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Product Manual 36569
(Revision A, 02/2014)
Original Instructions

DYNA 8000, 8200 & 8400 Series Electronic Governor Systems

Installation and Operation 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 QCC Technical Publications*, on the *publications page* of the QCC 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 QCC 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 Out-of-date translations are marked with .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.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

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Illustrations and Tables

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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 QCC 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.

Chapter 1.
General Information

Introduction

DYNA 8000, DYNA 8200, and DYNA 8400 governor systems provide engine governing for speed and power control of piston and gas turbine engines or steam and water turbines. The system components are a rotary actuator and an electronic controller, both of which are described further in this manual.

ACTUATOR
The actuator consists of an electromagnet with an iron armature rolling on the center shaft bearings. The actuator is provided with a return spring which balances the magnetic force of the armature. When DC current flows in the coil, the magnetic force moves the armature in the stator and this linear motion is transformed into rotary motion through a crank arm that forms part of the output shaft.

CONTROLLER
The electronic controller is the information processing unit of the governor assembly. It contains electronic components which process the input signal from the magnetic pickup to command the engine to the desired speed/RPM set into the controller. Electronic adjustments are available on the controller for field adjusting the unit as necessary.

DC POWER SOURCE
The governor system receives its power from a battery or an AC to DC power supply supplying 12 or 24 Vdc ± 20% to match the governor voltage. The average operating current consumption is 2.5A to 3.5A and the highest consumption is 14.75A during engine start-up or during a large load change. The power source must be rated above maximum stall current.

ISOCHRONOUS OPERATION
Isochronous operation is obtained by setting DROOP potentiometer fully counterclockwise. The DYNA governor is all electric, and it is normally operated in the isochronous mode; i.e., engine RPM is constant (± 0.25%) under steady state load conditions, up to the engine's maximum capability, regardless of load on the engine

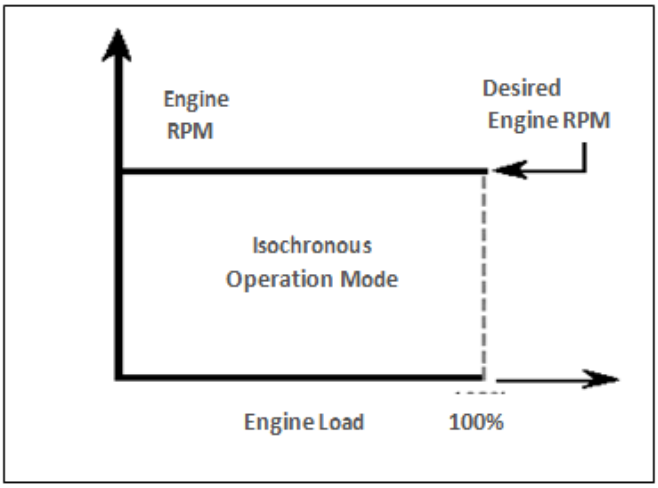


Figure 1. Isochronous Operation Mode

DROOP OPERATION

Droop operation is obtained by setting the DROOP potentiometer. *Clockwise* increases the droop. The amount of droop for a given setting depends on the magnetic pickup frequency and no-load to full-load actuator shaft rotation. A DROOP potentiometer setting of 10 o'clock will give about 4% droop, no load to full load when the pickup frequency is 4260 Hz and actuator shaft rotation is approximately 30° from no load to full load. Lower pickup frequency or smaller shaft rotation results in less droop for the system.

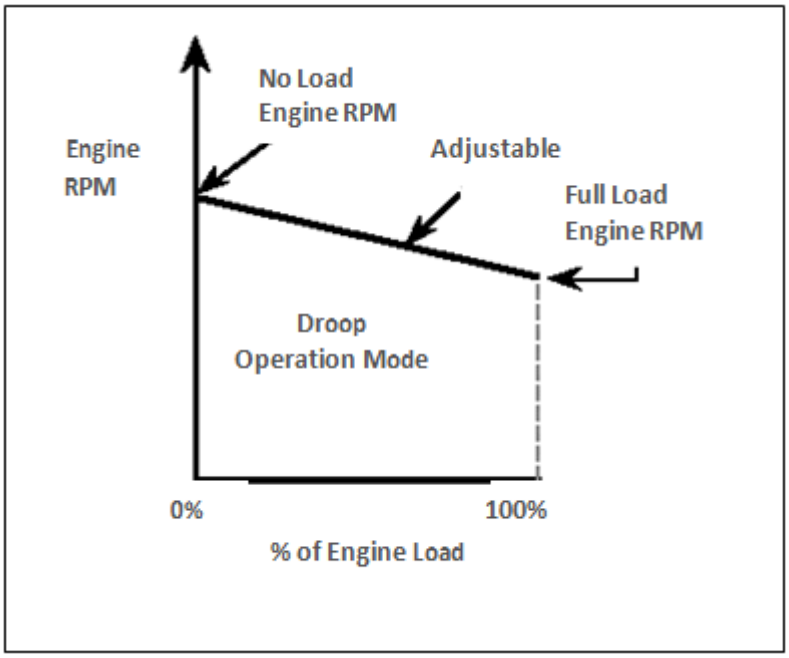


Figure 2. Droop Operation Mode

REMOTE SPEED ADJUSTMENT

An optional remote speed selector (DYNS-10000) is available for adjusting engine RPM from up to 90 meters (300 feet.) from the engine. Refer to the electrical wiring schematic shown in **Figure 6**. The potentiometer can be connected for a narrow (fine) or wide speed range control.

Chapter 2. Specifications

DYNA Actuator Specifications

Operating Voltage	12 Vdc or 24 Vdc ± 20%
Ambient Operating Temperature	-55 to + 125 °C (-65 to + 255 °F)
Mechanical Vibration	5 to 500 Hz, Curve F, per MIL-STD. 810D, Method 514-2
Connection	Terminal strip or “MS” connector
Sealed Unit	Oil, water, and dust tight

Actuator Selection Guide

DYNA Series	Work	Torque	Output	Current @ 12 Vdc		Current @ 24 Vdc		Nominal Response Time for 63% of Stroke	Weight
				Max. Amps at Stall	Nominal Steady State Amps	Max. Amps at Stall	Nominal Steady State Amps		
8000	1.2 J (0.9 ft-lb)	1.4 N·m 1.0 lb-ft	Rotary 35°	12.5 mA	3.5 A	9.5 mA	1.5 A	0.030 sec	5 kg (11.0 lb)
8200	2.85 J (2.10 ft-lb)	4.07 N·m 3.0 lb-ft	Rotary 45°	14.75 mA	4.5 A	14.0 mA	3.5 A	0.138 sec	8.4 kg (18.5 lb)
8400	5.8 J (4.3 ft-lb)	7.3 N·m 5.4 lb-ft	Rotary 45°	N/A	N/A	13.0 mA	2.0 A	0.104 sec	12.2 kg (27.0 lb)

DYNA 8000 Series Actuators

ACTUATOR MODEL	FORMER DYNC PART NUMBER	VOLTAGE	OUTPUT SHAFT ROTATION		ACTUATOR HEAD POSITION	MOUNTING		HAZARD-OUS DUTY
			CW	CCW		Stan-dard	Side	
DC11020-000-012	DYNC 11020-000-0-12	12 Vdc	■		—	■		
DC11020-000-024	DYNC 11020-000-0-24	24 Vdc	■		—	■		
DC11020-300-012	DYNC 11020-300-0-12	12 Vdc	■		—		■	■
DC11020-300-024	DYNC 11020-300-0-24	24 Vdc	■		—		■	■
DC11021-000-012	DYNC 11021-000-0-12	12 Vdc	■		180° from DC11020	■		
DC11021-000-024	DYNC 11021-000-0-24	24 Vdc	■		180° from DC11020	■		
DC11021-300-012	DYNC 11021-300-0-12	12 Vdc	■		180° from DC11020		■	■
DC11021-300-024	DYNC 11021-300-0-24	24 Vdc	■		180° from DC11020		■	■
DC11022-000-012	DYNC 11022-000-0-12	12 Vdc	■		90° CCW from DC11020	■		
DC11022-000-024	DYNC 11022-000-0-24	24 Vdc	■		90° CCW from DC11020	■		
DC11022-300-024	DYNC 11022-300-0-24	24 Vdc	■		90° CCW from DC11020		■	■
DC11023-000-024	DYNC 11023-000-0-24	24 Vdc	■		90° CW from DC11020	■		
DC11023-300-024	DYNC 11023-300-0-24	24 Vdc	■		90° CW from DC11020		■	■
DC11023-350-024	DYNC 11023-350-0-24	24 Vdc		■	90° CW from DC11020		■	

DYNA 8000 Series Actuators (cont'd.)

ACTUATOR MODEL	FORMER DYNC PART NUMBER	VOLTAGE	OUTPUT SHAFT ROTATION		ACTUATOR HEAD POSITION	MOUNTING		HAZARD-OUS DUTY
			CW	CCW		Stan-dard	Side	
DC11024-000-012	DYNC 11024-000-0-12	12 Vdc		■	—	■		
DC11024-000-024	DYNC 11024-000-0-24	24 Vdc		■	—	■		
DC11024-300-012	DYNC 11024-300-0-12	12 Vdc		■	—		■	■
DC11024-300-024	DYNC 11024-300-0-24	24 Vdc		■	—		■	■
DC11025-000-024	DYNC 11025-000-0-24	24 Vdc		■	90° CW from DC11024	■		
DC11025-300-012	DYNC 11025-300-0-12	12 Vdc		■	90° CW from DC11024		■	■
DC11026-000-012	DYNC 11026-000-0-12	12 Vdc		■	180° CCW from DC11024	■		
DC11026-000-024	DYNC 11026-000-0-24	24 Vdc		■	180° CCW from DC11024	■		
DC11026-300-012	DYNC 11026-300-0-24	12 Vdc		■	180° CCW from DC11024	■	■	■
DC11026-300-024	DYNC 11026-300-0-24	24 Vdc		■	180° CCW from DC11024	■	■	■
DC11028-000-012	DYNC 11028-000-0-12	12 Vdc		■	90° CCW from DC11024	■		
DC11028-300-012	DYNC 11028-300-0-12	12 Vdc		■	90° CCW from DC11024		■	
DC11028-300-024	DYNC 11028-300-0-24	24 Vdc		■	90° CCW from DC11024		■	

DYNA 8200 Series Actuators

ACTUATOR MODEL	FORMER DYNC PART NUMBER	VOLTAGE	OUTPUT SHAFT ROTATION		ACTUATOR HEAD POSITION	MOUNTING		HAZARD-OUS DUTY
			CW	CCW		Stan-dard	Side	
DC12000-000-012	DYNC 12000-000-0-12	12 Vdc	■		—	■		
DC12000-000-024	DYNC 12000-000-0-24	24 Vdc	■		—	■		
DC12001-000-012	DYNC 12001-000-0-12	12 Vdc	■		180° from DC12000	■		
DC12001-000-024	DYNC 12001-000-0-24	24 Vdc	■		180° from DC12000	■		
DC12002-000-012	DYNC 12001-000-0-12	12 Vdc	■		90° CCW from DC12000	■		
DC12003-000-024	DYNC 12003-000-0-24	24 Vdc	■		90° CW from DC12000	■		

DYNA 8400 Series Actuators

ACTUATOR MODEL	FORMER DYNC PART NUMBER	VOLTAGE	OUTPUT SHAFT ROTATION		ACTUATOR HEAD POSITION	MOUNTING		HAZARD-OUS DUTY
			CW	CCW		Stan-dard	Side	
DC14800-000-024	DYNC 14800-000-0-24	24 Vdc	■ †	■ †	—	■		

(†) Through output shaft makes available both CW and CCW output.

Controller Selection Guide

Any of the controllers listed below can be used on a DYNA 8000, DYNA 8200, or DYNA 8400 actuator. The controllers are categorized as either Derivative Pot or Non-Derivative Pot models, depending on their adjustability features.

Controller Input Signal Frequency

Select your controller for the correct input signal frequency range generated by the magnetic pickup at the maximum engine operated (RPM) speed. Use the following formula to convert from RPM to Hertz.

$$\frac{[(EngineRPM)\times(NumberOfTeeth)]}{[60s]} = [MpuHertz]$$

Controller Models

CONTROLLER MODEL	FORMER DYN1 PART NUMBER	VOLTAGE	FREQUENCY	CE MARKED
NON-DERIVATIVE POT MODELS				
8270-1021	DYN1-10654-000-0-12	12 Vdc	2500–5000 Hz	
8270-1004	DYN1-10654-000-0-24	24 Vdc	2500–5000 Hz	
8270-1072	DYN1-10654-001-0-24	24 Vdc	2500–5000 Hz	■
DERIVATIVE POT MODELS				
8270-1024	DYN1-10684-000-0-12	12 Vdc	2500–5000 Hz	
8270-1073	DYN1-10684-000-0-24	24 Vdc	2500–5000 Hz	

Controller Specifications

Operating Voltage	12 Vdc or 24 Vdc ± 20%
Ambient Operating Temperature	-40 to +85 °C (-40 to + 180 °F)
Temperature Stability	Better than ± 0.5% over a temperature range of -40 to + 75 °C (-40 to + 167 °F)
Output Current at 12 Vdc and 24 Vdc: **Current Draw w/o Actuator** **Maximum Amps at Stall**	 80 mA 13 A
Steady State Speed Band	± 0.25%
Adjustments: **Non-Derivative Pot Models** **Derivative Pot Models**	 Speed, Gain, Integral, and Droop Speed, Gain, Integral, Droop, and Derivative
Mechanical Vibration	Withstands the following vibration without failure or degraded performance: 0.06 inch double amplitude at 5 to 18 Hz; 1 G at 18 to 30 Hz; 0.02 inch double amplitude at 30 to 48 Hz; 2.5 G's at 48 to 70 Hz
Connection	Terminal strip
Circuit Boards	Boards are covered with a heavy conformal coating for moisture and vibration protection
Sealed Unit	Oil, water, and dust tight
Weight	0.863 kg (1.9 lb)

Chapter 3. Installation

The actuator of the governor assembly is mounted on the engine next to the fuel system. The magnetic pickup is normally mounted in the flywheel housing in such a way that it can count the teeth on the starter ring gear. The controller is off-mounted or installed in the engine control panel or cabinet.

1. Mount the actuator on a suitable rigid steel bracket or plate.

> **NOTICE** **Mounting kits are available for particular engines. Please contact your QCC customer service representative if you require mounting information or a kit.**

2. Set up the linkage and rod end bearings as shown in **Figures 4** and **5**.
3. Install the speed sensor (magnetic pickup) with SAE threads. (Magnetic pickups with M16x1.5 threads and 14.5 Ø mm tap drills are available.)
4. Remove the inspection cover over the ring gear teeth. (The magnetic pickup should not be installed in inspection covers.) Gear teeth should be free of burrs, excessive grease, or dirt.
5. Inspect the ring gear housing and pick a location where a 37/64" hole can be drilled such that the ring gear teeth will pass in front of the pickup pole face. After the 37/64" hole is drilled, use a 5/8-18 starting tap to cut threads for the magnetic pickup, and then run a bottom tap through the hole.

> **NOTICE** **The tapped hole should be drilled as perpendicular as possible over the center of the ring gear teeth.**

6. Manually rotate the ring gear until a tooth face is directly in the center of the tapped hole. Gently turn the magnetic pickup clockwise into the hole until it bottoms on the tooth, and back off 1/4 turn. Tighten the jam nut firmly, maintaining the 1/4 turn position.
7. Mount the controller in the control panel.
8. Connect the wiring as shown in **Figure 6** or according to your particular wiring diagram.

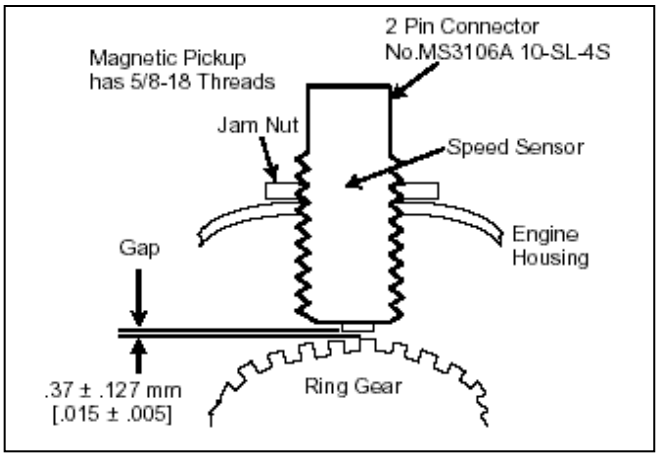


Figure 3. Installation of Magnetic Pickup

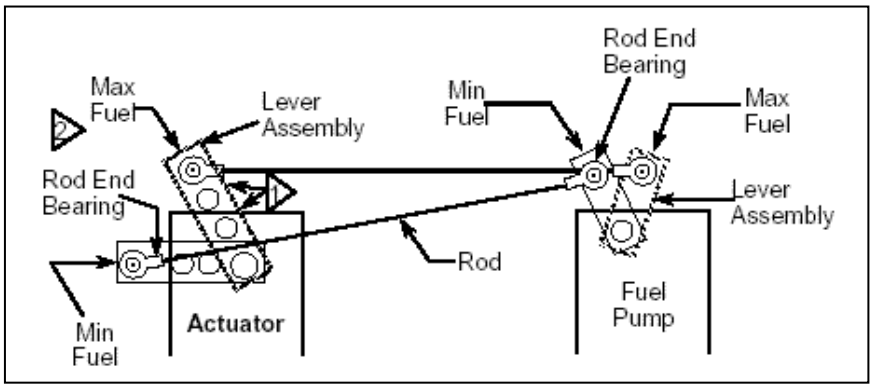


Figure 4. Rotary Actuator to Rotary Fuel Pump Linkage

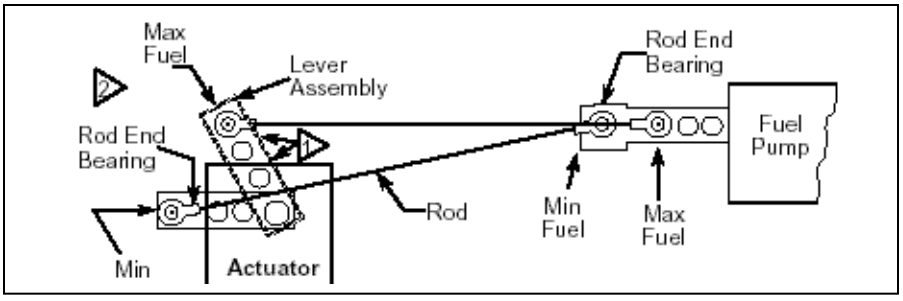


Figure 5. Rotary Actuator to Linear Fuel Pump Linkage

DIAGRAM NOTES

1. Choose hole in actuator lever which causes actuator to rotate through its maximum rotation to provide minimum to maximum fuel.

2. Non-linear linkage to actuator is proper for best operation. Provides low GAIN at light loads and high GAIN at heavy loads.

Controller Dimensions & Wiring Diagram

Dimensions are in mm. Dimensions in brackets [ ] are in inches.

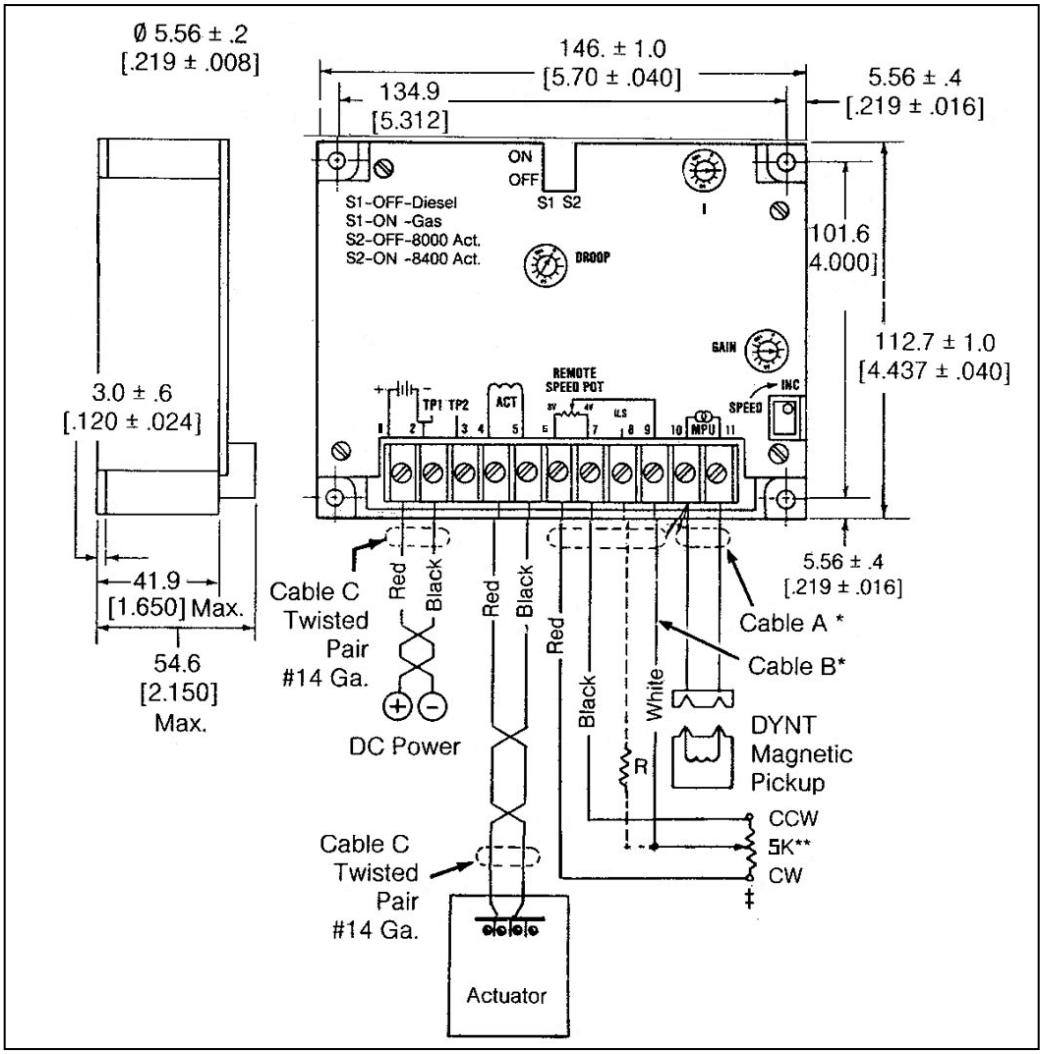


Figure 6. Dimensions & Wiring Diagram for 8270-1072 Controller

DIAGRAM NOTES

Cable A: DK44-XX 90°connector (specify length) *Cable B:* E26-22N (specify length)
Cable C: DZ70-004-XX terminal strip (specify length) OR MS connector

* Shielded cable – Customer should purchase a cable with a wrapped Mylar supported aluminum foil shield with a drain wire.

** Remote speed potentiometer and 499K ohm resistor is P/N DYNS-10000.

† The 5K remote speed potentiometer can be wired two different ways:

1. As shown by the solid line from the wiper of the 5K potentiometer and then connected to terminal #9 (no resistor required). Adjustable range is approximately ± 5% at 1800 RPM.
2. As shown by the dashed line from the wiper of the 5K potentiometer through resistor R and then connected to terminal #8. Reducing the value of R increases the remote adjustable speed range.

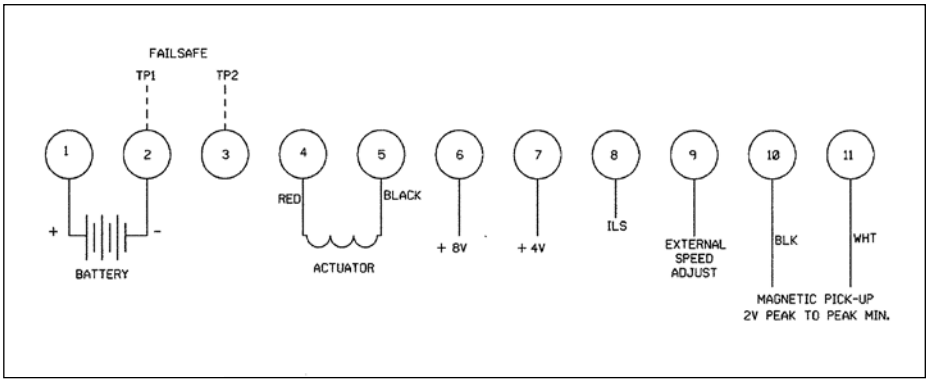


Figure 7. Wiring Diagram for CE Controllers

WARNING

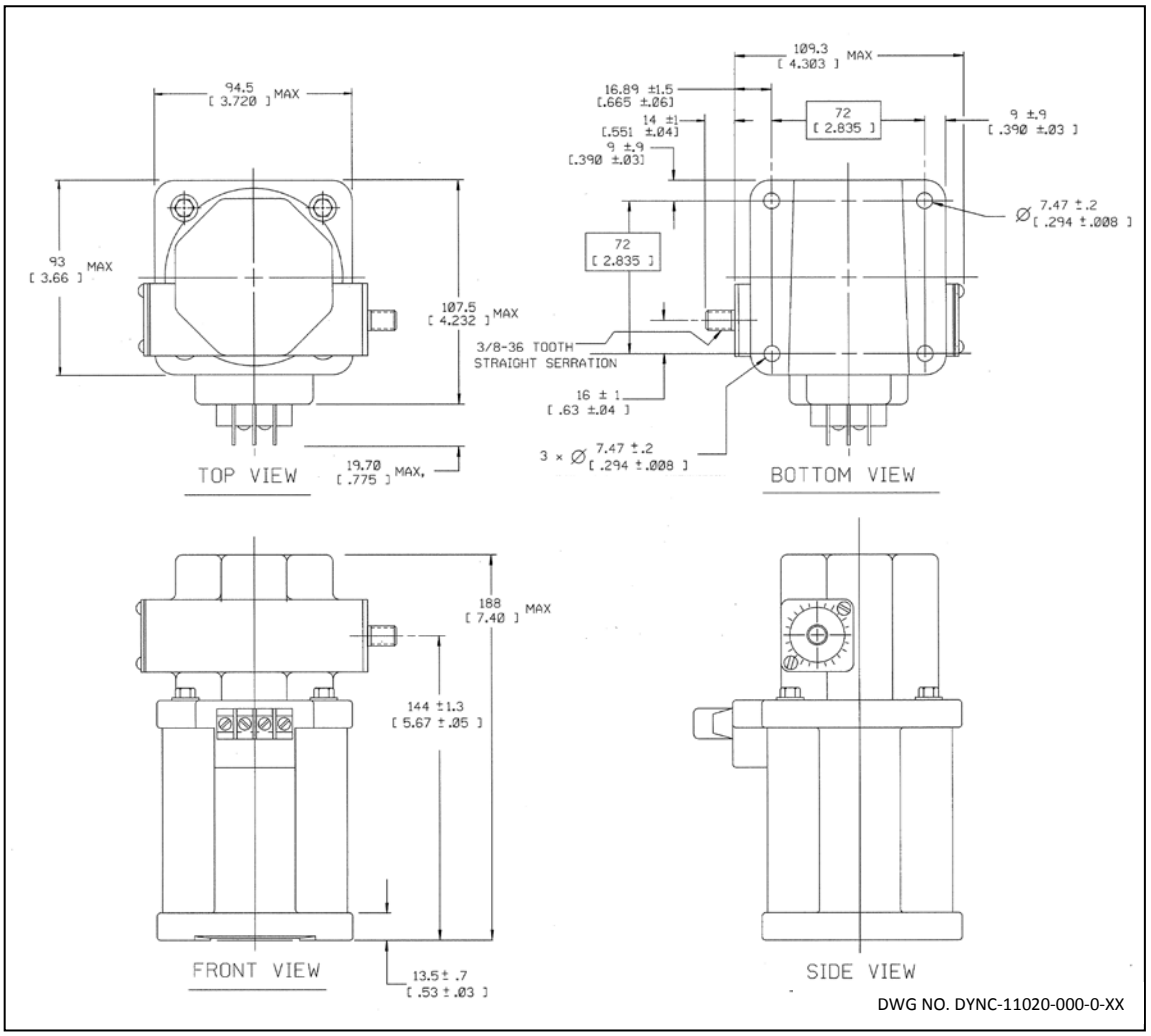
The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

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.

Actuator Dimensions

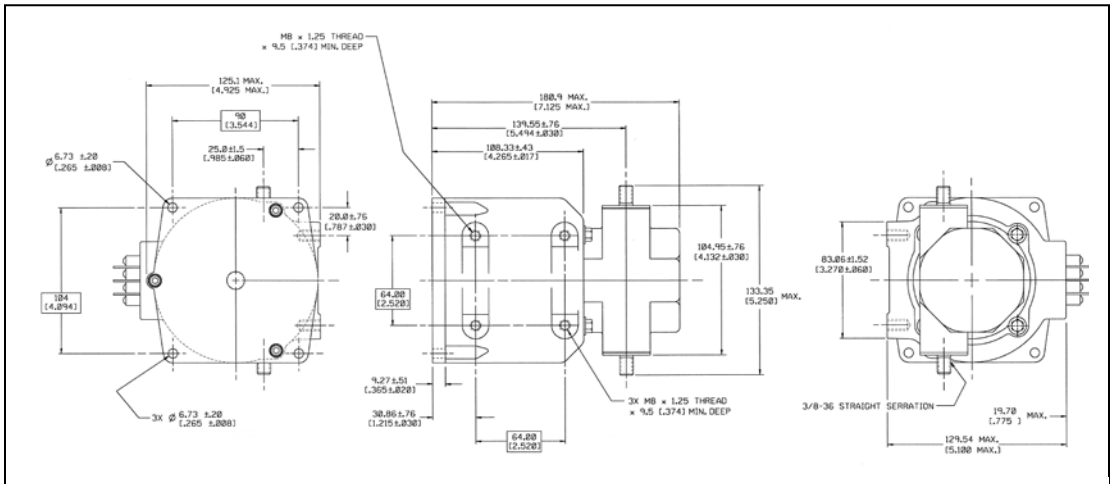
DYNA 8000 Series

Dimensions are in millimeters. Dimensions in brackets [ ] are inches.



DYNA 8200 Series

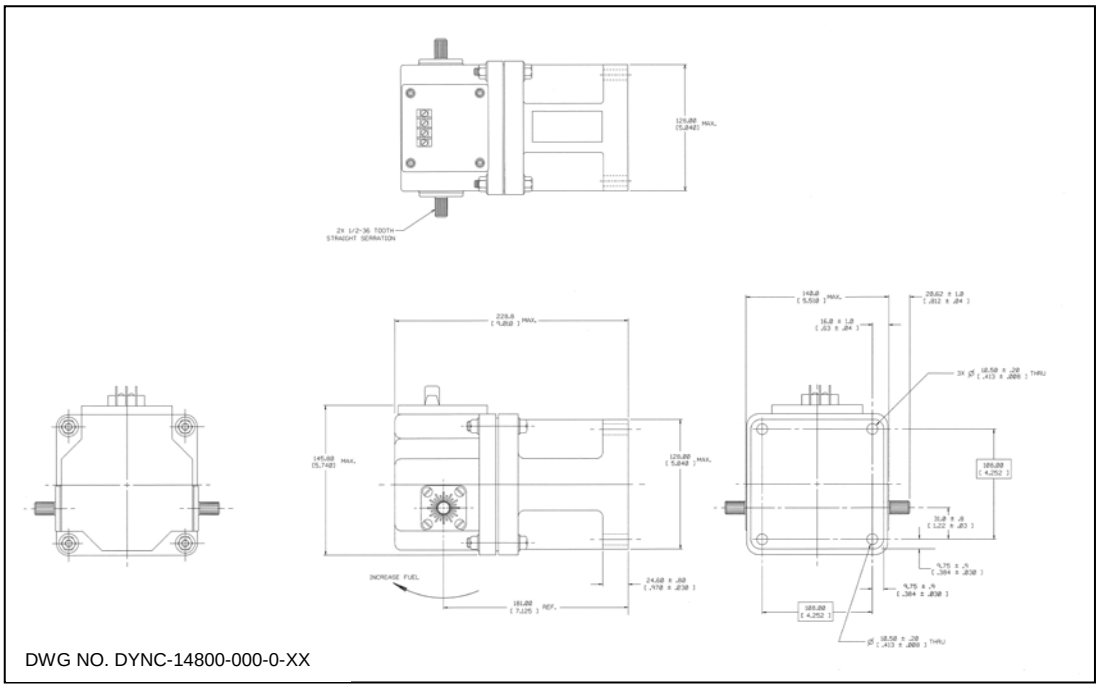
Dimensions are in millimeters. Dimensions in brackets [ ] are inches.



DWG NO DYNC-12001-000-0-XX

DYNA 8400 Series

Dimensions are in millimeters. Dimensions in brackets [ ] are inches.



DWG NO. DYNC-14800-000-0-XX

Chapter 4. Calibration

As mentioned previously, any of the controllers described in Chapter 2 can be used with DYNA 8000, DYNA 8200, or DYNA 8400 actuators. The controllers are categorized as either Derivative Pot or Non-derivative Pot models, depending on their adjustability features, and each category has its own calibration procedure. Follow the calibration instructions relevant to the controller type you have. Model numbers are provided to help you determine the correct calibration procedures to follow.

Switch SW1 and SW2 Adjustments

Switch adjustments are the same for both controller types. These switches allow for fuel response ranges (SW1 for matching either diesel or gas engine dynamics) and actuator selections (SW2 for either DYNA 8000, 8200, or 8400 actuators)

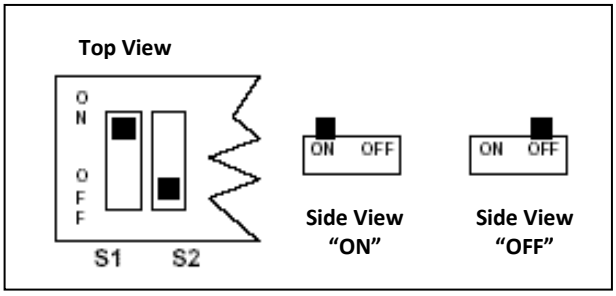
SW1 selects one of two integrating rate ranges. The diesel version integrates at twice the rate of the gas version

- Set S1 to the OFF position for diesel engine applications.
- Set S1 to the ON position for gas/gasoline engine applications.

NOTE: For some diesel engines, better operation may be obtained by placing SW1 in the ON position. If difficulty is experienced in the OFF position, try SW1 ON and recalibrate.

SW2 selects the point at which actuator coil current level causes the integrator limit to be actuated. This level is nominally 6.3A for the DYNA 8000 and 7.3A for the DYNA 8200 and 8400 actuators.

The easiest way to set the switches is to apply pressure with a small pointed object until the switch clicks into position.



Calibration Procedure for Non-Derivative Pot Controllers

Model Numbers:

8270-1021 (DYN1-10654-000-0-24)

8270-1004 (DYN1-10654-000-0-24)

8270-1072 (DYN1-10654-001-0-24) [CE Marked]

8270-1053 (DYN1-10654-704-0-12)

Connection Information

When using an ILS unit, the remote speed potentiometer may be left connected to the controller as shown.

When an ILS unit is used, connect 3-wire shielded cable to terminals 6, 7 and 8. Connect drain shield wire to terminal 10 at the controller only. The other end of drain shield wire is to be cut off and taped.

Calibration Procedures

1. Refer to **Figure 6** or **Figure 7** before making any adjustments of the potentiometers, DROOP, I, GAIN and SPEED.

2. Turn power OFF to be sure that the engine is not operating.

3. Initial potentiometer settings:
   a Set the I adjustment three divisions from zero and the GAIN at the second division from zero.
   b For isochronous operation, set DROOP counterclockwise to minimum position as shown in **Figure 1**.
   c For DROOP operation, set DROOP potentiometer clockwise to obtain desired amount of DROOP from no-load to full load. Turning potentiometer clockwise *increases* DROOP.

NOTICE	**If the full 35° rotation of the actuator shaft is used and the linkage adjusted to use only the active fuel range, the maximum obtainable DROOP would be approximately 12% at full load.**

4. Start the engine.

5. Adjust the controller speed potentiometer until the engine is operating at the desired engine RPM. Clockwise increases engine RPM.

6. If the governor system is unstable, slightly reduce the GAIN setting.

   NOTE: Except for the speed adjustment, the potentiometers have internal stops at the 0 and 100% positions.

7. With the engine unloaded, finalize the settings, I and GAIN adjustments as follows:

   a Turn the GAIN adjustment *clockwise* slowly until the actuator lever oscillates. (You may need to disturb actuator lever to cause oscillation.) Reduce the GAIN adjustment slowly *counterclockwise* until the lever is stable. Upset the lever by

hand. If the lever oscillates 3 to 5 diminishing oscillations and stops, the setting is correct.

b If system performance to load changes is satisfactory, omit step (c).

c Reduce the GAIN setting *counterclockwise* one division. Next, turn the I adjustment fully *clockwise* while observing the actuator lever. If the lever does not become unstable, upset it by hand. When the lever slowly oscillates, turn the adjustment *counterclockwise* slowly until the lever is stable. Upset the lever again; it should oscillate 3 to 5 times and then become stable for optimum response.

NOTE: Use whichever settings from steps (b) or (c) provide the best performance.

8. The unit is now calibrated.

Calibration Procedure for Derivative Pot Controllers

Model Numbers:

8270-1024 (DYN1-10684-000-0-12)

8270-1073 (DYN1-10684-000-0-24)

Calibration Procedures

1. Observe that potentiometer settings are adjustable from zero to 100%. Each small division is 10%. The speed potentiometer is 10K, 20 turn.

2. Set SW1 and SW2.

   Set switch, S1, for the correct engine:
   - Set S1 to the OFF position for diesel engine applications.
   - Set S1 to the ON position for gas/gasoline engine applications.

   Set switch S2 for the correct actuator:
   - Set S2 to the "OFF" position for DYNA 8000 actuator
   - Set S2 to the "ON" position for DYNA 8200 or 8400 actuator.

3. If a remote speed potentiometer is used for narrow range, set to mid range.

4. Initial potentiometer settings:

   - GAIN: 20%
   - I: 20%
   - D: 30%
   - DROOP: Zero

5. For isochronous operation, set DROOP *counterclockwise* to minimum position as shown in **Figures 2** and **3**.

6. For droop operation, set DROOP potentiometer *clockwise* to obtain desired amount of droop from no-load to full load. Turning potentiometer clockwise increases droop.

7. Start engine (No Load)

8. Adjust the controller speed potentiometer for desired engine speed.

9. Adjust the GAIN potentiometer *clockwise* until the engine begins to hunt. (If the engine remains stable at 100% GAIN, physically disrupt the actuator linkage by hand.) With the engine hunting, turn the GAIN potentiometer *counterclockwise* until stable.

10. Repeat step 9 for the "D" setting.

11. Repeat step 9 for the "I" setting.

12. The unit is now calibrated.
    NOTE: After calibration, it may be necessary to readjust the speed.

13. Conduct the following test:

    With the engine operating at rated speed, turn the electric governor off. When engine speed slows to approximately half of rated speed, turn the electric governor back on. Observe the overshoot. If there is a small hunt at steady state, slightly turn the "I" potentiometer *counterclockwise* until stable. In some cases, 2 to 3 Hz overshoot may be acceptable.

WARNING **For gas engines, make certain that method used does not put gas in exhaust which might result in an explosion.**

If possible, operate the unit through various load ranges up to 100% to ensure stability.

Chapter 5.
Diagnostics & Troubleshooting

SYMPTON: GOVERNOR IS COMPLETELY DEAD AND ACTUATOR LEVER STAYS AT MINIMUM POSITION WHEN POWER IS APPLIED TO GOVERNOR

Means of Detection	Corrective Action
Check battery voltage at terminals 1 and 2 on controller. Terminal 1 is positive.	Check battery connections and contacts for turning power ON to the controller.
Check for proper linkage setup.	Correct and free linkage.
Magnetic pickup signal absent or too low. Measure AC voltage across terminals 10 and 11 while cranking the engine. Voltage should be min. 2.5 VAC. **Note:** The voltmeter should have an impedance of 5000 ohms/volts or higher.	Check pole tip gap over gear tooth. Gap should be .037 mm ± 0.127 mm (0.015" ± 0.005").
Measure the resistance of the magnetic pickup coil. This should be above 150 ohms (250 ohms max).	If there is an open or shorted coil, replace the magnetic pickup.
Measure the resistance of each pin to the metal case of the magnetic pickup. No continuity should be evident.	If there is continuity to case, replace the magnetic pickup.
DC SUPPLY OFF. Place an insulated jumper between terminals 2 and 3 (TP1 & TP2). With DC ON, the actuator should go to full stroke. DC voltage at terminals 4 and 5 should be within 3 volts of the supply.	If the actuator still does not move to full stroke, continue with steps below.
Measure actuator coil resistance: *DYNA 8000* Coil resistance 0.75 ± 0.2 ohms @ 12 Vdc Coil resistance 2.3 ± 0.4 ohms @ 24 Vdc *DYNA 8200* Coil resistance .710 ± 0.2 ohms @ 12 Vdc Coil resistance 1.600 ± 0.4 ohms @ 24 Vdc *DYNA 8400* Coil resistance 1.630 ± 0.4 ohms @ 24 Vdc	If actuator coil is open or shorted to case, replace actuator. If governor still does not operate, continue with steps below.
Measuring the resistance of each coil lead to the actuator case should indicate an open circuit on a low scale of the ohm meter.	If continuity is detected, replace the actuator.
With the DC to the governor ON and the engine OFF, measure the DC voltage from terminal 6 (+) to terminal 2 (-). This should be approx. 8 Vdc.	If 8 Vdc is not present, replace the controller.
Between terminal 7 (+) to terminal 2 (-), the voltage should be approx. 4 Vdc.	If 4 Vdc is not present, replace the controller.

SYMPTON: ACTUATOR GOES TO FULL STROKE WHEN DC POWER IS TURNED ON (ENGINE IS NOT OPERATING)

Means of Detection	Corrective Action
Check magnetic pickup leads for proper shielded wire or open shield.	Verify and correct wiring as necessary**.**
Be sure there is no jumper between terminals 2 and 3.	Verify and correct wiring as necessary.
Failsafe circuit in the controller may be damaged or defective.	Replace controller.
With DC power OFF remove leads at actuator. Check continuity of each terminal to case. There should be no continuity between any terminal and case of the controller.	If continuity is detected, replace the controller.
If remote speed potentiometer has been connected to terminals 6, 7 and 9 of the controller, DISCONNECT THESE LEADS.	Turn DC power ON to the governor if the actuator is now normal. Proceed to Improper operation from Remote Speed Potentiometer Table, Step 1 on the next page.

SYMPTON: IMPROPER OPERATION FROM REMOTE SPEED POTENTIOMETER

Means of Detection	Corrective Action
Investigate wiring to remote speed potentiometer for open or shorted circuits.	Check wiring.
If the leads at terminals 6 and 7 to the remote speed potentiometer are reversed, speed control by the remote speed potentiometer will be reversed.	Correct wiring.
Lead wire to remote speed setting potentiometer should be 3-wire shielded cable.	Verify that the drain shield wire is isolated from ground at the potentiometer.
If terminal 7 lead to the remote speed potentiometer is open, engine speed will go high.	Correct the wiring.
If lead 9 (wiper lead to remote potentiometer) is open, there will be no control by the remote speed potentiometer.	Verify and correct wiring.
If lead 6 to the clockwise terminal of the remote speed potentiometer is open, speed will remain at the value set in the controller.	

SYMPTON: ERRATIC GOVERNOR OPERATION

Means of Detection	Corrective Action
Measure DC voltage at 1 and 2 on controller terminal strip. Normal battery voltage should be indicated.	If nominal voltage is present, wiring is correct.
Low battery voltage 20% below rated can cause erratic operation.	Check battery and charging system.
RFI noise due to incorrect shielding.	Correct wiring.
RFI noise fed through power supply leads.	Connect power leads directly to the battery.

SYMPTON: SLOW, SMALL AMPLITUDE HUNTING OF SPEED OR FREQUENCY

Means of Detection	Corrective Action
Sticking or very loose linkage.	Correct linkage.

SYMPTON: FAST OSCILLATION OF GOVERNOR LINKAGE

Means of Detection	Corrective Action
Verify calibration settings of the controller.	Readjust settings as necessary.

SYMPTON: ENGINE WILL NOT START; ACTUATOR GOES TO FULL FUEL DURING CRANKING

Means of Detection	Corrective Action
Make sure fuel is available.	Check fuel to engine. Check for correct wiring to the automatic shutdown circuits.
Air may be trapped in fuel line.	Air may be trapped in fuel line.
Try to operate engine manually.	

Revision History

Changes in Revision A—

- Delete UL listings for DYNA 8000 Series hazardous duty actuators

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