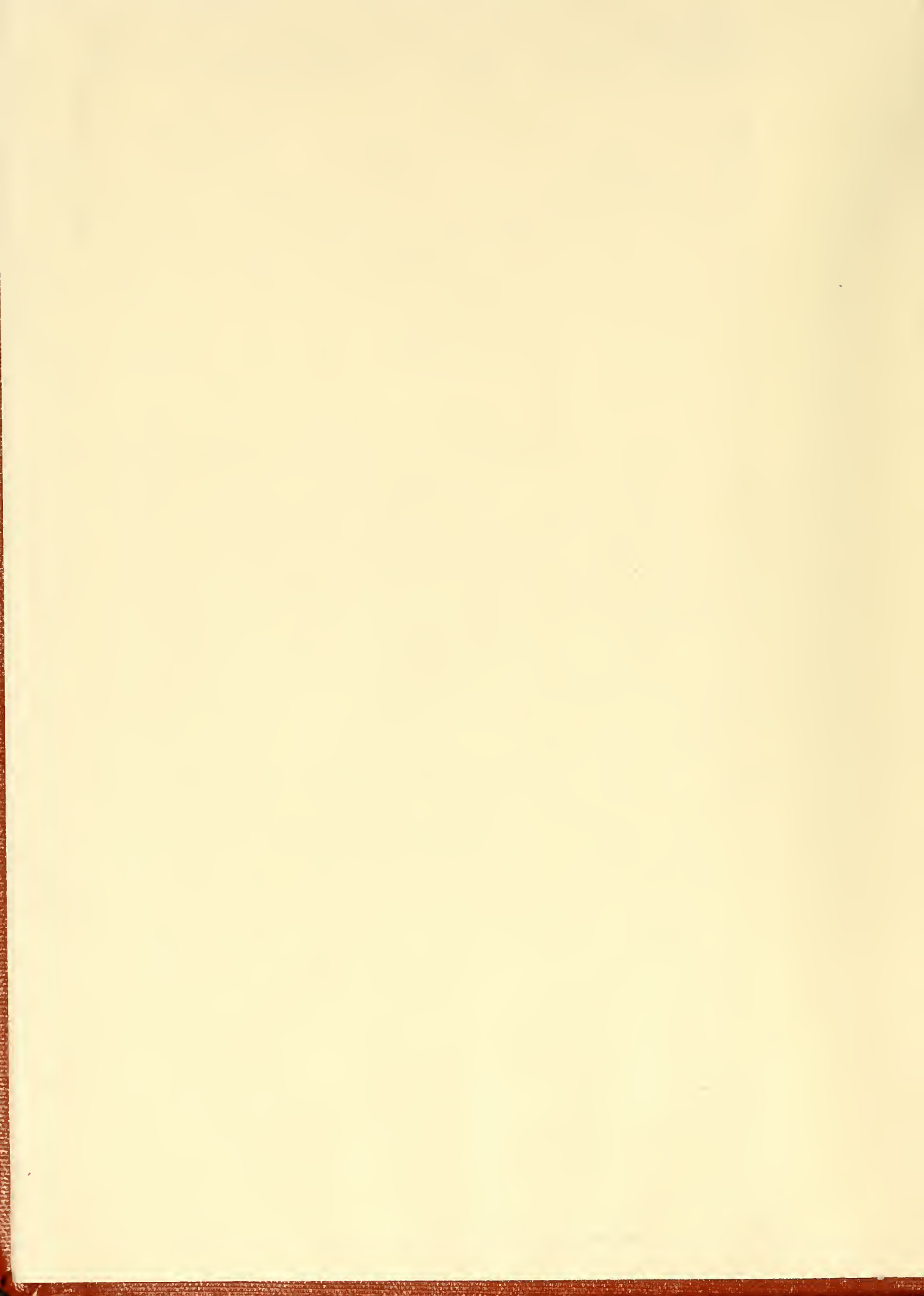


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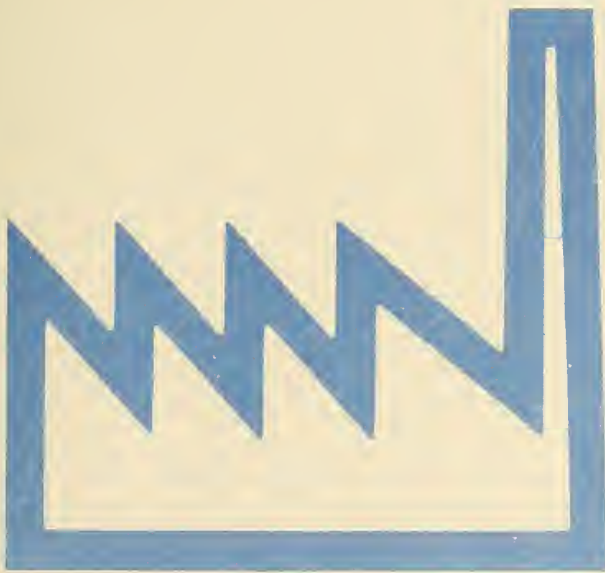
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The publications
from the 1982 Economic and
Agriculture Censuses are dedicated
to the memory of Shirley Kallek,
Associate Director for Economic Fields.
During her career at the Bureau of the
Census (1955 to 1983), she continually
directed efforts to improve
the timeliness and accuracy of
economic statistics.

1982 Census of Manufactures

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INTRODUCTION

ECONOMIC CENSUSES OVER TIME

The early beginnings of America's industrial output were first measured in the United States in the 1810 Decennial Census and again in 1820, when questions on manufacturing were included with those for population. Beginning with the 1840 Decennial Census, there were enumerations of manufactures and mineral industries at 10-year intervals up to and including the year 1900 for manufactures and 1940 for mineral industries. The latter census was again taken for 1954, 1958, 1963, and 1967.

Because of the increasing dominance of manufacturing in the early 20th century, Congress directed that quinquennial censuses of manufactures be taken beginning in 1905. However, from 1919 through 1939, these censuses were conducted every 2 years. The need for war-related current surveys in the early 1940's postponed the next census of manufactures until 1948 (for 1947). That census was again taken for 1954, 1958, 1963, and 1967.

Retail and wholesale trade data were first collected in 1930, and in 1933 information on selected service industries was added to the data-collection operation. These business censuses, as they were called, were again taken for 1935, 1939 (as part of the 1940 decennial program), 1948, 1954, 1958, 1963, and 1967.

Information on construction industries was obtained first in 1930 and again for 1935 and 1939. Data for the full spectrum of construction industries were not gathered again until 1968 (for 1967).

The need for transportation data to supplement information available from existing governmental or private sources was recognized by Congress in the late 1950's and early 1960's. The census of transportation (consisting of several surveys) was taken first for 1963 and again for 1967.

Since 1967, all of the above censuses have been taken quinquennially as part of the Census Bureau's economic census program. (For the 1977 censuses, the coverage of the service industries was broadened from "selected services" to "all services, except religious organizations and private households." A total of 41 additional four-digit standard industrial classifications¹ (SIC's) in 7 SIC major groups was added to the scope of the census. While most of the industries included for the first time for 1977 were covered again for 1982, some were not, i.e., hospitals; elementary and secondary schools; colleges, universities, and professional schools; junior colleges and technical institutes; labor unions and similar labor organizations; and political organizations.)

The first manufacturing census for an outlying area was conducted in Puerto Rico for the year 1909. Thereafter, with the exception of 1929, a census was taken at 10-year intervals through 1949. The first censuses of retail trade, wholesale trade, and selected service industries in Puerto Rico were conducted for 1939. These censuses also were taken for the years 1949, 1954, 1958, 1963, and 1967. A census of construction industries was introduced first in Puerto Rico for 1967. These censuses of Puerto Rico have been taken since then for the years 1972, 1977, and 1982.

Censuses of manufactures, retail trade, wholesale trade, and selected service industries were conducted in Guam and the

Virgin Islands of the United States for 1958, 1963, 1967, 1972, 1977, and 1982. Censuses of mineral industries were taken in the Virgin Islands of the United States for the years 1958, 1963, and 1967 but not since that time. A census of construction industries was also undertaken in these areas for 1972, 1977, and 1982.

Retail trade, wholesale trade, selected service industries, manufacturing, and construction industries were canvassed for the first time in the Northern Mariana Islands in 1983 (for 1982).

For 1982, the economic censuses and agriculture censuses were conducted concurrently.

USES OF THE ECONOMIC CENSUSES

The economic censuses are the major source for facts about the structure and functioning of the Nation's economy and provide essential information for government, business, industry, and the general public. They provide an important part of the framework for such composite measures as the gross national product, input-output measures, indexes of industrial production, and indexes measuring productivity and price levels. Information from the censuses is used to establish sampling frames and as benchmarks for current surveys of business activity, which are essential for measuring short-term economic conditions.

State and local governments use census data to assess business activities within their jurisdictions. The private sector uses the data to forecast general economic conditions; analyze sales performance; lay out sales territories; allocate funds for advertising; decide on locations for new plants, warehouses, or stores; and measure potential markets in terms of size, geographic areas, kinds of business, and kinds of products made or sold.

Following every census, thousands of businesses and other users purchase reports. Likewise, census facts are disseminated widely by trade associations, business journals, and newspapers. Volumes containing census statistics are available in most major public and college libraries. All 1982 data are available on microfiche from the U.S. Government Printing Office and most data on computer tape from the Census Bureau. Finally, the more than 50 State Data Centers also are suppliers of economic census statistics.

AUTHORITY AND SCOPE OF THE ECONOMIC CENSUSES

The economic censuses are required by law under title 13 of the United States Code, sections 131, 191, and 224, which directs that they be taken at 5-year intervals for the years ending in 2 and 7. The 1982 Economic Censuses covered manufacturing, mining, construction industries, retail trade, wholesale trade, service industries, and selected transportation activities. Special programs also cover minority-owned and women-owned businesses. The next economic censuses are scheduled to be taken in 1988 for the year 1987.

¹Standard Industrial Classification Manual: 1972. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 041-001-00066-6. 1977 Supplement. Stock No. 003-00500176-0.

CENSUS OF MANUFACTURES

General

The 1982 Census of Manufactures is the 31st census of manufactures of the United States. For 1982, it was conducted jointly with the censuses of mineral industries, construction industries, retail and wholesale trades, service industries, selected transportation activities, and minority-owned and women-owned businesses.

This report, from the 1982 Census of Manufactures, is one of a series of 82 industry reports, each of which provides statistics for groups of related industries. Additional separate reports will be issued for each State and on special subjects, such as size of establishments, legal form of organization, and fuels and electric energy consumed.

These separate reports will subsequently be issued as portions of the final census volumes. Volume I, Subject Statistics, will show comparative statistics for industries, States, and standard metropolitan statistical areas. It also will show selected subjects, such as concentration ratios in manufacturing, selected materials consumed, manufacturing activity in government establishments, and water use in manufacturing. Volume II, Industry Statistics, will be a consolidation of reports for the 82 groups of industries showing the same information that is shown in this report. Volume III, Geographic Area Statistics, will contain establishment-based data (number of establishments, employment, payroll, value added by manufacture, and capital expenditures) for each State and its important standard metropolitan statistical areas, counties, and places, by industry groups and important individual industries. Totals for "all manufacturing" will be shown for counties and places with more than 450 manufacturing employees. The introduction to the final volumes will discuss, at greater length, many of the subjects described in this introduction. For example, the volume text will discuss the relationship of value added by manufacture to National income by industry of origin, the changes in statistical concepts over the history of the censuses, and the valuation problems arising from intracompany transfers between manufacturing plants of a company and between manufacturing plants and sales offices and sales branches of a company.

Scope of Census and Definition of Manufacturing Industries

The 1982 Census of Manufactures covers all establishments employing one person or more primarily engaged in manufacturing as defined in the 1972 Standard Industrial Classification (SIC) Manual and its 1977 Supplement.¹ This is the system of industrial classification developed over a period of years by experts on classification in government and private industry under the guidance of the Office of Management and Budget. This system of classification is in general use among government agencies as well as organizations outside the government.

The SIC manual defines manufacturing as the mechanical or chemical transformation of inorganic or organic substances into new products. The assembly of component parts of products is also considered to be manufacturing if the resulting product is neither a structure nor other fixed improvement. These activities are usually carried on in plants, factories, or mills that characteristically use power-driven machines and materials handling equipment.

¹Standard Industrial Classification Manual: 1972. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 041-001-00066-6. 1977 Supplement. Stock No. 003-00500176-0.

Manufacturing production is usually carried on for the wholesale market, for transfers to other plants of the same company, or to the order of industrial users rather than for direct sale to the household consumer. Some manufacturers in a few industries sell chiefly at retail to household consumers through the mail, through house-to-house routes, or through salespersons. Some activities of a service nature (enameling, engraving, etc.) are included in manufacturing when they are performed primarily for the trade. They are considered nonmanufacturing when they are performed primarily to the order of the household consumer.

Relationship Between Annual Survey of Manufactures and Census of Manufactures

The Bureau of the Census conducts the annual survey of manufactures (ASM) in each of the 4 years between the censuses of manufactures. The ASM is based on a scientifically selected sample of approximately 55,000 establishments and collects the same industry statistics (employment, payroll, value of shipments, etc.) as the census of manufactures. In addition to collecting the information normally requested on the census form, the establishments in the ASM sample are requested to supply detailed information on assets, capital expenditures, retirements, depreciation, rental payments, supplemental labor costs, and costs of purchased services.

Establishment Basis of Reporting

The census of manufactures and the annual survey of manufactures are conducted on an establishment basis. A company operating at more than one location is required to file a separate report for each location. Companies engaged in distinctly different lines of activity at one location are requested to submit separate reports if the plant records permit such a separation and if the activities are substantial in size.

In 1982, as in earlier years, a minimum size limit was set for including establishments in the census. All establishments employing one person or more at any time during the census year are included. The same size limitation has applied since 1947 in censuses and annual surveys of manufactures. In the 1939 and earlier censuses, establishments with less than \$5,000 value of products were excluded. The change in the minimum size limit in 1947 does not appreciably affect the historical comparability of the census figures except for data on number of establishments for a few industries.

This report excludes information for separately operated administrative offices, warehouses, garages, and other auxiliary units that service manufacturing establishments of the same company (see Auxiliaries).

Manufacturing Universe and Census Report Forms

The 1982 Census of Manufactures universe includes approximately 345,000 establishments. The amounts of information requested from manufacturing establishments were dependent upon a number of factors. The more important considerations were the size of the company and whether it was included in the annual survey of manufactures. The methods of obtaining information for the various subsets of the universe to arrive at the aggregate figures shown in this publication are described below.

1. Small Single-Unit Companies Not Sent a Report Form

In the 1982 Census of Manufactures, approximately 140,000 small single-establishment companies were excused from filing reports. Selection of these small

establishments was done on an industry-by-industry basis and was based on annual payroll and total shipments data as well as on the industry classification codes contained in the administrative records of other Federal agencies. The cutoffs were selected so that these administrative records cases would account for no more than 3 percent of the value of shipments for the industry. Generally, all single-establishment companies with less than 5 employees were excused, while all establishments with more than 20 employees were mailed report forms.

Information on the physical location of the establishment, as well as information on payrolls, receipts (shipments), and industry classification, was obtained from the administrative records of other Federal agencies under special arrangements, which safeguarded their confidentiality. Estimates of data for these small establishments were developed using industry averages in conjunction with the administrative information. The value of shipments and cost of materials were not distributed among specific products and materials for these establishments but were included in the product and material "not specified by kind" (n.s.k.) categories.

The industry classification codes included in the administrative records files were assigned on the basis of brief descriptions of the general activity of the establishment. As a result, an indeterminate number of establishments were erroneously coded to the four-digit SIC level. This was especially true whenever there was a relatively fine line of demarcation between industries or between manufacturing and nonmanufacturing activity.

Sometimes these administrative record cases were given only a two- or three-digit SIC group. For the 1982 Census of Manufactures, these establishments were sent a separate classification form, which requested information on the products and services of the establishment. This form was used to code many of these establishments to the four-digit SIC level. Establishments that did not return the classification form were coded later to those four-digit SIC industries identified as "not elsewhere classified" (n.e.c.) within the given two- or three-digit industry groups.

As a result of these situations, a number of small establishments may have been misclassified by industry. However, such possible misclassifications have no significant effect on the statistics other than on the number of establishments.

The total establishment count for individual industries should be viewed as an approximation rather than a precise measurement. The counts for establishments with 20 employees or more are far more reliable than the count of total number of establishments.

2. Establishments Sent a Report Form

The 205,000 establishments covered in the mail canvass were divided into three groups:

a. **ASM sample establishments**—This group consisted of approximately 55,000 establishments covering all the units of large manufacturing establishments as well as a sample of the medium and smaller establishments. The probability of selection was proportionate to size (see appendix, Annual Survey of Manufactures).

In a census of manufactures year, the ASM report form (MA-1000) replaces the first page of the regular census form for those establishments included in the ASM. In addition to information on employment, payroll,

and other items normally requested on the regular census form, establishments in the ASM sample were requested to supply information on assets, capital expenditures, retirements, depreciation, rental payments, supplemental labor costs, and costs of purchased services. Results of the ASM inquiries are included in tables 3c and 3d of this report.

The census part of the report form is one of approximately 200 versions containing product, material, and special inquiries. The diversity of manufacturing activities necessitated the use of this many forms to canvass the approximately 450 manufacturing industries. Each form was developed for a group of related industries.

Appearing on each form was a list of products primary to the group of related industries, as well as secondary products and miscellaneous services that establishments classified in these industries were likely to be performing. Respondents were requested to identify the products, the value of each product, and, in a large number of cases, the quantity of the product shipped during the survey year. Space was also provided for the respondent to describe products not specifically identified on the form.

The report form also contained a materials-consumed inquiry, which varied from form to form depending on the industries being canvassed. The respondents were asked to review a list of materials generally used in their production processes. From this list, each establishment was requested to identify those materials consumed during the survey year, the cost of each, and, in certain cases, the quantity consumed. Once again, space was provided for the respondent to describe significant materials not identified on the form.

Finally, a wide variety of special inquiries was included to measure activities peculiar to a given industry, such as operations performed and equipment used.

b. **Large and medium establishments (non-ASM)**—Approximately 100,000 establishments were included in this group. A variable cutoff, based on administrative records payroll data and determined on an industry-by-industry basis, was used to select those establishments that were to receive one of the approximately 200 census of manufactures regular forms. The first page, requesting establishment data for items such as employment and payroll, was standard but did not contain the detailed statistics included on the ASM form. The product, material, and special inquiry sections supplied were based on the historical industry classification of the establishment.

c. **Small single-unit establishments (non-ASM)**—This group consisted of approximately 50,000 establishments. For those industries where application of the variable cutoff for administrative records cases resulted in a large number of small establishments being included in the mail canvass, an abbreviated or "short" form was used. These establishments received one of the approximately 80 versions of the short form, which requested summary product and material data and totals but no details on employment, payrolls, cost of materials, inventories, and capital expenditures.

Use of the short form has no adverse effect on published totals for the industry statistics; the same

data were collected on the short as well as the long form. However, detailed information on materials consumed was not collected on the short form; thus its use would increase the values of the n.s.k. categories.

Auxiliaries

In this industry report, the data on employment and payroll are limited to operating manufacturing establishments. The census report form filed for auxiliaries (ES-9200) requested a description of the activity of the establishments serviced. However, the auxiliaries were coded only to the two-digit major group of the establishments they served; whereas, the operating establishments were coded to a four-digit manufacturing industry. Data for the approximately 10,000 separately operated auxiliaries are included in the paperbound geographic area series, the bound volumes of the census of manufactures, and in a report issued as part of the 1982 Enterprise Statistics survey.

Auxiliaries are establishments whose employees are primarily engaged in performing supporting services for other establishments of the same company, rather than for the general public or for other business firms. They can be at different locations from the establishments served or at the same location as one of those establishments but not operating as an integral part thereof and serving two or more establishments. Where auxiliary operations are conducted at the same location as the manufacturing operation and operate as an integral part thereof, they usually are included in the report for the operating manufacturing establishment.

Included in the broad category of auxiliaries are administrative offices. Employees in administrative offices are concerned with the general management of multiestablishment companies, i.e., with the general supervision and control of two units or more, such as manufacturing plants, mines, sales branches, or stores. The functions of these employees may include (1) program planning, including sales research and coordination of purchasing, production, and distribution; (2) company purchasing, including general contracts and purchasing methods; (3) company financial policy and accounting, tax accounting, company sales and profit reports, and personnel accounting; (4) general engineering, including design of product machinery and equipment, and direction of engineering effort conducted at the individual operation locations; (5) direction of company personnel matters; and (6) legal and patent matters.

Other types of auxiliaries serving the plants or central management of the company include purchasing offices, sales promotion offices, research and development organizations, etc.

Industry Classification of Establishments

Each of the establishments covered in the census was classified in one of approximately 450 manufacturing industries in accordance with the industry definitions in the SIC system. Under this system of classification, an industry is generally defined as a group of establishments producing a single product or a closely related group of products. The product groupings from which industry classifications are derived are based on considerations such as similarity of manufacturing processes, types of materials used, types of customers, and the like. The resulting group of plants must be significant in terms of its number, value added by manufacture, value of shipments, and number of employees. The system operates in such a way that the definitions progressively became narrower with successive additions of numerical digits. There are 20 major groups (two-digit SIC), 143 industry groups (three-digit SIC), and approximately 450

industries (four-digit SIC). The product classes and products of the manufacturing industries have been assigned codes based on the industry from which they originate. There are about 1,500 classes of products, identified by a five-digit code, and about 11,000 products, identified by a seven-digit code. The seven-digit products are considered the primary products of the industry with the same four digits.

Accordingly, an establishment is usually classified in a particular industry on the basis of its major activity during a particular year, i.e., production of the products primary to that industry exceeds, in value, production of the products primary to any other single industry. In a few instances, however, the industry classification of an establishment is not only determined by the products it makes but also by the process employed in making those products. For example, establishments engaged in blast furnace operations, refining of nonferrous metals from ore, or rolling and drawing of nonferrous metals (processes which involve heavy capitalization in specialized equipment) would be classified according to the process used during a census year. These establishments then would be "frozen" in that industry during the following ASM years.

In either a census or ASM year, establishments included in the ASM sample with certainty weight, other than those involved with heavily capitalized activities described above, are reclassified by industry only if the change in the primary activity from the prior year is significant or the change has occurred for two successive years. This procedure prevents reclassification when there are minor shifts in product mix.

In ASM years, establishments included in the ASM sample with noncertainty weight are not shifted from one industry classification to another. They are retained in the industry where they were classified in the base census year (see appendix, Annual Survey of Manufactures). However, in the following census year, these ASM plants are allowed to shift from one industry to another.

The result of these rules covering the switching of plants from one industry classification to another is that, at the aggregate level, some industries comprise different mixes of establishments between survey years, and establishment data for such industry statistics as employment and payroll may be tabulated in different industries between survey years. Hence, comparisons between prior-year and current-year published totals, particularly at the four-digit SIC level, should be viewed with caution. This is true particularly for the comparison between the data shown for a census year versus the data shown for the previous ASM year.

As previously noted, the small establishments that may have been misclassified by industry are usually administrative-record cases whose industry codes were assigned on the basis of incomplete descriptions of the general activity of the establishment. Such possible misclassifications have no significant effect on the statistics other than on the number of establishments.

While some establishments produce only the primary products of the industry in which they are classified, all establishments of an industry rarely specialize to this extent. The industry statistics (employment, inventories, value added by manufacture, total value of shipments including resales and miscellaneous receipts, etc.) shown in tables 1a through 5a, therefore, reflect not only the primary activities of the establishments in that industry but also their secondary activities. The product statistics in tables 6a through 6c represent the output of all establishments whether or not they are classified in the same industry as the product. For this reason, in relating the industry statistics, especially the value of shipments to the product statistics, the

composition of the industry's output shown in table 5b should be considered.

The extent to which industry and product statistics may be matched with each other is measured by two ratios, which are computed from the figures shown in table 5b. The first of these ratios, called the primary product specialization ratio, measures the proportion of product shipments (both primary and secondary) of the establishments classified in the industry represented by the primary products of those establishments. The second ratio, called the coverage ratio, is the proportion of primary products shipped by the establishments classified in the industry to total shipments of such products by all manufacturing establishments.

However, establishments making products falling into the same industry category may use a variety of processes and materials to produce them. Also, the same industry classification (based on end products) may include both establishments that are highly integrated and those that put only the finishing touches on an already highly fabricated item. For example, the refrigeration industry includes instances of almost complete integration (production of the compressor, condensing unit, electric motor, casting, stamping of the case, and final assembly) all carried on at one plant. On the other hand, the condensing unit, the motor, and the case may be purchased and only assembled into the finished product.

In some instances, separate industry categories have been established for integrated and nonintegrated establishments. For other industries, the census provides separate statistics on the production of intermediate commodities made and used in the producing plant. For some industries characterized by many plants of the same company, separate figures on interplant transfer of products usually are shown.

Differences in the integration of production processes, types of operations, and alternatives in types of materials used should be considered when relating the industry statistics (employment, payrolls, value added, etc.) to the product and material data.

Value of Shipments for the Industry Compared With Value of Product Shipments

This industry report shows value of shipments data for industries and products. In tables 1a through 5a, these data represent the total value of shipments of all establishments classified in a particular industry. The data include the shipments of the products classified in the industry (primary to the industry), products classified in other industries (secondary to the industry), and miscellaneous receipts (repair work, sale of scrap, research and development, installation receipts, and resales). Product shipments shown in table 6a represent the total value of shipments of products classified as primary to an industry that were shipped by all manufacturing establishments regardless of their industry classification.

CENSUS DISCLOSURE RULES

In accordance with Federal law governing census reports, no data are published that would disclose the data for an individual establishment or company. However, the number of establishments classified in a specific industry is not considered a disclosure, so this item may be given even though other information is withheld.

The disclosure analysis for the industry statistics in tables 1a through 5a of this report is based on the total value of shipments. When the total value of shipments cannot be shown without disclosing information for individual companies, the complete line has been suppressed. However, the suppressed data are included in higher level totals. Additional disclosure analysis is performed for new capital expenditures that can be suppressed even though value of shipments data are publishable.

MICROFICHE AND COMPUTER TAPES

All the data in this report are available on microfiche. Selected data are also available on computer tape.

In addition to selected published data being on computer tape, one major data series, the location of manufacturing plants, will be available only on computer tape. This series presents the number of establishments by employment size class by four-digit SIC industry codes for States, counties, and places of 2,500 inhabitants or more. These data are available for both State and county by industry, and State and place by industry.

Microfiche reports are sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Computer tapes are sold by the Data User Services Division, Customer Services (Tapes), Bureau of the Census, Washington, D.C. 20233.

SPECIAL TABULATIONS

Special tabulations of data collected in the 1982 Census of Manufactures may be obtained on computer tape or in tabular form. The data will be in summary form and subject to the same rules prohibiting disclosure of confidential information (including name, address, kind of business, or other data for individual business establishments or companies) as are the regular publications.

Special tabulations are prepared on a cost basis. A request for a cost estimate, as well as exact specifications on the type and format of the data to be provided, should be directed to the Chief, Industry Division, Bureau of the Census, Washington, D.C. 20233.

ABBREVIATIONS AND SYMBOLS

The following abbreviations and symbols are used in this publication:

- Represents zero.
- (D) Withheld to avoid disclosing data for individual companies; data are included in higher level totals.
- (NA) Not available.
- (NC) Not comparable.
- (S) Withheld because estimate did not meet publication standards on the basis of either the response rate or a consistency review.
- (X) Not applicable.
- (Z) Less than half the unit shown.
- n.e.c. Not elsewhere classified.
- n.s.k. Not specified by kind.
- pt. Part.
- r Revised.
- SIC Standard Industrial Classification.

Other abbreviations, such as lb, gal, yd, doz, bbl, and s tons, are used in the customary sense.

Users' Guide for Locating Statistics

[For explanation of terms, see appendixes]

	Item	Four-digit industry statistics		
		Historical	Operating ratios	By geographic area
1	Number of companies	1 a		
2	Number of manufacturing establishments	1 a		2
	Employment and payroll:			
3	Number of employees	1 a	1 b	2
4	Payroll	1 a	1 b	2
5	Supplemental labor costs			
6	Production workers	1 a	1 b	2
7	Production-worker hours	1 a	1 b	2
8	Production-worker wages	1 a	1 b	2
	Shipments, cost of materials, and value added:			
9	Value of shipments (four-digit)	1 a	1 b	2
10	Product class shipments (five-digit)			
11	Product shipments (seven-digit)			
12	Value added by manufacture	1 a	1 b	2
13	Cost of materials	1 a	1 b	2
14	Fuels and electric energy			
15	Materials consumed by kind			
	Inventories:			
16	Total, end of year	1 a		
17	By method of valuation			
18	By stage of fabrication			
	Capital expenditures, assets, rental payments, and purchased services:			
19	New capital expenditures	1 a		2
20	Used plant and equipment expenditures			
21	Gross assets			
22	Depreciation			
23	Retirements of buildings and machinery			
24	Rental payments			
25	Purchased services			
	Ratios:			
26	Specialization	1 a		
27	Coverage	1 a		

*Number of companies with shipments of over \$100 thousand.

**Detailed information shown.

in This Report by Table Number

Four-digit industry statistics—Con.				Five-digit product class and seven-digit product statistics				
Summary and supplemental	By employment size	By industry and product class specialization	Materials consumed by kind	Industry-product analysis	Product shipments	Product class by geographic area	Historical product class	
3a					*6a			1
**3a	4	5a						2
3a	4	5a						3
3a	4	5a						4
**3d								5
**3a	4	5a						6
**3a	4	5a						7
3a	4	5a						8
3a	4	5a		5b, 5c				9
				5b, 5c	6a	6b	6c	10
					6a			11
3a	4	5a						12
**3a	4	5a						13
3a, 3d			7					14
								15
3b, 3c	4							16
3b, 3c								17
3b								18
**3a, **3d	4	5a						19
**3a, **3d								20
**3d								21
**3d								22
**3d								23
**3d								24
**3d								25
3a				5b				26
3a				5b				27

Engineering, Measuring and Controlling, and Optical Instruments

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DESCRIPTION OF INDUSTRIES AND SUMMARY OF FINDINGS

ENGINEERING, MEASURING AND CONTROLLING AND OPTICAL INSTRUMENTS

This report shows 1982 Census of Manufactures statistics for establishments classified in each of the following industries:

SIC Code and Title

- 3811 Engineering and Scientific Instruments
- 3822 Environmental Controls
- 3823 Process Control Instruments
- 3824 Fluid Meters and Counting Devices
- 3825 Instruments to Measure Electricity
- 3829 Measuring and Controlling Devices, N.E.C.
- 3832 Optical Instruments and Lenses

The industry statistics (employment, payroll, cost of materials, value of shipments, inventories, etc.) are reported for each establishment as a whole. Aggregates of such data for an industry reflect not only the primary activities of the establishments but also their activities in the manufacture of secondary products as well as their miscellaneous activities (contract work on materials owned by others, repair work, etc.). This fact should be taken into account in comparing industry statistics (tables 1a-5a) with product statistics (table 6a) showing shipments by all industries of the primary products of the specified industry. The extent of the "product mix" is indicated in table 5b, which shows the value of primary and secondary products shipped by establishments classified in the specified industry and the value of primary products of the industry shipped as secondary products by establishments classified in other industries.

Small single-unit companies with up to 20 employees (cutoff varied by industry) were excluded from the mail portion of the census. For these establishments (and a small number of larger establishments whose reports were not received at the time the data were tabulated), data on payrolls and receipts were obtained from administrative records of other government agencies. The remaining statistics were developed from industry averages.

Establishment data were tabulated based on industry definitions contained in the 1972 Standard Industrial Classification (SIC) Manual and its 1977 supplement.¹

INDUSTRY 3811, ENGINEERING AND SCIENTIFIC INSTRUMENTS

This industry comprises establishments primarily engaged in the manufacture of laboratory, scientific, and engineering instruments, such as nautical, navigational, aeronautical, surveying, and drafting; and instruments for laboratory work and scientific research (except optical instruments, in industry 3832).

¹Standard Industrial Classification Manual: 1972. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 10402. Stock No. 041-001-00066-6. 1977 Supplement. Stock No. 003-005-00176-0.

Establishments primarily engaged in the manufacture of surgical and medical instruments are classified in industry 3841; dental instruments and equipment in industry 3843; measuring, analyzing, and controlling instruments, including instruments for measuring electrical quantities and characteristics, in major industry group 382; and machinists' precision measuring tools in industry 3545.

In the 1982 Census of Manufactures, Industry 3811, Engineering and Scientific Instruments, recorded employment of 42.8 thousand. The total value of shipments for establishments classified in this industry was \$3,046 million.

The value of shipments figure shown above is in current (1982) prices. All dollar figures included in this report are at prices current for the year specified and, therefore, unadjusted for changes in price levels. Consequently, when making comparisons to prior years, users should take into consideration the inflation that has occurred.

The employment figure shown above was 1 percent above the 42.3 thousand reported in 1977. The leading States in employment in 1982 were California, Michigan, New Jersey, and Pennsylvania, accounting for approximately 40 percent of the industry's 1982 employment. This represents a shift from 1977 when California, New Jersey, Arizona, and Michigan also accounted for approximately 40 percent of the industry's employment.

Compared with 1981, employment decreased 2 percent. The 1981 data are based on the Bureau's annual survey of manufactures (ASM), which is a sample survey conducted each year between censuses.

Establishments in virtually all industries ship secondary products as well as products primary to the industry to which they are classified and have some miscellaneous receipts, such as resales and contract receipts. In current prices, industry 3811 shipped \$2,326 million of products primary to the industry, \$522 million of secondary products, and had \$198 million of miscellaneous receipts. Thus, the ratio of primary products to the total of both secondary and primary products shipped by establishments in the industry was 82 percent (specialization ratio). In 1977, this specialization ratio was 85 percent.

Establishments in this industry also accounted for 78 percent of products considered primary to the industry no matter where they actually were produced (coverage ratio). In 1977, the coverage ratio was 79 percent. The products primary to industry 3811, no matter in what industry they were produced, appear in table 6a and aggregate to \$2,964 million in current prices.

The total cost of materials and services used by establishments classified in the engineering and scientific instruments industry amounted to \$974 million in current prices. Data on specific materials consumed appear in table 7.

Establishments of single-unit companies in this industry with up to 10 employees were excluded from the mail portion of the census. The data for these establishments (and a small number of larger establishments whose reports were not received at the time the data were tabulated) were obtained from administrative

records of other agencies or developed from industry averages. These establishments accounted for 14 percent of total value of shipments.

INDUSTRY 3822, ENVIRONMENTAL CONTROLS

This industry comprises establishments primarily engaged in the manufacture of temperature and related controls for heating and air conditioning installations and refrigeration applications, which are electrically, electronically, or pneumatically actuated, and which measure and control variables, such as temperature and humidity; and automatic regulators used as components of household appliances. Establishments primarily engaged in the manufacture of industrial process controls are classified in Industry 3823, Process Control Instruments; motor control switches in Industry 3622, Industrial Controls; switches for household appliances in Industry 3643, Current-Carrying Wiring Devices; and appliance timers in Industry 3873, Watches, Clocks, and Watchcases.

In the 1982 Census of Manufactures, Industry 3822, Environmental Controls, recorded employment of 28.8 thousand. The total value of shipments for establishments classified in this industry was \$1,549 million.

The value of shipments figure shown above is in current (1982) prices. All dollar figures included in this report are at prices current for the year specified and, therefore, unadjusted for changes in price levels. Consequently, when making comparisons to prior years, users should take into consideration the inflation that has occurred.

The employment figure shown above was 26 percent below the 39.0 thousand reported in 1977. The leading States in employment in 1982 were California, Ohio, Illinois, and Minnesota, accounting for approximately 65 percent of the industry's 1982 employment. Data for Minnesota have been withheld to avoid disclosing data for individual companies. This represents a shift from 1977 when Ohio, Massachusetts, California, and Illinois accounted for approximately 60 percent of the industry's employment.

Compared with 1981, employment decreased 12 percent. The 1981 data are based on the Bureau's annual survey of manufactures (ASM), which is a sample survey conducted each year between censuses.

Establishments in virtually all industries ship secondary products as well as products primary to the industry to which they are classified and have some miscellaneous receipts, such as resales and contract receipts. In current prices, industry 3822 shipped \$1,386 million of products primary to the industry, \$119 million of secondary products, and had \$44 million of miscellaneous receipts. Thus, the ratio of primary products to the total of both secondary and primary products shipped by establishments in the industry was 92 percent (specialization ratio). In 1977, this specialization ratio was 80 percent.

Establishments in this industry also accounted for 90 percent of products considered primary to the industry no matter where they actually were produced (coverage ratio). In 1977, the coverage ratio was 92 percent. The products primary to industry 3822, no matter in what industry they were produced, appear in table 6a and aggregate to \$1,544 million in current prices.

The total cost of materials and services used by establishments classified in the environmental controls industry amounted to \$514 million in current prices. Data on specific materials consumed appear in table 7.

Establishments of single-unit companies in this industry with up to 20 employees were excluded from the mail portion of the census. The data for these establishments (and a small number of larger establishments whose reports were not received at the time the data were tabulated) were obtained from administrative records of other agencies or developed from industry averages. These establishments accounted for 9 percent of total value of shipments.

INDUSTRY 3823, PROCESS CONTROL INSTRUMENTS

This industry comprises establishments primarily engaged in the manufacture of industrial instruments and related products for measuring, displaying (indicating and/or recording), transmitting, and controlling process variables in manufacturing, energy conversion, and public service utilities. These instruments operate mechanically, pneumatically, electronically, or electrically to measure process variables, such as temperature, humidity, pressure, vacuum, combustion, flow, level, viscosity, density, acidity, alkalinity, specific gravity, gas and liquid concentration, sequence, time interval, mechanical motion, and rotation. Establishments primarily engaged in the manufacture of electrical integrating meters are classified in industry 3825; residential and commercial comfort controls in industry 3822; all liquid-in-glass and bimetal thermometers and glass hydrometers in industry 3829; recorder charts in major industry group 275; and optical instruments in industry 3832.

In the 1982 Census of Manufactures, Industry 3823, Process Control Instruments, recorded employment of 59.9 thousand. The total value of shipments for establishments classified in this industry was \$4,006 million.

The value of shipments figure shown above is in current (1982) prices. All dollar figures included in this report are at prices current for the year specified and, therefore, unadjusted for changes in price levels. Consequently, when making comparisons to prior years, users should take into consideration the inflation that has occurred.

The employment figure shown above was 29 percent above the 46.5 thousand reported in 1977. The leading States in employment in 1982 were Pennsylvania, California, Massachusetts, and New York, accounting for approximately 53 percent of the industry's 1982 employment. These same States were the leaders in 1977, when they accounted for approximately 60 percent of the industry's employment, although there has been some shift in the relative importance of individual States.

Compared with 1981, employment increased 12 percent. The 1981 data are based on the Bureau's annual survey of manufactures (ASM), which is a sample survey conducted each year between censuses.

Establishments in virtually all industries ship secondary products as well as products primary to the industry to which they are classified and have some miscellaneous receipts, such as resales and contract receipts. In current prices, industry 3823 shipped \$3,390 million of products primary to the industry, \$348 million of secondary products, and had \$268 million of miscellaneous receipts. Thus, the ratio of primary products to the total of both secondary and primary products shipped by establishments in the industry was 91 percent (specialization ratio). In 1977, this specialization ratio was 90 percent.

Establishments in this industry also accounted for 87 percent of products considered primary to the industry no matter where they actually were produced (coverage ratio). In 1977, the coverage ratio was 80 percent. The products primary to industry 3823, no matter in what industry they were produced, appear in table 6a and aggregate to \$3,915 million in current prices.

The total cost of materials and services used by establishments classified in the process control instruments industry amounted to \$1,168 million in current prices. Data on specific materials consumed appear in table 7.

Establishments of single-unit companies in this industry with up to 20 employees were excluded from the mail portion of the census. The data for these establishments (and a small number of larger establishments whose reports were not received at the time the data were tabulated) were obtained from administrative records of other agencies or developed from industry averages. These establishments accounted for 10 percent of total value of shipments.

INDUSTRY 3824, FLUID METERS AND COUNTING DEVICES

This industry comprises establishments primarily engaged in the manufacture of totalizing (registering) meters monitoring fluid flows, such as water meters and gas meters; and producers of mechanical and electromechanical counters and associated metering devices. Establishments primarily engaged in the manufacture of electricity integrating meters and electronic frequency counters are classified in industry 3825; and industrial process instruments in industry 3823.

In the 1982 Census of Manufactures, Industry 3824, Fluid Meters and Counting Devices, recorded employment of 11.0 thousand. The total value of shipments for establishments classified in this industry was \$727 million.

The value of shipments figure shown above is in current (1982) prices. All dollar figures included in this report are at prices current for the year specified and, therefore, unadjusted for changes in price levels. Consequently, when making comparisons to prior years, users should take into consideration the inflation that has occurred.

The employment figure shown above was 31 percent below the 15.9 thousand reported in 1977. The leading States in employment in 1982 were Pennsylvania, Connecticut, Wisconsin, and California, accounting for approximately 52 percent of the industry's 1982 employment. Data for Connecticut and Wisconsin have been withheld to avoid disclosing data for individual companies. This represents a shift from 1977 when Illinois, Pennsylvania, California, and Connecticut accounted for approximately 65 percent of the industry's employment.

Compared with 1981, employment decreased 28 percent. The 1981 data are based on the Bureau's annual survey of manufactures (ASM), which is a sample survey conducted each year between censuses.

Establishments in virtually all industries ship secondary products as well as products primary to the industry to which they are classified and have some miscellaneous receipts, such as resales and contract receipts. In current prices, industry 3824 shipped \$664 million of products primary to the industry, \$46 million of secondary products, and had \$18 million of miscellaneous receipts. Thus, the ratio of primary products to the total of both secondary and primary products shipped by establishments in the industry was 94 percent (specialization ratio). In 1977, this specialization ratio was 80 percent.

Establishments in this industry also accounted for 84 percent of products considered primary to the industry no matter where they actually were produced (coverage ratio). In 1977, the coverage ratio was 80 percent. The products primary to industry 3824, no matter in what industry they were produced, appear in table 6a and aggregate to \$787 million in current prices.

The total cost of materials and services used by establishments classified in the fluid meters and counting devices industry amounted to \$266 million in current prices. Data on specific materials consumed appear in table 7.

Establishments of single-unit companies in this industry with up to 20 employees were excluded from the mail portion of the census. The data for these establishments (and a small number of larger establishments whose reports were not received at the time the data were tabulated) were obtained from administrative records of other agencies or developed from industry averages. These establishments accounted for 8 percent of total value of shipments.

INDUSTRY 3825, INSTRUMENTS TO MEASURE ELECTRICITY

This industry comprises establishments primarily engaged in the manufacture of instruments for measuring the characteristics of electricity and electrical signals, such as voltmeters, ammeters, wattmeters, watt-hour meters, demand meters and equipment for testing the electrical characteristics of electrical, radio, and communication circuits, and of internal combustion engines. Establishments primarily engaged in the manufacture of electronic checkout, monitoring, evaluating, and other electronic support equipment for electronic navigational, radar, sonar, and other communications systems are classified in Industry 3662, Radio and TV Communication Equipment.

In the 1982 Census of Manufactures, Industry 3825, Instruments to Measure Electricity, recorded employment of 89.5 thousand. The total value of shipments for establishments classified in this industry was \$6,120 million.

The value of shipments figure shown above is in current (1982) prices. All dollar figures included in this report are at prices current for the year specified and, therefore, unadjusted for changes in price levels. Consequently, when making comparisons to prior years, users should take into consideration the inflation that has occurred.

The employment figure shown above was 35 percent above the 66.5 thousand reported in 1977. The leading States in employment in 1982 were California, Oregon, Massachusetts, and Colorado, accounting for approximately 54 percent of the industry's 1982 employment. Data for Colorado and Oregon have been withheld to avoid disclosing data for individual companies. This represents a shift from 1977 when California, Oregon, Illinois, and Colorado accounted for approximately 50 percent of the industry's employment.

Compared with 1981, employment decreased 5 percent. The 1981 data are based on the Bureau's annual survey of manufactures (ASM), which is a sample survey conducted each year between censuses.

Establishments in virtually all industries ship secondary products as well as products primary to the industry to which they are classified and have some miscellaneous receipts, such as resales and contract receipts. In current prices, industry 3825 shipped \$5,058 million of products primary to the industry, \$309 million of secondary products, and had \$753 million of miscellaneous receipts. Thus, the ratio of primary products to the total

of both secondary and primary products shipped by establishments in the industry was 94 percent (specialization ratio). In 1977, this specialization ratio was 90 percent.

Establishments in this industry also accounted for 91 percent of products considered primary to the industry no matter where they actually were produced (coverage ratio). In 1977, the coverage ratio was 89 percent. The products primary to industry 3825, no matter in what industry they were produced, appear in table 6a and aggregate to \$5,576 million in current prices.

The total cost of materials and services used by establishments classified in the instruments to measure electricity industry amounted to \$1,851 million in current prices. Data on specific materials consumed appear in table 7.

Establishments of single-unit companies in this industry with up to 10 employees were excluded from the mail portion of the census. The data for these establishments (and a small number of larger establishments whose reports were not received at the time the data were tabulated) were obtained from administrative records of other agencies or developed from industry averages. These establishments accounted for 7 percent of total value of shipments.

INDUSTRY 3829, MEASURING AND CONTROLLING DEVICES, N.E.C.

This industry comprises establishments primarily engaged in the manufacture of measuring and controlling devices, not elsewhere classified, including testing instruments to determine the physical properties of materials, nuclear instruments, aircraft engine instruments, and liquid-in-glass and bimetal thermometers.

In the 1982 Census of Manufactures, Industry 3829, Measuring and Controlling Devices, N.E.C., recorded employment of 37.4 thousand. The total value of shipments for establishments classified in this industry was \$2,195 million.

The value of shipments figure shown above is in current (1982) prices. All dollar figures included in this report are at prices current for the year specified and, therefore, unadjusted for changes in price levels. Consequently, when making comparisons to prior years, users should take into consideration the inflation that has occurred.

The employment figure shown above was 16 percent above the 32.3 thousand reported in 1977. The leading States in employment in 1982 were California, New York, Ohio and Illinois, accounting for approximately 49 percent of the industry's 1982 employment. This represents a shift from 1977 when California, Illinois, Pennsylvania, and Ohio accounted for approximately 55 percent of the industry's employment.

Compared with 1981, employment increased 1 percent. The 1981 data are based on the Bureau's annual survey of manufactures (ASM), which is a sample survey conducted each year between censuses.

Establishments in virtually all industries ship secondary products as well as products primary to the industry to which they are classified and have some miscellaneous receipts, such as resales and contract receipts. In current prices, industry 3829 shipped \$1,730 million of products primary to the industry, \$216 million of secondary products, and had \$249 million of miscellaneous receipts. Thus, the ratio of primary products to the total of both secondary and primary products shipped by establishments in the industry was 89 percent (specialization ratio). In 1977, this specialization ratio also was 89 percent.

Establishments in this industry also accounted for 83 percent of products considered primary to the industry no matter where they actually were produced (coverage ratio). In 1977, the coverage ratio also was 83 percent. The products primary to industry 3829, no matter in what industry they were produced, appear in table 6a and aggregate to \$2,073 million in current prices.

The total cost of materials and services used by establishments classified in the measuring and controlling devices, n.e.c., industry amounted to \$785 million in current prices. Data on specific materials consumed appear in table 7.

Establishments of single-unit companies in this industry with up to 5 employees were excluded from the mail portion of the census. The data for these establishments (and a small number of larger establishments whose reports were not received at the time the data were tabulated) were obtained from administrative records of other agencies or developed from industry averages. These establishments accounted for 13 percent of total value of shipments.

INDUSTRY 3832, OPTICAL INSTRUMENTS AND LENSES

This industry comprises establishments primarily engaged in the manufacture of instruments that measure an optical property; apparatus, except photographic, that projects or magnifies, such as binoculars, prisms, and lenses; optical sighting and fire control equipment; and related analytical instruments. Establishments primarily engaged in the manufacture of eyeglass lenses, frames, or fittings are classified in Industry 3851, Ophthalmic Goods; laboratory testing and scientific instruments are classified in industry 3811; and electronic tracking and fire control systems in industry 3662.

In the 1982 Census of Manufactures, Industry 3832, Optical Instruments and Lenses, recorded employment of 50.7 thousand. The total value of shipments for establishments classified in this industry was \$3,813 million.

The value of shipments figure shown above is in current (1982) prices. All dollar figures included in this report are at prices current for the year specified and, therefore, unadjusted for changes in price levels. Consequently, when making comparisons to prior years, users should take into consideration the inflation that has occurred.

The employment figure shown above was 68 percent above the 30.0 thousand reported in 1977. The leading States in employment in 1982 were California, Massachusetts, New York, and Connecticut, accounting for approximately 55 percent of the industry's 1982 employment. Data for Connecticut have been withheld to avoid disclosing data for individual companies. These same States were the leaders in 1977, when they accounted for approximately 60 percent of the industry's employment, although there has been some shift in the relative importance of individual States.

Compared with 1981, employment increased 17 percent. The 1981 data are based on the Bureau's annual survey of manufactures (ASM), which is a sample survey conducted each year between censuses.

Establishments in virtually all industries ship secondary products as well as products primary to the industry to which they are classified and have some miscellaneous receipts, such as resales and contract receipts. In current prices, industry 3832

shipped \$3,175 million of products primary to the industry, \$452 million of secondary products, and had \$187 million of miscellaneous receipts. Thus, the ratio of primary products to the total of both secondary and primary products shipped by establishments in the industry was 88 percent (specialization ratio). In 1977, this specialization ratio was 84 percent.

Establishments in this industry also accounted for 86 percent of products considered primary to the industry no matter where they actually were produced (coverage ratio). In 1977, the coverage ratio was 82 percent. The products primary to industry 3832, no matter in what industry they were produced, appear in table 6a and aggregate to \$3,678 million in current prices.

The total cost of materials and services used by establishments classified in the optical instruments and lenses industry amounted to \$1,432 million in current prices. Data on specific materials consumed appear in table 7.

Establishments of single-unit companies in this industry with up to 10 employees were excluded from the mail portion of the census. The data for these establishments (and a small number of larger establishments whose reports were not received at the time the data were tabulated) were obtained from administrative records of other agencies or developed from industry averages. These establishments accounted for 10 percent of total value of shipments.

Table 1a. Historical Statistics for the Industry: 1982 and Earlier Years

[Excludes data for auxiliaries. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Year ¹	Companies ² (no.)	All establishments ³		All employees		Production workers			Value added by manufacture ⁴ (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)	End-of-year inventories ⁴ (million dollars)	Ratios	
		Total (no.)	With 20 employees or more (no.)	Number (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)						Specialization (percent)	Coverage (percent)
INDUSTRY 3811, ENGINEERING AND SCIENTIFIC INSTRUMENTS															
1982 Census	738	771	272	42.8	869.1	25.9	49.8	439.9	2 101.1	974.2	3 046.2	102.8	821.9	82	78
1981 ASM	(NA)	(NA)	(NA)	43.5	816.6	27.7	54.4	428.7	1 943.3	948.6	2 864.7	115.3	689.5	(NA)	(NA)
1980 ASM	(NA)	(NA)	(NA)	44.7	781.9	28.0	57.3	401.2	1 821.3	903.7	2 667.6	108.6	675.9	(NA)	(NA)
1979 ASM	(NA)	(NA)	(NA)	42.2	662.0	26.8	53.2	336.5	1 573.9	778.0	2 290.2	79.7	576.0	(NA)	(NA)
1978 ASM	(NA)	(NA)	(NA)	46.2	662.8	27.6	54.2	327.1	1 517.8	790.9	2 244.9	64.0	576.4	(NA)	(NA)
1977 Census	740	786	279	42.3	584.4	24.7	48.7	280.7	1 287.2	681.4	1 926.7	57.4	470.1	85	79
1976 ASM	(NA)	(NA)	(NA)	43.5	575.7	25.4	51.3	262.7	1 223.8	636.7	1 846.8	44.4	449.9	(NA)	(NA)
1975 ASM	(NA)	(NA)	(NA)	46.4	561.4	26.8	54.0	261.1	1 112.1	609.0	1 780.4	40.1	434.6	(NA)	(NA)
1974 ASM	(NA)	(NA)	(NA)	46.4	520.6	28.1	55.1	249.2	1 056.5	578.5	1 587.6	41.0	477.6	(NA)	(NA)
1973 ASM	(NA)	(NA)	(NA)	41.3	429.5	25.0	48.4	211.3	818.1	456.2	1 243.8	28.3	336.1	(NA)	(NA)
1972 Census	703	743	266	36.7	358.8	22.2	43.2	183.1	653.2	361.6	1 023.4	18.8	256.5	88	72
1971 ASM	(NA)	(NA)	(NA)	44.3	401.3	26.9	52.3	204.7	685.2	408.6	1 587.1	25.3	292.1	(NA)	(NA)
1970 ASM	(NA)	(NA)	(NA)	50.5	437.3	31.3	61.9	226.9	725.3	436.9	1 180.6	23.2	277.5	(NA)	(NA)
1969 ASM	(NA)	(NA)	(NA)	47.2	384.3	29.1	58.2	198.5	661.4	421.1	1 054.8	25.7	253.2	(NA)	(NA)
1968 ASM	(NA)	(NA)	(NA)	45.2	347.3	29.1	59.2	183.5	633.1	407.5	1 031.9	26.6	230.7	(NA)	(NA)
1967 Census	642	677	282	46.1	327.1	31.4	64.0	191.2	617.4	405.5	1 000.8	21.8	218.6	88	74
INDUSTRY 3822, ENVIRONMENTAL CONTROLS															
1982 Census	221	245	89	28.8	497.5	20.6	36.2	301.9	1 025.7	514.3	1 549.1	66.8	361.7	92	90
1981 ASM	(NA)	(NA)	(NA)	32.6	527.8	23.9	45.5	337.6	991.1	588.4	1 587.1	72.6	348.3	(NA)	(NA)
1980 ASM	(NA)	(NA)	(NA)	33.2	502.3	24.8	48.9	338.1	969.5	592.2	1 541.5	60.6	344.7	(NA)	(NA)
1979 ASM	(NA)	(NA)	(NA)	35.1	474.8	26.8	52.3	325.0	872.2	511.5	1 366.2	46.3	312.8	(NA)	(NA)
1978 ASM	(NA)	(NA)	(NA)	40.0	487.1	31.4	61.5	345.0	951.5	568.7	1 492.5	49.4	308.5	(NA)	(NA)
1977 Census	182	201	91	39.0	450.3	30.6	57.9	315.6	859.6	529.4	1 358.7	47.7	285.9	80	92
1976 ASM	(NA)	(NA)	(NA)	31.5	336.6	23.3	44.1	217.3	737.2	376.8	1 071.7	21.6	227.0	(NA)	(NA)
1975 ASM	(NA)	(NA)	(NA)	26.6	274.2	18.3	34.5	164.7	526.9	275.0	827.2	11.6	183.9	(NA)	(NA)
1974 ASM	(NA)	(NA)	(NA)	33.3	303.8	24.3	45.0	193.4	594.3	338.2	916.8	26.2	209.5	(NA)	(NA)
1973 ASM	(NA)	(NA)	(NA)	33.0	288.1	25.5	48.4	191.4	606.8	281.3	857.8	18.0	176.2	(NA)	(NA)
1972 Census	117	131	62	30.7	253.6	23.3	44.5	166.4	511.8	223.8	728.1	17.1	141.3	86	90
1971 ASM	(NA)	(NA)	(NA)	30.0	241.2	21.6	40.8	150.4	449.6	218.1	659.6	19.4	139.8	(NA)	(NA)
1970 ASM	(NA)	(NA)	(NA)	32.6	242.2	23.5	44.5	151.3	441.3	209.9	649.6	17.3	132.5	(NA)	(NA)
1969 ASM	(NA)	(NA)	(NA)	33.2	243.8	24.3	48.2	155.3	451.2	210.7	653.5	20.4	141.6	(NA)	(NA)
1968 ASM	(NA)	(NA)	(NA)	32.8	229.1	23.8	47.0	145.0	462.6	211.3	672.6	15.8	130.0	(NA)	(NA)
1967 Census	88	105	54	31.4	210.8	22.6	45.2	131.1	419.7	193.9	618.0	13.2	124.6	81	94
INDUSTRY 3823, PROCESS CONTROL INSTRUMENTS															
1982 Census	584	625	288	59.9	1 243.7	29.8	57.3	476.0	2 804.3	1 167.8	4 005.8	126.9	1 071.2	91	87
1981 ASM	(NA)	(NA)	(NA)	53.6	1 013.4	28.1	55.7	421.0	2 437.7	1 088.4	3 508.6	117.1	934.7	(NA)	(NA)
1980 ASM	(NA)	(NA)	(NA)	51.2	897.4	26.6	53.1	370.2	2 049.5	986.8	2 991.6	94.2	860.0	(NA)	(NA)
1979 ASM	(NA)	(NA)	(NA)	51.4	828.1	27.1	54.5	353.0	1 895.8	875.6	2 682.1	83.5	775.3	(NA)	(NA)
1978 ASM	(NA)	(NA)	(NA)	50.6	765.6	25.5	50.8	311.0	1 609.6	764.6	2 328.5	74.1	643.6	(NA)	(NA)
1977 Census	382	426	207	46.5	664.8	23.4	47.0	265.9	1 399.4	657.1	2 022.0	52.1	555.9	90	80
1976 ASM	(NA)	(NA)	(NA)	35.6	465.0	18.1	36.3	182.5	954.0	419.5	1 357.2	35.1	393.5	(NA)	(NA)
1975 ASM	(NA)	(NA)	(NA)	40.2	528.5	18.6	37.0	180.7	819.6	423.4	1 237.9	31.1	410.4	(NA)	(NA)
1974 ASM	(NA)	(NA)	(NA)	41.6	503.4	20.1	40.6	185.1	868.7	444.0	1 245.5	31.4	421.4	(NA)	(NA)
1973 ASM	(NA)	(NA)	(NA)	40.8	441.0	20.4	41.5	169.6	739.3	338.4	1 039.1	31.9	339.0	(NA)	(NA)
1972 Census ⁵	175	192	133	35.6	342.9	18.4	37.1	146.8	620.4	271.1	883.6	27.3	271.7	86	83
INDUSTRY 3824, FLUID METERS AND COUNTING DEVICES															
1982 Census	132	144	69	11.0	197.3	6.9	13.0	109.1	459.2	266.1	726.7	27.5	171.7	94	84
1981 ASM	(NA)	(NA)	(NA)	15.2	256.8	10.3	20.2	153.7	530.0	368.0	901.1	32.2	182.8	(NA)	(NA)
1980 ASM	(NA)	(NA)	(NA)	16.5	247.9	11.3	22.2	152.7	533.6	358.6	884.0	27.8	192.4	(NA)	(NA)
1979 ASM	(NA)	(NA)	(NA)	17.8	245.5	11.9	23.6	143.2	556.7	315.0	844.2	28.6	203.1	(NA)	(NA)
1978 ASM	(NA)	(NA)	(NA)	17.0	221.6	11.8	23.4	138.4	489.4	273.9	749.9	18.0	172.0	(NA)	(NA)
1977 Census	100	111	62	15.9	197.6	11.2	22.5	118.0	429.0	231.3	650.4	19.9	148.8	80	80
1976 ASM	(NA)	(NA)	(NA)	13.8	161.5	9.5	18.3	93.5	352.1	187.3	531.7	12.8	129.4	(NA)	(NA)
1975 ASM	(NA)	(NA)	(NA)	13.4	143.9	9.2	17.9	82.4	297.0	162.9	475.0	12.7	119.9	(NA)	(NA)
1974 ASM	(NA)	(NA)	(NA)	13.2	126.0	9.4	18.8	75.0	272.4	168.3	431.5	13.2	110.7	(NA)	(NA)
1973 ASM	(NA)	(NA)	(NA)	9.7	85.3	6.6	13.5	49.5	196.6	129.1	322.7	9.6	83.7	(NA)	(NA)
1972 Census ⁵	51	61	43	8.8	76.8	5.9	11.7	43.1	180.9	108.1	296.2	7.0	65.2	90	79
INDUSTRY 3825, INSTRUMENTS TO MEASURE ELECTRICITY															
1982 Census	675	750	353	89.9	1 893.6	48.9	92.7	758.7	4 305.4	1 850.7	6 120.1	309.9	1 475.3	94	91
1981 ASM	(NA)	(NA)	(NA)	94.8	1 852.9	50.2	96.7	736.4	4 074.6	1 780.9	5 744.9	278.6	1 344.7	(NA)	(NA)
1980 ASM	(NA)	(NA)	(NA)	94.9	1 647.9	52.4	100.7	667.4	3 574.1	1 697.9	5 183.4	260.4	1 229.9	(NA)	(NA)
1979 ASM	(NA)	(NA)	(NA)	84.6	1 258.9	48.4	96.5	557.1	2 796.0	1 340.4	4 025.0	215.7	1 049.3	(NA)	(NA)
1978 ASM	(NA)	(NA)	(NA)	76.6	1 072.3	45.6	88.6	503.6	2 162.1	1 286.2	3 368.6	150.0	834.4	(NA)	(NA)
1977 Census	621	671	279	66.5	889.1	40.4	78.3	414.5	1 807.7	1 026.8	2 761.0	99.1	668.9	90	89
1976 ASM	(NA)	(NA)	(NA)	61.1	759.2	37.7	72.3	359.3	1 507.1	842.8	2 365.5	71.1	547.7	(NA)	(NA)
1975 ASM	(NA)	(NA)	(NA)	60.9	700.8	37.7	70.5	328.5	1 452.9	714.1	2 198.9	69.8	523.5	(NA)	(NA)
1974 ASM	(NA)	(NA)	(NA)	67.9	689.3	43.6	84.5	338.1	1 390.2	713.3	2 073.8	75.5	550.0	(NA)	(NA)
1973 ASM	(NA)	(NA)	(NA)	60.2	563.8	38.9	77.2	289.4	1 191.8	585.0	1 735.6	60.4	460.5	(NA)	(NA)
1972 Census	606	632	252	54.7	523.5	34.6	68.7	257.9	1 046.8	524.9	1 540.8	39.3	382.2	80	88
1971 ASM	(NA)	(NA)	(NA)	50.4	434.4	31.4	61.1	217.6	825.9	406.2	1 244.9	30.7	337.7	(NA)	(NA)
1970 ASM	(NA)	(NA)	(NA)	56.7	450.5	35.1	67.7	227.3	868.9	428.3	1 266.6	48.7	364.9	(NA)	(NA)
1969 ASM	(NA)	(NA)	(NA)	60.4	471.1	38.0	74.0	228.9	896.3	454.2	1 330.2	44.7	351.9	(NA)	(NA)
1968 ASM	(NA)	(NA)	(NA)	61.3	450.9	39.0	76.2	225.7	852.8	418.0	1 259.0	53.1	321.9	(NA)	(NA)
1967 Census	502	546	274	61.5	423.9	40.4	78.7	222.3	799.7	397.0	1 184.0	53.7	283.9	84	79

See footnotes at end of table.

Table 1a. Historical Statistics for the Industry: 1982 and Earlier Years—Con.

[Excludes data for auxiliaries. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Year ¹	All establishments ³			All employees		Production workers			Value added by manufacture ⁴ (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)	End-of-year inventories ⁴ (million dollars)	Ratios	
	Companies ² (no.)	Total (no.)	With 20 employees or more (no.)	Number (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)						Specialization (percent)	Coverage (percent)
INDUSTRY 3829, MEASURING AND CONTROLLING DEVICES, N.E.C.															
1982 Census.....	692	716	258	37.4	797.4	17.6	34.6	292.5	1 381.3	785.3	2 194.6	70.1	601.8	89	83
1981 ASM.....	(NA)	(NA)	(NA)	37.1	705.1	17.9	35.9	270.5	1 237.4	712.2	1 932.3	79.1	558.4	(NA)	(NA)
1980 ASM.....	(NA)	(NA)	(NA)	35.9	651.8	17.5	35.2	237.9	1 001.1	746.3	1 726.8	70.9	458.6	(NA)	(NA)
1979 ASM.....	(NA)	(NA)	(NA)	34.8	588.6	17.5	34.9	215.5	927.3	556.7	1 426.8	64.3	421.7	(NA)	(NA)
1978 ASM.....	(NA)	(NA)	(NA)	35.6	544.1	17.8	34.4	208.9	865.4	496.5	1 369.4	48.6	336.8	(NA)	(NA)
1977 Census.....	649	670	210	32.3	464.0	15.8	31.8	174.5	746.6	405.8	1 118.1	49.3	320.0	89	83
1976 ASM.....	(NA)	(NA)	(NA)	26.9	377.8	13.1	26.8	131.9	551.1	316.4	854.1	19.5	247.6	(NA)	(NA)
1975 ASM.....	(NA)	(NA)	(NA)	21.6	250.8	12.3	24.5	108.3	521.3	274.2	808.5	16.3	209.4	(NA)	(NA)
1974 ASM.....	(NA)	(NA)	(NA)	23.7	250.6	14.4	29.5	121.2	520.6	292.9	789.8	26.4	235.7	(NA)	(NA)
1973 ASM.....	(NA)	(NA)	(NA)	24.6	253.1	15.4	30.1	127.8	511.8	227.3	722.3	32.4	191.5	(NA)	(NA)
1972 Census ⁵	579	595	153	24.6	256.7	12.4	26.6	108.0	394.9	213.3	601.4	14.7	164.9	86	77
INDUSTRY 3832, OPTICAL INSTRUMENTS AND LENSES															
1982 Census.....	577	642	296	50.7	1 045.8	25.9	51.1	437.3	2 410.5	1 432.3	3 813.3	152.7	997.2	88	86
1981 ASM.....	(NA)	(NA)	(NA)	43.2	783.1	23.8	46.4	350.4	1 982.1	1 168.5	3 101.9	126.8	761.2	(NA)	(NA)
1980 ASM.....	(NA)	(NA)	(NA)	43.5	785.6	22.8	44.2	298.7	1 839.8	977.0	2 744.0	118.2	662.2	(NA)	(NA)
1979 ASM.....	(NA)	(NA)	(NA)	39.8	658.6	21.1	42.4	268.7	1 517.3	799.5	2 224.3	93.7	543.5	(NA)	(NA)
1978 ASM.....	(NA)	(NA)	(NA)	34.3	534.9	18.1	36.6	214.7	1 226.3	636.2	1 802.3	69.6	446.4	(NA)	(NA)
1977 Census.....	509	546	200	30.2	423.5	17.1	34.0	189.7	901.8	456.1	1 335.6	51.2	303.3	84	82
1976 ASM.....	(NA)	(NA)	(NA)	26.3	348.8	14.6	28.9	150.1	695.2	338.2	1 028.5	24.7	244.2	(NA)	(NA)
1975 ASM.....	(NA)	(NA)	(NA)	22.7	282.8	12.9	24.3	122.0	571.8	280.8	859.5	23.9	200.2	(NA)	(NA)
1974 ASM.....	(NA)	(NA)	(NA)	20.1	237.8	11.8	23.2	108.8	499.4	252.2	744.4	15.3	162.9	(NA)	(NA)
1973 ASM.....	(NA)	(NA)	(NA)	18.5	201.1	10.9	21.0	89.2	385.5	193.9	594.5	13.6	142.4	(NA)	(NA)
1972 Census.....	467	494	146	18.8	193.3	10.4	20.6	85.1	384.3	175.4	538.4	12.7	156.2	92	79
1971 ASM.....	(NA)	(NA)	(NA)	17.0	162.2	10.4	20.8	85.5	290.4	131.3	420.6	7.9	94.0	(NA)	(NA)
1970 ASM.....	(NA)	(NA)	(NA)	21.1	292.4	12.8	25.8	102.0	332.3	156.7	429.9	12.1	92.3	(NA)	(NA)
1969 ASM.....	(NA)	(NA)	(NA)	27.8	248.4	15.9	32.8	122.1	429.8	212.8	639.4	15.4	124.8	(NA)	(NA)
1968 ASM.....	(NA)	(NA)	(NA)	28.4	240.0	16.5	34.6	116.5	394.7	200.9	590.3	26.0	117.2	(NA)	(NA)
1967 Census.....	301	316	117	25.4	203.5	15.6	32.8	104.2	347.4	169.0	508.4	17.1	103.2	(NA)	(NA)

¹In annual survey of manufactures (ASM) years, data are estimates based on a representative sample of establishments canvassed annually and may differ from results of a complete canvass of all establishments. ASM publication shows percentage standard errors. Unless otherwise noted, for data prior to 1967, see 1967 Census of Manufactures, vol. II, table 1 of the Industry chapter.

²For the census, a company is defined as a business organization consisting of one establishment or more under common ownership or control.

³Includes establishments with payroll at any time during year.

⁴Effective with the 1982 Economic Censuses, uniform instructions for reporting inventories were introduced for all sector reports. Up to 1982, respondents were permitted to value inventories using any generally accepted accounting method (FIFO, LIFO, market, to name a few). In 1982, LIFO users were asked to first report inventory values prior to the LIFO adjustment and then to report the LIFO reserve and the LIFO value after adjustment for the reserve.

Because of this change in reporting instructions, the 1982 data for inventories and value added by manufacture included in the tables of this report are not comparable to the prior-year data shown above and in historical census of manufactures and annual survey of manufactures publications. Inventories and value added data estimated on a basis comparable to the historical data, using the reported information for 1982, are shown below:

Industries	End-of-1981 inventories (million dollars)	End-of-1982 inventories (million dollars)	1982 value added by manufacture (million dollars)
Industry 3811, Engineering and scientific instruments.....	753.7	776.6	2 098.1
Industry 3822, Environmental controls.....	365.6	343.7	1 028.6
Industry 3823, Process control instruments.....	1 060.3	1 010.4	2 799.5
Industry 3824, Fluid meters and counting devices.....	163.6	161.9	460.9
Industry 3825, Instruments to measure electricity.....	1 328.3	1 369.0	4 291.5
Industry 3829, Measuring and controlling devices, n.e.c.....	556.1	518.5	1 381.0
Industry 3832, Optical instruments and lenses.....	944.5	968.2	2 399.6

See Inventories in appendixes for explanation of the difference between end-of-1981 inventory figure shown in table and corresponding figure shown in footnote.

⁵Industry was defined or redefined for 1972 Census of Manufactures, so data are available only for years shown.

Table 1b. Selected Operating Ratios for the Industry: 1982 and Earlier Years

[For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Year	Payroll per employee (dollars)	Production workers as percent of total employment (percent)	Annual hours of production workers (number)	Average hourly earnings of production workers (dollars)	Cost of materials as percent of value of shipments (percent)	Cost of materials and payroll as percent of value of shipments (percent)	Value added per employee (dollars)	Payroll as percent of value added (percent)	Value added per production worker hour (dollars)
INDUSTRY 3811, ENGINEERING AND SCIENTIFIC INSTRUMENTS									
1982 Census.....	20 306	61	1 923	8.83	32	61	49 091	41	42.19
1981 ASM.....	18 772	64	1 964	7.88	33	62	44 674	42	35.72
1980 ASM.....	17 492	63	2 046	7.00	34	63	40 745	43	31.79
1979 ASM.....	15 687	64	1 985	6.33	34	63	37 296	42	29.58
1978 ASM.....	14 346	60	1 964	6.04	35	65	32 853	44	28.00
1977 Census.....	13 816	58	1 972	5.76	35	66	30 430	45	26.43
1976 ASM.....	13 234	58	2 020	5.12	34	66	28 133	47	23.86
1975 ASM.....	12 099	58	2 015	4.84	34	66	23 968	50	20.59
1974 ASM.....	11 220	61	1 961	4.52	36	69	22 769	49	19.17
1973 ASM.....	10 400	61	1 936	4.37	37	71	19 809	52	16.90

See footnotes at end of table.

Table 1b. Selected Operating Ratios for the Industry: 1982 and Earlier Years—Con.

[For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Year	Payroll per employee (dollars)	Production workers as percent of total employment (percent)	Annual hours of production workers (number)	Average hourly earnings of production workers (dollars)	Cost of materials as percent of value of shipments (percent)	Cost of materials and payroll as percent of value of shipments (percent)	Value added per employee (dollars)	Payroll as percent of value added (percent)	Value added per production worker hour (dollars)
INDUSTRY 3811, ENGINEERING AND SCIENTIFIC INSTRUMENTS—Con.									
1972 Census.....	9 777	60	1 946	4.24	35	70	17 798	55	15.12
1971 ASM.....	9 059	61	1 944	3.91	37	73	15 467	59	13.10
1970 ASM.....	8 659	62	1 978	3.67	37	74	14 362	60	11.72
1969 ASM.....	8 142	62	2 000	3.41	40	76	14 013	58	11.36
1968 ASM.....	7 684	64	2 034	3.10	39	73	14 007	55	10.69
1967 Census.....	7 095	68	2 038	2.99	41	73	13 393	53	9.65
INDUSTRY 3822, ENVIRONMENTAL CONTROLS									
1982 Census.....	17 274	72	1 757	8.34	33	65	35 615	49	28.33
1981 ASM.....	16 190	73	1 904	7.42	37	70	30 402	53	21.78
1980 ASM.....	15 130	75	1 972	6.91	38	71	29 202	52	19.83
1979 ASM.....	13 527	76	1 951	6.21	37	72	24 849	54	16.68
1978 ASM.....	12 177	78	1 959	5.61	38	71	23 787	51	15.47
1977 Census.....	11 546	78	1 892	5.45	39	72	22 041	52	14.85
1976 ASM.....	10 686	74	1 893	4.93	35	67	23 403	46	16.72
1975 ASM.....	10 308	69	1 885	4.77	33	66	19 808	52	15.27
1974 ASM.....	9 123	73	1 852	4.30	37	70	17 847	51	13.21
1973 ASM.....	8 730	77	1 898	3.95	33	66	18 388	47	12.54
1972 Census.....	8 261	76	1 910	3.74	31	66	16 671	50	11.50
1971 ASM.....	8 040	72	1 889	3.69	33	70	14 987	54	11.02
1970 ASM.....	7 429	72	1 894	3.40	32	70	13 537	55	9.92
1969 ASM.....	7 343	73	1 984	3.22	32	70	13 590	54	9.36
1968 ASM.....	6 985	73	1 975	3.09	31	65	14 104	50	9.84
1967 Census.....	6 713	72	2 000	2.90	31	65	13 366	50	9.29
INDUSTRY 3823, PROCESS CONTROL INSTRUMENTS									
1982 Census.....	20 763	50	1 923	8.31	29	60	46 816	44	48.94
1981 ASM.....	18 907	52	1 982	7.56	31	60	45 479	42	43.76
1980 ASM.....	17 527	52	1 996	6.97	33	63	40 029	44	38.60
1979 ASM.....	16 111	53	2 011	6.48	33	64	36 883	44	34.79
1978 ASM.....	15 130	50	1 992	6.12	33	66	31 810	48	31.69
1977 Census.....	14 297	50	2 009	5.66	32	65	30 095	48	29.77
1976 ASM.....	13 062	51	2 006	5.03	31	65	26 798	49	26.28
1975 ASM.....	13 147	46	1 989	4.88	34	77	20 388	64	22.15
1974 ASM.....	12 101	48	2 020	4.56	36	76	20 882	58	21.40
1973 ASM.....	10 809	50	2 034	4.09	33	75	18 120	60	17.81
1972 Census.....	9 632	52	2 016	3.96	31	69	17 427	55	16.72
INDUSTRY 3824, FLUID METERS AND COUNTING DEVICES									
1982 Census.....	17 936	63	1 884	8.39	37	64	41 745	43	35.32
1981 ASM.....	16 895	68	1 961	7.61	41	69	34 868	48	26.24
1980 ASM.....	15 024	68	1 965	6.88	41	69	32 339	46	24.04
1979 ASM.....	13 792	67	1 983	6.07	37	66	31 275	44	23.59
1978 ASM.....	13 035	69	1 983	5.91	37	66	28 788	45	20.91
1977 Census.....	12 428	70	2 009	5.24	36	66	26 981	46	19.07
1976 ASM.....	11 703	69	1 926	5.11	35	66	25 514	46	19.24
1975 ASM.....	10 739	69	1 946	4.60	34	65	22 164	48	16.59
1974 ASM.....	9 545	71	2 000	3.99	39	68	20 636	46	14.49
1973 ASM.....	8 794	68	2 045	3.67	40	66	20 268	43	14.56
1972 Census.....	8 727	67	1 983	3.68	36	62	20 557	42	15.46
INDUSTRY 3825, INSTRUMENTS TO MEASURE ELECTRICITY									
1982 Census.....	21 063	54	1 896	8.18	30	61	47 891	44	46.44
1981 ASM.....	19 545	53	1 926	7.62	31	63	42 981	45	42.14
1980 ASM.....	17 365	55	1 922	6.63	33	65	37 662	46	35.49
1979 ASM.....	14 881	57	1 994	5.77	33	65	33 050	45	28.97
1978 ASM.....	13 999	60	1 943	5.68	38	70	28 226	50	24.40
1977 Census.....	13 370	61	1 938	5.29	37	69	27 183	49	23.09
1976 ASM.....	12 426	62	1 918	4.97	36	68	24 666	50	20.85
1975 ASM.....	11 507	62	1 870	4.66	32	64	23 857	48	20.61
1974 ASM.....	10 152	64	1 938	4.00	34	68	20 474	50	16.45
1973 ASM.....	9 365	65	1 985	3.75	34	66	19 797	47	15.44
1972 Census.....	9 570	63	1 986	3.75	34	68	19 137	50	15.24
1971 ASM.....	8 619	62	1 946	3.56	33	68	16 387	53	13.52
1970 ASM.....	7 945	62	1 929	3.36	34	69	15 325	52	12.83
1969 ASM.....	7 800	63	1 947	3.09	34	70	14 839	53	12.11
1968 ASM.....	7 356	64	1 954	2.96	33	69	13 912	53	11.19
1967 Census.....	6 893	66	1 948	2.82	34	69	13 003	53	10.16
INDUSTRY 3829, MEASURING AND CONTROLLING DEVICES, N.E.C.									
1982 Census.....	21 321	47	1 966	8.45	36	72	36 933	58	39.92
1981 ASM.....	19 005	48	2 006	7.53	6	12	33 353	57	34.47
1980 ASM.....	18 156	49	2 011	6.76	43	81	27 886	65	28.44
1979 ASM.....	16 914	50	1 994	6.17	39	80	26 647	63	26.57
1978 ASM.....	15 284	50	1 933	6.07	36	76	24 309	63	25.16
1977 Census.....	14 365	49	2 013	5.49	36	78	23 115	62	23.48
1976 ASM.....	14 045	49	2 046	4.92	37	81	20 487	69	20.56
1975 ASM.....	11 611	57	1 992	4.42	34	65	24 134	48	21.28
1974 ASM.....	10 574	61	2 049	4.11	37	69	21 966	48	17.65
1973 ASM.....	10 289	63	1 955	4.25	31	67	20 805	49	17.00
1972 Census.....	10 435	50	2 145	4.06	35	78	16 053	65	14.85

See footnotes at end of table.

Table 1b. Selected Operating Ratios for the Industry: 1982 and Earlier Years—Con.

[For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Year	Payroll per employee (dollars)	Production workers as percent of total employment (percent)	Annual hours of production workers (number)	Average hourly earnings of production workers (dollars)	Cost of materials as percent of value of shipments (percent)	Cost of materials and payroll as percent of value of shipments (percent)	Value added per employee (dollars)	Payroll as percent of value added (percent)	Value added per production worker hour (dollars)
INDUSTRY 3832, OPTICAL INSTRUMENTS AND LENSES									
1982 Census	20 627	51	1 973	8.56	38	65	47 544	43	47.17
1981 ASM	18 127	55	1 950	7.55	38	63	45 882	40	42.72
1980 ASM	18 060	52	1 939	6.76	36	64	42 294	43	41.62
1979 ASM	16 548	53	2 009	6.34	36	66	38 123	43	35.79
1978 ASM	15 595	53	2 022	5.87	35	65	35 752	44	33.51
1977 Census	14 040	56	1 988	5.60	34	66	29 913	47	26.71
1976 ASM	13 262	56	1 979	5.19	33	67	26 433	50	24.06
1975 ASM	12 458	57	1 884	5.02	33	66	25 189	49	23.53
1974 ASM	11 831	59	1 966	4.69	34	66	24 846	48	21.53
1973 ASM	10 870	59	1 927	4.25	33	66	20 838	52	18.36
1972 Census	10 282	55	1 981	4.13	33	68	20 441	50	18.66
1971 ASM	9 541	61	2 000	4.11	31	70	17 082	56	13.96
1970 ASM	13 858	61	2 016	3.95	32	91	15 749	88	12.88
1969 ASM	8 935	57	2 063	3.72	33	72	15 460	58	13.10
1968 ASM	8 451	58	2 097	3.37	34	75	13 898	61	11.41
1967 Census	8 012	61	2 103	3.18	33	73	13 677	59	10.59

Note: For qualifications of data, see footnotes on table 1a.

Table 2. Industry Statistics for Selected States: 1982 and 1977

[Excludes data for auxiliaries. Includes data for States with 150 employees or more. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Industry and geographic area	1982											1977		
	E ¹	All establishments ²		All employees		Production workers			Value added by manufacture ⁴ (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)	All employees ³ (1,000)	Value added by manufacture (million dollars)
		Total (no.)	With 20 employees or more (no.)	Number ³ (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)						
INDUSTRY 3811, ENGINEERING AND SCIENTIFIC INSTRUMENTS														
United States	E1	771	272	42.8	869.1	25.9	49.8	439.9	2 101.1	974.2	3 046.2	102.8	42.3	1 287.2
Arizona	-	11	4	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	FF	(D)
Arkansas	-	5	3	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
California	E1	158	54	5.7	124.9	3.3	6.6	59.5	301.2	132.9	439.0	23.2	5.7	183.5
Colorado	E2	16	2	.2	2.6	.1	.2	1.3	5.8	2.7	8.6	.2	.3	6.2
Connecticut	-	22	11	1.1	21.9	.7	1.3	10.8	62.9	28.0	91.9	(D)	1.0	31.8
Delaware	-	3	1	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	CC	(D)
Florida	E1	32	7	1.6	23.5	1.2	2.0	15.5	93.6	48.0	134.5	2.0	1.0	26.0
Illinois	E1	38	17	1.6	31.7	1.0	1.7	14.6	71.6	43.7	114.9	1.5	2.6	88.4
Indiana	E2	7	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.4	7.1
Iowa	E1	5	2	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.8	20.0
Kansas	E5	9	5	.6	8.5	.4	.8	4.9	13.6	7.7	21.6	.5	.5	10.4
Louisiana	-	9	5	.6	14.8	.3	.6	4.8	42.3	16.6	59.2	2.3	(NA)	(NA)
Maine	-	4	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.3	7.3
Maryland	E2	22	4	.3	4.9	.2	.4	2.7	9.6	5.0	14.7	.5	.7	23.8
Massachusetts	-	56	21	2.8	61.0	1.7	3.6	35.0	127.0	59.3	178.6	6.2	2.9	87.9
Michigan	E1	34	15	4.3	92.4	3.0	5.9	63.7	173.6	69.6	249.4	9.4	3.4	85.0
Minnesota	E1	9	5	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.7	29.5
Missouri	-	6	2	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.3	8.5
Nevada	-	3	1	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
New Hampshire	E3	6	2	.2	3.2	.1	.2	2.4	7.0	5.0	12.0	.4	(NA)	(NA)
New Jersey	E2	49	21	3.9	89.3	2.1	4.5	41.0	132.0	99.2	241.5	3.9	3.9	118.2
New York	E1	63	22	2.1	37.8	1.3	2.6	16.9	81.6	47.9	128.7	2.1	1.9	56.4
North Carolina	-	5	2	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Ohio	-	30	6	.7	11.9	.4	.7	5.5	24.9	15.4	39.8	.8	1.2	29.4
Pennsylvania	-	39	20	3.4	66.1	2.4	4.6	43.1	170.0	92.0	252.3	7.7	2.4	78.6
Tennessee	E2	8	3	.3	4.6	.2	.2	1.8	5.7	5.3	11.1	(D)	CC	(D)
Texas	E4	40	11	1.0	19.8	.6	1.1	9.9	44.9	18.8	63.8	2.5	1.2	30.6
Virginia	-	8	3	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.3	9.0
Washington	-	12	3	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	EE	(D)
Wisconsin	-	15	5	2.5	41.7	1.1	1.8	16.2	73.7	34.7	111.0	3.6	FF	(D)

See footnotes at end of table.

Table 2. Industry Statistics for Selected States: 1982 and 1977—Con.

[Excludes data for auxiliaries. Includes data for States with 150 employees or more. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Industry and geographic area	1982											1977		
	E ¹	All establishments ²		All employees		Production workers			Value added by manufacture* (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)	All employees ² (1,000)	Value added by manufacture (million dollars)
		Total (no.)	With 20 employees or more (no.)	Number ³ (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)						
INDUSTRY 3822, ENVIRONMENTAL CONTROLS														
United States -----	-	245	89	28.8	497.5	20.6	36.2	301.9	1 025.7	514.3	1 549.1	66.8	39.0	859.6
Alabama-----	-	4	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
California-----	E3	39	15	4.9	85.9	3.3	5.7	47.7	157.6	77.7	244.0	12.8	5.2	113.7
Connecticut-----	-	4	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.6	10.7
Georgia-----	-	4	2	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Illinois-----	-	12	7	4.5	83.7	2.7	4.7	46.9	150.8	102.1	255.3	6.9	4.9	133.6
Indiana-----	-	6	4	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	2.0	35.7
Iowa-----	-	3	1	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Kentucky-----	-	3	2	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	EE	(D)
Massachusetts-----	-	9	3	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	5.6	118.0
Michigan-----	-	13	4	.3	5.0	.2	.5	2.9	14.0	11.1	25.9	.2	(NA)	(NA)
Minnesota-----	-	9	2	FF	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	FF	(D)
Missouri-----	-	6	4	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	EE	(D)
New Jersey-----	E1	11	4	.2	3.0	.1	.2	1.7	6.3	4.3	10.8	.1	.2	3.6
New York-----	E1	13	2	.6	6.2	.5	.7	4.5	11.1	13.3	24.3	(D)	.5	8.3
North Carolina-----	E4	5	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Ohio-----	-	24	12	4.7	61.5	4.0	6.2	45.9	138.3	58.3	195.9	12.6	6.9	121.2
Pennsylvania-----	-	12	2	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	2.1	33.2
Rhode Island-----	-	3	3	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	CC	(D)
South Carolina-----	-	1	1	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Virginia-----	-	2	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Wisconsin-----	-	7	3	.5	9.2	.3	.6	5.5	15.9	13.2	30.2	1.5	(NA)	(NA)
INDUSTRY 3823, PROCESS CONTROL INSTRUMENTS														
United States -----	E1	625	288	59.9	1 243.7	29.8	57.3	476.0	2 804.3	1 167.8	4 005.8	126.9	46.5	1 399.4
Alabama-----	-	5	3	.2	3.0	.1	.2	1.6	6.0	2.4	8.5	.2	(NA)	(NA)
Arizona-----	-	8	5	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
California-----	-	142	50	8.1	173.5	3.9	7.1	60.3	354.9	190.6	556.1	19.7	5.5	194.4
Colorado-----	-	15	8	.8	16.7	.3	.6	4.6	46.4	13.7	58.4	3.4	.2	9.1
Connecticut-----	-	28	14	3.7	70.6	2.0	3.6	31.3	150.8	57.5	207.7	4.5	2.7	83.2
Florida-----	-	14	6	.4	6.3	.2	.4	2.3	14.5	7.8	22.3	.2	.3	7.1
Illinois-----	-	32	16	4.2	74.0	2.7	5.0	39.5	141.5	65.6	210.8	7.6	3.2	80.1
Indiana-----	E1	13	7	.7	11.0	.3	.6	4.5	24.5	10.2	35.1	.7	CC	(D)
Iowa-----	-	4	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	EE	(D)
Kansas-----	-	3	3	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Kentucky-----	-	1	1	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Louisiana-----	-	5	4	.6	9.1	.4	.7	5.3	15.7	11.0	26.8	.8	BB	(D)
Maryland-----	E3	10	3	.2	4.7	.1	.2	2.5	11.3	4.9	16.3	.4	(NA)	(NA)
Massachusetts-----	-	43	26	6.7	112.0	3.8	7.1	51.8	426.8	142.8	566.4	11.5	7.1	181.8
Michigan-----	-	21	6	.4	9.5	.2	.5	5.1	18.1	7.5	25.8	1.0	.2	10.4
Minnesota-----	-	14	6	FF	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	1.6	56.1
New Jersey-----	-	33	13	1.2	21.2	.6	1.4	8.5	47.5	25.3	71.3	1.4	.8	26.7
New York-----	E1	36	20	5.2	106.9	2.3	4.4	36.3	204.1	78.8	287.7	(D)	4.2	128.4
North Carolina-----	E1	8	3	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Ohio-----	-	28	18	2.8	63.2	1.5	2.7	23.3	154.4	57.3	214.9	(D)	3.2	85.8
Oklahoma-----	-	13	8	1.6	39.3	.7	1.2	12.0	77.3	27.1	100.9	7.9	1.0	26.4
Pennsylvania-----	-	43	23	11.5	262.6	5.3	10.9	101.0	559.3	217.8	783.6	20.9	10.1	330.2
South Carolina-----	-	2	1	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Tennessee-----	-	4	1	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Texas-----	E1	39	20	2.5	55.5	1.2	2.4	21.2	121.0	63.2	180.8	5.4	1.4	43.4
Virginia-----	-	5	2	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
Washington-----	-	8	4	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
West Virginia-----	-	1	1	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Wisconsin-----	-	9	3	.2	4.1	.1	.2	1.7	10.0	4.1	13.7	.2	AA	(D)
INDUSTRY 3824, FLUID METERS AND COUNTING DEVICES														
United States -----	-	144	69	11.0	197.3	6.9	13.0	109.1	459.2	266.1	726.7	27.5	15.9	429.0
Alabama-----	-	4	3	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Arkansas-----	-	3	2	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
California-----	E1	24	8	.6	12.3	.5	.8	7.6	20.9	14.1	34.7	1.0	2.0	68.3
Colorado-----	-	3	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	CC	(D)
Connecticut-----	-	12	10	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	1.3	24.1
Georgia-----	-	3	2	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Illinois-----	-	6	5	.4	8.7	.2	.4	3.9	22.2	14.2	37.4	(D)	3.4	64.9
Massachusetts-----	-	3	1	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.2	4.1
Nebraska-----	-	2	1	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
New Jersey-----	E1	12	2	.2	4.2	.1	.2	1.8	7.4	4.9	12.2	.7	.5	14.2
North Carolina-----	-	1	1	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Pennsylvania-----	-	9	9	2.6	50.6	1.8	3.4	31.6	140.4	67.2	207.8	8.3	3.3	113.1
South Carolina-----	-	2	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	CC	(D)
Texas-----	E3	7	4	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.3	9.0
Virginia-----	-	2	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Wisconsin-----	-	4	3	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	EE	(D)

See footnotes at end of table.

Table 2. Industry Statistics for Selected States: 1982 and 1977—Con.

[Excludes data for auxiliaries. Includes data for States with 150 employees or more. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Industry and geographic area	1982										1977			
	E1	All establishments ²		All employees		Production workers			Value added by manufacture ⁴ (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)	All employees ³ (1,000)	Value added by manufacture (million dollars)
		Total (no.)	With 20 employees or more (no.)	Number ³ (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)						
INDUSTRY 3825, INSTRUMENTS TO MEASURE ELECTRICITY														
United States	-	750	353	89.9	1 893.6	48.9	92.7	758.7	4 305.4	1 850.7	6 120.1	309.9	66.5	1 807.7
Arizona	-	11	4	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
California	-	216	105	20.4	486.2	10.9	21.1	196.9	1 077.5	443.3	1 517.5	72.3	13.0	433.8
Colorado	-	16	5	FF	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	FF	(D)
Connecticut	E1	27	15	1.4	21.8	.8	1.7	9.2	50.9	26.9	77.1	2.4	1.0	24.8
Florida	E1	16	3	.5	7.3	.3	.6	3.6	16.5	6.3	23.2	1.2	.3	5.5
Georgia	-	2	1	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Illinois	-	32	17	3.2	55.1	1.7	2.8	22.1	129.0	138.9	270.6	10.6	5.4	152.1
Indiana	-	13	7	2.2	35.3	1.5	3.1	20.7	76.6	31.3	102.7	4.7	1.9	42.6
Kansas	E1	4	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
Maryland	-	14	9	.7	12.7	.5	1.0	6.8	28.2	13.1	40.6	.8	(NA)	(NA)
Massachusetts	-	42	25	8.2	172.2	4.0	7.6	68.3	350.5	177.3	547.2	49.9	4.2	131.1
Michigan	-	30	15	1.6	31.7	.8	1.6	14.5	67.9	45.1	111.0	2.0	1.6	49.3
Minnesota	-	14	7	1.8	39.0	.9	1.7	14.6	83.3	28.9	107.7	9.5	.2	5.4
Missouri	-	8	3	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Nevada	-	3	3	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	CC	(D)
New Hampshire	-	14	10	3.4	63.7	2.3	4.1	36.5	139.0	53.4	191.3	7.9	FF	(D)
New Jersey	-	38	19	4.7	110.4	2.2	4.4	39.4	217.4	122.0	327.2	8.8	3.5	107.9
New York	-	65	30	4.7	94.2	2.4	4.8	37.1	209.9	93.7	300.3	(D)	3.5	103.0
North Carolina	-	10	1	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	EE	(D)
Ohio	E1	34	17	FF	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	3.0	68.0
Oklahoma	E1	9	3	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Oregon	-	5	1	FF	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	FF	(D)
Pennsylvania	E2	32	12	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	1.6	37.5
Rhode Island	-	5	4	.4	9.0	.2	.4	2.1	17.3	6.8	23.9	.7	BB	(D)
South Carolina	-	2	1	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	CC	(D)
South Dakota	-	1	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
Texas	-	30	10	1.5	26.9	.8	1.3	10.2	51.0	34.0	82.9	2.1	1.2	35.1
Virginia	E3	8	4	.2	3.5	.1	.2	1.6	9.7	4.4	13.8	.4	CC	(D)
Washington	E2	14	8	FF	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	EE	(D)
Wisconsin	-	13	7	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.6	6.6
INDUSTRY 3829, MEASURING AND CONTROLLING DEVICES, N.E.C.														
United States	E1	716	258	37.4	797.4	17.6	34.6	292.5	1 381.3	785.3	2 194.6	70.1	32.3	746.6
California	-	130	33	8.8	211.1	2.3	4.6	46.6	260.8	151.3	418.8	9.0	9.1	118.9
Colorado	-	18	5	.5	10.2	.3	.5	4.3	17.6	10.1	27.7	.8	(NA)	(NA)
Connecticut	-	29	11	2.2	45.1	1.1	2.4	17.2	90.6	48.7	138.0	2.4	2.0	55.1
Florida	-	18	6	.5	7.7	.3	.6	3.5	21.0	10.1	30.5	1.4	.2	3.6
Illinois	-	38	19	3.0	66.1	1.4	3.0	25.6	129.9	101.7	235.5	(D)	3.2	101.4
Maryland	-	10	3	.2	3.0	.1	.2	1.5	5.4	2.8	8.1	.1	(NA)	(NA)
Massachusetts	-	46	15	2.9	69.6	1.4	2.9	29.9	114.6	58.6	175.4	5.6	2.2	66.6
Michigan	-	39	15	1.2	26.7	.6	1.2	10.8	43.5	24.1	67.7	1.4	.8	25.7
Minnesota	E1	6	3	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
New Jersey	-	33	18	1.1	21.5	.7	1.2	8.1	41.8	27.2	71.6	1.0	1.1	31.3
New Mexico	E1	6	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
New York	-	66	35	3.4	67.9	2.0	3.7	29.4	115.3	85.8	201.0	(D)	2.5	55.8
North Carolina	-	8	4	1.1	18.7	.6	1.0	5.7	46.6	16.3	60.7	(D)	CC	(D)
Ohio	-	46	19	3.3	72.1	1.3	2.5	19.7	113.6	66.3	179.9	(D)	2.9	77.0
Pennsylvania	-	34	18	2.6	49.5	1.7	2.9	28.5	95.9	42.4	144.0	3.2	3.2	86.9
Tennessee	-	9	4	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
Texas	-	65	22	2.2	41.2	1.4	2.9	24.3	90.5	58.0	151.9	14.0	.9	33.3
Vermont	-	2	1	EE	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	CC	(D)
Washington	-	15	4	.5	9.5	.2	.4	4.0	19.3	7.1	26.2	(D)	(NA)	(NA)
Wisconsin	E2	16	5	.3	4.3	.2	.3	2.3	7.3	4.5	11.8	.6	.3	8.7
INDUSTRY 3832, OPTICAL INSTRUMENTS AND LENSES														
United States	E1	642	296	50.7	1 045.8	25.9	51.1	437.3	2 410.5	1 432.3	3 813.3	152.7	30.2	901.8
California	-	169	81	11.4	255.9	5.7	11.3	101.0	673.5	383.3	1 068.1	42.7	5.7	192.6
Colorado	-	10	6	.6	11.6	.4	.7	5.6	25.7	12.4	36.9	1.0	.6	13.2
Connecticut	-	20	10	FF	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	FF	(D)
Florida	-	22	9	2.6	37.9	1.4	3.0	21.5	97.3	71.9	171.5	4.4	.3	8.5
Georgia	E8	3	1	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Illinois	-	31	12	1.8	40.6	1.1	2.0	16.7	88.8	51.3	138.9	2.5	1.4	38.2
Indiana	-	7	4	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
Iowa	-	2	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Maryland	E1	17	7	.7	15.0	.6	1.2	10.0	25.1	19.7	45.0	2.1	.5	11.1
Massachusetts	-	64	38	8.3	183.1	3.3	6.3	59.1	347.3	217.0	568.1	28.6	4.9	136.7
Michigan	-	14	3	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.7	25.3
Minnesota	-	11	3	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)
Mississippi	-	3	3	.3	4.1	.2	.4	2.6	5.8	3.2	9.1	(D)	.3	4.1
Missouri	-	5	3	.2	3.0	.1	.2	1.6	5.8	4.5	9.7	(D)	(NA)	(NA)
Nebraska	-	2	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
New Hampshire	-	11	5	FF	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	EE	(D)
New Jersey	-	31	13	1.2	25.6	.7	1.3	12.3	56.0	30.3	86.2	4.7	.7	17.3
New York	-	75	25	4.5	88.6	1.9	3.9	33.4	163.1	102.2	230.4	8.1	4.3	129.4
North Carolina	E1	5	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Ohio	E2	17	11	2.0	42.5	1.2	2.3	18.1	82.9	33.4	116.7	4.9	CC	(D)

See footnotes at end of table.

Table 2. Industry Statistics for Selected States: 1982 and 1977—Con.

[Excludes data for auxiliaries. Includes data for States with 150 employees or more. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Industry and geographic area	1982										1977		
	All establishments ²		All employees		Production workers			Value added by manufacture ⁴ (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)	All employees ³ (1,000)	Value added by manufacture (million dollars)
	E ¹	Total (no.)	With 20 employees or more (no.)	Number ³ (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)						
INDUSTRY 3832, OPTICAL INSTRUMENTS AND LENSES—Con.													
Oregon	--	8	5	CC	(D)	(D)	(D)	(D)	(D)	(D)	(D)	BB	(D)
Pennsylvania	--	34	20	2.7	55.7	1.3	2.6	21.3	104.1	62.1	168.8	4.4	1.5
South Carolina	--	1	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)	(NA)
Texas	--	25	16	2.8	51.7	1.7	3.2	23.5	129.9	61.3	189.9	10.1	1.5
Virginia	--	8	2	BB	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Washington	E3	9	2	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(NA)
Wisconsin	--	7	1	AA	(D)	(D)	(D)	(D)	(D)	(D)	(D)	AA	(D)

Note: For qualifications of data, see footnotes on table 1a.

¹Payroll and sales data for some small single-unit companies with up to 20 employees (cutoff varied by industry) were obtained from administrative records of other government agencies rather than from census report forms. These data were then used in conjunction with industry averages to estimate the items shown for these small establishments. This technique was also used for a small number of other establishments whose reports were not received at time data were tabulated. The following symbols are shown for those States where estimated data based on administrative records data account for 10 percent or more of figures shown: E1—10 to 19 percent; E2—20 to 29 percent; E3—30 to 39 percent; E4—40 to 49 percent; E5—50 to 59 percent; E6—60 to 69 percent; E7—70 to 79 percent; E8—80 to 89 percent; E9—90 percent or more.

²Includes establishments with payroll at any time during year.

³Statistics for some producing States have been withheld to avoid disclosing data for individual companies. However, for States with 150 employees or more, number of establishments is shown and employment size range is indicated by one of the following symbols: AA—150 to 249 employees; BB—250 to 499 employees; CC—500 to 999 employees; EE—1,000 to 2,499 employees; FF—2,500 employees or more.

⁴Beginning in 1982, all respondents were requested to report their inventories at cost or market prior to adjustment to LIFO cost. This is a change from prior years in which respondents were permitted to value their inventories using any generally accepted accounting method. Consequently, data for inventories and value added by manufacture are not comparable to prior-year data.

Table 3a. Summary Statistics for the Industry: 1982

[For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Item	Engineering and scientific instruments (SIC 3811)	Environmental controls (SIC 3822)	Process control instruments (SIC 3823)	Fluid meters and counting devices (SIC 3824)	Instruments to measure electricity (SIC 3825)	Measuring and controlling devices, n.e.c. (SIC 3829)	Optical instruments and lenses (SIC 3832)
Companies ¹ number..	738	221	584	132	675	692	577
All establishments ² do..	771	245	625	144	750	716	642
With 1 to 19 employees..... do..	499	156	337	75	397	458	346
With 20 to 99 employees..... do..	184	44	175	40	199	182	189
With 100 employees or more..... do..	88	45	113	29	154	76	107
All employees:							
Average for year..... 1,000..	42.8	28.8	59.9	11.0	89.9	37.4	50.7
Annual payroll ³ mil. dol..	869.1	497.5	1 243.7	197.3	1 893.6	797.4	1 045.8
Production workers:							
Average for year..... 1,000..	25.9	20.6	29.8	6.9	48.9	17.6	25.9
March..... do..	26.6	22.8	31.3	7.4	50.3	18.5	26.5
May..... do..	26.2	20.2	31.3	7.2	49.9	17.9	25.9
August..... do..	25.4	19.9	29.2	6.6	48.3	17.1	25.8
November..... do..	25.3	19.3	27.4	6.5	47.3	16.8	25.3
Hours..... millions..	49.8	36.2	57.3	13.0	92.7	34.6	51.1
January to March..... do..	12.9	9.6	15.3	3.7	23.5	9.0	13.0
April to June..... do..	12.7	9.3	15.1	3.4	23.8	8.9	13.0
July to September..... do..	12.1	8.6	13.8	2.9	22.9	8.4	12.7
October to December..... do..	12.2	8.7	13.2	3.1	22.5	8.4	12.2
Wages..... mil. dol..	439.9	301.9	476.0	109.1	758.7	292.5	437.3
Value added by manufacture ⁴ do..	2 101.1	1 025.7	2 804.3	459.2	4 305.4	1 381.3	2 410.5
Cost of materials, etc. ⁵ do..	974.2	514.3	1 167.8	266.1	1 850.7	785.3	1 432.3
Materials, parts, containers, etc., consumed..... do..	846.7	463.9	1 026.0	247.1	1 576.0	697.3	1 249.8
Resales..... do..	59.3	23.2	62.5	5.3	143.3	41.1	81.1
Fuels consumed ⁶ do..	7.0	5.9	8.6	3.0	13.6	5.0	8.0
Purchased electric energy ⁷ do..	22.7	15.0	30.2	6.8	45.8	19.7	31.9
Contract work..... do..	38.4	6.3	40.5	3.9	72.0	22.1	61.5
Value of shipments, including resales..... do..	3 046.2	1 549.1	4 005.8	726.7	6 120.1	2 194.6	3 813.3
Value of resales..... do..	89.8	36.2	95.3	9.7	497.6	86.0	111.2
Manufacturers' inventories (see tables 3b and 3c)							
Capital expenditures for plant and equipment ⁸ do..	107.6	67.4	142.3	28.2	330.3	76.5	171.9
New capital expenditures..... do..	102.8	66.8	126.9	27.5	309.9	70.1	152.7
New buildings and other structures..... do..	27.7	16.9	28.5	2.4	81.4	17.4	39.7
New machinery and equipment..... do..	75.1	49.9	98.4	25.1	228.4	52.7	113.0
Used capital expenditures..... do..	4.9	.7	15.5	.7	20.5	6.4	19.3
Primary product specialization ratio ⁹ percent..	82	92	91	94	94	89	88
Coverage ratio ¹⁰ do..	78	90	87	84	91	83	86

See footnotes at end of table.

Table 3a. Summary Statistics for the Industry: 1982—Con.

- ¹For the census, a company is defined as a business organization consisting of one establishment or more under common ownership or control.
- ²Includes establishments with payroll at any time during year.
- ³Data on supplemental labor costs are not included in annual payroll, but are shown in table 3d.
- ⁴Value added by manufacture is computed using inventory data reported on a cost or market basis prior to any adjustment to LIFO cost. See table 3b, footnote 1 for further explanation.
- ⁵Data on purchased services for the repair of buildings and machinery and for communication services are not included in cost of materials, etc., but are shown in table 3d.
- ⁶Data on purchased fuels by type were not collected for 1982. See MC82-S-4, Fuels and Electric Energy Consumed, for 1981 data on purchased fuels by type.
- ⁷Data on quantity of electric energy used for heat and power are included in table 3d.
- ⁸Data on capital expenditures for new machinery and equipment by type, depreciable assets, retirements, rental payments, and depreciation are included in table 3d.
- ⁹Represents ratio of primary product shipments to total product shipments (primary and secondary, excluding miscellaneous receipts) for establishments classified in industry.
- ¹⁰Represents ratio of primary products shipped by establishments classified in industry to total shipments of such products by all manufacturing establishments, wherever classified.

Table 3b. Value of Inventories for the Industry: End of 1981 and 1982

[Million dollars. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Item	Engineering and scientific instruments (SIC 3811)		Environmental controls (SIC 3822)		Process control instruments (SIC 3823)		Fluid meters and counting devices (SIC 3824)	
	End of 1981	End of 1982	End of 1981	End of 1982	End of 1981	End of 1982	End of 1981	End of 1982
Total inventories¹ -----	792.0	821.9	393.0	361.7	1 112.6	1 071.2	174.4	171.7
Detail by method of valuation:								
Subject to LIFO costing ² -----	154.1	178.7	118.4	109.7	399.8	387.3	66.6	59.5
LIFO reserve -----	38.8	46.7	55.7	52.8	88.0	93.5	15.9	18.0
LIFO value -----	115.2	132.0	62.8	56.8	311.8	293.8	50.6	41.4
Not subject to LIFO costing -----	521.8	535.6	246.2	232.0	549.1	569.7	88.4	94.1
Valuation method not reported ³ -----	113.8	105.5	28.1	19.7	162.2	112.1	18.4	18.0
Amount subject to LIFO reported without associated reserve and value ⁴ -----	2.3	2.2	.4	.3	1.5	2.0	1.0	-
Detail by stage of fabrication:								
Finished goods -----	153.2	177.7	89.8	103.1	171.3	188.5	40.4	39.8
Work in process -----	400.3	404.8	217.0	194.7	509.1	458.2	86.0	85.3
Materials and supplies -----	238.5	239.4	86.1	63.9	432.1	424.4	48.0	46.6

Item	Instruments to measure electricity (SIC 3825)		Measuring and controlling devices, n.e.c. (SIC 3829)		Optical instruments and lenses (SIC 3832)	
	End of 1981	End of 1982	End of 1981	End of 1982	End of 1981	End of 1982
Total inventories¹ -----	1 421.4	1 475.3	651.8	601.8	967.9	997.2
Detail by method of valuation:						
Subject to LIFO costing ² -----	373.3	388.1	201.2	161.9	108.9	120.5
LIFO reserve -----	102.6	119.0	93.9	83.3	27.1	37.2
LIFO value -----	270.7	269.2	107.2	78.6	81.9	83.3
Not subject to LIFO costing -----	889.4	968.1	330.7	341.7	739.9	770.2
Valuation method not reported ³ -----	158.0	118.5	116.5	95.2	116.8	104.5
Amount subject to LIFO reported without associated reserve and value ⁴ -----	.6	.6	3.5	2.9	2.2	2.1
Detail by stage of fabrication:						
Finished goods -----	273.2	309.9	148.1	151.8	263.3	310.4
Work in process -----	638.0	637.4	279.8	248.1	406.3	388.8
Materials and supplies -----	510.1	528.1	223.9	201.8	298.4	296.1

¹Effective with the 1982 Economic Censuses, uniform instructions for reporting inventories were introduced for all sector reports. Prior to 1982, respondents were permitted to value inventories using any generally accepted accounting method (LIFO, FIFO, market, to name a few). In 1982, all respondents were requested to report inventories at cost or market. LIFO users were asked to first report inventory values prior to the LIFO adjustment and then to report the LIFO reserve and the LIFO value after adjustment for the reserve. For further explanation, see inventories in appendixes.

²Only includes data reported by respondents who (a) indicated amount of inventories subject to LIFO cost, and (b) provided sufficient information to determine associated LIFO reserve and value figures.

³Includes data estimated for nonresponse and nonmail administrative records and data reported by respondents who provided total inventory figures without other information.

⁴Includes data reported by respondents who indicated their inventories were subject to LIFO cost, but did not provide associated LIFO reserve and value figures.

Table 3c. Inventories by Specific Method of Valuation for the Industry: End of 1982

[For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Item	Engineering and scientific instruments (SIC 3811)		Environmental controls (SIC 3822)		Process control instruments (SIC 3823)		Fluid meters and counting devices (SIC 3824)	
	Percent of total	Absolute standard error (percent)	Percent of total	Absolute standard error (percent)	Percent of total	Absolute standard error (percent)	Percent of total	Absolute standard error (percent)
Total inventories	100.0	(X)	100.0	(X)	100.0	(X)	100.0	(X)
Last-In, First-Out (LIFO) methods	21.7	(X)	30.3	(X)	36.2	(X)	34.6	(X)
Non-LIFO methods	65.2	(X)	64.2	(X)	53.2	(X)	54.8	(X)
Cost basis:								
First-In, First-Out (FIFO)	19.7	2.3	11.5	1.1	16.7	1.4	20.4	1.3
Average cost	5.3	.5	2.9	.1	11.3	1.4	8.8	.6
Specific or actual cost	12.5	.7	(S)	(S)	3.2	.5	(Z)	(Z)
Standard cost	27.5	1.6	48.4	1.2	19.5	1.1	25.0	1.5
Other	(Z)	(Z)	(S)	(S)	2.4	.4	(S)	(S)
Market basis:								
Market lower than cost	(Z)	(Z)	(Z)	(Z)	(Z)	(Z)	(Z)	(Z)
Market always used	(Z)	(Z)	(Z)	(Z)	.1	(Z)	(Z)	(Z)
Valuation method not reported	12.8	(X)	5.4	(X)	10.5	(X)	10.5	(X)
Amount subject to LIFO reported without associated reserve and value3	(X)	.1	(X)	.2	(X)	(Z)	(X)

Item	Instruments to measure electricity (SIC 3825)		Measuring and controlling devices, n.e.c. (SIC 3829)		Optical instruments and lenses (SIC 3832)	
	Percent of total	Absolute standard error (percent)	Percent of total	Absolute standard error (percent)	Percent of total	Absolute standard error (percent)
Total inventories	100.0	(X)	100.0	(X)	100.0	(X)
Last-In, First-Out (LIFO) methods	26.3	(X)	26.9	(X)	12.1	(X)
Non-LIFO methods	65.6	(X)	56.8	(X)	77.2	(X)
Cost basis:						
First-In, First-Out (FIFO)	19.8	1.2	21.5	1.6	22.5	7.4
Average cost	2.4	.2	5.7	.3	27.3	16.3
Specific or actual cost	9.3	1.3	11.0	.8	2.8	.9
Standard cost	32.1	1.3	17.1	1.4	24.6	8.0
Other	1.1	(Z)	1.3	.1	(Z)	(Z)
Market basis:						
Market lower than cost	1.0	(Z)	(Z)	(Z)	(Z)	(Z)
Market always used	(Z)	(Z)	(S)	(S)	(Z)	(Z)
Valuation method not reported	8.0	(X)	15.8	(X)	10.5	(X)
Amount subject to LIFO reported without associated reserve and value	(Z)	(X)	.5	(X)	.2	(X)

Note: The percentages shown for the LIFO and non-LIFO totals and the categories "valuation method not reported" and "amount subject to LIFO reported..." are based on the census universe estimates included in table 3b. The percentages shown for the specific non-LIFO methods of valuation (e.g., FIFO, etc.) are based on a representative sample of establishments included in the annual survey of manufactures (ASM) panel for 1982 (see appendixes for description of ASM). The absolute standard error of each of the ASM estimates is shown above.

Table 3d. Supplemental Industry Statistics Based on Sample Estimates: 1982

[For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Item	Engineering and scientific instruments (SIC 3811)		Environmental controls (SIC 3822)		Process control instruments (SIC 3823)		Fluid meters and counting devices (SIC 3824)	
	Amount (million dollars)	Relative standard error of estimate ¹ (percent)	Amount (million dollars)	Relative standard error of estimate ¹ (percent)	Amount (million dollars)	Relative standard error of estimate ¹ (percent)	Amount (million dollars)	Relative standard error of estimate ¹ (percent)
Supplemental labor costs:								
Total	181.8	3	130.0	1	269.5	2	46.0	1
Legal costs	68.0	3	51.5	1	100.9	2	20.0	1
Voluntary costs	113.8	3	78.5	2	168.6	3	26.0	1
Purchased services:								
Cost of purchased services for the repair of--								
Buildings and other structures	3.1	8	1.6	3	8.2	30	1.4	3
Response coverage ratio (percent) ²	72.4	(X)	53.3	(X)	69.5	(X)	83.9	(X)
Machinery	7.7	29	4.2	3	10.8	7	2.4	4
Response coverage ratio (percent) ²	75.6	(X)	60.2	(X)	71.1	(X)	83.9	(X)
Cost of purchased communication services	17.2	30	4.6	3	26.6	6	3.7	4
Response coverage ratio (percent) ²	75.7	(X)	87.6	(X)	70.0	(X)	87.8	(X)
Electric energy used for heat and power:								
Purchased:								
Quantity (million kWh)	391.6	2	282.8	1	482.8	1	130.4	1
Cost	22.7	(X)	15.0	(X)	30.2	(X)	6.8	(X)
Generated less sold (million kWh)	-	1	-	1	(S)	(S)	-	1
Gross book value of depreciable assets:								
Total:								
Beginning of year	669.3	6	400.3	4	860.4	3	231.4	2
New capital expenditures	100.0	10	62.1	4	117.6	5	25.2	4
Used capital expenditures	6.1	31	.5	1	14.1	9	.3	56
Retirements	44.3	7	20.7	11	32.6	8	9.7	18
End of year	731.1	5	442.2	3	959.4	2	247.2	2

See footnotes at end of table.

Table 3d. Supplemental Industry Statistics Based on Sample Estimates: 1982—Con.

Note: Data for total new capital expenditures, new building expenditures, new machinery expenditures, and total used expenditures are also shown in table 3a. Data in table 3a are census universe totals and may differ from annual survey of manufactures (ASM) sample estimates shown in this table. Data in this table represent best estimates of year-to-year change as measured by the continuing ASM sample. However, they are subject to sampling error and, hence, as estimates of level, are not as reliable as universe figures shown in table 3a.

¹For description of relative standard error of estimate, see Qualifications of the Data in appendixes.

²Measure of extent to which respondents reported each item. Derived for each item by calculating the ratio of weighted employment for those sample establishments that reported the specific inquiry to weighted total employment for all sample establishments classified in industry. (See appendixes for explanation of sample weight.)

³Represents total machinery and equipment expenditures for establishments that did not break down their expenditures by specific type.

Table 4. Industry Statistics by Employment Size of Establishment: 1982

[For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Industry and employment size class	E ¹	All establishments (no.)	All employees		Production workers			Value added by manufacture (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)	End-of-year inventories (million dollars)
			Number (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)					
INDUSTRY 3811, ENGINEERING AND SCIENTIFIC INSTRUMENTS												
Total.....	E1	771	42.8	869.1	25.9	49.8	439.9	2 101.1	974.2	3 046.2	102.8	821.9
Establishments with an average of—												
1 to 4 employees.....	E8	237	.5	6.6	.3	.5	3.9	17.1	9.1	26.3	.9	6.9
5 to 9 employees.....	E7	143	.9	14.7	.6	1.1	7.4	33.0	16.8	50.0	1.7	13.1
10 to 19 employees.....	E5	119	1.6	28.0	1.0	2.0	14.1	56.3	32.3	88.9	2.6	22.8
20 to 49 employees.....	E3	126	3.9	73.8	2.4	4.6	35.3	174.9	90.7	266.0	6.7	54.6
50 to 99 employees.....	E2	58	4.0	75.7	2.5	4.9	39.4	172.2	83.6	257.6	6.6	64.8
100 to 249 employees.....	E2	49	7.9	150.8	4.6	9.1	73.5	321.9	185.2	509.8	18.9	139.3
250 to 499 employees.....	-	22	7.7	151.9	4.9	9.8	81.6	398.8	182.1	569.4	10.8	159.5
500 to 999 employees.....	E1	12	8.3	199.1	4.4	8.8	89.0	408.9	191.5	588.2	24.7	188.0
1,000 to 2,499 employees.....	-	5	7.9	168.4	5.2	8.9	95.8	518.1	182.9	690.0	29.8	172.9
Covered by administrative records ²	E9	310	1.5	21.3	.9	1.8	10.9	48.9	24.5	74.0	2.9	20.7
INDUSTRY 3822, ENVIRONMENTAL CONTROLS												
Total.....	-	245	28.8	497.5	20.6	36.2	301.9	1 025.7	514.3	1 549.1	66.8	361.7
Establishments with an average of—												
1 to 4 employees.....	E8	71	.2	2.4	.1	.2	1.8	5.5	3.1	8.7	.2	2.0
5 to 9 employees.....	E7	42	.3	4.5	.2	.4	2.8	10.6	7.0	17.8	.4	3.9
10 to 19 employees.....	E6	43	.6	9.9	.4	.8	5.9	22.3	14.0	36.8	2.0	7.8
20 to 49 employees.....	E2	28	.9	14.7	.6	1.1	7.0	33.7	21.5	54.9	1.0	11.7
50 to 99 employees.....	-	16	1.2	20.8	.8	1.6	10.6	39.0	35.6	78.5	2.7	15.8
100 to 249 employees.....	-	15	2.3	30.6	1.5	2.6	14.7	47.5	34.3	86.4	3.9	20.2
250 to 499 employees.....	-	14	4.9	75.0	3.8	6.9	50.2	197.4	92.7	291.5	6.2	59.5
500 to 999 employees.....	E1	9	6.9	114.2	4.8	7.8	76.3	244.2	106.8	347.4	20.7	99.7
1,000 to 2,499 employees.....	-	6	11.7	225.5	8.4	14.8	132.6	425.6	199.2	627.0	29.6	140.9
2,500 employees or more.....	-	1	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Covered by administrative records ²	E9	97	.6	9.8	.5	.9	6.5	20.7	11.2	32.2	.8	7.5
INDUSTRY 3823, PROCESS CONTROL INSTRUMENTS												
Total.....	E1	625	59.9	1 243.7	29.8	57.3	476.0	2 804.3	1 167.8	4 005.8	126.9	1 071.2
Establishments with an average of—												
1 to 4 employees.....	E8	130	.3	4.5	.2	.3	2.1	12.4	6.6	19.2	1.0	10.6
5 to 9 employees.....	E8	100	.7	12.1	.4	.7	5.0	29.5	12.7	42.1	.9	11.5
10 to 19 employees.....	E5	107	1.5	28.2	.8	1.4	11.7	66.2	38.8	105.1	2.5	24.9
20 to 49 employees.....	E3	98	3.1	62.8	1.7	3.3	27.4	161.2	87.1	249.7	6.5	49.2
50 to 99 employees.....	E2	77	5.4	106.2	2.9	5.5	41.9	223.6	117.3	342.1	8.7	83.1
100 to 249 employees.....	E1	67	10.5	205.0	5.5	10.5	86.2	500.5	232.6	720.2	19.3	215.5
250 to 499 employees.....	-	27	10.0	188.8	5.6	10.8	89.2	378.0	179.1	567.0	26.8	136.6
500 to 999 employees.....	-	7	5.1	120.4	2.0	3.8	34.5	218.5	108.9	325.3	14.7	105.6
1,000 to 2,499 employees.....	-	10	23.3	515.7	10.6	21.0	177.9	1 214.3	384.5	1 635.1	46.4	434.2
2,500 employees or more.....	-	2	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Covered by administrative records ²	E9	229	1.9	29.8	1.0	1.9	12.1	68.9	31.3	100.9	2.5	28.2
INDUSTRY 3824, FLUID METERS AND COUNTING DEVICES												
Total.....	-	144	11.0	197.3	6.9	13.0	109.1	459.2	266.1	726.7	27.5	171.7
Establishments with an average of—												
1 to 4 employees.....	E8	31	.1	.8	(Z)	.1	.6	2.1	1.6	3.8	.1	.9
5 to 9 employees.....	E8	25	.2	3.1	.1	.2	1.9	5.8	4.0	9.7	.4	2.2
10 to 19 employees.....	E7	19	.3	4.0	.2	.3	2.0	7.5	4.5	12.0	.3	3.2
20 to 49 employees.....	E2	25	.8	13.9	.5	1.0	6.9	31.1	26.7	57.5	3.2	10.8
50 to 99 employees.....	E2	15	1.0	16.4	.7	1.3	8.8	43.6	23.5	67.9	1.1	10.1
100 to 249 employees.....	-	13	1.9	34.9	1.2	2.3	19.5	70.7	45.8	114.1	5.2	23.6
250 to 499 employees.....	-	11	3.9	61.6	2.5	4.4	36.9	154.2	95.2	252.4	8.8	69.4
500 to 999 employees.....	-	5	2.9	62.6	1.7	3.3	32.4	144.2	65.0	209.2	8.4	51.6
Covered by administrative records ²	E9	48	.3	4.7	.2	.4	2.9	10.2	7.1	17.5	.6	4.4
INDUSTRY 3825, INSTRUMENTS TO MEASURE ELECTRICITY												
Total.....	-	750	89.9	1 893.6	48.9	92.7	758.7	4 305.4	1 850.7	6 120.1	309.9	1 475.3
Establishments with an average of—												
1 to 4 employees.....	E9	159	.3	5.4	.2	.3	2.6	13.8	6.3	20.2	1.0	5.3
5 to 9 employees.....	E7	115	.8	15.4	.4	.8	5.8	35.0	17.7	52.7	2.8	12.3
10 to 19 employees.....	E5	123	1.7	29.5	1.0	1.9	13.5	64.2	34.1	98.4	3.4	21.0
20 to 49 employees.....	E3	120	3.6	66.7	2.1	4.1	28.5	146.9	77.9	222.5	8.1	49.3
50 to 99 employees.....	E2	79	5.6	104.7	3.1	6.0	41.5	225.6	115.0	345.0	13.4	81.8
100 to 249 employees.....	E1	81	12.6	247.3	7.0	13.5	98.6	538.7	274.2	807.5	26.6	195.9
250 to 499 employees.....	-	40	13.8	261.8	6.9	12.6	96.2	551.9	335.1	894.9	60.7	243.4
500 to 999 employees.....	-	15	10.3	219.3	5.2	10.2	85.4	412.6	213.0	608.2	40.3	161.2
1,000 to 2,499 employees.....	-	15	41.2	943.4	23.0	43.3	386.6	2 316.8	777.5	3 070.7	153.5	705.1
2,500 employees or more.....	-	3	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Covered by administrative records ²	E9	247	1.8	30.5	1.0	1.8	11.8	67.2	30.5	98.4	4.6	23.9

See footnotes at end of table.

Table 4. Industry Statistics by Employment Size of Establishment: 1982—Con.

[For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Industry and employment size class	E ¹	All establishments (no.)	All employees		Production workers			Value added by manufacture (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)	End-of-year inventories (million dollars)
			Number (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)					
INDUSTRY 3829, MEASURING AND CONTROLLING DEVICES, N.E.C.												
Total	E1	716	37.4	797.4	17.6	34.6	292.5	1 381.3	785.3	2 194.6	70.1	601.8
Establishments with an average of—												
1 to 4 employees	E8	251	.5	7.0	.3	.5	3.8	17.0	9.9	27.1	.7	6.7
5 to 9 employees	E7	107	.7	11.2	.4	.8	5.7	24.7	14.8	39.2	1.5	8.8
10 to 19 employees	E2	100	1.3	24.4	.8	1.4	11.0	54.3	29.8	84.1	2.2	15.2
20 to 49 employees	E2	124	3.9	72.5	2.3	4.6	35.1	142.8	84.0	230.1	7.4	49.4
50 to 99 employees	E1	58	4.1	83.2	2.3	4.4	33.3	158.5	105.0	266.0	8.8	71.4
100 to 249 employees	-	53	8.2	164.1	4.1	7.4	63.9	343.0	161.3	506.5	15.9	128.9
250 to 499 employees	-	13	4.7	100.1	2.6	5.4	46.4	185.1	113.0	302.8	14.3	98.1
500 to 999 employees	E2	5	3.3	71.6	1.5	3.3	25.0	142.0	97.4	239.0	7.5	75.9
1,000 to 2,499 employees	-	4	10.8	263.3	3.2	6.8	68.3	314.0	170.1	499.8	11.9	147.3
2,500 employees or more	-	1	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Covered by administrative records ²	E9	245	.8	10.6	.5	.9	5.1	26.6	15.5	42.5	1.1	10.9
INDUSTRY 3832, OPTICAL INSTRUMENTS AND LENSES												
Total	E1	642	50.7	1 045.8	25.9	51.1	437.3	2 410.5	1 432.3	3 813.3	152.7	997.2
Establishments with an average of—												
1 to 4 employees	E9	154	.3	4.7	.2	.4	2.9	12.1	7.6	19.8	1.1	4.6
5 to 9 employees	E7	98	.7	11.3	.4	.8	5.5	25.2	15.2	40.4	1.7	8.8
10 to 19 employees	E3	94	1.3	26.1	.8	1.6	12.8	55.0	25.2	80.1	2.7	17.5
20 to 49 employees	E1	119	3.7	71.2	2.3	4.6	36.5	152.4	76.5	227.8	12.3	46.3
50 to 99 employees	E2	70	4.7	94.3	2.7	5.3	43.2	219.6	122.3	342.2	14.8	76.7
100 to 249 employees	E1	56	8.6	169.8	5.0	10.0	77.3	400.7	238.4	637.9	21.5	171.3
250 to 499 employees	-	31	11.5	240.3	6.2	12.0	102.8	553.2	309.5	880.0	37.7	226.9
500 to 999 employees	-	12	8.4	208.0	3.8	7.4	76.6	437.2	223.3	670.8	34.3	146.0
1,000 to 2,499 employees	-	8	11.4	220.0	4.4	9.0	79.7	555.1	414.2	914.2	26.5	299.2
Covered by administrative records ²	E9	188	.9	11.7	.5	1.0	5.8	27.4	15.8	43.5	1.8	10.8

Note: For qualifications of data, see footnotes on table 1a. Data shown as a (D) are included in underscored figures above.

¹Payroll and sales data for some small single-unit companies with up to 20 employees (cutoff varied by industry) were obtained from administrative records of other government agencies rather than from census report forms. These data were then used in conjunction with industry averages to estimate the items shown for these small establishments. This technique was also used for a small number of other establishments whose reports were not received at time data were tabulated. The following symbols are shown for those States where estimated data based on administrative records data account for 10 percent or more of figures shown: E1—10 to 19 percent; E2—20 to 29 percent; E3—30 to 39 percent; E4—40 to 49 percent; E5—50 to 59 percent; E6—60 to 69 percent; E7—70 to 79 percent; E8—80 to 89 percent; E9—90 percent or more.

²Report forms were not mailed to small single-unit companies with up to 20 employees (cutoff varied by industry). Payroll and sales data for 1982 were obtained from administrative records supplied by other agencies of the Federal Government. Those data were then used in conjunction with industry averages to estimate the items shown. Data are also included in respective size classes shown.

Table 5a. Industry Statistics by Industry and Primary Product Class Specialization: 1982

[Table presents selected statistics for establishments according to their degree of specialization in products primary to their industry. Measures of plant specialization shown are (1) industry specialization: ratio of primary product shipments to total product shipments (primary plus secondary, excluding miscellaneous receipts) for the establishment; and (2) product class specialization: ratio of largest primary product class shipments to total product shipments (primary plus secondary, excluding miscellaneous receipts) for the establishment. See appendix for method of computing ratios. Statistics for establishments with specialization ratios of less than 75 percent are included in total lines but are not shown as a separate class. In addition, data may not be shown for various reasons; e.g., to avoid disclosing data for individual companies. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes.]

Industry or product class code	Industry or product class by percent of specialization	All establishments (number)	All employees		Production workers			Value added by manufacture (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)
			Number (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)				
3811	Engineering and scientific instruments:										
	Entire industry	771	42.8	869.1	25.9	49.8	439.9	2 101.1	974.2	3 046.2	102.8
	Establishments with 75 percent specialization or more	700	27.7	536.0	17.2	33.7	279.9	1 258.6	630.8	1 883.4	60.2
38111	Aeronautical, nautical, and navigational instruments:										
	Establishments with this product class primary	88	20.4	434.6	12.8	25.1	232.3	989.1	424.2	1 384.2	40.1
	Establishments with 75 percent specialization or more in class	63	9.7	200.0	6.1	12.8	107.2	446.0	195.6	627.9	16.7
38112	Laboratory and scientific apparatus:										
	Establishments with this product class primary	172	12.7	274.9	7.5	14.4	132.1	806.5	373.4	1 172.4	46.8
	Establishments with 75 percent specialization or more in class	142	9.2	194.2	5.5	10.6	95.9	505.8	254.1	757.1	28.9
38113	Surveying and drafting instruments:										
	Establishments with this product class primary	49	5.1	85.4	3.1	5.7	44.2	169.8	107.9	285.0	7.4
	Establishments with 75 percent specialization or more in class	41	4.5	72.7	2.8	4.9	38.4	150.3	97.7	255.1	6.9
3822	Environmental controls:										
	Entire industry	245	28.8	497.5	20.6	36.2	301.9	1 025.7	514.3	1 549.1	66.8
	Establishments with 75 percent specialization or more	227	26.3	445.6	18.8	32.6	274.3	917.6	465.1	1 402.0	60.4
3823	Process control instruments:										
	Entire industry	625	59.9	1 243.7	29.8	57.3	476.0	2 804.3	1 167.8	4 005.8	126.9
	Establishments with 75 percent specialization or more	581	49.7	1 043.7	24.3	46.9	392.2	2 426.7	984.8	3 440.6	101.1
3824	Fluid meters and counting devices:										
	Entire industry	144	11.0	197.3	6.9	13.0	109.1	459.2	266.1	726.7	27.5
	Establishments with 75 percent specialization or more	125	9.5	171.1	5.9	11.2	95.0	415.7	234.1	648.2	25.4
38242	Integrating and totalizing meters for gas and liquids:										
	Establishments with this product class primary	39	6.6	124.3	4.1	8.1	70.2	321.8	187.5	510.0	20.8
	Establishments with 75 percent specialization or more in class	30	5.5	104.5	3.4	6.9	59.2	291.8	163.0	452.1	18.8
38243	Counting devices:										
	Establishments with this product class primary	26	2.6	46.4	1.6	2.8	25.3	83.2	45.9	130.6	4.5
	Establishments with 75 percent specialization or more in class	22	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)

See footnotes at end of table.

Table 5a. Industry Statistics by Industry and Primary Product Class Specialization: 1982—
Con.

[Table presents selected statistics for establishments according to their degree of specialization in products primary to their industry. Measures of plant specialization shown are (1) industry specialization: ratio of primary product shipments to total product shipments (primary plus secondary, excluding miscellaneous receipts) for the establishment; and (2) product class specialization: ratio of largest primary product class shipments to total product shipments (primary plus secondary, excluding miscellaneous receipts) for the establishment. See appendix for method of computing ratios. Statistics for establishments with specialization ratios of less than 75 percent are included in total lines but are not shown as a separate class. In addition, data may not be shown for various reasons; e.g., to avoid disclosing data for individual companies. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes.]

Industry or product class code	Industry or product class by percent of specialization	All establishments (number)	All employees		Production workers			Value added by manufacture (million dollars)	Cost of materials (million dollars)	Value of shipments (million dollars)	New capital expenditures (million dollars)
			Number (1,000)	Payroll (million dollars)	Number (1,000)	Hours (millions)	Wages (million dollars)				
3824	Fluid meters and counting devices—Con.										
38244	Motor vehicle instruments:										
	Establishments with this product class primary	17	1.3	19.1	.8	1.5	9.1	38.4	22.2	59.6	1.5
	Establishments with 75 percent specialization or more in class	11	.9	12.6	.5	.9	6.0	23.7	13.6	36.5	1.2
3825	Instruments to measure electricity:										
	Entire industry	750	89.9	1 893.6	48.9	92.7	758.7	4 305.4	1 850.7	6 120.1	309.9
	Establishments with 75 percent specialization or more ..	694	82.1	1 736.6	45.1	85.2	702.1	4 020.9	1 693.2	5 675.4	289.4
38251	Integrating instruments, electrical:										
	Establishments with this product class primary	20	6.8	129.9	4.7	8.9	73.8	281.3	115.8	402.5	24.3
	Establishments with 75 percent specialization or more in class	17	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
38252	Test equipment for testing electrical circuits:										
	Establishments with this product class primary	257	67.5	1 482.4	35.1	66.8	554.6	3 468.3	1 461.0	4 880.0	255.6
	Establishments with 75 percent specialization or more in class	228	62.9	1 388.8	33.1	63.0	526.6	3 288.7	1 360.4	4 603.9	239.1
38253	Instruments to measure electricity, n.e.c.:										
	Establishments with this product class primary	90	11.5	215.1	6.8	12.5	102.6	415.6	204.6	627.0	20.6
	Establishments with 75 percent specialization or more in class	68	6.9	136.8	4.1	7.6	67.8	269.3	132.9	406.7	15.7
3829	Measuring and controlling devices, n.e.c.:										
	Entire industry	716	37.4	797.4	17.6	34.6	292.5	1 381.3	785.3	2 194.6	70.1
	Establishments with 75 percent specialization or more ..	662	30.8	661.2	13.9	27.4	229.3	1 124.5	661.1	1 810.2	59.9
38291	Aircraft engine instruments, except flight:										
	Establishments with this product class primary	20	4.3	93.2	2.5	5.1	43.3	152.9	82.8	239.4	7.1
	Establishments with 75 percent specialization or more in class	18	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
38292	Physical properties testing and inspection equipment:										
	Establishments with this product class primary	151	9.5	208.3	4.8	9.7	82.9	425.1	215.2	641.7	23.2
	Establishments with 75 percent specialization or more in class	131	8.2	179.0	4.3	8.4	73.4	377.5	192.6	571.9	20.7
38293	General purpose instruments:										
	Establishments with this product class primary	93	6.9	121.7	4.5	8.1	65.7	251.0	125.1	382.6	13.5
	Establishments with 75 percent specialization or more in class	72	3.1	50.4	2.1	3.9	27.2	108.3	66.1	177.2	8.6
38294	Nuclear radiation detection and monitoring instruments:										
	Establishments with this product class primary	58	13.6	316.2	4.0	8.4	73.4	433.4	293.6	739.7	19.2
	Establishments with 75 percent specialization or more in class	49	11.8	278.4	3.1	6.5	59.3	359.6	248.9	622.6	15.7
3832	Optical instruments and lenses:										
	Entire industry	642	50.7	1 045.8	25.9	51.1	437.3	2 410.5	1 432.3	3 813.3	152.7
	Establishments with 75 percent specialization or more ..	584	39.8	804.6	20.8	41.0	348.8	1 834.9	1 073.5	2 878.7	120.6
38324	Sighting, tracking, and fire control equipment:										
	Establishments with this product class primary	34	7.1	136.6	4.7	8.6	74.4	283.9	209.1	495.1	16.5
	Establishments with 75 percent specialization or more in class	23	3.0	56.5	2.0	3.9	29.4	98.8	62.9	159.8	5.9
38325	Optical instruments and lenses, n.e.c.:										
	Establishments with this product class primary	155	13.5	298.3	7.6	16.1	147.3	604.4	330.6	934.1	51.0
	Establishments with 75 percent specialization or more in class	137	12.2	269.4	6.9	14.5	133.0	552.9	298.3	851.2	47.2
38326	Analytical and scientific instruments, except optical:										
	Establishments with this product class primary	166	27.6	568.9	12.0	23.3	195.0	1 424.8	838.1	2 231.8	78.5
	Establishments with 75 percent specialization or more in class	134	19.4	390.6	8.6	16.4	136.3	961.6	559.3	1 495.6	52.9

Note: For qualifications of data, see footnotes on table 1a.

Table 5b. Industry-Product Analysis—Value of Shipments and Primary Product Shipments, Specialization and Coverage Ratios for the Industry: 1982 and Earlier Census Years

[An establishment is assigned to an industry based on shipment values of products representing largest amount considered primary to an industry. Frequently, establishment shipments comprise mixtures of products assigned to an industry (primary), those considered primary to other industries (secondary), and receipts for activities such as merchandising or contract work. Columns A-D show this product pattern for an industry, and column E shows primary product specialization ratio. The extent to which an industry's primary products are shipped by establishments classified in and out of an industry is shown in columns F-H and coverage ratio is shown in column I. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Industry and product group code	Industry and census year	Value of shipments					Value of primary product shipments			
		Total (million dollars)	Primary products (million dollars)	Secondary products (million dollars)	Miscellaneous receipts (million dollars)	Primary product specialization ratio Col. B ÷ Col. B + C (percent)	Total made in all industries (million dollars)	Made in this industry (million dollars)	Made in other industries (million dollars)	Coverage ratio Col. B ÷ Col. F (percent)
		A	B	C	D	E	F	G	H	I
3811	Engineering and scientific instruments ----- 1982--	3 046.2	2 326.2	521.8	198.2	82	2 964.4	2 326.2	638.2	78
	1977--	1 926.7	1 467.0	268.2	191.5	85	1 849.5	1 467.0	382.5	79
	1972--	1 023.4	799.7	110.3	113.4	88	1 106.0	799.7	306.3	72
3822	Environmental controls ----- 1982--	1 549.1	1 386.1	119.1	43.9	92	1 544.5	1 386.1	158.4	90
	1977--	1 358.7	1 017.7	261.6	79.4	80	1 106.4	1 017.7	88.7	92
	1972--	728.1	591.4	98.9	37.8	86	658.1	591.4	66.7	90
3823	Process control instruments ----- 1982--	4 005.8	3 390.4	347.6	267.8	91	3 915.1	3 390.4	524.7	87
	1977--	2 022.0	1 641.5	192.5	188.0	90	2 061.1	1 641.5	419.6	80
	1972--	883.6	656.9	107.2	119.5	86	794.7	656.9	137.8	83
3824	Fluid meters and counting devices ----- 1982--	726.7	663.6	45.5	17.6	94	787.1	663.6	123.4	84
	1977--	650.4	507.7	125.1	17.6	80	634.3	507.7	126.6	80
	1972--	296.2	259.1	27.7	9.4	90	327.4	259.1	68.3	79
3825	Instruments to measure electricity ----- 1982--	6 120.1	5 058.2	308.6	753.3	94	5 575.6	5 058.2	517.4	91
	1977--	2 761.0	2 276.4	254.4	230.2	90	2 566.2	2 276.4	289.8	89
	1972--	1 540.8	1 166.0	295.9	78.9	80	1 329.7	1 166.0	163.7	88
3829	Measuring and controlling devices, n.e.c. ----- 1982--	2 194.6	1 729.8	215.5	249.3	89	2 073.4	1 729.8	343.6	83
	1977--	1 118.1	890.9	105.2	122.0	89	1 073.1	890.9	182.2	83
	1972--	601.4	450.5	102.2	48.7	86	585.9	450.5	135.4	77
3832	Optical instruments and lenses ----- 1982--	3 813.3	3 175.4	451.5	186.5	88	3 678.4	3 175.4	503.0	86
	1977--	1 335.6	1 069.3	201.7	64.6	84	1 299.7	1 069.3	230.4	82
	1972--	538.4	464.4	47.9	26.1	92	584.7	464.4	120.3	79

Table 5c-1. Industry-Product Analysis—Shipments by Product Class and Industry: 1982

[Million dollars. Table shows where products of an industry (referred to as primary and listed in table 6a) are made and what products are made by establishments classified in an industry. Read down an industry column to find what products are produced in an industry. Only those product groups that have at least \$2 million in shipments from establishments classified in one of industries included in this chapter are shown. Read across to determine where products of industries in this chapter are produced. To extent that some of primary products are made in industries not included in this chapter, value of such shipments is shown in "Other industries" column. Specified "Other industries" are listed in table 5c-2 if they account for more than \$5 million of products primary to this chapter. For meaning of abbreviations and symbols, see explanatory text. For explanation of terms, see appendixes]

1982 product code	Product group, product class, and miscellaneous receipts	All industries	Engineering and scientific instruments (SIC 3811)	Environmental controls (SIC 3822)	Process control instruments (SIC 3823)	Fluid meters and counting devices (SIC 3824)	Instruments to measure electricity (SIC 3825)	Measuring and controlling devices, n.e.c. (SIC 3829)	Optical instruments and lenses (SIC 3832)	Other industries
	Total -----	(X) 3 046.2	1 549.1	4 005.8	726.7	6 120.1	2 194.6	3 813.3	(X)	
	Primary products-----	(X) 2 326.2	1 386.1	3 390.4	663.6	5 058.2	1 729.8	3 175.4	(X)	
	Secondary products-----	(X) 521.8	119.1	347.6	45.5	308.6	215.5	451.5	(X)	
	Miscellaneous receipts-----	(X) 198.2	43.9	267.8	17.6	753.3	249.3	186.5	(X)	
3811-	Engineering and scientific instruments -----	2 964.4	2 326.2	(D)	56.1	(D)	15.8	24.4	51.6	486.0
38111	Aeronautical, nautical, and navigational instruments -----	1 418.7	936.2	(D)	(D)	(D)	(D)	21.0	(D)	367.5
38112	Laboratory and scientific apparatus -----	1 083.6	953.1	(D)	(D)	(D)	(D)	(D)	(D)	102.7
38113	Surveying and drafting instruments -----	259.9	236.8	(D)	(D)	(D)	(D)	(D)	(D)	14.3
38110	Engineering and scientific instruments, n.s.k. -----	202.2	200.1	(D)	(D)	(D)	(D)	(D)	(D)	1.5
38220	Heating, air conditioning, appliance controls -----	1 544.5	(D)	1 386.1	12.9	(D)	4.8	(D)	(D)	135.8
38230	Process control instruments -----	3 915.1	54.7	(D)	3 390.4	14.0	31.8	59.9	47.6	(D)
3824-	Fluid meters and counting devices -----	787.1	(D)	(D)	29.8	663.6	(D)	(D)	(D)	74.2
38242	Integrating and totalizing meters for gas and liquids -----	519.6	(D)	(D)	(D)	471.6	(D)	.4	(D)	39.7
38243	Counting devices -----	162.0	(D)	(D)	(D)	119.1	(D)	(D)	(D)	18.0
38244	Motor vehicle instruments -----	76.2	(D)	(D)	(D)	45.5	(D)	(D)	(D)	14.6
38240	Fluid meters and counting devices, n.s.k. -----	29.3	(D)	(D)	(D)	27.5	(D)	(D)	(D)	1.8
3825-	Instruments to measure electricity -----	5 575.6	17.1	(D)	24.5	(D)	5 058.2	(D)	8.5	(D)
38251	Integrating instruments, electrical -----	363.2	(D)	(D)	(D)	(D)	351.5	(D)	(D)	5.6
38252	Test equipment for testing electrical circuits -----	4 455.2	9.2	(D)	8.9	(D)	4 017.9	(D)	(D)	398.9
38253	Instruments to measure electricity, n.e.c. -----	556.7	(D)	(D)	(D)	(D)	492.5	12.4	(D)	29.2
38250	Instruments to measure electricity, n.s.k. -----	200.5	(D)	(D)	(D)	(D)	196.2	(D)	(D)	(D)
3829-	Measuring and controlling devices, n.e.c. -----	2 073.4	29.3	(D)	46.6	(D)	27.6	1 729.8	64.9	(D)
38291	Aircraft engine instruments, except flight -----	311.0	14.1	(D)	(D)	(D)	(D)	212.1	(D)	(D)
38292	Physical properties testing and inspection equipment -----	635.2	6.9	(D)	13.9	(D)	5.5	564.5	15.0	(D)
38293	General purpose instruments -----	365.2	(D)	(D)	19.9	(D)	11.9	288.3	11.1	28.5
38294	Nuclear radiation detection and monitoring instruments -----	596.4	(D)	(D)	(D)	(D)	(D)	503.2	(D)	(D)
38290	Measuring and controlling devices, n.e.c., n.s.k. -----	165.6	(D)	(D)	(D)	(D)	(D)	161.8	1.0	(D)

See footnotes at end of table.

Table 5c-1. Industry-Product Analysis—Shipments by Product Class and Industry: 1982—Con.

[Million dollars. Table shows where products of an industry (referred to as primary and listed in table 6a) are made and what products are made by establishments classified in an industry. Read down an industry column to find what products are produced in an industry. Only those product groups that have at least \$2 million in shipments from establishments classified in one of industries included in this chapter are shown. Read across to determine where products of industries in this chapter are produced. To extent that some of primary products are made in industries not included in this chapter, value of such shipments is shown in "Other industries" column. Specified "Other industries" are listed in table 5c-2 if they account for more than \$5 million of products primary to this chapter. For meaning of abbreviations and symbols, see explanatory text. For explanation of terms, see appendixes.]

1982 product code	Product group, product class, and miscellaneous receipts	All industries	Engineering and scientific instruments (SIC 3811)	Environmental controls (SIC 3822)	Process control instruments (SIC 3823)	Fluid meters and counting devices (SIC 3824)	Instruments to measure electricity (SIC 3825)	Measuring and controlling devices, n.e.c. (SIC 3829)	Optical instruments and lenses (SIC 3832)	Other industries
3832-38324	Optical instruments and lenses ----- Sighting, tracking, and fire control equipment -----	3 678.4 505.4	68.0 (D)	- -	15.2 (D)	(D) -	44.8 -	(D) (D)	3 175.4 (D)	(D) 104.6
38325	Optical instruments and lenses, n.e.c. -----	922.8	(D)	-	(D)	(D)	(D)	(D)	857.1	54.6
38326	Analytical and scientific instruments, except optical -----	2 088.4	48.5	-	(D)	(D)	(D)	(D)	1 779.7	205.8
38320	Optical instruments and lens, n.s.k. -----	161.8	-	-	-	-	-	-	(D)	(D)
OTHER SHIPMENTS BY FOUR-DIGIT PRODUCT GROUP										
2522-	Metal office furniture -----	(X)	(D)	-	-	-	-	-	-	(X)
2819-	Industrial inorganic chemicals, n.e.c. -----	(X)	-	-	-	-	-	-	(D)	(X)
2831-	Biological products -----	(X)	-	-	-	-	-	-	(D)	(X)
3229-	Pressed and blown glass, n.e.c. -----	(X)	-	-	(D)	-	-	-	-	(X)
3231-	Products of purchased glass -----	(X)	-	-	(D)	-	-	-	(D)	(X)
3297-	Nonclay refractories -----	(X)	-	-	-	-	-	-	3.2	(X)
3339-	Primary nonferrous metals, n.e.c. -----	(X)	-	-	-	-	-	-	(D)	(X)
3357-	Nonferrous wire drawing and insulating -----	(X)	-	-	(D)	-	-	-	(D)	(X)
3433-	Heating equipment, except electric -----	(X)	-	(D)	(D)	-	-	-	-	(X)
3443-	Fabricated plate work (boiler shops) -----	(X)	-	-	(D)	-	-	-	(D)	(X)
3494-	Valves and pipe fittings -----	(X)	(D)	32.5	37.4	(D)	(D)	16.0	(D)	(X)
3534-	Elevators and moving stairways -----	(X)	-	-	-	-	(D)	-	(D)	(X)
3559-	Special industry machinery, n.e.c. -----	(X)	(D)	(D)	(D)	-	(D)	(D)	(D)	(X)
3561-	Pumps and pumping equipment -----	(X)	-	-	(D)	(D)	-	(D)	-	(X)
3563-	Air and gas compressors -----	(X)	(D)	(D)	(D)	-	-	-	-	(X)
3564-	Blowers and fans -----	(X)	-	(D)	(D)	-	-	(D)	-	(X)
3569-	General industrial machinery, n.e.c. -----	(X)	(D)	(D)	(D)	(D)	-	(D)	(D)	(X)
3573-	Electronic computing equipment -----	(X)	3.9	(D)	(D)	(D)	(D)	3.3	(D)	(X)
3589-	Service industry machinery, n.e.c. -----	(X)	-	-	(D)	(D)	-	-	-	(X)
3612-	Transformers -----	(X)	-	-	-	-	(D)	-	-	(X)
3621-	Motors and generators -----	(X)	(D)	-	-	-	(D)	-	-	(X)
3622-	Industrial controls -----	(X)	(D)	5.9	1.3	-	9.5	2.3	(D)	(X)
3643-	Current-carrying wiring devices -----	(X)	(D)	(D)	-	-	.3	(D)	(D)	(X)
3648-	Lighting equipment, n.e.c. -----	(X)	-	-	-	-	-	-	(D)	(X)
3651-	Radio and TV receiving sets -----	(X)	(D)	-	-	-	-	-	-	(X)
3661-	Telephone and telegraph apparatus -----	(X)	(D)	-	-	(Z)	(D)	(D)	-	(X)
3662-	Radio and TV communication equipment -----	(X)	162.8	(D)	15.3	(D)	61.1	(D)	(D)	(X)
3676-	Electronic resistors -----	(X)	-	-	-	-	(D)	(D)	(D)	(X)
3678-	Electronic connectors -----	(X)	-	-	-	-	(D)	(D)	(D)	(X)
3679-	Electronic components, n.e.c. -----	(X)	57.2	-	18.8	(D)	22.5	24.5	73.7	(X)
3693-	X-ray and electromedical apparatus -----	(X)	(D)	-	(D)	-	(D)	(D)	(D)	(X)
3751-	Motorcycles, bicycles, and parts -----	(X)	-	-	(D)	-	-	-	-	(X)
3769-	Space vehicle equipment, n.e.c. -----	(X)	(D)	-	-	-	-	(D)	-	(X)
3841-	Surgical and medical instruments -----	(X)	10.5	-	(D)	-	-	(D)	(D)	(X)
3842-	Surgical appliances and supplies -----	(X)	(D)	-	-	-	-	-	(D)	(X)
3843-	Dental equipment and supplies -----	(X)	(D)	-	-	-	-	(D)	-	(X)
3851-	Ophthalmic goods -----	(X)	-	-	-	-	-	-	(D)	(X)
3861-	Photographic equipment and supplies -----	(X)	(D)	-	-	-	-	-	(D)	(X)
3999-	Manufacturing industries, n.e.c. -----	(X)	(D)	(D)	-	-	-	-	-	(X)
MISCELLANEOUS RECEIPTS										
93000 00	Receipts for work done for others on their materials -----	(X)	15.0	(D)	(D)	(D)	(D)	12.1	(D)	(X)
99980 13	Sales of scrap and refuse -----	(X)	.2	1.0	.5	(D)	4.5	(D)	.4	(X)
99980 31	Receipts for installation or construction of products of the establishment -----	(X)	12.9	(D)	(D)	(D)	(D)	(D)	(X)	(X)
99980 41	Receipts for research and development work -----	(X)	1.4	(D)	(D)	(D)	(D)	(D)	1.3	(X)
99980 61	Receipts for repair work -----	(X)	54.5	(D)	39.4	4.5	37.0	31.3	(X)	(X)
99980 92	Engineering and software services -----	(X)	(D)	(D)	(D)	.1	2.1	(D)	(X)	(X)
99980 98	Other miscellaneous receipts, including receipts for repair work, etc. -----	(X)	(D)	(D)	30.8	(D)	(D)	48.0	23.3	(X)
99980 00	Miscellaneous receipts, n.s.k. -----	(X)	4.9	(D)	.4	(D)	.9	.5	(D)	(X)
99989 00	Sales of products bought and resold without further manufacture, processing, or assembly at establishment -----	(X)	89.8	36.2	95.3	9.7	497.6	86.0	111.2	(X)

Table 5c-2. Industry-Product Analysis—Other Industries With Shipments of Primary Products: 1982

[Million dollars. Table is a continuation of table 5c-1 and shows where products of industries in this chapter (referred to as primary products and listed in table 6a) are made. To extent that some of primary products are made in industries not included in this chapter, value of such shipments is shown in "Other industries" column of table 5c-1. Specified "Other industries" are listed in this table if they account for more than \$5 million of products primary to this chapter. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

1982 product code	Other industries	Value	1982 product code	Other industries	Value
3811-	ENGINEERING AND SCIENTIFIC INSTRUMENTS		3824-	FLUID METERS AND COUNTING DEVICES	
	3231 Products of purchased glass	(D)		3499 Fabricated metal products, n.e.c.	(D)
	3563 Air and gas compressors	(D)		3569 General industrial machinery, n.e.c.	(D)
	3621 Motors and generators	11.3		3579 Office machines, n.e.c., and typewriters	(D)
	3662 Radio and TV communication equipment	253.5		3586 Measuring and dispensing pumps	9.2
	3679 Electronic components, n.e.c.	(D)		3651 Radio and TV receiving sets	(D)
				3662 Radio and TV communication equipment	10.2
	3728 Aircraft equipment, n.e.c.	(D)	3825-	INSTRUMENTS TO MEASURE ELECTRICITY	
	3841 Surgical and medical instruments	28.0		3549 Metalworking machinery, n.e.c.	(D)
	3842 Surgical appliances and supplies	11.1		3573 Electronic computing equipment	26.4
	3851 Ophthalmic goods	(D)		3613 Switchgear and switchboard apparatus	15.2
	3873 Watches, clocks, and watchcases	(D)		3622 Industrial controls	9.1
				3661 Telephone and telegraph apparatus	(D)
3822-	ENVIRONMENTAL CONTROLS			3662 Radio and TV communication equipment	148.9
	3444 Sheet metal work	(D)		3676 Electronic resistors	(D)
	3469 Metal stampings, n.e.c.	(D)		3679 Electronic components, n.e.c.	97.4
	3494 Valves and pipe fittings	(D)		3693 X-ray, electromedical, and electrotherapeutic apparatus	(D)
	3567 Industrial furnaces and ovens	(D)	3829-	MEASURING AND CONTROLLING DEVICES, N.E.C.	
	3569 General industrial machinery, n.e.c.	(D)		3523 Farm machinery and equipment	(D)
				3662 Radio and TV communication equipment	(D)
	3643 Current-carrying wiring devices	9.4		3679 Electronic components, n.e.c.	(D)
	3651 Radio and TV receiving sets	(D)		3728 Aircraft equipment, n.e.c.	(D)
	3676 Electronic resistors	(D)		3761 Guided missiles and space vehicles	(D)
	3714 Motor vehicle parts and accessories	(D)		3841 Surgical and medical instruments	10.1
				3842 Surgical appliances and supplies	(D)
3823-	PROCESS CONTROL INSTRUMENTS		3832-	OPTICAL INSTRUMENTS AND LENSES	
	3443 Fabricated plate work (boiler shops)	(D)		2831 Biological products	(D)
	3494 Valves and pipe fittings	156.8		2834 Pharmaceutical preparations	(D)
	3498 Fabricated pipe and fittings	(D)		3569 General industrial machinery, n.e.c.	(D)
	3559 Special industry machinery, n.e.c.	(D)		3662 Radio and TV communication equipment	(D)
	3573 Electronic computing equipment	(D)		3671 Electron tubes, all types	(D)
				3679 Electronic components, n.e.c.	(D)
	3622 Industrial controls	14.6		3693 X-ray, electromedical, and electrotherapeutic apparatus	(D)
	3662 Radio and TV communication equipment	(D)		3761 Guided missiles and space vehicles	(D)
	3728 Aircraft equipment, n.e.c.	(D)		3841 Surgical and medical instruments	(D)
	3842 Surgical appliances and supplies	(D)		3842 Surgical appliances and supplies	(D)
				3851 Ophthalmic goods	(D)
				3861 Photographic equipment and supplies	(D)
				3955 Carbon paper and inked ribbons	(D)

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
ENGINEERING AND SCIENTIFIC INSTRUMENTS							
3811- --	Total -----	(NA)	(X)	2 964.4	(NA)	(X)	1 849.5
38111 --	Aeronautical, nautical, and navigational instruments, not sending or receiving radio controls:						
38111 00	Aeronautical, nautical, and navigational instruments, not sending or receiving radio signals (excluding engine instruments):						
	As reported in the census of manufactures -----	124	(X)	1 418.7	125	(X)	804.6
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products -----	(NA)	(X)	1 404.7	(NA)	(X)	755.3
	Flight and navigation sensors, transmitters, and displays:						
38111 01	Compasses (magnetic and gyroscopic) -----	(NA)	(X)	101.7	(NA)	(X)	48.3
38111 03	Radio navigation receivers and displays (including OMNI, radio magnetic, glide slope/localizer, DME, etc.) -----	(NA)	(X)	80.9	(NA)	(X)	48.1
38111 08	Altimeters (except radio and radar altimeters) -----	(NA)	(X)	55.3	(NA)	(X)	20.1
38111 10	Air speed indicators (including machmeters and air data computers) -----	(NA)	(X)	143.6	(NA)	(X)	61.1
38111 12	Acceleration indicators and systems components ----- thousands..	(NA)	(D)		(NA)	(X)	2.3
38111 13	Rate-of-climb indicators ----- do..	(NA)	(D)	36.5	(NA)	(X)	15.7
38111 15	Angle-of-attack indicators ----- do..	(NA)	(D)	4.7	(NA)	(X)	4.4
38111 17	Bank-and-turn indicators ----- do..	(NA)	(D)	10.1	(NA)	(X)	25.8
38111 22	Artificial horizon flight instruments ----- do..	(NA)	(D)	26.3	(NA)	(X)	8.4
38111 20	Other aerospace and navigational instruments -----	(NA)	(X)	28.4	(NA)	(X)	11.9
	Other aerospace and navigational instruments -----	(NA)	(X)	195.3	(NA)	(X)	60.6
	Gyroscopes sold separately:						
38111 21	Vertical ----- thousands..	(NA)		4.6	(NA)		16.0
38111 23	Directional ----- do..	(NA)		34.1	(NA)		29.0
38111 25	Free, torqued and untorqued -----	(NA)			(NA)		
38111 26	Rate, inertial grade -----	(NA)	(X)	85.0	(NA)	(X)	57.3
38111 28	Rate, non-inertial grade -----	(NA)	(X)	50.4	(NA)	(X)	38.3
	Airframe equipment instruments:						
38111 61	Position indicators (mechanical, as for landing gear, cowl flaps, stabilizers, etc.) -----	(NA)	(X)	13.2	(NA)	(X)	2.8
38111 63	Hydraulic system (both electrical and mechanical measuring means, as for liquid level and temperature and pressure indicators) -----	(NA)	(X)	25.9	(NA)	(X)	9.3
38111 64	Cabin environmental measuring and control instruments (air conditioning and heating, cabin pressure, oxygen, etc.) -----	(NA)	(X)	50.0	(NA)	(X)	19.0
38111 77	Thermocouple and thermocouple lead wire (aircraft type only) -----	(NA)			(NA)		
38111 80	Other aerospace flight instruments, including parts sold separately -----	(NA)	(X)	402.1	(NA)	(X)	168.3
38111 85	Nautical instruments (all types, including temperature, speed, pitch and roll instruments, and system components, etc.) ----- thousands..	(NA)	(X)	450.6	(NA)	(S)	25.1
38111 0A	Aeronautical, nautical, and navigational instruments, n.s.k. -----	(NA)	(X)	-	(NA)	(X)	101.8
38112 --	Laboratory and scientific apparatus:						
38112 00	Laboratory and scientific apparatus:						
	As reported in the census of manufactures -----	239	(X)	1 083.6	262	(X)	696.6
	As reported in Current Industrial Report MA-38B, Selected Instruments and Related Products -----	(NA)	(X)	1 028.0	(NA)	(X)	611.8
	Laboratory balances and scales:						
38112 20	Sensitivity of 5 centigrams or better ----- thousands..	(NA)		946.1	(NA)		27.8
38112 22	Sensitivity of less than 5 centigrams ----- do..	(NA)			(NA)		
38112 23	Laboratory furnaces and ovens -----	(NA)	(X)	32.7	(NA)	(X)	14.7
	Laboratory centrifuges:						
38112 24	Table-top type ----- thousands..	(NA)		17.2			29.9
	Floor type:						
38112 26	Refrigerated ----- do..	(NA)	(³)		(NA)	(X)	88.8
38112 30	Other ----- do..	(NA)	(³)	12.2	(NA)	(X)	370.9
38112 27	Laboratory evaporation and distillation apparatus -----	(NA)	(X)	17.7	(NA)	(X)	21.1
38112 28	Laboratory sterilizers and autoclaves -----	(NA)	(X)		(NA)	(X)	
38112 29	Laboratory burners and hot plates -----	(NA)	(X)	18.5	(NA)	(X)	2.0
38112 31	Laboratory granulators, mills, and other particle size reduction apparatus -----	(NA)	(X)	2.2	(NA)	(X)	1.6
38112 33	Laboratory dryers -----	(NA)	(X)	2.7	(NA)	(X)	
38112 35	Laboratory blenders, mixers, shakers, dispensers, fraction collectors, and other liquid sample preparation apparatus -----	(NA)	(X)	48.4	(NA)	(X)	24.7
38112 36	Laboratory incubators ----- thousands..	(NA)		5.5	(NA)		18.4
38112 38	Laboratory freezers ----- do..	(NA)		1.6	(NA)		16.3
38112 98	All other laboratory and scientific apparatus not specified above (including wet and dry baths, melting point apparatus, laboratory pyrometers, etc., excluding analytical instruments) -----	(NA)	(X)	415.3	(NA)	(X)	350.9
38112 99	Components, parts, and accessories for laboratory and scientific apparatus (sold separately) -----	(NA)	(X)	304.6	(NA)		
38112 0A	Laboratory and scientific apparatus, n.s.k. -----	(NA)	(X)	-	(NA)	(X)	80.2

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
ENGINEERING AND SCIENTIFIC INSTRUMENTS—Con.							
38113 —	Surveying and drafting instruments and laboratory furniture:						
38113 00	Surveying and drafting instruments and apparatus, and laboratory furniture, including photogrammetric equipment						
	As reported in the census of manufactures	57	(X)	259.9	52	(X)	168.9
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products	(NA)	(X)	256.2	(NA)	(X)	160.3
38113 32	Surveying instruments, including alidades, transits, plumb bobs, sextants, theodolites, surveyors' compasses, surveyors' levels, and tapes	(NA)	(X)	42.5	(NA)	(X)	28.7
38113 34	Drafting instruments and machines, manual and automatic, plotting instruments, slide rules, T-squares, drafting templates, and rules	(NA)	(X)	(⁶)	(NA)	(X)	18.6
38113 37	Programmetric and geodetic equipment, excluding cameras	(NA)	(X)	578.5	(NA)	(X)	113.0
38113 38	Laboratory furniture, including cabinets, cases, benches, tables, stools, and reagent shelves, etc.	(NA)	(X)	135.2	(NA)	(X)	113.0
38110 00	Engineering and scientific instruments, n.s.k., typically for establishments with 10 employees or more (see note)	(NA)	(X)	128.2	(NA)	(X)	88.7
38110 02	Engineering and scientific instruments, n.s.k., typically for establishments with less than 10 employees (see note)	(NA)	(X)	74.0	(NA)	(X)	90.7
ENVIRONMENTAL CONTROLS							
3822—	Total	(NA)	(X)	1 544.5	(NA)	(X)	1 106.4
38220 —	Automatic controls for regulating residential and commercial environments and appliances:						
38220 00	Automatic controls for regulating residential and commercial environments and appliances used as components of air conditioning, refrigeration, and comfort heating (including pneumatic controls):						
	As reported in the census of manufactures	153	(X)	1 512.3	145	(X)	1 092.2
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products	(NA)	(X)	1 439.5	(NA)	(X)	1 125.3
	Temperature responsive (thermostats):						
38220 21	Electric	(NA)		32 693.0	(NA)		108 138.7
38220 22	Pneumatic	(NA)		29 360.6	(NA)		490.3
38220 25	Pressure responsive (pressurstats)	(NA)		14 420.2	(NA)		104.8
38220 30	Hydronic responsive	(NA)		(⁶)	(NA)		7 253.2
38220 35	Humidity responsive (humidistats)	(NA)		1 345.0	(NA)		—
38220 40	Light responsive	(NA)		—	(NA)		—
38220 45	Electrostatic responsive	(NA)		—	(NA)		—
38220 50	Liquid level	(NA)		672.9	(NA)		(⁷)
38220 55	Defrost controls (except appliance regulators)	(NA)		—	(NA)		(⁷)
38220 60	Igniters	(NA)		(⁶)	(NA)		1 765.4
38220 65	Inherent motor protectors	(NA)		66 362.6	(NA)		762 615.8
38220 66	Microprocessor-based load programmers for building energy control	(NA)		432.2	(NA)		16.6
	Computerized energy control systems for buildings:						
38220 67	Less than 100 points (systems)	(NA)	(D)	(⁶)	(NA)		122 267.5
38220 68	100 to 199 points (systems)	(NA)	(D)	(⁶)	(NA)		141.6
38220 69	200 points or more	(NA)	(S)	27.5	(NA)		—
38220 71	Upgrades or additions to existing computerized energy control systems for buildings	(NA)		—	(NA)		—
38220 74	Other	(NA)		50 793.4	(NA)		556.6
	Controls for major appliances such as domestic laundry, and cooking appliances; refrigerators and freezers; vending machines; air conditioners; etc.:						
38220 75	Temperature responsive	(NA)		109 444.0	(NA)		95 891.3
38220 80	All other controls for appliances	(NA)		14 558.2	(NA)		23 883.1
38220 98	Parts for environmental controls	(NA)	(X)	41.6	(NA)	(X)	88.3
38220 0A	Automatic controls for regulating residential and commercial environments and appliances, n.s.k.	(NA)	(X)	—	(NA)	(X)	—
38220 02	Automatic controls for regulating residential and commercial environments and appliances, n.s.k., typically for establishments with less than 20 employees (see note)	(NA)	(X)	32.2	(NA)	(X)	14.2
PROCESS CONTROL INSTRUMENTS							
3823—	Total	(NA)	(X)	3 915.1	(NA)	(X)	2 061.1
38230 —	Process control instruments:						
38230 00	Process control instruments:						
	As reported in the census of manufactures	589	(X)	3 814.2	370	(X)	2 024.2
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products	(NA)	(X)	3 750.8	(NA)	(X)	1 906.1

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
	PROCESS CONTROL INSTRUMENTS—Con.						
38230 — 38230 00	Process control instruments —Con. Process control instruments —Con. As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products —Con. General purpose control system instruments and related equipment. (these instruments, commonly called receiver-type, do not measure the process variable directly, but operate from standardized transmission signals (electrical types—a.c. or d.c. milliampere, millivolt, or telemetering signals; pneumatic types—3 to 15 and 3 to 27 p.s.i. signals): Electronic systems-unified architecture (include all system-type control, display, and computing instruments actuated from standardized electrical transmission signals in which control and signal conditioning are integral with the display/operator interface): Controllers (recording, indicating, or blind) ----- thousands... 38230 35 Recorders, with or without self-contained, set-point 38230 36 stations ----- do... 38230 37 Indicators, with or without self-contained, set-point stations ----- do... 38230 38 Auxiliary stations and analog computing devices associated with the above (include manual loaders, auto-to-manual stations, ratio stations, adders, multipliers, integrators, etc.) ----- do... 38230 07 Electronic systems—non-unified architecture (include all system-type instruments and related equipment actuated from standardized electrical transmission signals in which control and signal conditioning are separated from the display/operator interface. Equipment should include single loop and multi-loop controllers, dedicated operator stations, shared CRT-based operator work stations, process I/O) ----- 38230 12 Industrial multifunction process computers (include hardware and standard software of CPU and all peripheral equipment of computers that provide centralized processing intelligence for at least two or more of the following functions: data manipulation and reporting, supervisory control, data acquisition, calculations using control algorithms, data base management, use of a high- level programming language and operator interface) ----- Pneumatic types (including all system-type control, display, and computing instruments actuated from standardized pneumatic transmission signals): 38230 39 Controllers (recording, indicating, or blind) ----- thousands... 38230 40 Recorders, with or without self-contained, set-point stations ----- do... 38230 41 Indicators, with or without self-contained, set-point stations ----- do... 38230 42 Auxiliary stations and analog computing devices associated with the above (including manual loaders, auto-to-manual stations, ratio stations, adders, multipliers, integrators, etc.) ----- do... 38230 43 Receiver-type gauges, analog and digital ----- do... 38230 44 Annunciators, industrial, electromechanical, and solid-state types ----- do... Temperature instruments (excluding receiver-type instruments): Electrical and electronic measuring types (thermocouple, resistance temperature detector, radiation, optical, thermistor, and other electrical sensors): 38230 45 Direct-deflecting types (controllers for all types of electrical temperature) ----- do... 38230 46 Direct-deflecting types (indicators and recorders for all types of electrical temperature sensors) ----- do... 38230 47 Electromechanical self-balancing types (electric or pneumatic controllers for all types of electrical temperature sensors) ----- do... 38230 48 Electromechanical self-balancing types (indicators, recorders, and integrators for all types of electrical temperature sensors) ----- do... 38230 49 Electronic controllers for all types of electrical temperature sensors ----- do... 38230 50 Digital indicators for all types of electrical temperature sensors, excluding data loggers ----- do... Transmitters, producing standardized electric or pneumatic analog transmission signals for all types of electrical temperature sensors: 38230 54 Electric ----- do... 38230 55 Pneumatic ----- do...	(NA)	711.7	'131.4	(NA)	384.4	47.5
		(NA)	58.3	72.5	(NA)	37.7	31.1
		(NA)	71.5	32.8	(NA)	37.9	11.1
		(NA)	34.2	15.0	(NA)	37.7	14.3
		(NA)	(X)	'519.1	(NA)	.4	36.6
		(NA)	(X)	'175.3			
		(NA)	52.2	'39.1	(NA)	44.8	21.4
		(NA)	9.1	10.8	(NA)	17.0	10.0
		(NA)	4.5	2.0	(NA)	7.5	2.1
		(NA)	27.4	9.3	(NA)	30.8	9.5
		(NA)	'542.7	'10.8	(NA)	267.6	9.9
		(NA)	12.2	33.3	(NA)	4.4	16.3
		(NA)			(NA)		
		(NA)			(NA)		
		(NA)	'602.9	'30.5	(NA)	57.9	10.2
		(NA)			(NA)	34.0	11.4
		(NA)	29.0	14.2	(NA)	31.8	14.9
		(NA)	15.4	32.3	(NA)	17.5	27.0
		(NA)	204.6	39.9	(NA)	151.3	21.7
		(NA)	56.1	30.9	(NA)	31.1	18.5
		(NA)	48.8	'16.2	(NA)		
		(NA)	1.8	1.2	(NA)	26.5	8.8

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text.]

1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
PROCESS CONTROL INSTRUMENTS—Con.							
38230 --	Process control instruments —Con.						
38230 00	Process control instruments —Con. As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products —Con. General purpose control system instruments and related equipment. (these instruments, commonly called receiver-type, do not measure the process variable directly, but operate from standardized transmission signals (electrical types—a.c. or d.c. milliampere, millivolt, or telemetering signals; pneumatic types—3 to 15 and 3 to 27 p.s.i. signals)) —Con. Temperature instruments (excluding receiver-type instruments) —Con. Mechanical measuring types filled system (liquid filled, vapor pressure, gas filled, and mercury filled types):						
38230 52	Indicating or recording controllers ----- thousands..	(NA)	228.5	34.8	(NA)	196.8	27.7
38230 53	Recorders, noncontrol (excluding indoor-outdoor and other household or appliance types) ----- do..	(NA)	35.6	8.4	(NA)	44.7	5.8
38230 56	Indicators only (excluding indoor-outdoor and other household or appliance types) ----- do..	(NA)	1 163.7	23.0	(NA)	807.2	18.1
38230 57	Transmitters producing standardized electric or pneumatic analog transmission signals ----- do..	(NA)	7.8	6.2	(NA)	9.1	4.6
38230 59	Primary temperature sensors (excluding aircraft types):						
38230 59	Thermocouples and thermocouple lead wire -----	(NA)	(X)	135.0	(NA)	(X)	72.3
38230 60	All other types (resistance temperature detectors, radiation and optical sensors, thermistors, etc.) -----	(NA)	(X)	68.3	(NA)	(X)	24.4
	Pressure (gauge, absolute vacuum) and draft measuring instruments connected to the process (excluding receiver-type instruments and receiver-type gauge):						
38230 61	Indicating or recording controllers ----- thousands..	(NA)	134.0	49.4	(NA)	2 267.7	33.8
38230 62	Recorders, noncontrol ----- do..	(NA)	11.0	4.9	(NA)	13.8	2.7
	Indicators only (excluding receiver-type gauges):						
38230 20	3-inch diameter or more ----- do..	(NA)	4 018.3	101.2	(NA)	12 966.0	71.2
38230 21	Less than 3-inch diameter ----- do..	(NA)	19 803.7	48.5	(NA)		
	Transmitters producing standardized analog transmission signals:						
38230 24	Transmitters producing standardized electronic analog transmission signals ----- do..	(NA)	180.3	76.1	(NA)	35.3	26.2
38230 25	Transmitters producing standardized pneumatic analog transmission signals ----- do..	(NA)	14.3	10.8	(NA)	19.7	8.5
	Flow and liquid level instruments:						
	Differential pressure types:						
38230 65	Indicating or recording controllers ----- do..	(NA)	49.0	17.0	(NA)	106.8	10.1
38230 66	Recorders, noncontrol and indicators, noncontrol Transmitters producing standardized analog transmission signals:	(NA)	110.4	46.3	(NA)	114.0	27.8
38230 27	Transmitters producing standardized electronic analog transmission signals ----- do..	(NA)	91.0	92.9	(NA)	84.6	65.7
38230 28	Transmitters producing standardized pneumatic analog transmission signals ----- do..	(NA)	25.8	26.9	(NA)		
38230 29	Primary pressure sensors (load cells, strain gauges, etc.) ----- do..	(NA)	23.1	18.2	(NA)	90.1	18.9
38230 68	Primary flow elements (including orifice plates, venturi tubes, flow tubes, flow nozzles, pitot tubes, etc.) ----- do..	(NA)	326.4	51.7	(NA)		
38230 01	Electromagnetic, flow meters (flow tubes):						
	Secondary device (magnetic transmitter, recorder, indicator, or controller which receives signal directly from primary device) ----- do..	(NA)	88.5	46.5	(NA)	42.3	22.9
38230 03	Primary device (magnetic flow tube) ----- do..	(NA)	58.5	33.3	(NA)	17.3	21.1
38230 04	Capacitance, ultrasonic, and other electronic types (including magnetic resonance, vortex-precession, and vortex-shedding type elements) ----- do..	(NA)	18.6	19.7	(NA)	5.0	3.6
38230 71	Variable area—controlling, recording, indicating, and transmitting instruments and associated primary flow elements ----- do..	(NA)	691.6	64.0	(NA)	279.9	36.1
38230 72	Float and displacement—controlling, recording, indicating, and transmitting instruments and associated primary flow elements ----- do..	(NA)	1 248.5	68.4	(NA)	246.1	34.6
38230 73	Turbine, mass-flow and other types of controlling, recording, indicating, and transmitting instruments and associated primary flow elements ----- do..	(NA)	72.0	62.8	(NA)	26.8	19.1
38230 74	Humidity instruments—controlling, recording, indicating and transmitting, and associated primary humidity elements (excluding home and general-purpose type) ----- do..	(NA)	75.7	16.6	(NA)	45.3	6.7
	Continuous process instruments for on-stream gas and liquid analysis (including indicators, recorders, controllers, and analysis electrodes and cells):						
38230 75	Chromatographic analyzers ----- do..	(NA)	10.0	42.2	(NA)	(S)	19.8
38230 76	Infrared analyzers ----- do..	(NA)	3.0	20.5	(NA)	4.8	20.5
38230 77	Oxygen analyzers ----- do..	(NA)	11.4	34.4	(NA)	8.1	19.1
38230 78	Other gas analyzers ----- do..	(NA)	27.5	59.7	(NA)	9.1	21.8
38230 79	PH analyzers ----- do..	(NA)	15.9	18.7	(NA)	7.6	8.6
38230 80	Other liquid analyzers ----- do..	(NA)	18.6	43.4	(NA)	7.2	11.3

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
PROCESS CONTROL INSTRUMENTS—Con.							
38230 —	Process control instruments —Con.						
38230 00	Process control instruments —Con. As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products —Con. Instruments for all process variables not listed above (speed, weight, position, sequence, density, specific gravity, mechanical load, electrical load, millivolts):						
	Electrical and electronic measuring types:						
38230 06	Direct-deflecting type controllers, indicators, and recorders ----- thousands...	(NA)	10.8	24.0			
38230 08	Electromechanical self-balancing electric or pneumatic controllers, indicators, recorders, and integrators ----- do...	(NA)	10.6	16.5	(NA)	20.7	13.3
38230 85	Digital indicators ----- do...	(NA)	1.7	5.8			
38230 86	Transmitters producing standardized electric or pneumatic analog transmission signals ----- do...	(NA)	18.2	6.8	(NA)	5.8	5.2
	Mechanical measuring types:						
38230 87	Indicating or recording controllers ----- do...	(NA)	6.5	8.6	(NA)	1.0	2.9
38230 88	Recorders, noncontrol ----- do...	(NA)	58.3	11.0	(NA)	2.5	2.7
38230 89	Indicators only ----- do...	(NA)			(NA)	41.0	5.7
38230 90	Transmitters, producing standardized electric or pneumatic analog transmission signals ----- do...	(NA)	22.5	22.1	(NA)	5.3	3.9
38230 15	Valve actuators and positioners, sold separately ----- do...	(NA)	162.5	81.9	(NA)	97.2	33.7
38230 98	All other industrial process instruments ----- do...	(NA)	(X)	509.9	(NA)	(X)	593.3
38230 91	Parts, supplies, accessories, other primary sensors, n.e.c., panelboards, and other equipment associated with process control instrumentation, n.e.c. ----- do...	(NA)	(X)	497.0	(NA)	(X)	260.1
38230 02	Process control instruments, n.s.k., typically for establishments with less than 20 employees (see note) ----- do...	(NA)	(X)	100.9	(NA)	(X)	36.9
FLUID METERS AND COUNTING DEVICES							
3824 —	Total -----	(NA)	(X)	787.1	(NA)	(X)	634.3
38242 —	Integrating and totalizing meters for gas and liquids:						
38242 00	Integrating and totalizing meters for gas and liquids: As reported in the census of manufactures ----- do...	60	(X)	519.6	42	(X)	344.0
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products ----- do...	(NA)	(X)	493.4	(NA)	(X)	334.3
	Gas meters, consumption registering:						
	Diaphragm type: positive displacements; aluminum, iron, and tin case:						
38242 22	Residential size (up to 400 cu ft/hr of 0.64 specific gravity gas, at 0.5 inches water drop) ----- thousands...	(NA)	1 349.1	58.5	(NA)	1 437.8	51.1
38242 24	Other sizes, including commercial and industrial ----- do...	(NA)	78.3	28.8	(NA)	41.2	11.0
38242 26	Rotary type (all sizes) ----- do...	(NA)	19.4	20.7	(NA)	9.6	10.7
38242 28	Turbine type (all sizes) ----- do...	(NA)	6.6	11.4	(NA)	3.7	5.2
	Liquid meters, positive displacement with registers and counters:						
	Water meters, consumption registering:						
38242 33	Small meters, up to and including 1 in. ----- do...	(NA)	2 561.7	81.6	(NA)	2 640.5	85.7
38242 35	Intermediate meters, more than 1 in. up to and including 2 in. ----- do...	(NA)	74.2	21.1	(NA)	70.3	13.7
38242 37	Large meters, more than 2 in. ----- do...	(NA)	34.0	25.4	(NA)	99.2	23.7
38242 41	Liquid fuel dispensing meters (excluding service station dispensing pumps) ----- do...	(NA)	317.6	68.8	(NA)	279.9	40.3
38242 98	Other liquid meters; industrial bulk plants, pipeline, batching, treatment facilities ----- do...	(NA)	204.0	101.0	(NA)	178.7	41.1
38242 99	Parts, components, and accessories for gas and liquid meters (sold separately) ----- do...	(NA)	(X)	76.1	(NA)	(X)	51.8
38243 —	Counting devices:						
38243 00	Counting devices, excluding motor vehicle instruments: As reported in the census of manufactures ----- do...	42	(X)	162.0	46	(X)	147.0
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products ----- do...	(NA)	(X)	166.8	(NA)	5 135.0	141.3
	Revolution counters, digital (including totalizing, predetermining, reset and production types, tally counters, lineal counters, measuring wheels, and vehicle operation registers):						
38243 61	Mechanical input ----- thousands...	(NA)	3 432.7	33.0	(NA)	3 213.1	38.1
38243 64	Electrical input ----- do...	(NA)	2 179.0	26.6	(NA)	1 665.7	18.9
38243 67	Electronic input ----- do...	(NA)	208.4	35.5	(NA)	136.7	60.8
38243 70	Pneumatic input ----- do...	(NA)	(¹⁰)	(¹⁰)			
38243 73	Other counters, including centrifugal tachometers and event recorders ----- do...	(NA)	1036.3	1019.7	(NA)	119.5	23.6
38243 76	Taximeters ----- do...	(NA)	5.7	1.7			
38243 79	All other counting devices not specified above, including parking meters ----- do...	(NA)	661.3	47.7			
38243 89	Components and parts for counting devices and parking meters (sold separately) ----- do...	(NA)	(X)	2.6	(NA)	(NA)	(NA)
38244 —	Motor vehicle instruments ----- do...	(NA)	(X)	76.2	(NA)	(X)	123.2
38244 11	Speedometers ----- do...	6	(X)	8.3			
38244 21	Tachometers ----- do...	10	(X)	12.2			
38244 31	Odometers ----- do...	4	(X)	5.5	(NA)	(X)	121.8
38244 99	Other motor vehicle instruments (fuel level, oil pressure, etc.) ----- do...	18	(X)	48.5			

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 product code	Product	1982		1977			
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
FLUID METERS AND COUNTING DEVICES—Con.							
38244 --	Motor vehicle instruments —Con.						
38244 00	Motor vehicle instruments, n.s.k. -----	(NA)	(X)	1.7	(NA)	(X)	1.4
38240 00	Fluid meters and counting devices, n.s.k., typically for establishments with 20 employees or more (see note) -----	(NA)	(X)	11.8	(NA)	(X)	8.0
38240 02	Fluid meters and counting devices, n.s.k., typically for establishments with less than 20 employees (see note) -----	(NA)	(X)	17.5	(NA)	(X)	12.1
INSTRUMENTS TO MEASURE ELECTRICITY							
3825- --	Total -----	(NA)	(X)	5 575.6	(NA)	(X)	2 566.2
38251 --	Integrating instruments, electrical:						
38251 00	Integrating instruments, electrical:						
	As reported in the census of manufactures -----	30	(X)	363.2	28	(X)	223.5
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products -----	(NA)	(X)	339.0	(NA)	(X)	215.8
	A.c. watt-hour meters:						
	Single phase:						
	Detachable types ----- thousands..	(NA)	}	3 117.1	(NA)	3 781.1	77.1
38251 10	A-base types ----- do..	(NA)					
38251 11	Switchboard types ----- do..	(NA)					
38251 14	Polyphase ----- do..	(NA)	416.2	45.1	(NA)	287.1	24.1
38251 15	Demand meters (kW and kva), combined watt-hour and demand meters (single phase and polyphase), and combined watt-hour and time switch meters ----- do..	(NA)	316.9	69.6	(NA)	325.9	50.5
38251 35	Other electrical integrating meters (including d.c. watt-hour meters, ampere-hour meters, and other miscellaneous integrating instruments not included in above classifications) -----	(NA)	(X)	45.3	(NA)	(X)	11.4
38251 51	Parts and accessories for electric integrating meters (including meter mountings, registers, and test equipment) sold separately -----	(NA)	(X)	81.2	(NA)	(X)	42.1
38251 61	Electrical integrating instruments, n.s.k. -----	(NA)	(X)	-	(NA)	(X)	10.5
38251 0A							
38252 --	Test equipment for testing electrical, radio and communication circuits, and motors:						
38252 00	Test equipment for testing electrical, radio and communication circuits, and motors:						
	As reported in the census of manufactures -----	312	(X)	4 455.2	253	(X)	1 784.9
	As collected in Current Industrial Report MA-38B, Selected Instruments and Related Products -----	(NA)	(X)	4 384.6	(NA)	(X)	1 706.0
	Voltage, current, and resistance measuring equipment (except multimeters):						
	Electronic:						
38252 20	Digital -----	(NA)	(X)	130.6	(NA)	(X)	9.1
38252 21	Analog -----	(NA)	(X)	50.6	(NA)	(X)	85.2
38252 22	Electrical (except panel meters) -----	(NA)	(X)	27.3	(NA)	(X)	14.5
	Multimeters:						
	Electronic:						
38252 28	Digital -----	(NA)	(X)	80.8	(NA)	(X)	42.9
38252 29	Analog -----	(NA)	(X)	6.7	(NA)	(X)	19.7
38252 30	Electrical -----	(NA)	(X)	17.6	(NA)	(X)	19.7
	Power and energy measuring equipment:						
	Electronic:						
38252 25	Analog -----	(NA)	(X)	7.9	(NA)	(X)	6.0
38252 26	Digital -----	(NA)	(X)	6.3	(NA)	(NA)	(NA)
38252 27	Electrical power measuring equipment (except electrical integrating instruments) -----	(NA)	(X)	5.1	(NA)	(X)	3.1
	Frequency measuring equipment:						
	Electronic frequency meters:						
38252 67	890 megacycle and above ----- thousands..	(NA)	}	36.0	(NA)	108.4	56.1
38252 68	Other ----- do..	(NA)					
38252 69	Electrical and mechanical frequency meters ----- do..	(NA)					
	Waveform measuring and/or analyzing equipment:						
	Oscilloscopes and plug-in accessories:						
38252 12	Less than 10 mc -----	(NA)	(X)	(¹¹)	}	(NA)	(X)
38252 13	10 mc or more -----	(NA)	(X)	11427.0			
38252 14	Oscillographs (low frequency) -----	(NA)	(X)	(¹²)			
38252 16	Other waveform measuring and analyzing equipment -----	(NA)	(X)	12248.5			294.6
	Signal generating equipment:						
38252 56	Audio -----	(NA)	(X)	66.0	(NA)	(X)	10.8
38252 58	RF (more than 20 kc to 890 megacycles) -----	(NA)	(X)	142.3	(NA)	(X)	60.8
38252 59	Microwave (890 megacycles and above) -----	(NA)	(X)	70.3	(NA)	(X)	14.2
	Field strength and intensity measuring equipment (including RFI measuring equipment):						
38252 91	Electronic -----	(NA)	(X)	118.8	(NA)	(NA)	(NA)
38252 92	Electrical field measuring equipment -----	(NA)	(X)	10.1	(NA)	(X)	59.0
	Impedance and standing wave ratio measuring equipment (transfer function measuring equipment):						
38252 93	Electronic impedance and related measuring equipment -----	(NA)	(X)	16.0	(NA)	(X)	5.5
38252 94	Standing wave measuring equipment (slotted lines, sliding shorts, reflectometers, and other SWR equipment) -----	(NA)	(X)	33.7	(NA)	(X)	11.8
38252 96	Electronic time measuring and counting equipment (electronic chronoscopes and chronometers, range calibrators, time interval measuring equipment, etc.) -----	(NA)	(X)	31.5	(NA)	(X)	30.3
38252 97	X-Y plotters (recorders):						
	Electronic -----	(NA)	(X)	167.5	(NA)	(X)	69.3

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
	INSTRUMENTS TO MEASURE ELECTRICITY—Con.						
38252 --	Test equipment for testing electrical, radio and communication circuits, and motors—Con.						
38252 00	Test equipment for testing electrical, radio and communication circuits, and motors—Con. As collected in Current Industrial Report MA-38B, Selected Instruments and Related Products—Con.						
38252 44	Multifunction test and measuring equipment: Combination and/or group test sets -----	(NA)	(X)	562.6	(NA)	(X)	168.1
38252 45	Component part test sets: Electron tube test equipment -----	(NA)	(X)	256.4	(NA)	(X)	3.1
38252 46	Semiconductor test equipment -----	(NA)	(X)	69.0	(NA)	(X)	83.8
38252 47	Other component part test sets and equipment -----	(NA)	(X)	190.4	(NA)	(X)	3.0
38252 48	Equipment and subassembly test equipment, n.e.c. -----	(NA)	(X)	190.4	(NA)	(X)	91.6
	Standards and calibration equipment for test measuring equipment, including laboratory types (metered bench-top, rack-mountable, or plug-in equipment):						
38252 72	Electronic -----	(NA)	(X)	94.6	(NA)	(X)	26.0
38252 74	Electrical -----	(NA)	(X)	39.2	(NA)	(X)	14.1
38252 52	Microwave test equipment, n.e.c. (890 megacycles and above) -----	(NA)	(X)	120.5	(NA)	(X)	48.5
38252 39	Analyzers for testing characteristics of internal-combustion engines (excluding aircraft) -----	(NA)	(X)	220.9	(NA)	(X)	151.7
38252 82	Associated devices for electronic and electrical test and measuring equipment -----	(NA)	(X)	77.8	(NA)	(X)	37.0
38252 98	Other test, measuring, and analyzing equipment for electronic and electrical circuits and equipment -----	(NA)	(X)	961.6	(NA)	(X)	286.1
38252 99	Parts and components for test equipment for testing electrical, radio and communication circuits, and motors (sold separately) -----	(NA)	(X)	28.6	(NA)	(X)	286.1
38253 --	Instruments to measure electricity, n.e.c.:						
38253 00	Instruments to measure electricity, n.e.c.:						
	As reported in the census of manufactures -----	126	(X)	556.7	154	(X)	429.9
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products -----	(NA)	(X)	539.0	(NA)	(X)	399.8
	Electrical indicating instruments:						
	Panel type instruments (includes all aircraft types and all miniaturized instruments (+ or - 3 percent) and rectifier instruments which can be enclosed in a case suitable for mounting on a panel and are an end product. Excluding all instruments for use on motor vehicles which are capable of accuracies of + or - 2 percent of full scale indication):						
38253 08	Digital panel meters (DPM) between 0.05 percent and 1 percent + or - 1 digit accuracy (excluding precision DVM's and electronic counters) ----- thousands..	(NA)	284.3	25.5	(NA)	339.6	25.6
38253 10	Analog solid state panel meters (generally of + or - 2 percent accuracy) with LED, LCD, or neon gas discharge display ----- do..	(NA)	89.2	6.9	(NA)		
38253 12	Panel type other than ruggedized or sealed (generally of 2 percent accuracy):						
	A.c. (including moving iron vane and dynamometer types) ----- do..	(NA)	528.4	11.5	(NA)	688.1	10.3
38253 13	D.c. (including rectifier and self-contained thermocouple types) ----- do..	(NA)	2 808.7	45.4	(NA)	3 522.7	42.1
38253 11	Panel types ruggedized or sealed (generally of 2 percent accuracy) ----- do..	(NA)	334.1	9.7	(NA)	628.4	11.3
	Panel types with control or signal initiating means (including instrument relays):						
38253 16	Indicating ----- do..	(NA)	89.2	7.4	(NA)	226.5	8.9
38253 17	Nonindicating ----- do..	(NA)			(NA)		
38253 19	All other panel type instruments, including ammeters and voltmeters for motor vehicles ----- do..	(NA)	9 480.2	39.9	(NA)	10 503.5	40.6
	Switchboard instruments which are generally of 1 percent accuracy:						
38253 23	A.c. (including moving iron vane and dynamometer types) ----- do..	(NA)	58.6	10.3	(NA)	55.8	7.1
38253 25	D.c. (including rectifier and thermocouple types) ----- do..	(NA)	56.8	7.9	(NA)	52.5	7.0
38253 27	Elapsed time meters (with and without reset) ----- do..	(NA)	1 481.2	24.3	(NA)	1 163.1	15.3
	Portable instruments which are generally capable of accuracies within + or - 2 percent full scale indication, can be enclosed in a case so that they can be moved and used at various locations, and are an end product:						
	Portable types (accuracy rating 0.11 percent through 0.50 percent) ----- do..	(NA)	2.6	1.4	(NA)	9.0	2.1
38253 30	Portable types (accuracy rating 0.51 percent through 2 percent) ----- do..	(NA)	80.7	6.6	(NA)	70.6	4.9
38253 35	Laboratory portable instruments with accuracies within + or - 1 percent up to 1/10 percent of full scale and better (all case sizes) ----- do..	(NA)	4.4	2.2	(NA)	45.0	3.4
38253 37	Volt-ohm millimeter (VOM), accuracy 0.10 percent through 5 percent ----- do..	(NA)	(¹³)	(¹³)	(NA)		
38253 45	Other electrical indicating instruments (except self-balancing types) ----- do..	(NA)	¹³ 180.6	¹³ 9.8	(NA)	(X)	5.6
	Electrical recording instruments (portable and for panel mounting):						
38253 50	Direct deflecting (direct acting) (except temperature calibrated instruments) ----- do..	(NA)	37.0	16.0	(NA)	334.2	17.2

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

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1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
	INSTRUMENTS TO MEASURE ELECTRICITY—Con.						
38253 — 38253 00	Instruments to measure electricity, n.e.c. —Con. Instruments to measure electricity, n.e.c. —Con. As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products —Con. Electrical recording instruments (portable and for panel mounting) —Con.						
38253 63	Oscillographic recorders: Pen or stylus type ----- thousands...	(NA)	93.4	64.0	(NA)		
38253 65	Light beam type ----- do...	(NA)	38.5	68.8	(NA)	57.7	90.5
38253 72	Other electrical recording instruments ----- Parts and accessories for indicating and recording instruments:	(NA)	(X)	116.7	(NA)	(X)	77.2
38253 74	Transducers for volts, amperes, watts, vars, frequency, temperature, and power factor -----	(NA)	(X)	35.3	(NA)	(X)	14.9
38253 75	Tachometer generators (except aerospace types) -----	(NA)	(X)	13.4	(NA)	(X)	2.5
38253 76	Other, including instruments shunts -----	(NA)	(X)	16.0	(NA)	(X)	13.4
38253 0A	Instruments to measure electricity, n.s.k. -----	(NA)	(X)	-	(NA)	(X)	-
38250 00	Instruments to measure electricity, n.s.k., typically for establishments with 10 employees or more (see note) -----	(NA)	(X)	102.1	(NA)	(X)	61.4
38250 02	Instruments to measure electricity, n.s.k., typically for establishments with less than 10 employees (see note) -----	(NA)	(X)	98.4	(NA)	(X)	66.4
	MEASURING AND CONTROLLING DEVICES, N.E.C.						
3829- --	Total -----	(NA)	(X)	2 073.4	(X)	(X)	1 073.1
38291 — 38291 00	Aircraft engine instruments, except flight: Aircraft engine instruments, except flight: As reported in the census of manufactures ----- As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products -----	42	(X)	311.0	49	(X)	120.1
38291 45	Temperature sensors, transmitters, and displays -----	(NA)	(X)	290.3	(NA)	(X)	115.2
38291 46	Pressure ratio sensors, displays, and controls -----	(NA)	(X)	53.9	(NA)	(X)	26.7
38291 47	Pressure and vacuum sensors, transmitters, and displays -----	(NA)	(X)	18.8	(NA)	(X)	8.5
38291 58	Fuel and oil flow rate sensors, transmitters, and displays, including mixture controls -----	(NA)	(X)	11.2	(NA)	(X)	11.6
38291 60	Fuel and oil quantity sensors, transmitters, and displays, including densitometers -----	(NA)	(X)	50.3	(NA)	(X)	8.7
38291 62	Tachometer generators and indicators -----	(NA)	(X)	56.4	(NA)	(X)	30.9
38291 98	All other not specified above -----	(NA)	(X)	9.2	(NA)	(X)	4.1
38291 99	Parts and components for aircraft engine instruments, except flight (sold separately) -----	(NA)	(X)	90.5	(NA)	(X)	24.9
38292 — 38292 00	Physical properties and kinematic testing and inspection equipment: Physical properties testing and inspection equipment and kinematic testing and measuring equipment: As reported in the census of manufactures ----- As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products -----	199	(X)	635.2	135	(X)	276.6
38292 33	Physical properties testing equipment, including hardness, tensile, stress, strain, abrasion, strength, torsion, wear, and similar testing equipment, including components and parts sold separately: -----	(NA)	(X)	590.7	(NA)	(X)	276.4
38292 35	Electrical and electronic types -----	(NA)	(X)	240.6	(NA)	(X)	63.5
38292 57	Other types -----	(NA)	(X)	30.4	(NA)	(X)	13.5
38292 59	Physical properties inspection equipment, including flow detection thickness, measuring and similar inspection equipment, including components and parts sold separately: -----	(NA)	(X)	130.8	(NA)	(X)	23.7
38292 92	Electrical and electronic types -----	(NA)	(X)	48.3	(NA)	(X)	37.9
38292 93	Other types -----	(NA)	(X)	74.7	(NA)	(X)	46.3
38292 0A	Vibration ----- Acceleration and all other kinematic test and measuring equipment -----	(NA)	(X)	65.9	(NA)	(X)	15.0
38293 — 38293 00	Physical properties and kinematic testing and inspection equipment, n.s.k. ----- Commercial, meteorological, and general purpose instruments: Commercial, meteorological, and general purpose instruments: As reported in the census of manufactures ----- As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products -----	146	(X)	365.2	143	(X)	226.8
38293 20	Barometers and barographs, aneroid and mercurial types, including recorders, wall, pendant, meteorological, hygro-thermographs, barometer-thermometer-humidity -----	(NA)	(X)	325.3	(NA)	(X)	195.3
38293 21	Hydrometers, glass, all types, including thermo-hydrometers ----- thousands...	(NA)	(X)	9.9	(NA)	(X)	10.3
		(NA)	356.6	2.4	(NA)	620.7	1.8

See footnotes at end of table.

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1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
	MEASURING AND CONTROLLING DEVICES, N.E.C.—Con.						
38293 --	Commercial, meteorological, and general purpose instruments — Con.						
38293 00	Commercial, meteorological, and general purpose instruments — Con. As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products — Con.						
38293 22	Liquid-in-glass thermometers: Engraved (etched) stem, thermoregulators, deep-sea reversing, laboratory, encased glass, ASTM standards, pocket case, max-min registering, except clinical	(NA)	(X)	9.5	(NA)	(X)	7.6
38293 23	Threaded and flanged types, fixed and adjustable angle, in-line and duct installations, for process, food, air conditioning, and refrigeration installations	(NA)		730.4	(NA)	450.3	3.7
38293 24	Household and commercial thermometers, such as wall, outdoor, domestic science, cupcase, filled systems, indoor-outdoor	(NA)		10 144.8	(NA)	23 505.8	14.3
38293 34	Clinical (fever) thermometers	(NA)		45 132.5	(NA)	39 010.9	16.8
38293 25	Bi-metal thermometers: Threaded and flanged types, for pipeline and duct installations, including general and pocket test	(NA)		3 235.0	(NA)	2 131.6	16.9
38293 26	Domestic science, commercial general test, indoor, outdoor, desk models, oven, refrigerator	(NA)		7 475.8	(NA)	8 763.6	12.3
38293 27	Infrared thermometers, portable	(NA)					
38293 28	Humidity indicating and recording instruments, such as bi-hygroscopic and hygroscopic element, indicators, psychrometers, wet and dry bulb, hygrometers, indicating hygrometers	(NA)	(X)	10.5	(NA)	(X)	16.1
38293 31	Other meteorological instruments, including speed and directional instruments, rain gauges, thermographs, and parts (sold separately)	(NA)	(X)	64.0	(NA)	(X)	68.3
38293 33	Other commercial and industrial instruments, including compasses, altimeters, test equipment for hydraulic and pneumatic systems and controls and parts (sold separately)	(NA)	(X)	151.8	(NA)	(X)	27.1
38293 0A	Commercial, meteorological, and general purpose instruments, n.s.k.	(NA)	(X)	-	(NA)	(X)	
38294 --	Nuclear radiation detection and monitoring instruments:						
38294 00	Nuclear radiation detection and monitoring instruments: As reported in the census of manufactures	71	(X)	596.4	73	(X)	344.2
38294 02	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products Radiation detecting elements, including ION chambers	(NA)	(X)	561.6	(NA)	(X)	350.7
38294 04	Solid state detectors	(NA)		40.1	(NA)	22.9	29.0
38294 06	Nuclear monitoring instruments, including environmental, personal dosimetry, and medical monitors, both stationary and portable types	(NA)	(X)	103.9	(NA)	(X)	189.4
38294 07	Medical and biological counting systems for in VIVO counting	(NA)					
38294 09	Sample and flow counting systems, manual and automatic	(NA)	(X)	28.7	(NA)	(X)	24.6
38294 19	Scalers	(NA)		11.8	(NA)	1.0	.9
38294 21	Special amplifiers for nuclear applications	(NA)		4.1	(NA)	3.9	2.3
38294 22	Pulse analyzers, including nuclear spectrometers: Single channel pulse height analyzers	(NA)		1.0	(NA)	.9	.7
38294 23	Multi-channel pulse height analyzers	(NA)		2.6	(NA)	2.4	32.5
38294 25	Count rate meters	(NA)		1.0	(NA)	1.5	1.1
38294 29	Measurement and control devices using BETA, Gamma, or Neutron gauge technology	(NA)	(X)	129.9	(NA)	(X)	46.9
38294 28	Input-output accessories for multi-channel analyzers	(NA)	(X)	1.5	(NA)	(X)	2.9
38294 30	Nuclear power supplies	(NA)	(X)	9.4	(NA)	(X)	
38294 32	Neutron and photon activation analysis systems	(NA)					
38294 34	Nuclear instrument modules, not elsewhere classified	(NA)	(X)	27.7	(NA)	(X)	6.3
38294 39	Other nuclear radiation detection and monitoring instruments	(NA)	(X)	146.8	(NA)	(X)	14.1
38294 98	Parts and components for nuclear radiation detection and monitoring instruments (sold separately)	(NA)	(X)	15.6	(NA)	(X)	
38290 00	Measuring and controlling devices, n.e.c., n.s.k., typically for establishments with 5 employees or more (see note)	(NA)	(X)	123.1	(NA)	(X)	76.3
38290 02	Measuring and controlling devices, n.e.c., n.s.k., typically for establishments with less than 5 employees (see note)	(NA)	(X)	42.5	(NA)	(X)	29.1
	OPTICAL INSTRUMENTS AND LENSES						
3832- --	Total	(NA)	(X)	3 678.4	(NA)	(X)	1 299.7
38324 --	Sighting, tracking, and fire control equipment, optical type:						
38324 00	Sighting, tracking, and fire control equipment, optical type: As reported in the census of manufactures	53	(X)	505.4	59	(X)	227.3
38324 01	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products Made from lenses, prisms, etc., produced in the same plant	(NA)	(X)	492.2	(NA)	(X)	208.0
38324 02	Made from purchased lenses, prisms, etc.	(NA)	(X)	289.9	(NA)	(X)	122.2
		(NA)	(X)	202.3	(NA)	(X)	85.8

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
OPTICAL INSTRUMENTS AND LENSES—Con.							
38325 --	Optical instruments and lenses, except sighting, tracking, and fire control equipment:						
38325 00	Optical instruments and lenses, except sighting, tracking, and fire control equipment:						
	As reported in the census of manufactures -----	170	(X)	922.8	165	(X)	390.0
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products -----	(NA)	(X)	893.7	(NA)	(X)	373.3
38325 01	Binoculars, prismatic and nonprismatic -----	(NA)	(X)	6.9	(NA)	(X)	.8
38325 05	Optical alignment and display instruments and systems, except photographic -----	(NA)	(X)	(¹⁴)	(NA)	(X)	28.2
38325 10	Optical test equipment including standard sources, modulators, optical comparators, interferometers (except optical microscopes) -----	(NA)	(X)	67.2	(NA)	(X)	81.6
38325 15	Optical microscopes -----	(NA)	(X)	59.4			
38325 20	Optical components, including mirrors, filters, gratings, coatings, movements, reflectors, reticles, prisms, monochrometers, light amplifiers, KERR cells, etc. -----	(NA)	(X)	167.7	(NA)	(X)	86.5
38325 21	Lenses, except ophthalmic focus lenses: Unmounted lenses -----	(NA)	(X)	69.0	(NA)	(X)	7.9
	Mounted lenses: Photographic lenses -----	(NA)	(X)	14.5	(NA)	(X)	8.1
38325 23	Other mounted lenses -----	(NA)	(X)	32.4			
38325 25	Other optical instruments, excluding analytical instruments listed above and sighting and fire control equipment -----	(NA)	(X)	1476.6	(NA)	(X)	148.0
38325 0A	Optical instruments and lenses, n.s.k. -----	(NA)	(X)	-	(NA)	(X)	12.2
38326 --	Analytical and scientific instruments, except optical:						
38326 00	Analytical and scientific instruments, except optical:						
	As reported in the census of manufactures -----	177	(X)	2 088.4	133	(X)	604.5
	As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products -----	(NA)	(X)	1 990.4	(NA)	(X)	588.7
	Electrochemical instruments: pH electrodes and meters -----	(NA)	(X)	39.2	(NA)	(X)	15.3
38326 01	Ion selective electrodes and meters -----	(NA)	(X)	15.2	(NA)	(X)	4.4
38326 03	Electrophoresis chambers and supplies -----	(NA)	(X)	26.9	(NA)	(X)	20.1
38326 04	Coulometric analysis, laboratory type -----	(NA)	(X)	(¹⁵)			
38326 02	Electrolytic conductivity instruments (laboratory type) -----	(NA)	(X)	(¹⁵)			
38326 06	Moisture analyzers -----	(NA)	(X)	(¹⁵)			
38326 09	Titration, including redox (oxidation-reduction potential) instruments -----	(NA)	(X)	1519.0	(NA)	(X)	8.7
38326 11	Specific ion measuring instruments, laboratory type -----	(NA)	(X)	-			
38326 18	Polarographic equipment (analyzers) -----	(NA)	(X)	(¹⁶)			
38326 52	Other, except process type -----	(NA)	(X)	1614.7			
38326 05	Photometers: Flame ----- number -----	(NA)					
38326 31	Other (including fluorescents, light scattering reflectants, helium glow, and light measuring) ----- do -----	(NA)	(X)	5.0	(NA)	(X)	(¹⁷)
38326 33	Chromatographic instruments: Gas ----- do -----	(NA)					
38326 07	Liquid ----- do -----	(NA)					
38326 35	Other, including paper, gel, and thin layer ----- do -----	(NA)					
38326 37	Spectrographs ----- do -----	(NA)	(X)	(¹⁸)	(NA)	(X)	19.9
38326 10	Spectrophotometric instruments: Atomic absorption ----- do -----	(NA)					
38326 41	Flame emission ----- do -----	(NA)					
38326 43	Optical emission, including spark, arc, and glow ----- do -----	(NA)					
38326 45	Optical emission, including laser excited source (including laser microprobe source emission, laser source Raman, and laser microprobe source ----- do -----	(NA)					
38326 46	Raman spectrometers ----- do -----	(NA)					
38326 47	Optical emission with inductively coupled plasma, ICP ----- do -----	(NA)					
38326 13	Infrared ----- do -----	(NA)					
38326 14	Ultraviolet, visible and colorimeters ----- do -----	(NA)					
38326 15	Fluorescent instruments, including fluorometers ----- do -----	(NA)					
38326 16	Densitometers, reflection, and glassmeters ----- do -----	(NA)					
38326 17	Other, including near ultraviolet and Raman ----- do -----	(NA)					
38326 19	Thermal analysis instruments ----- do -----	(NA)					
38326 20	Nuclear magnetic resonance instruments ----- number -----	(NA)					
38326 51	Neutron activation analysis ----- do -----	(NA)					
38326 21	Microscopes, electron and proton ----- do -----	(NA)					
38326 53	Particle beam excitation instruments ----- do -----	(NA)					
38326 55	Photon excitation analyzers ----- do -----	(NA)					
38326 23	Mass spectroscopy instrumentation ----- do -----	(NA)					

See footnotes at end of table.

Table 6a. Product and Product Classes—Quantity and Value of Shipments by All Producers: 1982 and 1977—Con.

[Includes quantity and value of products of this industry produced by (1) establishments classified in this industry (primary) and (2) establishments classified in other industries (secondary). Transfers of products of this industry from one establishment of a company to another establishment of the same company (interplant transfers) are also included. For further explanation, see Value of Shipments in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 product code	Product	1982			1977		
		Number of companies with shipments of \$100,000 or more	Product shipments ¹		Number of companies with shipments of \$100,000 or more	Product shipments ¹	
			Quantity ²	Value (million dollars)		Quantity ²	Value (million dollars)
	OPTICAL INSTRUMENTS AND LENSES—Con.						
38326 — 38326 00	Analytical and scientific instruments, except optical—Con. As reported in the Current Industrial Report MA-38B, Selected Instruments and Related Products—Con. Clinical laboratory instrumentation (including instruments used in the clinical laboratory for measuring, analyzing, and processing clinical specimens):						
38326 71	Chemistry—measure and identify substances, e.g., metabolites, enzymes, and drugs ----- number...	(NA)	15 057	160.8			
38326 72	Hematology—measure and identify substances or cells contained in blood or substances influencing the development and clotting of blood, e.g., cell counting coagulation factors ----- do...	(NA)	'8 068	142.3			
38326 73	Microbiology—enumerate or identify pathogenic organisms or measure their susceptibility to antimicrobial agents -----	(NA)	(X)	(²²)			
38326 74	Histology—process tissue and cells, e.g., tissue processors, cell stainers -----	(NA)	(X)	(²²)			
38326 75	Blood bank and immunology—process blood and specimens for testing, measuring and identifying; using immunoassay, substances in clinical specimens -----	(NA)	(X)	²² 64.1	(NA)	(X)	¹⁷ 139.5
38326 76	Other clinical laboratory instrumentation, not specified above ----- number...	(NA)	'18 873	'274.0			
38326 59	Elemental analysis instruments ----- do...	(NA)	184 879	'92.6			
38326 89	Other analytical and scientific instruments, not elsewhere classified -----	(NA)	(X)	135.0			
38326 98	Parts, components, and accessories for analytical and scientific instruments (sold separately), including photo tubes, thermal conductivity sensors, thermopiles, etc., which are not specifically provided for in product class 38325, optical instruments -----	(NA)	(X)	150.7			
38320 00	Optical instruments and lenses, n.s.k., typically for establishments with 10 employees or more (see note) -----	(NA)	(X)	118.3	(NA)	(X)	54.0
38320 02	Optical instruments and lenses, n.s.k., typically for establishments with less than 10 employees (see note) -----	(NA)	(X)	43.5	(NA)	(X)	23.9

Note: In 1982 Census of Manufactures, data for establishments of small single-unit companies with up to 20 employees were estimated from administrative-record data rather than data actually collected from respondents. Employment cutoff used for administrative records for each industry and shipments figures are included in code ending with "002". In both 1982 and 1977 Censuses of Manufactures, products not completely identified on standard forms were coded in appropriate product class (five-digit) followed by "00" or to appropriate product group code (four-digit) followed by "000".

¹Data reported by all producers, not just those with shipments of \$100,000 or more.

²For some establishments, data have been estimated from central unit values which are based on quantity-value relationships of reported data. The following symbols are used when percentage of each quantity figure estimated in this manner equals or exceeds 10 percent of published figure: * 10 to 19 percent estimated; ** 20 to 29 percent estimated. If 30 percent or more is estimated, figure is replaced by (S).

³For 1982, product codes 38112 26 and 38112 30 are combined to avoid disclosing data for individual companies.

⁴For 1982, product codes 38112 28 and 38112 29 are combined to avoid disclosing data for individual companies.

⁵For 1982, product codes 38113 34 and 38113 37 are combined to avoid disclosing data for individual companies.

⁶For 1982, product codes 38220 30 and 38220 35 are combined to avoid disclosing data for individual companies.

⁷For 1977, product codes 38220 50, 38220 55, and 38220 65 were combined to avoid disclosing data for individual companies.

⁸For 1982, product codes 38220 60 and 38220 65 are combined to avoid disclosing data for individual companies.

⁹For 1982, product codes 38220 67, 38220 68, and 38220 69 are combined to avoid disclosing data for individual companies.

¹⁰For 1982, product codes 38243 70 and 38243 73 are combined to avoid disclosing data for individual companies.

¹¹For 1982, product codes 38252 12 and 38252 13 are combined to avoid disclosing data for individual companies.

¹²For 1982, product codes 38252 14 and 38252 16 are combined to avoid disclosing data for individual companies.

¹³For 1982, product codes 38253 37 and 38253 45 are combined to avoid disclosing data for individual companies.

¹⁴For 1982, product code 38325 05 is included with product code 38325 25.

¹⁵For 1982, product codes 38326 02, 38326 06, and 38326 09 are included with product code 38326 11.

¹⁶For 1982, product code 38326 52 is included with product code 38326 05.

¹⁷For 1977, product codes 38326 31, 38326 33, 38326 51, 38326 53, 38326 55, 38326 71, 38326 72, 38326 73, 38326 74, 38326 75, 38326 76, 38326 59, and 38326 89 were included with product code 38326 98.

¹⁸For 1982, product codes 38326 10 and 38326 17 are combined to avoid disclosing data for individual companies.

¹⁹For 1977, product codes 38326 41 and 38326 43 were included with product code 38326 13.

²⁰For 1977, product codes 38326 45, 38326 46, and 38326 47 were included with product code 38326 17.

²¹For 1982, product code 38326 20 is included with product code 38326 21.

²²For 1982, product codes 38326 73 and 38326 74 are included with product code 38326 75.

Table 6b. Product Classes—Value of Shipments by All Producers for Specified States: 1982 and 1977

(Million dollars. Product classes covered are those that are economically significant and whose production is geographically dispersed, provided dispersion is not approximated by data in table 2. Also, product classes are not shown if they are miscellaneous or "not specified by type" classes. Statistics for some States are withheld because they are either less than \$2 million in product class shipments or they disclose data for individual companies in 1982. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Product class and geographic area	1982 value of product shipments	1977 value of product shipments	Product class and geographic area	1982 value of product shipments	1977 value of product shipments
38111, AERONAUTICAL, NAUTICAL, AND NAVIGATIONAL INSTRUMENTS			38252, TEST EQUIPMENT FOR TESTING ELECTRICAL CIRCUITS		
United States	1 418.7	804.6	United States	4 455.2	1 784.9
California	208.5	88.4	Arizona	29.2	(AA)
Connecticut	55.0	50.0	California	1 401.5	502.6
Florida	118.9	64.2	Connecticut	54.1	32.7
Illinois	6.9	4.6	Florida	23.0	(NA)
Kansas	18.7	(FF)	Illinois	152.6	127.2
Louisiana	39.3	(NA)	Maryland	39.6	(BB)
Massachusetts	109.9	56.4	Massachusetts	419.8	102.6
Michigan	92.1	(FF)	Michigan	104.0	60.3
New Jersey	144.2	99.3	Minnesota	82.6	(FF)
New York	38.9	29.1	Missouri	47.3	(EE)
Pennsylvania	98.6	52.9	New Hampshire	40.8	(NA)
38112, LABORATORY AND SCIENTIFIC APPARATUS			New Jersey	281.8	164.3
United States	1 083.6	696.6	New York	261.3	109.9
California	177.8	146.3	North Carolina	6.7	(BB)
Colorado	3.7	6.4	Ohio	53.8	28.5
Florida	10.2	(CC)	Pennsylvania	42.0	23.0
Illinois	86.3	56.8	Texas	61.4	28.5
Maryland	3.8	22.9	Virginia	4.8	(EE)
Massachusetts	53.4	(NA)	Washington	271.5	(FF)
Michigan	38.4	17.0	38253, INSTRUMENTS TO MEASURE ELECTRICITY, N.E.C.		
Minnesota	23.0	(FF)	United States	556.7	429.9
New Hampshire	8.8	(AA)	California	97.1	87.2
New Jersey	90.1	62.9	Connecticut	17.6	(NA)
New York	56.1	33.1	Florida	13.0	(AA)
Ohio	31.8	29.6	Illinois	36.3	31.5
Oregon	10.9	(CC)	Massachusetts	74.3	36.5
Pennsylvania	88.7	29.9	New Hampshire	24.8	33.0
Texas	21.1	12.4	New Jersey	24.0	(NA)
Virginia	3.7	4.5	New York	17.5	19.0
Wisconsin	9.9	(CC)	Ohio	73.9	49.0
38113, SURVEYING AND DRAFTING INSTRUMENTS			Pennsylvania	18.6	18.4
United States	259.9	168.9	38291, AIRCRAFT ENGINE INSTRUMENTS, EXCEPT FLIGHT		
California	39.2	19.4	United States	311.0	120.1
Connecticut	8.9	(BB)	California	54.5	8.7
Illinois	8.0	(BB)	Texas	8.9	(BB)
Massachusetts	4.1	(NA)	38292, PHYSICAL PROPERTIES TESTING AND INSPECTION EQUIPMENT		
New Jersey	7.7	(BB)	United States	635.2	276.6
New York	27.2	14.6	California	66.1	84.2
Texas	18.8	(BB)	Colorado	4.6	(AA)
38242, INTEGRATING AND TOTALIZING METERS FOR GAS AND LIQUIDS			Connecticut	45.3	(FF)
United States	519.6	344.0	Illinois	53.9	21.5
Arkansas	8.2	(BB)	Massachusetts	56.0	(NA)
California	12.4	25.1	Michigan	56.2	24.6
Connecticut	29.9	(FF)	New Jersey	25.4	18.3
Pennsylvania	182.9	136.9	New York	47.1	17.4
Texas	36.9	14.7	Ohio	24.1	19.4
38243, COUNTING DEVICES			Pennsylvania	52.8	28.9
United States	162.0	147.0	Texas	64.0	3.8
Arkansas	18.2	(BB)	Washington	18.5	(BB)
Illinois	30.8	20.1	Wisconsin	4.1	(NA)
Ohio	8.7	(BB)	38293, GENERAL PURPOSE INSTRUMENTS		
38244, MOTOR VEHICLE INSTRUMENTS			United States	365.2	226.8
United States	76.2	123.2	California	64.0	22.0
Connecticut	13.8	(AA)	Connecticut	15.7	8.9
38251, INTEGRATING INSTRUMENTS, ELECTRICAL			Florida	10.7	(NA)
United States	363.2	223.5	Illinois	5.7	11.4
California	7.4	10.2	Massachusetts	21.6	16.6
Ohio	9.0	(CC)	New Jersey	30.2	25.2
			New York	46.0	20.4
			Ohio	15.7	9.1
			Pennsylvania	55.7	47.2
			Texas	41.2	24.5
			Wisconsin	4.8	3.9

See footnotes at end of table.

Table 6b. Product Classes—Value of Shipments by All Producers for Specified States: 1982 and 1977—Con.

[Million dollars. Product classes covered are those that are economically significant and whose production is geographically dispersed, provided dispersion is not approximated by data in table 2. Also, product classes are not shown if they are miscellaneous or "not specified by type" classes. Statistics for some States are withheld because they are either less than \$2 million in product class shipments or they disclose data for individual companies in 1982. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

Product class and geographic area	1982 value of product shipments	1977 value of product shipments	Product class and geographic area	1982 value of product shipments	1977 value of product shipments
38294, NUCLEAR RADIATION DETECTION AND MONITORING INSTRUMENTS			38325, OPTICAL INSTRUMENTS AND LENSES, N.E.C.—Con.		
United States	596.4	344.2			
Illinois	105.1	(GG)	New Hampshire	16.1	(CC)
New York	37.1	12.8	New Jersey	19.8	13.1
Ohio	96.7	62.9	New York	129.3	88.4
Pennsylvania	11.4	(FF)	Pennsylvania	18.8	16.8
			Texas	16.1	(CC)
38324, SIGHTING, TRACKING, AND FIRE CONTROL EQUIPMENT			38326, ANALYTICAL AND SCIENTIFIC INSTRUMENTS, EXCEPT OPTICAL		
United States	505.4	227.3	United States	2 088.4	604.5
California	102.9	23.3			
Illinois	52.5	(FF)	California	622.9	183.0
Massachusetts	46.5	18.2	Colorado	38.2	(NA)
Mississippi	3.8	(AA)	Indiana	68.5	(EE)
New York	25.9	51.2	Maryland	31.6	(AA)
Pennsylvania	9.0	(CC)	Massachusetts	318.3	105.4
38325, OPTICAL INSTRUMENTS AND LENSES, N.E.C.					
United States	922.8	390.0	New Jersey	100.6	10.2
California	238.3	68.4	New York	85.7	28.5
Illinois	21.6	6.4	Oregon	9.1	(NA)
Massachusetts	110.3	46.1	Pennsylvania	133.9	(GG)
Missouri	3.7	(NA)	Texas	118.9	(EE)

Note: For 1977, the following value ranges (in million dollars) substitute for actual figures withheld to avoid disclosing data for individual companies: AA—less than \$2.0 but not 0; BB—\$2.0 to \$4.9; CC—\$5.0 to \$9.9; EE—\$10.0 to \$19.9; FF—\$20.0 to \$49.9; GG—\$50.0 or more.

Table 6c. Product Classes—Value Shipped by All Producers: 1982 and Earlier Years

[Million dollars. For meaning of abbreviations and symbols, see introductory text. For explanation of terms, see appendixes]

1982 product code	Product class	1982	1981 ¹	1980 ¹	1979 ¹	1978 ¹	1977	1972	1967
3811-	Engineering and scientific instruments	2 964.4	2 636.6	2 518.0	2 298.4	2 076.7	1 849.5	1 106.0	1 049.0
38111	Aeronautical, nautical, and navigational instruments	1 418.7	1 172.1	1 151.1	958.6	889.7	804.6	573.7	585.5
38112	Laboratory and scientific apparatus	1 083.6	990.5	919.4	910.0	794.7	696.6	335.9	259.7
38113	Surveying and drafting instruments	259.9	258.3	260.8	256.6	178.9	168.9	126.2	139.4
38110	Engineering and scientific instruments, n.s.k.	202.2	215.7	186.7	173.1	(S)	179.4	70.2	64.4
38220	Heating, air conditioning, appliance controls	1 544.5	1 487.5	1 423.4	1 336.1	1 224.2	1 106.4	658.1	523.6
38230	Process control instruments	3 915.1	3 663.2	3 118.0	2 654.6	2 384.6	2 061.1	794.7	(NA)
3824-	Fluid meters and counting devices	787.1	954.2	918.1	830.0	742.9	634.3	327.4	(NA)
38242	Integrating and totalizing meters for gas and liquids	519.6	634.6	628.9	471.2	414.3	344.0	207.7	189.2
38243	Counting devices	162.0	182.8	162.6	202.5	172.8	147.0	48.8	(NA)
38244	Motor vehicle instruments	76.2	101.0	108.2	140.8	134.5	123.2	70.1	71.4
38240	Fluid meters and counting devices, n.s.k.	29.3	35.7	18.4	15.5	21.3	20.1	.8	(NA)
3825-	Instruments to measure electricity	5 575.6	4 874.5	4 338.1	3 811.3	3 044.6	2 566.2	1 329.7	1 137.1
38251	Integrating instruments, electrical	363.2	293.1	288.5	289.5	254.5	223.5	169.5	101.6
38252	Test equipment for testing electrical circuits	4 455.2	3 792.8	3 367.7	2 861.0	2 183.3	1 784.9	869.0	700.4
38253	Instruments to measure electricity, n.e.c.	556.7	627.9	556.2	555.2	454.8	429.9	223.4	279.2
38250	Instruments to measure electricity, n.s.k.	200.5	160.7	125.6	105.5	152.0	127.9	67.8	56.5
3829-	Measuring and controlling devices, n.e.c.	2 073.4	1 663.8	1 512.4	1 299.0	1 374.8	1 073.1	585.9	(NA)
38291	Aircraft engine instruments, except flight	311.0	253.1	234.6	184.2	142.4	120.1	74.5	120.0
38292	Physical properties testing and inspection equipment	635.2	593.7	498.4	402.1	393.5	276.6	106.3	(NA)
38293	General purpose instruments	365.2	207.6	239.7	268.6	331.0	226.8	94.5	(NA)
38294	Nuclear radiation detection and monitoring instruments	596.4	444.0	420.9	329.7	394.5	344.2	198.2	(NA)
38290	Measuring and controlling devices, n.e.c., n.s.k.	165.6	165.5	118.7	114.4	113.4	105.4	112.4	(NA)
3832-	Optical instruments and lenses	3 678.4	3 067.0	2 788.3	2 334.7	1 840.1	1 299.7	584.7	559.1
38324	Sighting, tracking, and fire control equipment	505.4	330.0	329.1	274.0	207.7	227.3	83.1	176.7
38325	Optical instruments and lenses, n.e.c.	922.8	936.6	773.6	588.4	471.6	390.0	(NA)	(NA)
38326	Analytical and scientific instruments, except optical	2 088.4	1 686.8	1 614.7	1 407.8	1 085.7	604.5	(NA)	(NA)
38320	Optical instruments and lens, n.s.k.	161.8	114.6	70.8	64.4	75.1	77.9	57.2	28.6

¹Figures are estimates derived from a representative sample of manufacturing establishments canvassed in annual survey of manufactures and, therefore, may differ from results that would be obtained from a complete canvass of all manufacturing establishments. Standard errors associated with estimates are published in annual survey of manufactures volumes for this period.

Table 7. Materials Consumed by Kind: 1982 and 1977

[Includes quantity and cost of materials consumed or put into production by establishments classified only in this industry. For further explanation, see Cost of Materials in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 material code	Material	1982		1977	
		Quantity ¹	Delivered cost (million dollars)	Quantity ¹	Delivered cost (million dollars)
	INDUSTRY 3811, ENGINEERING AND SCIENTIFIC INSTRUMENTS				
	Materials, parts, containers, and supplies -----	(X)	846.7	(X)	556.1
	Mill shapes and forms, except castings and forgings:				
	Carbon steel:				
331011	Bars and bar shapes ----- 1,000 s tons..	(S)	5.5	1.9	1.8
331012	Sheet and strip ----- do..	(S)	24.6	25.0	9.1
331013	Plates ----- do..	(S)	.5	.2	.3
331015	Structural shapes ----- do..	(S)	.4	.2	.1
331017	Wire and wire products ----- do..	(S)	.3	(³)	(³)
331019	All other carbon steel mill shapes and forms ----- do..	(S)	1.2	32.0	31.1
	Alloy steel, except stainless:				
331021	Bars and bar shapes ----- do..	(S)	.2	2.9	.5
331029	All other alloy steel mill shapes and forms ----- do..	** .8	1.4	(S)	1.0
	Stainless steel:				
331033	Sheet and strip ----- do..	(S)	4.8	3.8	6.3
331050	All other stainless steel mill shapes and forms ----- do..	(S)	5.3	.7	2.3
335792	Insulated copper wire and cable, except magnet wire (quantity of copper content) ----- mil lb..	(S)	.5	.1	1.1
	Copper and copper-base alloy:				
335728	Bare wire (for electrical conduction only) ----- do..	(S)	.3	.3	.3
335102	Rod, bar, and mechanical wire, including extruded and/or drawn shapes ----- do..	(S)	.7	1.4	1.1
335143	Plate, sheet, and strip, including military cups and discs ----- do..	(S)	.1	.8	.2
335152	Pipe and tube ----- do..	(S)	.5	1.4	1.8
	Aluminum and aluminum-base alloy:				
335301	Sheet, plate, and foil ----- do..	(S)	3.3	1.8	1.7
335405	Extruded shapes, including extruded rod, bar, pipe, tube, etc. ----- do..	(S)	4.2	1.9	2.7
335008	All other aluminum mill shapes and forms (wire, rolled rod and bar, powder, welded tubing, etc.) ----- do..	(S)	4.0	1.2	1.2
	Castings (rough and semifinished):				
332011	Iron (gray and malleable):				
	Purchased ----- 1,000 s tons..	(S)	.9	(X)	(⁴)
	Produced and consumed ----- do..	-	(X)	(S)	(X)
332045	Steel:				
	Purchased ----- do..	(S)	1.0	1.1	3.8
	Produced and consumed ----- do..	(Z)	(X)	(S)	(X)
336100	Aluminum and aluminum-base alloy:				
	Purchased ----- mil lb..	(S)	8.6	(S)	7.4
	Produced and consumed ----- do..	(Z)	(X)	(S)	(X)
336200	Copper and copper-base alloy:				
	Purchased ----- do..	(S)	.3	.3	.8
	Produced and consumed ----- do..	(Z)	(X)	(S)	(X)
336902	Other nonferrous:				
	Purchased ----- do..	3.8	2.9	(X)	(X)
	Produced and consumed ----- do..	-	(X)	(X)	(X)
344401	Sheet metal products, except stampings ----- do..	(X)	13.6	(X)	12.6
345001	Bolts, nuts, screws, and screw machine products ----- do..	(X)	10.6	(X)	11.5
346901	Metal stampings ----- do..	(X)	4.5	(X)	3.9
349012	Fabricated wire products ----- do..	(X)	1.6	(X)	2.2
	Fractional horsepower electric motors (less than 1 hp):				
362110	Timing motors, synchronous and subsynchronous:				
	Purchased ----- millions..	(S)	10.1	(S)	4.8
	Produced and consumed ----- do..	-	(X)	(S)	(X)
362115	Other fractional horsepower electric motors, excluding timing motors:				
	Purchased ----- do..	(S)	8.5	(S)	6.6
	Produced and consumed ----- do..	-	(X)	(S)	(X)
	Bearings:				
356218	Ball ----- do..	(X)	6.1	(X)	5.4
356201	Roller ----- do..	(X)	.3	(X)	.2
367010	Electron tubes, except X-ray:				
	Purchased ----- millions..	(S)	1.6	1.7	2.0
	Produced and consumed ----- do..	(Z)	(X)	(S)	(X)
367408	Semiconductors:				
	Purchased ----- do..	(S)	27.4	28.5	18.8
	Produced and consumed ----- do..	(S)	(X)	(S)	(X)
367001	Resistors, capacitors, transformers, and other electronic-type components, except electron tubes and semiconductors ----- do..	(X)	40.6	(X)	42.3
364300	Current-carrying wiring devices ----- do..	(X)	2.9	(X)	11.7
282104	Plastics resins consumed in the form of granules, pellets, powders, liquids, etc., excluding sheets, rods, tubes, and shapes ----- do..	(X)	2.7	2.0	1.3
307902	Fabricated plastics products, except gaskets ----- do..	(X)	11.8	(X)	6.0
320101	Glass and glass products, excluding windows and mirrors ----- do..	(X)	8.8	(X)	2.8
382501	Electrical instrument mechanisms and meter movements, including instrument relays ----- do..	(X)	24.3	(X)	22.0
382591	Electrical measuring instruments and parts, n.e.c. ----- do..	(X)	7.9	(X)	6.3
360101	Electrical transmission, distribution, and control equipment ----- do..	(X)	2.1	(X)	1.8
357301	Electrical computing equipment and parts ----- do..	(X)	8.9	(X)	11.4
260003	Paper and paperboard products (except paperboard boxes, containers, and corrugated paperboard) ----- 1,000 s tons..	(S)	4.8	(X)	(⁴)
265001	Paperboard containers, boxes, and corrugated paperboard ----- do..	(S)	7.4	(X)	(⁴)
970099	All other materials and components, parts, containers, and supplies ----- do..	(X)	346.9	(X)	*223.1
971000	Materials, parts, containers, and supplies, n.s.k. ² ----- do..	(X)	221.8	(X)	114.8

See footnotes at end of table.

Table 7. Materials Consumed by Kind: 1982 and 1977—Con.

[Includes quantity and cost of materials consumed or put into production by establishments classified only in this industry. For further explanation, see Cost of Materials in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 material code	Material	1982		1977	
		Quantity ¹	Delivered cost (million dollars)	Quantity ¹	Delivered cost (million dollars)
INDUSTRY 3822, ENVIRONMENTAL CONTROLS					
	Materials, parts, containers, and supplies -----	(X)	463.9	(X)	490.8
	Mill shapes and forms, except castings and forgings:				
	Carbon steel:				
331011	Bars and bar shapes ----- 1,000 s tons..	(S)	4.7	4.0	2.5
331012	Sheet and strip ----- do..	**14.3	7.5	29.9	11.4
331013	Plates ----- do..			1.5	.6
331015	Structural shapes ----- do..			(D)	(D)
331017	Wire and wire products ----- do..	(S)	11.8	(D)	(D)
331019	All other carbon steel mill shapes and forms ----- do..			2.3	1.6
	Alloy steel, except stainless:				
331021	Bars and bar shapes ----- do..	(S)	3.0	(D)	(D)
331029	All other alloy steel mill shapes and forms ----- do..			.1	.4
	Stainless steel:				
331033	Sheet and strip ----- do..	(S)	3.5	11.2	6.8
331050	All other stainless steel mill shapes and forms ----- do..	(S)	5.4	3.6	6.1
335792	Insulated copper wire and cable, except magnet wire (quantity of copper content) ----- mil lb..	**3.6	4.5	1.2	1.8
	Copper and copper-base alloy:				
335728	Bare wire for electrical conduction only ----- do..	1.3	2.1	(D)	(D)
335102	Rod, bar, and mechanical wire, including extruded and/or drawn shapes ----- do..	**7.0	6.7	9.9	8.9
335143	Plate, sheet, and strip, including military cups and discs ----- do..	(S)	3.3	10.4	12.0
335152	Pipe and tube ----- do..	**2.9	4.8	11.5	11.9
	Aluminum and aluminum-base alloy:				
335301	Sheet, plate, and foil ----- do..			5.2	4.5
335405	Extruded shapes, including extruded rod, bar, pipe, tube, etc. ----- do..	*5.4	5.6	4.4	3.7
335008	All other aluminum and aluminum-alloy mill shapes and forms (wire, rolled rod and bar, powder, welded tubing, etc.) ----- do..	.6	.6	1.4	1.5
	Castings (rough and semifinished):				
332011	Iron (gray and malleable):				
	Purchased ----- 1,000 s tons..	(D)	(⁶)	(X)	(⁶)
	Produced and consumed ----- do..	-	(X)	(X)	(X)
332045	Steel:				
	Purchased ----- do..	(D)	(⁶)	.2	.7
	Produced and consumed ----- do..	(D)	(X)	(S)	(X)
336100	Aluminum and aluminum-base alloy:				
	Purchased ----- do..	**11.8	6.9	9.1	4.6
	Produced and consumed ----- do..	-	(X)	(S)	(X)
336200	Copper and copper-base alloy:				
	Purchased ----- do..	**1.5	1.4	2.7	3.2
	Produced and consumed ----- do..	-	(X)	(S)	(X)
336902	Other nonferrous:				
	Purchased ----- do..	(S)	54.8	(X)	(⁶)
	Produced and consumed ----- do..	(Z)	(X)	(X)	(X)
344401	Sheet metal products, except stampings ----- do..	(X)	3.2	(X)	2.0
345001	Bolts, nuts, screws, rivets, and screw machine products ----- do..	(X)	20.1	(X)	19.6
346901	Metal stampings ----- do..	(X)	21.5	(X)	8.9
349012	Fabricated wire products ----- do..	(X)	5.4	(X)	1.4
	Fractional horsepower electric motors (less than 1 hp):				
362110	Timing motors, synchronous and subsynchronous:				
	Purchased ----- millions..	(D)	(⁷)	(D)	(D)
	Produced and consumed ----- do..	-	(X)	(S)	(X)
362115	All other fractional horsepower electric motors, excluding timing motors:				
	Purchased ----- do..	(S)	75.9	146.6	.9
	Produced and consumed ----- do..	-	(X)	(S)	(X)
	Bearings:				
356218	Ball ----- do..	(X)	-	(X)	(D)
356201	Roller ----- do..	(X)	-	(X)	(D)
367010	Electron tubes, except X-ray:				
	Purchased ----- millions..	(D)	(⁸)	(D)	(D)
	Produced and consumed ----- do..	(X)	(X)	(S)	(X)
367408	Semiconductors:				
	Purchased ----- do..	(D)	66.8	(D)	(D)
	Produced and consumed ----- do..	-	(X)	(S)	(X)
367001	Resistors, capacitors, transformers, transducers, and other electronic-type components, except electron tubes and semiconductors ----- do..	(X)	29.9	(X)	(D)
364300	Current-carrying wiring devices ----- do..	(X)	5.4	(X)	(D)
282104	Plastics resins consumed in the form of granules, pellets, powders, liquids, etc., excluding sheets, rods, tubes, and shapes ----- do..	(X)	5.1	(X)	5.2
307902	Fabricated plastics products, except gaskets ----- do..	(X)	10.9	(X)	7.1
320101	Glass and glass products, excluding windows and mirrors ----- do..	(X)	.3	(X)	.1
382501	Electrical instrument mechanisms and meter movements, including instrument relays ----- do..	(X)	8.0	(X)	3.6
382591	Electrical measuring instruments and parts, n.e.c. ----- do..	(X)	.7	(Z)	.4
360101	Electrical transmission, distribution, and control equipment ----- do..	(X)	5.2	(Z)	.3
357301	Electronic computing equipment and parts ----- do..	(X)	7.8	(X)	(D)
260003	Paper and paperboard products (except paperboard boxes, containers, and corrugated paperboard) ----- 1,000 s tons..	(S)	.5	(X)	(⁶)
265001	Paperboard containers, boxes, and corrugated paperboard ----- do..	(S)	4.3	(X)	(⁶)
970099	All other materials and components, parts, containers, and supplies ----- do..	(X)	189.6	(X)	⁶ 288.0
971000	Materials, parts, containers, and supplies, n.s.k. ² ----- do..	(X)	56.7	(X)	28.7

See footnotes at end of table.

Table 7. Materials Consumed by Kind: 1982 and 1977—Con.

[Includes quantity and cost of materials consumed or put into production by establishments classified only in this industry. For further explanation, see Cost of Materials in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 material code	Material	1982		1977	
		Quantity ¹	Delivered cost (million dollars)	Quantity ¹	Delivered cost (million dollars)
	INDUSTRY 3823, PROCESS CONTROL INSTRUMENTS				
	Materials, parts, containers, and supplies -----	(X)	1 026.0	(X)	566.7
	Mill shapes and forms, except castings and forgings:				
	Carbon steel:				
	Bars and bar shapes ----- 1,000 s tons..	(S)	4.1	4.1	3.2
331011	Sheet and strip ----- do..	**7.2	4.0	6.0	3.0
331012	Plates ----- do..	(S)	.8	(S)	1.4
331013	Structural shapes ----- do..	.9	.5		
331015	Wire and wire products ----- do..	(S)	2.7	(S)	2.7
331017	All other carbon steel mill shapes and forms ----- do..	(S)	2.5	(S)	1.8
331019	Alloy steel, except stainless:				
	Bars and bar shapes ----- do..	(S)	2.8	.5	.8
331021	All other alloy steel mill shapes and forms ----- do..	(S)	3.2	.9	2.3
331029	Stainless steel:				
	Sheet and strip ----- do..	(S)	3.3	2.3	6.7
331033	All other stainless steel mill shapes and forms ----- do..	(S)	17.7	3.4	11.3
331050	Insulated copper wire and cable, except magnet wire (quantity of copper content) ----- mil lb..	(S)	3.9	.8	1.2
335792	Copper and copper-base alloy:				
	Bare wire for electrical conduction only ----- do..			.5	1.1
335728	Rod, bar, and mechanical wire, including extruded and/or drawn shapes ----- do..	(S)	6.7		
335102	Plate, sheet, and strip, including military cups and discs ----- do..	(S)	1.1	3.8	3.5
335143	Pipe and tube ----- do..	(S)	3.1	.8	.6
335152	Aluminum and aluminum-base alloy:				
	Sheet, plate, and foil ----- do..	(S)	1.3	2.2	2.1
335301	Extruded shapes, including extruded rod, bar, pipe, tube, etc. ----- do..	(S)	3.8	1.3	1.7
335405	All other aluminum mill shapes and forms (wire, rolled rod and bar, powder, welded tubing, etc.) ----- do..	(S)	.8	.2	.7
335008	Castings (rough and semifinished):				
	Iron (gray and malleable):				
	Purchased ----- 1,000 s tons..	(S)	7.2	(X)	(⁶)
332011	Produced and consumed ----- do..	(D)	(X)	(X)	(X)
332045	Steel:				
	Purchased ----- do..	**6.2	15.9	9.2	11.9
	Produced and consumed ----- do..	(Z)	(X)	(S)	(X)
336100	Aluminum and aluminum-base alloy:				
	Purchased ----- mil lb..	(S)	16.3	10.2	13.3
336200	Produced and consumed ----- do..	(D)	(X)	(S)	(X)
336200	Copper and copper-base alloy:				
	Purchased ----- do..	*4.9	5.5	3.6	5.4
	Produced and consumed ----- do..	(D)	(X)	(S)	(X)
336902	Other nonferrous:				
	Purchased ----- do..	**1.5	2.3	(X)	(⁶)
	Produced and consumed ----- do..	(S)	(X)	(X)	(X)
344401	Sheet metal products, except stampings ----- do..	(D)	21.0	(X)	6.8
345001	Bolts, nuts, screws, rivets, and screw machine products ----- do..	(X)	17.4	(X)	9.4
346901	Metal stampings ----- do..	(X)	12.8	(X)	6.6
349012	Fabricated wire products ----- do..	(X)	2.9	(X)	4.4
362110	Fractional horsepower electric motors (less than 1 hp):				
	Timing motors, synchronous and subsynchronous:				
	Purchased ----- millions..	(S)	5.2	.2	4.1
	Produced and consumed ----- do..	-	(X)	(S)	(X)
362115	Other fractional horsepower electric motors, excluding timing motors:				
	Purchased ----- do..	(S)	4.8	.1	1.8
	Produced and consumed ----- do..	(S)	(X)	(S)	(X)
356218	Bearings:				
	Ball ----- do..	(X)	2.2	(X)	.4
356201	Roller ----- do..	(X)	2.0	(X)	.1
367010	Electron tubes, except X-ray:				
	Purchased ----- millions..	(S)	1.9	653.4	1.9
	Produced and consumed ----- do..	-	(X)	(S)	(X)
367408	Semiconductors:				
	Purchased ----- do..	(S)	39.5	15.9	13.4
	Produced and consumed ----- do..	(S)	(X)	(S)	(X)
367001	Resistors, capacitors, transformers, transducers, and other electronic-type components, except electron tubes and semiconductors ----- do..	(X)	63.1	(X)	30.1
364300	Current-carrying wiring devices ----- do..	(X)	11.7	(X)	6.3
282104	Plastics resins consumed in the form of granules, pellets, powders, liquids, etc., excluding sheets, rods, tubes, and shapes ----- do..	(X)	2.8	(X)	.8
307902	Fabricated plastics products, except gaskets ----- do..	(X)	7.8	(X)	11.6
320101	Glass and glass products, excluding windows and mirrors ----- do..	(X)	6.9	(X)	3.2
382501	Electrical instrument mechanisms and meter movements, including instrument relays ----- do..	(X)	22.3	(X)	16.8
382591	Electrical measuring instruments and parts, n.e.c. ----- do..	(X)	40.5	(X)	16.7
360101	Electrical transmission, distribution, and control equipment ----- do..	(X)	8.2	(X)	17.3
357301	Electronic computing equipment and parts ----- do..	(X)	21.1	(X)	8.7
260003	Paper and paperboard products (except paperboard boxes, containers, and corrugated paperboard) ----- 1,000 s tons..	(S)	5.1	(X)	(⁶)
265001	Paperboard containers, boxes, and corrugated paperboard ----- do..	(S)	15.1	(X)	(⁶)
970099	All other materials and components, parts, containers, and supplies ----- do..	(X)	259.8	(X)	⁶ 236.2
971000	Materials, parts, containers, and supplies, n.s.k. ² ----- do..	(X)	342.4	(X)	93.6

See footnotes at end of table.

Table 7. Materials Consumed by Kind: 1982 and 1977—Con.

[Includes quantity and cost of materials consumed or put into production by establishments classified only in this industry. For further explanation, see Cost of Materials in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 material code	Material	1982		1977	
		Quantity ¹	Delivered cost (million dollars)	Quantity ¹	Delivered cost (million dollars)
INDUSTRY 3824, FLUID METERS AND COUNTING DEVICES					
	Materials, parts, containers, and supplies -----	(X)	247.1	(X)	213.0
	Mill shapes and forms, except castings and forgings:				
	Carbon steel:				
	Bars and bar shapes ----- 1,000 s tons..	(S)	1.5	*3.4	2.1
331011	Sheet and strip ----- do..	(S)	1.4	**2.5	1.4
331013	Plates ----- do..				
331015	Structural shapes ----- do..				
331017	Wire and wire products ----- do..	(S)	.8	(S)	2.5
331019	All other carbon steel mill shapes and forms ----- do..				
	Alloy steel, except stainless:				
331021	Bars and bar shapes ----- do..	(S)	.2		
331029	All other alloy steel mill shapes and forms ----- do..	(Z)	-	(S)	.3
	Stainless steel:				
331033	Sheet and strip ----- do..	**1	.5	1.4	3.1
331050	All other stainless steel mill shapes and forms ----- do..	(S)	1.0	(S)	1.1
335792	Insulated copper wire and cable, except magnet wire (quantity of copper content) ----- mil lb.	(D)	(⁹)	(S)	.5
	Copper and copper-base alloy:				
335728	Bare wire for electrical conduction only ----- do..		.1		
335102	Rod, bar, and mechanical wire, including extruded and/or drawn shapes ----- do..	(S)	4.1	6.5	4.3
335143	Plate, sheet, and strip, including military cups and discs ----- do..	(S)	.7	(S)	2.9
335152	Pipe and tube ----- do..	(D)	*.8	(S)	.1
	Aluminum and aluminum-base alloy:				
335301	Sheet, plate, and foil ----- do..	*.9	.7	(S)	1.8
335405	Extruded shapes, including extruded rod, bar, pipe, tube, etc. ----- do..	*.3	1.0		
335008	All other aluminum mill shapes and forms (wire, rolled rod and bar, powder, welded tubing, etc.) ----- do..	(S)	.2	(S)	4.0
	Castings (rough and semifinished):				
332011	Iron (gray and malleable):				
	Purchased ----- 1,000 s tons..	**5.1	8.4	(X)	(⁹)
	Produced and consumed ----- do..	-	(X)	(X)	(X)
332045	Steel:				
	Purchased ----- do..	(S)	1.3	*7.6	7.6
	Produced and consumed ----- do..	-	(X)	(S)	(X)
336100	Aluminum and aluminum-base alloy:				
	Purchased ----- mil lb..	*9.0	20.4	6.8	11.7
	Produced and consumed ----- do..	.3	(X)	(S)	(X)
336200	Copper and copper-base alloy:				
	Purchased ----- do..	(S)	12.1	6.2	8.7
	Produced and consumed ----- do..	(S)	(X)	(S)	(X)
336902	Other nonferrous:				
	Purchased ----- do..	(D)	(¹⁰)	(X)	(⁹)
	Produced and consumed ----- do..	-	(X)	(X)	(X)
344401	Sheet metal products, except stampings ----- do..	(X)	1.0	(X)	3.2
345001	Bolts, nuts, screws, rivets, and screw machine products ----- do..	(X)	12.5	(X)	9.9
346901	Metal stampings ----- do..	(X)	5.8	(X)	2.9
349012	Fabricated wire products ----- do..	(X)	1.3	(X)	(D)
	Fractional horsepower electric motors (less than 1 hp):				
362110	Timing motors, synchronous and subsynchronous:				
	Purchased ----- millions..	(D)	(⁷)	(D)	(D)
	Produced and consumed ----- do..	-	(X)	(S)	(X)
362115	Other fractional horsepower electric motors, excluding timing motors:				
	Purchased ----- do..	(S)	71.1	(D)	(D)
	Produced and consumed ----- do..	(S)	(X)	(S)	(X)
	Bearings:				
356218	Ball ----- do..				
356201	Roller ----- do..	(X)	1.4	(X)	1.4
367010	Electron tubes, except X-ray:				
	Purchased ----- millions..	-	-	(D)	(D)
	Produced and consumed ----- do..	-	(X)	(S)	(X)
367408	Semiconductors:				
	Purchased ----- do..	(S)	2.0	(D)	(D)
	Produced and consumed ----- do..	-	(X)	(S)	(X)
367001	Resistors, capacitors, transformers, transducers, and other electronic-type components, except electron tubes and semiconductors ----- do..	(X)	11.6	(X)	14.6
364300	Current-carrying wiring devices ----- do..	(X)	1.0	(X)	.3
282104	Plastics resins consumed in the form of granules, pellets, powders, liquids, etc., excluding sheets, rods, tubes, and shapes ----- do..	(X)	7.5	(X)	7.3
307902	Fabricated plastics products, except gaskets ----- do..	(X)	5.5	(X)	5.6
320101	Glass and glass products, excluding windows and mirrors ----- do..	(X)	1.5	(X)	.7
382501	Electrical instrument mechanisms and meter movements, including instrument relays ----- do..	(X)	1.7	(X)	2.7
382591	Electrical measuring instruments and parts, n.e.c. ----- do..			(X)	(D)
360101	Electrical transmission, distribution, and control equipment ----- do..	(X)	2.4	(X)	(D)
357301	Electronic computing equipment and parts ----- do..			(X)	(D)
260003	Paper and paperboard products (except paperboard boxes, containers, and corrugated paperboard) ----- 1,000 s tons..	(S)	.1	(X)	(⁹)
265001	Paperboard containers, boxes, and corrugated paperboard ----- do..	(S)	2.5	(X)	(⁹)
970099	All other materials and components, parts, containers, and supplies ----- do..	(X)	¹⁰ 90.0	(X)	⁹ 71.1
971000	Materials, parts, containers, and supplies, n.s.k. ² ----- do..	(X)	42.9	(X)	21.6

See footnotes at end of table.

Table 7. Materials Consumed by Kind: 1982 and 1977—Con.

[Includes quantity and cost of materials consumed or put into production by establishments classified only in this industry. For further explanation, see Cost of Materials in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 material code	Material	1982		1977	
		Quantity ¹	Delivered cost (million dollars)	Quantity ¹	Delivered cost (million dollars)
	INDUSTRY 3825, INSTRUMENTS TO MEASURE ELECTRICITY				
	Materials, parts, containers, and supplies -----	(X)	1 576.0	(X)	859.2
	Mill shapes and forms, except castings and forgings:				
	Carbon steel:				
331011	Bars and bar shapes ----- 1,000 s tons..	(S)	1.6	(S)	1.6
331012	Sheet and strip ----- do..	(S)	8.7	(S)	11.3
331013	Plates ----- do..	(S)	.5	(S)	.1
331015	Structural shapes ----- do..	(S)	.1	(S)	.4
331017	Wire and wire products ----- do..	(S)	.9	(S)	1.6
331019	All other carbon steel mill shapes and forms ----- do..	(S)		(S)	.1
	Alloy steel, except stainless:				
331021	Bars and bar shapes ----- do..	*1.1	.5	(S)	.6
331029	All other steel mill shapes and forms ----- do..	3.2	3.6	.6	3.4
	Stainless steel:				
331033	Sheet and strip ----- do..	**7	1.5	.7	1.4
331050	All other stainless steel mill shapes and forms ----- do..	(S)	1.8	(S)	3.1
335792	Insulated copper wire and cable, except magnet wire (quantity of copper content) ----- mil lb..	(S)	10.1	(S)	3.9
	Copper and copper-base alloy:				
335728	Bare wire for electrical conduction only ----- do..	**5.6	5.2	2.4	3.3
335102	Rod, bar, and mechanical wire, including extruded and/or drawn shapes ----- do..	*3.7	4.6	(S)	1.7
335143	Plate, sheet, and strip, including military cups and discs ----- do..	(S)	3.5	3.8	4.8
335152	Pipe and tube ----- do..	(S)	.2	(S)	.3
	Aluminum and aluminum-base alloy:				
335301	Sheet, plate, and foil ----- do..	*6.0	8.0	*5.9	6.0
335405	Extruded shapes, including extruded rod, bar, pipe, tube, etc. ----- do..	**2.8	3.5	**5.3	6.5
335008	All other aluminum mill shapes and forms (wire, rolled rod and bar, powder, welded tubing, etc.) ----- do..	*8.9	5.1	(S)	.8
	Castings (rough and semifinished):				
332011	Iron (gray and malleable):				
	Purchased ----- 1,000 s tons..	(D)	(¹)	(X)	(⁶)
	Produced and consumed ----- do..	(D)	(X)	(X)	(X)
332045	Steel:				
	Purchased ----- do..	(D)	(¹)	(S)	.8
	Produced and consumed ----- do..	-	(X)	(S)	(X)
336100	Aluminum and aluminum-base alloy:				
	Purchased ----- mil lb..	(S)	6.9	(S)	4.1
	Produced and consumed ----- do..	-	(X)	(S)	(X)
336200	Copper and copper-base alloy:				
	Purchased ----- do..	(S)	113.2	(S)	.1
	Produced and consumed ----- do..	-	(X)	(S)	(X)
336902	Other nonferrous:				
	Purchased ----- do..	(S)	.6	(X)	(⁶)
	Produced and consumed ----- do..	-	(X)	(X)	(X)
344401	Sheet metal products, except stampings ----- do..	(X)	34.9	(X)	15.2
345001	Bolts, nuts, screws, rivets, and screw machine products ----- do..	(X)	22.5	(X)	14.0
346901	Metal stampings ----- do..	(X)	10.8	(X)	6.5
349012	Fabricated wire products ----- do..	(X)	6.1	(X)	8.6
	Fractional horsepower electric motors (less than 1 hp):				
362110	Timing motors, synchronous and subsynchronous:				
	Purchased ----- millions..	(S)	4.6	(S)	4.5
	Produced and consumed ----- do..	-	(X)	(S)	(X)
362115	Other fractional horsepower electric motors, excluding timing motors:				
	Purchased ----- do..	(S)	4.4	(S)	5.1
	Produced and consumed ----- do..	-	(X)	(S)	(X)
	Bearings:				
356218	Ball ----- do..	(X)	2.4	(X)	.5
356201	Roller ----- do..	(X)	.4	(X)	.2
367010	Electron tubes, except X-ray :				
	Purchased ----- millions..	(S)	8.9	(S)	4.1
	Produced and consumed ----- do..	-	(X)	(S)	(X)
367408	Solid state semiconductors:				
	Purchased ----- do..	(S)	144.5	(S)	53.7
	Produced and consumed ----- do..	(S)	(X)	(S)	(X)
367001	Resistors, capacitors, transformers, transducers, and other electronic-type components, except electron tubes and semiconductors ----- do..	(X)	216.7	(X)	117.7
364300	Current-carrying wiring devices ----- do..	(X)	21.8	(X)	12.8
282104	Plastics resins consumed in the form of granules, pellets, powders, liquids, etc., excluding sheets, rods, tubes, and shapes ----- do..	(X)	8.0	(X)	7.4
307902	Fabricated plastics products, except gaskets ----- do..	(X)	13.2	(X)	10.6
320101	Glass and glass products, excluding windows and mirrors ----- do..	(X)	12.7	(X)	5.8
382501	Electrical instrument mechanisms and meter movements, including instrument relays ----- do..	(X)	82.7	(X)	18.3
382591	Electrical measuring instruments and parts, n.e.c. ----- do..	(X)	150.4	(X)	53.9
360101	Electrical transmission, distribution, and control equipment ----- do..	(X)	8.3	(X)	2.8
357301	Electronic computing equipment and parts ----- do..	(X)	56.1	(X)	21.0
260003	Paper and paperboard products, except paperboard boxes, containers, and corrugated paperboard ----- 1,000 s tons..	(S)	7.5	(X)	(⁶)
265001	Paperboard containers, boxes, and corrugated paperboard ----- do..	(S)	11.0	(X)	(⁶)
970099	All other materials and components, parts, containers, and supplies ----- do..	(X)	390.3	(X)	6304.7
971000	Materials, parts, containers, and supplies, n.s.k. ² ----- do..	(X)	287.7	(X)	135.9

See footnotes at end of table.

Table 7. Materials Consumed by Kind: 1982 and 1977—Con.

[Includes quantity and cost of materials consumed or put into production by establishments classified only in this industry. For further explanation, see Cost of Materials in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 material code	Material	1982		1977	
		Quantity ¹	Delivered cost (million dollars)	Quantity ¹	Delivered cost (million dollars)
	INDUSTRY 3829, MEASURING AND CONTROLLING DEVICES, N.E.C.				
	Materials, parts, containers, and supplies -----	(X)	697.3	(X)	357.5
	Mill shapes and forms, except castings and forgings:				
	Carbon steel:				
331011	Bars and bar shapes ----- 1,000 s tons..	(S)	2.9	6.9	4.0
331012	Sheet and strip ----- do..	(S)	1.3	3.5	1.8
331013	Plates ----- do..	(S)	2.0	2.0	1.6
331015	Structural shapes ----- do..	(S)	2.2	(S)	1.2
331017	Wire and wire products ----- do..	(S)	.6	(S)	.3
331019	All other carbon steel mill shapes and forms ----- do..	(S)	3.1	.8	.5
	Alloy steel, except stainless:				
331021	Bars and bar shapes ----- do..	(S)	1.4	1.8	2.1
331029	All other alloy steel mill shapes and forms ----- do..	(S)	1.1	.8	1.4
	Stainless steel:				
331033	Sheet and strip ----- do..	(S)	1.6	.9	2.1
331050	All other stainless steel mill shapes and forms ----- do..	(S)	5.2	(S)	3.4
335792	Insulated copper wire and cable, except magnet wire (quantity of copper content) ----- mil lb..	(S)	2.2	(S)	3.4
	Copper and copper-base alloy:				
335728	Bare wire (for electrical conduction only) ----- do..	(¹⁹)	(¹⁹)	(S)	.2
335102	Rod, bar, and mechanical wire, including extruded and/or drawn shapes ----- do..	(¹⁹)	(¹⁹)	5.7	3.1
335143	Plate, sheet, and strip, including military cups and discs ----- do..	^{13**} 5.4	^{13**} 7.6	(S)	1.9
335152	Pipe and tube ----- do..	1.5	1.6	(S)	1.9
	Aluminum and aluminum-base alloy:				
335301	Sheet, plate, and foil ----- do..	(S)	6.9	(S)	2.2
335405	Extruded shapes, including extruded rod, bar, pipe, tube, etc. ----- do..	(S)	6.4	3.5	1.2
335008	All other aluminum mill shapes and forms (wire, rolled rod and bar, powder, welded tubing, etc.) ----- do..	(S)	3.4	.6	.7
	Castings (rough and semifinished):				
332011	Iron (gray and malleable):				
	Purchased ----- 1,000 s tons..	(S)	2.2	(X)	(⁶)
	Produced and consumed ----- do..	(Z)	(X)	(X)	(X)
332045	Steel:				
	Purchased ----- do..	(S)	1.8	2.0	2.5
	Produced and consumed ----- do..	-	(X)	(S)	(X)
336100	Aluminum and aluminum-base alloy:				
	Purchased ----- mil lb..	(S)	4.7	.8	2.5
	Produced and consumed ----- do..	(Z)	(X)	(S)	(X)
336200	Copper and copper-base alloy:				
	Purchased ----- do..	(S)	.3	.4	.5
	Produced and consumed ----- do..	-	(X)	(S)	(X)
336902	Other nonferrous:				
	Purchased ----- do..	(S)	1.5	(X)	(⁶)
	Produced and consumed ----- do..	(X)	(X)	(X)	(X)
344401	Sheet metal products, except stampings ----- do..	(X)	8.6	(X)	7.1
345001	Bolts, nuts, screws, rivets, and screw machine products ----- do..	(X)	9.0	(X)	7.7
346901	Metal stampings ----- do..	(X)	4.3	(X)	1.7
349012	Fabricated wire products ----- do..	(X)	3.9	(X)	.6
	Fractional horsepower electric motors (less than 1 hp):				
362110	Timing motors, synchronous and subsynchronous:				
	Purchased ----- millions..	(X)	3.1	(S)	2.6
	Produced and consumed ----- do..	(X)	(X)	(S)	(X)
362115	Other fractional horsepower electric motors, excluding timing motors:				
	Purchased ----- do..	(X)	1.5	(S)	1.0
	Produced and consumed ----- do..	(X)	(X)	(S)	(X)
	Bearings:				
356218	Ball ----- do..	(X)	.7	(X)	.9
356201	Roller ----- do..	(X)	.2	(X)	.2
367010	Electron tubes, except X-ray:				
	Purchased ----- millions..	(X)	1.8	(S)	1.2
	Produced and consumed ----- do..	(X)	(X)	(S)	(X)
367408	Semiconductors:				
	Purchased ----- do..	(X)	17.8	(S)	9.0
	Produced and consumed ----- do..	(X)	(X)	(S)	(X)
367001	Resistors, capacitors, transducers, and other electronic-type components, except electron tubes and semiconductors ----- do..	(X)	35.0	(X)	29.0
364300	Current-carrying wiring devices ----- do..	(X)	6.9	(X)	1.0
282104	Plastics resins consumed in the form of granules, pellets, powders, liquids, etc., excluding sheets, rods, tubes, and shapes ----- do..	(X)	2.0	(X)	1.3
307902	Fabricated plastics products, except gaskets ----- do..	(X)	5.6	(X)	4.7
320101	Glass and glass products, excluding windows and mirrors ----- do..	(X)	4.3	(X)	3.9
382501	Electrical instrument mechanisms and meter movements, including instrument relays ----- do..	(X)	8.0	(S)	7.8
382591	Electrical measuring instruments and parts, n.e.c. ----- do..	(X)	21.8	(X)	5.7
360101	Electrical transmission, distribution, and control equipment ----- do..	(X)	6.6	(X)	2.7
357301	Electronic computing equipment and parts ----- do..	(X)	15.2	(X)	16.9
260000	Paper and paperboard products, except paperboard boxes, containers, and corrugated paperboard ----- 1,000 s tons..	(X)	-	(X)	(⁶)
265001	Paperboard containers, boxes, and corrugated paperboard ----- do..	(S)	6.5	(X)	(⁶)
970099	All other materials and components, parts, containers, and supplies ----- do..	(X)	213.1	(X)	⁶ 116.8
971000	Materials, parts, containers, and supplies, n.s.k. ² ----- do..	(X)	261.4	(X)	97.2

See footnotes at end of table.

Table 7. Materials Consumed by Kind: 1982 and 1977—Con.

[Includes quantity and cost of materials consumed or put into production by establishments classified only in this industry. For further explanation, see Cost of Materials in appendix. For meaning of abbreviations and symbols, see introductory text]

1982 material code	Material	1982		1977	
		Quantity ¹	Delivered cost (million dollars)	Quantity ¹	Delivered cost (million dollars)
	INDUSTRY 3832, OPTICAL INSTRUMENTS AND LENSES				
	Materials, parts, containers, and supplies -----	(X)	1 249.8	(X)	399.9
265001	Paperboard containers, boxes, and corrugated paperboard -- 1,000 s tons--	(S)	4.1	(X)	(¹³)
282104	Plastics resins consumed in the form of granules, pellets, powders, liquids, etc., but excluding sheets, rods, tubes, and shapes ----- mil lb--	(S)	5.2	(S)	4.5
307903	Plastics products consumed in the form of sheets, rods, tubes, and other shapes -----	(X)	8.6	(X)	2.3
383201	Lenses and prisms for optical sighting and fire-control equipment ----- millions--	(S)	37.3	(S)	17.0
322941	Lens blanks, optical and ophthalmic ----- do--	(S)	22.4	(S)	7.9
322901	Other optical glass -----	(X)	24.7	(X)	5.3
333903	Precious metals, all forms, including ingot, sheet, strip, solder, plating, electrodes, etc. ----- mil lb--	(S)	3.1	(S)	6.2
367001	Resistors, capacitors, transformers, transducers, and other electronic-type components and accessories, except electron tubes and semiconductors -----	(X)	134.2	(X)	66.4
367408	Semiconductors ----- millions--	*44.1	40.3	(S)	18.6
970099	All other materials and components, parts, containers, and supplies -----	(X)	519.6	(X)	¹³ 205.9
971000	Materials, parts, containers, and supplies, n.s.k. ² -----	(X)	450.3	(X)	65.8

¹For some establishments, data have been estimated from central unit values which are based on quantity-cost relationships of reported data. The following symbols are used when percentage of each quantity figure estimated in this manner equals or exceeds 10 percent of published figure: * 10 to 19 percent estimated; ** 20 to 29 percent estimated. If 30 percent or more is estimated, figure is replaced by (S).

²Total cost of materials of establishments that did not report detailed materials data, including establishments that were not mailed a form.

³For 1977, material code 331015 was included with material code 331019.

⁴For 1977, material codes 332011, 260003, and 265001 were included with material code 970099.

⁵For 1982, material codes 332011 and 332045 are combined with material code 336902 to avoid disclosing data for individual companies.

⁶For 1977, material codes 332011, 336902, 260003, and 265001 were included with material code 970099.

⁷For 1982, material codes 362110 and 362115 are combined to avoid disclosing data for individual companies.

⁸For 1982, material codes 367010 and 367408 are combined to avoid disclosing data for individual companies.

⁹For 1982, material code 335792 is included with material code 335152 to avoid disclosing data for individual companies.

¹⁰For 1982, material code 336902 is included with 970099 to avoid disclosing data for individual companies.

¹¹For 1982, material codes 332011 and 332045 are combined with 336200 to avoid disclosing data for individual companies.

¹²For 1982, material codes 335728 and 335102 are included with material code 335143.

¹³For 1977, material code 265001 was included with material code 970099.

APPENDIX A.

Explanation of Terms

This appendix is in two sections. Section 1 includes items which were requested of all establishments that were mailed census of manufactures forms including annual survey of manufactures (ASM) forms. Note that this section also includes several items (number of establishments and companies, value added, classes of products, and specialization and coverage ratios) that were not included on the report forms but were derived from information collected on the forms. Section 2 covers supplementary items that were requested only from establishments included in the ASM sample. Results of the supplementary ASM inquiries are included in tables 3c and 3d of this report.

SECTION 1. ITEMS COLLECTED OR DERIVED BASED ON ALL CENSUS OF MANUFACTURES (INCLUDING ASM) REPORT FORMS

Number of establishments and companies—As discussed in the Introduction, a separate report was required for each manufacturing establishment (plant) with one employee or more. An establishment is defined as a single physical location where manufacturing is performed. A company, on the other hand, is defined as a business organization consisting of one establishment or more under common ownership or control.

If the company operates at different physical locations, even if the individual locations are producing the same line of goods, a separate report was requested for each location. If the company operates in two or more distinct lines of manufacturing at the same location, a separate report was requested for each activity.

An establishment not in operation for any portion of the year was requested to return the report form with the proper notation in the "Operational Status" section of the form. In addition, the establishment was requested to report data on the number of custodial employees, capital expenditures, inventories, or any shipments from inventories during the portion of the year the plant was in operation.

In this report, data are shown for establishments in operation at any time during the year. A comparison with the number of establishments in operation at the end of the year will be provided in the Introduction to Part 1 of the General Summary subject report.

Employment and related items—The regular report forms requested separate information on production workers as of a payroll period for each quarter of the year and on other employees as of the payroll period which included the 12th of March.

All employees—This item includes all full-time and part-time employees on the payrolls of operating manufacturing establishments during any part of the pay period ending nearest the 12th of the months specified on the report form. Included are all persons on paid sick leave, paid holidays, and paid vacations during these pay periods. Officers of corporations are included as employees; proprietors and partners of unincorporated firms are excluded. The "all employees" number is the average number of production workers plus the number of other employees in mid-March. The number of production workers is the average for the payroll periods including the 12th of March, May, August, and November.

Production workers—This item includes workers (up through the line-supervisor level) engaged in fabricating, processing, assembling, inspecting, receiving, storing, handling, packing, warehousing, shipping (but not delivering), maintenance, repair, janitorial and guard services, product development, auxiliary production for plant's own use (e.g., power plant), recordkeeping, and other services closely associated with these production operations at the establishment covered by the report. Employees above the working-supervisor level are excluded from this item.

All other employees—This item covers nonproduction employees of the manufacturing establishment including those engaged in factory supervision above the line-supervisor level. It includes sales (including driver salespersons), sales delivery (highway truck drivers and their helpers), advertising, credit, collection, installation and servicing of own products, clerical and routine office function, executive, purchasing, financing, legal, personnel (including cafeteria, medical, etc.), professional, and technical employees. Also included are employees on the payroll of the manufacturing establishment who are engaged in the construction of major additions or alterations to the plant and who are utilized as a separate work force.

In addition to reports sent to operating manufacturing establishments, information on employment during the payroll period which included March 12 and annual payrolls was also requested of auxiliary units (e.g., administrative offices, warehouses, and research and development laboratories) of multiestablishment companies. However, these figures are not included in the totals for individual industries shown in this report. They are included in the general summary and geographic area reports and in the final bound volumes as a separate category.

Payrolls—This item includes the gross earnings of all employees on the payroll of operating manufacturing establishments paid in the calendar year 1982. Respondents were told they could follow the definition of payrolls used for calculating the Federal withholding tax. It includes all forms of compensation, such as salaries, wages, commissions, dismissal pay, all bonuses, vacation and sick leave pay, and compensation in kind, prior to such deductions as employees' Social Security contributions, withholding taxes, group insurance, union dues, and savings bonds. The total includes salaries of officers

of corporations, but excludes payments to proprietors or partners of unincorporated concerns. Also excluded are payments to members of Armed Forces and pensioners carried on the active payroll of manufacturing establishments.

The census definition of payrolls is identical to that recommended to all Federal statistical agencies by the Office of Management and Budget. It should be noted that this definition does not include employers' Social Security contributions or other nonpayroll labor costs, such as employees' pension plans, group insurance premiums, and workers' compensation.

The ASM provides estimates of employers' supplemental labor costs, both those required by Federal and State laws and those incurred voluntarily or as part of collective bargaining agreements. (Supplemental labor costs are explained later in this appendix.)

As in the case of employment figures, the payrolls of separate auxiliary units of multiestablishment companies are not included in the totals for individual industries or industry groups.

Production-worker hours—This item covers hours worked or paid for at the plant, including actual overtime hours (not straight-time equivalent hours). It excludes hours paid for vacations, holidays, or sick leave.

Cost of materials—This term refers to direct charges actually paid or payable for items consumed or put into production during the year, including freight charges and other direct charges incurred by the establishment in acquiring these materials. It includes the cost of materials or fuel consumed, whether purchased by the individual establishment from other companies, transferred to it from other establishments of the same company, or withdrawn from inventory during the year.

The important components of this cost item are (1) all raw materials, semifinished goods, parts, components, containers, scrap, and supplies put into production or used as operating supplies and for repair and maintenance during the year, (2) electric energy purchased, (3) fuels consumed for heat, power, or the generation of electricity, (4) work done by others on materials or parts furnished by manufacturing establishments (contract work), and (5) products bought and resold in the same condition. (See discussion of duplication of data below.)

Specific materials consumed—In addition to the total cost of materials, which every establishment was required to report, information was also collected for most manufacturing industries on the consumption of major materials used in manufacturing. The inquiries were restricted to those materials which were important parts of the cost of production in a particular industry and for which cost information was available from manufacturers' records. Information on the specific materials consumed is shown in table 7 if appropriate to the industry. Establishments consuming less than a specified amount (usually \$10,000) of a specific material were not requested to report consumption of that material separately. Also, the cost of materials for the small establishments for which either administrative records or short forms were used was imputed as "not specified by kind." (See the Introduction for the importance of administrative records in the industry.)

Value of shipments—This item covers the received or receivable net selling values, f.o.b. plant (exclusive of freight and taxes), of all products shipped, both primary and secondary, as well as all miscellaneous receipts, such as receipts for contract work performed for others, installation and repair, sales of scrap, and sales of products bought and resold without further

processing. Included are all items made by or for the establishments from materials owned by it, whether sold, transferred to other plants of the same company, or shipped on consignment. The net selling value of products made in one plant on a contract basis from materials owned by another was reported by the plant providing the materials.

In the case of multiunit companies, the manufacturer was requested to report the value of products transferred to other establishments of the same company at full economic or commercial value, including not only the direct cost of production but also a reasonable proportion of "all other costs" (including company overhead) and profit. (See discussion of duplication of data below.)

Individual products—As in previous censuses, data were collected for almost all industries on the quantity and value of individual products shipped. In the 1982 census program, information was collected on the output of approximately 11,000 individual product items. The term "product," as used in the census of manufactures, represents the finest level of detail for which output information was requested. Consequently, it is not necessarily synonymous with the term "product" as used in the marketing sense. In some cases it may be much more detailed and, in other cases, it is more aggregative. For example, "pharmaceutical preparations" was distributed into over 100 items; whereas, "motor gasoline" was reported as a single item.

Approximately 6,000 of the product items were listed separately on the 1982 census report forms. Data for about 5,000 products were obtained in the monthly, quarterly, or annual surveys comprising the Current Industrial Reports series of the Census Bureau. Totals for the year 1982 for these items, as derived from the commodity surveys, are shown in the "products shipped" table (table 6a) together with the tieline total value collected in the census for reconciliation purposes.

The list of products for which separate information was collected was prepared after consultation with industry and government representatives. Comparability with previous figures was given considerable weight in the selection of product categories so that comparable 1977 information is presented for most products.

Typically, both quantity and value of shipments information was collected. However, if quantity was not significant or could not be reported by manufacturers, only value of shipments was collected.

Shipments include both commercial shipments and transfers of products to other plants of the same company. For industries in which a considerable portion of the total shipments is transferred to other plants of the same company, separate information on interplant transfers was also collected. Moreover, for products that are used to a large degree within the same establishment as materials or components in the fabrication of other products, total production and often consumption of the item within the plant was collected. Typically, the information on production was also collected for products for which there are significant differences between total production and shipments in a given year because of wide fluctuations in finished goods inventories. Other measures of output of products with long production cycles were used as appropriate and feasible.

Classes of products—To summarize the product information, the separate products were aggregated into classes of products that, in turn, were grouped into all primary products of each industry. The code structure used is a seven-digit number for the

individual product, a five-digit number for the class of product, and a four-digit number for the total primary products in an industry. (See Introduction, Industry Classification of Establishments, for application of the coding structure to the assignment of SIC codes for establishments.)

In the 1982 census, the 11,000 products were grouped into approximately 1,500 separate classes on the basis of general similarity of manufacturing processes, types of materials used, and the like. However, the grouping of products was affected by the economic significance of the class and, in some cases, dissimilar products were grouped because the products were not sufficiently significant to warrant separate classes.

Duplication in cost of materials and value of shipments—The aggregate of the cost of materials and value of shipments figures for industry groups and for all manufacturing industries includes large amounts of duplication, since the products of some industries are used as materials by others. With some important exceptions, such as for motor vehicles and parts, this duplication is not significant at the four-digit industry level. However, it is significant at the two-digit and three-digit industry group level because these totals often include industries that represent successive stages in the production of a finished manufactured product. Examples are the addition of flour mills to bakeries in the "Food" group and the addition of pulp mills to paper mills in the "Paper and Allied Products" group of industries. Estimates of the overall extent of this duplication indicate that the value of manufactured products exclusive of such duplication (the value of finished manufactures) tends to approximate two-thirds of the total value of products reported in the census of manufactures.

Value added by manufacture—This measure of manufacturing activity is derived by subtracting the cost of materials, supplies, containers, fuel, purchased electricity, and contract work from the value of shipments (products manufactured plus receipts for services rendered). The result of this calculation is adjusted by the addition of value added by merchandising operations (i.e., the difference between the sales value and the cost of merchandise sold without further manufacture, processing, or assembly) plus the net change in finished goods and work-in-process between the beginning- and end-of-year inventories.

Because of the change in instructions for reporting inventories for 1982, the 1982 figure for value added is not strictly comparable to prior-year data. This is explained more fully in the inventories section below.

"Value added" avoids the duplication in the figure for value of shipments that results from the use of products of some establishments as materials by others. Value added is considered to be the best value measure available for comparing the relative economic importance of manufacturing among industries and geographic areas.

New and used capital expenditures—For establishments in operation and establishments under construction but not yet in operation, manufacturers were asked to report their new expenditures for (1) permanent additions and major alterations to manufacturing establishments, and (2) machinery and equipment used for replacement and additions to plant capacity if they were of the type for which depreciation accounts were ordinarily maintained.

The totals for new expenditures exclude that portion of expenditures leased from nonmanufacturing concerns, new facilities owned by the Federal Government but operated under

contract by private companies, and plant and equipment furnished to the manufacturer by communities and nonprofit organizations. Also excluded are expenditures for used plant and equipment (although reported in the census), expenditures for land, and cost of maintenance and repairs charged as current operating expenses.

Manufacturers were also requested to report the value of all used buildings and equipment purchased during the year at the purchase price. For any equipment or structure transferred to the use of the reporting establishment by the parent company or one of its subsidiaries, the value at which it was transferred to the establishment was to be reported. Furthermore, if the establishment changed ownership during the year, the cost of the fixed assets (building and equipment) was to be reported under used capital expenditures.

Total expenditures for used plant and equipment is a universe figure; i.e., it is collected on all census forms. However, the breakdown of this figure between expenditures for used buildings and other structures and expenditures for used machinery and equipment is collected only on the ASM form and is subject to sampling error (see table 3d). The data for total new capital expenditures, new building expenditures, and new machinery expenditures, as well as the data for total used expenditures, are shown in both tables 3a and 3d. The figure in table 3a is a census universe total and may differ from the results of the ASM sample shown in table 3d. Since the figures in table 3d are subject to sampling error, they are not considered as reliable as the universe figures.

End-of-year inventories—Respondents were asked to report their 1981 and 1982 end-of-year inventories at cost or market. Effective with the 1982 Economic Censuses, this change to a uniform instruction for reporting inventories was introduced for all sector reports. Prior to 1982, respondents were permitted to value inventories using any generally accepted accounting method (FIFO, LIFO, market, to name a few). In 1982, LIFO users were asked to first report inventory values prior to the LIFO adjustment and then to report the LIFO reserve and the LIFO value after adjustment for the reserve.

Because of this change in reporting instructions, the 1982 data for inventories and value added by manufacture included in the tables of this report are not comparable to the prior-year data shown in table 1a of this report and in historical census of manufactures and annual survey of manufactures publications. Inventories and value added data estimated on a basis comparable to the historical data, using the reported information for 1982, are shown in footnote 4 of table 1a. However, the end-of-1981 figure shown in this footnote may differ from the corresponding value published as part of the 1981 Annual Survey of Manufactures.

This difference at the four-digit SIC level is due primarily to the effects of industry shifts. As described in the Industry Classification of Establishments section of the Introduction, ASM noncertainty plants are allowed to shift from one industry to another in a census year; whereas, they are "frozen" in a particular industry in ASM years. Other explanations for this difference include the effects of sampling and processing errors and revisions to end-of-1981 data reported by respondents.

In using inventory data by stage of fabrication for "all industries" and at the two-digit industry level, it should be noted that an item treated as a finished product by an establishment in one industry may be reported as a raw material by another establishment in a different industry. For example, the finished-product inventories of a steel mill would be reported as raw

materials by a stamping plant. Such differences are present in the inventory figures by stage of fabrication shown for individual industries, industry groups, and "all manufacturing," which are aggregates of figures reported by establishments in specified industries.

Specialization and coverage ratios—These items are not collected on the report forms but are derived from the data shown in table 5b. An establishment is classified in a particular industry if its shipments of primary products of that industry exceed in value its shipments of the products of any other single industry.

As noted in the Introduction, an establishment's shipments include those products assigned to an industry (primary products), those considered primary to other industries (secondary

products), and receipts for miscellaneous activities (merchandising, contract work, resales, etc.). Specialization and coverage ratios have been developed to measure the relationship of primary product shipments to the data on shipments for the industry shown in tables 1a through 5a and data on product shipments shown in tables 6a through 6c.

Specialization ratio represents the ratio of primary product shipments to total product shipments (primary and secondary, excluding miscellaneous receipts) for the establishments classified in the industry.

Coverage ratio represents the ratio of primary products shipped by the establishments classified in the industry to the total shipments of such products that are shipped by all manufacturing establishments wherever classified.

SECTION 2. ITEMS COLLECTED ONLY ON ASM REPORT FORMS

Supplemental labor costs—Supplemental labor costs are divided into legally required expenditures and payments for voluntary programs. The legally required portion consists primarily of Federal old age and survivors' insurance, unemployment compensation, and workers' compensation. Payments for voluntary programs include all programs not specifically required by legislation whether they were employer initiated or the result of collective bargaining. They include the employer portion of such plans as insurance premiums, premiums for supplemental accident and sickness insurance, pension plans, supplemental unemployment compensation, welfare plans, stock purchase plans on which the employer payment is not subject to withholding tax, and deferred profit-sharing plans. They exclude such items as company-operated cafeterias, in-plant medical services, free parking lots, discounts on employee purchases, and uniforms and work clothing for employees. While the excluded items do benefit employees and all or part of their cost generally is similar to the items covered in the ASM labor costs statistics, accounting records do not generally provide reliable figures on net employee benefits of these types.

Cost of purchased services—ASM establishments were requested to provide information on the cost of purchased services for the repair of buildings and other structures, the repair of machinery, and communication services. Included in the cost of purchased services for the repair of buildings and machinery are payments made for all maintenance and repair work on buildings and equipment, such as painting, roof repairs, replacing parts, and overhauling equipment. Such payments made to other establishments of the same company and for repair and maintenance of any leased property are also included. Extensive repairs or reconstruction that were capitalized are considered capital expenditures for used buildings and machinery and are, therefore, excluded from this item. Repair and maintenance costs provided by an owner as part of a rental contract or incurred directly by an establishment in using its own work force are also excluded.

The response coverage ratio shown in table 3d for each of the three types of purchased services listed above is a measure of the extent to which respondents reported for each item. It is derived for each item by calculating the ratio of the weighted employment (establishment data multiplied by sample weight; see section 3) for those ASM establishments that reported the

specific inquiry to the weighted total employment for all ASM establishments classified in the industry.

Electric energy used for heat and power—Data on the cost of purchased electric energy were collected on all census forms. However, data on the quantity of purchased electric energy and quantity of generated-less-sold electric energy were collected only on the ASM forms. The cost and quantity of purchased electric energy represent the amount actually used during the year for heat and power. In addition, information was collected on the quantity of electric energy generated by the establishment and the quantity of electric energy sold or transferred to other plants of the same company.

Beginning- and end-of-year depreciable assets—The data encompass all fixed depreciable assets on the books of establishments at the beginning and at the end of the year. The values shown (book value) represent the actual cost of assets at the time they were acquired, including all costs incurred in making the assets usable (such as transportation and installation). Included are all buildings, structures, machinery, and equipment (production, office, and transportation equipment) for which depreciation reserves are maintained. Excluded are non-depreciable capital assets, including inventories and intangible assets, such as patent rights and royalties. Also excluded are land and depletable assets, such as timber and mineral rights.

The definition of fixed depreciable assets is consistent with the definition of capital expenditures. For example, expenditures include actual capital outlays during the year, rather than the final value of equipment put in place and buildings completed during the year. Accordingly, the value of assets at the end of the year includes the value of construction in progress. In addition, respondents were requested to make certain that assets at the beginning of the year plus new and used capital expenditures, less retirements, equalled assets at the end of the year.

New and used capital expenditures—The data for total new capital expenditures, new building expenditures, new machinery expenditures, and total used capital expenditures are collected on all census forms. However, the breakdown between expenditures for used buildings and other structures and expenditures for used machinery and equipment is collected only on the ASM form. (See further explanation on capital expenditures in section 1.)

Breakdown of new capital expenditures for machinery and equipment—ASM establishments were requested to separate their capital expenditures for new machinery and equipment into (1) automobiles, trucks, etc., for highway use, (2) computers and peripheral data processing equipment, and (3) all other.

The category "automobiles, trucks, etc., for highway use" is intended to measure expenditures for vehicles designed for highway use that were acquired through a purchase or lease-purchase agreement. Vehicles normally operating off public highways (vehicles specifically designed to transport materials, property, or equipment on mining, construction, logging, and petroleum development projects) are excluded from this item.

The "not specified by kind" or n.s.k. item for expenditures for new machinery and buildings, shown in table 3d, represents the total machinery and equipment expenditures for establishments that did not break down their expenditures for the three specific categories. This means that for most industries the specific categories are understated.

Retirements—Included in this item is the gross value of assets sold, retired, scrapped, destroyed, etc., during 1982. When a complete operation or establishment changed ownership, the respondent was instructed to report the value of the assets sold at the original cost as recorded in the books of the seller. The respondent was also requested to report retirements of equipment or structures owned by a parent company that the establishment was using as if it were a tenant.

Rental payments—This item includes rental payments for the use of all items for which depreciation reserves would be maintained if they were owned by the establishment, e.g., structures and buildings, and production, office, and transportation equipment. Excluded are royalties and other payments for the use of intangibles and depletable assets, and land rents where separable.

When an establishment of a multiestablishment company was charged rent by another part of the same company for the use of assets owned by the company, it was instructed to exclude that cost from rental payments. However, the book value (original cost) of these company-owned assets was to be reported as assets of the establishment at the end of the year.

If there were assets at an establishment rented from another company, and the rents were paid centrally by the head office of the establishment, the company was instructed to report these rental payments as if they were paid directly by the establishment.

Depreciation charges—This item includes depreciation and amortization charged during the year against assets. Depreciation charged against fixed assets acquired since the beginning of the year and against assets sold or retired during the year are components of this category. Respondents were requested to make certain that they did not report accumulated depreciation.



APPENDIX B.

Annual Survey of Manufactures (ASM) Sampling and Estimating Methodologies

DESCRIPTION OF SURVEY SAMPLE

The Annual Survey of Manufactures (ASM) contains two components. The mail portion of the survey is a probability sample of about 55,000 manufacturing establishments selected from a total of about 225,000 establishments. These 225,000 establishments represent all manufacturing establishments of multiunit companies and all single-unit manufacturing establishments with five employees or more tabulated in the 1977 Census of Manufactures. This mail portion is supplemented by a Social Security Administration list of new manufacturing establishments opened after 1977. The individual establishments were defined as the sampling unit for this sample. This is a change from the previous ASM sample when companies were used as the sampling unit. The implication of this change is that the probability of selection of any establishment relates only to the size of the establishment itself and is independent of the size of the company with which the establishment is affiliated. The efficiencies associated with the change to an establishment sample have made it possible to reduce the mail sample panel from 70,000 establishments in 1978 to 55,000 establishments in the current panel.

The nonmail portion of the survey includes all single-unit establishments that were tabulated with less than five employees in the 1977 Census of Manufactures. Although this portion contained approximately 125,000 establishments, it accounted for less than 2 percent of the estimate for total value of shipments at the total manufacturing level. This portion was not sampled; rather, the data for every establishment in this group were estimated based on selected information obtained annually from the administrative records of other Federal agencies. This administrative record information, which includes payroll, total employment, industry classification, and physical location of the establishment, was obtained under special conditions, which safeguard the confidentiality of both tax and census records. Estimates for data for these small establishments were developed using industry averages in conjunction with the administrative information.

The corresponding estimates for the mail and nonmail establishments were added together, along with the adjusted base-year differences as defined in Description of Estimating Procedures below. The remaining description of the survey sample relates only to the mail portion of the ASM sample.

All establishments with 250 employees or more in the 1977 census were included in the survey panel with certainty. These establishments collectively account for approximately 65 percent of the total value of shipments for manufacturing establishments in the 1977 census. Smaller establishments were sampled with probabilities ranging from 1.000 down to 0.005 in accordance with mathematical theory for optimum allocation of a sample.

The probabilities of selection assigned to the smaller establishments were proportional to measures of size determined for each establishment. For establishments included in the 1977 Census of Manufactures, the measure of size depended directly upon each establishment's 1977 product class values and the

historic variability of the year-to-year shipments of each product class. Roughly equivalent measures of size were assigned to postcensus birth establishments based on their industry codes and anticipated payroll, and employment.

The method of assigning measures of size was used in order to maximize the precision (that is, minimize the variance of estimates of the year-to-year change) in the value of product class shipments. Implicitly, it also gave weight to differences in employment, value added, and other general statistics, for these are highly correlated with value of shipments. Individual sample selection probabilities were obtained by multiplying each establishment's final measure of size by an overall sampling fraction coefficient calculated to yield a total expected sample size.

The sample selection procedure gave each establishment in the sampling frame an independent chance of selection. This method of independent selection permits the rotation of establishments into and out of a given sample panel without introducing a bias into the survey estimates.

DESCRIPTION OF ESTIMATING PROCEDURES

Most of the ASM estimates for the years 1978-1981 were computed using a modified "difference estimate" formula. For each item, a base-year difference was developed. This base-year difference is equal to the difference between the 1977 census published number for an item total and the linear ASM estimate of the total for 1977. The ASM linear estimate was obtained by multiplying each sample establishment's data by its sample weight (the reciprocal of its probability of selection) and summing the weighted values.

This base-year difference was then adjusted to reflect the estimated growth at the four-digit or, in the case of product classes, five-digit based Standard Industrial Classification (SIC) level from 1977 to the year of the survey; for example, 1981. It should be noted that due to processing constraints, the growth factors lagged one year; i.e., if 1981 is the survey year, they were not based on the estimated growth from 1977 to 1981 but rather the growth from 1977 to 1980. This one-year lag had negligible effect on the estimates, particularly at the total manufacturing level where the adjusted base-year difference accounted for less than 1 percent of the estimate for total value of shipments.

These adjusted base-year differences were then added to the corresponding current-year linear estimates, which include the sum of the estimates for the mail and nonmail establishments, to produce the estimates for the years 1978-1981. Estimates developed by this procedure usually are far more reliable than comparable linear estimates developed from the current sample data alone.

The 1982 sample data included in table 3d were also developed using difference estimates. However, since the universe totals for the census year (1977 or 1982) were not known, a modification of the procedure described above was necessary. For each item in table 3d, except purchased services and breakdown of expenditures for new machinery and equipment (see further description in appendix A, section 2), linear

estimates of the publication totals from the ASM mail sample were adjusted by the difference between imputed census totals and the corresponding ASM mail sample estimates of these imputed totals. These imputed totals are obtained by applying industry average ratios to control item values at the establishment level. For example, an imputed total beginning assets figure is obtained by multiplying each establishment's total value of shipments by the industry (four-digit SIC) average for the ratio of beginning assets to shipments.

Separate estimates for the nonmail establishments were not developed. However, their contribution to the publication estimates is reflected in the difference adjustment.

The method of inventory valuation percentages included in table 3c was developed using both complete census information and ASM estimates. The percentages for the four major categories (LIFO, non-LIFO, valuation method not reported, and LIFO reported without associated value and reserve) were derived from the complete census and correspond to the values included in table 3d. The percentages for the specific non-LIFO methods of valuations (FIFO, average cost, specific costs, etc.) are ratio estimates developed from the ASM in conjunction with the census universe estimate for the total of the non-LIFO methods.

QUALIFICATIONS OF THE DATA

The estimates developed from the sample are apt to differ somewhat from the results of a survey covering all companies in the sampled lists but otherwise conducted under essentially the same conditions as the actual sample survey. The estimates of the magnitude of the sampling errors (the differences between the estimates obtained and the results theoretically obtained from a comparable, complete-coverage survey) are provided by the standard errors of the estimates.

The particular sample selected for the ASM is one of a large number of similar probability samples that, by chance, might have been selected under the same specifications. Each of the possible samples would yield somewhat different sets of results, and the standard errors are measures of the variation of all the possible sample estimates around the theoretical, comparable, complete-coverage values.

Estimates of the standard errors have been computed from the sample data for selected statistics in this report. Except for table 3c, they are presented in the form of relative standard errors, the standard errors divided by the estimated values to which they refer. In table 3c, "absolute" standard errors of the estimates are presented.

In conjunction with its associated estimate, the relative standard error may be used to define confidence intervals (ranges that would include the comparable, complete-coverage value for specified percentages of all the possible samples).

The complete coverage value would be included in the range:

1. From one standard error below to one standard error above the derived estimate for about two-thirds of all possible samples.

2. From two standard errors below to two standard errors above the derived estimate for about 19 out of 20 of all possible samples.
3. From three standard errors below to three standard errors above the derived estimate for nearly all samples.

An inference that the comparable, complete-survey result would be within the indicated ranges would be correct in approximately the relative frequencies shown. Those proportions, therefore, may be interpreted as defining the confidence that the estimates from a particular sample would differ from complete-coverage results by as much as one, two, or three standard errors, respectively.

For example, suppose an estimated total is shown as 50,000 with an associated relative standard error of 2 percent, that is, a standard error of 1,000 (2 percent of 50,000). There is approximately 67 percent confidence that the interval 49,000 to 51,000 includes the complete-coverage total and about 95 percent confidence that the interval 48,000 to 52,000 includes the complete-coverage total.

In addition to the sample errors, the estimates are subject to various response and operational errors: errors of collection, reporting, coding, transcription, imputation for nonresponse, etc. These operational errors would also occur if a complete canvass were to be conducted under the same conditions as the survey.

Explicit measures of their effects generally are not available. However, it is believed that most of the important operational errors were detected and corrected in the course of the Bureau's review of the data for reasonableness and consistency. The small operational errors usually remain. To some extent, they are compensating in the aggregated totals shown. When important operational errors were detected too late to correct the estimates, the data were suppressed or were specifically qualified in the tables.

As derived, the estimated standard errors included part of the effect of the operational errors. The total errors, which depend upon the joint effect of the sampling and operational errors, are usually of the order of size indicated by the standard error, or only moderately higher. However, for particular estimates, the total error may considerably exceed the standard errors shown.

The concept of complete coverage under the conditions prevailing for the ASM is not identical to the complete coverage of the census of manufactures, as the censuses have been conducted. Nearly all types of operational errors that affect the ASM also occur in the censuses. The ASM and the censuses, are conducted under quite different conditions, and operational errors can be better controlled in the ASM than in the censuses. As a result, for many of the census figures, the errors are of the same order of size as the total errors of the corresponding annual survey estimates. The differences between the census and ASM operating conditions also disturb, to some degree, the comparability of the ASM and census data.

Any figures shown in the tables in this publication having an associated standard error exceeding 15 percent may be of limited reliability. However, the figure may be combined with higher-level totals, creating a broader aggregate, which then may be of acceptable reliability.

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PUBLICATION PROGRAM

1982 CENSUS OF MANUFACTURES

Publications of the 1982 Census of Manufactures, containing preliminary and final data on manufacturing establishments in the United States, are described below. Publication order forms for the specific reports may be obtained from any Department of Commerce district office or from Data User Services Division, Customer Services (Publications), Bureau of the Census, Washington, D.C. 20233

Preliminary Reports

Preliminary industry data are issued in 443 separate reports covering 452 industries (or combinations of industries). Preliminary data for States are grouped and released in reports for each of the nine census geographic divisions.

Final Reports

Final detailed statistics are issued in separate paperbound reports.

Industry series—82 reports (MC82-I-20A to -39D)

Each of the 82 reports provides information for a group of related industries (e.g., "dairy products" includes industries for butter, cheese, milk, etc.). Final figures for the United States are shown for each of the 452 manufacturing industries on quantity and value of products shipped and materials consumed, cost of fuels and electric energy, capital expenditures, assets, rents, inventories, employment, payroll, payroll supplements, hours worked, value added by manufacture, number of establishments, and number of companies. Comparative statistics for earlier years are provided where available.

For each industry, data on value of shipments, value added by manufacture, capital expenditures, employment, and payroll are shown by employment-size class of establishment and degree of primary product specialization. Statistics are given on production of specific products and consumption of energy and various materials by industry.

Geographic area series—51 reports (MC82-A-1 to -51)

A separate report for each State and the District of Columbia presents data for industry groups and industries on value of shipments, cost of materials, value added by manufacture, employment, payroll, hours worked, new capital expenditures, and number of manufacturing establishments for the State, SMSA's, and large industrial counties and places. Comparative statistics for earlier census years are shown for the State and large SMSA's. Manufacturing totals are presented for each county and for places with significant manufacturing activity. Detailed statistics—including inventories, assets, rents, and energy costs—are presented only in statewide totals.

Subject series—10 reports (MC82-S-1 to -10)

Each of the 10 reports contains detailed statistics for an individual subject, such as: selected materials consumed, selected metalworking

operations, manufacturing activity in government establishments, concentration ratios in manufacturing, type of organization, water use in manufacturing, fuels and electric energy consumed (separate publications for industry statistics, and State and SMSA statistics), textile machinery in place, production indexes, and a general National-level summary.

Final Report Volumes

Final paperbound reports subsequently are assembled and reissued in clothbound volumes.

- Volume I. Summary and Subject Statistics—data previously issued in series MC82-S.
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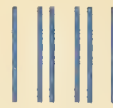
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Data on retail trade, wholesale trade, service industries, construction industries, mineral industries, enterprise statistics, minority-owned businesses, women-owned businesses, and transportation also are issued as part of the 1982 Economic Censuses. A separate series of reports covers the censuses of outlying areas—Puerto Rico, Virgin Islands of the United States, Guam, and the Northern Mariana Islands. All published reports and microfiche are sold by the Superintendent of Documents, U. S. Government Printing Office. Appropriate announcements and order forms describing these products are available free of charge from Data User Services Division, Customer Services (Publications), Bureau of the Census, Washington, D.C. 20233.

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