MARK III Manometric Perfusion Pump

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### Notes on the use of this manual

- References within the manual are shown in brackets
  eg (C – 4.2) = section C, part 4, instruction 2

- Part numbers (#) given in the text are unique for Dentsleeve

- The technical information and illustrations in this manual reflect specifications and operating procedures at the time of drafting. Some specifications and operating procedures differ from earlier manuals for Mark III perfusion pump models. Dentsleeve reserves the right to vary specifications and operating procedures as part of its continuous product improvement process.
Note: Schematic diagram of water perfusion circuit. Only critical components are shown.
Note: Pump length, channel numbers and spacings vary according to individual specifications. Standard deck version shown. Transducer types vary: Abbott Transpac 42582-10 transducers shown.
A - 3  MKIII Pump Air – Water System

Overview

A – 3  MKIII Pump Air – Water System

Low Pressure Gauge 0-250 kPa
#ZP1-GAUTF/1

Pressure Regulator
#ZP1-REG/1

Mini Male Quick Connect
#ZP1-FIT/SWISS-QM2-S-2PM

Black O' Ring
#ZP1-SEAOR/1

Gas Filter - 6.3 micron
#AP1-FLGA/1

Male Quick Connect
#ZP1-FIT/SWISS-CD-4002N

Mini Female Quick Connect
#ZP1FIT/SWISS-QM2-B-200

Female Low Fitting
#ZP1FIT/V/FTLLB210-1

Male Low Fitting
#ZC1-FIT/V/PMLTR/210-1

Female Quick Connect
#ZP1FIT/SWISS-CD-4002N

Four Pin Plug
#ZP1-PLUG/1

From Air Compressor, Wall Air Supply, or Air bottle supply
Max. Input Pressure:
240 kPa / 35 p.s.i.

110/220V

OPTIONAL
Compact Resistor
# R01-HRE/CO/1
# R01-HRE/CO/2
# R01-HRE/CO/3
# R01-HRE/CO/5
# R01-HRE/CO/15
# R01-HRE/CO/30
# R01-HRE/CO/45
# R01-HRE/CO/60

Water Filter (20 micron)
#AP1-FL/NA/1

Over Flow Jar
#ZC1-JLVD/1

Water Reservoir with all fittings
#ZP1-RES/P/1

Mini Female Quick Connect
#ZP1FIT/SWISS-QM2-B-200

Female Low Fitting
#ZP1FIT/V/FTLLB210-1

Deflector Cap/Red
#ZP1FIT/SWISS-4CPA-K/2-RD

Silicone Gasket in lid
#ZP1-SEA/GA/1

Silicone Gasket in bottom
#ZP1-SEA/GA/1

Lock Ring
#ZP1FIT/V/PM/LR/2

Power On/Off Switch
#ZP1-BOSS/1

Water Filter - 20 micron
#AP1-FL/NA/1

Female Low Fitting
#ZP1FIT/V/FTLLB210-1

Air Particle Monitor
#AP1-PM/1

Standard Resistor
# R01-HRE/ST/1-3
# R01-HRE/ST/2-3
# R01-HRE/ST/3-3
# R01-HRE/ST/4-3
# R01-HRE/ST/5-3
# R01-HRE/ST/6-3
# R01-HRE/ST/7-3

Water Reservoir & Channels with Pipe Clamp
#ZP1-FL/AM/1-N/P/3
Never drop. Do not use if visible damage.

Only pressurise reservoir with this line (C – 3.1).

Water level never less than 2cm (C – 10).

Air pressures never more than 300kpa / 45psi

Air perfusion channel. Only use for pharyngeal swallow monitoring (C – 9).
Assembly & filling of perfusate reservoir

1. Blow-off valve

2. Add water, then place perfusion float barrier on top

3. Tighten firmly to seal

Note: See E – 2 for Dentsleeve part #'s

Fill with particle free, degassed, distilled H₂O

Always use diffusion float barrier

Always use water filter
Part #: AP1FIL/WA/1

May 2003
Normal Use

For set-up and first use see E – 1 to E – 7

C – 2  Check, connect & set air supply

1

Click!

Air

2

Air

Set to 100 kPa / 15 psi

To gas supply

May 2003

No manual Use
Normal Use

Connection & flushing of water manifold

1. Connect to water manifold
   Part # ZP1FIT/SW/SS-QM2-B-B-200
   Air line from control box
   Filter
   Click!

2. Open

3. Open

4. Open, vent and close
C – 4  Check flow values of each hydraulic resistor

1  Standard resistor shown: flow is colour coded

<table>
<thead>
<tr>
<th>Flow ml/min</th>
<th>Tube Colour</th>
<th>Screw Colour</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>Black</td>
<td>White</td>
<td>R01HRE/ST/1(3)</td>
</tr>
<tr>
<td>0.02</td>
<td>Black</td>
<td>Black</td>
<td>R01HRE/ST/2(3)</td>
</tr>
<tr>
<td>0.04</td>
<td>Black</td>
<td>Red</td>
<td>R01HRE/ST/4(3)</td>
</tr>
<tr>
<td>0.08</td>
<td>Red</td>
<td>White</td>
<td>R01HRE/ST/8(3)</td>
</tr>
<tr>
<td>0.15</td>
<td>Red</td>
<td>Black</td>
<td>R01HRE/ST/15(3)</td>
</tr>
<tr>
<td>0.3</td>
<td>Green</td>
<td>White</td>
<td>R01HRE/ST/30(3)</td>
</tr>
<tr>
<td>0.45</td>
<td>Green</td>
<td>Red</td>
<td>R01HRE/ST/45(3)</td>
</tr>
<tr>
<td>0.6</td>
<td>Green</td>
<td>Black</td>
<td>R01HRE/ST/60(3)</td>
</tr>
</tbody>
</table>

1  Alternative: Compact hydraulic resistor

Water flow on case

The flow value is...

- Correct, go to  ▶  C – 5
- Changed, go to ▶  E – 5 or 6
Normal Use

Turn on water perfusion to fill each transducer  C – 5

1. Open pinch valve or clamp

Note: PVB DPT-6100 Transducer shown

2. Fill transducers

Note: Abbott Transpac 42582-10 Transducer Shown

Prefered position for 3 way stopcock - other than PVB DPT-6100
C – 6  Transducer calibration (if required)

1  Turn perfusion off - (C – 5)

2  Set transducer gain by applying standard external pressure

3  or use gravity calibration

-68cm H₂O, 50mm Hg

Note: Shows AP1CMA/TR/2

Connect to transducers

Pressurise with syringe

Note: Shows Dentsleeve calibration manifold; made according to channel numbers and spacings

Part #s AP1CMA/TR/1to5

C – 7  Connect catheter to transducers

1  Select correct channel

2  Twist & push on firmly

Note: Catheter detail is for Dentsleeve product
Water injection procedure - each channel

1. H₂O - no bubbles
2. Open side-port
3. Inject 5ml of H₂O
C – 8  Water injection procedure - each channel (continued)

4 Close side-port then remove syringe

Note: Arrangement for PVB DPT-6100 transducer shown
Check flow value for air perfusion manometry

1. Identify air perfusion channel pinch valve

2. Ensure resistor for air perfusion channel is correct

Only use air perfusion for detection of swallowing in pharynx

Air flow rate through hydraulic resistor is x100 water flow rate.

<table>
<thead>
<tr>
<th>Air flow ml/min</th>
<th>Water Flow ml/min</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.02</td>
<td>R01HRE/CO/2</td>
</tr>
<tr>
<td>4</td>
<td>0.04</td>
<td>R01HRE/CO/4</td>
</tr>
<tr>
<td>8</td>
<td>0.08</td>
<td>R01HRE/CO/8</td>
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</table>

Suitable compact resistors give airflow on case

Must be installed between manifold and transducer to limit air flow into manometric catheter to less than 10 ml/min
C – 10 Observation & refilling of perfusate reservoir

If perfusate exhausted, large volumes of gas may be perfused down catheter

1. Refill when at 2cm

2. Release pressure

Pull Back

3. Refill

Particle free, degassed, distilled H₂O

4. Restart perfusion

Tighten

Repressurise

Click!
1. Monitor air pressure. Maintain at 100kPa/15psi.

2. Check if air pressure drops

3. Check that air supply is adequate

OR

At least 130 kPa/20psi

At least 1000 kPa/150psi
Prevention, recognition and correction of hydraulic resistor blockage

1. Prevention of blockages - *Always* use perfusate filter

2. Minimise perfusate particle load

   - Double-distilled or de-ionised water
   - No particles in reservoir (E-2)

3. Replace water perfusate filter regularly - (G-1)

4. Check perfusate flow rates - assemble 1ml syringe barrel on transducer

5. Start perfusion - (C-2)

6. Measure time to deliver water

*Note:* for resistor flow rates < 0.15ml/min use 0.25 - 0.50 ml syringe barrels
Prevention, recognition and correction of hydraulic resistor blockage

7  Flushing of blocked resistors - remove resistor from circuit

8  Backflush forcibly

9  Observe water flow

10 Re-install - (E – 5)

OR

11 Remove resistor from circuit

12 Insert flush support tool - (E – 6)

13 Same steps as C – 11.7 to 11.10 above
Always ground

Turn on power switch. Power is on when switch is illuminated

Connect compressor air outlet to pump

Plug in compressor to pump control
Steps On Completion of Measurements

1. Depressurise
2. Close and disconnect from manifold
3. Remove lid
4. Drain Reservoir
5. Remove float & air dry

Lint & particle free surface

Do not transfer particles to internal surfaces of reservoir
D – 2  Water manifold

1  Close

D – 3  Air supply

1  Turn off compressor

2  Close cylinder valve

Steps On Completion of Measurements
Installation only by an approved, qualified biomedical engineer

1. Use air

**Note:** Air chosen as:

1. Air dissolution in perfusate prevented by perfusate float barrier.
2. More suitable for gas perfusion manometry than $N_2$.
3. Usually more available and cheaper than $N_2$.
4. Available from wall supply and simple compressors.

2. Set up for compressor, wall or air bottle supply

- Compressor: E – 1.3
- Wall: E – 1.4
- Air bottle: E – 1.6 or 1.9
3. Install next to pump deck or place on bottom shelf of trolley.

4. Identify air line.

   - Black Part # ZP1TUB/NS/1
   - Connects to pump Air inlet (C – 1.1) Part # ZP1FIT/SW/B-QC4-B-400ZN

5. Ensure air source is suitable:
   - 130 - 240 kPa or 20 - 35 psi
   - no oil or moisture
   - filtered to 0.5 micron

6. Make appropriate connection to supply.
7 Identify air line with Dentsleeve supplied regulator

- Connect to pump air inlet (C – 1.1)
- Cylinder pressure gauge
- Medical international air pin index (Size C cylinders only)
- Part # ZP1REG/HP/1
- Factory set by Dentsleeve to deliver 300 kPa / 45 psi

8 Identify air line if no high pressure regulator supplied

9 Connect to suitable locally sourced high pressure regulator with lockable outlet pressure control

10 Adjust regulator to deliver outlet pressure of 300 kPa / 45 psi
Set Up Procedures & Connection of Components

E – 2 Perfusate reservoir prior to first use

1. Check correct assembly of perfusate reservoir

- Blow-off valve
  Part # ZP1FIT/SW/SS-4CPA2-3

- Closure Knob

- ‘O’ ring
  Part # ZP1SEA/OR/1

- Gasket under lid
  Part # ZP1SEA/GA/1

- Reservoir outflow control device

- Gasket in channel
  Part # ZP1SEA/GA/1

- Outlet ‘O’ ring
  Part # ZP1SEA/OR/2

- Always use diffusion float barrier

- Always use water filter (C – 2.2)
  Part # AP1FIL/WA/1

2. Flush reservoir with water to remove any particles
Installation of pressure transducers

1

PVB DPT-6100
Abbott Transpac 42582-01

2
Mount bar removable
Installation of pressure transducers (continued)
Installation of pressure transducers (continued)
E – 4    Water perfusion manifold – removal
Water perfusion manifold – removal (continued)

2

Pinch valve

3
Standard hydraulic resistors

1. Identify standard resistor with correct flow value. (C – 4)

2. Prime resistor with water. Use 1 ml syringe for 0.6 - 0.15ml/min resistors. 0.5ml syringe for lower flow rates

3. Inject till water flows from other end

4. Fill resistor connector as syringe withdrawn

Particle-free water

No bubbles trapped in luer
Set Up Procedures & Connection of Components

Standard hydraulic resistors (continued)

5

Connect resistor to manifold side arm luer
Ensure resistor connector remains water filled

6

Push and rotate resistor firmly onto manifold luer

7

Open
E – 5  Standard hydraulic resistors (continued)

8  Debubble downstream resistor luer
   Inject particle-free water into bottom of luer

9  Ensure no bubbles are trapped

10 Connect to pressure transducer
    Preferred position for 3 way stopcock

11 Use special high pressure stopcock

12 Push and rotate resistor firmly onto
    3 way stopcock

Abbott transpac 42582-01 shown

Part # ZP1STO/HP/2

Water filled

Note PVB DPT-6100 transducer has integral stop-cock at transducer outlet

13 Final setup: Follow instructions from (C – 7.2)
1. Check flow values for each hydraulic resistor
2. Prime resistor with water - Use flush tool
3. Place flush tool on silicone rubber connector
4. Use 1 ml syringe for 0.6 – 0.15 ml/min resistors
   0.25 – 0.5 syringe for lower flow rates
5. Inject until water flows from other end
6. Fill resistor connector as syringe withdrawn
7. Remove flush tool
Compact resistors (continued)

8 Connect as shown

Note: Connectors are self-debubbling. PVB DPT-6100 transducer shown.
Compact resistors (continued)

9. Connect resistor to manifold sidearm

10. Open

11. Final set-up - follow from (C – 5.2).
Air perfusion circuit

N₂ perfusion into pharynx may dilute inspired oxygen - use only air for perfusate reservoir pressurisation in small children, as this gas is also used for gas perfusion circuit.

1. Identify circuit

2. Locate air manifold and check correctly connected

3. Resistor must **always** be installed
Select resistor that controls airflow to less than 10ml/min

Airflow is x100 waterflow

Appropriate compact resistors show airflow on case

Install air flow resistor between air manifold luer and transducer

No water prime required

Air perfusion to be used only for pharyngeal manometry
Cleaning & Disinfection

Cleaning of plastic parts

1. Clean with cloth and mild detergent

Sterilization of perfusate reservoir

1. Gas sterilize only

Sterilization of manifolds

1. Autoclavable

- Water manifold
- Air manifold

Hydraulic resistors

1. Not autoclavable
2. Autoclavable

Cleaning of compressor

1. Wipe with a dry cloth
Every 3 months (or as needed): perfusate water filter

1 Replace

Part # AP1FIL/WA/1
Every year or as needed: gas filters  G – 2

To be done only by an approved, qualified biomedical engineer

1. Disconnect gas supply then open control box (G – 3.2)

2. Use correct filter

Part # AP1FIL/GA/1

Gas (Black)

3. Replace filter

4. Check for air-tightness

Note: Gas filter life depends on quality of air – always use medical grade
Regular Maintenance

G – 3 Service of control box by Dentsleeve

1. Undo screw that holds control box
2. Send control box to Dentsleeve
Regular Maintenance

1. Check dessicant is orange. When it becomes green, replace.

   ![Diagram of dessicant with orange and green options]

   - Spread granules evenly onto tray, one granule deep.
   - Heat granules for approximately 5 hours. (or until it turns back to its original orange color) at 125°C (250°F) in a conventional oven.
   - Cool dessicant before replacing back into canister.

OR
Problem Solving

Diagnosis of abnormal air consumption  H – 1

1. Check compressor connection

For compressor malfunction, please contact Dentsleeve

OR

Air

Check regulator/cylinder connection

2. Pressurise air circuit - Turn on

3. Adjust air pressure

4. Turn off
H – 1  Diagnosis of abnormal air consumption (continued)

5. Recognise leakage - Wait 1 hour

6. Drop less than 33 kPa/5psi
   - No significant leak

7. Drop more than 33 kPa/5psi
   - Significant leak

8. Follow (H-1.9) below
Problem Solving

Diagnosis of abnormal air consumption (continued)  

9  Check for leakage outside control box

10  If there are bubbles, replace fitting - Part # ZP1FIT/SW/SS-QM2-B-200

11  Consult approved, qualified biomedical engineer to do check (H-1.12 to H-1.17) below

12  Leakage?

13  Open pump control box.

14  Remove control box lid/back
Problem Solving

H – 1 Diagnosis of abnormal air consumption (continued)

15 Filter leakage - tighten or replace

16 Check rest of air circuit
Abnormal air consumption - perfusate reservoir leakage

1. First exclude air circuit leakage - (H – 1)

2. Set pressure

3. Set up reservoir. Remove blow-off valve cap

4. No water

5. Pressurise

6. Locate site of leakage - observe underwater

7. Locate site of bubbling
Abnormal Air consumption - perfusate reservoir leakage (cont.)

8. If leak elsewhere, dismantle reservoir

9. Identify cause of leakage at base

10. Gasket clean and intact?

11. Identify cause of leakage at top

Check ‘O’ ring
Part # ZP1SEA/OR/1

Gasket underneath clean and intact?
Part # ZP1SEA/GA/1
## Specifications

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<th>Details</th>
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<td><strong>Air</strong></td>
<td>Medical grade only</td>
</tr>
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<td><strong>High pressure regulators</strong></td>
<td>CONCOA Medical Air (Air pin index)</td>
</tr>
<tr>
<td>Recommended first stage regulators (*if supplied)</td>
<td>Air 167 - 300kPa (25 - 45 psi) Compressor 130 - 240kPa (20 - 35 psi)</td>
</tr>
<tr>
<td><strong>Inlet pressure</strong></td>
<td>Pump inlet pressure (from gas supply first stage regulator)</td>
</tr>
<tr>
<td></td>
<td>Air Male Inlet</td>
</tr>
<tr>
<td></td>
<td>Air female connector to perfusate reservoir</td>
</tr>
<tr>
<td><strong>Supply lines (from gas bottles)</strong></td>
<td>Air (black) line</td>
</tr>
<tr>
<td><strong>Air supply on pump</strong></td>
<td>Adjustable 0 -250 kPa (0 - 36psi) Flow restricted to 30ml/min at 100kPa (15psi)</td>
</tr>
<tr>
<td><strong>Pressure relief valves</strong></td>
<td>Preset to 200 kPa (29psi)</td>
</tr>
<tr>
<td>Perfusate reservoir relief valve</td>
<td>Preset to 300 kPa (45psi)</td>
</tr>
<tr>
<td>Control box inlet overpressure relief valve</td>
<td></td>
</tr>
<tr>
<td><strong>Filtration</strong></td>
<td>0.5 micron male/female luer connection disposable disc filter</td>
</tr>
</tbody>
</table>

## Technical Support

1. Contact Dentsleeve for advice
2. See contact details on front cover
Spare Parts Kit

2x AP1FIL/GA/1 Gas filters, for installation within pump control box.

5x AP1FIL/WA/1 Water filters, for filtration of water perfusate

2x ZP1-OCD/PR/1 Reservoir outflow control device, for perfusate outflow.

Regulatory Information

Authorised European Representative
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