
1999 To 2003 Polaris FICHT Service Tool Troubleshooting Manual

This manual was developed to assist a properly trained, Polaris-MSD certified technician in troubleshooting the Polaris Direct Injection™ engine management system used on several Polaris Personal Watercraft manufactured since the 1999 model year.

It is our intent that this manual be used as a training guide and supplemental tool to be used in conjunction with Polaris Direct Injection™ Diagnostic Software program.

Please remember that this manual only references models manufactured from 1999 to 2003. Any additional FICHT-powered models will be included any future software updates.

No bulletins or service recommendations involving the 2003 Virage I, Genesis I, or MSX 140 Personal Watercraft were published or in the process of publishing at the time of this publication's development. Any and all service bulletins, or service recommendations that may be released for these models would be included in a future software update.

DATE OF PUBLICATION: 02/01/2003 REV. 1

Polaris Direct Injection Personal Watercraft Model Numbers

1999 GENESIS FFI™	B995094
2000 GENESIS FFI™	W005098D
2001 VIRAGE TXi	W015198D
2001 GENESIS I	W015098D
2002 VIRAGE I	W025101D
2002 VIRAGE TXi	W025198D
2002 GENESIS I	W025098D
2003 VIRAGE I	W035101CA
2003 GENESIS I	W035098CA
2003 MSX 140	W035303CA or B

Polaris FICHT-Specific Service Bulletins

PWC-99-05	PTO Head Change / RE-Map EMM
PWC-99-06	Ground Plate Replacement
PWC-99-07	Add Jumper Wire to LR503 / Add Ground Wire Harness
PWC-99-08	Stator and Stator Housing Update Kit
PWC-ALERT 01-02	Incorrect Fuel Line Routing
PWC ALERT 01-03	EMM Bracket Replacement
PWC ALERT 01-05	EMM Replacement
WAF-02-03	Hard Starting Issues Involving DI™ Personal Watercraft
PWC-02-01	EMM Driver Failure
PWC-02-05	EMM Water Outlet Hose Repair

NOTE: Reference the actual service bulletin for affected models, serial number lists and repair procedures.

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NOTE: It is unlawful to tamper with any system or function of Polaris DI™ model personal watercraft. Do not modify any part of the watercraft. Doing so may result in a fine and/or imprisonment.

Fuel Injection System - Components

Main Components

- EMM (Houses Engine Control Unit and Switching Regulator Board.)
- Fuel Injectors
- Capacitor
- Flywheel
- Stator (Magneto)
- Ignition Coils

Internal EMM Sensors

- Barometric Pressure Sensor
- EMM Temperature Sensor
- 45 Volt Circuit Sensor
- RPM Limiter
- ROM Verification

External EMM Sensors

- Air Temperature Sensor
- Water Temperature Sensor
- TPS (Throttle Position Sensor)
- CPS (Crankshaft Position Sensor)

S.L.O.W.™ Warning System (Speed Limiting Overheat Warning)

The EMM will go into S.L.O.W.™ mode to prevent serious engine and or EMM damage in the following instances:

- **Overheating Engine Cooling System**
- **Overheating EMM Condition**
- **Alternator Output Exceeds 45 Volts.**

When activated, fuel delivery is interrupted, and the EMM will begin a gradual five second drop in engine RPM to a threshold limit of approximately 3500 RPM. Additionally, the EMM will flash the "CHECK ENGINE" lamp on the MFI.

NOTE: The engine will run normally when RPM is under 3500 RPM. Above 3500 RPM, fuel delivery will be interrupted.

To recover from S.L.O.W.™ mode, two conditions must be satisfied:

- Failure that initiated S.L.O.W. must be repaired.
- Engine RPM must be returned to idle.

S.L.O.W.™ Service Codes

- Code 18 - Alternator 45V Above Expected Range
- Code 25 - EMM Temperature Above Expected Range
- Code 43 - Water Temperature Above Expected Range

FICHT Service Specifications

FUEL SYSTEM PRESSURE	20-30 PSI (138-207 KPA)
INJECTOR UNIT RESISTANCE	1.00 Ω
SPARK PLUG LEAD RESISTANCE	450 - 650 Ω
IGNITION COIL PRIMARY RESISTANCE	0.05 - 0.15 Ω
IGNITION COIL SECONDARY RESISTANCE	225 - 325 Ω
CRANKSHAFT POSITION SENSOR RESISTANCE	200 Ω (MAXIMUM)
AIR TEMPERATURE SENSOR RESISTANCE@ 77° F (25° C)	990-1010 Ω
WATER TEMPERATURE SENSOR RESISTANCE@ 77° F (25° C)	985 - 1015 Ω
12 VOLT STATOR WINDING RESISTANCE (PINS: 1 AND 12 / 2 AND 11)	0.1 - 0.3 Ω
45 VOLT STATOR WINDING RESISTANCE (PINS: 3 AND 10 / 4 AND 9 / 5 AND 8)	0.3 - 0.5 Ω
STATOR PINS: 1 - 12 (EACH) TO GROUND	O.L.
STATOR CRANKING VOLTAGE (APPROXIMATE) (WIRE COLORS ASSOCIATED WITH PINS LOCATED ON WIRING DIAGRAMS.) CHARGE BATTERY TO 12.5VDC PRIOR TO TESTING.	PINS: 1 AND 12 7VAC 2 AND 11 7VAC 3 AND 10 5VAC 4 AND 9 5VAC 5 AND 8 5VAC
THROTTLE POSITION SENSOR	4.70 VDC \pm 05 VDC @ 85° THROTTLE OPENING (USE THROTTLE FLIPPER) APPROXIMATELY .350 VDC CLOSED.

EMM Information Specifications

The following information should be verified against what the EMM displays when using the service tool software. When using the software, this information is displayed on the EMM INFORMATION screen must match the information in the table below.

EMM Information	1999 Genesis FFI™	2000 Genesis DI™	2001 Genesis i	2001 Virage TXi
Part Number	4010332*	4010393b	4010393b	4010415c
Program Version	3030074	3030074	3030074	3030074
Map Version	P0625	4010393b	4010393b	4010415c
Development Name**	N/A	Wolf77	Wolf77	WHALER37

EMM Information	2002 Virage i***	2002 Virage i****	2002 TXi	2002 Genesis i
Part Number	4010408a	4010408b	4010415d	4010393c
Program Version	3030096	3030096	3030074	3030074
Map Version	HAWK 76	HAWK 76	4010415d	4010393c
Development Name**	HAWK 76	HAWK 81	Whaler 37	Wolf 77

EMM Information	2003 Virage i	2003 Genesis i	2003 MSX 140
Part Number	4010408b	4010848	4010741
Program Version	3030096	3030074	3030074
Map Version	4010408b	WOLF 87	401074f
Development Name**	HAWK 81	WOLF 87	TAZ 103

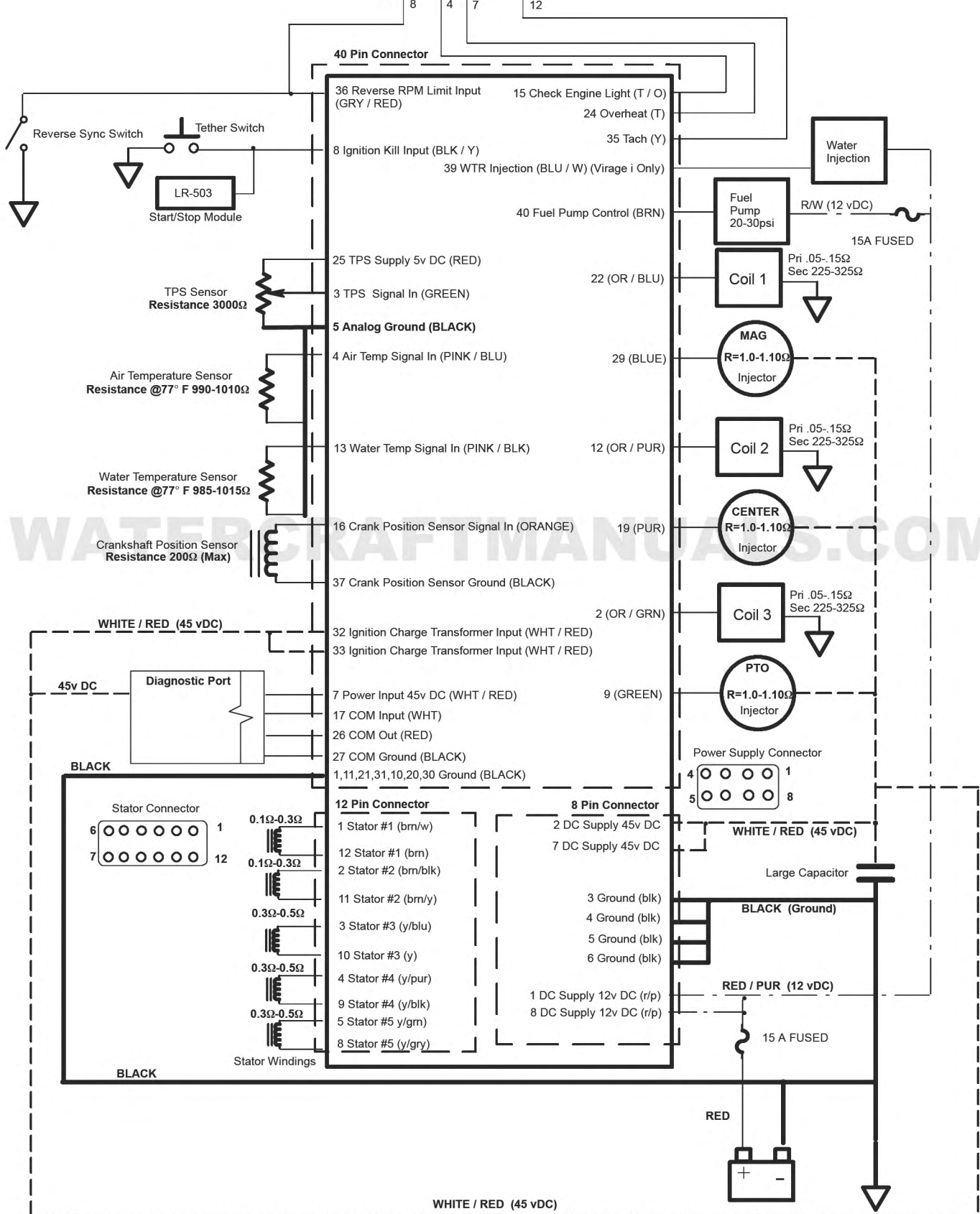
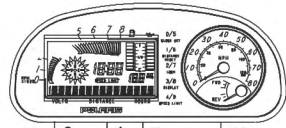
* = Revised EMM for 1999 models.

** = Development name may be listed as the map version when using the diagnostic software. There should be no problems with the software if the development name is listed as the map version.

*** = Engine serial number (1 - 500)

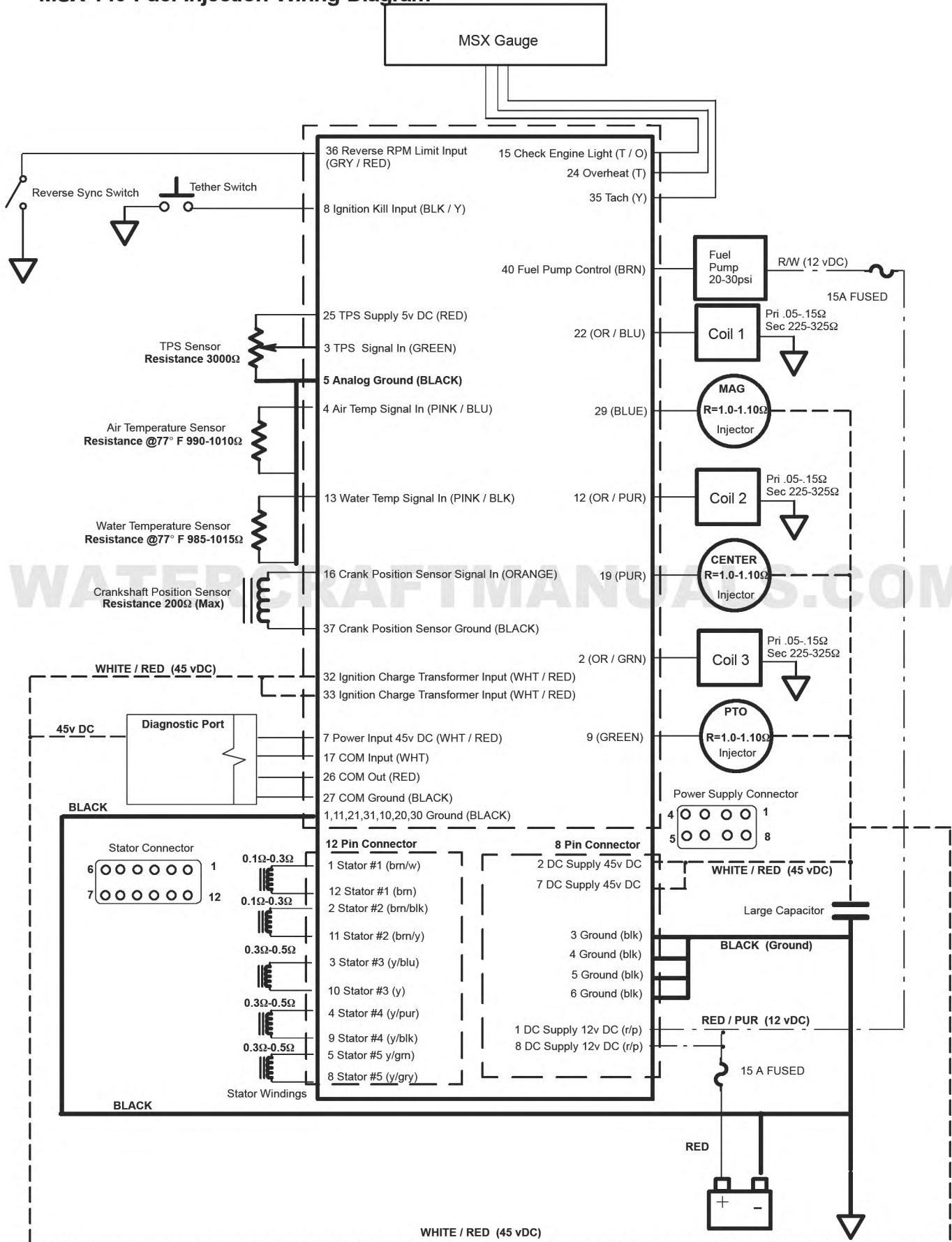
**** = Engine serial number (500 and on)

Fuel Injection Wiring Diagram

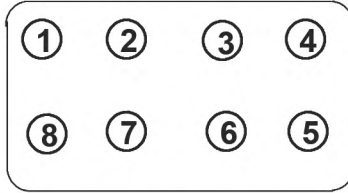


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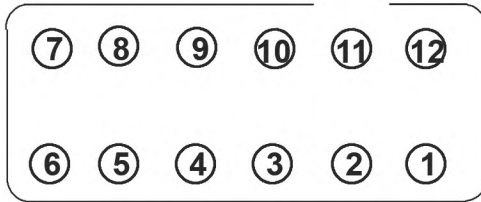
MSX 140 Fuel Injection Wiring Diagram



EMM Connectors



EMM 8 Pin Connector (EMM Side)

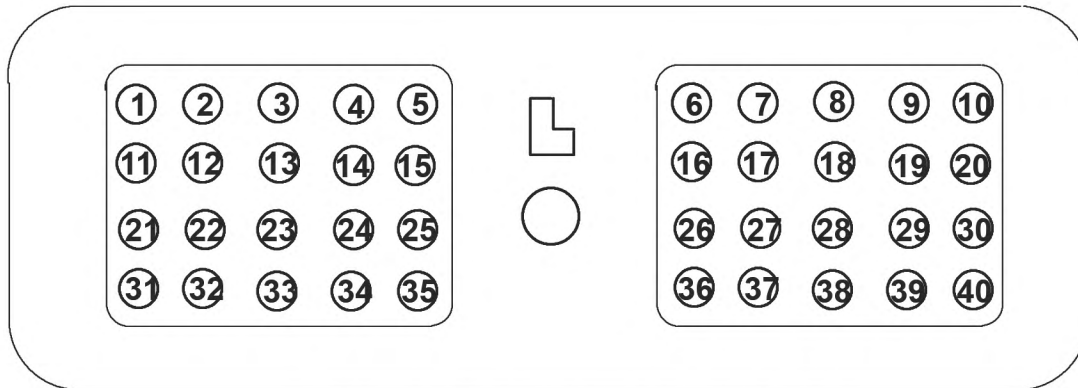


EMM 12 Pin Connector (EMM Side)

12 Pin Connector		8 Pin Connector	
1	STATOR WINDING 1 (BROWN / WHITE)	1	BATTERY POSITIVE VOLTAGE (RED / PURPLE)
2	STATOR WINDING 2 (BROWN / BLACK)	2	45 vDC FICHT POWER SUPPLY (WHITE / RED)
3	STATOR WINDING 3 (YELLOW / BLUE)	3	GROUND (BLACK)
4	STATOR WINDING 4 (YELLOW / BLUE)	4	GROUND (BLACK)
5	STATOR WINDING 5 (YELLOW GREEN)	5	GROUND (BLACK)
6		6	GROUND (BLACK)
7		7	45 vDC FICHT POWER SUPPLY (WHITE / RED)
8	STATOR WINDING 5 (YELLOW / GRAY)	8	BATTERY POSITIVE VOLTAGE (RED / PURPLE)
9	STATOR WINDING 4 (YELLOW / BLACK)		
10	STATOR WINDING 3 (YELLOW)		
11	STATOR WINDING 2 (BROWN / YELLOW)		
12	STATOR WINDING 1 (BROWN)		

NOTE: Two color wires are shown with main/trace colors.

EMM Connectors



EMM 40 Pin Connector (EMM Side)

1	IGNITION GROUND (BLACK)	21	IGNITION SYSTEM GROUND (BLACK)
2	PTO PRIMARY IGNITION (ORANGE / GREEN)	22	MAG PRIMARY IGNITION (ORANGE / BLUE)
3	THROTTLE POSITION SENSOR SIGNAL (GREEN)	23	
4	AIR TEMP. SENSOR SIGNAL (PINK / BLACK)	24	OVERHEAT WARNING SIGNAL (TAN)
5	AIR, WATER, TPS SENSOR GROUND (BLACK)	25	5V TPS REFERENCE SIGNAL (RED)
6		26	RS232 RX OUT SIGNAL (RED)
7	EMM POWER (WHITE / RED)	27	COMMUNICATION GROUND (BLACK)
8	ENGINE KILL SIGNAL (BLACK / YELLOW)	28	
9	PTO FUEL INJECTOR DRIVER CIRCUIT (GREEN)	29	MAG FUEL INJECTION DRIVER CIRCUIT (BLUE)
10	FUEL INJECTION GROUND (BLACK)	30	FUEL INJECTION GROUND (BLACK)
11	IGNITION SYSTEM GROUND (BLACK)	31	IGNITION SYSTEM GROUND (BLACK)
12	CTR PRIMARY IGNITION (ORANGE / PURPLE)	32	IGNITION SYSTEM POWER IN (WHITE / RED)
13	WATER TEMP. SENSOR SIGNAL (PINK / BLACK)	33	IGNITION SYSTEM POWER IN (WHITE / RED)
14		34	
15	CHECK ENGINE LAMP SIGNAL (TAN / ORANGE)	35	TACHOMETER SIGNAL / 6 PULSES-REV. (YELLOW)
16	CRANK POSITION SENSOR SIGNAL (ORANGE)	36	REVERSE MFI WARNING DISPLAY (GRAY / RED)
17	RS232 RX IN SIGNAL (WHITE)	37	CRANK POSITION SENSOR GROUND (BLACK)
18		38	
19	CTR FUEL INJECTOR DRIVER CIRCUIT (PURPLE)	39	WATER INJECTION SOLENOID GROUND (BLUE / WHITE) <i>VIRAGE I ONLY</i>
20	FUEL INJECTION GROUND (BLACK)	40	FUEL PUMP CIRCUIT GROUND (BROWN)

NOTE: Two color wires are shown with main/trace colors.

Service Codes

CODE	DESCRIPTION
11	SYSTEM OKAY - NO FAULT
12	THROTTLE POSITION SENSOR CIRCUIT MALFUNCTION
14	THROTTLE POSITION SENSOR ABOVE EXPECTED RANGE
15	ROM CHECKSUM ERROR
17	ALTERNATOR VOLTAGE BELOW EXPECTED RANGE
18	ALTERNATOR VOLTAGE ABOVE EXPECTED RANGE
23	EMM TEMPERATURE SENSOR CIRCUIT MALFUNCTION
24	EMM TEMPERATURE SENSOR BELOW EXPECTED RANGE
25	EMM TEMPERATURE SENSOR ABOVE EXPECTED RANGE
39	FUEL PUMP OPEN LOAD
41	COOLANT TEMPERATURE SENSOR CIRCUIT MALFUNCTION
42	COOLANT TEMPERATURE SENSOR BELOW EXPECTED RANGE
43	COOLANT TEMPERATURE SENSOR ABOVE EXPECTED RANGE
44	BAROMETRIC PRESSURE SENSOR CIRCUIT MALFUNCTION
45	BAROMETRIC PRESSURE SENSOR BELOW EXPECTED RANGE
46	BAROMETRIC PRESSURE SENSOR ABOVE EXPECTED RANGE
47	AIR TEMPERATURE SENSOR CIRCUIT MALFUNCTION
48	AIR TEMPERATURE SENSOR BELOW EXPECTED RANGE
49	AIR TEMPERATURE SENSOR ABOVE EXPECTED RANGE
51	#1 (MAG) FUEL INJECTOR OPEN LOAD
52	#3 (PTO) FUEL INJECTOR OPEN LOAD
53	#2 (CENTER) FUEL INJECTOR OPEN LOAD
59	FUEL PUMP DRIVER OVERHEATED
81	#1 (MAG) IGNITION COIL OPEN PRIMARY
82	#3 (PTO) IGNITION COIL OPEN PRIMARY
83	#2 (CENTER) IGNITION COIL OPEN PRIMARY
144	WATER INJECTION SOLENOID CIRCUIT MALFUNCTION

NOTE: Bold service codes are "hard codes" that will initiate S.L.O.W.™

"Hard" Service Code: Failure has occurred and is occurring at this time.

"Intermittent" Service Code: Failure occurred at some time during operation, but is not occurring at this time.

WARNING

The DI™ ignition system presents a serious shock hazard. The primary circuit operates at 300 volts; the secondary circuit operates in excess of 35,000 volts. Use caution to avoid injury from shock, or injury from your reaction to shock. Do not handle primary or secondary ignition components while the engine is cranking or running.

Service Codes - Failure Modes

Code 12 - Throttle Position Sensor Malfunction

Setting Conditions: RPM greater than 800 and TPS - ADC counts is greater than 1010 or TPS - ADC counts is less than 21.

What To Look For: Corrupted or damaged TPS circuit. Damaged throttle shaft or mis-adjusted throttle cable. Failed TPS sensor. An unplugged TPS will trigger this code.

Code 14 - Throttle Position Sensor Above Expected Range

Setting Conditions: RPM greater than 800 and TPS - ADC counts above 900.

What To Look For: Corrupted or damaged TPS circuit. Damaged throttle shaft or mis-adjusted throttle cable. Failed TPS sensor.

Code 15 - Program Checksum Error

Setting Conditions: Invalid checksum calculation in EMM program during power-up.

What To Look For: Corrupted EMM. EMM requires re-programing or replacement.

Code 17 - Alternator Voltage Below Expected Range

Setting Conditions: RPM is greater than 800, but less than 1500 AND alternator voltage is less than 22 vDC OR RPM is greater than 1500 AND alternator voltage is less than 32 vDC.

What To Look For: Damaged flywheel, damaged stator and/or associated wiring circuits. Loose pins or connectors. Loose or damaged capacitor. Malfunctioning regulator, SRB board (Located inside of EMM.)

Code 18 - Alternator Voltage Above Expected Range

Setting Conditions: Alternator voltage above 50 vDC at any time.

What To Look For: Damaged flywheel, damaged stator and/or associated wiring circuits. Damaged capacitor. Malfunctioning regulator, SRB board. (Located inside of EMM.)

Code 25 - EMM Temperature Above Expected Range

Setting Conditions: RPM is greater than 800 AND EMM Temperature is above 100 C.

What To Look For: S.L.O.W. mode will be activated. Plugged, kinked, or damaged cooling hoses. Obstructed water intake ports inside of pump. Cooling passage leak inside engine.

Code 39 - Fuel Pump Open Load

Setting Conditions: RPM is greater than 800 AND open circuit in fuel pump circuit.

What To Look For: Blown fuel pump fuse or breaker. Damaged wiring harness. Malfunctioning fuel pump or EMM.

Code 41 - Engine Temperature Circuit Malfunction

Setting Conditions: RPM is greater than 800 AND engine temp. ADC counts are greater than 1010 OR engine temp. ADC counts less than 10.

What To Look For: Damaged temp. sensor. Damaged circuit or wires.

Code 42 - Engine Temperature Below Expected Range

Setting Conditions: RPM is greater than 800 AND engine temp. is less than 0 C.

What To Look For: Damaged temp. sensor. Damaged circuit or wires. Operation in cold water, or lack of cooling water in engine.

Code 43 - Engine Temperature Above Expected Range

Setting Conditions: RPM is greater than 800 AND engine temp. is greater than 110 C.

What To Look For: Damaged temp. sensor. Damaged circuit or wires. Obstructed or plugged cooling hoses and/or pump assembly. Leaking cooling passage inside of engine.

Code 44 - Barometric Pressure Sensor Circuit Malfunction

Setting Conditions: RPM is greater than 800 AND BARO - ADC counts are greater than 1010 or less than 10 counts.

What To Look For: Plugged sensor hose located on underside of EMM. Malfunctioning EMM. If tube is not plugged, EMM replacement is required.

Code 45 - Barometric Pressure Sensor Below Expected Range

Setting Conditions: RPM is greater than 800 AND BARO pressure is below 55 kPA.

What To Look For: Plugged sensor hose located on underside of EMM. Malfunctioning EMM. If code 44 is also set, the sensor is damaged.

Code 46 - Barometric Pressure Sensor Above Expected Range

Setting Conditions: RPM is greater than 800 AND BARO. pressure is above 105 kPA.

What To Look For: Plugged sensor hose located on underside of EMM. Malfunctioning EMM. If code 44 is also set, the sensor is damaged.

Code 47 - Air Temperature Sensor Circuit Malfunction

Setting Conditions: RPM is greater than 800 AND Air Temp. - ADC counts are greater than 1010 or less than 10.

What To Look For: Malfunctioning sensor or wiring harness.

Code 48 - Air Temperature Below Expected Range

Setting Conditions: RPM is greater than 800 AND Air Temp. is less than -20 C.

What To Look For: Malfunctioning sensor or wiring harness. If code 47 set, the sensor is damaged.

Code 49 - Air Temperature Above Expected Range

Setting Conditions: RPM is greater than 800 AND Air Temp. is more than 65 C.

What To Look For: Malfunctioning sensor or wiring harness. If code 47 set, the sensor is damaged.

Codes 51 / 52 / 53 - Fuel Injector Open Load

Setting Conditions: RPM is greater than 800 AND open circuit on either MAG (51) / PTO (52) / CTR (53) fuel injectors.

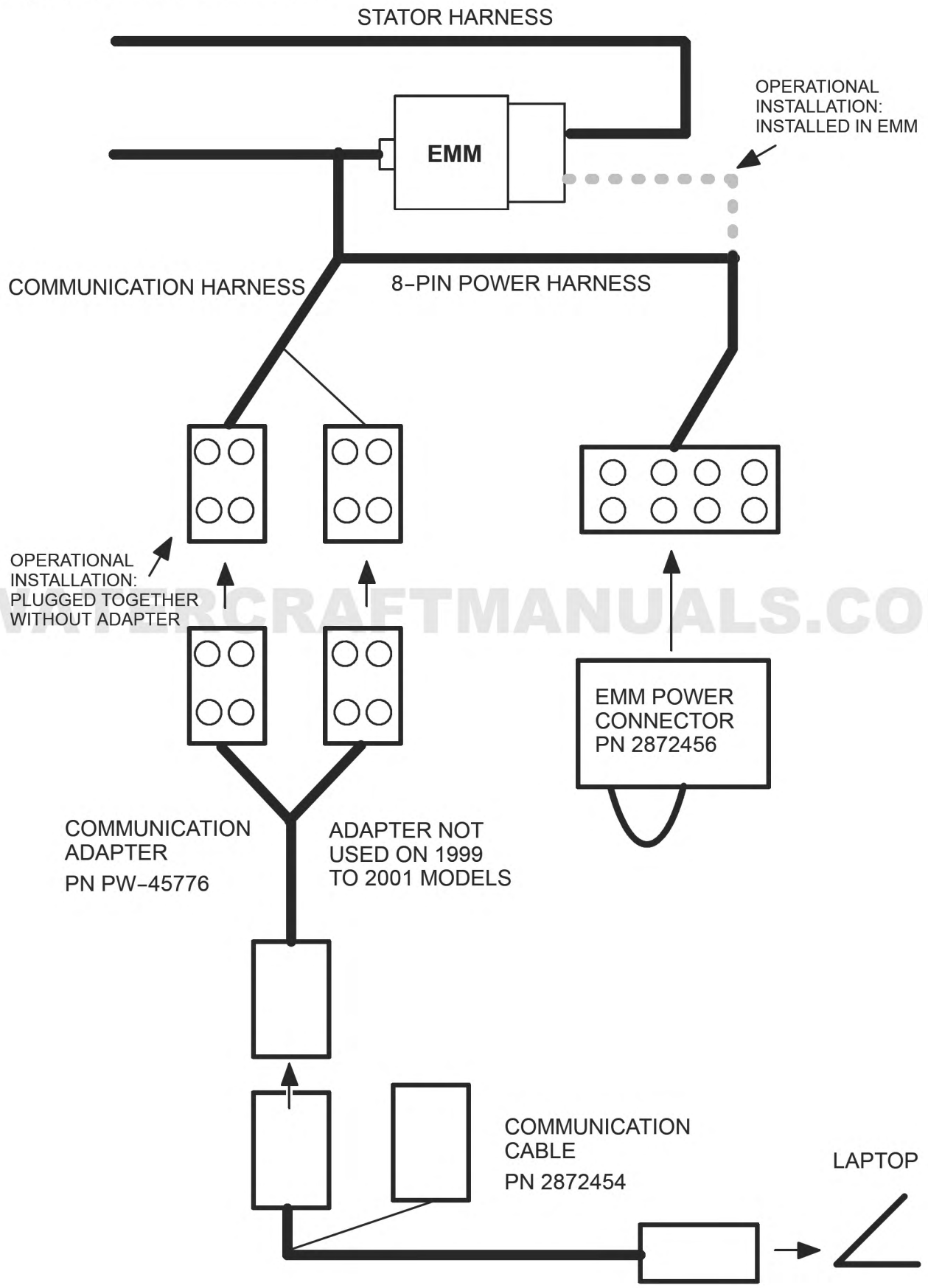
What To Look For: Malfunctioning fuel injector. Damaged wiring harness.

Codes 81 / 82 / 83 - Ignition Coil Primary Open Load

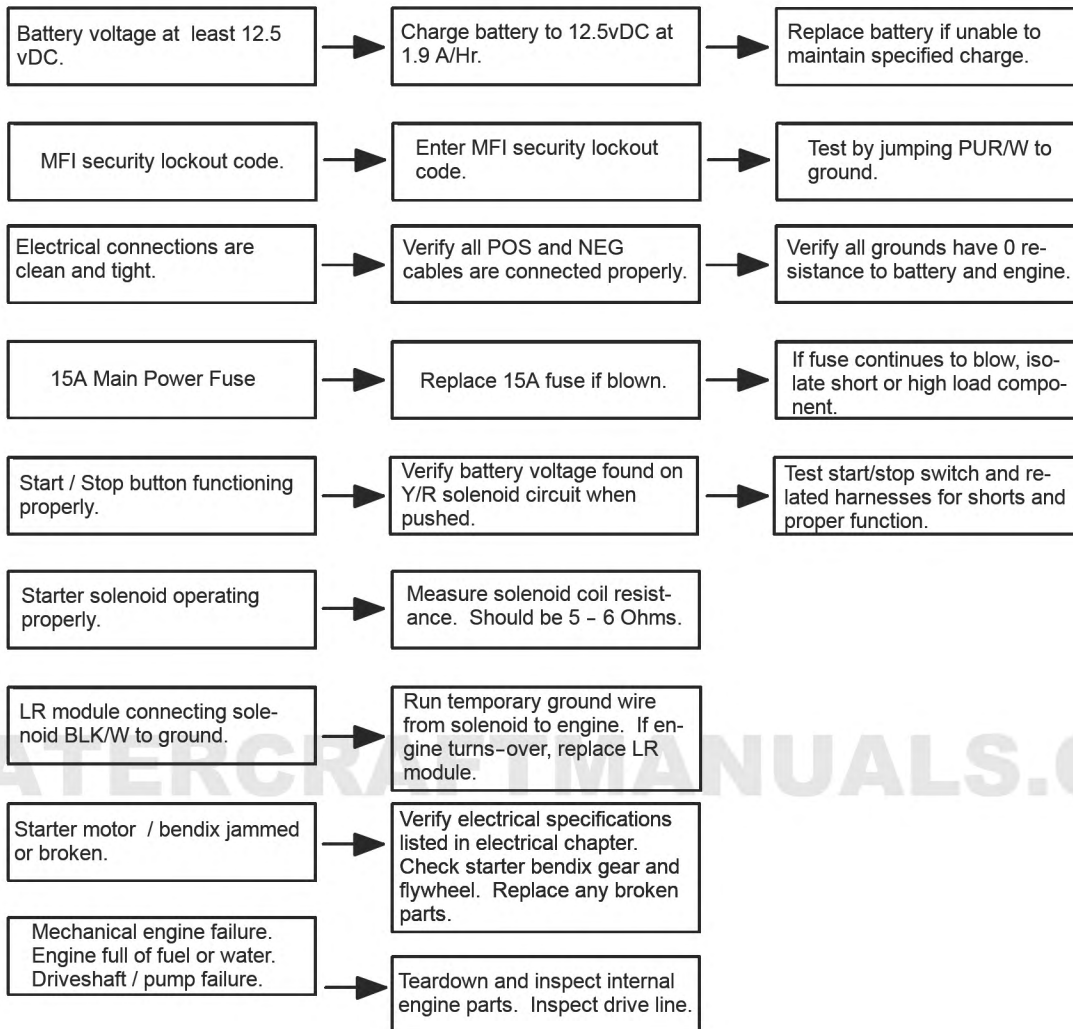
Setting Conditions: RPM is greater than 800 AND open circuit on either MAG (81) / PTO (82) / CTR (83) ignition coils.

What To Look For: Damaged ignition coil. Damaged wiring harness. Loose primary plug caps, heavy carbon depositing.

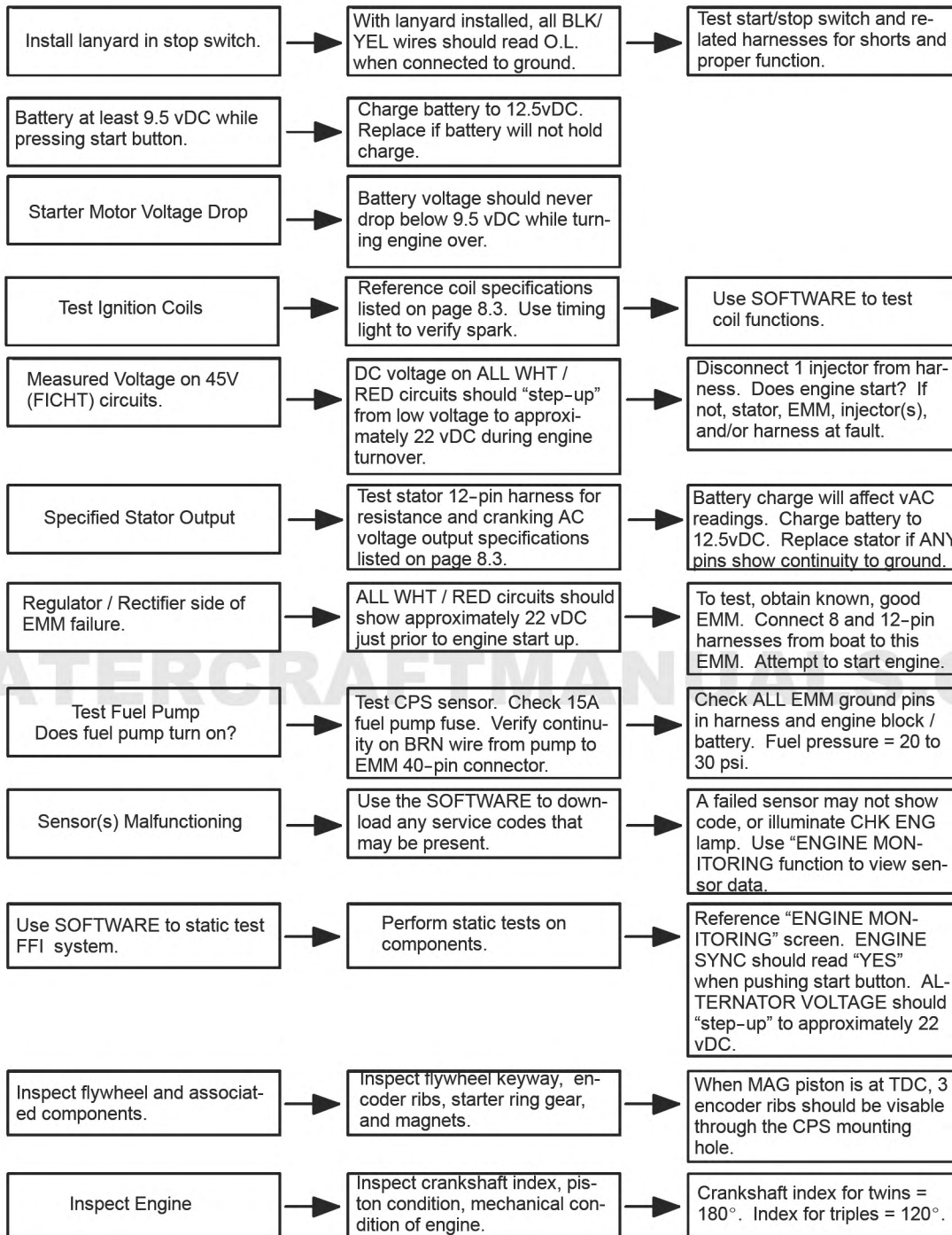
Laptop-To-EMM Connections



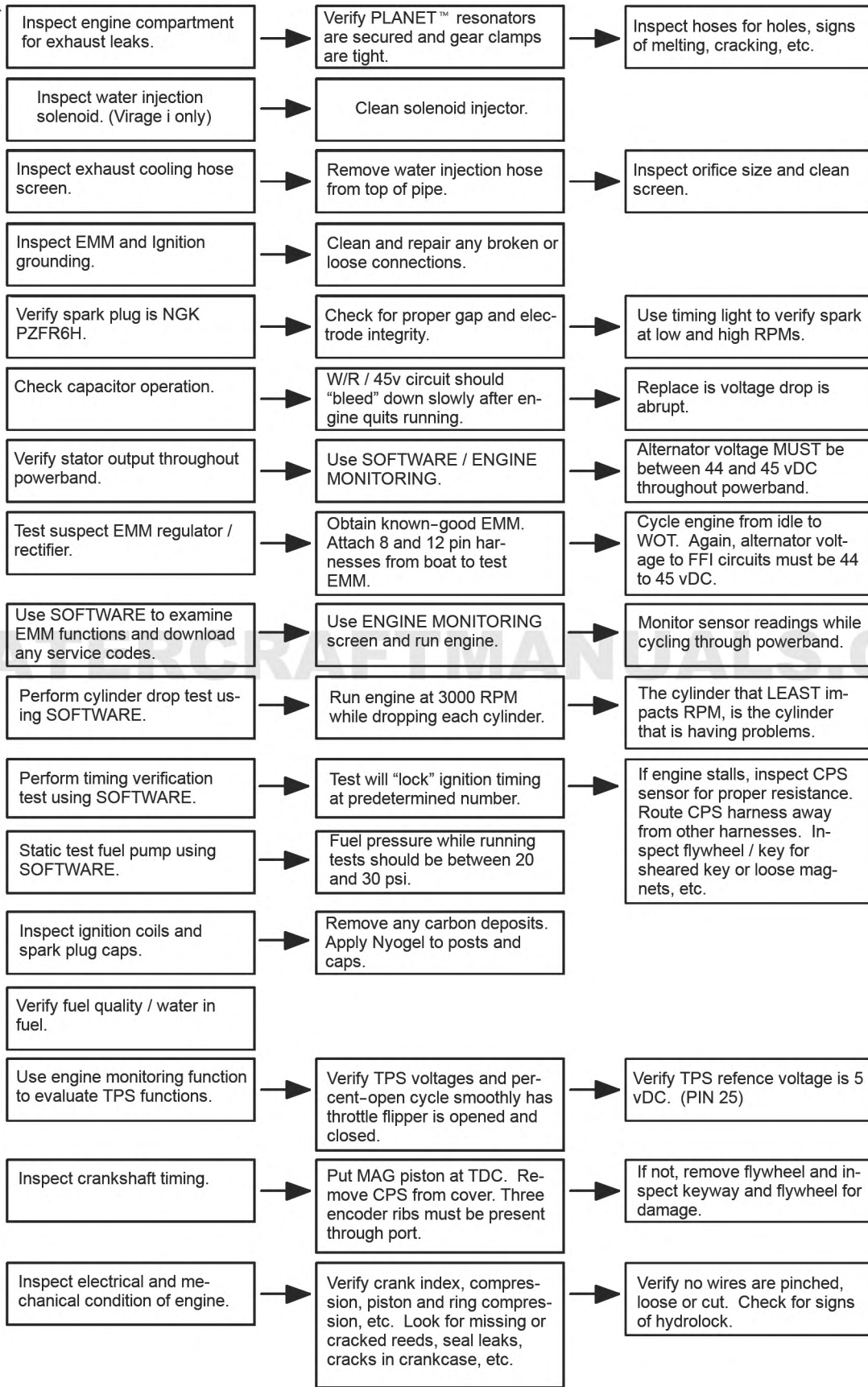
FICHT® Troubleshooting - “ENGINE WILL NOT TURNOVER” NON-MSX



FICHT® Troubleshooting - “ENGINE TURNS-OVER, BUT WILL NOT START” NON-MSX

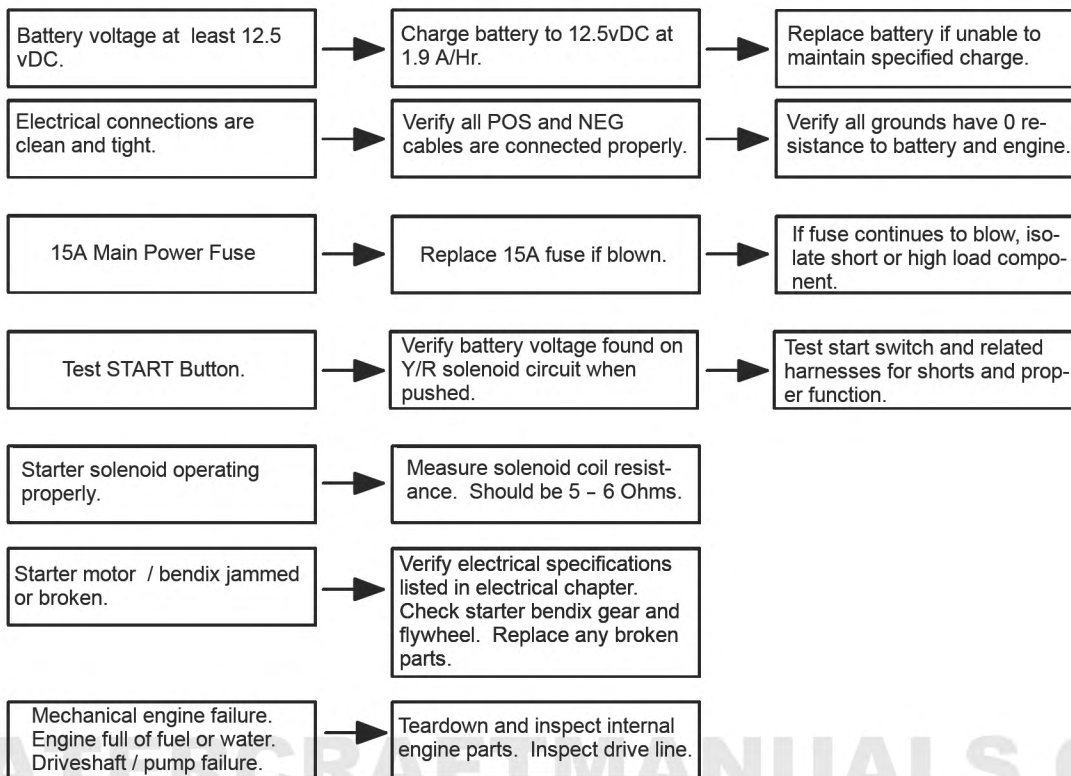


FICHT® Troubleshooting - “ENGINE DIES / LOSES POWER / NO TOP END” NON-MSX

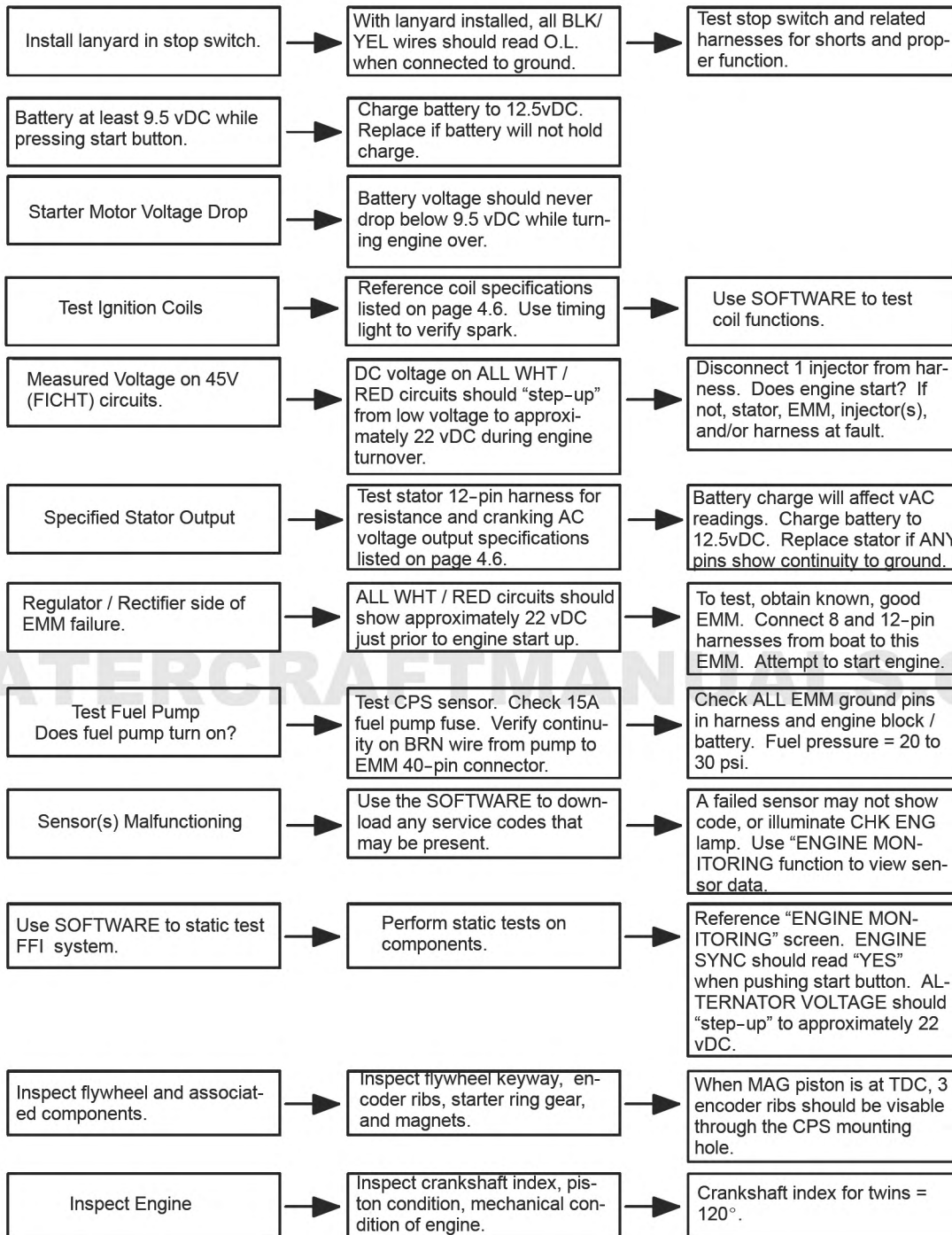


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FICHT® Troubleshooting - "ENGINE WILL NOT TURNOVER"



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