CENTRIFUGAL ECMO SYSTEMS

Biomedicus 550

Centrifugal pump
CENTRIFUGAL ECMO SYSTEMS

Terumo
CENTRIFUGAL ECMO SYSTEMS

Jostra

Roto flow
CENTRIFUGAL ECMO SYSTEMS

Sorin

Revolution
## Centrifugal pump’s

<table>
<thead>
<tr>
<th>Combo system</th>
<th>Stand alone system</th>
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<tbody>
<tr>
<td><img src="image1.jpg" alt="Combo system" /></td>
<td><img src="image2.jpg" alt="Stand alone system" /></td>
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</table>
Specifications

- Priming Volume 57ml
- Maximum Flow Rate 8lpm
- Maximum Outlet Pressure 800
- Inlet/Outlet Port 3/8 in. (9.5 mm)
- Pump Casing Polycarbonate
- Minimal surface area
- Large wash out holes
- Low blood transit time
- No stagnant areas
- Low heat generation
- Lower shear
- Excellent air handling ability
Specifications

Pressure VS Flow @ 8 lpm

Pressure @ 5 lpm
# Roller vs. Centrifugal

<table>
<thead>
<tr>
<th><strong>Roller</strong></th>
<th><strong>Centrifugal</strong></th>
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<tbody>
<tr>
<td>• Able to set totally or Partially occlusive</td>
<td>• Non – occlusive</td>
</tr>
<tr>
<td>• Positive displacement – pushes blood by squeezing raceway</td>
<td>• Passive displacement</td>
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<tr>
<td>• Flow = (stroke volume x rpms)</td>
<td>• Cones or impellers create kinetic energy using centrifugal force of fluid constrained vortexing</td>
</tr>
<tr>
<td>• Flow is not dependent on resistance</td>
<td>• Rpm’s are proportional to resistance</td>
</tr>
<tr>
<td></td>
<td>• Flow is inversely proportional to resistance</td>
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</table>
Centrifugal pumps are non-occlusive pumps which operate on the principle of entraining blood into the pump by a vortexing action of spinning impeller blades or rotating cones.

The impellers or cones are magnetically coupled with an electric motor and, when rotated rapidly, generate a pressure differential that causes the movement of blood.
Centrifugal pump

- Unlike roller pumps, they are totally non-occlusive.

- They are preload and afterload dependant; i.e., an increase in downstream resistance decreases forward flow delivered to the patient.
  - This has both favorable and unfavorable consequences.
  - Flow is not determined by rotational rate alone, so a flow meter must be incorporated in the arterial outflow to quantitate pump flow.
When the pump is connected to the patient’s arterial system but is not running, blood will flow backward through the pump and out of the patient unless the arterial line is clamped.

- This can cause reverse flow (left to right shunt), exsanguination of the patient or aspiration of air into the arterial line (e.g., from around the purse string sutures).

- **Thus, whenever the centrifugal pump is not running, the arterial line **MUST** be clamped!
Centrifugal pumps

- Flow is dependent on
  - Rpm’s
  - After load
  - Pre Load

- With limitation of Rpm’s, centrifugal pumps decrease risk of over pressurization and cavitation.
Centrifugal pump
Management suggestions

- Attention should be paid to line pressures and rpm’s upon establishment of full flow
  - Deviations of the various values will indicate appropriate actions to maintain full flow.
    - Increased Afterload – Decreased flow
    - Decreased Afterload – Increased flow
    - Increased Preload – Increased flow
    - Decreased Preload – Decreased flow
Assemble circuit using sterile technique.

Circuit must be completely gravity primed.

1. Plasmalyte bag hanging on IV pole
2. Entire circuit on floor except oxygenator
3. Oxygenator on oxygenator holder
4. Open stopcock to allow plasmalyte to flow
5. Open stopcock on oxygenator to allow air to escape
6. Ensure air moves with plasmalyte
7. Ensure “cone” is completely primed
8. Ensure oxygenator is completely primed and circuit de-aired
Centrifugal pump
Starting from scratch

Circuit placement
1. Circuit extends from pt as usual
2. Cone sits in the centrifugal head with the outlet pointed down.
3. Oxygenator in holder as standard
4. Circuit loops up from oxygenator and down thru bubble detector
5. Circuit goes down thru ERC approx 12” after bubble detector
6. Circuit goes back to pt as usual
7. Filter the circuit as usual
Blood prime as usual

Wait for Surgeon to cannulate ............... zzzzz

Once loop is handed off, before circuit is cut place a clamp on outlet side of cone.

Keep RPM’s @ 1000.

When surgeon give’s the go ensure ERC is open, slowly remove clamp from arterial limb.

Increase RPM’s while watching flow and pressures until desired flow achieved.

Continue to monitor pressures and flows