

RANGER & EXPLORER Class Safety Inspection Sheet Tutorial

COMPANY NAME: _____ COMPANY NUMBER: _____

2016 MATE ROV COMPETITION

From the Gulf of Mexico to Jupiter's Moon Europa: ROV Encounters in Inner and Outer Space

RANGER CLASS SAFETY CHECK LIST

Companies must bring this check list, the ROV, tether, surface controls, and any other item used in the deployment and operation of the ROV; they will all be inspected as part of the safety check. In addition, the SID, technical documentation, and any additional documentation needed to verify compliance must be made available to Safety Inspectors during the inspection process.

1.0 Initial Inspection Results	
	0, 5 or 10 points
	Fluid Power Used & Approved for Use? If yes to both, see item #4
	Laser Used & Approved for Use? If yes to both, see laser inspection
2.0 ROV Physical	
	All items attached to ROV are secure.
	Hazardous items are identified and protection provided.
	ALL Propellers are completely shrouded.
	No sharp edges or elements of ROV design that could cause injury to personnel or damage to pool surface.
3.0 ROV Electrical	
	Tether is properly secured at the ROV.
	No exposed motors.
	Brushless motors are considered exposed unless electrically sealed after purchase. Companies should provide proof of sealing procedure.
	No exposed copper or bare wire.
	All wiring securely fastened and properly sealed*.
	Any splices in tether are properly sealed*.
3.1 Surface Controls Electrical & Physical	
	Single attachment point to power source.
	Anderson Power Plugs for electrical attachment
	25 amp single inline fuse or circuit breaker within 30cm of power supply attachment point.
	Surface control station is built in a neat and workmanship like manner. No Loose components or unsecured wires. All electrical components covered inside an enclosure.
	Tether is properly secured at the surface control.
	No exposed copper or bare wire.
	120VAC wiring is separated from the DC wiring
	120VAC wiring must be clearly identified from the DC and control voltages with signage and/or wire color schemes. If color schemes, key provided for identification.
	All wires entering and leaving the surface control station must have adequate strain relief and wire abrasion protection as the wires pass through the enclosure. Tape, zip ties, string and similar methods are not acceptable
	All connectors utilized are properly type rated for their application. AC only rated connectors not be used for DC
*Properly sealed means that the wires cannot be exposed to water. Tape only sealing will allow the conduction of electricity through water.	

At minimum joints must be soldered, then sealed with silicone sealant and then finally taped. For in water taping, silicone self-vulcanizing tape is preferred over thermoplastic tape. Cables with exposed male connections on both ends are not allowed.

4.0 Pneumatic / Hydraulic (if applicable)	
	Passed pneumatics/hydraulics test.
	Pneumatic or hydraulic diagrams present?
	Pneumatic and/or hydraulic component documentation provided?
	Hydraulic fluid MSDS (if used)
	Fluid is compatible with the Biodegradable Food-Grade specification. Teams using water do not need to provide an MSDS.
	All pressure lines have minimum pressure rating 100psi (pneumatic) or 300psi (hydraulic) stamped on line or verified with specifications
	Valves meet the minimum pressure of 100 psi pneumatic or 300 psi hydraulic
	Attachment to pressure source is secure.
	Pressure is regulated to 40psi max for pneumatics and 150 psi max for hydraulics.
	Pressure vessels have a stamped pressure rating or verification by specification.
	Pressure vessels have current inspection sticker.
	Pressure vessels can be secured on pool deck.
	Company fabricated pressure accumulator test results are provided (if used).
	No hydraulic fluids are leaking.
	Pneumatics utilize compressed air or inert gas

INSPECTION #1	PASSED: 30
POINTS	
FAILED: Items to correct: (see rear of this sheet)	
INSPECTION #2	PASSED: 20
POINTS	
FAILED: Items to correct: (see rear of this sheet)	
INSPECTION #3	PASSED: 10
POINTS	
FAILED: Reason (see rear for details)	
Total Safety Points	
Initial Inspection [0 to 10] _____	
On Site Inspection [0 to 30] _____	
Total Points [0 to 40] _____	

Documentation — Be sure and bring these items to the safety inspection table; they will be used to help answer questions.

Physical — The ROV will be inspected for any items that may be unsafe to the participants or the facility.

Electrical — This is a major contribution to failed safety checks. Sloppy electrical wiring will run the risk of being disqualified. Everything should be done in a neat and workmanship-like manner.

Pneumatic/Hydraulic — If you are not using either, this section can be ignored. If you are using either or both, be sure that you passed the MATE fluid power quiz.

RANGER/EXPLORER Differences — The differences are in voltage and power supply attachments. Be sure you have the correct terminations for your class.



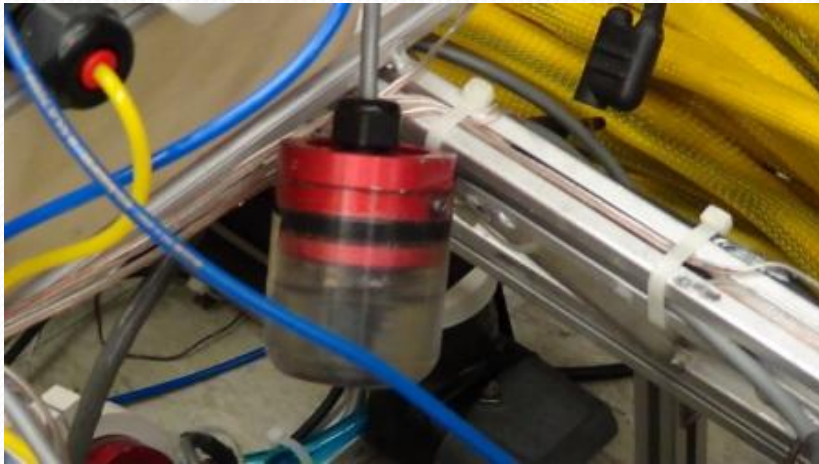
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2.0 Physical

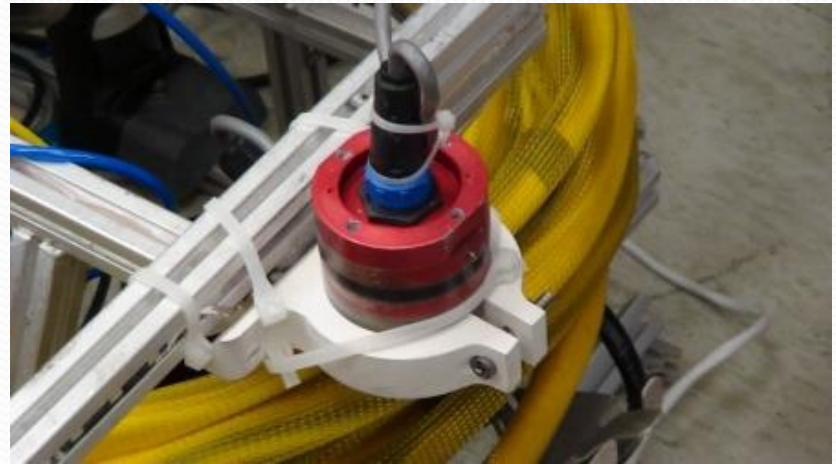
All items attached to ROV are secure and will not fall off.

Examples:

loose camera



securely attached camera



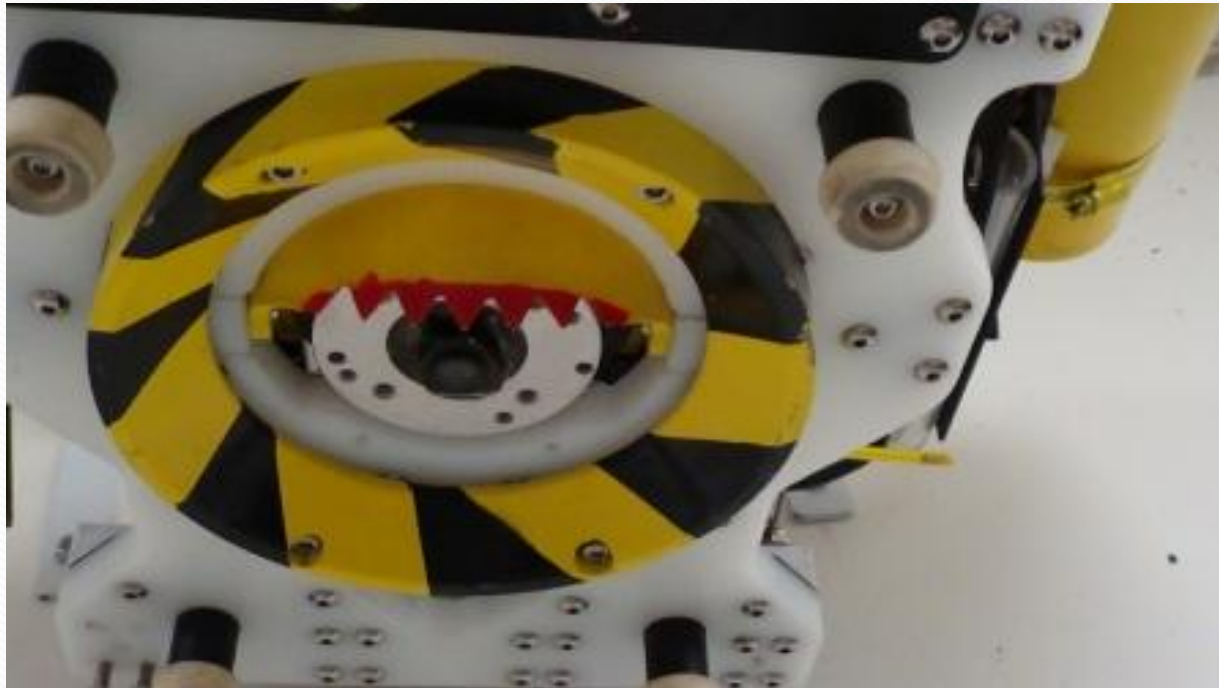
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2.0 Physical

Hazardous items are identified and protection provided.

Examples:

Sharp edges on the scoop are painted red; yellow and black safety warning colors are used elsewhere.



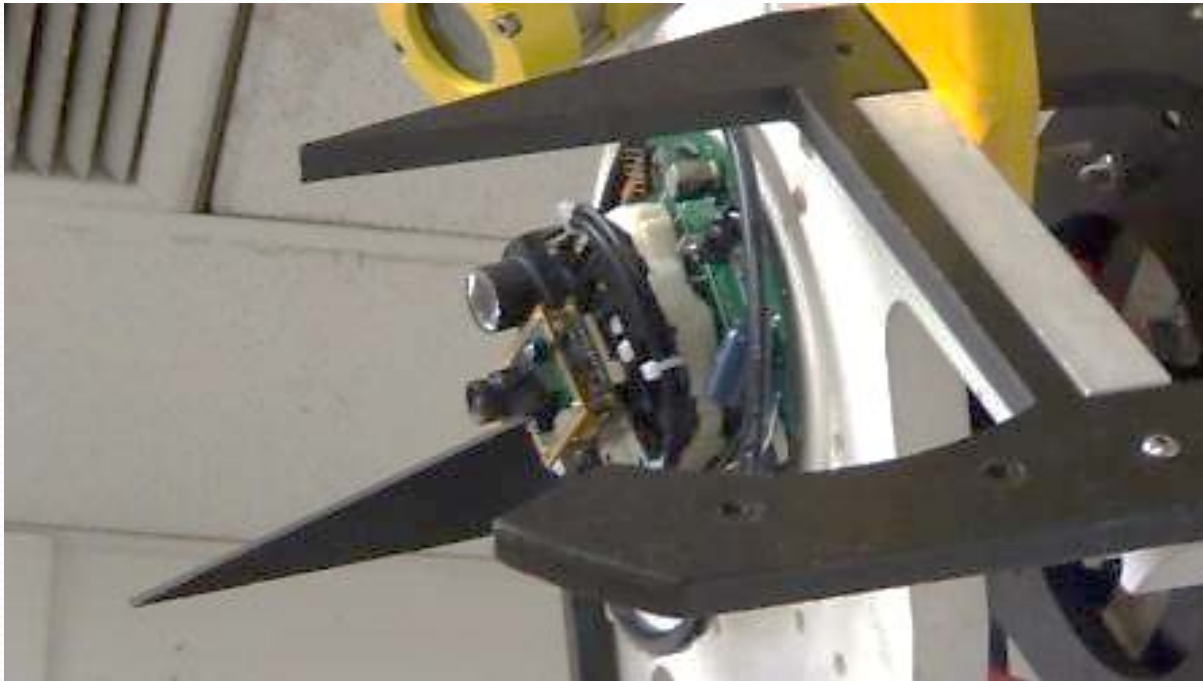
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2.0 Physical

No sharp edges or elements of ROV design that could cause injury to personnel or damage to pool surface.

Examples:

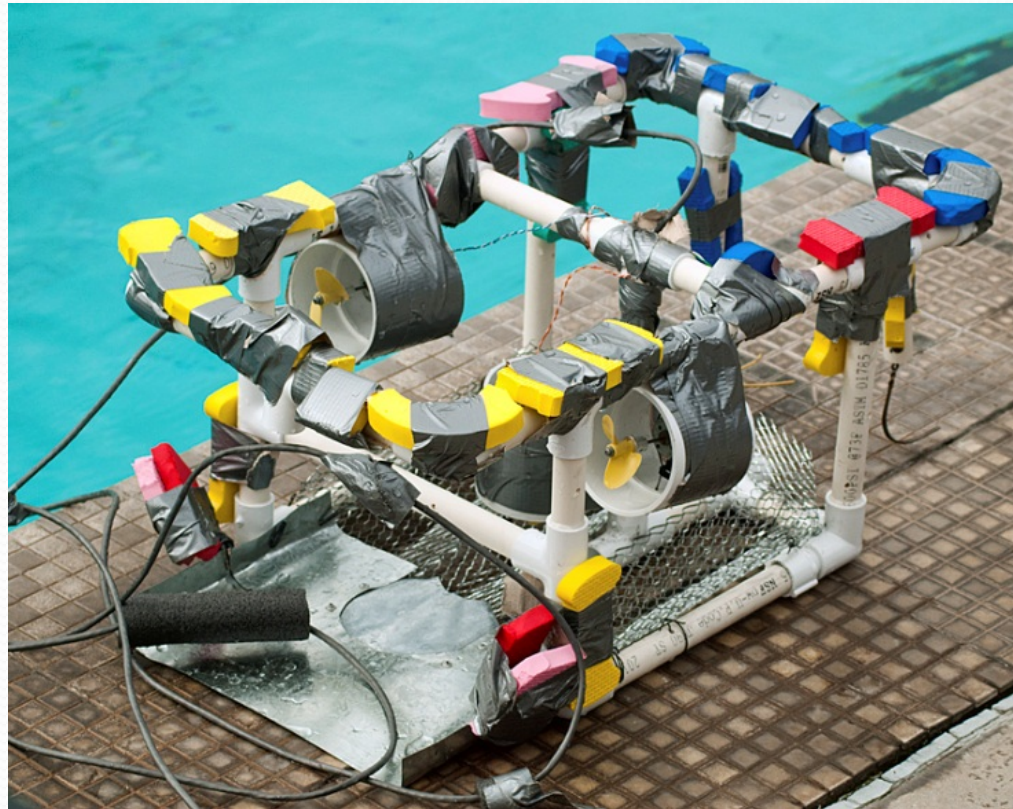
The points on the front of this ROV may look cool, but the judge deducted points for putting something that could be a danger to the divers.



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2.0 Physical

ALL Propellers must be shrouded even if they are enclosed inside the frame of the ROV



Shrouded

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3.0 Electrical (Ranger)

Single attachment point to power source.

Anderson power connectors are required to connect to MATE power source.

Single Inline fuse within 30cm of attachment point (power connectors). Fuses in each line are acceptable.

Ranger Class utilizes the RED & BLACK power connectors.

Looking at the end of the connectors, you will see a small A on the end of each. With the tip of the A pointing up, Black should be on the left and Red on the right



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3.0 Electrical (Explorer)

Single attachment point to power source.

Anderson power connectors are required to connect to MATE power source.

Single Inline fuse within 30cm of attachment point (power connectors). Fuses in each line are acceptable.

Explorer Class utilizes the Blue SB50 (50 amp) power connectors. Positive and Negative are marked on the connectors.



Red is Positive and Black is Negative

The terminals for these connectors must be crimped with a hydraulic or a ratcheting crimper designed for the terminals.

40A Fuse (or smaller) must be within 30cm of these terminals.

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3.0 Electrical (Ranger & Explorer)

Fuse Size Calculation

The team should have their fuse size calculation somewhere on their SID.

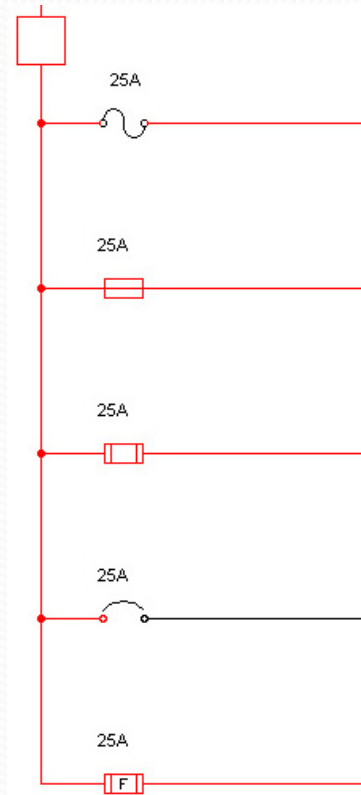
Review that calculation and verify that the attached fuse corresponds with their calculations.

ELEC-008R: The ROV system must have a fuse (or circuit breaker) that is calculated based upon the maximum current draw of the ROV. This overcurrent protection must be calculated as follows: $\text{ROV Overcurrent Protection} = \text{ROV Full Load Current} * 150\%$. The overcurrent protection value may be rounded up to the next standard fuse. In no case can that value exceed the 25A maximum. The fuse or circuit breaker must be installed in the positive power supply line within 30 cm of the power supply attachment point. The fuse may be a slow blow type. The SID and other electrical diagrams must show the fuse or circuit breaker and include the amperage of the overcurrent protection. In addition, the SID must show the calculations used in determining the overcurrent protection value. SIDs without these calculations shown will have 5 point deducted from Safety Points.

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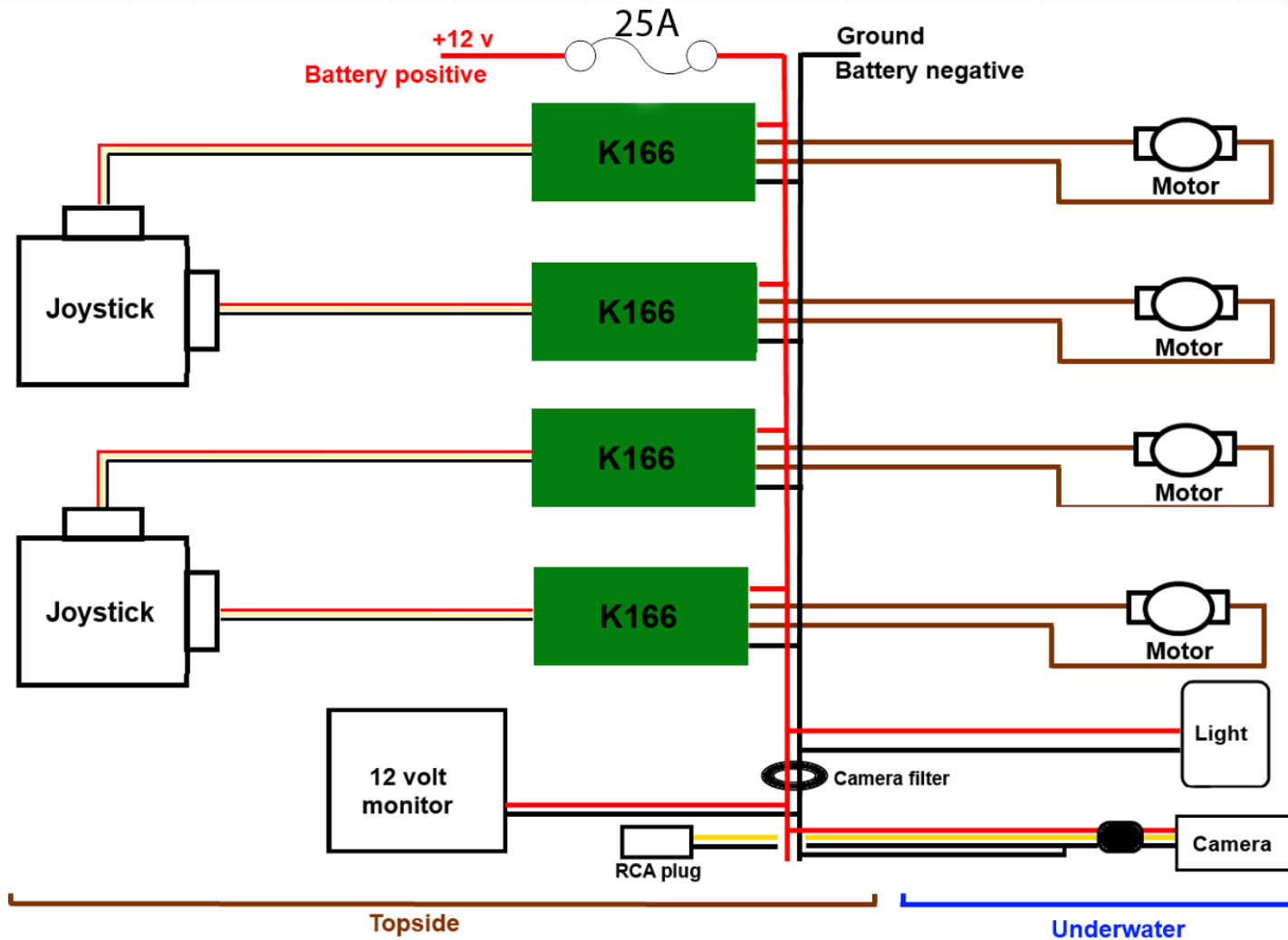
3.0 Electrical System Interconnection Diagram (SID)

- **System Interconnection Diagram (SID)** A SID is a system-level, connection diagram that includes electrical and, if applicable, fluid power wiring information. Board-level and component-level schematics should not be included; however, these may be brought to the engineering evaluation for reference purposes. The intent is to provide the competition judges with a one-line diagram showing how the various systems are interconnected without the detail of each and every wire.



These are the only acceptable fuse or circuit breaker symbols. A fuse is not a box, a line with an letter S over it, or any other non-standard symbol

Example SID



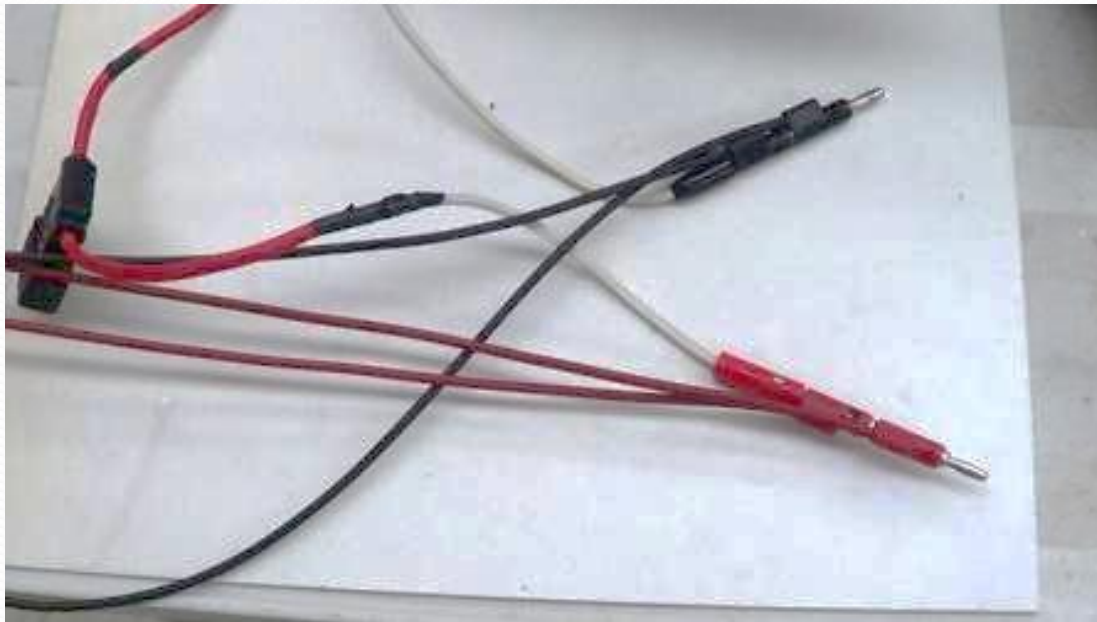
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3.0 Electrical

Single inline fuse or circuit breaker within 30cm of attachment point.

Examples:

This is an example of multiple attachments ahead of the fuse that **WILL NOT PASS**. Plus for Ranger class, we no longer use banana plugs.



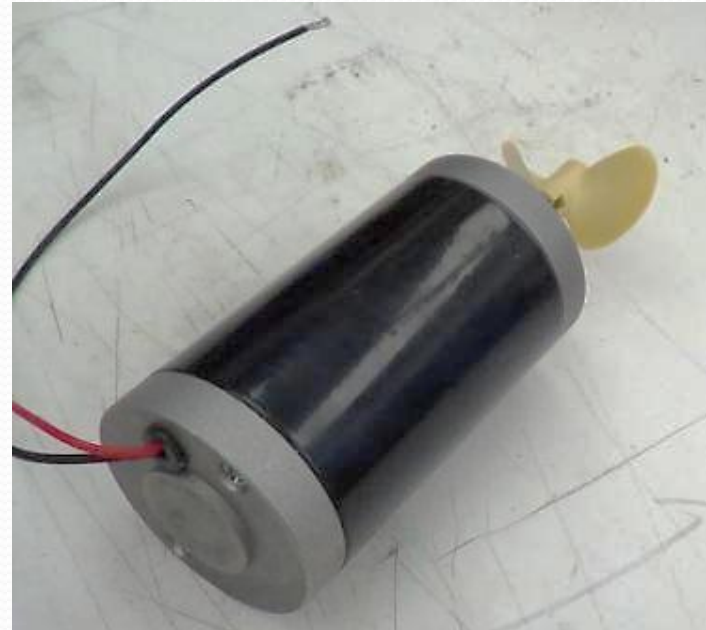
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3.0 Electrical

No exposed copper or bare wire. No exposed motors.

Examples:

These **WILL NOT** PASS. The motor on the left is both exposed and has bare wire. The motor on the right is exposed and not sealed.



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3.0 Electrical

No exposed copper or bare wire.

Examples:

This **WILL NOT** PASS. Using banana plugs at both ends of the wire to route power from one section to another. It is possible for the hot end of the wire to become unplugged and create a safety hazard.



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3.0 Electrical

Tether is properly secured at surface control point and at ROV.

Examples:

On the left, all the wires are loose and unsecured. On the right is an example of a well-secured tether.



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3.0 Electrical

Surface controls: All wiring and devices properly secured.

Examples:

The two pictures below are examples of loose wiring. There is no strain relief and the wires can easily pull loose from their connections.



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3.0 Electrical

Surface controls: All wiring and devices properly secured.

Examples: Properly secured

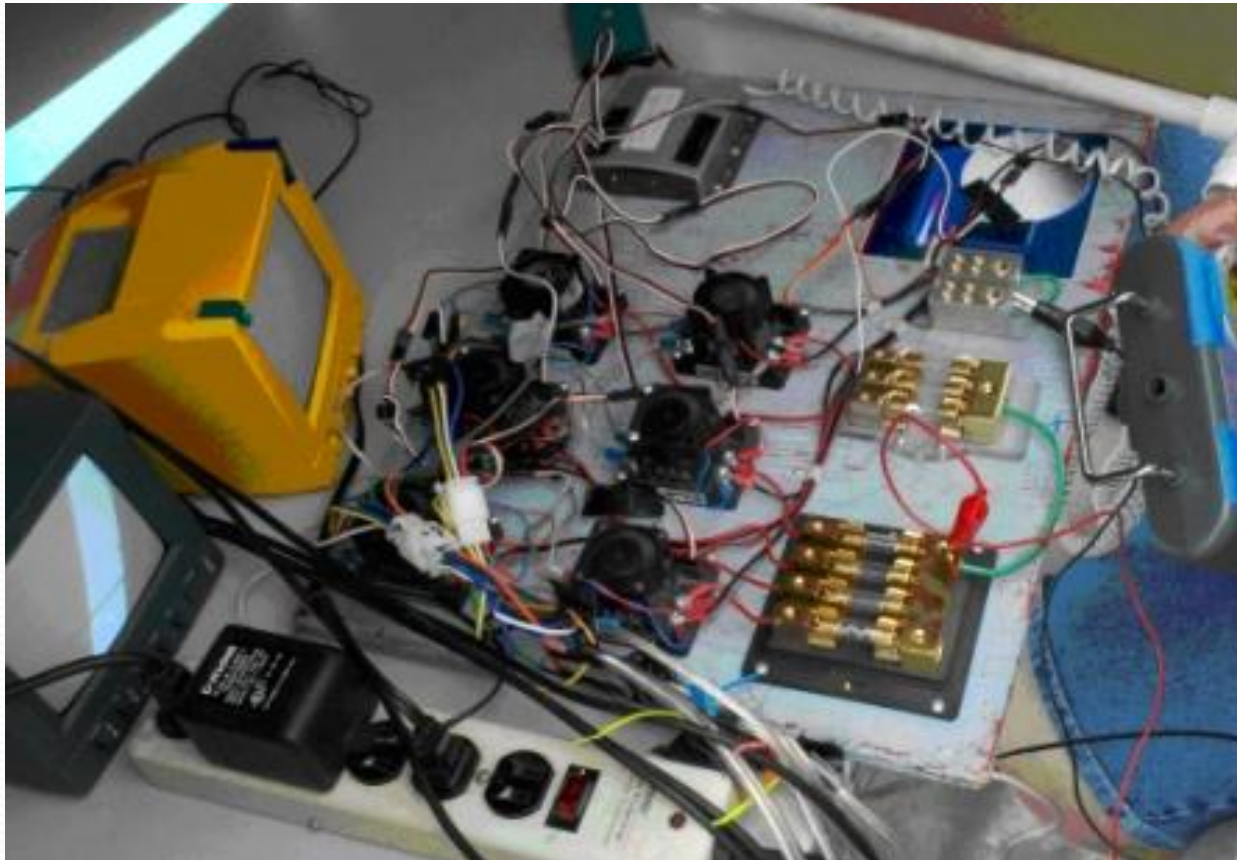


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3.0 Electrical

Surface controls: All control elements are mounted with wiring inside an enclosure.

There are multiple FAILS in the picture below!



- Exposed wiring
- Multiple fuses instead of single point fuse for power.
- Loose wires.
- Alligator clips used for connections.
- No strain relief provided for wires coming from power or going to ROV.

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3.0 Electrical – NEW IN 2016 FOR BOTH RANGER AND EXPLORER

ELEC-022R: Surface control stations must be built in a neat and workmanship like manner. Loose components and unsecured wires will not pass safety inspection.

ELEC-023R: Surface control stations by nature combine 120VAC and 12VDC wiring. The surface control stations must be wired in a manner such that the 120VAC wiring is separated from the DC wiring and the 120VAC wiring must be clearly identified from the DC and control voltages. Identification can be through signage and/or wire color schemes. All 120VAC wiring colors must use ANSI, NEMA or IEC standard wiring colors appropriate to each voltage. There must be a sign inside the surface control station indicating which wiring standard is being utilized.

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3.0 Electrical – NEW IN 2016 FOR BOTH RANGER AND EXPLORER

ELEC-024R: All wires entering and leaving the surface control station must have adequate strain relief and wire abrasion protection as the wires pass through the enclosure. Tape, zip ties, string and similar methods are not acceptable.

ELEC-025R: Any connectors utilized in the surface control station and elsewhere in the ROV system must be properly type rated for their application. AC rated connectors must not be used for DC. The connectors must also be rated at or above the voltage and current used in their application.



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3.0 Electrical (Related to ELEC-025R)

Dangerous Wiring Methods.

*When building your ROV, think about potential danger issues
Ask if someone were not told about a wiring issue, would they be safe.*

An example of this was seen in the use of 120VAC connectors to provide power for the ROV. One team distributed power on the surface using a 120VAC plug strip that had been modified to plug into the 12VDC MATE supply. Each thruster then had a 120VAC connector that plugged into the plug strip. This presents a very real safety hazard for the student who unknowingly plugs the thruster into 120VAC and ends up getting shocked or burned.

Safe wiring should need no warnings.



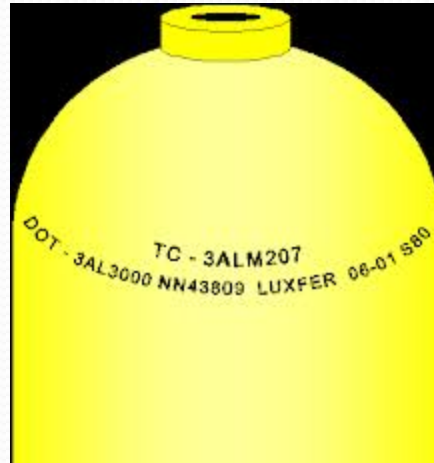
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4.0 Pneumatic / Hydraulic Checklist

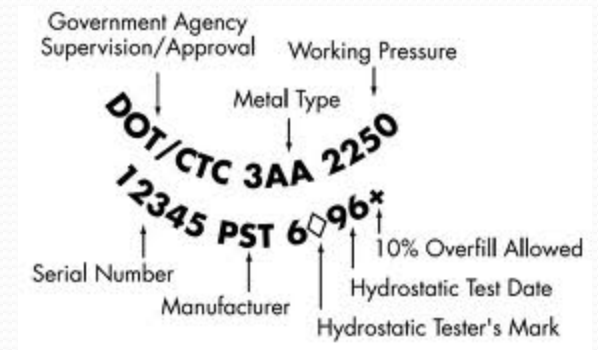
- ◆ Did you PASS the pneumatics/hydraulics test?
- ◆ Do you have your pneumatic or hydraulic diagrams present?
- ◆ Pneumatic and/or hydraulic component documentation provided?
- ◆ Are you using pressure rated lines and fittings?
- ◆ Is your attachment to pressure source is secure?
- ◆ Is your pressure is regulated to 40psi max for pneumatics and 150 psi max for hydraulics? **YOU MUST PROVIDE THE REGULATOR.**
- ◆ Are your pressure vessels have a stamped pressure rating or verification by specification and do the pressure vessels have current inspection sticker?
- ◆ Are your pressure vessels secured on pool deck and not rolling around?
- ◆ Company fabricated pressure accumulator test results are provided (if used).
- ◆ No hydraulic fluids are leaking.
- ◆ Do your pneumatics utilize compressed air or inert gas?

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4.0 Pneumatic / Hydraulic Examples of Tank Certifications and Inspection Stickers



The tank must have a current visual inspection certificate (above) AND current hydrostatic test stamp (on the right)



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5.0 Laser Checklist

- ◆ Did the team send the laser specs to the competition coordinator two weeks prior to the regional?
- ◆ Do your electrical schematics show the laser driver?
- ◆ Does your laser have an on/off switch on the surface controller?
- ◆ Is the laser powered through the MATE surface power supply?
- ◆ No batteries in the ROV powering the laser?
- ◆ Are your lasers the proper type? Visible Laser in 630-680 nm (red) or near 532 nm (green) Class I, Class II, or Class IIIa Category; Red Laser: 5mW or less Green Laser: 1 mW or less. **Be sure and bring your laser specs.**
- ◆ Is the laser voltage at or below laser rated voltage & current?
- ◆ EXPLORER class: Notification sheet showing laser specifications sent to MATE Center 2 weeks prior to their qualification event
- ◆ Does your ROV have a Laser shield or beam stop attachment within 30 cm of laser when out of water?
- ◆ Do the team members have laser safety glasses, regardless of the laser output power?

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SAFETY FIRST!

Our goal is not to fail teams and keep them from competing, but rather to run a fair and SAFE competition for all.

If you have a question or concern, please contact that MATE Center at izande@marinetech.org or (831) 646-3082. In this case it is better to ask for permission, not forgiveness. Remember, it is better to be **SAFE** than sorry!

