Using The Seadoo Diver Propulsion Vehicle (DPV)

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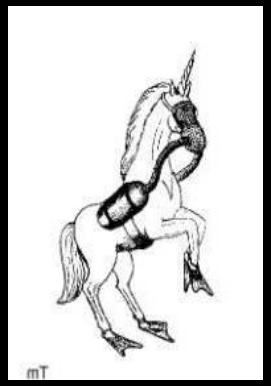
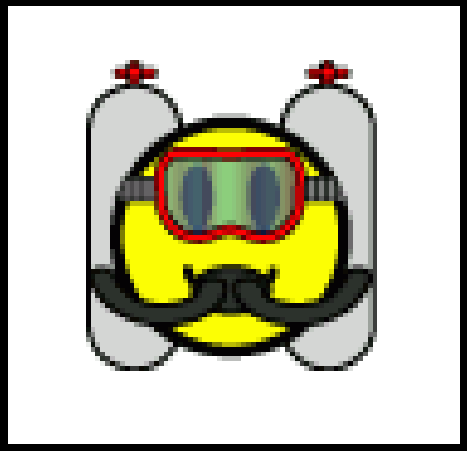
Knowledgeable, Physically Fit Divers

Gospel

According to "Harris"

Have More Fun!





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The Diver Propulsion Vehicle (DPV)

Advantages:

Extended Range

- Minimizes breathing gas consumption
- Reduces fatigue
- Can carry support equipment
- Allows diving to areas beyond a typical dive

Limitations:

Needs greater situational awareness

- Especially when rapidly changing depth
- Speed increases impact risk

May frighten marine life

Increased hypothermia risk

Need for DPV failure procedures

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Types of Diver Propulsion Vehicles

Based on Utilization / Capability

Recreational

- Facilitates underwater tourism
- Primary purpose: Enjoyment (Fun!)
- Limited speed / duration
  - But, extends typical time / duration
  - Reduces exertion / air consumption

Expedition / Technical

- Primary purpose: extended range
- Higher reliability
- Used in overhead environments

Military

- Facilitates military operations
- Enormous range / capacity

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DPV: Purchase Considerations

Battery Performance:
- Charging Times
- Duration
- Multiple Speeds
- Removable for Transport

Depth Rating

Handle Design

Weight and Buoyancy

Intended Use

Accessories
- Instrument panels
- Nose cones for trim
- Cameras mount
- Towing harness
- Transport cradle

Customer Support

Cost

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Seadoo Scooter Specifications

Dimensions: 24 x 15.2 x 12.3” (612 x 385 x 312 mm)
Weight (with battery): 18 lbs (8.2 kg)
Battery life: ~ 1.5 hours (factory specs)
Great Lakes cold water observations
72 minutes at slow speed
38 minutes at high speed
Depth rating: 100 ft / 30 m
Operating speed: ~ 1.5 mph / 2.3 km / h
Max speed: up to 3.0 mph / 4.8 km / h

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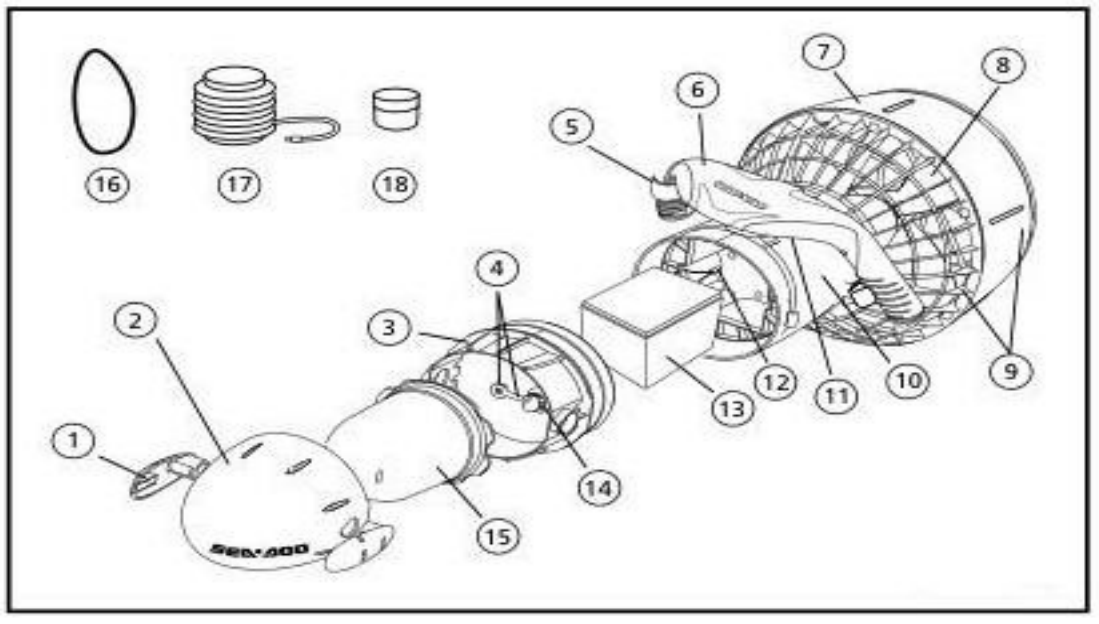
SeaDoo DPV Components



Standard

① Latch	⑪ Master Switch
② Nose Cone	⑫ Battery Leads
③ Inner Nose Cone	⑬ Battery
④ Vent Plug	⑭ Vent Hole
⑤ Triggers	⑮ Buoyancy Control Chamber
⑥ Handle	⑯ Silicone Ring
⑦ Nozzle	⑰ Pump
⑧ Propeller	⑱ Lubricant
⑨ Protective Grilles	
⑩ Battery Housing	

Added Computer & Compass

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Charging The Battery

Duracell Ultra (Dura 12-14F2)

12 Volts 14 Amp Hours AGM

Charging Time: 4-6 hours

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Access The Battery

1: Place Scooter in the vertical position

2: Rotate the nose cone handles 180 degrees

3: Remove the nose cone handles

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Access The Battery

4: Remove the nose cone

5: Remove the buoyancy control chamber

Unscrew the vent plug

(Vent plug unscrewed for travel / storage)

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Access The Battery

6: Attach pump hose

Squeeze pump to release inner nose cone

7: Unplug battery connections

Not Connected during transport / storage

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Access The Battery

8: Remove battery

(I prefer to charge outside of scooter)

9: Connect battery to charger

Connect charger to battery before ac connection of charger

(Charge until red LED blinks)

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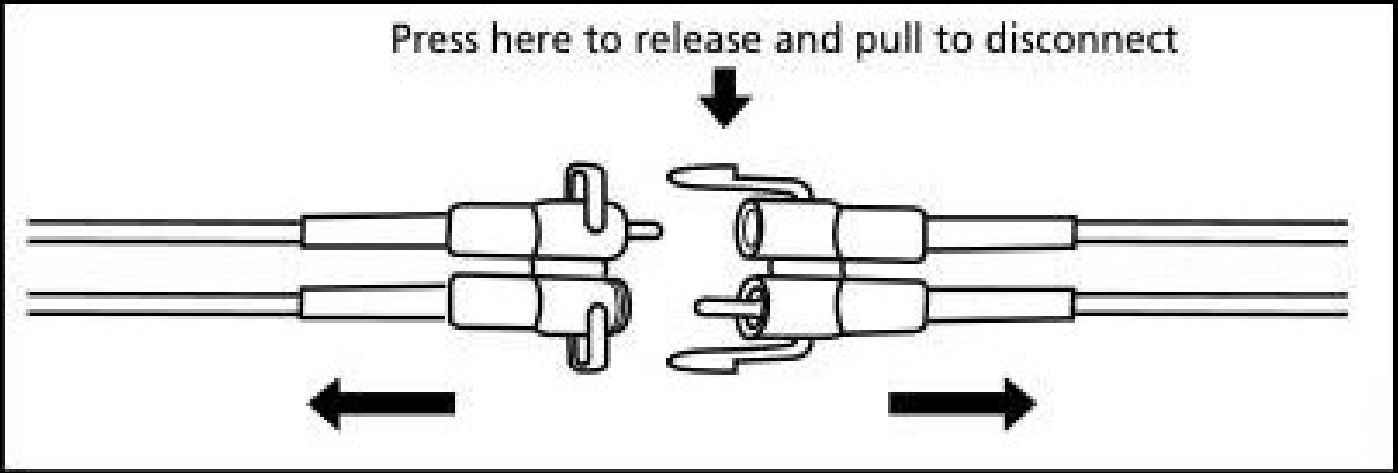
The Battery Connector



Transport / store unplugged

Connect battery to scooter just before use

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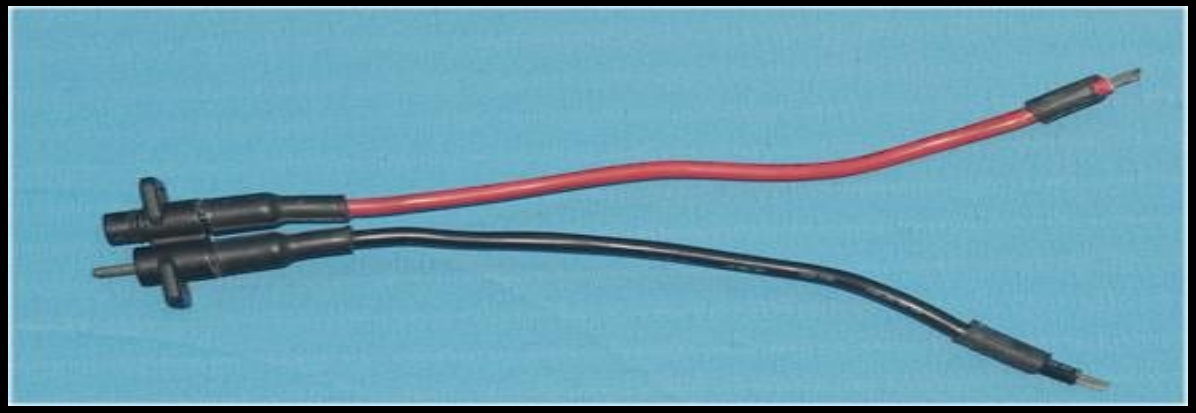
The Battery Connector



Battery Connector As Furnished

Requires soldering to battery terminals

Battery Connector With Soldered Quick-Connects

Saves soldering of connectors to battery

Facilitates changing batteries

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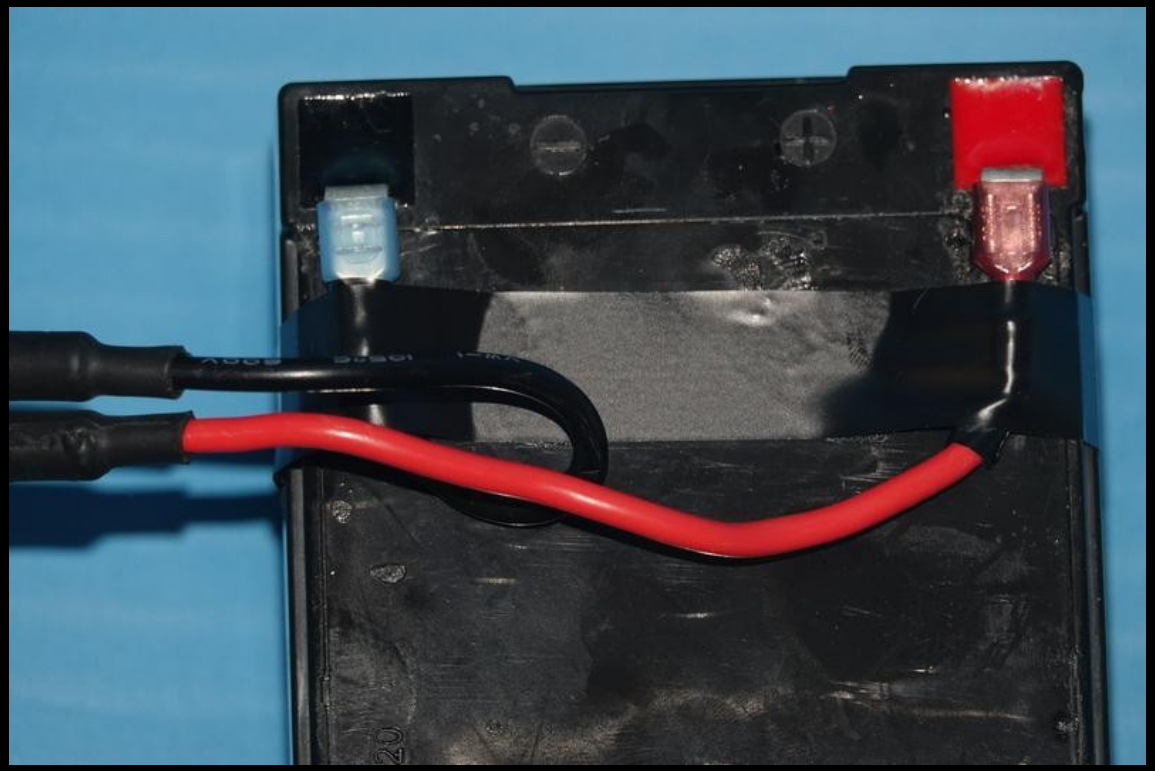
The Battery Connector



After connecting cable to battery
Secure cable with electrical tape

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Battery Charging Precautions

Use only manufacturer's supplied charger
 Other vendors voltage / charging rate may damage battery
First connect battery to charger, then to AC outlet
Charge battery in upright position
No open flames near charging station
Use only correct polarity
 connectors often colored red or black
After charging, wait ~ 30 minutes before use
 Allows any hydrogen gas to properly vent
If traveling, ensure charger is compatible with local AC

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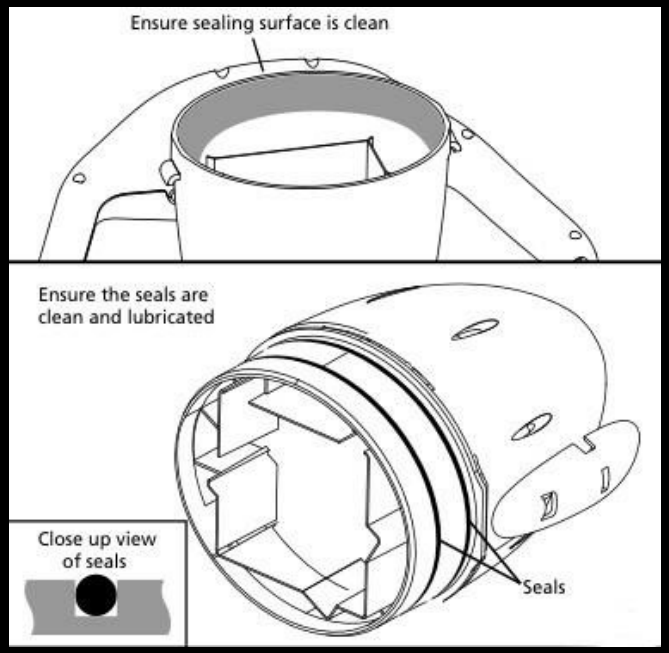
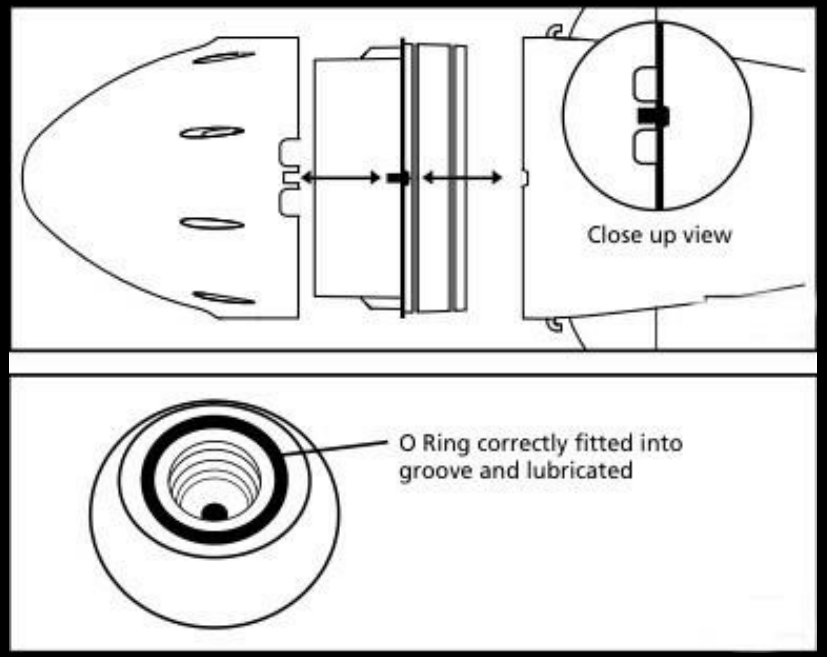
Reassemble the Scooter

Reverse the disassembly procedure

- Replace battery
  - Connect battery for use
  - Leave battery unconnected for transport / storage
- Replace inner nose cone
  - Clean and lightly grease O-rings
  - Connect vent plug for use … finger tight
  - Leave vent open for transport / storage





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Reassemble the Scooter

Continuing to reverse the disassembly procedure

- Replace buoyancy chamber
- Replace nose cone
- Insert handles
- Rotate handles to locking position

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Adjusting Buoyancy

As furnished, the scooter is slightly buoyant

To set as neutrally buoyant:

add rocks to buoyancy chamber (per instruction manual)

or, use handi-lead (177 g)

held in place with aquarium cement)

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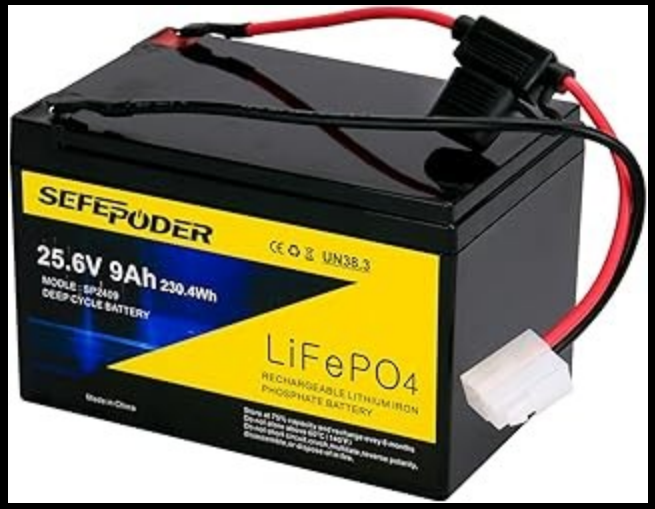
Battery Types



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Lead-Acid Battery
Most Commonly Used

Advantages

Relatively low cost
Partially re-charge without memory loss effect
Recharges easily

Disadvantages

Heaviest batteries
Liquid types restricted air travel
Damaged when totally discharged

NiMH (Replacement for NiCad)
Cadmium = Environmentally toxic

Advantages

Large power to weight ratio
- More power than lead-acid of same weight

No air transport restrictions

No memory issues

Recharges easily

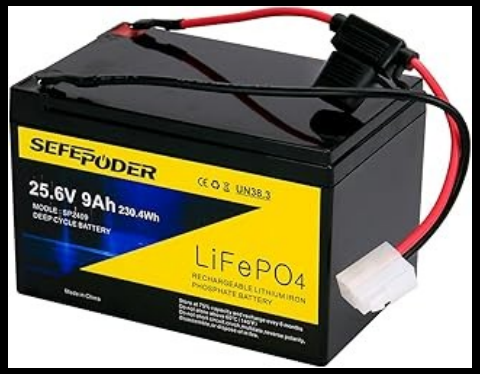
Disadvantages

High initial cost

Requires several charge / recharge cycles prior to use

Must recharge monthly during storage

Lithium Batteries



Advantages

Long cycle life

More power than lead-acid of same weight

Low Toxicity

Thermal stability

No memory issues

Recharges easily

Disadvantages

High initial cost

May not charge when cold

Flat discharge curve

Quality varies wildly across brands

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Maximizing Battery Performance

Charge only according to manufacturer's guidelines
Avoid total discharge of battery
Completely recharge within 24 hours of use
Replace battery when performance declines
Charge battery in cool (50-80 ^{0}F / 10-27 ^{0}C)
Charge in dry, protected space
Charge monthly during long-term storage

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Maintenance

A DPV represents a modest investment
Best to follow manufacture's guidelines to ensure best performance

Guidelines may vary, but most suggest:

- **Clean and lubricate all accessible O-rings**
- **Use freshly charged batteries**
- **Ensure battery port closed prior to use**
  (transport / store with port open)
- **Check operation prior to entering the water**
- **After use, rinse with fresh water, then dry**
- **Recharge battery shortly after use**
- **Store according to manufacturer's guidelines**

Air Transport Considerations

Ensure battery is disconnected

Lock trigger to prevent accidental engagement

Use manufacturer's carrying bag / container

Pad the DPV with foam

(Solid swim noodles can conform to DPV shape)

Expect substantial checked baggage fees

Check air transport battery regulations

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Dive Plans

Plan your dive; dive your plan

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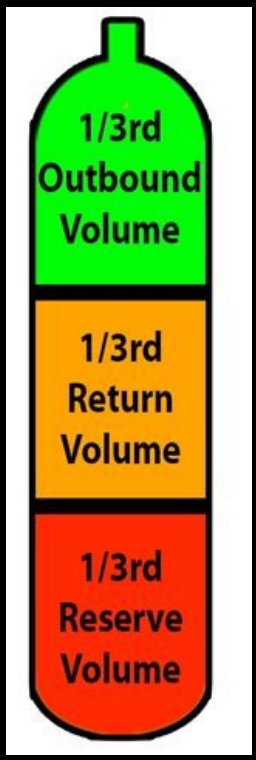
Determine Turn-Around Point

Start dive with fully charged battery
Use slowest appropriate speed to maximize battery endurance

Prime consideration: battery endurance
Secondary consideration: air consumption / deco obligation

Rule of thirds:
1/3 air / battery endurance to destination
1/3 air / battery endurance to return
1/3 air / battery endurance for safety /reserve
Avoid going farther than ability to return towing DPV



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Pre-Dive Procedures

- Fully charge battery
- Clean and lightly grease seals
- Assemble unit
  - battery disconnected for transport
  - battery connected just prior to diving
  - make sure vent is closed
- Inspect prop (no entanglements)
- Test DPV to ensure proper operation
  - Lock master switch to prevent accidental running
- Store out of the sun
  - Use the manufacturer's bag

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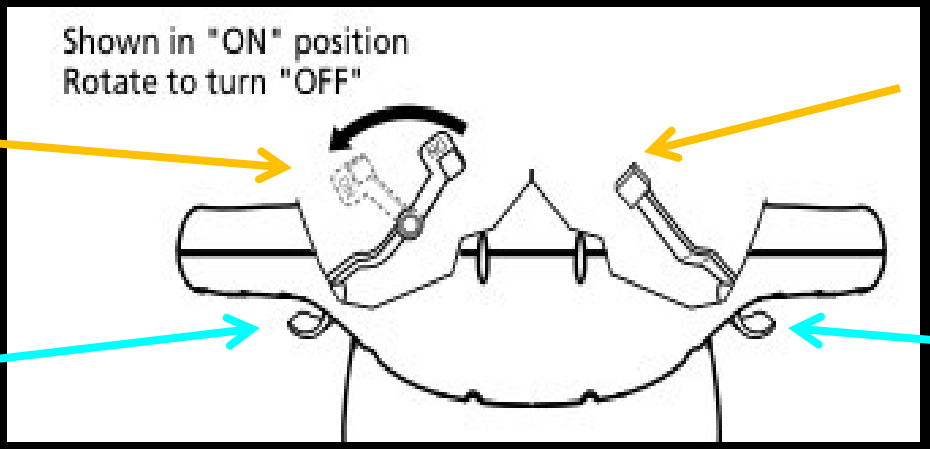
The Master Power Switch



On / Off Switch

Increase Speed Switch

Pull to engage

Pull to engage

Master Power Off
For transport / storage

Master Power On
For use

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Entry Procedures

From Dock:

- Secure DPV prior to entry
- Once in the water, grab the DPV and go diving

From Shore or mild surf:

- Hold DPV to avoid activating the DPV

Wait until at least chest deep to activate the DPV

- Keep prop below the surface

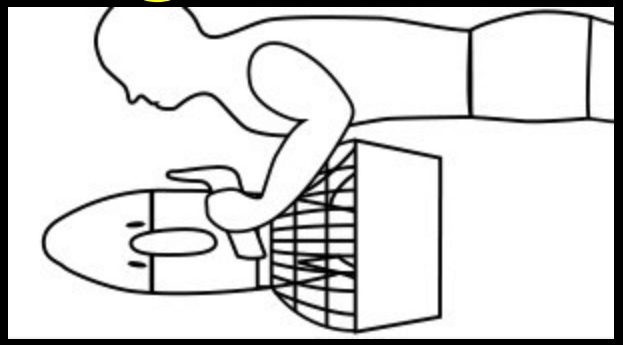
From Boat:

- First enter the water
- Have someone hand you the DPV

or

- Secure DPV ob a gear line prior to water entry

Using the Scooter



Keep scooter below plane of the body

Keeps prop wash below diver

Allows reading gauges

Position easier if elbows locked to body

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Using A Harness

Reduces arm fatigue

Allows One Hand operation

Facilitates brief hands-free contact with DPV

If scooter floods, it will sink … need quick release (snap-shackle)

Secure when not using (avoid prop entanglement)

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Ascent / Descent with DPV

DPV can change depth faster than ability to equalize ear pressures
DPV on rapid ascent increases barotrauma of ascent risk

Best to:

Change depth slowly at < 45 degree angle

If ascent line available:

Turn off DPV, use ascent line as normally practiced

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Descending With DPV
Both hands on DPV For Control

Frenzel Technique
Need Hands Free Equalization of Ear Pressures

Place tongue on the roof of the mouth… as far forward as possible
Hold tongue there
Imagine (‘cause you can’t physically do this):
  Driving the tongue through the top of your head
This “ tongue flick” sends a gentle flow of air up the Eustachian tube

You should hear a “click” in each ear
  From wave of air flow hitting the back of the tympanic membrane

Avoids all the issues with Valsalva
Safest method of equalizing ear pressures

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Buddy Technique

Both divers should have (preferably the same) DPV
Typically, one diver leads, other(s) as “wingman”
Diver without DPV can be towed
(Significantly reduces battery endurance)
Both divers use same speed (if variable speed is an option)
Avoid collision with other divers / underwater objects

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Avoiding Propeller Entanglements

A common issue

Avoid equipment “danglies”

Pay particular attention to SPG console / octopus

Keep DPV below plane of diver to ensure water flow

Take care when in areas of heavy aquatic vegetation

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Steering The DPV

Pivot Turn:

- Hold DPV away from body
- Point DPV in desired direction

Banking Turn:

- Roll body (30-40^0)
- Lift the nose
- Use fins for trim

With Tow Strap

- Like riding a bike
- Steer with handles
- Lean in desired direction

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Riding Tandem

- Transporting divers
  - Increase power drain
  - Used if one diver's DPV fails
- Two Common techniques:
  - Rider grabs towing diver's ankles
  - Rider grabs towing diver's cylinder valve
  - Rider attempts to be as streamlined as possible
- Both agree on signals (usually taps)

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Problem: DPV Fails During the Dive

Major Failure: flooding / battery drain

DPV needs towing back to entry point

- **Small lift bag facilitates long-distance tow**
- **Use Buddy DPV to tow diver/DPV**
  - **For efficiency, one diver behind diver with working DPV**

Immediately end dive

Return to entry / exit point

Extreme conditions (depth / current)

- **May have to abandon DPV**

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Problem: Runaway DPV

Low probability Event

Return to entry / exit point

Move master switch to “off” position

Block prop with rigid object

Keep in-water for cooling

Remove DPV from water

Disable DPV and disconnect battery

No not use until DPV serviced

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Problem: Out Of Air Emergency

Priority: Provide air to out-of-air diver
If necessary, abandon DPV's
With donor ample air, retain DPV's & surface
Swim back to entry / exit point

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Using the DPV On The Surface

General Techniques:

- Keep DPV parallel to body, below the plane of the diver
- Ensure equipment free of possible prop entanglement
- Carry legally proscribed surface marker

Using a snorkel

- Start by kicking to gain momentum, then engage the DPV
- Adjust speed to be comfortable
- Turn head slowly to avoid mask being dislodged by current
- Use minimum drag snorkel
- Keep fins straight and extended

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Exit Procedures

Shore Exit:

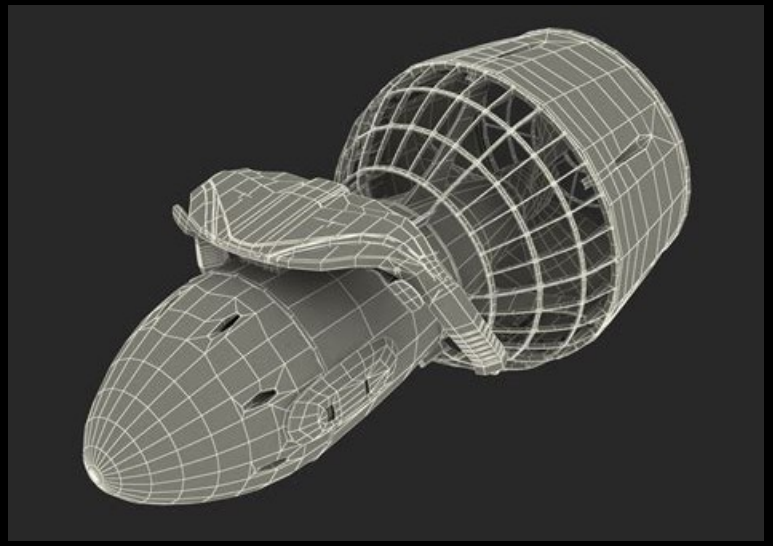
- Hold DPV so that power is not accidentally engage
- Remove fins for stability when walking

Boat Exit:

- Hand DPV to someone prior to exit
- Enter the boat
- If using tether line, make sure DPV is recovered

Post-Dive

Secure the DPV
Rinse with fresh water
Dry
Disconnect the battery for transport
Recharge battery as soon as possible



Protect the Underwater Environment

Dive carefully to protect fragile aquatic ecosystems
Keep dive gear from dragging across sea bottom / reefs
Keep skills sharp (continuing diving / continuing education
Avoid harmful interactions with aquatic life
Be an eco-tourist
Take nothing but pictures; leave nothing but bubbles
Be aware of fin tips dragging on the bottom
Respect underwater heritage
Report environmental disturbances to authorities
Set a good example



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