# RANGER & EXPLORER Class Safety Inspection Sheet Tutorial

**Safety Process** – Safety Inspections will start before the competition. In the past it has been done with a review by competition staff.

- Staff reviewed technical documents in the hopes of spotting problems.
- Notice was given to teams of items to fix before the competition.
- Many problems were caught and fixed, others slipped by. If it wasn't documented, there was no way to check.

**Initial Safety Inspections**.

- An itemized list of things that need to be shown by teams and how they meet specifications.
- Any team advancing to the International must adhere to these steps.
- Recommended that all Regionals implement to help with safety inspection.

**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.



MATE

## *NEW in 2017!!!* Company Safety Review

All RANGER companies advancing to the international competition must submit a company safety review that demonstrates compliance with the following specifications:

- Anderson Powerpole connectors are the main point of connection to the MATE supply (ELEC-010R) or (ELEC-010E).
- A properly sized fuse or breaker is within 30 cm of the main point of connection. The company must use a ruler to show this distance (ELEC-008R) or (ELEC-008E).
- Fuse calculations (ELEC-008R) or (ELEC-008E).
- The inside of the control box is does not have exposed wiring (ELEC-017R) or (ELEC-017E), the control box is neatly laid out with attention to workmanship (ELEC-022R) or (ELEC-022E), a separation and identification of 120VAC wiring from DC and control voltages (ELEC-023R) or (ELEC-023E). If AC wiring is not used in the control box, include a statement saying no AC is used.

## *NEW in 2017!!!* Company Safety Review (cont.)

- All wires entering and leaving the control system have proper strain relief (ELEC-024R) or (ELEC-024E).
- If hydraulics / pneumatics are used that the company has passed the Fluid Power Quiz (FLUID-014). If fluid power is not used on the vehicle, include a statement saying no fluid power is used.
- Hydraulic / pneumatic systems include a pressure release valve and regulator in the system (FLUID-007, FLUID-011), and that any pressurized cylinder, pressure storage device meets the MATE specifications (FLUID-012, FLUID-013).
- Any watertight housing on the vehicle can withstand pressure at 4 meters (MECH-001).
- All propellers are shrouded (MECH-006).
- The ROV has no sharp edges or elements of the ROV that could cause damage (MECH-006, ELEC-017R or ELEC-017E).

## *NEW in 2017!!!* Company Safety Review (cont.)

The **Company Safety Review** should include an explanation of how the system meets the safety specifications and photographs of the relevant system for review by the MATE Center staff.

Each item on the lists should be accompanied by photographs and text explanations showing how each specification is satisfied.

Upon reading this document, it should be clear to the safety inspector how the ROV meets all the required safety items.

## RANGER & EXPLORER Class Safety Inspection Sheet Tutorial

The **Company Safety Review** should include an explanation of how the system meets the safety specifications and photographs of the relevant system for review by the MATE Center staff.

Companies advancing the international competition must submit their Company Safety Review to the MATE Center by May 26th, 2017, along with (but as a separate document from) their technical documentation. Companies that do not submit a Company Safety Review will have 30 points deducted from their total score.*** (***Revised from manual 3/8/2017)

International competition safety inspectors will review companies' documentation for an **initial safety inspection** worth 10 points. Safety inspectors will also compile a list of the safety violations and publish them to the competition web site. This is not done to "call out" or embarrass companies in any way. It is to emphasize the fact that EVERYONE is responsible and accountable for ensuring a safe, successful event. It also allows the company to correct the safety violations before arriving at the international competition.

# Initial Safety Inspection Penalty points

Penalty points will be deducted from the initial safety inspection if:

- Companies do NOT submit the documentation two weeks before their regional event or by May 26th, 2017 for the international competition.
- The SID does not show a fuse or a fuse that does not use an ANSI, NEMA or IEC symbol.
- Fuse calculations are not shown on the SID.
- The vehicle uses fluid power, but a fluid power diagram is not included.
- The technical documentation is not submitted in a searchable PDF format.
- The technical documentation file is over 8MB in size.
- The company spec sheet, SIDs and company safety review are over 2MB in size.



MATE

## RANGER & EXPLORER Class Safety Inspection Protocol

**Before entering the water for practice or a product demonstration run, the ROV system must go through a safety inspection.**

**Once the company successfully passes inspection, they will turn in their safety inspection sheet and be presented with a Green PASSED Flag.**

**Companies must present the Green PASSED Flag to the pool practice/product demonstration coordinator before their vehicles are permitted to enter the water. Each company's flag will be uniquely identified with company number on the flag.**

## RANGER & EXPLORER Class Safety Inspection Protocol

**Competition staff will conduct a safety inspection of the vehicle using the safety inspection rubric.**

**If the safety inspector(s) identify a safety violation, companies will have the opportunity to address it. The pool practice or product demonstration run schedule will NOT change to allow companies more time.**

**If during the second safety review the**

**a. violation has not been properly addressed or**

**b. another violation is revealed**

**companies will have ONE additional opportunity to address the issue.**

## RANGER & EXPLORER Class Safety Inspection Protocol

**If during the third safety review a violation still exists, companies will not be permitted to participate in the underwater product demonstration component of the competition.**

**However, companies can still participate in the engineering and communication (technical documentation, product presentation, and marketing display) component.**

**Reminder: All companies must present the Green PASSED Flag to the pool practice or product demonstration judge before placing their vehicles in the water.**

**In addition, product demonstration station judges and competition officials can pause or stop a product demonstration run at any time if they feel that there is a potential safety concern.**

**New in 2017!!! Companies do not need to present their Green PASSED Flag to the judges during their product presentation.**

# 2017 RANGER SAFETY INSPECTION SHEET

**COMPANY NAME:**_____ **COMPANY NUMBER:**_____

**2017MATE ROV COMPETITION**

*Port Cities of the Future: Commerce, Entertainment, Health and Safety*

***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, company safety review, 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.

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| **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 40 psi 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 |

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| **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]** | _____. |

**Inspection #1: Items to address** **Judge:** _____

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**Inspection #2: Items to address** **Judge:** _____

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**Inspection #3: Reason** **Judge:** _____

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MATE

# 2017 EXPLORER SAFETY INSPECTION SHEET

**COMPANY NAME:**_____ **COMPANY NUMBER:**_____

**2017 MATE ROV COMPETITION**

*Port Cities of the Future: Commerce, Entertainment, Health and Safety*

***EXPLORER 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, company safety review, technical documentation, and any additional documentation needed to verify compliance must be made available to the Safety Inspectors during the inspection process.**

| **1.0 Initial Inspection Results** | |
|---|---|
| | 0, 5 or 10 points |
| | Fluid Power Used & Approved for Use?<br>If yes to both, see item #4 |
| | Laser Used & Approved for Use?<br>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 power conversion before ROV. |
| | No exposed motors.<br>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 |
| | 30 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)<br>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<br>100psi (pneumatic) or<br>300psi (hydraulic)<br>stamped on line or verified with specifications |
| | Valves meet the minimum pressure of<br>100 psi pneumatic or<br>300 psi hydraulic |
| | Attachment to pressure source is secure. |
| | Pressure is regulated to<br>40 psi max for pneumatics and<br>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 |

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|---|---|
| **INSPECTION #1 POINTS** | **PASSED: 30** |
| **FAILED: Items to correct: (see rear of this sheet)** | |
| **INSPECTION #2 POINTS** | **PASSED: 20** |
| **FAILED: Items to correct: (see rear of this sheet)** | |
| **INSPECTION #3 POINTS** | **PASSED: 10** |
| **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]** _____. | |

**Inspection #1: Items to address** **Judge:** _____

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**Inspection #2: Items to address** **Judge:** _____

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**Inspection #3: Reason** **Judge:** _____

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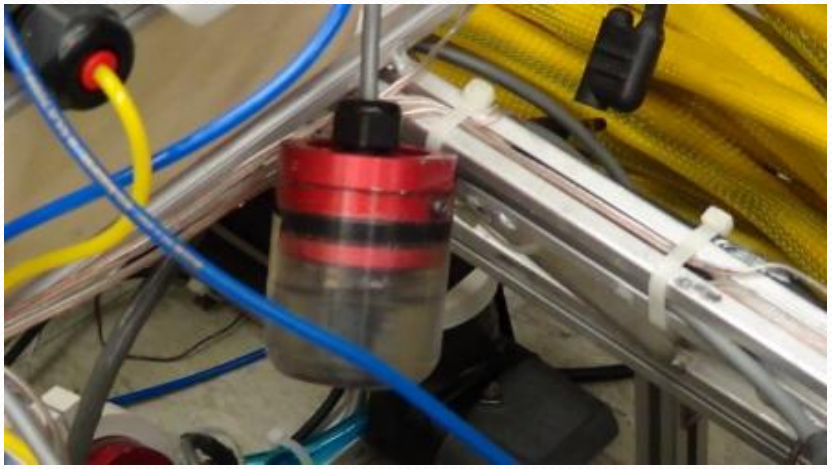
MATE

## 2.0 Physical

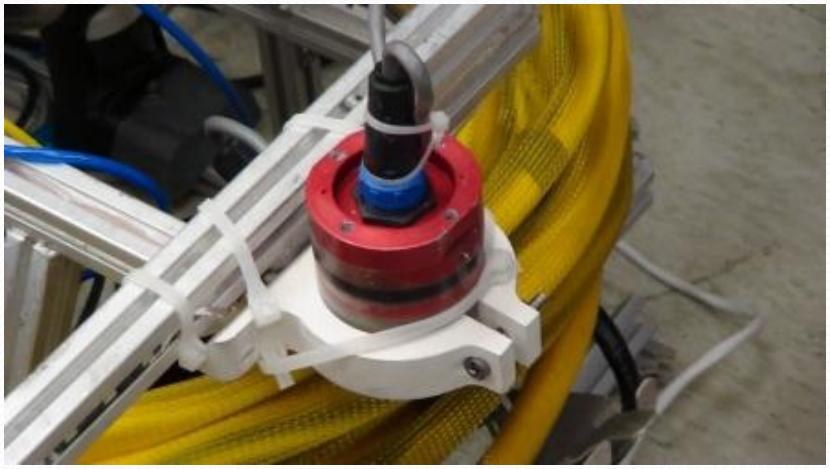
***All items attached to ROV are secure and will not fall off.***

**Examples:**

**loose camera**



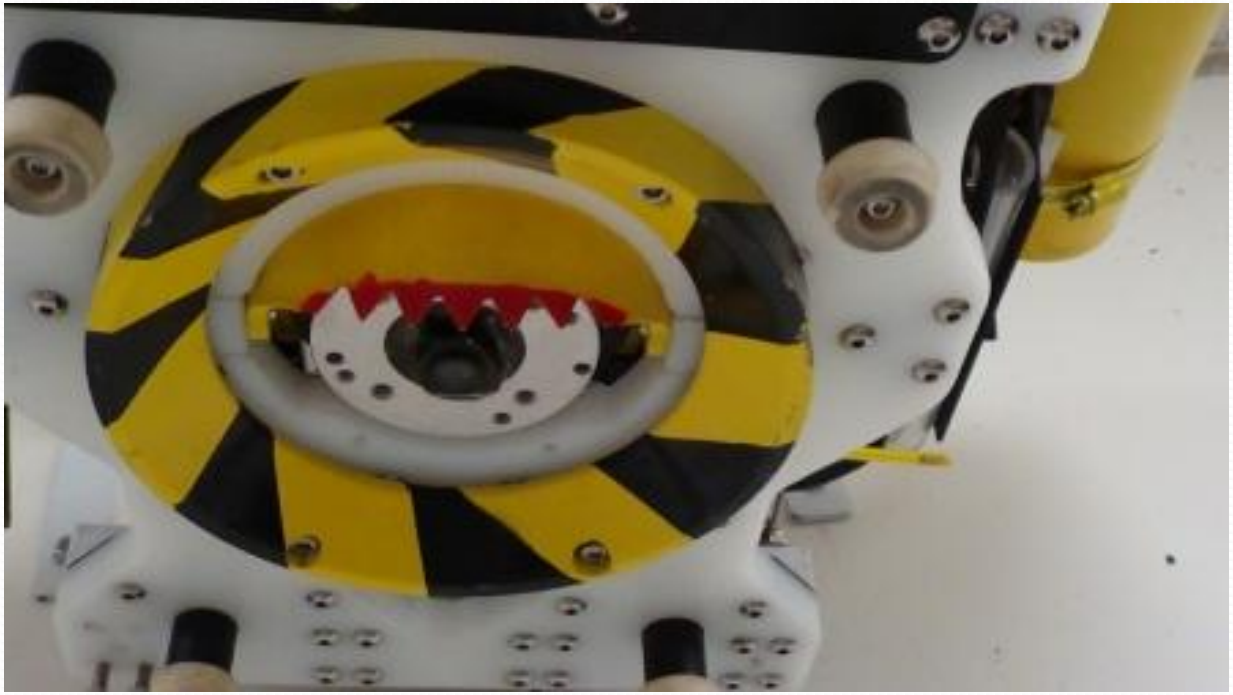
**securely attached camera**



## 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.**

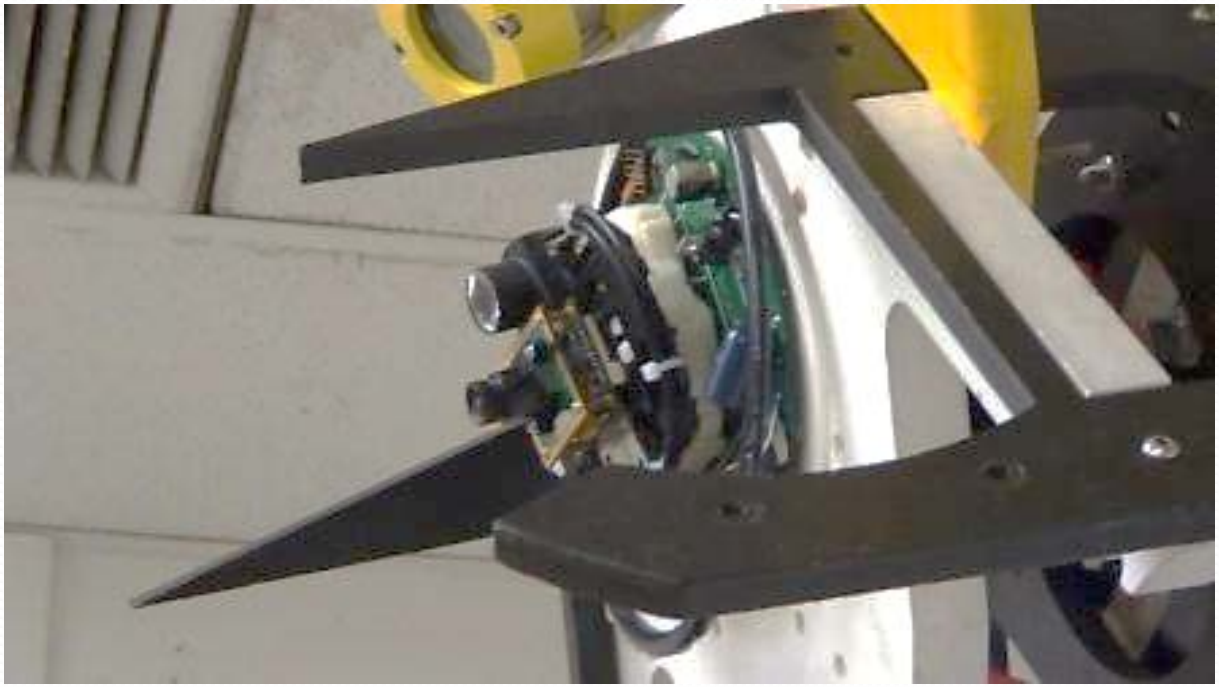


## 2.0 Physical

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

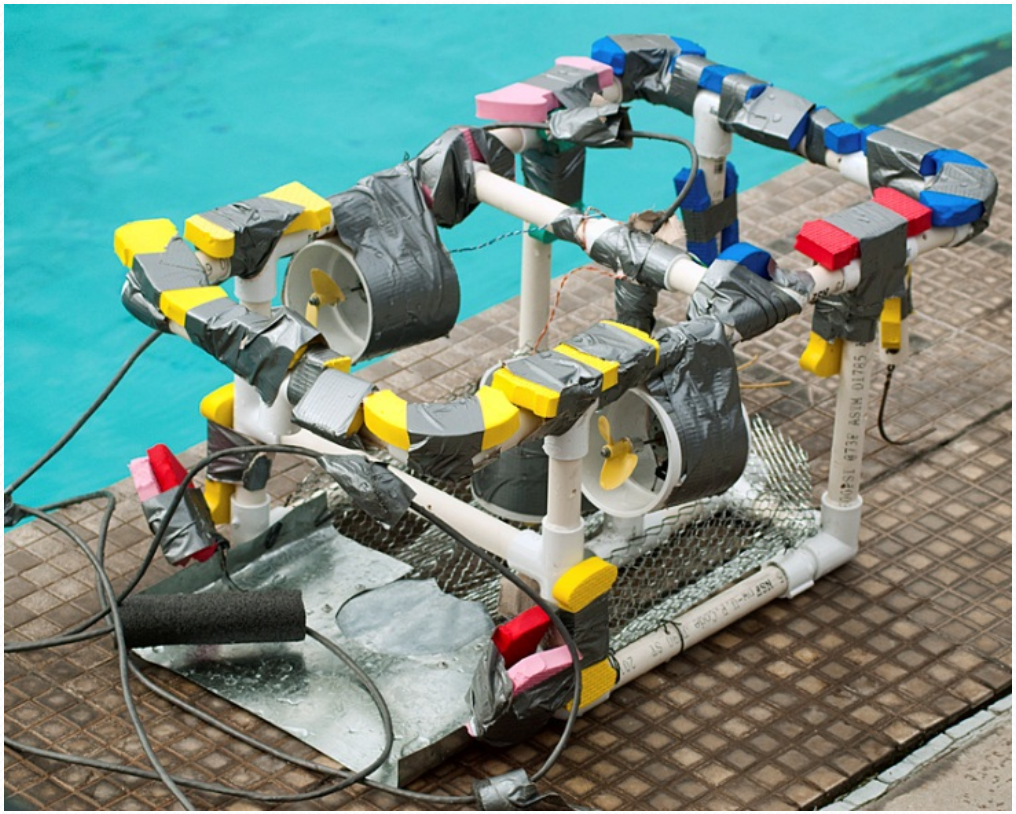
**Examples:**

**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.**



## 2.0 Physical

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



**Shrouded**

## 3.0 Electrical (Ranger)

**Single attachment point to power source.**

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

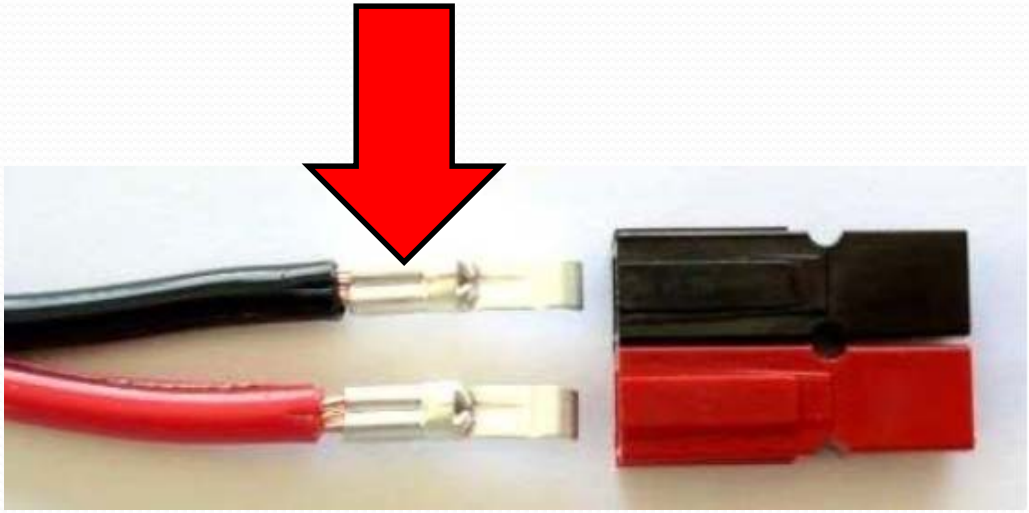
**Single Inline fuse within 30cm of attachment point (power connectors). Fuses in each line are acceptable.**

**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**

## 3.0 Electrical (Ranger)

**Problems with the Anderson Power Poles in Ranger class have developed when teams do NOT use the proper crimper for these connectors. Standard Electricians Crimpers will NOT work!**

**The crimp must be a roll crimp not a “squish” crimp**



## 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 SBS50BLU-BK (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.**

## 3.0 Electrical (Ranger & Explorer)

# Fuse Size Calculation

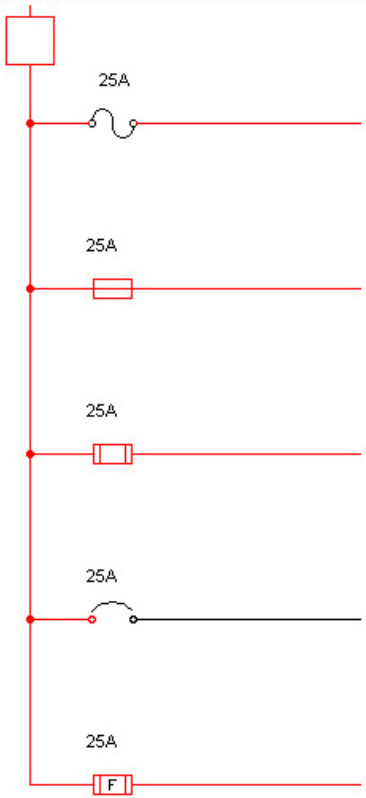
**The team should have their fuse size calculation somewhere on their SID.**

**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: ROV Overcurrent Protection = 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.

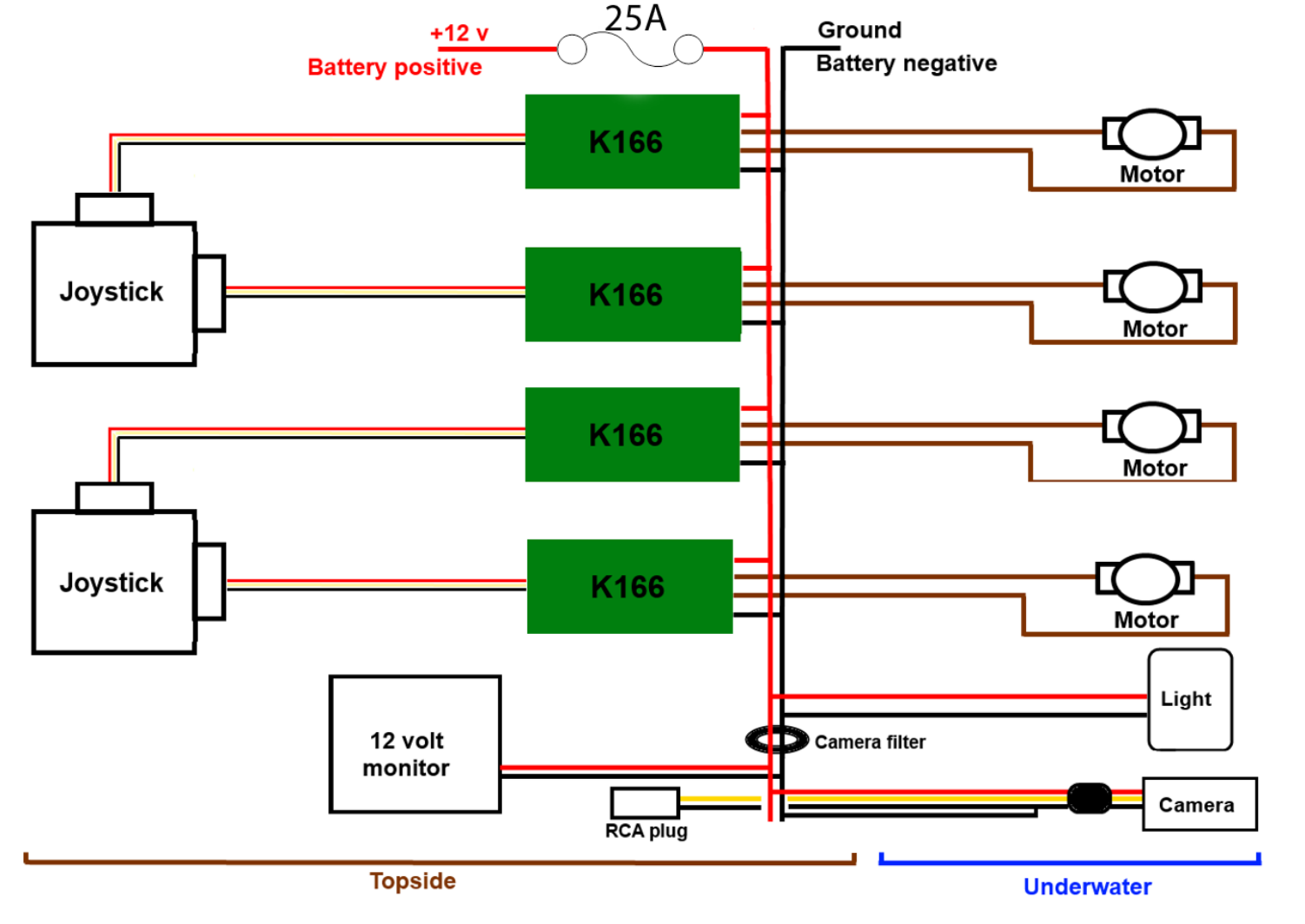
## 3.0 Electrical System Interconnection Diagram (SID)

- **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




MATE

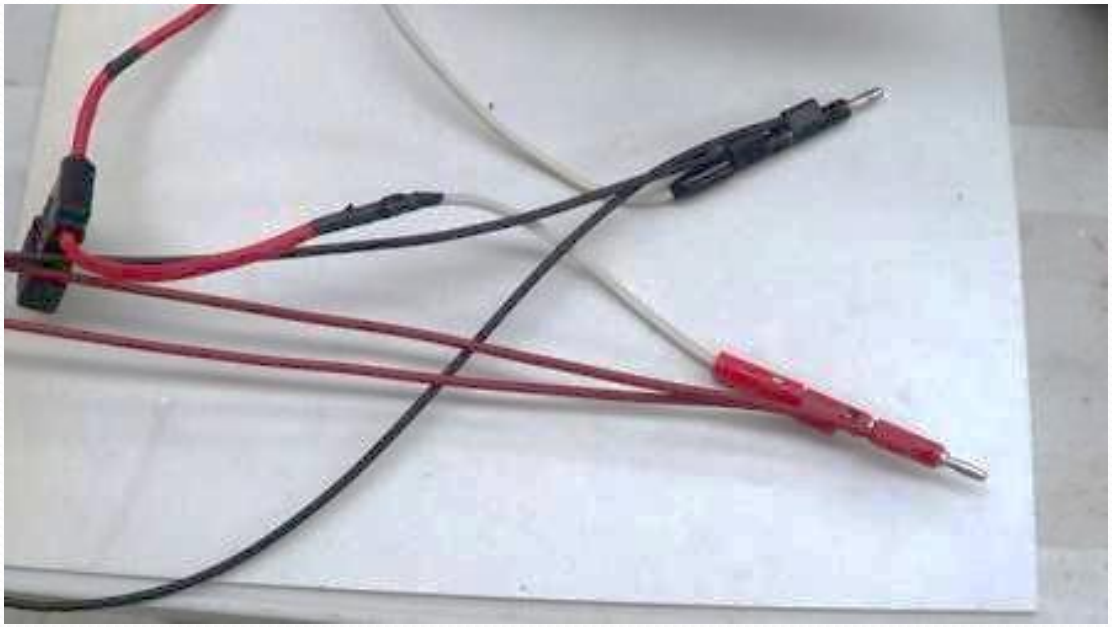
# RANGER & EXPLORER Class Safety Inspection Sheet Tutorial

## 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.**

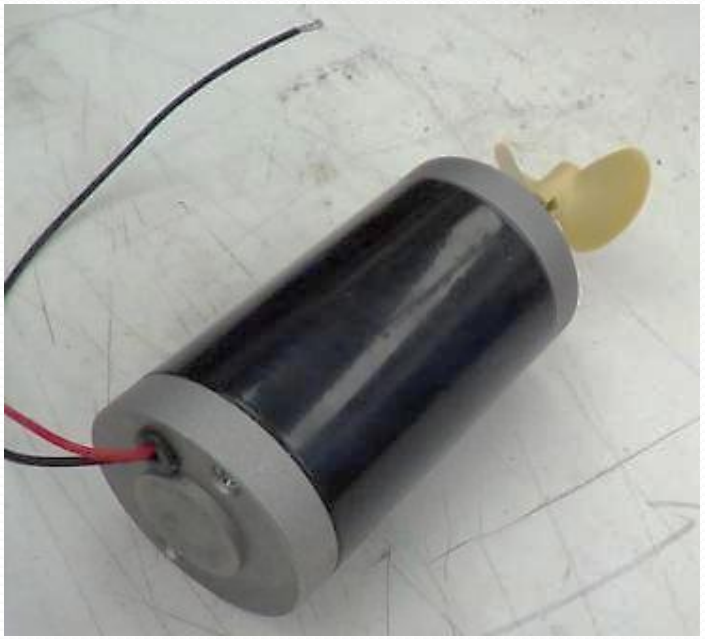


## 3.0 Electrical

***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.**

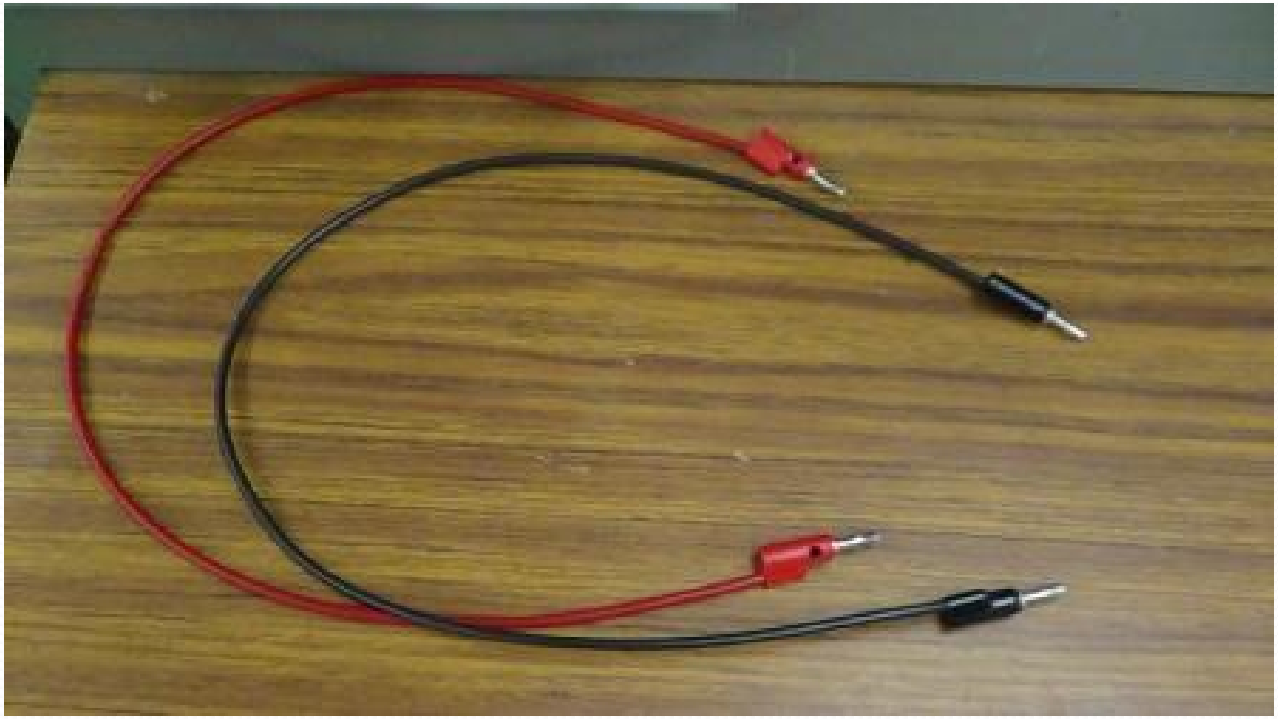


## 3.0 Electrical

***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.**



## 3.0 Electrical

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

**Examples:**

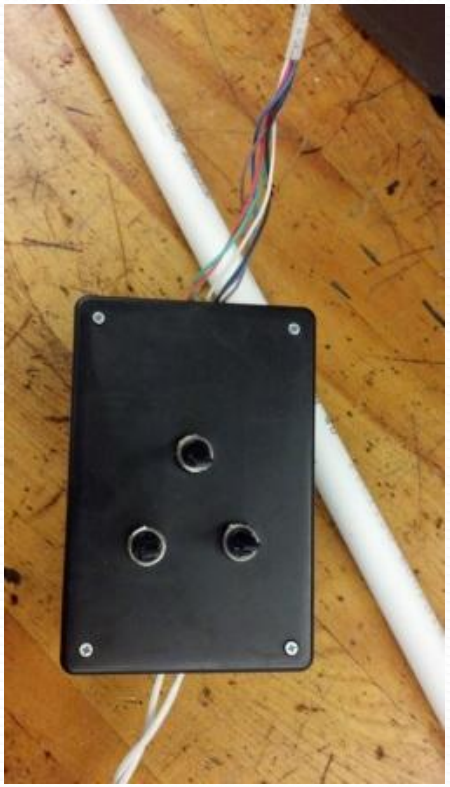
**On the left, all the wires are loose and unsecured. On the right is an example of a well-secured tether.**

## 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. Hot melt glue and tape are not acceptable strain relief items.**



## 3.0 Electrical

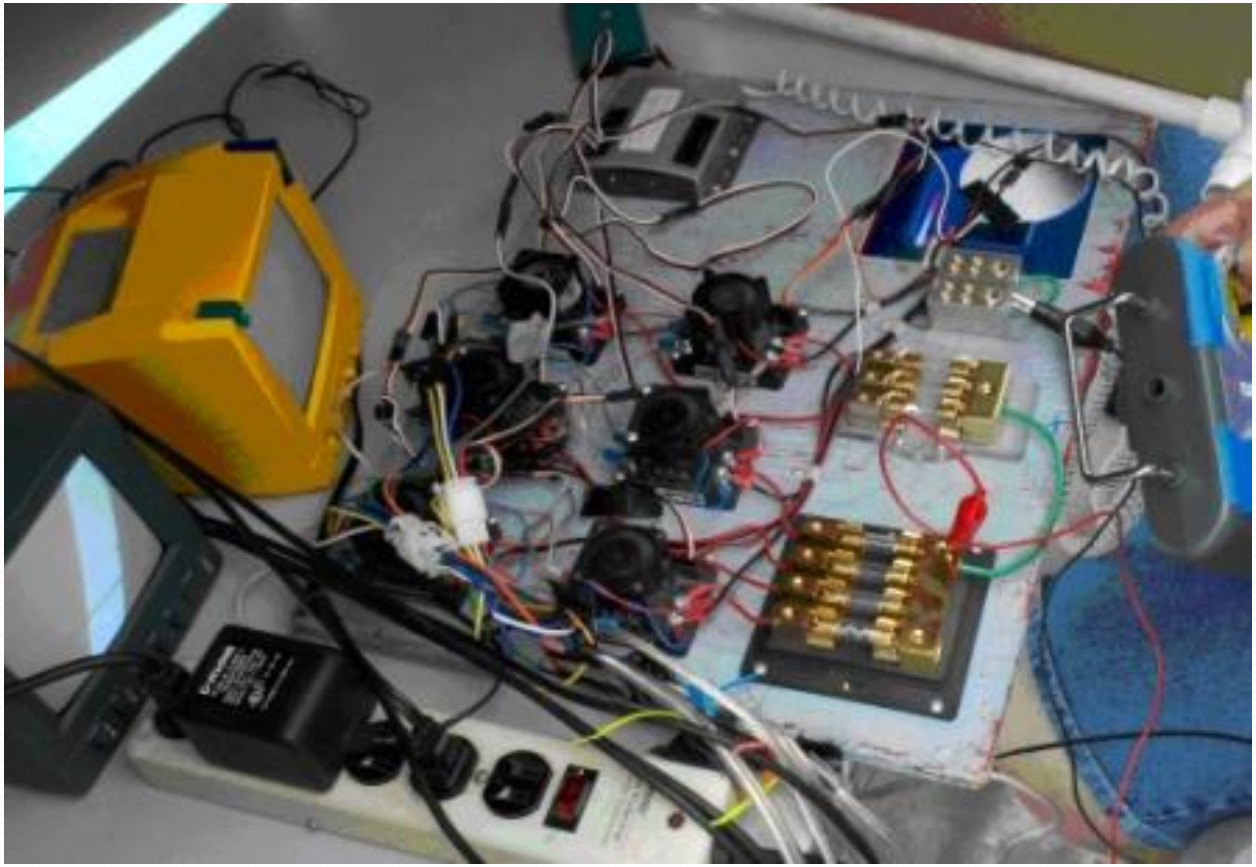
## *Surface controls: All wiring and devices properly secured.*

**Examples: Properly secured**

## 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.**

## 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.***

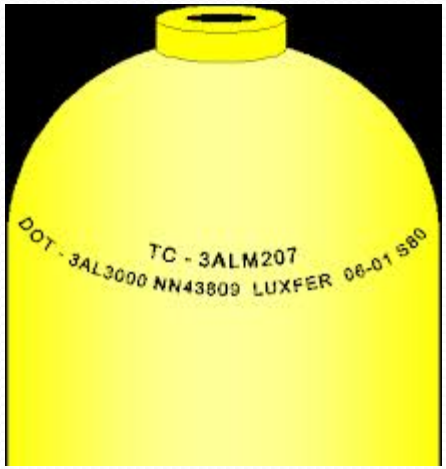
***An example of this was seen in the use of 120VAC connectors to provide power for the ROV. One team distributed power on the surface using a 120VAC plug strip that had been modified to plug into the 12VDC MATE supply. Each thruster then had a 120VAC connector that plugged into the plug strip. This 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.***

## 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?

# 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)




MATE

# 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?

# 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 jzande@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!**