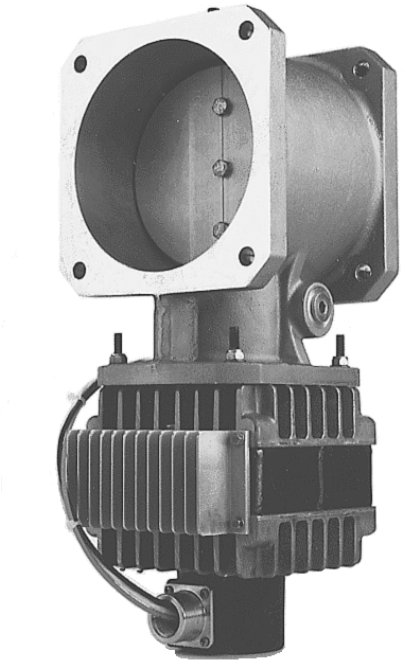
WOODWARD

Product Manual 04166
(Revision NEW)
Original Instructions



ProAct™ ITB Integrated Throttle Body and Actuator

Flo-Tech™ 107/120/135 mm Throttle Body with Integrated ProAct Actuator

Installation and Operation Manual

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

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.

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.

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the *publications page* on the Woodward website:
www.woodward.com/publications
The current revision and distribution restriction of all publications are shown in manual *26311*.

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

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.

NOTICE

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.

NOTICE

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*.

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Chapter 1.
General Information

Introduction

The ProAct™ ITB (ProAct driver and Flo-Tech™ 107/120/135 mm throttle bodies) is an electrically-actuated butterfly valve with integral driver which controls flow output. The 107/120/135 designations correspond to their prospective bore sizes in mm. This manual should be used in conjunction with the appropriate ProAct manual: 04176 (ProAct II) or 04127 (ProAct III).

This manual is intended to assist the engine designer/retrofitter in properly applying the Flo-Tech 107/120/135 throttle bodies. This manual is not intended to be a substitute for consultation with a Woodward application engineer.

Application

The Flo-Tech 107/120/135 throttle bodies are throttle valves with integrated electric actuators designed to throttle air or air/fuel for gaseous engines. This system is designed for direct replacement of traditional throttle valves, and requires no linkage between valve and actuator. These three sizes are designed to cover a wide range of engines and should be selected using the sizing procedure described below. For reference, the mass of the throttle valve is approximately 12.7 kg (28.0 lbs) with a ProAct II actuator, and 15.2 kg (33.5 lbs) with a ProAct III actuator.

Determining the Proper Valve Size

The proper size valve can be determined using the equation below. The required Cv (flow coefficient) should be calculated for both the minimum and maximum flows expected on the application. This design allows for a maximum travel of 75 degrees rotation.

Using these calculated Cv values, along with the graph and table below, select the closest valve that has an equivalent Cv at approximately 80% opening (60 degrees) maximum. Also, check that the particular valve's minimum Cv listed below is less than the minimum calculated Cv for good low idle performance. For further assistance, consult the Woodward engineering department.

$$Cv = Q * .00978 * (G * T / ((P1 - P2) * K)) ^ 0.5$$

where:
Cv = Flow Coefficient
Q = Mass Flow (PPH)
G = Specific Gravity (use 1.0 for air)
T = Absolute Temperature in degrees Rankine (460 + °F) [°F = 1.8 * °C + 32]
P1 = Inlet Pressure (psia) [1 psi = 6.895 kPa = 0.06895 bar]
P2 = Discharge Pressure (psia)
K = P2 (if P1-P2 is 10% or less than P1)
= P1 (if P1-P2 is 25% or more than P1)
= (P1 + P2)/2 (if P1-P2 is between 10 and 25% of P1)

*Note: P2 must be greater than .528 * P1 or flow becomes choked. If P2 is less than .528 P1, then use P2= .528*P1.*

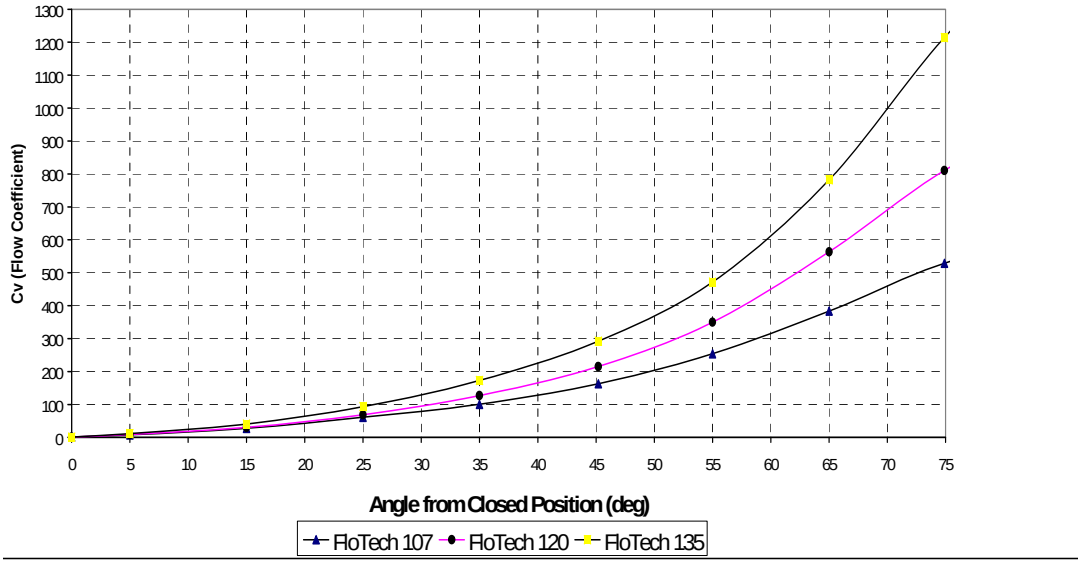

Figure 1-1. Cv vs Angle for Large Flo-Tech Throttle Bodies

IMPORTANT

These flow coefficients were determined using the test setup described in ANSI/ISA-S75.02-1996 "Control Valve Capacity Test Procedure".

Cv (Flow Coefficient)

Plate Angle	107 mm	120 mm	135 mm
0	1.08	1.09	1.10
5	7.82	8.68	11.51
15	27.39	30.42	40.67
25	61.00	68.96	93.33
35	100.78	127.28	172.75
45	162.86	215.44	292.46
55	254.06	350.02	471.51
65	383.78	563.30	782.29
75	529.11	810.50	1214.00

Table 1-1. Cv (Flow Coefficient)

Part Number Selection

After determining the proper valve size, the part number of the assembly can be determined from the table listed below. The 135 mm valve is offered in two versions, either with a ProAct II or a ProAct III actuator. The reason for this is that the 135 mm valve's typical torque requirements can overlap the transition point between the output torque of the ProAct II and III actuators. The determining factor is the pressure differential across the valve at various valve positions.

If the approximate pressure differentials are known by the end user, the graph below can be used to select the proper actuator. Delta P's at the corresponding valve plate angles that fall ***at or below*** the curve will permit the use of the ProAct II actuator with good system response as indicated in the ProAct II manual. If these values fall ***above*** this curve, a ProAct III actuator should be used. For applications that operate at or above this transition point with the ProAct II actuator, the expected degradation in performance would likely result in the actuator's inability to follow the command signal, resulting in engine hunting or instability.

For applications where the ProAct II actuator is sufficient, a cost advantage can be realized by the end user. However, some applications will require a ProAct III actuator coupled to the 135 mm valve. If the delta P's are not known and the end user would like assistance in making the selection, consult the Woodward engineering department.

Part Number	Bore Size (mm)	Max. Effective Flow Area (cm^2)	Actuator/Connector (conduit or MS)
8235-170	107	62.5	ProAct II/conduit
8235-178	107	62.5	ProAct II/MS
8235-171	120	81.2	ProAct II/conduit
8235-177	120	81.2	ProAct II/MS
8235-159	135	105.6	ProAct II/conduit
8235-181	135	105.6	ProAct II/MS
8235-172	135	105.6	ProAct III/MS
8235-183	135	105.6	ProAct III/conduit

Table 1-2. Part Numbers

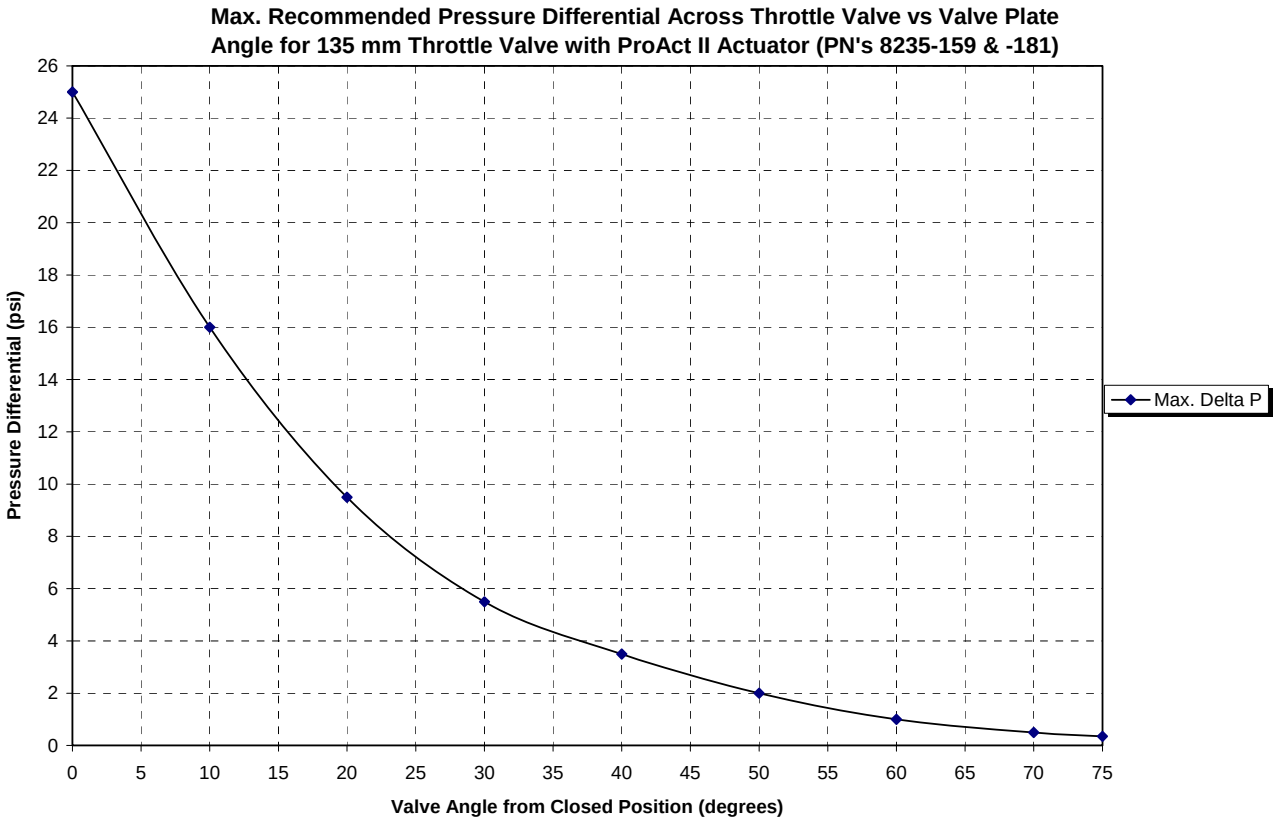

Figure 1-2. Maximum Recommended Pressure Differential

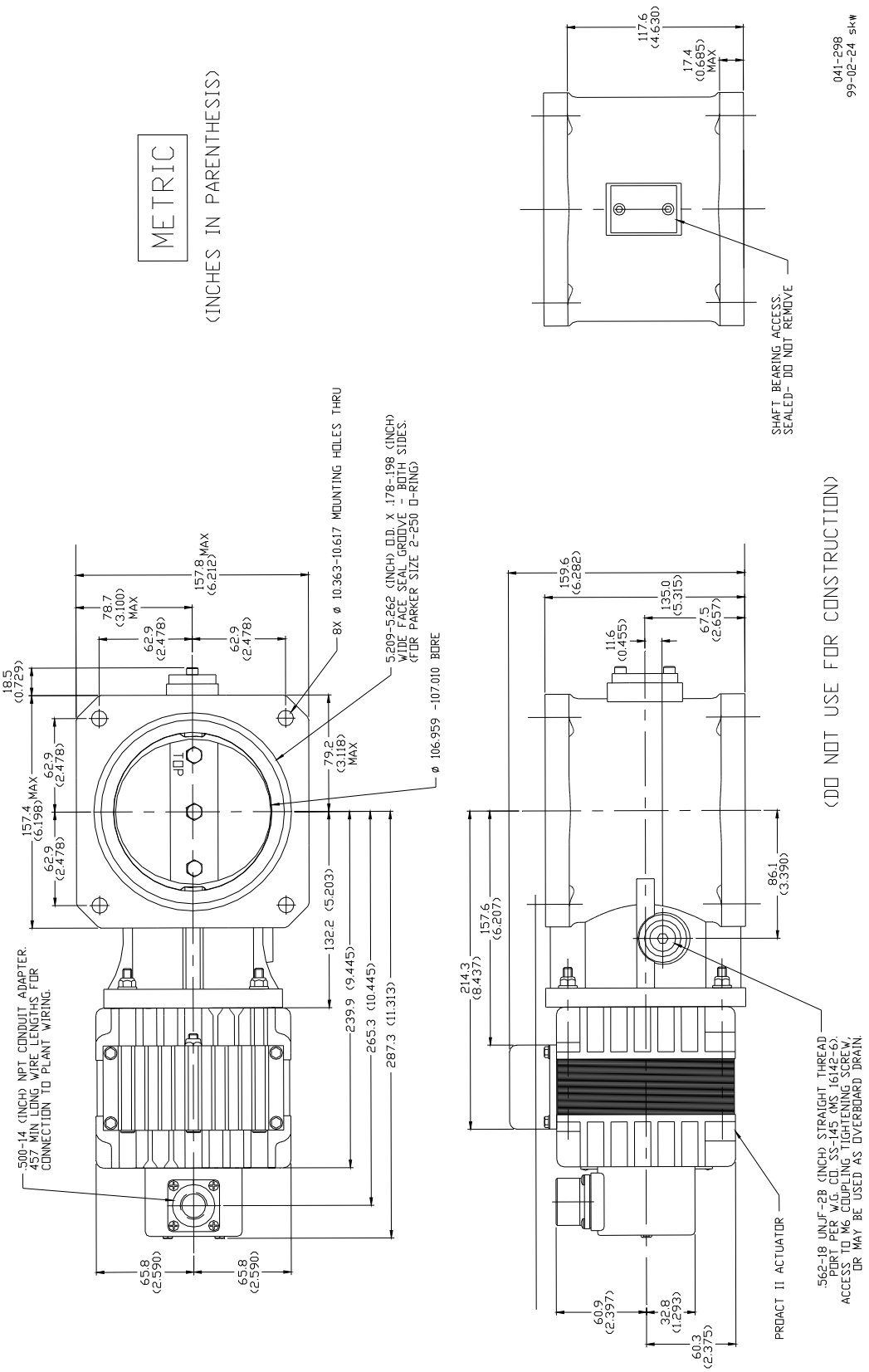

Figure 1-3. Outline Drawing of Flo-Tech 107 with ProAct II Actuator

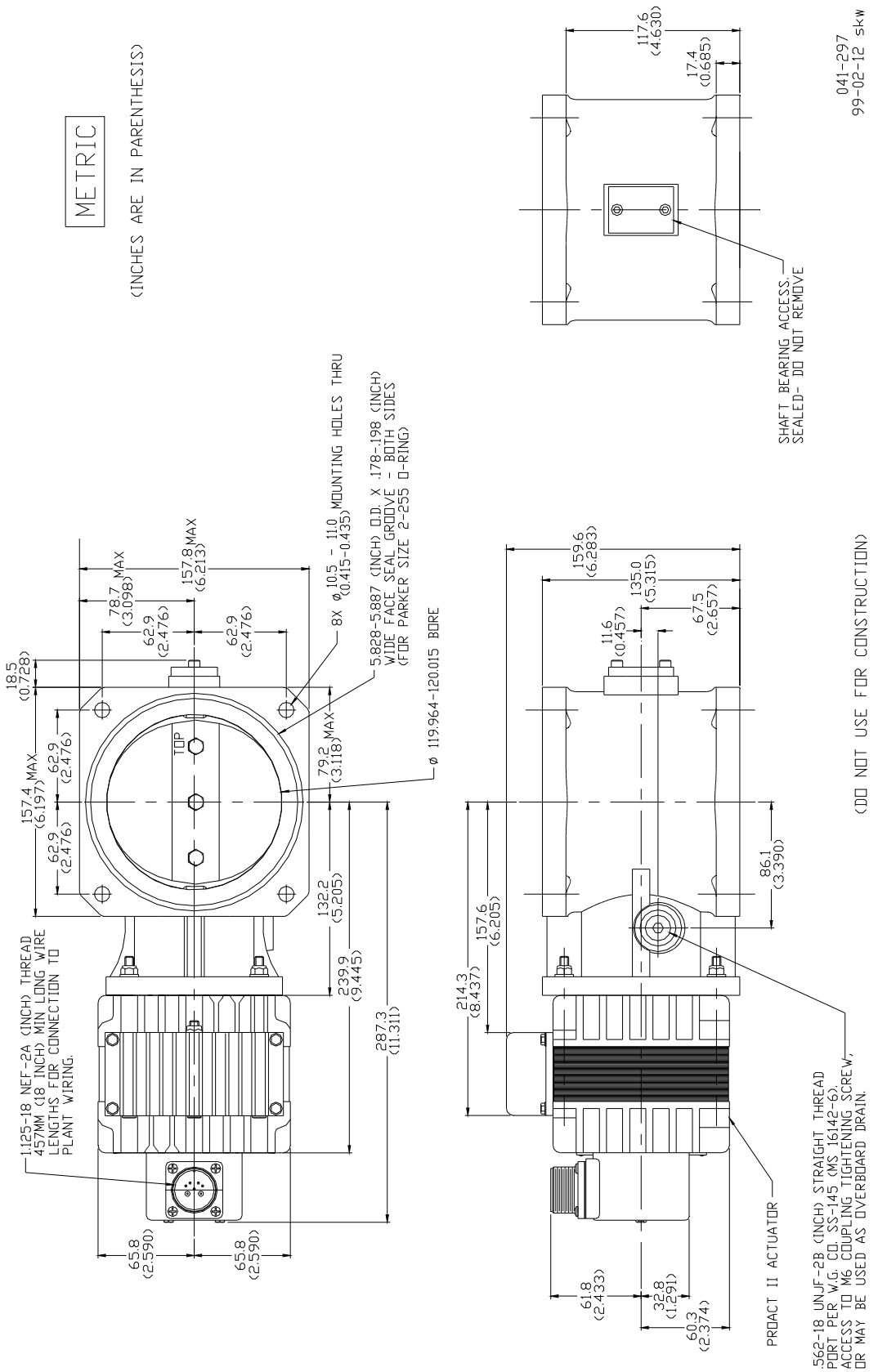

Figure 1-4. Outline Drawing of Flo-Tech 120 with ProAct II Actuator

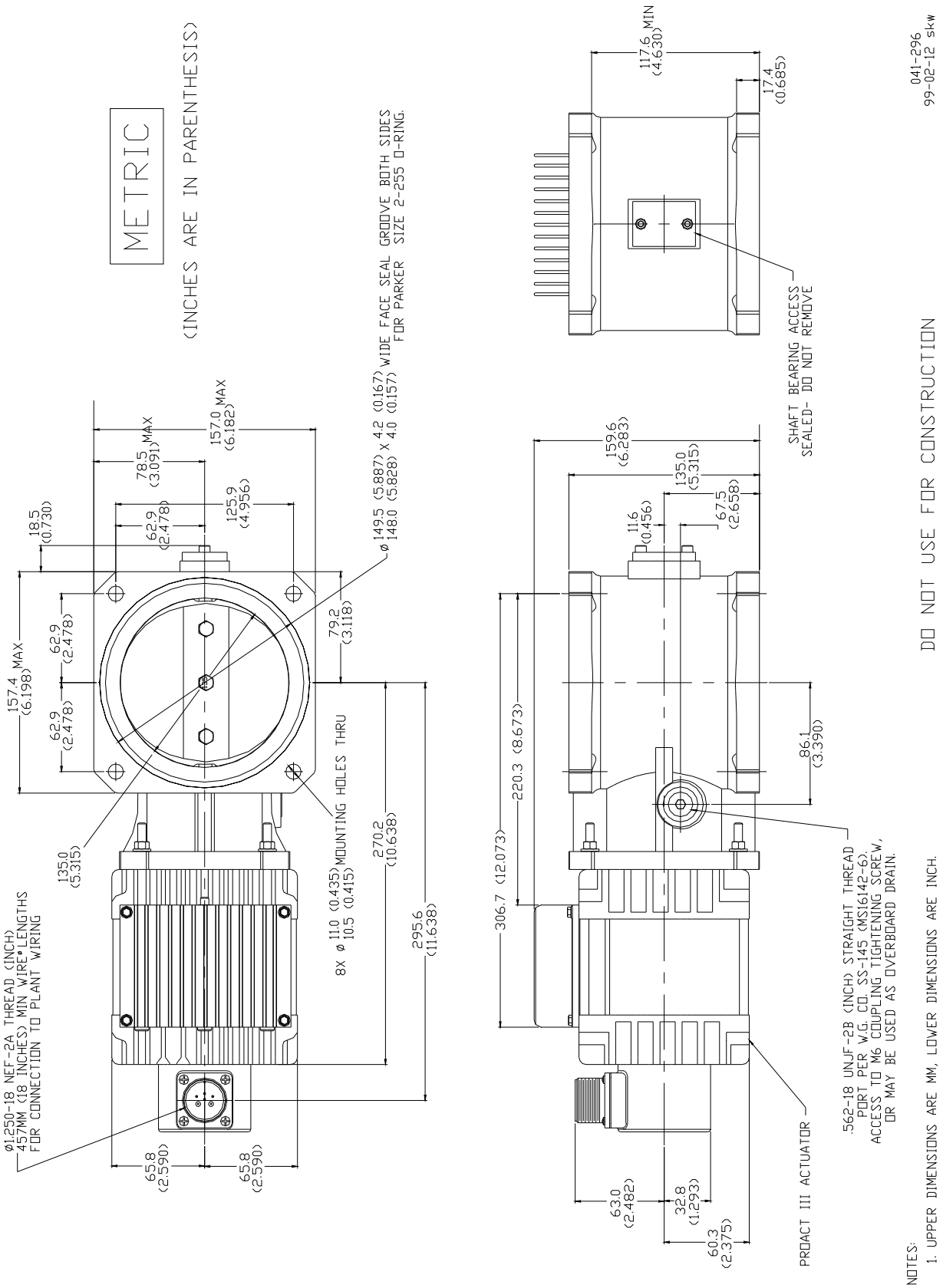

Figure 1-5. Outline Drawing of Flo-Tech 135 with ProAct III Actuator

Chapter 2. Installation

Unpacking

Be careful when unpacking the electronic driver. Check the driver for signs of damage, such as bent or dented panels, scratches and loose or broken parts. Notify the shipper and Woodward if damage is found.

Mounting

For driver mounting instructions, wiring, and thermal considerations regarding the actuator, refer to the ProAct™ Actuator manual installation procedure.

Locate the appropriate O-rings (specified on the outline drawing) in the grooves on both sides of the valve body. Install the four M10 or 3/8” bolts on both flanges and tighten evenly to a torque recommended by the engine manufacturer. The relationship between the valve body and the actuator has been pre-set by Woodward, therefore *no* adjustments are required by the end user.

The overboard drain connection is not required to be used by the end user but is included as an option. This feature is useful if the end user is concerned about gas leakage across the shaft seal. Normally, this leakage will be non-existent or minimal. However, if there is appreciable seal wear due to extended use or contamination, some leakage may occur.

Two common methods for handling gas leakage when using the overboard drain feature are:

- Venting of this chamber back to a fitting in the intake system upstream of throttle valve
- Venting to a natural gas detection device

If the overboard drain feature is to be used, make this connection using a fitting suitable for a –06 straight thread port with O-ring.

Chapter 3. Troubleshooting

Introduction

Improper engine operation is often the result of factors other than governor operation. The following paragraphs are provided to give tips about engine problems which can resemble governor problems. Make sure the engine is operating correctly before making any changes in the governor.

Attempting to correct engine or load problems with untimely governor adjustment can add to the problems involved with solving improper operation.

Most governor problems are corrected by carefully repeating the calibration procedure given in the governor manual. There are no adjustments available within the valve.

If possible, isolate the governor from the engine to determine if the problem is with the governor and not with the engine or the load on the engine.

Governor system faults are usually caused by problems in the installation. Carefully review all the wiring connections, the power supply, and the Flo-Tech™ actuator before making any adjustments to the control box. The throttle valve should be considered as a possible control problem if it was not removed during installation.

Fuel supply, pressure regulators, carburetors, and ignition conditions can present problems which resemble governor problems.

When the Governor is at Fault

If the engine will not start, the following problems may exist:

- Verify that any “open for shutdown” contacts are closed.
- Make sure the start fuel limit is not preventing adequate air flow.
- Verify that the 12 or 24 volt power supply is present at the appropriate governor terminals.

Stability Problems

Stability problems not caused by the engine or gas pressure at the carburetor require careful following of the setup procedure provided in the governor manual. Follow every step when readjusting the control.

If the engine oscillates when cold and stabilizes when warm, make sure that the desired (usually idle) dynamics have been selected. Turn the selected dynamics gain pot slightly counterclockwise. Turn the stability pot slightly clockwise if required to maintain stability.

Magnetic Pickup

The MPU must provide a minimum pulse signal of 1 volt to the control . It is highly unusual for an MPU to fail if it is properly installed. The most common failure is due to the pickup being screwed in too far and hitting the gear it is sensing. If the MPU does not produce the required signal, check the installation to make sure it is properly located on the sensed wheel. If the MPU is not close enough to the sensed gear it will not produce an adequate signal.

Several different sizes of MPUs are available to fit different size gears.

Check that the gear is of magnetic material, necessary to drive the MPU. Check the wiring from the MPU to the control.

Refer to Manual 82510, *Magnetic Pickups and Proximity Switches for Electric Governors*, for more information about required gear shapes, sizes, and surface speeds.

Note that the MPU generates a voltage signal when a tooth of the sensed gear breaks the magnetic field emitted from the tip of the pickup. The pickup does not require an excitation voltage from the control.

Chapter 4.
Product Support and Service Options

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (**EngineHelpDesk@Woodward.com**) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further course of action to pursue based on the available services listed in this chapter.

OEM or Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full-Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime.

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option, with the exception that the unit will be returned to you in "like-new" condition. This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:
- return number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:
- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

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*.

Replacement Parts

When ordering replacement parts for controls, include the following information:
- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact one of the Full-Service Distributors listed at **www.woodward.com/directory**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory published at **www.woodward.com/directory**.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used In Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Products Used In Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used In Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

For the most current product support and contact information, please visit our website directory at **www.woodward.com/directory**.

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number

Prime Mover Information

Manufacturer _____

Engine Model Number _____

Number of Cylinders _____

Type of Fuel (gas, gaseous, diesel, dual-fuel, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.)

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number

Symptoms

Description _____

_____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

ProAct™ ITB Control Specifications

Woodward Part Numbers:	
8235-170	107 mm bore, 62.5 cm² flow area, ProAct II/conduit
8235-178	107 mm bore, 62.5 cm² flow area, ProAct II/MS
8235-171	120 mm bore, 81.2 cm² flow area, ProAct II/conduit
8235-177	120 mm bore, 81.2 cm² flow area, ProAct II/MS
8235-159	135 mm bore, 105.6 cm² flow area, ProAct II/conduit
8235-181	135 mm bore, 105.6 cm² flow area, ProAct II/MS
8235-172	135 mm bore, 105.6 cm² flow area, ProAct III/MS
8235-183	135 mm bore, 105.6 cm² flow area, ProAct III/conduit

Operating Temperature Range	–40 to 100 °C (–40 to 212 °F)
Storage Temperature Range	–55 to 125 °C (–67 to 257 °F)
Vibration Qualification Test Spec	Woodward RV2 (0.1 G2/Hz Random, 10–2000 Hz, 12.8 Grms – 3 hrs per axis)
Shock Qualification Test Spec	40G, 11 ms sawtooth pulse
Weight	15.2 kg (33.5 lbs)

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 04166.

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Email and Website—www.woodward.com

**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.

2012/9/Colorado