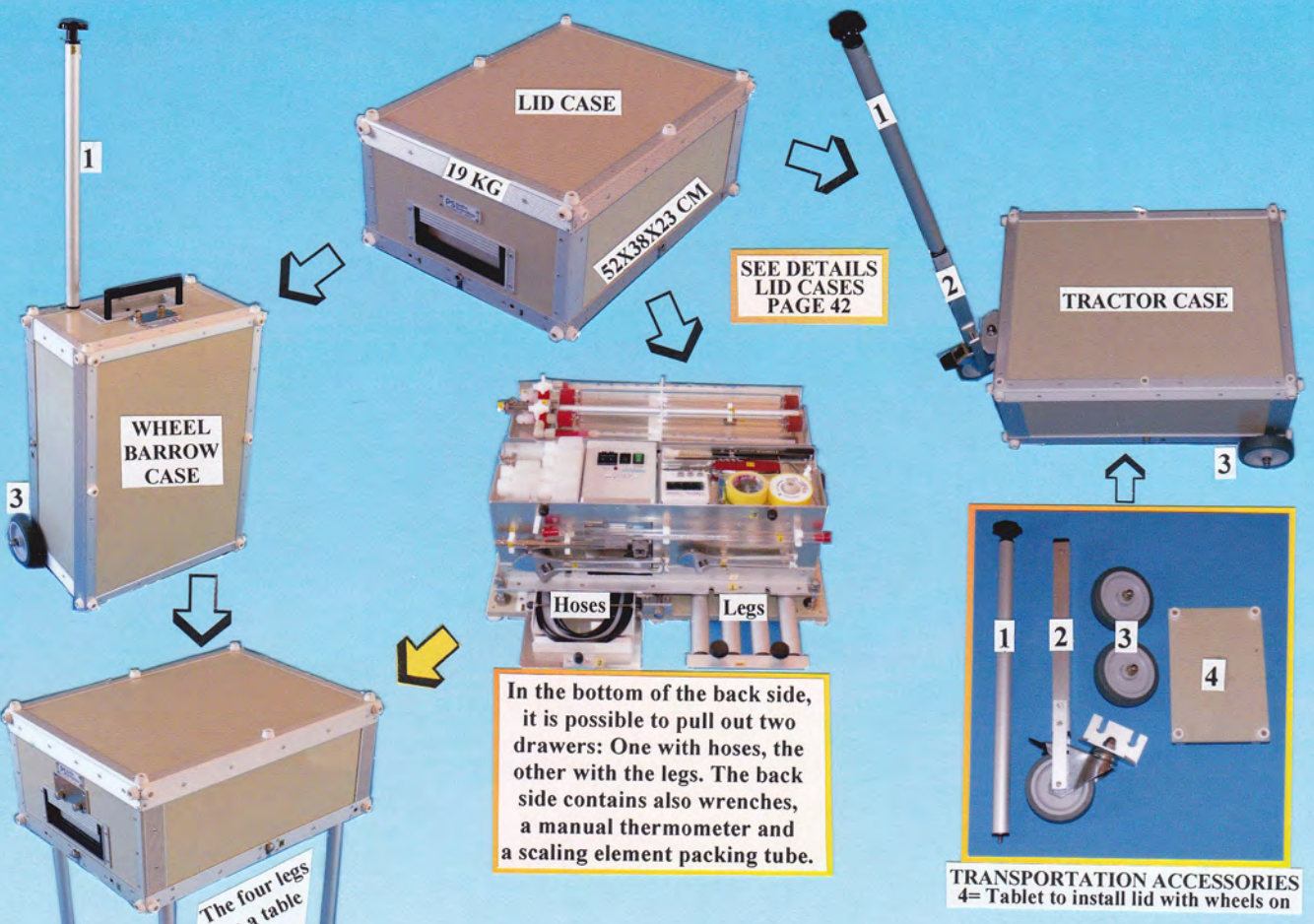
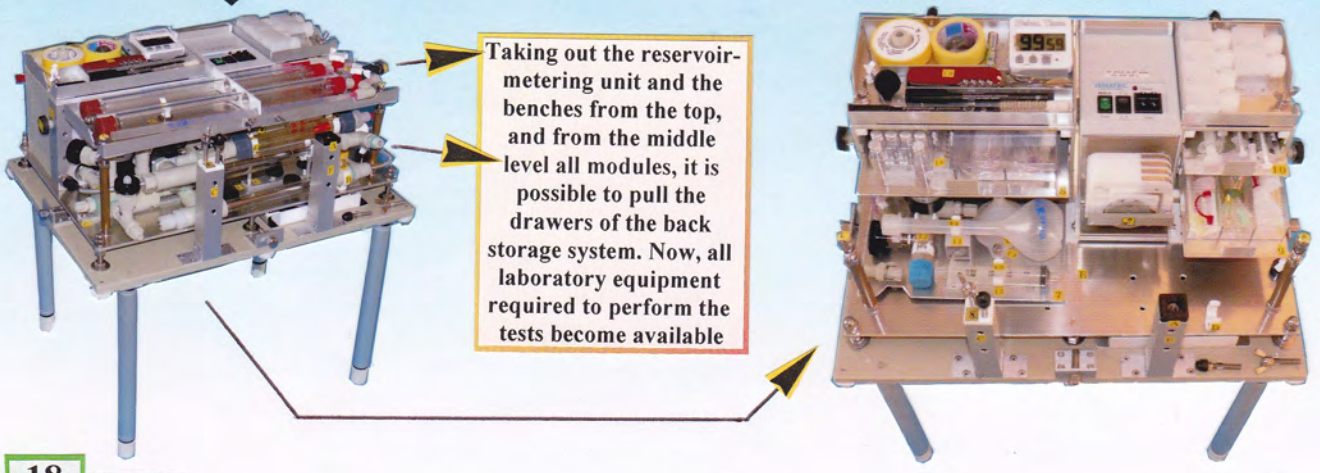
Chemical Treatment Simulation Machines

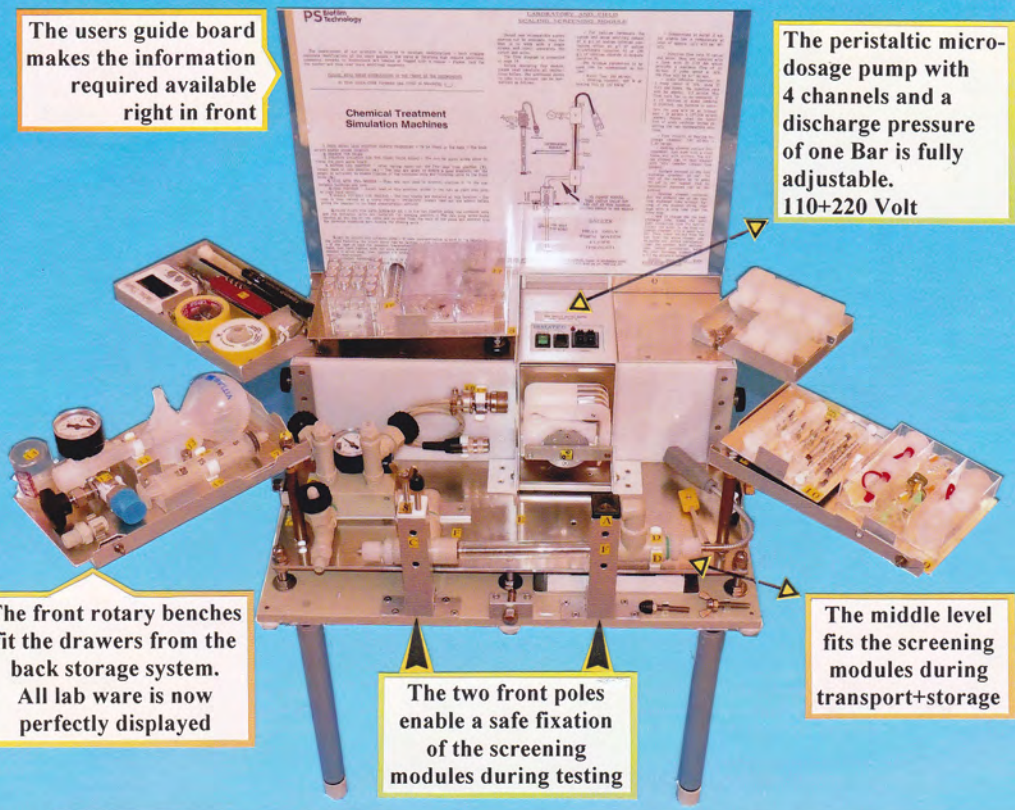
Portable field or laboratory instrumentation to select under flow and on-line CORROSION INHIBITORS, SCALE INHIBITORS and BIOCIDES



In spite of its complexity, the instrumentation is small, light, easy to operate, ideal to be used in the most remote locations



The users guide board makes the information required available right in front



The peristaltic micro-dosage pump with 4 channels and a discharge pressure of one Bar is fully adjustable. 110+220 Volt

RESERVOIR AND METERING FACILITIES

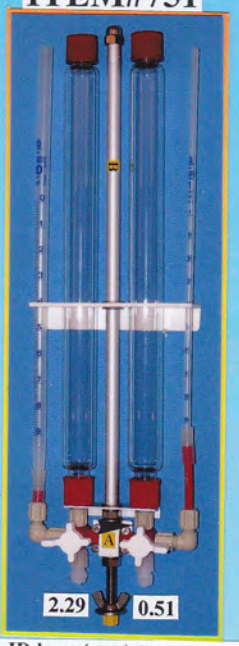
The glass cylinder at the right side is to store chemicals, the one at the left side is to store scaling or corrosive solutions – Both are connected to measuring pipettes through a 3 way valve, thus injection rate control with stop watch is possible.

The front rotary benches fit the drawers from the back storage system. All lab ware is now perfectly displayed

The two front poles enable a safe fixation of the screening modules during testing

The middle level fits the screening modules during transport+storage

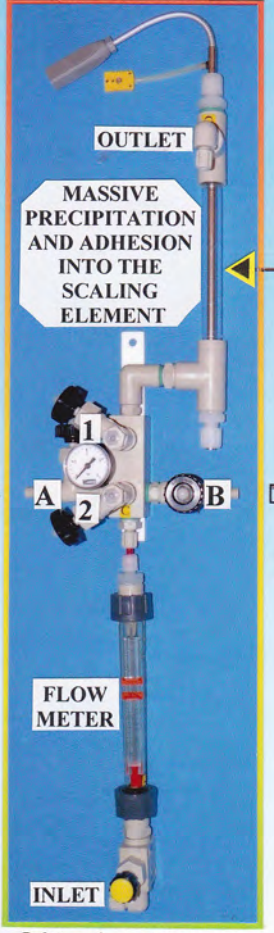
ITEM#751



ID hose (mm) to pump through luer-lock connection

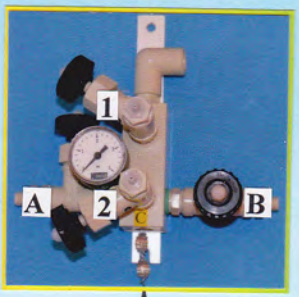
SCALE INHIBITOR SCREENING

PAGE 39
ITEM#73



Inlet main water source: Tap water or field water

The scaling solution flows through the annulus between glass tube and scaling element
SCALING CHAMBER



Static mixer inside

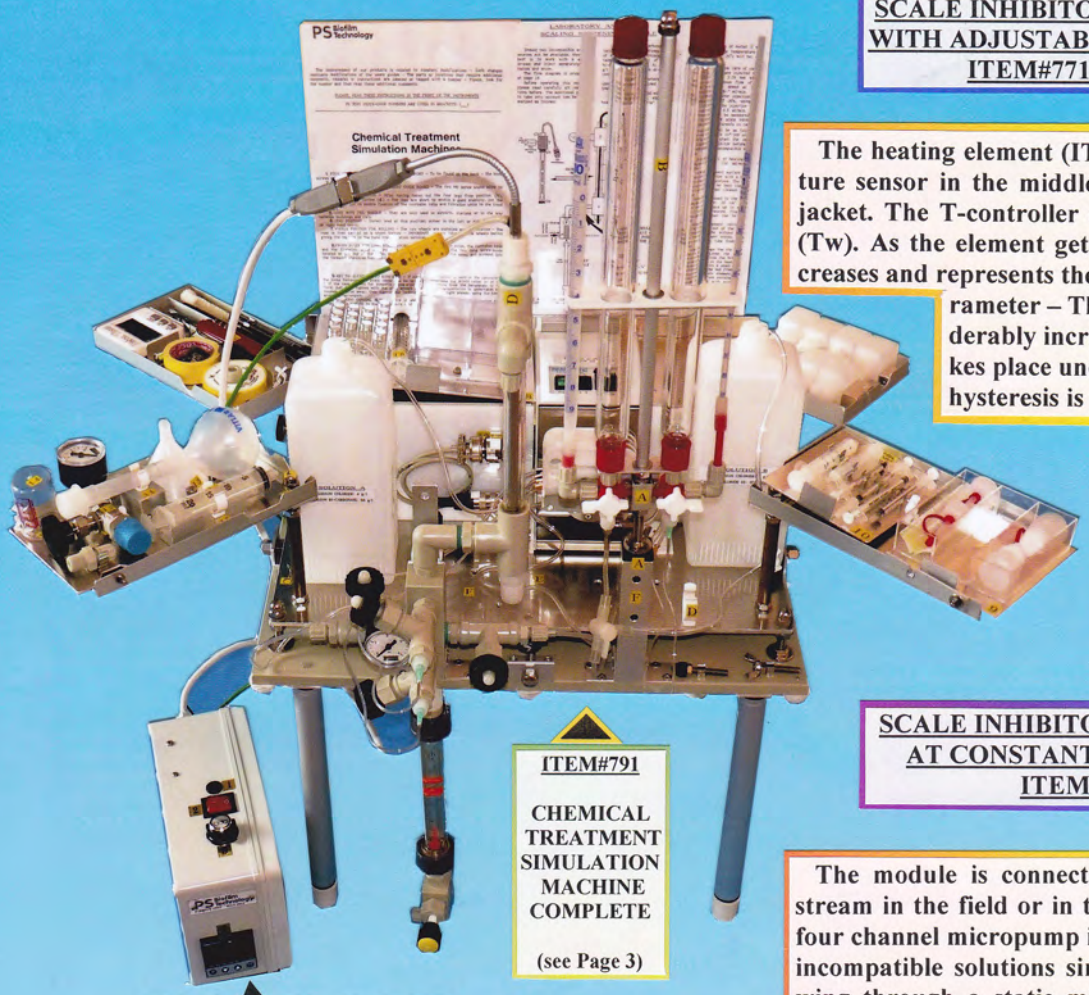
INJECTION POINT MANIFOLD

The two incompatible solutions are injected into point A and B. Chemicals can be injected into point 1 and 2 directly into the stream with an internally built-in capillary tube.

SCALE INHIBITOR SCREENING WITH ADJUSTABLE HEAT FLUX ITEM#771 and 791

The heating element (ITEM#675) has a temperature sensor in the middle and in contact with the jacket. The T-controller displays its process value (Tw). As the element gets scaled, such a value increases and represents the basic differentiation parameter – The set value is then considerably increased so that heating takes place under continuous basis. The hysteresis is programmed so that no overheating can take place.

It is then possible to log, assess and study the kinetics of scale adherence.



ITEM#791

CHEMICAL TREATMENT SIMULATION MACHINE COMPLETE

(see Page 3)

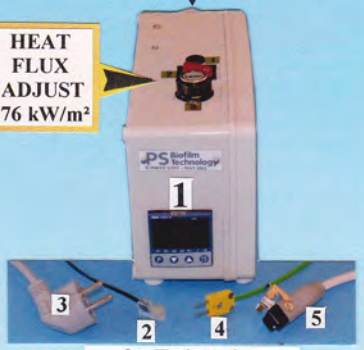
HEATING DRIVE UNIT

SCALE INHIBITOR SCREENING AT CONSTANT HEAT FLUX ITEM#766

The module is connected to any type of water stream in the field or in the laboratory – With the four channel micropump it is possible to inject two incompatible solutions simultaneously – After flowing through a static mixer, the scaling solution drops pressure, precipitates in the scaling chamber and adheres into the 25 cm² surface of the scaling tube which is heated from inside with a 350 W heating element. The result is a massive scale adhesion within the first 15 minutes of exposure.

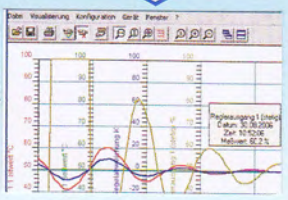
Such a phenomenon can be observed visually through the glass tube of the scaling chamber – In the other two injection points, two chemicals, scale inhibitors or combinations can be injected at once.

HEAT FLUX ADJUST 176 kW/m²



2 – To interface
3 – To main
4 – To thermocouple
5 – To heating element

The temperature controller (1) displays simultaneously the Tw and set value and is delivered with an interface + USB/TTL converter. A windows software consists of a multi-channel recording facility with graphical presentation and storage facilities.



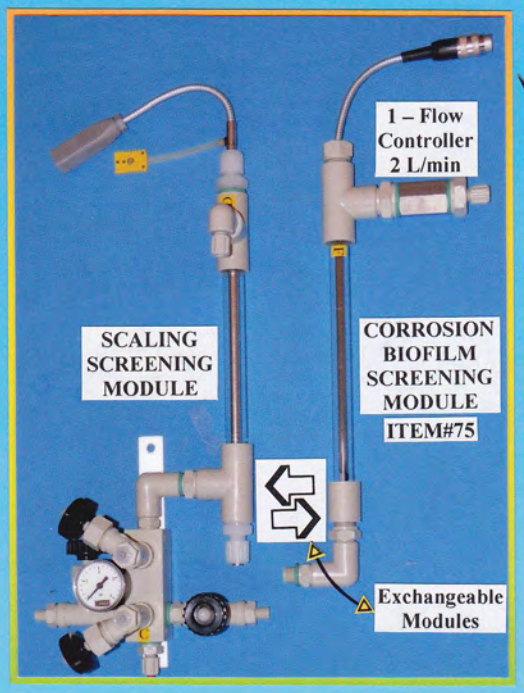
BASIC DIFFERENTIATION PARAMETER

The scaling element (tube) is weighed before and after exposure. The weight difference represents the SCALE ADHESION under DYNAMIC CONDITIONS – It can be expressed in mg/cm².hour – The comparison of the scaling rate with and without scale inhibitor will determine the % of SCALE ADHERENCE INHIBITION under flow conditions.

30 minutes exposure is the ideal duration of one test – In one day it is possible to screen 5 or 6 scale inhibitors.

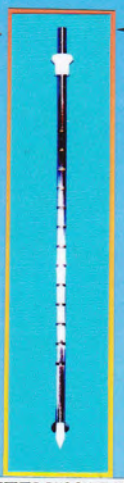
ITEM#736
SCALING ELEMENTS

ITEM#775 – BACK-UP CASE CONTAINING THE HEATING DRIVE UNIT + BOTTLES TO STORE SCALE SOLUTIONS AND 5X ITEM#736 – 110 or 220 V

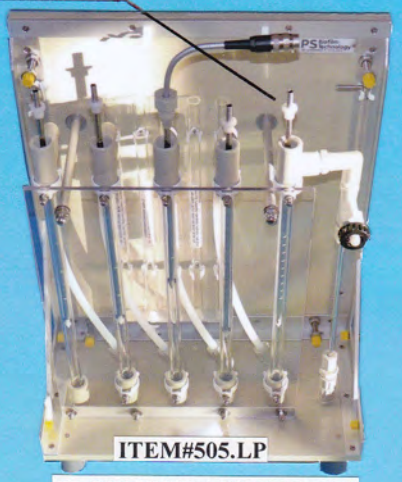


To screen biocides, mature biofilms developed in a Flow Unit Assembly are treated in the Biofilm Screening Module.

Corrosion Probes can be exchanged by biofilm arrays



ITEM#221.LP BIOFILM ARRAY-12



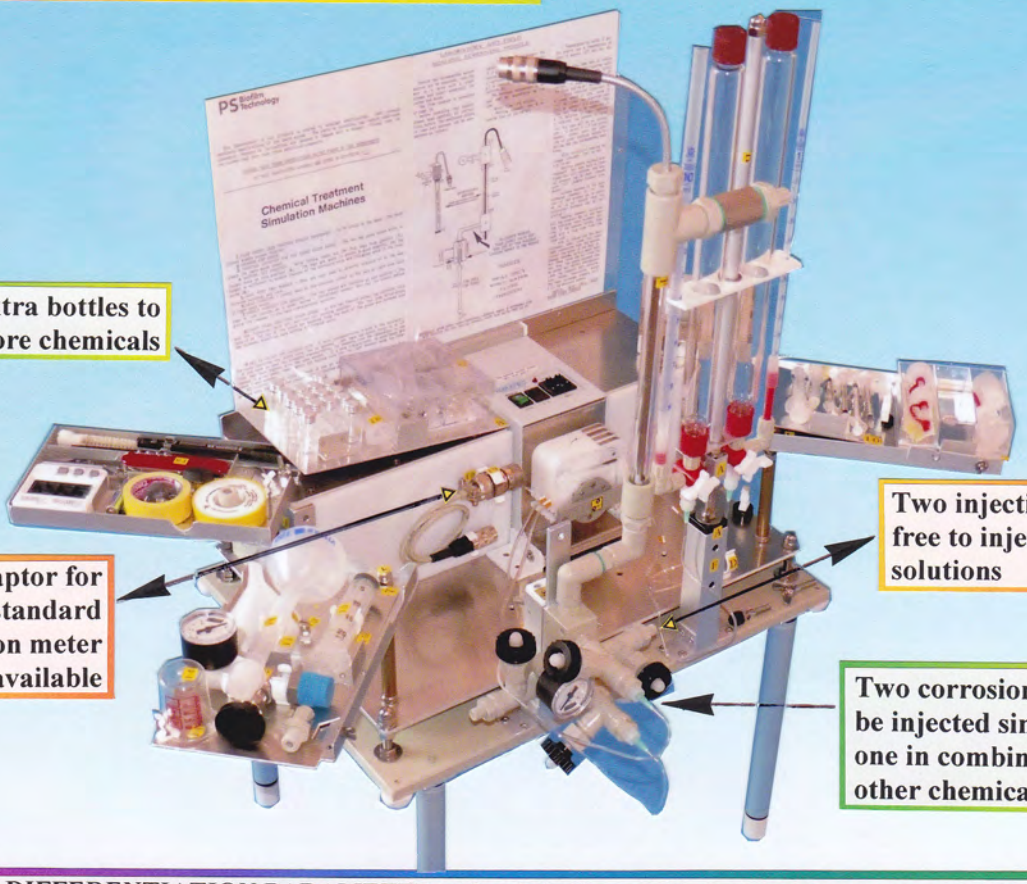
ITEM#505.LP

FLOW UNIT ASSEMBLY-5 (SEE PAGE 14)

CORROSION INHIBITOR SCREENING

The pressure is regulated by the pressure reducer (see two pages before) – A pressure of one Bar is sufficient to maintain the gases dissolved. The flow controller device (1) maintains the flow constant – Usually the tests are conducted with a flow of 2 L/min – Flow controllers for other flow rates are available upon request.

The retrievable bayonet probes can be used for any type of electrochemical technique. However, the easiest method to perform rapid screening is to use Linear Polarization Resistance (LPR) techniques. In systems containing carbon dioxide and even with hydrogen sulfide but no oxygen, the corrosion rate of freshly exposed surfaces becomes stable usually within the first ten minutes of exposure.



Extra bottles to store chemicals

Two injection points are free to inject corrosive solutions

Adaptor for standard corrosion meter available

Two corrosion inhibitors can be injected simultaneously or one in combination with other chemicals

BASIC DIFFERENTIATION PARAMETER: After injecting small amounts of corrosion inhibitor, 2 to 10 ppm, it is possible to observe a sharp decrease of corrosion rate within the next 15 minutes. That represents, indeed, the basic differentation parameter. Using such a technique, it is possible to screen up to two products per hour.

BIOCIDE SCREENING PROCEDURES

DYNAMIC TIME-KILL TEST ON BIOFOULED SURFACES

After the colonization period in a Flow Unit Assembly (see page before), the mature biofilm arrays are transferred into the Biofilm Screening Module, where a slug of biocide at a given concentration is applied. During treatment, coupons are transferred each 5 or 10 minutes into broth bottles for the specific type of bacteria to test or to aseptic bottles containing field water and after sonication a serial dilution is made according the procedures mentioned in the Microbial Transfer Case. Using such a procedure 5 to 6 biocides can be screened in one day.

BASIC DIFFERENTIATION PARAMETER

The products to select are the ones exhibiting total kill within the shortest contact time and the ones that show the greatest reduction of the bacterial population. The test gives also an idea of the optimum contact time for a given constant concentration.

SIMULATION OF PERIODIC SLUG TREATMENT

Provided that the assembly can be left on stream for a long period of time, a periodic slug treatment program can be planned. If the product is already selected, each unit can be treated with a different program, that is varying concentration, duration and frequency of the slug. Such test enables optimization of the treatment parameters. If three Flow Unit Assemblies are available, then it is possible to vary a single parameter in each assembly, that allows independent optimization of each treatment parameter. Such tests can also be conducted on aged surfaces, thus kill and regrowth studies can be undertaken.

SIMULATION OF CONTINUOUS INJECTION AND MULTIPLE TREATMENT PARAMETERS

Those investigations are performed injecting continuously small amounts of corrosion inhibitors or biofilm preventives. The continuous treatment can be compared with slug treatment and against combinations of both types.

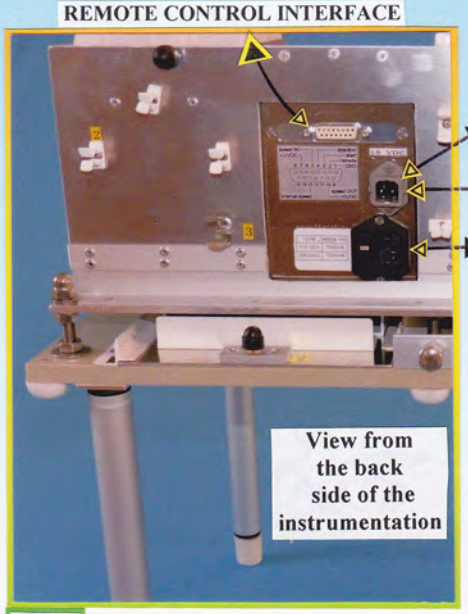
Accumulator Recharge Facilities

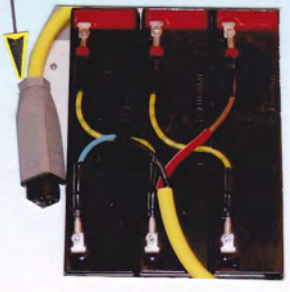
DC Power Supply

1 – Accumulator recharge set-up

The scaling tests require AC 110 or 220 V current. Corrosion inhibitor and biocide tests can be performed with a DC 18 V. They are obtained by serial connection of 3 accumulators: 6 V, 2.8 Ah

REMOTE CONTROL INTERFACE





The accumulators are recharged all three together in parallel – It takes approx. 2 hours

COMPATIBILITY SIMULATION STUDIES

Chemical compatibility is a very broad notion. In principle, two or more chemicals are called compatible when they do not exhibit any kind of negative influence on their effectiveness when applied together. A second type of compatibility problems takes place when the injection of a chemical produces solids, thus deteriorating the water quality.

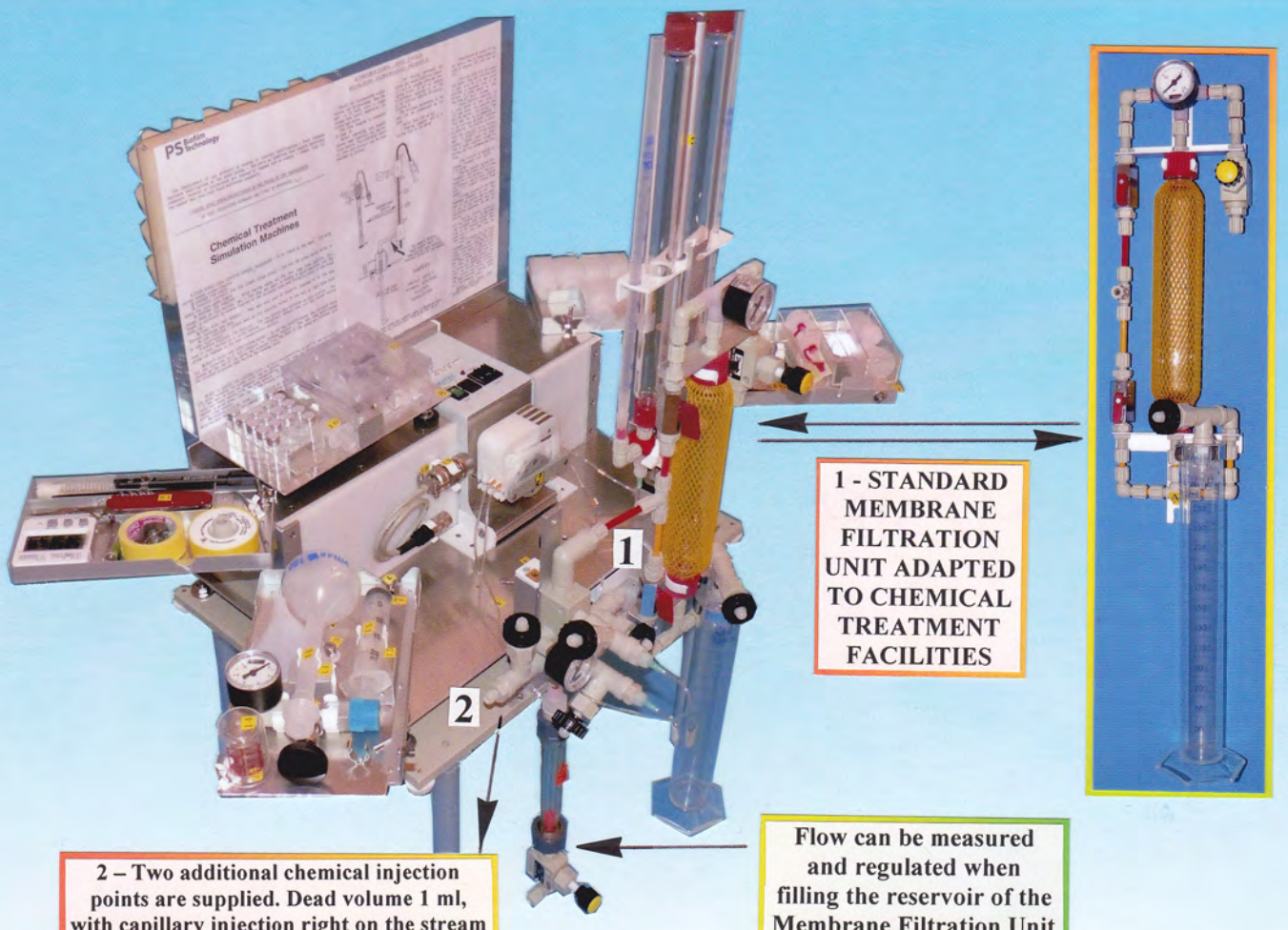
Multiple compatibility studies: The two additional injection points enable to perform scale inhibitor screening injecting one additional chemical or test the effectiveness of corrosion inhibitors and biocides injecting simultaneously 3 additional chemicals. The compatibility study programmes are multiple and should be adjusted to each particular situation.

WATER QUALITY COMPATIBILITY

It is studied with the Membrane Filtration Unit supplied. Such tests can be performed with simultaneous injection of up to four chemicals.

The procedure is easy, during the filling of the reservoir of the Membrane Filtration Unit, the flow is maintained constant with the valve of the pressure reducer and the one at the inlet of the flow meter. Once the flow is determined, the injection rate is adjusted accordingly.

It is then just the matter of running filtration rates and suspended solids with the Membrane Filtration Unit and comparing the results with blank tests without chemical injection.



ITEM#777

MEMBRANE FILTRATION UNIT ADAPTED TO ITEMS#776, 971, 776 or 991 WITH ADDITIONAL FLOW METER + 2 ADDITIONAL INJECTION POINTS – DELIVERED IN AN ADDITIONAL CARRYING CASE