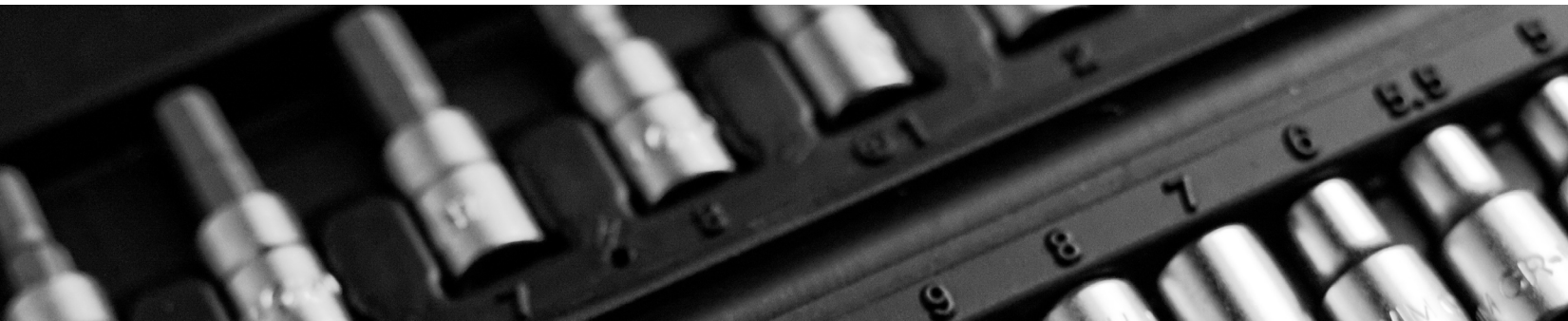




# PLM ESSENTIALS

## 1. PART NUMBERING

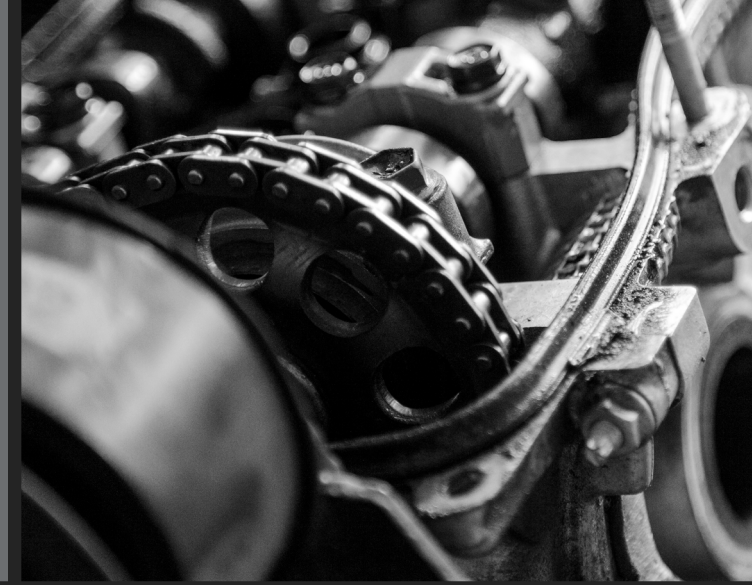


# CONTENTS

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01_	<b>1.0. PART NUMBERING</b> 1.1. The DNA of product development	06_	<b>6.0. FUNCTION GROUPS</b> 6.1. Function group structure
02_	<b>2.0. WHAT IS A PART NUMBER?</b> 2.1. Part numbering stakeholders 2.2. Part numbering pre-engagement	07_	<b>7.0. SUB-FUNCTION GROUPS</b> 7.1. Sub-function group structure
03_	<b>3.0. PROBLEMS WITH THE SYSTEM</b> 3.1. Problems with the system 3.2. What did the manufacturer require?	08_	<b>8.0. JUSTIFICATION AND EVIDENCE</b> 8.1. Justification & evidence for the new system
04_	<b>4.0. INDUSTRY EXAMPLES</b> 4.1. Significant complex intelligent part numbering 4.2. Significant detailed intelligent part numbering 4.3. Significant simple intelligent part numbering 4.4. Non-significant numeric sequential part numbering	09_	<b>9.0. RISKS OF THE NEW SYSTEM</b> 9.1. Risks of the new system
05_	<b>5.0. DECISION CRITERIA</b> 5.1. Decision criteria for selecting a part 5.2. The part numbering system implemented	10_	<b>10.0. ABOUT QUICK RELEASE</b> 10.1. About Quick Release 10.2. Strength in numbers

# 1 PART NUMBERING



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.

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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 pushes costs down.

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## *PART NUMBERING THE DNA OF PRODUCT DEVELOPMENT*

To create new products or develop new versions of existing ones, you need visibility of every part required, and the simplest way of managing this is by assigning a code to each.

But part numbering is far from straight forward and needs to include many elements of a part's design, from its function all the way to its colour.

To help understand how to create such a system, we've compiled a detailed case study of one we architected for a London-based electric vehicle innovator.

# WHAT IS A PART NUMBER?

A part number is the identifier of a unique component design, used as a reference to the part design during the manufacturing process. It must be clear, concise and easy to use.

At its most basic, it can be a unique set of characters (a non-significant part numbering system) and at its most complex, it can encode any number of part attributes (a significant part numbering system).

Finding the balance between these two extremes makes the creation of parts easier and allows them to be identified simply when needed.

You should note that a part number is different from a serial number, which identifies an individual physical part rather than a part design.

Any new part number needs to be integratable with the manufacturer's ongoing projects but also scalable as they grow into different products.

## PART NUMBERING STAKEHOLDERS

Since part numbering is the core identifier of all engineering content, departments affected by it include:

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

## PART NUMBERING PRE-ENGAGEMENT

As of March 2017, the manufacturer used three different part number systems.

### VEHICLE A

For Vehicle A, the manufacturer used Sage to generate part numbers, split by a Sage Group, part type, and then a five-digit incremental number, all separated by hyphens.

00-1-12345		
00	SAGE GROUPING (E.G.	02 - DRIVE TRAIN, 06 - BODY SYSTEM)
1	1 - ASSEMBLY, 2 - COMPONENT	
12345	SEQUENTIAL NUMBERING	

After this, they generated part numbers from a Microsoft Excel macro-driven Design Release System (DRS).

## PART NUMBERING

The mask follows a similar set of rules, but the first section now has reference to a vehicle type (the rules are different for Vehicle B and for Vehicle C).

The part then has a part type code followed by a five-digit number split by hyphens.

### VEHICLE B

The first section of the part numbering for Vehicle B has two grouped part codes: a three-digit number and a two-digit number. The rest of the part number follows the Vehicle A part numbering system described above.

000-00-1-12345	
000-00	ROBORACE GROUPING (E.G. 226-045 DRIVETRAIN, 226-012 CHASSIS)
1	1 - ASSEMBLY, 2 - COMPONENT
12345	SEQUENTIAL NUMBERING

### VEHICLE C

For Vehicle C projects, the project code was used as the first section part number.

000-00-1-12345	
000-00	ROBORACE GROUPING (E.G. 226-045 DRIVETRAIN, 226-012 CHASSIS)
1	1 - ASSEMBLY, 2 - COMPONENT
12345	SEQUENTIAL NUMBERING

# PROBLEMS WITH THE SYSTEM

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There's also an issue that when revising for a future iteration of B12, the manufacturer won't be able to differentiate between parts created for the first B12 project and parts created for the next B12 project.

Capturing the type of the part (i.e. assembly or component) works only if:

**1) No changes will be made to the part type** (e.g. if the part starts off as an assembled part, but is later changed to become a bought in component, the part number itself would need to be changed.)

**2) The part won't be simultaneously used as an assembled part in some usages and as a component part in others**

## SO WHAT DID THE MANUFACTURER REQUIRE?

One part numbering system for all projects, which is robust enough to be able to change the procurement/manufacturing type of a part without the need to change the part number.

Any new part number also needs to be able to be integrated with the manufacturer's ongoing projects, but also be scalable as the manufacturer grows into a wider model range.

For the first section of all part numbers, there was a mix of using a Project ID and/or Function Group ID.

- **The Sage-based system captures the Functional Area but doesn't capture the Project**
- **The Vehicle B system captures the Project ID and some presentation of the Functional Area, but the grouping gives potential for duplication and confusion (e.g. 226-011 [Body] and 226-013 [Body])**
- **The Vehicle C system captures the vehicle type, but doesn't capture the Functional Group**



# INDUSTRY EXAMPLES

## SIGNIFICANT COMPLEX INTELLIGENT PART NUMBERING

BK21-V04310-AAW	
B	YEAR INITIALLY DESIGNED FOR
K2	PRODUCT LINE (I.E. VEHICLE LINE) INITIALLY DESIGNED FOR
1	DESIGN RESPONSIBLE ACTIVITY
V	BODY STYLE
04310	SIGNIFICANT BASE NUMBER (I.E. 3600 = STEERING WHEEL)
A	VARIANT
A	CHANGE LEVEL
W	COLOURED INDICATOR

High level of complexity involved in defining unique part number.

**Pros:** Creates unique parts for any vehicle type, model, trim, and colour, whilst capturing the level of change. Easy to identify variants of the same functional part. Easy to identify the specific function of a part. Easy to remember. Large number of available part numbers.

**Cons:** Requires a high level of management - change of attributes requires a change of part which will result in the release of multiple new parts. Data integrity can be quick to deteriorate if processes are not followed.



## SIGNIFICANT DETAILED INTELLIGENT PART NUMBERING

19A1314CP.01	
19	FIRST PROJECT INITIALLY DESIGNED FOR
A	FUNCTION GROUP
1314	INCREMENTED NUMBER
C	BODY STYLE
P	PRODUCTION OR PROTOTYPE INDICATOR
.	SEPARATOR
01	REVISION

**Pros:** Can capture the project number for the purposes of budget and/or reporting on new parts if crossing over. Get a physical impression of whether the part is a prototype or production.

**Cons:** A new part number is needed when revising from prototype to production, or when changing the revision.



## SIGNIFICANT SIMPLE INTELLIGENT PART NUMBERING

1E0012314AB	
1	VEHICLE
E	FUNCTION GROUP
0012314	SEQUENTIAL NUMBERING
AB	REVISION

**Pros:** Parts are identifiable to vehicle and function group without too much attribute detail, so they're easy to manage.

**Cons:** Including a revision within the part number for Product Lifecycle Management (PLM) systems create an administrative burden, not only for the creation of the part, but also for the release process associated to part creation.

## NON-SIGNIFICANT NUMERIC SEQUENTIAL PART NUMBERING

4800015966
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**Pros:** Easy to assign new part numbers, taking the next available number in the system.

**Cons:** Inability to identify the part based on part number alone, so identifying parts takes time.

## DECISION CRITERIA FOR SELECTING A PART

- **USEFULNESS** All rules must be helpful and efficient
- **INTERPRETATION ACCURACY** Users must be able to quickly and accurately work with part numbers manually
- **ERROR RECOVERY** Errors in raising parts must be quickly identifiable and easy to rectify
- **SUITABLY UNIQUE** Part numbers must be distinct where the difference between parts matters and indistinct where it does not
- **SYSTEM AGNOSTIC** Length and character content must be suitable to all systems
- **MINIMAL ADMIN BURDEN** Numbering Scheme must not require excess administration

### The ideal system must:

- Be concise and formatted in a way that minimizes administration errors when using part numbers
- Be applicable across platforms and programmes (i.e. for Truck, Bus, Roborace, etc.)
- Be able to be interpreted and identified easily
- Provide high level information on the origin of the part, the engineering function responsible, and its usage
- Reduce the need for re-release or additional releases to a minimum
- Differentiate between production intent and prototype or test parts
- Be system agnostic in terms of length and characters, with the ability to be future-proof – not being limited by part character length
- Have a consistent format and length

## THE PART NUMBERING SYSTEM IMPLEMENTED

Ownership of parts was a key driver in deciding a part numbering system for the manufacturer. The human interpretation of a part was also key for communication and familiarisation across all affected departments.

XY000000AA-0000	
X	FUNCTION GROUP
Y	SUB-FUNCTION GROUP
000000	SEQUENTIAL NUMBER
AA	REVISION (CAPTURED IN ATTRIBUTE)
-0000	COLOUR/TRIM CODE (CAPTURED IN ATTRIBUTE)

Function Group	A single character to define the responsible engineering Function Group (i.e. C = Chassis, E = Electrical, etc.) – see Function Group table
Sub-Function Group	A single character to define the responsible engineering sub-functional group (i.e. A following C [CA] would define a chassis- suspension group part, etc.) – See Sub-Function Groups table
Sequential Number	Six numeric digits which incrementally increase based on the selected Function and Sub-Function Group ID. Six characters allow for 999999 parts for each combination of function and sub-function group.

Revision and Colour/Trim codes are captured with part attributes within the PLM and affixed to the part number

## PART NUMBERING

in the Enterprise Resource Planning (ERP) system for procurement and inventory management. They're also affixed on drawings (or with a colour/trim table) and imprinted onto parts. When a design change is made to a part that's interchangeable with its predecessor, it would need a new revision (i.e. AA to AB). A design change that makes the part non-interchangeable would require a new part number to be issued (i.e. EA001596 to EA001651). Part maturity is captured within the revision code (detail is captured within the part attribute document).

As an example for prototype parts, the revision would take on a two-letter format (i.e. AA for the first prototype part, AB for the second prototype part), whereas a production part would take on a two-number format (i.e. 01 for the first production part, 02 for the second production part).

E.g. a prototype release of electrical part EA001596 would hold a revision of AA within the revision part attribute. Releasing the part into the ERP system will generate part number EA001596AA. Once the part is ready for production release it would hold a revision of 01, releasing the part into the ERP system as part number EA00159601.

When the parts are configured and loaded into an ERP system, the colour code of the part is post-fixed to the part number where relevant.

E.g. part EA001596, revision 01, which has two colour options 1002 [Black] & 1024 [Cream] would generate two part numbers within the ERP: EA00159601-1002 & EA00159601-1024.

Details of revision and colour coding are captured within part attributes.

# FUNCTION GROUPS

Function Groups classify the engineering team who created and are responsible for the part.

An example structure is listed below in the Function Group table.

B	STRUCTURES/BODY-IN-WHITE
C	CHASSIS
D	INTERIOR TRIM
E	ELECTRICAL
F	EXTERIOR TRIM
G	POWERTRAIN
S	SOFTWARE

Additional pseudo Function Groups are needed for parts to be grouped or classified, and these will have the codes:

A	ALPHA / CONCEPT PARTS
V	VALIDATION
Y	STANDARD / CATALOGUE PARTS
Z	PHANTOM LEVEL ASSEMBLY

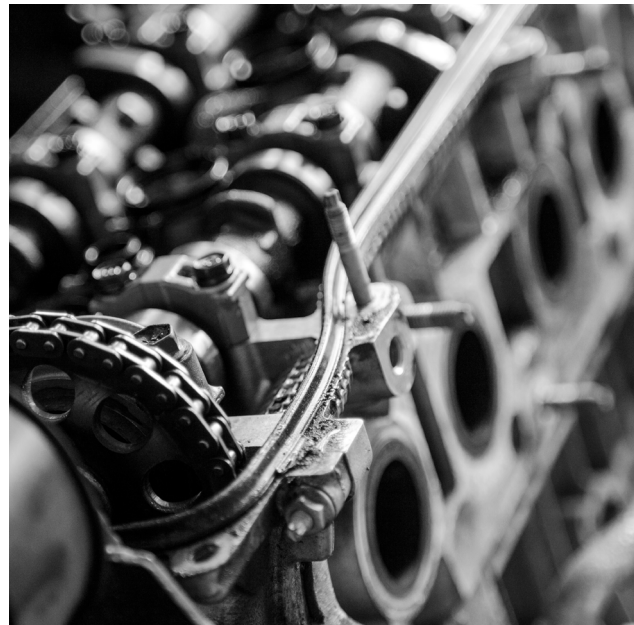
Alpha or Concept parts can only be used within design packages, and not for prototype or production. Alpha or Concept parts can't be bought in.

Validation parts are used to capture design envelopes and homologation items such as manikins or wheel turning spaces.

Due to the nature of standard design or catalogue parts (such as riv-nuts and bolts) being cross functional, they are put into their own classification [Y].

This gives visibility that the part is standard and the design is not internally owned. The supplier part number will be captured against the catalogue part as a part attribute [VENDOR PART NUMBER].

Phantom parts are used to group similar items together but can't be bought in or produced, such as the group for all Chassis items.



## PART NUMBERING



# SUB-FUNCTION GROUPS

Sub-function groups help with further identification. A single character following the function group is used to give distinction to the parts.

An example structure is listed below with guidance from the parent Function Group.

B	STRUCTURES / BODY IN WHITE
A	BODY
B	BUMPER
C	CROSSMEMBER
D	DIVIDER
E	STRUT

C	CHASSIS
A	TRACTION MOTOR
B	FRONT SUSPENSION
C	REAR SUSPENSION
D	WHEELS & TYRES
E	BRAKES
F	PEDALS
G	STEERING
H	DRIVESHAFTS

D	INTERIOR TRIM
A	SEATS
B	IP
C	CENTRE CONSOLE
D	DOOR
E	HEADLINES
F	PARCEL SHELF
G	PILLARS
H	FLOOR
J	RESTRAINTS
K	DIVIDER

E	ELECTRICAL
A	HV
B	HV BATTERY
C	HV WIRE HARNESS
D	LV BATTERY
E	LV WIRE HARNESS
F	INTERIOR LIGHTS
G	INVERTER
H	DISPLAY
J	SECURITY
K	SAFETY
L	INFOTAINMENT
M	CONTROLS
N	EXTERIOR LIGHTING
P	HVAC

F	EXTERIOR
A	TRIM
B	WIPERS
C	PANELS
D	GLAZING
E	CLOSURES

## PART NUMBERING

G	POWERTRAIN
A	ENGINE MOUNTS
B	AIR INTAKE
C	COOLING SYSTEM
D	HEAT SHEILDS
E	ANCILLARIES AND GENERATORS
F	ENGINE
G	FUEL
H	EXHAUST

V	VALIDATION
A	ERGONOMICS
B	VISION
C	PACKAGE CLEARANCES
D	VEHICLE ATTITUDE

Where a function group doesn't have a designated sub-function group [S] Software for example, the sub-function group code will be [A] (e.g. [SA]).

Characters not to be used include [I], [O] and [X] due to these characters being misinterpreted as numeric characters [1], [0] and a block out character.

This list is given as an example and is not exhaustive.

# JUSTIFICATION & EVIDENCE FOR THE NEW SYSTEM

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In formulating a part numbering system for the manufacturer, we chose a system that would complement the modular, inter-vehicle nature of their designs, using carry-over parts.

Utilising a combination of letters and numbers makes the identification of parts easier for human interpretation. Setting a part number mask that's used across the company will also help users identify parts on different programmes.

Capturing the firm's emphasis on inter-vehicle, modular parts is an important and conscious decision for having the Function/Engineering Group as the first element of the part number.

This element doesn't focus on the vehicle the part is being designed for, but instead, on a part that's been designed for many vehicles, transferring the emphasis of the part number to the role, design, and ownership of the part, rather than the vehicle.

The ability to identify the specific functional or sub-functional group associated with the part was highlighted as an important aspect to capture within the part number, as it gives cross-departmental overview on the purpose of the part.

By capturing the Revision in the part attribute, the system minimises the administrative burden of generating new part numbers in the PLM, and a revision history can be captured and linked to one part.

This is opposed to generating new part numbers in the PLM, which requires adding revisions manually.

By using the Revision attribute to capture the part maturity differentiated by its format, the part number generated can be used to easily identify prototype parts. This minimizes the risk of a prototype part being mixed up with a production part, and provides clear visibility in inventory management, reducing the risk of fitting a prototype part to a production vehicle.

Housing a sequential numbering system gives just under one million new parts per function and sub-function group, potentially allowing for 10 million to 100 million parts to be created within the company.

A medium sized automotive manufacturer released around 90,000 parts in 14 years, and with this in mind, the manufacturer will be able to easily fit within this part numbering system as they scale.

## PART NUMBERING



# RISKS OF THE NEW SYSTEM

- 1. Capturing the part maturity with two numeric values limits the part to 99 iterations, but the risk of a part needing to be released as a prototype part more than 99 times is extremely low. The majority of manufacturers will release no more than 10 prototypes per part**
- 2. Not capturing a specific vehicle or Project ID within the part number lends the part to being used for more than one project and across platforms or programmes if needed, which makes the part more accessible to different projects**

It's important to capture the first project the part was designed for, so when parts are being used across programmes, thought and reference can be given to the previous project if design modifications are needed.

By not capturing the first project the part was designed for within the part number, there's a risk of this information not being available 'at-a-glance' within the part number. But this is outweighed by the drive for inter-vehicle parts and mitigated by being captured in an accessible location (like the description).

- 3. Capturing the revision as a part attribute within the PLM system and as part of the part number in the ERP system allows tracked revision changes of one part in the PLM, whilst maintaining the ability to track the procurement and inventory history with the ERP**

There's a risk of disconnect between the two systems if the relationship for the masking between the PLM and ERP systems isn't aligned. But this is mitigated by the main body of the part number being captured in both systems. Only the Revision and Colour/Trim Code post-fixes differ between parts in the two systems.





## ABOUT QUICK RELEASE\_

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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?](#)

## STRENGTH IN NUMBERS

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An engineering team is a billion-dollar asset. Don't let part numbering stand in the way of their delivering the competitive advantage to thrive.

QR\_ have advised on and implemented part numbering systems for EV start-ups, specialist, volume, and commercial vehicle manufacturers.

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

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