



PFD Technology and Wearability

Presented to you by: the PFD Manufacturers' Association

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What is boating?

- Different People
- Mindsets
- Objectives
- Ambitions
- Boating conditions
- Extremes of water temperature
- Weather conditions
- All of the above

Boating....



Boating...



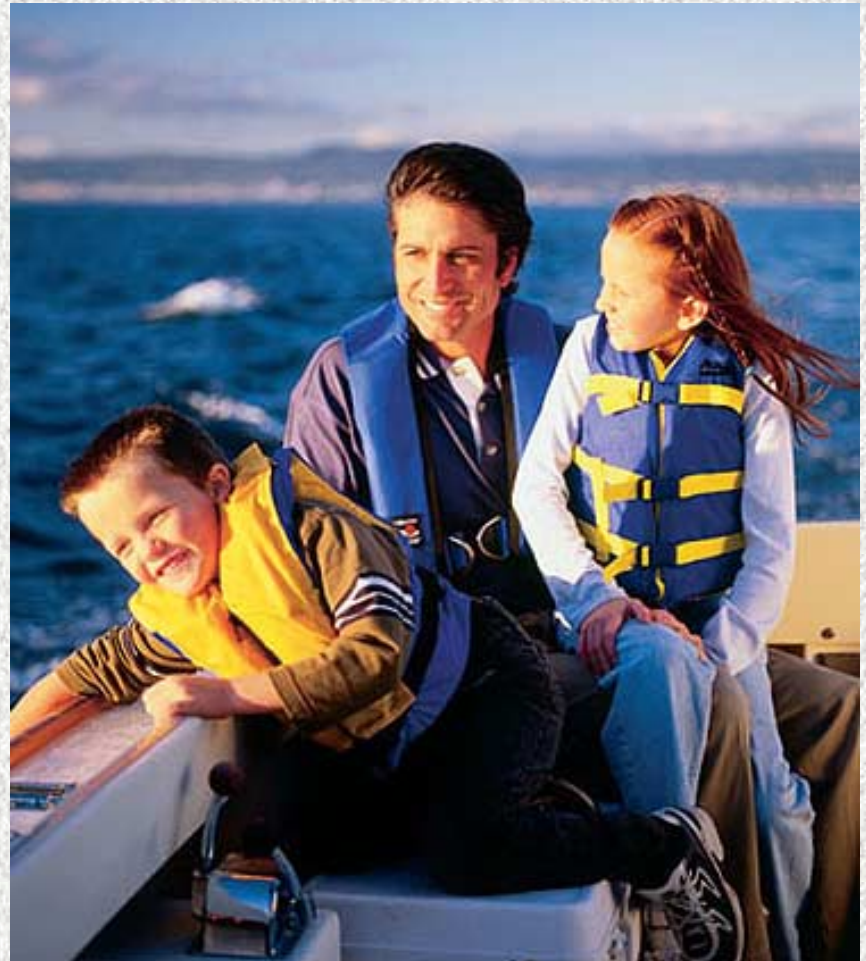
Boating....



Boating....



Boating....



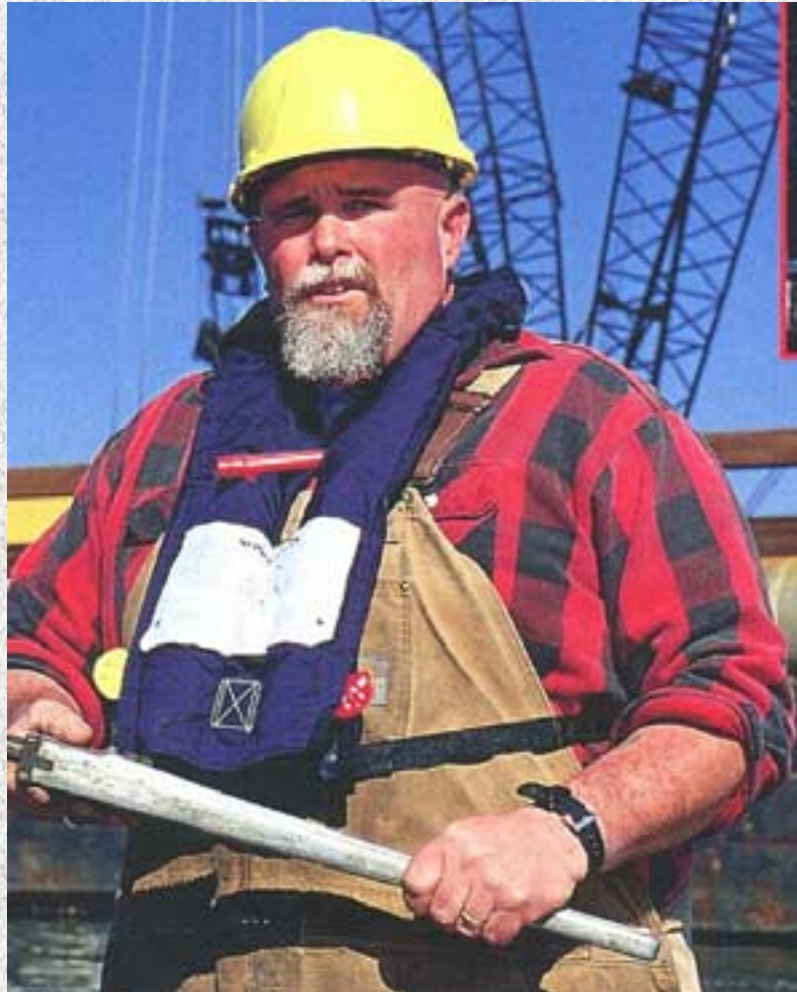
Boating....



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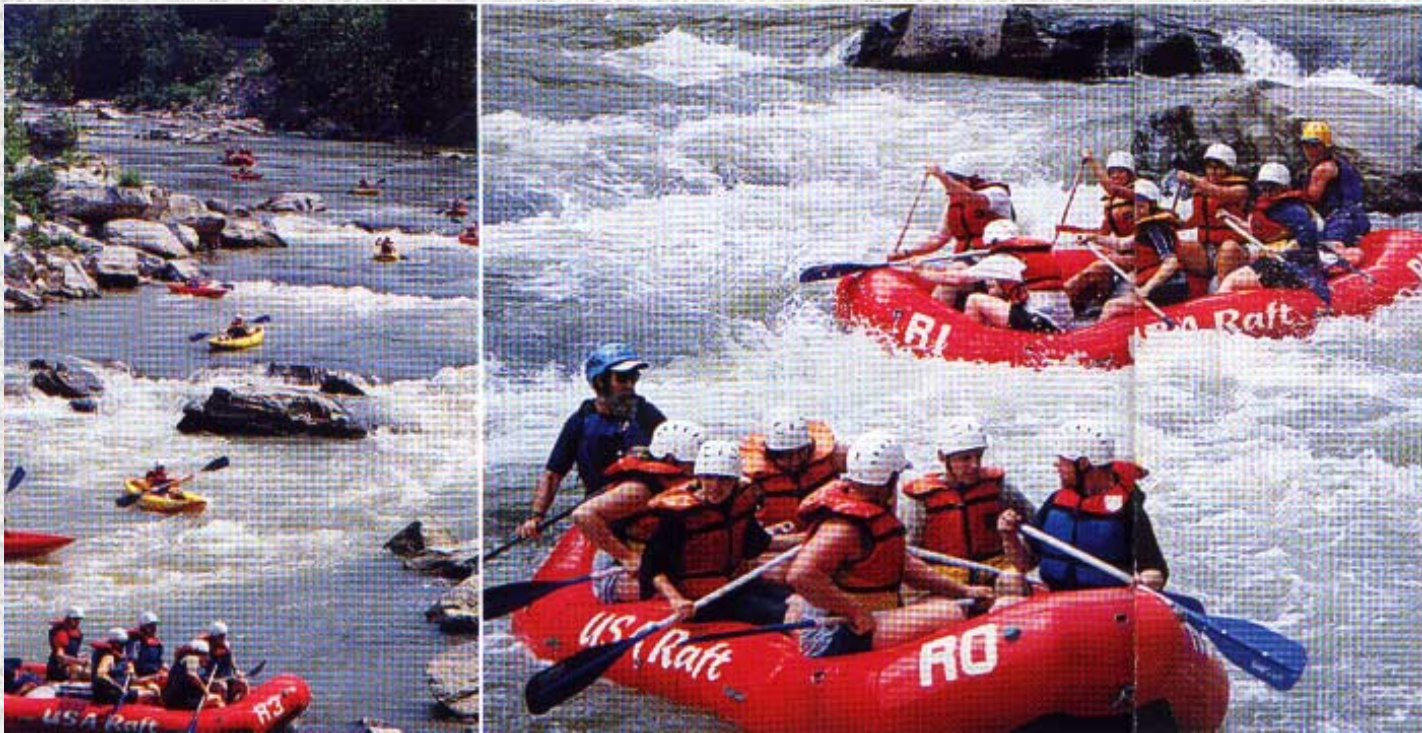
Boating....



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Boating....



Boating....



Boating....





The Perfect PFD

- Always protects the airway -- Effective
- Always ready to work -- Reliable
- Always "on" -- Worn or Wearable

(100%E × 100%R × 100%W = Perfect PFD)

- Does the perfect PFD exist? -- NO
- Can it exist? -- Probably not

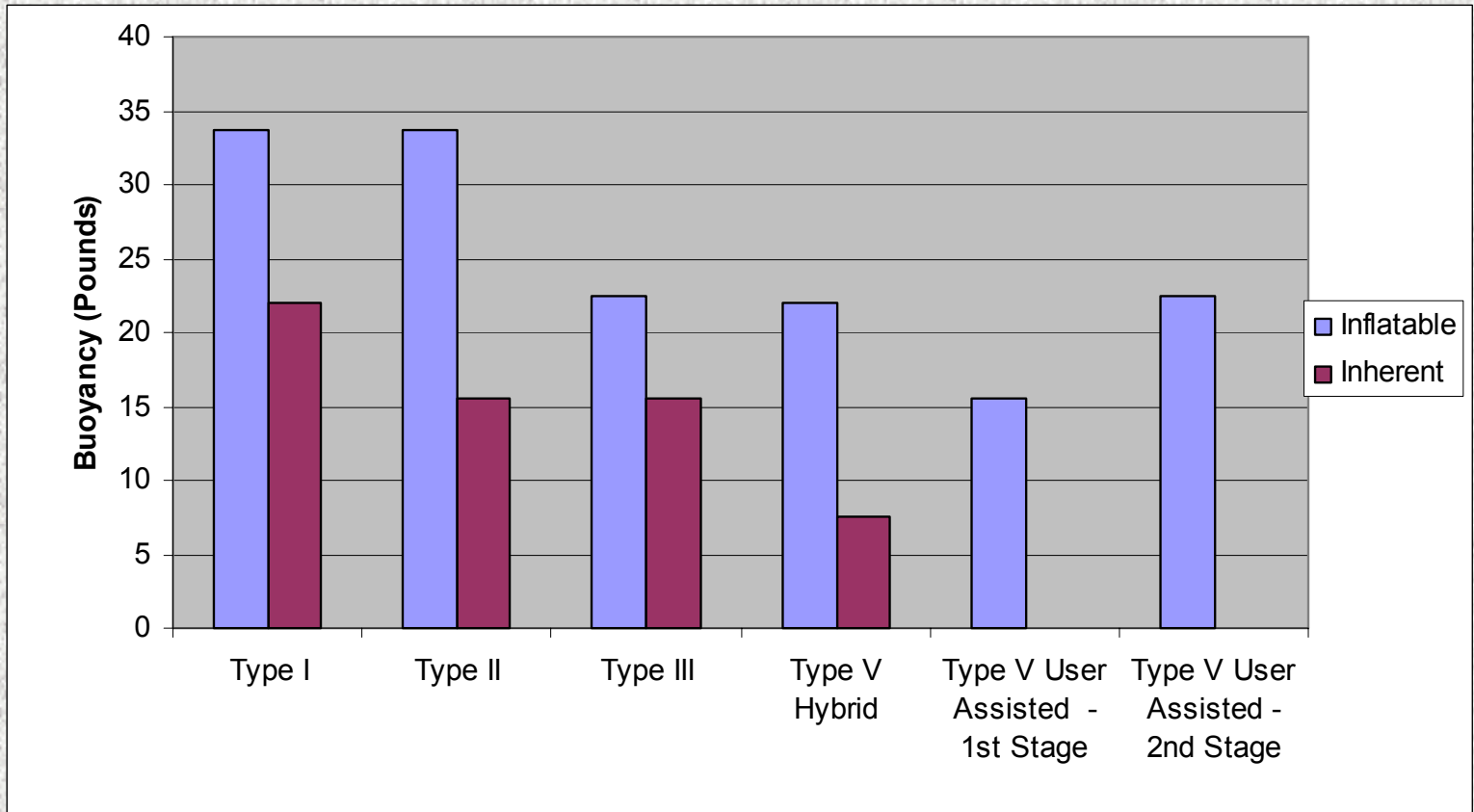


PERFORMANCE

Effectiveness and Reliability....

Let's examine the requirements.

Adult Buoyancy (minimum)



*Other Type V Performance will vary based on conditions of approval.

Recreational Hybrid Buoyancy



| Size | Type | Min. Buoyancy (Pounds) | |
|-------|----------|------------------------|-------------------|
| | | Inherent (Foam) | Inflated Total |
| Adult | I | 15.5 | 32 |
| Adult | II & III | 10 | 22 |
| Adult | V | 7.5 | 22 |
| Youth | I | 11 | 18 |
| Youth | II & III | 9 | 15 |
| Youth | V | 7.5 | 15 |
| Child | I | 9 | 15 |
| Child | II | 7 | 12 |





Face-up Turning: (Minimum Self-righting Requirement)

| | Type I | Type II | Type III |
|------------|----------------|-------------------------|-----------------|
| Inflatable | 100% in 5 sec. | 96% in 5 sec. | 80% in 6.5 sec. |
| Inherent | 70% in 6 sec | T-II reference + 2 sec. | Not Required |

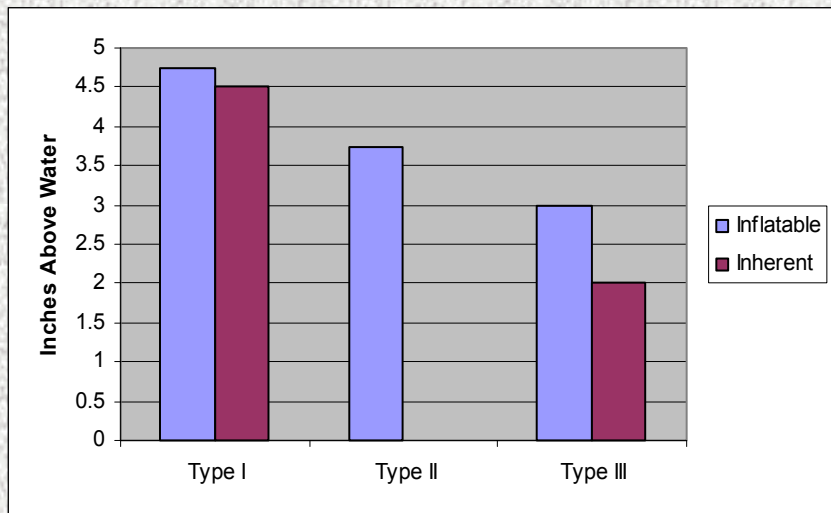
Adult Universal tested on 18 subjects of diverse sizes (30” to 52” chest) and shapes.

- * Type V Performance will vary based on conditions of approval.
- Type V Hybrid with Type II performance: Type V reference +2 seconds.
- Type V Hybrid with Type III performance: Not required.
- Type V User Assisted: 80% in 6.5 seconds, or = to reference vests.

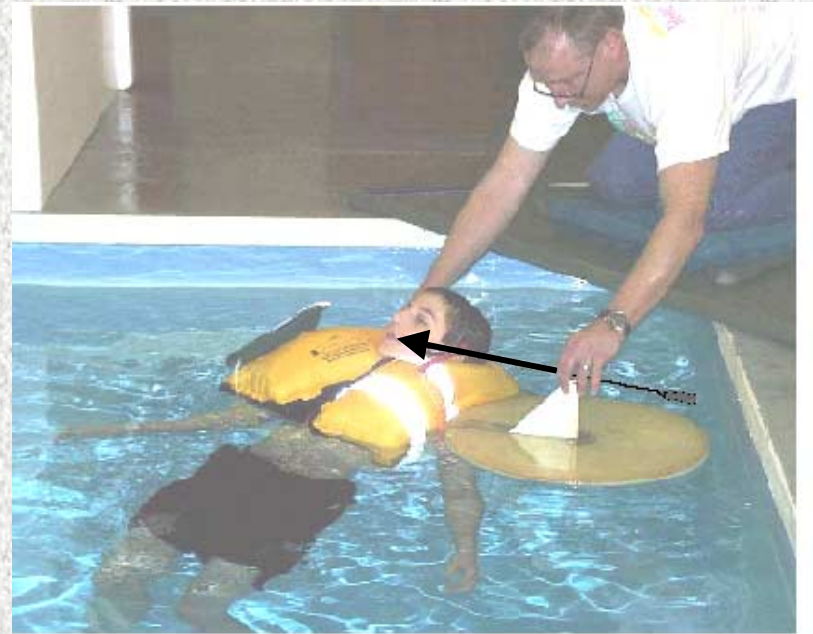
Refer to the PFD Label for which type of PFD the device may be substituted to meet the carriage requirement.

Freeboard

Water to Mouth Height - Minimum Average



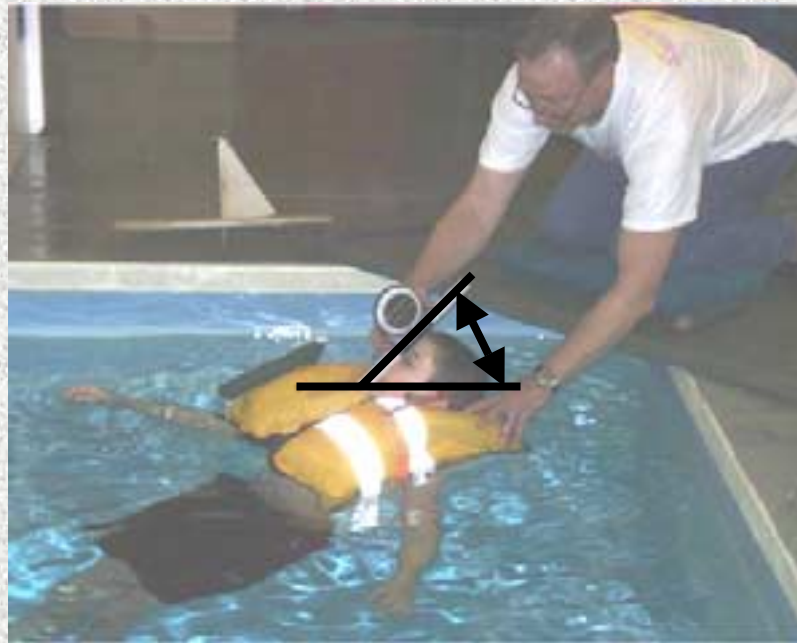
| | Type I | Type II | Type III |
|------------|--------|-----------------|----------|
| Inflatable | 4.75 | 3.75 | 3 |
| Inherent | 4.5 | reference - 1/4 | 2 |



- *Type V Performance will vary based on conditions of approval.
- Type V Hybrid: Deflated Freeboard ≥ 1 " and when Inflated:
Hybrid reference vest average - 1/4" for Type II performance,
or 2" for Type III performance.
- Type V User Assisted: Freeboard ≥ 1 " when 1st Stage Inflated,
or 2" for 2nd Stage Inflated.

Face Plane Angle

Minimum Average Above Horizontal

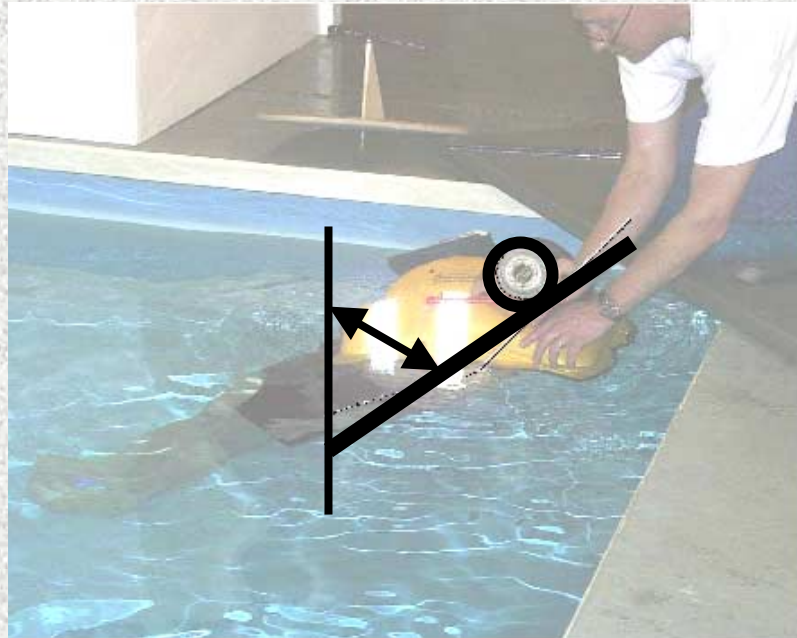


| Face Plane | Type I | Type II | Type III | Type V Hybrid (Type II) | Type V Hybrid (Type III) | Type V User Assisted |
|------------|--------|----------------|----------|-------------------------|--------------------------|----------------------|
| Inflatable | 30 | 20 | N/A | >20 and > reference | N/A | N/A |
| Inherent | 30 | > reference -5 | N/A | | | |

*Other Type V Performance requirements will vary based on conditions of approval.

Body Torso Angle

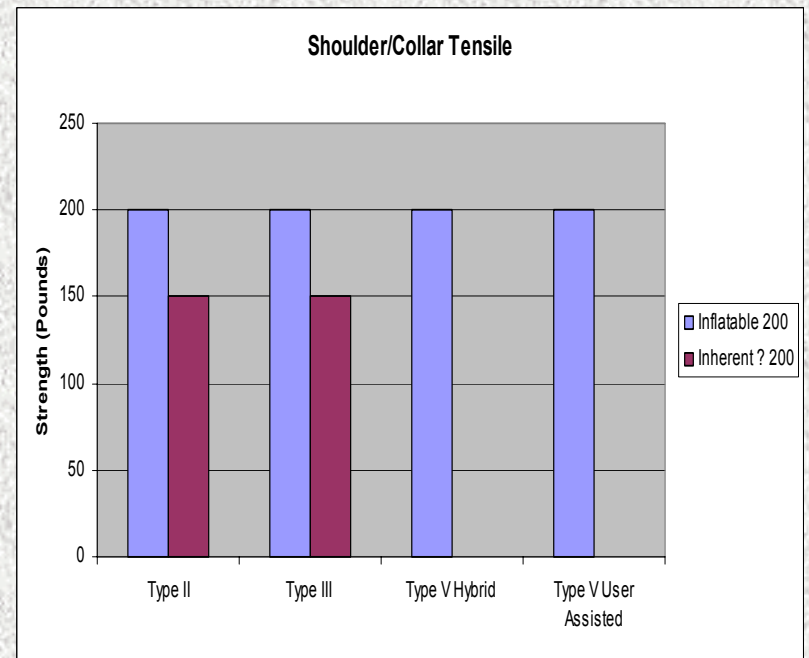
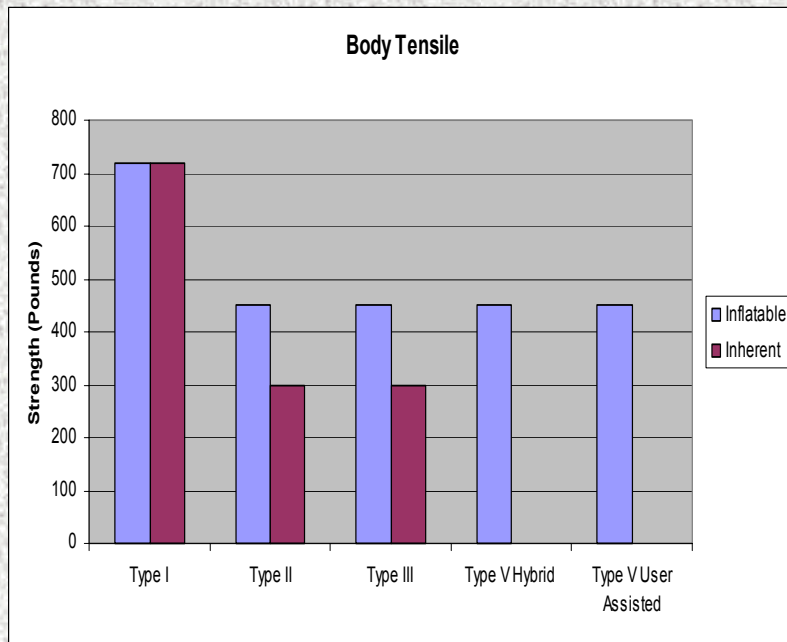
Average Back of Vertical



| | | | |
|------------|------------|---------|----------|
| Body Torso | Type I | Type II | Type III |
| Inflatable | 30 min | 30 min | 0 min |
| Inherent | >reference | 0 min | 0 min |

*Type V Performance requirements will vary based on conditions of approval.

Tensile Strength (Minimum)





Other Tests (examples)

- Donning
- Water entry (jump)
- Water emergence
- Dynamic strength
- Ride-up
- Pocket flotation stability
- Flame exposure
- Water retention
- Hardware secureness
- High/low temperature
- Solvent exposures
- Weathering exposure
- Tear strength
- Seam strength
- 6 weeks soil burial
- Pamphlet strength of attachment



Design Considerations

Affordability

Effectiveness

Reliability

Wearability

In-Water Performance

Durability

Size of User

Ease of Donning

Strength

Softness

User Activity

Puncture Resistance

Abrasion

Visibility

Flame Resistance

Convenience

Climate (hot/cold)

Color-fastness

Non-Restrictive

Ease of Use

Compression

Body Coverage

Pockets

Solvent Exposure

Light Weight

Product liability



Financial Commitment \$\$\$

- Internal product development
- UL testing
- UL Follow-up inspection
- Delayed product introduction
- Marketing
- Production tooling
- Material acquisition
- Labor costs
- Factory expenses
- Inventory
- Distribution

How it used to be...





Do I want to wear this?





Or This?





You Have Other Options....

- Let's take a look at a few.
- There are PFDs...

To Keep You Warm...



To Keep You Cool....



and to keep you "Really Cool"



Specialized Applications



Inflatables





What Is An Inflatable Device?

- Traditionally, Personal Flotation Devices use inherently buoyant materials, such as foam, to stay afloat. Inflatable PFDs, as their name indicates, rely on inflatable chambers that provide buoyancy when inflated. Uninflated, they are less bulky than inherently buoyant PFDs. Inflatables come in a variety of USCG defined PFD Performance Types. The specific type of PFD is determined by characteristics like the amount of buoyancy, its in water performance and the type of inflation mechanism used. All inflatables share these same basic components:
 - An air holding chamber
 - An inflation tube to add air to a chamber orally, as well as to deflate a chamber
 - A source of compressed gas, usually CO₂ (not required on some hybrid designs)
 - An inflation mechanism to discharge the gas from the cylinder into the chamber

Second Stage Donning



| | Type I | Type II | Type III | Type V Hybrid | Type V User Assisted |
|------------|-------------|-------------|---------------|---------------|----------------------|
| Inflatable | Not Allowed | Not Allowed | Yes - Allowed | Some* | Yes - Allowed |
| Inherent | N/A | N/A | N/A | N/A | N/A |



*Type V donning requirements will vary based on conditions of approval.



Inflation Mechanisms

| Feature | 1F | 2F | 3F | 6F |
|--------------------------------------|--------------------|---------------------|---------------------|---------------------|
| Manual/Automatic | Required | Required | Not Allowed | Not Required |
| Manual Only | Not Allowed | Not Allowed | Allowed | Allowed |
| Cylinder Seal Indicator | Required | Required | Required* | Not Required |
| Single Point Status Indicator | Required | Not Required | Not Required | Not Required |

*This upgraded feature became required for 3F inflators effective 9/1/02.



Activation Method

Manual/Automatic - Cylinder is pierced when “Jerk to Inflate” handle is pulled or Automatically when submerged in water.

Manual - Cylinder is pierced only when “Jerk to Inflate” handle is pulled.

Cylinder Seal Indicator

Shows “ready” status
without cylinder removal.

Red “STOP”

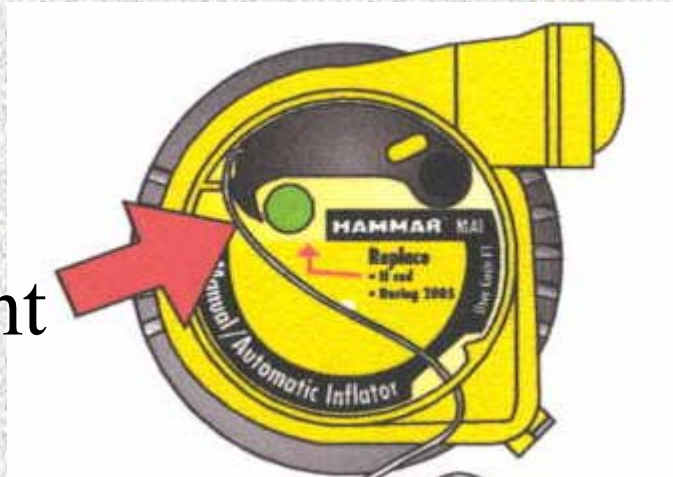
Green “GO”

Red indicates this cylinder has
been fired and must be replaced.



Status Indicators

Single Point



Multi-Point





1F Inflator

- Manual/Automatic actuation
- Cylinder Seal Indication
- Single Point Status Indicator - Must be Visible Before and After Donning

Tested to 120 degrees F @ **95%** RH

1F Inflator

Green "GO"
Red "STOP"



Single Point
Status Indicator



1F Inflator

Green "GO"



Single Point
Status Indicator

Red "STOP"



1F Inflator



**Single Point
Status Indicator**

Red "STOP"

Green "GO"



2F Inflator

Manual/Automatic actuation

Cylinder Seal Indication Required

Multi-Point Status Indicators Allowed

All Indicators Activate Simultaneously

Tested to 120 degrees F @ **80%** RH

Indicators Must be Visible Before and After Donning

(There are currently none approved.)



3F Inflator

Manual Only

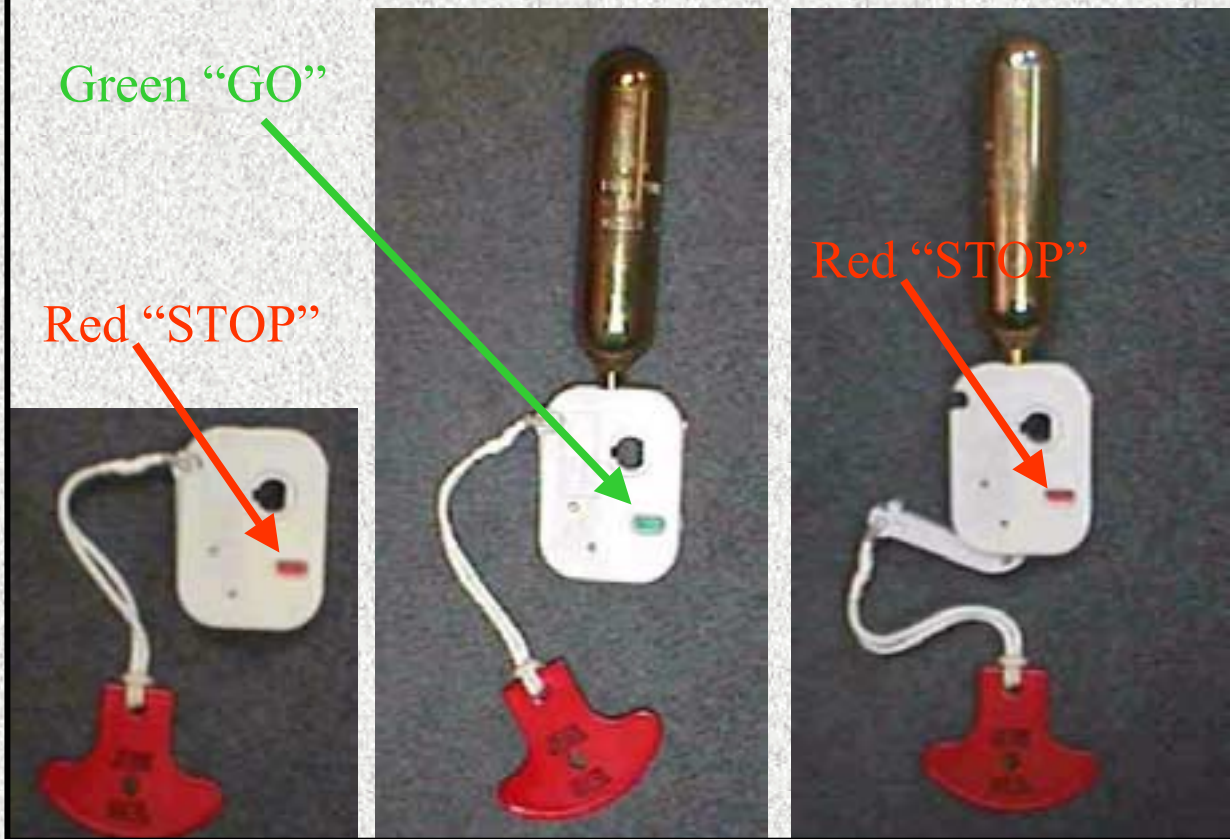
Cylinder Seal Indicator

Multi-Point Indicators Allowed

Indicators Must be Visible Before and After Donning

3F Inflator

Manual With Cylinder Seal Indicator



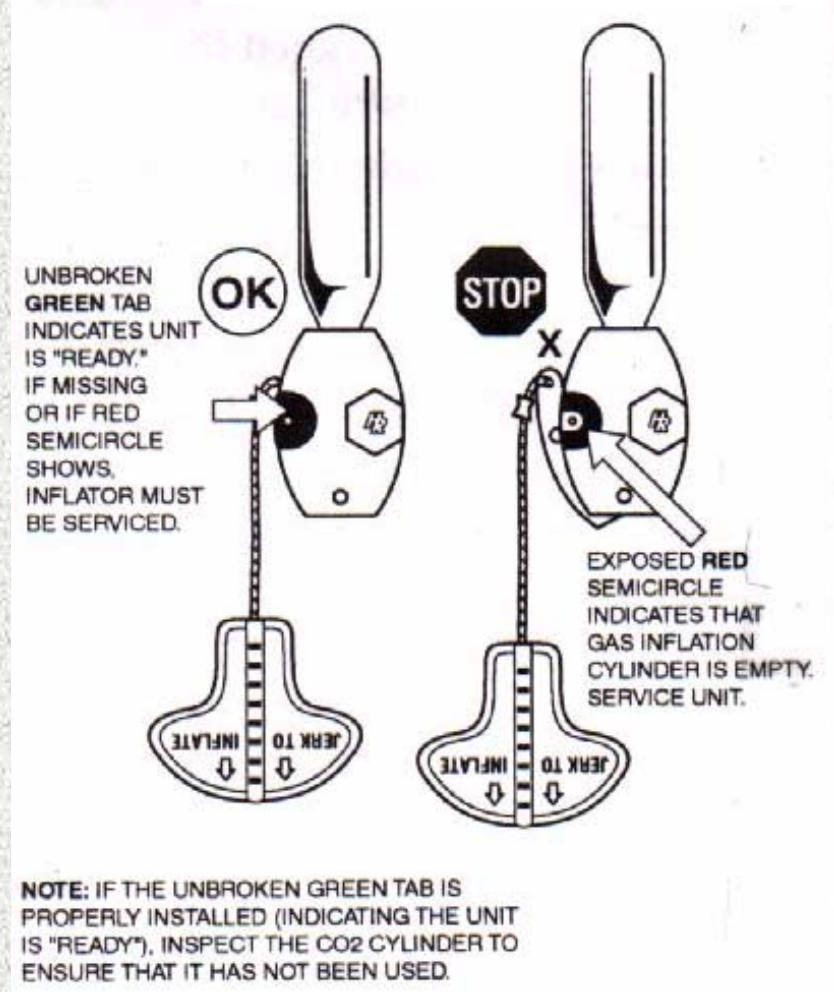


6F Inflator

Manual or Manual /Automatic
NO Cylinder Seal Indicator
Multi-Point Indicators Allowed

Man./Auto. Tested to 120
degrees F @ **80%** RH

6F Manual Inflator



6F Manual/Automatic Inflators



Multi-point Indicators

Green "GO"
Red "STOP"





Inflatable Device Components

| | Type I | Type II | Type III | Type V Hybrid (Type II) | Type V Hybrid (Type III) | Type V User Assisted |
|-------------------|-----------|--------------|-------------------|-------------------------|--------------------------|----------------------|
| Multiple Chambers | Required | Not Required | Not Required | Not Required | Not Required | Not Required |
| Retro-Reflective | Required | Not Required | Not Required | Not Required | Not Required | Not Required |
| Inflator Type | 1F and 3F | 1F and 2F | 1F, 2F, 3F, or 6F | 1F and 2F | 1F, 2F, 3F, and 6F | 1F, 2F, 3F, and 6F |

Inflation Mechanism Types

| Feature | 1F | 2F | 3F | 6F |
|-------------------------------|-------------|--------------|--------------|--------------|
| Manual/Automatic | Required | Required | Not Allowed | Not Required |
| Manual Only | Not Allowed | Not Allowed | Allowed | Allowed |
| Cylinder Seal Indicator | Required | Required | Required* | Not Required |
| Single Point Status Indicator | Required | Not Required | Not Required | Not Required |

6F inflators are only permitted for use on Type V devices that are required to be worn to meet the carriage laws.



Frequently Asked Questions

1. Is there an age requirement for inflatables?

Yes. Inflatables are only approved for use by people 16 years and older. People under the age of 16 must have inherently buoyant or hybrid device in their size range on board the boat to meet the carriage requirements. At some point in the future there may be standards developed for children's inflatables.

2. Are inflatables approved for all boating activities?

No. Fully inflatable PFD's are not approved for high speed applications such as riding a PWC, water-skiing, or tubing. For these activities the user needs buoyancy while in the water, and it is not reasonable to expect that the wearer would stop, deflate the chamber, rearm the inflator and repack the PFD after each water entry or wetting, which is routine during these activities.



Frequently Asked Questions

3. Are Inflatables type V's required to be worn?

The answer is the same for any Type V. You must read the PFD label and understand the special conditions of the Type V. The label will say whether or not that particular PFD needs to be worn.

4. Can I use my CO2 Cylinder more than once?

No. Once the cylinder has been punctured all of the gas will escape. This is why you should check whether the cylinder is full before each outing, If there is no gas you cannot inflate the device. If you can not inflate the device, it will not provide you with any buoyancy.



Frequently Asked Questions

5. Will any CO2 Cylinder work?

No. It is important to use a rearm kit that includes a cylinder that is supplied by the maker of the vest. There are a variety of CO2 cylinders in stores for various uses. They may not be of the correct weight (grams of CO2), or they may not have the correct thread size. The correct cylinder to use will be indicated on the PFD itself and in the Owners Manual, or can be obtained by calling the PFD manufacturer.

6. How long will my CO2 Cylinder last?

A CO2 cylinder does not have a shelf life as such. They are specially coated to reduce the chance of rusting. During routine maintenance, you should check for any signs of rust. If there is any rust, you should replace the cylinder at once.



Frequently Asked Questions

7. How often should I replace the water sensing element?

Different manufacturers use different manual/automatic mechanisms. Read the owners manual carefully to understand the maintenance.

8. Can I convert my manual/automatic to a manual only device?

No - unless it is a Type V PFD with specific instructions on the label and in the owner's manual on how this is done for the mechanism it uses. Converting a PFD not specifically approved for this purpose violates the regulations that require a PFD to be serviceable in order to meet the carriage requirements.



Frequently Asked Questions

9. How should I maintain my inflatable?

Before each outing, you should check to be sure that the CO2 cylinder is full. If your device has a cylinder seal indicator, it will show GREEN if the cylinder is full. If it shows RED, you must replace the cylinder. If there is no cylinder seal indicator, you must unscrew the cylinder and visually examine the seal to be sure that it has not been broken. Every three months you should examine your PFD using the guidelines in the Owners Manual. This should include checking the fabric and belts for any abrasion or other signs of deterioration, checking the hardware to be sure that it has not been broken, and orally inflating the PFD to see that it holds air overnight without softening.



Frequently Asked Questions

10. I do not know how to swim. Should I use an inflatable?

No. A non-swimmer could panic in an unexpected fall into the water, and forget that they may need to activate the inflator mechanism. Non-swimmers would be advised to use an inherently buoyant or hybrid PFD that provides flotation without any action on their part.

11. How long will an inflatable PFD remain inflated?

CO₂ gas from the cylinder will permeate the chamber fabric over time. If you are in the water for a long time, it may be necessary to top off the inflatable orally, by blowing air in through the oral tube.



Frequently Asked Questions

12. Can I use my inflatable in very cold conditions?

At or below 40 degrees F, automatic activation and inflation time using CO2 gas will be longer. Wearing a partially inflated PFD in these conditions will provide some initial buoyancy while the PFD fully inflates.

CAUTION: Do not fully inflate orally and then inflate with a CO2 cylinder. Repeated CO2 inflation after oral inflation may damage the PFD to the point that it will not hold air.



Confused???

Don't be.

Just remember to check the PFD label and its attached PFD Pamphlet and other literature. If the PFD is an inflatable, it will also have an Owner's Manual attached to thoroughly describe its features and approval limitations.

PFDMA - Promoting Boating Safety



- National Safe Boating Council
- National Association of State Boating Law Administrators
- UL Standards Technical Panel
- International Standards Organization
- PFD University training classes
- Facts About Life Jackets booklet
- Lifejackets Today video
- Link between retailers and safety organizations



Conclusion

Whether you choose an inflatable or an inherently buoyant PFD, choose to WEAR IT! Your life depends on it!