



# IANA

INTERMODAL ASSOCIATION  
OF NORTH AMERICA™

*Intermodal Adapts – Celebrating 30 years*



# Harness and Lights Presentation

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September 30, 2021, 2:00 PM ET

# Housekeeping

- Audience will be muted
- A question & answer session will follow the presentation
- Submit questions by clicking the Q&A icon at the bottom of your screen
- A recording of this webinar, including the slides, will be available soon



# Today's Presenters

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- IRP C.103 AUTOMATIC TIRE INFLATION SYSTEM – INSPECT AND REPAIR
- IRP C.104 CREDENTIALS, MARKINGS AND LABELING – INSPECT
- IRP C.105 FLOOD WATER DAMAGE – INSPECT AND REPAIR

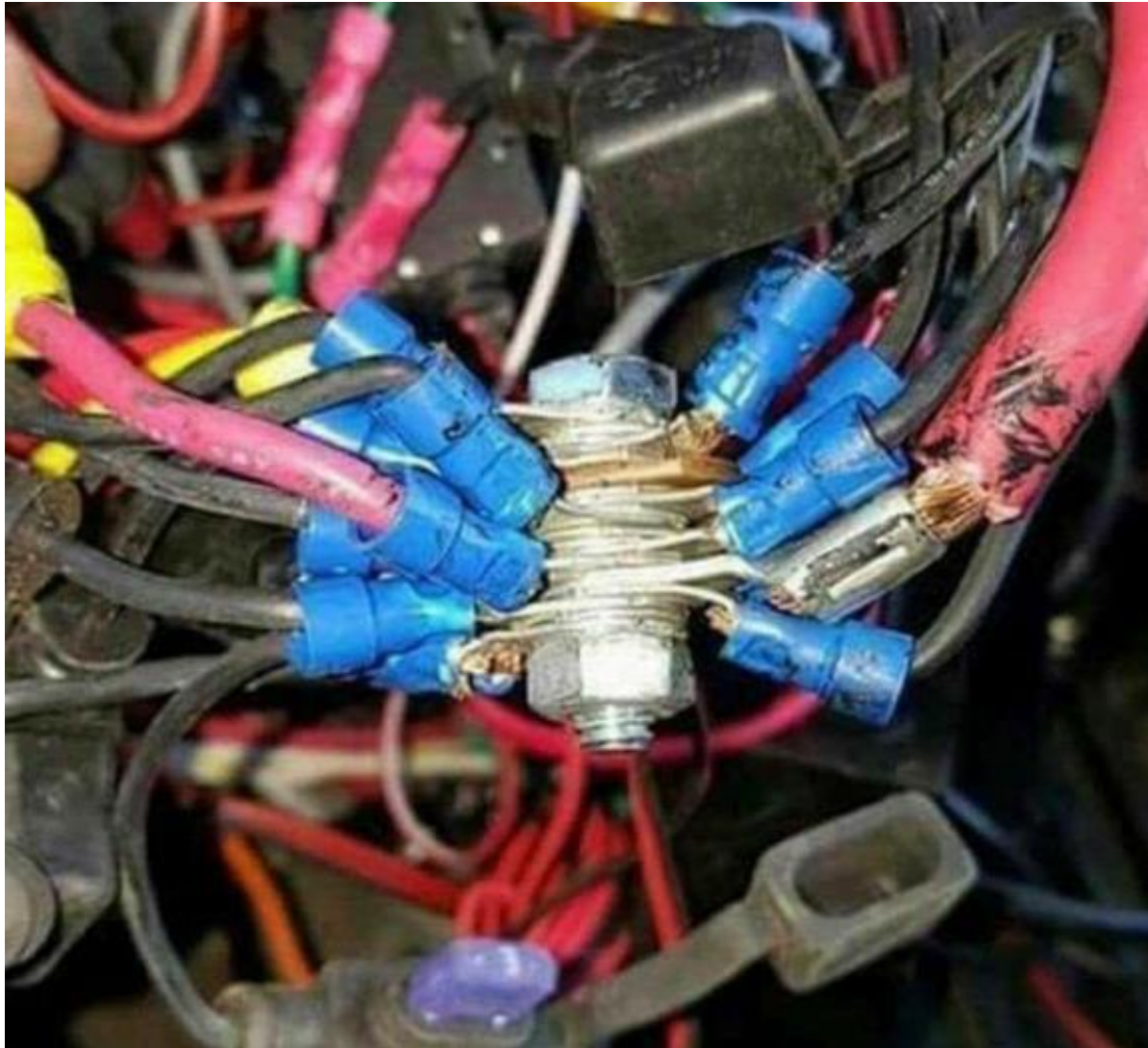
### SECTION 200 – Electrical and Lamps

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- IRP C.303 TUBELESS TIRE – DEMOUNT AND MOUNT
- IRP C.304 BIAS PLY TIRE – PUNCTURE REPAIR





**Do not use this tool**



**Test Light, Checks for power only**



## Multi-Meter

Checks & measures voltage

Check continuity

- **The non-destructive way**
- **Never probe that wire !**



**The Proper Tool**

## Checks Continuity



## Gives you proper voltage!



- Basics in Electricity
- Trailer Lighting Requirements
- Trailer Wiring
- Diagnostics
- Wire Repair (Choosing the proper wire)
- Wire Repair (Method of Repair)
- Wire Repair (Application)
- Shrink Tubing
- Back Probing
- Questions

# Basics in Electricity

Volt - The unit of measurement applied to the difference in electrical potential between two points; that is, the potential for electricity to flow. Voltage is usually referenced from “ground.”

Resistance - As electrons flow through conductors, they meet opposition, due to the collisions between the electrons flowing and the electrons and atoms of the conductor.

Amp - The unit of measurement applied to the flow of electrical current through a conductor.

Power - Power is the amount of work that can be accomplished in a specified amount of time. Work here is simply defined as converting energy from one form to another.

## OHM's Law

- Current (I)
- Voltage (V)
- Power (P)
- Resistance (R)

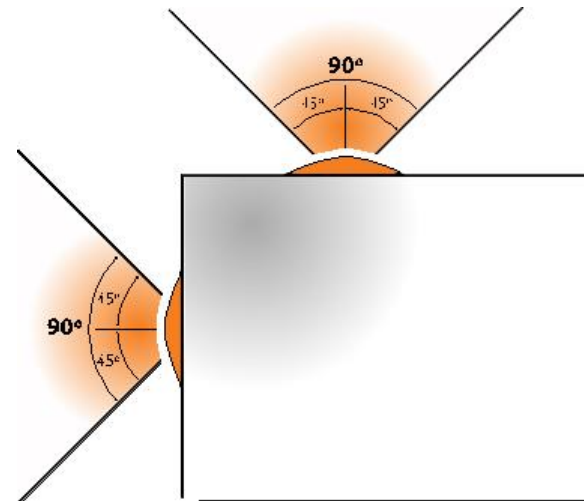
- Given any of the two quantities on the left you can find the other
- $V = I \times R$
- $I = V / R$
- $R = V / I$
- $P = V \times I$

# Trailer Lighting Requirements



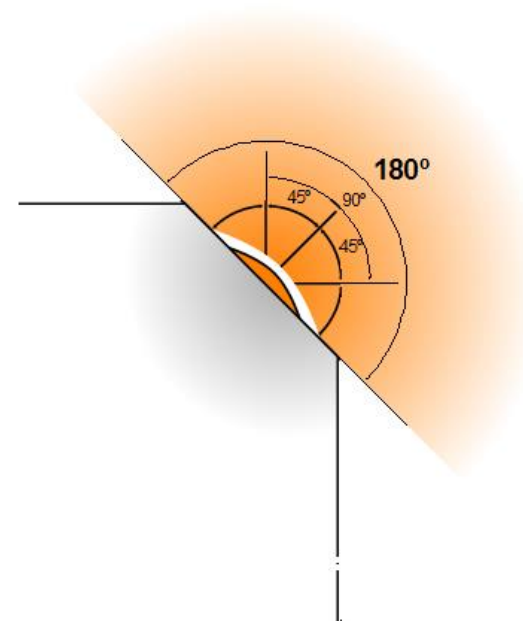
## SAE P2 Rated Lamp

- Projects Light at a 90 Degree Angle
- One Mounted on Top/Front per Side as Required by FMVSS108
- One Mounted on Top/Side per Side as Required by FMVSS108

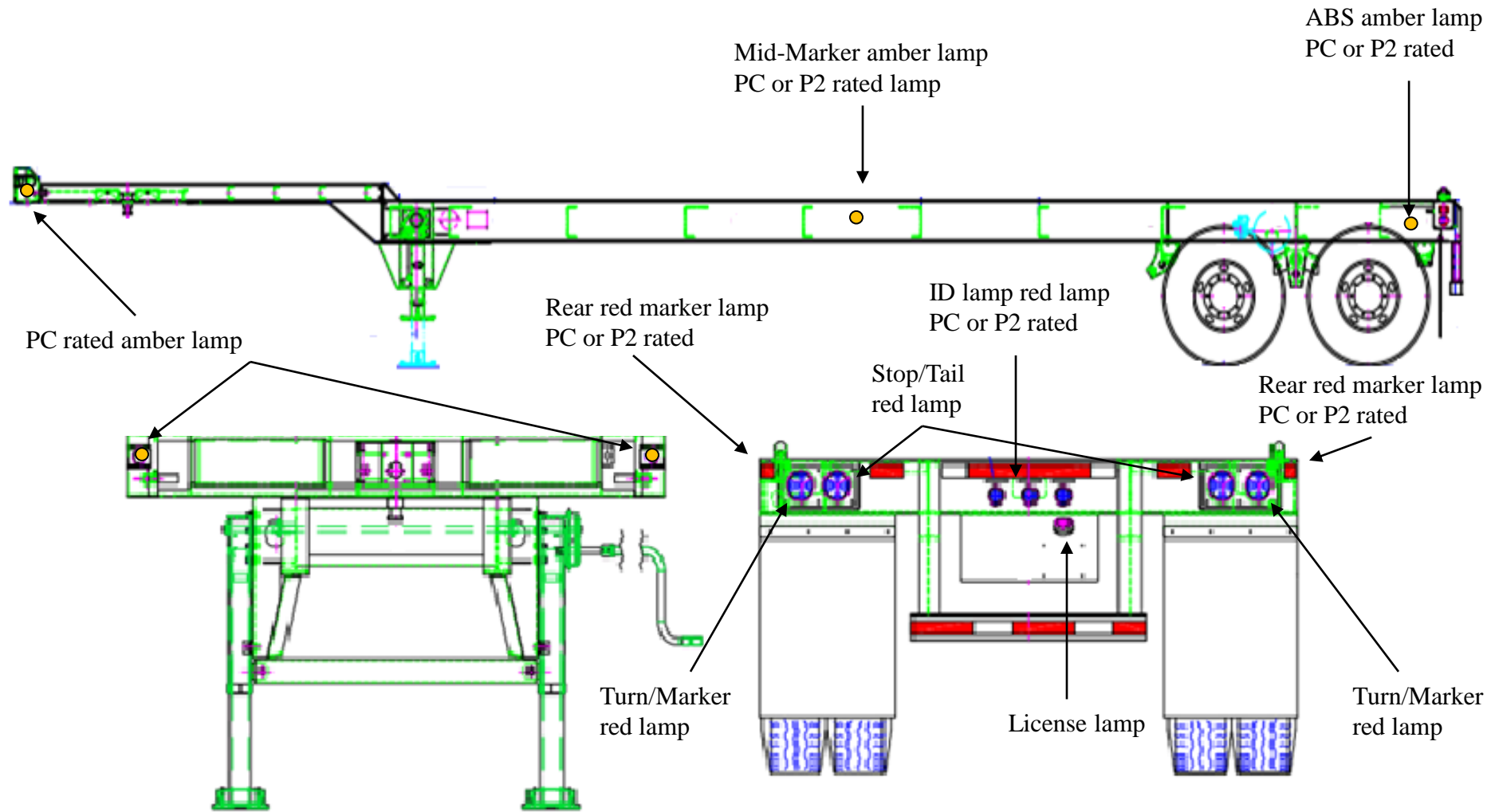


## SAE PC Rated Lamp

- Projects Light at a 180 Degree Angle
- One Mounted on Top on a 45 Degree Radius per Side as Required by FMVSS108



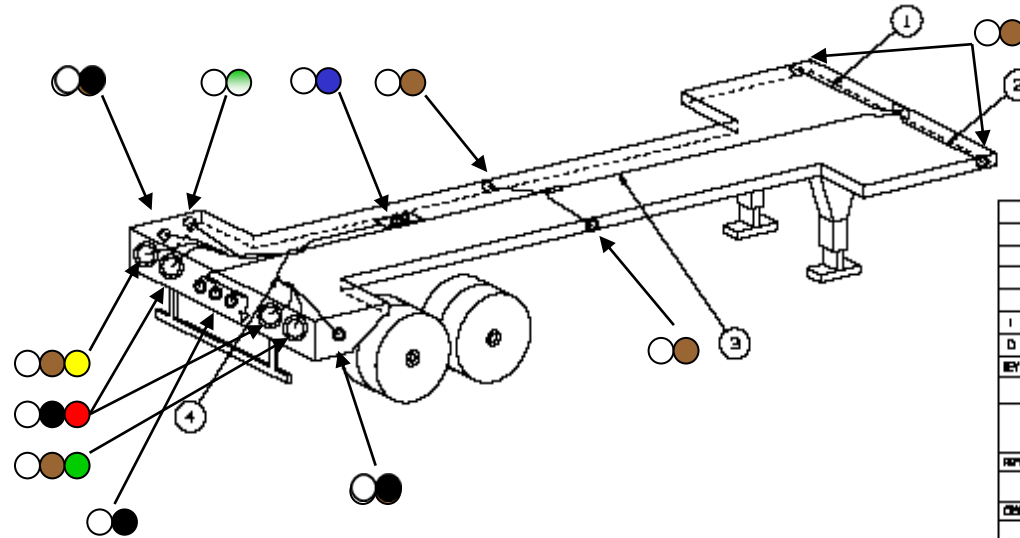
# Trailer Lighting Requirements




# Trailer Wiring

**NOTES:**

1. HARNESS DESIGNS AND PART NUMBERS WILL BE FINALIZED WITH TRAILER MANUFACTURER.
2. THE MAIN CABLE SHALL BE CONSTRUCTED FROM 1-8, 2-10, 4-12 GAUGE WIRES.
3. ALL OTHER CABLE SHALL BE COMPRISED OF 14 GAUGE WIRES.
4. ALL SPLICES ARE TO BE PROTECTED WITH AN OVERMOLD.
5. ALL CABLE ASSEMBLIES WILL BE FULLY JACKETED FROM LAMP PLUG TO MOLD.
5. CUSTOMER ASSUMES ALL RESPONSIBILITY FOR COMPLYING WITH FMVSS 108 AND/OR OTHER LAWS AND REGULATIONS IMPOSING SAFETY REQUIREMENTS.



4	HARN-88, REAR SILL, INC, ABS FLT	1
3	HARN-55, 7 COND MAIN W/M/D W/C	1
2	HARN-88, 2 COND FL LO M/C 40"	1
1	HARN-55, 2 COND FL LO M/C 68"	1
ITEM	DESCR (PT CON)	REQ.

1	4-12-08	REVISED PART NUMBERS	300057 PRR	-	
0	12-8-07	RELEASE	30175 PRR	-	
REV	DATE	DESCRIPTION	BY	CHK	APP
REVISION HISTORY					
THIS DRAWING CONTAINS CONFIDENTIAL, PROPRIETARY INFORMATION UNLESS OTHERWISE INDICATED OTHERWISE. IT IS TO BE CONTROLLED AS THE BUREAU OF PATENT RIGHTS. IF OTHER SUPPLIERS OR CONTRACTORS TO MANUFACTURE THESE MANUFACTURED, USE OR WILL USE THIS INFORMATION, THESE SUPPLIERS MUST SIGNATURE THESE SUPPLIERS					
REVISIONS OR. NO.		VIEWABLE PROJECTION			
CONTRACTOR PART NO.		OR DATA SOURCE			
			 <b>TRUCK-LITE CO., INC.</b> FALCONER, NEW YORK USA		
REVISED	DATE	BY	CHK	APP	DATE
NTS	-	-	-	-	48503B.1

## Industry Standard Wiring Color Codes

### SAE J560 STANDARDS

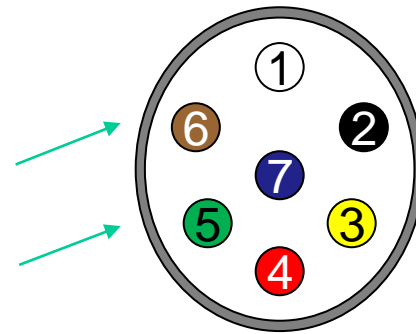
Conductor Identification	Wire Color	Lamp and Signal Circuits
Wht	White	Ground return to towing vehicle
Blk	* Black	Clearance, side marker & license plate lamps
Yel	Yellow	Left hand turn signal & hazard signal lamps
Red	Red	Stop lamps and antilock devices
Grn	Green	Right hand turn signal & hazard signal lamps
Brn	* Brown	Tail, clearance, side marker lamps & identification lamps
Blu	Blue	Auxiliary/ABS power

\*It is recommended to balance the circuits as practicable.



J-560

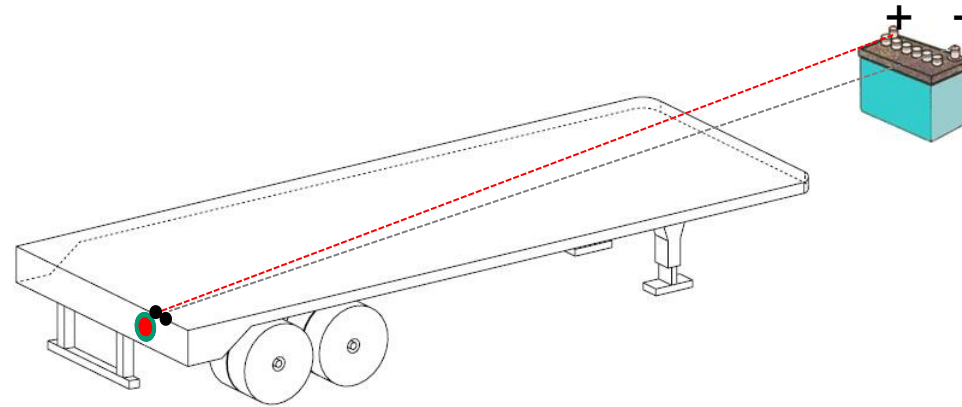
You have to have  
Brown Dirt  
Before you can grow  
Green Grass



You have to have Black  
Asphalt  
Before you can paint Yellow  
Lines

Colors of the United States  
Flag  
White / Blue / Red

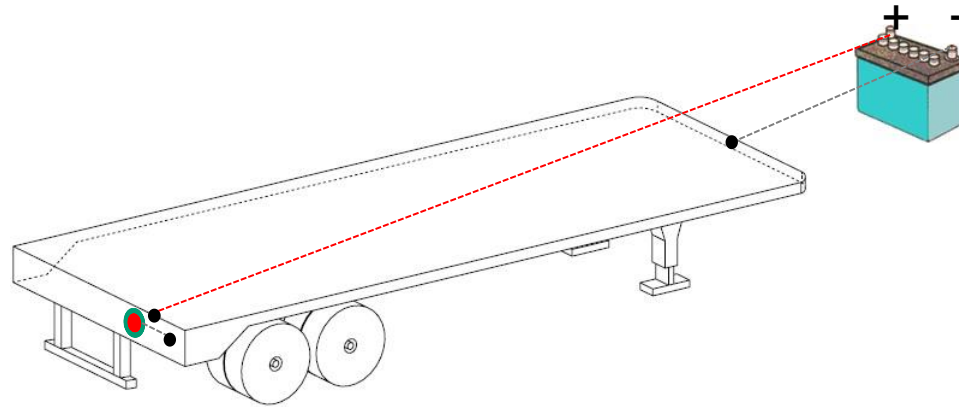
## Internal Ground vs Chassis Ground



Internal Ground System



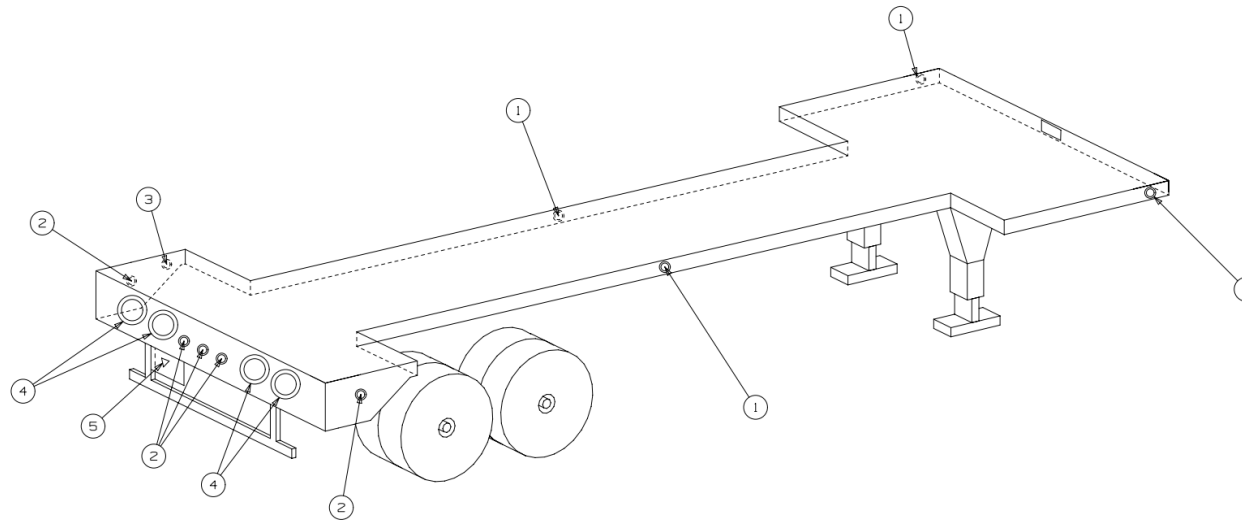
## Internal Ground vs Chassis Ground



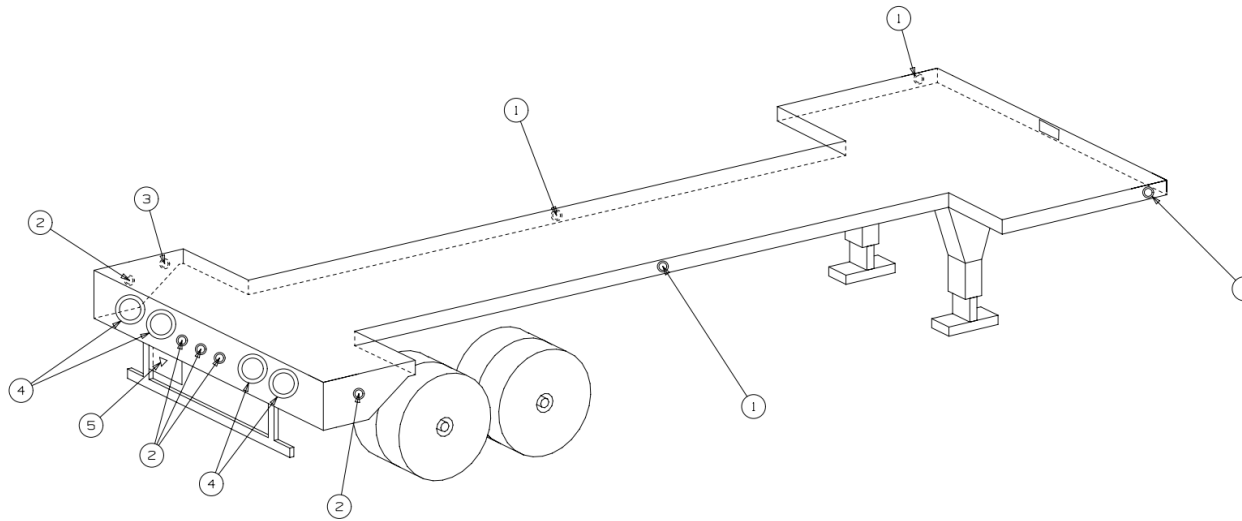
Chassis Ground System



Diagnostics



- Power the System
- Check each circuit one at a time
- Make notes of the system before doing any repairs
- Evaluate your notes to determine a starting point



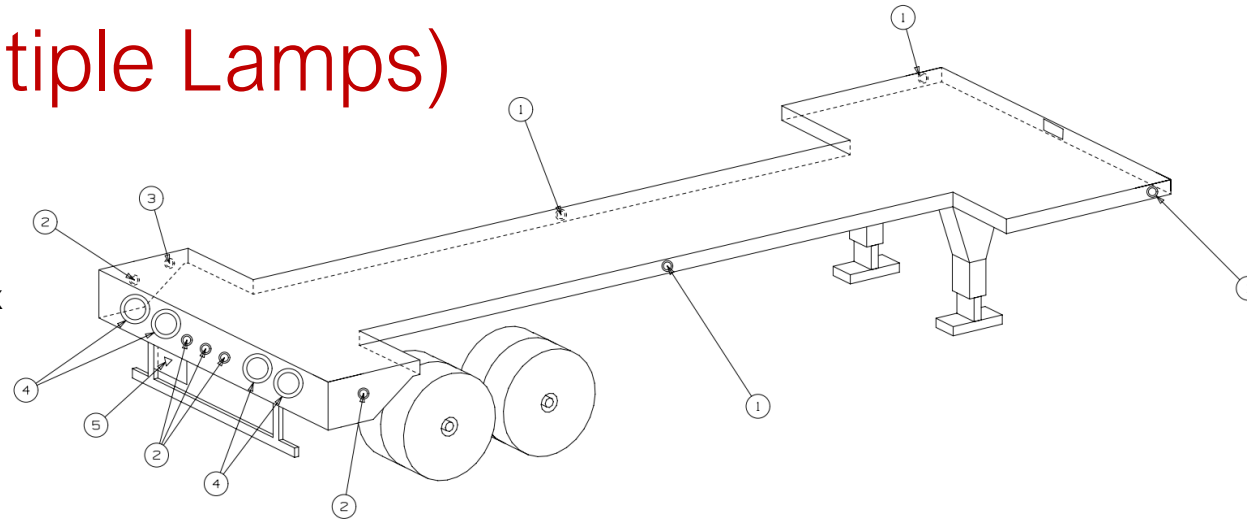
## Function Out (Single Lamp)

- Failed Lamp
- Corroded Contacts
- Corroded Wiring
- No Voltage
- Low Voltage
- No Ground
- Weak Ground

Focus on that area using the “Tools of the Trade” to determine the cause of failure and repair accordingly

## Circuit Out (Multiple Lamps)

- No power from power source
- Faulty Trailer Cord
- Faulty nose box
- Faulty circuit breaker in nose box
- Short in system
- Low Voltage
- No Ground
- Weak Ground
- Corroded wiring



Focus on the J560 Nose Box and Trailer Cord area using the “Tools of the Trade” to determine the cause of failure and repair accordingly

## Wire Repair (Choosing the Proper Wire)

- Selecting the correct wire type
- Selecting the correct wire size

## Wire Selection for Repair

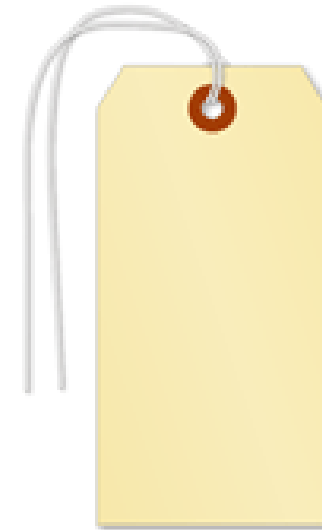
- **Low-Voltage Primary Electrical Cable Specification for Heavy-Duty Electrical Repair**
  - Only use SAE Certified Wire
    - SAE J1127 Low Voltage Battery Cable
    - SAE J1128 Low Voltage Primary Wire
    - SAE J2549 Single Conductor Cable for Heavy Duty Applications



## Wire Identification

– Cable packaging shall be identified with the following:

- Manufacturer's Name
- SAE Specification
- Wire Temperature Rating
- SAE Wire Type
- SAE Wire Size and Color





## SAE Primary Wire

- **SAE Primary Wire Types:**
  - TWP - Thin Wall, Thermoplastic Insulated
  - GPT – General Purpose, Thermoplastic Insulated
  - HDT – Heavy-Duty, Thermoplastic Insulated
  
  - HTS – Heavy-Duty, Thermoset Elastomer Insulated
  
  - TXL – Thin Wall, Cross-linked Polyolefin Insulated
  
  - GXL – General Purpose, Cross-linked Polyolefin Insulated
  - SXL – Standard-Duty, Cross-linked Polyolefin Insulated
- **Recommended types TXL, GXL and SXL. GXL is a good overall choice to cover most service needs.**

## Plastic Insulation Challenges

- Plastic material can soften and move as temp increases.



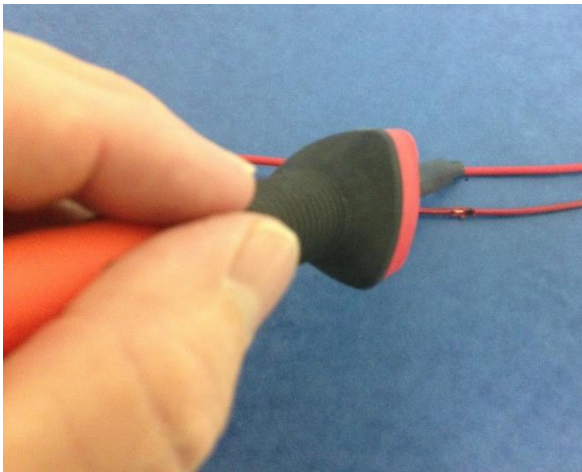
## Do I have the proper wire?

- If you are unsure what you have in the shop. Wire can be inspected visually.
- Most plastic wire types have a glossy surface while the cross-linked or thermoset wires are dull or mat surface in appearance.



## Shop Cross-linking Test

- A simple test to verify the wire is cross-linked, use a hot soldering iron on the insulation to confirm no melting.



## Wire Size (AWG)

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- Everything electrical depends on current flow
- Conductors that carry the electricity are a critical part of the system
- Wire size is important to allow proper flow of electrons
- Resistance is opposition to current flow
- Wire too small in diameter will oppose current flow
- Electrons do not have enough room to pass
- No room to pass, lots of collisions
- Lots of collisions, lots of heat

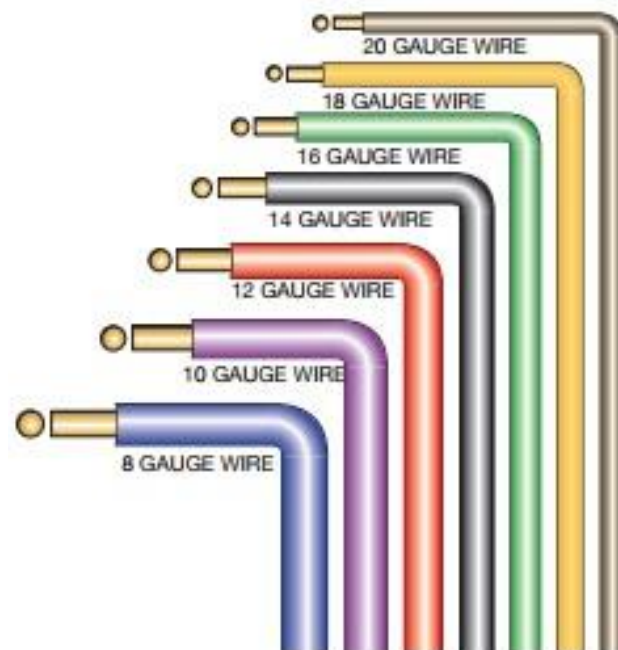
- Example: Four Model 40 S/T/T Incandescent lamps 40 feet from the power source will require 10 amperes. What size wire (AWG) will you need to carry the current properly ?

# Wire Repair (Choosing the Proper Wire)

Max Current (Approx.)	Length Up to 30 feet	Up to 40 feet	Up to 50 feet	Up to 60 feet	Up to 80 feet	Up to 100 feet	Up to 120 feet
1	14	14	14	14	14	14	14
2	14	14	14	14	14	14	14
3	14	14	14	14	14	14	12
4	14	14	14	14	14	12	12
5	14	14	14	14	12	12	12
6	14	14	14	14	12	12	10
7	14	14	14	12	12	10	10
8	14	14	12	12	10	10	10
10	12	12	12	12	10	10	8
11	12	12	12	10	10	8	8
12	12	12	12	10	10	8	8
15	12	12	10	10	8	8	8
18	12	10	10	8	8	8	8
20	12	10	10	8	8	8	6
25	12	10	8	8	8	6	6
30	12	10	8	8	8	6	6
35	12	10	8	8	6	6	6

\*Recommended minimum wire gauge size for Stop, and Ground circuits

# Wire Repair (Choosing the Proper Wire)





## Summary

- **Only use SAE Certified Wire**
  - SAE J1128 Low Voltage Primary Wire Types TXL, GXL & SXL
    - GXL good overall choice for most service needs.
- **Verify Cable Packaging Identifies Wire Specifications**
  - Get the right wire for safe long lasting repairs.
- **Choose Proper Wire Size**

## Wire Repair (Method of Repair)

Correct wire repair requires the understanding of how improper wire connectors can affect electrical components and the entire electrical system.

## Vinyl Crimp Terminals

- PVC (polyvinyl chloride) insulation
- Crimp ridges for correct crimping
- Solid colored cover
- Best suited for non-exposed areas



## Nylon Crimp Terminals

- High temperature nylon
- Securely attached sleeve and insulation
- Higher abrasion resistance
- Translucent cover
  - Easier to properly place crimp
- Best suited for non-exposed areas



## Solder Seal Terminals

- Fluxed solder ring
- Strong positive connection
- Environmentally sealed connection
- Can be more time consuming



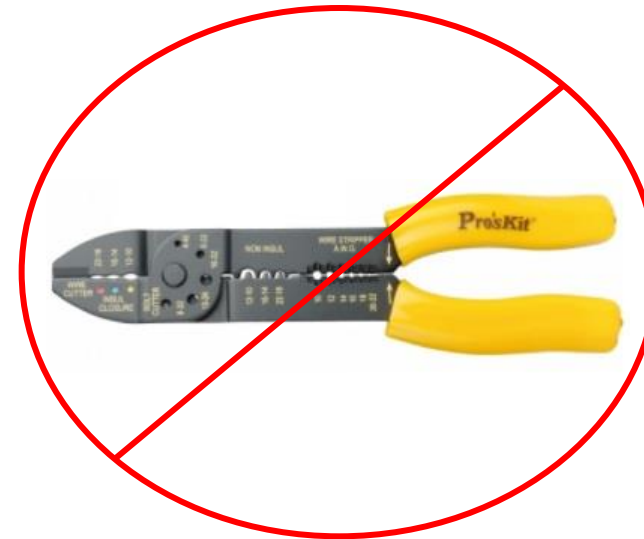
## Multi Link Terminals

- Crimped, soldered, sealed
- Meets or exceeds OEM specifications
- Fluxed solder ring
- Translucent adhesive lined connector



# Wire Repair (Method of Repair)

- Tool with precise radial closing motion
- Integrated, releasable ratchet ensures the complete crimp process
- Low hand force thanks to an optimal force transmission ratio
- Does not provide proper crimp
- Can tear Insulation on connector



## Wire Repair (Application)

It is very important to start with clean wire... Cut away any corrosion and wire that has become stiff or brittle.

If you do not start with clean wire, you are not making a proper repair!

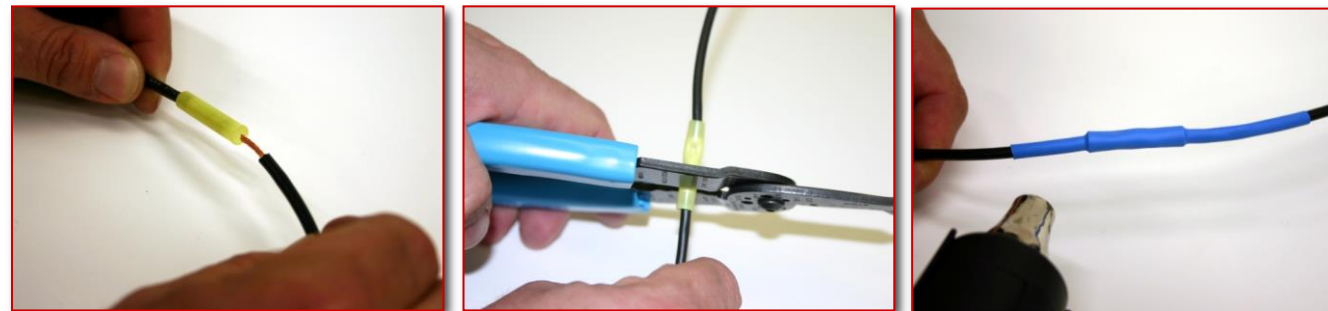
Next trim just enough insulation to make your crimp.



## Splicing In New Wire

### Crimp Connectors

- Crimp connectors can be used as an alternative to soldering
- Wires must pass all the way into the crimp, with insulation not being extended into the crimp
- More effective at being completed at road side
- Crimps must be closed fully to avoid failing
  - Test by pulling with equal force used to tie a shoe
  - Be sure there are no gaps exposed in closure
- Must also be covered with shrink tube

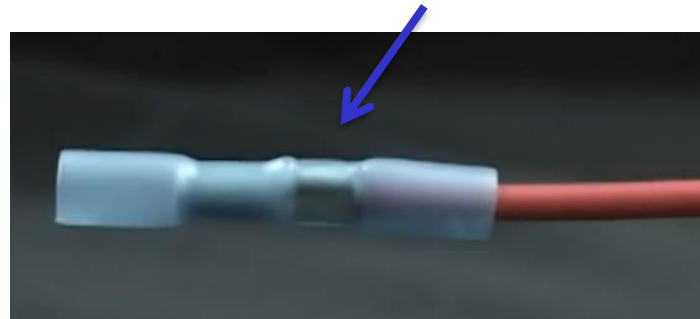


## Crimping Location



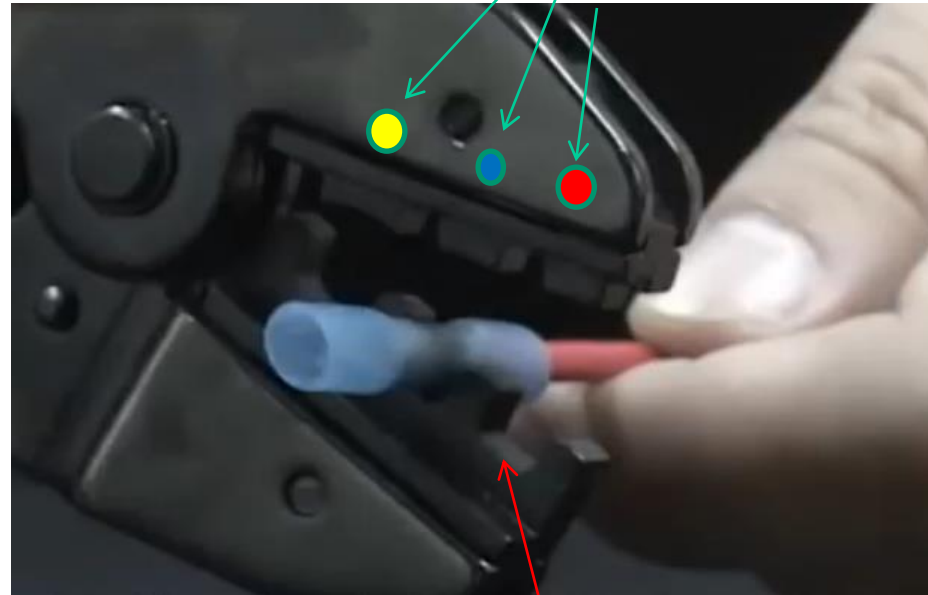
In the center of a butt connector is the wire stop.

Crimps are made between the wire stop and the end of the barrel. UL (United Laboratories) recommends 50 pounds of pressure on a crimp to make a correct crimp.



# Wire Repair (Application)

Color coded crimp dies



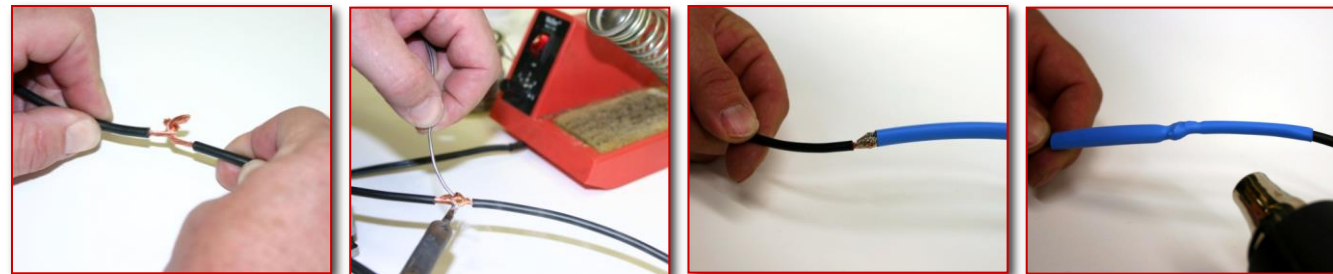
Notice the flat die area.

## Splicing In New Wire

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### Soldering Wire

- Soldering the wires together can be an excellent method if it is used with the added protection of heat shrink tube to protect the joint from corrosives
- Before twisting wire together, use j-bends for added strength when soldering
- Ensure solder covers entire surface of exposed wire
- Ensure shrink tube covers all exposed wire



# Shrink Tubing

## Shrink Tubing

- What is Shrink Tubing ?
- Types of Shrink Tubing
- Single Wall vs Dual Wall
- Determining Shrink Tubing Size and Length
- Tools for Applying Shrink Tubing
- Applying Shrink Tubing

## What is Shrink Tubing

- It is a shrinkable plastic tube used to insulate wires, providing abrasion resistance and environmental protection for stranded and solid wire conductors, connections, joints and terminals in electrical work



# Types of Shrink Tubing

- (FEP) Fluorinated ethylene propylene
- (PVDF) Polyvinylidene fluoride
- PVC
- Silicone rubber
- Viton
- Polyolefin (Most Common)





## Single Wall vs Dual Wall

### Single Wall Shrink Tubing

- Outer Shell
  - Insulates
  - Provides strain relief
  - Protects against mechanical damage
  - Protects against abrasion

### Dual Wall Shrink Tubing

- Outer Shell
  - Insulates
  - Provides strain relief
  - Protects against mechanical damage
  - Protects against abrasion
- Inner Shell
  - Unique hot-melt adhesive
  - Formulated to adhere to all major types of automotive wire insulation
  - Forms an effective barrier against automotive fluids and moisture
  - Protects against corrosion and water-wicking

## Determining Shrink Tubing Size and Length

### **Determine the diameter size of the tubing.**

1. Measure the diameter of the underlying materials to be covered - at the widest part.
2. Select tubing that is 20% - 30% larger than this measurement

### **Determine the length of the tubing.**

1. Heat shrinkable tubing has a small loss of length during the recovery process.
2. Longitudinal shrinkage varies from 5% to approximately 15% - depending on the material.
3. It is recommended to add an additional 1" to the area being covered

## Tools for Applying Shrink Tubing

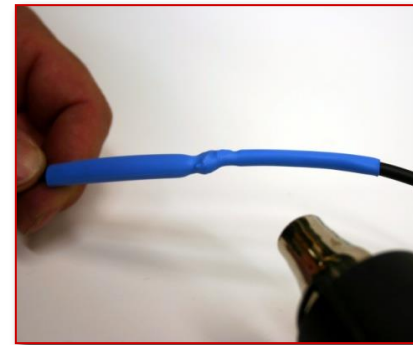
- Heat Gun (Preferred)
- Soldering Iron
- Butane Torch
- Lighter



## Applying Shrink Tubing

1- Remove all sharp edges before applying the shrink tubing.

2- After determining Type, Size, and Length of Shrink Tubing, position the tubing on the area to be covered and allow 1" additional length on each end.



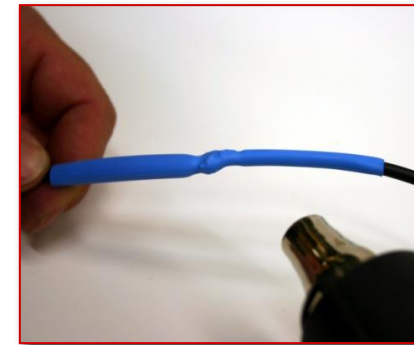
## Applying Shrink Tubing

3- Using a heat source start in the middle the Shrink Tubing and work your way to each end while rotating your heat source to each end

- By starting in the middle you push condensation out of the area being protected
- By starting in the middle you allow the adhesive to flow from the middle out
- By rotating your heat source you prevent scorching of the Shrink tubing and of the insulated wires

4- Ensure shrink tube covers all exposed wire.

**The repair is only as good as the person fixing it.**





## Back Probing

# Back Probing

- What is Back Probing
- Why Back Probe
- What are you Back Probing Into
- Pro's of Back Probing
- Con's of Back Probing
- Alternative Methods in lieu of Back Probing

# What is Back Probing

- Back probing is a means of testing a wire in a connector that is plugged into a component. For example you will use a small test lead or it is common to use a sewing needle, you will put your needle or test lead at the area where the wire enters the connector from the back while it is plugged into the component.





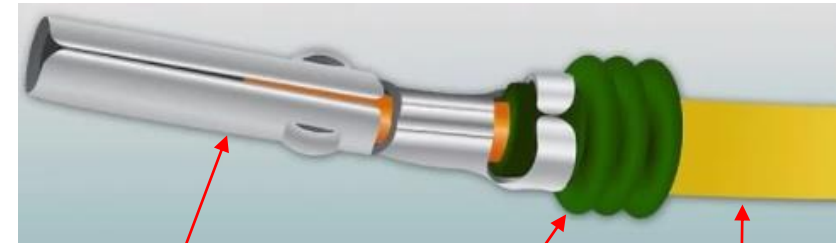
# Why Back Probe ?

- To obtain Voltage on a circuit while under a load
- eliminates the need to puncture the insulation on the wire to test a circuit under a load
- Because it is easy



# What are you Back Probing into ?

- A insulated wire that is designed to protect copper or aluminum wire from environmental elements
- Triple-ribbed, self-lubricating silicone seal
- Tin Plated Terminal



Tin Plated  
Terminal

Triple-Ribbed,  
Self  
Lubricating  
Silicone Seal

Insulated  
Wire

# Pro's of Back Probing

- Easy to slip a pin of some nature in between the seal and the installation of the wire



# Con's of Back Probing

- Could compromise the integrity of the installation on the wire which opens the wire up to the environment
- Could compromise the integrity of the triple ribbed silicone seal which opens the seal up to the environment
- Dependent of the tool used a short could be caused
- You may not have a secure connection thus causing false readings

# Alternative Method

- Adapter Pig Tail
  - Easy to make
  - Will not compromise the integrity of seals
  - Will not compromise the integrity of wire insulation
  - No worries about shorts
  - Safe to use



A blue semi-truck is parked on a paved surface at a port. In the background, there is a large suspension bridge with green towers and a pier with colorful shipping containers. The sky is clear and blue.

# Questions?

Enter them with the Q&A button



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