WGS970

Solid Floater PVC Oil Boom

Operation and Maintenance Manual

Directory

WGS970 Solid Float PVC Oil Boom Operation and Maintenance Manual

1.Introduction

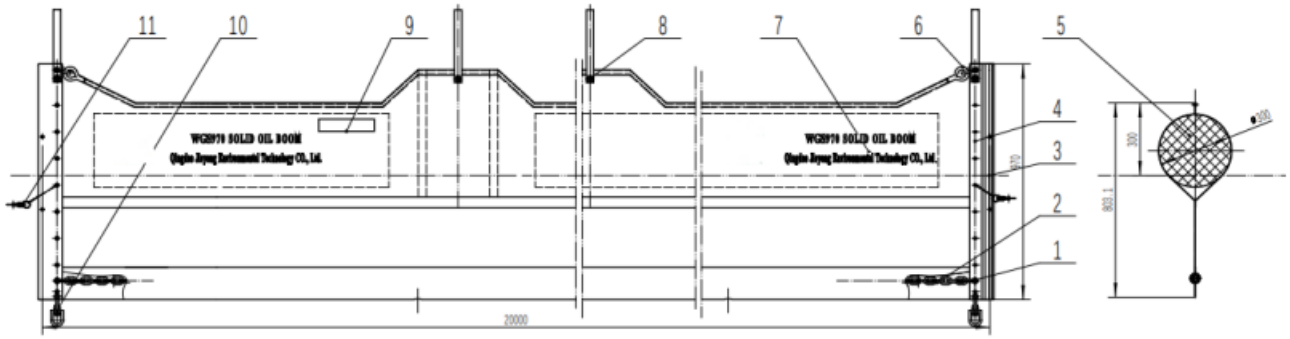
WGS970 Solid Float PVC Oil Boom is designed for containing oil spills on water surfaces and direct the flow of spilled oil, facilitating its recovery. The boom has excellent structural design, capable of containing oil on both sides, with a high float-to-weight ratio, good wave-riding ability, and strong oil retention capacity. It can intercept various types of oils such as diesel, marine fuel oils, heavy and medium crude oils, and light oils.

The WGS970 Solid Float PVC Oil Boom is a general-purpose, horizontal foam solid float, high-strength, double-sided PVC-coated boom, featuring strong resistance to wind and waves, durability, ease of use, and easy cleaning and maintenance, making it suitable for long-term deployment in water.

The WGS970 Solid Float PVC Oil Boom is applicable in ponds, lakes, rivers, harbors, and coastal waters.

Besides intercepting and guiding oil spills, it can also be used to contain certain chemical liquids, clean floating debris, and protect specific water areas.

2.Structure and Features



1. Shackle 12
2. 10mm Counterweight chain
3. ASTM F962 Z-Type Connector
4. Clamping Plate
5. PE Float
6. 304 Plastic Coated Steel Wire Rope
7. PVC Plastic-Coated Fabric
8. Handle
9. Reflective strip
10. Quick Release Pin Assembly

11. Stainless Steel OX-type Swivel Anchor Point

The structure and component names of the flexible PVC oil boom

The oil boom is made of high-strength PVC-coated fabric that is resistant to aging, oil, UV rays, and seawater, using high-frequency welding technology to form an oil barrier both above and below the water. A stainless steel wire rope is welded along the top of the boom and connected to the Z-type connector, serving as a tensile component to bear the pulling force. The upper part of the boom features polyethylene floats, with the flexible floats being cylindrical. The section of the boom below the float is called the skirt, and a high-strength counterweight chain wrapped in PVC fabric is attached to the bottom of the skirt, helping to maintain the vertical position and a certain underwater depth of the boom in the water. This also acts as a longitudinal tension element, bearing the force exerted by water flow and wind on the oil boom. The upper stainless steel wire rope and the bottom counterweight chain serve as two longitudinal tension elements to withstand the forces from water flow and wind on the boom. The Z-type connectors at both ends meet the ASTM F962 standard, used for connecting boom sections.

A section of the oil boom consists of 12 floats and is typically 20 meters long. Anchor points are located at both ends of the section for connecting anchor ropes when deploying the boom.

3.Performance and Main Technical Parameters

Model	WGS970
Total Height	970mm
Above Water Height	300mm
Below Water Height	500mm
Section Length	20m
Plastic-Coated Fabric	PVC coated fabric weight >900g/㎡, color: orange
Float	The float is made of closed-cell polyethylene (PE) material, forming a foam cylindrical float
Connecting Components	Bolts, nuts, washers, shackles, swivel rings, wire ropes, quick-release pins, etc., are made of 304 stainless steel
Connection	Complies with ASTM F962 (“Z” type connector) standard
Joint connection	The "Z" type connector is secured with two 304 stainless steel quick-release pins
Weld	Manufactured using high-frequency welding
Counterweight chain	The counterweight chain complies with DIN 763 standard
Anchor Point	The lower part of the ASTM Z-type joint connection features 2 anchoring points made of 304 stainless steel.

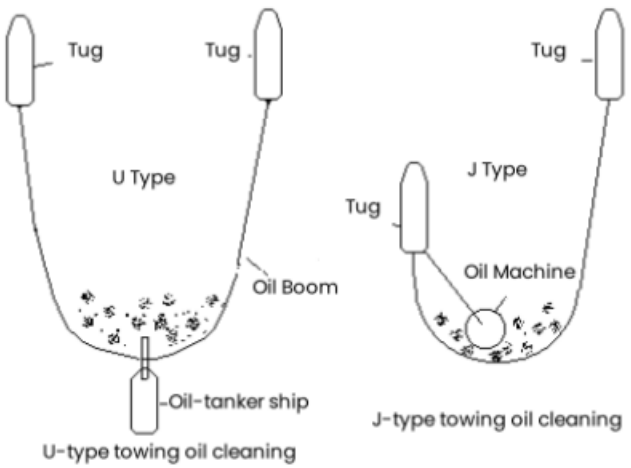
Floating Weight Ratio	Buoyancy Ratio 8.06:1. Recorded by contractor.
Reflective strip	Equipped with reflective film according to SOLAS cellular maritime standards.
Handle	The top of the oil boom has 13 lift handles with a spacing of approximately 1550 mm.
Wire Rope On The Top	The top of the oil boom includes a lifting rope made of 8 mm diameter PVC-coated 304 stainless steel wire rope.
Tractor	Each 200 meters of oil boom is equipped with 2 sets of tow heads. The tow rope is made of polypropylene, with a diameter of 24 mm and a length of 20 m.
Max Wave Resistance	2m
Max Wind Speed	20 m/s
Max Current Speed	2 Kn
Storage Temp Range	-20～50℃
Tensile Strength	40 kN
Packaging	1.55*1.5*1.0m(20m)
Section Weight	105kg

4.Usage

1.Oil Boom Drag and Oil Sweeping

Commonly used methods include U (V) type and J type double-vessel towing (see diagram on the next page), or single-vessel towing. The oil boom can be towed from both sides, with a single vessel being able to tow a width of several meters to tens of meters. For double-vessel towing, the oil boom can extend to several hundred meters. The towing speed should not be too high, generally less than 1.0 meters/second (2 knots), and should also be determined based on the tensile strength along the length of the oil boom.

The calculation of the total towing force F is as follows:



1) Water resistance can be calculated using formulas (1) and (2):

$F_c = 98.242 A_c V_c^2 g$..... (1)

$A_c = I_c d$ ..... (2)

Where:

F_c -- the water resistance, in Newtons (N).

A_c -- the projected area of the oil boom below the water surface in the direction of the current, in square meters (m^2).

I_c-- the projected length of the oil boom in the direction of the current, in meters (m).

d is the draft of the oil boom, in meters (m).

V_c -- the relative velocity of the oil boom with respect to the water, in meters per second (m/s).

g --the acceleration due to gravity, in Newtons per kilogram (N/kg), generally taken as **g**=9.8 N/kg.

2) Wind resistance can be calculated using formulas (4) and (5):

$F_w = 98.242\ A_w (V_w/40)^2 g$.....(4)

$A_w = I_w h$ ..... (5)

Where:

Fw--the wind resistance, in Newtons (N).

Aw--the projected area of the oil boom above the water surface in the direction of the wind, in square meters (m^2).

Iw--the projected length of the oil boom in the direction of the wind, in meters (m).

h--the freeboard of the oil boom, in meters (m).

Vw--the relative velocity of the oil boom with respect to the wind, in meters per second (m/s).

3) The total load from wind and water flow is:

$F = F_c + F_w = 98.242 A_c V_c^2 g + 98.242\ A_w (V_w/40)^2 g$

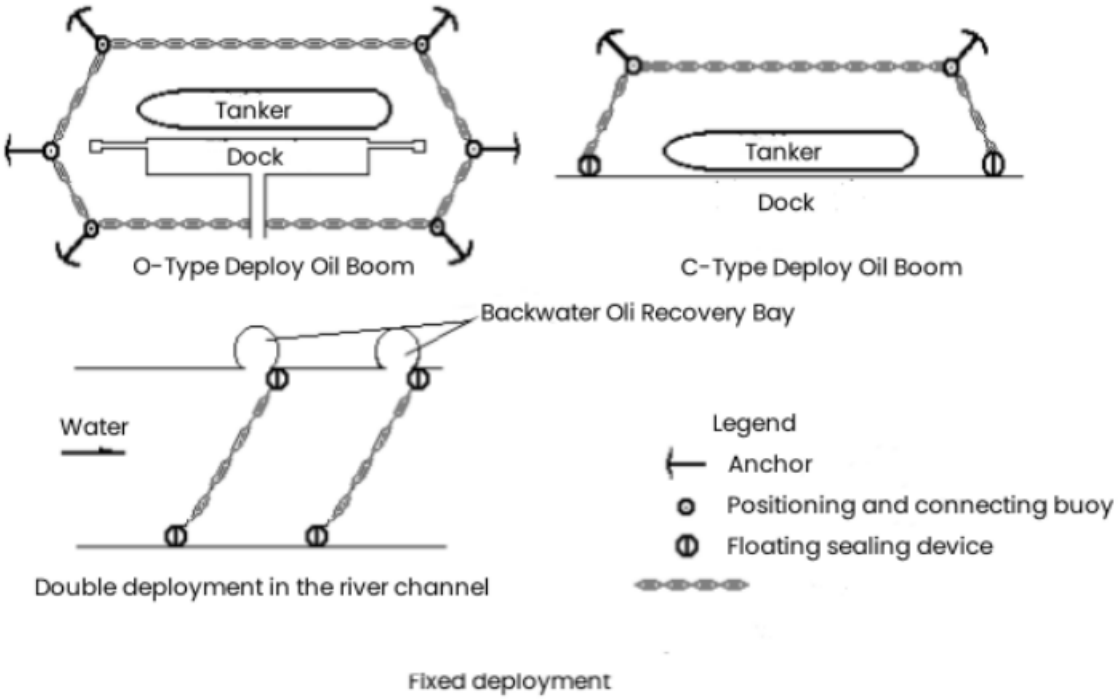
The towing speed V can be determined based on climate conditions, the strength of the oil boom, specifications, and sweep width. Then, the required total power NNN of the towing vessel can be determined from the towing force T and the towing speed V:

N=TV (W) (6)

A general rule of thumb is: N=0.0037T kW

For double-vessel towing, the power of each vessel is generally not less than 0.5N

2. Fixed Arrangement of Oil Boom(Refer to the below pictures)



In rivers, deploying more than one line of oil booms can provide better interception of spilled oil. When spanning across a river or ditch, ensure that the oil boom is arranged at an angle relative to the river or ditch. Both ends should be secured above the highest (potential) water level to prevent the oil from flowing over the ends. Special care should be taken to prevent floating oil from being washed away from the edges of the boom.

Estimated Length of the Oil Boom:

O-type Deployment: oil boom length ≈ (Ship Length+Ship Width+100m)×2...(3)

C-type Deployment: oil boom length ≈ Docking Length+Ship Width×2+100m...(4)

In areas where anchoring is not permitted, the oil boom can be placed a minimum of 2 meters away from the vessel.

Auxiliary devices for securing and deploying the oil boom include: floating barriers, positioning and connecting buoys, support rings, support rods, anchors, anchor lines, floats, quick connectors, and tow heads, among others (usage described below).

The selection of anchors, the number of anchors, and the choice of anchor lines are as follows:

To calculate the total anchoring force of the oil boom T_{total} :

number of anchors $n=T_{total}/T_{anchor}$(5)

where:

T_{total} -- the total anchoring force, in Newtons (N).

T_{anchor}-- the anchoring force of a single anchor, in Newtons (N).

n- the number of anchors.

The anchoring force of a single anchor depends on the type and size of the anchor and the quality of the seabed. Clay is preferable for the seabed, with sand and mud being progressively less suitable. The anchoring force of a single anchor should be 4 to 20 times its weight. Typically, one anchor is used for a 40-meter-long oil boom. For unidirectional currents, the weight of the anchor may be increased and the number of anchors reduced as appropriate.
The connection between the anchor and the oil boom is shown in the below diagram.

The anchor rope should be at an angle of less than 30° to the water surface or be 3 to 7 times the water depth. The length of the anchor rope should be determined based on the conditions of the water body; in adverse conditions, a longer anchor rope is required The anchor rope must have sufficient strength.

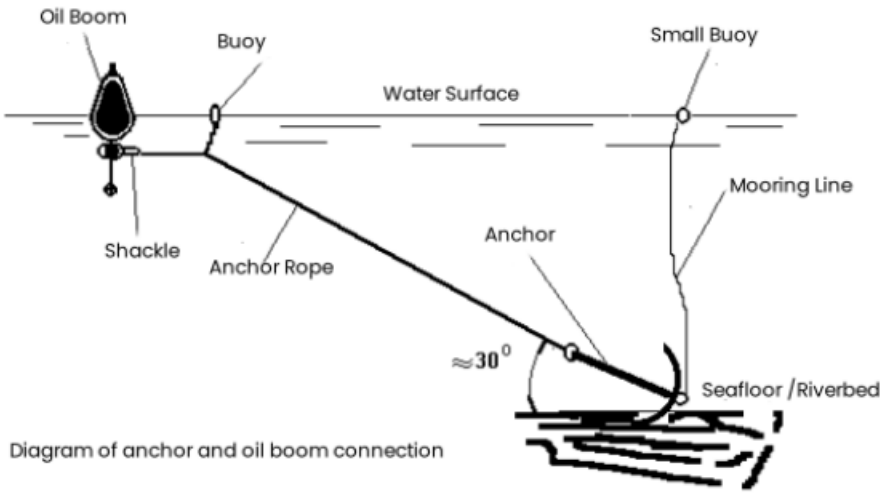


Diagram of anchor and oil boom connection

The rope can be made of polyethylene or polypropylene, which are lighter than water, or chains and steel wire ropes can be used as substitutes. Chains or steel wire ropes can be used for the underwater section, with the remainder being plastic rope. When using plastic rope, all connection points should be treated to prevent abrasion and avoid the rope from fraying.

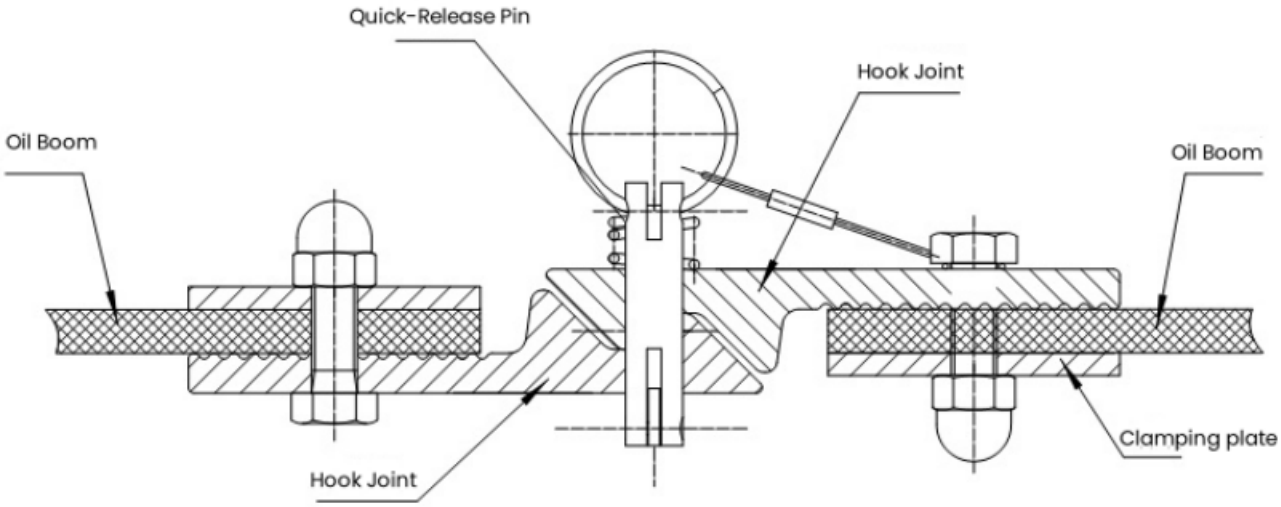
Sometimes, heavy objects such as concrete can be used as substitutes for anchors. In this case, the weight of the heavy object should be more than three times the anchoring force required.

3.Deployment, Towing, and Expansion of the Oil Boom

(1)Connecting the Oil Boom

The oil booms are typically manufactured in 20-meter sections. They are generally connected onshore or on the deck to achieve the required length. Alternatively, the connected sections of the oil boom can be placed in the water and towed by a boat to the designated area of use, where they are then connected together.

Connection Method for Z-type Joints: Align the hooks of the Z-type joints and secure them using quick-release pins (or bolts and nuts for long-term installations). The specific connection process is shown in the diagram below.



WGS970 Solid Floater PVC Oil Boom Z-type Joint Connection

For the fixed deployment of oil booms and their connection to the shore, a floating isolation device should be used to ensure that the boom does not rub against the shore as water levels change and to prevent oil leakage. The track of the floating isolation device should be vertical. When the shoreline is sloped, soil treatment should be carried out.

If the shore slope changes gradually, the oil boom should be secured at a point slightly away from the water's edge and above the highest operational water level. This should be complemented with absorbent materials for sealing. However, the boom is prone to wear, and the sealing effectiveness may be compromised.

(2) **Deployment of the Oil Boom**

When deploying the oil boom from the shore or a vessel into the water, a tugboat should assist, or the deployment vessel should proceed against the current. The boom should be deployed in sections to avoid disturbances. Prior to deployment, ensure the boom is properly arranged to

avoid twisting. Pay attention to the direction during deployment; once deployed, it is difficult to untwist.

When deploying or retrieving the oil boom, be cautious as it may be damaged by the shore or the vessel. Using rollers, chutes, or similar equipment at corners can make the process safer and more efficient.

(3) **Straight-line Towing of the Oil Boom**

When towing, pay attention to the length of the tow rope. Maintain a distance of at least 15 meters or 5 times the deck height between the oil boom and the stern of the vessel. Use specialized tow heads for towing the oil boom.

The towing speed in a straight line should be calculated based on the strength of the oil boom, and the required power of the vessel can also be determined:

$$T_{straight} = 7.5LV^2 \quad ...(5)$$

- $T_{straight}$--the towing force required for straight-line towing, in Newtons (N).
- L--the length of the towed oil boom, in meters (m).
- V--the relative velocity of the water flow with respect to the oil boom, in meters per second (m/s).

When towing the oil boom, start slowly and accelerate gradually. Reduce speed when turning, and only accelerate after making a turn when the boom has been towed straight for at least ten meters. Typically, the length of the towed oil boom should not exceed 200 meters. The maximum straight-line towing speed should be ≤8 knots, and the curve towing speed should be ≤2 knots.

(4) **The arrangement and deployment of the oil boom should be planned in detail in advance.**

During deployment, consider the size and direction of the current. One end of the oil boom can be towed to a predetermined point and anchored. Allow it to drift with the current, then use a boat to anchor the boom at the next fixed point. Repeat this process section by section.

In cases of low current, you can anchor the oil boom at the main points, turning points, or connection points first, and then set the intermediate anchors along the boom. Once the oil boom is initially deployed, further adjust the positions of the anchors to ensure the boom is arranged correctly.

A person should be assigned to monitor the deployed oil boom to prevent failure due to changes in hydrometeorological conditions or anchor drift, which could result in ineffective deployment or loss of the boom.

4.Oil Boom Recovery and Storage

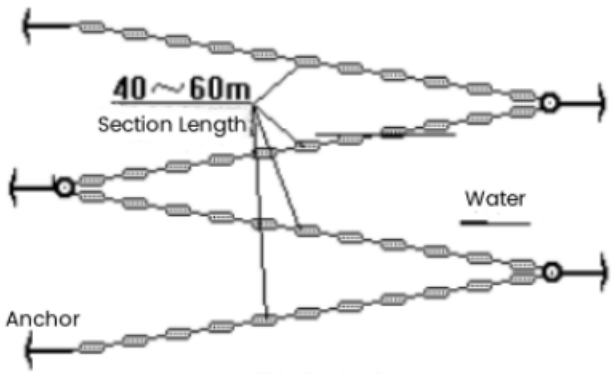
The recovery process of the oil boom is the reverse of deployment but should consider the storage method used.

The oil boom can be stored onshore or on a vessel. However, retrieving the boom from the water can damage it, so it is best to use rollers or chutes on the shore or vessel to minimize wear. Onshore, the boom can be laid out or stacked (taking care not to cause tangling) and can also be wound using a winch.

When storing a solid floater oil boom with a winch, the volume can be quite large, but mechanical handling is relatively convenient. Cranes or other equipment can be used to lift the boom in sections onto the shore or vessel, but care should be taken to avoid lifting from the boom's lift handles. Instead, the boom should be lifted from the anchoring points.

Before bringing the boom ashore or onto the vessel, all anchor lines should be detached from the boom. The storage area should be well-ventilated and protected from direct sunlight.

Storing the oil boom in water is suitable for frequent intermittent operations. With single-end anchoring, the oil boom drifts freely with the current and wind, which helps distribute forces evenly and reduces the risk of damage. In narrow water areas, the boom can be folded into a zigzag shape on the surface (see the diagram on the right). It is preferable to align the straight sections with the current and flow direction.



Z-shaped storage of oil booms in water

Structures can be used instead of anchors to secure the boom. Ensure that the oil boom does not come into contact with other booms or structures to avoid abrasion.

When storing the oil boom in water, it is not always necessary to detach all anchors from the boom. A single boat can carry an anchor line and tow the anchor and boom to the storage location. Additionally, another small boat can lift the rear anchor and follow the boom, making it easier to

transport the boom between the deployment and storage sites. For individual anchor movements, it is not necessary to lift the anchor onto the boat; simply towing the anchored line will suffice.

Before a typhoon or strong wind arrives, the oil boom must be moved ashore.

5、Cleaning and Maintenance of the Oil Boom

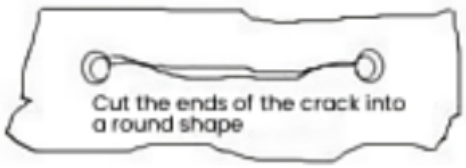
The oil boom must be cleaned promptly if it becomes contaminated with oil. It is best to use a specialized cleaning machine, but cotton rags, oil dispersants, and brushes can also be used for cleaning. For oil booms stored in the water for extended periods, regularly remove any accumulated debris and periodically bring the boom ashore for inspection.

Regularly inspect the oil boom, replace any missing parts, and remove sections that cannot be repaired. Reassemble the boom according to the manufacturer's recommendations. For localized damage or abrasions, repair with oil boom fabric and adhesive.

6、Repair Methods

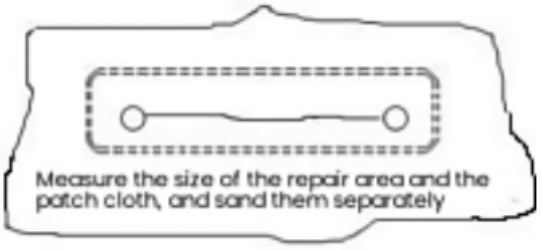
a. Cut the ends of the cracks into rounded shapes to prevent further propagation.

b. Cut a piece of PVC fabric with at least a 50mm overlap around the damaged area, ensuring the edges of the patch are rounded.



c. Clean the damaged area of the oil boom and the PVC fabric with a suitable cleaning agent.

d. Use tools like a wooden file to smooth the damaged area and the PVC fabric, then clean them again with the cleaning agent.



e. Apply cold adhesive, provided with the product, to both the PVC fabric and the damaged area. Do not perform adhesive work in humid weather. Considering the drying speed of the adhesive and bonding performance, it is best to use a hairdryer to expedite drying.

f. Test the dryness of the adhesive on the PVC fabric with your fingertip. Once it feels slightly tacky, you can begin the bonding process.

g. Starting from one end, apply the PVC fabric to the damaged area of the oil boom, ensuring that air is fully expelled from between the fabric and the boom.

h. Apply weight to the patched area and leave it for 8 hours before use.