James Heal™

OPERATOR'S GUIDE

AquAbrasion - Wet and Dry Abrasion Tester

Featuring the Intuitive Touchscreen User Interface

James H. Heal & Co. Ltd.
Halifax, England

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Setting the Standard

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Background

Thank you for investing in the **AquAbrasion 1819** from **James Heal**.

James Heal would like to assure you that we are committed to providing you with first class Instruments, Test Materials, excellent Customer Service and Support. You are part of a growing global community who consider **James Heal** products to be of the highest quality whilst offering excellent value for money.

In addition to our very successful 1600 series Martindale Testers, we now bring you the **1819 AquAbrasion Tester** which is the first automated wet abrasion testing instrument of its kind. Not only can this machine conduct standard dry abrasion testing but it is designed to conduct wet abrasion testing through the automatic dosing of samples with liquid at a constant rate throughout the full duration of the test and also intermittently during testing along with an additional wetting-out feature prior and post testing.

Historical Background

As the original & best manufacturers of the Martindale, a few years ago we were approached by the leading innovator in waterproof protection fabrics to design a 'wet' Martindale that would help them test the integrity of their materials when subjected to abrasion under wet conditions. After thorough design & development, the AquAbrasion was born. This proved to be very successful in fulfilling the customer's requirements and they were delighted with the product, so much so that their use was rolled out throughout the company creating multiple orders.
And now the time has come for everyone to experience the features and benefits of the AquAbrasion for themselves.

Features and Benefits

A commitment to continuous investment in the latest design and manufacturing technology enables **James Heal** to bring superior quality and feature-rich instruments such as the AquAbrasion Tester within the reach of the whole Textile Testing Community.

Features and benefits include:

- Versatility - can be used wet & dry both simultaneously and separately
- 4 Pump Modes – Dry, Wet, Intermittent and Pre & Post test
- Easy installation & operation
- Intuitive touchscreen user interface with adjustable dosing feature
- Individual dosing lines for testing multiple liquor types simultaneously
- Multiple drain holes to ensure free draining.
- Model 1819 has a hinged lift-up top plate for easy access to abrading tables & cleaning
- Weighted tube clamps to ensure full uptake of liquor from beaker
- Individual thread holes to ensure ordered unhindered dosing through the tubes
- Suitable for fabric abrasion, sock abrasion, leather (ball plate), line contact plate testing
- Complies with known Martindale standards and test methods.
- Individual station counters and totaliser
- Easy change of motion from the Lissajous pattern to straight line movement.
- Comfortable and easy access to every station from the front, without removing the top plate
- Finger grips to facilitate (when required) removal of top plate
- Low power consumption
- Higher speed for accelerated testing (x1.5)
- Jog speed (slow speed) for positioning Top Plate
- "Quick lock" clamping rings
- UKAS Calibration by **James Heal Service & Calibration**
- Standard 18 months warranty
- Test Materials: abrasive cloth, woven and nonwoven felts and foam
- Real value for money – The AquAbrasion tests both wet & dry.

Standards

The AquAbrasion 1819 in dry mode can conduct testing to all standards the 1600 Series of Martindale Abrasion and Pilling Testers comply with:

- ASTM D4966 (Abrasion)
- ASTM D4970 (Pilling)
- BS 5690:1991 (Superseded by EN ISO 12947)
- SFS 4328: 1979 (Superseded by EN ISO 12947)
- BS 3424: Part 24 (Method 27A)
- EN ISO 12947 series
- EN ISO 12945-2
- EN 15977
- SN 198 525 and SN 198 529
- IS 12673 (Plane Abrasion - Method 1)
- ISO 17704
- ISO 20344
- ISO 26082-1 (IUP 53-1)
- AWI TM 112 (Abrasion) and TM 196 (Pilling)
- IWTO TM 40
- JIS L 1096
- M&S P17 and P19
- Next TM18, TM18a and TM18b
- SATRA PM 31
- EN 388 (thick specimen holder available)
- and many more …

It is essential that reference be made to the appropriate standards as well as to performance specifications issued by your customers/buyers.

Lifting the Top Plate on the AquAbrasion 1819

The AquAbrasion 1819, like the Martindale 1609 has the feature of the hinged top plate, allowing easy access to all nine stations.

Rests for front top plate

The Top Plate is in two parts and both parts can be removed.

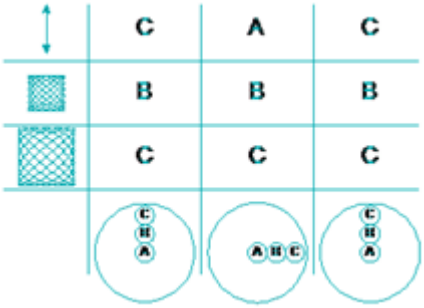
The larger front part can be detached from the smaller back part. Ensuring no tubes are attached, simply but carefully lift the front part and it will detach from the back part.

When detached, the front top plate can be stored by placing against the rests.

The smaller back part can be lifted away to allow access to the Drive Pins to change the motion of the AquAbrasion.

Always ensure any tubing is moved out of the way.

Changing the Rubbing Motion



The instrument is supplied with the Drive Pegs in position C ready for abrasion testing. To change the motion, lift or remove the Top Plate and set the Drive Pegs as required: Straight Line, 24mm Lissajous or 60.5mm Lissajous.

Typically the 60.5mm Lissajous motion is used for abrasion tests and the 24mm Lissajous motion for pilling tests. However, there are some exceptions, e.g., ASTM D4970 for pilling uses 60.5mm, so please consult the test method.

It takes 16 rubs to make a complete Lissajous figure.

Introduction to Applications

As the AquAbrasion can carry out both wet and dry testing, the AquAbrasion complies with all the same standards that the Martindale complies with.

Therefore, the following information is supplied to aid the user carry out testing in conjunction with current dry testing standards and test methods, it is not a replacement for these documents. The information and advice supplied is of a generic form and for more specific and detailed information the standards, test methods and specifications should be consulted. Information is provided for:

Dry Testing	**Typical Standard**
Abrasion Test	EN ISO 12947 parts 1 to 4
Pilling Test	EN ISO 12945-2
Sock Abrasion Test	EN 13770

Wet Testing	
Footwear: Test methods for uppers, linings and insocks – Abrasion resistance	ISO 17704
Personal protective equipment Test methods for footwear Determination of abrasion resistance of lining and insock	ISO 20344 Part 6.12

Block

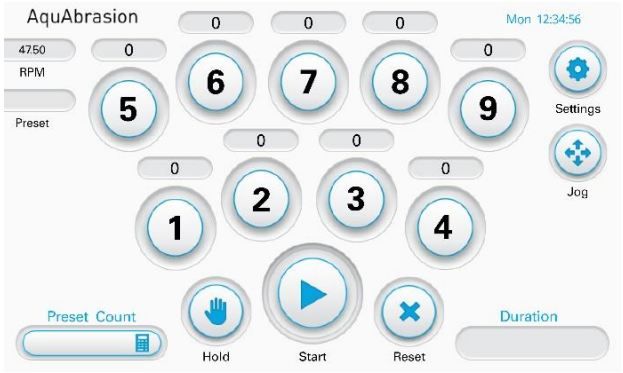
Spanner

For all wet testing a specimen holder will be used. To tighten these, the AquAbrasion is supplied with a block spanner

The block spanner has a non-slip base to allow for portability between workstations. It can also be permanently fixed to the work surface in the most ergonomic position for the user if required.

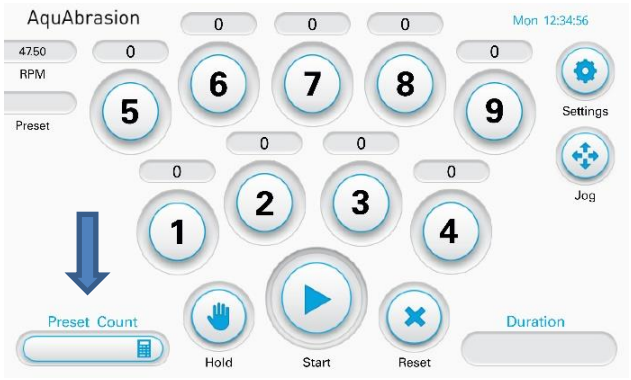
Intuitive Touchscreen User Interface

The 1819 AquAbrasion features an intuitive touchscreen user interface.



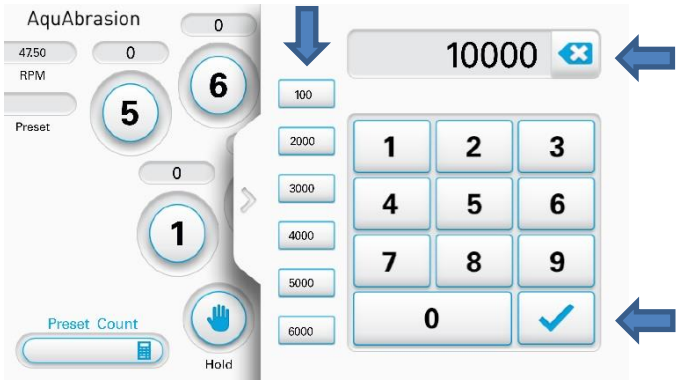
1819 Home Screen

Using the Touchscreen User Interface



Home Page

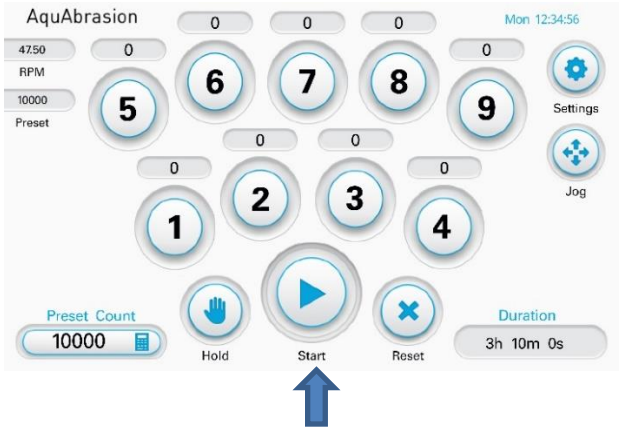
To start a test: Press the Preset Count button with the keypad icon to input rubs required.



Key Pad

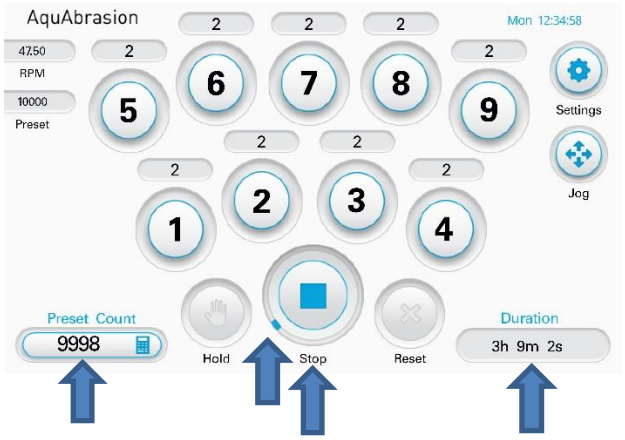
Enter the amount of rubs required using the keypad followed by pressing the tick button.

Favourites can be stored by entering the required number of rubs and holding down on one of the rectangular preset tabs to the left of the keypad. Then select by pressing by the tick.



Test is set up

Once the test has been set up, the Preset Count will display the amount of rubs and the Test End display will show when the test will be complete. The test can be started by pressing the start button.

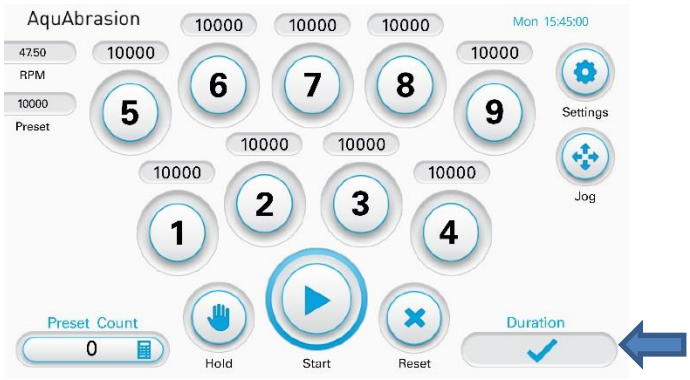


Test Running

Whilst the test is running, the Preset Count will count down the rubs and the displays on each station will count up the number of rubs.

The hold, reset, settings and jog buttons will be greyed out once the test is running.

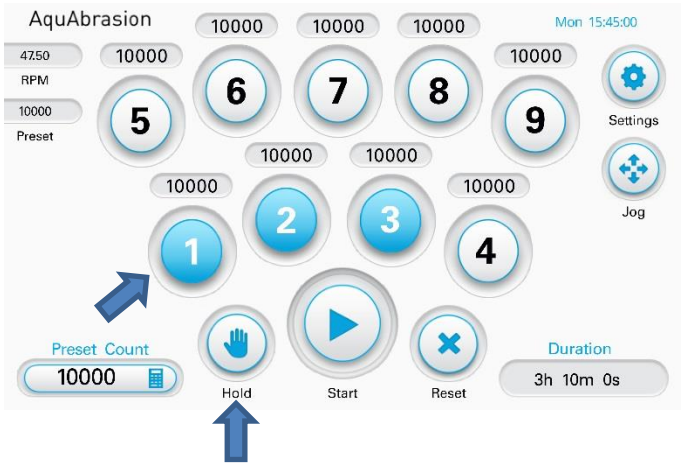
The Play button will also change to a stop button *whilst running* with a cyan ring around it to show the progress of the test.



Test complete

Once the test has completed, the progress ring will glow and the Test End will show a tick symbol.

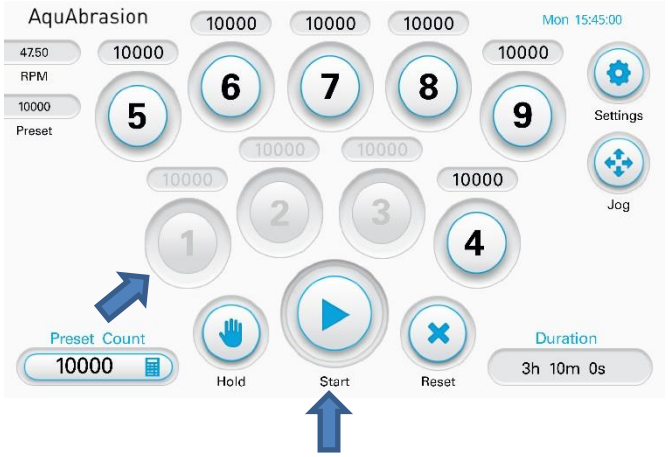
The buttons previously greyed out are now active and available for use.



Hold stations

To hold stations, select the stations you wish to hold.

Once pressed, the stations highlight blue to show they have been selected, then press the hold button. 



Held Stations

The stations on hold will grey out to show they are being held.

To start the test, press the start button. 

Test Running

When the test is running, the stations on hold will still be greyed out and not increase in count.

Test complete

Once the test has completed, the held stations will stay held and greyed out.

Reset Stations

Press the stations that you would like to reset. The selected stations will light up cyan (blue). Once you have made your selection press  the button.

Reset selected stations

A warning box will appear to ensure you are wanting to reset the count on the selected stations.

To confirm the reset press the  button.

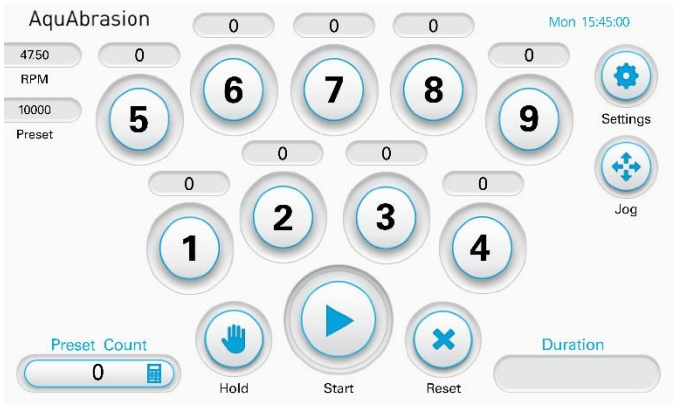
Reset stations

The reset stations will clear their counts back to zero.

Reset all stations

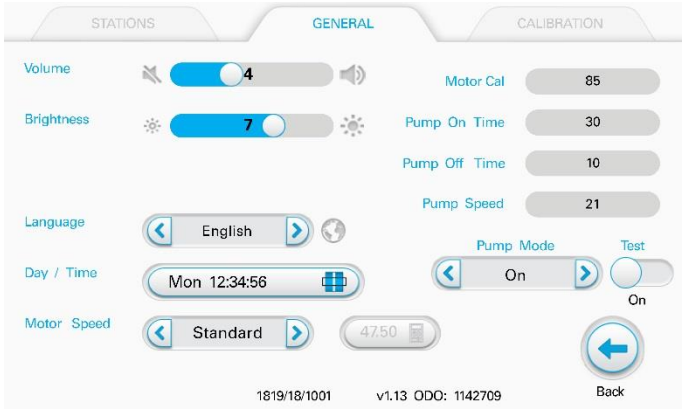
To reset all stations hold and press the ‘x’ button for 2 seconds.

A warning box will appear to ensure you are wanting to reset the count on all the stations. To confirm the reset press the tick button 



Reset all stations

All the stations will clear their counts back to zero and any stations on hold will no longer be on hold.

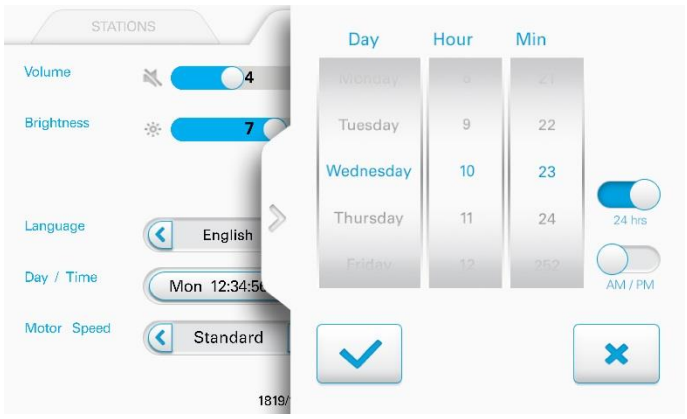


Settings – General

The following settings can be controlled by pressing Settings on the home page and then the GENERAL tab:

- Lights
- Volume
- Brightness
- Language
- Day & Time
- Motor speed
- Motor Calibration (Lissajous/rub break adjustment for low revolution tests)
- Pump On Time

- Pump Off Time
- Pump Speed
- Pump Mode
- Test (Pump On/Off switch)

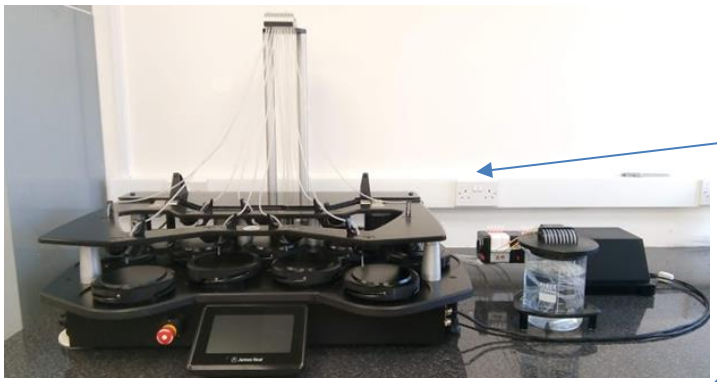


Setting the day and time

A roller wheel controller will appear once the Day & Time button is pressed.
The day and time can be set by rolling the wheels around to the correct setting.
AM/PM or 24 hour clock can also be selected.

Once selected, press the tick 

Setting up the AquAbrasion to Perform Wet Testing

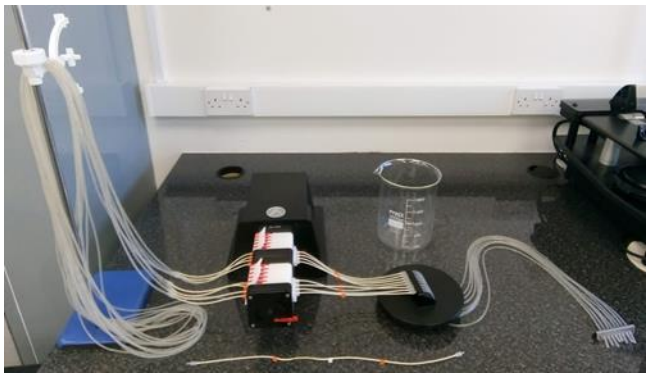


This is how the AquAbrasion will look once all the liquor tubes are in place.

Firstly, a plug must fitted to the power cable. It is strongly advised that this is carried out & tested by a qualified electrician. Once fitted it should be plugged into a socket higher than the base of the AquAbrasion.

Secondly, ensure the waste liquid pipe is firmly fitted into the outflow drainage connector situated on the back left of the machine.

To ensure full drainage of waste liquid, ensure the pipe falls lower than the machine and directly into either a drain pipe or container large enough to hold the amount of water intended to flow through the machine during testing.



Tube & pump assembly (stand to the left not provided).

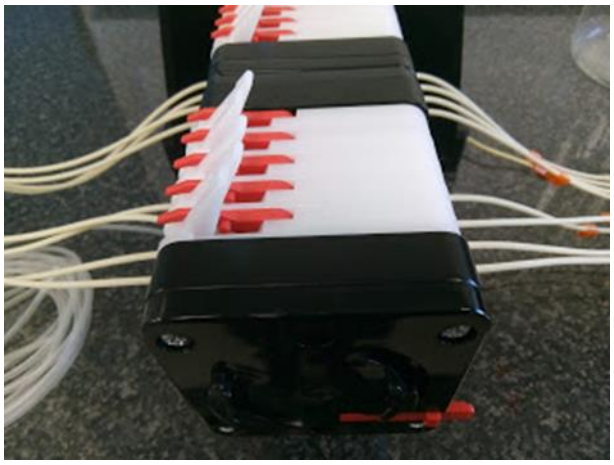
There are two silicone tube length types, of which there are 9 of each:

- Short tubes - which attach to pump & water supply beaker
- Long tubes - which attach to the pump & AquAbrasion

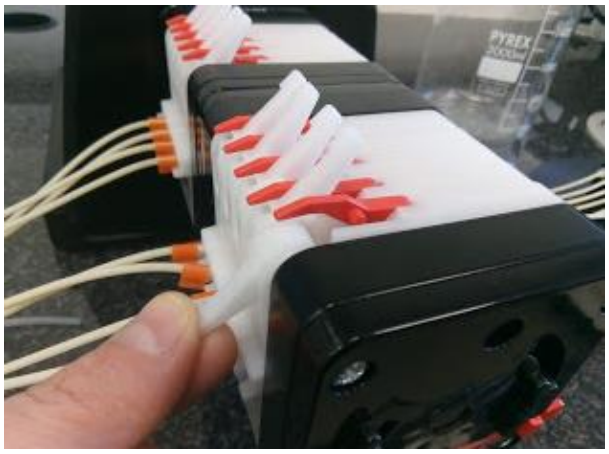
There is a third tube type – the Pump Tube - which is white rubber with orange & white clips on and opaque connectors at each end – these go through the pumping mechanism.

Inserting the Pump Tubes

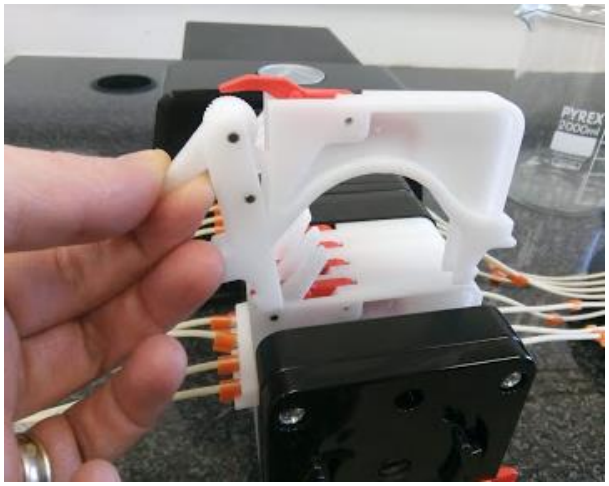
Take the white rubber pump tube. Insert or remove & replace as follows:



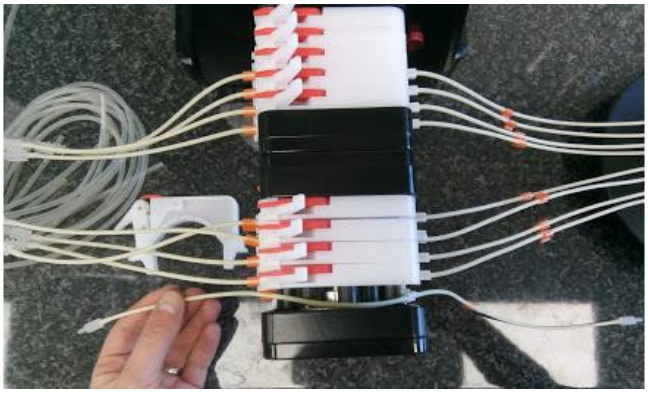
When all the pump tubes are locked in place, the white levers on each station dosing section on the pump are in the ‘up’ position.



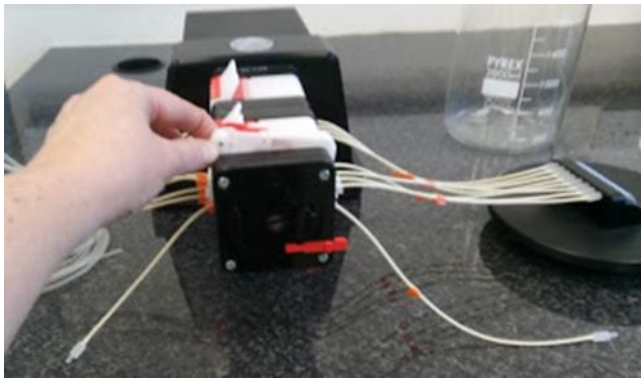
Remove the white plastic tube housing by moving the white lever through 180° to the ‘down’ position.



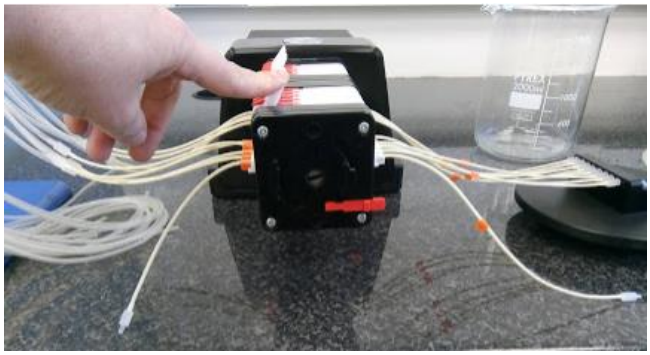
Lifting vertically, remove the housing.



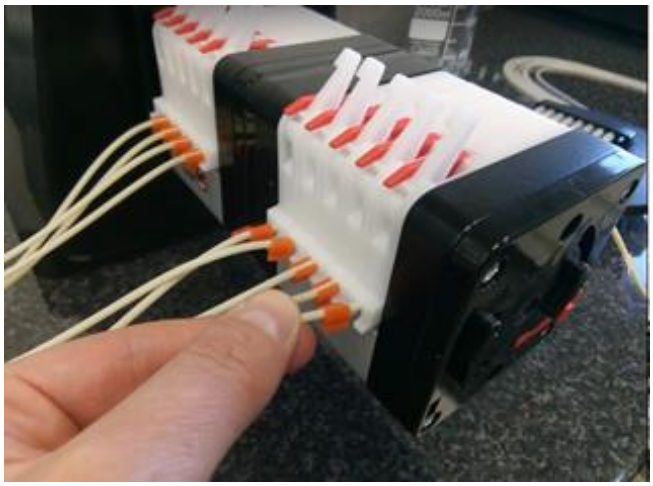
Take the pump tube and lay across the pump mechanism centrally – with the nose of the pump assembly facing you, ensure that there is an orange clip to the left and white to the right (NB There will always be a spare orange clip).



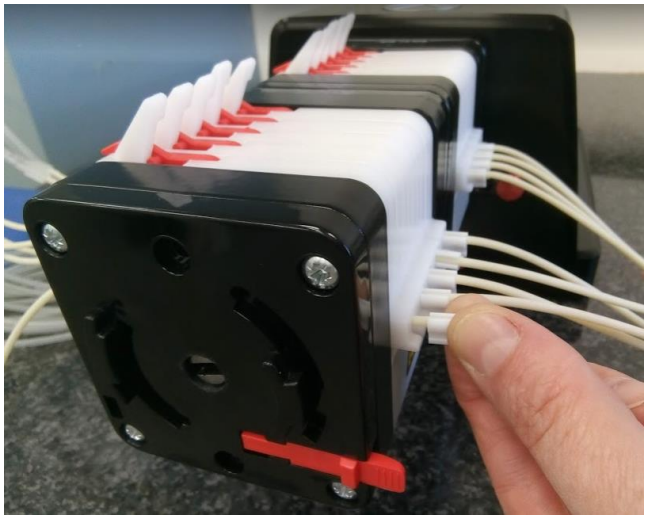
Replace the tube housing pushing down firmly ensuring it is flush with the other housings, checking the orange & white clips on the tube are just outside the housing.



Return the lever through 180° to lock the housing back in place.



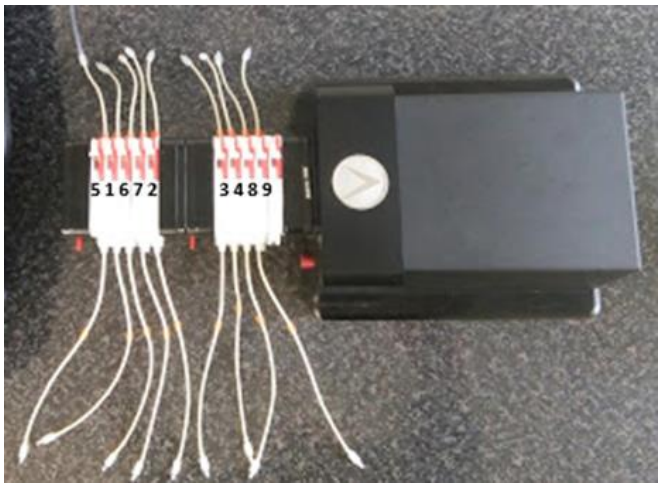
Pull the tube gently to snap the orange clips into place on the side of the pump housing.



On the other side, pull the tube gently to snap the white clips into place on the side of the pump housing. (NB There will always be a spare orange clip to the left of the white clip).

The pump tube is now in position, repeat the preceding steps as required until there are 9 pump tubes fitted.

Attaching the long silicone dosing tubes from the pump to the AquAbrasion



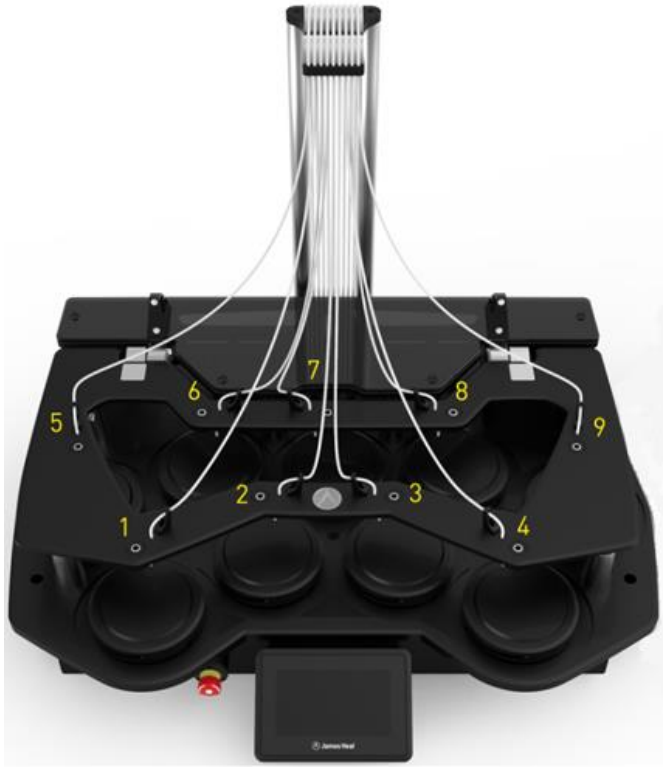
For ease of tube threading, the suggested threading scheme sequence & method is as follows:

AquAbrasion Station: 5,1,6,7,2,3,4,8,9

With the pump nose end pointing left towards the AquaAbrasion.

Thread from left to right of the pump tube assembly.

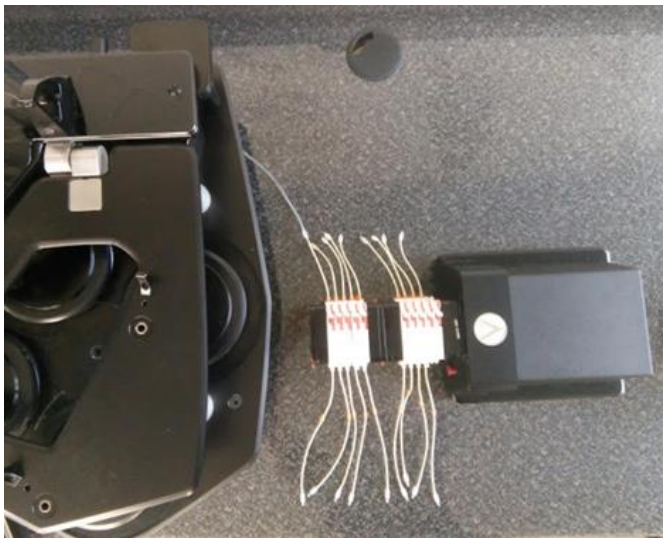
Then left to right through the AquAbrasion tube stand head.



To the following stations on the AquAbrasion:

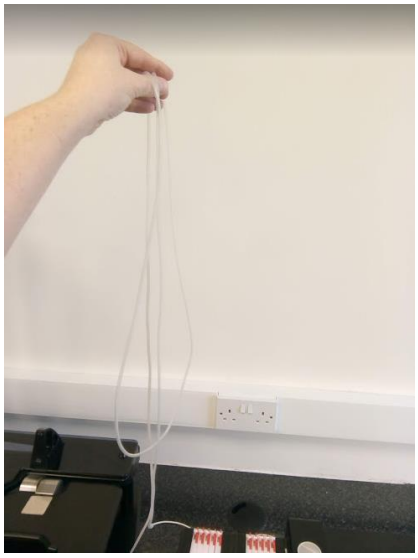
Station: 5,1,6,7,2,3,4,8,9

The touch screen layout corresponds to the AquAbrasion station layout.



To thread the first long silicone tube, take a tube & attach it to the very left pump tube, situated at the end of the pump nose, using the connector.

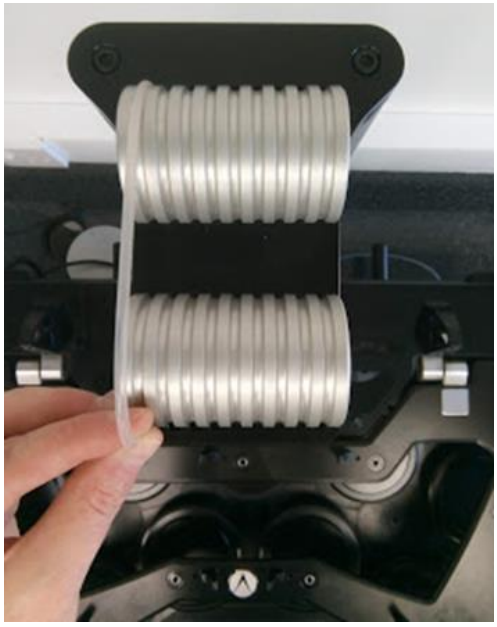
Tubes connected.



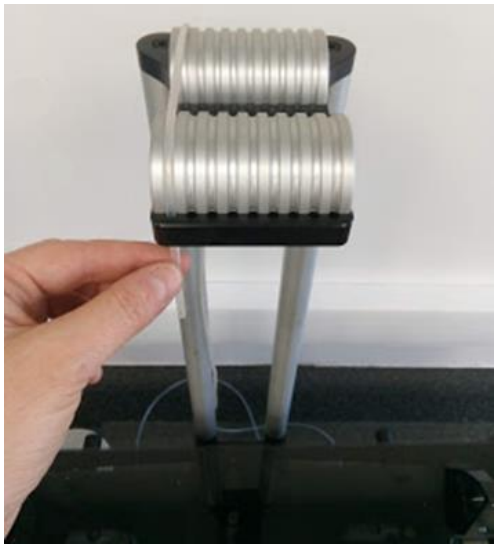
Once connected, take the long silicone tubing and begin threading onto the AquAbrasion.

Take the tube round the back of the stand.

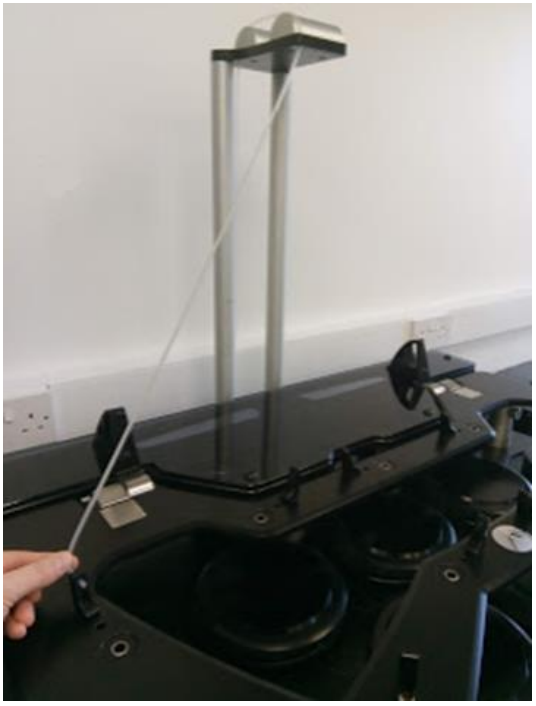
Underneath the head of the stand, feed the tube through the first hole on the left through to the upper side of the top plate.



Pull the tube up and over the stand head, ensuring the tube is resting in the first groove.



Thread down through the corresponding hole at the front of the stand head.



Take tube across and thread (for the first tube) into station 5 on the back left of the AquAbrasion.

Threading firstly through the hole on the tube mount attached to the top of the hinged top plate.

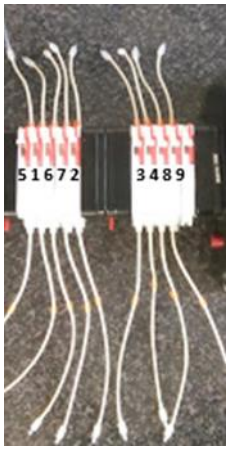
Pass through the hole in the top plate, through to the underside of the top plate.

Raise the top plate on its hinge and thread the tube through the tube mount on the underside of the lid.

Close the lid and begin the process again with the next long silicone tube until all stations are connected to the pump using the sequence as given in detail at the start of this section and as in the pictorial outline below.

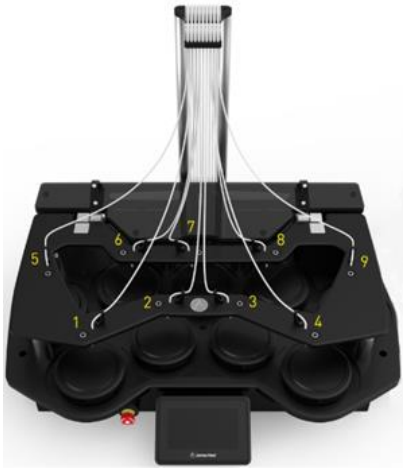
Once the test specimens & abradants are in place on the table and in the specimen holder the tube will be situated just above the specimen holder – Ensure that a small gap of approximately 5mm is left between the top of the specimen holder and the tube to allow for the liquid to exit the tube.

Illustrations of how to load the specimen holders & abradant tables with test materials can be found further in this operating guide.



Pump Tubes

Tube Stand Head



AquAbrasion Stations

Touch Screen

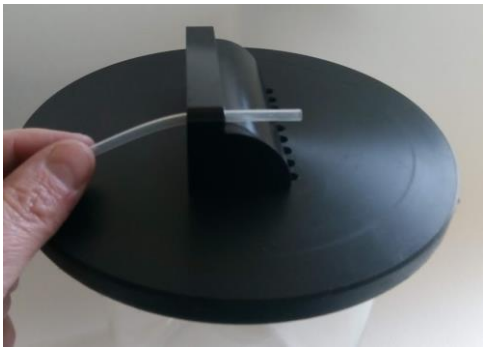
Attaching the short silicone dosing tubes from the pump to the beaker

Lid and liquor beaker from which the tubes feed the AquAbrasion with liquid via the pump mechanism.

Lid front.

Lid rear.

Thread the short silicone tube through the rear of the lid.



Through to the front of the lid.

Thread tube through the lower hole.

Through to the underside of the lid.

Continue threading in this way until all required short silicone tubes are in place – up to a maximum of 9 tubes to correspond with the maximum number of AquAbrasion stations.

Once all the tubes are through, the tubes need to be threaded through the End Weight (see next picture) – This is designed to ensure the maximum amount of liquid is drawn from beaker by holding the tube ends on the bottom of the beaker.

Feed the tube from one side of the End Weight to the other. Note that the holes are angled to allow for ease of threading.

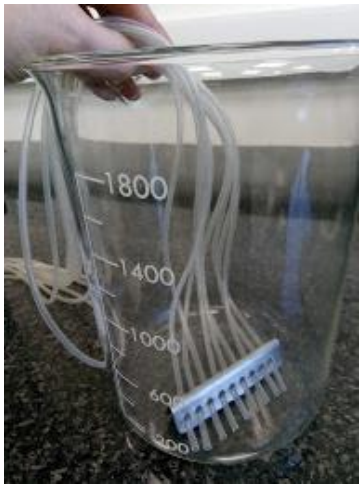
Allow approximately 15mm to protrude through the end weight to allow the weight to sit on the bottom of the jar easily and optimise liquor uptake.

End Weight fully threaded.

Short silicone tubing, lid & end weight assembly.

There is ample tube length provided to allow for various positioning's of the beaker in relation to the pump when connected.

If required, the tubes can be shortened by cutting with scissors.

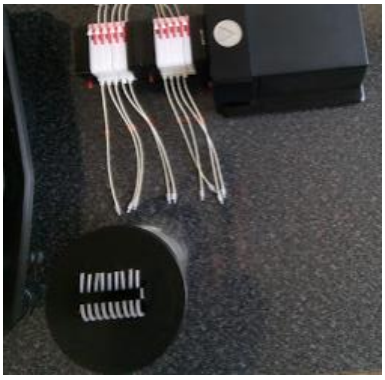


Place the weighted tubes in the beaker ensuring the end weight is standing on the bottom of the beaker with the ends of the tubes pointing downwards to ensure maximum liquor uptake.

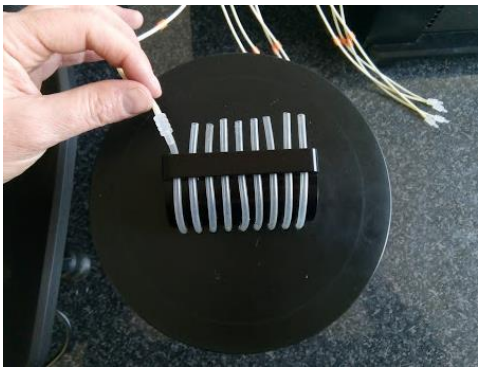
Place the lid onto the beaker.

As mentioned previously, if required, the tubes can be shortened by cutting with scissors.

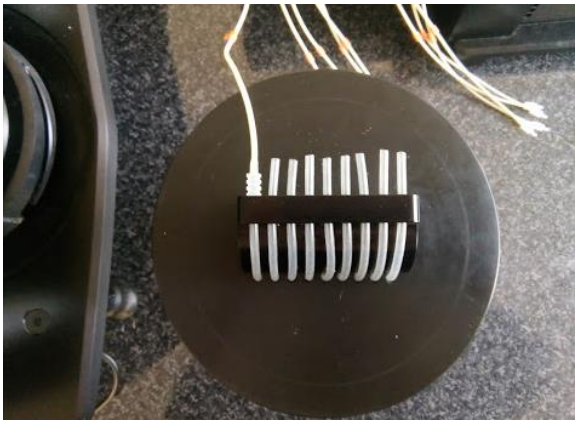
The silicone tubing used for the AquAbrasion was chosen for its flexibility & resistance to kinking, however as a precaution, always check that no kinks or traps are present in the tubing before beginning the test.



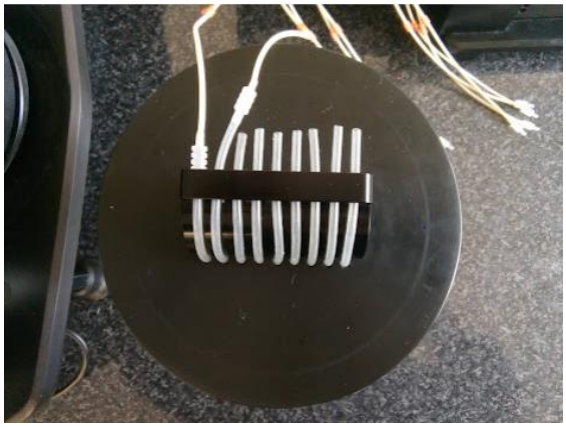
Move the beaker near the pump to begin connecting the short silicone tubes to the pump tubes.



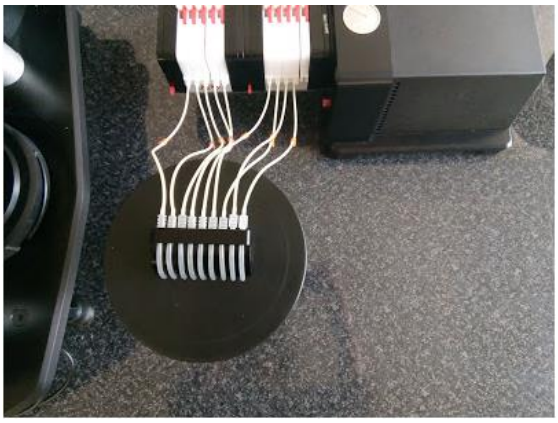
Take the first pump tube on the left closest to the end of the pump nose and attach using the connector, to the left short silicone tube protruding from the lid of the liquor beaker.



Push the connected tube connector into the hole on the lid – this is simply for to keep the tubes tidy.
If more tube is required due to the positioning of the beaker needing to be further away from the pump than illustrated here then it will not be possible to do this.



Continue connecting the tubes until finished.



Once all the short silicone tubes are connected to the pump tubes the assembly will look like this.

Place the beaker in the stand.

At this stage liquid can be added:

In situ: Lift the lid and pour in liquid using a jug

Removed: Take the lid off, remove beaker, fill with required liquor and replace tubes & lid – ensuring the tubes and weights are placed correctly (as outlined previously).

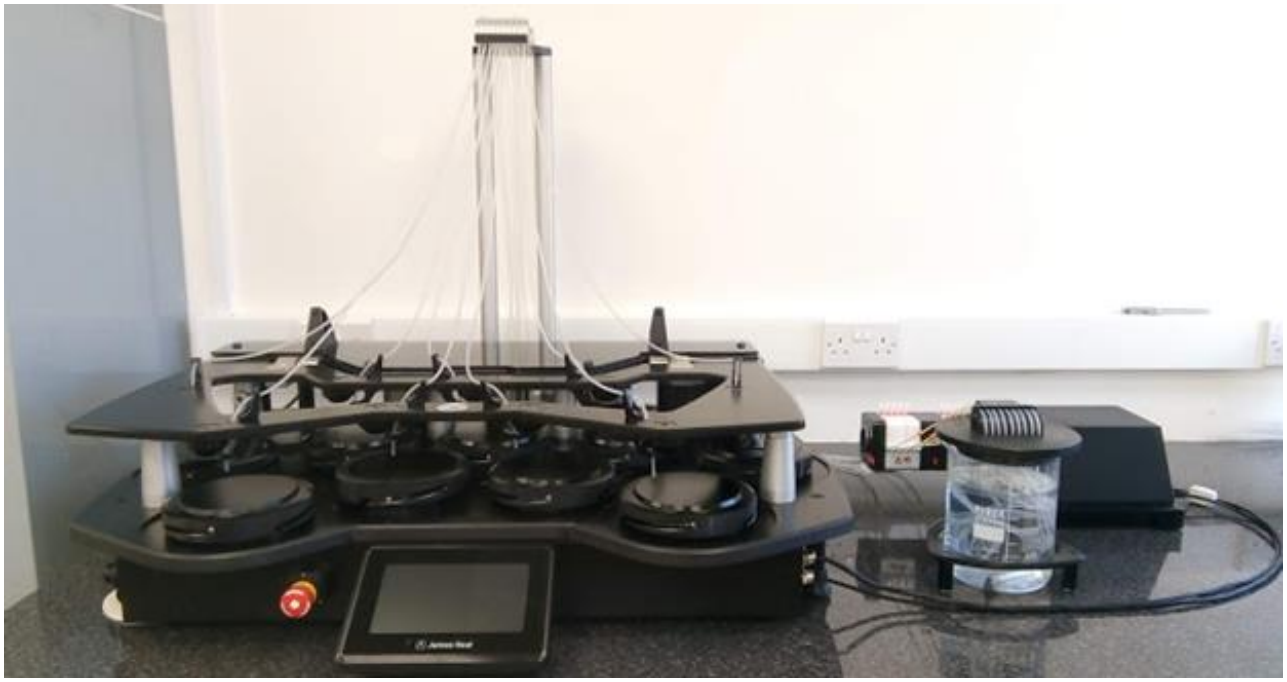
The AquAbrasion must be set up with the long tubes at the back & short tubes at the front when the pump nose faces to the left - otherwise the pumping mechanism will operate in reverse sucking air in & blowing bubbles into the liquid in the beaker!

Finally, connect the AquAbrasion to the pump.

As the power & VGA cable are situated on the right of the AquAbrasion then ideally is better to place the pump on the right of the AquAbrasion as illustrated in this document.

However, if space on this side is limited, then it is possible to place the pump on the left of the AquAbrasion, ensuring that the pump nose is still facing to the left, & run the two cables round & underneath the AquAbrasion to the left side & plug into the back of the pump.

The power lead is on the left & VGA lead on the right – The VGA connector will need securing through the tightening of the screw pegs on either side of the connector.



Once the tubes are fully threaded the AquAbrasion will look as above.

As outlined previously, the AquAbrasion must always be fed using the short silicone tubing drawing the liquor from the beaker, situated on the near-side, through the pump, with the pump nose facing to the left. The long silicone dosing tubes must be connected to the off side feeding through to the AquAbrasion tube head stand and down to the AquAbrasion stations.

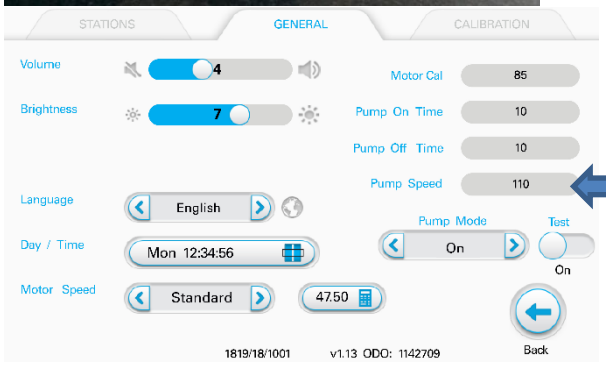
Otherwise, if the tubes are connected to the pump the other way around, the pump will suck air in and blow bubbles into the liquid.

The illustrated set up is a suggestion, the pump can also be placed on the left of the AquAbrasion with the pump nose still facing to the left & keeping the beaker and short silicone tubes on the near side with the long silicone tubes feeding through to the AquAbrasion on the off-side. Simply, run the two cables round & underneath the AquAbrasion through to the left side & plug into the back of the pump.

Priming the Pump & Tubing Apparatus

Before testing, it will be necessary to draw the liquid through the tubing system from the beaker, through the pump and onto the AquAbrasion stations. To do this conduct the following:

Ensure the beaker is full of the test liquid.

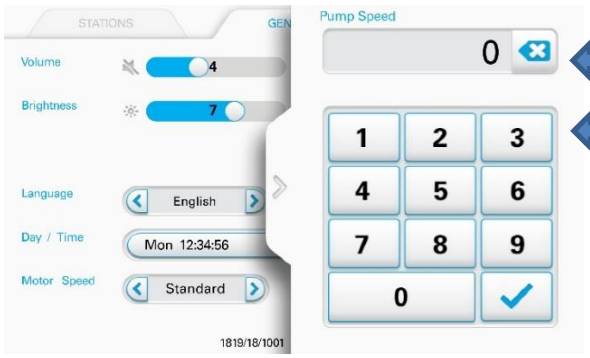


Set the Pump Speed to its highest setting 110 RPM.

Do this by:

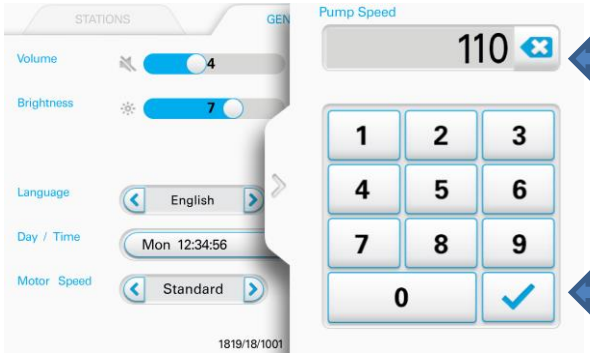
Select Pump Speed by touching inside the grey box.

This will bring up the Pump Speed Screen.



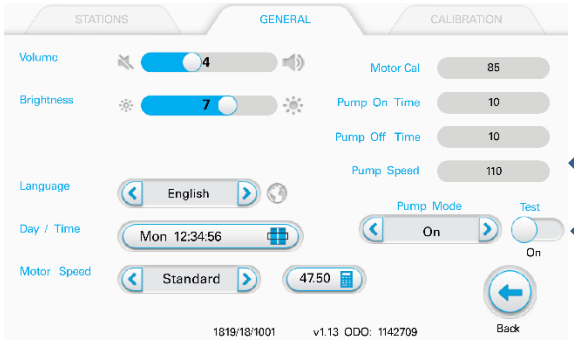
Press and hold the 'x' to zero the pump speed.

Using the key pad select the required 110 RPM.



Once the Pump Speed is set to 110 RMP.

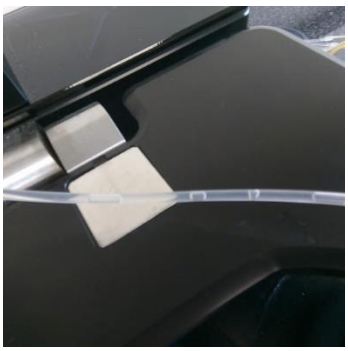
Select the blue tick ✔ to set the pump speed, you will then be taken back to the General Screen.



On the General screen the Pump Speed will now read 110 RPM

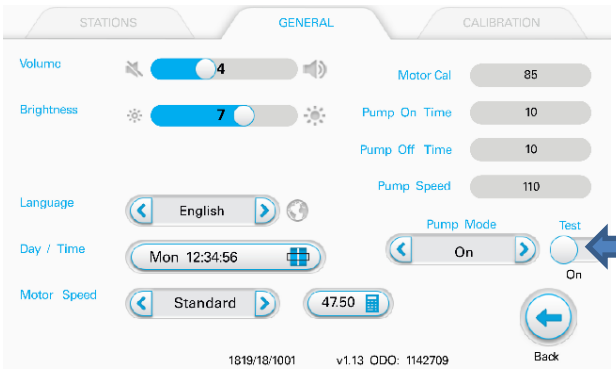
Ensuring that all the tubes are fully in place and no fabric or sample holders are on the AquAbrasion station tables and the hinged top plate is fully lowered – Select the Test toggle and slide from the left..

..To the right to turn on the pump. The liquid will now begin to draw through the tubes.



The liquid will be seen drawing through the tubing, along with air bubbles.

Once the liquid begins to come through tubes and onto the abrading tables on each station, allow the liquor to pull through some more until there are no air bubbles left in the pipe.



Stop the Pump by sliding the Test toggle back to the left.

Lift the hinged top plate and wipe away the water with an absorbent cloth

The Pump & Tubes are now fully primed for:

The Pump Speed determining the liquor dosing flow rate to be established.

The Pump Mode to be set.

The specimens & abradants mounted.

After which AquAbrasion wet testing can begin.

Pump Speed Dosing Rate Table

All the following rates are approximate. However they will not vary greatly from the table below. To verify the exact flow rate of your pump see the following section 'Determining the dosing flow rate onto the specimen'.

Pump Speed RPM	Millilitres per minute
21	1
42	2
63	3
84	4
105	5

Determining the dosing flow rate onto the specimen

The revolutions per minute (RPM) of the pump determines the flow rate of the liquor through the tube onto the specimen.

For example:

The flow rate of deionised water with the Pump Speed set at 21 RPM equates to approximately 1 millilitre (ml) per minute when the Pump Mode is set to 'On' continuously throughout the test.

Liquids with different viscosities will have different flow rates and the pump speed will need to be adjusted accordingly.

Calibration & Pump Speed Determination Method

The revolutions per minute (RPM) of the pump determines the flow rate of the liquor through the tube onto the sample.

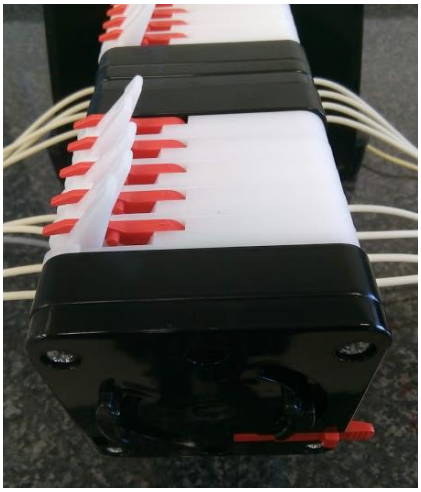
The flow rate of deionised water with the Pump Speed set at 21 RPM equates to approximately 1 millilitre (ml) per minute being dosed onto the specimen.

For example: If 3ml of deionised water is required to flood the sample every minute, set the Pump Speed to 63 RPM (3ml x 21RPM)

The maximum Pump Speed is 110RPM – This achieves a maximum dosing of deionised water of approximately 5.24 ml per minute.

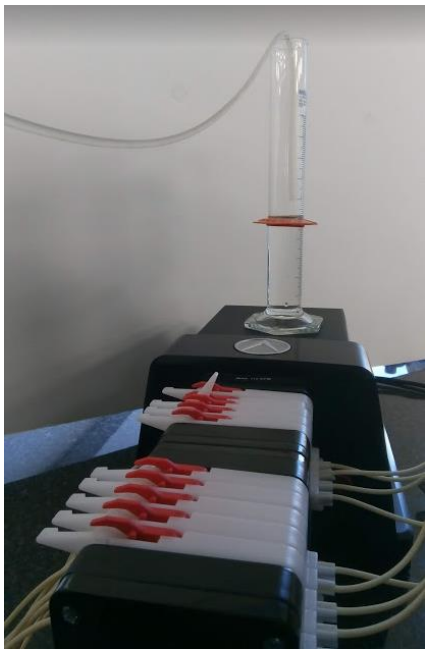
The above figures are approximate & relate to deionised water only. Also each individual pump will differ slightly and the pump dosing volume per second may drift overtime as the pump tubes flatten (these must also be checked regularly & changed if necessary – see page 13). It is necessary therefore, that before conducting any testing the pump is calibrated & the RPM of the Pump Speed is established in relation to the millilitres per minute dosage and all subsequent calculations then made from this established reference figure. It is especially necessary if a liquid of a different viscosity is used – the higher the viscosity i.e the thicker the liquid, the higher the Pump Speed will need to be to achieve e.g 1ml per minute.

To do this take the following steps:

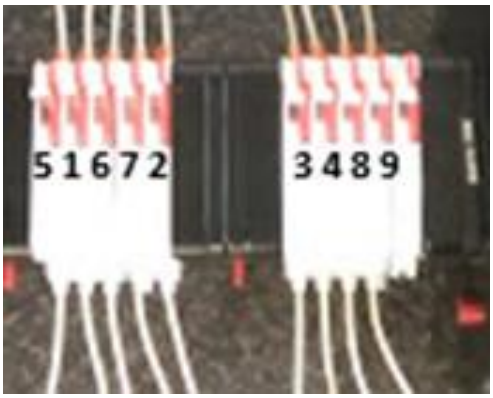


Dis-engaging the pumping tubes

All the white levers on the pump will be in the upright (1 o'clock) position locking each pump tube into place – all levers except one, will need to be dis-engaged.



To dis-engage the white pump levers, move all of the levers, except for one, from the locked position (at 1 o'clock) through 120˚anti-clockwise to the horizontal position (at 9 o'clock)



For ease, use the right hand pump tube which corresponds with AquAbrasion Station 9.

Simply, remove the long silicone tubing from the thread holes in the hinged top plate on station 9 and place the tube into a measuring cylinder.

Using station 9 is for illustration only, using any of the other working stations and its corresponding pump tube is acceptable.

Decide upon how many millilitres you would like to draw to conduct the verification.

This depends upon the capacity of measuring cylinder used.

Here, a 100ml capacity glass measuring cylinder was chosen as this size cylinder is large & sturdy enough to hold the tubing without pulling it over.

A liquor drawing of 50ml was chosen at a setting of 21RPM to check the millilitres per minute.

The orange measuring guide was set to 50ml.

The long silicone tube was placed into the beaker to just above the 50ml fill line – If the tube is placed below the fill line, then the mass of the tube would displace the water and give a false reading.

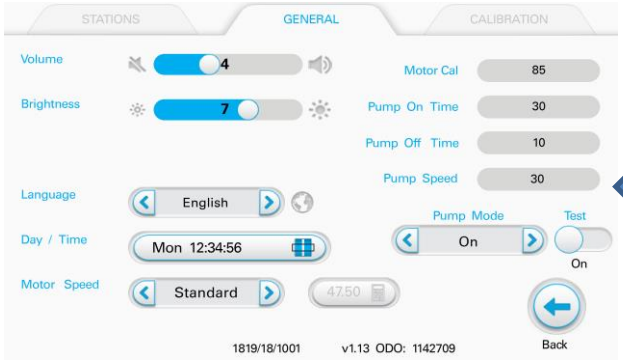
Please note:

1) Smaller cylinders may be used but they will need to be fixed in place to ensure that there is no likelihood of the cylinder toppling or the tube coming out.

2) Smaller volumes may also be used to determine &/or verify the Pump Speed required as this will accelerate the verification. However, it is advisable to use a smaller cylinder to enable the user to gain more accurate volumetric readings.

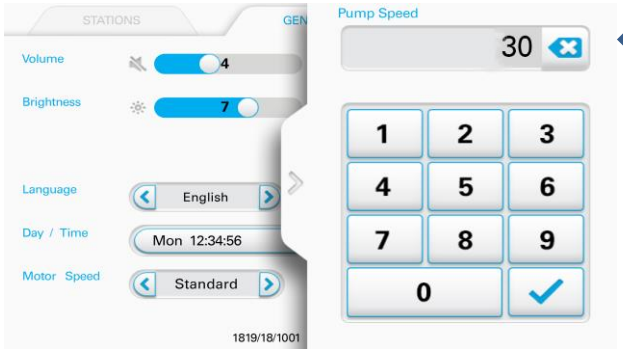
On the touch screen, select the Settings button.

This will take you to the General Screen.



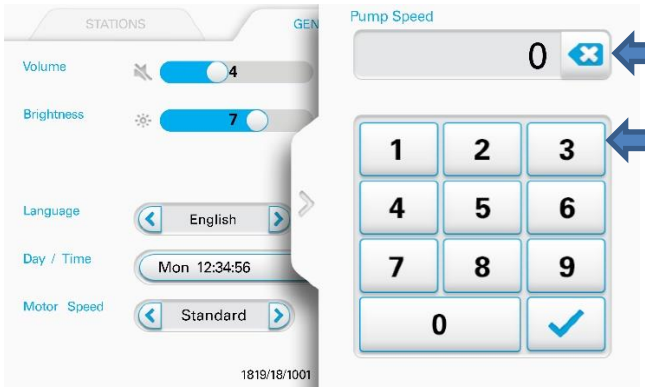
Select Pump Speed by touching inside the grey box.

This will bring up the Pump Speed screen (below)



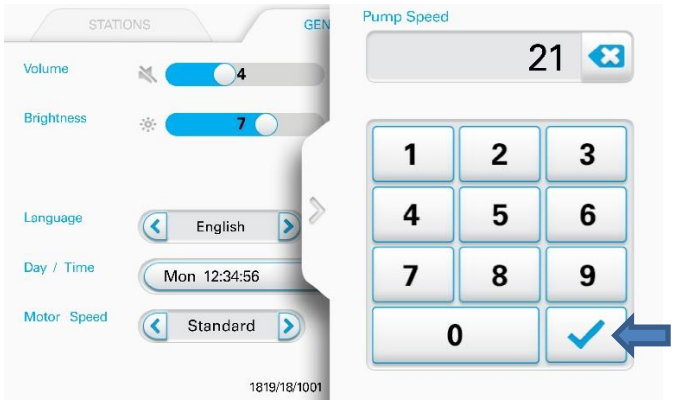
Press and hold the 'x' to zero the pump speed.

Using the key pad select the required RPM e.g. 21

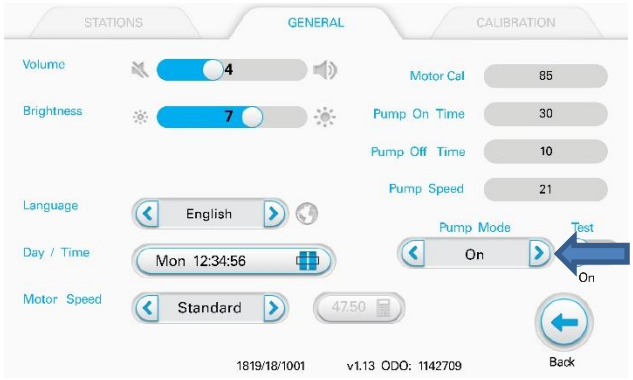


Once the Pump Speed is zeroed.

Use the key pad to select the required pump speed e.g. 21



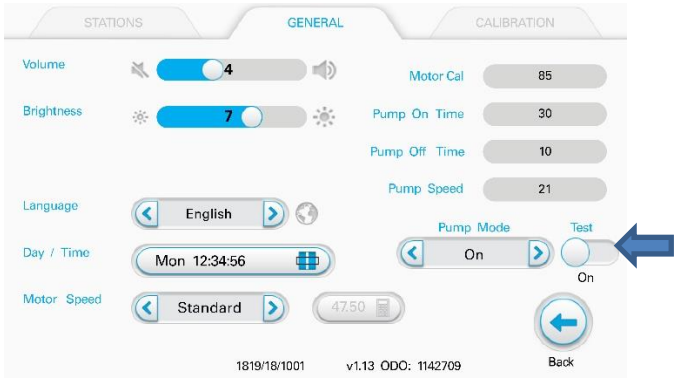
Select the blue tick ✔ to set the pump speed, you will then be taken back to the General Screen.



In Pump Mode, using the arrows select ‘On’

‘On’ signifies that the Pump Mode is set to continuous pumping when the test is in operation.

(See following section for all Pump Mode settings & descriptions)

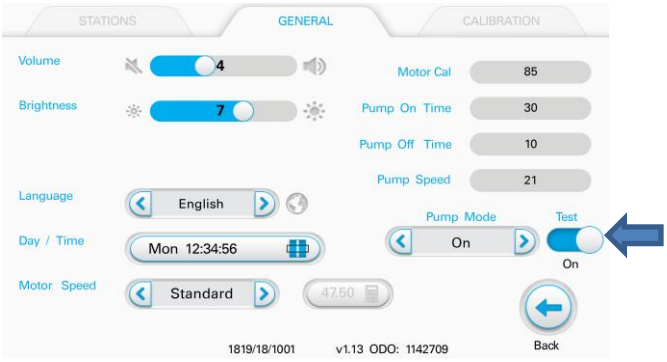


The Test switch will be toggled to the left and greyed out, showing that the pump is switched off.

As the amount of millilitres to be used to verify the flow rate is 50ml

Take a stopwatch and set it to count down from 50 mins to zero.

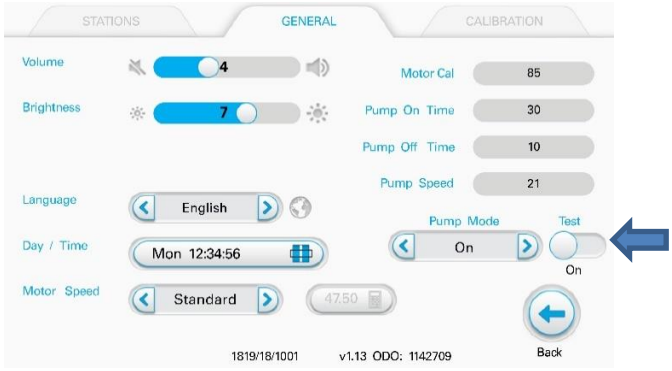
It is advisable to use a stopwatch with a function on it that indicates when it is nearing the end of its count down e.g. one minute from the end to alert the operative to return to the test in time for the Test toggle switch to be turned off.



Simultaneously, start the stopwatch & start the pump by toggling the Test switch to the right highlighting it blue.

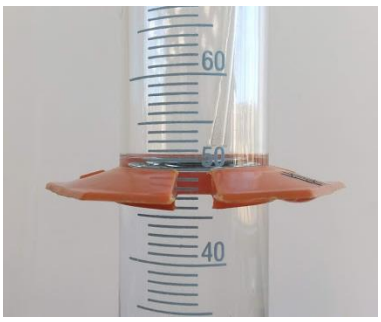
This will turn the pump on.

When the Stopwatch has reached zero...



Immediately stop the test by sliding the Test toggle to the left greying out the area.

This will turn the pump off.



Check the amount of liquid pumped into the measuring cylinder.

Ensure that the liquid level reading is taken from the bottom of the meniscus.

To determine if the Pump Speed (RPM) is set correctly to pump 1 millilitre per minute, in 50 minutes the liquid level should be exactly on 50ml.

If the liquid level is higher or lower 50ml, then the Pump speed will need adjusting using the following calculations:

Achieved millilitres at set RPM = actual millilitres per minute at set RPM
Expected millilitres at set RPM

e.g. 55ml at 21RPM = 1.1 millilitres at 21RPM
50ml at 21RPM

To adjust the RPM to achieve 1 millilitre per minute:

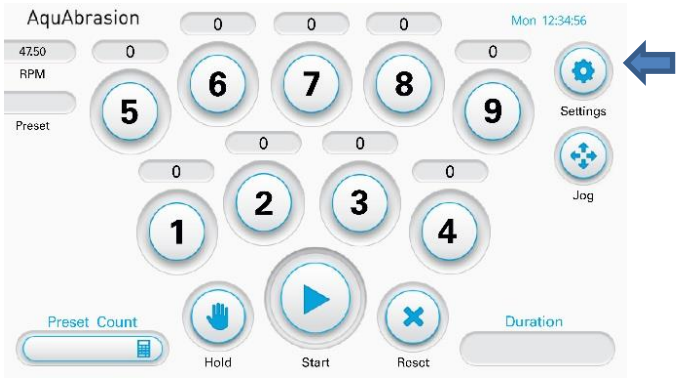
Current RPM = Required Pump Speed RPM for 1 millilitre per minute
Actual ml/min

e.g. 21 RPM = Pump Speed of 19 RPM setting required for 1 millilitre per minute
1.1 ml/min

Adjust the Pump Speed accordingly – It is advisable to conduct this pump speed test again to ensure that the adjustments made are correct.

Pump Mode Operation

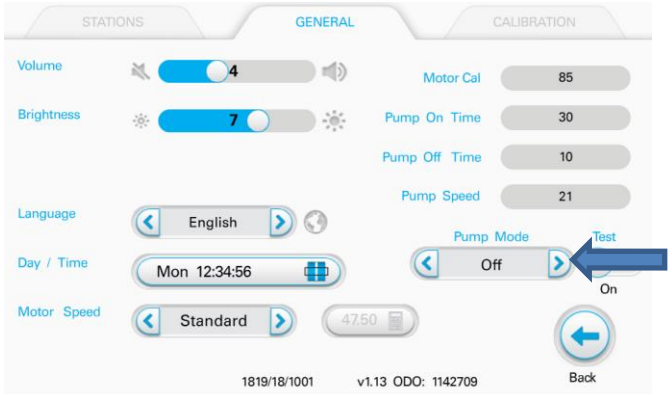
There are 4 Pump Mode settings:



Access the General screen via first selecting the Settings icon on the front screen

On the General screen, locate Pump Mode

The arrows on either side of the Pump Mode bar are used to scroll through the 4 settings. (see below)



'Off' Pump Mode

The first setting is 'Off' – This allows the AquAbrasion to run in dry test mode and so can be used in the same manner as a standard Martindale.

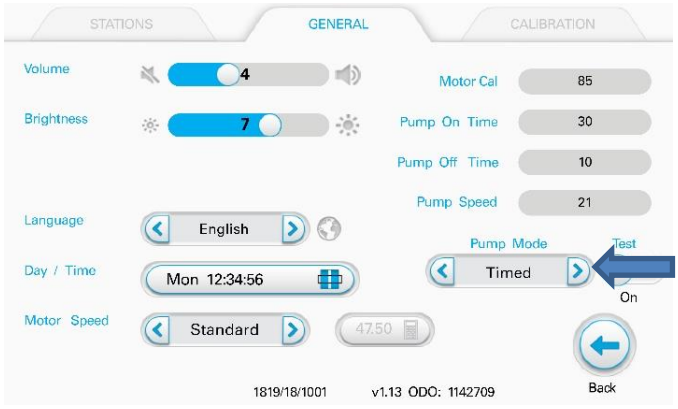
When running in the Off mode there is no need to have the pump or tubes attached.

It can be used with the tubes attached, but ensure that any residue liquid in the pipes has been completely pumped out & the instrument is dry.

'On' Pump Mode

The 'On' Pump Mode setting is required for continuous dosing.

The Pump starts as soon as the start button is pressed on the front screen until the last rub has been made and the AquAbrasion stops.



Timed Pump Mode

'Timed' mode enables the user to set the priming times at both beginning and end of the test.

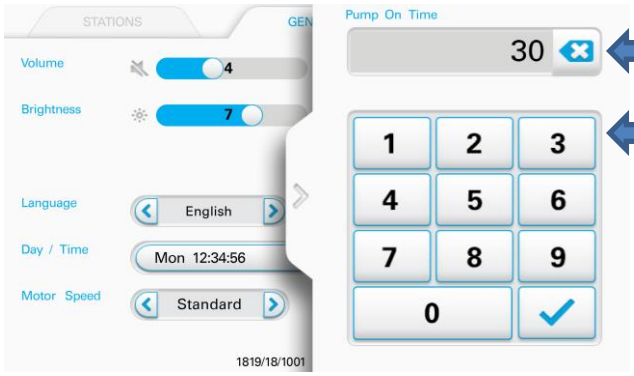
This allows for any pre and/or post wetting to be conducted whilst the AquAbrasion is not in motion.

Select 'Timed' mode by using the arrows

Pre-Test Wetting

To set the wetting time to begin before the AquAbrasion starts to move beginning its rubbing cycle.

Select 'Pump On Time' by touching inside the grey box.



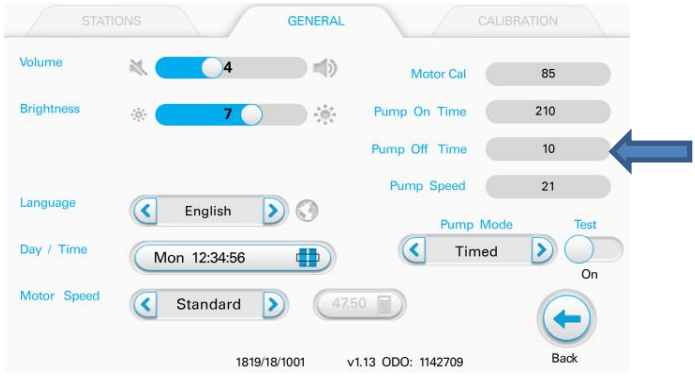
The Pump On Time is zeroed (0) by press and holding the '**x**' on the Pump On Time box.
Use the key pad to select the required pre-test sample wetting time required e.g. 210 seconds

The time entered must always be in **seconds**.

Once the required pre-test wetting time in seconds has been entered using the key pad...

Select the blue tick ✔ to set Pump On Time and return to the General Screen

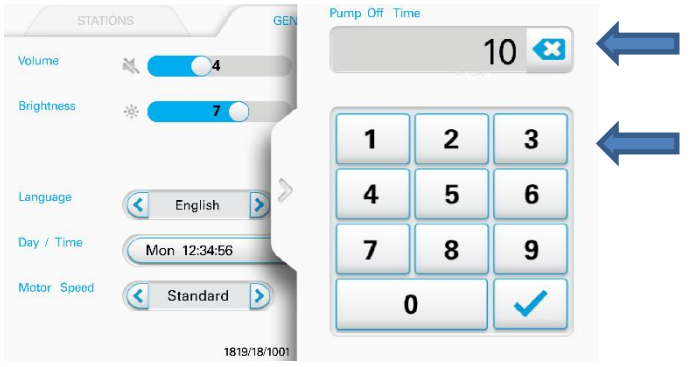
The Pump On Time is now set.



Post-Test Wetting

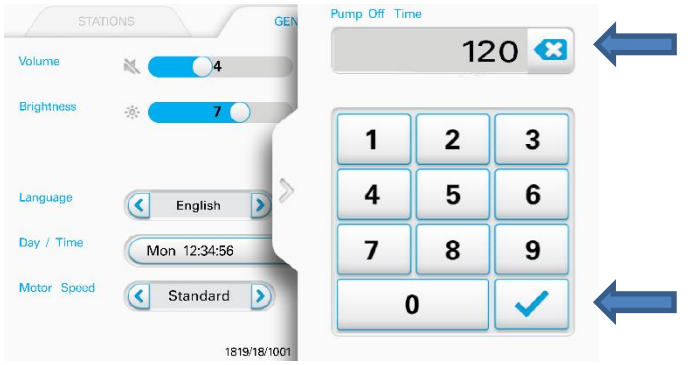
To set the wetting time to continue *after* the AquAbrasion come to the end of its rubbing cycle and the top plate stopped moving.

Select 'Pump Off Time' by touching inside the grey box.



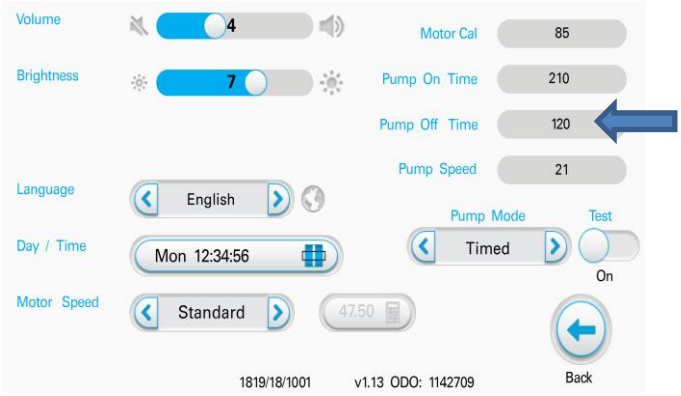
The Pump Off Time is zeroed (0) by press and holding the '**x**' on the Pump On Time box.
Use the key pad to select the required pre-test sample wetting time required e.g. 120 seconds

The time entered must always be in **seconds**.

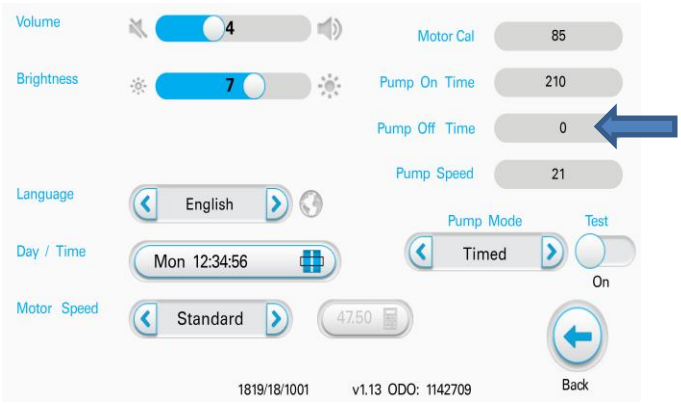


Once the required post-test wetting time in seconds has been entered using the key pad...

Select the blue tick ✔ to set Pump On Time and return to the General Screen.



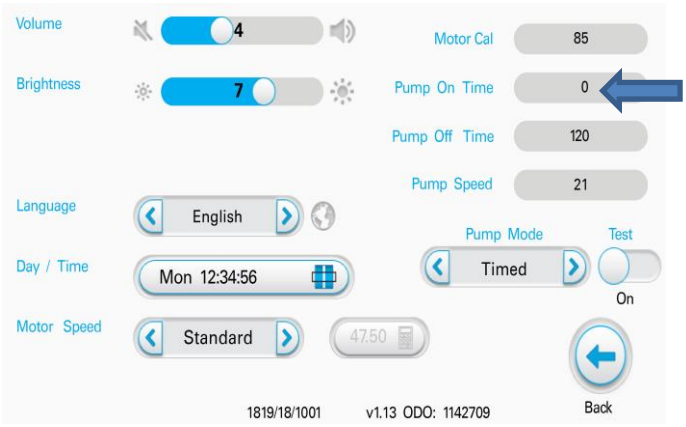
The Pump Off Time is now set.



Setting Only Pre or Post Test Wetting

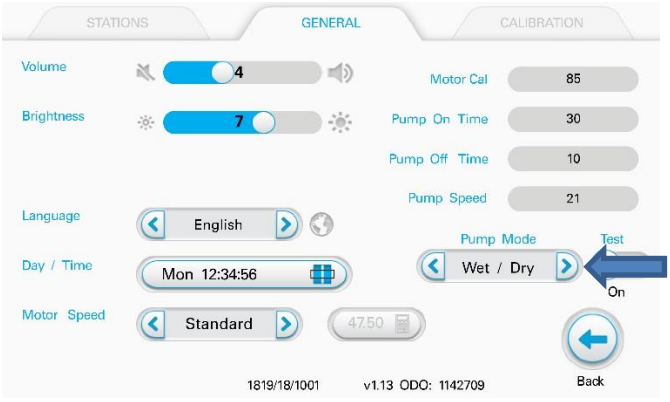
If only the pre-test wetting is required, then simply set the Pump On Time to the required time & the Pump Off Time to zero (0)

The pump will then start dosing as required *before* the AquAbrasion rub cycle starts but will stop when the AquAbrasion rubbing action stops.



If only the post-test wetting is required, then simply set the Pump Off Time to the required time & the Pump On Time to zero (0)

The pump will then start dosing as required at the same time as the AquAbrasion rub cycle starts but will stop at the required time *after* AquAbrasion rubbing action stops.



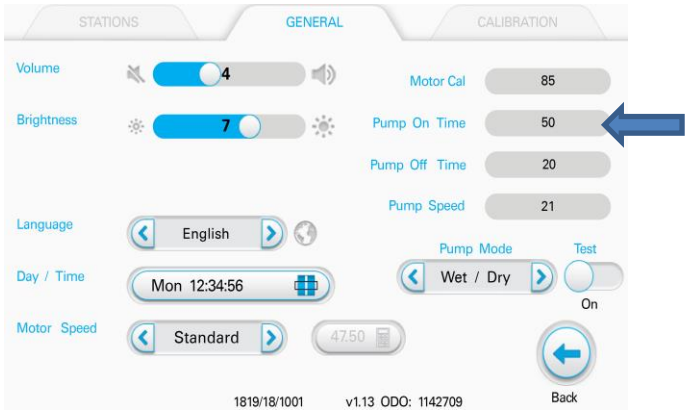
Wet/Dry Pump Mode

This turns the pump on & off at pre-set intermittent intervals during the test.

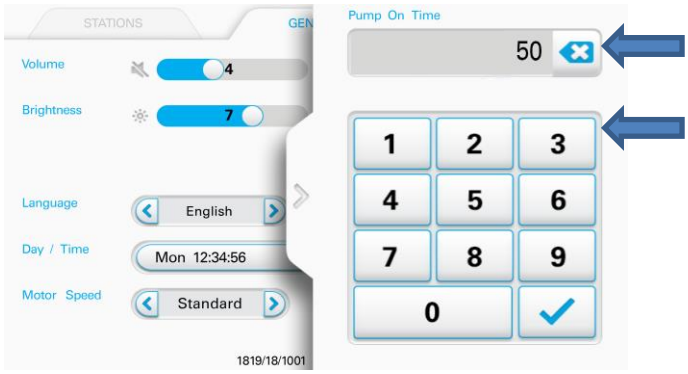
The Pump On Time is used to set 'Wet' time - the duration in seconds of the time the pump is wetting the specimen.

The Pump Off Time is used to set the 'Dry' time - the duration in seconds of the time the pump is switched off and no liquid is dosing the specimen.

Using the arrows select Wet/Dry mode.



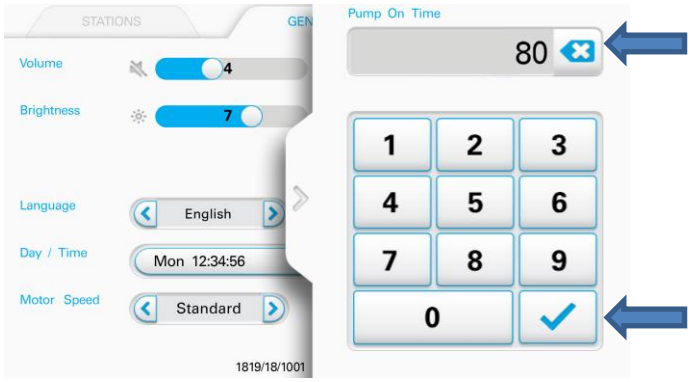
To set the duration in seconds of each interval time the specimen is to be wetted, select Pump On Time by touching inside the grey box.



The Pump On Time is zeroed (0) by press and holding the '**x**' on the Pump On Time box.

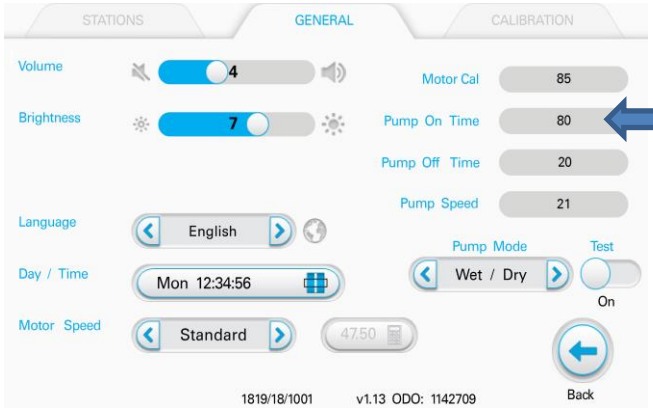
Use the key pad to select the required Wet time – i.e. the sample wetting interval required e.g. 80 seconds

The time entered must always be in **seconds**.

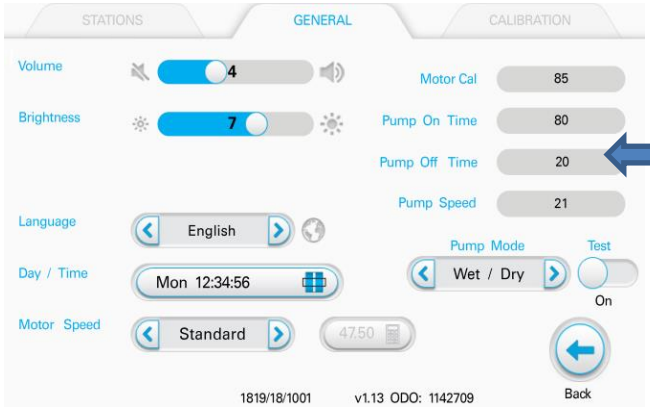


Once the required wetting interval in seconds has been entered using the key pad...

Select the blue tick ✔ to set Pump On Time and return to the General Screen.



The required Pump On Time interval will now show on the General screen.

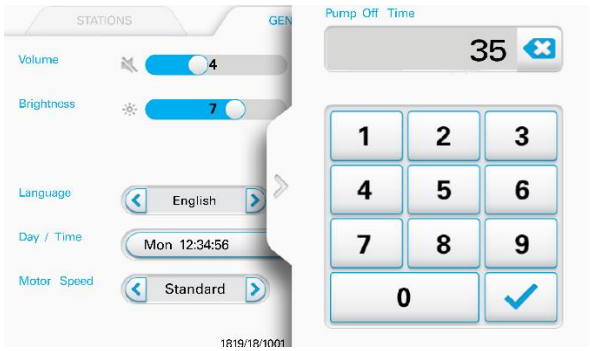


Select Pump Off Time to set the Dry time duration by touching inside the grey box.

The Pump Off Time is zeroed (0) by press and holding the '**x**' on the Pump On Time box.

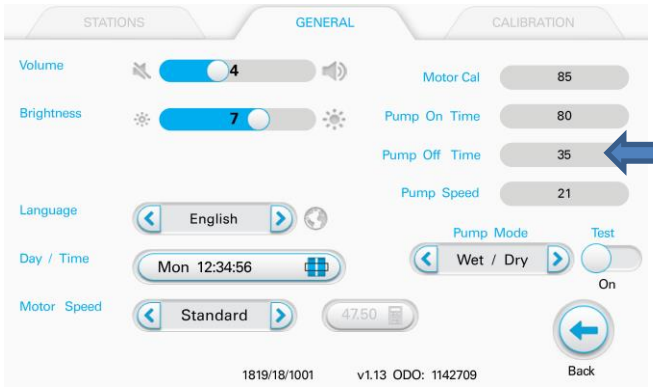
Use the key pad to select the required specimen intermittent Dry time required e.g. 35 seconds

The time entered must always be in **seconds**.



Once the required intermittent Dry time in seconds has been entered using the key pad...

Select the blue tick ✔ to set Pump On Time and return to the General Screen.



The required Pump Off Time interval will now show on the General screen.

Wet Testing Applications

Footwear Abrasion Testing with Intermittent Automated Wetting-out Dosing

The automatic dosing system of the AquAbrasion eliminates the need for user intervention at the rewetting stages saving on time & attendance.

It complies with the following standards:

ISO 17704 Footwear - Test methods for uppers, linings and insocks - Abrasion Resistance

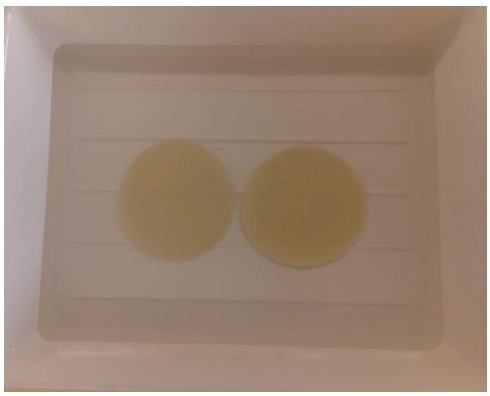
ISO 20344 - Personal protective equipment - Test methods for footwear - 6.12 Determination of abrasion resistance of lining and insock

These tests require the pre-wetted abradant fabric and under felt to be rewetted with up to 30 ml of water at given intervals throughout the test.

How to conduct Abrasion Resistance testing for uppers, linings and insocks - using the AquAbrasion

ISO 17704 & ISO 20344 test methods are very similar. The following pages detail abradant & specimen preparation methods for wet testing after which the ISO 17704 method has been selected for use in the AquAbrasion 'How to step-by-step guide'. This shows how to use the AquAbrasion to wet-out the abradant & specimen as the test is running & should be used in conjunction with the published standard which can be purchased from the ISO website.

Abradant Preparation for Footwear Abrasion Test Methods



Fully wet out the 140mm diameter wool abradant & woven felt in deionised water

ISO 20344 6.12.5.3 gives 3 methods of wetting out:

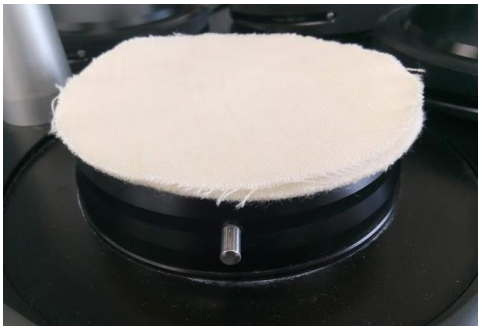
a) Soak overnight;

b) Agitate thoroughly in water

c) Wet with a high pressure water jet.

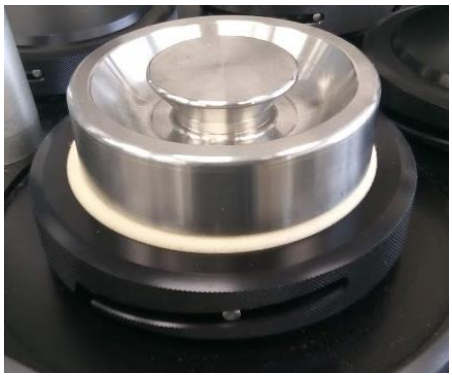
ISO 17704 states option c only.

After wetting, allow excess water to drain.



Place the wet-out felt on the abrading table & the wet-out wool abradant on top.

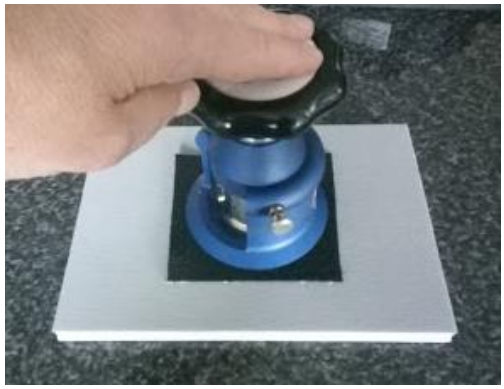
Place the press weight on top



Put the clamp ring on & turn to secure in place.

The abradant station is now ready.

Specimen Preparation



Cut out the specimen to be tested using a 38mm diameter specimen cutter.

If the specimen fabric has a mass per unit area of less than 500 g/m² a backing disc of 38mm diameter needs to be used.

Using the Block Spanner

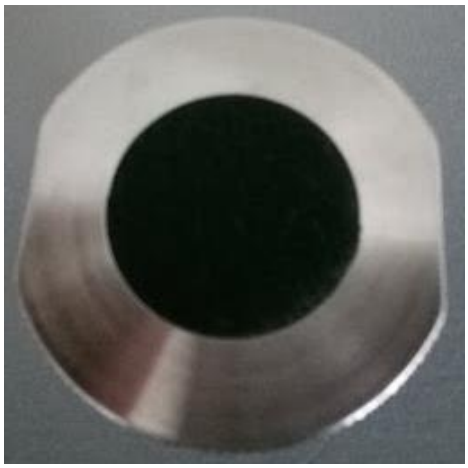
Place the base of the specimen holder, base down, into the block spanner.

Place the specimen ***face down*** into the specimen holder base and place the foam disc on top.

Then place the metal specimen holder insert on top of the foam.

Screw the specimen holder top onto the base.

Assembled specimen holder.



Underside of specimen holder showing face of specimen – the area to be tested.

Take the specimen to the AquAbrasion abrading table.

Place the specimen holder face down onto the abradant, just underneath the sample holder guide hole on the top plate.

Then place the spindle through the hole and into the specimen holder.

Ensure the 12kPa weight attached to the top of the spindle.

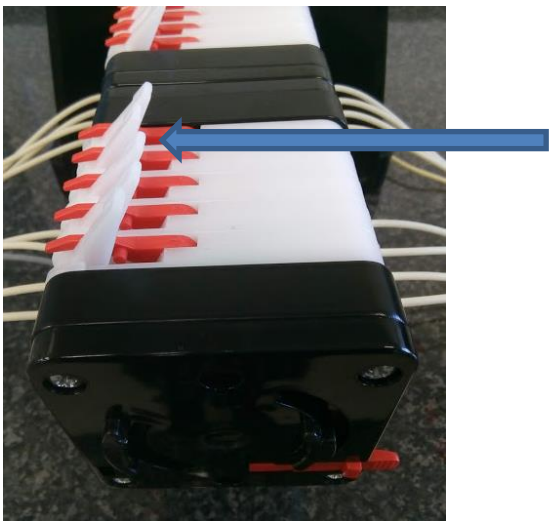
At least two specimens need to be tested for wet abrasion and also two for dry testing.

For dry testing conduct the loading method in the same way as described but without first wetting out the abradant or felt.

As only two stations (min.) are needed for wet testing, only two stations need to be set up on the AquAbrasion.

If the AquAbrasion dosing system has been previously fully set up, it will be necessary to disengage the rest of the stations.

This will also allow for the dry testing to be conducted at the same time.

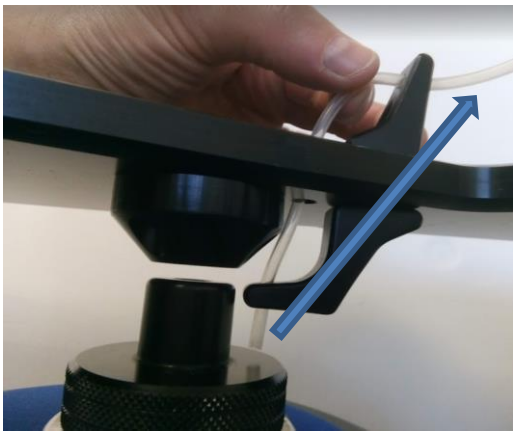


To dis-engage the pumping tubing:

All the white levers on the pump needed to provide wet testing need to be in the upright (1 o'clock) position locking each pump tube into place to allow the water to pump through.

All other levers will need to be dis-engaged.

To dis-engage the pump tubing select the white pump levers, move all of the levers, except for the required amount (in this case two), from the locked position (at 1 o'clock) through 120˚anti-clockwise to the horizontal position (at 9 o'clock).



If there is liquid in the tubes from previous use, it is advisable to remove the tubes from the stations where dry testing is to be conducted.

Determining the settings required for dosing in accordance with ISO ISO 17704 & ISO 20344

These tests require the pre-wetted abradant fabric and under felt to be rewetted with up to 30 ml of water at given intervals throughout the test.

The method employed using the AquAbrasion to achieve this is as follows:

Using the following parameters to establish the pump 'On' & 'Off' times are set:

One Rub/Cycle is 0.8 seconds

Speed of 1ml dose at Pump Speed setting of 100RPM is approx. 12.6 secs

To determine the pump speed setting required for 1ml at 100RPM:

Set the Pump Speed at 100RPM, dis-engage all tubes except one, put this tube into a 100ml measuring cylinder and using a stopwatch time how long in seconds it takes to fill to 100ml.

From the result, calculate the time in seconds it takes to pump 1ml at 100RPM e.g:

If 100ml pumped at 100RPM takes 1260 seconds therefore 1 ml at 100RPM is 1260 ÷ 100ml = 12.6 secs

For further illustrations & to verify the pump speed refer to section: 'Method to Verify Pump Speed.'

Setting the AquAbrasion to automatically wet-out the abradant in accordance with ISO 17704 using the Touch Screen a Step by Step guide:

On the General Screen - Initially set the following:

Pump On Time ('Wet' rub): 378 secs (472 rubs) = 30ml dose at 12.6 secs per ml

Pump Speed: 100 RPM

The Pump Off Time & Pump Mode will change throughout the test:

Pump Mode: Set to **'Off'** for first three inspection stages 0-1600, 1600-3200 & 3200-6400 rubs; Set to **'Wet/Dry'** for the remaining settings.

Pump Off Time: Set to 4742 secs (5928 rubs) up to and including Rub Setting Number 6400 rubs & corresponding Rub Inspection Interval 12800 rub stage.

Set to 9862 secs (12328 rubs) for all the stages preceding this i.e. Rub Setting Number 12800 rubs & corresponding Rub Inspection Interval 25600 rubs onwards is set to 9862 secs (12328 rubs) for the rest of the test. – See table below.

The table below shows the settings required for each stage of the test:

Following the step-by step guide below & referencing the 'Touch Screen Interface User Guidance' the settings for each stage are input in the following sequence:

The settings highlighted in **blue** are input on the General Screen accessed via the Settings icon on the Main Screen. Once input select the 'Back' arrow to return to the Main Screen;

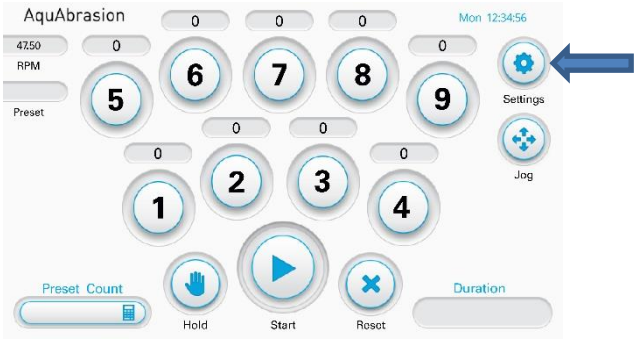
The settings highlighted **green** are input on the Main Screen in the Pre-Set Count.

Once the required Test Stage settings have all been input, the test stage can be started:

Test Stage	Pump Mode Setting	Pump Time Off in Seconds	Pump Time On in Seconds	Rub Setting Duration Number in Rubs	Rub Inspection Interval in Rubs	Rub Wetting Dosing Occurrence & Duration in Rubs	Re-Wet Abradant
1	Off	Pre-set To 4742	Pre-set To 378	1600	1600	N/A	No
2	Off			1600	3200	N/A	No
3	Off			3200	6400	*See note below	Yes
4	Wet/Dry	4742	378	6400	12800	6400-6872	Yes
5	Wet/Dry	9862	378	12800	25600	12800-13272	Yes
6	Wet/Dry	9862	378	25600	51200 the End Point	25600-26072 & 38400-38872	Yes Yes

* Wet dosing begins at the beginning of each successive cycle except for the final cycle where dosing is both at the start and in the middle of the extended cycle.

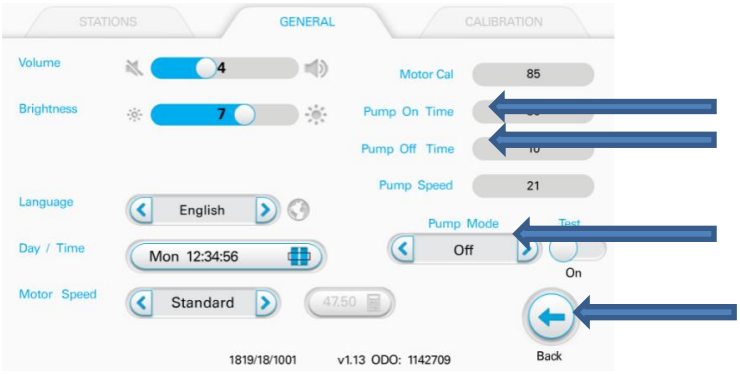
Using the Touch Screen



Select Settings icon on the Main Screen.

This open the General Screen.

Stage 1

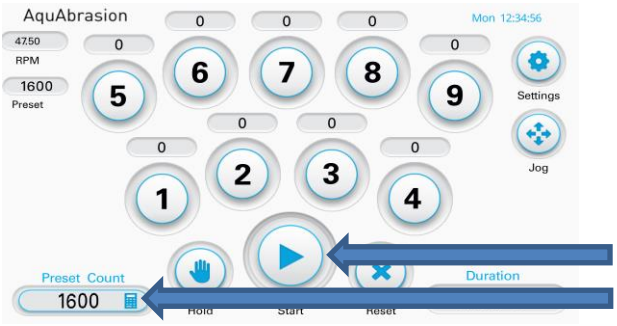


In General Screen set:

Pump On Time: 378 (Pre-set)
Pump Off Time: 4742 (Pre-set)

Pump Mode: Off

'Back' to set & return to Main Screen



Set the count to 1600 rubs & start test.

Once the test is completed, the Preset Count will show zero and the Duration will display a tick.

The completed number of rubs will show above each station i.e. 1600

The Preset box (below RPM box) will show what number of rubs for that individual stage has been completed i.e. 1600

Remove the specimen holder, carry out the assessment & replace the specimen holder to continue the next stage of testing.

Stage 2

Set the Preset Counter again to 1600 rubs for the next series of rubs required & start the test.

At the end of this 2nd stage, 3200 total rubs will have been reached.

The Preset Count box will read zero

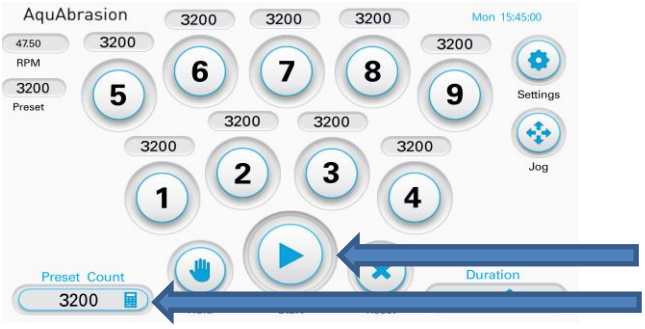
The Duration will be marked with a tick

The total accumulated number of rubs completed throughout the test so far will show above each station i.e. 3200

The number of rubs set for this stage will show in Preset i.e. 1600

Remove the specimen holder, carry out the assessment & replace the specimen holder to continue the next stage of testing.

Stage 3



Set the Preset Counter to 3200 rubs for the next series of rubs required & start the test.

At the end of this 3rd stage, 6400 total rubs will have been reached.

The Preset Count box will read zero

The Duration will be marked with a tick

The total accumulated number of rubs completed throughout the test so far will show above each station i.e. 6400

The number of rubs set for this stage will show in Preset i.e. 3200

Remove the specimen holder, carry out the assessment & replace the specimen holder to continue the next stage of testing.

Stage 4

Select Settings icon on the Main Screen.

This open the General Screen.

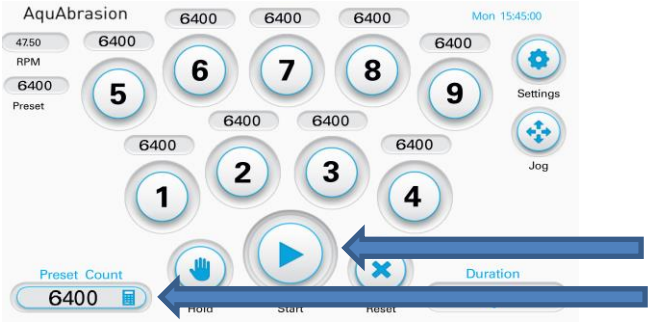
In General Screen set:

Ensure Pump On Time is 378

Ensure Pump Off Time is 4742

Change Pump Mode to Wet/Dry

Select Back to return to Main Screen



Set the Preset Counter to 6400 rubs for the next series of rubs required & start the test.

At the beginning of this test, the pump will pump 30ml onto the sample to re-wet the abradant from rub 6400 to 6872 over a time of 378 seconds.

At the end of this 4th stage, 12800 total rubs will have been reached and the fabric rewetted.

The Preset Count box will read zero

The Duration will be marked with a tick

The total accumulated number of rubs completed throughout the test so far will show above each station i.e. 12800

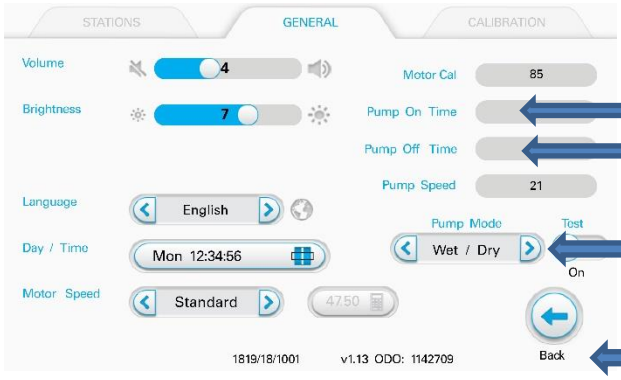
The number of rubs set for this stage will show in Preset i.e. 6400

Remove the specimen holder, carry out the assessment & replace the specimen holder to continue the next stage of testing.

Stage 5

Select Settings icon on the Main Screen.

This open the General Screen.



In General Screen set:

Ensure Pump On Time is 378

Change Pump Off Time to 9862

Ensure Pump Mode is set to Wet/Dry

Select Back to return to Main Screen

Set the Preset Counter to 12800 rubs for the next series of rubs required & start the test.

At the beginning of this test, the pump will pump 30ml onto the sample to re-wet the abradant from rub 12801 to 13272 over a time of 378 seconds.

At the end of this 5th stage, 25600 total rubs will have been reached and the fabric rewetted.

The Preset Count box will read zero

The Duration will be marked with a tick

The total accumulated number of rubs completed throughout the test so far will show above each station i.e. 25600

The number of rubs set for this stage will show in Preset i.e. 12800

Remove the specimen holder, carry out the assessment & replace the specimen holder to continue the next stage of testing.

Stage 6

The final stage

Set the Preset Counter to 25600 rubs for the next series of rubs required & start the test.

At the beginning of this test, 30ml will be pumped onto the sample to re-wet the abradant at two intervals: Rub 25600 to 26072 and Rub 38400 to 38872 as specified by ISO 17704. No inspection is required at 38400 rubs, so this stage runs non-stop to Test End Point at 51200 rubs.

End Point Reached at 51200 rubs

Test Complete

At the end of this 6th stage, 51200 total rubs will have been reached achieving the maximum End Point and the fabric rewetted twice - once at the beginning and once at the half way point of the rub cycle.

The Preset Count box will read zero

The Duration will be marked with a tick

The total accumulated number of rubs completed throughout the test will show above each station i.e. 51200

The number of rubs set for this stage will show in Preset i.e. 25600.

Remove the specimen holder, carry out the assessment & report.

Test Complete.

As some tests require both wet & dry testing, if both test methods employed use the same interval stages then both wet & dry tests can be conducted simultaneously on the same machine.

For dry testing simply dis-engage the white pump levers connected to the stations to be used for dry testing or disconnect the required tubes situated at the beaker lid.

In tests where specimens need to be tested for wet abrasion and also for dry testing.

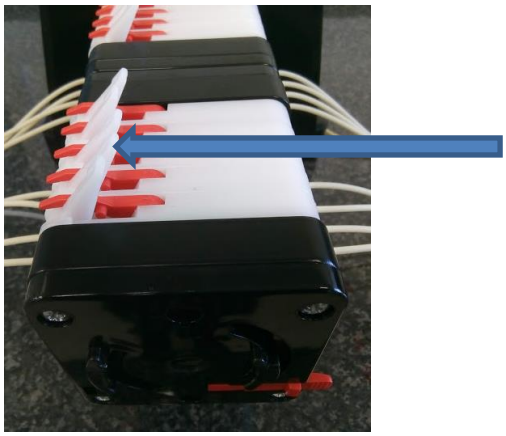
Conduct the loading method in the same way as described previously but without first wetting out the abradant or felt.

If, for instance, only two stations are needed for wet testing, only two stations need to be set up on the AquAbrasion (See AquAbrasion Set-Up at the beginning of this guide).

If the AquAbrasion dosing system has been previously fully set up, it will be necessary to disengage the rest of the stations.

This will also allow for the dry testing to be conducted at the same time.

Disengaging the Tubing to Enable Dry Testing

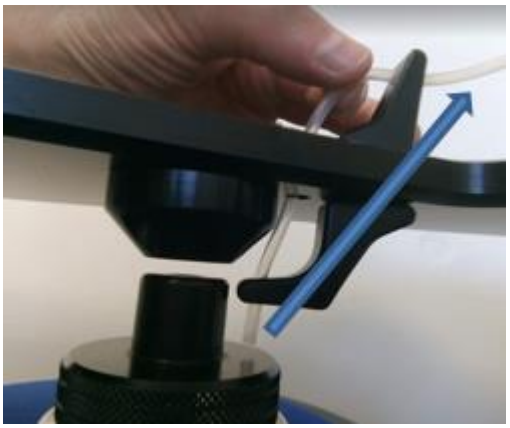


To disengage the pumping tubing:

All the white levers on the pump needed to provide wet testing need to be in the upright (1 o'clock) position locking each pump tube into place to allow the water to pump through.

All other levers will need to be dis-engaged.

To dis-engage the pump tubing select the white pump levers, move all of the levers, except for the required amount (in this case two), from the locked position (at 1 o'clock) through 120°anti-clockwise to the horizontal position (at 9 o'clock).



If there is liquid in the tubes from previous use, it is advisable to remove the tubes from the stations where dry testing is to be conducted.

Concurrent testing using different liquors

The AquAbrasion allows different liquors to be used for testing concurrently.

The user determines which stations require different liquors, splits the corresponding tubing and places them in separate beakers containing the different required liquors.

The dosing rate (Pump Speed) and delivery type (Pump Mode) and Rub RPM of the Machine (AquAbrasion) must be the same for all tests when testing in this manner.

⚠ USE DUE CARE & DILIGENCE WHEN CONSIDERING TESTING WITH DIFFERENT LIQUORS SIMULTANEOUSLY.

⚠DO NOT RUN LIQUIDS THROUGH THE SILICONE TUBING THAT MAY CAUSE DETERIATION OF THE TUBES.

⚠ALWAYS USE DEIONISED WATER TO THOROUGHLY FLUSH THE WHOLE SYSTEM AFTER USE UNTIL ONLY CLEAN DEIONISED WATER RUNS FROM THE DRAIN PIPE.

⚠DO NOT USE LIQUIDS THAT COULD CAUSE AN ADVERSE REACTION WHEN MIXED TOGETHER AT THE DRAINAGE POINT.

⚠DO NOT USE STRONG ACIDS, ALKALIS OR HIGHLY VISCOSE LIQUIDS SUCH AS CREAMS & OILS NOR ANY CHEMICALS THAT COULD BE HARMFUL TO PERSONNEL OR EQUIPMENT.

Liquor Replenishment Interval

This is dependent upon the pump speed which determines the millilitres per minute delivery and needs to be calculated accordingly.

Beakers hold 1800ml e.g. If set at 1ml/min and all 9 stations are running the liquor will take 3hrs 30mins to be used. (1800/9 = 200mins = 3hrs 20 mins)

To attain full 1800ml delivery, the beakers need to be filled to 10mm (1cm) above the 1800ml line to allow for full uptake.

Extending the Replenishment Duration

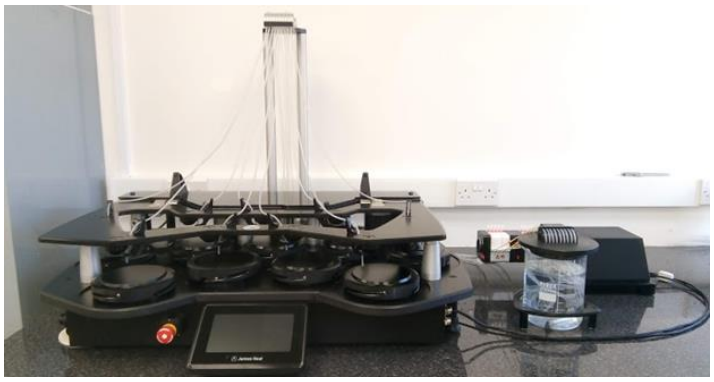
To extend the top-up time e.g. to allow for overnight testing, extra beakers (lids & weights) can be used and the tubes split between the beakers

e.g. split the 9 into 3 & place in 3 beakers to extend the re-filling time by 3: 3x3hr 20 mins = 10 hours (check calculation 1800ml/3 = 600mins = 10 hours)

Self-Abrading Test Method with Continuous Dosing.

A test method suggestion to determine how a fabric performs when being abraded against itself in wet conditions. EN ISO 12947 parts 1 to 4 were referenced and the test method modified.

Preparing the specimens and loading the AquAbrasion



Ensure the AquAbrasion is fully setup & primed for wet testing – See 'Setting up the AquAbrasion to Perform Wet Testing'

Remove the clamping ring from the station table (commonly known as the abrading table), with an anti-clockwise twist.

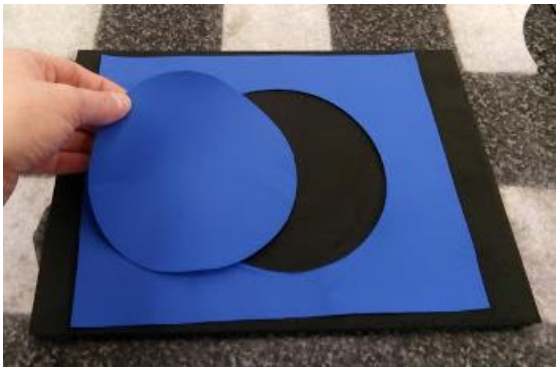
Table without clamp ring.

Place woven felt pads 140mm diameter directly onto the table.

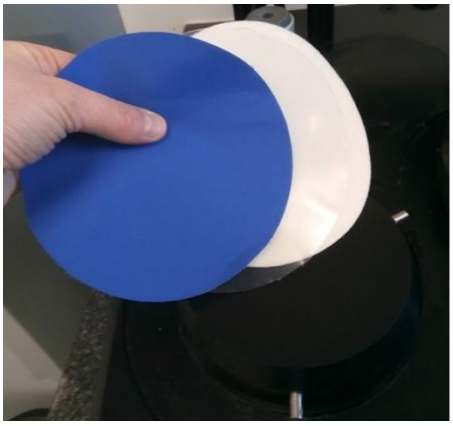
Using a 140mm diameter cutter cut out a piece of BHT-free polythene film.

Place on top of the felt.

Using a 140mm diameter cutter



Cut out 140mm diameter specimen fabric.



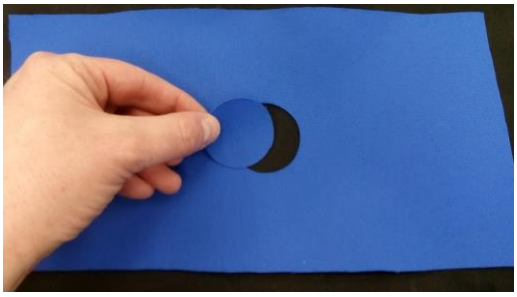
Place the specimen fabric on top of the film.

Place on press weight

Replace clamping ring.

The base self abradant specimen is prepared.

Using a 38mm cutter.



Cut out 38mm diameter specimen.

Using a block spanner

Unscrew the sample holder & place the base into the block spanner.

Place 38mm diameter specimen fabric face down into the specimen holder base

The reverse must face upwards.

In the same manner using a 38mm diameter cutter, cut out a piece of film and place on top of the specimen.

If the mass of specimen is less than 500 grams per square metre, take a disc of 38mm foam and place it on top of the film.

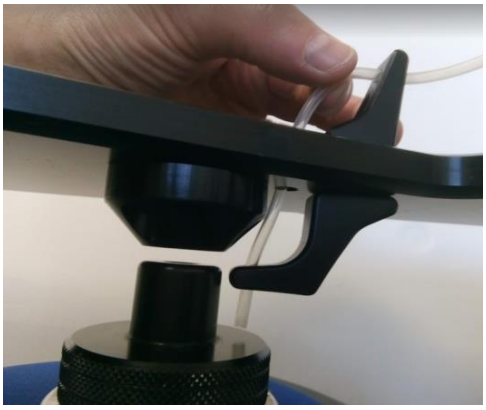
If the specimen fabric weighs more than this, then omit the foam disc.

Place the specimen holder metal insert on top of the discs.

Place the top of the specimen holder onto the assembly.

Screw onto the base.

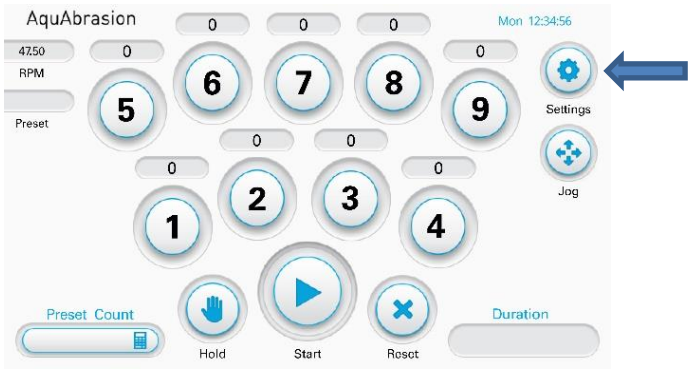
The 38mm specimen is now prepared with the face side showing.



Place the prepared 38mm specimen holder onto face down onto the prepared station table holding the 140mm specimen.

Place the spindle with 12kPa load on top through the AquAbrasion hinged top plate and into the specimen holder.

Inputting the required settings into the AquAbrasion using the Touch Screen



Access the General Screen via first selecting the Settings icon on the front Main Screen

On the General Screen, locate Pump Mode

'On' Pump Mode

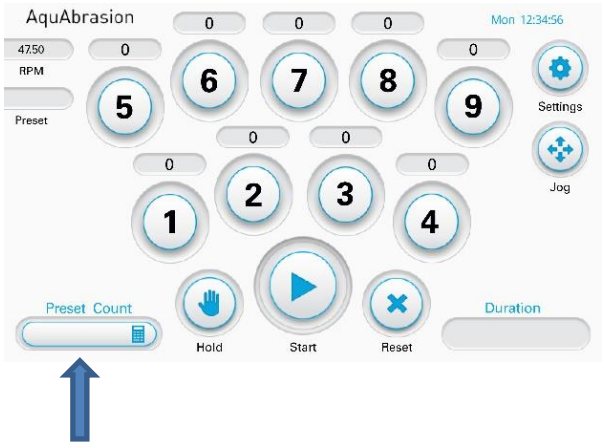
The arrows on either side of the Pump Mode bar are used to scroll through the 4 settings.

Select the 'On' Pump Mode setting - This is required for continuous dosing.

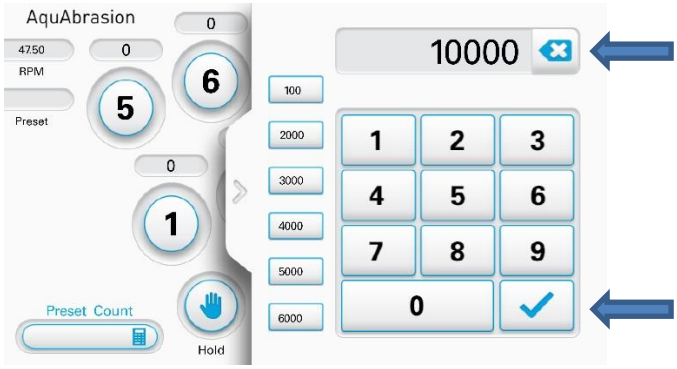
Set the Pump Speed to deliver the required dosing rate e.g. 1ml per minute – See 'Determining dosing flow rate of specimen' section.

Select the back arrow to save and return to the Main Screen.

The Pump starts as soon as the Preset Count is set (i.e. number of rubs) & the start button is pressed on the front screen, and runs until the last rub has been made and the AquAbrasion stops.



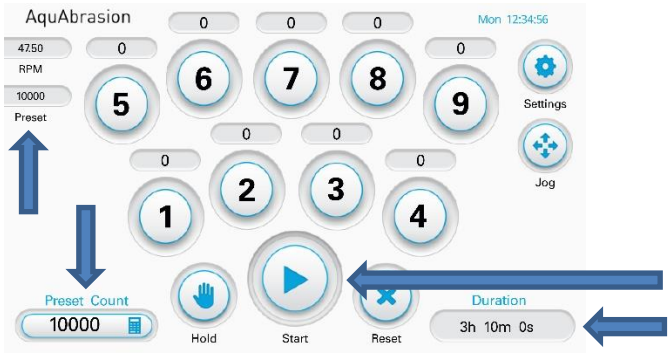
To set the number of rubs required, select Preset Count.



This will show the rub input screen.

Using the keypad enter the required number of rubs e.g. 10000

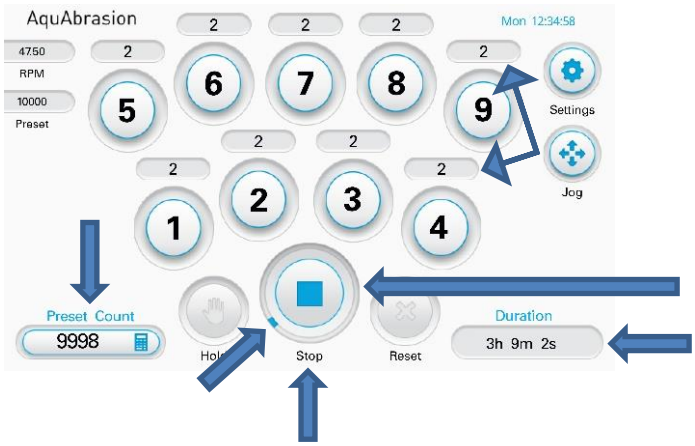
Select the tick to enter & return to the Main Screen



The set number of rubs will show in the Preset Count box and the Pre-set box

Select enter to start the test

The Pump will start immediately & administer the required amount of liquid onto the specimen at the required constant rate until the end of the test.

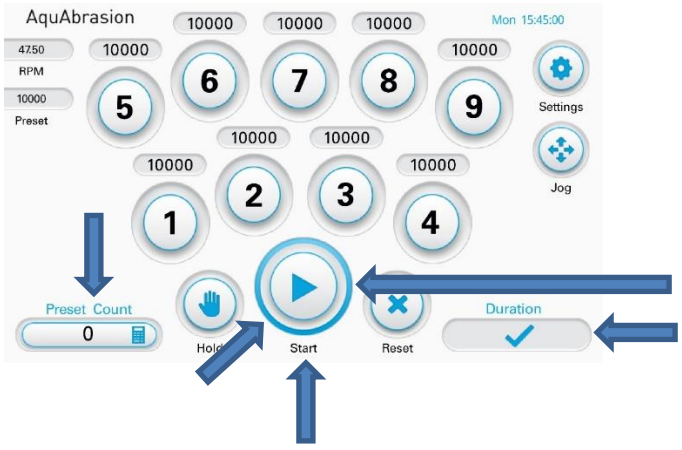


When the test has started the Start button & arrow will now become the Stop button with a square in the centre and the blue progress bar will begin to circle the button.

The Preset Count will count down every rub.

The Duration will also count down.

The individual Station counters will begin to count up the number of rubs made.



The test is completed once the Preset count reads zero.

The Stop button becomes a Start button again.

The Progress Bar around the Stop/Start button is completely blue.

The Duration box shows a tick.

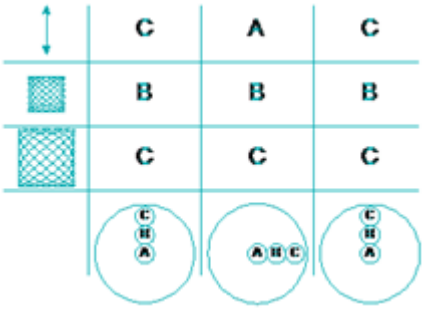
The individual stations show the full number of rubs originally input has been reached.

The specimens can now be inspected and put back onto test again or removed from their holders for reporting or further testing such as strength, spray rate or water penetration tests.

Dry Abrasion, Pilling & Sock Test Set-up

The following are generic test setups for the AquAbrasion & Martindale – please note that the specimen spanner on these photographs is different to the block spanner used for the AquAbrasion which is independent of the machine unlike the attached one depicted. However, the preparation principle is the same.

Abrasion Test



Set the motion to abrasion by setting all three (3) the Drive Pegs in position C, large Lissajous.

Abrading Table Preparation:

Remove the top plate or use the jog key to provide easy access to the abrading table.

Remove any material such as yarn or fibrous debris from the abrading table.

Place a 140mm diameter piece of felt centrally on the Abrading Table.

The felt need only be replaced when damaged or excessively soiled.

Place a 140mm diameter piece of SM25 abrasive cloth, face up, and centrally on the felt.

If the SM25 abrasive cloth is creased it should not be used.

The SM25 abrasive cloth is replaced after each test. Some standards also state replacing the abrasive cloth after each 20000 or 50000 rubs if the test exceeds this number of rubs.

Carefully place the pressing weight centrally on to the SM25 abrasive cloth, taking care not to move felt and SM25 abrasive cloth.

Place the Quick-Lock Clamp Ring onto the three (3) locking pins and twist in a clockwise manner and with a slight downward force.

Check the edge of the abrasive cloth is retained by the clamp ring. If the edge protrudes, reposition the felts and abrasive cloth centrally before re-clamping.

Remove the pressing weight.

Specimen Holder Preparation:

Place the sample holder nut in the block spanner.

Place the 38mm diameter specimen, face down, centrally into the sample holder nut.

Creased or damaged specimens should not be used.

Avoid excessive handling of the specimen.

Place the 38mm diameter piece of Polyetherurethane (PU) foam centrally into the sample holder nut on top of the specimen.

Carefully place the sample holder insert in to the specimen holder nut, on top of the PU foam.

Place the sample holder body on to the sample holder nut and carefully engage the screw threads.

With the screw threads engaged, apply a slight down ward force while at the same turning the sample holder body in the clockwise direction until tight.

Check the specimen is securely held and none of its edge protrudes out of the sample holder nut.

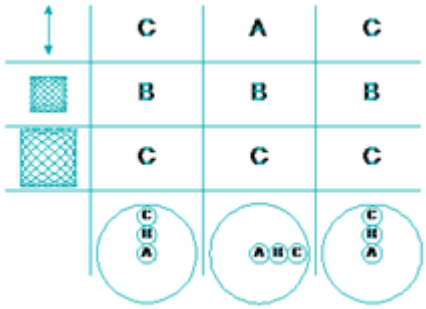
Insert the spindle into the sample holder body. The end with an O-ring should be inserted.

Add the correct loading weight onto the spindle, either 9 kPa or 12 kPa, and tighten the grub screw using the tool provided.

Place a loaded sample holder on each of the abrading tables.

Select the loading weight, 9 kPa or 12 kPa, appropriate to the test to be performed and insert the spindle through the bearing housing in the top plate. Locate the spindle in the sample holder bush and press the spindle down so it is fully located.

Pilling Test - Dry Testing Only



Due to the configuration of the AquAbrasion in relation to the pilling sample holder it is not advisable to conduct wet pilling tests using this instrument.

Set the motion to pilling by setting all three (3) the drive pegs in position B, small Lissajous.

Abrading Table Preparation:

Remove the top plate or use the jog key to provide easy access to the abrading table.

Remove any material such as yarn or fibrous debris from the abrading table.

Place a 140mm diameter piece of felt centrally on the abrading table.

The felt need only be replaced when damaged or excessively soiled.

The pilling test can be carried out in two (2) ways: with abrasive cloth or with another specimen from the test sample. In this case we are showing a pilling test for apparel fabric.

Place a 140mm diameter piece of the sample, free of creases, face up, and centrally on top of the felt.

Carefully place the pressing weight centrally on to the sample, taking care not to move felt and sample.

Place the Quick-Lock Clamp Ring onto the three (3) locking pins and twist in a clockwise manner and with a slight downward force.

Check the edge of the sample is retained by the clamp ring. If the edge protrudes, reposition the felt and sample centrally before re-clamping.

Remove the pressing weight.

Specimen Holder Preparation:

Place the specimen mounting mandrel in the black rubber retaining ring.

Place the specimen face down on the specimen mounting mandrel.

Place a piece of 90mm diameter felt centrally on the specimen.

Place the pilling sample holder centrally down on the specimen and felt.

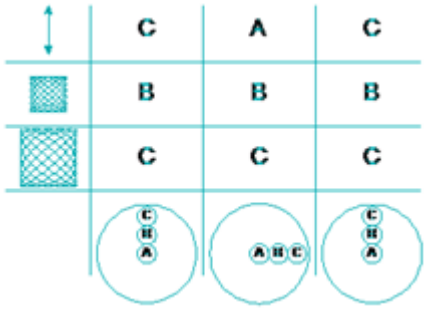
Gently press the sample holder against the specimen mounting mandrel (use your thumbs to do this) while at the same time rolling up the black rubber retaining ring until it grips the specimen on to the pilling sample holder.

This illustration also shows the additional mass, typically only used for testing upholstery fabrics.

Typically, a pilling test requires three (3) specimens to be tested.

The number of rubs is generally very much less than an abrasion test, usually in the range of 125 rubs to 7000 rubs.

Sock Abrasion Test - Dry Testing Only



Set the motion to abrasion by setting all three (3) the drive pegs in position C, large Lissajous.

Abrading Table Preparation:

Remove the top plate or use the jog key to provide easy access to the abrading table.

Remove any material such as yarn or fibrous debris from the abrading table.

Place a 140mm diameter piece of felt centrally on the abrading table.

The felt need only be replaced when damaged or excessively soiled.

Place a 140mm diameter piece of SM25 abrasive cloth, face up, and centrally on the felt.

If the SM25 abrasive cloth is creased it should not be used.

The SM25 abrasive cloth is replaced after each test.

Carefully place the pressing weight centrally on to the SM25 abrasive cloth, taking care not to move felt and SM25 abrasive cloth.

Place the Quick-Lock Clamp Ring onto the three (3) locking pins and twist in a clockwise manner and with a slight downward force.

Check the edge of the abrasive cloth is retained by the clamp ring. If the edge protrudes, reposition the felts and abrasive cloth centrally before re-clamping.

Remove the pressing weight.

Specimen Holder Preparation:

Place the block spanner adaptor on to the fixed block spanner.

This is a spring loaded device.

Place the modified sample holder nut on to the block spanner adaptor.

Place the 38mm diameter specimen, face down, centrally into the modified sample holder nut.

Creased or damaged specimens should not be used.

Avoid excessive handling of the specimen.

Place the pinned ring, needles first, down through the specimen into the holes in the modified sample holder nut.

PU foam is not used.

Place the hard rubber precision ball with the 20mm diameter end making contact with the specimen.

Place the sample holder body on to the sample holder nut and carefully engage the screw threads.

With the screw threads engaged, apply a slight down ward force while at the same turning the sample holder body in the clockwise direction until tight.

Check the specimen is securely held.
Note how the specimen protrudes out of the sample holder nut.

Mounted sample holder, complete with spindle and loading weight.

Typically only the loading weight marked “12 kPa” is used. This gives an actual pressure on the specimen of 24 kPa.

Test four (4) specimens.

Mounting Easily Stretched Materials

This device and procedure can be used to mount specimens which are easily stretched (and therefore easily distorted) and specimens which curl (or roll up) after cutting.

The device is specified in ISO 12947-2.

The test specimens of dimensions 60 x 60 mm are cut out or stamped in square shape parallel with the stitches or threads, conditioned and placed on the square table mount measuring 45 x 45 mm of the test bed with the side to be abraded facing downwards.

A clip of 30 mm edge length is placed on each of the four sides of the test specimen hanging over the table, secured and a weight hung on each clip without stretching the specimen.

The four weights are placed on the bracket that can be lowered.

The mass of each weight complete with clamp is 100 g.

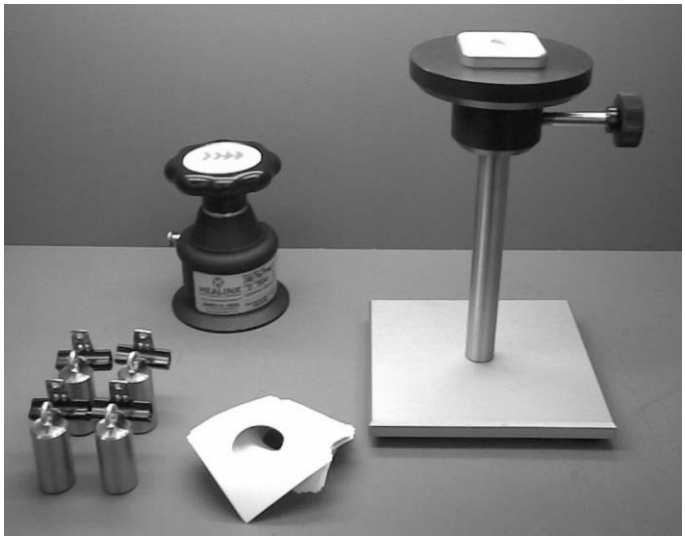
The clamps and weights are then lowered and raised three times in quick succession so that the test specimen is subjected to loading (extended) three times by the four weights and the load released.

The bracket is then lowered again with renewed loading (extension) of the test specimen. In this state a square foil measuring about 55 x 55 mm and which has a 30 mm diameter hole in the centre is pressed on to the extended test specimen and affixed to it by means of the adhesive. The bracket is then raised again.

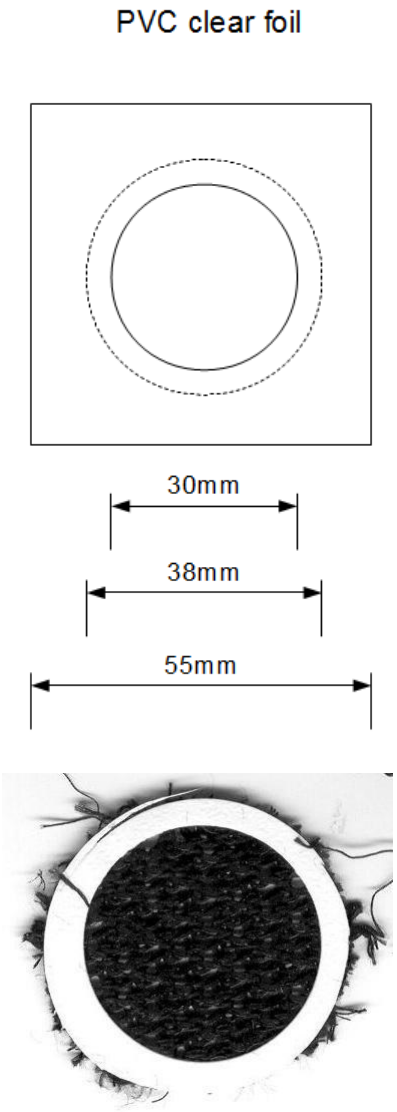
The weights are removed from the specimen, the specimen is removed from the mounting device and the test specimen size of 38 mm stamped or cut out for the abrasion test.

Care is to be taken that the hole of 30 mm diameter stamped in the foil is precisely centred so that the stamped out specimen is held in the lightly extended state by a foil circle 4 mm wide.

To prevent the circular adhesion area loosening, the test specimen is mounted in the specimen holder immediately after stamping or cutting.



794-512 Specimen Mounting Device and 902-222 Sample Cutter 38mm

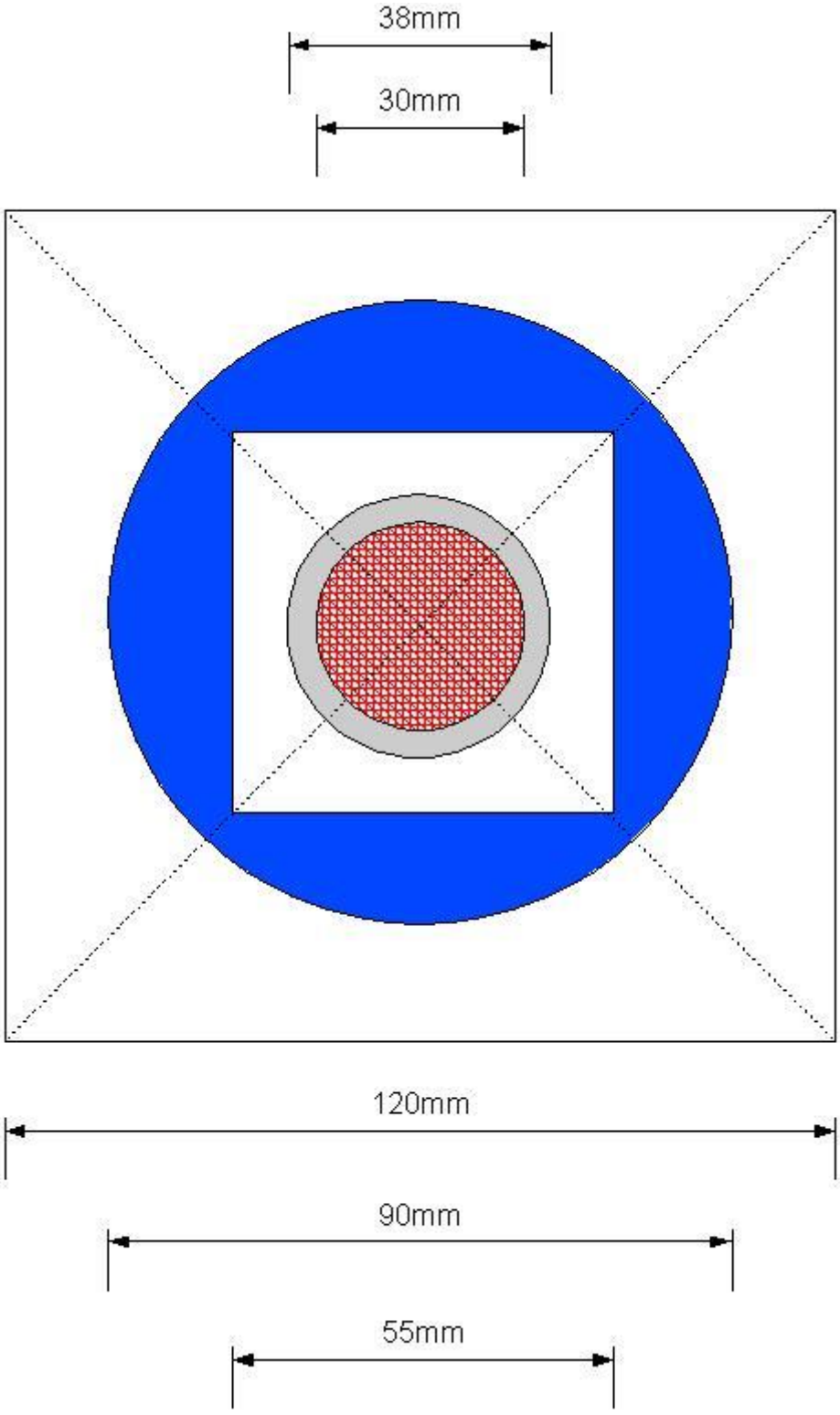


Example of prepared specimen

Cutting Template for Stretch Mounting Device

See next page for template for printing.

Paper Template 120mm x 120mm, with 90mm diameter circle surrounding a 55mm square about a common centre, drawn on it.
Outer case diameter of cutter is 90mm.
Inner diameter of foil 30mm.
Sticky foil square 55mmx55mm.


38mm
30mm
120mm
90mm
55mm

Accessories

Wet Testing Assembly

526-893	Beaker Assembly (Beaker/Lid/Weight & Stand) (1 pce)
390-278	Silicone Tube 2.5mm Bore (30 metres)
390-277	Tube Connectors (Polypropylene Nipples) (18 pcs)
390-276	Pump Tube (Marprene Double Manifold Tubing) (9pcs)

Abrasion — EN ISO 12947, ISO 17704 & ISO 20344

794-620 **Abrasion Station Kit**, comprising:
- 1 x Sample Holder
- 1 x 9 kPa Weight
- 1 x 12 kPa Weight
- 2 x Spindle

Recommended minimum order quantity: 4

902-222 **Circular Sample Cutter**, 38mm diameter
For the rapid and accurate preparation of 38mm diameter test specimens

766-200 **Grey Scale for Assessing Colour Change**, ISO 105-A02
For assessing the change in colour of test specimens during the abrasion test

788-761 **Lissajous Figure Marker Pen**
For checking the Lissajous Figure according to EN ISO 12947-1

788-760 Lissajous Figure Recording Paper - per pack (50)

794-512 **Mounting Device for Easily Stretched Fabrics**
Supplied complete with 4 weights and 50 foils

785-507 Additional Foils - per pack (50)

794-621 **Thick specimen holder for EN 388**

Pilling — EN ISO 12945-2

794-517 **Pilling station Kit**, comprising:
- 1 x Sample Holder
- 1 x Sample Retaining Ring
- 1 x Ring Weight
- 1 x Spindle

Recommended minimum order quantity: 3

525-256 **Specimen Mounting Mandrel**
This is an essential accessory for mounting specimens for the pilling test

766-451 **Full Set EMPA Photographic Standards**
This complete set contains 3 x 4 mounted photographs for woven fabrics and 3 x 4 for knitted fabrics

Sock Abrasion — EN 13770 Method 1

794-518 **Sock Abrasion Station Kit**, comprising:
- 1 x Sock Sample Holder
- 1 x Pinned Ring
- 1 x Precision Ball
- 1 x Spindle

Recommended minimum order quantity: 4

525-311 **Block Spanner Adaptor** (for Sock Abrasion – one per instrument)

Abrasion & Pilling

902-221 **Sample Cutter**, 140mm diameter

Test Materials

Abrasion

701-202	Pack (5m) SM25 Abrasive Cloth
701-203	Roll (50m) SM25 Abrasive Cloth
701-207	Pack (100) Pre-cut Discs of SM25 Abrasive Cloth
714-602	Pack (20) Nonwoven Felt Pads (140mm diameter)
714-612	Pack (20) Woven Felt Pads (140mm diameter)
706-792	Pack (100)BHT-Free Polythene Film 63 Microns
786-256	Pack (2000) Pre-cut Discs of Polyetherurethane Foam (38mm diameter)

Pilling

714-602	Pack (20) Nonwoven Felt Pads (140mm diameter)
714-612	Pack (20) Woven Felt Pads (140mm diameter)
714-601	Pack (20) Nonwoven Felt Pads (90mm diameter)
714-611	Pack (20) Woven Felt Pads (90mm diameter)
356-301	Pack (10) Sample Retaining Rings
701-202	Pack (5m) SM25 Abrasive Cloth

Sock Abrasion

393-254	Pack (2) Spare Precision Balls
701-202	Pack (5m) SM25 Abrasive Cloth
714-612	Pack (20) Woven Felt Pads (140mm diameter)

Please enquire about any other accessories or test materials not listed here, that may be available from James Heal.

Calibration

Sock Abrasion

202-409	UKAS Certificate of Calibration for Martindale (up to 10 stations) - Textile
201-828	ISO Certificate of Calibration for Sock Abrasion Station Kit (up to 4 kits)
201-920	ISO Certificate of Calibration for Sock Abrasion Station Kit (up to 8 kits)

Abrasion & Pilling

202-409	UKAS Certificate of Calibration for Martindale (up to 10 positions) - Textiles
202-410	UKAS Certificate of Calibration for Martindale (up to 10 positions) - Textiles (with additional reference to paragraph 7.3.2 of EN ISO 12947-1)

Safety

- ⚠ The instrument is very heavy, therefore do not attempt to lift without suitable lifting apparatus or use two or more able-bodied people.

  AquAbrasion 90 kg

- The 1819 AquAbrasion complies with the CE regulations in full. See Compliance Statements.

- The 1819 AquAbrasion has been specifically designed with operator health and safety in mind. These instruments ensure the minimum of operator stress and fatigue, and is virtually silent in operation to suit the laboratory environment.

- ⚠ Care should be taken when lifting the Top Plate.

- ⚠ Care should be taken to prevent anything heavy (e.g., weights) from impacting on the Control Panel.

- ⚠ Care should be taken to avoid placing the hand between the Abrading Stations and the Top Plate whilst in motion.

- Leave sufficient space around the instruments to allow unrestricted and safe operator access. See Installation section & Installation Guide.

- Along with the main body of the instrument, ensure enough height for the tube stand and enough room at the side for pump & beaker

- Consider the placement of the outfall pipe for the liquid which is situated at the left back of the machine and provide the most direct route for the pipe to travel downwards into a drain/waste water container.

- ⚠ When using in liquids due care & diligence must be taken. Do not use any liquids that may cause harm to personnel or equipment. Always read safety sheets & heed their advice.

- ⚠ Take caution when handling & cleaning the base plate due to sharp edges.

Emergency Stop

This switch is designed to bring the drive mechanism to an immediate halt in an emergency situation.

When pressed the switch will latch in the stop position.

To unlock the switch, twist the red cap in a clockwise direction.

Attempting to start a test with the switch in the stop position will result in a warning message being displayed.

Cleaning

- At every inspection interval, ensure the liquor is draining freely, if any detritus is being shed by the samples wipe this off the machine.
- Wipe down the machine after each test and wash & dry the sample holders & spindles thoroughly.
- Periodically inspect Abrading Tables for indents. Damaged Abrading Tables should be replaced.
- Periodically inspect the Sample Holders and Spindles for signs of damage. Damaged or worn parts should be replaced.
- Keep the instrument scrupulously clean. Remove accumulated debris from all parts. Clean up oil and grease stains immediately.
- Keep the Spindles clean. A trace of light oil applied via a cloth is recommended in a high humidity environment and before & after each wet test.
- Keep the Drive Slots and the Drive Pegs free from debris.
- Use only a dry soft cloth when cleaning the Control Panel. DO NOT use any solvents or abrasive cleaning agents.

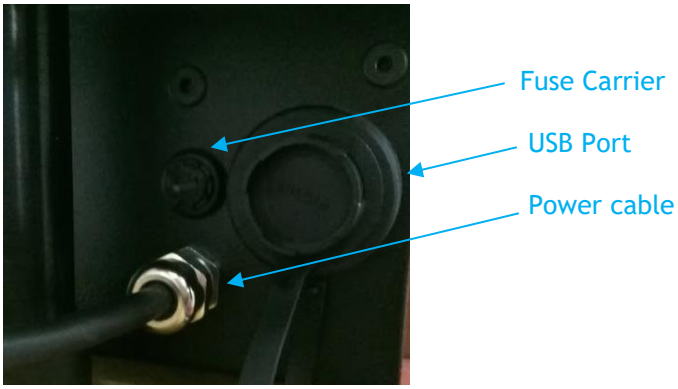
Draining & Cleaning Liquor Tubes After Testing

- After any non-deionised water testing, always wash the AquAbrasion and tubes through.
- Ensure the stations are clear of specimens and the tubing is still in place on the AquAbrasion and the top plate is down.
- Fill the with deionised water, turn the pump speed to 100 and switch the 'Test' button (on the General Screen) to on.
- Run until all the water has run through the pipes, onto the station tables and out through the drainage pipes on the AquAbrasion.
- Ensure no water is left in the tubes by allowing the pump to run for a short while after all the water has been pulled through and so pulling through air until there is no water left in the tubes.
- Wipe down the AquAbrasion with a clean dry cloth.

Service and Calibration

User Servicing

- At approximately monthly intervals, clean away any oxidised or contaminated grease from the Drive Pins, Bushes, Drive Slots and Wear Plates and re-apply fresh 1600 Series Martindale Grease to the same areas using the Plastic Spatula provided. See Replacement Parts (Spares), below.
- Mains electrical fuses are located just above the power lead at the left-hand side of the instrument.
- To replace the fuses, ensure the instrument is switched off – this is by switching on and off at the wall plug socket. Using a flat head screwdriver turn the fuse drawer cover to expose the fuse cartridge. Fit new 2A and 1A 20mm anti-surge fuses. The 2A fuse is fitted to the 110V side and the 1A is fitted to the 220V side of the carrier.
- The mains cable cannot be removed as it is wired directly into the instrument.
- The USB port is accessed via a snap on lid and is used to upload software updates.



Service & Calibration Support

The AquAbrasion is a world-class product, fully supported by our world-leading Maintenance and Calibration Service - covering installation, operator training, regular maintenance, UKAS Calibration and on-line technical and applications support.

James Heal Service & Calibration is available Worldwide – Contact our Service & Calibration Support email for further details: support@james-heal.co.uk

Unpacking

Do not dispose of any packaging material until all standard and optional accessories are accounted for. If there are any discrepancies, please contact your supplier or Local Agent immediately.

Remove any staples, wire strapping and adhesive tape.

Lift out the top box, containing the accessories.
Remove the adhesive tape and ensure that all accessories are present.

Using both hands remove the outer sleeve.
Carefully remove the instrument from its packing case and place it on a firm, flat surface.

The instrument weighs approximately 90 kg, therefore do not attempt to lift without suitable lifting apparatus or use two or more able-bodied people.

Installation

Stand the instrument on a firm, level table or surface (Lifting equipment required).
Lower the top plate so that each of the three (3) Drive Pegs locates into the three (3) Drive Slots.
Ensure the Top Plate is resting on the three (3) Bearing Pads.
Screw in the Tube Stand at the back middle of the AquAbrasion with the screws provided.

Connect the instrument to the correct electrical supply using the mains lead supplied.

Power Requirements	110-230 V ± 10%, 50/60 Hz, 60 W (mains electricity must be free from spikes and surges exceeding 10% of nominal voltage) (Universal Voltage & Frequency)

	Depth	**Height to Top Plate Hinge**	**Overall Height - to Tube Stand Top**	**Width**	**Weight**
AquAbrasion 1819	670 mm	309 mm	750mm	877 mm	85 kg

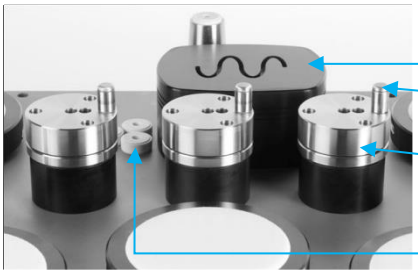
Please note: The AquAbrasion is a 'wet' Martindale for which the mains lead is wired directly into machine, with no on/off switch - this is to reduce risk of water ingress.
No plug is fitted to the AquAbrasion to allow for the customer/agent to fit correct plug required.

Identification of Parts

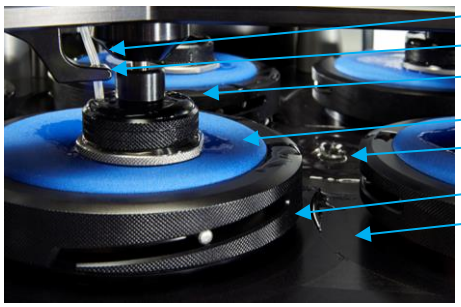
This illustration shows the AquAbrasion 1819

Unscrew the two (2) Support Bars and screw into the rear of the instruments. In this way they act as spacers giving adequate clearance at the rear of the instrument.

Tube Stand
Silicone Tubes
Beaker
Beaker Housing
Pump
Load cell
Specimen holder
Abrading Table
Touch Screen
Emergency Stop Button
Clamp Rings
Support Towers



Touchscreen User Interface
Motor Housing (do not cover the ventilation slot)
Drive Pegs (position can changed to allow different types of motion)
Drive Towers
Spare Bearing Pads



Dosing Tube
Dosing Tube Guide
Sample Holder
Abrading Table
Drain hole
Clamp
Drainage channel

Compliance Statements

Product End-of-Life Disassembly Instructions (WEEE)

The **Waste from Electric and Electronic Equipment (WEEE)** disassembly instructions are intended for use by end-of-life recyclers or treatment facilities. They provide the basic instructions for the disassembly of this product to remove the components and materials requiring selective treatment.

Items Requiring Selective Treatment

Model 1819		
Item Description	**Notes**	**Qty. of Items included in Product**
Printed Circuit Boards (PCB) or Printed Circuit Assemblies (PCA)	With a surface area greater than $10cm^2$	
Batteries	All types including standard alkaline and lithium coin or button style batteries	
Mercury containing components	e.g. mercury in lamps, display backlights, switches, batteries	

EU Conformity

- Machinery Directive 2006/42/EC
- Low Voltage Directive (LVD) 2014/35/EU
- Electromagnetic Compatibility (EMC) Directive 2014/30/EU
- Waste Electrical and Electronic Equipment recycling (WEEE) Directive 2012/19/EU
- Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU

Specifications

Mode of Operation	**Abrasion**	**Pilling**	**Sock Abrasion**
Standard	EN ISO 12947 ISO 17704 & ISO 20344	EN ISO 12945-2	EN 13770
Number of specimens	Model 1819 – up to 9		
Exposed area of test specimen	6.45 cm^2	64.5 cm^2	3.14 cm^2
Working pressure on test specimen	9 kPa (apparel) 12 kPa (upholstery & footwear)	2.5 cN/cm^2 (knitted) 6.5 cN/cm^2 (woven)	23.86 kPa
Rotational speed	47.5 ± 2.5 rpm (optional but non-standard x1.5 speed)		
Total stroke of drive units	60.5 ± 0.5 mm	24.0 ± 0.5 mm	60.5 ± 0.5 mm
Parallelism of top plate to abrading tables	0.05 mm		
Maximum circumferential parallelism of sample holders to abrading tables	0.05 mm		

Dimensions and Weights

	Depth	**Height to Top Plate Hinge**	**Overall Height - to Tube Stand Top**	**Width**	**Weight**
AquAbrasion 1819	670 mm	309 mm	750mm	877 mm	85 kg

Revision History

See front cover for publication number, e.g., 290-1819-1$A.
The letter following the dollar symbol shows the revision status of the document.

Rev	Date	Originator	Details of revision
A	23/05/19	SEW	New Guide
B	30/05/19	SEW	Sharp edges on base plate note
C	13/06/19	SEW	Dosing table added & Flush instruction