

D-2 INCORPORATED

Automatic Particle Counter

JF-PC-N



OPERATION MANUAL

DWG. NO.: 495-010

REV 4

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1. General Information and Safety

1.1. List of Acronyms

ABS	Acrylonitrile Butadiene Styrene
AC	Alternating Current
Ah	Ampere-hour
AH	Avery Hardoll
APC	Automatic Particle Counter
COTS	Commercial off the Shelf
°C	Degrees Centigrade
DC	Direct Current
DWG	Drawing
ECO	Engineering Change Order
FED-STD	Federal-Standard
F.O.B.	Free On Board
FTM	Federal Test Method
Hz	Hertz
In	Inch
IP	Ingress Protection
ISO	International Standards Organization
JF-PC	Jet Fuel-Particle Counter
lbs.	Pounds
LCD	Liquid Crystal Display
Li-Ion	Lithium-Ion
L x W x H	Length by Width by Height
µm	Micron (ISO 4407)
µm(c)	Micron (ISO 11171)
MIL-STD	Military-Standard
mL	Milliliter
mm	Millimeter
Min.	Minute
MRC	Maintenance Requirement Card
NO.	Number
NSN	National Stock Number
OEM	Original Equipment Manufacturer
OLED	Organic Light-Emitting Diode
ORP	Oxidation-Reduction Potential
%	Percent
PC	Personal Computer
PE	Polyethylene
pH	Potential for Hydrogen
PMS	Planned Maintenance System
psi	Pounds per square inch
REV	Revision
RMA	Returned Material Authorization

s	Second
SN	Serial Number
SS	Stainless Steel
V	Volts
VAC	Volts Alternating Current
VDC	Volts Direct Current
W	Watts
Wh	Watt-hour

1.2. Note/Caution/Warning Summary

Notes for User:



WARNING!

There is a danger to life and limbs or a risk of serious injury if the notes on safety are disregarded!



CAUTION!

There is a risk of injury and damage to property if the notes on safety are disregarded!



ATTENTION!

There is a risk of damage to property if the notes on safety are disregarded!



IMPORTANT!

Notes on working procedures.

Note: this manual applies to the Navy Automatic Particle Counter (APC). Read the instructions in this manual carefully before powering or operating the unit. Other models of the unit may or may not have different functionalities and users should refer to the specific owner's manual for the model they have. D-2 Incorporated will accept no liability for damages due to non-observance of this manual.



ATTENTION! *If the instructions in the operating manual are not adequately adhered to, then there shall be no entitlement to services under warranty.*

Information in this manual is subject to change without notice and does not represent a commitment on the part of D-2 Incorporated. No part of this manual may be reproduced or transmitted in any form or

by any means without prior written consent of D-2 Incorporated. Where manuals are written in several languages, the language in which it was created is considered the original.

1.3. Manual Introduction

D-2 Incorporated continuously strives to meet the full expectations of its customers, and comments on the structure, content, and the ability of this manual to answer questions regarding the APC are welcome. Please contact sales@d-2inc.com for any suggestions or comments. This manual is provided with the understanding that future versions of this unit may have additional commands or functionality that differ from what is shown in this manual and may vary from the present operation.

This manual is organized into 7 sections including:

- Section 1 – General Information and Safety – This section provides general APC information and a description of the safety markings used throughout this manual.
- Section 2 – APC Description and Specifications – This section provides a detailed description of the APC unit and the specifications for the parts of the unit.
- Section 3 – APC Operating Instructions – This section provides the APC general operating instructions and setup.
- Section 4 – Maintenance – This section describes the basic APC unit maintenance.
- Section 5 – Troubleshooting – This section provides troubleshooting for the APC unit.
- Section 6 – APC Unit Storage and Shipping Instructions – This section discusses the instructions for storing and shipping the APC.
- Section 7 – APC Repair/Rebuild – The APC unit is the lowest field-repairable part; this section provides instruction for returning the unit to D-2 for repair/rebuild.
- Appendices – Provides additional information related to the Navy APC.

2. APC Description and Specifications

2.1. General Description

The JF-PC Automatic Particle Counter (APC) is a ruggedized portable unit that can be equipped with an optional shoulder carrying case. The APC can be provided with an AC/DC power cord option or a battery/charging device option for power. This unit was designed to meet extreme military operational environments with a simplified user interface consisting of an organic light-emitting diode (OLED) display and two push buttons that control every aspect of operation. Figure 1 shows the faceplate of the APC.

The APC can perform particle count analysis on inline samples or bottle samples. A variety of hoses are provided as part of the APC standard kit to make connections to various sampling points. The general features of the APC include:

- Test time for each sample is less than 3 minutes
- Lightweight (~15 pounds and size of shoebox) and self-contained
- Push button operation for up to 200 tests on a fully charged battery
- Sample flow inlet and outlet are controlled by internal pump

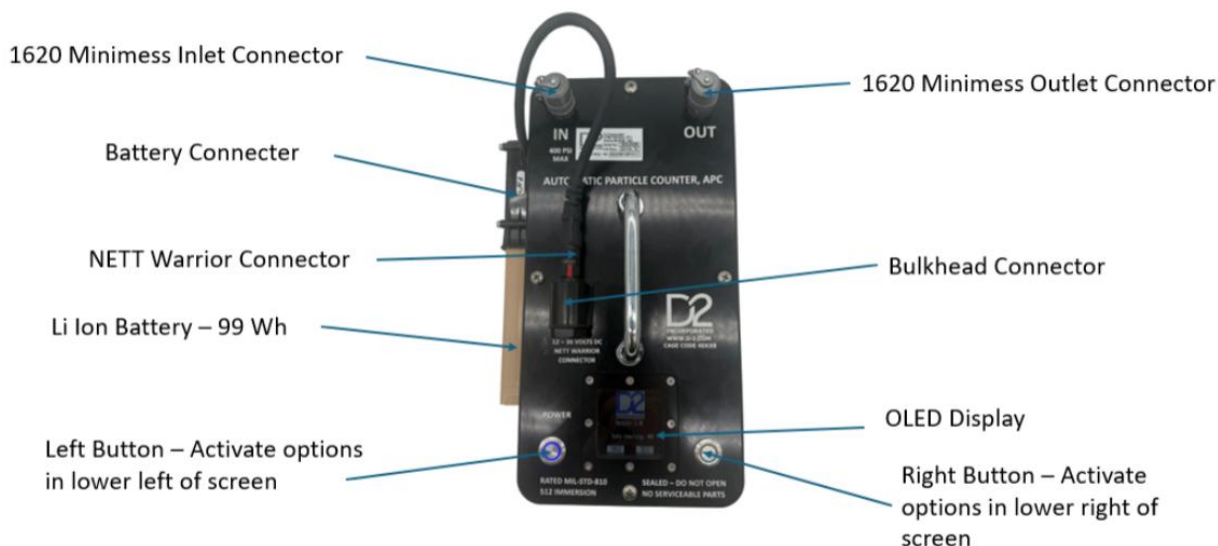


Figure 1. APC Details

The APC operates in accordance with Federal Test Method (FTM) 1203.0 of FED-STD-791G but uses an increased flow rate during flush strokes to reduce test time and increase flush efficiency. This unit performs two cycles per sample measurement. Each cycle is sequenced via the following order:

1. 30 mL flush (at 60 mL/min).
2. 10 mL sample (at 30 mL/min).
3. 30 mL flush (at 60 mL/min).
4. 10 mL sample (at 30 mL/min).

This adds up to a total volume requirement of 80 mL for each cycle. The two sample particle readings are averaged and results displayed in ISO codes. The screen and right selection button light up green or red to alert the operator of a pass or fail, respectively, per Navy specified standards (see Go/No-go Values in Section 3.1).



ATTENTION! *The Navy APC is designed for fuel particle measurement only. No other uses are authorized and may void the warranty.*

The Navy APC has five (5) default fuels and ISO code test conditions. Each fuel selection corresponds to a different ISO code limit, and this is explained more in Section 3.1. The five (5) default fuel types are:

- jet fuel
- jet receipt: pier side
- jet receipt: oiler/barge
- diesel fuel: gas turbine
- ISO readout only

The ISO readout only fuel type allows a user to test a fuel that has no ISO code limits. This mode only reports values found, allowing the user to test unknown fuel types and obtain information about the fuel's cleanliness.



IMPORTANT! Refer to specific Navy PMS and MRC guidance for requirements for validation/verification and factory calibration.

D-2 Incorporated is responsible for calibrating the APC to ISO 11171 specifications. D-2 Incorporated provides a certificate to the user confirming this calibration. Once in service, the unit shall be validated/verified on a yearly basis. However, the ISO 11171 calibration itself is valid for five (5) years, at which time, the user must ship the APC back to D-2 Incorporated to have it recalibrated to ISO 11171 specifications. When units are sent in for recalibration, D-2 Incorporated will also perform a pressure test on the APC to 400 psi, and a test confirming the unit's full functionality.

2.2. Specifications

The specifications for the APC are listed and discussed in this section. Section 2.2.1 shows the specifications for the APC unit, Section 2.2.2 shows the specifications for the battery and its charger, and Section 2.2.3 details specifications of the hoses.

2.2.1. APC Unit

Table 1 lists the specifications for the APC unit.

Table 1. Specifications for the APC

Technical Specifications	
Operation	
Principle of operation	Laser obscuration
Test Method	FTM 1203.0 (FED-STD-791G)
Particle size range	4µm(c) to 30µm(c)
Calibration	In accordance with ISO 11171
Test duration	2.5 minutes
Pressure (max.)	400 psi
Sample temperature range	-30 to 50°C
Operating temperature range	-30 to 50°C
Sampling method	Inline sample or bottle sample
Display and control system	160-color dimmable display, red/green ISO grading, dual backlit push buttons
Measurement	
Measuring channels	4 size channels displayed on unit (4µm, 6µm, 14µm, 30µm)
Counts per measurement (max.)	60,000 counts/mL
Coincidence error limit	60,000 particles/mL ≥4µm(c) with ≤5% co-incidence error (ISO 11171)
Sample viscosity (max.)	64 mm ² /s @ 20°C
Sample volume	80 mL
Sample delivery	Integral piston pump downstream of the optical measurement cell
Sample flow rate	30 mL/min. test, 60 mL/min. flush
Data Management	
Results format	Cumulative, particles/mL, ISO 4406 cleanliness codes/classes
Memory	400 test points
External data output	Memory output to PC or Serial Printer
Power Requirements	
Voltage	12VDC to 36VDC
Battery	99Wh, 6.8Ah lithium-ion (8 hours, 200 tests min.)
Physical	
Size (H x W x D)	7.0" x 7.0" x 11.8"
Weight (w/battery, w/o battery)	11.5 lbs., 10.5 lbs.
Construction	Aluminum Case
Environmental	IP67, MIL-STD-810 Method512-Immersion Procedure 1 (1 meter, 5% salt, 30 minutes)
Carry case	Padded 800d face Ultra-PE blended with high-tenacity polyester shoulder carry case
Hose connectors	1620 Minimesh

Figure 2 below shows a photo of a top view of the APC when it is powered off.



Figure 2. APC (Top View) Powered Off

2.2.2. Battery/Charger

Table 2 lists the specifications for the APC battery provided by D-2. The battery has been selected to ensure that 200 tests can be performed on a full charge.

Table 2. Specifications for the APC Battery (JF-PC-SBP)

Technical Specifications	
Type	Lithium-ion (carbon/lithiated metal oxide)
Voltage	14.4V nominal, 16.8V max.
Dimensions (H x W x D)	0.9" x 3.0" x 7.1"
Weight	1.05 lbs.
Energy Rating	99Wh
Capacity	6.8Ah

Figure 3 shows a photo of the battery.



Figure 3. APC Li Ion Battery

Figure 4 shows a photo of the connection details for the battery.



Figure 4. Connection Details for the Battery

The pin-out descriptions from left to right in Figure 4 are positive, negative, clock, data, and charge. These pin-out descriptions are confirmed in Table 3. The D-2 Incorporated part number for this battery is JF-PC-SBP, which is shown in Table 5.

Table 3. Pin-out Descriptions of the APC Battery

Symbol	Meaning
+	Positive
-	Negative
H	Clock
D	Data
C	Charge

Table 4 lists the specifications for the APC's battery charger, which is powered from 100 VAC to 240 VAC, 50/60Hz, 55W.

Table 4. Specifications for the APC Battery Charger (JF-PC-SBP-CHR)

Technical Specifications	
National Stock Number (NSN)	Pending
Interface Controller Dimensions (L x W x H)	3.0" x 0.9" x 1.2"
Power Supply Dimensions (L x W x H)	4.3" x 2.0" x 1.2"
Cable Dimensions	30.0"
Weight	0.56 lbs.
Operating Temperature	-20 to 50°C
Storage Temperature	-40 to 70°C
Material/Color	High impact ABS/tan and black
Disposal	Check local regulations (contains 0% mercury or cadmium)

Figure 5 shows a photo of the complete battery charger assembly which includes a 2-prong plug, AC/DC power block and battery charge connector.



Figure 5. Battery Charger Cord

Figure 6 shows the connection details for the battery charger.



Figure 6. Connection Details for the Battery Charger

The pin-in descriptions from bottom to top in Figure 6 are positive, negative, clock, data, and charge. These are synonymous with the pin-out descriptions listed in Table 3 for the battery. The D-2 Incorporated part number for this battery charger is JF-PC-SBP-CHR. The battery charging procedures are described in Section 2.4.2.

2.2.3. Hoses

There are four (4) hose types included in the standard configuration of the APC; they are listed in Table 5 located in Section 2.4.1. All hoses are two (2) meters long, except for H-6-A-0-0-0-1 (Section **Error! Reference source not found.**) which is 22" long. They are made of stainless steel, and each end of the hose has stress springs installed to prevent kinking, collapsing and damage during connection. All hoses have at least one end which is classified as a 1620F connector (shown in Figure 7).



Figure 7. Typical 1620F Connector

2.2.3.1. H-2-A-1-0-0-1

H-2-A-1-0-0-1 is the D-2 Incorporated part number for the hose with a 1620F connector at one end and a short connector at the other end. The 1620F connector is shown in Figure 7. Figure 8 shows the entire hose.

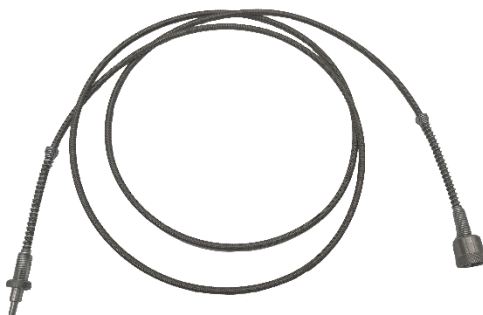


Figure 8. H-2-A-1-0-0-1 Hose

Figure 9 shows a closer view of the short connector.



Figure 9. Short Connector

2.2.3.2. H-2-A-2-0-0-1

H-2-A-2-0-0-1 is the D-2 Incorporated part number for the hose with a 1620F connector on one end and a long connector on the other end. The 1620F connector is shown in Figure 7. Figure 10 shows the entire hose. In Figure 10, the yellow cap covers the 1620F connector.



Figure 10. H-2-A-2-0-0-1 Hose

Figure 11 shows a closer view of the long connector.



Figure 11. Long Connector

2.2.3.3. H-2-A-4-0-0-1

H-2-A-4-0-0-1 is the D-2 Incorporated part number for the hose that has a 1620F connector on both ends. For reference, the 1620F connector is shown in Figure 7. Figure 12 shows the entire hose.



Figure 12. H-2-A-4-0-0-1 Hose

2.2.3.4. H-6-A-0-0-0-1

H-6-A-0-0-0-1 is the D-2 Incorporated part number for the hose that has a 1620F connector on one end and a standpipe connector on the other end. This hose is used for validation/verification and bottle sampling. For reference, the 1620F connector is shown in Figure 7. Figure 13 shows the entire hose. In Figure 13, the black cap covers the 1620F connector. This hose is 22 inches long.



Figure 13. H-6-A-0-0-1 Hose

! **IMPORTANT!** *Install the plastic tube provided with the validation/verification fluid and avoid direct insertion of the standpipe connector to prevent contamination of the fluid from dirt on the hose and spring.*

Figure 14 shows a closer view of the standpipe connector. This should be connected to the plastic tube provided with the validation/verification fluid when used for validation/verification.



Figure 14. Standpipe Connector

2.3. Theory of Operation

Automatic particle counters are used in many industries to measure particles in fluids. The Navy's fuel APC measures the laser obscuration created when a liquid is pulled through a narrow optical window and a laser is directed through the liquid. The block diagram of the APC is depicted in Figure 15, which specifically shows how the APC operates when it is taking a bottle sample as the sampling method.

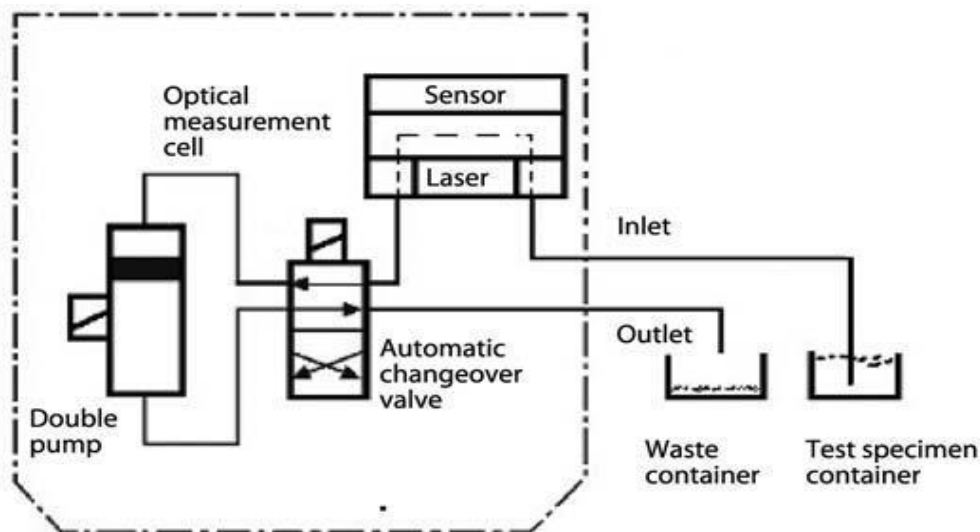


Figure 15. APC Block Diagram

At the heart of the APC is an optical measurement cell that uses a laser to measure the total fuel contamination (sediment and free water). It is designed to return readings in particles/mL and ISO 4406 code in $\geq 4 \mu\text{m}$, $\geq 6 \mu\text{m}$, $\geq 14 \mu\text{m}$, and $\geq 30 \mu\text{m}$ channels (size bin). This unit utilizes a high-resolution optical sensor to measure the shadows of particles as they pass through the laser and output a signal proportional to the size of the particle to the digital processor. The particle detection is then categorized into a size bin, and the data is recorded in the sample reading.

2.4. What's In The Box?

The D-2 APC can be purchased in two configurations: APC unit only or as a complete kit. Optional accessories are available separately for purchase. Section **Error! Reference source not found.** provides a summary of what is included when the APC unit is purchased as a standalone item. Section 2.4.1 summarizes what is included in the standard configuration of the complete APC kit.

2.4.1. Standard Configuration

Table 5 shows what is included in the standard configuration of the APC kit.

Table 5. Standard Configuration Parts Included with APC Kit.

Part Number	Description	Quantity
JF-PC-C-0-0-S-0-1-0	Navy APC w/ Side Battery Holder	1
JF-PC-SCC	Shoulder Carry Case	1
H-2-A-1-0-0-1	Particle Counter 1620F to Short Connection Hose, SS, 2M, Spring Loaded	2
H-2-A-2-0-0-1	Particle Counter 1620F to Long Connection Hose, SS, 2M, Spring Loaded	1
H-2-A-4-0-0-1	Particle Counter 1620F to 1620F Connection Hose, SS, 2M, Spring Loaded	2
H-6-A-0-0-0-1	Particle Counter 1620F to Standpipe Connection Hose, SS, 22", Spring Loaded	1
JF-PC-SBP	Li-Ion Battery 99Wh	1
JF-PC-SBP-CHR	Battery Charger 110Vac Legacy Style	
JF-PC-VF-N	Bottle of Verification Fluid, PartiStan 2806	1
JF-PC-CTB	Sampling/Verification, Bagged Clean Hose	1
495-010	Owner's Manual (this document)	1

2.4.2. Battery Charging



WARNING! Read and understand all instructions before using the charger. Failure to follow all instructions may result in electric shock, fire, and/or serious injury.

The battery charger, as shown in Figure 5, includes two parts. These two parts are an interface connector that is wired to a power supply, and a 30-inch cable with a two-prong plug.



CAUTION! Do not disassemble this charger or any parts associated with this charger. This charger is not user serviceable.

Figure 5 shows the entirety of the battery charger, and Figure 16 shows the interface connector that is wired to the power supply without the 30-inch cable plugged into it.

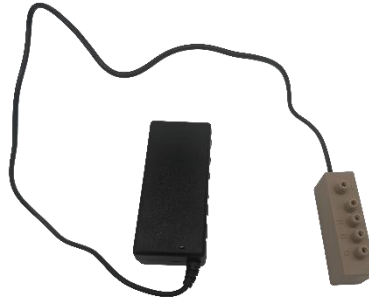


Figure 16. Interface Connector (tan block), Factory Wired to Power Supply (black block)

To charge the battery, follow the below step-by-step procedure:



WARNING! *This charger is only intended for use with the battery provided by D-2. Do not attempt to use this charger to charge any other battery.*

1. Plug the two-prong plug end of the cable into an appropriate AC power source. This charger can operate on any source of AC power, including 100VAC to 240VAC, 50/60Hz, or 55W.



WARNING! *Do not allow any foreign materials of a conductive nature to enter the charger or contact any exposed electrical contacts.*

2. Plug the other end of the cable into the power supply depicted in Figure 16. Figure 17 shows the exact location to plug this into the power supply.
3. Plug the interface connector into the battery by lining up the pin-out connector of the battery with the pin-in connector of the interface. These are listed in Table 3 and Figure 18 shows the location of this connection.

Figure 17 shows the location of cable insertion on the power supply.



Figure 17. Location of Cable Insertion on Power Supply

Figure 18 shows battery disconnected from the battery charger to display location of the connection.

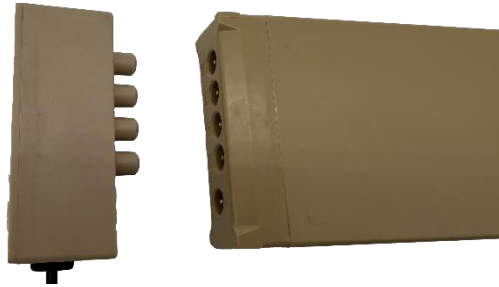


Figure 18. Battery Separated from Battery Charger

When the procedure for charging the battery is properly followed, the battery/battery charger system should look like what is depicted in Figure 19.



Figure 19. Battery Undergoing Charging (Two-prong Plug Plugged into Outlet Not Shown in Photo)

There is a battery charge display indicator located on the side of the battery. The display has a marking for zero charge on the left side and 100% charge on the right side. As the battery charges, black squares will illuminate on this display indicating the amount of battery charge. Figure 20 shows what the display looks like when the battery has a low charge. Notice the black square slightly above and to the right of the '0.'



Figure 20. Battery Indicator Display at Low Charge

Figure 21 shows what this display looks like when the battery is fully charged. Notice the black squares fill the display, compared to what is shown in Figure 20.



Figure 21. Battery Indicator Display at Full Charge

3. APC Operating Instructions

3.1. Testing Procedure

This section will detail the step-by-step procedure to properly run a test using the APC. Before reading this step-by-step procedure, see the top view of APC powered on in Figure 22.

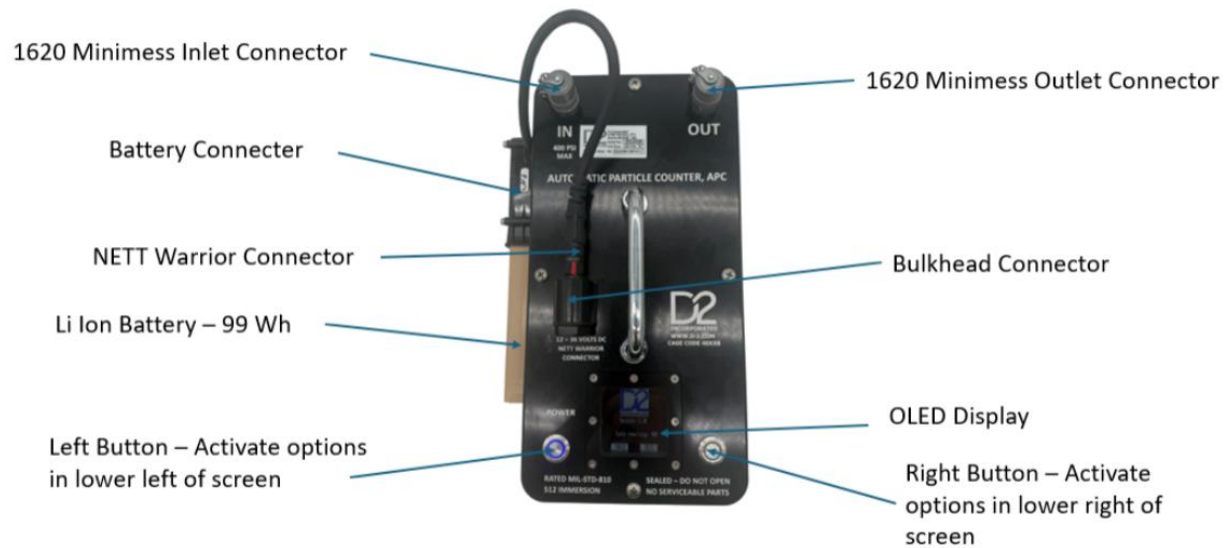


Figure 22. APC (Top View) Powered On

The items pointed out in Figure 22 will be referenced throughout the rest of Section 3.

There are ISO code values that the APC outputs to the user at the conclusion of each test. These ISO code values are whole numbers. Depending on the type of fuel being tested, there are ISO code limits that determine whether the sampled fuel passes or fails the test. These are also known as 'go/no-go' values. Table 6 shows the maximum passing limits for each fuel type.

For example, the (standard) jet fuel test has an ISO code limit of 19, 17, 14, and 13 for the 4 μ m(c), 6 μ m(c), 14 μ m(c), and 30 μ m(c) particle size channels, respectively. If one of the ISO code values that the APC outputs is greater than this limit at its respective particle size channel for a sampled fuel, then that sampled fuel will fail the test. In this case, a sample of standard jet fuel outputting ISO code values at 20, 17, 14, and 13 for the 4 μ m(c), 6 μ m(c), 14 μ m(c), and 30 μ m(c) respective particle size channel would fail

its test (because 20 is greater than 19 for the 4µm(c) particle size channel). If all the ISO code values that the APC outputs are less than or equal to this limit at its respective particle size channel for a sampled fuel, then that sampled fuel will pass the test. In this case, a sample of standard jet fuel outputting ISO code values at 19, 17, 14, and 13 for the 4µm(c), 6µm(c), 14µm(c), and 30µm(c) respective particle size channels would pass its test.

Table 6. Go/No-go Values Classified by Fuel Type

Navy Model	ISO Code Limit
Fuel Type	[≥4µm(c)/≥6µm(c)/≥14µm(c)/≥30µm(c)]
Jet	19/17/14/13
Jet Receipt: Pier Side	22/20/16/11
Jet Receipt: Oiler/Barge	22/21/17/12
Diesel Fuel: Gas Turbine	20/19/18/17
ISO Readout Only	N/A

3.1.1. Preparation for Testing

The APC should be prepared for testing following the procedures below. Configuration of the APC hoses varies depending on whether the fuel will be tested inline or bottles samples will be collected for testing.

3.1.1.1. Inline Samples



CAUTION! *Operating the pump without hoses connected can result in a pump failure and result in a unit computer malfunction.*

Inline samples are those that are collected in real-time from a flowing fuel line. Preparation for testing of inline samples is as follows:

1. Unscrew the caps on the inlet and outlet port connections that are chain-linked to the APC.



ATTENTION! *Failure to fully hand-tighten the connectors will cause pump errors and negatively affect particle reading. To prevent damage to threads from overtightening, the user must not use a wrench to tighten the hoses.*

2. Screw one end of one H-2-A-4-0-0-1 hose to the inlet port on the APC.
3. Screw one end of the other H-2-A-4-0-0-1 hose to the outlet port on the APC.
4. Screw the open end of the H-2-A-4-0-0-1 hose connected to the inlet port to the desired pressurized fuel line.



IMPORTANT *Ensure the hose connected to the outlet port is connected to a test point downstream of where the inlet hose is connected to preserve sample integrity.*

5. Screw the open end of the H-2-A-4-0-0-1 hose connected to the outlet port to a different location on the pressurized fuel line.
6. Follow Steps 1-9 of the testing procedure listed in Section 3.1.2.

3.1.1.2. Inline Nozzle Samples

Inline nozzle samples are those that are collected in real time from a flowing fuel line. The key difference between this section and Section 3.1.1.1 is the type of application, as this section outlines inline samples that can be facilitated with the H-2-A-1-0-0-1 and H-2-A-2-0-0-1 hoses. Preparation for testing of inline nozzle samples is as follows:

1. Unscrew the caps on the inlet and outlet port connections that are chain-linked to the APC.



ATTENTION! *Failure to fully hand-tighten the connectors will cause pump errors and negatively affect particle reading. To prevent damage to threads from overtightening, the user must not use a wrench to tighten the hoses.*

2. Screw the 1620F Minimesh connector end of either the H-2-A-1-0-0-1 or the H-2-A-2-0-0-1 hose to the inlet port on the APC.
3. Screw the 1620F Minimesh connector end of either the other H-2-A-1-0-0-1 or the H-2-A-2-0-0-1 hose to the outlet port on the APC.
4. Connect the open end of the hose connected to the inlet port to the desired pressurized fuel line.
5. Connect the open end of the hose connected to the outlet port to a different location on the pressurized fuel line.
6. Follow Steps 1-9 of the testing procedure listed in Section 3.1.2.

3.1.1.3. Bottle Samples

Bottle samples are samples that have been pulled from the fuel source and collected in a bottle for testing.

3.1.1.3.1. Bottle Testing Guidelines

Prior to preparing the APC to test a bottle sample, ensure the samples are collected in accordance with the following:

1. Unless otherwise specified, collect a sample of at least 100 mL.
2. Avoid power mixing (use of power tools to mix a solution) as this can modify particles, break up agglomerated particles, or entrain air.
3. Use clean and dry sample containers that can transport the sample without contamination. A clear glass quart bottle with a threaded cap should be used.
4. Before taking the sample, rinse the sample containers with the products about to be sampled. Do this at least three times. Each rinse shall use product equal to 10% to 20% of the container volume. A rinse shall include closing and shaking the container for a minimum of five (5) seconds and then draining the product. Alternatively, the test specimen container may be cleaned by washing thoroughly with filtered heptane (Heptane-Reagent grade filtered down to 0.45µm) or clean jet fuel and then allowed to dry in a clean environment.
5. The efficacy of the test specimen container can be checked by testing a sample of filtered heptane (Heptane-Reagent grade filtered down to 0.45µm) or clean jet fuel in the cleaned

test specimen container. This should give a count of less than 100 for the 4µm(c) particle size channel.

6. Do not fill the sample container more than 90% full.
7. Ensure that when the sample is divided into smaller portions, each portion accurately represents the original sample and that the rest of the sample stays in the original container.
8. Gently shake the sample in its container for at least a minute, sufficiently to ensure that a representative test specimen can be drawn into the test specimen container.
9. Immediately after gently shaking, pour the mixed sample into the test specimen container and close with a clean cap. Ensure that the test specimen container is less than 90% full.

3.1.1.3.2. Bottle Testing Preparation

1. See Section 3.1.1.3.1 for instructions to be followed before continuing to Step 2 of this procedure.
2. Unscrew the caps on the inlet and outlet port connections that are chain-linked to the APC.
3. Screw the 1620F Minimesh connector end of the H-6-A-0-0-0-1 hose to the inlet port of the APC.
4. Screw the 1620F Minimesh connector end of either the H-2-A-1-0-0-1 or the H-2-A-2-0-0-1 hose to the outlet port of the APC.



ATTENTION! *Failure to fully hand tighten the connectors will cause pump errors and negatively affect particle reading. To prevent damage to threads from overtightening, the user must not use a wrench to tighten the hoses on to either the inlet or outlet port of the APC.*

5. Submerge the open end of the hose connected to the inlet port of the APC into a fluid contained in a bottle, such that the open end of the hose sits in the middle of the fluid and does not touch the sides or bottom of the container.
6. Submerge the open end of the hose connected to the outlet port of the APC into a clean, empty waste container.
7. Follow Steps 1-9 of the testing procedure listed in Section 3.1.2.

3.1.2. Running a Test

Turn on the APC following the below procedure:

1. Insert the battery into the battery connector as shown in Figure 22. Ensure that the pin-out connector of the battery is firmly locked into the corresponding location on the battery connector.
2. Press and hold the left selection button (for about one (1) second) until the ring around the left selection button illuminates blue and the ring around the right selection button illuminates green (do not press the right selection button).



IMPORTANT *The APC can store up to four hundred (400) tests. Test data entries stored in APC memory that are deleted or overwritten cannot be recovered. When the*

data overwrites, it overwrites the oldest file stored. Record data to an alternative medium before this happens, otherwise it will be lost.

Figure 23 depicts what the APC will look like when it is first turned on. Notice the version (2.40 as shown) and the number of tests remaining before the memory starts to overwrite.



Figure 23. APC Power On Screen

Use the left and right selection buttons, as described below, to run a test:

3. Press the right selection button of the APC to select 'TEST' (as shown in Figure 23). After selecting 'TEST', the APC screen will display as shown in Figure 24.

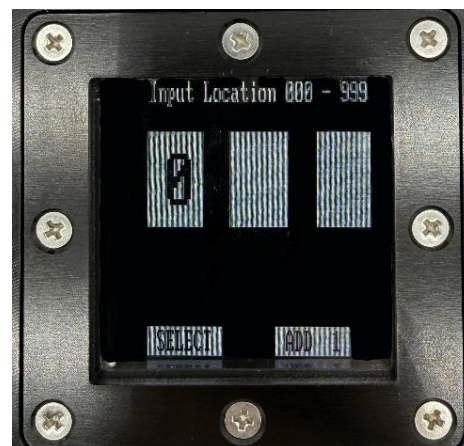


Figure 24. APC Input Location Screen



IMPORTANT Bottle samples still need to be logged based on what location is chosen.

4. Enter the sample location. To do this, press the right selection button to utilize the 'ADD 1' option to increase to the desired number. Once the desired number is displayed, press the left selection button to utilize the 'SELECT' option and move to the next number. See Figure 25 for an example of what the APC will display when an input location is entered.
5. Once the desired sample location is displayed, confirm by pressing the 'SELECT' button again.

! IMPORTANT! *If the user presses the right selection button to utilize the 'ADD 1' option when a value is '9,' then the value will cycle back to '0.' Notice that there are one thousand (1,000) input locations numbered '000-999.'*

! IMPORTANT! *The user must press the left selection button to utilize the 'SELECT' option to confirm all three digits.*



Figure 25. APC Final Input Location Screen

6. Once the sample location number has been entered and confirmed, press the left selection button to utilize the 'FUEL' option to proceed. If the location number needs to be corrected, press the 'CLEAR' button to go back to Step 3 of this procedure and re-enter the location number. Figure 26 shows the display when the 'FUEL' button is pushed.

! IMPORTANT! *If the user wants to completely exit this command, the quickest way to do so would be to turn the unit off. The instructions for how to turn this unit off are explained in Step 9 of this procedure.*



Figure 26. APC Fuel Type Screen

7. Press the right selection button to utilize the 'SCROLL' option to move the white dot next to the desired fuel type for this test. Then press the left selection button, 'SELECT', to start the test. See Figure 27 to see what the APC will look like while taking a sample to test, as well as Figure 28 to see examples of what the APC screen will look like when a test is complete.



ATTENTION! Pressing the left selection button to utilize the 'SELECT' option immediately starts the test. If the user does not want to continue the test after doing this, then the right selection button needs to be pressed to utilize the 'CANCEL' option to stop the test. Refer to Figure 27 to see what the APC looks like while taking a sample. Notice the 'CANCEL' option in the bottom right corner of the screen.



Figure 27. APC Sample in Progress Screen



IMPORTANT! The countdown timer on the screen may not align precisely to the test time. If the timer hits 0.0 seconds remaining but the results do not show up, the user

should wait until the results screen (examples shown in Figure 28) populates before continuing to the next step.

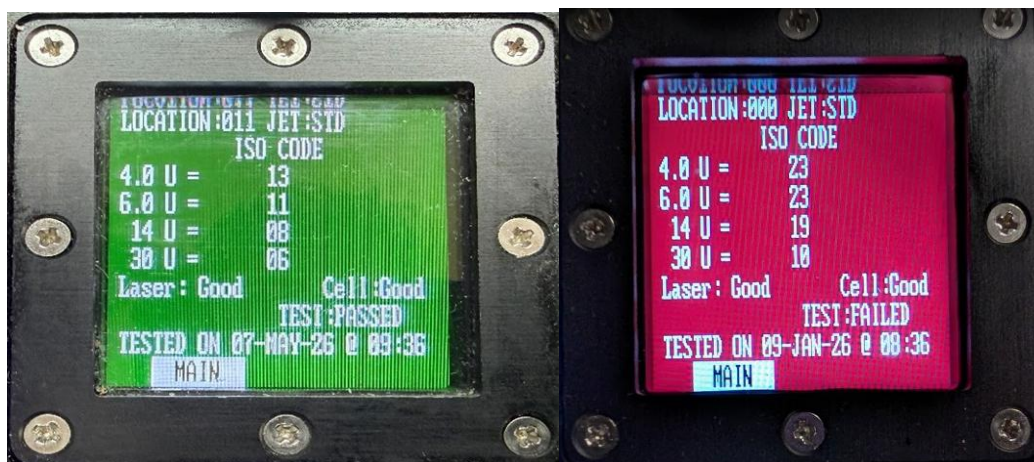


Figure 28. APC Passing Results Screen (Left) and APC Failing Results Screen (Right)



IMPORTANT! Each example shown in Figure 28 shows the average of the two (2) 10 mL samples as explained in Section 2.1. It also shows the corresponding ISO codes and indicates whether the test passes or fails as determined by the ISO codes listed in Table 6. Figure 28 shows a passing test on the left, as evident by the green lit screen, as well as the message 'TEST: PASSED.' Figure 28 shows a failing test on the right, as evident by the red lit screen, as well as the message 'TEST: FAILED.' Other information on this screen includes the location selected after Step 4 in this procedure, the fuel type, the laser health, the cell health, and the time and date of the test. For more detailed information on the laser condition of the most recent test completed, see Section 3.2.2.2. For more detailed information on the cell condition of the most recent test completed, see Section 3.2.2.3. Results are automatically saved to the APC and can be viewed later following the instructions in Section 3.2.1.2.

8. Press the left selection button, 'MAIN' to return to the main screen as shown in Figure 23.
9. Turn off the APC by pressing and holding the left selection button for two (2) seconds.



IMPORTANT! The APC will automatically turn off if it remains idle for ten (10) minutes.

3.2. Tool Options

This section covers different tool options that are available for use within the APC software.

3.2.1. 'MEMORY' Options

This section details the options that are available to use under the 'Memory Actions' screen of the APC. To access the memory options, follow the below step-by-step procedure:

1. Turn the APC on following the APC start-up procedure in Section 3.1.2.
2. Press the left selection button of the APC to select 'TOOLS.' See Figure 22 for the left selection button, and Figure 23 for the 'TOOLS' command.
3. Press the left selection button of the APC to select 'MEMORY.' Figure 29 shows the display with the 'MEMORY' option available.



Figure 29. APC Memory/Maintenance Option Screen



IMPORTANT! If the APC does not detect any memory files, then there will be a message that reads 'No Memory Files detected.' If this occurs, then the 'Memory Screen' will not be accessible. Figure 30 provides an example of this message. To exit this screen, press the right selection button to select 'MAINT.,' which will take the user to 'Maintenance Screen 1.' Then, press the left selection button for the 'BACK TO MAIN' command. This will take the user back to what is shown on the OLED display in Figure 23. Further information on the maintenance screen ('Maintenance Screen 1') will be provided in Section 3.2.2.



Figure 30. APC 'No Memory Files detected.' Message

Upon completing this procedure, the 'Memory Actions' screen should be displayed on the display, as shown in Figure 31.

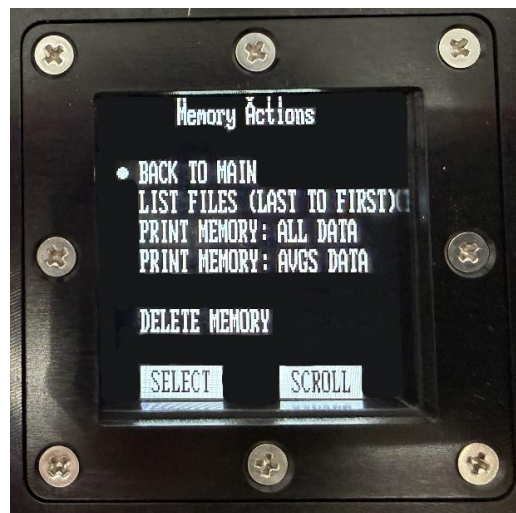


Figure 31. APC 'Memory Actions' Screen

As shown in Figure 31, there are five options within the 'Memory Actions' screen, which will be explained in Sections 3.2.1.1-3.2.1.3. When reading these sections, Figure 31 will be used as a starting reference point.

When accessing this screen, also notice the 'SELECT' and 'SCROLL' options. When pressing the left selection button, the 'SELECT' option will be utilized to move the user to the next screen based upon which option was selected via the location of the white dot on the screen (see the white dot next to the 'BACK TO MAIN' option in Figure 31). When pressing the right selection button, the 'SCROLL' option will be utilized to move the white dot one row downward. If the user presses the right selection button

when the white dot is already at the bottom-most row, then the white dot will appear at the top-most row.

3.2.1.1. 'BACK TO MAIN' Option

The 'BACK TO MAIN' option allows the user to return to the screen that appears when the APC is turned on, as shown in Figure 23.

To select the 'BACK TO MAIN' option, starting on the screen displayed in Figure 31, press the left selection button to utilize the 'SELECT' option. Since the white dot is already to the left of the 'BACK TO MAIN' option, the 'SELECT' option will take the user back to the screen shown in Figure 23.

3.2.1.2. 'LIST FILES (LAST TO FIRST)' Option

The 'LIST FILES (LAST TO FIRST)' option allows the user to scroll, select, and view files saved on the APC.

To select the 'LIST FILES (LAST TO FIRST)' option, starting on the screen displayed in Figure 31, press the right selection button to utilize the 'SCROLL' option, then press the left selection button to utilize the 'SELECT' option. Figure 32 shows the screen that will be shown once this is followed.

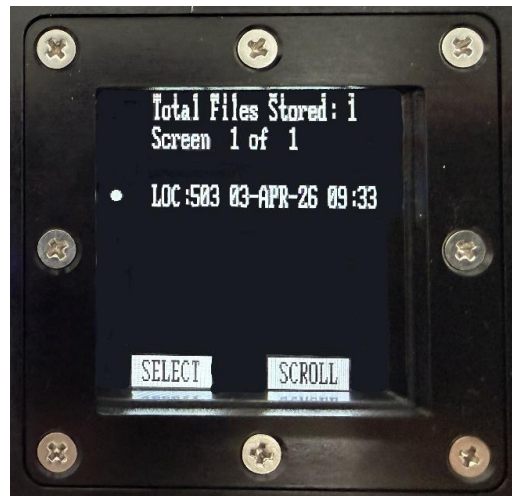


Figure 32. 'LIST FILE (LAST TO FIRST)' Option Screen

Notice similarly to what is described in Section 3.2.1, the 'SELECT' and 'SCROLL' options, along with the white dot, which is located to the left of the 'NEXT SCREEN' option shown in Figure 32. The same methodology for navigating and selecting is also applicable to this screen.

This screen will display five samples at a time and the APC can save up to four hundred (400) files, so there can be as many as eighty (80) screens under this option.

Notice the screen in Figure 32, as it shows the number of total files currently stored, the screen number that the user is currently on, the 'NEXT SCREEN' option, and the five (5) files that appear on the screen. Also notice that these five (5) files are each categorized by location (based upon what is shown in Figure 32), date, and time. When utilizing the 'SCROLL' option by pressing the right selection button, the white dot only appears next to the bottom six (6) rows (the 'NEXT SCREEN' option, and the five (5) files shown

on the screen). If the user chooses to run a test while all four hundred (400) test locations contain a saved test, then the data will be overwritten from the oldest saved file, as mentioned in Section 3.1.2.

To view a specific file, press the right selection button to utilize the 'SCROLL' option until the white dot is next to the desired file, then press the left selection button to utilize the 'SELECT' option. Figure 33 shows examples of what the screen will display once a file is selected. Notice in Figure 33 that the screen is lit green or red indicating a passing result or a failing result, respectively.



Figure 33. APC Passing File View Example (Left) and APC Failing File View Example (Right)

In both Figure 33 examples, the left and right options are now, respectively, 'MAIN' and 'BACK.' Pressing the left selection button will take the user back to the APC start-up screen, described in Section 3.2.1.1. Pressing the right selection button will take the user back to the previous screen, as shown in Figure 32.

! **IMPORTANT!** If the user uses the 'NEXT SCREEN' option and makes it to the last screen of stored files, then the 'NEXT SCREEN' option disappears. In this instance, the user will have to press the left selection button to utilize the 'SELECT' option, then press the left selection button again to utilize the 'MAIN' option, which will take the user back to screen that appears when the APC is starting up. This is the quickest possible way to exit the final screen of the 'LIST FILES (LAST TO FIRST)' option.

3.2.1.3. 'DELETE MEMORY' Option

The 'DELETE MEMORY' option allows the user to delete all files that have been previously saved on the APC.

To select the 'DELETE MEMORY' option, starting on the screen displayed in Figure 31, press the right selection button to utilize the 'SCROLL' option five times, then press the left selection button to utilize the 'SELECT' option. Figure 34 shows what the display will look like once this option is selected.



IMPORTANT! Notice in Figure 31, the gap between the 'PRINT MEMORY: AVGS DATA' option and the 'DELETE MEMORY' option. The white dot that indicates what will be selected to the user will move down to this gap, and then the user must press the right selection button again to utilize the 'SCROLL' option to access to 'DELETE MEMORY' option. If the left selection button is pressed to use the 'SELECT' option while the white dot is in this gap, then nothing will happen. In this case, the user must press the right selection button to utilize the 'SCROLL' option to choose a valid option.

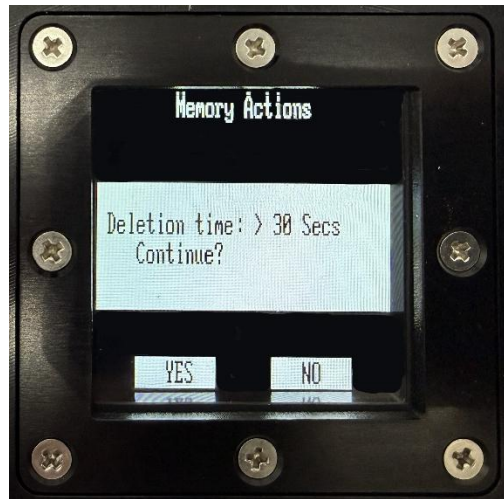


Figure 34. APC 'DELETE MEMORY' Option Screen

In Figure 34, the left and right options are 'YES' and 'NO', respectively. The APC gives an estimate of how long it will take to delete all files. Pressing the left selection button will prompt the APC to confirm that the files will be deleted. Pressing the right selection button will prompt the APC to go back to the 'Memory Actions' screen with the white dot still next to the 'DELETE MEMORY' option.

3.2.2. 'MAINT.' Options

This section details the options that are available to use under the 'Maintenance Screen 1' screen of the APC. To access the maintenance screen, follow the below step-by-step procedure:

1. Turn the APC on following the APC start-up procedure in Section 3.1.2.
2. Press the left selection button of the APC to select 'TOOLS.' See Figure 22 for the left selection button, and Figure 23 for the 'TOOLS' command.
3. Press the left selection button of the APC to select 'MAINT.' Figure 29 shows the display with the 'MAINT.' option available.

Upon selecting 'MAINT', the 'Maintenance Screen 1' screen should be displayed on the screen, as shown in Figure 35.



Figure 35. APC 'Maintenance Screen 1' Screen

There are eight options within the 'Maintenance Screen 1' screen and they will be explained in Sections 3.2.2.1-3.2.2.8. When reading these sections, Figure 35 will be used as a starting reference point.

When accessing this screen, notice the 'SELECT' and 'SCROLL' options. When pressing the left selection button, the 'SELECT' option will be utilized to move the user to the next screen based upon which option was selected via the location of the white dot on the screen (see the white dot next to the 'BACK TO MAIN' option in Figure 35). When pressing the right selection button, the 'SCROLL' option will be utilized to move the white dot one row downward. If the user presses the right selection button in attempt to utilize the 'SCROLL' option while the white dot is already at the bottom-most row, then the white dot will appear at the top-most option.

3.2.2.1. 'BACK TO MAIN' Option

The 'BACK TO MAIN' option allows the user to return to the screen that appears when the APC is turned on, as shown in Figure 23.

To select the 'BACK TO MAIN' option, starting on the screen displayed in Figure 35, press the left selection button to utilize the 'SELECT' option. Since the white dot is already to the left of the 'BACK TO MAIN' option, the 'SELECT' option will take the user back to the screen shown in Figure 23.

3.2.2.2. 'LASER CONDITION' Option

The 'LASER CONDITION' option allows the user to view the laser condition of the most recent sample taken on the APC.



IMPORTANT! When the APC is turned off and on again, the laser condition will report a '0%' until a sample is performed. The laser condition may also report a '0%' if a sample has been initiated then canceled. After a sample is performed, the laser condition will give a non-zero percentage when accessing this screen.

To select the 'LASER CONDITION' option, starting on the screen displayed in Figure 35, press the right selection button to utilize the 'SCROLL' option, then press the left selection button to utilize the 'SELECT' option. Figure 36 shows what the OLED display will look like once this option is selected. Notice the message depicted, as well as the percentage of the laser condition. Values greater than 120 for the laser condition are considered failures. Section 5 explains the procedure for how to perform troubleshooting on the APC if this occurs.



Figure 36. APC Laser Condition Screen

Notice in Figure 36, the left and right selection options are 'MAIN' and 'BACK', respectively. Pressing the left selection button to utilize the 'MAIN' option will take the user back to the screen that appears when the APC is turned on, as shown in Figure 23. Pressing the right selection button to utilize the 'BACK' option will take the user back to the 'Maintenance Screen 1' screen with the white dot next to the 'LASER CONDITION' option.

3.2.2.3. 'CELL CONDITION' Option

The 'CELL CONDITION' option allows the user to view the cell condition of the most recent sample taken on the APC.



IMPORTANT! When the APC is turned off and on again, the cell condition will report a '0%' until a sample is performed. This is not considered a failure. The cell condition may also report a '0%' if a sample has been initiated then canceled. After a sample is performed, the cell condition will give a non-zero percentage when accessing this screen.

To select the 'CELL CONDITION' option, starting on the screen displayed in Figure 35, press the right selection button to utilize the 'SCROLL' option two times, then press the left selection button to utilize the 'SELECT' option. Figure 37 shows what the display will look like once this option is selected. Notice the message depicted, as well as the percentage of the cell condition. Values less than or equal to 80 for the cell condition means the APC should be cleaned/serviced. Section 5 explains the procedure for how to perform troubleshooting on the APC if this occurs.

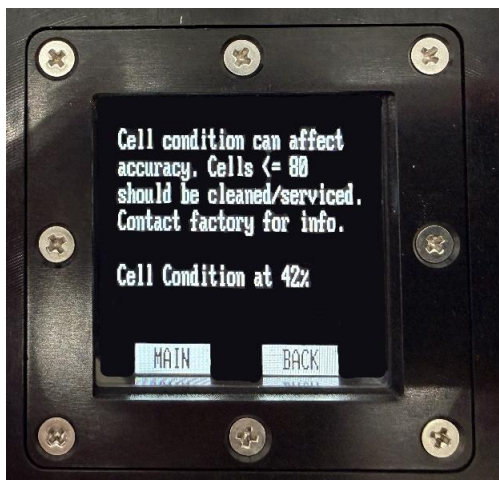


Figure 37. APC Cell Condition Screen

Notice in Figure 37, the left and right selection options are 'MAIN' and 'BACK' respectively. Pressing the left selection button to utilize the 'MAIN' option will take the user back to screen that appears when the APC is turned on, as shown in Figure 23. Pressing the right selection button to utilize the 'BACK' option will take the user back to the 'Maintenance Screen 1' screen with the white dot next to the 'CELL CONDITION' option.

3.2.2.4. 'SET DATE/TIME' Option

The 'SET DATE/TIME' option allows the user to set the current date and time on the APC.

To select the 'SET DATE/TIME' option, starting on the screen displayed in Figure 35, press the right selection button to utilize the 'SCROLL' option three times, then press the left selection button to utilize the 'SELECT' option. Figure 38 shows what the OLED display will look like once this option is selected. Notice that the left and right selection options are 'CHANGE' and 'DOWN', respectively.

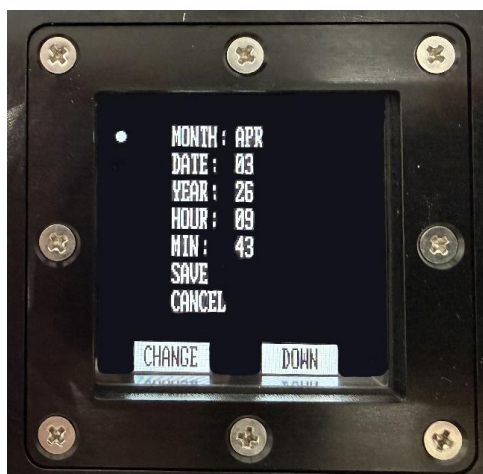


Figure 38. APC Set Date/Time Screen

As shown in Figure 38, the user can change the month, date, year, hour, and minute. There are two rows at the bottom titled 'SAVE' and 'CANCEL.' Pressing the left selection button to utilize the 'CHANGE' option will increase the unit of time the white dot is beside by a quantity of one (1). If the left selection button is pressed to utilize the 'CHANGE' option when the unit of time is at its maximum value, then the unit of time will cycle back to that specific unit of time's minimum value.

IMPORTANT! *If the user scrolls down to the 'SAVE' or 'CANCEL' rows, then the left selection options will become 'SAVE' or 'CANCEL' respectively. To confirm changes made to the date and time, the user must press the left selection button when the white dot is next to 'SAVE.' Since some of these units of time have relatively large ranges, it may save the user time by pressing the left selection button when the white dot is next to 'CANCEL,' which will prompt the APC to cancel any changes made to the date or time. Pressing the left selection button when the white dot is beside either 'SAVE' or 'CANCEL' will take the user back to 'Maintenance Screen 1' with the white dot next to the 'SET DATE/TIME' option.*

3.2.2.5. 'VALIDATION TEST' Option

The 'VALIDATION TEST' option allows the user to run a test to confirm the APC is calibrated and operating correctly.

To select the 'VALIDATION TEST' option, starting on the screen displayed in Figure 35, press the right selection button to utilize the 'SCROLL' option four times.

ATTENTION! *If the left selection button is pressed while the white dot is next to the 'VALIDATION TEST' option, then the validation/verification process will immediately commence. If the user wants to cancel the validation/verification process, then the left selection button can be pressed to utilize a 'CANCEL' option, which will prompt the APC to stop the validation/verification process immediately.*

Press the left selection button to utilize the 'SELECT' option to commence the validation/verification process.

Further information on how to properly perform a validation/verification (which is synonymous with this 'VALIDATION TEST' option) on the APC will be described in Section 3.3.

3.2.2.6. 'INSTALLED PERIPHERALS' Option

The 'INSTALLED PERIPHERALS' option allows the user to view the peripherals installed on the APC.

To select the 'INSTALLED PERIPHERALS' option, starting on the screen displayed in Figure 35, press the right selection button to utilize the 'SCROLL' option five times. Then press the left selection button to utilize the 'SELECT' option. Figure 39 shows what the display will look like once this option is selected. Notice that the left and right selection options are 'MAIN' and 'BACK', respectively.



Figure 39. APC Peripheral Screen

Pressing the left selection button to utilize the 'MAIN' option will take the user back to the APC start-up screen shown in Figure 23. Pressing the right selection button to utilize the 'BACK' option will take the user back to 'Maintenance Screen 1' with the white dot next to the 'INSTALLED PERIPHERALS' option. Notice in Figure 39, the only installed peripheral is 'PARTICLE COUNTER.'

3.2.2.7. 'REVERSE FLUSH' Option

The 'REVERSE FLUSH' option allows the user to perform a reverse flush on the APC.

! **IMPORTANT!** A reverse flush is a specialized procedure that the APC can perform that reverses the direction of fluid flow through the unit. During a reverse flush, the outlet port functions as the inlet, and the inlet port functions as the outlet. This is primarily used to flush debris from the APC, and it will be referenced in Section 5 as a critical troubleshooting step if the APC becomes clogged.

The purpose of a reverse flush is to clean out the APC if it appears there is debris in the flow path. Details on how to more accurately determine this, as well as how to troubleshoot, will be explained in Section 5.

To select the 'REVERSE FLUSH' option, starting on the screen displayed in Figure 35, press the right selection button to utilize the 'SCROLL' option six times. Then press the left selection button to utilize the 'SELECT' option. Figure 40 shows what the display will look like once this option is selected. Notice that the left and right selection options are 'FLUSH' and 'MAINT', respectively.

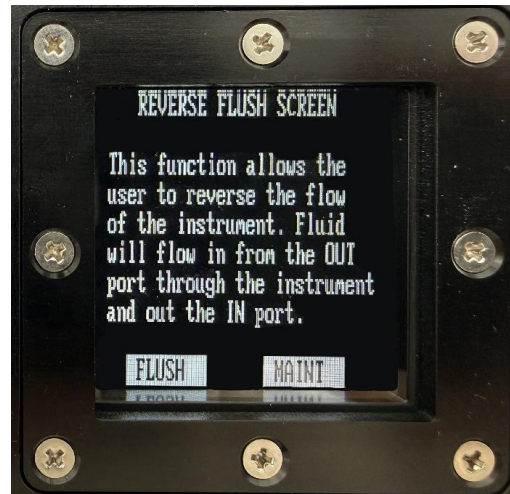


Figure 40. APC Reverse Flush Screen

Pressing the left selection button to utilize the 'FLUSH' option will take the user to the 'Continue Flush?' screen, which is shown in Figure 41. Pressing the right selection button to utilize the 'MAINT' option will take the user back to 'Maintenance Screen 1' with the white dot next to the 'REVERSE FLUSH' option.



Figure 41. APC Continue Flush Screen



ATTENTION! What is shown in Figure 41 is the last screen that the user will see before the APC begins performing a reverse flush. Before pressing the left selection button to utilize the 'YES' option, the user must make sure that the input port is connected to a waste receptacle.

The warning message, shown in Figure 41, is a reminder that the input port must be connected to a waste receptacle. The left and right selection options are 'YES' and 'NO', respectively. Pressing the left selection button to utilize the 'YES' option will prompt the APC to begin a reverse flush, and pressing the right selection button to utilize the 'NO' option will take the user back to 'Maintenance Screen 1' with the white dot next to the 'REVERSE FLUSH' option.

3.2.2.8. 'LCD CONTRAST' Option

The 'LCD CONTRAST' option allows the user to adjust the contrast (brightness) of the APC display screen.

To select the 'LCD CONTRAST' option, starting on the screen displayed in Figure 35, press the right selection button to utilize the 'SCROLL' option seven times. Then press the left selection button to utilize the 'SELECT' option. Figure 42 shows what the display will look like once this option is selected. Notice that the left and right selection options are 'SELECT' and 'NEXT', respectively. Figure 42 displays a message to explain what these options perform. Pressing the left selection button to utilize the 'SELECT' option automatically confirms the contrast selected, and it takes the user back to the APC start-up screen shown in Figure 23. Pressing the right selection button to utilize the 'NEXT' option increases the contrast by a quantity of one (1). If the right selection button is pressed to utilize the 'NEXT' option when the contrast is maximized, then the contrast will cycle back to the dimmest option. Notice there are eight (8) dots underneath the 'USE SELECT TO QUIT' message. These are the dots that quantify the contrast. At a minimum, there will be one (1) dot, and at a maximum, there will be fifteen (15) dots.



Figure 42. APC LCD Contrast Screen

! **IMPORTANT!** When turning the APC off and on again, the contrast automatically resets at half scale. This option also begins at half scale, as depicted in the message at the top of the screen in Figure 42, 'CONTRAST BEGINS AT HALFSCALE.' This also applies if this screen is accessed again after setting a contrast other than half scale.

3.3. Validation/Verification

This section outlines the validation/verification of the APC, as well as how to perform a validation/verification test. See Table 7 for the items that are included in the APC validation/verification kit.

Table 7. Parts Included with Validation/Verification Kit

Part Number	Description
JF-PC-VF-N	PartiStan MTD 2806 Verification Fluid, 400 mL
JF-PC-CTB	Sampling/Verification, Bagged Clean Hose

Follow the step-by-step procedure below to prepare the APC:

! **IMPORTANT!** Do not use the H-2-A-4-0-0-1 hose during validation/verification of the APC.

! **IMPORTANT!** Do not turn off the APC after this procedure. Instead, wait until completing all the procedures in this section before turning off the APC.

1. See Section 3.1.1.3.1 for instructions to be followed before continuing to Step 2 of this procedure.
2. Turn on and prepare the APC by following steps 1-6 of the APC start-up procedure in Section 3.1.2.

3. Unscrew the caps on the inlet and outlet port connections that are chain-linked to the APC.
4. Screw the 1620F Minimesh connector end of the H-6-A-0-0-0-1 hose to the inlet port of the APC.
5. Screw the 1620F Minimesh connector end of either of the remaining H-2-A-1-0-0-1 or H-2-A-2-0-0-1 hose to the outlet port of the APC.



IMPORTANT! When following steps 6-7 of this procedure, use filtered heptane (Heptane-Reagent grade filtered down to 0.45µm) or clean jet fuel.

6. Submerge the open end of the H-6-A-0-0-0-1 hose into a fluid contained in a bottle, such that the open end of the hose sits in the middle of the fluid and does not touch the sides or bottom of the container.
7. Submerge the open end of the hose connected to the outlet port of the APC into a clean, empty waste container.
8. Follow steps 7-8 of the APC start-up procedure in Section 3.1.2.

Follow the step-by-step procedure below to prepare the validation/verification fluid:

1. Fill the ultrasonic cleaner with water.
2. Plug the cable of the ultrasonic cleaner into an appropriate power source.
3. Turn on the ultrasonic cleaner per unit directions to start/stop the sonication.



IMPORTANT! Do not fully open the bottle of validation/verification fluid after Step 3.

4. Loosen the cap on the bottle of validation/verification fluid (JF-PC-VF-N).



IMPORTANT! When placing the bottle of validation/verification fluid in the ultrasonic cleaner, ensure the water in the ultrasonic cleaner goes at least halfway up the bottle. If this is not the case, then repeat Step 1 of this procedure so that the water in the ultrasonic cleaner goes at least halfway up the bottle of validation/verification fluid.

5. Place the bottle of validation/verification fluid standing up in the ultrasonic cleaner and sonicate for 60 seconds.
6. Remove the bottle of validation/verification fluid from the ultrasonic cleaner.
7. Close and fully tighten the cap of the bottle of validation/verification fluid and invert end over end repeatedly at a rate of once per second for 60 seconds.
8. Loosen the cap on the bottle of validation/verification fluid.
9. Place the bottle of validation/verification fluid standing up in the ultrasonic cleaner and sonicate for another 60 seconds.
10. Remove the bottle of validation/verification fluid from the ultrasonic cleaner.
11. Close and fully tighten the bottle of validation/verification fluid and invert end over end repeatedly for 60 seconds.



IMPORTANT! *If the bottle of validation/verification fluid does not sit for 20 seconds after this step, then the bubbles in the bottle of validation/verification fluid will adversely alter the measurement.*

12. Let the bottle of validation/verification fluid sit for 20 seconds to allow bubbles to dissipate.
13. Perform the validation/verification procedure for the APC immediately.



IMPORTANT! *If the user is performing a validation/verification on multiple APC units, this procedure must be repeated in between each validation/verification.*

Follow the step-by-step procedure below to validate/verify the APC:

1. Submerge the open end of the H-6-A-0-0-0-1 hose with plastic tube (JF-PC-CTB) into the validation/verification fluid contained in the bottle of validation/verification fluid.
2. Submerge the open end of the hose connected to the outlet port of the APC into a clean, empty waste container.
3. Follow Section 3.2.2.5 to commence the validation/verification.



IMPORTANT! *If the result of the 'VALIDATION TEST' is within the range of the lower and upper limit of the values printed on the validation/verification fluid bottle, then the validation/verification was successful. If the result of the 'VALIDATION TEST' was outside the range of values printed on the bottle of validation/verification fluid, then the validation/verification failed and the APC needs to be shipped to D-2 Incorporated for recalibration. See Section 3.4 for calibration of the APC.*

3.4. Calibration

D-2 Incorporated requires the APC to be factory-calibrated every five (5) years, or upon failing the validation/verification procedure outlined in Section 3.3. The APC comes with a calibration sheet tailored to the specific unit being used.



IMPORTANT! *The calibration sheet contains the date the APC was calibrated by D-2 Incorporated, as well as the date the next calibration is due. The due date of the next calibration will be five (5) years after the calibration date.*

If the APC requires calibration, then the user must ship the unit back to D-2 Incorporated following the shipping instructions explained in Section 6, as well as the APC repair/rebuild instructions explained in Section 7.

4. Maintenance

This section is intended to describe the basic steps that should be taken to properly maintain the APC.

4.1. APC Unit

When the user is finished using the APC, it should be turned off by pressing the left selection button for two (2) seconds to turn off the APC. This can be done at any time the APC is turned on.



WARNING! Before wiping the APC with isopropanol alcohol, ensure that the unit is not visibly damaged, is turned off, and the battery has been removed.

After testing, the user should inspect the APC for visual damage and wipe it down using a cloth wipe (clean) and isopropanol alcohol.

4.2. Battery/Charger



WARNING! Read and understand all of Section 2.4.2 (Battery Charging) before performing any maintenance on the battery or the charger.



WARNING! Shock hazard. If the battery is inserted into the APC, it must be disconnected from the APC before cleaning. If the battery is connected to the charger, it must be disconnected before cleaning. If the charger is connected to an AC power source, it must be disconnected before cleaning the charger.

Debris may be removed from the exterior of the battery (as well as the charger) by using a cloth wipe (clean and dry) or a non-metallic brush (soft). Do not use water or cleaning solutions.

4.3. Hoses

When the user is finished using the APC, the hoses should be removed before cleaning them. This can be done while the APC is on or off.



CAUTION! The user can remove the hoses from the APC while the APC is turned on, but do not remove the hoses while the APC is running a test.

The user should inspect the hoses for visual damage and ensure that the stress springs are properly attached to the end of the hoses. The purpose of these stress springs is to prevent kinking, collapsing or damaging the hoses. The user should wipe any fuel residue off the hoses using a cloth wipe (clean and dry) to avoid accelerated degradation.



ATTENTION! The hoses are intended to bend, but do not bend them to such a small radius that causes them to kink. This will permanently damage the hose and require replacement.

If fluid flow through the hose is miniscule and slow, refer to Section 5 for troubleshooting.

4.4. Shoulder Carry Case

After testing, the user should check the shoulder carry case for visible fraying of the material, as well as general visible damage. If the shoulder carry case is visibly frayed or damaged, then the user shall contact D-2 Incorporated for a replacement.



CAUTION! The user should not use the shoulder carry case if it is visibly frayed or damaged.

Before attempting to clean the shoulder case, remove the APC. The shoulder case can be machine washed in cold water with mild detergent. The case should be hung to air dry. Do not place the shoulder case in a machine dryer.

5. Troubleshooting

This section will cover basic APC troubleshooting – unit will not turn on, battery charging, hose connections leaking, etc.

5.1. Troubleshooting Introduction

This section describes issues that may arise while operating the APC, malfunctions causing these issues, and corrective actions that should be performed to properly fix each issue, and in Section 5.2, these will be organized in table format.



WARNING! *The user must read and understand the entirety of this section before sending the APC or its inoperable parts back to D-2 Incorporated. The user must not attempt to work on the APC using any methodology outside the scope of this manual. The user must also read and understand the entirety of Sections 6 and 7.*

For each malfunction/symptom listed, the corrective actions should be followed to remedy the malfunction. Some steps may be bypassed if a particular component listed is not malfunctioning. All procedures shall be reviewed to ensure that potential cause and effect outcome of the step does not impact subsequent steps.

A malfunction may be corrected at any point during these troubleshooting procedures. At that point, once the user verifies that the malfunction or symptom that initiated the troubleshooting process has been eliminated, no further troubleshooting is required.

5.2. Troubleshooting Procedures

5.2.1. APC Will Not Turn On

Table 8 shows fault condition, malfunctions, and corrective actions for troubleshooting the APC when it will not turn on.

Table 8. APC Will Not Turn On Troubleshooting

Fault Condition	Malfunction	Corrective Action
APC will not turn on.	Unit does not turn on when left selection button is presses.	Press and hold the left selection button for at least one second, until the ring around the left selection button illuminates blue light and the right selection button illuminates green light (it is not needed to press the right selection button).
		Verify APC turns on. Select appropriate statement below: a. Return APC to service if it turns on. b. Proceed to next malfunction if APC does not turn on.
	Battery not installed properly.	Verify that battery is securely installed in the battery holder on the APC.
		Press and hold the left selection button until the ring around the left selection button illuminates blue light and the right selection button illuminates green light (it is not needed to press the right selection button).
		Verify APC turns on. Select appropriate statement below: a. Return APC to service if it turns on. b. Proceed to next malfunction if instrument does not turn on.
	Battery not charged.	Inspect battery charge indicator of battery to ensure that the battery is charged.
		If no charge is indicated, remove and charge the battery.

		When battery is fully charged, securely reinstall battery in the battery holder on the APC.
		If battery does not charge, proceed to battery not charging troubleshooting, Section 5.2.2.

5.2.2. Battery Not Charging

Table 9 shows fault condition, malfunctions, and corrective actions for troubleshooting the battery when it is not charging.

Table 9. Battery Not Charging Troubleshooting

Fault Condition	Malfunction	Corrective Action
Battery not charging.	Battery damaged.	Inspect appearance of battery. Select appropriate statement below: a. Proceed to next malfunction if battery does not show evidence of damage. b. Replace battery if battery shows evidence of damage.
		Remove battery charger from battery.
	Battery electrical contacts dirty.	Inspect electrical contacts. Select appropriate statement below: a. Proceed to Section 5.2.3 if contacts do not show evidence of dirt or corrosion. b. Proceed to Step 3 if contacts show evidence of dirt or corrosion.
		Clean contacts with non-metallic brush.
		Install battery charger to battery.
		Return unit to service.

5.2.3. Battery Charger Not Charging Battery.

Table 10 shows fault condition, malfunctions, and corrective actions for troubleshooting the battery charger when it is not charging the battery.

Table 10. Battery Charger Not Charging Battery Troubleshooting

Fault Condition	Malfunction	Corrective Action
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Battery charger not charging battery.	Charger electrical contacts dirty.	Inspect electrical contacts. Select appropriate statement below: a. Proceed to next malfunction if contacts do not show evidence of dirt or corrosion. b. Proceed to Step 2 if contacts show evidence of dirt or corrosion.
		Clean contacts with non-metallic brush.
		Install battery charger into battery and observe charge progress on indicator bar on battery. Select the appropriate statement below: a. Re-install battery into APC and return the unit to service if battery charges properly. b. Replace battery with a new one and return unit to service if battery does not charge properly.
	Power supply connector is damaged.	Inspect connector on instrument end of power cable. Select appropriate statement below: a. Proceed to next malfunction if there is no damage visible on power supply connector. b. Replace battery charger if damage is evident on power supply connector.
		Install battery charger to battery.
	Power supply is malfunctioning.	Test battery charger. Select appropriate statement below: a. Proceed to Step 3 if power output on battery charger output cables is within standards. b. Replace battery charger if power output on battery charger output cables is not within standards.

		Replace battery charger that does not allow battery to be charged.
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5.2.4. Cell/Laser Health Failure Message

Table 11 shows fault condition, malfunctions, and corrective actions for troubleshooting the APC when it gives a cell/laser health failure message after running a test.

Table 11. Cell/Laser Health Failure Message Troubleshooting

Fault Condition	Malfunction	Corrective Action
Cell/laser health failure message.	No hoses are connected to APC (causes a cell failure message if there is no fluid in APC).	Hand tighten hoses until there is no longer movement (to prevent damage to threads from overtightening, do not tighten with a wrench) on the inlet and outlet ports of the APC. Select the appropriate statement below: a. Return APC to service if hand tightening the hoses resolves the cell and/or laser health failure message. b. Proceed to next malfunction if hand tightening the hoses does not resolve the cell and/or laser health message.
	In-air test is performed (causes a cell failure message).	Perform a test by following Section 3.1.1.3 using filtered heptane or clean jet fuel as the submersed fluid in Step 5 of the procedure in Section 3.1.1.3.2. Select the appropriate statement below: a. Return APC to service if performing a test resolves the cell and/or laser health failure message. b. Proceed to next malfunction if performing a test does not resolve the cell and/or laser health message.
	Hoses are not completely screwed on.	Hand tighten hoses until there is no longer movement (to

		prevent damage to threads from overtightening, do not tighten with a wrench) on the inlet and outlet ports of the APC. Select the appropriate statement below: a. Return APC to service if hand tightening the hoses resolves the cell and/or laser health failure message. b. Proceed to next malfunction if hand tightening the hoses does not resolve the cell and/or laser health failure message.
	A long connector is connected to a short hose (causes a cell failure message).	Replace hoses with hoses that have the correct actuator length. Hand tighten hoses until there is no longer movement (to prevent damage to threads from overtightening, do not tighten with a wrench) on the inlet and outlet ports of the APC. Select the appropriate statement below: a. Return APC to service if replacing the hoses resolves the cell and/or laser health failure message. b. Proceed to next malfunction if replacing the hoses does not resolve the cell and/or laser health message.
	The cell condition is less than or equal to 80, or the laser condition is greater than 120.	Perform a reverse flush by screwing the 1620F Minimes connector end of either the H-2-A-1-0-0-1, H-2-A-2-0-0-1, or the H-6-A-0-0-0-1 hoses to the inlet port of the APC, screwing the 1620F Minimes connector end of one of those remaining hoses to the outlet port of the APC, and following Section 3.2.2.7 to conduct a reverse flush. Select

		the appropriate statement below: a. Return APC to service if the reverse flush resolves the cell and/or laser health failure message. b. Proceed to Step 2 if the reverse flush does not resolve the cell and/or laser health failure message.
		Perform a test by following Section 3.1.1.3 using filtered heptane or clean jet fuel as the submersed fluid in Step 5 of the procedure in Section 3.1.1.3.2. Select the appropriate statement below: a. Return APC to service if performing a test resolves the cell and/or laser health failure message. b. Return APC to D-2 Incorporated for service if performing a test does not resolve the cell and/or laser health failure message.

5.2.5. Poor Fuel Flow to APC

Table 12 shows fault condition, malfunctions, and corrective actions for troubleshooting poor fuel flow to the APC.

Table 12. Poor Fuel Flow to APC Troubleshooting

Fault Condition	Malfunction	Corrective Action
Poor fuel flow to APC.	One or both hoses connected to the APC are damaged.	Inspect both hoses. Select appropriate statement below: a. Proceed to next malfunction if hoses show no evidence of damage. b. Proceed to Step 2 if hoses show evidence of damage.
		Replace both hoses. Select the appropriate statement below:

		a. Return to service if replacing both hoses resolves the fuel flow issue. b. Proceed to next malfunction if replacing both hoses does not fix the fuel flow to the APC.
	There is a kink in one or both hoses (internally damaged).	Replace both hoses. Select the appropriate statement below: a. Return to service if replacing both hoses resolves the fuel flow issue. b. Proceed to next malfunction if replacing both hoses does not fix the fuel flow to the APC.
	The APC is clogged (the output volume is at most 77 mL).	Perform a test by following Section 3.1.1.3 using filtered heptane or clean jet fuel as the submersed fluid in Step 5 of the procedure in Section 3.1.1.3.2, and submerging the outlet hose in a graduated cylinder of at least 100 mL. Select the appropriate statement below: a. Return APC to service if performing a test results in an output of at least 80 mL into the graduated cylinder. b. Proceed to Step 2 if performing a test results in an output of less than 80 mL. Perform a reverse flush by screwing the 1620F Minimes connector end of either the H-2-A-1-0-0-1, H-2-A-2-0-0-1, or the H-6-A-0-0-0-1 hoses to the inlet port of the APC, screwing the 1620F Minimes connector end of one of those remaining hoses to the outlet port of the APC, and following Section 3.2.2.7 to utilize the APC to commence the reverse flush. Select the appropriate statement below:

		a. Return APC to service if the reverse flush resolves the fuel flow issue. b. Proceed to Step 3 if the reverse flush unsuccessfully fixes the fuel flow to the APC.
		Perform a test by following Section 3.1.1.3 while using filtered heptane or clean jet fuel as the submersed fluid in Step 5 of that procedure. Select the appropriate statement below: a. Return APC to service if this test successfully fixes the fuel flow to the APC. b. Return APC to D-2 Incorporated for service if the fuel flow continues to be poor.

5.2.6. Pump Failure

Table 13 shows fault condition, malfunctions, and corrective actions for pump failure in the APC.

Table 13. Pump Failure Troubleshooting

Fault Condition	Malfunction	Corrective Action
Pump failure (no hoses connected to APC, fluid in APC).	APC is showing a blue screen while performing a sample.	Connect hoses to APC. Hand tighten hoses until there is no longer movement (to prevent damage to threads from overtightening, do not tighten with a wrench) on the inlet and outlet ports of the APC. Select appropriate statement below: a. Return APC to service if connecting the hoses resolves the pump failure. b. Proceed to Step 2 if connecting the hoses to APC does not resolve the pump failure.
		Perform a reverse flush by screwing the 1620F Minimesh connector end of either the H-2-A-1-0-0-1, H-2-A-2-0-0-1, or the H-6-A-0-0-0-1 hoses to the inlet port of the APC, screwing the

		1620F Minimes connector end of one of those remining hoses to the outlet port of the APC, and following Section 3.2.2.7 to utilize the APC to commence the reverse flush. Select the appropriate statement below: a. Return APC to service if the reverse flush resolves the pump failure issue. b. Return APC to D-2 Incorporated for service if the reverse flush does not resolve the pump failure issue.
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6. APC Unit Storage and Shipping Instructions



WARNING! Remove fuel from the APC before shipping.

6.1. APC Unit

This section is intended to describe storage and shipping requirements for the APC. The user should follow the APC maintenance procedures described in Section 4.1 before storing the APC.

6.1.1. Storage

The APC should be stored in a stable location (where it won't be susceptible to physical damage). For example, the APC can be stored in its original shipping box. The only item required to be removed before storing the APC are the hoses from the APC inlet and outlet connections. The APC can be stored with the battery inserted (if the APC is turned off), and the APC can be stored with the shoulder carry case still attached to the unit.

6.1.2. Shipping

The APC can be shipped in the same shipping box as the case, battery and/or hoses, but these items should not be attached to or inserted into the APC. Before shipping the APC, the remaining fuel inside the unit should be removed by performing a test with hoses properly attached to the inlet and outlet ports, with the inlet hose being open to the air and not submersed in any liquid. To perform this test, follow the test procedure outlined in Section 3.1.2.



IMPORTANT! When running this test, ensure that the hoses are connected properly to the inlet and outlet ports. Otherwise, the check valve in either of the ports will not allow air to enter the APC. Also ensure that a waste container is available to collect any fuel expelled through the outlet port. The user will know that the APC is ready to ship when the outlet port quits expelling volume. This procedure is also recommended before long-term storage to avoid accelerated degradation of the unit. Long term storage is defined as 6 months or longer.

When shipping the APC, pack it appropriately such that it does not get damaged during shipping. For D-2 Incorporated's shipping address, see Section 7.

6.2. Battery/Charger



WARNING! Shock hazard. Ensure the ziptop bag used to store the battery and charger (while having all individual units unplugged from each other) is clean, dry, and not ripped. Do not allow water or any liquid to enter the bag that stores or ships the battery or the charger. If this occurs, the components must be removed, dried, and placed in a new bag that is clean, dry, and not ripped.

This section is intended to describe basic storage and shipping requirements for the APC battery and charger. The user should follow the battery/charger maintenance procedures explained in Section 4.2 before storage.

6.2.1. Storage

The battery can be stored while connected to the APC if the APC is turned off. If the user chooses to remove the battery from the APC, then both the battery and its charger should be stored near the APC to minimize any chance of losing them. The battery and the charger can be stored in the shipping box that was used to ship the APC to the user.

It is recommended to use a ziptop bag to store the battery and the charger. The battery should not be stored connected to the charger and the charging block should not be plugged into the 30-inch cable.

6.2.2. Shipping



IMPORTANT! *The unit may not be allowed to ship if the battery charge is greater than or equal to 35% of its full charge. The user must ensure that the battery only has one black square (see Figure 20) to guarantee that the battery is at less than 35% of its full charge.*

When shipping the battery and charger, it is recommended to ship these items (in a ziptop bag) in the same box as the APC. If using a shipper, ask the shipping company to insert the battery and the charger in the same shipping box before they are shipped. For D-2 Incorporated's shipping address, see Section 7.

6.3. Hoses

This section is intended to describe basic storage and shipping requirements for the APC hoses. The user should follow the connection hose maintenance procedures explained in Section 4.3 before storage.

6.3.1. Storage

The hoses should be stored in a stable location with, but not attached to, the APC. The hoses can be stored in the same shipping box that was used to ship the APC to the user.

The hoses may be stored in ziptop bags. If bags are used, they should be marked with the D-2 part number. Hoses of the same part number may be stored in the same bag. These ziptop bags should be stored with the APC to prevent misplacement.

6.3.2. Shipping



WARNING! *Remove fuel from the hoses before shipping. After performing the flush described in Section 6.1, the user should wipe the exterior of the hoses down with a clean and dry cloth to remove any fuel residue.*

When shipping the hoses, it is recommended to ship them (while the hoses are in ziptop bags) in the same box as the APC. For D-2 Incorporated's shipping address, see Section 7.



WARNING! *Ensure the ziptop bags used to store/ship the hoses are as clean and dry as possible and ensure that the bags are not ripped.*



ATTENTION! Use large ziptop bags so kinking, collapsing, or damaging the hoses is avoided. This applies to both storing and shipping the hoses.

6.4. Shoulder Carry Case

This section describes basic storage and shipping requirements for the APC shoulder carry case. The user should follow the shoulder carry case maintenance procedures explained in Section 4.4 before storage.

6.4.1. Storage

The shoulder carry case can be stored while it is on the APC. If it is removed, it should be stored with the APC to avoid misplacement.

6.4.2. Shipping

The shoulder case should be shipped in the same box as the APC. It is acceptable to ship the case while attached to the APC. For D-2 Incorporated's shipping address, see Section 7.



ATTENTION! If the shoulder carry case has recently been washed following the instructions given in Section 4.4, ensure it has finished air drying before shipping.

7. APC Repair/Rebuild

The APC is considered the lowest repairable part; it shall not be opened to attempt repairs. Opening the unit may void its warranty. If all options in this manual regarding validation/verification, maintenance, and troubleshooting are unsuccessful, then the user must ship the APC and its inoperable parts back to D-2 Incorporated for repair/replacement. See Appendix B for D-2 Incorporated's service request form.



WARNING! Do not attempt any service on the APC or its inoperable parts that are outside the scope of this manual. If the information in this manual does not successfully allow the user to correct a specific problem(s) with the APC or its inoperable parts, it must be shipped back to D-2 Incorporated for repair/replacement.



ATTENTION! If the instructions in the operating manual are not adequately adhered to, then there shall be no entitlement to services under warranty.

To ship the APC and its inoperable parts back to D-2 Incorporated, follow the shipping instructions explained in Section 6, and ship the APC and its inoperable parts back to D-2 Incorporated's at the following address:

D-2 Inc.
6 Otis Park Drive
Bourne, MA 02532

D-2 Incorporated should also be contacted via phone at +1-508-329-2046 and/or via email at sales@d-2inc.com so they are prepared to receive the shipment.

Appendix A. FTM 1203.0 Precision

The APC operates with the following precision in accordance with Federal Test Method 1203.0.

Repeatability – The difference between successive test results obtained by the same operator with the same apparatus under constant operating conditions on nominally identical test material would, in the normal and correct operation of the test method, exceed the value below only in one case in 20. Table A-1 shows the repeatability and applicable ranges for particle sizes (cumulative count) $\geq 4 \mu\text{m(c)}$, $\geq 6 \mu\text{m(c)}$, $\geq 14 \mu\text{m(c)}$ and $\geq 30 \mu\text{m(c)}$ for container samples. Table A-2 shows the repeatability and applicable ranges for particle sizes (cumulative count) $\geq 4 \mu\text{m(c)}$, $\geq 6 \mu\text{m(c)}$, and $\geq 14 \mu\text{m(c)}$ for on-line samples.

Reproducibility, Single Site – The difference between two test results independently obtained by different operators using different apparatuses on nominally identical test material at the same location would, in the normal and correct operation of the test method, exceed the value below only in one case in 20. Table A-1 shows the reproducibility and applicable ranges for particle sizes (cumulative count) $\geq 4 \mu\text{m(c)}$, $\geq 6 \mu\text{m(c)}$, $\geq 14 \mu\text{m(c)}$, and $\geq 30 \mu\text{m(c)}$ for bottle samples. Table A-2 shows the reproducibility and applicable ranges for particle sizes (cumulative count) $\geq 4 \mu\text{m(c)}$, $\geq 6 \mu\text{m(c)}$ and $\geq 14 \mu\text{m(c)}$ for on-line samples.

NOTE: On-line samples analyzed for the interlaboratory study used to generate the repeatability and reproducibility of this method did not contain sufficient $\geq 30 \mu\text{m(c)}$ particles to calculate precision of this method. $\geq 30 \mu\text{m(c)}$ particles are still required to be reported.

Table A-1. Container sample precision and range per 1 mL.

<u>Parameter size band</u>	<u>Range of results</u>	<u>Repeatability, r</u>	<u>Reproducibility, R</u>
≥4 μm(c)	360-14999	$0.5513 * x^{0.7809}$	$0.4525 * x^{0.9168}$
≥6 μm(c)	115-31321	$0.4771 * x^{0.8451}$	$1.0649 * x^{0.8451}$
≥14 μm(c)	20-2871	$0.1498 * x^{1.0868}$	$0.3924 * x^{1.0868}$
≥30 μm(c)	20-1592	$1.1746 * x^{0.8928}$	$1.9265 * x^{0.8583}$

Where: x = the average of the 2 results being compared.

Table A-2. On-line precision and range per 1 mL.

<u>Parameter size band</u>	<u>Range of results</u>	<u>Repeatability, r</u>	<u>Reproducibility, R</u>
≥4 μm(c)	44-3499	$1.1792 * x^{0.6721}$	$3.4659 * x^{0.6721}$
≥4 μm(c)	3500-25489	$0.1123 * x^{0.9616}$	$3.4659 * x^{0.6721}$
≥6 μm(c)	8-24820	$0.3498 * x^{0.8498}$	$1.0796 * x^{0.8498}$
≥14 μm(c)	1-2232	$0.5061 * (x+0.0001)^{0.8854}$	$1.104 * (x+0.0001)^{0.8854}$

Appendix B. RMA

The service request form as shown in Figure B-1 shall be filled out and included in the APC shipment to D-2. Failure to provide the required information may result in service delays.



D-2 Inc SERVICE REQUEST FORM

* Required Data (Note: We will not be able to complete the service/shipping process without this)

Request Date:		* Return Authorization (RMA)	
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Customer Detail:

*	Lab/Fuel Site/Ship Name			
	PO or Req#			
		Name	Phone	Email
*	Point of Contact: Main			
	POC / Technical			
*	Financial Contact (CC Authorization)			

Return Shipment Detail: (Note: You are responsible for shipping your equipment to D-2)

*	Street or FPO Unit/Box#	
	Address 2 (Warehouse, Bldg etc)	
	Address 3	
*	City	
*	State / Province / FPO AP/AE	
*	Postal Code & Country	

Equipment Service Detail/Check Service Required →

Qty	Product/Description	Calibration	Repair	Other (Describe)
	JF-1A Series: In Line Conductivity			
	JF-WA1 Series: Hydro-Light DFWD			
	JF-1A-ST Series: Handheld Cond.			
	JF-WSI Series: Water Separability			
	JF-PC Series: Particle Counter			
	Other (Describe)			
	Materials used in testing (fuel type, additive, chemical, etc)			

For Repairs/Other - Describe Instrument Failure Mode & Your Requirements

Figure B-1. Sample Service Request Form.

Appendix C. Limited Warranty

Subject to the limitations contained in “Limitation of Remedy & Liability” section, as shown below, Seller warrants that products provided will perform to the ability of the published specifications or Industry Method(s) claimed by the Seller. The Seller certifies that the goods manufactured, or services provided will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period.

Standard laboratory products are warranted for twelve (12) months from the date of initial calibration, which will be referenced by supplied documentation or electronically embedded into the product’s memory or both.

Specialized equipment in the form of product line additive systems, also known as “Skids” are warranted for twelve (12) months from the initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first.

Marine laboratory or deployment products are warranted for twelve (12) months from the date of initial calibration, which will be referenced by supplied documentation or electronically embedded into the product’s memory or both.

If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, correct any errors that are found by Seller in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty and shall be at Buyer’s expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Seller. All costs of dismantling, reinstallation and freight and the time and expenses of Seller’s personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller. Goods repaired and parts replaced by Seller during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by Seller. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

LIMITATION OF REMEDY AND LIABILITY: Seller shall not be liable for damages caused by delay in performance. The remedies of buyer set forth in this agreement are exclusive. In no event, regardless of the form of the claim or cause of action (whether based in contract, infringement, negligence, strict liability, other tort or otherwise), shall seller’s liability to buyer and/or its customers exceed the price to buyer of the specific goods manufactured or services provided by seller giving rise to the claim or cause of action. Buyer agrees that in no event shall seller’s liability to buyer and/or its customers extend to include incidental, consequential or punitive damages. The term “consequential damages” shall include but not



be limited to, loss of anticipated profits, revenue or use and costs incurred including without limitation for capital, fuel and power, and claims of buyer's customers.

Equipment supplied by but not manufactured by D-2 Incorporated, is supported only to the extent of the original manufacturer's original warranties. All OEM sensors which utilize electrodes (oxygen cartridges, pH, ORP, etc.) is warranted at the time of shipment, and shall perform upon initial installation within stated specifications. If the product proves to be defective within the OEM's warranty, we will replace the product or defective part with a similar model, product or part, but only to the extent that the OEM will warrant.

All returned products must be accompanied by a Returned Material Authorization (RMA) number issued by D-2 Incorporated. Shipments will not be accepted without the RMA number. An RMA number can be obtained by calling Customer Service Department at 508-329-2046 or by emailing Sales@D-2inc.com. D-2 can supply a customer return Procedure and a D-2 Service Request form which can be filled out and returned with the instrument to answer the following parameters...

Return Material Authorization Number Model/Serial Number

Brief Description of the Problem Customer Contact/Telephone Number

CALIBRATION SERVICE POLICY

A calibration only service is available for JF-PC-N.

The service is limited to instruments requiring only calibration and minor adjustment. Instruments that are not operating properly and require repair or replacement parts will not be covered. If repair is necessary the customer will be contacted and apprised of the additional cost. In the event that the customer does not approve repair, the unit will be returned in "as received" condition and the teardown and inspection charge will be invoked.

Appendix D. Firmware Revision History

Include revision history details from Firmware level of initial issue – should include any software modification details - could be here or beneath the Manual Revision

Firmware Version	Description
2.40	Changed saved File listing from First-To-Last to Last-To-First
2.41	Fixed Incorrect fuel name headings on non JF-PC-N units

Appendix E. APC Assembly/Parts Information

WARNING! *This is for reference only. The APC should not be disassembled in the field. The user should defer to Section 7 if the scope of this manual does not correct the problem(s) with the APC or its inoperable parts that the user is experiencing.*

The following section shows APC unit disassembly views, as well as a table that lists the parts referenced in the views. Figures E-1 through E-4 show various exploded views of the APC, and Table E-1 shows the parts list that is associated with the item number bubbles in those figures.

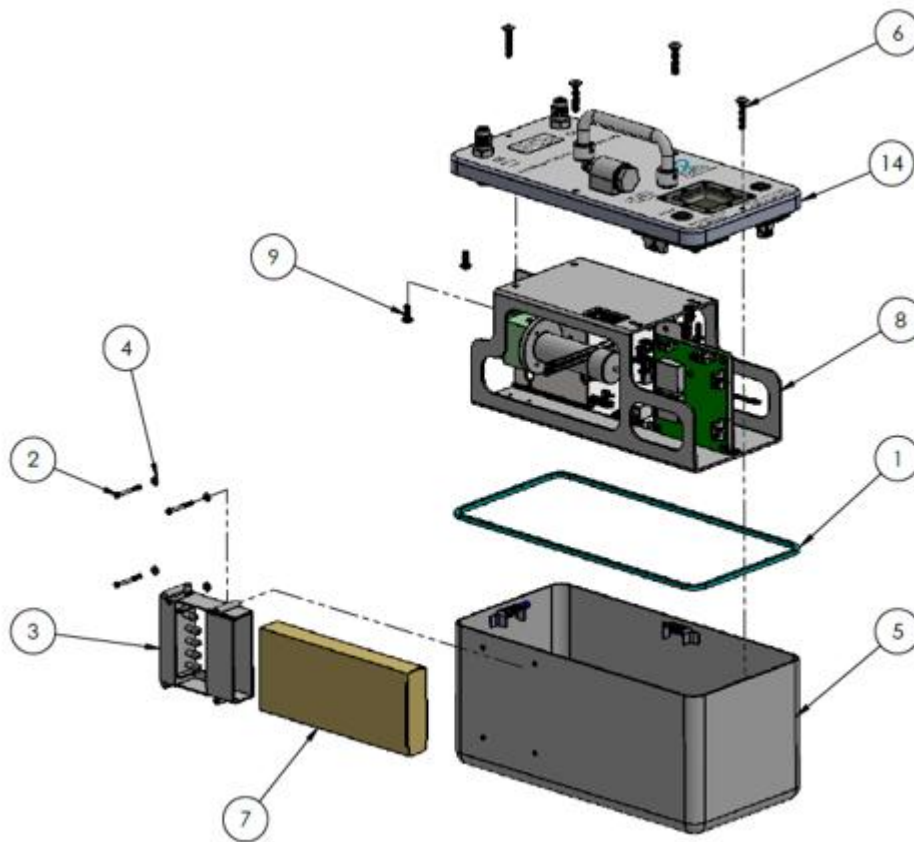


Figure E-1. Exploded view of APC, Entire Assembly.

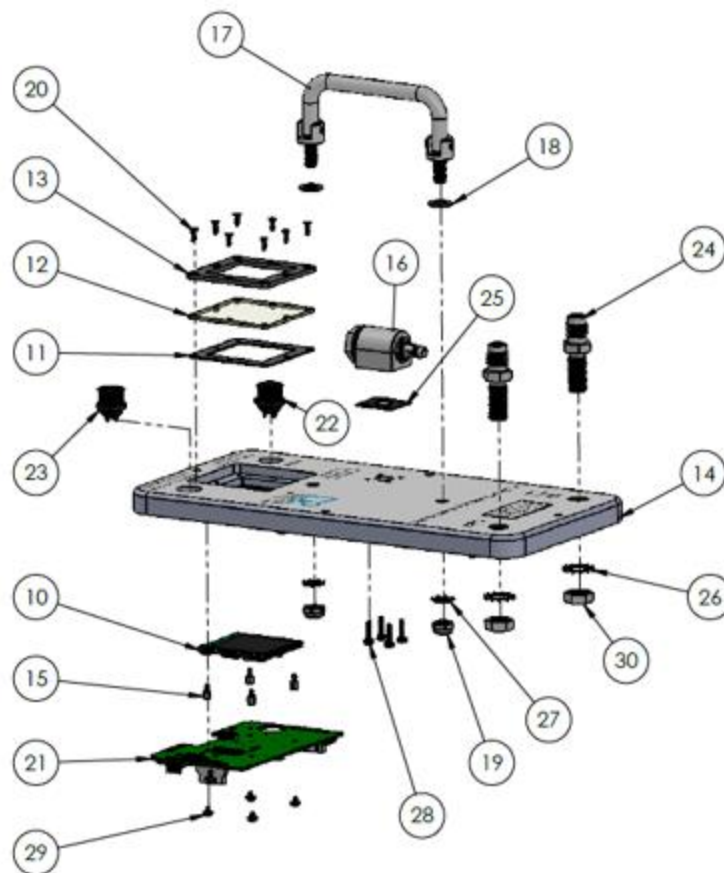


Figure E-2. Exploded View of APC, Controls Assembly.

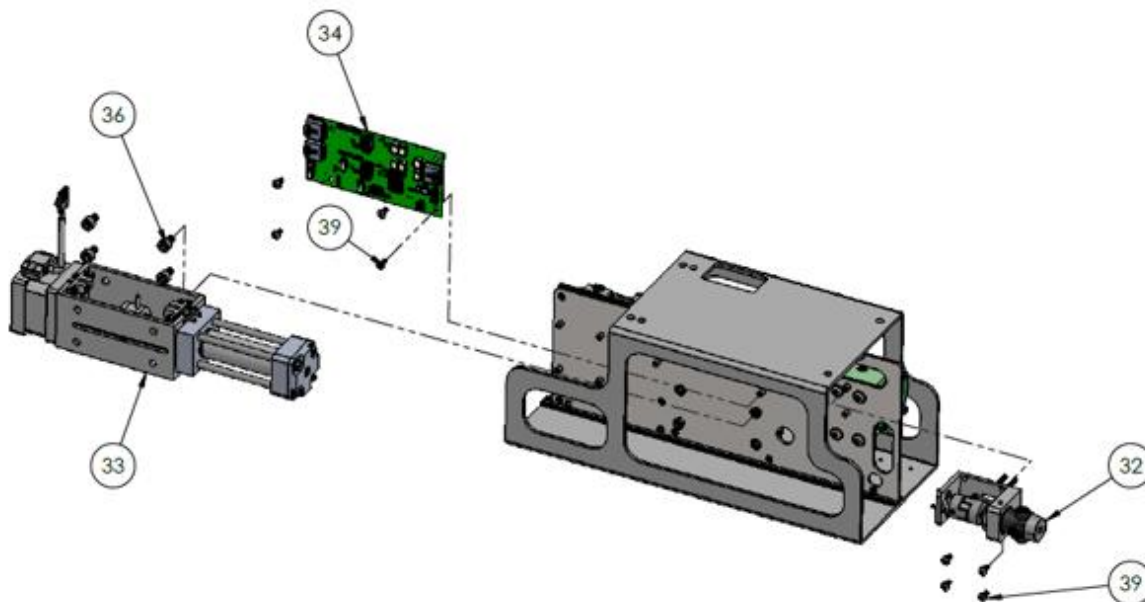


Figure E-3. Exploded View of APC, Internal Assembly.

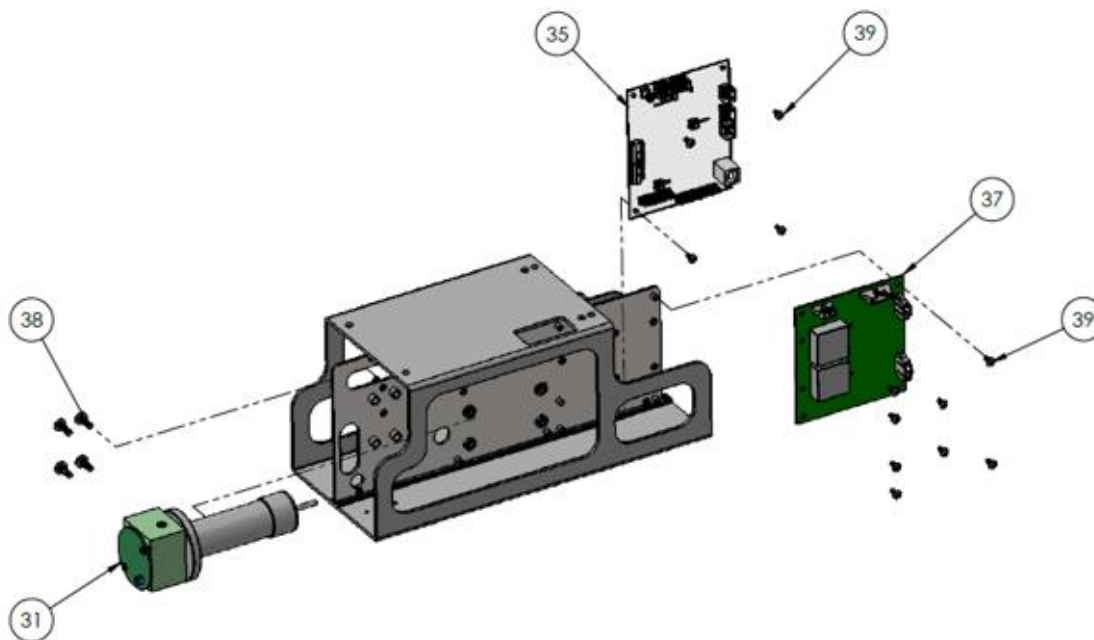


Figure E-4. Exploded View of APC, Internal Assembly, Other Side.

Table E-1. Parts List for APC.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	2825-1298N2	Multipurpose Neoprene Foam Cord 3/16" Diameter	1
2	2830-93080 S	SCREW, M5 X 0.5 X 30 MM LG, SHC, Alloy Steel	4
3	4001-BTE-70909-PGF1	Docking Station, NETT, Passive GF	1
4	2831-9351	Nylon Plastic Washer	4
5	495-032	Assy, Cover Bottom	1
6	90825A201	Sealing Pan Head Screws	4
7	3902-BT-70909AV	BATTERY	1
8	495-192	Chassis, Ext. Based	1
9	2830-10059	18-8 Stainless Steel Flanged Button head Screw	4
10	2453-PIXXILCD-25P4	Screen, OELD, 1.5 Dia, Serial, w/Micro SD Programmed	1
11	495-023	Gasket Window, Display, Viton	1
12	495-022	Window, Display, Polycarbonate	1
13	495-024	Bezel Window, Display	1
14	495-040	TopCover	1
15	2821-93HA5MM	STANDOFF, 3MM X 5MM LG, M-F, ALUMINUM	4
16	495-084	Assy, RTG Angle Power Connector Block	1
17	2828-M286-6	Handle. Fold Down, 286 mm Spacing, Crome	1
18	2831-37902	Viton Fluoroelastomer Rubber Sealing Washer	2
19	2830-98001	NUT, M8 X 1.25 MM, Nylon Lock, Zinc Plated	2
20	2830-93920	SCREW, M3 x 0.5 x 8MM LG, FHP, W/O-RING, 18-8 SS	8
21	495-097R3	Display Board Assembly	1
22	495-112	Assy, Cable, Push Button Left to Display_CPU Card	1
23	495-113	Assy, Cable, Push Button Right to Display_CPU Card	1
24	495-215	MINIMESS 1620 BULKHEAD, MODIFIED WITH 14/-28 FB PORT	2
25	495-085	Gasket, RTG Mount Block	1
26	2831-99051	Tight-Grip External-Tooth Lock Washers	2
27	2831-99651	Zinc-Plated Steel External-Tooth Lock Washers	2
28	2830-93082	Sealing Socket Head Screws	4
29	2830-93081	Stainless Steel Pan Head Screws	4
30	2103-04-22.00	Hex Nut	2
31	495-180	Assy, Chemtract Detector - 1_4-28 FB Swivel Fittings	1
32	495-159	Assy - Cross Over Valve	1
33	495-153	Assy, Pump to Seperate Valve	1
34	495-057	Assy - PUMP CONTROL CARD W-HEAT SINKS	1
35	5000-700-0100-002-D	700-010-002-D_Chemtec_Counter_Board	1
36	2830-96080	SCREW, M5 X 0.8 X 8 MM LG, HHC, 18-8 SS	4
37	495-077	Assy, Power Supply, Chemtrac Version	1
38	2830-08080	SCREW, M5 X 0.8 X 8 MM LG, HHC, 18-8 SS	4
39	2830-93020	SCREW, M3 x 0.5 x 6 MM LG, W/LCK. PH, 18-8 SS	20

DWG. NO.: 495-010

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