# The BOM is Key to Certifications

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## Abstract

Documentation issues can sink your certifications project just as fast – if not faster – than actual technical problems. And the single contributor to documentation is a lack of attention to the humble bill of material (BOM).

## Overview

We've said it before – not many people like doing documentation. It is usually considered a necessary evil at best – at worst, it is a non-value-added activity that actively drains effort from more practical engineering and design efforts.

Regardless, you have to do your documentation – and do it well – if you expect to have any hope of getting the hazardous locations certifications you want (and deserve!).

## The BOM (Bill of Materials) Is Key

When considering documentation, the equation is simple:

***No BOMs = No certifications***

Despite this, the number-one issue that we see is a lack of attention to bills of material (BOMs). Surprising, but true!

## What's The Big Deal?

BOMs are critical for all kinds of reasons.

For hazardous locations generally – and for intrinsic safety specifically! –agencies (and consultants!) need BOMs to:

- Identify a starting point for understanding the product / project;
- Gain an initial understanding of the construction;
- Identify the correct PCB assemblies, wiring, and electrical components (such as motors);
- Identify make/break points (such as relays, connectors and switches);

- Identify relevant mechanical parts such as enclosure parts, seals, and gaskets;
- Identify internal and external enclosures, their parts and their boundaries;
- Identify the correct markings and labels;

All of this information is used to drill further down into the design to identify the specific relevant characteristics of each relevant part and assembly.

This makes the humble bill of material the cornerstone of any good documentation package, and the natural starting point for all certification efforts.

In fact, agencies often look for the top-level BOM before trying to look for anything else.

## Can't It Be Done Another Way?

It is true that some – or even all – of this information might be obtained by examining schematics, PCB layouts, assembly drawings, and the like. In theory, it's possible to get by without ever creating a discrete bill of material.

In practice, this is often not straightforward. At best, it's impractical. Often, it's a nightmare.

For example:

1. Reviewing lots of individual schematic, assembly, part and mechanical drawings takes a lot longer than checking a single BOM.

2. If you have no BOM, you have to start remembering all of the names, drawing numbers, etc. of all of the individual parts, assemblies, and drawings you need. This is a lot harder than having them all on a single BOM for easy reference.

3. Parts and assemblies change. Without a BOM, you can't know if the design is using the right versions, or which versions have to be certified. Sometimes there can be more than one valid revision.

4. When examining schematics:

    a. Schematics may not visibly identify parts by OEM name or part number, often lack critical information such as power ratings or tolerances, and are not intended to show items like package size or footprint. Metadata, when present, is often not kept up-to-date and is often unreliable.

    b. Schematics may or may not indicate which parts are intentionally unpopulated or the full scope of all possible build variations.

c. Schematic drawing numbers or file names may or may not match with PCB layouts or Gerber plots, making it unnecessarily difficult to identify which schematics correspond to which PCBs.

d. Schematics are PCB-centric and often don't include potentially important parts such as cells, batteries, wiring harnesses, plugs, connectors, switches, motors, fans and other items that are located off of the PCB. This leaves these parts totally unidentifiable.

e. The initial set of schematics for multi-board designs is often incomplete.

5. When examining assembly drawings:

a. Many products are complicated and have a lot of assembly drawings. Often, it's difficult even to find or identify the top-level assembly drawing, which wastes considerable time.

b. Assembly drawings are often organized semi-randomly, making it difficult to determine how a product is actually put together.

c. The initial set of assembly drawings is rarely complete, leading to gaps.

d. Assembly drawings might or might not contain parts lists.

If present, these lists might or might not identify parts by OEM name or OEM part number, as is required in a proper BOM.

These lists also might or might not identify the materials for parts, which is often important.

This is not to say that assembly drawings, part drawings, schematics, PCB plots and the like aren't necessary – they absolutely are.

However, the BOM is the only document that brings it all together in one place. This makes it both especially useful and a practical necessity.

## Fine – What Do I Do?

Creating a solid set of bills of material (and associated documentation) for your design requires at least the following:

1. PCB-level BOMs are not enough. You absolutely need a top-level bill of material.

Besides providing an obvious starting point for comprehension, the top-level BOM is usually critical for identifying critical items, such as:

- All of the parts of the enclosure;
- Internal devices not on a schematic, such as wiring harnesses, cells, batteries, cables, plugs, motors, fans, heat sinks, etc.;
- Mechanical items such as fasteners, gaskets, sealants, adhesives, etc.; and
- The correct version of markings and labels.

Not providing a top-level BOM is possibly the most common error we encounter.

2. If it's not a buy part, it needs a BOM.

   This applies to:

   - Sub-assemblies that are constructed from other parts in-house;
   - Sub-assemblies that are kitted and sent out for assembly (such as PCBAs); and
   - Parts that are modified from their purchased, off-the-shelf condition, either in-house or by an outside vendor.

3. Each and every BOM needs a unique drawing number, plus a visible revision, both of which must be plainly and obviously identifiable as such.

   The drawing number for a BOM cannot be identical to the drawing number for a corresponding schematic, PCB layout, assembly drawing, etc. They can be similar, but not the same.

   These items must also be visible when the file is viewed or printed. This means that file names are not drawing numbers.

4. BOMs should always plainly identify the name and part number of the assembly (or assemblies) that they build.

5. Each and every part on every BOM must list the following:

   - OEM name;
   - OEM part number;
   - Description; and
   - Internal part number (where one exists)

   For build parts, the OEM name can be any of your own company, "By specification", "Generic", "Any vendor", or similar. The OEM part number can be an internal part number (where used), the drawing number of corresponding Gerbers, assembly drawing, etc., "By specification", or similar.

6. Every build part on every BOM should have a corresponding assembly drawing.

   For PCB assemblies, these consist of the schematics and Gerber layouts; for other parts, it is usually a mechanical assembly drawing.

7. Every buy part on every BOM should have an OEM specification sheet.

8. Once certified, each and every change to the BOM must be given to the agency for approval – even if the information is not relevant to safety.

   For this reason, BOMs should never include information that is open-ended, variable, or subject to frequent changes. These will drive constant updates to your agency and will cost you a lot of money.

   Information that should never be on a BOM includes:

   - Distributors, vendors or resellers
   - Distributor part number
   - Links or hyperlinks to OEM data sheets or product pages
   - Links or hyperlinks to vendor product pages
   - Price
   - Lead time
   - Minimum purchase quantity (MPQ)
   - In-house stock status
   - Quantity in-stock at vendors
   - Prototyping, qualification or test status
   - Project management milestones or status

9. BOMs should never have blank cells, as it is not possible to determine after the fact if the information was omitted deliberately or accidentally.

10. BOMs must be consistently named according to their drawing number, revision, and (optionally) an identification of the assembly that they build.

## Summary

In our experience, bills of material are some of the most critical – yet most neglected – aspects of design documentation. This can be a critical error.

Spending more time on proper BOMs now will greatly simplify the effort needed to evaluate, certify and manufacture your equipment later. It is well worth the effort.

SPARK INSTITUTE

## About Spark Institute

Spark Institute is a full-service consultancy that specializes in intrinsically safe and hazardous locations design services. Our experience covers North American, ATEX, and IEC requirements.

### Design Consulting

Know what you want, but don't know how? Put our years of experience to work for you. We can design hazardous locations products to your specifications.

### Design Evaluation

Have an existing product, design, or concept? Spark Institute can help evaluate your design to the relevant standards to help ensure compliance. Take advantage of our experience to reduce your risks before making costly mistakes.

### Training Services

Good designers aren't born - they're trained. Our training courses will drastically shorten the learning curve for both new and experienced designers. Courses can be tailored to your product lines on request.

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