

RANGER Class Preview Product Demonstration

Inner Space: Rigs to Reefs

An oil platform in the Gulf of Mexico's Green Canyon lease block #272 no longer produces enough oil to make it economically feasible to continue drilling operations. The plan is to decommission the platform and turn it into an artificial reef. Before removing the top of the platform and converting the base into an artificial reef habitat, the oil well must be capped.

Your company is tasked with securing a cap to the wellhead. This task involves installing a flange on top of the wellhead, securing the flange with a bolt, installing a cap onto the flange, and securing the cap with bolts.

This task involves the following steps:

- **Installing a flange to the top of the wellhead – 10 points**
- **Securing the flange to the wellhead with one bolt – 10 points**
- **Installing a wellhead cap over the flange – 10 points**
- **Securing the cap to the flange with two bolts – 10 points each, 20 points total**

Product Demonstration Notes:

The steps of the Rigs to Reef task must be done in order. The bolt must be inserted into the flange before the cap can be installed. If companies cannot complete a step of this product demonstration, they cannot skip steps and continue. Companies may alternate between the steps of the Rigs to Reefs task and other product demonstrations.

At the competition, the flange, wellhead cap, and all the bolts will be located on an elevator on the bottom of the pool. The elevator will be within 1 meter of the base of the wellhead. Note: This elevator will be specific to this task; it will not be the same as the elevator used in the Mission to Europa product demonstration.

Companies are not permitted to pre-install bolts into the flange or wellhead cap while those components are on the elevator. Only when the flange is installed may the bolts be inserted into the holes to secure it. Only when the wellhead cap is installed can the bolts be inserted into the ports to secure the cap to the flange.

Companies must attach the flange to the top of the wellhead. The wellhead will be constructed of a cement base with a 2-inch wellhead. At the top, the size of the wellhead will decrease to 1 ¼-inch PVC pipe. The top of the wellhead will be 60 cm to 1.25 meters above the pool bottom. The flange will be constructed of a 3-inch to 2-inch ABS reducer bushing. A length of 1/8-inch rope will serve as a grab point for the flange.

Companies must attach the flange over the top of the wellhead. The flange must sit flush against the 2-inch to 1 ¼-inch lip on the wellhead. The flange must be oriented so the Velcro side is facing upwards. Companies will receive 10 points when they have attached the flange to the top of the wellhead.

Once a flange is installed, it must be secured with one bolt. Bolts will be constructed from a ½-inch PVC tee and a bolt covered in Velcro loops. The flange will have six holes. Companies may insert the bolt into any of the six holes. The final 5 cm of the 1 ¼-inch cut wellhead pipe will be covered with Velcro hooks. The ends of the bolts will be covered with Velcro loops. The Velcro connection will secure the bolt into the holes and secure the flange onto the pipe. Companies will receive 10 points when the bolt successfully secures the flange. A successful installation is defined as the bolt staying in the hole on the flange when the ROV releases it. If the bolt falls out of the flange, it must be re-installed in order to receive 10 points.

Companies must install the cap onto the flange. The cap will be constructed from a 3-inch to 2-inch ABS reducer bushing. A length of 1/8-inch rope will serve as a grab point for the cap. Two ½-inch end caps are attached to the top of the bushing. The cap must be oriented so the Velcro side is facing downwards and the end caps are facing upwards. Companies will receive 10 points for successfully installing the cap. A successful cap installation is defined as bottom of the cap sitting flush against the top of the flange.

The bolt securing the flange to the pipe must stay in place when the cap is installed. If the bolt falls out of the flange when the cap is inserted, companies must re-insert the bolt into the flange before they can receive points for installing the cap.

Once the cap has been installed, it must be secured by inserting two bolts into the ports on top of the cap. The ports are constructed of ½-inch end caps with Velcro on the inside of the cap. Companies will receive 10 points for each bolt that is successfully installed into the ports on the top of the cap, 20 points total. A successful installation is defined as the bolt staying in the end cap port when the ROV releases it. If a bolt falls out of the cap, it must be re-installed in order to receive 10 points.

Any product demonstration items dropped from the vehicle to the pool bottom (flange, cap, bolts) will not count as penalty debris. All three bolts must remain secured in place for 5 seconds after completion of the Rigs to Reefs product demonstration task in order to retain full points.

PROP BUILDING INSTRUCTIONS & PHOTOS

Wellhead

The wellhead is constructed from 2-inch PVC pipe and couplings set into a cement base. To construct the cement base, fill a 40 cm oil pan with cement. Before the cement dries, set a 2-inch PVC coupling into the cement and let the cement dry.

1. Cut a 40 cm to 75 length of 2-inch PVC pipe. Insert this length of 2-inch pipe into the 2-inch coupling in the dried cement. Attach another 2-inch coupling to the top end of the pipe.
2. Insert a 2-inch to 1 ¼-inch coupling (Home Depot model #PVC021083000HD, Internet # 204836418, Store SKU # 744965) into the other end of the 2-inch coupling. Cut an 8.5 cm length of 1 ¼-inch PVC pipe. Insert the length of pipe into the reducer bushing.

3. Cut a length of 5 cm wide industrial strength Velcro hooks. The length of this Velcro should stretch all the way around the 1 ¼-inch pipe. Adhere the Velcro 1 cm below the top of the 8.5 cm pipe in the top of the wellhead.



RANGER product demonstration build photo 1: The wellhead.

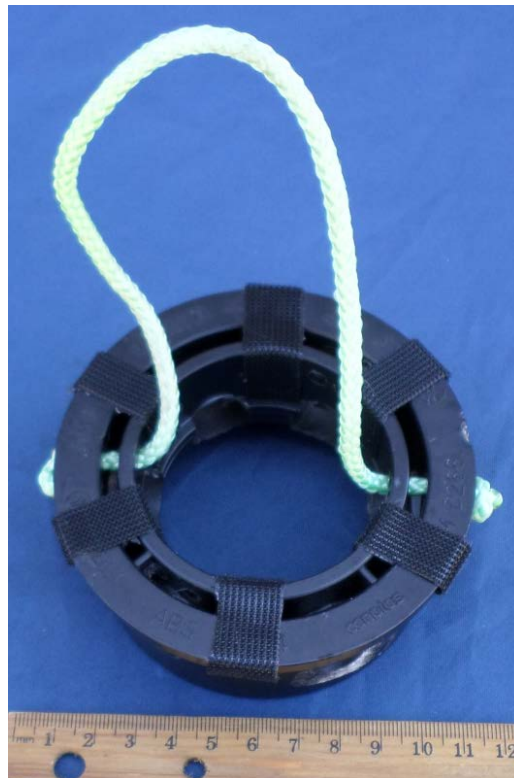
Flange

The flange is constructed from an ABS 3-inch to 2-inch reducer bushing (Home Depot model #C58012FHD32, Internet #100343802, store SKU # 188301). Holes are drilled through the walls of the flange. Bolts inserted through these holes will secure the flange to the end of the pipeline. To construct the flange:

Design note: There are two 3-inch to 2-inch ABS reducer bushing designs available in Hardware stores, one with a round top and beveled edge, or one with an octagonal cap and angled edge. The part number given refers to both designs. Either reducer bushing design can be used to complete the product demonstration task. Your regional coordinator will inform you which bushing design will be used at your regional competition. RANGER class companies should expect to find either reducer bushing design at the international competition.

1. Drill six 5/8-inch holes through the side wall of the flange at 60° angles around the 360° circumference. These holes should go all the way through the wall, from the outside to the middle of the reducer bushing.
2. Cut six 1 cm x 5 cm lengths of Velcro hooks. Attach these six rectangles of Velcro to the top of the flange, centering each rectangle between two of the six holes drilled into the flange.
3. Cut a 40 cm length of 1/8-inch Nylon rope (Home Depot model #14068, Internet #202048182, Store SKU #140287). Drill two 3/16-inch holes through the top side wall of the flange on opposite sides. These holes should go all the way through the wall, from the outside to the middle of the reducer bushing.
4. Push the 40 cm length of rope through both 3/16-inch holes. Tie an overhand knot on the ends of each rope to secure the rope to the flange.

Design note: The overhand knots must be on the outside of the flange in order for the flange to fit over the 1 ¼-inch wellhead pipe.



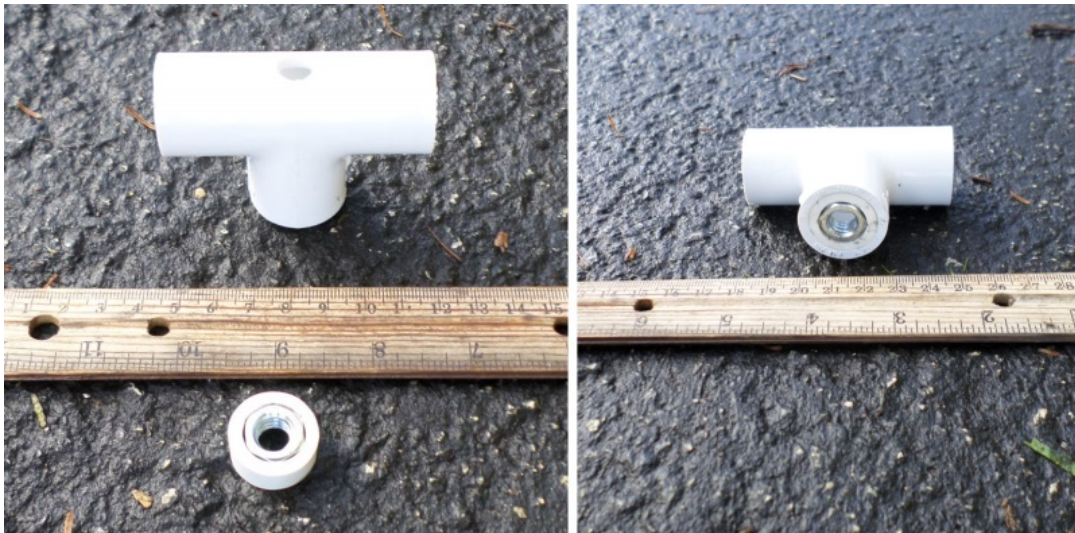
RANGER product demonstration build photo #2: Flange with Velcro strips attached.

Bolts

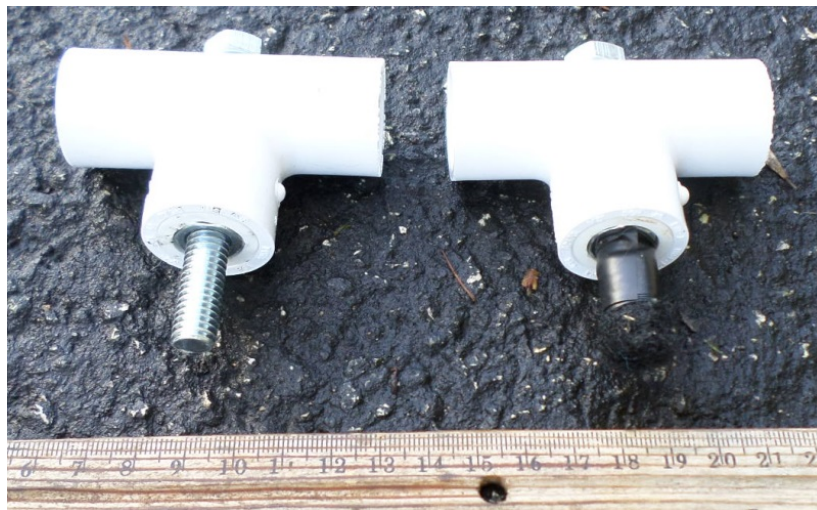
The bolts are constructed from 3-inch long 3/8-inch x 16 thread bolts through a ½-inch PVC tee, which serves as a holder for the bolts. Velcro loops around the end of the bolt will secure the bolt to the Velcro hooks on the end of the wellhead pipe. To construct a bolt:

1. Drill a 3/8-inch hole through the center of the middle opening of a PVC tee.

2. Cut a 1 cm long length of ½-inch PVC pipe. Use a hammer to force a 3/8-inch nut inside the 1 cm length of PVC pipe. Insert the 1 cm length of pipe into the middle opening of the PVC tee.
3. Push a 3-inch long 3/8-inch bolt through the hole in the tee and screw it into the nut inserted into the middle opening of the tee. The bolt should extend approximately 2.5 cm beyond the middle opening of the tee.
4. Cut a 5 cm x 1 cm rectangle of Velcro loops. Attach the middle of the Velcro loop rectangle to the end of the 3/8-inch bolt. Secure the 2 cm Velcro on either side of the middle of the rectangle to the sides of the bolts. Wrap plastic tape tightly around the ends of the Velcro loop rectangle to secure it to the end of the bolt.



RANGER product demonstration build photo #3: PVC base of the bolt with 3/8-inch nut inserted.



RANGER product demonstration build photo #4: Completed bolt without Velcro. Completed bolt with Velcro.

Wellhead cap

The wellhead cap is constructed from an ABS 3-inch to 2-inch reducer bushing (Home Depot model #C58012FHD32, Internet #100343802, store SKU # 188301). It has four ½-inch PVC end caps screwed into the top side to serve as ports for the bolts. To construct the wellhead cap:

1. Cut a 2 cm length of 2-inch PVC pipe. Insert the 2 cm length of pipe into the 2 cm opening on the reducer bushing.
2. Insert a 2-inch knockout cap (Home Depot model #39101, Internet #100137732, Store SKU #508257) into the 2-inch pipe.
3. Use a screw to secure a ½-inch PVC end cap to the outside of the top edge of the 3-inch to 2-inch ABS reducer bushing. The screw should go straight down into the side wall of the bushing. Repeat this three more times (four end caps total) at equal distances around the bushing.
4. Cut four 1.8 cm x 1.8 cm squares of Velcro hooks. Adhere the sticky side of the Velcro to the inside bottom surface of the four end caps, over the screw heads holding them in place.
5. Cut four 5 cm x 3 cm lengths of Velcro loops. Attach them around the bottom, angled end of the 3-inch to 2-inch reducer bushing.
6. Cut a 40 cm length of 1/8-inch Nylon rope (Home Depot model #14068, Internet #202048182, Store SKU #140287). Drill two 3/16-inch holes through the top side wall of the wellhead cap on opposite sides.
7. Push the 40 cm length of rope through both 3/16-inch holes. Tie an overhand knot on the ends of each rope to secure the rope to the wellhead cap.



RANGER product demonstration build photo #5: Wellhead cap with four ports for bolts.

PRODUCT DEMONSTRATION PHOTOS



Product demonstration photo: Flange installed on wellhead.



Product demonstration photo: Bolt inserted into installed flange.



Product demonstration photo: Wellhead cap installed onto secured flange.



Product demonstration photo: Two bolts installed to secure wellhead cap to secured flange.