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

Company Safety Review

All EXPLORER and 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 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).
- EXPLORER class must use a certain fuse (ELEC-001).
- Fuse calculations (ELEC-008R) or (ELEC-008E) should be included and a properly sized fuse used.
- 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.

MATE

Company Safety Review (cont.)

- All wires entering and leaving the ROV and control box 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).
- New in 2018!!! All propellers are shrouded and guarded to IP-20 standards (MECH-006). The guard / shroud must completely enclose the thruster so no object of 12.5 mm can reach the propeller.
- Any Non-ROV Device is detailed for safety.
- The ROV has no sharp edges or elements of the ROV that could cause damage (MECH-006, ELEC-017R or ELEC-017E).

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 24th, 2018, along with (but as a separate document from) their technical documentation. Companies that do not submit a Company Safety Review by the required date will be DISQUALIFIED from advancing to the international competition.

International competition safety inspectors will review companies' documentation for an **initial safety inspection** worth 20 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.

Powering a Non-ROV-Device

- EXPLORER may use power for their lift bag release mechanism and their inductive coupling power source.
- RANGER may use power for their OBS release mechanism.
- Non ROV Device may not have thrusters or cameras. Only the components of the designated system.

- Power may be supplied from surface or from on-board batteries. Power is limited to 12V and 3 amps.
  - If powered from the surface, device must have a 3 amp fuse within 30 cm of battery.
  - Onboard power must be AAA, AA, A, A23, C, D or 9-volt alkaline batteries only.
  - Onboard batteries should be mounted, not loose, in the container.
  - The battery container must be designed so it will open or release if pressure inside becomes greater than the external pressure.
    - One end of container pops off
    - Both a 3 psi pressure release valve AND a Schrader valve (EXPLORER only)

A SID is required for any powered Non-ROV Device.

Documentation of powered Non-ROV Device

- EXPLORER companies must provide a written explanation of how their lift bag release mechanism works to the size and weight and or station judges.
- EXPLORER companies using power for the lift bag release or for their inductive coupling MUST provide an SID for these devices.

- RANGER companies must provide a written explanation of how their OBS release mechanism works to the size and weight and/or station judges.
- RANGER companies using power for their OBS release MUST provide an SID for this release.

Failure to provide the necessary documentation or SID means companies will not be allowed to complete their in-water product demonstration.

Initial Safety Inspection Penalty points

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

- Companies do NOT submit the documentation at least two weeks before their regional event or by May 24th, 2018 for the international competition.
- Documents are not submitted with the proper naming format.
- 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 Company Safety Review does contain the necessary information.

- The RANGER OBS information document or the EXPLORER lift bag release document is not documented.

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.

MATE

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.

Note: Companies do not need to present their Green PASSED Flag to the judges during their product presentation.

MATE

2018 RANGER SAFETY INSPECTION SHEET

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

2018 MATE ROV COMPETITION

Jet City: Aircraft, Earthquakes and Energy

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 to 20 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
	Properly sized inline fuse 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 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

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:** _____

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

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

MATE

2018 EXPLORER SAFETY INSPECTION SHEET

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

2018 MATE ROV COMPETITION

Jet City: Aircraft, Earthquakes and Energy

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 to 20 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 has proper strain relief at the ROV.
	No power conversion before 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
	Properly sized (Littlefuse brand) fuse 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 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

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:** _____

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

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

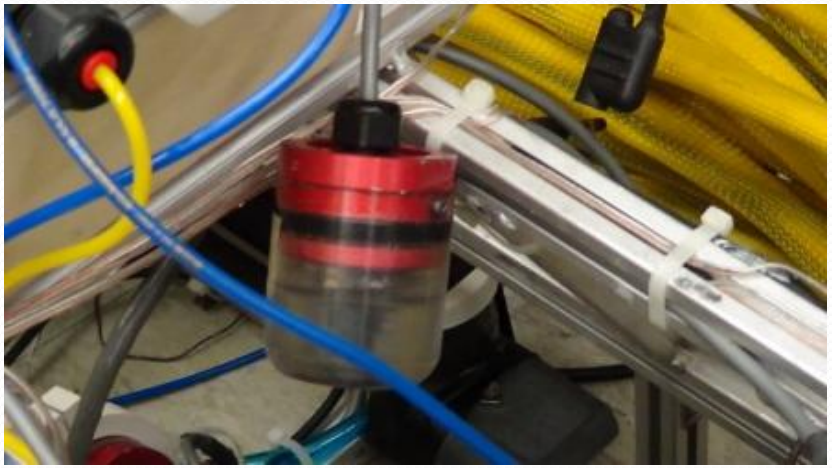
MATE

2.0 Physical

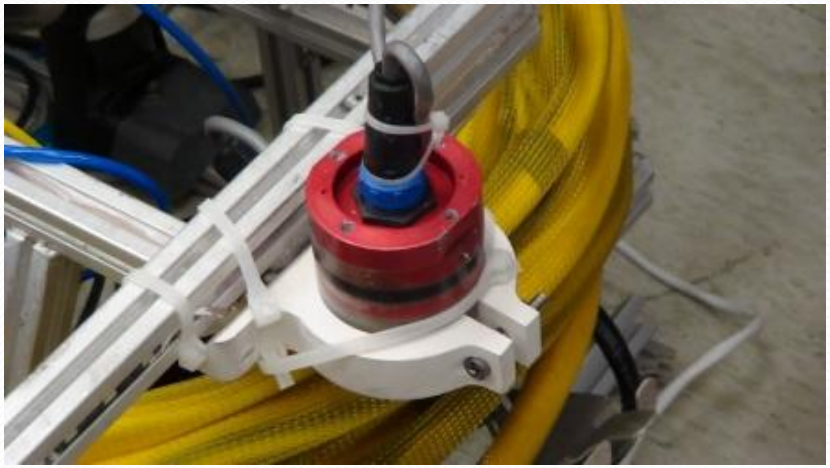
All items attached to ROV are secure and will not fall off.

Examples:

loose camera



securely attached camera



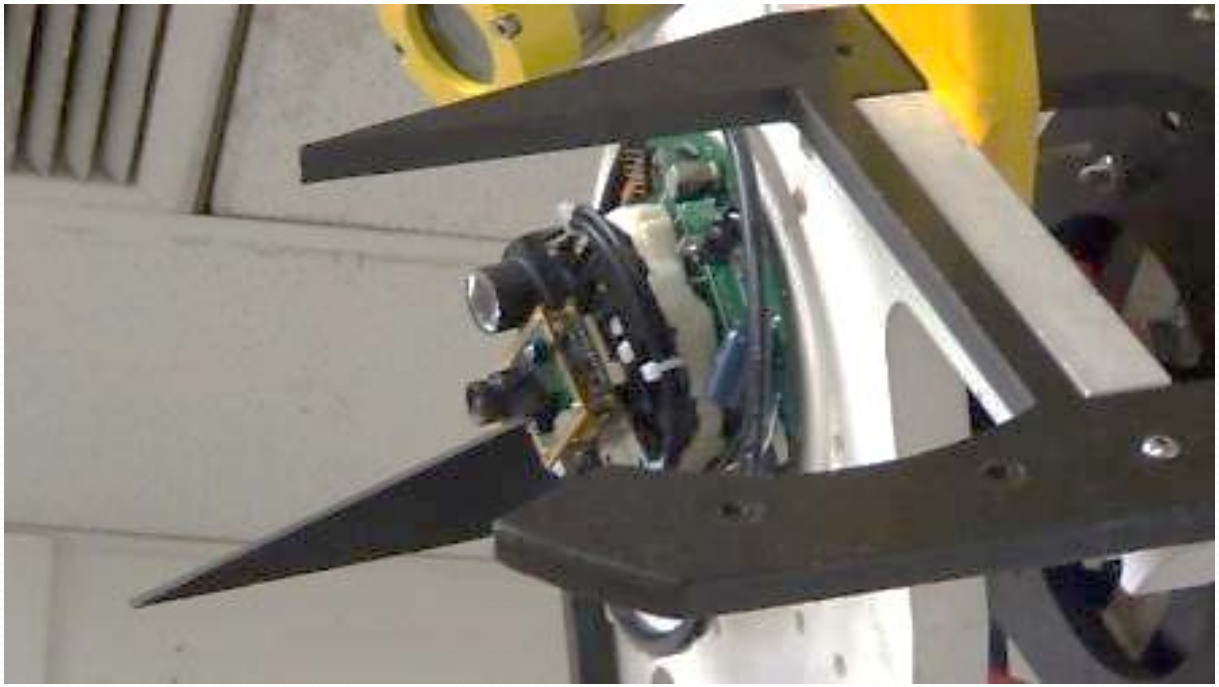
MATE

2.0 Physical

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

Examples:

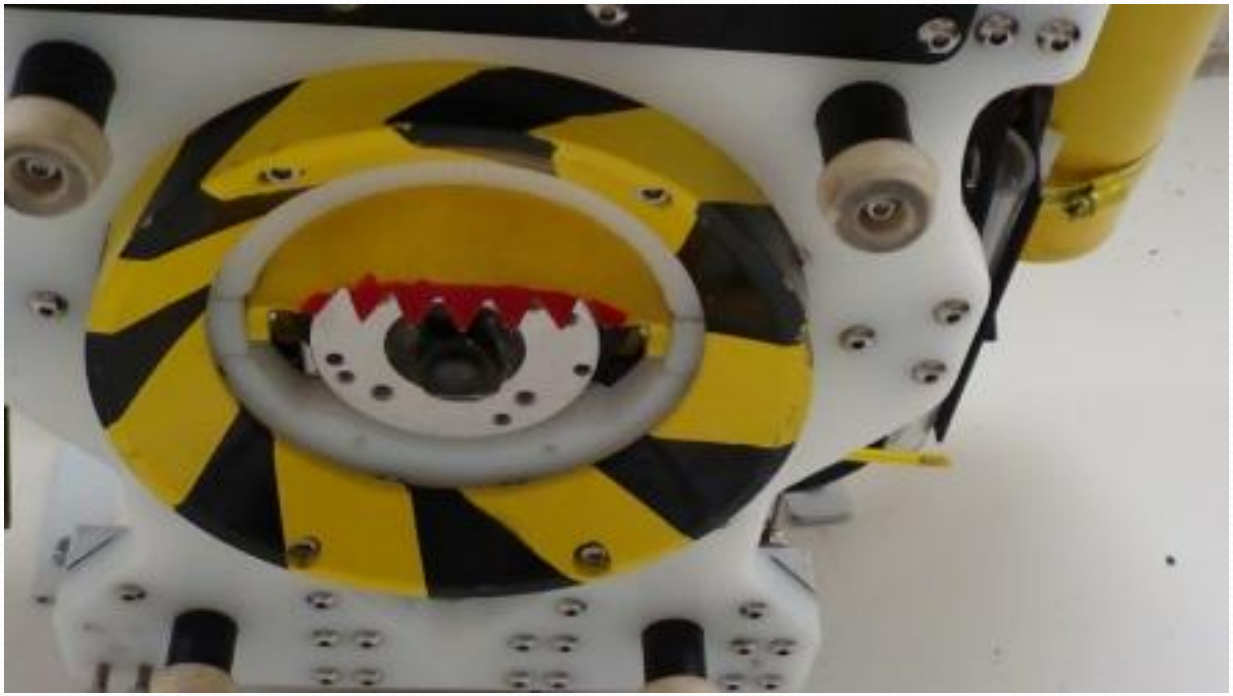
The points on the front of this ROV may look cool, but the judge deducted points for putting something that could be a danger to the divers.



2.0 Physical

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.



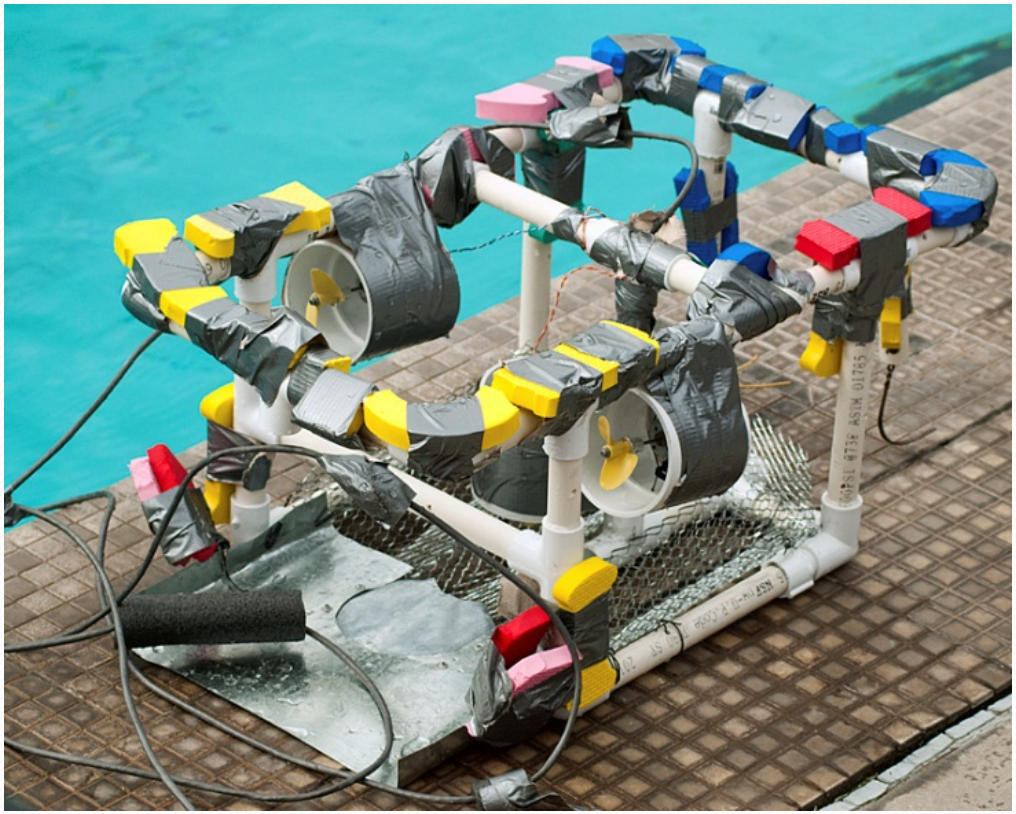
MATE

2.0 Physical

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

Note that the shrouds shown do not meet IP-20 standards and are not acceptable shrouds/guards for propellers.

This will not pass inspection!



Insufficient shrouding

MATE

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.

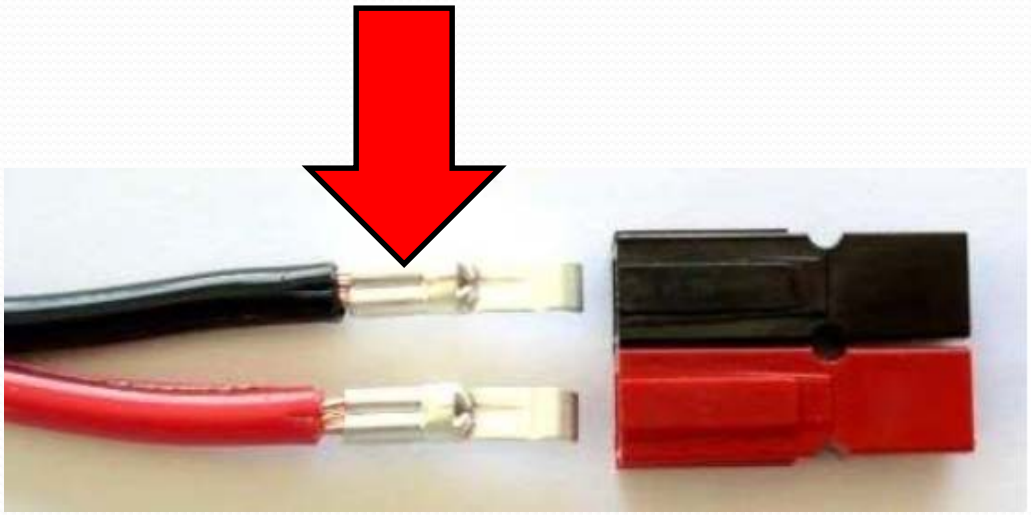
Ranger Class utilizes the RED & BLACK power connectors. Looking at the end of the connectors, you will see a small A on the end of each. With the tip of the A pointing up, Black should be on the left and Red on the right

MATE

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



MATE

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). Specific Fuses this year!!!!!.

Explorer Class utilizes the Blue SBS50BLU-BK (50 amp) power connectors. Positive and Negative are marked on the connectors.

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

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

MATE

3.0 Electrical (Ranger & Explorer)

Fuse Size Calculation

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

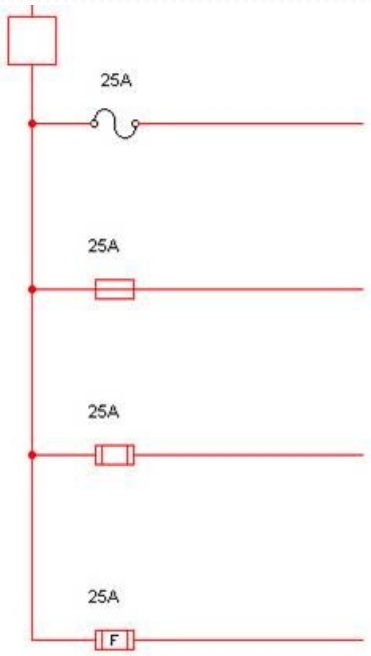
Review that calculation and verify that the attached fuse corresponds with their calculations.

ELEC-008: The ROV system must have a fuse 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 for RANGER and 30A for EXPLORER. The fuse 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 and include the amperage of the overcurrent protection. In addition, the SID must show the calculations used in determining the overcurrent protection value.

New in 2018!!! Circuit breakers are not allowed.

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.



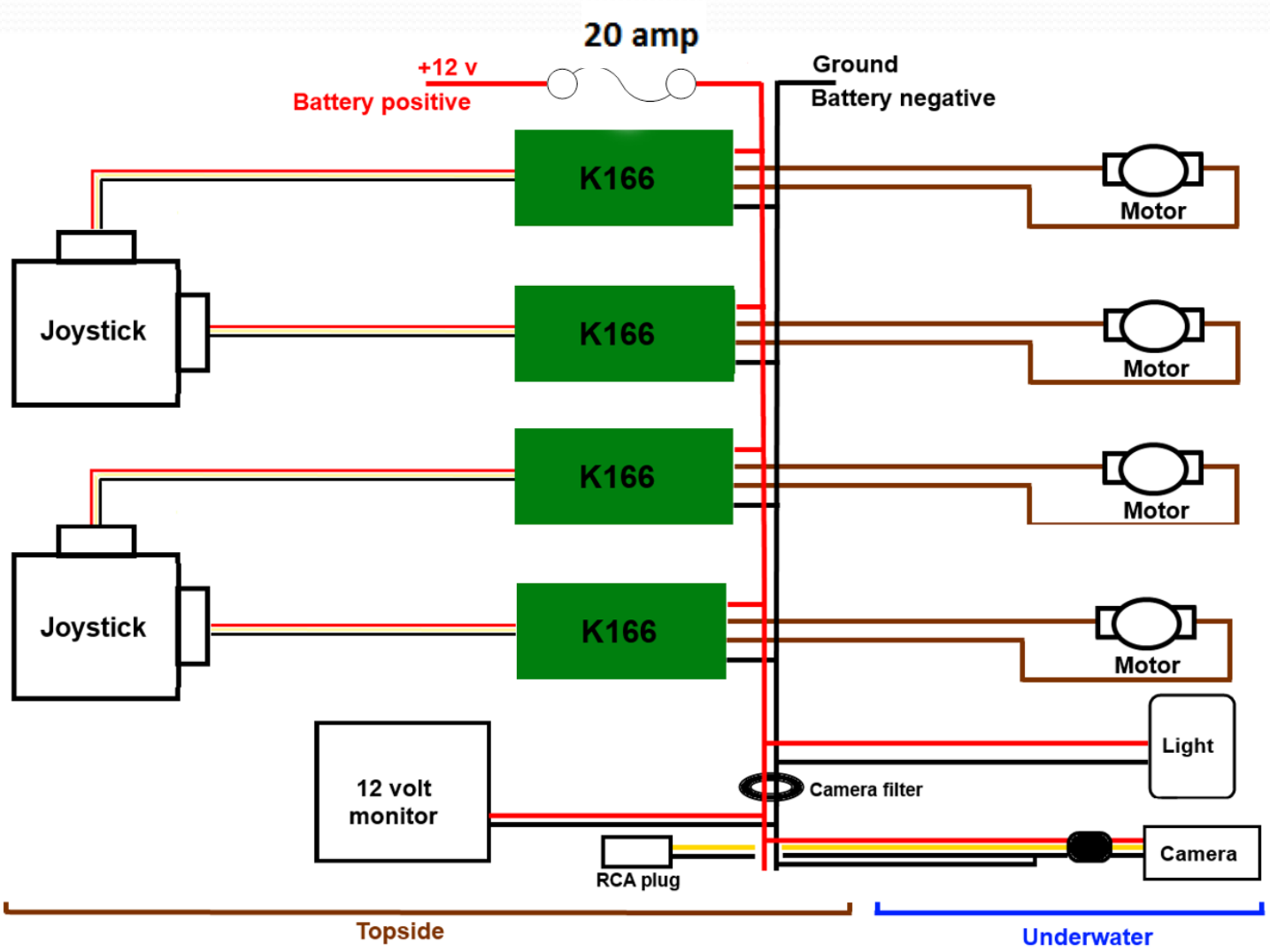
These are the only acceptable fuse symbols.
A fuse is not a box, a line with an letter S over it, or any other non-standard symbol

Example SIDs can be found in the **Technical Documentation** of teams from previous years.

https://www.marinetech.org/tech-reports/

MATE

Example RANGER SID



Fuse calculations:
4 motors = 12A
2 cameras = 0.6A
1 gripper = 1.2A

Total: 13.8 * 1.5 = 20.7A

20 amp fuse used

MATE

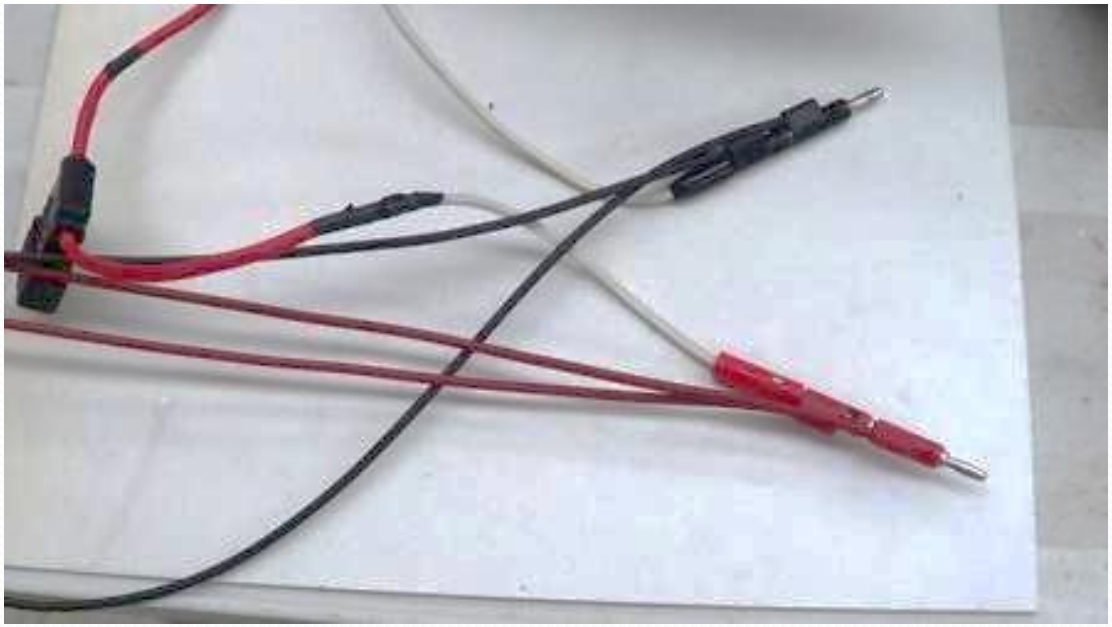
RANGER & EXPLORER Class Safety Inspection Sheet Tutorial

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.

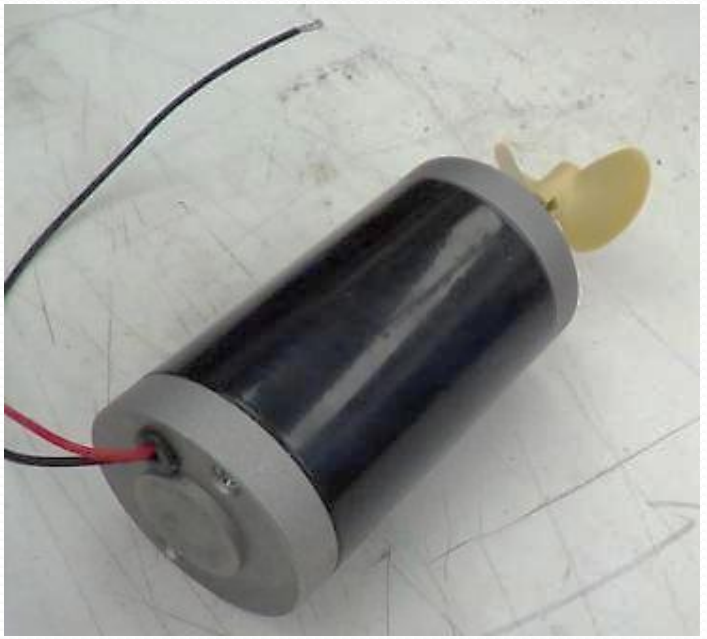


MATE

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.



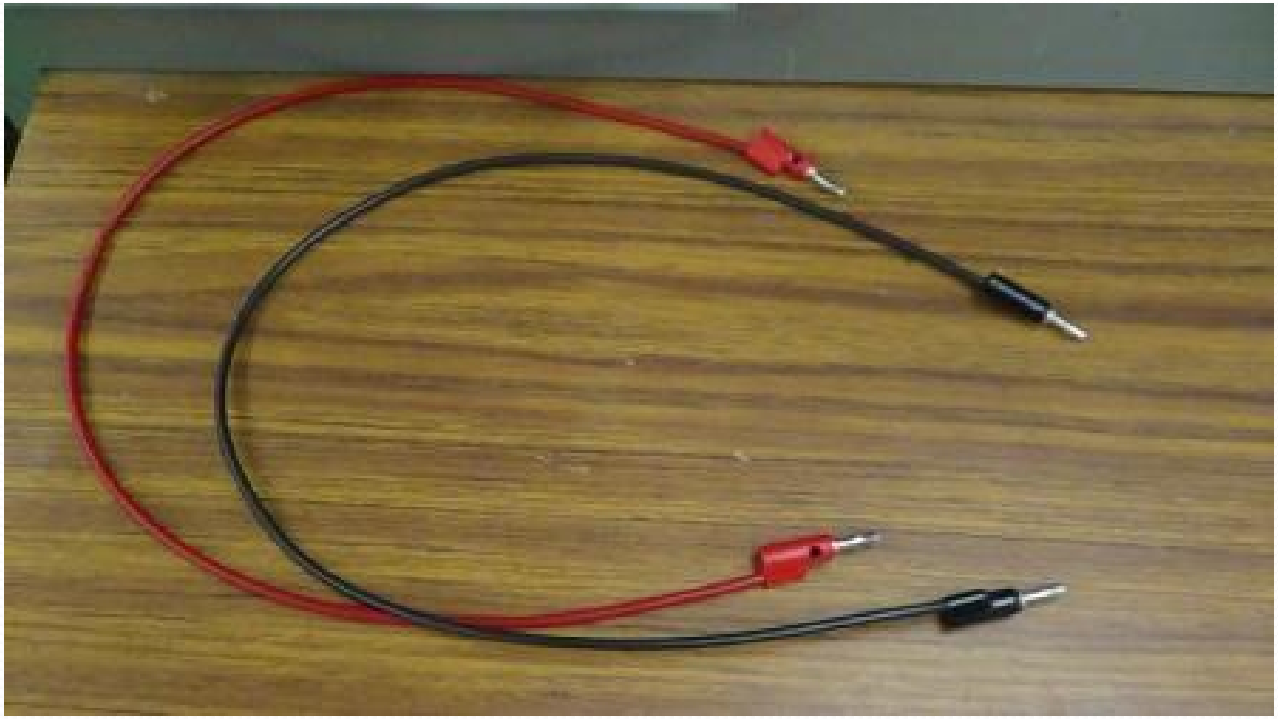
MATE

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.



MATE

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.

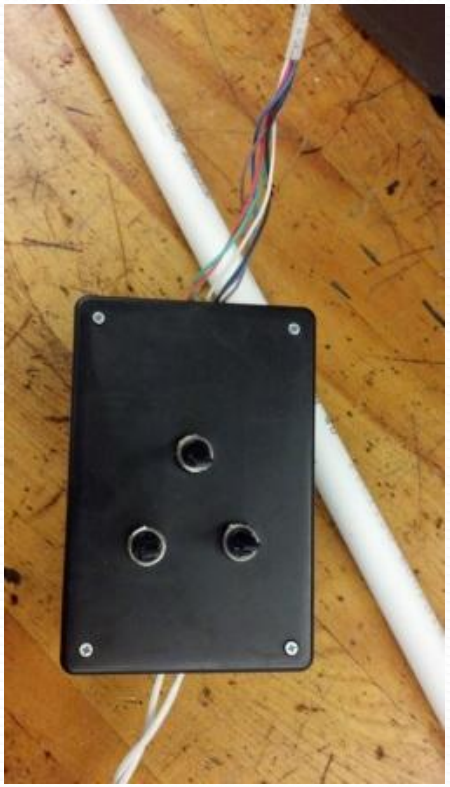
MATE

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.



MATE

3.0 Electrical

Surface controls: All wiring and devices properly secured.

Examples: Properly secured

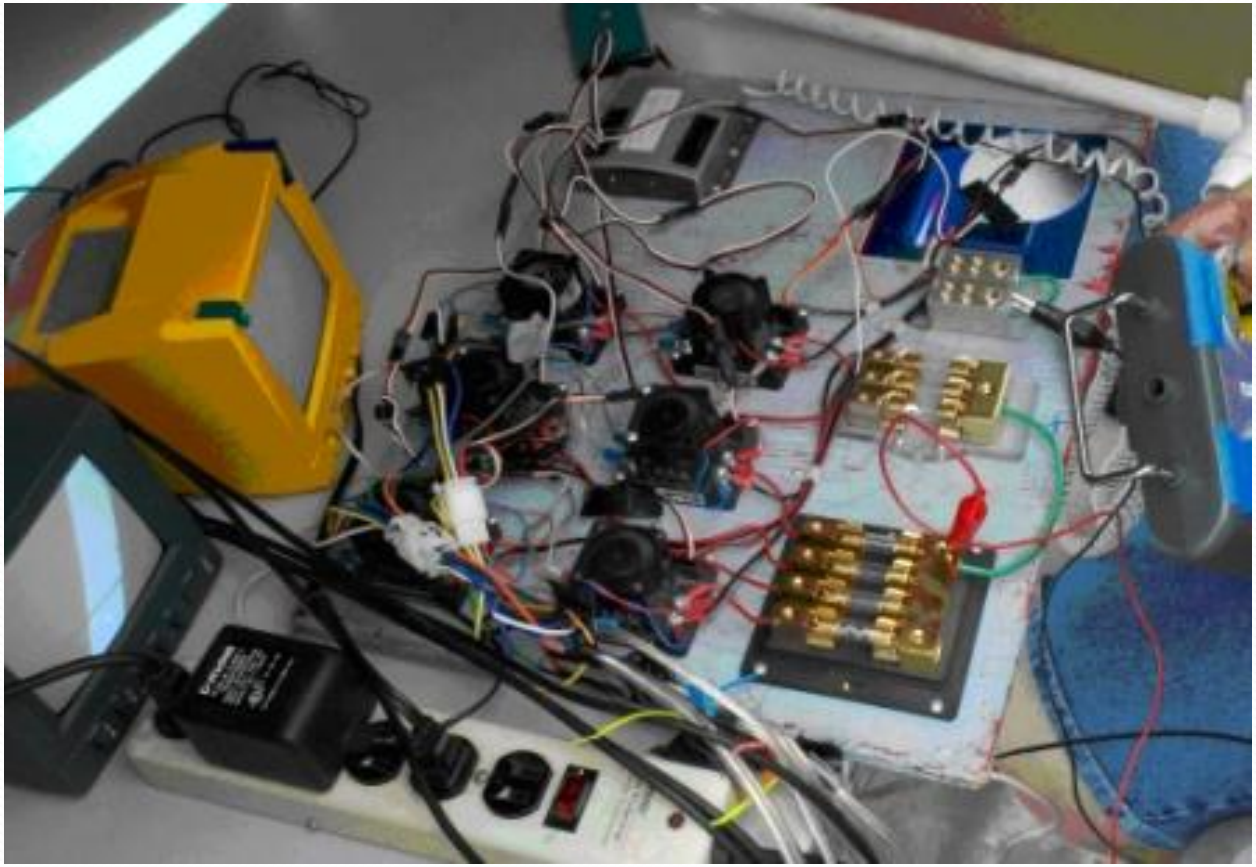
MATE

RANGER & EXPLORER Class Safety Inspection Sheet Tutorial

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.**

MATE

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.

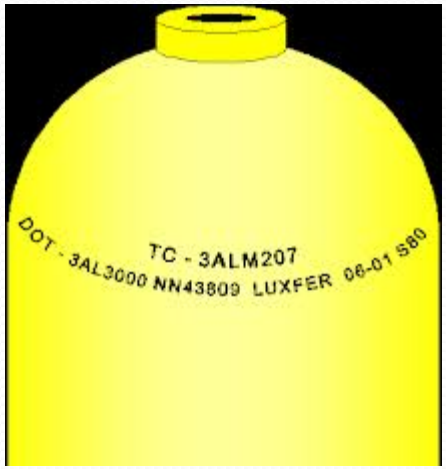
4.0 Pneumatic / Hydraulic Checklist

- ◆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?

MATE

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, You can ask your question on the MATE forum boards at: https://www.marinetech.org/forums/ or contact that MATE Center at mgardner@marinetech.org. In this case it is better to ask for permission, not forgiveness. Remember, it is better to be SAFE than sorry!