



White Paper:

Meeting the needs of “Engineer to Order” Businesses
with Jobscope Enterprise ERP

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Introduction

Companies in 'Engineer to Order' manufacturing (ETO) and similar businesses - and there are a number of related descriptions or designations - have significantly different and often conflicting operational needs to that of repetitive volume manufacturers.

The most important outcome that arises from these different needs is that the vast majority of Enterprise Requirements Planning (ERP) systems currently available which are designed around volume manufacture business models and as a result are often, at best, a compromise fit when used by an ETO business. These often very different and very real business needs have created a strong market demand for ***Jobscope Enterprise*** which is one of the few - if not the only - ERP system exclusively designed for the 'Engineer to Order' marketplace.

This paper examines the industries that typically Engineer and Manufacture to Order. It outlines the differences in some of the key business processes between various types of manufacturing requirements and how these in turn lead to different ERP system requirements.

It highlights how ETO companies with different business needs are not always well served by conventional ERP solutions that are designed around traditional volume manufacturing operations.

It explores the specific system needs of ETO companies and what this means for the design, feature, function and operational capability of an ERP system to support the business.

Finally the document outlines how the unique design of ***Jobscope Enterprise*** makes it an important tool for any company that operates in an "Engineer to Order" manufacturing environment by identifying capabilities and modes of operation of ***Jobscope Enterprise*** that manages the specific needs identified.

However, it is not an exhaustive list of ***Jobscope Enterprise***'s capability, and therefore it is not a total assessment of all the product's features and functions.

What is an 'Engineer to Order' Business?

A business in the Engineer to Order (ETO) market is best defined as one that significantly changes the fit, form and function of products it manufactures in order to meet specific needs of individual customers - which are usually a single item or a relatively small production batch.

ETO is not universal term for this form of manufacture – other terms, which for the purposes of this paper will be considered to meet the same or similar needs include:

- Design to Order
- Contract Manufacturing
- Project Manufacturing

It is, in essence, the opposite of repetitive volume manufacture. ETO companies normally work to over-arching design principles, reflecting best practice and capability to manufacture, but they will often change and modify their designs for each customer specific order.

This process should not be confused with ‘mass customisation’ - which differs from ETO in two important ways:

Firstly, at an early stage in the design and engineering process the customisation of volume products is already anticipated and allowed for with a range of possible production options – these are often defined before any specific customer is consulted.

Secondly, although an end product may appear to be unique, that is only because of the specific permutation of options. The individual options and subcomponents themselves are not unique, and overall the fit form and function of the product will be similar to others selected from the same list of options.

By way of illustration, a car ordered with an unusual combination of engine, colour and accessories may well appear to be unique - but it is still fundamentally the same as the other cars from the manufacturer’s product line - and the manufacturer will not have had to customise the design or the manufacturing processes to suit its specific production.

Conversely a steam generation plant for a distillery is very likely to be unique - the manufacturing company will have had to accommodate customer specific design constraints imposed upon them - the resulting product will probably be different from the previous one they manufactured, and is also likely to be different from the next one they manufacture.

Any simple form of industry classification cannot distinguish ETO companies - since it is a total business process and not, for example, a category of manufactured product or related services. Thus ETO companies can be found throughout manufacturing, capital goods, electrical engineering, oil and gas products, aerospace, construction and practically every other industrial sector.

Breadth of activities covered

The scope of most traditional volume based ERP systems is often too narrow and data structure requirements insufficiently flexible for ETO manufacturers. This is best explained by analysing some of the business processes required within an ETO company:

Product Definition and Cost of Selling

Within an ETO business it is generally the case that prior to manufacture there is often extensive work required in product definition (estimating, design, engineering, etc) before any procurement or manufacturing activity commences. This phase almost always requires discussions with clients, suppliers, etc and some percentage of the effort, often substantial, is usually ‘pre-sale’ (i.e. ahead of any order being placed) and the costs incurred therefore represents a potential investment risk. ETO manufacturers need to carefully plan and account for these product definition activities as they can often have as significant an impact on the overall profitability and timeliness of a project as any of the subsequent manufacturing tasks.

Companies need to keep a watchful eye on the pre-sale expense incurred, lest the contract is won - but at an unacceptable cost. Not all business is necessarily good business, particularly if the initial pre-sale cost is too high. This situation can at times be in significant contrast with volume manufacturing businesses.

In simple terms, volume manufacturers design a product once (although it may be modified and enhanced during its lifecycle) and then make it numerous times. The costs of the product definition development tasks can be amortised over the product's life - possibly thousands or millions of items. These costs and, undesirable though they may be, this includes any overruns to the initial definition budget - can therefore be managed in the context of a long term volume pricing strategy unlike an ETO business that usually only gets one opportunity on each contract to recover its initial costs.

Similarly, for volume manufacturers, any elapsed time overruns in the product definition phase will affect the time-to-market of the product, but it does not necessarily have any effect on the lead-time to deliver a specific customer order, and is therefore not included by most ERP systems as part of the order to cash process.

Most ETO and similar one-off projects have unique requirements, the lead-time of the product definition processes will directly impact on the delivery and profitability of the project, and most importantly, an ERP system should allow for these to be incorporated into the planning and costing process.

As discussed, the uniqueness of individual projects means that product definition costs cannot normally be amortized against future repeat production volumes. Far from ignoring these costs, *Jobscope Enterprise* allows for design and engineering expense to be recorded, with the resultant costs carefully controlled. The benefits of the *Jobscope Enterprise* approach are that management can better understand the engineering costs - whether they are pre- or post-sale, and as a result have the opportunity to better control crucial sales, design and engineering resources.

Commissioning and Installation

Post the product manufacturing phase, ETO companies often have to manage very large and demanding commissioning and installation processes.

After final assembly, and often after delivery to the customer's site, a project may require extensive planning, coordination and manpower effort to complete. For example a manufacturer of heating boilers may have to involve their own labour, subcontractors, testing agencies, transport, and the customer's labour resources, to finally commission the project.

Volume manufacturers see things differently. Once they ship the product - to the right quality standard and timeframe - they rightly regard their involvement as essentially complete and the contract fulfilled. Depending on what it is, the product can then be distributed to end users, or re-sellers or other manufacturers who know what to do with it. As a result their lead-time calculation only covers up to final assembly and ship and consequently their ERP system operates on that basis.

For ETO focused companies *Jobscope Enterprise* allows for the inclusion of the installation and commissioning activities into the Project plan and monitors the resultant time and cost incurred. For example, subcontractor costs and time - both amount incurred and time elapsed - can be included at any stage of the project with appropriate actual, forecast and budget comparisons made available for analysis and action.

Moreover, promise dates within projects can be committed to, based on a fuller understanding of all the activities and requirements involved.

From these examples it can be seen that companies who recognise that they are ETO manufacturers should seek to procure ERP systems that have the capability to plan and account for numerous activities before and after the basic manufacturing operations.

Jobscope Enterprise is such a system – it has been specifically designed to meet the needs of ETO businesses. It is an ERP system that recognises it is not simply the factory floor that needs to be planned and managed. Indeed for many ETO companies, the factory floor activities can sometimes be the easier part of fulfilling an order - the real challenges and management focus is often required elsewhere to successfully meet the customer's requirements.

The following sections deal in more detail with selected features of the Jobscope Enterprise solution relating to ETO businesses and how these compare to the traditional ERP products targeted at repetitive volume manufacturing companies.

Business Planning

As already described, simply compiling the purchasing and manufacturing lead times will not necessarily determine the 'time-to-deliver' of a project, since projects often have to take account of product definition activities and commissioning and installation processes. However it is not simply the scope of the planning that differs between volume and ETO manufacturing operations there are other key differences in the way that they approach the planning process.

Bill of Material

The Bill of Material (BOM) data is vital to any ERP system as it impacts on most every aspect of the business - product planning, lead-time calculations, purchasing, etc. Received wisdom suggests that in most structured manufacturing control systems, the level of BOM accuracy must be very high for it to be of real value.

The BOM and the way its data is handled is significantly different for ETO manufacture to that of volume manufacturing. This is because a BOM in a project environment should not be limited to factory-produced components, or bought-in items necessary to complete the final assembly. For example, in order to successfully commission an ETO project many items - tools, jigs and fixtures, spares and commodities may be required.

This requirement may not appear to be significantly different to that of a volume ERP system which will recognise that a specific jig must be available to produce a component in the factory.

However, to highlight the differences, consider the supply of a specialist machine tool. To commission the machine may well require labour and facilities, including, for example, a cement mixer, concrete and reinforcing steel, in order to bed it down - but this can only occur after the machine is manufactured and shipped – and of course these items are required at the customer's site, not in the manufacturer's factory. In most every case, an ERP designed to focus on volume production simply would not recognise these detailed requirements and could not satisfactorily accommodate their inclusion – although they are an important part of a standard ETO manufacturing and supply process.

Basis of Planning

ETO manufacturers cannot work solely in elapsed time - they also need to calculate the resource effort involved. For example, if a project has 100 man hours worth of installation - it could mean one person for 100 hours, or it could be deployed more quickly with a larger crew. Time losses in one area may be made up in another. If a specific design task is budgeted to take a team of five people, and one falls ill and can't be replaced a design time over-run may well be inevitable. However a project driven organisation may still be capable of making up the lost time by increasing applied effort in other downstream activities in order to hit the overall deadline.

When planning within *Jobscope Enterprise*, you can quickly see the status of all items within a project. This is vital because the key management requirement is to have an ERP system that can reflect the changing dynamics within the business and enable management to respond and re-plan as necessary.

Planning Issues and Priorities

Traditional volume manufacturing systems operate without recognising the potential range of business priorities and needs. MRPI and MRPII usually work on 'oldest order first', Advanced Planning and Optimised Production Technology (OPT) use more sophisticated algorithms, but do not normally recognise a 'rush job' required to meet a specific customer order or change of priority. The way volume ERP systems use planning algorithms to aggregate demand for by pulling like demand together from different orders, or looking ahead to the future for economic batches or possibly breaking down requirements in to smaller batches, to make manufacturing operations more flexible and efficient, can mean it is often difficult to see 'why' any one job on the factory floor is needed or its specific business priority. This can lead to lack of clarity, a breakdown in internal communication and poor short-term planning decisions.

ETO companies require clarity to be able to manage priorities. The business tends to be much more specific customer order driven and subject to constant change. This demands that everyone in the business knows what is important to the delivery of the project plan and requires an ERP system with the ability to manage the rapid and frequent change.

ETO manufacturers know that they cannot always be in control of lead-times. Many issues can impact the plan to deliver even an apparently simple project:

- Customer late with the design approval
- Cannot get access to the site on the required day
- Wide load needs a police escort
- Safety critical welds not inspected on time

All of these and similar issues have an impact on delivering the plan and in some cases it may not be possible to have any direct control over the situation. In other cases it may be possible to change the situation – but change must be accounted for, understood and managed, since it can profoundly affect the delivery time and cost of the overall project.

For volume manufacture, planning and re-planning processes can be amazingly complex, demanding the optimum utilisation of plant, equipment and absorption of overheads. An ETO manufacturer has the same complex business demands but is often required to manage some entirely different planning problems.

Jobscope Enterprise provides complete flexibility in the Bill of Material, allowing products and processes to be easily defined for a project.

The *Jobscope Enterprise* planning engine considers both applied effort and priorities. This allows organisations to distinguish between the important and the immediate. It is clearly necessary when changing priorities come in to play that a business can expedite some activities - even if it is in the knowledge that as a result other work may be delayed.

Above all, the planning in *Jobscope Enterprise* is clear and simple to understand. Material requirements are calculated without the need for overnight batch runs. The system will not mask demand in complex MRP batching routines. By analysing requirements in Microsoft Project - which is a standard feature in *Jobscope Enterprise*, planners can decide which orders to aggregate prioritise or re-plan. *Jobscope Enterprise* is flexible enough to cope with the rapidly changing priorities and unique circumstances of each project.

Commercials – Financial Controls

All companies need to control profit and cash! Clearly, one of the key benefits of any ERP system should be to maintain on-line, accurate, timely information and provide corporate-wide visibility of financial issues. Yet, even in this key area of the business, the needs and priorities of volume and ETO manufacturers are not always identical.

Contract focussed Accounting

In ETO based businesses financial information within the management reporting system is usually more focused on the profitability and cash flow of individual contracts and projects than on departmental or organisational financial performance. The nature of the business means each project can often have a high cash investment relative to the size and financial capacity of the organisation. As a result individual projects can at times literally make or break the company.

Payments for a contract may be staggered over the life of the project - including retention amounts for acceptance of a job long after its completion. These receipts - often known as 'stage payments' - may happen at any point in the project, and depending on the contract, can be based on milestones which include committed purchases or major events in manufacturing. The impact of stage payments on cash flow can determine the priorities in the production or delivery sequence. The ability to view the overall status of deliverables and to be able to change them is critical to the financial success of the business and *Jobscope Enterprise* is proven to be well equipped to support this vital requirement.

Spend versus Achievement

ETO manufacturers are rightly highly focused on spend versus achievement. For each project, and at any point in time, they need to know exactly what they have committed in purchases, billable hours, material, etc. Equally important, they need to know the 'cost to complete' - what's left to spend in order to finish the project. Flexibility is often required in a commercial environment. In volume manufacture, work-in-progress normally becomes stock when the factory build is complete, but ETO manufacturers may wish to control when and if work-in-progress moves to the cost of sale of the project - which may be well after shipment from the factory.

The analysis functions in *Jobscope Enterprise* can reveal every detail about each contract – its cost to date, requirements to complete, current activities, etc, - all on one screen.

In summary, ETO manufacturers have specific needs which can make all the difference in their pursuit of being a 'world class' business. They need flexible accounting systems that can separate corporate accounting from project accounting, but does both automatically. By having a flexible account coding system, companies can ensure that they can set up the corporate accounts (departments, overheads, costs and sales etc.) in any way they see fit, and re-arrange them as often as is desired. This is in contrast to traditional ERP systems that often force the company to shoehorn project accounting into the general ledger. This invariably results in an overly complicated chart of accounts, and a lack of flexibility in the management reporting.

Jobscope Enterprise has the ability to keep detailed accounts by monitoring all the transactions on a contract - including manufacturing and material movements. Its contract accounting facilities have often been likened to having separate companies for each contract.

Most importantly, from a single screen, management can see everything that pertains to a single contract including purchasing, sales, WIP, hours booked, commitments, cash received, etc.

Concurrency and Change Management

Concurrency of process in manufacturing requires team working and the sharing of knowledge. In an ETO organisation many activities can take place simultaneously in order to satisfy the customer's deadlines and can occur in many combinations – sell, design, engineer, procure, manufacture, test, ship, commission, bill, maintain, etc. To support this complex set of processes there are a number of requirements needed to achieve a high level true concurrency within an ETO business:

Change Management

Change management can be fundamentally different in ETO manufacturing to that of volume manufacture. This can be an extremely difficult problem to manage through a traditional ERP system, yet it is a problem that ETO manufacturers face constantly. In volume manufacture, making a change is almost always about the future configuration of a part, assembly or process and how and when it will change – it is not usually about something that has already been manufactured or is in progress.

In ETO manufacturing the change effected may be in response to a problem during installation, it could be instigated by a customer request during manufacture, it could be as a result of a production problem, the availability of a purchased part, a design change, etc. The potential reasons are many, but the effect of the change is immediate and the impact is almost always on the current and scheduled manufacturing work.

Cost Management

Under most circumstances change will have a financial as well as an operational impact. The business needs timely and accurate information including:

- What is the cost difference between the designs?
- What is lost or unusable?

- What is still good or re-workable?

The ETO company must be able to identify not only the net difference in cost price between the versions of product, but also the lost investment in manufactured and purchased parts which are no longer required, committed purchase orders, tools which need to be changed etc. The effects of a change needs to be fully understood and, before implementing the change, whether it is chargeable or not, an ETO company must know the exact impact on the business.

Jobscope Enterprise has been designed to handle the challenges of an ETO company's Concurrency and Change Management processes. Partial bills of material can be released to allow the commencement of production or procurement of what is firmly defined - what remains undefined can follow later. Although undefined parts or processes cannot be manufactured or purchased until engineering released, these 'place holders' can be added to bills of material allow a full visibility of what is likely to come – in order for downstream activities can get a total view of the project. Moreover changes can be rolled down through the system and the cost implications understood. The on-line planning will identify un-needed parts or process changes instantaneously. These features permit real concurrency between operations and design, as well as reducing lead times and costs.

Conclusion

Companies that Engineer to Order or Manufacture to Order, who are contract or project driven have very specific ERP system requirements. Their needs are far from identical to a volume manufacturer and these differences are crucial to the success of their business.

Competitive advantage is hard enough for manufacturers to gain and retain and they should never compromise on their system requirements. When procuring an ERP system they should be extremely demanding in order to understand the scope, the feature and function and flexibility in how it supports project based operations and the related financial controls.

They should be as least as demanding of their ERP supplier as their own customers are of them. Companies that currently have an ERP system should carryout a similar review - the cost of using an inappropriate system can be far greater than the cost of change.

Jobscope Enterprise is unusual - it is a specialist tool that has been uncompromisingly designed to meet the needs of companies in the Engineer to Order and similar businesses. It is delivered and supported by In2grate Business Solutions who have implemented in excess of 400 ERP projects around the world.

In2grate Business Solutions is the master affiliate in EMEA for the *Jobscope Enterprise* ERP system for engineer to order manufacturers, and maintenance repair and overhaul focused businesses.

Jobscope Enterprise is the ERP component of the wider In2grate Enterprise "d2order" architecture for ETO companies, which includes CAD, Design Automation, Product Configuration, CRM, Workflow, Integration and Portal Technology.

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