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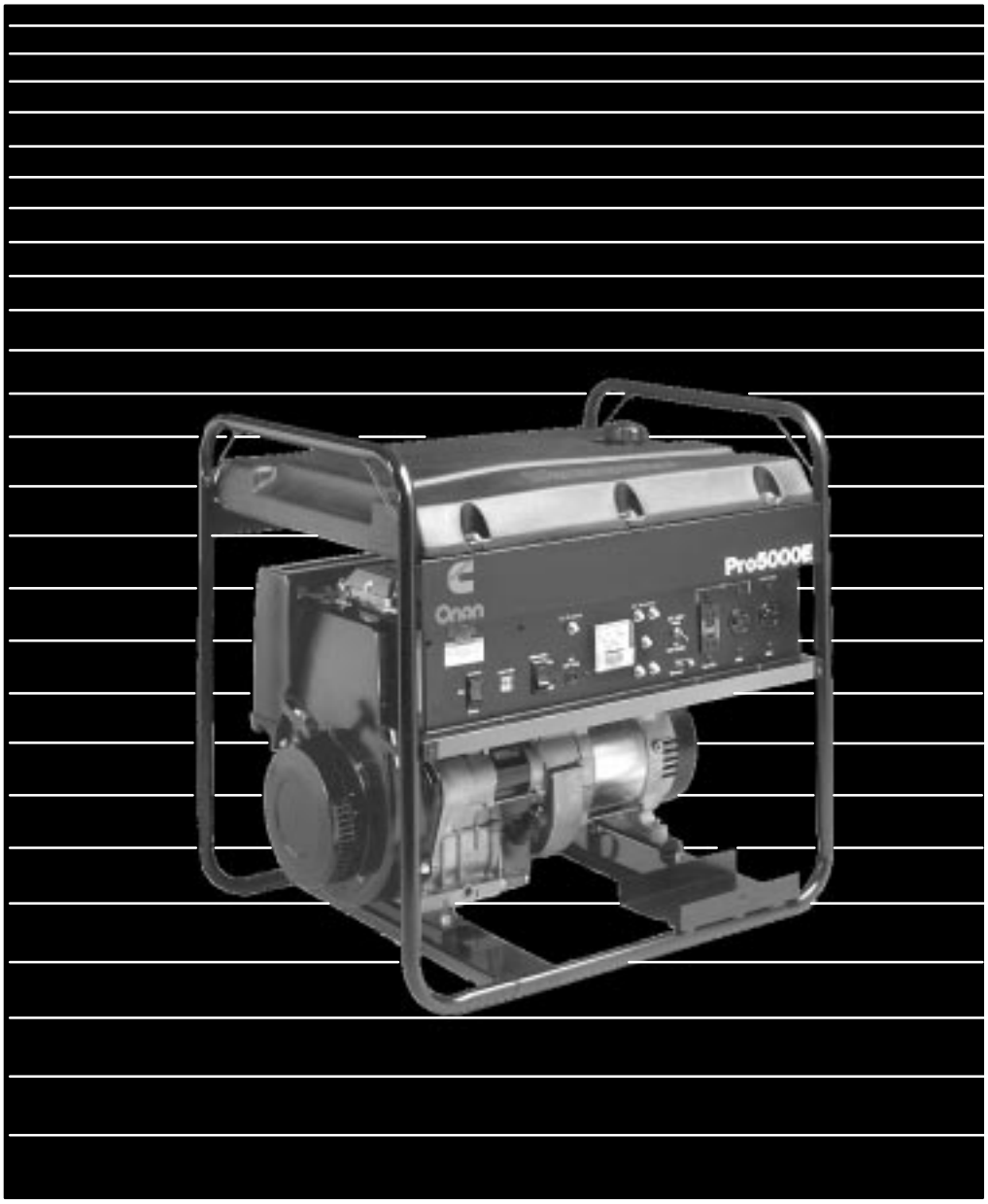
Onan Portable GenSets

Service Manual

Controls and Generators:
Standard EGPAA, EGPAB, EGPAC, EGPAD;
Pro EGHAM, EGHEM, EGHAA, EGHAB, EGHEB



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Safety Precautions

Before operating the generator set, read the Operator's Manual and become familiar with it and your equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER ***This symbol warns of immediate hazards which will result in severe personal injury or death.***

⚠WARNING ***This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.***

⚠ CAUTION ***This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.***

Fuels, electrical equipment, batteries, exhaust gases and moving parts present potential hazards that could result in severe personal injury. Take care in following these recommended procedures.

FUEL AND FUMES ARE FLAMMABLE. Fire, explosion, and severe personal injury can result from improper practices.

- DO NOT fill fuel tanks with the engine running. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT SMOKE OR ALLOW AN OPEN FLAME near the generator set or fuel tank.
- DO NOT store or transport the generator set without first removing the fuel from the fuel tank.
- DO NOT SMOKE while servicing batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

EXHAUST GASES ARE DEADLY

- Engine exhaust contains CARBON MONOXIDE, a dangerous gas that is potentially lethal. Avoid carbon monoxide inhalation by operating the generator set outdoors where exhaust gases can be discharged directly into the open air.
- Do not operate the generator set in any type of enclosure that could allow exhaust gases to accumulate. Direct exhaust gas away from areas where people are gathered and away from buildings or enclosures.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Before performing any maintenance on the generator set, disconnect the spark plug wire (and the starting battery negative [-] cable on electric start sets) to prevent accidental starting.
- Keep hands away from moving parts.
- Do not wear loose clothing or jewelry while servicing any part of the generator set. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- If adjustments must be made while the generator set is running, use extreme caution around hot manifolds and moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Disconnect starting battery before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved device and after building main switch is open. Consult an electrician in regard to emergency power use.

GENERAL SAFETY PRECAUTIONS

- Have a fire extinguisher nearby. Maintain extinguisher properly and become familiar with its use. Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.
- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause over heating and engine damage, and present a potential fire hazard.
- DO NOT store anything on the generator set such as oil cans, oily rags, chains, wooden blocks, etc. A fire could result or operation could be adversely affected. Keep the generator set clean and dry at all times.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

Table of Contents

Section 1. Introduction

INTRODUCTION

This manual contains service information on the control and generator of the Onan Standard and Pro series portable generator sets. Subjects include:

- **Generator troubleshooting and disassembly**
- **Control troubleshooting and disassembly**
- **Genset and control repair and adjustments**
- **Engine teardown and overhaul (Pro series 2.0 kW, 3.5 kW, 4.0 kW only)**

Specifications are listed for all generator sets.

Dimensions, clearances and torque specs are listed for all Pro series generator sets.

Schematic/wiring diagrams are included for all Standard and Pro series generator sets.

Briggs and Stratton engines (all Standard series gensets) should be serviced/repaired by authorized Briggs and Stratton service personnel.

Overhaul of Onan Elite engines (Pro 5.0 kW, 6.0 kW) is covered in Onan publication 965-0758 (Elite E125H, E140H Engine Service Manual).

Read all service procedures completely before beginning any repair work and observe all cautions and warnings. It is extremely important that the generator set be operated in compliance with all applicable state, local, U.S. Forest Service and EPA codes or restrictions. Improper service can result in an unsafe condition that could result in severe personal injury, death, and/or equipment damage.

MODEL IDENTIFICATION

When obtaining parts, provide the model and serial numbers from the genset nameplate (Figure 1-1).

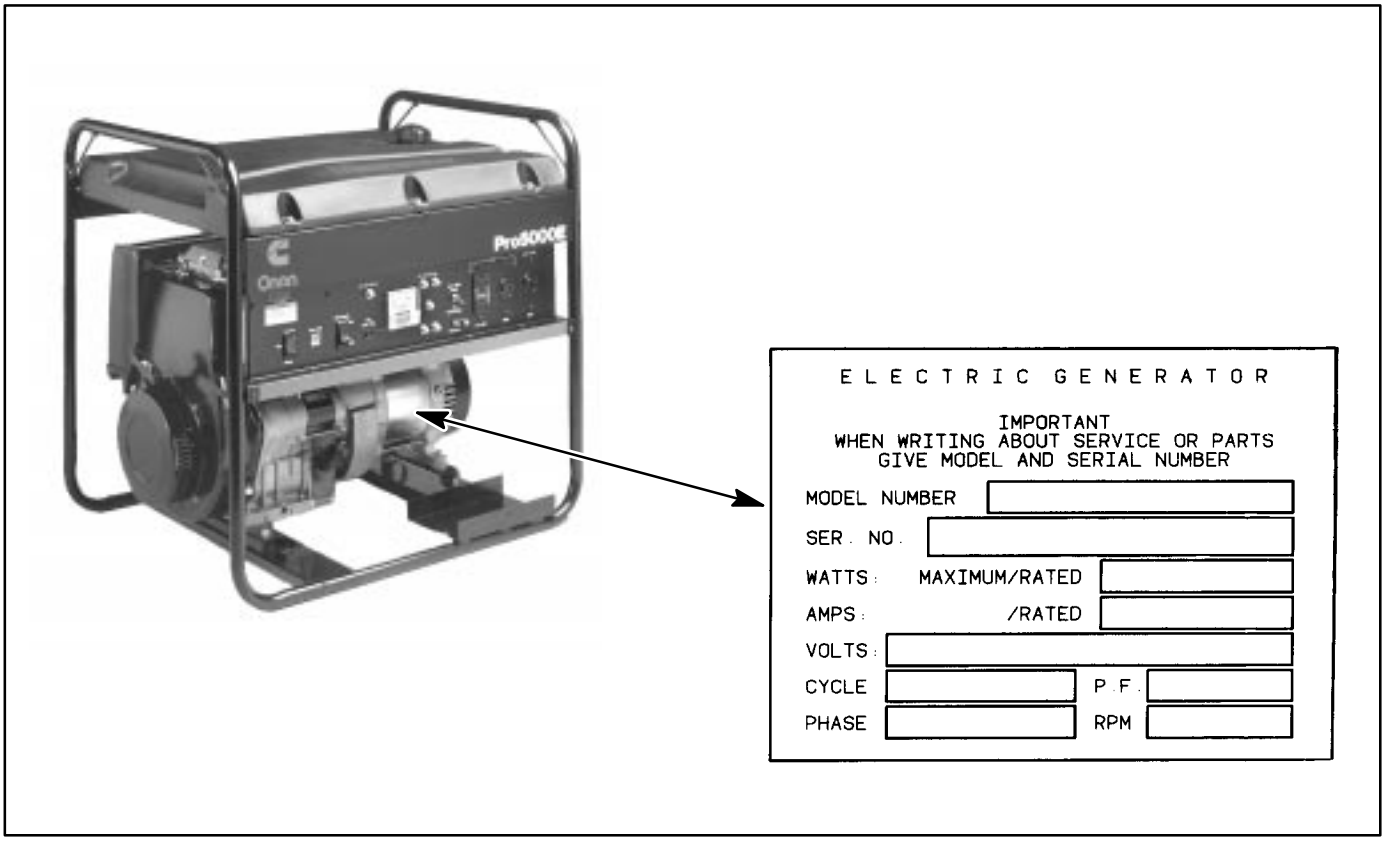


FIGURE 1-1. GENSET IDENTIFICATION

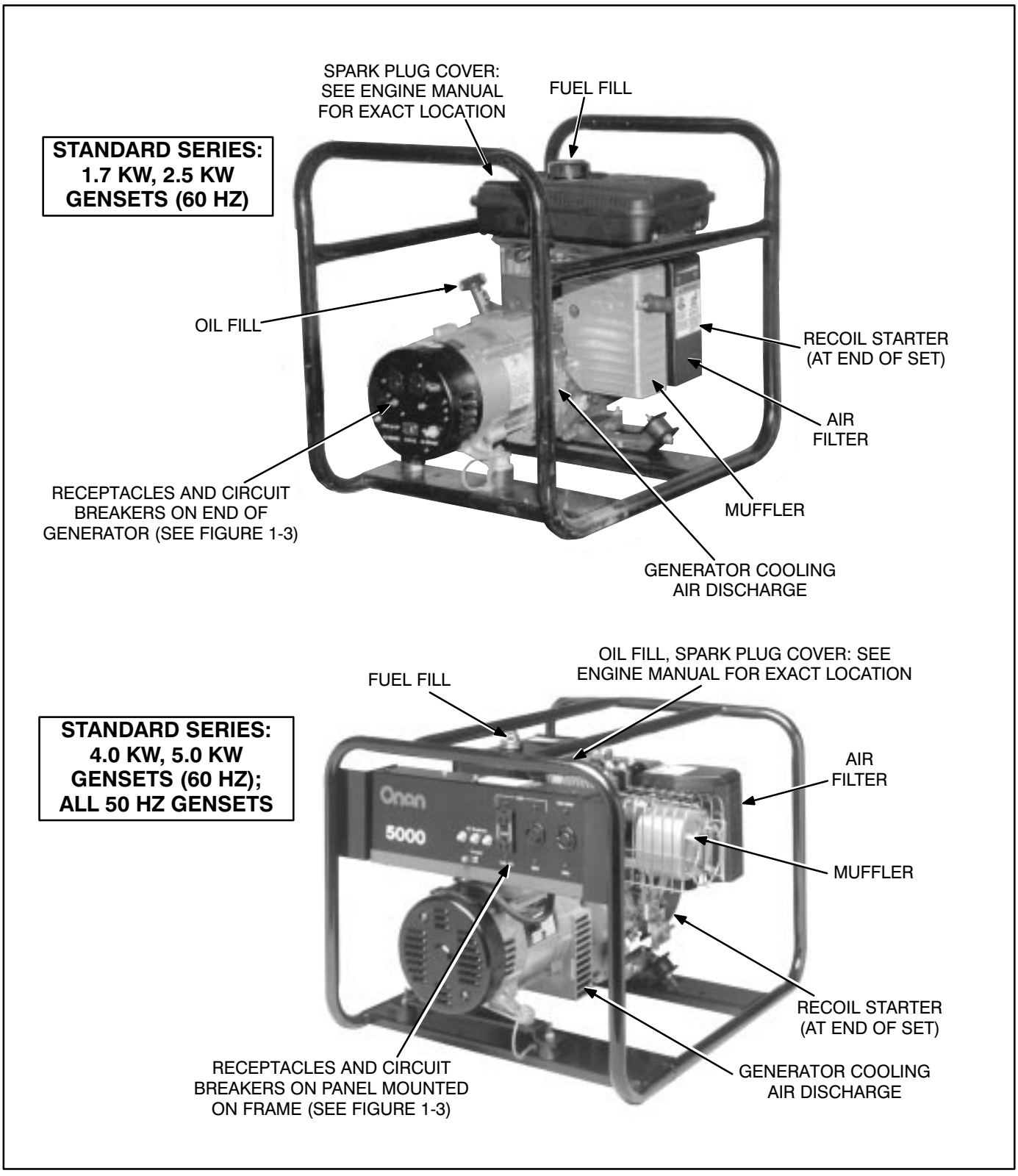


FIGURE 1-2. STANDARD SERIES GENERATOR SETS

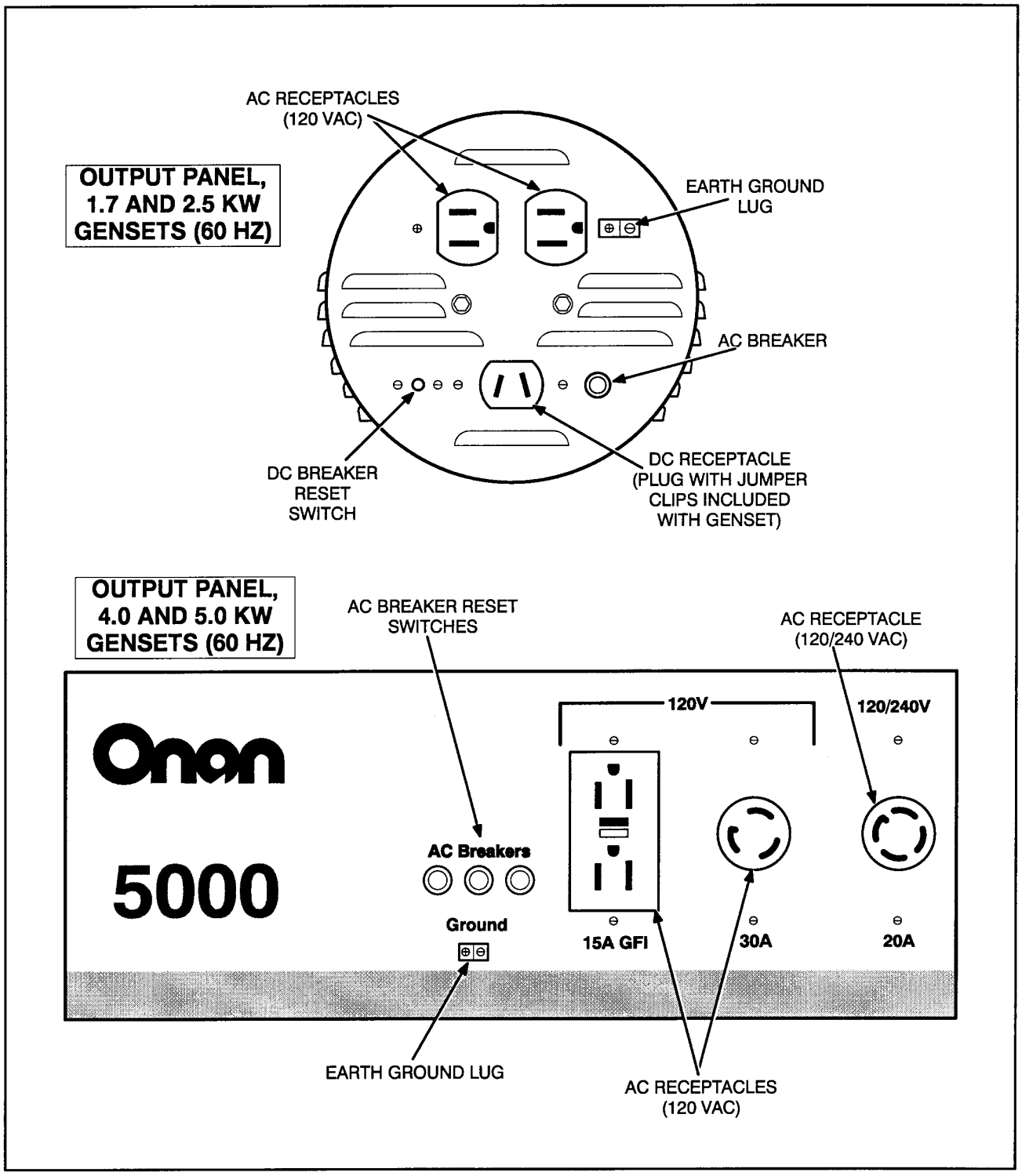
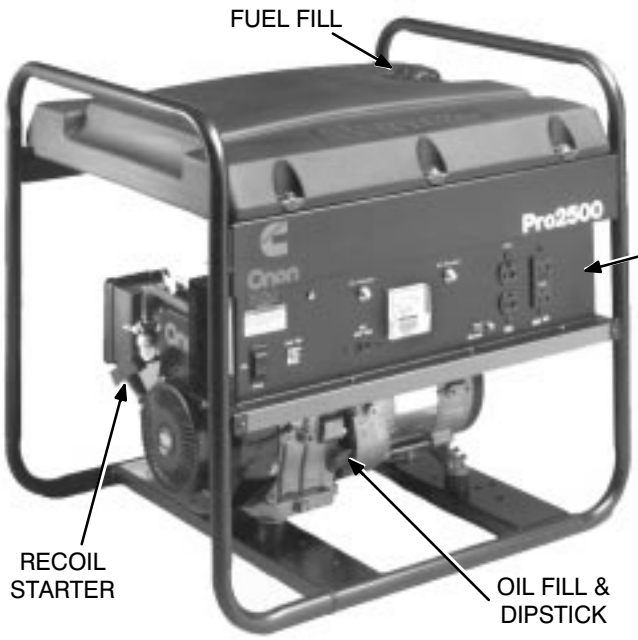


FIGURE 1-3. STANDARD SERIES 60 HZ OUTPUT PANELS

PRO SERIES:
2.0 KW, 2.5 KW,
3.5 KW, 4.0 KW
GENERATOR SETS



PRO SERIES:
5.0 KW, 6.0 KW
GENERATOR SETS

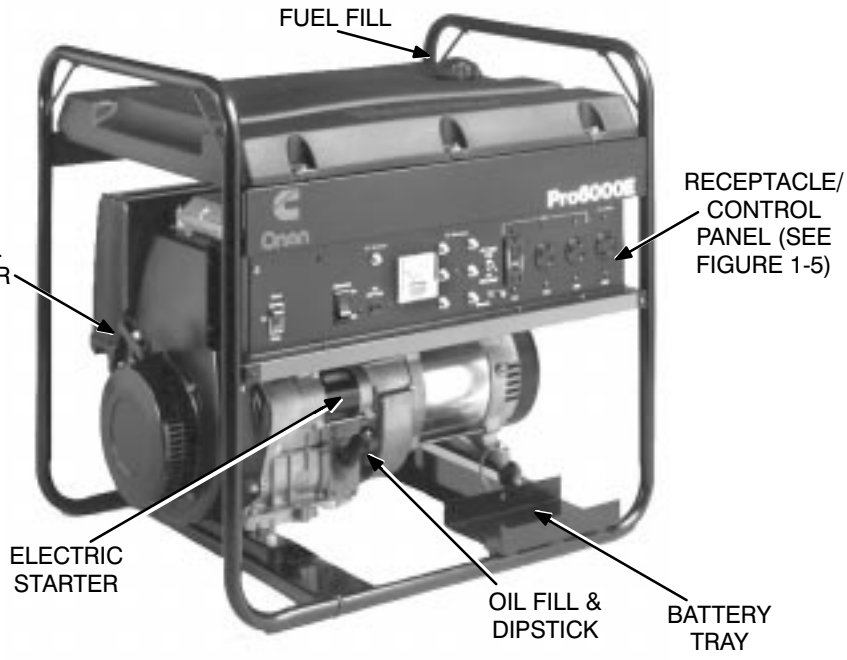
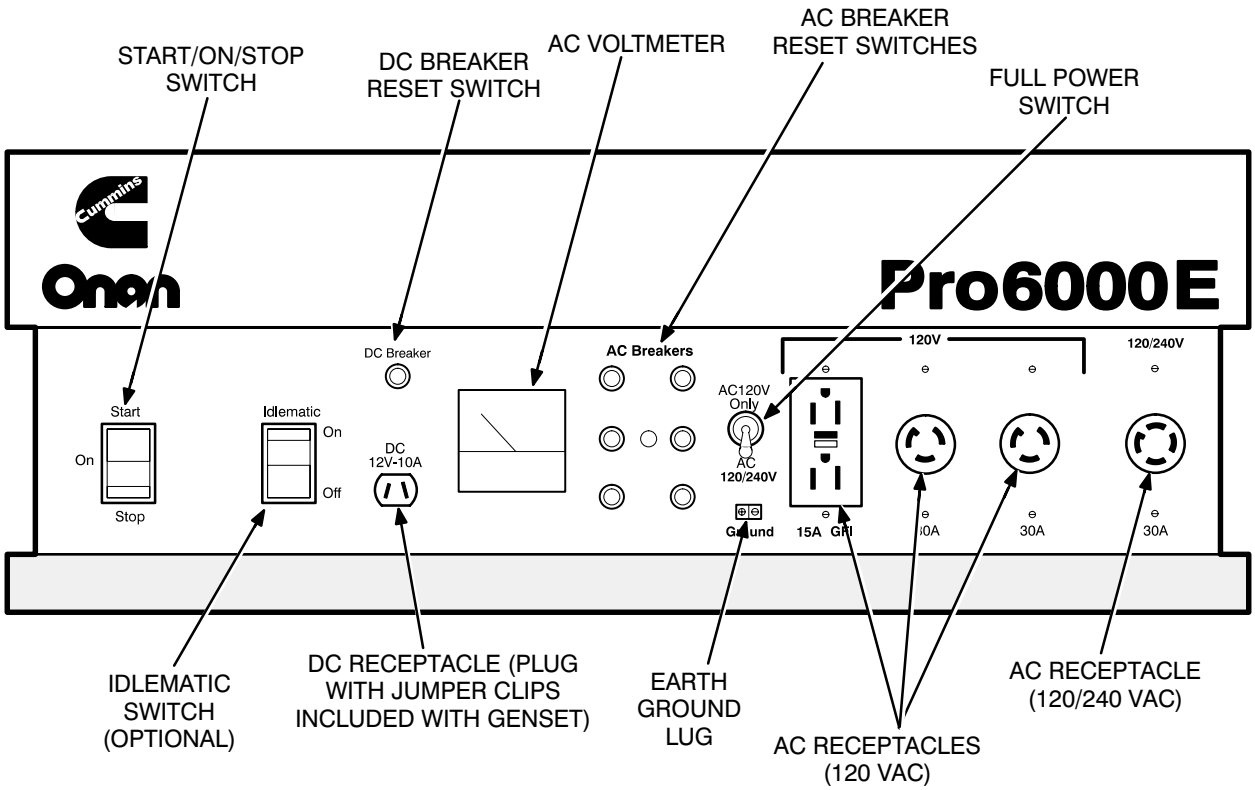
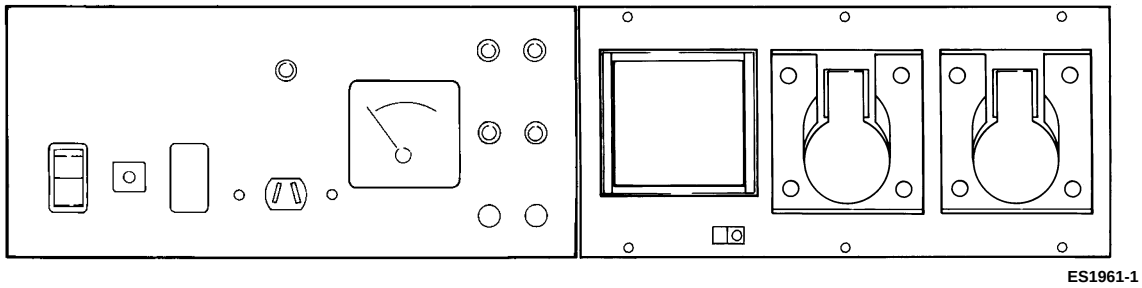


FIGURE 1-4. PRO SERIES GENERATOR SETS



FACEPLATE WITH AC RECEPTACLES (60 HZ GENSETS)



FACEPLATE WITH COVERED AC RECEPTACLES (50 HZ GENSETS)

FIGURE 1-5. PRO SERIES CONTROL/OUTPUT PANELS

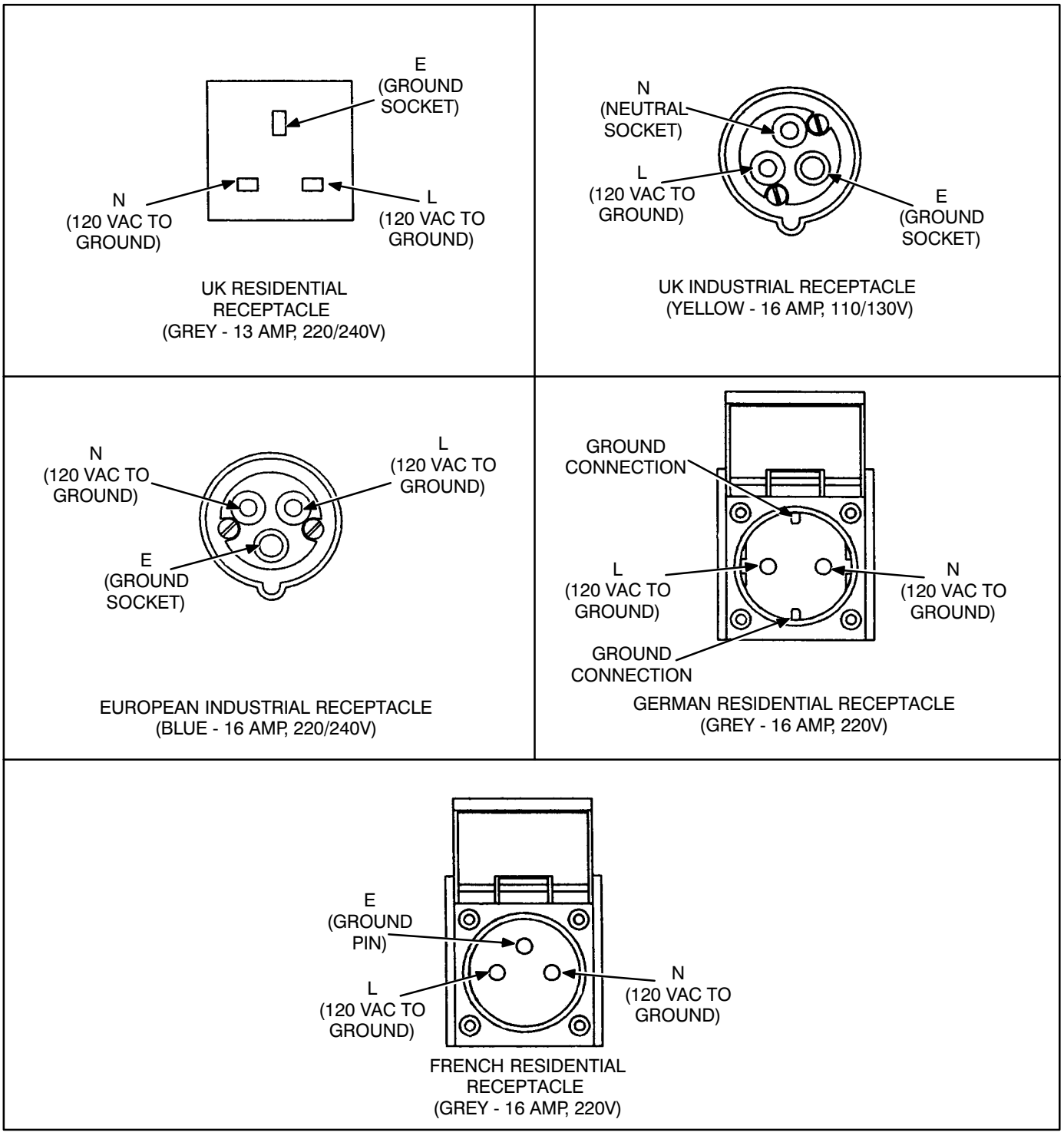


FIGURE 1-6. RECEPTACLE VARIATIONS, 50 HZ GENERATOR SETS

Section 2. Specifications

STANDARD SERIES GENERATOR SETS

60 HZ GENSETS	1.7 EGPAA	2.5 EGPAB	4.0 EGPAC	5.0 EGPAD
Frequency (Hz)	60	60	60	60
Voltage	120	120	120/240	120/240
Wattage (Max.)	1700 (14.2 A)	2500 (20.8 A)	4000 (33.3/16.7 A)	5000 (41.6/20.8 A)
Wattage (Rated)	1500 (12.5 A)	2000 (16.7 A)	3500 (29.2/14.6 A)	5000 (41.6/20.8 A)
DC Output:	12 VDC/60 W	12 VDC/120 W	N/A	N/A
AC Receptacles:	1 dup 120 V 15A	1 dup 120 V 15A	1 dup 120 V 15 A 1 120 V 30 A (NEMA L5-30R) 1 240 V 20 A (NEMA L14-20R)	1 dup 120 V 15 A 1 120 V 30 A (NEMA L5-30R) 1 240 V 20 A (NEMA L14-20R)
ENGINE				
Engine Type (all gensets)	Briggs and Stratton Industrial Plus air-cooled	Briggs and Stratton Industrial Plus air-cooled	Briggs and Stratton Industrial Plus air-cooled	Briggs and Stratton Industrial Plus air-cooled
Engine Speed (RPM)	3600	3600	3600	3600
Fuel	Gasoline	Gasoline	Gasoline	Gasoline
Engine Oil Capacity	19.2 oz. (0.6 L)	19.2 oz. (0.6 L)	43.2 oz. (1.3 L)	48 oz. (1.4 L)
Starting System	Recoil	Recoil	Recoil	Recoil
Fuel Tank Capacity	4.0 qt/3.8 L	4.0 qt/3.8 L	6.0 qt/5.7 L	6.0 qt/5.7 L
Horsepower	3.5	5	8	11
Displacement (cc)	148	206	319	400
GENERATOR SET				
Dry Weight	72.4 lbs (32.8 kg)	85.6 lbs (38.83 kg)	134 lbs (60.78 kg)	155.5 lbs (70.53 kg)
Length	23.5 in. (596.9 mm)	23.5 in. (596.9 mm)	28 in. (711.2 mm)	28 in. (711.2 mm)
Width	17 in. (431.8 mm)	17 in. (431.8 mm)	23.25 in. (590.55 mm)	23.25 in. (590.55 mm)
Height	20.3 in. (515.62 mm)	20.3 in. (515.62 mm)	20.75 in. (527.05 mm)	20.75 in. (527.05 mm)
Operating Hours Rated Output	3.3	2	2	1.6
FEATURES				
Air Cleaner	Dual Element	Dual Element	Dual Element	Dual Element
Low Oil Shutoff	No	Yes	Yes	Yes
Low Oil Light	No	Yes	Yes	Yes
Electronic Ignition	Yes	Yes	Yes	Yes
Muffler	Standard	Standard	Standard	Standard
USDA Spark Arrester	Yes	Yes	Yes	Yes
Fuel Tank Mounting	Engine	Engine	Engine	Engine
Voltage Reg. Type	Capacitor	Capacitor	AVR	AVR
AC and DC Manual-Reset Breaker	Yes	Yes	Yes	Yes
Control Panel Mounting	Generator	Generator	Frame	Frame
Start/Stop Switch Mtg.	Engine	Engine	Engine	Engine

STANDARD SERIES GENERATOR SETS

50 HZ GENSETS	1.4 EGPAA	2.0 EGPAB	3.5 EGPAC	5.0 EGPAD
Frequency (Hertz)	50	50	50	50
Voltage	110/220	110/220	110/220	110/220
Wattage (Max.)	1400	2000	3500	5000
Wattage (Rated)	1400	1800	3000	4500
Current (Rated)	12.7/6.4 A	16.4/8.2 A	27.2/13.6 A	40.9/20.4 A
DC Output:	12 VDC/50 W (4.2 A)	12 VDC/100 W (8.3 A)	N/A	N/A
AC Receptacles:	Several types available; see Figure 4	Several types available; see Figure 4	Several types available; see Figure 4	Several types available; see Figure 4
ENGINE				
Engine Type (all gensets)	Briggs and Stratton Industrial Plus air-cooled	Briggs and Stratton Industrial Plus air-cooled	Briggs and Stratton Industrial Plus air-cooled	Briggs and Stratton Industrial Plus air-cooled
Engine Speed (RPM)	3000	3000	3000	3000
Fuel	Gasoline	Gasoline	Gasoline	Gasoline
Engine Oil Capacity	19.2 oz. (0.6 L)	19.2 oz. (0.6 L)	43.2 oz. (1.3 L)	48 oz. (1.4 L)
Starting System	Recoil	Recoil	Recoil	Recoil
Fuel Tank Capacity	4.0 qt (3.8 L)	4.0 qt (3.8 L)	4.0 qt (3.8 L)	4.0 qt (3.8 L)
Horsepower	3.5	5	8	11
Displacement (cc)	148	206	319	400
GENERATOR SET				
Dry Weight	84.5 lbs (38.4 kg)	95.5 lbs (43.3 kg)	139 lbs (63.05 kg)	169 lbs (76.66 kg)
Length	23.5 in. (596.9 mm)	23.5 in. (596.9 mm)	26.8 in. (680.72 mm)	29 in. (736.6 mm)
Width	17.25 in. (438.15 mm)	17.25 in. (438.15 mm)	19 in. (482.6 mm)	21.2 in. (538.48 mm)
Height	20.5 in. (520.7 mm)	20.5 in. (520.7 mm)	21.3 in. (541.02 mm)	24.8 in. (629.92 mm)
Operating Hours at Rated Output	3.5	2.3	1.5	1.3
FEATURES				
Air Cleaner	Dual Element	Dual Element	Dual Element	Dual Element
Low Oil Shutoff	No	Yes	Yes	Yes
Low Oil Light	No	Yes	Yes	Yes
Electronic Ignition	Yes	Yes	Yes	Yes
Muffler	Standard	Standard	Standard	Standard
USDA Spark Arrester	Yes	Yes	Yes	Yes
Fuel Tank Mounting	Engine	Engine	Engine	Engine
Voltage Reg. Type	Capacitor	Capacitor	AVR	AVR
AC and DC Manual-Reset Breaker	Yes	Yes	Yes	Yes
Control Panel Mounting	Frame	Frame	Frame	Frame
Start/Stop Switch Mtg.	Engine	Engine	Engine	Engine

PRO SERIES GENERATOR SETS

60 HZ GENSETS	2.5 EGHAA	4.0 EGHAB	4.0 EGHEB
GENERATOR DETAILS			
AC Output:			
Frequency (Hertz)	60	60	60
Voltage	120	120/240	120/240
Wattage (Max. Power)	2500	4000	4000
Wattage (Rated Power)	2000	3500	3500
Current (Rated Amperes)	16.7	29.2/14.6	29.2/14.6
DC Output:	12 VDC/120 W (10 A)	12 VDC/120 W (10 A)	12 VDC/120 W (10 A)
ENGINE DETAILS			
Engine Type	GH170 overhead valve, single cylinder, air-cooled, 4-cycle	GH280 overhead valve, single cylinder, air-cooled, 4-cycle	GH280 overhead valve, single cylinder, air-cooled, 4-cycle
Engine Speed (RPM)	3600	3600	3600
Fuel	Gasoline	Gasoline	Gasoline
Engine Oil Capacity	0.63 qt (0.6 L)	0.95 qt (0.9 L)	0.95 qt (0.9 L)
Spark Plug Gap	0.028 in. (0.7 mm)	0.028 in. (0.7 mm)	0.028 in. (0.7 mm)
Engine Valve Lash	Intake and Exhaust: 0.002 - 0.0039 in. (0.05 - 0.10 mm)	Intake and Exhaust: 0.002 - 0.0039 in. (0.05 - 0.10 mm)	Intake and Exhaust: 0.002 - 0.0039 in. (0.05 - 0.10 mm)
Ignition Timing (BTDC) (fixed)	21°	25°	25°
Starting System	Recoil	Recoil	Electric/Recoil
Horsepower	5.5 bhp max	9.0 bhp max	9.0 bhp max
Displacement (cc)	169	274	274
GENERATOR SET DETAILS			
Dry Weight	110 lb (50 kg)	145 lb (66 kg)	155 lb (70 kg)
Dimensions:			
Length - Inches	26.8 (681)	26.8 (681)	26.8 (681)
Width - Inches	22 (559)	22 (559)	22 (559)
Height - Inches	24.6 (625)	24.6 (625)	24.6 (625)
Fuel Tank Capacity	6.5 gal (24.6 L)	6.5 gal (24.6 L)	6.5 gal (24.6 L)
Rated Output Operating Hours	20	13	13
Battery Requirements:			
Battery (Group U1)	-	-	12 Volt
Cold Cranking Amps (at 32° F[0° C])	-	-	235

PRO SERIES GENERATOR SETS

60 HZ GENSETS	5.0 EGHAB	5.0 EGHEB	6.0 EGHEB
GENERATOR DETAILS			
AC Output:			
Frequency (Hertz)	60	60	60
Voltage	120/240	120/240	120/240
Wattage (Max. Power)	5000	5000	6000
Wattage (Rated Power)	5000	5000	5500
Current (Rated Amperes)	41.6/20.8	41.6/20.8	45.8/22.9
DC Output:	12 VDC/120 W (10 A)	12 VDC/120 W (10 A)	12 VDC/120 W (10 A)
ENGINE DETAILS			
Engine Type	Elite E140H overhead valve, single cylinder, air-cooled, 4-cycle	Elite E140H overhead valve, single cylinder, air-cooled, 4-cycle	Elite E140H overhead valve, single cylinder, air-cooled, 4-cycle
Engine Speed (RPM)	3600	3600	3600
Fuel	Gasoline	Gasoline	Gasoline
Engine Oil Capacity	1.0 qt (0.95 L)	1.0 qt (0.95 L)	1.0 qt (0.95 L)
Spark Plug Gap	0.035 in. (0.89 mm)	0.035 in. (0.89 mm)	0.035 in. (0.89 mm)
Engine Valve Lash	Intake and Exhaust: .006 - .010 in. (0.15 - 0.25 mm)	Intake and Exhaust: .006 - .010 in. (0.15 - 0.25 mm)	Intake and Exhaust: .006 - .010 in. (0.15 - 0.25 mm)
Ignition Timing (BTDC) (fixed)	23°	23°	23°
Starting System	Recoil	Electric/Recoil	Electric/Recoil
Horsepower	14 bhp max	14 bhp max	14 bhp max
Displacement (cc)	390	390	390
GENERATOR SET DETAILS			
Dry Weight	175 lb (79 kg)	185 lb (84 kg)	205 lb (94 kg)
Dimensions:			
Length - Inches	29.2 (742)	29.2 (742)	29.2 (742)
Width - Inches	22.5 (572)	22.5 (572)	22.5 (572)
Height - Inches	28.3 (719)	28.3 (719)	28.3 (719)
Fuel Tank Capacity	8 gal (30.3 L)	8 gal (30.3 L)	8 gal (30.3 L)
Rated Output Operating Hours	10	10	9
Battery Requirements:			
Battery (Group U1)	-	12 volt	12 volt
Cold Cranking Amps (at 32° F[0° C])	-	235	235

PRO SERIES GENERATOR SETS

50 HZ GENSETS	2.0 EGHAM	3.5 EGHEM	5.0 EGHEM
GENERATOR DETAILS			
AC Output:			
Frequency (Hertz)	50	50	50
Voltage	110/220	110/220	110/220
Wattage (Max. Power)	2000	3500	5000
Wattage (Rated Power)	1800	3000	4500
Current (Rated Amperes)	16.4/8.2	27.2/13.6	40.9/20.4
DC Output:	12 VDC/100 W (8.3 A)	12 VDC/100 W (8.3 A)	12 VDC/100 W (8.3 A)
ENGINE DETAILS			
Engine Type	GH170 overhead valve, single cylinder, air-cooled, 4-cycle	GH280 overhead valve, single cylinder, air-cooled, 4-cycle	Elite E140H overhead valve, single cylinder, air-cooled, 4-cycle
Engine Speed (RPM)	3000	3000	3000
Fuel	Gasoline	Gasoline	Gasoline
Engine Oil Capacity	0.63 qt (0.6 L)	0.95 qt (0.9 L)	1.0 qt (0.95 L)
Spark Plug Gap	0.028 in. (0.7 mm)	0.028 in. (0.7 mm)	0.035 in. (0.89 mm)
Engine Valve Lash	Intake and Exhaust: 0.002 - 0.0039 in. (0.05 - 0.10 mm)	Intake and Exhaust: 0.002 - 0.0039 in. (0.05 - 0.10 mm)	Intake and Exhaust: .006 - .010 in. (0.15 - 0.25 mm)
Ignition Timing (BTDC) (fixed)	21°	25°	23°
Starting System	Recoil	Electric/Recoil	Electric/Recoil
Horsepower	5.5 bhp max	9.0 bhp max	14 bhp max
Displacement (cc)	169	274	390
GENERATOR SET DETAILS			
Dry Weight	119 lb (54 kg)	165 lb (75 kg)	207 lb (94 kg)
Dimensions:			
Length - Inches	26.8 (681)	26.8 (681)	29.2 (742)
Width - Inches	22 (559)	22 (559)	22.5 (572)
Height - Inches	24.6 (625)	24.6 (625)	28 (719)
Fuel Tank Capacity	6.5 gal (24.6 L)	6.5 gal (24.6 L)	8.0 gal (30.3 L)
Rated Output Operating Hours	20.5	13.5	10.5
Battery Requirements:			
Battery (Group U1)	-	12 volt	12 Volt
Cold Cranking Amps (at 32° F[0° C])	-	235	235

Section 3. Dimensions and Clearances

Pro Series Gensets 4.0 kW and lower (GH170, GH280 engines):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	ENGINE MODEL	FACTORY SPECIFICATION	ALLOWABLE LIMIT
CYLINDER HEAD			
Cylinder head surface flatness	GH170	–	0.05 (0.0020)
Compression pressure	GH280	–	196 kPa 28 psi
VALVES			
Valve Clearance (Intake and Exhaust)	GH170	0.05 to 10 (0.0020 to 0.0039)	–
	GH280	0.05 to 10 (0.0020 to 0.0039)	–
Valve Seat Width	GH170	1.00 to 1.30 (0.039 to 0.051)	1.7 (0.067)
	GH280	1.00 to 1.30 (0.039 to 0.051)	1.7 mm (0.067)
Valve Seat Angle	GH170	45°	–
	GH280	45°	–
Valve Face Angle	GH170	45°	–
	GH280	45°	–
Clearance between Valve and Valve Guide			
Intake	GH170	0.020 to 0.044 (0.0008 to 0.0017)	0.1 (0.0039)
Intake	GH280	0.025 to 0.055 (0.0010 to 0.0022)	0.1 (0.0039)
Exhaust	GH170	0.040 to 0.072 (0.0016 to 0.0028)	0.1 (0.0039)
Exhaust	GH280	0.040 to 0.075 (0.0016 to 0.0030)	0.1 (0.0039)

Pro Series Gensets 4.0 kW and lower (GH170, GH280 engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	ENGINE MODEL	FACTORY SPECIFICATION	ALLOWABLE LIMIT
VALVES continued			
Valve Stem O. D.			
Intake	GH170	5.468 to 5.480 (0.2153 to 0.2157)	–
Intake	GH280	6.460 to 6.475 (0.2543 to 0.2549)	–
Exhaust	GH170	5.440 to 5.460 (0.2142 to 0.2150)	–
Exhaust	GH280	6.440 to 6.460 (0.2535 to 0.2543)	–
Valve Guide I. D.			
Intake	GH170	5.500 to 5.512 (0.2165 to 0.2170)	–
Intake	GH280	6.500 to 6.515 (0.2559 to 0.2565)	–
Exhaust	GH170	5.500 to 5.512 (0.2165 to 0.2170)	–
Exhaust	GH280	6.500 to 6.515 (0.2559 to 0.2565)	–
VALVE TIMING			
Intake Valve			
Open	GH170	70° before T.D.C.	–
	GH280	70° before T.D.C.	–
Close	GH170	110° after B.D.C.	–
	GH280	128° after B.D.C.	–
Exhaust Valve			
Open	GH170	110° before T.D.C.	–
	GH280	118° before T.D.C.	–

Close	GH170	70° after B.D.C.	−
	GH280	80° after B.D.C.	−

Pro Series Gensets 4.0 kW and lower (GH170, GH280 engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	ENGINE MODEL	FACTORY SPECIFICATION	ALLOWABLE LIMIT
VALVE SPRING			
Free Length	GH170	33.0 to 33.5 (1.2992 to 1.3189)	32.7 (1.2874)
	GH280	32.8 to 33.3 (1.2913 to 1.3110)	32.5 (1.2795)
Setting Load/Setting Length	GH170	5.90 kgf/22.5 mm (13.0 lbs./0.886 in.)	5.3 kgf/22.5 mm (11.7 lbs/0.886 in.)
	GH280	6.44 kgf/27.0 mm (14.2 lbs/1.063 in.)	5.6 kgf/27.0 mm 12.3 lbs/1.063 in.)
Tilt (allowable squareness limit)	GH170	–	1.5 (0.0590)
TAPPET			
Clearance between tappet and guide	GH170	0.035 to 0.075 (0.0014 to 0.0030)	0.1 (0.0039)
	GH280	0.030 to 0.070 (0.0012 to 0.0028)	0.1 (0.0039)
Tappet O. D.	GH170	7.960 to 7.975 (0.3133 to 0.3140)	–
	GH280	8.960 to 8.975 (0.3528 to 0.3533)	–
PUSH ROD			
Push Rod Alignment	GH170	–	0.2 (0.0079)
	GH280	–	0.2 (0.0079)
CAMSHAFT			
Side Clearance	GH170	–	0.2 (0.0079)
	GH280	–	0.2 (0.0079)
Cam Heights (IN., EX.)	GH170	26.10 (1.0276)	26.00 (1.0236)
	GH280	32.44 (1.2772)	32.34 (1.2732)

Pro Series Gensets 4.0 kW and lower (GH170, GH280 engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	ENGINE MODEL	FACTORY SPECIFICATION	ALLOWABLE LIMIT
CAMSHAFT continued			
Camshaft Alignment	GH170	–	0.05 (0.0020)
	GH280	–	0.05 (0.0020)
Oil Clearance of Camshaft Journal	GH170	0.016 to 0.052 0.00063 to 0.00205	0.1 (0.0039)
	GH280	0.016 to 0.052 (0.00063 to 0.00205)	0.1 (0.0039)
Camshaft Journal O. D.	GH170	14.966 to 14.984 (0.5892 to 0.5899)	–
	GH280	17.966 to 17.984 (0.7073 to 0.7080)	–
Crankcase Bore I.D. (for Camshaft)	GH170	15.000 to 15.018 (0.5906 to 0.5913)	–
	GH280	18.000 to 18.018 (0.7087 to 0.7094)	–
PISTON, PISTON RING			
Piston Boss I. D.	GH170	14.995 to 15.003 (0.5904 to 0.5907)	15.05 (0.5925)
	GH280	17.994 to 18.002 (0.7084 to 0.7087)	18.05 (0.7106)
Piston Skirt O. D.	GH170	66.955 to 66.970 (2.6360 to 2.6366)	66.87 (2.6327)
	GH280	78.950 to 78.970 (3.1083 to 3.1091)	78.87 (3.1051)
Piston Ring Thickness			
Top Ring, Second Ring Oil Ring	GH170	1.47 to 1.49 (0.0579 to 0.0587) 2.47 to 2.49 (0.0972 to 0.0980)	1.45 (0.0571) 2.45 (0.0965)
Top Ring, Second Ring Oil Ring	GH280	1.47 to 1.49 (0.0579 to 0.0587) 2.47 to 2.49 (0.0972 to 0.0980)	1.45 (0.0571) 2.45 (0.0965)

Clearance between Piston Ring and Groove	GH170	0.02 to 0.06 (0.0008 to 0.0024)	0.1 mm (0.0039)
	GH280	0.02 to 0.06 (0.0008 to 0.0024)	0.1 mm (0.0039)

Pro Series Gensets 4.0 kW and lower (GH170, GH280 engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	ENGINE MODEL	FACTORY SPECIFICATION	ALLOWABLE LIMIT
PISTON, PISTON RING continued			
Piston Ring Gap			
Top Ring, Second Ring	GH170	0.2 to 0.4 (0.0079 to 0.0157)	0.9 (0.0354)
Oil Ring		0.2 to 0.4 (0.0079 to 0.0157)	0.9 (0.0354)
Top Ring, Second Ring	GH280	0.2 to 0.4 (0.0079 to 0.0157)	0.9 (0.0354)
Oil Ring		0.2 to 0.4 (0.0079 to 0.0157)	0.9 (0.0354)
CONNECTING ROD			
Connecting Rod Alignment	GH170	–	0.04 (0.016)
	GH280	–	0.04 (0.016)
Clearance between Piston Pin and Small End Bore	GH170	0.010 to 0.025 (0.00039 to 0.00098)	0.1 (0.0039)
	GH280	0.010 to 0.025 (0.00039 to 0.00098)	0.1 (0.0039)
Piston Pin O. D.	GH170	15.000 to 15.005 (0.5906 to 0.5907)	–
	GH280	18.000 to 18.005 (0.7087 to 0.7089)	–
Small End Bore	GH170	15.015 to 15.025 (0.5911 to 0.5915)	–
	GH280	18.015 to 18.025 (0.7093 to 0.7096)	–

Pro Series Gensets 4.0 kW and lower (GH170, GH280 engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	ENGINE MODEL	FACTORY SPECIFICATION	ALLOWABLE LIMIT
CRANKSHAFT			
Crankshaft Alignment	GH170	–	0.04 (0.016)
	GH280	–	0.04 (0.016)
Clearance between Crank Pin and Connecting Rod Big End Bore	GH170	0.015 to 0.040 0.00059 to 0.00157)	0.1 (0.0039)
	GH280	0.015 to 0.050 0.00059 to 0.00197)	0.1 (0.0039)
Crank Pin O. D.	GH170	29.975 to 29.985 (1.1801 to 1.1805)	–
	GH280	33.475 to 33.485 (1.3179 to 1.3183)	–
Connecting Rod Big End Bore	GH170	30.000 to 30.015 (1.1811 to 1.1817)	–
	GH280	33.500 to 33.515 (1.3189 to 1.3199)	–
Side Clearance of Connecting Rod Crank PIn	GH170	0.4 to 1.1 (0.0157 to 0.0433)	1.3 (0.051)
	GH280	0.4 to 1.1 (0.0157 to 0.0433)	1.3 (0.051)
Side Clearance of Crankshaft	GH170	–	0.2 (0.079)
	GH280	–	0.1 (0.0039)
CYLINDER LINER			
Cylinder Wear	GH170	67.00 to 67.02 (2.6378 to 2.6386)	67.12 (2.6425)
	GH280	79.00 to 79.02 3.1102 to 3.1110	79.12 (3.1150)

5.0kW, 6.0 kW Pro Series Gensets (Elite E140H engines):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	FACTORY SPECIFICATION		ALLOWABLE LIMIT
	MINIMUM	MAXIMUM	
CYLINDER BLOCK			
Cylinder Bore I.D.			
Standard	84.200 (3.3150)	84.225 (3.3160)	84.325 (3.3199)
.25 Oversize	84.450 (3.3248)	84.475 (3.3258)	84.575 (3.3297)
.50 Oversize	84.700 (3.3347)	84.725 (3.3356)	84.825 (3.3396)
Cylinder Bore Taper	–	–	0.10 (0.004)
Cylinder Bore Out-of-Round	–	–	0.05 (0.002)
CAMSHAFT			
Lobe Height, Diameter Over Nose			
E125 Intake	34.23 (1.348)	34.55 (1.360)	33.73 (1.328)
E125 Exhaust	34.53 (1.359)	34.85 (1.372)	34.03 (1.340)
E140 Intake	35.09 (1.381)	35.41 (1.394)	34.59 (1.362)
E140 Exhaust	35.09 (1.381)	35.41 (1.394)	34.59 (1.362)
End Clearance	0.10 (0.004)	0.20 (0.008)	0.25 (0.010)
Journal Bearing O.D.	17.975 (.7077)	17.990 (.7083)	17.93 (.7059)
Journal Bearing Clearance (in gearcase)	0.01 (.0004)	0.05 (.0020)	0.08 (.0031)
BALANCER SHAFTS			
End Clearance (Both Shafts)	0.10 (0.004)	0.20 (0.008)	0.25 (0.010)
Journal Bearing O.D.	21.875 (0.8612)	21.890 (0.8618)	21.83 (0.8594)
Journal Bearing Clearance (in gearcase)	0.02 (0.0008)	0.056 (0.0022)	0.08 (0.0031)

5.0kW, 6.0 kW Pro Series Gensets (Elite E140H engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	FACTORY SPECIFICATION		ALLOWABLE LIMIT
CRANKSHAFT			
Stroke	70 (2.76)	70 (2.76)	–
Connecting Rod Journal O.D.			
Standard	33.475 (1.3179)	33.485 (1.3183)	–
.25 Undersize	33.225 (1.3081)	33.235 (1.3085)	–
.50 Undersize	32.975 (1.2982)	32.985 (1.2986)	–
End Clearance	0.10 (.004)	0.20 (.008)	0.25 (0.010)
CONNECTING ROD			
Pin Bore I.D.	20.015 (0.7880)	20.025 (0.7884)	20.071 (0.7902)
Large Bore I.D.			
Standard	33.500 (1.3189)	33.525 (1.3199)	–
.25 Undersize	33.250 (1.3091)	33.275 (1.3100)	–
.50 Undersize	33.000 (1.2992)	33.025 (1.3002)	–
Large Bore Clearance	0.015 (0.0006)	0.050 (0.0020)	0.100 (0.0040)
Side Clearance on Crankshaft	0.40 (0.016)	1.10 (0.043)	1.50 (0.059)
PISTON			
Piston Skirt O.D. 90 Degrees to Pin and 26.5 mm (1.043 inch) from Top of Piston			
Standard	84.09 (3.311)	84.12 (3.312)	–
.25 Oversize	84.34 (3.320)	84.37 (3.322)	–
.50 Oversize	84.59 (3.330)	84.62 (3.331)	–
Pin Bore I.D.	20.004 (0.7876)	20.012 (0.7879)	20.022 (0.7883)

5.0kW, 6.0 kW Pro Series Gensets (Elite E140H engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	FACTORY SPECIFICATION		ALLOWABLE LIMIT
	MINIMUM	MAXIMUM	
PISTON PIN			
Piston Pin O.D.	20.000 (0.7874)	20.005 (0.7876)	19.990 (0.7870)
Clearance in Piston Pin Bore	−.001 (.0000)	.012 (0.0005)	0.03 (0.0012)
Clearance in Connecting Rod Pin Bore	.010 (0.0004)	.025 (0.0010)	.035 (0.0014)
PISTON RINGS			
Top Compression Ring Thickness	1.47 (.058)	1.49 (.059)	1.42 (.056)
Second Compression Ring Thickness	1.47 (.058)	1.49 (.059)	1.42 (.056)
Top Compression Ring to Ring Groove Clearance	0.03 (0.001)	0.08 (0.003)	0.13 (0.005)
Second Compression Ring to Ring Groove Clearance	0.03 (0.001)	0.08 (0.003)	0.13 (0.005)
Top Compression Ring End Gap	0.25 (0.010)	0.51 (0.020)	1.00 (0.039)
Second Compression Ring End Gap	0.25 (0.010)	0.51 (0.020)	1.00 (0.039)
Oil Ring Side Rail Gap	0.38 (0.015)	1.40 (0.055)	1.80 (0.071)
INTAKE VALVE			
Valve Stem O.D.	6.960 (0.2740)	6.975 (0.2746)	–
Valve Guide I.D.	7.000 (0.2756)	7.015 (0.2762)	–
Valve Stem to Valve Guide Clearance	0.03 (0.001)	0.06 (0.002)	0.10 (0.004)
Valve Lash	0.15 (.006)		0.25 (0.010)
Face Angle	45°		–
INTAKE VALVE SEAT			
Seat Width	1.1 (.043)		1.7 (.067)
Seat Angle	45°		–

5.0kW, 6.0 kW Pro Series Gensets (Elite E140H engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	FACTORY SPECIFICATION		ALLOWABLE LIMIT
	MINIMUM	MAXIMUM	
EXHAUST VALVE			
Valve Stem O.D.	7.940 (0.3126)	7.960 (0.3134)	–
Valve Guide I.D.	8.000 (0.3150)	8.015 (0.3156)	–
Valve Stem to Valve Guide Clearance	0.04 (.002)	0.08 (.003)	0.10 (.004)
Valve Lash	0.15 (.006)		0.25 (0.010)
Face Angle	45°		–
EXHAUST VALVE SEAT			
Seat Width	1.1 (0.043)		1.7 (0.067)
Seat Angle	45°		–
VALVE SPRINGS—INTAKE AND EXHAUST			
Valve Spring Free Length (Approx.)	43.5 (1.713)		–
Valve Spring Length			
Valve Closed	32.6 (1.28)		–
Valve Open	23.2 (0.91)		–
Spring Load (Valve Closed Length)	12.6 kg (27.7 lb)	14.6 kg (32.1 lb)	–
Spring Load (Valve Open Length)	26.4 kg (58.2 lb)	28.4 kg (62.7 lb)	24.9 kg (55 lb)
VALVE ROCKER ARM			
Rocker Arm Bore I.D.	12.000 (0.4724)	12.018 (0.4718)	–
Rocker Arm Shaft O.D.	11.973 (0.4714	11.984 (0.4718)	–
Rocker Arm to Rocker Shaft Clearance	0.016 (0.0006)	0.045 (0.0018)	0.15 (0.0059)

5.0kW, 6.0 kW Pro Series Gensets (Elite E140H engines) (continued):

All dimensional tolerances and clearances are in millimetres (inches) at 21° C (70° F) unless otherwise indicated.	FACTORY SPECIFICATION		ALLOWABLE LIMIT
	MINIMUM	MAXIMUM	
LUBRICATING SYSTEM			
Rotor Lobe Clearance	0.15 or less (0.006 or less)		0.20 (0.008)
Outer Rotor to Pump Body Clearance	0.12 (0.005)	0.19 (0.007)	0.25 (0.010)
Rotor to Cover Clearance	0.02 (0.001)	0.09 (0.004)	0.25 (0.010)
IGNITION SYSTEM			
Spark Plug Gap	0.89 (0.035)	1.02 (0.040)	–
Magneto Coil to Rotor Magnet Clearance	0.25 (0.010)	0.40 (0.016)	–
STARTER MOTOR			
Commutator O.D.	28.0 (1.102)		27.00 (1.063)
Difference of Commutator O.D.'s	–	0.05 (0.002)	0.016 (0.41)
Armature Shaft to Bushing Clearance	0.02 (0.001)	0.07 (0.003)	0.20 (.008)
Mica Undercut	0.45 (0.018)	0.75 (0.030)	0.20 (0.008)

Section 4. Torque Specifications

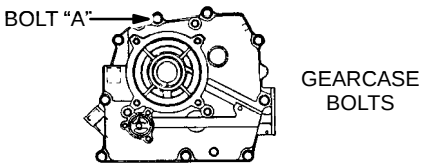
Mounting screws and nuts must be tightened to the specified torque settings listed in the following tables. Torque specifications can vary by engine size. The engine model number must be identified by referring to the Specifications section before using the engine torque specifications. The cylinder head mounting screws must be tightened in the proper sequence: refer to the appropriate engine manual.

TABLE 4-1. GH170, GH280 ENGINE TORQUE SPECIFICATIONS

ITEM	ENGINE MODEL	FOOT-POUNDS	NEWTON•METERS
Spark Plug	GH170	7.2 to 18.1	9.8 to 24.5
	GH280	7.2 to 18.1	9.8 to 24.5
Rocker Mounting Nut	GH170	43.4 to 50.6	58.8 to 68.6
	GH280	47.0 to 54.2	63.7 to 73.6
Cylinder Head Screws	GH170	18.1 to 23.9	24.5 to 32.4
	GH280	15.9 to 20.3	21.6 to 27.5
Crankcase Screws	GH170	10.1 to 14.5	13.7 to 19.6
	GH280	10.1 to 14.5	13.7 to 19.6
Connecting Rod Screws	GH170	10.1 to 14.5	13.7 to 19.6
	GH280	17.4 to 21.7	23.5 to 29.4
Rocker Arm Lock Nut	GH170	5.8 to 9.4	7.8 to 12.7
	GH280	8.0 to 12.3	10.8 to 16.7
Governor Lever Screw	GH170	5.1 to 8.7	6.9 to 11.8
	GH280	8.0 to 14.5	10.8 to 19.6
Flywheel Mounting Nut	GH170	43.4 to 50.6	58.8 to 68.6
	GH280	47.0 to 54.2	63.7 to 73.5

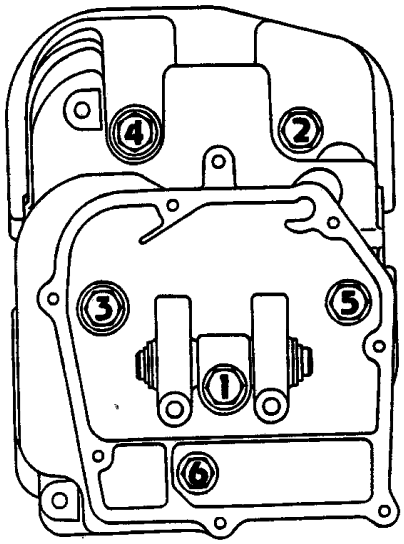
TABLE 4-2. ELITE E140H ENGINE TORQUE SPECIFICATIONS (from Elite E140H Engine Manual)

	DESCRIPTION	BOLT SIZE	METRIC (N-m)	ENGLISH (LB-FT)	INSTRUCTIONS
GEARCASE	Connecting Rod Bolts	M8 x 44	24-27	18-20	
	Gearcase Bolts	M8 x 35, 50, 75	16-22	12-16	< Torque the gearcase bolts in a clockwise direction starting with bolt “A”. Torque bolt “A” twice.
	Oil Pump Cover Screws	M6 x 14	7-11	5-8	
	Oil Pickup Tube	M6 x 14	7-11	5-8	
	Oil Drain Plugs	1/4” NPT	7-11	5-8	
	Fuel Pump Pulse Line Elbow	1/8” NPT	7-9.5	5-7	
	LOPCO or Pipe Plug	1/8” NPT	7-9.5	5-7	
	Adapter Filter Head	3/4”-16	47-54	35-40	
	Oil Filter	-	-	-	< Turn the oil filter 3/4-1 turn after gasket contacts base.
CYLINDER HEAD	Cylinder Head Bolts				
	No. 1-5 Bolts	M10 x 66, 86, 125	42-50	31-37	< Torque the cylinder head bolts in sequence shown. Two bolts outside valve cover (#2 & #4) to be retorqued after others are torqued.
	No. 6 Flange Bolt	M8 x 50	16-22	12-16	
	Valve Lash Adjusting Nut	M7	7-11	5-8	
	Valve Rocker Cover Bolts	M6 x 25	7-11	5-8	< Tighten every other valve rocker cover bolt until all bolts are tightened. Torque the first bolt twice.
	Spark Plug	M14-1.25	24-30	18-22	



INTAKE SYSTEM	Pulse Pump to Air Cleaner Pan	#10	2.3-2.8	1.7-2.1 (20-25 lb-in)	
	Intake Elbow to Cylinder Head	M8 x 50	11-16	8-12	
	Air Cleaner Pan to Cylinder Block	M8 x 16	11-16	8-12	< Tighten twice (1-2-1).
	Carburetor to Intake Elbow	M6 x 85	10-15	7-11	< Tighten twice (1-2-1).
	Air Cleaner Wingnut	1/4”-20	-	-	< Tighten 6 to 8 clicks after seating air cleaner.
	Control Plate Screws	M5 x 16, 30	7-9.5	5-7	
	Throttle Stop Screw Bracket	M5 x 10	2.7-5.4	2-4	
	Fuel Line Hold Down Screw	#10-16	1.4-2	1-1.5 (12-18 lb-in)	
	Throttle Cable Clamp Screw	#10-32	1.4-2	1-1.5 (12-18 lb-in)	
ELECTRICAL	Voltage Regulator Screws	1/4” x 50	6.7-8.1	5-6 (60-72 lb-in)	
	Starter Bolts	M8 x 40	16-22	12-16	
	Alternator Stator Screws	M6 x 25	10-15	7-11	
	Ignition Coil Bolt	M6 x 30	10-15	7-11	
	Connector-Wire Harness to Blower Housing	M4 x 12	1.4-2	1-1.5 (12-18 lb-in)	
SHEET METAL	Blower Housing Bolts	M6 x 20	7-11	5-8	
	Blower Housing to Manifold Bolt	M6 x 14	10-15	7-11	
	Starter Cover Bolts	3/8” x 16	25-35	18-26	
	Chaff Screen Bolts	M6 x 10	7-11	5-8	
	Stationary Guard Bolts	M6 x 20	1-1.2	1-1.5 (12-18 lb-in)	
	Recoil Starter Cup Screw	1/4”-20	7-11	5-8	
	Recoil Starter Bolts	M6 x 12	7-11	5-8	
	Cylinder Air Housing Bolt	M6x10	7-11	5-8	
		M8x16	11-16	8-12	
MISC	Governor Arm Nut	M6	8.1-10.9	6-8	
	Flywheel Nut	M18	122-138	90-102	
	Oil Fill Tube	M8x20	11-16	8-12	

CYLINDER HEAD TORQUE SEQUENCE



NOTE: THESE TORQUE VALUES PROVIDE PROPER TIGHTNESS WITHOUT DANGER OF STRIPPING THREADS. ALL THREADS MUST BE CLEAN AND RUST-FREE. LIGHTLY OIL ALL THREADS EXCEPT ON THE SPARK PLUG.

TABLE 4-3. GENERATOR TORQUE SPECIFICATIONS

ITEM	FOOT-POUNDS	NEWTON•METERS
ROTOR THROUGH-BOLT	19 - 20	25.7 - 27.1
STATOR THROUGH-BOLT	4.3 - 6.5	5.9 - 8.8
ADAPTER BRACKET TO ENGINE	13 - 15.9	17.7 - 21.6
OUTPUT TERMINAL NUT	1.4 - 1.8	1.9 - 2.45

When tightening torques are not specified, tighten the screws and nuts according to Table 4-3. The torque setting for securing the generator set to the frame vibration isolators is 16 ft-lbs (21.7 N•M).

TABLE 4-4. GENERAL USE TORQUE SPECIFICATIONS

GRADE	NO-GRADE OR 4T			7T		
NOMINAL DIAMETER	N•M	kgl•m	ft-lbs	N•M	kgl•m	ft-lbs

M5	2.45 to 3.92	0.25 to 0.40	1.82 to 2.89	3.9 to 6.9	0.4 to 0.7	2.9 to 5.1
M6	4.41 to 7.85	0.45 to 0.80	3.25 to 5.79	6.9 to 13.7	0.7 to 1.4	5.1 to 10.1
M8	10.8 to 19.6	1.1 to 2.0	8.0 to 14.5	17.7 to 32.4	1.8 to 3.3	13.0 to 23.9
M10	22.6 to 41.2	2.3 to 4.2	16.6 to 30.4	37.3 to 68.6	3.8 to 7.0	27.5 to 50.6

Section 5. Preparing to Service

TROUBLESHOOTING

Before servicing the generator set, follow a systematic troubleshooting procedure to locate the problem. For servicing purposes, the generator set can be divided into the following sections:

- Engine: Primary Systems
- Control
- Generator
- Engine Block Assembly

Dimensions, clearances and torque specs are listed for all Pro series generator sets.

Control schematic/wiring diagrams are included for all Standard and Pro series generator sets.

Briggs and Stratton engines (all Standard series gensets) should be serviced/repaired by authorized Briggs and Stratton service personnel.

Overhaul of Onan Elite engines (Pro 5.0 kW, 6.0 kW) is covered in Onan publication 965-0758 (Elite E125H, E140H Engine Service Manual).

The troubleshooting sections list typical problems along with possible causes and corrective actions. Note that some problems might have several possible causes. It may be necessary to investigate each possible cause in order to isolate the actual source of the problem.

SPECIAL TOOLS

Engine

A complete set of standard and metric shop tools are required to service the engine.

Control and Generator

A complete set of standard and metric shop tools are required to service the control and generator. Also needed are:

- Lead or dead blow hammer
- Battery hydrometer
- Torque wrench
- VOM multimeter
- Frequency meter
- Armature growler
- Load test panel
- Jumper wires

SAFETY CONSIDERATIONS

Always consider the safety aspects of any service procedure. Servicing presents several hazards that the service technician must be aware of to safely complete the job. Study the safety precautions on pages iii and iv of this manual and familiarize yourself with the hazards listed in Table 5-1. Approach the job in a safety-conscious manner. Being safety conscious is the most effective way to avoid injury to yourself and to others. Reduce the risk of an accident by adopting the following safeguards.

Safeguards to Avoid Hazards

Use personal protection: Protect your body by wearing the appropriate safety equipment such as:

- Safety shoes
- Gloves
- Safety glasses

Do not wear rings, jewelry or loose clothing: they might get caught on equipment, or conduct electricity.

Reduce the hazard: A safe, orderly work area and well-maintained equipment reduce the risk of hazard. Leave all guards and shields in place on machinery, and maintain equipment in top condition. Store flammable liquids in approved containers, away from flame, spark, pilot light, arc-producing equipment and other ignition sources. Keep the work area clean, well-lighted, and well-ventilated. Keep fire extinguishers and safety equipment nearby, and be prepared for any emergency.

TABLE 5-1. HAZARDS AND THEIR SOURCES

- **Fire and explosions**
  - Leaking or spilled fuel
  - Hydrogen gas from charging battery
  - Oily rags improperly stored
  - Flammable liquids improperly stored
  - Any fire, flame, spark, pilot light, arc-producing equipment or other ignition sources
- **Poisonous gases**
  - Carbon monoxide from faulty exhaust
  - Operating power unit where exhaust gases can accumulate
  - Phosgene gas from freon in contact with an open flame
- **Burns**
  - Hot exhaust pipes
  - Hot engine surfaces
  - Hot engine oil
  - Electrical short in DC wiring system
- **Rotating Machinery**
  - Jewelry or loose clothing catching in moving parts
- **Heavy Objects**
  - Removing power unit from vehicle
  - Removing heavy components
- **Slippery Surfaces**
  - Leaking or spilled oil

Develop safe work habits: Unsafe practices are the cause of most accidents involving tools or machinery. Be familiar with your tools and machines and learn how to use them safely. Use the right tool for the job, and check its condition before starting.

Follow all warnings and cautions in this manual, and take extra precautions when working around electrical equipment. Avoid working alone, and do not take risks. Do not work when tired or after consuming any alcohol or drug that makes the operation of equipment unsafe.

Be prepared for a potential accident: The Red Cross and public safety departments offer courses in first aid, CPR, and fire control. Use this information to be ready for an accident.

Be safety-conscious, and make safety procedures part of the work routine.

Section 6. Engine – Primary Systems

INTRODUCTION

Engine primary systems include the following:

- Exhaust System
- Cooling System
- Ignition System
- Crankcase Ventilation System
- Governor
- Fuel System
- Recoil Starter
- Electric Starter
- Oil Watch System

These systems can be serviced without major disassembly of the set. Use the following troubleshooting guide to help locate problems related to the engine primary systems. See Troubleshooting Generator Set Control (Section 7) for problems related to starting the genset.

Standard Series Gensets NOTE:

On the Standard Series generator sets, most of these systems will be serviced by Briggs and Stratton service technicians. These include ignition, lubrication and fuel systems, and the starting system.

TABLE 6-1. TROUBLESHOOTING ENGINE PRIMARY SYSTEMS

⚠WARNING Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.

Trouble	Possible Cause	Corrective Action
Engine Misfires	1. Faulty ignition due to: a. worn or fouled spark plug b. faulty ignition system c. faulty plug wire 2. Lean fuel mixture due to: a. incorrectly adjusted carburetor b. incorrect float level c. dirt in carburetor d. vacuum leak 3. Contaminated fuel 4. Dirty air cleaner	 1a. Clean or replace spark plug. 1b. See *Ignition System* section. 1c. Check spark plug wire and replace if necessary. 2a. See *Carburetor Adjustment* section. 2b. Check carburetor float. 2c. Disassemble carburetor and clean all passages. 2d. Locate leak, check for loose carburetor. 3. Drain fuel tank and refill with fresh fuel. 4. Clean or replace air cleaner.
Engine Backfires	1. Faulty ignition due to: a. worn or fouled spark plug b. faulty ignition system 2. Lean fuel mixture due to: a. incorrectly adjusted carburetor b. incorrect float level c. dirt in carburetor d. vacuum leak 3. Excessive engine wear	 1a. Clean or replace spark plug 1b. See *Ignition System* section. 2a. See *Carburetor Adjustment* section. 2b. Check carburetor float. 2c. Disassemble carburetor and clean all passages. 2d. Locate leak, check for loose carburetor. 3. E140H engine: See Onan Elite Horizontal engine manual 965-0758 GH170, GH280 engines: See *Engine Block Assembly* section

Trouble	Possible Cause	Corrective Action
Engine Lacks Power	1. Faulty ignition due to: a. worn or fouled spark plug b. faulty ignition system	 1a. Clean or replace spark plug. 1b. See *Ignition System* section.
	2. Dirty air cleaner	2. Clean or replace air cleaner.
	3. Restricted fuel flow due to plugged	3. Clean or replace fuel filter.
	4. Incorrect fuel mixture due to: a. incorrectly adjusted carburetor b. incorrect float level or c. dirt in carburetor	 4a. See *Carburetor Adjustment* section. 4b. Check carburetor float. 4c. Disassemble carburetor and clean all internal passages.
	5. Exhaust system blocked or restricted.	5. Locate and remove cause of blockage.
	6. Incorrect valve clearance or defective valve(s)	6. Adjust valve clearance/inspect valves E140H engine: See Onan Elite Horizontal engine manual 965-0758 GH170, GH280 engines: See *Engine Block Assembly* section
	7. No load speed set too low	7. Adjust governor setting.
	8. Excessive engine wear or damage to engine	8. E140H engine: See Onan Elite Horizontal engine manual 965-0758 GH170, GH280 engines: See *Engine Block Assembly* section
	9. Choke valve blockage or choke lever set incorrectly	9. Open choke lever fully, if problem continues see *Fuel System* section.
Engine Overheats	1. Restricted air flow due to dirt or debris blocking air inlet or outlet	1. Clear away any debris that may restrict airflow.
	2. Dirt or oil covering engine cooling fins.	2. Clean away all dirt and oil from engine cooling fins.
	3. Cooling fan plugged or broken	3. Inspect cooling fan, see *Generator Service* section.
	4. Lean fuel mixture due to: a. incorrectly adjusted carburetor b. incorrect float level c. dirt in carburetor	 4a. See *Carburetor Adjustment* section. 4b. Check carburetor float. 4c. Disassemble carburetor and clean all internal passages.

Trouble	Possible Cause	Corrective Action
Black Exhaust Smoke	1. Rich fuel mixture due to: a. dirty air cleaner b. choke closed c. incorrectly adjusted carburetor d. dirt in the carburetor	 1a. Clean or replace air cleaner. 1b. Check choke setting. 1c. See *Carburetor Adjustment* section. 1d. Disassemble carburetor and clean all internal passages.
White or Blue Exhaust Smoke	1. Lean fuel mixture due to: a. dirty air cleaner b. incorrect float level c. incorrectly adjusted carburetor d. dirt in the carburetor 2. Clogged or faulty breather 3. Contaminated fuel 4. Excessive engine wear	 1a. Clean or replace air cleaner. 1b. Check carburetor float. 1c. See *Carburetor Adjustment* section. 1d. Disassemble carburetor and clean all internal passages. 2. Clean or replace breather. 3. Drain and replace fuel. 4. E140H engine: See Onan Elite Horizontal engine manual 965-0758 GH170, GH280 engines: See *Engine Block Assembly* section
Engine Hunts or Surges	1. Sticking or binding governor linkage 2. Incorrect governor adjustment 3. Faulty governor spring 4. Incorrect fuel mixture due to: a. incorrectly adjusted carburetor b. incorrect float level or c. dirt in carburetor 5. Governor mechanism worn excessively 6. Fuel supply problem caused by: a. Dirty fuel filter b. Contaminated fuel supply	1. Check linkage alignment and straighten or replace. Clean governor linkage. 2. See *Governor* section. Also: E140H engine: See Onan Elite Horizontal engine manual 965-0758 GH170, GH280 engines: See *Engine Block Assembly* section 3. Replace governor spring. 4a. See *Carburetor Adjustment* section. 4b. Check carburetor float. 4c. Disassemble carburetor and clean all internal passages. 5. E140H engine: See Onan Elite Horizontal engine manual 965-0758 GH170, GH280 engines: See *Engine Block Assembly* section 6a. Clean or replace fuel filter. 6b. Drain and refill fuel supply.

Trouble	Possible Cause	Corrective Action
Uses Too Much Oil (Note: New engines sometimes use excess oil during break-in)	1. Oil viscosity is too light or oil is diluted	1. Drain oil and refill with correct viscosity oil.
	2. Crankcase breather valve is dirty or defective	2. Clean crankcase breather or replace if defective.
	3. Oil leaks	3. Locate source of leak and repair as required.
	4. Excessive engine wear	4. E140H engine: See Onan Elite Horizontal engine manual 965-0758 GH170, GH280 engines: See *Engine Block Assembly* section
	5. Light loading	5. Do not run set at no load for long periods of time.
Engine Shuts Down and Will Not Restart	1. Low oil level	1. Add oil as required.
	2. Low oil level switch defective	2. Replace oil level switch. E140H engine: See Onan Elite Horizontal engine manual 965-0758 GH170, GH280 engines: See *Engine Block Assembly* section)
	3. Fouled spark plug	3. Clean or replace spark plug.
	4. Faulty fuel system	4. See Fuel System section for service procedures.

EXHAUST SYSTEM

The exhaust system consists of a muffler/tailpipe assembly that has an exhaust pipe with a flange for mounting the muffler directly to the engine, and another flange for mounting to the generator flange (5 and 6kW models). Most models have a spark arrester screen that is located inside the exhaust outlet pipe.

If inspection reveals leaking joints or connections, loose fasteners, or broken or damaged components, then **service the muffler immediately**. Always replace a defective muffler assembly with a new original equipment replacement part.

NOTE: Do not attempt to repair a broken muffler assembly by welding. Do not replace worn-out components with parts that do not meet factory specs.

Clean out the spark arrester periodically to prevent buildup of carbon deposits on the spark arrester screen (see the *Maintenance* section of Operator's Manual). Failure to provide and maintain a spark arrester muffler can be in violation of the law. Contact an Onan parts distributor for approved replacement exhaust parts.

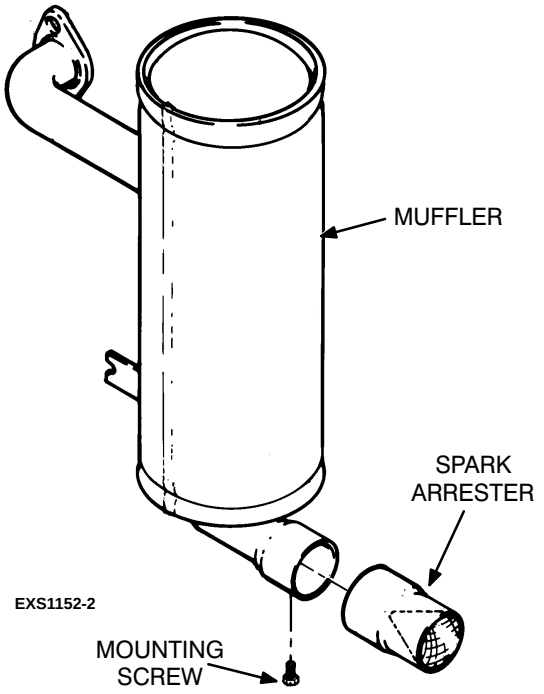
⚠WARNING ***Exhaust gas presents the hazard of severe personal injury or death. Do not operate the generator set if there are any exhaust leaks. Have the exhaust system repaired before using the generator set.***

Disassembly: Allow set to cool before servicing.

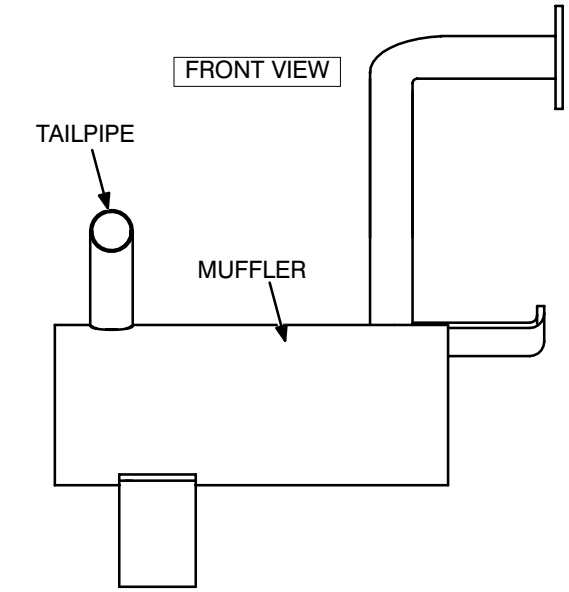
1. Remove the heat shield that covers the exhaust pipe and engine.
2. Remove the mounting nuts that secure the muffler flange to the engine.
3. Remove the screws that secure the muffler to the muffler support bracket (and to the generator flange on the 5 and 6 kw models) and remove the exhaust gasket.

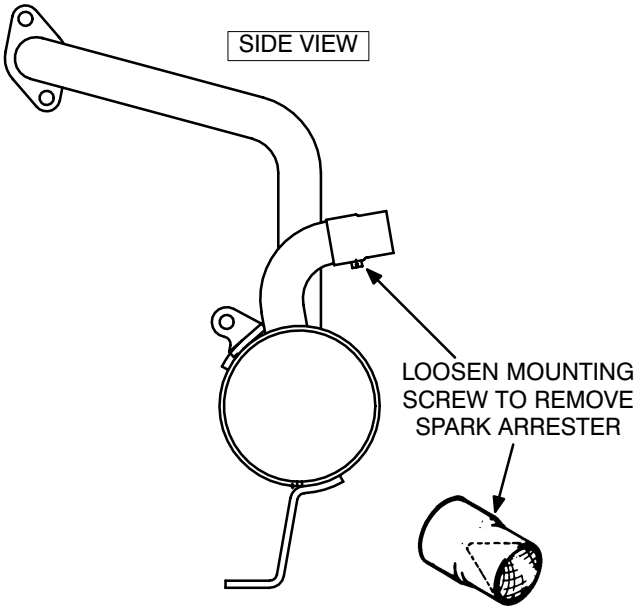
Assembly: Obtain the required Onan original replacement parts and proceed as indicated.

1. Install a new exhaust gasket. Mount the muffler flange to the engine (and also to the generator flange on the 5 and 6 kW models). Install the mounting nuts and support bracket screws finger tight to align all the mounting holes.
2. Tighten mounting hardware to the specified torque.
3. Install heat shield (on models so equipped) and secure with mounting screws.



PRO SERIES GENSETS 4.0 KW AND BELOW





PRO SERIES GENSETS 5.0 AND 6.0 KW

FIGURE 6-1. TYPICAL MUFFLER ASSEMBLIES

COOLING SYSTEM

The engine and generator are air-cooled. A constant airflow is critical for the engine and generator to prevent excessive heat buildup.

The engine is cooled by a centrifugal fan that is part of the engine flywheel. Air is drawn in through the openings in the spiral case and is forced out between the engine cowling and the engine cooling fins. Figure 6-2 illustrates air flow on a typical Onan portable genset.

The generator is cooled by a centrifugal fan inside the generator assembly, mounted on the engine end of the rotor shaft. The generator fan draws cooling air in through the generator end cover, across the stator and rotor, then discharges the heated air through the air outlet in the adapter plate.

Keep the air inlet openings and the air discharge openings free of any obstructions, to avoid restricting airflow. Dirt, dust, and other debris that can clog the air openings should be removed during periodic maintenance. Debris might also become lodged between the cooling fins on the engine block and cylinder head. If this happens, heat transfer is greatly reduced and engine overheating can occur. Use a brush or low-pressure compressed air to remove any dirt or debris that may be lodged in the engine cooling fins.

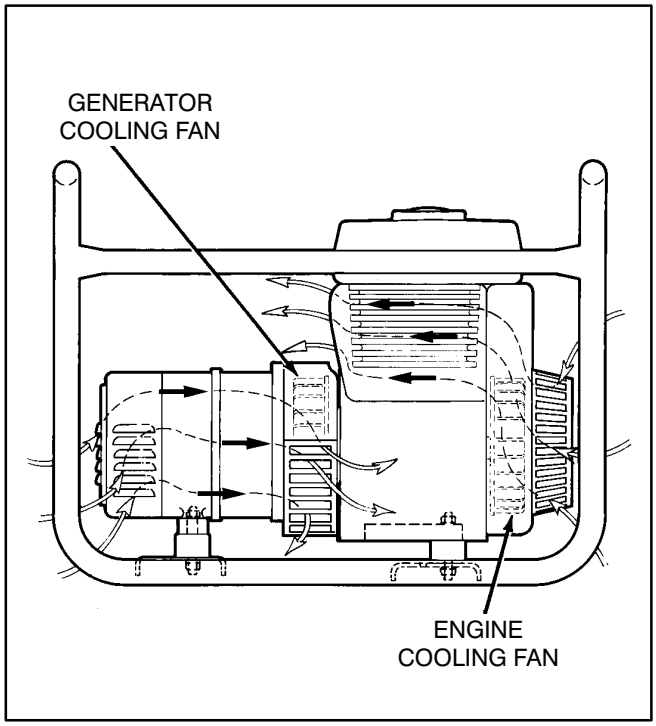


FIGURE 6-2. TYPICAL COOLING AIRFLOW

IGNITION SYSTEM

NOTE: Repairs on the ignition systems on the Standard series portable gensets will be performed by Briggs and Stratton service personnel.

2.5 kW, 4.0 kW Pro Series Gensets (GH170, GH280 Engines)

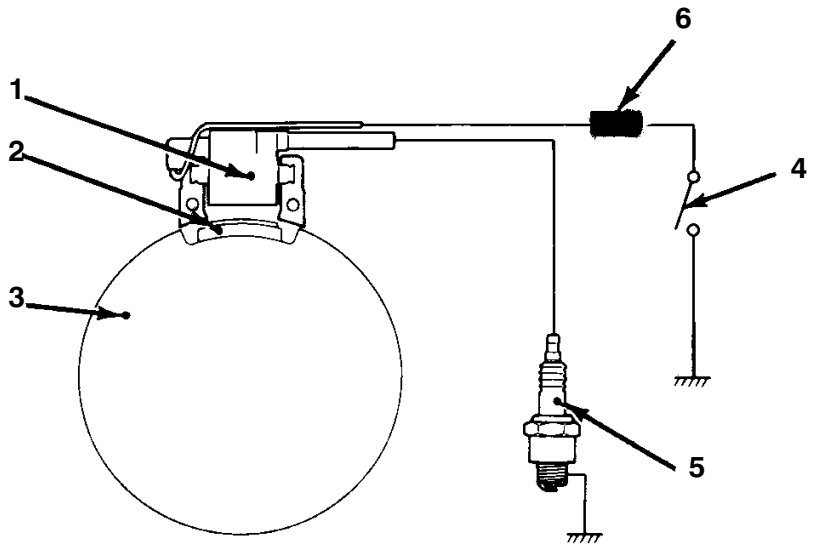
The Pro portable gensets use a breakerless transistor magnet ignition system that is energized by a magnet on the flywheel. If the spark plug (see Spark Plug section) and the wiring are in good working condition, and low or no spark is produced during engine cranking, proceed to the following ignition service sections.

Wiring: Check ignition wiring for loose connections and cuts or breaks in the insulation. Clean all terminals and connections and test for continuity with an ohmmeter. Use a megger to check for breaks in the spark plug wire insulation.

Transistor Magnet Ignition: This ignition system consists of two parts: an ignition control unit to generate primary current and secondary high voltage, and an ignition time control unit to induce high voltage in the ignition coil by controlling the primary current. A magnet mounted to the flywheel induces a voltage in the ignition control unit when the engine is cranked over. See Figure 6-3.

Transistor Magnet Ignition Check:

1. Measure the clearance between the Transistor Magnet Unit and the flywheel magnet (Figure 6-4).
2. If the clearance is not within 0.0157 to 0.0236 inches (0.4 to 0.6 mm), loosen the mounting screws and adjust clearance to fall within specified clearance.



1. TRANSISTOR MAGNET UNIT
2. MAGNET
3. FLYWHEEL
4. STOP SWITCH
5. SPARK PLUG
6. 1P CONNECTOR

FIGURE 6-3. TRANSISTOR MAGNET IGNITION, GH170 AND GH280 ENGINES

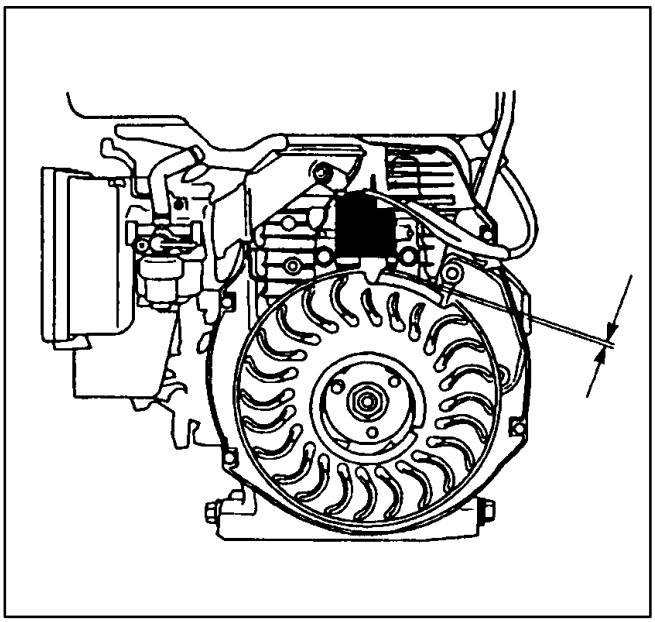


FIGURE 6-4. MEASURING CLEARANCE BETWEEN TRANSISTOR MAGNET UNIT AND FLYWHEEL MAGNET (GH170, GH280 ENGINES)

3. Disconnect the 1P connector (Figure 6-3) from the stop switch.
4. Disconnect the high voltage lead from the spark plug.
5. With an accurate analog ohmmeter, measure the resistance between the 1P connector and a clean metal ground point on the engine.
6. The resistance between the primary coil and ground, measured in step 5, should be approximately 0.5 to 1.3 ohms. If abnormal reading is measured, replace the transistor magnet unit.
7. Measure the resistance between the spark plug lead and a clean metal ground point on the engine (Figure 6-5).
8. The resistance between the secondary coil and ground, measured in step 7, should be 9k to 13 kohms. If abnormal reading is measured, replace the transistor magnet unit.
9. The remaining circuitry of the transistor magnet ignition unit cannot be tested with a meter. If each of the components in the ignition system test good and low or no spark are produced, re place the transistor magnet unit.

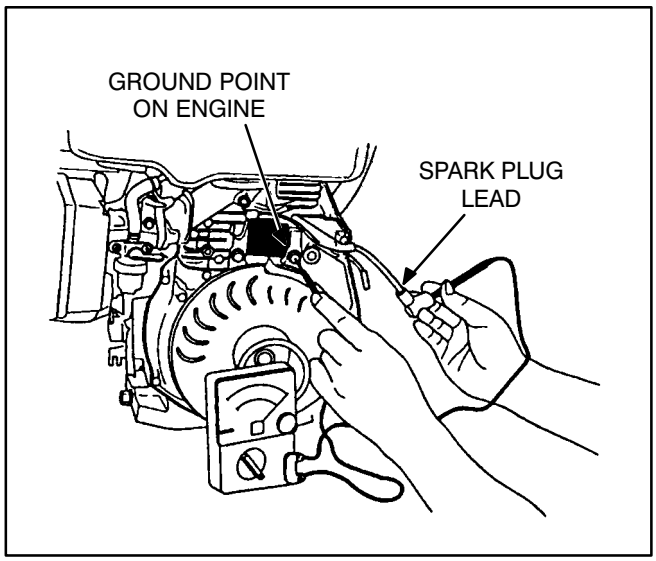


FIGURE 6-5. CHECKING SECONDARY COIL, GH170 AND GH280 ENGINES

5.O kW, 6.0 kW Pro Series Gensets (Elite E140 Engine)

NOTE: See the Onan Elite E125H/E140H Service Manual for more information on the ignition system for the 5.0 and 6.0 kW gensets.

Magneto: This genset uses a magneto consisting of a stationary coil and flywheel magnet to fire the spark plug (Figures 6-6 and 6-7). The primary winding of the coil has a grounding terminal for connecting a shutoff (kill) switch (see Elite service manual). Ignition timing is determined by the angular relationship of the flywheel magnet to the shaft keyway and is not adjustable.

⚠WARNING ***Gasoline is highly flammable and can cause severe personal injury or death. Make certain that no gasoline or other flammable fumes are present during ignition testing***

⚠WARNING ***Electrical shock can cause severe personal injury or death. Do not touch the ignition components during testing.***

Ignition Spark Check: If the spark plug has been serviced or replaced but the ignition system still appears to be the cause of the problem, perform an ignition spark check by disconnecting the spark plug cable from the spark plug (do not remove the plug) and connecting it to a test plug. (If you do not

have a test plug, use a new plug of the same type.) Ground the side electrode of the test plug to the engine block, crank the engine and observe the test plug. **Do not touch the plug or plug wire during testing**.

- **Good Spark -** The ignition system is not the problem.
- **Weak Spark -** Check and readjust the magneto air gap as instructed in this section. Replace the magneto coil assembly if the spark plug cable and connector are not in good condition.
- **No Spark -** First check to see that:
  - The grounding lead is not damaged or being pinched
  - The stop (kill) switch is connected properly
  - The low oil pressure cutoff switch is functioning properly.

  Then, if there is still no spark, and the grounding terminal is not being grounded, replace the magneto coil assembly.

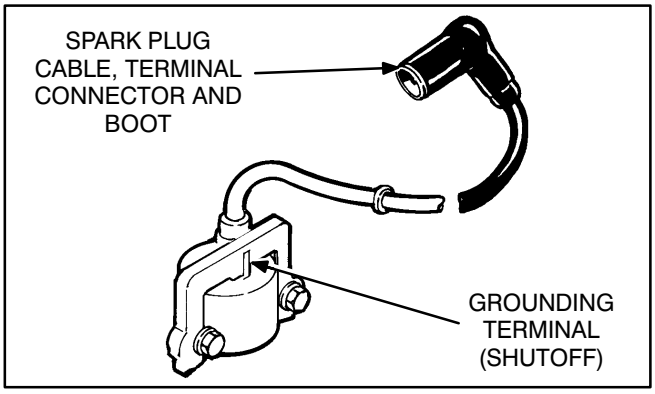


FIGURE 6-6. MAGNETO COIL ASSEMBLY, ELITE E140H ENGINE

Magneto Air Gap: Measure the air gap between the core of the magneto coil and flywheel magnet (Figure 6-7). If necessary, loosen the magneto coil mounting screws and readjust the gap as specified (*Section 2. Dimensions and Clearances*).

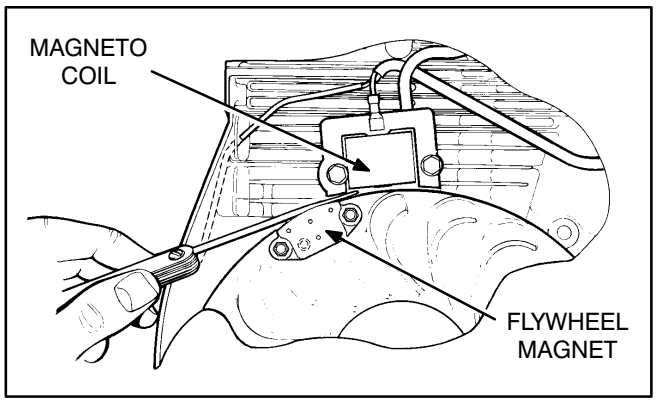


FIGURE 6-7. MEASURING MAGNETO AIR GAP, ELITE E140H ENGINE

Spark Plug (All Gensets)

Remove and inspect the spark plug at the intervals indicated in the Operator's Manual. Clean the electrode with a wire brush to remove carbon deposits. Measure and reset the electrode gap to the specified setting (Figure 6-8). Replace the spark plug if the electrode or insulator are deformed or cracked.

The spark plug is located behind the control panel on the 5.0 and 6.0 kW Pro models. If necessary, the fuel tank can be raised for easier service access as follows:

1. Let the generator set cool down completely. Check fuel level in the fuel tank and reduce the level if tank is full to avoid spilling. Use a pump designed for use with fuels to lower fuel tank level and store fuel in a clean container designed for fuel storage.
2. Close the fuel shutoff valve on the bottom of the fuel tank.
3. Remove the fuel tank mounting nuts and raise the control panel side of the fuel tank high enough to access the spark plug. Support the fuel tank to prevent tilting or dropping.

   ⚠WARNING ***Fuel presents the hazard of fire or explosion that can cause severe personal injury or death. Shut fuel valve and handle fuel tank carefully to prevent fuel leakage. Reduce fuel level in fuel tank to reduce the risk of spilling fuel. Do not permit any flame, spark, pilot light, cigarette, arcing switch or equipment, or other ignition source near the fuel system. Keep an ABC type fire extinguisher nearby.***

Carefully examine the plug to determine the source of an engine problem. Spark plug appearances and their causes include:

- Carbon fouled - Check for a poor high tension lead connection or low compression.
- Oil fouled - Check for faulty choke operation, rich fuel mixture, or dirty air filter.
- Burned or overheated - Check for leaking intake manifold gasket, lean fuel mixture, or incorrect spark plug type.
- Chipped insulator - Bend only side electrode when setting gap.
- Splash fouled - Check for accumulated combustion chamber deposits. See Cylinder Head section.
- Light tan or grey deposits - Normal plug color.

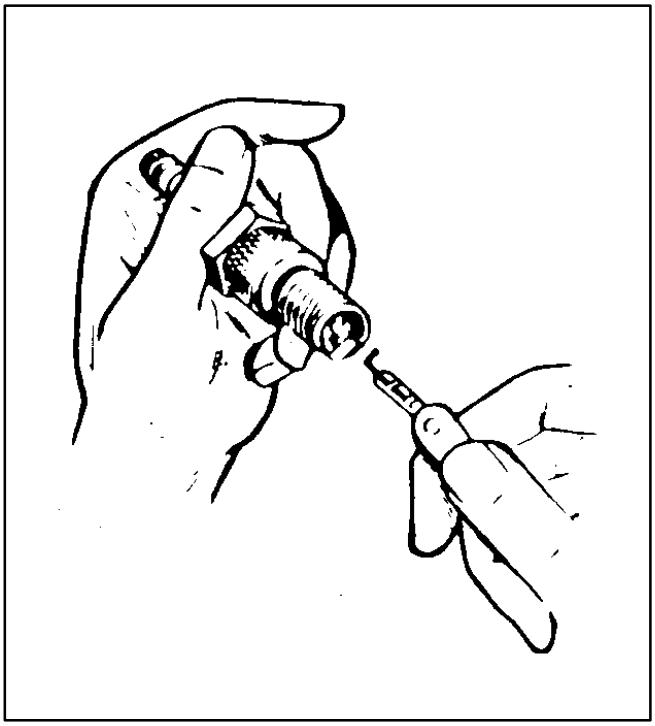


FIGURE 6-8. MEASURING PLUG GAP

CRANKCASE VENTILATION SYSTEM

NOTE: Maintenance of the crankcase ventilation system on the Standard series portable gensets will be performed by Briggs and Stratton service personnel.

Pro Series Gensets

The crankcase breather prevents pressure from building up in the crankcase, and prevents oil contamination by removing moisture or gasoline vapors and other materials from the crankcase. These vapors are routed to the carburetor where they are mixed with the incoming air and burned in the combustion chamber. A sticky breather valve can cause oil leaks, high oil consumption, rough idle, reduced engine power, and rapid formation of sludge and varnish within the engine. Oil leaks at the seals can mean the crankcase breather is blocked.

Cleaning the breather: Remove the breather tube and access the breather (see the appropriate engine manuals: GH170, GH280 engines see Section 9 of this manual). Remove the breather from the cylinder head and inspect it. The reed valve must be flat with no sign of creases or other damage. If the breather is defective, replace it. If the breather is dirty, clean it in parts cleaning solvent. Check breather tube and air passages for clogging and clean as required.

⚠WARNING ***Most parts cleaning solvents are flammable and can result in severe personal injury if used improperly. Follow the manufacturer's recommendations when installing parts.***

GOVERNOR/THROTTLE ADJUSTMENTS

NOTE: Maintenance of the governor system on the Standard series portable gensets will be performed by Briggs and Stratton service personnel. However, the general principles described below will apply to all Standard and Pro series portable gensets.

Several factors can affect governor operation. Binding in the governor shaft, governor linkage, or carburetor throttle will cause erratic governor action or alternately increase and decrease the engine speed (hunting). Rich or lean carburetor adjustments can cause hunting, and a fouled spark plug can cause missing and hunting.

The carburetor adjustment screws must be correctly adjusted before governor adjustments are made. If the carburetor needs adjusting, see the Carburetor Adjustments section before making final adjustments to the governor.

Disconnect all loads from the generator set. Connect a frequency meter to the generator output receptacle. Adjustments should be made in the following sequence. To adjust the engine speed only, proceed to step 4.

GH170, GH280 Engines:

1. Check the governor linkage for binding or excessive looseness. Check the springs for bending or damage and straighten or replace as needed. Make sure the springs are attached to the correct mounting hole where applicable (Figure 6-9).
2. Loosen the screw at the lower end of the governor lever (Figure 6-9).
3. Hold the throttle valve in the fully open position with the governor lever. Turn the groove on the governor lever shaft fully clockwise with a screwdriver and tighten in that position. Tighten the governor lever tightening screw to 5.1 to 8.7 ft lbs (6.9 to 11.8 N•M). Check to make sure the throttle is held in the fully open position after tightening.
4. Start the engine. Make sure the speed control lever is in the high speed position or that the Idlematic is Off. Operate the generator set with no load until it is warm. See Figure 6-10.
5. Check the no-load frequency for a normal reading of 63 ± 0.5 Hz (3750-3780 rpm) or 53 ± 0.5 Hz (3150-3180 rpm) for 50 Hz models.
6. If an abnormal reading is measured, adjust the speed as follows:

   Models Without Idlematic: Move the speed control lever to a position between the high and low speed settings. Adjust the high speed screw by turning it counterclockwise to increase engine speed or clockwise to decrease engine speed.

   Models Below 5 kW (without Idlematic): One full turn of the adjustment screw will change the frequency approximately 1-14 Hz. Do not turn the adjustment screw more than 2 turns.

   After making an initial adjustment, move the speed control lever to the high speed setting and recheck frequency. Repeat this process until a normal no-load speed is obtained.

   Models With Idlematic: Set the Idlematic control to On. Adjust the high speed screw by turning it clockwise to increase engine speed or counterclockwise to decrease engine speed. One full turn of the adjustment screw will change the frequency approximately 3.7 Hz. Do not turn the adjustment screw more than 3/4 turns. After making an initial adjustment, set the Idlematic control to Off and recheck frequency. Repeat this process until a normal no-load speed is obtained.

Springs tend to lose their calibrated tension through fatigue after long usage and may require replacement. If the governor action is erratic after adjustments are made, replace the spring. If this does not improve operation, the problem may be within the governor mechanism (see Engine Block Assembly, Section 9 of this manual).

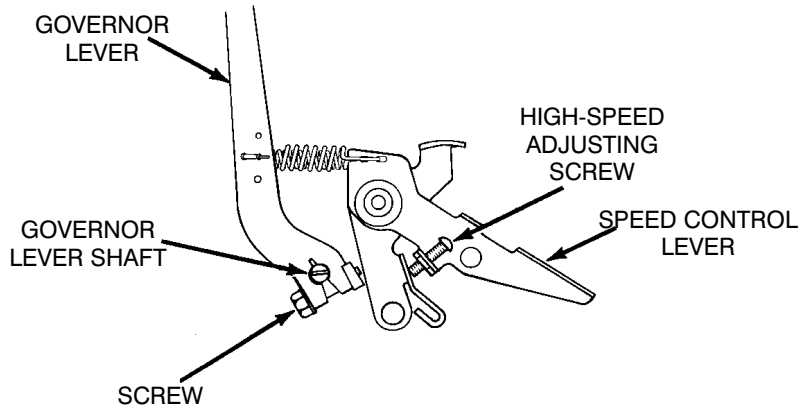
Elite E140H Engines:

NOTE: Consult the E140H Service Manual (Onan part number 965-0758) for information on governor arm adjustment. Note that the governor arm must be repositioned on its shaft whenever the intake manifold or carburetor is replaced or reinstalled. This must be accomplished, if necessary, before speed adjustments are performed.

Set the Idlematic control to On, and loosen the throttle adjustment lock nut. Adjust the engine speed by turning the throttle adjustment nut until the frequency is within the range specified above. Tighten the throttle adjustment lock nut.

Springs tend to lose their calibrated tension through fatigue after long usage and may require replacement. If the governor action is erratic after adjustments are made, replace the spring. If this does not improve operation, the problem may be within the governor mechanism (see Elite E140H Service Manual).

GH170 ENGINE



GH280 ENGINE WITH IDLEMATIC

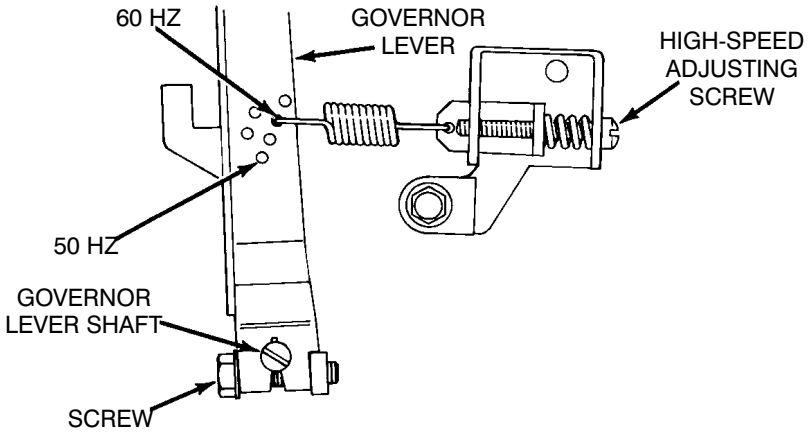


FIGURE 6-9. GOVERNOR/THROTTLE ADJUSTMENTS, GH170 AND GH280 ENGINES

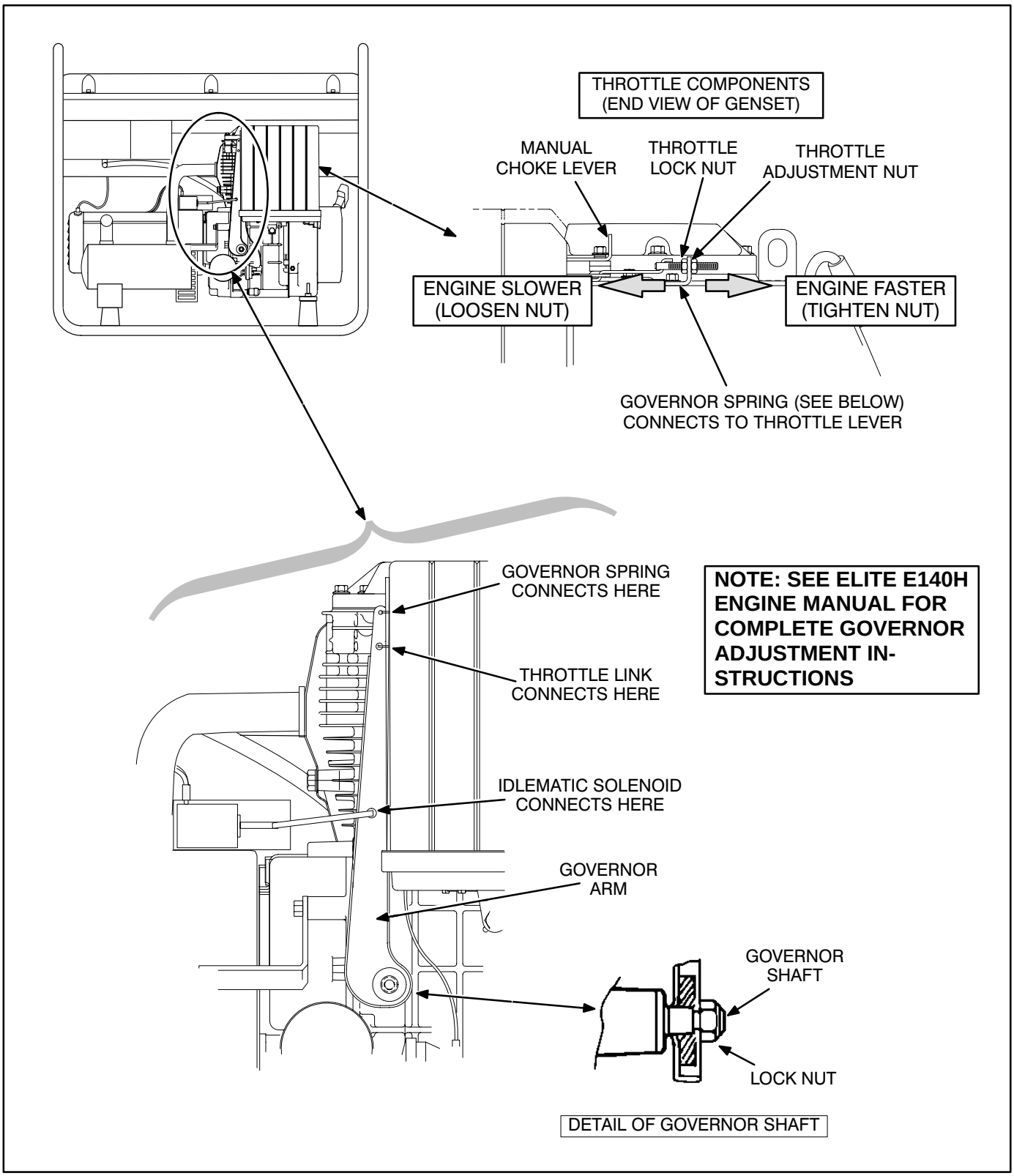


FIGURE 6-10. GOVERNOR/THROTTLE ADJUSTMENTS, ELITE E140H ENGINE

FUEL SYSTEM

NOTE: Maintenance of the fuel system on the Standard series portable gensets will be performed by Briggs and Stratton service personnel. Consult the Briggs and Stratton engine manual included with the Operator's Manual for more information. However, the general principles described below will apply to all Standard and Pro series portable gensets.

The main components of the fuel system are:

- Carburetor
- Air Filter Assembly
- Fuel Filter

Each of the components in the fuel system must be in good working condition and the carburetor must be properly adjusted for efficient generator set operation. See the following sections for servicing each of these components.

Air Filter Assembly

Service the air filter at the intervals recommended in the Operator's Manual. In dusty conditions, service the air filter more often. When replacing the air filter, use only an Onan-approved filter. **Standard Series gensets: Consult the air filter instructions in the Briggs and Stratton operator's manual included with the generator set.**

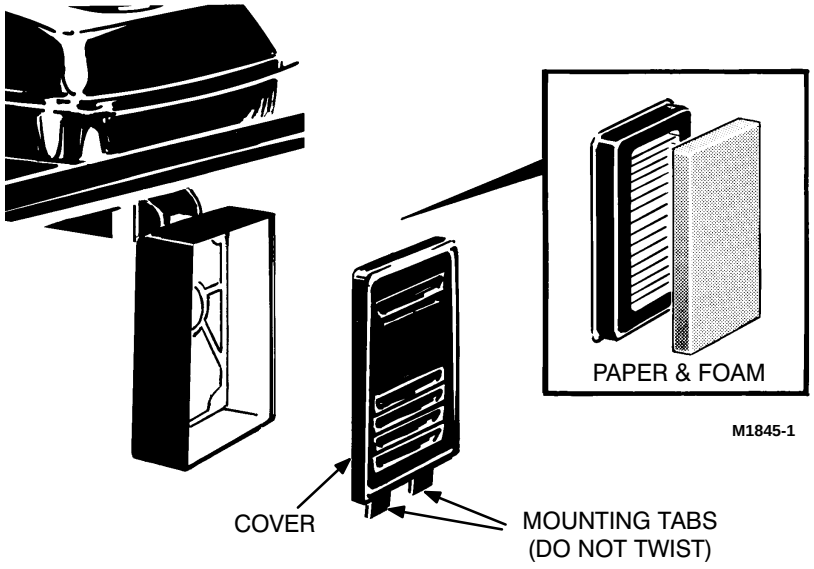
There are three types of air filter assemblies used on these models: foam filter only, foam wrapper on paper element, and paper element only. Follow the filter service procedures that apply to the filter system on the generator set.

1. Carefully remove the air cleaner cover and remove the air cleaner element.
2. Follow the service procedures listed by the type of filter used.

   Foam Wrapper On Paper Filter: Remove foam wrapper and wash in detergent and water. Dry foam wrapper thoroughly. Use low pressure air on the inside of the paper element to remove dust and dirt. Replace paper element at every sixth cleaning or sooner if dusty operating conditions exist.

   Paper Filter Only: Use low pressure air on the inside of the paper element to remove dust and dirt. Replace paper element at every sixth cleaning or sooner if dusty operating conditions exist.
3. Reassemble filter into the housing and carefully install the air cleaner cover.

GH170 AND GH280 ENGINES



ELITE E140H ENGINE

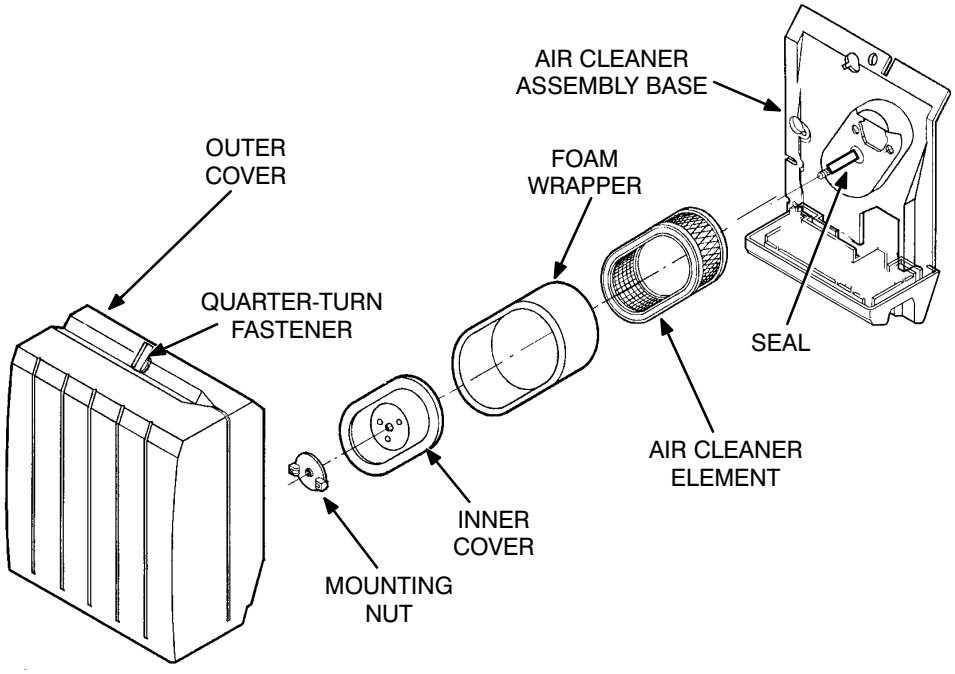


FIGURE 6-11. AIR FILTER REPLACEMENT

Fuel Filter Replacement

⚠WARNING ***Fuel presents the hazard of fire or explosion that can cause severe personal injury or death. Do not permit any flame, spark, pilot light, cigarette, arcing switch or equipment, or other ignition source near the fuel system. Inspect for fuel leaks any time service is performed on the fuel system. Keep a fire extinguisher rated ABC near work area.***

Clean or replace the fuel filter at the interval recommended in the Maintenance Schedule or if performance problems occur and bad fuel is suspected.

Gensets 4.0 kW And Below:

1. Turn the fuel supply valve to the closed position and allow the set to operate until it runs out of fuel. Let the generator set cool down before proceeding.
2. Remove the fuel line from the fuel shutoff valve and collect the fuel in a suitable container.
3. See Figure 6-12. Unscrew the sediment bowl from the fuel supply valve and clean it.
4. Remove the screen and clean any dirt and particulate off the screen.
5. Reinstall the screen and sediment bowl. Attach the fuel line securely to the fuel shutoff valve.

5.0 And 6.0 kW Gensets:

These sets have a fuel filter screen mounted inside the gas tank at the fuel shutoff elbow. The screen should be replaced when performance problems occur or bad fuel is suspected.

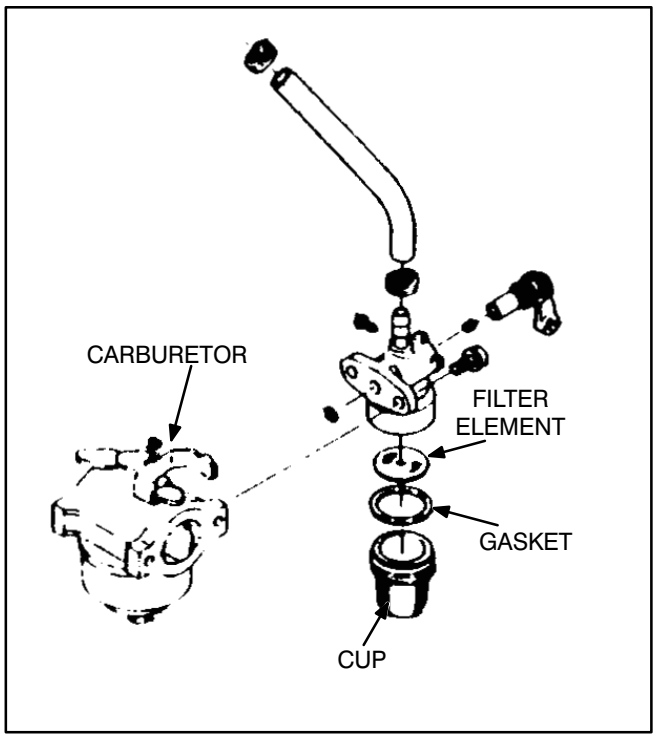


FIGURE 6-12. FUEL FILTER REPLACEMENT, GH170 AND GH280 ENGINES

Carburetor

Under normal circumstances, fuel mixture adjustments should not be attempted. Nor should the carburetor be overhauled. Instead, a malfunctioning carburetor should be replaced. See CARBURETOR REMOVAL / INSTALLATION in this section.

On the 5.0/6.0 Pro portable, the carburetor main fuel jet (fixed-type) may be replaced with the optional high-altitude jet if the engine is operated at an altitude above 5000 feet [1524 meters]. See the Elite E125H/E140H Service Manual (p.n. 965-0758) for instructions.

⚠WARNING ***Fuel presents the hazard of fire or explosion that can cause severe personal injury or death. Close the fuel valve and drain the fuel from the float chamber when servicing carburetor. Do not permit any flame, spark, pilot light, cigarette, or other ignition source near the fuel system. Keep an ABC type fire extinguisher nearby.***

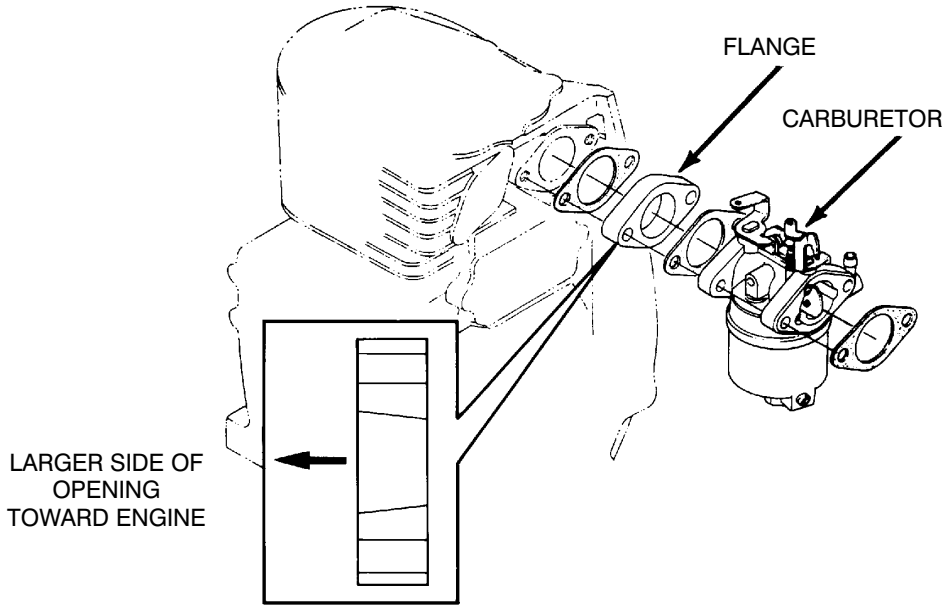
Carburetor Removal:

Refer to Figure 6-13. Remove the air cleaner assembly. Disconnect the governor linkage, fuel line, throttle linkage, and choke control linkage. Remove the carburetor assembly from the intake elbow.

Carburetor Replacement:

Install the carburetor assembly on the intake elbow. Tighten the through bolts as specified in *Section 4. Assembly Torques.* Connect choke control linkage, throttle linkage, fuel line, and governor linkage. Make sure the breather tube and rubber seal are installed properly. Install the air cleaner assembly as instructed in this section. Always use new gaskets when installing a carburetor.

GH170 AND GH280 ENGINES



ELITE E140H ENGINE

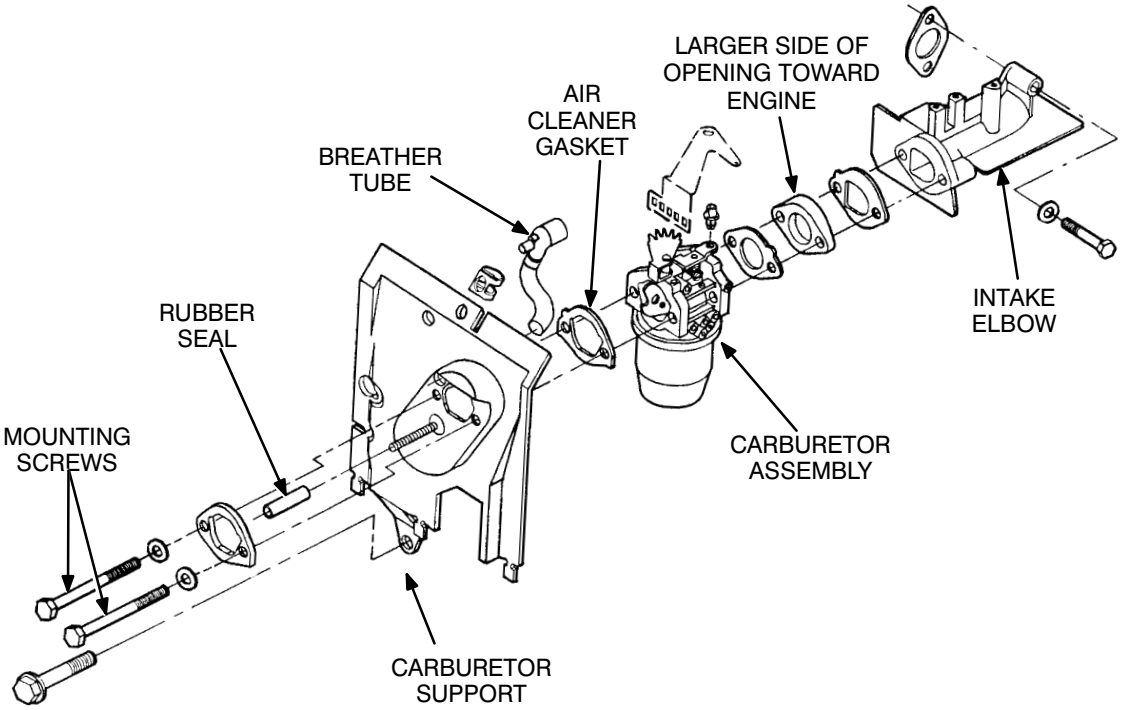


FIGURE 6-13. CARBURETOR REMOVAL/REPLACEMENT

RECOIL AND ELECTRIC STARTING SYSTEMS

Recoil Starter

NOTE: Maintenance of the recoil starter on the Standard series portable gensets will be performed by Briggs and Stratton service personnel.

Recoil starters are included with each of the portable models, including the electric start models. If the starter rope or recoil spring require service, carefully follow the instructions listed below. The following instructions are for a typical recoil starter, some design variations occur between models and attention should be paid to the disassembly process to help in reassembly.

⚠WARNING ***Contact with sharp or moving parts can cause severe personal injury. Work carefully and wear protective eye wear, gloves, and clothing when working on the recoil starter due to the possibility of sharp flying and rotating parts.***

Recoil Starter Disassembly:

1. Remove the recoil starter assembly from the spiral case (Figure 6-14) and check operation. If the recoil starter operates properly and the engine was difficult to turn over, the problem could be in the Engine Block Assembly (see engine manuals).
2. Slowly pull the starter rope out by its handle until it is all the way out. Note the number of revolutions required to pull rope all the way out.
3. Hold the reel with pressure in the direction of the arrow shown in Figure 6-15 to prevent it from unwinding. Remove the rope from the reel, keep pressure on the reel and carefully allow the reel to slowly unwind until it stops rotating.

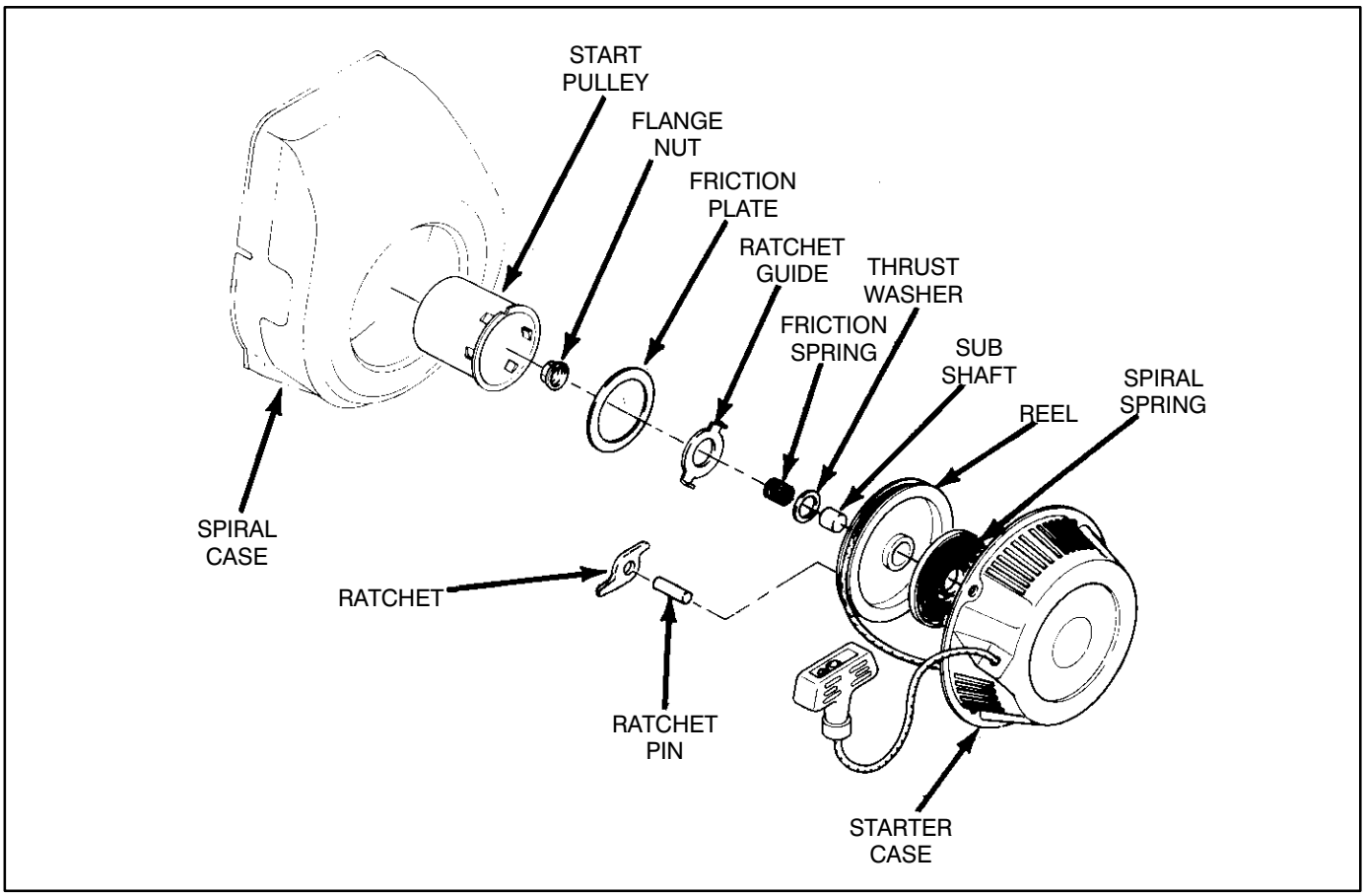


FIGURE 6-14. TYPICAL RECOIL STARTER ASSEMBLY

4. If rope replacement is all that is needed, proceed to step 5 of the assembly section. If spring replacement is necessary proceed to step 5 of this section.

   ⚠WARNING ***Moving parts can cause severe personal injury. Do not proceed without using protective eye wear, gloves and clothing.***

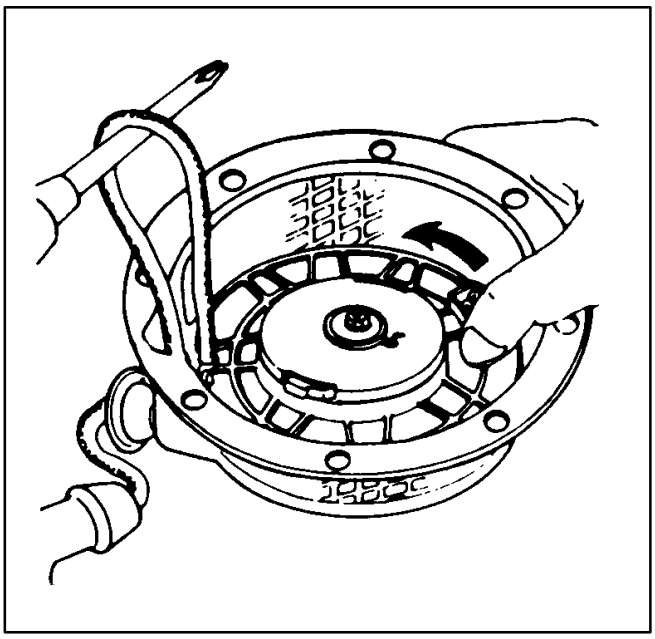


FIGURE 6-15. STARTER ROPE REMOVAL

5. Remove the friction plate mounting nut, friction plate, ratchet guide, ratchet, and friction spring (Figure 6-14).
6. Proceed carefully because the spiral spring is always under tension and it can spring out (unwind) when lifting the reel. Slowly lift out the reel while rotating it slightly clockwise and counterclockwise to disengage the spiral spring from the spring hook. Note the direction that the coil is wound.
7. Carefully remove the spring and replace it in the same direction that it came out according to the assembly instruction in the following section.

Recoil Starter Assembly:

⚠WARNING ***Moving parts can cause severe personal injury. Do not proceed without using protective eye wear, gloves and clothing.***

1. Engage the outer end of the spiral spring in the notch in the recoil starter and rewind the spring into the reel.
2. If the outer end of the spiral spring projects outward after winding the spring, bend the end inward. Make sure inner end of the spiral spring will come in contact with the shaft.
3. Apply heat resistant grease to the spring.
4. With the reel and spiral spring in alignment with the starter shaft, install the reel. Install the friction spring, ratchet guide, ratchet, friction plate and mounting nut on the starter shaft. Secure clutch plate mounting nut (Figure 6-14).
5. Carefully wind the reel in the direction shown in Figure 6-15 the number of revolutions counted during disassembly. Hold the reel to prevent it from unwinding.
6. Install the starter rope by threading it through the reel and out the opening in the starter case. Secure the rope to the starter handle and allow the starter coil to slowly unwind.
7. Check ratchet operation before installing the recoil starter on the generator set.

Electric Starter

A 12-volt electric starter with negative ground is used for cranking the generator set on certain models. Because the starter is an integral part of the set control system, check the control circuitry (refer to the Control section) before servicing the starter. Test the starter and starter solenoid prior to disassembling the starter for service. Use the following procedures to disassemble, inspect, and reassemble the starter.

Starter Test (GH280 Engine):

1. Disconnect the battery and control leads from the starter and starter solenoid (tag leads).
2. Remove the starter assembly from the generator set.
3. Disconnect the lead from the “C” terminal of the starter.

4. Connect a jumper lead from the battery positive (+) to the lead removed in step 3 (Figure 6-17).

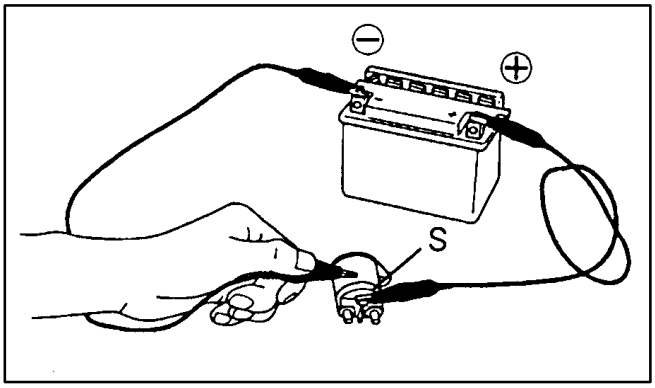


FIGURE 6-16. STARTER MOTOR TEST, GH280 ENGINE

5. Connect a jumper lead momentarily between the starter body and the negative (-) battery terminal.
6. If the motor does not run, proceed to Starter Service. If the motor does run, proceed to the Starter Solenoid Test.

Starter Solenoid Test (GH280 Engine):

1. Connect a jumper lead between the battery positive (+) terminal and the starter solenoid "S" terminal (Figure 6-17).

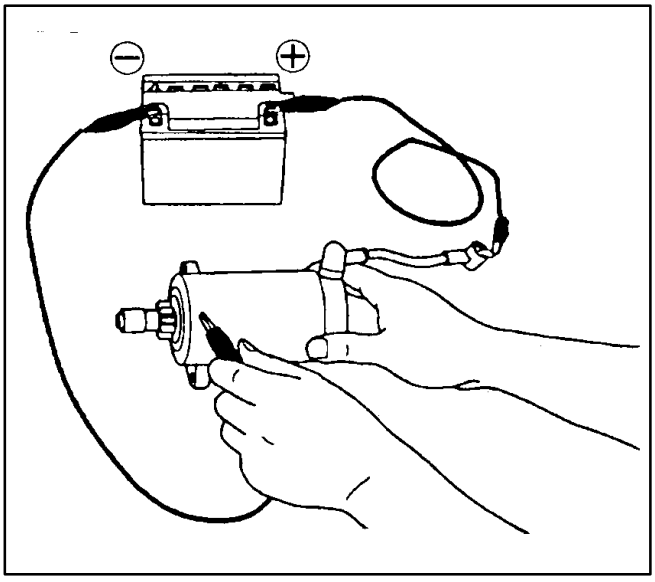


FIGURE 6-17. STARTER SOLENOID TEST, GH280 ENGINE

2. Momentarily connect a jumper lead between the battery negative (-) terminal and the solenoid body. The solenoid contacts should close. If the solenoid does not activate, replace it.

Starter and Solenoid Test (Elite E140H Engine):

See Figure 6-18. Before removing a starter because the engine does not crank:

1. Make sure that the battery is fully charged and that the connections are clean and tight and that the battery cables are in good condition. If it is necessary to reconnect the battery, connect the positive (**+**) battery cable first.
2. Disconnect the spark plug cable so that the engine will not start. Then bypass the start circuit with a jumper between the Start and the Battery Positive (**+**) terminals on the solenoid (Figure 6-18). If the engine cranks, the solenoid and starter are probably okay. If the engine does not crank, go to Step 3.
3. Bypass the starter solenoid with a jumper between the Motor and the Battery Positive (**+**) terminals on the solenoid (Figure 6-18). If the motor responds, it is probably okay and it may only be necessary to replace the solenoid.

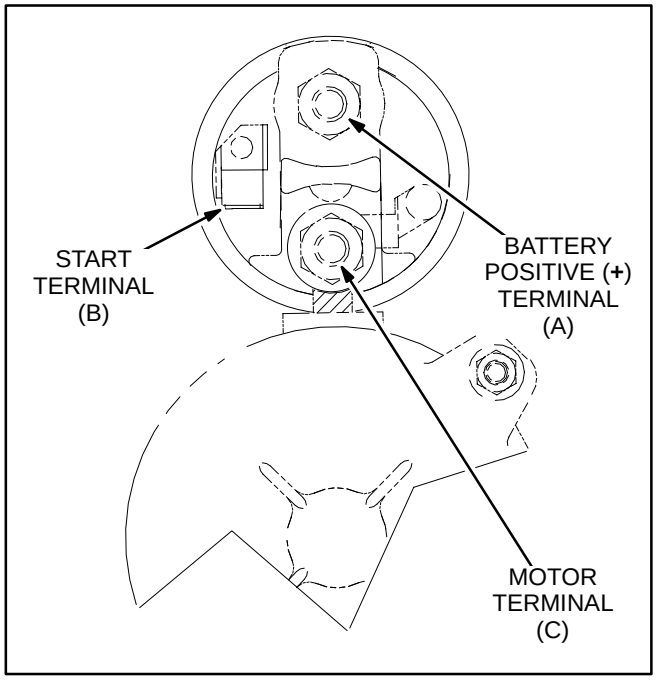


FIGURE 6-18. STARTER SOLENOID TERMINALS, ELITE E140H ENGINE

⚠WARNING ***Accidental starting of the engine can result in severe personal injury or death. Disconnect the negative (-) battery cable and spark plug wire before servicing the engine, controls, or associated equipment.***

Starter Disassembly/Assembly:

To completely disassemble the starter, refer to Figures 6-19 or 6-20. Be careful when removing the brush and commutator to avoid damage. The brush springs are under tension and should be removed carefully.

⚠WARNING ***Contact with moving parts can cause severe personal injury. Work carefully when disassembling the starter because it contains springs that are under tension. Wear protective eye wear during service.***

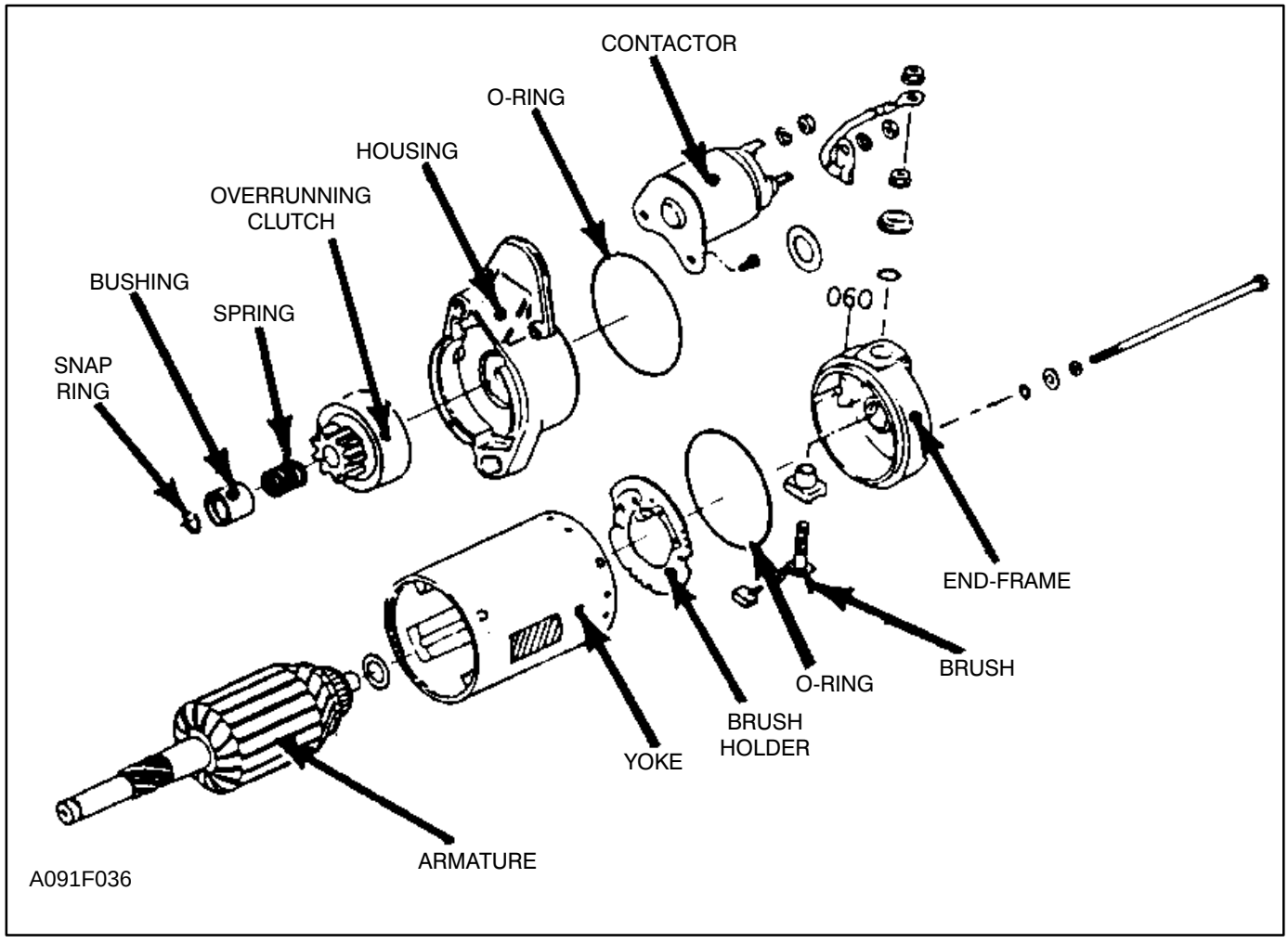


FIGURE 6-19. STARTER ASSEMBLY, GH170 AND GH280 ENGINES

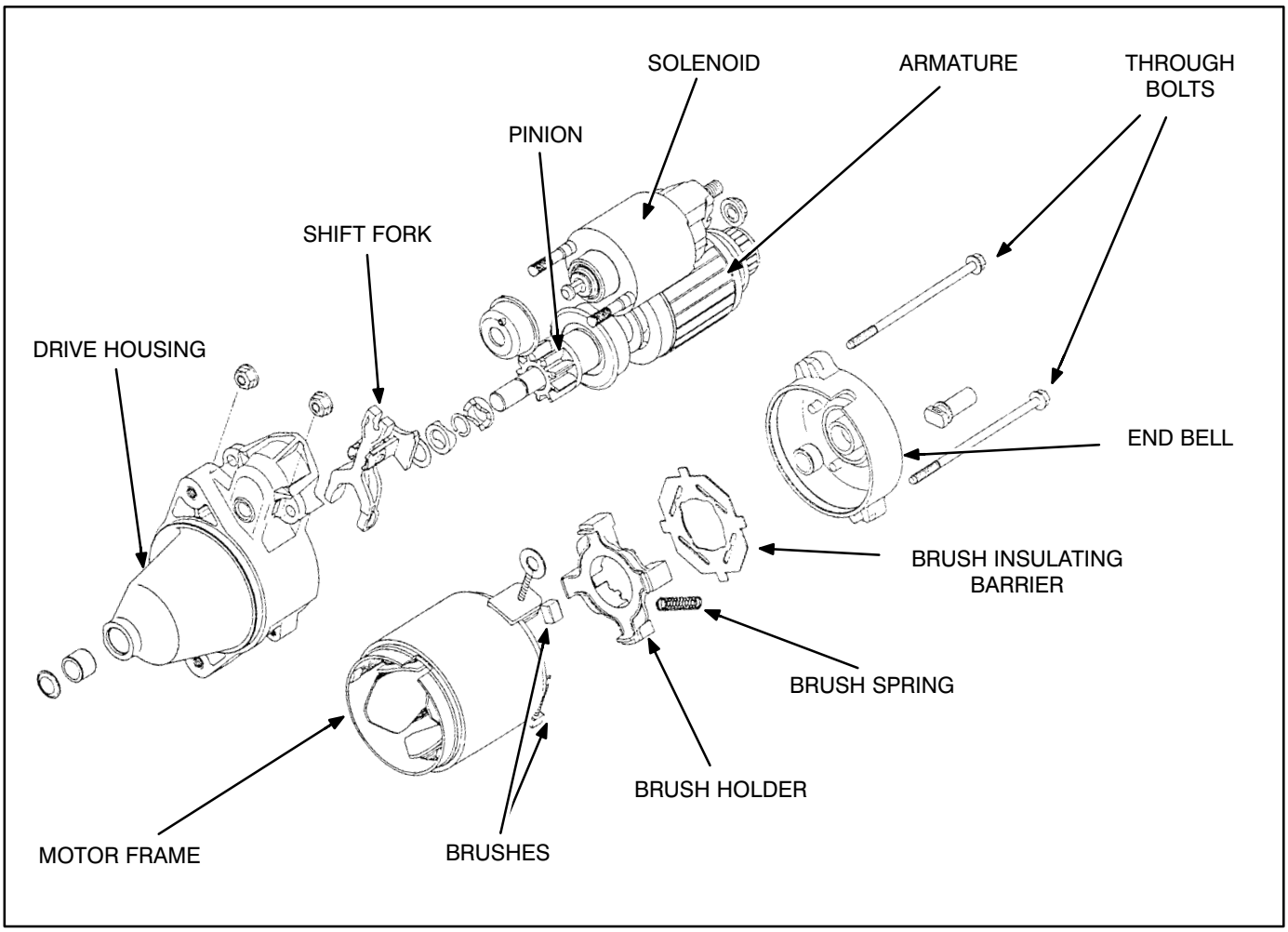


FIGURE 6-20. STARTER ASSEMBLY, ELITE E140H ENGINE

Checking Starter Components

Overrunning Clutch

1. Check the clutch for smooth operation (Figure 6-21).
2. The overrunning clutch should engage and rotate with the pinion shaft and disengage in reverse.

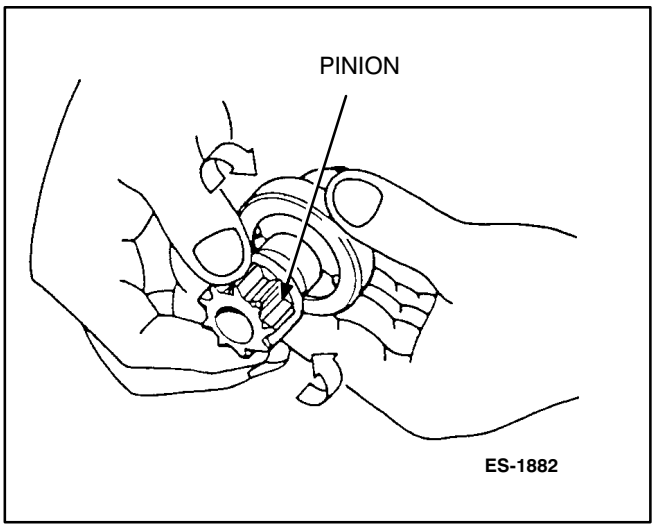


FIGURE 6-21. OVERRUNNING CLUTCH

Armature:

1. Use an ohmmeter to check for continuity between the armature segments as shown in Figure 6-22.
2. Continuity should be measured between each of the segments. If any of the segments are open, replace the armature.

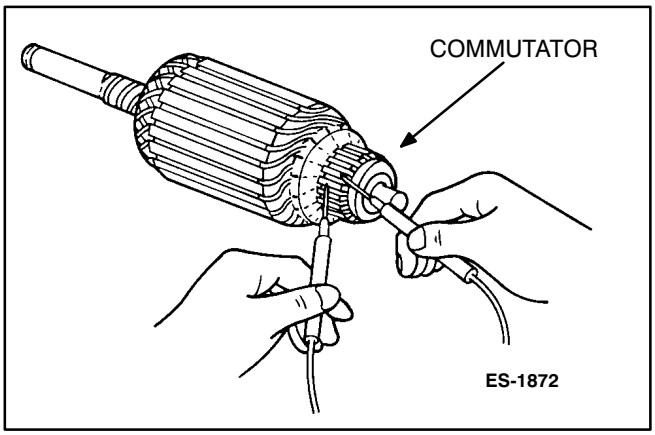


FIGURE 6-22. MEASUREMENT BETWEEN COMMUTATOR SEGMENTS

3. Measure continuity between the commutator segments and the armature coil core (Figure 6-23), and between commutator segments and the armature shaft (Figure 6-24).
4. If continuity is measured between the commutator segments and the armature coil core or armature shaft, replace the armature.

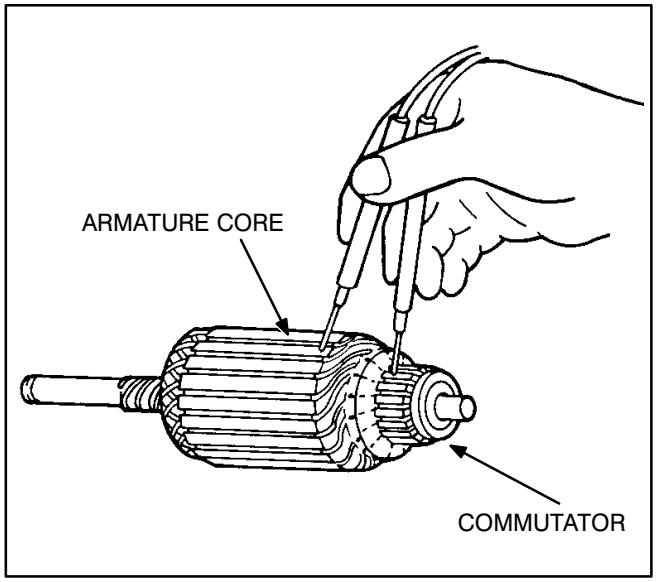


FIGURE 6-23. COMMUTATOR TO CORE MEASUREMENT

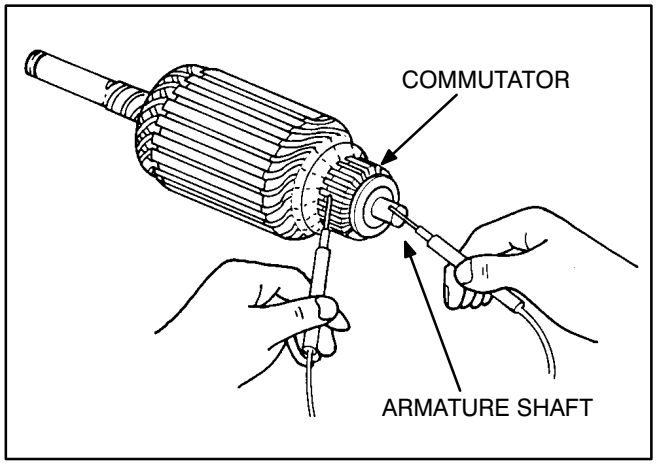


FIGURE 6-24. COMMUTATOR TO SHAFT MEASUREMENT

5. Check for continuity between the armature coil core and the armature shaft (Figure 6-26). If continuity is measured replace the armature.

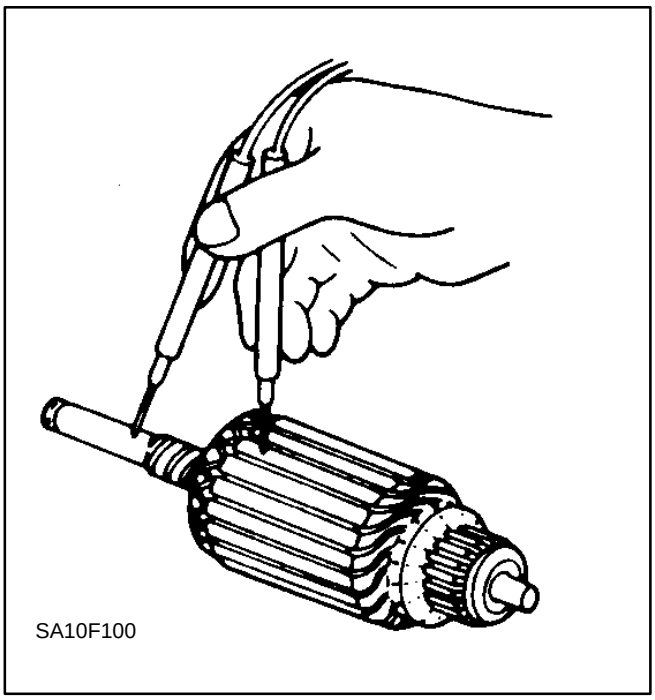


FIGURE 6-25. ARMATURE CORE TO SHAFT MEASUREMENT

Brush Wear:

1. Measure the brush length, dimension “A” in Figure 6-26.
2. If the length is less than 0.366 in (9.3 mm) on GH280 engine starter or 0.236 in (6.0 mm) on Elite E140H engine starter, replace the brush holder assembly.

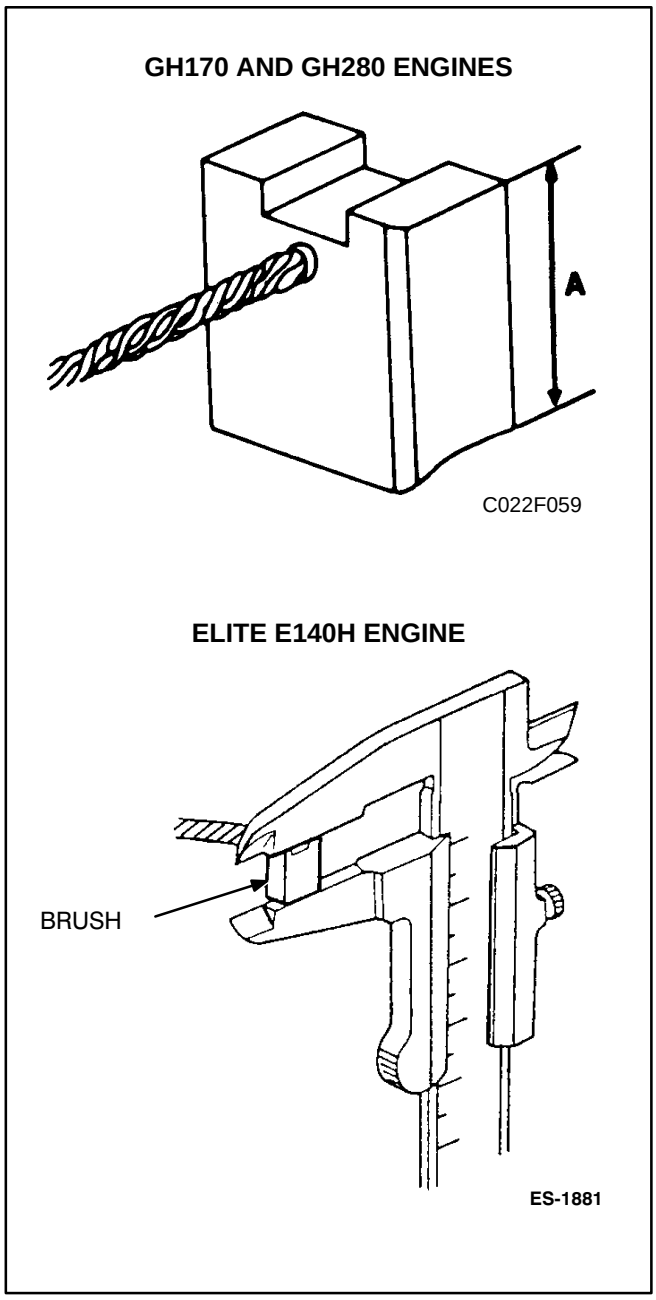


FIGURE 6-26. BRUSH LENGTH

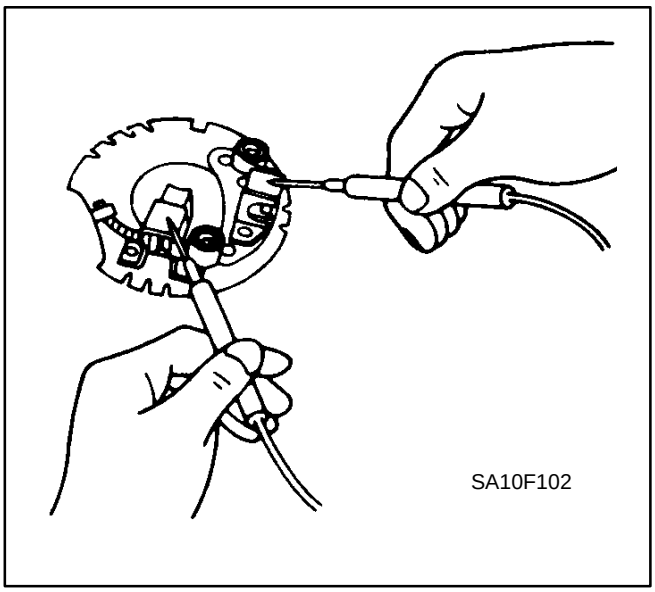


FIGURE 6-27. BRUSH HOLDER CHECK

Commutator and Mica:

1. If the commutator surface is dirty or dusty, clean it with sandpaper.
2. Measure the commutator O.D. at several points with a vernier caliper (Figure 6-28).
3. If the minimum O.D. is less than 1.039 in (26.4 mm) on GH280 engine starter or 1.063 in (27 mm) on Elite E140H engine starter, replace the armature.
4. If the difference between measurements exceeds 0.016 in (0.4 mm), correct the commutator on a lathe.

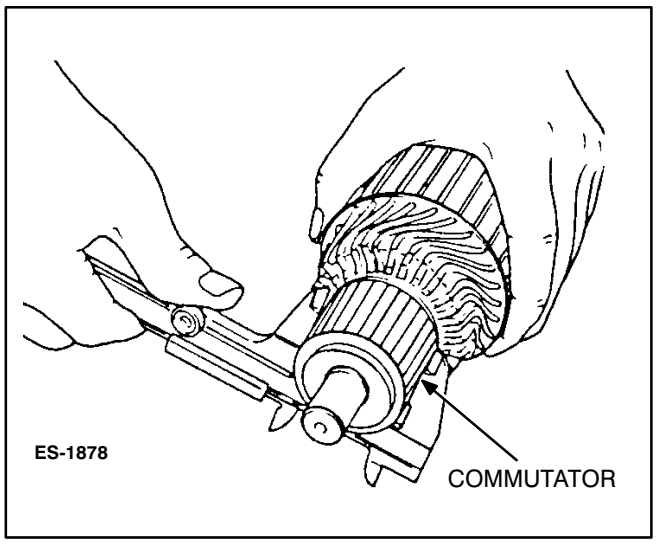


FIGURE 6-28. MEASURING COMMUTATOR O.D.

5. Measure the mica undercut depth (Figure 6-29).
6. If the undercut depth is less than 0.0079 in (0.2 mm), use a saw blade to undercut the mica between the segments.

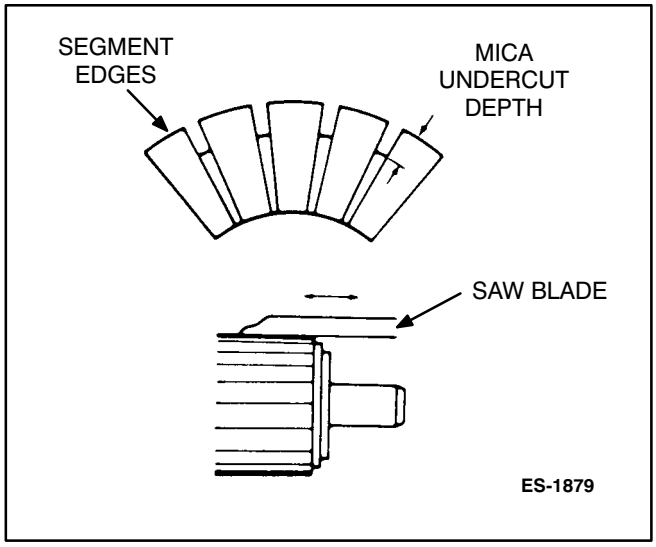


FIGURE 6-29. MICA UNDERCUT SERVICE

Field Coil (Elite E140H Engine):

1. Check continuity across the yoke and brush with an ohmmeter (Figure 6-31). If continuity is not measured, replace the yoke assembly.

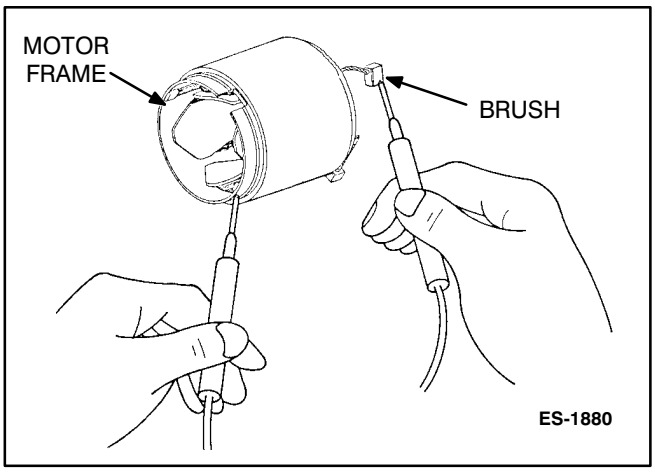


FIGURE 6-30. FIELD COIL CHECK

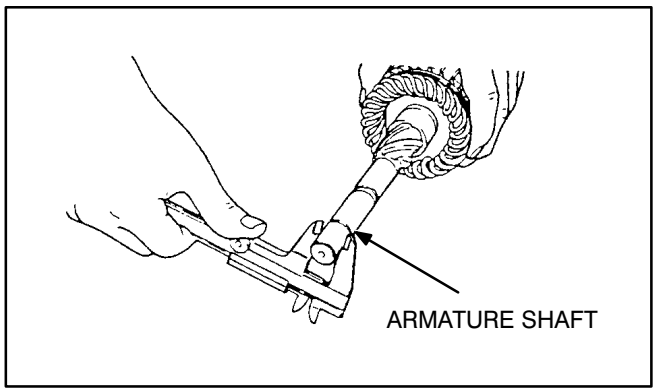


FIGURE 6-32. MEASURING ARMATURE SHAFT O.D.

Armature Shaft Bushings (Elite E140H Engine):

1. Measure the bushing I.D. on the front and rear bushing (Figure 6-31).
2. Measure the armature shaft O.D. on both ends (Figure 6-32).
3. If the clearance exceeds 0.0079 in (0.2 mm) replace the bushing.

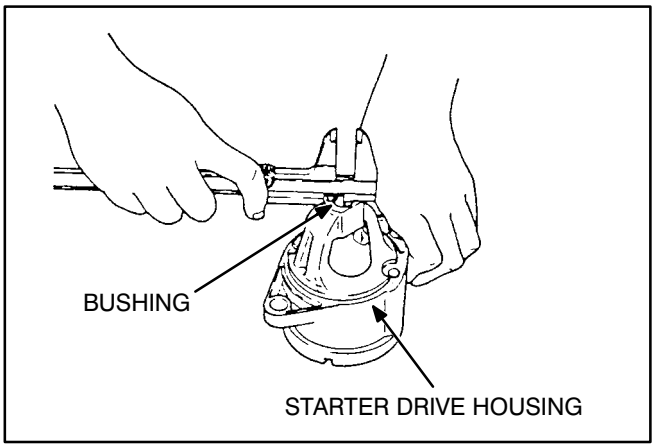


FIGURE 6-31. MEASURING BUSHING I.D.

LUBRICATION SYSTEM

NOTE: Maintenance of the lubrication system on the Standard series portable gensets will be performed by Briggs and Stratton service personnel.

Oil Pump (Elite E140H Engine)

See the Elite Engine Service Manual for information on the oil pump.

Oil Watch System

The gensets use an oil watch system that is designed to prevent engine damage due to a low oil level (or low oil pressure on sets using the Elite E140H engine). The design of the oil watch system varies with engine size and type. Figure 6-39 shows a typical oil watch system. Each system consists of an oil watch unit, an LED lamp, and an oil level switch or oil pressure switch, except the Elite E140H engine which does not have an LED lamp.

Oil Level Switch:This uses a float to monitor the oil level in the crankcase. When the oil level goes below the normal working level, the float moves down and closes the switch. A continuity test of the switch can be made between the lead from the oil level switch and ground. The meter will indicate an open circuit when the crankcase has a sufficient oil level and indicate a short when the oil level is below the normal working level.

Oil Pressure Switch (Elite E140H): This senses crankcase oil pressure and closes its contacts when the crankcase oil pressure goes below 1 psi.

Oil Watch Unit: When the oil level switch closes, the ignition voltage, from the primary of the ignition coil, is grounded through the oil watch unit and the oil level switch causing the engine to stop. At the same time the oil watch unit, powered by the voltage from the ignition coil, sends a signal to the LED lamp causing it to illuminate, indicating that the oil level is low.

Oil Watch Unit (Elite E140H): has a built-in time delay of approximately 15 seconds that prevents the engine from being shut down before the oil pump has enough time to build up oil pressure. After the delay, if the oil pressure is not at least 1 psi, the low oil pressure switch will ground the ignition voltage and cause the engine to stop. Figure 6-34 depicts the components of the E140H oil pressure monitoring system.

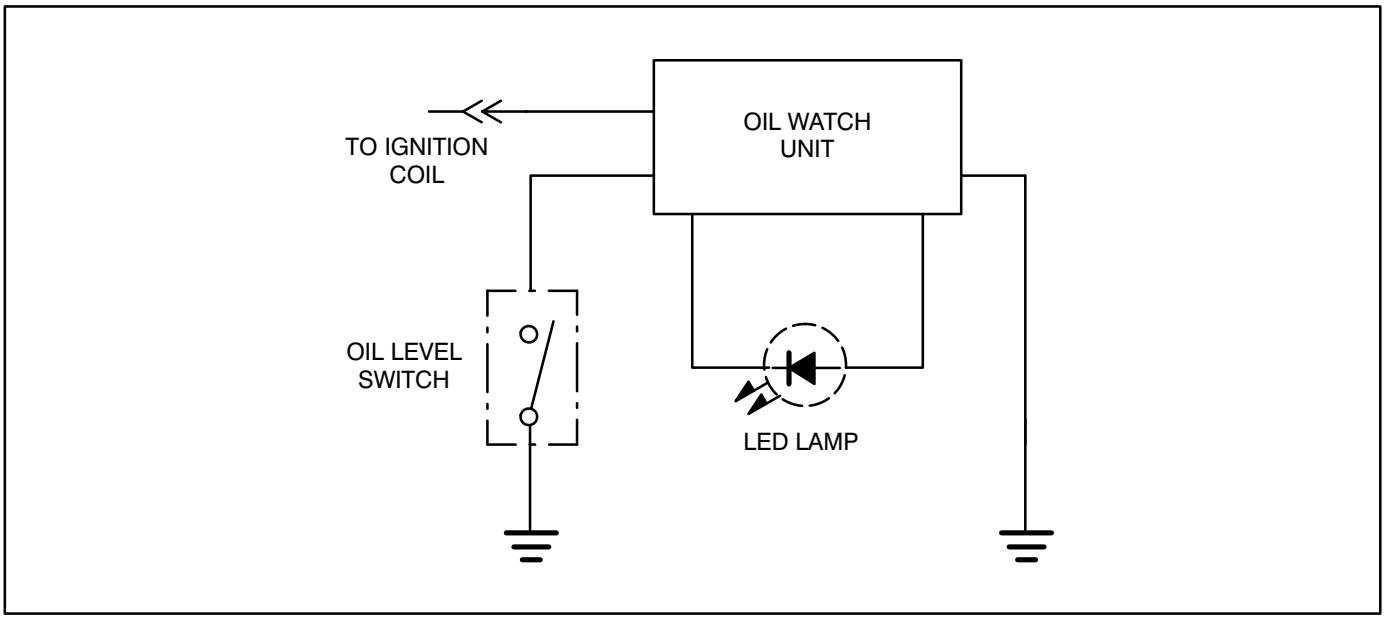


FIGURE 6-33. TYPICAL OIL WATCH SYSTEM

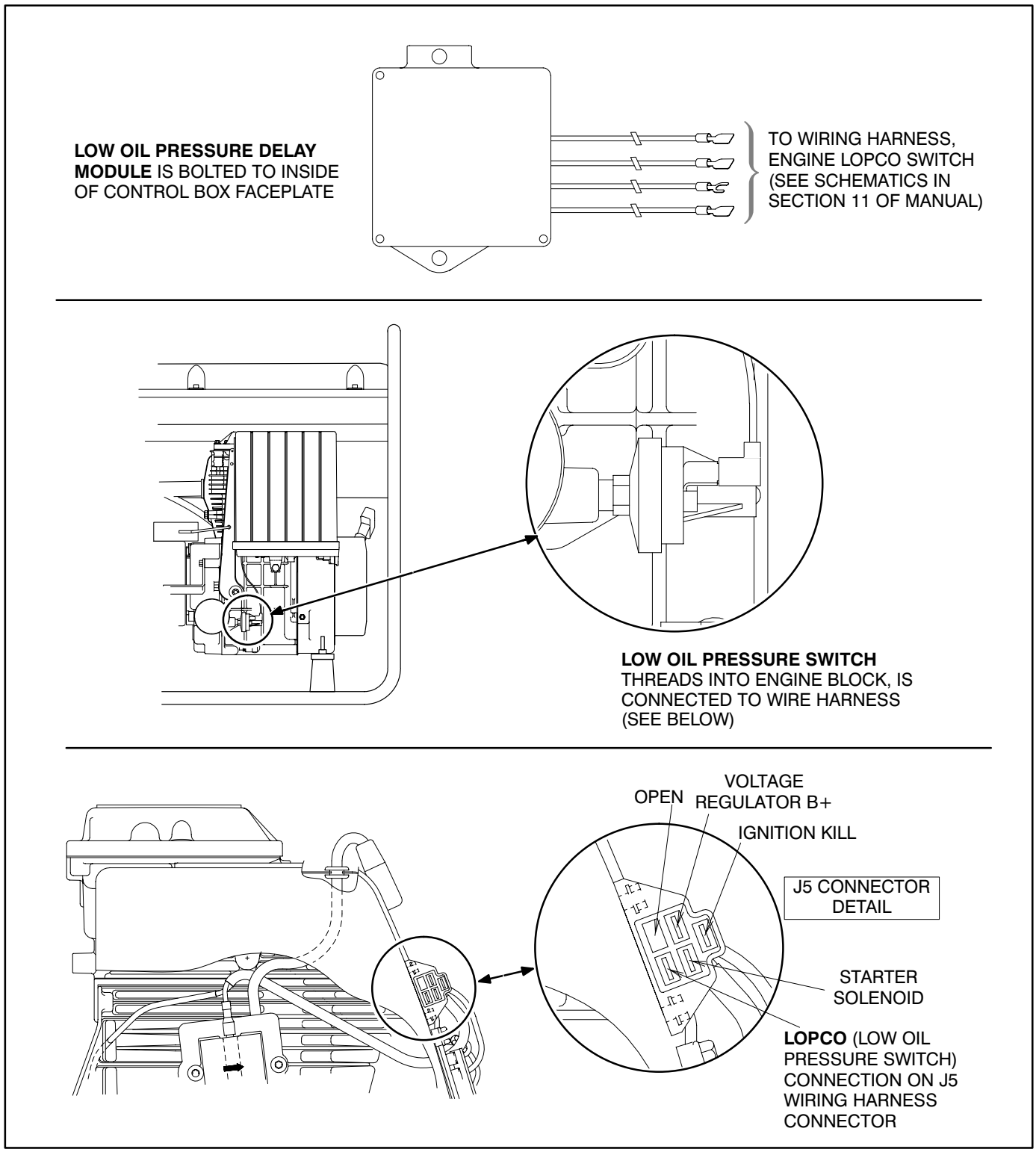


FIGURE 6-34. OIL PRESSURE CONNECTIONS (E140H ILLUSTRATED)

Section 7. Control

INTRODUCTION

The control system includes all the functions that relate to starting, monitoring for fault conditions, instrumentation, battery charging, and stopping.

STANDARD SERIES GENSETS

Note that most of these functions are found on the Pro series of portable generator sets only. **The only components found on the Standard series control panels are circuit breakers and output receptacles.**

CONTROL PANEL (PRO SERIES GENSETS)

This section describes generator set controls for all models. Some control features are not available on certain sets. Review the control descriptions that apply to your specific model.

Control Components

On/Stop Switch (Manual Start Models): Starts the set when the switch is in the On position. Stops engine operation when held in the Stop position.

Start/On/Stop Switch (Electric Start Models): Pushing switch into the Start position begins engine cranking. When engine starts, release the switch and it will return to the On position. To stop the engine, hold the switch in the Stop position until the engine stops running.

Low Oil Light: Indicates low engine oil level. Low Oil Light will flash during cranking (except engine) or will flash during operation (except Elite E140H engine) and the generator set will stop if the engine oil level or pressure is below the low working level.

Voltmeter: Indicates generator AC output line voltage.

AC and DC Circuit Breakers: Provide protection for the generator from short circuits or overloads.

Full Power Switch: Allows operator to select full power operation from the 120 VAC receptacles or shared power between the 120 VAC and 240 VAC receptacles. Switch setting also affects voltmeter readings; refer to voltmeter description.

Idlematic Switch: Automatic engine speed control. In the On position, the engine operates at idle speed until a load is applied. The Idlematic automatically increases the engine to full speed when a load is applied. This feature reduces engine wear and conserves energy. In the Off position the engine operates at full speed.

Additional Controls

Fuel Valve: Controls fuel flow to engine. Setting fuel valve to Open position allows fuel to flow to engine. Set fuel valve to Closed position when generator set is not in use.

Choke Lever: Restricts air flow to the carburetor for starting a cold engine.

Speed Control Lever: Sets engine speed. This lever should be maintained in the high speed (“H”) position at all times. Periodically check setting to make sure it is in the proper position.

CONTROL OPERATION

This section describes the control operation for both the electric start and recoil start models. Follow the control operation that is similar to your specific model. Refer to the schematic diagram for your specific model to help follow the circuit description (see Section 11). For actual engine starting, refer to the Operator’s Manual to review important safety precautions and operating instructions.

Electric Start

Holding the Start/On/Stop switch in the Start position connects battery positive (B+) to the start solenoid. The solenoid energizes and closes the solenoid switch. The solenoid switch connects battery positive (B+) to the starter and the engine begins to crank. As the engine starts to run, the Start/On/Stop switch should be released. The switch will automatically return to the center (On) position and the engine will continue to run. In the On position, power is no longer connected to the starter solenoid and the solenoid switch opens removing power from the starter motor.

Electric start models can also be recoil started when the start/on/stop switch is placed in the On position.

Recoil Start

Move the On/Off switch to the On position. This opens a ground path from the Ignition Control Unit and allows ignition spark to develop in the magneto-type ignition when the recoil starter is pulled.

Oil Watch

The Oil Watch monitors the engine oil level or pressure. If the engine oil level is low, the Oil Watch indicator illuminates (except on the Elite E140H engine) and the Oil Watch grounds the output from the Ignition Control Unit to stop the engine.

Battery Charge Circuit - Electric Start Models Only

The charging circuit supplies battery charge voltage. It consists of an AC output voltage from the Ignition Control Unit. The output is rectified to DC by a diode, or a voltage regulator on Elite E140H engines. This charges the battery at a variable rate (1 ampere maximum, or 5 amp maximum on Elite E140H engines), during set operation. The charge rate varies with the generator load and battery condition.

Stopping

Holding the Start/On/Stop or On/Stop switch (depending on model) in the Off position causes the output from the Ignition Control Unit to be grounded. This eliminates ignition voltage and stops the engine. If switch does not stop engine, check to make sure switch wiring is making proper contact.

CONTROL TROUBLESHOOTING

Use the following troubleshooting guide to help locate problems related to the control components only. Refer to the appropriate wiring diagram in Section 11 for wiring terminal identification.

The troubleshooting guide covers both the electric start models and the recoil start models. After identifying the problem, refer to the guide for the possible cause and the recommended corrective action.

Always refer to the specific wiring diagram that corresponds to the model number of the generator set when troubleshooting.

TABLE 7-1. CONTROL TROUBLESHOOTING

⚠**WARNING** ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***

Trouble	Possible Cause	Corrective Action
Engine Does Not Crank (Electric Start Models Only)	1. Defective Start/On/Stop switch.	1. Check switch for continuity and replace if defective.
	2. Open circuit in wiring between Start/On /Stop switch and starter solenoid or between battery and starter.	2. Check wiring and connections for continuity and repair if defective.
	3. Insufficient voltage for cranking due to: a. Battery not charged, or b. terminal connections loose or dirty c. defective charge circuit d. defective Ignition Control Unit charge circuit.	3a. Check condition of battery and recharge or replace as needed. 3b. Clean and tighten battery cable connections, starter connections and ground connections. 3c. Check diode and replace if defective. 3d. Refer to Section 6, Engine - Primary Systems for test procedures.
	4. Defective starter solenoid or starter.	4. Refer to Section 6, Engine - Primary Systems for test procedures.
Engine Does Not Start (Recoil Start Models Only)	1. Defective On/Stop or Engine On/Off switch.	1. Check switch for continuity and replace if defective.
	2. Open circuit in wiring between On/Stop or Engine On/Off switch.	2. Check wiring and connections for continuity and repair if defective.
	3. Defective Ignition Module	3. Refer to Section 6, Engine - Primary Systems for test procedures.
	4. Low oil level	4. Check oil level and fill if necessary.
Full Power Switch Does Not Function Properly	1. Defective Full Power switch	1. Check switch for continuity and replace if defective
	2. Wire connections to Full Power switch are not making contact or are miswired.	2. Check for good wire connections and compare connections with wiring diagram in Section 11.

Trouble	Possible Cause	Corrective Action
Idlematic Does Not Operate (Only used on certain models)	1. Defective Idlematic switch.	1. Check switch for continuity and replace if defective.
	2. Wire connections to Idlematic switch, Idlematic Control, or Idlematic Solenoid are not making contact or are miswired	2. Check for good wire connections and compare connections with wiring diagram in Section 11.
	3. Defective Idlematic Solenoid	3. Check Idlematic solenoid for a binding plunger movement.
	4. Defective Idlematic Control	4. Check to see that the appropriate generator leads pass through the current transformer. Test Idlematic Control.
Engine Cannot Be Turned Off With Switch	1. Defective Start/On/Stop switch, On/Start switch, or Engine On/Off switch.	1. Check switch for continuity and replace if defective.
	2. Open circuit in switch wiring.	2. Check wire connections to switch.

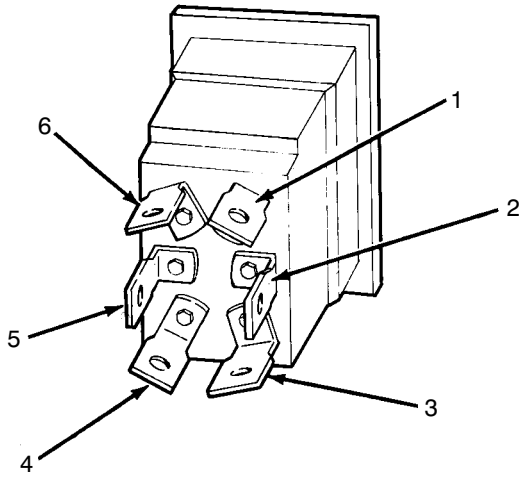
CONTROL TESTS

The following control component checks are an aid to isolating faulty components. Disconnect battery leads (electric start models) before servicing. Always disconnect the negative (-) battery cable first to reduce the risk of arcing.

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on the inside cover page.***

Start/On/Stop Switch

Remove the control panel mounting screws and pull the panel forward. Disconnect and tag the wires from the switch and connect an ohmmeter to the contacts shown in Figure 7-1. Continuity should be measured between terminals 1-2 and 5-6 when the switch is held in one direction and between 2-3 and 4-5 when the switch is held in the other position. Infinity should be measured between each of these pairs of contacts when the switch is released to its normally open center position. If an abnormal reading is measured replace the switch.



SWITCH HELD IN ONE DIRECTION:
CONTINUITY BETWEEN TERMINALS **1-2, 5-6**

SWITCH HELD IN OPPOSITE DIRECTION:
CONTINUITY BETWEEN TERMINALS **2-3, 4-5**

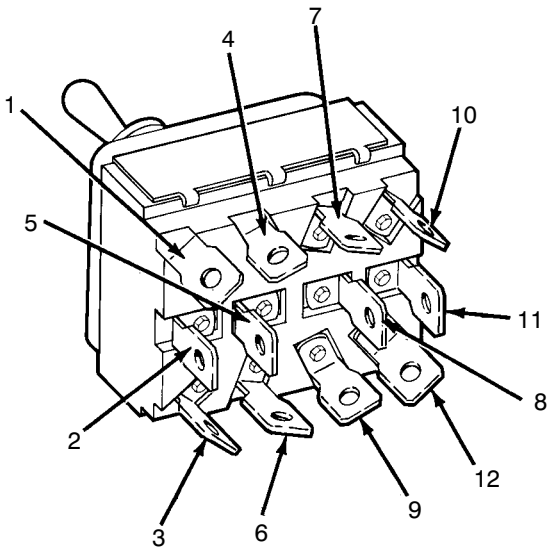
FIGURE 7-1. START/ON/OFF SWITCH TEST

On/Stop Switch

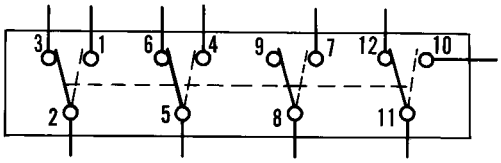
Remove the control panel mounting screws and pull the panel forward. Disconnect the wires from the switch and connect an ohmmeter between the two contacts on the rear of the switch. The meter should indicate infinity when the switch is in the On position and continuity when the switch is in the Stop position. If an abnormal reading is measured replace the switch.

Full Power Switch

Remove the control panel mounting screws and pull the panel forward. Disconnect and tag the wires from the switch. Connect an ohmmeter to each set of contacts shown in Figure 7-2.



FULL POWER SWITCH
(REAR VIEW)



FULL POWER SWITCH CONTACTS SHOWN
IN FULL POWER (AC 120V) POSITION

FIGURE 7-2. FULL POWER SWITCH TEST

Idlematic Switch

Remove the control panel mounting screws and pull the panel forward. Disconnect the wires from the switch and connect an ohmmeter between the two contacts on the rear of the switch. The meter should indicate continuity when the switch is in the On position and infinity when the switch is in the Off position. If an abnormal reading is measured replace the switch.

Idlematic Control and Idlematic Solenoid

When the Idlematic switch is set to On and the generator set is running at no-load, the Idlematic Control should sense the no load condition and supply the Idlematic Solenoid with 9 to 17 VDC. The solenoid should pull on the governor arm to reduce the engine speed. If the Idlematic switch checks good, check for free movement of the solenoid plunger. Also check all wire connections to the Idlematic Control, Idlematic Switch and Idlematic Solenoid. If plunger movement is good and the wiring is good, prepare to measure DC voltage at solenoid.

⚠WARNING ***Electrical shock can cause severe personal injury or death. Use extreme caution when working on electrical circuitry. Attach and remove meter leads only when generator set is not operating. Do not touch meter or meter leads during testing.***

Connect a DC voltmeter to the leads from the Idlematic Solenoid (Figure 7-3). Start generator set and push Idlematic switch to On. Observe voltmeter reading. Stop generator set operation. If 8 to 17 VDC was measured and the solenoid did not operate, replace the solenoid. If no or low voltage was measured, replace the Idlematic Control.

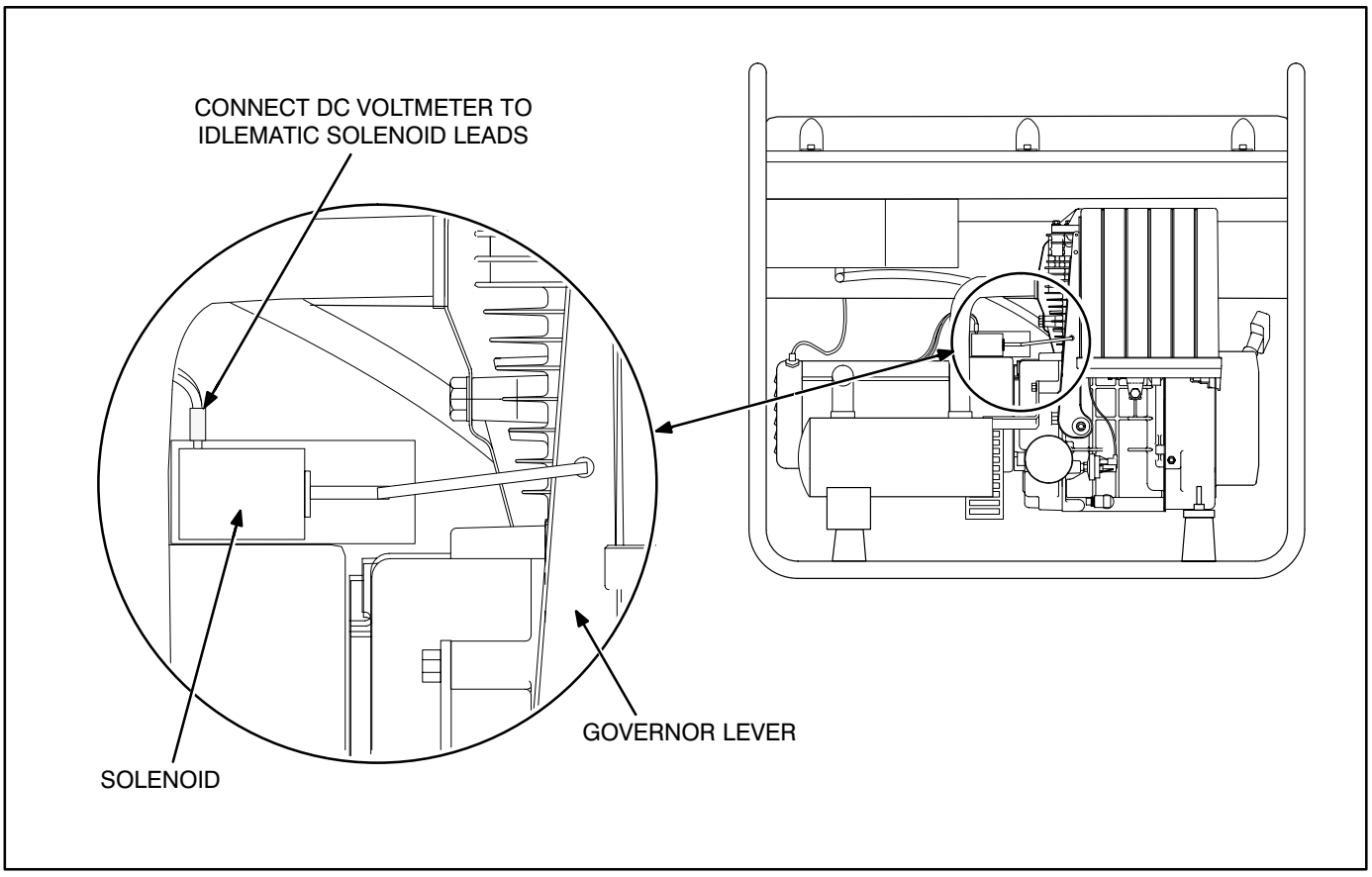


FIGURE 7-3. IDLEMATIC SOLENOID TEST

Section 8. Generator

INTRODUCTION

The generator is a revolving-field, self-exciting, 2-pole design. An AVR module (Automatic Voltage Regulator) or a capacitor-based voltage regulator is used, depending on genset model. AC and DC load connections are made through outlets on the control panel or generator housing. AC and DC circuit breakers provide overload protection for the generator.

GENERATORS USING AUTOMATIC VOLTAGE REGULATORS (All gensets except Standard models under 2.5 kW)

The generator components are:

- Stator
- Rotor
- Brushes
- Diode Assembly
- Generator Cooling
- AVR (Automatic Voltage Regulator)

Stator

The stator consists of three coils: a main coil, a sub coil, and a DC coil. These coils are wound around slots in the stator laminations. The main coil generates the AC output. The sub coil provides excitation to help magnetize the rotor. The DC coil is used to provide power to the DC output circuit. There is also a small winding on the stator that is used for voltage sensing by the voltage regulator.

Pro sets with Elite E140H engines: A separate DC alternator is built into the engine, which is used to recharge the genset starting battery, and is covered in this manual section.

Rotor

The rotor has permanent magnets placed at the top of the two outer poles for initial excitation. Coils are wound around each of the two poles to magnetize the entire core.

The rotor consists of a center shaft that holds the rotor laminations, two slip rings, a press fit bearing, and a centrifugal cooling fan. The entire assembly is connected directly to the tapered engine crankshaft by means of a through bolt. The rotor is supported on the other end by the end bell, which is placed over the rotor bearing and secured to the adapter.

Brushes and Brush Block

The brush block is a one-piece molded part that mounts to the end bell and contains two brushes. The brushes ride on the rotor slip rings. The excitation voltage from the sub coil of the stator assembly is supplied to the voltage regulator and then to the rotor coil through the brushes. Each brush is kept in contact with its slip ring by a spring mounted inside the brush block.

Diode Assembly

The diode assembly is used for full-wave rectification of the AC output from the stator DC coil. This circuit provides the 12-volt DC output.

Generator Cooling

Cooling airflow for the generator is provided by a centrifugal fan that is mounted on the engine end of the rotor shaft. Air is drawn through the end cover and across the stator and rotor assemblies, then discharges out the adapter openings.

Voltage Regulator

A transistor-type automatic voltage regulator (AVR) is mounted inside the end cover: it is used to maintain the output voltage at a constant level.

AVR-Equipped Generator Operation

The schematic shown in Figure 8-4 is provided to help follow the generator operating description.

When the rotor assembly begins revolving, the permanent magnets mounted on the rotor induce a small AC voltage across the stator sub coil. The sub coil voltage is fed into the voltage regulator and is then applied, as DC voltage, to the rotor field coil through the brushes and slip rings. As the current flows through the field coil it magnetizes the rotor core, creating a magnetic field that induces an AC voltage in the main coil of the stator. The level of AC voltage induced in the stator main coil increases as engine speed increases. The voltage regulator monitors and controls the amount of AC voltage provided from the main coil to the load (see the *Volt-*

age Regulator Operation section). Output voltage is fed to the external load through the outlets mounted on the generator end cover or on the control panel.

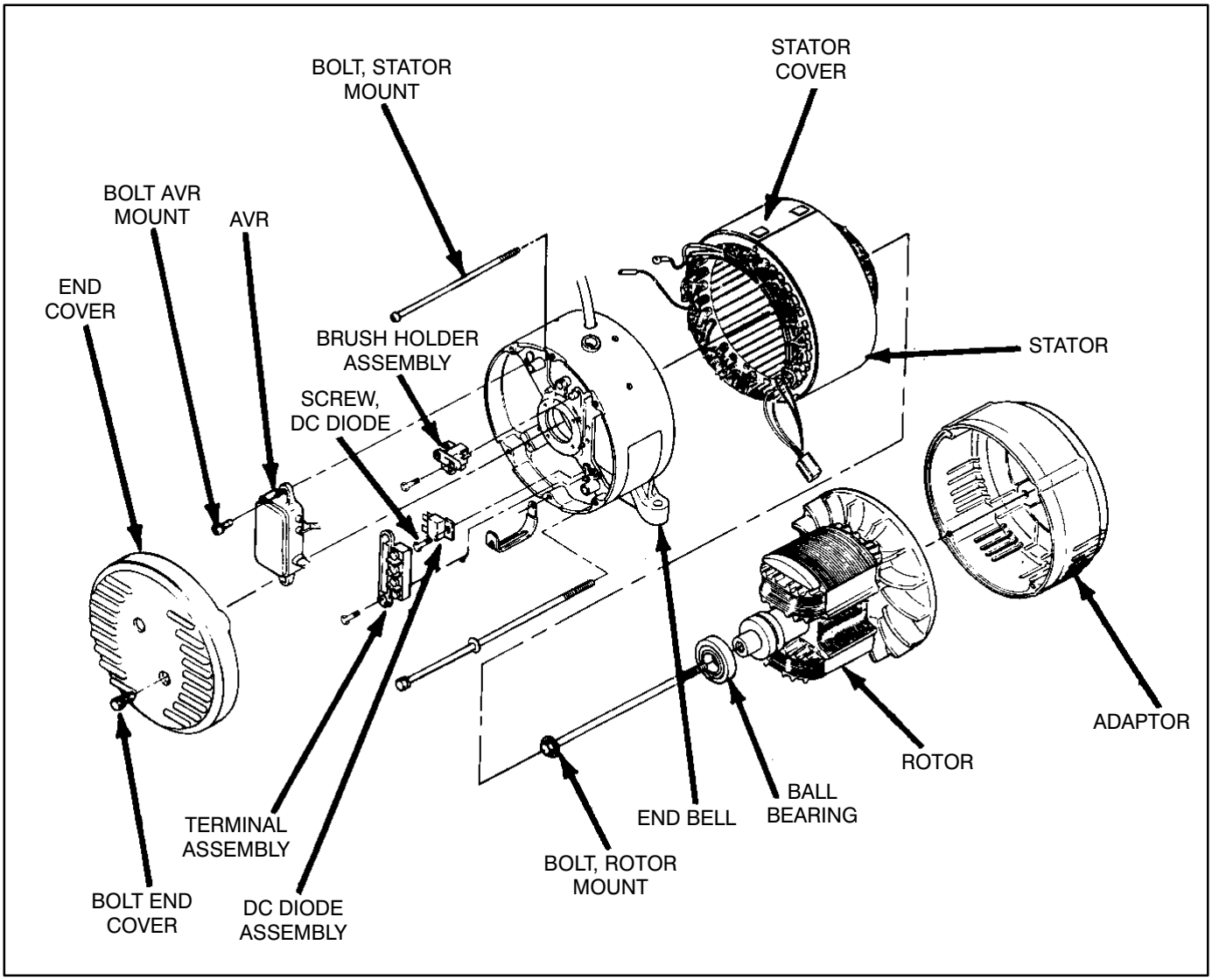


FIGURE 8-1. TYPICAL GENERATOR WITH AUTOMATIC VOLTAGE REGULATOR

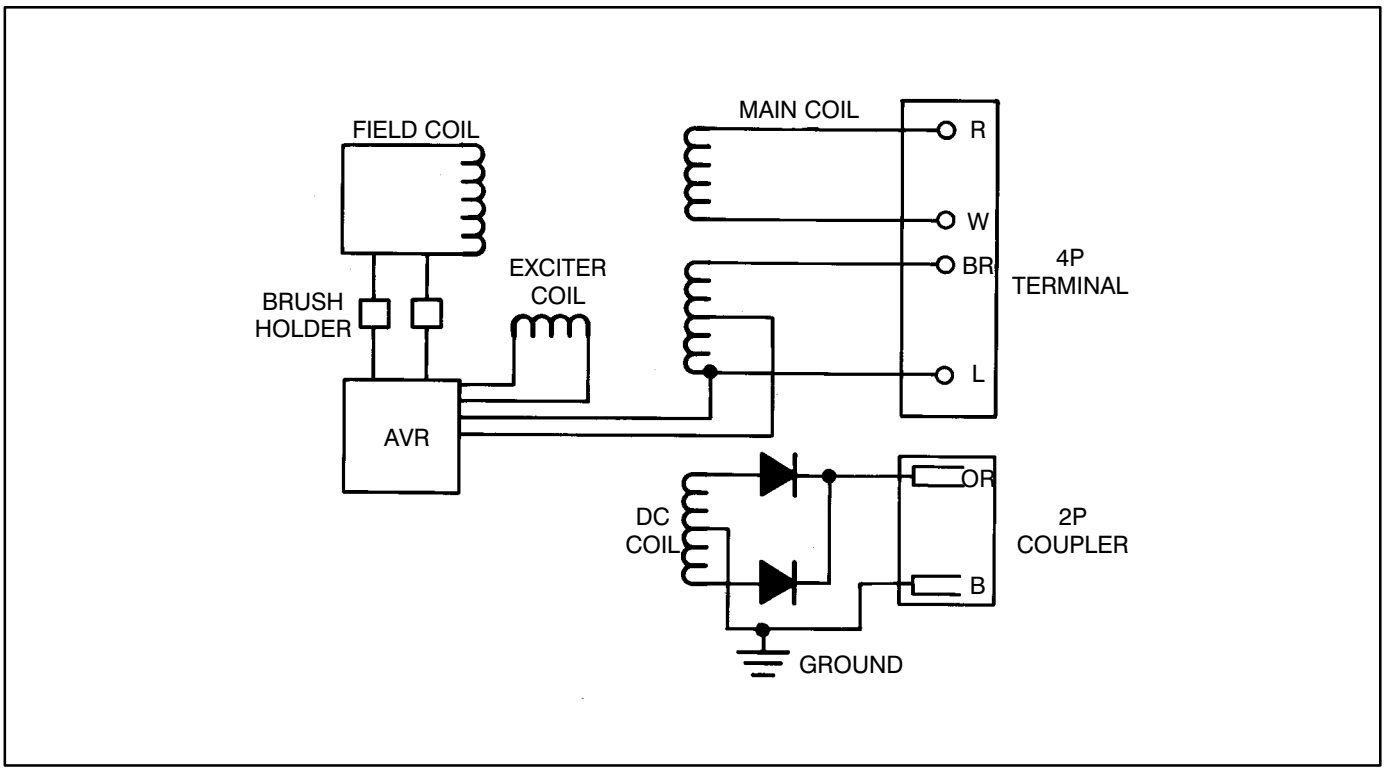


FIGURE 8-2. TYPICAL SCHEMATIC FOR GENERATORS WITH AUTOMATIC VOLTAGE REGULATORS

Automatic Voltage Regulator Operation

The automatic voltage regulator can maintain a steady output voltage even when the load and engine speed vary. The regulator constantly measures the output voltage generated at the stator main coil. If the output voltage exceeds the specified voltage, the voltage regulator reduces the current to the stator field coil, causing the output voltage to decrease. When additional load is applied to the generator, the output voltage starts to decrease. The regulator senses a decrease in output voltage and increases the current to the rotor field until the reference voltage and the output voltage match. By repeating this process, the rated output voltage is held constant with various amounts of load.

12 VDC Output System (Elite E140H Engine only)

The Elite E140H engine is equipped to provide a 12 volt DC output for recharging the cranking battery (Figures 8-3 and 8-4). The system consists of a permanent magnet flywheel alternator and a solid state rectifier/voltage regulator. The alternator produces 5 amps, and uses 3 magnets in its flywheel.

NOTE: Consult the Elite E140H Engine Service Manual for detailed troubleshooting instructions on the Elite 12 VDC output system.

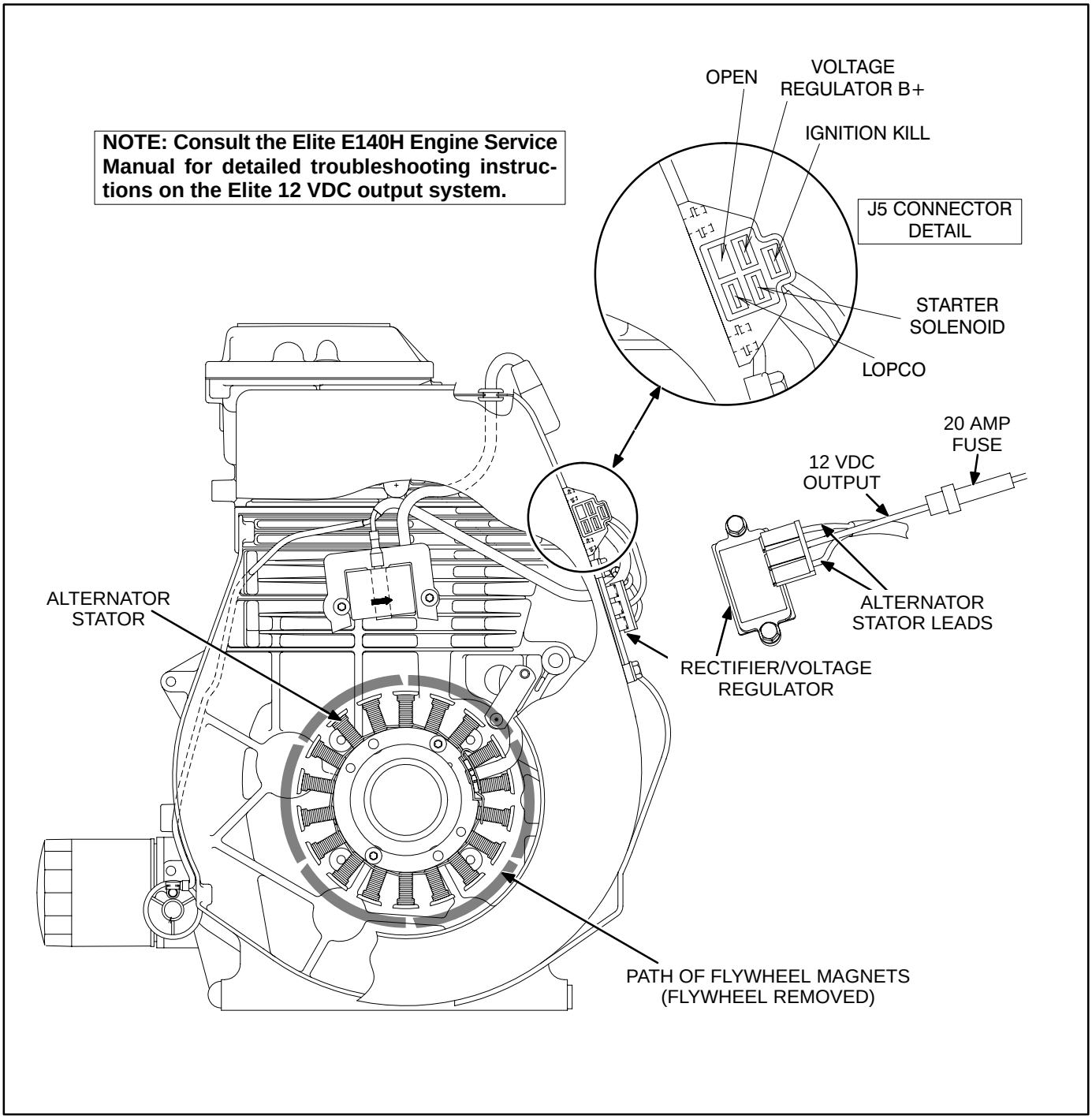


FIGURE 8-3. ELITE E140H FLYWHEEL ALTERNATOR AND VOLTAGE REGULATOR

12 VDC System Tests

Keep the following points in mind when testing or servicing the 12 VDC output system.

⚠ CAUTION ***Operation with reversed positive (+) and negative (-) battery connections or without connection to a battery will damage the voltage regulator and/or the alternator stator.***

1. Never reverse the battery leads.

2. Charging system tests require a fully charged battery in good condition. Make sure the engine is being run long enough and fast enough in service to recharge the battery after each start. Alternator output is proportional to engine speed and accessories consume power otherwise available for battery recharging.

3. The voltage regulator has built in protection against open circuit and short circuit faults (B+ terminal). It will not "turn on" under either condition or when battery discharge is extreme.

4. Check to see that the connections at the terminals of the voltage regulator (three) are clean and tight.

5. Check to see that the wiring connected to the **B+** terminal (middle) of the voltage regulator is not damaged, shorted or grounded.

6. To ensure a good ground path to battery negative (**-**), check to see that the voltage regulator mounting surface is clean and that the screws are tight.

7. Check to see that the positive and negative battery cables have good connections at the battery and engine and that they are not damaged.

After checking all of the above perform the following tests if there still is no alternator output when the engine is running between 1800 and 3600 RPM. Refer to Table 8-1 for test specifications. Use a multi-meter (Simpson 270) when testing the alternator.

TABLE 8-1. 12 VDC OUTPUT SYSTEM TEST SPECIFICATIONS

BATTERY VOLTAGE	VOLTAGE REGULATOR OUTPUT	STATOR OUTPUT	STATOR RESISTANCE
12 to 13 VDC	13.6 to 14.7 VDC @ Any Speed Within Operating Range	Approx. 29 VAC @ 1800 RPM & 57 VAC @ 3600 RPM	5 amp system: 0.54 to 0.66 Ohms 20 amp system: 0.27 to 0.33 Ohms

1. Check battery voltage when the engine is not running. If not within specifications (Table 8-1), charge the battery before going to Step 2.

2. With the engine running, check voltage regulator output (DC voltage) at the battery terminals. Replace the voltage regulator if output is greater than specified. If voltage regulator output is less than specified, go to Step 3.

3. Disconnect the alternator stator leads from the voltage regulator (see Figure 8-3) and test for alternator stator output (AC voltage) with the engine running. If stator output is less than specified, go to Step 4. If stator output is as specified but voltage regulator output is low, replace the voltage regulator.

4. Shut down the engine and check for electrical resistance between either alternator stator lead and ground (bare engine metal) using an ohmmeter. The meter should indicate infinite resistance on its highest scale. If resistance is high, go to Step 5. If not, replace the stator.

5. Check alternator stator resistance by connecting an ohmmeter across the stator leads. Replace the alternator stator assembly if stator resistance on the lowest scale of the meter is either higher or lower than specified. Replace the flywheel assembly if alternator stator resistance is as specified but alternator stator output is less than specified. The probable cause is loss of magnetism.

Elite 12 VDC Wiring Connections

Figure 8-4 shows a portion of wiring diagram 625-3196, illustrating the Elite 12 VDC charging system.

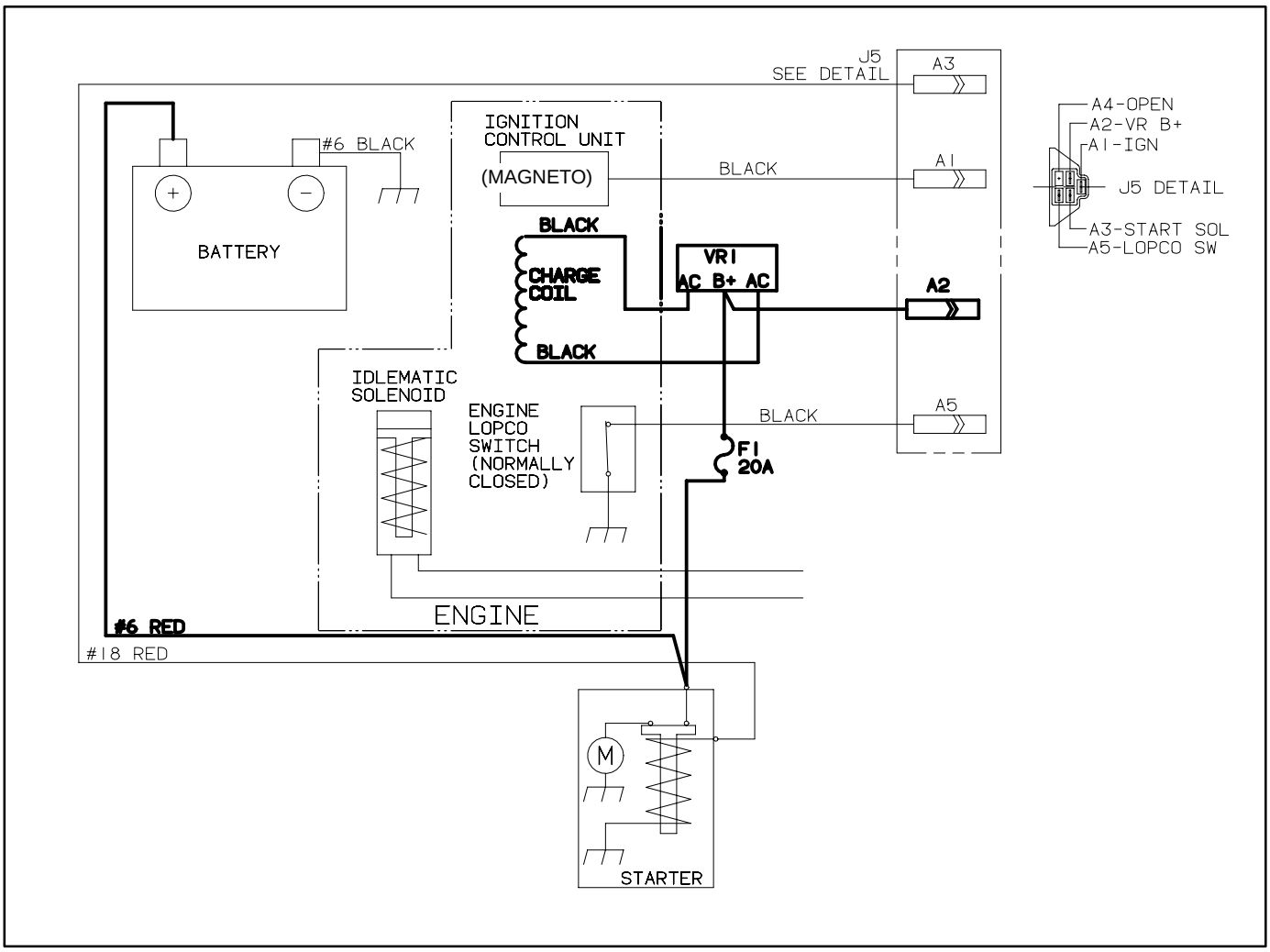


FIGURE 8-4. ELITE E140H DC OUTPUT/CHARGING SYSTEM (FROM 625-3193, 625-3194, 625-3196)

GENERATORS USING CAPACITOR VOLTAGE REGULATORS (Standard model gensets 2.5 kW and under)

The generator consists of the following major components:

- Stator
- Rotor
- Diode Assembly
- Generator Cooling
- Capacitor-Type Voltage Regulator

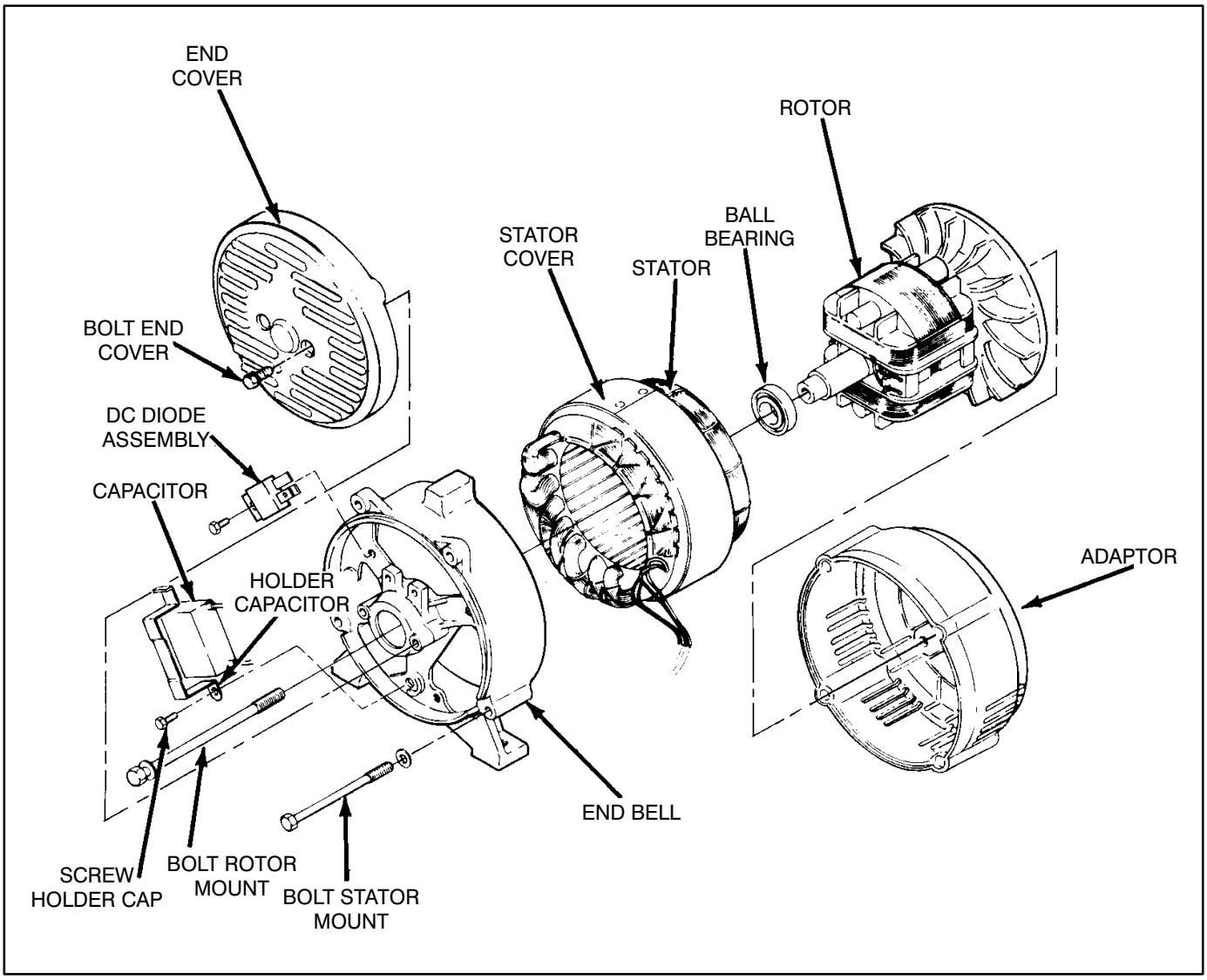


FIGURE 8-5. TYPICAL GENERATOR WITH CAPACITOR-TYPE REGULATION

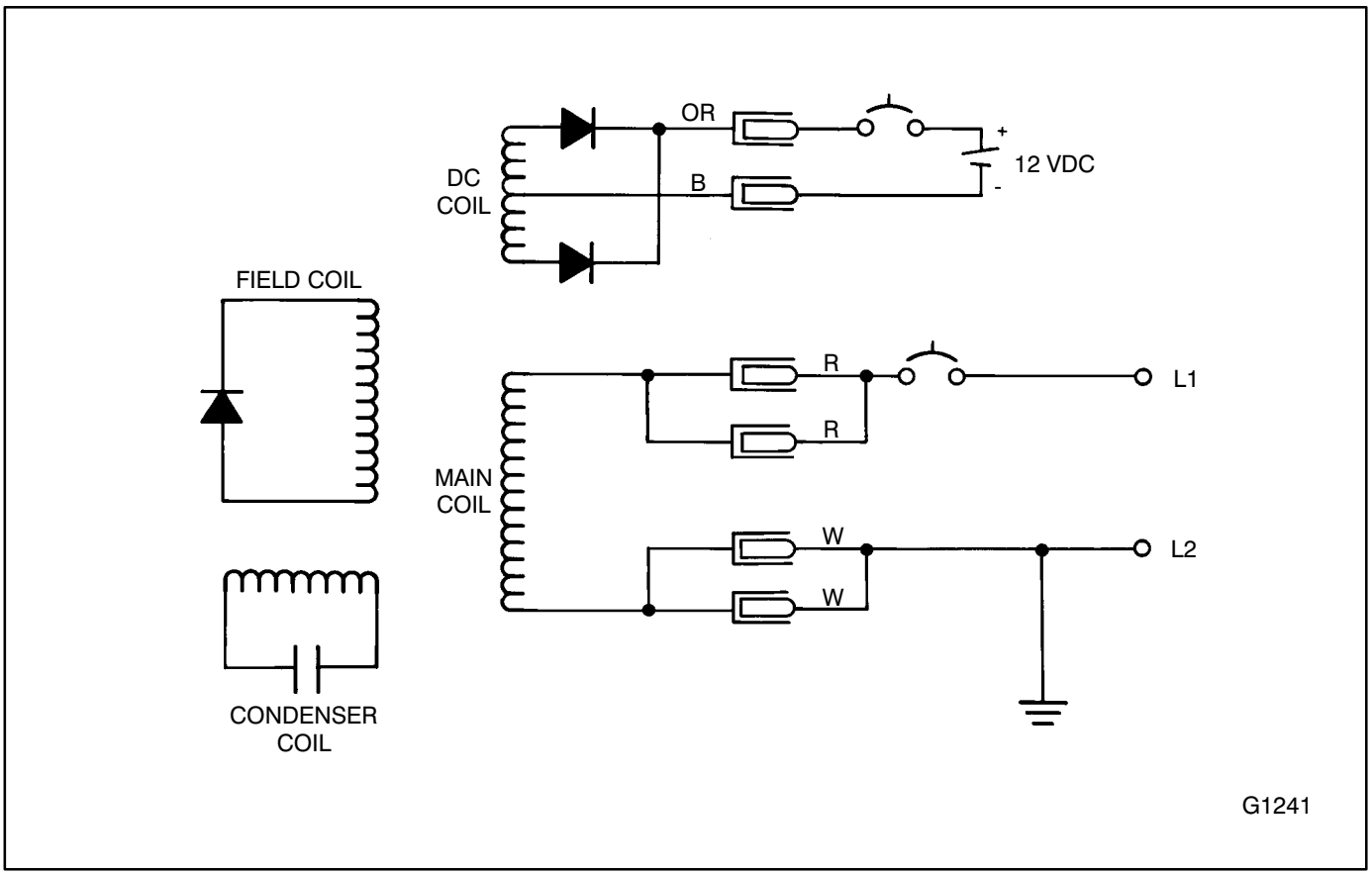


FIGURE 8-6. TYPICAL GENERATOR SCHEMATIC FOR MODELS WITH CAPACITOR REGULATION

Stator

The stator consists of three coils: a main coil, a sub coil, and a DC coil. These coils are wound around slots in the stator laminations. The main coil generates the AC output. The sub coil provides excitation to help magnetize the rotor. The DC coil is used to provide power to the DC output circuit.

Rotor

The rotor is a brushless design with permanent magnets at the top of the two outer poles for initial excitation. Each pole has a coil wrapped around it and a rectifying diode is connected to each coil. The two coils on the rotor work with the sub coil on the stator to magnetize the entire rotor core.

The rotor consists of a center shaft that holds the rotor laminations, a press fit bearing, and a centrifugal cooling fan. The entire assembly is connected directly to the tapered engine crankshaft by means of a through bolt. The rotor is supported on the other end by the end bell, which mates with the rotor bearing. The end bell is secured to the adapter.

Diode Assembly

The diode assembly is used for full-wave rectification of the AC output from the stator DC coil. This circuit provides the 12-volt DC output.

Generator Cooling

Cooling airflow for the generator is provided by a centrifugal fan that is mounted on the engine end of the rotor shaft. Air is drawn through the end cover and across the stator and rotor assemblies, then discharges out the adapter openings.

Capacitor-Type Voltage Regulator

A capacitor is connected to the sub coil of the stator assembly. The capacitor establishes a voltage by

causing a leading current to flow through the coil. The capacitor also allows the generator to compensate for voltage changes to maintain the output voltage at a constant level.

Capacitor Regulator-Equipped Generator Operation

The schematic shown in Figure 8-6 is provided to help follow the generator operating description. Always refer to the specific schematic that corresponds to the model number of the generator set when troubleshooting.

When the rotor assembly begins revolving, the permanent magnets in the rotor induce a small amount of AC voltage across the stator main coil and sub coil. With the capacitor connected to the stator sub coil, this voltage causes a leading current to flow through the coil producing magnetism in the coil. This magnetism induces a voltage in the coils of the revolving rotor. The diode connected to the rotor coil rectifies the current in the coil to produce a DC current. DC current flowing through the coil increases the magnetism of the rotor to create a more powerful magnet.

The strongly magnetized rotor causes an increase in the amount of AC voltage induced in the stator, which causes a stronger leading current to flow through the stator sub coil. This process continues until the engine comes up to speed and a constant voltage is reached.

When a load is connected to the generator, an increase in the stator main coil current would cause a drop in the output voltage due to the impedance (AC resistance) of the winding; however, the leading current, caused by the capacitor connected to the sub coil, reduces the winding resistance to a value below the no-load condition. This current, coupled with the load current, increases the main coil magnetism to compensate for the voltage drop due to the load. In this way, the voltage output remains fairly constant with varying loads.

GENERATOR TROUBLESHOOTING

Use the following troubleshooting guide to help locate problems related to the generator. Figures 8-1 and 8-5 show the location of most of the generator components. Refer to the wiring diagrams in Figures 8-2 and 8-6 for location of the wiring terminal connections. It is not necessary to remove the stator or rotor for troubleshooting. All of the test points are located inside the generator end cover. After identifying the problem, refer to the troubleshooting guide for the possible cause and the recommended corrective action. Refer to the *Generator Testing* section for component test procedures.

Refer to the troubleshooting table that applies to the type of voltage regulator used in the specific model being serviced (see *Specifications* section).

TABLE 8-2. TROUBLESHOOTING CHART FOR MODELS WITH AUTOMATIC VOLTAGE REGULATOR

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***

Trouble	Possible Cause	Corrective Action
No AC Output Voltage	1. Open AC circuit breaker.	1. Locate cause of overload and correct as required. Reset breaker.
	2. Open circuit between stator main coil and AC receptacle. Defective receptacle.	2. Check for continuity and correct if circuit is open. Check for defective receptacle.
	3. Defective stator main coil.	3. Test stator main coil for open, shorted, or grounded windings and replace if defective.
AC output voltage only 6 to 18 VAC	1. Defective rotor coil.	1. Test rotor coil for open, shorted, grounded windings and replace if defective.
	2. Defective stator sub coil.	2. Test stator sub coil for open, shorted, or grounded windings and replace if defective.
	3. Faulty brushes or slip rings.	3. Check brushes and replace if defective. Inspect slip rings and clean if needed.
	4. Faulty Voltage Regulator (AVR).	4. If the rotor and stator test good, and the brush block and slip rings are good, replace the AVR module and recheck.
	5. Faulty permanent magnet in rotor.	5. Replace rotor after checking other possible causes for 6 to 18 VAC.
AC output voltage too low or too high	1. Engine governor incorrectly adjusted.	1. Check engine speed. Refer to Engine Primary System section.
	2. Faulty voltage regulator (AVR)	2. Replace the AVR module and recheck.
Noisy Generator	1. Worn rotor shaft bearing.	1. Replace end bearing.
	2. Rotor and stator rubbing together due to: a. varnish lumps b. rotor misaligned with crankshaft	2a. Check for varnish lumps between rotor and stator and remove as required. 2b. Follow specified assembly procedures to correct rotor to crankshaft alignment.

TABLE 8-3. TROUBLESHOOTING CHART FOR MODELS WITH AUTOMATIC VOLTAGE REGULATOR

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***

Trouble	Possible Cause	Corrective Action
Generator Overheats	1. Generator overloaded due to defective circuit breaker.	1. Replace circuit breaker. Do not exceed specified load when operating set.
	2. Airflow restricted due to dirt or debris covering vent openings in cover or adapter.	2. Clean away all dirt or debris as required.
	3. Stator windings covered with oil or dirt	3. Clean stator windings.
	4. Defective windings in rotor or stator.	4. Test each component for open, grounded, or shorted windings and replace if defective.
Low or no DC output	1. Open DC circuit breaker.	1. Locate cause of overload and correct as required. Reset breaker.
	2. Open circuit between stator DC coil and diode assembly or between diode assembly and receptacle.	2. Check for continuity and correct if circuit is open.
	3. Defective stator DC coil.	3. Test stator DC coil for open, grounded or shorted windings.
	4. Defective diode assembly.	4. Test diode assembly for open or short.

TABLE 8-4. TROUBLESHOOTING CHART FOR MODELS WITH CAPACITOR-TYPE VOLTAGE REGULATOR

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***

Trouble	Possible Cause	Corrective Action
No AC Output Voltage	1. Open AC circuit breaker.	1. Locate cause of overload and correct as required. Reset breaker.
	2. Open circuit between stator main coil and AC receptacle. Defective receptacle.	2. Check for continuity and correct if circuit is open. Check for defective receptacle.
	3. Defective stator main coil.	3. Test stator main coil for open, shorted, or grounded windings and replace if defective.
AC output voltage only 3 to 18 VAC	1. Defective stator sub coil.	1. Test stator sub coil for open, shorted, or grounded windings and replace if defective.
	2. Defective rotor coil or defective rotor winding diode.	2. Test rotor coil for open, shorted, or grounded winding and defective diode. Replace rotor if defective.
	3. Open or shorted capacitor.	3. Test capacitor for open or short and replace if defective.
AC output voltage too low or too high	1. Engine governor incorrectly adjusted.	1. Refer to Engine Primary System section.
Noisy Generator	1. Worn rotor shaft bearing.	1. Replace end bearing.
	2. Rotor and stator rubbing together due to: a. varnish lumps b. rotor misaligned with crankshaft	2a. Check for varnish lumps between rotor and stator and remove as required. 2b. Follow specified assembly procedures to correct rotor to crankshaft alignment.

TABLE 8-5. TROUBLESHOOTING CHART FOR MODELS WITH CAPACITOR-TYPE VOLTAGE REGULATOR

⚠WARNING ***Many troubleshooting procedures present hazards that can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.***

Trouble	Possible Cause	Corrective Action
Generator Overheats	1. Generator overloaded due to defective circuit breaker.	1. Replace circuit breaker. Do not exceed specified load when operating set.
	2. Airflow restricted due to dirt or debris covering vent openings in cover or adapter.	2. Clean away all dirt or debris as required.
	3. Stator windings covered with oil or dirt.	3. Clean stator windings.
	4. Defective windings in rotor or stator.	4. Test each component for open, grounded, or shorted windings and replace if defective.
Low or no DC output	1. Open DC circuit breaker.	1. Locate cause of overload and correct as required. Reset breaker.
	2. Open circuit between stator DC coil and diode assembly or between diode assembly and receptacle.	2. Check for continuity and correct if circuit is open.
	3. Defective stator DC coil.	3. Test stator DC coil for open, grounded or shorted windings.
	4. Defective diode assembly.	4. Test diode assembly for open or short.

GENERATOR SERVICE

This section describes the procedures for generator stator and rotor removal and installation for all models. Refer to Figure 8-1 or 8-5 to identify the various generator components described in each section.

⚠ CAUTION ***Careless handling of the rotor or stator can damage the insulation on the windings. Do not allow windings to be brushed or scraped during service.***

Stator Removal

1. Remove the generator and cover and disconnect all wiring connectors. Tag wires if connectors are not polarized or color matched.

   ⚠ CAUTION ***On models with automatic voltage regulators, the brush block assembly will be damaged during disassembly if it is not removed.***

2. On models with AVRs: Remove the brush block assembly (Figure 8-7) by removing the Phillips head mounting screw. Pull brush block off mounting stud and lift to remove.
3. Remove the mounting blots that secure the end bell to the frame.
4. Remove the stator mounting bolts that secure the end bell to the adapter, and carefully pull the end bell and stator assembly off together. Be careful not to damage the rotor windings.
5. For stator replacement only: Remove the two Phillips head screws that secure the stator to the end bell. Carefully separate the end bell from the stator assembly to prevent damage to the windings.

Rotor Removal

1. Loosen the rotor through-bolt two or three turns and tap rotor through-bolt head with a lead hammer to loosen the rotor from the tapered shaft. Be careful not to strike the slip rings or rotor windings.
2. Remove rotor through-bolt and carefully remove the rotor and place it on a soft surface to prevent damage to windings.

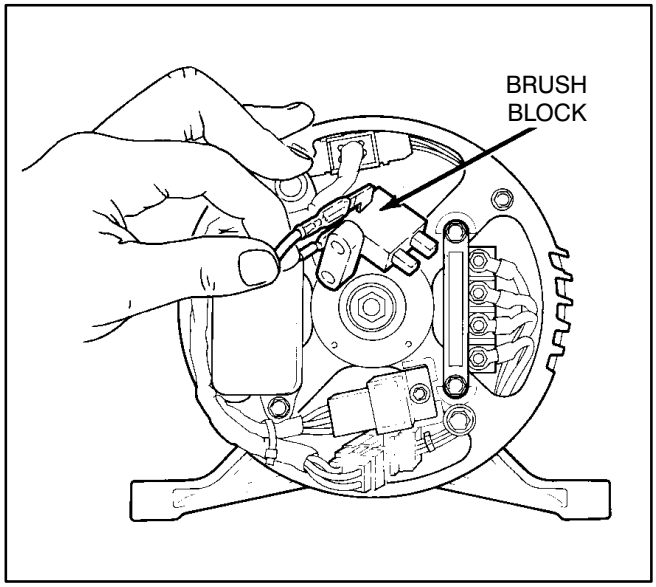


FIGURE 8-7. BRUSH BLOCK

Rotor Installation

1. Clean tapered mounting shaft and rotor shaft to remove all dirt and oil.
2. Carefully install rotor onto tapered shaft. Insert through-bolt into mounting shaft and hand tighten.

3. Secure rotor with a strap wrench (Figure 8-8) and tighten to torque specified in Section 4 of this manual.

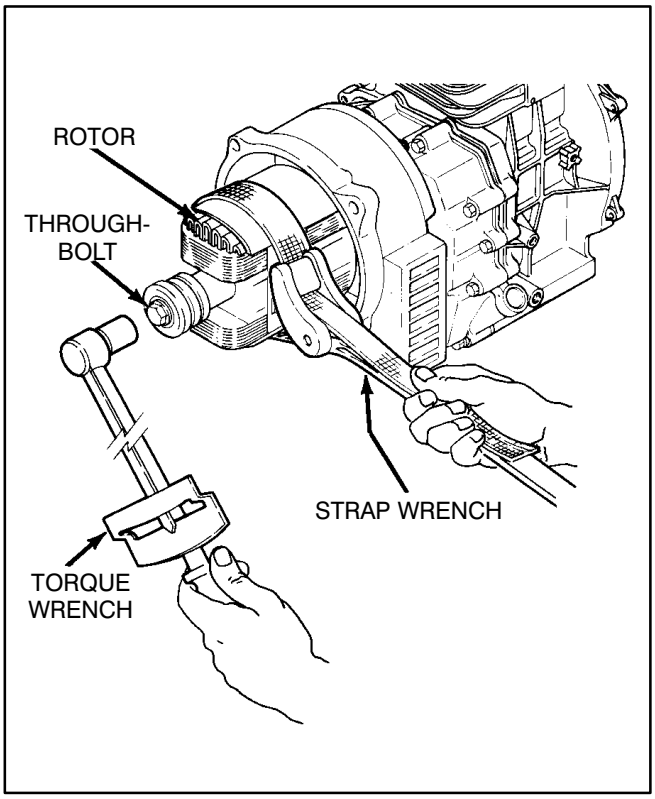


FIGURE 8-8. SECURING ROTOR FOR INSTALLATION

Stator Installation

1. Assemble end bell to stator if previously removed. Use two mounting screws to secure the stator to the end bell.
2. Install stator assembly over rotor. Be careful to avoid damaging rotor windings. Push stator assembly into position until seated with adapter on engine.
3. Secure stator assembly to the adapter using four stator mounting bolts tightened to the torque specified in Section 4 of this manual.
4. Secure end bell to mounting frame and tighten to the specified torque.
5. Pull recoil starter over slowly to check stator and rotor alignment. Rotor should move without rubbing against the stator.
6. Reconnect all wire connections. If applicable, tighten terminal block mounting nuts to the torque specified in Section 4 of this manual.
7. On models with automatic voltage regulators: Install brush block onto mounting stud and secure with mounting screw (Figure 8-7).
8. Place end cover over end bell and secure.

Rotor Bearing Replacement

The rotor bearing is press-fit on the rotor shaft. Read through each of the following procedures before starting replacement.

1. Remove the rotor assembly as described in the Generator Service section.
2. Cover the end of the rotor shaft with a hardened washer to prevent deformation of the shaft during bearing removal. Use a small gear puller to remove the bearing.
3. Place the rotor shaft, engine end down, on a rod or other mating surface that will protect the rotor shaft taper and cooling fan from damage.
4. Press rotor bearing onto rotor shaft (press on inner race of bearing only) until it rests in its original position.

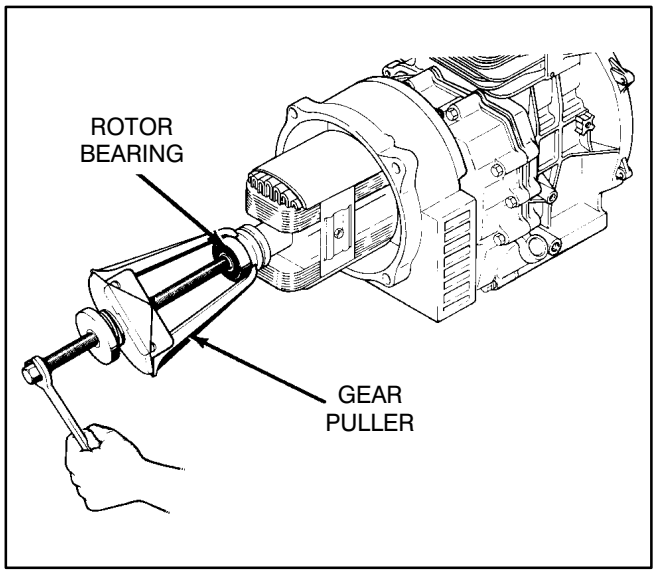


FIGURE 8-9. ROTOR BEARING REMOVAL

GENERATOR TESTING FOR MODELS WITH AUTOMATIC VOLTAGE REGULATORS

This section covers test procedures for the generator windings and for the brushes and slip rings. Refer to the previous section for diode assembly testing. Follow the troubleshooting procedures in this section to locate the possible cause of the problem, then perform the recommended corrective action. Remove the generator end cover and perform tests as described. If the generator set has been running, allow the generator set to cool down completely before making resistance measurements.

Check all wire harness connectors and leads for continuity before component testing or generator disassembly. Refer to wire diagrams for lead locations.

Stator Test

The stator main, sub, and DC coils can be tested with an ohmmeter. Testing for shorted windings requires a digital ohmmeter that can read to within 0.01 ohms. The stator can be tested without removing it from the generator. Figure 8-10 shows the stator test points.

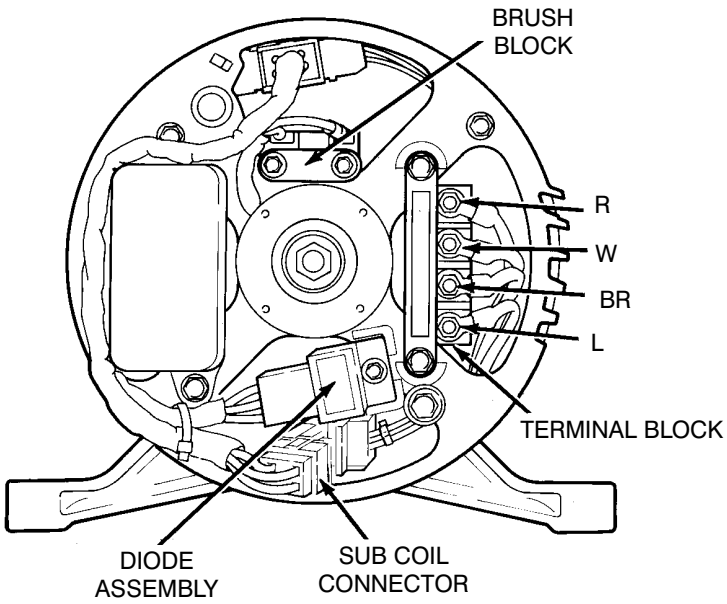


FIGURE 8-10. GENERATOR TESTING

TABLE 8-5. GENERATOR WINDING RESISTANCE						
Generator Size/Hz	**4 kW - 60 Hz**	**5 kW - 60 Hz**	**6 kW - 60 Hz**	**2 kW - 50 Hz**	**3.5 kW - 50 Hz**	**5 kW - 50 Hz**
STATOR						
Main Coil	0.7 - 1.0 Ω	0.7 - 1.0 Ω	0.9 - 1.0 Ω	1.0 - 1.4 Ω	0.5 - 0.7 Ω	0.3 - 0.5 Ω
Sub Coil	1.2 - 1.6 Ω	1.0 - 1.4 Ω	0.8 - 1.2 Ω	2.1 - 2.5 Ω	1.1 - 1.4 Ω	0.8 - 1.2 Ω
DC Coil	0.6 - 1.0 Ω	0.5 - 1.0 Ω	0.4 - 1.0 Ω	0.4 - 0.8 Ω	0.4 - 0.6 Ω	0.4 - 0.6 Ω
ROTOR						
Coil	47 Ω	55 Ω	65 Ω	46 Ω	47 - 54 Ω	61 Ω

Stator Main Coil Test:

Remove the stator leads from the terminal block and connect the meter leads (see Figure 8-10) to the red and white leads from the stator main coil. Repeat test for second stator main coil brown and blue leads. Refer to Table 8-6 for the stator sub coil resistance value. A high resistance reading indicates an open winding. A reading of less than the value shown indicates a shorted winding. If an open or shorted winding is detected, replace the stator.

Stator Ground Test:

Remove the main coil wires from the terminal block and remove the sub coil and diode assembly wire connectors. Set the ohmmeter to the highest resistance scale and then connect one test prod to the metal stator lamination stack. Touch the other test prod to the red or white terminal from the main coil Repeat the test for the other main coil (brown or blue lead) and the sub coil by measuring between the stator stack and one of the yellow leads from the stator sub coil. Repeat the test again for the DC coil by measuring between the stator stack and one of the gray leads from the stator DC coil. A reading of less than one megohm indicates a ground. Replace a grounded stator with a new stator.

If the stator tests good, proceed to rotor tests.

Rotor Test

The rotor can be tested with an ohmmeter. Remove the generator end cover and remove the brush block assembly (see Generator Service section) for testing. Refer to Figure 8-11 for the test points.

Rotor Coil Test:

Touch ohmmeter meter test prods to the slip rings (Figure 8-11). Make certain that good contact is made. It may be necessary to clean the slip rings as described in the Slip Ring Check section. Refer to Table 8-5 for the rotor coil resistance value. If an open or short is detected, replace the rotor.

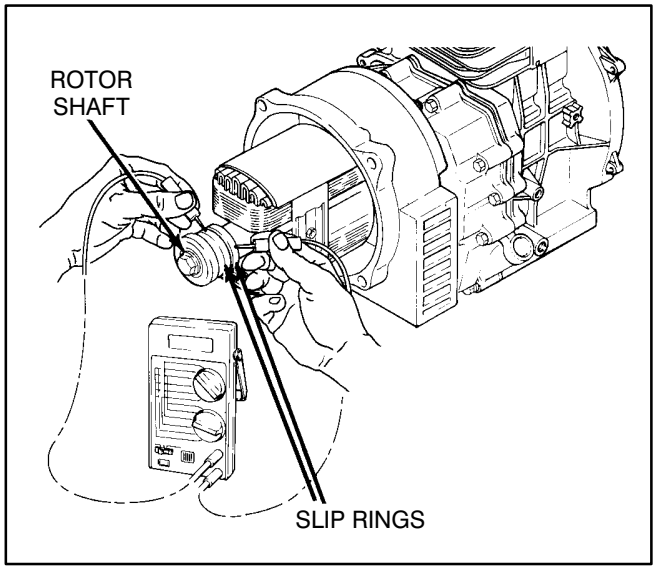


FIGURE 8-11. ROTOR TESTING

Rotor Winding Ground Test:

To test for grounds, set the ohmmeter to the highest resistance scale. Touch one test prod to one of the slip rings and touch the other test prod to the rotor shaft. A reading of less than one megohm indicates the rotor is grounded. Replace a grounded rotor with a new rotor.

Brush Assembly Check

Follow the stator removal instructions through the brush block assembly removal procedure in the Generator Service section. Check for excessive brush wear. Measure the height of the brushes as shown in Figure 8-12. If the brushes are less than the minimum height, or if the brushes have a rough slip ring surface, replace the brush assembly.

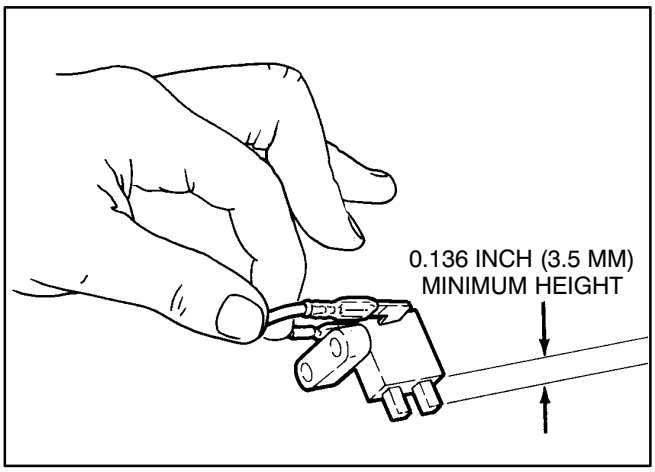


FIGURE 8-12. BRUSH HEIGHT MEASUREMENT

Slip Ring Check

Follow Generator Service section through stator removal. Inspect the slip rings for signs of dirt, oil, or other contaminants. Also check for roughness in the brush contact area. Wipe slip ring surface clean. Rough slip rings can be refurbished using a commutator stone. Use the following procedure to service:

1. Follow Generator Service procedures to remove the rotor.
2. Place rotor in machine lathe and center. Turn rotor and use commutator stone against rotating slip rings to clean and true slip rings. Turn rotor until all grooves or roughness are smoothed out.

***WARNING** Contact with rotating machinery can result in severe personal injury. Keep hands and fingers clear while servicing slip rings.*

***CAUTION** Careless handling of rotor can damage the insulation on the windings.*

3. Clean rotor and prepare for reinstallation. Follow Generator Service section to install rotor and remaining generator components.

Automatic Voltage Regulator

There are no specific tests that can be made on the Automatic Voltage Regulator. When the voltage regulator does not appear to be working properly, and the other generator components test good, replace the voltage regulator and check for proper operation.

GENERATOR TESTING FOR MODELS WITH CAPACITOR VOLTAGE REGULATION

This section covers test procedures for the generator windings, the regulator capacitor, and for the diode assembly. Follow the troubleshooting procedures in this section to locate the problem, the n perform the recommended corrective action. Remove the generator and cover and perform tests as described. If the generator set has been running, allow it to cool down completely before making resistance measurements.

Check all wire harness connectors and leads for continuity prior to component testing or generator disassembly. Refer to wire diagrams for lead locations.

Stator Test

The stator main, sub and DC coils can be tested with an ohmmeter. Testing for shorted windings requires a digital type ohmmeter that can read to within 0.01 ohms. The stator can be tested without removing it from the generator. Figure 8-13 shows the stator test points.

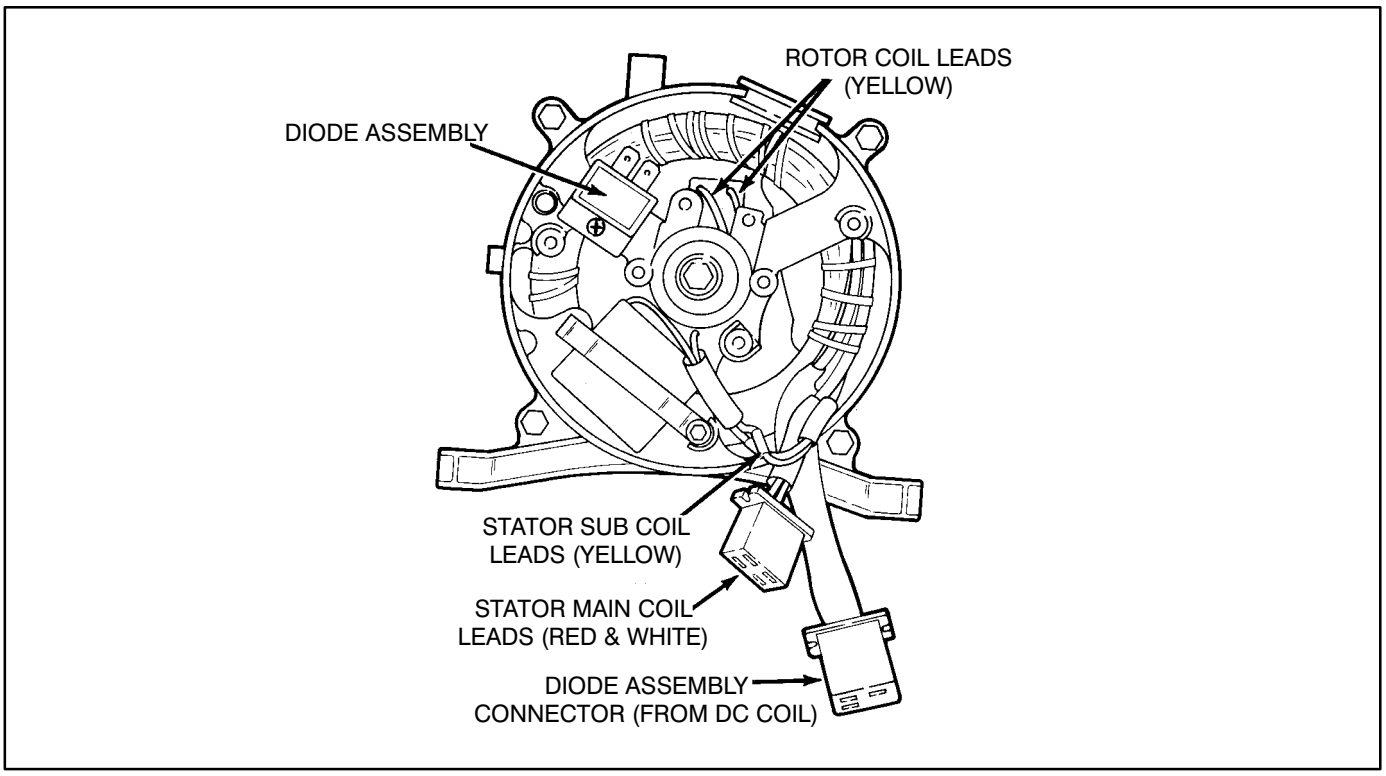


FIGURE 8-13. GENERATOR TESTING

TABLE 8-6. GENERATOR WINDING RESISTANCE			
Generator Size/Hz	**1.4 kW - 60 Hz 1.7 kW - 60 Hz**	**2.5 kW - 60 Hz**	**1.4 kW - 50 Hz**
STATOR			
Main Coil	0.7 - 1.4 ohms	0.5 - 1.0 ohms	1.0 - 1.5 ohms
Sub Coil	7 ohms	8 ohms	6.7 ohms
DC Coil	0.8 ohms	0.6 ohms	0.65 ohms
ROTOR			
Coil	13.5 ohms	23.5 ohms	23.5 ohms

Stator Main Coil Test:

Remove the connector from the stator main coil and connect the meter leads (Figure 8-8) to the red and white leads from the stator main coil. Refer to Table 8-5 for the stator main coil resistance value. A high resistance reading indicates an open winding. A reading of less than the value shown indicators a shorted winding. If an open or shorted winding is detected, replace the stator.

Stator Sub Coil Test:

Remove the connector from the stator sub coil and connect the meter leads (Figure 8-13) to the yellow leads from the stator sub coil. Refer to Table 8-6 for the stator sub coil resistance value. A high resistance reading indicates an open winding. A reading of less than the value shown indicates a shorted winding. If an open or shorted winding is detected, replace the stator.

Stator DC Coil Test:

Remove the connector from the diode assembly and connect the meter leads (Figure 8-13) to the gray leads from the stator DC coil. Refer to Table 8-6 for the DC coil resistance value. A high resistance reading indicates an open winding. A reading of less than the value shown indicates a shorted winding. If an open or shorted winding is detected, replace the stator.

Stator Ground Test:

Remove the wire connectors from the stator main coil, sub coil, and diode assembly. Set the ohmmeter to the highest resistance scale and then connect one test prod to the metal stator lamination stack. Touch the other test prod to red or white terminal from the main coil. Repeat the test for the sub coil by measuring between the stator stack and one of the yellow leads from the stator sub coil. Also repeat the test for the DC coil by measuring between the stator stack and one of the gray leads from the stator DC coil. A reading of less than one megohm indicates a ground. Replace a grounded stator with a new stator.

If stator tests good, proceed to rotor tests.

Rotor Test

The rotor can be tested without removing it from the generator. Remove the generator end cover and refer to Figure 8-8 for the test points.

Rotor Coil Test:

The rotor coil winding has a diode connected in series with it. Using pointed meter test prods, touch ohmmeter test prods to the two posts that the yellow rotor winding leads attach to (see Figure 8-8). It is necessary to pierce the insulation on the posts to obtain an accurate reading of the winding resistance. Also, because a diode is attached in series with the windings, the meter leads must be reversed for a second reading. Refer to Table 8-13 for the rotor coil resistance value. It is normal to measure a high resistance reading in one direction and the listed resistance reading in the other direction. A high resistance reading in both directions indicates an open winding or diode. A reading of less than the value shown in Table 8-6 in one direction indicates a shorted winding or diode. If an open or short condition is detected, replace the rotor.

Rotor Coil Ground Test:

To test for grounds, set the ohmmeter to the highest resistance scale. Touch one test prod to the rotor shaft and hold it there. Touch the other test prod to one of the posts that the yellow rotor winding leads attach to (see Figure 8-13). It is necessary to pierce the insulation on the posts to obtain an accurate reading. A reading of less than one megohm indicates the rotor is grounded. Replace a grounded rotor with a new rotor.

Capacitor Test

The capacitor can be tested with a capacitor checker or an analog ohmmeter. Disconnect both wire leads connected to the capacitor and attach meter (Figure 8-13). A capacitor checker attached to the capacitor leads should indicate approximately 13 mfd. An analog ohmmeter connected to the capacitor leads should cause the meter to momentarily deflect toward continuity and then indicate infinity. Reversing the meter should provide the same indication. Replace a shorted or open capacitor.

Diode Assembly Test

The diode assembly contains two diodes in one potted assembly. The diode assembly can be tested with an ohmmeter that has a diode measurement setting or a high resistance scale that uses an internal 9-volt battery. Remove the wire connector from the diode assembly and attach the test leads as shown in Figure 8-14. Reverse meter leads and check continuity in the opposite direction. Repeat test for second diode. Each diode should indicate continuity in one direction and infinite resistance in the other direction.

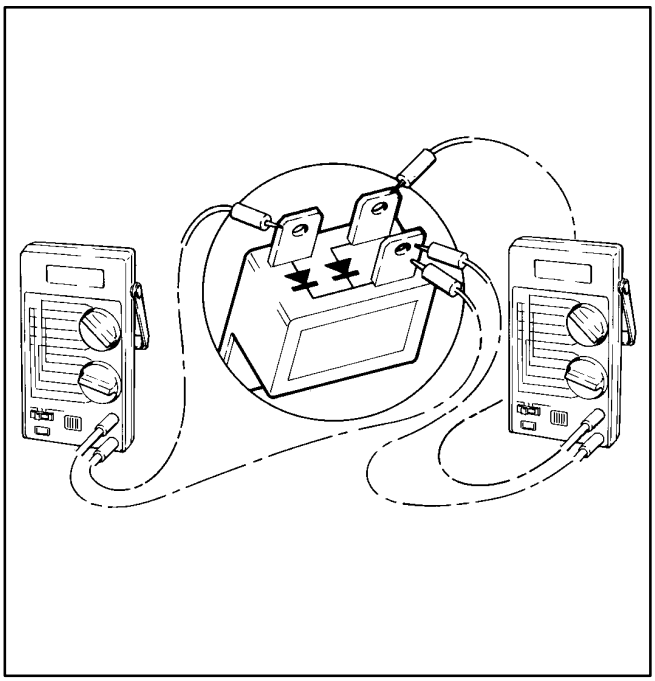


FIGURE 8-14. TESTING DIODE ASSEMBLY

Section 9. Engine Block Assembly (GH170, GH280)

INTRODUCTION

This section covers service procedures for the engine block assembly for the generator sets using GH170 and GH280 engines. **Briggs and Stratton engines (Standard series portables) are repaired by Briggs and Stratton personnel. Elite E140H engines (5.0 kW and larger Pro series portables) are covered in the Elite Horizontal Service Manual.**

This assembly includes the cylinder block cylinder head, valve system, piston, connecting rod, crankshaft, and camshaft. The following section is divided into three main subjects: engine disassembly, engine part inspections, and valve adjustments.

Performing major service on the engine block requires removal of the generator (Section 8) and the primary engine systems (Section 6). Refer to the appropriate section for the disassembly procedures.

Make sure the engine oil has been drained before starting engine block disassembly. Remove the oil fill cap and oil drain plug to remove engine oil.

A suggested order of disassembly follows:

1. Head cover and breather
2. Rocker arms, push rods, and cylinder head
3. Intake and exhaust valves
4. Crankcase cover and camshaft
5. Connecting rod and piston
6. Crankshaft and governor lever shaft

ENGINE DISASSEMBLY

Head Cover and Breather

Remove the head cover to gain access to the cylinder head and valve system. Use the following procedure to service.

1. Remove head cover mounting bolts and pull off head cover. See Figure 9-1.
2. Remove the breather element. Observe breather orientation for reassembly.
3. Clean head cover being careful not to damage the gasket sealing area.
4. Clean cylinder head cover and cylinder head thoroughly in gasket mating area. Install new gasket with grooved side facing the cylinder head. Make sure breather assembly is installed correctly.
5. Place head cover in position and torque until all bolts are tightened to the specified torque.

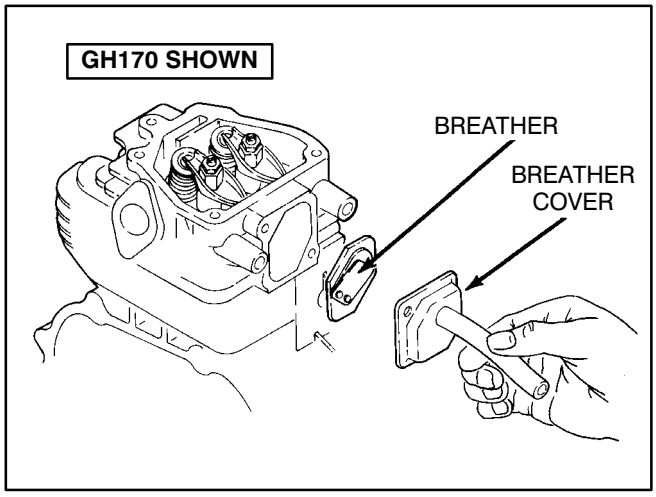


FIGURE 9-1. HEAD COVER AND BREATHER REMOVAL

Rocker Arms, Push Rods and Cylinder Head

Remove the cylinder head for cleaning when poor engine performance is noticed or to inspect the valves. Use the following procedures to service.

1. Remove rocker arm mounting nuts, then remove rocker arms and push rods (Figure 9-2).

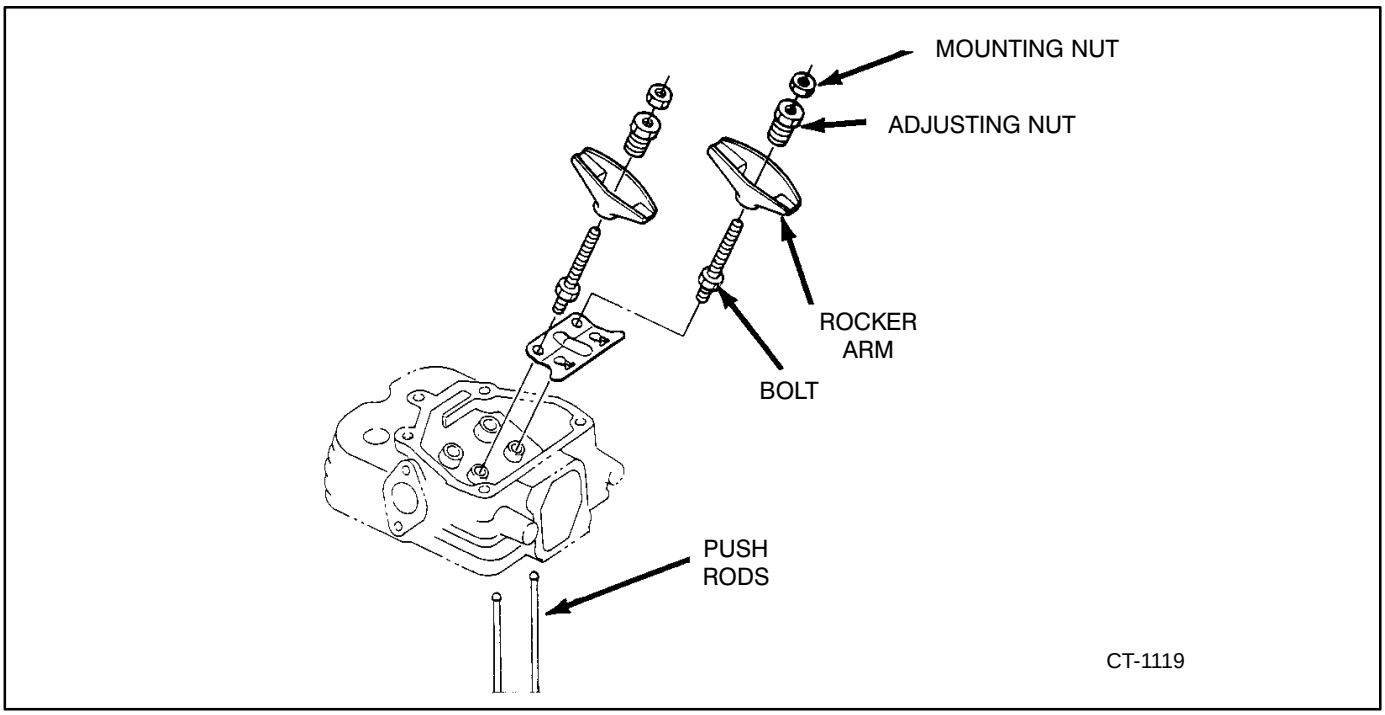


FIGURE 9-2. ROCKER ARM REMOVAL

2. Remove spark plug.
3. Remove the cylinder head mounting bolts and lift off the head. Remove the head gasket.

   ⚠ CAUTION ***Warping can occur if the head is removed while hot. Wait until the engine has cooled before removing cylinder head.***

4. Remove all carbon deposits from cylinder head. Be careful not to damage outer sealing surface where gasket fits. The head is made of aluminum and can be damaged by careless handling.
5. Use new head gasket and clean both cylinder head and cylinder block thoroughly where gasket rests.
6. Place head in position and follow head torque tightening sequence shown in Figure 9-3. Start out tightening all bolts to 14 ft-lb (19.6 n•m), then tighten to the specified torque (see Torque Specification section).

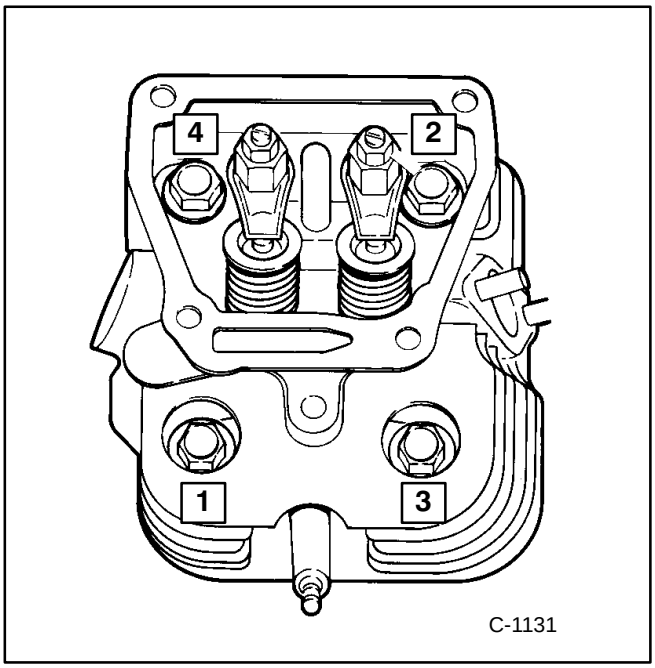


FIGURE 9-3. CYLINDER HEAD TIGHTENING SEQUENCE

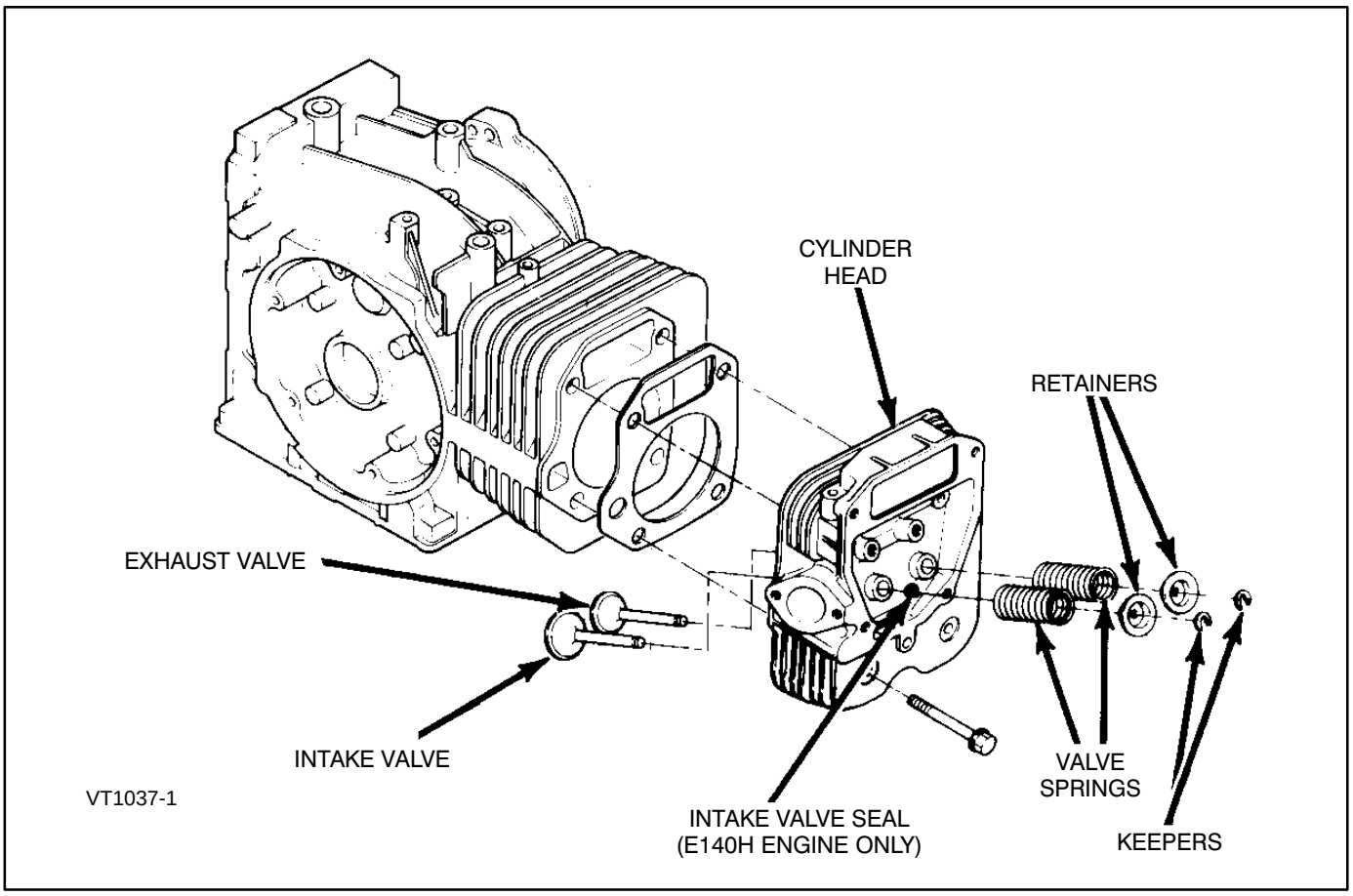


FIGURE 9-4. VALVE REMOVAL

Intake and Exhaust Valves

Depress the valve spring retainer using a 9/16 inch crows-foot wrench on a 6 inch extension and remove keeper. See Figure 9-4. Remove spring retainer and spring, then remove valve. When reinstalling apply oil to the valve stem.

Crankcase Cover

1. Remove the crankcase cover mounting bolts. The crankcase is fixed at two places with knockout pins. do not attempt to pry the crankcase cover off or damage can result (Figure 9-5). Hold the crankcase cover and lightly tap the end of the shaft with a plastic hammer.
2. Remove the crankcase cover very carefully to prevent the shaft from scraping the lip surface of the oil seal.
3. Remove and tag shims from the crankshaft and camshaft. Shim widths differ and they must be reassembled in their original positions.

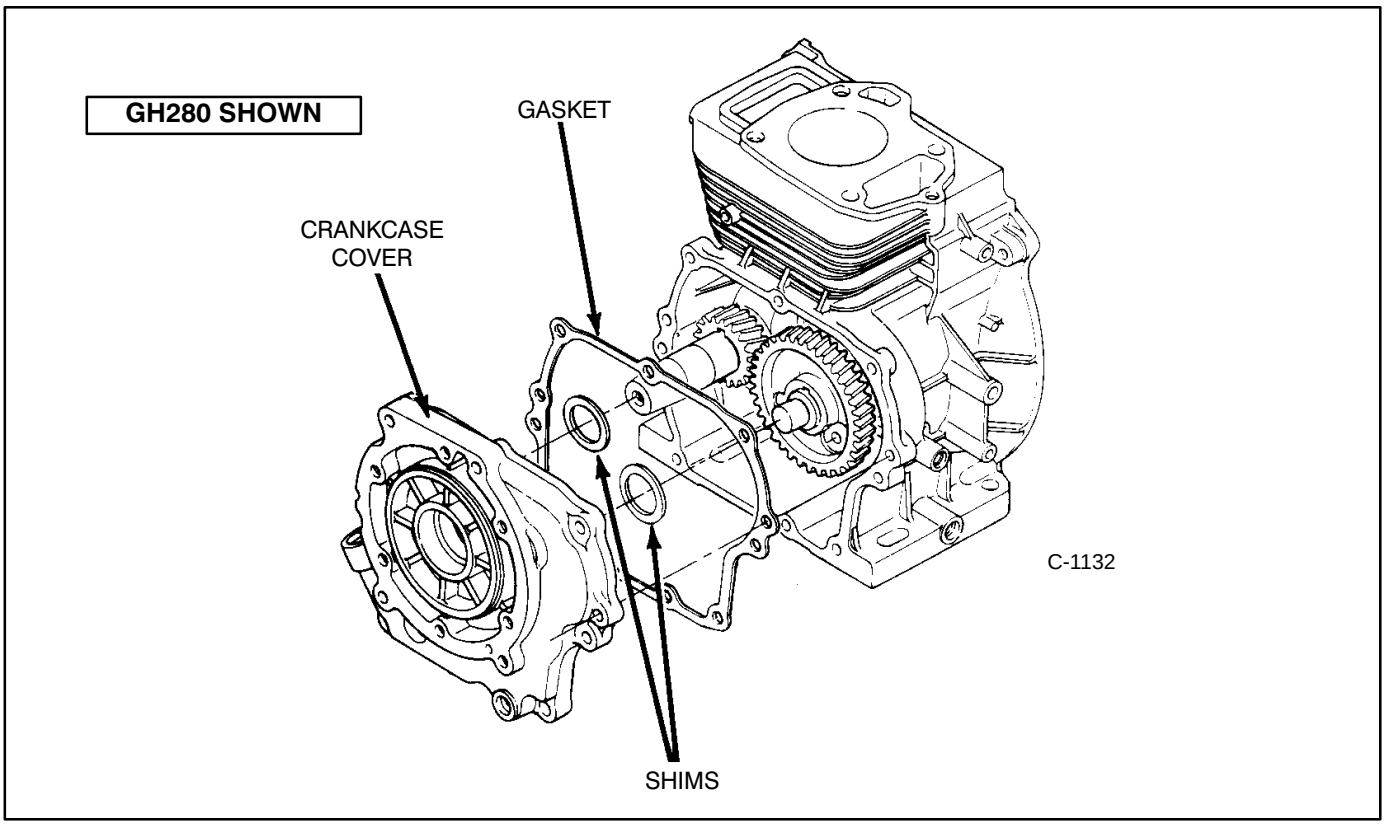


FIGURE 9-5. CRANKCASE COVER

4. Use a new gasket and clean the crankcase cover and the engine block where the gasket rests. Place crankcase cover in position and torque until all bolts are tightened to the specified torque (see Torque Specifications section). When installing the cover make sure the governor shaft is properly positioned.

Camshaft and Tappets

1. Place the engine upside down on a clean flat surface.
2. Pull out the camshaft and cam gear as an assembly (Figure 9-6).
3. Remove the tappets. Tappet clearances differ and the tappets must be reassembled in their original positions.
4. For installation, apply oil to the tappets and the tooth surface of the cam gear. Align the marks on the cam gear and crank gear as shown in Figure 9-7.

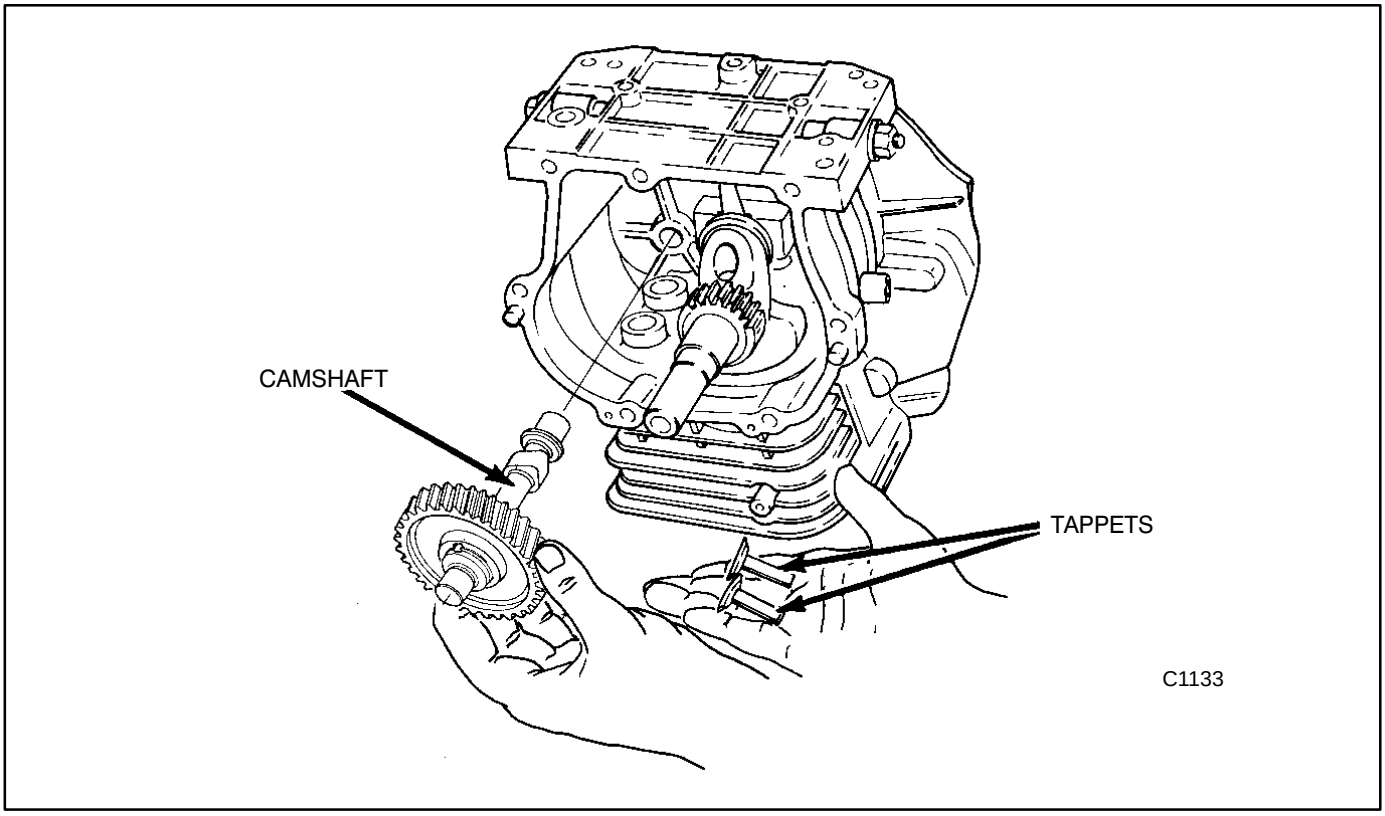


FIGURE 9-6. CAMSHAFT AND TAPPET REMOVAL

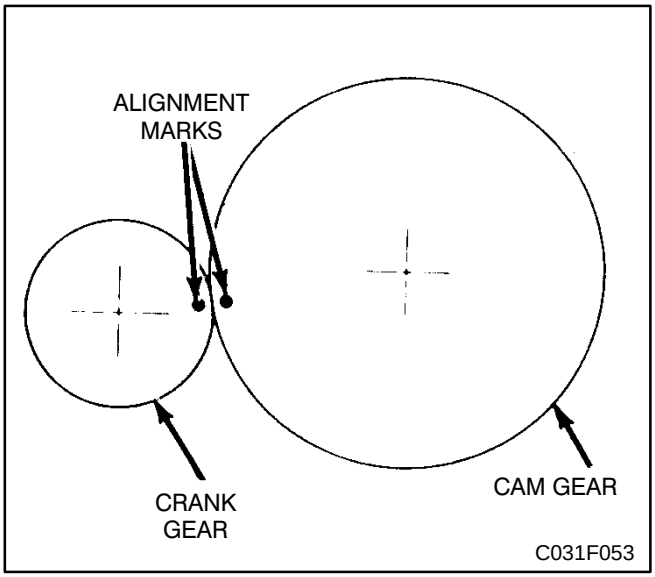


FIGURE 9-7. CAM GEAR AND CRANKGEAR ALIGNMENT

Piston and Crankshaft

The piston assembly consists of the piston, piston pin, and connecting rod assembly. After piston removal, all parts must be carefully inspected for damage and wear. Remove the carbon from the top of the cylinder bore and check for a ridge. remove ridge with a ridge reamer before attempting piston removal. Remove the piston as follows:

⚠ CAUTION ***Improper use of a ridge reamer can damage the cylinder bore. Follow tool manufacturer's instructions and be careful when using a ridge reamer.***

1. Remove two bolts from connecting rod. Mark direction of assembly for connecting rod, cap and splasher.
2. Lift the rod cap from the rod and push the piston assembly through the top of the cylinder (Figure 9-8). Be careful not to scratch the crankpin or the cylinder wall when removing.

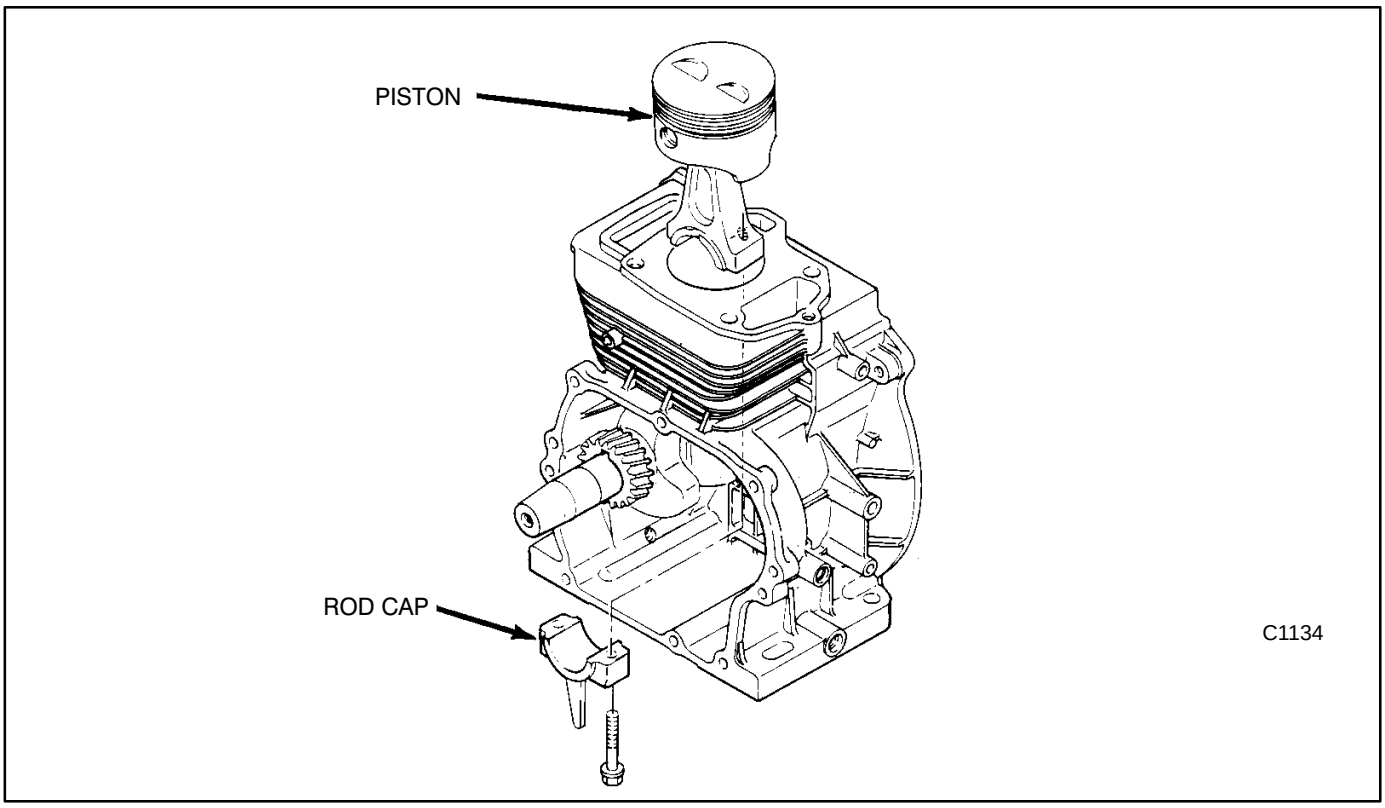


FIGURE 9-8. PISTON REMOVAL

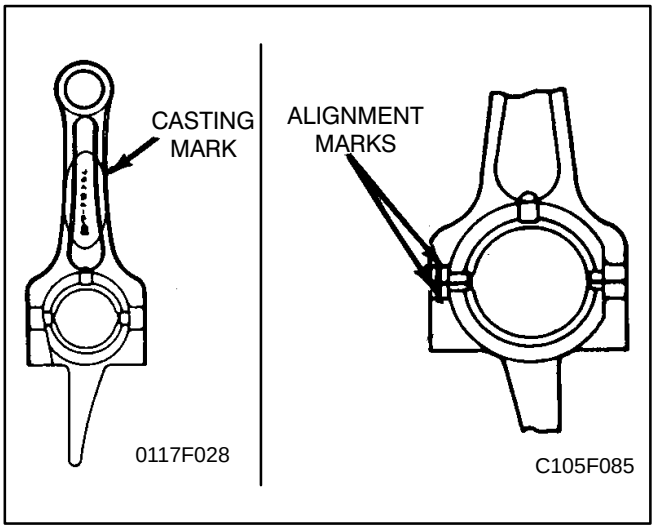


FIGURE 9-9. CONNECTING ROD AND CAP MARKINGS

3. Remove the crankshaft after the connecting rod and piston have been removed, carefully pull the crankshaft out of the oil seal and bearing.
4. Remove the crankshaft after the connecting rod and piston have been removed, carefully pull the crankshaft out of the oil seal and bearing.
5. For installation, lubricate the bearings with engine oil. slide the crankshaft into the bearing. Install the crankcase cover and check to see that the crankshaft turns freely.
6. Assemble the connecting rod so the casting mark faces the flywheel (Figure 9-16). Also align the marks on the cap and the connecting rod.

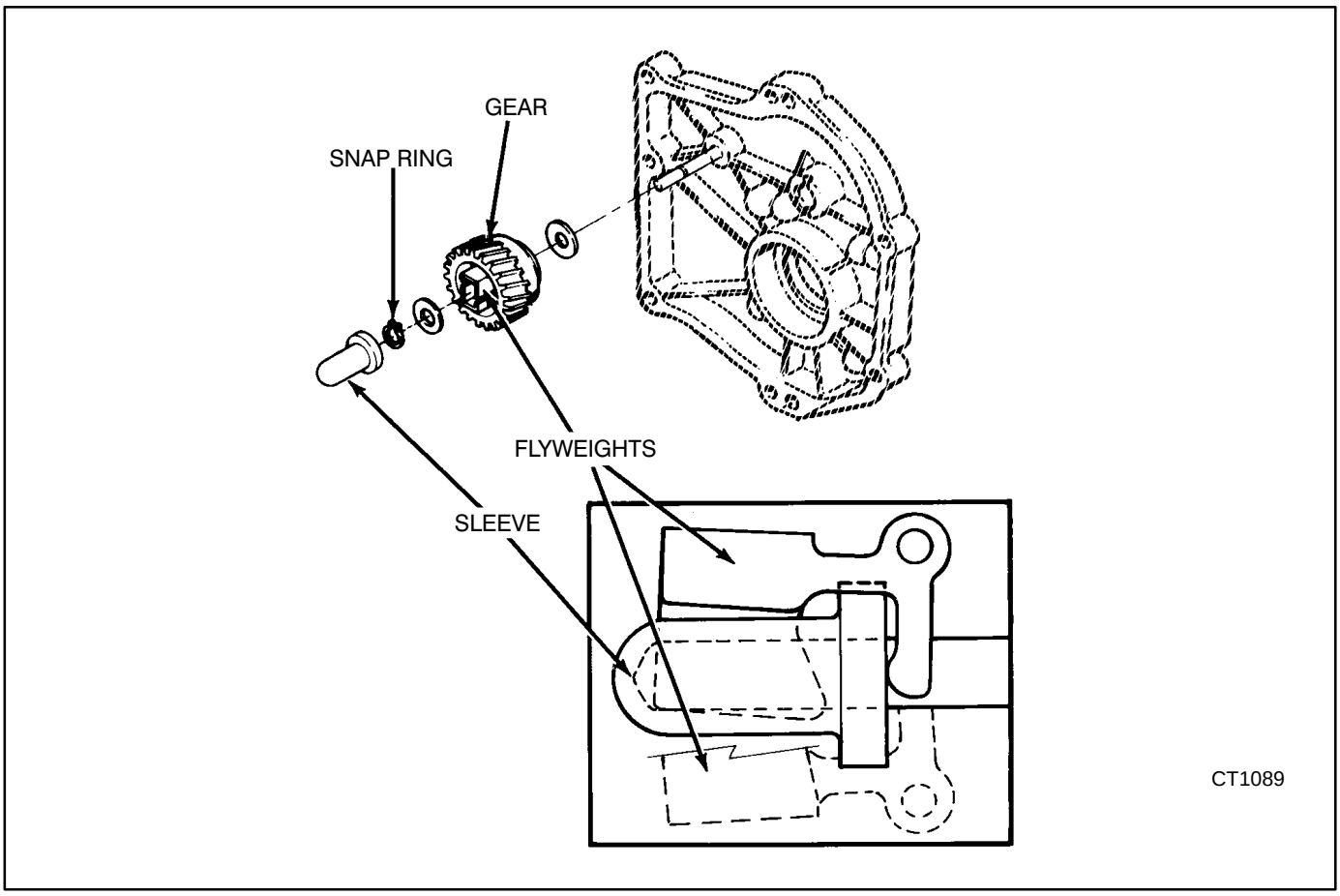


FIGURE 9-10. GOVERNOR

Governor

With the crankcase cover removed, the governor can be inspected or disassembled for service, if necessary. The governor assembly must spin freely on the center pin without excessive looseness or wobble. Sleeve tip wear is the most common cause of governor failure. If governor sleeve, gear, or flyweights are worn or otherwise damaged, replace them. To disassemble, remove the snap ring from the governor center pin and slide governor gear assembly off mounting shaft being careful not to lose outer washer. See Figure 9-10. To install governor, assemble in reverse order of removal (see inset drawing, Figure 9-10, for position of flyweight and sleeve.)

To remove the governor shaft, remove the retainer clip outside the block then pull the governor shaft in through the crankcase.

Bearings

One bearing is pressed into the engine block and the other bearing is pressed into the crankcase cover. The bearing in the engine block can be pressed out after the oil seal is removed (see following section). The bearing in the crankcase cover can be pulled out using a puller. Clean the bearing mounting surfaces and press new bearings back in.

Oil Seal

Use an oil seal remover to pry the oil seal out of the engine block. Clean the oil seal resting surface and lubricate surface before installing new oil seal. Press new oil seal into the engine block until oil seal is flush with cylinder block boss (Figure 9-11). Lubricate the lips of the oil seal with a light coating of grease. This provides initial lubrication until engine oil reaches the seal.

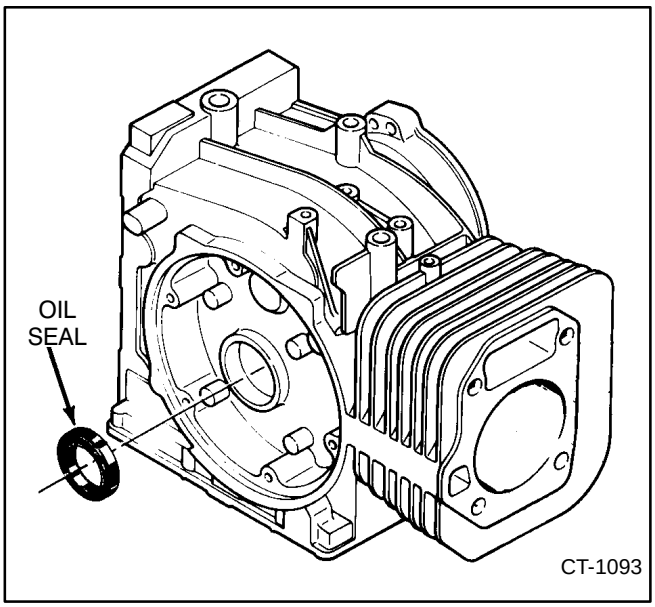


FIGURE 9-11. OIL SEAL

Timing Gears

If replacement of either the crankshaft gear or the camshaft gear becomes necessary, it is recommended that both gears be replaced. Each of these gears are pressed on. The crankshaft gear requires a gear separator and puller to remove and the camshaft gear requires a press to remove. Both gears can be installed using a press. These gears use a Woodruff key to provide correct positioning on the shaft. Each timing gear is stamped with an "O" near the edge. The gear teeth must mesh so that these marks exactly coincide when the gears are installed in the engine.

Oil Level Switch

Remove the oil level switch from inside the crankcase if the switch is defective or if the engine block will be cleaned or replaced.

INSPECTION OF ENGINE PARTS

The following section describes procedures for inspecting each of the major engine components.

Cylinder Head

1. Clean the cylinder head surface.
2. Place a straight edge on the top of the cylinder head as shown in Figure 9-12. Use a feeler gauge to measure the amount of distortion.
3. If the measurement exceeds the specified limit, replace the cylinder head.

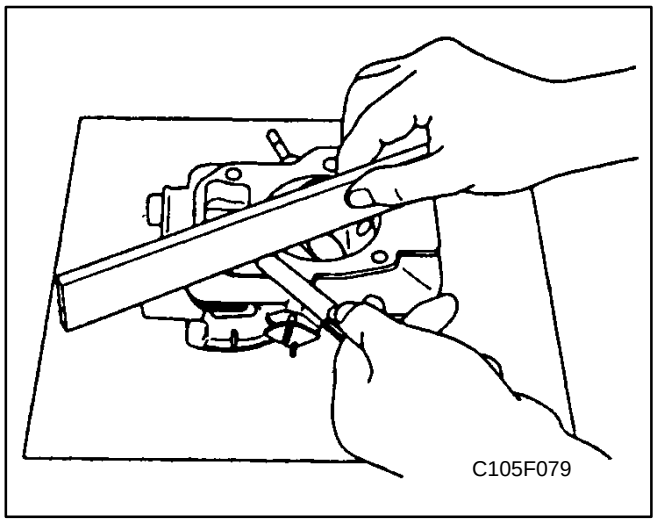


FIGURE 9-12. CYLINDER HEAD SURFACE FLATNESS

Cylinder Block

Cleaning: After removing the piston, crankshaft, cylinder head, etc., inspect the block for cracks and extreme wear. If block is still serviceable, prepare it for cleaning as follows:

1. Scrape all old gasket material from block.
2. Remove grease and scale from cylinder block by agitating in a bath of commercial cleaning solution or hot soapy washing solution.
3. Rinse block in clean hot water to remove cleaning solution.

Inspection: When rebuilding the engine, thoroughly inspect block for any condition that would make it unfit for further use. This inspection must be made after all parts have been removed and block has been thoroughly cleaned and dried.

1. Make a thorough check for cracks using any standard method of crack detection. One method of crack detection follows: Minute cracks may be detected by coating the sus-

pected area with a mixture of 25 percent kerosene and 75 percent light motor oil. Wipe the part dry and immediately apply a coating of zinc oxide (white lead) dissolved in wood alcohol. If cracks are present, the white coating will become discolored at the defective area. Replace a cracked cylinder block.

2. Inspect all machined surfaces and threaded holes. Carefully remove any nicks or burrs from machined surfaces. Clean out tapped holes and clean up any damaged threads.
3. Check cylinder head mounting area for flatness with a straight edge an a feeler gauge.

Cylinder Bore Inspection: Inspect cylinder bore for scuffing, scratches, wear, and scoring. If cylinder bore is scuffed, scratched, scored, or worn, the block must be bored to an oversize or replaced.

When the appearance of the cylinder bore is good and there are no scuff marks, check cylinder bore for wear or out-of-round as follows:

1. Measure the I.D. of the cylinder liner with a cylinder gauge at six points as shown in Figure 9-13.
2. If the measurement exceeds the allowable limit, the cylinder will need to be bored to an oversize and then be honed.

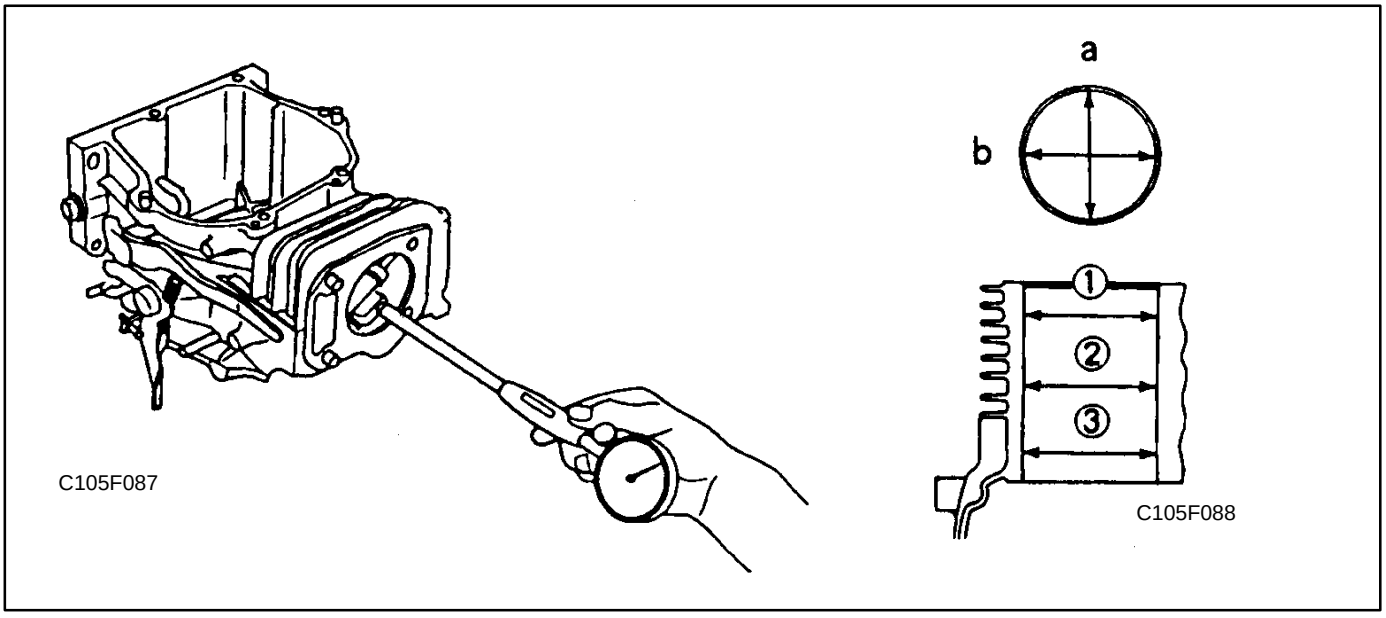


FIGURE 9-13. MEASURING CYLINDER WEAR

Pistons, Rings, and Connecting Rod

The piston has two compression rings and one oil control ring. Remove these rings from the piston using a piston ring expander as shown in Figure 9-14.

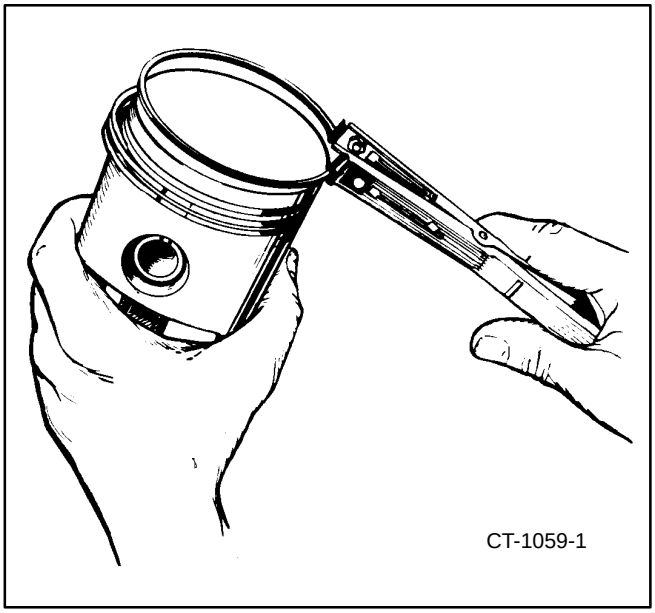


FIGURE 9-14. REMOVING PISTON RINGS

Remove the piston pin retainer from each side and push the piston pin out. remove dirt and deposits from the piston surfaces with parts cleaning solvent. Clean the piston ring grooves with a groove cleaner (Figure 9-15) or the end of a piston ring filed to a sharp point. Care must be taken not to remove metal from the groove sides.

⚠ CAUTION ***Using caustic cleaning solvent or wire brush for cleaning pistons will damage piston. Use only parts cleaning solvent. When cleaning the connecting rod in solvent, include the rod bore. Blow out all passages with low pressure compressed air.***

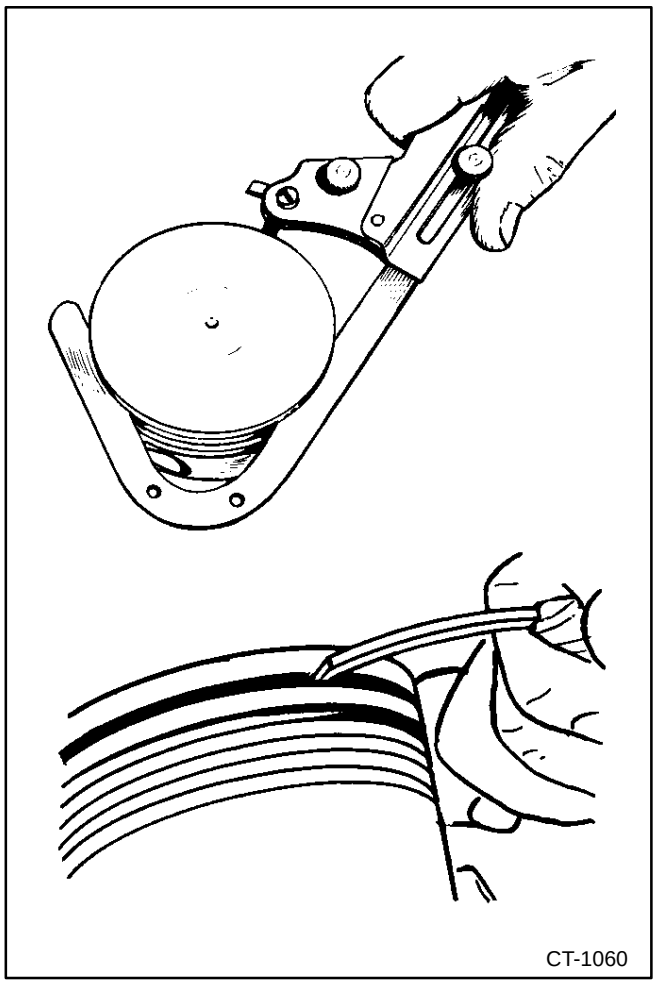


FIGURE 9-15. CLEANING RING GROOVES

The following section covers inspection procedures for piston and connecting rod.

Piston Inspection: Inspect the piston for fractures at the ring lands, skirt, and pin bosses. Check for wear at the ring lands using a new ring and feeler gauge as shown in Figure 9-16. Replace the piston when the side clearance of the rings exceed the specified limit.

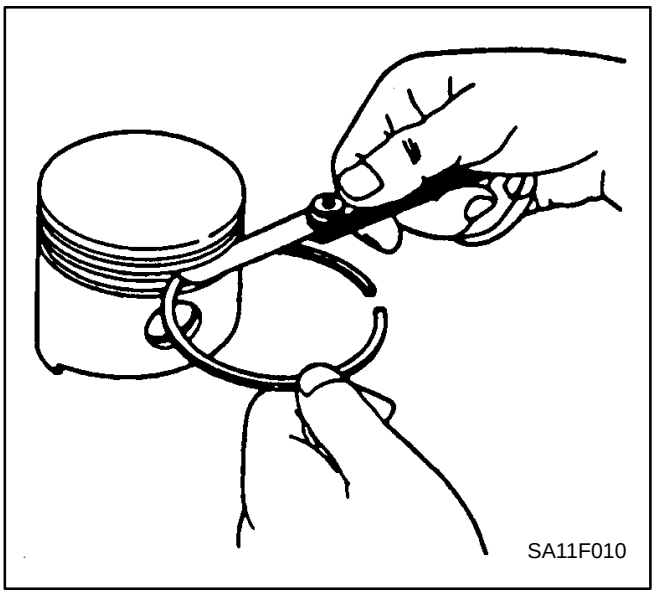


FIGURE 9-16. CHECKING RING LAND

Piston Skirt O.D. Measurement:

1. Measure the piston skirt O. D. with an outside micrometer (Figure 9-17).
2. If the measurement is less than the allowable limit, replace the piston.

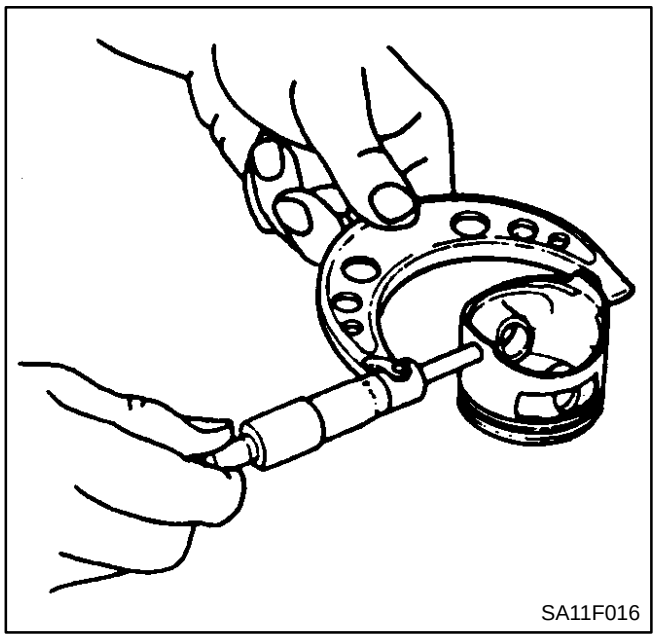
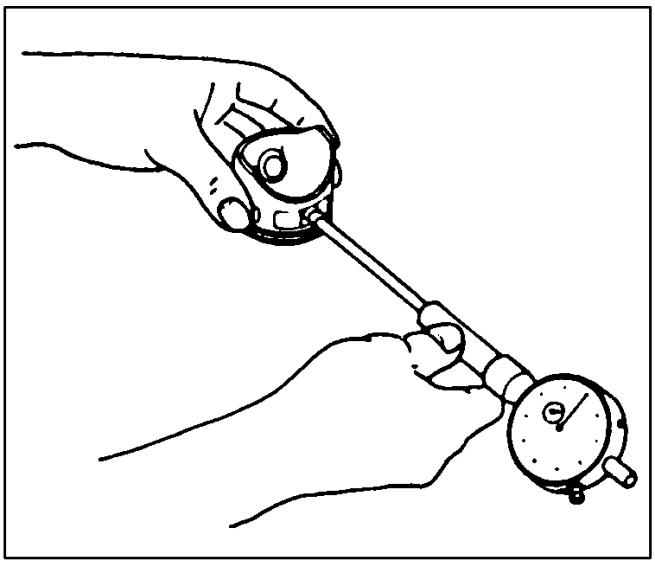


FIGURE 9-17. PISTON SKIRT MEASUREMENT

Piston Boss I.D.:

1. Measure the piston boss I.D. in both the vertical and horizontal direction with a cylinder gauge (Figure 9-18).
2. If the measurement exceeds the allowable limit, replace the piston.

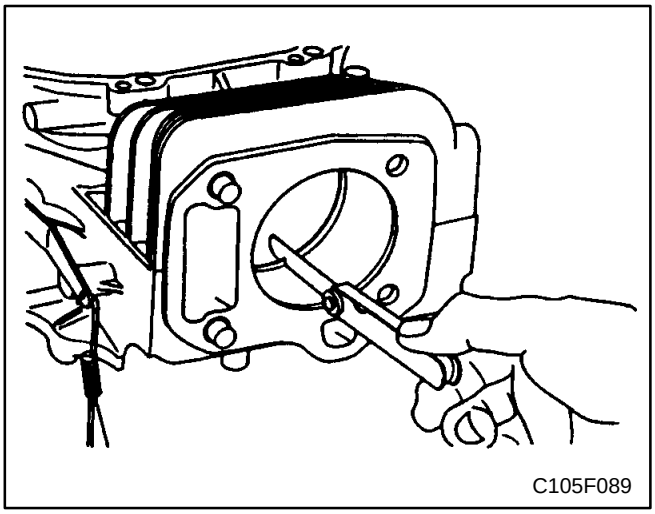


SA11F012

FIGURE 9-18. PISTON BOSS I. D.

Piston Ring Gap:

1. Insert piston ring into cylinder. Use piston head to push ring down to bottom of cylinder.
2. Measure the ring gap with a feeler gauge as shown in Figure 9-19.
3. If the ring gap exceeds the allowable limit, replace the ring.

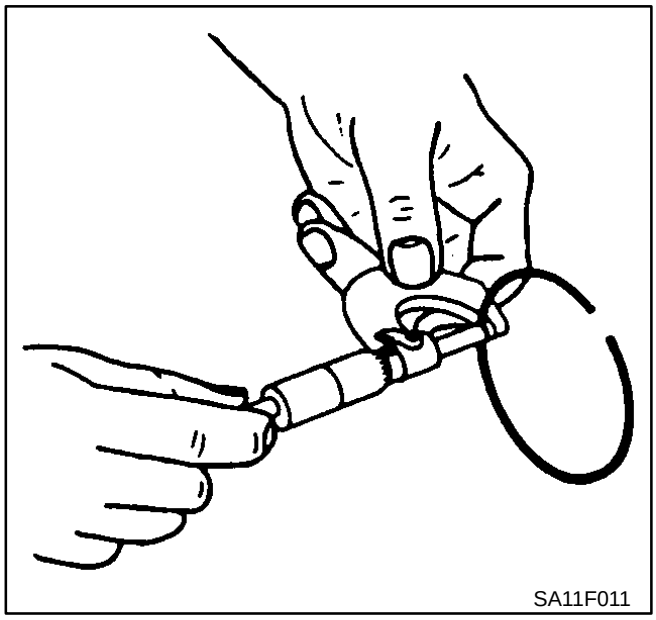


C105F089

FIGURE 9-19. MEASURING RING GAP

Piston Ring Thickness

1. Measure the piston ring thickness with an outside micrometer (Figure 9-20).
2. If the thickness is less than the allowable limit, replace the ring.



SA11F011

FIGURE 9-20. RING THICKNESS

Piston Assembly

Install the rings on the piston beginning with the oil control ring. Use a piston ring spreader to prevent twisting or excessive expansion of the ring. Compression rings are marked with the word “top” or a mark on one side of the ring to indicate which side faces the top of the piston. Unmarked rings may be installed either way. Stagger ring gaps 120 degrees apart. Do not position ring gaps on thrust face of cylinder.

Clearance between Piston Pin and Connecting Rod Small End Bore

1. Measure the piston pin O.D. and connecting rod small end bore with a micrometer (Figure 9-21). Then calculate the difference.
2. If the clearance exceeds the allowable limits, replace them.

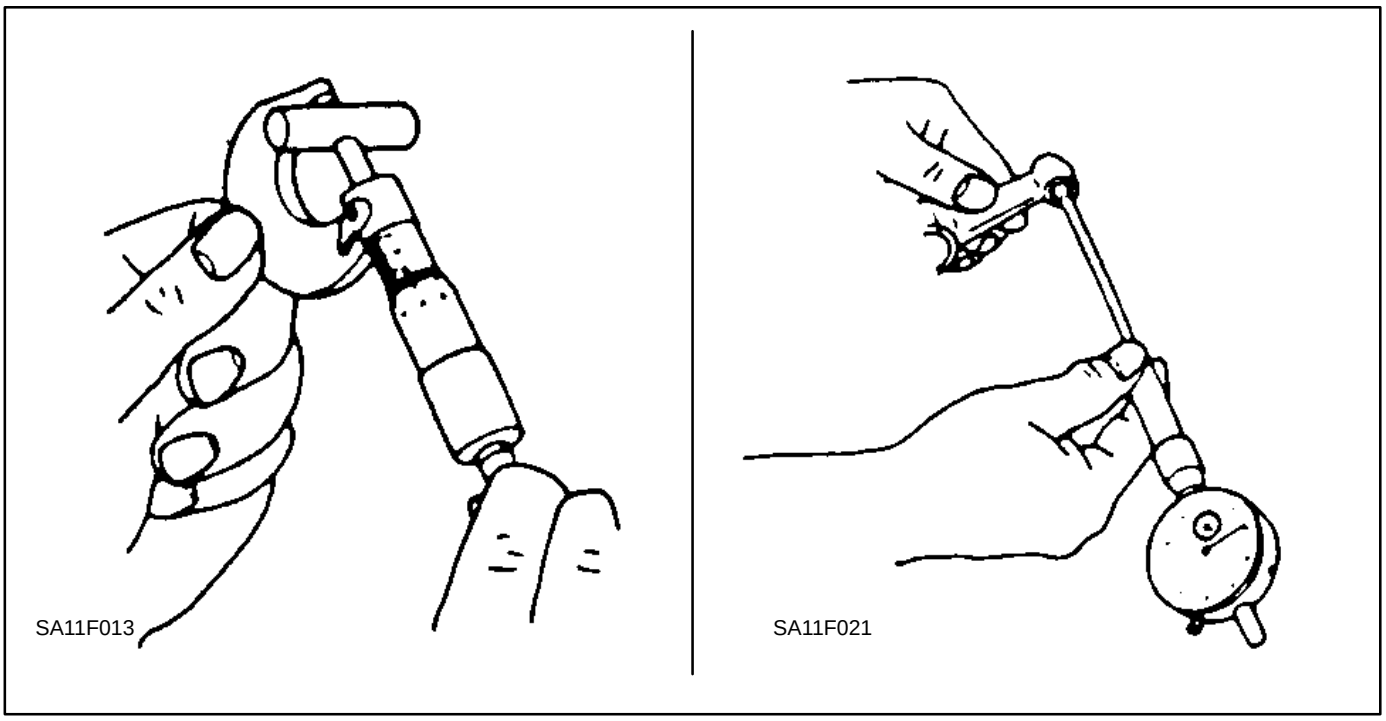


FIGURE 9-21. PISTON PIN AND CONNECTING ROD CLEARANCE

Clearance Between Crank Pin and Connecting Rod Big End Bore

1. Measure the crank pin O. D. and the connecting rod big end bore with a micrometer, and calculate the difference (Figure 9-22).
2. If the clearance exceeds the allowable limits, replace them.

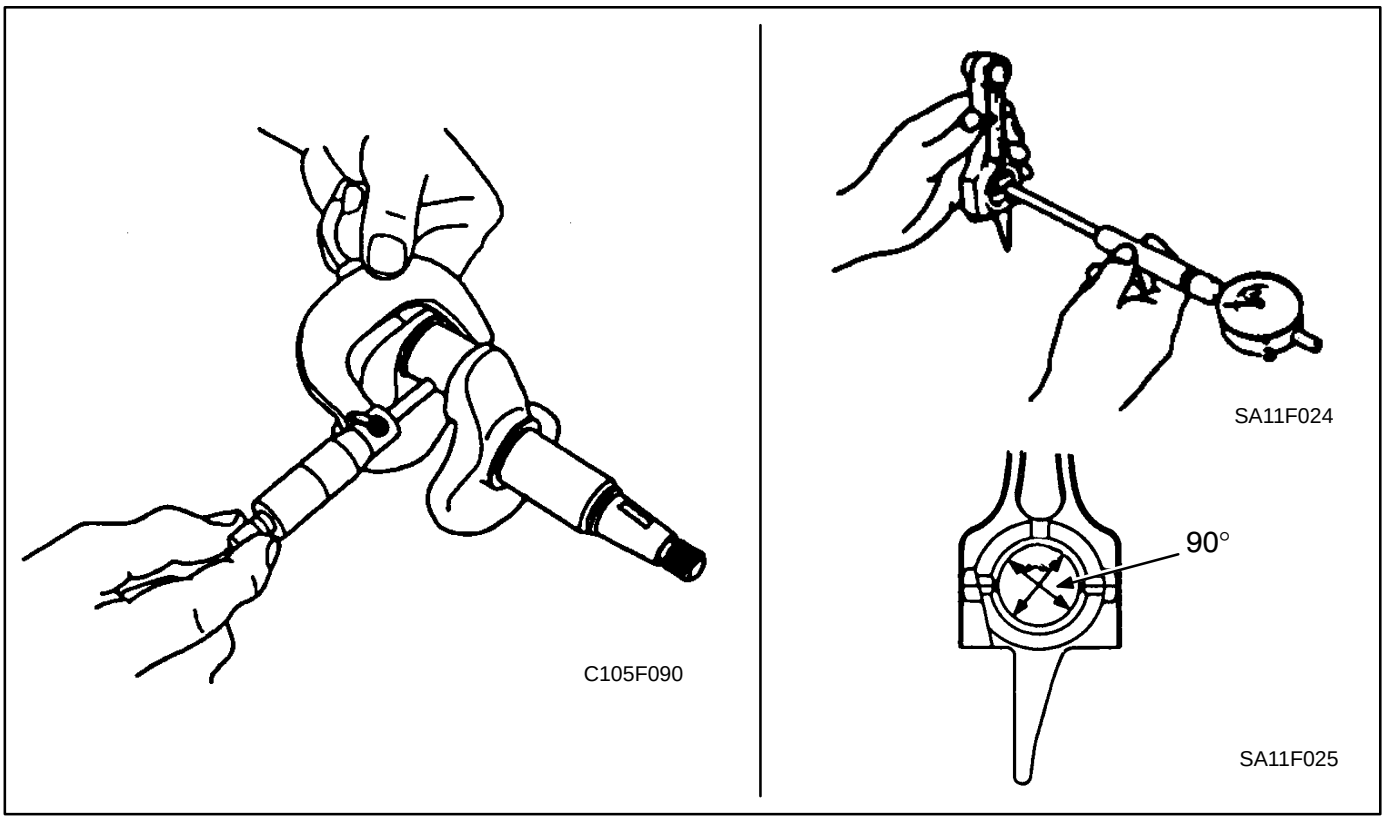


FIGURE 9-22. CRANK PIN AND CONNECTING ROD CLEARANCE

Side Clearance of Connecting Rod on Crank Pin

1. Assemble the connecting rod to the crank pin.
2. Measure the side clearance with a feeler gauge (Figure 9-23).
3. If the clearance exceeds the allowable limits, replace them.

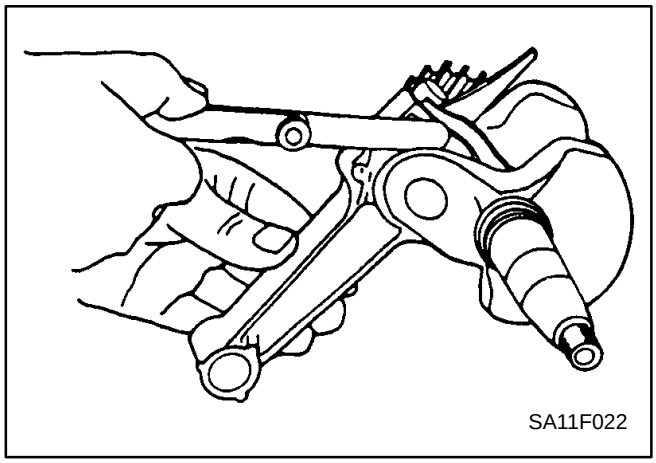


FIGURE 9-23. SIDE CLEARANCE OF CONNECTING ROD ON CRANK PIN

Cam Heights for Intake and Exhaust

1. Measure the height of the cam at its highest point with an outside micrometer (Figure 9-24).
2. If the measurement is less than the allowable limit, replace the camshaft.

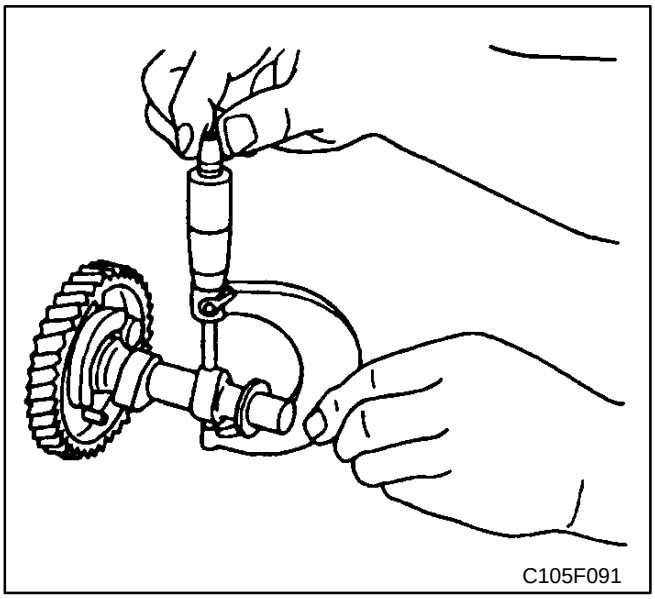


FIGURE 9-24. INTAKE AND EXHAUST CAM HEIGHTS

Side Clearance of Crankshaft

1. Set a dial gauge, as shown in Figure 9-25, push the shaft in and measure the clearance.
2. If the side clearance exceeds the allowable limits, adjust with shims.

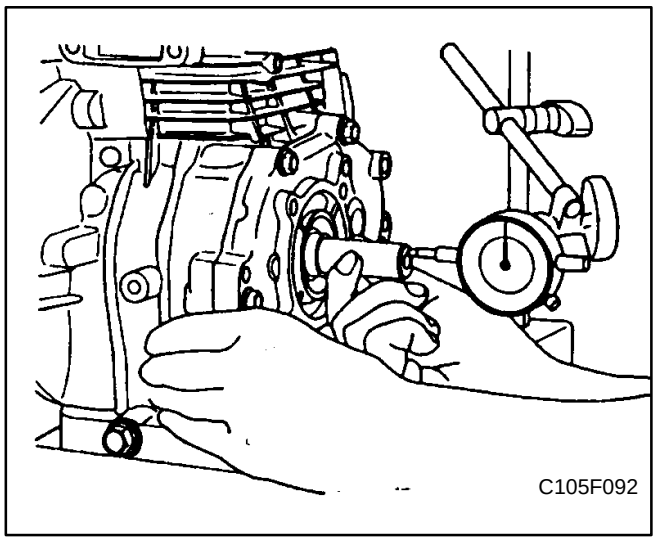


FIGURE 9-25. SIDE CLEARANCE OF CRANKSHAFT

VALVE SYSTEM

This section discusses overhead valve inspection and service on the GH170 and GH280 engines. The Elite engines are covered in the Elite engine manual.

Check the valve face for evidence of burning, warping, out-of-round, and carbon deposits (see Figure 9-26). Burning and pitting are caused by the valve failing to seat tightly. This condition is often caused by hard carbon particles on the seat. It may also be due to weak valve springs, insufficient tappet clearance, warping, and misalignment.

Warping occurs mainly due to exposure to intense heat. Out-of-round wear follows when the seat is pounded by a valve whose head is not in line with the stem and guide. If a valve face is burned or warped, or the stem is worn, install a new one.

Too much clearance in the intake guide admits air and oil into the combustion chamber affecting carburetion, increasing oil consumption, and making heavy carbon deposits. Carbon insulates metal and retains the heat. This increases combustion chamber temperature and causes warping and burning.

Unburned carbon residue gums valve stems and causes them to stick in the guide. Deposits of hard carbon with sharp points projecting become white hot and cause pre-ignition and pinging.

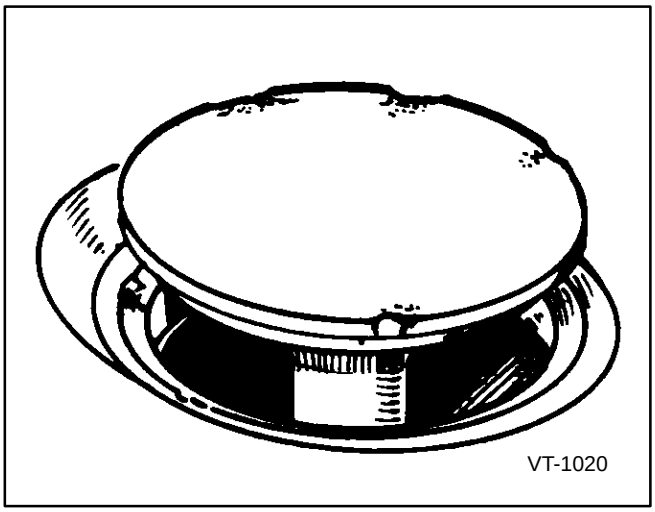


FIGURE 9-26. VALVE FACE

OVERHEAD VALVE INSPECTION AND SERVICE

Check Clearance Between Valve Stem and Valve Guide

1. Measure the valve stem O. D. with an outside micrometer (Figure 9-27).
2. Measure the valve guide at the largest point with a small hole gauge.
3. If the clearance exceeds the allowable limit, replace the valve guide and valve.

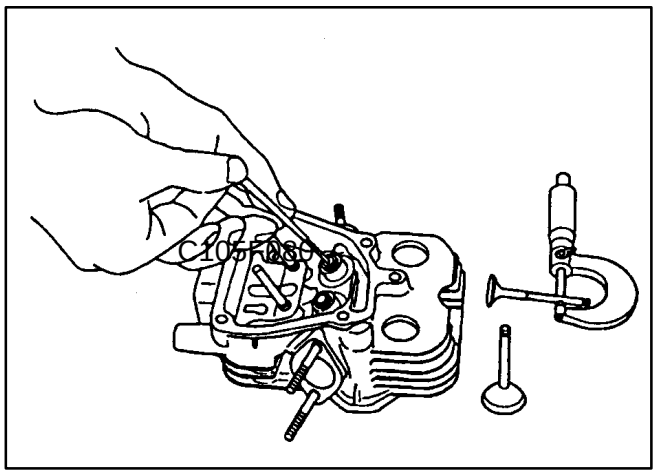


FIGURE 9-27. CLEARANCE BETWEEN VALVE STEM AND VALVE GUIDE

Check Valve Seat Surface Width

1. Clean the valve seat surface.
2. Measure the valve seat width (Figure 9-28) with a vernier calipers.
3. Apply red lead to the valve surface to check for scratches or unevenness.
4. When the measurement is within the allowable limit, check the seating ration. If the ration is less than 70%, the valve seat needs to be reground.
5. If the measurement exceeds the allowable limit, replace the valve and regrind the valve seat (see Regrinding Seat Surface).

Regrinding Seat Surface:

1. Grind valve seat surface with a 45° cutter. Use a cutter appropriate for the valve seat surface and valve guide diameter (Figure 9-28).
2. Install valve and check for contact between valve face and valve seat with red lead. (Figure valve has been in use for a long time the seat tends to come in contact with the upper side of the valve face.)
3. Cut and readjust the width using a 15° cutter so the valve seat width makes contact in the same dimension as the valve face width.

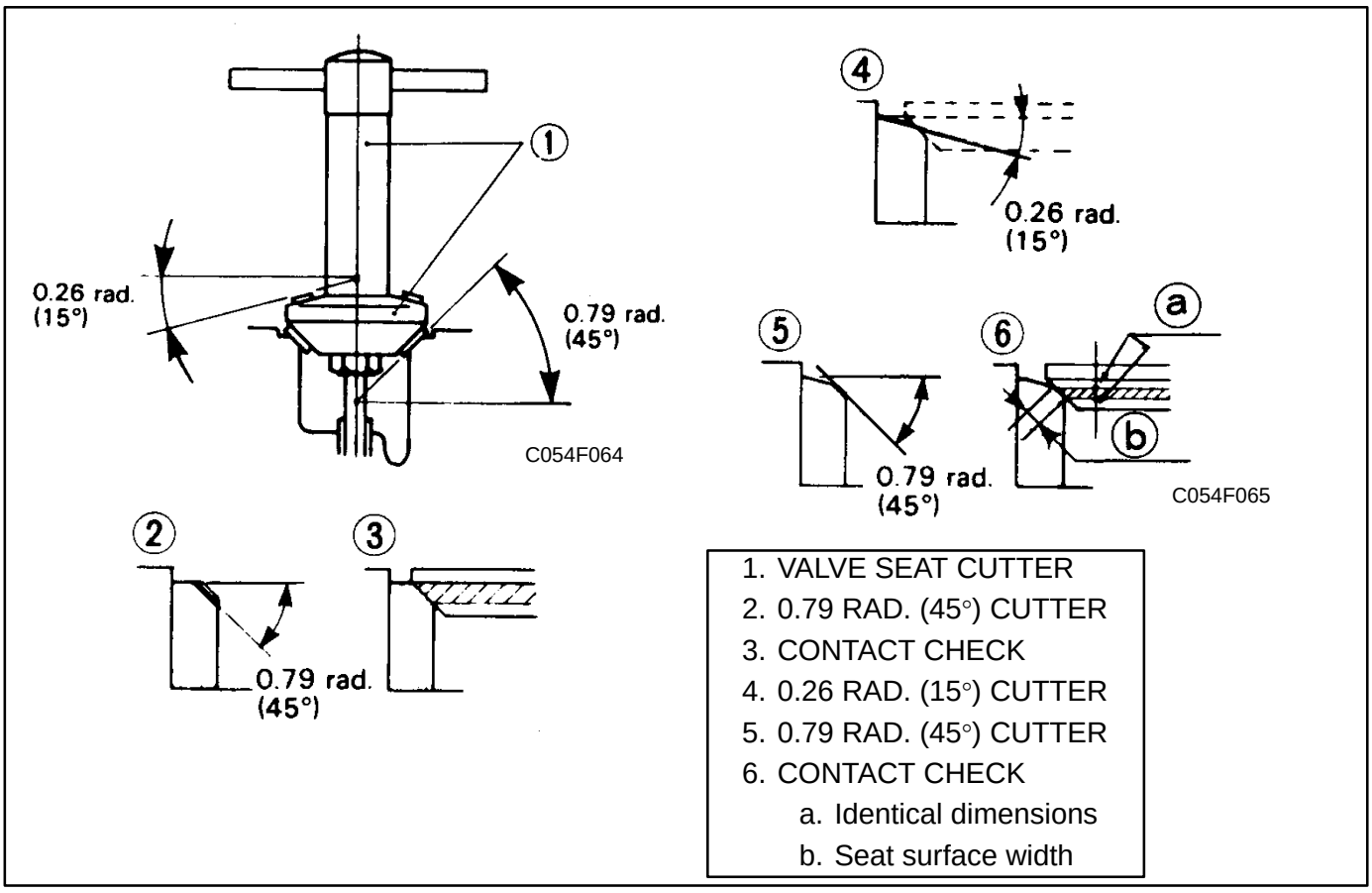


FIGURE 9-28. REGRINDING VALVE SEAT

4. Cut the valve seat surface again with a 45° cutter and recheck the contact between the valve and seat.
5. Repeat steps three and four until the correct contact is achieved.
6. Lap the valve seat until the seated rate is more than 70% of the total contact area.
7. Use a grinding compound to finish the seat surface.

Check Valve Spring Free Length

1. Measure the valve spring length (dimension “A”) with a vernier calipers (Figure 9-29).
2. If spring length is less than the allowable limit replace it.

Check Valve Spring Squareness

1. Place the spring on a surface plate and use a square (Figure 9-29) to check squareness.
2. Turn the spring and measure to obtain the greatest dimension “B”.
3. Check for spring damage and scratches.
4. Replace the spring if it is damaged or out of square by more than 0.0591 inches (1.5 mm).

Checking Valve Clearance

The engine is equipped with adjustable valve tappets. Adjust the valve clearance only when the engine is at ambient temperature. Proceed as follows:

1. Inspect valve stems for proper alignment with tappets.
2. Advance the engine until both of the valves are closed and there is no pressure on the valve lifters (piston at top dead center).
3. Clearances are shown in the Specifications section. For each valve, the gauge should just

pass between the top of the valve stem and the rocker arm (Figure 9-30).

4. Check the cylinder head mounting bolt torque (see Cylinder Head, this section), before performing valve lash adjustment.
5. To correct the valve clearance, place a wrench on the adjusting nut and a wrench on the outer locking nut. Loosen the outer locking nut and turn the adjusting nut as needed t obtain the correct clearance. Tighten locking nut after adjustment is made.
6. Recheck the valve clearance after adjustment has been made and also check the rocker arm bolts to see that they have not loosened as a result of adjusting the valve clearance.

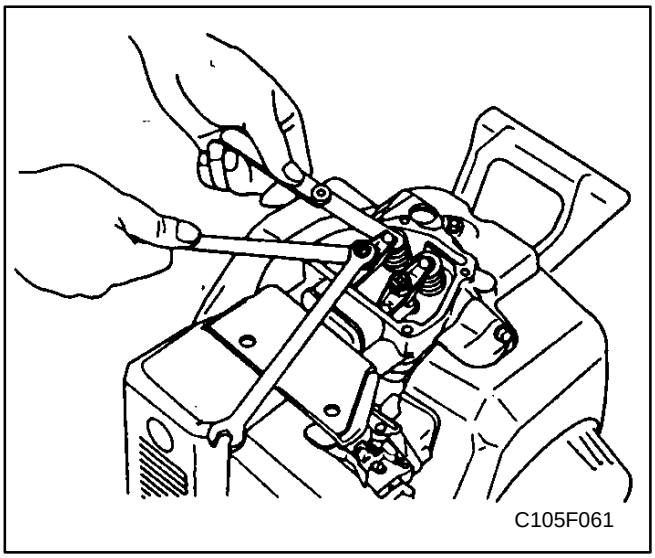


FIGURE 9-30. CHECKING VALVE CLEARANCE

COMPRESSION RELEASE SYSTEM

The overhead valve engines have a compression release system that decreases the amount of effort required to start the engine with the recoil starter (Figure 9-31). If it becomes difficult to crank the engine over with the recoil starter, and the recoil starter mechanism works properly when it is removed from the generator set, the problem may be in the compression release system. The system works as follows:

1. As the engine is started, a spring (4) pulls in on a flyweight (3) which in turn pushes a decompression pin (2) upward.
2. The decompression pin pushes up and opens the exhaust valve (1) momentarily to release compression and make recoil starting easier.
3. As the engine speeds up, the flyweight is forced outward by centrifugal force and the decompression pin moves down so that it no longer contacts the exhaust valve.

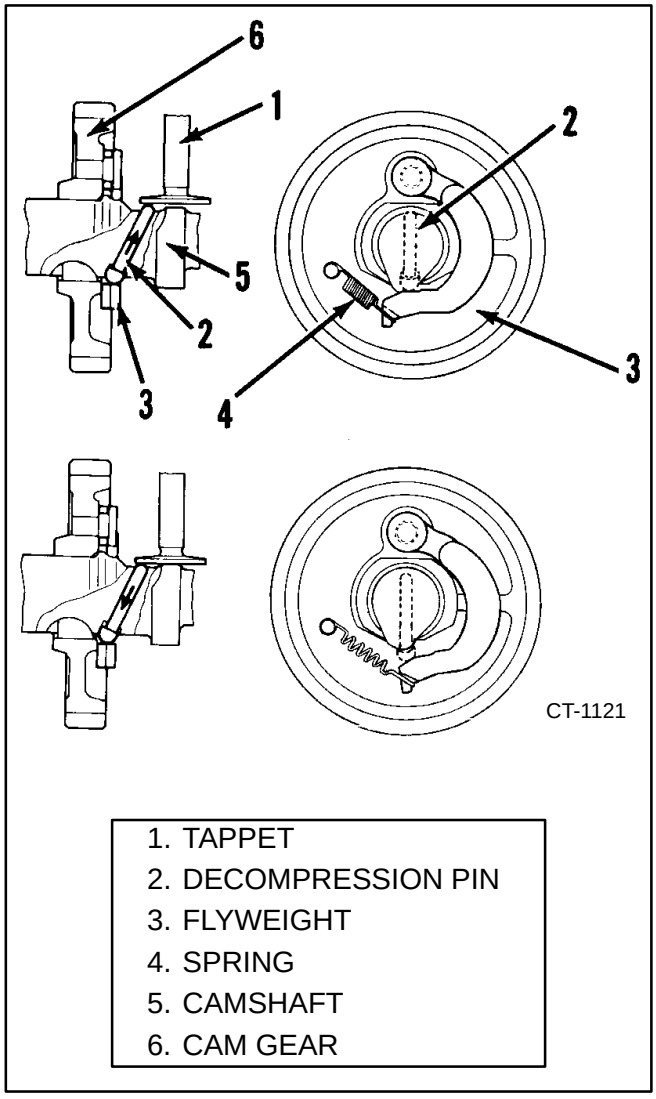


FIGURE 9-31. COMPRESSION RELEASE SYSTEM

Section 10. Service Checklist

GENERAL

After servicing, inspect and test the generator set to confirm that it will operate properly and will pull the full rated load. Check each of the following areas before putting the set into service.

LUBRICATION

If the engine oil was drained during service, fill the crankcase with oil of the recommended classification and viscosity. Refer to the Operators Manual for the specific recommendations and procedures.

WIRING

Verify that all wiring connections are tight and are routed properly. Check each of the following:

- Control Wires
- Ground Strap
- Battery Cables (Electric Start Models Only)

INITIAL START ADJUSTMENTS

⚠WARNING ***Inhalation of exhaust gas can result in severe personal injury or death. Do not operate the generator set in poorly ventilated areas such as indoors, inside tanks, confined areas, depressions, or any area where exhaust gases might accumulate. Locate the exhaust outlet so that exhaust gases will not accumulate during operation.***

⚠WARNING ***Generator sets produce heat and electrical arcing that can ignite gases, combustibles, or explosive materials, causing severe personal injury or death. Do not operate if flammable atmosphere or materials may be present.***

Open the fuel valve. Make sure that the speed control lever is set to high (“H”). If necessary, close the choke for starting. Start the generator set. If necessary, adjust the governor speed adjustment screw to obtain a safe no-load operating speed. With no load applied, listen for any unusual sounds or vibrations. Close the choke as the engine warms up. When the choke is completely open, adjust the carburetor and governor as specified in the Fuel System section.

OUTPUT CHECK

Use a load test panel to apply progressively greater loads until full load is reached. Operate the generator set at its full rated output to make sure the set operates properly.

EXHAUST SYSTEM

With the generator set operating, inspect the entire exhaust system including the muffler and exhaust pipe. Visually and audibly inspect all welds, connections, and joints. If leaks are detected, shut the generator set down and make repairs before operating the generator set. Repair corroded exhaust components before leaks occur.

Section 11. Wiring Diagrams

This section contains the control wiring diagrams for the Standard and Pro portable generator sets. Refer to the list below to identify the drawing number and page.

625-3230 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.

BLACK
IGNITION CONTROL UNIT
STOP
SPST
ENGINE

ORANGE
BLACK
T1 RED
T2 WHITE
T3 BROWN
T4 BLUE
DC- DC+ T4 T3 T2 T1
DC+ DC- T3 T4 T1 T2
#18 RED
#18 BLACK
#12 BLACK
#12 WHITE
#12 BLACK
#12 WHITE
(REAR VIEW)
#12 GREEN
#12 GREEN
EARTH (NEUTRAL BONDED TO EARTH) (NOTE 4)
GENERATOR

CB9
15 AMP
DC RECEPTACLE
#18 RED
CB1
10 AMP
CB2
10 AMP
#12 BLACK
#12 BLACK
#12 BLACK
#12 BLACK
T1 T4 T1 T4
NEU GND
(REAR VIEW)
#12 WHITE
NEU GND
T1 T4 T1 T4
(REAR VIEW)
10 INCHES OF #12 WHITE
10 INCHES OF #12 BLACK TAPE OR INSULATE TO PREVENT SHORTING
#12 GREEN
PANEL EARTH (NOTE 3)
RECEPTACLE PANEL
CONTROL BOX

300-3824-01
RECEPTACLE PANEL SHOWN

CADAM DWG

DR	J GRIFFIN	05/19/95						
CHKD BY MFG	T V PHAN	05/19/95						
APPROVED	D XYKIS	05/26/95						

MODEL FIRST USED ON: 1.4 kW STD 50 BLANK PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

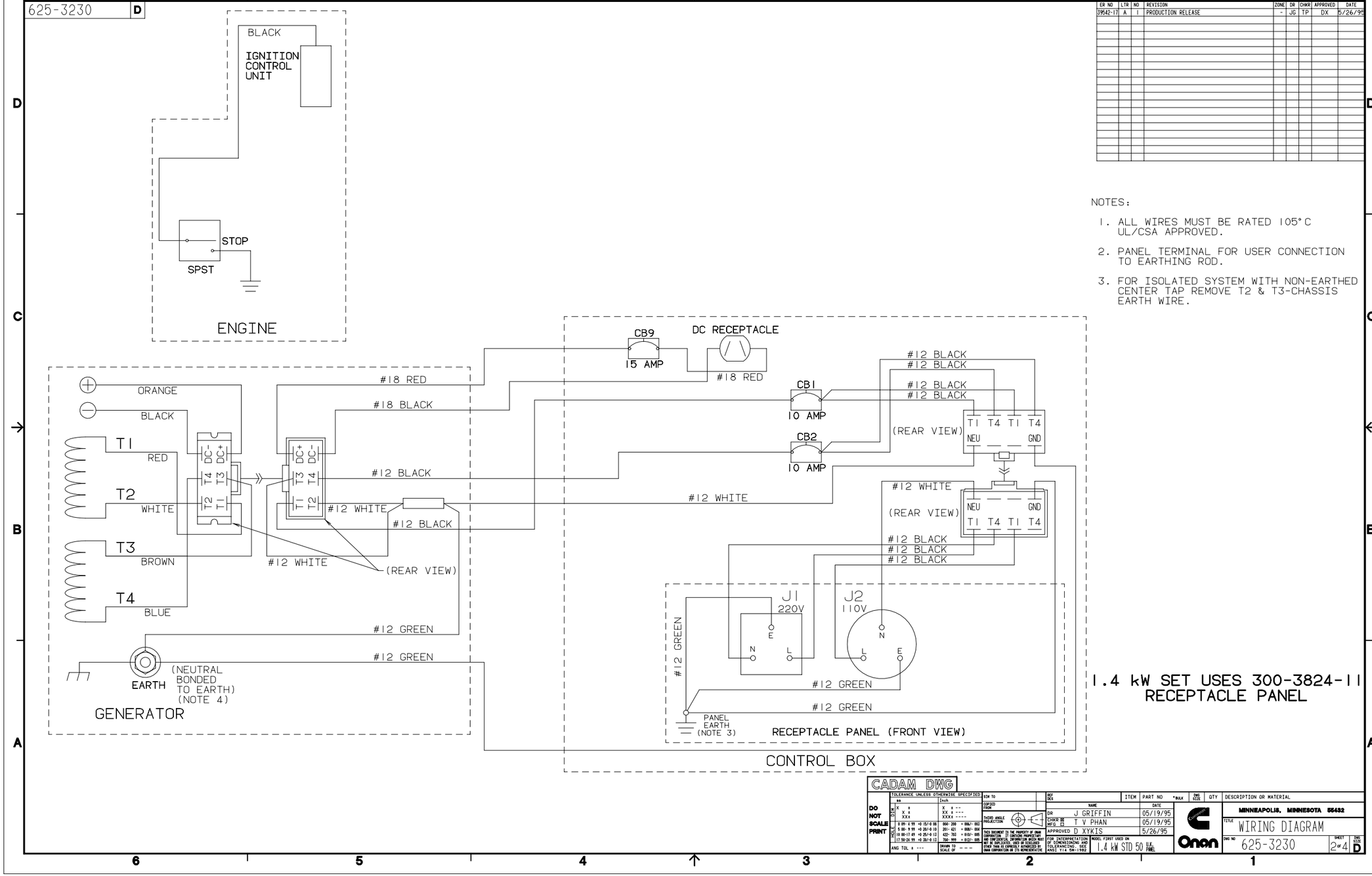
DWG NO: 625-3230 SHEET 1 of 4 DWG SIZE D

625-3230 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
19542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.



1.4 kW SET USES 300-3824-11 RECEPTACLE PANEL

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

DO NOT SCALE PRINT

	NAME	DATE
DR	J GRIFFIN	05/19/95
CHKR	T V PHAN	05/19/95
MFG		
APPROVED	D XYKIS	5/26/95

MODEL FIRST USED ON: 1.4 kW STD 50 H.K. PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

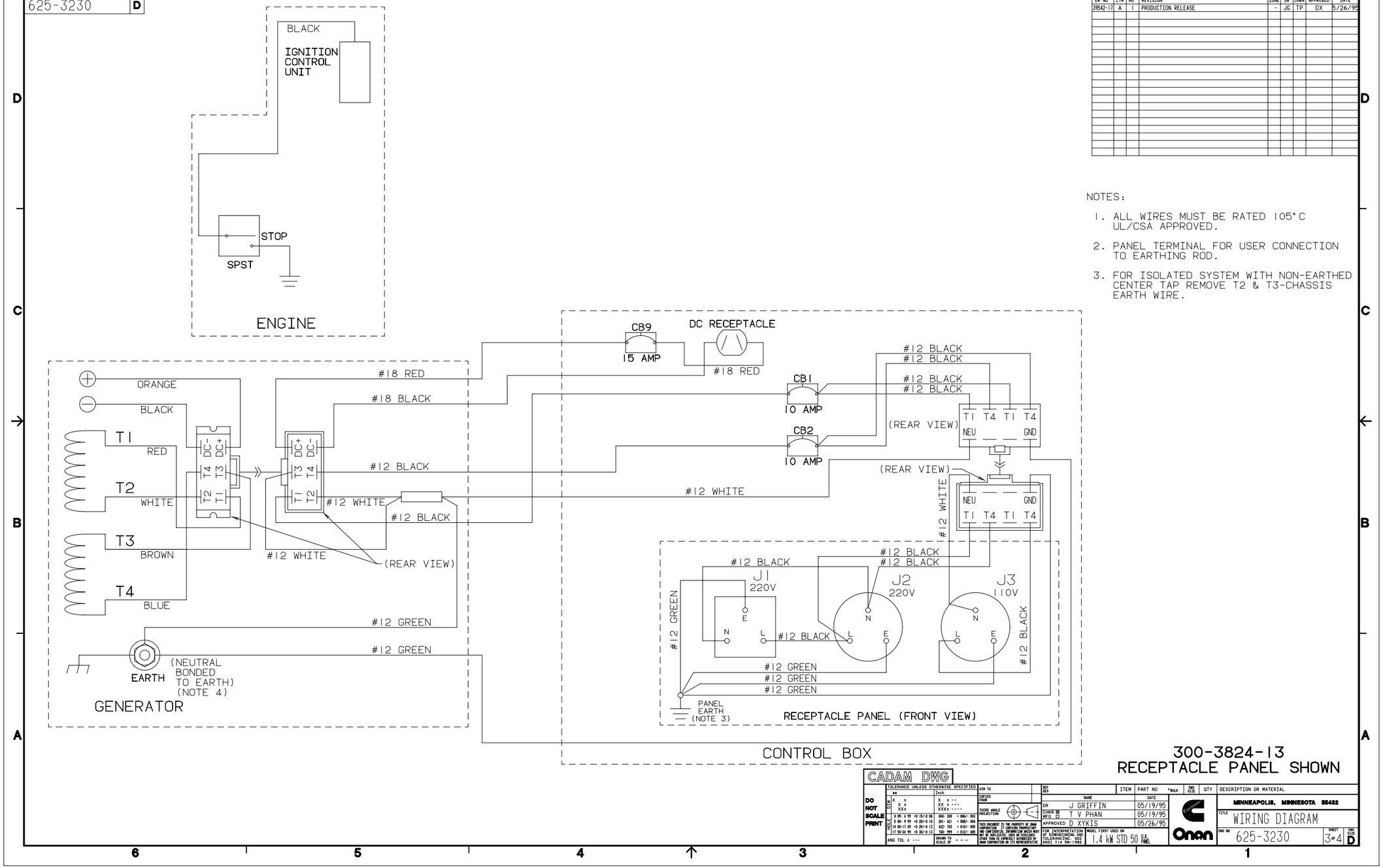
DWG NO: 625-3230 SHEET: 2 of 4 SIZE: D

625-3230 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
J9542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.



300-3824-13
RECEPTACLE PANEL SHOWN

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

DO NOT SCALE PRINT

NAME	DATE
DR J GRIFFIN	05/19/95
CHKR PE MFG TV PHAN	05/19/95
APPROVED D XYKIS	05/26/95

MODEL FIRST USED ON 1.4 kW STD 50 Hz PANEL

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

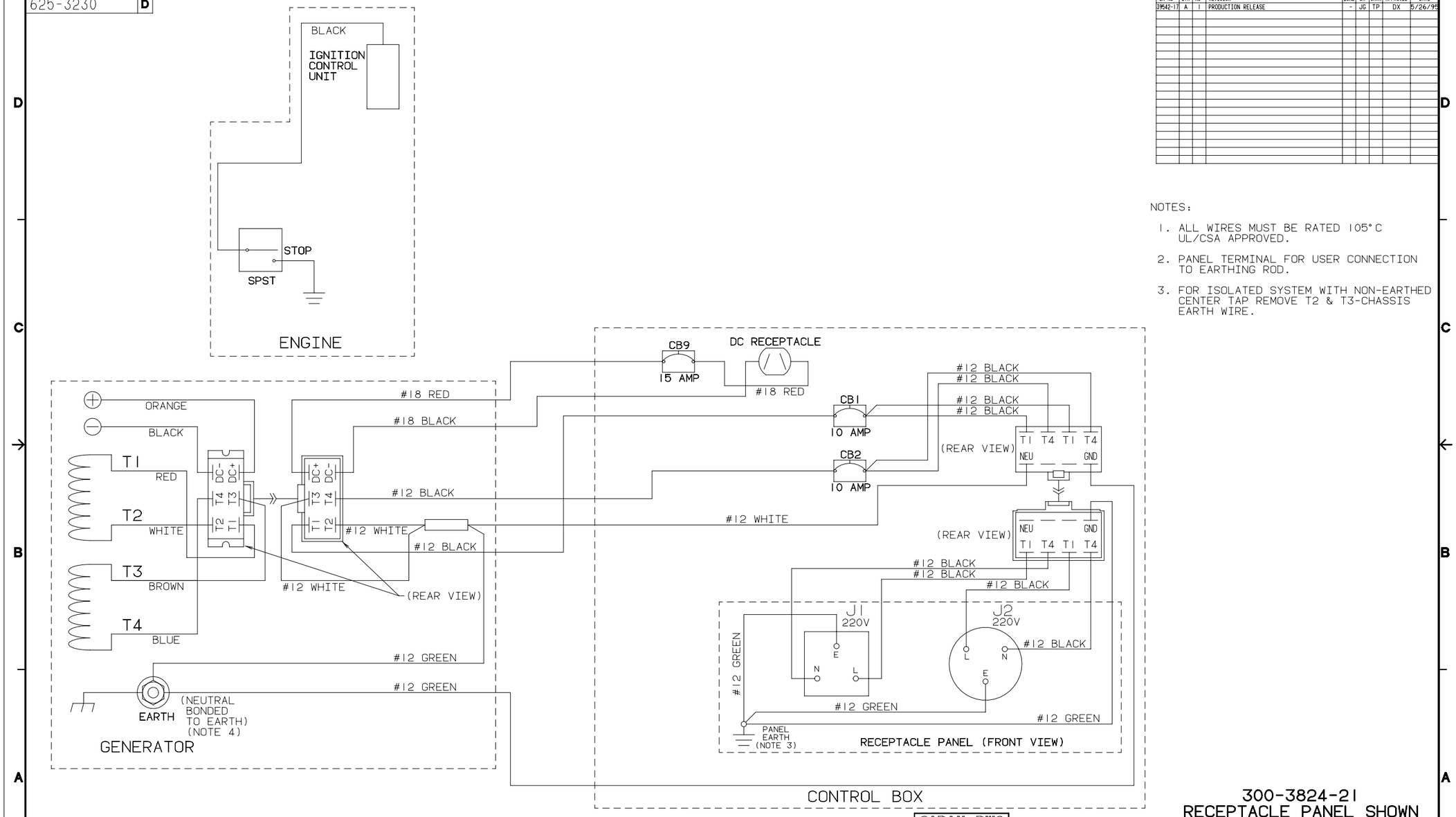
DWG NO 625-3230 SHEET 3 of 4 DWG SIZE D

625-3230 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
19542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.



300-3824-21
RECEPTACLE PANEL SHOWN

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

DO NOT SCALE PRINT

	NAME	DATE
DR	J GRIFFIN	05/19/95
CHKR BE MFG	T V PHAN	05/19/95
APPROVED	D XYKIS	05/26/95

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: 1.4 kW STD 50 EURO PANEL

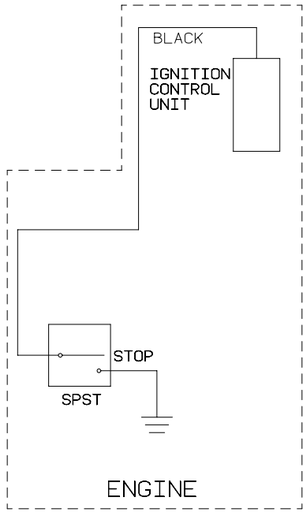
Onan — MINNEAPOLIS, MINNESOTA 55432

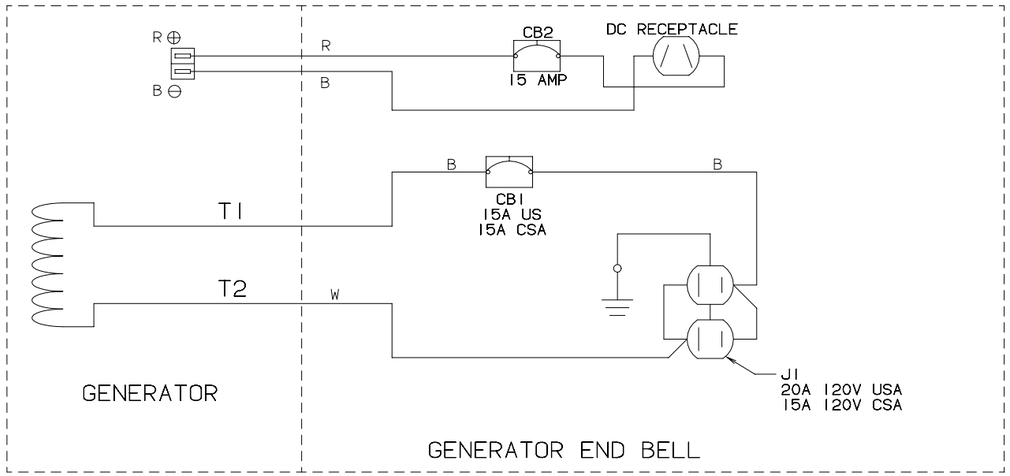
TITLE: WIRING DIAGRAM

DWG NO: 625-3230 SHEET 4 of 4 SIZE D

625-3231 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
36542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95





NOTES:

1. A 15A 120V RECEPTACLE IS ALSO ACCEPTABLE FOR USA APPLICATION.
2. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.

CADAM DWG

	NAME	DATE
DR	J GRIFFIN	5/22/95
CHK'R / MFG	T V PHAN	5/22/95
APPROVED	D XYKIS	5/26/95

MODEL FIRST USED ON: 1.7 kW STD

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

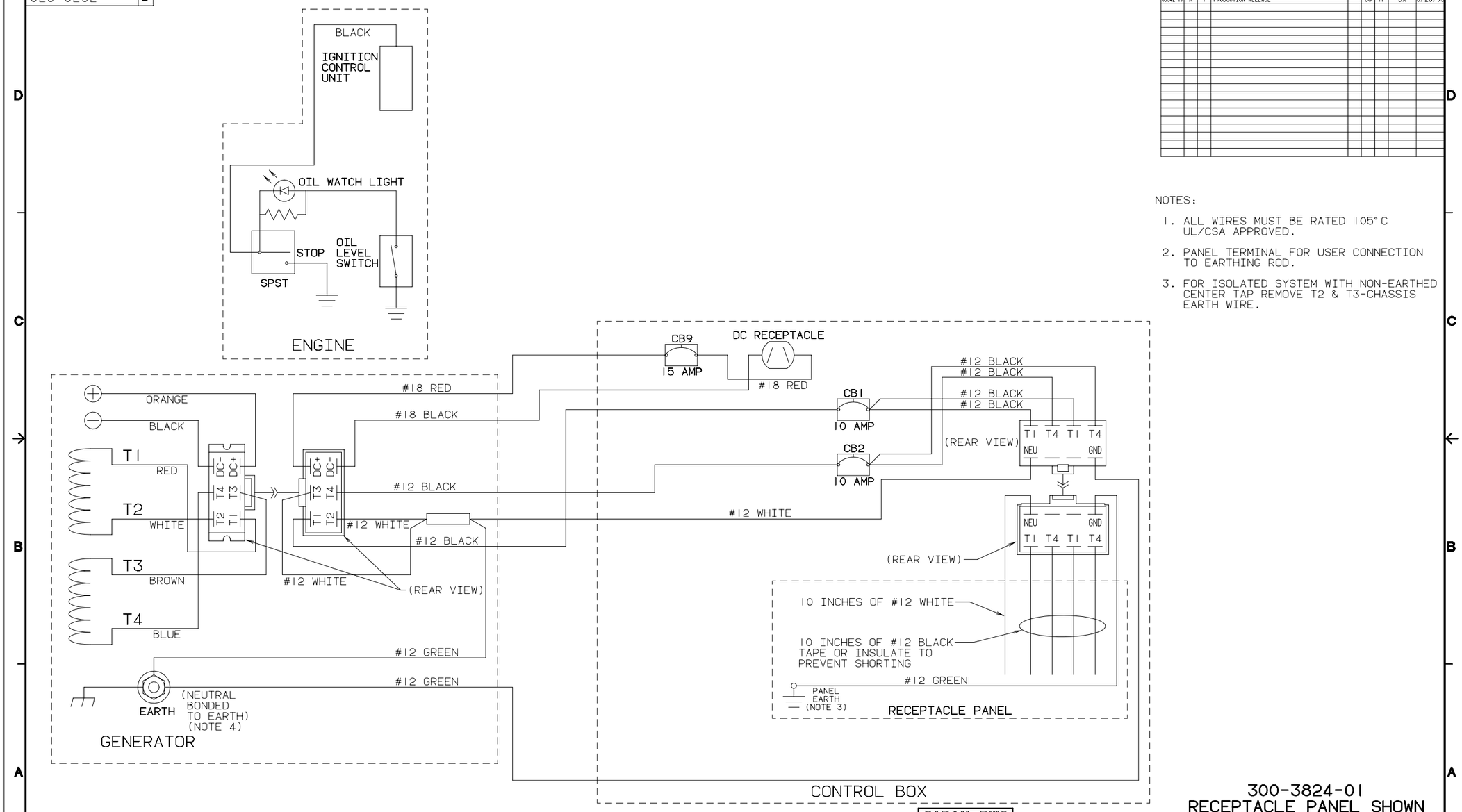
DWG NO: 625-3231 SHEET 1 of 1 SIZE D

625-3232 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
J9542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.



300-3824-01
RECEPTACLE PANEL SHOWN

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

DO NOT SCALE PRINT

NAME	DATE
DR J GRIFFIN	05-22-95
CHKR & MFG T V PHAN	05-22-95
APPROVED D XYKIS	05-26-95

MODEL FIRST USED ON 2.0 kW STD 50 BLANK PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

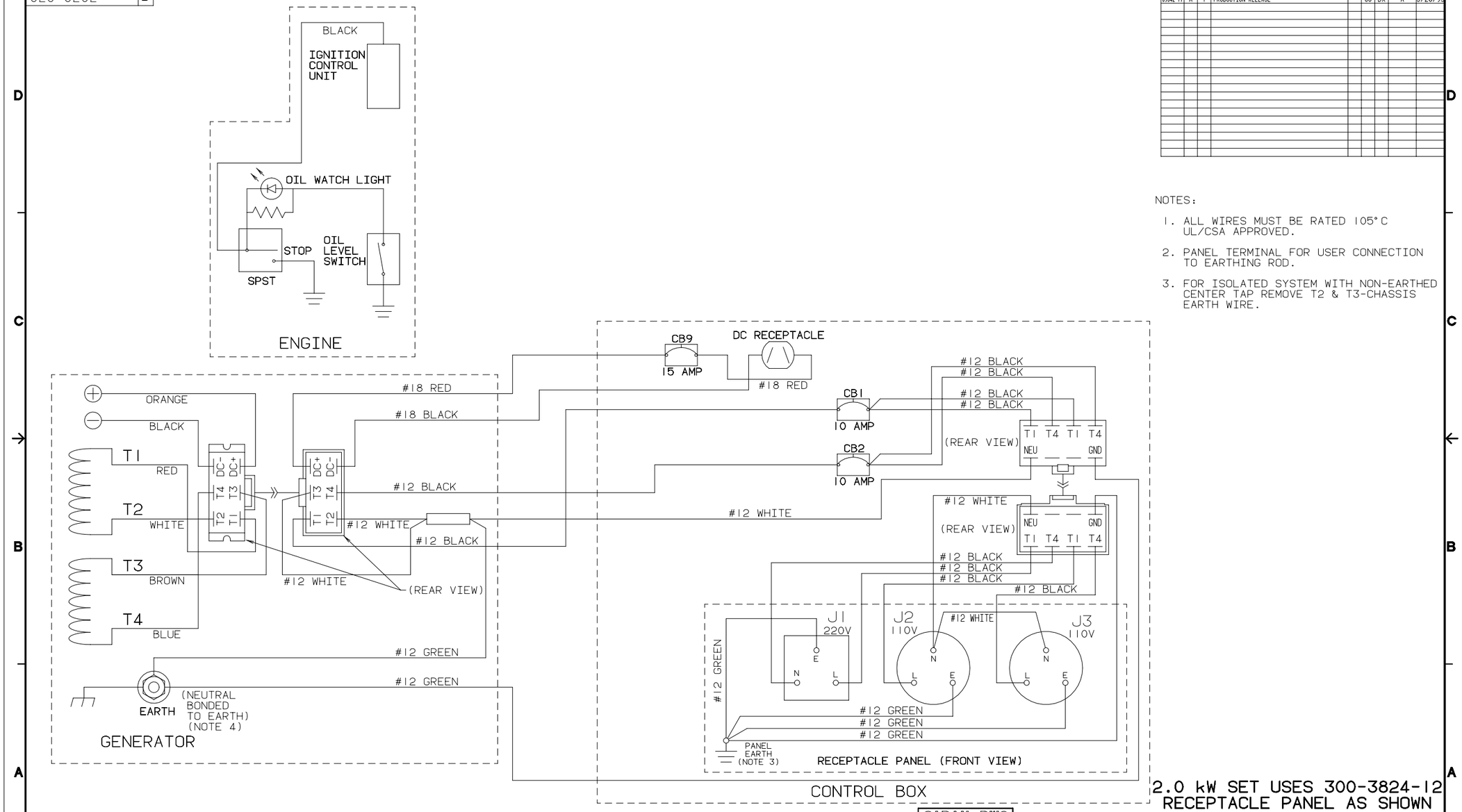
DWG NO 625-3232 SHEET 1 of 4 DWG SIZE D

625-3232 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JG	DX	A	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.



2.0 kW SET USES 300-3824-12 RECEPTACLE PANEL AS SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

MODEL FIRST USED ON: 2.0 kW STD 50 H.K. PANEL

Onan — MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

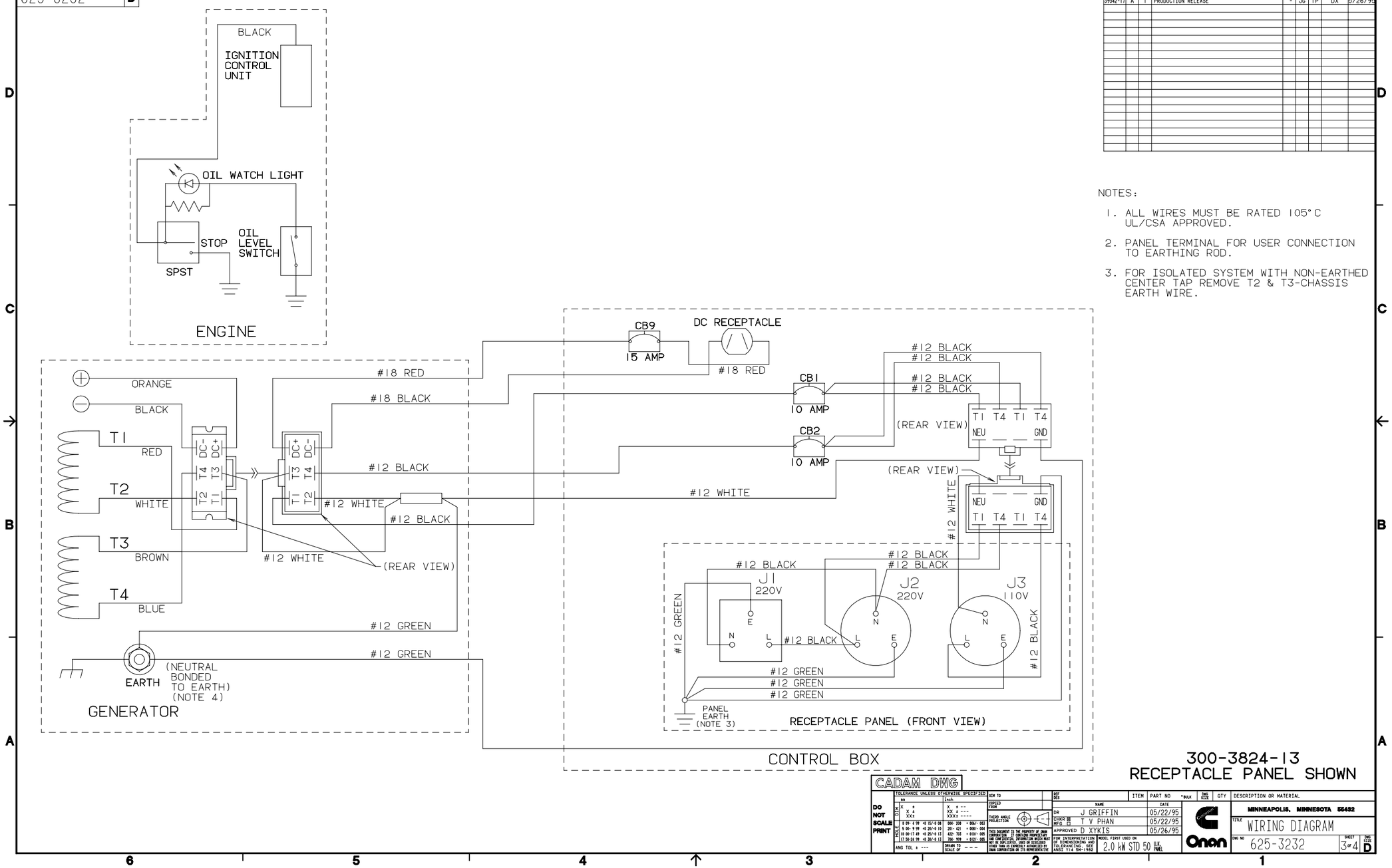
DWG NO: 625-3232 SHEET 2 OF 4 DWG SIZE D

625-3232 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
J9542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.



300-3824-13
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DR	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR	T V PHAN	05/22/95
MFG		
APPROVED	D XYKIS	05/26/95

MODEL FIRST USED ON 2.0 kW STD 50 Hz PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

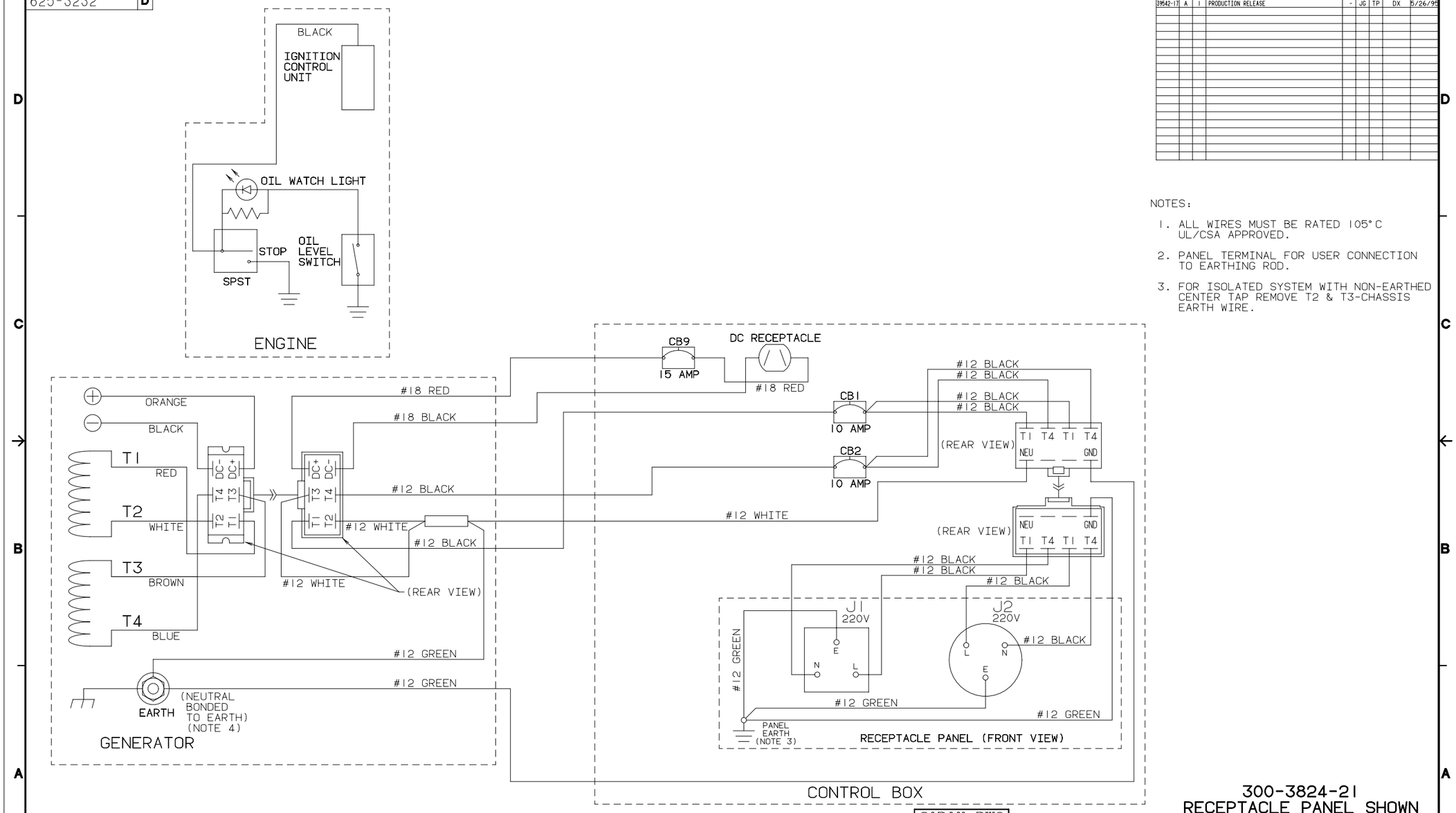
DWG NO 625-3232 SHEET 3 of 4 DWG SIZE D

625-3232 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
19542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.



300-3824-21
RECEPTACLE PANEL SHOWN

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

DO NOT SCALE PRINT

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR BE MFG	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

MODEL FIRST USED ON: 2.0 kW STD 50 EURO PANEL

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

Onan

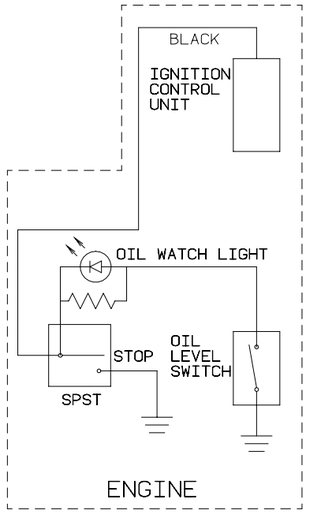
MINNEAPOLIS, MINNESOTA 55432

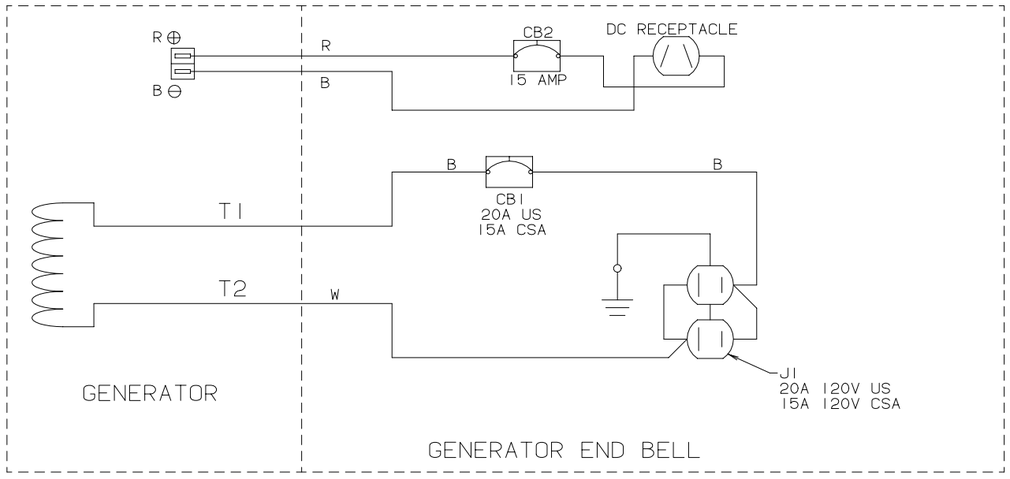
TITLE: WIRING DIAGRAM

DWG NO: 625-3232 SHEET: 4 OF 4 DWG SIZE: D

625-3233 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
U9542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95





CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

DO NOT SCALE PRINT

ANG TOL ± ---

DRAWN
SCALE OF ---

NEXT ASSY
USED ON
COPIED FROM
THIRD ANGLE PROJECTION

	NAME	DATE
DR	J GRIFFIN	5/22/95
CHK'R MFG	T V PHAN	5/22/95
APPROVED	D XYKIS	5/26/95

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON 2.5 kW STD

ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

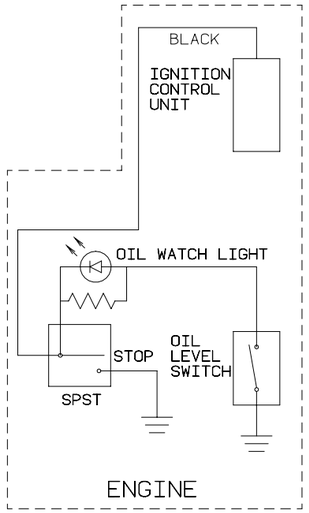
MINNEAPOLIS, MINNESOTA 55432

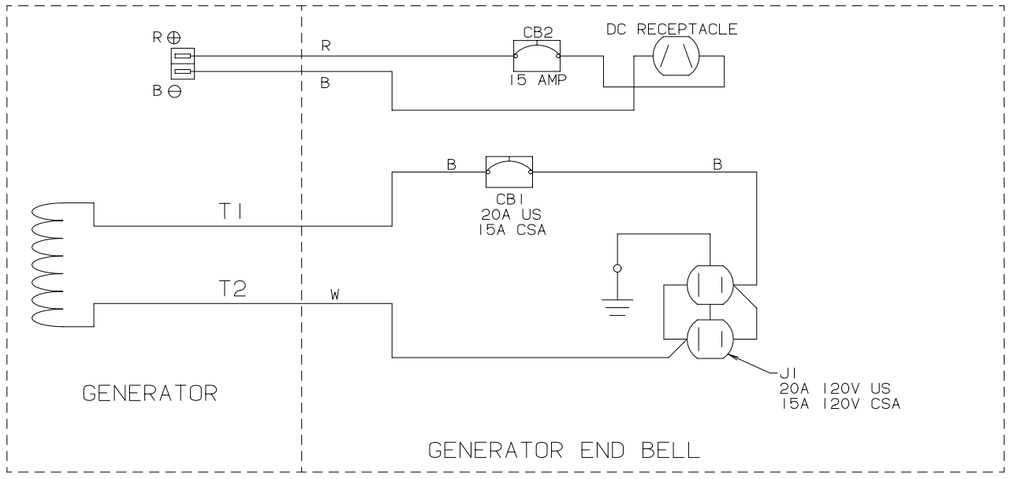
TITLE WIRING DIAGRAM

DWG NO 625-3233 SHEET 1 of 1 DWG SIZE D

625-3234 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-	17A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95





CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED: mm — DEC X ±.x, XX ±.xx, XXX ±.xxx; Inch — DEC X ±.x, XX ±.xx, XXX ±.xxx; ANG TOL ± ---; DRAWN TO SCALE OF ---

DO NOT SCALE PRINT

NAME	DATE
DR J GRIFFIN	5/22/95
CHK'R MFG J T V PHAN	5/22/95
APPROVED D XYKIS	5/26/95

MODEL FIRST USED ON: 2.5 kW STD US

Onan — MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

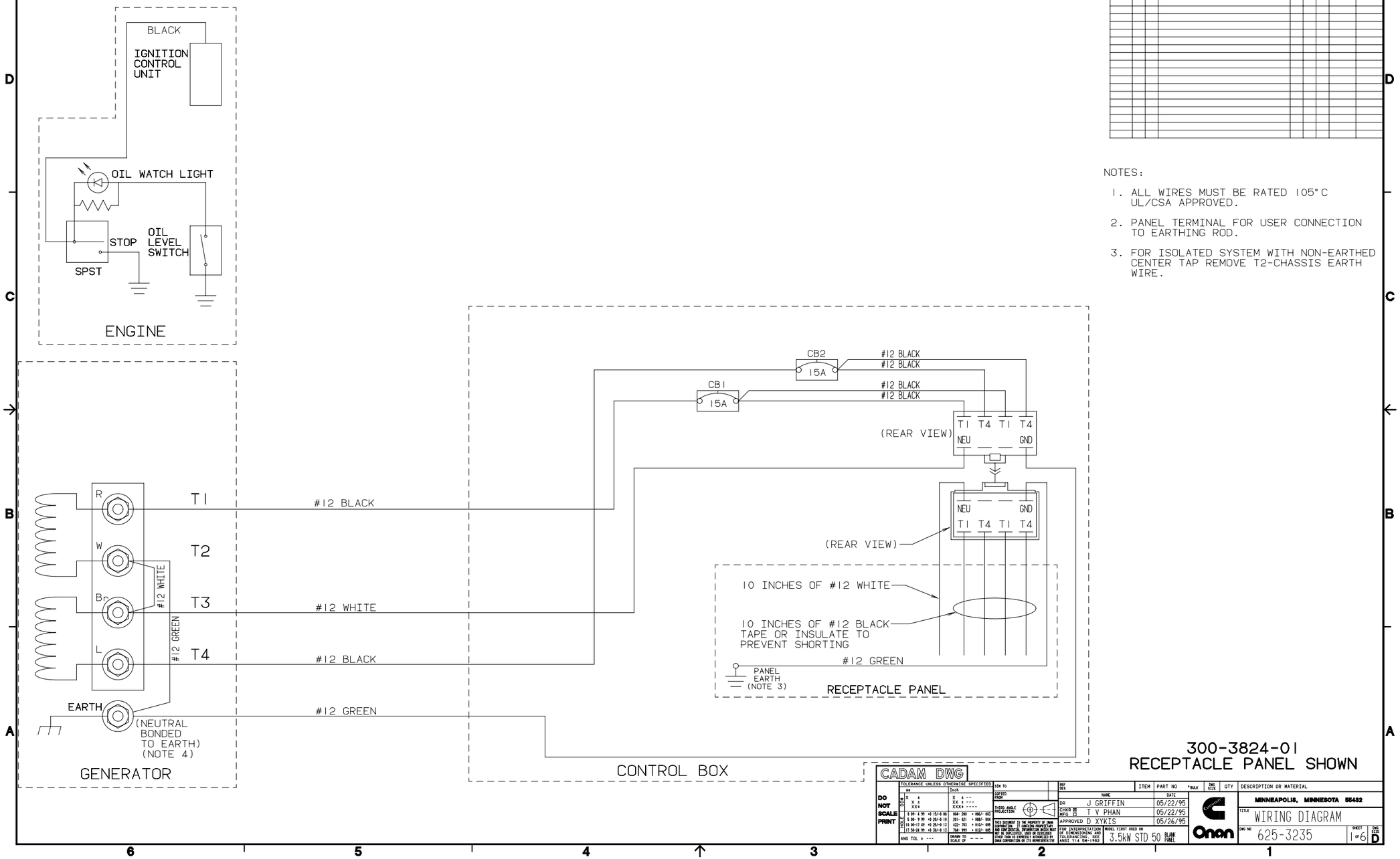
DWG NO 625-3234 — SHEET 1 of 1 — DWG SIZE D

625-3235 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-01
RECEPTACLE PANEL SHOWN

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

	mm	inch
DO NOT SCALE PRINT	X ± ---	X ± ---
	X.X ± ---	XX ± ---
	XX.X ± ---	XXX ± ---
DECIMALS	0 09- 4 99 ± 10/-0 08	.004- .399 ± .006/- .003
	5 00- 9 99 ± 20/-0 10	.201- .421 ± .008/- .004
	10 00-17 49 ± 25/-0 13	.420- .703 ± .010/- .005
	17 50-24 99 ± 38/-0 13	.704- .999 ± .012/- .005

ANG TOL ± ---

SIM TO
COPIED FROM
THIRD ANGLE PROJECTION

REF DES	ITEM	PART NO	*MAK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DE MFG. D	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON 7.5kW STD 50 BLANK PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

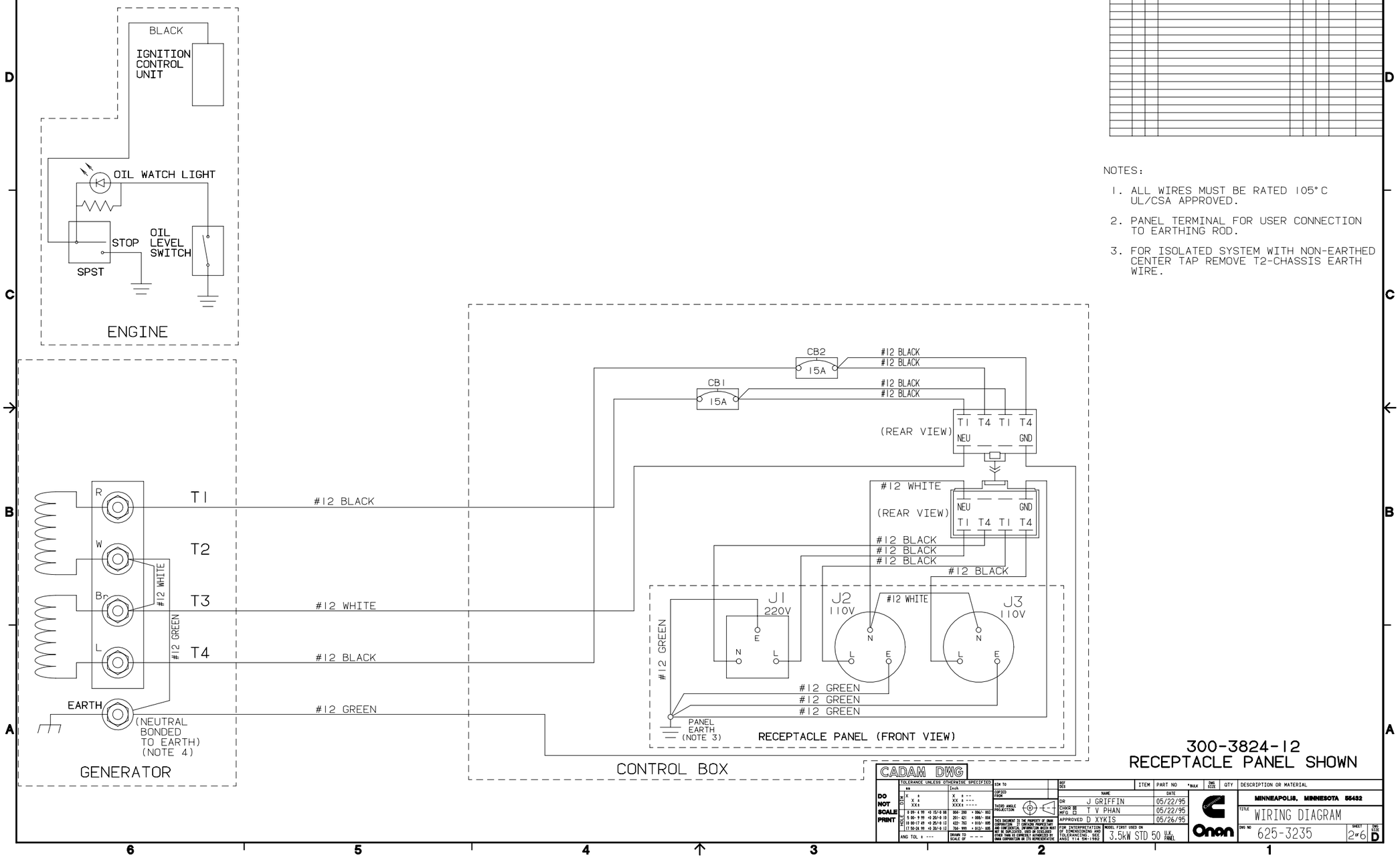
DWG NO: 625-3235 | SHEET: 1 of 6 | DWG SIZE: D

625-3235 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
J9542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-12
RECEPTACLE PANEL SHOWN

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED
DO NOT SCALE PRINT
ANG TOL ± ---

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DESIGN MFG. ENG.	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

THIRD ANGLE PROJECTION

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON 3.5kW STD 50 U.K. PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

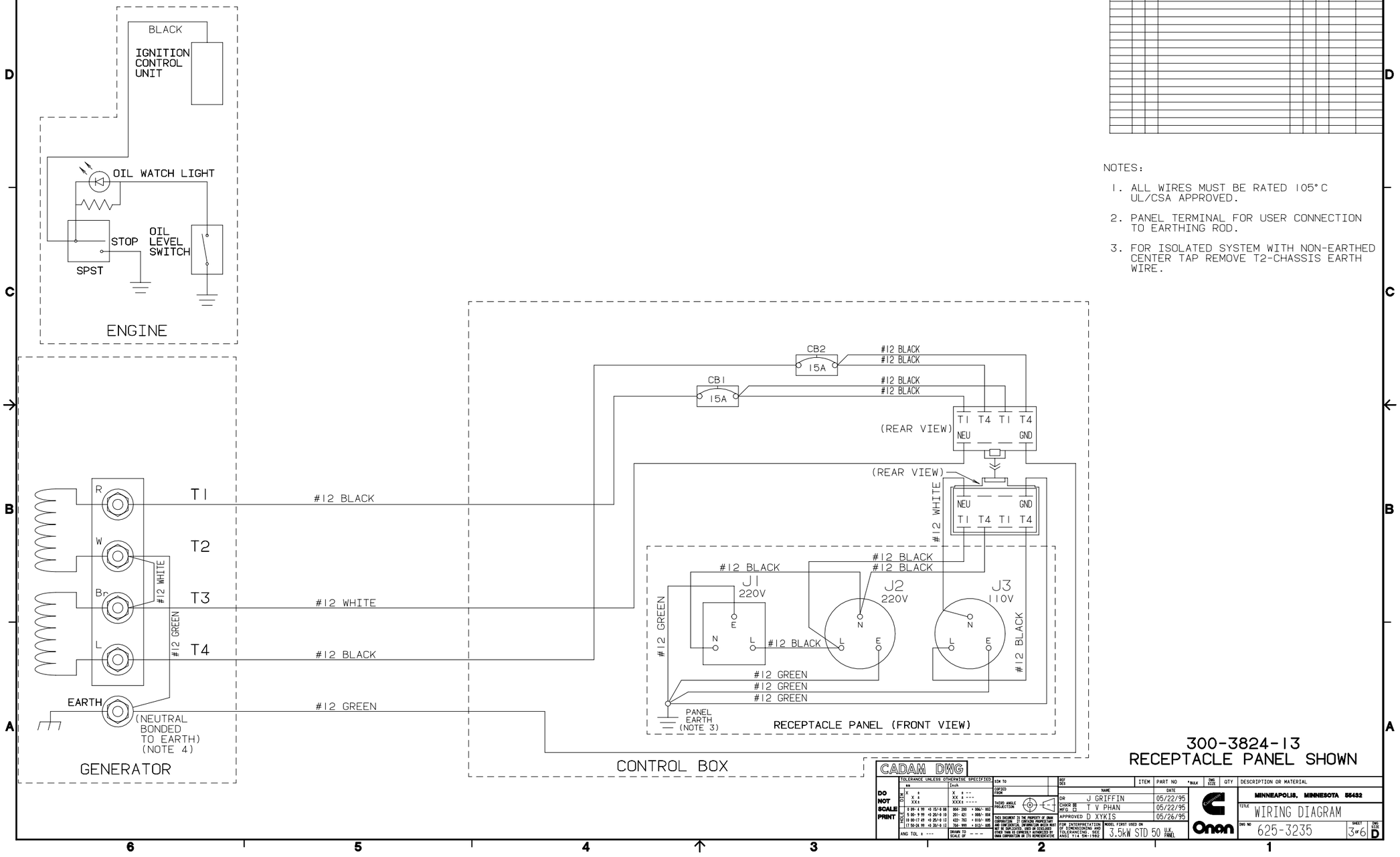
DWG NO 625-3235 SHEET 2×6 DWG SIZE D

625-3235 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-13
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	Inch
	X ±	X ± ---
	X ±	XX ± ---
	XX ±	XXX ± ---
A	0 99-4 99 +0 15/-0 08	.004-.200 +.006/-.003
B	5 00-9 99 +0 20/-0 10	.201-.421 +.008/-.004
C	10 00-17 49 +0 25/-0 13	.422-.783 +.010/-.005
	17 50-24 99 +0 30/-0 13	.784-.999 +.012/-.005

ANG TOL ± --- DRAWN TO SCALE OF ---

THIRD ANGLE PROJECTION

REF DES	ITEM	PART NO	*MAX	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DESIGN MFG. ENG	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: 7.5kW STD 50 H.K. PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

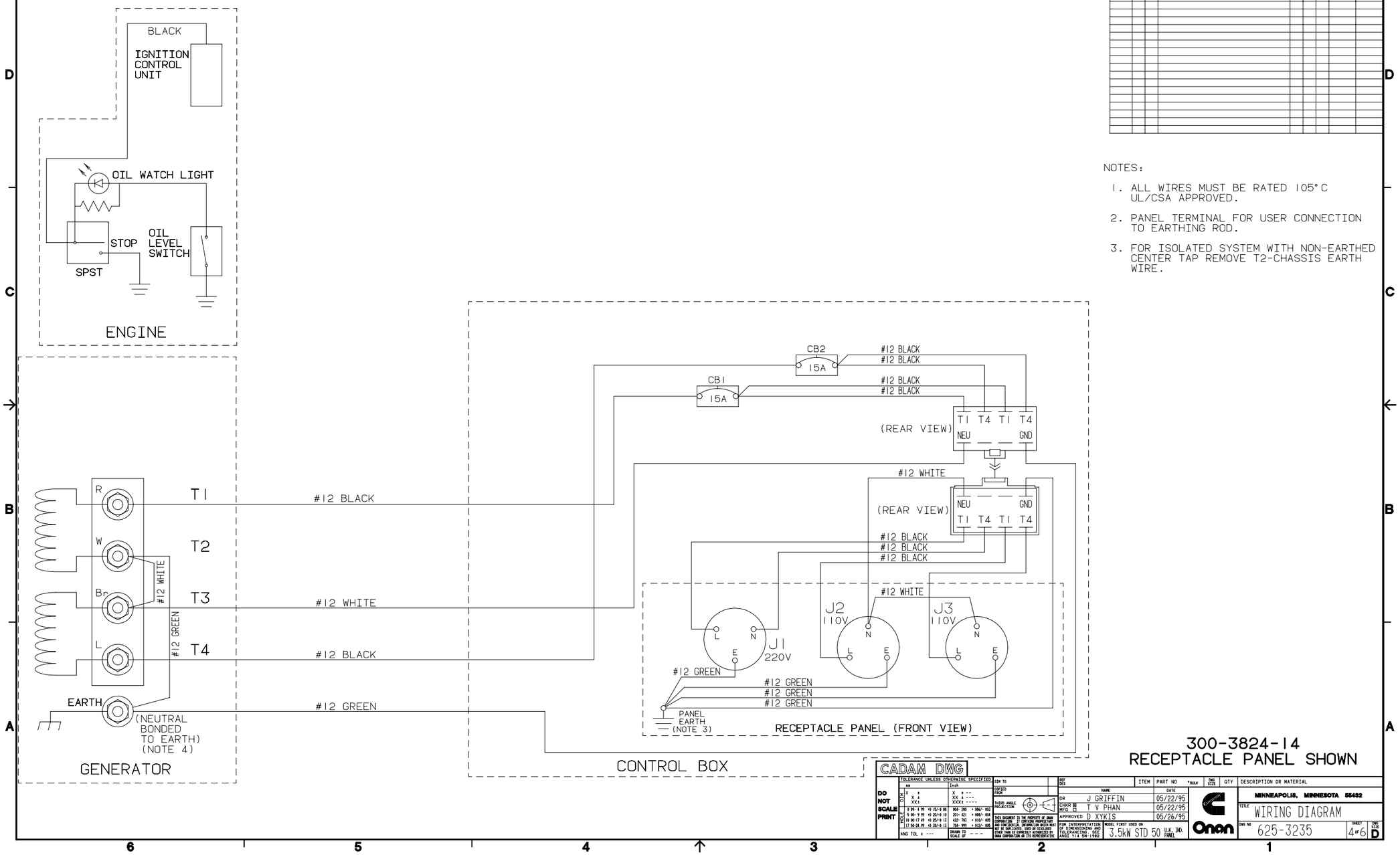
DWG NO: 625-3235 SHEET 3=6 DWG SIZE D

625-3235 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-14
RECEPTACLE PANEL SHOWN

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED
DO NOT SCALE PRINT
ANG TOL ± ---

REF DES	ITEM	PART NO	*MAX	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DESIGN MFG ENG	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

MODEL FIRST USED ON 3.5kW STD 50 U.K. IND. PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

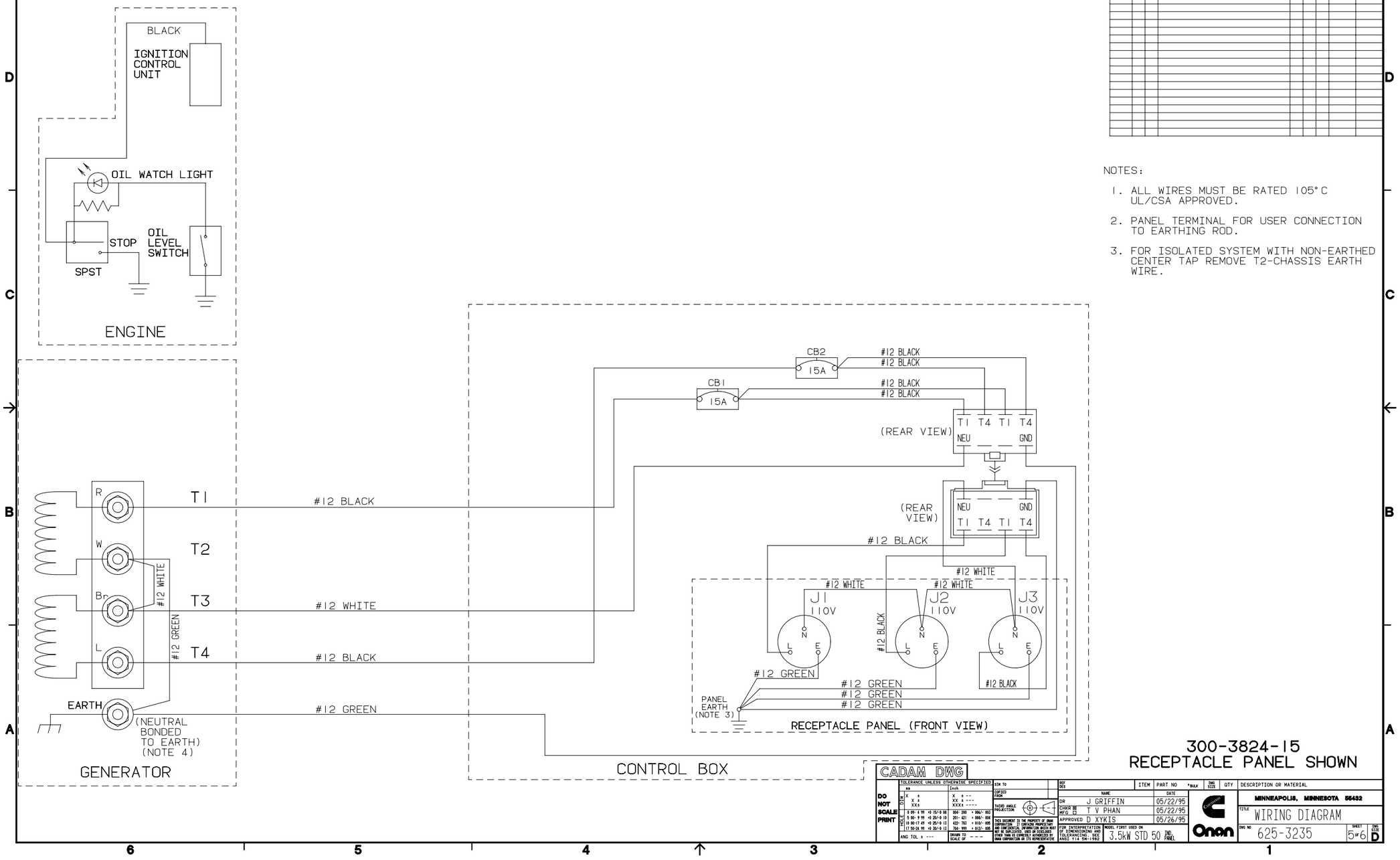
DWG NO 625-3235 SHEET 4×6 DWG SIZE D

625-3235 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-15
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DRAWN	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DR MFG. ENG.	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

THIRD ANGLE PROJECTION

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: 7.5kW STD 50 IND. PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

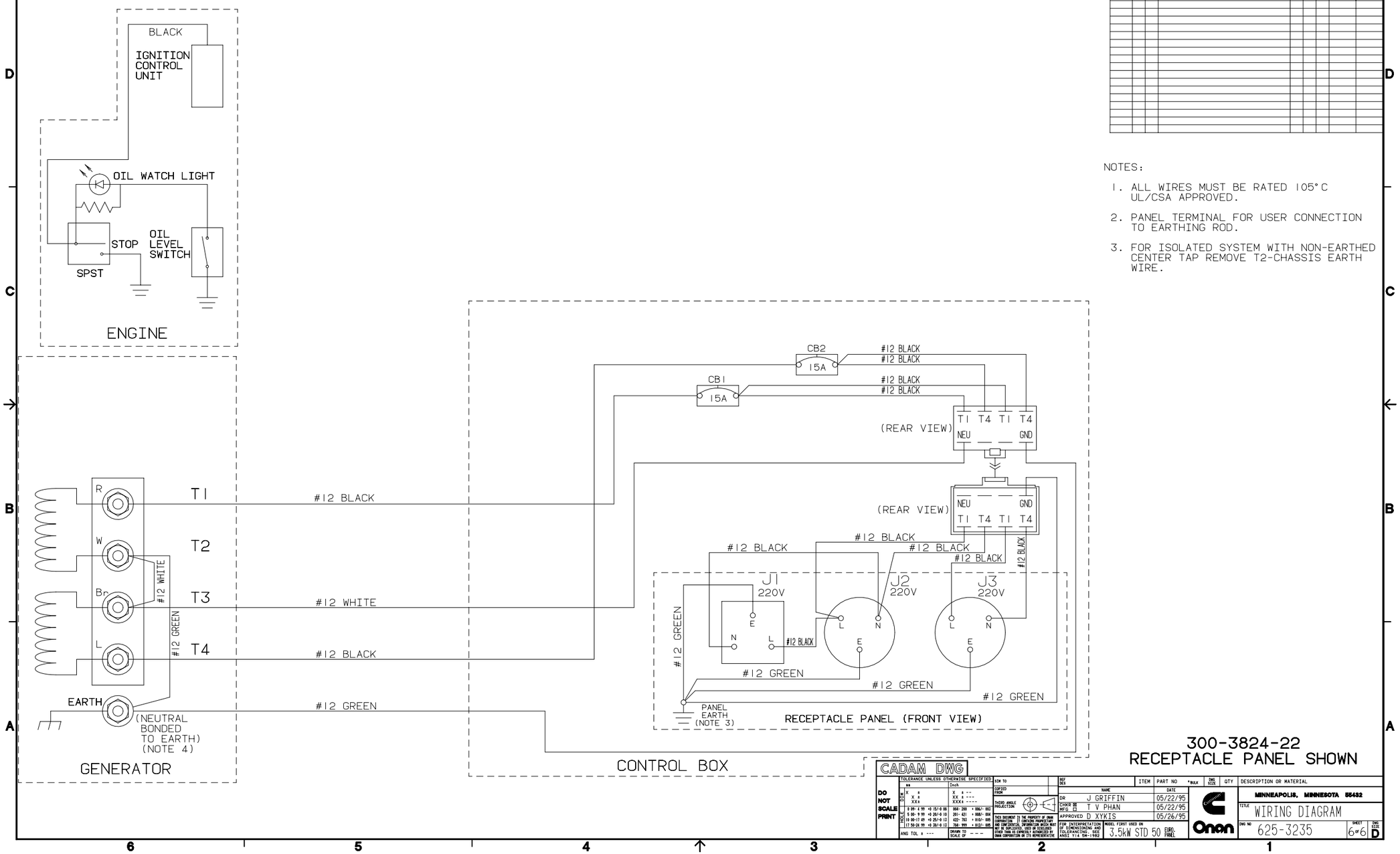
DWG NO: 625-3235 SHEET 5×6 DWG SIZE D

625-3235 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
J9542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-22
RECEPTACLE PANEL SHOWN

CADAM DWG

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DES MFG D	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

MODEL FIRST USED ON: 7.5kW STD 50 BRD. PANEL

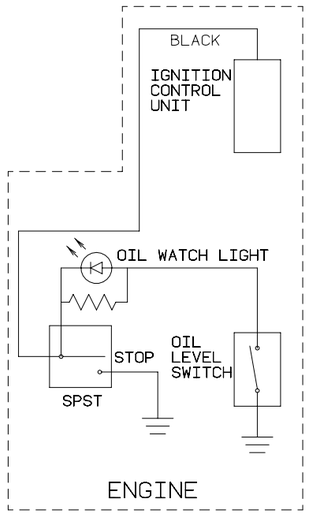
MINNEAPOLIS, MINNESOTA 55432

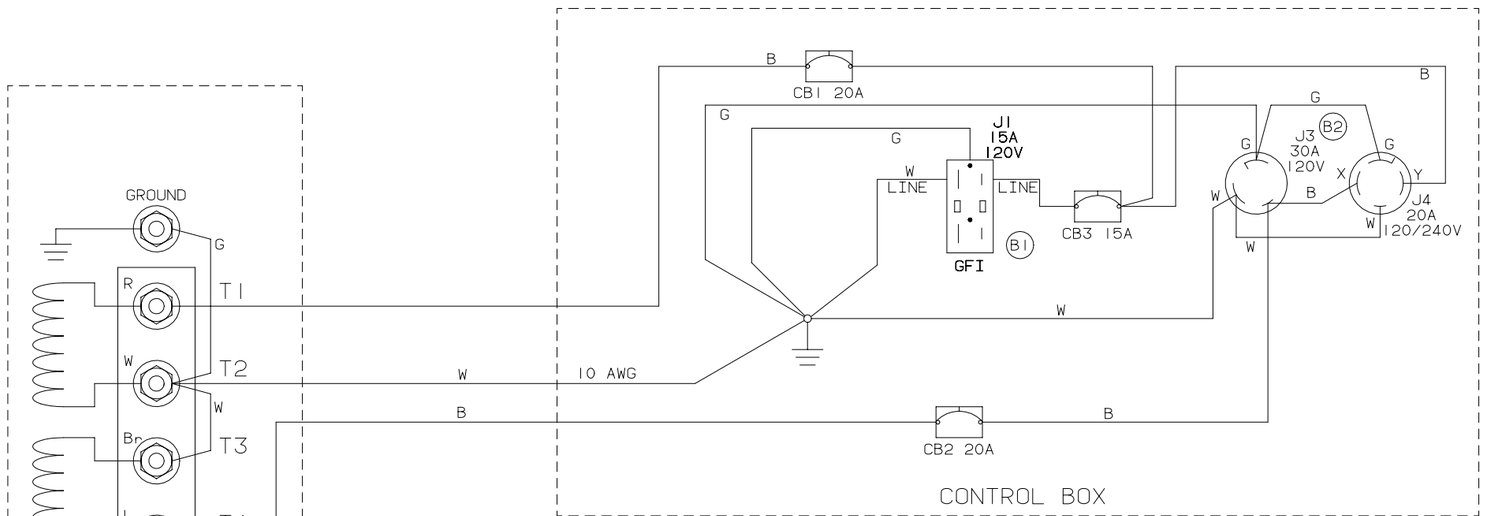
TITLE: WIRING DIAGRAM

DWG NO: 625-3235 SHEET 6×6 DWG SIZE D

625-3236 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JDG	TP	DX	5/26/95





CADAM DWG

ITEM	PART NO	DWG SIZE	QTY	DESCRIPTION OR MATERIAL
				MINNEAPOLIS, MINNESOTA 55432

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

TOLERANCE UNLESS OTHERWISE SPECIFIED
DO NOT SCALE PRINT
AND TOL ± ---
DRAWN TO SCALE OF ---
THIRD ANGLE PROJECTION
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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982
MODEL FIRST USED ON 4kW STD CSA

Onan

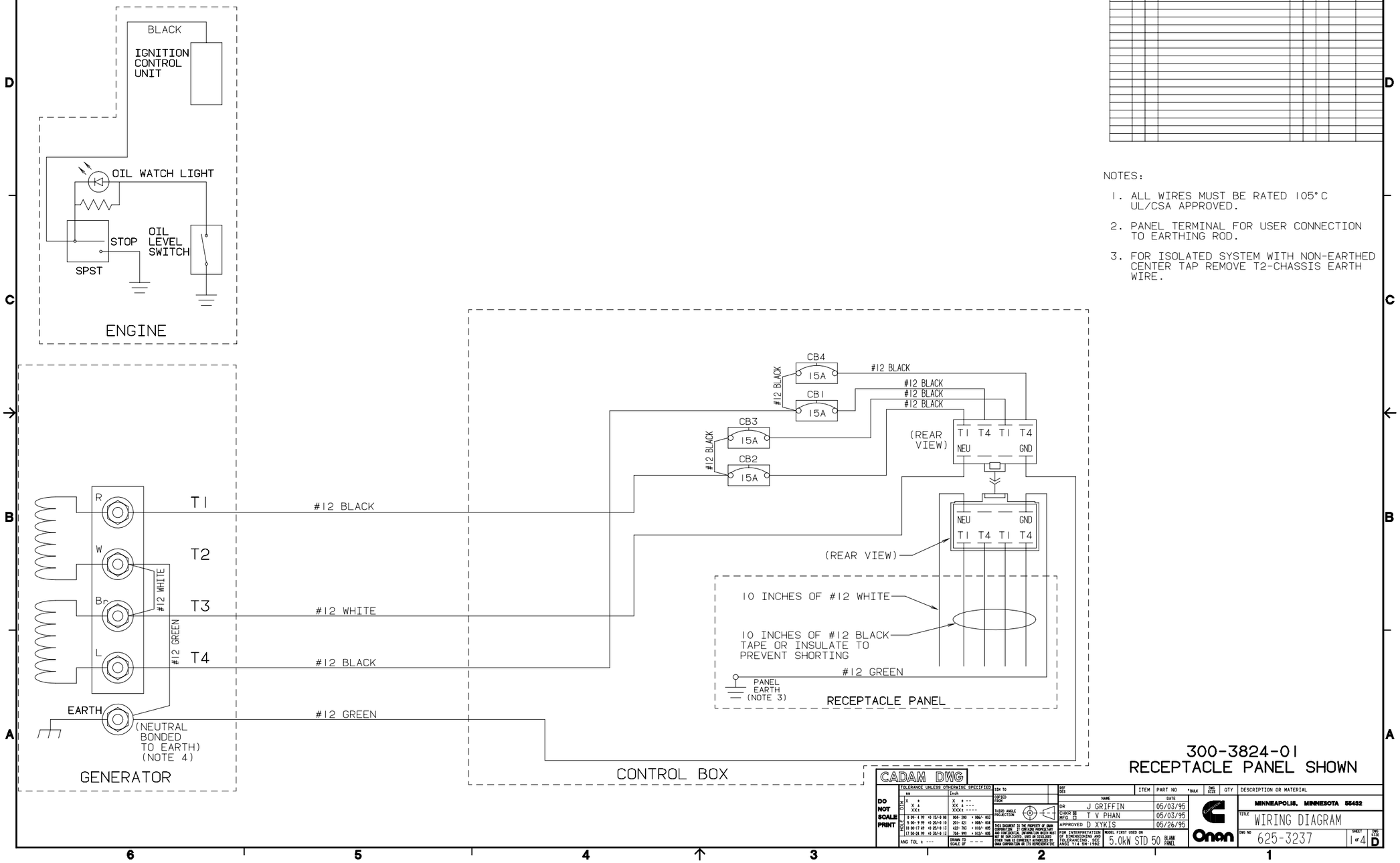
TITLE WIRING DIAGRAM
DWG NO 625-3236
SHEET 1 of 1
DWG SIZE D

625-3237 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-01
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DR	NAME	DATE
DR	J GRIFFIN	05/03/95
CHKR DE	T V PHAN	05/03/95
MFR E		
APPROVED	D XYKIS	05/26/95

MODEL FIRST USED ON: 5.0kW STD 50 BLANK PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

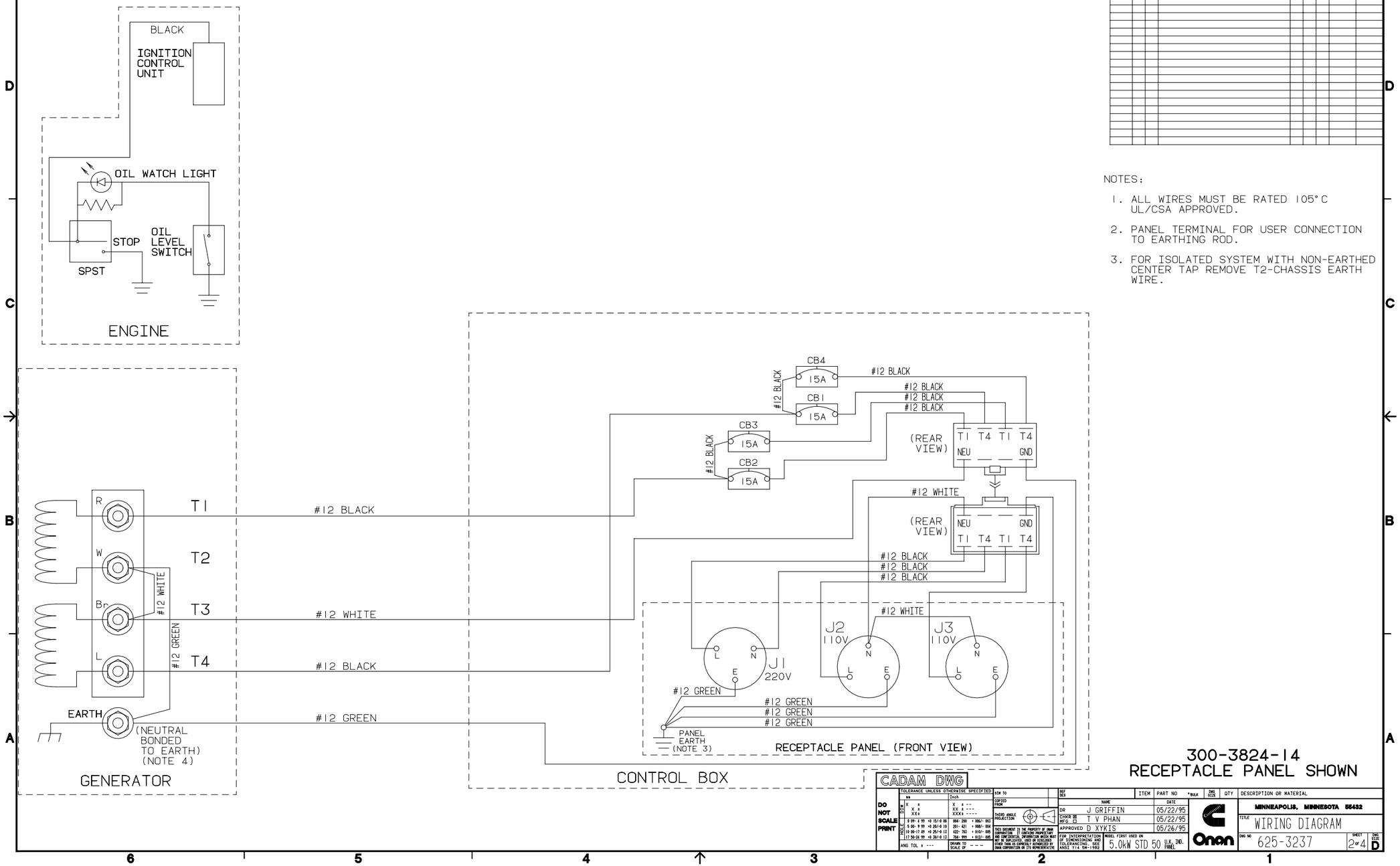
DWG NO: 625-3237 SHEET 1 OF 4 SIZE D

625-3237 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
19542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-14
RECEPTACLE PANEL SHOWN

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

DO NOT SCALE PRINT

DRAWN	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DE MFG ES	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

THIRD ANGLE PROJECTION

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON 5.0kW STD 50 U.K. IND. PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

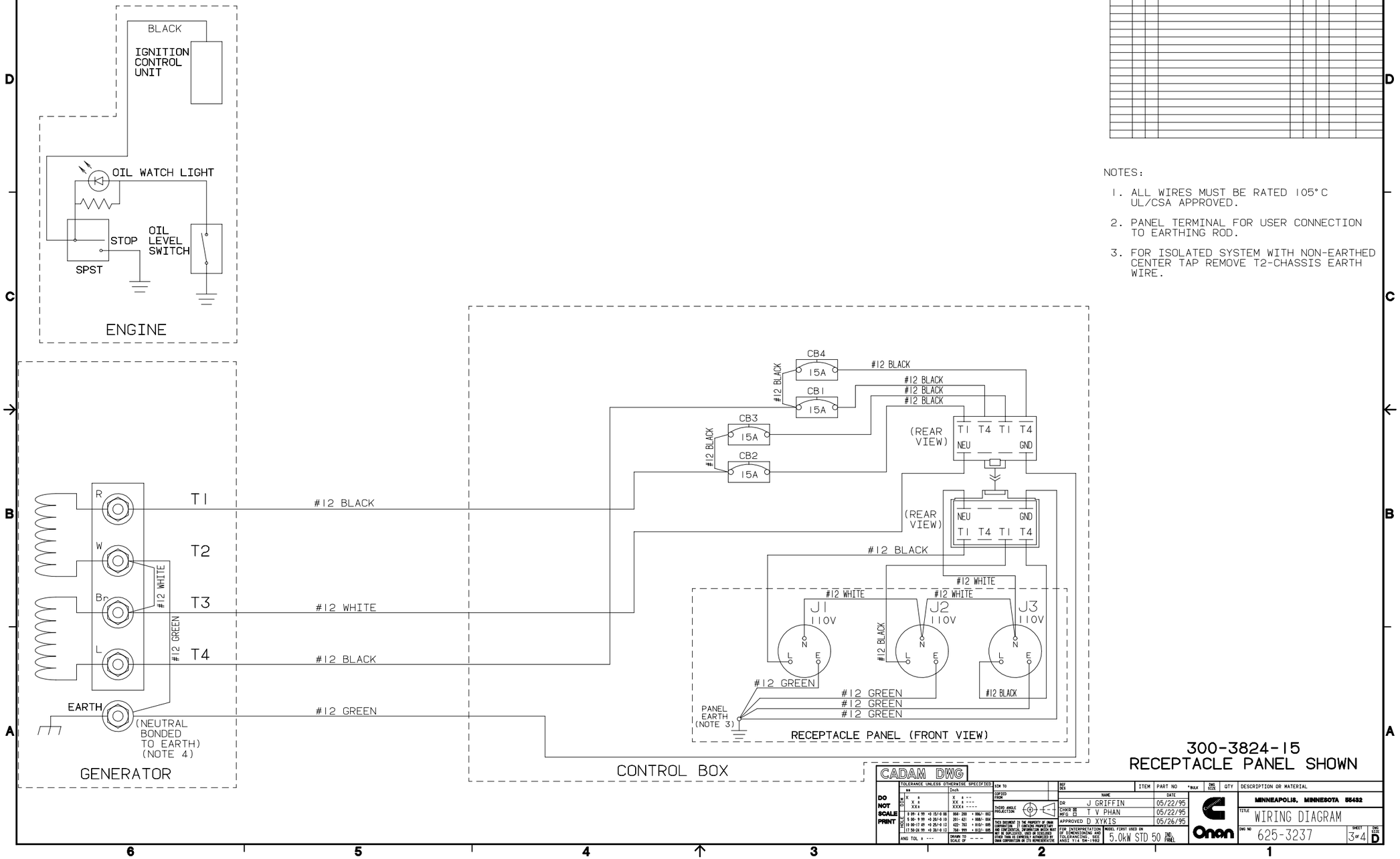
DWG NO 625-3237 SHEET 2 OF 4 DWG SIZE D

625-3237 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
J9542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-15
RECEPTACLE PANEL SHOWN

CADAM DWG

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DE MFR ES	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

MODEL FIRST USED ON 5.0kW STD 50 IND. PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

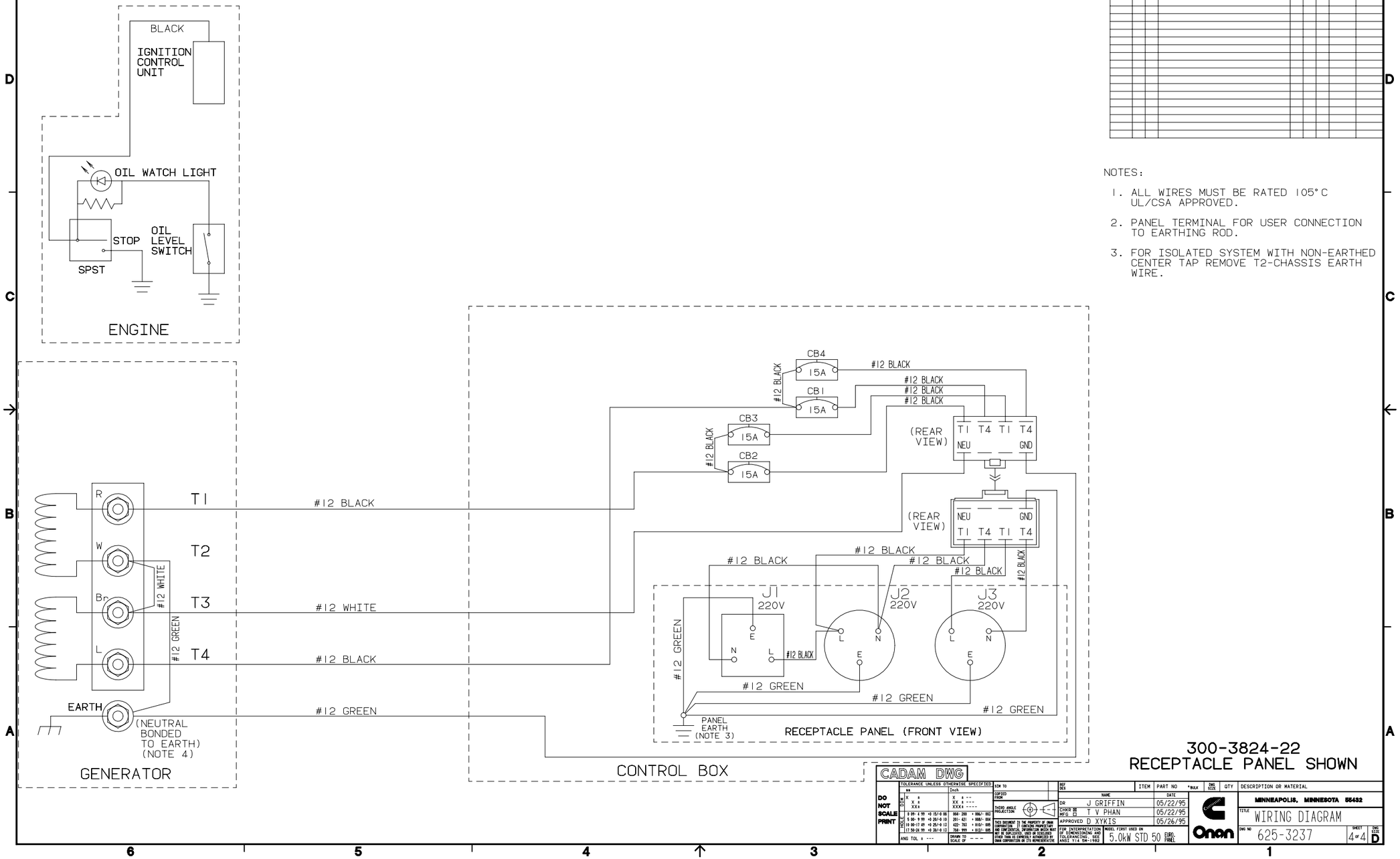
DWG NO 625-3237 SHEET 3 OF 4 DWG SIZE D

625-3237 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.



300-3824-22
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

	NAME	DATE
DR	J GRIFFIN	05/22/95
CHKR DES MFG	T V PHAN	05/22/95
APPROVED	D XYKIS	05/26/95

THIRD ANGLE PROJECTION

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: 5.0kW STD 50 EUDL PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

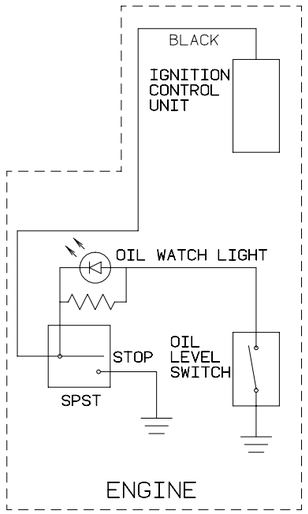
DWG NO: 625-3237 | SHEET 4 OF 4 | DWG SIZE D

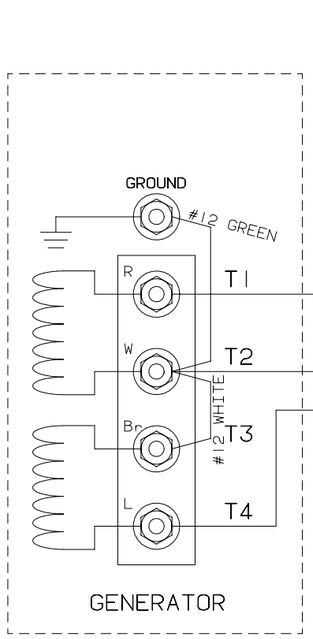
625-3238 D

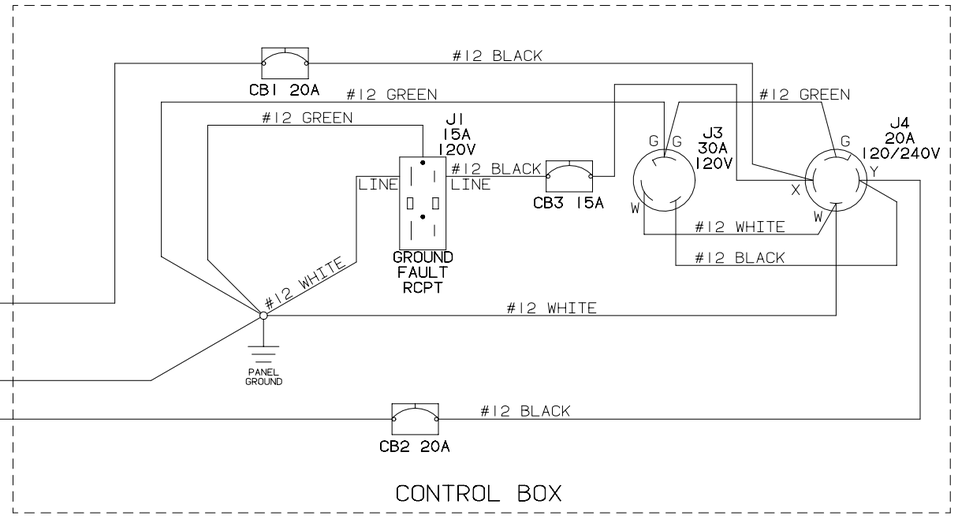
ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39542-17	A	1	PRODUCTION RELEASE	-	JDG	TP	DX	5/26/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.







CADAM DWG

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED	DIM to	REF DES	ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL
	mm: X ± / X.x ± / XX.x ± ; Inch: X ± --- / XX.x ± ---- / XXX.x ± ----	COPIED FROM							MINNEAPOLIS, MINNESOTA 55432
	HOLE DIA: 0.99–4.99 +0.15/-0.08; 5.00–9.99 +0.20/-0.10; 10.00–17.49 +0.25/-0.12; 17.50–24.99 +0.30/-0.13	THIRD ANGLE PROJECTION	DR	NAME: J GRIFFIN	DATE: 05/22/95				TITLE: WIRING DIAGRAM
	ANG TOL ± ---	DRAWN TO SCALE OF ---	CHKD BY MFG ENG	T V PHAN	05/22/95				
	004-200 +006/-003; 201-421 +008/-004; 422-703 +010/-005; 704-999 +012/-005		APPROVED	D XYKIS	05/26/95				DWG NO: 625-3238 SHEET 1 of 1 SIZE D

FOR INTERPRETATION OF DIMENSIONS, TOLERANCING AND TERMINOLOGY USE ANSI Y14.5M-1982

MODEL FIRST USED ON: 5kW STD CSA

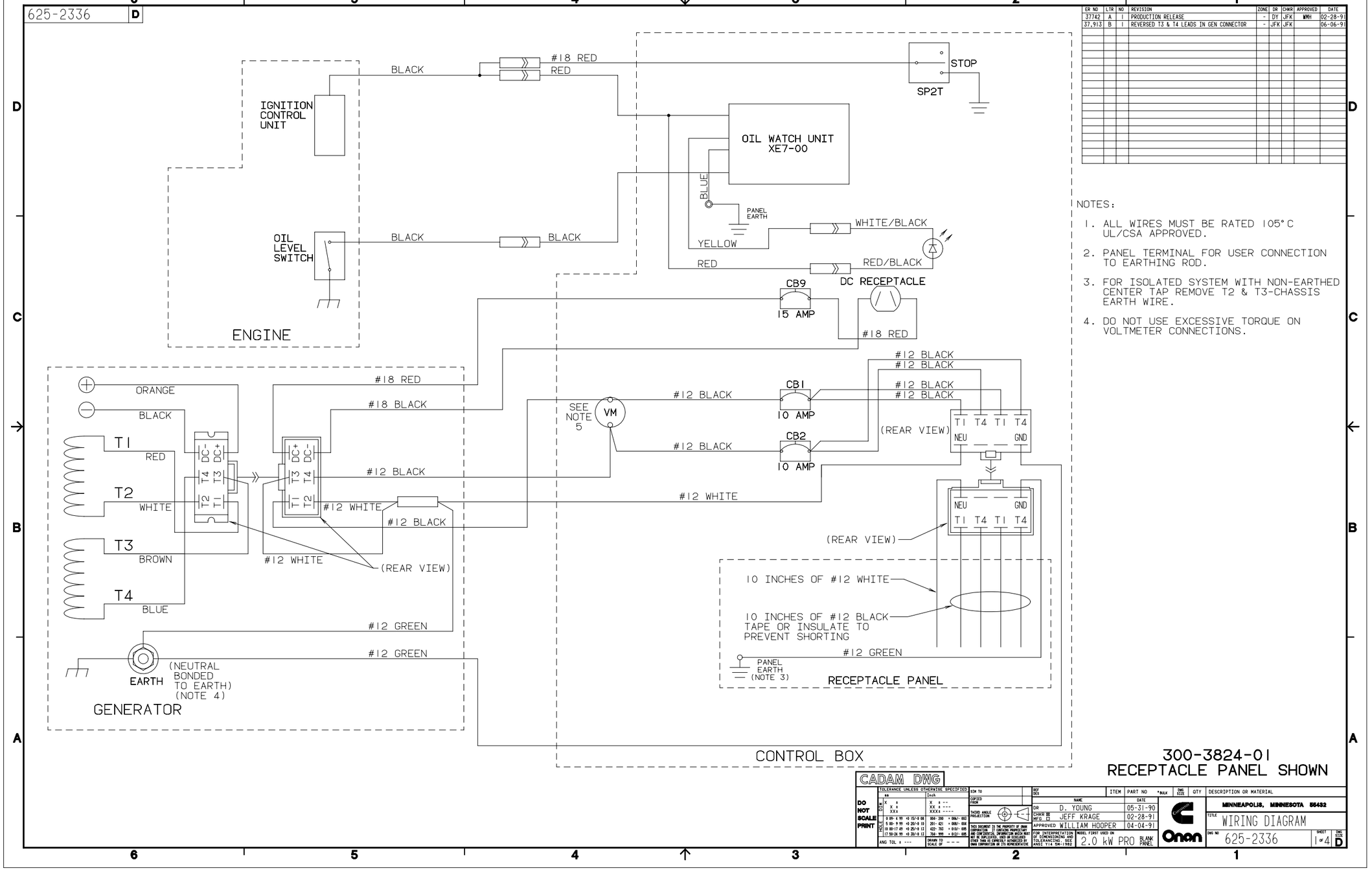
Onan

625-2336 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37742	A	1	PRODUCTION RELEASE	-	DY	JFK	WMH	02-28-91
37,913	B	1	REVERSED T3 & T4 LEADS IN GEN CONNECTOR	-	JFK	JFK		06-06-91

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.



300-3824-01
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

	DR	CHK	APPROVED
NAME	D. YOUNG	JEFF KRAGE	WILLIAM HOOPER
DATE	05-31-90	02-28-91	04-04-91

MODEL FIRST USED ON 2.0 kW PRO BLANK PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

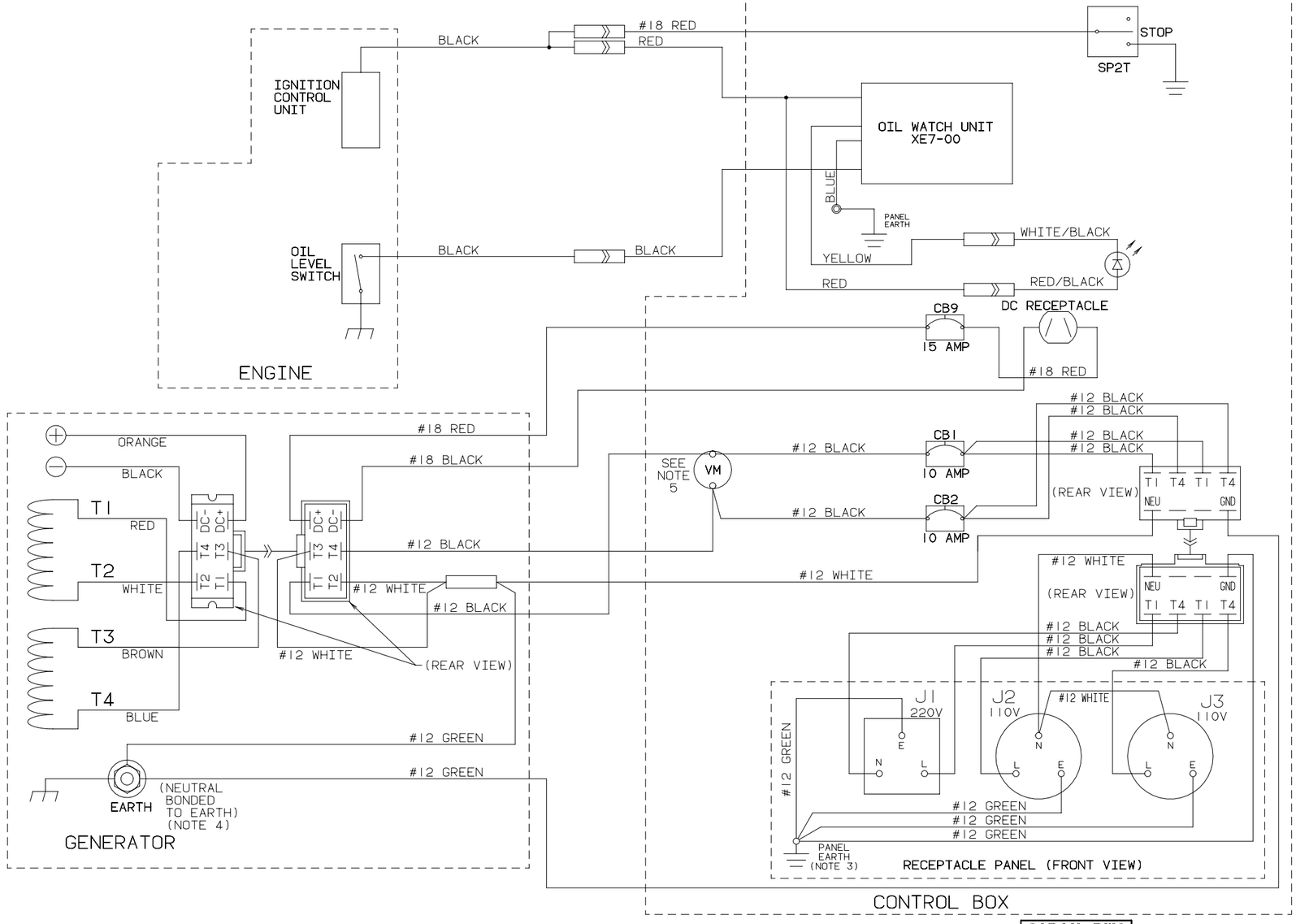
DWG NO 625-2336 SHEET 1 of 4 DWG SIZE D

625-2336 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37742	A	1	PRODUCTION RELEASE	-	DY	JFK	WMH	02-28-91
37,913	B	1	REVERSED T3 & T4 LEADS IN GEN CONNECTOR	-	JFK	JFK		06-06-91

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.



300-3824-12
RECEPTACLE PANEL SHOWN

CADAM DWG

	NAME	DATE
DR	D. YOUNG	05-31-90
CHKR OR MFG	JEFF KRAGE	02-28-91
APPROVED	WILLIAM HOOPER	04-04-91

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1982

MODEL FIRST USED ON 2.0 kW PRO U.K. PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

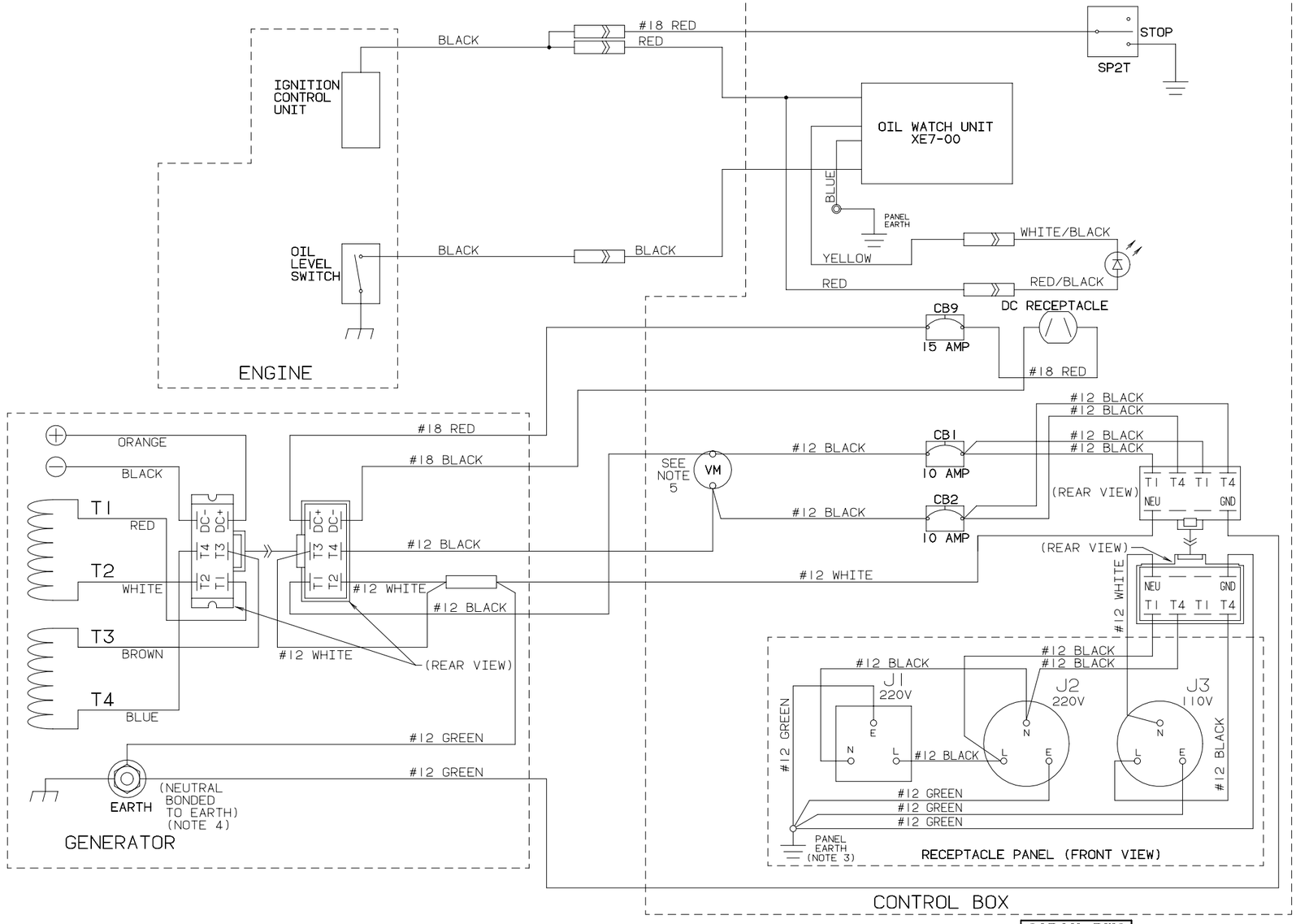
DWG NO 625-2336 SHEET 2 OF 4 REV LTR D

625-2336 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37742	A	1	PRODUCTION RELEASE	-	DY	JFK	WMH	02-28-91
37,913	B	1	REVERSED T3 & T4 LEADS IN GEN CONNECTOR	-	JFK	JFK		06-06-91

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.



300-3824-13
RECEPTACLE PANEL SHOWN

CADAM DWG

	NAME	DATE
DR	D. YOUNG	05-31-90
CHKR ENG MFG	JEFF KRAGE	02-28-91
APPROVED	WILLIAM HOOPER	04-04-91

MODEL FIRST USED ON: 2.0 kW PRO U.K. PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

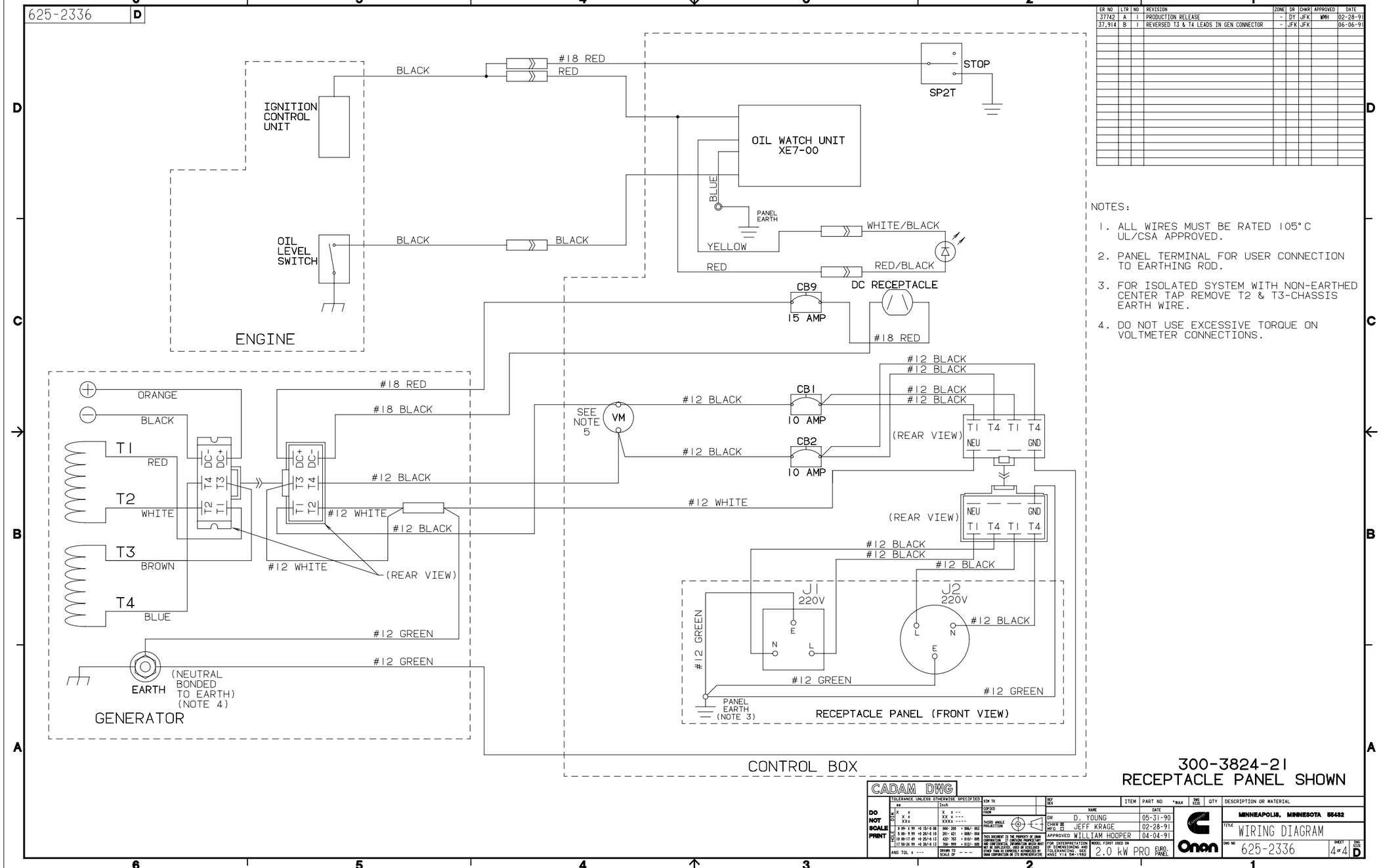
DWG NO: 625-2336 SHEET 3*4 DWG SIZE D

625-2336 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37742	A	1	PRODUCTION RELEASE	-	DY	JFK	WMH	02-28-91
37,914	B	1	REVERSED T3 & T4 LEADS IN GEN CONNECTOR	-	JFK	JFK		06-06-91

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2 & T3-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.

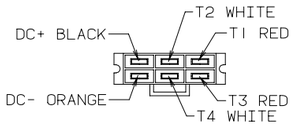


300-3824-21
RECEPTACLE PANEL SHOWN

CADAM DWG

DR	D. YOUNG	05-31-90	MINNEAPOLIS, MINNESOTA 55432				
CHKR	JEFF KRAGE	02-28-91	TITLE	WIRING DIAGRAM			
APPROVED	WILLIAM HOOPER	04-04-91	DWG NO	625-2336	SHEET	4 of 4	DWG SIZE D
MODEL FIRST USED ON	2.0 kW PRO EURO. PANEL						

625-2360 D



DETAIL
OF GENERATOR
INTERNAL CONNECTOR

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
36,786	A	1	PRODUCTION RELEASE	-	CSE			04-24-90

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
3. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.

IGNITION CONTROL UNIT
BLACK
#18 RED
RED
STOP
SP2T
OIL WATCH UNIT XE7-00
BLUE
PANEL GROUND
YELLOW
WHITE/BLACK
RED
RED/BLACK
DC RECEPTACLE
OIL LEVEL SWITCH
BLACK
BLACK
ENGINE
CB2
15 AMP
#18 RED
#12 BLACK
#12 GREEN
CB1 20A
#18 BLACK
#12 GREEN
J1 20A 120V
#12 WHITE
R
B
#18 RED
#18 BROWN
#18 WHITE
VM
SEE NOTE 2
PANEL GROUND
LINE
#12 BLACK
LINE
T1
#12 BLACK
LOAD
GFI
J2 20A 120V
T2
#12 WHITE
#12 WHITE
#12 BLACK
LOAD
T3
#12 BLACK
T4
#12 WHITE
#12 GREEN
GROUND
CONTROL BOX
GENERATOR

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	inch	mm
X ±	X ± ---	9 09-1 99 ±0.25/0.08
X.X ±	XX ± ---	5 90-9 99 ±0.20/0.10
X.XX ±	XXX ± ---	10 00-17 49 ±0.25/0.13
ANG TOL ± ---		17 50-24 99 ±0.30/0.13

inch	mm
004-200	±.006/.003
201-621	±.008/.004
622-703	±.010/.005
704-999	±.012/.005

DRAWN TO SCALE OF ---

SIM TO
COPIED FROM
THIRD ANGLE PROJECTION

REF DES	ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

	NAME	DATE
DR	C.S.EDWARDS	04-24-90
CHKR		
MFG		
APPROVED		

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON 2.5 kW PRO/US

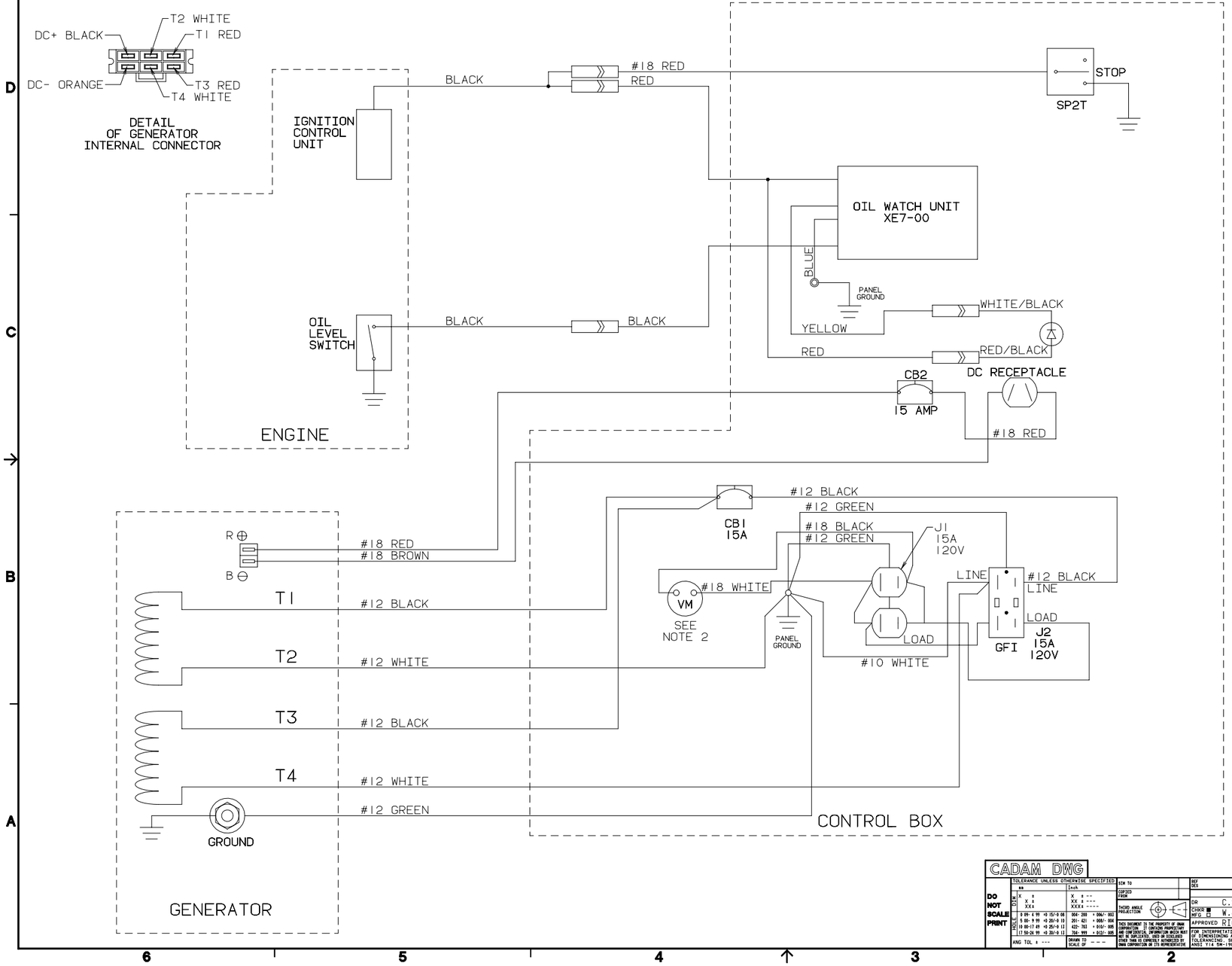
MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

DWG NO 625-2360 SHEET 1 of 1 DWG SIZE D

625-2376 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
36,786	A	1	PRODUCTION RELEASE	-	CSE	WL	RS	04-24-90
37,625	B	1	MISC CHGS REQUESTED. SEE ER.	-	CSE			10-29-90



NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
3. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

NAME	DATE
DR C.S.EDWARDS	04-24-90
CHECK MFG W.J.LEHMANN	05-07-90
APPROVED RICH SCROGGINS	5-4-90

MODEL FIRST USED ON 2.5 kW PRO/CSA

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

DWG NO 625-2376 SHEET 1 of 1 DWG SIZE D

625-2337 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37,742	A	1	PRODUCTION RELEASE	-	DY	JFK		03-19-91

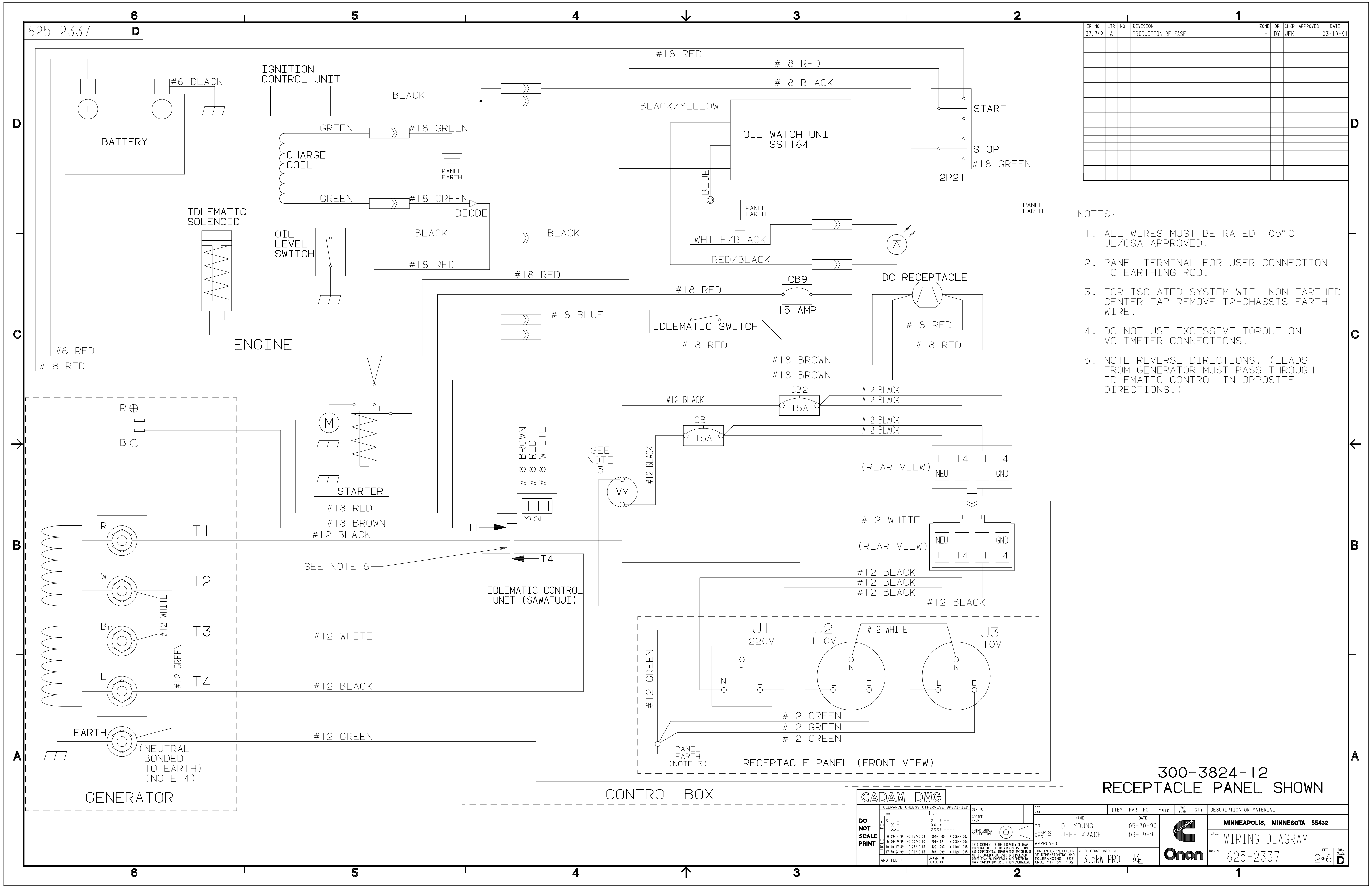
NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)

300-3824-01
RECEPTACLE PANEL SHOWN

CADAM DWG

DR	D. YOUNG	05-30-90	MINNEAPOLIS, MINNESOTA 55432				
CHKR MFG. ENG.	JEFF KRAGE	03-19-91	TITLE	WIRING DIAGRAM			
APPROVED			DWG NO	625-2337	SHEET	1 of 6	DWG SIZE D



625-2337 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37,742	A	1	PRODUCTION RELEASE	-	DY	JFK		03-19-91

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)

300-3824-13
RECEPTACLE PANEL SHOWN

CADAM DWG

ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED: .xx ± .02; Inch: X ± .1, XX ± .03, XXX ± .005; ANG TOL ± .5°

NEXT ASSY | USED ON | COPIED FROM | THIRD ANGLE PROJECTION

	NAME	DATE
DR	D. YOUNG	05-30-90
CHKR OR MFG. ENG.	JEFF KRAGE	03-19-91
APPROVED		

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: 3.5kW PRO E U.K. PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

DWG NO: 625-2337 | SHEET 3 of 6 | DWG SIZE D

625-2337 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37,742	A	1	PRODUCTION RELEASE	-	DY	JFK		03-19-91

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)

300-3824-14
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED	DRAWN TO SCALE OF ---	DR D. YOUNG 05-30-90	CHK'R MFG. ENG. JEFF KRAGE 03-19-91	APPROVED

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

DWG NO 625-2337 SHEET 4 OF 6 DWG SIZE D

625-2337 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37,742	A	1	PRODUCTION RELEASE	-	DY	JFK		03-19-91

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)

300-3824-15
RECEPTACLE PANEL SHOWN

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED	NEXT ASSY	ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL
	.xx ± .02, .xxx ± .005 Inch; X ± .1, XX ± .03, XXX ± .005	COPIED FROM						MINNEAPOLIS, MINNESOTA 55432
	THIRD ANGLE PROJECTION	DR D. YOUNG 05-30-90; CHK'R OR MFG. ENG. JEFF KRAGE 03-19-91; APPROVED						TITLE WIRING DIAGRAM
	ANG TOL ± ---	DRAWN TO SCALE OF ---	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982	MODEL FIRST USED ON 3.5kW PRO E IND. PANEL				DWG NO 625-2337 SHEET 5 of 6 DWG SIZE D

625-2337 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
37,742	A	1	PRODUCTION RELEASE	-	DY	JFK		03-19-91

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)

300-3824-22
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DRAWN D. YOUNG 05-30-90
CHK'R JEFF KRAGE 03-19-91
APPROVED

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

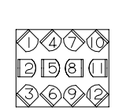
DWG NO 625-2337 SHEET 6 OF 6 DWG SIZE D

625-2374 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
36,786	A	1	PRODUCTION RELEASE	-	CSE			04-24-90

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.
3. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
4. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
5. FULL POWER SWITCH S1 SHOWN IN 120 VOLT POSITION.



REAR VIEW OF SWITCH S1 WITH KEYWAY DOWN.

DETAIL A

BATTERY
#6 BLACK
IGNITION CONTROL UNIT
BLACK
#18 RED
#18 RED
#18 BLACK
START
STOP
#18 GREEN
2P2T
PANEL GROUND
BLACK/YELLOW
OIL WATCH UNIT SS1164
GREEN
#18 GREEN
CHARGE COIL
PANEL GROUND
IDLEMATIC SOLENOID
GREEN
#18 GREEN
DIODE
BLUE
PANEL GROUND
WHITE/BLACK
RED/BLACK
OIL LEVEL SWITCH
BLACK
BLACK
#18 RED
#18 RED
CB6
15 AMP
DC RECEPTACLE
#18 RED
#18 BLUE
#18 WHITE
IDLEMATIC SWITCH
#18 RED
#18 RED
ENGINE
#6 RED
#18 RED
#18 BROWN
#18 BROWN
#12 BLACK
#10 GREEN
#12 GREEN
J1 15A 120V
J3 30A 120V
J4 20A 120/240V
CB1 20A
#18 BLACK
#12 BLACK
#12 WHITE
LINE
#12 BLACK
LINE
CB4 15A
GFI
#12 BLACK
#12 WHITE
#10 BLACK
VM
SEE NOTE 3
#10 WHITE
#18 BROWN
#18 RED
#18 WHITE
#10 WHITE
#12 WHITE
#12 BLACK
CB2 20A
CB3 30A
#12 BLACK
#12 BLACK
CB5 20A
#12 BLACK
#12 BLACK
#10 BLACK
#18 BLACK
S1
#10 BLACK
CONTROL BOX
R
B
GROUND
#12 GREEN
R
T1
W
T2
Br
T3
L
T4
GENERATOR
STARTER
#18 RED
#18 BROWN
#12 WHITE
#12 BLACK
#12 BLACK
#12 BLACK
SEE NOTE 4
T1
T4
IDLEMATIC CONTROL UNIT (SAWAFUJI)
SEE DETAIL A AND NOTE 5

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED

DO NOT SCALE PRINT

DRAWN TO SCALE OF ---

ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

DR C.S.EDWARDS 04-24-90
CHECK
MFG ENG
APPROVED

THIRD ANGLE PROJECTION

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING - SEE ANSI Y14.5M-1982

MODEL FIRST USED ON 4kW PRO E/CSA

Onan

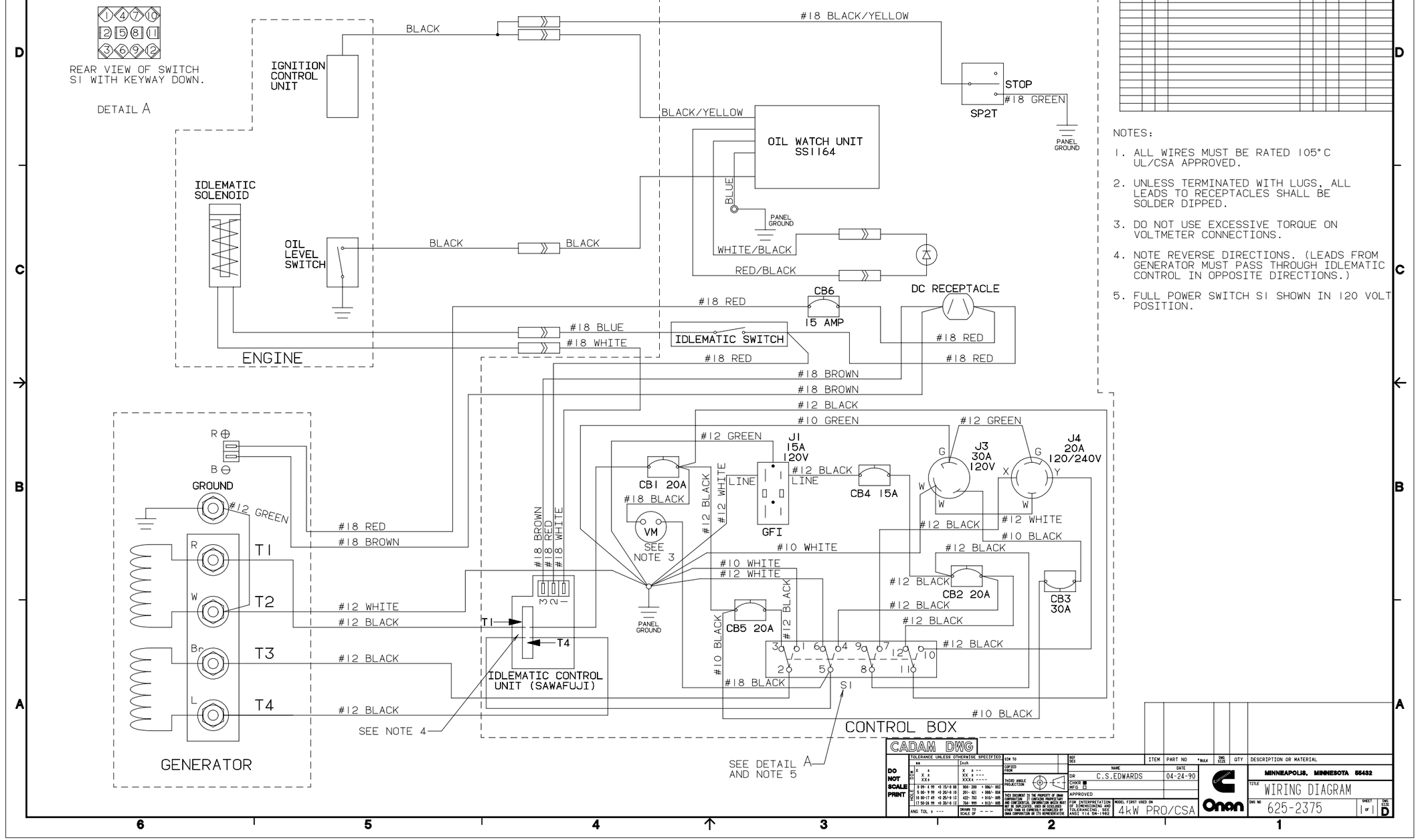
MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

DWG NO 625-2374 SHEET 1 OF 1 DWG SIZE D

625-2375 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
36,786	A	1	PRODUCTION RELEASE	-	CSE			04-24-90



NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.
3. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
4. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
5. FULL POWER SWITCH S1 SHOWN IN 120 VOLT POSITION.

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DRAWN C.S.EDWARDS 04-24-90

APPROVED

MODEL FIRST USED ON 4kW PRO/CSA

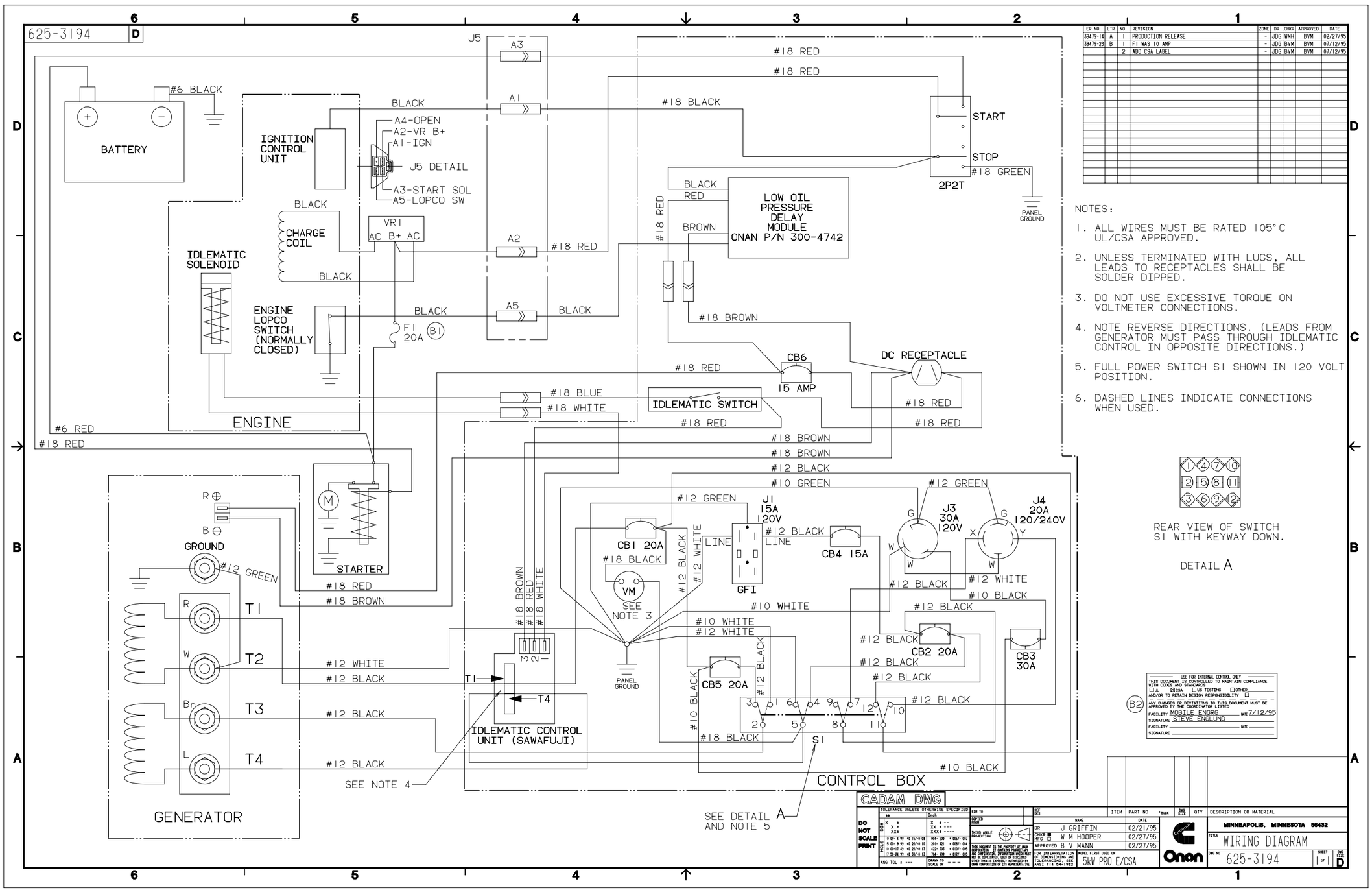
MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

DWG NO 625-2375 SHEET 1 of 1 SIZE D

625-3194 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39479-14	A	1	PRODUCTION RELEASE	-	JDG	WMH	BVM	02/27/95
39479-28	B	1	F1 WAS 10 AMP	-	JDG	BVM	BVM	07/12/95
		2	ADD CSA LABEL	-	JDG	BVM	BVM	07/12/95



NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.
3. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
4. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
5. FULL POWER SWITCH S1 SHOWN IN 120 VOLT POSITION.
6. DASHED LINES INDICATE CONNECTIONS WHEN USED.

REAR VIEW OF SWITCH S1 WITH KEYWAY DOWN.

DETAIL A

B2 USE FOR INTERNAL CONTROL ONLY
THIS DOCUMENT IS CONTROLLED TO MAINTAIN COMPLIANCE WITH CODES AND STANDARDS
☐ UL ☒ CSA ☐ VB TESTING ☐ OTHER _____
AND/OR TO RETAIN DESIGN RESPONSIBILITY ☐ _____
ANY CHANGES OR DEVIATIONS TO THIS DOCUMENT MUST BE APPROVED BY THE ORIGINATOR LISTED
FACILITY MOBILE ENGRG DATE 7/12/95
SIGNATURE STEVE ENGLUND
FACILITY _____ DATE _____
SIGNATURE _____

CADAM DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED
mm: X ± , XX ± , XXX± | Inch: X ± ---, XX ± ---, XXX± ----
DO NOT SCALE PRINT
HOLE SIZE: 9 99-4 89 +0 15/-0 08 | 5 00-9 99 +0 20/-0 10 | 10 00-17 89 +0 25/-0 13 | 17 50-24 39 +0 30/-0 13
ANG TOL ± ---
DRAWN TO SCALE OF ---
.000- .299 +.006/-.002 | .300- .421 +.008/-.004 | .422- .703 +.010/-.005 | .704- .999 +.012/-.005
NEXT ASSY
COPIED FROM
THIRD ANGLE PROJECTION
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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING - SEE ANSI Y14.5M-1982
MODEL FIRST USED ON 5kW PRO E/CSA

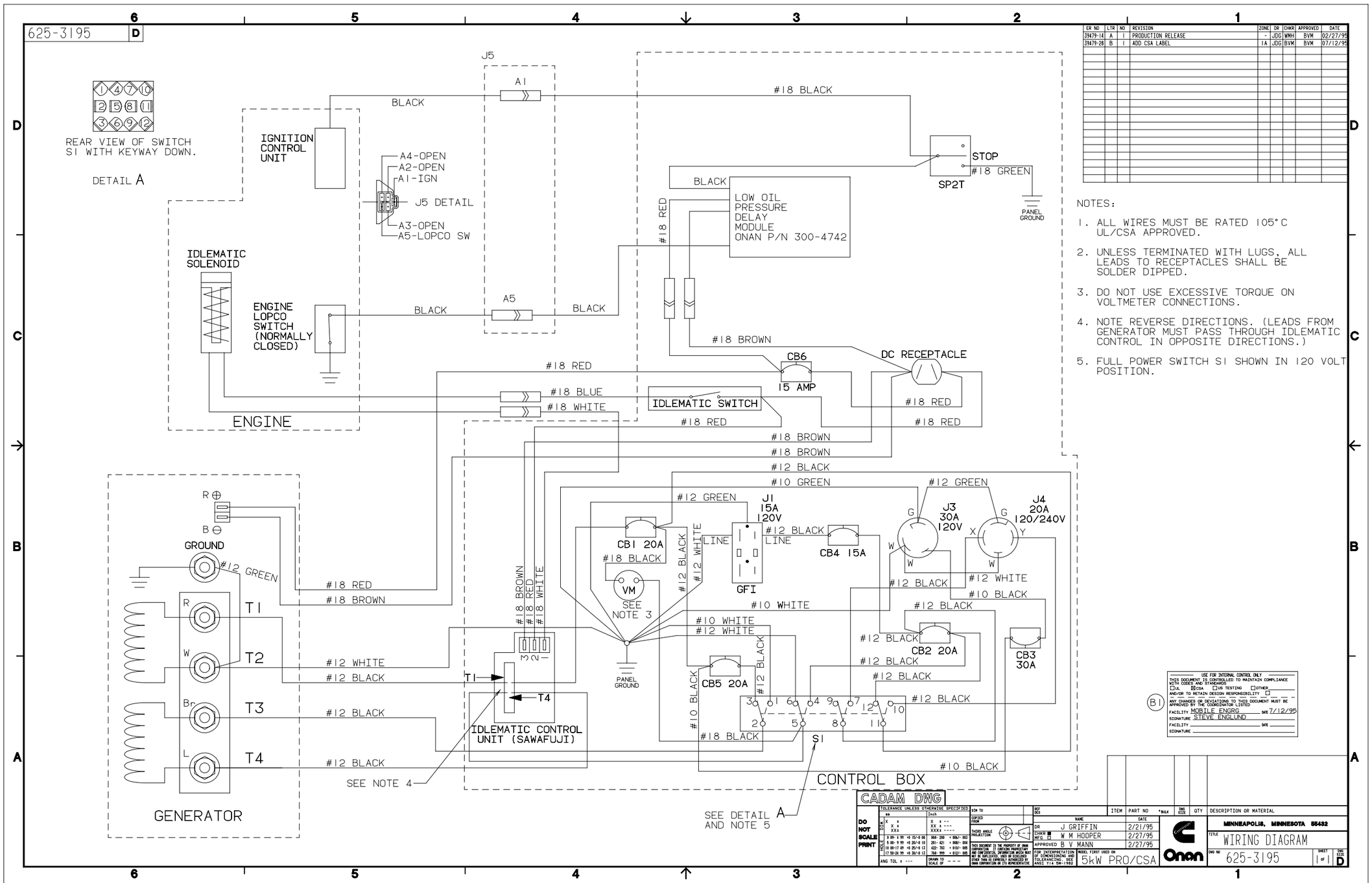
REF DES	ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

	NAME	DATE
DR	J GRIFFIN	02/21/95
CHKR ☒ MFG ☐	W M HOOPER	02/27/95
APPROVED	B V MANN	02/27/95

MINNEAPOLIS, MINNESOTA 55432
TITLE WIRING DIAGRAM
DWG NO 625-3194
SHEET 1 OF 1
DWG SIZE D

625-3195 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39479-14	A	1	PRODUCTION RELEASE	-	JDG	WMH	BVM	02/27/95
39479-28	B	1	ADD CSA LABEL	1A	JDG	BVM	BVM	07/12/95



NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.
3. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
4. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
5. FULL POWER SWITCH S1 SHOWN IN 120 VOLT POSITION.

USE FOR INTERNAL CONTROL ONLY
THIS DOCUMENT IS CONTROLLED TO MAINTAIN COMPLIANCE WITH CODES AND STANDARDS:
☐UL ☒CSA ☐VDE TESTING ☐OTHER
AND/OR TO RETAIN DESIGN RESPONSIBILITY ☐
ANY CHANGES OR DEVIATIONS TO THIS DOCUMENT MUST BE APPROVED BY THE CORPORATOR LISTED
FACILITY MOBILE ENGRG DATE 7/12/95
SIGNATURE STEVE ENGLUND
FACILITY DATE
SIGNATURE

B1

CADAM DWG

	NAME	DATE
DR	J GRIFFIN	2/21/95
CHK'R MFG. ENG.	W M HOOPER	2/27/95
APPROVED	B V MANN	2/27/95

TOLERANCE UNLESS OTHERWISE SPECIFIED
DO NOT SCALE PRINT
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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING REFER TO ANSI Y14.5M-1982
MODEL FIRST USED ON 5kW PRO/CSA

ITEM | PART NO | QTY | DESCRIPTION OR MATERIAL

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

DWG NO 625-3195 SHEET 1 OF 1 DWG SIZE D

625-3196 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39479-14	A	1	PRODUCTION RELEASE	-	JG	WMH	BVM	02/27/95
39479-28	B	1	F1 WAS 10 AMP	5C	JG	BVM	BVM	07/12/95
		2	SEE SHEET 2	-	JG	BVM	BVM	07/12/95
		3	SEE SHEET 3	-	JG	BVM	BVM	07/12/95
		4	SEE SHEET 4	-	JG	BVM	BVM	07/12/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
6. DASHED LINES INDICATE CONNECTIONS WHEN USED.

300-3824-01
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DRAWN TO SCALE OF ---

ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

	NAME	DATE
DR	J GRIFFIN	02/21/95
CHKR BE MFG E	W M HOOPER	02/27/95
APPROVED B V MANN		02/27/95

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING - SEE ANSI Y14.5M-1982

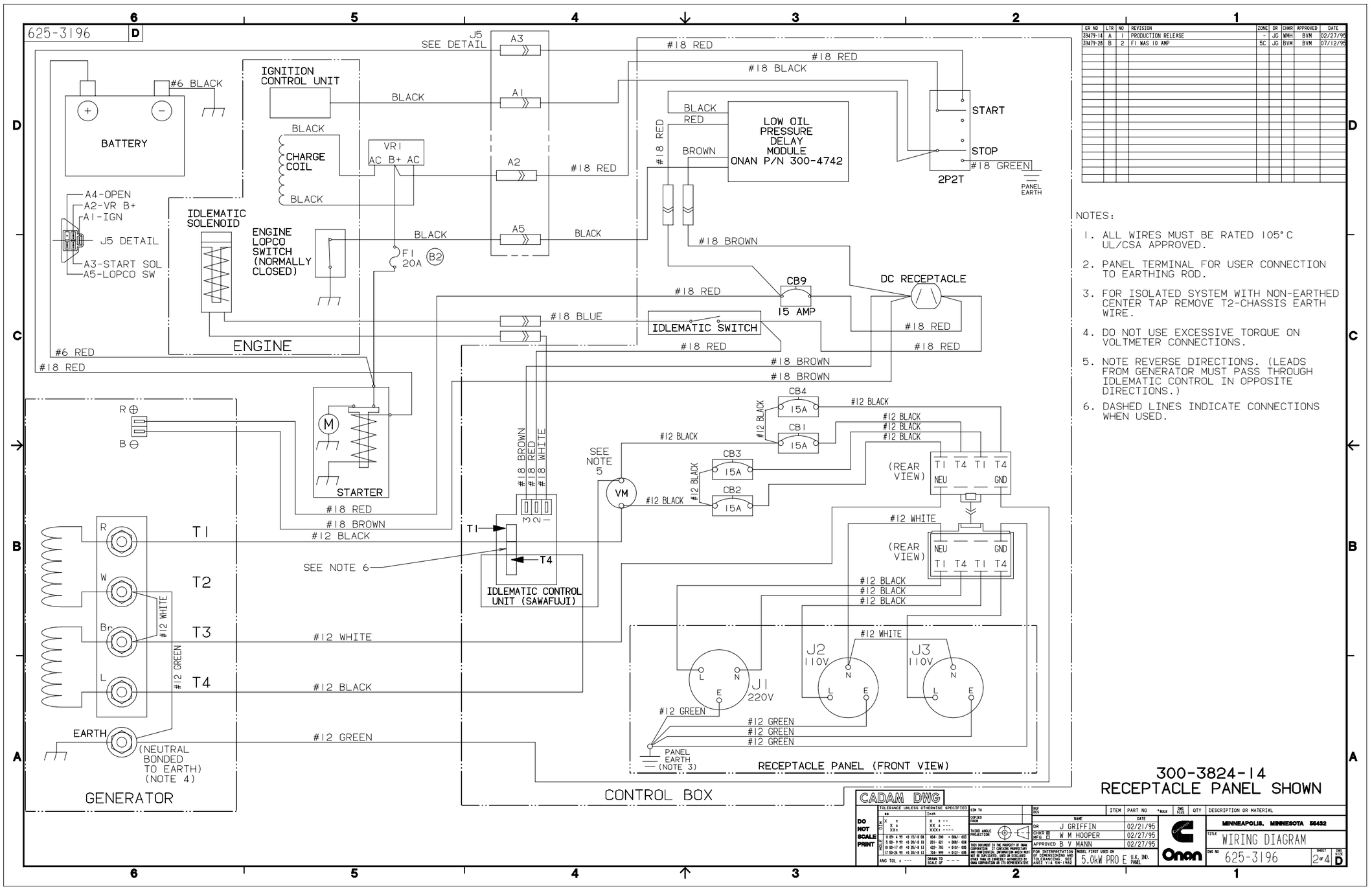
MODEL FIRST USED ON 5.0kW PRO E BLANK PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

DWG NO 625-3196 SHEET 1 OF 4 DWG SIZE D



ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39479-14	A	1	PRODUCTION RELEASE	-	JG	WMH	BVM	02/27/95
39479-28	B	2	F1 WAS 10 AMP	5C	JG	BVM	BVM	07/12/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
6. DASHED LINES INDICATE CONNECTIONS WHEN USED.

300-3824-14
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT

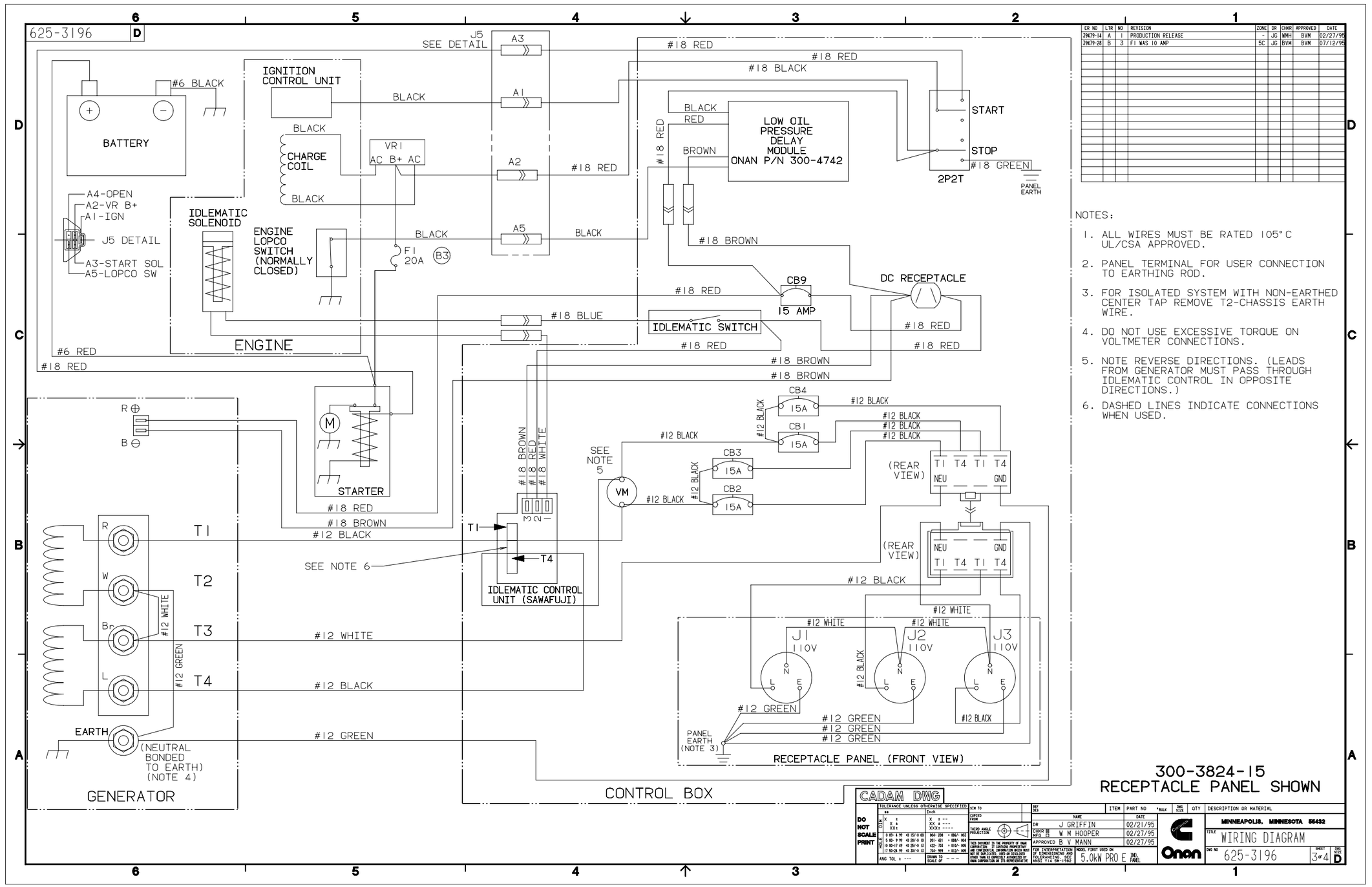
DR	J GRIFFIN	02/21/95
CHKR	W M HOOPER	02/27/95
MFG ENG	W M HOOPER	02/27/95
APPROVED	B V MANN	02/27/95

MODEL FIRST USED ON: 5.0kW PRO E U.K. IND. PANEL

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

DWG NO: 625-3196 SHEET: 2×4 SIZE: D



ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39479-14	A	1	PRODUCTION RELEASE	-	JG	WMH	BVM	02/27/95
39479-28	B	3	F1 WAS 10 AMP	5C	JG	BVM	BVM	07/12/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
6. DASHED LINES INDICATE CONNECTIONS WHEN USED.

CADAM DWG

DO NOT SCALE PRINT

	NAME	DATE
DR	J GRIFFIN	02/21/95
CHKR DR MFG. ENG	W M HOOPER	02/27/95
APPROVED	B V MANN	02/27/95

THIRD ANGLE PROJECTION

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON 5.0kW PRO E IND. PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

DWG NO 625-3196 SHEET 3 OF 4 SIZE D

300-3824-15
RECEPTACLE PANEL SHOWN

625-3196 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39479-14	A	1	PRODUCTION RELEASE	-	JG	WMH	BVM	02/27/95
39479-28	B	4	FI WAS 10 AMP	5C	JG	BVM	BVM	07/12/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. PANEL TERMINAL FOR USER CONNECTION TO EARTHING ROD.
3. FOR ISOLATED SYSTEM WITH NON-EARTHED CENTER TAP REMOVE T2-CHASSIS EARTH WIRE.
4. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
5. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
6. DASHED LINES INDICATE CONNECTIONS WHEN USED.

300-3824-22
RECEPTACLE PANEL SHOWN

CADAM DWG

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED			ITEM	PART NO.	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL
	mm: X ± , XX ±	Inch: X ± .--- , XX ± .--- , XXX ± .----							
	ANG TOL ± ---	DRAWN TO SCALE OF ---							

	NAME	DATE
DR	J GRIFFIN	02/21/95
CHKR BE MFG. E	W M HOOPER	02/27/95
APPROVED B V MANN		02/27/95

THIRD ANGLE PROJECTION

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING - SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: 5.0kW PRO E EURO-PANEL

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE: WIRING DIAGRAM

DWG NO: 625-3196 SHEET 4 OF 4 DWG SIZE D

625-3193 D

ER NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
39479-14	A	1	PRODUCTION RELEASE	-	JDG	WMH	BVM	02/27/95
39479-28	B	1	F1 WAS 10 AMP	5C	JDG	BVM	BVM	07/12/95
		2	ADD CSA LABEL	1A	JDG	BVM	BVM	07/12/95

NOTES:

1. ALL WIRES MUST BE RATED 105°C UL/CSA APPROVED.
2. UNLESS TERMINATED WITH LUGS, ALL LEADS TO RECEPTACLES SHALL BE SOLDER DIPPED.
3. DO NOT USE EXCESSIVE TORQUE ON VOLTMETER CONNECTIONS.
4. NOTE REVERSE DIRECTIONS. (LEADS FROM GENERATOR MUST PASS THROUGH IDLEMATIC CONTROL IN OPPOSITE DIRECTIONS.)
5. FULL POWER SWITCH S1 SHOWN IN 120 VOLT POSITION.
6. DASHED LINES INDICATE CONNECTIONS WHEN USED.

REAR VIEW OF SWITCH S1 WITH KEYWAY DOWN.

DETAIL A

USE FOR INTERNAL CONTROL ONLY
THIS DOCUMENT IS CONTROLLED TO MAINTAIN COMPLIANCE WITH CODES AND STANDARDS
☐UL ☒CSA ☐US TESTING ☐OTHER
AND/OR TO RETAIN DESIGN RESPONSIBILITY ☐
ANY CHANGES OR DEVIATIONS TO THIS DOCUMENT MUST BE APPROVED BY THE COORDINATOR LISTED
FACILITY MOBILE ENGRG DATE 7/12/95
SIGNATURE STEVE ENGLUND
FACILITY DATE
SIGNATURE

B2

J5 A3 #18 RED
#18 RED
#6 BLACK
BLACK A1 #18 BLACK
BATTERY
IGNITION CONTROL UNIT
A4-OPEN
A2-VR B+
A1-IGN
J5 DETAIL
A3-START SOL
A5-LOPCO SW
START
STOP
#18 GREEN
2P2T
PANEL GROUND
#18 RED
BLACK
RED
BROWN
LOW OIL PRESSURE DELAY MODULE ONAN P/N 300-4742
BLACK
CHARGE COIL
VR1
AC B+ AC
A2
BLACK
IDLEMATIC SOLENOID
ENGINE LOPCO SWITCH (NORMALLY CLOSED)
BLACK
A5
BLACK
F1 20A (B1)
#18 BROWN
CB6
15 AMP
DC RECEPTACLE
#18 RED
#18 BLUE
#18 WHITE
IDLEMATIC SWITCH
#18 RED
#18 RED
#18 BROWN
#18 BROWN
#6 RED
#18 RED
ENGINE
#10 BLACK
#10 GREEN
#10 GREEN
#12 GREEN
#12 GREEN
J1 15A 120V
J2 30A 120V
J3 30A 120V
J4 30A 120/240V
CB1 25A
#18 BLACK
#12 WHITE
LINE
#12 BLACK
LINE
GFI
CB4 15A
#10 BLACK
#12 WHITE
#10 BLACK
R
B
GROUND
#10 GREEN
STARTER
#18 RED
#18 BROWN
#10 WHITE
#10 WHITE
#10 WHITE
#10 WHITE
CB7 30A
#10 BLACK
#12 BLK
CB2 25A
CB3 30A
#10 BLACK
#10 BLACK
#12 BLACK
#10 BLACK
R
T1
W
T2
Br
T3
L
T4
#10 WHITE
#10 BLACK
#10 BLACK
#18 BROWN
#18 RED
#18 WHITE
T1
T4
CB5 25A
#18 BLACK
SEE NOTE 4
IDLEMATIC CONTROL UNIT (SAWAFUJI)
SEE NOTE 3
VM
PANEL GROUND
SEE DETAIL A AND NOTE 5
S1
CONTROL BOX
GENERATOR

CADAM DWG

ITEM	PART NO	*BULK	DWG SIZE	QTY	DESCRIPTION OR MATERIAL

	NAME	DATE
DR	J GRIFFIN	02/21/95
CHK'R ☒ MFG ☐	W M HOOPER	02/27/95
APPROVED	B V MANN	02/27/95

MINNEAPOLIS, MINNESOTA 55432

TITLE WIRING DIAGRAM

DWG NO 625-3193 SHEET 1 of 1 DWG SIZE D

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON 6kW PRO E/CSA

DO NOT SCALE PRINT

Onan

Cummins Power Generation
1400 73rd Avenue N.E.
Minneapolis, MN 55432
763-574-5000
Fax: 763-528-7229