From: Wells,T.Cynthia CTR (NHTSA)
To: Fogle, Brenda CTR (NHTSA)
Subject: FW: VOQ #11088712 Featherlite 1620-14
Date: Tuesday, June 12, 2018 8:23:26 AM
Attachments: SureWire - 2013.pdf
12V Interior Light Installation- Roof Install Hat Roof Bows.pptx
4-Way Wiring Harness Installation- Page 3.pptx
4-Way Wiring Harness Installation- Page 2.pptx
4-Way Wiring Harness Installation- Page 1 Spanish Version.pptx
4-Way Wiring Harness Installation- Page 1.pptx
NBAS-0003 Work Instruction Chassis Wiring 20171003 - New Bristol.xlsx
QUALITY STANDARDS.DOCX

From: Harrison, Jonathan (NHTSA)

Sent: Tuesday, June 12, 2018 8:06 AM

Subject: FW: VOQ #11088712 Featherlite 1620-14

Randy and Cynthia,

Please add this email to VOQ #11088712 in public repository.

Thank you.

Jon Harrison

From: [redacted]
Sent: Monday, June 11, 2018 4:14 PM
To: Harrison, Jonathan (NHTSA) <jonathan.harrison@dot.gov>
Subject: RE: VOQ #11088712 Featherlite 1620-14

The delay on this response is not due to “instantaneously” creating the attached, or not being able to find the documentation. It is wholly my accountability that this took longer than it should have – it wasn’t a reflection of not having the answer.

Files have been attached as evidence of Statement 1 below:

1. UTC believes the unit referenced is a one-time occurrence that does not reflect the level of quality or specifications we use to design or produce our trailers.

2. SUREWIRE Guidelines for wiring specifications. This was first documented in 2011, used initially in draft form before this, but our first filed package was 2011. The latest update is attached (dated 2013) and we have been following it ever since.

3. The Harness Installation documents attached (Process Documents) are dated 2012, so they provide a manufacturing process set of evidence.

4. SWaP Work Instructions – documentation for the assembly of our new product line (SWaP = single weld and paint). Dated 2017.

5. Quality Standards – created 2017, updated March 2018. With a new Quality Manager for our Cargo Division, and the Continuous Improvement approach to our products, this is part of our quality standards.

I hope this provides an appropriate data set to support Statement 1. We also obviously stand behind our workmanship and warranty our product accordingly.

Thanks, [redacted]

From: Harrison, Jonathan (NHTSA) [mailto:jonathan.harrison@dot.gov]
Sent: Tuesday, April 24, 2018 9:52 AM
To: [redacted] Seymour, Nate (NHTSA) <Nate.Seymour@dot.gov>
Subject: VOQ #11088712 Featherlite 1620-14

[redacted]

[redacted] has notified this agency in his vehicle owners' questionnaire that his trailers' wiring is, apart from it's typical insulation, unprotected from rough, irregular edges and appears susceptible to damage from it. The picture he sent, included as an attachment in this email, is from the overhead section of his trailer. Chapter 5, section 5-1 of the NFPA 1192 standard holds that –unless the passthrough is through wood—it is to be "insulated by an acceptable liner…to include grommets, … water hose, at least 2 wraps of duct tape (masking tape not acceptable), convoluted tubing, or adhesive-type-rubberized caulks that completely surround the conductors". Additionally, the section goes on to mention that a "smooth", "rolled" edge is required "that the wire can safely touch". The edge shown in [redacted]' picture is clearly not smooth and can certainly lead to unnecessary chafing of wires.

Can you say if this instance is a one-time occurrence? That someone left grommets out of Mr. [redacted] trailer only, but that all your other trailers are up to standard? Is your typical procedure to wrap passed-through wires or caulk them instead? Can you show pictures of this (or use of grommets) in pictures of other units or in assembly procedures currently in place at your manufacturing facility?

Thank You.

Jon Harrison
Safety Defects Specialist
Medium and Heavy Duty Vehicles Division
Office of Defects Investigation
National Highway Traffic Safety Administration
NEF-106, Rm W45-223
1200 New Jersey Ave. SE.
Washington DC 20590
202-366-8833

Universal Trailer Corporation

Author:	Andy Barg		
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Department:	Assembly		
Work Center:	Wiring		
Process:	Wire Trailer Cage		

Icon Legend

Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required
Face Shield and Safety Glasses Required	Safety Inspection Required
Hard Hat Required	Quality Inspection Required
Respirator Required	

Work Instruction Index

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

Universal Trailer Corporation

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	Respirator Required		

WIRING STANDARDS

Section 1: **4-pin Wiring** This applies to all UTC brands.

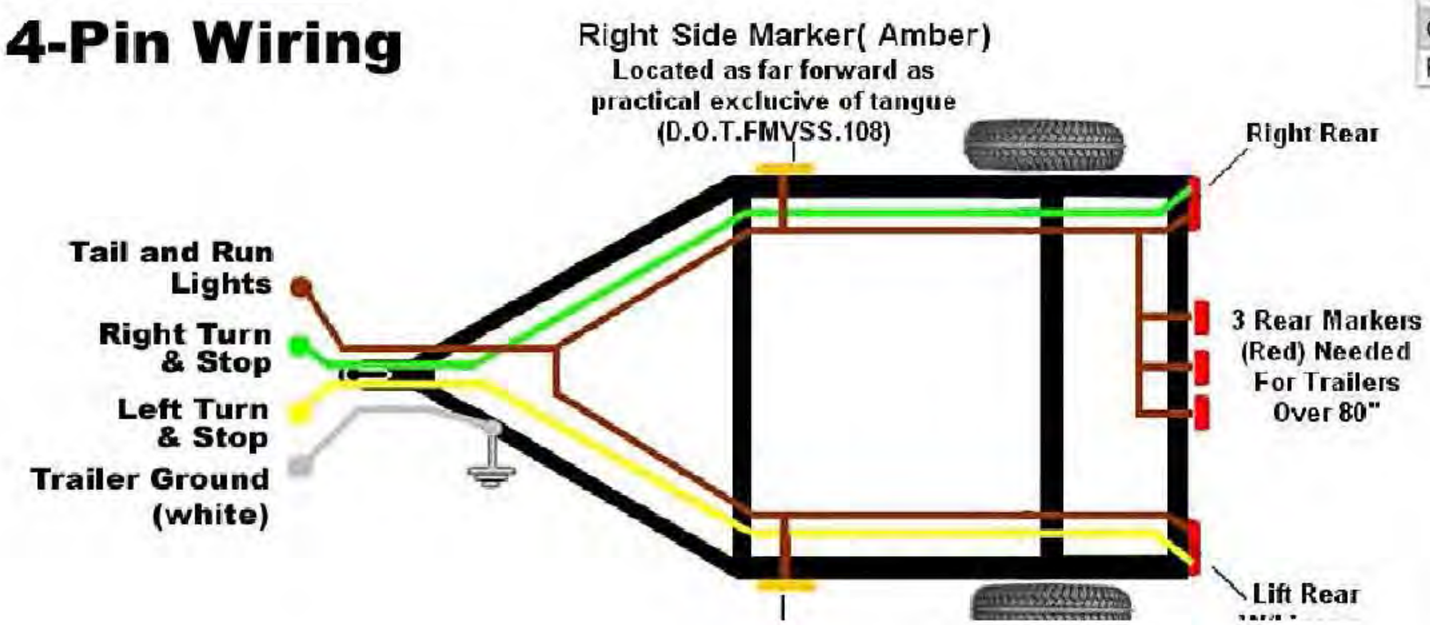
All trailers with 4-pin connectors shall comply with the following color code.

	Connector & Trailer Wire Color
A) Tail & Run Lights	Brown
B) Right Turn & Stop	GREEN
C) Left Turn & Stop	YELLOW
D) Trailer Ground	White

4-Pin Round and Flat Connectors

Function	Color	Wire Size
Tail lights	Brown	AWG-14
Left turn / brakes	Yellow	AWG-14
Ground	White	AWG-14
Right turn / brakes	Green	AWG-14

4-Pin Wiring



Lift Side Marker(Amber)

W/Licence
Plate Bracket

Universal Trailer Corporation EXISS SOONER Haulmark A FAMILY OF BRANDS

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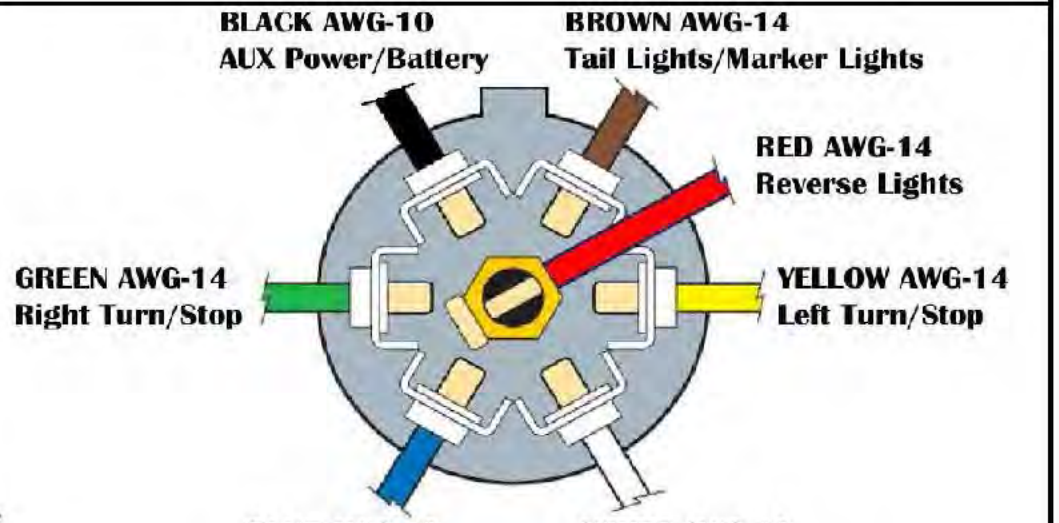
Face Shield and Safety Glasses Required		Safety Inspection Required	
Hard Hat Required		Quality Inspection Required	
Respirator Required			

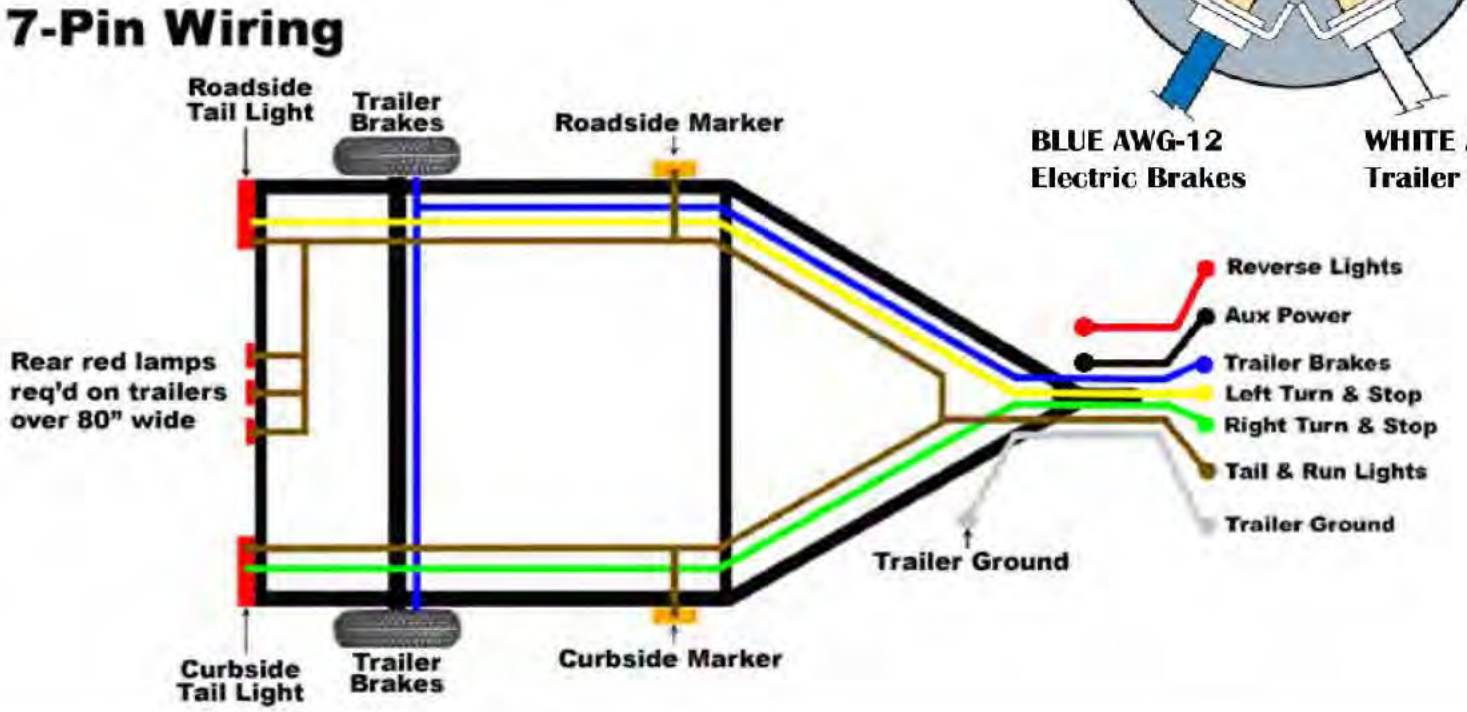
WIRING STANDARDS

Section 2: 7-pin Wiring This applies to all UTC brands.

All trailers with 7-pin connectors shall comply with the following color code.

Connector & Trailer Wire Color	
A) Tail & Run Lights	Brown
B) Right Turn & Stop	GREEN
C) Left Turn & Stop	YELLOW
D) Trailer Ground	White
E) Electric Brakes	Blue
F) Auxiliary Power	Black
G) Reverse Lights	RED





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Icon Legend

Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required		Weld Hood, Apron, Sleeves, Gloves Required	
Face Shield and Safety Glasses Required		Safety Inspection Required	
Hard Hat Required		Quality Inspection Required	
Respirator Required			

WIRING STANDARDS

Section 3: Brake Wiring

A) The following wire scheme applies to all electric brakes: single, tandem and triple axle trailers.

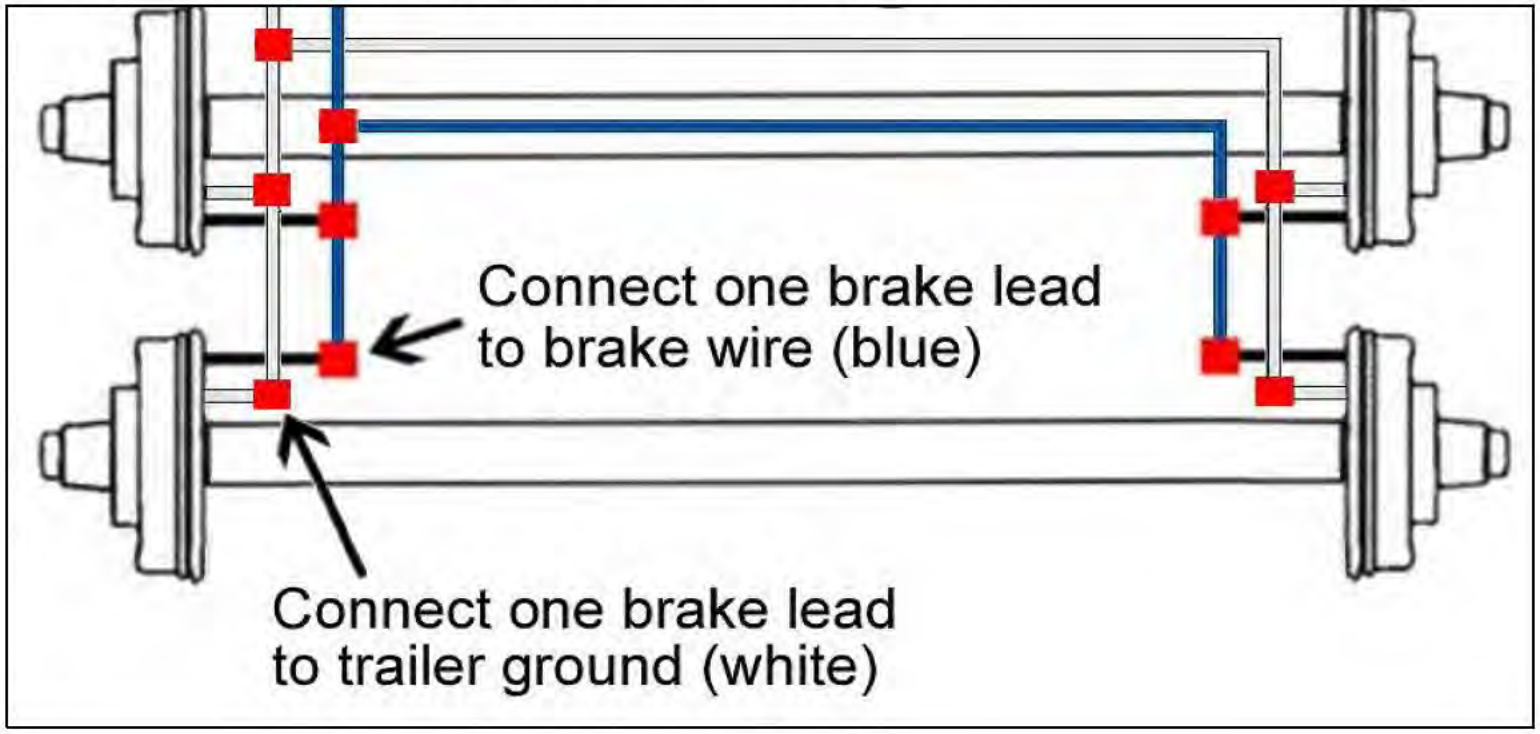
B) Brakes are to wired with both brake wire and brake ground wire to the front of the trailer.

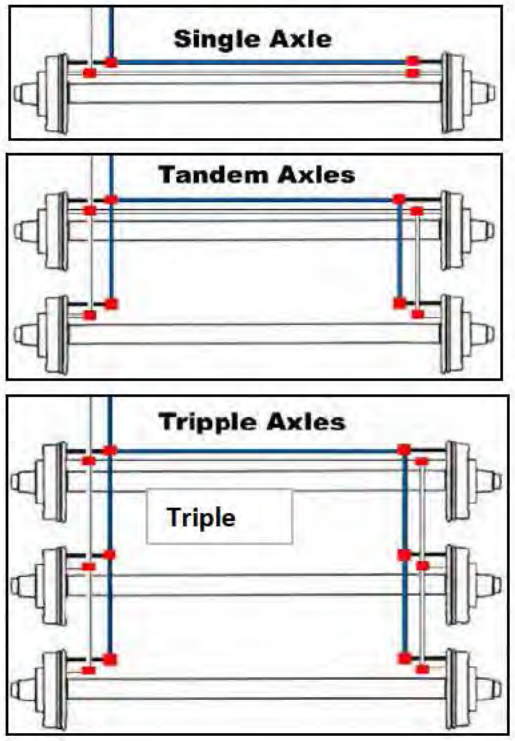
C) The brake wire shall be blue and sized as called out on the following diagram.

D) The brake ground wire is to be the same size as the blue brake wire and shall be white.

Brake Wire Sizing:

AWG-14 for trailer length 4' - 13'
AWG-12 for trailer length 14' - 29'
AWG-10 for trailer length 30' - 53'





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Respirator Required	

WIRING STANDARDS

Section 4: Connectors and Wiring

Securing Wires: A) wiring (100/1000 series trailers) is to be secured at each wall post using cable tie UTC#970210 W/ #10 mounting hole, 8" 50 lb. tensile UV black nylon.
B) as an alternative, wires may pass through drilled holes and protected with a grommet at each hole.
All wires that pass through holes in the framing shall be protected with a grommet or a wire loom. No exceptions.

Tapping into a thru-wire: A) use a connector of the type shown here when tapping onto a thru-wire. They are color coded as follows. Use the appropriate size for the wires installed.

<u>Connector Color Code:</u>

Wire Size	Connector Color
AWG-10-12	YELLOW
AWG-14-18	Blue
AWG-18-22	RED

Splicing Two or More Wires: use wire nuts when splicing two or more wires as follows: A) strip approximately 1/2" of the wire sheathing of each wire. B) tightly twist the wire strands of each wire. C) when connecting stranded wires to stranded wires hold the wire ends side-by-side then twist on the wire nut until it is tight. D) when connecting a stranded wire to a solid wire, hold the wire ends together so that the stranded wire is approximately 1/8" beyond the end of the solid wire, then twist on the wire nut until it is tight. E) when <u>more than three wires</u> are connected use the next size larger wire nut.

<u>Connector Color Code:</u>

Wire Size	Connector Color
AWG-10-12	RED
AWG-12-14	YELLOW
AWG-14-18	ORANGE
AWG-16-20	Blue
AWG-20-22	GREY

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Hard Hat Required	Quality Inspection Required
Respirator Required	

WIRING STANDARDS

Section 5: Basic Electrical Circuits for Trailers According to National Electric Code, NEC

A. LIGHTING and RECEPTACLES are wired similarly. Both are 120V circuits. Both can be either 15A or 20A circuits.

B. 120 volt lighting circuits may have up to 10 lights per circuit.

C. Receptacle circuits may have up to 8 receptacles per circuit.

D. Circuits combining both lights and receptacles may have no more than 8 devices total.

E. All wire splices must be made within an approved electrical box for circuits 50V and greater.

F. Wire nuts, crimp lugs, or terminal strips may be used for wire splicing.

G. Wire gauge (AWG) must match Amperage connected to the circuit.

AWG		Amp Capacity
18		7A
16		10A
14		15A
12		20A
10		30A
8		40A
6		55A
4		70A
3		85A
2		95A
1		110A

Circuit CODE Requirements
1. Wire size is determined by the requirements of the devices connected to it. For 120V lighting and receptacles it will be either AWG-14 (15A) or AWG-12 (20A).
2. The circuit breaker rating is determined by the smallest wire gauge within the circuit

Grounding and CODE Requirements
1. All electrical devices operating at 50 volts or greater shall be grounded. In most situations electrical items are grounded to the Earth. However, trailers are isolated from the Earth by rubber tires. Therefore we “chassis ground” all electrical items in/on a trailer that are 50 volts or greater.
2. When the trailer is connected to shore power Earth ground is brought in with the shore power cable through the motor base and into the service panel. Because the service panel is chassis grounded, the shore power connects Earth ground with chassis ground making the trailer electrically “safe”, provided that the trailer is wired per the NEC (National Electric Code) which UTC requires.

NEC, *National Electric Code, Applies to all applications of 50V and Greater*

Section 5: Basic Electrical Circuits for Trailers - continued

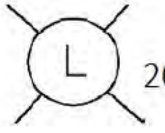
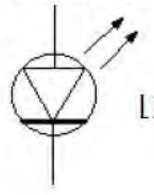
Types of Electrical "Loads"

In our trailers, we provide electricity for three basic categories of electrical "loads". They are:

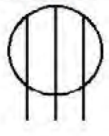
1. Outlets (receptacles such as duplex receptacles). These are all 120V at either 15A or 20A.

   Electrical symbol:  120V

2. Lighting such as 12V LED lighting and 120V incandescent or fluorescent lighting.

   Electrical symbol:  20V  12V (LED)

3. Appliances such as a microwave, refrigerator, air compressor, air conditioner, etc. are typically provided a dedicated outlet or leave the wires "stubbed-out" with the ends capped for the customer to hard-wire to the appliance. These are either 120V or 240V.

   Electrical symbols:  20V  240V

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Icon Legend

Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required
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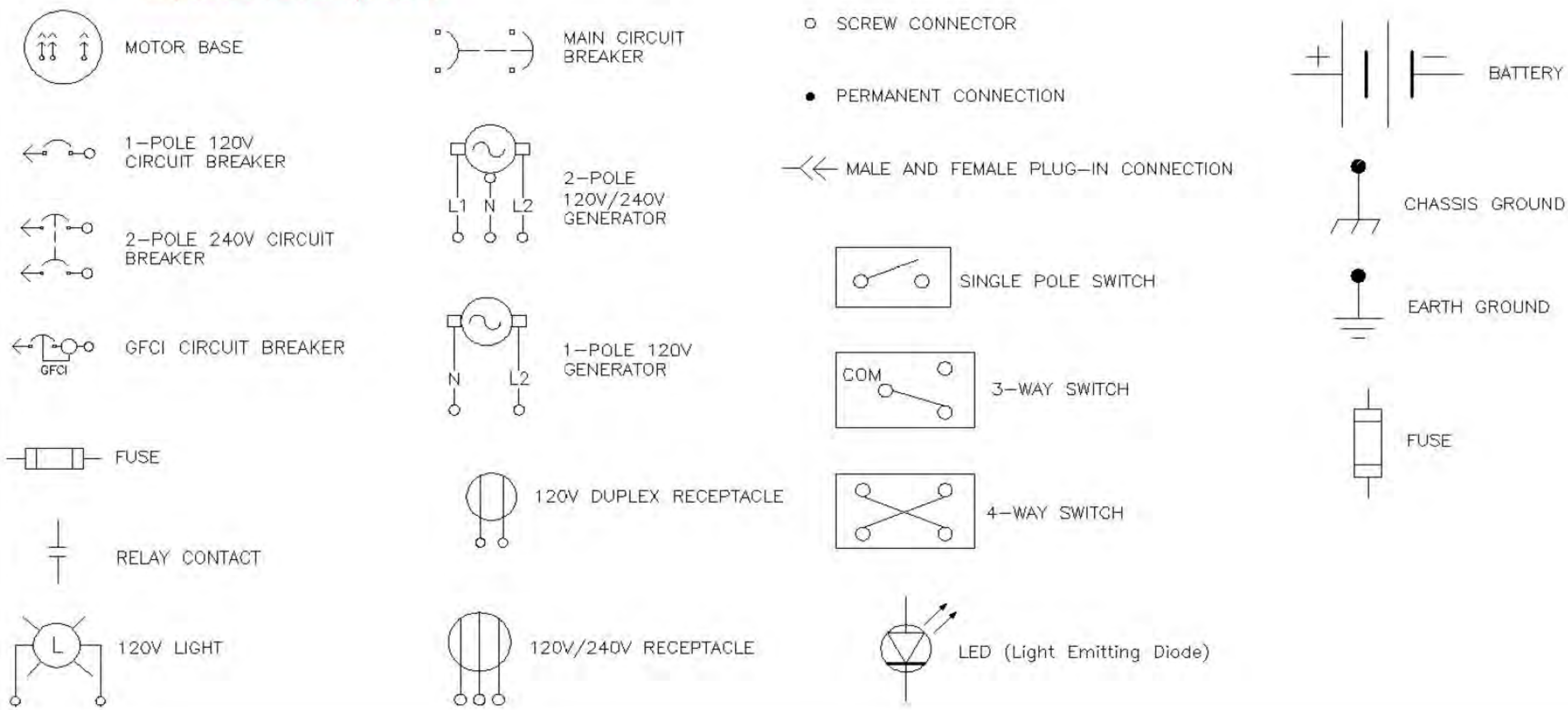
WIRING STANDARDS

Section 5: Basic Electrical Circuits for Trailers - continued

Key of Electrical Symbols



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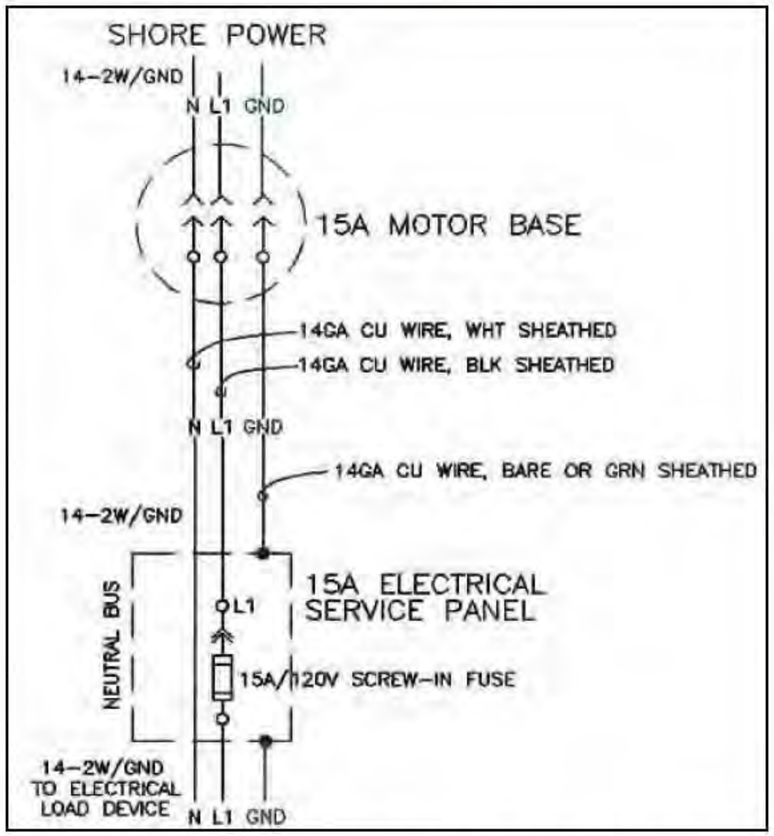
Hard Hat Required	Quality Inspection Required
Respirator Required	

WIRING STANDARDS

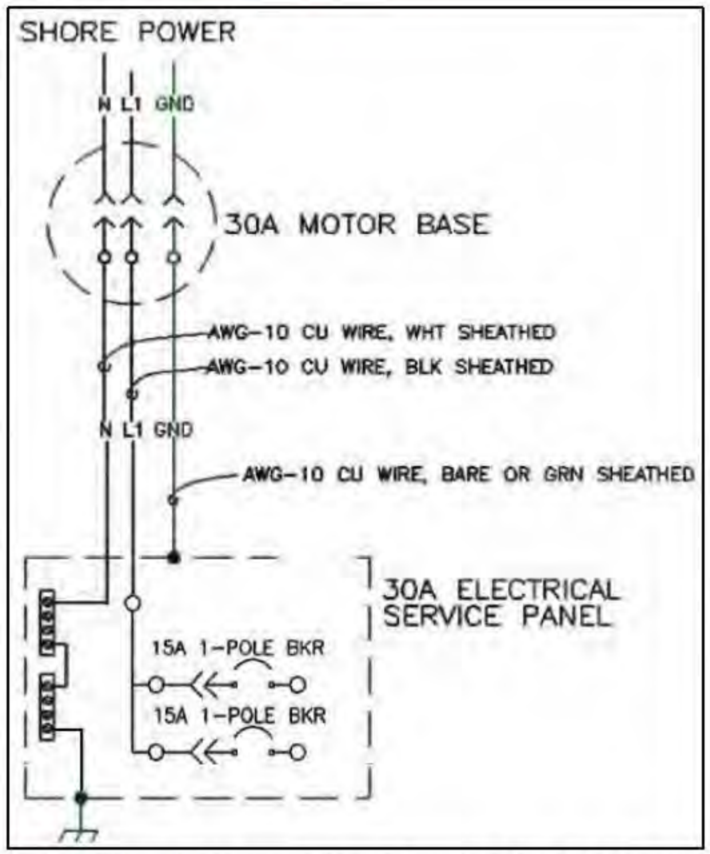
Section 5: Basic Electrical Circuits for Trailers - 15A, 30A and 50A Services

15 Amp Service



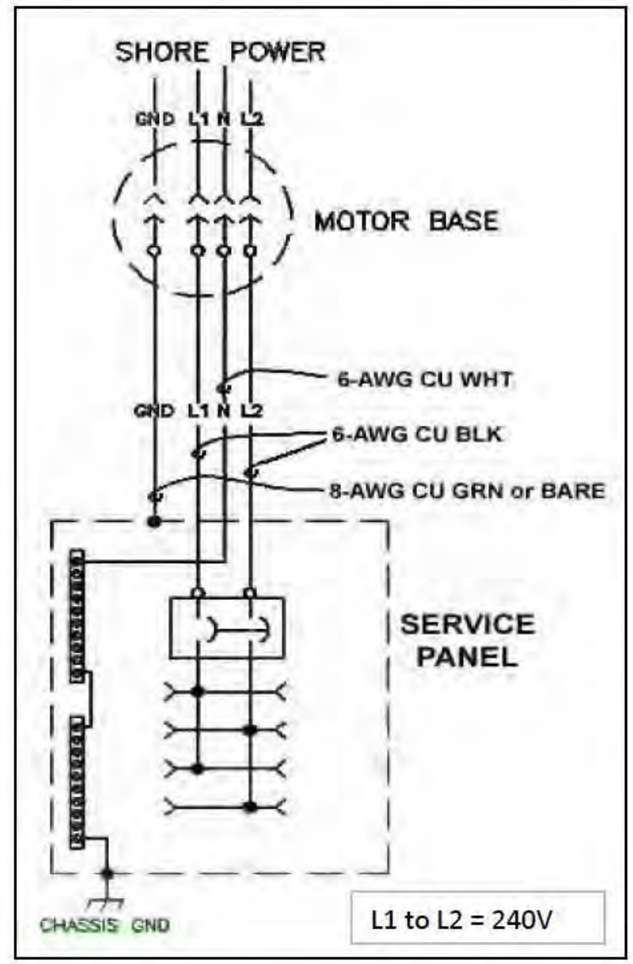
A 2 kW portable generator will supply 120V@15A and may be connected to the trailer at the motor base.

30 Amp Service



A 4 kW portable generator will supply 120V@30A and may be connected to the trailer at the motor base.

50 Amp Service



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	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

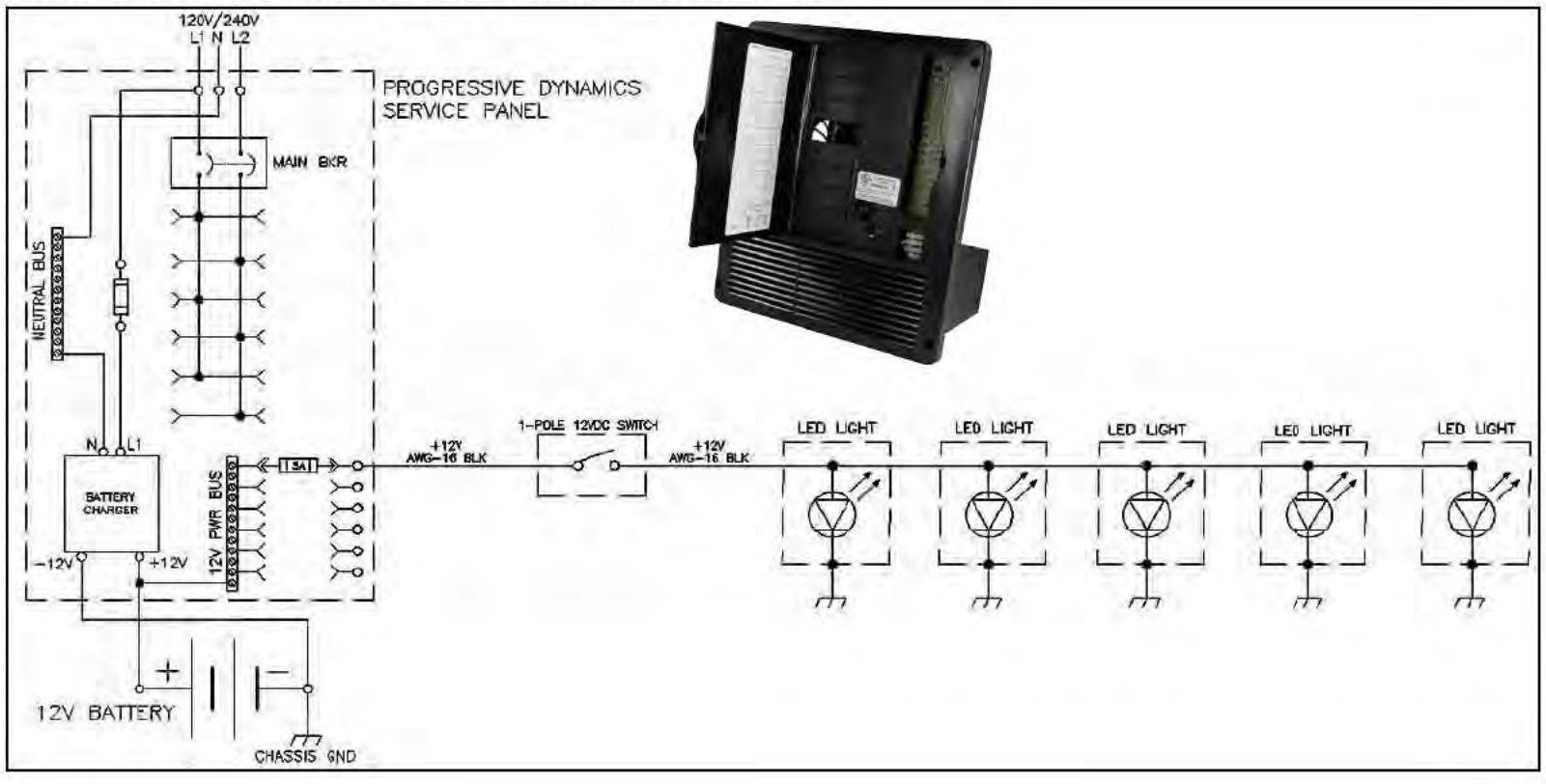
WIRING STANDARDS

Section 6: 12 Volt LED Lighting

A. **Maximum number of lights allowed on a single circuit:**

The UTC guideline is 20 LED marker lights per amp

B. LED circuit example when using a Progressive Dynamics Service Panel



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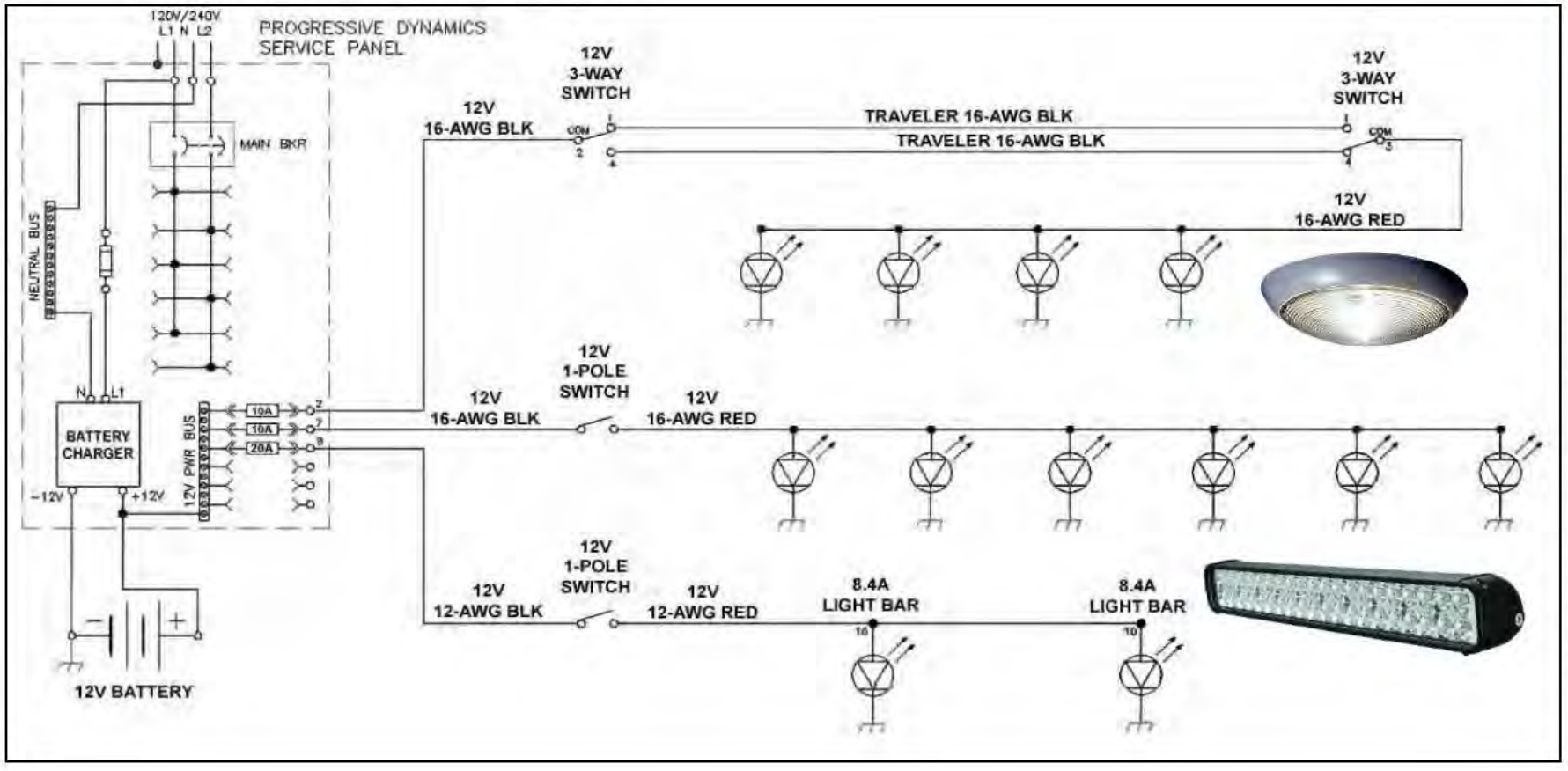
	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

WIRING STANDARDS

Section 6: 12 Volt LED Lighting - continued

A. Example of three different LED lighting circuits



Note: Unlike AC devices, DC (battery powered) devices are polarized. Meaning that DC lighting will not work unless the positive (+) connects to power (hot), and the neutral (-) to ground. Typically, the black wire connects to power and white wire connects to ground. HOWEVER, this is not always the case. For instance, 12V LED dome Light (PN 3504223) is wired backwards from the supplier, making the black wire ground and the power (hot) wire white. **TIP:** check LED light/device with a battery to determine which is (+) and which is (-) before connecting to the trailer wiring.

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WIRING STANDARDS

Section 6: 12 Volt LED Lighting - continued

A. LED Strip-lighting

Operates at .25A per foot = 4 feet per amp.
A 10A circuit provides for 40 feet of LED strip-lighting
A 5A circuit provides for 20 feet of LED strip-lighting

UTC limits LED strip lighting to 4-ft per amp at 12 volts

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Respirator Required			

WIRING STANDARDS

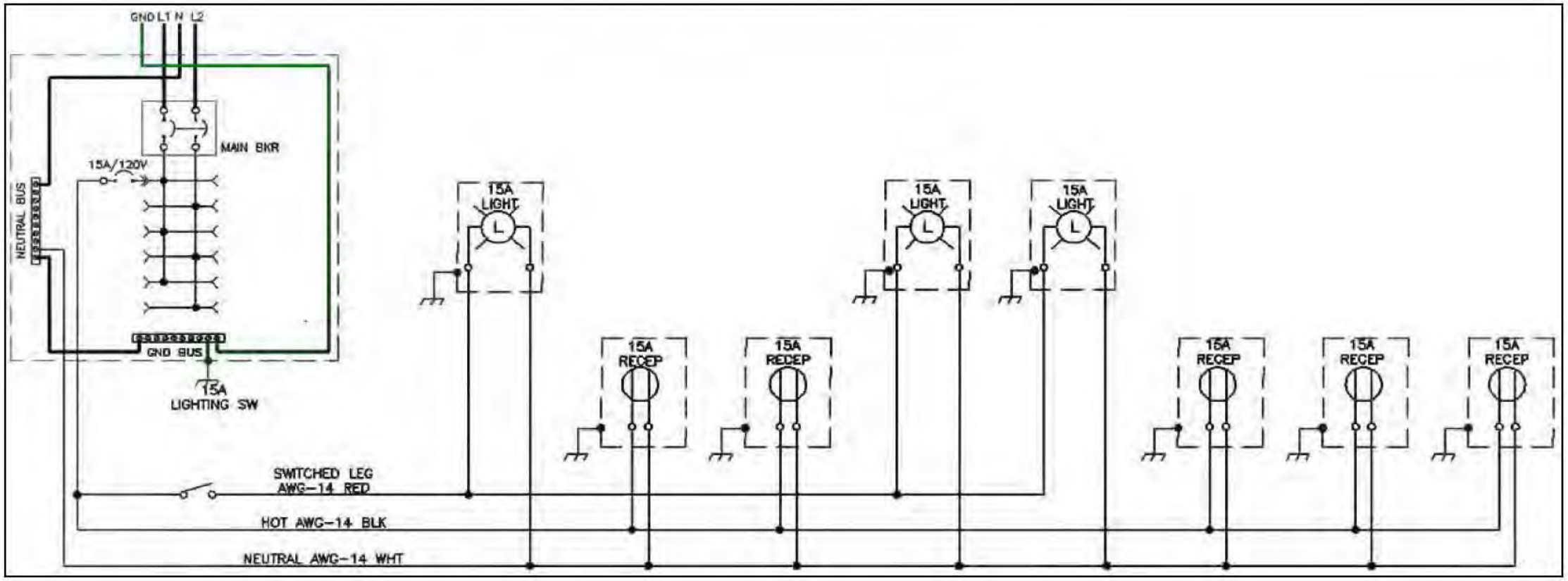
Section 7: 120V Lighting & Receptacles

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

A. A lighting circuit may be as simple as one light with a switch. Sometimes there may not even a light switch as the light(s) may be turned on and off at the circuit breaker.

B. If only lights are contained in a circuit, a maximum of 10 incandescent lights are allowed

C. If lights and receptacles are combined into one circuit, then the total number of devices allowed is eight.



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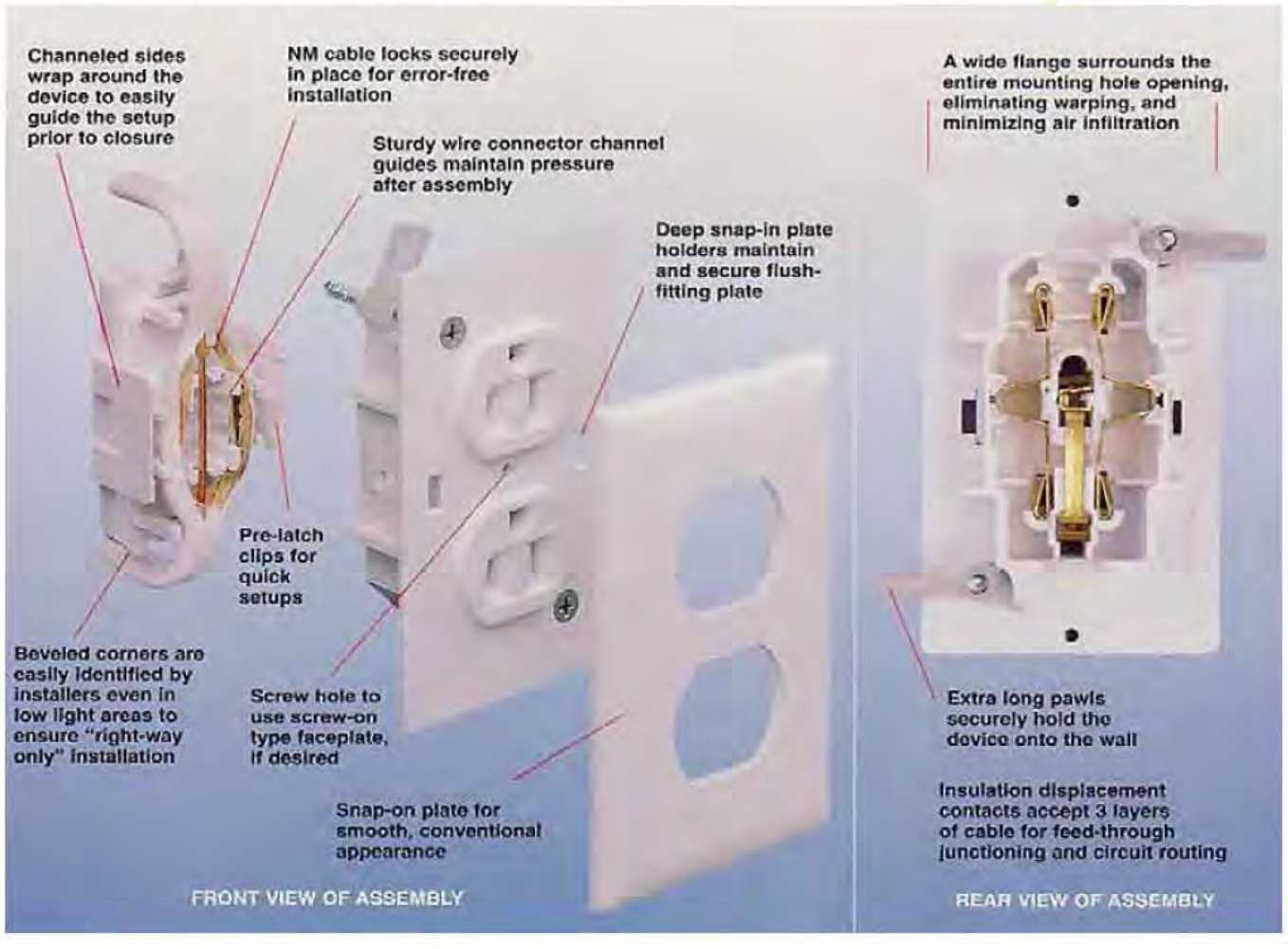
WIRING STANDARDS

Section 7: 120V Lighting Switches & Receptacles - Wirecon Self-contained Wireing Devices

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

A. Wirecon Self-contained Wiring Devices - Introduction



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	Respirator Required		

WIRING STANDARDS

Section 7: 120V Lighting Switches & Receptacles - Wirecon Self-contained Wiring Devices

A. Wirecon Self-contained Wiring Devices - Installation Overview

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

1. Pull a 12" loop through the routed hole.

2. Use the tool to slit and form the NM cable.

3. Load the slit Romex in the back of the device. No need to remove the insulation.

4. Snap close the front of the device onto the loaded back using the installation tool.

5. Push the device into the wall opening and mount it into the wall. Apply the wall plate.

Fig. 2 No need to remove outer jacket.

WT624 Slitter Tool & Assembly Tool

All devices are in two parts: (1) the "cover," located in the back of the device, holds in and inserts the conductors into place, and (2) the "enclosure" which includes the face and mounting pawls, and which surrounds the switch or receptacle contacts. One of the four corners of the cover and enclosure assembly is beveled (cut at an angle). To maintain proper polarity, it is important that the beveled corners of the cover and the enclosure assembly be aligned, and the black conductor be installed on the beveled, right hand side of the device. This will facilitate easier installation when secured in the wall opening.

In every installation the cable is laid in the back cover first. Use the WT824 installation tool to join the cover enclosure assembly. The cover pushes the conductors into the contacts in the enclosure assembly. In cases where more than one cable is installed in the device, each cable must be individually inserted into the contacts by the cover. The device must be re-opened and re-closed for each cable installed in the device. Note: the cable sheathing must be inside the device.

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Respirator Required			

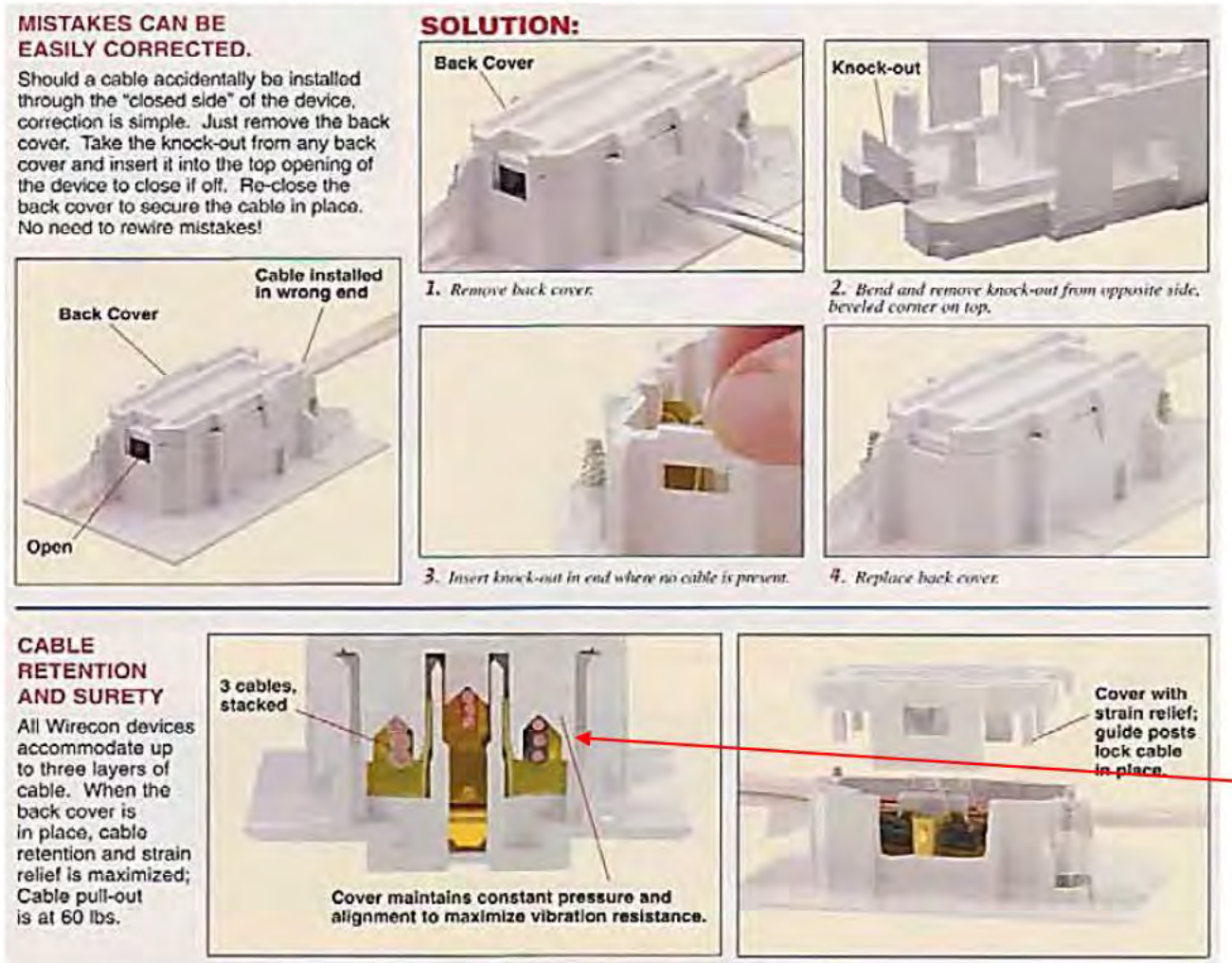
WIRING STANDARDS

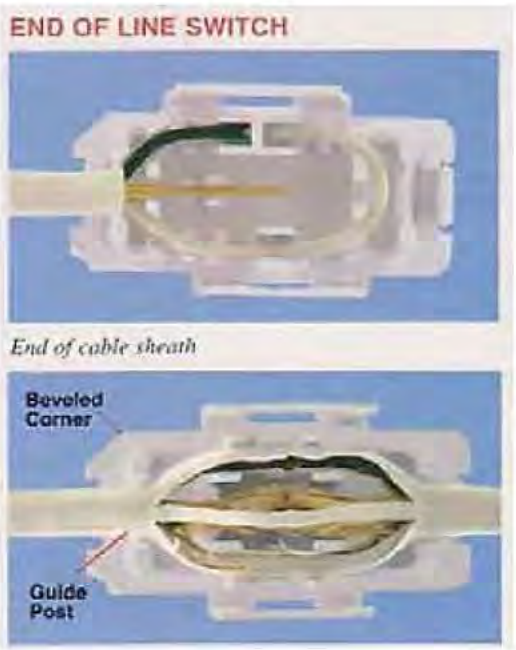
CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

Section 7: 120V Lighting Switches & Receptacles - Wirecon Self-contained Wiring Devices

B. Wirecon Self-contained Wiring Devices End of Line Switch, Corrections and Junctions with Multiple Wires.

Fig. 3 No need to remove individual wire insulation.





Note: each wire is individually pressed into place, then the cover is removed for the next wire

Icon Legend

Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required
Face Shield and Safety Glasses Required	Safety Inspection Required
Hard Hat Required	Quality Inspection Required
Respirator Required	

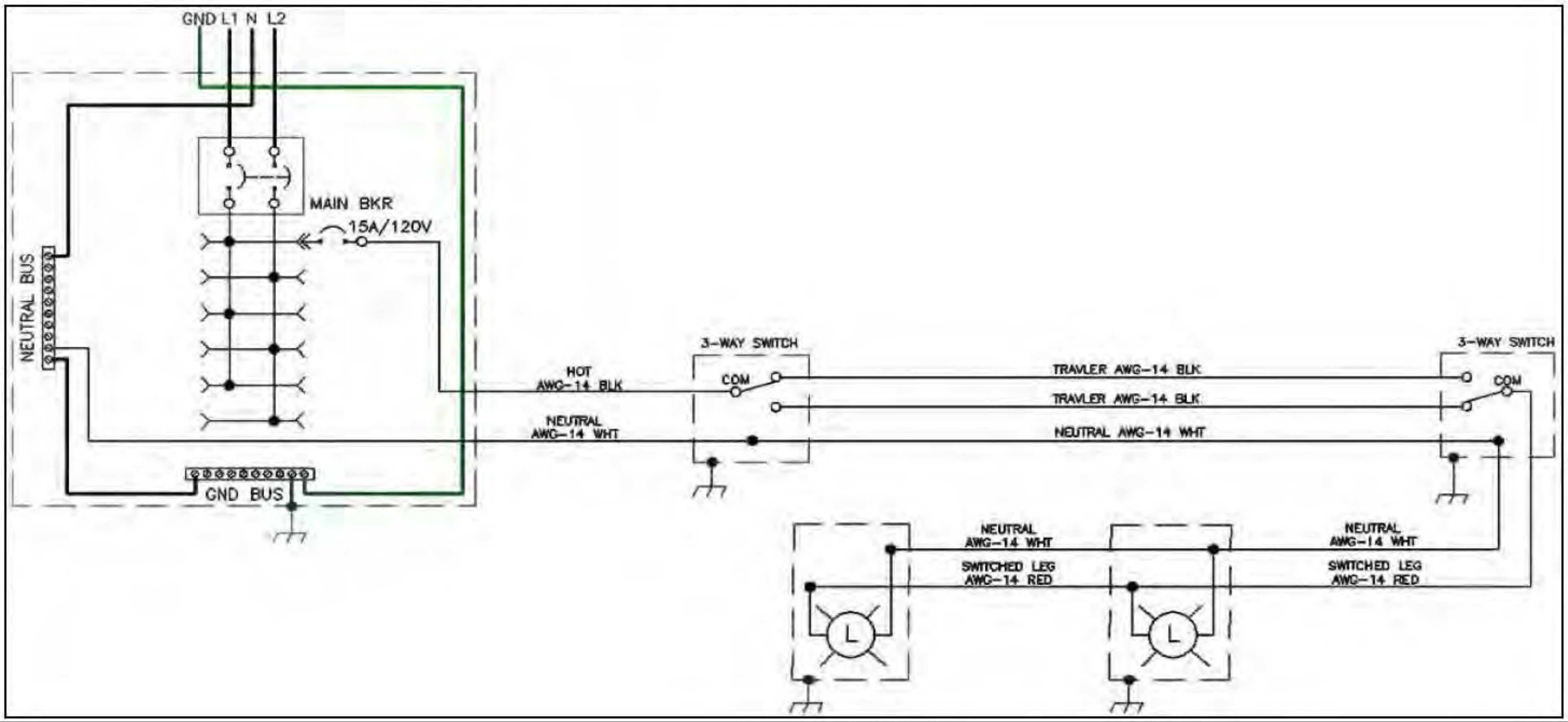
WIRING STANDARDS

Section 7: 3-Way Switching Circuits

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

It is common to install 3-way switches, one switch at the pass through door and the other at the ramp door for the convenience of the customer. The 3-way switches are connected by two wires called "travelers".

Note: There are several ways to wire circuits for 3-way switches. Here is one of the most common ways.



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Icon Legend

	Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required	
	Face Shield and Safety Glasses Required	Safety Inspection Required	
	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

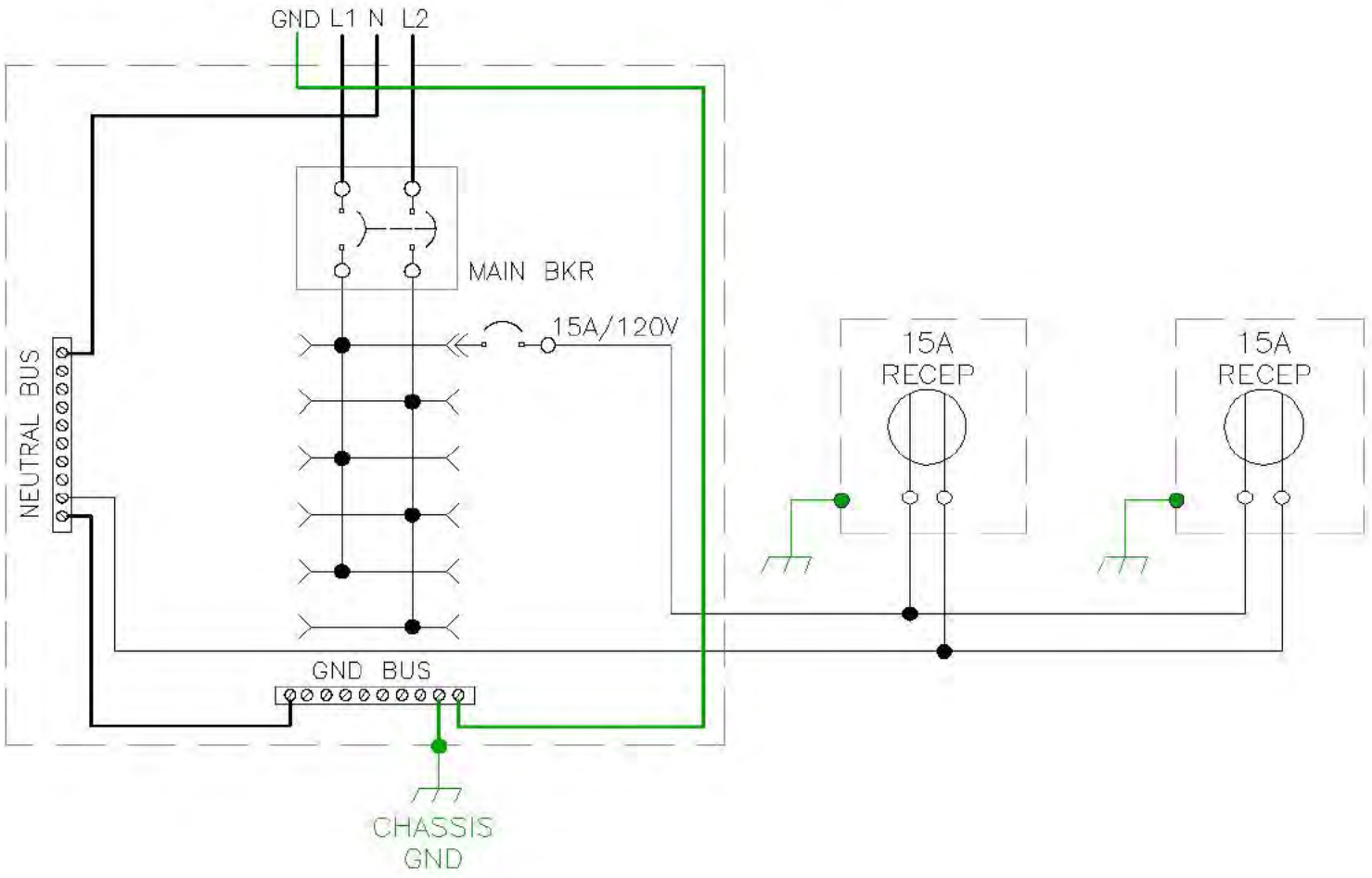
WIRING STANDARDS

Section 7: Electric Receptacles

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

A. 120 Volt Receptacles. A maximum of 8 duplex receptacles may be included on a circuit if no other devices are included on the circuit.

This rule applies to 15A and 20A circuits



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Icon Legend

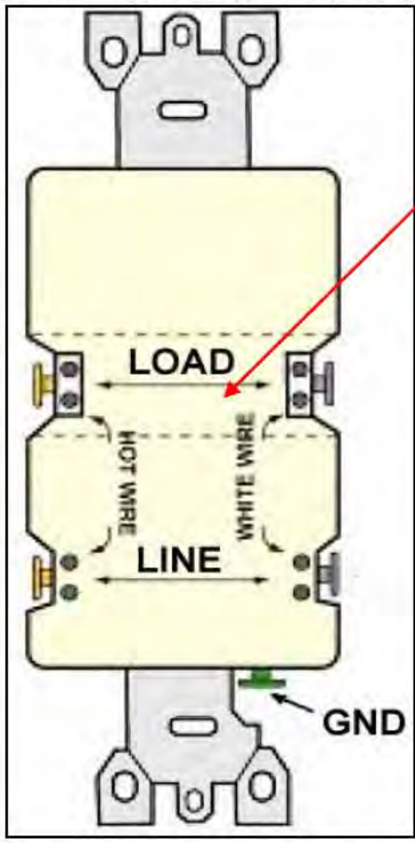
Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required
Face Shield and Safety Glasses Required	Safety Inspection Required
Hard Hat Required	Quality Inspection Required
Respirator Required	

WIRING STANDARDS

Section 8: **GFCI Circuits - Ground Fault Circuit Interrupters**

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

A. Designed to protect people



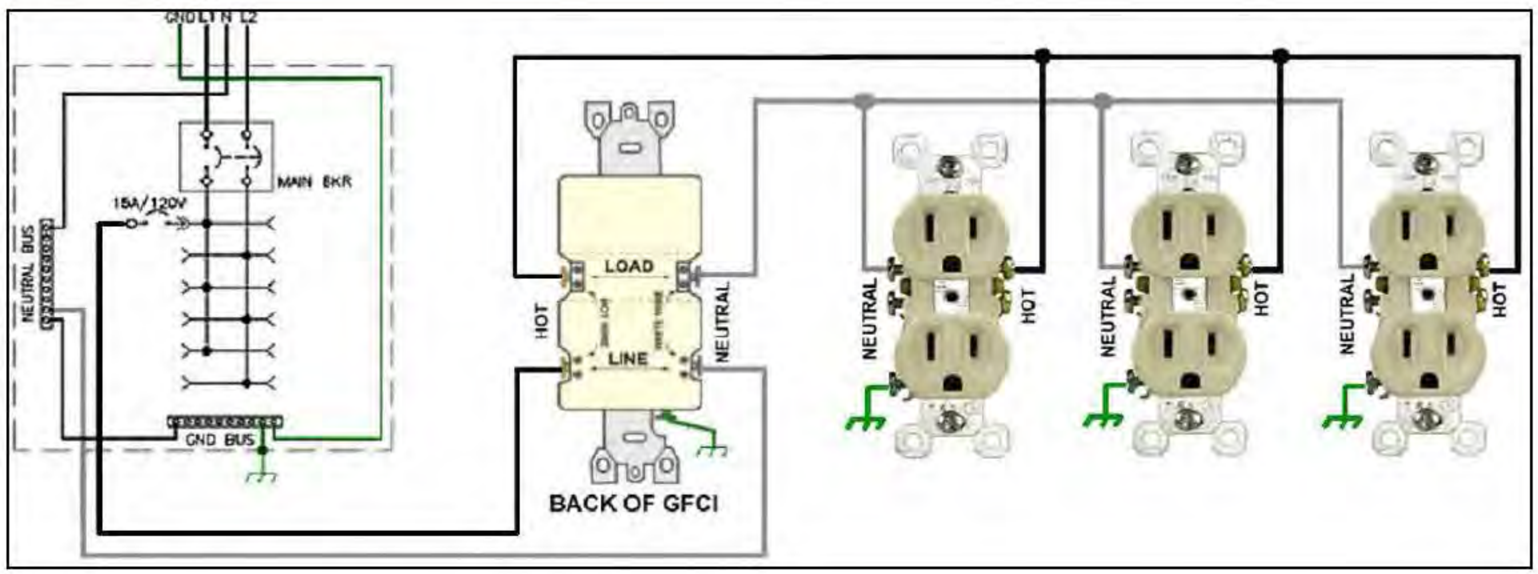
BACK of GFCI outlet

The back of all GFCI receptacles have this information on them.

- Supply terminals are labeled LINE.
- LOAD terminals are for feeding other receptacles that are to be GFCI protected.

Up to 7 additional standard receptacles can be GFCI protected from one GFCI receptacle.

The additional receptacles are wired to the LOAD terminals of the GFCI receptacle.



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Icon Legend

	Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required	
	Face Shield and Safety Glasses Required	Safety Inspection Required	
	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

WIRING STANDARDS

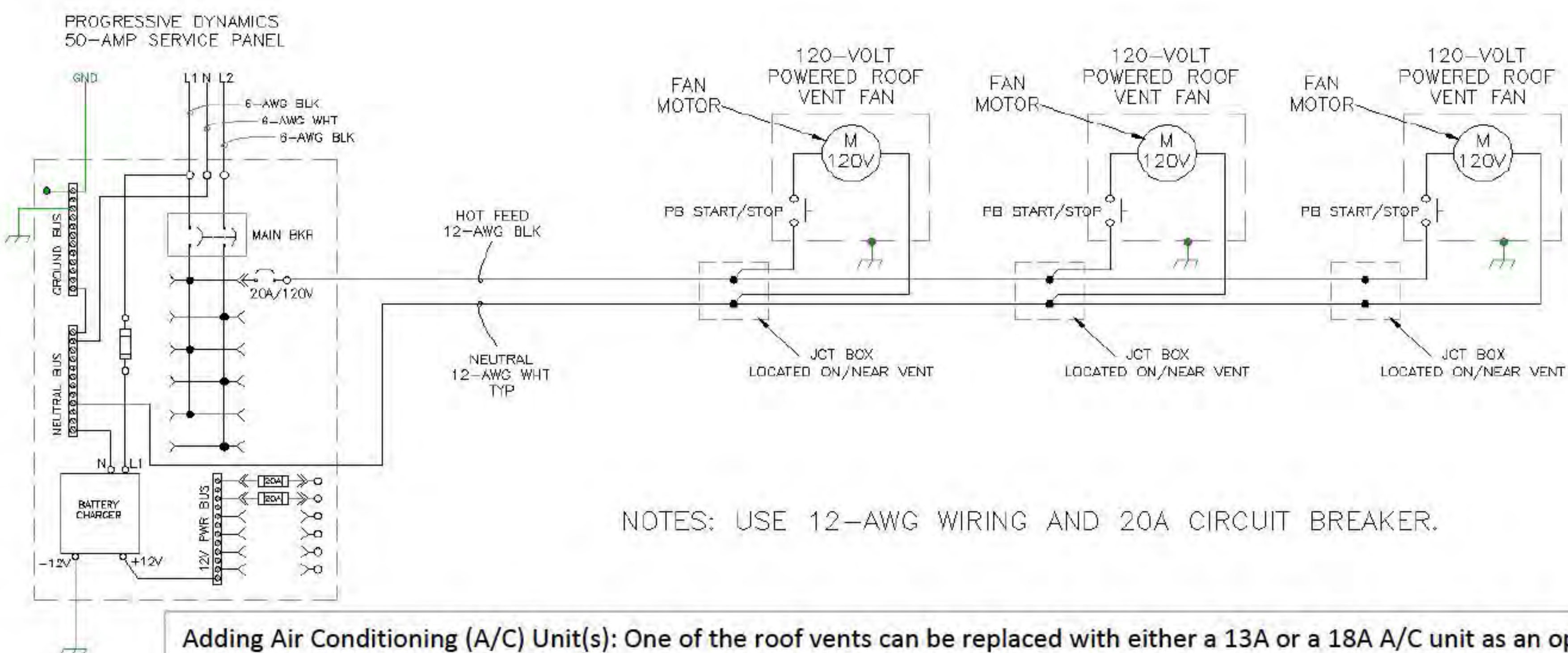
Section 9: Powered Roof Vents

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

A. 120V AC Powered Roof Vents

TYPICAL 120VAC POWERED ROOF VENT

NOTE: UP TO 3 POWERED ROOF VENTS MAY BE ON ONE CIRCUIT.



Adding Air Conditioning (A/C) Unit(s): One of the roof vents can be replaced with either a 13A or a 18A A/C unit as an option; however, only one A/C unit on a 12-AWG wire and a 20A breaker circuit as depicted above. If more than one A/C is called for in an order, then each additional A/C unit must be wired and fused appropriately on a separate circuit.

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Icon Legend

	Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required	
	Face Shield and Safety Glasses Required	Safety Inspection Required	
	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

WIRING STANDARDS

Section 10: LED Safety Flasher System (option)

LED Light Control Circuit Option - LED Safety Flasher System

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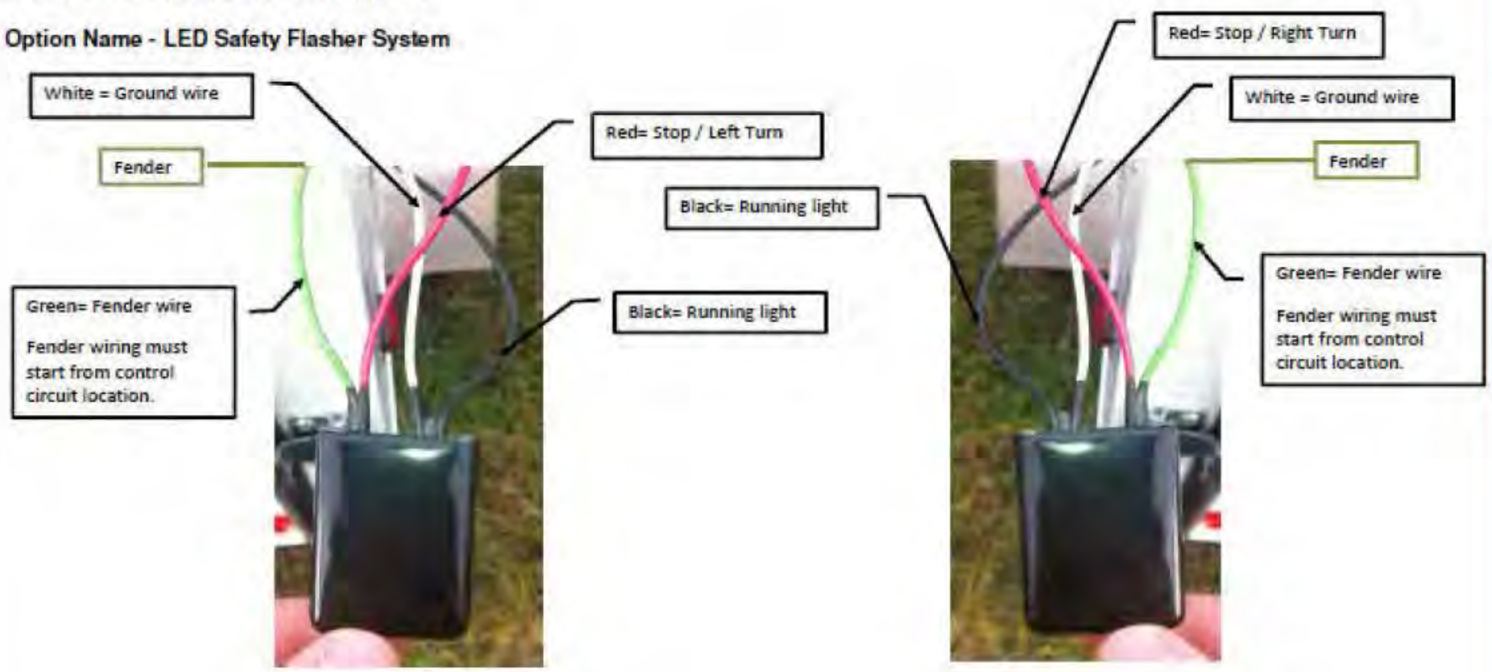
Engineering Change - Instructions / Continuation:

875000 - LED LIGHT CONTROL CIRCUIT

Option Name - LED Safety Flasher System



Roadside Curbside

Connect and store the control circuits at the interior of each rear corner post

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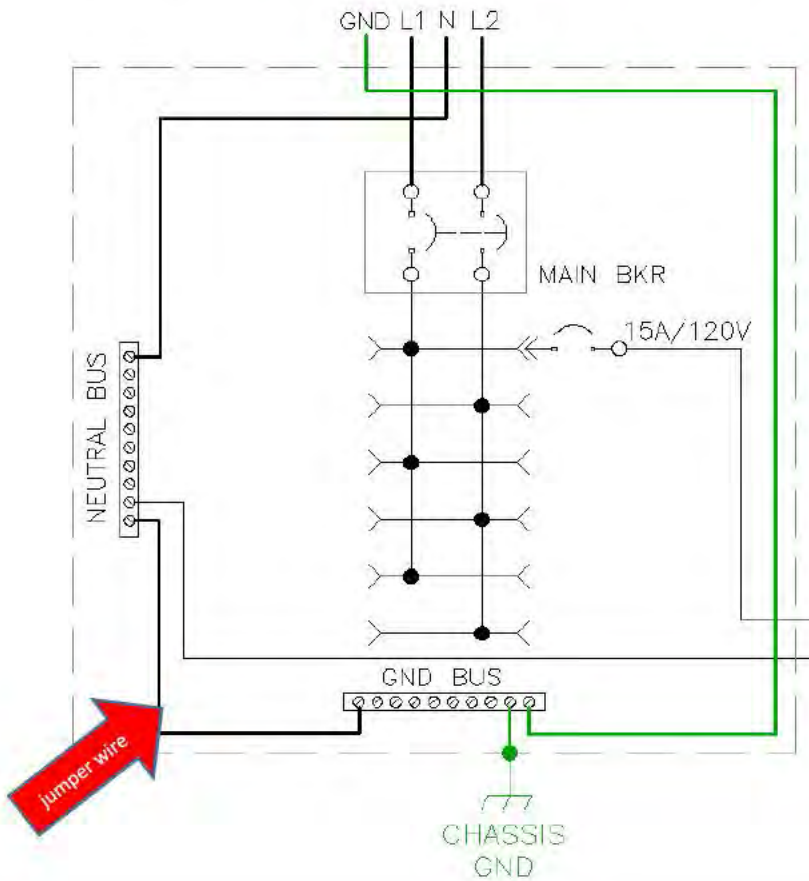
Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required		Weld Hood, Apron, Sleeves, Gloves Required	
Face Shield and Safety Glasses Required		Safety Inspection Required	
Hard Hat Required		Quality Inspection Required	
Respirator Required			

WIRING STANDARDS

Section 11: Short Circuits and the Importance of Jumper Wire Installation

A short circuit is a situation where a hot wire (L1) finds a path to the chassis ground. Short circuits are dangerous, but can be prevented by careful installation (I.E. protect the insulation to prevent wearing and bare wire contact to the metal trailer cage and remember to install the ground-to-neutral jumper). When the ground-to-neutral jumper is properly installed in the breaker box and a hot short to ground were to occur, a circuit breaker would trip.



CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

With the jumper wire installed between the ground bus and the neutral bus, any short to ground has a direct path to neutral and the breakers will trip as designed.

INSTALL THE JUMPER WIRE ONLY AFTER ALL HYPOT TESTING IS COMPLETE, BUT DO NOT FORGET IT!

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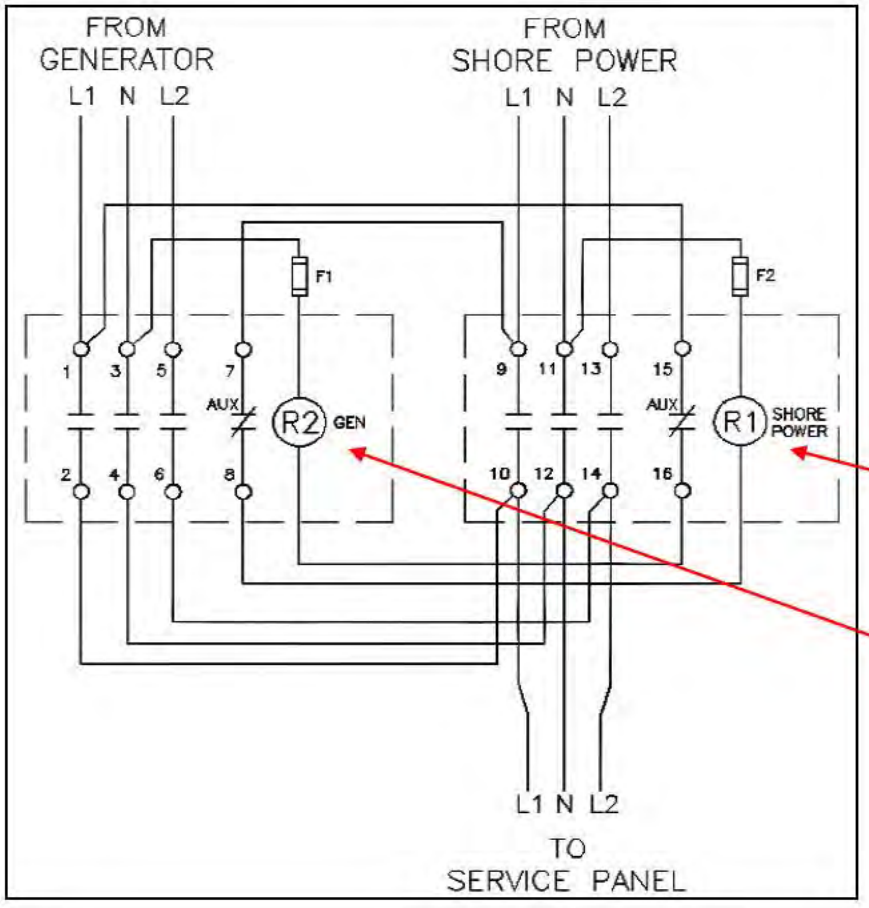
	Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required	
	Face Shield and Safety Glasses Required	Safety Inspection Required	
	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

WIRING STANDARDS

CAUTION: RISK OF ELECTRICAL SHOCK. Disconnect power before installing

Section 12: Automatic Transfer Switches - ATS

An automatic transfer switch or ATS automatically directs the source of power from either a portable generator or from "shore power" (electricity from the utility company) to the trailer's service panel. The ATS uses a relay, an electronically operated switch, to open or close circuits and is designed to prevent more that one source of power to service panel. A diagram shows the typical circuit for the ATS.



The ATS is used to "relay" electrical power from either SHORE POWER via the motor base or from a GENERATOR to the *service panel*.

It will allow one or the other but not both at the same time to power the service panel.

ESCO Model LPT50BRD

When R1 is energized, its normally closed aux contact (which is in series with R2) opens and prevents R2 from being energized.
When R2 is energized, its normally closed aux contact (which is in series with R1) opens and prevents R1 from being energized.

Attention:
Should both ***shore power*** and ***generator*** be energized at the same time, shore power will overpower the generator and trip open the circuit protection of the generator. This situation could damage or destroy the generator.
Since it is very important that when one source of power is ON that the other is **locked-out**, it is very important that the ATS is wired correctly and tested before the trailer is shipped to the customer.

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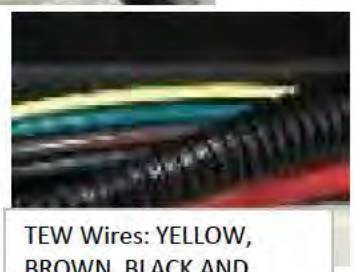
Face Shield and Safety Glasses Required		Safety Inspection Required	
Hard Hat Required		Quality Inspection Required	
Respirator Required			

Process Step	Process Description	Process Picture	Requirements
1	NOTE: THIS WORK INSTRUCTION DESCRIBES WIRING A TRAILER CAGE. OTHER INSTRUCTIONS DESCRIBE CONNECTING LIGHTS AT INTERIOR TRIM AND FINAL OPERATIONS A) Begin WIRING after the next completed trailer cage is moved forward from TOX operation. Before moving a trailer, remember to sweep and run floor magnet to prevent screws from piercing tires.	  Safety Reminder: Secure the ramp door to the hoop until the Spring Counter-balance has been installed.	Trailer Dolly, Safety Chain Safety Reminder: check that all ladders, lifts, scaffolding, tools have been removed, and call out to warn others before moving a trailer.
2	Steps 2 - 10 proceed installation of floor DECKING. **Trailers Without Electric Brakes:** A) Drill and deburr wiring access hole in tongue large enough for loom (see step 9). B) Thread purchased wire harness through wire access hole (road side), through the tongue and into the chassis. **Trailers With Electric Brakes:** A) Thread pre-cut TEW wires through wire access hole (road side), through the tongue and into the chassis. B) Encase the TEW wires in plastic loom before threading the wires through the chassis. Feed loom into the tongue 6"-12". Clip the wires in loom to the chassis and secure them at the hoop so they do not become damaged laying on the floor.	     TEW Wires: YELLOW, BROWN, BLACK AND GREEN	Drill Purchased wire harnesses for trailers without electric brakes.  TEW wire for trailers with electric brakes. 

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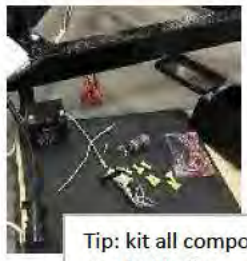
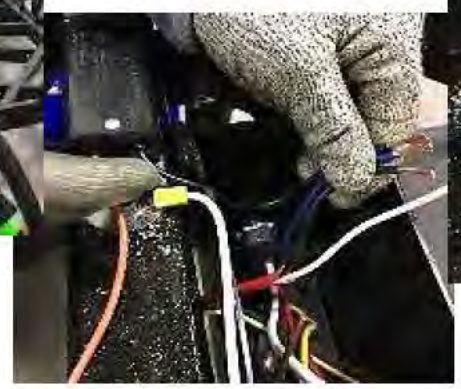
Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required		Weld Hood, Apron, Sleeves, Gloves Required	
Face Shield and Safety Glasses Required		Safety Inspection Required	
Hard Hat Required		Quality Inspection Required	
Respirator Required			

Process Step	Process Description	Process Picture	Requirements
3	**Trailers With Electric Brakes:** A) Drill 2 holes in plastic electrical box. B) Pull TEW wires into the box and fasten the box to the tongue.	 drill hole in hinged end and tongue side 	Drill, Impact Driver  Tip: kit all components needed before starting to wire the box
4	**Trailers With Electric Brakes continued:** A) Install pigtail to the box. B) Fasten the breakaway controller to the tongue with a screw over a ground wire. Plug in break away cable.	  	Impact Driver, Plyers Tip: cut wires to length for each connection, then strip them. When the red pigtail wire is not used, do not strip it.

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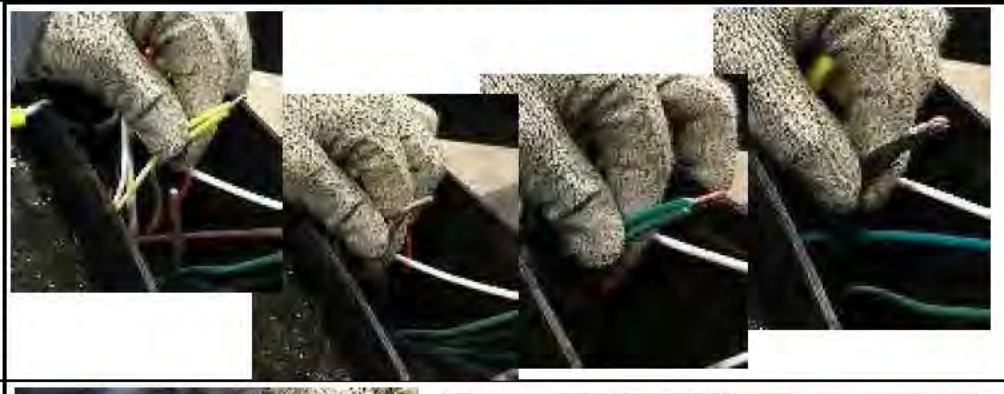
Icon Legend

	Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required	
	Face Shield and Safety Glasses Required	Safety Inspection Required	
	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

Process Step	Process Description	Process Picture	Requirements
5	**Trailers With Electric Brakes continued:** A) cut to length, strip, twist and wire nut 1) black brake, black break-away and blue pig tail wires; 2) all 4 white wires (includes battery lead wire with crimped connector) Note: <u>use the red wire nut when connecting 4 wires</u>, use the yellow wire nut for connections of 3 or 2 wires.		Wire Stripper, Crimper Quality Reminder: check all wires in each wire nut making sure that they are securely connected and that no copper is exposed under the wire nut.
6	**Trailers With Electric Brakes continued:** 3) both yellow wires; 4) both brown wires; 5) both green wires; 6) and the 2 remaining black wires.		Wire Stripper
7	**Trailers With Electric Brakes continued:** A) cut strip and crimp a connector on the orange break-away wire (battery lead). B) check all wire connections to assure that all wires are connected correctly. Note: the red pig-tail wire may not be used. C) set the battery on top in the box, but do not connect it at this time.		Wire Stripper, Crimper Quality Reminder: check all wire connections to make sure they are correct.

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Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required		Weld Hood, Apron, Sleeves, Gloves Required	
Face Shield and Safety Glasses Required		Safety Inspection Required	
H dH tR i d		Quality Inspection Required	
Respirator Required			

Process Step	Process Description	Process Picture	Requirements
8	**Trailers Without Electric Brakes:** A) measure 5'6" from access hole in tongue to end of connector to create the pig-tail. B) wrap pig-tail with plastic loom inserting the loom into the access hole. C) starting at the connector, wrap connector and loom with electrical tape 8" - 10" down the loom.		Tape Measure
9	**Trailers Without Electric Brakes continued:** A) crimp screw connector to the white wire. B) attach the white wire to the tongue at the access hole. C) secure the loom to the frame with a wire tie under the grounding screw used on the white wire connection to the frame. Replaces Battery Box for 7000 series with idler brake.  This junction box is used with a single axle idler brake trailer with the 7000 series package as It allows a 7 way connector needed for the 7000 series package with backup lights.	 	Wire Stripper, Crimper, Impact Driver

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Face Shield and Safety Glasses Required		Safety Inspection Required	
Hard Hat Required		Quality Inspection Required	
Respirator Required			

Process Step	Process Description	Process Picture	Requirements
10	**Trailers Without Electric Brakes:** A) pull wires apart starting at the tail end to the tongue and frame junction. B) using coupling connectors, crimp an additional 4' to the green wire and crimp 8' to the brown wire. C) Encase the wires in plastic loom before threading the wires through the chassis. D) Feed loom into the tongue 6"-12". Clip the wires in loom to the chassis and secure them at the hoop so they do not become damaged laying on the floor.	    do not tie knots for the rear clearance lights - this was an old practice.	Impact Driver
11	**Between trailers, prepare line side materials for the next trailer:** A) drill holes in electric box. B) cut bundle of TEW wires to length. C) cut single TEW wires to length: brown @ 18' (8 1/2 forearm wraps), black at 12' (6 forearm wraps). D) kit components needed for electric box. E) restock electric cart as needed.	 Cut black, brown, green and yellow TEK wire to 32', 15 wraps from thumb around the elbow back to the thumb (forearm wrap).  drill hole in hinged end and in tongue side  kit components inside the electric box ready for the next trailer	Drill, Wire Cutter

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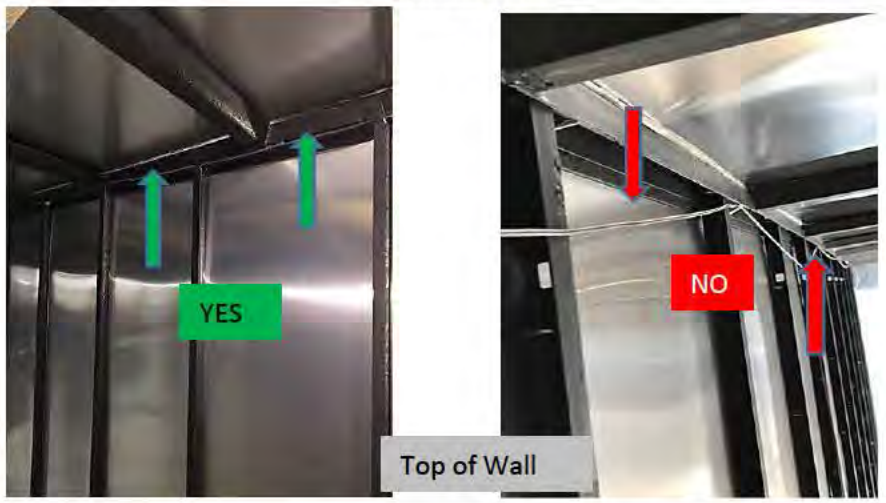
Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required		Weld Hood, Apron, Sleeves, Gloves Required	
Face Shield and Safety Glasses Required		Safety Inspection Required	
Hard Hat Required		Quality Inspection Required	
Respirator Required			

Process Step	Process Description	Process Picture	Requirements
12	**Wiring Cage in Preparation of Lights - Series 100/1000 Top of Wall**: A) use 8" black zip tie with a screw loop, Fastenal p/n 63475, with a #10 screw with the #3 point p/n 970012 and attach the zip tie and wire (loop wire through zip tie 2x at each end of run) to the roof frame channel on rearward side of every wall post. B) wires are pulled snug along the length of the wall. Zip ties are pulled tight on the wires and the excess tie material cut off.		 Drill, Driver Tape does not last and does not project quality.
13	**Wiring Cage in Preparation of Lights - Series 100/1000 Along Sides:** A) drill 3/8" holes and install round grommets. B) run wire through the grommets, not through holes without grommets.		Drill, Driver Unprotected wires may wear and short-out overtime.

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Icon Legend

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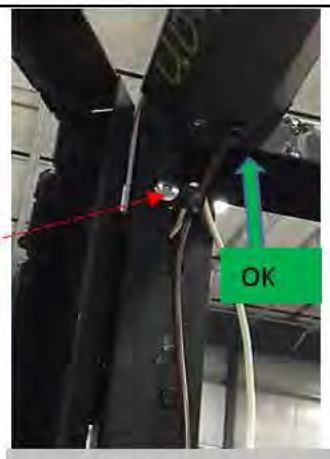
	Face Shield and Safety Glasses Required	Safety Inspection Required	
	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

Process Step	Process Description	Process Picture	Requirements
14	**Wiring Cage in Preparation of Lights - Series 100/1000 Front Corners**: A) attach pre-crimped white ground wire. B) drill 3/8" hole and insert round grommet for the brown wire running across the roof. C) use wire retainer for vertical runs of wire.	 Front Road-Side Corner   Front Curb-Side Corner	Drill, Driver 
15	**Wiring Cage in Preparation of Lights - Series 100/1000 Rear Corners:** A) attach pre-crimped white ground wire. B) drill 3/8" hole and insert round grommet in the last wall support on both sides and insert brown wire. 	 Rear Road-Side Corner  Rear Curb-Side Corner	Drill, Driver, Connector Crimping Plyers Rear corner panels p/n 150300 shall be installed floor to ceiling as shown to cover wire loops and connection points after functional testing. 

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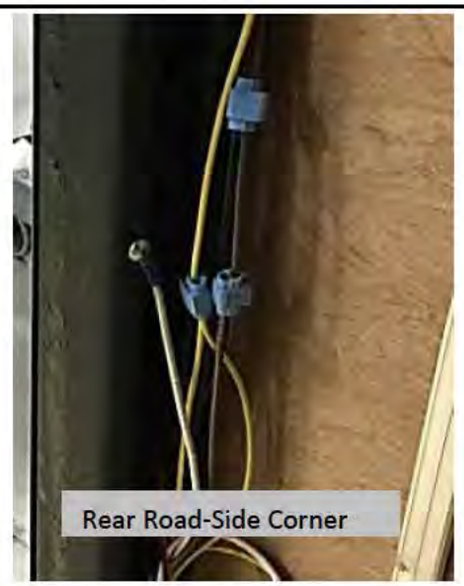
	Glasses, Hearing Protection, Steel Toed Shoes, Gloves Required	Weld Hood, Apron, Sleeves, Gloves Required	
	Face Shield and Safety Glasses Required	Safety Inspection Required	
	Hard Hat Required	Quality Inspection Required	
	Respirator Required		

Process Step	Process Description	Process Picture	Requirements
16	**Wiring Cage in Preparation of Lights - Series 300/3000 Road-Side**: A) attach pre-crimped white ground wire. B) drill 3/8" hole and insert round grommet for the brown wire running through the wall.	 Front Road-Side Corner 	Drill, Driver Quality Reminder: it is faster to install wires through punched holes in the trailer cage; however, this practice may lead to insulator wearing which leads to ground faults and malfunctions for our customers. Please use the prescribed methods to run all electric wiring. It takes a little bit more time and effort, but it is worth it to our current and future customers, and to us.
17	**Wiring Cage in Preparation of Lights - Series 300/3000 Road-Side continued**: A) attach pre-crimped white ground wire. B) Connect blue-splice connectors as shown.	 Middle Road-Side - top Middle Road-Side - bottom  Rear Road-Side Corner	Drill, Driver, Connector Crimping Plyers

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Face Shield and Safety Glasses Required	Safety Inspection Required
Hard Hat Required	Quality Inspection Required
Respirator Required	

Process Step	Process Description	Process Picture	Requirements
18	**Wiring Cage in Preparation of Lights - Series 300/3000 Curb-side**: A) attach pre-crimped white ground wire. B) drill 3/8" hole and insert round grommet for the brown wire running through the wall.	 Front Curb-Side Corner  Secure wire so it cannot fall back into the wall.  Rear Hoop - top (same for 100/1000 Series)	Drill, Driver
19	**Wiring Cage in Preparation of Lights - Series 300/3000 Curb-Side continued**: A) attach pre-crimped white ground wire. B) Connect blue-splice connectors as shown. All trailers shall be functionally tested for electrical operation before being declared as complete. 	 Middle Curb-Side - top  Rear Curb-Side - bottom  Rear Curb-Side Corner	Drill, Driver, Connector Crimping Plyers Rear corner panels shall be installed floor to ceiling as shown to cover wire loops and connection points after functional testing. 

Universal Trailer Corporation

Last Change Date:	8/4/2017	
Document #:	NBAS-0003	
Revision Letter:	C	page 33 of 33
Facility:	New Bristol	
Department:	Assembly	
Work Center:	Wiring	
Process:	Wire Trailer Cage	

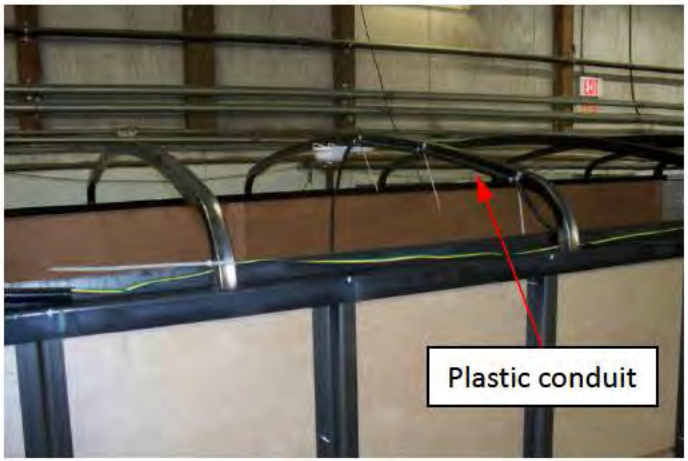
Revision Level	Rev Date	Revision By:	Brief Description of Change(s)
Original	5/3/2017	A. Barg	draft
Original	5/17/2017	A. Barg	add per QA 5/15/17 Use grommets & wire ties, not electric tape and punched holes without grommets.
A	5/23/2017	A. Barg	added engineering standards to the original document, pages 1-4.
B	9/27/2017	A. Barg	added Index page 1, NEC & Engineering Standards: Sections 5-8, pages 6-17.
C	10/4/2017	A. Barg	added powered roof vent (page 20), Self-contained Receptacles and Switches (pages 14 - 16), LED Safety Flasher option (page 21) and notes on LED polarity exceptions (page 11), Automatic Transfer Switches (page 23), and updated Index to reflect the new content (page 1).

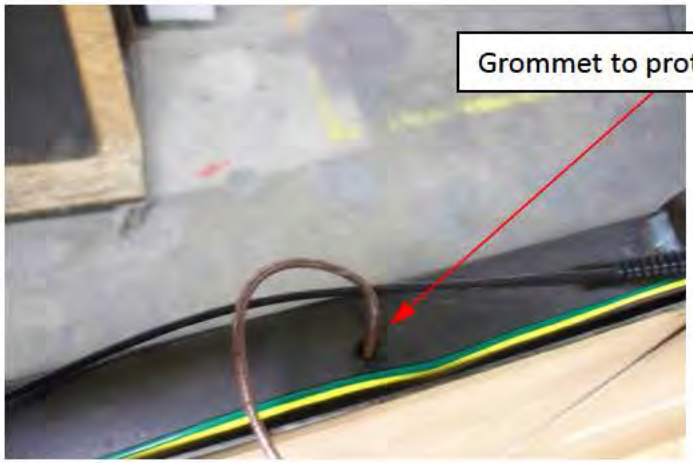
Where Used: All Haulmark Trailers using 4-Way Plugs

Installation

When the wire bundle reaches the top of the roof front, it is either tie wrapped to the first roadside top bow of the trailer or tucked behind the roof bow. The bundle is then routed along the inside of the roof bows (either radius or flat) and tie wrapped to every other roof bow. For radius roof bows, it is important to tuck the wire bundle in between the top sidewall and the roof bow as shown in the picture below.

Wiring is also installed for the light switch and the light fixtures. The wire for these is spliced into the 4-way wire bundle using butt connectors or wire nuts. Plastic conduits and grommets are used to protect the wiring from sharp corners where cuts can occur.





UNIVERSAL TRAILER	**ST 4.9.1** **Title:** Cargo Group Quality Standards	**Initial Release:** 3/19/2018 **Revision Date:** 3/19/2018 **Revision No:** -
Prepared by: Justin Hess		**11/20/2017**
Approved by: David Owenby		**11/20/2017**

1. **PURPOSE**
   1.1. To establish standard quality and inspection criteria for all Wells Cargo and Haulmark manufacturing processes.
2. **SCOPE**
   2.1. Applicable to Universal Trailer Corporation, Ogden, UT facility
3. **RESPONSIBILITY**
   3.1. Quality Assurance
   3.2. Engineering
   3.3. Management
4. **REFERENCE DOCUMENTS**
   4.1. Cargo Group Quality Standards
5. **NONCONFORMANCES**
   5.1. All nonconforming conditions described hereafter which require Quality or Engineering disposition will be recorded and processed in Thrive .
6. **VISUAL ACCEPTANCE CRITERIA (EXPOSED SURFACES)**
   6.1. All visual acceptance criteria on exposed surfaces, both interior and exterior, will be based on "eye level"
   6.2. "Eye level" is between 48-84" off the ground when the trailer is on its tires. Issues in the "eye level" area will be considered more severe than issues that fall below or above these dimensions
   6.3. Acceptable Conditions
      6.3.1. Scratches at "eye level" are acceptable given they are less than 1", don't go through the paint and are not visible from 3' away in sunlight
      6.3.2. Two or more scratches on any panel is unacceptable and will be cause for panel replacement.
      6.3.3. Scratches above or below "eye level" must be no longer than 2" and not visible from 3' away in sunlight.
      6.3.4. Touch-ups are acceptable as long as paint is blended and not noticeably different from 3' away in sunlight.
      6.3.5. "Eye level" dents not visible at 3' away are acceptable provided it doesn't take away from the overall appearance and quality of the trailer
      6.3.6. Dents outside of "eye level" will be graded on severity and location
   6.4. Unacceptable Conditions
      6.4.1. Scratches through paint at "eye level"
      6.4.2. Two or more scratches on any panel
      6.4.3. Scratches above or below "eye level" longer than 2"
      6.4.4. Unsuitable touch-ups
      6.4.5. "Eye level" dents visible at 3'

6.4.6. Two or more dents on the same panel

6.4.7. Any scratch or damage to metal sheet or trim extrusions which produces a shiny appearance, burr, or sharp edge and cannot be reworked to an acceptable condition

7. WELDS

7.1. Acceptable Condition

7.1.1. Weld bead width, height, appearance and penetration must be acceptable per industry standards

7.2. Unacceptable conditions subject to Quality disposition include:

7.2.1. Missing welds

7.2.1.1.Any weld shown on a print or drawing that has not been applied

7.2.1.2.Any weld that has been incorporated into a specific process by manufacturing or engineering that has not been applied.

7.2.1.3.A consecutive series of welds in which one or more was skipped.

7.2.2. Holes

7.2.2.1.Any weld that has a hole or void incorporated into finished process. One hole in any finished weld may be tacked in to cover hole. Two or more holes will be re-welded.

7.2.3. Cracked

7.2.3.1.Any weld that has split or cracked or the actual weld is beginning to separate.

7.2.4. Excessive weld

7.2.5. Insufficient weld

7.2.6. Double weld

7.2.7. Insufficient penetration or “cold” welds

7.2.8. Welds that have missed one of the two pieces that is to be joined together

7.2.9. Excessive penetration or “hot” welds

7.2.10. Porosity

7.2.11. Excessive cratering

Figure 1 Excessive penetration or "hot" welds

Figure 2 Weld missed one of the two pieces to be joined

Figure 3 Insufficient penetration or "cold" welds

Figure 4 Double weld

Figure 5 Insufficient weld

Figure 6 Excessive weld

Figure 7 Holes or voids. One hole may be tacked in, two or more holes must be re-welded

Figure 8 Cracked welds

8. OPENINGS (DOOR, WINDOWS, RAMPS, ETC.)

8.1. Acceptable Condition

8.1.1. All door, window, and ramp openings must be square and built to size per print, Engineering instructions, or best practices

8.1.2. All openings must be within ¼" of width and height requirements

8.2. Unacceptable conditions which require rework:

8.2.1. Not square

8.2.2. Incorrect size

8.2.3. Nonconforming welds (see 7.2)

9. CHASSIS

9.1. Acceptable Condition

9.1.1. All chassis will be cut, assembled and welded per print, Engineering instructions, or best practices

9.2. Unacceptable Conditions

9.2.1. Incorrect lengths

9.2.2. Incorrect parts used

9.2.3. Nonconforming welds (see 7.2)

10. AXLES

10.1. Acceptable Condition

10.1.1. Axles will be welded or fastened to the chassis per axle manufacturer instructions, print, Engineering instructions, or best practices

10.2. Unacceptable Conditions

10.2.1. Incorrect axle

10.2.2. Incorrect location

10.2.3. Failure to add risers where applicable

10.2.4. Nonconforming welds (see 7.2)

11. REAR HOOP/WALL

11.1. Acceptable Condition

11.1.1. Rear hoop/wall will be assembled and welded per print, Engineering instructions, or best practices

11.2. Unacceptable Condition

11.2.1. Incorrect height/width

11.2.2. Incorrect spring

11.2.3. Incorrect taillight location

11.2.4. Incorrect hinge location

11.2.5. Nonconforming welds (see 7.2)

12. RAMPS

12.1. Acceptable Condition

12.1.1. Ramps must be cut, assembled, and welded per print, Engineering instructions, or best practices

12.1.2. Welds on exterior of ramp must be per print or Engineering instruction.

12.1.3. Ramp will open and close with minimal effort.

12.1.4. Ramp will seal completely with no visible daylight showing thru.

12.2. Unacceptable Condition

12.2.1. Incorrect height/width

12.2.2. Visible daylight showing

12.2.3. Plates in incorrect location

12.2.4. Incorrect material per BOM

12.2.5. Ramp cable brackets in wrong location or improperly welded and correct rating for wieght
12.2.6. Nonconforming welds (see 7.2)

13. SIDE WALLS

13.1. Acceptable Condition
13.1.1. Side walls must be cut, assembled, and welded per print, Engineering instructions, or best practices
13.1.2. Side wall must be straight, parallel to the main rail, and not deviate more than 1" side-to-side along the length of the wall. Gaps to 3/8" inch.

13.2. Unacceptable Condition
13.2.1. Incorrect height/length
13.2.2. Incorrect material per BOM
13.2.3. Incorrect vertical post spacing
13.2.4. Openings wrong size
13.2.5. Openings in wrong location
13.2.6. Height variation causing bows or humps
13.2.7. Nonconforming welds (see 7.2)
13.2.8. Side wall is bowed/not straight, and variation is more than 1"

14. ROOFS

14.1. Acceptable Condition
14.1.1. Roofs must be cut, assembled, and welded per print, Engineering instructions, or best practices
14.1.2. Roof must be straight and flat with any deviation, including sagging, less than 1"

14.2. Unacceptable Condition
14.2.1. Incorrect length/width
14.2.2. Incorrect spacing
14.2.3. Roof vent location incorrect or off-center
14.2.4. Missing reinforced roof bow where applicable
14.2.5. Roof is bowed/sagging more than 1"
14.2.6. Nonconforming welds (see 7.2)

15. FLOOR TIE-DOWN PLATES

15.1. Acceptable Condition
15.1.1. Floor tie-down plates must be in correct location and welded per print, Engineering instructions, or best practices

15.2. Unacceptable Condition
15.2.1. Incorrect location

16. COUPLERS

16.1. Acceptable Condition
16.1.1. Purchased couplers must be installed per manufacturer instructions.

16.1.2. Couplers made in-house must be cut, assembled, and welded per print, Engineering instructions or best practices

16.1.2.1. Couplers made in-house must be inspected by approved personnel throughout the process

16.2. Unacceptable Condition

16.2.1. Wrong coupler

16.2.2. Not square to the frame

16.2.3. Nonconforming welds (see 7.2)

17. SAFETY CHAINS

17.1. Acceptable Condition

17.1.1. Safety chains must be correct size, length, and weight rating per BOM

17.2. Unacceptable Conditions

17.2.1. Incorrect size

17.2.2. Incorrect length

17.2.3. Incorrect chain weight rating

17.2.4. Correct location

17.2.5. Incorrect hook per BOM

17.2.6. Nonconforming welds as applicable (see 7.2)

18. GRINDING

18.1. Welds must be ground smooth before paint where panels are attached (internal and external)

19. PAINT

19.1. Acceptable Condition

19.1.1. Trailer must be prepped and painted per print, Engineering instructions, or best practices

19.1.2. Paint must be uniform in appearance free of runs, build-up, drips, and completely cover exposed metal

19.2. Unacceptable Condition

19.2.1. Incorrect color

19.2.2. Improper preparation

19.2.3. Imperfections or inconsistency in paint coverage

19.2.4. Insufficient or excess coverage

19.2.5. Missing coverage in required areas

19.2.6. Exposed rust

20. UNDERCOATING

20.1. Acceptable Condition

20.1.1. Undercoating must completely envelop frame, crossmembers, outriggers, per print, Engineering instructions, or best practices

20.2. Unacceptable Condition

20.2.1. Insufficient or excess coverage

20.2.2. Drips

20.2.3. Runs

20.2.4. Exposed rust

Figure 9 Cracked paint (alligator skin)

Figure 11 Runs and build-up

Figure 10 Drips

Figure 12 Exposed rust

21. WOOD

21.1. DECKING/FLOORING

21.1.1. Standard Practice

21.1.1.1.Place jacks underneath the trailer and carefully lower ramp onto secure surface before working on decking

21.1.1.2.Measure, cut, and place decking pieces on the ramp and chassis

21.1.1.3.Evenly space and drive decking screws across the width of the trailer at each chassis crossmember (3 screws on 4' wide, 4 screws on 5 & 6' wide, 5 screws on 7' wide, and 6 screws on 8' wide)

21.1.2. Acceptable Condition

21.1.2.1. Flooring is complete, level, with no gaps, missing screws and all screw holes puttied

21.1.2.2.Beavertail gaps may be filled with silicone

21.1.2.3.Ramp extensions must be complete with no gaps, missing screws and all screw holes puttied

21.1.2.4.Painted floors must be painted around perimeter and tie-down holes

21.1.3. Unacceptable Condition

21.1.3.1.Large gaps between floor boards

21.1.3.2.Missing screws

21.1.3.3.Height variation between floor boards

21.1.3.4.Screw holes not puttied

21.1.3.5.Missing floor paint

21.1.3.6.Damaged floor boards or delamination

21.1.3.7.Screws not flush or seated correctly

21.2. MAIN CABLES

21.2.1. Standard Practice

21.2.1.1.Encase the TEW wires in plastic loom before threading wires through the chassis

21.2.1.2.Thread cable through the tongue and into the chassis

21.2.1.3.Secure cable at the hoop so it does not become damaged laying on the floor. Must be secured to the frame.

21.2.2. Acceptable Condition

21.2.2.1.Main cable is cut to correct length, protected from damage as appropriate, and wired correctly to the brakes

21.2.3. Unacceptable Conditions

21.2.3.1.Main cable is too short

21.2.3.2.Damaged cable(s)

21.2.3.3.Sagging below frame

21.2.3.4.Wired incorrectly to the brakes

21.3. FLOOR/WALL TIE DOWN

21.3.1. Acceptable Condition

21.3.1.1.All tie downs are in correct location, square, and tight to the mounting surface

21.3.2. Unacceptable Condition

21.3.2.1.Incorrect location

21.3.2.2.Crooked

21.3.2.3.Not flat to the floor

21.3.2.4.Loose bolts

21.3.2.5.Missing nuts

22. INTERIOR WALLS

22.1. Standard Practice

22.1.1. Position jack stand under the main rail near the rear hoop on each side of the trailer and carefully lower the ramp onto a secure surface

22.1.2. Mark the centers of the front wall posts on the floor decking (3/8-1/2" long)

22.1.3. Measure and cut interior panels to size per the trailer type and model configuration

22.1.4. Screw at the top and bottom of each panel and at 16" intervals if possible. For smaller panels on top 1 screw centered between top and bottom screws is adequate.
22.1.5. Hang panels vertically on front wall if possible (typical on v-nose configurations)
22.1.6. Working front to back toward the ramp hang the panels horizontally
22.1.7. Hang the top panel 1" above the bottom panel, this allows you to easily see the post as you screw down
22.1.8. Staple trim pieces starting at the front wall at each vertical panel seal working front to back toward the ramp
22.1.9. Add top, middle and bottom trim at each seam

22.2. Acceptable Condition
22.2.1. Walls are square, free of holes, damage, and tight to the posts
22.2.2. Batten trim is straight, tight to the wall and free of damage

22.3. Unacceptable Condition
22.3.1. Not square or straight
22.3.2. Warped
22.3.3. Delamination
22.3.4. Missing screws
22.3.5. Holes in the wall/trim
22.3.6. Blowouts around cutouts

23. ELECTRICAL

23.1. Standard Practice
23.1.1. National Electric Code (NEC) applies to all applications of 50V and greater
23.1.2. Lighting and receptacles are wired similarly. Both are 120V circuits and can be either 15A or 20A circuits
23.1.3. 120V lighting circuits may have up to 10 lights per circuit
23.1.4. Receptacle circuits may have up to 8 receptacles per circuit
23.1.5. Circuits combining both receptacles and lights may have no more than 8 devices total
23.1.6. All wire splices must be made within an approved electrical box for circuits 50V and greater
23.1.7. Wire nuts, crimp lugs, or terminal strips may be used for wire splicing
23.1.8. Wire gauge (AWG) must match amperage connected to the circuit
23.1.9. Wire size is determined by the requirements of the devices connected to it. For 120V lighting and receptacles will be either AWG-14 (15A) or AWG-12 (20A)
23.1.10. The circuit breaker rating is determined by the smallest wire gauge within the circuit
23.1.11. All electrical devices operating at 30V or greater shall be "chassis grounded".
23.1.12. For 12V LED lighting, 20 LED marker lights are allowed per amp
23.1.13. LED strip-lighting operates at 0.25A per foot therefore a 10A circuit provides for 40 feet of LED strip-lighting. UTC limits LED strip lighting to 4-ft per amp at 12 volts

23.1.14. Ground Fault Circuit Interrupters (GFCI) are designed to protect people. Up to 7 standard receptacles can be GFCI protected from one GFCI receptacle. The additional receptacles are wired to the LOAD terminals of the GFCI receptacle.

23.1.15. Up to (3) 120V AC powered roof vents may be allowed on one circuit (12-AWG wiring and 20A circuit breaker)

23.1.16. Only one Air Conditioning (A/C) unit may be wired and fused per circuit. Each additional unit must be wired and fused appropriately on a separate circuit.

23.2. Acceptable Condition

23.2.1. All electrical wiring must be per NEC, secured properly, and free of damage

23.2.2. All light and ground drops in the correct location

23.2.3. Any exposed wire must be covered in loom

23.2.4. Adequate connections in wire nuts, butt connectors, and scotch-locks

23.2.5. Pig-tails must be correct length, typically 36" from tip of coupler

23.2.6. Passed Electoral Test

23.3. Unacceptable Condition

23.3.1. Not wired per code, engineering instructions, BOM or specification

23.3.2. Exposed wire

23.3.3. Inadequate seating in scotch-locks

23.3.4. Inadequate connections in wire nuts, butt connectors, and scotch-locks

23.3.5. Short pig-tails

23.3.6. Ground and drops pinched, damaged, or in wrong location

23.3.7. Failed Electrical Test

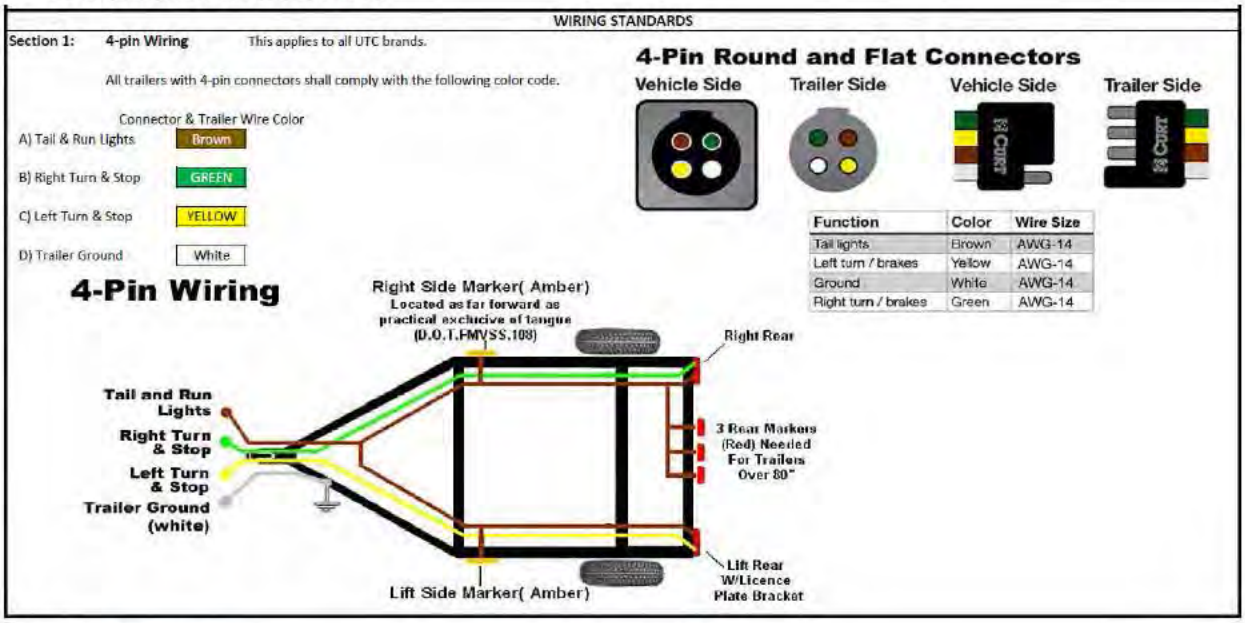


Figure 13 4-pin wiring schematic

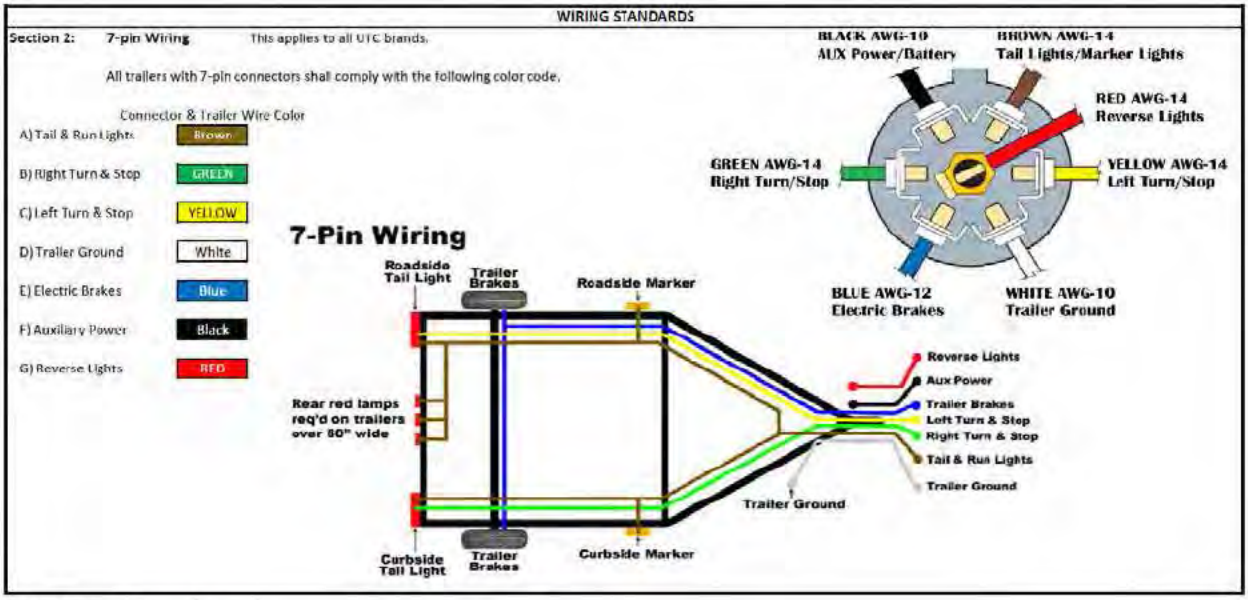


Figure 14 7-pin wiring schematic

24. SHEET METAL

24.1. Standard Practice

24.1.1. Measure, cut, and stage sheet metal panels for exterior covering

24.1.2. Inspect panels for damage before hanging

24.1.3. For degabond, grind post first (excludes SWaP Trailers), prep posts using a clean rag and alcohol. Fold the rag exposing a clean section for each new post and change rags frequently. Cut a 3/8" hole in the tip of the degabond and run a ¼" thick bead of product on the posts.

24.1.4. For VHB tape, clean and prime the panels (and posts for aluminum) using a clean section of rag with each wipe.

24.1.5. Hang sheet metal and drive 2 screws in the top rail to temporarily hold the sheet

24.1.6. Hang each sheet so that the front of the sheet (closest to the A-frame) slides under the panel in front it

24.1.7. For screw down trailers, mark screw locations on posts starting at 5" from the top and at 6" or 8" intervals depending on the model

24.1.8. Rasp holes and pull wire leads through hole for marker lights depending on model ensuring panels aren't damaged during the process

24.1.9. Header and footer for doors and ramps may be held with small strips of seam tape until trims are put on

24.2. SCREW DOWN

24.2.1. Acceptable Condition

24.2.1.1. Screw lines are straight, spaced evenly, and free of burrs and defects

24.2.1.2. Screws are fully seated

24.2.1.3. Seams are seam-taped or filled with silicone
24.2.1.4. Seams are flat and free of bubbles
24.2.1.5. Bend and place the rear corner piece on before screwing down the final vertical screw line on the side walls
24.2.2. Unacceptable Conditions
24.2.2.1. Screw lines are not straight
24.2.2.2. Unevenly spaced
24.2.2.3. Burrs or pig-tails are present
24.2.2.4. Not fully seated
24.2.2.5. Seams are missing seam tape or silicone
24.2.2.6. Seams are not flat or has bubbles
24.2.2.7. Any damage to panels which exceeds visual acceptance criteria covered in 6.1
24.3. BONDED
24.3.1. Acceptable Condition
24.3.1.1. Posts and sheet metal panels must be prepped per manufacturing instructions, engineering instructions or best practices
24.3.1.2. Panels must be straight, flat, and rolled properly ensuring adequate bond tight to the trailer
24.3.2. Unacceptable Condition
24.3.2.1. Posts/sheet metal was not prepped properly leading to insufficient bond
24.3.2.2. Bubbling or dents as a result of panels not being laid/rolled out flat
24.3.2.3. Any damage which exceeds visual acceptance criteria covered in 6.1

25. ROOFS

25.1. Standard Practice
25.1.1. Caution: Always maintain three-point contact when working on a scaffold, lift, or ladder. Free both hands and use caution when climbing up or down ladders.
25.1.2. Ensure roof and top 5" of front, side and rear walls are free of impediments and debris including sheet metal and screws
25.1.3. Ensure correct trim per BOM is used and remains free of damage during installation
25.1.4. Rasp holes for wire feeds
25.1.5. Caulk the entire perimeter of the roof ensuring a smooth and thorough seal between roof and trim
25.2. Acceptable Condition
25.2.1. Roof metal must be cut and secured per print, engineering instructions or best practices
25.2.2. All roof metal must be a single sheet covering the entire area of the trailer
25.2.3. All roof metal must be damage free and have adequate sealant coverage ensuring water-proof seal

Figure 15 Caulk the perimeter of the roof filling every void

25.2.4. Roof vents or other roof-mounted options must be secured and sealed properly

25.3. Unacceptable Condition

25.3.1. Screw holes in the roof

25.3.2. Inadequate sealant coverage

25.3.3. Leaks

25.3.4. Sloppy sealant coverage

26. TRIM

26.1. Standard Practice

26.1.1. Check Bill of Material for correct trim to be used

26.1.2. Measure and cut trims to size

26.1.3. Screw down starting on one end ensuring trim is straight and screws are evenly spaced

26.2. Acceptable Condition

26.2.1. Trims must be correct per Bill of Material and fastened tight to the trailer

26.3. Unacceptable Condition

26.3.1. Incorrect trim used

26.3.2. Trim too short

26.3.3. Trim too long

26.3.4. Improper or varying spacing in screws

26.3.5. Trim does not lay flat against the trailer

26.3.6. Trim is scratched or damaged beyond repair (see 6.1)

27. DOORS

27.1. Acceptable Condition

27.1.1. Doors will be appropriate per Bill of Material, free of damage, and open and close freely without binding

27.1.2. No Daylight showing

27.2. Unacceptable Condition

27.2.1. Door binds during opening/closing

27.2.2. Skin, trim, or other features are damaged

27.2.3. Light is visible around frame in the upper portion of door

27.2.4. Double rear doors are not centered in opening

27.2.5. Hardware is not straight including door straps and cam-bars

27.2.6. Latches require excessive effort to lock into hasp

27.2.7. Daylight showing

28. RAMPS

28.1. Standard Practice

28.1.1. Ramp hinges are welded or fastened to the frame and the ramp at weld or SWaP cage assembly

28.1.2. Ramp springs are typically installed before woods and wound after floors have been installed

28.1.3. Safety caution: When springs are tight they hold a lot of energy. Please be careful when winding the spring and ensure you have a firm grip on the lever bars and tighten the set screws securely.

28.1.4. Install ramp door spring counterbalance (run cable from ramp to cable bracket hole, insert pin through swivel grommet and cable bracket and secure with a cotter pin)

28.1.5. Bolt counterbalance to the hoop mounting brackets, run a paint line along the length of the spring, loosen set screws and using 2 lever bars wind the spring

28.1.6. Ramp springs are hand wound to appropriate number of windings according to best practices or engineering instruction

28.1.7. Measure, cut and install interior and exterior ramp trim

28.1.8. Mark hasp plates, install barlocks, center and install hasp

28.1.9. Install (3) rubber bumpers evenly spaced below top of exterior ramp trim

28.1.10. Install license plate bracket left of center screw line or center light

28.2. Acceptable Condition

28.2.1. Hinges must be securely welded or fastened to chassis and ramp ensuring smooth operation

28.2.2. Ramps must open and close without binding or excessive gaps between the ramp and the rear wall

28.2.3. Ramp spring must be wrapped to appropriate number of windings to ensure ease of use and safety for the end user

28.2.4. Set screws in ramp spring must be pointing down with the ramp in an open position

28.2.5. No daylight showing

28.3. Unacceptable Condition

28.3.1. Ramp is missing hardware

28.3.2. Ramp requires excessive force to open

28.3.3. Ramp requires excessive force to lift/close

28.3.4. Set screws are pointing up with the ramp in an open position, blocking access above spring

28.3.5. Set screws on ramp spring are loose

28.3.6. Daylight showing

29. STONEGUARD

29.1. Standard Practice

29.1.1. Verifying proper size based on Bill of Materials

29.1.2. Measure, bend, and cut the stoneguard to fit the trailer

29.1.3. Cut around the A-frame and the width of the trailer all at once with the jigsaw to avoid rework later

29.1.4. Apply double-sided tape to the top edge of the stoneguard and apply adhesive around the perimeter

29.1.5. Peel a few inches of tape off one end and apply stoneguard to metal. Line up the stoneguard and peel the remaining of the tape off and press the stoneguard firmly against the sheet metal.

29.1.6. Screw down the stoneguard ensuring screws are evenly spaced and completely seated

29.1.7. Apply trim around the tongue, roadside and curbside ends of the stoneguard

29.2. Acceptable Condition

29.2.1. Stoneguard is measured, cut, bent and fit snug against the trailer with no bubbles

29.3. Unacceptable Condition

29.3.1. Stoneguard is too long and hangs off either end of the trailer

29.3.2. Stoneguard is too short and exposes sheet metal on the front wall

29.3.3. Bubbles are present

29.3.4. Dents or damage is present that exceeds visual acceptance criteria (see 6.1)

29.3.5. Stoneguard does not adhere or lay flush against the sheet metal

30. SILICONE

30.1. Standard Practice

30.1.1. A continuous bead of silicone will be applied to top of stoneguard, around taillights, and side wall vents

30.2. Acceptable Condition

30.2.1. Silicone is clean and free of voids, gaps, and completely covers area to be sealed

30.3. Unacceptable Condition

30.3.1. Silicone has voids or gaps

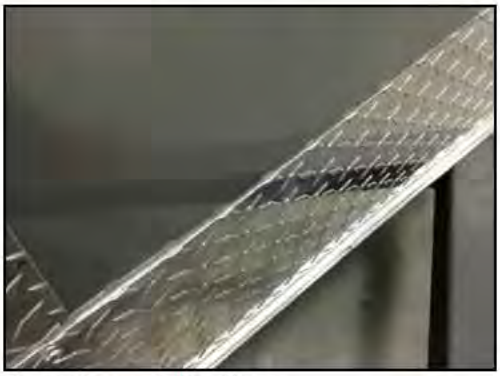


Figure 16 Acceptable silicone

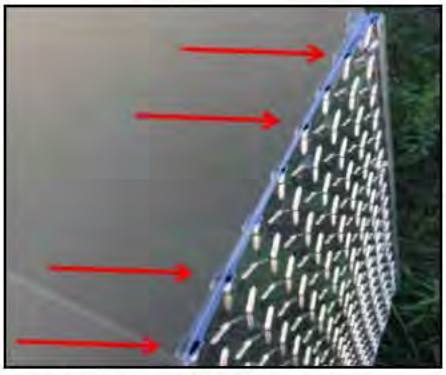


Figure 17 Unacceptable silicone

31. WATER TEST

32. FENDERS

32.1. Fenders are to be positioned between 3.5 and 5 inches above the top of tire.

32.2. The endpoints of the fender bottoms are to be parallel from one side to the other. Shown by green line below:

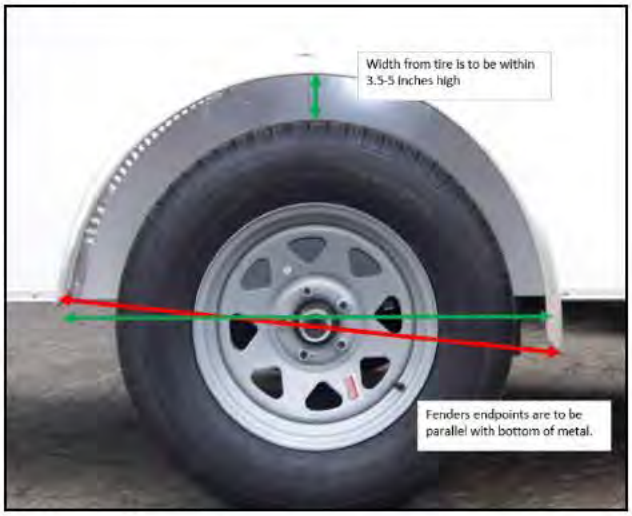


Figure 18 Fender Requirements

Wiring guidelines in accordance with RVIA, SAE, and NATM

REVISION HISTORY					
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0	00	2/14/2011	-	JP	-
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Ground

SAE J1292 - Ground wire

Ground terminal devices shall be made to the vehicle structure, frame or engine.

A serrated cutting terminal may be utilized to make proper contact on painted surfaces

NATM 39.3.29 Grounds

The battery ground and trailer return ground connections on a grounded system shall be readily accessible. The contacts surfaces of electrical connections shall be clean and free of oxide, paint, or other non-conductive coatings.

Wiring protection

NATM 393.28 Wiring protection

All wiring shall be protected when passing through holes in metal by a grommet, or other means, or the wiring shall be encased in a protective covering. (convolute)

RVIA- 5-1

In routing if conductors, and hole or slot, in other than wood, is to be insulated by the installation of an acceptable liner. These may include grommets and convoluted tubing.

- Support is also provided by any horizontal surface that acts to support the conductors. For the purposes of support, tape will be acceptable (duct tape, masking tape) In most cases, the conductors only need to be supported until wall or ceiling panels are put in place.

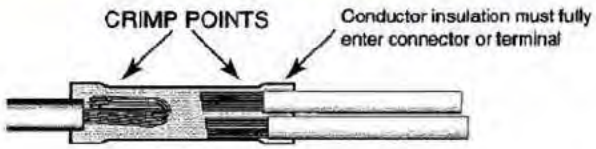
Wiring Connections

RVIA 6-1.3 Size and Use

A single conductor can be counted as two conductors of its size if the conductor's uninsulated strands are doubled back upon itself within the crimp portion of the terminal or connector. (see below)

RVIA 6.1-8 Protection

All strans of conductors must enter the splice device.



SUREWIRE

NOTES - ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

1. **Do NOT substitute or splice in different color wire on run.**
2. **Place convolute (snake skin) on all 90 degree bends**
3. **Place convolute (snake skin) when wire makes contact with sharp corners**

Material:

Finish:

Wt.(lb.):

Standard Tolerance Unless Otherwise Specified	
Fraction	± 1/8"
X.X	± 0.1
X.XX	± 0.03
X.XXX	± 0.010
Angular	± 1.0

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WELLS CARGO

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Approved By: JP	Date:	Description: SureWire	
Filename: SureWire - 2011.dwg		Sheet: 1 of 7	

7-Way Plug - Wiring

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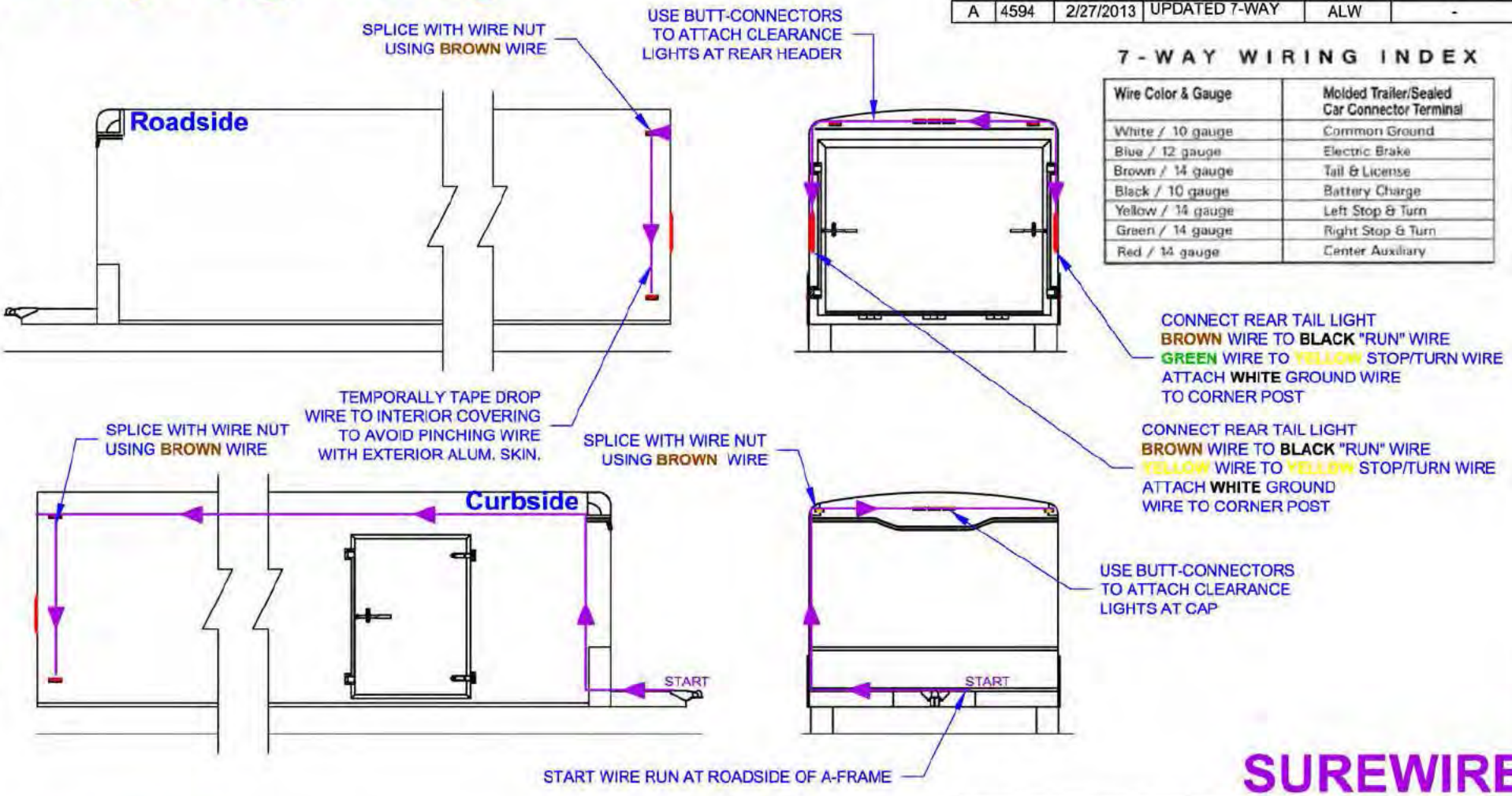

7 - WAY WIRING INDEX

Wire Color & Gauge	Molded Trailer/Sealed Car Connector Terminal
White / 10 gauge	Common Ground
Blue / 12 gauge	Electric Brake
Brown / 14 gauge	Tail & License
Black / 10 gauge	Battery Charge
Yellow / 14 gauge	Left Stop & Turn
Green / 14 gauge	Right Stop & Turn
Red / 14 gauge	Center Auxiliary

SUREWIRE

——— = WIRE RUN

NOTES - ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

1. Do NOT substitute or splice in different color wire on run.
2. Place convolute (snake skin) on all 90 degree bends
3. Place convolute (snake skin) when wire makes contact with sharp corners

Material:

Finish:

Wt.(lb.):

Standard Tolerance Unless Otherwise Specified	
Fraction	± 1/8"
X.X	± 0.1
X.XX	± 0.03
X.XXX	± 0.010
Angular	± 1.0

Size: A	Scale:	Drawing No: SureWire	Rev.: A
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WELLS CARGO

4-Way Plug - Wiring

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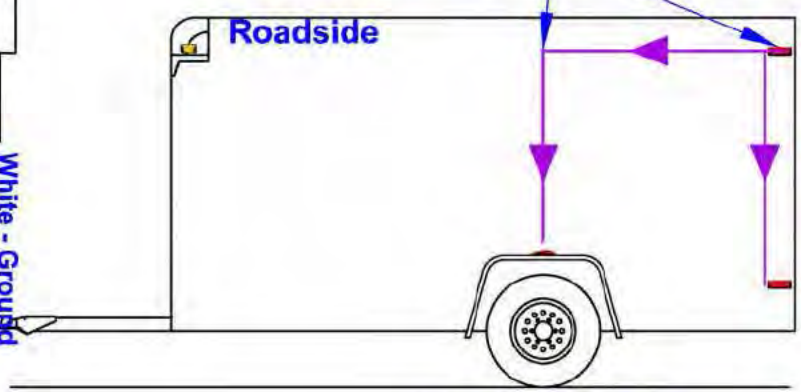

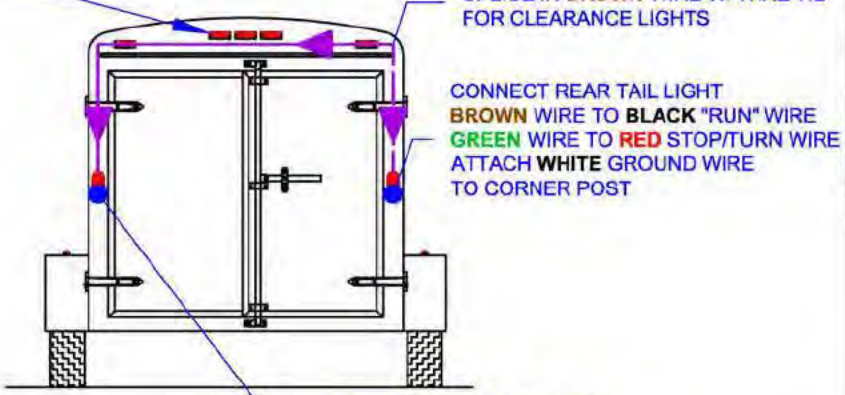

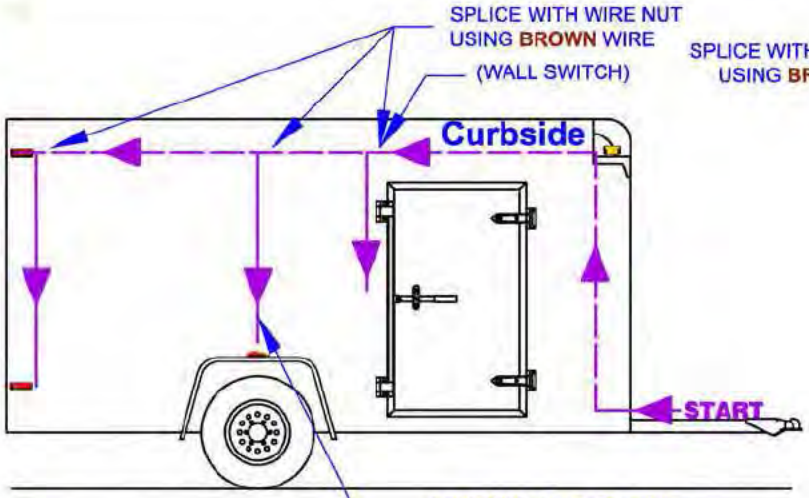

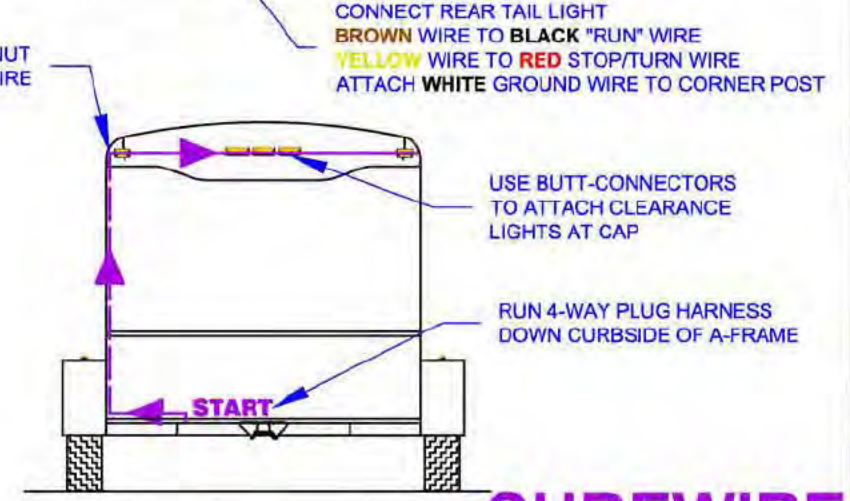

SUREWIRE

= 4-WAY PLUG

= SPLICED WIRE

NOTES - ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

1. Do NOT substitute or splice in different color wire on run.
2. Place convolute (snake skin) on all 90 degree bends
3. Place convolute (snake skin) when wire makes contact with sharp corners

Material:	
Finish:	
Wt.(lb.):	

Standard Tolerance Unless Otherwise Specified	
Fraction	± 1/8"
X.X	± 0.1
X.XX	± 0.03
X.XXX	± 0.010
Angular	± 1.0

Size: A	Scale:	Drawing No: SureWire	Rev.: A
Drawn By: JP	Date: 3/1/2011		
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Approved By: JP	Date:	Description: SureWire	
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WELLS CARGO

7-Way Plug - Wiring

SUREWIRE

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NOTE: CONNECT WIRES USING WIRE NUTS
ELECTRICAL TAPE IS NOT REQUIRED

GREEN
TAIL LIGHT
RIGHT STOP/TURN

RED
AUXILIARY
REAR BACK-UP LIGHTS

BROWN
CLEARANCE LIGHT
TAIL LIGHT
LICENSE PLATE LIGHT

BLACK
BATTERY CHARGE

WHITE
GROUND

YELLOW
TAIL LIGHT
LEFT STOP/TURN

BLUE
BRAKE WIRE

Roadside Tail light

BROWN WIRE
JUMPER WIRE
HEADER CLEARANCE
LIGHTS

BROWN WIRE
OUTGOING
CLEARANCE

GREEN 7-WAY
HARNESS WIRE
RIGHT TURN

BROWN WIRE
LICENCE PLATE LIGHT

YELLOW 7-WAY
HARNESS WIRE
LEFT TURN

BLACK WIRE
TAIL LIGHT - RUN

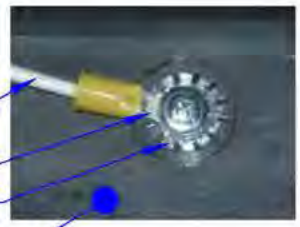
YELLOW WIRE
TAIL LIGHT -
STOP/TURN

Curbside Tail light

BROWN WIRE
INCOMING
CLEARANCE

YELLOW WIRE
TAIL LIGHT
STOP/TURN

BLACK WIRE
TAIL LIGHT
RUN



GROUND WIRE

EYE TERMINAL

STAR WASHER

A-FRAME STEEL TUBE

CLEARANCE LIGHT

SINGLE WIRE

BUTT-CONNECT
POSITIVE WIRE
WITH **BROWN** WIRE

BUTT-CONNECT
NEGATIVE WIRE
WITH **WHITE** WIRE

DOUBLE WIRE

BUTT-CONNECT
POSITIVE WIRE
WITH **BROWN** WIRE

NOTES - ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

1. **Do NOT substitute or splice in different color wire on run.**
2. **Place convolute (snake skin) on all 90 degree bends**
3. **Place convolute (snake skin) when wire makes contact with sharp corners**

Material:

Finish:

Wt.(lb.):

Standard Tolerance Unless Otherwise Specified	
Fraction	± 1/8"
X.X	± 0.1
X.XX	± 0.03
X.XXX	± 0.010
Angular	± 1.0

Size: A	**Scale:**	**Drawing No:** SureWire	**Rev.:** A
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4-Way Plug - Wiring

SUREWIRE

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A	4594	2/27/2013	UPDATED 7-WAY	ALW	-

NOTE: CONNECT WIRES
USING BUTT-CONECTORS

WHITE
GROUND

BROWN
CLEARANCE LIGHT
TAIL LIGHT
LICENSE PLATE LIGHT

YELLOW
TAIL LIGHT
LEFT STOP/TURN

GREEN
TAIL LIGHT
RIGHT STOP/TURN

Roadside Tail light

BROWN WIRE
OUTGOING
CLEARANCE

BLACK WIRE
TAIL LIGHT - RUN

RED WIRE
TAIL LIGHT -
STOP/TURN

BROWN WIRE
JUMPER WIRE
HEADER CLEARANCE
LIGHTS

BROWN WIRE
LICENCE PLATE LIGHT

BROWN 4-WAY
HARNESS WIRE
CLEARANCE LIGHTS

GREEN 4-WAY
HARNESS WIRE
RIGHT TURN

YELLOW WIRE
JUMPER WIRE

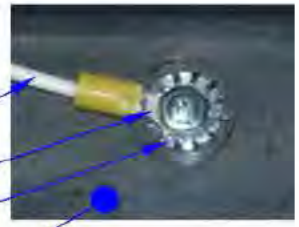
Curbside Tail light

BROWN WIRE
INCOMING
CLEARANCE

BLACK WIRE
TAIL LIGHT
RUN

RED WIRE
TAIL LIGHT
STOP/TURN

YELLOW 4-WAY
HARNESS WIRE
LEFT TURN



GROUND WIRE

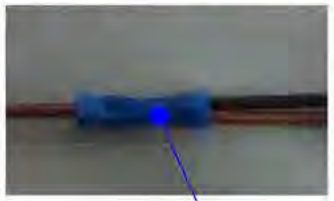
EYE TERMINAL

STAR WASHER

A-FRAME STEEL TUBE

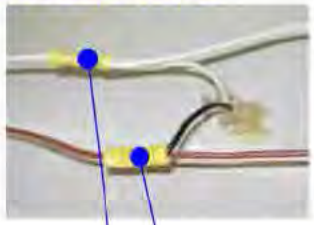
CLEARANCE LIGHT

SINGLE WIRE



BUTT-CONNECT
POSITIVE WIRE
WITH BROWN WIRE

DOUBLE WIRE



BUTT-CONNECT NEGATIVE
WIRE WITH WHITE WIRE

BUTT-CONNECT POSITIVE
WIRE WITH BROWN WIRE

NOTES - ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

1.	Do NOT substitute or splice in different color wire on run.
2.	Place convolute (snake skin) on all 90 degree bends
3.	Place convolute (snake skin) when wire makes contact with sharp corners

Material:

Finish:

Wt.(lb.):

Standard Tolerance Unless Otherwise Specified	
Fraction	± 1/8"
X.X	± 0.1
X.XX	± 0.03
X.XXX	± 0.010
Angular	± 1.0

Size: A	**Scale:**	**Drawing No:** SureWire	**Rev.:** A
Drawn By: JP	**Date:** 3/1/2011		
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WELLS CARGO

FLAT FRONT - Routing SUREWIRE

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A	4594	2/27/2013	UPDATED 7-WAY	ALW	-

CURBSIDE

FLAT FRONT WALL ROUTE

APPLY CONVOLUTE
WHEN WIRING MAKES
ANGLE CHANGE
OR MAKE CONTACT
W/ STEEL OR PLYWOOD
ONE SIDE OF THE CONVOLUTE
MUST BE TAPED TO WIRING

PLACE CONVOLUTE (SNAKE SKIN)
WHEN WIRE MAKES CONTACT
WITH SHARP CORNERS

BE SURE GROUND
WIRE DOES **NOT**
MAKE ACUTE ANGLE

GROMMET MUST
BE USED WHEN
ROUTING THROUGH HOLE

SUPPORT TAPE TO BE USED
(DUCT OR MASKING TAPE)
DO NOT TIE WIRES

RUN PLUG
DOWN A-FRAME

DRILL HOLE THROUGH
TOP OF FRONT CROSSMEMBER
AND RUN 4-WAY PLUG

MASKING TAPE USED
TO SECURE WIRE
DURING BUILD

NOTES - ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

1.	Do NOT substitute or splice in different color wire on run.
2.	Place convolute (snake skin) on all 90 degree bends
3.	Place convolute (snake skin) when wire makes contact with sharp corners

Material:

Finish:

Wt.(lb.):

Standard Tolerance Unless Otherwise Specified	
Fraction	± 1/8"
X.X	± 0.1
X.XX	± 0.03
X.XXX	± 0.010
Angular	± 1.0

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WELLS CARGO

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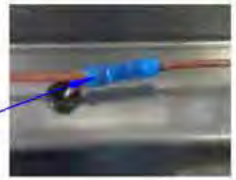
Approved By: JP	**Date:**	Description: SureWire	
Filename: SureWire - 2011.dwg		Sheet: 6 of 7	

ROUND FRONT-Routing SUREWIRE

REVISION HISTORY					
REV	ECN#	DATE	DESCRIPTION	CHECKED	APPROVED
0	00	2/14/2011	-	JP	-
A	4594	2/27/2013	UPDATED 7-WAY	ALW	-

NOTE:
BROWN WIRE, 4-WAY PLUG
BROWN WIRE, 7-WAY PLUG

BUTT CONNECTORS ARE USED WHEN DROPPING A WIRE THROUGH THE SIDEWALL



PLACE CONVOLUTE (SNAKE SKIN) WHEN WIRE MAKES CONTACT WITH SHARP CORNERS

BE SURE GROUND WIRE DOES **NOT** MAKE ACUTE ANGLE

GROMMET MUST BE USED WHEN ROUTING THROUGH HOLE

SUPPORT TAPE TO BE USED (DUCT OR MASKING TAPE) **DO NOT** TIE WIRES

DRILL HOLE THROUGH BOTTOM FRONT BOW

MASKING TAPE USED TO SECURE WIRE DURING BUILD

NOTES - ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

1.	Do NOT substitute or splice in different color wire on run.
2.	Place convolute (snake skin) on all 90 degree bends
3.	Place convolute (snake skin) when wire makes contact with sharp corners

Material:

Finish:

Wt.(lb.):

Standard Tolerance Unless Otherwise Specified	
Fraction	± 1/8"
X.X	± 0.1
X.XX	± 0.03
X.XXX	± 0.010
Angular	± 1.0

Size: A	**Scale:**	**Drawing No:** SureWire	**Rev.:** A
Drawn By: JP	**Date:** 3/1/2011		
Checked By:	**Date:**	**Model:**	
Approved By: JP	**Date:**	**Description:** SureWire	
Filename: SureWire - 2011.dwg		**Sheet:** 7 of 7	