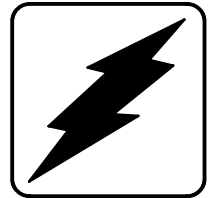


Operation and Installation

Commercial Generator Sets



Models:

COM6 (24 VDC)
COM6 (48 VDC)

KOHLER[®]
POWER SYSTEMS

9001
KOHLER
POWER SYSTEMS
NATIONALLY REGISTERED

TP-5863 7/05d

California Proposition 65

WARNING

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Product Identification Information

Product identification numbers determine service parts. Record the product identification numbers in the spaces below immediately after unpacking the products so that the numbers are readily available for future reference. Record field-installed kit numbers after installing the kits.

Generator Set Identification Numbers

Record the product identification numbers from the generator set nameplate(s).

Model Designation _____

Specification Number _____

Serial Number _____

Accessory Number	Accessory Description
------------------	-----------------------

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Controller Identification

Record the controller description from the generator set operation manual, spec sheet, or sales invoice.

Controller Description _____

Engine Identification

Record the product identification information from the engine nameplate.

Manufacturer _____

Model Designation _____

Serial Number _____

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Safety Precautions and Instructions

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. **SAVE THESE INSTRUCTIONS.**

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that **will cause severe personal injury, death, or substantial property damage.**

WARNING

Warning indicates the presence of a hazard that **can cause severe personal injury, death, or substantial property damage.**

CAUTION

Caution indicates the presence of a hazard that **will or can cause minor personal injury or property damage.**

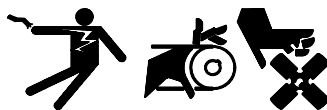
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



**Accidental starting.
Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Battery

WARNING



**Sulfuric acid in batteries.
Can cause severe injury or death.**

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Engine Backfire/ Flash Fire

WARNING

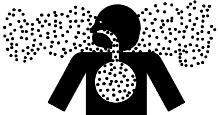


**Fire.
Can cause severe injury or death.**

Do not smoke or permit flames or sparks near fuels or the fuel system.

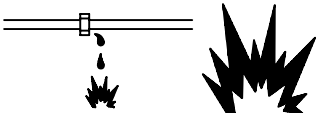
Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner removed.

Exhaust System

⚠ WARNING

Carbon monoxide. Can cause severe nausea, fainting, or death.
The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building.

Fuel System

⚠ WARNING

Explosive fuel vapors. Can cause severe injury or death.
Use extreme care when handling, storing, and using fuels.

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

Propane (LP)—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

Natural Gas—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

Gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LP vapor gas or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

Hazardous Voltage/ Electrical Shock

⚠ WARNING	
	
Hazardous voltage. Moving rotor. Can cause severe injury or death.	
Operate the generator set only when all guards and electrical enclosures are in place.	

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocuting is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

High voltage test. Hazardous voltage can cause severe injury or death. Follow the instructions of the test equipment manufacturer when performing high-voltage tests on the rotor or stator. An improper test procedure can damage equipment or lead to generator set failure.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Heavy Equipment

⚠ WARNING

Unbalanced weight. Improper lift can cause severe injury or death and/or equipment damage.
Use slings under skid to balance and lift generator set.

Hot Parts

⚠ WARNING

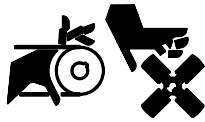
Hot engine and exhaust system. Can cause severe injury or death.
Do not work on the generator set until it cools.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

Moving Parts

⚠ WARNING

Hazardous voltage. Moving rotor. Can cause severe injury or death.
Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING

Rotating parts. Can cause severe injury or death.
Operate the generator set only when all guards, screens, and covers are in place.

Tightening the hardware. Flying projectiles can cause severe injury or death. Loose hardware can cause the hardware or pulley to release from the generator set engine and can cause personal injury. Retorque all crankshaft and rotor hardware after servicing. Do not loosen the crankshaft hardware or rotor throbolt when making adjustments or servicing the generator set. Rotate the crankshaft manually in a clockwise direction only. Turning the crankshaft bolt or rotor throbolt counterclockwise can loosen the hardware.

Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

Notice

NOTICE

Hardware damage. The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. To indicate hardness, American Standard hardware uses a series of markings, and metric hardware uses a numeric system. Check the markings on the bolt heads and nuts for identification.

Notes

This manual provides operation instructions for COM6 generator sets equipped with a microprocessor controller.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the beginning of this manual. Keep this manual with the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect the parts often and perform required service at the prescribed intervals. Maintenance work must be performed by appropriately skilled and suitably-trained maintenance personnel familiar with generator set operation and service.

California Emission Certification

If your engine/generator has one of the following identification labels, it is certified to meet Small Off-Road Engine (SORE) emission standards for EPA/CARB.

IMPORTANT ENGINE INFORMATION
 THIS ENGINE MEETS EMISSION
 REGULATIONS FOR U.S. EPA PH1
 SMALL ENGINES AND 2000-2001
 CALIFORNIA SI SORES *

DISPLACEMENT:
 FAMILY:
 BUILD DATE:

REFER TO OWNERS MANUAL FOR
 SAFETY, MAINTENANCE SPECS AND
 ADJUSTMENTS. FOR SALES AND
 SERVICE IN US/CANADA CALL:
 1-800-544-2444

THIS ENGINE IS CERTIFIED TO OPERATE
 ON

KOHLER
 POWER SYSTEMS

* Spark-Ignited Small Off-Road Engines

The COM6 engine/generator is certified to operate on natural gas or LP vapor.

The CH20 engine is certified with an oxygen sensor and engine control module.

IMPORTANT ENGINE INFORMATION
 THIS ENGINE MEETS U.S. EPA PHASE 1 AND
 CALIFORNIA 2006 AND LATER EMISSION
 CONTROL REGULATIONS FOR SI SORE

FAMILY
DISPL (CC)
MODEL NO.
SPEC. NO.
SERIAL NO.

 N11236

EMISSION COMPLIANCE PERIOD:
 EPA: CARB: EXTENDED

THIS ENGINE IS CERTIFIED TO OPERATE ON:
 PROPANE / NATURAL GAS

REFER TO OWNER'S MANUAL FOR SAFETY,
 MAINTENANCE SPECS AND ADJUSTMENTS.
 FOR SALES AND SERVICE IN US/CANADA,
 CALL:
 1-800-544-2444
 WWW.KOHLERENGINES.COM

KOHLER engines
 KOHLER CO. KOHLER, WISCONSIN USA

The Emission Compliance Period referred to on the Emission Control or Air Index label indicates the number of operating hours for which the engine has been shown to meet CARB emission requirements. The following table provides the Engine Compliance Period (in hours) associated with the category descriptor found on the certification label.

Emission Compliance Period (hours)			
CARB	Moderate, 125	Intermediate, 250	Extended, 500

Refer to certification label for engine displacement.

Exhaust Emission Control System for COM6 (CH20) is EM, ECM, 02S.

Routine Service Parts

Contact your Kohler generator distributor/dealer for a complete list of service parts for your generator set.

Part Description	Part No.
Engine:	
Air Filter Element	24 083 08
Air Filter Precleaner	24 083 02
Annual Maintenance Kit Includes the following: Air Filter Element (1) Air Filter Precleaner (1) Lube Oil Filter (1) Mobil 1, 5W-30 (2 qts) Oil Drain Bag (1) Instruction Sheet	345095
Oil Filter	12 050 01
Oil Type	Mobil 1, 5W-30, API Service Class, SF, SG, or SH
Spark Plug	24 132 01

Service Assistance

For professional advice on generator set power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric
- Visit the Kohler Power Systems website at KohlerPowerSystems.com
- Look at the labels and stickers on your Kohler product or review the appropriate literature or documents included with the product
- Call toll free in the US and Canada 1-800-544-2444
- Outside the US and Canada, call the nearest regional office

Headquarters Europe, Middle East, Africa (EMEA)

Kohler Power Systems
ZI Senia 122
12, rue des Hauts Flouviars
94517 Thiais Cedex
France
Phone: (33) 1 41 735500
Fax: (33) 1 41 735501

Asia Pacific

Power Systems Asia Pacific Regional Office
Singapore, Republic of Singapore
Phone: (65) 6264-6422
Fax: (65) 6264-6455

China

North China Regional Office, Beijing
Phone: (86) 10 6518 7950
(86) 10 6518 7951
(86) 10 6518 7952
Fax: (86) 10 6518 7955

East China Regional Office, Shanghai
Phone: (86) 21 6288 0500
Fax: (86) 21 6288 0550

India, Bangladesh, Sri Lanka

India Regional Office
Bangalore, India
Phone: (91) 80 3366208
(91) 80 3366231
Fax: (91) 80 3315972

Japan, Korea

North Asia Regional Office
Tokyo, Japan
Phone: (813) 3440-4515
Fax: (813) 3440-2727

Latin America

Latin America Regional Office
Lakeland, Florida, USA
Phone: (863) 619-7568
Fax: (863) 701-7131

1.1 Generator Set Concepts

The Kohler COM6 generator set provides reliable standby DC power to communication sites in place of, or in addition to, batteries.

The telecommunication system batteries provide power for communication systems at 24, 48, 60, or 90 volts. Maintained by utility-powered rectifiers, most battery-powered sites provide 8 hours of reserve power.

Kohler COM6 generator set functions coordinate with the telecommunications power systems and rectifiers. When power fails, the telecom power control system signals the generator to start. Following a time delay, the unit starts and provides DC power for continued system operation.

The Kohler COM6 has local and remote annunciation and control capabilities. The unit runs on natural gas or LP vapor.

1.2 System Functional Description

The Kohler COM6 generator set system consists of the generator set (engine and generator) and the control system. The controller includes controls, alarm circuitry, interfaces, rectifiers, filters, an AC-powered start battery charger, and an output circuit breaker. The generator set provides regulated DC to the telecommunications power system.

The Kohler CH20 engine drives a direct-connected variable-speed, 3-phase special-voltage generator to produce high-frequency AC power. A 3-phase, full-wave rectifier in the control system rectifies the output to produce low-ripple, unfiltered DC power. A filter system consisting of capacitors and an inductor smooths the low-ripple DC wave form to nearly pure DC. The output line circuit breaker provides protection for downstream devices in case of overload and a convenient means of disconnecting the generator from the load for servicing and testing.

The permanent magnet-type generator output voltage increases with rpm. Conversely, as system load increases at any specific rpm, generator voltage decreases. These characteristics combine to provide a generator set which operates at low speeds and fixed voltage under very light loads. As loads increase, the control system maintains generator voltage by increasing generator set rpm.

During normal operation, the controller capacitors charge to operating voltage. With the generator set not

running and the control system breaker open, the capacitors discharge over a period of several minutes through bleeder resistors connected directly across the capacitor terminals. The filter capacitors hold charge voltage and, when the breaker is open, the bleeder resistors are the only load on the generator set. With the resistors as the only load the generator has difficulty maintaining precise voltage control. If the system batteries are connected, the control system breaker opens and the generator set idles for several minutes. Start and run the generator set before closing the system breaker to minimize surge current flowing to the filter capacitors.

1.3 Specifications

Figure 1-1, Figure 1-2, and Figure 1-3 contain general generator set, alternator, and engine specifications. Refer to the service section and the engine service manual for specific service details.

	24 VDC	48 VDC
Manufacturer	Kohler	
Dimensions, L x W x H, mm (in.)	712 x 966 x 712 (28 x 38 x 28)	
Weight, kg (lb. dry)	193 (425)	
Rated kW	6	
Frequency, Hz	360-720	
Rated Voltage (after rectifier)	26.2 VDC	52.0 VDC
Rated Amps	230	115
DERATION: Derate approximately 3.5% per 300 m (1000 ft.) over 600 m (2000 ft.) above sea level. Derate 1% for each 5.5°C (10°F) increase in temperature above 49°C (120°F).		

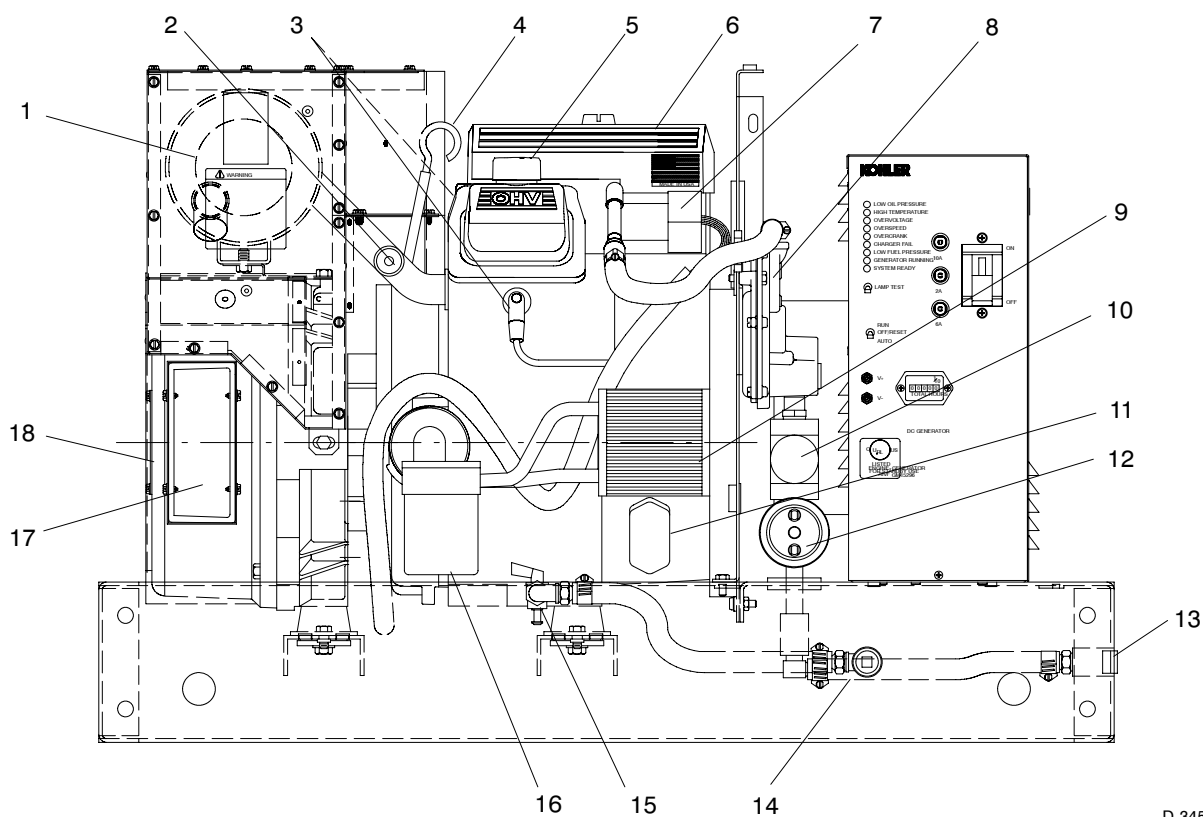
Figure 1-1 Generator Set Specifications

	24 VDC	48 VDC
Stator Resistance, ohms	0.0028	0.045
Stator Type	3-phase dual wye (6 leads)	3 lead
Excitation Method (rotor)	Permanent Magnet Brushless	
Coupling Type	Direct	
Insulation (stator)	Class 180, Epoxy Varnish, Vacuum Impregnated	
Winding Material	Copper	
Bearing, Number and Type	1, Replaceable Ball	

Figure 1-2 Generator Specifications

	24 VDC	48 VDC
Manufacturer	Kohler	
Make/Model	CH20	
Cycle	4	
Number Cylinders	2	
Compression Ratio	8.5:1	
Displacement, cc (cu. in.)	624 (38)	
Rated Horsepower (using natural gas fuel)	15	
Rpm	1800–3600	
Bore, mm (in.)	77 (3.03)	
Stroke, mm (in.)	67 (2.64)	
Valve Material: Intake Exhaust	Steel Stellite®	
Valve Train	Overhead Valve	
Cylinder Block Material	Alum. w/Cast Iron Liners	
Cylinder Head Material	Aluminum	
Piston Rings	2 Compression, 1 Oil	
Crankshaft Material	Heat Treated, Ductile Iron Casting	
Bearings, Number & Type	2, Replaceable Sleeve	
Governor	Electronic	
Lubrication System	Full Pressure	
Oil Capacity (with filter and cooler), L (qt.)	2.0 (2.1)	
Oil Type (summer/winter)	Mobil 1, 5W-30, API Classification SF, SG, or SH	
Oil Pressure, kPa (psi)	172–241 (25–35)	
Low Oil Pressure, kPa (psi)	24.1 ±13.8 (3 1/2 ±1 1/2)	
Fuel Type	Factory Set for Natural Gas (propane adaptable)	
Fuel Pressure, mm water (in. water column)	178–280 (7–11)	
Low Fuel Pressure, in. water column	5.5 ±0.25	
High Engine Temperature, °C (°F)	152 (305)	
Battery Voltage	12	
Battery Ground	Negative	
Battery Recommendation (min.)	500 CCA at 0°F (see Section 6)	
Spark Plug Type (Kohler part no.)	24 132 01	
Spark Plug Gap, mm (in.)	1.02 (0.040)	
Spark Plug Tightening Torque, Nm (ft. lb.)	24.4–29.8 (18–22)	
Ignition System	Capacitor Discharge	
Engine-driven Battery Charger	15 Amp, Regulated	
Starter Motor	Electric, Solenoid Shift	
Cooling System	Integrated Air Cooling	

Figure 1-3 Engine Specifications



D-345000A-P

- | | | |
|----------------------------|--------------------------------------|--------------------------------------|
| 1. Exhaust muffler | 7. Fuel metering valve | 13. Fuel supply connection (1/2 NPT) |
| 2. Oxygen sensor | 8. Fuel pressure regulator | 14. Oil drain (1/2 NPT) |
| 3. Spark plug (quantity 2) | 9. Engine oil cooler | 15. Oil drain valve |
| 4. Engine oil dipstick | 10. Fuel shutoff solenoid | 16. Engine oil filter |
| 5. Engine oil fill | 11. Engine battery charger regulator | 17. Generator cooling air inlet |
| 6. Air cleaner | 12. Fuel pressure switch | 18. Generator |

Figure 1-4 COM6 Service View

Notes

2.1 Prestart Checklist

Check the following items before each attended startup and at regular intervals. Refer to Section 3, Scheduled Maintenance, for service procedures.

Air Cleaner. Keep air cleaner element clean. Install element to keep unfiltered air from entering engine.

Battery. Ensure tight battery connections. Maintain full battery electrolyte level.

Exhaust System. Keep exhaust outlet clear. Keep silencer and piping tight and in good condition.

Fuel Level. Keep propane tank(s), when used, full to ensure adequate fuel supply.

Lamp Test. Toggle the lamp-test switch to verify operation of all controller LEDs.

Oil Level. Maintain oil level at or near full mark on dipstick but not over.

Operating Area. Check for obstructions that could block the flow of cooling air. Keep the air intake and exhaust areas free of obstructions. Do not leave rags, tools, or debris on or near the generator set.

Note: Minimize surge current flowing to the filter capacitors. With the system batteries connected, the circuit breaker open, and the generator set out-of-service for several minutes, start and run the generator set before closing the system breaker.

2.2 Control System

2.2.1 Features

The following paragraphs refer to Figure 2-1.

Control Fuses. Fuses are on controller front panel.

- **(F1) 10-Amp Generator Set Controller.** Fuse protects controller circuit board.
- **(F2) 2-Amp Battery Charger AC Input.** Fuse protects generator set starting battery charger.
- **(F3) 6-Amp Battery Charger DC Output.** Fuse protects generator set starting battery charger.

DC Circuit Breaker. Circuit breaker protects connected cabling from overload. It also provides a means of disconnecting the generator set and controller system from system batteries for service.

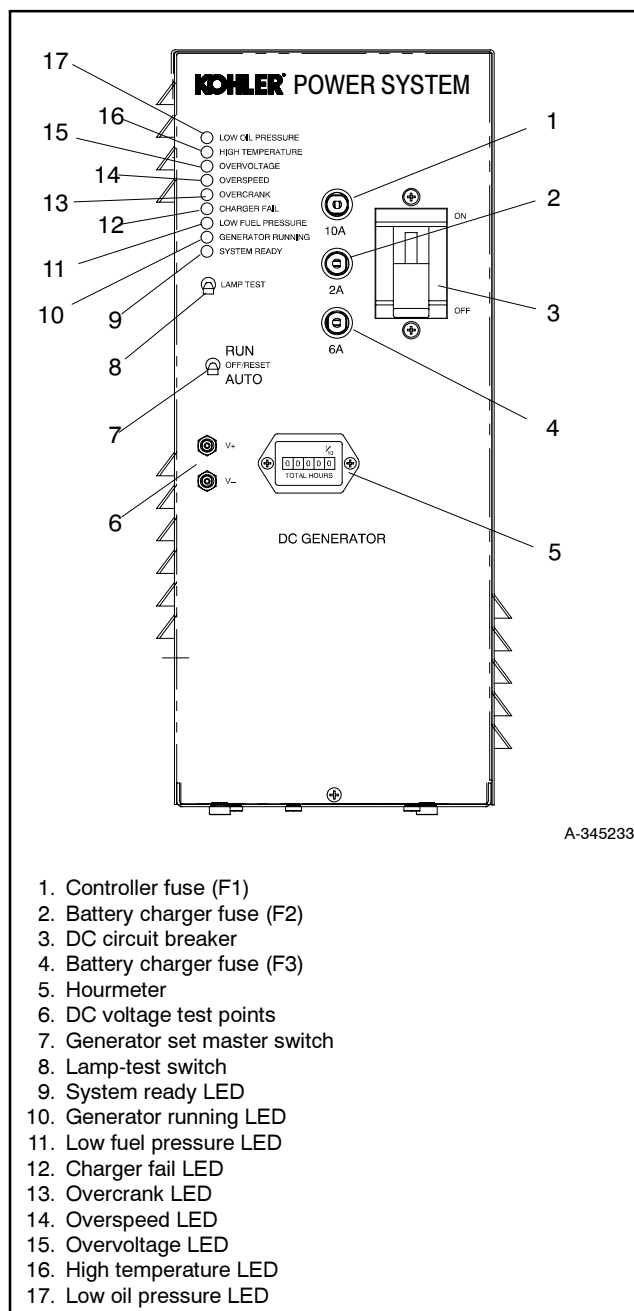


Figure 2-1 Controller (front view)

Refer to Figure 2-1 and Figure 2-2 with the following descriptions to identify control system components.

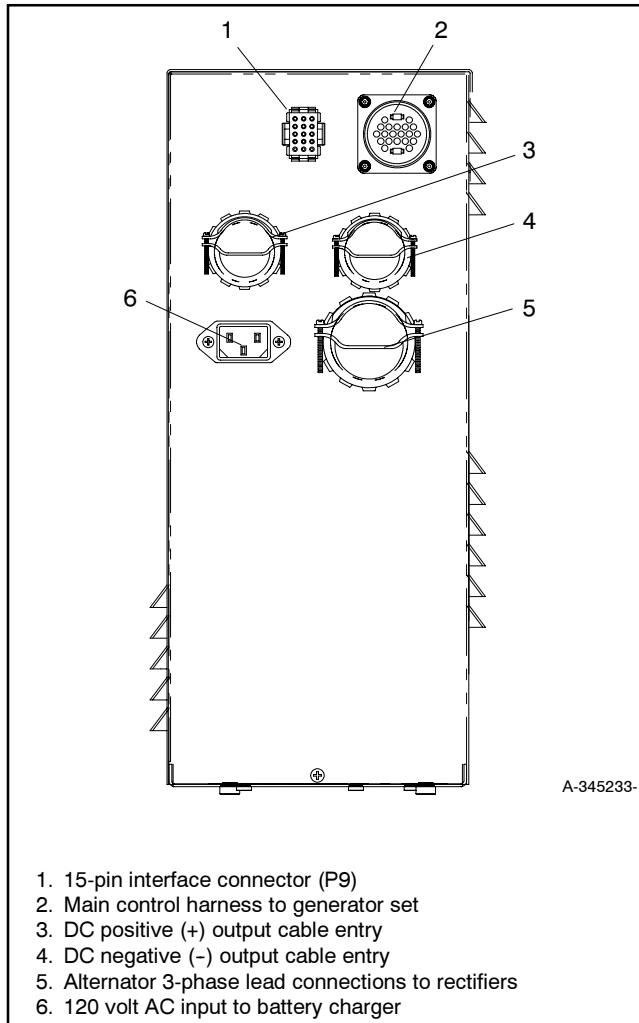


Figure 2-2 Controller (rear view)

DC Voltage Test Points. Test point monitors capacitor charge or generator DC voltage output. Test point also monitors system battery voltage when circuit breaker is closed.

Hourmeter. Hourmeter records generator set total operating hours for reference in scheduling maintenance.

Generator Set Master Switch. Switch functions as control reset and generator set operation switch. Refer to Section 2.2.3, Starting, Section 2.2.4, Stopping, and Section 2.3, Controller Resetting Procedure.

Lamp-Test. Switch tests the controller indicator LEDs.

System Ready LED. Lamp illuminates green when generator set master switch is in AUTO position and the control system senses no faults. The circuit breaker

alarm is independent of system ready indication and may be open even though system ready indication is lit.

Generator Running LED. Lamp illuminates green when the generator set is operating.

Low Fuel Pressure LED. Lamp illuminates red if low fuel pressure condition exists when generator set master switch is in the RUN or AUTO position.

Charger Fail LED. Lamp illuminates red if battery charger voltage is below 11.5 volts or above 15.0 volts.

Overcrank LED. Lamp illuminates red and cranking stops if engine does not start after 70 seconds of cyclic cranking. If the starter or engine does not turn (locked rotor), cranking stops and overcrank lamp lights after 2 seconds.

Overspeed LED. Lamp illuminates red if generator set shuts down because of overspeed condition. Overspeed lamp also illuminates and generator set shuts down if speed signal is lost.

Overvoltage LED. Lamp illuminates red if generator set shuts down because of overvoltage condition.

High Temperature LED. Lamp illuminates red if engine shuts down because of high engine temperature. High temperature shutdown is inhibited for 30 seconds after startup. Shutdown occurs 5 seconds after the high engine temperature condition is detected.

Low Oil Pressure LED. Lamp illuminates red if generator set shuts down because of insufficient oil pressure. Low oil pressure fault shutdown is inhibited for 30 seconds after startup. Shutdown occurs 5 seconds after oil pressure falls below shutdown pressure.

2.2.2 Connections

Refer to Figure 2-2 and the descriptions below for controller connections.

15-Pin Communication Connector. Connect mating cabinet interface harness.

Main Control Harness. Connect main control harness to generator set.

120 Volt AC Input to Battery Charger. Input provides AC power to the battery charger.

DC Output Connections. DC output connections to the Telco system battery.

2.2.3 Starting

Review Section 2.1, Prestart Checklist, before starting equipment. See Safety Precautions section of this manual before proceeding.

Note: Minimize surge current flowing to the filter capacitors. If the system batteries are connected, the circuit breaker is open, and the generator set has not run for several minutes, ensure the generator set is started and running before closing the system breaker.

Local Starting

Move the generator set master switch on the controller to the RUN position to start the generator set. See Figure 2-1.

Remote Starting

Move the generator set master switch to the AUTO position to allow startup from a remote location via remote control. System Ready LED should be illuminated. See Section 2.4.2, Time Delay Starting.

2.2.4 Stopping

Local Stopping

Move the generator set master switch to the OFF/RESET position. Engine will stop. See Figure 2-1.

Note: The controller has a transient start/stop function to avoid accidentally cranking the rotating engine. If the generator set master switch is momentarily placed in the OFF/RESET position and then quickly returned to RUN, the generator set stops and then restarts after 10 seconds.

Auto Stopping

When the generator set master switch is in the AUTO position and start commands no longer exist, the unit runs for a 5-minute cooldown period and then shuts down, returning to the system ready state.

2.3 Controller Resetting Procedure (Following Fault Shutdown)

Use the following procedure to reset the generator set controls after a fault shutdown.

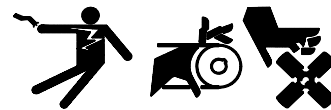
Note: Disconnect the generator set from the Telco battery system prior to system restart.

1. Determine which fault LED is on.
2. Correct cause of fault shutdown.
3. Position the generator set master switch to OFF/RESET, resetting all faults, and then to RUN to start the generator set.
4. Observe the startup and operation of the generator set to verify the correction of the shutdown fault.
5. Move the generator set master switch to OFF/RESET to stop generator set.
6. Move generator set master switch to AUTO position to allow auto starting of generator set system (see Section 2.2.3, Starting). System Ready LED should illuminate.
7. Close circuit breaker to reconnect generator set to Telco battery system.

2.4 Generator Set Remote Starting

There are two methods of starting the generator set from a remote location via the interface connector (P9). The generator set can be started after a programmable time delay, e.g. following a normal AC failure start. It can also be started immediately from remote location via the P9 connector, e.g. control from remote monitoring or exercise start. Both starting methods require the generator set master switch be in the AUTO position.

WARNING



**Accidental starting.
Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

2.4.1 Remote (Immediate) Starting

Closure of the Immediate Start contacts of P9 from a remote location results in the immediate start of the generator set if the master switch is in the AUTO position.

2.4.2 Time Delay (AC Power Fail) Starting

The start time delay, Time Delay Engine Start (TDES), eliminates unnecessary generator set starting during brief AC power interruptions. When AC power is interrupted, the Telco system controller immediately issues the AC power fail start command. The generator

set control delays for a switch-selectable TDES which can be set at 2, 4, 8, or 16 minutes. Standard setting is 2 minutes.

Use the control circuit board's dip switch to field-adjust time delays. Use only position 1 and 2 toggles on the switch. Toggle 3 is nonfunctional.

1. Carefully remove controller top cover to view the controller circuit board.
2. Locate the dip switch on the generator set controller board. See Figure 2-3 for dip switch location on the controller circuit board and for dip switch settings.

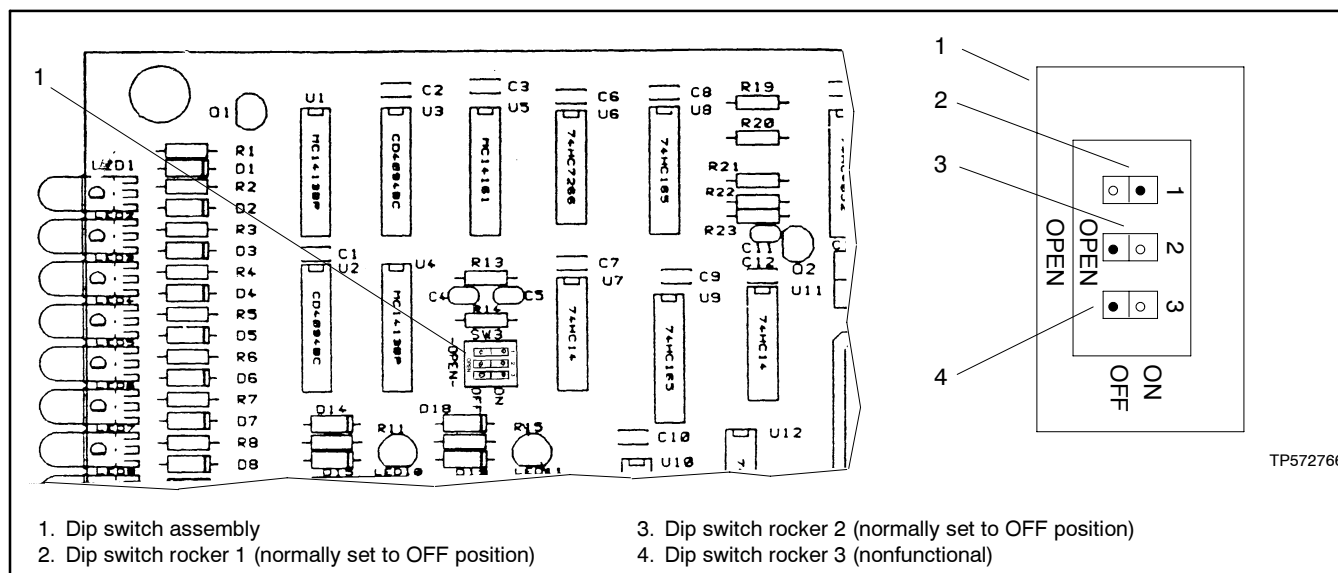


Figure 2-3 TDES Dip Switch Location

3. Depress the indicated end of the dip switch to set to the specified TDES setting. Refer to Figure 2-4 for options.

Use the tip of a pen or other pointed tool to depress the end of the toggle rockers. For a 4-minute time delay on engine starting, move position 1 toggle of the TDES switch to the ON position and position 2 toggle to the OFF or OPEN position.

Switch 1	Switch 2	TDES (Minutes)
OFF	OFF	2
ON	OFF	4
OFF	ON	8
ON	ON	16

Figure 2-4 TDES Switch Setting Options

Section 3 Scheduled Maintenance

See Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set.

Have all generator service performed at specified intervals by a trained service technician or an authorized service distributor/dealer.

3.1 Maintenance Schedule

Perform Service at Intervals Indicated (X)	Before Each Attended Startup	Every 100 Hours or 12 Months*	Every 500 Hours
Clean exhaust outlet if needed	X		
Check oil level, add oil if needed	X		
Check fuel supply (natural gas turned on)	X		
Clean cooling air inlets and outlets	X		
Remove loose dirt from compartment	X		
Replace air cleaner		X [†]	
Change lube oil		X	
Replace lube oil filter		X [‡]	
Check and tighten electrical connections		X	
Check and tighten mounting bolts and vibromounts		X	
Replace air precleaner		X	
Replace air cleaner element		X	
Clean battery terminals and reconnect		X	
Replace spark plugs [§]			X
* Whichever comes first [†] Service more often if operating in dusty or dirty conditions. Check oil cooler fins; clean if necessary. [‡] Service more often if operating in dusty or dirty conditions. [§] Check spark plug condition and gap every 200 hours.			

3.2 Lubrication System

The engine has a positive pressure lubrication system and low oil pressure shutdown.

3.2.1 Low Oil Pressure Shutdown

The low oil pressure shutdown feature protects the engine against internal damage if the oil pressure drops below preset limits. It does not protect against damage caused by operating with the oil level below the safe range. Check oil level regularly and add oil as needed.

3.2.2 Oil Check

Before operating a new COM6, fill the engine crankcase to the maximum mark with recommended oil. Do not check oil level with the generator set operating. Check crankcase oil level before each attended start.

Note: Do not overfill crankcase.

Oil Check Procedure

Shut down the COM6 and wait several minutes before checking oil level to obtain most accurate reading.

1. Remove the dipstick and wipe it clean.
2. Reposition dipstick in tube and push it all the way down into the tube.
3. Remove the dipstick and check the level.

The oil level should fall between the marks on the dipstick. Do not operate the generator set if oil level registers outside these marks.

3.2.3 Oil Change

See Section 3.1, Maintenance Schedule, for recommendations on oil change and oil filter replacement intervals.

Oil Change Procedure

Whenever possible, drain the oil while it is still warm.

1. Drain the Oil
 - a. Place the generator set master switch in the OFF position.
 - b. Disconnect generator set engine starting battery, negative (-) lead first.
 - c. Place container below oil drain connection in skid.
 - d. Remove plug from end of oil drain connection.
 - e. Open oil drain valve on engine.
 - f. Allow time for engine to drain completely.
 - g. Close oil drain valve on engine when oil has drained completely.
 - h. Replace oil drain connection plug in skid.
2. Replace Oil Filter
 - a. Remove oil filter by rotating filter counterclockwise with an oil filter wrench.

Note: Dispose of all waste materials (engine oil, fuel, filter, etc.) in an environmentally safe manner.

 - b. Apply a light coat of clean oil to the rubber seal of the new oil filter.
 - c. Install new oil filter following instructions provided with oil filter.
3. Fill with oil. Add new oil of specified weight and grade specified in Section 1, Specifications.
4. Check for leaks.

- a. Check that the generator master switch is in the OFF position.
- b. Reconnect the generator set engine starting battery, negative (-) lead last.
- c. Start generator set and check for leaks around oil filter.
- d. Stop generator set and tighten oil filter to stop any leaks.

3.3 Gas Fuel System

The gas fuel system is factory adjusted for natural gas. The fuel system can be used with LP fuel. The fuel system uses a fuel solenoid valve to control fuel flow to the fuel pressure regulator. The fuel regulator reduces fuel pressure as fuel passes to the fuel-control valve. The fuel-control valve, under the control of an emission control module, manages fuel metering under varying load and speed conditions. The emission control module adjusts the fuel metering valve to maintain minimum emissions as sensed by an oxygen sensor in the exhaust. The carburetor or mixer receives gaseous fuel and mixes it with intake air for consumption by the engine.

3.4 Cooling System

To prevent overheating, keep the compartment cooling air inlets and outlets clean and unobstructed.

A fan in the alternator draws cooling air into the alternator and expels it at the engine alternator adapter. An engine fan draws cooling air through louvers in the control compartment, over control and heat sink fins and into the engine. Fins on the engine flywheel direct cooling air past the cylinder head fins and force warm air into the compartment.

A third evacuation fan internal to the alternator evacuates most of the warm air from the compartment into the muffler housing.

Mixed engine exhaust and cooling air is expelled through louvers at the rear of the cabinet.

3.5 Ignition System Operation

3.5.1 Ignition System

Kohler Command™ engines use a fixed timing capacitive discharge ignition system. Ignition module(s) mounted on the engine next to the flywheel generate high voltage to charge a capacitor. The capacitor holds the charge until the magnet assembly on the flywheel moves past the ignition module. The capacitors discharge their energy through a transformer creating a high energy discharge which fires the spark plug at the correct moment.

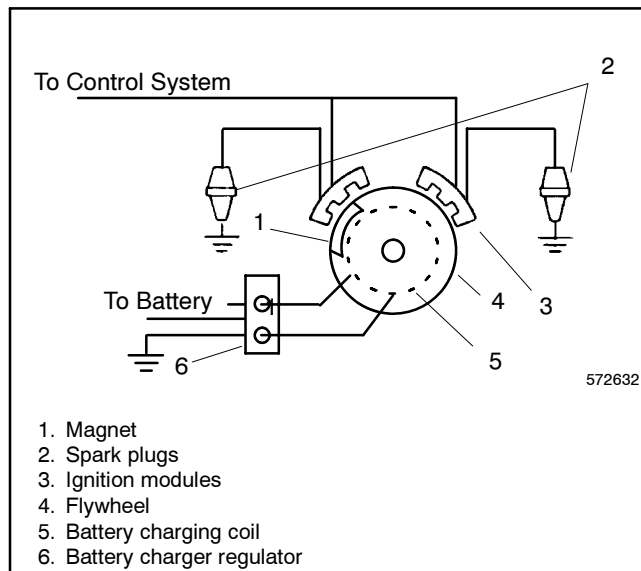


Figure 3-1 Electronic Magneto Ignition System

3.5.2 Battery Charging

Magnets mounted inside the flywheel excite a battery charging coil under the flywheel to produce battery charging current. A battery charging regulator rectifies and regulates the output of the battery charging system for charging the engine starting battery.

3.5.3 Spark Plugs

See Section 3.1, Maintenance Schedule, for spark plug replacement intervals. If spark plugs are removed for any reason, reset gap or replace plug if needed. A light gray or tan residue on plug electrodes indicates proper generator operation. A white, blistered coating indicates possible overheating. A black (carbon)

coating indicates a possible overrich fuel mixture caused by a clogged air cleaner, improper mixer adjustment, or excess oil consumption.

Note: Do not service spark plugs. Install only new, recommended spark plugs tightened to specifications.

3.6 Electronic Governor

The closed-loop governor system consists of an electronic governor control and an electromechanical actuator. The system regulates engine speed to achieve specified DC output voltage. The generator supplies a speed signal to the governor control unit in the form of AC electrical pulses. The control unit compares the frequency of these pulses to a preset reference in the speed command and provides a compensatory signal to the actuator. The actuator controls the carburetor and hence the engine speed.

Note: To prevent erratic operation and undesirable voltage changes, do not touch or move the linkage between the actuator and carburetor while the engine is running.

3.7 Air Cleaner

The engine has a dry-type air cleaner. Remove the precleaner and element for cleaning at the time interval specified in the Maintenance Schedule. Wash a dirty precleaner. Lightly tap the paper element against a flat surface to dislodge loose surface dirt. Do not clean the paper element with liquid or blow out with compressed air. Replace oily, dirty, bent, or damaged precleaner and element. See Routine Service Parts for part numbers and see Section 3.1, Scheduled Maintenance, for service interval.

3.8 Alternator Service

Under normal operating conditions, routine alternator maintenance is not required.

Replace the end bracket bearing at engine overhaul or every 10,000 hours of operation. Service more frequently if bearing inspection indicates excessive rotor end play or bearing damage from corrosion or heat buildup. The end bracket bearing is sealed and requires no additional lubrication.

Notes

Section 4 General Troubleshooting

Use the following charts as a quick reference in troubleshooting problems. Generator set faults are listed by groups and include likely causes and corrections. It is recommended that service be done

only by trained service technicians or authorized service distributors/dealers. Improper repair by unqualified personnel can lead to additional failures.

Problem	Possible Cause	Corrective Action
Unit does not crank	Battery weak or dead	Recharge or replace battery
	Controller fuse blown	Replace controller fuse
	Engine harness twistlock connector not fully locked tight	Loosen twist ring, reengage and lock by twisting past detent
	Start switch defective	Replace start switch
	Remote start cable disconnected	Reconnect start cable
	Starter solenoid defective	Replace starter solenoid
	Battery connections loose, dirty or incorrect	Correct, clean, or tighten battery connections
Unit cranks but does not start	Air cleaner clogged	Clean or replace air cleaner
	Spark plug faulty	Replace or regap spark plugs
	Ignition module(s) fault	Have unit serviced by an authorized Kohler service distributor/dealer
	Fuel control valve adjustment too rich	Initialize, see Section 6.11, Fuel System Initialization
	Spark plug wire connection loose	Reconnect and/or tighten spark plug wire
	Fuel valve shutoff or out of fuel	Replenish fuel or correct valve shutoff
	Battery weak or dead	Recharge or replace battery
Unit starts hard	Air cleaner clogged	Clean or replace air cleaner element
	Spark plug faulty	Replace or regap spark plugs
	Ignition module(s) weak or intermittent	Have unit serviced by an authorized Kohler service distributor/dealer
Unit stops suddenly	Air cleaner clogged	Clean or replace air cleaner element
	Spark plug faulty	Replace or regap spark plugs
	Fuel starvation	Replenish fuel
	Engine harness twistlock connector not fully locked tight	Loosen twist ring; reengage and lock by twisting past detent
	Controller fault	Check controller LEDs and correct fault
	Controller fuse blown	Replace fuse
	Emissions system fault	Have unit serviced by an authorized Kohler service distributor/dealer
Unit lacks power or operates erratically	Engine harness twistlock connector not fully locked tight	Loosen twist ring; reengage and lock by twisting past detent
	Air cleaner clogged	Clean or replace air cleaner element
	Insufficient cooling	Inspect and clean cooling system
	Engine overload	Reduce load on generator set
	Spark plug faulty	Replace or regap spark plugs
	Fuel supply problem	Check valves and fuel pressure
	Governor system linkage binding	Clean or remove restriction from linkage
	Emissions system too rich	Initialize, see Section 6.11, Fuel System Initialization
Unit overheats	Air openings clogged	Clean intake and outlet openings
	Air cleaner clogged	Clean or replace air cleaner element

Figure 4-1 Troubleshooting

Notes

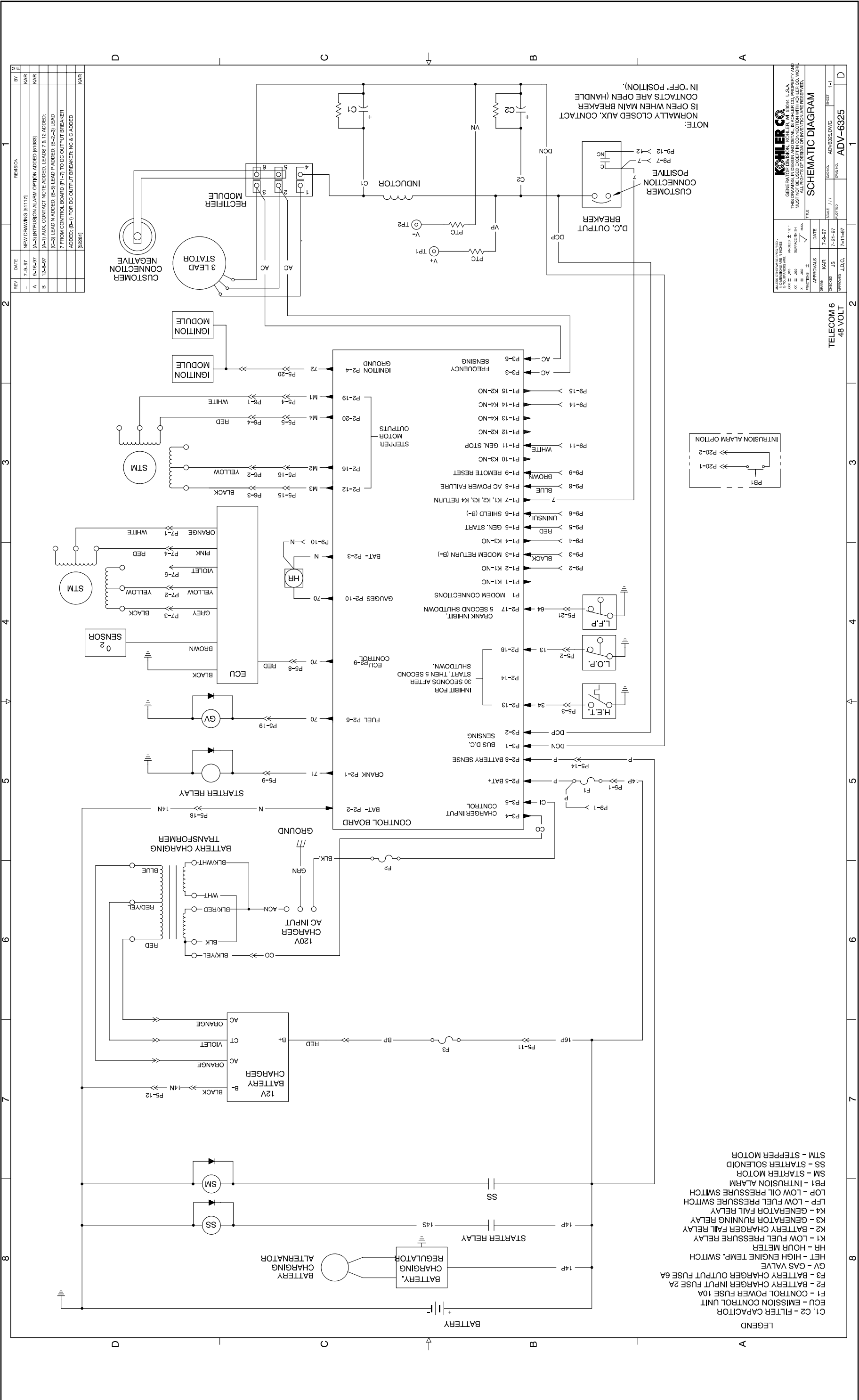
Section 5 Wiring Diagrams

Use the Wiring Diagram list to determine the correct information for a given model and spec number. Find that version number in Figure 5-1 and turn to the page listed.

Controller Description	Drawing No.	Page
COM6 Microprocessor Controller		
Generator Point-to-Point (24 VDC)	345243-D	27
Controller Point-to-Point (24 VDC)	A-345233B-G	28
Controller Schematic Diagram (24 VDC)	ADV-6306-C	29
Generator Point-to-Point (48 VDC)	345334-C	30
Controller Schematic Diagram (48 VDC)	ADV-6325-B	31
Controller Interconnection Diagram (48 VDC)	A-345315B-J	32

Figure 5-1 Wiring Diagrams Reference

Notes



6.1 Installation

Use this section as a guide when installing a Kohler COM6 generator set. Follow the installation instructions and comply with state and local building and electrical codes.

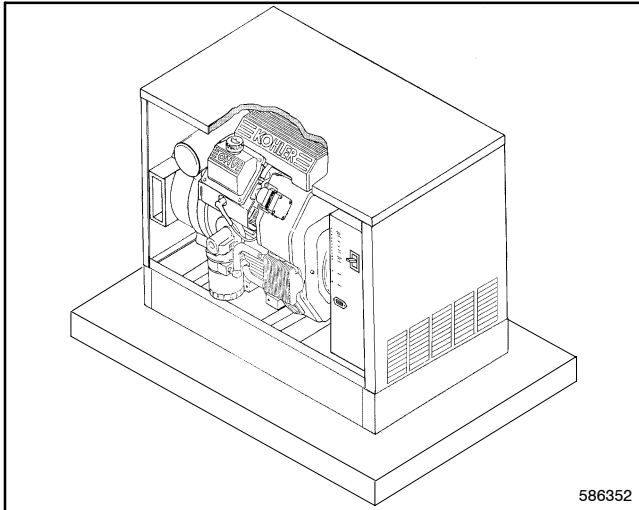


Figure 6-1 Generator Set and Cabinet

6.1.1 Battery

Kohler recommends a 500 CCA, BCI group battery or equivalent for use with the COM6 generator set.

Battery specifications:

- 500 CCA @ -18°C (0°F)
- Automotive or light commercial type, calcium/calcium construction
- Top terminal
- Dimensions (see Figure 6-2)

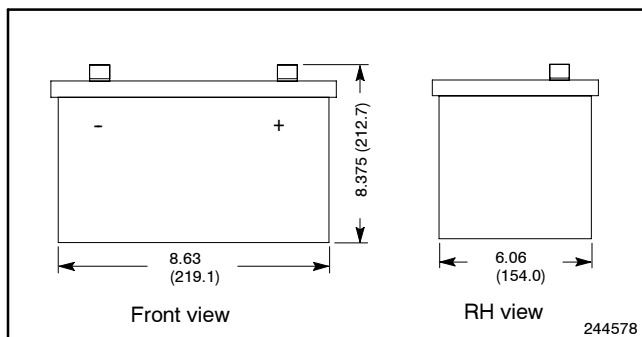


Figure 6-2 Battery Dimensions

6.1.2 Weight Considerations

Generator set weight determines the installation method at the site. Typical installations mount the generator set on concrete at ground level. Some, however, are on upper levels of steel, concrete, or wood structures.

Determine the generator set weight from the generator set specification sheet. Add the weight of accessory items to the total weight requirements. Weight considerations are especially important in upper story or roof installations.

6.1.3 Mounting

Figure 6-3 and Figure 6-4 show typical mounting surface details and dimensions. Mount the cabinet on a level concrete surface. Seal the bottom of open-mounted units using marine plywood to ensure design cooling air flow and to restrict the entry of debris and/or wildlife through the bottom of the skid.

Note: Disassemble the housing to gain access to the mounting hole in upper left corner of Figure 6-3.

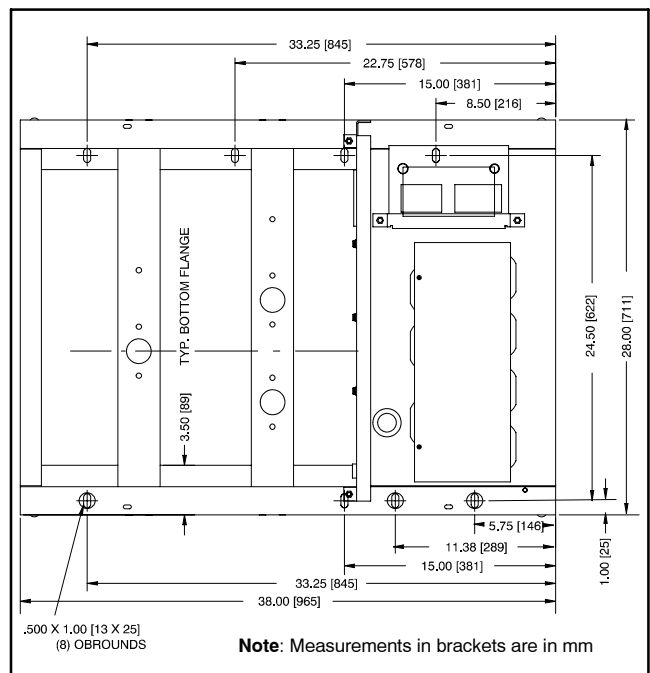


Figure 6-3 Cabinet Mounting Surface

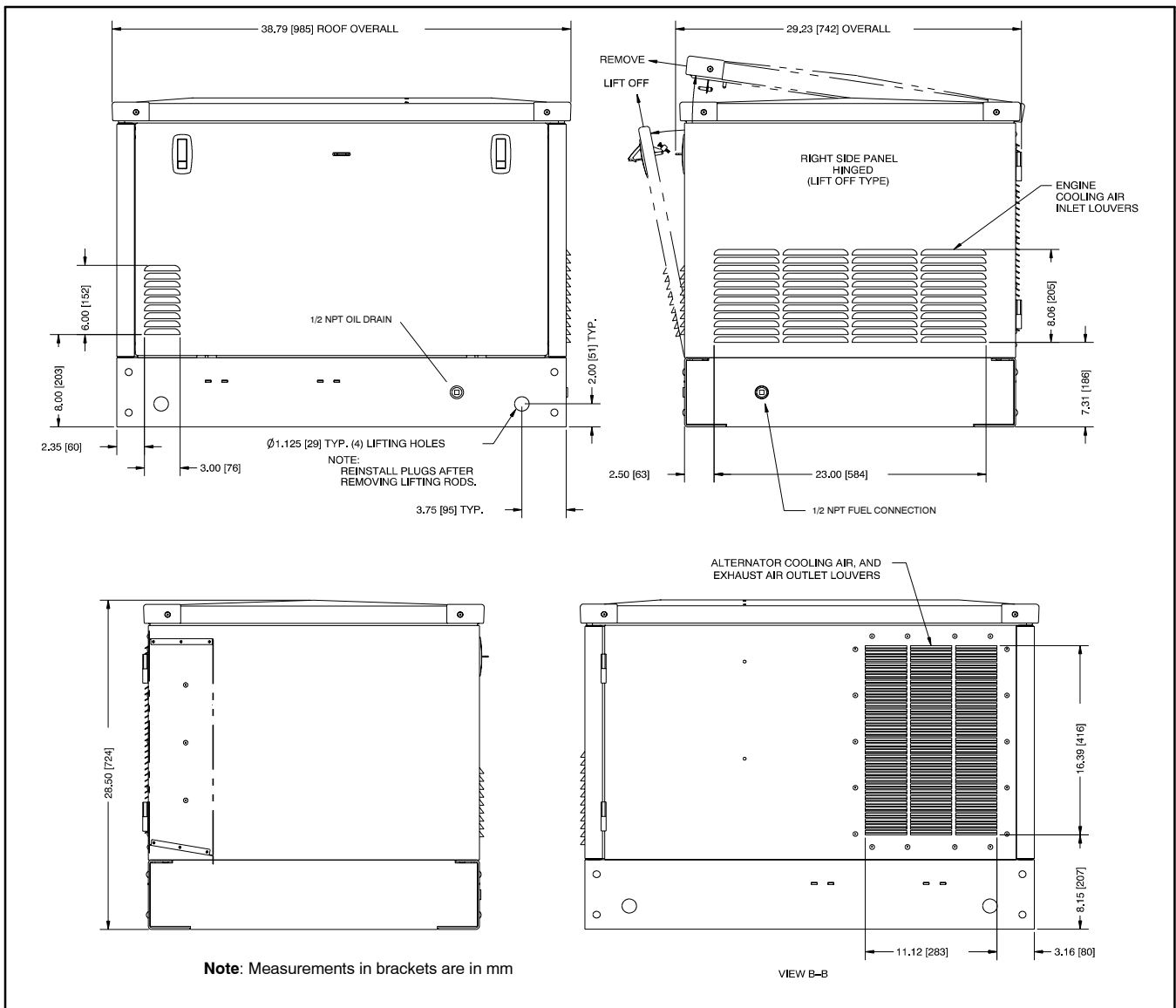


Figure 6-4 Cabinet Dimensions

6.1.4 DC Output Cable Sizing

Select cabling based on four considerations: code compliance, adequate ampacity, voltage drop, and connectability. Unless otherwise noted, all lengths given in this section are one way lengths.

Provide double-stud lugs for easy handling and installation.

Code Compliance

The owner and installer must comply with federal, state, and local codes. The National Electrical Code (NEC) exempts telecommunications sites, but safety is the prime consideration and local authorities may require adherence to NEC and other codes.

Ampacity

The NEC Table 310-17 provides ampacities for insulated conductors in free air. Use Table 310-17 as a guideline for selecting cabling. The engine compartment exposes cabling to higher-than-average ambient temperatures. The manufacturer recommends 90°C cable.

Voltage Drop

The COM6 generator set provides power to a telecommunication site without significantly affecting the site batteries. For this reason output voltage is approximately midway between open circuit and float voltage. If the selected cabling causes excessive voltage drop, the delivered voltage falls below open

circuit voltage causing the batteries to discharge. For the combined positive and negative cables, limit round trip (2 x one way length) voltage drop at full rated current to 1 volt maximum for 24-volt systems and 2 volts maximum for 48-volt systems.

Sizing Procedure

Use the table in Figure 6-5 to determine the required cable size, or calculate it using the voltage drop method. Calculation instructions appear after the table.

Cable Qty., Gauge	Maximum Cable Length, ft.		Conductor Ampacity	Ref: Ohms/1000 ft.
	24V (230A)	48V (115A)		
One 3-gauge	N/A	20	165	0.213
One 2-gauge	N/A	25	190	0.169
Two 2-gauge	13	52	380	0.085
One 1-gauge	N/A	33	220	0.134
Two 1-gauge	16	65	440	0.067
One 1/0	11	41	260	0.106
Two 1/0	21	82	520	0.063
One 2/0	13	52	300	0.0843
Two 2/0	26	103	600	0.0422

Figure 6-5 COM6 Installation Cable Selection

To use the table, refer to the cable length column for the correct voltage application. Move down the column to a length as long as or longer than that required for installation. The corresponding cable quantity and gauge from the first column is the correct cable size for this application.

Note: The manufacturer recommends the selections shown in bold type in Figure 6-5 for side-by-side installations. Ratings are based on THHN 90°C rated insulated copper cable in free air.

The voltage drop method can also be used to calculate the required cable size. Use the following equation for maximum permissible cable resistance in conjunction with Figure 6-5 to determine the maximum allowable cable length. Use the maximum allowable cable resistance shown in Figure 6-6 for the ohms in the equation.

$$\text{ohms/1000 ft.} = \frac{\text{Ohms (from Figure 6-6)} \times 1000}{\text{Cable length in ft. (one way)} \times 2}$$

Item	24 V	48 V
Maximum cable resistance, ohms	0.00435	0.00217
Unit amperes	230	115

Figure 6-6 Values for Voltage Drop Calculations

Find the cable size and quantity in Figure 6-5 that meet *all* of the following criteria.

- The cable resistance value shown in the last column of Figure 6-5 is less than or equal to the calculated value.
- The conductor ampacity shown in Figure 6-5 is greater than the unit amperes from Figure 6-6.
- The length of cable required for the installation is less than or equal to the length shown in column 2 or 3 for the voltage used, 24 or 48 V.

Example: Voltage Drop Calculation

For a 24 volt COM6 installation requiring cables 13 ft. long or less:

$$\frac{0.00435 \text{ Ohms} \times 1000}{13 \text{ ft. (one way)} \times 2} = 0.1673 \text{ ohms/1000 ft.}$$

The unit amperes for a 24-volt system is 230 amps (from Figure 6-6).

Apply the three criteria to determine the cable size. Compare the calculated resistance value (0.1673 ohms), the length of cable (13 ft.), and the unit amperes (230) to Figure 6-5. This installation requires two 2-gauge cables.

6.2 Installation Tools

COM6 installation requires the following tools:

- Adjustable wrench, 1 1/8 in. opening
- Gas leak detection fluid (soap suds)
- Load bank, 6 kW, 24 VDC or 48 VDC
- Nut driver set, 3/16–1/2 in.
- Pipe wrenches
- Socket set, 1/4–3/4 in.
- Standard screwdriver set
- Teflon® pipe tape
- Wrench set, 1/4–3/4 in.

Teflon® is a registered trademark of DuPont Co.

6.3 Installation Site Inspection

Perform a thorough inspection of the chosen installation site before installing generator set. Check for the following:

1. Ensure that the gas pipe size meets size specifications in the Figure 6-7 chart. Measure the pipe length from the gas utility pressure regulator (7–11 in. water column output pressure) to the end of the pipe where it connects to the fuel inlet on the left-hand side of the unit. Compare the length with the chart in Figure 6-7. Replace piping longer than the listed maximum length with the specified pipe length before proceeding.

Pipe Size	Maximum Pipe Length
1/2 in. NPT	6.1 m (20 ft.)
3/4 in. NPT	21.3 m (70 ft.)
1 in. NPT	61 m (200 ft.)

Figure 6-7 Maximum Gas Pipe Length

2. Ensure that the gas installer bleeds air from the gas lines at the time of installation.
3. Inspect air inlet and outlet openings inside and out to ensure that debris is not blocking free air flow.

6.4 Generator Set Inspection

Complete a thorough inspection of the generator set. Check for the following:

1. Inspect the generator for loose or damaged parts or wires. Repair or tighten prior to installation.
2. Check engine oil. Fill, if necessary, with recommended make and grade of oil.
3. Cover hose connections and fittings with soap solution and turn on the fuel supply. Soap bubbles indicate a fuel leak. Repair or correct any leaks before proceeding. Refer to Safety Precautions and Instructions at the beginning of this manual.

6.5 DC Power Output Connections

The COM6 uses a floating DC output, allowing customer connection to floating, positive ground, or negative ground systems. Standard units have the circuit breaker connected on the positive side of the DC output.

Some customer applications use units with the circuit breaker connected on the negative side of the DC output. The following instructions explain how to connect the output leads for standard systems.

Standard Systems

Standard units have the circuit breaker connected on the positive (+) side of the DC output. Connect the output leads inside the controller box as described below and shown in Figure 6-8. Use cable that meets the specifications described in Section 6.1.4, DC Output Cable Sizing.

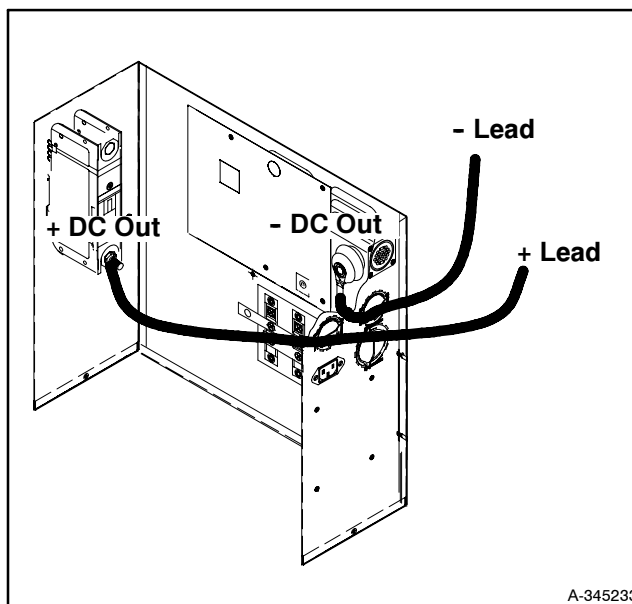


Figure 6-8 Standard COM6 DC Output Connections

Connection Procedure for Standard Systems

1. Connect the the positive (+) output lead to the lower terminal of the circuit breaker.
2. Connect the negative (-) output lead to the red (or orange) insulated stand-off in the upper back corner of the control box. See Figure 6-8.

Special Applications

Some customer applications use systems that have the circuit breaker connected on the negative (-) side of the DC output.

For more information, please contact Kohler Co., Generator Applications Engineering.

6.6 Starting Battery System Connection

1. Fully charge the starting battery before placing it in service.
2. Clean battery posts and/or adapters, if necessary. Install the battery post adapters.
3. Connect the positive lead to the engine start battery. Do not connect the negative lead to the battery. Connect the negative lead when instructed during the tests described in Section 6.10, Recommended Commissioning Tests.
4. Plug the 120 volt AC into the control system after placing the battery into service.

Note: If the battery needs to be replaced, use a new battery that meets the specifications in Section 1, Specifications.

6.7 Battery Charger Power Cord

Cords with IEC 320 C-13 connectors mate with the AC input to the battery charger. Belden cords #17500 (6 ft. 7 in. long), #17250 (7 ft. 6 in. long), and #17501 (9 ft. 10 in. long) fill the functional requirements of the battery charger power cord, but safety and code compliance is the installer's responsibility. Other cords are available to meet special temperature and other requirements.

6.8 Remote Cabinet Interface Cable Connections

The following tables show input and output connections, functions, and cable designations.

6.8.1 Inputs

Pin #	Function
P9-3*	Alarm Ground and Command Common
P9-5	Immediate Generator Start (Engine Start)
P9-6	Shield Ground (shield only, do not use)
P9-8	AC Power Fail (TDES Start)
P9-9	Remote Reset
P9-11	Immediate Generator Stop
* Pin P9-3 is common for pins 3, 8, 9, and 11.	

6.8.2 Outputs

Pin #	Function
P9-1	(+) 12 V Start Battery Voltage
P9-2	Low Fuel Pressure, Normally Open
P9-4	Generator Running, Normally Open
P9-7	Relay Common Connection
P9-10	(-) 12 V Start Battery Voltage
P9-12	Circuit Breaker Trip (open when breaker is open)
P9-13	Circuit Breaker Trip (open when breaker is open)
P9-14	Generator Fail, Normally Closed
P9-15	AC Battery Charger Fail, Normally Closed
* Pin P9-7 is common for pins 2, 4, 14, and 15.	

Note: The Generator Fail Output Alarm is a reverse annunciation alarm. The non-alarm state energizes and holds open the contact output allowing loss of DC control power to close the contact. The closed contact issues the alarm.

6.9 Prestart Installation Check

Review the entire installation procedure. Inspect all wiring and connections to verify that the unit is ready for operation. Remove any obstructions from the air inlets at the left-hand side and front and from the exhaust outlet at the rear of cabinet.

6.10 Recommended Commissioning Tests

Refer to Section 1.2, System Functional Description, before proceeding with this section.

Many of the recommended commissioning tests use the controller generator set master switch, labelled RUN-OFF/RESET-AUTO. In the RUN position, the control system immediately starts the engine/alternator. In the OFF/RESET position, the control system immediately stops the engine/alternator. The OFF/RESET position renders the unit inoperable and resets the control system. The AUTO position enables automatic engine/alternator starting in response to a remote start signal from the Telco power system.

Commissioning Test Procedure

1. Position the generator set master switch to OFF/RESET.
2. Position the controller circuit breaker switch to OFF.
3. Connect the generator output to a load bank for testing. Do not yet connect the communication system batteries or DC bus. The manufacturer recommends load bank size from 2/3 to full generator set rating (4–6 kW for the COM6 model).
4. Connect the engine start positive battery cable if it is not already connected. Connect the negative battery cable to the engine start battery. The electronic governor system resets itself by closing the throttle (moving it to the alternator end of its travel) each time battery power is connected. Verify governor operation by observing this movement and/or listening for a clicking sound as it closes the throttle each time battery power is connected. The controller front should show no lights (LEDs) except possibly the low fuel LED.
5. Operate the lamp-test switch on the controller. Verify that all LEDs illuminate. Check the LED and/or LED wiring if not lit by the lamp-test switch.
6. Position the generator set master switch to AUTO. The green system-ready light illuminates, indicating system readiness.

7. **Low Fuel Test:** Turn the fuel off. An illuminated low pressure fuel LED indicates no fuel pressure at the fuel system inlet. To reset the controller, move the generator set master switch to OFF/RESET.

8. **Overcrank Test.** The overcrank test verifies that the control system operates properly and that the overcrank shutdown functions, if necessary.

- a. Move the generator set master switch from the OFF/RESET to the RUN position. After a brief pause, the unit begins a cranking cycle of 20 seconds cranking followed by 5 seconds rest. After three cranking cycles, the control system stops cranking and indicates an overcrank fault on the controller front panel LED.
- b. Return the generator set master switch to the OFF/RESET position. The overcrank fault resets and extinguishes the overcrank LED.
- c. Turn on the fuel supply. Move the generator set master switch to the RUN position. The unit cranks and starts when fuel reaches the fuel system. The generator running LED lights. Starting difficulty caused by air in the fuel lines occurs only on the first start after installation or repairs. See Section 6.11, Fuel System Initialization.

When the unit starts with the circuit breaker open after an inactive period, the filter capacitors carry no charge. As the unit reaches nominal speed, voltage rises to near or slightly above rated level. The controls immediately sense the increased voltage and reduce the engine speed. When the discharge resistors or other loads reduce the capacitor voltage, the controls incrementally increase the engine speed to achieve the specified voltage level. The unit remains stable with the discharge resistors as the only load. See Section 1.2, Systems Functional Description.

Measure the voltage at the V+ and V- test jacks near the circuit breaker to verify voltage of approximately 26.2 or 52.0 VDC.

6.11 Fuel System Initialization

A unit that fails to start or runs poorly after purging all air from the fuel lines indicates an excessively rich emissions system. Rich emissions occur when a new engine set at the factory for natural gas is used with LP gas, or when the unit runs low or out of fuel. Initial cranking and false start attempts may also cause the emission system to adjust to an excessively rich condition.

Note: Never attempt to adjust the fuel pressure regulator. Adjustment attempts void the warranty and usually do not correct the problem. Adjusting the regulator can also cause hazardous conditions, excess emissions, and engine damage.

Reduce the fuel supply to the unit until it runs acceptably and the emission system readjusts for fuel intake. Reduce the unit's fuel supply for the first 20–40 seconds of operation in one of two ways:

- Squeeze the fuel hose between the fuel regulator system and the engine with fingers only. **Do not use pliers or other similar tools which can damage the hose.**
- Turn off the fuel supply valve to reduce fuel pressure. The unit starts and runs until fuel runs out. Alternately turn the fuel on and off until operation stabilizes.

After 20–40 seconds the emissions system adjusts to site fuel conditions and eliminates excessively rich fuel conditions.

Note: To change from LP gas back to natural gas, allow the unit to run after closing the fuel supply valve. As the unit runs out of fuel, the oxygen sensor adjusts the fuel metering valve to a setting rich enough to allow the unit to start with natural gas fuel using the initialization procedure above.

Notes

Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere	cfm	cubic feet per minute	ext.	external
ABDC	after bottom dead center	CG	center of gravity	F	Fahrenheit, female
AC	alternating current	CID	cubic inch displacement	fglass.	fiberglass
A/D	analog to digital	CL	centerline	FHM	flat head machine (screw)
ADC	analog to digital converter	cm	centimeter	fl. oz.	fluid ounce
adj.	adjust, adjustment	CMOS	complementary metal oxide substrate (semiconductor)	flex.	flexible
ADV	advertising dimensional drawing	cogen.	cogeneration	freq.	frequency
AHWT	anticipatory high water temperature	com	communications (port)	FS	full scale
AISI	American Iron and Steel Institute	coml	commercial	ft.	foot, feet
ALOP	anticipatory low oil pressure	Coml/Rec	Commercial/Recreational	ft. lb.	foot pounds (torque)
alt.	alternator	conn.	connection	ft./min.	feet per minute
Al	aluminum	cont.	continued	g	gram
ANSI	American National Standards Institute (formerly American Standards Association, ASA)	CPVC	chlorinated polyvinyl chloride	ga.	gauge (meters, wire size)
AO	anticipatory only	crit.	critical	gal.	gallon
API	American Petroleum Institute	CRT	cathode ray tube	gen.	generator
approx.	approximate, approximately	CSA	Canadian Standards Association	genset	generator set
AR	as required, as requested	CT	current transformer	GFI	ground fault interrupter
AS	as supplied, as stated, as suggested	Cu	copper	GND, 	ground
ASE	American Society of Engineers	cu. in.	cubic inch	gov.	governor
ASME	American Society of Mechanical Engineers	cw.	clockwise	gph	gallons per hour
assy.	assembly	CWC	city water-cooled	gpm	gallons per minute
ASTM	American Society for Testing Materials	cyl.	cylinder	gr.	grade, gross
ATDC	after top dead center	D/A	digital to analog	GRD	equipment ground
ATS	automatic transfer switch	DAC	digital to analog converter	gr. wt.	gross weight
auto.	automatic	dB	decibel	H x W x D	height by width by depth
aux.	auxiliary	dBA	decibel (A weighted)	HC	hex cap
A/V	audiovisual	DC	direct current	HCHT	high cylinder head temperature
avg.	average	DCR	direct current resistance	HD	heavy duty
AVR	automatic voltage regulator	deg., °	degree	HET	high exhaust temperature, high engine temperature
AWG	American Wire Gauge	dept.	department	hex	hexagon
AWM	appliance wiring material	dia.	diameter	Hg	mercury (element)
bat.	battery	DI/EO	dual inlet/end outlet	HH	hex head
BBDC	before bottom dead center	DIN	Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss)	HHC	hex head cap
BC	battery charger, battery charging	DIP	dual inline package	HP	horsepower
BCA	battery charging alternator	DPDT	double-pole, double-throw	hr.	hour
BCI	Battery Council International	DPST	double-pole, single-throw	HS	heat shrink
BDC	before dead center	DS	disconnect switch	hsg.	housing
BHP	brake horsepower	DVR	digital voltage regulator	HVAC	heating, ventilation, and air conditioning
blk.	black (paint color), block (engine)	E, emer.	emergency (power source)	HWT	high water temperature
blk. htr.	block heater	EDI	electronic data interchange	Hz	hertz (cycles per second)
BMEP	brake mean effective pressure	EFR	emergency frequency relay	IC	integrated circuit
bps	bits per second	e.g.	for example (<i>exempli gratia</i>)	ID	inside diameter, identification
br.	brass	EG	electronic governor	IEC	International Electrotechnical Commission
BTDC	before top dead center	EGSA	Electrical Generating Systems Association	IEEE	Institute of Electrical and Electronics Engineers
Btu	British thermal unit	EIA	Electronic Industries Association	IMS	improved motor starting
Btu/min.	British thermal units per minute	EI/EO	end inlet/end outlet	in.	inch
C	Celsius, centigrade	EMI	electromagnetic interference	in. H ₂ O	inches of water
cal.	calorie	emiss.	emission	in. Hg	inches of mercury
CARB	California Air Resources Board	eng.	engine	in. lb.	inch pounds
CB	circuit breaker	EPA	Environmental Protection Agency	Inc.	incorporated
cc	cubic centimeter	EPS	emergency power system	ind.	industrial
CCA	cold cranking amps	ER	emergency relay	int.	internal
ccw.	counterclockwise	ES	engineering special, engineered special	int./ext.	internal/external
CEC	Canadian Electrical Code	ESD	electrostatic discharge	I/O	input/output
cert.	certificate, certification, certified	est.	estimated	IP	iron pipe
cfh	cubic feet per hour	E-Stop	emergency stop	ISO	International Organization for Standardization
		etc.	et cetera (and so forth)	J	joule
		exh.	exhaust	JIS	Japanese Industry Standard
				k	kilo (1000)
				K	kelvin

kA	kiloampere	MTBO	mean time between overhauls	rly.	relay
KB	kilobyte (2 ¹⁰ bytes)	mtg.	mounting	rms	root mean square
kg	kilogram	MW	megawatt	rnd.	round
kg/cm ²	kilograms per square centimeter	mW	milliwatt	ROM	read only memory
kgm	kilogram-meter	μF	microfarad	rot.	rotate, rotating
kg/m ³	kilograms per cubic meter	N, norm.	normal (power source)	rpm	revolutions per minute
kHz	kilohertz	NA	not available, not applicable	RS	right side
kJ	kilojoule	nat. gas	natural gas	RTV	room temperature vulcanization
km	kilometer	NBS	National Bureau of Standards	SAE	Society of Automotive Engineers
kOhm, kΩ	kilo-ohm	NC	normally closed	scfm	standard cubic feet per minute
kPa	kilopascal	NEC	National Electrical Code	SCR	silicon controlled rectifier
kph	kilometers per hour	NEMA	National Electrical Manufacturers Association	s, sec.	second
kV	kilovolt	NFPA	National Fire Protection Association	SI	<i>Système international d'unités</i> , International System of Units
kVA	kilovolt ampere	Nm	newton meter	SI/EO	side in/end out
kVAR	kilovolt ampere reactive	NO	normally open	sil.	silencer
kW	kilowatt	no., nos.	number, numbers	SN	serial number
kWh	kilowatt-hour	NPS	National Pipe, Straight	SPDT	single-pole, double-throw
kWm	kilowatt mechanical	NPSC	National Pipe, Straight-coupling	SPST	single-pole, single-throw
L	liter	NPT	National Standard taper pipe thread per general use	spec, specs	specification(s)
LAN	local area network	NPTF	National Pipe, Taper-Fine	sq.	square
L x W x H	length by width by height	NR	not required, normal relay	sq. cm	square centimeter
lb.	pound, pounds	ns	nanosecond	sq. in.	square inch
lbm/ft ³	pounds mass per cubic feet	OC	overcrank	SS	stainless steel
LCB	line circuit breaker	OD	outside diameter	std.	standard
LCD	liquid crystal display	OEM	original equipment manufacturer	stl.	steel
ld. shd.	load shed	OF	overfrequency	tach.	tachometer
LED	light emitting diode	opt.	option, optional	TD	time delay
Lph	liters per hour	OS	oversize, overspeed	TDC	top dead center
Lpm	liters per minute	OSHA	Occupational Safety and Health Administration	TDEC	time delay engine cooldown
LOP	low oil pressure	OV	overvoltage	TDEN	time delay emergency to normal
LP	liquefied petroleum	oz.	ounce	TDES	time delay engine start
LPG	liquefied petroleum gas	p., pp.	page, pages	TDNE	time delay normal to emergency
LS	left side	PC	personal computer	TDOE	time delay off to emergency
L _{wa}	sound power level, A weighted	PCB	printed circuit board	TDON	time delay off to normal
LWL	low water level	pF	picofarad	temp.	temperature
LWT	low water temperature	PF	power factor	term.	terminal
m	meter, milli (1/1000)	ph., ∅	phase	TIF	telephone influence factor
M	mega (10 ⁶ when used with SI units), male	PHC	Phillips head crimp (screw)	TIR	total indicator reading
m ³	cubic meter	PHH	Phillips hex head (screw)	tol.	tolerance
m ³ /min.	cubic meters per minute	PHM	pan head machine (screw)	turbo.	turbocharger
mA	milliampere	PLC	programmable logic control	typ.	typical (same in multiple locations)
man.	manual	PMG	permanent-magnet generator	UF	underfrequency
max.	maximum	pot	potentiometer, potential	UHF	ultrahigh frequency
MB	megabyte (2 ²⁰ bytes)	ppm	parts per million	UL	Underwriter's Laboratories, Inc.
MCM	one thousand circular mils	PROM	programmable read-only memory	UNC	unified coarse thread (was NC)
MCCB	molded-case circuit breaker	psi	pounds per square inch	UNF	unified fine thread (was NF)
meggar	megohmmeter	pt.	pint	univ.	universal
MHz	megahertz	PTC	positive temperature coefficient	US	undersize, underspeed
mi.	mile	PTO	power takeoff	UV	ultraviolet, undervoltage
mil	one one-thousandth of an inch	PVC	polyvinyl chloride	V	volt
min.	minimum, minute	qt.	quart, quarts	VAC	volts alternating current
misc.	miscellaneous	qty.	quantity	VAR	voltampere reactive
MJ	megajoule	R	replacement (emergency)	VDC	volts direct current
mJ	millijoule	rad.	power source	VFD	vacuum fluorescent display
mm	millimeter	RAM	radiator, radius	VGA	video graphics adapter
mOhm, mΩ	milliohm	RDO	random access memory	VHF	very high frequency
MOhm, MΩ	megohm	ref.	reference	W	watt
MOV	metal oxide varistor	rem.	remote	WCR	withstand and closing rating
MPa	megapascal	Res/Coml	Residential/Commercial	w/	with
mpg	miles per gallon	RFI	radio frequency interference	w/o	without
mph	miles per hour	RH	round head	wt.	weight
MS	military standard	RHM	round head machine (screw)	xfmr	transformer
m/sec.	meters per second				
MTBF	mean time between failure				

Appendix B Operating Hour Service Log

Use the log below to keep a cumulative record of operating hours on your generator set and the dates required services were performed. Enter hours to the nearest quarter hour.

[illegible]

Notes

Notes

Notes

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