CABLE MANUFACTURING & ASSEMBLY CO. INC.

WHAT YOU NEED TO KNOW TO DESIGN A WIRE HARNESS

Wire Harnesses Were Designed and Manually Assembled on the Fly

Historically, wire harness design was addressed during unit assembly. If considered earlier in the design–build process, change orders to wiring and other components throughout the build often affected the spacing and fit of the originally planned harness configuration. As a result, harness design and assembly were rarely automated and often designed and manually assembled on the fly.

Advanced Technology Takes Wire Harness Design to Earlier Design Stages

With the advent of integrated electrical and mechanical design software and automated tracking of change orders throughout the design and build processes, harness design has been incorporated into the earlier stages of the manufacturing process. When considered during the definition, requirements, or specification phases of a project, harness design and assembly can be more automated.

Does Technology Change What You Need to Know to Design a Wire Harness?

Despite the advancement of technology, there are still many factors to consider in designing a wire harness. What do you need to know to design a wire harness? In this short white paper, we'll review harness design considerations and identify most of the specification requirements.

Start with the Basics

First, start with the basics. For each harness, know the characteristics of the wires:

- Length, including length tolerance
- Color
- AWG properties
- UL rating (i.e., flame rating and temperature rating) and insulation diameter
- Wire end properties, including cut type (e.g., blunt), strip requirements (i.e., strip length and tolerance), and coating (i.e., coating type, strip length, and solder type)
- Voltage and current requirements
- Signal levels
- OEM specifications and/or requirements

Visualize the Finished Harness

Identify and specify the pin board or assembly board. Ensure that all of the necessary components of the harness will meet the required operating temperature or temperature rise from current flow when the harness is in place.

Organize the Details

Next, consider the required treatments for both ends of each wire. For each wire crimp, note:

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- Contact part number for each side (i.e., left and right), ensuring that specified crimp accommodates wire gauge, coating, and/or insulation
- Length requirement between contacts
- Pull test requirements

For each connector, note:

- Connector housing part number, ensuring that specified housing accommodates wire gauges, coatings, and/or insulation
- Pin 1 designation
- Pin out
- Color codes
- Length requirement between connector and wire end
- Continuity test requirements

Consider Limitations and Other Requirements

Next, think through the wire bundle routing in the finished harness, especially if the bundle will be exposed to abrasion, movement or vibration, shock, moisture, or traffic. Specify:

- Labeling
- Ties, taping, straps, lacing, sleeves, or conduit
- Branching
- Locks or seals
- Heat shrinking
- Shielding

For each, specify label copy, part numbers, sizes, types, application positions, and shield terminations.

Prevent Errors Before They Occur

Next, consider identifying possible assembly errors.

- Can any terminals be polarized? Keyed?
- Does the harness design have an appropriate grounding scheme?
- Is there any possibility of crosstalk or signal/power interference?
- Is there enough room in the harness for wire bundles to run without interfering with other components?
- Are all wires sufficiently long enough to accommodate service loops at termination?
- Are bundles long enough to accommodate turn radii around corners within the harness?
- Can the finished design keep wire bundles intact and in place during unit installation?

Consider How the Finished Harness Will Get to Assembly

Consider the harness' packaging requirements.

- Will a harness be bundled with each unit for assembly?
- Will quantities of harnesses be bagged as a set?
- Does the harness require boxing or other special handling prior to assembly?

Plan for Substitutions

Finally, whenever possible, specify generic harness components and determine whether derivatives are acceptable. Any allowance for the most efficient sourcing of materials and for best-fit choices to be made during assembly can reduce costs

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and production time.

Track All Changes

If harness design occurs early in the overall design process, ensure that all changes to wiring during design finalization and throughout the build process are identified, tracked, and resolved through the harness design. Update the bill of materials. Even the most minor change to a single wire can affect the harness material requirements, configuration or layout and fit, tooling requirements, and testing requirements. Expensive and time consuming changes can be avoided when all changes are tracked and resolved through the harness design.

Contact Us

Harness design can seem daunting. It is an extremely detailed process, requiring knowledge of the design intent, electrical or signal requirements and limitations, and of manufacturing best practices. Contact us for more information about how to make your harness design process smooth and trouble-free.

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