INDUSTRIAL DATA PROCESSING APPLICATIONS REPORT

Applications	Integrated Information System
Type of Industry	Valve Manufacturer
Name of User	Worcester Valve Co. West Boylston, Mass.

Equipment Used	IBM System/360 Model 30 Data Processing System
	IBM 357 Data Collection System
	Friden Computyper

Synopsis

Worcester Valve Co. has integrated its data collection and data processing procedures using an IBM System/360 Model 30 data processing system, an IBM 357 data collection system and a Friden Computyper.

The system handles orders, updates inventory records, computes moving average costs and helps control production. Daily and weekly reports enable purchasing and production control personnel to keep up-to-date on items on order.

In addition, the integrated information system at Worcester Valve maintains quality control over parts which can be rejected at various points in the plant -- from receiving to assembly.

Worcester Valve Company manufactures ball valves and employs 160 persons.

In a recent five year period, business at Worcester nearly doubled -- going from $2.8 million to $5.5 million. During the same period, inventory decreased from $900,000 to $850,000, while the company improved service to its customer from 90 percent effectiveness to 98 percent effectiveness.

Worcester Valve, a major supplier of ball valves to industry, has improved the efficiency of its internal operations by increasing and improving the flow of information within the company.

Information concerning production, inventory, sales and suppliers is provided by a relatively small IBM System/360 Model 30, 16K data processing system in conjunction with an IBM 357 data collection system. According to the company's management, the key to the effectiveness of the system is the speed and flexibility of the computer coupled with a number of efficient procedures which have been instituted in the plant's major departments.

Most significant about Worcester Valve's system is that it represents an integration of data collection and processing procedures representing nearly every aspect of the company's business. Instead of being a set of distinct application programs, each with an individual source and data bank file, the system maintains a single set of commonly used files with programs designed to accommodate one another and serve several different plant functions.

Remote terminals located inside the plant simplify, hasten and improve the accuracy of the reports that update work-in-process, open order and inventory records.

The company's ball and butterfly valves range in size from 1/4 inch to 12 inches. They must be able to stand up under a number of diverse environments and are fabricated from a variety of materials ranging from plastics to metals to rubber. This variety of materials is responsible for the bulk of Worcester's inventory problems. In the 1/4 inch valve alone more than 250 different combinations are produced.

The range of the products involved makes it impractical to produce for anticipated demand because of the high cost of the finished goods inventory. Instead the company produces basic parts against a forecasted demand and assembles parts primarily to customer order.

WORCESTER VALVE CO. INC. FINISHED PRODUCT INVENTORY DATE 10/17/67

PRODUCT CODE	ON ORDER					QUANTITY		STATUS				USAGE	
	DIST. CODE	ORDER NO.	SCHED. DATE	SUFFIX	QUANTITY	IN PROCESS	FINISHED STORES	THIS WEEK	1ST WEEK	2ND WEEK	3RD WEEK & GREATER	FREQ.	QUANTITY
	30026	862	11/10		10								
	30198	868	11/10		10								
					20								
					121	*	3 *	7CR*	41CR	50CR	20CR	20	271
20 41 1 10 SE	30174	425	10/20		10								
	30242	446	10/20		10								
	30100	721	10/20		50								
					70								
	30096	561	10/27		10								
	30066	76238	10/27		4								
					14								
	30502	683	11/03		10								
	30490	845	11/03		10								
					20								
	30066	765	11/10		10								

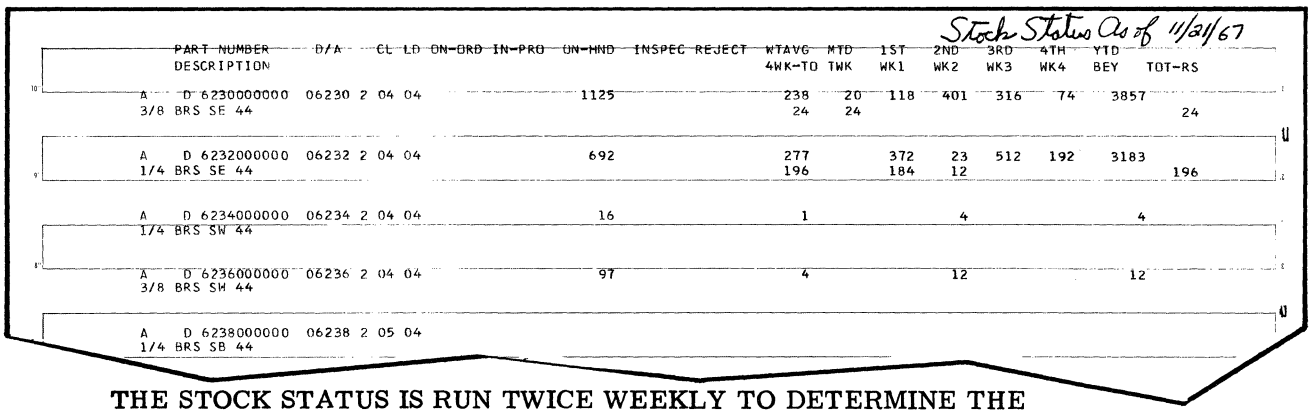
THE FINISHED PRODUCT INVENTORY LISTS ASSEMBLIES COMPLETED TO FILL CUSTOMERS' ORDERS.

In terms of maintaining customer service and reducing inventory costs, efficiency demands that routine paperwork be performed rapidly and accurately. Timely and meaningful data on current sales, inventory production and purchases is a necessity. The data processing system the company has instituted achieves all of the above ends.

THE SYSTEM

Worcester Valve's Data Processing System goes into action when a customer order is received. New orders are entered daily through the Friden Computyper which generates punched cards for each order. After an audit control check, the card set is entered into the computer which generates shipping papers and enters the order on the open sales order disc file. Sales order acknowledgements -- once used by the company -- have been replaced by a weekly open sales order report.

Twice weekly a computer run is made to determine what orders are due to be completed at specified periods of times. Based on this information, a bill of materials explosion determines the upcoming parts requirement and the status of each part in inventory.



Stock Status As of 11/21/67

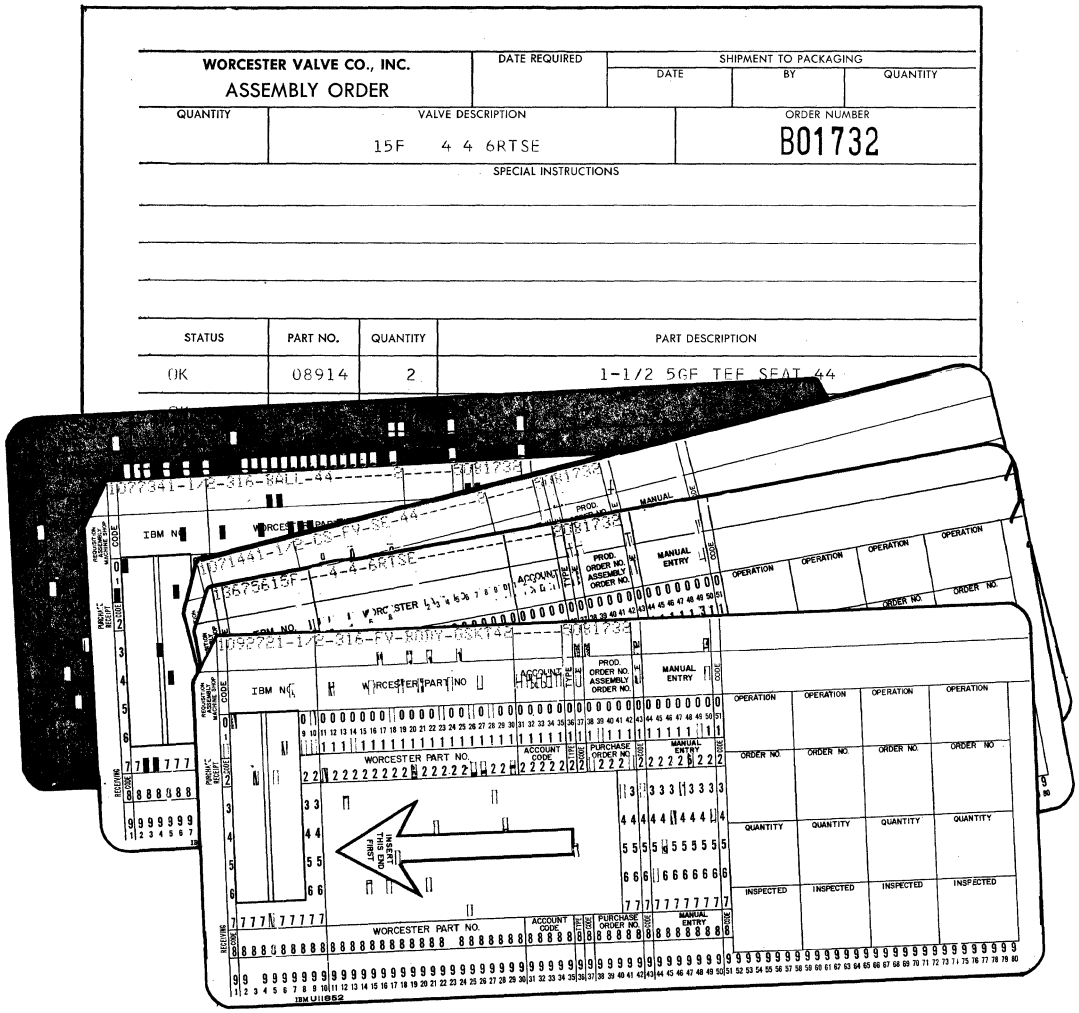
PART NUMBER / DESCRIPTION	D/A	CL	LD	ON-ORD	IN-PRO	ON-HND	INSPEC	REJECT	WTAVG 4WK-TO	MTD TWK	1ST WK1	2ND WK2	3RD WK3	4TH WK4	YTD BEY	TOT-RS
A D 6230000000 3/8 BRS SE 44	06230	2	04	04		1125			238 24	20 24	118	401	316	74	3857	24
A D 6232000000 1/4 BRS SE 44	06232	2	04	04		692			277 196		372 184	23 12	512	192	3183	196
A D 6234000000 1/4 BRS SW 44	06234	2	04	04		16			1		4				4	
A D 6236000000 3/8 BRS SW 44	06236	2	04	04		97			4		12				12	
A D 6238000000 1/4 BRS SB 44	06238	2	05	04												

THE STOCK STATUS IS RUN TWICE WEEKLY TO DETERMINE THE FUTURE PARTS REQUIREMENTS AND THE STATUS OF EACH IN INVENTORY.

Also, based on this analysis, assembly orders and the punched cards for requisitioning, assembling and reporting the completion of assembly and shipment are automatically prepared and hand collated into an assembly packet. The packet is then forwarded to production control for the loading and scheduling of the assembly department.

The packet's parts requisition cards are used as an authorization to retrieve necessary parts from the company's Triax automated storage control and delivery system. The Triax system is a huge, electro-mechanical installation that encompasses a movable "picking" mechanism that moves among tiers of shelves to retrieve parts. The system is activated by an operator who uses pushbuttons to input codes derived from the punched cards.

When the assembly department has pulled the necessary materials from inventory the cards are transmitted -- via 357 terminal -- back to data processing, where they are used to update the parts inventory file. (The 357 terminals are linked to a card punch in the computer center. The punched cards produced from remote input are then fed into the computer system.) In essence, this series of steps has enabled Worcester Valve to maintain a tight control over inventory. The job cards are also used to report completion of assembly orders and shipment of the finished product to the customer. The report of completion, in turn, is used to reduce the requirements file and trigger the billing operation.

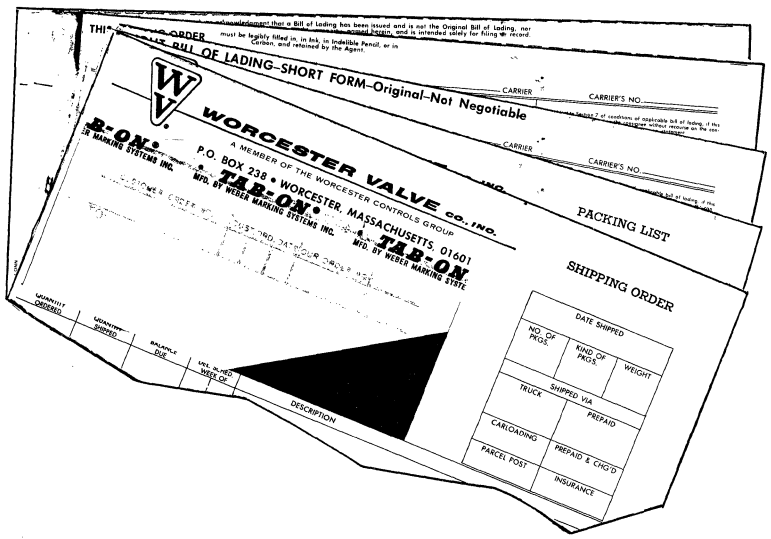


WORCESTER VALVE CO., INC. ASSEMBLY ORDER	DATE REQUIRED	SHIPMENT TO PACKAGING		
		DATE	BY	QUANTITY
QUANTITY	VALVE DESCRIPTION		ORDER NUMBER	
	15F 4 4 6RTSE		B01732	

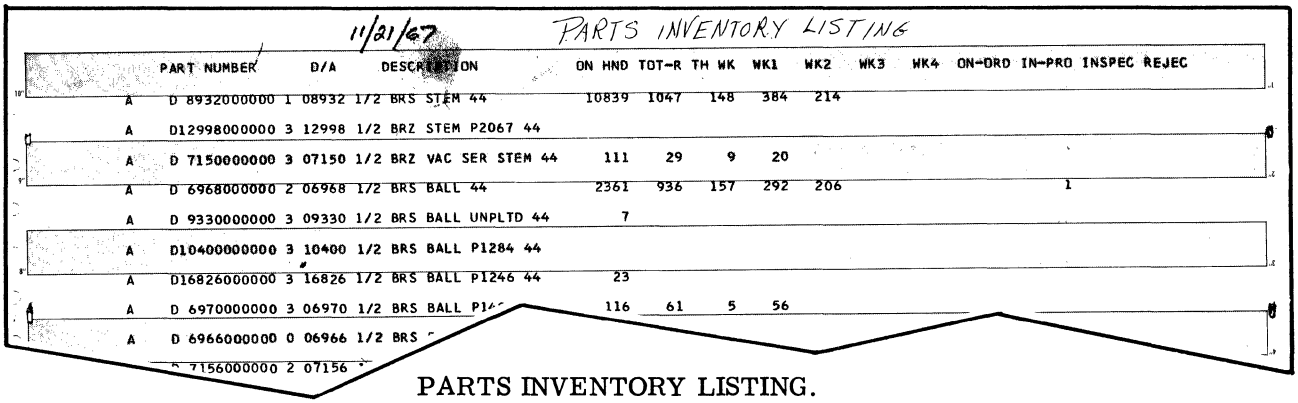
SPECIAL INSTRUCTIONS

STATUS	PART NO.	QUANTITY	PART DESCRIPTION
OK	08914	2	1-1/2 5GF TFF SEAT 44

AN ASSEMBLY ORDER AND ASSOCIATED CARDS FOR REQUISITIONING, ASSEMBLING AND REPORTING.



THE SHIPPING ORDER TRIGGERS THE BILLING OPERATION.



11/21/67 PARTS INVENTORY LISTING

	PART NUMBER	D/A	DESCRIPTION	ON HND	TOT-R	TH WK	WK1	WK2	WK3	WK4	ON-ORD	IN-PRO	INSPEC	REJEC
A	D 8932000000	1	08932 1/2 BRS STEM 44	10839	1047	148	384	214						
A	D12998000000	3	12998 1/2 BRZ STEM P2067 44											
A	D 7150000000	3	07150 1/2 BRZ VAC SER STEM 44	111	29	9	20							
A	D 6968000000	2	06968 1/2 BRS BALL 44	2361	936	157	292	206						1
A	D 9330000000	3	09330 1/2 BRS BALL UNPLTD 44	7										
A	D10400000000	3	10400 1/2 BRS BALL P1284 44											
A	D16826000000	3	16826 1/2 BRS BALL P1246 44	23										
A	D 6970000000	3	06970 1/2 BRS BALL P14	116	61	5	56							
A	D 6966000000	0	06966 1/2 BRS											
	D 7156000000	2	07156											

PARTS INVENTORY LISTING.

DETERMINING INVENTORY

Requirements for the parts inventory are determined weekly. Initially, order requirements are exploded against the bill of materials file. This produces the gross number of parts required for each of the four monthly time periods based on customer orders.

Then a forecasting routine is exercised to generate requirements for that portion of the four month period not adequately covered by actual customer orders. This permits the company to arrange for the orderly procurement of items needing a long lead-time.

The forecasting routine examines demand for the previous three months and exponentially smoothes the figures according to formula, giving Worcester a predicted sales volume figure. Results are used as anticipated parts usage and are combined with actual requirements to determine total parts needed.

These figures are then netted against the inventory file which indicates parts on hand and on order by a specific monthly time period. The figures are reviewed by production control for preparation of purchase orders and master manufacturing schedules.

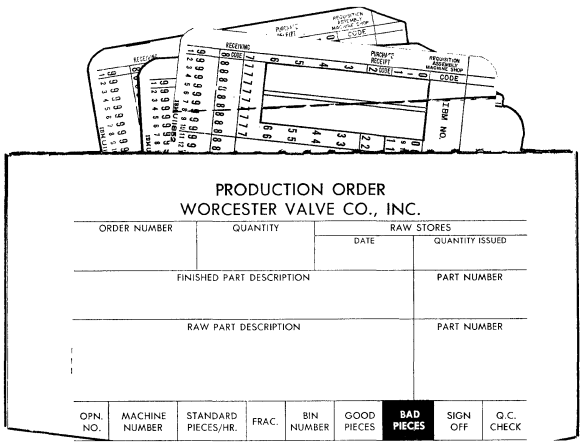
Production Control prepares a manufacturing requisition which is channeled back to the EDP center. Data Processing in turn prepares production order packets similar to the assembly packets. The production packets include a deck of four types of cards:

-- Material requisition from the Triax System

-- A traveler card to return the finished part to the Triax System

-- Multiple operation cards to record labor costs

-- Multiple machine load schedule cards to prepare shop floor schedules



A PRODUCTION PACKAGE

WITH A DECK OF WORK CARDS.

The Triax requisition card opens up a work and process control record. It is from this file that a weekly list is prepared showing the load on the work centers by due date. By referring to this report, production control can determine whether the plant is carrying an appropriate load or whether additional action is needed to adjust the load.

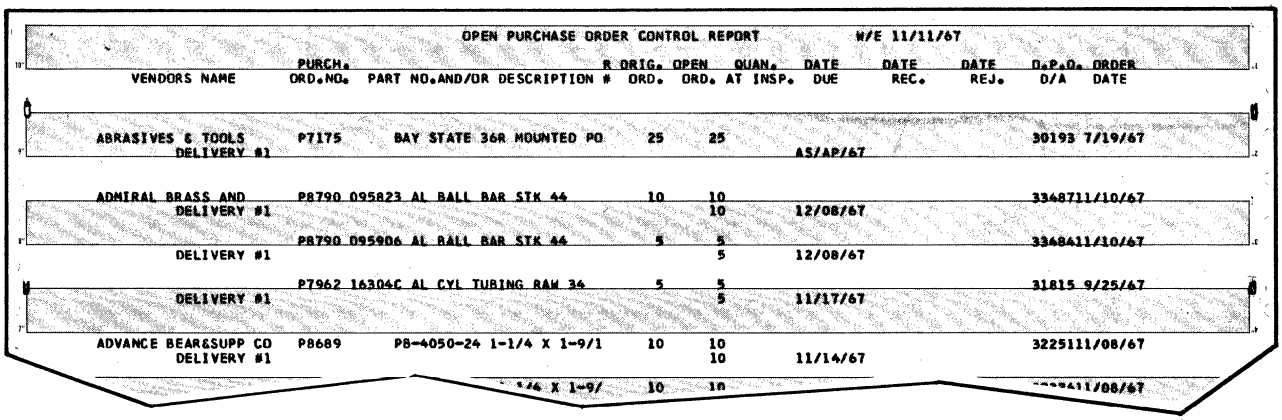
Operation cards are used by manufacturing to report completion of each operation, as well as placement in work and process storage. When the job is finished, the job card is inserted into the 357 terminal where the quantity is registered on the terminal's key-slide. When this step is completed the operations card and employee ID card are inserted into the 357 and the reporting task is completed. The report will then be used to adjust the load on the work-in-process and ultimately to adjust the inventory file and record direct labor costs.

PURCHASING

Production Control is also responsible for preparing purchasing requisitions. Indicated on a special form are part numbers, name, quantity and required delivery date. The purchasing form is forwarded to the purchasing group where it is reviewed for possible revision. Then a vendor is selected on the basis of price and other considerations.

Information on the purchasing requisition is then entered into the computer and purchase orders are printed. The computer is actually given only a series of disc addresses, quantity and price. But, by referring to the designated files, the computer can extract the vendor's name and address and complete part description to complete the purchase order.

As the purchase order is written, the program updates inventory records so that a subsequent generation of requirements will not duplicate any orders. A record of the order is also established in the open purchase order file.



OPEN PURCHASE ORDER CONTROL REPORT W/E 11/11/67

VENDORS NAME	PURCH. ORD.NO.	PART NO.AND/OR DESCRIPTION	R ORIG. ORD.	OPEN ORD.	QUAN. AT INSP.	DATE DUE	DATE REC.	DATE REJ.	P.O. D/A	ORDER DATE
ABRASIVES & TOOLS	P7175	BAY STATE 36R MOUNTED PO	25	25					30193	7/19/67
DELIVERY #1						AS/AP/67				
ADMIRAL BRASS AND	P8790 095823	AL BALL BAR STK 44	10	10					3348711	/10/67
DELIVERY #1				10		12/08/67				
	P8790 095906	AL BALL BAR STK 44	5	5					3348411	/10/67
DELIVERY #1				5		12/08/67				
	P7962 16304C	AL CYL TUBING RAW 34	5	5					31815	9/25/67
DELIVERY #1				5		11/17/67				
ADVANCE BEAR&SUPP CO	P8689	P8-4050-24 1-1/4 X 1-9/1	10	10					3225111	/08/67
DELIVERY #1				10		11/14/67				
		*/4 X 1-9/	10	10						/08/67

WEEKLY REPORT PRODUCED BY COMPUTER IS USED INSTEAD OF STACKS OF PURCHASE ORDER COPIES TO ASCERTAIN STATUS OF PARTS ORDERS.

Finally, two punched cards are produced so that receiving and inspection can report processing the ordered items through the three 357 data collection terminals on the plant floor. Such reports are used to update the open order file and produce a daily receipt list. The receipts list informs both purchasing and production control that the order has arrived and is at inspection. Then, when a physical inspection is completed -- assuming the items have been approved -- a report is made through one of the 357 terminals so that the inventory file can be readjusted, the open order file relieved and entry made into the report for accounts payable. From the accounts payable system material cost information is picked up for use in the average moving cost system.

The key slides on the terminals permit the receiving clerk to indicate the actual number of parts he receives and whether or not this agrees with the amount stipulated on the purchase order. Thus it is just as easy to report partial or split shipments as to report normal fulfillment of the order.

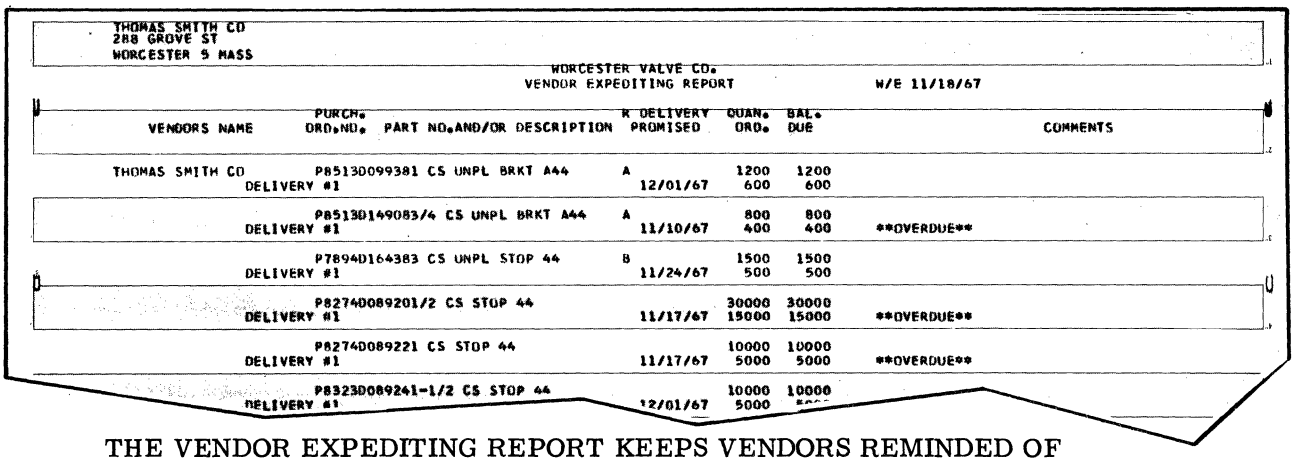
Changes are processed with equal facility by the system. Any department making a change to a previously issued purchase order simply completes a pre-printed punched card. The change is reviewed by purchasing and then processed by the computer for updating both inventory and open order records and for issuing a new or revised purchase order. This program also creates new receiving cards.

Changes to the plant's work orders are coded to indicate that an earlier job must first be deleted from the records. The work-in-process report will then be adjusted during the next regular processing to show the changes made in the shop load.

Reports

Two weekly reports help control the flow of materials and parts into the plant from vendors. One of these is the list of open purchase orders by vendor. This is used throughout the week by purchasing and production control to refer to any questions about items on order. It is far easier than searching through file drawers for copies of purchase orders. Most questions about orders can be answered directly from this report.

The other report is the vendor expediting report, a list of orders placed with each vendor by delivery date. A list of each vendor's commitments (overdue or due in the next two weeks) is sent to him so that he can check his own arrangements or remember to call Worcester Valve if he cannot meet the stated delivery dates. This report, which is also sent to purchasing and production control, saves a good deal of the reminder telephone calls that used to be made because of the critical nature of certain items. Dozens of vendors are reminded each week without any effort by the purchasing agent.



THOMAS SMITH CO
288 GROVE ST
WORCESTER 9 MASS

WORCESTER VALVE CO.
VENDOR EXPEDITING REPORT W/E 11/18/67

VENDORS NAME	PURCH. ORD.NO.	PART NO.AND/OR DESCRIPTION	R	DELIVERY PROMISED	QUAN. ORD.	BAL. DUE	COMMENTS
THOMAS SMITH CO	P8513D099381	CS UNPL BRKT A44	A		1200	1200	
	DELIVERY #1			12/01/67	600	600	
	P8513D149083/4	CS UNPL BRKT A44	A		800	800	
	DELIVERY #1			11/10/67	400	400	**OVERDUE**
	P7894D164383	CS UNPL STOP 44	B		1500	1500	
	DELIVERY #1			11/24/67	500	500	
	P8274D089201/2	CS STOP 44			30000	30000	
	DELIVERY #1			11/17/67	15000	15000	**OVERDUE**
	P8274D089221	CS STOP 44			10000	10000	
	DELIVERY #1			11/17/67	5000	5000	**OVERDUE**
	P8323D089241-1/2	CS STOP 44			10000	10000	
	DELIVERY #1			12/01/67	5000	[illegible]	

THE VENDOR EXPEDITING REPORT KEEPS VENDORS REMINDED OF THEIR COMMITMENTS, SAVING REMINDER TELEPHONE CALLS.

Quality Control

The system is designed so that parts can be rejected easily at various points in the plant, including receiving, inspection, parts storage, manufacturing and assembly. Quality Control completes a rejection report which identifies the parts, quantity and reason for rejection. This goes to production control and purchasing. These departments collaborate on a decision to: scrap, rework in plant, return to vendor or to use as is. This information is then added to the reject form.

The Quality Control department also enters a reject card. This is transmitted through a 357 terminal to data processing for inclusion in the daily updating reports. This entry appears as a daily listing of product rejections.

After the disposition is resolved, the accounting department reviews both card and reject notice for any required financial adjustment. Then the information is processed by the computer to trigger any of the following actions which will be appropriate: update the inventory file; update work-in-process file; create a rework list for new production orders; create a debit memo and a new entry in the open order file; produce a scrap report for production control records; and suggest a letter by purchasing to the vendor.

Design Criteria

One of the design criteria established for the system at Worcester Valve is the importance of being able to handle exception as easily as routine matters. A major role of the system is to control exceptional conditions; the overdue order, the overstocked inventory item, the overloaded work center, the order change. Because these can be handled within the bounds of the system, customers and vendors gain extra benefits. Thus plant personnel get their work done more effectively without a constant crisis.

Processing of rejected orders is an example. Instead of relying upon manual handling, the computer has been programed to update the necessary files, create rework call cards, print out debit memos or suggest sending a reject letter. The paperwork on what once was a tedious problem is dispatched quickly and accurately, with all the appropriate steps initiated properly.

Another design criterion established for the system is its position in relation to the business. Instead of being a support function for the plant, the Worcester Valve system is the main source for information, the only way to handle orders and the basis for most purchasing and production decisions.

RESULTS AND FUTURE PLANS

For Worcester Valve -- improved data handling techniques have had a direct effect on management techniques and the increased profitability that comes from tighter production and inventory control procedures. In addition, delivery lead time has been cut from six weeks to three weeks and manufacturing lead time from seven weeks to under three weeks.

Many of the future plans of Worcester Valve will depend to a great extent on the needs of the company, and innovations in the manufacturing process. It is difficult to pinpoint exact needs, but current indications are that the company may someday go to a real time on-line data processing system tied directly to the Triax system for shop loading and scheduling as well as moving and scheduling materials under management exception controls.