

Step	Task	Hazard		Controls	Responsible
Research and Design. Software development					
All the time building ROV	Searching, programming, working in CADs, communicating and other PC work	Spinal, neck, arm and joint injuries. Eyestrain and stress.		Organize workflow and workspace right. Use ergonomic chair and keyboard. Make short rest breaks and do stretching exercises	All
Manufacturing					
Making electrical components: Custom PCBs performing	Etching PCBs	Chemical reagents	Inhalation	Work in well-ventilated areas and use mask or respirator	Electronic Engineer
			Chemical burns and skin injury	Use gloves and proper clothing	
	Cutting copper board and drilling holes in PCB	Eye injuring with cuttings		Use safety glasses	Electronic Engineer, Design Engineer
		Dust inhalation		Use mask or respirator	
		Hand or skin injury		Use proper clothing	
	Making electrical components: Soldering components and wires	Manual components soldering with solder iron and/or hot air blower	Chemical reagents	Lead/flux fume inhalation	Work in well-ventilated areas and use mask or respirator
Lead solder poisoning				Use gloves and washing hands with soap after work	
Skin injury				Use gloves and proper clothing	
Lead/flux fume eye injuring				Work in well-ventilated areas and use safety glasses	
Thermal burns with hot surfaces			Use proper clothes. Do not touch hot surfaces with hands. Use appropriate equipment. Turn off equipment when you don't work with it		
Eye injury with solder "spit"			Use safety glasses		

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		Fire and surround property damage		Keep work area tidy and clean. Do not work near flammable things. Turn off equipment when you don't work with it	
		Electrocution		Make sure that object is powered off from power source	
Making electrical components: Post-processing	Cutting wires and cleaning flux	Chemical reagents	Inhalation	Work in well-ventilated areas and use mask or respirator	Electronic Engineer
			Chemical burns and skin injury	Use gloves and proper clothing	
		Eyes injuring with wire offcuts from using side-cutters		Use safety glasses	
Making mechanical components: Performing parts	Working with machine and power tools	Machine entanglement		Avoid loose-fitting clothes	Design Engineer
		Eyes injury caused by cuttings		Use safety glasses	
		Ear injury caused by noise		Use hearing protection	
		Cuts, punctures and scrapes		Use gloves and proper clothing	
	Working with hand tools	Cuts, punctures and scrapes caused by hand tools		Use gloves and proper clothing	
Making mechanical components:	Grinding and polishing	Dust inhalation, eyes injuring		Use safety glasses and respirators	Design Engineer
	Coating	Paint aerosol inhalation, eyes injuring		Use safety glasses and respirators. Work in well-ventilated areas	

Step	Task	Hazard	Controls	Responsible
Post-processing	Sealing with resins	Poisoning: inhalation reagents and skin injury	Use gloves and respirators. Work in well-ventilated areas	
Assembling: Electrical	Connecting wires and mounting parts and boards	Electrocution; fire caused by short circuit	Use right connectors, proper color marking and tagout. Make sure that object is powered off from power source	Electronic Engineer
Assembling: Mechanical	Screwing and other working with hand-tools	Cuts, punctures and scrapes by hand tools	Use gloves and proper clothing. Choose right tools. Make sure that tools are in fine condition	Design Engineer
Testing				
Primary components testing	Electrical testing	Electrocution; fire caused by short circuit	Use right connection scheme, proper color marking and tagout for components. Make sure that object is powered off from power source or make sure that you have easy access to killswitch	Design Engineer, Electronic Engineer
	Mechanical testing. Pressure testing for tubes	Cuts, punctures and scrapes by broken and/or weak mounted parts	Use proper tools, safety glasses and right clothing	
Storage and transportation				
Storing	Placing ROV on storage	ROV falling down from shelf can cause injuries	Before placing to storage shelf make sure that all cables disconnected and neatly folded and locks on control box are closed. Make sure that ROV placed properly	All
		Overexertion injury: spinal or arm injuries	Use proper lifting technics	
Transportation	Carrying ROV by hands	Entangling in tether	Make sure that tether neatly folded	All
		Overexertion injury: spinal or arm injuries	Use proper lifting and carrying technics	

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ROV operating				
Operations before launching	Placing ROV on the pool side	Fall into water	Use non-slipper shoes. Avoid standing close to the water unless necessary	All
		Overexertion injury: spinal or arm injuries	Use proper lifting and carrying technics	
		Entangling in tether	Make sure that tether neatly folded	
	Connecting cables	Electrocution	Make sure that there are no exposed wires. Also, make sure that ROV and Surface Equipment are fully powered off	
Launching	Startup Surface Equipment and ROV	Electrocution	Make sure that there are no exposed wires. Do not touch Surface Equipment with wet hands	All
Operating ROV	Put ROV into water	Fall into water. Spinal or arm injuries	Be careful when you put ROV into water. Use proper throwing technics	Electronic Engineer
		Injuries caused by ROV	Make sure that Pilot don't manipulate ROV when you put ROV into water	
	Pilot's working	Spinal, neck, arm and joint injuries	Use right workspace organization. Use special preparing technics	Pilot
	Surface Tether management	Fall into water	Use non-slipper shoes	Mechanical Engineer
Entangling in tether		Cable always should be under control		
Shutting down and packing	ROV retrieval from pool	Fall into water	Use non-slipper shoes	All
		Overexertion injury: spinal or arm injuries	Use proper lifting and carrying technics	
		Entangling in tether	Cable always should be under control	

Step	Task	Hazard	Controls	Responsible
	Disconnecting cables	Electrocution	Make sure that there are no exposed wires. Also, make sure that ROV and Surface Equipment are fully powered off	
	Packing and removing from pool side	Overexertion injury: spinal or arm injuries	Use proper lifting and carrying technics	
		Fall into water	Use non-slipper shoes	
		Entangling in tether	Fold tether neatly	
Theory and practice				
Required training	<ol style="list-style-type: none"> 1. Knowledge of safety precautions for working with electrical appliances. 2. Knowledge of the procedure for loading and unloading the ROV. 3. Experience in the management of an underwater robot in the pool. 			
Necessary personal protective equipment (PPE)	<ol style="list-style-type: none"> 1. Safety glasses and closed footwear for all work with the ROV. 2. Hearing protection during use with power tools and loud equipment. 3. Gloves and masks/respirators for use with potentially hazardous substances. 4. Non-slip footwear when working in the pool. 			
A short list of things considered potentially dangerous	<ol style="list-style-type: none"> 1. High-speed rotating propeller blades. 2. Various resins and other chemical sealants. 3. Chemical reagents used for cleaning and subsequent processing of components. 4. Mechanical and power tools for manufacturing parts of ROV. 5. High-voltage electronics of ROV. 			
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