Section 5

DF9.9B/15A/20A (310001 and later)

FOREWORD

This supplement describes the technical data and servicing procedures for the following models:

DF9.9B/BE/BR (00995F-310001 and later)
DF15A/AE/AR (01504F-310001 and later)
DF20A/AE/AR (02002F-310001 and later)

This supplement describes only service information which differs from the main manual. Whenever servicing the above models, consult this supplement first. For any section, item or description not found in this supplement, refer to Section 00 through Section 4.

IMPORTANT NOTICE

WARNING / CAUTION / NOTICE / NOTE

Please read this manual and follow its instructions carefully. To emphasize special information, the symbol and the words **⚠ WARNING**, **⚠ CAUTION**, ***NOTICE*** and **NOTE** have special meanings.
Pay special attention to the messages highlighted by these signal words.

⚠ WARNING

Indicates a potential hazard that could result in death or serious injury.

⚠ CAUTION

Indicates a potential hazard that could result in minor or moderate injury.

NOTICE

Indicates a potential hazard that could result in damage to the motor or boat.

NOTE

Indicates special information to make maintenance easier or instructions clearer.

Please note, however, that the warnings and cautions contained in this manual cannot possibly cover all potential hazards relating to the servicing, or lack of servicing, of the outboard motor. In addition to the **⚠ WARNING**, **⚠ CAUTION**, and ***NOTICE*** stated, you must also use good judgment and observe basic mechanical safety principles.

⚠ WARNING

This service manual is intended for authorized Suzuki outboard motor dealers and qualified service technicians only.
Apprentice mechanics or do-it-yourself mechanics that don't have the proper tools and equipment may not be able to properly perform the services described in this manual. Improper repair may result in injury to the mechanic and may render the engine unsafe for the boat operator and passengers.

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NOTE

For the screen toned sections with asterisk (*) in the “TABLE OF CONTENTS” below, refer to the same sections of the service manual mentioned in the “FOREWORD” of this manual.

Section 0

General Information

CONTENTS

NOTE

For the items with asterisk (*) in the "CONTENTS" below, refer to the same section of the service manual mentioned in the "FOREWORD" of this manual.

General Information

Specifications

Specifications (DF9.9B)

CENDK1120107004

NOTE

These specifications are subject to change without notice.

Model Pre-Fix

Item	Unit	Data		
		DF9.9B	DF9.9BE	DF9.9BR
PRE-FIX		00995F		

Dimensions and Weight

Item		Unit	Data		
			DF9.9B	DF9.9BE	DF9.9BR
Overall length (front to back)		mm (in.)	662 (26.1)		609 (24.0)
Overall width (side to side)		mm (in.)	336 (13.2)		
Overall height	S	mm (in.)	1 093 (43.0)		
	L	mm (in.)	1 220 (48.0)		
Weight (without engine oil)	S	kg (lbs)	44 (97)	48 (106)	47 (104)
	L	kg (lbs)	45 (99)	49 (108)	48 (106)
Transom height	S	mm (in. type)	422 (15)		
	L	mm (in. type)	549 (20)		

Performance

Item	Unit	Data		
		DF9.9B	DF9.9BE	DF9.9BR
Maximum output	kW (PS)	7.3 (9.9)		
Recommended operating range	r/min	4 700 – 5 700		
Idle speed	r/min	850 ± 50 (in-gear: Approx. 800 – 900)		

Powerhead

Item	Unit	Data		
		DF9.9B	DF9.9BE	DF9.9BR
Engine type		4-stroke SOHC		
Number of cylinders		2		
Bore	mm (in.)	60.4 (2.38)		
Stroke	mm (in.)	57.0 (2.24)		
Total displacement	cm^3 (cu. in)	327 (19.9)		
Compression ratio	: 1	10.5		
Spark plug	NGK	CPR6EA-9		
Ignition system		Digital CDI		
Fuel supply system		Electronic fuel injection		
Exhaust system		Through prop exhaust		
Cooling system		Water cooled		
Lubrication system		Wet sump by trochoid pump		
Starting system		Manual	Electric	
Throttle control		Twist grip		Remote control
Choke system		—		

Fuel and Oil

Item	Unit	Data		
		DF9.9B	DF9.9BE	DF9.9BR
Fuel		Suzuki highly recommends the use of alcohol-free unleaded gasoline with a minimum pump octane rating of 87 (R/2 + M/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.		
Engine oil		• API classification: SG, SH, SJ, SL, SM or NMMA FC-W classification: SG, SH, SJ, SL, SM • Viscosity rating: SAE 10W-40 or NMMA FC-W 10W-40		
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change		
Gear oil		SUZUKI Outboard Motor Gear Oil or SAE 90 hypoid gear oil, API classification GL-5.		
Gearcase oil capacity	ml (US/Imp. oz)	250 (8.4/8.8)		

Bracket

Item	Unit	Data		
		DF9.9B	DF9.9BE	DF9.9BR
Trim angle	degree	0 – 16 (–8 to 8)		
Number of tilt pin position		5		
Maximum tilt angle	degree	73 (–8 to 65)		

Lower Unit

Item	Unit	Data		
		DF9.9B	DF9.9BE	DF9.9BR
Reversing system		Gear		
Transmission		Forward-Neutral-Reverse		
Reduction system		Bevel gear		
Gear ratio		12 : 25 (2.08)		
Drive line impact protection		Spline drive rubber hub		
Propeller shaft rotation (When shift into forward)		Clockwise		
Propeller		Blade x Dia. (in.) x Pitch (in.)		
		3 x 9 and 1/4 x 7 3 x 9 and 1/4 x 8 3 x 9 and 1/4 x 9 3 x 9 and 1/4 x 10 3 x 9 and 1/4 x 11		

Specifications (DF15A/E/R, DF20A/E/R)

CENDK1120107005

NOTE

These specifications are subject to change without notice.

Model Pre-Fix

Item	Unit	Data					
		DF15A	DF15AE	DF15AR	DF20A	DF20AE	DF20AR
PRE-FIX		01504F			02002F		

Dimensions and Weight

Item		Unit	Data					
			DF15A	DF15AE	DF15AR	DF20A	DF20AE	DF20AR
Overall length (front to back)		mm (in.)	662 (26.1)		609 (24.0)	662 (26.1)		609 (24.0)
Overall width (side to side)		mm (in.)	336 (13.2)					
Overall height	S	mm (in.)	1 093 (43.0)					
	L	mm (in.)	1 220 (48.0)					
Weight (without engine oil)	S	kg (lbs)	44 (97)	48 (106)	47 (104)	44 (97)	48 (106)	47 (104)
	L	kg (lbs)	45 (99)	49 (108)	48 (106)	45 (99)	49 (108)	48 (106)
Transom height	S	mm (in. type)	422 (15)					
	L	mm (in. type)	549 (20)					

Performance

Item	Unit	Data					
		DF15A	DF15AE	DF15AR	DF20A	DF20AE	DF20AR
Maximum output	kW (PS)	11.0 (15)			14.7 (20)		
Recommended operating range	r/min	5 000 – 6 000			5 300 – 6 300		
Idle speed	r/min	850 ± 50 (in-gear: Approx. 800 – 900)					

Powerhead

Item	Unit	Data					
		DF15A	DF15AE	DF15AR	DF20A	DF20AE	DF20AR
Engine type		4-stroke SOHC					
Number of cylinders		2					
Bore	mm (in.)	60.4 (2.38)					
Stroke	mm (in.)	57.0 (2.24)					
Total displacement	cm^3 (cu. in)	327 (19.9)					
Compression ratio	: 1	10.5					
Spark plug	NGK	CPR6EA-9					
Ignition system		Digital CDI					
Fuel supply system		Electronic fuel injection					
Exhaust system		Through prop exhaust					
Cooling system		Water cooled					
Lubrication system		Wet sump by trochoid pump					
Starting system		Manual	Electric		Manual	Electric	
Throttle control		Twist grip		Remote control	Twist grip		Remote control
Choke system		—					

Fuel and Oil

Item	Unit	Data					
		DF15A	DF15AE	DF15AR	DF20A	DF20AE	DF20AR
Fuel		Suzuki highly recommends the use of alcohol-free unleaded gasoline with a minimum pump octane rating of 87 (R/2 + M/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.					
Engine oil		• API classification: SG, SH, SJ, SL, SM or NMMA FC-W classification: SG, SH, SJ, SL, SM • Viscosity rating: SAE 10W-40 or NMMA FC-W 10W-40					
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change					
Gear oil		SUZUKI Outboard Motor Gear Oil or SAE 90 hypoid gear oil, API classification GL-5.					
Gearcase oil capacity	ml (US/Imp. oz)	250 (8.4/8.8)					

Bracket

Item	Unit	Data					
		DF15A	DF15AE	DF15AR	DF20A	DF20AE	DF20AR
Trim angle	degree	0 – 16 (–8 to 8)					
Number of tilt pin position		5					
Maximum tilt angle	degree	73 (–8 to 65)					

Lower Unit

Item	Unit	Data					
		DF15A	DF15AE	DF15AR	DF20A	DF20AE	DF20AR
Reversing system		Gear					
Transmission		Forward-Neutral-Reverse					
Reduction system		Bevel gear					
Gear ratio		12 : 25 (2.08)					
Drive line impact protection		Spline drive rubber hub					
Propeller shaft rotation (When shift into forward)		Clockwise					
Propeller		Blade x Dia. (in.) x Pitch (in.)					
		3 x 9 and 1/4 x 7 3 x 9 and 1/4 x 8 3 x 9 and 1/4 x 9 3 x 9 and 1/4 x 10 3 x 9 and 1/4 x 11					

Service Data (DF9.9B/15A/20A)

CENDK1120107006

NOTE

- **These service data are subject to change without notice.**
- **The following data is applied to all version of each model of DF9.9B/15A/20A.**

Powerhead

Item	Unit	Data		
		DF9.9B	DF15A	DF20A
Recommended operating range	r/min	4 700 – 5 700	5 000 – 6 000	5 300 – 6 300
Idle speed	r/min	850 ± 50 (in-gear: Approx. 800 – 900)		
**Cylinder compression pressure	kPa (kgf/cm^2, psi.)	DF9.9B/15A/20A (With decompression system): 350 – 900 (3.5 – 9, 50 – 128) {Crank with recoil starter}		
**Cylinder compression pressure max. difference between cylinders	kPa (kgf/cm^2, psi.)	100 (1.0, 14)		
**Engine oil pressure	kPa (kgf/cm^2, psi.)	200 – 500 (2.0 – 5.0, 29 – 71) at 3 000 r/min (At normal operating temp.)		
Engine oil		• API classification: SG, SH, SJ, SL, SM or NMMA FC-W classification: SG, SH, SJ, SL, SM • Viscosity rating: SAE 10W-40 or NMMA FC-W 10W-40		
Engine oil amounts	L (US/Ipm. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change		
Thermostat operating temperature	°C (°F)	48 – 52 (118 – 126)		

**Figures shown are guidelines only, not absolute service limits.

Cylinder Head / Camshaft

Item			Unit	Data		
				DF9.9B	DF15A	DF20A
Cylinder head distortion		Limit	mm (in.)	0.06 (0.002)		
Manifold seating faces distortion		Limit	mm (in.)	0.06 (0.002)		
Cam height	IN	std.	mm (in.)	23.710 – 23.870 (0.9335 – 0.9398)		
		Limit	mm (in.)	23.610 (0.9295)		
	EX	std.	mm (in.)	23.530 – 23.690 (0.9264 – 0.9327)		
		Limit	mm (in.)	23.430 (0.9224)		
Camshaft journal oil clearance	Upper	std.	mm (in.)	0.020 – 0.062 (0.0008 – 0.0024)		
		Limit	mm (in.)	0.100 (0.0039)		
	Lower	std.	mm (in.)	0.020 – 0.062 (0.0008 – 0.0024)		
		Limit	mm (in.)	0.100 (0.0039)		
Camshaft journal bore diameter	Upper	std.	mm (in.)	25.000 – 25.021 (0.9843 – 0.9851)		
	Lower	std.	mm (in.)	23.000 – 23.021 (0.9055 – 0.9063)		
Camshaft journal outside diameter	Upper	std.	mm (in.)	24.959 – 24.980 (0.9826 – 0.9835)		
	Lower	std.	mm (in.)	22.959 – 22.980 (0.9039 – 0.9047)		
Rocker arm shaft to rocker arm clearance		std.	mm (in.)	0.016 – 0.045 (0.0006 – 0.0018)		
		Limit	mm (in.)	0.060 (0.0024)		
Rocker arm inside diameter		std.	mm (in.)	13.000 – 13.018 (0.5118 – 0.5125)		
Rocker arm shaft outside diameter		std.	mm (in.)	12.973 – 12.984 (0.5107 – 0.5112)		

Valve / Valve Guide

Item			Unit	Data		
				DF9.9B	DF15A	DF20A
Valve diameter		IN	mm (in.)	26 (1.02)		
		EX	mm (in.)	22 (0.87)		
Valve clearance (Cold engine condition)	IN	std.	mm (in.)	0.18 – 0.22 (0.007 – 0.009)		
	EX	std.	mm (in.)	0.18 – 0.22 (0.007 – 0.009)		
Valve seat angle	IN		—	15°, 45°		
	EX		—	15°, 45°		
Valve guide to valve stem clearance	IN	std.	mm (in.)	0.010 – 0.037 (0.0004 – 0.0015)		
		Limit	mm (in.)	0.070 (0.0028)		
	EX	std.	mm (in.)	0.035 – 0.062 (0.0014 – 0.0024)		
		Limit	mm (in.)	0.090 (0.0035)		
Valve guide inside diameter	IN, EX	std.	mm (in.)	5.500 – 5.512 (0.2165 – 0.2170)		
Valve guide protrusion	IN, EX	std.	mm (in.)	9.8 – 10.2 (0.39 – 0.40)		
Valve stem outside diameter	IN	std.	mm (in.)	5.475 – 5.490 (0.2156 – 0.2161)		
	EX	std.	mm (in.)	5.450 – 5.465 (0.2146 – 0.2152)		
Valve stem deflection	IN	Limit	mm (in.)	0.14 (0.006)		
	EX	Limit	mm (in.)	0.18 (0.007)		
Valve stem runout	IN, EX	Limit	mm (in.)	0.05 (0.002)		
Valve head radial runout	IN, EX	Limit	mm (in.)	0.08 (0.003)		
Valve head thickness	IN	std.	mm (in.)	—		
		Limit	mm (in.)	0.5 (0.02)		
	EX	std.	mm (in.)	—		
		Limit	mm (in.)	0.5 (0.02)		
Valve seat contact width	IN	std.	mm (in.)	0.9 – 1.1 (0.035 – 0.043)		
	EX	std.	mm (in.)	0.9 – 1.1 (0.035 – 0.043)		
Valve spring free length		std.	mm (in.)	33.16 (1.31)		
		Limit	mm (in.)	31.50 (1.24)		
Valve spring preload		std.	N (kg, lbs)	82 – 95 (8.2 – 9.5, 18 – 21) at 28.5 mm (1.12 in)		
		Limit	N (kg, lbs)	75 (7.5, 16.5) at 28.5 mm (1.12 in)		
Valve spring squareness		Limit	mm (in.)	1.0 (0.04)		

Cylinder / Piston / Piston Ring

Item			Unit	Data		
				DF9.9B	DF15A	DF20A
Cylinder distortion		Limit	mm (in.)	0.06 (0.002)		
Piston to cylinder clearance		std.	mm (in.)	0.0271 – 0.0425 (0.0011 – 0.0017)		
		Limit	mm (in.)	0.100 (0.0039)		
Cylinder bore		std.	mm (in.)	60.400 – 60.415 (2.3780 – 2.3785)		
Cylinder measuring position			mm (in.)	50 (1.969) from cylinder top surface		
Piston skirt diameter		std.	mm (in.)	60.365 – 60.380 (2.3766 – 2.3772)		
Piston measuring position			mm (in.)	9 (0.354) from piston skirt end		
Cylinder bore wear		Limit	mm (in.)	0.10 (0.0039)		
Piston ring end gap	1st	std.	mm (in.)	0.12 – 0.25 (0.0047 – 0.0098)		
		Limit	mm (in.)	0.70 (0.028)		
	2nd	std.	mm (in.)	0.26 – 0.39 (0.0102 – 0.0154)		
		Limit	mm (in.)	0.70 (0.028)		
Piston ring free end gap	1st	std.	mm (in.)	Approx. 6.3 (0.2480)		
		Limit	mm (in.)	5.0 (0.1969)		
	2nd	std.	mm (in.)	Approx. 5.6 (0.2205)		
		Limit	mm (in.)	4.5 (0.1772)		
Piston ring to groove clearance	1st	std.	mm (in.)	0.030 – 0.070 (0.0012 – 0.0028)		
		Limit	mm (in.)	0.12 (0.005)		
	2nd	std.	mm (in.)	0.020 – 0.060 (0.0008 – 0.0024)		
		Limit	mm (in.)	0.10 (0.004)		
Piston ring groove width	1st	std.	mm (in.)	1.02 – 1.04 (0.040 – 0.041)		
	2nd	std.	mm (in.)	1.21 – 1.23 (0.048 – 0.048)		
	Oil	std.	mm (in.)	2.01 – 2.03 (0.079 – 0.080)		
Piston ring thickness	1st	std.	mm (in.)	0.97 – 0.99 (0.038 – 0.039)		
	2nd	std.	mm (in.)	1.17 – 1.19 (0.046 – 0.047)		
Pin clearance in piston pin hole		std.	mm (in.)	0.002 – 0.013 (0.0001 – 0.0005)		
		Limit	mm (in.)	0.05 (0.0020)		
Piston pin outside diameter		std.	mm (in.)	15.995 – 16.000 (0.6297 – 0.6299)		
		Limit	mm (in.)	15.980 (0.6291)		
Piston pin hole diameter		std.	mm (in.)	16.002 – 16.008 (0.6300 – 0.6302)		
		Limit	mm (in.)	16.030 (0.6311)		
Pin clearance in conrod small end		std.	mm (in.)	0.006 – 0.019 (0.0002 – 0.0007)		
		Limit	mm (in.)	0.050 (0.0020)		
Conrod small end bore		std.	mm (in.)	16.006 – 16.014 (0.6302 – 0.6304)		

Crankshaft / Conrod

Item		Unit	Data		
			DF9.9B	DF15A	DF20A
Conrod small end inside diameter	std.	mm (in.)	16.006 – 16.014 (0.6302 – 0.6304)		
Conrod big end oil clearance	std.	mm (in.)	0.025 – 0.045 (0.0010 – 0.0018)		
	Limit	mm (in.)	0.080 (0.0031)		
Conrod big end inside diameter	std.	mm (in.)	29.025 – 29.034 (1.1427 – 1.1431)		
Crank pin outside diameter	std.	mm (in.)	28.989 – 29.000 (1.1413 – 1.1417)		
Crank pin outside diameter difference (Out-of-round and taper)	Limit	mm (in.)	0.010 (0.0004)		
Conrod big end side clearance	std.	mm (in.)	0.100 – 0.250 (0.0039 – 0.0098)		
	Limit	mm (in.)	0.350 (0.0138)		
Conrod big end width	std.	mm (in.)	19.950 – 20.000 (0.7854 – 0.7874)		
Crank pin width	std.	mm (in.)	20.10 – 20.20 (0.7913 – 0.7953)		
Crankshaft journal runout	Limit	mm (in.)	0.04 (0.0016)		
Crankshaft journal oil clearance	std.	mm (in.)	0.020 – 0.047 (0.0008 – 0.0019)		
	Limit	mm (in.)	0.080 (0.0031)		
Crankcase bearing holder inside diameter	std.	mm (in.)	35.000 – 35.008 (1.3780 – 1.3783)		
Crankshaft journal outside diameter	std.	mm (in.)	31.989 – 32.000 (1.2594 – 1.2598)		

Item		Unit	Data		
			DF9.9B	DF15A	DF20A
Crankshaft journal outside diameter difference (Out-of-round and taper)	Limit	mm (in.)	0.010 (0.0004)		
Crankshaft bearing thickness	std.	mm (in.)	1.486 – 1.490 (0.0585 – 0.0587)		
Crankshaft thrust play	std.	mm (in.)	0.10 – 0.30 (0.004 – 0.012)		
	Limit	mm (in.)	0.60 (0.024)		
Crankshaft length	std.	mm (in.)	126.8 – 126.9 (4.992 – 4.996)		
Crankcase length	std.	mm (in.)	127.0 – 127.1 (5.000 – 5.004)		

Electrical

Item		Unit	Data		
			DF9.9B	DF15A	DF20A
Ignition timing		Degrees at r/min	5° BTDC – 14° BTDC	5° BTDC – 10° BTDC	5° BTDC – 20° BTDC
Over revolution limiter		r/min	5 900	6 200	6 300
CKP sensor resistance		Ω at 20 °C	148 – 222 (R/B – B)		
Power source coil resistance		Ω at 20 °C	2.1 – 3.2 (W – B): Manual start model		
Ignition coil resistance	Primary	Ω at 20 °C	0.08 – 0.11 (O – B)		
	Secondary	kΩ at 20 °C	3.5 – 4.7 (H·T cord – H·T cord)		
Spark plug cap resistance		kΩ at 20 °C	4 – 6		
Battery charge coil resistance		Ω at 20 °C	0.5 – 0.8: Manual start model 0.7 – 1.1: Electric start model		
Battery charge coil output (12 V)		Watt	72: Manual start model 144: Electric start model		
Standard spark plug	Type	NGK	CPR6EA-9		
	Gap	mm (in.)	0.8 – 0.9 (0.031 – 0.035)		
Fuse amp. rating		A	Electric starter model 30A: Main 10A: ECM		
Recommended battery capacity (12 V)		Ah (kC)	35 (126) or larger		
Fuel injector resistance		Ω at 20 °C	10 – 14		
IAC valve resistance		Ω at 20 °C	31 – 42		
IAT sensor/Cylinder temp. sensor (Thermistor characteristic)		kΩ at 25 °C	1.8 – 2.3		
Starter motor relay coil resistance		Ω at 20 °C	145 – 190: Electric start model		

Starter Motor (Only for Electric Start Model)

Item		Unit	Data		
			DF9.9B	DF15A	DF20A
Max. continuous time of use		Sec.	30		
Motor output		kW	1.4		
Brush length	std.	mm (in.)	16.0 (0.63)		
	Limit	mm (in.)	12.0 (0.47)		
Commutator undercut	std.	mm (in.)	0.5 – 0.8 (0.02 – 0.03)		
	Limit	mm (in.)	0.2 (0.01)		
Commutator outside diameter	std.	mm (in.)	29.0 (1.14)		
	Limit	mm (in.)	28.0 (1.10)		

Peak Voltage

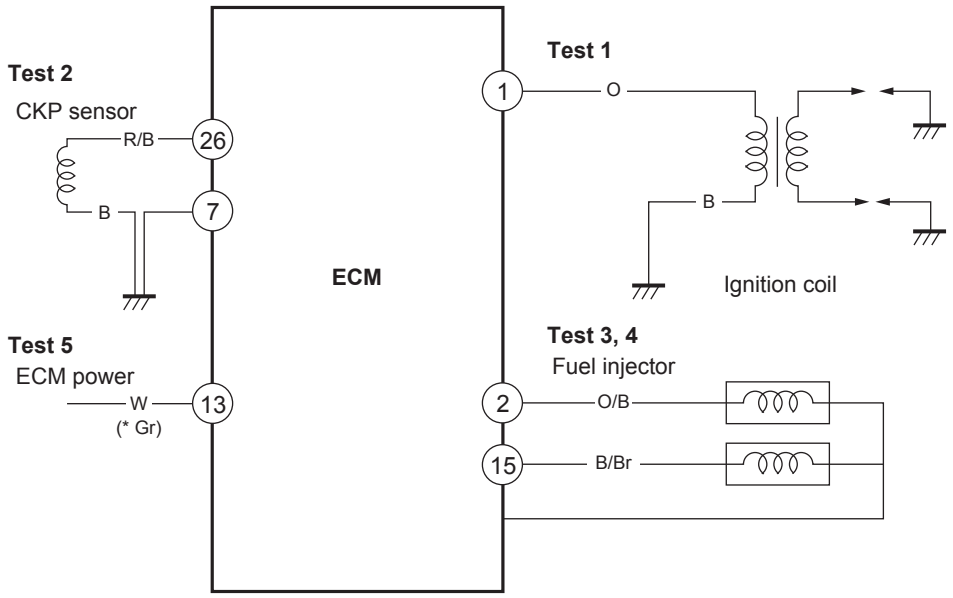
NOTE

Requirement for peak voltage measurement:

- **Remove all spark plugs to eliminate the variables at cranking speed.**
- **Use a STEVENS peak voltage tester, model CD-77.**
- **Use the 26-pin test cord.**
- **Crank with recoil starter or starter motor.**

Electric starter model

Testing sequence		Tester probe		Peak voltage	Tester range	Remarks
		(+) [Red]	(–) [Black]			
1	Ignition coil primary output	Orange	GND	110 V or over	NEG 500	• With ignition coil connected. • Use the 26 pin test cord.
2	CKP sensor output	Red/Black (Harness No.26 terminal)	GND	1.0 V or over	SEN 5	• With ECM connector disconnected.
3	Fuel Injector signal No.1	Orange/ Black	GND	20 V or over	POS 50	• With fuel injector connected. • Use the 26 pin test cord.
4	Fuel Injector signal No.2	Black/ Brown	GND	20 V or over	POS 50	
5	DC power for ECM	White (*: Gray)	GND	8 V or over	POS 50	• With rectifier connected. • Use the 26 pin test cord.



(*: Remote control model)

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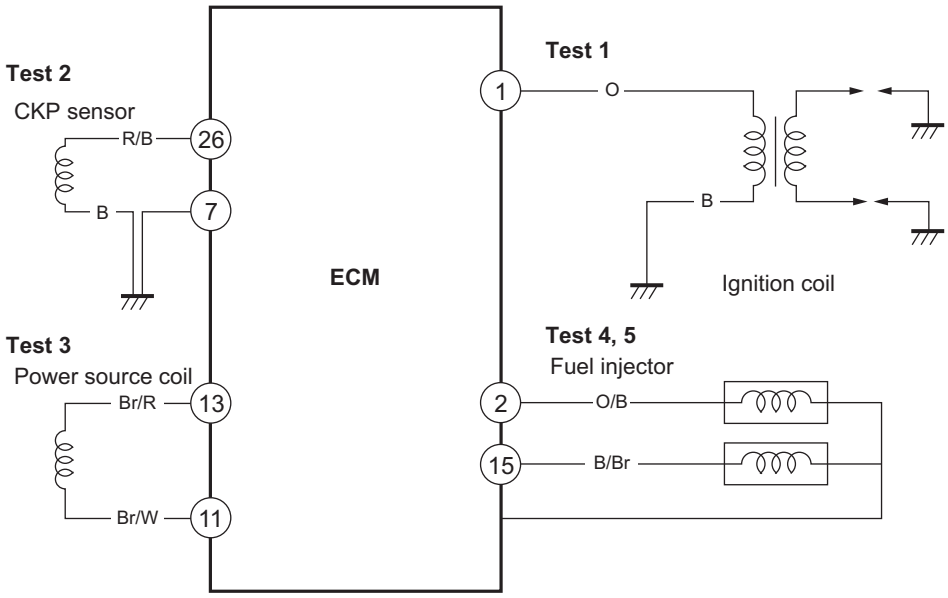
Manual starter model

Testing sequence		Tester probe (+) [Red]	Tester probe (–) [Black]	Peak voltage	Tester range	Remarks
1	Ignition coil primary output	Orange	GND	100 V or over	NEG 500	• With ignition coil connected. • Use the 26 pin test cord.
2	CKP sensor output	Red/Black (Harness No.26 terminal)	GND	1.0 V or over	SEN 5	• With ECM connector disconnected.
3	Power source coil output	Brown/Red (Harness No.13 terminal)	Brown/White (Harness No.11 terminal)	16 V or over	POS 50	• With ECM connector disconnected.
4	Fuel Injector signal No.1	Orange/Black	GND	20 V or over	POS 50	• With fuel injector connected. • Use the 26 pin test cord.
5	Fuel Injector signal No.2	Black/Brown	GND	20 V or over	POS 50	



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Maintenance and Tune-Up

Service Instructions

Oil Pressure Check (Remote Control Model)

CENDK1120206020

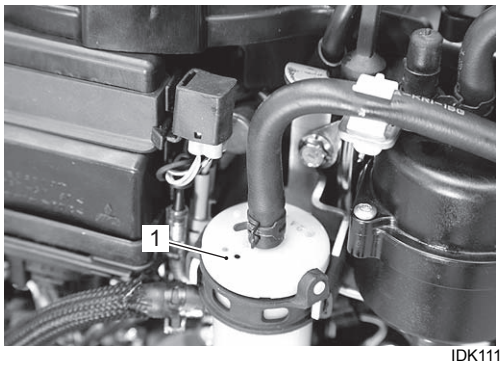
⚠ CAUTION

Engine oil can be hot enough to burn you.

Do not remove the oil pressure gauge adapter when the engine is hot. Wait until engine cools.

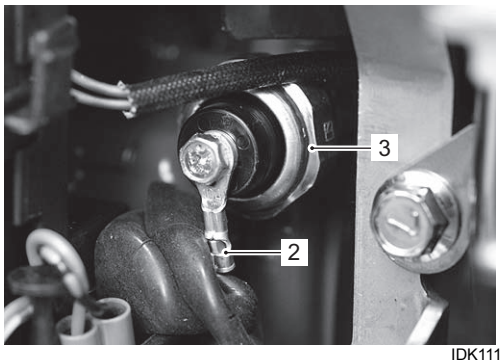
Check the engine oil pressure periodically.

1) Check the engine oil level.
2) Temporarily remove the SDS service connector from electric part holder.
3) Temporarily remove the fuel filter (1) from filter bracket.



IDK111020063-01

4) Loosen screw and disconnect blue/yellow lead wire (2) from oil pressure switch (3).
Remove the oil pressure switch.



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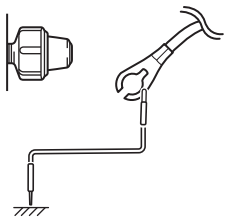
5) Connect the oil pressure switch lead wire to engine body ground by using an appropriate jumper wire.



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NOTE

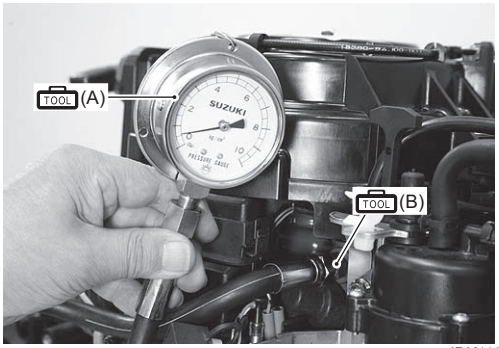
You should remove oil pressure switch after disconnecting its lead when perform the oil pressure test.
Then diagnostic code of oil pressure switch will be displayed while performing the test.
Connect the oil pressure switch lead wire to engine body ground by using an appropriate jumper wire before the test (turning on the ignition switch).
So that the diagnostic code won't be displayed.
After the engine starts, disconnect the jumper wire from switch lead wire.

NOTE

For cancellation of the "self-diagnostic indication", refer to "Self-Diagnostic System Description" in related manual.

6) Install oil pressure gauge adaptor into oil pressure switch hole in place of oil pressure switch.

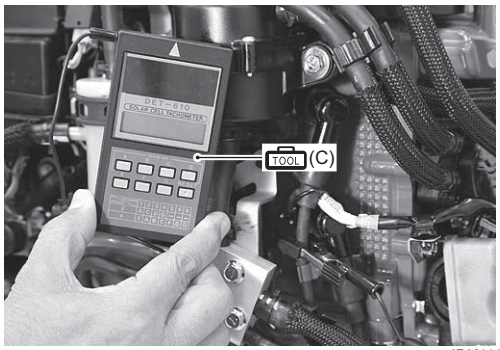
Special tool
TOOL (A): 09915–77311 (Oil pressure gauge)
TOOL (B): 09915–78211 (Oil pressure gauge adapter)



IDK111020065-01

7) Install the fuel filter to filter bracket.
8) Attach the engine tachometer to ignition coil high-tension cord.

Special tool
TOOL (C): 09900–26006 (Engine tachometer)



IDK111020066-01

9) Start engine and allow to warm up.
10) After the engine starts, disconnect the jumper wire from switch lead wire.
11) After warming up, shift into forward gear and increase engine speed to 3 000 r/min., then compare pressure indicated on gauge to specifications.

NOTE

The figure shown below is a guideline only, not an absolute service limit.

Oil pressure
200 – 500 kPa (2.0 – 5.0 kg/cm^2, 29 – 71 psi.) at 3 000 r/min., oil temp. at normal operating temp.

12) If oil pressure is lower or higher than specification, the following causes may be considered.
Low oil pressure
- Clogged oil filter
- Leakage from oil passages
- Defective oil pump
- Defective oil pressure regulator
- Damage O-ring
- Combination of above items

High oil pressure
- Using an engine oil of too high viscosity
- Clogged oil passage
- Clogged oil pressure regulator
- Combination of above items

13) After testing, reinstall oil pressure switch. Refer to “Oil Pressure Switch Removal and Installation” in related manual.
14) Check the engine oil level.

Section 1

Power Head

CONTENTS

NOTE

For the items with asterisk (*) in the "CONTENTS" below, refer to the same section of the service manual mentioned in the "FOREWORD" of this manual.

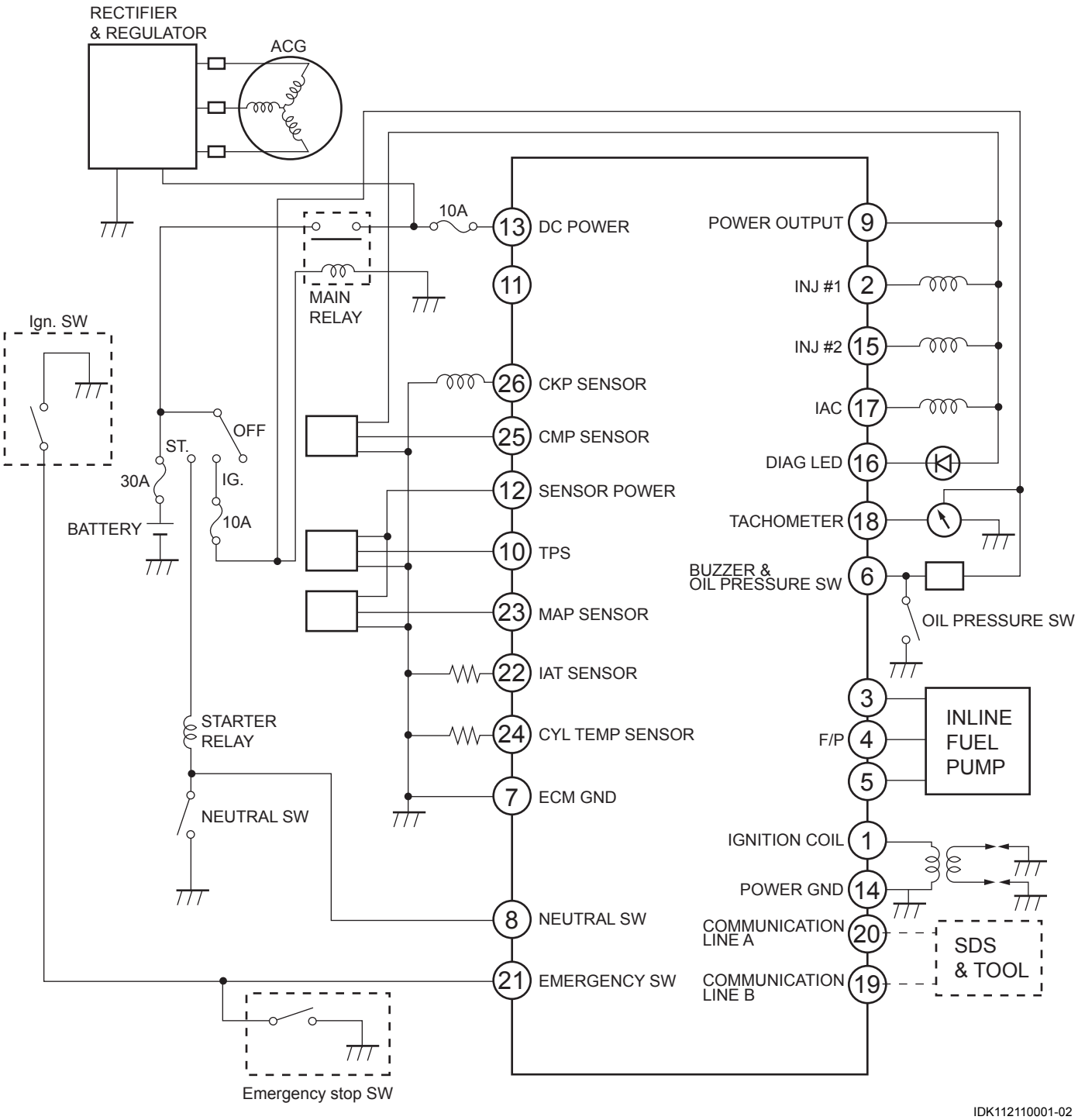
Engine Control

General Description

Engine Control Module (ECM) (Remote Control Model)

CENDK1121101007

ECM Input / Output Circuit Diagram
Remote control model



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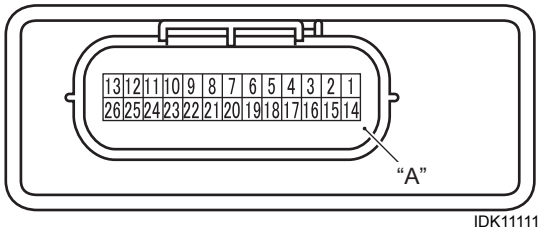
ECM Connector / Terminals Layout



IDK111110007-01

"A": ECM

Remote control model

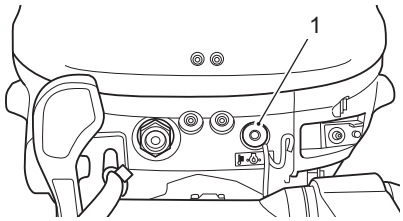
Terminal	Wire color	Circuit
1	O	Ignition coil
2	O/B	No.1 Fuel injector
3	B/Y	High pressure fuel pump (V)
4	B/R	High pressure fuel pump (W)
5	B/W	High pressure fuel pump (U)
6	Bl/Y	Oil pressure switch
7	B	Ground for ECM
8	Y/G	Neutral switch
9	Gr/R	Power output
10	Br/Y	Throttle position sensor
11	–	–
12	R	Power for sensor (5 V)
13	Gr	DC power for ECM
14	B	Ground for ECM power
15	B/Br	No.2 Fuel injector
16	P	Diag LED
17	W/B	IAC valve
18	Y/B	Tachometer
19	Y	Communication line (B)
20	O/Y	Communication line (A)
21	Bl/R	Emergency stop switch
22	Lg/B	IAT sensor
23	W	MAP sensor
24	Lg/W	Cylinder temp. sensor
25	Y/Bl	CMP sensor
26	R/B	CKP sensor

Caution System Description (Remote Control Model)

CENDK1121101008

The following three caution systems alert the operator when an abnormality occurs on the engine.

- OVER-REVOLUTION CAUTION
- LOW OIL PRESSURE CAUTION
- OVERHEAT CAUTION



IDK111110023-02

1. Caution lamp

Caution type	Caution lamp	*Caution buzzer	Engine RPM limited
Over-revolution	Yes	No	Yes
Low oil pressure	Yes	Yes	Yes
Overheat	Yes	Yes	Yes

*: Remote control model only

Lamp Check / Buzzer Check
(Remote control models)
When the ignition key is turned to the “ON” position:

- Caution lamps turns on for two seconds.
- Caution buzzer sounds.

NOTE

On remote control model:
The caution buzzer sounds when ignition switch is turned ON.
Then it stops sounding when engine starts and the oil pressure switch turns OFF by reaching engine oil pressure at 15 kPa (0.15 kg/cm^2, 2 psi.).

Over-Revolution Caution System
Condition:
The ECM controlled over revolution limiter will engage at the engine speeds shown below. Once engaged it will initiate an intermittent fuel injection signal to reduce engine speed.

Over revolution limiter
DF9.9B: 5 900 r/min
DF15A: 6 200 r/min
DF20A: 6 300 r/min

Action:

Engine speed	• Automatically reduced to approx.3 000 r/ min. by an intermittent fuel injection signal. • If the operator decreases the engine speed below the over revolution system maximum preset value, within 10 seconds, the over-revolution caution control will be cancelled.
Caution lamp	Caution lamp lights continuously.

Reset:
Close the throttle to reduce the engine speed below approx. 3 000 r/min. for one second.

NOTE

In neutral gear, the preset maximum engine speed value before the over-revolution caution system activates is 3 000 r/min.
In the operation of Neutral gear over-revolution caution system, the caution lamp does not light.
To cancel the Neutral gear over-revolution caution control, close throttle completely.

Low Oil Pressure Caution System

Condition:

Immediate activation of the system when the oil pressure switch is turned “ON” due to an engine oil pressure drop below 15 kPa (0.15 kg/cm^2, 2 psi.) while engine is running.

Action:

Engine speed	• Automatically reduced to approx. 2 000 r/min. maximum by an intermittent fuel injection signal. • The engine automatically stops 3 minutes after the caution system is activated.
Caution lamp	Caution lamp lights continuously.
Caution buzzer	Sound in a series of long (1.5 sec.) beeps.

NOTE

If the engine is automatically stopped due to the caution system, the engine can be started again. However, the caution system will repeatedly activate until the cause is eliminated.

Reset:

Stop the engine and check the engine oil level. Refill the engine oil to the correct level if it is below the low oil level mark.

If the engine oil level is correct, the following causes may be considered:

- Improper oil viscosity.
- Malfunctioning oil pressure switch.
- Clogged oil strainer or oil filter.
- Worn oil pump relief valve.
- Oil leakage from the oil passage.
- Excessive wear/damage of oil pump.

NOTE

The low oil pressure caution system will reset when the oil pressure is restored to over 15 kPa (0.15 kg/cm^2, 2 psi.) at approx. 2 000 r/min. or less engine speed operation.
The engine must be stopped and checked immediately once the system is activated.

Overheat Caution System

Immediate activation of the system when:

- Cylinder temperature reaches 90 °C (194 °F)
- The rate of cylinder wall temperature variation within a given time exceeds the preset rate.

Action:

Engine speed	• Automatically reduced to approx. 3 000 r/min. maximum by intermittent fuel injection and ignition signals. • The engine automatically stops 3 minutes after the caution system is activated.
Caution lamp	Caution lamp lights continuously.
Caution buzzer	Sound in a series of long (1.5 sec.) beeps.

NOTE

If the engine is automatically stopped due to the caution system, the engine can be started again. The caution system will repeatedly activate until the cause is eliminated.

Reset:

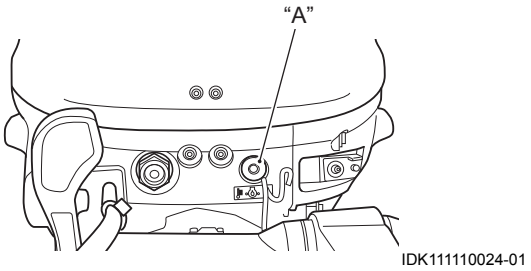
System reset will occur when the cylinder temperature drops below the limits shown below. However, the system may be activated again unless the cause for overheat (such as insufficient water) is removed.

Reset temperature	Approx. 70 °C (158 °F)

Self-Diagnostic System Description (Remote Control Model)

CENDK1121101009

The self-diagnostic system alerts the operator when an abnormality occurs in a signal from a sensor, or switch, etc. When the system is activated, the caution lamp flashes (lights intermittently) according to each code pattern along with buzzer sound.



IDK111110024-01

"A": Caution lamp

NOTE

- **The buzzer sound will be stopped approx. 30 seconds after activating the diagnostic system during engine operation.**
- **Diagnostic code indication appears by the caution lamp during ignition key turns ON. However, the buzzer keeps sounding by the pattern of oil pressure caution if engine stops.**

Priority / Code / Pattern for Self-Diagnostic System Operation

0: OFF, 1: ON

Priority	Failed item	Code	Lamp flashing pattern	Fail-Safe system active
1	MAP sensor 1	3 – 4	 MCODE00D34-0-01	Yes
2	Cylinder temp. sensor	1 – 4	 MCODE00D14-0-01	Yes
3	IAT sensor	2 – 3	 MCODE00D23-0-01	Yes
4	CKP sensor	4 – 2	 MCODE00D42-0-01	No
5	CMP sensor	2 – 4	 MCODE00D24-0-01	No
6	Air intake system	2 – 2	 MCODE00D22-0-01	Yes
7	MAP sensor 2	3 – 2	 MCODE00D32-0-01	No
8	Fuel injector	4 – 3	 MCODE00D43-0-01	No
9	Throttle position sensor	2 – 1	 MCODE00D21-0-01	Yes
10	Rectifier/Regulator (Over-charging)	1 – 1	 MCODE00D11-0-01	No
11	Oil pressure switch (R model)	5 – 3	 MCODE00D53-0-01	No

NOTE

- **If two or more items fail at once, the self-diagnostic indication appears according to the priority order. The indication repeats three times.**
- **If the failed item remains, the self-diagnostic indication appears again after starting the engine.**
- **After correcting the failed item, the self-diagnostic indication appears until the ECM receives the proper signal with the engine running.**
- **Cancellation of the self-diagnostic indication is automatically performed when the failure is corrected and a normal signal is received by the ECM for a period of 20 – 30 seconds.**

NOTE

To cancel the diagnostic display for oil pressure switch failure, perform the following procedure after it is corrected:

1. **Turn the ignition key to ON. The diagnostic code for oil pressure switch failure will continue to be displayed until a normal signal sequence is received by the ECM.**
2. **Turn the ignition key to OFF once and turn ON again.**
   At the second turning on, cancel of the oil pressure switch failure code is completed.

Oil Change Reminder System Description (Remote Control Model)

CENDK1121101010

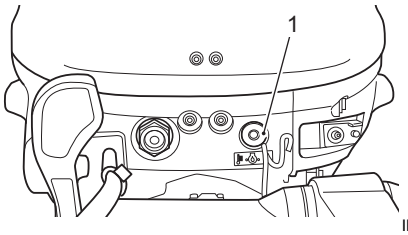
This system informs the operator that it is time to change the ENGINE OIL based on the recommended maintenance schedule.
When the total motor operating hours has reached the pre-programmed hours, the caution lamp will flash.
If the engine is running, the buzzer will begin a series of double beeps additionally.
The above mentioned indication will repeat until the activated system is manually canceled.

NOTE

The buzzer sound will be stopped approx. 30 seconds after activating system during engine operation.

NOTE

This system will activate up to 2 100 hour's operation.



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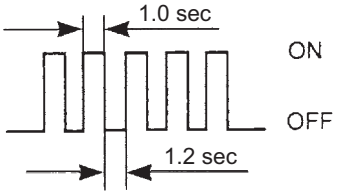
1. Caution lamp

Indication of System Activation

Caution lamp flashing pattern



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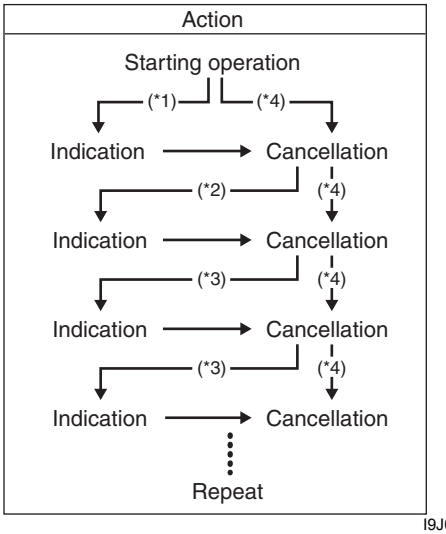

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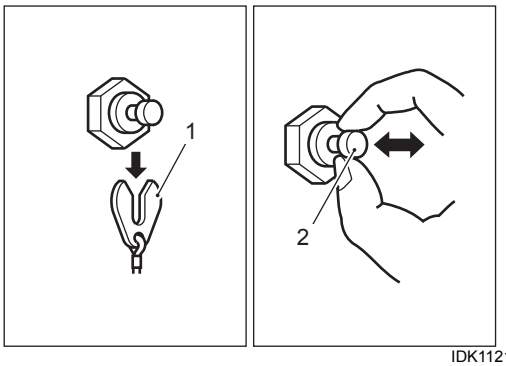
*1:	Lapse of initial 20 hour's operation
*2:	Lapse of 80 hour's operation
*3:	Lapse of 100 hour's operation
*4:	When performing cancellation before system activation

Cancellation Procedure

1) Sift into “NEUTRAL”.
2) Turn the ignition key to the “ON” position.
3) Pull out the emergency stop switch plate (1).
4) Pull up the emergency stop switch knob (2) three times within 3 seconds. The caution lamp is no longer lit when the reminder cancellation is successful.



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5) Turn the ignition key to the “OFF” position.
6) Set the plate (1) in the original position.

NOTE

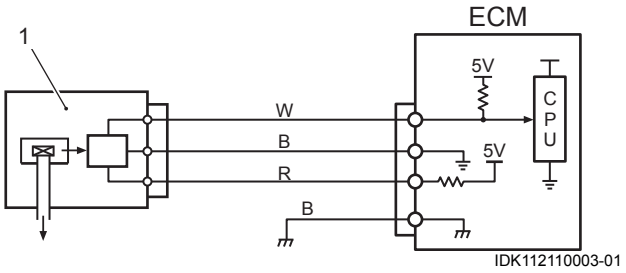
- **Cancellation of the system is possible whether or not the engine oil has been replaced.**
  Once the system has been activated, SUZUKI strongly recommends that the engine oil be replaced before canceling the system.
- **If the engine oil has been replaced with the system not activated, it is still necessary to perform the cancellation procedure to reset the Oil Change Reminder System.**

Diagnostic Information and Procedures

Self-Diagnostic Code “3 – 4” MAP Sensor (Remote Control Model)

CENDK1121104015

Wiring Diagram



1. MAP sensor

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the MAP sensor connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of the MAP sensor connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 2.

No
- “R” wire open, “R” wire shorted to ground or a poor wire connection.
- If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 2

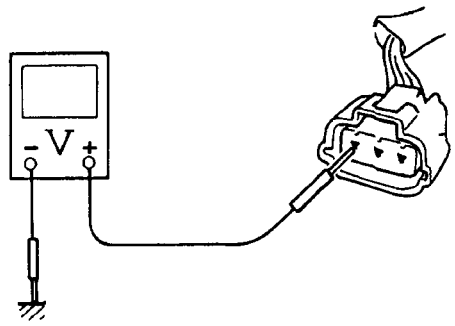
1) Check the MAP sensor output voltage change.
   Refer to “MAP Sensor Output Voltage Inspection” in related manual.

Is it in good condition?

Yes — Substitute a good ECM and recheck.

No
- Faulty MAP sensor.
- “R” wire shorted to “W” wire, “B” wire open, poor “B” wire connection, poor “W” wire connection, “W” wire open or poor MAP sensor connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

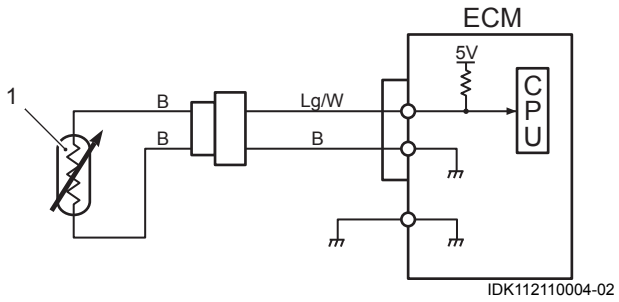
For step 1



Self-Diagnostic Code “1 – 4” Cylinder Temp. Sensor (Remote Control Model)

CENDK1121104016

Wiring Diagram



1. Cylinder temp sensor

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the cylinder temp. sensor connector.
2) With the ignition switch “ON”, check the voltage at the “Lg/W” wire terminal of the cylinder temp. sensor connector.

Is the voltage 4 V or more?

Yes — Go to step 2.

No
- “Lg/W” wire shorted to the “B/W” wire or ground circuit.
- If the wiring is OK, substitute a known-good ECM and recheck.

Step 2

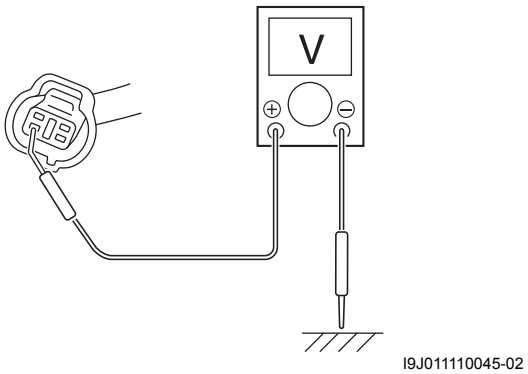
1) Check the Cylinder temp. sensor.
Refer to “Cylinder Temp. Sensor Inspection” in related manual.

Is it in good condition?

Yes — Poor Cylinder Temp. sensor connection, intermittent trouble or a faulty ECM may be the cause.

No — Faulty Cylinder Temp. sensor.

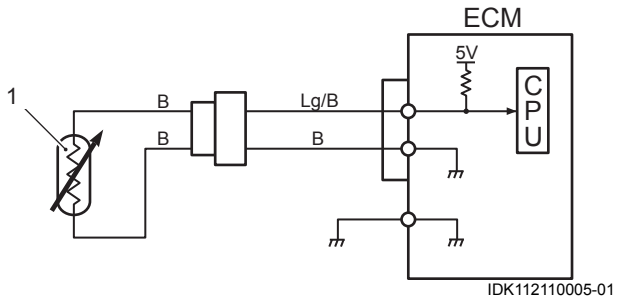
For step 1



Self-Diagnostic Code “2 – 3” IAT Sensor (Remote Control Model)

CENDK1121104017

Wiring Diagram



1. IAT sensor

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect IAT sensor connector.
2) With the ignition switch “ON”, check the voltage at the “Lg/B” wire terminal of the IAT sensor connector.

Is the voltage 4 V or more?

Yes — Go to step 2.

No
- “Lg/B” wire shorted to “B” wire or ground circuit.
- If the wiring is OK, substitute a known-good ECM and recheck.

Step 2

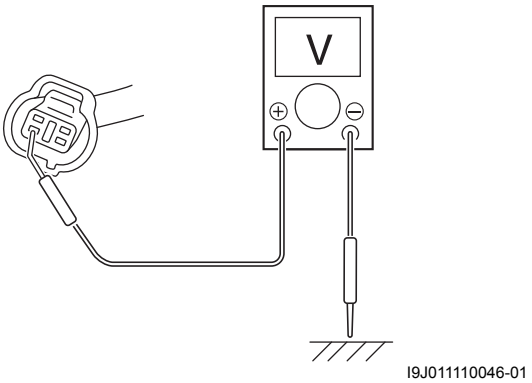
1) Check the IAT sensor.
   Refer to “IAT Sensor Inspection” in related manual.

Is it in good condition?

Yes — Poor IAT sensor connection, intermittent trouble or a faulty ECM may be cause.

No — Faulty IAT sensor.

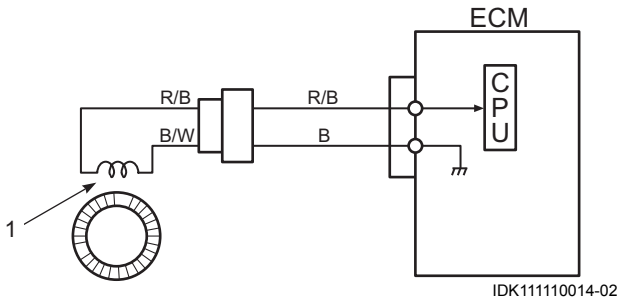
For step 1



Self-Diagnostic Code “4 – 2” CKP Sensor (Remote Control Model)

CENDK1121104018

Wiring Diagram



1. CKP sensor

Troubleshooting

Step 1

1) Check the CKP sensor air gap.
   Refer to “CKP Sensor Removal and Installation” in related manual.

Is it in good condition?

Yes Go to step 2.

No Incorrectly adjusted air gap.

Step 2

1) Check the CKP sensor resistance.
   Refer to “Resistance Check” in related manual.

Is it in good condition?

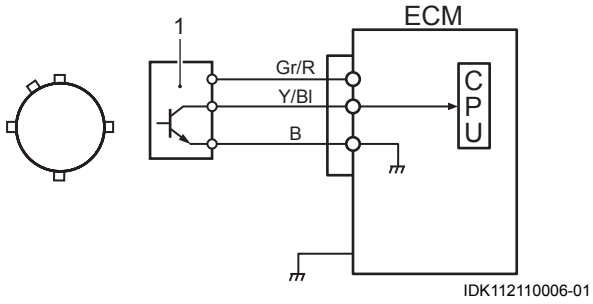
Yes Open wire between the CKP sensor and the ECM, poor lead wire connection or sensor lead wires are shorted to each other. If lead wire and connection are ok, intermittent trouble or a faulty ECM may be the cause.

No Faulty CKP sensor.

Self-Diagnostic Code “2 – 4” CMP Sensor (Remote Control Model)

CENDK1121104019

Wiring Diagram



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1. CMP sensor

Troubleshooting

Step 1

Is CMP sensor installed properly and the wire harness connected securely?

Yes — Go to step 2.

No — Correct.

Step 2

1) With the ignition switch “OFF”, disconnect the connector from the CMP sensor.
2) Check for proper connection to the CMP sensor at “Gr/R”, “Y/Bl” and “B” wire terminals.
3) If OK, turn the ignition switch “ON” and check the voltage at the “Gr/R”, “Y/Bl” and “B” wire terminals of the CMP sensor connector.

CMP sensor voltage
Terminal “Gr/R”: 10 – 14 V
Terminal “Y/Bl”: 4 – 5 V
Terminal “B”: 0 V

Is the voltage satisfactory?

Yes — Go to step 5.

No — Go to step 3.

Step 3

Was terminal “Y/Bl” voltage in step 2 within specification?

Yes — Go to step 4.

No — “Y/Bl” wire open or shorted to ground/ power supply circuit. If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 4

Was terminal “Gr/R” voltage in step 2 within specification?

Yes — Go to step 5.

No — “Gr/R” wire open circuit. If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 5

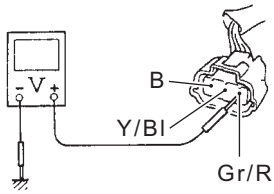
1) Check the CMP sensor and sensor trigger vane. Refer to “CMP Sensor Inspection” in related manual.

Is check result satisfactory?

Yes — Substitute a known-good ECM and recheck.

No — Replace CMP sensor.

For step 2

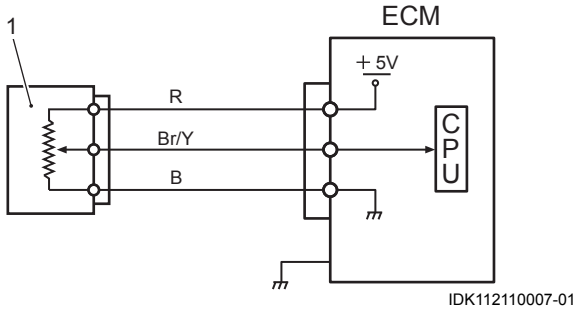


IDK111110008-01

Self-Diagnostic Code “2 – 2” Air Intake System (Remote Control Model)

CENDK1121104020

Wiring Diagram



IDK112110007-01

1. TPS

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the TPS connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of TPS connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 2.

No
- “R” wire open, “R” wire shorted to ground circuit or poor wire connection.
- If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 2

1) Check the TPS output voltage change. Refer to “TPS Inspection” in related manual.

Is it in good condition?

Yes — Go to step 3.

No
- Faulty TPS.
- “R” wire shorted to “Br/Y” wire, “B” wire open, poor “B” wire connection, poor “Br/Y” wire connection, “Br/Y” wire open or poor TPS connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

Step 3

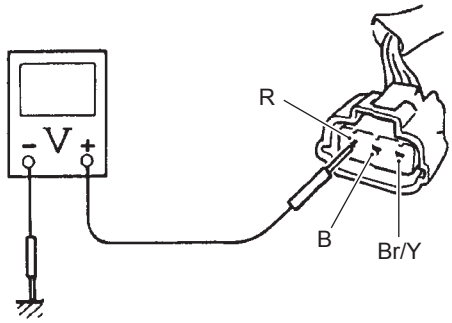
1) Check the MAP sensor, IAC system and intake manifold (system) for air leakage.

Is the result OK?

Yes — Intermittent trouble or faulty ECM. Substitute a known-good ECM and recheck.

No — Faulty air intake system.

For step 1

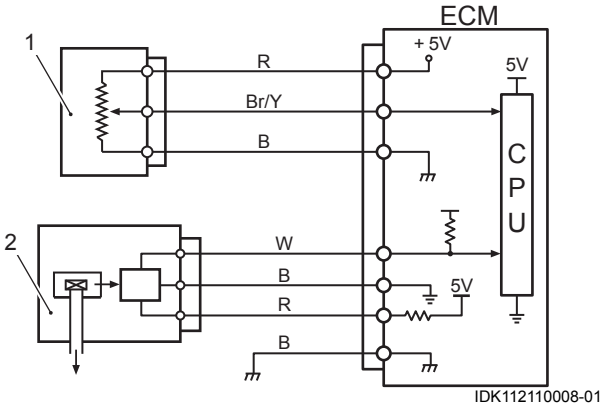


IDK111110009-02

Self-Diagnostic Code “3 – 2” MAP Sensor 2 (Remote Control Model)

CENDK1121104021

Wiring Diagram



1. TPS	2. MAP sensor

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the MAP sensor connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of the MAP sensor connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 2.

No
- “R” wire open, “R” wire shorted to ground circuit or poor wire connection.
- If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 2

1) Check the MAP sensor output voltage change. Refer to “MAP Sensor Output Voltage Inspection” in related manual.

Is it in good condition?

Yes — Go to step 3.

No — Faulty MAP sensor.

Step 3

1) With the ignition switch “OFF”, disconnect the TPS connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of the TPS connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 4.

No
- “R” wire open, “R” wire shorted to ground circuit or poor wire connection.
- If the wiring and connection is OK, substitute a known- good ECM and recheck.

Step 4

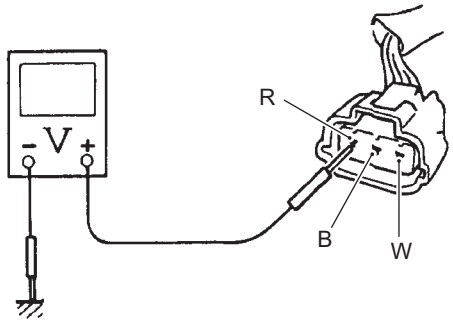
1) Check the TPS output voltage change. Refer to “TPS Inspection” in related manual.

Is it in good condition?

Yes — Intermittent trouble, substitute a known-good ECM and recheck.

No
- Faulty TPS.
- “R” wire shorted to “Br/Y” wire, “B” wire open, poor “B” wire connection, poor “Br/Y” wire connection, “Br/Y” wire open or poor TPS connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

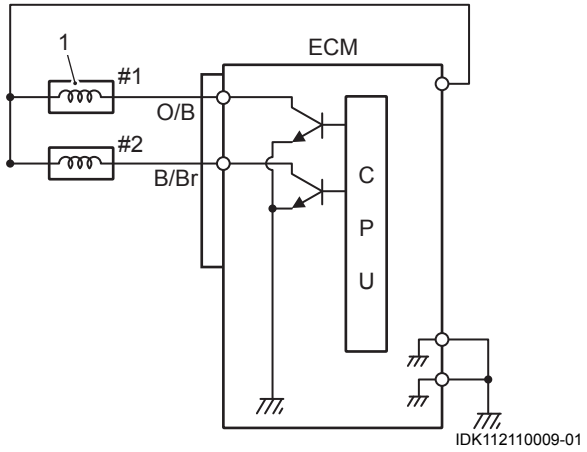
For step 1



Self-Diagnostic Code “4 – 3” Fuel Injector (Remote Control Model)

CENDK1121104022

Wiring Diagram



1. Fuel injector

Troubleshooting

Step 1

1) Turn the ignition switch ON.
Using a sound scope, check that each injector has an operating sound when the engine is cranking.

Do all injectors make an operating sound?

Yes — Fuel injector and its circuit are in good condition.

No — Go to step 2.

Step 2

1) Check the fuel injector, the wiring connection and the wire harness of the fuel injector not making the operating sound.

Are all of the above OK?

Yes — Substitute a known-good ECM and recheck.

No — Faulty injector or its circuit.

Step 3

1) With the ignition switch “OFF”, disconnect the connector from the fuel injector.
2) Check the voltage at “Gr/R” wire terminal with the ignition switch “ON”.

Is the voltage 12 V (battery voltage)?

Yes — Go to step 4.

No — Power circuit open.

Step 4

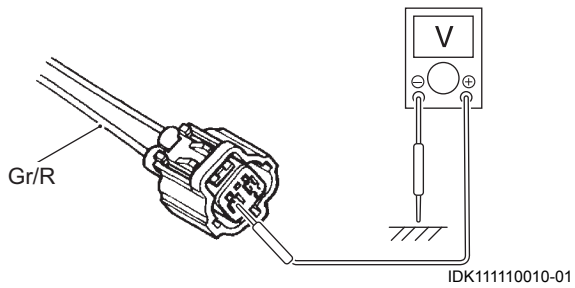
1) Disconnect the ECM connector with the ignition switch “OFF”, and check all of the injectors for resistance.
Refer to “Resistance Check” in related manual.

Is the resistance 10 – 14 Ω for each injector?

Yes — Substitute a known-good ECM and recheck.

No — Faulty injector or its circuit.

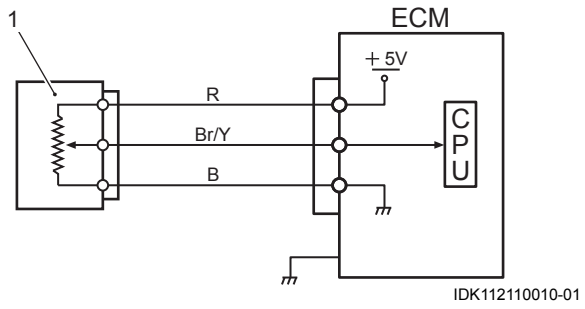
For step 3



Self-Diagnostic Code “2 – 1” TPS (Throttle Position Sensor) (Remote Control Model)

CENDK1121104023

Wiring Diagram



1. TPS

Troubleshooting

Step 1

1) With the ignition switch “OFF”, disconnect the TPS connector.
2) With the ignition switch “ON”, check the voltage at the “R” wire terminal of the TPS connector.

Is the voltage approx. 4 – 5 V?

Yes — Go to step 2.

No
- “R” wire open, “R” wire shorted to ground circuit or poor connection.
- If the wiring and connection is OK, substitute a known-good ECM and recheck.

Step 2

1) Check the TPS output voltage change.
Refer to “TPS Inspection” in related manual.

Is it in good condition?

Yes — Substitute a known-good ECM and recheck.

No
- Faulty TPS.
- “R” wire shorted to “Br/Y” wire, “B” wire open, poor “B” wire connection, poor “Br/Y” wire connection, “Br/Y” wire open or poor TPS connection.
- If the wiring and connection is OK, intermittent trouble or a faulty ECM may be the cause.

Self-Diagnostic Code “1 – 1” Rectifier / Regulator (Over Charging) (Remote Control Model)

CENDK1121104024

NOTE

It is difficult to thoroughly check the rectifier/regulator. Before replacing it with new one, check that the ground point has good electrical contact.

Troubleshooting

Step 1

1) Check the rectifier/regulator.
Refer to “Rectifier / Regulator Inspection” in related manual.

Is the result OK?

Yes — Go to step 2.

No — Faulty rectifier/regulator.

Step 2

1) With the engine running, check charging voltage at idle speed.

Is the result 16 V or higher?

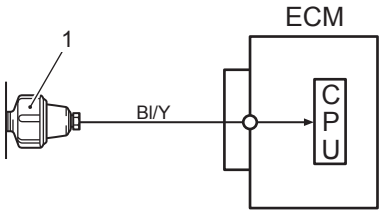
Yes — Faulty rectifier/regulator.

No — Faulty ECM or wire continuity/connection failure.

Self-Diagnostic Code “5 – 3” Oil Pressure Switch (Remote Control Model)

CENDK1121104025

Wiring Diagram



IDK112110011-01

1. Oil pressure switch

Troubleshooting

Step 1

1) With the ignition switch “OFF”, remove the oil pressure switch wire at switch.
2) With the ignition switch “ON”, check the voltage between the oil pressure switch wire terminal and body ground.

Is the voltage approx. 5 V?

Yes Go to step 2.

No
- Oil pressure switch wire open or poor connection.
- If wire and connection are OK, substitute a known-good ECM and recheck.

Step 2

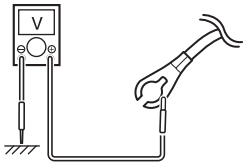
1) Check the oil pressure switch operation.
   Refer to “Oil Pressure Switch Inspection” in related manual.

Is it in good condition?

Yes Poor oil pressure switch wire connection, intermittent trouble or a faulty ECM may be the cause.

No Faulty oil pressure switch.

For step 1



I9J011110064-01

Service Instructions

Inspection of The ECM and Its Circuit (Remote Control Model)

CENDK1121106005

NOTICE

If you connect a voltmeter or ohmmeter directly to ECM terminals by removing ECM connector, you can damage the control module.

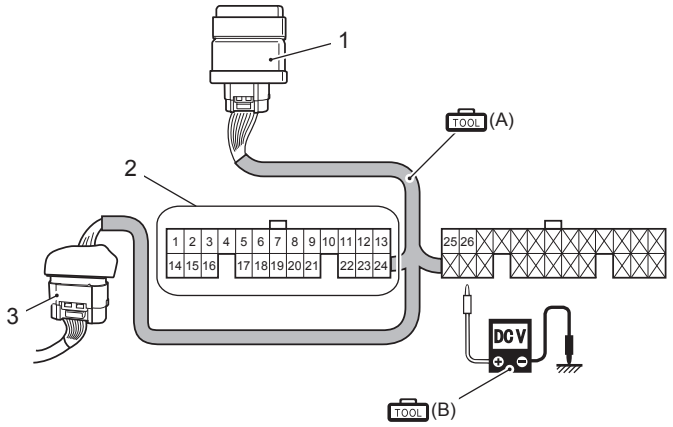
Never connect a voltmeter or an ohmmeter directly to any terminal of ECM by disconnecting control module connector.

Special tool

TOOL (A): 09930–88940 (26-pin test cord)
TOOL (B): 09930–99320 (Digital tester)

Tester knob indication
DCV

1) Turn the ignition switch “OFF”.
2) Connect the 26-pin test cord between the ECM and wire harness as shown in figure.

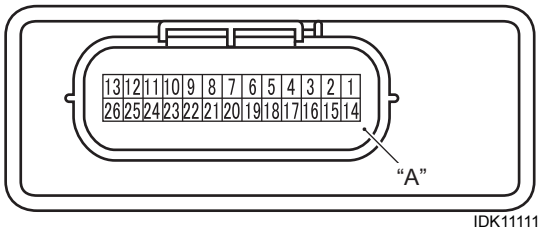


IDK112110012-02

1. ECM	2. White connector	3. Wire harness

3) Turn the ignition switch “ON”.
4) Connect the tester probe (“–”, Black) to body ground, and measure the voltage according to the “Circuit Voltage Table” (Page 1A-19).

Circuit Voltage Table
Remote control model



IDK111110007-01

"A": ECM terminal

Terminal	Wire color	Circuit	Standard voltage	Condition/Remarks
1	O	Ignition coil	—	—
2	O/B	No.1 Fuel injector	Approx. 12 V	• Ignition switch ON.
3	B/Y	High pressure fuel pump (V)	Approx. 0.6 V	• Ignition switch ON.
4	B/R	High pressure fuel pump (W)	Approx. 0.6 V	• Ignition switch ON.
5	B/W	High pressure fuel pump (U)	Approx. 0.6 V	• Ignition switch ON.
6	Bl/Y	Oil pressure switch	—	—
7	B	Ground for ECM	—	—
8	Y/G	Neutral switch	Approx. 0 V	• Ignition switch ON. • Shift into Neutral
			Approx. 4.7 V	• Ignition switch ON. • Shift into Forward or Reverse
9	Gr/R	Power output	Approx. 8 V	• Ignition switch ON. • While cranking engine with starter motor.
			Approx. 12 V	• Ignition switch ON.
10	Br/Y	Throttle position sensor	Approx. 0.7 V	• Ignition switch ON. • Throttle FCT
			Approx. 4 V	• Ignition switch ON. • Throttle WOT
11	—	—	—	—
12	R	Power for sensor (5V)	Approx. 5 V	• Ignition switch ON.
13	Gr	DC power for ECM	Approx. 12 V	• Ignition switch ON.
14	B	Ground for ECM power	—	—
15	B/Br	No.2 Fuel injector	Approx. 12 V	• Ignition switch ON.
16	P	Diag LED	—	—
17	W/B	IAC valve	Approx. 0 V	• Ignition switch ON.
18	Y/B	Tachometer	—	—
19	Y	Communication line (B)	—	—
20	O/Y	Communication line (A)	—	—
21	Bl/R	Emergency stop switch	Approx. 5 V	• Ignition switch ON. • Stop switch plate IN.
			Approx. 0 V	• Ignition switch ON. • Stop switch plate OUT.
22	Lg/B	IAT sensor	0.04 – 4.6 V	• Ignition switch ON.
23	W	MAP sensor	0.79 – 4.2 V	• Ignition switch ON.
24	Lg/W	Cylinder temp. sensor	0.14 – 4.75 V	• Ignition switch ON.
25	Y/Bl	CMP sensor	Approx. 0.3 V or 5 V	• Ignition switch ON.
26	R/B	CKP sensor	—	—

Engine Electrical Devices

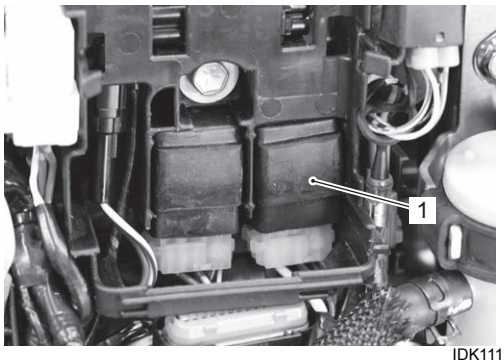
General Description

Sensor and Switch Description (Remote Control Model)

CENDK1121301003

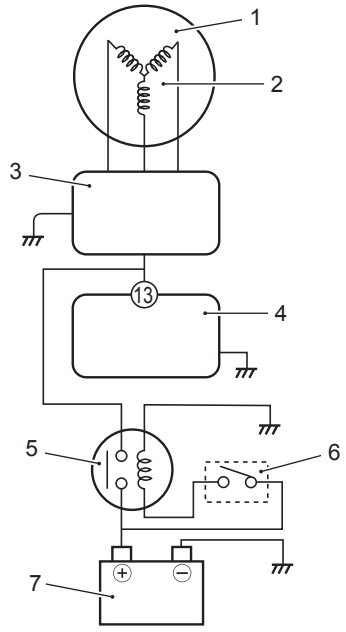
Main Relay

The main relay is installed in the electric parts holder. When energized by turning the ignition switch “ON”, charging circuit is formed which supplies charging current to the battery.



IDK111130027-02

1. Main relay	



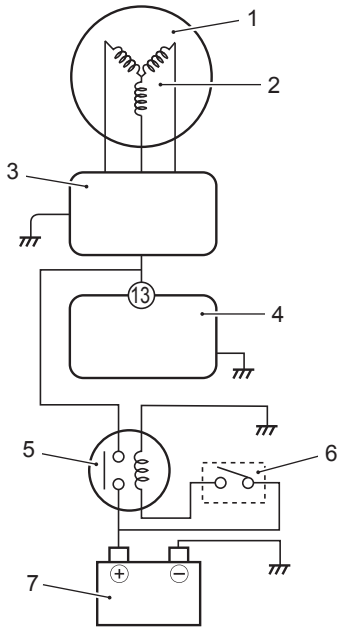
IDK112130008-01

1. Flywheel	5. Main relay
2. Battery charge coil	6. Ignition switch
3. Rectifier/Regulator	7. Battery
4. ECM	

ECM Power Source (Remote Control Model)

CENDK1121301004

The AC output from the battery charge coil is rectified to DC power by the rectifier/regulator. The DC power inputs to ECM through ECM No.13 terminal, and it is supplied to the engine control system.



IDK112130001-03

1. Flywheel	5. Main relay
2. Battery charge coil	6. Ignition switch
3. Rectifier/Regulator	7. Battery
4. ECM	

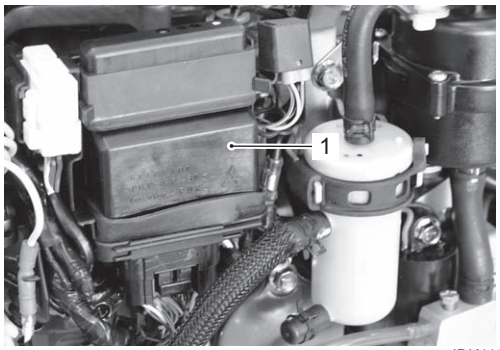
Service Instructions

Cylinder Temp. Sensor Removal and Installation (All Models)

CENDK1121306021

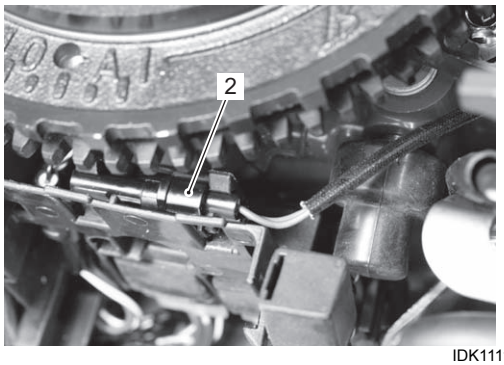
Removal

1) Remove the recoil starter.
   Refer to “Recoil Starter Removal and Installation” in related manual.
2) Disconnect lead wire connector from ECM (1), then remove ECM.



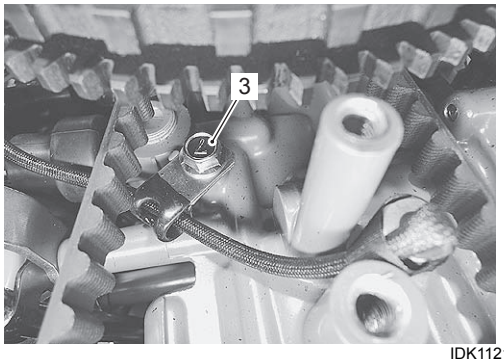
IDK111130028-02

3) Disconnect the cylinder temp. sensor lead wire connector (2).



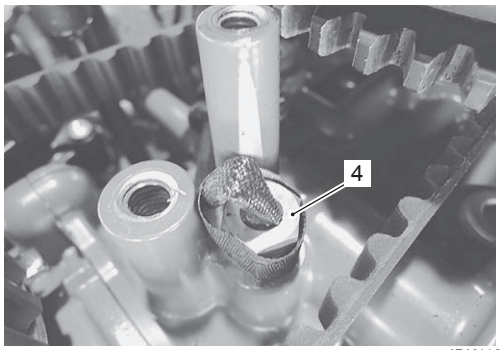
IDK111130029-02

4) Remove the bolt (3) securing lead wire clamp.



IDK112130004-01

5) Remove the tape securing sensor lead wire.
   Loosen and remove the cylinder temp. sensor (4).



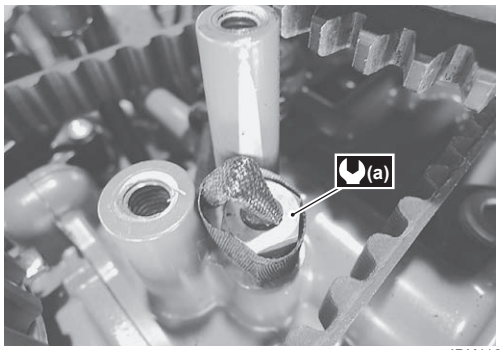
IDK112130005-01

Installation

Installation is reverse order of removal.

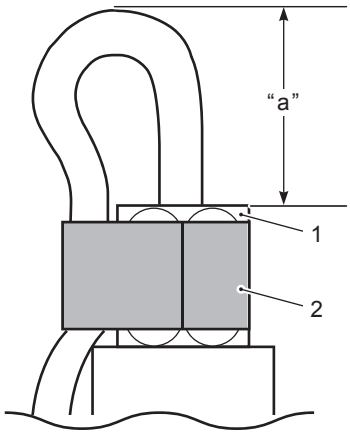
- Clean mating surface of sensor and cylinder.
- Tighten sensor to specified torque.

Tightening torque
Cylinder temp. sensor (a): 9 N·m (0.9 kgf-m, 6.5 lbf-ft)



IDK112130006-01

- Fix the sensor lead wire to sensor with heat-resisting tape as shown.



IDK112130007-01

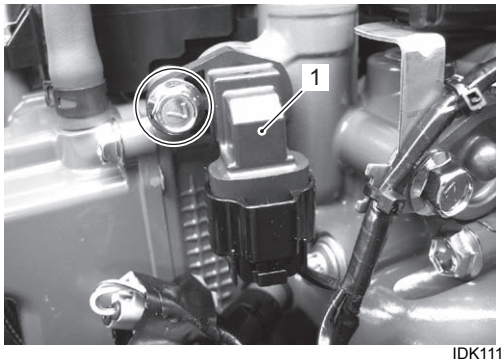
1. Cylinder temp sensor	“a”: Approx. 15 mm
2. Taping	

- Connect connector to sensor securely.
- Check to ensure that all removed parts are back in original position.
- Check that sensor lead wire is routed properly and away from hot or rotating parts.
  Refer to “Wiring Harness Routing Diagram” in related Manual.

CMP Sensor Inspection (Remote Control Model)

CENDK1121306018

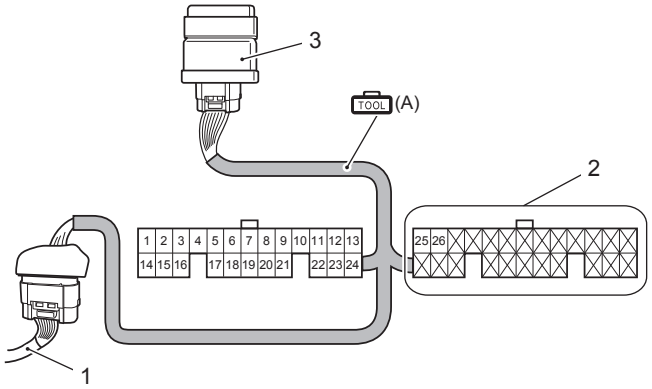
1) Turn the ignition switch “OFF”.
2) Remove the bolt and CMP sensor (1).



IDK111130034-01

3) Connect the 26-pin test cord between ECM and wire harness as shown in figure.

Special tool
TOOL (A): 09930–88940 (26-pin test cord)



IDK112130002-01

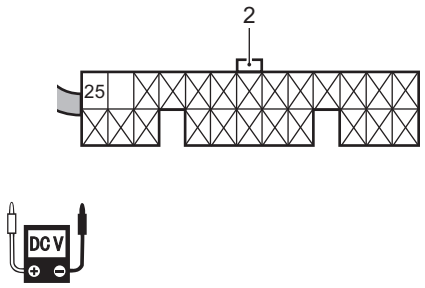
1. Wire harness	2. Black connector	3. ECM

4) Connect the tester probe (“+”, Red) to No.25 terminal.
5) Connect the tester probe (“–”, Black) to No.7 terminal (or to body ground).

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
DC Voltage (⎓)

26-pin test cord (Black connector)

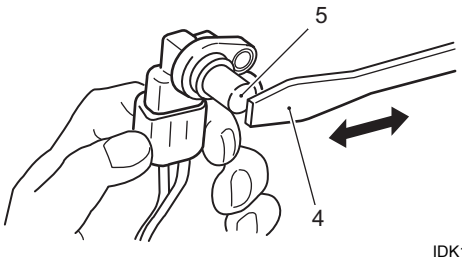


IDK111130011-02

6) Turn the ignition switch “ON”.
7) Measure the voltage when the tip of a steel screwdriver is brought near and then pulled away from the sensor tip.

When screwdriver is brought near
Approx. 5 V

When screwdriver is pulled away
Approx. 0.3 V



IDK111130018-02

4. Screw driver	5. CMP sensor

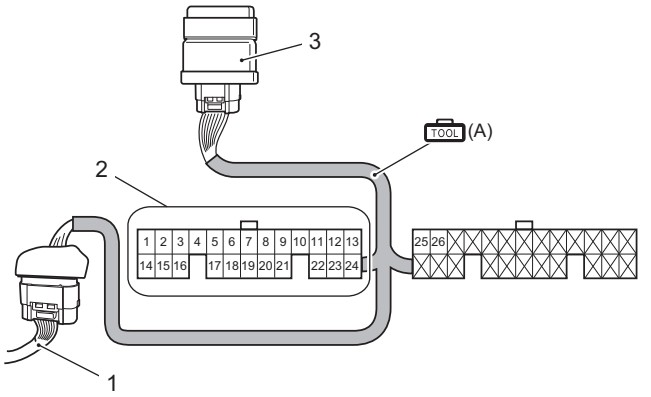
8) If the voltage does not change in the above test, check wire harnesses for open and short.
   If wire harnesses are in good condition, replace CMP sensor and recheck.
9) Reinstall CMP sensor.

MAP Sensor Output Voltage Inspection (Remote Control Model)

CENDK1121306019

1) Turn the ignition switch “OFF”.
2) Connect the 26-pin test cord between ECM and wire harness as shown in figure.

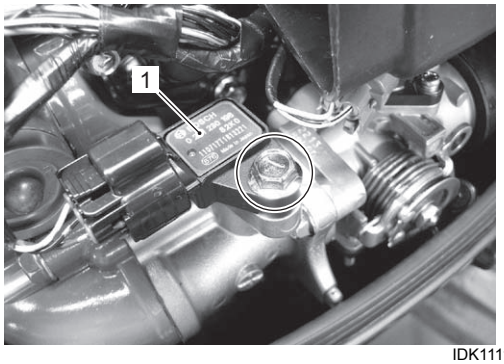
Special tool
TOOL (A): 09930–88940 (26-pin test cord)



IDK111130012-01

1. Wire harness	2. White connector	3. ECM

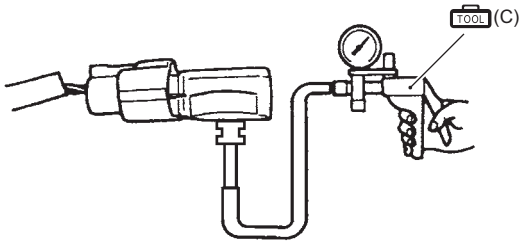
3) Remove the bolt and MAP sensor (1) from intake manifold.



IDK111130038-01

4) Connect vacuum pump gauge (with hose) to MAP sensor as shown in figure.

Special tool
TOOL (C): 09917–47011 (Vacuum pump gauge)



IDK111130002-03

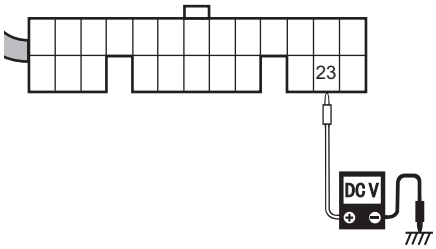
5) Turn the ignition switch “ON”.
6) While applying negative pressure (vacuum) to MAP sensor, measure “23” terminal voltage.

MAP sensor output voltage change

Negative pressure: kPa (kg/cm^2, mmHg)	0 (0, 0)	40 (0.4, 300)	80 (0.8, 600)
“23” terminal voltage (V)	4.00	2.42	0.84

(At 759.8 mmHg, 101.3 kPa, 29.91 inHg barometric pressure.)

26-pin test cord (White connector)



IDK111130013-01

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
DC Voltage (⎓)

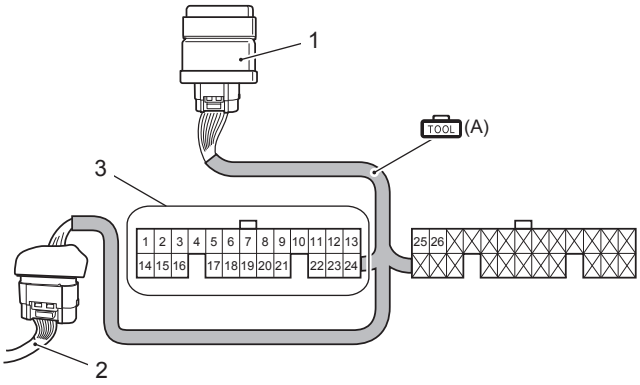
7) If out of specification, Check wire harnesses for open and short. If wire harnesses are in good condition, replace MAP sensor and recheck.
8) Reinstall MAP sensor.
Refer to “MAP Sensor Removal and Installation” in related manual.

TPS Inspection (Remote Control Model)

CENDK1121306020

1) Turn the ignition switch “OFF”.
2) Connect the 26-pin test cord between ECM and wire harness as shown in figure.

Special tool
TOOL (A): 09930–88940 (26-pin test cord)



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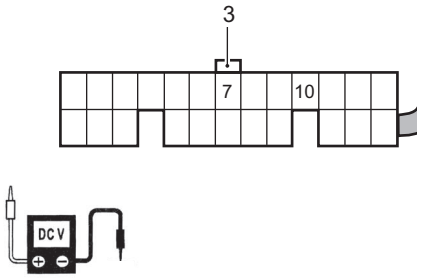
1. ECM	2. Wire harness	3. White connector

3) Connect tester probe (“+”, Red) to No.10 terminal.
4) Connect tester probe (“–”, Black) to No.7 terminal (or to body ground)

26-pin test cord (White connector)



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5) Turn the ignition switch “ON”.
6) Check for sensor output voltage.
Slowly move the throttle control lever to open, and check if voltage changes linearly within specification, according to throttle valve opening angle.

Sensor output voltage
FCT position: Approx. 0.7 V
WOT position: Approx. 4.0 V

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
DC Voltage (⎓)

NOTICE

The throttle body will lose its original performance if it has been disassembled and reassembled.

Do not try to adjust or remove any of the throttle body component parts (Throttle position sensor, throttle valve, throttle stop screw, etc.).
These components have been factory adjusted to precise specifications.

7) If out of specification, check wire harness for open and short. If wire harnesses are in good condition, replace the throttle body and recheck.

Power Unit Lubrication

Service Instructions

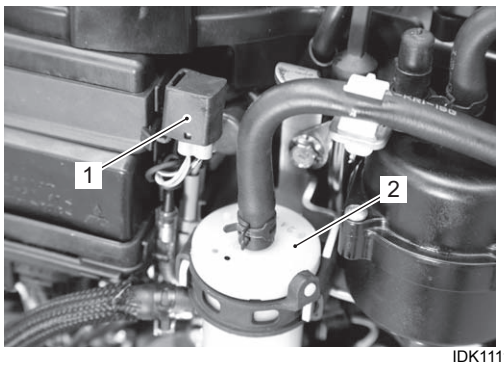
Oil Pressure Switch Inspection (Remote Control Model)

CENDK1121506006

NOTE

Before checking the oil pressure switch, make sure the engine oil pressure is within specification.

1) Temporarily remove the SDS service connector (1) from electric part holder.
2) Temporarily remove the fuel filter (2) from filter bracket.



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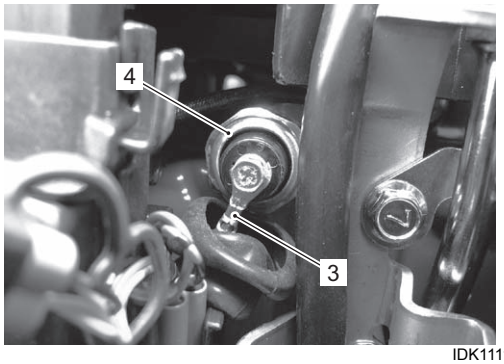
3) Remove the blue/yellow lead wire (3) from oil pressure switch (4).



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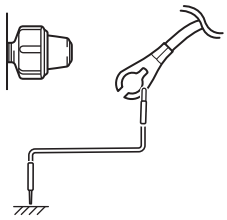
4) Connect the oil pressure switch lead wire to engine body ground by using an appropriate jumper wire.



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NOTE

You should remove oil pressure switch lead when perform the oil pressure switch inspection.
Then diagnostic code of oil pressure switch will be displayed while performing the inspection.
Connect the oil pressure switch lead wire to engine body ground by using an appropriate jumper wire before the engine starts (turning on the ignition switch).
So that the diagnostic code won't be displayed.
After the engine starts, disconnect the jumper wire from switch lead wire.

NOTE

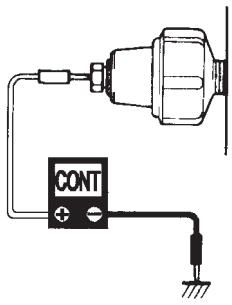
For cancellation of the "self-diagnostic indication", refer to "Self-Diagnostic System Description" in related manual.

5) Install the fuel filter to filter bracket.
6) After the engine starts, disconnect the jumper wire from switch lead wire.
7) Check the continuity between the switch terminal and engine body ground.

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
Continuity (•))))

Oil pressure switch continuity
Engine running: Infinity
Engine stopped: Continuity



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8) If measurement exceeds specification, replace oil pressure switch.
9) After testing oil pressure switch, reinstall parts removed earlier.

Starting System

Service Instructions

Ignition Switch Inspection (Remote Control Model)

CENDK1121906009

Inspect the ignition switch using the following procedures:

1) Disconnect the ignition switch from remo-con box wiring harness.
2) Check continuity between wiring leads at the key positions shown in the chart.
3) If out of specification, replace the ignition switch.

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
Continuity (•))))

Key position	Switch Lead Wires					
	B	G	W	Gr	Br	O
OFF	○—○					
ON			○—○			
START			○—○	○	○	
FREE						
PUSH			○	○	—	○

○—○ : Continuity

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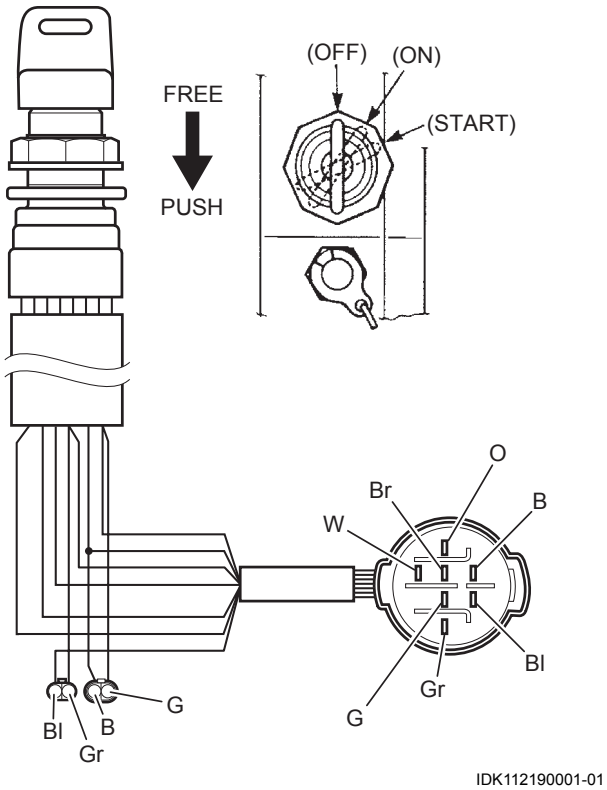

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Charging System

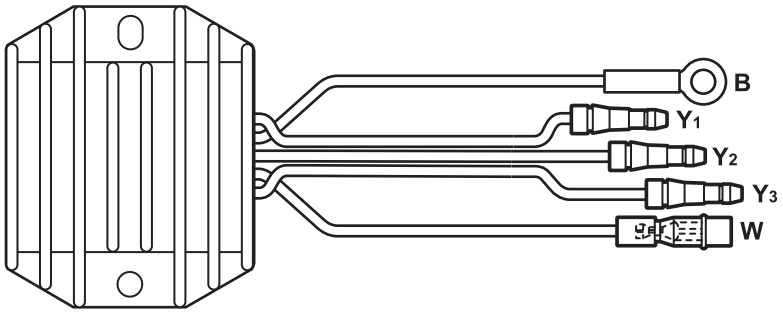
Service Instructions

Rectifier / Regulator Inspection (All models)

CENDK1121B06011

Recommended tester for inspection has been changed.
Inspect the rectifier/regulator in the following procedures:

1) Remove the rectifier/regulator.
   Refer to “Rectifier / Regulator Removal and Installation” in related manual.
2) Measure voltage between leads in the combinations shown.
   If measurement exceeds specification, replace rectifier/regulator.



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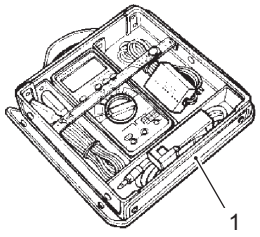
Special tool
TOOL : 09900–25008 (Multi circuit tester set)

Tester knob indication
Diode test (⊣◀)



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1. Multi circuit tester set

Unit: V

		Tester probe (+)				
		W	B	Y1	Y2	Y3
Tester probe (–)	W	—	0.4 – 0.8	0.3 – 0.6	0.3 – 0.6	0.3 – 0.6
	B	*	—	*	*	*
	Y1	*	0.3 – 0.6	—	*	*
	Y2	*	0.3 – 0.6	*	—	*
	Y3	*	0.3 – 0.6	*	*	—

*: 1.4 V or more (Tester’s battery voltage.)

NOTE

If the tester reads 1.4 V or below when the tester probes are not connected, replace its battery.

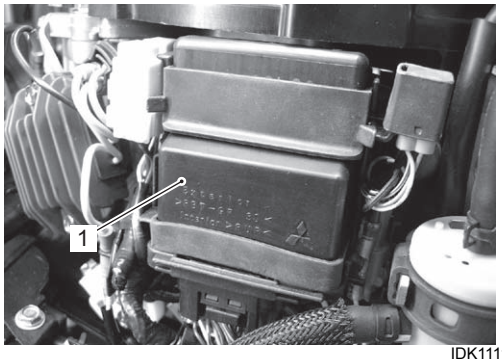
3) Install the rectifier/regulator.

Main Relay Inspection (Remote Control Model)

CENDK1121B06010

Inspect the main relay using the following procedures:

1) Disconnect lead wire connector from ECM (1), then remove ECM.



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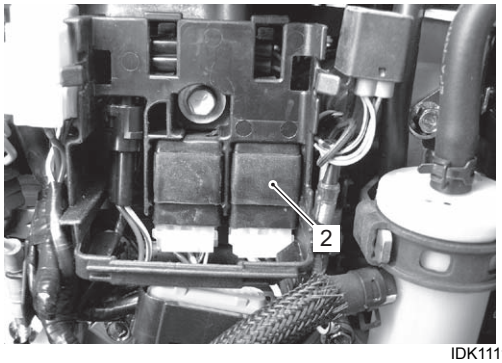
2) Pull out the main relay and relay cover (2) from electric parts holder.

3) Remove the relay cover (3), then disconnect the main relay (4) from the lead wire connector.



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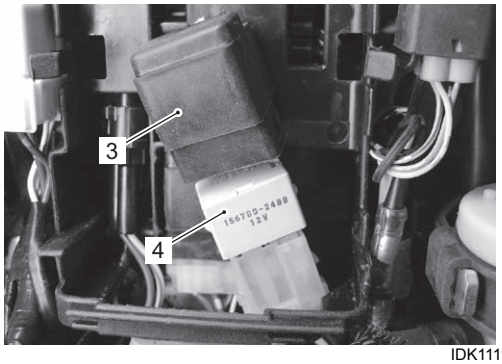

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4) Check continuity between terminal (5) and (6) each time 12 V power supply is applied to terminal (7) and (8).
Connect the positive (+) lead to terminal (8), and negative (–) lead to terminal (7).

NOTICE

If the 12 V power supply wire is connected to wrong terminal or touched to each other, the power supply wire, tester may be damaged.

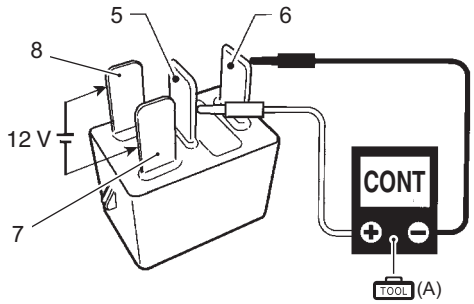
Be careful not to touch 12 V power supply wires to each other or with other terminals.

Special tool
TOOL : 09930–99320 (Digital tester)

Tester knob indication
Continuity (•))))

Main relay function

	Continuity
12 V power applied	Yes
12 V power not applied	No



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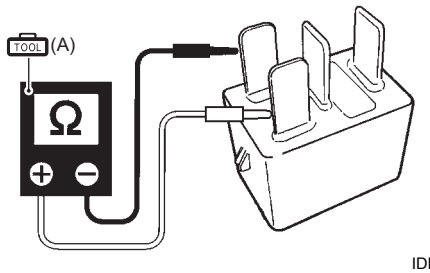
5) Measure the resistance between relay terminals (7) and (8).
If out of specification, replace main relay.

Tester knob indication
Resistance (Ω)

Main relay solenoid coil resistance
Standard: 145 – 190 Ω



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6) Reinstall parts removed earlier.

Section 4

Wire / Hose Routing

CONTENTS

NOTE

For the items with asterisk (*) in the "CONTENTS" below, refer to the same section of the service manual mentioned in the "FOREWORD" of this manual.

Wire Routing

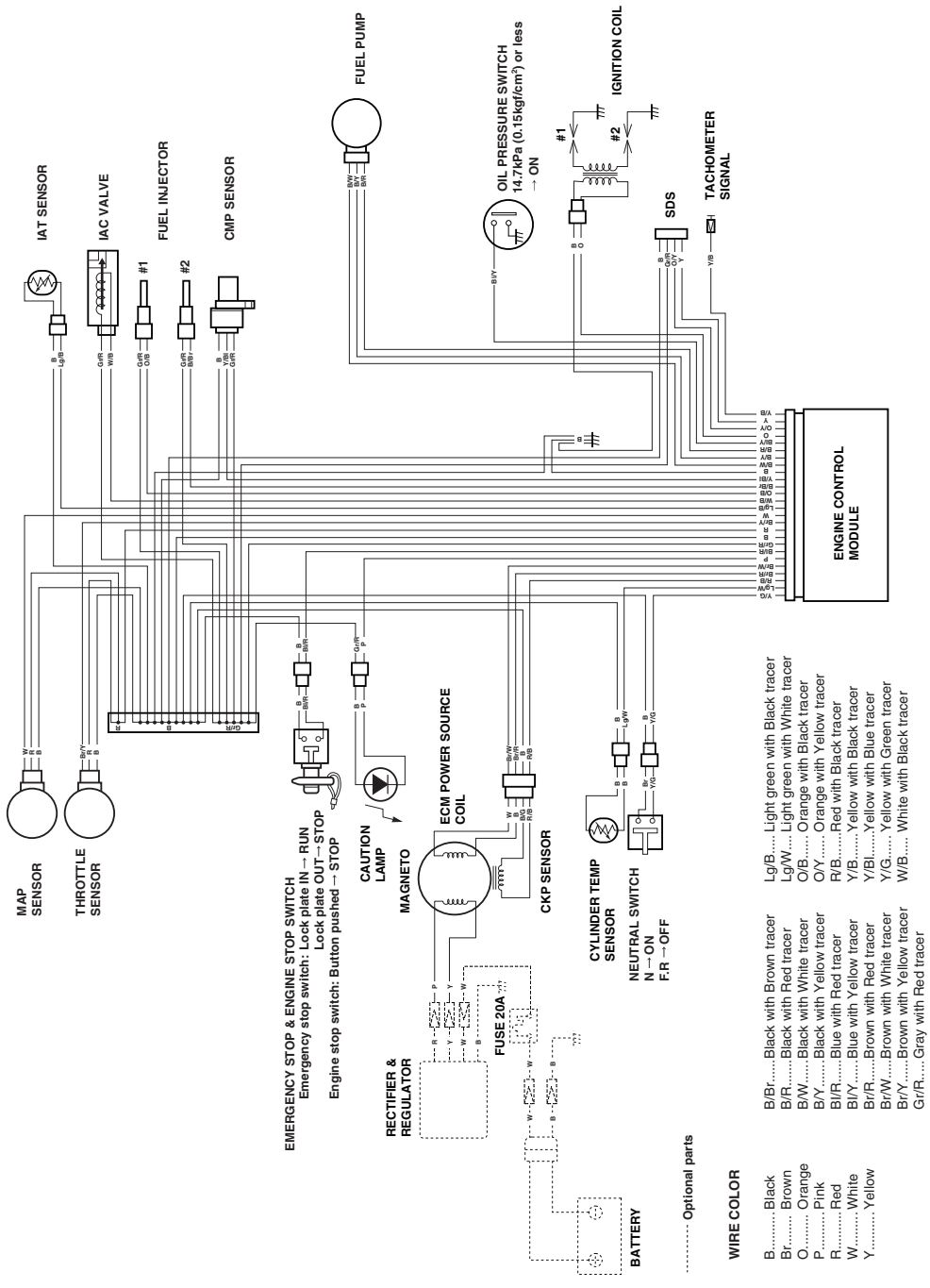
Schematic and Routing Diagram

Wiring Diagram (DF9.9B/15A/20A)

CENDK1124102003

Refer to “Wire Color Symbols” in Section 0A in related manual.

DF9.9B/DF15A/20A



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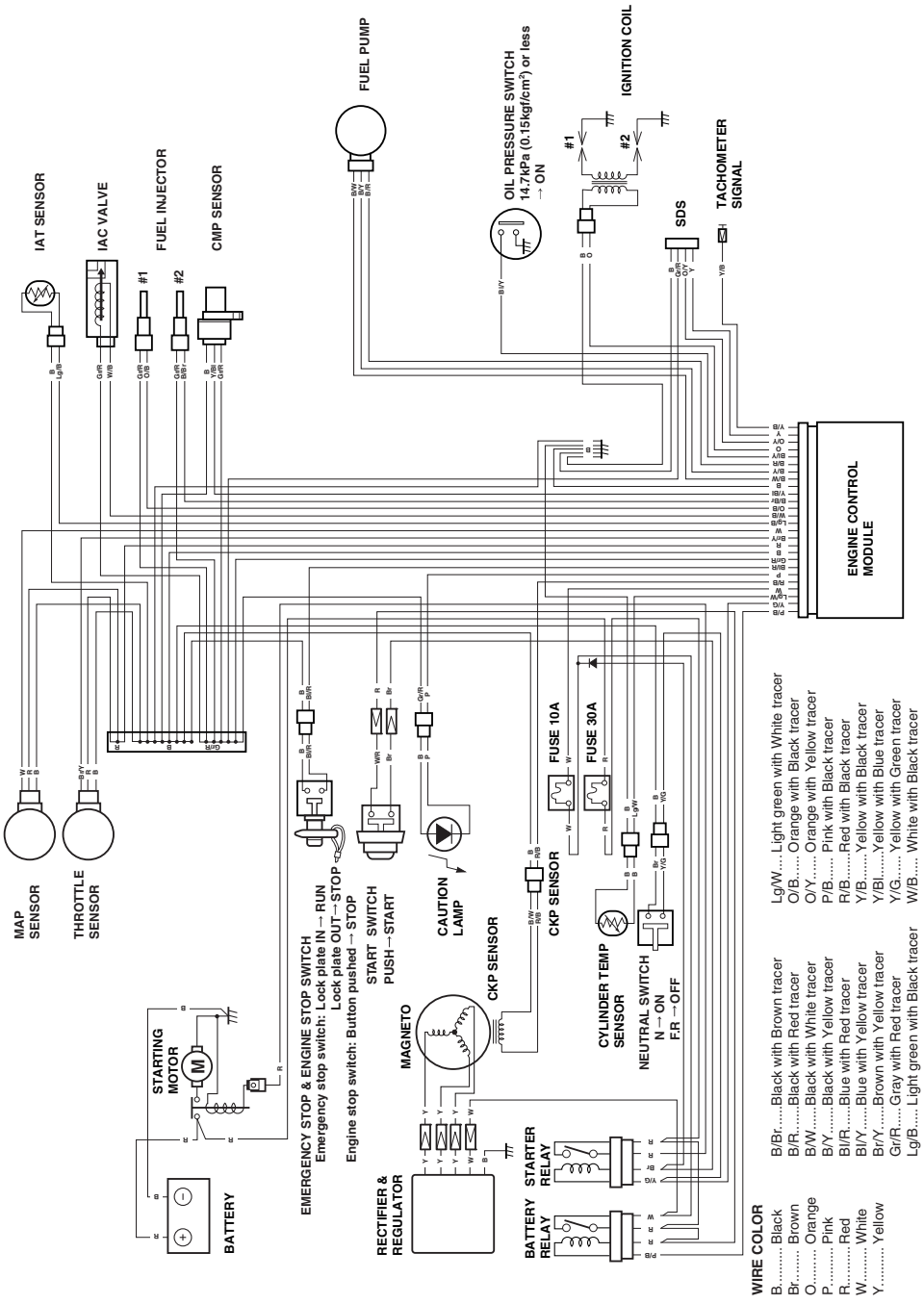
DF9.9BE/DF15AE/20AE



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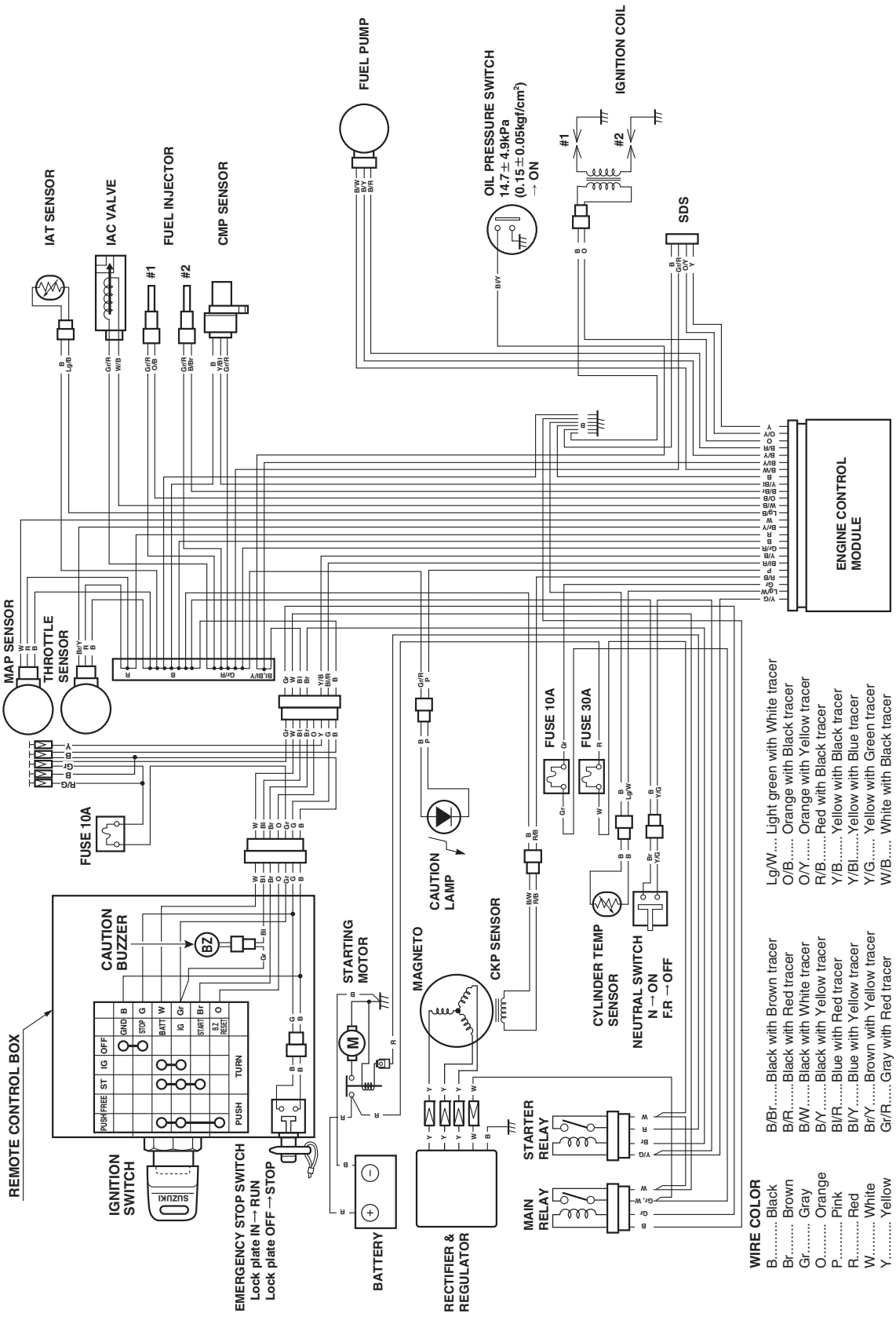
DF9.9BR/DF15AR/DF20AR



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