



“C” type Generator End User’s Manual Addendum

**For 15,17.5, 20 and
25kW gensets with “C”
in third position in
Serial Number**

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Please read this manual carefully prior to installing and operating this generator. If you have any questions please feel free to contact us at 800-760-0027 or via our website at www.powertech-gen.com

General Technical Data of the Generators

- Synchronous brushless generator, single phase
- Rated 22kW and 25kW, 120/240V, 250/125Amps
- 4-pole, 60Hz, 1800RPM, PF=1.0, Continuous Duty
- Temp rise 105 °C / 50 °C ambient temperature
- Suitable for operation with VR3.1
- Insulation Class H
- SAE 4, SAE 7 ½
- Single bearing

The use of any spare parts that are not genuine or not expressly authorized shall free Power Technology Southeast, Inc. from any warranty liability and any responsibility concerning conformity to regulations and relevant consequences.

Installation, after-sales modifications and maintenance must be carried out by adequately trained staff.

TABLE OF CONTENTS

RULES FOR SAFE OPERATION.....	4
RECEIVING THE GENERATOR.....	5
STORING THE GENERATOR	5
INSTALLATION.....	6
LIFTING THE GENERATOR.....	6
LOCATION/ENVIRONMENT.....	6
MOUNTING GENERATOR TO ENGINE	6
EARTH/GROUND THE GENERATOR.....	6
OPERATION	7
BEFORE STARTUP	7
START-UP	7
SHUTDOWN	7
MAINTENANCE.....	8
GENERAL MAINTENANCE.....	8
INSULATION RESISTANCE TEST	8
DRYING OUT THE GENERATOR WINDINGS.....	8
TROUBLESHOOTING.....	9
MECHANICAL ISSUES.....	9
ELECTRICAL ISSUES.....	9
FLASHING THE FIELD	11
REPLACING THE RECTIFIED ASSEMBLY	11
AVR ADJUSTMENTS.....	11
RESISTANCE VALUES FOR WINDINGS	11
APPENDIX A – EXPLODED VIEW	12
APPENDIX B – SPARE PARTS LIST	13
APPENDIX C – Wiring diagram for Single Phase Generator (4 LEADS).....	14

RULES FOR SAFE OPERATION



CAUTION!

FAILURE TO FOLLOW INSTRUCTIONS IN THIS MANUAL MAY LEAD TO SERIOUS INJURY OR EVEN DEATH! THIS EQUIPMENT IS TO BE OPERATED BY TRAINED AND QUALIFIED PERSONNEL ONLY! THIS EQUIPMENT IS FOR INDUSTRIAL USE ONLY.

The following safety guidelines should always be used when operating, servicing, or maintain the generator end.

DO NOT operate or service this equipment before reading this entire manual. This equipment should not be operated by persons under 18 years of age.

ALWAYS make sure generator installation is in accordance with electrical codes for your location.

ALWAYS have a qualified electrician perform the generator wiring installation.

NEVER operate this equipment without proper protective clothing, shatterproof glasses, steel toed boots and other protective devices.

NEVER operate this equipment when not feeling well due to fatigue, illness or taking medicine.

NEVER operate this equipment under the influence of drugs or alcohol.

NEVER use accessories or attachments, which are not recommended by your local distributor or original manufacturer for this equipment. Manufacture does not assume responsibility for any accident due to equipment modifications.

ALWAYS check the machine for loosened threads, bolts, or other parts before starting.

NEVER operate the generator in an explosive atmosphere or where fire could result.

ALWAYS allow the generator to cool before performing service and maintenance functions. Contact with **HOT** components can cause serious burns.

NEVER operate the generator in any enclosed or narrow area where free flow of the air is restricted. If the air flow is restricted it will cause serious damage to the generator or engine and may cause injury to people. The generator engine gives off **DEADLY** carbon monoxide gas.

ALWAYS make sure generator is properly grounded.

DO NOT place hands or fingers inside the generator when engine is running (generator is rotating).

NEVER allow power cables or cords to lay in water or any other liquid.

The electrical voltage required to operate the generator can cause severe injury or even death through physical contact with live circuits. Turn all circuit breakers **OFF** before performing maintenance on the generator.

ALWAYS make sure that electrical circuits are properly grounded per the National Electrical Code (NEC) and local codes before operating generator. Severe injury or death by electrocution can result from operating an ungrounded generator. If the unit is sold internationally (outside USA), please make sure that grounding is done according to the local electrical code.

ALWAYS store equipment properly when not being used. Equipment should be stored in a clean and dry location.



DANGER!

HAZARDOUS VOLTAGE. Voltage or current hazard sufficient to cause shock, burn, or death. Disconnect and lockout power before servicing.

NEVER touch output terminals during operation. This is extremely dangerous. **ALWAYS** stop the machine and place the circuit breaker in the “OFF” position when contact with the output terminals is required. There exists the possibility of electrocution, electrical shock or burn, which can cause severe bodily harm or even death!

Back feed to a utility system can cause electrocution and or property damage. **DO NOT** connect to any building's electrical system except through an approved device or after building main switch is opened. **ALWAYS** have a licensed electrician perform the installation.

RECEIVING THE GENERATOR

Once the generator is received you should first examine it carefully for any damages during shipping and for missing parts. If there is shipping damage, then please make note of the damage with the carrier, and contact Power Technology Southeast, Inc. immediately.

NOTE: Please note any damage with the carrier and be sure to note this damage on the Bill of Lading document. Take digital photos when available and be sure to properly document the damage.

STORING THE GENERATOR

If the generator is not immediately used, it should be stored indoors in a clean and dry environment.

If the generator is stored for an extended period of time, it should be cleaned and tested before operation. Also, check all bolts for tightness and examine the insulation on lead wires for chafing.

NOTE: Wet windings should be thoroughly dried out before operation otherwise serious damage to the generator can result. Please see the Maintenance section of the User Manual on how to how to dry out the generator windings.

INSTALLATION

Check the generator thoroughly before starting installation. Make sure there is no damage during shipment or during storage.

Perform the Insulation Resistance Test and dry out the generator windings if necessary. Check Maintenance Section of this Manual for additional instructions.

LIFTING THE GENERATOR



WARNING!

THE GENERATOR LIFTING EYE IS DESIGNED FOR LIFTING THE GENERATOR ONLY. IT IS NOT DESIGNED TO USE TO LIFT THE GENERATOR AND ENGINE (GENERATOR SET). USING EQUIPMENT WITHOUT PROPER LOAD BEARING CAPACITY CAN CAUSE SEVERE INJURY AND DAMAGE.

Do not lift single bearing generators without the rotor anchor bar securely fixed. Remove the rotor anchor bar only when attaching the generator to the engine. Lift the generator horizontally in order to prevent the rotor from slipping out.

LOCATION/ENVIRONMENT

Installation of the generator to the engine must be done in a location that is protected from moisture, dust, dirt, and harmful fumes.

Generator intake and outlet air passages need to be unobstructed during generator operation. Please do not mount any obstructions that would restrict the airflow. The generator needs sufficient air circulation in order to provide proper cooling. Make sure that hot air from radiator or engine does not pass through the generator.

Make sure the mounting surface (generator set base) has sufficient strength, rigidity, and uses the proper anti-vibration mounts in order to keep vibration and noise to a minimum.

MOUNTING GENERATOR TO ENGINE

Generator is mounted to the engine by the use of the generator coupling disc which fits perfectly into the recess on the engine flywheel.

Holes on the coupling disc correspond to threaded holes on the engine's flywheel. The coupling disc will mate with the prime mover's flywheel so that concentricity is obtained.

Coupling to Engine:

1. Make sure that the generator and engine are level.
2. Carefully pull out the main rotor assembly from the generator housing. Be careful not to damage the copper stator windings.
3. Make sure the generator coupling disc is flat against the engine flywheel and fits perfectly into the recess on the engine flywheel. Use appropriate bolts and hardened washers to mount the coupling disc to the engine flywheel. Tighten with calibrated torque wrench. Split type lock washers should NOT be used due to possible damage to coupling disc.
4. Mount generator housing over rotor and mount to engine housing. Check that the exciter rotor and exciter stator are aligned.
5. Mount the generator SAE housing to the engine housing. If bolted properly there should be no further alignment necessary.

EARTH/GROUND THE GENERATOR

The generator housing has to be connected to ground. If flexible anti-vibration mounts are used, then an earth conductor should be

connected in parallel to the base for proper grounding. Generator has an “earthing” bolt on the housing.



WARNING!

MAKE SURE THAT GENERATOR EARTHING/GROUNDING IS DONE PROPERLY. NOT DOING SO CAN CAUSE SHOCK AND EVEN DEATH.

OPERATION

BEFORE STARTUP

The following steps are recommended prior to starting the generator for the first time:

1. Make sure generator and engine are level and bolted securely on a base.
2. Check visually for any foreign materials.
3. Make sure all nuts and bolts are tightened properly.
4. Check all connections against the wiring diagram – especially the generator lead wires. Make sure connections are tight and properly insulated. Vibration can cause connections to loosen, disconnect or rotate causing short circuits.
5. Make sure generator is grounded correctly using generator grounding bolt located on the housing.
6. Make sure fan screen is assembled on the bell housing.

START-UP

1. Make sure generator is in no-load condition - disconnect generator output from load. This can be done by switching the circuit breaker in the OFF position or not connecting a load to the gen set terminals.
2. Remove field excitation wires (F-) and (F+) from AVR. (See the Automatic Voltage Regulator User Manual).

3. Check that that all engine start-up procedures have been followed.
4. Start engine and adjust engine speed initially between 60Hz to 62Hz (for 60Hz rated generator). Reference engine manual for how to adjust speed.
5. Using properly rated voltmeter check line-to-line and line-to-neutral residual voltages on generator terminal connections. Residual voltages will be much smaller than rated generator voltages. If voltages are unbalanced or not according to expected ratios, shut down the engine and re-check the wiring.
6. If voltages are correct (balanced), shut down the engine and connect exciter field wires (F-) and (F+) to AVR. (See the Automatic Voltage Regulator User Manual).
7. Start the engine again. Have voltmeter hooked up to generator terminal board and adjust voltage to the rated value (120V/240V) by rotating the AVR voltage adjust screw. (See the Automatic Voltage Regulator User Manual).
8. Once AVR is adjusted, check again all line-to-line and line-to-neutral voltages on generator terminal connections for proper voltage levels.
9. If voltage levels in Step 8 are correct, then shut down the engine, and close the main circuit breaker to the load. Start up engine with load applied.
10. Check generator speed (frequency) under load. Adjust as necessary.
11. It is recommended to apply different load levels for a few minutes (25% load, 50% load, 75% load, full load, and 110% load) to the generator and test voltage levels for proper adjustment and function.

SHUTDOWN

Shutdown varies based on the engine used. Please reference the engine User Manual for proper shut down procedures.

MAINTENANCE

GENERAL MAINTENANCE

- Check generator windings for buildup of dirt, oil, or any other substances. If found, please remove rotor and clean. Make sure the generator windings are dry before assembling.
- Check generator intake and exhaust venting openings (bearing cover and bell housing screen) to ensure airflow is not obstructed. Clean as needed.
- Periodically check bearings for unusual operation. Unusual operation is defined by excessive vibrations, unusual noise, grease leaking, etc. Replace bearings if unusual operation determined.
- Before operation check the resistance of the stator winding by performing the Insulation Resistance Test. The reading should be greater than 2 MΩ otherwise drying out the windings will be necessary.

INSULATION RESISTANCE TEST

1. Disconnect all electronic components, AVR, etc.
2. Short out the diodes on the rotating diode assembly.
3. Use a MegOhmMeter or Insulation Multimeter rated at least 500V and connect between an output lead terminal and ground, and later disconnect the lead wires from the terminal board and measure the resistance between lead wires and ground.
4. Measured value of insulation resistance for all windings to ground and between phases. Measured values should be greater than 2 MΩ. If not, then dry out the generator windings.

DRYING OUT THE GENERATOR WINDINGS

One or more of the following methods can be used to dry out the windings.

- Push hot air through the generator using heaters and blowers. Make sure the air can flow freely through the generator. Also, be careful not to overheat the windings which could cause permanent damage.
- Run the generator set unexcited by disconnecting the AVR terminals (open circuit) for 15 minutes.
- Oven dry the generator for up to 3 hours at 60°C-80°C temperature. Make sure to remove AVR during oven drying.

Once the Insulation Resistance is raised to a level of greater than 2 MΩ then the generator can be put into service.

TROUBLESHOOTING

MECHANICAL ISSUES

SYMPTOM	CAUSE	SOLUTION
Generator Overheating	Air vents obstructed, preventing normal air flow required for cooling	Check vents at rear bearing cover and fan intake air vent and make sure obstructions are removed.
	Load exceeds generator rated load	Reduce the load on the generator to equal or below rated load listed on generator name plate.
	High ambient temperature	Improve airflow to generator. Make sure that hot air is not recycled from generator or engine.
	High altitude	Altitude reduces the rating and affects the cooling of generator. Reduce load of generator until overheating stops.
Excessive Vibration / Noise	Misalignment of coupling between generator and engine.	Realign and tighten connection between coupling disc and engine flywheel, and generator housing and engine housing. Make sure correct grade bolts are used and are tightened to appropriate torque level using calibrated torque wrench.
	Faulty or damaged bearing	Replace bearing.

ELECTRICAL ISSUES

SYMPTOM	CAUSE	SOLUTION
Generator will not excite, no voltage	Exciter stator output voltage too low to start AVR	First try increasing the engine speed to 110% of rated RPM for a few seconds to see if excitation is achieved. If this does not work then Flash the Field to restore residual magnetism.
	Loss of residual magnetism	Flash the Field to restore the residual magnetism.
	Faulty AVR	Adjust or replace AVR. See AVR Manual.
	Faulty diodes or rectifier assembly	Check diodes first. Then replace the faulty rectifier assembly.
	Disconnected or shorted exciter rotor or main rotor lead wires	Check lead wires for short or disconnection and repair.
No load voltage too low	Damaged or burnt exciter rotor/stator, stator or rotor windings	Check windings (visual check, smell check), measure resistances and compare with the rated values. Replace faulty parts.
	Check engine speed (RPM)	Increase speed on engine slowly to increase voltage. Do not increase speed over 110% of rated RPM.
	Incorrect or faulty wiring.	Check wiring against the Generator Wiring Diagrams in the Appendix. Check wires for short and open connections.
	AVR not adjusted correctly	Calibrate AVR by adjusting the Voltage screw / potentiometer. See AVR Manual.

Damaged or burnt exciter rotor/stator, stator or rotor windings

Check windings (visual check, smell check), measure resistances and compare with the rated values. Replace faulty parts.

ELECTRICAL ISSUES (continued)

SYMPTOM	CAUSE	SOLUTION
No load voltage too high	AVR not adjusted correctly	Calibrate AVR by adjusting the Voltage screw / potentiometer. See AVR Manual.
	Check engine speed (RPM)	Decrease speed until rated voltage is achieved. Rated voltage is listed on generator name plate.
	Incorrect or faulty wiring	Check wiring against the Generator Wiring Diagrams in the Appendix. Check wires for short and open connections.
	Faulty AVR	Adjust or replace AVR. See AVR Manual.
Voltage below nominal, under load	AVR not adjusted correctly	Calibrate AVR by adjusting the Voltage screw / potentiometer. See AVR Manual.
	Current too high (excessive load) or speed below nominal	Reduce load and make sure current does not exceed rated current.
	Faulty AVR	Adjust or replace AVR. See AVR Manual.
	Faulty diodes	Check the diodes. Replace the rectifier assembly.
Voltage above nominal, under load	AVR not adjusted correctly	Calibrate AVR by adjusting the Voltage screw / potentiometer. See AVR Manual.
	Faulty AVR	Adjust or replace AVR. See AVR Manual.
Unstable voltage	Non-uniform rotation of engine	Check for uniform rotation of engine. Engine could be at fault. Check with engine User Manual or manufacturer for further troubleshooting.
	Misalignment of generator and engine.	Check for mounting of rotor and stator on engine. Check that air gap is even on all sides. Re-mount rotor and generator housing on engine.
	AVR is unstable	Calibrate AVR by adjusting the Stability control screw (potentiometer) on AVR. See AVR Manual.

SERVICE

FLASHING THE FIELD

Residual magnetism of the exciter stator may be lost or weakened if the generator is not operated for long periods of time, during long periods of transport, or due to other situations.

While flashing the field, the generator MUST BE out of operation.

Steps to flashing the field

1. Make sure the generator is not in operation (not rotating) and all terminals disconnected.
2. Disconnect exciter stator leads F+ and F- from the AVR.
3. Connect 12V DC battery to terminals F+ and F-, making sure that the (+) pole of the 12V DC battery is connected to F+ and (-) pole connected to F-.
4. Connect battery leads for approximately 3 to 5 seconds and then disconnect from F+ and F-.
5. Reconnect the F+ and F- to AVR.
6. Start the engine and run at rated RPM, with no load and check voltages.
7. Re-flash the field if generator voltage does not build up to rated values.

REPLACING THE RECTIFIED ASSEMBLY

1. Disconnect the exciter stator leads F+ and F- from AVR.
2. Remove the rear bearing cover.
3. Remove the bearing from the shaft.
4. Disconnect all the wires to the rectifier assembly.
5. Remove rectifier assembly.
6. Replace with new or repaired rectifier assembly. Lock the screws with thread adhesive and reconnect all the wires.
7. Mount the bearing on the shaft.

8. Put back on the rear bearing cover.

AVR ADJUSTMENTS

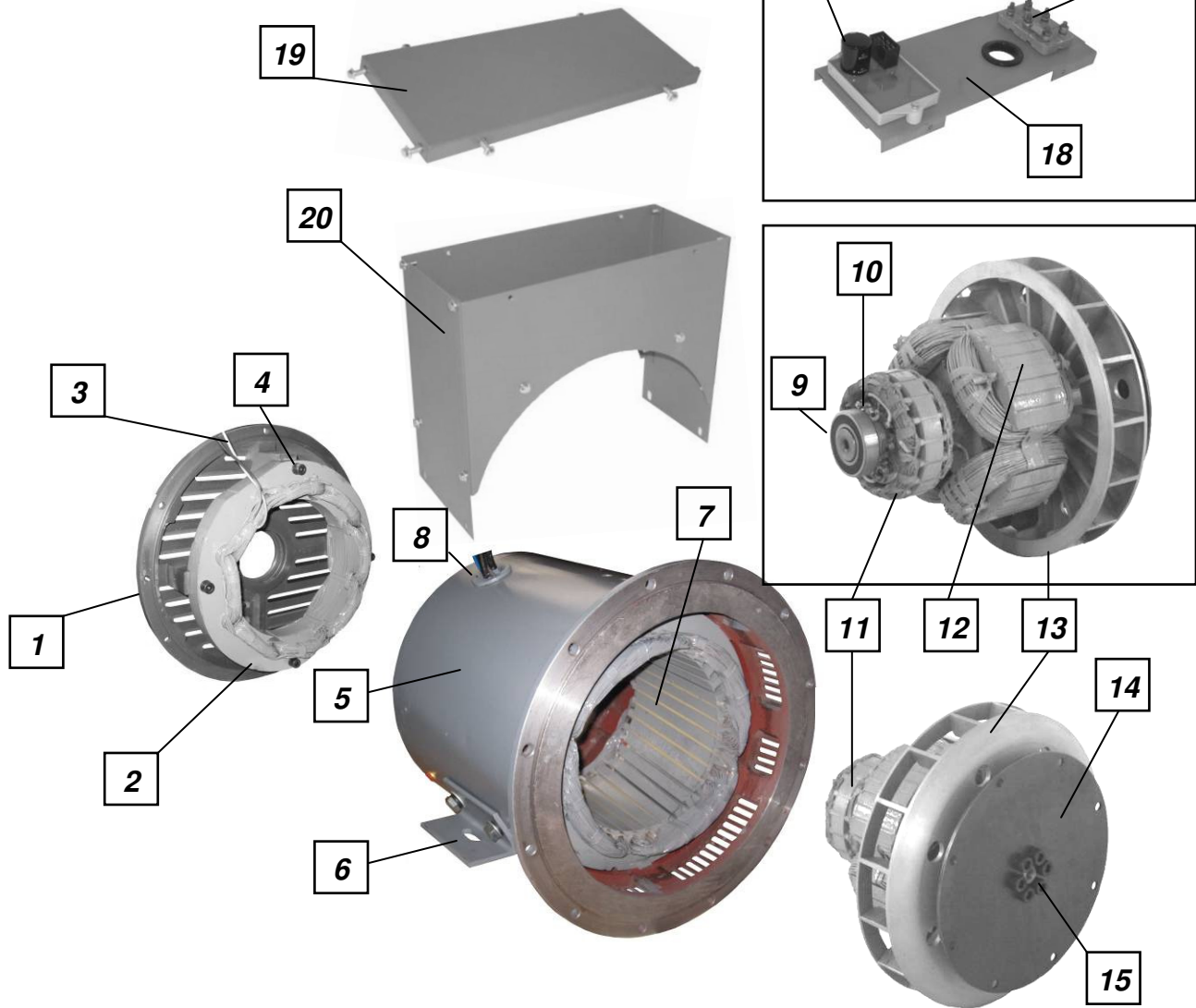
Adjustments on the AVR include screws / potentiometers that can adjust voltage and stability.

- Voltage Adjustment - Change the output voltage by adjusting the Voltage potentiometer screw on the AVR. Make sure generator is rotating at rated RPM. Turn clockwise to increase voltage and counter clockwise to reduce voltage. See AVR manual for additional instructions.
- Stability Adjustment – Change the stability of the generator by adjusting the Stability potentiometer screw on the AVR. Turn clockwise to increase stability and counter clockwise to reduce stability. See AVR manual for additional instructions.

RESISTANCE VALUES FOR WINDINGS

Rating (kW)	Stator U1-U2 (mΩ)	Rotor (Ω)	Exciter Stator (Ω)	Exciter Rotor (mΩ)
20	60	1.03	18	126
22	60	0.9	18	130
25	47	1.0	18	130

APPENDIX A – EXPLODED VIEW



Reference Number	Part Name	Reference Number	Part Name
1	Bearing cover	11	Exciter rotor
2	Exciter stator	12	Main rotor
3	Exciter stator lead wires	13	Fan
4	Bolts for exciter stator	14	Coupling disc
5	Generator housing	15	Bolts for coupling disc
6	Generator mounting feet	16	Automatic Voltage Regulator (AVR)
7	Stator	17	Terminal board
8	Terminal lead wires (4 leads)	18	Base for AVR and Terminal board
9	Bearing	19	Control box cover
10	Rectifier assembly	20	Control box

APPENDIX B – SPARE PARTS LIST

Reference Number	Part Name	Part Number
1	Bearing cover	*1CB-xx-001-00
2	Exciter stator	*1CB-xx-002-00
3	Exciter stator lead wires	N/A
4	Bolts for exciter stator	N/A
5	Generator housing	N/A
6	Generator mounting feet	N/A
7	Stator	N/A
8	Terminal lead wires (4 – 12 leads)	N/A
9	Bearing	*1CB-xx-009-00
10	Rectifier assembly	*1CB-xx-010-00
11	Exciter rotor	*1CB-xx-011-00
12	Main rotor	*1CB-xx-012-00
13	Fan	*1CB-xx-013-00
14	Coupling disc	N/A
15	Bolts for coupling disc	N/A
16	Automatic Voltage Regulator	VR3.1-00UL
17	Terminal board	1CB-TB-00UL
18	Base for AVR and Terminal board	N/A
19	Control box	*1CB-xx-019-00
20	Control box cover	N/A

* “-xx-“ –Insert kW rating for generator to complete Part Number. For example, Exciter Stator for 25kW generator is 1CB-25-002-00.

APPENDIX C – Wiring diagram for Single Phase Generator

