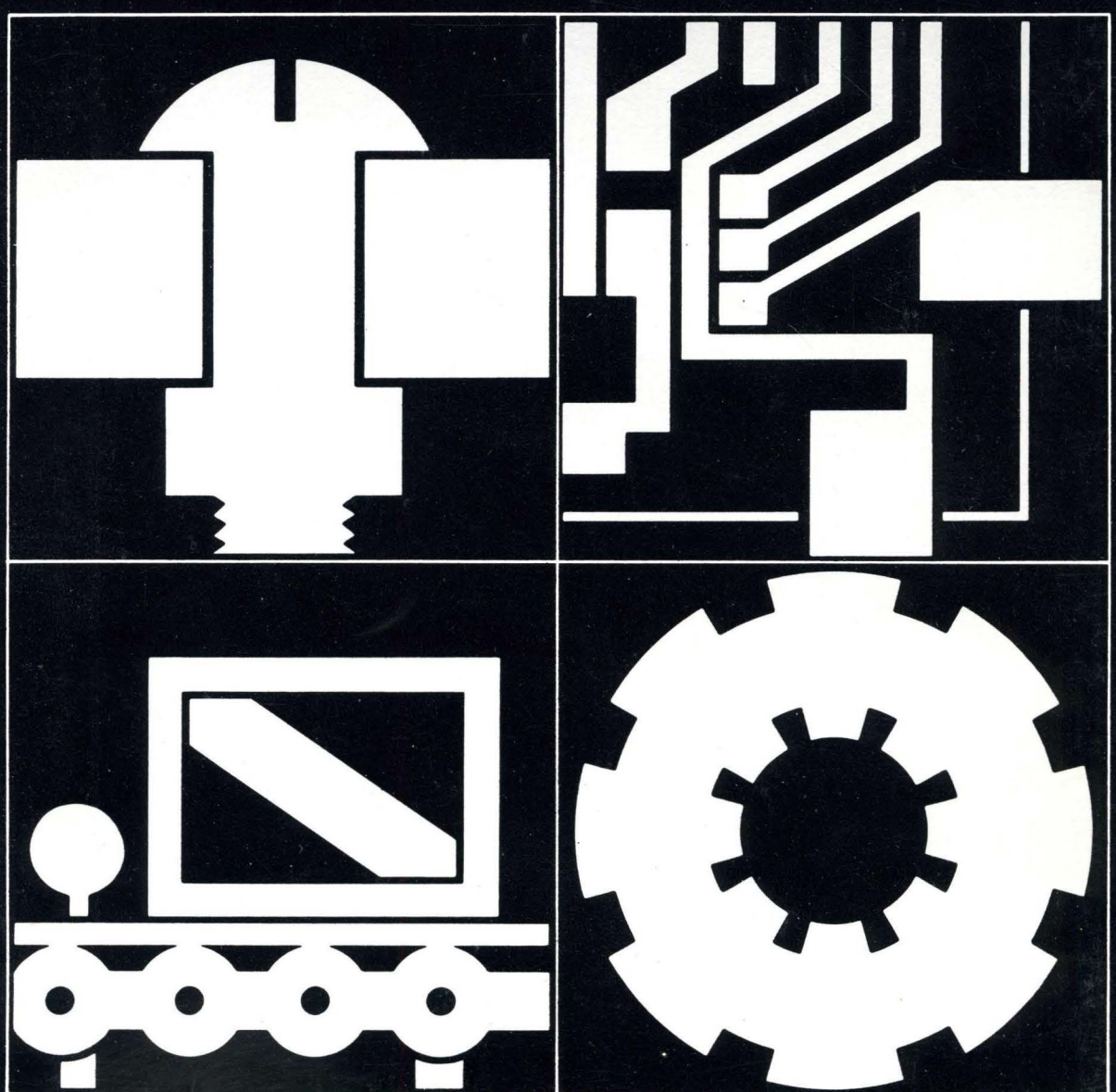
IBM

Communications Oriented Production Information and Control System

Volume VIII

System Data Base



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Foreword

COPICS (Communications Oriented Production Information and Control System) is a series of concepts that outline an approach to an integrated computer-based manufacturing control system. The concepts deal with problems common to most companies, from a forecast of customer orders, through development of the master production schedule, to production and shipment of the product. COPICS is involved, therefore, with allocation and control of most of the major resources of a company – plant, equipment, manpower, and materials.

COPICS evolved from the approach to manufacturing applications presented in the IBM publication *The Production Information and Control System* (GE20-0280). In COPICS those applications are defined from a communications point of view and have been expanded in scope.

The twelve COPICS chapters provide management with a guide for development of a dynamic online manufacturing control system that is terminal and communications oriented and event responsive. The chapters present the system's concepts in a manner designed to help develop a system that can truly respond to the requirements of all levels of operating personnel and management. Little knowledge of computers is assumed, although some prior exposure to computer concepts and familiarity with such terms as "program", "files", etc., is helpful. Emphasis is on what the problems are and *why* their solution is valuable. How specific problems are solved is discussed only at that level of detail required to assure managers that the solution is feasible. The computer is not, itself, the system, but is, rather, a tool to be used by the manager.

The COPICS concepts are oriented to production and related manufacturing applications. They are not concerned directly with other major areas, such as finance, marketing, and personnel, although the COPICS approach collects data that will be helpful to these areas.

Throughout the COPICS publications, distinction is made between a given COPICS concept, the corresponding chapter, and the corresponding plant department by the use of small capital letters, italics, and initial capital letters, respectively. For example, reference may be made to the COPICS concept PURCHASING AND RECEIVING, or to material in *Chapter 10, Purchasing and Receiving*, or to the plant departments called Purchasing and Receiving.

The complete system is presented in eight volumes containing, in all, 17 sections. The Management Overview section is also available as a separate publication, G320-1230. The contents and IBM order numbers of the eight volumes are as follows:

Volume I	G320-1974	Management Overview, System Requirements, Index, Glossary
Volume II	G320-1975	Chapter 1 Engineering and Production Data Control
		Chapter 2 Customer Order Servicing
Volume III	G320-1976	Chapter 3 Forecasting
		Chapter 4 Master Production Schedule Planning
Volume IV	G320-1977	Chapter 5 Inventory Management
Volume V	G320-1978	Chapter 6 Manufacturing Activity Planning
		Chapter 7 Order Release
Volume VI	G320-1979	Chapter 8 Plant Monitoring and Control
		Chapter 9 Plant Maintenance
Volume VII	G320-1980	Chapter 10 Purchasing and Receiving
		Chapter 11 Stores Control
		Chapter 12 Cost Planning and Control
Volume VIII	G320-1981	System Data Base

To obtain the complete set of eight volumes please order the IBM Bill of Forms number GBOF-4115.

Contents

Throughout the various application chapters of COPICS, the need for the *management of change* has been stressed. Many systems cannot respond to changing management requirements because the necessary information base has been too rigidly organized. Even if the information is arranged to provide answers to anticipated as well as to current problems, it is often not recognized that company development is dynamic. For example, a system designed to give greater customer satisfaction by improving delivery dates may later need to respond to the new situation that it has helped to create: in subsequent years the principal objective may be to obtain the maximum output from the more heavily loaded plant.

The organization of basic data must therefore be flexible. It must allow continuous system development to answer new needs, without causing periodic, massive, and costly reorganizations.

System Data Base considers the problems involved in organizing this basic information and at the same time providing the required flexibility.

Limitations of Conventional Systems

Company data is not always maintained for most effective use. Systems have often been developed separately, each based on specially created data files. Often, these files are not related to each other at all. Engineering departments may hold product information in the form of parts lists, representing the way in which the products are built, while the accountant's product records may be organized by his own system of cost codes (Figure 1).

The development of many unrelated sets of data files leads to duplication of data, and the volume of this data creates additional problems. Alterations to the data are made by many different departments – engineering, production, accounting, purchasing and sales – and the number of changes themselves is also voluminous.

Because of these conditions, inconsistencies inevitably develop. Attempts to reduce these inconsistencies are costly, and are rarely successful. The use of inconsistent data has several ill effects:

- It causes errors in actual production (for example, it may cause parts to continue being manufactured to the wrong engineering change level).

- It obscures attempts to measure performance, since there is no single, sound basis for comparison (for example, labor cost variances may be based on out-of-date routings).
- It leads to decisions based on incomplete or inaccurate information (for example, engineering changes may be approved despite inaccurate estimates of the cost effect).

Furthermore, the separate sets of files fail to answer many of management's needs. It is often impossible to obtain quick, complete, and accurate answers to such questions as: What is the cost effect of a change of material? Of the introduction of a new machine? Of a change in plant layout? Similarly, the time it takes an engineer to search for every usage of an existing part could be better spent in more creative work.

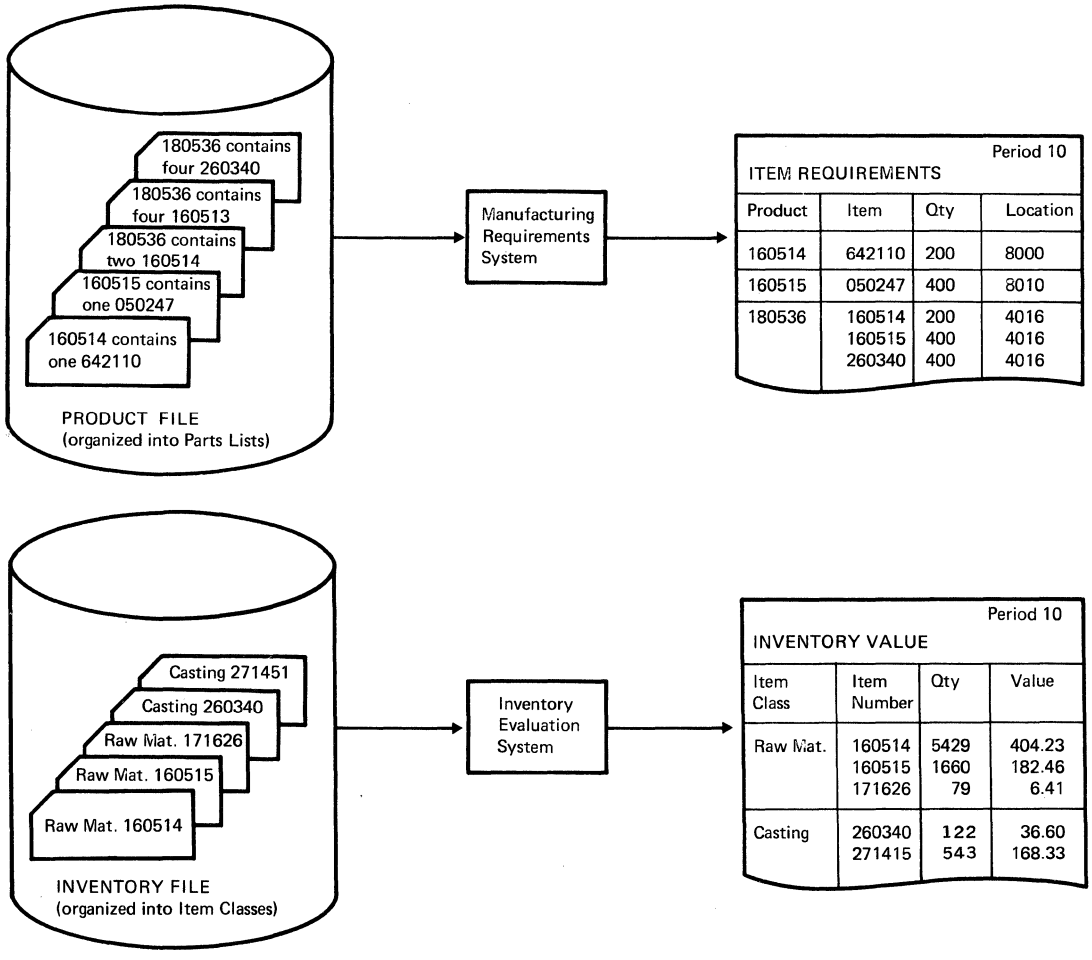


Figure 1. In conventional manufacturing and accounting systems separate data files are used

Characteristics of an Integrated System

Although it is sometimes convenient to organize and control information in several different locations (as in the case of a company that has several plants), information organization should usually be on a companywide basis, with the objectives of:

- Eliminating the data duplication, and therefore the inconsistencies, by representing each data item only once
- Making the data available to each user in the form in which he requires it
- Providing the flexibility to allow future development and reorganization without too much additional cost
- Developing techniques by which the basic data can be maintained in a current and accurate condition so that it is capable of providing information on demand

Data organized to achieve these objectives can provide a flexible basis for manufacturing planning and execution, and at the same time enable engineers to retrieve and use design information effectively. It also permits the simulation of alternative courses of management action.

These enhanced capabilities bring increased confidence in the quality of the results obtained from the system. This confidence arises as much from the improvement in procedures for data creation and change handling, which are developed during the initial phases of system installation, as from the capabilities of the data base itself. If this confidence does not exist, informal systems will be created as substitutes. For example, if the system's inventory records have inaccuracies, bin cards will still be maintained "as a check on the computer", even though the bin cards probably contain more errors than the computer records.

Data Base Organization

A company using a conventional system often maintains many data bases – engineering data, sales data, personnel data, etc. (Figure 2). Each data base is organized for the convenience of its users. An integrated data base should also allow each authorized user to obtain the data he needs as if it had been organized for his own use.

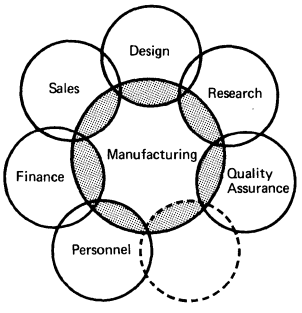


Figure 2. Conventional systems have multiple data bases

When computer applications are developed separately, the various data files usually have their own method of data organization and their own data formats. The programs using the files are, of course, designed for those organizations and formats; and a change in the organization or

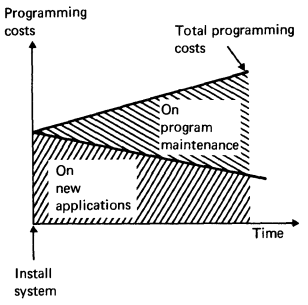


Figure 3. Increasing load on program maintenance

data format of a file necessitates changes to all programs using the particular file. This causes problems in:

- Maintenance of existing programs
- Development of new applications

The maintenance problem

As the number of files grows, and with it the number of programs, the problem of program maintenance also grows. A point in time can be foreseen when the major part of programming resources will be consumed by this increasing volume of minor program changes and the subsequent testing of altered programs (Figure 3).

The lack of a data base system and inadequate planning of applications are the cause of expensive alterations at a later date. The fear of such alterations has in the past inhibited the development of many major systems. Because of inability to foresee how a system could be developed in the future, system designers have been reluctant to make their specifications firm enough for work on them to proceed quickly. This situation is unacceptable to management, who cannot be expected to wait several years before seeing worthwhile results from system development work.

Data base flexibility

To achieve profitable results in the short term without prejudicing longer-term development, the long-range planning of systems development should be restricted to a skeleton master plan. This plan foresees the general areas in which development is intended, together with the general system requirements for these areas, without specifying the detailed requirements.

This approach recognizes that management's methods and requirements will change during the planning and implementation of a large system. Failure to provide sufficient flexibility for these changes can make a system out of date before it is installed.

If the early applications use a data base organization that is flexible, a subsequent change in the requirements of a future system, or in the order of implementation of future systems, does not have a heavy impact on work already completed.

With the continued development and use of applications the impact on the computing system changes. At the time of installation the system is designed to use the computer efficiently. Over a period of time, however, the relative frequencies of particular types of transactions change, and may lower the efficiency of the computing system. Usually, this situation can be corrected only by a partial redesign of the system, the file organization, or both.

In order to reduce program maintenance, a high degree of "data independence" is required. Data independence allows an application programmer to define his own *logical data structures* (the particular data structures required by a specific application) without concern for the physical storage medium (disk, tape, etc.) or for the method of organizing records within that medium. Conversely, with data independence, it is possible to change the type of physical storage device or the way the data is organized, without having to modify the application programs. Data independence makes it possible to:

data independence

- Change record layouts without reprogramming
- Add new types of data to an existing data base
- Connect related information from separate data bases

With these facilities, the progressive introduction of new data allows the development of new applications that use both new and existing data. Thus the creation of duplicate data is avoided.

Since the logical structure of the data no longer dictates the physical storage method, each application program can be written without knowledge of the organization and access method used to retrieve data.

This independence also enables physical data records to be reorganized periodically to provide the most efficient use of the computing system, without necessitating program changes.

Essential objectives

The data base for an integrated computer system must meet certain clearly defined objectives:

- To eliminate redundant data within the user's data processing environment. If data is never duplicated, the maintenance effort is reduced and the accuracy of data available to users is increased.
- To provide a system that offers evolutionary growth, that is, the ability of the user to start with one application and add the others as they are required.
- To reduce application program maintenance, allowing the company to apply a larger percentage of its data processing resources to future application design and development.
- To provide online maintenance of data bases, thus ensuring that data is always up to date.

In addition, it is likely in some instances that the user will wish to establish his data bases in a batch environment and move to a teleprocessing system at some later time.

If a data base is to meet the design objectives discussed, certain features are essential. These are described under:

- Data Structures
- Logical Data Structures
- The Data Base Interface

Data Structures

The sharing of data between applications requires an ability to group data in varying combinations according to the requirements of each application. This grouping is facilitated by segmenting each data record into smaller units or "segments". The segments required by an individual application can then be retrieved as required, the others being ignored.

Various aspects of segmentation are discussed under:

- Segmented Records
- Hierarchical Segmentation
- Protected Data
- Variable Length Records

Segmented records

The actual breakdown of a record into its several segments is to some extent arbitrary. Data elements ("fields") associated with each other, or likely to be processed together, are gathered into the same segment. In Figure 4 the basic information about a manufactured item (number, description, etc.) is grouped into one segment (identification segment); all "on-hand quantity" fields for a number of store locations, together with the field "quantity undergoing inspection", are collected into an inventory segment; and so on. Each segment is given a name, and can be retrieved by any application program when "called" by that name. The breakdown of the record into its segments is described to the computer system independently of the application program. A Data Base Interface routine is responsible for interpreting each "call" and initiating retrieval of the required segments.

IDENTIFICATION			INVENTORY		
Item Number	Description	Status	On-Hand (Location 1)	On-Hand (Location 2)	Inspection Quantity

Figure 4. Data is gathered into segments for processing

Hierarchical segmentation

The retrieval of several associated segments required by an application program is facilitated by the "hierarchical" organization of the segments within a record. A hierarchical record can be represented graphically as a tree structure (Figure 5). The hierarchical relationships do not imply a particular physical organization, but the record appears to the application program as if it were organized this way.

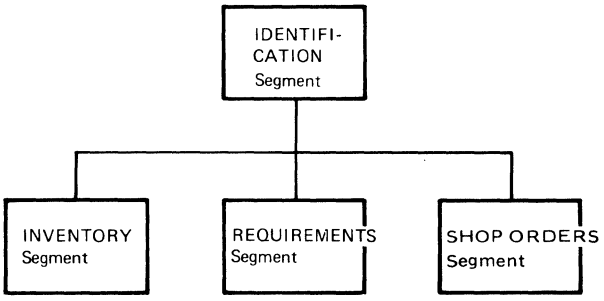


Figure 5. A segmented hierarchical record

The identification segment in the structure is called the "root segment". The root segment always contains the basic identification of the record, such as item number or machine number, tool number, shop order number, customer number, etc. The root segment may also include generally used fields, such as item type, description, etc.

Segments below the root are referred to as dependent segments, or "children" of the root segment, which is then referred to as the "parent". Either the whole record or certain specified segments can be retrieved for processing upon request by a particular application program (Figure 6).

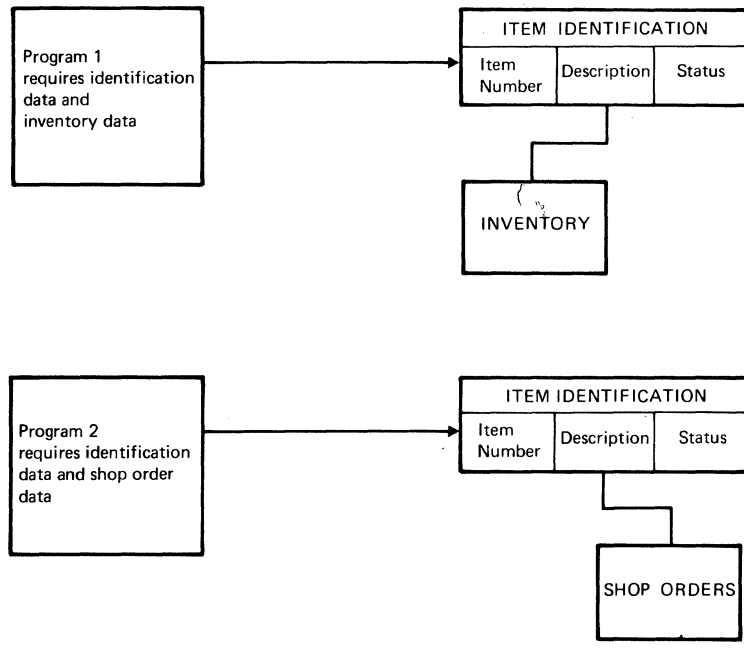


Figure 6. Different application programs select different segments for processing

Protected data

It is often desirable to protect certain information from unauthorized access. Chosen segments can therefore be declared to the system as "protected" data. In Figure 7, the shaded segments represent data protected from user A, who is unable to access the SECURITY and AUTHORIZATION segments, but is allowed to retrieve other segments.

The shaded segments in Figure 8 represent data protected from access by user B. As far as he is concerned, the entire data base consists only of the EMPLOYEE IDENTIFICATION, EDUCATION, and RELATED EXPERIENCE segments.

Protection of data is one of the functions of the Data Base Interface and will be discussed later under that heading.

Variable length records

The amount of information associated with each item in the data base varies widely with the item and also with time. For example, the number of operations required in the manufacture of a part varies with the part; and the number of orders outstanding for a chosen end product constantly changes with time. This means that the number of segments dependent on another segment is highly variable.

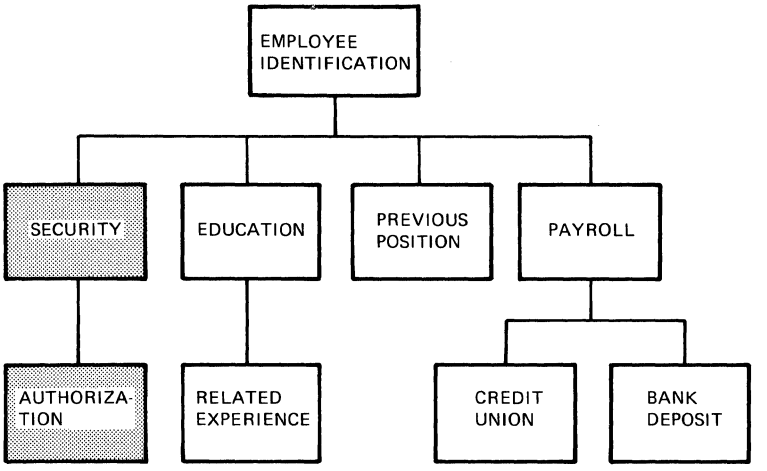


Figure 7. Data protected from access by user A

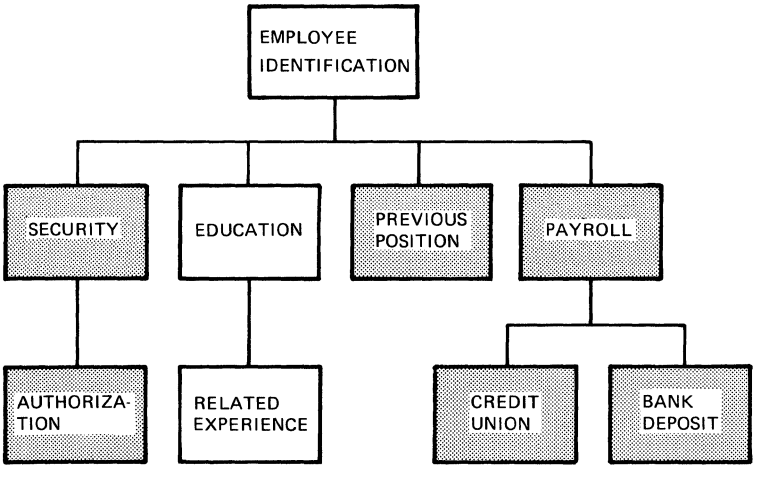


Figure 8. Data protected from access by user B

In fact, dependent segments can be repeated any number of times, while some parent segments have no dependent segment. For example, each routing header segment has a different number of operation segments dependent upon it (Figure 9); the routing header itself, however, is not present if the item concerned is a raw material or a purchased item and, as such, has no routing. Thus, in concept, the structure can be considered to have three dimensions below the root segment.

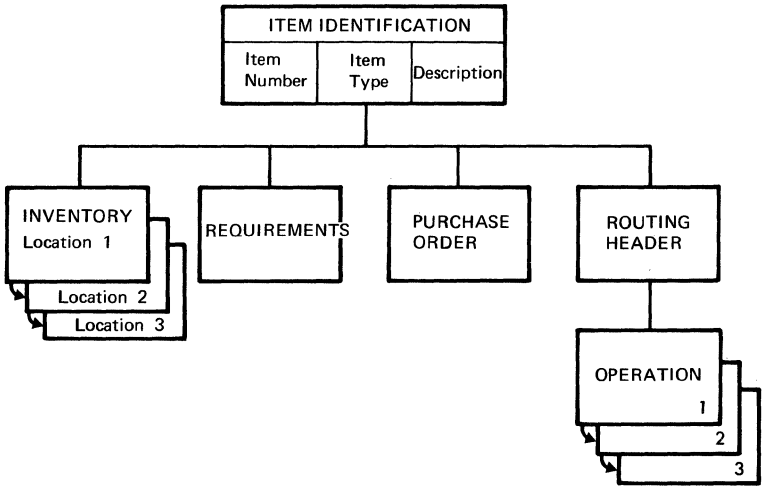


Figure 9. Multiple segments provide a variable length capability

Also, different types of dependent segments inevitably have different lengths. (For instance, the size of the operation segment is not the same as that of the order segment.) Thus the data base record is fully flexible in both format and length. However, all segments of one type (say, all operation segments) have the same size not only within a record, but also within the entire data base.

Since the segments constituting a record are different in both size and number, records cannot be stored efficiently as a continuous string of data. The relationships between the segments are therefore maintained by "pointers" connecting the segments to one another; thus the physical disposition of the segments is irrelevant. In Figure 9 pointers connect the inventory segments for the different stores locations; similarly, each operation segment is connected to the next. The pointers are created and maintained by Data Base Management routines, and the programmer need not be aware of them. (Data Base Management is also responsible for creation, maintenance, and retrieval of records from the physical data base.)

The use of pointers enables the system to access any or all of the associated segments when required by an application program.

Logical Data Structures

The previous section indicated how records are structured, and how their segments are related by pointers that provide *physical* connections. This section deals with *logical* data structures that are specific to particular application programs. A logical structure is defined within the program concerned, and represents the way the data base "appears" to the program. Often each program's view of the data base is different, and different again from the actual physical storage. The logical structure defines how chosen segments (from one or more physical data bases) are to be regrouped by the system for use by a particular application program.

For example, consider a situation where two physical data bases have been created (Figure 10). The first of these is an Item Inventory data base, which represents all purchased items. Dependent upon each ITEM segment are a number of SUPPLIER segments representing the manufacturers of the item. Each item also has a related INVENTORY segment, and each supplier segment has a number of PURCHASE ORDER segments.

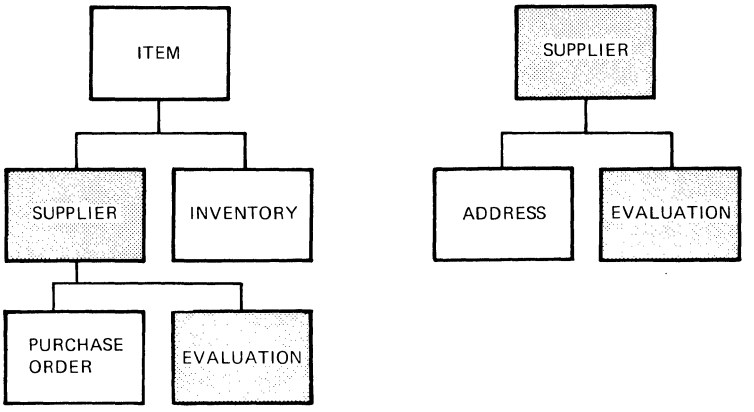


Figure 10. Duplication of data in two physical data bases

The second data base is the supplier data base. There is a SUPPLIER segment for each source of supply, and dependent on each of these is an ADDRESS segment and an EVALUATION segment, giving supplier evaluation details about delivery standards, quality, etc.

This example shows duplicate supplier data in the two data bases. This duplication is unnecessary. In fact, data can always be structured to avoid redundancy without sacrificing quick and efficient retrieval of

associated segments. This is achieved by techniques discussed under the following headings:

- Interrelated Data Bases
- Interrelated Records
- Complex Data Structures

Interrelated data bases

The two physical data bases shown in Figure 10 can be correlated as in Figure 11. The SUPPLIER segment under ITEM has been replaced by a pointer. This pointer segment connects the Item Inventory data base with the SUPPLIER segment in the Supplier data base. Redundant data has been eliminated.

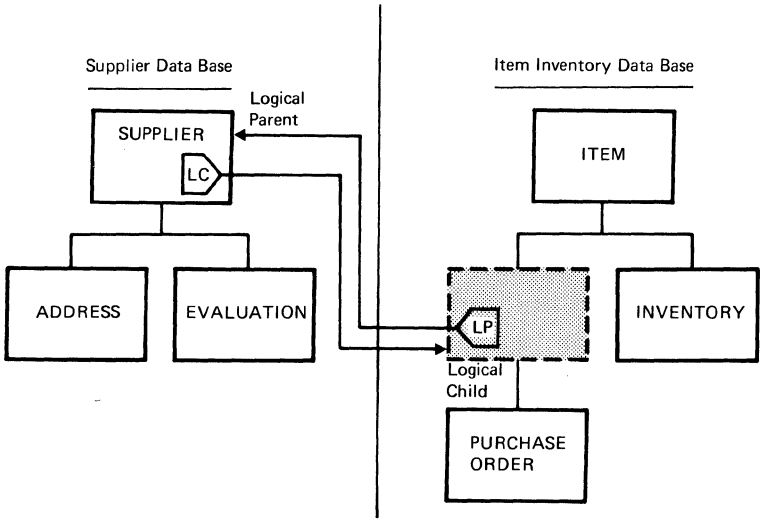


Figure 11. Interrelated data bases

The SUPPLIER segment in the Supplier data base is said to be the logical parent (LP) of the related segment (logical child, LC) in the Item Inventory data base.

This pointer segment now has a physical parent, ITEM, and a logical parent, SUPPLIER.

If there are several Suppliers of the item, a series of logical parent pointers is required under ITEM. Each pointer relates to a SUPPLIER segment in the Supplier data base (Figure 12).

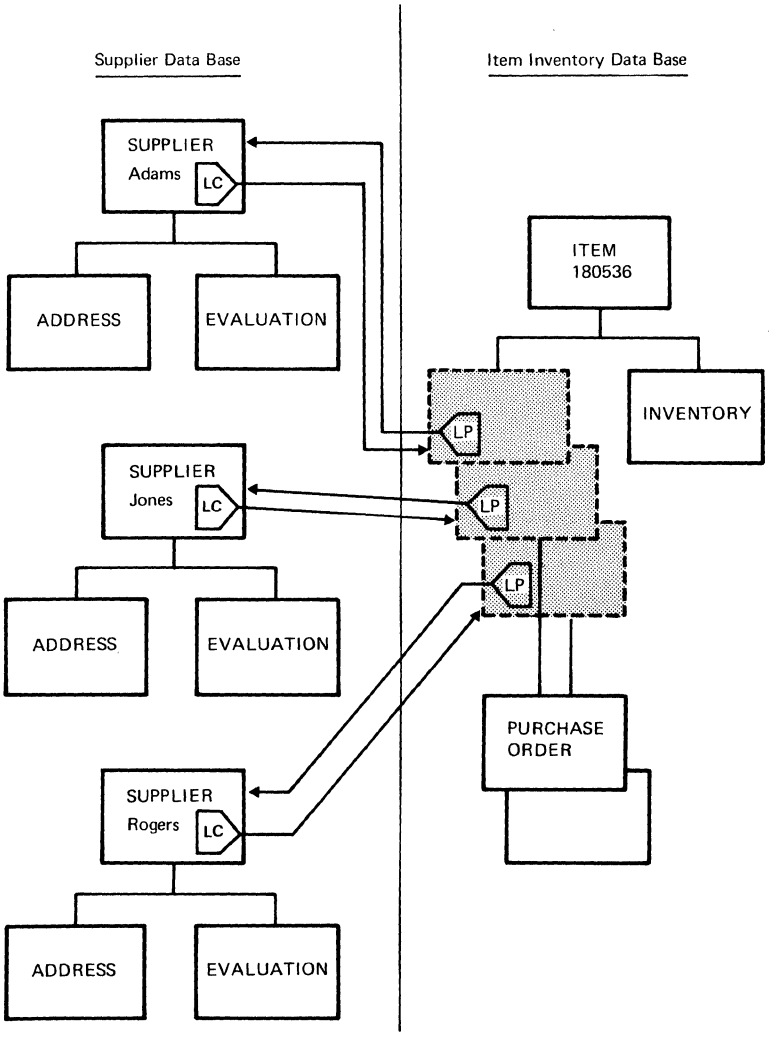


Figure 12. Multiple logical pointers

Given the logical child and logical parent pointers in the Supplier and the Item Inventory data bases respectively, it is possible to define logical data structures composed of segments in both physical data bases.

logical data structure definition

Figure 13 shows an example of a logical structure as defined by a certain application program. In this structure SUPPLIER is a dependent of ITEM. When the logical data structure is thus defined, it is possible to access a chosen item segment and through it establish an evaluation of all suppliers of the item. This is accomplished by following the logical pointers.

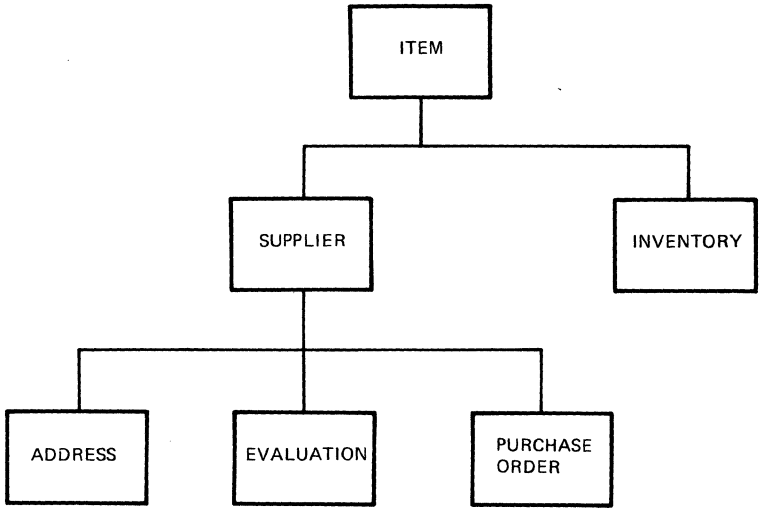


Figure 13. Logical data structure of an item record

Another application program might define a supplier structure as shown in Figure 14. Here ITEM is a dependent of SUPPLIER. It is now possible to access a SUPPLIER segment and through it retrieve all purchase orders for items furnished by that supplier.

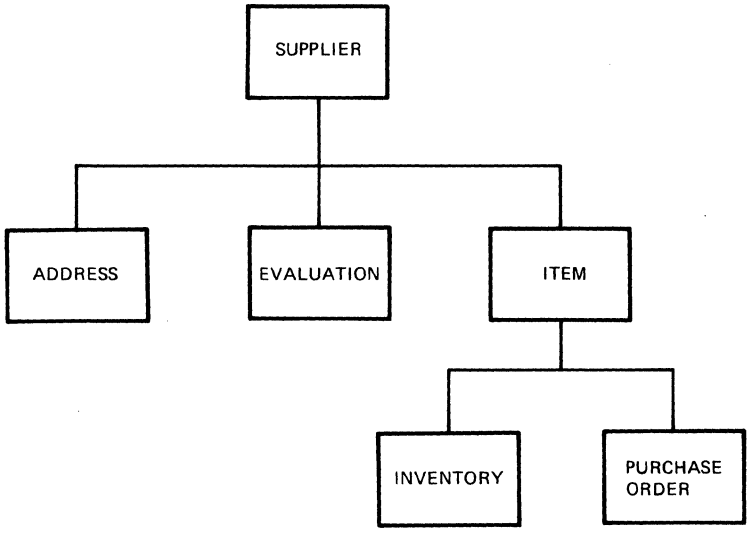


Figure 14. Logical data structure of a supplier record

Physically, neither of these structures exists, but the physical data bases can be processed as though they were so structured. The application programmer need not be concerned with the pointers that relate the logical and physical data structures; these are also maintained by the Data Base Management function. As far as the programmer is concerned, the required data can be considered a simple hierarchical structure.

logical twin pointers

The logical structuring of data as shown in Figure 14 is made possible by the creation of additional pointers called *logical twin* pointers. Such pointers connect the logical children of a parent segment. In the example in Figure 15, children and parent pointers are in different physical data bases. All items provided by any single supplier are connected as logical twins (LT).

From the SUPPLIER segment "Adams" in the Supplier data base, the logical child pointer can be followed to ITEM 123456. Following the logical twin pointer establishes that Adams also supplies item 777777. The next pointer in the twin chain shows that item 180536 is also supplied by Adams.

Interrelated records

Extension of the use of pointers also provides the ability to associate data within the same physical data base. For example, Figure 16 illustrates a data base representing all manufactured items. Many items are assembled from component items, and the assembly/component relationship can be established by pointers. Under ITEM A are COMPONENT segments that are simply pointers to the root segments for the assembly's component parts. Thus assembly A is made from subassemblies B and C and part number 2. The COMPONENT segments for subassembly B point, in turn, to the records for its components (C, 1, 2 respectively).

The advantage of this organization is that redundant data is eliminated; duplicate records would result if separate bills of material for each assembly were stored.

Figure 17 shows how related data base records can be assembled into a unique logical structure for common processing of assembly and component segments. The segments ITEM, STRUCTURE, INVENTORY, and ORDERs of assembly A are retrieved together with the segments ITEM, INVENTORY, and REQUIREMENTs of component 2.

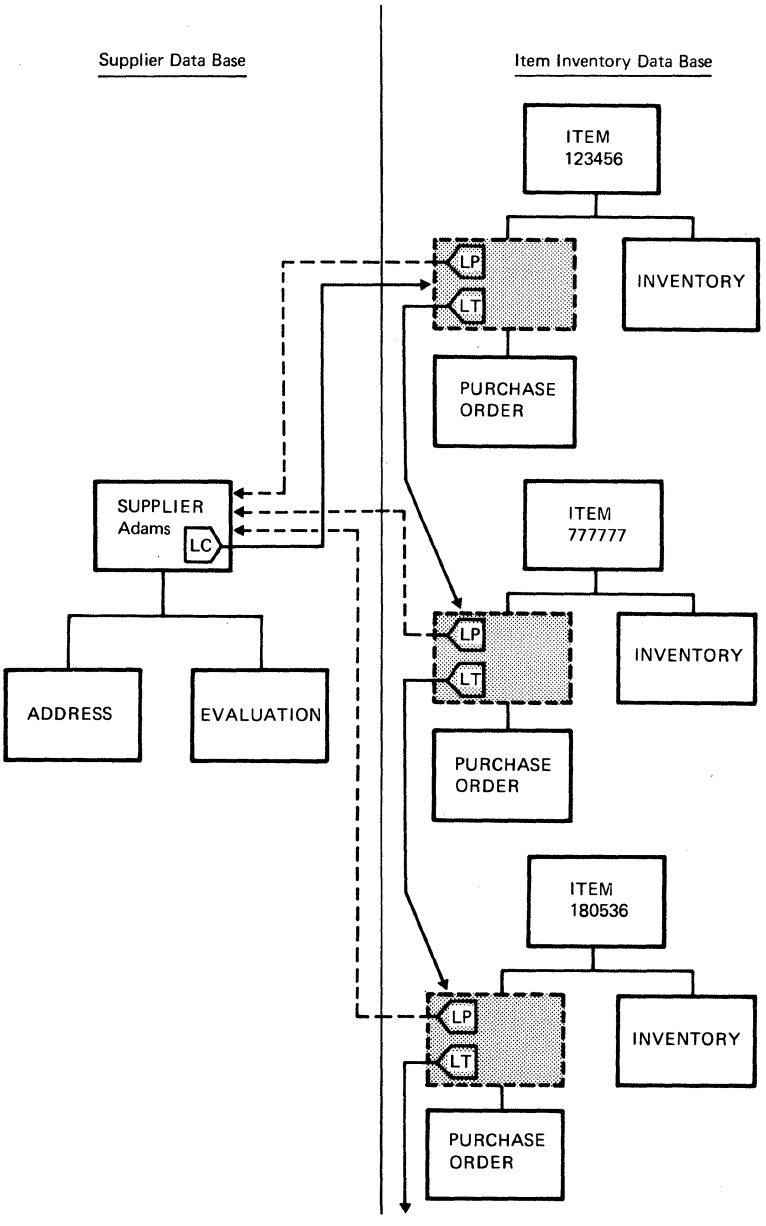


Figure 15. Logical twin pointers

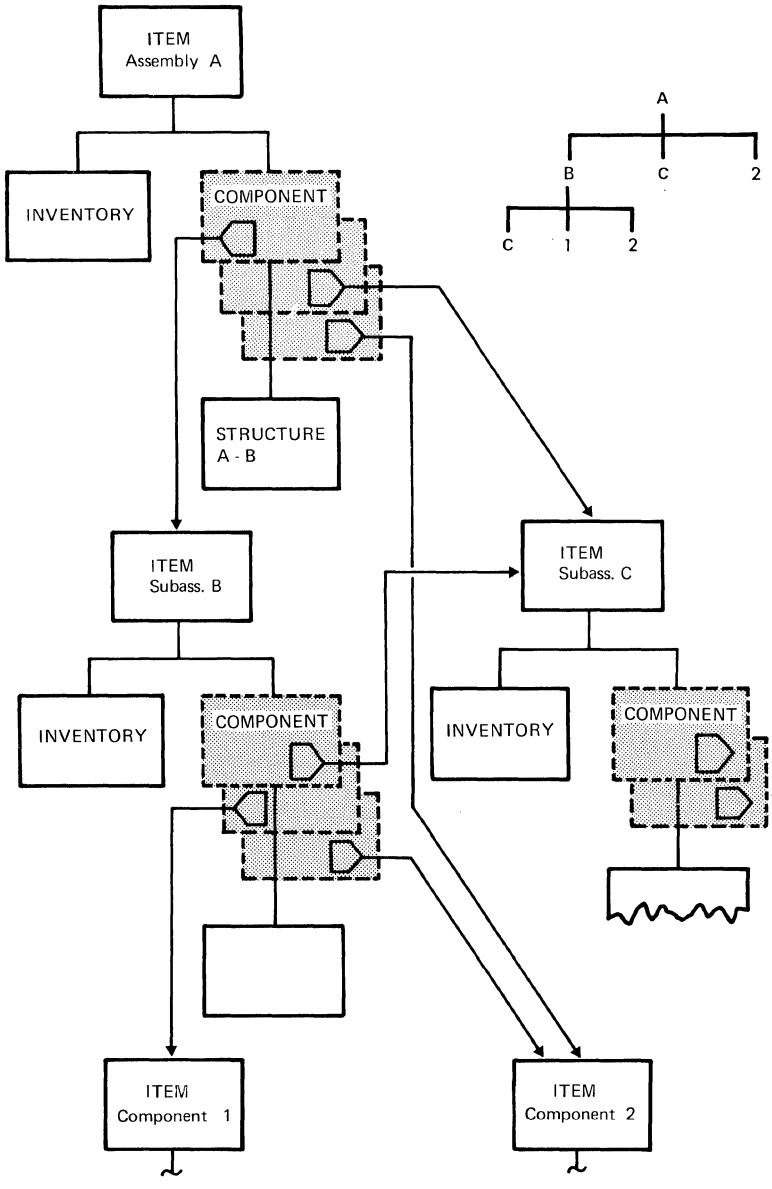


Figure 16. Assembly relationship defined by segment pointers

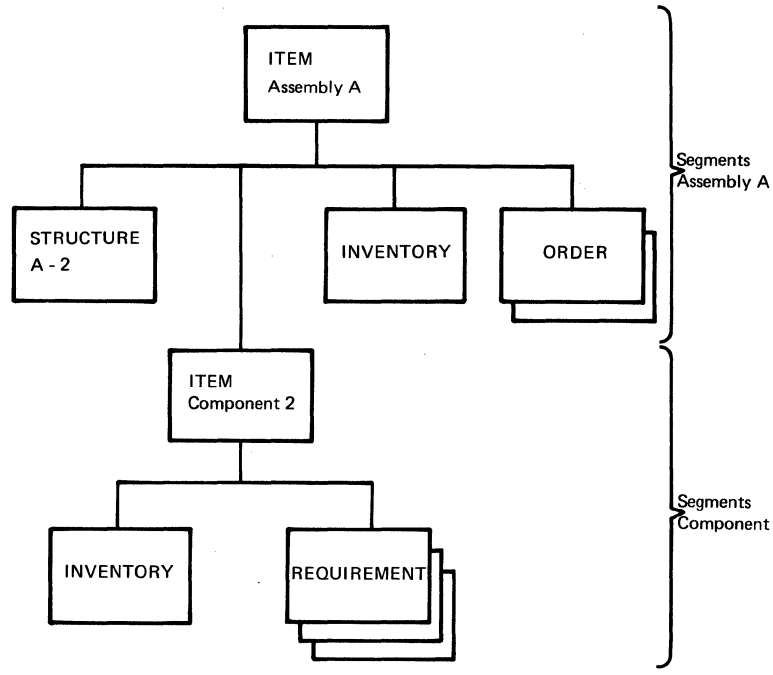


Figure 17. Logical record assembled for processing from physical records of assembly A and component 2.

where-used facility

The logical twin pointer facility can also be used within a single data base. For example, Figure 18 illustrates a where-used retrieval. The Product data base is used to provide information about all the assemblies that have a specific item as component.

The ITEM segment of the chosen item (component 1) points to the item record of assembly A, on which it is used. The item records of the other assemblies (B and K) that also use component 1 can be accessed by following the logical twin chain.

Complex data structures

Through use of the data base pointers, it is possible to build a complex logical structure connecting segments within the same data base and several other data bases.

In Figure 19 each item record has a segment pointing to a standard routing record stored in a separate physical data base. The standard routing record consists of one HEADER segment and a variable number of OPERATION segments. Associated with each operation segment is a pointer to the record of the work center where the operation is performed, and to the record of the tool used. Work center records and tool records are also stored in separate data bases to avoid redundant data.

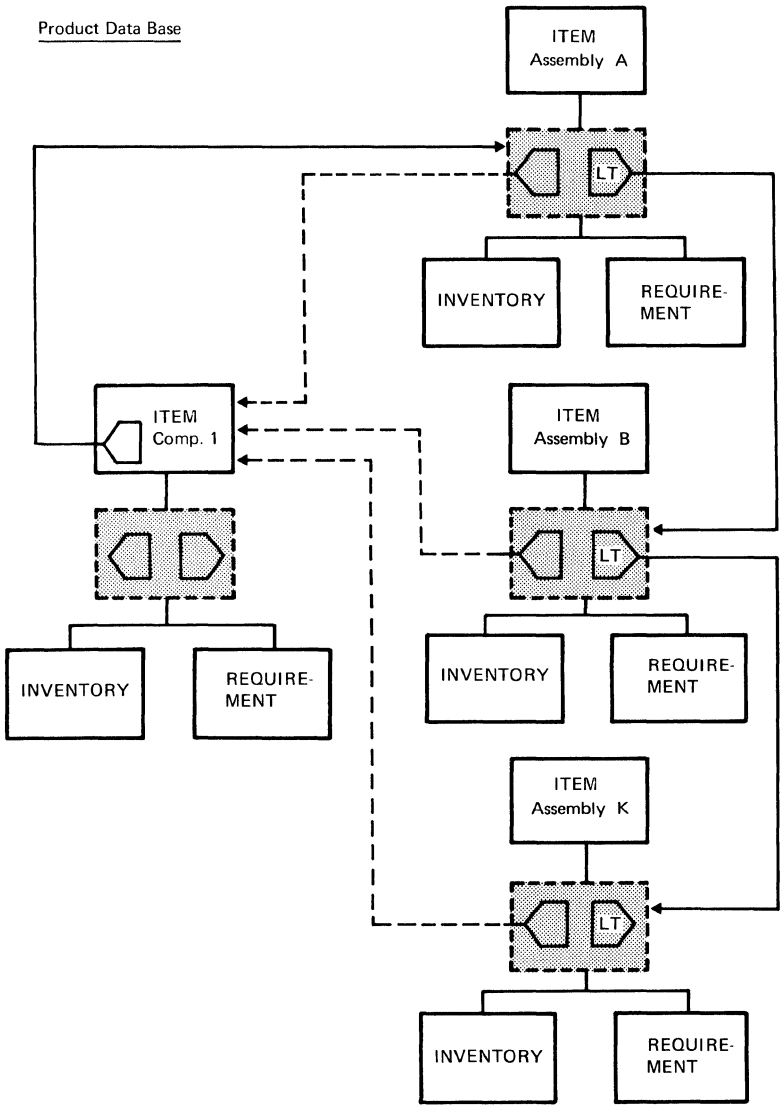


Figure 18. Component where-used provided by logical twin chain

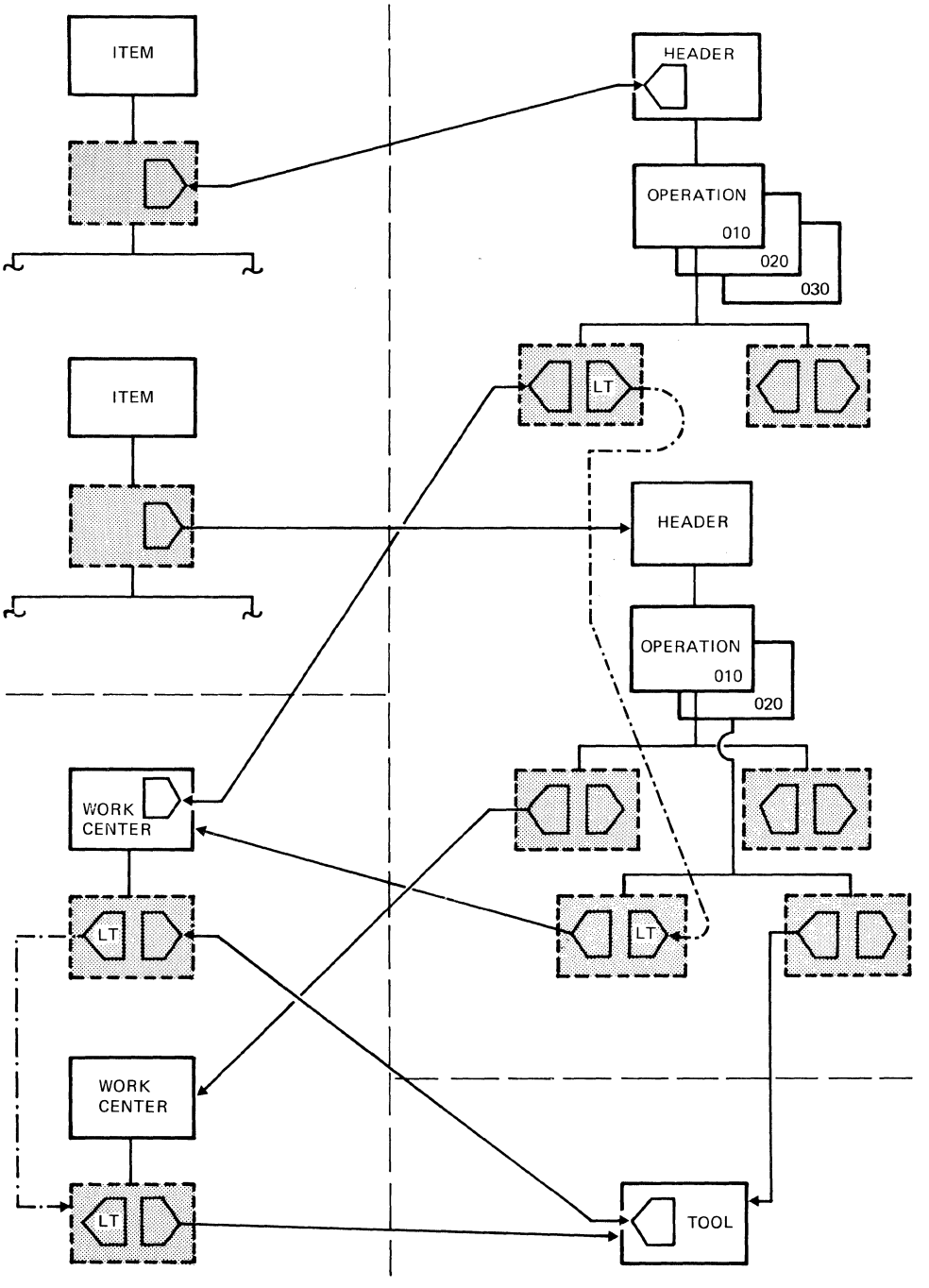


Figure 19. Connections within and between data bases

Logical twin pointers here connect all operations performed in the same work center, and all work centers using the same tool.

A typical logical structure, as viewed by an application program requesting tool where-used information, is shown in Figure 20.

Note that for clarity, only the major segments and pointers are shown in this example (as in previous ones). To provide the necessary flexibility in the grouping of segments for use in different applications, and to provide a variable record format, several hierarchical levels with many segments are required in each physical data base.

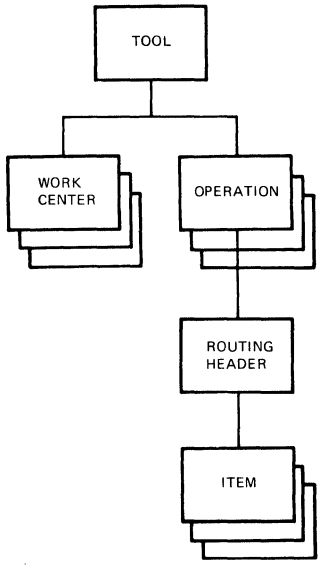


Figure 20. An application program segment structure, using the connections of Figure 19

The Data Base Interface

To summarize so far: Each data base record is composed of one or more segments, and segments from different records can be retrieved and grouped as required by individual programs. Each segment is given a unique name, which is recorded in the system along with specifications of the corresponding physical record. Any segment can then be retrieved for processing by an application program when requested by name.

The physical reorganization of the records does not demand changes in application programs; programming and data base maintenance can thus proceed independently.

Figure 21 shows in simplified form the relationship between an application program and an associated physical data base. A Data Base Interface interprets each call and transfers control to the Data Base Management routines; these initiate retrieval of the required segments.

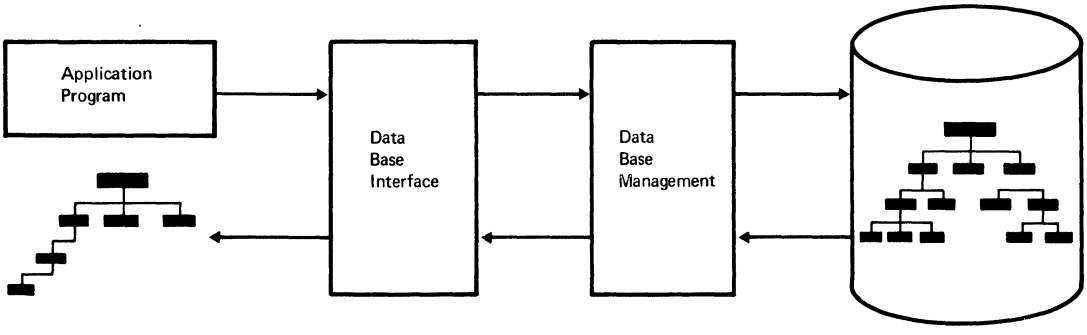


Figure 21. Records are retrieved by Data Base Management and passed to the application program via a Data Base Interface

Function of the interface

The Data Base Interface thus acts as a controlling connection between the application program and Data Base Management. It first refers to a "library" containing a description of each logical data structure used by the application program. The Data Base Interface also specifies the function required (data base create, retrieve only, or retrieve and update) and identifies the segments within each data base to which the application program is allowed access. Retrieval of protected data is thus prevented.

Figure 22 shows an application program which is processing two physical data bases and which also views the data in two ways – that is, as two distinct hierarchical structures. The program therefore contains two logical data structure definitions. Each of these must be related to the descriptions of the two *physical* data bases recorded in Data Base Management files. By accessing these files, Data Base Management routines resolve the relationships between the logical and physical descriptions.

With this concept, the physical organization and access method can be changed at any time without recompilation of the application program; program maintenance is no longer problematic.

Physical data storage

The rules determining the physical storage method used depend on the relative frequency of access of each type of segment. It is more important to ensure a relatively short overall access time than to have a close physical connection between two segments that are logically related but accessed together only once a week.

A data base manager or system programmer is usually responsible for choosing the physical organization and access method that best suits his particular installation. When historical data is kept over a long time, one of the system programmer's duties is to decide which records should be stored on direct access devices and which on sequential access storage media such as magnetic tape.

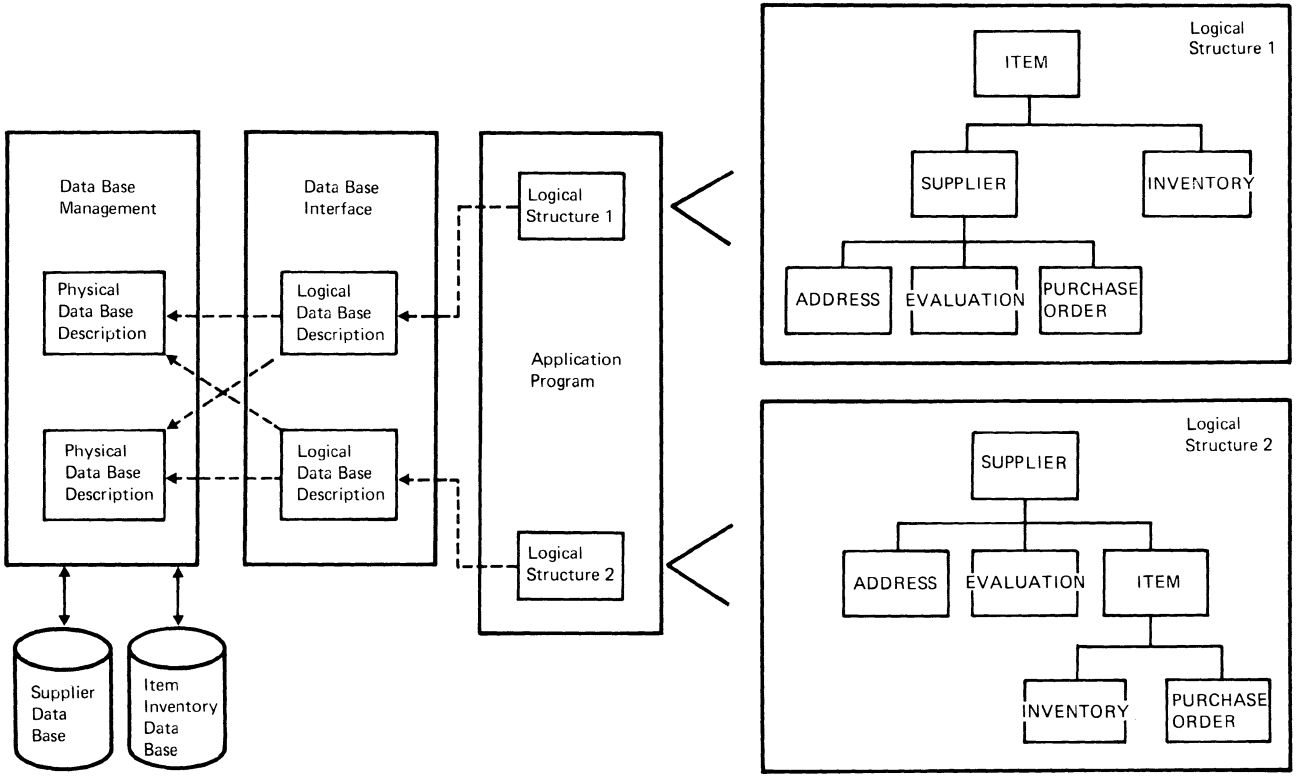


Figure 22. Multiple logical data structures within an application program

Example – Order Dependence

This section gives a more detailed example of data base relationships and the way they are used in a particular COPICS application – namely, the determination of "order dependence".

When a shop or purchase order is known to be late, the question usually asked is: Which customer order is affected? This can be answered by using certain "pegging" information stored in the connection segments. These segments establish the relationship between the several demands for an item and the stock or orders planned to meet them. Demand for an item can be generated by a shop order for a higher-level assembly, a customer order, or a miscellaneous demand.

These demands are covered by:

- Stock on hand
- Released or planned shop orders
- Released or planned purchase orders

Other uses of this pegging information (for example, association of a customer order number with all related shop orders) are discussed in *Chapter 5, Inventory Management.*

The connection segments are maintained by INVENTORY MANAGEMENT and are used extensively in MANUFACTURING ACTIVITY PLANNING. The relationship between component and assembly orders determines a "network" which is used in scheduling the orders.

Figure 23 shows the basic data held in the product definition records and used in planning the requirements of a subassembly B, which is used in assembly A and also sold as a service part. In order to assemble B, the component C is needed.

A planned order for 10 pieces of A, due on date 205, generates a dependent demand for 20 of B on date 201. This demand is computed using the lead time offset (4 days) and the quantity per assembly (2) stored in the STRUCTURE segment associated with the pointer from A to B.

It has already been shown (Figure 15) that, using the COMPONENT pointer 1, a logical structure for an assembly and its components can be regrouped for processing. An additional pointer between PLANNED ORDER and DEPENDENT DEMAND is not required. The relationship, shown by line 2 in Figure 23, is established by a common reference

number. Here the planned order has reference number 1234, which is stored in both segments. (For released orders this reference is the actual shop order number.)

A similar relationship exists between the released order for 20 of B, due on date 208, and the dependent demand for 20 of C. (It is assumed that the item C components have been allocated but not yet issued from stock.)

The figure shows there are other demands, both dependent and independent, for item B. (The origins of these requirements have been omitted for clarity.)

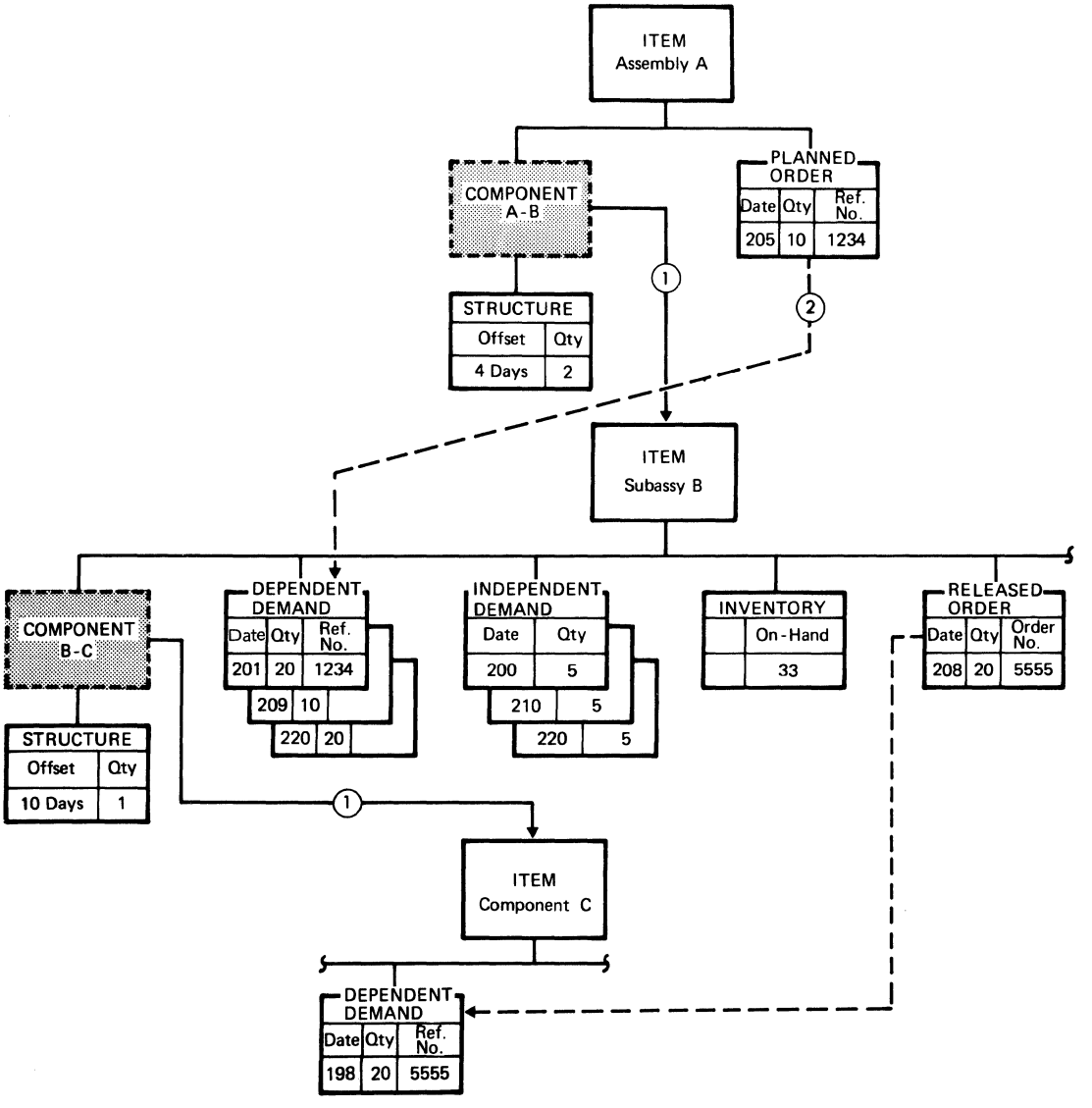


Figure 23. Basic product definition data used for MATERIAL REQUIREMENTS PLANNING

The INVENTORY segment for item B shows that an on-hand quantity of 33 is available. This inventory is allocated to three demands, as shown in Figure 24 by dotted lines (marked 3). Three CONNECTION segments are used to establish these relationships. Again, these segments contain not pointers but common references. In the case of the dependent demand for 20 pieces (date 201), the reference number (1234) also relates to the planned order of assembly A.

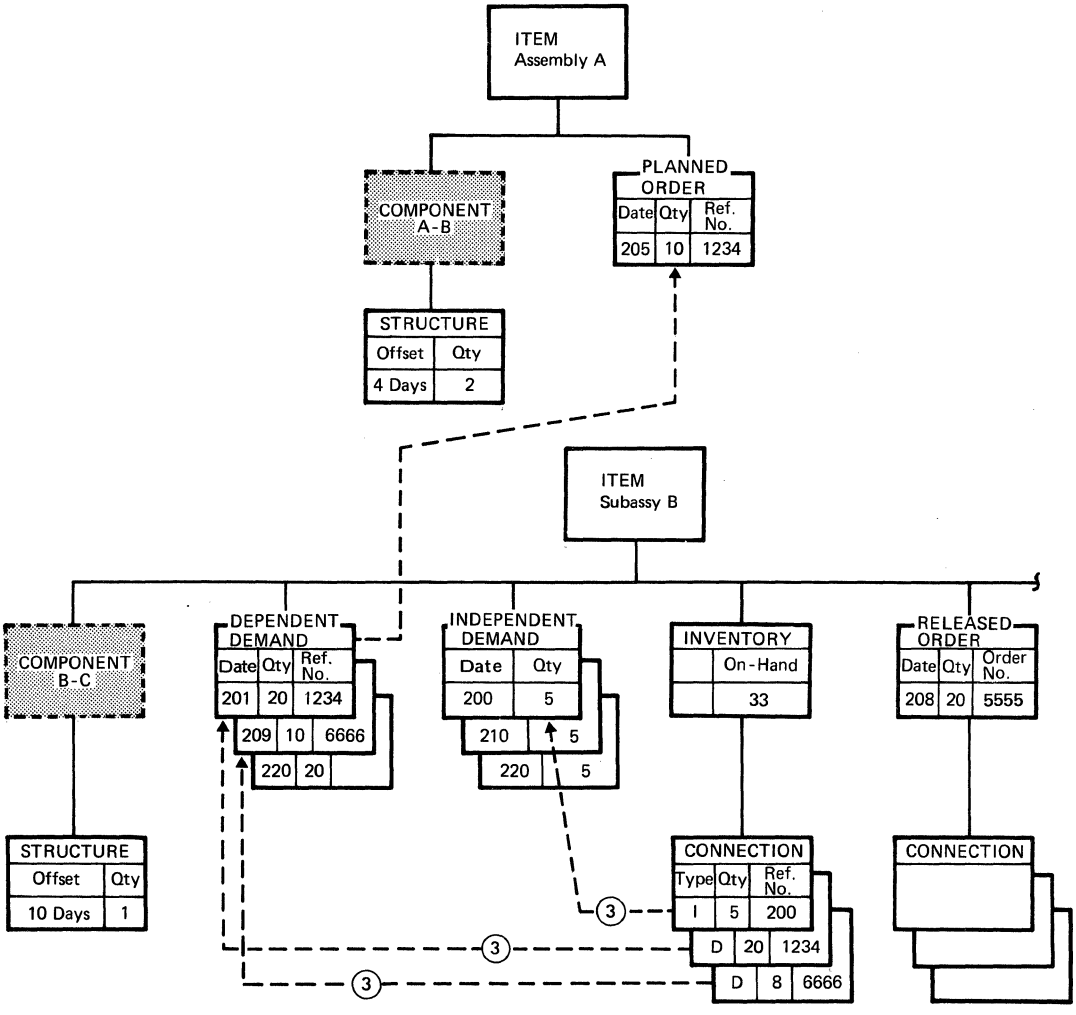


Figure 24. Allocation of on-hand inventory

Single-level pegging

Similarly the released and planned orders for B are allocated to the various requirements (as shown by broken lines in Figure 25). Note that for allocations to dependent demand, the reference in the CONNECTION segment is the reference number of the higher-level order. This establishes the connection between component and parent order and is sometimes referred to as "single-level pegging".

For allocations to independent demand the reference in the CONNECTION segment is either a customer order number or a date.

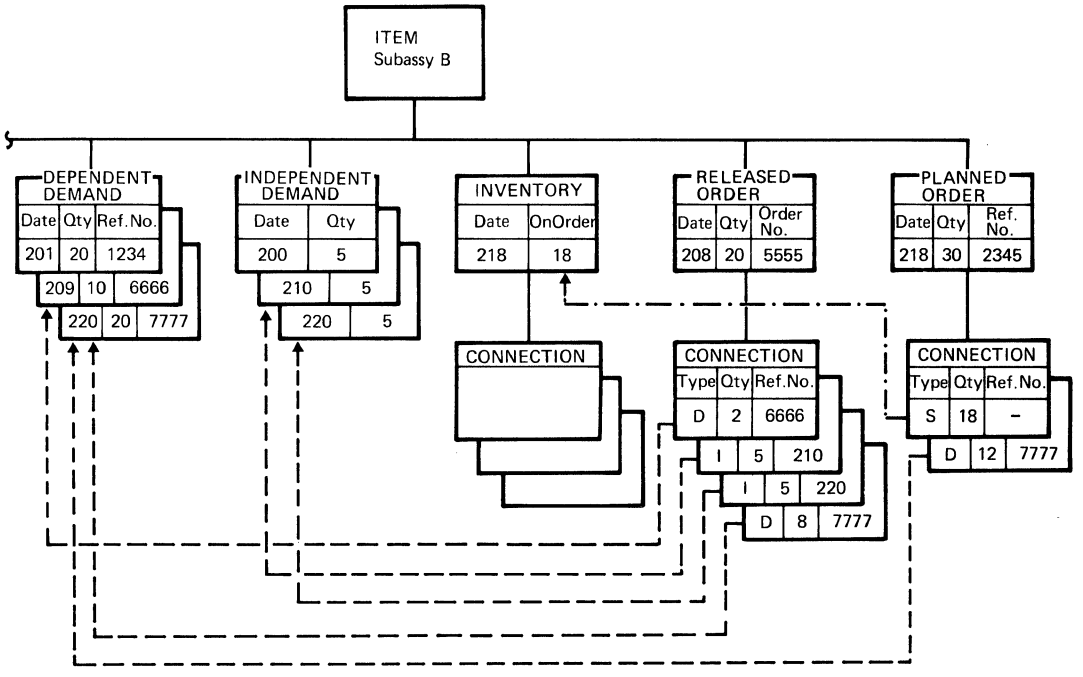


Figure 25. Allocation of order quantities

Full pegging

In single-level pegging, the where-used connection is maintained only between the component order and the assembly order where it is directly used. In full pegging, the top-level order identity is carried down through all levels. This means that information stored in a higher-level CONNECTION segment must be duplicated in the DEPENDENT DEMAND segment of the lower level. This, in turn, necessitates a DEPENDENT DEMAND segment for each CONNECTION segment, and not only for each ORDER segment (Figure 26).

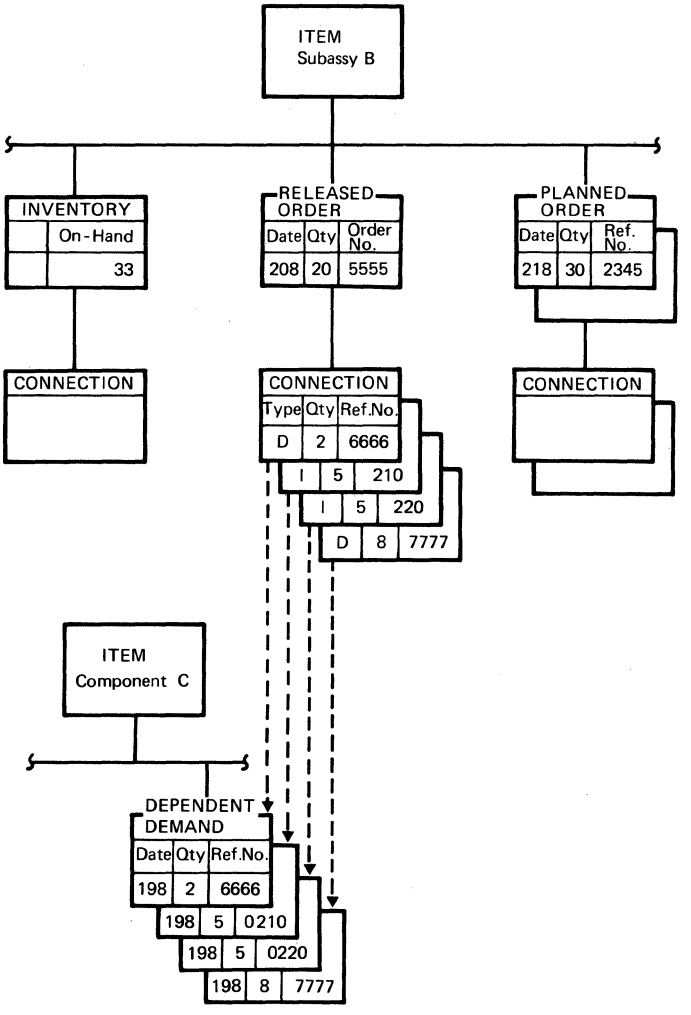


Figure 26. Full pegging requires a dependent demand segment for every higher-level connection segment

Summary – Data Base Features

The data base features described in this section include:

- Data independence, achieved by separating *logical data structures* from *physical data bases.* This protects application programs from system changes.
- Selective access to data, achieved through the segmentation of records into smaller units. This gives protection to confidential data and allows independent retrieval of the required segments.
- Related data connections, achieved by establishing logical parent/children pointers and logical twin pointers in hierarchical data structures. This enables data of a similar nature to be gathered from the same and/or different data bases.

These features allow the creation, maintenance, and retrieval of a comprehensive but flexible information base, with all the data needed by a manufacturing system. Since the data appears to be stored under an organization that suits each user, the requirements of engineers, production personnel, and accountants can be satisfied without duplication of information. Using these concepts, system development is not inhibited by program maintenance problems, as the programs are insulated from the effects of normal development and change.

In batch processing, individual transactions are accumulated and processed periodically against the data base. The limiting factor is the allowable interval between the processing of successive batches. Whether batch processing is used depends on how current the user's information needs to be, and on the cost of alternate forms of processing.

Since, with batch processing, the computer data base is updated only at intervals, the information it contains cannot be completely up to date. A particular user, therefore, may or may not have current information at his disposal. The information can, however, be kept more current through use of data communication or teleprocessing. Remote terminals provide the ability to enter transactions as immediate "messages", allowing both inquiry and update capability. The use of teleprocessing does not preclude batch processing techniques for such functions as the production of reports or the servicing of complex inquiries.

This section addresses some of the COPICS transaction processing techniques, and their interaction with the data base, under the headings of:

- Online transaction processing (with an example of a stores transaction)
- Action Files (an Action File record is generated whenever some action is required outside the system, for example, a decision as to whether a receipt can be accepted or not).
- Trigger files (transactions are accumulated in a trigger file over a certain time span before actual processing is "triggered").

A description of the requirements which have to be considered when installing terminal facilities can be found in *System Requirements*.

Online transaction processing

Data communication is made possible by the use of remotely located input/output terminals, connected to the computer, which provide the user with access to the data base. The communication network enables the system to receive and transmit a variety of message types for multiple applications. Terminals need not be dedicated to specific applications.

Control information describing each message type allows the system to initiate message processing. Each message entry leads to either an inquiry or an updating of the data base.

Use of terminals connected "online" to the computer also allows transaction editing at the source, with notification of errors for immediate correction. Inline editing detects any error before the responsible person leaves the terminal and while he still has the source document. He is thus able to check and reenter the correct transaction there and then. The result is a more accurate data base.

Figure 27 illustrates how a "planned issue" transaction is handled by the computer, allowing for complete editing and security of the information. The following steps are included:

1. The transaction is entered at the terminal by the storeroom clerk.

Transaction (code)	PI
Order number	1002
Item number	180536
Requested quantity	330

   Note: Other data, such as operator number, can be entered at the same time (see *Chapter 8, Plant Monitoring and Control*), but here only the data directly related to inventory accounting is considered.

2. The transaction is transmitted via the communication line to the line control program in the computer.
3. A line control program puts the transaction into an input queue according to a predetermined priority, and records the transaction in a log.
4. When it reaches the head of the queue, the transaction is read by a message handler program.
5. The message handler, using the transaction code, determines which transaction processing program is responsible (*Issues*, Receipts, Orders, etc.).
6. The transaction processing program makes sure that the transaction includes all required information, and obtains the necessary master records from the data base files (for example, *inventory record*, order record, etc.).

450	Allocated	336	330	1002
Stock on hand	Status	Date	Quantity	Order No.

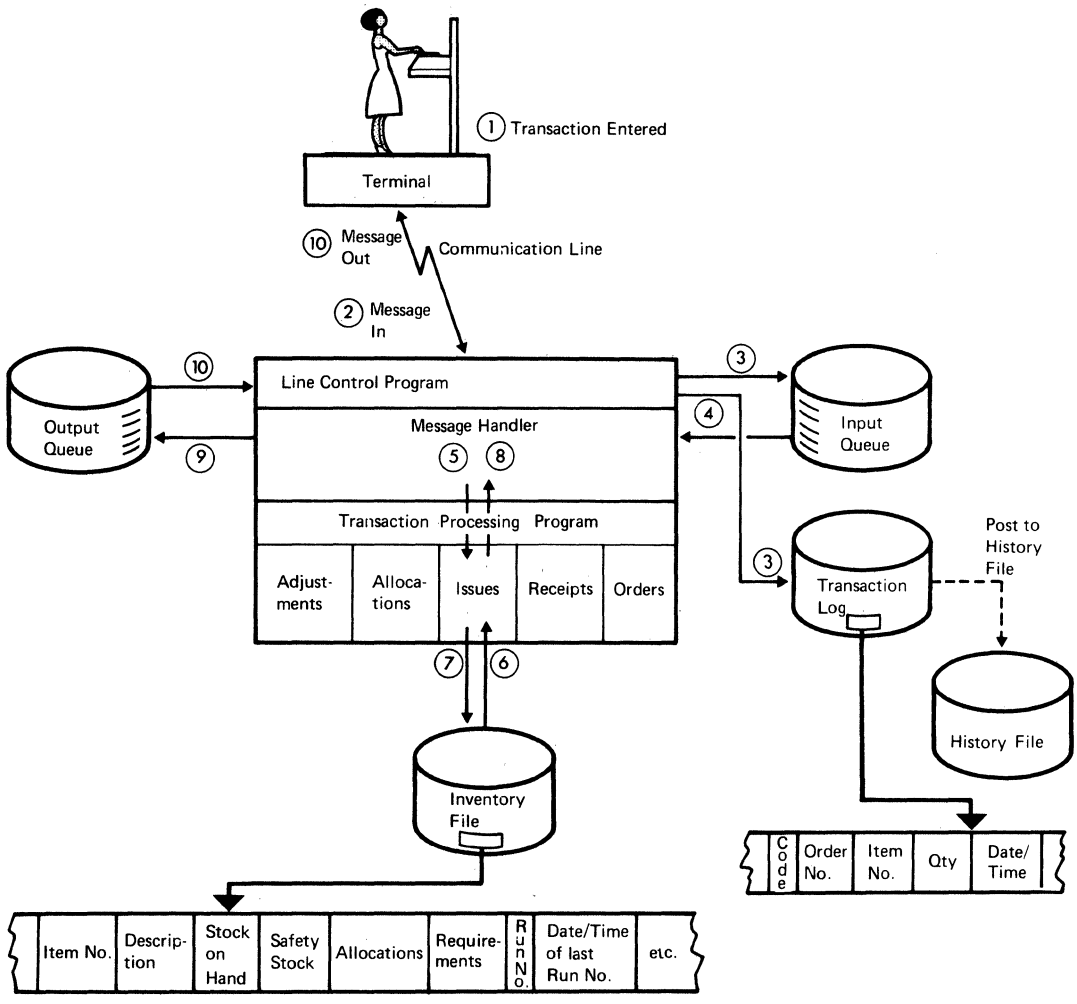


Figure 27. Online transaction processing

7. The transaction processing program checks the validity of the transaction and updates the data base records.

120	Delivered	335	330	1002	27
Stock on hand	Status	Date	Quantity	Order no.	Run no.

8. At completion of processing, the transaction processing program returns control to the message handler.

9. The message handler places the outgoing message in an output queue for transmission to its destination.

10. As soon as the required communication line is available, the output message is removed from the queue by the line control program and is transmitted to the terminal.

    Note: The time taken for such a transaction varies with the number of messages in the queue, priority, type of terminal, computer speed, etc. A typical response time from entry of transaction to completion of output message may be five seconds.

Action Files

Online maintenance of the data base implies automatic processing, without human intervention. On the occasions when intervention is necessary, it is requested via an Action File record. Such records are generated, for example, when:

- A planned order has to be authorized by the inventory administrator before release.
- The plant floor requests maintenance of a machine after breakdown.
- Assistance is necessary to correct an invalid transaction from a terminal.

In these cases someone has to review, correct, or update the information before processing of the transaction can continue. The Action File is used to initiate such action.

action file concept

In a real-time environment, the progress of a request for action must be monitored by the system. Action Files are maintained continuously, and since each request cannot be serviced immediately, records can accumulate. Each Action File therefore represents a queue of work analogous to that waiting at a work center.

Each queue of Action File records is organized for the employee who must process it. Within this queue, different types of work are separated and a priority is assigned to each job (Figure 28).

Via his terminal, the analyzer can request summaries of his Action File to help him decide which items to process first (Figure 29). He may also ask the system to rearrange his work in a new, more convenient sequence.

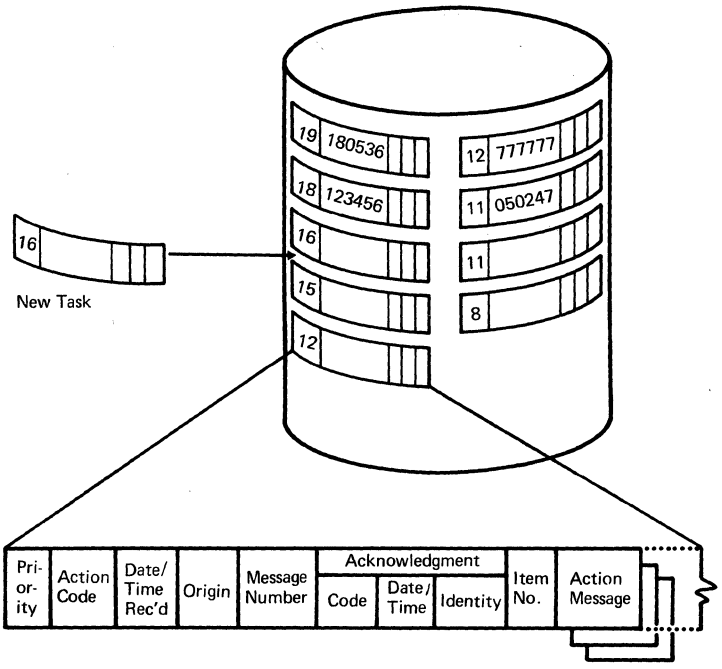


Figure 28. Action File of inventory administrator

PURCHASING ACTION FILE

BUYER: R. SMITH NO. 52248

SUMMARY:	OVERDUE	OPEN
DELIVERIES	5	-
QUOTATIONS	6	25
EXPEDITES	2	10
ACKNOWLEDGMENTS	3	-
REQUISITIONS	5	130

LINE NO.	PRIOR-ITY	ACTION	ORDER NO.	ITEM NO.	SHORT DESCRIPTION	SUPPLIER NO.	DAYS LATE OR O'DUE
10	19	LATE DELIVERY	27754	180536	SPINDLE	471002	21
20	18	LATE DELIVERY	31739	050247	BRACKET	471002	18
30	17	LATE DELIVERY	38840	160513	SPUR GEAR	329014	14
40	17	QUOTE O'DUE	22851	290611	KEY	202171	20
50	15	EXPEDITE	23962	260340	COUPLING	471002	
60	13	LATE DELIVERY	34065	120242	VALVE	347333	9
70	13	QUOTE O'DUE	25173	060428	SLEEVE	821100	13
80	12	ACKN. O'DUE	26284	130840	GEAR	679291	12

Figure 29. Display of the summary of a Buyer's Action File

processing the jobs

Through an Action File program the employee is assigned the successive jobs from his queue. He makes his decisions, uses the appropriate application to process any changes, and requests the next job. Thus the Action File replaces the "in" basket of the hard-copy environment with a terminal-oriented work queue that the employee may review on request (Figure 30). As each job is processed, it is removed from the Action File.

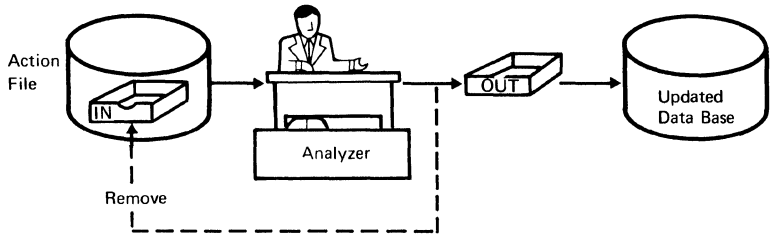


Figure 30. "In" basket replaced by Action File

related action files

When an Action File request is not serviced within a certain time (say, when a request for maintenance is not answered within two hours), it can be added to the Action File of the responsible supervisor or manager for further action. The employee initially involved is informed via his Action File that this step has been taken.

A task requiring decisions from more than one department or person appears on the Action File of each. For example, a decision regarding a new item may involve data from Inventory Control, Purchasing, Production Planning, Costing, and Inspection. Figure 31 shows requests for this data being made via the respective Action Files (see "Creation of Item Data" in *Chapter 1, Engineering and Production Data Control*).

Interdepartmental requests (as when an order entry clerk wants details of material availability) are also handled by the system, which makes an entry in the appropriate Action File (Figure 32).

advantages of action files

The main advantages of the Action File concept are:

- Online communication between personnel and personnel, and between personnel and the system
- Separation of transactions and messages needing human intervention from those that can be processed automatically by the application programs
- No interruption of the main processing in case data is faulty or needs clarification

The use of Action Files is further discussed in *System Requirements,* and examples are given in each chapter.

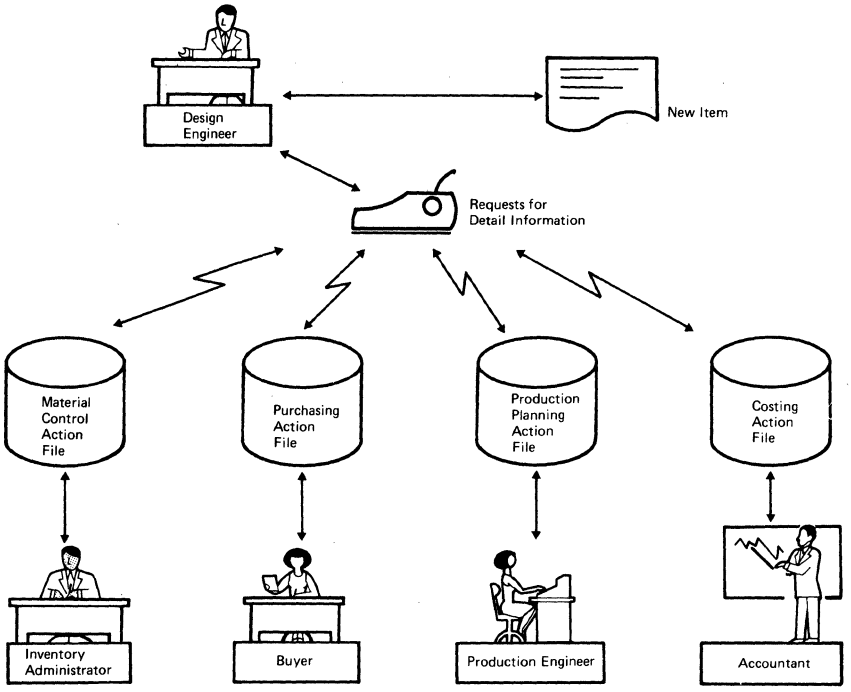


Figure 31. Creation of item data requires actions of several departments

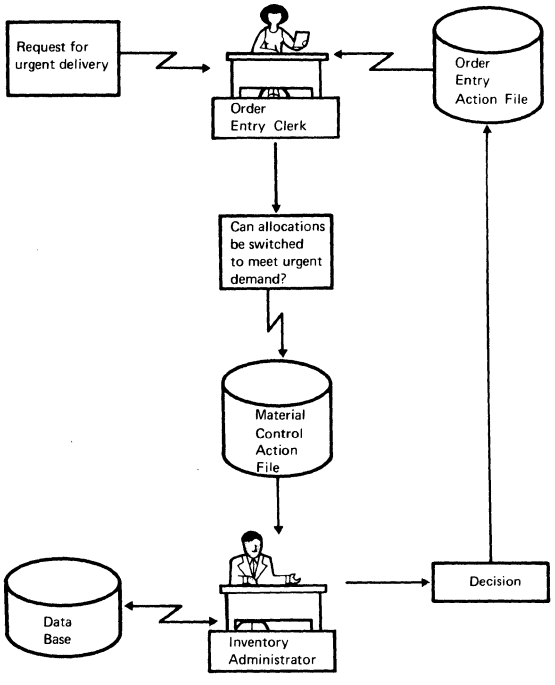


Figure 32. Action File used for data communication between departments

Trigger files

In some circumstances the data base need not be updated immediately upon receipt of a transaction. Consider the following transactions, each of which necessitates "net change" action:

- Changes to the master production schedule – for example, addition or cancellation of a customer order via CUSTOMER ORDER SERVICING, or a change to the forecast
- Engineering changes – for example, cancellation, addition, or changes to an item in a product structure, or a change of effective date
- Inventory transactions – say, an unscheduled issue or an inventory adjustment after physical counting
- Changes in rules – such as a new lot size limitation or a change to a lead time

The system must be able to accept these transactions as they occur in order to perform an edit function and report back errors immediately. In a number of cases, however, it is not necessary to update the records after every transaction but merely to log the transaction on an intermediate storage device, and update the record later. "Later" may mean milliseconds or hours, depending on the application.

If, for instance, those changes to the production plan that result from rush orders are processed immediately, whereas normal changes may be made only twice a day, the overall processing performance can be maintained without loss of accuracy.

The transactions that "trigger" a net change are therefore analyzed by the system before being processed and are queued in priority sequence in a "trigger" file (Figure 33). Analysis here implies:

- Editing each transaction for proper authority and for validity of contents
- Evaluating the urgency of each transaction – for instance:

  Class A transactions demand immediate response (such as a transaction requiring a decision by the production analyzer before processing can continue). All Class A transactions go direct to the analyzer's Action File.

  Class B transactions queue for processing. For example, multiple transactions for the same item are sequenced by priority, issues being processed before additional requirements.

  Class C transactions are stored for subsequent batch processing.
- Placing the transaction in the correct file for processing, or initiating processing for immediate response

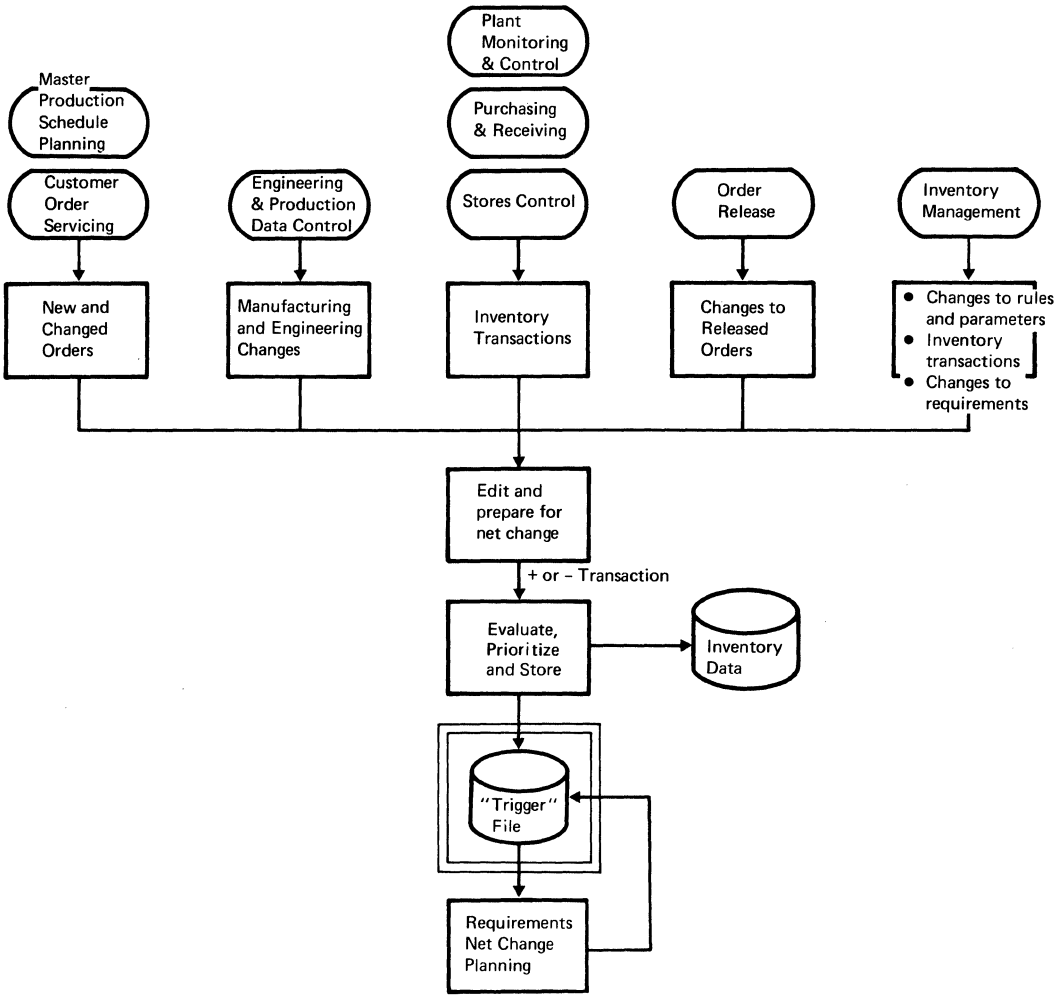


Figure 33. Use of a "trigger" file in requirements net change planning

Before an information system can be implemented, the detailed contents of the data base must be decided upon. Each file in the data base contains records, which in turn contain segments (of various hierarchical levels); each segment consists of a number of fields. The files, records, segments and fields used vary widely from user to user.

The file overview given here and the record descriptions in the next section cover most of the requirements for a complete production information system. Individual users will choose those appropriate for their own applications. In many instances additional segments, fields, and codes will be required. These can be added as necessary.

additional files

The overview does not claim to be complete. Specifically, the reader should refer to the particular application area description for details of the Action Files required, such as the stores picking list. These are not included here.

Parts of the data base can be copied for temporary use as work files. This allows faster processing if satellite computers are installed (say, on the shop floor or in stores). Since the use of work files varies greatly with the system configuration, no details of their contents are given here.

Among other files *not* included in this section are those representing tables – for example, Automated Design Engineering (ADE) tables (see *Chapter 1, Engineering and Production Data Control*), characteristics and standards, inspection requirements, cost indices, etc.

historical files

Only a few of the historical files, such as purchase history, maintenance history, etc., are shown here. Other files containing historical data such as employee history or transaction history are fairly self-evident and are not included.

Segmentation

The grouping of records into several data base files and the grouping of fields into segments is very flexible, and normally differs between installations.

The particular grouping suggested here and in the record description should be considered typical but by no means rigid. Figure 34 shows some of the possible approaches, using manufacturing routing data as an example.

If all the fabricated items have individual manufacturing routings, the routing can be considered as part of the item data. This means that the routing can be stored as a part of the product definition record (Figure 34A).

If, however, a manufacturer is producing a number of similar items, and the same routing is used for groups of items, storing of the manufacturing routings in a separate file may be better (Figure 34B). This case has been assumed in the record description given here.

Again certain of the segments of the manufacturing routings can be stored separately as part of a further file (Figure 34C). For example, operation descriptions, which are normally lengthy and used only for printing the manufacturing route sheet, can be separated, together with numerical control data. This allows a "stripped" routing file, containing only the master scheduling data online for inquiries and update.

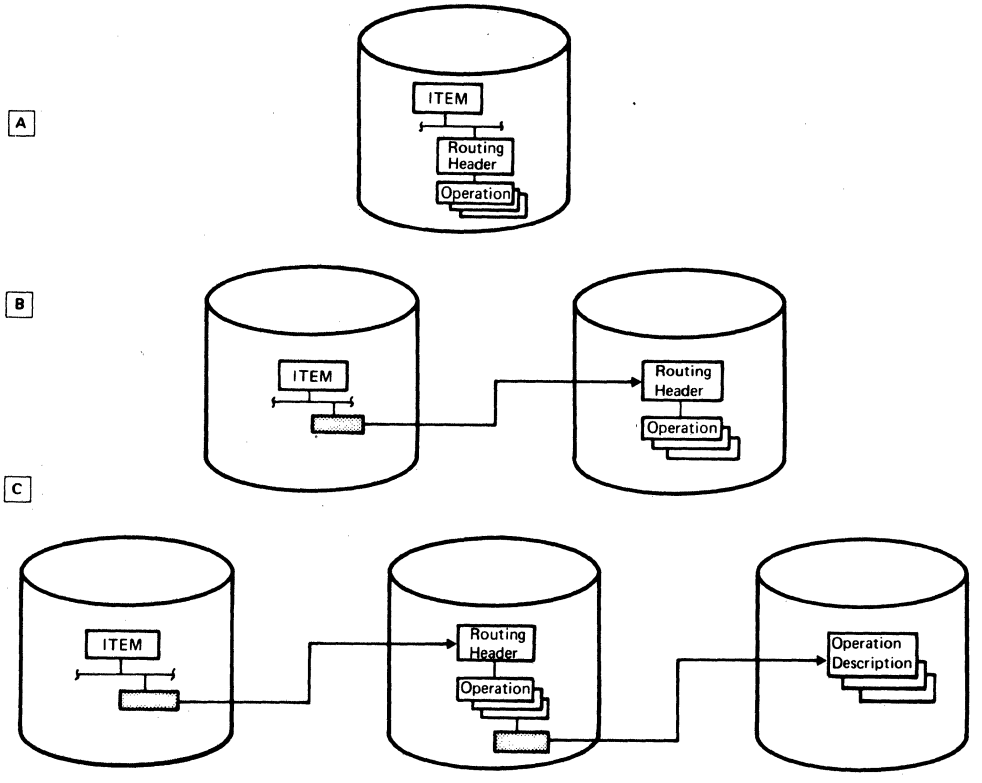


Figure 34. Different approaches to storing manufacturing routing data

Purchasing data provides a second example of flexibility in storing data. Purchase requisitions and purchase orders are represented by many common data fields, and here both types of record have been included in the same file. Alternatively, the two types could be stored in two separate files.

File overview

Figure 35 shows the relationship of the files used in COPICS for which a detailed field description is given under "Record Descriptions". Figure 36 illustrates how the major segments in each of the files are connected. The primary connections indicate where a direct connection or pointer would normally be used between two sets of data, for instance a pointer in the Item Record to the Manufacturing Routing for the item. The secondary connections indicate where only a reference number would normally be used to refer to another set of data; for instance, the item number is common in the Product Definition and in the Product History files.

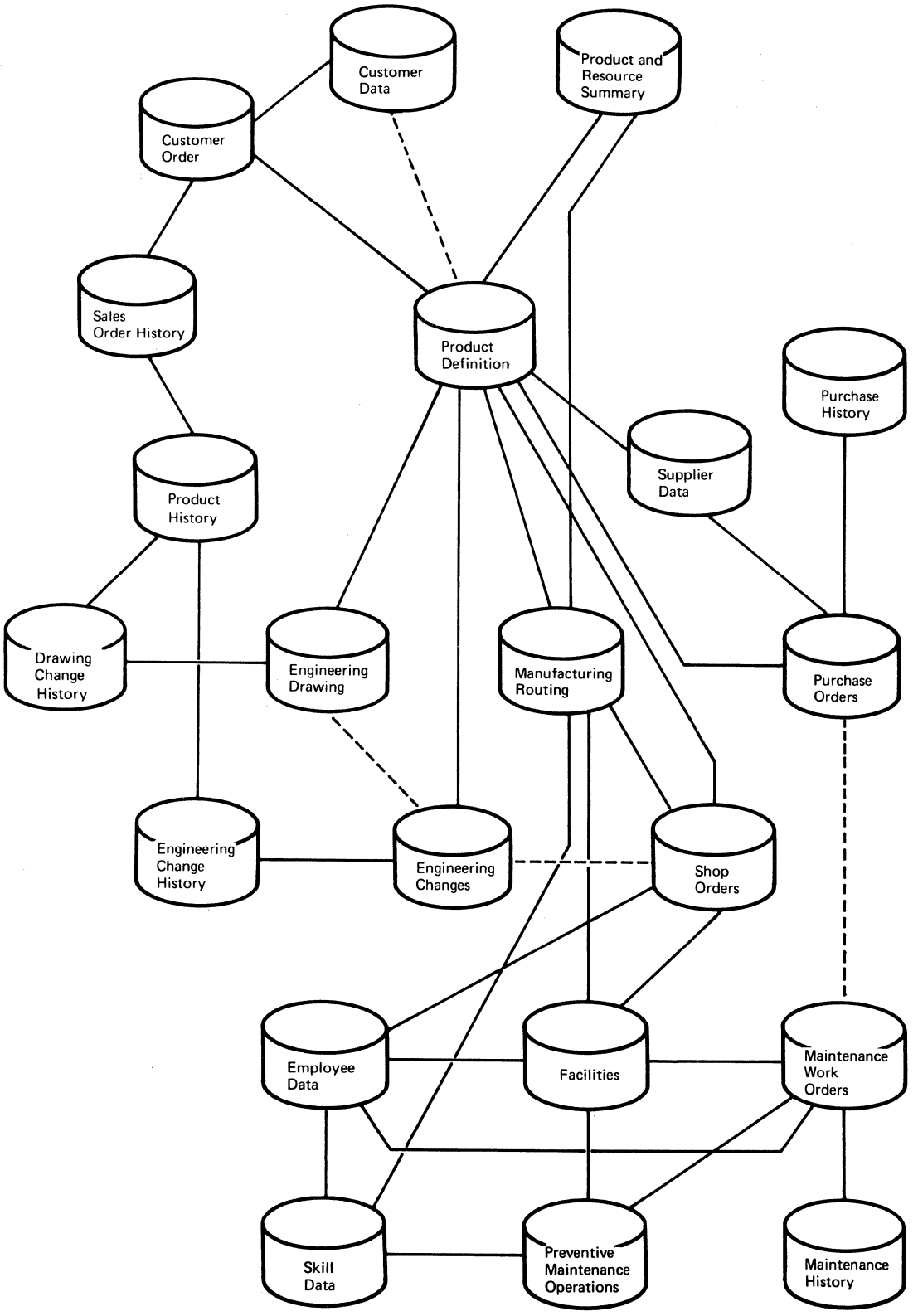


Figure 35. COPICS file overview

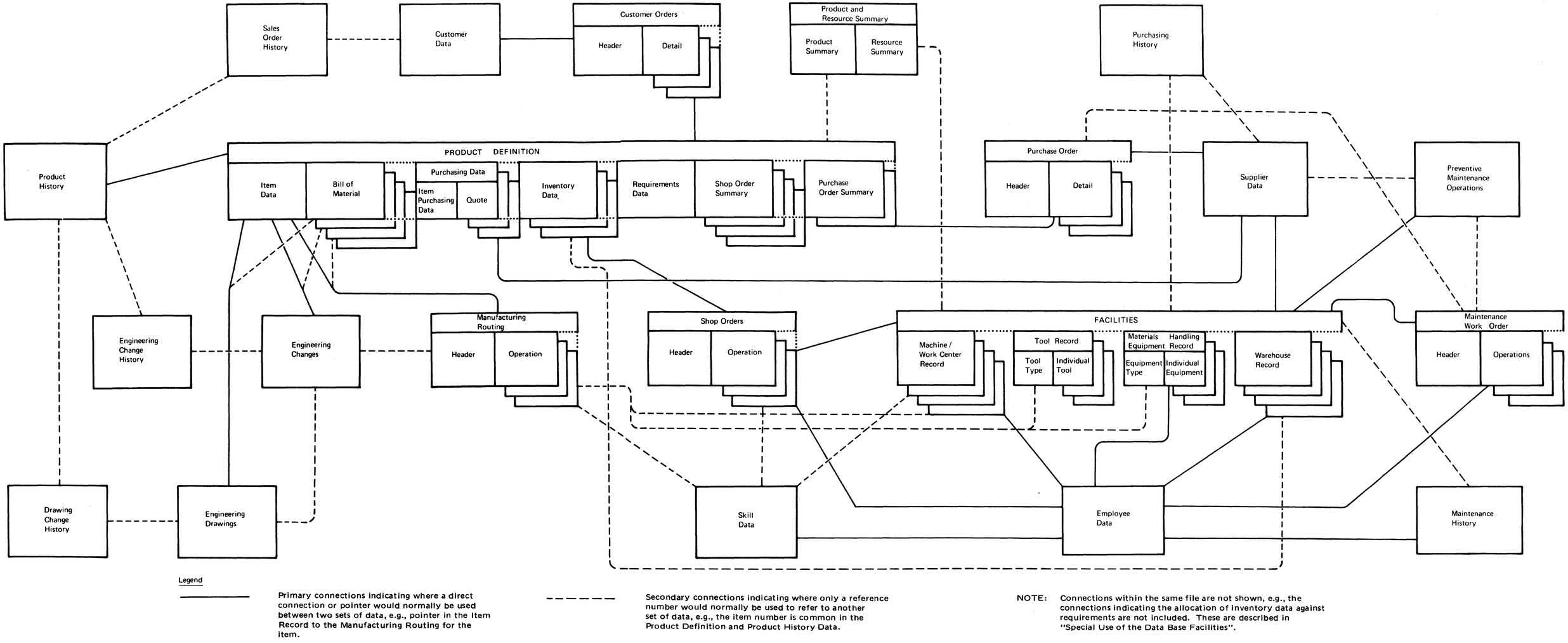


Figure 36. Relationship between the COPICS files

Introduction

The purpose of this record description section is to:

- Give an overview of the data fields described in the numbered chapters
- Give a short explanation of the information held in each of these fields
- Show how the fields could be grouped into segments within physical files
- Indicate which data is generated by the system, and which has to be provided by the user

In order to avoid repetitions of similar descriptions, the following conventions have been used.

Historical data

In most cases it is not economical to store the details of every transaction over a long time span. Historical data is therefore *summarized* by period, by month, by year, etc. It also can be exponentially smoothed or represented by a formula or model.

The forecasting segment of the Product Definition file illustrates the universal types of field commonly used to summarize historical data. The choice of field type depends mainly on available computer capacity and the degree of detail required; the actual number of fields varies greatly between users. For this reason (apart from the example in the forecasting segments) any historical data is represented in the associated record description by just one entry for each statistic (say, historical machine queue time). Each such entry is identified by the letters HD.

Origin of data

Codes indicating the origin of data are included with the field descriptions:

S = system-generated

U = user-provided

SU = normally system-generated but possibly user-provided

US = normally user-provided but possibly system-generated

The category will obviously vary according to the amount of data the user already has on the system. The code given assumes that most of the basic data files are on the system.

Common descriptions

Where a segment consists of fields whose names are identical to those of another segment previously described, the description is not repeated; reference is made to the earlier appearance. For example, the "activities reported" segment containing time started, time completed, etc., is common to both the Shop Order file and the Maintenance Work Order file. Note that different *data* is contained in the respective fields.

Multiple segments and fields

As explained in "Data Base Features", multiple segments provide a variable length capability. Segments and fields that can occur a variable number of times – such as the supplier identification segment in the Product Description Record – are identified here by the letter M (multiple occurrence). Multiple fields should be repeated within a segment often enough to provide for the statistical majority of requirements. In general, therefore, some empty fields are inevitable. If there are insufficient fields for a particular situation, a further segment is created.

Connections

Fields that provide connections to other parts of the data base are described as "reference". A reference can be either the identification (say, item number) or a pointer (such as to the item identification segment). A pointer provides the "address" at which the root segment is located.

Universal fields

Certain fields are included in every record and possibly every segment. Such fields are represented in the Record Descriptions only when required for fuller understanding:

- *Record Type Code* – a unique code which identifies the different types of records within a file.
- *Number of Inquiries* – a counter incremented by one whenever an inquiry is made about this record or segment.
- *Last Update* – date and time of the most recent update. It is normally included once per record and once for every status field and is identified by the abbreviation SF in the field descriptions – for example, in the Order Status Code.
- *Date Closed* – date at which the processing on the record is terminated. After this date the record is kept for information only and could be canceled at any time.

- *Feasibility Values* – the two limits of the range of values normally expected during data collection (for example, quantity count on job completion). The limits are used during the editing of data entry from a terminal.

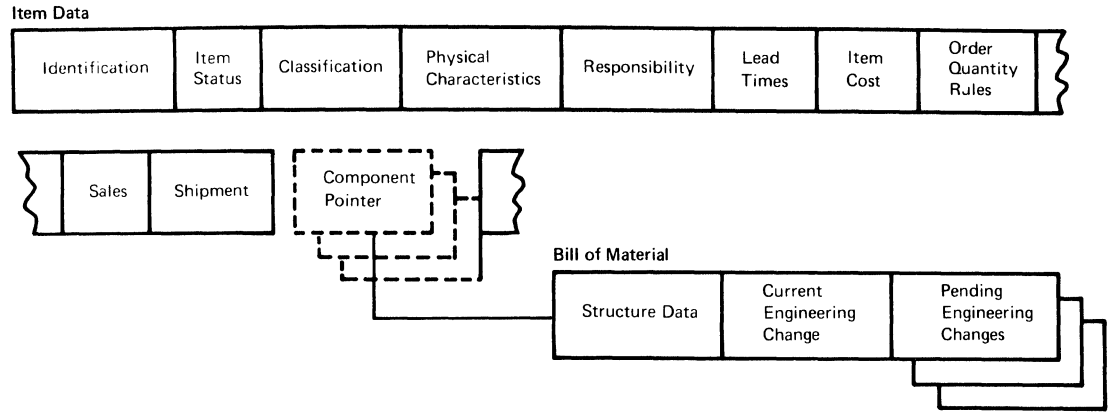
Product Definition

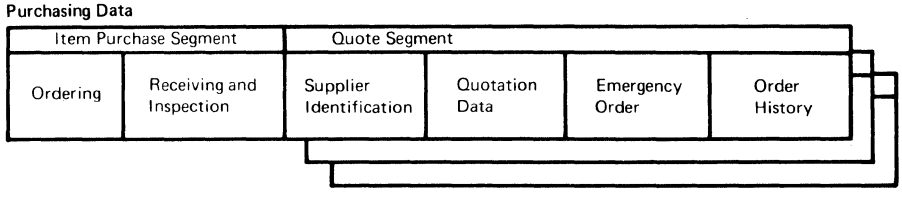
Each item having a unique item number is represented by a Product Definition record. For ease of reference the data is grouped under the headings:

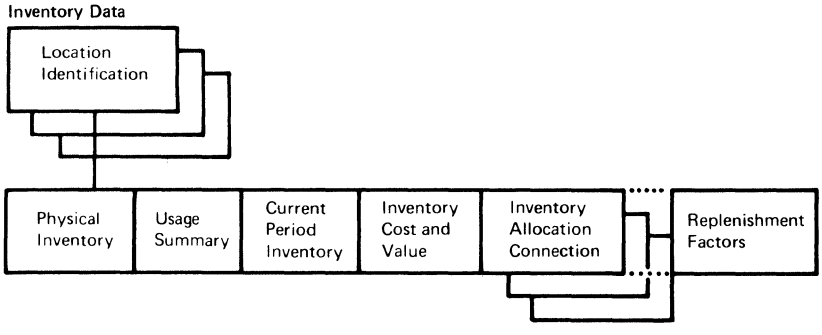
- Item Data
- Bill of Material
- Purchasing Data
- Inventory Data
- Requirements Data
- Shop Order Summary Data
- Purchase Order Summary Data

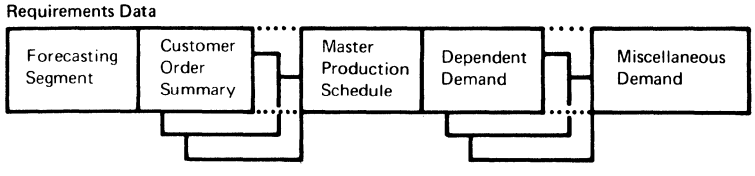
The first group (Item Data) is present for all items, since it contains basic identification data; but some or all of the other groups can be omitted for particular items. For instance, a purchased item normally has neither Bill of Material nor Shop Order Summary Data.

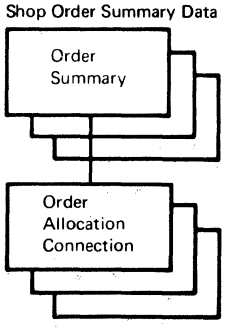
The grouping of the data under seven separate headings does not imply an additional level in the hierarchical structure (see "Hierarchical Segmentation" under "Data Structures").

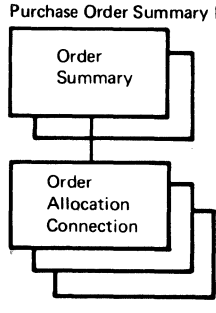












Product Definition Records

Product Definition — Item Data

In the Product Definition record, certain basic data ("item data") is always present. Item data comprises the essential information needed to define the item for all applications (manufacturing, finance, and engineering). It is relatively static.

IDENTIFICATION

U *Item Number*

Unique identifying number assigned to the item.

US *Engineering Change Level*

A suffix to the item number, representing the current engineering change version.

US *Drawing Number*

Numeric identification of the drawing associated with the item. Used as a reference to the Engineering Drawing file.

U *Short Description*

Item description of limited length (using abbreviations if necessary). The limit is the same for all items and depends on the desired output format; in particular, a visual terminal display has limited capacity.

U *Long Description (M)*

Full item description, using a variable number of fields of the same length as the Short Description. Normally the Long Description will fill several lines of an output display.

U *Foreign Language Description (M)*

Description of the item in a foreign language, as required by the sales department. Each description is preceded by a language code.

U *Sales Catalog Number*

Unique number by which the item is identified in the sales catalog (if different from the Item Number).

ITEM STATUS

US SF *Item Production Status*

Code indicating the current status of the item – for example:

1 = new (not yet in production)

2 = in production

3 = superseded by another

4 = obsolete (data for information only)

5 = to be deleted (when convenient)

US *Superseding Item Number*

Reference to the item that has replaced this item.

U *Substitute Items (M)*

Identification of the items that can be used to replace this item in case of shortage.

US *Current Engineering Change Number*

The number of the effective engineering change of the item.

US *Effectivity Date*

The date the engineering change was effective.

SU *Affected Component Indicator*

Indicates that this item is a component affected by an engineering change to a structure.

CLASSIFICATION

S *Value Classification*

Code indicating the importance of the item. This code can help determine the method of inventory management.

U *Item Type*

Each item is coded by "type" – for example:

1 = assembled

2 = fabricated

3 = raw material

4 = purchased

5 = subcontracted

U *Item Family*

Code associated with a group of similar items. Items are in the same family if their methods of manufacture are more or less the same – that is, if they use the same resources (materials and work centers) in similar amounts.

U *Demand Type*

Code identifying items considered (for control purposes) to have "independent" demand.

U *Material Code*

A locally applicable code (ASA, BSI, DIN, etc.) specifying the material used to fabricate the item.

U *Pilferage Code*

Indicates that the item is subject to pilferage (and therefore requires special security measures).

S *Low-Level Code*

Number indicating the lowest level at which this item is found in any product structure.

U *Instructions for Materials Handling (M)*

Instructions for special handling or storage – e.g., if the item is radioactive, poisonous, inflammable, temperature-sensitive, fragile, etc. This field can contain abbreviated instructions or a code representing standard instructions.

U *Resource Code*

A numeric designation of the item as a resource subject to RESOURCE REQUIREMENTS PLANNING.

U *Resource Group*

A code associated with a whole group of items considered as resources. Total requirements for the group can then be calculated.

U *Pegged Item Indicator*

Shows whether inventory and/or orders for this item are to be "pegged" to the requirements they cover.

PHYSICAL CHARACTERISTICS

U *Unit of Measure*

Units in which item quantities are expressed (pieces, kilos, etc.).

U *Conversion Factor*

If quantities are to be expressed (on printed reports) in units other than the above, this factor shows the relationship.

U *Unit Weight*

Weight of one unit of the item (see "Unit of Measure").

U *Dimensions*

Space (length, width, height) required to store this item.

U *Effective Volume*

The value to be used in the calculation of space requirements for transport and storage. (This is not necessarily computed from the Dimensions, because of complex shapes, additional protection material, etc.)

RESPONSIBILITY

U *Manufacturing Plant*

Number identifying the plant (in a multiplant environment) where the item is normally manufactured.

U *Inventory Administrator*

Administrator responsible for all decisions made about this item.

LEAD TIMES

US *Planned Purchase Lead Time*

The allowed interval between placing an order and receiving it from the supplier. (Sum of the longest supplier quotation plus internal review time.) Used in material requirements planning.

U *Minimum Purchase Lead Time*

Shortest lead time quoted by any supplier.

U *Purchase Order Review Time Adjustment*

If the internal review time for a purchase order for this item differs significantly from the Standard Internal Review Time, this factor is used to modify the standard value.

U *Receiving Lead Time Adjustment*

If the time for receiving and inspecting a purchase order for this item differs significantly from the Standard Receiving Time, this factor is used to modify the standard value.

U *Planning Manufacturing Lead Time*

The normal (planned) lead time required to produce an order for this item. If the lead time varies with the order quantity, it can be calculated from the next five fields listed here.

U *Safety Lead Time*

Number of days by which the expected completion date precedes the required date. This is an insurance against processing delays.

SU *Total Setup Time*

The sum of setup times for all operations required to produce an order for this item. Used only if lead time is dependent on order quantity.

SU *Total Run Time per Unit*

The sum of the run times (for all operations) required to produce one unit of the item. Used only if lead time is dependent on order quantity.

SU *Run Time Unit of Measure*

The units in which the total run time is expressed (shop days, tenths of shop days, etc.). Used only if lead time is dependent on order quantity.

SU *Total Interoperation Time*

The sum of the interoperation times (for all operations in the routing for this item). Used only if lead time is dependent on order quantity.

U *Lead Time quoted to Customers*

The interval, as quoted to customers, between acceptance of an order and its delivery.

ITEM COSTS

U *Unit Cost*

Cost of one unit of the item (used in calculation of economical lot size). Could be the standard cost.

S

Date of Last Unit Cost Change

The date of the most recent unit cost update.

SU

Total Setup Cost

Total cost of setups and teardowns for all operations required to produce an order for this item. The cost of each setup can include both labor and machine costs. This field is used in EOQ calculations.

U

Standard Direct Labor Cost

Total standard cost of direct labor used to produce one unit of the item (including setups). Used in the annual plan.

SU

Standard Direct Labor Cost for Components

Total standard cost of direct labor used to produce the components used in one unit of this item. Needed only for "value-added" taxes.

U

Standard Direct Material Cost

A standard value representing the variable material cost (of components or raw material) that can be directly attributed to the production of this item. This is the original cost used in the annual plan. If value-added tax is in force, this estimate does not include the cost of labor involved in the manufacture.

US

Standard Direct Machine Cost

The cost of machine time required for production of one unit of the item. This is calculated from the Machine-Hour Rate and the unit machine time for the item. The unit machine time is the Standard Machine Time for the item, modified by the Work Center Efficiency factor to reflect the normal performance. Unit time also includes machine setup and teardown time attributable to one unit, based on the Normal Order Quantity.

U

Standard Direct Cost Adjustment (M)

Adjustment to the above cost. Planned changes are stored as net changes to the standard cost.

U

Reason for Cost Adjustment (M)

Code indicating the reason for the above adjustment, such as method change, material price change, etc.

U *Effective Date for Adjustment (M)*

The standard cost adjustment is applied in calculations from this date onward.

U *Cost Adjustment Type (M)*

A code, defined locally, indicating the reason for the adjustment.

S HD *Actual Labor Cost*

Actual labor cost data required during the creation of the system-generated Standard Direct Labor Cost.

S HD *Actual Material Cost*

Depending on the cost accounting system used, this is either:

The most recent material cost

A weighted average material cost

The material cost for each batch (stored in a variable number of fields with the batch identification)

S HD *Actual Machine Cost*

Actual machine cost data required during the creation of the system-generated Machine-Hour Rate.

SU *Overhead Rate*

The indirect cost to be added to the direct cost in the calculation of total unit cost. Usually expressed as a percentage. Needed only if the rate varies by item.

ORDER QUANTITY RULES

U *Order Policy Code*

Indicates the method used to calculate the order size for this item – for example:

1 = standard EOQ formula.

2 = discrete quantity. Order quantities match individual requirements.

3 = Carry Level. The order quantity is determined from the Carry Level value.

4 = fixed order quantity. The quantity is taken from the Standard Lot Size field.

5 = part-period balancing. The order quantity is calculated using the part-period technique (sometimes referred to as least total cost).

6 = stabilized rate. The quantity is calculated so as to provide a stable production rate (e.g., if this item is used in a feeder line of an assembly plant).

U *Order Quantity Category*

Code used to determine (from a table) the Order Cost, Carrying Rate, and the formula used for order quantity calculation.

U *Quantity Alteration Dampener*

Positive and negative dampening limits (two subfields) used in the order alteration calculation. If a net change quantity lies within these limits, it is ignored.

US *Order Policy Cutoff Date*

Cutoff date modifier used in the planned order function of MATERIAL REQUIREMENTS PLANNING. This is the date (shop day) beyond which all requirements are ignored.

U *Shelf Life Limit*

The maximum time this item can be kept in storage.

SU *Normal Order Quantity*

The amount normally ordered either from the plant or a supplier (usually the average historical economical lot size). Used in determining the safety stock level for items with "independent" demand.

U *Minimum Order Quantity*

Minimum allowable order quantity.

U *Order Quantity Rounding Factor*

The number to be used in rounding up the order quantity (for example, even 100s or multiples of 10).

U *Maximum Order Quantity*

Maximum allowable order quantity.

U *Order Size Restriction Code*

Indicates the reason for the minimum and maximum restrictions above.

S *Item Yield Factor*

Percentage increase applied to planned order quantities to reflect scrap losses at this level of assembly. Can be dependent on order size.

U *Lot Size Item Control Code*

Identifies those items that should be ordered in lot sizes related to end item (or customer) orders.

U *Spare Parts Lot Sizing Code*

Indicates that spare part requirements for this item must be lot-sized *before* adding them to the gross requirements.

U *Non-Requisitioning Code*

Identifies the items for which no requisitions are issued even if the dependent demand is calculated.

SALES

U *Selling Price*

List price at which an end item (or service part) is sold.

U *Item Discount Classification*

Used with the Customer Discount Code to determine the discount offered to a particular customer for this item. (This is not a quantity discount.)

U *Configuration Editing Data*

Codes used to check the feasibility of the order configuration.

SHIPMENT

U *Standard Packing Quantity*

Quantity usually packed together in a single shipping unit, e.g., ten electric motors in a packing case.

U *Minimum Shipping Quantity*

Minimum quantity shipped to a customer.

U *Container Type*

A code indicating the type of container used for shipment, e.g., pallet, drum, etc.

U *Pallet Quantity*

Quantity representing a standard pallet load for storing and shipping.

U *Standard Packing Instructions (M)*

Standard instructions indicating how the item should be packed. (Complex instructions can also be quoted in the routing sheet.)

U *Shipping Class*

Code used to determine the shipping charge for this item (e.g., glass has a high insurance rate and therefore a higher charge).

Product Definition — Bill of Material

Bill of material data is stored within the Product Definition record. It indicates the materials or components required in the production of the item.

One Product Structure record is maintained for each constituent part (that is, for each component of an assembly, or for the raw material used in a fabricated part). Note that the Product Structure records are stored in the Product Definition record of the parent item and not in a separate file. (See also "Logical Data Structures".)

The Engineering Change segments represent only changes affecting particular structures, for example, the replacing of one component by another.

STRUCTURE DATA

U *Component Number*

Reference to a component, raw material, or disposable tool on a bill of material.

U *Structure Type*

Indicates for which type of bill of material this record is valid – for example:

1 = all

2 = engineering bill of material

3 = manufacturing bill of material

4 = spares assembly

5 = disposable tool

US *Explosion Code*

Code identifying structures with components considered (for control purposes) to have "independent" demand. It depends on the demand type in the component record and is repeated here to achieve better processing performance.

S *Low-Level Code of Component*

Number indicating the lowest level at which the component is found in any product structure. This is duplicated from the component record to achieve better processing performance.

U *Quantity per Assembly*

Number of units of the component required to make one unit of the parent.

S HD *Product Structure Scrap Allowance*

Allowance for component scrap expected in the production of this parent.

S *Product Structure Offset Adjustment*

The approximate number of shop days between the release of the parent order and the date the component is required (this field is present to avoid accessing the routing record during MATERIAL REQUIREMENTS PLANNING).

US *Point of Usage*

Number of the work center or portion of the assembly line where the component is introduced.

US *Parent Operation Number*

The point (Operation Number) in the parent routing where the component is required.

CURRENT ENGINEERING CHANGE

US *Current Engineering Change Number*

A number associated with an engineering change. Numbers are allocated sequentially and used to find detailed information about this change (stored in the Engineering Changes file). There is a direct correspondence between this number and the Engineering Change Level.

S *Effectivity Start of Present Change*

Indicates when the current structure became effective. Expressed either as a date or a serial number, according to the Effectivity Code.

US *Planned Effectivity End*

Indicates when the current structure will be changed (if known). Expressed as a date, a serial number, a quantity, or the number of a pending engineering change, according to the Effectivity Code.

US *Effectivity Code*

Associated with every effectivity start and end field and determines the method by which an engineering change is defined:

1 = by date

2 = by quantity

3 = by serial number

4 = by another engineering change number

S *Estimated Effectivity End Date*

If the Planned Effectivity End is not expressed as a date, the system converts the serial number, quantity, or number of a pending change, to this estimated date.

PENDING ENGINEERING CHANGES (M)

Some fields within this segment are duplicates of data in the Engineering Change file; they are needed for planning purposes.

US *Pending Engineering Change Number*

Refers to a planned engineering change. Also used to find the detail information on this change (stored in the Engineering Change file).

US *Pending Engineering Change Level*

A suffix, added to the item number, representing a pending version of this item.

US *Controlling Engineering Change Number*

Identifies a group of pending engineering changes related to each other.

US *Pending Effectivity Start*

Indicates when the planned engineering change becomes effective. Expressed either as a date, a quantity, or a serial number, according to the Effectivity Code.

US *Pending Effectivity End*

Indicates how long the planned engineering change will be valid (if known). Expressed as a date, a quantity, a serial number or the number of another pending engineering change, according to the Effectivity Code.

S *Estimated Start Date*

If the Pending Effectivity Start is not expressed as a date, the system converts the quantity or the serial number to this estimated date.

S *Estimated End Date*

If the Pending Effectivity End is not expressed as a date, the system converts the quantity, serial number, or number of another engineering change to this estimated date.

SU *Engineering Change Action Code*

Indicates whether the pending change is an addition or a deletion to the present engineering change.

Product Definition — Purchasing Data

Purchase data is stored within the Product Definition record of each purchased item. Data consists of a general segment (the Item Purchase segment) valid for all suppliers, and a variable number of individual segments (the Quote segment) for each supplier. One Quote segment links one item to one vendor (in the Supplier file) who can supply the particular item.

■ Item Purchase Segment

ORDERING

U *Joint Replenishment Group Code*

Associated with all items that have to be checked when a purchase order is placed for this item.

U *Ordering Code*

Indicates how the item is ordered – for example:

1 = quotation is obtained only when planned orders exist

2 = call-off order (against a blanket order)

3 = order is generated automatically by the system

4 = procedure determined by the buyer

U *Blanket Order Horizon*

Specific date or number of periods defining the time limit used in negotiating blanket orders with the supplier.

S HD *Purchase Order History*

Fields summarizing the purchase orders placed for this item.

S HD *Purchase Quantity History*

Fields summarizing the quantity of the items that were purchased.

U *Order Cost Modification*

Fixed additional cost to place an order for this item (irrespective of the quantity).

U *Requisition Lead Time Modification*

The average additional time in days between issuing a requisition and sending an order to the supplier.

U *Purchase Weighting Factors*

Three factors used to apply different weights to supplier delivery, quality, and price ratings when they are combined. Necessary only if the weightings required for the item are different from those of the Commodity Class.

U *Split Supply*

The number of suppliers among whom purchases of this (key) item must be divided.

RECEIVING AND INSPECTION

U *Early Delivery Code*

Indicates that early delivery can be accepted.

U *Receiving Location (M)*

Designates the location to which this item should be shipped. Could be a code.

U *Inspection Location (M)*

Designates the location in the shop where this item is to be inspected after a shipment is received. Required only if this is not the standard inspection location associated with the Receiving Location.

U *Accept Undershipment*

A factor (%) used to determine whether to accept an undershipment for this item. If the quantity received is less than this percentage of the quantity expected, the shipment is rejected.

U *Accept Overshipment*

A factor (%) used to determine whether to accept an overshipment for this item. If the quantity received is greater than this percentage of the quantity expected, the shipment is rejected.

U *Inspection Percentage*

The percentage (by quantity) of a shipment of this item which should be inspected after delivery (zero means no inspection required).

U *Acceptance Percentage*

The percentage of a shipment that must be in satisfactory condition before the shipment is accepted.

■ **Quote Segment**

SUPPLIER IDENTIFICATION

U *Supplier Number*

Identification of the supplier associated with this quote segment. Expandable to include the address of the supplier master record.

U *Supplier Contact*

Name of supplier's employee who handles orders and inquiries specifically for this item.

U *Supplier Telephone Number*

Telephone number of supplier contact, if different for this item.

U *Supplier's Item Number*

The number by which the supplier associated with this quote segment refers to this item.

U *Blanket Purchase Order Number*

Number of a single purchase order covering several repeatable purchases.

U *Expedite Code*

Indicates that orders on this supplier will be expedited.

QUOTATION DATA

U *Quotation Number*

Number assigned by Purchasing to identify a supplier's quotation.

U *Supplier's Quotation Reference*

The reference number used by the supplier to identify his quotation.

U *Lead Time Quotation*

The expected number of shop days between issuing a new price quote request for this item to this supplier and the receipt of an answer.

U *Lead Time Purchasing*

The expected number of shop days between the time an order for this item to this supplier is produced and the arrival of the first shipment.

U

Quotation Validity

The interval (in shop days) over which a price quotation for this item from this supplier is considered valid.

SU

Temporary Quotation Code

Indicates that this quotation has not yet been accepted by the responsible buyer.

U

Quotation Renewal Code

Denotes whether new quotations are obtained automatically or only when planned orders exist for the item.

S

Date Last Quote

The date on which the supplier associated with this quote segment last sent a price quotation for this item.

US

Quote Request Date

The date on which a request for price quotation for this item was sent to the supplier, who has not yet responded (otherwise blank).

U

Price Break (M)

Supplier prices based on lot quantities, stated, together with Minimum Lot Quantity, as a series of price/quantity fields.

U

Minimum Lot Quantity (M)

The minimum batch quantity (of this item) that can be provided by this supplier at the price quoted above. If the order quantity required is less than the first quantity in the series, no price is available from this record.

U

Maximum Lot Quantity

The maximum batch quantity for which the lowest price (in the price/quantity fields above) is valid. For bigger batches, a special quote has to be requested.

U

Supplier's Setup Charge

The cost of setting up to make this item, when it is separately identified by the supplier.

U

Supplier's Additional Charge

Additional charges made by the supplier, such as for tools.

U *Special Receiving Cost*

Additional handling costs incurred when receiving this item from the supplier.

U *Special Terms*

Supplier's payment terms, if different for this item.

U *FOB Point*

The point from which shipping costs for this item are charged to the user and not covered by the supplier. (This information is stored in a similar field in the Supplier Master record, if there is only one point of shipment for all items delivered by this supplier.)

U *Purchasing Requirements (M)*

Details of drawings, tools, consigned items, materials, etc., that accompany orders for this item from this supplier.

EMERGENCY ORDER

U *Emergency Lead Time*

The quoted time between placing an emergency order and its receipt from this supplier.

U *Unit Price for Emergency Order*

Special unit price quoted by the supplier for orders delivered with an emergency lead time.

U *Quantity Limitation for Emergency Order*

Maximum quantity that can be ordered with an emergency lead time.

ORDER HISTORY

S HD *Order Summary*

Field summarizing previous order quantities received for this item.

S HD *Price Summary*

Field summarizing price history for this item, including price changes, date, and quantity at that price.

Product Definition — Inventory Data

Inventory data is held in the Product Definition record of every item represented.

All or part of the data in this record can be summarized for a single plant or several plants, or can be maintained by individual stock location. The warehouse inventory can be maintained independently at the level desired by the user. On the other hand, the same inventory control rules may apply to all locations. If, for example, an item is stocked at several locations and the inventories are interchangeable, only one Safety Stock field is necessary.

Each segment must therefore include Location Identification fields, indicating which stores are represented by the data in the remaining fields.

LOCATION IDENTIFICATION (M)

Subsegment repeated in all segments of Inventory Data.

U *Plant or Warehouse Number*

Identification of the plant or warehouse with which this segment is associated.

U *Stock Location*

Identification of the physical location where this item is stocked.

U *Bin Location*

Identification of the first location within the store where this item is kept (aisle, rack, bin, etc.).

S *Last Update*

The date and the time when the inventory data for this stock location was last updated.

PHYSICAL INVENTORY

U *Type of Inventory Count*

Code denoting frequency of physical inventory taking – for example:

1 = annual count

2 = period count on fixed dates

3 = rotating counts

U *Interval Between Counts*

For periodic (rotating) inventory count, the standard time span between two counts.

U SF *Physical Count*

Actual count (quantity or weight) recorded at last physical check.

U *Checker Number*

Identity of employee counting the inventory.

U *Inspection in Store*

Code indicating that the items must be inspected not only on receipt but also when in stores (for items with limited shelf life).

U *Date of Last Count*

Date inventory was counted (for this item).

S *Movements since Physical Count*

Number of movements since last count.

S *Estimated Date of Next Count*

Date of next inventory count as generated by the system.

USAGE SUMMARY

S HD *Total Issues*

Total quantity issued from this location.

S HD *Unplanned Issues*

Total unplanned issues from this location. Unplanned issues are required for replacing excessive scrap, for special tests, for booked losses, etc.

S HD *Unfulfilled Demand*

Total demand quantity that could not be satisfied immediately (because of stockouts, previous allocations, etc.).

S HD *Periods without Issues*

Total number of periods without any issue.

S HD *Stockouts*

Fields summarizing the number of times that a demand could not be met (though the item is stocked and should be available).

CURRENT PERIOD INVENTORY

U *Inventory Type Code*

Used to categorize inventory for planning, stocking, and ordering – for example:

0 = new

1 = equivalent-to-new

2 = renovate

3 = recondition

4 = available for rework (to equivalent-to-new)

S *Demand*

Total demand for this item (whether satisfied or not) during the current time period.

S *Issues*

Total inventory disbursements (issues) during the current time period.

S *Receipts*

Total inventory received during the current time period.

S *Transfers and Adjustments*

Total of the transfers and adjustments made to the inventory of this item during the current time period.

S *On-Hand Quantity*

Total units on hand at this stock location.

S *Floor Stock*

Estimate of the number of units of this item issued to the shop floor but not used in production (applies to items issued in excess of requirements). Can also be treated as another stock location.

INVENTORY COST AND VALUE

S HD *Deterioration Factor*

Based on experience; used to determine the extent of stock losses due to deterioration (rust, dehumidification, etc.), aging, wear through reuse, or other causes.

U *Depreciation Category*

Used to compute the depreciation (reduction in value) of the inventory for this item. Normally used for maintenance parts.

S *Reduced Value*

Remaining value of the stock after depreciation.

U *Insurance Class*

Code indicating the insurance rate for storing the item. This field is used as a Carrying Rate element; it is required only if the item is excessively exposed (e.g., in an outdoor location) and therefore needs substantially higher insurance than normal.

U *Branch Warehouse Handling Cost*

Code representing the warehouse handling cost. Required only if the handling cost for this item differs significantly from the normal handling cost for this store location. It is used to calculate the economical warehouse handling quantity and serves also as a Carrying Rate element.

INVENTORY ALLOCATION (M)

S *Allocation from On-Hand*

Quantity allocated from the on-hand stock to a particular requirement.

S *Type of Allocation*

Code indicating the type of allocation of the on-hand quantity above:

1 = tentative allocation to independent demand

2 = tentative allocation to dependent demand

3 = firm allocation to independent demand

4 = firm allocation to dependent demand

S

Where-Used Reference Number

Reference to the demand to which the on-hand quantity above has been allocated.

REPLENISHMENT FACTORS

U

Inventory Control Code

Indicates how the inventory is controlled:

1 = requirements planning

3 = Carry Level

5 = time-phased "order point"

SU

Carry Level

The inventory level that should be reached on receipt of each replenishment order. This is used for slow-moving items.

SU

Safety Stock

The extra stock quantity maintained to meet above-average demand during the replenishment lead time.

U

Safety Factor

If statistical methods are used to calculate the safety stock, this factor is multiplied by the MAD (mean absolute deviation) to determine the safety stock. Alternatively the safety factor may be expressed as a number of days or a percentage of the lead time.

U

Order Point

The quantity expected to be consumed during the replenishment lead time plus a safety lead time. This field is used only for certain independent demand items, where the standard time series planning procedure (described in *Chapter 5, Inventory Management*) is not used.

Product Definition — Requirements Data

The requirements data is stored within the Product Definition record for each unique item and for each item group (also identified by a unique number). The data consists mainly of information required or established by MASTER PRODUCTION SCHEDULE PLANNING and INVENTORY MANAGEMENT. It includes fields for dependent and independent demand.

FORECASTING SEGMENT

S *Model Type*

Demand model established by Forecasting – for example:

1 = horizontal

2 = trend

3 = exponential

4 = seasonal (with base series)

5 = adaptive smoothed

U *Alpha Factor*

The "smoothing constant". The factor by which the current value is weighted when the new average value is calculated.

S *Trend*

The estimated demand increase (or decrease) per period. Used to adjust the projection and so allow for an ascending or descending usage pattern.

S *Seasonal Base Indices (M)*

A series of computed factors used to adjust the demand for seasonal patterns.

S *Average Demand*

Depending on the demand model, this represents an arithmetic average, an exponentially smoothed average, or a theoretical "first average".

S *Second Average*

Field used by the system for calculation of trend forecast models.

S *Warning Signal Statistic*

Sum of deviations between actual demand and projected demand; used to determine the accuracy of the projection.

S *Mean Absolute Deviation (MAD)*

The average of the differences between actual demand and forecast demand for an item. (All differences are considered positive.)

S *Warning Signal Count*

The number of successive periods in which the warning signal was issued.

S *Forecast Limits (by period) (M)*

Confidence limits associated with the demand forecast. Expressed as percentages of the forecast quantity (e.g., 80% and 120%).

U *Forecast Horizon*

Number of periods over which the forecast is made.

U *Judgment Factor (by Period) (M)*

A series of manually provided factors used to adjust a demand projection.

U *Demand Modification Code*

Indicates how unusual demand is to affect the forecast.

U *Life Curve Code*

Identification of the curve (if any) used to modify the forecast.

S *Demand Distribution Analysis (M)*

Series of fields summarizing the frequency of demands recorded during the replenishment lead time (for slow-moving items).

CUSTOMER ORDER SUMMARY (M)

A connection segment required for "pegging" each customer order. Duplication of some data is necessary in order to avoid accessing the Customer Order record during the "pegging" procedure.

S *Customer Order Number*

Identification of the customer order, which is summarized in the following fields. The same identification is associated with the detail information in the Customer Order record.

S *Customer Order Shipment Date*

The date on which shipment of this order is planned. This is a duplicate of the Planned Shipment Date in the Customer Order record.

S *Shipment Quantity*

The quantity to be shipped on the date quoted above.

S *Customer Order Status*

A code indicating whether this order is "firm". If so, the allocations made for the associated requirements are also firm.

MASTER PRODUCTION SCHEDULE

U *Length of Planning Horizon*

Number of periods covered by the master production schedule.

U *Requirements Storage Code*

Indicates whether the requirements for this item are stored in date/ quantity fields or by time series.

U *Projection Code*

Indicates how the forecast on which this master production schedule is based has to be modified:

1 = no modification

2 = forecast modified by judgment factors

3 = forecast modified by a life curve

SU *Master Production Schedule Quantity (M)*

Future requirements for finished products; these requirements reflect the on-hand inventory situation and any planned inventory surplus.

S *Master Production Schedule Date (M)*

Date (or period number) of the requirements in the Master Production Schedule Quantity field. Not required if continuous time series are used.

U *Demand Code*

Indicates the source of demand on which the master production schedule is based – for example:

1 = demand forecast

2 = field warehouse shipping schedule

3 = interplant orders

4 = customer orders

5 = miscellaneous demand

DEPENDENT DEMAND

U *Dependent Demand Storage Code*

Indicates whether the dependent demand is stored in date/quantity fields or in time "buckets".

S *Dependent Demand Quantity (M)*

Demand generated from requirements for higher-level assemblies (and therefore calculated directly rather than forecast).

S *Dependent Demand Date/Period*

Date or period number of the requirements stored in the Dependent Demand Quantity field. Not required if time "buckets" are used.

S *Order Identification*

Identification of the order (for an end item or service part) that generated this dependent demand. Required only if full pegging is used in INVENTORY MANAGEMENT.

S *Order Control Code*

Indicates whether the demand can be grouped with other requirements into a single lot, e.g., for government contracts.

MISCELLANEOUS DEMAND

U *Miscellaneous Demand Storage Code*

Indicates whether the miscellaneous demand data is stored in date/quantity fields or as time series buckets, and whether it is to be added to the other independent demand.

S HD *Miscellaneous Demand Quantity (M)*

Requirements that have been forecast for unplanned issues, to cover losses, deterioration, excessive scrap, stock record adjustments, etc.

S *Miscellaneous Demand Date/Period (M)*

Date or period number of the requirements stored in the Miscellaneous Demand Quantity field. Not required if continuous time buckets are used.

Product Definition — Shop Order Summary Data

Shop order summary data is stored within the Product Definition record for each planned and released order of an item fabricated or assembled in the shop. The Shop Order Summary segment is created by INVENTORY MANAGEMENT. (Some fields will be duplicated when a Shop Order record is created by MANUFACTURING ACTIVITY PLANNING. This summary segment is maintained to allow faster retrieval and processing when detailed information is not required – for example, in MATERIAL REQUIREMENTS PLANNING.)

ORDER SUMMARY

S *Shop Order Number*

A number assigned by the system to the shop order summarized in this segment. The same identification is used in the Shop Order record.

U SF *Shop Order Status*

Indicates current degree of commitment:

1 = planned (subject to change)

2 = planned (firm, cannot be changed by the system)

3 = released

S *Scheduled Release Date*

The date the order should be released for production.

S *Scheduled Due Date*

The date the shop order is scheduled to be completed.

S *Original Order Quantity*

Production quantity originally released.

S *Planned Completion Quantity*

The quantity planned to be completed. Initially the same as the previous field, but updated to reflect the quantity completed at each operation (updating occurs only if the deviation from the planned quantity exceeds certain limits).

S *Order Priority*

A value reflecting the importance of this order relative to all other orders. (This is a duplicate of the Shop Order Priority in the Shop Order record.)

SU *Associated Orders*

Reference to other orders on which this one is dependent (for instance, when two shop orders must be completed at the same time).

ORDER ALLOCATION CONNECTION (M)

This is a connection segment required for "pegging" the shop orders to the requirements. Duplication of some data is necessary in order to avoid accessing the Shop Order record during MATERIAL REQUIREMENTS PLANNING.

S *Gross Demand Quantity*

The gross quantity of this item required for a particular higher-level order (identified in the Where-Used Order Number field).

S *Net Allocation*

The remaining quantity required to meet the above demand after netting against stock and previous shop orders. For example, if 20 pieces of this item are required for the higher-level order, and 5 are in stock and 6 are covered by a previous order, the remaining 9 are the dependent demand net quantity required from *this* shop order.

S *Type of Allocation*

Code indicating the type of allocation for the shop order quantity above:

1 = tentative allocation to independent demand

2 = tentative allocation to dependent demand

3 = firm allocation to independent demand

4 = firm allocation to dependent demand

S *Where-Used Order Number*

The number of the higher-level order to be served by this shop order (the higher-level order is normally an internal shop order but can be a customer order in the case of a service part).

S *Requirement Due Date*

The date on which the requirement must be met. Several requirements, each generated by a higher-level shop order or by a customer order, may be covered by the order.

S *Lot Size Order Control Code*

Indicates, in conjunction with the Order Identity and the Lot Size Item Control Code, whether the requirement can be grouped into a lot with other requirements. If this code is present, the shop order will cover only requirements bearing the same Order Identity – for example, a government contract.

S *Order Identity*

Indicates, in conjunction with the Lot Size Order Control Code and the Lot Size Item Control Code, whether the requirement can be grouped into a lot with requirements from other orders. If this field is non-blank and the Lot Size Item Control Code is present, the order will cover only requirements bearing the same Order Identity (whether the Lot Size Order Control Code is present or not).

SU *Serial Number (M)*

The two limits of the range of serial numbers by which the allocation of finished products is referenced.

Product Definition — Purchase Order Summary Data

Purchase order summary data is stored within the Product Definition Record for each planned and released purchase order (including subcontracted or interplant orders). The Purchase Order Summary segment is created by INVENTORY MANAGEMENT. Some fields will be duplicated when a Requisition record is created by the ORDER RELEASE function. This summary segment is maintained to allow faster retrieval and processing when detail information is not required (e.g., in MATERIAL REQUIREMENTS PLANNING).

ORDER SUMMARY

S *Purchase Order Reference Number*

A number assigned by the system to the purchase order or requisition summarized in this segment. The same identification is used in the Purchase Order record.

SU SF *Purchase Order Status*

Indicates current degree of commitment:

0 = planned (subject to change)

1 = planned (firm, cannot be changed by the system)

2 = requisition issued

3 = request for quotation issued

4 = purchase order issued

S *Scheduled Release Date*

The date the requisition should be released to purchasing.

SU *Scheduled Due Date*

The date the purchase order is planned to be received.

SU *Planned Purchase Quantity*

The quantity which is planned to be received. Initially computed by the system, it can be updated by Purchasing to reflect the quantity actually ordered.

SU *Associated Orders (M)*

Reference to other orders on which this one is dependent (for instance, when two purchase orders must be received at the same time).

ORDER ALLOCATION CONNECTION (M)

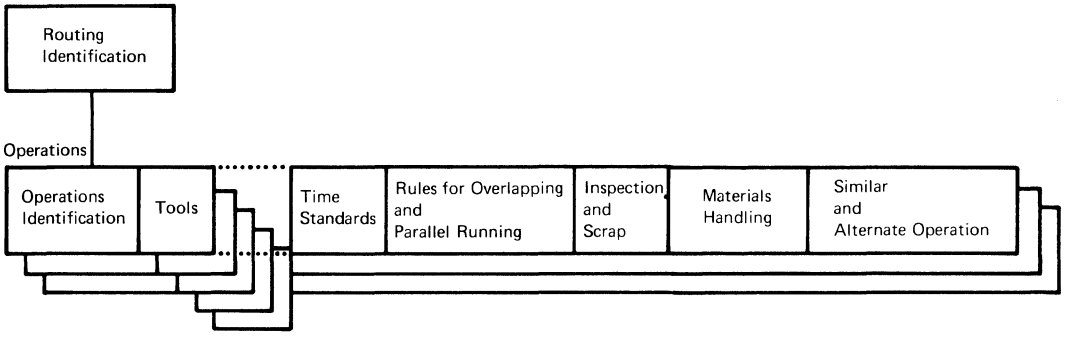
This is a connection segment required for "pegging" the purchase orders to the requirements. Duplication of some data is necessary in order to avoid accessing the Purchase Order record during Material Requirements Planning.

This segment contains the same fields described in the Order Allocation Connection segment within the Shop Order Summary Data.

Manufacturing Routings

The Manufacturing Routing data consists of one record for each routing. The record includes a header segment, valid for the whole process, and a variable number of detail segments for each operation. It is created by ENGINEERING AND PRODUCTION DATA CONTROL.

As stated earlier under "Segmentation", it is assumed that the same routing can be used for several similar items. The Manufacturing Routing record is in this case linked to the associated Product Definition records.



Manufacturing Routings

■ Routing Identification

U *Standard Routing Number*

Identifies the standard routing sheet. The routing specifies the operations required to produce the items and their sequence, with alternate operations and routings wherever appropriate. If all fabricated items have different routings (see Figure 34A), the Routing Number is usually the same as the Item Number.

U *Planning Change Level*

A suffix to the above number indicating the change level of the routing. Not necessarily the same as the engineering change level.

U *Routing Code*

A code used to classify the routing according to the type of documentation needed:

1 = assembly item

2 = component (fabricated)

3 = process

4 = NC/DNC

U *Routing Type*

A code to identify the use of the routing:

1 = standard
2 = alternate
3 = blanket
4 = composite
5 = temporary
6 = rework
7 = specific
8 = purchased item

U *Alternate Routing (M)*

Number of the standard routing that can be used as an alternate.

US *Number of Print Lines*

Number of print lines required for the operation description; used for page numbering.

U *Operation Group Code*

Number associated with a group of identical or similar operations.

■ **Operations**

OPERATION IDENTIFICATION

U *Operation Number*

Number assigned to this operation. The successive operations in any one routing are normally numbered in ascending sequence, since they represent the standard method of processing the item. The actual sequence of processing a particular order is governed by the Sequence Number in the Shop Order record.

U *Short Description*

Operation description of limited length, quoting only essential activities (drill, mill, deburr, etc.). The length is the same for all operations and depends on the format of the output (for displays and printouts).

U *Long Description (M)*

Full operation description using a variable number of fields. The description can be of any length.

U *Work Center*

Number identifying the machine or labor group that performs this operation.

U *Machine Number*

Number of a specific machine in the work center on which this operation must be performed.

US *Drawing Number (M)*

Numeric identification of the drawing used for this particular operation. Can be a reference to the Engineering Drawing file.

U *Numerical Control Tape Number*

Numeric identification of the numerical control tape required for this operation.

U *Composite Operation Usage Code*

In a composite routing this code indicates whether this operation is to be performed on a particular item (in process operations, for example, similar items use the same routing but only some are plated).

U *Labor Grade*

Skill level required to perform this operation (this governs the hourly rate).

TOOLS (M)

U *Tool Number*

Identifies the tool required for this operation.

U *Tool Quantity*

The number of tools (of the type specified above) required for this operation.

US *Tool Description*

Short description of the required tool. (This field is a duplicate of that in the Tool file, to improve processing performance.)

U *Tool Disposition Code*

Indicates whether the same tool is required again in a subsequent operation or can be returned after usage.

U *Setup Code*

Specifies the setup facilities required:

1 = operator

2 = machine

3 = operator and machine

4 = separate setup pool

5 = separate setup pool and operator

6 = separate setup pool and machine

7 = all three

U *Standard Setup Time*

The established time standard for setting up the equipment required for this operation.

U *Setup Time Basis*

The manner in which the standard setup time is expressed. The following codes also apply to other time standards described later:

1 = units per minute

2 = units per hour

3 = tenths of hours per unit

4 = tenths of days per unit

5 = tenths of hours irrespective of lot size

6 = tenths of days irrespective of lot size

U *Standard Machine Time*

The established time standard used to calculate the total time required to perform this operation. The standard may include setup time if that time is insignificant.

U *Standard Labor Time*

The established standard time used to calculate the man-hours required for this operation. The standard may include setup time if such time is not treated separately. Standard Labor Time is not the same as Standard Machine Time if employee operates several machines.

U *Time Basis for Machine and Labor Standards*

The manner in which the standard machine and labor times are expressed (see "Setup Time Basis").

U *Short Quantity Time Allowance*

An increment applied to the standard time when the order quantity is small. Often allowed where incentive bonus systems are installed.

U *Interoperation Time*

When not blank, this overrides the interoperation time calculated from the various standard elements. This time cannot be reduced.

U *Critical Life*

The maximum acceptable time interval between the completion of the previous operation and the start of this one (to avoid oxidation or excessive hardening, etc.).

RULES FOR OVERLAPPING AND PARALLEL RUNNING

U *Overlap Code*

Specifies the rule by which overlapping with the following operation is performed:

0 = never

1 = based on pieces

2 = based on hours

3 = based on moves

4 = this and following operation take place concurrently

U *Overlap Factor*

Pieces, tenths of hours, or number of moves, depending on the Overlap Code. Not used if Overlap Code is 0 or 4.

U *Multiple Facility Code*

Specifies the rule by which work is performed on multiple machines or by multiple men:

0 = never

1 = based on number of pieces

2 = based on number of hours

3 = based on multiple machine factor

U *Multiple Facility Factor*

The content of this field varies with the code above. When the Multiple Facility Code is 1, the *number of pieces* is divided by the number in this field and the result rounded to the next higher integer to give the number of machines (or men). When the Multiple Facility Code is 2, *the number of run hours* is divided by the number in this field and the

result rounded to the next higher integer to give the number of machines. When the Multiple Facility Code is 3, *the number of setup hours* is multiplied by the number in this field. The result is divided into the number of run hours and the result rounded to the next higher integer to give the number of machines.

U *Maximum Number of Facilities*

Maximum number of men or machines to be used for the operation (normally limited by the number of tools available).

U *Minimum Send-Ahead Quantity*

Minimum amount of work that must be done before a fraction of the lot is sent ahead to the next operation (expressed as a number of units).

U *Minimum Send-Ahead Work Hours*

Same as above, but expressed as a number of work hours.

INSPECTION AND SCRAP

U *Inspection Code*

Indicates that inspection is required but not specified as an operation in the routing.

US HD *Inspection Sampling Rule*

A code used to indicate the choice of sampling technique for inspection (e.g., inspection after quantity X).

S HD *Shrinkage Factor*

The percentage loss of pieces considered normal for this operation.

MATERIALS HANDLING

U *Transport Facility Number*

Identification of the type of facility (fork lift truck, overhead crane, hoist, etc.) required to move the item. This can be a reference to a facility record.

U *Handling Description*

Brief description of the handling facility – fork, hoist, etc.

U *Special Handling Instructions (M)*

Special instructions for material handling (for wrapping, packing, lifting, etc.).

U *Handling Time*

Additional handling time for this operation because of special handling needs (expressed as a percentage of the run time).

SIMILAR AND ALTERNATE OPERATIONS

U *Grouping Code*

A code indicating which jobs can be run together, or successively, using the same or similar setup. A sequence number identifies the sequence in which jobs should be run (for example, in a paint-spraying operation, yellow before black).

U *Alternate Operation Number*

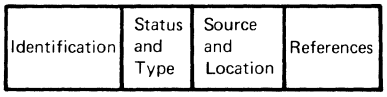
Number of the operation (within the same routing) that can be performed as an alternate.

U *Alternate Operation Code*

Code to indicate this is an alternate operation.

Engineering Drawings

The Engineering Drawing file consists of one record for each engineering drawing. Each individual record is linked to the Product Definition record and to the Engineering Change record of the items and changes valid for this drawing.



Engineering Drawings

IDENTIFICATION

U *Drawing Number*

Identifies the drawing associated with this record. It does not represent any classification.

U *Issue Level*

Current level of the drawings issued. Assigned by the design department.

U *Title*

Descriptive name of the drawing (normally from the drawing itself).

U *Dimensions*

A code used to identify the size (length and breadth) of the drawing.

U *Number of Sheets*

The number of sheets in a single drawing (not including copies).

STATUS AND TYPE

U SF *Drawing Status*

A code used to define where the drawing is applicable:

1 = preliminary drawing

2 = normal production

3 = withdrawn

U *Drawing Type*

Used to indicate whether this drawing contains only engineering information or is a manufacturing drawing.

SOURCE AND LOCATION

U *Drawing Source*

A code indicating which drawing office issued the original drawing (if multiple locations are involved).

U *Design Group*

Identifies the group or section of the drawing office that did the original design for this drawing.

U *Man Responsible*

Personnel number or initials of the employee who approved the current drawing.

U *Current Master Drawing Location*

A code showing the current location of the master drawing – for example:

1 = drawing office

2 = print room

3 = microfilming

4 = drawing library

US SF *Maintained Copies Location Code (M)*

Indicates the location of maintained copies (say, a department number within a plant, or a supplier number).

REFERENCES

U *Item Number (M)*

Identification number of the item to which this drawing applies.

U *Engineering Change Number*

The engineering change number (of the item) that corresponds to the current drawing.

US *Drawing Used On*

The number of the drawing (or the address of its record) for the assembly on which this item is used.

U *Contract Number*

Customer Order Number (if this drawing is valid for only one particular contract).

U *Specification Number*

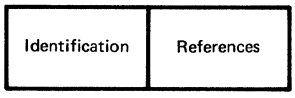
A one-time end item number for a particular made-to-order item (drawing is valid only for one contract).

U *Superseding Drawing Number*

Number and issue level of the drawing replaced by the current drawing.

Drawing Change History

The Drawing Change History file consists of one record for each former status change of an engineering drawing.



Drawing Change History

IDENTIFICATION

S *Drawing Number*

Identification of the drawing associated with this record. It does not represent any classification.

S *Issue Level*

Current level of the drawings issued. Assigned by the Design Office.

S SF *Drawing Status*

A code used to define where the drawing is applicable:

1 = preliminary drawing

2 = normal production

3 = withdrawn

REFERENCES

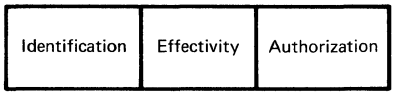
This segment contains the same fields described in the References segment of the Engineering Drawing file. However, references are established by identification (e.g., Drawing Number) and not by a disk (or tape, etc.) address.

Engineering Changes

The Engineering Change file consists of one record for each current individual change or group of engineering changes (group changes are identified by the Record Type field).

Each individual Engineering Change record is linked to the Product Definition record of the item(s) affected. The connection is made to the Item Data (if the change is valid for the item) or to the Product Structure Data (if only particular assembly-component structures are affected).

The individual Engineering Change record is also linked to its associated Engineering Drawing Master record and, if several changes are dependent on each other, to the Engineering Change Group record.



Engineering Changes

IDENTIFICATION

U *Engineering Change Number*

A control number identifying a revision to the bill of material (made and authorized by the engineering department). Can apply to an individual or a group change.

U *Record Type*

Code to distinguish between an individual engineering change and a group change.

U *Engineering Change Group Number*

Links together individual engineering changes when they are dependent on each other.

U *Reason for Change*

A code to denote why the change was made:

1 = safety

2 = field trouble

3 = cost reduction

4 = product improvement

5 = correction

6 = factory service

7 = standardization

U *Description (M)*

A detailed description of the change. The description can be of any length.

U *Previous Change Number*

The number of the engineering change that was effective before the current change number (for the same item or assembly structure).

EFFECTIVITY

U *Effectivity Class*

A code indicating when this change becomes effective.

1 = at stock runout

2 = at a defined stock level

3 = at a given date

4 = with a specific order number

5 = with a specific serial number

6 = immediately

7 = retrospectively

U *Effectivity Limit*

Depending on the Effectivity Class, this can either be a stock level, a date, an order number, or a serial number.

U *Group Effectivity Code*

Indicates the relationship between the effective dates of individual changes within a group change:

1 = successive changes

2 = simultaneous changes

3 = no sequence prescribed

U *Group Effectivity Sequence Number*

If the individual engineering changes of a group must become effective in a defined sequence (see "Group Effectivity Code"), this is the sequence number within the group.

U *Assembly or Structure Affected (M)*

Pointers to the item or structure affected by this change.

AUTHORIZATION

U *Originator*

Identification of the person who initiated this change.

U *Approval Reference (M)*

Employee number of the person responsible for approval.

U *Disposal*

Code to indicate disposal method for superseded model:

1 = keep remaining items as spare parts

2 = rework all items

3 = scrap all items when new items are available

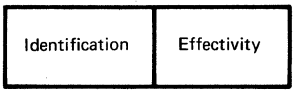
4 = use to a specified quantity

5 = mandatory change (immediate withdrawal)

Engineering Change History

The Engineering Change History file consists of one record for each individual or group engineering change that has been superseded. The required data is transferred from the Engineering Change file (for current changes) after a new change becomes effective.

These records of past changes are kept primarily to provide, with data from the Product History file, information about products no longer fabricated.



Engineering Change History

IDENTIFICATION

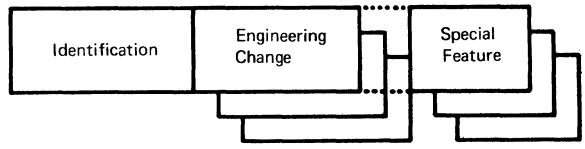
This segment contains the same fields described in Identification segment of the Engineering Change file. The Description field could be an abbreviation.

EFFECTIVITY

This segment contains the same fields described in the Effectivity segment of the Engineering Change file.

Product History

The Product History file consists of one record for each end item produced. The record includes an Engineering Change segment for each change applicable to that product. It can also include a Special Feature segment for additional items included in the product to meet a customer specification (not covered by an engineering change). Product History records are used, together with the data stored in the Engineering Change History file and in the Drawing Change History file, to provide information about products already delivered to the customer. For details see *Chapter 1, Engineering and Production Data Control.*



Product History

IDENTIFICATION

S *Product Group Number*

Code associated with a group of similar end items. (This corresponds to the Item Family field in the Product Definition record.)

S *Product Number*

Unique identifying number assigned to the item. (This corresponds to the Item Number field in the Product Definition record.)

S *Effectivity Code*

This is associated with every effectivity start and ending field and determines the method by which an Engineering Change is defined.

1 = by date

2 = by quantity

3 = by serial number

4 = by another Engineering Change Number

ENGINEERING CHANGE (M)

S *Engineering Change Number*

A control number associated with an engineering change. It provides access to detailed information about the change (stored in the Engineering Change file or in the Engineering Change History file).

S *Engineering Change Group Number*

Links together individual engineering changes when they are dependent on each other (not required if this is a group segment).

S *Effectivity Start*

Indicates when the above engineering change became effective. Expressed either as a date, serial number, or customer order number, according to the Effectivity Code.

S *Effectivity End*

Indicates when the above engineering change was no longer effective. Expressed either as a date, a serial number, or a customer order number, according to the Effectivity Code.

SPECIAL FEATURE (M)

S *Customer Specification Number*

A number associated with a customer order specifying modifications to a standard product. Such a change is often not covered by an engineering change.

S *Item Number (M)*

Identification of the item associated with this customer specification.

S *Serial Number (M)*

The serial number of the first unit supplied to the customer of the item specified above.

S *Quantity (M)*

The quantity associated with the item above.

S *Effectivity Start*

Indicates when the above customer specification became effective. Expressed either as a date, an end product serial number, or a customer order number, according to the Effectivity Code.

S *Effectivity End*

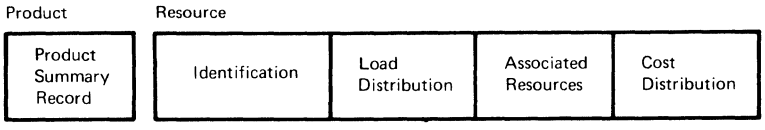
Indicates when the above customer specification was discontinued. Expressed either as a date, an end product serial number or a customer order number, according to the Effectivity Code.

Product and Resource Summary

The Product and Resource Summary contains two different types of data required by MASTER PRODUCTION SCHEDULE PLANNING:

Summarized Product Data – containing a summary of the requirements needed to produce one unit of a product or product group. Requirements include labor and machine-hours (by resource), critical raw materials, etc.

Summarized Resource Data – containing data for each major resource (key work center, group of work centers, Production Engineering, Design Engineering, etc.) used in MASTER PRODUCTION SCHEDULE PLANNING. Data includes the resource requirement profile based on the current master production schedules.



Product and Resource Summary

■ Product Summary Record

U *Item Number*

Identifying number assigned to each unique item, as in the Product Definition record.

U *Item Family*

A code associated with an Item Family (Product Group) as in the Product Definition record.

S *Product Load Profile (M)*

A series of points defining a cumulative load curve. The curve represents the period-by-period loads imposed on a resource by the production of one unit of this product. (Not present if this record is for an Item Family.)

S *Average Product Load Distribution (M)*

The "average" of the Product Load Distributions for all products in the Item Family designated above. Each individual distribution is "weighted" in proportion to the forecast average demand for the product. (Not present if this record is for a unique Item.)

S *Cash Requirements Distribution (M)*

A series of points defining a cumulative cash requirements curve. The curve represents the period-by-period cash requirements for the production of one unit of this product.

U *Key Material or Component (M)*

Reference to the key material or component. It represents material or components with a procurement lead time that is longer than the materials planning horizon.

■ **Resource Summary Record**

IDENTIFICATION

U *Resource Code*

Unique numeric code allocated to this resource.

U *Resource Description*

Description of the resource (e.g., "Fabrication Department").

LOAD DISTRIBUTION

S *Resource Load Profile (M)*

A series of points defining a cumulative load curve. The curve represents the future period-by-period loads to be imposed on this resource, based on the current master production schedules and considering all products.

US *Learning Curve (M)*

A series of values (%) used to adjust the product load distribution of a recently introduced product and to reflect the increased load on the resource during the learning process.

ASSOCIATED RESOURCES

U *Primary Resource Code*

The resource code of the primary resource with which this resource is associated. The loads on the associated resource are derived from those on the primary resource, using the correlation curve below.

U *Correlation Curve (M)*

A series of points defining a correlation curve, showing the relationship between loads on this resource and those of the primary resource designated above.

COST DISTRIBUTION

(Only for "manpower resources")

U — *Number of Workers*

Normal number of workers in this resource.

U — *Normal Hours per Week*

Normal working hours per worker per week (excluding overtime).

U — *Number of Overtime Workers (M)*

Average number of workers available for overtime.

U — *Overtime Hours per Week (M)*

Average weekly overtime hours that each of the above workers can contribute.

US HD — *Percentage Allowance*

Reduction factor applied to the values for Normal Hours and Overtime Hours above. The reduction represents an allowance for nonproductive breaks.

S HD — *Efficiency Factor*

A factor (%) applied to the values for Normal Hours and Overtime Hours above. This factor reflects the efficiency of the resource, that is, the relationship between standard operation times and the times actually achieved.

U — *Weekly Overhead Cost*

An estimate of the overhead costs (excluding labor) incurred by this resource each week.

S HD — *Normal Hourly Rate*

The average hourly pay for the workers who constitute this resource (overtime payments excluded).

S HD — *Overtime Hourly Rate*

The average hourly pay for overtime work by this resource.

S HD — *Subcontracting Hourly Rate*

An estimate of the hourly rate charged by a subcontractor to perform the work of this resource.

U — *Effectivity Date*

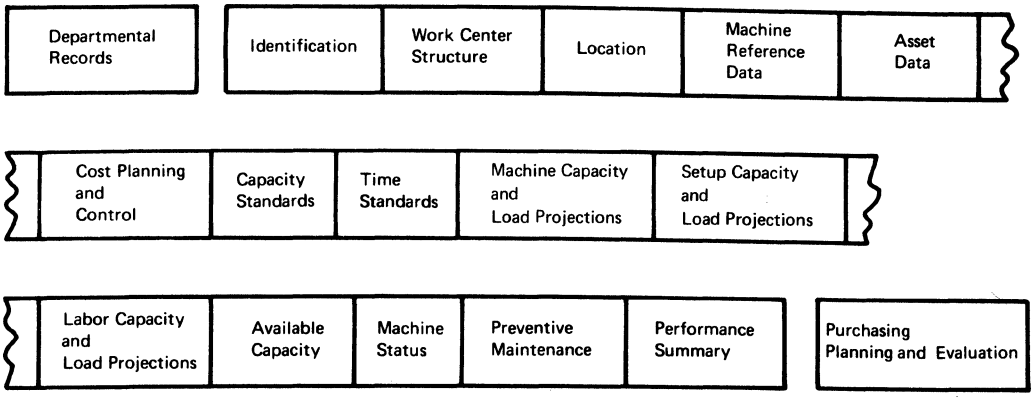
The date from which the "cost curve" information above is effective.

Facilities

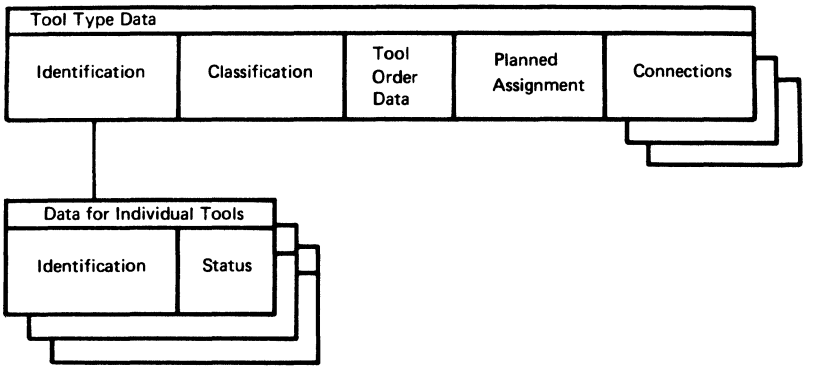
The Facilities file includes four record types, which are listed under the four headings:

- Work Center/Machines
- Tools
- Materials Handling Equipment
- Warehouses

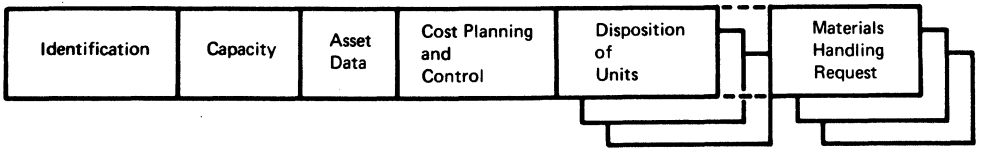
Machine/Work Center Record



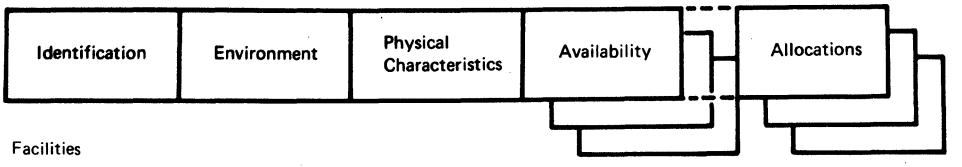
Tool Record



Materials Handling Equipment Record



Warehouse and Stores Record



Facilities

Facilities — Work Center/Machine Record

One Work Center/Machine record is maintained for each unique machine, each specified group of machines, and each specified work center – for example:

Horizontal mill, serial no. 123456, 42 inch bed	-	individual machine
All 42 inch bed horizontal mills	-	group of machines
All horizontal mills	-	work center

For loading purposes, a work center is generally considered to be a group of like machines. A machine with unique characteristics can, by itself, be considered a work center (for example, if a plant has only one 250-ton press).

Some of the fields described in this record apply only to machines, others only to work centers, and others to both machines and work centers. (A record includes all types of data, if the work center has only one machine.)

The connections between a work center and the machines grouped in it are established through a bidirectional linkage, joining the associated Work Center/Machine records. Each Work Center record is further linked to Manufacturing Routing and Shop Order records, and each Machine record to Preventive Maintenance Operation records and Maintenance Order records.

DEPARTMENTAL RECORDS

Workload planning is not limited to the production shops, but can be applied to other departments, such as Purchasing, Materials Handling, Receiving, Inspection, Stores, etc. These departments are considered here as work centers.

The data required for the workload planning in each of these areas is quite similar and will be contained in departmental records. An additional segment will be required for evaluation purposes. An example of such a segment is included for the purchasing department.

IDENTIFICATION

U *Machine/Work Center Number*

Machine number or work center number (associated with a group of machines). A machine with unique characteristics can itself be considered a work center. The work center number may consist of two parts: a department or cost center identification and a machine group identification. However, work center identification is treated as one field. A work center can be a labor work center and represent (for example) an assembly area, or a pool of setup men.

U *Description*

Description of the particular machine (or work center).

U *Resource Code*

Classifies the machines into broader groups with similar functions – vertical mills, horizontal lathes, etc. This code is also used as identification in the Product and Resource Summary file.

U *Record Type*

A code used to identify the type of record:

1 = machine

2 = machine group

3 = work center with a single machine

4 = work center with multiple machines, but no intermediate machine groups

5 = work center composed of machine groups and machines

6 = work center without machines (labor group, setup group, etc.)

WORK CENTER STRUCTURE

U *Work Center Number*

Reference to the work center to which this machine or machine group belongs (used only if Record Type = 1 or 2).

U *Machine Group Number (M)*

The content of this field varies with the Record Type. When Record Type = 1, this field refers to the machine group to which the machine described in this record belongs. When Record Type = 5, it refers to the machine groups belonging to the work center described in this record.

U *Machine Number (M)*

Reference to the machine belonging to this machine group (Record Type = 2) or to this work center (Record Type = 4 or 5).

LOCATION

U *Department Number*

Identification of the department with which this work center/machine is associated could be part of the Work Center Number.

U *Cost Center*

Identification of the department, etc., responsible for costs in this work center. Could be part of the Work Center Number.

U *Location Code*

A code indicating the geographic location of the work center within the plant.

U *Foreman*

Employee number of the foreman responsible for the work center.

U *Input Terminal*

Identification of the terminal normally used for data collection from this work center.

U *Output Terminal*

Identification of the terminal where messages are normally received.

U *Alternate Work Center*

Number of the work center which can be used as an alternative in case of overloads.

U *Supplying Warehouse Number (M)*

Reference to the stock location where orders completed in this work center are usually shipped (used only if multiple stock locations).

MACHINE REFERENCE DATA

(Only in machine records.)

U *Machine Manufacturer*

Identification or name and address of the manufacturer of the particular machine.

U *Machine Supplier*

Identification or name and address of the supplier.

U *Purchase Order Number*

Identification of the purchase order for the machine.

U *Purchase Date*

Date on which this machine was purchased.

U *Machine Catalog Number*

Original catalog or model number of the machine.

U *Supplier's Serial Number*

The original serial number given by the supplier.

U *Engineering Drawing Number (M)*

The number that identifies the drawing for this machine.

US *Engineering Change Number*

The current number of the engineering change for this machine.

U *Dimensions*

Length, width, and height of the machine.

U *Weight*

Weight of the machine.

ASSET DATA

(Only in machine records.)

U *Asset Ledger Number*

A number assigned to every machine to identify it for accounting purposes.

U *Original Value*

Value of the machine when it was acquired.

U *Depreciation Method*

A code used to indicate how to compute the period-by-period depreciation in the value of the machine.

U *Depreciation Period*

The time span during which the depreciation method defined above is valid, if any.

U *Installation Date*

Date at which this machine was installed for the first time within the company. This is also the start of the Depreciation Period.

SU *Capitalized Work Order (M)*

Identification of a work order whose cost has been added to the value of the machine for costing purposes.

U *Short Description*

Work order description having a limited length and using abbreviations if necessary. This field is required since the same data in the Work Order Detail record is not usually retained long enough.

U *Date Completed*

Date this capitalized work order was completed.

SU *Capitalization Cost.*

The cost of the work order defined above.

S SF *Capitalization Status*

A code to indicate whether a work order cost has already been capitalized or is pending capitalization.

S SF *Current Value*

The current book value of this machine; this reflects ordinary and extraordinary depreciation as well as capitalized cost.

COST PLANNING AND CONTROL

U *Labor Grade*

Skill level normally required to operate in this work center. This governs the hourly rate.

U *Machine Hour Rate*

The standard machine cost per hour.

U *Overhead Cost Distribution Basis (M)*

A measure of the physical size of this work center (number of employees, surface area, volume, or value of machines, etc.). Used for the distribution of indirect cost.

CAPACITY STANDARDS

(Only in work center records.)

U *Number of Machines*

Number of machines in the work center.

U *Number of Men Planned*

The number of men planned for this work center.

S HD *Number of Men Actual*

The actual number of men who have been working in this work center.

S HD *Work Center Efficiency*

The ratio of standard hours to actual hours. It reflects historic data and is used to adjust the capacity of the work center.

U *Equipment Availability Standard*

Ratio of downtime hours to running hours. Used to establish maintenance interval on statistically controlled basis.

U *Number of Shifts*

Number of shifts generally worked by this center.

U *Hours per Shift (M)*

Number of hours normally worked by each shift (one field per shift).

TIME STANDARDS

(Only in work center records.)

U *Downtime Standard*

Allowable number of times per year that the machine can go down without serious consequences at other work centers.

U

Preparation Time

Time for which work is delayed before processing (the delay is caused by some preparatory operation not in the routing, such as marking out). Expressed as a percentage of the operation duration (setup plus run).

U

Planned Queue Time

Standard time interval during which a shop order awaits processing of an operation in the work center.

S HD

Historical Queue Time

Time interval during which a shop order awaits processing of an operation in the work center; summarized from actual values.

SU HD

Postoperation Time

The interval, after completion of an operation, during which the parts are delayed. Expressed as a percentage of setup plus run time. Possible causes of delay include inspection and cooling.

SU HD

Wait Time

Average time interval during which completed parts await transportation. Can be a standard for all work centers.

U

Substitute Setup Time

Substitute time to be used if no setup is recorded for the operation in the standard routing.

U

Substitute Operation Time

Substitute time to be used if no run time is recorded for the operation in the standard routing.

U

Prime Load Code

The type of load hours considered of "prime" importance for this work center:

0 = no load hours accumulated

1 = run machine-hours

2 = setup hours

3 = setup hours plus run machine-hours

4 = run labor hours

5 = setup hours plus run labor hours

U *Secondary Load Code*

The type of load hours considered of "secondary" importance. The possible codes are as above.

U *Load Leveling Code*

Indicates whether load leveling is considered necessary for this work center.

0 = no leveling (loading to infinite capacity)

1 = load to be leveled

MACHINE CAPACITY AND LOAD PROJECTIONS

(Only in work center records.)

U *Normal Daily Machine Capacity (M)*

Normal number of machine-hours to be worked by this center each day. This can vary across the planning horizon. The information consists of a quantity (total daily hours) and an effectivity date. (The next field has a similar format.)

U *Maximum Daily Machine Capacity (M)*

Maximum number of machine-hours that can be worked by this center each day. This can vary across the planning horizon.

S *Machine Work Load (M)*

Accumulated machine load per period. Loads are determined by period (across the planning horizon) by MANUFACTURING ACTIVITY PLANNING , and are constantly updated.

SETUP CAPACITY AND LOAD PROJECTIONS

(Only in work center records.)

U *Normal Daily Setup Capacity (M)*

Normal number of setup hours to be worked by this center each day. This can vary across the planning horizon. The information consists of the total daily hours and an effectivity date. (The next field has a similar format.)

U *Maximum Daily Setup Capacity (M)*

Maximum number of setup hours that can be worked by this center each day. This can vary across the planning horizon.

S *Setup Work Load*

Accumulated setup load per period. Loads are determined by period (across the planning horizon) by MANUFACTURING ACTIVITY PLANNING.

LABOR CAPACITY AND LOAD PROJECTIONS

U *Normal Daily Labor Capacity (M)*

Normal number of labor hours to be worked by this center each day. This can vary across the planning horizon. The information consists of the total daily hours and an effectivity date. (The next field has a similar format.)

U *Maximum Daily Labor Capacity*

Maximum number of labor hours that can be worked by this center each day. This can vary across the planning horizon.

S *Overtime Start Date (M)*

Date at which a requirement for overtime begins.

S *Overtime End Date (M)*

Date at which the requirement ends.

S *Planned Overtime Hours (M)*

The number of overtime hours planned for each day during the time span defined above.

U *Authorized Overtime Hours (M)*

The number of currently authorized overtime hours for each day during the time span defined above.

S *Labor Work Load*

Accumulated labor load per period. Loads are determined by period (across the planning horizon) by MANUFACTURING ACTIVITY PLANNING.

AVAILABLE CAPACITY

(Only in work center records.)

SU SF *Available Machine Capacity Today*

Total number of machine-hours actually available to be worked today.

SU SF *Available Setup Capacity Today*

Total number of setup hours actually available to be worked today.

SU SF *Available Labor Capacity Today*

Total number of labor hours actually available to be worked today.

MACHINE STATUS

(Only in machine records.)

S *Current Workload in Queue*

Current total workload (in hours) represented by the queue at the work center (includes the jobs already being processed).

U SF *Current Machine Status*

Indicates current activity on this machine:

0 = inactive (for example, when machine is not yet installed)

1 = idle

2 = in operation (for details see "Current Order Status")

3 = broken down (repair not yet started)

4 = in repair

5 = preventive maintenance

8 = used only as backup machine

9 = unusable (awaiting deletion)

S *Current Order Number*

Number of the order currently being worked on at this machine or in this work center.

S SF *Current Order Status*

Indicates current status of the order described above:

3 = setup started

4 = setup completed

5 = run started

6 = interrupted

7 = completed, teardown started

SU *Man or Team Assigned (M)*

Employee or team number currently assigned to this machine.

PREVENTIVE MAINTENANCE (M)

(Only in machine records, one segment per PM operation.)

U — *Preventive Maintenance Operation Number*

Identification of the preventive maintenance operation. Used also as a reference to the corresponding standard PM operation record.

S — *Last Preventive Maintenance Performed*

Date that the above operation was most recently performed on this machine.

SU — *Employee Performing Last Inspection*

Identification of the employee who performed the maintenance operation.

U — *Employee Performing Next Inspection*

Identification of the employee assigned to the next planned inspection.

SU — *Preventive Maintenance Date*

Planned date of next preventive maintenance for this machine.

S — *Preventive Maintenance Downtime*

Time during which the machine will be unavailable because of maintenance work.

S — *Order Released Code*

Specifies whether an order for this PM function exists in the Maintenance Work Order file.

PERFORMANCE SUMMARY

S HD — *Item Family Manufactured (M)*

A code associated with a group of items manufactured in the work center (see "Item Family" under "Product Definition"); used for measuring machine performance.

S HD — *Item Family Quantity Completed (M)*

Fields summarizing the total quantity of this product group completed. Includes reworked items.

S HD *Item Family Rework Quantity (M)*

Fields summarizing the total quantity of this product group which needed rework.

S HD *Item Family Quantity Scrapped (M)*

The total quantity of this product group, based on previous observations, which has been scrapped.

S HD *Direct Standard Hours*

The total number of standard hours, based on previous plans, directly attributed to the production of items.

S HD *Direct Actual Hours*

The total number of actual hours, based on previous reports, directly attributed to the production of items.

S *Indirect Labor Code (M)*

Code used to classify the indirect labor hours (for rework, cleanup, waiting, etc.) recorded in the fields which follow.

S HD *Indirect Actual Hours (M)*

Field summarizing the total number of actual hours attributed to this indirect labor code.

S HD *Standard Allowance Indirect Hours (M)*

A standard ratio between direct and indirect labor hours allowed for this indirect labor code.

PURCHASING PLANNING AND EVALUATION

(Only for the purchase department record. Some of the fields below can be detailed by buyer group.)

S *Work Forecast*

The total number of items to be bought by period.

SU *Purchase Orders Planned*

The number of purchase orders to be placed by period; based on the Work Forecast.

S *Volume of System Orders*

The number of purchase orders placed automatically by the system, by period.

S *Purchase Orders Actual*

The number of purchase orders placed by period.

S HD *Actual Purchase Cost*

The actual cost of purchases.

SU HD *Standard Purchase Cost*

The base standard cost of actual purchases.

S HD *Purchasing Quality Index*

Fields summarizing the supplier quality indices.

S HD *Purchasing Delivery Index*

Fields summarizing the supplier delivery indices.

Facilities — Tool Record

A Tool record is one of the four record types within the Facilities Master file.

As described in *Chapter 8, Plant Monitoring and Control*, consumable tools can be treated as if they were components in the product structures, and should therefore be represented in the Product Definition file. At the other extreme, large tools that can cause bottlenecks in production (because only one or two units are available) can be considered for planning purposes as machines and should be represented by the first type of Facility record (Work Centers and Machines).

For each remaining tool type used in the manufacturing and maintenance process, a tool record is maintained. There may be several units of the same tool type, each identified by a unique serial number.

Usually each Tool record is linked to the record of the Manufacturing Routing in which the tool is required.

■ Tool Type Data

IDENTIFICATION

U *Tool Number*

A unique number to identify the type of tool (or tool set).

US *Tool Drawing Number*

Drawing identification number and/or pointer to the Engineering Drawing record. (Only for tools produced or renovated within the plant.)

U *Tool Description*

A name or series of descriptive codes that further identify the tool type.

U *Number of Tools*

The number of tools (or tool sets) of the type defined above.

U *Estimated Tool Life*

Interval after which the tool normally needs maintenance. Stated in the same terms as Accumulated Usage (see below).

CLASSIFICATION

U *Tool Classification*

A general classification code for tool types with similar functions.

U *Inspection Code*

Specifies the inspection procedure for this tool type (for example, after each use).

U *Maintenance Code*

If maintenance is performed, this code indicates the procedure to be followed (for example, after each use, or after so many hours).

U *Usage Code*

A code specifying the units in which tool usage is measured, for example, hours of use, hours of actual cutting time, number of pieces worked.

TOOL ORDER DATA

Tool Order Data is maintained in segments similar to those described in the Product Definition record, under the headings "Order Quantity Rules" (which is under "Item Data"), "Purchasing Data", and "Shop Order Summary Data". The choice of fields within these segments depends on the complexity of the tool procurement procedure.

PLANNED ASSIGNMENT

Each Planned Assignment segment represents the assignment of a tool of the given type to a particular job. In cases where an individual tool is assigned, a similar segment is included under the corresponding serial number. Planned assignments are duplicates of those in the Shop Order file.

S *Work Center*

Number of the work center to which a tool of this type is assigned.

SU *Order Number*

The number of the order to which the tool is assigned.

S *Requirement Dates*

The dates (from, to) when the tool is required for use on the order identified above.

CONNECTIONS

US *Alternate Tool (M)*

Reference to a similar tool type that could be used as a substitute.

US *Where-Used Manufacturing Routing (M)*

Reference to a manufacturing routing on which this tool type is used.

US *Where-Used Work Center (M)*

Reference to the work center in which this tool type is normally used.

US *Preventive Maintenance Operation (M)*

Reference to the next maintenance work order.

- **Data for Individual Tools**

IDENTIFICATION

U *Serial Number*

Where there are several units of the same tool type, this suffix identifies an individual unit.

U *Stores Location*

Identification of the location where this tool is normally stored.

S SF *Current Location*

Identifies the current location of the tool (if not in store). Can be a work center and machine number (if the tool is in use) or a code indicating where a repair or maintenance is being performed.

STATUS

SU SF *Tool Status*

A code denoting the current status of the tool – for example:

0 = inactive

1 = in the tool store (ready for use)

2 = in use

3 = broken down (repair not yet started)

4 = out for repair

5 = preventive maintenance or reshaping

6 = used only as backup tool

S HD *Accumulated Usage*

A total that reflects the usage of this tool to date. It is expressed in hours, pieces, etc., according to the usage code.

SU SF *Remaining Tool Life*

The expected remaining life before this tool wears out. Expressed in hours, pieces, etc., according to the Usage Code. Since this figure can be adjusted after inspections, it is not necessarily the difference between Estimated Tool Life and Accumulated Usage.

S *Date Last Inspection*

The shop date on which this tool was last inspected.

Facilities – Materials Handling Equipment Record

The Materials Handling Equipment record is the third record type within the Facilities Master file.

One record is maintained for each facility controlled by the Materials Handling Dispatch Center (see *Chapter 8, Plant Monitoring and Control*). Data for other transport facilities permanently assigned to a work center (e.g., cranes or fork lift trucks) can be maintained in Work Center/Machine or in Tool records.

One transport facility can comprise several units, identified by individual serial numbers.

IDENTIFICATION

U *Transport Facility Number*

A unique number identifying a transport facility.

U *Facility Description*

A name or series of descriptive codes to further identify the facility.

U *Transport Type*

Code classifying transport facilities into broader groups with similar functions, e.g., fork lift trucks, medium trucks, heavy trucks, etc.

CAPACITY

U *Number of Units*

The number of units of the facility identified by the Transport Facility Number.

U *Transport Capacity*

The maximum load (weight, volume, quantity, etc.) that can be transported by each unit of this facility.

U *Capacity Units of Measure*

A code defining the unit of measure of the above capacity.

ASSET DATA

This segment contains the same fields described in the Asset Data Segment of the Machine record.

COST PLANNING AND CONTROL

U *Material Handling Hourly Rate*

The standard handling cost per hour

DISPOSITION OF UNITS (M)

(One segment per transport unit.)

U *Serial Number*

A suffix which identifies each transport unit specifically.

U *Cost Center*

Identification of the cost center to which costs are allocated.

S SF *Availability Status*

A code indicating the current availability of this particular transport unit:

1 = available

2 = assigned to a move request

3 = in repair

4 = used only as reserve

S *Current Assignment*

The number of the move request to which the unit is currently assigned.

U SF *Current Location*

Identification of the last reported location of this unit.

US *Assigned Employee*

Number of the employee currently assigned to use this unit.

MATERIALS HANDLING REQUEST (M)

(One segment per move request.)

S *Move Request Number*

A number assigned by the system to each outstanding request for transportation received by the Materials Handling Dispatch Center.

SU *Origin*

Number of the work center and/or the employee who made the request for transportation.

US *Destination*

Identification of the location to which the material has to be moved.

Facilities — Warehouse and Stores Record

The warehouse data is stored in one record for each class of storage facility (store, shelf, rack, bin, etc.).

The records contain information on the facility's characteristics and environment, as well as on the hierarchical physical relationship between storage classes (for example, which bin is within which warehouse).

Connections are maintained between the Inventory Data (Product Definition records) and the Warehouse record to indicate in which locations items are stored.

IDENTIFICATION

U *Storage Identification*

Unique identification of the storage facility (warehouse, shelf, rack, vat, bin, etc.).

U *Storage Location*

A code indicating the physical location of the store within the plant. This could be part of the Storage Identification for immovable storage.

U *Storage Class*

Code classifying the storage facility – for example:

1 = warehouse

2 = shelf

3 = rack

4 = vat

5 = bin

U *Storage Description*

Description of the storage facility, using abbreviations if necessary.

ENVIRONMENT

(Only in warehouse records.)

U *Physical Environment*

Code showing any special conditions obtaining in this warehouse – air-conditioned, dust-free, under lock, etc.

U *Usage Restrictions*

Indicates whether this facility is to be used only for particular purposes:

1 = imported items without customs clearance

2 = storage area assigned to a particular customer – say, for government contracts

U *Shifts Manned*

Shifts during which items can be taken in or out of this warehouse.

U *Foreman*

Employee number of the stores foreman.

PHYSICAL CHARACTERISTICS

U *Storage Dimensions*

Length, width, and height of this storage.

U *Storage Volume*

Practical, usable space in this facility. This is not necessarily computed from the Storage Dimensions.

U *Maximum Dimensions of Contents*

Maximum length, width, and height of items that can be stored in this facility. These can be smaller than the Storage Dimensions, because of partitions, doors, accesses, etc.

U *Maximum Weight*

Weight limit for the items to be stored.

U *Access Method*

Indicates how items stored in this facility can be accessed (whether a ladder is required, etc.).

U *Item Restriction (M)*

Identification of the item or item family (as defined in the Product Definition record) to which the use of this storage facility is restricted – for example, potassium cyanide used for heat treatment, or acid solutions used in plating processes.

AVAILABILITY (M)

(One segment per facility type.)

U *Facility Type*

A code indicating the type of bin, and used for matching characteristics of items and bins.

U *Number of Facilities*

Number of individual bins (or vats, shelves, etc.) of this type.

S *Number of Vacant Facilities*

Number of unoccupied bins (or vats, shelves, etc.) of this type.

ALLOCATIONS (M)

(One segment per individual facility.)

U *Detail Location*

Code (say, a grid reference) indicating the physical location of a single bin (or vat, shelf, etc.).

U *Bin Serial Number*

Serial number identifying a single bin or vat. This could be the Detail Location or part of it.

SU *Item Number (M)*

Identification of the item stored in the bin (or vat, shelf, etc.). Note that the storage location of the items is cross-referenced in the Inventory Data within the Product Definition record.

SU *Item Serial Number (M)*

The Serial Numbers (from, to) of the item specified above.

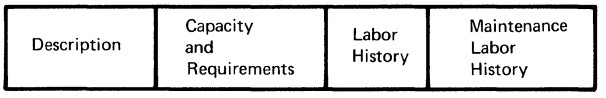
S *Date of Last Movement*

Date of last receipt or issue from this bin (or vat, shelf, etc.).

Skill Data

The Skill Data file consists of one record for each class of technical knowledge or expertise identified by a skill code.

Each record is linked to the records of the employees having this skill.



Skill Data

DESCRIPTION

U *Skill Code*

Numeric identification used to classify the technical knowledge or expertise of the employees.

U *Skill Description*

Descriptive outline of the skill.

CAPACITY AND REQUIREMENTS

U *Normal Weekly Capacity*

Normal available man-hours per week of this skill.

U *Allowed Capacity Extension (M)*

Number of man-hours by which the normal capacity per period can be extended. This can be accomplished by overtime, by shifting employees who have several skills, or by temporary hiring.

S *Released Hours (M)*

Summarized number of man-hours per week required to work on released orders.

SU *Overtime Hours (M)*

The overtime hours included in the total hours summarized above.

U *Standard Response Time*

A standard value indicating the time between the request for a work order requiring this skill and the beginning of the work.

LABOR HISTORY

S HD *Labor Training History*

Fields summarizing the hours per man spent on training.

S HD *Direct Work History*

Fields summarizing the hours per man required for direct work.

S HD *Indirect Work History*

Fields summarizing the hours per man spent on indirect work.

MAINTENANCE LABOR HISTORY

(Only for skills of Plant Maintenance.)

S HD *Response Time History*

Fields summarizing actual response times.

S HD *Preventive Maintenance History*

Fields summarizing the hours per man spent on planned preventive maintenance.

S HD *Scheduled Maintenance History*

Fields summarizing the hours per man spent on scheduled maintenance other than preventive maintenance.

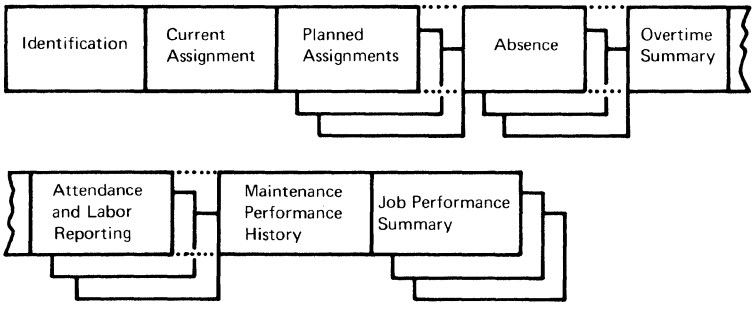
S HD *Standby History*

Fields summarizing the hours of standby per man.

Employee Data

The Employee file contains one record for each employee. Only the fields required by COPICS have been included here.

Each record can be linked to the associated records in the Skill file and to the record for the Work Center to which the employee is assigned.



Employee Data

IDENTIFICATION

U *Employee Number*

Unique number identifying the employee.

U *Name*

Name of this employee (stored as it should appear in displays and reports).

U *Qualifications*

Academic or professional qualifications of the employee.

U *Sex*

Code to indicate male or female.

U *Skill Code (M)*

Code used to define the level of skill (labor grade) of this employee. The same code is used as identification in the Skill Master file. If several codes are present, the first is considered to be the normal code.

CURRENT ASSIGNMENT

U *Normal Department Number*

Identification of the department where the employee normally works.

U *Assigned Work Center*

Identification of the work center where the employee is currently working.

U *Assignment Code*

Indicates whether the assignment is to extend beyond the current date.

U *Team Number*

Identification of the team of which this employee is a member.

U *Shift*

The identification of the shift the employee is currently working.

U *Normal Start Time*

Time at which the employee normally starts to work. Needed for staggered working.

U *Normal Stop Time*

Time at which the employee normally stops work. Needed for staggered working hours.

U *Authorized Overtime Dates (M)*

Time span for which overtime has been authorized (dates "from" and "to").

U *Authorized Overtime Hours (M)*

Amount of overtime authorized for each day of the time span above.

PLANNED ASSIGNMENTS (M)

SU *Planned Assignment Start*

Planned start time and date of future assignment.

SU *Planned Assignment End*

Planned completion time and date of the assignment.

SU *Planned Assignment Order Number*

Order number associated with the planned assignment.

SU *Planned Assignment Operation Number*

Operation number associated with the planned assignment.

ABSENCE (M)

U *Absence Reason*

Code indicating the reason for the absence – for example:

1 = vacation

2 = illness

3 = union business

4 = visit to hospital

U SF *Absence Authorization*

Number of employee who authorized the planned absence.

U *Absence Time*

Time span of the planned or expected absence (dates or time "from" and "to").

OVERTIME SUMMARY

S HD *Overtime Accepted*

A weighted average of the overtime hours this employee agreed to work.

S HD *Overtime Rejected*

A weighted average of the overtime hours this employee refused to work.

ATTENDANCE AND LABOR REPORTING (M)

(One segment per activity.)

U *Activity Code*

Code designating the activity reported by this transaction:

1 = arrival at work

2 = departure from work

3 = setup

4 = run

5 = interruption (not required for end-of-shift interruption)

6 = resumption (not required if restart at start of shift)

7 = teardown

8 = inspection

The transactions reporting the start and the end of setup, run, teardown, or inspection are combined into one segment.

U *Activity Start*

Time at which the start of this activity was reported.

U *Activity End*

Time at which the completion of this activity was reported. Required only for setup, run, teardown, and inspection.

U *Shop Order Number*

The number of the shop or work order or a charge code associated with this activity. Blank for attendance reporting.

U *Operation Number*

The operation number (within the shop or work order) associated with this activity. Blank for attendance reporting.

U *Interruption Code*

A code associated with an interruption (or resumption) due to reasons other than normal shift start and end.

MAINTENANCE PERFORMANCE HISTORY

(Only for maintenance workers.)

S HD *Attributable Breakdowns*

The number of times a machine broke down after preventive maintenance done by this maintenance worker.

S HD *Total Preventive Maintenance Work Orders*

The total number of preventive maintenance work orders over the same time span as above.

JOB PERFORMANCE SUMMARY (M)

This segment summarizes the performance of employees working on standard shop orders.

S HD *Item Family Manufactured*

A code associated with a group of items manufactured in the work center (see "Item Family" under "Product Definition") used for measuring machine performance.

S HD *Item Family Quantity Completed*

Fields summarizing the total quantity of this product group completed. Includes reworked items.

S HD *Item Family Rework Quantity*

Fields summarizing the total quantity of this product group which needed rework.

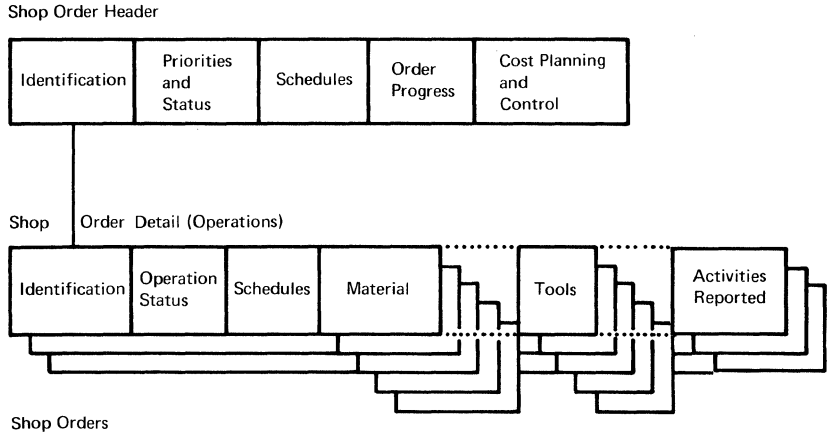
S HD *Item Family Quantity Scrapped*

The total quantity of this product group, based on experience, which has been scrapped.

Shop Orders

The Shop Orders file consists of one record for each individual manufacturing order for an item. Planned and released orders respectively are identified by the Status Code field. Each record has a general segment (Shop Order Header) and a variable number of detail segments (Shop Order Detail), one for each operation.

The Shop Order record is created by MANUFACTURING ACTIVITY PLANNING. It is linked to the Product Definition record (Shop Order Summary Data) for the item.



■ Shop Order Header

IDENTIFICATION

US *Order Number*

A number assigned by Production Control or by the system to a given shop order. (Each order may combine requirements generated by several higher-level orders.)

S *Split Order Number*

Number of the split order after the original order has been divided into two or more smaller quantities. Can be a suffix to the Order Number above.

S *Item Number*

The number of the item concerned.

S *Network Number*

A number assigned by the system to a group of related shop orders required in the production of an end item.

S *Engineering Change Level*

A suffix to the item number representing the version of the item to be produced.

SU *Drawing Level*

A suffix to the drawing number representing the version of the drawing to be used for this order. Required only if this does not coincide with the Engineering Change Level.

SU *Routing Level*

A suffix to the routing number representing the version of the standard routing to be used for this order. Required only if this does not coincide with the Engineering Change Level.

U *Order Description (M)*

Descriptive information about this order. If this field is omitted, the item description is used as an alternative.

SU *Original Order Quantity*

The production quantity originally released.

SU *Number of Operations*

The total number of operations to be performed in producing the order.

S *Ship to Location*

Identification of the location where the allocated quantity has to be moved after completion of this order. Used only if the allocated items are not sent to stores (e.g., when required immediately in the production of a higher-level assembly or for shipment to a customer).

PRIORITIES AND STATUS

U *External Priority*

A value, provided by management, which reflects the importance of the order (e.g., because of a penalty clause an order is given a high priority). Used to calculate the Order Priority.

S *Network Priority*

Priority value associated with the network containing this order. It is used in ORDER RELEASE PLANNING to determine the sequence in which networks should be loaded.

S *Order Priority*

A value calculated by the system and used to rank this order relative to all others. Among the major factors affecting the Order Priority are:

Number of days delay beyond due date.

Slack between earliest and latest start date.

External Priority.

US SF *Status Code*

A code denoting the current status – for example:

1 = planned

2 = firm

3 = released

4 = held up for engineering change

5 = canceled

S *Expedited Order Flag*

Indicates that this order has been expedited. Used to avoid averaging in the calculation of lead time deviation.

SCHEDULES

S *Planned Order Release Date*

Date on which the order should be released; determined by MANUFACTURING ACTIVITY PLANNING.

S *Earliest Start Date*

Earliest Start Date established by CAPACITY REQUIREMENTS PLANNING.

S *Latest Start Date*

Latest Start Date (established by CAPACITY REQUIREMENTS PLANNING) consistent with meeting the Due Date.

S *Slack/Delay for Shop Order*

A positive value represents the order "slack" (difference between the Earliest and Latest Start Dates for this order); a negative value represents "delay" (difference between expected Completion Date and original Due Date).

S *Slack/Delay for Network*

Difference between the Earliest Finish Date and the required finish date (due date) for the end item. If the former precedes the latter, the difference represents "slack" (positive); otherwise it represents "delay" (negative).

S *Interoperation Time Reduction Factor*

Factor that was used to reduce the Interoperation Times when the order was rescheduled.

S *Number of Days Delayed/Advanced*

Adjustment to Latest Start Date, determined by ORDER RELEASE PLANNING; necessary for "load-leveling".

S *Scheduled Start Date*

The date this order was originally scheduled for release to the shop.

S *Scheduled Due Date*

The date on which the order was scheduled to be completed.

US *Actual Start Date*

The date the order was actually started, as determined by feedback.

US *Actual Completion Date*

The shop date on which the order was reported complete.

ORDER PROGRESS

US *Current Operation Number*

The number of the operation currently being performed.

US *Current Work Center*

The number of the work center where the work is currently being performed.

US *Quantity Completed Previous Operation*

The quantity reported complete for the current operation.

US *Current Operation Quantity Completed*

The quantity reported complete for the current operation.

US *Scrap Reported*

The quantity of scrap recorded over all operations to date.

SU *Send-Ahead Quantity*

The quantity which has been "split" from the original order, and sent ahead for earlier completion.

SU *Held Back Quantity*

The number of pieces on which work is suspended, pending a change in design, further inspection, etc.

U *Held Back Reason*

Code indicating the reason for holding back the above quantity.

U *Rework Quantity*

The number of defective items requiring rework (salvage).

S *Operations Remaining*

The number of operations remaining to complete the order.

SU *Hours Required*

The number of hours' work remaining to complete the order.

COST PLANNING AND CONTROL

S *Standard Material Cost to Date*

The accumulation of the standard costs for the material used in the order (sum of the standard material cost for completed operations).

SU *Actual Material Cost to Date*

The actual material costs that were reported for the completed operations.

S *Standard Labor Cost to Date*

The sum of the standard labor costs of completed operations.

SU *Actual Labor Cost to Date*

The actual labor costs that were reported for the completed operations.

S *Standard Machine Hours to Date*

The sum of standard machine hours for all completed operations.

SU *Actual Machine Hours to Date*

The actual machine hours reported for all completed operations.

S *Standard Labor Hours to Date*

The sum of the standard labor hours for completed operations.

SU *Actual Labor Hours to Date*

The actual labor hours reported for completed operations.

S *Special Engineering Cost*

The actual cost incurred so far for special engineering on this order.

S *Special Tooling Cost*

The actual cost incurred so far to make special tools required for this order.

S *Special Transportation Cost*

The actual cost incurred so far for nonstandard transport necessary for this order.

S *Special Testing Cost*

The actual cost incurred so far for special testing necessitated by standard order specifications.

■ **Shop Order Detail** (Operations)

IDENTIFICATION

US *Operation Number*

The number assigned to this operation. (Does not necessarily reflect the manufacturing sequence.)

US *Sequence Number*

A number indicating the position of this operation in the routing for this order.

US *Operation Description*

A short description of the operation (the full description is stored in the Routing file).

US *Work Center*

The machine or labor group which performs the work.

S *Machine or Work Group*

The subgroup within a work center on which this operation must be run, e.g., because of labor skill or tolerance limits. It can refer to two or more machines within a work center.

US *Machine Number*

The number of a specific machine in the work center on which this operation must be run or is running. (If any machine can perform the work, this is blank until the actual assignment is made.)

S *Succeeding Operation Number*

Reference to the next operation to be performed.

OPERATION STATUS

S *Operation Priority*

A computed value which helps to determine the sequence of operations at a work center. A major factor in the Operation Priority is the Order Priority.

S *Critical Path Code*

A code to identify those operations which lie on the "critical path" for a network of orders. Such operations have no "slack".

S *Routing Reference Code*

Used for references to the standard Routing:

1 = prime operation

2 = alternate operation

3 = added operation

4 = deleted operation

S SF *Status Code*

Indicates current status of this operation:

0 = inactive (not yet scheduled by the Operation Sequencer)

1 = scheduled

2 = dispatched (allocated to an operator)

3 = setup started

4 = setup completed

5 = run started

6 = interrupted

7 = completed, awaiting transportation

8 = moved

US *Man Number (M)*

Identification of the employee or team assigned to this operation.

SCHEDULES

S *Earliest Start Date*

The earliest possible start date (three fields) determined by the subsystems of MANUFACTURING ACTIVITY PLANNING:

- CAPACITY REQUIREMENTS PLANNING
- ORDER RELEASE PLANNING
- OPERATION SEQUENCING

The dates are kept for later comparison.

S *Latest Start Date*

The latest acceptable start date (three fields) determined by the three subsystems of MANUFACTURING ACTIVITY PLANNING.

SU *Critical Life*

The maximum acceptable time interval between the completion of the previous operation and the start of this operation (e.g., for surface treatment to prevent oxidation).

SU *Position in Routing*

Used to define the relative position of this operation within the routing:

1 = first operation

2 = intermediate operation

3 = last operation

US *Scheduling Counter*

A counter that is incremented every time the schedule is changed (either manually or by the system).

S *Operation Delayed Counter*

Number of times this operation was scheduled for "today", but not performed.

MATERIAL (M)

SU *Required Component or Material*

The item number of any component or necessary material (e.g., cleaning fluid) introduced at this point of the routing.

SU *Required Component or Material Quantity*

The quantity associated with the above item.

SU *Stock Location*

The number of the stores location issuing this material.

Requisition Status:

A code to indicate the progress of the above requisition:

1 = requested (in a "picking queue" at the warehouse)

2 = delivered

3 = component not available but production can continue

4 = short components or material (suspend production)

S *Arrival Time*

The time at which the component or material arrived at the work center (and entered the queue).

S *Interim Location*

Code to identify a temporary location if the requested component or material was not delivered at the work station (e.g., if no space was available).

TOOL (M)

S *Requested Tool Number*

Tool number and serial number identifying the tool required for this operation.

S SF *Tool Availability Code*

Used to indicate the current availability status of this tool:

0 = field not yet used

1 = tool not available because of delay on another operation

2 = available, not yet requested

3 = available, requested

4 = at work center

5 = returned

ACTIVITIES REPORTED

US *Queue Start Time*

Time at which the items were reported to have arrived at the work center. (For a "gateway" operation, where the necessary components may arrive at different times, this represents the arrival of the last component).

US *Operation Start Time*

The time at which either setup or run start was reported.

SU *Start Time Code*

Identifies if the above time represents start of setup or start of run.

US *Partial Completion (Time Reported) (M)*

The time at which a partial completion of the operation was reported.

US *Partial Completion Quantity (M)*

The quantity (or the % of the operation hours) completed at the time reported above.

US *Interruption (Time Reported)*

The time at which this operation was interrupted (not required for end-of-shift interruption). Only the most recent interruption is retained. Setup time, run time, or teardown time is automatically accumulated in case of an interruption.

US *Resumption (Time Reported)*

The time at which this operation was restarted (not required if restart at start of shift).

US *Interruption Code*

A code associated with an interruption (or resumption) due to reasons other than normal shift start and end:

1 = operator absence (illness, etc.)

2 = machine breakdown

3 = tool failure

4 = excessive scrap

5 = missing components

6 = resumption of work at other than normal shift start (early or late)

7 = interruption of work at other than normal shift end (early or late)

US *Operation Completion (Time Reported)*

The time this operation was completed.

US *Teardown Completion (Time Reported)*

The time at which the completion of teardown, (e.g., the dismantling of a fixture) was reported.

US *Inspection Completion (Time Reported)*

The time at which the completion of inspection was reported (not used if inspection is represented as an operation in the routing).

S *Accumulated Setup Time*

Total time reported so far for setup of this operation (see also "Interruption – Time Reported").

S *Accumulated Run Time*

Total run time reported so far for this operation (see also "Interruption – Time Reported").

S *Accumulated Teardown Time*

Total time reported so far for teardown of this operation (see also "Interruption – Time Reported").

US *Quantity Completed*

The quantity completed (for this operation).

US *Quantity Scrapped*

The quantity scrapped (for this operation).

US *Rework Quantity*

The number of items needing rework.

US *Inspection Number*

Number of employee who has made the inspection (unless inspection is an operation in the routing).

US *Actual Labor Cost*

The computed total labor cost for all activities reported for this operation (including setup, teardown, etc.).

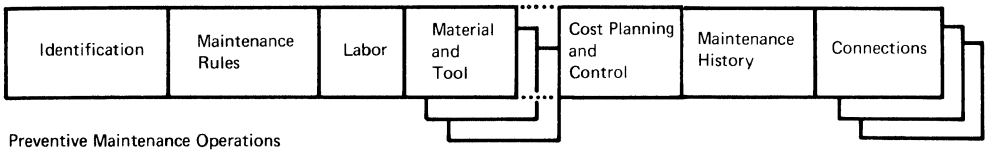
US *Actual Material Cost*

The computed total material cost for components added or raw material used during this operation.

Preventive Maintenance Operations

The master data for preventive maintenance is stored in this file. Each record represents one standard operation and is comparable to an operation segment in the Manufacturing Routing file.

These records are created by the preventive maintenance system, using the facilities described in *Chapter 1, Engineering and Production Data Control.*



Preventive Maintenance Operations

IDENTIFICATION

U *PM Operation Number*

Identifying number assigned to each unique standard preventive maintenance operation.

U *Short Description*

A short description of the operation to be performed.

U *Long Description (M)*

Operation description with more wording. Normally the long description will fill several lines in output format and will, therefore, be stored as a variable number of fields each of which is the same length as the short description.

U *Maintenance Instructions (M)*

Reference to additional instructions for this operation, e.g., volume and page number of the preventive maintenance handbook.

U *Maintenance Classification*

Code used to group similar maintenance operations, such as replacing seals on pumps, etc.

MAINTENANCE RULES

U *Priority Code*

A management-provided value reflecting the importance of the preventive maintenance operation (for example, replacing a cutting tool on an automatic machine is more important than replacing a filter in an air conditioning unit). It has the same effect on the calculation of PM priorities as the External Priority for shop orders.

U *Interruption Code*

Specifies whether the equipment can be used for normal production during the maintenance.

US *Standard Maintenance Interval*

Standard time interval between two successive maintenance operations.

U *Interval Unit of Measure*

Code indicating the time unit of the Standard Maintenance Interval:

1 = shop calendar days

2 = weeks

3 = months

4 = years

U *Associated PM Operation Number (M)*

Identifying number of an associated maintenance operation that must be done during the same maintenance cycle.

LABOR

U *Skill Required*

Indicates the skill needed to perform this operation.

U *Number of Men Required*

Number of men (each with the skill defined above) needed to perform this operation.

US *Standard Labor Hours*

The established standard for the direct labor hours to perform this operation.

MATERIAL AND TOOL (M)

U *Required Material Number*

Reference to the material (typically, spare parts for replacements) required for this operation.

U *Required Material Quantity*

The quantity of the material defined above.

U *Required Tool Number*

Reference to the tool required for this operation.

COST PLANNING AND CONTROL

U *Standard Labor Cost*

The established standard cost of the direct labor to perform this operation.

S HD *Actual Labor Cost*

The labor cost of this operation (based on experience).

U *Standard Material Cost*

The established standard cost for the material used for this preventive maintenance operation.

S HD *Actual Material Cost*

Fields summarizing the material cost for previous operations.

MAINTENANCE HISTORY

S HD *Maintenance Interval*

Fields summarizing previously established Standard Maintenance Intervals.

U *Interval Increment Code*

Indicates how much the system can increase the maintenance interval automatically if no failure occurs.

S HD *Times PM Performed*

Number of times this operation was performed since the last change of the maintenance interval.

S HD *Actual Labor Hours*

The direct labor hours, based on previous observations, to perform this operation.

S HD *Failures Attributed*

Number of equipment failures caused by PM not being performed in time.

S HD *Mean Time to Failure*

The elapsed time, based on experience, between a PM operation and a failure.

CONNECTIONS (M)

US *Machine Number*

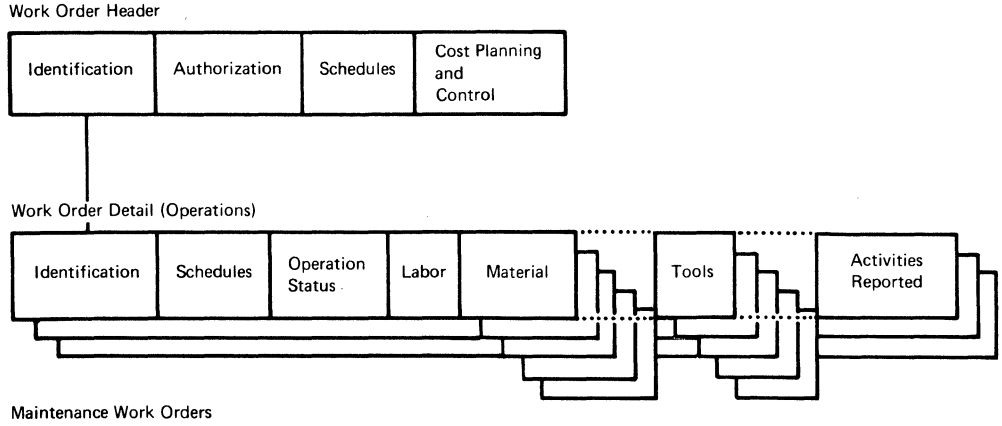
Reference to the machine on which this PM operation has to be performed.

Maintenance Work Orders

The Maintenance Work Orders file consists of one record for each work order (preventive maintenance, repair, installation, engineering change of facilities, etc.).

Each record consists of general data (Work Order Header) and a variable number of detail segments (Work Order Detail) for each operation.

The Work Order record is created by PLANT MAINTENANCE and is linked to the record of the facility associated with this work order.



■ Work Order Header

IDENTIFICATION

US *Work Order Number*

A number assigned by Maintenance Control or by the system to a particular equipment maintenance or repair order.

U *Work Order Type*

Code used to classify work orders:

1 = preventive maintenance

2 = planned maintenance

3 = breakdown

4 = installation

5 = engineering change

US *Work Center Number*

The location where the work order is to be processed.

U *Equipment Asset Number*

The number of the specific equipment on which the repair or maintenance was performed.

U *Maintenance Code*

Code designating general type of maintenance (e.g., electrical maintenance on generator).

US *Work Order Description*

Descriptive information about this order.

U *Work Order External Priority*

A value given by management to identify critical work orders:

1 = routine

5 = semicritical

9 = critical

S *Work Order Priority*

A computed value used to rank this order relative to all others. Among the major factors affecting the order priority are external priority and number of days delay.

AUTHORIZATION

U *Maintenance Planner*

Number of employee responsible for planning this order.

S *Time of Entry*

The time at which the request for the repair order was made.

S *Time of Authorization*

The time at which the planner gave the authorization to release the order.

U *Originating Department*

Number of the department which initiated the work order.

U *Account Number*

Number of account to which this work order will be charged, if not standard based on machine or department.

SCHEDULES

US *Number of Operations*

The total number of operations associated with this work order.

SU *Earliest Start Date*

Earliest Start Date either established by CAPACITY REQUIREMENTS PLANNING (for planned work orders) or defined by the planner (for critical repair orders).

U *Requested Finish Date*

The date this order should be completed. This date is either requested by the originating department or set by the planner.

U *Actual Start Date*

The shop date the order was reported started.

U SF *Estimate Hours Remaining*

An estimate of the hours' work remaining to complete the work order. Normally used only for repair orders.

U *Actual Completion Date*

The shop date the order was reported complete.

U *Current Operation Number*

The number of the operation currently being worked.

COST PLANNING AND CONTROL

US *Estimated Material Cost*

An estimate of the total material cost associated with this work order.

S SF *Actual Material Cost*

The sum of the actual material costs reported to date.

US *Estimated Labor Cost*

An estimate of the total labor cost associated with this work order.

S SF *Actual Labor Cost*

The sum of the actual labor cost reported to date.

U *Capitalization Code*

Indicates whether work order costs are to be added to equipment history record.

■ **Work Order Detail** (Operations)

IDENTIFICATION

US *Operation Sequence Number*

A number indicating the position of this operation within the work order.

U *Operation Number*

The original number assigned to this repair or maintenance operation.

US *Operation Description*

Operation description of limited length, quoting only essential activities, e.g., change oil, replace filter, etc. (the full description is stored in the Preventive Maintenance Operations file). The length is the same for all operations and depends on the format of the output (for displays and printouts).

US *Maintenance Instructions (M)*

Reference to additional instructions for this operation, e.g., volume and page number of the preventive maintenance handbook.

U *Contractor Number*

Number of the outside contractor assisting in the maintenance of this machine.

SCHEDULES

(Only for planned orders.)

U *Firm Start Date*

A scheduled start date (provided by the planner) which must be observed (e.g., when an "outside" engineer is to perform the preventive maintenance at a fixed time, or when there is an interrelationship with other orders).

U *Interruption Code*

Specifies that equipment cannot be used for production during maintenance.

S *Earliest Start Date*

For a planned repair causing an interruption of production on the machine; the earliest possible start date determined by the three subsystems of MANUFACTURING ACTIVITY PLANNING:

CAPACITY REQUIREMENTS PLANNING

ORDER RELEASE PLANNING

OPERATION SEQUENCING

S *Latest Start Date*

For a planned repair causing an interruption of production; the latest acceptable start date determined by the subsystems of MANUFACTURING ACTIVITY PLANNING.

S *Latest Finish Date*

For a planned repair causing an interruption of production; the latest acceptable finish date determined by the subsystems of MANUFACTURING ACTIVITY PLANNING.

OPERATION STATUS

U SF *Status Code*

Indicates current status of this operation:

0 = inactive

1 = scheduled

2 = dispatched

3 = waiting for material

4 = waiting for supplier

5 = in progress

6 = interrupted

7 = completed

9 = closed

U SF *Percent Complete*

The latest estimate from the shop floor of work performed on this operation, expressed as a percentage of the total.

LABOR

U *Labor Skill Required*

Used to identify the skill required to perform this operation.

U *Number of Men Required*

Number of men (each with the skill defined above) required to perform this operation.

U *Standard Labor Hours*

The established standard for the direct labor hours to perform this operation. If no standard is available, this is an estimate.

US SF *Current Labor Hours Estimate*

The latest estimate of the total labor hours required to perform this operation. This is the sum of reported labor hours plus an estimate of the remaining labor hours.

US *Employee Number (M)*

Number of employee assigned to this operation.

U *Estimated Labor Cost*

The standard (or the initially estimated) labor cost for this operation.

US SF *Actual Labor Cost*

The accumulation of direct labor cost reported for this operation.

MATERIAL (M)

US *Requested Material Number*

The identification of the material (typically, spare parts for replacements) required for this operation.

US *Requested Material Quantity*

The quantity of the material defined above.

U SF *Material Request Status*

0 = inactive

1 = requested (in the warehouse's picking queue)

2 = delivered

3 = purchase requisition issued

U *Location*

Code to identify a temporary location if the delivered material was not stored near the machine to be maintained.

TOOLS (M)

U *Requested Tool Number*

Tool number and serial number identifying the maintenance tool required for this operation.

US *Availability Code*

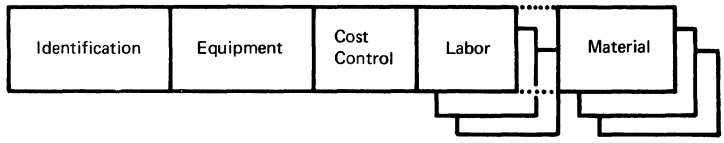
Used to indicate the current availability status of this tool. (For codes see similar field in the Shop Order record.)

ACTIVITIES REPORTED

This segment contains the same fields described in the Activities Reported segment of the Shop Order record.

Maintenance History

The Maintenance History file consists of one record for each completed maintenance work order. It contains a complete history of all maintenance work performed on a piece of equipment including costs and type of maintenance performed.



Maintenance History

IDENTIFICATION

S *Work Order Number*

A number assigned by Maintenance Control or by the system to a particular machine maintenance or repair order.

S *Work Order Type*

Code used to classify work orders:

1 = preventive maintenance
2 = planned maintenance
3 = breakdown
4 = installation
5 = engineering change

S *Date Requested or Planned*

The date this order should have been completed. This date was either requested by the originating department or set by the planner.

S *Actual Start Date*

The shop date the order was reported as having started.

S *Maintenance Order Description*

Descriptive information about this order.

S *Work Order External Priority*

A value given by management to identify critical work orders – for example:

1 = routine
5 = semicritical
9 = critical

EQUIPMENT

S *Work Center Number*

The location where the work order was processed.

S *Equipment Asset Number*

The number of the specific equipment on which the repair or maintenance was performed.

S *Resource Code*

Classifies the equipment into broader groups with similar functions, e.g., vertical mills, horizontal mills, etc. This code is also used as identification in the Product and Resource Summary file.

S *Failure Code*

A code entered by the maintenance planner to indicate the type of failure. The nature of the code was determined by the user and could be used for later analysis – for example:

1 = bearing failure

2 = motor failure

3 = electrical fault

COST CONTROL

S *Account Number*

Number of the account to which this work order was charged.

S *Total Labor Cost*

The sum of the total labor cost reported to date.

S *Total Material Cost*

The sum of the total material costs reported to date.

S *Capitalization Code*

Indicates whether work order costs are to be added to equipment history record.

LABOR (M)

S *Craft Code*

Used to identify the craft required to perform this operation.

S *Actual Labor Hours*

The total hours for each type of labor on this work order.

S *Actual Labor Cost*

The total cost for each type of labor on this work order.

MATERIAL (M)

S *Material Number*

The identification of the material (typically, spare parts for replacements) required for this operation.

S *Material Quantity*

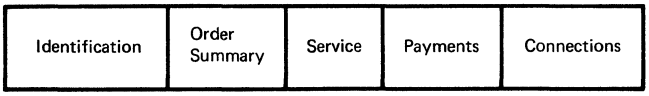
The quantity of the material defined above.

S *Actual Material Cost*

The total cost for this material on the work orders.

Supplier Data

The Supplier Data file consists of one record for each unique supplier (vendor) identified by a supplier number. It is connected to the item data by means of Quote segments in the Product Definition record and by Purchase Order records in the Purchase Order file.



Supplier Data

IDENTIFICATION

U *Supplier Number*

A number identifying the supplier of purchased items, tools, or machines.

U *Name*

Name of this supplier.

U *Address*

The address for this supplier

U *Supplier Contact*

The name of the employee of this supplier to contact for information. If the contact person changes for a particular order, a similar field will be used in the Quote segment of the Product Definition record.

U *Telephone Number*

The telephone number of this supplier to be used when information is required. If this varies by order, a similar field will be used in the Quote segment of the Product Definition record.

U *Buyer Number*

Employee number, code, or initials of responsible buyer.

ORDER SUMMARY

S HD *Orders Year-to-Date*

The number of orders placed with this supplier so far this year.

S HD *Orders Previous Year*

The number of orders placed with this supplier during the preceding year.

S HD *Rejected Shipments Year-to-Date*

The number of deliveries from this supplier rejected so far this year.

S HD *Rejected Shipments Previous Year*

The number of deliveries from this supplier that were rejected during the preceding year.

S *Last Shipment Date*

The date the most recent shipment from this supplier was received.

SERVICE

S HD *Quality Rating*

Specifies the quality of the deliveries received from this supplier. The rating can be expressed in different ways according to the inspection procedures used.

S HD *Delivery Rating*

Indicates the standard of delivery service which this supplier has provided in the past.

S HD *Price Rating*

The cumulative ratio of the supplier's price to base standard price for items supplied.

US *Major Commodities (M)*

The most important products offered by this supplier. Without quote, there is no direct link from the item record to this file when a possible new supplier is sought.

U *Commodity Capacity (M)*

The agreed total available supplier capacity for each commodity class.

S *Commodity Load (M)*

The capacity required for outstanding orders for each commodity class, by period.

U *Acknowledgment Flag*

Indicates that an acknowledgment is required of orders placed with this supplier.

U

Comments (M)

Information about a supplier, required by the purchasing department for printed or displayed reports. Can contain abbreviated comments or a code representing a standard comment. If comments are required by item, a similar field is included in the Quote segment of the Product Definition record.

PAYMENTS

U

Method of Payments

A code indicating method of payment:

0 = not defined

1 = direct bank transfer

2 = direct post account transfer

3 = check

4 = cash

U

Supplier's Bank

Reference to the supplier's bank where the bank transfer has to be sent.

U

Account Number

Bank account or post account number of the supplier.

U

Supplier Discount Code

Code used to define payment discount terms offered by this supplier. If the discount is item-dependent, a similar field can be used in the Quote segment of the Product Definition record.

S SF

Payment Year-to-Date

The amount paid to this supplier so far this year (all items).

S

Payments Last Year

The amount paid to this supplier last year.

S SF

Payments Due

Total amount due for payment.

CONNECTIONS

SU

Item Number (M)

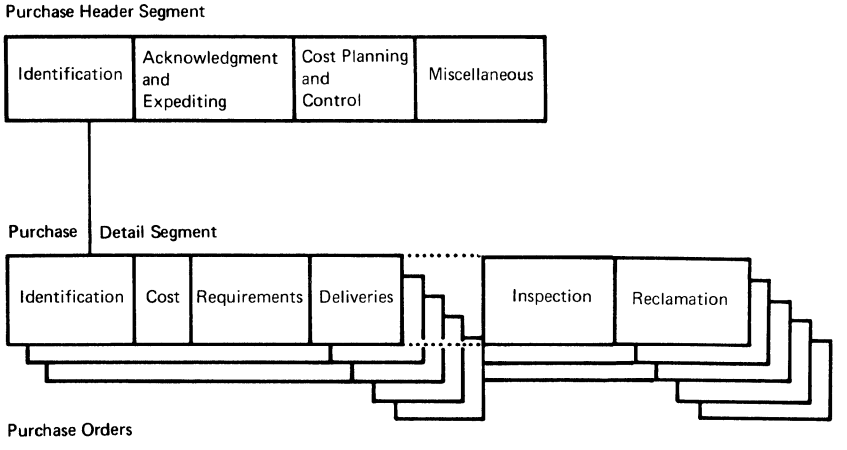
Reference to the item number for which there is a quotation from this supplier.

S *Purchase Order Number (M)*

Reference to an outstanding purchase order from this supplier.

Purchase Orders

The Purchase Order file consists of one record for each current requisition being reviewed by a buyer and each current order to a supplier. The two types are similar except for an identifying code (Activity Code), and consist of a general segment (Purchase Header segment) and a variable number of individual segments (Purchase Detail segment) for each item within the same order. The requisition record is created by ORDER RELEASE and initially has only one detail segment. An Order record is either created directly (by PURCHASING AND RECEIVING) or, more normally, comes from changing the identifying code of a Purchase Requisition record. Several requisitions can be combined by the buyer into a single order; each of them is then represented by a separate Purchase Detail segment.



- **Purchase Header Segment**

IDENTIFICATION

S *Purchase Order Number*

Identification number serially assigned to successive purchase orders or requisitions.

SU SF *Activity Code*

Code denoting the current activity on this order:

0 = planned order

1 = firm order

2 = requisition

3 = quotation

4 = released (pending arrival)

5 = partial receipt

6 = received in full

7 = pending cancellation

8 = canceled

9 = closed

S *Purchase Requisition Date*

Date the requisition was sent to the buyer.

S *Purchase Order Date*

Date that the firm purchase order was prepared.

S *Emergency Order Code*

Indicates that this order has been entered on an emergency basis and that further information is to be provided by the requisitioner.

SU *Cancellation Code*

A code indicating that this order cancels or is canceled by another order.

SU *Cancellation Order Number*

Identification of the purchase order canceling or canceled by this order.

SU *Priority Number*

Priority given to this requisition within the buyer's work queue.

S *Buyer Number*

Buyer to whom the requisition was directed.

SU *Supplier Number*

Identification number assigned to the supplier of this order.

SU *Supplier Type*

Indicates the business relation of the supplier:

1 = proprietary

2 = subcontractor

3 = other plant

US *Purchase Order Type*

Indicates number of shipments covered by the order:

1 = standard order (single shipment)

2 = more than one shipment specified

3 = blanket order, i.e., required shipments will be "called off" from the supplier throughout the period. One "blanket" order covers, say, a year's supply.

ACKNOWLEDGMENT AND EXPEDITING

SU *Acknowledgment Code*

Used to indicate whether an acknowledgment is expected or has been received for this order:

0 = no acknowledgment expected

1 = order acknowledgment expected

2 = acknowledgment of alteration expected

5 = order acknowledgment received with no supplier-initiated changes

6 = alteration acknowledgment received with no supplier-initiated changes

8 = order acknowledgment received with supplier-initiated changes

9 = alteration acknowledgment received with supplier-initiated changes

SU *Expected Acknowledgment Date*

The shop date by which an acknowledgment of acceptance of this order or order alteration is expected from the supplier.

S *Acknowledgment Reminder Date*

The date on which the supplier was reminded that the order had not yet been acknowledged.

S *Expedite Date*

The date on which the latest expedite notice was sent to the supplier.

S SF *Alteration Sequence Number*

The number of the current alteration for this order. This field is set to zero when the order is created and incremented by one for each alteration.

SU *Critical Item Code*

Code indicating that this is a "critical" production part. Purchasing and the inventory administrator should be notified when the shipment is received.

COST PLANNING AND CONTROL

SU SF *Estimated Cost*

An estimate of the total cost of this purchase order.

SU *Total Order Price*

Nominal buying price for the order (this could cover several items).

U *Order Discount Terms (M)*

Payment discount terms agreed by the supplier (used only if different from standard terms stored in the Supplier Master file).

U *Other Charges (M)*

Costs in addition to the purchase price of the items. This includes setup charges, miscellaneous freight, insurance, handling, crating, etc.

S *Total Amount Paid*

Total amount paid to the supplier to date (for this order).

U *Order Account Number*

Accounts payable charge number (used only if different from standard supplier account number).

S *Date Last Payment*

Date of most recent payment to supplier (for this order).

MISCELLANEOUS

S *Number of Inquiries*

A count of the number of inquiries regarding this order.

US *Date Closed*

Date on which the processing of this order is completed.

■ **Purchase Detail Segment**

IDENTIFICATION

US *Item Number*

Identification of the item (as in the product definition record).

S *Item Line Number*

Numeric reference which identifies the Purchase Detail segment and the line within the purchase order.

U *Supplier's Item Number*

Identification used by the supplier for this item.

S *Item Description*

Short description of this item, duplicated from the Product Definition record.

SU *Engineering Change Level*

The engineering change level at which this item should be inspected. Blank if "current".

COST

U *Unit Price*

Cost of the item per unit of measure (see below). This value overrides that stored in the Product Definition record in case of a special agreement, and for products not stored in the data base, e.g., a new chair for the conference room.

SU *Unit of Measure*

The unit of measure for which the above price is quoted (piece, dozen, pound weight, etc.). It can be different from the unit of measure stored in the Product Definition record.

REQUIREMENTS

S *Requisition Number*

Number of original internal requisition against which this order has been prepared. May be the same as the Purchase Order Number.

S *Requisition Date*

Date that the requisition for parts or material was issued by ORDER RELEASE.

U *Requisitioning Department*

The department number or employee number of the person responsible for creating the requisition.

U *Requisition Details*

Any special instructions, delivery location, etc., relating to the requisition.

S *Date Required*

The date, established by MATERIAL REQUIREMENTS PLANNING and ORDER RELEASE PLANNING, on which the items are required.

S *Quantity Required*

The original quantity quoted on the Purchase Requisition.

U *Quantity Ordered*

Quantity ordered by Purchasing (normally equals Quantity Required).

US SF *Order Change – Quantity (M)*

The revised order quantity (for order alterations involving only quantity and/or delivery date).

U SF *Order Change – Delivery (M)*

The revised delivery date (for order alterations involving only delivery date and/or quantity).

DELIVERIES (M)

(One subsegment per shipment within item.)

SU *Ship Date*

Date of shipment from supplier.

U *Estimated Delivery Date*

Date that shipment is to be received.

SU *Stock Date*

Date that parts or material are entered into inventory.

US *Disposition (M)*

Location to which the shipment should be sent upon receipt – for example, count station, inspection, etc.

US *Destination*

Department or area to which the shipment should be sent finally – for example, stores, user department, etc.

U *Supplier First Promise Date*

Date that the shipment was originally promised by the supplier.

U SF *Supplier Latest Promise Date*

Date the shipment is currently promised.

S *Date Received*

Actual date the shipment was received.

U *Expected Quantity*

The quantity expected in this shipment.

U *Quantity Received*

The quantity actually received in this shipment.

U *Supplier's Delivery Note Number*

Reference number of the supplier's shipping document.

U *Checker Number*

The employee number of the receiving clerk who entered the data regarding this receipt.

US *Number of Containers*

Number of pallets or containers needed for this shipment. This would correspond to the number of Receipt Identification Cards generated.

U SF *Current Location Code*

The current disposition of the receipt:

1 = receiving area

2 = counting and weighing

3 = inspection

4 = reclamation

5 = stores

6 = in transit

7 = shipping

U *Location Number*

Bin number or floor area location in the receiving location where the shipment is currently stored awaiting counting, inspection, etc.

INSPECTION (M)

This segment may be required either by shipment or by order.

U *Receiving Report Number*

Number of the supplier's receipt document.

S *Date of Inspection*

The date the inspection was completed.

U *Quantity Rejected*

The total quantity of parts or material rejected.

U *Inspector Number*

Employee number of the inspector checking this receipt.

RECLAMATION (M)

U *Date into Reclamation*

Date and time the rejected items were received in Reclamation Control. Used to control how long items remain in this department.

U *Quantity Accepted*

The quantity Reclamation Control has decided can be accepted.

U *Quantity Scrap*

The quantity Reclamation Control has decided must be scrapped.

U *Quantity Returned to Supplier*

The quantity Reclamation Control has decided should be returned to the supplier.

U *Quantity for Rework*

The quantity Reclamation Control has decided must be reworked in the plant, probably because of the urgency of the items.

U *Reclamation Report Reference*

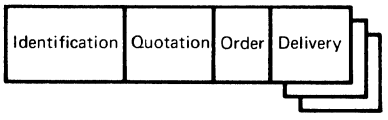
The Document reference number of the report authorizing disposition of the items.

U *Inspector Number*

The employee number of the reclamation inspector.

Purchase History

The Purchase History file contains one record for each previous quotation and for each previous order for an item. There can thus be several records for the same item.



Purchase History

IDENTIFICATION

S *Item Number*

Identifying number assigned to the item (as in the Product Definition record).

S *Supplier Number*

Identification of the supplier associated with this quote or order record.

QUOTATION

S *Quotation Number*

Number assigned by Purchasing to identify a supplier's quotation.

S *Date Last Quote*

The date on which the supplier associated with this quote segment last sent a price quotation for this item.

S *Price Break (M)*

Supplier prices based on lot quantities stated, together with Minimum Lot Quantity, as a series of price/quantity fields.

S *Supplier's Quotation Reference*

The reference number used by the supplier to identify his quotation.

S *Supplier's Additional Charge*

Additional charges made by the supplier, such as for tools.

S *Special Receiving Cost*

Additional handling costs incurred when receiving this item from the supplier.

S *Special Terms*

Supplier's payment terms, if different for this item.

S *Engineering Change Level*

The engineering change level at which this item was inspected.

ORDER

S *Purchase Order Number*

Identification number serially assigned to successive purchase orders or requisitions.

S *Purchase Order Date*

Date that the firm purchase order was prepared.

S *Buyer Number*

Buyer to whom the requisition was directed.

S *Unit Price*

Cost of the item per unit of measure (see below). This value overrides that stored in the Product Definition record in case of a special agreement and for products not stored in the data base, e.g., a new chair for the conference room.

S *Unit of Measure*

The unit of measure for which the above price is quoted (piece, dozen, pound weight, etc.). It can be different from the unit of measure stored in the Product Definition record.

S *Quantity Ordered*

Quantity ordered by Purchasing.

DELIVERY (M)

(Only in order records.)

S *Date Received*

Actual date the shipment was received.

S *Quantity Received*

The quantity actually received in this shipment.

S *Supplier's Delivery Note Number*

Reference number of the supplier's shipping document.

S *Destination*

Department or area to which the shipment was sent finally – for example, stores, user department, etc.

S *Receiving Report Number*

Number of the supplier's receipt document.

S *Quantity Accepted*

The quantity Reclamation Control decided could be accepted.

S *Quantity Scrap*

The quantity Reclamation Control decided should be scrapped.

S *Quantity Returned to Supplier*

The quantity Reclamation Control decided should be returned to the supplier.

S *Quantity for Rework*

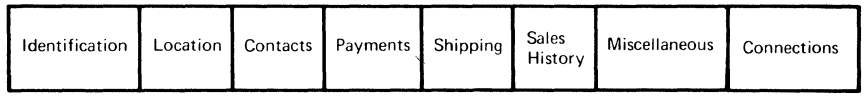
The quantity Reclamation Control decided should be reworked in the plant, probably because of the urgency of items.

S *Reclamation Report Reference*

The document reference number of the report authorizing disposition of the items.

Customer Data

The Customer Data file consists of one record for each customer (identified by a unique customer number). The record is linked to the Product Description file via the Customer Order file (in the case of current orders) and via the Customer Order History file (in the case of past orders).



Customer Data

IDENTIFICATION

U *Customer Number*

A numeric designation unique to the customer. (It does not represent any classification.)

U *Customer Name*

Name of the customer.

U *Customer Type*

A code used to classify customers. This code, developed locally, includes, for example:

Wholesale

Retail

Internal

Consignee

U *Standards Specification*

The locally applicable industry standard (ASA, BSI, DIN, etc.) associated with specifications quoted to the customer.

U *Language Code*

Defines the language to be used in order acknowledgment documents, bills, etc.

LOCATION

U *Customer Head Office Address*

Subfields each containing one line of this customer's head office address. (The postal code is assumed to be included in this and also in the following addresses.)

U *Customer Ship-To Address*

Subfields each containing one line of the address to which an order is to be shipped.

U *Location Code*

A geographic location classification used for vehicle scheduling.

U *Customer Invoice-To Address*

Subfields each containing one line of the address to which invoices are sent. This address may be different from the ship-to address.

U *Customer Copy-To Address*

Subfields each containing one line of the address to which copies of the order acknowledgment and of the order delivery document are sent.

U *Sales Area*

Identification of the sales area for this customer. This field can be divided into subfields coded by:

Region

Country

District

Branch office

Area

CONTACTS

U *Sales Representative*

Employee number of the sales representative assigned to this customer.

U *Customer Department*

A department number provided by the customer to identify which of his departments is concerned.

U *Customer Contact*

Name of the customer's employee to contact concerning orders from this customer.

U *Customer Phone (M)*

Telephone number of customer contact.

PAYMENTS

U *Account Number*

Number used for account purposes (if not the Customer Number).

U *Credit Limit*

The maximum credit allowed this customer.

S *Outstanding Credit*

The total current credit of this customer.

S *Date Last Payment*

The date on which the last payment was received from this customer.

S *Amount Last Payment*

The last amount paid by this customer.

S *Date Last Invoice*

The date on which the last invoice was sent to this customer.

S *Amount Last Invoice*

The amount of the last invoice to this customer.

U *Customer Discount Code*

Used (together with the Item Discount Classification stored in the Product Definition file) to determine the discount terms offered to this customer for a particular item.

U *Terms of Payment*

Used to define special or additional discounts offered to this customer if he pays his bills within given time limits, e.g., 3% reduction for payment within 10 days, 2% reduction for payment within 30 days. Could be a standard for all customers.

U *Cash-on-Delivery Code*

Indicates whether the customer has to pay his bills in cash on delivery of his order.

U *Invoice Copies*

Indicates how many copies of the bills have to be sent to the customer.

SHIPPING

U *Shipping Document Copies*

Indicates how many copies of the shipping documents have to accompany the delivery of a customer order.

U *Shipping Method*

A code used to define the standard method of shipping orders to this customer:

1 = by road

2 = by rail

3 = by air

6 = order-dependent

A similar field can be included in shipments segment of the Customer Order record to override the standard.

U *Trucker (M)*

The name of a trucker who can deliver to this customer. Could be a code.

U *Special Packing Instructions*

A series of codes corresponding to special packing instructions from the customer – for example:

Use waterproof packing

Use special oil protection against corrosion

Only the specifications not covered by the Standard Packing Instructions in the Product Definition file are required here. If these instructions are dependent on specific orders, a similar field can be used in the Customer Order record.

U *Standard Shipping Instructions*

A series of codes corresponding to customer shipping instructions, specifying, for instance:

The pallet sizes he can handle

The maximum weight he can lift

Permissible delivery times

If these instructions are dependent on specific orders, a similar field can be used in the Customer Order record.

U *FOB – Point*

The delivery point beyond which the customer must accept the shipment charge, for instance:

The shipping dock

His receiving dock

A port

This may be a code or an abbreviation.

U *Special Shipping Time*

The variation from the standard number of shop days required for the shipping of orders. This time allows for activities such as packing, marking, weighing, loading and transporting up to the FOB point.

S *Charged Containers*

The number of containers and/or pallets currently remaining to be returned from the customer.

SALES HISTORY

S HD *Item Family Bought (M)*

A code showing which group of items this customer has bought in the past. It corresponds to the Item Family Code in the Product Description records of items sold.

S HD *Product Type Sales Value*

The average sales price for this product or product type.

S HD *Sales Statistics*

Fields summarizing deliveries of the Item Family defined above.

MISCELLANEOUS

U *Comment Type (M)*

A code to identify the type of comment in the comment fields, and what documents they are printed on.

U *Comments (M)*

Stored information about the customer (or customer orders) which is shown on printed or displayed reports. This field could contain abbreviated comments or a code representing a standard comment.

CONNECTIONS

SU *Current Order (M)*

Reference to a current order placed by this customer.

SU *Past Order (M)*

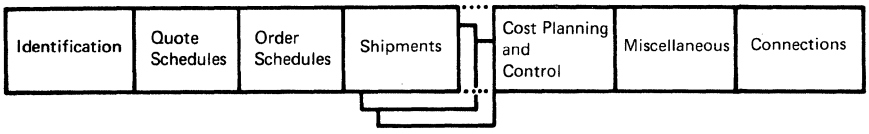
Reference to a previously completed order placed by this customer.

Customer Orders

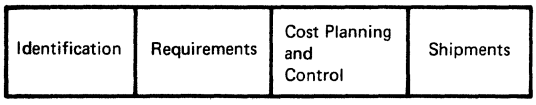
The Customer Order file consists of one record for each current request for a quote or current order from a customer (identified by the "Status Code"). The record comprises a general segment (Customer Order Header) and a variable number of individual segments (Customer Order Detail) for each item within the same order.

The Customer Order record is created by CUSTOMER ORDER SERVICING. Several independent requests for a quote can be combined by the sales department into a single order; each of them is then represented by a separate Customer Order Detail segment.

Customer Order Header Segment



Customer Order Detail Segment



Customer Orders

■ Customer Order Header Segment

IDENTIFICATION

SU *Customer Order Number*

Identification number assigned to the customer quote or customer order. Numbers are serially assigned.

U *Customer Number*

Identification of the customer as in the Customer file.

S SF *Status Code*

A code denoting the current status of this order:

1 = quotation (confirmation required by production analyzer)

2 = quoted (waiting for acceptance from customer)

3 = conditional order

4 = open customer order

5 = released to shipping

6 = due in shipping

7 = partially delivered

8 = delivered

9 = pending cancellation

10 = canceled

11 = closed

The same codes can be used on the item level.

U *Customer Reference Number*

The reference or order number used by the customer for this order.

U *Customer Contact*

Name of the customer employee handling this order. This field (if nonblank) overrides that in the Customer Master record.

U *Customer Telephone*

The telephone number to be used to contact this customer overrides the corresponding field in the Customer Master record.

QUOTE SCHEDULES

(Only in quote records.)

U *Order Quote Request Date*

The date the request for a quote was received from the customer.

U *Date Quote Due*

The latest date the quote can be submitted to the customer.

US *Date Quote Sent*

The date on which the quote was sent to the customer.

US *Date Quote Expires*

The latest date on which an order confirmation is expected. If no confirmation is received by this date, the quote is either repeated or canceled.

ORDER SCHEDULES

US *Date Order Placed*

The date on which the order was placed.

U *Customer Order Type*

Used to identify single or multiple shipment orders:

1 = standard order

2 = bulk, multiple shipment

3 = blanket order

U *Customer Order Priority*

A value assigned by management to any customer order considered urgent (e.g., because of penalty clause). If the priority is item-dependent, a similar field can be used in the Customer Order Detail segment.

U *Ship Partial Code*

Used to indicate whether delivery can be made by partial shipments or if the order has to be complete before the shipment.

SHIPMENTS

(One subsegment per shipment within order.)

SU *Shipment Number*

A suffix (to the order number) used to identify shipments.

U SF *Due Date*

The delivery date most recently established. Changes to this date can be initiated either by the customer or by production.

U *Planned Shipment Date*

The date this delivery is to be shipped to the customer.

U *Export Code*

Indicates to which country this order is exported. Used for cost control, tax reimbursement, addition of special features, documentation control, etc.

U *Trucker*

The name of the trucker transporting this shipment.

U *Special Delivery Instructions*

Delivery instructions peculiar to this partial shipment. Can contain abbreviated comments or a code representing a standard comment.

SU *Delivery Charges*

Delivery cost to be charged to the customer. This is either a standard or actual cost billed by the trucker.

S SF *Shipment Status*

A code showing the status of an order being shipped. Generated as a result of transaction reporting:

5 = released to shipping
6 = due in shipping
7 = partially delivered
8 = delivered

U *Shipment Completion*

The actual date the shipment was completed.

COST PLANNING AND CONTROL

S *Total Invoice Amount*

Summarized amount the customer is charged for this order (all items).

U *Special Order Discount*

Special discount agreed for this order. If this information is present, it overrides the standard Customer Discount Terms.

U *Method of Payment*

Indicates the method of payment, e.g., progress payments or single payments (lump sum).

U *Date Payment Due (M)*

The date on which payment is due in case of progress payments.

U *Amount Due (M)*

The amount due on the date quoted above.

S SF *Total Amount Paid*

Total amount paid for this order so far.

MISCELLANEOUS

U *Customer Specification Number (M)*

Identification of customer special instructions regarding modifications on standard products.

U *Miscellaneous Information (M)*

Information or instructions peculiar to this order which cannot be stored in the standard fields. This field could contain abbreviated comments or codes representing standard comments.

S SF *Order Alteration Number*

The number of the current version of this order. This field is set to zero when the order record is created and incremented by one for each alteration.

CONNECTIONS

US *Related Order (M)*

Reference to any order related to this one.

■ **Customer Order Detail Segment**

IDENTIFICATION

U *Item Number*

Numeric identification of the item associated with this segment (as in the Product Definition file).

US *Item Line Number*

Numeric reference used to identify the segment (line) sequentially within the customer order.

S *Item Description*

Short description of this item (duplicated from the Product Definition record to improve processing).

S *Original Order Number*

Order Number of the original request for quotation. Used if several separate quotations are combined into a single order.

U *Order Origin*

A code used to identify the origin of this order, e.g., phone, salesman, mail, etc.

REQUIREMENTS

U *Date Required (M)*

Delivery date originally requested by the customer.

U *Quantity Required (M)*

The original quantity required by the customer.

U *Quantity Variance Allowable*

The maximum deviation (positive and negative) from the requested quantity that the customer is willing to accept.

U *Reconditioned Acceptable Code*

Used to indicate whether the customer will accept a reconditioned product.

U *Special Export Requirements (M)*

Special requirements which can not be covered by the Export Code.

U *Inspection Point (M)*

The point in the fabrication process (defined by an operation number within the standard routing) where the customer makes his own inspection.

COST PLANNING AND CONTROL

U *Item Price*

Unit price of this item. This field is either a duplicate of the Selling Price in the Product Definition record, or a specially arranged price.

U *Packing Charges*

Additional cost for special packing to be charged to the customer.

SU *Miscellaneous Charges*

Special cost (incurred during production) to be charged to the customer.

SHIPMENTS

(One subsegment for every shipment of this item.)

U *Shipment Number*

A suffix (to the order number) used to identify the partial shipment (as in the Customer Order Header segment).

US *Quantity*

The quantity of this item to be delivered in this shipment.

U *Allowed Deviation on Shipment*

Difference between due quantity and actual delivery tolerated by the customer.

U *Quantity Delivered*

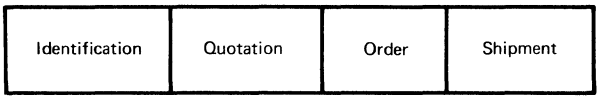
The actual quantity of this item delivered in this shipment.

U *Shipping Location*

Code defining the location from which this partial delivery is to be shipped.

Sales History

The Sales History file contains one record for each previous quotation and order for the product.



Sales History

IDENTIFICATION

S *Item Number*

Numeric identification of the item associated with this segment, as in the Product Definition file.

S *Customer Number*

Identification of the customer as in the Customer file.

QUOTATION

S *Quotation Number*

Number assigned by Sales to identify a quotation to the customer.

S *Date Quote Due*

The latest date by which the quote had to be submitted to the customer.

S *Date Quote Sent*

The date on which the quote was sent to the customer.

ORDER

S *Customer Order Number*

Identification number assigned to the customer order. Numbers are serially assigned.

S *Customer's Reference Number*

The reference or order number used by the customer for this order.

S *Date Order Placed*

The date on which the order was placed.

S *Customer Order Priority*

A value assigned by management to any customer order considered urgent (e.g., because of penalty clause). If the priority is item-dependent, a similar field can be used in the Customer Order Detail segment.

S *Quantity Ordered*

The original quantity required by the customer.

S *Item Price*

Unit price of this item. This field is either a duplicate of the Selling Price in the Product Description record, or a specially arranged price.

S *Order Discount*

Discount valid for this order. Either the standard customer discount terms, or a special discount agreed to for this order.

S *Quantity Dispatched*

The actual total quantity delivered to the customer for this order.

S *Packing Charges*

Additional cost for special packing charged to the customer.

S *Miscellaneous Charges*

Special costs incurred during production and charged to the customer.

SHIPMENT

(Only in Order Records.)

S *Shipment Number*

A suffix (to the order number) used to identify the partial shipment (as in the Customer Order Header segment).

S *Shipment Date*

The actual date of this shipment.

S *Quantity Delivered*

The actual quantity of this item delivered in this shipment.

Notes

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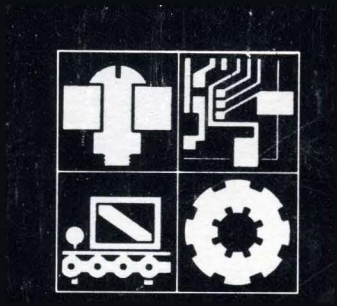

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