

JOB SAFETY ANALYSIS

Safety Information for Epoxsea, Inc.



DEVELOPING, MANAGING AND OPERATING THE ORCA

TASK	HAZARDS	CONTROLS
Developing the Orca		
1. Using heavy machinery, hand tools and power tools	Ear injury	Wear noise blocking earmuffs to reduce exposure to high sound levels.
	Eye injury	Wash hands after using power tools while minimizing contact with face. Wear protective goggles to prevent foreign objects (e.g. sparks, particulate matter) from damaging eyes.
	Flesh wound or dismemberment	Check any machinery and tools for any loose parts or malfunctions before use. Do not put any parts of the body in close proximity of moving blades.
	Short-term respiratory irritation and long-term respiratory damage	Wear gas masks to prevent inhalation of particulate metallic matter.
2. Cutting buoyancy foam	Skin burn	Make sure that hot wire foam cutter is switched off when not in use.
3. Waterproofing circuit boards, wires, and buoyancy foam	Eye irritation	Wash hands after working with epoxy while minimizing contact with eyes.
	Skin irritation	Wear protective gloves to minimize contact of epoxy with the skin.
	Short-term respiratory irritation and long-term respiratory damage	Wear gas masks to prevent inhalation of toxic fumes. Turn on overhead ventilation system to remove toxic fumes.
4. Applying a layer of carbon fiber on buoyancy foam	Eye irritation	Wash hands after working with carbon fiber while minimizing contact with eyes.
	Splinters	Wear gloves to prevent carbon fiber splinters from entering the skin.
	Short-term respiratory irritation and long-term respiratory damage	Wear gas masks to prevent inhalation of particulate carbon fiber. Turn on overhead ventilation system to remove particulate carbon fiber.
5. Applying fiberglass to make molds	Eye irritation	Wash hands after working with epoxy while minimizing contact with eyes.
	Splinters	Wear gloves to prevent fiberglass splinters from entering the skin.

	Short-term respiratory irritation and long-term respiratory damage	Wear gas masks to prevent inhalation of particulate fiberglass. Turn on overhead ventilation system to remove particulate fiberglass.
6. Soldering circuit boards and electronic equipment	Fire hazard	Make sure that soldering irons are switched off when not in use.
	Short-term respiratory irritation and long-term respiratory damage	Wear gas masks to prevent inhalation of toxic fumes. Turn on overhead ventilation system to remove toxic fumes.
	Skin burn	Make sure that soldering irons are switched off when not in use.
Managing and Operating the Orca		
7. Loading and unloading the Orca and equipment onto and out of the transportation cart	Back injury from lifting heavy objects	Bend at hips and knees only, while keeping upper back straight and having a small arch in the lower back. Do not lift any heavy objects above the shoulder level. Do not twist body while holding a heavy object.
	Finger and hand injury	Make sure grip is strong and safe at all times.
	Foot injury	Wear covered shoes to protect feet from falling objects.
	Wrist injury	Make sure wrists and forearms are kept straight when carrying heavy objects.
8. Transporting the Orca	Foot injury	Walk at the side or behind the transportation cart to prevent it from running over feet. Secure any moving parts apart from the wheels with locks and cable ties to prevent them from falling.
	Impact with the transportation cart	Avoid walking in front of the transportation cart while in motion.
9. Setting up the power box	Overvoltage	Constantly check that the voltage reading to ensure that it is kept at a safe level of about 48.0V. Check the voltage supplied by the power socket before connecting anything to it.
10. Setting up the air pump	Over-pressurized air pump	Constantly check the pressure reading to ensure that it is kept at a safe level of about 275 kPa. Do not leave the air pump unattended. Make sure that the air pump reading has no defects. Make sure the air pump safely pressurizes and depressurizes.
11. Setting up the tether	Loose tether	Connect the tether to the control box and the Orca, and secure it with the carabiners attached to the side of the control box and the frame of the Orca respectively.
	Tangled tether	Wrap the tether properly around the tether transportation cart when going to or leaving the pool.

	12. Managing the tether	Tether damage from pulling	One person has to be in charge of supplying enough tether to the Orca to prevent the Orca from pulling on the tether.
		Tripping on the tether	Make sure tether is laid neatly on the floor without tangling. Make sure tether does not block walking path.
	13. Dry running the Orca	Damage to manipulators and frame	Make sure the Orca is put on top of its stand to prevent its manipulators and frame from getting damaged.
		Flesh wound from motor blades	Put warning labels on the motors. Do not put hands on motor blades while in motion. Constantly check the status of the motors.
	14. Operating the Orca	Back strain	Keep back straight while operating the Orca.
		Eye strain	A distance of about 30cm should be kept between the pilot of the Orca and the control box screen. Adjust the brightness of the screens to a comfortable level.
		Motor malfunction	A watchdog timer is implemented through software which will automatically stop power from being sent to the motors when they become unresponsive.
		Shoulder strain	Do not keep shoulders tense when operating the Orca.
	15. Deploying and retrieving the Orca to and from the water	Back, shoulder and forearm strain	At least two people should hold the Orca when deploying or retrieving it.
		Flesh wound from motor blades	Put warning labels on the motors. Do not put hands on motor blades while in motion. Constantly check the status of the motors.
		Mild electric shock or electrocution	Make sure all electronic equipment are placed on dry areas. Check and secure all connections properly. Visually inspect all cables and wires to check if any of them are broken or exposed, and replace them if necessary.
	Required Training: Method of operation for machinery and power tools Loading and unloading procedures Power check and set-up procedures Proper operation of air pump		Required Personal Protective Equipment (PPE): Covered shoes Gas masks Noise-blocking earmuffs Protective gloves Protective goggles

Other Information: See *Orca Technical Documentation* for more information on *Safety*

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