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# Effective packaging-related specification management software for a packaging documentation system

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# Effective Packaging-Related Specification Management Software for a Packaging Documentation System

by

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CERTIFICATE OF APPROVAL

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M.S. DEGREE THESIS

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for the requirements for the
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EFFECTIVE PACKAGING-RELATED
SPECIFICATION MANAGEMENT SOFTWARE FOR
A PACKAGING DOCUMENTATION SYSTEM

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## Dedication

This thesis is dedicated to my family, my parents, and my friends who supported me throughout this entire venture. Without their guidance, support, love, and enthusiasm this thesis could not have been possible.

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**Abstract**

An extreme amount of time and money is lost when a company utilizes an inadequate packaging documentation system. Problems such as confusion, decreased productivity, inaccurate information, and inefficient time to market arise. Having the right tool (in this case specific software) for the job will successfully provide needed information to flow throughout a packaging documentation system. In investigating the importance of this tool, Duracell will be the company focused on as part of this case study. Duracell's current packaging documentation system consists of a series of internal electronic transfers and physical distribution of packaging specifications. Relevant information is distributed among departments inside the company and other departments/affiliated businesses outside of the company. Duracell, as well as many other companies, can cut significant costs by effectively managing information and having well-organized proficiently operating specification management software. The purpose of this study is to compare, evaluate, and determine Duracell's current packaging documentation management needs. After examining DCS (Document Control System) 6.0 Professional, it was found to be a much more effective software than Duracell's current DCS software system, DCS 2000. The hypothesis of this particular study is that all the types of Duracell's packaging documentation (artwork, bill of materials, CAD drawings, pallet patterns, planograms, etc.) can be integrated into DCS 6.0 Professional, which can offer a great deal of cost and time savings throughout Duracell's packaging documentation system. The study determines that DCS 6.0 Professional, when properly used, can provide Duracell with a business solution that enables successful management functions for completed packaging documentation to occur through Duracell's internal and external organization on a consistent basis.

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# 1. INTRODUCTION TO DURACELL'S PACKAGING SPECIFICATION SOFTWARE AND PACKAGING DATA MANAGEMENT PROCESSES

## 1.1. Internal Problems and Causes with DCS 2000 and Management

In May 1999, Duracell's packaging department had become the primary user for its packaging specification management software - Document Control System (DCS) 2000 - within the Bethel, CT based Headquarters. This specification software developed by Mystic Management Systems, Inc. has shortcomings for developing an effective packaging documentation system, which negatively effects internal/external management.

As a result, DCS 2000 limits Duracell's packaging data management processes by not effectively guiding the document lifecycle in terms of workflow. Duracell's packaging department does not function as successfully as it could, since DCS 2000 is lacking in web-based technology that was utilized years before the installation of DCS 2000. Additionally, it was never thoroughly analyzed for its effectiveness in providing information to manufacturing affiliates.

The major problem with DCS 2000 is that it does not save time. This affects how management follows procedures for packaging documentation guidelines. The software technology does not help create a sufficient amount of document approval/distribution time and effectiveness for packaging engineers. Technological support cannot be sufficiently provided for DCS 2000 malfunctions due to the number of errors that occur during use. This is because the platform (Microsoft Visual FoxPro) DCS 2000 was created upon provides limited capabilities. The interface it was created upon is also not always user-friendly in the way it is organized, and computer glitches on it occur frequently. Morning updates (automatic back up of work) and computer freezes create too much down time for Duracell's packaging department. This

negatively impacts the rapid turn around of projects. If it takes the packaging department longer to do its job, then it takes other Duracell internal departments and Duracell's off-site manufacturing affiliates longer to do their job as well. This ultimately has a negative impact on the delivery time to market, which is extremely important in such a competitive industry.

The packaging department's general documentation needs are to generate and manage material specification documents (artwork, bill of materials, CAD drawings, supporting text documents, etc.). This can be accomplished via a rapid and effective process for all new product launches and ongoing product modifications. This specification information is vital for batteries to be packaged on time in order to meet the various production and shipment deadlines. The majority of a packaging engineer's workload should not be focused on having to follow a long inefficient process when creating or revising documents and then approving them one by one. The focus should be spending more time on cost savings, new products, and productivity improvement programs.

DCS 2000 is a personal computer-based program and a database that specifically addresses documentation for packaging component and material specifications. The platform for the database used by DCS 2000, Microsoft Visual FoxPro, contains data fields of item codes or part numbers for many document types that can sometimes make it confusing for the average user to decide what document types to use. Appendix A is a list describing all of Duracell's packaging documentation types. For example, a certain type of document can be found under several document types. Some document types are imported into the DCS 2000 templates and others are created within DCS 2000 templates. Documents can be created with other Windows-based applications including Adobe Illustrator, CAD, CAPE, spreadsheets, word processing, and

many others (Mystic Home Page 1). In essence, DCS 2000 resembles a multi-user environment put into a single system.

There are four main types of packaging documentation at Duracell in DCS 2000: drawing specifications, bill of materials (BOMs), graphic specifications, and pallet patterns. Drawing specifications use AutoCAD (Automated Computer Aided Drafting/Design) 2000 software. A user (Duracell draftsman) develops all of Duracell's packaging component drawings. Adobe Acrobat software is used to create drawing files in a published document format so that drawings can be imported into DCS 2000. In DCS 2000, users (Duracell packaging engineers and document coordinators) create BOMs within templates in the database/software. Graphic specifications are produced by Duracell vendors on their own software, such as Adobe Illustrator. The artwork document ends up being in a published document format in order for the user (Duracell graphic coordinator) to import any artwork into DCS 2000. Pallet patterns are developed in CAPE software that the users (Duracell packaging engineers) develop for all the patterns. The pallet patterns are then converted into a published document format so that any pallet pattern can be imported into DCS 2000.

The BOM is the formula for all kinds of battery packaging components (primary packaging, secondary packaging, tertiary packaging, etc.) that come together in a proper sequence and quantity for completion of the packaged product. Many different types of packaging documentation can go into it along with any other significant related documentation that needs to be included. In Appendix B, views of BOM information within DCS 2000 are given to illustrate what may go into a BOM. Since the BOM is a list of packaging components and related documents, it is important to remember that a well-structured BOM can simplify planning woes, keep the production line moving, and ease new product introduction (Garwood

10). An in-depth analysis of reoccurring issues with BOMs is studied more in the following section of this chapter.

Management problems with workflow reflect an inconsistency of terminology that occurs with DCS 2000. The way one packaging engineer describes a component may not be how another packaging engineer does so in DCS 2000. This can create misunderstanding or confusion when searching for documents or when manufacturing affiliates receive hard copies of BOMs. Other problems are that (a) sometimes documents are missed or dropped from the once a week distribution of documents to manufacturing affiliates or (b) they end up going out to the wrong manufacturing affiliates. All of these problems may cause packaging component waste because products are made to the wrong or an outdated specification. BOM information might not be provided correctly to a Duracell planning force in a timely manner.

Internally, planning demand management needs to have part numbers, component quantities, and other relevant packaging specification information from the packaging BOM. Sometimes incorrect information is copied from the BOM into supply chain management's software, Enterprise Resource Planning (ERP) system called J.D. Edwards (JDE) by the user. This creates ineffective communication between the two systems. Employees have a certain degree of accountability when copying information from one system to another. However, there is available technology that could be utilized for such a major company as Duracell. The cost of this technology would be balanced by increased process effectiveness. DCS 2000 and JDE software should be two systems that can be integrated together by having a programmed interface between them. It is hard to measure or put a price tag on the benefits of technological improvements, but by decreasing the chances of having incorrect information sent out for product shipments and forecasting, Duracell would benefit with respect to customer and

employee satisfaction. The time saved could be spent on reducing operating costs and gaining market share on Duracell's competitors.

## 1.2. External Problems and Causes with DCS 2000 and Management

Some of Duracell's manufacturing operations will sometimes produce up to 200 different Stock Keeping Units (SKUs) each month and average a 15-line changeover daily. Each SKU averages about 6 component parts. It is absolutely critical to Duracell's operation to have the correct parts on the production line. Packaging data have a crucial role by getting the correct information in order for it to be produced and to not have waste occur.

A questionnaire (appendix C) was given to Duracell affiliates that are involved with the packaging data in order to determine the external problems of Duracell's packaging documentation.

In 18 of 29 responses, a majority of negative responses came from manufacturing plants (internal manufacturing and contract packaging). These are very important acknowledgements, since Duracell's manufacturing plants use all the document types packaging engineers develop at the Bethel, CT-based headquarters. The hard copy of the BOM's layout is problematic, because the design of the layout is difficult for internal/external affiliates to understand. Thus, the use of any kind of specification management software will increase process effectiveness.

Of all the packaging documents listed as "ineffective" in the questionnaire, the BOM was listed most often as "ineffective." This means documentation issues occurred for most of the documents listed. BOMs at most of Duracell's manufacturing divisions are very difficult for the user to understand. Interpretation is difficult for manufacturing employees who need to use BOMs. Their understanding is that the BOMs replaced the packaging charts (the old style BOM), which provided users more information to package the product. The BOMs are more confusing and often wrong or appear to be wrong. It was much easier to read and interpret the old_style matrix or chart that showed components going into assemblies from left to right on the

page. Quantities per item were easy to read and straight forward. The "old style" packaging charts listed items in packing order, not numerical order. The current BOM requires manufacturing to calculate some things needed for them to develop the UPC bar code labels that go on inner and outer cartons. Manufacturing does not receive artwork in a timely manner, and they have even had to request copies at times. When inaccurate BOMs are issued, manufacturing has to request updated BOMs in order to meet ISO compliance. They may also receive artwork that does not pertain to the correct manufacturing plant and will usually get either the drawings or the artwork; hardly do they ever receive both the drawings and artwork together. The drawings themselves are effective, but the issue is the timeliness with which they receive them. Furthermore, product arrives on the dock without any color standards and without an update of the measurable print.

A confusing terminology problem exists in the BOM and Packaging Change Notification (PCN) documents. Manufacturing has noticed terminology issues. Inner cartons, shipper cartons, display cartons, and stamping requirements can be confusing. BOMs do not use commonly referred to terms that manufacturing uses. Having all the related documents listed is also confusing. What would be more helpful is a clear segregation of actual items used to build the product (BOM), along with the related documents. At times, two revisions for the same drawing appear on a BOM. The revision at the top appears to be a two-digit number with the "0" always to the side of the actual revision number. For example, 2 0 would be shown rather than 2. Someone not very familiar with the BOM process would mistake that as a revision 20. Often PCNs will have non-manufacturing plant items on them. What is needed is a code that will tell manufacturing if an item is for their particular manufacturing plant. This would save time because manufacturing affiliates would not have to call the packaging department about

information not relevant to that manufacturing plant. Throughout Duracell, all affiliates need to strive for consistency of terminology and insure that all involved understand why certain part numbers are assigned (i.e., custom promotional components part numbers vs. packaging component part numbers).

The flow and configuration of information to manufacturing is done in an unorganized way. The biggest information flow problem manufacturing sees is timing inconsistency with regards to J.D. Edwards (JDE) software, which is not a DCS 2000 function. It is not uncommon to have demand for product without having the BOM, artwork, or other document types. There are also times that new artwork is sent, but material cannot be ordered, because JDE setup is not complete.

Packaging documentation items on BOMs are in numerical order, not by sequence of packaging events as on the "old style" BOM (appendix D). Items listed in sequence of events would be more helpful.

The artwork and drawing documents still come in at odd times, not all together as requested. One without the other is not effective. PCNs do not always come first, and sometimes manufacturing is not sure why they are getting the revisions/duplicate copies. At times they receive PCNs and do not know what finished goods are affected, and do not receive revised BOMs at the time a part number is revised. Consistency with the artwork transmittal letter needs to be developed by having the letter state what it is replacing or if it is new. It would be a good idea to reference the applicable PCN.

An important manufacturing view is that the overall packaging documentation would be better delivered if it used an electronic media rather than paper (hard copy), since they do not always receive the relevant documents in a timely manner. A web-based program, which lets

you see specification information online, was determined to be a needed feature as long as it was configured and designed the right way. Automatic approval, automatic notification, and revision history including current and old drawings should be key features for this program for appropriate users to get the applicable packaging specifications information.

A Duracell manufacturing representative suggested the packaging department have a team formed consisting of members from all users of the system. Plant representation from all the plants should be on this team.

According to the representative, a web-based system should allow the following characteristics:

- printing of true colors for artwork.
- automatic Packaging Change Request (PCR) approval, including manufacturing locations that are affected, even if generated in Bethel Packaging Engineering.
- automatic approval in order to allow for designees to approve in the absence of the approver.
- user-friendly system, especially with respect to access to and viewing of prints, layouts, artwork, etc. that a battery packer could use. (Anonymous 1)

Manufacturing and Quality associates would like to go on-line directly from the manufacturing floor. This would enable them to search on the specific item they need (i.e. pallet configuration, assembly drawings, etc.) without having to come to the office area and go through file drawers or books of hundreds of documents to find the one item they need.

In general, a web-based program would be of great benefit to all. Such a program would ensure that everyone is working with the most current revision. It would eliminate hard copy distributions at Bethel packaging department and plant/facility locations. A suggestion by a

Duracell quality assurance manager best describes how the set-up of BOM's should be considered:

> When designing the DCS layout, keep the internal and external users in mind. Further, the manager says, Consider the user. What the packaging engineer wants to see is not the same as what the manufacturing supervisor or quality auditor wants to see. Give them what they need to do an effective job. Manufacturing wants concise information without lots of extra stuff included. (Anonymous 2)

### 1.3. Packaging Industry's Material Costs and Benefits of Web-Based Technology

Virtually every company needs to have its products shipped to the end user, and for Duracell it is at the retail level. This means that a majority of companies need and use transport packaging. Many organizations do not have an understanding of the cost saving opportunities possible with respect to the redesign of transport packaging.

Robert Fiedler and Douglas Tenpas presented the following information at the 2001 International Conference on Transport Packaging:

> The transport packaging market is growing at a rapid rate. The market for these products amounted to $30,000,000,000 in material costs in 1997. The overall packaging material costs for the transport packaging market in the United States industry was projected to be $40,000,000,000 by the end of 2001. The entire packaging industry will spend an estimated $115,000,000,000 in packaging materials by 2001, and the total worldwide estimate is over $300,000,000,000. Furthermore, the impacts of distribution packaging methods extend well beyond the direct costs. The effects on product quality, distribution expense, line and distribution throughput, and communication performance typically dwarfs the material expense. (2)

This is why it is important to have a packaging documentation system that incorporates an effective data and content management solution. By this means, the appropriate information can get to the right user in a Web format. A web-based program is a cost-effective system that can assist in decision-making and improve supply chain management.

A well documented and organized effort to improve packaging designs and implementation process, combined with a real web-based documentation management system, can enable an organization to dramatically reduce their packaging costs. In addition to a

reduction in the costs of packaging, the organization will also improve material handling, reduce transportation costs, reduce inventory, reduce warehouse space, reduce damage due to packaging, and improve company communication and supplier relationships.

## 1.4. Hypothesis

DCS 6.0 Pro is packaging specification management software that can offer a great deal of cost and time savings throughout Duracell's packaging documentation management system.

To test this hypothesis, two types of packaging-related specification management software systems were subjected to data analysis. Duracell's software system is called DCS (Document Control System) 2000. The new technology analyzed in this study, DCS 6.0 Pro, should be a replacement product or upgrade for Duracell's packaging department. After Duracell's data management needs were established, the data analysis was performed under an operator conditioned computer environment in order to complete an evaluation for DCS 6.0 Pro. Both types of developed software systems lead up to producing the Bill of Materials (BOMs), which will display all the packaging components for building the packaged product. Comparisons were made between DCS 2000's and DCS 6.0 Pro's end results with respect to how effectively they produce packaging specification documents that go into the BOM document. The evaluation section outlines the particular analysis procedures used in this study.

# 2. PACKAGING SPECIFICATION MANAGEMENT SOFTWARE TECHNOLOGY

## 2.1. An Outlook on Currently Developed Software in the Marketplace

In the packaging industry, few companies exist for the development of packaging specification management software. In this study, Global PKG, Inc., Mountain Systems, Inc., Mystic Management Systems, Inc., Paxonix, and Sky Technology Partner, LLC are the only companies found to offer complete off the shelf packaging-related software management systems. Most of these companies are in the process of updating or developing new software systems in order to meet packaging documentation and supply chain management needs. It is expected that most of these companies will have these systems developed within a year.

Each type of software these companies have produced or are in the process of producing has some significant differences in internal functions. Some current versions are lacking in areas of security access, version control, and in the dynamic updating of data. The external functions that build a web environment for packaging documentation are a true differentiator among packaging-related software companies. Companies that deal with packaging documentation and purchase software with a web-based program are realizing that they can effectively use this technology to exchange critical business information in a real-time web environment. They are bringing products to market faster and at a lower cost than their competition.

A packaging engineer's best alternative for solving complex problems may be a team of resources and contacts that can be drawn together and communicate real time on a web-based program. Today's e-commerce tools are providing solutions to revitalize the packaging engineer's position, as well as providing instant resources and the ability to develop and maintain relationships with colleagues, suppliers, and customers. The challenge for the packaging engineer and the company is often the transition to the new technology.

## 2.2. Global PKG, Inc.

The GlobalPKG website states GlobalPKG is the only comprehensive web-based solution for the fragmented packaging industry today. (GlobalPKG) While GlobalPKG may be comprehensive, this is not exactly a true statement since the other companies previously listed either already have a web-based solution or will soon be coming out with one.

GlobalPKG is a relatively new company that has a product demo on its website. The publication Packaging World reported in April 2002 that the GlobalPKG company was founded from two other failed companies. A firm named 3Com streamlined package design through the use of an application service provider called WebPkg . Meanwhile, Proctor & Gamble started some involvement with an online solutions provider, Packtion (Reynolds). However, both Packtion and WebPkg have gone out of business, and the latter company is said to be resurfacing at www.gpkg.com.

GlobalPKG mentions on its website that it is committed to the idea that a product-centric approach toward packaging solutions can address the enormous impact that packaging has on the total cost of product and reveal intriguing opportunities to enhance competitive advantage throughout product life cycle (GlobalPKG).

## 2.3. Mountain Systems, Inc.

Mountain Systems, Inc. (MSI) is a leading application software development company for the manufacturing industries. In 1999, Sarbrook Company, Inc. was acquired by Mountain Systems, Inc. and added the software WinSpex to Mountain Systems Inc.'s line of products and services. Sarbrook Company, Inc. was founded in 1990 to offer fully integrated software systems to meet its clients' manufacturing information control needs. The goal: to maximize a company's management and distribution of information, thereby increasing their efficiency, performance, and profitability (Sarbrook).

Though the product promises great results, MSI has decided to phase out WinSpex by fall 2003 in order to introduce a new product. Thus, it would not be worthwhile to incorporate WinSpex in the near term. The software development company IntellaPac is taking over all of WinSpex business applications, but technical support is limited.

One of the advantages of using WinSpex was increased accuracy in their software by way of standardized specification formats, which reduces the chance of errors and/or duplication. Security has strict control over access and approvals, and access to each data field can be individually controlled. A full audit history is automatically recorded for monitoring and quality compliance.

Another key objective of this and other software specifications systems is reducing time to market. This can be achieved via shorter lead times for approval of new and revised packaging materials. Enhanced communications between individuals, departments, and locations results in a more efficient workflow. Immediate real time, on-line access to information is available to all users concurrently with this software.

With Winspex, specifications systems are designed to meet individual company needs, with a standardized template created for each packaging type. For example, the system for a user of plastic bottles might include templates for bottles, closures, labels, and outer cases. These would be custom designed to accommodate a company's specific data requirements.

## 2.4. Mystic Management Systems, Inc.

Mystic Management Systems, Inc. (MMS) was founded in 1984 to develop database solutions for specification and document control (Mystic Home Page 2). Mystic specializes in applications for document change control, document life cycle management, and work flow integration. Mystic is one the earliest entrants into the packaging and Planning Demand Management (PDM) market. The base software system, DCS 2000, was developed with the idea to provide a secure and structured method for handling critical information relating to product design and associated manufacturing processes. MMS had announced plans to launch a new Document Control and Specification Management Software Solution on October 1, 2002, named DCS 6.0 Professional. DCS 6.0 Professional is being marketed as a high-performance document control and specification management application that provides great flexibility and enterprise collaboration that aids companies in controlling their documentation processes and addressing stringent regulatory requirements (Mystic Home Page 1). This application has a web-based program.

## 2.5. Paxonix

Paxonix announced in December 2000 the development of an Internet enabled system designed to help consumer product companies improve profitability and global competitiveness through new and better ways of creating and commercializing packaging. Paxonix is responding to the need for a more integrated and collaborative approach to packaging design and development. They are looking to help companies accelerate their speed to market for new product launches and relaunches. (Paxonix Home Page 1)

This system would be difficult to implement at Duracell, since getting started begins with transitioning projects, project teams and assets to the Paxonix environment. Transitioning to this system would be extremely difficult for Duracell or any other company that already has a solid foundation with another packaging software system. However, Paxonix does provide a service team to, among other things, assist with converting a company's product and package development process over into the Paxonix environment.

Companies joining Paxonix can utilize tools defined by their level of monthly subscription. The tools, available to both PC and Mac users via standard Internet browsers, employ intuitive features to guide users. Users begin by accessing Paxonix's packaging specification service to build packaging and specifications from scratch, or else they can work from designs stored in templates. Artwork for a customer's brands or products can easily be retrieved from a centralized library through the digital asset management service. Graphic and structural components can be prototyped by using Paxonix's 3-D modeling software. (Panonix Home Page 2)

Paxonix tools include Information Services, where users will find: a library of packaging designs for use within the public domain, market research, industry news, including certain

regulatory information, and best-practice approaches. Also planned are educational courses in packaging subjects for personnel with different functional backgrounds and levels of experience, as well as training sessions for Paxonix tools and services and packaging equipment technology.

A key element of Paxonix is its collaboration tool set, which allows companies to convene design, production and project management teams in a coordinated working environment. It also allows for real time audio and video conferencing, as well as task management and storage capabilities.

## 2.6. Sky Technology Partners, LLC

IntellaPac, a subsidiary of Sky Technology Partner, LLC is a software solution provider for product and packaging specification management solutions. IntellaPac Pro claims to be the first 100% fully off-the-shelf, web-enabled, template-driven specification management system. Its key feature is that it provides a powerful database that serves as a central repository for specification and related content. IntellaPac Pro is a tool that supports communication, collaboration, and process improvements throughout the product development and delivery cycle. It is a suite of products built around product and packaging specifications, including quality and ingredients add-on modules. IntellaPac provides implementation and process improvement consulting services to promote the effective use of IntellaPac Pro to meet client objectives. This software is currently being developed and expected to be introduced in the first quarter of 2003. (IntellaPac)

## 2.7. Reasons for Staying with Mystic's Software

After researching many companies that develop packaging documentation management software, I have concluded that Mystic Management System, Inc. is the right choice for Duracell's packaging department. Going to another system would be an expensive and time intensive change. Such an extreme change would only be valuable if there were dramatic cost reduction capabilities in going with another system. Furthermore, some of the companies examined do not necessarily offer all of what they advertise. After previewing the software demos, I found that some systems had many control problems with important documents. Additionally, staying with the same company would help the transition to the new technology, DCS 6.0 Pro. Having Mystic convert the existing data operating in DCS 2000 to DCS 6.0 Pro minimizes the challenge.

Mystic's "Upgrade Proposal of DCS 2000 to DCS 6.0," sums up the positive influence DCS 6.0 Pro would have on Duracell:

> DCS 6.0 Professional is a complete upgrade of DCS 2000. It is a document control system that takes all of the functionality from its previous versions developed over the years, and migrates in to a more widely accepted technology platform. This solution will enable Duracell, The Gillette Company in Bethel, Connecticut to continue to maintain a quality electronic document control system while incorporating technology and architecture that are the most flexible, up-to-date and widely used. This upgrade not only gratifies users and information technology personnel, but its open platform enables easy interfacing with other enterprise applications, that in turn satisfies employees throughout the organization. (2)

The technology changes found in Mystic's newly developed DCS 6.0 Pro have been analyzed to determine if the software can adequately manage Duracell's packaging documentation and to see if the upgrade to DCS 6.0 Pro is worth Duracell's time and money. The results are detailed later in this study.

# 3. THE IDEAL SYSTEM FOR DURACELL'S PACKAGING SPECIFICATION MANAGEMENT SYSTEM

## 3.1. Process Flow of Packaging Documentation/Project Information

In order to have effective packaging data management software, a proper flow of information has to be developed in an organized sequence for each packaging engineer's project. A packaging engineer should be able to clearly detail the steps that need to be done to successfully finish a project. Packaging data management software should assist in guiding the flow of packaging information for proper approval in an efficient manner. If the software is effective, then procedures for work should be in place. Duracell has done this to some extent in order to standardize the flow of information.

Duracell's packaging development and revision process helps packaging engineers by having them determine how documentation is developed from start to finish. This process was highlighted by the Duracell Packaging Department's Flowchart (appendix E), which displays the key steps that are established for completion of a project. The first step comes from the Packaging Change Request (PCR), which explains the need for packaging component(s) revision or introduction. This documentation work is established by the department(s) involved in the packaging components completion, and it needs to be completely thorough for proper execution. Currently, all of the steps that follow PCR approval involve working with DCS 2000. The approval of this documentation is exported into DCS 2000 and given a code for reference.

Projects can be started with information from the packaging engineer and the information from the PCR. Research tools provided within DCS 2000 help initiate the management of the project. If any packaging components do not exist, new CAD designs, new part numbers,

material options, and terminology have to be taken into consideration. Development can lead to more approvals for new products by evaluating prototypes, component testing, and artwork.

An example of a less difficult project, which does not involve a lot of steps for completion, might be a date code change on a blister card. No structure changes occur. Only a revision to the text in the artwork would be made. The drawing would have a revision number change to it, and no dimensional changes would need to be taken into consideration. Approvals would need to be done quickly using DCS 2000 in order for documents to be released in distribution for production in a timely manner.

Duracell's packaging development project process would ideally make packaging engineers pinpoint what to consider when dealing with a project. This process was created by the Duracell Packaging Department's Flow Chart (appendix E), which displays key steps for knowing what processes to take into consideration for completion of a project. The entire flow chart possesses a course of actions that can fulfill a majority of project demands that come from the PCR.

The most important category involves the measurements category, since projects can or should be measured by how well a packaging engineer is effectively completing the work at hand. The steps listed in the flow chart are developmental steps that a packaging engineer must be familiar with in order to take the correct course of action.

### 3.2. Needed Software or Management Functions

The amount of software functions Duracell needs to operate and manage on a successful basis should be determined by use of a well thought out checklist. The checklist (table 1), developed by Industry of Packaging Professionals (IoPP), displays the possible functions or requirements any company would need to take into consideration when managing packaging documentation systems.

**Table 1**

**Automatic Packaging Specifications System Checklist**

1. **<u>What needs to be included</u>?**
    1. **Packaging Information - Standard "Boilerplate"**
    2. **Free Text**
    3. **CAD and/or hard copy drawings**
    4. **Attachment files - Text**
    5. **Attachment files - Non-text (scanned or computer generated)**
    6. **Attachment files - Self launching external applications or viewers**
    7. **Label/ Graphics Control**
    8. **Packaging Test Methods**
    9. **Approved Vendor List**
    10. **Bill of Material System**

2. **<u>Who will use the specifications</u>?**
    1. **Manufacturing/ Engineering/ Maintenance**
    2. **Quality Assurance**
    3. **Purchasing**
    4. **Planning**
    5. **Marketing/ Graphic Design**
    6. **Vendors**

3. **<u>What will we use the specifications for</u>?**
    1. **Specify packaging for purchasing**
    2. **Cost Savings Programs - Identify materials and cost sensitivity**
    3. **Inventory Control and Production Planning**
    4. **Incoming inspection and manufacturing troubleshooting**
    5. **Guidelines for graphics designers**
    6. **Historical records of technical specifications and/or graphics**

*(Table continues)*

Table 1 (continued)

4. **Special Requirements and Opportunities**
    1. **Secure read, write and approval system**
    2. **GMP, ISO 9000 and other outside requirements**
    3. **Obsolete record maintenance and purging**
    4. **Secure and/or public Internet specification availability**
    5. **Special report generation**
    6. **Hardware, Software and budget requirements**

*Note*. This checklist was presented at the May 1996 meeting on "Automated Packaging Specifications" of the NJ Chapter of IoPP: © 1996 Andrea S. Mandel. (Mandel)

The four categories from the checklist (1) What needs to be included?, (2) Who will use the specifications?, (3) What will we use the specifications for? and, (4) Special Requirements and Opportunities are almost all of the functions or requirements needed for Duracell's system. Under the "What needs to be included?" heading, an additional function needs to be considered for Duracell and other companies utilizing packaging software management tools. This function is "Updates in Technological Innovation," which would enable constant growth and software development maturity.

Companies rely upon information to pass through a series of processes based on document approvals in order for products to reach the marketplace faster in a controlled manner. This gives companies the competitive edge that they need to become successful. Duracell technologically needs web-based technology, interface software (computer programming) technology, and server technology to maximize its process efficiency.

The IoPP checklist is a useful tool for a new company's packaging department to help with packaging documentation. A new company's packaging department might not know how to go about purchasing documentation software and might not understand all the proper management functions that need to coordinate with it.

The Duracell packaging department needs to improve and update its checklist. The checklist below (table 2) is an example of what would help Duracell implement a better system. The functions of this system and this checklist will be evaluated throughout the new DCS system in chapter 4.

**Table 2**

**Ten Needed Software or Management Functions**
(functions are listed in no particular order)

1. Web-based technology
2. Oracle server
3. Security/Control capabilities
4. Daily automatic back up system performed at a downtime
5. Consistency of terminology
6. Interface with J.D. Edwards
7. New BOM format
8. Greater search capabilities
9. Greater approval capabilities
10. Having DCS functions effectively manage workflow

Source: List created by Gregory M. Cullen.

The reason to have web-based technology for Duracell is to have faster distribution of approved documents to the proper manufacturing affiliates. Currently, the packaging department mails out hard copies of documents on Thursday of every business week. Therefore, it is a once per week distribution of documents. Sometimes hard copies are not mailed for one reason or another, or if they are mailed, they may not be sent to the proper manufacturing affiliates. Web-

based technology would prevent many errors from happening, along with enabling a faster approval process. A paperless system that releases most of the documentation would be ideal. The end result would be a success, as long as it is properly managed.

If Duracell had an Oracle server, it would be able to provide a much more stable and scaleable platform than DCS 2000 as a back-end database option. Since DCS 2000 at Duracell uses a Microsoft Visual FoxPro platform, many errors occur (mostly computer glitches) because of a lack of database stability. If Oracle were used, it would enable more functionally within the system.

Security and control capabilities are important protections for Duracell's packaging-related specification documents to ensure the integrity of confidential documents. If documents were to get out to Duracell's competitors, it could lead to an uncompetitive edge for business profit. Vendors or suppliers could have unauthorized access to documents that are not assigned to them. They should not be able to view any documentation that does not pertain to them.

Another good function is a daily automatic system back up during down time. This enables work to done at a time when it needs to be (rather than having users wait for the back up to be complete). Currently, the system does an automatic back up or else does the morning updates when the first employee logs into DCS 2000 each morning. This DCS 2000 process can take from 20 to 30 minutes to complete. Computer work may need to be done first thing in the morning. Therefore, the system should ideally be scheduled to run independently in the background without needing an employee log-in and not at a time when a great deal of work needs to be done.

Consistency of terminology is important for Duracell in order to clarify what is being conveyed to the user. There are many circumstances where internal or external departments do

not understand the packaging terminology being used on the BOMs. Changing the hard copy document of a BOM format and effective communication are the solutions to this problem.

A reason for Duracell to have an interface with J.D. Edwards is to eliminate errors that occur when the supply chain department has to retype information that comes from BOMs. Time is saved by not having to re-type packaging information.

Duracell should have a new BOM format to decrease confusion that occurs with terminology and digit values. Much of the ineffectiveness brought to light by the questionnaire (appendix C) can be resolved with a different layout that incorporates the hard copy of the BOM.

Duracell needs to have greater search capabilities to make it faster and easier to approve needed documents. Being able to search for dimensions in a packaging component that has the same dimensions you are looking for can save time. Being able to get an exact match for a component or come close to an exact match for a component that you need is an effective tool. Having search tools that extend beyond DCS 2000 capabilities (search by code, document type, status level, data field, title phrase, etc.) would be an advantage for many projects done at Duracell.

Greater approval capabilities can be valuable for Duracell, and it would be enabled with reminder notices to approvers and the ability to change a user in the system in order to make approvals. If a packaging engineer is sick or goes on vacation and a document needs an approval, the system administrator or someone could be assigned to approve the document. This would eliminate the need to wait for a packaging engineer who put a packaging document in a certain status (such as Submitted) where other engineers could not get to this document to make an approval. Reminders for approvals from DCS would help a great deal, since many packaging engineers usually have a large workload. Projects needing completion could be managed better

throughout the department. Lastly, mass approval of documents is another option that would facilitate document approval.

The reason to have DCS effectively manage workflow at Duracell is for guidance purposes. All levels of packaging engineering (entry to senior) should get in the habit of having a reference for any projects in front of them at all times. A function that can record and organize by categorizing each status level of documents (new, review, submitted, approval, current, and historic) worked on by the user would be helpful.

### 3.3. Avoiding Obstacles

In evaluating hundreds of software packages over the years, Dave Garwood explains three isolated reasons why "computer solutions" fail:

> 1) *Company's expectations of the software packages significantly exceed the packages' capability.* While customizing and modifying software packages should be minimized, enhancements are usually inevitable. Writing programs to interface with existing systems is often required. Some features may be necessary for one company but not for another, which is logical, since it's impractical for the software packages to have every feature every company needs available. Many companies purchased a software package and were simply not prepared to bring the software capabilities up to match their needs.
>
> 2) *Shortcomings in software packages are discovered too late.* This is the "Surprise!" syndrome. One might expect the packages to be functionally complete. They aren't. If missing items aren't discovered until deep into the implementation process, you can expect lengthy delays while programmers fill in the blanks.
>
> 3) *Inadequate support from Systems and Data Processing.* Competent Systems/Data Processing personnel are a critical resource, especially when the software is not complete. When enhancements or modifications to software packages are required, people with a sense of urgency and a track record of getting the job done are essential. There are educational and behavioral questions here as well. Sometimes programmers don't really understand the user's needs. This typically happens in companies where time isn't spent educating Data Processing people as well as users. (198-199)

What can Duracell do to overcome each of these three obstacles? The best answer for this question is to try to be prepared for every possible outcome of DCS output. Duracell can use

Mystic's history of programming experience to its advantage. Since Duracell has worked with Mystic on its first software, it is easier to know what to expect on the next up and coming software.

By having all areas of documentation and management researched, an easier solution will be achieved. Effectively working with Mystic by together developing a specification management system will help Mystic develop a software version based on Duracell's needs. By providing the necessary management tools and having the proper technical support will make the end result a successful experience. Standardized training for all users will help educate them about efficient document work processes.

# 4. EVALUATION OF THE DCS 6.0 PRO SYSTEM

## 4.1. Conditions of Evaluation

The conditions used for DCS 6.0 Pro have been conducted on the basis of Duracell's needs. An upgrade to DCS 6.0 Pro will be determined by the changes made to DCS 2000. A comparison of DCS 2000 and DCS 6.0 Pro will be examined to find the strengths and weaknesses of the new DCS 6.0 system.

A demonstration CD of DCS 6.0 Pro software, an evaluation guide that comes with this demo, and questions answered by the DCS IT Manager will be the basis for the comparison between DCS 2000 and DCS 6.0 Pro. Documents used in DCS 2000 will be examined in DCS 6.0 Pro through Duracell's current DCS 2000 process of creating, approving, and releasing documents.

The first step towards setting conditions was choosing the necessary functions Duracell needs in order to develop an ongoing successful packaging department operation, which was explained in chapter 3. The second step is to evaluate how the ten functions will be achieved or accomplished through DCS 6.0 Pro. This step was conducted from Mystic's understanding of how this new software is going to work for Duracell. The third step is to acknowledge what requirements are needed to operate DCS 6.0 Pro beyond the ten functions needed. The fourth step is to determine if Mystic's new technology and pricing for a DCS 6.0 Pro upgrade is a reasonable deal.

If the changes have 90% of what the needed changes are from the ten needed functions checklist, then a passing result will be given. Fair pricing for the software must be negotiated between Mystic Management Systems, Inc. and Duracell. Fair pricing for DCS 6.0 Pro should be based on the history of Duracell dealing with Mystic's DCS 2000 system and the amount of

savings DCS 6.0 could potentially provide for Duracell. The 90% passing rate has to include an effective web-based capability. A passing result will mean a recommendation to stay with Mystic Management Systems, Inc. and purchase of DCS 6.0 Pro.

### 4.2. Processes Used for Evaluation

The following processes have been used to evaluate the performance of DCS 6.0 Pro:

The first process used for evaluating the ten functions was to get the necessary questions answered in order to determine if the ten functions can be achieved effectively. The IT Manager, Dave Ahrens, is the leader for developing DCS 2000 and DCS 6.0 Pro. He will be answering any questions.

The second process for some of the ten needed functions will be evaluated through use of Mystic's DCS 6.0 Pro evaluation demo. The ten functions will be evaluated to determine which can be examined through use of the demo. The functions that cannot be examined through use of the demo will be evaluated by the questions answered by Dave Ahrens. The needed functions (table 2) that were addressed by the Demo and evaluation guide will have a (D) next to them.

**Table 3**

**Ten Needed Software or Management Functions (D)**
(functions are listed in no particular order)

1. Web-based technology
2. Oracle server
3. Security/Control capabilities (D)
4. Daily automatic back up system performed at a downtime
5. Consistency of terminology (D)
6. Interface with J.D. Edwards
7. New BOM format
8. Greater search capabilities (D)
9. Greater approval capabilities
10. Having DCS functions effectively manage workflow (D)

Source: List created by Gregory M. Cullen.

Each one of these needs will be thoroughly examined. Function numbers 4, 7, and 10 on the checklist especially will be analyzed, since Duracell encounters problems with these functions on DCS 2000.

The third process is to determine if a new BOM format for hard copies could be developed for manufacturing affiliates. From this process, a current version of a BOM within DCS 2000 will be used to reformat a layout for a new BOM format hard copy. This process would create a solution to a major problem that DCS 2000 has developed.

The fourth process is providing the deliverables needed for Duracell to implement DCS 6.0 Pro from Mystic Management Systems, Inc.

The fifth process is having a cost comparison between DCS 2000 and DCS 6.0 Pro, along with any analysis of how much this technology should be currently worth, all things considered. The cost differences will be provided in the section 4.3.

## 4.3. Cost Differences with the Two Systems

| Description | Qty | Per Cost | Total Cost |
|---|---|---|---|
| Editorial User Licenses – Connecticut Installation | xx | $xxxx | $xxxx |
| Editorial User Licenses – Additional Installation in Germany† | x | $xxxx | $xxxx |
| View Only User Licenses | x | $xxxx | $xxxx |
| DCSmail | x | $xxxx | $xxxx |
| Custom Template Conversion | x | $xxxx | $xxxx |
| Data Conversion | | | $xxxx |
| Installation & Training | | | $xxxx |
| Increase in Technical Support Agreement | | | $xxxx |
| **TOTAL UPGRADE PRICE** | | | **$69,500.00** |

† Cost is applicable if a separate Data Repository will be installed at this location. A separate repository indicates that a complete and independent system installation of DCS 6.0 Professional, and yet accessible by other Duracell locations. Remote locations can have the ability to access the system over a Wide Area Network. If users in Germany are accessing the DCS system via WAN, then pricing is included in Bethel, Connecticut location.

**Proposal Terms:** *Proposal is effective for 15 days commencing on October 9, 2002.*
**Payment Terms:** *50% deposit due upon acceptance of proposal, remaining balance due after installation.* (Mystic)

Source: Upgrade Proposal.

**Fig. 1. An upgrade proposal price for DCS 6.0 Pro.**

MYSTIC MANAGEMENT SYSTEMS, INC.

# Invoice

| DATE | INVOICE # |
|---|---|
| 11/9/98 | xxxx |

12 Roosevelt Avenue.
Mystic, CT 06355

| BILL TO |
|---|
| xxxx |

| P.O. NO. | TERMS | PROJECT | |
|---|---|---|---|
| | On Receipt | | |

| DESCRIPTION | RATE | AMOUNT |
|---|---|---|
| DCS SYSTEM - File Server system 60 concurrent users on single server | xxxx | xxxx |
| Installation and testing | | |
| Configuration and Training | | |
| Including | | |
| DCS Mail module | | |
| Custom Software Development | xxxx | xxxx |
| Modification of standard modules | | |
| to meet Duracell requirements | | |
| PCN Template | | |
| Cape Interface | xxxx | xxxx |
| Allowance for Conversion of Data | xxxx | xxxx |
| Payment Terms: | | |
| 30% on receipt of invoice $xxxx | | |
| 30% on December 15 $xxxx | | |
| 30% on system start-up (Jan 15, 1999) $ xxxx | | |
| 10% 30 days after start-up $ xxxx | | |
| CT Sales Tax | xxxx | xxxx |
| | **Total** | $88,500.00 |

Note: Cost was approximately $88,500.

**Fig. 2. Duracell's cost for DCS 2000.**

The pricing for DCS 6.0 Pro is estimated pricing, which does not include the resources Duracell needs upon installation (Oracle Server, Website Server, etc.). Currently, pricing for this new software might be under negotiations. The cost difference between a DCS 6.0 Pro upgrade and the total price of the entire system is approximately $19,000. The upgrade is clearly an economical choice. This upgrade pricing does not reflect what the pricing would be for a company that needs to do a complete changeover of a new specification management software system. A custom template conversion for Duracell is approximately $4,500 less expensive on DCS 6.0 Pro.

# 5. RESULTS

## 5.1. Perspective of Processes Analyzed

Under each needed function a process summary is presented for what DCS 6.0 Pro can or cannot accomplish for Duracell.

**1. Web-based technology**

DCS 6.0 Pro has a companion product, DCS.Net, which is a browser-based search application with password controlled access for locating and retrieving documents. It uses ASP (Active Server Pages) Microsoft Application for a Web Component, which provides web-based searching, viewing, and printing capabilities for Duracell affiliates that have connectivity to Duracell's Wide Area Network (WAN). A web-based application reduces hard copies of packaging documentation sent out in Duracell's once a week distribution process to Duracell's manufacturing affiliates. Since documents are electronically sent, the cost and time of mailing BOMs and other documents will no longer be a concern. Production of packaging components will be more effective because manufacturing affiliates will get the approved document faster. There is also an e-mail component that supports automatic distribution of documents to internal or external e-mail addresses. This function can be simply notification or distribution by attachment. Mystic has made a great achievement towards web-based technology.

**2. Oracle server**

For Duracell to have any type of effective specification management system, an Oracle server needs to be purchased, which is a separate cost from the DCS 6.0 Pro system. Oracle has the power to deal with database information storage, and DCS 6.0 Pro should be run off this type of platform. DCS 6.0 Pro has Visual Base (VB) 6 written in Oracle platform, which will provide

more database storage capability for the packaging department. It is written as a layered architecture based on COM objects written in Visual Basic version 6.0. DCS 6.0 Pro has a front-end client, also written in VB 6.0 and a view only client written in ASP (Active Server Pages) as a Browser-based application. The software supports either Oracle or MS SQL Server as back-end database options. Duracell will need an Oracle server for hosting DCS 6.0 Pro. Having an Oracle server will ensure a successful result in that a much more stable and scaleable platform will be provided than with DCS 2000.

**3. Security/control capabilities**

DCS 6.0 Pro offers better security than DCS 2000 by configuring user names, passwords, and their respective affiliated groups. Certain groups, departments, or company affiliates can have access to particular folders of information. DCS 6.0 Pro allows them to become controlled users (determined by the system administrator), which allows them to request documents from a search engine by a proxy server that relays to Duracell's site. From any location, the most up-to-date documents can be accessed, which creates fewer errors. When the Duracell site receives the request, it is forwarded back to the user. The system administrator not only controls who can be a user, but also what type or types of packaging documentation a user can have access to for viewing, downloading, or printing purposes. The way DCS 6.0 Pro is built, users who are not from within the packaging department are not allowed to see the folders of other types of packaging documentation from the desktop browser paradigm. The available user controls are shown in figure 3:

- View-Only access, where users can only view the content of Approved, Current and Historic documents. Contributors can create, edit and if given the right, delete documents but they cannot approve documents.
- Approvers are granted the rights to perform almost every function within the DCS 6.0 Pro system, except tasks associated with system administration (create users, groups document types, etc.)
- Administrators are given full access to the DCS 6.0 Pro system; they have the ability to configure the system settings. (Mystic Evaluation 6)

**Fig. 3. DCS 6.0 Pro User Controls.**

The evaluation of the demo showed how these controls (figure 3) were successfully achieved. Appendix F shows a print screen of the demo displaying the template used for dealing with user rights.

DCS 6.0 Pro supports multiple document repositories. Each repository can be accessed from any site that is on the network. A user would need a DCS 6.0 Pro account to log-in to a given repository. Each user at a given repository can have unique rights to the document folders. A user may not even know of the existence of some folders or may be able to navigate to other folders and not see any documents in that folder. Other folders that users have access rights for will enable them to read the documents within it, while in still other folders they may be given edit or approval rights. A user who has administrative rights configures all of these actions. Data fields can be defined as required for approval, forcing users to supply a value to this field before it can be submitted for approval (Anonymous 3). DCS 6.0 Pro has more enhanced security and control by configuring user names, passwords and their respective affiliated groups.

**4. Daily automatic back up system performed at a downtime**

DCS 6.0 Pro users will no longer see or be aware of a morning update at Duracell. This new system allows an update process that runs independently in the background and can be scheduled to occur several times a day if desired. The IT Manager, Dave Ahrens, would help Duracell in the development of this process. This is a great result, since the first user in the morning who logs in into DCS will not have to wait to use the system.

**5. Consistency of terminology**

Improvements with DCS 6.0 Pro include the ability to sort out keywords in the drop-down sections for packaging choices and the search process. Having DCS 6.0 Pro interface with an Enterprise Resource Planning (ERP) system, such as J.D. Edwards, will prevent mistakes by not having a person retype what is being said. The result ends up being a success in terms of two needed functions: consistency of terminology and greater search capabilities. Appendix F includes a display of the administrator's capabilities of accessing a template to determine what keywords will be used. Drop down fields that limit the user's choice of words to help produce the BOM enables the system to manage what terminology will be used in certain sections of the BOM.

Each initially approved BOM still needs to be looked over by a packaging manager to catch mistakes that would mislead company affiliates. Packaging engineers' terminology in the notes section of the BOM will be less confusing to an affiliate that is using the BOM. The best way for Duracell and other companies to avoid confusion throughout internal and external affiliates is to have effective communication through phone calls, faxes, e-mails, and meetings. Therefore, words or acronyms for a certain product or package do not create issues. This new updated DCS system does sort out confusion.

**6. Interface with J.D. Edwards**

The IT Manager, Dave Ahrens, can work with Duracell to develop and interface to J.D. Edwards, Duracell's Enterprise Resource Planning (ERP) system. Packaging specification information will be able to flow from DCS 6.0 Pro to J.D. Edwards. This will be a great benefit for Duracell's supply chain department since they will not have to retype important information that comes from packaging BOMs. This would also eliminate errors that might occur from retyping.

**7. New BOM format**

To evaluate the problems with BOM hard copies, two questions were answered by the IT Manager.

Greg Cullen: At Duracell, company-manufacturing affiliates receive BOM information. Before DCS 2000, the packaging department used an old system called Paradox. It showed BOM information in a print out or hard copy in a way that was easier for manufacturing personnel to use. Manufacturing feels it was much easier to read and interpret the "old style" matrix or BOM that showed components going into assemblies from left to right on the page. Quantities per item were easy to read and straightforward for them. Can DCS 6.0 Pro provide a better organized hard copy of the BOM that would be more effective than how DCS 2000 currently provides them?

IT Manager: Yes, we can create a BOM report that is better suited to your needs. We will be happy to work with you in designing a custom report for this.

Greg Cullen: At times, two revisions for the same drawing appear on a BOM. The revision at the top appears to be a two-digit number with the "0" always to the side of the actual revision

number (i.e., 2 0 rather than 2). Someone not as familiar with the BOM process might mistake that as a revision 20. Would this be represented differently with DCS 6.0 Pro?

IT Manager: In DCS 6.0, we have dropped the Temporary revision number paradigm, which is the extra number that follows the revision number that you referred to. You will not see this anywhere in DCS 6.0 Pro.

Appendix D illustrates the old BOM hardcopy. Appendix G illustrates the current BOM hardcopy. Lastly, appendix H illustrates the proposed BOM hardcopy. In these appendices the problems with the current BOM hard copy are displayed. These problems can be easily solved with a new proposed BOM hard copy (appendix H). With the ability to change the hard copy design, company affiliates will find evaluating the proposed hardcopy less confusing.

**8. Greater search capabilities**

To evaluate whether DCS 6.0 Pro had better search capabilities or not, the following question was answered by the IT Manager.

Greg Cullen: Can search features become customized with the ability to search for dimensions of a packaging component as well as having the other search features in the search engine (search by code, document type, status level, data field, title phrase, etc.)?

IT Manager: Most likely they are. Templates data are fully searchable. Document types can have user-defined attributes which are searchable with all the other standard search options. We will also be extending the search capabilities offered in DCS 6.0 Pro beyond what is presently there and would like to incorporate any of your needs in that process. The differences in extended search capabilities can be seen appendix F.

**9. Greater approval capabilities**

DCS 6.0 Pro has a companion product, DCSmail, which allows e-mail notifications. Different notifications can be developed, depending on what the system administrator allows. The e-mail notifications can be reminders for document review or approval and can go out to company affiliates from the creator or a proxy creator. DCSmail configures a message reminder until the document is approved. A function can set a reminder as needed: every hour, three hours, day, etc. and can be turned off for weekends and vacations.

DCS 6.0 Pro also has a function whereby the system administrator can give out proxy user capabilities to the authorized packaging department users in order to allow approval of a document under the original creator, whom may have submitted it. This will decrease the problems incurred by waiting for a packaging engineer who put a packaging document in a certain status, such as submitted, where other engineers cannot get this document to make an approval. It is also possible for DCS 6.0 Pro to provide a mass approval or deletion of documents.

Another approval capability is electronic signatures. DCS 6.0 Pro can track and document these signatures for reporting and auditing requirements. It forces users to re-enter their name and password whenever a significant document event (new, review, submitted, approval, current, and historic) occurs.

A great advantage in DCS 6.0 Pro is the ability to perform mass approvals or mass deletions. Currently, DCS 2000 makes the user approve documents one by one, and this can take time if many documents were created. Having a function that does mass approvals or deletions is necessary for the faster approval or deletion of multiple documents.

**10. Having DCS functions effectively manage workflow**

DCS 6.0 Pro will enable Duracell packaging data management processes to be more effective by guiding the document. The interface is similar to Microsoft Windows Explorer. Documents can be organized into a folder structure based on the system administrator's design (appendix F). The interface is very intuitive and familiar. The result of this familiarity with users is a significant reduction in implementation and training time.

DCS 6.0 Pro will use a document check in/check out paradigm. A checked out document can be edited immediately, worked on at home, or while traveling; then checked back in. (Anonymous 4) However, internal documentation types like templates and BOMs must be worked on in the Main DCS 6.0 Pro environment. The types of documents that can be checked out are external documents that are Windows-style documents (Word, Excel, etc.), which are imported into DCS 6.0 Pro.

To move workflow along, DCS 6.0 Pro has the capability to process automatic calculations (millimeters into inches) in a section of a template. DCS 6.0 Pro also has the ability to configure document contact information at the document level. This ability will make it easier for manufacturing to know how to develop a document, with contact information at their fingertips.

Improvements in editing capabilities would be achieved by having new relational linking. This allows expanded editing capabilities, which makes it easier to work more effectively in DCS 6.0 Pro. DCS 2000 used user data as primary key in its relational tables, making that data non-editable. DCS 6.0 Pro uses numeric key to relate records in different tables. This allows complete editing of all user configuration data. When a batch of documents is imported, users will not be required to revise these imported documents. Instead, they supply a code and

revision number, and this data can be edited when the document is in new status. Group names, department names, user names can now all be edited in DCS 6.0 Pro.

DCS 6.0 Pro has an effective way of measuring work for a user by having the capability to do monthly reports. For audit purposes Duracell can rapidly receive archived documents with linked relationships. Permanent transaction logs provide tracking for each document and a configurable audit log allows administration to view who has been working on the document and what actions they performed. DCS 6.0 Pro system supports the compliance of numerous government and standards organizations regulations, including FDA Title 21 CFR Part 11, cGMP and ISO 9000 standards. DCS 2000 allows you to select what is and what is not audited. DCS 6.0 Pro automatically audits all relevant information, and no setup is required (Mystic Software 3).

## 5.2. Perspective of Deliverables Needed for DCS 6.0 Pro

In order for this implementation to be as efficient and effective as possible, the details deliverables by Mystic Management Systems, Inc. and Duracell, The Gillette Company, Bethel, Connecticut must be required.

**MYSTIC MANAGEMENT SYSTEMS DELIVERABLES:**
Mystic Management Systems, Inc. proposes to install into DCS 2000, DCSmail solution:

- Conversion of existing data operating in DCS 2000 for operating on DCS 6.0 Professional at Mystic Managements Systems location.
- Conversion of three (3) existing custom templates at Mystic Managements Systems location.
- Testing of all data and custom templates in the DCS 6.0 Professional System at Mystic Management Systems location.
- Pre training, Mystic Management Systems will coordinate and collaborate with Duracell to prepare for data coding and setup.
- Implementation and installation of software and data will take place at the Duracell, The Gillette Company location in Bethel, Connecticut with a representative from Mystic Management Systems onsite.
- Training of all users and administrators by a representative from Mystic Management Systems, Inc. will take place at the Duracell, The Gillette Company location in Bethel, Connecticut.

**DURACELL, A PART OF THE GILLETTE COMPANY, DELIVERABLES:**
Mystic Management Systems, Inc. requires that Duracell, The Gillette Company provide the following support for upgrading their DCS 2000 system to DCS 6.0 Professional:

- Provide and send a complete copy of current DCS 2000 system and existing data for the conversion and development of DCS 6.0 Professional to Mystic Management Systems, Inc.
- Any technical support for installing files and granting network privileges.
- A MS SQL or Oracle Server for hosting DCS 6.0 Professional.
- A Windows Server to Host scheduled services.
- A Website Server to host DCS.Net – if applicable.
- Pre training, Duracell will have coordinated all setup and coding requirements with the support and collaboration of Mystic Management Systems.
- Duracell will provide an appropriate operating system for installation and operation of all software products.

Duracell will provide an environment conducive to learning and training users and administrators. (Mystic Upgrade 4)

**Fig. 4. Deliverable Requirements.**

These deliverable requirements are important points to realize in order to determine the significant costs of labor and additional software that might have to be applied when updating the system. DCS 6.0 Pro is packaging-related specification software that needs the mentioned deliverable requirements to perform effectively, which is a standard practice for purchasing this type of software.

### 5.3. Perspective of Cost and Rating of DCS 6.0 Pro

A new company wanting to purchase Mystic's DCS 6.0 Pro would require a different contract than Duracell's prospective contract. This would also come at a higher cost for the software. The upgrade price was determined by Mystic to be approximately $69,500. A lower cost should be evaluated on the basis of history between Duracell and Mystic. Many difficulties that were not the fault of the user occurred with using DCS 2000. Downtime caused by DCS 2000 errors has created a lack of trust with the software. The data conversion cost and installation and training costs, which were over $15,000, were waived from the initial cost. The total cost of $52,000 would be a more acceptable cost for the upgrade of DCS 6.0 Pro, especially considering the hardship DCS 2000 has created at Duracell.

Over the last four years Mystic has provided respectable business with Duracell. Yearly maintenance costs of DCS 2000 and providing the technical support have been needed due to the numerous problems that have existed with DCS 2000. Understanding how Mystic has progressed over the years has established them as an honest company to deal with for an upgrade.

The amount of opportunity cost savings that can be accrued from using DCS 6.0 Pro is substantial. For example, the amount of time saved from using DCS 6.0 Pro to release approved documents can be taken from seven days down to one day. Hypothetically, Wal-Mart's business for Duracell is projected to be approximately 30% of the Duracell's $100,000,000 annual sales. From the annual sales, 15% of that amount comes from a product mix of batteries that are in powerstation displays. These displays are considered to be an effective promotional tool for Duracell, and the annual sales calculate to be $15,000,000 a year out of a four-quarter year. Each quarter consists of having $3,750,000 sales, which is $288,461.54 sales per week. The

sales per week is an opportunity cost that occurs from on time delivery of powerstation displays to Wal-Mart. If the BOMs for the powerstation displays need to get to production scheduling in less than a week and it does not happen, that could potentially reduce opportunity cost by $288,461.54 of sales. The faster a BOM is approved and released to manufacturing means incremental opportunity cost will increase towards being able to do more powerstation display business.

The end result for this Wal-Mart business example is extreme; however Wal-Mart is not the only retailer Duracell has as a customer. If Duracell can effectively satisfy all of its retailers by getting product to them faster, it means sales can be increased. Better scheduling for run time on the production floor needs to happen in order for DCS 6.0 Pro to have the potential for improving processes and increasing profit. Furthermore, beating competitors to market and capturing their sales could arise from the example given. The faster release of errorless packaging documentation can make a difference for generating sales and establishing a positive relationship with retailers.

The overall results from the research gathered on DCS 6.0 Pro and a complete understanding of the system and its needs have been established. DCS 6.0 Pro is a positive solution to all of the ten needed functions at Duracell. The end result of this system would cut down a product's time to market by having a faster approval of documents and the distribution of documents would be faster since approval is done on-line. Labor time and cost would also diminish, since Duracell's planning demand management would not have to retype information from BOMs. The whole system is a more effective solution in which all types of personnel will be able to adjust. The DCS 6.0 Pro functions, per the criteria noted earlier, allow the rating of

the system to be 100%. Mystic's pricing can be renegotiated, and such a renegotiation of price would be dealt with under the terms of Duracell and Mystic.

# 6. CONCLUSIONS

## 6.1. Conclusions

Based on the lack of capabilities and the problems that arise with DCS 2000, an upgrade to DCS 6.0 Professional would be a sensible decision to make for a packaging-related specification management system with great operating potential. From the CD demo offered by Mystic Management Systems, Inc. and other research presented in this study, DCS 6.0 Pro has proven that its system is extremely beneficial for Duracell. With DCS 6.0 Pro it enables Duracell to:

a) Have an open platform that has the ability to interface with J.D. Edwards.

b) Reduce cost and time associated with the once a distribution process of documents in the Packaging Department.

c) Create a sufficient amount of document approval/distribution time and effectiveness for packaging engineers.

d) Reduce time to market.

e) Decrease rework by eliminating outdated specifications.

f) Assure compliance with ISO 9000 standards, and other government and standards organization regulations.

g) Communicate with internal and external departments more effectively.

These are some changes that would make Duracell's organization more effective. Packaging engineers at Duracell would be able to focus more of their skills on cost savings opportunities, new products, and productivity improvement programs. This solution would help

Duracell maintain a quality specification control system, while integrating technology and software design that are the most flexible, up to date and widely used.

### 6.2. Future Considerations

If Duracell should implement DCS 6.0 Pro, the following considerations are important to remember:

a) The creation of a custom template should be worked closely with a Mystic's programmer and internal /external managers who are affected by this software in order to have the most effective system – the programmer really needs to understand the user's needs.

b) All of the end-users who have to deal with DCS 6.0 Pro, and communicate effectively by making sure how the system will be utilized before the purchase of DCS 6.0 Pro.

c) If this system will become global, then important differences with the system may have to be taken into account, such as the differences in measurements (inches and millimeters).

d) Training must be provided to every type of user and each user needs to be completely aware of how to use DCS 6.0 Pro.

e) That data conversion between DCS 2000 and DCS 6.0 Pro must be done properly – Duracell needs to have a full understanding of how it is going to be implemented.

Productivity of packaging engineers is greatly influenced by packaging-related specification management software systems. The faster packaging component documents accurately receive approval will result in having a BOM document approved, which will greatly enhance the day-to-day operations of Duracell. Packaging engineers are then capable of effectively managing change that leads to improve productivity and cost savings.

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## Appendix A: Types of Duracell's Packaging Documents

The current 24 DCS Document Types are described below, along with the current total amount of that document type in DCS 2000 on September 23rd, 2002. This list does not include any revision(s) that might have been made for each document.

ARTK – Artwork is a published document file that is used as an electronic file developed for printing a specific packaging component. The artwork will specify graphic size, shape, and color. A user creates a total of ten digits that comprise the document code in all artwork documents. The current total amount of this document type is 5,619.

ARTL – Artwork Transmittal Letter is a letter written in a word document file to a vendor that releases packaging component artwork. It describes the specific component artwork, color standards, and revisions, if they were made, to the artwork. Personnel who are responsible for the integrity of this artwork receive copies of this document. This document code is included with all artwork transmittal letters. The current total amount of this document type is 1,240.

BILL – Bill of Materials (BOMs) are used to list quantities, describes packaging components, display notes for manufacturing use, and list related documentation required for a specific packaged product. The document identifies each component and associated document by part number. Each component is assigned a quantity value for package arrangement in the first section of the BOM. In the second section (Related Documents), no quantity values are needed. However, every attached component code is needed for all the planning or production information. The BOM code is essentially the Storage Keeping Unit (SKU) created by a user. This code varies a great deal, depending on the type of packaging BOM (consumer unit pack, open stock, display, etc.). The current total amount of this document type is 4,511.

CPPN – Cape Pallet Pattern is developed for each product/package to indicate how manufacturing should stack and wrap cartons on pallets for shipment. This information is in the Related Documents section of BOMs. DCS 2000 will automatically generate all codes. The current total amount of this document type is 1,052.

CUPK – Consumer Unit Pack contains a template of information for the Related Documents section of BOMs. It describes the primary pack title, code and revision numbers, plant(s) where manufacturing occurs, quantity of product, size (outside dimensions), cube, weight, and notes. The current total amount of this document type is 342.

DASS – Autocad Drawings of Product/Packaging Assembly shows how packaging components are assembled together, and is found in the Related Documents section of BOMs. The current total amount of this document type is 170.

DIST – Distribution, Secondary Packaging contains a template of information for the related documents section of BOMs. It describes the secondary packaging – title, code and revision numbers, plant(s) where manufacturing occurs, quantity of product, size (outside dimensions), cube, weight, and notes. The current total amount of this document type is 1,637.

DOC – Wordpad is not used on a regular basis, but could be used for notes or presenting guidelines. The current total amount of this document type is 1 for heat seal, varnish, and high gloss coatings.

DRWG – Autocad Drawings of Components is used to graphically represent components or assemblies by showing their outline and associated dimensions. Sections that identify artwork, revisions, or important component notes are usually included on the document. The current total amount of this document type is 4,053.

FCST – Excel Document Project Forecasts can be used to forecast projects. The current total amount of this document type is 3.

FLOW – Visio Documents of Process Flows are used to document the process of any important packaging processes. This is important in order for employees or customers to get a better understanding of how the system works. The current total amount of this document type is 2.

IASS – Illustrator Assembly Drawing provides digital pictures of how packaging component assembly works. It is adequate to use for display assembly. The current total amount of this document type is 6.

INDX – Excel Document of Item Index is an index for barcode information, color standard information, financial information, or a rejected PCR. The current total amount of this document type is 48.

MEMO – Memorandum is used as an informal written note for interoffice circulation. This document type can contain checklists, code lists, guidelines, procedures, and project matrixes, or any other information that contains directive, advisory, or informative matter. It's common to see planograms under this document type, but these are typically established under the code PLNG. The current total amount of this document type is 143.

NCOM – Non Packaging Engineering Controlled Component is used for Custom Promotional Components (CPC), which can be stickers, Instantly Redeemable Coupons (IRC), risers, tearpads, etc. The current total amount of this document type is 667.

PASS – Power Point Document of Product/Packaging Assembly provides pictures and descriptions of product/packaging assembly. The current total amount of this document type is 6.

PCN – Packaging Change Notification is used whenever a new pack type or configuration is requested and/or an alteration to a current packaging documentation is required. Several documents with the same change may be incorporated onto one PCN. Each product sales number or storage keeping unit (SKU) should be linked to the PCN, along with the items affected by the change. For instance, if a CAD drawing changes dimensions or anything in the notes section, the PCN has to link that affected drawing. The current total amount of this document type is 1,368.

PCR – Packaging Change Request is used whenever a new pack type or configuration is requested and/or an alteration to a current packaging specification is required. It is also used for any other additional changes that may affect packaging components. Several charts, drawings, or specifications with the same change may be incorporated onto one PCR. Ideally, each product sales number or storage keeping unit (SKU) should be listed separately on the PCR with the items affected by the change listed in as much detail as possible. The current total amount of this document type is 149.

PLNG – Prepack Planogram is used for display configurations by prepacking different types of product into the display trays, and is attached in the Related Documents section of the BOM. An arrangement of certain kinds of battery blocks is necessary throughout the display, since usually no Duracell displays contain entirely the same battery item. The current total amount of this document type is 148.

PPSU – Pallet Pattern Summary Template contained a template of information on pallet size outside dimensions, cube, weight, cases per layer, and layers per pallet. Now, CPPN documents are used instead, since they contain all relevant information. The current total amount of this document type used among older BOM versions is 556.

PROD – Product contains a template of information on product description, code, revision number, status level, plants where the product being produced, quantity of that product, product size outside dimensions, product's cube, product's weight, and product's chemistry. The current total amount of this document type is 115.

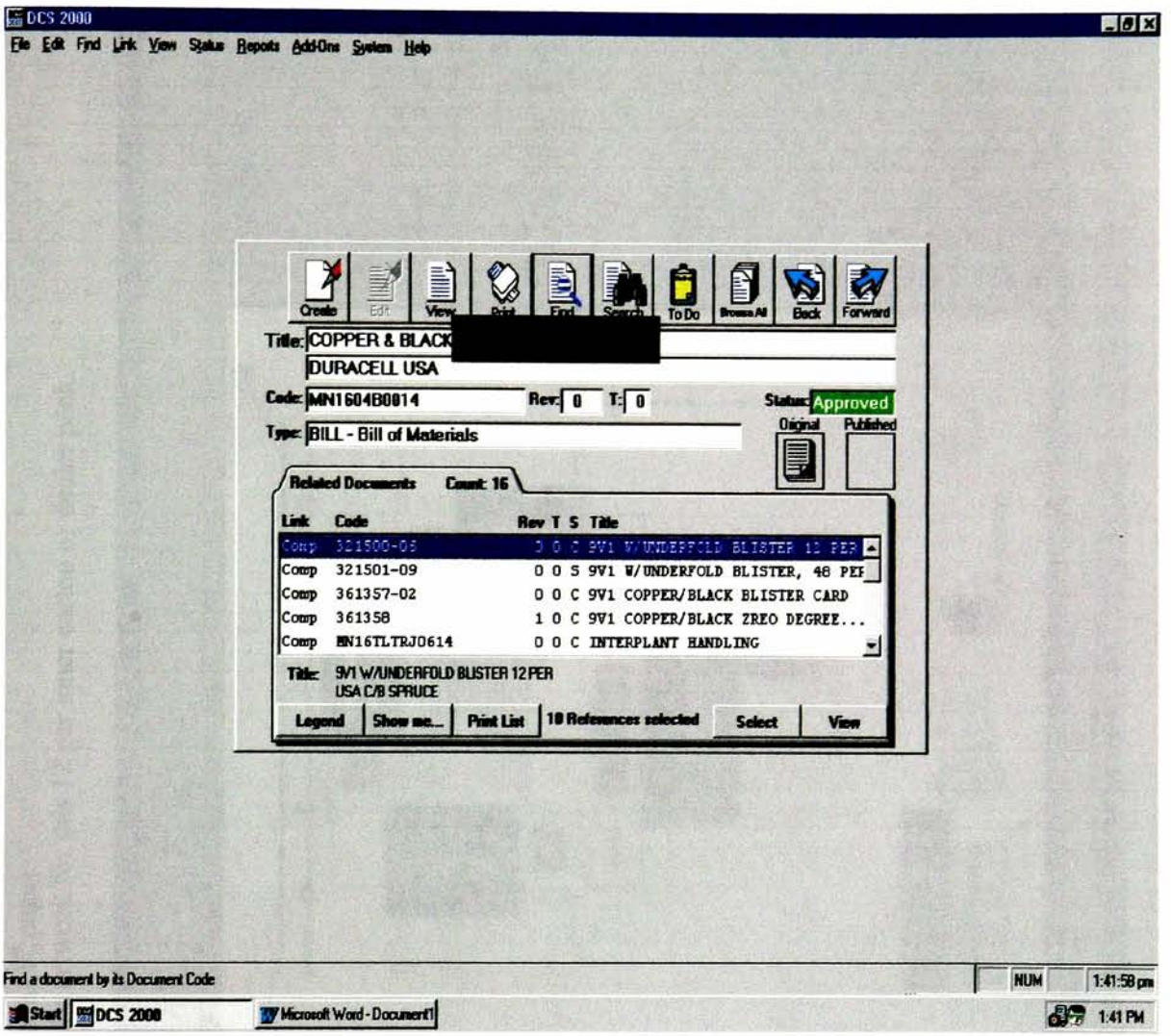
SPEC – Engineering Document Specification contains important information on process requirements for carton marking specification, code date specification, export requirements, standard practice for performance testing of shipping, and material specification. The current total amount of this document type is 10.

UCOMM – The Unprinted Packaging Engineering Controlled Component code is used for rendering all packaging components that do not have printing on them (e.g. blisters, fillers, labels, pallet caps, shippers, shrouds, stickers, etc.). The current total amount of this document type is 1,604.

WASS – Word Assembly Document is used for plant and retail assembly instructions. The current total amount of this document type is 82.

## Appendix B: Views of BOM Information within DCS 2000

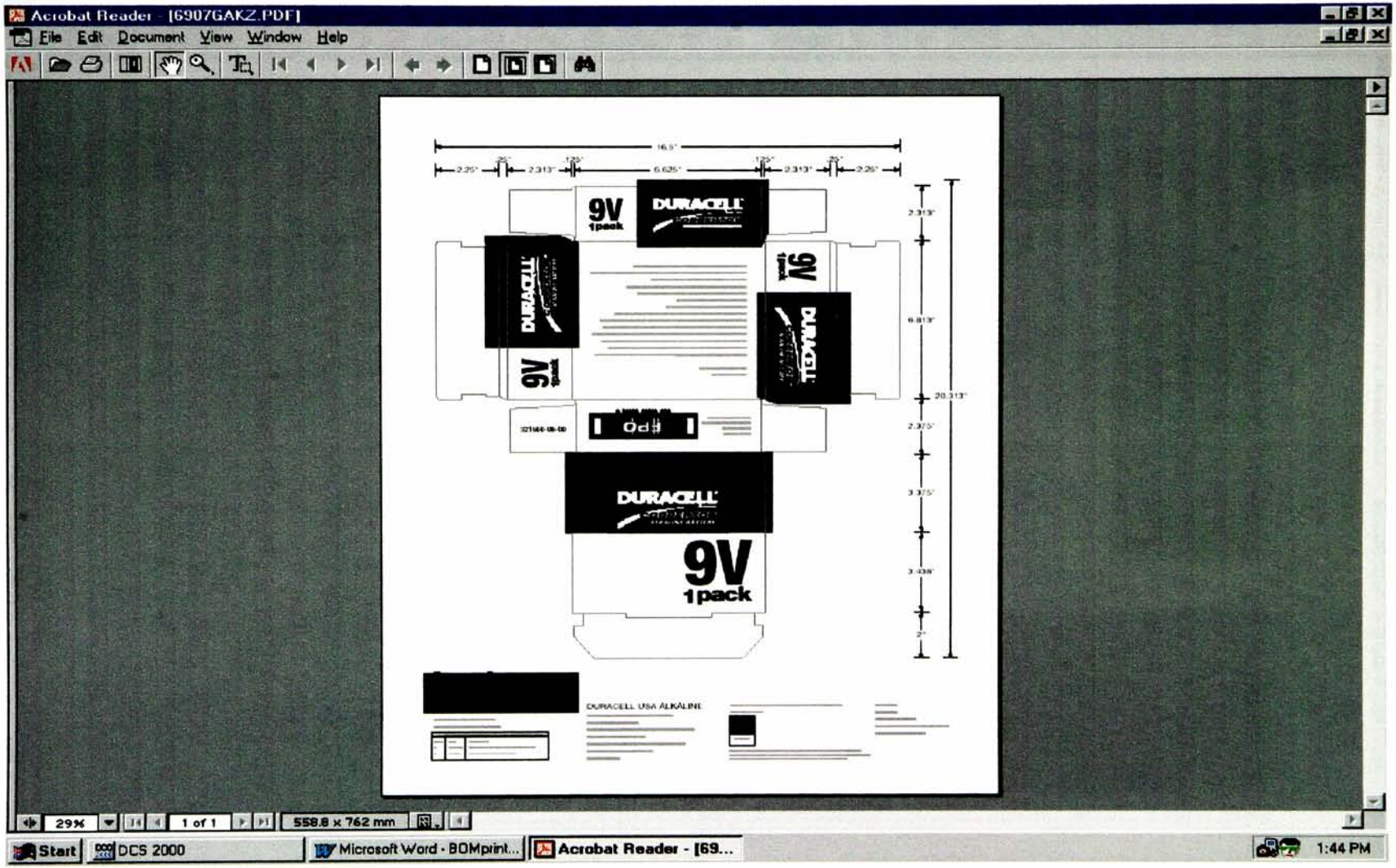
The print screen below is a BOM from the SKU- MN1604B0014 in DCS 2000.



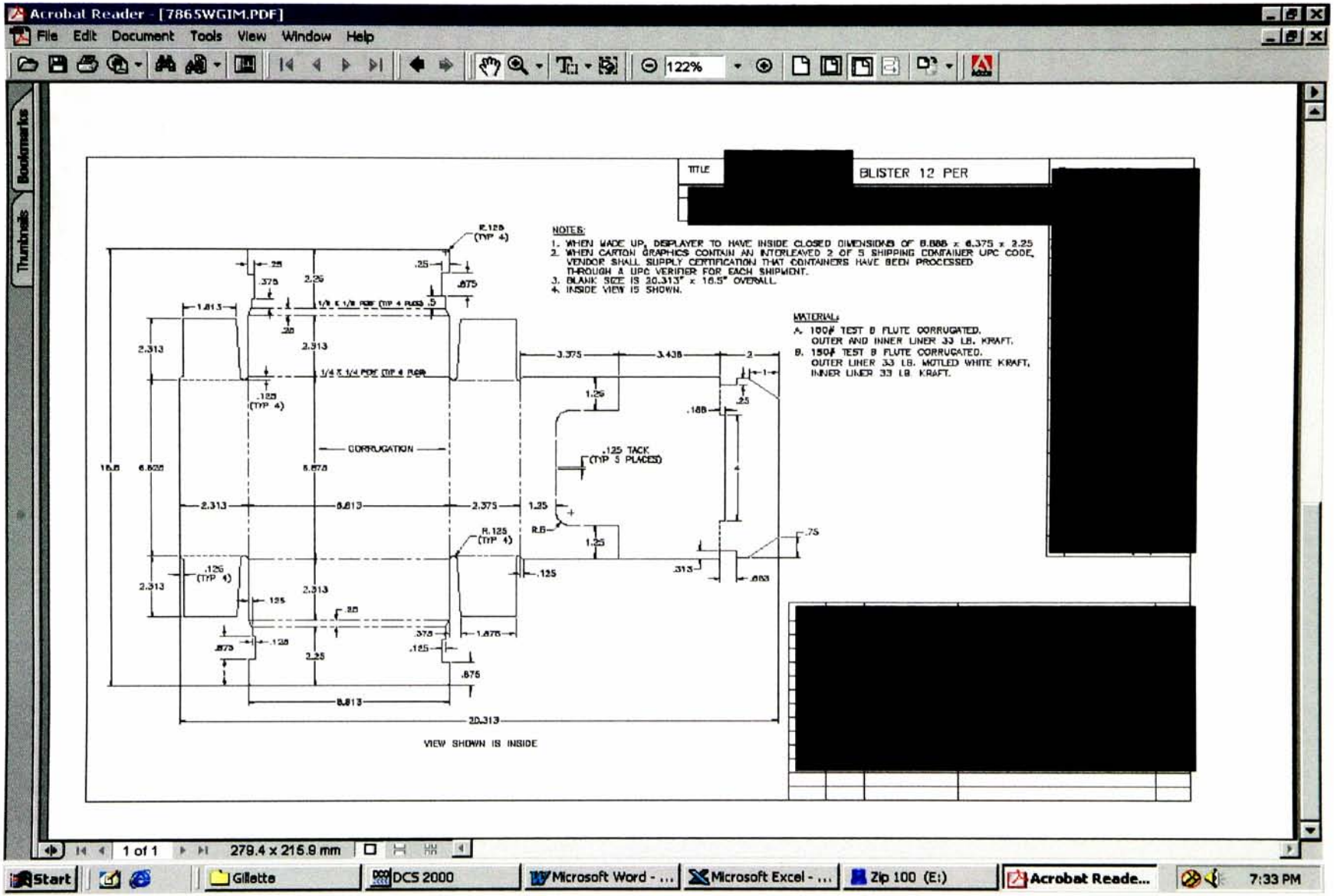

The status can be any of the following: New, to Review (if required), to Submitted, to Approved, to Current, to Historic, and to Archive. Moving from Approved to Current status depends upon the date that the document officially became effective. Moving from the Current to Historic status depends upon the date that the document officially expires. The user can set the date. A document moves into the Archived status after it become Historic. The users set the time parameters for when a document will shift into the Archived status.

If each component were viewed within DCS 2000 the following print screens would be seen. Appendix G, under SKU – MN1604B0014, can be used to follow each component that is a part of this BOM.

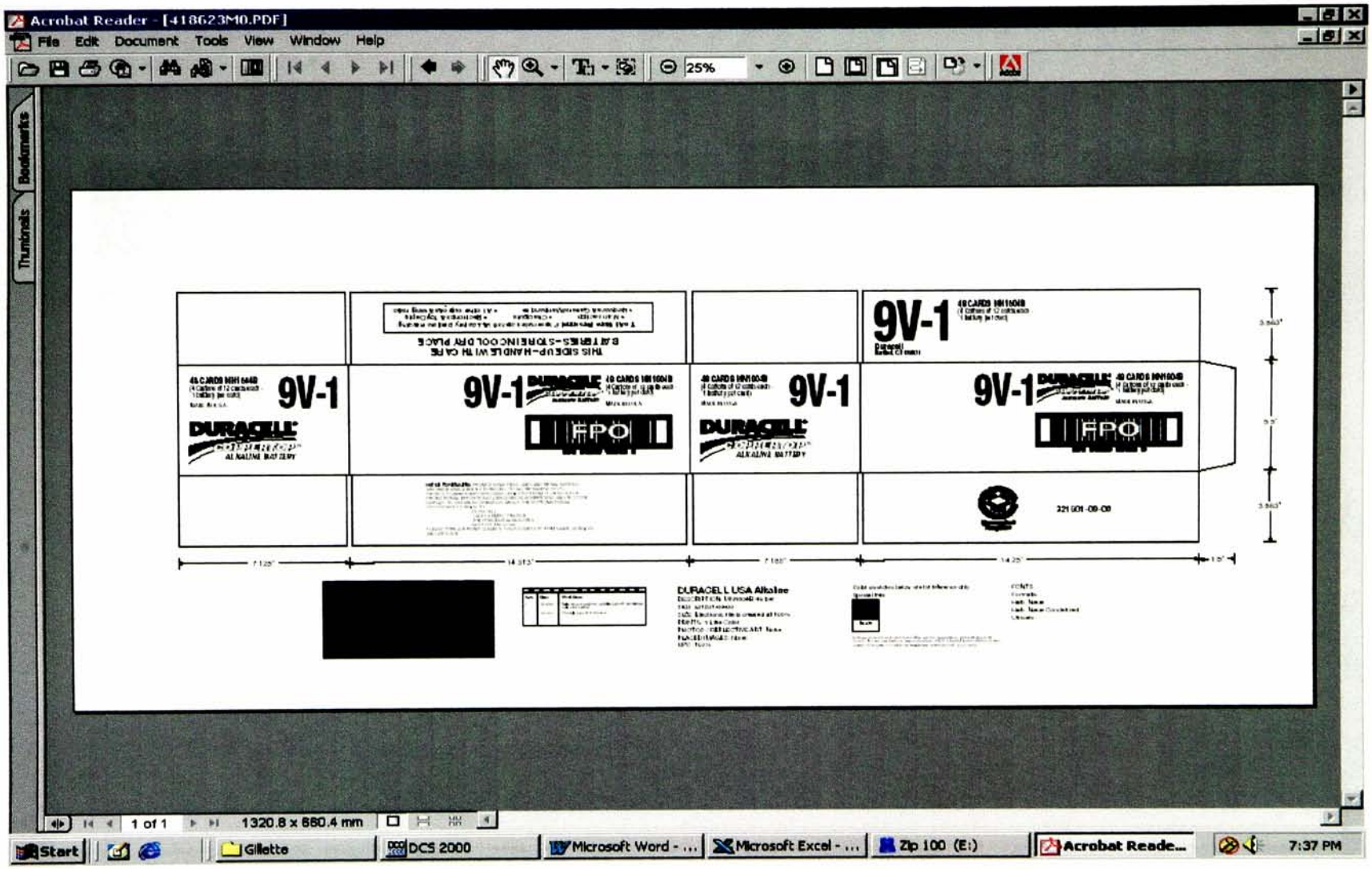
BILL OF MATERIALS – Main Section (1st page)
Part number 321500-06-00 contains the artwork for this 12 per inner carton or dealer pack.



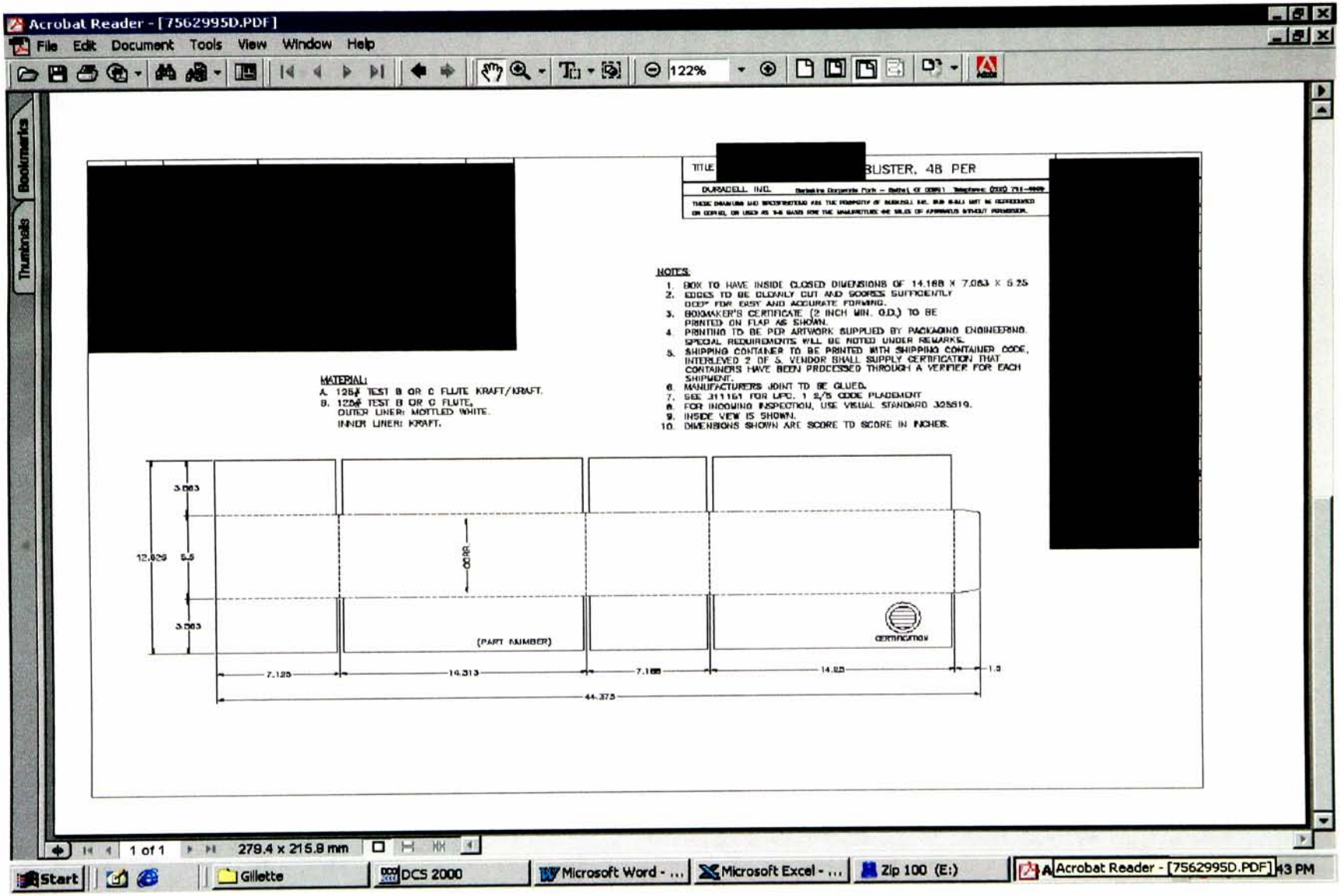
Part number 321500 contains the drawing for this 12 per carton.



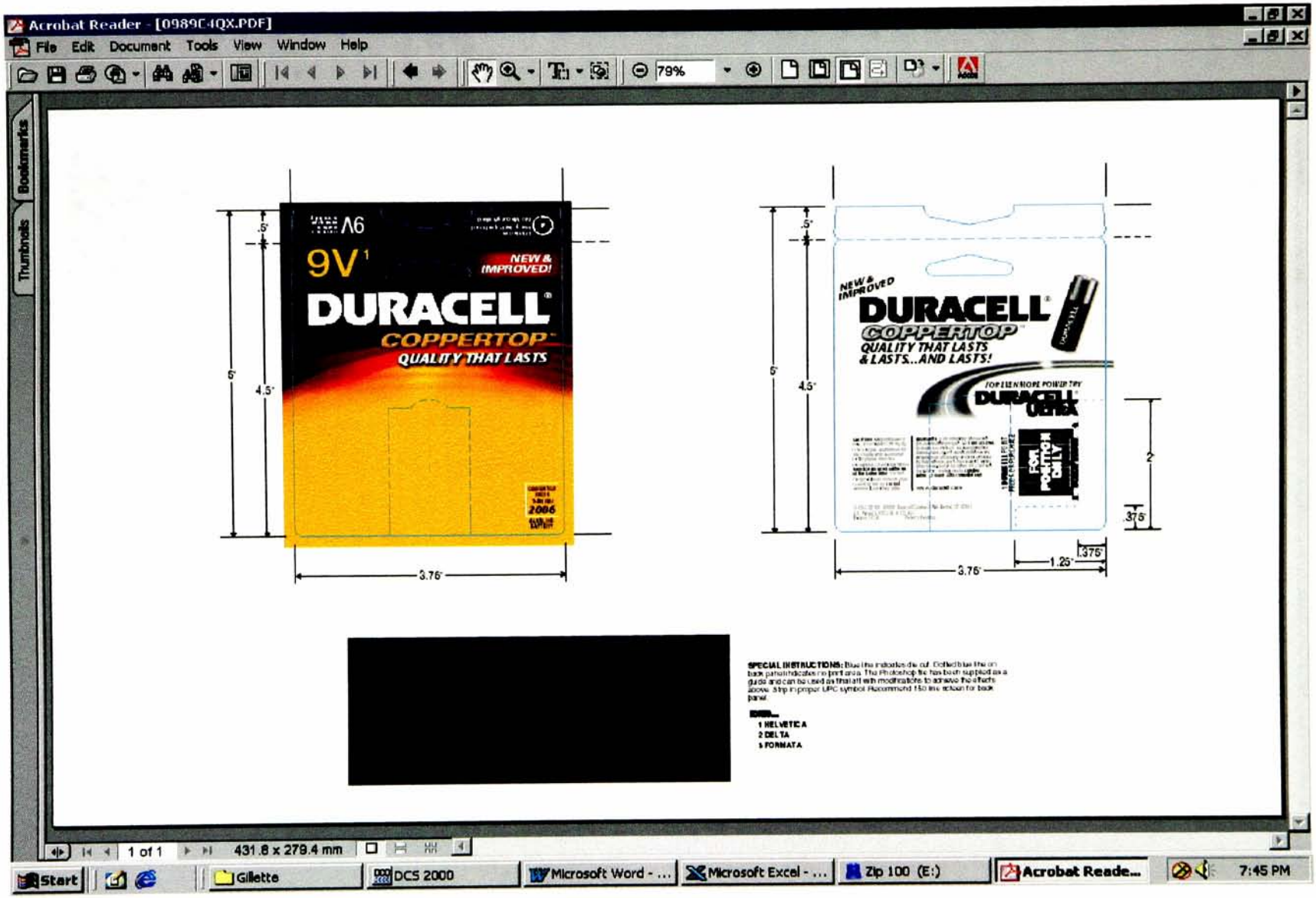
Part number 32501-09-00 contains the artwork for this 48 per shipper.



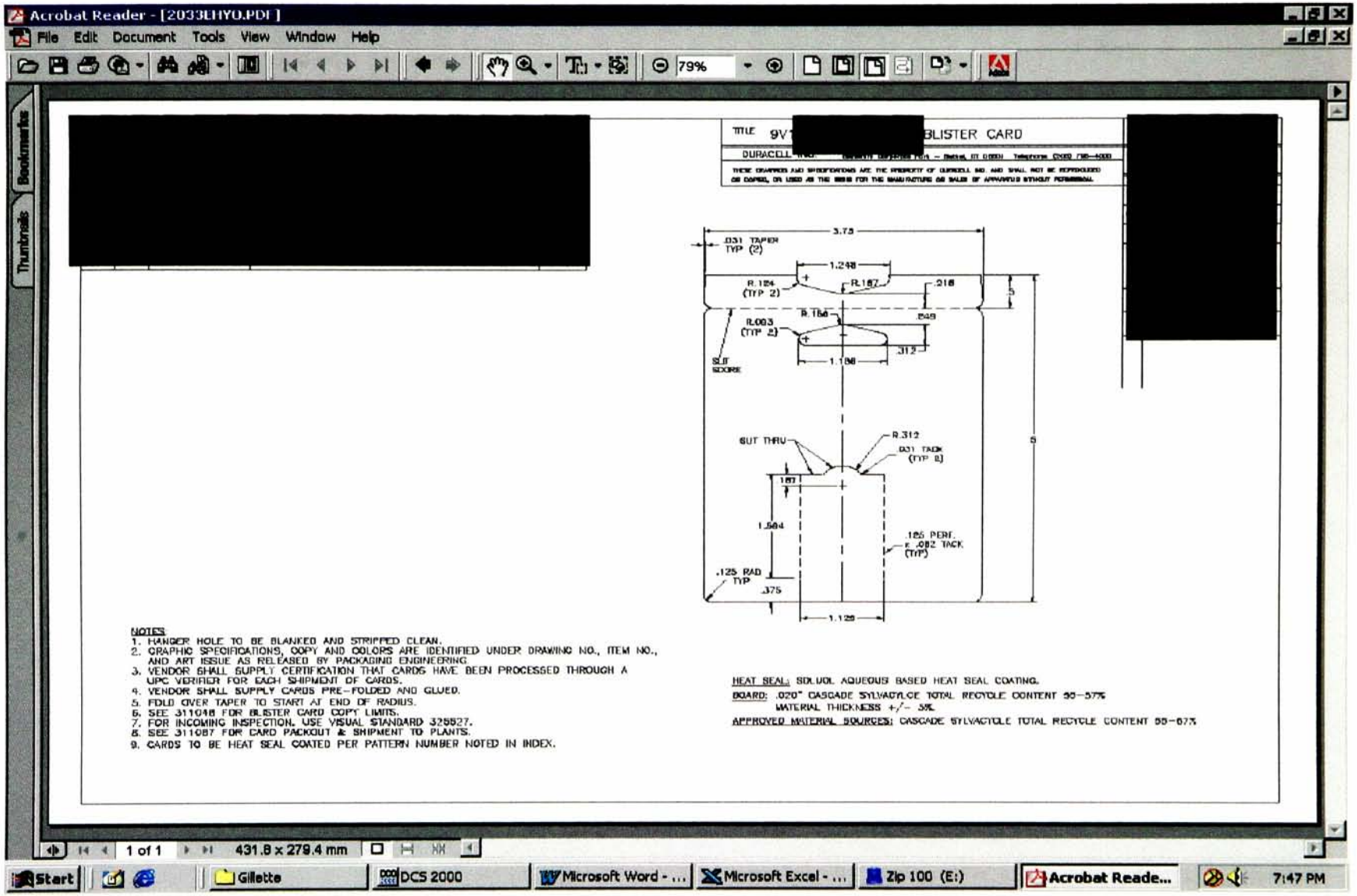
Part number 32501-09-00 contains the drawing for this 48 per shipper.



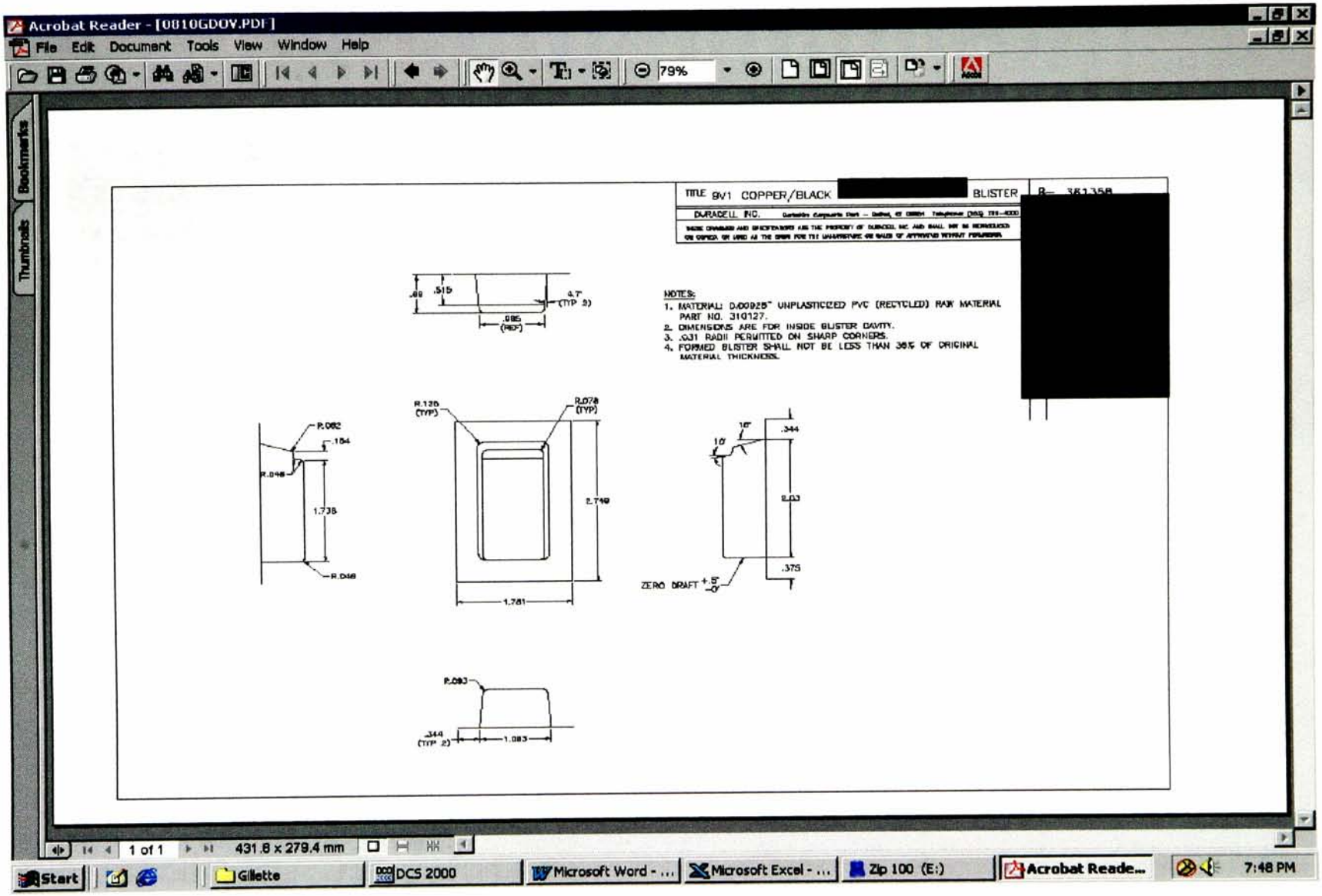
Part number 361357-02-00 contains the artwork for the blister card or the consumer unit pack.



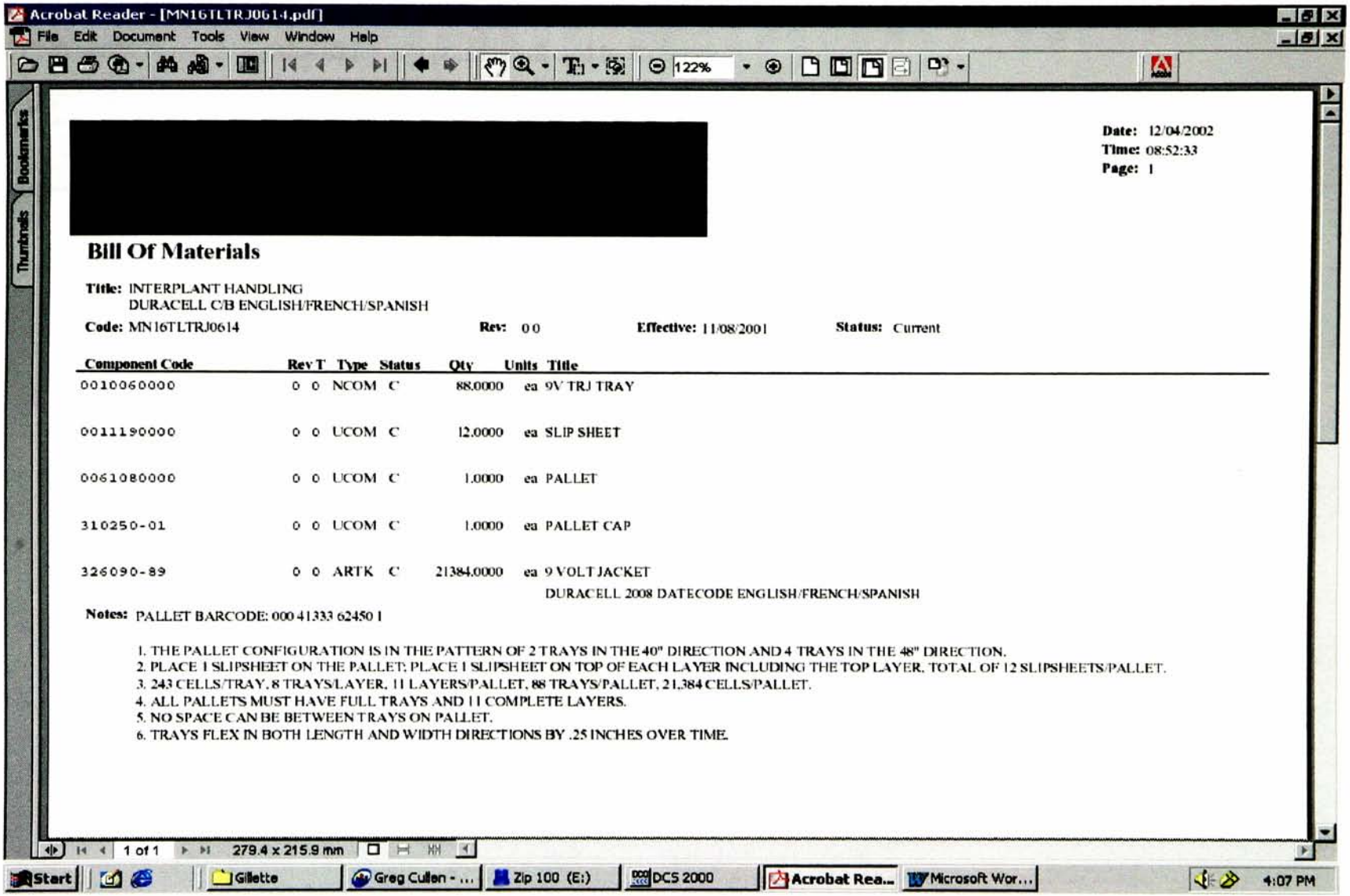
Part number 361357 contains the drawing for the blister card or the consumer unit pack.



Part number 361358 contains the drawing for the blister card or the consumer unit pack.

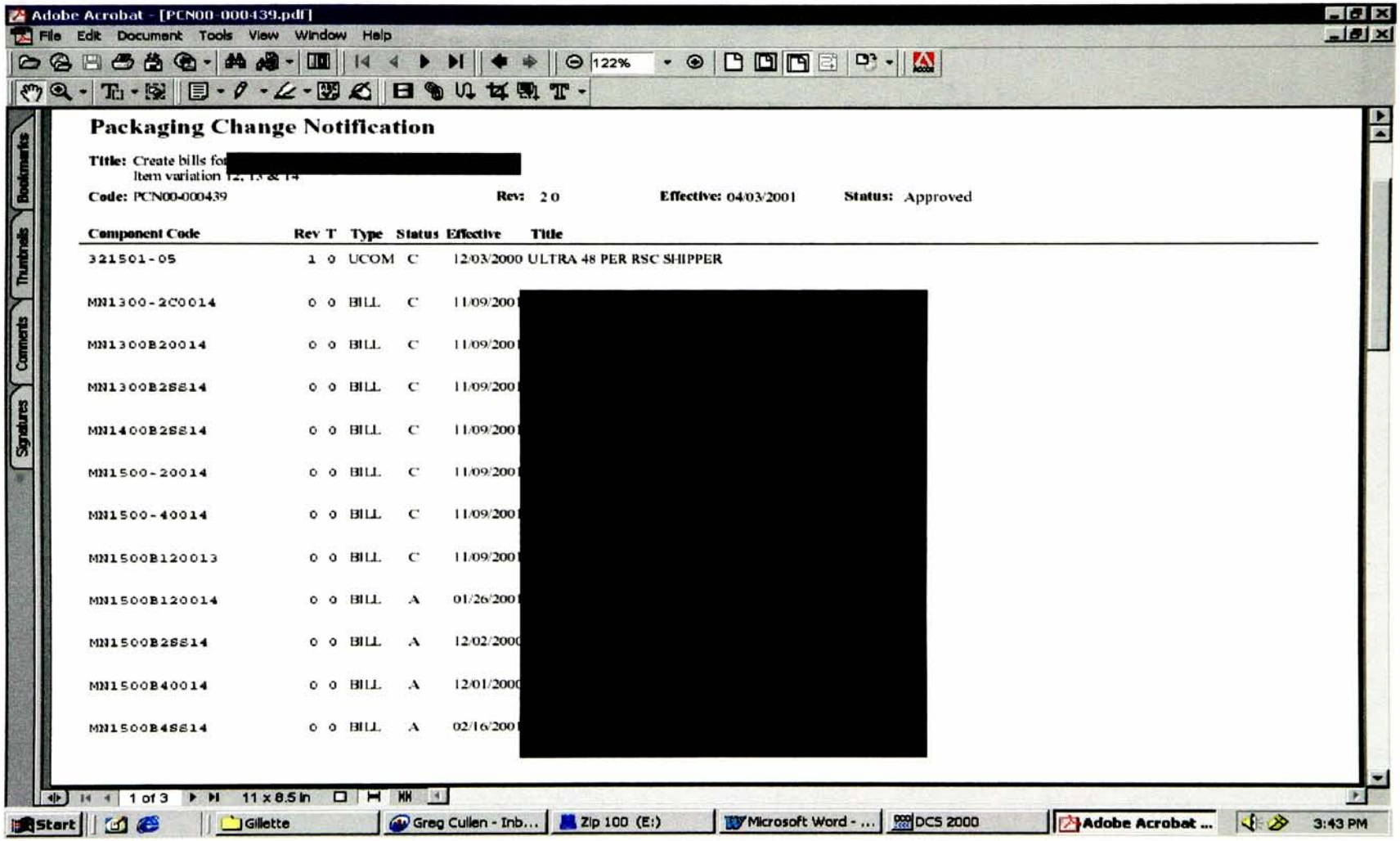


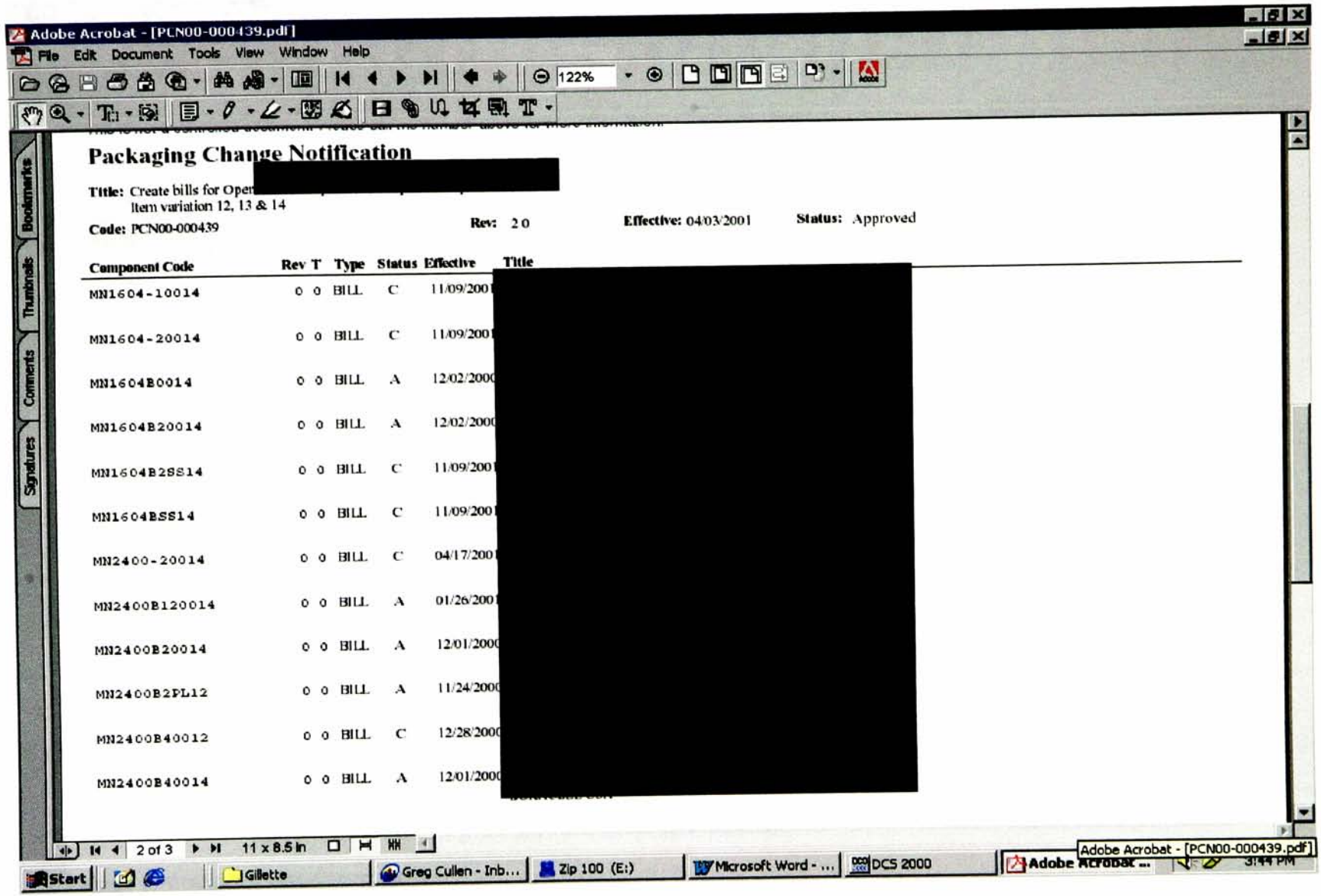
MN16TLTRJ0614 contains the labels/handling procedures used for the batteries.

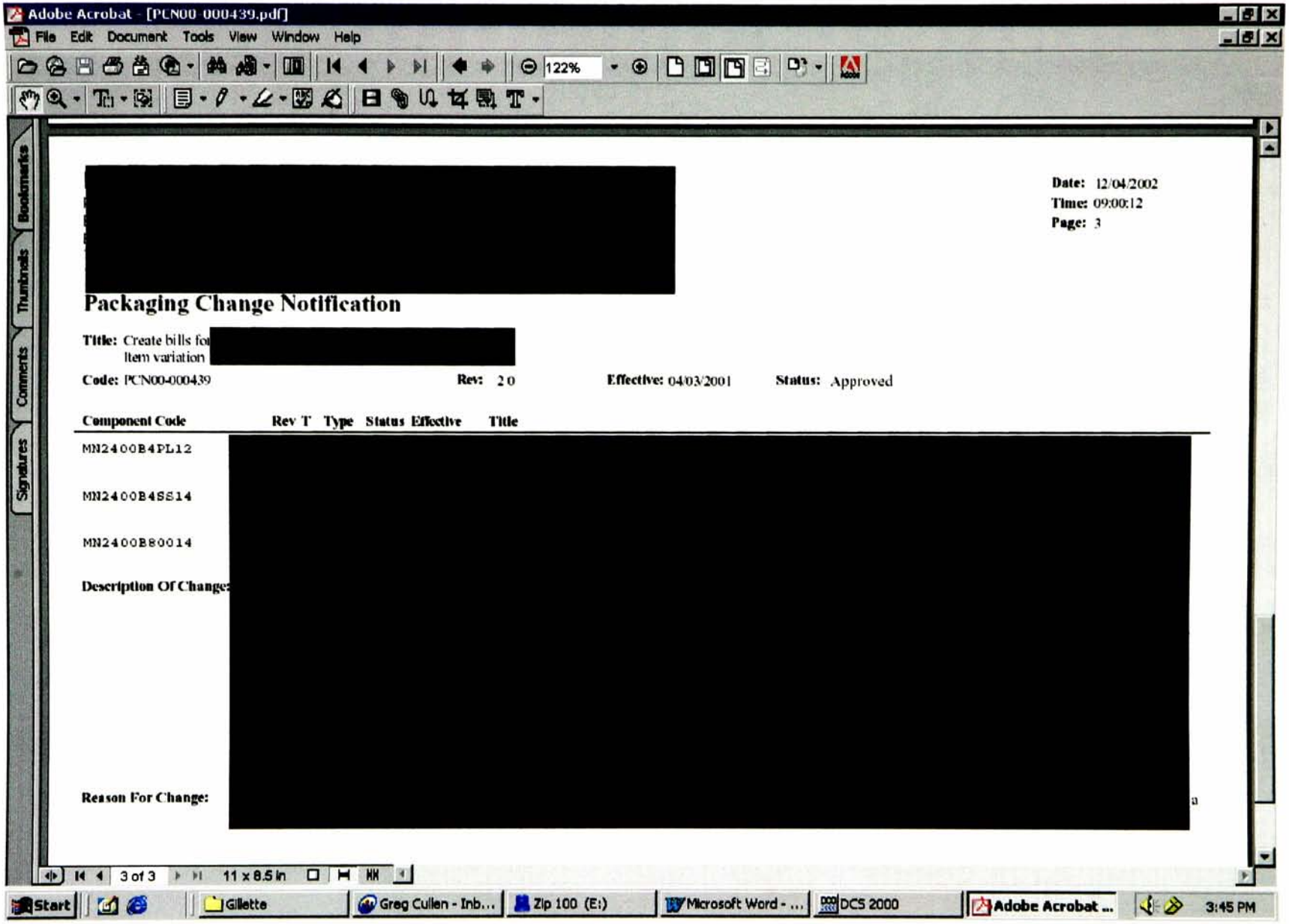


RELATED DOCUMENTS – Below are the rest of the documents that were not on the main page of the BOM because they did not have a unit value.

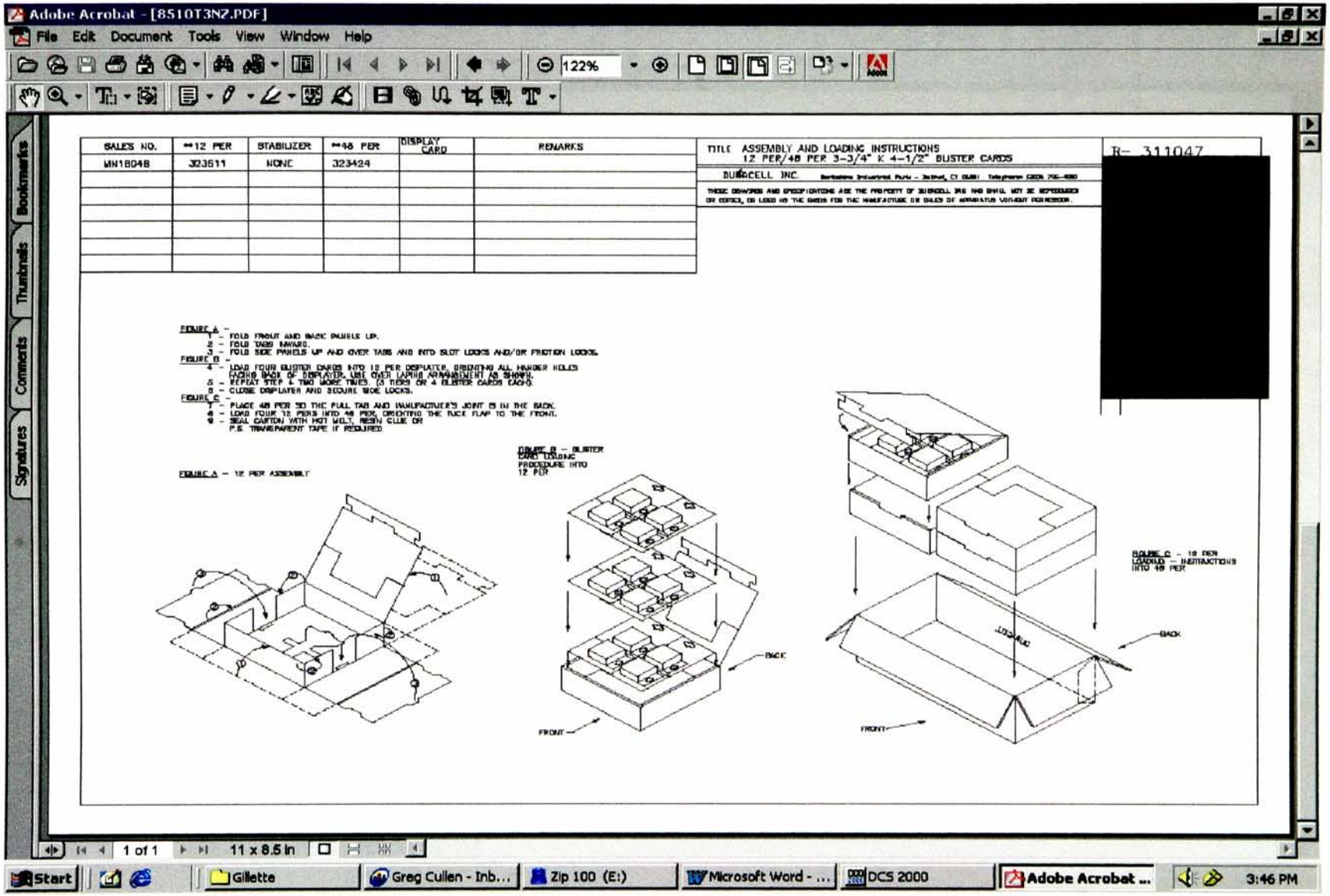
PCN00-000439 rev. 2 contains all the components affected by a change.



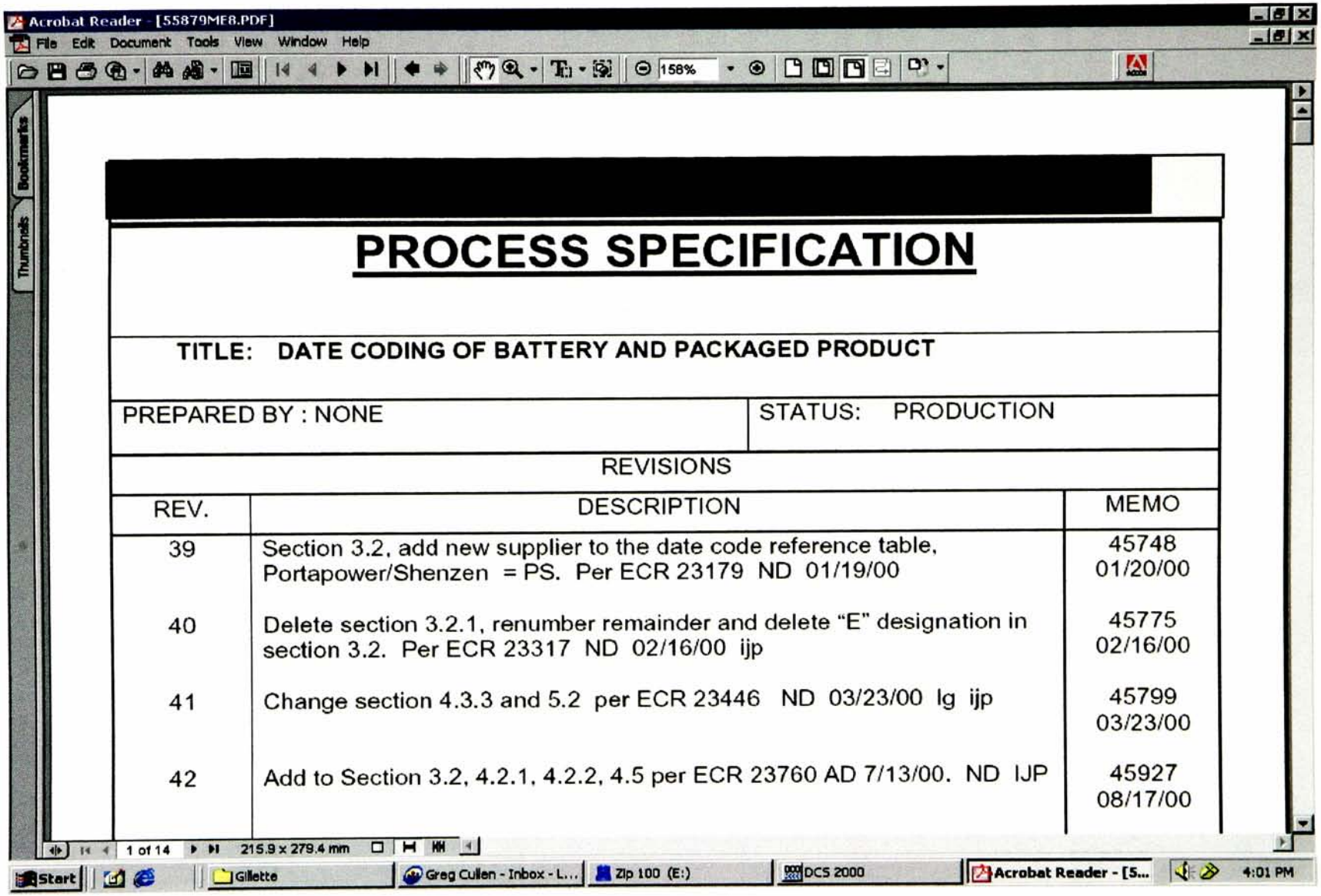

Adobe Acrobat - [PCN00-000439.pdf]
File Edit Document Tools View Window Help
122%
Bookmarks
Thumbnails
Comments
Signatures
Packaging Change Notification
Title: Create bills for Open
Item variation 12, 13 & 14
Code: PCN00-000439
Rev: 2 0
Effective: 04/03/2001
Status: Approved
Component Code Rev T Type Status Effective Title
MN1604-10014 0 0 BILL C 11/09/200
MN1604-20014 0 0 BILL C 11/09/200
MN1604B0014 0 0 BILL A 12/02/200
MN1604B20014 0 0 BILL A 12/02/200
MN1604B2SS14 0 0 BILL C 11/09/200
MN1604BSS14 0 0 BILL C 11/09/200
MN2400-20014 0 0 BILL C 04/17/200
MN2400B120014 0 0 BILL A 01/26/200
MN2400B20014 0 0 BILL A 12/01/200
MN2400B2PL12 0 0 BILL A 11/24/200
MN2400B40012 0 0 BILL C 12/28/200
MN2400B40014 0 0 BILL A 12/01/200
2 of 3
11 x 8.5 in
Start
Gillette
Greg Cullen - Inb...
Zip 100 (E:)
Microsoft Word - ...
DCS 2000
Adobe Acrobat ...
Adobe Acrobat - [PCN00-000439.pdf]
3:44 PM


Adobe Acrobat - [PCN00-000439.pdf]
File Edit Document Tools View Window Help
122%
Bookmarks
Thumbnails
Comments
Signatures
[redacted]
Date: 12/04/2002
Time: 09:00:12
Page: 3
Packaging Change Notification
Title: Create bills fo
Item variation
[redacted]
Code: PCN00-000439
Rev: 2 0
Effective: 04/03/2001
Status: Approved
Component Code
Rev T
Type
Status
Effective
Title
MN2400B4PL12
MN2400B4SS14
MN2400B80014
[redacted]
Description Of Change:
Reason For Change:
3 of 3
11 x 8.5 in
Start
Gillette
Greg Cullen - Inb...
Zip 100 (E:)
Microsoft Word - ...
DCS 2000
Adobe Acrobat ...
3:45 PM

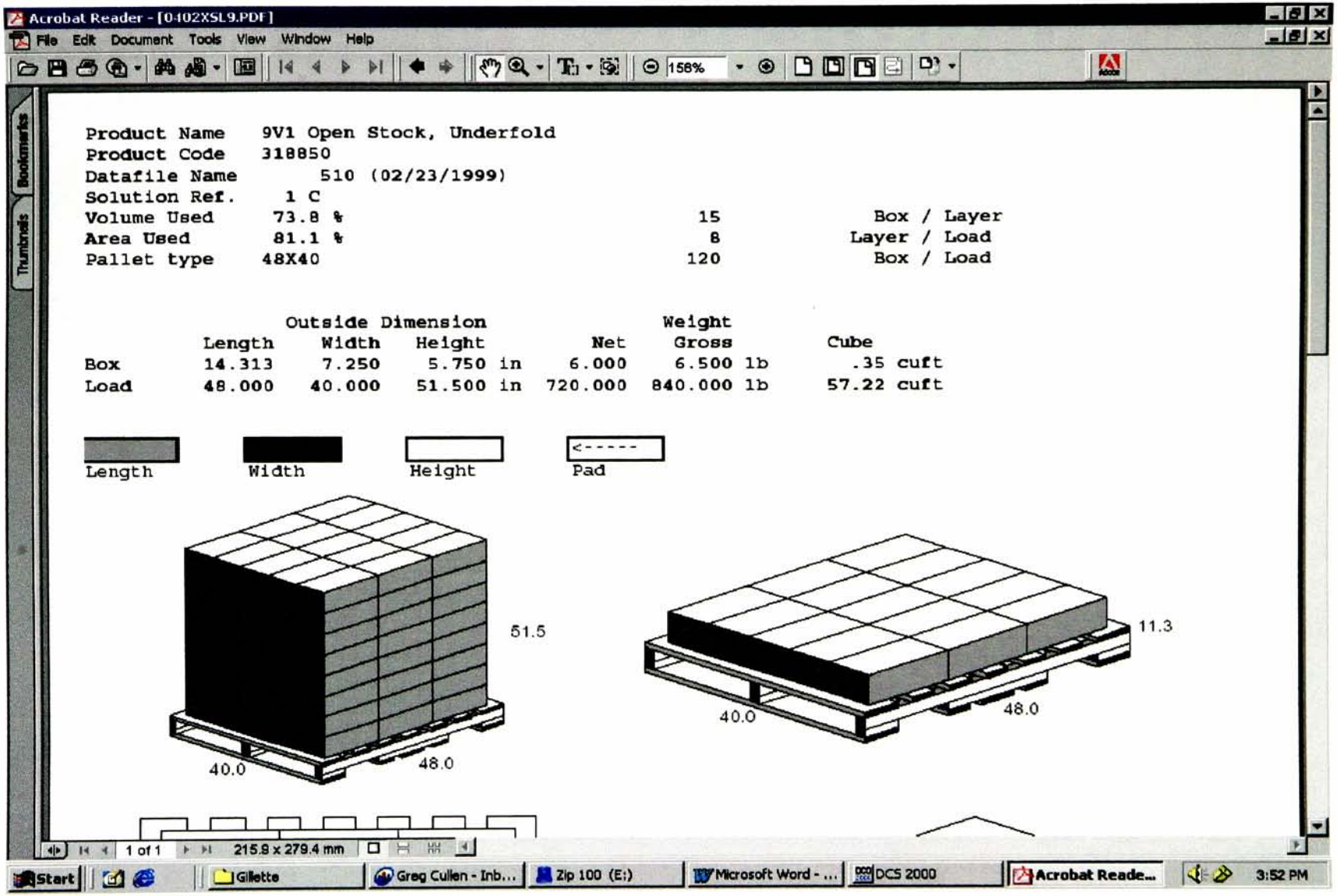
Part Number 311047 contains an assembly drawing.



Part Number 315755 contains code date specification process.

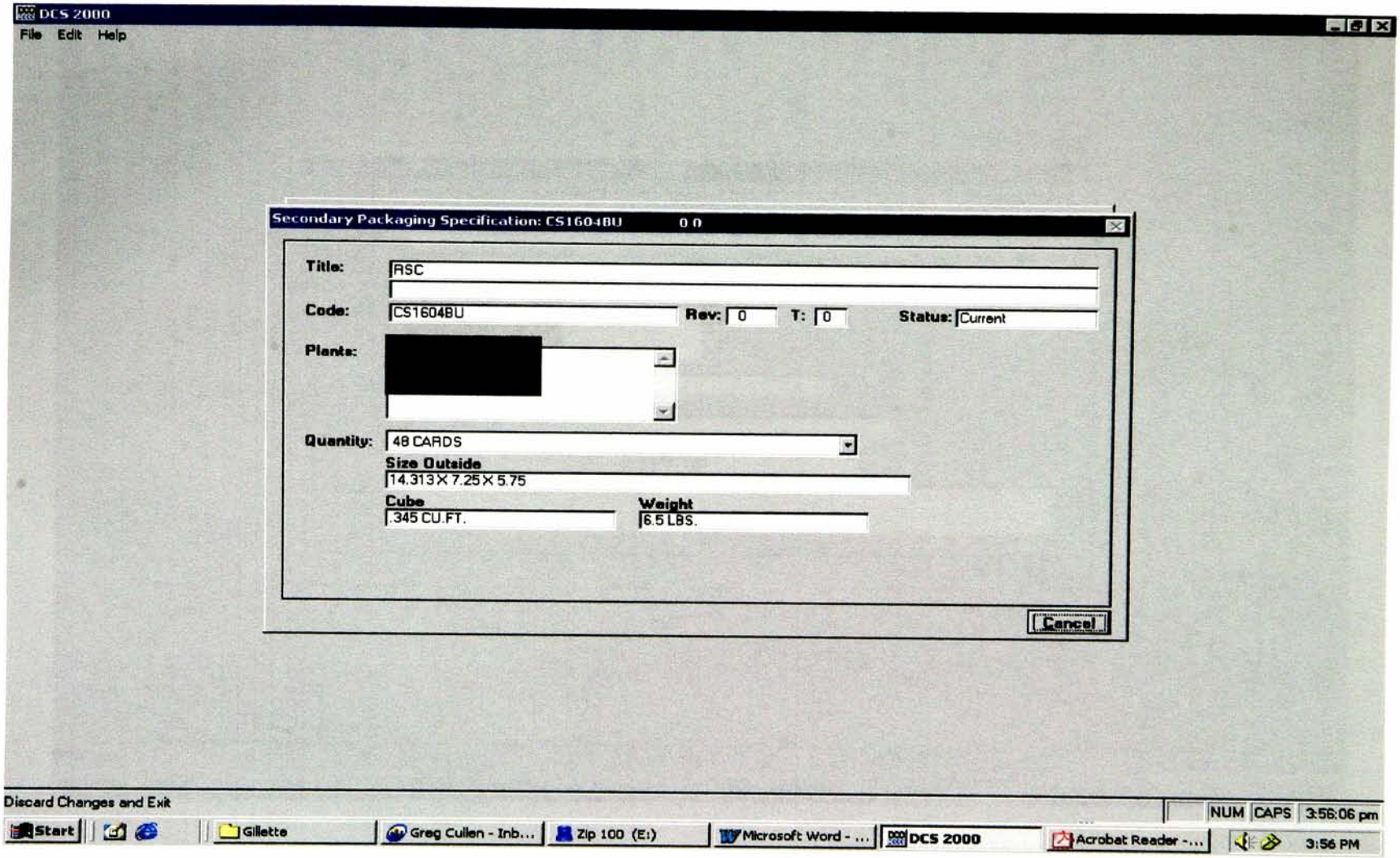


Part Number 318850-510 contains the pallet pattern.

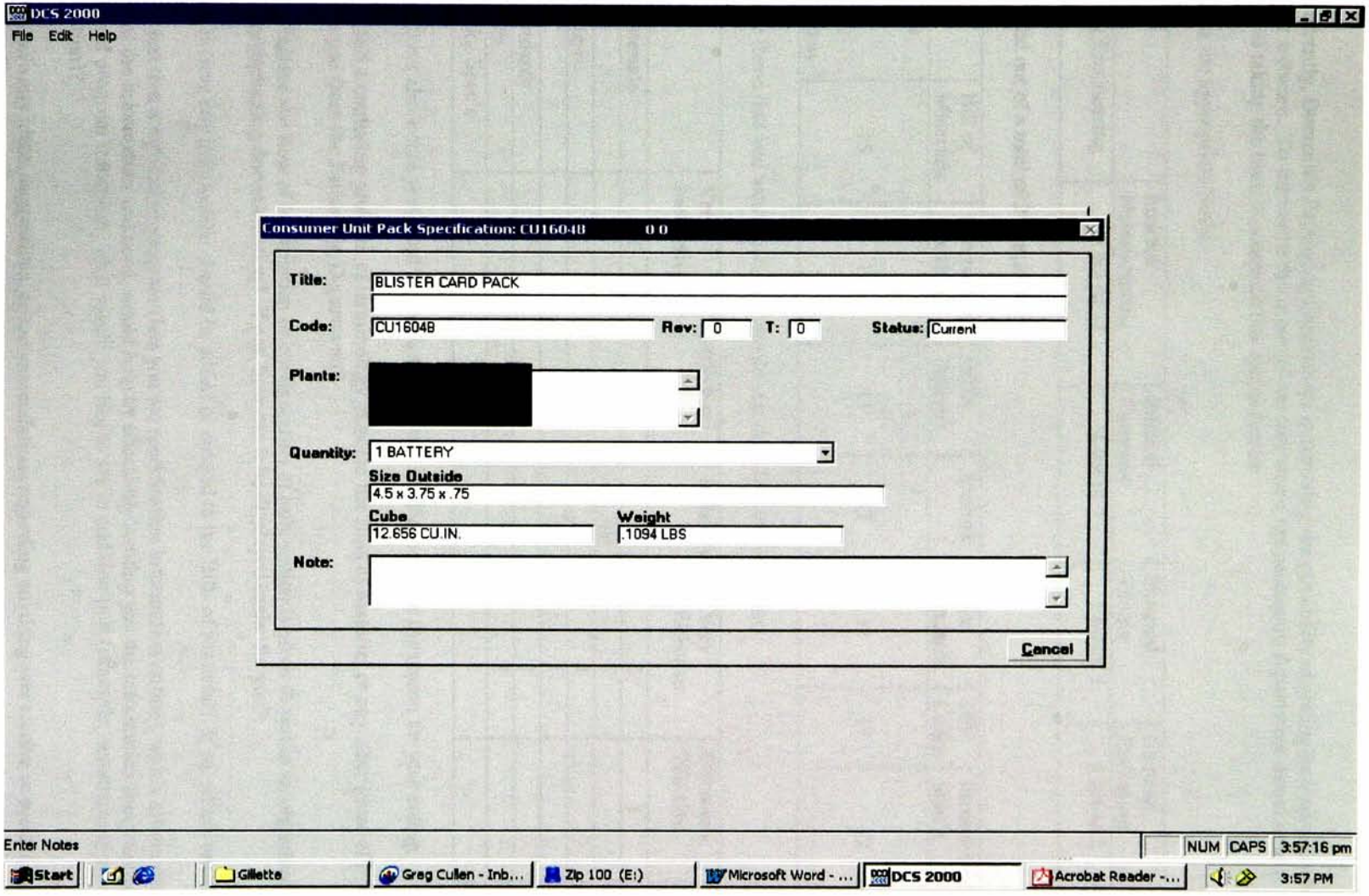


Drawing 361701 was not implemented into the BOM.

This print screen below is a template of information (dimension, cubic ft., weight, etc.) for the shipper. It is printed out as a hard copy and provided to the proper plant locations.



This print screen below is a template of information (dimension, cubic ft., weight, etc.) for the consumer unit pack. It is printed out as a hard copy, and provided to the proper plant locations.



# Appendix C: Questionnaire

Currently, Duracell's Packaging Department is exploring the possibility of getting new specification management software. To determine the needs of our customers, the packaging department would greatly appreciate you taking the time to complete this questionnaire.

Place an X in the appropriate boxes.

| | Internal Manufacturing | Internal Corporate | External Vendor | Contract Packaging |
|---|---|---|---|---|
| Packaging Engineering Customer | 9 out of 12 | 4 out of 7 | 1 out of 5 | 4 out of 5 |

*18 responded out of a total of 29 questioned

| | Bill of Materials | Component Drawings | Pallet Patterns | Artwork | Color Standards | UPC Codes | Product/Pkg Spec's |
|---|---|---|---|---|---|---|---|
| Check if you use the following Packaging Documentation | 15 | 17 | 15 | 12 | 11 | 11 | 12 |

Of the above items that you would use, how would you rate their effectiveness?

| | Very Ineffective | Ineffective | Effective | Very Effective | Extremely Effective |
|---|---|---|---|---|---|
| Bill of Materials | 1 | 4 | 7 | 2 | 1 |
| Drawings | | 2 | 10 | 5 | |
| Pallet Patterns | | 1 | 10 | 4 | |
| Artwork | | 2 | 9 | 1 | |
| Color Standards | | 1 | 8 | 2 | |
| UPC Codes | | 3 | 6 | 2 | |
| Product/Pkg Spec's | | | 11 | 1 | |

1.) Of the items above that you listed as ineffective or very ineffective, state the reason for your rating.

2.) Do you feel a confusing problem of terminology exists in the Bills of Material or any other piece of information given to you from the Packaging Department?

3.) Do you believe the flow of information or configuration of information is given to you in an organized way from any packaging documentation? If not, how can it be displayed easier for you?

4.) Do you believe any information should be added or deleted to the Bills of Material? If so, which ones?

5.) Do you feel that a web-based program (lets you see specification information online), which allows you to view and print the information you need, would help by effectively sending you the information that you need? If a web-based program transpires, what would you like to see in addition to it (example: automatic approval notification)?

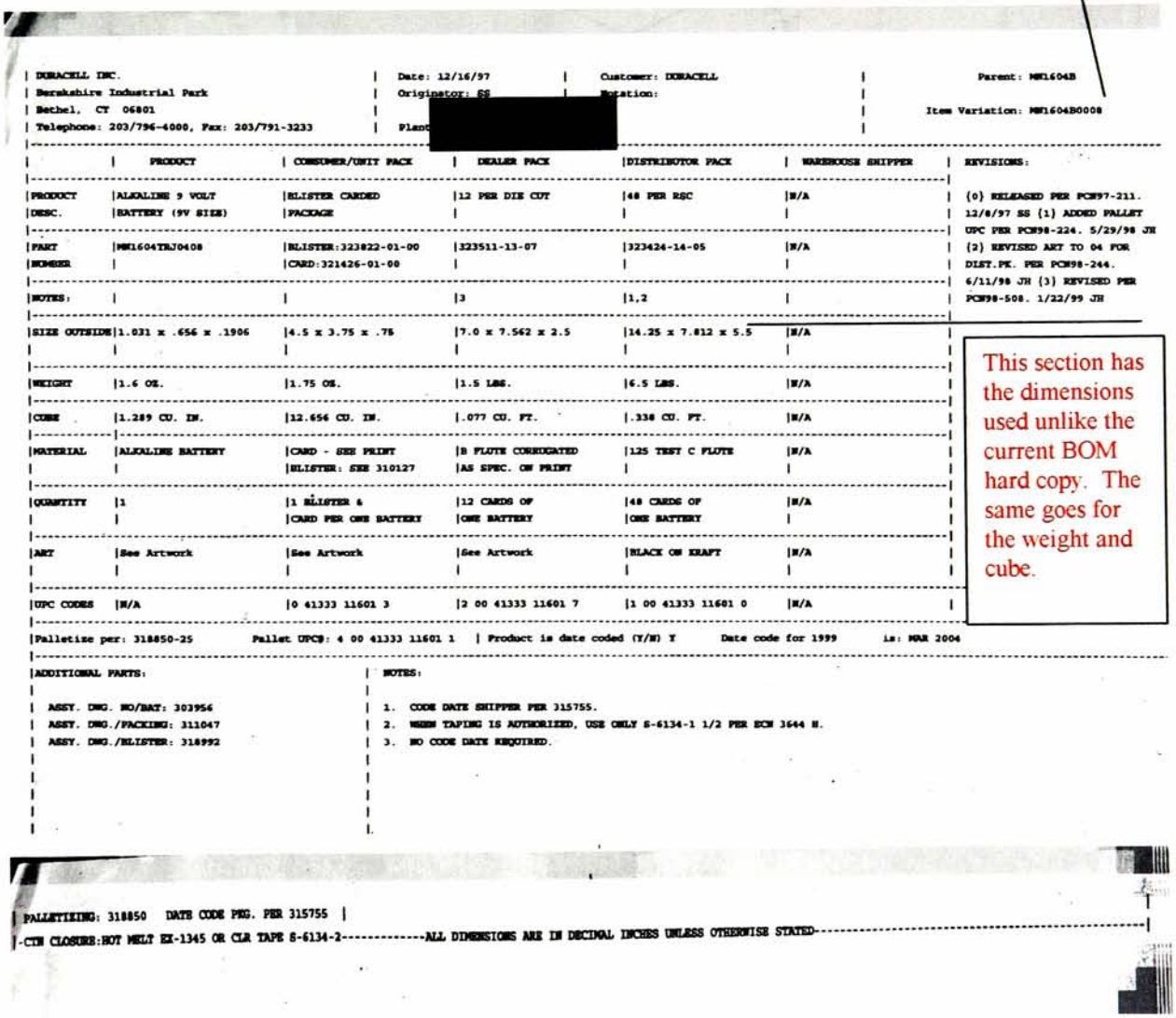
6.) Do you have any ideas, suggestions, or recommendations regarding anything you receive or send to the Packaging Department?

## Appendix D: View of an Old BOM Hard Copy

This is the "old style" BOM document given to manufacturing. It was used before May 1999 from software called Paradox. The format of this hard copy is also how it was viewed on the computer monitor, unlike any of Mystic's DCS versions. A majority of manufacturing affiliates do prefer this hard copy to the current BOM used in distribution.

This BOM (MN1604B0008 – revision 3) helped produce 48 blisters (323822-01-00) and 48 cards (321426-01-00) with a total of 48 Duracell CopperTop 9V batteries/labels (MN1604TRJ0408). A total of 12 cards went into a 12 per cartons or dealer packs (323511-13-07). A total of 4 dealer packs went into 1 shipper (323424-14-05).

This section contains the SKU.



| DURACELL INC. | Date: 12/16/97 | Customer: DURACELL | Parent: MN1604B |
|---|---|---|---|
| Berkshire Industrial Park | Originator: SS | Rotation: | |
| Bethel, CT 06801 | | | Item Variation: MN1604B0008 |
| Telephone: 203/796-4000, Fax: 203/791-3233 | Plant [redacted] | | |

| | PRODUCT | CONSUMER/UNIT PACK | DEALER PACK | DISTRIBUTOR PACK | WAREHOUSE SHIPPER | REVISIONS: |
|---|---|---|---|---|---|---|
| PRODUCT DESC. | ALKALINE 9 VOLT BATTERY (9V SIZE) | BLISTER CARDED PACKAGE | 12 PER DIE CUT | 48 PER RSC | N/A | (0) RELEASED PER PCN97-211. 12/8/97 SS (1) ADDED PALLET UPC PER PCN98-224. 5/29/98 JH (2) REVISED ART TO 04 FOR DIST.PK. PER PCN98-244. 6/11/98 JH (3) REVISED PER PCN98-508. 1/22/99 JH |
| PART NUMBER | MN1604TRJ0408 | BLISTER:323822-01-00 CARD:321426-01-00 | 323511-13-07 | 323424-14-05 | N/A | |
| NOTES: | | | 3 | 1,2 | | |
| SIZE OUTSIDE | 1.031 x .656 x .1906 | 4.5 x 3.75 x .75 | 7.0 x 7.562 x 2.5 | 14.25 x 7.812 x 5.5 | N/A | |
| WEIGHT | 1.6 OZ. | 1.75 OZ. | 1.5 LBS. | 6.5 LBS. | N/A | |
| CUBE | 1.289 CU. IN. | 12.656 CU. IN. | .077 CU. FT. | .338 CU. FT. | N/A | |
| MATERIAL | ALKALINE BATTERY | CARD - SEE PRINT BLISTER: SEE 310127 | B FLUTE CORRUGATED AS SPEC. ON PRINT | 125 TEST C FLUTE | N/A | |
| QUANTITY | 1 | 1 BLISTER & CARD PER ONE BATTERY | 12 CARDS OF ONE BATTERY | 48 CARDS OF ONE BATTERY | N/A | |
| ART | See Artwork | See Artwork | See Artwork | BLACK ON KRAFT | N/A | |
| UPC CODES | N/A | 0 41333 11601 3 | 2 00 41333 11601 7 | 1 00 41333 11601 0 | N/A | |

This section has the dimensions used unlike the current BOM hard copy. The same goes for the weight and cube.

Palletize per: 318850-25 Pallet UPC#: 4 00 41333 11601 1 | Product is date coded (Y/N) Y Date code for 1999 is: MAR 2004

ADDITIONAL PARTS:

ASSY. DWG. NO/BAT: 303956
ASSY. DWG./PACKING: 311047
ASSY. DWG./BLISTER: 318992

NOTES:

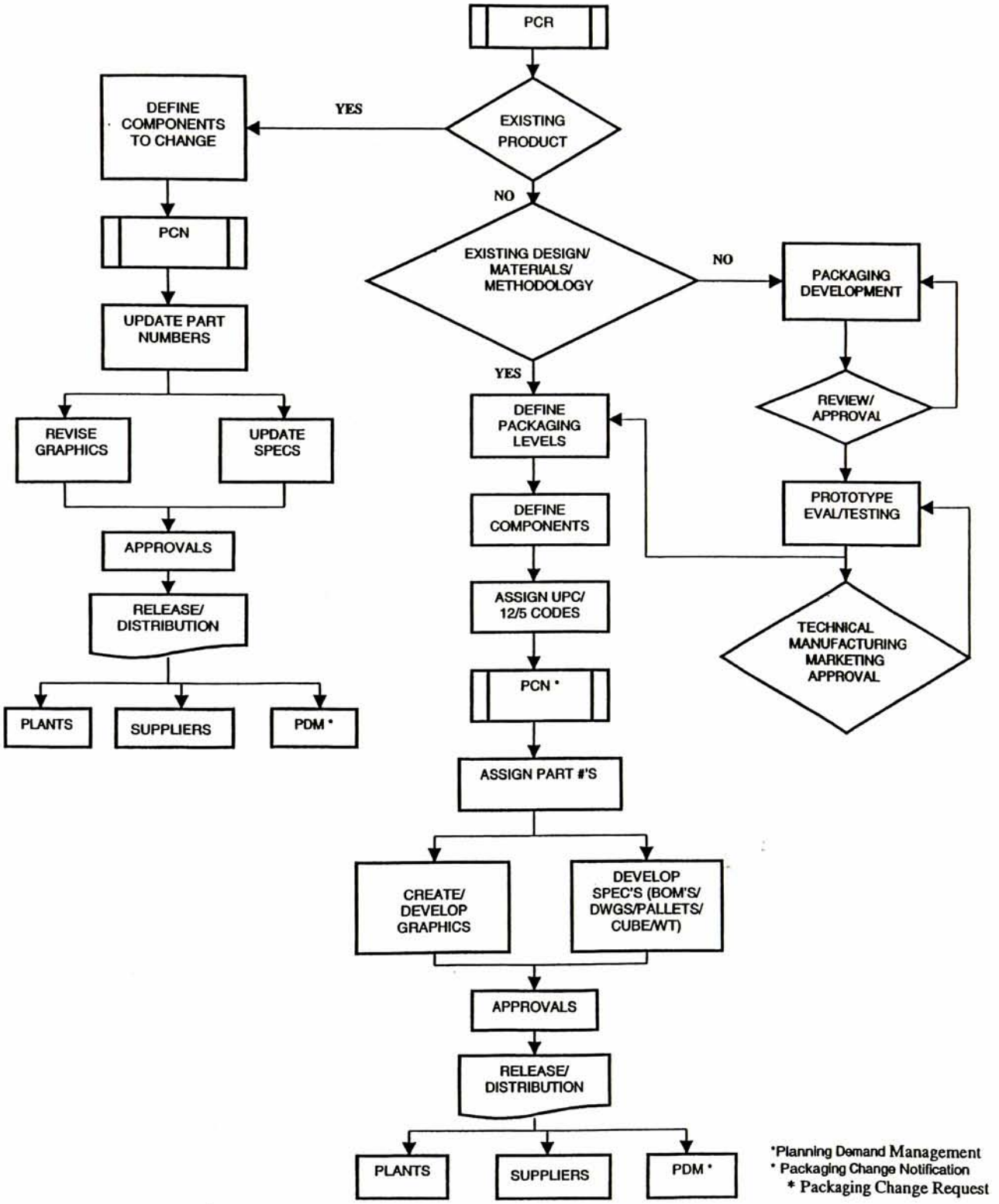
1. CODE DATE SHIPPER PER 315755.
2. WHEN TAPING IS AUTHORIZED, USE ONLY 8-6134-1 1/2 PER ECN 3644 H.
3. NO CODE DATE REQUIRED.

PALLETIZING: 318850 DATE CODE PKG. PER 315755

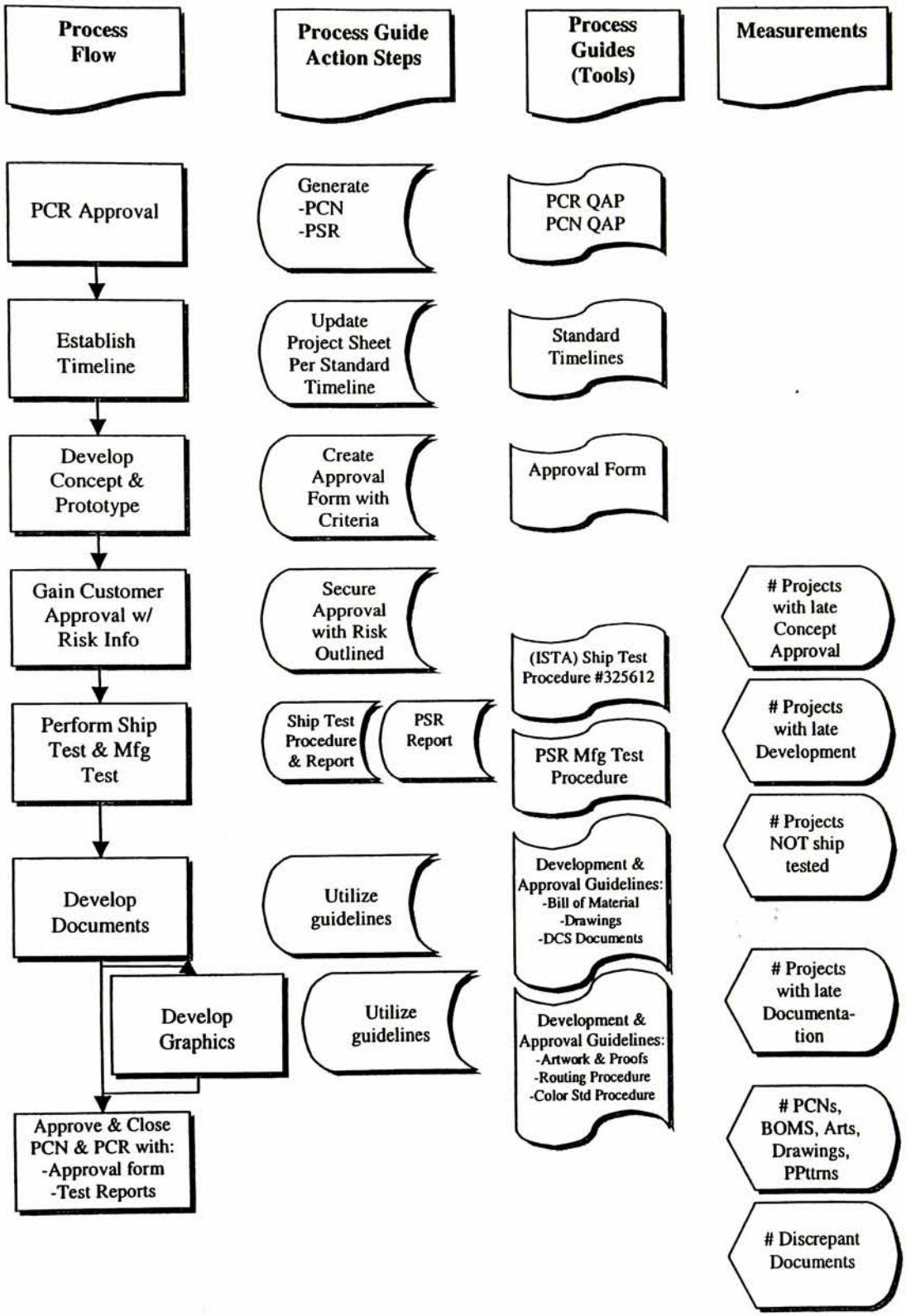
-CTN CLOSURE:HOT MELT EX-1345 OR CLR TAPE 8-6134-2----------ALL DIMENSIONS ARE IN DECIMAL INCHES UNLESS OTHERWISE STATED----------

## Appendix E: Duracell's Packaging Department Flowcharts

Packaging Development/Revision Process

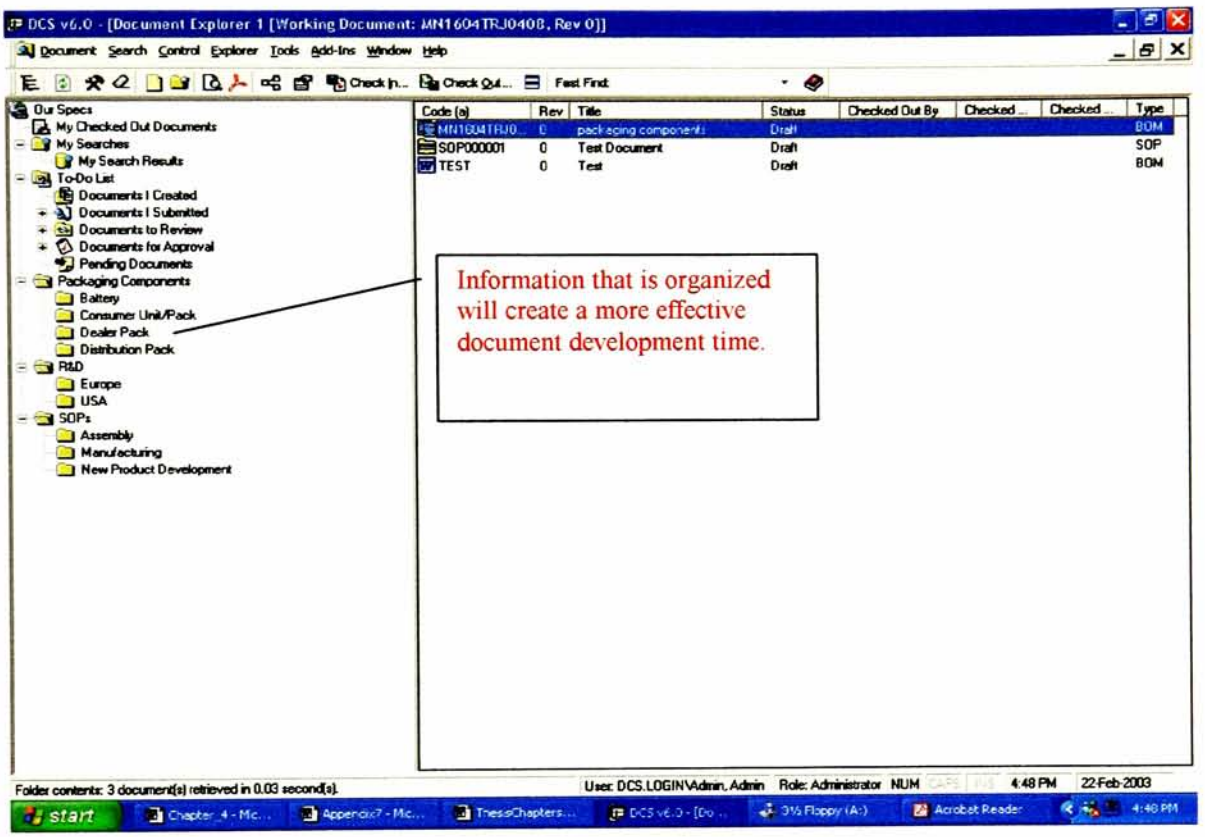


Packaging Project Development Process



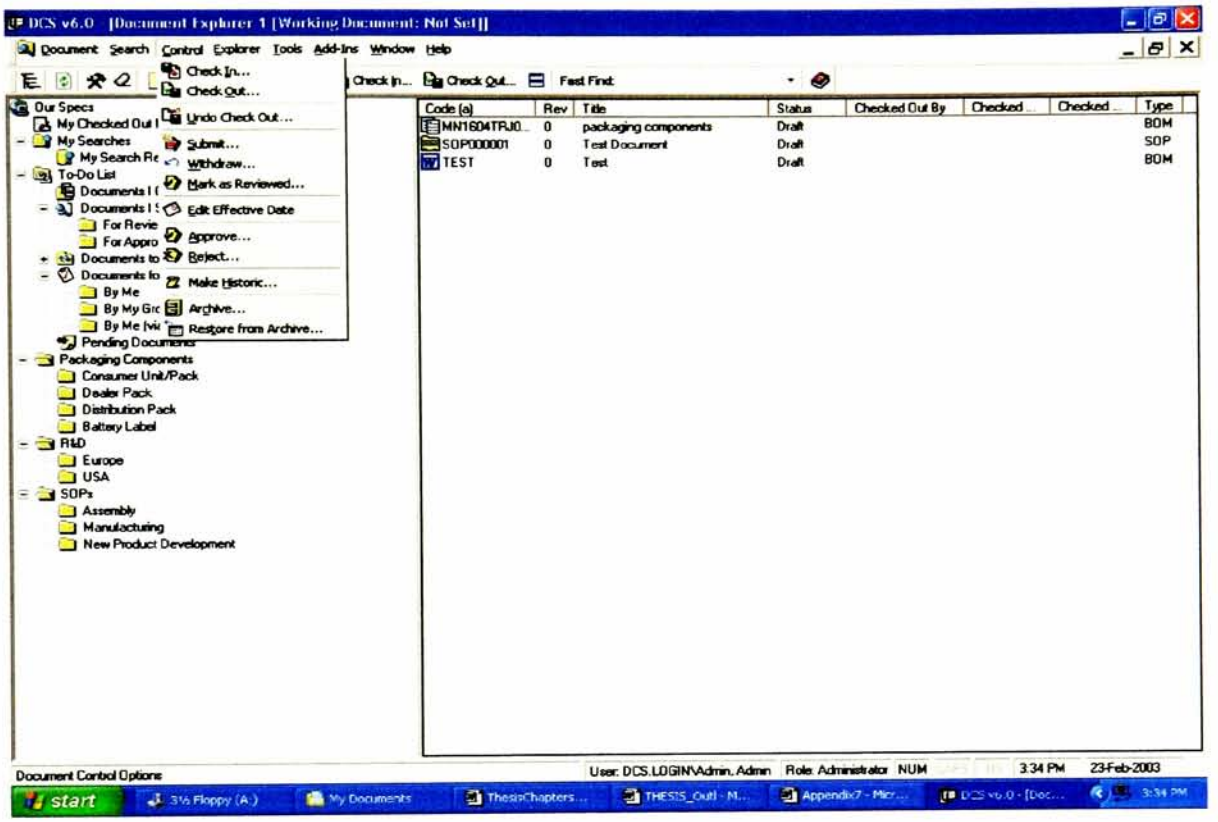
## Appendix F: Views of Needed Functions in DCS 6.0 Pro

Below is an example of how organized the DCS 6.0 Pro Interface can be by it supporting a desktop paradigm. When comparing it to the BOM viewed in Appendix B pg. DCS 2000 way is not as organized as DCS 6.0 Pro.

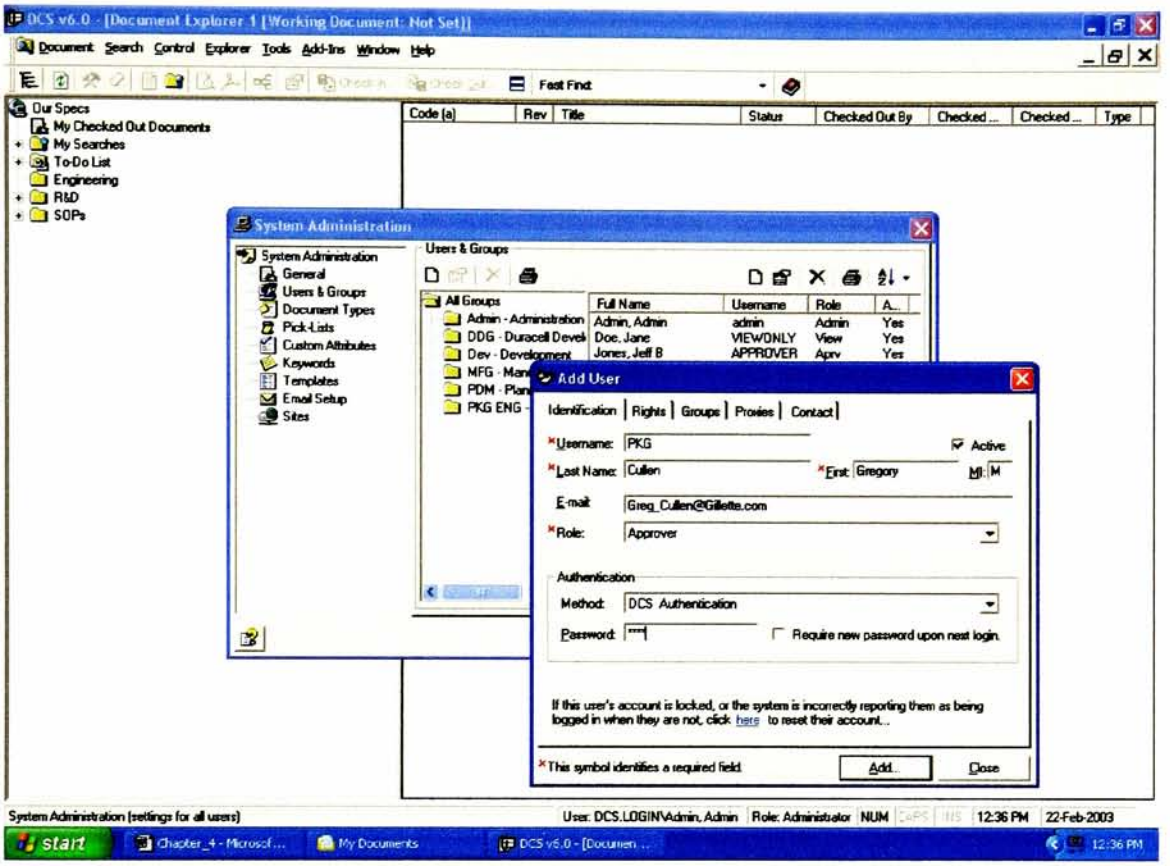



DCS functions can now effectively manage workflow, since a user can customize to compliment the way they use the system. The main tool in this interface is the document browser, which is similar in look and feel to the MS Windows Explorer with added capabilities. Multiple document browsers can be opened at one as child windows of the DCS 6.0 Pro application. Document can be organized into user-defined folders providing another way to access document quickly.

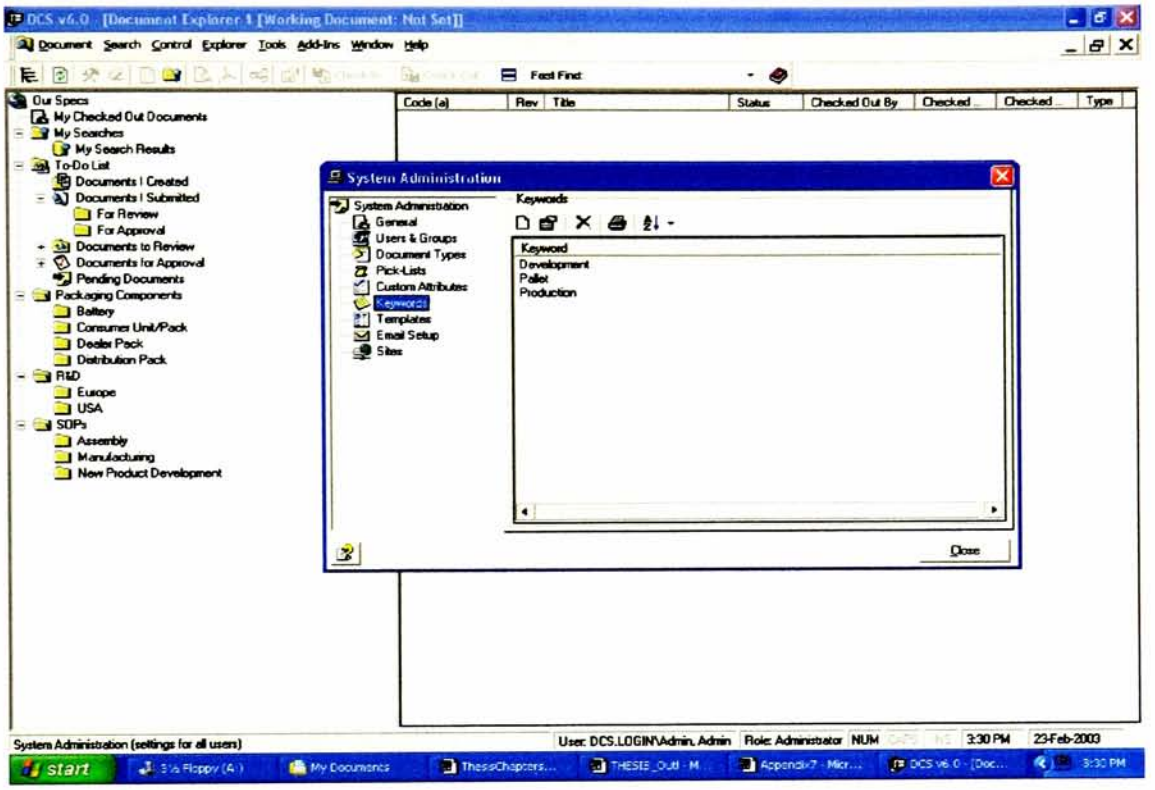
Easy access to controls in order to make approvals or any other functions needed to deal with a documentation approval is developed in DCS 6.0 Pro, and also DCS 2000. The difference between the two is that DCS 6.0 Pro has approval notification capabilities that lead to web-based technology's (not shown below) ability to have e-mail notification to users for reviewing, approving, and other document related information.



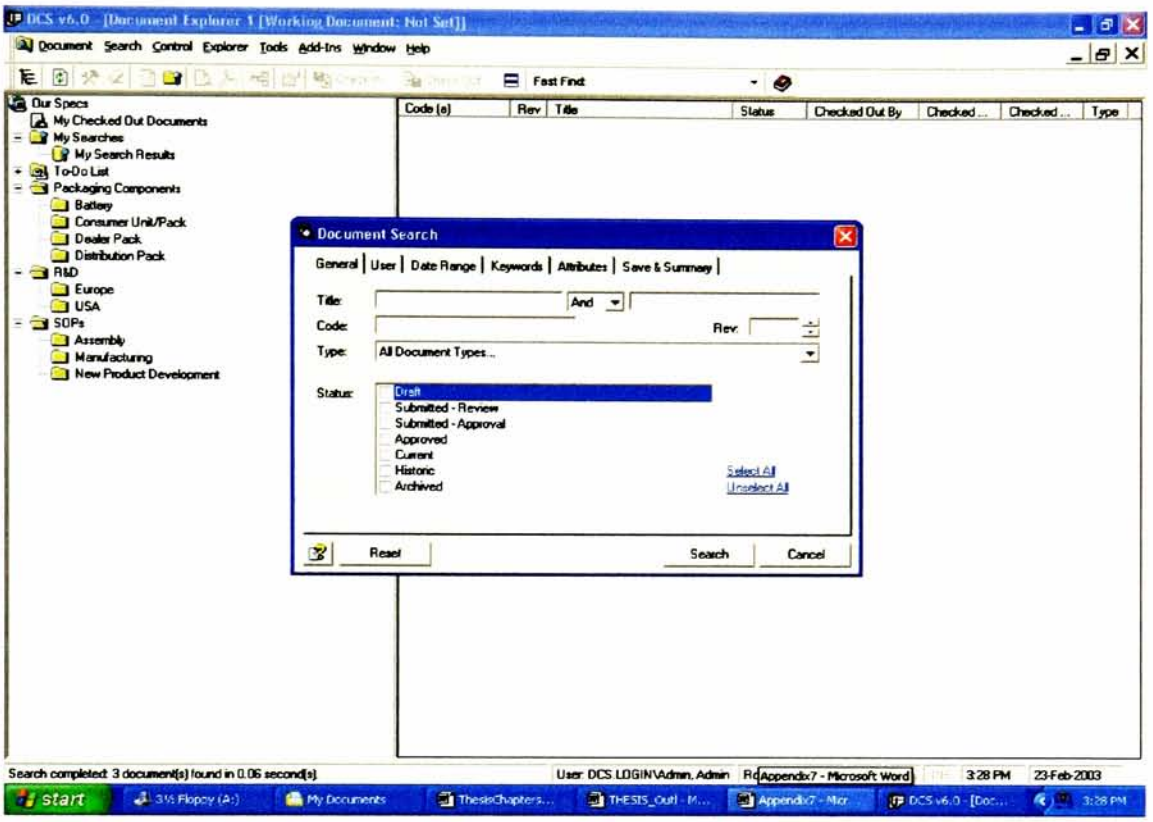
In DCS 6.0 Pro, system administrators will have greater flexibility to enable or disable features, functionality, choices, and access to particular Groups, Departments, Users, Contacts, Document Types, etc (Mystic reference). Being able to edit user groups for user capabilities secures that every type of affiliate will be chosen for the right viewing privileges.



Keywords are associated with documents in DCS 6.0 Pro in order to facilitate the search process and narrow down the search (reference, Mystic). The system administrator can set-up which keywords will be implemented during the search process. Packaging engineers could try to correct title BOMs or other document types by keywords for better searching capabilities. The end-result would be a consistency of terminology among document title headings.



Web-based searching, viewing and printing for global distribution of operational documents transpire in DCS 6.0 Pro. The system allows users to search for documents within the program. The search results only show those documents, which the user has right to.




Users can search for documents using a variety and/or combination of different methods. Below are descriptions from Mystic's Evaluation Guide of these search methods and the * means DCS 2000 does not have this type of search capability.

The General tab allows the user to search based on the following criteria:

- Title Phrase – Users can search for a document using the title phrase if the document code is not known
- Code & Rev – This field allows the user to search for the document by document code and revision number.
- Document Type – User can select a specific document type to search, if code and title are not known.
- Status – Users also have the ability to search document s in specific statuses, such as Draft, Submitted – Review, Submitted – Approved, Approved, Current, Historic and Archived.

The User tab allows searching based on the following criteria:

- *User Type – This field allows users to search for documents based on certain actions that were performed by a specific user. For example, the action types include, Documents created by, Documents submitted for review by, Documents submitted for approval by, Documents checked out by and Documents checked in by.
- *Application User – This field would be used to associate a specific user with the above action.

The Date Range tab allows users to search documents based on the following criteria:

- Date Criteria – This option allows users to search for the type of actions that occurred to documents during a specific time frame. Users can search by Document creation date, Properties modified, Submitted for review, Submitted for approval, Review completion, Document Approval, Scheduled effective date.
- Date – The user can specify the date range in which the above selected activity occurred.

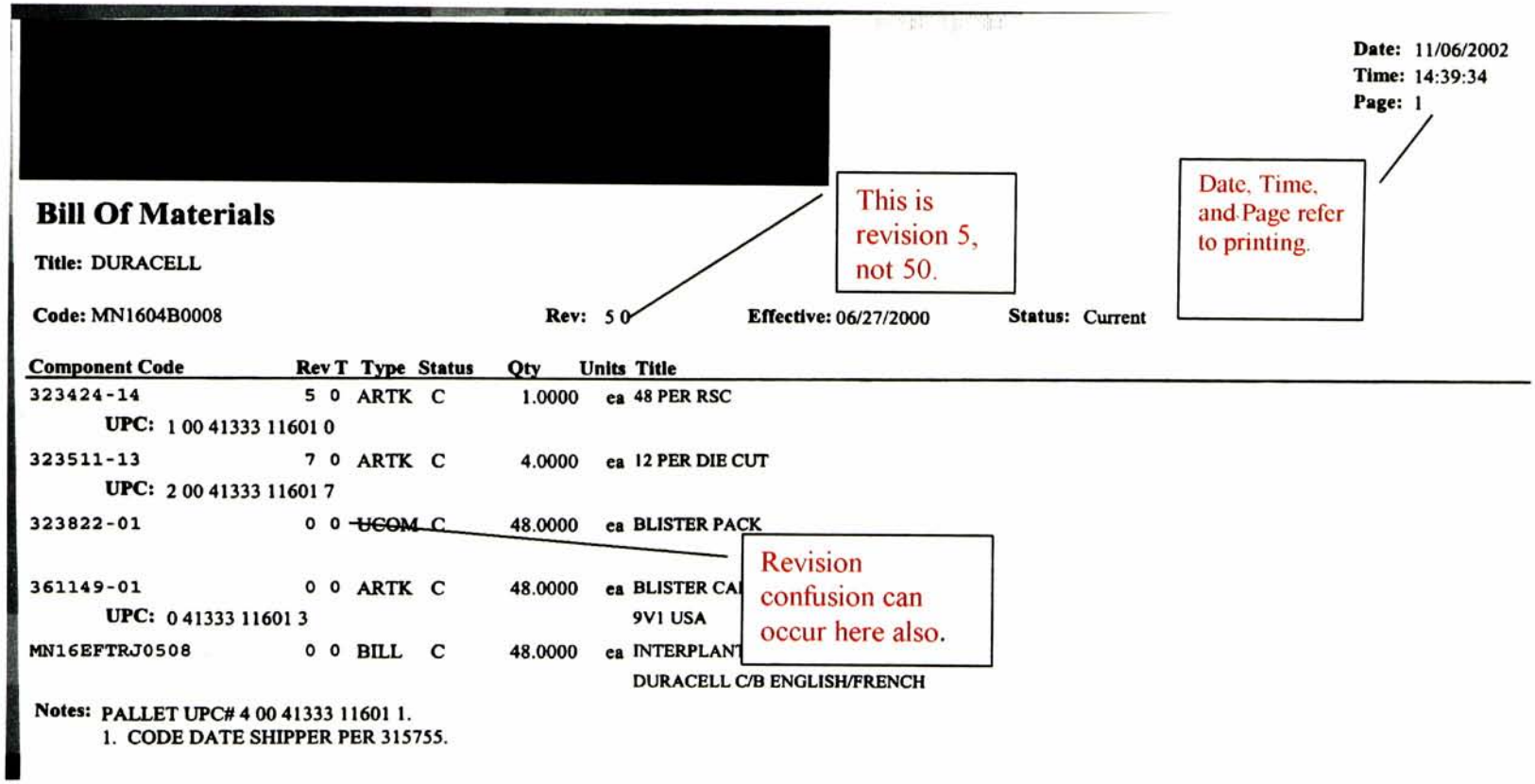
The keyword tab allows users to search for documents that have certain keywords assigned to them.

*The Attributes tab allows users to search for documents based on the custom attributes values that are assigned to the document. The user simply selects that attributes to be searched and enters the desired search critieria.

*The Save & Summary gives a short description of the search criteria selected and gives the user the options to save the search, if frequently performed, for later uses.

## Appendix G: View of Current BOM Hard Copies

Below is the "current style" BOM document, which is now given to manufacturing affiliates. BOM format for the "old style" BOM document incorporated a lot of information into it. As you can see from comparing, the current BOM hold information that can be confusing and limited to the user. The related documents section holds information from either having templates build-in DCS or having documents imported into DCS. This section gives the user part numbers to look into or print out for a hard copy. Manufacturing needs to get a hard copy mailed to them to use and store on file.



[redacted]

**Date:** 11/06/2002
**Time:** 14:39:34
**Page:** 1

This is revision 5, not 50.

Date, Time, and Page refer to printing.

**Bill Of Materials**

**Title:** DURACELL

**Code:** MN1604B0008 **Rev:** 5 0 **Effective:** 06/27/2000 **Status:** Current

| Component Code | Rev | T | Type | Status | Qty | Units | Title |
|---|---|---|---|---|---|---|---|
| 323424-14 | 5 | 0 | ARTK | C | 1.0000 | ea | 48 PER RSC |
| UPC: 1 00 41333 11601 0 | | | | | | | |
| 323511-13 | 7 | 0 | ARTK | C | 4.0000 | ea | 12 PER DIE CUT |
| UPC: 2 00 41333 11601 7 | | | | | | | |
| 323822-01 | 0 | 0 | ~~UCOM~~ | C | 48.0000 | ea | BLISTER PACK |
| 361149-01 | 0 | 0 | ARTK | C | 48.0000 | ea | BLISTER CA |
| UPC: 0 41333 11601 3 | | | | | | | 9V1 USA |
| MN16EFTRJ0508 | 0 | 0 | BILL | C | 48.0000 | ea | INTERPLANT |
| | | | | | | | DURACELL C/B ENGLISH/FRENCH |

Revision confusion can occur here also.

**Notes:** PALLET UPC# 4 00 41333 11601 1.
1. CODE DATE SHIPPER PER 315755.

MN1604B0008 – revision 4 was made since a new blister hole occurred for the blister card. MN1604B0008 became revision 5 in order for it to become historical (PCN02-00092 document explains the changes made).

## DCS 2000: Related Documents

Date: 10/23/2002
Time: 10:58:07
Page: 1

**Title:** DURACELL

**Code:** MN1604B0008 **Rev:** 5 **T:** 0 **Type:** BILL **Status:** Current

| Link | Code | Rev | T | Status | Title |
|---|---|---|---|---|---|
| BOM | ASTCBUHQ01 | 0 | 0 | Current | PAYLESS CASHWAYS ASSORTMENT -Q1, 2001 - ULTRA AND C/B<br>000 41333 11886 4 |
| Comp | 323424-14 | 5 | 0 | Current | 48 PER RSC |
| Comp | 323511-13 | 7 | 0 | Current | 12 PER DIE CUT |
| Comp | 323822-01 | 0 | 0 | Current | BLISTER PACK |
| Comp | 361149-01 | 0 | 0 | Current | BLISTER CARD - NEW HANGER HOLE<br>9V1 USA |
| Comp | MN16EFTRJ0508 | 0 | 0 | Current | INTERPLANT HANDLING<br>DURACELL C/B ENGLISH/FRENCH |
| PCN | PCN00-000145 | 0 | 0 | Approved | NEW HANGER HOLE |
| PCN | PCN00-000145 | 1 | 0 | Approved | NEW HANGER HOLE |
| PCN | PCN02-000292 | 0 | 0 | Approved | CHANGE BOMS TO HISTORIC STATUS |
| RfCh | 311047 | 1 | 0 | Current | PACKING ASSEMBLY DRAWING |
| RfCh | 318850-025 | 6 | 0 | Current | PALLET PATTERN |
| RfCh | 318992 | 0 | 0 | New | BLISTER ASSEMBLY DRAWING |
| RfCh | CS1604B | 0 | 0 | Current | RSC |
| RfCh | CU1604B | 0 | 0 | Current | BLISTER CARD PACK |

Mistake occurred with PCNs – usually no more than one PCN to a BOM.

This PCN is ok, since this BOM was made a revision 5, in order to become Historic status

Link RfCH means it is a referential child type of link, which enables this kind of information (dimensions, cube, weight, pallet pattern, etc.) to be imported or typed into a template within DCS 2000. Manufacturing affiliates do not have to see dimensions, cube, and weight on the BOM. Hard copies of these kinds of documents are provided to them when need be.

**DCS 2000: Related Documents**

**Title:** DURACELL

**Code:** MN1604B0008 **Rev:** 5 **T:** 0 **Type:** BILL **Status:** Current

| Link | Code | Rev | T | Status | Title |
|---|---|---|---|---|---|
| RfCh | DP1604B | 0 | 0 | Current | DIE CUT CARTON |

Below is an example of a BOM with no revisions for a new SKU. The difference between MN1604B0008 and MN1604B00014 is that MN1604B00014 has a newer version of chemistry to the battery. Plus, new part numbers are used for new graphics on card and new card, new date code, new blister, new label, new 12 per inner carton, and new 48 per shipper.

[redacted]

**Date:** 10/23/2002
**Time:** 11:17:27
**Page:** 1

## Bill Of Materials

**Title:** COPPER & BLACK [redacted]
DURACELL USA

**Code:** MN1604B0014 **Rev:** 0 0 **Effective:** 12/02/2000 **Status:** Approved

| Component Code | Rev | T | Type | Status | Qty | Units | Title |
|---|---|---|---|---|---|---|---|
| 321500-06 | 0 | 0 | ARTK | C | 4.0000 | ea | 9V1 W/UNDERFOLD BLISTER 12 PER |
| UPC: 200 41333 11601 7 | | | | | | | USA C/[redacted] |
| 321501-09 | 0 | 0 | ARTK | S | 1.0000 | ea | 9V1 W/UNDERFOLD BLISTER, 48 PER |
| UPC: 100 41333 11601 0 | | | | | | | DURACELL USA [redacted] |
| 361357-02 | 0 | 0 | ARTK | C | 48.0000 | ea | 9V1 COPPER/BLACK BLISTER CARD |
| UPC: 0 41333 11601 3 | | | | | | | [redacted] |
| 361358 | 1 | 0 | DRWG | C | 48.0000 | ea | 9V1 COPPER/BLACK ZREO DEGREE DRAFT BLISTER |
| MN16TLTRJ0614 | 0 | 0 | BILL | C | 48.0000 | ea | INTERPLANT HANDLING |
| | | | | | | | DURACELL C/B ENGLISH/FRENCH/SPANISH |

S means it is in submitted status – This BOM will not be able to hit current status until it is approved

**Notes:** PALLET BARCODE: 4 00 41333 11601 1.

In DCS 2000 a BOM functionally provides controlled assembly of BOMs. Component documents are added to the BOM through a user-friendly linking routine. Once incorporated, component quantities are added along with units of measure from a pick list. Specific business rules apply to the relationship between BOMs and components. These automated integrity checks ensure that a BOM will never become approved and effective without the components also being approved and effective.

## DCS 2000: Related Documents

Date: 10/23/2002
Time: 11:17:29
Page: 1

**Title:** COPPER & BLACK DROP BLISTER [redacted]
DURACELL USA
**Code:** MN1604B0014 **Rev:** 0 **T:** 0 **Type:** BILL **Status:** Approved

| Link | Code | Rev | T | Status | Title |
|---|---|---|---|---|---|
| Comp | 321500-06 | 0 | 0 | Current | 9V1 W/UNDERFOLD BLISTER 12 PER |
| Comp | 321501-09 | 0 | 0 | Submitted | [redacted] |
| Comp | 361357-02 | 0 | 0 | Current | |
| Comp | 361358 | 1 | 0 | Current | 9V1 COPPER/BLACK ZREO DEGREE DRAFT BLISTER |
| Comp | MN16TLTRJ0614 | 0 | 0 | Current | INTERPLANT HANDLING<br>DURACELL C/B ENG |
| PCN | PCN00-000439 | 0 | 0 | Approved | Create bills for Open S<br>Item variation 12, 13 & |
| PCN | PCN00-000439 | 1 | 0 | Approved | Create bills for Open S<br>Item variation 12, 13 & |
| PCN | PCN00-000439 | 2 | 0 | Approved | Create bills for Open S<br>Item variation 12, 13 & |
| RfCh | 311047 | 1 | 0 | Current | PACKING ASSEMBLY DRAWING |
| RfCh | 315755 | 47 | 0 | Current | CODE DATE SPECIFICATION |
| RfCh | 318850-510 | 0 | 0 | Current | PALLET PATTERN<br>9V1 OPEN STOCK, UNDERFOLD |
| RfCh | 361701 | 0 | 0 | New | 9V1 BLISTER ASSEMBLY DRAWING<br>(ZERO DRAFT) |
| RfCh | CS1604BU | 0 | 0 | Current | RSC |
| RfCh | CU1604B | 0 | 0 | Current | BLISTER CARD PACK |
| RfCh | DP1604BU | 0 | 0 | Current | DIE CUT CARTON |

## Appendix H: View of a Proposed New BOM Format

Below is an example of a layout of a new BOM design created by Greg Cullen to help manufacturing affiliates clearly understand each component. It would enable Mystic to be able to create this format, along with having internal and external departments better understand the information.

**BILL OF MATERIALS**

**Title:** COPPER & BLACK [redacted]
DURACELL USA

**Code:** MN1604B0014 **Rev:** 00 **Effective:** 12/02/2000 **Status:** Approved

| Product | Component Code's Title | Component Code/ Applicable UPC | Rev. # | Document Type | Status | Qty | Unit |
|---|---|---|---|---|---|---|---|
| Battery | Interplant Handling Duracell C/B English/French/Spanish | MN16TLTRJ0614 | 0 | BILL | C | 48 | ea |
| Consumer Unit/Pack | 9V1 Copper/Black Blister Card | 361357-02 | 0 | ARTK | C | 48 | ea |
| | | **UPC:** 0 41333 11601 3 | | | | | |
| Consumer Unit/Pack | 9V1 Copper/B [redacted] Dra | 361358 | 1 | DRWG | C | 48 | ea |
| Dealer Pack | 9V1 W/Under [redacted] USA C | 321500-06 | 0 | ARTK | C | 4 | ea |
| | | **UPC:** 200 41333 11601 7 | | | | | |
| Distribution Pack | 9V1 W/Under [redacted] USA C/B Sploce | 321501-09 | 0 | ARTK | S | 1 | ea |
| | | **UPC:** 100 41333 11601 0 | | | | | |

**Notes:** Pallet Barcode: 4 00 41333 11601 1

## RELATED DOCUMENTS

**Title:** COPPER & BLACK [redacted]
DURACELL USA

**Code:** MN1604B0014 **Rev:** 00 **Effective:** 12/02/2000 **Status:** Approved

| Document Link Types | Component Code's Title | Component Code | Rev. # | Status |
|---|---|---|---|---|
| Comp | 9V1 W/Underfold Blister 12 per USA C/B Spruce | 321500-06 | 0 | C |
| Comp | 9V1 W/Unde[redacted] USA | 321501-09 | 0 | S |
| Comp | 9V1 Copper/[redacted] | 361357-02 | 0 | C |
| Comp | 9V1 Copper/[redacted] Draft Blister | 361358 | 1 | C |
| Comp | Interplant Handling Duracell C/B English/French/Spanish | MN16TLTRJ0614 | 0 | C |
| PCN | Create Bills for Open Stock Drop Blister & [redacted] tem Var | PCN02-000439 | 0 | A |
| PCN | Create B[redacted] Drop Blister & [redacted] tem Var | PCN02-000439 | 1 | A |
| PCN | Create B[redacted] Drop Blister & [redacted] tem Variation 12, 13, & 14 | PCN02-000439 | 2 | A |
| RfCh | Packaging Assembly Drawing | 311047 | 1 | C |
| RfCh | Code Date Specification | 315755 | 47 | C |
| RfCh | Pallet Pattern 9V1 Open Stock, Underfold | 318850-510 | 0 | C |
| RfCh | 9V1 Blister Assembly Drawing (Zero Draft) | 361701 | 0 | N |
| RfCh | RSC | CS1604B4 | 0 | C |
| RfCh | Blister Card Pack | CU1604B | 0 | C |
| RfCh | Die Cut Carton | DP1604BU | 0 | C |