



Installation, Operating and Maintenance Instructions
UNITOR
DIESO FILTRATION TEST KIT
(DFTK)
Model DFTK MK10

UNITOR™



PRELIMINARY MATERIAL



Figure 1 Unitor Dieso Filtration Test Kit (DFTK)

PURPOSE OF THIS MANUAL

This manual has been prepared to assist in the preparation, use and care of the Unitor DFTK Dieso Filtration Test Kit (see Equipment Identification below).

This manual is not intended to replace the Test Method, which should be consulted to ensure full compliance with the requirements.

EQUIPMENT IDENTIFICATION

The model and serial number of the instrument are marked on the inside of the instrument case. The power supply voltage and frequency (where applicable) are also shown. This information must be quoted in any technical query, or when ordering accessories and spare parts.

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1. APPLICATIONS

The Unitor Dieso Filtration Test Kit conforms to **IP 387** Test Method.

Note: The embedded software enables tests conforming to IP387 to be carried out automatically.

2. DESCRIPTION

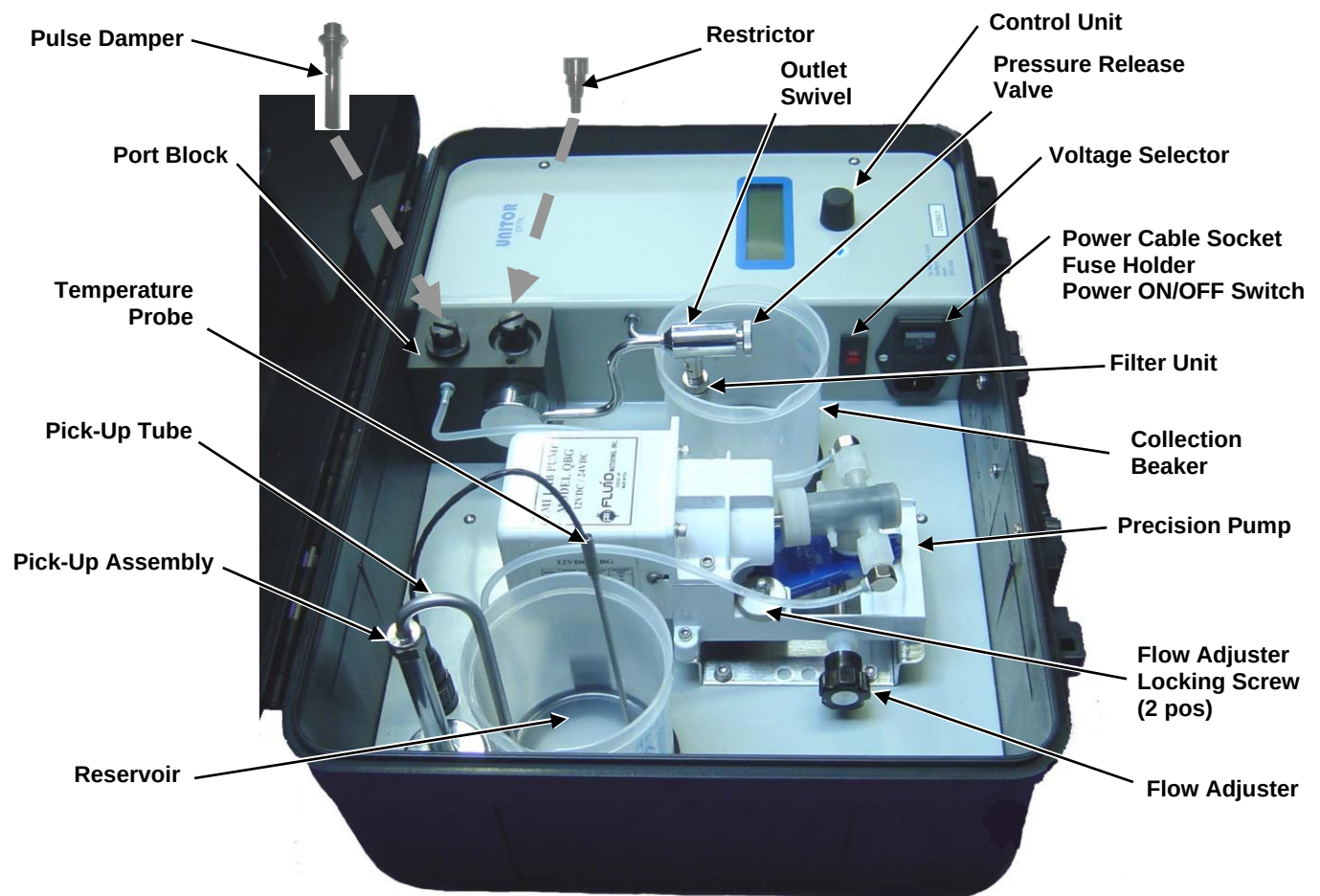


Figure 2 Main Components

2.1. DESCRIPTION

The Unitor Dieso Filtration Test Kit (DFTK) is designed to determine the Filter Blocking Tendency (FBT) of distillate fuels, including diesel, gas oil.

The principle of the test is that a sample is passed through a specified filter at a constant flow rate. The pressure drop across the filter and the flow time (thus volume) are monitored. The result is calculated from either the pressure drop after a specified volume has passed through the filter, or the volume when the pressure drop has reached a specified level.

The DFTK comprises a Reservoir for the sample, Pick-Up Assembly with integral temperature probe, Precision Pump, Outlet Swivel Assembly, Filter Unit, Collection Beaker for spent sample, and Control Unit. All components are mounted within the case.

The Filter Unit comprises a Filter Unit and a disposable Filter Element and is supplied with this kit.

2.2. OPERATION

The Filter Unit is attached to the Outlet Swivel Assembly, which is then pivoted down over the Collection Beaker. Sample is placed in the Reservoir, and the Reservoir positioned on the base under the Pick-Up Assembly. The Pick-Up Assembly, comprising the Temperature Probe and Pick-Up Tube, is lowered into the Reservoir.

The Precision Pump draws the sample from the Reservoir via the Pick-Up Tube and pumps it through a Pulse Damper and Restrictor to smooth the flow, and then to the Outlet Swivel Assembly. The sample passes through the Filter Unit at a rate of 20ml/min, and is discharged into the Collection Beaker. A Pressure Release Valve at the end of the Outlet Swivel Assembly allows the sample path to be bled of air, and aids cleaning.

The user interface comprises two push buttons (the  Button and the  Button), a Multifunctional (SMART) Control, and a twenty-character by four-line Display mounted on the Control Unit. The Display provides simple on-screen instructions, test and sample parameters, and results.

The pressure drop across the filter, the time that the Pump has been running, and the sample temperature are monitored by the Control Unit. The end of test conditions are met when either 300ml of sample has passed through the filter (derived from the known flow rate of the pump at 20ml/min and the elapsed time that the pump has been running), or the pressure drop across the filter has reached 105kPa. The Control Unit calculates the test result in terms of Filter Blocking Tendency (FBT).

On completion of a test, an audible warning is sounded, the pump is switched off, and the test parameters and result are displayed.

2.3. CALIBRATION AND MAINTENANCE

The user is able to verify and calibrate the temperature probe, pressure sensor and pump flow rate to certified sources via the Control Panel

OEM maintenance and calibration kits (see page 32 for specifications) are available from Wilhelmsen Ships Service UK, allowing the user to comprehensively overhaul the DFTK.

2.4. COMPONENTS OF KIT

Part No.	Description	Qty
BEAKER.400	Beakers (Reservoir & Collection)	2
FILTER.HOLDER	Filter Unit (Attached to Outlet Swivel Assy)	1
PT100.DFTK.MK9	Temperature sensing probe	1

BOX.R3.BLACK		Parts box (BLACK) fitted into lid of case	1
Consisting of :-			
	LEAD.4.DFTK.MK9	Mains lead	1
	FILTER.GF/A (FBT)	Filter Paper box 100	2
	SCREEN.13	Support Screen	1
	WASHER.PTFE.01	P.T.F.E. Flat Washer	2
	FORCEPS.100.V	Forceps	1
	TUBE.POLY.1	Inlet/Outlet Polythene Tubing	1.25m
	RESTRICTOR.WIRE	Restrictor Cleaning Wire	2
	FILTER.HOLDER	Filter Unit	1
	KEY.MFT.01	Restrictor/Damper Key	1

SEALKIT.DFTK.MK9		Seal Kit	1
Consisting of :-			
	ORING.16X2VI75	Damper 'O'ring	1
	ORING.4X2VI75	Restrictor 'O'ring small	3
	ORING.9X2VI75	Restrictor 'O'ring large	3
	ORING.4X2VI75	Outlet Swivel Assembly 'O'ring (small)	3
	ORING.9X2VI75	Outlet Swivel Assembly 'O'ring (large)	1
	ORING.9X2VI75	Filter Unit 'O'ring	2
	ORING.3X1.5VI75	Pressure Release Valve O'ring (small)	3
	ORING.6X2VI75	Pressure Release Valve O'ring (large)	3

3. INSTALLATION - GENERAL

3.1. SAFETY

3.1.1. SAFETY WARNINGS

- 1) ALWAYS WEAR SAFETY GLASSES AND PROTECTIVE CLOTHING.
- 2) READ THIS MANUAL BEFORE INSTALLING OR OPERATING THE INSTRUMENT.
- 3) THIS INSTRUMENT SHOULD ONLY BE INSTALLED AND OPERATED BY TRAINED STAFF, WHO ARE FAMILIAR WITH THE RELEVANT LABORATORY AND ENGINEERING PRACTICES.
- 4) IT IS THE USER'S RESPONSIBILITY TO ENSURE THAT ALL RELEVANT REQUIREMENTS OF LOCAL AND NATIONAL HEALTH AND SAFETY LEGISLATION ARE COMPLIED WITH DURING INSTALLATION AND OPERATION OF THIS INSTRUMENT.

3.1.2. SAFETY DEVICES

- 1) An over-pressure device will cut power to the Pump and show an error message on the display if the pressure exceeds 200kPa (see Section 4.12).
- 2) The DFTK is electrically protected by a fuse (see Section 3.3.).

3.2. UNPACKING

The instrument should be carefully unpacked upon receipt;

- 1) Retain all packaging for future storage or transport of the instrument.
- 2) Check the contents against the Packing List
- 3) Check the instrument visually for damage, particularly if the packaging is damaged in any way.
- 4) Any damage, shortfall, or problems with compatibility to local power supply must be notified to Unitor or their agents at the earliest opportunity.

3.3. POWER SUPPLY CONNECTIONS

- 1) The DFTK requires connection to a suitable mains power supply of 115 or 230Vac ($\pm 15\%$), 50/60Hz.
- 2) Verify that the voltage and frequency is suitable for use with the local power supply.
- 3) Set the Voltage Selector (situated on the panel next to the mains power socket) to the appropriate position.
- 4) Connect the power supply lead to the supply using the following colour convention: -

BROWN	-	LINE/LIVE
BLUE	-	NEUTRAL
GREEN/YELLOW	-	EARTH/GROUND
- 5) The DFTK is protected by a 1Amp anti-surge HBC type fuse, situated in a fuse holder tray integral with the mains power socket and ON/OFF switch on the panel next to the mains power socket inside the instrument case.

3.4. LOCATION

- 1) Place the DFTK on a flat, level surface.
- 2) Use in a dust free environment.
- 3) Use in a well ventilated area.

4. CONTROL PANEL AND SCREENS

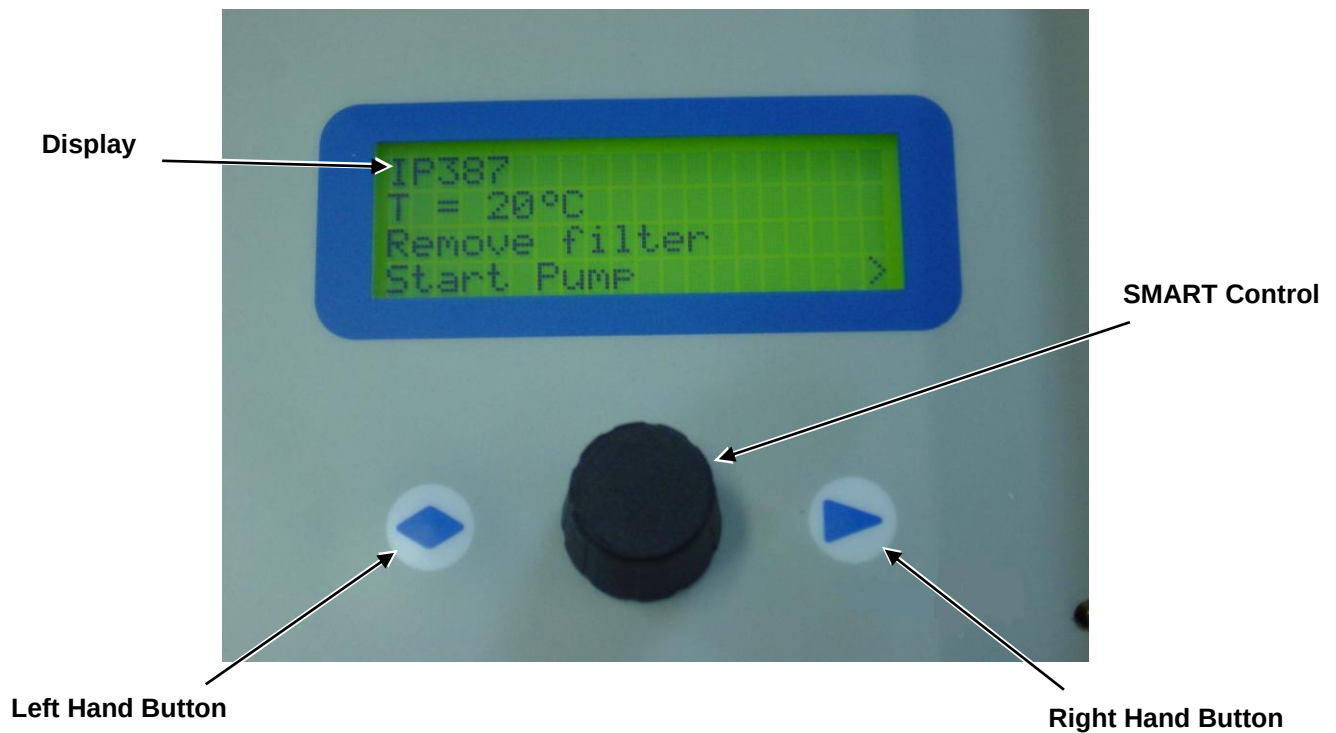


Figure 3 Control Panel

- 1) The user interface for DFTK is the Control Panel, comprising a 20-character x 4-line display, two Buttons and a rotary SMART Control.
- 2) The Display shows instructions, information, and error messages in a series of screens.

Note: For a detail description of each screen, refer to Appendix A.

Note: For a description of the screens used in the calibration procedures, refer to Section 7.

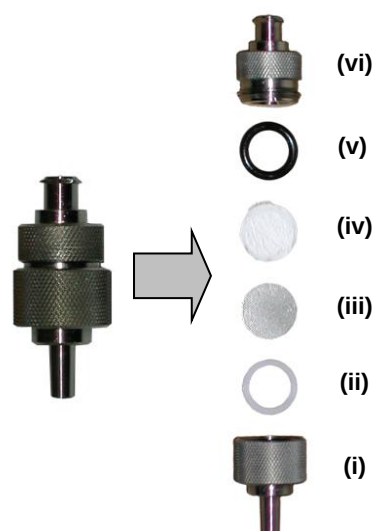
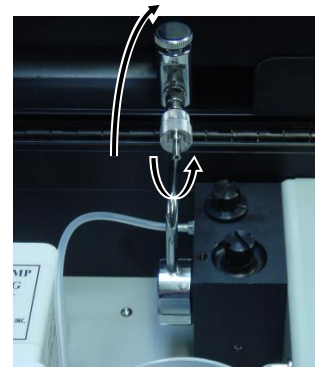
- 3) The screens are navigated by the Buttons and the SMART control;
 - a) The SMART control scrolls through available options.
 - b) If the <> graphic is shown on the screen, pressing the left-hand Button will select that option.
 - c) If the > graphic is shown on the screen, pressing the right-hand Button will select that option.

5. OPERATION

Note: A test can be aborted at any time by pressing and holding the  button until the Prime 1 screen is displayed.

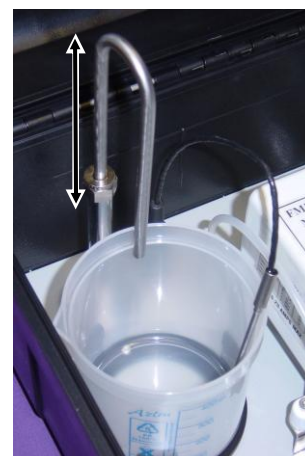
5.1. PREPARE FILTER

- 1) Pivot the Outlet Swivel Assembly upwards.
- 2) Remove the Filter Unit from the Outlet Swivel Assembly;
 - a) The Filter Unit is attached to the Outlet Swivel Assembly by a Luer Lock type coupling.
 - b) Rotate the Filter Unit counter-clockwise 1 turn to detach it from the Outlet Swivel Assembly.
- 3) Fit a Filter Element;
 - a) Unscrew the upper half of the filter body from the lower half.
 - b) Remove and separate the Viton 'O' Ring, Filter Element, Support Screen, and PTFE Washer.
 - c) Discard the Filter Element and any other damaged or blocked component.
 - d) Reassemble the Filter Unit, using a new Filter Element, in the following order;
 - i) Filter Lower Body
 - ii) PTFE Washer
 - iii) Support Screen
 - iv) Filter Element
 - v) Viton 'O' Ring
 - vi) Filter Upper Body



5.2. LOAD SAMPLE

- 1) Raise the Pick-Up Assembly, remove and clean the Reservoir.
- 2) Decant the volume of sample specified in the test Method (350 +/- 5ml) into the clean Reservoir.
- 3) Place the Reservoir beneath the Pick-Up Assembly, locating it into its holder.
- 4) Lower the Pick-Up Assembly into the Reservoir.
- 5) Place the temperature probe into Reservoir.

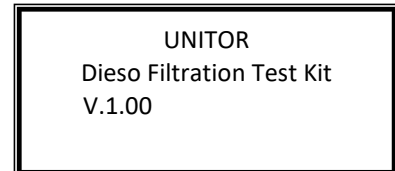


5.3. SWITCH ON

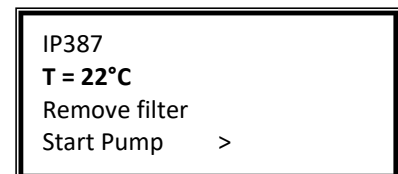
- 1) Connect the power cable and switch the Power ON/OFF Switch to the ON (I) position.



- 2) The START-UP screen will be displayed briefly.



- 3) The PRIME 1 screen will open.

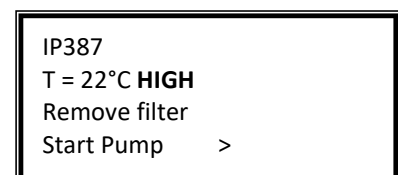


5.4. CHECK SAMPLE TEMPERATURE

- 1) The second line of the PRIME 1 screen will show the sample temperature.

- 2) If the sample temperature is outside the limits specified in the Test Method, the temperature will be followed by a HIGH or LOW message.

Note: High or Low sample temperature will not prevent the DFTK from continuing with the test but will invalidate the test result with reference to the Test Method.



5.6. PRIME DFTK

- 1) Place the Collection Beaker under the Outlet Swivel Assembly, locating it in the holder.
- 2) Pivot the Outlet Swivel Assembly down.
- 3) Make sure the Pressure Release Valve is closed (turn clockwise to close).
- 4) Press the  button to start the Pump.



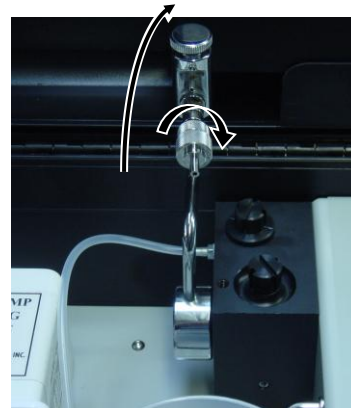
- 5) The PRIME 2 screen will open automatically.
 - a) The top line of the screen will show the pressure between the Pump output and the exit of the Outlet Swivel Assembly.
 - b) The third line of the screen will show the time that the Pump has been running.
 - c) The pressure should remain constant at approximately 0kPa. If the pressure increases, there may be a blockage in the Outlet Swivel Assembly (Section 10 Fault Finding refers).
 - d) The Pump can be switched ON and OFF by pressing the  button.
 - i) When the Pump is switched OFF the timer will stop.
 - ii) When the Pump is switched ON, the timer will reset to 0.
- 6) When 20 – 30 ml of sample has been collected in the Collection Beaker, press the  button. The pump will switch OFF and TEST 1 screen will open.

IP387 P= 0 kPa
T = 22°C
60 seconds
<> ON/OFF Primed >

IP387
T = 22°C P = 0kPa
Fit filter
Start Test >

5.7. INSTALL FILTER

- 1) Pivot the Outlet Swivel Assembly upwards.
- 2) Fit the Filter Unit to the Outlet Swivel Assembly;
 - a) The Filter Unit is attached to the Outlet Swivel Assembly by a Luer Lock type coupling.
 - b) Rotate the Filter Unit clockwise 1 turn to attach it to the Outlet Swivel Assembly.
- 3) Remove the Collection Beaker and discard any sample from it.
- 4) Replace the Collection Beaker under the Outlet Swivel Assembly, locating it in the holder.
- 5) Pivot the Outlet Swivel Assembly down.



5.8. START THE TEST

- 1) Press the  button to start the test. The pump will start and TEST 2 screen will open;
 - a) The second line of the display will show the pressure between the pump and the Filter Unit.
 - b) The third line of the display will show the time that the pump has been running.
- 2) If after 20 seconds the ERROR 1 screen opens, the pressure is lower (INITIAL P LOW) or higher (INITIAL P HIGH) than specified in the test method, either;
 - a) Press the  button to continue the test.
 - i) TEST 2 screen re-opens.
 - ii) The operation of the pump and timer has not been interrupted while ERROR 1 screen has been open.
 - b) Press the  button to abort the test.
 - i) The pump will stop.
 - ii) ERROR 2 screen will open.
 - iii) Press the  button to return to the PRIME 1 screen.

IP387
T = 22°C P = 8kPa
15 seconds
TEST IN PROGRESS

IP387
T = 22°C P = 4kPa
INITIAL P LOW
<> Abort Continue >

IP387

INITIAL P LOW
TEST ABORTED

5.9. RESULTS

- 1) The test will end automatically when either the total volume of pumped sample reaches 300ml or the pressure drop is 105kPa:
 - a) The pump will stop.
 - b) An audible alarm will sound.
 - c) The RESULT screen will open.
 - i) The fourth line of the display will show the calculated result.
 - ii) If the pressure after the first 20 seconds of the test was either lower or higher than specified in the test method, the first line of the display will display the test method followed by INITIAL P LOW or INITIAL P HIGH.

IP387
T = 22°C P = 30kPa
900 seconds
TEST IN PROGRESS

IP387
T = 22°C P = 30kPa
F=20ml/min. V=300ml
Result FBT = 1.04

6. VERIFICATION

6.1. SCHEDULE

To ensure accuracy the DFTK must be verified in accordance with the following recommendations:

- 1) Scheduled verification of pressure and temperature should be carried out every 6 months.
- 2) Verification of flow should be carried out in accordance with the Test Method.
- 3) In addition to the scheduled verification, the DFTK should also be verified in the following special circumstances;
 - a) If the instrument has not been used for a period of more than 6 months.
 - b) When an unexpected or inconsistent result is obtained.
 - c) When specified in the Test Method.

Note: IP 387 require verification of the filter medium whenever new batches of filters are used. Refer to the Test Method for instructions.

6.2. EQUIPMENT REQUIRED

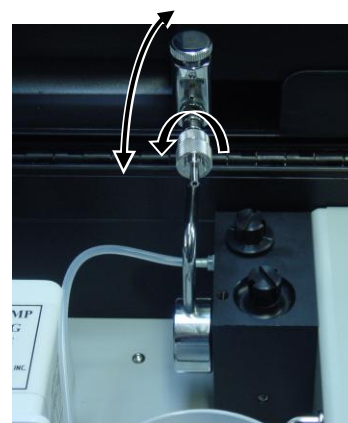
- 1) Calibrated Thermometer, 0 to 60°C, 0.1°C resolution.
- 2) Measuring Cylinder, 500ml minimum capacity, graduated, borosilicate glass.
- 3) Calibrated Pressure Gauge, 0 to 350kPa, 0.5kPa resolution, suitable for diesel, attached to a 0.5m length of nylon tubing.
- 4) Calibrated Stopwatch, 0 to 1000 seconds minimum.

Note: IP 387 require the use of a verification fluid. Refer to the Test Method for instructions on the preparation of the fluid.

6.3. VERIFICATION PROCEDURE

6.3.1. PREPARATION

- 1) Switch the Power ON/OFF Switch on the panel of the DFTK to the OFF (0) position.
- 2) Pivot the Outlet Swivel Assembly upwards.
- 3) Remove the Filter Unit from the Outlet Swivel Assembly;
 - a) The Filter Unit is attached to the Outlet Swivel Assembly by a Luer Lock type coupling
 - b) Rotate the Filter Unit counter-clockwise 1 turn to detach it from the Outlet Swivel Assembly.
- 4) Remove the temperature sensor and raise the Pick-Up Assembly, then remove the Reservoir.
- 5) Decant a 400ml sample of Diesel into the Reservoir. Ensure that the temperature of the sample is between 15 and 25°C.
- 6) Place the Reservoir in the DFTK, lower the Pick-Up Assembly and insert the temperature sensor.



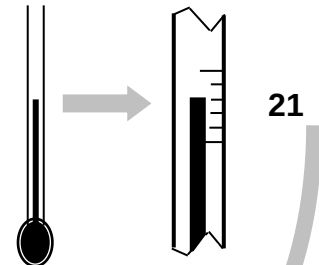
6.3.2. TEMPERATURE

- 1) Switch the Power ON/OFF Switch to the ON (I) position.
- 2) The START-UP screen will be displayed briefly.

UNITOR
Dieso Filtration Test Kit
V.1.00

- 3) The PRIME 1 screen will open automatically.
- 4) The second line of the display will show the sample temperature **as measured by the DFTK**.
- 5) Insert a calibrated thermometer into the Reservoir adjacent to the temperature Sensor probe.
- 6) Wait for 300 seconds while the temperature reading on the thermometer stabilises.
- 7) Note the temperature **as measured by the calibrated thermometer**.

IP387
T = 22°C
Remove filter
Start Pump >



- 8) Check the temperature shown on the second line of the display. If the temperature shown on the display disagrees with the temperature shown on the calibrated thermometer by more than 1°C, refer to Section 7 Calibration.
- 9) Remove the calibrated thermometer and proceed to pressure verification (Section 6.3.3.).

IP387
T = 21°C
Remove filter
Start Pump >

6.3.3. PRESSURE

- 1) Attach a calibrated pressure gauge via a 0.5m length of nylon tube to the Filter Unit, after first removing the Filter Element.

CAUTION: A PRESSURE INSTRUMENT THAT IS COMPATIBLE WITH DIESEL MUST BE USED.

CAUTION: THE AIR TRAPPED IN THE NYLON TUBE BETWEEN THE DFTK AND THE PRESSURE TEST INSTRUMENT IS REQUIRED TO PREVENT A RAPID RISE IN PRESSURE CAUSING THE OVER-PRESSURE SENSOR TO SWITCH THE PUMP OFF.

- 2) The PRIME 1 screen should still be open from the verification of temperature procedure (Section 6.3.2.).

- 3) Press the ► button to start the Pump.

IP387
T = 22°C
Remove filter
Start Pump >

- 4) The PRIME 2 screen will open automatically.
- 5) The top line of the screen will show the pressure between the Pump output and the exit of the Outlet Swivel Assembly.

IP387 **P = 0 kPa**
T = 22°C
12 seconds
<> ON/OFF Primed >

- 6) When the pressure shown on the calibrated pressure instrument reads 105kPa, press the  button to stop the Pump.
 - a) If the pressure shown is too high, loosen the Pressure Release Valve to bleed off some pressure.
 - b) If the pressure shown is too low, press the  button to re-start the Pump. (The Pump can be switched ON and OFF by pressing the  button)
- 7) Check the pressure reading on the display. If the reading is not $105 \pm 7\text{kPa}$ refer to Section 7 Calibration.

Gauge reading = 105kPa

IP387 P = 105kPa
T = 22°C
50 seconds
<> ON/OFF Primed >

- 8) Slowly unscrew the Pressure Release Valve to bleed off the pressure, and then re-tighten.

Note: When releasing pressure, sample may to spray from the Pressure Release Valve. Keep a cloth to hand to wipe up any spillage, and drape over the Pressure Release Valve if necessary.

- 9) Disconnect the calibrated pressure instrument and nylon tube from the Filter Unit and remove from Outlet Swivel Assembly.

6.3.4. PUMP FLOW

- 1) Pivot the Outlet Swivel Assembly down over the Collection Beaker.
- 2) Close the Pressure Release Valve.



- 3) The PRIME 2 screen should still be open from the verification of pressure procedure (Section 6.3.3.).
- 4) Press the  button to start the Pump.

IP387 P = 0 kPa
T = 22°C
12 seconds
<> ON/OFF Primed >

- 5) When no air bubbles flow from the Outlet Swivel Assembly press the  button to switch the Pump off.
- 6) Empty any diesel in the Collection Beaker back into the Reservoir.
- 7) Press the  button to start the Pump. The timer displayed on the third line of the display will reset to zero (0).

IP387 P = 0 kPa
T = 22°C
0 seconds
<> ON/OFF Primed >

8) When the timer shows 600, press the  button to stop the Pump.

IP387 P = 0 kPa
T = 22°C
600 seconds
<> ON/OFF Primed >

9) Pivot the Outlet Swivel Assembly up and remove the Collection Beaker.

10) Decant the contents of the Collection Beaker into a measuring cylinder. If the volume of diesel is not 200 +/- 10ml, refer to Section 7 Calibration.

11) Press and hold the  button until the PRIME 1 screen is displayed.

IP387
T = 22°C
Remove filter
Start Pump >

12) Switch the Power ON/OFF Switch to the OFF (0) position.

13) Fit the Filter Unit to the Outlet Swivel Assembly;

- The Filter Unit is attached to the Outlet Swivel Assembly by a Luer Lock type coupling
- Rotate the Filter Unit clockwise 1 turn to attach it to the Outlet Swivel Assembly.

14) Place the Collection Beaker in position on the DFTK.

15) Pivot the Outlet Swivel Assembly down over the Collection Beaker.



7. CALIBRATION

7.1. SCHEDULE

DFTK requires calibration only when there is an unexplained discrepancy in verification (Section 6).

7.2. EQUIPMENT REQUIRED

- 1) Calibrated Thermometer, 0 to 60°C, 0.1°C resolution.
- 2) Measuring Cylinder, 500ml minimum capacity, graduated, borosilicate glass.
- 3) Calibrated Pressure Test Instrument must have an accuracy of 0.25% or better, and be suitable for calibrating up to 150kPa.
- 4) Calibrated stopwatch, 0 to 900 seconds.

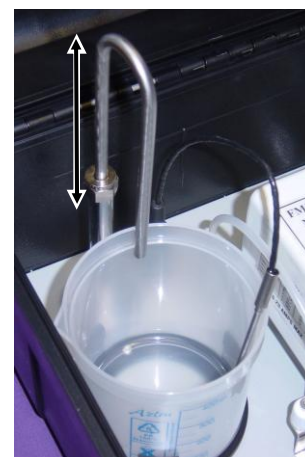


7.3. CALIBRATION PROCEDURE

CAUTION: IT IS NOT POSSIBLE TO CALIBRATE THE TEMPERATURE OR PRESSURE INDEPENDENTLY. MAKE SURE THAT ALL OF THE REQUIRED CALIBRATION EQUIPMENT IS AVAILABLE BEFORE STARTING THE PROCEDURE.

7.3.1. PREPARATION

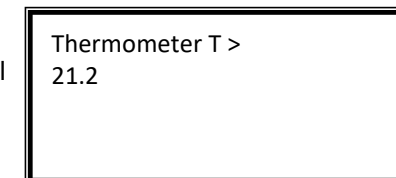
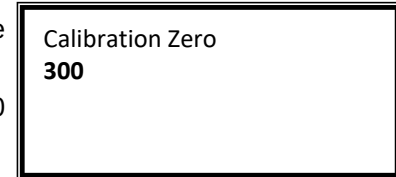
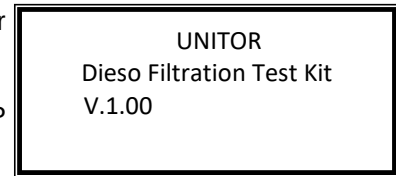
- 1) Prepare at least 400ml of sample. Ensure that the temperature of the sample is between 15 and 25°C
- 2) Switch the Power ON/OFF Switch on the DFTK to the OFF (0) position.
- 3) Pivot the Outlet Swivel Assembly upwards.
- 4) Remove the Filter Unit from the Outlet Swivel Assembly;
 - a) The Filter Unit is attached to the Outlet Swivel Assembly by a Luer Lock type coupling
 - b) Rotate the Filter Unit counter-clockwise 1 turn to detach it from the Outlet Swivel Assembly.
- 5) Pivot the Outlet Swivel Assembly down over the Collection Beaker.
- 6) Raise the Pick-Up Assembly, remove the temperature sensor and remove the Reservoir.
- 7) Decant 400ml of sample into the Reservoir.
- 8) Place the Reservoir beneath the Pick-Up Assembly, in its locating holder on the DFTK.
- 9) Lower the Pick-Up Assembly and insert the temperature sensor into the Reservoir.
- 10) Refer to Section 7.3.2. to enter the calibration mode.



7.3.2. ENTERING CALIBRATION MODE

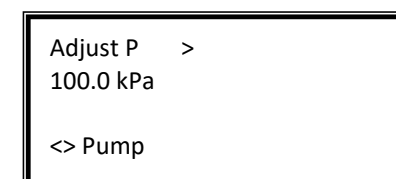
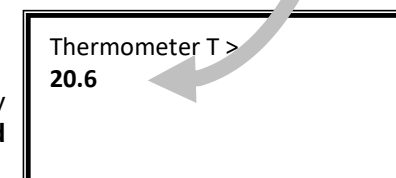
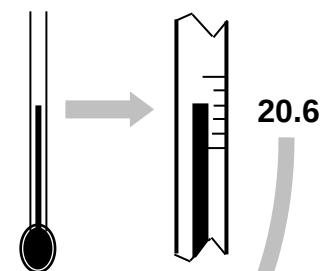
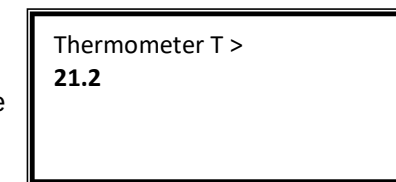
Note: Calibration can be aborted, and the original settings retained at any time by switching the DFTK OFF (using the Power ON/OFF switch on the left hand side on the Display panel) before reaching the final stage of Pressure Calibration

- 1) Press and hold the  and  buttons and switch the Power ON/OFF Switch ON (I) position.
- 2) Continue to hold the  and  buttons while the START-UP screen is displayed
- 3) Release the  and  buttons when the CALIBRATE START screen opens.
- 4) Insert a calibrated thermometer into the Reservoir adjacent to the Pick-Up Assembly.
- 5) The second line of the display will start to count down towards 0 seconds while the temperature stabilises.
- 6) When the countdown reaches 0, the CALIBRATE T screen will automatically open.
- 7) Proceed to Section 7.3.3. Temperature Calibration



7.3.3. TEMPERATURE CALIBRATION

- 1) The second line of the CALIBRATE T screen will show the sample temperature (in °C) **as measured by the DFTK**.
- 2) Note the temperature shown on the calibrated thermometer in the Reservoir.
- 3) Rotate the SMART Control until the second line of the display shows the temperature (in °C) **as measured by the calibrated thermometer**.
- 4) Press the  button to enter the calibrated value.
- 5) The CALIBRATE P screen will automatically open.
- 6) Remove the calibrated thermometer from the Reservoir.
- 7) Proceed to Section 7.3.4. Pump Flow Calibration.

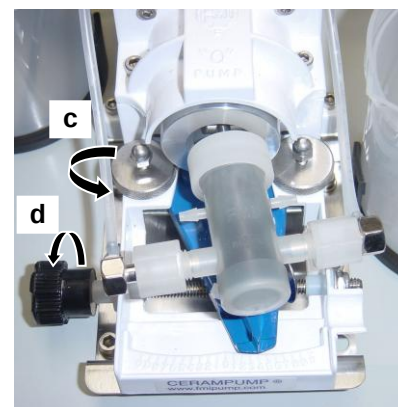


7.3.4. PUMP FLOW CALIBRATION

- 1) Bleed any air from the Pump and associated pipework;
 - a) Press the  button to start the Pump.
 - b) Allow approximately 20ml of sample to be pumped into the Collection Beaker, and then press the  button again to stop the Pump.
 - c) Pour the collected liquid from the Collection Beaker back into the Reservoir.
- 2) Press the  button to start the Pump and start a calibrated stopwatch at the same time.
- 3) After 600 +/- 30 seconds, press the  button to switch off the Pump and wait for any drips to stop.
- 4) Pivot the Outlet Swivel Assembly up and remove the Collection Beaker
- 5) Using a graduated measuring cylinder, measure the volume of the contents of the Collection Beaker. If the volume is not 200ml as specified in the Test Method, adjust the Pump as follows;
 - a) Empty the measuring cylinder back into the Reservoir.
 - b) Loosen the two Flow Adjuster Locking Screws.
 - c) Rotate the Flow Adjuster counter-clockwise to increase the flow or clockwise to decrease the flow.
 - d) Replace the Collection Beaker beneath the Outlet Swivel Assembly and pivot the Outlet Swivel Assembly down into position.
 - e) Repeat steps 2) to 5) until the flow is as specified in the Test Method.
 - f) Tighten the two Flow Adjuster Locking Screws.
- 6) When the flow rate is 20 +/- 1ml/min, in accordance with the Test Method, proceed to Section 7.3.5. Pressure Calibration.

Adjust P >
100.0 kPa

<> Pump



7.3.5. PRESSURE CALIBRATION

- 1) Attach a calibrated pressure tester to Outlet Swivel Assembly where the Filter Unit would normally be connected.
- 2) The second line of the CALIBRATE P screen will show a default pressure calibration point of 100kPa.
- 3) Use the calibrated pressure tester to apply air at the required calibration pressure (100kPa recommended) to the Outlet Swivel Assembly.
- 4) Rotate the SMART Control until the display on the DFTK shows the same pressure **as the value indicated by the calibrated pressure tester**.

Adjust P >
100.0 kPa

<> Pump

Adjust P >
90.0 kPa

<> Pump

CAUTION: THE NEXT STEP WILL SAVE THE CALIBRATION DATA. TO ABORT THE CALIBRATION AND RETAIN THE SETTINGS ALREADY IN MEMORY, SWITCH THE DFTK OFF USING THE POWER ON/OFF SWITCH ON PANEL AT LEFT HAND SIDE OF DISPLAY.

- 5) Press the ► button to enter the calibration value and open the CALIBRATE END screen.
- 6) Switch the Power ON/OFF Switch to the OFF (0) position.
- 7) Slowly unscrew the Pressure Release Valve to bleed off the pressure, then re-tighten



Note: When releasing pressure, sample may spray from the Pressure Release Valve. Keep a cloth to hand to wipe up any spillage, or drape over the Pressure Release Valve if necessary.

- 8) Remove the calibrated pressure tester from the Outlet Swivel Assembly.
- 9) Fit the Filter Unit to the Outlet Swivel Assembly;
 - a) The Filter Unit is attached to the Outlet Swivel Assembly by a Luer Lock type coupling.
 - b) Rotate the Filter Unit clockwise 1 turn to attach it to the Outlet Swivel Assembly.
- 10) Place the Collection Beaker in position on the DFTK.
- 11) Pivot the Outlet Swivel Assembly down over the Collection Beaker.



8. QUALITY ASSURANCE

- 1) The DFTK has been fully tested, validated and calibrated in accordance with an ISO9001 Quality Assurance System. All parts and subassemblies have been checked against test procedures and specifications before final assembly.
- 2) The DFTK performs a full test before being packed for shipping.
- 3) Safety
 - a) The DFTK conforms to the requirements of BS EN1010-1 and has passed an electrical safety test using a Portable Appliance Tester for Class 1 BS IEC appliances (appliances with a functional insulation throughout and the chassis connected to earth). This test includes -
 - i) Visual inspection
 - ii) Earth bonding test - exposed metal parts have less than 0.1 ohms resistance at 25A ac for 8 seconds
 - iii) Insulation test - 500V dc between earth pin and live/neutral pins connected together gives an insulation resistance of greater than 2Megohms
 - iv) Flash test - 1.5kV ac RMS (may be omitted due to EMC filter requirements)
 - v) Load test
 - vi) Operational test - the power level is monitored
 - vii) Earth leakage test - current to earth is monitored
- 4) EMC/FCC Requirements
 - a) The DFTK conforms to the requirements of BS EN61326 and related standards.
 - b) The instrument is CE tested and marked.

9. MAINTENANCE

- 1) With reasonable care and under normal usage the DFTK will require little or no maintenance.
- 2) Regularly verify the DFTK as detailed in section 6.
- 3) If DFTK is to be stored for more than four weeks, or if dirty/heavy samples have been used, flush with paraffin to clear old sample.

CAUTION: DO NOT WASH OR FLUSH THE DFTK WITH SOLVENTS OTHERWISE DAMAGE TO THE PUMP MAY OCCUR.

- 4) Should any queries arise when using our equipment, we will be pleased to assist. Quote the full serial number and electrical supply information in any correspondence. This information is shown on the identification plate on the instrument.

10. FAULT FINDING

FAULT	POSSIBLE CAUSE	REMEDY
DURING PRIMING		
Pressure increases with time	Filter Unit still attached	Remove Filter Unit
	Partial blockage	Remove and clean Restrictor and Pulse Damper
Pump stops, Error 3 screen appears	Blockage, pressure has exceeded 200kPa	Remove and clean Restrictor and Pulse Damper
Air bubbles in flow from outlet	Pressure Release Valve open	Close Pressure Relief Valve
	Pick-Up Assembly not immersed in Sample	Lower Pick-Up Assembly
	Air still in fluid system	Continue to prime DFTK
	Pump Inlet connection loose	Tighten inlet
	Inlet tubing cracked/hardened	Replace tubing
DURING TEST		
Pump stops, Error 3 screen appears	Blockage, pressure has exceeded 200kPa	Remove and clean Restrictor, Pulse Damper, and Filter Unit
Pressure increases rapidly	Partial Blockage in Restrictor and/or Pulse Damper	Remove and clean Restrictor and Pulse Damper
	Partial Blockage in Filter Unit	Remove and clean Filter Unit
Pressure fluctuates	Pressure Release Valve not fully closed	Close Pressure Relief Valve
	Pick-Up Assembly not fully immersed in Sample	Lower Pick-Up Assembly fully
	Air in fluid system	Prime DFTK
	Leak from seals in Filter Unit	Replace 'O' Ring and PTFE Washer
	Leak from Restrictor or Pulse Damper 'O' Rings	Replace 'O' Rings
	Pulse Damper choked.	Remove Pulse Damper and wipe out excess fluid.
Pressure abnormally low	Leak from Outlet Swivel Assembly Swivel	Replace 'O' Rings
	Filter Element not fitted in Filter Unit	Fit Filter Element
	Filter Unit not replaced after priming	Fit Filter Unit
	Pressure Release Valve open	Close Pressure Relief Valve
	Pick-Up Assembly not immersed in Sample	Lower Pick-Up Assembly
	Air in fluid system	Prime DFTK
	Leak from Restrictor or Pulse Damper 'O' Rings	Tighten Restrictor and/or Pulse Damper. Replace 'O' Rings
Sample leakage from Outlet Swivel Assembly and/or Filter Unit	Leak from Outlet Swivel Assembly Swivel	Replace 'O' Rings
	Leak from Luer Lock fitting	Remove and re-attach Filter Unit
	Leak from Filter Unit	Tighten Filter Unit upper body onto lower body Replace 'O' Ring and PTFE Washer
	Leak from Pressure Release Valve	Close Pressure Release Valve Replace Pressure Release valve 'O' Ring
	Leak from Outlet Swivel Assembly Swivel	Replace 'O' Rings
Inconsistent results	Out of calibration	Re-calibrate

DURING CALIBRATION		
Inconsistent pump volume flow	Flow Adjuster Locking Screws Loose	Re-calibrate and tighten screws
	Pick-Up Assembly not immersed in Sample	Lower Pick-Up Assembly fully
Pressure from pressure calibrator cannot be maintained	Leak from Pressure Release Valve	Close Pressure Release Valve
	Leak from Restrictor or Pulse Damper 'O' Rings	Replace Pressure Release valve 'O' Ring
	Leak from Outlet Swivel Assembly Swivel	Replace 'O' Rings
GENERAL FAILURE		
Pump stops	Over Pressure	Clean system of blockage
	Pump failure	Replace filter
	Control PCB failure	Replace Pump
Display goes blank	Display failure	Replace Control PCB
	Control PCB failure	Replace Display
Pump stops and Display goes blank	Power failure	Replace Control PCB
		Check mains power supply
		Replace fuses
		Replace mains lead
	Control PCB Failure	Replace Control PCB

11. REPAIR

WARNING: BEFORE REMOVING ANY PROTECTIVE PANELS OR COVERS, DISCONNECT THE EQUIPMENT FROM THE SUPPLY. WHERE EQUIPMENT HAS TO REMAIN LIVE DURING TESTING OR ADJUSTMENT ALWAYS EXERCISE GREAT CARE WHEN WORKING NEAR EXPOSED LIVE TERMINALS

If the DFTK is to be returned to our factory for repair, ensure that it is adequately packed for the intended method of transport. Inadequate packing may cause returned instruments to be damaged in transit, resulting in additional cost and time to rectify. Please contact our Repairs Administration for any help or advice you may need.

11.1. RESTRICTOR

The Restrictor is mounted on the top of the Port Block and works in conjunction with the Pulse Damper to smooth the flow of sample after the Pump.

WARNING: BEFORE CARRYING OUT THE FOLLOWING PROCEDURES, SLOWLY OPEN THE PRESSURE RELEASE VALVE TO RELIEVE ANY RESIDUAL PRESSURE.

11.1.1. REMOVAL AND REFITTING

- 1) Using the Damper Extraction Key unscrew the Restrictor counter-clockwise and lift out.
- 2) Re-fitting is the reverse of removal. Tighten the Restrictor sufficiently to compress the 'O' Ring seals slightly.

11.1.2. CLEANING

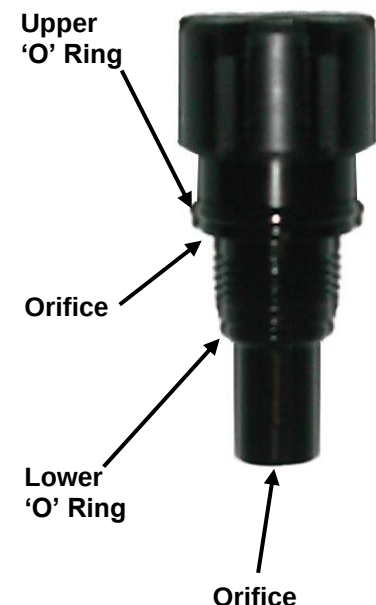
- 1) Use the cleaning wire to clear any obstruction in the small orifice in the bottom of the Restrictor.
- 2) Use the cleaning wire to clear any obstruction in the small orifice in the side of the Restrictor, just below the Upper 'O' Ring.
- 3) Use a soft, lint-free cloth to wipe the body of the Restrictor and the 'O' Ring seals.

11.1.3. 'O' RING REPLACEMENT

- 1) The 'O' Ring seals should be replaced if they are:
 - a) Loose
 - b) Distorted
 - c) Damaged
 - d) Hardened
 - e) Leaking
- 2) Use a soft, lint-free cloth to wipe the body of the Restrictor and the 'O' Ring seals.
- 3) Remove the old lower 'O' Ring from the Restrictor.
- 4) Remove the Upper 'O' Ring from the Restrictor.
- 5) Ease the new Upper 'O' Ring over the end of the Restrictor and up the body.

CAUTION: TAKE CARE NOT TO DAMAGE THE 'O' RING WHEN IT PASSES OVER THE THREADED PORTION OF THE BODY.

- 6) Check that the 'O' Ring has seated in its groove.



- 7) Ease the new Lower 'O' Ring over the end of the Restrictor and up the body.
- 8) Check that the 'O' Ring is seated in its groove.

11.2. PULSE DAMPER

The Pulse Damper is mounted on the top of the Port Block and works in conjunction with the Restrictor to smooth the flow of sample after the Pump.

WARNING: BEFORE CARRYING OUT THE FOLLOWING PROCEDURES, SLOWLY OPEN THE PRESSURE RELEASE VALVE TO RELIEVE ANY RESIDUAL PRESSURE.

11.2.1. REMOVAL AND REFITTING

- 1) Using the Damper Extraction Key unscrew the Pulse Damper counter-clockwise and lift out of the Port Block.
- 2) Re-fitting is the reverse of removal. Tighten the Pulse Damper sufficiently to compress the 'O' Ring seal slightly.

11.2.2. CLEANING

- 1) Use a soft, lint-free cloth to wipe the body of the Pulse Damper and the 'O' Ring.
- 2) Use a twist of soft, lint-free cloth to wipe the interior of the Pulse Damper

11.2.3. 'O' RING REPLACEMENT

- 1) The 'O' Ring seal should be replaced if it is:
 - a) Loose
 - b) Distorted
 - c) Damaged
 - d) Hardened
 - e) Leaking
- 2) Use a soft lint free cloth to wipe the body of the Pulse Damper and the 'O' Ring seal.
- 3) Remove the old 'O' Ring from the Pulse Damper.
- 4) Slide the new 'O' Ring over the end of the Pulse Damper and up the body.

CAUTION: TAKE CARE NOT TO DAMAGE THE 'O' RING WHEN IT PASSES OVER THE THREADED PORTION OF THE BODY.

- 5) Check that the 'O' Ring is seated in its groove.



11.3. PRESSURE RELEASE VALVE

The Pressure Release Valve is mounted on the Outlet Swivel Assembly.

WARNING: BEFORE CARRYING OUT THE FOLLOWING PROCEDURES, SLOWLY OPEN THE PRESSURE RELEASE VALVE TO RELIEVE ANY RESIDUAL PRESSURE.

11.3.1. REMOVAL AND REFITTING

- 1) Rotate the Pressure Release Valve counter-clockwise and remove from the Outlet Swivel Assembly.
- 2) Re-fitting is the reverse of removal. Tighten the Pressure Release Valve sufficiently to compress the 'O' Ring seals slightly.

11.3.2. CLEANING

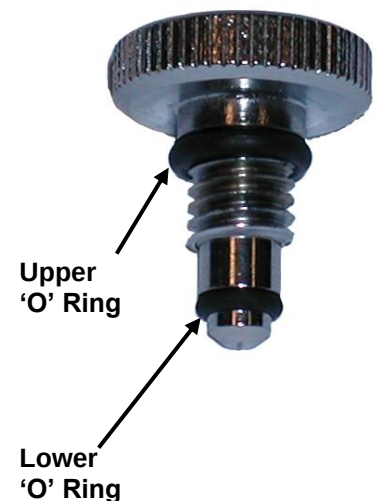
- 1) Use a soft, lint-free cloth to wipe the body of the Pressure Release Valve and the 'O' Rings.

11.3.3. 'O' RING REPLACEMENT

- 1) The 'O' Ring seals should be replaced if they are:
 - a) Loose
 - b) Distorted
 - c) Damaged
 - d) Hardened
 - e) Leaking
- 2) Use a soft lint free cloth to wipe the body of the Pressure Release Valves and the 'O' Ring seals.
- 3) Remove the old lower 'O' Ring from the Pressure Release Valve.
- 4) Remove the old Upper 'O' Ring from the Pressure Release Valve.
- 5) Slide the new Upper 'O' Ring over the end of the Pressure Release Valve and up the body.

CAUTION: TAKE CARE NOT TO DAMAGE THE 'O' RING WHEN IT PASSES OVER THE THREADED PORTION OF THE BODY.

- 6) Check that the 'O' Ring has seated in its groove.
- 7) Slide the new Lower 'O' Ring seal over the end of the Pressure Release Valve.
- 8) Check that the 'O' Ring is seated in its groove.



11.4. OUTLET SWIVEL ASSEMBLY

WARNING: BEFORE CARRYING OUT THE FOLLOWING PROCEDURES, SLOWLY OPEN THE PRESSURE RELEASE VALVE TO RELIEVE ANY RESIDUAL PRESSURE.

11.4.1. REMOVAL

- 1) Using a 3mm hexagonal key, remove the lock screw from the hole to the left of the Restrictor.
- 2) Using a 3mm hexagonal key, remove the grub screw from the same hole to the left of the Restrictor.



- 3) Pull the Outlet Swivel Assembly out of the Manifold Block by rotating clockwise and anticlockwise at the same time.

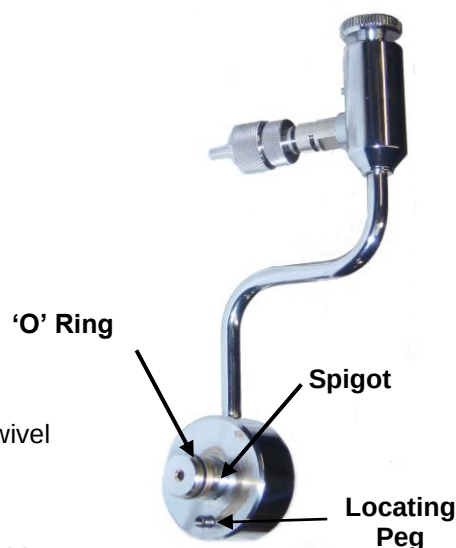


11.4.2. CLEANING

- 1) Use a soft, lint-free cloth to wipe the Outlet Swivel Assembly and the 'O' Ring.

11.4.3. 'O' RING REPLACEMENT

- 1) The 'O' Ring seal should be replaced if it is:
 - a) Loose
 - b) Distorted
 - c) Damaged
 - d) Hardened
 - e) Leaking
- 2) Use a soft, lint-free cloth to wipe the body of the Outlet Swivel Assembly and the 'O' Ring seal.
- 3) Remove the old 'O' Ring from the Outlet Swivel Assembly.
- 4) Slide the new 'O' Ring over the end of the Outlet Swivel Assembly.
- 5) Check that the 'O' Ring is seated in its groove.



11.4.4. REFITTING

- 1) Gently push the Outlet Swivel Assembly into the hole in the Manifold Block by rotating clockwise and anticlockwise at the same time. The wide groove on the Spigot must align with the grub screw hole on the top of the Manifold Block. Make sure that the locating peg engages into the slot in the Manifold Block.
- 2) Using a 3mm hexagonal key, replace the grub screw into the hole to the left of the Restrictor. Screw the grub screw in as far as it will go, then unscrew it approximately half a turn. The Outlet Swivel Assembly should be secure in the Manifold Block and be able to pivot up and down smoothly.
- 3) Using a 3mm hexagonal key, replace the lock screw into the hole to the right of the Restrictor. Tighten the lock screw against the grub screw.



11.5. PUMP ASSEMBLY AND TUBING

WARNING: BEFORE CARRYING OUT THE FOLLOWING PROCEDURES, SLOWLY OPEN THE PRESSURE RELEASE VALVE TO RELIEVE ANY RESIDUAL PRESSURE.

DISCONNECT POWER SUPPLY LEAD BEFORE COMMENCING THE FOLLOWING OPERATIONS.

11.5.1. REPLACING PUMP TUBING

- 1) Replace the tubes one at a time.
- 2) Carefully pull the tubing off the barbed spigots.
- 3) Use the old tube as a template to cut the correct length of replacement tubing.
- 4) Push the new tubing fully over the barbed spigots, avoid kinking the tube.

11.5.2. REPLACING INLET TUBING

- 1) Remove the Reservoir and the Collection Beaker.
- 2) Remove the six screws that retain the Panel.
- 3) Lift up panel from the right first, using the small chrome handle between the Manifold Block and the collection beaker.
- 4) Lift out panel from the right first.
- 5) Stand the Panel up onto its side.



- 6) The Inlet Tubing runs from the suction manifold to the end of the Pick-Up tube.
- 7) Remove the old tube from the barbed spigot by levering the tube off the spigot.
- 8) Pull the old tubing out of the Pick-up tube.
- 9) Use the old tube as a template to cut the correct length of replacement tubing.



- 10) Holding the Pick-Up tube in its lowered position, push the new tube through the pipe from behind the panel, until it reaches the end. Form a loop before pushing the remaining end over the barbed spigot, avoid kinking the tube.



- 11) Replace the Panel by sliding in the left side first and then lowering into position.



WARNING: ENSURE THAT THE INLET TUBE IS LYING FLAT AT THE BOTTOM OF THE CASE AND THAT NO CABLES WILL BE TRAPPED, BEFORE FINAL FIXING.

- 12) Finally replace the six retaining screws.

12. SPECIFICATION

Filter Blocking Tendency (FBT) Range: 1.0 to 30 (Low number best)

End of Test Point Automatic detection/selection

IP387: 105kPa or 300ml

Maximum Pressure: 200kPa

Flow Rate: 20ml/min, adjustable

Power Supply: 110/120Vac or 220/240Vac, switchable

Power: 200W

Dimensions: (H x W x D): 20cm x 48cm x 38cm

Weight: 12kg

12. REPLACEMENT COMPONENTS

OEM maintenance and calibration kits are available from Wilhelmsen Ships Service UK, allowing the user to comprehensively overhaul the DFTK: below is a list of replacement components available.

If you require any further equipment or assistance, please contact Wilhelmsen Ships Service UK. Full OEM calibration and servicing is also available from Wilhelmsen Ship Service UK.

Part No.	Description	Qty
BEAKER.400	Beakers (Reservoir & Collection)	1
KEY.MFT.01	Restrictor/Damper Key	1
RESTRICTOR.DFTK.01	Restrictor with O-rings	1
DAMPER.DFTK.01	Damper with O-rings	1

DFTK.SERVICE.KIT.01	Maintenance Kit	1
Consisting of :-		
ORING.16XV175	Damper 'O'ring	1
ORING.4X2V175	Restrictor 'O'ring small	6
ORING.6X2V175	Pressure Release Valve O'ring (large)	3
ORING.9X2V175	Restrictor 'O'ring large	6
ORING.3X1.5V175	Pressure Release Valve O'ring (small)	3
RESTRICTOR.WIRE	Restrictor Cleaning Wire	2
FUSE.1.0A	1amp fuse 20mm	1
SEAL.FMI.01	Lip Seal for FMI Pump R408-1A	2
KEY.DFTK.01	Damper Key	1

DFTK.TESTKIT.D2068	Test Kit	1
Consisting of :-		
FILTER.GF/A (FBT)	Filter Paper box 100	1
FILTER.HOLDER	Filter Unit	1
FORCEPS.100.V	Forceps	1

SEALKIT.DFTK.MK9	Seal Kit	1
Consisting of :-		
ORING.16X2V175	Damper 'O'ring	1
ORING.4X2V175	Restrictor 'O'ring small	3
ORING.9X2V175	Restrictor 'O'ring large	3
ORING.4X2V175	Outlet Swivel Assembly 'O'ring (small)	3
ORING.9X2V175	Outlet Swivel Assembly 'O'ring (large)	1
ORING.9X2V175	Filter Unit 'O'ring	2
ORING.3X1.5V175	Pressure Release Valve O'ring (small)	3
ORING.6X2V175	Pressure Release Valve O'ring (large)	3

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APPENDIX A SCREENS

A.1. OVERVIEW

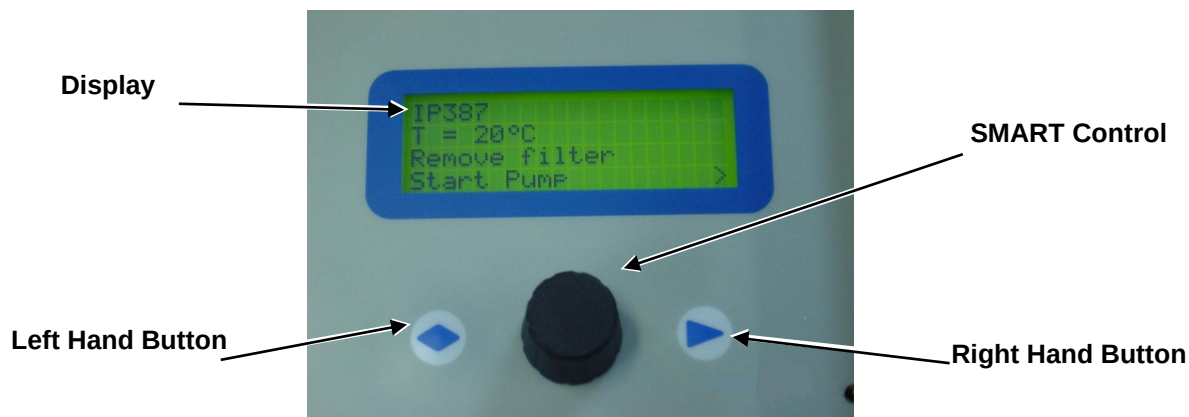
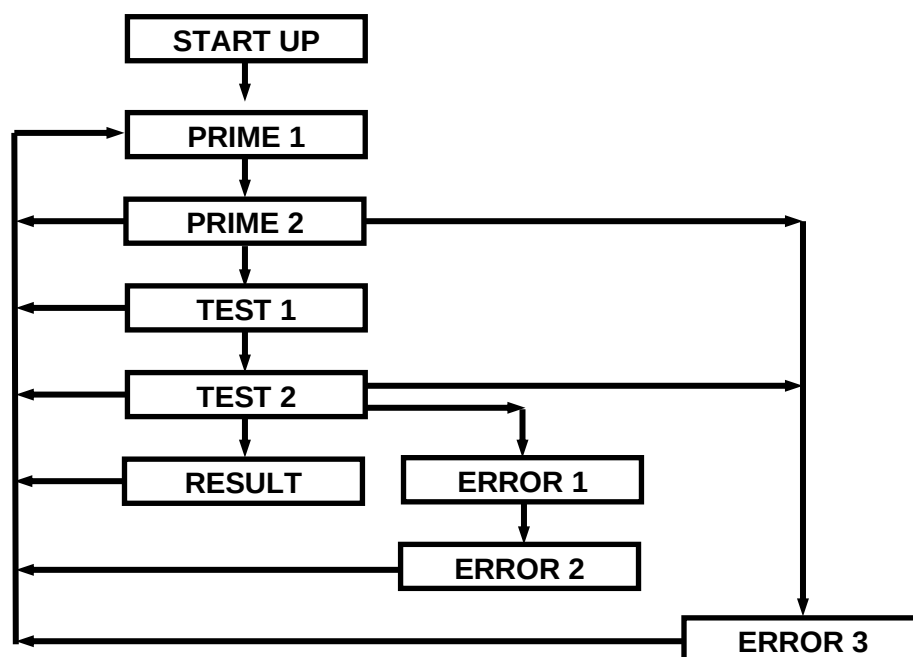


Figure A1 Control Panel

- 1) The user interface for DFTK is the Control Panel, comprising a 20-character x 4-line display, two Buttons and a rotary SMART Control.
- 2) The Display shows instructions, information, and error messages in a series of screens.
- 3) The screens are navigated by the Buttons and the SMART control;
 - a) The SMART control scrolls through available options.
 - b) If the <> graphic is shown on the screen, pressing the left-hand Button will select that option.
 - c) If the > graphic is shown on the screen, pressing the right-hand Button will select that option.

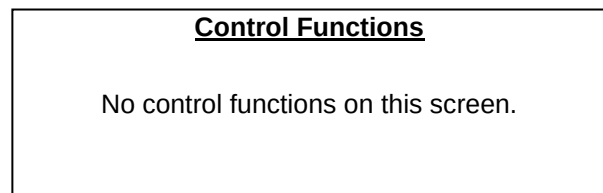
A.2. SCREEN FLOW CHART



Note: For a description of the screens used in the calibration procedures, refer to Section 7.

A.3. START-UP

- 1) The START-UP screen is automatically displayed after the power is switched on, and will show information about the version of software installed in the DFTK.



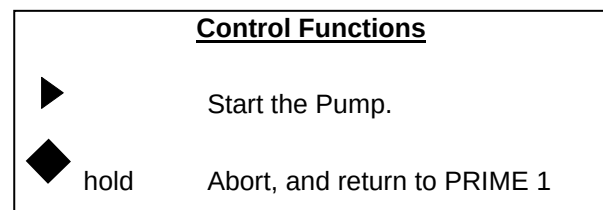
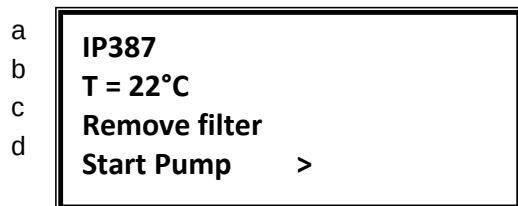
- a) Version of the installed software.

Note: It is recommended that a note be made of this information. The instrument serial number and software version must be quoted on all technical queries.

- 2) After a short delay, the START-UP screen will change to the PRIME 1 screen

A.4. PRIME 1

- 1) The PRIME 1 screen opens automatically after the START-UP screen.
- 2) The PRIME 1 and subsequent PRIME 2 screens allow the user to bleed air from the system, ensure that the Filter Assembly is filled with sample, and provides a means to verify the flow rate.



- a) Test Method.

- b) Sample temperature.

- i) **T = XX°C** where XX = Sample temperature in °C, and the temperature is within the limits of the Test Method.
- ii) **T = XX°C HIGH** where XX = Sample temperature in °C, and the temperature is above 25°C.
- iii) **T = XX°C LOW** where XX = Sample temperature in °C, and the temperature is below 15°C.

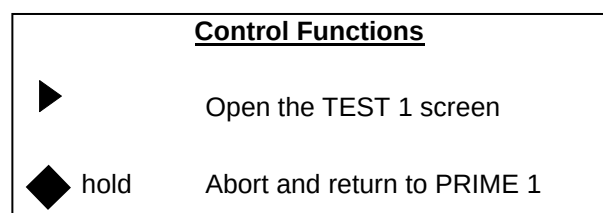
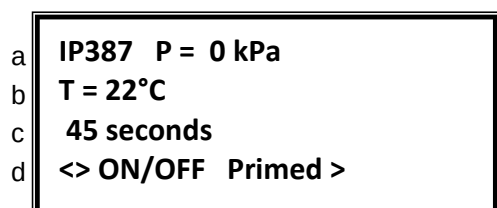
- c) Instruction to remove the Filter Unit from the Outlet Swivel Assembly.

- d) Prompt to start the Pump.

- 3) The PRIME 1 screen will be displayed until the ► button is pressed to start the Pump. Once the Pump has been started, the PRIME 2 screen will be displayed.
- 4) To abort the procedure and return to the PRIME 1 screen, press and hold the ◆ button.

A.5. PRIME 2

- 1) The PRIME 2 screen is shown after the Pump has been started in the PRIME 1 screen, and allows the user to control the pump.



- a) Test Method selected and pressure drop in kPa (see previous screens).

Note: Should remain approximately 0kPa during priming.

- b) Sample temperature (see previous screen).
 - c) Elapsed time in seconds that the Pump has been running.
 - d) Prompt to either start/stop the Pump or move on to the next screen.
- 2) The PRIME 2 screen will remain on display until the ► button is pressed to open the TEST 1 screen.
 - 3) The Pump can be switched off and on by briefly pressing the ◆ button. The time will be frozen on the display when the Pump is switched off, and reset to 0 when switched back on.
 - 4) To abort the procedure and return to the PRIME 1 screen, press and hold the ◆ button.
 - 5) If the pressure exceeds 200kPa, the Pump will stop and the ERROR 3 screen will be displayed.

A.6. TEST 1

- 1) The TEST 1 screen is shown after the ► button has been pressed in the PRIME 2 screen, and allows the user to start the test.

a	IP387
b	T = 22°C P = 0 kPa
c	Fit filter
d	Start Test >

<u>Control Functions</u>	
►	Select the displayed method.
◆ hold	Abort and return to PRIME 1

- a) Test Method.
 - b) Sample temperature and pressure drop (see previous screens).
 - c) Instruction to fit the Filter Unit onto the Outlet Swivel Assembly.
 - d) Prompt to start the test and move on to the next screen.
- 2) The TEST 1 screen will remain on display until the ► button is pressed to start the test and open the TEST 2 screen.
 - 3) To abort the procedure and return to the PRIME 1 screen, press and hold the ◆ button.

A.7. TEST 2

- 1) The TEST 2 screen is shown after the ► button has been pressed in the TEST 1 screen, and displays the progress of the test.

a	IP387
b	T = 22°C P = 14 kPa
c	600 seconds
d	TEST IN PROGRESS

<u>Control Functions</u>	
◆ hold	Abort and return to PRIME 1

- a) Test Method.
 - b) Sample temperature and pressure drop (see previous screens).
 - c) Elapsed time in seconds that the Pump has been running.
 - d) Status.
- 2) The TEST 2 screen will remain on display until the end of test conditions are reached or if after 20 seconds the pressure is not within the range required by the Test Method;
 - a) If the end of test conditions has been met, the RESULT screen will open automatically.

- b) If the pressure after 20 seconds is too low or too high (<7kPa or >21kPa for IP 387, the ERROR 1 screen will open automatically.
- c) If the pressure exceeds 200kPa the Pump will switch off and ERROR 3 screen will open.
- 3) To abort the procedure and return to the PRIME 1 screen, press and hold the  button.

A.8. RESULT

- 1) The pump will switch off automatically and the RESULT will be displayed when any of the following End of Test conditions occur:
 - a) 300ml of sample has flowed through the filter.
 - b) The pressure drop is 105kPa.
- 2) The RESULT screen displays the conditions at the end of the test and the result.

a	IP387	
b	T = 22°C P = 30 kPa	
c	F=20ml/min. V=300 ml	
d	Result FBT = 1.04	

<u>Control Functions</u>	
	Return to PRIME 1 screen

- a) Test Method.
- b) Sample temperature in °C and pressure drop in kPa (see previous screens).
- c) Flow Rate in ml/min and total volume of sample Pumped through filter in ml.
- d) Result. **FBT** IP387
- 3) If the test was a continuation from an ERROR 1 screen, the first line of the display will show:
 - a) **IP387 INITIAL P LOW** the pressure was too low after 20 seconds.
 - b) **IP387 INITIAL P HIGH** the pressure was too high after 20 seconds.
- 4) Press the  button to return to the PRIME 1 screen.

A.9. ERROR 1

- 1) If after 20 seconds the pressure drop is too low or too high the ERROR 1 screen will be displayed and an audible warning will sound. The Pump will continue to run.

a	IP387	
b	T = 22°C P = 4 kPa	
c	INITIAL P LOW	
d	<> Abort Continue >	

<u>Control Functions</u>	
	Continue the test.
	Abort and open ERROR 2

- a) Test Method.
- b) Sample temperature and pressure drop (see previous screens).
- c) Error detected.
 - i) **INITIAL P LOW** the pressure drop after 20 seconds is less than 7kPa.
 - ii) **INITIAL P HIGH** the pressure drop after 20 seconds is above than 21kPa.

- d) Prompt to either abort or continue the test.
- 2) The ERROR 1 screen will remain on display until either;
 - a) Press the  button to continue the test. The display will return to the TEST 2 screen.
 - b) Press the  button to abort the test. The Pump will stop and ERROR 2 screen will be displayed.

A.10. ERROR 2

- 1) ERROR 2 screen will open if the  button has been pressed in the ERROR 1 screen to abort the test.

a IP387 b INITIAL P LOW c TEST ABORTED	<u>Control Functions</u>  Return to the PRIME 1 screen.
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- a) Test Method (see previous screen).
- b) Error detected (see previous screen).
- c) Status.
- 2) The ERROR 2 screen will remain on display until the  button is pressed to return to the PRIME 1 screen.

A.11. ERROR 3

- 1) ERROR 3 screen will open and the Pump will switch off automatically if the pressure exceeds 200kPa at any time.

TEST ABORTED PRESSURE LIMIT EXCEEDED CLEAR BLOCKAGE	<u>Control Functions</u>  Return to the PRIME 1 screen.
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- 2) The ERROR 3 screen will remain on display until the  button is pressed to return to the PRIME 1 screen.

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