# Installation, Operation and Maintenance Manual
# Steady State Fuel Systems (SSFS)

***Reliability Made Simple***

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**DOCUMENT FORMAT & USE NOTES**

This manual is authored as a **controlled master document** intended for formal issuance and professional use.

**Authorized Issuance Formats**

This document may be issued in the following standalone formats without modification of technical content:

1. **Master Installation, Operation & Maintenance Manual (IOM)**
   Audience: Owners, Operators, AHJs, Commissioning Agents
2. **Engineering Submittal Package**
   Content Source: Appendix E
   Audience: Engineers of Record, Plan Reviewers, Lenders
3. **Distributor Installation Handbook**
   Content Source: Appendix F
   Audience: Authorized SSFS Distributors

**PDF Issuance Requirements**

When exported to PDF, all issued documents shall include:

- SSFS letterhead cover page
- Footer with document title, revision number, and page numbering
- Revision history table (Appendix G)

No technical content may be altered without a corresponding revision entry.

## 1. INTRODUCTION

Thank you for choosing **Steady State Fuel Systems, LLC (SSFS)** as your partner in mission-critical fuel delivery systems. SSFS designs and manufactures highly reliable fuel supply systems intended to support diesel-powered emergency generators and boilers serving essential facilities.

This manual provides installation, operation, and maintenance guidance for the Steady State Fuel System. Some information may appear in more than one section; this repetition is intentional and is provided to emphasize critical operating and safety concepts.

The SSFS is engineered to eliminate the dependency on traditional electrical level switches, solenoid valves, and frequent pump cycling associated with conventional day tank systems. By operating concurrently with the emergency generator, the SSFS minimizes changes of state, reduces component wear, and improves overall system reliability.

Additional information, installation examples, and technical support resources are available at:
www.steadystatefuelsystems.com

## 2. SYSTEM OVERVIEW

The Steady State Fuel System is a patent-pending fuel delivery system designed to replace the function of a traditional generator day tank. The system integrates a continuous-duty positive displacement pump, fuel delivery manifold, onboard fuel reservoir, filtration, and heat exchange into a single, unified package.

The SSFS operating philosophy is based on maintaining continuous fuel circulation whenever the generator is operating. Fuel is drawn from the main storage tank, circulated through the SSFS, and returned to the main tank, with only the required volume diverted to maintain the onboard fuel reservoir.

This steady-state approach significantly reduces reliance on electrical control devices and minimizes failure modes associated with frequent starts, stops, and control transitions.

**Major System Components**

- Powder-coated steel frame with integrated drip tray
- UL-508 listed PLC control panel with 7-inch HMI touchscreen
- Continuous-duty TEFC motor and positive displacement pump
- Onboard steel fuel reservoir with rupture basin and leak detection
- Patented fuel delivery manifold with integral float control
- High-efficiency particulate and water filtration system
- Differential pressure monitoring and bypass protection
- Cross-flow plated heat exchanger
- Isolation valves for service and maintenance
- Optional duplex pump configuration for redundancy

## 3. WARNINGS & DESIGN CONSIDERATIONS

### Over-Pressurization

The SSFS is factory tested at elevated pressure; however, it is critical that the installed system provide an unobstructed fuel return path to the main storage tank. The SSFS is not designed to absorb pressure created by thermal expansion or blocked return piping. The onboard fuel reservoir must be vented to atmosphere at all times.

### Fuel Supply and Return Piping

Fuel oil supply piping shall be a minimum of:

- 3/4 inch nominal diameter for 5 GPM systems
- 1 inch nominal diameter for 11 GPM systems

Fuel return piping must be routed directly back to the main storage tank with minimal restrictions. A priming tee upstream of the pump suction is strongly recommended.

### Anti-Siphon Protection

Where the SSFS is installed below the maximum fuel level of the main storage tank, an approved anti-siphon device is required. Care must be taken not to exceed the maximum allowable lift of 15 feet.

### Fuel Compatibility

The SSFS is designed for diesel fuel and fuel oil only. Gasoline or other volatile fuels shall not be used.

## 4. INSTALLATION

### Receiving and Inspection

Upon receipt, inspect the system carefully for shipping damage. Any damage must be documented on the bill of lading and reported to the carrier. If significant damage is observed, the shipment should be refused.

### Location and Mounting

The SSFS should be located as close as practical to the emergency generator. The system shall be mounted on a level concrete pad and securely anchored using approved fasteners at the provided mounting locations.

### Piping Connections

All piping connections are NPT. Fuel supply and return connections are clearly labeled on the skid:

- FOS / FOR – Main storage tank circulation
- FOSG / FORG – Generator supply and return

A foot valve shall be installed at the main tank supply connection to maintain system prime.

### Electrical Requirements

A dedicated single-phase 208/230 VAC power supply is required. Electrical installation shall comply with all applicable codes and the provided wiring diagrams.

## 5. INSTALLATION EXAMPLES

Representative installation examples are provided on the SSFS website. These examples are intended as guidance only. Final system configuration shall be reviewed by the design engineer and AHJ.

## 6. SYSTEM OPERATION

### 6.1 Operating Philosophy

The SSFS is designed to operate concurrently with the emergency generator, providing continuous fuel circulation and reservoir level control without reliance on electrical level switches or solenoid valves.
When the generator is running, the SSFS runs.

### 6.2 Touchscreen / HMI Display

Operation and monitoring of the Steady State Fuel System (SSFS) are performed through the touchscreen Human-Machine Interface (HMI) integrated into the UL-508 listed control panel. The HMI is intended for operator monitoring and alarm indication only. No field programming or modification of control logic is required or permitted for normal operation.

Sample screen configurations are included below for reference:

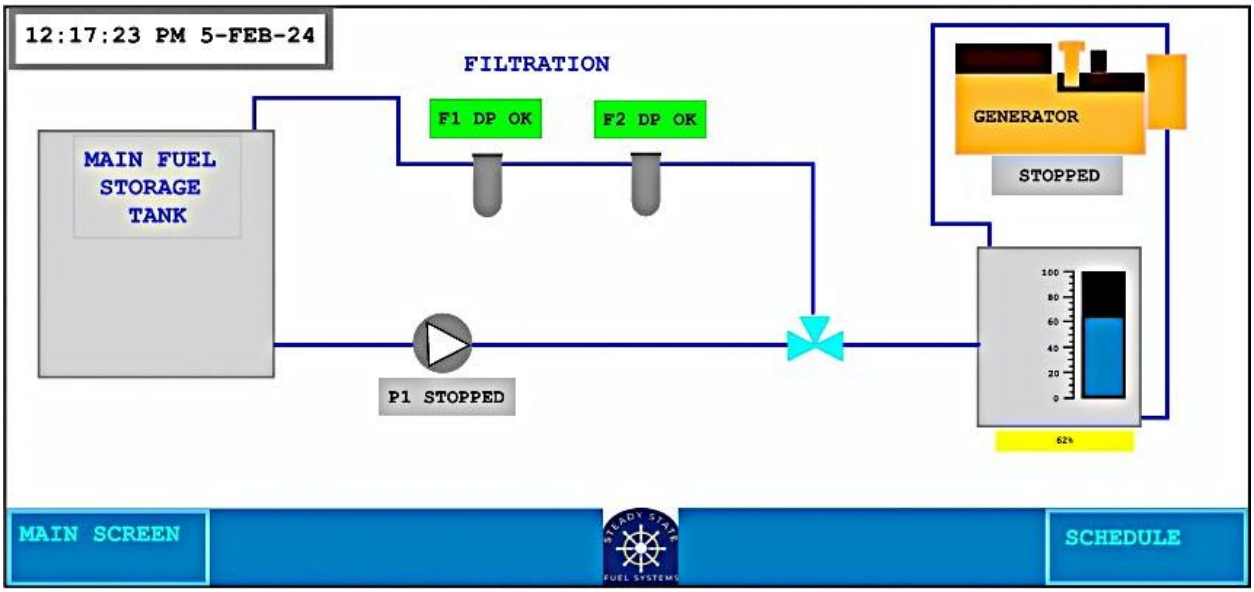


Figure 6-1 – HMI Display: Idle (Representative Screen Only)

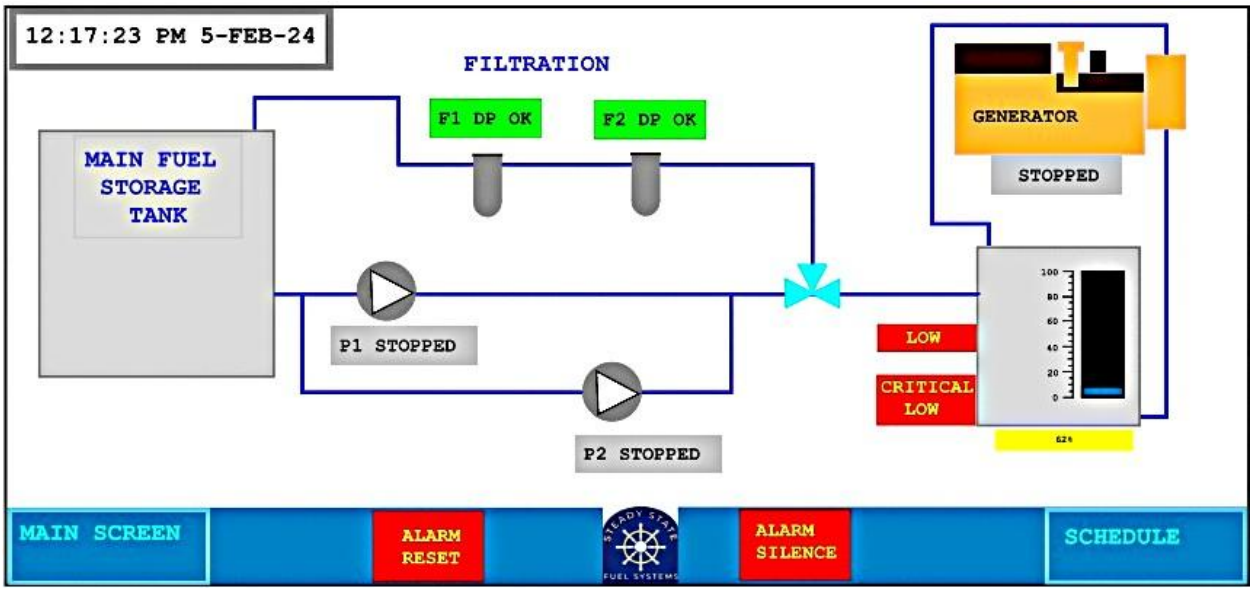


Figure 6-2 – HMI Display: Alarm Condition (Representative Screen Only)

## 6.3 Normal Operation – Generator Running

Upon receipt of a generator run signal, the SSFS energizes the fuel supply pump or lead pump in duplex configurations. Fuel is drawn from the main storage tank and circulated through the system for the duration of generator operation.

## 6.4 Fuel Flow and Reservoir Level Control

Fuel enters the SSFS through the inlet strainer and isolation valve before entering the pump. Downstream, fuel is directed either to the onboard reservoir through a mechanically actuated float valve or through the bypass circuit for filtration and heat exchange.

### 6.5 Filtration and Heat Management

Fuel routed through the bypass circuit is filtered for particulate and free water contamination. Differential pressure across the filters is monitored continuously. Fuel then passes through the heat exchanger to limit temperature rise before returning to the main storage tank.

**NOTE**
A filter differential pressure (ΔP) alarm indicates a restricted filter condition and may necessitate filter replacement in accordance with Section 6.9.

### 6.6 Alarms and Protective Functions

The control system monitors filter differential pressure, fuel flow (where applicable), reservoir level, and leak detection. Audible and visual alarms alert operators to abnormal conditions.

### 6.7 Standby Fuel Polishing Operation

The SSFS may operate independently of the generator on a programmed schedule to polish fuel from the main storage tank.

### 6.8 Simplex and Duplex Pump Configurations

Simplex systems operate with a single pump. Duplex systems utilize lead/lag logic with automatic transfer upon loss of flow confirmation.

### 6.9 Filter Replacement Procedure

**WARNING**
Fuel systems may be pressurized. Failure to properly isolate and depressurize the filter manifold prior to servicing may result in fuel release, equipment damage, fire hazard, or personal injury.

Filter replacement shall be performed only by qualified service personnel familiar with fuel oil systems and site safety procedures. Filters are typically replaced in response to a filter differential pressure indication or as part of scheduled maintenance. Filter inspection and replacement intervals shall be established and documented in accordance with Section 7 – Equipment Maintenance.

Prior to servicing the filter manifold, the system shall be placed in a safe condition and all applicable lockout/tagout, spill containment, and fire safety procedures shall be observed.

To isolate the filter manifold for service, the bypass valve shall be opened to maintain uninterrupted fuel circulation. Once bypass flow is established, the upstream and downstream isolation valves located on either side of the filter manifold shall be closed. After isolating the filter manifold, pressure shall be relieved by slowly opening the vent valve located on the manifold. An appropriate container shall be placed beneath the vent valve prior to opening. Residual pressure may be present, and care shall be taken to relieve pressure gradually.

Once the manifold has been fully depressurized, the filters may be removed and replaced. Removed filters will contain fuel; appropriate containment shall be provided to capture any fuel released during removal.

Upon completion of filter replacement, the vent valve shall be closed, isolation valves returned to their normal operating position, and the bypass valve returned to its normal position in accordance with system operating procedures. The system shall be inspected for leaks prior to returning to normal operation.

## 7. EQUIPMENT MAINTENANCE

- Maintenance activities described in this section are limited to inspection, verification, and component replacement as indicated by alarms or scheduled intervals. All service work shall be performed by qualified personnel in accordance with site procedures.
- Inspect containment basin and leak detection devices
- Verify proper operation of venting and float mechanisms
- Confirm unobstructed return piping

## 8. EMERGENCY PROTOCOLS

Alarm conditions indicate abnormal system status and require evaluation in accordance with site emergency procedures. Operators shall not attempt repairs or system modifications unless authorized by facility management.

## 9. TROUBLESHOOTING GUIDE

| Condition | Possible Cause | Action |
|---|---|---|
| Filter alarm | Loaded filters | Replace filters |
| Pump alarm | Loss of prime or flow | Inspect suction piping and pump |
| Leak alarm | Fuel detected in basin | Inspect system and piping |

Troubleshooting actions are limited to observation and notification. Corrective maintenance shall be performed by qualified service personnel.

## 10. CONTACT INFORMATION

Steady State Fuel Systems, LLC
Website: www.steadystatefuelsystems.com

## 11. LIMITED WARRANTY

SSFS warrants its products to be free from defects in materials and workmanship for one year from the date of purchase, subject to the terms and limitations outlined in this manual. SSFS liability is limited to repair or replacement of defective components.

## APPENDIX A – SEQUENCE OF OPERATIONS (REFERENCE ONLY)

This appendix provides a detailed Sequence of Operations (SOO) for the Steady State Fuel System (SSFS). It is intended as a technical reference for engineers, commissioning agents, and Authorities Having Jurisdiction (AHJs). It is not intended for routine operator interaction or field modification.

### A.1 System Overview

The SSFS is a continuous-duty fuel delivery system designed to operate concurrently with diesel engine operation. The system maintains fuel circulation between the main storage tank and the generator supply by mechanical level regulation, eliminating reliance on electrically actuated day tank fill logic.

### A.2 Simplex Pump System – Detailed Sequence of Operation

1. When the generator receives a start command, a generator run signal is provided to the SSFS control panel.
2. Upon receipt of the run signal, the simplex fuel supply pump is energized and begins continuous operation.
3. Fuel is drawn from the main storage tank through the suction piping, isolation valve, and inlet strainer.
4. The positive displacement pump pressurizes the fuel and delivers it to the fuel distribution manifold.
5. If the onboard reservoir fuel level is below the normal operating level, the mechanical float valve opens and a pre measured amount of fuel is delivered to the reservoir while the remaining flow is routed through the backpressure check valve.
6. Fuel enters the onboard reservoir until the operating level is reached.
7. When the reservoir reaches operating level, the float valve closes.
8. With the float valve closed, all fuel is diverted through the bypass circuit.
9. Bypass fuel flows through the filtration assembly for removal of particulate and free water.

10. Differential pressure across the filters is monitored for indication of filter condition.
11. Filter bypass protection allows continued fuel flow under elevated differential pressure conditions.
12. Filtered fuel passes through the fuel-to-fuel heat exchanger.
13. Heat is transferred from warm return fuel to cooler supply fuel to limit reservoir temperature rise.
14. Fuel exiting the heat exchanger returns to the main storage tank.
15. The SSFS continues to operate for the duration of generator runtime.
16. Upon generator shutdown, the generator run signal is removed and the fuel supply pump stops.

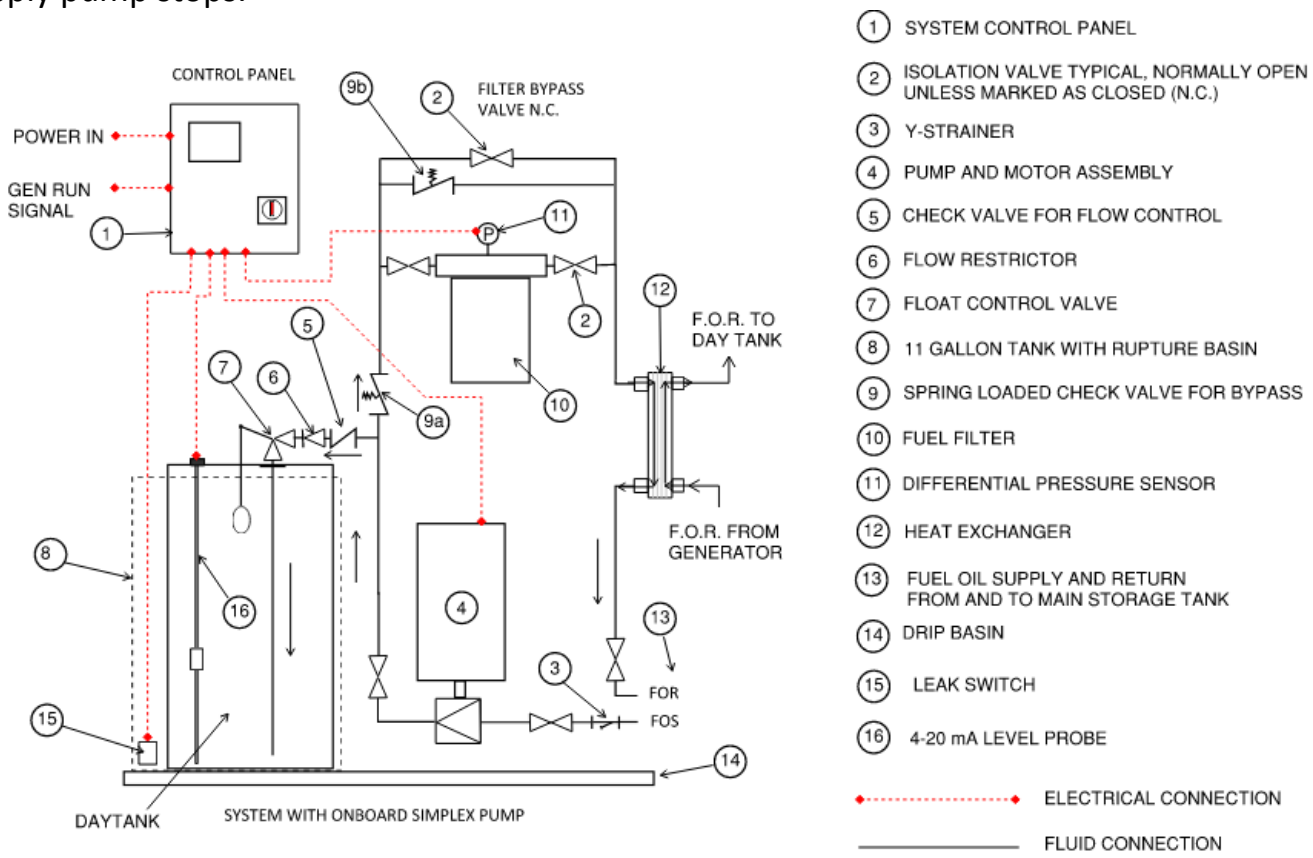


*Figure A-1 – Standard System with Simplex Fuel Supply Pump*

### A.3 Duplex Pump System – Detailed Sequence of Operation

1. The duplex configuration includes two fuel supply pumps arranged in a lead/lag configuration.
2. Upon receipt of a generator run signal, the designated lead pump is energized.
3. Fuel flow is verified by the flow indication device.
4. If adequate fuel flow is confirmed, the lead pump continues operation.
5. If adequate flow is not confirmed within the configured verification interval, a pump failure alarm is generated.
6. Upon pump failure indication, the lag pump is automatically energized.
7. Fuel circulation continues using the lag pump without interruption.
8. Under normal operating conditions, only one pump operates at a time.
9. All remaining fuel routing, filtration, heat exchange, and return functions operate identically to the simplex system.

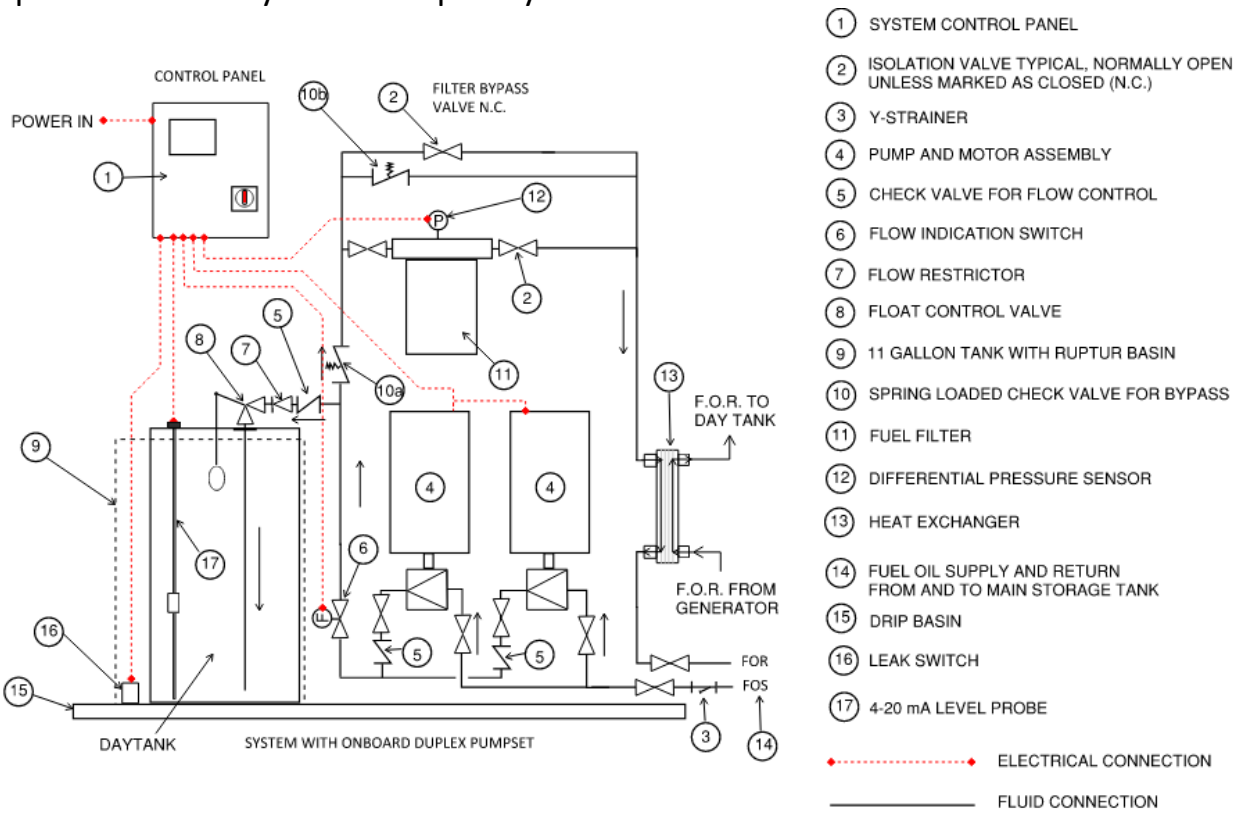


*Figure A-2 – System with Duplex Fuel Supply Pumps*

### A.4 Alarm and Protective Functions (Reference)

Protective and monitoring functions include filter differential pressure indication, leak detection within the rupture basin, pump status monitoring, and flow verification. Alarm annunciation is provided locally at the control panel HMI. Operator response to alarm conditions is addressed in Section 8 – Emergency Protocols.

### A.5 Fuel Polishing Operation (Reference)

The SSFS may be configured to operate independently of generator runtime for fuel polishing. During polishing operation, fuel is circulated from the main storage tank through the filtration and heat exchange assemblies and returned to the storage tank in accordance with commissioning configuration.

## APPENDIX B – COMMISSIONING CHECKLIST

This checklist is intended for use by qualified commissioning personnel to verify proper installation and operation of the Steady State Fuel System prior to placing the system into service.

### Pre-Start Verification

- System securely anchored and level
- Fuel supply and return piping installed per design
- Unobstructed return path to main storage tank verified
- Atmospheric vent installed and unobstructed
- Anti-siphon protection installed where required
- Electrical power connected and verified
- All isolation valves in normal operating position

### Operational Verification

- Generator run signal correctly received by SSFS
- Fuel supply pump starts on run signal
- Fuel flow confirmed (duplex systems)
- Reservoir level maintained via float control
- Bypass flow verified when reservoir is full
- No visible fuel leaks observed

### Alarm Verification

- Filter differential pressure alarm tested
- Leak detection alarm tested
- Pump failure alarm tested (duplex systems)

Commissioned By: _____ Date: _____

**APPENDIX C – MAINTENANCE LOG TEMPLATE**

This log is provided to assist owners and operators in documenting routine inspections and maintenance activities.

| Date | Inspection / Service Performed | Findings | Corrective Action | Technician |
|---|---|---|---|---|
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## APPENDIX D – SYSTEM DESCRIPTION (SUMMARY)

The Steady State Fuel System (SSFS) is a continuous-duty fuel delivery system designed to supply diesel-powered emergency generators and boilers with a reliable and uninterrupted fuel source. The system replaces the traditional electrically controlled day tank by maintaining a steady circulation of fuel from the main storage tank through an onboard reservoir.

By operating concurrently with the generator, the SSFS minimizes changes of state, reduces mechanical and electrical wear, and enhances overall system reliability. Fuel quality is improved through continuous filtration and temperature control via an integrated heat exchanger. Mechanical level regulation eliminates dependence on electrical level switches and solenoid valves.

The SSFS is suitable for mission-critical facilities where reliability, simplicity, and maintainability are paramount.

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## APPENDIX E – ENGINEERING SUBMITTAL SUMMARY

### SUBMITTAL PACKAGE NOTE

This appendix may be issued as a standalone Engineering Submittal Package without modification. When issued independently, Appendices F and G shall be included for scope definition and document control.

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### System Description

This summary is intended for inclusion in construction submittals and engineering review packages.

### System Description

The Steady State Fuel System (SSFS) is a continuous-duty fuel delivery system designed to support diesel-powered emergency generators and boilers. The system replaces the operational function of a traditional day tank by maintaining steady fuel circulation from the main storage tank through an onboard reservoir.

### Design Intent

- Continuous operation concurrent with generator runtime
- Mechanical fuel level regulation without electrical level switches

- Reduced change-of-state failures
- Integrated filtration and heat management

**Codes & Applications**

- Intended for mission-critical fuel oil systems
- Suitable for healthcare, data centers, utilities, and essential facilities

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**APPENDIX F – DISTRIBUTOR INSTALLATION HANDBOOK**

**DISTRIBUTOR ISSUANCE NOTE**

This appendix constitutes the official Distributor Installation Handbook and may be issued as a standalone document. When issued independently, Appendix G (Document Control & Revision History) shall be included.

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This appendix constitutes the **authorized Distributor Installation Handbook** for Steady State Fuel Systems. This section may be issued as a standalone document to authorized distributors.

**Scope of Supply**

- SSFS skid-mounted fuel system
- Control panel and onboard instrumentation
- Installation, Operation & Maintenance Manual (this document)

**Distributor Responsibilities**

- Verify site conditions match approved drawings and specifications
- Coordinate piping and electrical installation
- Confirm anti-siphon and venting requirements are met
- Perform pre-start inspection prior to commissioning
- Coordinate commissioning with owner, EOR, and AHJ

**Excluded Responsibilities**

- Fuel system engineering or design services
- Generator control programming unless explicitly contracted
- Long-term maintenance, service, or warranty repairs

Distributors shall not deviate from approved installation practices without written authorization from SSFS.

## APPENDIX G – Fuel Reservoir Tank Capacity Chart

| Fuel Height (in) | Gallons | Fuel Height (in) | Gallons |
|---|---|---|---|
| 0.00 | 0.00 | 9.25 | 7.21 |
| 0.25 | 0.19 | 9.50 | 7.40 |
| 0.50 | 0.39 | 9.75 | 7.60 |
| 0.75 | 0.58 | 10.00 | 7.79 |
| 1.00 | 0.78 | 10.25 | 7.99 |
| 1.25 | 0.97 | 10.50 | 8.18 |
| 1.50 | 1.17 | 10.75 | 8.38 |
| 1.75 | 1.36 | 11.00 | 8.57 |
| 2.00 | 1.56 | 11.25 | 8.77 |
| 2.25 | 1.75 | 11.50 | 8.96 |
| 2.50 | 1.95 | 11.75 | 9.16 |
| 2.75 | 2.14 | 12.00 | 9.35 |
| 3.00 | 2.34 | 12.25 | 9.55 |
| 3.25 | 2.53 | 12.50 | 9.74 |
| 3.50 | 2.73 | 12.75 | 9.94 |
| 3.75 | 2.92 | 13.00 | 10.13 |
| 4.00 | 3.12 | 13.25 | 10.32 |
| 4.25 | 3.31 | 13.50 | 10.52 |
| 4.50 | 3.51 | 13.75 | 10.71 |
| 4.75 | 3.70 | 14.00 | 10.91 |
| 5.00 | 3.90 | 14.25 | 11.10 |
| 5.25 | 4.09 | 14.50 | 11.30 |
| 5.50 | 4.29 | 14.75 | 11.49 |
| 5.75 | 4.48 | 15.00 | 11.69 |
| 6.00 | 4.68 | 15.25 | 11.88 |
| 6.25 | 4.87 | 15.50 | 12.08 |
| 6.50 | 5.06 | 15.75 | 12.27 |
| 6.75 | 5.26 | 16.00 | 12.47 |
| 7.00 | 5.45 | 16.25 | 12.66 |
| 7.25 | 5.65 | 16.50 | 12.86 |
| 7.50 | 5.84 | 16.75 | 13.05 |
| 7.75 | 6.04 | 17.00 | 13.25 |
| 8.00 | 6.23 | 17.25 | 13.44 |
| 8.25 | 6.43 | 17.50 | 13.64 |
| 8.50 | 6.62 | 17.75 | 13.83 |
| 8.75 | 6.82 | 18.00 | 14.03 |

## APPENDIX H – DOCUMENT CONTROL & REVISION HISTORY

REV11 – Added graphical NOTE callout in Section 6.9, added maintenance interval table in Section 7, and updated revision history. (Date)

This document is subject to revision. Only the latest issued revision shall be considered valid.

| Revision | Date | Description | Author |
|---|---|---|---|
| 0 | 12/22/2025 | Initial release | SSFS |
| 1 | 12/26/2025 | Professional IOM revision, commissioning and distributor appendices added | SSFS |

**End of Manual**

This appendix provides a detailed Sequence of Operations (SOO) for the Steady State Fuel System (SSFS). It is intended as a technical reference for engineers, commissioning agents, and Authorities Having Jurisdiction (AHJs). It is not intended for routine operator interaction or field modification.