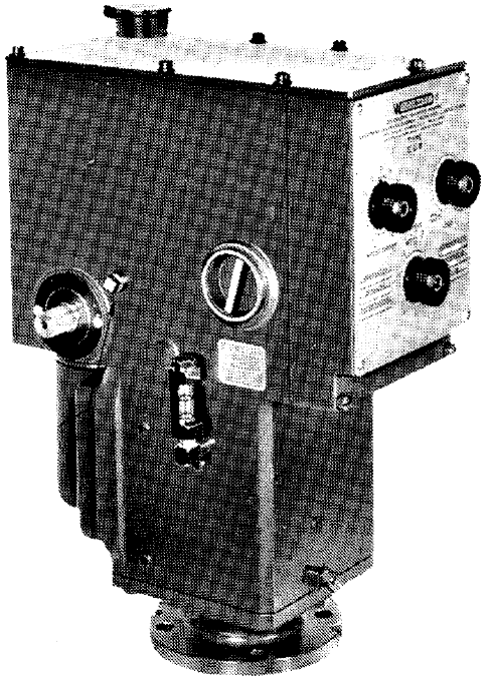
WOODWARD

Product Manual 54066
(Revision A)
Original Instructions



EGB-10C, -13C, -35C, & -50C Governor/Actuator Installation

Installation Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

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Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

EGB-10C, -13C, -35C, & -50C Governor/Actuator Installation

Introduction

General

The EGB-10C, EGB-13C, EGB-35C, and EGB-50C Governor/Actuators (EGB) contain an electric actuator and a mechanical governor. Normally, the electric actuator will control the prime mover and the mechanical governor will serve as a backup in event of actuator or actuator signal failure.

The EGB contains three distinct but interrelated sections:
- An electric actuator system (actuator)
- A centrifugal or mechanical governor system (governor)
- A hydraulic amplifier to amplify the force output of the two systems

The three sections are interconnected through the loading piston and this piston determines terminal shaft position. Either the actuator system or the governor system can control the position of the loading piston. Normally, the system with the lowest speed setting will be the controlling system.

Governor

The governor system contains a needle valve. Access to this valve is found on the side of the housing (Figure 2). The governor also contains the following adjustment knobs on the front of the EGB:
- Speed Droop
- Load
- Speed

IMPORTANT **The load limit will establish a maximum fuel limit regardless of the system in command.**

⚠WARNING **The load-limit knob cannot shut the engine down if linkage is wrong or if moving the terminal shaft to minimum-fuel position does not shut off all fuel.**

Actuator

The actuator system contains a needle valve through a hole on the side of the housing (Figure 2). The actuator is influenced by signals sent from an electronic control. Each electronic control will have internal adjustment pots clearly labeled as to their function. Speed-setting pots are external to the electronic control. Further information may be found in the manuals pertaining to the associated control.

Compensated governor/actuators such as the EGB-10C, EGB-13C, EGB-35C, and EGB-50C may be used ONLY with EG-A or EG-M electronic controls. Other electronic controls are designed for proportional governing systems and must not be used with compensated governor/actuators.

Installation

General

Place a new gasket between the base of the EGB and the engine mounting pad. Lower the EGB onto the mounting pad—do not force it into position. The splined shaft of the EGB must fit into the engine's drive with a free slip fit.

IMPORTANT

This fit must not exhibit any excess play or tightness. Incorrect clearance between mating parts can result in excessive wear, breakage, or seizure of the parts. An overspeed condition or a runaway engine could result from such damage.

The EGB must be positioned square to the engine linkage. Install nuts over mounting-studs and snug them into position so that governor is firmly in place. Turn the engine over several times to seat the EGB and ensure correct gear engagement. After the EGB is seated, torque the nuts to 62 to 68 lb-ft (84 to 92 N·m).

Attach the electrical plug containing signal wires to the connector located on the side of the EGB.

Oil

Attach all booster and cooler lines (if used) to the EGB. Fill the EGB with oil to the mid point on the oil sight gauge. Use oil conforming to Woodward specifications described in Woodward manual 25071. The same oil used in the engine may be used in the EGB provided it meets all requirements.

IMPORTANT

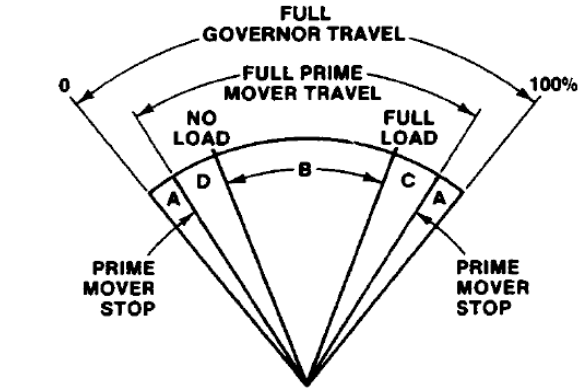
If the booster servo and cooler require filling, the EGB actuator will need approximately 2.5 US quarts (2.4 L) of oil. Air must be bled from the booster and cooler (see Manuals 36684 and 36641) prior to starting the engine.

After filling the actuator with oil, actuate the start sequence a few times to further bleed the booster; do not allow the engine to start. After starting the engine, add or drain oil to maintain mid point on the oil sight gage while running. Oil level will stabilize in five minutes.

Linkage

The terminal shaft must overtravel the engine fuel-setting lever. This means the fuel-setting lever must reach its minimum-fuel and maximum-fuel positions before the terminal shaft reaches either end of its limit of travel. The EGB was designed to have a minimum terminal shaft rotation of 27 degrees between the no-load and maximum-load positions.

Once the linkage is properly positioned, carefully tighten retaining bolt to avoid damaging the EGB terminal shaft.



A - OVERTRAVEL TO INSURE PRIME MOVER STOPS ARE REACHED

B - NO LOAD TO FULL LOAD TRAVEL — NORMALLY 2/3 OF FULL GOVERNOR TRAVEL IS RECOMMENDED

C - TRAVEL REQUIRED TO ACCELERATE THE PRIME MOVER

D - TRAVEL REQUIRED TO DECELERATE OR SHUT DOWN PRIME MOVER

Figure 1. Actuator Travel

Disconnect electrical signal

Disconnect the actuator signal wires from the electronic control. Refer to the manual for the control in use.

IMPORTANT

The actuator system can be set to move to either minimum-fuel or maximum-fuel position if the electronic control fails or the electrical signal is lost. The normal lost-signal setting provides for increase to the maximum-fuel position; however, special models have been factory adjusted for return to the minimum-fuel position. This installation procedure is established for the normal maximum-fuel configuration. For information on specially configured minimum-fuel models, contact Woodward or your authorized dealer or distributor.

Initial Engine Start—Mechanical Governor

Set the governor's speed-setting knob to low idle.

Set the load-limit knob at its highest position. If engine requires less than full fuel for starting, the load may be set at a lower position. The load-limit control must be returned to maximum position after engine is started. Most engines are operated with the load set at the highest position.

⚠WARNING

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Start the engine according to manufacturer's instructions. If the engine unaccountably increases speed, immediately initiate shutdown procedures and determine the cause of the problem.

Let the engine run for ten minutes for warm-up. **CONTINUOUSLY MONITOR THE OIL LEVEL DURING THE WARM-UP**. Add oil if necessary.

Mechanical System Checks

Needle Valve Adjustment

Remove the governor needle valve access plug. Open the needle valve 2 turns.

⚠WARNING

If the engine excessively hunts when the needle valve is at the 2-turn position, reposition the needle valve toward the closed position until the hunt is apparent but not extreme.

Disturb the engine by:

- Making a quick speed-setting change
- Moving the engine fuel rack

See if the governor begins to hunt. If hunting is not observed, open the needle valve another turn and again disturb the engine. Do not open needle valve more than 3 turns. If the engine does not hunt after the valve is 3 turns open, return the valve to the 1-1/2 turn position and leave the valve in that position.

After one-half minute running time with engine hunt, slowly close the needle valve until engine speed settles out—then disturb the engine in the manner previously explained. There may be a slight overshoot or undershoot of the governor, but there should be no hunting. If hunting is present, close the needle valve slightly and test again. Repeat until hunting is gone. NEVER close the needle valve any farther than necessary because this will result in a sluggish and slow engine response to load changes. **NEVER CLOSE THE NEEDLE VALVE UNTIL IT IS TIGHT**.

Replace the needle valve access plug.

Speed Droop Adjustment

When the actuator system is controlling the engine, the governor speed-droop control knob normally is set for 3 percent droop. Three percent droop is obtained when the governor speed-droop pointer is located between the 2 and the 4 marks. Check the actual droop by noting the speed change from no-load to full-load speed. Calculate droop by dividing the observed speed change by no-load speed.

Electrical Checks

Run the engine without load and at approximately normal speed under control of the governor. While the engine is running under these conditions, make the following checks:

EG-A Control

The voltages between the wires connected between terminals 1 and 2, 2 and 3, and 1 and 3 is approximately 120, 208, or 240 volts. The correct voltage will be indicated on the control nameplate.

Under a no-load condition, there must be no voltage in wires connected to terminals 5 and 6, 7 and 8, and 9 and 10 of the control.

EG-M Control Box, AC Power Supply, Single Phase

Make sure the voltage between wires normally connected to terminals 1 and 2 is 120 volts.

When all indicated readings have been obtained, shut the engine down and reconnect actuator signal wires to their correct positions on the electronic control terminal block.

Electronic Control

Verity that all terminal block and actuator connections are made in accordance with the furnished installation wiring diagram.

Set control adjustments as follows:

EG-A Control
(60 Hz operation requires a jumper between terminals 23 and 24. 50 Hz does not require a jumper.)

Amplifier Gain
    Set at mid position
Droop
    Set at mid position
De-Droop (if so equipped)
    Refer to manual for control

EG-M Control
Amplifier Gain
    Set at mid position
Stability
    Set at mid position
Droop
    Set at mid position
Load Gain
    Set at full counterclockwise (ccw) position

Engine Start—Electric Actuator

After completing the previous adjustments, remove actuator needle valve access plug and set needle valve one turn open.

If droop is required, set the mechanical droop-control knob between the numbers 2 and 4.

Set the governor speed-control knob at approximately the normal speed position.

Set the electronic control's speed-setting potentiometer at maximum-speed position—full clockwise (cw).

⚠WARNING

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Start the engine according to the manufacturer's instructions. The governor system will control speed during starting when the electronic control speed-setting potentiometer is full cw.

If the speed is slower than anticipated, turn the electronic control speed-setting potentiometer ccw. If the speed increases the speed-setting potentiometer may be connected in reverse. Shut the engine down and reverse the following wires:

- EG-A Control—wires 13 and 15
- EG-M Control—wires 6 and 8

Reset the speed-setting potentiometer to the maximum-speed position.

Start the engine as previously described.

Adjust the governor's speed setting to approximately 3 percent above no-load rated speed. The effect of governor droop will reduce the speed to approximately 1-1/2 percent of no-load rated speed as the power piston moves toward the full-load position.

Turn the electronic control's speed-setting potentiometer ccw to decrease speed setting. (When the electric control's speed setting calls for a speed slower than the governor speed setting, the actuator system will assume control of the engine). Continue turning the electronic control's speed-setting potentiometer until the engine is at rated no-load speed.

The objective of the next step is to set the electronic control's Amplifier Gain as far as possible in the cw direction while opening the actuator needle valve as much as possible. Connect a voltmeter, across terminals 17 and 18 of the EG-A Control or terminals 4 and 5 of the EG-M Control.

If the engine is stable:

1. Turn the electronic control Amplifier Gain adjustment cw until the engine begins to hunt. Now turn the electronic control's Stability adjustment either cw or ccw—whichever direction will stabilize the engine.

    a. If the engine cannot be stabilized by turning the Stability adjustment, reset the Stability to its mid position and turn the Amplifier Gain ccw until the engine becomes stable.

    b. Reset the speed-setting potentiometer to obtain rated speed.

IMPORTANT **Anytime the gain adjustment changes, the speed setting will change.**

c. When the engine is stable, disturb the system by:
   — Making a quick speed-setting change
   — Moving engine fuel-rack
   — Moving control valve
   Observe speed change.

2. Open the actuator needle valve in 1/8 turn increments until the engine begins to hunt. Turn the electronic control Stability adjustment to achieve stability.

⚠WARNING **Use care when running engine after completing each 1/8 turn of the actuator needle valve, Instability can occur very abruptly, and a 1/8 turn could create an unstable condition that did not previously exist.**

a. If the engine will not settle down, reset the Stability adjustment to its maximum cw position and close the needle valve 1/8 turn. Use the electronic control Gain adjustment (if necessary) to stabilize the engine.

b. Repeat step 2, opening the actuator needle valve and adjusting the electronic control for stable operation, until no further improvement in transient response is achieved.

3. Typical electronic control final settings are:

a. Amplifier Gain—Mid position to 3/4 turn cw.

b. Needle valve—3/4 to 1 1/2 turn open.

If engine is unstable:

1. Close the actuator needle valve until the engine becomes stable.

a. When the engine becomes stable, follow the procedure outlined in the “stable” section.

b. If the engine does not stabilize, the cause is outside the actuator system or the electronic control.

c. If the engine does not stabilize, verify that:
   — The linkage is arranged to use at least 60% of the available actuator output from no-load to full-load positions.
   — The linkage is not sloppy or binding.
   — The governor’s oil supply does not contain air bubbles.
   — The engine voltage regulator is functioning properly.
   — The speed signal supplied to the EG-M Control is correct.

Once set for proper operation, the electronic amplifier control gain and stability settings and the actuator needle valve should require no further adjustment.

Replace the needle valve access plug and remove the voltmeter.

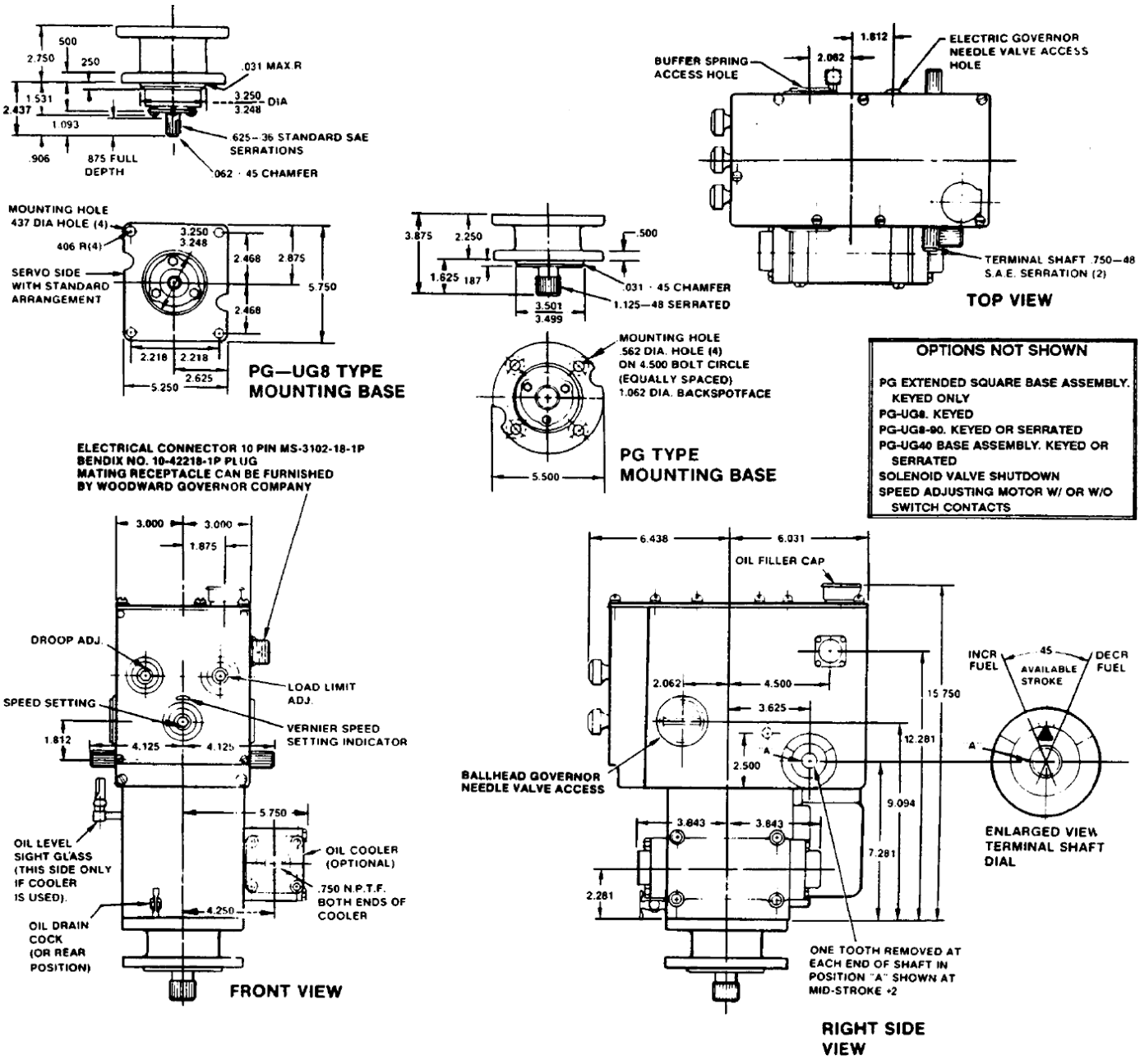


Figure 2. EGB-XXC Outline Drawing

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 54066A.

PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

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