Bill of Materials: The Data Backbone of Manufacturing and Procurement

The bill of materials (BOM) is a structured list of all components, parts, raw materials and accessories required to manufacture a product. It defines the quantity, structure and often also the allocation of the individual parts, thus forming the interface between engineering, production and procurement. Without a consistent BOM, neither demand quantities can be determined correctly, nor can comparable quotations be obtained or costs calculated on a sound basis.

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Key facts at a glance

01 The BOM lists all parts with quantities required to manufacture a product or assembly.

02 There are various types such as engineering, manufacturing, spare parts and variant BOMs, each with a different purpose.

03 Multi-level BOMs map product structures down to the lowest assembly level and thereby drive material requirements planning.

04 For procurement, the BOM is the basis for BOM explosion, demand calculation, enquiry preparation and cost analysis.

05 Data quality is decisive: incorrect quantities or missing parts lead directly to missing parts, extra costs and delivery delays.

06 In many industries, BOMs are also relevant for compliance and documentation, for example for material certificates or standards conformity.

Definition: bill of materials

The bill of materials is a structured data object that describes all materials, parts, assemblies and raw materials required to manufacture a product, together with their quantities and relationships. It is one of the core master data items of a manufacturing company and a prerequisite for material requirements

planning, costing and production control.

Basic structure and data fields

A BOM typically contains line item number, article or part number, designation, unit of measure, quantity required per unit, scrap factor and often an item type (purchased part, in-house manufactured part, raw material). References to drawings, standards, material groups and supplier details are also common. Depending on the system, fields for version, validity, preferred and alternative parts are added.

- Line item position and hierarchy level
- Part number and designation
- Quantity, scrap, unit of measure
- Supplier or source of supply

Distinction from recipes and routings

While the BOM describes the 'what' of production, the routing defines the 'how', i.e. work steps, resources and times. In process manufacturing, a recipe frequently takes the place of the BOM, mapping quantities as percentages or proportions. For procurement, the BOM remains the authoritative reference because it determines the discreteness and quantity of the parts to be procured.

Types of bills of materials at a glance

Depending on the use case and lifecycle phase of a product, different BOM types are used. Knowing the respective perspective allows procurement requirements to be derived more precisely and improves communication with engineering and production.

Engineering and manufacturing BOMs

The engineering BOM reflects the product structure from a development perspective and follows the functional assembly breakdown. The manufacturing BOM translates this structure into a production-ready assembly sequence and adds operating supplies, small parts and consumables where necessary. Both may differ, for example when the engineering breakdown and the assembly sequence diverge.

Spare parts, variant and project BOMs

The spare parts BOM additionally includes parts not contained in the main BOM, such as screws, circuit boards or accessories, but which are relevant for service and maintenance. Variant BOMs describe product families with options and control which parts are valid for each variant. In contract manufacturing, a customer-specific project BOM is also frequently derived from the standard structure.

Multi-occurrence and flat BOMs

In multi-occurrence BOMs, the same part appears at multiple line items and levels, which is realistic but

less clear for costing and demand aggregation. Flat BOMs resolve this by showing each part exactly once with its total quantity per product. Assembly BOMs for production control and costing BOMs for quotation and target prices are also practically relevant.

BOMs in the procurement process: from explosion to sourcing

For buyers, the BOM is the starting point for practically any quantity-based procurement. It enables fully automatic BOM explosion, i.e. the calculation of total demand for a product or order across all levels, including stock levels, open purchase orders and scrap.

Demand determination and enquiry preparation

BOM explosion yields gross and net requirements per article, which are allocated to purchase orders or framework supply agreements depending on the planning method. For new parts or tenders, the BOM serves as the attachment basis for enquiry line items and technical specifications. A clean structure facilitates tender management because identical parts can be bundled across multiple projects.

Cost perspective: costing and price logic

The BOM is the basis for target costs, actual-versus-target comparisons and modular cost breakdown along the total cost tree. It immediately shows which parts account for the largest share of material costs and where price negotiations or design changes have the greatest leverage. Where raw material prices are volatile, price-sensitive raw materials can be specifically addressed via a raw material sliding price clause or a raw material surcharge, based on the BOM quantity.

Supplier management and procurement strategy

Based on the BOMs, procurement objects can be classified, for example by critical materials, ABC criteria or supply capability. Strategic parts lend themselves to early supplier involvement and joint development, C-parts to framework agreements, consolidation or catalogue and ancillary supplies. Where supply bottlenecks pose risks, a good BOM structure supports multiple sourcing and contingency management because alternative parts and second sources can be identified directly.

Key KPIs and metrics around the bill of materials

The quality and impact of the BOM can be measured. Buyers and supply chain managers thereby gain objectivity for data maintenance, process control and supplier evaluation.

Data quality and master data maintenance

Typical key figures are the proportion of error-free BOM line items, BOM accuracy per production order, or the number of retroactively corrected BOMs. In practice, BOM accuracy of over 98 per cent is considered desirable; below that, missing parts, rework and unplanned replacement purchases increase significantly. Timeliness, such as the average time from engineering change to effective BOM change in the ERP, is also a relevant early indicator.

Procurement and process key figures

Key figures derived from the BOM include material requirements accuracy, schedule adherence per line item, material index figures, or the proportion of duplicate and obsolete parts. For supplier management, service level targets and contract coverage can be evaluated per BOM line item, i.e. what percentage of demand is handled via framework agreements. Such values often also feed into early warning indicators, for example when call-off commitments and actual availability diverge.

Risks, controls and typical sources of error

Errors in the BOM have an immediate impact on procurement, production and customer commitments. Systematic controls and clear responsibilities are therefore essential.

Typical sources of error

Common problems are outdated versions, missing or incorrect quantities, parts that are no longer available (obsolescence), duplicate part numbers and missing alternative parts. Unclear responsibilities between engineering, production planning and procurement also lead to inconsistencies. It is particularly critical when changes (engineering change requests) are implemented in the CAD system but not transferred to the ERP system.

Controls and compliance

Proven controls include version and approval processes with defined responsibilities, regular BOM checks based on completed production orders, and automatic consistency checks between engineering and ERP. In addition, the BOM serves compliance functions: it can technically support material certificates, declarations of conformity, chemical substance disclosures or procurement policy compliance (for example regarding prohibited substances or supply chain thresholds). Whether specific obligations apply in individual cases should be verified by qualified review each time.

Impact on availability and customer commitments

Inaccurate BOMs distort availability checks and thus commitments to customers. Systems that map capable to promise (CTP) use the BOM to check whether and when an order is feasible taking material and capacity into account. If the BOM is faulty, trust in planning data erodes, affecting all downstream processes.

Current developments: digitalisation and resilience

The BOM is increasingly becoming the digital pivot for resilience, sustainability and automation in procurement. Companies that maintain their BOM data cleanly can implement new requirements significantly faster.

PLM, ERP and data models

The trend is towards seamless, integrated data models in which engineering and manufacturing BOMs

are versioned and maintained across the entire lifecycle. PLM systems manage the product structure, ERP systems the planning-relevant data; interfaces or an integrated platform avoid duplicate data maintenance. AI-supported tools increasingly assist with reconciliation, classification and the detection of obsolescence or duplicates.

Resilience and sustainability

Complete, multi-level BOMs are a prerequisite for risk transparency, for example to identify critical upstream products, single sourcing risks or dependencies on regions whose supply is to be relocated as part of reshoring initiatives. In the sustainability context, the BOM serves as a basis for product-level carbon accounting, recycled content or supplier requirements, for example in connection with science-based targets. Take-back and return processes can also be cleanly mapped at BOM level, for example where partial return obligations apply.

Typical metrics

Metric	Typical value
BOM accuracy	> 98% *Proportion of error-free line items in checked production orders; typical benchmark from practice*
Framework contract coverage ratio	often 60–80% *Proportion of BOM demand handled via framework agreements*
Obsolescence line item ratio	< 2% *Proportion of parts that can no longer be sourced in active BOMs*
Change lead time	typically a few days *Time from engineering change to the effective BOM change in the ERP*

Practical example

A medium-sized machinery manufacturer repeatedly experienced material shortages and mis-procurements even though the planning data appeared plausible. The cause was incomplete BOM maintenance: small assembly parts were missing, alternative parts were not recorded, and engineering changes reached procurement with delay. Through structured clean-up and clear processes, the data basis was stabilised.

- Complete auditing and clean-up of all active production BOMs, including duplicates and obsolescence checks
- Introduction of a regulated change process requiring every engineering change to become effective in the ERP before release

- Classification of all BOM line items by criticality, connecting strategic parts with second sources and C-parts with framework supply agreements
- Introduction of monthly control reports on BOM accuracy and deviations per completed production order

Conclusion

The bill of materials is far more than a technical parts list: it is the data backbone on which engineering, production, procurement and sales align. For buyers, its quality determines whether demand, prices, risks and commitments are reliable. Companies should therefore invest in master data maintenance, clearly regulated change processes and integrated systems. Those who keep their BOMs consistent and up to date create the foundation for efficient procurement, resilience and reliable cost calculations.

Frequently asked questions

? What is a bill of materials in simple terms?

A bill of materials (BOM) lists all parts and materials required to manufacture a product or assembly, each with quantity and designation. It is the central working document for engineering, production and procurement. In English-language documents, the term Bill of Materials (BOM) is used.

? What types of bills of materials are there?

Typical types are the engineering BOM, the manufacturing BOM, and the spare parts, costing and variant BOMs. They differ in structure, content and purpose. Which type is relevant in a given case depends on the lifecycle phase and the company's processes.

? Why does procurement need the bill of materials?

Procurement uses the BOM for BOM explosion to determine total demand, for preparing enquiries and tenders, and for cost calculation. It shows which parts are needed in which quantities and where price or sourcing levers lie. It also forms the basis for supplier management and risk transparency.

? What is the difference between an engineering BOM and a manufacturing BOM?

The engineering BOM reflects the product structure from a development perspective and follows the functional assembly breakdown. The manufacturing BOM maps the assembly and production sequence and often adds consumables and operating supplies. Both may differ in structure and content.

? How do you create a bill of materials?

It is typically created in engineering, for example in the CAD or PLM system, and is then transferred to the ERP system. Clear part numbers, quantities, scrap factors, version management and approval processes are important. In practice, dual checking by engineering and production planning has proven its worth.

? What does multi-level bill of materials mean?

A multi-level BOM represents nesting: a finished product consists of assemblies, which in turn consist of sub-assemblies and individual parts. It shows the product structure hierarchically and is a prerequisite for correct BOM explosion and material requirements planning. Flat BOMs, by contrast, are one-level and aggregate parts once per product.

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