

MICROSEP® MARK X

MODEL NO. 140-00-0010
OPERATION MANUAL



NOTICE

THIS MODEL INSTRUMENT WILL NOT PERFORM THE ASTM D5000, "STANDARD PRACTICE FOR EVALUATING ACTIVITY OF CLAY ELEMENTS USING A SIDE-STREAM SENSOR" OR THE CLAY MONITOR TEST METHODS. THESE METHODS CAN BE RUN USING MODEL 140-00-0005A WHICH ALLOWS THE 15-SECOND SYRINGE TIME.

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Service & Warranty Policy

See Emcee Electronics, Inc Service and Warranty Manual

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1.0 SCOPE

1.1 The **Microsep® Mark X** incorporates solid state design and self-contained power source. The instrument provides a quick, portable means for field and laboratory use to rate the ability of aviation turbine fuels to release entrained or emulsified water when passed through fiberglass coalescence material.

2.0 SIGNIFICANCE

2.1 The test provides a measure of surface active materials in Aviation turbine fuels. These are known to affect the ability of filter separators to separate free water from fuel.

3.0 DEFINITION

3.1 To distinguish from the standard Water Separometer rating (WSIM) and Minisonic Separometer rating WSIM (MSS), the Microsep® numerical rating should be reported as Microsep® rating (MSEP).

4.0 SUMMARY OF METHOD

4.1 The fuel sample is emulsified with water in a syringe, using the emulsifier which is programmed to operate for a predetermined time period. After emulsification there is a programmed waiting period to allow time to insert the plunger, add the ALUMICEL® COALESCER and place the entire assembly on the syringe drive. The sample is expelled from the syringe at a programmed rate by the syringe drive mechanism through a standard ALUMICEL® COALESCER. When all of the fuel has been expelled from the syringe, another programmed waiting period is initiated to allow the coalesced water to settle. At the end of the settling time period, an audible signal sounds. Immediately after the audible signal stops, the meter indicates the Microsep® rating which is a measure of the uncoalesced water remaining in the fuel. The results are reported on a 0-100 scale to the nearest whole number. High ratings indicate the water is easily coalesced, and the fuel is relatively free of surfactant materials. A test can be performed in approximately 5 minutes.

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5.0 APPARATUS

5.1 The **Microsep® Mk X** is a completely portable and self-contained unit, operating on an internal rechargeable battery. The unit may be operated at sites where no AC power supply is available. It also may be operated while connected to an AC power line. Detachable power cords are available for various voltages. The AC power source will power the unit and charge the battery. Space is available in the case lid to store disposable materials for running several tests.

5.2 The main features of the **Microsep® Mk X** are shown in Figure 1 through Figure 3. Figure 1 shows the right hand panel supporting the emulsifier and syringe drive. Figure 2 shows the control panel. Figure 3 shows the instrument ready for test.

5.2.1 The MAIN POWER is controlled by momentarily depressing the "ON" switch. In the battery mode a steady lamp at the ON switch location indicates the battery level is sufficient for testing. In the AC mode the lamp at the ON switch location will flash at a steady rate which indicates the AC source and instrument supply is ready for testing. The power is turned off by momentarily depressing the "OFF" switch. If power is inadvertently left on closing the right hand drive panel will also turn off the instrument. The battery is automatically charged and maintained when the AC power cord is attached to the power line.

5.2.2 The TEST SELECT section allows the operator to select any of 4 standard test, Jet A, Jet B, Clear & Bright, or Diesel. Individual test parameters are described in sections 9.0 through 15.0.

5.2.3 Each of the standard test sequences are prompted via the alpha-numeric display. The prompting is intended to assist the operator with both the next step requirements and timing position. A count down timer is used to help the transition from automatic function to operator function.

5.2.4 The "RESET" pushbutton, located on the main control panel, automatically resets the electronic program to test scan and positions the syringe drive into the packing mode.

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5.2.5 The SYRINGE DRIVE, EMULSIFIER, and TURBIDIMETER mechanisms utilized for **non-standard** test can be accessed by selecting the "ALT.PGM." switch described in section 14.0.

5.2.6 The TEST section consists of the "CLEAN 1", "CLEAN 2", "RUN", and "RESET" switches.

5.2.7 The ALERT section is utilized as an annunciator. The "ERROR ALERT" indicator will light when various problems occur such as, syringe drive stalled, syringe drive elapsed time limits are exceeded, emulsifier speeds are out of limits, turbidimeter adjustment error, or battery not sufficiently charged for test completion. The "COLLECT SAMPLE" indicator will light when 15 mL of fuel sample is left for collection.

5.2.8 The TURBIDIMETER, located under the main control panel, consists of a well for placing the sample vial, a light source and a photocell.

5.3 The small parts and supplies needed to carry out the test are shown in Figure 4 and consist of the following.

5.3.1 PIPETTE - An automatic hand pipette for use with disposable plastic tip. (Supplied with Instrument - Part No. 140-90-5983)

5.3.2 DRIP PAN - A pan used to receive the waste fuel. (Supplied with Instrument - Part No. 140-90-7902)

5.3.3 CONTAINER - A bottle of distilled water. (Included in six-pack supply kit)

5.3.4 SYRINGE (barrel and plunger) - A disposable 50 mL plastic syringe. (Part of Six-Pack)

5.3.5 SYRINGE PLUG - A plug for the syringe. (Part of Six-Pack)

5.3.6 ALUMICEL® COALESCER - A pre-calibrated aluminum, throwaway coalescer cell with a tapered end to fit the syringe. (Part of Six-Pack)

5.3.7 VIALS - A glass vial pre-marked for proper turbidimeter positioning. (Part of Six-Pack)

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5.4 SIX-PACK - A new syringe, pipette tip, test sample vial, plug and ALUMICEL® COALESCER are used in each test. These disposable parts are available from Emcee in a kit containing all the disposables for 6 tests. (Part No. 840.99-5944)

6.0 REAGENTS

6.1 WATER - Distilled, Clean and surfactant-free. (Included in six-pack supply kit)

7.0 PREPARATION OF APPARATUS

7.1 If possible, locate the instrument in an area where the temperature is between 65 degrees F. and 85 degrees F. Test performed outside of these temperature limits may not meet ASTM repeatability/reproducibility criteria.

7.2 Remove the instrument from the protective foam case. Open the lid, insert your finger into the hole in the right panel and raise the panel until completely vertical and locked in place. If AC power is available, check to be certain the source voltage matches the power requirements and connect the power cord.

7.3 Have ready a supply of syringes, ALUMICEL® COALESCERS, vials, plugs, pipette tips, drip pan, and distilled water. All are provided with the instrument and Six-Pack.

7.4 The syringe drive speeds are controlled with an internal micro-controller and are automatically checked during each test. The syringe drive time is measured and compared to an internal clock. If the syringe speed is out of acceptable limits (+/- 2 seconds) the "ERROR ALERT" indicator will illuminate, an audio alarm will sound, and the display will indicate ERR-03. Pressing the "RESET" switch will allow additional test to be completed. If this error repeats itself you should contact customer service.

7.5 If the instrument is to be operated in a location where an AC outlet is not available, the instrument should be charged for approximately 16 hours before testing. The unit will function properly for approximately 25 tests before battery recharging is necessary.

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8.0 PREPARATION OF SAMPLE

8.1 Obtain and handle the samples with the utmost care and cleanliness as required in the ASTM Procedure D-3948. Before pouring the test sample from container, wipe the container outlet thoroughly with a clean, lintless wipe. Then pour the test sample into a clean beaker or directly into the syringe.

8.2 If the sample for test is not within the test temperature limits let the container stand or preferably put sample in a clean beaker and let it come to operating temperature.

9.0 JET A TEST PROCEDURE

9.1 Prepare the **MICROSEP® Mk X** as stated in section 7.0.

9.2 Momentarily depress the "ON" switch. The annunciator lamps located in the "TEST SELECT" box will then be scanning for your selection. Depress switch "Jet A". This will initiate the standard automatic program for Jet A fuel.

9.3 The annunciator lamp on the "CLEAN 1" switch will be illuminated which indicates the program can be started by momentarily depressing this switch.

9.4 At the end of the first clean cycle when the mixer motor stops, remove the syringe barrel from the emulsifier, discard the fuel, and drain the syringe thoroughly. Add 50 (\pm 1) mL of fresh fuel into the syringe and place the syringe barrel on the emulsifier mount (turn to lock into place). Visually inspect that the syringe barrel is properly aligned concentrically with the mixer and is not touching the propeller.

9.4.1 The annunciator lamp on the "CLEAN 2" switch will be illuminated which indicates the program can be continued by momentarily depressing this switch.

9.5 Add about 15 or 20 mL of the fuel to be tested to a clean vial, wipe with a clean, lintless wipe and insert into the TURBIDIMETER (the hole directly above the PROGRAM and METER sections). Align the black vial mark with the white line on the front panel.

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9.6 Remove the syringe from the emulsifier, empty the fuel, draining thoroughly, and add exactly 50 mL of test fuel.

9.7 Using a fresh tip on the hand pipette, add 50 microliters of distilled water to fuel sample as follows. Push in plunger, immerse tip just below the water surface, release the plunger and withdraw from the water slowly to avoid water drips adhering to the outside of the tip. Immerse the tip of the pipette just below the fuel surface in the center of the syringe, to ensure the water drops break away cleanly and fall to the bottom; push the plunger, withdraw the pipette, and then release the plunger.

9.8 Place the syringe on the emulsifier turning to lock in place.

9.9 The annunciator lamp on the "RUN" switch will be illuminated which indicates the program can be continued by momentarily depressing this switch.

JET A PROGRAM

Pulsed Tone		4 Seconds
Auto 100 Adjust Period	2-30	Seconds
Emulsification		30 Seconds
Wait		40 Seconds
Syringe Drive Down		45 Seconds
Wait		64 Seconds
Steady Tone		4 Seconds
Meter Read and Display		10 Seconds

9.9.1 The program starts with a read meter warning followed by an AUTO 100 adjustment period. During this 2 to 30 second period the turbidimeter will automatically adjust the light intensity to a 100 level. If the sample is too opaque or a problem exist in the turbidity circuit an ERR-04 will be displayed after 30 seconds. (ERR Codes are described in section 15.0)

9.9.2 After the emulsification period, remove the syringe from the emulsifier and insert the plunger. Remove the plug from the bottom, replace it with an ALUMICEL® COALESCER, and place the whole assembly onto the syringe drive mechanism. Attach ground lead between ground jack on side of syringe drive and ALUMICEL®

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COALESCER. Place a waste container beneath the syringe to collect the unwanted fuel.

9.9.3 When the syringe starts down, remove and empty the sample vial and prepare for sample collection. The audio alert and the C/S indicator will indicate the proper time to collect the last 15 milliliters from the syringe.

9.9.4 Wipe any fuel from outside vial surface and place the sample vial in the turbidimeter and rotate to the marked position.

9.9.5 When the steady tone starts the meter will automatically turn on and display the reading. Record the reading and report as Microsep® rating (MSEP rating). If the reading shuts down before the operator records the reading, the "RECALL" switch can be pressed. This will display the type of test previously selected and the results.

10.0 JET B TEST PROCEDURE

10.1 Prepare the **MICROSEP® Mk X** as stated in section 7.0.

10.2 Momentarily depress the "ON" switch. The annunciator lamps located in the "TEST SELECT" box will then be scanning for your selection. Depress switch "Jet B". This will initiate the standard automatic program for Jet B fuel.

10.3 The annunciator lamp on the "CLEAN 1" switch will be illuminated which indicates the program can be started by momentarily depressing this switch.

10.4 At the end of the first clean cycle when the mixer motor stops, remove the syringe barrel from the emulsifier, discard the fuel, and drain the syringe thoroughly. Add 50 (\pm 1) mL of fresh fuel into the syringe and place the syringe barrel on the emulsifier mount (turn to lock into place). Visually inspect that the syringe barrel is properly aligned concentrically with the mixer and is not touching the propeller.

10.4.1 The annunciator lamp on the "CLEAN 2" switch will be illuminated which indicates the program can be continued by momentarily depressing this switch.

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10.5 Add about 15 or 20 mL of the fuel to be tested to a clean vial and insert into the TURBIDIMETER (the hole directly above the PROGRAM and METER sections). Align the black vial mark with the white line on the front panel.

10.6 Remove the syringe from the emulsifier, empty the fuel, draining thoroughly, and add 50 (+/-1) mL of test fuel.

10.7 Using a fresh tip on the hand pipette, add 50 microliters of clean water to fuel sample as follows. Push in plunger, immerse tip just below the water surface, release the plunger and withdraw from the water slowly to avoid water drips adhering to the outside of the tip. Immerse the tip of the pipette just below the fuel surface in the center of the syringe, to ensure the water drops break away cleanly and fall to the bottom; push the plunger, withdraw the pipette, and then release the plunger.

10.8 Place the syringe on the emulsifier, turning to lock in place.

10.9 When securely in place depress the "RUN" pushbutton. This will initiate the automatic program.

JET B PROGRAM

Pulsed Tone	4 Seconds
Auto 100 Adjust Period	2-30 Seconds
Emulsification	30 Seconds
Wait	40 Seconds
Syringe Drive Down	25 Seconds
Wait	64 Seconds
Steady Tone	4 Seconds
Meter Read and Display	10 Seconds

10.9.1 The program starts with a read meter warning followed by an AUTO 100 adjustment period. During this 2 to 30 second period the turbidimeter will automatically adjust the light intensity to a 100 level. If the sample is too opaque or a problem exist in the turbidity circuit an ERR-04 will be displayed after 30 seconds. (ERR Codes are described in section 15.0)

10.9.2 After the emulsification period, remove the syringe from the emulsifier and insert the plunger. Remove the plug from the bottom, replace it with an ALUMICEL® COALESCER, and place the whole assembly onto the syringe drive mechanism. Attach ground

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lead between ground jack on side of syringe drive and ALUMICEL® COALESCER. Place a waste container beneath the syringe to collect the unwanted fuel.

10.9.3 When the syringe starts down, remove and empty the sample vial and prepare for sample collection. The audio alert and the C/S indicator will indicate the proper time to collect the last 15 milliliters from the syringe.

10.9.4 Wipe any fuel from outside vial surface and place the sample vial in the turbidimeter and rotate to the marked position.

10.9.5 When the steady tone starts the meter will automatically turn on and display the reading. Record the reading and report as Microsep® rating (MSEP rating). If the reading shuts down before the operator records the reading, the "RECALL" switch can be pressed. This will display the type of test previously selected and the results.

11.0 CLEAR AND BRIGHT TEST PROCEDURE

11.1 A numeric value can be determined with the **Microsep® Mk X** relative to sample haze. Using this procedure a fuel sample is passed through a filter to remove water and particulate contamination. This sample provides a clear and bright reference which is compared to the original sample in the turbidimeter.

11.2 Prepare the **MICROSEP® Mk X** as stated in section 7.0.

11.3 Momentarily depress the "ON" switch. The annunciator lamps located in the "TEST SELECT" box will then be scanning for your selection. Depress switch "CLEAR/BRIGHT". This will initiate the standard automatic program for Clear & Bright test. The syringe drive mechanism will automatically move to the up position.

11.4 The annunciator lamp on the "RUN" switch will be illuminated which indicates the program can be started by momentarily depressing this switch.

11.5 Remove a plunger from a 50 mL syringe, insert a plug in

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the bottom and add approximately 50 mL of fuel to be tested. Insert the plunger. Remove the plug from the bottom, replace it with a special ALUMICEL® COALESCER marked CLEAR & BRIGHT. Insert the syringe assembly into the syringe drive mechanism.

11.6 Momentarily depress the "RUN" pushbutton this will initiate the automatic program.

CLEAR & BRIGHT PROGRAM

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Syringe Drive Down	45 Seconds
Pulsed Tone	4 Seconds
Auto 100 Adjust Period	2 - 30 Seconds
Wait while Operator changes vial sample	30 Seconds
Steady Tone	4 Seconds
Meter Read	10 Seconds

11.7 The automatic program starts by passing the test fuel through the ALUMICEL® COALESCER marked CLEAR & BRIGHT. Prepare the sample vial for fuel collection. The audio alert and the C/S indicator will indicate the proper time to collect the last 15 mL from the syringe.

11.8 Place the vial of filtered fuel into the turbidimeter and rotate to the marked position.

11.9 When the pulsed tone starts the meter will automatically turn on. During this period the turbidimeter will automatically adjust the light intensity for a 100 level.

11.10 Discard the fuel sample and place 15 mL of unfiltered fuel into the sample vial. Insert sample vial into the turbidimeter and rotate to the marked position.

11.10 When the steady tone starts the meter will automatically turn on and display the reading. Record the reading and report as the Clear and Bright. If the reading shuts down before the operator records the reading, the "RECALL" switch can be pressed. This will display the type of test previously selected and the results.

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12.0 DIESEL FUEL TEST PROCEDURE

12.1 Prepare the **MICROSEP® Mk X** as stated in section 7.0.

12.2 Momentarily depress the "ON" switch. The annunciator lamps located in the "TEST SELECT" box will then be scanning for your selection. Depress switch "Diesel". This will initiate the standard automatic program for Diesel fuel.

12.3 The annunciator lamp on the "CLEAN 1" switch will be illuminated which indicates the program can be started by momentarily depressing this switch.

12.4 At the end of the first clean cycle when the mixer motor stops, remove the syringe barrel from the emulsifier, discard the fuel, and drain the syringe thoroughly. Add 50 (\pm 1) mL of fresh fuel into the syringe and place the syringe barrel on the emulsifier mount (turn to lock into place). Visually inspect that the syringe barrel is properly aligned concentrically with the mixer and is not touching the propeller.

12.4.1 The annunciator lamp on the "CLEAN 2" switch will be illuminated which indicates the program can be continued by momentarily depressing this switch.

12.5 Add about 15 or 20 mL of the fuel to be tested to a clean vial, wipe with a clean, lintless wipe and insert into the TURBIDIMETER (the hole directly above the PROGRAM and METER sections). Align the black vial mark with the white line on the front panel.

12.6 Remove the syringe from the emulsifier, empty the fuel, draining thoroughly, and add exactly 50 mL of test fuel.

12.7 Using a fresh tip on the hand pipette, add 50 microliters of distilled water to fuel sample as follows. Push in plunger, immerse tip just below the water surface, release the plunger and withdraw from the water slowly to avoid water drips adhering to the outside of the tip. Immerse the tip of the pipette just below the fuel surface in the center of the syringe, to ensure the water drops break away cleanly and fall to the bottom; push the plunger, withdraw the pipette, and then release the plunger.

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12.8 Place the syringe on the emulsifier turning to lock in place.

12.9 The annunciator lamp on the "RUN" switch will be illuminated which indicates the program can be continued by momentarily depressing this switch.

DIESEL PROGRAM

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Pulsed Tone	4 Seconds
Auto 100 Adjust Period	2-30 Seconds
Emulsification	30 Seconds
Wait	40 Seconds
Syringe Drive Down	45 Seconds
Wait	64 Seconds
Steady Tone	4 Seconds
Meter Read and Display	10 Seconds

12.9.1 The program starts with a read meter warning followed by an AUTO 100 adjustment period. During this 2 to 30 second period the turbidimeter will automatically adjust the light intensity to a 100 level. If the sample is too opaque or a problem exist in the turbidity circuit an ERR-04 will be displayed after 30 seconds. (ERR Codes are described in section 15.0)

12.9.2 After the emulsification period, remove the syringe from the emulsifier and insert the plunger. Remove the plug from the bottom, replace it with an ALUMICEL® COALESCER, and place the whole assembly onto the syringe drive mechanism. Attach ground lead between ground jack on side of syringe drive and ALUMICEL® COALESCER. Place a waste container beneath the syringe to collect the unwanted fuel.

12.9.3 When the syringe starts down, remove and empty the sample vial and prepare for sample collection. The audio alert and the C/S indicator will indicate the proper time to collect the last 15 milliliters from the syringe.

12.9.4 Wipe any fuel from outside vial surface and place the sample vial in the turbidimeter and rotate to the marked position.

12.9.5 When the steady tone starts the meter will automatically turn on and display the reading. Record the reading and report as Microsep® rating (MSEP rating). If the reading shuts down

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before the operator records the reading, the "RECALL" switch can be pressed. This will display the type of test previously selected and the results.

13.0 FIELD SERVICE

The **MICROSEP® Mk X** has been calibrated and adjusted at the factory and should require very little maintenance. This section, however, may assist in cases of minor difficulties that do not require factory service.

13.1 If a syringe alert indication - ERR-03 occurs: Repeat the test insuring the syringe is centered in the drive mechanism and not binding. Use only a new syringe and plunger since the rubber on the plunger will swell causing increased drag. If possible, time the total syringe down time with a stopwatch. If the time is correct 45 +/- 2 seconds (mode A) or 25 +/- 1 second (mode B) and the alert is not repeated the instrument can be put back into service. If the syringe is within normal limits and the alert system is still triggered the internal clocking system would be at fault and would require factory service. If the syringe drive time is near or above the 47 second time limit it may be due to the syringe gear lubrication. The syringe drive mechanism should be removed from the support panel and cleaned using a suitable solvent (Toluene or Kerosene) and blow dry with an air pressure source. Do not clean the motor. The gears and rack should then be lubricated with Molykote. After remounting the syringe drive on the support panel, cycle the syringe drive several times and repeat the test. Should the drive time still be out of limits factory service will be required.

13.1 If an Emulsifier Speed indication - ERR-05 occurs: Fill a syringe with 50 mL of Jet A fuel and run a CLEAN 1, CLEAN 2, RESET sequence several times. The Emulsifier speed is automatically corrected each 10 seconds. When the Speed seems to have only minor changes, continue the test into the normal emulsification period. During this cycle the RPM will be checked and if within tolerance will not give the ERR-05 code. If the error continues factory service will be required

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14.0 ALTERNATE PROGRAM DESCRIPTIONS

14.1 A calibration test program is part of the **MICROSEP® Mk X** instrument, the purpose is to run each function individually for speed and sensitivity adjustments.

14.2 Pressing the "ALT.PGM." switch during the normal test scan allows you to enter the calibration program. If none of the test functions are selected in 5 seconds the instrument will return to the normal test scan mode.

14.3 The functions switch codes are as follows.

14.3.1 The Jet-A switch will run the syringe drive to the upper limit.

14.3.2 The Jet-B switch will run the syringe from the upper limit to the lower limit in 45 seconds.

14.3.4 The Clear.Bright switch will run the syringe from the upper limit to the lower limit in 30 seconds.

14.3.5 The Diesel switch will run the syringe from the upper limit to the lower limit in 25 seconds.

14.3.6 The Clean-1 switch will turn on the Emulsifier motor, pressing the switch a second time will turn it back off

14.3.7 The Clean-2 switch will run the automatic 100 adjustment on the turbidimeter

14.3.8 The Run switch will take a reading on the sample in the turbidimeter well using the current 100 reference setting and maintain the reading until the switch is pressed a second time.

14.3.9 The Recall switch will provide the revision level of the internal software.

14.3.10 The Reset switch will return the instrument to the standard scan mode.

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15.0 ERROR CODE DESCRIPTIONS

ERR-01 Syringe stalled while traveling up. Usually caused by a conflict such as a case lid not being fully open. Remove the mechanical restriction and press the reset button.

ERR-02 Syringe stalled while traveling down. Usually caused by one of several errors such as leaving the syringe plug instead of the filter attached to the syringe, a large misalignment of the piston centering causing a load due to the angle when the syringe is pressed sideways or foreign material can clog the syringe hole. Remove the mechanical restriction and press the reset button. If the stalled error cause can not be determined the operator should contact customer service.

ERR-03 This Syringe drive was either fast or slow by more than 2 seconds which is outside of approved limits for a valid test. Usually caused by a large misalignment of the piston centering. If error repeats itself the operator should contact customer service.

ERR-04 The Turbidimeter could not auto adjust to 100. This error is caused by either a turbidimeter component failure or a sample too opaque to allow a sufficient light transfer. Under some conditions the error could be caused by failure of the operator to insert the vial and/or reference sample. The instrument will try for 30 seconds to balance the light intensity for a 100 reference level. If after that time it cannot meet the requirement it will sound an audible alarm and display ERR-04. If error repeats itself the operator should contact customer service.

ERR-05 The Emulsifier Speed is outside of acceptable limits. The speed is self adjusting and the error is usually caused by a faulty component. If error repeats itself the operator should contact customer service.

ERR-06 The battery is not charged sufficiently to run a test. The battery is tested during the first clean and if the charge is too low the test will be stopped. A LO BAT indication identifies the need for AC power to recharge the batteries, however the battery should have sufficient charge to finish the test. The LO BAT indication will reappear at the end of the test to remind the operator to apply charging power.

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16.0 PHOTOGRAPHS

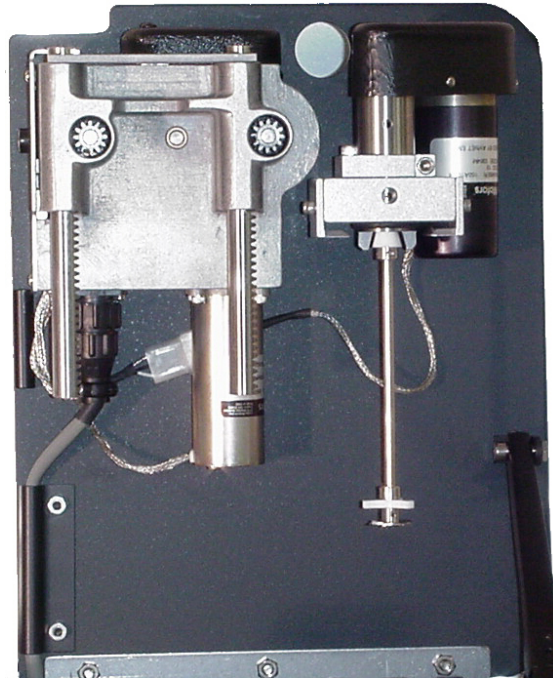


Figure 1

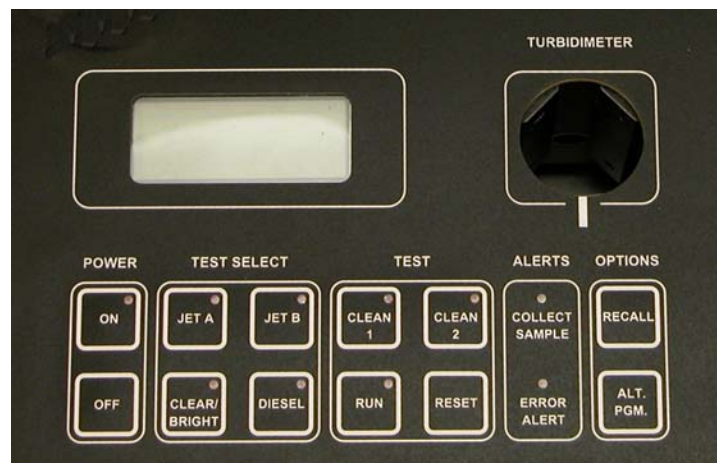


Figure 2

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Figure 3

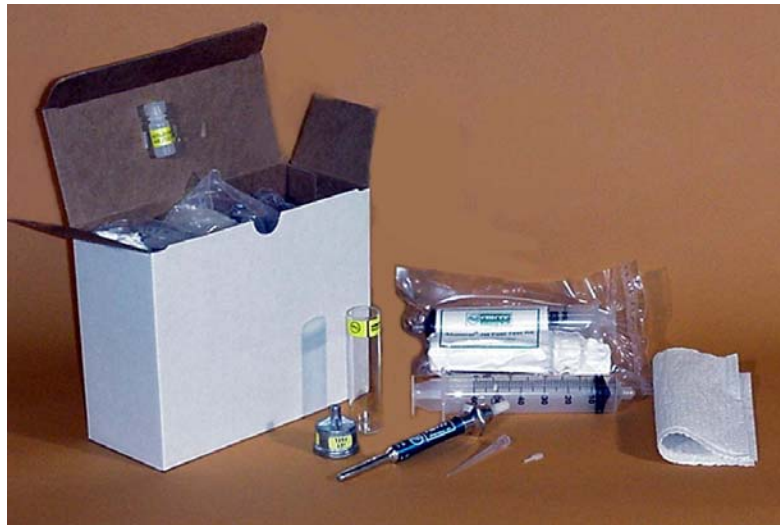


Figure 4

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