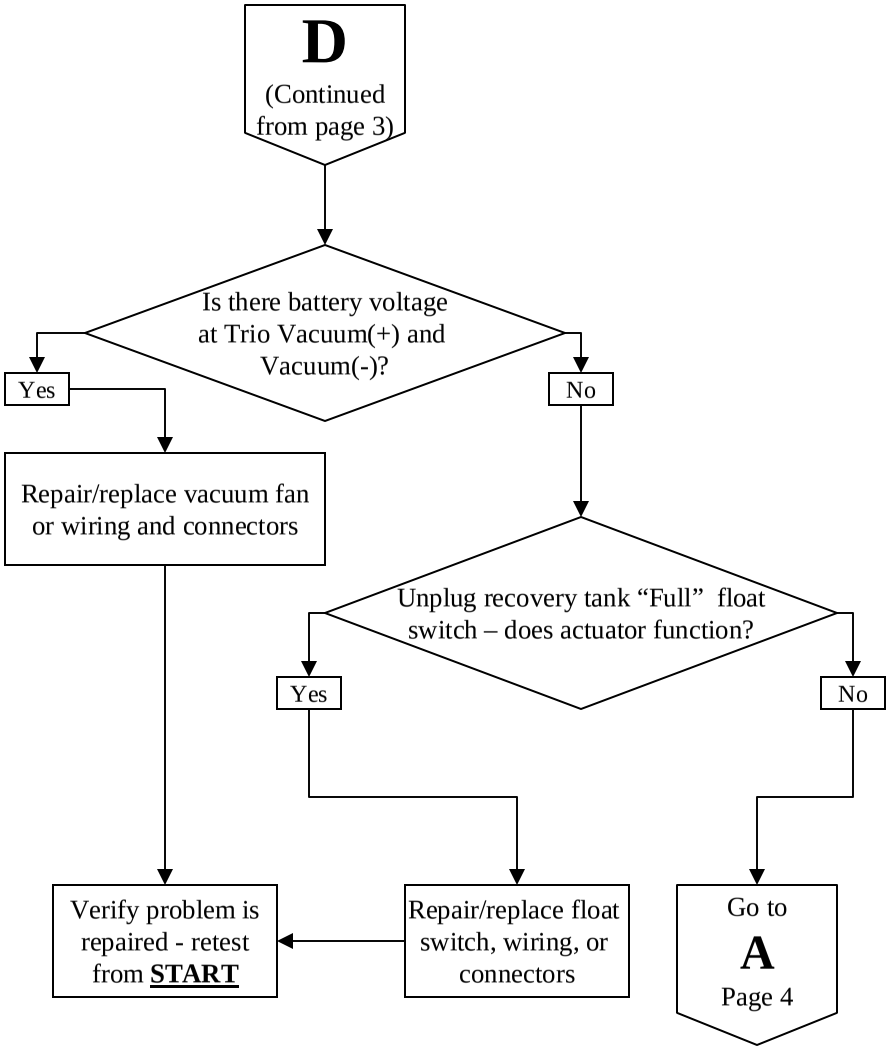
Safety & Test Requirements:	
Disconnect traction motor plug on Trio	Drive wheel off ground, back wheels blocked
Throttle pedal depressed (forward)	Unplug seat switch
Recovery tank level below float switches	Key & Scrub switch "on"



Scrubbing System Troubleshooting

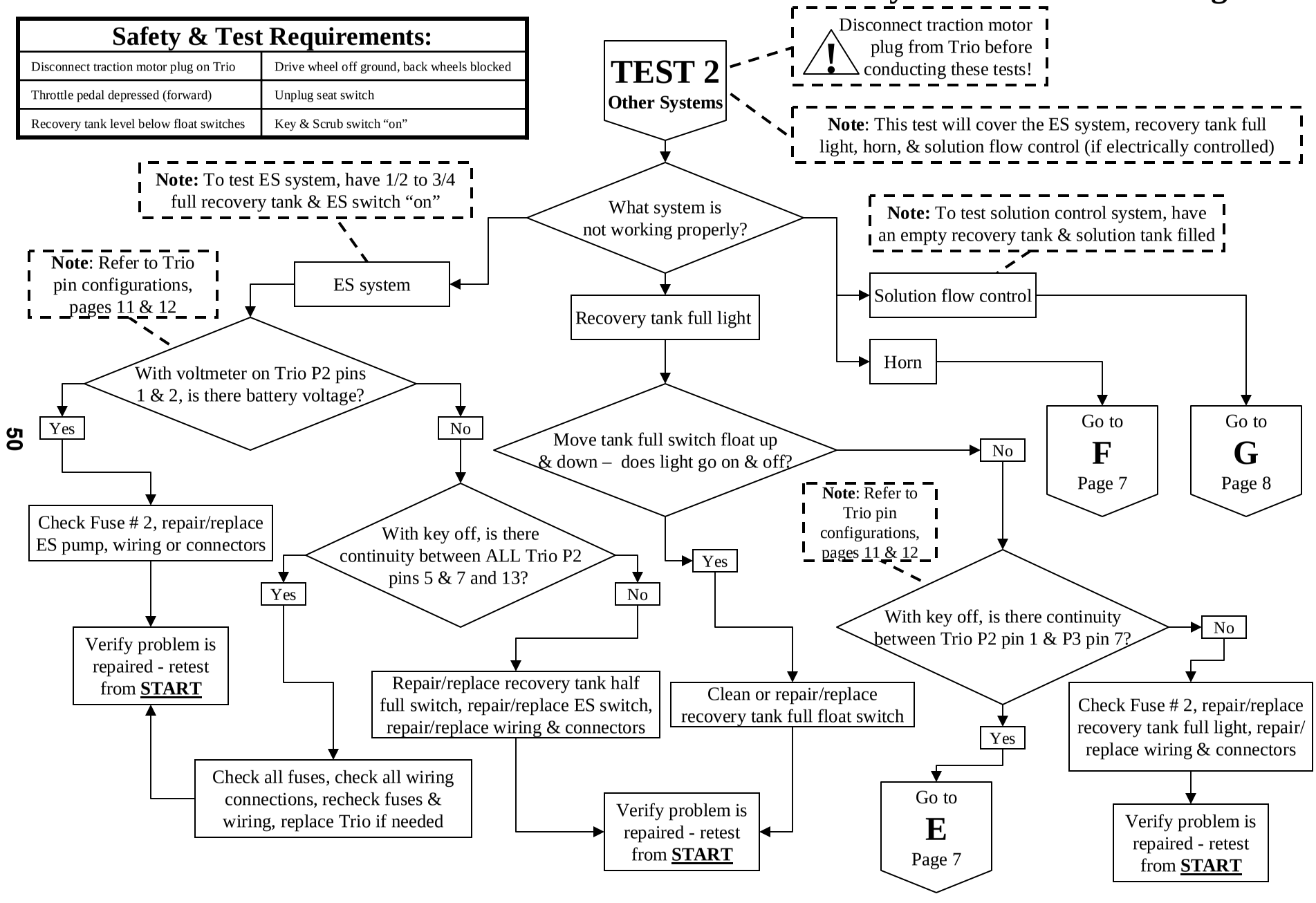
Safety & Test Requirements:	
Disconnect traction motor plug on Trio	Drive wheel off ground, back wheels blocked
Throttle pedal depressed (forward)	Unplug seat switch
Recovery tank level below float switches	Key & Scrub switch "on"





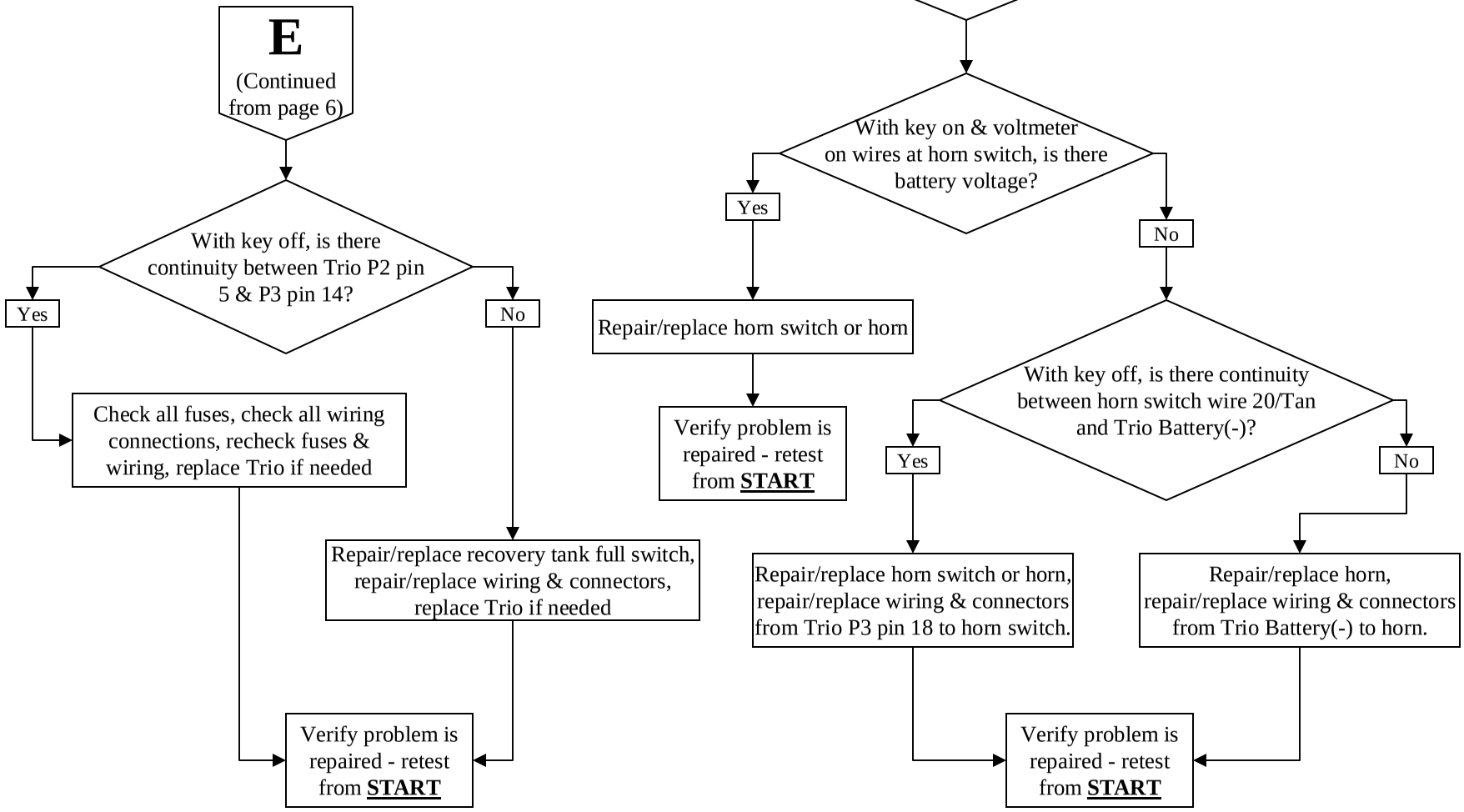
Other Systems Troubleshooting

Safety & Test Requirements:	
Disconnect traction motor plug on Trio	Drive wheel off ground, back wheels blocked
Throttle pedal depressed (forward)	Unplug seat switch
Recovery tank level below float switches	Key & Scrub switch "on"

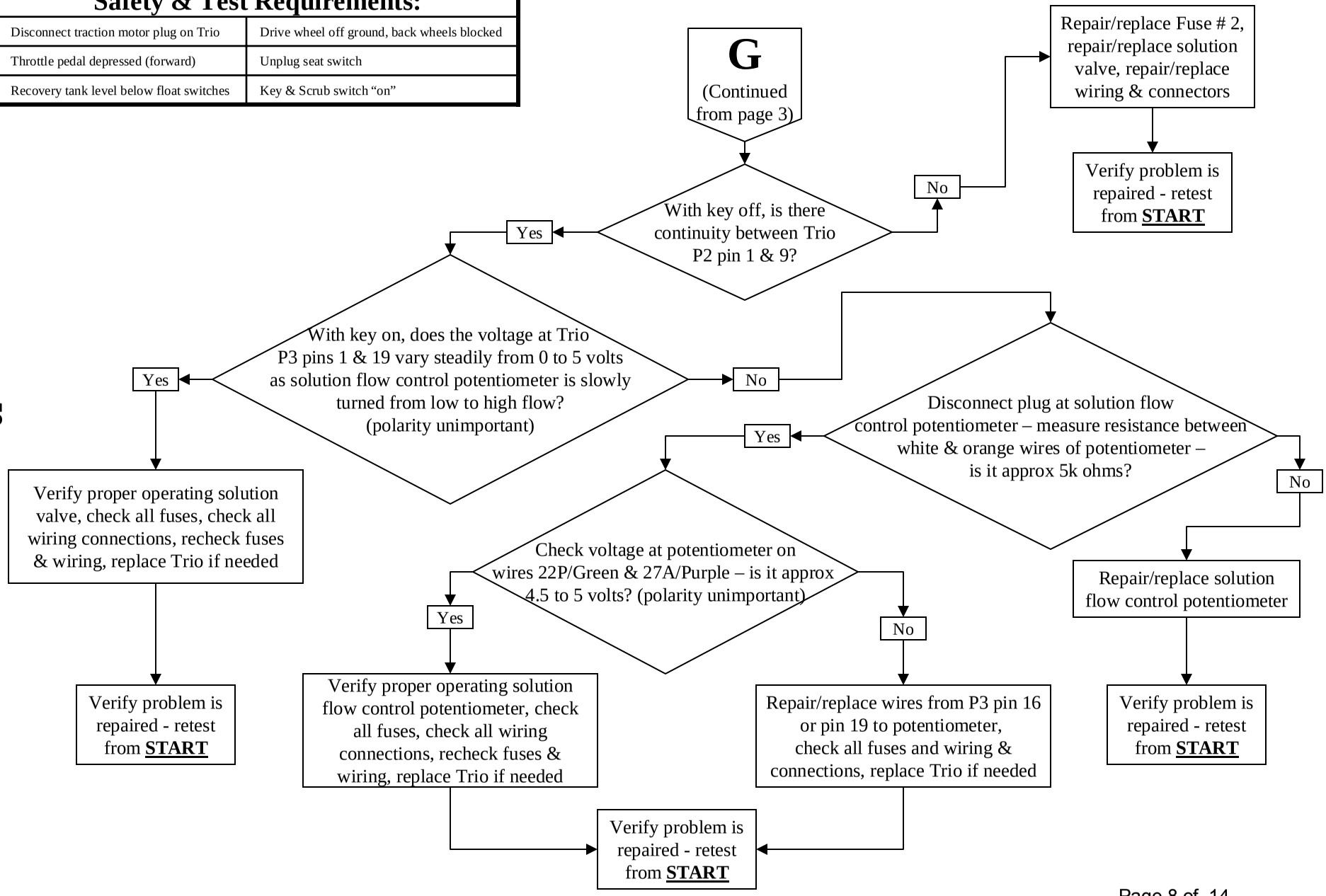


Other Systems Troubleshooting

Safety & Test Requirements:	
Disconnect traction motor plug on Trio	Drive wheel off ground, back wheels blocked
Throttle pedal depressed (forward)	Unplug seat switch
Recovery tank level below float switches	Key & Scrub switch "on"



Safety & Test Requirements:	
Disconnect traction motor plug on Trio	Drive wheel off ground, back wheels blocked
Throttle pedal depressed (forward)	Unplug seat switch
Recovery tank level below float switches	Key & Scrub switch "on"



Propelling Troubleshooting

Safety & Test Requirements:	
Disconnect traction motor plug on Trio	Drive wheel off ground, back wheels blocked
Key switch "on"	Unplug seat switch

TEST 3
Propel System

Note: This test will cover the traction motor & foot throttle

Does machine propel with seat switch unplugged and traction plug plugged into Trio?

Yes → Repair/replace seat switch, repair/replace wiring and connectors, replace Trio if needed → Verify problem is repaired - retest from **START**

No → Is BDI "rippling" up and down?

Yes → **Note**: Refer to Trio pin configurations, pages 11 & 12

No → Go to **H** Page 10

Measure NEUTRAL voltage at Trio P3 pins 9 & 10 - Is it approx.2.25 to 2.5 volts? (polarity not important)

Yes →

⚠ Disconnect traction motor plug from Trio before conducting this test!

With leads still connected, press throttle pedal slowly to full forward, then slowly to full reverse – Is there a steady rise/fall from Neutral voltage to 0 volts in one direction, and to approx. 5 volts in the other direction? (polarity not important)

Yes → Go to **H** Page 10

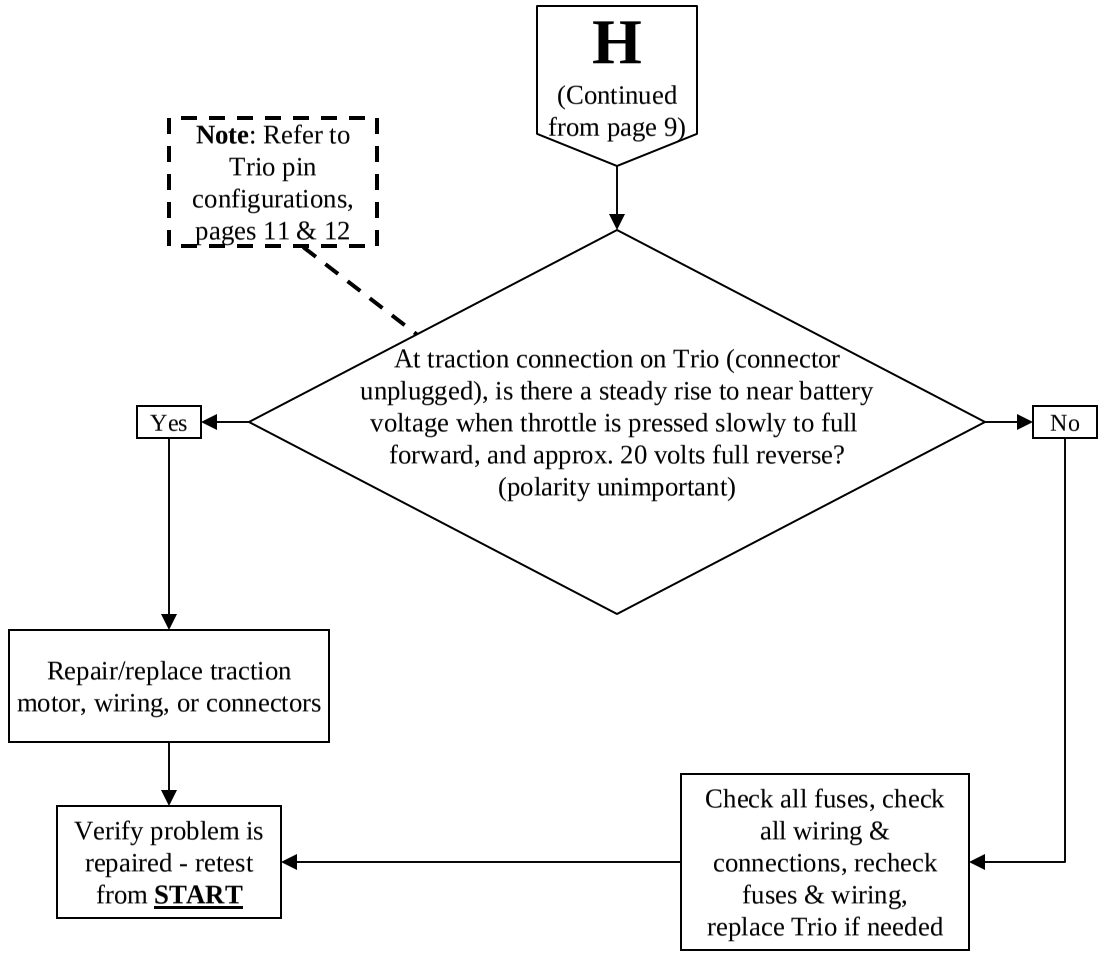
No → With key off, unhook connector P3 – measure resistance on connector plug wires on pins 9 & 20 – is it approx. 10k ohms?

Yes → Adjust or repair/replace throttle potentiometer → Verify problem is repaired - retest from **START**

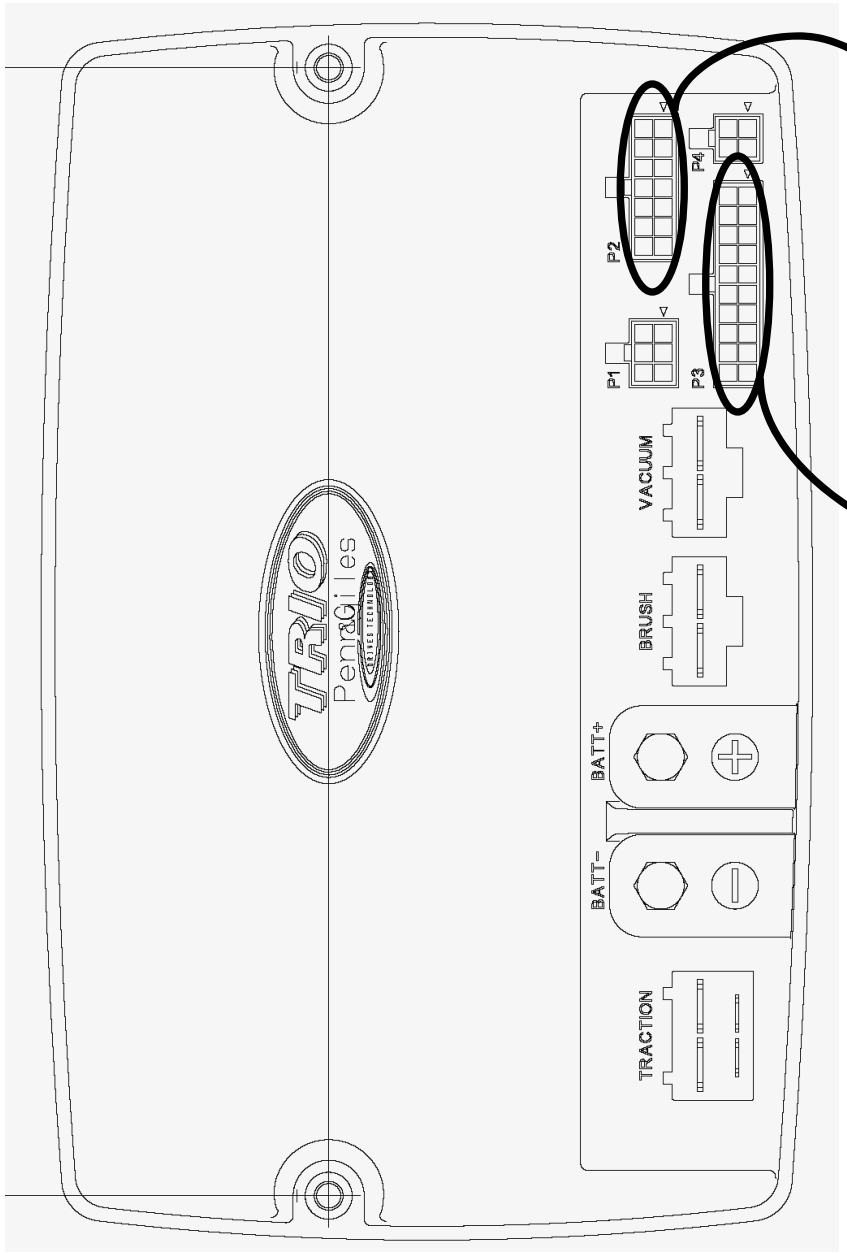
No → Replace throttle potentiometer. With P3 connected & key on , check/adjust potentiometer to get 2.25 to 2.5 volts at Trio P3 pins 9 & 10 → Verify problem is repaired - retest from **START**

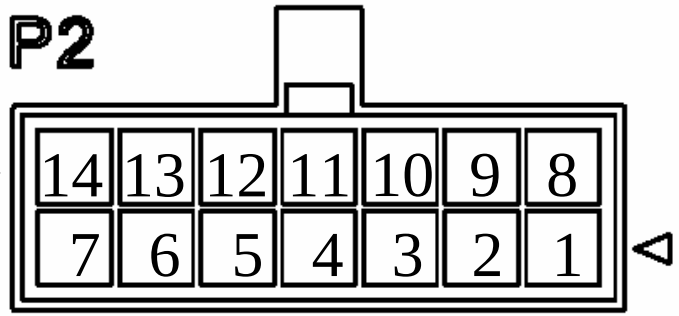
Propelling Troubleshooting

Safety & Test Requirements:	
Disconnect traction motor plug on Trio	Drive wheel off ground, back wheels blocked
Key switch “on”	Unplug seat switch

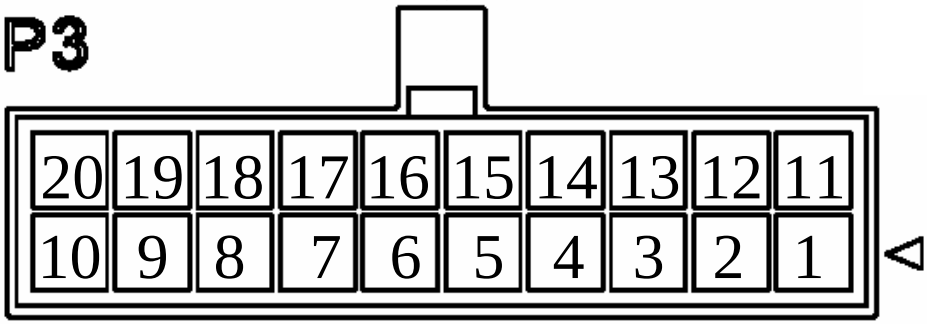


Trio Pin Configurations





NOTE: As viewed from rear of connectors (wire side)



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Trio Pin Inputs & Outputs

Connector P2

pin	input/output	description
P2-1	OUTPUT	SWITCHED BATTERY (+) FROM KEY SWITCH
P2-2	OUTPUT	ES PUMP [BATTERY (-)]
P2-3	OUTPUT	SQUEEGEE ACTUATOR [BATTERY (+) OR (-)]
P2-4	OUTPUT	SCRUB HEAD ACTUATOR [BATTERY (+) OR (-)]
P2-5	OUTPUT	0 VDC REFERENCE
P2-6	INPUT	SCRUB HEAD ACTUATOR RETRACT
P2-7	INPUT	ES SWITCH
P2-8	X	NOT USED
P2-9	OUTPUT	SOLUTION VALVE [BATTERY (-)]
P2-10	OUTPUT	SQUEEGEE ACTUATOR [BATTERY (+) OR (-)]
P2-11	OUTPUT	SCRUB HEAD ACTUATOR [BATTERY (+) OR (-)]
P2-12	X	NOT USED
P2-13	INPUT	RECOVERY TANK HALF FULL SWITCH
P2-14	INPUT	SCRUB HEAD ACTUATOR EXTEND

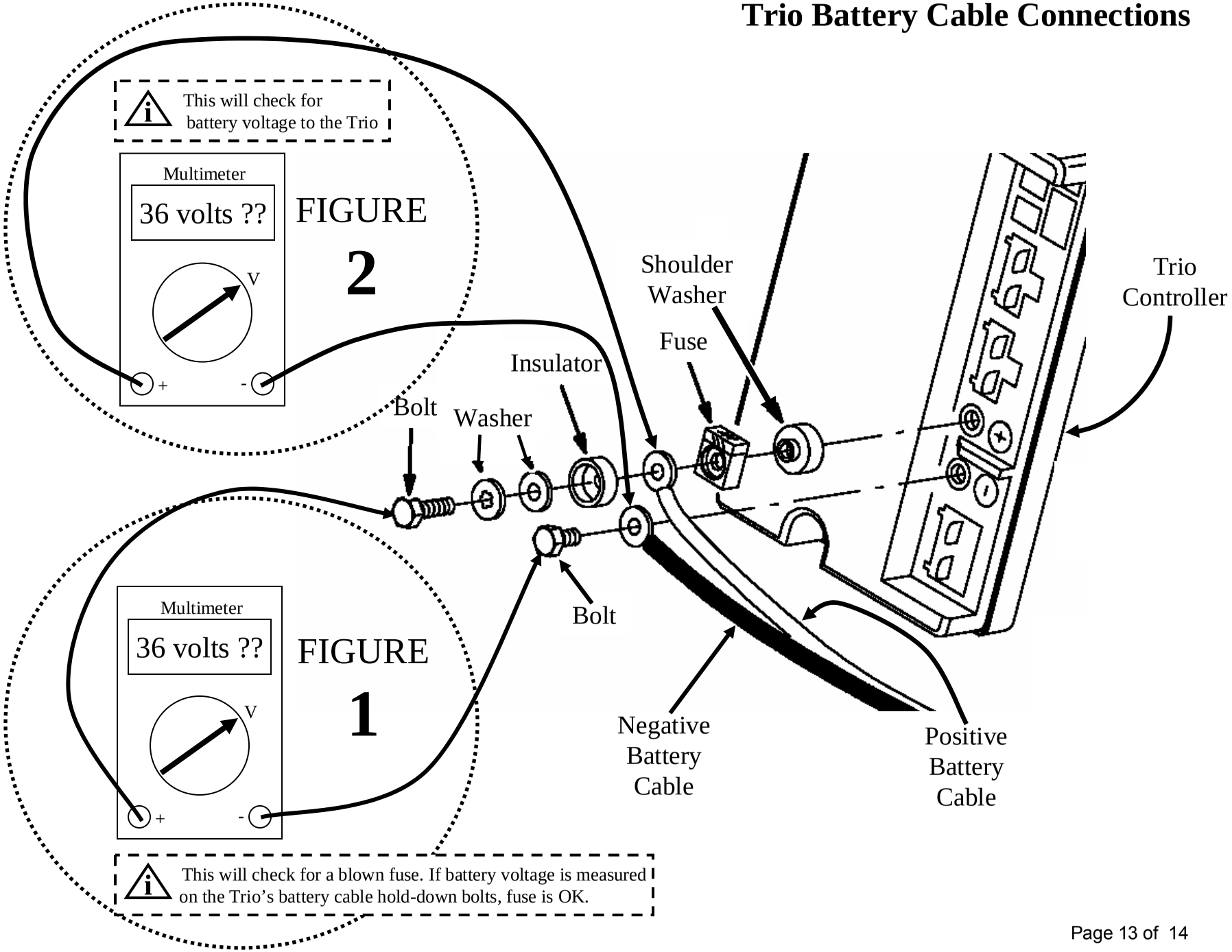
Connector P3

pin	input/output	description
*P3-1	INPUT	SOLUTION FLOW CONTROL (0 TO 5 VDC)
P3-2	INPUT	SCRUB HEAD TYPE (TRI-STATE)
P3-3	INPUT	SCRUB ON/OFF & BRUSH PRESSURE
P3-4	INPUT	EMERGENCY STOP SWITCH
**P3-5	INPUT	SOLUTION FLOW CONTROL (0 TO 5 VDC)
P3-6	OUTPUT	BATTERY DISCHARGE INDICATOR
P3-7	OUTPUT	RECOVERY TANK FULL LAMP [BATTERY (-)]
P3-8	OUTPUT	CONSTANT BATTERY (+)
P3-9	OUTPUT	0 VDC REFERENCE
P3-10	INPUT	THROTTLE POSITION (0 TO 5 VDC)
P3-11	INPUT	SCRUB MODE SWITCH (TRI-STATE)
P3-12	INPUT	SCRUB ON/OFF & BRUSH PRESSURE
P3-13	X	NOT USED
P3-14	INPUT	RECOVERY TANK FULL SWITCH
P3-15	INPUT	SEAT SWITCH
P3-16	OUTPUT	5 VDC REFERENCE
P3-17	OUTPUT	BACK-UP ALARM [BATTERY (-)]
P3-18	INPUT	SWITCHED BATTERY (+) FROM KEY SWITCH
P3-19	OUTPUT	0 VDC REFERENCE
P3-20	OUTPUT	5 VDC REFERENCE

* P3-1 not used on machines with serial numbers 10143033 and above

** P3-5 not used on machines with serial numbers 00000000 to 10143032

Trio Battery Cable Connections



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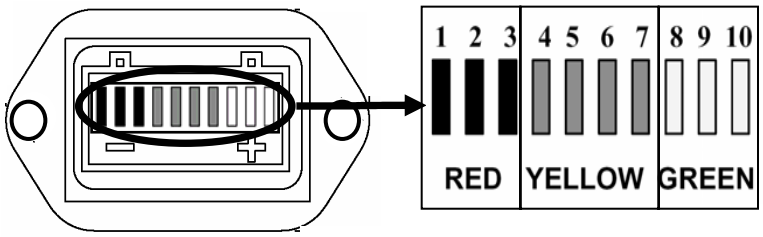
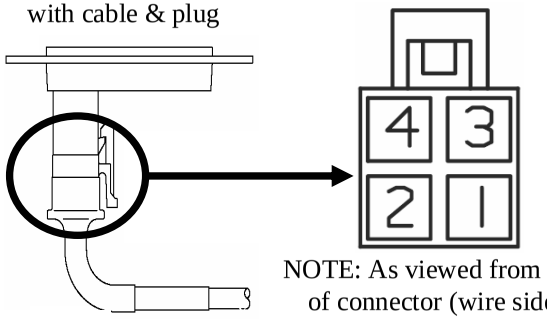
BDI Status Indicators

Indicator	Description
Red, yellow, and green LED's lit (not flashing)	System OK, no faults found, adequate charge in batteries
Only red and yellow LED's lit (not flashing)	Batteries will soon need to be charged
Only red LED's lit (not flashing)	Charge batteries immediately
LED's ripple up only (not down)	Batteries are being charged
BDI blinks on every 5 seconds	Controller has entered sleep mode after 20 minutes of inactivity
BDI flashing rapidly	Fault has been sensed; Refer to BDI Diagnostic Codes below
Ripple Up & Down	Throttle pedal depressed at start-up

BDI top view



BDI side view
with cable & plug



NOTE: As viewed from rear of connector (wire side)

BDI Diagnostic Codes

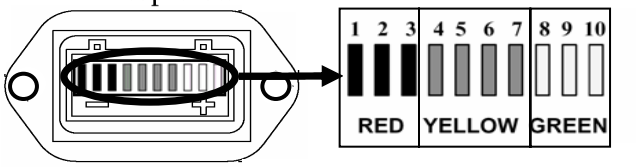
# Bars Flashing	Description of Fault	Possible Causes
1	LOW BATTERY VOLTAGE	Batteries need charged; Bad connection to batteries
2	TRACTION MOTOR FAULT	Bad connection to propel motor
3	SCRUB BRUSH MOTOR FAULT	Bad connection to scrub brush motors
4	NOT USED	
5	VACUUM MOTOR FAULT	Bad connection to vacuum fan motor
6	SEAT SWITCH FAULT	Operator not on seat; Faulty seat switch
7	THROTTLE FAULT	Throttle depressed before start-up
8	CONTROL SYSTEM FAULT	Emergency Stop Switch activated; Wiring issue; Faulty Trio controller
9	NOT USED	
10	EXCESSIVE BATTERY VOLTAGE	Bad connection to batteries
NOTE: Ripple Up & Down indicates throttle pedal depressed at start-up		

Trio BDI Information for Models with Optional On-board Charger

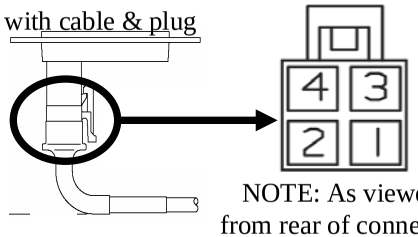
BDI Status Indicators

Indicator	Description
Red, yellow, and green LED's lit (not flashing)	System OK, no faults found, adequate charge in batteries
Only red and yellow LED's lit (not flashing)	Batteries will soon need to be charged
Only red LED's lit (not flashing)	Charge batteries immediately
LED's ripple up only (not down)	Batteries are being charged
BDI blinks on every 5 seconds	Controller has entered sleep mode after 20 minutes of inactivity
BDI flashing rapidly	Fault has been sensed; Refer to BDI Diagnostic Codes below
Ripple Up & Down	Throttle pedal depressed at start-up

BDI top view



BDI side view with cable & plug



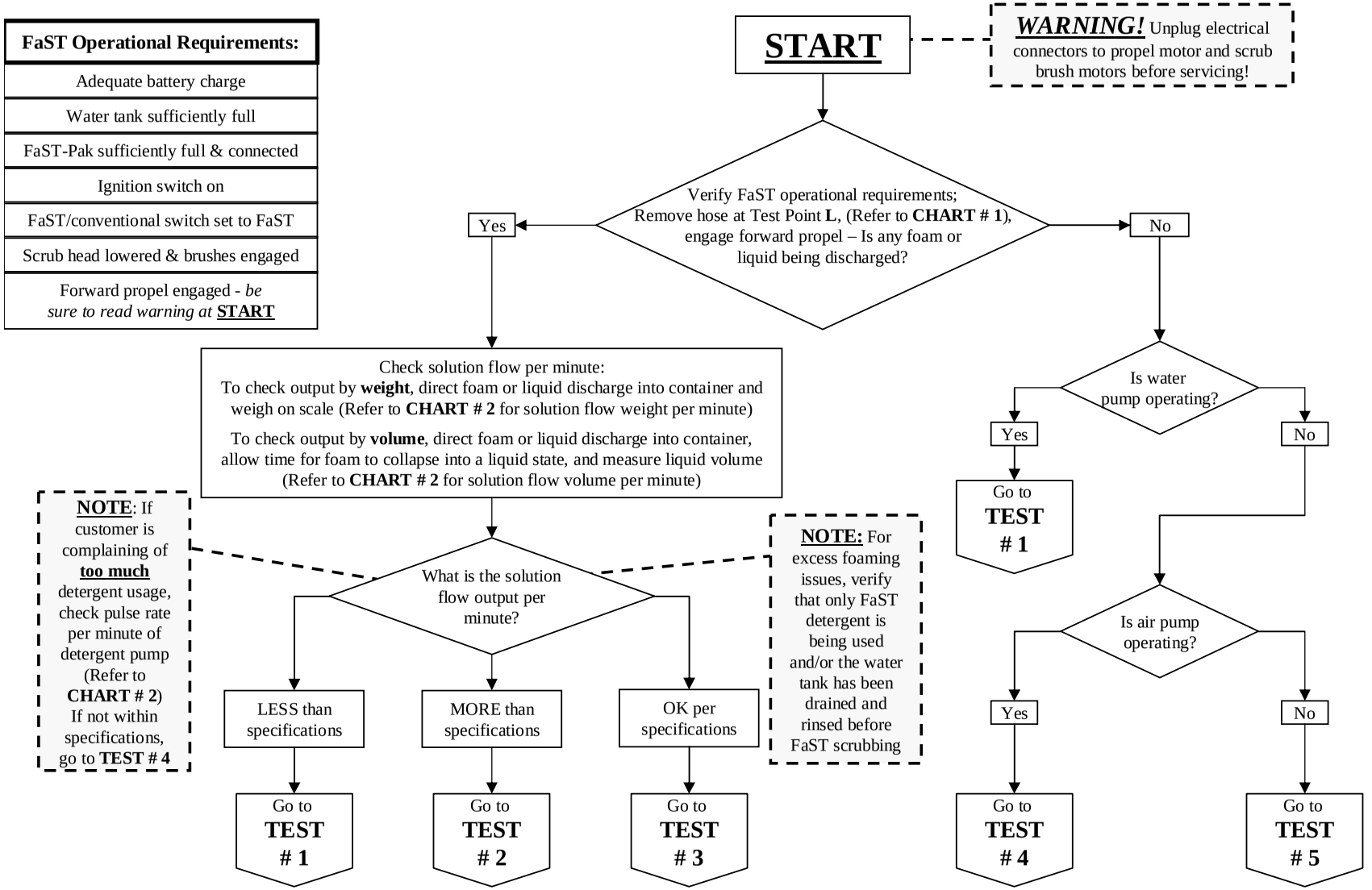
NOTE: As viewed from rear of connector (wire side)

BDI Diagnostic Codes

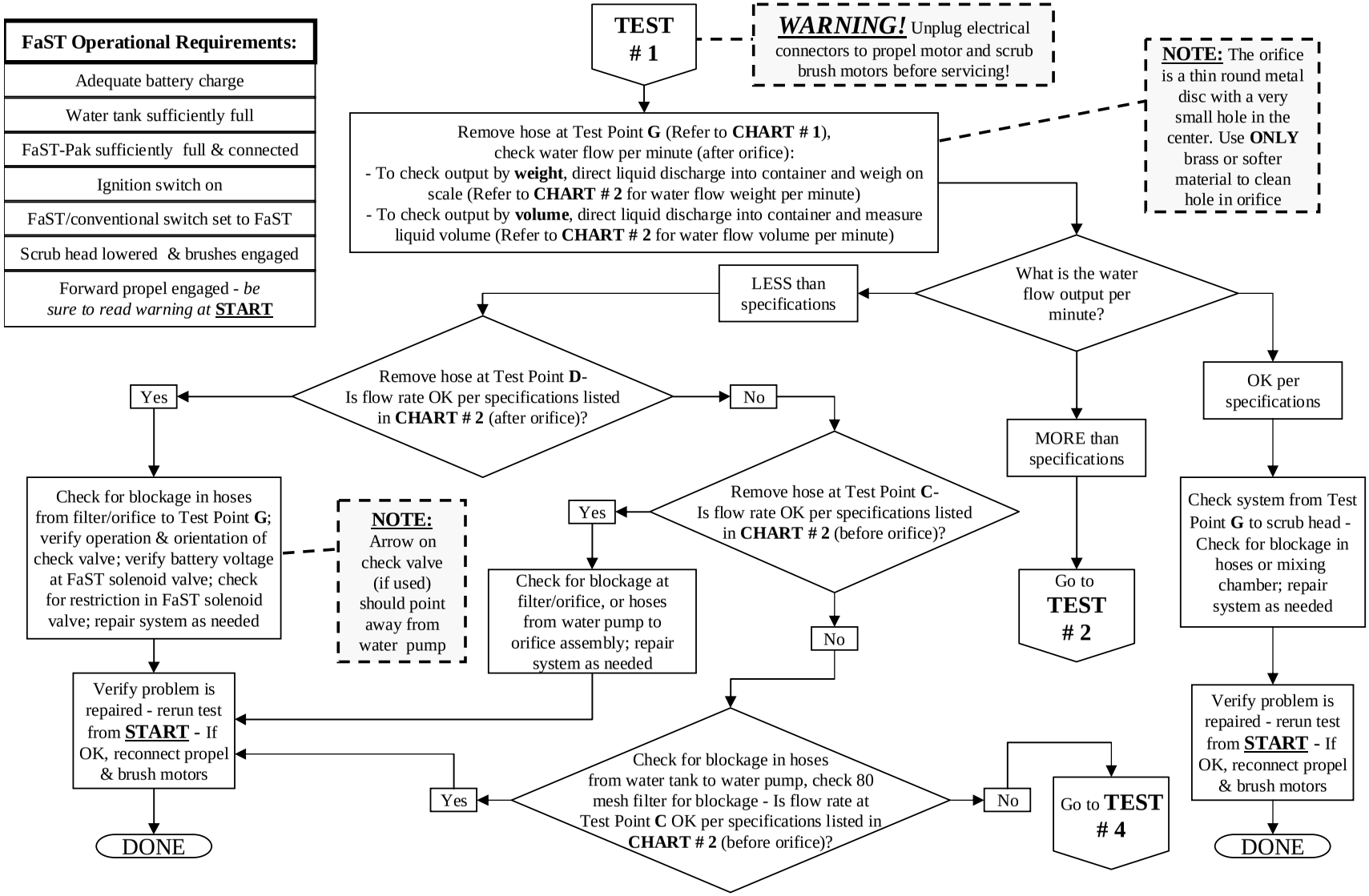
# Bars Flashing	# of Flashes	Description of Fault	Possible Causes
1	**1**	LOW BATTERY VOLTAGE	Batteries need charged; Bad connection to batteries
2	**1**	TRACTION MOTOR FAULT	Bad connection to propel motor
3	**1**	SCRUB BRUSH MOTOR FAULT	Bad connection to scrub brush motors
4	**1**	SCRUB HEAD ACTUATOR FAULT	Faulty actuator; Actuator unplugged
	2	SQUEEGEE ACTUATOR FAULT	Faulty actuator; Actuator unplugged
5	**1**	VACUUM MOTOR FAULT	Bad connection to vacuum fan motor
6	**1**	SEAT SWITCH FAULT	Operator not on seat; Faulty seat switch
7	**1**	THROTTLE FAULT	Throttle depressed before start-up
	2	INPUT SWITCH FAULT	Incorrect throttle pedal signal; Open throttle potentiometer
8	**1**	CONTROL SYSTEM FAULT	Emergency Stop Switch activated; Wiring issue; Faulty Trio controller
9	**1**	RECOVERY TANK FULL FAULT	Faulty level sensor; ; Level sensor unplugged
	2	BACK-UP ALARM FAULT	Faulty back-up alarm; Shorted back-up alarm or faulty wiring
	3	SOLUTION VALVE FAULT	Incorrect solution valve signal; Open solution valve potentiometer
	4	ES PUMP FAULT	Faulty ES pump; Shorted ES pump or faulty wiring
	5	HOUR METER FAULT	Faulty hour meter; Shorted hour meter or faulty wiring
10	**1**	EXCESSIVE BATTERY VOLTAGE	Bad connection to batteries
NOTE: Ripple Up & Down indicates throttle pedal depressed at start-up			

FaST Overall System Troubleshooting

FaST Operational Requirements:
Adequate battery charge
Water tank sufficiently full
FaST-Pak sufficiently full & connected
Ignition switch on
FaST/conventional switch set to FaST
Scrub head lowered & brushes engaged
Forward propel engaged - *be sure to read warning at* **START**

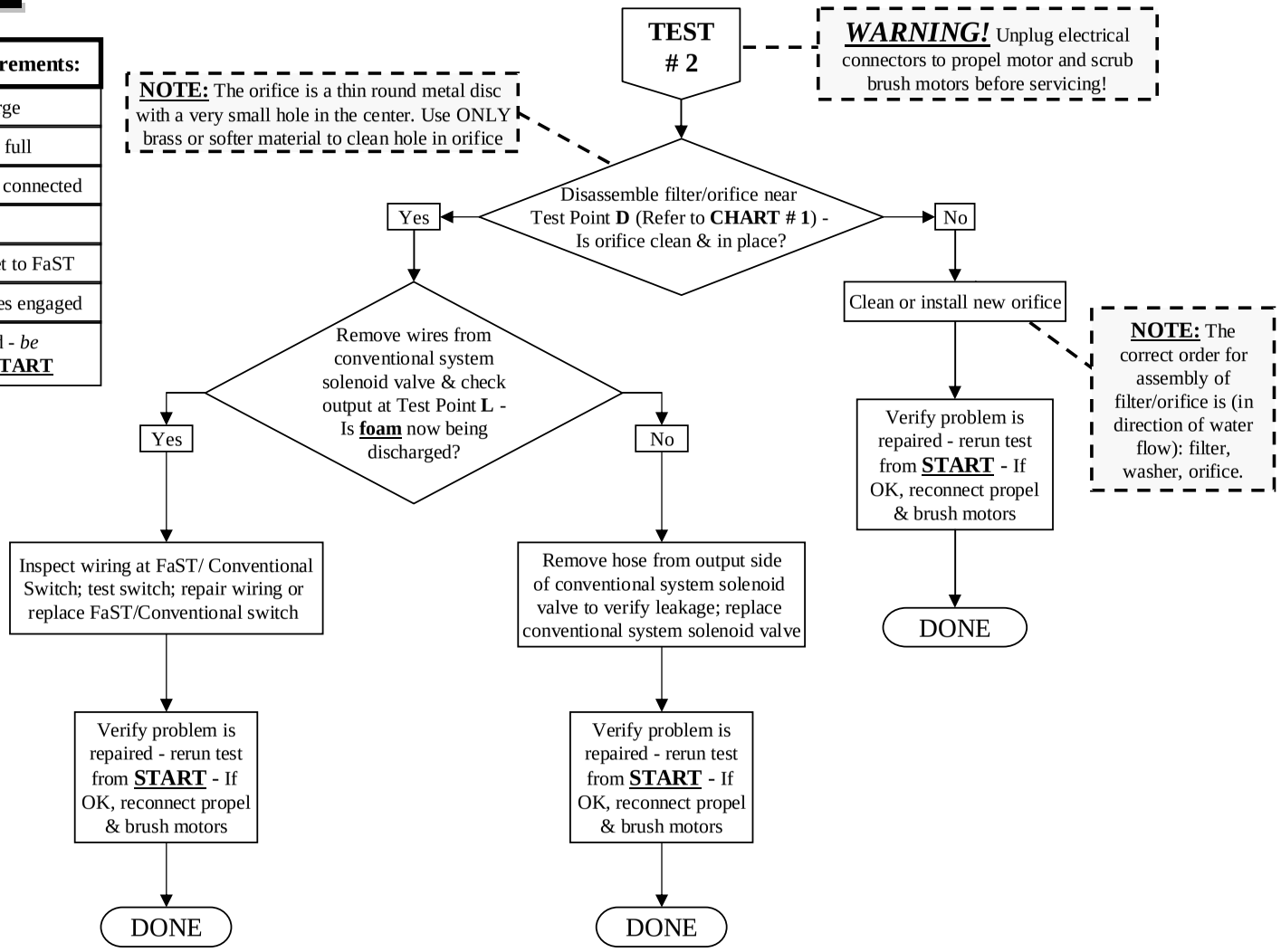


FaST Troubleshooting - TEST #1 (Low/no water or foam)

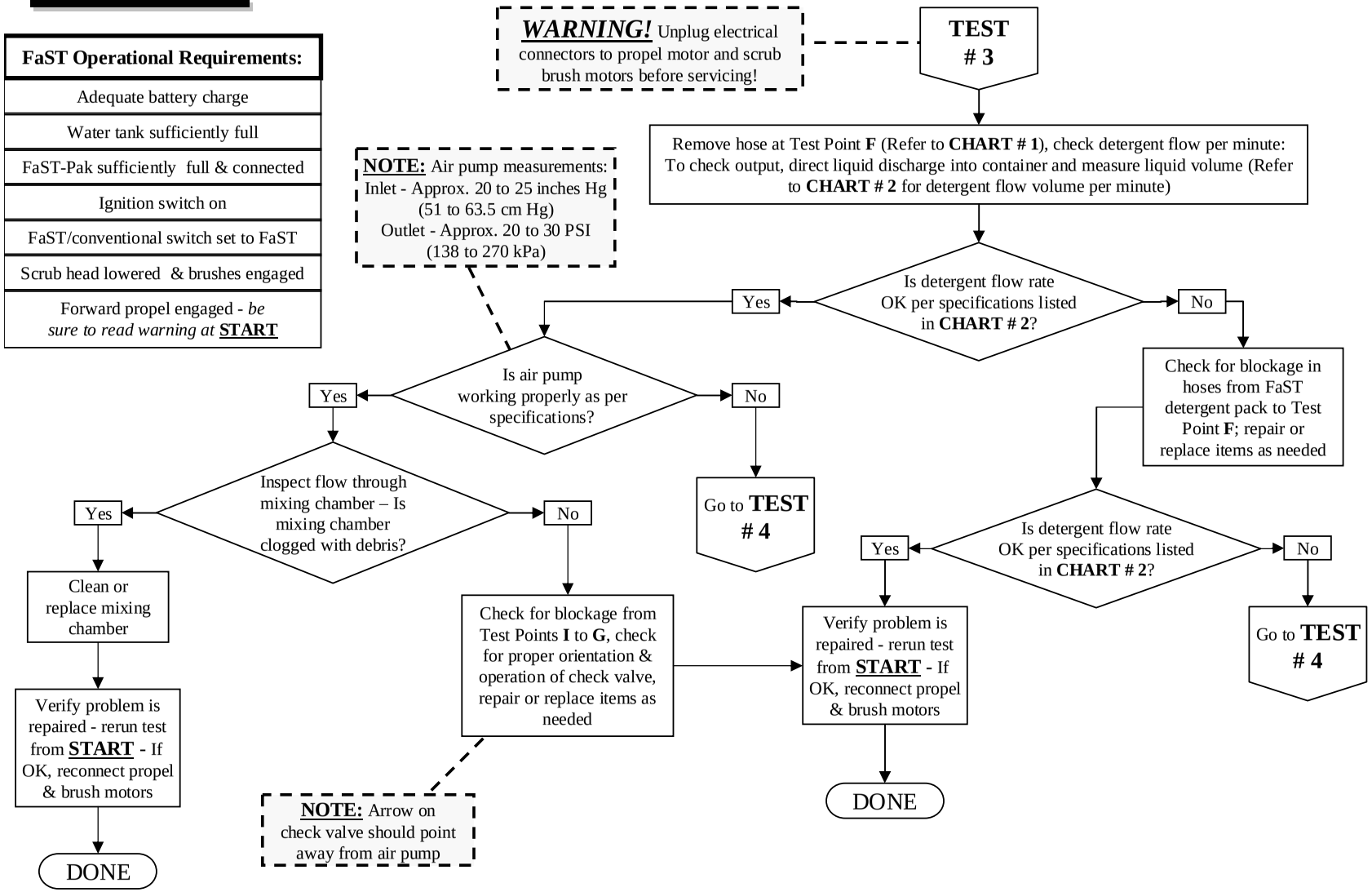


FaST Troubleshooting - TEST #2 (Too much water and low/no foam)

FaST Operational Requirements:
Adequate battery charge
Water tank sufficiently full
FaST-Pak sufficiently full & connected
Ignition switch on
FaST/conventional switch set to FaST
Scrub head lowered & brushes engaged
Forward propel engaged - *be sure to read warning at* **START**

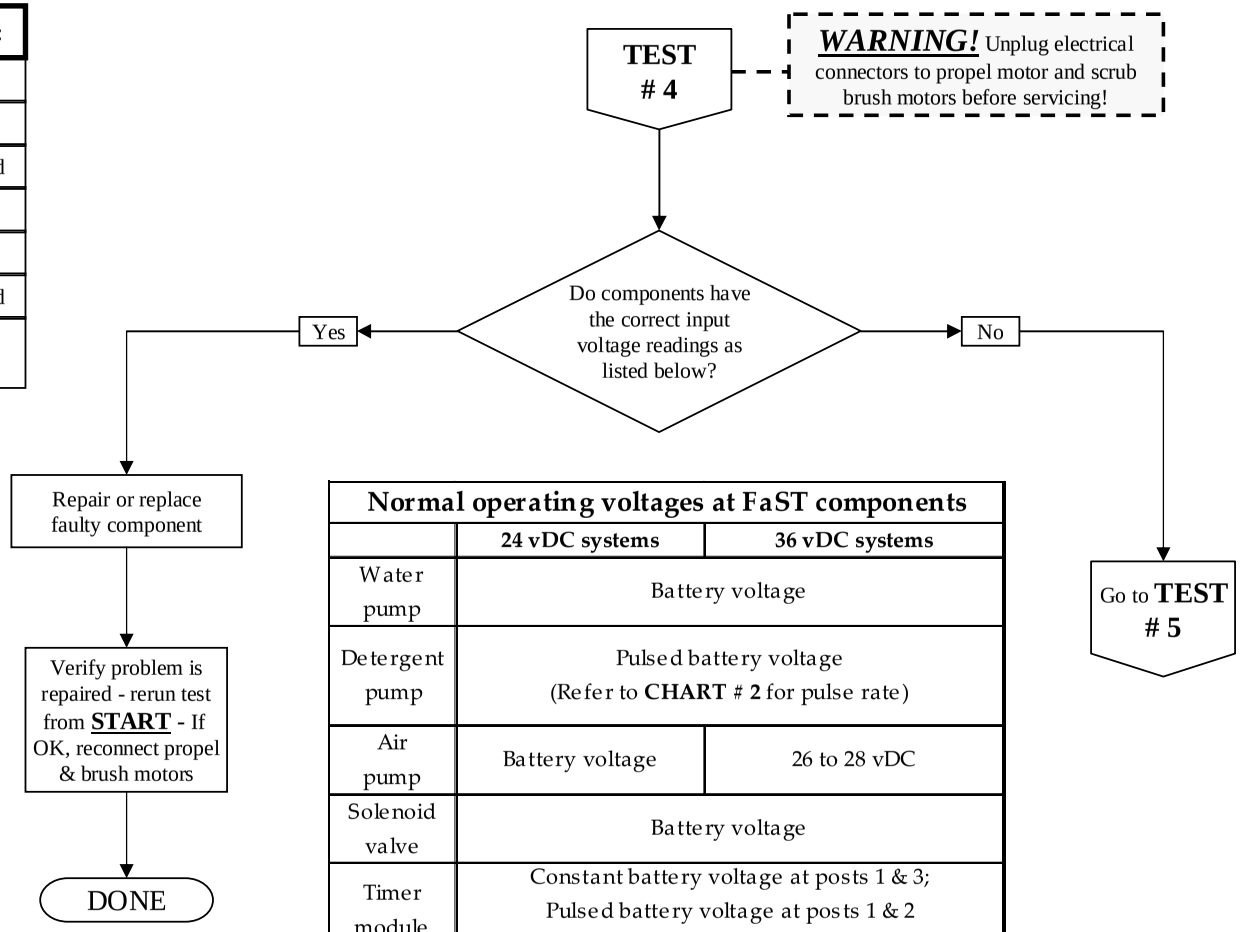


FaST Troubleshooting - TEST #3 (Water OK, no foam)



FaST Troubleshooting - TEST #4 (Individual component testing)

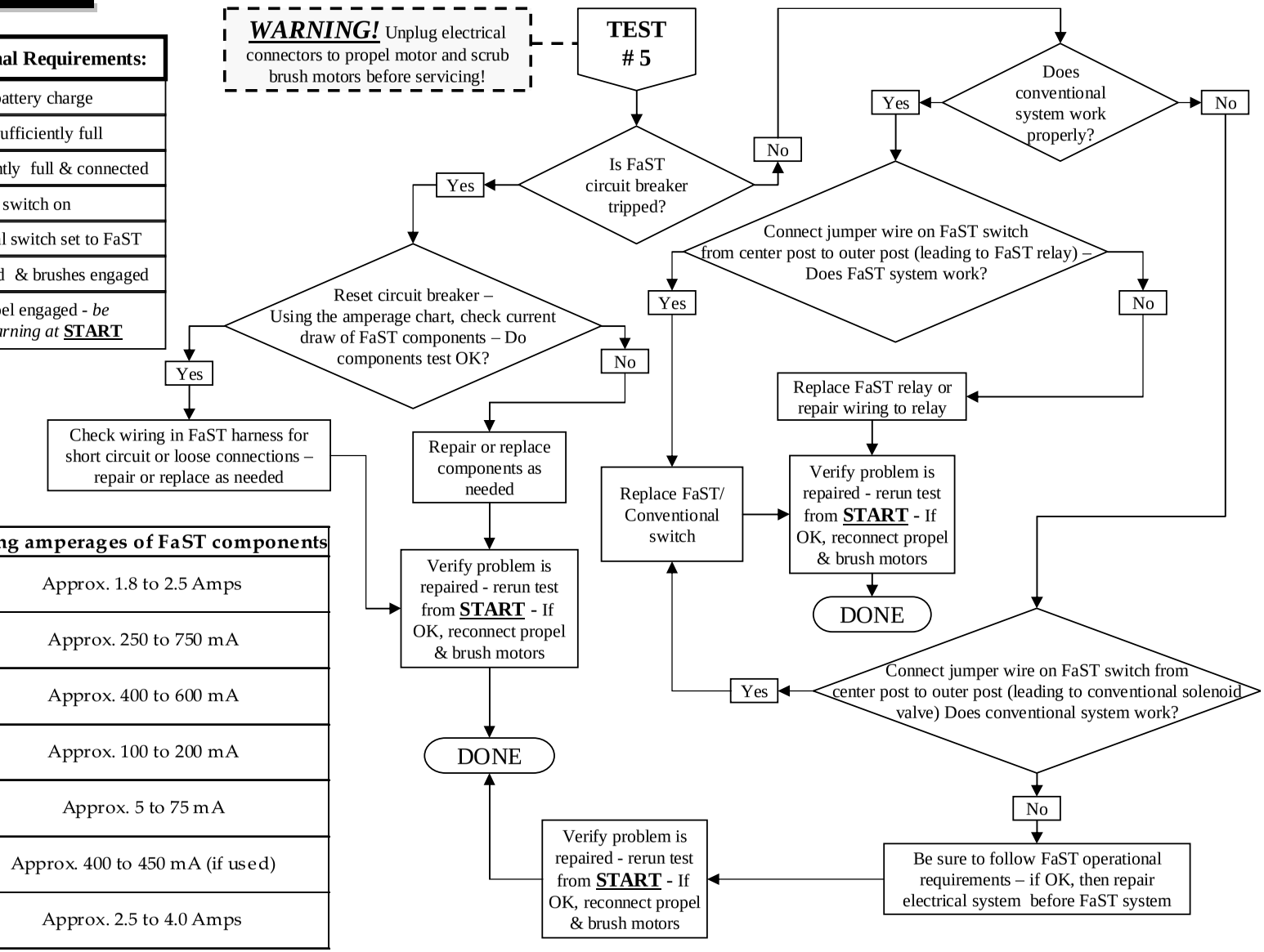
FaST Operational Requirements:
Adequate battery charge
Water tank sufficiently full
FaST-Pak sufficiently full & connected
Ignition switch on
FaST/conventional switch set to FaST
Scrub head lowered & brushes engaged
Forward propel engaged - *be sure to read warning at* **START**



Normal operating voltages at FaST components		
	24 vDC systems	**36 vDC systems**
Water pump	Battery voltage	
Detergent pump	Pulsed battery voltage (Refer to **CHART # 2** for pulse rate)	
Air pump	Battery voltage	26 to 28 vDC
Solenoid valve	Battery voltage	
Timer module	Constant battery voltage at posts 1 & 3; Pulsed battery voltage at posts 1 & 2 (Refer to **CHART # 2** for pulse rate)	
22 ohm resistor	Not used	8 to 12 vDC Voltage drop across resistor

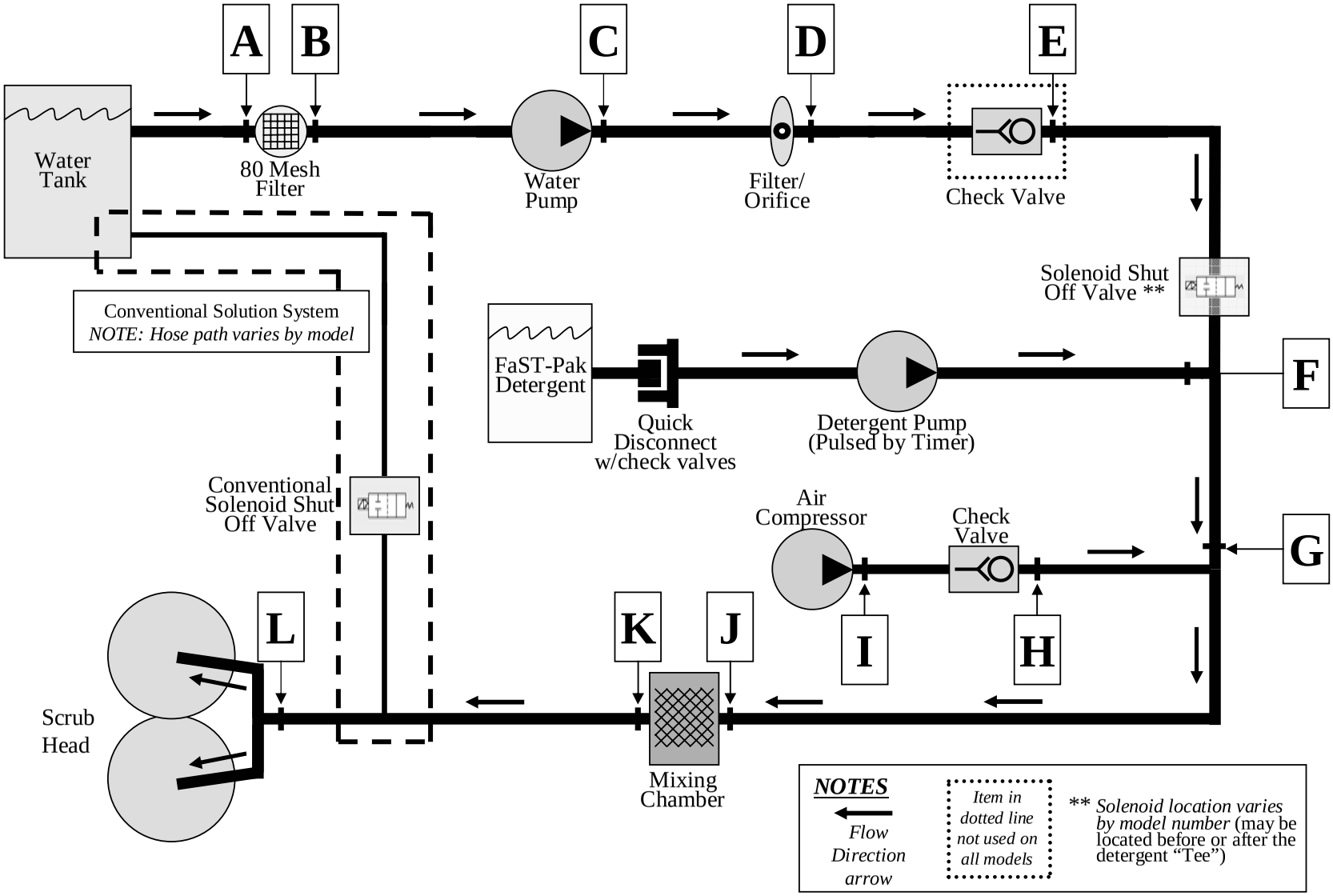
FaST Troubleshooting - TEST #5 (Overall electrical testing)

FaST Operational Requirements:
Adequate battery charge
Water tank sufficiently full
FaST-Pak sufficiently full & connected
Ignition switch on
FaST/conventional switch set to FaST
Scrub head lowered & brushes engaged
Forward propel engaged - *be sure to read warning at* **START**



Normal operating amperages of FaST components	
Water pump	Approx. 1.8 to 2.5 Amps
Detergent pump	Approx. 250 to 750 mA
Air pump	Approx. 400 to 600 mA
Solenoid valve	Approx. 100 to 200 mA
Timer module	Approx. 5 to 75 mA
22 ohm resistor	Approx. 400 to 450 mA (if used)
System Total	Approx. 2.5 to 4.0 Amps

FaST Test Points - CHART # 1



FaST Specifications - CHART # 2

FaST water and detergent flow specification chart

Description / Measurement	Specification
Water Pump part #	1005866
Water Pump pressure before orifice (psi)	40-45 (internally relieved)
Water pressure after orifice (psi)	3.0
Water Pump head part #	391433
Water flow before orifice (L/min)	5.3
Water flow before orifice (GPM)	1.4
Water flow before orifice (kg/min)	5.3
Water flow before orifice (lb/min)	11.66
Liquid flow after orifice (L/min)	1.13
Liquid flow after orifice (GPM)	0.3
Liquid flow after orifice (kg/min)	1.13
Liquid flow after orifice (lb/min)	2.5
Orifice & body part #	1014675
Orifice plate part #	1014011
Orifice diameter (inches)	0.045
Detergent pump pulse rate per min	34.7
Detergent flow (ml/min)	1.25

Optional On-board Charger Setup Instructions

DESCRIPTION:

The charger is set at the factory to match the batteries supplied with your machine. These instructions explain how to change the charger settings if the charger is purchased as an aftermarket part or if the charger settings need to be changed for different type or size of batteries.
Please follow step-by-step instructions.

SPECIAL TOOLS / CONSIDERATIONS: NONE

(Estimated time to complete: 5 minutes)

PREPARATION:

This charger has nine settings for various types of batteries. **Always make sure the charger is at the proper setting BEFORE charging batteries**.

The green indicator light flashes (when the charger is first plugged into an AC outlet) to show the charger setting . DO NOT plug the charger into a battery at this point. Count the number of flashes separated by a pause to determine the charger setting (i.e.,three flashes, pause, three flashes, pause, etc. means the charger is in the third setting). Refer to Fig. 1.

Fig. 1

Tennant uses only two of the charger settings;

1. Setting 3 (3 flashes) is for 36 VDC systems with battery ratings between 200–250Ah.

2. Setting 7 (7 flashes) is for 36 VDC systems with battery ratings more than 250Ah.

NOTE: If charging batteries not supplied by Tennant, use the charger manufacturer's instructions to determine which setting to use.

3. Read the instructions provided by the charger manufacturer and the instructions and safety messages (Refer to Fig. 2) mounted on the charger for installation/operation instructions and safety information.

Fig. 2

Optional On-board Charger Setup Instructions

TO CHANGE CHARGER SETTING:

1. Plug the charger into the an AC outlet. The charger will run through a self test for about 2 seconds. Then the green indicator light will flash for 11 seconds to show the charger's current setting. (See previous page). The charger setting must be changed during this 11 second time span.

NOTE: If you waited more than 11 seconds to change the setting, the red indicator light will turn on. When this happens, unplug the charger from the AC outlet, wait a few seconds, then replug it into the outlet to start the cycle over.

2. During the 11 second time span, connect the charger to the battery connector for 3 seconds, and then unplug the charger from the battery (Refer to Fig. 3). The charger will advance to the next setting.

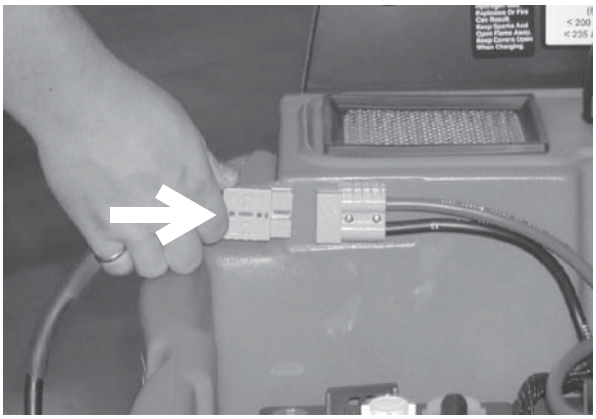


Fig. 3

3. Repeat previous step until the desired setting is displayed.

4. After the desired setting is reached, plug the charger connector into the battery connector until the output relay clicks (this happens 10 seconds after it is plugged in). The indicator light will flash red and the setting is saved in the charger memory.

NOTE: To change to a setting for another size battery, unplug the charger from the AC outlet, wait a few seconds, then replug the charger back into the AC outlet. Follow Steps 2 through 4 to change the setting.

5. The charger can now be used to charge batteries. (See Machine Operation manuals for charging instructions).

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