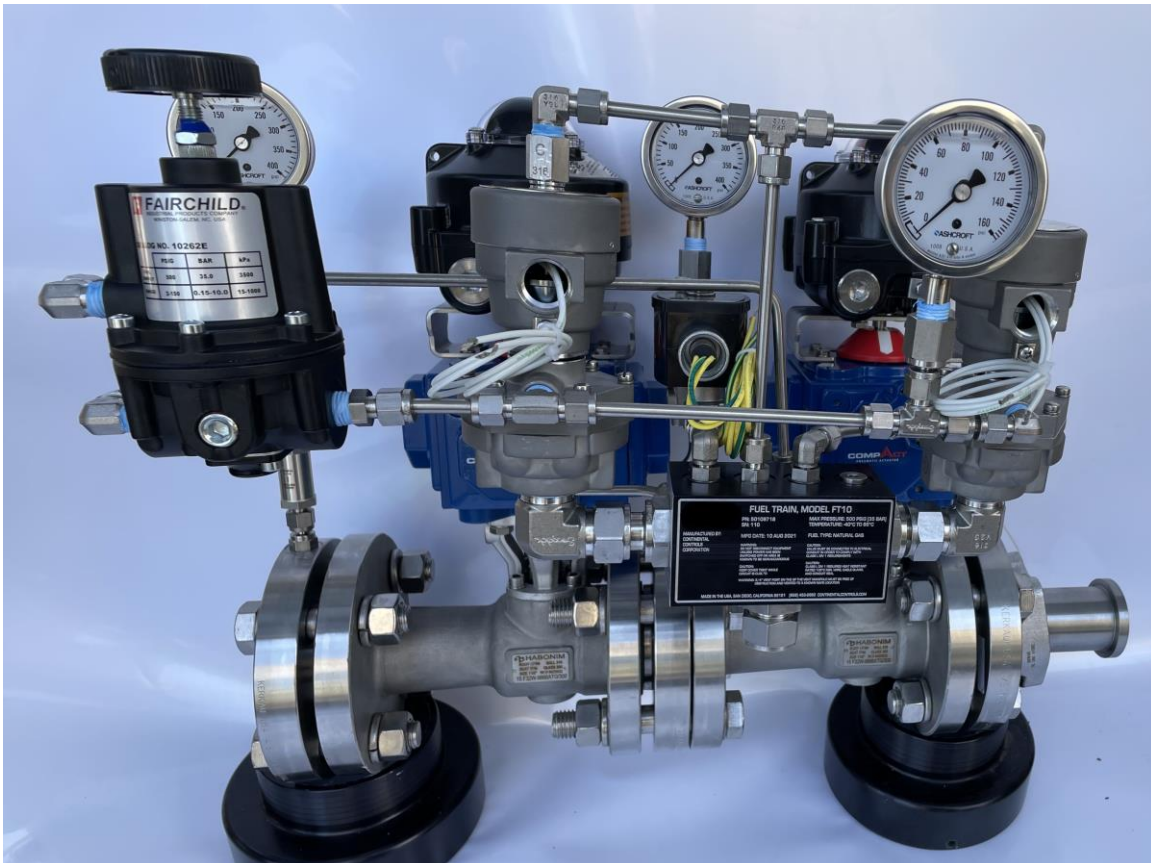


Installation and Operating Manual

Fuel Train Model FT10, FT50 & DLE



II 2 G
Ex d IIA T4 Gb



0036



Class I, Div 1, 2, Group D: T4

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1 Introduction

1.1 General Description

This manual provides instruction and maintenance information for the Fuel Train model FT10 and FT50.

It is highly recommended that the user read this manual in its entirety before commencing operations. It is the policy of Continental Controls Corporation that it is neither our intention nor our obligation, to instruct others on how to design or implement engine control systems. Continental Controls Corporation will not assume responsibility for engine controls not designed or installed by our authorized representatives.

This manual is intended to help the end user install and operate the Fuel Train model FT10 and FT50 in the manner in which they were intended and in a way to minimize risk of injury to personnel or damage to engine or equipment.

Do **NOT** attempt to operate, maintain, or repair the Fuel Train until the contents of this document have been read and are thoroughly understood.

Every attempt has been made to provide sufficient information in this manual for the proper operation and maintenance of the Fuel Train model FT10 and FT50.

All information contained within shall be considered proprietary information and its release to unauthorized personnel is strictly prohibited.

If additional information is required, please contact:

Continental Controls Corporation
7720 Kenamar Ct, Suite C
San Diego, CA, 92121
(858) 453-9880

1.2 Overview

This manual is designed to describe the installation and operation of the Fuel Train model FT10 and FT50 on gas engines.

The combination of a sophisticated mechanical design with the advanced electronic design and on-board microprocessor along with the elegant software integration combines to provide the best available control technology for controlling gas engines.

2 Safety Warning

2.1 General Description

The Continental Controls Fuel Train is used with natural gas. Natural Gas and Air, when combined, the mixture becomes very combustible. When contained within an enclosure, such as a gas turbine engine or its exhaust system can explode in a violent manner when ignited. It is necessary to always use extreme caution when working with any fuel system.

- When installing the Fuel Train in a class I division 1 group D or EEx d IIA T4 environment; heat resistant rating of 105°C min Cable, Cable Gland, Conduit Seal, and Conduit Wires must be used at the ½ NPT threaded opening. Installation of all electrical Equipment will be in compliance with the National Electric Code (NEC). The customer is responsible for termination wires into the Isolation Solenoid Valve terminals.
- Use fasteners with yield stress greater than 3.45MPa.
- The equipment may be used with flammable gases and vapors with apparatus groups IIA and with temperature class T4 in the ambient temperature range -40 and +85°C (-20 and +85°C for ATEX).
- The equipment is only certified for use in ambient temperatures in the range -40 and +85°C (-20 and +85°C for ATEX) and should not be used outside this range.
- Installation shall be carried out by suitably trained personnel in accordance with the applicable code of practice e.g. EN 60079-14:2007.
- Inspection and maintenance of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice e.g. EN 60079-17:2007.
- Repair of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice e.g. EN 60079-19:2011.
- Putting into service, use, assembling, and adjustment of the equipment if applicable shall be detailed. Drawings and/or diagrams must be included if they are necessary to complete these tasks.
- Components to be incorporated into or used as replacement parts of the equipment shall be fitted by suitably trained personnel in accordance with the manufacturer's documentation.
- If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.
- Do not disconnect equipment unless power has been switched off and area is known to be non-hazardous.

- Open circuit before removing cover.
- Sealing devices must be used and shall be fitted directly at enclosure wall when using conduit.
- Cable glands shall be suitable for the environment and shall be certified as flameproof if used in Division 1 application to connect outside electric wire.
- NPT cable glands and conduit to be installed minimum 5 full.
- Select the appropriate cable glands for the number of 18AWG (minimum) conductors.
- When cable entries or conduit entries are not used, user or installer shall close by certified blanking
- Always ground the enclosure in accordance with local electric codes. The most effective enclosure grounding method is a direct connection to earth ground with minimal impedance.

Methods for grounding the enclosure include:

Internal ground connection: The internal ground is located inside the body.

External ground connection: The ground bracket is located on the side of the body. (Min 18AWG wire required)

- Fire and gas detection monitoring system must be present on the turbine skid. It's the responsibility of the end user to have both the Fire and gas detection monitoring system per the turbine manufacturer.
- Although the Fuel Train is pressure tested for leaks at the factor, it's highly recommended after installation of the fuel train, to leak the test the Fuel Train on the engine skid for any possible loose connection that might have occurred during the handling.
- All Vent lines must be vented to a known safe location.
- Assure that the actuator is isolated from the air supply or electrical ancillaries before attempting to perform any maintenance.
- Before disconnecting the actuator from a valve, always be sure the line has been depressurized and drained. Cycle the valve a few times to relieve any pressure that could be trapped in the body cavity.
- Utmost caution must be taken when handling the actuator. Only trained and qualified maintenance personnel who have read these instructions should disassemble or assemble the actuator.
- Before operating an actuator which is connected to a valve in the pipeline make sure you know the valve function.
- Do not attempt to remove the actuator pistons by use of air pressure when the covers have been removed.

- Do not leave any grip key or shaft connection attached to the actuator or try to manually operate the actuator while it is still connected to the air pressure.
- Use the actuator within the pressure and temperature limits indicated on the nameplate or as specified in the product catalogue and IOM.
- The operator must follow and observe any national or local safety laws and regulations.
- Any product warranty will be invalidated in the case of improper operation resulting from misapplication or faulty maintenance.
- The warranty does not cover hi- cycle installations. Hi cycle applications are defined as 1 cycle/minute on average measured on an hourly basis.
- Every 500,000 cycles you should replace all the soft parts of the actuator with original Repair Kits.

Failure to follow the above rules may lead to possibly serious damage to equipment or injury to personnel!

3 Fuel Train FT10 / FT50

3.1 General Description

The Fuel Train isolation valve provides shutdown on a gas turbine by rapidly halting the flow of gaseous fuel. The supply pressure is used to move a spring-loaded piston in the valve. When the valve is energized, gas pressure drives the spring-loaded piston open, admitting fuel to the turbine. When the current signal to the electrical solenoid is interrupted, the spring loaded second-stage piston changes states to vent off primary control pressure. The main spring then forces the primary piston to the seal, stopping all flow. The pneumatic valve, pilot valve for pneumatic and ¼" vent valve are normally closed valves.

3.2 Application

The Fuel Train FT10 and FT50 are designed to provide extremely fast shutoff of gaseous fuel flow to an industrial gas turbine engine. Gas flow is stopped when the valve is closed, or when pilot pressure is removed, with zero leakage from inlet to outlet. It is suitable for operation with gas temperatures between -40 and +85°C (-20 and +85°C for ATEX).

The valve can achieve ANSI Class IV shut-off capability. Normally-closed valve may be used for emergency and normal shut own operation. Stainless steel construction assures availability of the valve despite corrosive service conditions or even catastrophic fire.

This product is suitable for use on industrial turbines up to 5820 hp output (FT10) and for 38,000 hp output (FT50) range with single or multiple combustion fuel manifold systems.

3.3 Hardware

It is highly recommended that the user read this manual in its entirety before commencing operations. It is the policy of Continental Controls Corporation that it is neither our intention nor our obligation, to instruct others on how to design or implement engine control systems. Continental Controls Corporation will not assume responsibility for engine controls not designed or installed by our authorized representatives.

Fuel Train FT10

Fuel Train FT10 is 1 ½" pipe fuel train with double block and bleed technology for Gas Flow Control Valve Model AGV10.

Fuel Train FT50

Fuel Train FT50 is 2" pipe fuel train with double block and bleed technology for Gas Flow Control Valve Model AGV50.

DLE FT10

Dry Low Emission Fuel Train FT10 is 1 ½" pipe fuel train with double block and bleed technology for Gas Flow Control Valve Model AGV10 Main and Pilot.

DLE FT50

Dry Low Emission Fuel Train FT10 is 2" pipe fuel train with double block and bleed technology for Gas Flow Control Valve Model AGV50 Main and Pilot.

Primary Shutoff Valve

Pneumatic actuator ball valve that provides positive gas shutoff. Failed closed when system pressure is lost.

Secondary Shutoff Valve

Pneumatic actuator ball valve provides positive gas shutoff. Failed closed when system pressure is lost.

Pneumatic Actuator Isolation Solenoid Valve

24VDC solenoid valve that provides pressure to operate the pneumatic actuators.

Isolation Solenoid Valve Pressure Regulator

Regulates pressure to the inlet of pneumatic actuator isolation valve at 115-135 psig. The inlet of the pressure regulator is equipped with inline 15 micron filter. As preventative maintenance, the filter must be checked. After inspection replace the filter if required. The filter part number is 50109809.

Vent Valve

24VDC normally open solenoid valve. When energized, it is in the closed position. When de-energized, the valve is in open position.

Exhaust Manifold

Vents from pneumatic actuators, pneumatic actuator isolation solenoid valves and vent valve are connected into the block and provides 3/4" single exhaust port to a known safe location for venting.

Limit Switch

Both primary and secondary pneumatic actuator ball valve are equipped with limit switch with SPDT contacts (16A@125/250VAC, 10A@30VDC, 0.6A@125VDC)

Pressure Gauge

The fuel train is equipped with analog liquid filled pressure gauges to provide visual indication of gas pressure to the system and out of the system.

Fuel Control Valve Pilot Stage Filter

The fuel train is equipped with 10 micron coalescing filter to provide clean gas pressure to the pilot stage of the AGV10 / AGV50. As preventative maintenance, the filter must be checked. After inspection replace the filter element if required. The filter element part number is 50109169.

3.4 Specifications

	Performance:	Closing Time Within 0.200 second
Operating Conditions / Environment		
	Chemical Compatibility:	NACE Compliant for all typical gas fuels
	Fuel Temperature:	-40 °C to +85 °C
	Ambient Temperature:	-40 °C to +85 °C
	Fuel Types:	Natural Gas, Propane, Ethane, Methane
	Fuel Train Supply Pressure:	Normal Operation 150 to 500 psig
	Pneumatic Isolation Valve Reg. Pressure:	Normal Operation 80 to 95 psig
	Fuel Solid Particle Contaminant:	<10 µm diameter, 30 ppm by volume
	Pilot Filtration:	10 µm
Isolation Solenoid Valve Electrical Specifications		
	Voltage Available:	24 Vdc, 2 amps
	Wiring Interface:	½-14 NPT Conduit Entry
Vent Valve Electrical Specifications		
	Voltage Available:	24 Vdc, 1 amp
	Wiring Interface:	½-14 NPT Conduit
Limit Switch Specifications		
	Contacts:	SPDT (16A@125/250VAC, 10A@30VDC, 0.6A@125VDC)
	Wiring Interface:	3/4-“ NPT Conduit Entry
Mechanical Specifications		
	Inlet:	1-1/2” or 2” socket weld flange per ANSI B16.5; 600 lb
	Outlet:	SAE Series 61, 1-1/2” or 2” 4-bolt flange
	Pneumatic Valve Status:	Normally Closed
	Pneumatic Isolation Valve Status:	Normally Closed
	¼” Vent Valve Status:	Normally Open
	Weight:	FT10 = 120 lbs; FT50 = 135lbs
Regulatory Compliance		
	CSA:	CSA Certified for Class I Div 1 and Div 2, Groups C & D, T4
	ATEX:	Declared to 94/9/EEC
	PED:	PED 97/23/EC module H
	API:	API 607, ISO 10497
	Safety Integrity Level (SIL):	IEC 61508-2 SIL 2/3
	Valve Design:	ANSI B16.34, API 6D / ISO 14313, ISO 17292
	H2S:	NASE MR-0175, ISO 15156-1/2/3

4 Installation

4.1 General Description

It is highly recommended that the user read this manual in its entirety before commencing operations. It is the policy of Continental Controls Corporation that it is neither our intention nor our obligation, to instruct others on how to design or implement engine control systems. Continental Controls Corporation will not assume responsibility for engine controls not designed or installed by our authorized representatives.

4.2 Initial Inspection

The Fuel Train should be inspected immediately after unpacking. Check for any damage that may have occurred during shipping. If there are any questions regarding the physical integrity of the valve and requires repairs and services, call Continental Controls immediately.

NOTE: If possible, keep the original shipping container. If future transportation or storage of the Fuel Train is necessary, this container will provide the optimum protection.

- Always provide an adequate supply pressure for the application.
- Always provide good filtration to the Fuel Train. Dirty fuel would cause the valve not to work properly and could damage the internal components.
- Supply the valve with 24Vdc with 3 amps at the isolation solenoid valves and vent valve. Using small gauge wire may cause a large voltage drop resulting in inadequate power at the valve. Local NEC guidelines must be followed for any wiring connections
- Do not install the valve in such a manner where condensate may build up inside the isolation solenoid valve electronics housing.

4.3 General Considerations

When considering where to place the Fuel Train it is recommended that several issues be kept in mind.

- The Fuel Train should be located away from any extreme sources of heat. Operating ambient temperature is -40°C to $+85^{\circ}\text{C}$ [-20°C to $+85^{\circ}\text{C}$ for ATEX]. Temperatures higher than this will require special precautions from the manufacturer. However, if the temperature of the fuel gas is $< 85^{\circ}\text{C}$, this will act as a heat sink and the valve may then be mounted in extreme temperature environments.
- Supply gas temperature will not influence the flow of fuel through the acceptable operating temperature range of the valve (see above). If the fuel gas temperature is anticipated to exceed 85°C , the fuel valve will need to be modified by the manufacturer.
- Pressure variation in the fuel supply does not affect the gas flow through the valve, providing that the pressure does not drop below the minimum required for that fuel flow.

Vent Valve (1/4" Solenoid Valve)

ASCO valve is a direct acting normal open solenoid valve. At 24 VDC the solenoid consumes 1 amp of power. The valve is supply 1/2 conduit entry with lead wires.

Wire Color	Function
Green	+24 VDC
Green	24 VDC Common
Green / Yellow	Frame ground

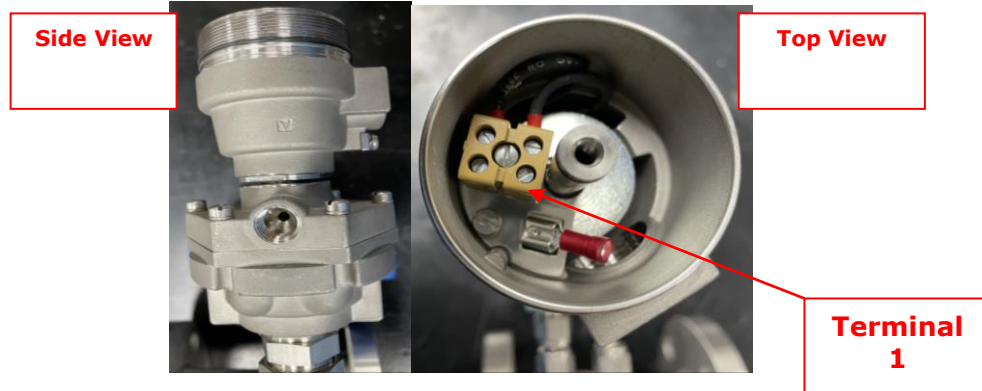
*+24 VDC power can be applied to any of the 2 green lead wires.

Isolation Solenoid Valve (For Pneumatic Actuator)

Versa 3 port, 2 position direct acting pneumatic valve that is normally closed. At 24 VDC the solenoid consumes 1 amp of power. The valve is supply 1/2 FNPT conduit entry with 18" lead wires. The

Wire Color	Function
Terminal 1 (White Lead Wire)	+24 VDC
Terminal 2 (White lead Wire)	24 VDC Common
Red Spade Terminal	Frame ground

*+24 VDC power can be applied to any of the 2 green lead wires.



5 Preventative Maintenance

5.1 General Description

The Fuel Train has been designed to operate reliably with a minimum amount of maintenance. To ensure optimum performance, periodic inspection and cleaning is necessary.

Preventative maintenance issues can be integrated into the current maintenance schedule of the turbine engine. Most maintenance requires little effort and no downtime of the Fuel Train.

5.2 Cleaning

Exterior cleaning will aid in the visual inspection of the external casing and ensure good connections. Ethyl alcohol or mild soapy water can be used as cleaning agents. It is recommended that the valve be cleaned every 60 days. If environmental conditions are extremely dirty, more frequent cleaning will be necessary.

5.3 External Pilot Gas Filter

The pilot gas filter, if installed, should be changed every six (6) months or more frequently if operations if necessary. A replacement filter (part no. 50109169) may be ordered from Continental Controls.

5.4 Isolation Valve Pressure Regulator Inline Filter

The isolation solenoid pressure regulator inline filter should be inspected every six (6) months or more frequently if operations if necessary. A replacement filter (part no. 50109809) may be ordered from Continental Controls.

5.5 Limit Switch

Maintenance, under normal conditions at six-month intervals or 10,000 cycle operation. When conditions are more severe, more frequent inspections may be required.

- Insure valve actuator alignment
- Ensure wiring is insulated, connected and terminated properly
- Ensure all screws are present and tight
- Ensure cleanliness of internal electrical devices
- Ensure conduit connections are installed properly and are dry
- Check internal devices for condensation
- Check enclosure O rings seals and verify that the O ring is not pinched between housing
- Visually inspect during open/close cycle
- Inspect identification labels for wear and replace if necessary

5.6 Pneumatic Actuator

SIL

Under normal operating conditions the valve should be inspected for proper functioning and signs of deterioration every 50,000 cycles or 6 months (whichever comes first). Under

severe operating conditions inspection should be more frequently; detected defects should be repaired promptly. Severe operating conditions can be defined as:

- Application temperature less than -20 deg C
- Application temperature higher than +230 deg C
- Flow velocity higher than 5 m/sec for liquids, and 200 m/sec for gaseous
- Acidic media PH < 5 or alkaline media PH > 9

It's recommended a proof test interval of 12 months; in case of Fail to Open ESD system, a partial stroke is acceptable to confirm that the installation is functioning properly. For ESD systems with a Fail-To-Close demand, it is necessary to plan a system shut-down; de-energize the system and inspect the valve turning to its fully closed position. It is essential to log-in the following parameters on site QA records as proof for preserving SIL capabilities: date, hour, name and signature of the responsible engineer, air pressure on site, time to close the valve, time to open the valve. The manufacturer recommends valve full maintenance operation every 500,000 cycles or 4 years, whichever comes first (refer to Para. 7 in this IOM for maintenance instructions). The combined corrosion and erosion allowance for the valve body wall thickness is 1 mm. When this allowance has been eroded or corroded, mechanically removed or otherwise, the valve should no longer be used. Inspect the valve wall thickness every time the valve is maintained. The estimated mean time to repair (MTTR) a valve, i.e. time net (line draining or cooling down time excluded from the valve MTTR) of replacing old valve with a new one is 60 minutes. When a valve has been repaired or any maintenance was performed, check the valve for proper function (proof testing).

5.6 Vent Valve (¼" Solenoid Valve)

Keep the medium flowing through the valve as free from dirt and foreign material as possible. Periodic exercise of the valve should be considered if ambient or fluid conditions are such that corrosion, elastomer degradation, fluid contamination build up, or other conditions that could impede solenoid valve shifting are possible. The actual frequency of exercise necessary will depend on specific operating conditions. A successful operating history is the best indication of a proper interval between exercise cycles. Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

6 Troubleshooting

6.1 Limit Switch

The following instructions are offered for the most common difficulties encountered during installation and start-up.

Signal fails to main control room.

- Check the wiring of limit switch box in accordance with wiring diagram.
- Check where the cams or switches are damaged or broken.
- Check the main signal wire from the terminal strip.
- Re-set the limit switch box.
- Verify the current position transmitter resistance value.
- Check potentiometer gear jamming.
- Check the zero and span calibration.
- Check the card damaged or not.

Tools

- 1 Set Metric Allen Key (Hex Wrench)
- Set Screw Drivers
- 1 Set Metric Spanner
- 1 Wire Stripper long Nose
- 1 Needle nose plier
- 1 Multi Meter (AC, DC, Resistance)

6.2 Vent Valve (¼" Solenoid Valve)

Incorrect Pressure: Check valve pressure. Pressure to valve must be within range specified on name plate. Excessive Leakage: Disassemble valve (see Maintenance) and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly

- Disassemble valve using exploded views for identification of parts.
- Remove solenoid, see separate instructions.
- Unscrew solenoid base sub-assembly with wrench. Remove core assembly, core spring, and solenoid base gasket from valve body.
- For normally open construction remove spring, and disc holder assembly.
- All parts are now accessible to clean or replace. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Reassembly

- Use exploded views for identification, orientation and placement of parts.
- Lubricate all gaskets with DOW CORNINGr200 Compound lubricant or an equivalent high-grade silicone oil.
- For normally open construction, install disc holder assembly and disc holder spring.
- Replace solenoid base gasket, core assembly with core spring and solenoid base sub-assembly. Note: For core assemblies with internal type core springs, install wide end of core spring in core assembly first, closed end of core spring protrudes from top of core assembly.
- Torque solenoid base sub-assembly to 175 ± 25 in-lbs [$19,8 \pm 2,8$ Nm].
- Install solenoid. See separate solenoid instructions. Then make electrical hookup to solenoid.

7 Warranty

7.1 Warranty

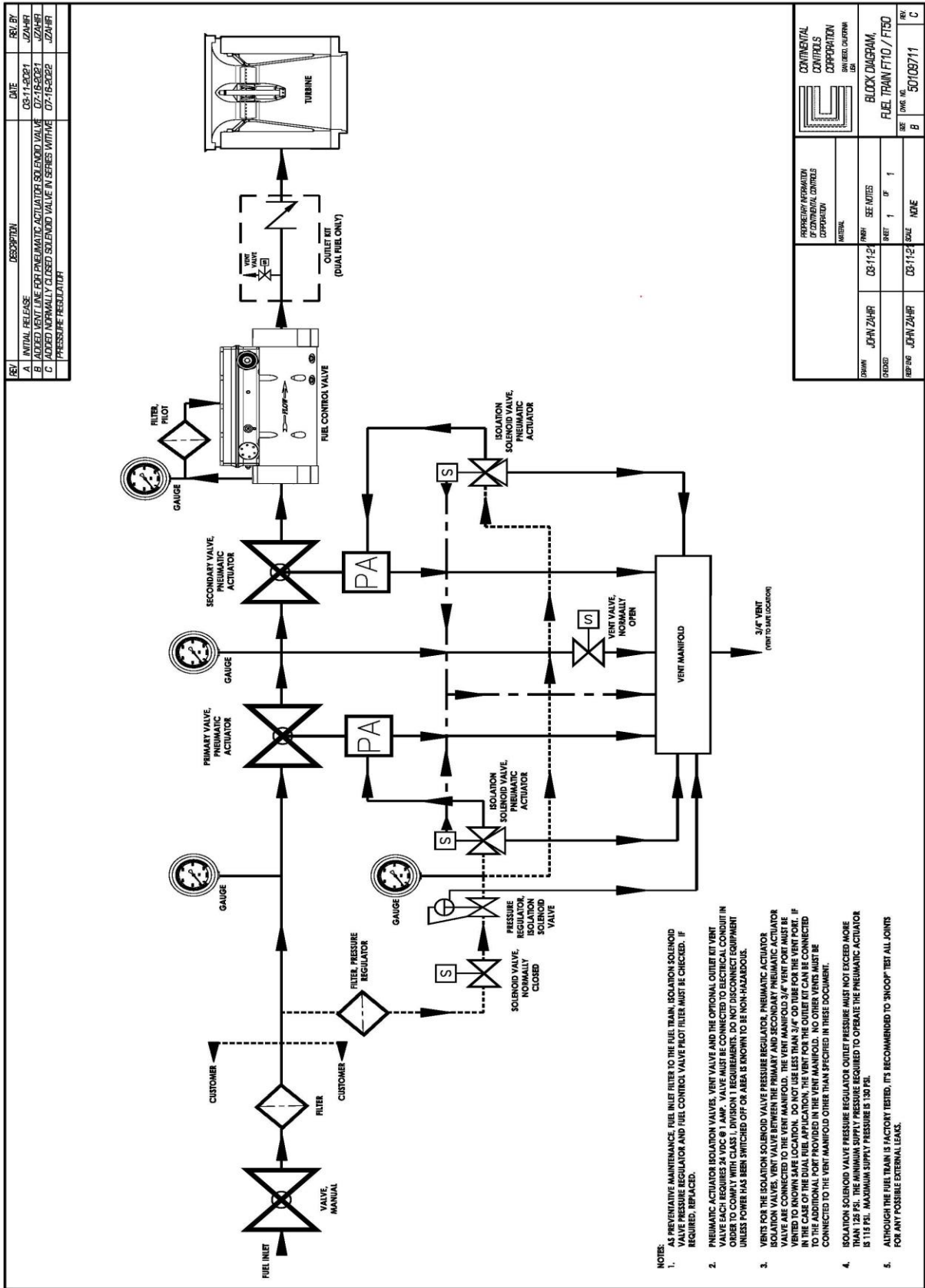
Continental Controls Corporation warrants that all goods furnished by CCC are free from defects in workmanship and material as of the time and place of delivery.

As a matter of general warranty policy, CCC honors an original buyer's warranty claim in the event of failure within 12 months of shipment to the end-user, when the equipment has been installed and operated under normal conditions and in accordance with installation instructions contained in the operating manual and generally accepted operating practices.

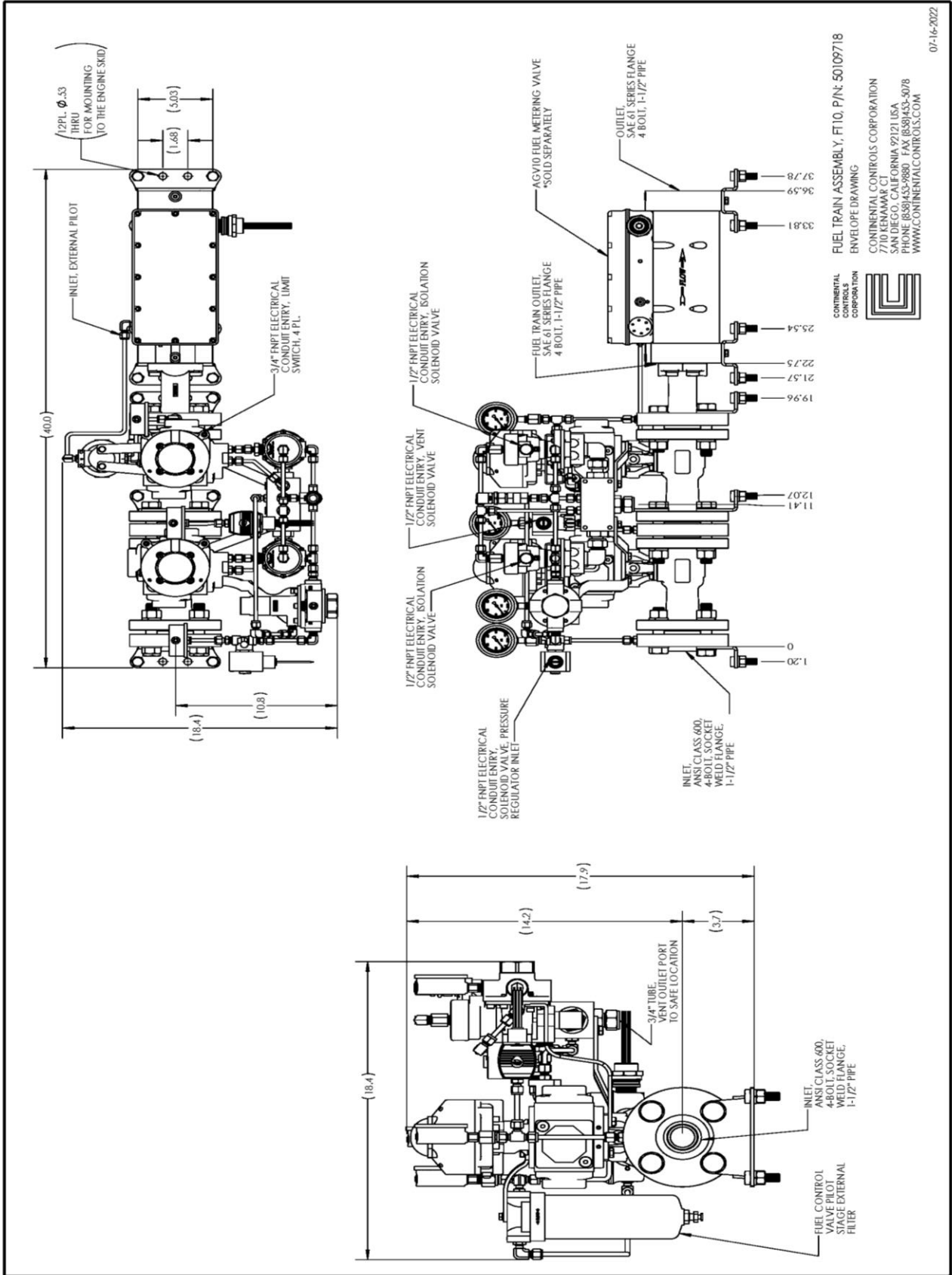
All warranty work must be performed and CCC's manufacturing facility in San Diego. The customer is responsible for shipment or delivery of the product to the CCC facility. CCC will pay return ground freight. The customer will pay any expedited freight fees.

8 Block Diagram & Envelope Drawings

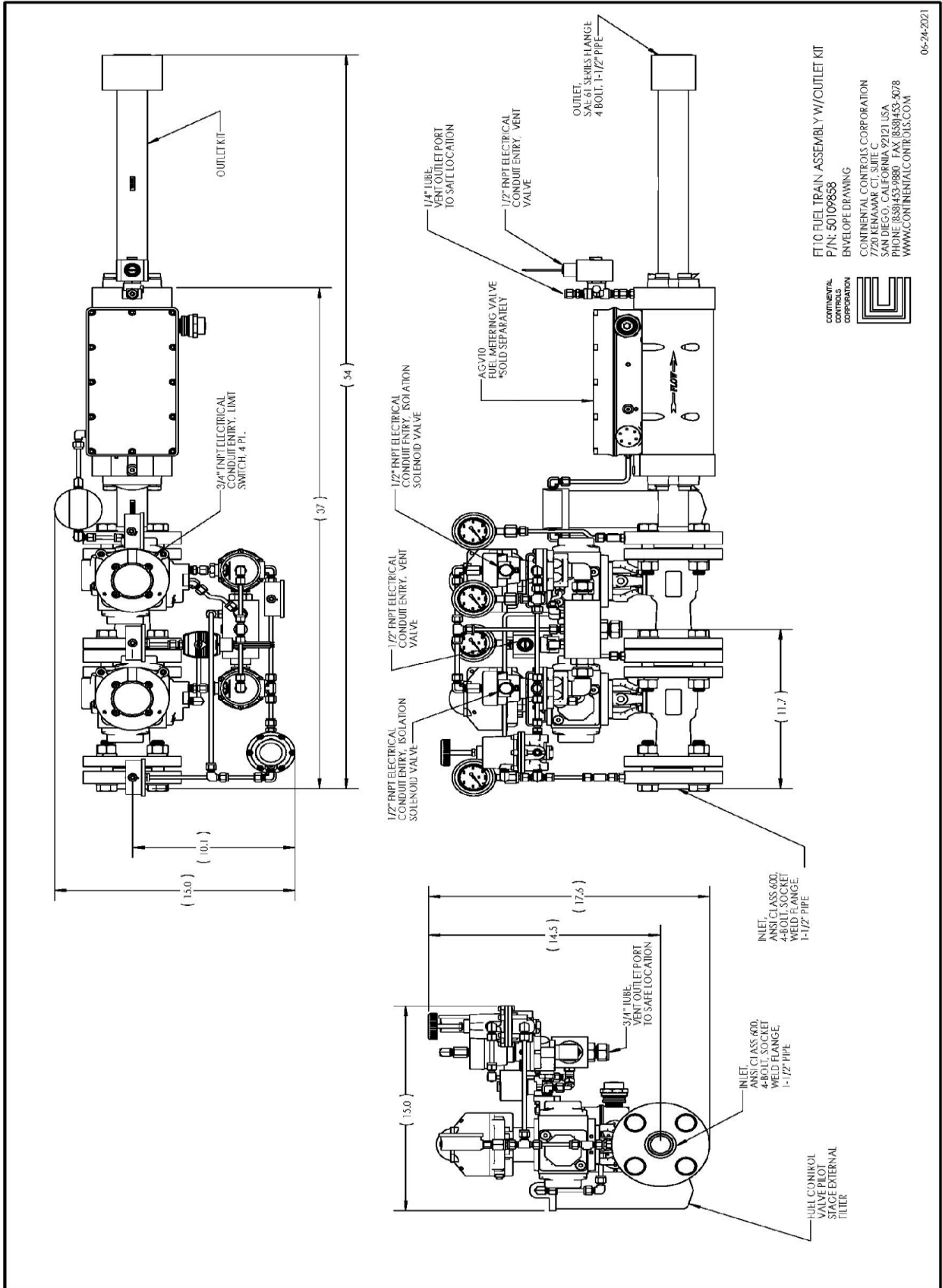
8.1 Block Diagram



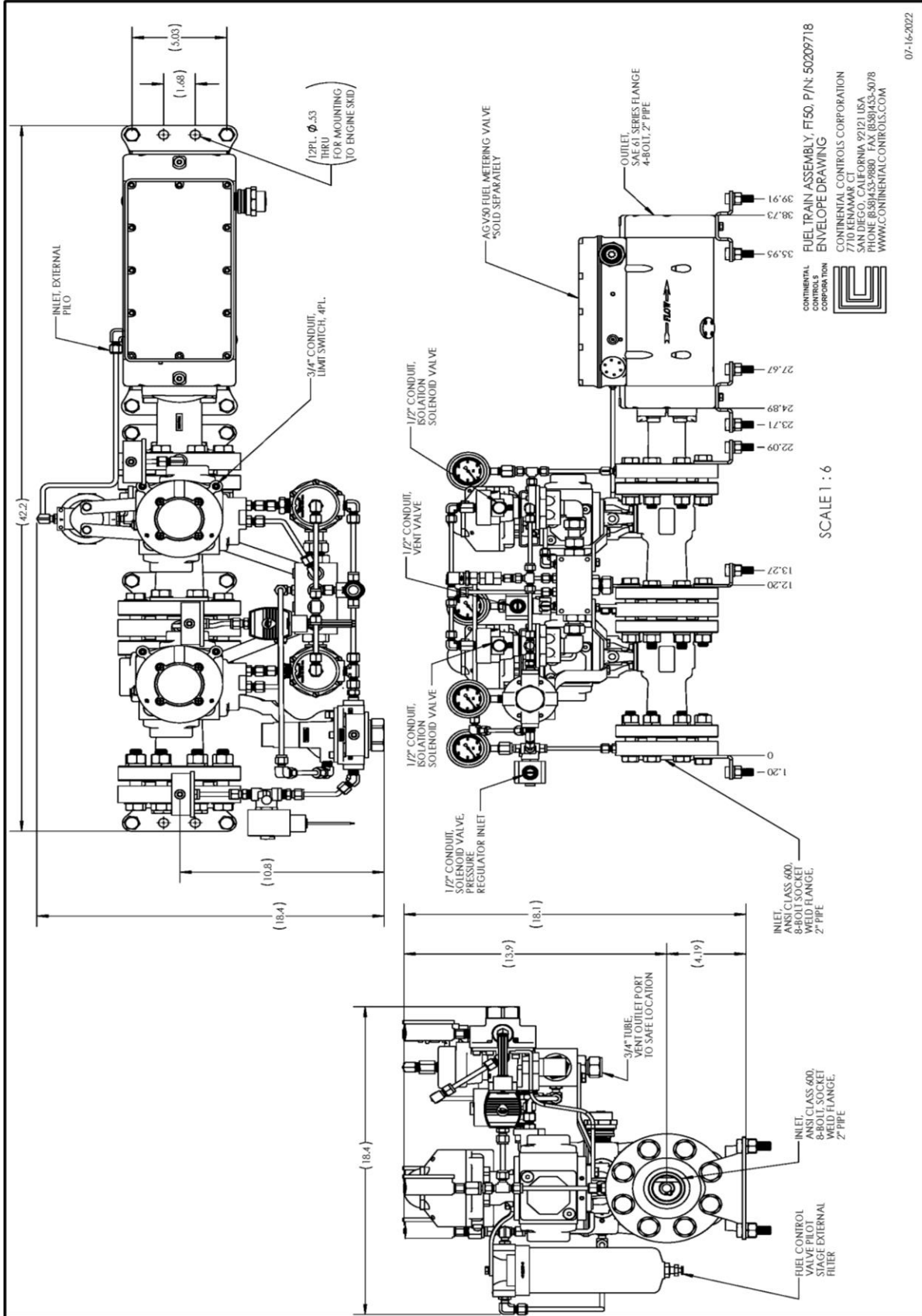
8.2 Fuel Train Model FT10



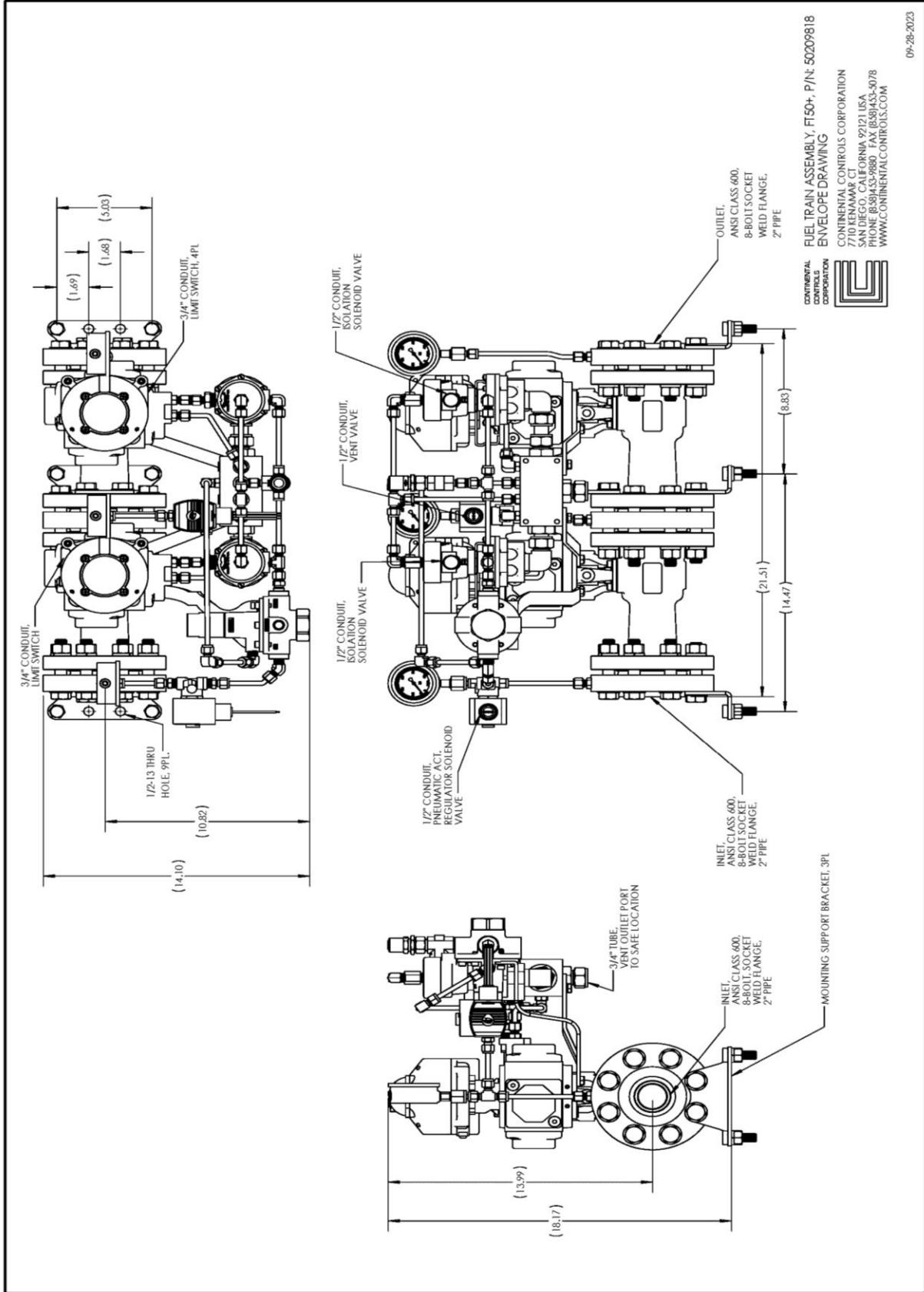
8.3 Dual Fuel Train FT10



8.5 Fuel Train Model FT50

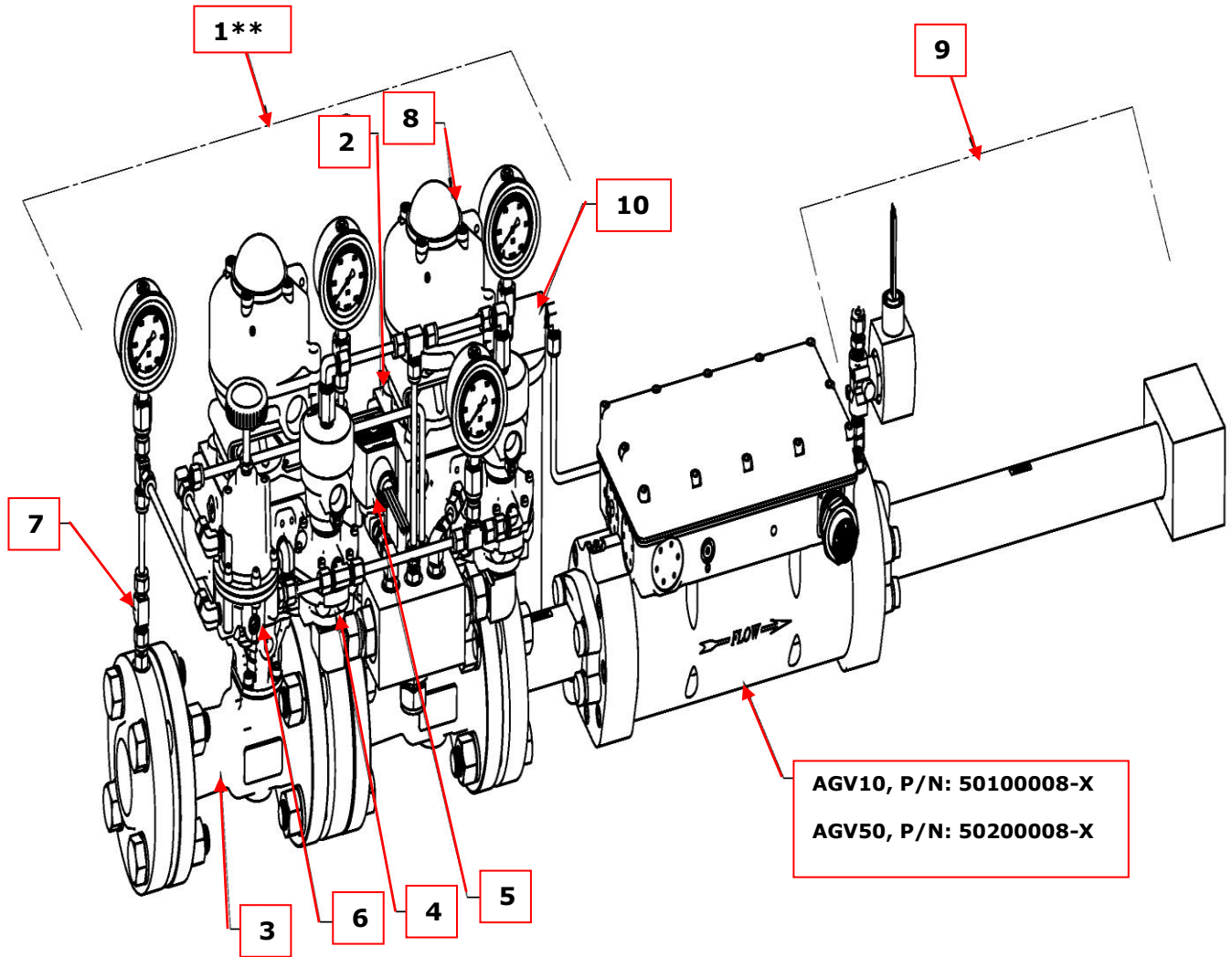


8.6 Fuel Train Model FT50+



9 Part Numbers

Below is the list of part numbers for the Fuel Train model FT10, DLE FT10, FT50, DLE FT50. Some spare parts are common between each type of fuel trains. If items that is not listed below are required, contact Continental Controls Corp for further assistance.



Item #	Part Number	Description
1**	50109718	Fuel Train, Model FT10
1**	50109708	DLE (DRY LOW EMISSION) FT10
1**	50209718	Fuel Train, Model FT50
1**	50209708	DLE (DRY LOW EMISSION) FT50
2	50109719	VALVE, PNEUMATIC, METRIC SEAL, FIRE-SAFE, 1 1/2" SERIES ANTI-STATIC
3	50109729	VALVE, PNEUMATIC, 1 1/2" BALL
4	50109739	ISOLATION SOLENOID VALVE, 1/4" FNPT, NORMALLY CLOSED, 24 VDC, PNEUMATIC VALVE
5	50109789	VALVE, DIRECT ACTING, 1/4" FNPT, NBR SEAL, 24 VDC, NORMALLY OPEN, 2-WAY, CLASS I DIVISION 1 EXPLOSION PROOF, S.S.
6	50109799	REGULATOR, PRESSURE, 0-150 PSIG, 1/4" FNPT, ISOLATION SOLENOID VALVE
7	50109809	FILTER, INLINE, 1/4" TUBE, 15 MICRON, ISOLATION VALVE PRESSURE REGULATOR
8	50109819	LIMIT SWITCH, PNEUMATIC ACTUATOR
9	50109818	KIT, OUTLET, AGV10
10*	50109089	FILTER ELEMENT, EXTERNAL PILOT
10*	50109099	FILTER, EXTERNAL PILOT
11	50209729	VALVE, PNEUMATIC, 2" BALL