

**OHIO DEPARTMENT OF DEVELOPMENT**  
**Office of Strategic Research**

**THE OHIO MACHINERY INDUSTRY**



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**A State Affiliate of the U.S. Census Bureau**



**Bob Taft, Governor**

**Bruce Johnson, Director**

# **THE OHIO MACHINERY INDUSTRY**

**JULY 2005**

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# INTRODUCTION



## INTRODUCTION AND INDUSTRY DEFINITION

With few exceptions, machinery manufacturers do not make headlines the way steel or motor vehicle producers do. Yet there are good reasons for reporting on the machinery manufacturing industry. One key aspect of the industrial revolution has been the substitution of machines and mechanical power (regardless electricity usage) for human activity in the production of goods. People in the machinery industry make *the machines and equipment used* in making almost everything else. A few examples of almost everything else include lumber, food and beverage products, paper, publications, chemicals, rubber and plastic products, semiconductors, textiles and clothes, primary and fabricated metal products, appliances, product packages and labels, transportation equipment, furniture, dental and medical equipment, jewelry, buttons, gaskets and caskets. Tractors, mowers, combines, compressors, and pumps are machinery industry products. Equipment for moving material in factories, warehouses and ports – as well as people in buildings – is classified in the machinery industry. Machinery for the extraction of oil, natural gas, minerals and metals is included, as is machinery and equipment for constructing buildings, roads, and dams. Dies, jigs, fixtures and some power tools, welders, fans, heaters, ovens, furnaces, air-conditioners and refrigeration equipment – all used in various production processes – are also included. The industry's concentration in Ohio makes any change significant for the state's economy.

The list above only begins to convey the diversity of this major industry. The North American Industry Classification System (NAICS) organizes the 49 individual machinery industries – each making a variety of products – into seven groups. They are *agriculture-construction-mining* (NAICS code 3331), *industrial* (3332), *commercial and service* (3333), *ventilation-heating-air-conditioning (VHAC) and commercial refrigeration* (3334), *metalworking* (3335), *engine-turbine-power transmission* (3336)<sup>1</sup>, and *other general-purpose machinery* (3339). The first three groups listed include machinery and equipment designed for specialized use. The last three groups include general-purpose machinery and equipment. The appendix lists the specific industries and has additional examples of their products.

This report provides an overview of this important industry. Four sections follow this introduction. The first focuses on the industry in Ohio, describing the geographic distribution, and noting various companies' operations and their collective impact on the state's economy. The second charts recent industry trends in Ohio and compares them with the industry in other states and the nation in general. The third reviews of the comments of industry analysts and their forecasts for the future. The last is an appendix containing technical terms and data tables for those seeking a more detailed understanding of the industry. The graphs and many of the discussions herein are based on, and refer to, the appendix tables.

Statistics used in this report come principally from the U.S. Bureaus of the Census and Economic Analysis.

## EXECUTIVE SUMMARY

- The latest available data show 2,075 machinery industry establishments in Ohio employing 84,400 people; those figures represent 7.4 percent of the U.S. industry's establishments and 7.2 percent of its work force.
- Metalworking and other general-purpose machinery (NAICS 3335 and 3339) are the two largest machinery industry groups in Ohio, with over 1,450 establishments and over 46,700 employees between them.
- The greatest concentrations of industry employment in Ohio occur in welding and soldering equipment (333992 – 26.7 percent of the U.S.), metal forming machine tools (333513 – 24.2 percent), rolling mill machinery (333516 – 20.2 percent), and plastics and rubber industry machinery (33322 – 17.5 percent).
- Although they vary by specific industry, the latest available data show the average annual wage for machinery employees in Ohio was \$43,744 – about 102 percent of the national average; wages in Ohio were highest in other engine equipment (333618 – \$63,928) and lowest in air purification equipment (333411 – \$30,496).
- The industry is diffused across the state, with at least one such establishment in 86 counties. The majority of jobs are in Cuyahoga, Montgomery, Hamilton, Summit, Franklin, Lake, Auglaize, Clermont, and Lorain Counties.
- Based on the latest Gross State Product figures, Ohio ranks fourth in the nation in machinery production (333); as judged by the dollar value-added at industry establishments, Ohio led the nation in the production of other general-purpose machinery, and was second in metalworking machinery.
- The latest Economic Census data also show that within the machinery industry, Ohio led the nation in value-added in five specific industries, was second in nine and third in five:
  - #1 Food products, industrial and commercial fans and blowers, metal forming machine tools, rolling mill machinery, and welding and soldering equipment;
  - #2 Lawn and garden equipment, plastic and rubber working, industrial molds, special dies-tools-fixtures-and-jigs, machine tool accessories, mechanical power transmission, conveyors, industrial trucks-tractors-trailers-stackers, and fluid-power pumps and motors;
  - #3 Mining equipment, other metalworking equipment, pumps, packaging, and fluid-power cylinders and actuators.

- 45 companies on Fortune's U.S. 1,000 or Global 500 lists have machinery industry plants in Ohio. Five of these companies have their world headquarters in the state: Cooper Tire & Rubber, Dana, Goodyear Tire & Rubber, Parker Hannifin, and Timken.
- Lincoln Electric Holdings is the largest employer in Ohio's machinery industry with 3,500 people, while Crown Equipment and Illinois Tool Works each employ over 2,000 in the state; 3M, Berkshire-Hathaway, Emerson Electric, Gorman-Rupp, Isuzu, and MTD Products have between 1,000 to 1,999 employees here.
- 79 companies (or their subsidiaries) from 14 foreign nations employed at least 12,300 people in Ohio's machinery industry in 2004; nine of them were on Fortune's Global 500 list.
- Capital expenditures in Ohio by machinery industry companies generally have been slightly less than proportional to value-added originating in Ohio, although the commercial and service and VHAC and commercial refrigeration groups are an exception.
- The Ohio Department of Development recorded 92 major industry investments by 87 companies during the 2002-2004 period totaling \$409 million, the largest of which is the Isuzu-GM partnership's expansion of the diesel engine plant in Moraine.
- While the fortunes of machinery industries more or less follow the fortunes of their customers, analysts have identified a number of trends characterizing many companies regardless of their specific industry: globalization, the increasing importance of foreign trade, consolidation, diversification of product lines, providing greater value for customers, faster rates of innovation, and increasing use of the Internet for e-commerce.
- Analysts are generally optimistic about the immediate future of the machinery industry; however, they disagree about long-term prospects. They predict the number of jobs will increase at a slower-than-average rate; some groups will do better than others.



## **DESCRIPTION OF OHIO'S MACHINERY INDUSTRY**

# Leading and Notable Machinery Manufacturing Establishments in Ohio Employing 500 or More Persons 2004



- Key**
- Machinery Establishment
  - Ohio County

Source:  
 2005 Selectory CD-ROM, Prospecting  
 Business Database, Harris InfoSource,  
 Twinsburg, Ohio

Prepared by:  
 Ohio Department of Development,  
 Office of Strategic Research (June 2005)

## NOTABLE MACHINERY INDUSTRY MANUFACTURERS

Forty-five companies on Fortune magazine's U.S.-1,000 or Global-500 lists have machinery industry establishments in Ohio. Five of them maintain their world headquarters in Ohio: Cooper Tire & Rubber, Dana, Goodyear Tire & Rubber, Parker Hannifin, and Timken. Lincoln Electric Holdings is the largest employer in Ohio's machinery industry with 3,500 people. Illinois Tool Works is second with over 2,300, and Crown Equipment is third with about 2,200. Other companies employing from 1,000 to 1,999 people in Ohio include 3M, Berkshire-Hathaway, Emerson Electric, Gorman-Rupp, Isuzu, and MTD Products.<sup>2</sup>

The map above shows the locations of the 23 establishments with at least 500 employees. The list below includes the Fortune companies with at least 50 people at a site as well as other companies employing 500 or more people in Ohio and having at least 50 people at a site. It is organized by NAICS code and includes the location county of the site. Machinery manufacturing is not the principal business of some companies on the list. However, the sites of such companies are included because the primary NAICS codes of the specific establishments define them as part of the industry.

Group/Company/Subsidiary	Primary NAICS	Location County	Jobs at Site
<b>3331: Agriculture-Construction-Mining</b>			
MTD Products, Inc.	333112	Cuyahoga	320
MTD Products, Inc./MTD Midwest Industries	333112	Huron	1,100
Textron, Inc.*/Steiner Turf Equipment, Inc.	333112	Wayne	160
Trimble Navigation Ltd./Trimble Engineering & Construction	33312	Montgomery	600
<b>3332: Industrial</b>			
Illinois Tool Works, Inc.*/Ride Quality Products Akron	33322	Summit	175
KKR & Co.*-Siemens AG*/Demag Plastics Group	33322	Cuyahoga	370
FMC Technologies, Inc.*/FMC FoodTech.	333294	Erie	250
Henny Penny Corp.	333294	Preble	500
Illinois Tool Works, Inc.*/Hobart Corp.	333294	Highland	260
Nestle SA*/Norse Dairy Systems	333294	Franklin	120 <sup>+</sup>
<b>3333: Commercial and Service</b>			
Standard Register Co.	333313	Montgomery	500

Group/Company/Subsidiary	Primary NAICS	Location County	Jobs at Site
3M*/3M Precision Optics, Inc.	333314	Clermont	1,100
ABN AMRO Holding*/Cincinnati Industrial Machinery Co.	333319	Hamilton	200
Illinois Tool Works, Inc.*/Hobart Corp.	333319	Miami	1,100
Mitsubishi Heavy Industries, Ltd.*/Mitsubishi Heavy Industries America	333319	Columbiana	50 <sup>+</sup>
Pentair, Inc.*/Pentair Pump	333319	Ashland	400
3334: VHAC and Commercial Refrigeration			
Thermo Electron Corp.*/Thermo Forma, Inc.	333411	Washington	500
Lennox International, Inc.*/Armstrong Air Conditioning, Inc.	333415	Huron	300
Parker Hannifin Corp.*	333415	Cuyahoga	100
3335: Metalworking			
Ashland, Inc.*/Ashland Specialty Chemical Co./Casting Solutions Div.	333511	Cuyahoga	70
Cooper Tire & Rubber Co.*/Mold Production Div.	333511	Hancock	100
Metaldyne Corp.*/Hydraulic Controls Div.	333511	Cuyahoga	100
MTD Products, Inc./Industrial Plastics Co.	333511	Medina	100
SGS Tool Co./Burr Div.	333512	Summit	100
Alcoa, Inc.*/Stolle Machinery, Inc.	333513	Shelby	52
Federal Signal Corp./Dayton Progress Corp.	333514	Montgomery	650
Metaldyne Corp.*/Di-Rite Co.	333514	Cuyahoga	298
Federal Signal Corp./Clappdico Corp.	333515	Lucas	100
Federal Signal Corp./Manchester Tool Co.	333515	Summit	130
Kennametal, Inc.*	333515	Ashtabula	500
Kennametal, Inc.*	333515	Cuyahoga	400
Newell Rubbermaid, Inc.*/IRWIN Industrial Tool Co.	333515	Clinton	400
SGS Tool Co.	333515	Summit	360
SGS Tool Co./End Mill Div.	333515	Summit	70
Itochu International, Inc.*/P E Technologies, Inc.	333516	Cuyahoga	80
3336: Engine, Turbine, and Power Transmission			
Rolls-Royce PLC/Rolls-Royce Energy Systems, Inc.	333611	Knox	800

Group/Company/Subsidiary	Primary NAICS	Location County	Jobs at Site
Joy Global*/Joy Mining Machinery/Bedford Gear Div.	333612	Cuyahoga	145
Dana Corp.* & Daido Metal/Dana Glacier Daido America LLC	333613	Logan	425 <sup>+</sup>
Dover Corp.*/Dover Resources, Inc./OPW Engineered Systems, Inc.	333613	Warren	80
DuPont & Co.*/DuPont Vespel Parts & Shapes	333613	Cuyahoga	150
Metaldyne Corp.*/Forging Operations/Shaft Operations	333613	Carroll	250
DaimlerChrysler AG*/Detroit Diesel Remanufacturing	333618	Guernsey	550
Isuzu Motors Ltd.*-General Motors Corp.*/DMAX Ltd.	333618	Montgomery	1,000
<b>3339: Other General-Purpose Machinery</b>			
Crane Co.*/Crane Pumps & Systems, Inc.	333911	Miami	250
Crane Co.*/Deming Pump Div.	333911	Columbiana	115
Giant Industries, Inc.*	333911	Lucas	75
Gorman-Rupp Co.	333911	Richland	500
Gorman-Rupp Co.	333911	Richland	450
Gorman-Rupp Co./Gorman-Rupp Industries	333911	Richland	100
Pentair, Inc.*/Hydromatic Pumps, Inc.	333911	Ashland	210
Saint-Gobain*/Saint-Gobain Calmar, Inc.	333911	Fayette	300
Berkshire Hathaway, Inc.*/Scott Fetzer Co./Campbell Hausfeld	333912	Hamilton	663
Emerson Electric Co.*/Copeland Corp.	333912	Shelby	1,700
Illinois Tool Works, Inc.*/Ransburg Electrostatic	333912	Lucas	50
Dover Corp.*/Dover Resources, Inc./Hydro Systems Co.	333913	Hamilton	100
Manitowoc Co., Inc.*/Manitowoc Beverage Systems	333913	Lucas	198
Nordson Corp.	333913	Cuyahoga	75
Nordson Corp.	333913	Lorain	300
Goodyear Tire & Rubber Co.*/Engineered Products Div.	333922	Union	300
KKR & Co.*-Siemens AG*/Demag Cranes & Components/ Crane America Services, Inc.	333923	Cuyahoga	210
Crown Equipment Corp.	333924	Auglaize	2,000
Crown Equipment Corp.	333924	Mercer	150
Crown Equipment Corp./Crown Lift Trucks	333924	Montgomery	60
General Electric Co., Inc.*	333924	Hamilton	900

Group/Company/Subsidiary	Primary NAICS	Location County	Jobs at Site
Illinois Tool Works, Inc.*/Hobart Ground Power	333924	Miami	50
Stanley Works*/Stanley Assembly Technologies	333991	Cuyahoga	200
Berkshire Hathaway, Inc.*/Scott Fetzer Co./Western Enterprises	333992	Cuyahoga	250
Berkshire Hathaway, Inc.*/Scott Fetzer Co./Western Enterprises	333992	Lorain	190
Illinois Tool Works, Inc.*/Hobart Brothers Co.	333992	Miami	700
Lincoln Electric Holdings*/Lincoln Electric Co.	333992	Cuyahoga	3,000
Lincoln Electric Holdings*/Lincoln Electric Co.	333992	Lake	500
DuPont & Co.*/Liqui-Box Corp.	333993	Franklin	65
International Paper*/Packaging Development Center	333993	Clermont	800
Paxar Corp./Paxar Americas, Inc.	333993	Montgomery	757
Nordson Corp.	333994	Lorain	300
Parker Hannifin Corp.*	333995	Summit	80
Parker Hannifin Corp.*/Automation Actuator Div.	333995	Medina	125
Crane Co.*/Lea Romec Div.	333996	Lorain	200
Parker Hannifin Corp.*/Cylinder Div.	333996	Auglaize	200
Parker Hannifin Corp.*/Denison Hydraulics, Inc.	333996	Union	200
Parker Hannifin Corp.*/Hydraulic Valve Div.	333996	Lorain	200
Robert Bosch GmbH*/Bosch Rexroth Corp.	333996	Wayne	386
Mettler-Toledo International, Inc.*/Mettler-Toledo, Inc.	333997	Delaware	140
Mettler-Toledo International, Inc.*/Mettler-Toledo, Inc.	333997	Franklin	220
Mettler-Toledo International, Inc.*/Mettler-Toledo, Inc.	333997	Franklin	150
Mettler-Toledo International, Inc.*/Mettler-Toledo, Inc.	333997	Franklin	110
Ingersoll-Rand Co. Ltd.	333999	Williams	500
Parker Hannifin Corp.*/Hydraulic Filter Div.	333999	Fulton	200
Rockwell Automation, Inc.*/Entek	333999	Delaware	110

Notes: \* - A Fortune U.S. 1,000 or Global 500 company.

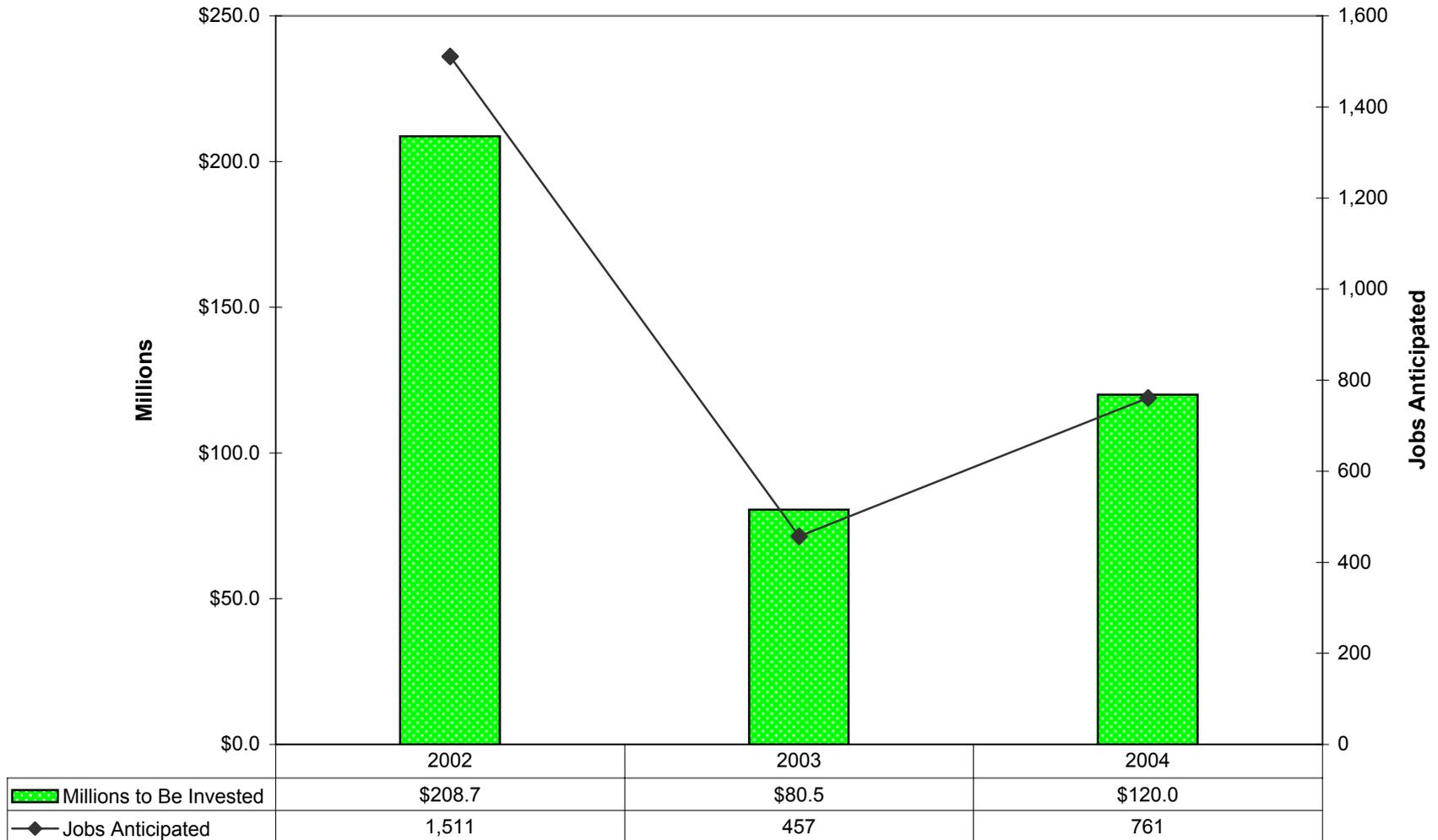
+ - Jobs figure is from Office of Strategic Research (2005a).

Sources: Fortune (2004, 2005), Harris (2004), LexisNexis (2004), Office of Strategic Research (2005a).



## Investment Announcements in Ohio's Machinery Industry, 2002-2004

Three-Year Totals: \$409.3Million; 2,729 Jobs



Source: Office of Strategic Research

## RECENT EXPANSIONS AND ATTRACTIONS

From 2002 through 2004 the Office of Strategic Research recorded 92 major investments by 87 companies in Ohio's machinery industry totaling almost \$409.3 million (M). The largest dollar amounts and projected new jobs from investments were recorded in 2002. These figures include the \$87.0M invested by Isuzu and General Motors to expand operations at the DMAX plant in Moraine – by far the single largest machinery industry investment in this three-year time period. Excluding that investment and the anticipated 185 new jobs leaves totals of \$121.7M and 1,326 for 2002, still the largest totals for any year covered.

The Isuzu-GM investment also skews the industry group statistics. Excluding it from the engine, turbine and transmission equipment group (NAICS 3336) lowers the group's three-year totals from \$108.8M and 314 jobs – the largest and fourth largest subtotals, respectively – to \$21.8M and 129 jobs – the smallest subtotals. After the exclusion, other general-purpose machinery (3339) received the largest investment – \$79.8M and 668 jobs. Metalworking machinery (3335) received the next largest amount – a \$64.8M and 431 jobs, closely followed by industrial machinery (3332) – \$62.4M and 654 jobs, and VHAC and commercial refrigeration (3334) – \$57.4M and 251 jobs. Industry groups receiving the smallest investments were commercial and service machinery (3333) – \$22.0M and 176 jobs, and agriculture-construction-mining (3331) – \$14.1M and 235 jobs.

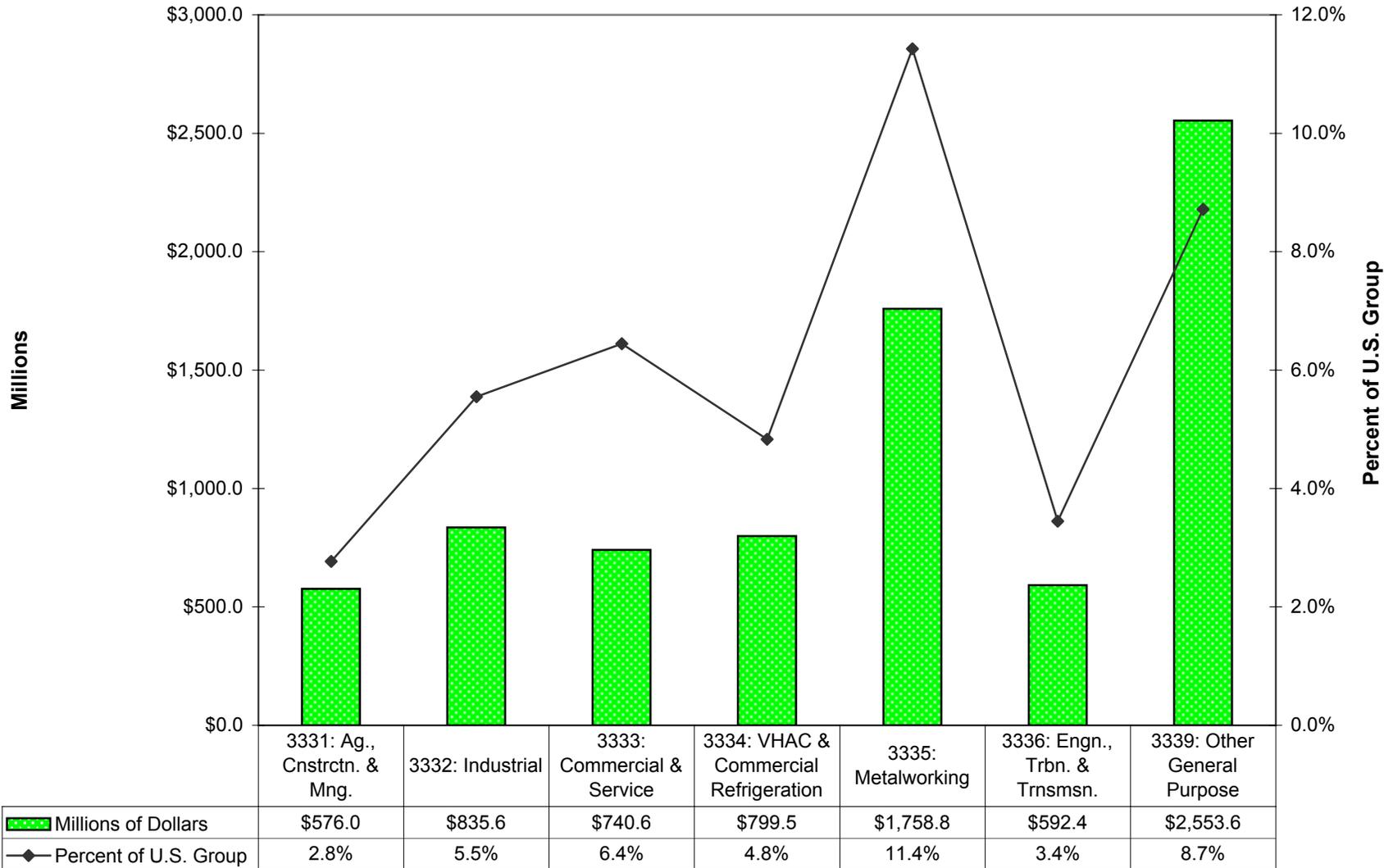
No other company's investment came close to that of Isuzu-GM, but eight invested at least \$10M. These include Atlantic Tool & Die, DaimlerChrysler, Emerson Electric, First Solar, Liebert North America, Mettler-Toledo, Milacron, and Ransohoff (Office of Strategic Research, 2005b).

These counts are derived from a list of major investments compiled by the Office of Strategic Research (2005b). To be included, a major investment must meet at least one of the following criteria: 20,000 square feet of new space; \$1 million to be spent for land, building(s), or equipment; or 50 new jobs. Many of the major investments are phased in over a two-to-three year cycle, with production and employee counts phased in after project completion. The data are not comparable with the Census data on capital expenditures.

See Table A1

# Value-Added by Group in Ohio's Machinery Industry, 2003

Total Dollars and Percent of U.S. Totals



Source: U.S. Bureau of the Census.

## THE COMPOSITION OF OHIO'S MACHINERY INDUSTRY: GROSS STATE PRODUCT AND VALUE-ADDED

Gross State Product (GSP) data are summary figures for the net value of goods and services provided by people and capital in each industry of every state. With some minor technical exceptions, GSP is the state counterpart to the national Gross Domestic Product (GDP). Machinery manufacturers in Ohio produced \$5.73 billion (B) of goods in 2003 – this was 1.44 percent of Ohio's total GSP, and 5.94 percent of the value of all machinery made in America. Ohio's total GSP was 3.65 percent of the U.S. total.<sup>3</sup> Comparing the last two percentages – 5.94 vs. 3.65 – indicates that American machinery production is concentrated here. Ohio ranks fourth among the 50 states and the District of Columbia in machinery production and seventh in total GSP.

Value-added data from the 2003 Annual Survey of Manufacturers provide additional insight into Ohio's machinery industry by focusing on the groups in the industry.<sup>4</sup> The chart above illustrates the distribution of value-added across the groups and the percentages of national production originating in Ohio. The largest group is other general-purpose machinery (NAICS 3339, \$2.55B), followed by metalworking (3335, \$1.76B). These two groups accounted for 54.9 percent of machinery industry (333) value-added in Ohio. These groups also are more concentrated in Ohio with 8.7 and 11.4 percent, respectively, of the national industry group value-added originating here. Ohio ranks first in the nation in other general-purpose machinery and second in metalworking machinery manufacturing.

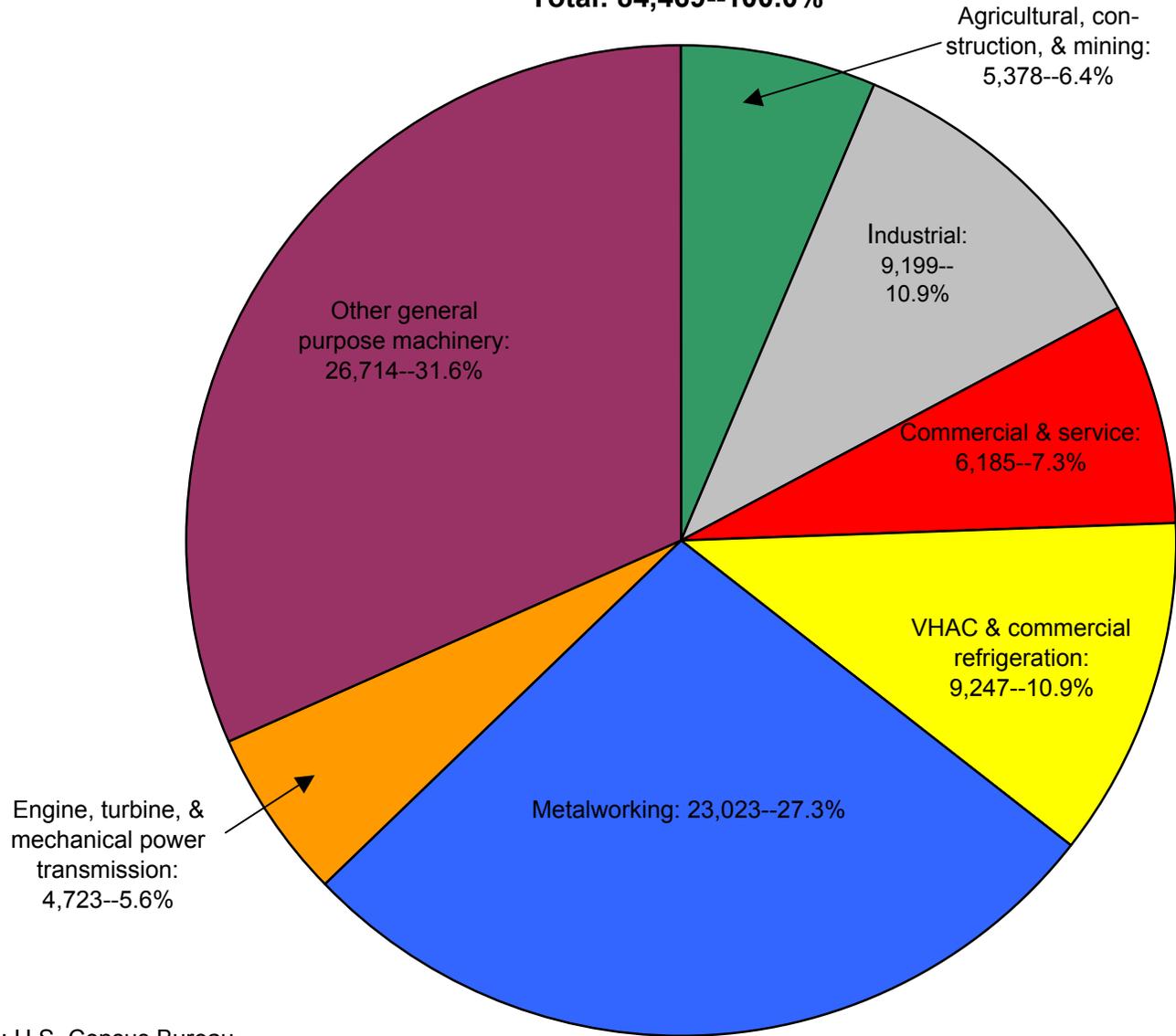
The production of commercial and service (3333), industrial (3332), and VHAC and commercial refrigeration machinery (3334) are somewhat concentrated in Ohio with 6.4, 5.5, and 4.8 percent, respectively, of national production. Ohio ranked fifth in the nation in each group. The production of agricultural, construction, and mining machinery, and engines, turbines, and transmission equipment is not concentrated here.

Initial reports from the 2002 Economic Census provide more details about the nature of the industry in Ohio. These are the industries that drive Ohio's GSP rank to fifth. As judged by value-added, Ohio ranks first in the nation in five machinery industries: food products, industrial and commercial fans and blowers, metal forming machine tools, rolling mill machinery, and welding and soldering equipment. Ohio ranks second in nine industries: lawn and garden equipment, plastic and rubber working, industrial molds, special dies-tools-fixtures-and-jigs, machine tool accessories, mechanical power transmission, conveyors, industrial trucks-tractors-trailers-stackers, and fluid-power pumps and motors. Ohio ranks third in five industries: mining equipment, other metalworking equipment, pumps, packaging, and fluid-power cylinders and actuators. Details about product classes are in the appendix tables.

See tables A2a-A2c

# Employment in Ohio's Machinery Industry, 2002

Total: 84,469--100.0%



Source: U.S. Census Bureau.

## THE COMPOSITION OF OHIO'S MACHINERY INDUSTRY: EMPLOYMENT

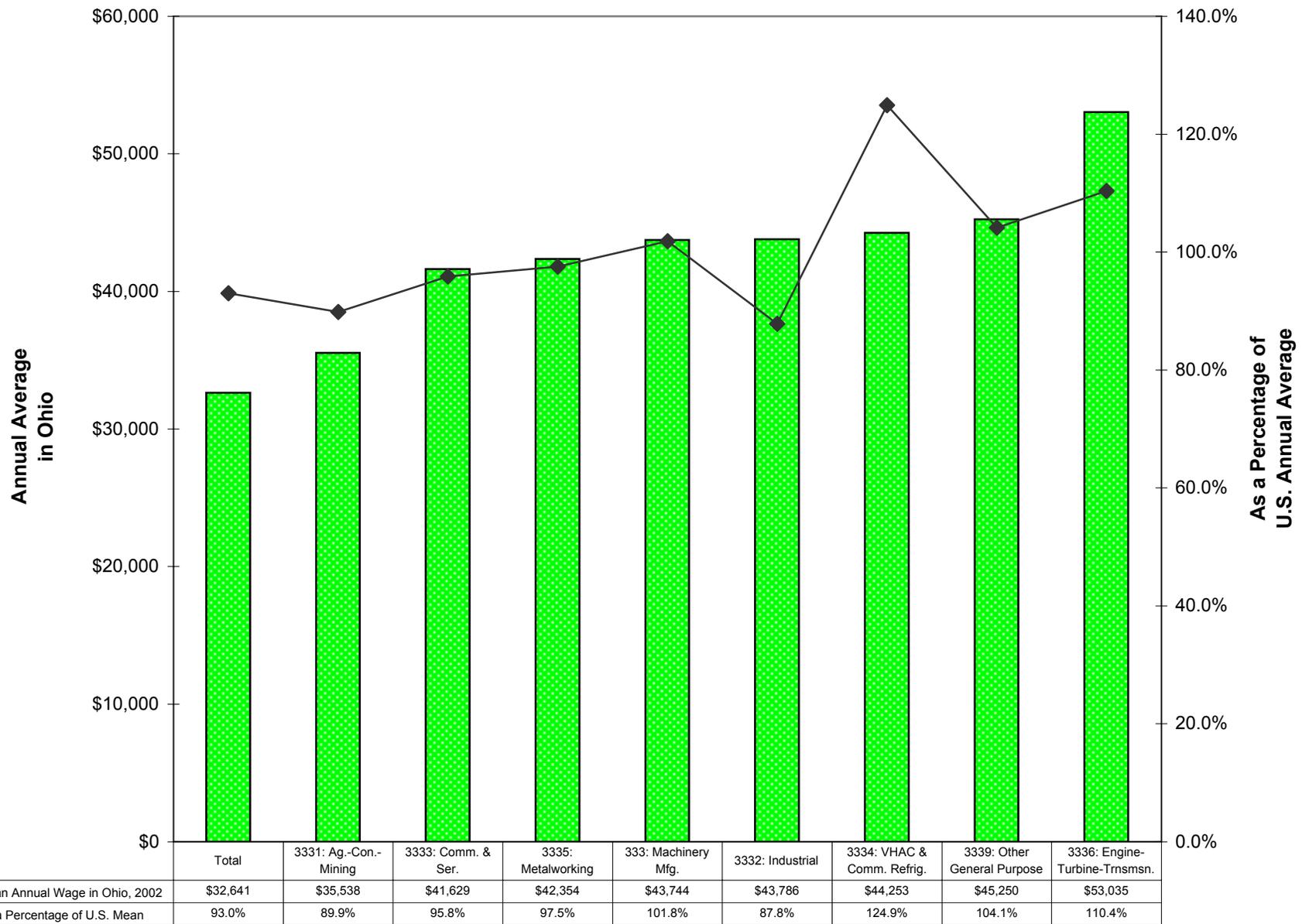
2,075 establishments employed over 84,400 people in Ohio's machinery industry (NAICS 333) during 2002. No one group dominates the industry. As judged by employment, the two largest groups are producers of other general-purpose machinery (3339 – 26,700 jobs) and metalworking machinery (3335 – 23,000 jobs). The same two groups also have the largest numbers of establishments: 475 and 976, respectively. Other groups, in descending order of employment, are VHAC and commercial refrigeration (3334 – over 9,200 jobs), industrial machinery (3332 – 9,200 jobs), commercial and service machinery (3333 – almost 6,200 jobs), agricultural-construction-mining (3331 – close to 5,400 jobs) and engines, turbines, and transmission equipment (3336 – over 4,700 jobs).

Between seven and eight percent of the nation's machinery industry establishments and employees were found in Ohio in 2002. (Ohio's portions of all private non-farm employees and associated establishments were 4.2 and 3.8 percent, respectively.) Metalworking machinery production is particularly concentrated in Ohio, with 10 percent of the national industry group's establishments and 12 percent of the jobs. Other groups with generally greater-than-average concentration of the industry in Ohio include industrial machinery, VHAC and commercial refrigeration, and other general-purpose machinery.

The average industry establishment in Ohio employs about the same number of people (41) as the average industry establishment in the U.S. (42). There is, however, variation among the groups. The VHAC and commercial refrigeration and the engine-turbine-transmission equipment groups typically employ the largest numbers (U.S. Bureau of the Census, 2004).

See Table A3

## Comparing Ohio Industry-Group Wages with National Averages, 2002



Source: U.S. Census Bureau.

Total-Industry-Group

## INDUSTRY WAGES

The average annual wage for an Ohio machinery industry (NAICS 333) worker was \$43,744 in 2002. This was about 102 percent of the corresponding average for the U.S. – \$42,960. Annual averages vary among industry groups, but the groups clustered in the \$41,500--\$45,500 range in Ohio. The exceptions were employees in agricultural-construction-mining (3331), averaging less than \$36,000, and those in engines-turbines-transmissions (3336) who averaged \$53,000.

Greater variation is shown among the individual industries. The lowest-paying industries were air purification equipment (333411) and agricultural implements (33311). The highest paying industries were other engine equipment (333618 – \$63,928), photographic and photocopying equipment (333315 – \$54,905), and rolling mill machinery (333516 – \$54,877).

While wages in Ohio's machinery industry are slightly greater than the national average, they are not uniformly greater. Wages for Ohio workers in the VHAC and commercial refrigeration group (3334) were 125 percent of the corresponding U.S. average, while those in the industrial machinery group (3332) were 88 percent of the national group average. Again, greater variation occurs among industries. Jobs in fluid power cylinders and actuators (333995) paid 79 percent of the national average for that industry, while power-driven hand tools (333991), AC-warm-air-furnaces-refrigeration (333415), and other engine equipment job paid over 130 percent of the national averages.

See Table A4



## THE DISTRIBUTION OF INDUSTRY ESTABLISHMENTS IN OHIO

The map above illustrates the distribution of 2,075 machinery industry establishments across Ohio in 2002. They are widely distributed, with 86 counties having at least one such establishment. However, the majority of establishments were located in eight counties: Cuyahoga – 306, Montgomery – 167, Summit – 164, Lake – 115, Hamilton – 113, Lucas – 73, Stark – 65, and Franklin – 61. Lorain and Mahoning each had between 50 and 60 establishments. Seventeen counties had from 20 to 49 establishments, 14 had from 10 to 19 establishments, and 45 had from one to nine.

See Table A5





## THE DISTRIBUTION OF INDUSTRY EMPLOYMENT IN OHIO

The map above illustrates the distribution of the 84,400-plus machinery industry jobs across Ohio in 2002; employment closely follows the distribution of establishments. The majority of jobs were located in nine counties: Cuyahoga – almost 12,100, Montgomery – 8,160-plus, Hamilton – 5,360, Summit – almost 4,440, Franklin – almost 3,460, Lake – 2,980, Auglaize – 2,660-plus, Clermont – 2,560-plus, and Lorain – about 2,370. Miami and Shelby Counties also had well over 2,100 jobs each. Fourteen counties had between 1,000 and 1,999 jobs, and 41 counties had 100 to 999 jobs.

See Table A5

## FOREIGN INVESTMENT IN OHIO

Seventy-nine foreign-based companies have subsidiaries and/or joint ventures in Ohio's machinery industry; nine are on Fortune's Global 500 list. The nine are: ABN AMRO Holding, DaimlerChrysler, Isuzu Motors, Mettler-Toledo International, Mitsubishi Heavy Industries, Nestle, Robert Bosch, Saint-Gobain, and Siemens. The list in Appendix Table A6 identifies all 79 companies, the countries where the home office is located, their Ohio subsidiaries, and the total number of employees here.

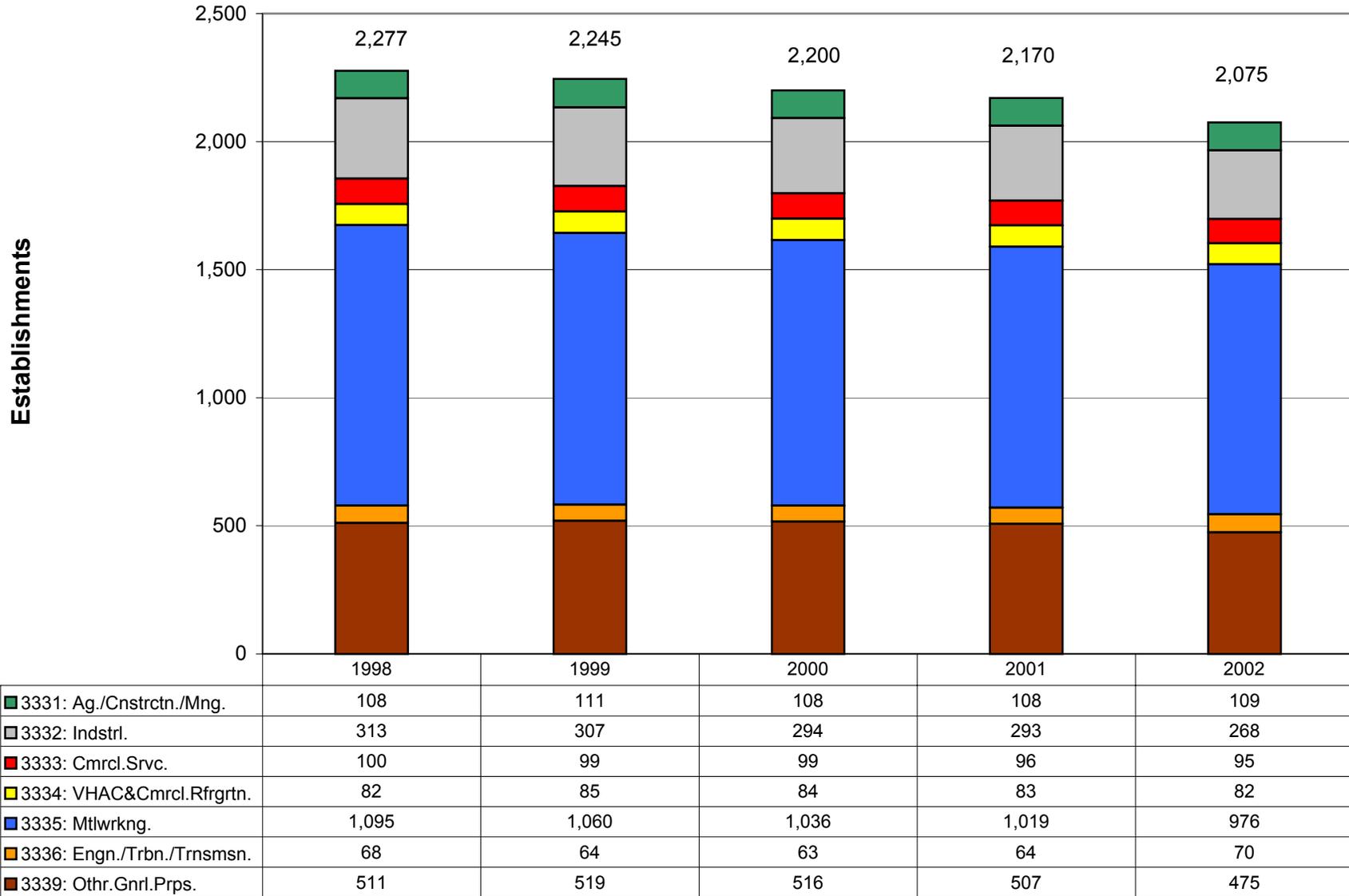
The foreign parent companies or joint venture partners have headquarters in 14 nations. Twenty-four are located in Japan, 17 in Germany, nine in the United Kingdom, eight in Canada, and five in Switzerland. Three each are headquartered in France and the Netherlands, and two each in Austria, Finland, and Italy. Belgium, Denmark, Norway, and South Korea are home to one a-piece.

Altogether, the 79 companies employ 12,310 people. Isuzu is the single largest employer with 1,000 people at its DMAX subsidiary (a joint venture with GM), followed by Rolls Royce with 800, Siemens with 671,<sup>5</sup> Mettler-Toledo with 660, and DaimlerChrysler with 550.

See Table A6

## TRENDS

## Establishment Trends in Ohio's Machinery Industry: 1998-2002



Source: U.S. Census Bureau.

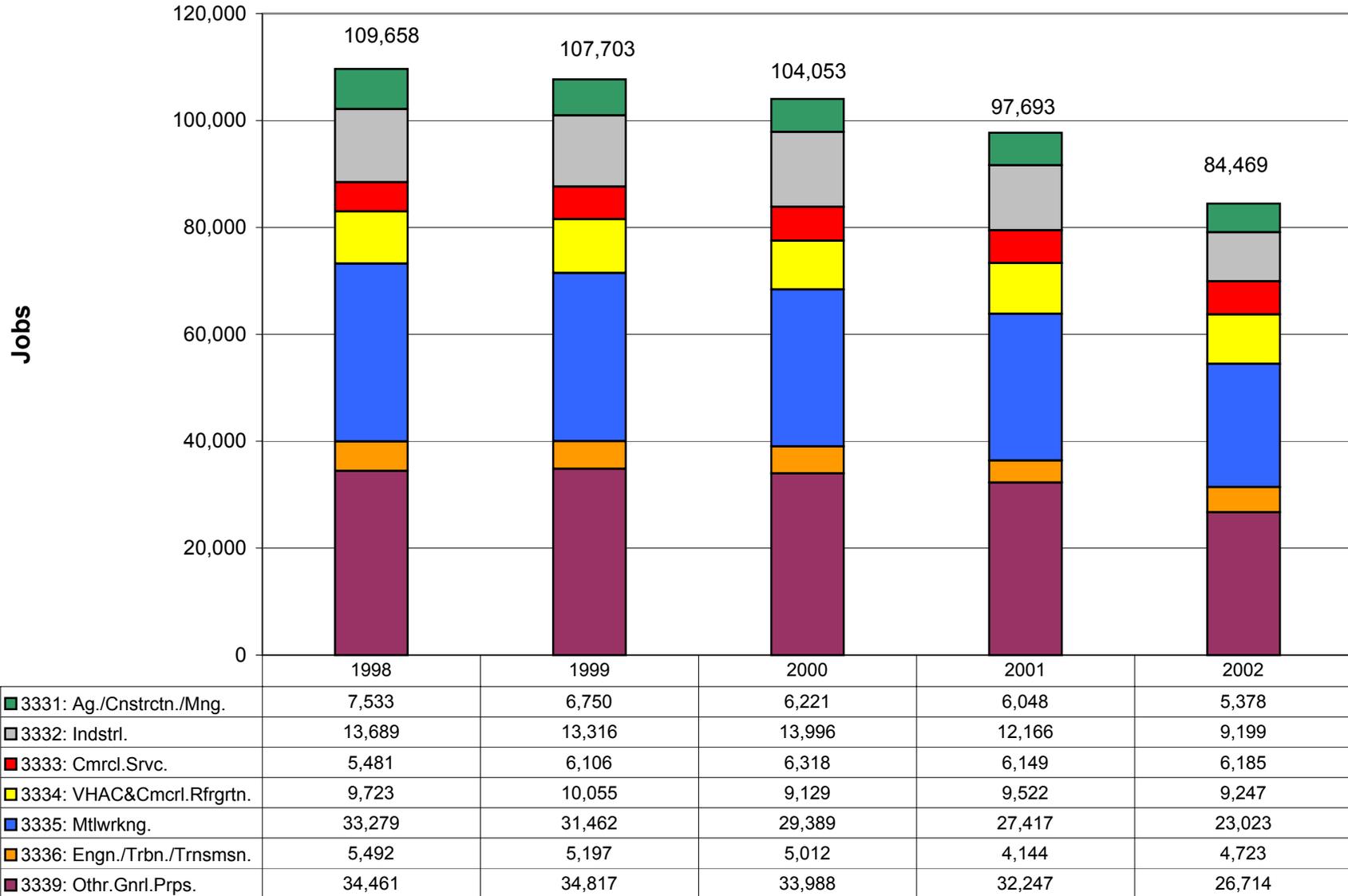
## ESTABLISHMENTS

Machinery industry establishments as a whole (NAICS 333) declined in Ohio since the implementation of NAICS (1998). The chart above shows that the total fell every year from 2,277 in 1998 to 2,075 in 2002 – the latest year for which figures are available. This is a loss of almost nine percent in four years. The chart above also shows that the declining number of establishments was concentrated in the three largest groups: industrial machinery (3332, down 14 percent), metal-working machinery (3335, down almost 11 percent), and other general-purpose machinery (3339, down 7 percent). The loss of five commercial and service industry establishments (3333) is slight. The numbers of establishments in other industry groups appear to have fluctuated; no trends are apparent.

What happened in Ohio was similar to what happened in the nation as a whole. Data in the appendix table show a steady decrease in the total number of machinery industry establishments in the U.S. This description is more or less accurate for every industry group; for some, the losses of establishments began after 1998. The data in the appendix table also show that the total number of manufacturing establishments (31-33) in Ohio and the nation decreased, albeit at a slower rate than in machinery manufacturing.

See Table A7

## Employment Trends in Ohio's Machinery Industry: 1998-2002



Source: U.S. Census Bureau.

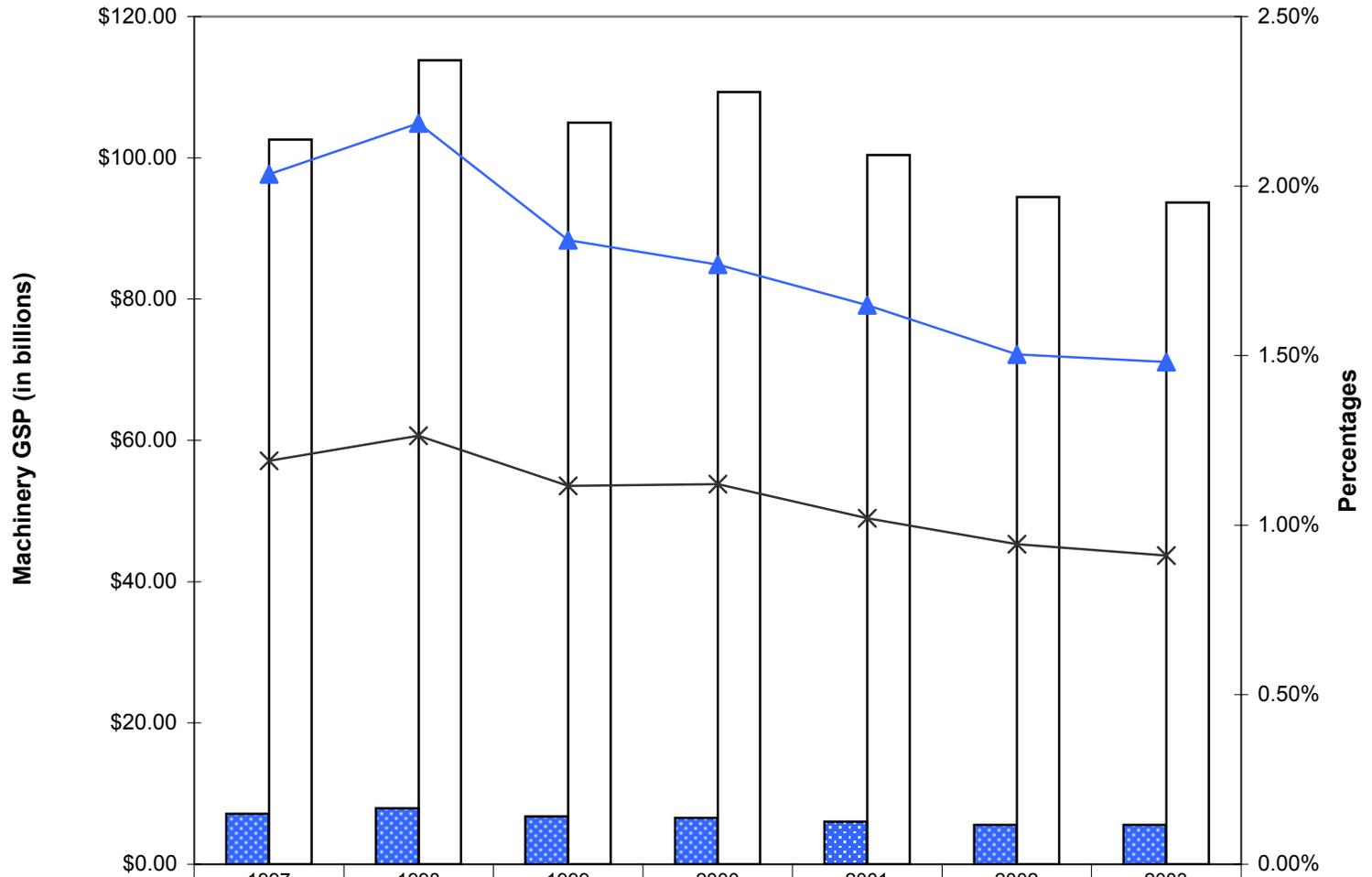
## EMPLOYMENT

Employment in machinery manufacturing as a whole (NAICS 333) declined in Ohio since the implementation of NAICS (1998). The chart above shows that employment fell every year from over 109,000 in 1998 to less than 85,000 in 2002 – the latest year for which figures are available. This is a loss of 23 percent in just four years. The chart above also illustrates that employment in every group except commercial and service industry machinery (3333) was lower in 2002 than in 1998. The majority of job losses – 18,000 – occurred in metalworking (3335) and other general-purpose machinery (3339). It may be noteworthy that employment in engine, turbine & transmission equipment (3336) increased from 2001 to 2002.

What happened in Ohio was more or less part of what happened in America. Data in the appendix table show that national machinery industry employment fell each year, declining by 19.3 percent for the period, and national employment figures for every industry group were lower in 2002 than in 1998. The appendix table also shows that the job losses in machinery manufacturing were relatively greater than in the manufacturing sector (31-33). From 1998 through 2002, 16.6 percent of all manufacturing jobs in Ohio disappeared while 15.5 percent of such jobs in America vanished.

See Table A8

## Machinery Manufacturing's Roles in Ohio & U.S. Economies



Ohio Machinery GSP	\$7.13	\$7.92	\$6.77	\$6.57	\$6.03	\$5.55	\$5.57
U.S. Machinery GSP	\$102.58	\$113.80	\$104.96	\$109.30	\$100.40	\$94.45	\$93.65
Machinery as Percent of Ohio Total	2.03%	2.19%	1.84%	1.77%	1.65%	1.50%	1.48%
machinery as Percent of U.S. Total	1.19%	1.26%	1.12%	1.12%	1.02%	0.94%	0.91%

Source: U.S. Bureau of Economic Analysis.

## GROSS STATE PRODUCT

As previously mentioned, Gross State Product (GSP) data are summary figures for the net value of goods and services provided by people and capital in each industry of every state. Real changes in the economy and constituent industries – i.e., the volume(s) of goods produced and services provided – can be discerned only after accounting for inflation. The chart above illustrates real changes in volume of machinery produced from 1997 through 2003: output in Ohio peaked in 1998 and declined every year through 2002 before increasing by \$20 million (M) in 2003. The net change was a nearly 22 percent drop in production. The decline across the country was less pronounced: 8.7 percent – from \$102.58 billion (B) to \$93.65B.

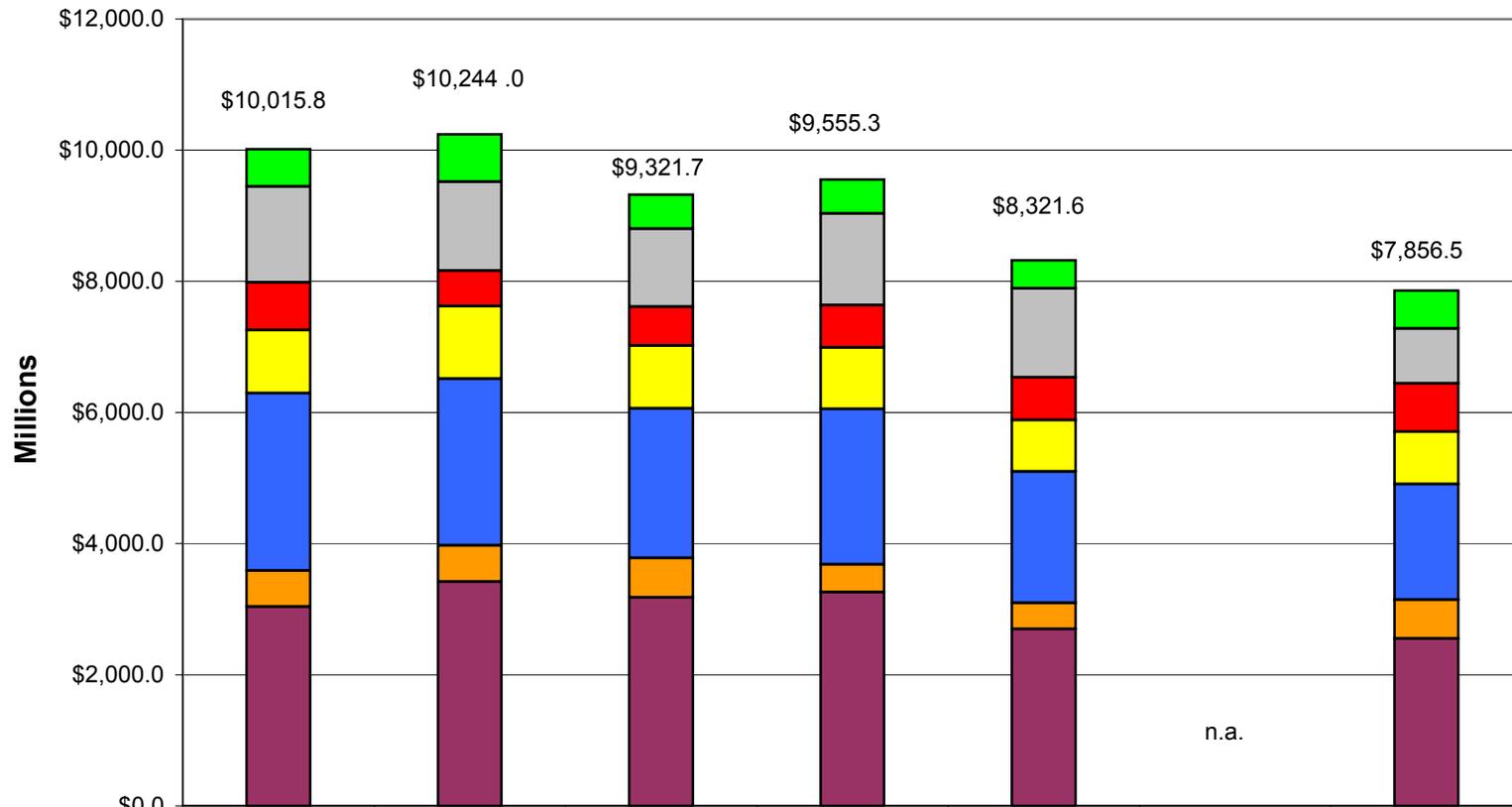
During the same time both Ohio's and America's economies experienced overall real growth. Consequently, machinery industry output also declined as a percentage of total output both in Ohio and across the nation. The chart above shows that machinery comprised 2.19 percent of Ohio's total in 1998, but only 1.48 percent of the total in 2003. Similarly, national industry output fell from 1.26 percent of the U.S. total to .91 percent.

The industry remains concentrated in Ohio: 5.94 percent of U.S. machinery industry output originated in Ohio during 2003, while 3.65 percent of all goods and services came from Ohio that year. However, the industry is not quite as concentrated here as it was in 1998 when 7.96 percent of industry output came from Ohio and the state was the source of 4.03 percent of all goods and services in the nation.

Whether these changes reflect the cyclical nature of the industry or a structural change in the economy – or both – cannot be determined from this data during such a short time period.<sup>6</sup> Some industry analysts think that these changes are a result of lower manufacturing costs in a rapidly industrializing China (Business Week, 2004).

See Table A9

## Value-Added by Group in Ohio, 1997-2003



	1997	1998	1999	2000	2001	2002	2003
■ 3331: Ag./Cnstrctn./Mng.	\$565.6	\$721.9	\$517.0	\$523.0	\$429.7	\$0.0	\$576.0
■ 3332: Indstrl.	\$1,463.9	\$1,357.7	\$1,193.1	\$1,392.7	\$1,356.9	\$0.0	\$835.6
■ 3333: Cmrcl. & Srvc.	\$729.5	\$542.0	\$590.8	\$649.4	\$648.7	\$0.0	\$740.6
■ 3334: VHAC/Cmrcl.Rfrgrtn.	\$964.2	\$1,105.6	\$956.7	\$936.1	\$787.9	\$0.0	\$799.5
■ 3335: Mtlwrkng.	\$2,703.6	\$2,543.3	\$2,283.3	\$2,371.7	\$2,001.2	\$0.0	\$1,758.8
■ 3336: Engn./Trbn./Trnsmnsn.	\$548.8	\$555.3	\$601.2	\$421.6	\$403.0	\$0.0	\$592.4
■ 3339: Othr.Gnrl.Prps.	\$3,040.1	\$3,418.2	\$3,179.7	\$3,260.9	\$2,694.3	\$0.0	\$2,553.6

Source: U.S. Census Bureau. Note: n.a. - not available.

## VALUE-ADDED BY GROUP

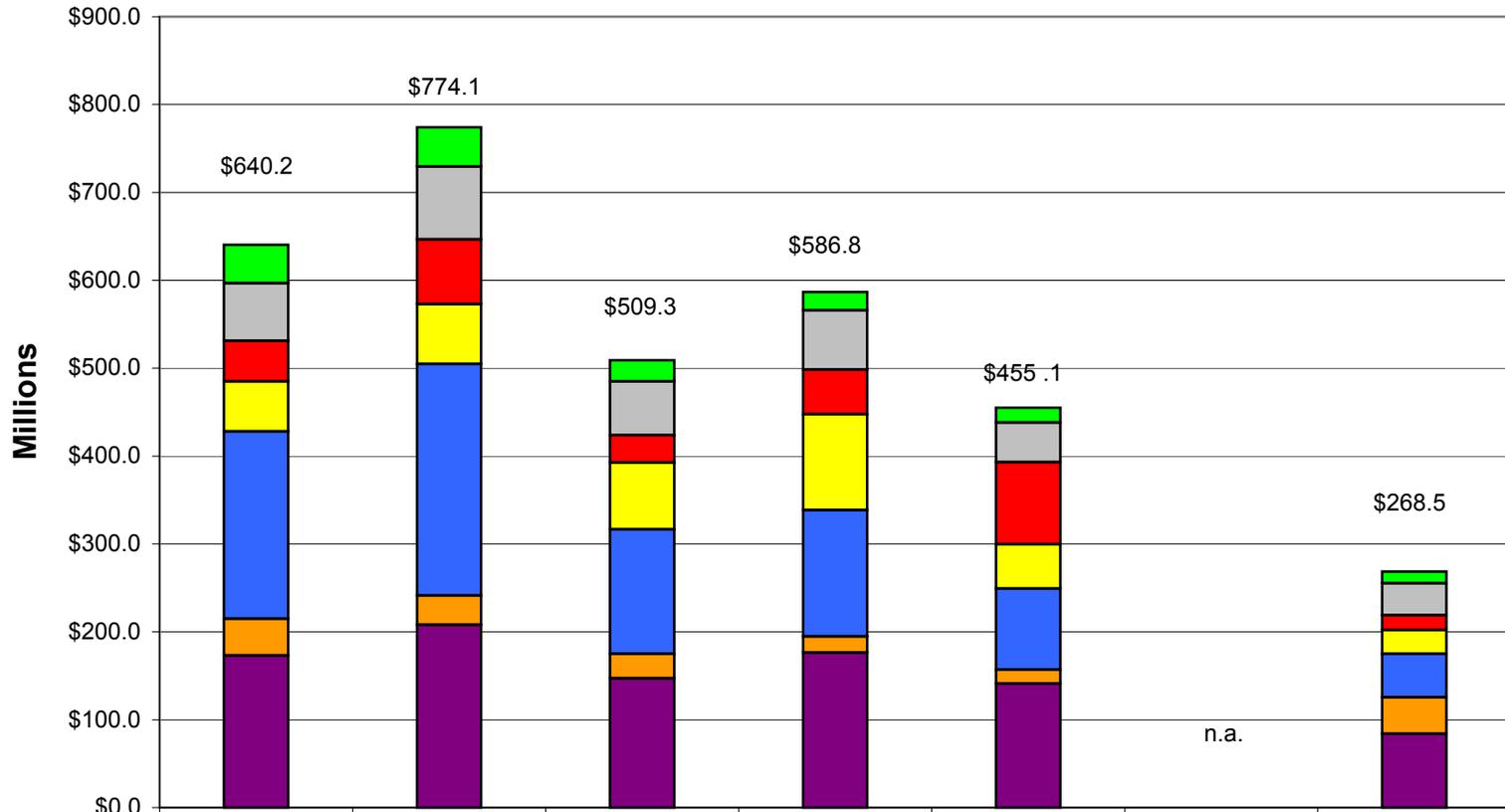
As before, value-added data provide additional insight into the machinery industry. Although the chart above makes no adjustment for inflation, it shows that the declining industry (NAICS 333) output was spread across four of the seven groups. Only in engines, turbines, and transmission equipment (3336) does output appear to be even somewhat greater in 2003 than in 1997 – and only after a drop in production during 2000 and 2001. Similarly, the output of commercial and service industry machinery (3333) fell in 1998 before recovering to its 1997 level in 2003. Output of agricultural, construction, and mining machinery (3331) fluctuated, but was little changed. (Group data from the 2002 Census of Manufactures are unavailable as this is written.)

Nationally, five of the seven industry groups showed declines, aggregating to a net industry decline during the same time. The notable differences from Ohio were the national decrease in commercial and service industry output and the apparent increase in output of VHAC and commercial refrigeration equipment (3334).

The net effect of these changes was that the concentration of commercial and service machinery manufacturing in Ohio increased while concentration of other industry group production here decreased, except for that of agricultural, construction, and mining machinery (3331), which showed a slight increase.

See Table A10

## Capital Expenditures by Group in Ohio, 1997-2003



	1997	1998	1999	2000	2001	2002	2003
■ 3331: Ag./Cnstrctn./Mng.	\$43.5	\$44.5	\$24.5	\$20.9	\$17.1	\$0.0	\$13.2
■ 3332: Indstrl.	\$65.6	\$83.0	\$61.2	\$67.5	\$45.0	\$0.0	\$36.6
■ 3333: CmcrL. & Srvc.	\$46.0	\$73.5	\$30.8	\$50.9	\$93.4	\$0.0	\$16.9
■ 3334: VHAC/CmcrL.Rfgrtn.	\$57.1	\$68.4	\$76.2	\$108.9	\$50.5	\$0.0	\$27.0
■ 3335: Mtlwrkng.	\$213.0	\$263.5	\$141.9	\$143.7	\$92.4	\$0.0	\$49.1
■ 3336: Engr./Trbn./Trnsmsn.	\$41.8	\$33.2	\$27.5	\$18.4	\$15.6	\$0.0	\$41.7
■ 3339: Othr.Gnrl.Prps.	\$173.2	\$208.0	\$147.2	\$176.4	\$141.2	\$0.0	\$83.9

Source: U.S. Census Bureau. Note: n.a. - not available.

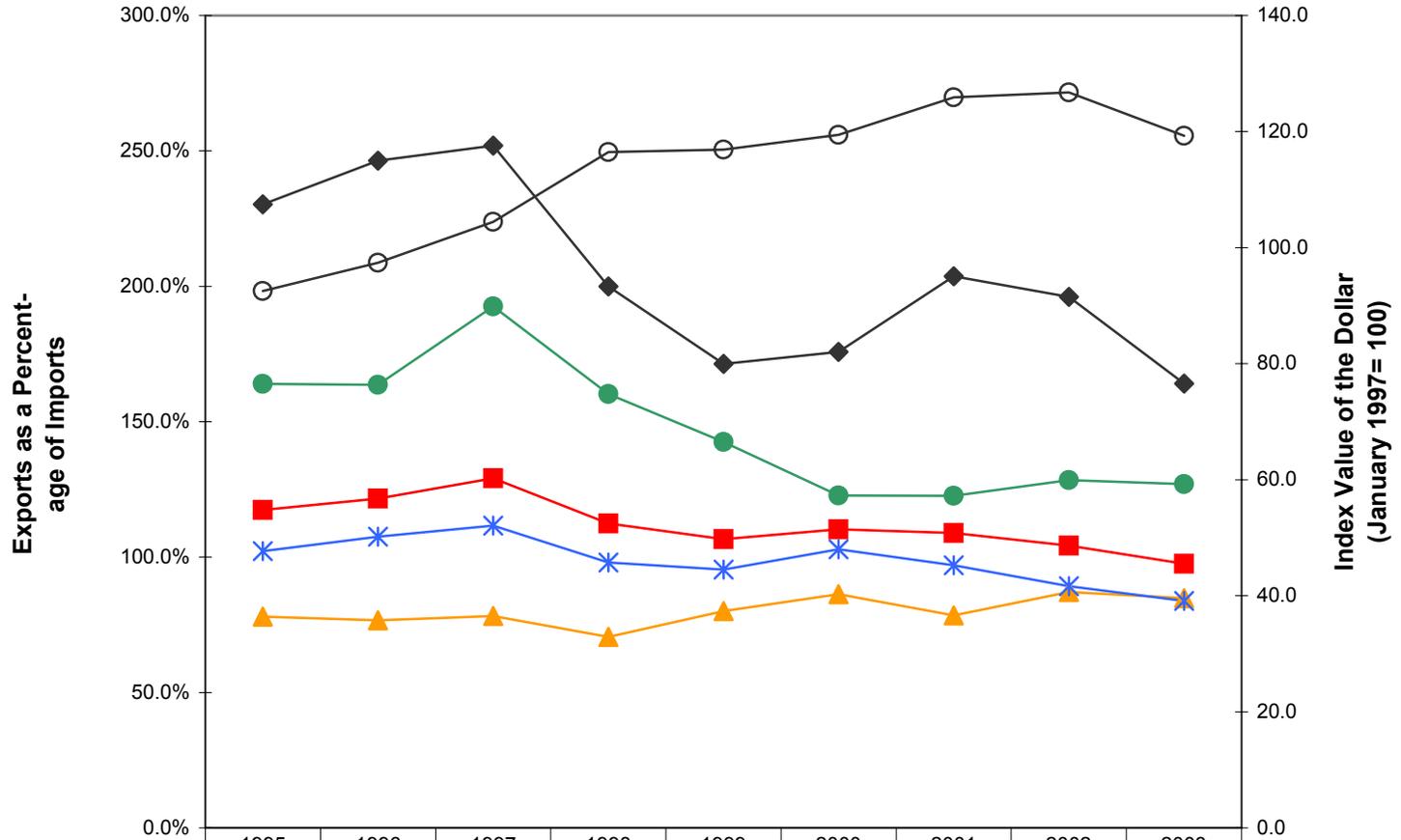
## CAPITAL EXPENDITURES BY GROUP

The chart above shows that capital expenditures in Ohio in the machinery industry fell from a peak of \$774.1 million (M) in 1998 to \$268.5M in 2003, although the decline was interrupted by an increase from \$509.3M in 1999 to \$586.8M in 2000. Expenditures were down in every group except for engine, turbine, and transmission equipment (NAICS 3336), which was little-changed from 1997. Even for this last group, capital expenditures fell from 1998 through 2001 before rebounding in 2003. (As with value-added, the chart above makes no adjustment for inflation, and data from the 2002 Census of Manufactures are unavailable as this is written.) Data in table A11 show that the group trends were usually more pronounced in Ohio than in the nation as a whole. The most notable exception was engine, turbine, and transmission equipment, which fell at the national level.

Capital expenditures in Ohio by industry companies generally have been less-than-proportional to the value-added originating in the state; the proportion of national capital expenditures going into Ohio averaged only 95 percent of the proportion of value-added originating here. The exceptions to this were activity in commercial and service (3333) and VHAC and commercial refrigeration equipment (3334).

See Tables A10 & A11

## U.S. Exports as a Percentage of Imports with the Index Value of the Dollar



	1995	1996	1997	1998	1999	2000	2001	2002	2003
Overall summary	117.4%	121.7%	129.1%	112.4%	106.6%	110.3%	108.9%	104.3%	97.5%
Oil drilling, mining, construction	230.3%	246.4%	252.0%	199.9%	171.3%	175.8%	203.7%	196.2%	164.1%
Industrial engines, pumps, compressors	163.9%	163.6%	192.6%	160.2%	142.5%	122.7%	122.6%	128.4%	126.9%
Machine tools & metalworking	78.0%	76.6%	78.2%	70.6%	80.0%	86.2%	78.4%	87.1%	84.8%
Other industrial, ag & service	102.2%	107.6%	111.6%	98.0%	95.4%	102.9%	97.0%	89.3%	83.8%
Dollar Value	92.52	97.40	104.44	116.48	116.87	119.44	125.91	126.75	119.28

Sources: Federal Reserve Board and the U.S. Bureau of Economic Analysis.

## IMPORTS AND EXPORTS OF MACHINERY

The chart above shows that aggregate exports of machinery exceeded imports from 1995 until 2003.<sup>7</sup> Even then, exports of some types of machinery – oil drilling, mining, construction, industrial engines, pumps, and compressors – still surpassed the corresponding imports. The notable exception has been machine tools and metalworking machinery; exports of such have trailed imports throughout this time. Imports and exports of other industrial, agricultural and service machinery have fluctuated, with imports exceeding exports in more recent years.

The general increase in the value of the dollar may explain part of this shift: the higher value of the dollar means goods made in America are more expensive for foreigners to buy, while foreign-made goods become less expensive for Americans to buy. Although there may be a time lag, this relationship appears to be stronger in the case of industrial engines, pumps and compressors, but less pronounced with oil drilling, mining, construction, and other industrial, agricultural and service machinery. The higher value of the dollars appears to have no effect on imports and exports of machine tools and metalworking machinery.

The recent drop in the value of the dollar, which averaged 113.79 in 2004 (Federal Reserve Board, 2005), may presage decreasing imports and increasing exports of machinery, reversing a number of the trends discussed above. However, other factors may work against this. Some writers are concerned about the effect of China's rapid industrialization on America's manufacturing base. They believe that the large volume of low cost imports from China – including machinery – are reducing America's manufacturing base, and manufacturers in Ohio are no exception. One of the factors they cite is the under-valuation of the yuan, which abets the already low cost of Chinese labor (Business Week, 2004; Rulan, 2005). The yuan is more or less pegged to the value of the dollar (about 8.28::1), and has changed little since 1995 (Federal Reserve Board, 1999-2005).<sup>8</sup>

See Table A12



## **OVERVIEW AND FORECASTS**

## AN OVERVIEW OF THE MACHINERY INDUSTRY<sup>9</sup>

Many machinery industry establishments sell their products to other establishments in specific industries and are, therefore, affected by what is happening in their client industries. Some of these linkages are obvious; each of the industries in the industrial machinery group (NAICS 3332) supplies a major industry or industry group. The names denote the industries with which they are linked: sawmill and woodworking, plastics and rubber, paper, textile, printing, food products, and semiconductor. Additional examples from other groups include commercial laundry equipment (333312) and rolling mill machinery (333516 – for primary metal production).

Other linkages are somewhat more broadly based. Farm machinery (333111) is sold to farmers and farm companies, but droughts and government policies also affect sales.<sup>10</sup> Manufacturers of turbines and turbine generator sets (333611) are linked to utilities, which are in turn subject to oil, gas and coal prices as well as being regulated institutions. Construction machinery (33312) is dependent on residential and non-residential construction and repair, the mining industry, and public works. Mining and oilfield machinery (33313) depends on mining, oil, and mineral prices and environmental and safety concerns. Pumps and compressors (33391) depends on water and sewer construction and the chemical, paper, pulp, petroleum, and food and beverage industries. Pumps and compressors are also incorporated into a variety of machines (Hingher, 2005).

What is noteworthy about the linkage between these industries and their clients is how it affects them. Some machinery industries have a narrow economic base. For example, if the oil and gas industry is depressed, then the oil- and gas-field machinery industry tends to be depressed. Consequently, such machinery industries can be highly cyclical.<sup>11</sup> On the other hand, some industries sell their goods to the public or a variety of industries. Examples include lawn and garden equipment (333112), office machinery (333313), photographic and photocopying equipment (333315), and power hand tools (333991). These industries tend to be less cyclical because they are broadly based. Indeed, Fiore (2005) notes that some makers of farm machinery have expanded operations to include related types of industrial, construction, lawn and garden machinery and equipment to reduce the impact of volatile agricultural prices.

The direct and indirect markets for machinery are so diverse that any overall analysis of the industry would merely be an aggregation of analyses for the individual industries and industry groups. Furthermore, the importance of assessments and forecasts for industries and industry groups has more or less importance for Ohio, depending on the concentration of the industries here and even which companies are located here.

Space limitations preclude an industry-by-industry analysis of machinery manufacturing. However, analysts of different industries repeatedly mention several interrelated trends. They include globalization, the increasing importance of foreign

trade, consolidation, diversification of product lines, providing greater value for customers, faster rates of innovation, and the use of the Internet for conducting business. Hingher (2005) states that the machinery industry has been global for some time. Many companies no longer think of serving only their home country customers because opportunities for higher rates of growth are more likely to be found in the developing or newly industrialized areas of the world – most notably China, but also Latin America, the Middle East, Eastern Europe. Statistics show that exports are a growing portion of revenues for many industries. This undoubtedly reflects the impact of the North American Free Trade Agreement (NAFTA), and the general lowering of trade barriers. However, freer trade is a two-way street, and the reduced trade barriers have resulted in increased imports and meant serious competition for U.S.-based manufacturers.

In light of this, American machinery companies have taken a number of actions to remain competitive. Some have established operations in foreign countries (whether following their customers or circumventing trade barriers), formed joint ventures with local companies, or purchased competitors. (Fiore (2005) notes that these strategies date to the 1980s.) An international presence also creates an organization where customers can obtain different products for their various locations and do so under the same procurement strategy and budget. Furthermore, emerging markets often are low cost areas in which to do business (Hingher, 2005).

Mergers, acquisitions, joint ventures and alliances can have other advantages regardless of whether they cross national boundaries: broadening customer bases, diversifying product lines for less vulnerability to industry cycles, obtaining greater market penetration, achieving greater economies of scale, reducing costs by integrating operations, and providing more resources for research and development (R & D). However, bigger has not always been better. Some companies did not realize an increase in revenues commensurate with the greater size or costs. Under such circumstances, companies will spin-off or sell divisions not fitting with their strategies and drop products not part of their core competencies (Hingher, 2005).

R & D activities have not only led to longer-lasting, more productive machinery, they have advanced automation by incorporating human experience, rules and decision-making into machines via sensors and programmable logic controllers.<sup>12</sup> Implementation of new technologies may disrupt production for a short period of time as training and maintenance issues are resolved, but it may be more valuable over longer terms. Providing greater value for customers means more than a low price. Speed, reliability, and easy and quick routine maintenance make for greater productivity and more than compensate for a higher initial price (Hingher, 2005).

Use of the Internet facilitates the conduct of business. Communications and transactions may be speeded-up, expenses may be reduced for customers and suppliers, and comparisons of products and prices are made easier (also Fiore, 2005).

## THE SHORT- AND LONG-TERM FORECASTS

The short-term outlook for at least some machinery makers is more or less good, continuing the expansions recorded in 2003 and 2004. Strong sales of farm machinery and equipment are expected in 2005 due to higher farm income. Non-residential construction probably will do well, particularly with the passage of the highway bill, but residential construction may show only marginal improvement (Fiore, 2005). Industrial machinery manufacturers also are expected to do well in 2005; the pace of growth may be slower but more sustainable than in 2003 and 2004. Capacity utilization rates have improved, but are not sufficiently high to justify adding capacity. Consequently, orders for new industrial machinery may lean more towards the replacement of old machinery than the more fundamental change of further automation (Hingher, 2005).<sup>13</sup> Recent high prices for oil and natural gas may lead to some increased expenditures for oil field and gas equipment, but the money may go more for up-grades and refurbishment than for new machinery (Glickman, 2005).

Analysts disagree in their long-term forecast for the machinery industry. On one hand, the writers of Business Week (2004) foresee American manufacturing – including machinery – eroded by low-priced Chinese imports. They conclude that only a multi-pronged, concerted effort will eventually stop it. Fiore (2005) argues that significant grain reserves will persist due to production subsidy programs. These programs prop up farm income and sales of farm equipment in the short-term, but the long-term effect is excess crop production that suppresses prices and, therefore, income, which, in turn, suppresses machinery and equipment sales. Farm equipment and machinery makers also face tough competition in a mature market. Fiore (2005) expects construction equipment makers to keep pace with overall economic growth. He also thinks they may focus more on repair in the future now that the interstate highway system is complete and there is little demand for new dams.

On the other hand, Berman (2004) forecasts a rate of growth in output from machinery manufacturers that is *greater* than for the economy as a whole: 4.0 vs. 3.3 percent per year, respectively, from 2002 to 2012. This is a turn-around from the preceding decade – 1992-2002 – during which the average annual growth rate in output from machinery manufacturers was less than for the economy as a whole: 2.1 vs. 3.3 percent. Berman (2004) expects the higher growth to be led by other general-purpose (NAICS 3339, 5.2 percent), metalworking (3335, 4.9 percent), and industrial (3332, 4.4 percent) machinery. Output from commercial and service industry (3333) and agricultural, construction and mining machinery makers is expected to be above average: 3.6 and 3.5 percent, respectively. (The latter may include the effect of the long-term rise in oil and gas prices forecast by Glickman (2005).) Output growth rates for VHAC, commercial refrigeration, engines, turbines and power transmission are forecast to be positive but slower than average. If these forecasts are accurate, then they are good news for Ohio's machinery industry given the concentration of other general-purpose, metalworking, and industrial machinery manufacturing in the state.

However, cheery outlooks for long-term economic growth do not necessarily mean increased jobs. In contrast with the higher-than-average economic growth rates mentioned above, Berman (2004) predicts that national machinery industry employment will grow at a slower-than-average pace. He expects only the employment growth rate in other general-purpose machinery to exceed the national average (although the rate for metalworking machinery will come close). Employment gains at a slower pace are also predicted in agricultural, construction, mining, commercial, service, VHAC, and commercial refrigeration machinery. He forecasts no change for the engine, turbine, and transmission group, and a net loss of jobs in the industrial machinery group. Forecasts from the Ohio Dept. of Job and Family Services' Bureau of Labor Market Information (ODFJS/BLMI, 2004) for Ohio can be described simply: the employment gains in VHAC, commercial refrigeration, metalworking, and other general purpose machinery are predicted to be greater than the job losses in agricultural, construction, mining, engine, turbine, transmission, industrial, commercial and service industry machinery and equipment. The employment growth rate forecast for machinery manufacturing in Ohio is positive, but slower than the overall rate for the state.

See Table A13
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## **APPENDICES**

## DETAILED TABLES

**TABLE A1: EXPANSIONS AND ATTRACTIONS IN OHIO'S MACHINERY INDUSTRY, 2002-2004**

Year	Parent/Company/Division	County	NAICS Code	Product	New or Expansion	Amount Invested	Anticipated New Jobs	Space (Sq.Ft.)
2002	Accuform Manufacturing	Mahoning	333513	Tools for castings	Expansion	\$1,110,000	5	
2002	Allied Machine & Engineering	Tuscarawas	333515	Drills	Expansion	\$2,500,000		
2002	Alpha Welding & Fabricating	Lawrence	333298	Cullet processing systems	New	\$1,500,000		21,000
2002	Apache Technologies	Montgomery	333314	Laser alignment devices	Expansion	\$1,500,000	27	
2002	Automated Packaging Systems	Portage	333993	Packaging machinery	Expansion	\$4,027,000		
2002	Cleveland Tool & Machine	Cuyahoga	333414	Air-conditioning machinery	Expansion	\$1,200,000	8	
2002	Crown Equipment Corp.	Auglaize	333924	Lift trucks	Expansion	\$2,000,000		
2002	DaimlerChrysler AG/Detroit Diesel Remanufacturing	Guernsey	333618	Diesel engines	Expansion		50	
2002	David Round	Cuyahoga	333923	Industrial cranes	New	\$2,000,000	9	36,000
2002	Enerco Group, Inc.	Cuyahoga	333414	Heating equipment	Expansion	\$3,050,000	30	120,000
2002	Enerfab, Inc.	Hamilton	333294	Steel tank parts	Expansion	\$3,000,000	70	
2002	First Solar LLC	Wood	333414	Heating equipment	Expansion	\$19,000,000		
2002	Gradall Industries	Tuscarawas	33312	Excavators	Expansion	\$5,000,000		
2002	Hawkline	Brown	333111	Farm implements	New	\$1,700,000	65	85,000
2002	Hunter Manufacturing	Cuyahoga	333994	Vehicle heating systems	Expansion	\$2,468,000	57	25,000
2002	Hydraulic Technologies	Crawford	333995	Hydraulic cylinders	Expansion	\$1,700,000	71	
2002	IMI Norgren PLC/IMI Norgren, Inc.	Montgomery	333995	Cylinders	Expansion	\$2,700,000	25	
2002	Industrial Waste Control	Mahoning	333999	Power cleaning equipment	New	\$3,650,000	45	41,000
2002	Isuzu Motors Ltd./DMAX Ltd.	Montgomery	333618	Diesel engines	Expansion	\$87,000,000	185	
2002	Kadant Black Clawson	Warren	333291	Paper making machinery	New	\$3,500,000	50	24,000
2002	Lakin General Corp.	Auglaize	333111	Agricultural equipment parts	New	\$3,750,000	65	
2002	Mettler-Toledo, Inc.	Franklin	333997	Scales	New	\$11,600,000		130,000
2002	Midwest Filtration	Butler	333999	Filters	New		30	96,000
2002	Milacron	Clermont	33322	Plastic making machinery	New	\$14,400,000	75	
2002	Morgan Engineering Systems	Stark	333923	Cranes	New	\$3,300,000	65	
2002	NAPCO, Inc.	Darke	333923	Hoists	New	\$2,600,000	50	80,000
2002	National Machinery LLC	Seneca	333513	Cold-forming machinery	New		250	
2002	Norse Dairy Systems	Franklin	333294	Food processing machinery	Expansion	\$1,152,000		27,900
2002	Peerless Machinery	Shelby	333294	Food products machinery	Expansion	\$3,066,000	111	60,000
2002	RRR Development Co.	Stark	33322	Tire building machines	New	\$4,800,000	25	55,000
2002	Select-Arc	Shelby	333999	Welding electrodes	Expansion	\$1,800,000	16	
2002	Stanley Works/Stanley Air Tools	Cuyahoga	333991	Air tools	Expansion	\$3,000,000		50,000
2002	TSS Technologies, Inc.	Hamilton	333298	Machine assembly	Expansion	\$5,530,000	53	
2002	Versa LLC	Madison	333922	Material handling machinery	New	\$2,100,000	64	208,000
2002	VMAXX	Auglaize	333515	Adapters for cutting tools	New	\$3,000,000	10	25,000
2002 Subtotals						\$208,703,000	1,511	1,083,900

**TABLE A1: EXPANSIONS AND ATTRACTIONS IN OHIO'S MACHINERY INDUSTRY, 2002-2004**

Year	Parent/Company/Division	County	NAICS Code	Product	New or Expansion	Amount Invested	Anticipated New Jobs	Space (Sq.Ft.)
2003	Brilex Industries	Mahoning	333518	Custom machinery	Expansion	\$1,484,000	10	
2003	Butech	Columbiana	333518	Cutting machinery	Expansion	\$1,047,000	10	
2003	CECO Environmental Corp./Kirk & Blum Manufacturing	Clermont	333412	Air pollution controls	New	\$6,200,000	40	125,000
2003	CHC Industries	Medina	333518	Wire machinery	Expansion	\$1,250,000	36	
2003	Cold Jet, Inc.	Clermont	333298	Cleaning machines	Expansion		70	
2003	Dayton Progress Corp.	Montgomery	333514	Metal dies	Expansion	\$4,600,000		
2003	Efficient Molding & Die	Cuyahoga	333511	Industrial molds	New	\$2,700,000		130,000
2003	Emerson Electric Co./Copeland Corp.	Shelby	333919	Compressors	Expansion	\$12,500,000		
2003	Ferriot, Inc.	Summit	333511	Molds	Expansion	\$9,100,000	50	
2003	Great Lakes Power Lift	Lake	33312	Power equipment	New		25	110,000
2003	International Paper	Clermont	333993	Paper product development	Expansion	\$3,000,000	70	
2003	Kaneta Kogyo Co. Ltd./Bucyrus Precision Tech	Crawford	333613	Power transmission	Expansion	\$7,500,000	16	72,000
2003	Kennametal, Inc.	Ashtabula	333515	Cutting tools	Expansion	\$1,650,000		
2003	Neundorfer, Inc.	Lake	333411	Air cleaning systems	Expansion	\$3,000,000	10	
2003	OKI Systems	Franklin	333924	Industrial equipment	New	\$1,500,000		41,000
2003	Opticast, Inc.	Hancock	333319	Eyeglass machinery	Expansion		50	
2003	Ransohoff, Inc.	Butler	333319	Cleaning equipment	Expansion	\$10,000,000	10	
2003	Rockstedt Tool and Die	Medina	333298	Tool & die maker	Expansion	\$6,500,000	25	
2003	Siemens AG/Van Dorn Demag	Cuyahoga	33322	Plastic making machinery	Expansion	\$5,700,000		
2003	Taylor's Industrial Services	Morrow	333322	Plastic industry machinery	Expansion	\$1,550,000	30	
2003	Topaz Tool & Die	Greene	333514	Dies	New	\$1,265,000	5	
2003 Subtotals						\$80,546,000	457	478,000
2004	Applied Vision Co.	Summit	333314	Machine vision systems	New	\$1,800,000	35	32,000
2004	Atlantic Tool & Die	Cuyahoga	333514	Tool & die shop	Expansion	\$12,000,000		100,000
2004	BeamAlloy Technologies	Franklin	333319	Coatings equipment	Expansion	\$1,159,000	2	
2004	Burmah Castrol PLC/Foseco Metallurgical	Cuyahoga	333511	Foundry supplies	Expansion	\$5,600,000	42	
2004	Cascade Kenhan, Inc.	Hancock	333924	Forklifts	Expansion	\$2,549,000	30	
2004	Cenmac Metal Works	Marion	333999	Machine shop	New	\$1,000,000	2	25,600
2004	Combi Packaging	Stark	333993	Packaging equipment	Expansion	\$445,000	30	31,200
2004	Crown Equipment Corp.	Mercer	333924	Forklifts	Expansion	\$1,335,000	8	
2004	DaimlerChrysler AG/Detroit Diesel Remanufacturing	Guernsey	333618	Diesel engines	Expansion	\$12,600,000	55	126,400
2004	Emerson Electric Co./Copeland Corp.	Shelby	333912	Air-conditioning compressors	Expansion	\$700,000		20,000
2004	Energy Storage Technologies	Montgomery	333415	Temperature control products	Expansion	\$1,300,000	30	
2004	Fecon, Inc.	Warren	33312	Construction machinery	New	\$2,200,000		56,000
2004	First Solar LLC	Wood	333414	Solar modules	Expansion	\$5,000,000	20	
2004	Goodyear Tire & Rubber Co.	Union	333922	Conveyor belts	Expansion	\$1,270,000	20	
2004	Herschel Products	Summit	333511	Machinery	New	\$2,000,000		

**TABLE A1: EXPANSIONS AND ATTRACTIONS IN OHIO'S MACHINERY INDUSTRY, 2002-2004**

Year	Parent/Company/Division	County	NAICS Code	Product	New or Expansion	Amount Invested	Anticipated New Jobs	Space (Sq.Ft.)
2004	Induction Tooling	Medina	333315	Heating equipment	Expansion	\$1,950,000	7	12,000
2004	Industry Products	Miami	333514	Tool & die shop	Expansion	\$500,000		25,500
2004	Kennametal, Inc.	Ashtabula	333515	Cutting tools	Expansion	\$6,000,000		
2004	Liebert North America	Delaware	333415	Power supply products	Expansion	\$15,800,000	113	
2004	Markley Enterprises/Diecraft	Hamilton	333514	Tool & die shop	Expansion	\$1,665,000	9	
2004	Melink Corp.	Clermont	333319	Ventilation systems	New	\$2,500,000	15	
2004	MTD Products, Inc./MTD Consumer Group	Huron	333112	Outdoor power equipment	Expansion	\$1,400,000	80	
2004	Myco Plastic Corp.	Trumbull	33322	Custom molds	Expansion	\$2,500,000	50	90,000
2004	Nelson Stud Welding	Lorain	333992	Welding equipment	Expansion	\$2,540,000	4	
2004	Nilpeter USA	Hamilton	333293	Printing equipment	Expansion	\$1,500,000	25	21,400
2004	Parker Hannifin Corp.	Cuyahoga	3334111	Hydraulic equipment	Expansion	\$2,868,000		
2004	Saint-Gobain/Saint-Gobain Calmar, Inc.	Fayette	333911	Non-aerosol pumps	Expansion	\$6,760,000	12	
2004	SGS Tool Co.	Summit	333512	Machine tools	Expansion	\$6,000,000		
2004	Stewart Filmscreen	Clermont	333315	Film screens	Expansion	\$1,541,000		22,000
2004	Tokai Rubber Industries Ltd./DRT Manufacturing Co.	Montgomery	333298	Machine tools	Expansion	\$6,000,000		
2004	Trentec, Inc.	Hamilton	333999	Machinery	Expansion	\$1,000,000	5	5,000
2004	TSS Technologies, Inc.	Hamilton	333298	Machining	Expansion	\$3,300,000	100	
2004	Ultra-Met Co.	Champaign	333512	Machine tools	Expansion	\$1,300,000	4	
2004	Ver-Mac Industries	Knox	333999	Air filtration systems	Expansion	\$1,200,000		40,650
2004	Waltco Truck Equipment	Summit	333924	Tailgate lifts	Expansion	\$1,052,000	55	
2004	Wellman Products	Cuyahoga	333613	Friction materials	New	\$1,700,000	8	21,000
2004 Subtotals						\$120,034,000	761	628,750
Grand totals 2002-2004						\$409,283,000	2,729	2,190,650

Source: Office of Strategic Research (2005a).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (JK, DL, 3/05).



**TABLE A2a: VALUE-ADDED IN THE MACHINERY INDUSTRY BY GROUP, 2003 (in millions)**

Area	Industry Group*							
	333	3331	3332	3333	3334	3335	3336	3339
U.S.	\$125,782.1	\$20,821.3	\$15,060.2	\$11,490.9	\$16,548.4	\$15,392.9	\$17,175.8	\$29,292.6
Alabama	\$728.2	\$131.9	\$0.0	\$87.3	\$151.7	\$108.1	D	\$268.3
Alaska	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Arizona	\$815.5	\$108.3	\$251.5	\$0.0	\$163.7	\$107.4	\$0.0	\$0.0
Arkansas	\$1,514.5	\$288.0	\$0.0	\$0.0	\$642.6	\$111.4	\$0.0	\$277.7
California	\$9,015.4	\$330.8	\$2,518.2	\$1,886.1	\$760.2	\$907.0	\$798.8	\$1,814.2
Colorado	\$966.1	\$0.0	\$135.2	\$256.0	\$203.2	\$0.0	\$0.0	\$220.5
Connecticut	\$2,188.1	\$0.0	\$636.9	\$404.2	\$0.0	\$314.5	\$303.0	\$414.5
Delaware	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
District of Columbia	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Florida	\$2,242.5	\$89.1	\$185.5	\$1,010.5	\$165.1	\$192.6	\$0.0	\$530.1
Georgia	\$2,787.9	\$647.7	\$401.1	\$132.0	\$765.1	\$76.0	\$260.2	\$505.8
Hawaii	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Idaho	\$242.2	\$87.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Illinois	\$10,440.6	\$3,166.2	\$964.4	\$799.7	\$839.1	\$1,140.1	\$1,425.8	\$2,105.3
Indiana	\$3,947.7	\$258.7	\$255.0	\$234.3	\$921.5	\$588.3	\$820.9	\$869.1
Iowa	\$4,975.5	\$3,379.3	\$162.4	\$199.0	\$440.4	\$141.9	\$120.6	\$531.8
Kansas	\$1,933.7	\$823.8	\$154.9	\$0.0	\$393.8	\$0.0	\$0.0	\$370.3
Kentucky	\$1,553.9	\$127.6	\$0.0	\$0.0	\$459.2	\$271.9	\$158.5	\$408.0
Louisiana	\$753.6	\$312.9	\$0.0	\$120.9	\$112.6	\$0.0	\$0.0	\$102.0
Maine	\$249.5	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$84.1
Maryland	\$991.3	\$0.0	\$0.0	\$0.0	\$180.1	\$0.0	D	\$359.5
Massachusetts	\$2,722.9	\$0.0	\$1,030.0	\$360.8	\$165.0	\$330.2	\$130.5	\$651.0
Michigan	\$8,870.5	\$247.5	\$740.7	\$219.5	\$339.6	\$3,926.1	\$1,199.0	\$2,198.1
Minnesota	\$3,684.6	\$614.4	\$309.2	\$751.2	\$312.2	\$420.5	\$99.3	\$1,177.8
Mississippi	\$1,132.4	\$235.9	\$0.0	\$0.0	\$218.2	\$0.0	\$170.4	\$288.7
Missouri	\$2,751.1	\$129.7	\$255.6	\$207.5	\$726.2	\$301.1	\$182.8	\$948.3
Montana	\$143.9	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Nebraska	\$914.1	\$581.5	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$126.6

**TABLE A2a: VALUE-ADDED IN THE MACHINERY INDUSTRY BY GROUP, 2003 (in millions)**

Area	Industry Group*							
	333	3331	3332	3333	3334	3335	3336	3339
Nevada	\$340.6	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$186.8
New Hampshire	\$862.1	\$0.0	\$176.1	\$187.6	\$0.0	\$0.0	\$0.0	\$329.8
New Jersey	\$2,139.7	\$0.0	\$343.8	\$330.5	\$329.8	\$282.3	\$0.0	\$738.8
New Mexico	\$113.5	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
New York	\$4,905.3	\$124.4	\$762.4	\$327.6	\$694.8	\$562.1	\$764.0	\$1,670.1
North Carolina	\$4,022.9	\$807.7	\$431.1	\$320.0	\$480.6	\$262.3	\$412.8	\$1,308.4
North Dakota	\$667.5	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Ohio	\$7,856.5	\$576.0	\$835.6	\$740.6	\$799.5	\$1,758.8	\$592.4	\$2,553.6
Oklahoma	\$2,278.0	\$570.0	\$207.6	\$0.0	\$297.3	\$0.0	D	\$730.1
Oregon	\$939.2	\$134.1	\$241.2	\$124.9	\$0.0	\$77.6	\$0.0	\$282.9
Pennsylvania	\$4,927.8	\$706.3	\$734.6	\$308.6	\$567.2	\$901.7	\$172.4	\$1,537.0
Rhode Island	\$349.1	\$0.0	\$0.0	\$0.0	\$0.0	\$79.7	\$0.0	\$186.9
South Carolina	\$8,401.3	\$151.5	\$186.0	\$128.6	\$284.7	\$171.5	\$7,062.3	\$416.7
South Dakota	\$396.6	\$146.8	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$115.4
Tennessee	\$4,227.7	\$878.0	\$116.9	\$288.9	\$1,539.0	\$318.0	\$309.2	\$777.6
Texas	\$7,305.2	\$2,062.1	\$833.3	\$310.6	\$1,877.4	\$259.2	\$317.8	\$1,644.7
Utah	\$456.6	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$202.1
Vermont	\$271.4	\$0.0	\$0.0	\$0.0	\$0.0	\$112.1	\$0.0	\$0.0
Virginia	\$1,744.5	\$353.1	\$153.0	\$91.0	\$546.0	\$131.8	\$0.0	\$374.5
Washington	\$1,365.2	\$0.0	\$265.7	\$108.9	\$140.3	\$302.7	\$0.0	\$449.4
West Virginia	\$196.1	\$74.3	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Wisconsin	\$6,307.3	\$1,686.5	\$868.8	\$329.5	\$515.4	\$783.2	\$733.6	\$1,390.1
Wyoming	\$74.0	D	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0

Notes: D - Suppressed - usually to maintain confidentiality; \$0.0. - may only indicate that the state and industry combination was too small to be covered by the survey. \* - Group figures may not sum to the total because of unresolved classification questions.

Source: U.S. Bureau of the Census (2005a).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 6/05).

**Table A2b: Value-Added for Selected Machinery Industries in Ohio and the U.S., 2002**

NAICS Code	Industry Title	Value-added (\$1,000,000s)		Ohio as Percent- age of U.S.	Ohio's Apparent <sup>^</sup> Rank	Top 5 States
		Ohio	U.S.			
333111	Farm mchnry. & eqpt.	\$86.4	\$6,968.2	1.2%	11	IA, IL, NE, MN, KS
333112	Lawn & garden eqpt.	\$181.6	\$2,420.4	7.5%	2	TN, <b>OH</b> , PA, IL, IN
33312	Construction eqpt.	\$233.5	\$7,639.1	3.1%	8	IL, WI, NC, PA, KS
333131	Mining mchnry. & eqpt.	\$74.9	\$883.7	8.5%	3	PA, WV, <b>OH</b> , TX, UT
33321	Sawmill & Woodworking mchnry.	\$24.5	\$567.9	4.3%	8	OR, NC, MN, MS, IN
33322	Plastic & rubber working mchnry.	\$201.9	\$1,551.8	13.0%	2	MI, <b>OH</b> , PA, IL, MA
333291	Paper industry mchnry.	\$38.5	\$1,032.4	3.7%	6	WI, PA, MA, NJ, NY
333292	Textile mchnry.	\$20.3	\$568.3	3.6%	6	SC, NC, GA, PA, NY
333293	Printing mchnry. & eqpt.	\$65.6	\$1,559.6	4.2%	7	NY, IL, PA, CA, MA
333294	Food products mchnry.	\$208.8	\$1,697.2	12.3%	1	<b>OH</b> , IL, WI, CA, IA
333298	All other industrial mchnry.	\$236.4	\$4,039.5	5.9%	6	IL, CA, NY, TX, MI
333315	Photographic & photocopying eqpt.	\$35.3	\$1,091.2	3.2%	6	CA, MA, MN, NY, NJ
333319	Other commercial & service mchnry.	\$348.1	\$6,322.8	5.5%	5	FL, CA, IL, MN, <b>OH</b>
333411	Air purification eqpt.	\$41.6	\$1,225.5	3.4%	8	TX, IL, WI, NC, CA
333412	Industrial & commercial fans & blowers	\$129.5	\$1,032.9	12.5%	1	<b>OH</b> , MO, IL, WI, NC
333414	Heating eqpt., exc. warm air furnaces	\$87.4	\$2,247.9	3.9%	9	IN, CA, PA, MN, NY
333415	AC, warm air furnaces, & refrigeration eqpt.	\$504.1	\$12,020.9	4.2%	9	TX, TN, AR, IA, MO
333511	Industrial molds	\$409.7	\$3,836.1	10.7%	2	MI, <b>OH</b> , IL, PA, CA
333512	Machine tools, metal cutting type	\$80.3	\$1,431.9	5.6%	7	MI, CA, NY, IL, WI
333513	Machine tools, metal forming types	\$129.7	\$637.8	20.3%	1	<b>OH</b> , MI, IL, PA, NY
333514	Special dies, tools, jigs & fixtures	\$562.7	\$4,846.0	11.6%	2	MI, <b>OH</b> , IL, WI, PA
333515	Machine tool accessories	\$307.5	\$3,333.0	9.2%	2	MI, <b>OH</b> , IL, CA, PA
333516	Rolling mill mchnry.	\$64.3	\$245.1	26.2%	1	<b>OH</b> , PA*
333518	Other metalworking mchnry.	\$123.9	\$1,621.0	7.6%	3	MI, IL, <b>OH</b> , NY, PA
333613	Mechanical power transmission eqpt.	\$163.2	\$1,639.7	10.0%	2	WI, <b>OH</b> , MI, PA, TX
333911	Pumps & pumping eqpt.	\$288.8	\$3,624.9	8.0%	3	OK, CA, <b>OH</b> , TX, WI

**Table A2b: Value-Added for Selected Machinery Industries in Ohio and the U.S., 2002**

NAICS Code	Industry Title	Value-added (\$1,000,000s)		Ohio as Percent- age of U.S.	Ohio's Apparent <sup>^</sup> Rank	Top 5 States
		Ohio	U.S.			
333922	Conveyors & conveying eqpt.	\$267.2	\$3,080.3	8.7%	2	MI, <b>OH</b> , CA, IL, WI
333924	Industrial trucks, tractors, trailers, stackers	\$174.3	\$1,710.7	10.2%	2	TX, <b>OH</b> , MO, IN, NC
333992	Welding & soldering eqpt.	\$710.9	\$2,010.5	35.4%	1	<b>OH</b> , MI, WI, NH, TX
333993	Packaging mchnry.	\$204.8	\$2,341.0	8.7%	3	IL, CA <b>OH</b> , WI, GA
333995	Fluid power cylinders & actuators	\$132.2	\$1,846.4	7.2%	3	NY, CA, <b>OH</b> , MI, WI
333996	Fluid power pumps & motors	\$109.6	\$1,288.8	8.5%	2	IL, <b>OH</b> , KS, CA, MI
333999	Misc. general purpose mchnry.	\$243.9	\$5,502.0	4.4%	8	MI, MO, PA, CA, MN

Notes: ^ - Data for one or more states may have been suppressed, and, if available, could change the rank;

\* - No additional states were ranked. Abbreviations used: AC - airconditioning; Eqpt. - equipment; Exc. - except; H - heating; Mchnry. - machinery; Mfg. - manufacturing; Misc. - miscellaneous; V - ventilation.

Source: U.S. Bureau of the Census (2005c).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 3/05).

**Table A2c: Value of Shipments for Selected Machinery Product Classes in Ohio and the U.S., 2002**

NAICS Code	Product Class Title	Value of Shipments (\$1,000,000s)		Ohio as Percent- age of U.S.	Ohio's Apparent <sup>A</sup> Rank	Top 5 States
		Ohio	U.S.			
333111C	Parts for farm mchnry., sold separately	\$2.9	\$1,353.9	0.2%	13	IA, IL, WI, NE, KS
333111G	All other farm mchnry. & eqpt., exc. parts, including attachments	\$30.8	\$1,802.7	1.7%	11	NE, IN, IA, CA, WI
3331201	Power cranes, excavation loaders, dozers, etc.	\$173.6	\$11,913.8	1.5%	9	IL, NC, WI, KS, OK
3331208	Other construction mchnry. & eqpt., exc. parts	\$110.0	\$1,879.4	5.9%	4	WI, MI, PA, <b>OH</b> , TX
3331209	Parts for construction mchnry. & eqpt., sold separately	\$115.8	\$2,263.4	5.1%	4	IL, WI, PA, <b>OH</b> , OK
3331319	Parts & attachments, mining machinery & eqpt., sold separately	\$61.2	\$619.8	9.9%	1	<b>OH</b> , TX, PA, WV, MI
3332103	Woodworking mchnry., including parts, attachments & accessories	\$21.1	\$711.6	3.0%	9	MN, OR, MS, IN, CA
3332201	Plastics-working mchnry. & eqpt., exc. patterns & molds	\$409.0	\$2,382.7	17.2%	1	<b>OH</b> , MI, PA, IL, MA
3332203	Rubber-working mchnry. & eqpt., exc. tire molds	\$100.7	\$210.0	47.9%	1	<b>OH</b> , CA, NC, IN, PA
3332911	Paper industry mchnry.	\$47.8	\$939.8	5.1%	3	WI, MA, <b>OH</b> , PA, NY
3332913	Parts & attachments for paper industry mchnry., sold separately	\$22.3	\$538.6	4.1%	4	WI, PA, LA, <b>OH</b> , GA
3332923	Parts & attachments for textile mchnry.	\$6.8	\$285.1	2.4%	6	SC, NC, GA, PA, NY
3332933	Printing presses, other than lithographic	\$50.3	\$334.1	15.1%	2	NJ, <b>OH</b> , PA, IL, MI
3332939	All other misc. printing trades mchnry.	\$29.6	\$1,428.5	2.1%	9	NY, CA, IL, MA, NJ
3332943	Commercial food products mchnry.	\$110.5	\$994.8	11.1%	2	IL, <b>OH</b> , GA, CA, WA
3332945	Mchnry. & eqpt. for processing foods, beverages & animal feed	\$131.7	\$990.3	13.3%	1	<b>OH</b> , WI, CA, IA, KS
3332981	Chemical mfg. mchnry. & eqpt. & parts	\$50.6	\$1,249.1	4.1%	7	TX, NY, IL, NC, PA
3332983	Foundry mchnry. & eqpt., exc. patterns & molds	\$50.5	\$403.4	12.5%	3	MI, NY, <b>OH</b> , IL, WI
3332987	All other misc. special industry mchnry. & eqpt.	\$320.7	\$3,443.5	9.3%	4	MI, CA, IL, <b>OH</b> , CT
3333191	Commercial cooking & food-warming eqpt.	\$245.1	\$2,115.1	11.6%	3	IL, CA, <b>OH</b> , WI, TN
3333193	Commercial & industrial vacuum cleaners, including parts & attachments	\$38.3	\$470.1	8.1%	4	MI, CA, MN, <b>OH</b> , NY
3333195	Automotive maintenance eqpt., exc. handtools	\$34.8	\$632.4	5.5%	2	MI, <b>OH</b> , TX, IL, PA
333319A	Misc. mchnry. products, exc. electrical	\$222.2	\$5,419.9	4.1%	9	CA, MN, IL, WI, MI
3334111	Dust collection & air purification eqpt., industrial gas cleaning systems	\$24.7	\$721.7	3.4%	4	WI, TX, IL, <b>OH</b> , NC
3334113	Dust collection & air purification eqpt., cleaning incoming air	\$53.2	\$1,375.5	3.9%	6	NC, TX, IL, CA, KY
3334147	Floor & wall furnaces, unit & infrared heaters & mechanical stokers	\$47.3	\$441.9	10.7%	2	IN, <b>OH</b> , MI, IL, CA
333414A	Other heating eqpt., exc. electric, including parts	\$131.0	\$1,416.6	9.2%	1	<b>OH</b> , CA, PA, TN, NY
3334152	Heat transfer eqpt., mechanical refrigerated, self-contained	\$61.2	\$4,775.3	1.3%	15	GA, NY, TX, AR, MO
3334153	Commercial refrigerators & related eqpt.	\$171.1	\$2,740.8	6.2%	4	IL, TX, CA, <b>OH</b> , TN
3334159	All other misc. refrigeration & AC eqpt.	\$5.3	\$927.8	0.6%	6	CA, AZ, TX, IL, FL
333415D	Parts & accessories for AC & heat transfer eqpt.	\$76.6	\$1,697.4	4.5%	7	WI, TX, TN, IA, IN
333415E	Unitary AC eqpt., exc. air source heat pumps	\$386.3	\$5,403.8	7.1%	3	TN, TX, <b>OH</b> , OK, GA
3335122	Metal grinding, polishing, buffing, honing & lapping machines	\$12.8	\$312.5	4.1%	3	MI, PA, <b>OH</b> , NY, WI
3335124	Metal milling machines, exc. machining centers	\$17.5	\$51.3	34.2%	1	<b>OH</b> , MI*

**Table A2c: Value of Shipments for Selected Machinery Product Classes in Ohio and the U.S., 2002**

NAICS Code	Product Class Title	Value of Shipments (\$1,000,000s)		Ohio as Percent- age of U.S.	Ohio's Apparent <sup>A</sup> Rank	Top 5 States
		Ohio	U.S.			
3335125	Machine tools for home workshops, etc. (metalworking only)	\$7.1	\$78.3	9.0%	2	MI, <b>OH</b> , CA*
3335126	Parts for metal cutting-type machine tools, sold separately	\$108.4	\$566.2	19.1%	2	MI, <b>OH</b> , NY, CA, WI
3335129	Other metal cutting machine tools, exc. those designated for home use	\$34.3	\$458.4	7.5%	3	MI, IL, <b>OH</b> , WI, CA
333512A	Metal boring & drilling machines, exc. machining centers	\$3.5	\$114.7	3.1%	3	IL, WI, <b>OH</b> *
3335131	Metal punching, shearing, bending & forming machines	\$35.6	\$351.5	10.1%	2	MI, <b>OH</b> , IL*
3335133	Metalworking presses, exc. forging & die-stamping presses	\$78.3	\$204.7	38.2%	1	<b>OH</b> , MI, PA, CA*
3335135	Other metal forming machine tools, exc. metalwork presses	\$59.6	\$228.4	26.1%	1	<b>OH</b> , MI, PA, IL, MA
3335137	Parts for metal forming machine tools, sold separately, rebuilt or remanufactured	\$75.0	\$242.3	30.9%	1	<b>OH</b> , MI, IL, PA, IN
3335151	Small cutting tools for machine tools & metalworking mchnry.	\$263.8	\$2,863.3	9.2%	3	MI, IL, <b>OH</b> , CA, PA
3335153	Other attachments for machine tools & metalworking mchnry.	\$90.3	\$962.8	9.4%	3	MI, WI, <b>OH</b> , MO, NY
3335163	Cold rolling mill mchnry.	\$18.4	\$71.7	25.6%	1	<b>OH</b> *
3335165	Other rolling mill mchnry., including tube mill mchnry. & parts	\$68.5	\$271.6	25.2%	1	<b>OH</b> , PA, IL*
3335181	Assembly machines	\$117.4	\$1,829.9	6.4%	3	MI, IL, <b>OH</b> , NY, TN
3335183	Other metalworking mchnry., exc. handheld & ultrasonic	\$70.1	\$738.3	9.5%	2	MI, <b>OH</b> , MA, IL, FL
3336133	Mechanical power transmission eqpt., exc. speed changers, drives & gears	\$223.0	\$2,095.6	10.6%	2	WI, <b>OH</b> , PA, TX, NY
3339111	Pump and pumping eqpt.	\$581.4	\$5,062.0	11.5%	1	<b>OH</b> , OK, CA, TX, WI
3339115	Parts & attachments for pumps & pumping eqpt.	\$28.7	\$1,140.2	2.5%	9	CA, NY, MI, OK, TX
3339121	Air & gas compressors & vacuum pumps	\$225.8	\$2,608.3	8.7%	2	NY, <b>OH</b> , PA, OK, MA
3339125	Parts for air & gas compressors, including packing compressors	\$54.1	\$583.6	9.3%	4	NY, PA, TX, <b>OH</b> , IL
3339127	Industrial spraying eqpt.	\$9.2	\$823.5	1.1%	4	MI, IN, CA, <b>OH</b> *
3339221	Unit handling conveyors & conveying systems, exc. hoists & farm eqpt.	\$219.8	\$2,223.5	9.9%	2	MI, <b>OH</b> , KY, AR, MO
3339223	Parts for unit handling conveyors & conveying systems	\$36.1	\$251.0	14.4%	2	MI, <b>OH</b> , CA, WI, KY
3339228	Bulk material handling conveyors & conveying systems	\$102.6	\$1,590.9	6.4%	4	MI, PA, TX, <b>OH</b> , IL
3339229	Parts, bulk material handling conveyors & conveying systems	\$29.8	\$550.8	5.4%	3	IL, IA, <b>OH</b> , MI, WI
3339242	Industrial trucks & tractors, mobile straddle carriers, cranes, etc.	\$432.8	\$3,422.7	12.6%	1	<b>OH</b> , IN, TX, IL, GA
3339243	Parts & attachments, industrial trucks & tractors, sold separately	\$81.4	\$983.3	8.3%	3	TX, NC, <b>OH</b> , IN, MI
3339923	Arc welding electrodes, metal	\$469.1	\$682.2	68.8%	1	<b>OH</b> , MI, CA*
3339927	Resistance welders, components, accessories & electrodes	\$90.3	\$565.9	16.0%	2	MI, <b>OH</b> , CA, WI, IL
333992A	Other welding eqpt., components & accessories	\$34.0	\$601.8	5.7%	3	MI, CA, <b>OH</b> , CT, IN
3339931	Packing, packaging & bottling mchnry., exc. parts	\$302.0	\$2,910.4	10.4%	2	IL, <b>OH</b> , MN, CA, GA
3339935	Parts for packing, packaging & bottling mchnry.	\$42.8	\$651.6	6.6%	5	IL, WI, CA, SC, <b>OH</b>
3339951	Nonaerospace type hydraulic fluid power cylinders & actuators, linear & rotary	\$110.8	\$956.8	11.6%	2	IL, <b>OH</b> , IA, WI, MI
3339953	Nonaerospace type pneumatic fluid power cylinders & actuators, linear & rotary	\$44.2	\$520.7	8.5%	4	IN, MI, IL, <b>OH</b> , NY
3339955	Parts, nonaerospace hydraulic & pneumatic fluid power cylinders & actuators	\$45.1	\$369.1	12.2%	1	<b>OH</b> , WI, IL, CA, NY
3339963	Nonaerospace type rotary & other fluid power pumps	\$43.7	\$492.2	8.9%	2	IL, <b>OH</b> , FL, KS*

**Table A2c: Value of Shipments for Selected Machinery Product Classes in Ohio and the U.S., 2002**

NAICS Code	Product Class Title	Value of Shipments (\$1,000,000s)		Ohio as Percent- age of U.S.	Ohio's Apparent <sup>^</sup> Rank	Top 5 States
		Ohio	U.S.			
3339965	Nonaerospace type fluid power motors	\$6.9	\$369.8	1.9%	2	IL, <b>OH</b> *
3339967	Aerospace type fluid power pumps & motors	\$11.1	\$212.9	5.2%	2	CA, <b>OH</b> *
3339969	Parts, fluid power pumps, motors & hydrostatic transmissions	\$15.3	\$510.0	3.0%	3	CA, FL, <b>OH</b> , MI, MN
3339991	Filters & strainers, exc. fluid power	\$118.9	\$2,373.0	5.0%	9	MN, MI, CT, IL, CA
3339997	All other misc. general industrial mchnry.	\$212.8	\$3,242.1	6.6%	4	MI, PA, TX, <b>OH</b> , IL
333999A	All other misc. mchnry. products, exc. electrical	\$12.0	\$906.3	1.3%	10	CA, MI, PA, MA, TX

Notes: ^ - Data for one or more states may have been suppressed, and, if available, could change the rank; \* - No additional state were ranked.

Abbreviations used: AC - air conditioning; eqpt. - equipment; exc. - except or excluding; mchnry. - machinery; mfg. - manufacturing; misc. - miscellaneous.

Source: U.S. Bureau of the Census (2005c).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 3/05).

**Table A3: Machinery Industry Establishments and Employment, Ohio and the U.S.: 2002 Means and Percentages**

NAICS Code	Shorter Industry Title	Ohio			U.S.			Ohio as a Percentage of the U.S.	
		Establishments	Employment	Mean	Establishments	Employment	Mean	Establishments	Employment
	Total	271,181	4,743,151	17.5	7,200,770	112,400,654	15.6	3.8%	4.2%
333	Machinery Mfg.	2,075	84,469	40.7	27,941	1,166,221	41.7	7.4%	7.2%
3331	Agricultural, Construction & Mining Mchnry.	109	5,378	49.3	2,937	176,458	60.1	3.7%	3.0%
33311	Agricultural Implements	38	1,957	51.5	1,367	79,005	57.8	2.8%	2.5%
333111	Farm Mchnry. & Eqpt.*	29	666	23.0	1,217	55,742	45.8	2.4%	1.2%
333112	Lawn & Garden Eqpt.*	9	1,428	158.7	150	23,263	155.1	6.0%	6.1%
33312	Construction Mchnry.	46	2,591	56.3	783	59,627	76.2	5.9%	4.3%
33313	Mining & Oil and Gas Field Mchnry.	25	830	33.2	787	37,826	48.1	3.2%	2.2%
333131	Mining Mchnry.*	17	666	39.2	274	9,938	36.3	6.2%	6.7%
333132	Oil & Gas Field Mchnry.*	8	33	4.1	513	27,888	54.4	1.6%	0.1%
3332	Industrial Mchnry.	268	9,199	34.3	4,226	146,269	34.6	6.3%	6.3%
33321	Sawmill & Woodworking Mchnry.	13	561	43.2	292	6,720	23.0	4.5%	8.3%
33322	Plastics & Rubber Industry Mchnry.	68	2,940	43.2	558	16,820	30.1	12.2%	17.5%
33329	Other Industrial Mchnry.	187	5,698	30.5	3,376	122,729	36.4	5.5%	4.6%
333291	Paper Industry Mchnry.	14	415	29.6	298	11,484	38.5	4.7%	3.6%
333292	Textile Mchnry.*	7	143	20.4	423	8,758	20.7	1.7%	1.6%
333293	Printing Mchnry. & Eqpt.	22	627	28.5	456	14,266	31.3	4.8%	4.4%
333294	Food Products Mchnry.	23	1,401	60.9	560	17,009	30.4	4.1%	8.2%
333295	Semiconductor Mchnry.*	6	143	23.8	259	30,445	117.5	2.3%	0.5%
333298	All Other Industrial Mchnry.	115	2,973	25.9	1,380	40,767	29.5	8.3%	7.3%
3333	Commercial & Service Industry Mchnry.	95	6,185	65.1	2,358	111,610	47.3	4.0%	5.5%
333311	Automatic Vending Machines*	2	333	166.5	98	6,853	69.9	2.0%	4.9%
333312	Commercial Laundry Eqpt.	0	0	n.a.	57	3,281	57.6	0.0%	0.0%
333313	Office Mchnry.*	3	143	47.7	119	16,602	139.5	2.5%	0.9%
333314	Optical Instruments & Lenses	8	1,549	193.6	474	20,723	43.7	1.7%	7.5%
333315	Photographic & Photocopying Eqpt.	8	232	29.0	316	13,182	41.7	2.5%	1.8%
333319	Other Commercial & Service Mchnry.	74	3,945	53.3	1,294	50,969	39.4	5.7%	7.7%
3334	VHAC & Commercial Refrigeration Eqpt.	82	9,247	112.8	1,800	156,821	87.1	4.6%	5.9%
333411	Air Purification Eqpt.	16	848	53.0	360	13,597	37.8	4.4%	6.2%

**Table A3: Machinery Industry Establishments and Employment, Ohio and the U.S.: 2002 Means and Percentages**

NAICS Code	Shorter Industry Title	Ohio			U.S.			Ohio as a Percentage of the U.S.	
		Establishments	Employment	Mean	Establishments	Employment	Mean	Establishments	Employment
333412	Industrial & Commercial Fans & Blowers	12	974	81.2	182	11,281	62.0	6.6%	8.6%
333414	Heating Eqpt. (Exc. Warm Air Furnaces)	15	924	61.6	418	21,484	51.4	3.6%	4.3%
333415	AC, Warm Air Furnaces, & Refrigeration Eqpt.	39	6,501	166.7	840	110,459	131.5	4.6%	5.9%
3335	Metalworking Mchnry.	976	23,023	23.6	9,346	187,361	20.0	10.4%	12.3%
333511	Industrial Molds	244	4,996	20.5	2,270	41,760	18.4	10.7%	12.0%
333512	Machine Tools, Metal Cutting Type	45	1,969	43.8	540	19,820	36.7	8.3%	9.9%
333513	Machine Tools, Metal Forming Types	44	2,248	51.1	316	9,285	29.4	13.9%	24.2%
333514	Special Dies, Tools, Jigs & Fixtures	424	7,616	18.0	4,079	62,426	15.3	10.4%	12.2%
333515	Machine Tool Accessories	160	4,070	25.4	1,630	37,240	22.8	9.8%	10.9%
333516	Rolling Mill Mchnry.	15	478	31.9	77	2,361	30.7	19.5%	20.2%
333518	Other Metalworking Mchnry.	44	1,646	37.4	434	14,469	33.3	10.1%	11.4%
3336	Engine, Turbine & Transmission Eqpt.	70	4,723	67.5	922	96,501	104.7	7.6%	4.9%
333611	Turbines & Turbine Generator Sets*	8	1,428	178.5	116	19,560	168.6	6.9%	7.3%
333612	Speed Changers, Drives & Gears*	23	666	29.0	246	13,180	53.6	9.3%	5.1%
333613	Mechanical Power Transmission Eqpt.	23	1,122	48.8	279	17,021	61.0	8.2%	6.6%
333618	Other Engine Eqpt.	16	1,746	109.1	281	46,740	166.3	5.7%	3.7%
3339	Other General Purpose Mchnry.	475	26,714	56.2	6,352	291,201	45.8	7.5%	9.2%
33391	Pumps & Compressors	53	5,362	101.2	818	55,238	67.5	6.5%	9.7%
333911	Pumps & Pumping Eqpt.	23	3,369	146.5	452	30,623	67.8	5.1%	11.0%
333912	Air & Gas Compressors	22	1,401	63.7	295	19,823	67.2	7.5%	7.1%
333913	Measuring & Dispensing Pumps	8	592	74.0	71	4,792	67.5	11.3%	12.4%
33392	Material Handling Eqpt.	123	6,551	53.3	1,700	78,058	45.9	7.2%	8.4%
333921	Elevators & Moving Stairways	7	375	53.6	187	9,359	50.0	3.7%	4.0%
333922	Conveyors & Conveying Eqpt.	68	2,896	42.6	795	33,077	41.6	8.6%	8.8%
333923	Hoists, Cranes & Monorails	16	663	41.4	294	14,189	48.3	5.4%	4.7%
333924	Industrial Trucks, Tractors, Trailers, Stackers	32	2,617	81.8	424	21,433	50.5	7.5%	12.2%
33399	All Other General Purpose Mchnry.	299	14,801	49.5	3,834	157,905	41.2	7.8%	9.4%
333991	Power-Driven Handtools	21	1,287	61.3	217	13,153	60.6	9.7%	9.8%
333992	Welding & Soldering Eqpt.	26	4,698	180.7	268	17,621	65.8	9.7%	26.7%
333993	Packaging Mchnry.	41	2,256	55.0	640	23,680	37.0	6.4%	9.5%
333994	Industrial Furnaces & Ovens	38	795	20.9	355	11,998	33.8	10.7%	6.6%

**Table A3: Machinery Industry Establishments and Employment, Ohio and the U.S.: 2002 Means and Percentages**

NAICS Code	Shorter Industry Title	Ohio			U.S.			Ohio as a Percentage of the U.S.	
		Establishments	Employment	Mean	Establishments	Employment	Mean	Establishments	Employment
333995	Fluid Power Cylinders & Actuators	30	1,424	47.5	305	20,765	68.1	9.8%	6.9%
333996	Fluid Power Pumps & Motors	15	1,370	91.3	169	12,391	73.3	8.9%	11.1%
333997	Scales & Balances (Exc. Laboratory)	6	452	75.3	109	3,469	31.8	5.5%	13.0%
333999	Misc. General Purpose Mchnry.	122	2,519	20.6	1,771	54,828	31.0	6.9%	4.6%

Notes: \* - Ohio employment figure is estimated. Abbreviations used: Eqpt. - equipment; Exc. - except; Mchnry. - machinery; Mfg. - manufacturing; Misc. - miscellaneous; VHAC - ventilation, heating, air-conditioning.

Source: U.S. Bureau of the Census (2004).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 3/05).

**Table A4: Machinery Industry Wages and Employment, Ohio and the U.S.: 2002 Means and Percentages**

NAICS Code	Shorter Industry Title	Ohio			U.S.			Ohio Mean as Percentage of U.S.
		Wages (millions)	Employment	Annual Mean	Wages (millions)	Employment	Annual Mean	
	Total	\$154,820.4	4,743,151	\$32,641	\$3,943,179.6	112,400,654	\$35,081	93.0%
333	Machinery Mfg.	\$3,695.0	84,469	\$43,744	\$50,101.4	1,166,221	\$42,960	101.8%
3331	Agricultural, Construction & Mining Mchnry.	\$191.1	5,378	\$35,538	\$6,978.9	176,458	\$39,550	89.9%
33311	Agricultural Implements	\$65.1	1,957	\$33,282	\$2,755.2	79,005	\$34,874	95.4%
333111	Farm Mchnry. & Eqpt.*	D	666	n.a.	\$2,076.1	55,742	\$37,246	n.a.
333112	Lawn & Garden Eqpt.*	D	1,428	n.a.	\$679.1	23,263	\$29,191	n.a.
33312	Construction Mchnry.	\$94.2	2,591	\$36,342	\$2,543.7	59,627	\$42,660	85.2%
33313	Mining & Oil and Gas Field Mchnry.	\$31.8	830	\$38,352	\$1,679.9	37,826	\$44,413	86.4%
333131	Mining Mchnry.*	D	666	n.a.	\$392.9	9,938	\$39,539	n.a.
333132	Oil & Gas Field Mchnry.*	D	33	n.a.	\$1,287.0	27,888	\$46,149	n.a.
3332	Industrial Mchnry.	\$402.8	9,199	\$43,786	\$7,291.3	146,269	\$49,849	87.8%
33321	Sawmill & Woodworking Mchnry.	\$21.3	561	\$38,048	\$257.0	6,720	\$38,250	99.5%
33322	Plastics & Rubber Industry Mchnry.	\$136.8	2,940	\$46,532	\$708.3	16,820	\$42,113	110.5%
33329	Other Industrial Mchnry.	\$244.6	5,698	\$42,934	\$6,325.9	122,729	\$51,544	83.3%
333291	Paper Industry Mchnry.	\$20.6	415	\$49,636	\$531.4	11,484	\$46,277	107.3%
333292	Textile Mchnry.*	D	143	n.a.	\$317.5	8,758	\$36,251	n.a.
333293	Printing Mchnry. & Eqpt.	\$28.6	627	\$45,574	\$655.7	14,266	\$45,961	99.2%
333294	Food Products Mchnry.	\$58.4	1,401	\$41,719	\$746.4	17,009	\$43,881	95.1%
333295	Semiconductor Mchnry.*	D	143	n.a.	\$2,271.8	30,445	\$74,621	n.a.
333298	All Other Industrial Mchnry.	\$126.3	2,973	\$42,468	\$1,803.1	40,767	\$44,230	96.0%
3333	Commercial & Service Industry Mchnry.	\$257.5	6,185	\$41,629	\$4,847.5	111,610	\$43,432	95.8%
333311	Automatic Vending Machines*	D	333	n.a.	\$235.9	6,853	\$34,423	n.a.
333312	Commercial Laundry Eqpt.	\$0.0	0	n.a.	\$117.4	3,281	\$35,768	n.a.
333313	Office Mchnry.*	D	143	n.a.	\$797.3	16,602	\$48,025	n.a.
333314	Optical Instruments & Lenses	\$69.6	1,549	\$44,947	\$986.0	20,723	\$47,580	94.5%
333315	Photographic & Photocopying Eqpt.	\$12.7	232	\$54,905	\$603.8	13,182	\$45,805	119.9%
333319	Other Commercial & Service Mchnry.	\$160.9	3,945	\$40,776	\$2,107.1	50,969	\$41,341	98.6%
3334	VHAC & Commercial Refrigeration Eqpt.	\$409.2	9,247	\$44,253	\$5,556.3	156,821	\$35,431	124.9%
333411	Air Purification Eqpt.	\$25.9	848	\$30,496	\$425.4	13,597	\$31,285	97.5%

**Table A4: Machinery Industry Wages and Employment, Ohio and the U.S.: 2002 Means and Percentages**

NAICS Code	Shorter Industry Title	Ohio			U.S.			Ohio Mean as Percentage of U.S.
		Wages (millions)	Employment	Annual Mean	Wages (millions)	Employment	Annual Mean	
333412	Industrial & Commercial Fans & Blowers	\$40.9	974	\$42,030	\$414.7	11,281	\$36,759	114.3%
333414	Heating Eqpt. (Exc. Warm Air Furnaces)	\$37.9	924	\$41,054	\$786.6	21,484	\$36,612	112.1%
333415	AC, Warm Air Furnaces, & Refrigeration Eqpt.	\$304.5	6,501	\$46,836	\$3,929.7	110,459	\$35,576	131.7%
3335	Metalworking Mchnry.	\$975.1	23,023	\$42,354	\$8,136.6	187,361	\$43,428	97.5%
333511	Industrial Molds	\$214.9	4,996	\$43,008	\$1,811.4	41,760	\$43,376	99.1%
333512	Machine Tools, Metal Cutting Type	\$89.0	1,969	\$45,201	\$953.6	19,820	\$48,113	93.9%
333513	Machine Tools, Metal Forming Types	\$106.0	2,248	\$47,173	\$427.2	9,285	\$46,014	102.5%
333514	Special Dies, Tools, Jigs & Fixtures	\$308.7	7,616	\$40,537	\$2,687.8	62,426	\$43,056	94.2%
333515	Machine Tool Accessories	\$148.0	4,070	\$36,360	\$1,432.5	37,240	\$38,466	94.5%
333516	Rolling Mill Mchnry.	\$26.2	478	\$54,877	\$116.8	2,361	\$49,468	110.9%
333518	Other Metalworking Mchnry.	\$82.3	1,646	\$49,981	\$707.3	14,469	\$48,885	102.2%
3336	Engine, Turbine & Transmission Eqpt.	\$250.5	4,723	\$53,035	\$4,637.4	96,501	\$48,055	110.4%
333611	Turbines & Turbine Generator Sets*	D	1,428	n.a.	\$1,125.5	19,560	\$57,541	n.a.
333612	Speed Changers, Drives & Gears*	D	666	n.a.	\$529.0	13,180	\$40,136	n.a.
333613	Mechanical Power Transmission Eqpt.	\$52.3	1,122	\$46,611	\$698.5	17,021	\$41,036	113.6%
333618	Other Engine Eqpt.	\$111.6	1,746	\$63,928	\$2,284.4	46,740	\$48,876	130.8%
3339	Other General Purpose Mchnry.	\$1,208.8	26,714	\$45,250	\$12,653.4	291,201	\$43,452	104.1%
33391	Pumps & Compressors	\$230.7	5,362	\$43,023	\$2,516.2	55,238	\$45,553	94.4%
333911	Pumps & Pumping Eqpt.	\$136.5	3,369	\$40,513	\$1,378.7	30,623	\$45,022	90.0%
333912	Air & Gas Compressors	\$67.2	1,401	\$47,965	\$919.2	19,823	\$46,372	103.4%
333913	Measuring & Dispensing Pumps	\$27.0	592	\$45,613	\$218.3	4,792	\$45,555	100.1%
33392	Material Handling Eqpt.	\$299.3	6,551	\$45,690	\$3,265.9	78,058	\$41,839	109.2%
333921	Elevators & Moving Stairways	\$13.1	375	\$34,989	\$355.5	9,359	\$37,988	92.1%
333922	Conveyors & Conveying Eqpt.	\$123.0	2,896	\$42,485	\$1,521.5	33,077	\$45,998	92.4%
333923	Hoists, Cranes & Monorails	\$31.5	663	\$47,525	\$547.6	14,189	\$38,593	123.1%
333924	Industrial Trucks, Tractors, Trailers, Stackers	\$131.6	2,617	\$50,305	\$841.3	21,433	\$39,251	128.2%
33399	All Other General Purpose Mchnry.	\$678.8	14,801	\$45,862	\$6,871.3	157,905	\$43,515	105.4%
333991	Power-Driven Handtools	\$64.8	1,287	\$50,353	\$486.6	13,153	\$36,996	136.1%
333992	Welding & Soldering Eqpt.	\$239.1	4,698	\$50,887	\$856.7	17,621	\$48,621	104.7%
333993	Packaging Mchnry.	\$101.6	2,256	\$45,049	\$1,141.5	23,680	\$48,203	93.5%
333994	Industrial Furnaces & Ovens	\$39.5	795	\$49,747	\$490.0	11,998	\$40,842	121.8%

**Table A4: Machinery Industry Wages and Employment, Ohio and the U.S.: 2002 Means and Percentages**

NAICS Code	Shorter Industry Title	Ohio			U.S.			Ohio Mean as Percentage of U.S.
		Wages (millions)	Employment	Annual Mean	Wages (millions)	Employment	Annual Mean	
333995	Fluid Power Cylinders & Actuators	\$47.9	1,424	\$33,662	\$883.5	20,765	\$42,549	79.1%
333996	Fluid Power Pumps & Motors	\$58.0	1,370	\$42,323	\$530.4	12,391	\$42,802	98.9%
333997	Scales & Balances (Exc. Laboratory)	\$20.7	452	\$45,777	\$130.1	3,469	\$37,511	122.0%
333999	Misc. General Purpose Mchnry.	\$107.1	2,519	\$42,532	\$2,352.4	54,828	\$42,905	99.1%

Notes: \* - Ohio employment figure is estimated. Abbreviations used: Eqpt. - equipment; Exc. - except; Mchnry. - machinery; Mfg. - manufacturing; Misc. - miscellaneous; VHAC - ventilation, heating, air-conditioning.

Source: U.S. Bureau of the Census (2004).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 3/05).

**TABLE A5: ESTABLISHMENTS AND EMPLOYMENT IN THE MACHINERY INDUSTRY, BY COUNTY IN OHIO: 2002**

Area Name	Establish- ments	Employ- ment	Area Name	Establish- ments	Employ- ment	Area Name	Establish- ments	Employ- ment
Ohio	2,075	84,469	Greene	17	239	Morrow	3	143 *
Adams	1	33 *	Guernsey	11	661	Muskingum	3	143 *
Allen	10	208	Hamilton	113	5,360	Noble	1	10 *
Ashland	13	1,192	Hancock	8	437	Ottawa	9	211
Ashtabula	23	758	Hardin	5	134	Paulding	1	10 *
Athens	3	33 *	Harrison	4	143 *	Perry	3	143 *
Auglaize	20	2,665	Henry	9	203	Pickaway	5	143 *
Belmont	3	61	Highland	2	333 *	Pike	2	10 *
Brown	2	143 *	Hocking	0	0	Portage	41	736
Butler	47	1,900	Holmes	2	10 *	Preble	9	666 *
Carroll	6	68	Huron	11	1,515	Putnam	7	293
Champaign	6	185	Jackson	3	33 *	Richland	25	1,165
Clark	26	833	Jefferson	3	33 *	Ross	1	10 *
Clermont	24	2,566	Knox	6	1,582	Sandusky	17	358
Clinton	9	228	Lake	115	2,980	Scioto	1	10 *
Columbiana	36	1,108	Lawrence	7	459	Seneca	14	760
Coshocton	2	33 *	Licking	7	24	Shelby	24	2,166
Crawford	13	765	Logan	6	39	Stark	65	1,576
Cuyahoga	306	12,099	Lorain	51	2,373	Summit	164	4,439
Darke	8	176	Lucas	73	1,736	Trumbull	33	477
Defiance	7	420	Madison	5	175	Tuscarawas	19	1,307
Delaware	17	335	Mahoning	56	1,241	Union	6	666 *
Erie	13	1,006	Marion	4	254	Van Wert	8	114
Fairfield	12	484	Medina	46	926	Vinton	2	10 *
Fayette	1	33 *	Meigs	0	0	Warren	25	1,065
Franklin	61	3,459	Mercer	10	217	Washington	7	196
Fulton	12	398	Miami	49	2,329	Wayne	26	1,497
Gallia	1	10 *	Monroe	2	10 *	Williams	24	1,397
Geauga	26	876	Montgomery	167	8,163	Wood	26	705
			Morgan	2	333 *	Wyandot	2	33 *

Notes: \* - Employment is estimated; therefore, county figures will not sum to the state total. However, the fact that using the estimates produces a total figure for Ohio that is only slightly greater than the actual figure means that the estimates, on average, are very good.

Source: U.S. Census Bureau (2005b).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 3/05).

**TABLE A6: FOREIGN CORPORATIONS WITH MACHINERY INDUSTRY ESTABLISHMENTS IN OHIO**

Foreign Parent(s)	Country	Ohio Subsidiaries	Co. Jobs
ABN AMRO Holding*	Netherlands	Cincinnati Industrial Machinery Co.	200
AEG Elektrofotografic GmbH	Germany	AEG Photoconductor Corp.	68
Aida Corp.	Japan	Aida-Dayton Technologies Corp.	130
Aker Kvaener ASA	Norway	EPCO	100
Anest Iwata Corp.	Japan/U.S.	Powerex-Iwata Air Technology, Inc. (a joint venture with the Campbell Hausfeld subsidiary of Berkshire-Hathaway, Inc.*)	30
ATS Corp.	Canada	ATS Machine & Tool Co.	15
Babcock Borsig AG	Germany	TLT Babcock Inc.	60
BARCO NV	Belgium	Barco Simulation	100
Barudan Co., Ltd.	Japan	Barudan America, Inc.	47
Canadian Feed Screws	Canada	American Feed Screws, Inc.	20
CECO Environmental Corp.	Canada	Kirk & Blum Manufacturing	250
CFS Holding BV	Netherlands	CFS North America, Inc.	20
Charter PLC	United Kingdom	Morgantown Machine & Hydraulic	50
Consumer Packaging, Inc.	Canada	Anchor Glass Container Corp.	190
Daewoo Corp.	S. Korea	Daewoo Heavy Industries America	40
Daido Metal	Japan/U.S.	Dana Glacier Daido America (a joint venture with Dana Corp.*)	425
Daifuku Company, Ltd.	Japan	Daifuku America Corp.	175
DaimlerChrysler AG*	Germany	Detroit Diesel Remanufacturing	550
DMS Bliss Corp.	France	DMS Bliss Corp.	40
Durr AG	Germany	Henry Filters	200
Ebner Industrieofenbau GmbH	Austria	Ebner Furnaces, Inc.	60
Falkenroth Gruppe	Germany	Falkenroth, Inc.	175
Fenner PLC	United Kingdom	Fenner Dunlop Americas	166
Fette GmbH	Germany	LMT-Fette	30
Framatome Group	France	FCI Automotive	125
FSP Holding AG	Switzerland	ARGO-HYTOS, Inc.	10
Fujitec	Japan	Fujitec America, Inc.	388
Furukawa Co., Ltd.	Japan	Gougler Industries, Inc.	175
		Kent Tool	75
General Electric Co. PLC	United Kingdom	American Fan Co.	150
GKN PLC	United Kingdom	GKN Sinter Metals, Inc.	325
Green Fuji & Hongo America	Japan	DieNamic Solutions LLC	75

**TABLE A6: FOREIGN CORPORATIONS WITH MACHINERY INDUSTRY ESTABLISHMENTS IN OHIO**

Foreign Parent(s)	Country	Ohio Subsidiaries	Co. Jobs
Grob-Werke GmbH & Co. AG	Germany	Grob Systems, Inc.	183
Heidelberger Druckmaschinen	Germany	Baumfolder Corp.	100
Isuzu Motors, Ltd.*	Japan	DMAX, Ltd. (a joint venture with General Motors Corp.*)	1,000
Itochu Corp.	Japan	Bevcorp, LLC	75
		P E Technologies	80
Jax Mold & Machine, Ltd.	Canada	Athens Mold & Machine, Inc.	25
KCI Konecranes PLC	Finland	Crane Pro	15
		Konecranes Americas	60
		R & M Materials Handling	40
Kobe Steel, Ltd.	Japan	Kobelco Stewart Bolling, Inc.	100
Kone Corp.	Finland	Princeton Delivery Systems	70
		Waltco Truck Equipment Co.	385
Korber Schleifring Group AG	Germany	United Grinding Technologies, Inc.	76
Koyo Seiko Co., Ltd.	Japan	Koyo Corp. of USA	85
Kvaerner Corp.	United Kingdom	EPCO	150
Linde AG	Germany	Linde Gas LLC	10
		Linde Hydraulics Corp.	40
LNS SA	Switzerland	LNS America, Inc.	54
Makino Milling Machine Co.	Japan	Makino, Inc.	250
Mettler-Toledo International, Inc.*	Switzerland	Mettler-Toledo, Inc.	660
Mitsubishi Heavy Industries, Ltd.*	Japan	Mitsubishi Heavy Industries America, Inc.	50
Mitutoyo Corp.	Japan	Mitutoyo America Corp./Nelson Precision, Inc.	20
Nestle SA*	Switzerland	Norse Dairy Systems	120
Nippon Pneumatic Kogyo, Ltd.	Japan	NPK Construction Equipment	50
		NPK Manufacturing, Inc.	20
NKT Holding A/S	Denmark	Alto US (a.k.a. American-Lincoln)	150
NV Twentsche Kabel Holding	Netherlands	VMI Americas, Inc.	37
Odawara Engineering Co., Ltd.	Japan	Odawara Automation, Inc.	70
Palfinger	Austria	Tiffin Loader Crane/Palfinger USA	30
Patriot Forge, Inc.	Canada	Morgan Engineering Systems, Inc.	65
Ralph McKay Industries	Canada	Empire Plow Co., Inc.	51
Robert Bosch GmbH*	Germany	Bosch Rexroth Corp.	380
Rolls Royce PLC	United Kingdom	Rolls Royce Energy Systems, Inc.	800

**TABLE A6: FOREIGN CORPORATIONS WITH MACHINERY INDUSTRY ESTABLISHMENTS IN OHIO**

Foreign Parent(s)	Country	Ohio Subsidiaries	Co. Jobs
Saint-Gobain Corp.*	France	Saint-Gobain Calmar, Inc.	300
Salvagnini Italia SPA	Italy	Salvagnini America, Inc.	25
Sandoz, Ltd.	Switzerland	Ceilcote Air Pollution Control	75
Sankyo Co., Ltd.	Japan	Sankyo America, Inc.	20
Sanyo Tool Co., Ltd.	Japan	Superion, Inc.	40
Seeberger GmbH	Germany	Seepex, Inc.	48
Sematic Group	Italy	Tyler Elevator Products	150
SEW-Eurodrive GmbH & Co.	Germany	SEW-Eurodrive, Inc.	100
Siebtechnik GmbH	Germany	TEMA Systems, Inc.	30
Siemens AG*	Germany/U.S.	Demag Cranes & Components, and Demag Plastics Group (joint ventures with Kohlberg, Kravis, Roberts & Co.*)	641
	Germany	Siemens Dematic	30
Smiths Group PLC	United Kingdom	Tech Development, Inc.	75
Stromag AG	Germany	Stromag, Inc.	40
Taikisha, Ltd.	Japan	TKS Industrial Co.	26
Tatematsu Mold Works & Tanazawa Hokkoshu	Japan	Midwest Mold & Texture Corp.	33
Thames Water PLC	United Kingdom	PCI Membrane Systems, Inc.	9
Tipco, Inc.	Canada	Tipco Punch, Inc.	36
Tomkins PLC	United Kingdom	Lau Industries, Inc., including Lau Conaire Mayfran International, Inc.	110 322
Vogelsang Gruppe	Germany	Vogelsang USA	400
Yaskawa Electric Corp.	Japan	Yaskawa Electric America, Inc.	35
Total Jobs:			12,310

Note: \* - A Fortune U.S. 1,000 or Global 500 company.

Sources: American Business Directories (2003), Fortune (2004, 2005), Harris (2004), Office of Strategic Research (2005a), and various company websites.

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 4/05).

**Table A7: Machinery Industry Establishment Trends, Ohio and the U.S.: 1998-2002**

NAICS Code	Shorter Industry Title	1998	1999	2000	2001	2002	Changes: 1998-2002	
							Number	Percent
Ohio	Total	270,343	270,766	270,509	269,944	271,181	838	0.3%
31-33	Manufacturing	18,052	17,930	17,704	17,597	17,189	-863	-4.8%
333	Machinery Mfg.	2,277	2,245	2,200	2,170	2,075	-202	-8.9%
3331	Agricultural, Construction & Mining Mchnry.	108	111	108	108	109	1	0.9%
3332	Industrial Mchnry.	313	307	294	293	268	-45	-14.4%
3333	Commercial & Service Industry Mchnry.	100	99	99	96	95	-5	-5.0%
3334	VHAC & Commercial Refrigeration Eqpt.	82	85	84	83	82	0	0.0%
3335	Metalworking Mchnry.	1,095	1,060	1,036	1,019	976	-119	-10.9%
3336	Engine, Turbine & Transmission Eqpt.	68	64	63	64	70	2	2.9%
3339	Other General Purpose Mchnry.	511	519	516	507	475	-36	-7.0%
U.S.	Total	6,941,822	7,008,444	7,070,048	7,095,302	7,200,770	258,948	3.7%
31-33	Manufacturing	366,249	360,244	354,498	352,619	344,341	-21,908	-6.0%
333	Machinery Mfg.	30,824	30,177	29,442	28,922	27,941	-2,883	-9.4%
3331	Agricultural, Construction & Mining Mchnry.	3,181	3,110	3,044	2,964	2,937	-244	-7.7%
3332	Industrial Mchnry.	4,649	4,674	4,544	4,408	4,226	-423	-9.1%
3333	Commercial & Service Industry Mchnry.	2,576	2,550	2,490	2,457	2,358	-218	-8.5%
3334	VHAC & Commercial Refrigeration Eqpt.	1,868	1,819	1,779	1,814	1,800	-68	-3.6%
3335	Metalworking Mchnry.	10,538	10,168	9,873	9,691	9,346	-1,192	-11.3%
3336	Engine, Turbine & Transmission Eqpt.	958	971	961	949	922	-36	-3.8%
3339	Other General Purpose Mchnry.	7,054	6,885	6,751	6,639	6,352	-702	-10.0%

Sources: U.S. Census Bureau (2000, 2001, 2002, 2003b, 2004).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 5/05).

**Table A8: Machinery Industry Employment Trends, Ohio and the U.S.: 1998-2002**

NAICS Code	Shorter Industry Title	1998	1999	2000	2001	2002	Changes: 1998-2002	
							Number	Percent
Ohio	Total	4,806,046	4,867,368	5,001,980	4,932,943	4,743,151	-62,895	-1.3%
31-33	Manufacturing	994,788	982,853	988,612	936,161	829,456	-165,332	-16.6%
333	Machinery Mfg.	109,658	107,703	104,053	97,693	84,469	-25,189	-23.0%
3331	Agricultural, Construction & Mining Mchnry.	7,533	6,750	6,221	6,048	5,378	-2,155	-28.6%
3332	Industrial Mchnry.	13,689	13,316	13,996	12,166	9,199	-4,490	-32.8%
3333	Commercial & Service Industry Mchnry.	5,481	6,106	6,318	6,149	6,185	704	12.8%
3334	VHAC & Commercial Refrigeration Eqpt.	9,723	10,055	9,129	9,522	9,247	-476	-4.9%
3335	Metalworking Mchnry.	33,279	31,462	29,389	27,417	23,023	-10,256	-30.8%
3336	Engine, Turbine & Transmission Eqpt.	5,492	5,197	5,012	4,144	4,723	-769	-14.0%
3339	Other General Purpose Mchnry.	34,461	34,817	33,988	32,247	26,714	-7,747	-22.5%
U.S.	Total	108,117,731	110,705,661	114,064,976	115,061,184	112,400,654	4,282,923	4.0%
31-33	Manufacturing	16,945,834	16,659,930	16,473,994	15,950,424	14,393,609	-2,552,225	-15.1%
333	Machinery Mfg.	1,444,438	1,398,226	1,377,950	1,332,854	1,166,221	-278,217	-19.3%
3331	Agricultural, Construction & Mining Mchnry.	220,938	207,328	199,497	193,884	176,458	-44,480	-20.1%
3332	Industrial Mchnry.	197,896	181,012	183,398	177,435	146,269	-51,627	-26.1%
3333	Commercial & Service Industry Mchnry.	128,572	130,751	129,077	125,312	111,610	-16,962	-13.2%
3334	VHAC & Commercial Refrigeration Eqpt.	170,863	177,520	178,626	179,211	156,821	-14,042	-8.2%
3335	Metalworking Mchnry.	255,350	239,484	232,695	220,206	187,361	-67,989	-26.6%
3336	Engine, Turbine & Transmission Eqpt.	112,920	112,560	112,406	104,525	96,501	-16,419	-14.5%
3339	Other General Purpose Mchnry.	357,899	349,571	342,251	332,281	291,201	-66,698	-18.6%

Sources: U.S. Census Bureau (2000, 2001, 2002, 2003b, 2004).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 5/05).

**TABLE A9: MACHINERY AND TOTAL GROSS STATE PRODUCT FOR OHIO AND THE U.S., 1997-2003**  
(in millions of chained 2000 dollars, except percentages and ratios)

Industry Titles	Gross State Product							Percent Change (or Difference) 1997-2003
	1997	1998	1999	2000	2001	2002	2003	
Ohio: Total GSP	\$350,603	\$362,461	\$367,895	\$371,228	\$365,791	\$369,354	\$375,740	7.17%
Machinery GSP	\$7,134	\$7,920	\$6,771	\$6,566	\$6,030	\$5,554	\$5,567	-21.97%
As a Percentage Total	2.03%	2.19%	1.84%	1.77%	1.65%	1.50%	1.48%	-0.55%
U.S.: Total GSP	\$8,620,955	\$9,004,669	\$9,404,249	\$9,749,104	\$9,836,571	\$10,009,433	\$10,289,220	19.35%
Machinery GSP	\$102,579	\$113,799	\$104,960	\$109,296	\$100,402	\$94,453	\$93,653	-8.70%
As a Percentage Total	1.19%	1.26%	1.12%	1.12%	1.02%	0.94%	0.91%	-0.28%
Ohio as a Percentage of U.S.: Total	4.07%	4.03%	3.91%	3.81%	3.72%	3.69%	3.65%	-0.42%
Machinery	6.95%	6.96%	6.45%	6.01%	6.01%	5.88%	5.94%	-1.01%
Ohio::U.S. Concentration Ratio	1.71	1.73	1.65	1.58	1.62	1.59	1.63	-0.05

Source: U.S. Bureau of Economic Analysis (2005).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 6/05).

**TABLE A10: VALUE-ADDED BY GROUP IN THE MACHINERY INDUSTRY FOR OHIO AND U.S., 1997-2003**  
(in millions of current dollars, except percentages)

Industry Titles	Value-Added						Percent Change (or Dif- ference) 1997-2003	
	1997	1998	1999	2000	2001	2002		2003
Ohio: 333 Machinery Industry Total	\$10,015.8	\$10,244.0	\$9,321.7	\$9,555.3	\$8,321.6	n.a.	\$7,856.5	-21.6%
3331: Agricultural, Construction & Mining Mchnry.	\$565.6	\$721.9	\$517.0	\$523.0	\$429.7	n.a.	\$576.0	1.8%
3332: Industrial Mchnry.	\$1,463.9	\$1,357.7	\$1,193.1	\$1,392.7	\$1,356.9	n.a.	\$835.6	-42.9%
3333: Commercial & Service Industry Mchnry.	\$729.5	\$542.0	\$590.8	\$649.4	\$648.7	n.a.	\$740.6	1.5%
3334: VHAC & Commercial Refrigeration Eqpt.	\$964.2	\$1,105.6	\$956.7	\$936.1	\$787.9	n.a.	\$799.5	-17.1%
3335: Metalworking Mchnry.	\$2,703.6	\$2,543.3	\$2,283.3	\$2,371.7	\$2,001.2	n.a.	\$1,758.8	-34.9%
3336: Engine, Turbine & Transmission Eqpt.	\$548.8	\$555.3	\$601.2	\$421.6	\$403.0	n.a.	\$592.4	7.9%
3339: Other General Purpose Mchnry.	\$3,040.1	\$3,418.2	\$3,179.7	\$3,260.9	\$2,694.3	n.a.	\$2,553.6	-16.0%
U.S.: 333 Machinery Industry Total	\$137,934.7	\$141,268.8	\$139,610.6	\$146,053.9	\$131,103.4	n.a.	\$125,782.1	-8.8%
3331: Agricultural, Construction & Mining Mchnry.	\$24,431.9	\$26,248.8	\$20,217.7	\$21,113.0	\$20,929.2	n.a.	\$20,821.3	-14.8%
3332: Industrial Mchnry.	\$19,456.1	\$17,746.2	\$19,599.1	\$24,816.2	\$17,447.9	n.a.	\$15,060.2	-22.6%
3333: Commercial & Service Industry Mchnry.	\$14,215.1	\$15,212.5	\$15,228.4	\$14,315.2	\$11,813.8	n.a.	\$11,490.9	-19.2%
3334: VHAC & Commercial Refrigeration Eqpt.	\$14,637.8	\$15,513.4	\$16,962.3	\$16,825.7	\$15,855.1	n.a.	\$16,548.4	13.1%
3335: Metalworking Mchnry.	\$19,331.1	\$19,239.8	\$18,419.7	\$19,274.1	\$16,029.9	n.a.	\$15,392.9	-20.4%
3336: Engine, Turbine & Transmission Eqpt.	\$14,530.6	\$15,106.6	\$17,013.4	\$16,078.9	\$18,962.0	n.a.	\$17,175.8	18.2%
3339: Other General Purpose Mchnry.	\$31,332.2	\$32,201.5	\$32,170.0	\$33,630.8	\$30,065.5	n.a.	\$29,292.6	-6.5%
Ohio as Percentage of U.S.: 333 Machinery Industry Total	7.3%	7.3%	6.7%	6.5%	6.3%	n.a.	6.2%	-1.0%
3331: Agricultural, Construction & Mining Mchnry.	2.3%	2.8%	2.6%	2.5%	2.1%	n.a.	2.8%	0.5%
3332: Industrial Mchnry.	7.5%	7.7%	6.1%	5.6%	7.8%	n.a.	5.5%	-2.0%
3333: Commercial & Service Industry Mchnry.	5.1%	3.6%	3.9%	4.5%	5.5%	n.a.	6.4%	1.3%
3334: VHAC & Commercial Refrigeration Eqpt.	6.6%	7.1%	5.6%	5.6%	5.0%	n.a.	4.8%	-1.8%
3335: Metalworking Mchnry.	14.0%	13.2%	12.4%	12.3%	12.5%	n.a.	11.4%	-2.6%
3336: Engine, Turbine & Transmission Eqpt.	3.8%	3.7%	3.5%	2.6%	2.1%	n.a.	3.4%	-0.3%
3339: Other General Purpose Mchnry.	9.7%	10.6%	9.9%	9.7%	9.0%	n.a.	8.7%	-1.0%

Note: n.a. - not available.

Source: U.S. Bureau of the Census (2003a, 2005a).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 6/05).

**TABLE A11: CAPITAL EXPENDITURES BY GROUP IN THE MACHINERY FOR OHIO AND U.S., 1997-2003**  
(in millions of current dollars, except percentages)

Industry Titles	Capital Expenditures							Percent Change (or Dif- ference) 1997-2003
	1997	1998	1999	2000	2001	2002	2003	
Ohio: 333 Machinery Industry Total	\$640.2	\$774.1	\$509.3	\$586.8	\$455.1	n.a.	\$268.5	-58.1%
3331: Agricultural, Construction & Mining Mchnry.	\$43.5	\$44.5	\$24.5	\$20.9	\$17.1	n.a.	\$13.2	-69.7%
3332: Industrial Mchnry.	\$65.6	\$83.0	\$61.2	\$67.5	\$45.0	n.a.	\$36.6	-44.1%
3333: Commercial & Service Industry Mchnry.	\$46.0	\$73.5	\$30.8	\$50.9	\$93.4	n.a.	\$16.9	-63.2%
3334: VHAC & Commercial Refrigeration Eqpt.	\$57.1	\$68.4	\$76.2	\$108.9	\$50.5	n.a.	\$27.0	-52.7%
3335: Metalworking Mchnry.	\$213.0	\$263.5	\$141.9	\$143.7	\$92.4	n.a.	\$49.1	-76.9%
3336: Engine, Turbine & Transmission Eqpt.	\$41.8	\$33.2	\$27.5	\$18.4	\$15.6	n.a.	\$41.7	-0.3%
3339: Other General Purpose Mchnry.	\$173.2	\$208.0	\$147.2	\$176.4	\$141.2	n.a.	\$83.9	-51.5%
U.S.: 333 Machinery Industry Total	\$8,835.7	\$9,527.6	\$9,298.4	\$9,267.4	\$8,322.2	n.a.	\$5,385.2	-39.1%
3331: Agricultural, Construction & Mining Mchnry.	\$1,478.0	\$1,500.9	\$1,255.9	\$1,204.9	\$1,145.3	n.a.	\$867.7	-41.3%
3332: Industrial Mchnry.	\$1,439.7	\$1,607.2	\$1,385.7	\$1,522.4	\$1,427.6	n.a.	\$711.9	-50.6%
3333: Commercial & Service Industry Mchnry.	\$852.6	\$815.7	\$779.2	\$803.1	\$945.1	n.a.	\$504.6	-40.8%
3334: VHAC & Commercial Refrigeration Eqpt.	\$780.4	\$1,048.3	\$1,078.8	\$1,073.7	\$1,004.1	n.a.	\$468.2	-40.0%
3335: Metalworking Mchnry.	\$1,464.4	\$1,596.4	\$1,592.1	\$1,477.9	\$1,002.5	n.a.	\$695.5	-52.5%
3336: Engine, Turbine & Transmission Eqpt.	\$1,056.4	\$1,192.3	\$1,348.0	\$1,392.5	\$1,232.8	n.a.	\$964.6	-8.7%
3339: Other General Purpose Mchnry.	\$1,764.2	\$1,766.7	\$1,858.7	\$1,792.9	\$1,564.8	n.a.	\$1,172.7	-33.5%
Ohio as Percentage of U.S.: 333 Machinery Industry Total	7.2%	8.1%	5.5%	6.3%	5.5%	n.a.	5.0%	-2.3%
3331: Agricultural, Construction & Mining Mchnry.	2.9%	3.0%	1.9%	1.7%	1.5%	n.a.	1.5%	-1.4%
3332: Industrial Mchnry.	4.6%	5.2%	4.4%	4.4%	3.1%	n.a.	5.1%	0.6%
3333: Commercial & Service Industry Mchnry.	5.4%	9.0%	4.0%	6.3%	9.9%	n.a.	3.3%	-2.0%
3334: VHAC & Commercial Refrigeration Eqpt.	7.3%	6.5%	7.1%	10.1%	5.0%	n.a.	5.8%	-1.5%
3335: Metalworking Mchnry.	14.5%	16.5%	8.9%	9.7%	9.2%	n.a.	7.1%	-7.5%
3336: Engine, Turbine & Transmission Eqpt.	4.0%	2.8%	2.0%	1.3%	1.3%	n.a.	4.3%	0.4%
3339: Other General Purpose Mchnry.	9.8%	11.8%	7.9%	9.8%	9.0%	n.a.	7.2%	-2.7%

Note: n.a. - not available.

Source: U.S. Bureau of the Census (2003a, 2005a).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 6/05).

**TABLE A12: INDEX VALUE OF THE DOLLAR, AND IMPORTS AND EXPORTS OF SELECTED MACHINERY, 1995-2003**  
(in millions of current dollars)

Subject	1995	1996	1997	1998	1999	2000	2001	2002	2003
Index Value of the Dollar	92.52	97.40	104.44	116.48	116.87	119.44	125.91	126.75	119.28
Exports summary:	\$64,729	\$69,805	\$81,503	\$77,593	\$73,860	\$84,810	\$77,925	\$72,498	\$73,244
Oil drilling, mining & construction	\$11,498	\$12,671	\$15,936	\$15,913	\$11,965	\$12,598	\$14,057	\$12,893	\$12,834
Industrial engines, pumps & compressors	\$9,504	\$9,593	\$11,724	\$10,919	\$10,992	\$11,602	\$11,992	\$11,601	\$11,690
Machine tools & metalworking machinery	\$5,241	\$5,799	\$6,503	\$6,274	\$6,208	\$7,468	\$5,816	\$5,174	\$5,253
Other industrial, agricultural & service machinery	\$38,486	\$41,742	\$47,340	\$44,487	\$44,695	\$53,142	\$46,060	\$42,830	\$43,467
Imports summary	\$55,151	\$57,377	\$63,133	\$69,045	\$69,305	\$76,914	\$71,575	\$69,529	\$75,098
Oil drilling, mining & construction	\$4,993	\$5,143	\$6,325	\$7,960	\$6,984	\$7,166	\$6,901	\$6,573	\$7,823
Industrial engines, pumps & compressors	\$5,798	\$5,863	\$6,088	\$6,817	\$7,715	\$9,453	\$9,780	\$9,034	\$9,210
Machine tools & metalworking machinery	\$6,718	\$7,569	\$8,315	\$8,892	\$7,757	\$8,659	\$7,416	\$5,943	\$6,193
Other industrial, agricultural & service machinery	\$37,642	\$38,802	\$42,405	\$45,376	\$46,849	\$51,636	\$47,478	\$47,979	\$51,872
Balance of trade:	\$9,578	\$12,428	\$18,370	\$8,548	\$4,555	\$7,896	\$6,350	\$2,969	-\$1,854
Oil drilling, mining & construction	\$6,505	\$7,528	\$9,611	\$7,953	\$4,981	\$5,432	\$7,156	\$6,320	\$5,011
Industrial engines, pumps & compressors	\$3,706	\$3,730	\$5,636	\$4,102	\$3,277	\$2,149	\$2,212	\$2,567	\$2,480
Machine tools & metalworking machinery	-\$1,477	-\$1,770	-\$1,812	-\$2,618	-\$1,549	-\$1,191	-\$1,600	-\$769	-\$940
Other industrial, agricultural & service machinery	\$844	\$2,940	\$4,935	-\$889	-\$2,154	\$1,506	-\$1,418	-\$5,149	-\$8,405
Exports as a percentage of imports:	117.4%	121.7%	129.1%	112.4%	106.6%	110.3%	108.9%	104.3%	97.5%
Oil drilling, mining & construction	230.3%	246.4%	252.0%	199.9%	171.3%	175.8%	203.7%	196.2%	164.1%
Industrial engines, pumps & compressors	163.9%	163.6%	192.6%	160.2%	142.5%	122.7%	122.6%	128.4%	126.9%
Machine tools & metalworking machinery	78.0%	76.6%	78.2%	70.6%	80.0%	86.2%	78.4%	87.1%	84.8%
Other industrial, agricultural & service machinery	102.2%	107.6%	111.6%	98.0%	95.4%	102.9%	97.0%	89.3%	83.8%

Sources: Federal Reserve Board (1999-2005); U.S. Bureau of Economic Analysis (2004: 90 & 92).

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**Table A13: Projections for Machinery Industry Employment by Group, Ohio and the U.S.: 2002-2012**

NAICS Code	Shorter Industry Title	Jobs		Changes: 2002-2012	
		Actual 2002	Projected 2012	Number	Percent
Ohio	Total	5,813,800	6,376,100	562,300	9.7%
31-33	Manufacturing	884,100	842,700	-41,400	-4.7%
333	Machinery Mfg.	89,100	89,700	600	0.7%
3331 & 3336	Subtotal: Agricultural, Construction & Mining plus Engine, Turbine & Transmission Eqpt.*	10,600	8,900	-1,700	-16.0%
3332	Industrial Mchnry.	9,600	8,200	-1,400	-14.6%
3333	Commercial & Service Industry Mchnry.	7,100	6,700	-400	-5.6%
3334	VHAC & Commercial Refrigeration Eqpt.	8,800	9,000	200	2.3%
3335	Metalworking Mchnry.	27,100	27,900	800	3.0%
3339	Other General Purpose Mchnry.	25,900	29,000	3,100	12.0%
U.S.	Total Non-agricultural Wage & Salary Employment	144,014,000	165,319,000	21,305,000	14.8%
31-33	Manufacturing	15,307,000	15,149,000	-158,000	-1.0%
333	Machinery Mfg.	1,237,000	1,357,000	120,000	9.7%
3331	Agricultural, Construction & Mining Mchnry.	201,000	212,000	11,000	5.5%
3332	Industrial Mchnry.	132,000	125,000	-7,000	-5.3%
3333	Commercial & Service Industry Mchnry.	132,000	141,000	9,000	6.8%
3334	VHAC & Commercial Refrigeration Eqpt.	167,000	189,000	22,000	13.2%
3335	Metalworking Mchnry.	217,000	251,000	34,000	15.7%
3336	Engine, Turbine & Transmission Eqpt.	100,000	100,000	0	0.0%
3339	Other General Purpose Mchnry.	288,000	339,000	51,000	17.7%

Note: \* - The Bureau of Labor Market Information makes no forecasts for industries with fewer than 5,000 employees. The figures for the combined groups are remainders obtained by subtraction.

Sources: Berman (2004), ODJFS/BLMI (2004).

Prepared by: Office of Strategic Research, Ohio Dept. of Development. Telephone 614/466-2116 (DL, 5/05).

## NAICS CODE DEFINITIONS AND EXAMPLES

- 333 Machinery Manufacturing. The products of manufacturers in this major industry apply mechanical force to perform work. Machinery products are distinguished from fabricated metal products (NAICS code 332) by the use of multiple metal forming techniques and the complexity of assembly in their creation. Design is important in machinery production, and is considered part of the production process for classification purposes.
- 3331 Agricultural, Construction & Mining Machinery.
- 33311 Agricultural Implements.
- 333111 Farm Machinery & Equipment. Examples include combines, cotton gins, feed processing equipment, planters, plows, farm tractors and attachments, milking machines and poultry brooders. Commercial mowing and other turf and grounds care equipment is also included.
- 333112 Lawn & Garden Equipment. Examples include powered lawn mowers, lawn and garden tractors, tillers, yard vacuums and blowers for the home. Non-powered lawn and garden equipment is classified in fabricated metal products (332).
- 33312 Construction Machinery. Examples include surface mining machinery, logging equipment, backhoes, bulldozers, cranes and tractors and attachments used for construction, off-highway trucks, pile drivers, powered post hole diggers, road graders, and portable crushing, pulverizing and screening equipment.
- 33313 Mining & Oil & Gas Field Machinery.
- 333131 Mining Machinery. Examples include products for underground use such as coal breakers and cutters, core and rock drills, mining cars and stationary rock crushers. Underground locomotives are classified as transportation equipment (336).
- 333132 Oil & Gas Field Machinery. Examples include derricks, drilling and production machinery. Water well drilling machinery is also included. Offshore and floating drilling platforms are classified as transportation equipment (336).
- 3332 Industrial Machinery.
- 33321 Sawmill & Woodworking Machinery. Examples include circular and band saws, planers and sanders. The distinguishing characteristic is that none of these is hand-held. Hand-held, non-powered equipment is classified in fabricated metals (332).
- 33322 Plastics & Rubber Industry Machinery. Examples include compression, extrusion and injection molding machines for plastics, and tire building and recapping machinery and equipment. Excluded are industrial metal molds for rubber and plastic products.
- 33329 Other Industrial Machinery.

- 333291 Paper Industry Machinery. Examples include pulp making machinery, and paper and paperboard making and converting machinery.
- 333292 Textile Machinery. Examples include drawing, extruding, finishing, knitting, spinning, texturizing and weaving machinery.
- 333293 Printing Machinery & Equipment. Examples include printing presses, typesetting and bindery machinery. Textile printing machinery is classified as textile machinery. Photographic and photocopying machinery and equipment are excluded.
- 333294 Food Products Machinery. Examples include homogenizers, pasteurizers, ice cream freezers, dough mixers, bakery ovens, pastry rolling machines, slicers, choppers, meat and poultry preparation and processing machines – all for commercial or industrial use. Commercial cooking and food warming equipment is excluded.
- 333295 Semiconductor Machinery. Also included are wafer processing and semi-conductor assembly and packaging. Printed circuit board machinery is excluded. Semiconductor testing instruments are classified as computer and electronic products (334).
- 333298 All Other Industrial Machinery. Examples include machinery and equipment for tanneries, petroleum refining, chemical processing, insulating wires and cables, and making cigarettes, circuit boards, glass, light bulbs and tubes, sewing machines and shoes (and their repair). Also included are cement, chemical and wood kilns.
- 3333 Commercial & Service Industry Machinery.
- 333311 Automatic Vending Machines. Examples include coin-operated mechanisms for vending machines, lockers, and laundry machines, and vending machines operated by tokens, paper currency, or magnetic cards. Arcade games are miscellaneous products (339).
- 333312 Commercial Laundry Equipment. Also included are dry-cleaning and pressing machines. Machines and equipment for household use are classified as appliances (335).
- 333313 Office Machinery. Examples include calculators, typewriters, dedicated word processing equipment and mail-handling machinery. Computers and peripheral equipment, facsimile machines, time clocks and associated stamps and automatic tellers are classified as computer and electronic products (334). Pencil sharpeners, staplers and staple removers, hand paper punches, cutters, trimmers, and other hand office equipment are classified as miscellaneous products (339).
- 333314 Optical Instruments & Lenses. Examples include binoculars, telescopes, microscopes, photographic lenses, prisms, and machinery and equipment for polishing, coating, and mounting lenses. Plastic lens blanks are considered plastic products (3261), and glass lens blanks are a non-metallic mineral product (327). Ophthalmic focus lenses are miscellaneous products (339). Electron and proton microscopes are classified as

- computer and electronic products (334).
- 333315 Photographic & Photocopying Equipment. Examples include microfilm equipment, photocopiers, and cameras using photographic film. However, the film, paper, cloth, plates and chemicals used in photography part of chemical manufacturing. Television, video, and digital cameras are part of computer and electronic products (334).
- 333319 Other Commercial & Service Machinery. Examples include carnival and amusement park rides, car-washing machinery, commercial coffee makers, commercial cooking equipment, industrial and commercial vacuum cleaners, carpet sweepers, motor vehicle alignment equipment, power washer cleaning equipment, and water treatment equipment.
- 3334 Ventilation, Heating, Air-conditioning (VHAC) & Commercial Refrigeration Equipment.
- 333411 Air Purification Equipment. Examples include stationary equipment for industrial dust and fume collection, electrostatic precipitation, air washers and warm air furnace filters. Portable air purification equipment is classified a household appliances (335).
- 333412 Industrial & Commercial Fans & Blowers. Examples include attic, ventilation and exhaust fans. Other than attics, household fans are considered household appliances (335).
- 333414 Heating Equipment. (Exc. Warm Air Furnaces). Examples include boilers, stoves, floor and wall furnaces, and wall and baseboard units. Electric space heaters and household stoves and ranges are classified as household appliances (335). Industrial, power and marine boilers are fabricated metal products (332). Commercial cooking equipment and industrial process furnaces and ovens classified elsewhere.
- 333415 AC, Warm Air Furnaces, & Refrigeration Equipment. Examples include AC units and their compressors and condensers, humidifiers and dehumidifiers, heat pumps, refrigerated counter and display cases, refrigerated drinking fountains, soda fountain cooling and dispensing equipment, and snow making machines. Motor vehicle AC systems and condensers are classified as transportation equipment (336). Household refrigerators and freezers are household appliances (335), as are portable humidifiers and dehumidifiers.
- 3335 Metalworking Machinery.
- 333511 Industrial Molds. All molds for casting materials such as plastics, glass, rubber and metals are classified herein, except for steel ingots.
- 333512 Machine Tools, Metal Cutting Type. Examples include grinders, lathes, and machines for boring, drilling, buffing, polishing and milling. Accessories and power-driven hand tools are classified elsewhere.
- 333513 Machine Tools, Metal Forming Type. Examples include punches and presses, and machines for sheering, bending, forming, forging and die-casting. Accessories, rolling mill machinery, and power-driven hand tools are classified elsewhere.

- 333514 Special Dies, Tools, Jigs & Fixtures. A jig is a guide or template for tools. The general difference between a die and a mold is that the former shapes solids and highly viscous material, while the latter shapes liquids that solidify.
- 333515 Machine Tool Accessories. Examples include knives and bits for lathes, drill bits, measuring attachments, tools to cut internal threads on pipes and nuts, etc. Saw blades and handsaws are classified as fabricated metal products (332).
- 333516 Rolling Mill Machinery. Rolling mills reduce or change the cross-sectional area of a metal slab by the compressive force of rotating rolls. The process is similar to squeezing clothes through the wringers of an old fashion washing machine.
- 333518 Other Metalworking Machinery. Examples include assembly machines, wire making machinery and equipment, and coil-winding and cutting machinery.
- 3336 Engine, Turbine & Transmission Equipment.
- 333611 Turbines & Turbine Generator Sets. Generators are classified as electrical equipment, and aircraft turbines are classified as transportation equipment (336).
- 333612 Speed Changers, Drives & Gears. Power transmission equipment for motor vehicles and aircraft is classified as transportation equipment (336). Hydrostatic drives are classified elsewhere.
- 333613 Mechanical Power Transmission Equipment. Examples include hydrostatic drives, plain bearings, couplings, joints and drive chains. Brakes and clutches, except for motor vehicles and electromagnetic industrial controls, are also included. Power transmission equipment for motor vehicles and aircraft is classified as transportation equipment (336).
- 333618 Other Engine Equipment. Establishments in this industry manufacture internal combustion engines, except those used for aircraft and gasoline powered automobiles. Diesel engines for motor vehicles are included.
- 3339 Other General Purpose Machinery.
- 33391 Pumps & Compressors.
- 333911 Pumps & Pumping Equipment. A variety of pumps are included: reciprocating, turbine, centrifugal, rotary, diaphragm. Pumps for domestic water systems, oil wells and oil fields, and sump pumps are also included. Pumps for motor vehicles – oil, water, power steering, etc. – are classified as transportation equipment (336). Measuring and dispensing pumps, vacuum pumps, and fluid power pumps and motors are classified elsewhere.
- 333912 Air & Gas Compressors. A variety of compressors are included: reciprocating, centrifugal, nonagricultural spraying and dusting, and spray gun units. Vacuum pumps are included, except those for laboratories. Laboratory pumps are classified in miscellaneous manufacturing (339). AC pumps and compressors are

classified elsewhere.

- 333913 Measuring & Dispensing Pumps. Examples include those for gasoline and lubricating oil.
- 33392 Material Handling Equipment.
- 333921 Elevators & Moving Stairways. Examples include garage and service station automobile lifts, dumbwaiters, escalators, moving walkways, and passenger and freight elevators.
- 333922 Conveyors & Conveying Equipment. Examples include a variety of types: belt, carousel, gravity, tow and trolley. Conveyors used on farms are included, as are pneumatic tubes.
- 333923 Hoists, Cranes & Monorails. Examples include aerial work platforms, tow truck hoists, block and tackle, metal pulleys (except for power transmission), and winches. Construction cranes, aircraft loading hoists, and power transmission pulleys are classified elsewhere.
- 333924 Industrial Trucks, Tractors, Trailers, Stackers. Examples include aircraft loading hoists, forklifts, pallet loaders and un-loaders, and portable loading docks. Construction and farm tractors are classified elsewhere. Motor vehicle trailers are classified as transportation equipment (336).
- 33399 All Other General Purpose Machinery.
- 333991 Power-Driven Hand Tools. Examples include drills, screw-guns, circular saws, chain saws, staplers, and nailers, whether electrically or pneumatically powered. Hand tools used only in construction such as tampers, jackhammers and augers, are classified elsewhere. Un-powered woodcutting tools are classified as fabricated metal products (332).
- 333992 Welding & Soldering Equipment. A variety of types are included: arc, gas, electron beam, laser, plasma, resistance and ultrasonic. The electrodes and wires for welding are also included, but handheld soldering equipment and transformers for arc welders are excluded.
- 333993 Packaging Machinery. Examples include machines for bottling, canning, labeling and wrapping.
- 333994 Industrial Furnaces & Ovens. Also included are induction and dielectric heating equipment and some kilns. Bakery and cremating ovens are classified elsewhere, as are cement, chemical and wood kilns.
- 333995 Fluid Power Cylinders & Actuators. The two types of fluid power are hydraulic and pneumatic.
- 333996 Fluid Power Pumps & Motors. The two types of fluid power are hydraulic and pneumatic.
- 333997 Scales & Balances (Exc. Laboratory). Laboratory scales and balances are classified as miscellaneous manufactures (339).
- 333999 Miscellaneous General Purpose Machinery. Examples include automatic fire sprinklers, baling machines, bridge and gate lifting machines, cremating ovens, hydraulic and pneumatic jacks, industrial centrifuges, and sieves and screening equipment.

## NOTES

- 1 Power transmission in this industry excludes electricity and motor vehicle transmissions.
- 2 Notable is not used as an evaluative term. It refers only to company size in two ways: being named on either of Fortune's lists, or employing at least 500 people in Ohio. The 45 companies include some not listed in the text – specifically those having less than 50 employees at a site. The employment totals for the companies named also include those sites with less than 50 people whether or not the company is on either of Fortune's lists. General Motors is included because it has an interest in the DMAX facility, but Isuzu is the more active partner in operating DMAX. The Montgomery County facility makes diesel engines for motor vehicles. However, NAICS classifies all diesel engines as machinery because most are made for other uses. This also explains why DaimlerChrysler's Detroit Diesel Remanufacturing is on the list.
- 3 U.S. GSP is the sum of the GSPs for the 50 states and the District of Columbia. It is very close to, but not identical with, the GDP due to some minor technical differences. Figures in this section have not been adjusted for inflation.
- 4 Value-added (VA) and GSP data are closely related. In fact, compiling VA data is one step in the process of calculating GSP. VA figures, roughly the difference between the value of shipments and the costs of labor and material, are larger than GSP figures because additional costs have not been excluded from the former (e.g., the cost of services purchased by the manufacturing establishment). While VA and GSP are not identical, comparing portions of the national industry groups originating in Ohio is still instructive. If a state's proportion of U.S. industry group's VA is greater than the state's proportion of U.S. GSP, then the industry group is most likely concentrated in the state.
- 5 The 671 figure includes 471 in Siemens' joint ventures with Kohlberg, Kravis, Roberts & Co. In fact, Siemens' stake in the joint ventures is only 20 percent.
- 6 The switch from the Standard Industrial Classification (SIC) to the North American Industry Classification System (NAICS) beginning in 1997 created a discontinuity that prevents longer-term analysis.
- 7 Categories used in the graph and supporting table may not be based on NAICS. They were included only because they were close to NAICS industry group titles. Import and export data are available for earlier years, but the index value of the dollar shown in the graph and table dates to 1995 (Federal Reserve Board, 1999; U.S. Bureau of Economic Analysis, 2004).

- 8 The writers cite additional factors that they believe have given China the largest trade surplus with the U.S. of any single nation (see Crutsinger, 2005; U.S. Bureau of Economic Analysis, 2004: 88). These include the sheer size of the population, which provides a large home market allowing businesses economies of scale as well as the human resources for occupations requiring a variety of skills, and the country's openness to foreign investment, which permits companies to establish operations serving the Chinese market and producing goods for export to other countries. The writers also suggest possible remedies for the trade imbalance: allowing the yuan to strengthen, getting Americans to save more, reducing the budget deficit, aggressively enforcing trade laws, and doing a better job of defending intellectual property, and possibly reopening the deal allowing China into the World Trade Organization (WTO rules forbid currency manipulation). The writers do not believe correcting the trade imbalance will be easy. They also recognize that low cost imports, including machinery, are a boon to American customers (Business Week, 2004).
- 9 The general overview is based on McGraw-Hill (2000) and supplemented by analysts cited.
- 10 Farm subsidies, price supports, and set-asides are various financial arrangements intended to stabilize prices and, therefore, farm income. Stable farm income should lead to a stable demand for farm machinery and equipment. However, Fiore (2005) argues that they have the unintended effect of exacerbating supply-demand imbalances by encouraging farmers to plant more crops despite low prices, ultimately increasing the likelihood of low prices and weak long-term income growth. He also says that government regulations may have little impact on farmers. For example, farmers may pay for required less-polluting-but-more-expensive engines with government funds.
- 11 Maintenance and repair work helps smooth-out the ups and downs of cyclical industries.
- 12 It is ironic that various technical advances have not only made machinery longer lasting but, in conjunction with heightened competition, have made product life cycles shorter.
- 13 Hingher's (2005) concept of industrial machinery is broader than that conveyed by NAICS 3332. It includes pumps, valves and compressors for controlling the flow of gases and liquids. Flow control has lots of applications, including mechanical power transmission in machinery for construction, agriculture, metalworking, material handling and assembly. Pumps and valves also are part of VHAC and commercial refrigeration equipment. Flow control is also important for machinery not classified in 333 such as transportation equipment and home appliances.

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