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PLM ESSENTIALS

4. BILL OF MATERIALS (BOM) SETUP

QR_

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4 BILL OF MATERIALS (BOM) SETUP

At the heart of all complex engineering and associated manufacturing processes is Product Data Management (PDM) - the business function that organises, maintains and reports all product data.

PLM captures and tracks information on the individual parts, components and modules that constitute a finished product throughout its lifecycle, including changes made during development.

This includes part numbers, supplier details, CAD drawings and more, with everything stored in a database easily accessible to the likes of project managers, engineers, salespeople, purchasing and QA teams.

Efficient management of product data helps develop products quicker, get them to market faster, and push costs down.

BILL OF MATERIALS (BOM)

THE INVENTORY OF COMPLEX ENGINEERING

When building a complex product, with a multitude of parts, it's important to have a complete list of everything you'll need throughout production. This list is called the BOM.

It usually contains a list of raw materials, items, parts, components and assemblies associated with a product, along with the directions to make it. It's essential that this is followed by the letter, for quality consistency.

To show you a typical BOM setup, and what it consists of, we've put together a detailed case study of one we created for a leading electric vehicle manufacturer.

WHAT IS AN eBOM?

An Engineering Bill of Material (eBOM) is a special type of bill of material structured from a design perspective, rather than a manufacturing perspective (mBOM).

How an eBOM is setup within an organisation determines how that company manages its working efforts for engineers and overall BOM configuration.

The creation of a BOM for each buildable variation involves a high level of engineering effort and very low level of configuration management, whereas a BOM which contains all items for one super set of variations (a Super BOM) has a low effort of engineering but requires a high level of configuration management.

WHO USES AN eBOM?

Since the eBOM is the backbone of product development, departments affected by it include:

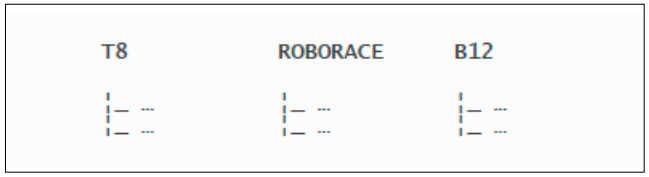
- **Engineering**
- **Purchasing**
- **Homologation**
- **R&D**
- **Suppliers**
- **Manufacturing/Production**
- **Styling/Concept**
- **Finance**
- **Quality**

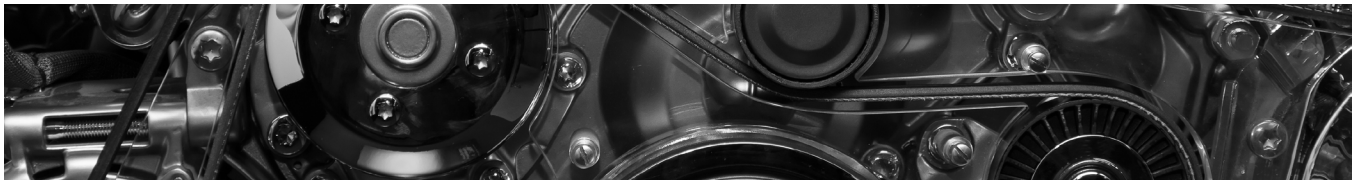
PRE-ENGAGEMENT

The manufacturer used a model-specific eBOM, capturing all variant configurations for one specific model (e.g., Vehicle A). Another eBOM is created for Vehicle B.

This style of eBOM works if the two products are very different. But when two products contain many common parts, a different style of eBOM would be needed to reduce engineering effort.

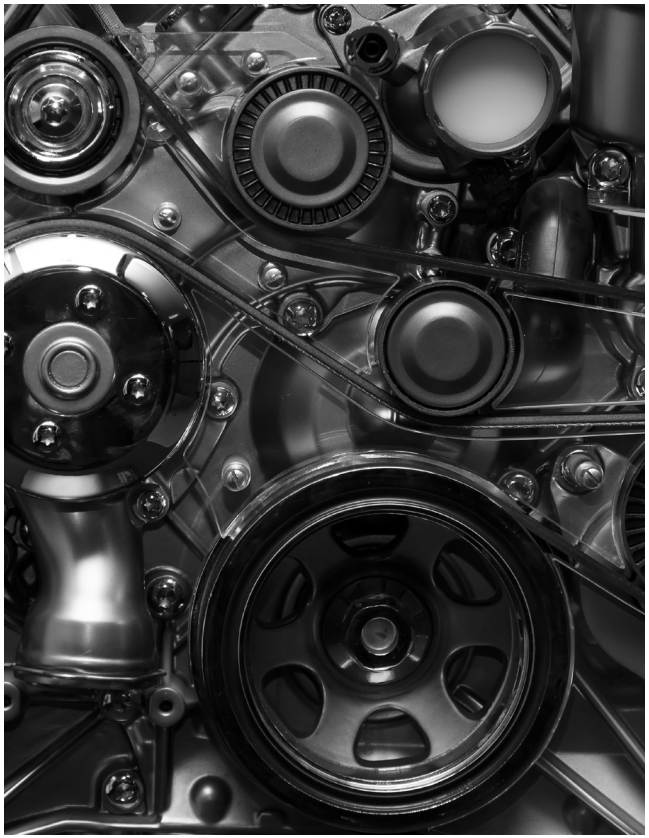
At the point of engagement, there was no BOM for Vehicle A.





The procurement strategy had not been defined for how the products will be purchased and what the supply chain would be.

This document suggests guidelines for how a BOM should be setup initially, and also give guidance on how it could evolve. Any proposal would need to be able to be integrated into the manufacturer's ongoing projects but also needs to be scalable as they grow into different products.



BOM OPTIONS

PROGRAMME BOM

A single engineering BOM consisting of all parts required for a single programme. Multiple models and variants can be configured from this BOM.

With only one BOM being managed, there is little engineering effort needed, so changes made to one part don't need to be repeated in multiple BOMs.

Configuration management for this type of BOM requires a high level of effort to manage variant configuration.

MODEL BOM

Several engineering BOMs capturing several Models of a product (i.e., separate Vehicle A and Vehicle B BOMs). Different product variants can be configured from each of these BOMs.

Engineering effort is increased as changes to a part in one BOM may need changes to be made in another BOM. Configuration management for this type of BOM still needs a high level of effort to manage variant configuration.

VARIANT BOM

Multiple engineering BOMs capturing all the top-level variants of a product model (i.e., separate Vehicle A Variant 1, Vehicle A Variant 2, Vehicle B Variant 2, etc.). Subsets of product variants can be configured from each of these BOMs.

Engineering effort is increased further as changes to a part in one BOM are now more likely to need the same changes in a variety of other BOMs. Configuration management for this type of BOM is lower as only subsets of each variant are now required to be configured.

SUB VARIANT BOM

Engineering BOMs for each and every configuration of a product variant (i.e., separate Vehicle A Variant 1 Low Spec, Vehicle A Variant 1 High Spec, Vehicle A Variant2 Low Spec, etc.).

Engineering effort for this type of BOM is very high, as a change to one T4 part will affect many BOMs which will also need to be changed. Configuration management for this type of BOM is minimal/obsolete as the BOM is fully configured already. There are no further variant configurations with this type of BOM.

ORGNISATIONAL STRUCTURE

Throughout the automotive industry, manufacturers group the work of engineers together in the structure of the BOM. This enables the engineering teams to work on their specific areas and release their relevant parts.

The procurement strategy for most manufacturers follows a similar suit, where chassis assemblies and exterior assemblies are procured as separate entities. OEMs don't typically purchase pre-assembled items that are cross-functional (e.g., a mixed chassis and exterior assembly).

DECISION CRITERIA FOR SELECTING A BOM SETUP

- **Usefulness** - the type of BOM must allow all engineers to work on one specific programme
- **Well defined** - the type of BOM must give engineers a clear understanding when a new BOM is required
- **System agnostic** - the type of BOM must be able to be used in any type of system
- **Minimise admin burden** - the BOM type must be suitable, to reduce any further administrative burden

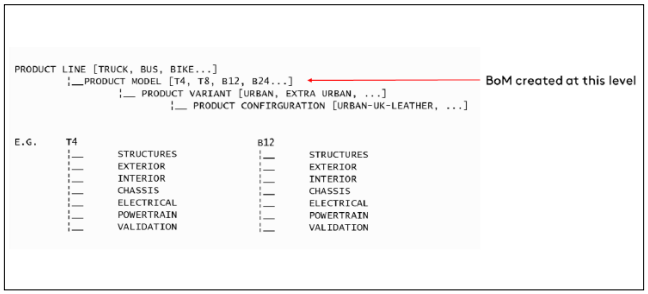
The ideal system must:

- Allow engineers to be able to work on one programme without the over complication of seeing parts from other programmes
- Have clear boundaries as to the purpose of the type of BOM chosen
- Be used across all programmes being run
- Be able to be used in both PLM and ERP system to drive an accurate BOM throughout the organisation
- Reduce or prevent any administration of the BOM outside of the PLM system

THE OPTION SELECTED

To help the manufacturer reduce the admin burden upon engineers, a Programme BOM setup should be used. This will allow engineers to work within a single BOM for a programme, saving time and duplication of work compared to working with a Model or Variant BOM. Changes that need to be made which could affect multiple models or configurations of an assembly would only need to be released within the one BOM, as opposed to duplicating the release work within various BOMs for each model variant.

A Programme BOM will require more comprehensive configuration management compared to a variant level BOM, which will require separate consideration.

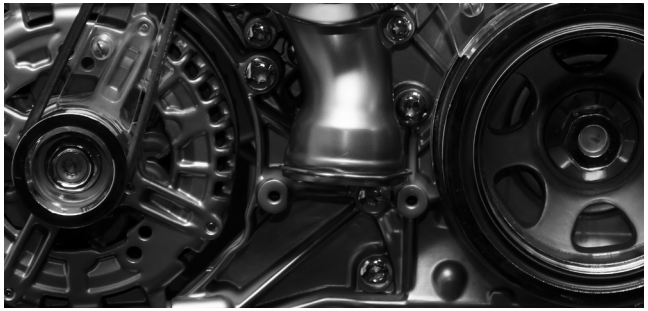


INITIAL SETUP

The Programme BOM should be set up for each product that's defined by a programme. The programme could be the initial design of a product, or even an upgrade to an existing product.

```
E.G.   PROGRAMME FOR T4 INITIAL DESIGN
       PROGRAMME FOR T8 INITIAL DESIGN
       PROGRAMME FOR T4 UPGRADE
```

When a programme is looking to redevelop an existing product, a 'copy' of the product's BOM should be taken, rather than reworking the initial programmes BOM. This allows for the BOMs to be compared but doesn't allow for a previously 'locked-down' approved BOM to be reopened for redesign.



TOP LEVEL STRUCTURE

The initial structure of the BOM was split by engineering departments (function groups), allowing engineers to have a space within the BOM to complete their work and release parts without being reliant on other function groups.

```
E.G.   T4
       |__   STRUCTURES
       |__   EXTERIOR
       |__   INTERIOR
       |__   CHASSIS
       |__   ELECTRICAL
       |__   POWERTRAIN
       |__   VALIDATION
```

Capturing validation as a separate function group allowed for envelopes, door sweeps, manikins, etc. to be viewed by engineers in the context of their parts and their interactions, while also being easily removable when creating an mBOM.

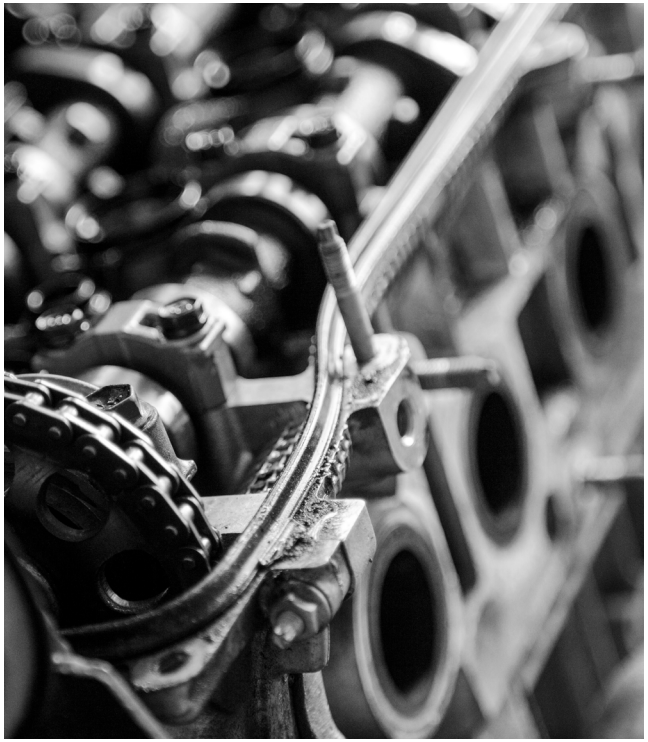
All product variants in the programme will be captured within the BOM. These will be captured under each engineering functional area as separate assembly groups (i.e., Variant 1 Motor, Variant 2 Motor). These will be controlled for manufacturing via product configuration.

```
E.G.   T4
       |__   ELECTRICAL
              |__   URBAN MOTOR          [URBAN]
              |__   EXTRA-URBAN MOTOR    [EXTRA-URBAN]
```

How the engineering structure of assemblies are created is captured within the upcoming Engineering Structures instalment of PLM Essentials.

As the BOM matures and larger assemblies are realised, a reorganisation of the top-level structure might be needed so that larger assemblies can be purchased.

Using this structure allows for new variants to be added to the BOM as the vehicle is developed. This is important as the manufacturer develops its modular strategy.

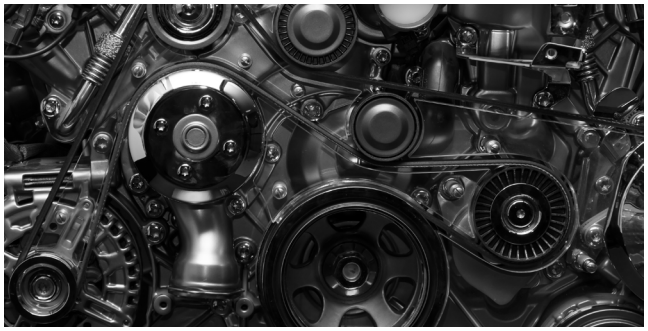


JUSTIFICATION FOR OPTION SELECTION

Reducing the administrative burden on engineers is a key factor that affected the choice of BOM. The Programme-BOM significantly reduces the number of releases and BOM work needed if an assembly is used on multiple models and variants.

Instead of releasing the assembly in different BOMs which house the different models or variants, the assembly is released in just one BOM.

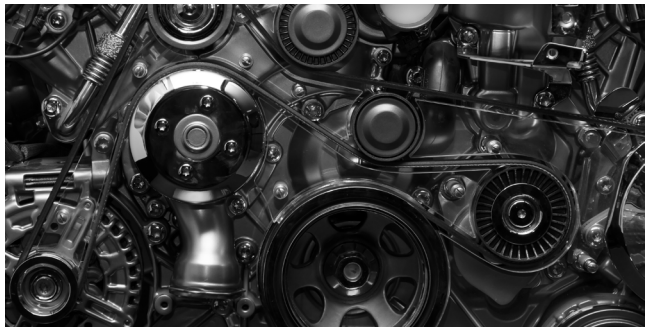
The top-level structure recommended in this case will give engineers the ability to release parts quickly that are within their area of expertise.

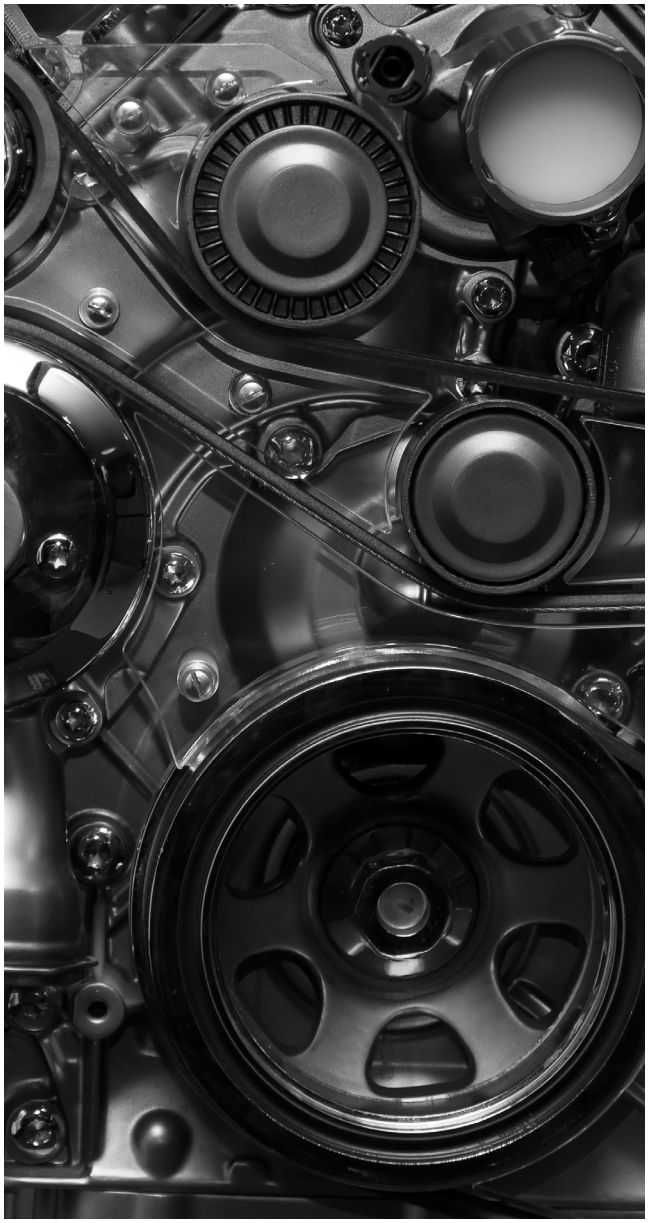


RISKS OF THE NEW SYSTEM

By using a Programme BOM setup, full configuration management will be needed. The admin burden is reduced upon the engineers, but a configuration management team would be needed to deal with the complexity of the BOM.

Managing the top-level structure of the BOM by function groups works as a platform for engineers to create their assembly structures and hang their parts to, while enabling them to have a devoted space to work. But as the BOM matures and procurement strategies evolve, the need to merge the higher-level structures may be needed.





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ABOUT QUICK RELEASE_

Quick Release_ is the leading Product Lifecycle Management consultancy. QR_ has 350+ professionals across three continents working alongside some of the largest, most innovative and prestigious vehicle manufacturers, aerospace technologists and Tier 1 suppliers.

Our mission is to enhance competitive advantage by bringing products to market faster and more efficiently. We do this by improving product data quality and flow through every part of a business from concept to manufacture, working with senior management teams to tackle the biggest blockers of productivity; we release engineers to focus on the product, not the data.

Leveraging bespoke tools, methodologies and benchmarking, our professionals offer the full spectrum of PLM services designed to guide start-ups through the unknown unknowns, take businesses looking to scale to the next level, and facilitate transformation in established manufacturing and technology OEMs. Read more: Why does PDM matter?

IT'S ALL MATERIAL..

If you'd like to know more about BOM setup, eBOM setup or any other aspect of PLM, we'd love to hear from you.

QR_ have structured, validated and maintained BOMs for EV start-ups, specialist, volume, and commercial vehicle manufacturers.

Our SMEs would love to hear your Bill of Material headaches and explore quick, unobtrusive solutions that deliver lasting, whole-business value.

UK: Paul Crabtree | paul.crabtree@quickrelease.co.uk

US: George Creasy | george.creasy@quickreleaseinc.com

ES: Gemma Monje | gemma.monje@quickrelease.es

AUS: Patrick McDivitt | patrick.mcdivitt@quickrelease.com.au

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