

Enabling Technologies That Transform Our World

At MKS, we have a long history of leveraging our collective curiosity to understand and develop solutions that are at the core of many key technological innovations. These innovations have driven accelerated roadmaps for semiconductor manufacturing, electronics and packaging, and specialty industrial applications.

Our mission is to be the innovation leader and trusted partner that pushes the boundaries of possibility.

To Our Shareholders

MKS' performance in 2023 highlighted the resilience of our business through a soft demand environment for products where we play a foundational role, including memory chips and other critical electronic components that enable advanced electronic devices, such as PCs, smartphones and servers. MKS is structured to manage through cycles with a broad portfolio of differentiated, proprietary solutions that offer attractive profit margins, and a culture of prudent cost control.

2023 also marked our first full year operating with Atotech. Atotech's industry-leading chemistry and plating equipment solutions augment our broad range of leading technologies, uniquely position us within the Electronics & Packaging market, and provide us with a higher mix of more stable consumables and services revenue. We are on track to achieve our target post-acquisition cost synergies and have increased engagement with combined customers of MKS and Atotech on next-generation designs for advanced package substrates, a critical enabler for new applications, such as artificial intelligence. We remain excited about revenue opportunities that leverage Atotech's business within our broader portfolio.

With most industry observers expecting a recovery in our end markets to slowly unfold in the second half of 2024, we believe MKS is prepared to capture exciting new opportunities. We have continued to invest in our business, strengthening our position as a critical enabler of advanced electronics with our foundational solutions for the Semiconductor and Electronics & Packaging markets. Our leading applications within our Specialty Industrial portfolio extend our reach into additional markets and generate attractive cash flow for our business.

Of course, our strategic positioning must be complemented by strong business execution. In 2023, we delivered on our innovation roadmaps, controlled costs, managed our balance sheet, and secured design wins with key customers, all of which are critical to generating attractive growth and value creation in the years ahead. It is worth noting that we achieved these goals despite the ransomware incident we experienced in early 2023. I am both humbled by and grateful for the way our global team rallied to contain this issue, communicated transparently with customers and successfully restored normal business operations.

The strength of our team and culture is a running theme at MKS, and recently this was reflected in industry accolades we received, such as being named to *US News and World Report's* inaugural "Best Companies to Work for in the Industrials and Business Services Industry" list, as well as being named by *Newsweek* and Statista as one of "America's Most Responsible Companies for 2024."

We are excited to continue to deliver innovations that are foundational to the next generation of advanced electronic devices. We appreciate the continued support of our customers, who rely on MKS to solve their toughest challenges, our shareholders, who have placed their trust in MKS to deliver value creation, and our employees, who work relentlessly to deliver on the MKS promise.

In 2023, we delivered on our innovation roadmaps, controlled costs, managed our balance sheet, and secured design wins with key customers, all of which are critical to generating attractive growth and value creation in the years ahead.



John T.C. Lee
President and Chief Executive Officer



Madhuri A. Andrews
EVP and CIO



Seth H. Bagshaw
EVP, CFO and Treasurer



Sally Ann Bouley
EVP and CHRO



Kathleen F. Burke
EVP, General Counsel
and Secretary



Henry C. Chang
SVP and GM, Asia



Mark M. Gitin
EVP and GM,
Photonics Solutions Division



David P. Henry
EVP, Operations and
Corporate Marketing



James A. Schreiner
EVP and COO,
Materials Solutions Division



Eric R. Taranto
EVP and GM,
Vacuum Solutions Division

Cautionary Statement Regarding Forward-Looking Statements

This Annual Report contains “forward-looking statements” within the meaning of the Private Securities Litigation Reform Act of 1995, Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934 regarding the future financial performance, business prospects and growth of MKS Instruments, Inc. (“MKS,” the “Company,” “our,” or “we”). These statements are only predictions based on current assumptions and expectations. Any statements that are not statements of historical fact (including statements containing the words “will,” “projects,” “intends,” “believes,” “plans,” “anticipates,” “expects,” “estimates,” “forecasts,” “continues” and similar expressions) should be considered to be forward-looking statements. Actual events or results may differ materially from those in the forward-looking statements set forth herein. Among the important factors that could cause actual events to differ materially from those in the forward-looking statements that we make are the need to generate sufficient cash flows to service and repay the substantial indebtedness we incurred in connection with our acquisition of Atotech Limited (“Atotech” and such transaction, the “Atotech Acquisition”), which we completed in August 2022; the terms of our existing credit facilities under which we incurred such debt; our entry into the chemicals technology business through the Atotech Acquisition, in which we did not have previous experience and which may expose us to significant additional liabilities; the risk that we are unable to integrate the Atotech Acquisition successfully or realize the anticipated synergies, cost savings and other benefits of the Atotech Acquisition; legal, reputational, financial and contractual risks resulting from the ransomware incident we identified in February 2023, and other risks related to cybersecurity, data privacy and intellectual property; competition from larger, more advanced or more established companies in our markets; the ability to successfully grow our business, including through growth of the Atotech business and growth of the Electro Scientific Industries, Inc. business, which we acquired in February 2019, and financial risks associated with those and potential future acquisitions, including goodwill and intangible asset impairments; manufacturing and sourcing risks, including those associated with limited and sole source suppliers and the impact and duration of supply chain disruptions, component shortages, and price increases; changes in global demand; the impact of a pandemic or other widespread health crisis; risks associated with doing business internationally, including geopolitical conflicts, such as the conflict in the Middle East, trade compliance, regulatory restrictions on our products, components or markets, particularly the semiconductor market, and unfavorable currency exchange and tax rate fluctuations, which risks become more significant as we grow our business internationally and in China specifically; conditions affecting the markets in which we operate, including fluctuations in capital spending in the semiconductor, electronics manufacturing and automotive industries, and fluctuations in sales to our major customers; disruptions or delays from third-party service providers upon which our operations may rely; the ability to anticipate and meet customer demand; the challenges, risks and costs involved with integrating or transitioning global operations of the companies we have acquired; risks associated with the attraction and retention of key personnel; potential fluctuations in quarterly results; dependence on new product development; rapid technological and market change; acquisition strategy; volatility of stock price; risks associated with chemical manufacturing and environmental regulation compliance; risks related to defective products; financial and legal risk management; and the other important factors described in Part I, Item 1A of the Form 10-K for the year ended December 31, 2023 included in this Annual Report. We are under no obligation to, and expressly disclaim any obligation to, update or alter these forward-looking statements, whether as a result of new information, future events or otherwise, even if subsequent events cause our views to change.

**UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549
FORM 10-K**

(MARK ONE)

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 2023

Or

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the transition period from _____ to _____

Commission File number 0-23621

MKS INSTRUMENTS, INC.

(Exact Name of Registrant as Specified in Its Charter)

Massachusetts
*(State or other Jurisdiction of
Incorporation or Organization)*

2 Tech Drive, Suite 201, Andover, Massachusetts
(Address of Principal Executive Offices)

04-2277512
*(I.R.S. Employer
Identification No.)*

01810
(Zip Code)

(978) 645-5500

(Registrant's Telephone Number, including area code)

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, no par value	MKSI	Nasdaq Global Select Market

Securities registered pursuant to Section 12(g) of the Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer Accelerated filer Emerging growth company
Non-accelerated filer Smaller reporting company

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report.

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements.

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b).

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes No

Aggregate market value of the voting and non-voting common equity held by nonaffiliates of the registrant as of June 30, 2023 based on the closing price of the registrant's common stock on such date as reported by the Nasdaq Global Select Market: \$7,227,510,869.

Number of shares outstanding of the issuer's common stock, no par value, as of February 20, 2024: 67,055,404

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the definitive Proxy Statement for our 2024 Annual Meeting of Shareholders, to be filed with the Securities and Exchange Commission no later than 120 days after the close of our fiscal year ended December 31, 2023, are incorporated by reference into Part III of this Annual Report on Form 10-K.

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SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K contains “forward-looking statements” within the meaning of the Private Securities Litigation Reform Act of 1995, Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934 regarding the future financial performance, business prospects and growth of MKS Instruments, Inc. (“MKS”, the “Company”, “our”, or “we”). These statements are only predictions based on current assumptions and expectations. Any statements that are not statements of historical fact (including statements containing the words “will,” “projects,” “intends,” “believes,” “plans,” “anticipates,” “expects,” “estimates,” “forecasts,” “continues” and similar expressions) should be considered to be forward-looking statements. Actual events or results may differ materially from those in the forward-looking statements set forth herein.

Among the important factors that could cause actual events to differ materially from those in the forward-looking statements that we make are the need to generate sufficient cash flows to service and repay the substantial indebtedness we incurred in connection with our acquisition of Atotech Limited (“Atotech” and such transaction, the “Atotech Acquisition”), which we completed in August 2022; the terms of our existing credit facilities under which we incurred such debt; our entry into the chemicals technology business through the Atotech Acquisition, in which we did not have previous experience and which may expose us to significant additional liabilities; the risk that we are unable to integrate the Atotech Acquisition successfully or realize the anticipated synergies, cost savings and other benefits of the Atotech Acquisition; legal, reputational, financial and contractual risks resulting from the ransomware incident we identified in February 2023, and other risks related to cybersecurity, data privacy and intellectual property; competition from larger, more advanced or more established companies in our markets; the ability to successfully grow our business, including through growth of the Atotech business and growth of the Electro Scientific Industries, Inc. business, which we acquired in February 2019, and financial risks associated with those and potential future acquisitions, including goodwill and intangible asset impairments; manufacturing and sourcing risks, including those associated with limited and sole source suppliers and the impact and duration of supply chain disruptions, component shortages, and price increases; changes in global demand; the impact of a pandemic or other widespread health crisis; risks associated with doing business internationally, including geopolitical conflicts, such as the conflict in the Middle East, trade compliance, regulatory restrictions on our products, components or markets, particularly the semiconductor market, and unfavorable currency exchange and tax rate fluctuations, which risks become more significant as we grow our business internationally and in China specifically; conditions affecting the markets in which we operate, including fluctuations in capital spending in the semiconductor, electronics manufacturing and automotive industries, and fluctuations in sales to our major customers; disruptions or delays from third-party service providers upon which our operations may rely; the ability to anticipate and meet customer demand; the challenges, risks and costs involved with integrating or transitioning global operations of the companies we have acquired; risks associated with the attraction and retention of key personnel; potential fluctuations in quarterly results; dependence on new product development; rapid technological and market change; acquisition strategy; volatility of stock price; risks associated with chemical manufacturing and environmental regulation compliance; risks related to defective products; financial and legal risk management; and the other important factors described in Part I, Item 1A of this Annual Report on Form 10-K. We are under no obligation to, and expressly disclaim any obligation to, update or alter these forward-looking statements, whether as a result of new information, future events or otherwise, even if subsequent events cause our views to change.

SUMMARY OF RISK FACTORS

Below is a summary of the principal factors that make an investment in MKS speculative or risky. This summary does not contain all of the information that may be important to you, and you should read the below summary in conjunction with the more detailed discussion of risks set forth under the heading “Risk Factors” in Part I, Item 1A of this Annual Report on Form 10-K.

Acquisition Risks

- *The Atotech Acquisition involves numerous risks, and we may not be able to effectively integrate Atotech's business and operations or realize the expected benefits from the acquisition, which could materially harm our operating results.*
- *As part of our business strategy, we have entered into and may continue to pursue business combinations and acquisitions that may be difficult to identify and complete, challenging and costly to integrate, disruptive to our business and our management, and/or dilutive to stockholder value.*

Financial Risks

- *Our consolidated indebtedness has increased substantially as a result of the Atotech Acquisition. This increased level of indebtedness could adversely affect us, including by increasing our interest expense and decreasing our business flexibility.*
- *The terms of our Term Loan Facility and Revolving Facility (each as defined below) impose significant financial obligations and risks upon us, limit our ability to take certain actions, and could discourage a change in control.*
- *A material amount of our assets represents goodwill and intangible assets. We incurred a net loss as a result of impairments of these assets in 2023 and our net income may be significantly reduced in subsequent periods by future impairments of these assets.*

Risks Related to Cybersecurity, Data Privacy and Intellectual Property Protection

- *We are exposed to risks related to cybersecurity and data privacy threats and incidents, such as the ransomware event we identified in February 2023, and we are subject to restrictions and changes in laws and regulations governing data privacy and data protection, any of which could have a material adverse effect on our business.*
- *Our proprietary technology is important to the continued success of our business. Our failure to protect this proprietary technology may significantly impair our competitive position.*

Risks Related to Our Operations

- *Supply chain disruptions and other manufacturing interruptions or delays have affected our ability to meet customer demand and have led to higher costs, while the failure to estimate customer demand accurately has resulted in excess or obsolete inventory, all of which has negatively impacted, and we expect will continue to impact, our business.*
- *Our dependence on sole and limited source suppliers and international suppliers has negatively impacted, and could continue to impact our ability to manufacture products and systems.*
- *Our failure to successfully manage the transition of certain of our products to other manufacturing locations, the transition of certain of our products to or from contract manufacturers and the transition of certain other functions to centralized locations would likely harm our business, financial condition and operating results.*
- *Our products could contain defects, which would increase our costs and seriously harm our business, financial condition, operating results and customer relationships.*
- *Chemical manufacturing is inherently hazardous and could result in accidents that disrupt our operations or expose us to significant losses or liabilities.*
- *We outsource a number of services to third-party service providers, which decreases our control over the performance of these functions. Disruptions or delays at our third-party service providers could adversely impact our operations.*
- *The loss of net revenues from any one of our major customers would likely have a material adverse effect on us.*
- *Key personnel have been, and may continue to be, difficult to attract and retain.*

Risks Related to Our Industries and Markets

- *The semiconductor, electronics manufacturing and automotive industries we serve are characterized by periodic fluctuations in business activity that may cause a reduction in demand for our products.*
- *Many of the markets and industries we serve are highly competitive, are subject to rapid technological advancement, and have narrow design windows, and if we fail to introduce new and innovative products or improve our existing products, or if our products or the applications we invest in do not achieve widespread adoption, our business, financial condition and operating results will be harmed.*
- *We offer products for multiple markets and must face the challenges of supporting the distinct needs of each of the markets we serve.*

Risks Related to Operating a Global Business

- *We face significant risks associated with doing business internationally.*
- *We face significant risks associated with doing increased business in China in particular.*
- *Unfavorable currency exchange rate fluctuations may lead to lower operating results or may cause us to change customer pricing, which could result in reduced sales and losses.*

Legal, Tax, Regulatory and Compliance Risks

- *We previously identified a material weakness in our internal control over financial reporting and may discover additional material weaknesses in the future. Our inability to remediate material weaknesses in the future, and our inability to achieve and maintain effective disclosure controls and procedures and internal control over financial reporting, could adversely affect our results of operations, our stock price and investor confidence in our Company.*
- *If significant trade restrictions or tariffs on our products or components that are imported from or exported to China continue or are increased, our business, financial condition and operating results may be materially harmed.*
- *We are subject to international trade compliance regulations, and violations of those regulations could result in fines or trade restrictions, which could have a material adverse effect on us.*
- *Changes in tax rates or tax regulation or the termination of tax incentives could affect our operating results.*
- *Many of our products and customers are subject to numerous laws regulating the production and use of chemical substances, and some of our products may need to be reformulated or discontinued to comply with these laws and regulations.*
- *We are subject to environmental regulations. If we fail to comply with these regulations, our business could be harmed.*
- *We are exposed to various risks related to legal proceedings, including, for example, product liability claims, intellectual property infringement claims, regulatory claims, contractual claims and class action litigation, which if successful, could have a material adverse effect on our commercial relationships, business, financial condition and operating results.*

Risks Related to Pandemics and other Widespread Health Crises

- *The effects of the COVID-19 pandemic had, and the emergence of other widespread health crises may have, an adverse effect on our business, financial condition and operating results.*

Risks Related to Owning Our Common Stock

- *Our quarterly operating results have fluctuated, and are likely to continue to vary significantly, which may result in volatility in the market price of our common stock.*
- *The market price of our common stock has fluctuated and may continue to fluctuate for reasons over which we have no control.*

PART I

Item 1. *Business*

MKS Instruments, Inc. (“MKS”, the “Company”, “our”, or “we”) was founded in 1961 as a Massachusetts corporation. We enable technologies that transform our world. We deliver foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging, and specialty industrial applications. We apply our broad science and engineering capabilities to create instruments, subsystems, systems, process control solutions and specialty chemicals technology that improve process performance, optimize productivity and enable unique innovations for many of the world's leading technology and industrial companies. Our solutions are critical to addressing the challenges of miniaturization and complexity in advanced device manufacturing by enabling increased power, speed, feature enhancement, and optimized connectivity. Our solutions are also critical to addressing ever-increasing performance requirements across a wide array of specialty industrial applications.

Where You Can Find More Information

We file reports, proxy statements and other documents with the Securities and Exchange Commission (“SEC”). Our SEC filings are available to you on the SEC’s website at <http://www.sec.gov>.

Our website is <http://www.mks.com>. We are not including the information contained in our website as part of, or incorporating it by reference into, this Annual Report on Form 10-K. We make available free of charge through our website our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K and amendments to these reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended (the “Exchange Act”), as soon as reasonably practicable after we electronically file such materials with, or furnish them to, the SEC.

Atotech Acquisition

On August 17, 2022 (the “Effective Date”), we completed the acquisition of Atotech Limited (“Atotech”), through the acquisition of the entire issued share capital of Atotech by Atotech Manufacturing, Inc., a Delaware corporation and indirect wholly owned subsidiary of the Company (the “Atotech Acquisition”).

Atotech, which we operate as our Materials Solutions Division, develops leading process and manufacturing technologies for advanced surface modification, electroless and electrolytic plating, and surface finishing. Applying a comprehensive systems-and-solutions approach, Atotech’s portfolio includes chemistry, equipment, software, and services for innovative and high-technology applications in a wide variety of end markets. Atotech further broadens the Company’s capabilities by bringing leadership in critical chemistry solutions for electronics and packaging and specialty industrial applications.

Markets and Applications

Since our inception, we have focused on satisfying the needs of our customers by establishing long-term collaborative relationships. We have a diverse base of customers across our three end-markets, semiconductor, electronics and packaging, and specialty industrial.

We have developed the following two product strategies that have been instrumental in delivering value to our customers and helping them solve their most complex problems:

- Our Surround the Wafer® offering includes a wide range of products, design and development services, system-level integration, training programs, calibration, service, and repair for our semiconductor customers. This unique combination of products and services enables our customers to solve the challenges of ultra-thin layers, new materials and complex 3D structures while maintaining quality and productivity levels. We have cultivated this strategy over the past two decades by adding critical enabling technologies to our portfolio. The Surround the Wafer offering is an update from what we previously referred to as Surround the Chamber®, given our broadened exposure in photonics solutions for lithography, metrology and inspection, which extends beyond just the vacuum chamber.
- Our Surround the Workpiece® offering includes product design and development, system-level integration, research and development, system, subsystem and component selection, and maintenance, repair and calibration services in the field of laser-based guidance and control for manufacturing processes. In connection with the Atotech Acquisition, we introduced an extension of the Surround the Workpiece offering called Optimize the Interconnect®, which refers to MKS’ combined laser drilling and chemistry solutions geared towards accelerating innovation and customers’ time-to-market in printed circuit board (“PCB”) and package substrate manufacturing.

At its core, MKS is a foundational enabler of miniaturization and complexity. We believe there are three secular trends benefiting MKS. First is the impact of a world that continues to be increasingly interconnected, driving the need for smaller, more powerful and feature-rich advanced electronic devices, which is enabled by semiconductor manufacturing, laser processing and chemistry solutions. Second is the increasing complexity of technology transitions in semiconductor, PCB and package substrate manufacturing, which leads to inflections, such as extreme vertical structures and process engineering at the atomic level, as well as increased interconnect density and smaller features. These inflections provide additional growth opportunities for MKS, as we believe we are uniquely positioned to deliver the broadest and deepest portfolio of solutions. Third is the accelerating need for laser-based precision manufacturing techniques, which are enabled by lasers, photonics, optics, precision motion control, vibration control and systems solutions.

We believe our long history and deep expertise in solving critical problems position us well to address these challenges for our customers.

Semiconductor Market

MKS is a critical solutions provider for semiconductor manufacturing. Our products are used in major semiconductor processing steps, such as deposition, etching, cleaning, lithography, metrology, and inspection. The semiconductor industry continually faces new challenges, as products become smaller, more powerful and highly mobile. Ultra-thin layers, smaller critical dimensions, new materials, 3D structures, and the ongoing need for higher yield and productivity drive the need for tighter process measurement and control, all of which MKS supports. We believe we are the broadest critical subsystem provider in the wafer fabrication equipment ecosystem and address over 85% of the market. We have characterized our broad and unique offering as Surround the Wafer to reflect the technology enablement we provide across almost every major process in semiconductor manufacturing today.

The semiconductor market is subject to rapid demand shifts, which are difficult to predict. We cannot be certain as to the timing or extent of future demand or any future softness in the semiconductor capital equipment industry. For example, due in part to these demand shifts, our semiconductor market revenue sequentially decreased 28% in 2023, but it sequentially increased 12% in 2022 and 32% in 2021.

Approximately 41%, 58%, and 62% of our net revenues for 2023, 2022, and 2021, respectively, were from sales to our semiconductor market. This decrease from 2022 to 2023 was primarily a result of the full-year impact of the Atotech Acquisition, as MSD only sells into our electronics and packaging and specialty industrial markets.

Electronics and Packaging Market

MKS is a foundational solutions provider for the electronics and packaging market. Our portfolio includes photonics components, laser drilling systems, electronics chemistries and plating equipment that are critical for the manufacturing of PCBs and package substrates, and critical to wafer level packaging (“WLP”) applications. Similar to the semiconductor industry, the PCB, package substrate and WLP industries increasingly demand smaller features, greater density, and better performance. In addition, the electronics and packaging market also includes sales of our vacuum and photonics solutions for display manufacturing applications. We characterize our complementary offering of laser systems and chemistry solutions as Optimize the Interconnect, to reflect the unique technology enablement we provide at the interconnect level within PCBs, package substrates and WLPs.

Approximately 25%, 15%, and 12% of our net revenues for 2023, 2022, and 2021, respectively, were from sales to our electronics and packaging market.

Specialty Industrial Market

MKS’ strategy in specialty industrial is to leverage our domain expertise and proprietary technologies across a broad array of applications in industrial technologies, life and health sciences, and research and defense markets.

Industrial Technologies

Industrial technologies encompasses a wide range of diverse applications, including chemistries for functional coatings, surface finishing and wear resistance in the automobile industry, vacuum solutions for synthetic diamond manufacturing and photonics for solar manufacturing. Other applications include vacuum and photonics solutions for light emitting diode and laser diode manufacturing.

Life and Health Sciences

Our products for life and health sciences are used in a diverse array of applications, including bioimaging, medical instrument sterilization, medical device manufacturing, analytical, diagnostic and surgical instrumentation, consumable medical supply manufacturing and pharmaceutical production.

Research and Defense

Our products for research and defense are sold to government, university and industrial laboratories for applications involving research and development in materials science, physical chemistry, photonics, optics and electronics materials. Our products are also sold for monitoring and defense applications including surveillance, imaging and infrastructure protection.

Approximately 34%, 27%, and 26% of our net revenues for 2023, 2022, and 2021, respectively, were from sales to our specialty industrial market.

International Markets

A significant portion of our net revenues is from sales to customers in international markets. For 2023, 2022, and 2021, international net revenues accounted for approximately 66%, 58%, and 57%, respectively, of our total net revenues. A significant portion of our international net revenues were from sales to customers in China, Germany, Japan and South Korea. We expect that international revenues will continue to account for a significant percentage of total net revenues for the foreseeable future. Long-lived assets located outside of the United States accounted for approximately 58% and 57% of our total long-lived assets in 2023 and 2022, respectively. Long-lived assets include property, plant and equipment, net, right-of-use assets, and certain other assets.

Reportable Segments, and Product and Service Offerings

We are divided into three divisions: the Vacuum Solutions Division (“VSD”), the Photonics Solutions Division (“PSD”) and the Materials Solutions Division (“MSD”). MSD represents the Atotech business and was established following the Atotech Acquisition. We group our product offerings by our reportable segments: VSD, PSD and MSD. Global Service represents our service offerings and consists of total services for all three of our reportable segments.

VSD delivers foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging and specialty industrial applications. VSD products are derived from our core competencies in pressure measurement and control, flow measurement and control, gas and vapor delivery, gas composition analysis, electronic control technology, reactive gas generation and delivery, power generation and delivery and vacuum technology. Its products include:

- *Pressure and Vacuum Control Solutions Products*, which consist of direct and indirect pressure measurement.
- *Materials Delivery Solutions Products*, which include flow and valve technologies as well as integrated pressure measurement and control subsystems, which provide customers with precise control capabilities.
- *Power Solutions Products*, which consist of microwave and radio frequency power delivery systems, radio frequency matching networks and metrology products. Our power delivery solutions are used to provide energy to various etching, stripping and deposition processes.
- *Plasma and Reactive Gas Products*, which consist of remote plasma and ozone generators that create reactive species. A reactive gas is used to facilitate various chemical reactions in the processing of thin films, including the deposition of films, etching and cleaning of films and surface modifications.

PSD provides a broad range of instruments, components and subsystems to leading edge semiconductor manufacturing, electronics and packaging and specialty industrial applications. PSD products are derived from our core competencies in lasers, photonics, optics, temperature sensing, precision motion control and vibration control. Its products include:

- *Laser Products*, which consist of continuous wave and pulsed nanosecond and ultrafast lasers based on diode, diode-pumped solid-state and fiber laser technologies.
- *Photonics Products*, which include precision motion control, optical tables and vibration isolation systems, photonic instruments, high-performance optics and optical assemblies, opto-mechanical components, temperature-sensing products for wafer fabrication systems, laser and LED measurement products, including laser power and energy meters and laser beam profilers and complex optical and photonic subsystems.

- *Laser-based systems for PCB manufacturing*, which include flexible interconnect PCB processing systems and high-density interconnect (“HDI”) solutions for the creation of blind micro-vias necessary for the manufacturing of PCBs (flexible, rigid-flexible, multilayer, HDI) and package substrates.

MSD develops leading process and manufacturing technologies for advanced surface modification, electroless and electrolytic plating, and surface finishing. Applying a comprehensive systems-and-solutions approach, MSD's portfolio includes chemistry, equipment, software, and services for innovative and high-technology applications in our electronics and packaging and specialty industrial markets. Its products include:

- *Advanced chemical processes, production equipment and software solutions*, for the manufacturing of PCBs, package substrates and wafers used in smartphones, computers, other consumer electronics, server and data centers, automotive electronics, and the medical and industrial industries.
- *Advanced chemical processes and production equipment for decorative and functional surface finishing*, which include decorative, corrosion-protective, and wear-resistant coatings for various end markets, such as automotive, construction, energy, household appliance and heavy machinery.
- *Advanced chemical processes for paint support applications*, including pretreatment, stripping and overspray treatment for various end markets such as automotive, construction, aviation, heavy machinery and household appliance.

For further information on our segments, see Note 22 to the Notes to Consolidated Financial Statements contained in Part II, Item 8 of this Annual Report on Form 10-K.

Global Service includes:

- Installation services and training for many of our products.
- On-site services for maintenance and repair of equipment and critical subsystems.
- Technical support offices and technology centers located near many of our customers’ facilities.
- Repair and calibration services at internal service depots and authorized service providers located worldwide.
- Warranties on our products that typically range from one to three years, with the majority of the warranties on our products ranging from one to two years. We typically provide warranties on our repair services for periods ranging from 90 days to up to one year, depending upon the type of repair. We also offer extended warranties on our products ranging from one to five years.

Customers

We sell our products and services to thousands of customers worldwide, in a wide range of end markets. Net revenues from our top ten customers accounted for 30%, 42% and 46% of net revenues for 2023, 2022 and 2021, respectively. None of our customers in 2023 accounted for greater than 10% of net revenues.

Sales and Marketing

Our worldwide sales and marketing organizations are also critical to our strategy of maintaining close relationships with a wide array of customers across a diverse set of advanced applications, including semiconductor capital equipment manufacturers, semiconductor device manufacturers, PCB and package substrate manufacturers, and customers across a range of specialty industrial applications. We market and sell our products and services through our global direct sales organization, an international network of independent distributors and sales representatives, our websites and product catalogs. We maintain a marketing staff that identifies customer requirements, assists in product planning and specifications, and focuses on future trends in the markets we serve.

Research and Development

Our products incorporate sophisticated technologies to measure, monitor, deliver, analyze, power, control and improve complex semiconductor and advanced manufacturing processes, thereby enhancing uptime, yield and throughput for our customers. With the Atotech Acquisition, we also offer a broad portfolio of specialty chemistry solutions for advanced surface modification, electroless and electrolytic plating, surface finishing, functional coating and corrosion resistance applications. MSD

is supported by 15 state-of-the-art global technology centers, which are used to conduct extensive research and development in order to anticipate future industry requirements.

We continue to develop our products as we strive to meet our customers' evolving needs. We have developed, and continue to develop, new products to address industry trends, such as the shrinking of integrated circuit critical dimensions and technology inflections, and, in the flat panel display and solar markets, the transition to larger substrate sizes, which require more advanced processing and process control technology, the continuing drive toward more complex and accurate components and devices within the handset, tablet and high performance computing markets, the transition to 5G for both communications devices and infrastructure, the growth in units and via counts in the HDI PCB and package substrate markets, and the industry transition to battery-powered vehicles in the automotive market. In addition, we have developed, and continue to develop, products that support the migration to new classes of materials, ultra-thin layers, and 3D structures that are used in small geometry manufacturing. In our chemistry and equipment plating businesses, a majority of our research and development investment supports existing customers' product improvement needs and their short-term research and development goals, which enables us to pioneer new high-value solutions while limiting commercial risk.

We involve our marketing, engineering, manufacturing and sales personnel in the development of new products in order to reduce the time to market for new products. Our employees also work closely with our customers' development personnel, helping us to identify and define future technical needs on which to focus research and development efforts. We support research at academic institutions targeted at advances in materials science, semiconductor process development and photonics.

Our research and development expenses were \$288 million, \$241 million and \$200 million for 2023, 2022 and 2021, respectively. Our research and development efforts include numerous projects, none of which are individually material, and generally have a duration of 3 to 36 months, depending upon whether the product is an enhancement of existing technology or a new product. Our current initiatives include projects to enhance the performance characteristics of older products, to develop new products and to integrate various technologies into subsystems.

Manufacturing

Manufacturing activities include the assembly and testing of components and subassemblies, which are integrated into our products. Our manufacturing facilities are located in Austria, Brazil, Canada, China, Czech Republic, France, Germany, India, Israel, Italy, Malaysia, Mexico, Romania, Singapore, South Korea and the United States. In addition, we rely on significant subcontracted operations in Mexico and selected contract manufacturers in Asia. Our business depends on the timely supply of products and services that meet the rapidly changing technical and volume requirements of our customers, which depends in part on the timely delivery of parts, components and subassemblies from suppliers, including contract manufacturers. We purchase a wide range of electronic, optical, mechanical and electrical components, some of which are designed to our specifications. We consider our lean manufacturing techniques and responsiveness to customers' significantly fluctuating product demands to be a competitive advantage.

Backlog

We generally schedule production of our products based upon our customers' delivery requirements. Lead times for many of our products are very short, as a large portion of our orders are received and shipped within 90 days. Some of the plating equipment manufactured by MSD has longer lead times of up to 12 months. In many cases, orders may be subject to cancellation or rescheduling by the customer with limited or no penalty. Our backlog at any particular date, therefore, is not necessarily indicative of actual sales which may be generated for any succeeding period. Historically, our backlog levels have fluctuated based upon the ordering patterns of our customers and changes in our manufacturing capacity.

Competition

The market for our products is cyclical and highly competitive. Principal competitive factors include product quality, performance and price, historical customer relationships, breadth of product line, ease of use, manufacturing capabilities and responsiveness, and customer service and support. Although we believe that we compete favorably with respect to these factors, we can make no assurances that we will continue to do so.

We encounter substantial competition in most of our product lines, although no single competitor competes with us across all product lines. Certain of our competitors have greater financial and other resources than we do. In some cases, competitors are smaller than we are, but are well established in specific product niches.

For example, in VSD, Advanced Energy Industries, Inc. offers products that compete with our power solutions, plasma and reactive gas and photonics products. Inficon, Inc. offers products that compete with our pressure and vacuum control solutions products. Hitachi Ltd., Horiba Ltd., Brooks Instrument and VAT, Inc. offer products that compete with our materials delivery solutions products.

In PSD, Trumpf Group, Lumentum Holdings Inc., IPG Photonics Corporation, EdgeWave GmbH and Amplitude Systemes SA offer products that compete with our laser products. Coherent Corp., Excelitas Technologies Corp., Jenoptik AG and Thorlabs, Inc. offer products that compete with our laser and photonics products. Sigma Koki Co., Ltd. and PI miCos GmbH offer products that compete with our photonics products. Our laser-based systems for PCB manufacturing primarily compete with laser-based systems provided by Via Mechanics, Ltd., EO Technics Co., Ltd. and Mitsubishi Electric Corporation.

In MSD, Element Solutions Inc., DuPont de Nemours, Inc., Uyemura, Dipsol Chemicals Co., Ltd., JCU International, Inc. and Okuno Chemical Industries Co., Ltd. offer products that compete with our chemistry products. Schmid Group, Process Automation International Limited and Manz AG offer products that compete with our plating equipment products.

Sources and Availability of Materials, Parts and Components

We use various suppliers and contract manufacturers to supply materials, parts and components for manufacturing and support of our product lines. Although our intention is to establish multiple sources of supply whenever practicable, we have sole or limited source supply arrangements for certain materials, parts and components, such as certain metals and electronic components. Certain of our sole or limited source supply arrangements are the result of “copy exact” requirements of our customers. We may not be able to procure these materials, parts and components from alternate sources at acceptable prices and quality within a reasonable time, or at all. The risk of loss or interruption of this supply could impact our ability to deliver certain products on a timely basis. For additional information about risks related to our supply chain, please refer to our Risk Factors in Part I, Item 1A of this Annual Report.

Patents and Other Intellectual Property Rights

We rely on a combination of patent, copyright, trademark and trade secret laws and license agreements to establish and protect our proprietary rights. As of December 31, 2023, we owned 690 U.S. patents and 3,121 foreign patents that expire at various dates through 2042. As of December 31, 2023, we had 169 pending U.S. patent applications. Foreign counterparts of certain U.S. applications have been filed or may be filed at the appropriate time.

We require each of our employees, including our executive officers, to enter into standard agreements pursuant to which the employee agrees to keep confidential all of our proprietary information and to assign to us all inventions while they are employed by us.

Government Regulations

We are subject to various federal, state, local and international laws and regulations relating to the development, manufacture, sale and distribution of our products and services, and it is our policy to comply with the laws in every jurisdiction in which we conduct business. Regulations include, but are not limited to, those related to the environment, corruption, bribery, import and export controls, competition, product safety, workplace health and safety, employment, labor and data privacy. The following describes certain significant regulations that may have a material effect on our capital expenditures, earnings and competitive position. For additional information about risks related to government regulations, please refer to “Risk Factors—Legal, Tax, Regulatory and Compliance Risks” in Part I, Item 1A of this Annual Report on Form 10-K.

Trade Compliance

We are subject to trade compliance laws in both the United States and other jurisdictions where we operate, including export regulations such as the U.S. Export Administration Regulations, administered by the U.S. Department of Commerce’s Bureau of Industry and Security, and the International Traffic in Arms Regulation, administered by the Department of State’s Directorate of Defense Trade Controls.

Environmental Regulations

We are subject to various, federal, state, local and international laws and regulations relating to environmental protection, including those governing discharges of pollutants into the air, water and land, the reporting, generation, use, handling, storage, transportation, treatment and disposal of hazardous substances, waste and other materials and the cleanup of contaminated sites. These environmental regulations include the European Union Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals and the Toxic Substances Control Act in the United States.

Human Capital

In order to compete and succeed in highly competitive markets and industries that are subject to rapid technological change, we believe it is critical to attract, motivate and retain a dedicated, talented and innovative team of employees. As part of these efforts, we strive to foster a diverse, equitable and inclusive community, invest in continuous learning and development, engage meaningfully with employees, offer a competitive compensation and benefits program and provide a safe and healthy workplace.

As of December 31, 2023, we had a total workforce of approximately 10,200 individuals, excluding contracted employees, across 37 countries, with 33% located in the Asia-Pacific region, 33% located in Europe, the Middle East and India, and 34% located in the Americas. Of our total workforce, approximately 10,000 were employees and approximately 200 were temporary workers. Of our total workforce, 18% work in research and development, 56% work in operations, manufacturing, service and quality assurance, and 26% work in sales, order administration, marketing, finance, human resources, legal, information technology, general management and other administrative functions.

Diversity, Equity and Inclusion

At MKS, we embrace the strength found in our diversity – a diversity of perspectives, experiences, and thoughts. Our commitment is to cultivate an inclusive environment where all team members feel valued and empowered to bring their authentic selves to their work. This dedication stems from our belief that diverse viewpoints not only spur innovation but also fuel exceptional performance and sustainable progress. Diversity, equity, and inclusion (“DE&I”) is deeply ingrained in our cultural fabric.

The composition of our executive team reflects this commitment, with women representing 30% and people of color representing 30%. Similarly, our Board of Directors is comprised of 38% women, 25% people of color and 13% LGBTQ+ members, and our Lead Director is a woman. We have garnered recognition for our efforts to advance gender diversity on public company boards.

To further foster DE&I at MKS, we have implemented several initiatives:

- Since 2020, over 320 of our global leaders have completed a six-week DE&I program led by a renowned consulting firm in the field.
- Throughout the year, we provide DE&I training for all employees and bias awareness sessions for our global talent acquisition and management teams.
- We have bolstered our recruitment and selection procedures by introducing our MKS Hiring Guide & Toolkit, which is designed to attract top talent while mitigating bias.
- Consistent with our Corporate Governance Guidelines, we actively seek diverse candidates for our Board of Director nominees.
- We routinely conduct comprehensive analyses of pay practices across gender and other diversity dimensions in our major regions of operations to identify and rectify any disparities promptly and effectively. Our recent global compensation analysis, spanning several years, has resulted in equitable pay for our workforce with minimal adjustments.
- We offer regional and global initiatives, such as mentoring programs, DE&I-focused book clubs, webinars, and workshops to provide opportunities for our diverse workforce to engage and thrive.

Learning and Development

MKS remains steadfast in its dedication to fostering learning and professional growth. We offer our employees a diverse array of programs, courses, and resources aimed at enhancing their career trajectories and fostering knowledge-sharing among peers. Our performance management framework is designed to provide ongoing, actionable feedback and facilitate dynamic career development conversations throughout the year.

In 2023, we expanded our course offerings to encompass areas such as employee engagement, change management, and leadership excellence, underscoring our commitment to continuous improvement. Furthermore, many of our leaders successfully completed the DE&I course as part of this initiative as mentioned above.

We extend financial assistance for higher education to eligible employees, including support for college and graduate studies. Additionally, we ensure accessibility to online learning resources in local languages for all staff, thus bolstering the professional growth opportunities for our entire workforce.

Employee Engagement

MKS remains dedicated to fostering meaningful connections with its employees. In 2023, MKS conducted its third annual global employee engagement survey, marking a significant milestone as it included Atotech employees for the first time post-acquisition. The survey findings were analyzed and shared with our President and Chief Executive Officer, the executive leadership team, and our Board of Directors. Comprehensive communication of the results was extended to all employees, supplemented with executive videos and both in-person and virtual focus groups to pinpoint prevailing themes. Leveraging these themes and data points, tailored action items were created to encourage meaningful change.

Additionally, our executive leadership team routinely engages in direct communication with employees worldwide, ensuring alignment with the Company's strategic goals. Our executive leadership team is committed to continuously enhancing MKS' workplace environment and steering organizational growth, with the annual engagement survey serving as a pivotal component for gathering employee insights.

Compensation and Benefits

MKS is committed to providing total compensation packages that attract, motivate and retain our employees. Additionally, MKS is committed to recognizing and rewarding employees' sustained performance and results. We run a recognition program for all U.S. employees, which allows peer-to-peer recognition and recognition by managers. We continue to assess the potential expansion of this recognition program globally. We also maintain a global flexible work policy. We are committed to ensuring that our total compensation packages are externally competitive and internally equitable, while supporting our business plans and strategies.

As employee turnover is an indicator of employee satisfaction, we monitor turnover globally. MKS has a very stable and committed workforce, as evidenced by low voluntary turnover. Our voluntary turnover in 2023 was below 8%. Our employee average tenure is more than nine years.

Health and Safety

MKS is committed to providing a safe and healthy workplace for all employees. We accomplish this through strict compliance with applicable laws and regulations regarding workplace safety, including recognition and control of workplace hazards, tracking injury and illness rates, utilizing a global travel health program and maintaining detailed emergency and business continuity plans. We also provide mandatory environmental, health, and safety training to ensure all employees are provided with the education to perform their jobs safely and to protect the environment.

In 2022, we instituted MEHS, a formal Global MKS Management System for Environmental, Health, and Safety, to protect our employees, other stakeholders, and the environment. We continue to implement this strong foundation across our organization in a stepwise process.

In addition, we offer employees and eligible family members a full range of health and wellness programs, as well as many clinical and administrative services.

Additional information regarding MKS' activities related to its people and sustainability can be found in our Environmental, Social, Governance Report, which is accessible through the Environmental, Social and Governance section of our website. Our Environmental, Social, Governance Report is updated periodically. None of the information on, or accessible through, MKS' website is part of this Annual Report on Form 10-K or is incorporated by reference herein.

Item 1A. Risk Factors

This section describes certain risks we face in our business. Additional risks that we do not yet know of or that we currently believe are immaterial may also impair our business. If any of the events or circumstances described in this section actually occurs, our business, financial condition or operating results could suffer, and the market price of our common stock could decline. In assessing these risks, investors should also refer to the other information contained in or incorporated by reference into this report and our other filings with the Securities and Exchange Commission ("SEC").

Acquisition Risks

The Atotech Acquisition involves numerous risks, and we may not be able to effectively integrate Atotech's business and operations or realize the expected benefits from the acquisition, which could materially harm our operating results.

The acquisition of Atotech Limited ("Atotech") in August 2022 (the "Atotech Acquisition") significantly increased our size, including with respect to revenue, product offerings, number of employees and facilities, and geographic exposure. Atotech's products and technology, and certain of its markets and customer base, are significantly different from our historical experience. In particular, we did not have previous experience in the specialty chemistry industry, which Atotech serves. Atotech's chemistry business is also subject to highly complex environmental regulations, across multiple jurisdictions around the globe, and may expose us to significant additional liabilities for past or future activities.

Integrating Atotech's business and operations with ours has been and will continue to be complex, challenging and time-consuming and has required and continues to require significant efforts and expenditures, and we may not be able to achieve the integration in an effective, complete, timely or cost-efficient manner.

Other potential risks related to the Atotech Acquisition include our ability to:

- Expand our financial and management controls and reporting systems and procedures to integrate and manage Atotech;
- Integrate our information technology ("IT") systems to enable the management and operation of the combined business;
- Realize expected synergies resulting from the Atotech Acquisition during our expected timeframe;
- Maintain and improve Atotech's operations;
- Retain and expand Atotech's customer base while aligning our sales efforts;
- Avoid lost revenue resulting from the distraction of our personnel as a consequence of the Atotech Acquisition and ongoing integration efforts;
- Retain key Atotech personnel;
- Recognize and capitalize on technology enhancement opportunities presented by our combined businesses;
- Develop sufficient knowledge of Atotech's products and technology and certain of its markets and customer base such that we can manage Atotech's business effectively; and
- Successfully integrate our respective corporate cultures such that we achieve the benefits of acting as a unified company.

Other potential risks related to the Atotech Acquisition include:

- Operating in geographies that are new to us, and increasing our exposure to high-risk geographies;
- The assumption of unknown or contingent liabilities, or other unanticipated events or circumstances; and
- The potential to incur or record significant cash charges, such as integration and restructuring, or non-cash charges, such as the write down of the carrying value of fixed assets, intangible assets and goodwill obtained in the Atotech Acquisition, which could adversely impact our cash flow or lower our earnings in the period or periods for which we incur such charges or write down such assets.

For example, as described in Note 13 to the Notes to Consolidated Financial Statements, following triggering events at each of our electronics ("EL") and general metal finishing ("GMF") reporting units, which together represent the Atotech business and constitute our Materials Solutions Division ("MSD"), we recorded goodwill and intangible asset impairments at MSD of \$1.3 billion during the quarter ended June 30, 2023 and, following an annual impairment analysis of all our reporting units, we recorded goodwill and intangible asset impairments at MSD of \$62 million during the quarter ended December 31, 2023. These impairments were in part due to softer industry demand, particularly in the personal computer and smartphone markets, that negatively affected MSD's revenues and operating results.

If we are unable to successfully or timely integrate the operations of Atotech's business into our business, we may be unable to realize the revenue growth, synergies and other anticipated benefits resulting from the Atotech Acquisition and our business could be adversely affected. Additionally, we have incurred and will continue to incur transaction-related costs. Although we expect that the elimination of duplicative costs, as well as the realization of other efficiencies related to the integration of the businesses, should allow us to offset certain transaction and integration-related costs over time, this net benefit may not be

achieved in the near term, or at all. Further, we may not realize the expected benefits from the Atotech Acquisition, including the revenues and operating results we anticipate. Any of the foregoing risks could materially harm our combined business, financial condition and results of operations.

As part of our business strategy, we have entered into and may continue to pursue business combinations and acquisitions that may be difficult to identify and complete, challenging and costly to integrate, disruptive to our business and our management, and/or dilutive to stockholder value.

As a part of our business strategy, we have entered into and continue to pursue business combinations and acquisitions. Our ability to successfully identify suitable acquisition targets, complete acquisitions on acceptable terms, and efficiently, effectively and profitably integrate and operate our acquired businesses is critical to our growth. We may not be able to identify target companies that meet our strategic objectives or successfully negotiate and complete acquisitions with companies we have identified on acceptable terms. Further, we may incur significant expense in pursuing acquisitions that cannot be completed, or are significantly delayed, due to regulatory or other restrictions. Additionally, our credit facilities only permit us to make acquisitions under certain circumstances, and also restrict our ability to incur additional indebtedness in certain circumstances. As a result, our ability to pursue our acquisition strategy may be hindered by our indebtedness. Moreover, we may not realize the benefits we anticipate from these acquisitions, because of significant challenges, such as:

- The difficulty, distraction, resource requirements, cost and disruption of integrating the operations, technology and personnel of the acquired companies;
- The potential disruption of our ongoing business and distraction of management;
- Possible internal control or other compliance weaknesses of the acquired companies;
- Significant expenses related to the acquisitions, including any resulting shareholder litigation;
- The assumption of unknown or contingent liabilities associated with acquired businesses;
- The potential to incur or record significant cash or non-cash charges or write down the carrying value of intangible assets and goodwill obtained in the acquisitions, which could adversely impact our cash flow or lower our earnings in the period or periods for which we incur such charges or write down such assets;
- Potentially incompatible cultural differences between us and the companies we acquire;
- Incorporating the acquired companies' technology and products into our current and future product lines, and successfully generating market demand for these expanded product lines;
- Potential additional geographic dispersion of operations;
- The difficulty in achieving anticipated synergies and efficiencies;
- The difficulty in leveraging the acquired companies' and our combined technologies and capabilities across our product lines and customer base;
- Burdensome requirements or conditions imposed by government regulators in connection with their review of acquisitions, including divestitures and restrictions on the conduct of our business or the business of the acquired companies; and
- Our ability to retain key customers, suppliers and employees of the acquired companies.

We may also face competitive disadvantages by selling products that are new to us and/or selling products in markets and geographies that are new to us. In addition, if we are not successful in completing acquisitions or integrating acquired businesses, we may need to re-evaluate our growth strategy. We may incur substantial expenses and devote significant management time and resources to complete acquisitions that may not generate the financial results we planned to achieve. We may also choose to close or divest certain sectors or divisions of acquired companies, which would reduce our overall revenue and could require us to record losses and/or spend cash relating to such closures or divestitures.

We continue to experience significant risks associated with the acquisition of Electro Scientific Industries, Inc. ("ESI" and such transaction, the "ESI Merger"), which we completed in 2019. These risks include our ability to retain key personnel and to realize the anticipated growth in net revenues from the acquired business, as well as the potential to incur or record significant cash or non-cash charges or write down the carrying value of intangible assets and goodwill obtained in the ESI Merger, which could adversely impact our cash flow or lower our earnings in the period or periods for which we incur such charges or write down such assets. For example, as described in Note 13 to the Notes to Consolidated Financial Statements, following a triggering event at the Equipment Solutions Business ("ESB") reporting unit, which represents the ESI business and is a part of our Photonics Solutions

Division (“PSD”), we recorded goodwill and intangible asset impairments at our ESB reporting unit of \$524 million during the quarter ended June 30, 2023, and following an annual impairment analysis at all our reporting units, we recorded goodwill impairment of \$13 million at our ESB reporting unit during the quarter ended December 31, 2023.

In addition, we could use substantial portions of our available cash for all or a portion of the purchase price of future acquisitions. We could also issue additional securities as consideration for or to finance these acquisitions, which could cause significant stockholder dilution, or obtain additional debt financing, which would increase our costs, reduce our future cash flow and subject us to covenants and other restrictions that may impede our ability to manage our operations, without achieving the desired accretion to our business.

As a result of our previous acquisitions, we presently have several different decentralized operating and accounting systems. We will need to continue to modify our accounting policies, internal controls, procedures and compliance programs to provide consistency across all of our operations. In order to increase efficiency and operating effectiveness and improve corporate visibility into our decentralized operations, we continue to review opportunities to integrate enterprise resource planning systems where practical. Any future implementations may risk potential disruption of our operations during the conversion periods and the implementations could require significantly more management time and higher implementation costs than currently estimated.

Financial Risks

Our consolidated indebtedness has increased substantially as a result of the Atotech Acquisition. This increased level of indebtedness could adversely affect us, including by increasing our interest expense and decreasing our business flexibility.

As of December 31, 2023, we had approximately \$5.0 billion of principal indebtedness outstanding under a senior secured term loan facility (the “Term Loan Facility”) comprised of three tranches: a \$744 million loan (the “USD Tranche A”), a \$3.6 billion loan (the “USD Tranche B”) and a €593 million loan (the “Euro Tranche B”). As of December 31, 2023, we also had \$500 million of available borrowing capacity under a senior secured revolving credit facility (the “Revolving Facility”) and together with the Term Loan Facility, the “Credit Facilities”). On January 22, 2024, we (i) increased our USD Tranche B by an aggregate principal amount of \$490 million, (ii) increased our Euro Tranche B by an aggregate principal amount of €250 million and (iii) used a portion of the proceeds of such increases to prepay our USD Tranche A in full (the “USD Tranche A Refinancing”). On February 13, 2024, we increased the available borrowing capacity under our Revolving Facility by \$175 million (the “Revolving Facility Increase”). As a result of the USD Tranche A Refinancing, as of January 22, 2024, we had approximately \$5.0 billion of principal indebtedness under our Term Loan Facility comprised of a \$4.1 billion USD Tranche B and a €843 million Euro Tranche B. As a result of the Revolving Facility Increase, as of February 13, 2024, we had \$675 million of available borrowing capacity under our Revolving Facility. This level of indebtedness could have the effect, among other things, of reducing our flexibility to respond to changing business, industry and economic conditions, limiting our ability to obtain financing in the future and increasing interest expense.

We also have incurred and will continue to incur various costs and expenses associated with our indebtedness. The amount of cash required to pay interest on our increased indebtedness levels following completion of the Atotech Acquisition, and the demands on our cash resources that come from that debt, are significantly greater than the amount of cash flows required to service the levels of indebtedness we incurred prior to the Atotech Acquisition. Our increased levels of indebtedness following completion of the Atotech Acquisition could also reduce funds available for working capital, capital expenditures, acquisitions and other general corporate purposes and may create competitive disadvantages relative to other companies with lower debt levels. If we do not achieve the expected benefits and cost savings from the Atotech Acquisition, or if the financial performance of the combined company does not meet current expectations, then our ability to service our indebtedness may be adversely impacted.

Despite our current level of indebtedness, we and our subsidiaries may still be able to incur more indebtedness. Although our debt agreements contain restrictions on the incurrence of additional indebtedness, these restrictions are subject to certain qualifications and exceptions, and thus, additional indebtedness may be incurred in compliance with these restrictions. This could further exacerbate the risks we describe.

Moreover, we may be required to raise substantial additional financing to fund working capital, capital expenditures, acquisitions or other general corporate requirements. Our ability to arrange additional financing or refinancing will depend on, among other factors, our financial position and performance, as well as prevailing market conditions and other factors beyond our control. There can be no assurance that we will be able to obtain additional financing or refinancing on terms acceptable to us or at all.

The terms of our Term Loan Facility and Revolving Facility impose significant financial obligations and risks upon us, limit our ability to take certain actions, and could discourage a change in control.

As of December 31, 2023, the total principal balance of our USD Tranche A was \$744 million, the total principal balance of our USD Tranche B was \$3.6 billion and the total principal balance of our Euro Tranche B was €93 million. As a result of the USD Tranche A Refinancing, as of January 22, 2024, no principal was outstanding under the USD Tranche A, the total principal balance of our USD Tranche B was \$4.1 billion and the total principal balance of our Euro Tranche B was €843 million. As of December 31, 2023, our Revolving Facility provided us with a senior secured revolving credit facility of up to \$500 million. As a result of the Revolving Facility Increase, as of February 13, 2024, our Revolving Facility provided us with a senior secured revolving credit facility of up to \$675 million. We have not borrowed against our Revolving Facility as of February 13, 2024.

All amounts outstanding under the Term Loan Facility and the Revolving Facility bear interest at a variable interest rate. Although we hedge some of the variable interest rate exposure, as interest rates have increased, debt service requirements on our variable rate debt have increased. Further interest rate increases, if they occur and we do not hedge such variable rates, will create higher debt service requirements, which would adversely affect our cash flows. In addition, changes in our credit ratings could affect the cost and availability of future borrowings and, accordingly, our cost of capital. The ratings of our indebtedness reflect each nationally recognized statistical rating organization's opinion of our financial strength, operating performance and ability to meet our debt obligations. We cannot make any assurances that we will achieve or maintain a particular rating in the future.

Our Term Loan Facility and Revolving Facility contain several negative covenants that, among other things and subject to certain exceptions, restrict our ability and/or our subsidiaries' ability to:

- Incur additional indebtedness;
- Pay certain dividends on our capital stock or redeem, repurchase or retire certain capital stock or certain other indebtedness;
- Make certain investments, loans and acquisitions;
- Engage in certain transactions with our affiliates;
- Sell assets, including capital stock of our subsidiaries;
- Materially alter the business we conduct;
- Consolidate or merge;
- Incur liens; and
- Engage in sale-leaseback transactions.

In addition, our Revolving Facility requires that we meet a financial covenant based on a consolidated leverage ratio test in certain circumstances. Under our Revolving Facility, whenever the aggregate amount of loans outstanding under the Revolving Facility (net of (a) all letters of credit (whether cash collateralized or not) and (b) unrestricted cash of us and our restricted subsidiaries) exceeds 35% of the aggregate commitments under the Revolving Facility, our first lien net leverage ratio cannot exceed 6.00 to 1.00.

Our ability to comply with these provisions may be affected by events beyond our control, including prevailing economic, financial and industry conditions. These restrictions on our ability to engage in or benefit from these actions may also limit our flexibility in planning for, or reacting to, changes in and opportunities for our business, such as limiting our ability to engage in mergers and acquisitions. This could place us at a competitive disadvantage. If the matters described in our other risk factors result in a material adverse effect on our business, financial condition or operating results, we may be unable to comply with the terms of our credit facilities or experience an event of default.

Our Term Loan Facility and Revolving Facility contain customary events of default, including:

- Failure to make required payments;
- Failure to comply with certain agreements or covenants;
- Materially breaching any representation or warranty;
- Failure to pay, or cause acceleration of, certain other indebtedness;
- Certain events of bankruptcy and insolvency;
- Failure to pay certain judgments; and

- A change in control of us.

The amount of cash available to us for repayment of amounts owed under these credit facilities will depend on our usage of our existing cash balances and our operating performance and ability to generate cash flows from operations, which will be subject to financial, business and other factors affecting our operations, many of which are beyond our control. We cannot provide any assurances that we will generate sufficient cash flows from operations to service our debt obligations. Any failure to repay these obligations as they become due would result in an event of default under the credit facilities.

If an event of default occurs, the lenders may end their obligation to make loans to us under the credit facilities and may declare any outstanding indebtedness under these credit facilities immediately due and payable. In such case, we would need to obtain additional financing or significantly deplete our available cash, or both, to repay this indebtedness. Any additional financing may not be available on reasonable terms or at all, and significant depletion of our available cash would harm our ability to fund our operations or execute our broader corporate objectives. If we were unable to repay outstanding indebtedness following an event of default, then in addition to other available rights and remedies, the lenders could initiate foreclosure proceedings on substantially all of our assets. Any such foreclosure proceedings or other rights and remedies successfully implemented by the lenders in an event of default would have a material adverse effect on our business, financial condition and operating results.

Further, because a change in control of us constitutes an event of default under these credit facilities, this may be a deterrent to some potential acquirers, as it would likely require an acquirer to repay any outstanding borrowings under these credit facilities.

A material amount of our assets represents goodwill and intangible assets. We incurred a net loss as a result of impairments of these assets in 2023 and our net income may be significantly reduced in subsequent periods by future impairments of these assets.

As of December 31, 2023, our goodwill and intangible assets, net, represented approximately \$5.2 billion, or 57% of our total assets. Goodwill is generated as a result of our acquisitions when the cost of an acquisition exceeds the fair value of the net tangible and identifiable intangible assets we acquire. For example, as a result of the Atotech Acquisition, we added significant additional goodwill and intangible assets because the cost of the Atotech Acquisition significantly exceeded the fair value of Atotech's net tangible and identifiable intangible assets. Intangible assets relate primarily to the developed technologies, customer relationships, trade names and trademarks acquired by us as part of our acquisitions of other companies. Goodwill and indefinite-lived intangible assets are subject to an impairment analysis at least annually based on the fair value of the reporting unit in which the respective goodwill and intangible assets are recorded. In addition, intangible assets and goodwill are subject to an impairment analysis whenever events or changes in circumstances indicate that the carrying value of the intangible asset might not be recoverable. As described in Note 13 to the Notes to Consolidated Financial Statements, following triggering events at each of our EL and GMF reporting units, which together constitute MSD, and the ESB reporting unit of PSD, we recorded goodwill and intangible asset impairments of \$1.8 billion during the quarter ended June 30, 2023 and, following an annual impairment analysis of all our reporting units, we recorded goodwill and intangible asset impairments of \$75 million during the quarter ended December 31, 2023. We will continue to monitor and evaluate the carrying value of goodwill and intangible assets. If market and economic conditions or business performance deteriorate, the likelihood that we would record another impairment charge would increase. Any impairment charge could materially and adversely affect our financial condition and operating results, including by significantly reducing our net income in future periods.

Risks Related to Cybersecurity, Data Privacy and Intellectual Property Protection

We are exposed to risks related to cybersecurity and data privacy threats and incidents, such as the ransomware event we identified in February 2023, and we are subject to restrictions and changes in laws and regulations governing data privacy and data protection, any of which could have a material adverse effect on our business.

We rely on various IT networks and systems, some of which are managed by third parties, to process, transmit and store electronic information and to carry out and support a variety of business activities, including, among others, finance and accounting, order management, human resources, communications, manufacturing, research and development, intellectual property, supply chain management, sales and IT, including critical functions such as internet connectivity, network communications, and email. Many of these activities are processed via Software-as-a-Service ("SaaS") products provided by third parties and hosted on their own networks and servers or on third-party networks and servers. The data on such IT networks and systems includes confidential information, personally identifiable information, transactional information and intellectual property belonging to us and our employees, customers, suppliers and other business partners.

We and our third-party administrators, vendors and partners are subject to ongoing cybersecurity threats, including ransomware and other malware, hacking, phishing, smishing, denial of service attacks, employee errors or malfeasance, telecommunication failures, system failures, natural disasters and other attacks and events. We cannot guarantee that these threats

will not have an adverse impact on our business, financial condition or results of operations. For example, as further described in “Management’s Discussion and Analysis of Financial Condition and Results of Operations—Ransomware Event” in Part II, Item 7 of this Annual Report on Form 10-K, in February 2023, we identified that we had become subject to a ransomware event. Based on our investigation, we concluded ransomware actors encrypted certain of our systems by deploying malware. This incident required us to temporarily suspend operations at certain of our facilities and had a material impact during the three months ended March 31, 2023 on our ability to process orders, ship products and provide service to our Vacuum Solutions Division (“VSD”) and PSD customers. For the year ended December 31, 2023, we incurred net costs related to the incident of approximately \$15 million. We expect to continue to incur these and other costs related to the incident in the future. In addition, as a result of the incident, we were previously subject to two lawsuits, and we may be subject to future litigation, investigations, claims or actions, in addition to fines, penalties, or other obligations related to impacted data, whether or not such data is misused.

We face the challenge of supporting our older IT systems and implementing necessary upgrades. Further, as we transition to using more cloud-based solutions that are dependent on the internet or other networks to operate, we expose ourselves to additional or different cybersecurity and other data security threats, whether directly or through our third-party administrators, vendors and partners. As cybersecurity threats rapidly evolve and become increasingly difficult to detect and defend against, our current security controls and measures may not be effective in detecting vulnerabilities or preventing cybersecurity incidents. These risks may be further amplified by the increased reliance on remote access to IT systems as a result of the use of SaaS software, cloud and remote services, and employees working remotely. Additionally, we may need to update security protocols for, transition to or from, or integrate various information management systems as a result of mergers, acquisitions and divestitures. The systems that we acquire or that are used by acquired entities or businesses may pose security risks of which we are unaware or unable to mitigate, particularly during the transition of these systems.

The evolving regulatory landscape for data privacy presents a number of legal and operational challenges, and our efforts to comply with relevant regulations may be unsuccessful. For example, regulations in the European Union (the “EU”) and China prohibit the transfer of personally identifiable information from their respective countries to other countries whose laws do not adequately protect personal data. While we have utilized certain permitted approaches for transferring personally identifiable information from these countries, these approaches may be invalidated by courts or regulatory bodies and we may be required to ascertain an alternative legal basis for such transfers. Additionally, based on our investigation of the ransomware event we identified in February 2023, we became aware on February 13, 2023 that the ransomware actors may have exfiltrated personal information from our systems. We provided notifications to individuals and to regulators in accordance with applicable laws, and we may be required to provide additional notifications in the future. See “—We are exposed to various risks related to legal proceedings, including, for example, product liability claims, intellectual property infringement claims, regulatory claims, contractual claims and class action litigation, which if successful, could have a material adverse effect on our commercial relationships, business, financial condition and operating results” below for more information regarding legal risks associated with privacy-related matters.

A failure to comply with the evolving regulatory landscape, or a breach of our operational or security systems or infrastructure, or those of our customers, suppliers and other business partners, could disrupt our business, including business operations and manufacturing processes; result in the disclosure, misuse, corruption or loss of confidential or other valuable business information, including intellectual property, personally identifiable information and other critical data of ours and our employees, customers, suppliers and other business partners; result in competitive disadvantages to the extent the information is competitively sensitive; damage our reputation; negatively affect our relationships with our employees, customers, suppliers and other business partners, including loss of confidence, which could lead to loss of or reduction in orders; divert the attention of management; cause losses; result in litigation, investigations or liability under contracts; require notifications to regulatory authorities and impacted individuals; result in significant penalties and/or fines from regulatory bodies, including pursuant to privacy laws and export control laws; add to the complexity of our compliance obligations; increase our cybersecurity protection costs; and result in the incurrence of remediation costs. These adverse effects would likely be amplified in the event a breach of operational or security systems remains undetected for an extended period of time.

The costs of compliance with, and other burdens imposed by, privacy, cybersecurity, data protection and data localization laws, regulations and policies, including restrictions on marketing activities, could have a material adverse effect on our business, financial condition and operating results. For example, as a result of the ransomware event described above, we have incurred costs, and we expect to continue to incur costs, which may be significant, in connection with efforts to investigate the incident, assess the impact of the incident, recover our systems, enhance our data security and protect against unauthorized access to, or manipulation of, our systems and data. Despite incurring these costs, we may not have identified and may not be able to remediate all of the potential causes of the incident, and similar incidents may occur in the future. Further, customers and third-party providers increasingly demand rigorous contractual provisions regarding privacy, cybersecurity, data protection, confidentiality, and intellectual property, which may also increase our overall compliance burden and potential liability.

Although we maintain insurance related to cybersecurity risks, these costs, expenses, liability and other matters may not be adequately covered by insurance and may result in an increase in our costs for insurance or insurance not being available to us on

economically feasible terms, or at all. Insurers may also deny us coverage as to any future claim. Any of these results could harm our business, financial condition and reputation.

Our proprietary technology is important to the continued success of our business. Our failure to protect this proprietary technology may significantly impair our competitive position.

Our success and ability to compete depend in large part upon protecting our proprietary technology. We rely on a combination of patent, trademark and trade secret protection and other agreements, such as nondisclosure agreements and other contractual agreements with our employees and third parties, to protect our proprietary rights. The steps we have taken may not be sufficient to prevent the misappropriation of our intellectual property, particularly in countries and regions outside, for example, the United States and Europe, where laws may not protect our proprietary rights as fully. For example, the patent prosecution and enforcement systems within China and India, where we have a significant customer base and manufacturing presence, are less robust than these systems in certain other jurisdictions and, as a result, we may be limited in our ability to enforce our intellectual property rights there. We may also be at a disadvantage in any enforcement proceeding in China and India as a foreign entity seeking protection against a locally headquartered company. Patent and trademark laws and trade secret protection may not adequately deter third-party infringement or misappropriation of our patents, trademarks, trade secrets and similar proprietary rights. In addition, patents issued to us may be challenged, invalidated or circumvented. The loss or expiration of any of our key patents could lead to a significant loss of sales of certain of our products and could materially affect our operating results. We have in the past and may in the future be subject to or may initiate interference proceedings, validity challenges or opposition proceedings in the U.S. Patent and Trademark Office, the European Patent Office, or similar agencies, which can demand significant financial and management resources. The process of seeking patent protection can be time consuming and expensive and patents may not be issued from pending or future applications. Moreover, our existing patents or any new patents that may be issued may not be sufficient in scope or strength to provide meaningful protection or a commercial advantage to us. We may initiate claims, enforcement actions or litigation against third parties for infringement of our proprietary rights in order to determine the scope and validity of our proprietary rights or the proprietary rights of our competitors, which claims could result in costly litigation, the diversion of our technical and management personnel and the assertion of counterclaims by defendants, including counterclaims asserting invalidity of our patents. We will take such actions where we believe that they are of sufficient strategic or economic importance to us to justify the cost.

Risks Related to Our Operations

Supply chain disruptions and other manufacturing interruptions or delays have affected our ability to meet customer demand and have led to higher costs, while the failure to estimate customer demand accurately has resulted in excess or obsolete inventory, all of which has negatively impacted, and we expect will continue to impact, our business.

Our business depends on the timely supply of products and services that meet the rapidly changing technical and volume requirements of our customers, which depends in part on the timely delivery of raw materials, parts, components and subassemblies from our suppliers, including contract manufacturers. For example, from the first quarter of 2021 until the second half of 2023, we experienced significant constraints due to global supply chain disruptions, including procuring electronic components, which negatively impacted our sales, costs and margins, and our ability to timely produce products to meet customer demand. Supply constraints and the potential for shortages caused us to increase safety stock levels, which has increased the amount of inventory we hold. Cyclical industry conditions and volatility of demand for our products increase capital, technical, operational and other risks for us and for companies throughout our supply chain. We have experienced, and we expect to continue to experience, significant disruptions in our supply chain, interruptions of our manufacturing operations, delays in our ability to deliver products or services, increased costs, price volatility, and customer order cancellations, which have been, or may in the future be, as a result of:

- Volatility in the availability and cost of materials, including electronic components, whether due to interruptions in production by suppliers, allocations of products to other purchasers, fluctuations in foreign currency exchange rates, changes in worldwide price levels (whether due to inflationary pressures or otherwise), environmental limitations, geopolitical issues or other factors;
- Pandemics such as COVID-19, natural disasters or other events beyond our control (such as earthquakes at our facilities in California or Oregon, floods or storms, wildfires, power outages, such as rolling blackouts previously experienced in China, regional economic downturns, social unrest, political instability, terrorism, or acts of war), particularly where we or our suppliers, subcontractors and contract manufacturers conduct manufacturing;
- Global logistics network challenges, such as limited availability of and constraints on freight capacity;
- IT or infrastructure failures; and

- New laws or regulations.

For example, MSD uses certain raw materials derived from petrochemical based feedstocks, the prices of which have historically been subject to periods of rapid and significant upward and downward movement. We may not be able to pass on price increases in raw materials, or price increases by our suppliers, to our customers due to competitive pricing pressure, and, even when we are able to do so, there may be a delay between price increases in raw materials and our ability to increase the prices of our products.

In addition, if we need to rapidly increase our business and manufacturing capacity to meet increases in demand or expedited shipment schedules, this may exacerbate any interruptions in our manufacturing operations and supply chain and the associated effect on our working capital. Moreover, if actual demand for our products is different than expected, we may purchase more or fewer parts than necessary or incur costs for canceling, postponing or expediting delivery of parts. If we purchase inventory in anticipation of customer demand that does not materialize, or if our customers reduce or delay orders, we may incur excess inventory charges. Any of these factors could materially and adversely affect our business, financial condition and operating results.

Our dependence on sole and limited source suppliers and international suppliers has negatively impacted, and could continue to impact, our ability to manufacture products and systems.

We rely on sole and limited source suppliers and international suppliers for some of our raw materials, components, subassemblies and software that are critical to manufacturing our products and/or our testing and operations processes due to unique properties or component designs as well as specialized quality and performance requirements. For example, on a local basis, MSD relies on a limited number of suppliers of palladium, its most significant raw material input by value. Our reliance on sole and limited source suppliers and international suppliers involves a number of risks, including:

- The inability to obtain an adequate supply of required raw materials or components, including if our suppliers cannot scale their manufacturing output to meet our demands;
- Quality and reliability problems with raw materials or components, which in turn may adversely affect our products' quality and reliability;
- Prohibitively higher raw material or component prices due to the imposition of tariffs;
- Supply chain disruptions, including as a result of the relocation of certain low-cost and sole and limited source suppliers to less-developed countries;
- Reduced control over pricing and timing of delivery of raw materials and components;
- The inability of our suppliers to develop technologically advanced products to support our growth and development of new products;
- The unavailability of service and/or spare parts for critical capital equipment; and
- The inability or unwillingness of our suppliers to continue to offer supplies or services on commercially acceptable terms.

At times, we have not been able to, and in the future, we may not be able to, obtain and qualify alternative sources of these components on favorable terms, on a timely basis, or at all, whether because there are a limited number of suppliers or because we have entered into supply agreements with certain suppliers that contain certain minimum purchase requirements. The use of alternative sources could require us to redesign our products, which could result in increased costs, shipping delays and the need to requalify products with customers, particularly those with “copy exact” requirements. Any inability to redesign our products could result in further costs and shipping delays. Increased costs would decrease our profit margins if we could not pass these costs to our customers. Further, shipping delays damage, and may continue to damage, our relationships with customers and have a material adverse effect on our business and operating results.

Our failure to successfully manage the transition of certain of our products to other manufacturing locations, the transition of certain of our products to or from contract manufacturers, and the transition of certain functions to centralized locations would likely harm our business, financial condition and operating results.

As part of our continuous cost-reduction and business continuity efforts, we continue to relocate the manufacturing of certain of our existing product lines and subassemblies to, and initiate the manufacturing of certain new products in, our facilities in China, Israel, Mexico, Romania and Singapore, as well as to our significant subcontracted operations in Mexico and selected contract manufacturers in Asia. In addition, we have relocated certain segments of other functions to, or initiated certain segments

of other functions in, centralized locations, including relocating certain procurement activity to Mexico and Romania, relocating certain IT and research and development activity to India, relocating certain administrative finance, payroll, software and IT activity to Poland, and initiating engineering activity in India. In the future, we may expand the level of functions that we initiate in or move to other global locations to take advantage of cost efficiencies or for business continuity purposes. However, we may not be able to achieve significant cost savings or other benefits from these actions. For example, costs may increase as development and manufacturing expense increase and labor, material, shipping and facility-related costs rise, as we have seen in our manufacturing locations in China. If these costs increase to the extent that we no longer realize the cost savings we anticipated, we may need to relocate these operations and functions to other lower-cost regions. Additionally, if we are unable to successfully manage the relocation, initiation or oversight of these operations and functions, including identifying, training and retaining skilled labor, our business, financial condition and operating results would be harmed.

In particular, transferring product lines to other manufacturing locations and/or to or from our contract manufacturers' facilities often requires us to transplant complex manufacturing equipment and processes across a large geographical distance, train a completely new workforce concerning the use of this equipment and these processes and comply with local regulations. In addition, certain of our customers may require us to requalify products supplied to them in connection with the relocation of manufacturing operations. If we are unable to manage these transfers and training smoothly and comprehensively, or if we are unable to requalify products in a timely manner, we could suffer manufacturing and supply chain delays, excessive product defects, harm to our operating results and our reputation, and loss of customers. Further, the utilization of overseas manufacturing locations and contract manufacturers may require additional transportation and shipping providers, customs tariffs or export licenses, which may be difficult or costly to obtain.

Additionally, qualifying contract manufacturers and commencing volume production is expensive and time-consuming, and there is no guarantee we will continue to do so successfully. Further, our reliance on contract manufacturers reduces our control over compliance, assembly, quality assurance, production costs and material and component supply for our products. If we fail to manage our relationships with our contract manufacturers, or if any of our contract manufacturers violate laws or regulations or experience financial difficulty, delays, disruptions, capacity constraints or quality control problems, our ability to ship products to our customers could be impaired and our competitive position and reputation could be harmed. Further, if we or our contract manufacturers are unable to negotiate with suppliers for reduced material or component costs, our operating results could be harmed.

In addition, our contract manufacturers may terminate our agreements with them, including immediately if we become insolvent or fail to perform a material obligation under the agreements. If we are required to change contract manufacturers or assume internal manufacturing operations, including due to the termination of one of our contract manufacturing contracts, we will likely suffer manufacturing and shipping delays, lost sales, increased costs and damage to our customer relationships, any of which would harm our business, financial condition and operating results.

Our products could contain defects, which would increase our costs and seriously harm our business, financial condition, operating results and customer relationships.

Many of our products are inherently complex in design and, in some cases, require extensive customization and/or ongoing regular maintenance. Further, the manufacturing of these products often involves a highly complex and precise process and the utilization of specially qualified materials or components that conform to stringent specifications. Many of our products also require highly skilled labor. As a result of the technical complexity of these products, design defects, skilled labor turnover, changes in our or our suppliers' manufacturing processes or the inadvertent use of defective or nonconforming materials or software by us or our suppliers could adversely affect our manufacturing yields and product reliability. This could in turn harm our business, operating results, financial condition and customer relationships.

We provide warranties for our products, and we accrue allowances for estimated warranty costs at the time we recognize revenue for the sale of the products. The determination of such allowances requires us to make estimates of product return rates and expected costs to repair or replace the products under warranty. We establish warranty reserves based on historical warranty costs for our products. If actual return rates or repair and replacement costs differ significantly from our estimates, our operating results would be negatively impacted.

Our customers may discover defects in our products after the products have been fully deployed and operated under peak stress conditions. In addition, some of our products are combined with other suppliers' products, which may contain defects. Further, some of our customers use our products in ways other than their intended purpose. As a result, should problems occur, it may be difficult to identify the source of the problem. If we are unable to promptly identify and fix defects or other problems, we could experience, among other things:

- Loss of customers;
- Increased costs of product returns and warranty expenses;

- Increased costs required to analyze and mitigate the defects or problems;
- Damage to our reputation;
- Failure to attract new customers or achieve market acceptance;
- Diversion of development, engineering and service resources; and/or
- Legal action by our customers or their customers.

The occurrence of any of these factors could seriously harm our business, financial condition and operating results.

Chemical manufacturing is inherently hazardous and could result in accidents that disrupt our operations or expose us to significant losses or liabilities.

The hazards associated with chemical manufacturing and the related storage and transportation of chemical raw materials, products and waste are inherent to MSD's operations. These hazards could lead to an interruption or suspension of operations and have a material adverse effect on the productivity and profitability of a particular manufacturing facility or on our business as a whole. Potential risks include storage tank leaks and ruptures, explosions and fires, and chemical spills and other discharges or releases of toxic or hazardous substances or gases. These risks could be caused or exacerbated by mechanical failures, unscheduled downtime, labor difficulties, transportation interruptions, inclement weather, natural disasters, cybersecurity breaches or terrorist attacks. These hazards may result in personal injury and loss of life, damage to property, and contamination of the environment, which may result in a suspension of operations and the imposition of civil or criminal fines, penalties and other sanctions, cleanup costs, and claims by our employees, governmental entities or third parties. We are dependent on the continued operation of our production facilities, and the loss or shutdown of operations at any of our major operating facilities could have a material adverse effect on our business, financial condition and operating results.

We outsource a number of services to third-party service providers, which decreases our control over the performance of these functions. Disruptions or delays at our third-party service providers could adversely impact our operations.

We outsource a number of services, including certain IT systems and systems management, logistics, contract manufacturing, payroll and tax functions, to third-party service providers. While outsourcing arrangements may lower our cost of operations, they also reduce our direct control over the services rendered. This diminished control may have an adverse effect on the quality or quantity of services rendered, on our ability to quickly respond to changing market conditions, or on our ability to ensure compliance with all applicable domestic and foreign laws and regulations. If we do not effectively develop and manage our outsourcing strategies, if required export and other governmental approvals are not timely obtained, if our third-party service providers do not comply with laws or perform as anticipated, or do not adequately protect our data, including from cybersecurity breaches, or if there are delays or difficulties in enhancing business processes, we may experience operational difficulties, increased costs, manufacturing or service interruptions or delays, loss of intellectual property rights or other sensitive data, quality and compliance issues, and challenges in managing our product inventory or recording and reporting financial and management information, any of which could materially and adversely affect our business, financial condition and operating results.

The loss of net revenues from any one of our major customers would likely have a material adverse effect on us.

Our top ten customers accounted for approximately 30%, 42% and 46% of our net revenues for 2023, 2022 and 2021, respectively. In any one reporting period, a single customer or several customers may contribute an even larger percentage of our consolidated net revenues. While the Atotech Acquisition has mitigated our reliance on these customers to some degree, the loss of any of these customers or any significant reduction in orders by these customers, including reductions due to economic, market or competitive conditions or regulatory requirements, would likely have a material adverse effect on our business, financial condition and operating results. None of our significant customers has entered into an agreement with us requiring it to purchase any minimum quantity of our products.

Attempts to lessen the adverse effect of any loss or reduction of net revenues through the rapid addition of new customers would be difficult because a relatively small number of companies dominate the semiconductor and electronics manufacturing industries. Further, prospective customers typically require lengthy qualification periods prior to placing volume orders with a new supplier. Our future success will continue to depend upon:

- Our ability to maintain relationships with existing key customers;
- Our ability to attract new customers and satisfy any required qualification periods;
- Our ability to introduce new products in a timely manner for existing and new customers;

- The successes of our original equipment manufacturer (“OEM”) customers in creating demand for their capital equipment products that incorporate our products; and
- Our ability to gain significant customers in new, emerging segments of our markets.

Key personnel have been, and may continue to be, difficult to attract and retain.

Our ability to maintain and grow our business is directly related to the service of our employees, who we consider to be a significant asset. Our performance is directly tied to our ability to hire, train, motivate and retain qualified personnel, including highly skilled technical, financial, managerial, and sales and marketing personnel. There is significant competition for personnel in the technology and sciences marketplace, particularly in certain geographies where we are located, including the Boston area, Orange County and the San Francisco Bay area of California, China, Germany, Japan and Singapore. Also, employees in our industries are increasingly able to work remotely, which could increase employee mobility and turnover, making it more difficult for us to attract and retain employees. In addition, many of our product manufacturing processes and product services require deep technical expertise, and it can be particularly challenging to identify and attract candidates and retain employees possessing such expertise. We have experienced, and may continue to experience, attrition in certain key positions. For example, Seth H. Bagshaw, our Executive Vice President, Chief Financial Officer and Treasurer, will retire from these positions on April 1, 2024, and as of February 27, 2024, we had yet to appoint his replacement. A related challenge is that a significant portion of our technical talent is nearing retirement age, and we may have difficulty attracting a sufficient number of employees with the necessary skills to replace them. If we are unable to hire sufficient numbers of qualified employees or retain and motivate existing employees, our business and operating results would be harmed.

Risks Related to Our Industries and Markets

The semiconductor, electronics manufacturing and automotive industries we serve are characterized by periodic fluctuations in business activity that may cause a reduction in demand for our products.

Our business depends upon capital expenditures of semiconductor device manufacturers (which in turn depends upon the demand for semiconductors), electronics manufacturers and Tier 1 and Tier 2 suppliers for the automotive industry. All of these industries have historically experienced cyclical variations in product supply and demand. For example, while our sales to semiconductor capital equipment manufacturers and semiconductor device manufacturers sequentially increased 12% in 2022, our semiconductor revenue sequentially decreased 28% in 2023, as a result of softening in the market. These sometimes sudden and severe cycles can result from many factors, including overall consumer and industrial spending and demand for electronic products that drive manufacturer production. These cycles can also result from manufacturers' capacity utilization, timing of new product introductions, demand for customers' products, inventory levels relative to demand, access to affordable capital, labor conditions, prices of commodities and energy costs. The timing, severity and duration of these cycles are difficult to predict, and we may not be able to respond effectively to these cycles.

During downturns in the semiconductor and electronics manufacturing industries, periods of overcapacity have resulted in significantly reduced demand for our products, which may result in lower gross margins due to reduced absorption of manufacturing overhead, as our ability to rapidly and effectively reduce our cost structure in response to such downturns is limited by the fixed nature of many of our expenses in the near term. During downturns in the automotive industry, we have experienced a similar effect on the gross margins of the GMF business of MSD. Further, our ability to reduce our long-term expenses is constrained by our need to continue investing in next-generation product technology and to support and service our products. In addition, due to the relatively long manufacturing lead times for some of the products we sell to these industries, we may incur expenditures or purchase raw materials or components for products we are unable to sell. As a result, downturns in these industries may materially harm our business, financial condition and operating results. Conversely, during upturns in these industries, we may have difficulty rapidly and effectively increasing our manufacturing capacity to meet sudden increases in customer demand. If we fail to do so, we may lose business to our competitors and our relationships with our customers may be harmed.

Many of the markets and industries we serve are highly competitive, are subject to rapid technological advancement, and have narrow design windows, and if we fail to introduce new and innovative products or improve our existing products, or if our products or the applications we invest in do not achieve widespread adoption, our business, financial condition and operating results will be harmed.

We operate in highly competitive markets characterized by rapid technological advances, frequent product introductions and enhancements, changing customer requirements, evolving industry standards, substantial capital investment and increasing price pressure. Our success depends upon our ability to continuously develop, market and support superior products, processes and solutions. Factors that could harm our competitive position include:

- Our failure to anticipate demand for and internally develop or acquire new, improved and disruptive technologies;
- Our investment in emerging applications that do not achieve widespread adoption or significant growth;
- Delays in introducing new, enhanced and differentiated products, many of which are difficult to design and manufacture because of their sophistication and complexity;
- Reduced manufacturing capabilities, customer service or support;
- Our inability to have semiconductor device manufacturers direct semiconductor capital equipment manufacturers to use our products at their semiconductor fabrication facilities;
- Our inability to have global electronics OEMs specify our products in their manufacturing processes for the rigid PCB manufacturers they use;
- Failure of customers to achieve market demand for their products that incorporate our technologies;
- Efforts of customers to internally develop products that compete with our technologies or to engage subcontract manufacturers or system integrators to manufacture competitive products on their behalf;
- Competitors that develop products that offer superior performance or technological features;
- Competitors with greater financial, technical, marketing and other resources, including ownership by or affiliations with members of government, political entities or larger, multinational businesses, which may offer a number of competitive advantages, such as the ability to incur lower costs due to control over sources of components and raw materials or exclusive agreements with suppliers thereof;
- Competitors with greater recognition and stronger presences in specific product niches and/or regions, including in the specialty chemicals industry;
- Competitors, particularly in Asia, that are able to develop low-cost competitive products;
- Difficulties in displacing competitors' products that are designed into customers' products;
- Pricing pressure from customers and competitors, particularly new competitors that offer aggressive price and payment terms in an attempt to gain market share, and especially during cyclical downturns in our markets, when end-markets become more sensitive to costs and competitors are more likely to seek to maintain or increase market share, reduce inventory or introduce more technologically advanced or lower-cost products;
- Industry consolidation among competitors, which could exacerbate certain of these factors; and
- Regulatory changes that prevent or restrict the supply of our products and services to a particular industry, market or country.

Certain of these factors could cause customers to defer or cancel orders for our products and/or place orders for our competitors' products. This is particularly significant to us, as our success depends on many of our products being designed into new generations of equipment and manufacturing processes. Certain markets in which we operate, such as the semiconductor capital equipment market and the mobile phone market, which is part of our electronics and packaging market, experience cyclicity and unevenness in capital spending. If we are unable to introduce new products in a timely manner or are otherwise unsuccessful in making sales to customers, we may miss market upturns or fail to have our products or subsystems designed into our customers' products. For example, new products designed by capital equipment manufacturers historically have had a lifespan of five to fifteen years. We must develop products that are technologically advanced in a timely manner so that they are positioned to be chosen for use in each successive generation of capital equipment.

These factors could also prompt us to agree to pricing concessions or extended payment terms with our customers, in an effort to expand into new markets, gain volume orders or improve customer cost of ownership in highly competitive applications. In other cases, we may discontinue selling certain products if we cannot offset price erosion through shifts in operations.

Finally, these factors could render the portfolios of products or lines of business from which we generate significant net revenues obsolete. For example, MSD has lost business to customers who identify alternative materials or processes and therefore no longer require as much or any specialty chemicals. If our customers or the industries we serve shift to other technologies, our business, financial condition and operating results would be harmed.

We offer products for multiple markets and must face the challenges of supporting the distinct needs of each of the markets we serve.

We offer products for very diverse markets. Because we operate in multiple markets, we must work constantly to understand the needs, standards and technical requirements of many different applications within these markets, and must devote significant resources to developing different products for these markets. Product development is costly and time consuming. We must anticipate trends in our customers' industries and develop products before our customers' products and processes are commercialized. If we do not anticipate our customers' needs and future activities, we may invest substantial resources in developing products that do not achieve broad market acceptance. Our growth prospects rely in part on successful entry into new markets, which depends on displacing competitors who are more familiar with these markets and better known to customers. In many cases, we are attempting to enter or expand our presence in these new markets with newly introduced products that are not yet proven in the industry. Our decision to continue to offer products to a given market or to penetrate new markets is based in part on our judgment of the size, growth rate, profitability and other factors that contribute to the attractiveness of a particular market. If our product offerings in any particular market are not competitive, our analyses of a market are incorrect or our sales and marketing approach for a market is ineffective, we may not achieve anticipated growth rates in this market, and our business, financial condition and operating results would be harmed.

Further, serving diverse markets requires an understanding of different sales cycles and customer types, and the development and maintenance of a complex global sales team and sales channels to support each market's differing needs. It also requires dynamic operations that can support both complex, customized product builds as well as quick turn-around for commercial off-the-shelf sales. If we fail to provide sales and operational support for our diverse markets, our business, financial condition and operating results would be harmed.

Risks Related to Operating a Global Business

We face significant risks associated with doing business internationally.

We face significant risks from our substantial operations in, sales to, and purchases from international markets. Our presence and operations in international markets, and the risks associated with doing business internationally, may continue to change and will likely increase if our business grows. These risks, many of which we have experienced, include:

- Adverse changes or instability in political or economic conditions in countries or regions where we and our customers and suppliers are located, including currency devaluations, debt defaults, lack of liquidity and recessions;
- Challenges of administering our diverse business and product lines globally;
- Actions of government regulatory authorities, including embargoes, sanctions (including "anti-blocking" rules), executive orders, import, export, and reexport restrictions, antiboycott laws, tariffs (including anti-dumping and countervailing duties), currency controls, trade restrictions and trade barriers (including retaliatory actions), license requirements (including license-specific restrictions and provisos), citizenship requirements, nationality restrictions, environmental requirements and other rules and regulations (including extraterritorial rules and regulations) applicable to the manufacture, import, export, reexport or end-use of our products, all of which may be complicated and conflicting, require significant investments in cost, time and resources for compliance, negatively impact revenues and margins, and impose strict and severe penalties for non-compliance;
- Political and social attitudes, laws, rules, regulations and policies within countries that favor domestic companies over non-domestic companies, including customer- or government-supported efforts to promote the development and growth of local competitors;
- Greater risk of violations of U.S. and international laws and regulations, including anti-corruption and trade laws, and our code of conduct, by our employees, sales representatives, distributors or other agents;
- Ambiguous or vague laws that make collecting payments or seeking recourse difficult;
- Increased credit risk and differing financial conditions of customers and distributors, resulting in longer accounts receivable collection periods and payment cycles, increased bad debt write-offs and additions to reserves;
- Overlapping, burdensome and differing tax structures and laws;
- Potential for certain tax benefits to be revoked or reclaimed;
- Reduced, inconsistent or differing protection of intellectual property, including unequal recognition and treatment of multi-national corporations' rights by hostile or indifferent governments;

- Increasingly stringent privacy, security, consumer and data protection laws, such as the EU General Data Protection Regulation, the Data Security Law of China and the China Personal Information Protection Law;
- Shipping, logistics and other supply chain complications or cargo security requirements, including forced-labor mitigation rules and increased shipping costs, the latter of which certain parts of our business are experiencing as a result of the attacks on shipping in the Red Sea;
- Adverse currency exchange rate fluctuations;
- Restrictions on currency conversion or the transfer of funds, including restrictions on certain financial institutions themselves;
- Compliance costs, withholding taxes and legal and contractual restrictions associated with repatriating overseas earnings;
- Increased risk of exposure to significant health concerns (such as Monkeypox, COVID-19, Sudden Acute Respiratory Syndrome, Avian Influenza and the H7N9, Ebola or Zika viruses);
- Differences in business practices, culture, language and management style;
- Complex, burdensome and differing labor and employment laws and practices;
- Changing labor conditions and difficulties staffing, managing, and rationalizing our foreign operations, including, rising wages and other labor costs, retention of employees, the formation of labor unions and works councils and the maintenance of defined benefit pension plans;
- Nationalization or other expropriation of private enterprises or land;
- Involuntary geopolitical annexations or accessions through military force or otherwise; and
- Increased risk of exposure to civil unrest, terrorism, government sanctioned and non-government sanctioned acts of violence, and military activities.

If we experience any of the risks associated with doing business internationally, our business, financial condition and operating results could be significantly harmed.

We have significant facilities and operations and a considerable number of employees in Israel. A number of our products are manufactured in facilities located in Israel. Following the Hamas attack on Israel in October 2023, some of our employees in Israel were called for active military duty. While, as of February 27, 2024, our facilities in Israel remain operational, the continuation, escalation or expansion of the Israel-Hamas war, including the expansion of hostilities into other parts of the Middle East, and other regional conflicts could negatively affect business conditions and significantly disrupt our operations in Israel. More broadly, the future of peace efforts between Israel and its neighboring countries remains extremely uncertain. Any other armed conflicts or further political instability in the region could similarly negatively affect our business, including if additional employees in Israel are called for active military duty. If the Israel-Hamas war continues, escalates or expands, or another military conflict or war in the region arises, our operations in Israel could be disrupted, including by the absence of one or more key employees or a significant number of other employees. Any such disruptions could adversely affect our business.

MSD has limited operations and employees in Belarus. Historically, we have made immaterial sales into Russia and Belarus. As a result of the ongoing military conflict between Russia and Ukraine, including the imposition of sanctions on Russia, Belarus and related parties, our sales into Belarus and Russia have ceased. Any additional disruptions, including the expansion of sanctions in connection with the conflict, could adversely affect our business.

The U.S. government continues to take action against certain of our customers, particularly our customers located in Asia, including indictments for various criminal charges, and in some cases, restrictions on doing business with these customers (or restrictions on third parties from engaging designated entities), including the suspension of our ability to fill outstanding orders. These actions have caused us, and will in the future cause us, to lose anticipated revenue from product sales, the amount of which could be significant. In addition, these or other customers could elect to purchase products from unaffected non-U.S. competitors, even when trade restrictions are not in place, jeopardizing our long-term relationship with them. Further, compliance with regulatory restrictions may cause us to breach contractual obligations, which could result in costs, penalties and litigation. Additionally, potential customers in certain countries, particularly in Asia, have a strong preference for technology and products developed by suppliers based in their home countries. The trade dispute between the U.S. government and the Chinese government has reinforced and broadened this preference, as potential and existing customers seek to avoid the uncertainty related to the trade dispute. While we have attempted to mitigate these issues by establishing a significant local presence in many of these countries, companies like us that are based elsewhere remain at a disadvantage.

We face significant risks associated with doing increased business in China in particular.

The Atotech Acquisition significantly increased our operations and assets in, and revenues generated from, China. As a result of our presence in China, we are subject to the following significant risks:

- Adverse changes in Chinese political, economic or social conditions or Chinese laws, regulations or policies, including the imposition of unexpected or confiscatory taxation, restrictions on currency conversion, imports and sources of supply, devaluations of currency, the nationalization or other expropriation of private enterprises, or the reversal of economic reform policies that encourage private economic activity, foreign investments and greater economic decentralization;
- Differing economic practices compared to most developed countries, including with respect to the amount of government involvement, control of foreign exchange and allocation of resources;
- Uncertainties presented by the Chinese legal system, which is not fully integrated and continues to rapidly evolve, impeding our ability to interpret certain Chinese laws and regulations, predict and evaluate the outcome of administrative and court proceedings and the level of legal protection in China and enforce contracts we have entered into in China; and
- Chinese controls on the convertibility of Renminbi into foreign currencies and, in certain cases, the remittance of currency out of China, restricting our ability to remit sufficient foreign currency to pay dividends or make other payments to us, or otherwise satisfy foreign currency-denominated obligations.

If we experience any of the risks associated with doing business in China, our business, financial condition and operating results could be significantly harmed.

Unfavorable currency exchange rate fluctuations may lead to lower operating results or may cause us to change customer pricing, which could result in reduced sales and losses.

Although we report our financial position and operating results in U.S. dollars, a significant portion of our net revenues are from customers in international markets where we invoice in currencies other than the U.S. dollar, and we have facilities where costs are incurred in currencies other than the U.S. dollar. In addition, we carry certain assets and liabilities in currencies other than the U.S. dollar. The indebtedness we incurred in connection with the Atotech Acquisition includes a Euro tranche of €843 million as of January 22, 2024, the date of the USD Tranche A Refinancing. Currency exchange rate fluctuations could have an adverse effect on our assets, liabilities, net revenues, expenses and operating results and we could experience losses with respect to our hedging activities. Unfavorable exchange rate fluctuations could require us to increase or decrease prices to customers, which could result in lower net revenues from such customers. Alternatively, if we do not adjust the prices for our products in response to unfavorable currency fluctuations, our operating results could be adversely affected by declining net revenues or profit margins for our products. Such exchange rate fluctuations could also increase the costs and expenses of our non-U.S. operations when translated into U.S. dollars or require us to modify our current business practices. In addition, most sales made by our foreign subsidiaries are denominated in the currency of the country in which these products are sold and the currency they receive in payment for such sales could be less valuable on a U.S. dollar basis at the time of receipt as a result of exchange rate fluctuations. We enter into foreign exchange forward contracts to reduce a portion of our currency exposure arising from intercompany sales of inventory as well as intercompany accounts receivable and intercompany loans. However, we cannot be certain that our efforts will be adequate to protect us from significant exchange rate fluctuations or that such efforts will not expose us to additional exchange rate risks.

Legal, Tax, Regulatory and Compliance Risks

We previously identified a material weakness in our internal control over financial reporting and may discover additional material weaknesses in the future. Our inability to remediate material weaknesses in the future, and our inability to achieve and maintain effective disclosure controls and procedures and internal control over financial reporting, could adversely affect our results of operations, our stock price and investor confidence in our Company.

Section 404 of the Sarbanes-Oxley Act of 2002 requires that companies evaluate and report on the effectiveness of their internal control over financial reporting. In addition to the Company's evaluation, our independent registered public accounting firm provides an opinion regarding the effectiveness of our internal control over financial reporting. As disclosed in more detail in Part II, Item 9A, "Controls and Procedures" below, following the ransomware incident in February 2023, we identified a material weakness as of December 31, 2022 in our internal control over financial reporting. Our assessment was we did not maintain sufficient IT controls to prevent or detect, on a timely basis, unauthorized access to our financial reporting systems. Specifically, we did not design or maintain effective controls with respect to our financial reporting systems related to access authentication,

intrusion detection and response capability, and backup and restoration such that recovery from a cybersecurity incident could be performed in a more timely manner.

Internal controls related to our financial reporting systems are important to accurately reflect our financial position and results of operations in our financial reports. Due to the material weakness in our internal control over financial reporting, we also concluded our disclosure controls and procedures were not effective as of December 31, 2022.

Failure to have effective internal control over financial reporting and disclosure controls and procedures can impair our ability to produce accurate financial statements on a timely basis and could lead to a restatement of our financial statements. If, as a result of the ineffectiveness of our internal control over financial reporting and disclosure controls and procedures, we cannot provide reliable financial statements, our business decision processes may be adversely affected, our business and results of operations could be harmed, investors could lose confidence in our reported financial information and our ability to obtain additional financing, or additional financing on favorable terms, could be adversely affected.

Our management took action to remediate the material weakness, concluding that the material weakness had been fully remediated as of December 31, 2023. Additional details regarding the remediation efforts are disclosed in Part II, Item 9A, “Controls and Procedures” below. Although we remediated this material weakness, we could in the future identify additional internal control deficiencies that could rise to the level of a significant deficiency or material weakness or uncover other errors in financial reporting. There can be no assurance that future remediation efforts will be successful, that our internal control over financial reporting will be effective as a result of these efforts, or that any future significant deficiencies may not be material weaknesses that would be required to be reported in future periods. In addition, we cannot provide assurance that our independent registered public accounting firm will be able to attest that such internal controls are effective when they are required to do so.

If we fail to remediate any future material weaknesses and maintain effective disclosure controls and procedures or internal control over financial reporting, our ability to accurately record, process, and report financial information and, consequently, our ability to prepare financial statements within required time periods could be adversely affected. Failure to maintain effective internal controls could result in a failure to comply with SEC rules and regulations, stock exchange listing requirements, and the covenants under our debt agreements, subject us to litigation, investigations or enforcement actions, negatively affect investor confidence in our financial statements, and adversely impact our stock price and ability to access capital markets. The defense of any such claims, investigations or enforcement actions could cause the diversion of the Company’s attention and resources and could cause us to incur significant legal and other expenses even if the matters are resolved in our favor.

If significant trade restrictions or tariffs on our products or components that are imported from or exported to China continue or are increased, our business, financial condition and operating results may be materially harmed.

Trade tensions between the United States and China have increased substantially in recent years, resulting in significant trade restrictions that have significantly harmed our business. These regulations include tariff increases, additional sanctions against specified entities, and the broadening of restrictions and license requirements for specified end-uses of those of our products that are subject to these restrictions, including restrictions surrounding specific product groups, applications and/or end uses. The U.S. government concerns relate to, among other things, national security concerns and the concept of “military/civil fusion” in China, a national strategy in which military technologies are developed or produced alongside commercial, non-military items, often by private or quasi-government companies. In addition to targeted comprehensive sanctions against specific firms, in recent years, “Entity List” designations and “military end-user” controls have been significantly modified, as were some rules relating to items produced outside the United States that incorporate more than de minimis levels of U.S. controlled content or derived from (i.e., the “direct product” of) U.S. origin technologies. Recently, in October 2022, the U.S. Department of Commerce’s Bureau of Industry and Security (“BIS”) implemented new and novel restrictions related to end-uses in semiconductor, semiconductor manufacturing, supercomputer, and advanced computing, along with certain equipment used to develop and produce them, as well as controls around the activities of U.S. persons in certain markets, including China. These regulations, which BIS amended in October 2023 (as amended, the “BIS Rules”), have resulted in, and may in the future result in, loss of business, both directly to China end-customers, and indirectly through our OEM customers, as well as additional export license requirements on shipments of our products, parts and supplies, and associated increased administrative burdens. For example, as a result of the BIS Rules, we estimate our net revenues were reduced by approximately \$200 to \$250 million in 2023. The extraordinary complexity of these rules, combined with the likelihood of further amendments from BIS, significantly increases our risk of non-compliance, which could result in fines and other penalties, and could change how these rules impact us. While we continue to adjust our policies and practices to ensure compliance with these regulations, and we will seek to mitigate their impact, there can be no assurances that current or future regulations and tariffs will not have a material adverse effect on our business.

Since the beginning of 2019, regulatory changes have been implemented at an extraordinarily high pace, which increases the resources needed to monitor and comply with regulations, while heightening the risk of non-compliance. Such regulatory changes include the addition by BIS of China-based Huawei Technologies Co., Ltd. (“Huawei”), Semiconductor Manufacturing International Corporation (“SMIC”), Yangtze Memory Technologies Corp (“YMTC”) and many of their respective affiliates onto

its Entity List. Accordingly, we have implemented additional monitoring processes and suspended orders from Huawei, SMIC, YMTC and certain other designated Chinese-based customers, where those orders are subject to U.S. jurisdiction. We have also been negatively impacted by the cancellation of orders from customers who are suppliers to these firms. BIS has also modified the Foreign Direct Product and “military end-use” rules, expanded the scope of products and technologies that would require licenses for military end-uses, primarily in China, and expanded the list of “military end users,” mostly in China. Beginning in October 2022, the BIS Rules imposed new restrictions on our ability to sell, ship, service and support certain equipment and otherwise conduct business with certain counterparties, primarily China-based companies involved in semiconductor manufacturing, which has negatively impacted, and we expect will continue to negatively impact, our revenues. At the same time, BIS also added numerous China-based companies, including companies with which we do business, to its “Unverified List.” Placement on the Unverified List may be an indication of additional future restrictions by BIS, as was the case with YMTC, which was added to the Unverified List in October 2022 and was then added to the Entity List in December 2022.

Increased restrictions on China may lead to regulatory retaliation by the Chinese government and further escalate geopolitical tensions between China and Taiwan. China has adopted, and announced its intention to further adopt, new regulations, which could have an adverse effect on our operations. For example, in response to the imposition of U.S. tariffs in 2018 and 2019, China imposed its own retaliatory tariffs. In 2019, China’s Ministry of Commerce also announced an “unreliable entity list” under which non-Chinese entities that cut off supply to Chinese companies may be subject to government action. Because many of the mechanisms for being named to the list, removed from the list, and enforcement remain ill-defined and unavailable to the public, the potential impacts of the regulation remain unknown. In addition, in 2023, China adopted export curbs on crucial raw materials, including gallium, germanium, and graphite, that may have both direct and indirect adverse impacts on our business and supply chain.

The ongoing geopolitical tensions and economic uncertainty between the United States and China caused by recent tariffs, Entity List and “military end user” designations, foreign-made product rules and the BIS Rules, and the unknown impact of current and future Chinese trade regulations, may continue to increase costs, as well as restrict our ability to sell, or decrease demand from customers to purchase, our products, directly and indirectly, which could materially harm our business, financial condition and operating results. This trade uncertainty has caused, and may continue to cause, customers to delay or cancel orders, as they mitigate their own supply chain and cost exposure by sourcing from locally based suppliers or suppliers based in other countries. Such delays and cancellations could have a material impact on our business, financial condition and operating results. It is possible that additional trade restrictions will be imposed, and that existing tariffs will be increased on imports of our products or the components used in our products and/or that our business will be impacted by additional retaliatory tariffs or restrictions imposed and/or increased by China or other countries in response to existing or future tariffs. These developments could cause us to lose additional sales and customers, incur increased costs and lower margins, seek alternative suppliers, raise prices or make changes to our operations, any of which could materially harm our business, financial condition and operating results.

We are subject to international trade compliance regulations, and violations of those regulations could result in fines or trade restrictions, which could have a material adverse effect on us.

We are subject to trade compliance laws in both the United States and other jurisdictions where we operate. For example, exports of our products and technology developed or manufactured in the United States are subject to export controls imposed by the U.S. government and administered by the U.S. Departments of Commerce and, to a lesser extent, State and Treasury. Export regulations govern exports of our products and technology developed or manufactured in other countries, including, for example, Austria, China, France, Germany, Israel, Romania and Singapore. In certain instances, these regulations may require obtaining licenses from the administering agency prior to exporting products or technology to international locations or foreign nationals, including foreign nationals employed by us in the United States and abroad. For products and technology subject to the U.S. Export Administration Regulations administered by BIS, the requirement for a license is dependent on the type and end use of the product and technology, the final destination and the identity and nationality of the end user. Virtually all exports from the United States of defense articles subject to the International Traffic in Arms Regulations, administered by the Department of State’s Directorate of Defense Trade Controls, require a license. The Israeli Ministry of Economy and the Defense Export Control Agency of the Israeli Ministry of Defense administer similar export regulations and license requirements, which apply to many of our products and technology developed or manufactured in Israel. In addition, the Romanian Ministry of Foreign Affairs and the Department for Export Controls administer similar export regulations and license requirements, which apply to many of our products and technology developed or manufactured in Romania. Obtaining export licenses can be difficult and time-consuming, and we may not be successful in obtaining them. Failure to obtain export licenses to enable product and technology exports could reduce our net revenues, harm our relationships with our customers and could adversely affect our business, financial condition and operating results. Compliance with export regulations may also subject us to additional fees and costs. The absence of comparable export restrictions on competitors, whether due to technical specifications or such competitors’ geography, may adversely affect our competitive position.

In addition, if we or our international representatives or distributors fail to comply with any of these export regulations, we or they could be subject to civil and criminal and monetary and non-monetary penalties and costly consent decrees, and we could experience disruptions to our business, restrictions on our ability to export products and technology, damage to our reputation and significant harm to our business and operating results. We are engaged in a systematic, risk-based review of our compliance-related activities to identify and remediate known and suspected weakness (e.g., product export classification). In connection with that review, we identified certain activities that were non-compliant with applicable trade regulations, and have submitted appropriate voluntary disclosures to applicable authorities to report such non-compliance. While such instances of non-compliance have not had a material adverse impact on us to date, it is not yet known whether, or to what extent, this continuing review will yield additional reportable non-compliance. Additionally, while we have implemented policies and procedures to comply with these laws, we cannot be certain that our employees, contractors, suppliers or agents will not violate such laws or our policies.

Changes in tax rates or tax regulation or the termination of tax incentives could affect our operating results.

As a global company, we are subject to taxation in the United States and various other countries. Significant judgment is required to determine and estimate worldwide tax liabilities. Our future annual and quarterly effective tax rates could be materially affected by numerous factors, including changes in the following: applicable tax laws; the organizational structure of our business, including reorganizations, location of assets and outstanding indebtedness; composition of pre-tax income in countries with differing tax rates; our determinations of tax liabilities; and/or valuation of our deferred tax assets and liabilities.

Changes in U.S. tax law, such as the Tax Cuts and Jobs Act, the Inflation Reduction Act, and changes in regulations and tax guidance may affect our business. Additionally, the United States is considering various corporate and international income tax proposals, which, if enacted, could have a material impact on our provision for income taxes and effective tax rate.

Many countries in which we operate are implementing legislation and other tax changes to align their tax systems with the Organisation for Economic Co-operation and Development global minimum tax rate known as Pillar Two of the Global Anti-Base Erosion (“GloBE”) rules. The GloBE rules provide a framework for a coordinated multi-country system of taxation intended to ensure large multinational enterprise groups pay a minimum level of tax on the income arising in each of the jurisdictions where they operate. Many jurisdictions, including many EU countries, have enacted certain provisions of the GloBE rules effective as of January 1, 2024. The GloBE rules could have a materially adverse effect on our financial condition and operating results.

We are subject to regular examination by the U.S. Internal Revenue Service and state, local and foreign tax authorities. We regularly assess the likelihood of favorable or unfavorable outcomes resulting from these examinations to determine the adequacy of our provision for income taxes. Although we believe our tax estimates are reasonable, we can make no assurances that any final determination of tax liability will not be materially different from the treatment reflected in our historical income tax provisions and accruals, which could materially and adversely affect our financial condition and operating results.

We qualify for tax incentives based on our ability to meet, on a continuing basis, various tests relating to our employment levels, research and development expenditures and other qualification requirements in a particular jurisdiction. While we intend to operate in such a manner to maintain and maximize our tax incentives, we can make no assurances that we have so qualified or that we will so qualify for any particular year or jurisdiction. If we fail to qualify or remain qualified for certain tax incentives, the tax incentives we previously received may be terminated and/or retroactively revoked, requiring repayment of past tax benefits, and we would be subject to an increase in our effective tax rate, which could have a materially adverse impact on our financial results.

Many of our products and customers are subject to numerous laws regulating the production and use of chemical substances, and some of our products may need to be reformulated or discontinued to comply with these laws and regulations.

As MSD manufactures specialty chemicals, we are subject to chemicals approvals, registrations and regulations around the world, including European Union Regulations on Registration, Evaluation, Authorisation and Restriction of Chemicals (“EU REACH”) in the EU, the Toxic Substances Control Act (“TSCA”) in the United States, and similar laws and regulations in certain other jurisdictions in which we and our customers operate. In recent years, changes to existing laws and regulations and the adoption of new laws and regulations have imposed new obligations, including restrictions and prohibitions on highly hazardous substances, could also force us to reformulate or discontinue certain of our products.

Governmental, regulatory, and societal demands for increasing levels of product safety and environmental protection are resulting in increased pressure for more stringent regulatory control with respect to the chemical industry, including with respect to manufacturing, importing and using chemicals. For example, EU REACH imposes comprehensive compliance obligations and establishes mechanisms to identify and restrict high-concern chemicals, and comparable regulatory requirements have now been adopted in several other countries. As another example, in the United States, the core provisions of TSCA were amended in June 2016 for the first time in nearly 40 years. Among the more significant changes, the amended TSCA mandates risk evaluation of existing “high priority” chemicals. In addition, the U.S. Environmental Protection Agency (the “EPA”) must make a no “unreasonable risk” finding before a new chemical can be fully commercialized. These laws and regulations generally create

uncertainty about whether existing chemicals important to our business may be designated for restriction and whether the approval process for new chemicals may become more difficult and costly. These changes could adversely impact our ability to supply certain products to our customers and could also result in compliance obligations, fines, ongoing monitoring and other future business activity restrictions, which could have a material adverse effect on our business, financial condition and operating results.

Perfluorooctanesulfonic acid and other per- and polyfluoroalkyl substances (“PFAS”) are chemical agents that have been targeted for risk assessment, restriction, regulation and high-priority remediation and are the subject of litigation and governmental investigations in the United States and other countries. While we have developed a suite of products that do not require any PFAS chemicals and, when adopted by the industry, will obviate the need for PFAS-containing mist suppressants and wetting agents, we continue to sell a limited number of products that contain permissible levels of PFAS. We have been named as a defendant in a lawsuit related to PFAS and we have received a request for information from, and responded to, a state agency.

International environmental protection requirements, including chemical regulation requirements, and enforcement of these requirements, may become more stringent in the future and could result in material costs relating to regulatory compliance, liabilities, litigation proceedings, or other impacts, such as restrictions or prohibitions on our products. Future regulatory or other developments could also restrict or eliminate the use of, or require us to make modifications to, our products, packaging, manufacturing processes, transportation methods, and technology, which could have a material adverse effect on our business, financial condition, and operating results. Our production facilities require permits, such as environmental, operating, and product-related permits and import/export permits, which are subject to renewal and, in some circumstances, revocation. We may not obtain the necessary permits. In addition, permits may be discontinued or may contain significant and costly new requirements. If a permit for a production facility is not renewed or is revoked, the facility may need to be closed temporarily or permanently, which may have a material adverse effect on our business, financial condition and operating results. Failure to obtain or maintain permits for our facilities or other failure to comply with applicable environmental regulations could result in the shutdown of, or suspension of operations at, our plants.

Many of our customers are subject to the same or similar environmental regulations. The impact of these regulations on our customers and our customers' ability to comply with these regulations is outside of our control. However, non-compliance by our customers could have an indirect negative effect on our business. We must monitor relevant chemical regulatory developments in order to limit the associated risks of new developments by triggering countermeasures, such as alternative products and phase-outs, at the right time.

We are subject to environmental regulations. If we fail to comply with these regulations, our business could be harmed.

Our operations are subject to various federal, state, local and international laws and regulations relating to environmental protection, including those governing discharges of pollutants into the air, water and land, the reporting, generation, use, handling, storage, transportation, treatment and disposal of hazardous substances, waste and other materials and the cleanup of contaminated sites. In the United States, we are subject to the federal regulation and control of the EPA, and we are subject to regulations and controls of comparable authorities in other countries. Some of our operations, including our chemical operations, require environmental permits and controls to prevent and reduce air and water pollution, and these permits are subject to modification, renewal and revocation by issuing authorities. Future developments, administrative actions or liabilities relating to environmental matters, including sanctions such as capital expenditure obligations, clean-up and removal costs, long-term monitoring and maintenance costs, costs of waste disposal, natural resource damages and payments for property damage and personal injury, could have a material adverse effect on our business, financial condition or operating results.

Although we believe that our safety procedures for using, handling, storing and disposing of such materials comply with the standards required by applicable federal, state, local and international laws and regulations, we cannot completely eliminate the risk of accidental contamination or injury from these materials, including risks related to our chemical products, which are inherently hazardous. We have been, and may in the future be, subject to claims by employees or third parties alleging contamination or injury, and could be liable for damages, which liability could exceed the amount of our liability insurance coverage (if any) and the resources of our business.

Certain portions of the soil at the former facility of our Spectra-Physics lasers business, located in Mountain View, California, and certain portions of the aquifer surrounding the facility, through which contaminated groundwater flows, are part of an EPA-designated Superfund site and are subject to a cleanup and abatement order from the California Regional Water Quality Control Board. Spectra-Physics, which we acquired as part of the Newport acquisition in April 2016 and which had been acquired by Newport in 2004, along with other entities with facilities located near the Mountain View, California facility, were identified as responsible parties with respect to this Superfund site, due to releases of hazardous substances during the 1960s, 1970s and 1980s. Spectra-Physics and the other responsible parties entered into cost-sharing agreements covering the costs of remediating the off-site groundwater impact. The site is mature, and investigations, monitoring and remediation efforts by the responsible parties have been ongoing for approximately 35 years. We have certain ongoing costs related to investigation, monitoring and remediation of the site that have not been material to us as a whole in the recent past. However, while we benefited from the indemnification of

certain costs by a third party in the past, that indemnification is now in a transition period, and we will become subject to a greater portion of costs of remediation going forward. Our ultimate costs of remediation and other potential liabilities are difficult to predict. In the event that the EPA and the California Regional Water Quality Control Board determine that the site cleanup requires additional measures to ensure that it meets current standards for environmental contamination, or if they enhance any of the applicable required standards, we will likely become subject to additional remediation obligations in the future. In addition to our investigation, monitoring and remediation obligations, we may be liable for property damage or personal injury claims relating to this site. While we are not aware of any material claims at this time, such claims could be made against us in the future. If significant costs or other liability relating to this site arise in the future, our business, financial condition and operating results would be adversely affected.

In addition, some of MSD's manufacturing facilities and former facilities have an extended history of chemical manufacturing operations or other industrial activities, and contaminants have been detected at some of those sites. We or our predecessors have in the past been, and are currently, required to remediate contamination at several of these current and former sites, and there remains some risk that further investigation and remediation might be necessary.

The environmental regulations that we are subject to include a variety of federal, state, local and international regulations that restrict the use and disposal of materials used in the manufacture of our products or require design changes or recycling of our products. If we fail to comply with any present or future regulations, we could be subject to future liabilities, the suspension of manufacturing or a prohibition on the sale of products we manufacture. In addition, these regulations could restrict our ability to equip our facilities or could require us to acquire costly equipment, or to incur other significant expenses to comply with environmental regulations, including expenses associated with the recall of any non-compliant product and the management of historical waste. For example, in addition to EU REACH, which regulates the use of certain hazardous substances in certain products, the EU has enacted the Waste Electrical and Electronic Equipment Directive, which requires the collection, reuse and recycling of waste from certain products. Compliance with such laws requires significant resources. These regulations may require us to redesign our products or source alternative components to ensure compliance with applicable requirements, for example by mandating the use of different types of materials in certain components. Any such redesign or alternative sourcing may increase the cost of our products, adversely impact the performance of our products, add greater testing lead-times for product introductions, or in some cases limit the markets for certain products. Further, such environmental laws are frequently amended, which increases the cost and complexity of compliance. For example, such amendments have in the past resulted in, and may in the future result in, certain of our products falling within the scope of a directive, even if they were initially exempt. In addition, certain of our customers, particularly OEM customers whose end products may be subject to these directives, may require that the products we supply to them comply with these directives, even if not mandated by law. Because certain directives, for example, those issued from the EU, are implemented in individual member states, compliance is particularly challenging. Our failure to comply with any of such regulatory requirements or contractual obligations could result in our being directly or indirectly liable for costs, fines or penalties and third-party claims, and could jeopardize our ability to conduct business in certain countries.

We are exposed to various risks related to legal proceedings, including, for example, product liability claims, intellectual property infringement claims, regulatory claims, contractual claims and class action litigation, which if successful, could have a material adverse effect on our commercial relationships, business, financial condition and operating results.

From time to time, we may be involved in legal proceedings, enforcement actions or claims regarding product performance, product warranty, product certification, product liability, patent infringement, misappropriation of trade secrets, other intellectual property rights, data privacy, antitrust, environmental regulations, trade regulations, securities, contracts, unfair competition, employment, workplace safety, and other matters. We can provide no assurance of the outcome of these legal proceedings, enforcement actions or claims or that the insurance we maintain will be adequate to cover them.

For example, some of our products, such as certain ultrafast lasers, are used in medical and scientific research applications where malfunctions could result in serious injury. Certain of our products may be hazardous if not operated properly or if defective. Other products of ours, including our chemicals products and laser systems, are inherently hazardous and must be used with particular care. We are exposed to significant risks for product liability claims in the event of a significant line down situation or if death, personal injury or property damage results from the handling, use or storage of our products, including our chemical products and laser systems. We may experience material product liability losses in the future. We currently maintain insurance for certain product liability claims. However, our insurance coverage may not continue to be available on acceptable terms, if at all. This insurance coverage also may not adequately cover liabilities that we incur. Further, if our products are defective, we may be required to recall or redesign these products. A successful claim against us that exceeds our insurance coverage level or that is not covered by insurance, or any product recall, could have a material adverse effect on our commercial relationships, business, financial condition and operating results.

In addition, securities class action lawsuits and derivative lawsuits are often brought against companies who have entered into business combinations and acquisitions. We were previously involved in securities class action litigation in connection with the acquisitions of Newport and ESI. In each case, the plaintiffs alleged, among other things, that the then-current directors of the

acquired company breached their fiduciary duties to their respective shareholders by agreeing to sell the company through an inadequate and unfair process, leading to inadequate and unfair consideration, by agreeing to unfair deal protection devices, and by omitting material information from the proxy statement. We, or the companies we acquire, may be subject to additional securities class action litigation in connection with other recently completed or future business combinations and acquisitions.

With respect to data privacy and intellectual property, as a result of the ransomware event described under “Risks Related to Cybersecurity, Data Privacy and Intellectual Property Protection” above, and under “Management’s Discussion and Analysis of Financial Condition and Results of Operations—Ransomware Event” below, we were previously subject to two lawsuits, and we may be subject to future litigation, investigations, claims or actions, in addition to fines, penalties, or other obligations related to impacted data, whether or not such data is misused.

While we intend to vigorously defend any lawsuits, in light of the inherent uncertainties involved in such proceedings, we may incur losses associated with any such proceedings. Additionally, ongoing legal and other costs related to any potential future proceedings and inquiries, may be substantial, and losses associated with any adverse judgments, settlements, penalties or other resolutions of such proceedings and inquiries could be significant and have a material adverse impact on our business, reputation, financial condition, cash flows and operating results.

In addition, we have from time to time received claims from third parties alleging that we are infringing certain trademarks, patents or other intellectual property rights held by them. Such infringement claims have in the past resulted in, and may in the future result in, litigation, settlement or enforcement action. Any such action could be protracted and costly, and we could become subject to damages for infringement, or to an injunction preventing us from making, selling or using certain of our products or services, or using certain of our trademarks. Such claims could also result in the necessity of obtaining a license or paying damages relating to one or more of our products, services or current or future technologies, which may not be available on commercially acceptable terms or at all. Any intellectual property action and the failure to obtain necessary licenses or other rights or develop substitute technology may divert management’s attention from other matters and could have a material adverse effect on our business, financial condition and operating results. In addition, the terms of some of our customer contracts require us to indemnify the customer for any claim of infringement brought by a third party based on our products. Claims of this kind may have a material adverse effect on our commercial relationships, business, financial condition or operating results.

Although our standard commercial documentation sets forth the terms and conditions that we intend to apply to commercial transactions with our business partners, counterparties to these transactions may not explicitly agree to our terms and conditions. In situations where we engage in business with a third party without an explicit written agreement regarding the applicable terms and conditions, or where the commercial documentation applicable to the transaction is subject to interpretation, we may have disputes with those third parties regarding the applicable terms and conditions of our transaction with them. These disputes could result in deterioration of commercial relationships, costly and time-consuming litigation or additional concessions or obligations being offered by us to resolve these disputes, or could impact our net revenue or cost recognition. Any of these outcomes could materially and adversely affect our business, financial condition and operating results.

In addition, from time to time in the normal course of business we indemnify parties with whom we enter into contractual relationships, including customers, suppliers, consultants and lessors, with respect to certain matters. We have agreed, under certain conditions, to hold these parties harmless against losses, such as those arising from a breach of representations or covenants, negligence or willful misconduct, and other third-party claims that our products and/or technologies infringe intellectual property rights. We may be compelled to enter into or accrue for probable settlements of alleged indemnification obligations, or we may be subject to potential liability arising from our customers’ involvement in legal disputes. In addition, notwithstanding the provisions related to limitations on our liability that we seek to include in our business agreements, the counterparties to such agreements may dispute our interpretation or application of such provisions, and a court of law may not interpret or apply such provisions in our favor, any of which could result in an obligation for us to pay significant additional damages and engage in costly legal proceedings. It is difficult to determine the maximum potential amount of liability under any indemnification obligations, whether or not asserted, due to the unique facts and circumstances likely to be involved in any particular claim. Our business, financial condition and operating results in a reported fiscal period could be materially and adversely affected if we expend significant amounts in defending or settling any asserted claims, regardless of their merit or outcomes.

Legal proceedings, enforcement actions and claims, whether with or without merit, and associated internal investigations, may be time-consuming and expensive to prosecute, defend or conduct; divert management’s attention and other resources; inhibit our ability to sell our products or services; result in adverse judgments for damages, injunctive relief, penalties and fines; and negatively affect our business, including result in a material adverse effect on our financial condition, operating results and cash flows. We can make no assurances regarding the outcome of current or future legal proceedings, enforcement actions, claims or investigations or that the insurance we maintain will be adequate to cover them.

Risks Related to Pandemics and other Widespread Health Crises

The effects of the COVID-19 pandemic had, and the emergence of other widespread health crises may have, an adverse effect on our business, financial condition and operating results.

The COVID-19 pandemic subjected, and the emergence of other widespread health crises may subject, our business, financial condition and operating results to a number of risks, including:

- Supply chain disruptions and other operational challenges, including shortages of and significant price increases and increased lead times for raw materials, components and subassemblies, in particular where we rely on sole and limited source suppliers, increased employee turnover, increased health and safety measures, site closures, and other restrictions on the movement of people, goods and raw materials, which could reduce our ability to obtain materials from suppliers and meet customer demand, in each case on favorable terms, on a timely basis, or at all, harming our relationships with customers, creating opportunities for competitors and exposing us to contractual disputes or liability;
- The implementation of government mandates and other regulatory actions, including periodic business shutdowns, manufacturing restrictions, and quarantines, which could reduce or halt our operations or the operations of our customers and suppliers, carry into the future for an extended or unknown duration, and contain complex requirements that make compliance difficult;
- Decreased employee productivity or availability, whether due to illnesses or due to the measures we or government authorities may take to mitigate their spread and effects, including site closures, restrictions on travel and vaccine mandates, which could lead to employee attrition; and
- A decline in industry and global economic conditions that reduces demand from and weakens the financial health of our customers, resulting in delayed or canceled orders, requests for payment deferrals or other contract modifications, and, if we do not anticipate significant or sudden decreases in order patterns, excess inventory.

These risks may be heightened in certain geographies, segments and markets. For example, some of our GMF customers were negatively impacted by disruptions associated with COVID-19 in China from the fourth quarter of 2022 into the first quarter of 2023. In addition, the COVID-19 pandemic exacerbated, and the emergence of other widespread health crises could exacerbate, the other risks described here and in our future filings with the SEC.

Risks Related to Owning Our Common Stock

Our quarterly operating results have fluctuated, and are likely to continue to vary significantly, which may result in volatility in the market price of our common stock.

A substantial portion of our shipments occurs shortly after an order is received, and therefore we generally operate with a relatively low level of backlog. As a result, a decrease in demand for our products from one or more customers could occur with limited advance notice and could have a significant adverse effect on our operating results in any particular period. Further, we often recognize a significant portion of the revenue of certain of our business lines in the last month of a fiscal quarter, due in part to the tendency of some customers to wait until late in a quarter to commit to purchase our products as a result of capital expenditure approvals and budgeting constraints occurring at the end of a quarter, or the hope of obtaining more favorable pricing from a competitor. Thus, variations in timing of sales can cause significant fluctuations in our quarterly sales, gross margin and profitability. In addition, orders expected to ship in one period could shift to another period due to changes in the timing of our customers' purchase decisions, requests for rescheduled delivery dates, material shortages, manufacturing capacity constraints or logistics delays. Our orders are generally subject to rescheduling or cancellation without penalty other than reimbursement in certain cases for certain labor and material costs. Our operating results for a particular period may be adversely affected if our customers, particularly our largest customers, cancel or reschedule orders, or if we cannot fill orders in time due to material shortages, capacity constraints or unexpected delays in manufacturing, testing, shipping, delivery or product acceptance. Also, we base our manufacturing plans on our forecasted product mix. If the actual product mix varies significantly from our forecast, we may not be able to fill some orders, which would result in delays in the shipment of our products and could shift sales to a subsequent period. Moreover, a significant percentage of our expenses are fixed and based in part on expectations of net revenues. Our inability to adjust spending quickly enough to compensate for any shortfall would magnify the adverse impact of a shortfall in net revenues on our operating results.

Customers of our high-value, more complex products often require substantial time to qualify our products and make purchase decisions. In addition, some of our sales to defense and security customers are under major defense programs that involve

lengthy competitive bidding and qualification processes. These customers often perform, or require us to perform, extensive configuration, testing and evaluation of our products before committing to purchase them, which can require a significant upfront investment in time and resources. The sales cycle for these products from initial contact through shipment varies significantly, is difficult to predict and can last more than a year. If we fail to anticipate the likelihood of, or the costs or timing associated with, sales of these products, or the cancellation or rescheduling of orders for these products, our business and operating results would be harmed.

Our worldwide sales to customers in the research and defense markets rely to a large extent on government funding for research and defense-related programs. Any decline in government funding as a result of reduced budgets in connection with fiscal austerity measures, revised budget priorities or other causes would likely result in reduced sales of our products that are purchased either directly or indirectly with government funding, which would have an adverse impact on our operating results. Concerns regarding the global availability of credit may also make it more difficult for our customers to raise capital, whether debt or equity, to finance their projects and purchases of capital equipment, which would adversely affect sales of our products and therefore harm our business and operating results.

Market seasonality also causes fluctuations in our operating results. MSD has generally experienced its strongest revenue in the second half of the fiscal year, mostly driven by consumption trends during the holiday season, and its lowest revenue in the first quarter of the fiscal year, mostly driven by the slowdown in production in China as a result of the Lunar New Year. In addition, we typically experience our strongest revenue in the research market in the fourth quarter of our fiscal year as a result of government spending patterns, and our highest revenue in the electronics manufacturing market in the second half of our fiscal year as a result of consumer spending during the holiday season.

Other factors that could cause fluctuations in our financial results include:

- A worldwide economic slowdown or disruption in the global financial markets;
- Fluctuations in our customers' capital spending, industry cyclicality (particularly in the semiconductor, electronics manufacturing and automotive industries), levels of government funding available to our customers (particularly in the life and health sciences and the research and defense markets) and other economic conditions within the markets we serve;
- The timing of the receipt of orders within a given period;
- Demand for our products and the products sold by our customers;
- Disruption in sources of supply;
- Production capacity constraints;
- Regulatory and trade restrictions in the countries where we source, manufacture or sell our products;
- Specific features requested by customers;
- Natural disasters or other events beyond our control (such as earthquakes, floods or storms, regional economic downturns, pandemics, social unrest, political instability, terrorism, or acts of war);
- IT or infrastructure failures;
- The timing of product shipments and revenue recognition within a given quarter;
- Changes in our pricing practices or in the pricing practices of our competitors or suppliers, including as a result of inflationary pressures;
- Our and our competitors' timing in introducing new products;
- Engineering and development investments relating to new product introductions, and significant changes to our manufacturing and outsourcing operations;
- Market acceptance of any new or enhanced versions of our products;
- The timing and level of inventory obsolescence, scrap and warranty expenses;
- The availability, quality and cost of components and raw materials we use to manufacture our products;
- Changes in our effective tax rates;
- Changes in our capital structure, including cash, marketable securities and debt balances, and changes in interest rates;
- Changes in bad debt expense based on the collectability of our accounts receivable;

- The timing, type and size of acquisitions and divestitures, and related expenses and charges;
- Fluctuations in currency exchange rates;
- Our expense levels;
- Impairment charges for goodwill, intangible assets or long-lived assets; and
- Fees, expenses and settlement costs or judgments against us relating to litigation or regulatory compliance.

As a result of these factors, among others, we may experience quarterly or annual fluctuations in our operating results, and our operating results for any period may fall below our expectations or the expectations of public market analysts or investors. In any such event, the price of our common stock could fluctuate or decline significantly. Consequently, we believe that quarter-to-quarter and year-to-year comparisons of our operating results, or any other similar period-to-period comparisons, may not be reliable indicators of our future performance.

The market price of our common stock has fluctuated and may continue to fluctuate for reasons over which we have no control.

The stock market has from time to time experienced, and is likely to continue to experience, extreme price and volume fluctuations. For example, the closing price of our common stock ranged from a high of \$112.97 to a low of \$65.32 between January 1, 2023 and December 31, 2023. Prices of securities of technology companies have been especially volatile and have often fluctuated for reasons that are unrelated to the operating performance of the companies. Historically, the market price of shares of our common stock has fluctuated greatly and could continue to fluctuate due to a variety of factors. In the past, companies that have experienced volatility in the market price of their stock have been the subject of securities class action litigation. If we become the subject of securities class action litigation, it could result in substantial costs and a diversion of our management's attention and resources.

We may not pay dividends on our common stock.

Holders of our common stock are only entitled to receive dividends when and if they are declared by our Board of Directors. Our credit facilities restrict our ability to pay dividends on our capital stock under certain circumstances. Although we have declared cash dividends on our common stock since 2011, and occasionally increased the dividends from prior quarters, we are not required to do so, and we may reduce or eliminate our cash dividend in the future. This could adversely affect the market price of our common stock.

Some provisions of our restated articles of organization, as amended, our amended and restated by-laws and Massachusetts law could discourage potential acquisition proposals and could delay or prevent a change in control.

Anti-takeover provisions could diminish opportunities for stockholders to participate in tender offers, including tender offers at a price above the then-current market price of our common stock. Such provisions may also inhibit increases in the market price of our common stock that could result from takeover attempts. For example, while we have no present plans to issue any preferred stock, our Board of Directors, without further stockholder approval, may issue preferred stock that could have the effect of delaying, deterring or preventing a change in control of us. The issuance of preferred stock could adversely affect the voting power of the holders of our common stock, including the loss of voting control to others. In addition, our amended and restated by-laws provide for a classified Board of Directors consisting of three classes. Our classified board could also have the effect of delaying or deterring a change in control of our Company.

Item 1B. Unresolved Staff Comments

None.

Item 1C. Cybersecurity

Risk Management and Strategy

Processes for Assessing, Identifying and Managing Material Risks from Cybersecurity Threats

We primarily assess, identify and manage material risks from cybersecurity threats through our enterprise information security program, which is maintained by our Chief Information Security Officer (“CISO”) and overseen by our Executive Vice President and Chief Information Officer (“CIO”).

Our enterprise information security program, which is designed to ensure that our information systems are adequately protected, is based on frameworks established by the National Institute of Standards and Technology and other applicable industry standards. Following the ransomware incident we identified in February 2023, we made certain enhancements to our enterprise information security program, including with respect to privileged access management, security monitoring and response, and application backup and recovery. We consider our enterprise information security program to be a key component of our overall risk management system.

As part of our enterprise information security program, we regularly assess and deploy technical safeguards designed to protect our information systems from cybersecurity threats. In addition, we maintain incident response and recovery plans, the effectiveness of which is tested and evaluated on a regular basis. We also provide privacy and security training to enhance employee awareness of how to detect and respond to cybersecurity threats.

We regularly engage assessors, consultants, auditors and other third parties to support our enterprise information security program. These assessments include a variety of activities, including information security maturity assessments, audits and independent reviews of our information security control environment and operating effectiveness.

The information provided by these assessments is used to improve our enterprise information security program, including cybersecurity policies, standards, processes and practices. In addition, the results of significant assessments are reported to management and the Audit Committee of our Board of Directors (the “Board”).

We also have processes in place to oversee and identify risks from cybersecurity threats associated with the use of third-party service providers. Third-party service providers are subject to security risk assessments at the time of on-boarding, contract renewal, and upon detection of an increase in risk profile. We have similar processes in place to oversee and identify cybersecurity-related risks posed by our suppliers.

Risks from Cybersecurity Threats

As discussed above, in February 2023, we identified that we had become subject to a ransomware incident. Based on our investigation, we concluded ransomware actors encrypted certain of our systems by deploying malware. This incident required us to temporarily suspend operations at certain of our facilities and had a material impact during the three months ended March 31, 2023 on our ability to process orders, ship products and provide service to our VSD and PSD customers.

In addition, based on our investigation of the incident, we became aware that ransomware actors may have exfiltrated personal information from our systems. We provided notifications to individuals and to regulators in accordance with applicable laws, and we may be required to provide additional notifications in the future.

We and our third-party administrators, vendors and partners are also subject to ongoing cybersecurity threats. While we cannot guarantee that these threats will not have an adverse impact on us, we do not believe such threats are reasonably likely to materially affect us, including our business strategy, results of operations, or financial condition.

Governance

Board of Directors’ Oversight of Risks from Cybersecurity Threats

The Audit Committee is primarily responsible for oversight of risks from cybersecurity threats. As provided for in the Amended & Restated Audit Committee Charter, the Audit Committee oversees the steps management has taken to monitor and control our data privacy and cybersecurity risk exposure. The Board delegated this responsibility to the Audit Committee in part because it includes members with significant experience and/or expertise in cybersecurity and other technology matters.

The Audit Committee is informed of risks from cybersecurity threats through regular reports from our CIO and CISO. The Audit Committee actively engages with our CIO and CISO regarding these risks. Depending on the materiality of a risk, the Audit Committee, CIO or CISO may report on such risk to the full Board.

In addition, from time to time, the Board may constitute a special committee to focus on a particular cybersecurity matter or risk. As discussed above, in February 2023, we identified that we had become subject to a ransomware incident. Our Board of Directors responded quickly and constituted a special committee of the Board for cybersecurity, which included Gerald G. Colella, the Chair of our Board, Elizabeth A. Mora, the Chair of our Audit Committee, and Peter J. Cannone III and Joseph B. Donahue, each a member of our Audit Committee, to oversee the investigation, recovery, and restoration phases following the incident (the “Special Committee”). The Special Committee held 21 meetings during the first three months following the identification of the incident. At these meetings, our Chief Executive Officer, our Chief Financial Officer, our General Counsel, our Executive Vice President of Operations and Corporate Marketing, and our then-Chief Information Officer reported to the Special Committee on various aspects of the incident, including the information technology forensic investigation, business restoration and recovery activities, and the impact of the incident on our annual audit and assessment of internal controls as well as the filing of our Annual Report on Form 10-K for the year ended December 31, 2022.

Management’s Role in Assessing and Managing Material Risks from Cybersecurity Threats

Management is integral to assessing and managing our material risks from cybersecurity threats. While all members of management are involved in the review of these risks, our CIO has primary oversight of our cybersecurity program. Our CIO is a seasoned technology leader and change agent who has served as the top technology executive for multi-billion-dollar global organizations spanning diverse industries. With over 25 years of experience, our CIO has led business and information technology transformation, implemented global digital strategies, and optimized and integrated governance, risk, and compliance frameworks, processes and technologies in complex regulatory and industry environments. We believe our CIO’s knowledge, skills and experience provide significant value to our Company.

Our CIO and CISO provide regular reports to management regarding risks from cybersecurity threats and the prevention, detection, mitigation and remediation of cybersecurity incidents. Within our information technology organization, our CISO and other key members of our information security team provide regular reports to our CIO.

As discussed above, our CIO and CISO also provide regular reports regarding risks from cybersecurity threats to our Audit Committee and, depending on the materiality of a risk, the full Board. In addition, from time to time, members of management may provide reports to a special committee of the Board for cybersecurity. For example, as discussed above, management provided regular reports to the Special Committee on various aspects of the ransomware incident we identified in February 2023.

Item 2. Properties

The following table provides information concerning MKS' principal and certain other owned and leased facilities as of December 31, 2023:

Country	City	Sq. Ft.	Activity	Reportable Segment	Owned/Leased
China	Guangzhou	704,000	Manufacturing, Warehouse, Sales and Research and Development	MSD	Owned and Leased
	Shenzhen	253,000	Manufacturing and Service	VSD	Leased
	Tianjin	179,000	Manufacturing, Office, Warehouse, Sales	MSD	Owned
	Yangzhou	156,000	Manufacturing, Warehouse, and Office	MSD	Owned and Leased
Germany	Berlin	200,000	Manufacturing, Office, Research and Development	MSD	Leased
	Feucht	301,000	Manufacturing, Warehouse, Office and Research and Development	MSD	Owned
	Neuruppin	170,000	Manufacturing, Warehouse, Office and Research and Development	MSD	Owned
India	Manesar	189,000	Manufacturing, and Research and Development	MSD	Owned
Mexico	Nogales	124,000	Manufacturing and Service	VSD and PSD	Leased
South Korea	Hwasung	107,000	Manufacturing, Sales, and Office	MSD	Owned and Leased
	Yongin-si	179,000	Research and Development, Office, Warehouse, Service, Sales	VSD	Owned
United States	Andover, MA	76,000	Corporate Headquarters and Research and Development	VSD	Leased
	Beaverton, OR	113,000	Manufacturing, Office and Warehouse	PSD	Leased
	Broomfield, CO	107,000	Manufacturing, and Research and Development	VSD	Leased
	Irvine, CA	191,000	Manufacturing, and Research and Development	PSD	Leased
	Milpitas, CA	103,000	Manufacturing, Sales, Customer Support, Service and Research and Development	PSD	Leased
	Rochester, NY	156,000	Manufacturing, Sales, Customer Support, Service and Research and Development	VSD	Owned
	Rock Hill, SC	201,000	Manufacturing, Warehouse, Office and Research and Development	MSD	Owned
	Wilmington, MA	118,000	Manufacturing, Customer Support, Service and Research and Development	VSD	Owned

In addition to the significant facilities listed above, MKS also has manufacturing, sales and marketing, customer support and services operations in various other leased and owned facilities throughout the world. See “Business—Sales and Marketing” and “Business—Reportable Segments, and Product and Service Offerings” in Part I, Item 1 of this Annual Report on Form 10-K. We believe that our current facilities are suitable and adequate to meet our needs.

Item 3. Legal Proceedings

We are subject to various legal proceedings and claims, which have arisen in the ordinary course of business. In the opinion of management, the ultimate disposition of these matters will not have a material adverse effect on our results of operations, financial condition or cash flows.

Item 4. Mine Safety Disclosures

Not applicable.

PART II

Item 5. Market for the Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities

Common Stock

Our common stock is traded on the Nasdaq Global Select Market under the symbol MKSI.

As of February 20, 2024, we had 65 stockholders of record.

Dividend Policy and Cash Dividends

Holders of our common stock are entitled to receive dividends when and if they are declared by our Board of Directors. Our Board of Directors declared a cash dividend of \$0.22 per share during each quarter of 2023, which totaled \$59 million or \$0.88 per share. During 2022, our Board of Directors declared a cash dividend of \$0.22 per share during each quarter of the year, which totaled \$52 million or \$0.88 per share.

On February 5, 2024, our Board of Directors declared a quarterly cash dividend of \$0.22 per share to be paid on March 8, 2024 to shareholders of record as of February 26, 2024.

Future dividend declarations, if any, as well as the record and payment dates for such dividends, are subject to the final determination of our Board of Directors. The Board of Directors intends to declare and pay cash dividends on our common stock based on our financial conditions and results of operations of the Company, although it has no obligation to do so. Our credit facilities contain covenants that restrict our ability to grant cash dividends in certain circumstances.

Share Repurchase Program

On July 25, 2011, our Board of Directors approved, and on July 27, 2011, we publicly announced a share repurchase program for the repurchase of up to an aggregate of \$200 million of our outstanding common stock from time to time in open market purchases, privately negotiated transactions or through other appropriate means. The timing and quantity of any shares repurchased depends upon a variety of factors, including business conditions, stock market conditions and business development activities, including, but not limited to, merger and acquisition opportunities. These repurchases may be commenced, suspended or discontinued at any time without prior notice.

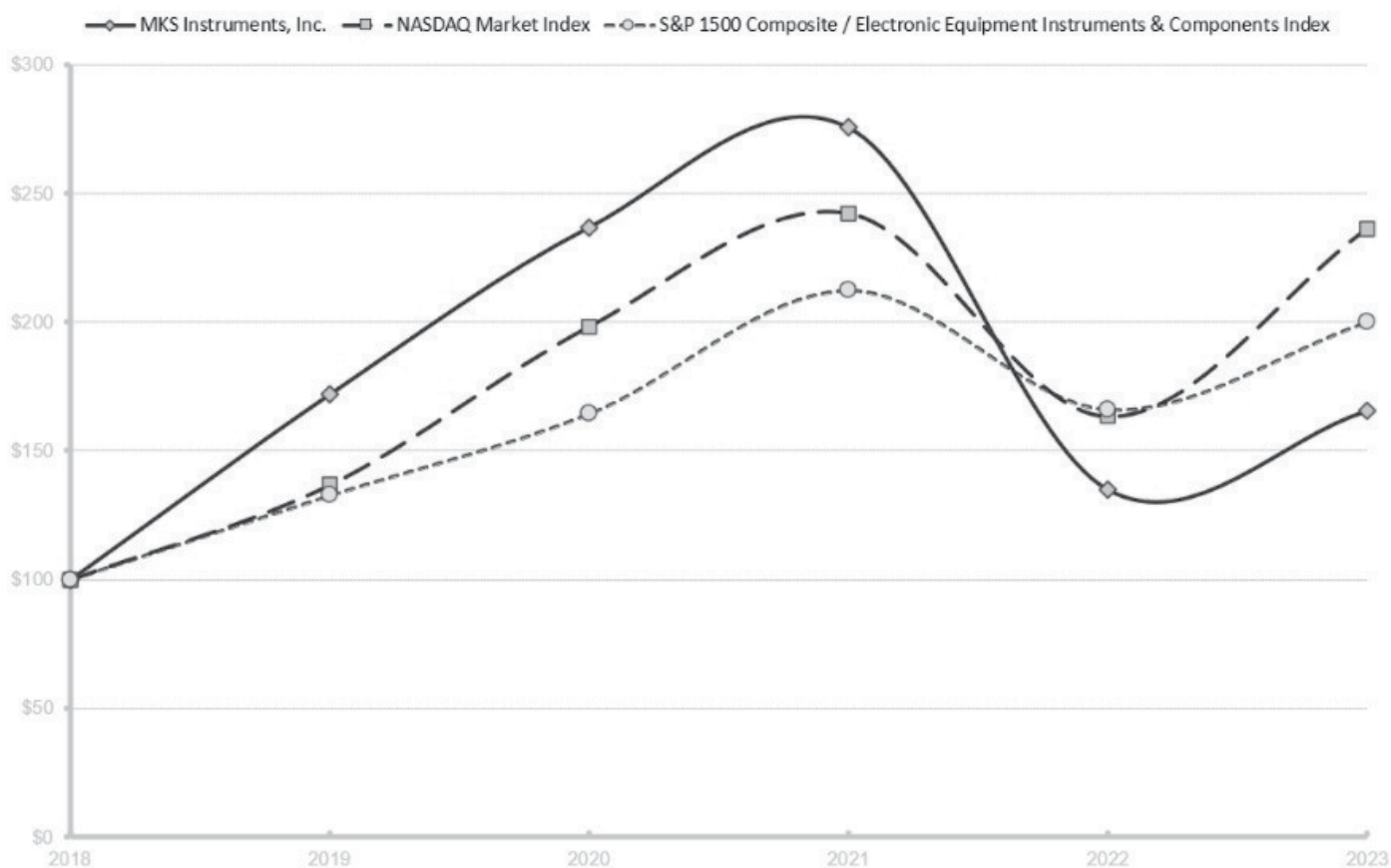
During 2023 and 2022, we did not repurchase any shares of common stock. We have repurchased approximately 2.6 million shares of common stock for approximately \$127 million pursuant to the program since its adoption.

Comparative Stock Performance

The following graph compares the cumulative total shareholder return (assuming reinvestment of dividends) from investing \$100 on December 31, 2018, and plotted at the last trading day of each of the fiscal years ended December 31, 2019, 2020, 2021, 2022 and 2023 of MKS' common stock; a peer group index representing all companies comprising the S&P 1500 Composite Electronic Equipment Instruments & Components Index and the Nasdaq Market Index. The stock price performance in the graph below is not necessarily indicative of future price performance.

Performance Graph

COMPARISON OF CUMULATIVE TOTAL RETURN



ASSUMES \$100 INVESTED ON DEC. 31, 2018
ASSUMES DIVIDEND REINVESTED
FISCAL YEAR ENDING DEC. 31, 2023

	2018	2019	2020	2021	2022	2023
MKS Instruments, Inc.	\$ 100.00	\$ 171.90	\$ 236.70	\$ 275.42	\$ 135.02	\$ 165.51
Nasdaq Market Index	\$ 100.00	\$ 136.69	\$ 198.10	\$ 242.03	\$ 163.28	\$ 236.17
S&P 1500 Composite / Electronic Equipment, Instruments & Components Index	\$ 100.00	\$ 132.66	\$ 164.30	\$ 212.24	\$ 166.02	\$ 199.92

Item 6. Reserved.

Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations

The Management’s Discussion and Analysis of Financial Condition and Results of Operations (“MD&A”) describes principal factors affecting the results of our operations, financial condition, cash flows and liquidity, as well as our critical accounting policies and estimates that require significant judgment and thus have the most significant potential impact on our Consolidated Financial Statements, and is intended to better allow investors to view the Company from management’s perspective. This section focuses on material events and uncertainties known to management that are reasonably likely to cause reported financial information not to be necessarily indicative of our future operating results or of our future financial condition. This section provides an analysis of our financial results for the year ended December 31, 2023 compared to the year ended December 31, 2022. For the discussion and analysis covering the year ended December 31, 2022 compared to the year ended December 31, 2021, please refer to “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in Part II, Item 7 of our Annual Report on Form 10-K for the year ended December 31, 2022, as filed with the SEC on March 14, 2023.

Overview

We enable technologies that transform our world. We deliver foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging, and specialty industrial applications. We apply our broad science and engineering capabilities to create instruments, subsystems, systems, process control solutions and specialty chemicals technology that improve process performance, optimize productivity and enable unique innovations for many of the world's leading technology and industrial companies. Our solutions are critical to addressing the challenges of miniaturization and complexity in advanced device manufacturing by enabling increased power, speed, feature enhancement and optimized connectivity. Our solutions are also critical to addressing ever-increasing performance requirements across a wide array of specialty industrial applications.

Ransomware Event

On February 3, 2023, we identified that we had become subject to a ransomware event. We took immediate action to activate our incident response and business continuity protocols to contain the incident, including engaging appropriate incident response professionals and notifying law enforcement authorities. We then initiated the recovery phase, contained the incident, reopened our affected manufacturing and service operations and completed restoration of our information technology (“IT”) systems, including our enterprise resource planning systems.

Based on our investigation, we concluded ransomware actors encrypted certain of our systems by deploying malware. This incident required us to temporarily suspend operations at certain of our facilities and had a material impact in the first quarter of 2023 on our ability to process orders, ship products and provide service to our Vacuum Solutions Division (“VSD”) and Photonics Solutions Division (“PSD”) customers. As a result of our inability to fulfill orders, we estimated the ransomware event negatively impacted our revenue in the first quarter of 2023 by approximately \$160 million. We recovered substantially all of this revenue in the second and third quarters of 2023, as we shipped orders that were delayed during the first quarter. The incident did not impact the operations of our Materials Solutions Division (“MSD”).

We engaged security specialists to assist in the review, assessment and remediation of our IT controls and strengthened access requirements and unauthorized access detection. We also implemented procedures to facilitate more timely restoration of our financial reporting systems.

As a result of the ransomware event, we incurred approximately \$15 million of net costs for the twelve months ended December 31, 2023. These costs were primarily comprised of various third-party consulting services, including forensic experts, restoration experts, legal counsel, and other IT and accounting professional expenses, enhancements to our cybersecurity measures, costs to restore our systems and access our data, and employee-related expenses, including with respect to increased overtime. We expect to continue to incur these and other costs related to this incident in the future. As a result of the incident, we were previously subject to two lawsuits, and we may be subject to future litigation, investigations, claims or actions, in addition to fines, penalties, or other obligations related to impacted data, whether or not such data is misused. For additional information on the risks we face related to this incident and other cybersecurity incidents, refer to “Risk Factors—Risks Related to Cybersecurity, Data Privacy and Intellectual Property Protection” and “Risk Factors—Legal, Tax, Regulatory and Compliance Risks” in Part I, Item 1A of this Annual Report on Form 10-K.

Segments and Markets

We have three divisions, which are our reportable segments, known as VSD, PSD and MSD.

VSD delivers foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging and specialty industrial applications. VSD products are derived from our core competencies in pressure measurement and control, flow measurement and control, gas and vapor delivery, gas composition analysis, electronic control technology, reactive gas generation and delivery, power generation and delivery, and vacuum technology.

PSD provides a broad range of instruments, components and subsystems to leading edge semiconductor manufacturing, electronics and packaging and specialty industrial applications. PSD products are derived from our core competencies in lasers, photonics, optics, temperature sensing, precision motion control and vibration control.

MSD develops leading process and manufacturing technologies for advanced surface modification, electroless and electrolytic plating, and surface finishing. Applying a comprehensive systems-and-solutions approach, MSD's portfolio includes chemistry, equipment, software, and services for innovative and high-technology applications in our electronics and packaging and specialty industrial markets.

Since our inception, we have focused on satisfying the needs of our customers by establishing long-term collaborative relationships. We have a diverse base of customers across our primary-served markets, which include semiconductor, electronics and packaging, and specialty industrial.

<i>(dollars in millions)</i>	Years Ended December 31,			
	2023		2022	
		% Total		% Total
Semiconductor	\$ 1,479	41%	\$ 2,041	58%
Electronics and Packaging	916	25%	541	15%
Specialty Industrial	1,227	34%	964	27%
Total net revenues	<u>\$ 3,622</u>	<u>100%</u>	<u>\$ 3,547</u>	<u>100%</u>

Semiconductor Market

MKS is a critical solutions provider for semiconductor manufacturing. Our products are used in major semiconductor processing steps, such as deposition, etching, cleaning, lithography, metrology, and inspection. The semiconductor industry continually faces new challenges as products become smaller, more powerful and highly mobile. Ultra-thin layers, smaller critical dimensions, new materials, 3D structures, and the ongoing need for higher yield and productivity drive the need for tighter process measurement and control, all of which MKS supports. We believe we are the broadest critical subsystem provider in the wafer fabrication equipment (“WFE”) ecosystem and address over 85% of the market. We have characterized our broad and unique offering as Surround the Wafer to reflect the technology enablement we provide across almost every major process in semiconductor manufacturing today.

Approximately 41% and 58% of our net revenues for 2023 and 2022, respectively, were from sales to customers in the semiconductor market. This decrease was primarily a result of the full-year impact of the Atotech Acquisition, as MSD only sells into our electronics and packaging and specialty industrial markets, as well as an overall decline in revenue from customers in our semiconductor market.

Net revenues from customers in our semiconductor market decreased by \$562 million, or 28%, in 2023, compared to 2022, due primarily to a decrease of \$541 million in VSD given decreased industry spending on deposition and etch equipment for memory applications, particularly NAND, where MKS is a critical solutions provider.

In general, the semiconductor capital equipment industry is subject to rapid demand shifts, which are difficult to predict, and we cannot be certain as to the timing or extent of future demand or any future softening in the semiconductor capital equipment industry. In addition to these rapid demand shifts, the semiconductor capital equipment industry is subject to significant trade restrictions.

In October 2022, the U.S. Department of Commerce's Bureau of Industry and Security (“BIS”) implemented new and novel restrictions related to end-uses in semiconductor, semiconductor manufacturing, supercomputer, and advanced computing, along with certain equipment used to develop and produce them, as well as controls around the activities of U.S. persons in certain markets, including China. These rules, which BIS amended in October 2023 (as amended, the “BIS Rules”), restrict our direct and indirect sales to U.S. Arms Embargoed Countries, including China and primarily impact our semiconductor market. As a result of the BIS Rules, we estimate our net revenues were reduced by approximately \$200 to \$250 million in 2023.

Electronics and Packaging Market

MKS is a foundational solutions provider for the electronics and packaging market. Our portfolio includes photonics components, laser drilling systems, electronics chemistries and plating equipment, that are critical for the manufacturing of PCBs and package substrates, and critical to wafer level packaging (“WLP”) applications. Similar to the semiconductor industry, the

PCB, package substrate and WLP industries demand smaller features, greater density, and better performance. In addition, the electronics and packaging market also includes sales of our vacuum and photonics solutions for display manufacturing applications. We characterize our complementary offering of laser systems and chemistry solutions as Optimize the Interconnect, to reflect the unique technology enablement we provide at the Interconnect level within PCBs, package substrates and WLPs.

Approximately 25% and 15% of our net revenues for 2023 and 2022, respectively, were from sales to customers in our electronic and packaging market. This increase was primarily a result of the full-year impact of the Atotech Acquisition, as MSD only sells into our electronics and packaging and specialty industrial markets.

Net revenues from customers in our electronics and packaging market increased by \$375 million, or 69%, in 2023 compared to 2022. This increase was driven primarily by the full-year impact of the Atotech Acquisition, with MSD net revenues increasing by \$403 million. This increase was primarily offset by a decrease of \$26 million in PSD net revenues, in part due to decreased industry demand for flexible PCB via drilling systems as customers have temporarily slowed capacity expansion. In addition, demand for flexible PCB via drilling systems, which are a part of PSD, and demand for chemistry solutions, which are a part of MSD, have softened due to a decline in end market demand for consumer electronics, such as smartphones and personal computers.

Specialty Industrial Market

MKS' strategy in specialty industrial is to leverage our domain expertise and proprietary technologies across a broad array of applications in industrial technologies, life and health sciences, and research and defense markets.

Industrial Technologies

Industrial technologies encompasses a wide range of diverse applications, including chemistries for functional coatings, surface finishing and wear resistance in the automobile industry, vacuum solutions for synthetic diamond manufacturing and photonics for solar manufacturing. Other applications include vacuum and photonics solutions for light emitting diode and laser diode manufacturing.

Life and Health Sciences

Our products for life and health sciences are used in a diverse array of applications, including bioimaging, medical instrument sterilization, medical device manufacturing, analytical, diagnostic and surgical instrumentation, consumable medical supply manufacturing and pharmaceutical production.

Research and Defense

Our products for research and defense are sold to government, university and industrial laboratories for applications involving research and development in materials science, physical chemistry, photonics, optics and electronics materials. Our products are also sold for monitoring and defense applications, including surveillance, imaging and infrastructure protection.

Approximately 34% and 27% of our net revenues for 2023 and 2022, respectively, were from customers in our specialty industrial market. This increase was primarily a result of the full-year impact of the Atotech Acquisition, as MSD only sells into our electronics and packaging and specialty industrial markets.

Net revenues from customers in our specialty industrial market increased by \$263 million, or 27%, in 2023, compared to 2022. This increase was driven primarily by the full-year impact of the Atotech Acquisition with MSD net revenues increasing by \$286 million offset by decreases of \$19 million and \$4 million at VSD and PSD, respectively.

International Markets

A significant portion of our net revenues is from sales to customers in international markets. International net revenues accounted for approximately 66% and 58% of our total net revenues in 2023 and 2022, respectively. A significant portion of our international net revenues was from customers in China, Germany, Japan and South Korea. We expect that international revenues will continue to account for a significant percentage of total net revenues for the foreseeable future. Long-lived assets located outside of the United States accounted for approximately 58% and 57% of our total long-lived assets as of December 31, 2023 and 2022, respectively. Long-lived assets include property, plant and equipment, net, right-of-use assets, and certain other assets.

Critical Accounting Policies and Estimates

MD&A discusses our Consolidated Financial Statements, which have been prepared in accordance with accounting principles generally accepted in the United States (“U.S. GAAP”). The preparation of these financial statements requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. On an ongoing basis, we evaluate our estimates and judgments, including those related to revenue recognition, inventory, warranty costs, pension plan valuations, stock-based compensation expense, intangible assets, goodwill and other long-lived assets and income taxes. We base our estimates and judgments on historical experience and on various other factors that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

We believe the following critical accounting policies affect the most significant judgments, assumptions and estimates we use in preparing our Consolidated Financial Statements:

Revenue Recognition. We account for revenue using Accounting Standards Codification 606, “Revenue from Contracts with Customers” (“ASC Topic 606”). We apply ASC Topic 606 using the following steps:

- Identify the contract with a customer
- Identify the performance obligations in the contract
- Determine the transaction price
- Allocate the transaction price to performance obligations in the contract
- Recognize revenue when or as we satisfy a performance obligation

Revenue is recognized when or as obligations under the terms of a contract with our customer have been satisfied and control has transferred to the customer. The majority of our performance obligations, and associated revenue, are transferred to customers at a point in time, generally upon shipment of a product to the customer or receipt of the product by the customer and without significant judgments. We recognize revenue over time for contracts relating to the manufacturing, modifications and retrofits of our plating equipment, as the equipment is built to customer specification, and we have an enforceable right to payment for the performance completed to date. For these sales, we use the cost-to-cost input method to measure progress. In cases, where cost-to-cost is not proportionate to our progress in satisfying the performance obligation because of uninstalled materials, we adjust the measure of progress and recognize revenue to the extent of cost incurred to satisfy the performance obligation under the contract. Revenue from customized products with no alternative future use to us, and that have an enforceable right to payment for performance completed to date, is also recorded over time. We consider this to be a faithful depiction of the transfer to the customer of revenue over time as the work is performed or service is delivered. Adjustments for custom products were not material for 2023, 2022 or 2021.

Installation services, other than those related to our plating equipment, are not significant, are usually completed in a short period of time and, therefore, are recorded at a point in time when the installation services are completed, rather than over time, as they are not material. Extended warranty, service contracts, and repair services, which are transferred to the customer over time, are recorded as revenue as the services are performed. For repair services, we make an accrual at each quarter end based upon historical repair times within our product groups to record revenue based upon the estimated number of days completed to date, which is consistent with ratable recognition.

Revenue is measured as the amount of consideration we expect to receive in exchange for transferring goods or providing services. Performance obligations promised in a contract are identified based on the products or services that will be transferred to the customer that are both capable of being distinct, whereby the customer can benefit from the product or service either on its own or together with other resources that are readily available from third parties or from us, and are distinct in the context of the contract, whereby the transfer of the product or service is separately identifiable from other promises in the contract. Sales tax, value add tax, and other taxes we collect concurrent with revenue-producing activities are excluded from revenue. Our normal payment terms are 30 to 60 days but vary by the type and location of our customers and the products or services offered. The time between invoicing and when payment is due is not significant. For certain products and services and customer types, we require payment before the products are delivered to, or the services are performed for, the customer. None of our contracts in each of the periods presented contained a significant financing component.

We periodically enter into contracts with our customers in which a customer may purchase a combination of goods and or services, such as products with installation services or extended warranties. These contracts include multiple deliverables that we evaluate to determine if the deliverables are separate performance obligations. Once we determine the performance obligations, we then determine the transaction price, which includes estimating the amount of variable consideration to be included in the

transaction price, if any. To the extent the transaction price includes variable consideration, we estimate the amount of variable consideration that should be included in the transaction price utilizing either the expected value method or the most likely amount method, depending on the method we expect to better predict the amount of consideration to which we will be entitled. There are no constraints on the variable consideration recorded. We then allocate the transaction price to each performance obligation in the contract based on a relative stand-alone selling price charged separately to customers or using an expected cost-plus margin method. The corresponding revenues are recognized when or as the related performance obligations are satisfied, which are noted above. The impact of variable consideration was immaterial in each of the periods presented.

Our standard assurance warranty is normally 12 to 24 months. We sell separately priced service contracts and extended warranty contracts related to certain of our products, in particular related to our plating and laser-based products. These separately priced contracts generally range from 12 to 60 months. We normally receive payment at the inception of the contract and recognize revenue over the term of the contract in proportion to the costs expected to be incurred in satisfying the obligations under the contract. We have elected to use the practical expedient related to disclosing remaining performance obligations as of December 31, 2023 and 2022, as the majority have a duration of less than one year.

We monitor and track the amount of product returns, provide for sales return allowances and reduce revenue at the time of shipment for the estimated amount of such future returns, based on historical experience. We make estimates evaluating our allowance for doubtful accounts. While product returns have historically been within our expectations and established provisions, there is no assurance that we will continue to experience the same return rates that we have in the past. Any significant increase in product return rates could have a material adverse impact on our operating results for the period in which such returns materialize.

While we maintain a credit approval process, significant judgments are made by management in connection with assessing our customers' ability to pay at the time of shipment. Despite this assessment, from time to time, our customers are unable to meet their payment obligations. We continuously monitor our customers' creditworthiness and use our judgment in establishing a provision for estimated credit losses based upon our historical experience and any specific customer collection issues that we have identified. While such credit losses have historically been within our expectations and the provisions established, there is no assurance that we will continue to experience the same credit loss rates that we have in the past. A significant change in the liquidity or financial position of our customers could have a material adverse impact on the collectability of accounts receivable and our future operating results. Bad debt expense was immaterial in 2023, 2022 and 2021.

Inventory. We value our inventory at the lower of cost or net realizable value, cost being determined using a standard costing system that approximates actual costs, based on a first-in, first-out method. We regularly review inventory quantities on hand and record a provision to write-down excess and obsolete inventory to its estimated net realizable value, if less than cost, based primarily on our estimated forecast of product demand. Once our inventory value is written-down and a new cost basis has been established, the inventory value is not increased due to demand increases. Demand for our products can fluctuate significantly. A significant increase in the demand for our products could result in a short-term increase in the cost of inventory purchases as a result of supply shortages or a decrease in the cost of inventory purchases as a result of volume discounts, while a significant decrease in demand could result in an increase in the charges for excess inventory quantities on hand. In addition, our industry is subject to technological change, new product development and product technological obsolescence that could result in an increase in the amount of obsolete inventory quantities on hand. Therefore, any significant unanticipated changes in demand or technological developments could have a significant impact on the value of our inventory and our reported operating results. Excess and obsolete expense was \$64 million, \$21 million and \$16 million for 2023, 2022 and 2021, respectively. The higher excess and obsolete charge in 2023 was partially the result of an inventory write-off related to the discontinuation of a product line and partially the result of reduced forecasted usage.

Warranty Costs. We provide for the estimated costs to fulfill customer warranty obligations upon the recognition of the related revenue. We provide warranty coverage for our products for periods ranging from 12 to 36 months, with the majority of our products for periods ranging from 12 to 24 months. Short-term accrued warranty obligations, which expire within one year, are included in other current liabilities and long-term accrued warranty obligations are included in other liabilities in the consolidated balance sheets. We estimate the anticipated costs of repairing our products under such warranties based on the historical costs of the repairs and any known specific product issues. The assumptions we use to estimate warranty accruals are re-evaluated periodically in light of actual experience and, when appropriate, the accruals are adjusted. Our determination of the appropriate level of warranty accrual is based upon estimates. Should product failure rates differ from our estimates, actual costs could vary significantly from our expectations. Defective products will be either repaired or replaced, generally at our option, upon meeting certain criteria.

Pension Plans. Several of our non-U.S. subsidiaries have defined benefit pension plans covering employees of those subsidiaries. Some of the plans are unfunded, as permitted under the plans and applicable laws. For financial reporting purposes, we obtained actuarial reports supporting the calculation of net periodic pension costs that used a number of actuarial assumptions, including a discount rate for plan obligations, an assumed rate of return on pension plan assets and an assumed rate of compensation increase for employees covered by the various plans. We reviewed these actuarial assumptions and concluded they

were reasonable based upon our judgment, considering known trends and uncertainties. Actual results that differ from these assumptions would impact future expense recognition and the cash funding requirements of our pension plans.

Stock-Based Compensation Expense. We record compensation expense for all stock-based compensation awards to employees and directors based upon the estimated fair market value of the underlying instrument. Accordingly, stock-based compensation cost is measured at the grant date, based upon the fair value of the award.

We typically issue restricted stock units (“RSUs”) as stock-based compensation. We also provide certain employees the opportunity to purchase our shares through an Employee Stock Purchase Plan (“ESPP”). For RSUs, the fair value is the closing market price of the stock on the date of grant. We estimate the fair value of shares issued under our ESPP using the Black-Scholes pricing model, which incorporates a number of complex and subjective variables, including expected stock price volatility over the term of the awards, expected life, risk-free interest rate and expected dividends. Management determined that blended stock-based compensation, a combination of historical and implied volatility, is more reflective of market conditions and a better indicator of expected volatility than historical or implied volatility alone.

Certain RSUs involve stock to be issued upon the achievement of performance conditions (“performance shares”) under our stock incentive plan. Such performance shares become available, subject to time-based vesting conditions if, and to the extent that, financial performance criteria for the applicable period are achieved. Accordingly, the number of performance shares earned will vary based on the level of achievement of financial performance objectives for the applicable period. For each quarter until such time that our financial performance can ultimately be determined, we estimate the number of performance shares to be earned based on an evaluation of the probability of achieving the financial performance objectives. Such estimates are revised, if necessary, in subsequent periods when the underlying factors change our evaluation of the probability of achieving the financial performance objectives. Accordingly, share-based compensation expense associated with performance shares may differ significantly from the amount recorded in the current period.

The assumptions used in calculating the fair value of share-based compensation awards represents management’s best estimates, but these estimates involve inherent uncertainties and the application of management’s judgment. As a result, if factors change and we use different assumptions, our stock-based compensation expense could be materially different in the future.

Intangible Assets, Goodwill and Other Long-Lived Assets. As a result of our acquisitions, we have identified intangible assets and generated significant goodwill. Definite-lived intangible assets are valued based on estimates of future cash flows and amortized over their estimated useful life. Determining fair value requires the exercise of significant judgment, including assumptions about appropriate discount rates as well as forecasted revenue, terminal growth rate, gross profit and operating expenses.

Goodwill and indefinite-lived intangible assets are subject to annual impairment testing as well as testing upon the occurrence of any event that indicates a potential impairment. Intangible assets and other long-lived assets are also subject to an impairment test if there is an indicator of impairment. If our expectations of future results and cash flows are significantly diminished, intangible assets, goodwill and other long-lived assets may be impaired and the resulting charge to operations may be material. When we determine that the carrying value of intangible assets or other long-lived assets may not be recoverable based upon the existence of one or more indicators of impairment, we use the projected undiscounted cash flow method to determine whether an impairment exists, and then measure the impairment using discounted cash flows. To measure impairment for goodwill, we compare the fair value of our reporting units by measuring discounted cash flows to the book value of the reporting units. Goodwill would be impaired if the resulting implied fair value was less than the recorded book value of the goodwill.

The estimation of useful lives and expected cash flows requires us to make significant judgments regarding future periods that are subject to factors outside of our control. Changes in these estimates can result in significant revisions to the carrying value of these assets and may result in material charges to the results of operations.

We have elected to perform our annual goodwill impairment test as of October 31 of each year, or more often if events or circumstances indicate that there may be impairment. Goodwill is the amount by which the cost of acquired net assets exceeded the fair value of those net assets on the date of acquisition. We allocate goodwill to reporting units at the time of acquisition or when there is a change in the reporting structure and base that allocation on which reporting units will benefit from the acquired assets and liabilities. Reporting units are defined as operating segments or one level below an operating segment, referred to as a component. The estimated fair value of our reporting units was based on discounted cash flow models derived from internal earnings and internal and external market forecasts. Determining fair value requires the exercise of significant judgment, including assumptions about appropriate discount and perpetual growth rates, as well as forecasted revenue growth rates and gross profit and operating expenses. Discount rates are based on a weighted average cost of capital (“WACC”), which represents the average rate a business must pay its providers of debt and equity. The WACC used to test goodwill is derived from a group of comparable companies. Assumptions in estimating future cash flows are subject to a high degree of judgment and complexity. We make every effort to forecast these future cash flows as accurately as possible with the information available at the time the forecast is developed.

During the quarter ended June 30, 2023, as a result of softer industry demand, particularly in the personal computer and smartphone markets, we concluded there was a triggering event at our Electronics (“EL”) and general metal finishing (“GMF”) reporting units, which together constitute MSD, and our Equipment Solutions Business (“ESB”) reporting unit of PSD. We concluded there was no triggering event at our other reporting units within VSD and PSD.

For the EL, GMF and ESB reporting units, we performed a quantitative assessment of goodwill using a combination of a market approach and the income approach. This quantitative assessment resulted in a non-cash goodwill impairment of \$826 million for the EL reporting unit, \$428 million for the GMF reporting unit and \$372 million for the ESB reporting unit. In addition, we recorded a \$49 million impairment of in-process research and development (“IPR&D”) allocated to the EL reporting unit and a \$152 million impairment related to completed technology allocated to the ESB reporting unit.

In performing our annual goodwill impairment test, we are permitted to first assess qualitative factors to determine whether it is more likely than not that the fair value of our reporting unit is less than its carrying amount, including goodwill. In performing the qualitative assessment, we consider certain events and circumstances specific to the reporting unit and to the entity as a whole, such as macroeconomic conditions, industry and market considerations, overall financial performance and cost factors when evaluating whether it is more likely than not that the fair value of a reporting unit is less than its carrying amount. We are also permitted to bypass the qualitative assessment and proceed directly to the quantitative assessment. If we choose to undertake the qualitative assessment and we conclude that it is more likely than not that the fair value of the reporting unit is less than its carrying amount, we would then proceed to the quantitative impairment assessment. In the quantitative assessment, we compare the fair value of the reporting unit to its carrying amount, which includes goodwill. If the fair value exceeds the carrying value, no impairment loss exists. If the fair value is less than the carrying amount, a goodwill impairment loss is measured and recorded.

As of October 31, 2023, we performed our annual impairment assessment of goodwill by bypassing the qualitative assessment and using a quantitative assessment for all of our reporting units. As a result of higher WACC mainly caused by overall higher market interest rates, we recorded additional non-cash goodwill impairment charges of \$48 million and \$13 million at our EL and ESB reporting units, respectively. There was no goodwill impairment at any of our other reporting units. In addition, we recorded a \$14 million impairment of IPR&D allocated to the EL reporting unit.

We will continue to monitor and evaluate the carrying value of goodwill and intangible assets. If market and economic conditions or business performance deteriorate, this could increase the likelihood of us recording an impairment charge. Our stock price and any estimated control premium are factors affecting the assessment of the fair value of our underlying reporting units for purposes of performing any goodwill impairment assessment.

Income Taxes. We evaluate the realizability of our net deferred tax assets and assess the need for a valuation allowance on a quarterly basis. The future benefit to be derived from our deferred tax assets is dependent upon our ability to generate sufficient future taxable income in each jurisdiction of the right type to realize the assets. We record a valuation allowance to reduce our net deferred tax assets to the amount that is expected to be realized. To the extent we establish a valuation allowance, an expense is recorded within the provision for income taxes line in the consolidated statements of operations and comprehensive (loss) income.

Accounting for income taxes requires a two-step approach to recognize and measure uncertain tax positions. The first step is to evaluate the tax position for recognition by determining if, based on the technical merits, it is more likely than not that the position will be sustained upon audit, including resolutions of related appeals or litigation processes, if any. The second step is to measure the tax benefit as the largest amount that is more than 50% likely of being realized upon ultimate settlement. We re-evaluate these uncertain tax positions on a quarterly basis. This evaluation is based on factors including, but not limited to, changes in facts or circumstances, changes in tax law, effectively settled issues under audit and new audit activity. Any change in these factors could result in the recognition of a tax benefit or an additional charge to the tax provision.

Derivatives. As a result of our global operating activities and variable interest rate borrowings, we are exposed to market risks from changes in foreign currency exchange rates and interest rates, which may adversely affect our operating results and financial position. We address these risks through a risk management program that includes the use of derivative financial instruments. We operate the program pursuant to documented corporate risk management policies. We enter into derivative instruments for risk management purposes only, including derivatives designated as hedging instruments and those utilized as economic hedges. We do not enter into derivative instruments for trading or speculative purposes.

We have used derivative instruments, such as foreign exchange forward contracts and options, to manage certain foreign currency exposure, and interest rate swaps and interest rate caps to manage certain interest rate exposure. Changes in fair value of derivative instruments are recognized in the consolidated statement of operations or, if hedge accounting is applied, in Other Comprehensive (Loss) Income (“OCI”) for the effective portion of the changes in fair value. The cash flows resulting from foreign exchange forward contracts are classified in the consolidated statements of cash flows as part of cash flows from operating activities. All derivatives are stated at fair value in the consolidated balance sheets.

Accounting principles for qualifying hedges require detailed documentation that describes the relationship between the hedging instrument and the hedged item, including, but not limited to, the risk management objectives and hedging strategy and

the methods to assess the effectiveness of the hedging relationship. We assess the hedging relationships, both at the inception of the hedge and on an ongoing basis, using either the critical terms matching approach or a regression analysis approach to determine whether the designated hedging instrument is highly effective in offsetting changes in the value of the hedged item.

By nature, all financial instruments involve market and credit risks. We enter into derivative instruments with a diversified group of major investment grade financial institutions, for which no collateral is required. We have policies to monitor the credit risk of these counterparties. While there can be no assurance, we do not anticipate any material non-performance by any of these counterparties.

Results of Operations

The following table sets forth, for the periods indicated, the percentage of total net revenues of certain line items included in our consolidated statements of operations and comprehensive (loss) income data:

	Years Ended December 31,	
	2023	2022
Net revenues:		
Product	88.3%	87.9%
Service	11.7	12.1
Total net revenues	100.0	100.0
Cost of revenues:		
Product	48.3	50.0
Service	6.4	6.4
Total cost of revenues (exclusive of amortization shown separately below)	54.7	56.4
Gross profit	45.3	43.6
Research and development	8.0	6.8
Selling, general and administrative	18.6	13.7
Acquisition and integration costs	0.4	1.5
Restructuring	0.6	0.3
Fees and expenses related to repricing of Term Loan Facility	0.1	—
Amortization of intangible assets	8.1	4.1
Goodwill and intangible asset impairments	52.5	—
Gain on sale of long-lived assets	(0.1)	(0.2)
(Loss) income from operations	(42.9)	17.4
Interest income	(0.5)	(0.1)
Interest expense	9.8	5.0
Loss on extinguishment of debt	0.2	—
Other expense, net	0.7	0.3
(Loss) income before income taxes	(53.2)	12.1
(Benefit) provision for income taxes	(2.4)	2.7
Net (loss) income	(50.8)%	9.4%

Year Ended December 31, 2023 compared to 2022

The following table sets forth our net revenues for products and services:

Net Revenues

(Dollars in millions)	Years Ended December 31,	
	2023	2022
Product	\$ 3,200	\$ 3,119
Service	422	428
Total net revenues	\$ 3,622	\$ 3,547

Net product revenues increased \$81 million in 2023, compared to 2022, primarily driven by the full-year impact of the Atotech Acquisition with MSD net product revenues increasing by \$668 million compared to 2022, partially offset by decreases in VSD and PSD product revenues of \$533 million and \$52 million, respectively. VSD and PSD net product revenues were negatively impacted by volume decreases as a result of softening demand in our semiconductor and electronics and packaging markets.

Net service revenues consisted mainly of fees for services related to the maintenance and repair of our products, sales of spare parts, and installation and training. Net service revenues decreased \$6 million in 2023, compared to 2022, primarily due to a decrease in VSD net service revenues of \$28 million partially offset by the full-year impact of the Atotech Acquisition with MSD net service revenues increasing by \$22 million. The decrease in VSD net service revenues was a result of decreases in sales to customers in our semiconductor market.

Total international net revenues, including product and service, were \$2.4 billion in 2023, compared to \$2.1 billion in 2022. The increase in 2023 was primarily driven by the full-year impact of the Atotech Acquisition. The increase in international net revenues was primarily from increases in sales to customers in China, India and Japan.

The following table sets forth our net revenues by reportable segment:

Net Revenues

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Vacuum Solutions Division	\$ 1,404	\$ 1,966
Photonics Solutions Division	1,012	1,064
Materials Solutions Division	1,206	517
Total net revenues	<u>\$ 3,622</u>	<u>\$ 3,547</u>

Net revenues for our VSD segment decreased \$562 million in 2023, compared to 2022, which was largely reflective of volume decreases in the semiconductor market.

Net revenues for our PSD segment decreased \$52 million in 2023, compared to 2022, partially due to volume decreases in the semiconductor market and partially due to decreases in net revenues in the electronics and packaging market caused by decreased industry demand for flexible PCB via drilling equipment as a result of softened demand for electronics, such as personal computers, data center servers and smartphones.

Net revenues for our MSD segment increased \$689 million in 2023 compared to 2022, primarily due to the full-year impact of the Atotech Acquisition.

The following table sets forth gross profit as a percentage of net revenues by product and service:

Gross Profit Excluding Amortization

<i>(As a percentage of net revenues)</i>	Years Ended December 31,		% Points Change
	2023	2022	
Product	45.4%	43.1%	2.3%
Service	45.0	47.4	(2.4)
Total gross profit percentage	<u>45.3%</u>	<u>43.6%</u>	<u>1.7%</u>

Gross profit as a percentage of net product revenues increased by 2.3 percentage points in 2023, compared to 2022, primarily due to the full-year impact of the Atotech Acquisition, as MSD had higher gross margins than VSD and PSD, as well as favorable product mix, including contributions from MSD and lower warranty costs. These increases in gross margin were partially offset by lower factory absorption at VSD and higher excess and obsolete inventory charges, mainly related to the discontinuation of a product line.

Gross profit as a percentage of net service revenues decreased by 2.4 percentage points in 2023, compared to 2022, primarily due to unfavorable product mix and unfavorable overhead absorption partially offset by lower freight and duty costs.

The following table sets forth gross profit as a percentage of net revenues by reportable segment:

Gross Profit Excluding Amortization

<i>(As a percentage of net revenues)</i>	Years Ended December 31,		% Points Change
	2023	2022	
Vacuum Solutions Division	41.3%	43.5%	(2.2)%
Photonics Solutions Division	43.7	46.9	(3.2)
Materials Solutions Division	51.4	37.1	14.3
Total gross profit percentage	<u>45.3%</u>	<u>43.6%</u>	<u>1.7%</u>

Gross profit as a percentage of net revenues for VSD decreased in 2023, primarily due to lower revenue volumes and unfavorable overhead absorption as a result of softening demand in our semiconductor market, and higher excess and obsolete inventory charges, partially offset by lower material costs.

Gross profit as a percentage of net revenues for PSD decreased in 2023, primarily due to higher excess and obsolete inventory charges, mainly related to the discontinuation of a product line, lower revenue volumes and unfavorable product mix.

Gross profit as a percentage of net revenues for MSD increased in 2023, primarily due to the full-year impact of the Atotech Acquisition which resulted in higher revenue volumes and favorable product mix. In addition, gross profit as a percentage was lower in 2022, due to \$52 million of inventory step-up amortization related to the Atotech Acquisition.

Research and Development

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Research and development	\$ 288	\$ 241

Research and development expenses increased \$47 million in 2023, compared to 2022, primarily due to an increase of \$56 million resulting from the full-year impact of the Atotech Acquisition partially offset by decreases of \$5 million in project material costs and \$2 million in professional and consulting fees.

Our research and development efforts are primarily focused on developing and improving our instruments, components, chemistry, subsystems, systems and process control solutions to improve process performance and productivity. We have thousands of products, and our research and development efforts primarily consist of a large number of projects related to these products, none of which is individually material to us. Projects typically have a duration of 3 to 36 months but may be extended for development of new products.

We continue to make product advancements to meet our customers' evolving needs. We have developed, and continue to develop, new products to address industry trends, such as the shrinking of integrated circuit critical dimensions and technology inflections, and, in the flat panel display and solar markets, the transition to larger substrate sizes, which require more advanced processing and process control technology, the continuing drive toward more complex and accurate components and devices within the handset and tablet market, the transition to 5G for both devices and infrastructure, the growth in units and via counts in the high-density interconnect PCB drilling market, and the industry transition to electric cars in the automotive market. In addition, we have developed, and continue to develop, products that support the migration to new classes of materials, ultra-thin layers, and 3D structures that are used in small geometry manufacturing. In our chemistry and equipment plating businesses, a majority of our research and development investment supports existing customers' product improvement needs and their short-term research and development goals, which enables us to pioneer new high-value solutions while limiting commercial risk. Research and development expenses consist primarily of salaries and related expenses for personnel engaged in research and development, fees paid to consultants, material costs for prototypes and other expenses related to the design, development, testing and enhancement of our products.

We believe that the continued investment in research and development and ongoing development of new products are essential to the expansion of our markets. We expect to continue to make significant investment in research and development activities. We are subject to risks from products not being developed in a timely manner, as well as from rapidly changing customer requirements and competitive threats from other companies and technologies. Our success depends on many of our products being designed into new generations of equipment for the semiconductor, electronics and packaging, and specialty industrial markets. We seek to develop products that are technologically advanced so that they are positioned to be chosen for use in each successive generation of semiconductor, electronics and packaging, and specialty industrial markets applications. If our products are not chosen to be designed into our customers' products, our net revenues may be reduced during the lifespan of those products.

Selling, General and Administrative

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Selling, general and administrative	\$ 675	\$ 488

Selling, general and administrative expenses increased \$187 million during 2023, compared to 2022, primarily due to an increase of \$173 million resulting from the full-year impact of the Atotech Acquisition and \$15 million in net costs incurred in 2023 as a result of the ransomware event.

Acquisition and Integration Costs

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Acquisition and integration costs	\$ 16	\$ 52

Acquisition and integration costs incurred during 2023 and 2022 were primarily related to consulting and professional fees related to the Atotech Acquisition.

Restructuring

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Restructuring	\$ 20	\$ 10

Restructuring charges incurred in 2023 were related to severance costs as a result of various global cost savings initiatives implemented during the year. Restructuring charges in 2022 primarily related to executive payments related to the Atotech Acquisition, severance costs due to a global cost-saving initiative, the closure of two facilities in Europe and movement of certain products to low-cost regions.

Fees and expenses related to repricing of Term Loan Facility

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Fees and expenses related to repricing of Term Loan Facility	\$ 2	\$ —

In 2023, we recorded fees and expenses related to the First Amendment, as defined and described further below under “Credit Facilities.”

Amortization of Intangible Assets

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Amortization of intangible assets	\$ 295	\$ 146

Amortization of intangible assets increased \$149 million in 2023, compared to 2022, primarily due to amortization of intangible assets from the Atotech Acquisition.

Goodwill and Intangible Asset Impairments

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Goodwill and intangible asset impairments	\$ 1,902	\$ —

During the quarter ended June 30, 2023, as a result of softer industry demand, particularly in the personal computer and smartphone markets, we concluded there was a triggering event at our EL and GMF reporting units, which together constitute MSD, and the ESB reporting unit of PSD. We concluded there was no triggering event at our other reporting units within VSD and PSD.

For the EL, GMF and ESB reporting units, we performed a quantitative assessment of goodwill using a combination of a market approach and income approach. Fair value estimates are based on complex series of judgments about future events and uncertainties and rely heavily on estimates and assumptions that have been deemed reasonable by our management. There are inherent uncertainties and management judgment required in these determinations.

This quantitative assessment resulted in a non-cash goodwill impairment of \$826 million for the EL reporting unit, \$428 million for the GMF reporting unit and \$372 million for the ESB reporting unit. In addition, we recorded a \$49 million impairment of IPR&D allocated to the EL reporting unit and a \$152 million impairment related to completed technology allocated to the ESB reporting unit.

On October 31, 2023, we performed our annual goodwill and intangible asset impairment assessment. As a result of higher WACC mainly caused by overall higher market interest rates, we recorded additional non-cash goodwill impairment charges of

\$48 million and \$13 million at our EL and ESB reporting units, respectively. In addition, we recorded a \$14 million impairment of IPR&D allocated to the EL reporting unit. There were no impairments at any of our other reporting units.

We will continue to monitor and evaluate the carrying value of goodwill and intangible assets. If market and economic conditions or business performance deteriorate, the likelihood that we would record an impairment charge would increase, which could materially and adversely affect our financial condition and operating results.

Gain on Sale of Long-Lived Assets

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Gain on sale of long-lived assets	\$ (2)	\$ (7)

In 2023 and 2022, we recorded gains as a result of receiving cash from the sale of a minority interest investment in a private company.

Interest Expense, Net

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Interest expense, net	\$ 339	\$ 173

Interest expense, net, increased by \$166 million in 2023, compared to 2022, primarily due to the full-year impact of borrowings under the Term Loan Facility, as described below.

Loss on extinguishment of debt

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Loss on extinguishment of debt	\$ 8	\$ —

In connection with the First Amendment, as defined and described further below under “Credit Facilities,” we recorded a loss on extinguishment of debt.

Other Expense, Net

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
Other expense, net	\$ 27	\$ 11

Other expense, net, for 2023 and 2022 primarily related to changes in foreign exchange rates.

(Benefit) Provision for Income Taxes

<i>(Dollars in millions)</i>	Years Ended December 31,	
	2023	2022
(Benefit) provision for income taxes	\$ (87)	\$ 100

Our effective tax rates for 2023 and 2022 were 4.5% and 23.1%, respectively. Our effective tax rate for 2023 was lower than the U.S. statutory tax rate, mainly due to the impairment of goodwill and intangible assets.

Our effective tax rate for 2022 was higher than the U.S. statutory tax rate, mainly due to additional withholding taxes related to the change of indefinite reinvestment assertion, the U.S. global intangible low-taxed income inclusion, offset by the U.S. deduction for foreign derived intangible income and the geographic mix of income earned by our international subsidiaries being taxed at rates lower than the U.S. statutory tax rate.

As of December 31, 2023, total gross unrecognized tax benefits, which excludes interest and penalties, was \$86 million. As of December 31, 2022, total gross unrecognized tax benefits, which excludes interest and penalties, was \$83 million. The net increase was primarily attributable to the addition of unrecognized U.S. federal tax credits.

We accrue interest and, if applicable, penalties for any uncertain tax positions. Interest and penalties are classified as a component of income tax expense. As of December 31, 2023 and 2022, we accrued interest on unrecognized tax benefits of approximately \$7 million and \$6 million, respectively.

Over the next 12 months, it is reasonably possible that we may recognize approximately \$12 million of previously net unrecognized tax benefits, excluding interest and penalties, related to various U.S. federal, state and foreign tax positions, primarily due to the expiration of statutes of limitations.

We are subject to examination by U.S. federal, state and foreign tax authorities. The U.S. federal statute of limitations remains open for tax years 2020 through the present. The statute of limitations for our tax filings in other jurisdictions varies between fiscal years 2017 through the present. We also have certain federal credit carryforwards and state tax loss and credit carryforwards that are open to examination for tax years 2002 through the present. In addition, the 2017 transition tax remains open for examination.

In 2023, we recorded a net charge to income tax expense of \$7 million, due to additional reserves offset by the expiration of certain statutes of limitations. In 2022, we recorded a net charge to income tax expense of \$5 million, due to additional reserves offset by the closure of a tax audit and expiration of certain statutes of limitations.

Our future effective tax rate depends on various factors, including the impact of tax legislation, further interpretations and guidance from U.S. federal and state governments on the impact of proposed regulations issued by the Internal Revenue Service, as well as the geographic composition of our pre-tax income and changes in income tax reserves for unrecognized tax benefits. A number of jurisdictions in which we operate are in the process of adopting Pillar Two Model Rules (“Pillar Two”) for a global 15% minimum tax as promulgated by the Organisation for Economic Co-operation and Development. Pillar Two could materially increase our future effective tax rate. We cannot be certain regarding the amount of the effective tax rate increase until all jurisdictions in which we operate adopt legislation and implement a version of Pillar Two. We monitor these factors and timely adjust our estimates of the effective tax rate accordingly. We expect the geographic mix of pre-tax income will continue to have a favorable impact on our effective tax rate. However, the geographic mix of pre-tax income can change based on multiple factors including the Atotech Acquisition, resulting in changes to the effective tax rate in future periods. While we believe we have adequately provided for all tax positions, amounts asserted by taxing authorities could materially differ from our accrued positions as a result of uncertain and complex application of tax laws and regulations. Additionally, the recognition and measurement of certain tax benefits include estimates and judgment by management. Accordingly, we could record additional provisions or benefits for U.S. federal, state, and foreign tax matters in future periods as new information becomes available.

Liquidity and Capital Resources

Cash, cash equivalents and short-term investments at December 31, 2023 and 2022 totaled \$875 million and \$910 million, respectively. The primary driver of our current and anticipated future cash flows is, and we expect will continue to be, cash generated from operations, consisting primarily of our net (loss) income, excluding non-cash charges and changes in operating assets and liabilities.

Our total cash and cash equivalents at December 31, 2023 consisted of \$319 million held in the United States and \$556 million held by our foreign subsidiaries. We believe that our current cash and investments position and available borrowing capacity, together with the cash anticipated to be generated from our operations, will be sufficient to satisfy our estimated working capital, planned capital expenditure requirements, payments of debt, and any future cash dividends declared by our Board of Directors or share repurchases through at least the next 12 months and the foreseeable future.

In periods when our sales are growing, higher sales to customers will result in increased trade receivables, and inventories will generally increase as we build products for future sales. This may result in lower cash generated from operations. Conversely, in periods when our sales are declining, our trade accounts receivable and inventory balances will generally decrease, resulting in increased cash from operations.

Net cash provided by operating activities was \$319 million for 2023 and resulted from a net loss of \$1,841 million, which included non-cash charges of \$2,259 million, mainly as a result of goodwill and intangible asset impairment charges of \$1,902 million, offset by a net increase in working capital of \$99 million. The net increase in working capital was primarily due to a decrease in accounts payable of \$99 million, a decrease in income taxes payable of \$64 million and an increase in inventory of \$76 million. This net increase in working capital was partially offset by a decrease in accounts receivable of \$114 million, as a result of lower business levels, and a decrease in other current and non-current assets of \$50 million, primarily as a result of a decrease in right of use assets of \$31 million, and a decrease in other current and non-current assets of \$19 million.

Net cash provided by operating activities was \$529 million for 2022 and resulted from net income of \$333 million, which included non-cash net charges of \$353 million, offset by a net increase in working capital of \$157 million. The net increase in working capital was primarily due to increases in inventory of \$236 million, as a result of increased business levels, and a decrease of \$31 million in accrued compensation, resulting from the payment of variable compensation. These increases in working capital

were partially offset by a decrease in other current and non-current assets of \$28 million, an increase in accounts payable of \$61 million and an increase in income taxes payable of \$19 million.

Net cash used in investing activities was \$84 million for 2023, consisting primarily of \$87 million in capital expenditures, offset by \$3 million in proceeds from the sale of long-lived assets.

Net cash used in investing activities was \$4.6 billion for 2022, primarily due to \$4.5 billion used for the Atotech Acquisition, net of cash and cash equivalents acquired, and \$164 million in capital expenditures, partially offset by \$76 million in net maturities of investments.

Net cash used in financing activities was \$259 million for 2023, primarily due to \$403 million of payments on our Term Loan Facility and \$59 million of dividend payments, partially offset by \$216 million in proceeds from our Term Loan Facility.

Net cash provided by financing activities was \$4.0 billion for 2022, primarily due to \$5.2 billion in net proceeds from our Term Loan Facility offset by \$962 million of payments on borrowings, primarily related to payment of our prior term loan facility, a \$100 million voluntary prepayment on the USD Tranche A (as defined below), a \$22 million regularly scheduled payment on the Term Loan Facility, \$52 million in dividend payments and \$249 million in payments of deferred financing costs.

For the year ended December 31, 2023, we paid cash dividends of \$59 million in the aggregate or \$0.88 per share. For the year ended December 31, 2022, we paid cash dividends of \$52 million in the aggregate or \$0.88 per share. Future dividend declarations, if any, as well as the record and payment dates for such dividends, are subject to the final determination of our Board of Directors. Holders of our common stock are entitled to receive dividends when and if they are declared by our Board of Directors. Under the terms of our Term Loan Facility and Revolving Facility, each as defined and described further below, we may be restricted from paying dividends under certain circumstances.

On February 5, 2024, our Board of Directors declared a quarterly cash dividend of \$0.22 per share to be paid on March 8, 2024 to shareholders of record as of February 26, 2024.

Atotech Acquisition

On August 17, 2022 (the “Effective Date”), we completed the Atotech Acquisition. The total net purchase price, including cash consideration, net of cash acquired, value of MKS shares issued, repayment of Atotech debt and settlement of share-based awards totaled \$5.7 billion. We funded the payment of the aggregate cash consideration with a combination of cash on hand and the proceeds from the Term Loan Facility, as defined below. As a result of the Atotech Acquisition, we issued an aggregate of 10.7 million shares of our common stock to the former Atotech shareholders.

Credit Facilities

In connection with the completion of the Atotech Acquisition, we entered into the Credit Agreement, dated as of August 17, 2022, by and among us, the lenders and letter of credit issuers party thereto and JPMorgan Chase Bank, N.A., as administrative agent and collateral agent (as amended from time to time, the “Credit Agreement”). The Credit Agreement provided for (i) a senior secured term loan facility comprised of three tranches: a \$1.0 billion loan (the “USD Tranche A”), a \$3.6 billion loan (the “2022 USD Tranche B” and together with the 2023 USD Tranche B (as defined below), as the context may require, the “USD Tranche B”) and a €600 million loan (the “Euro Tranche B” and together with the USD Tranche A and the USD Tranche B, the “Term Loan Facility”), each of which were borrowed in full on the Effective Date, and (ii) a senior secured revolving credit facility of \$500 million (the “Revolving Facility” and, together with the Term Loan Facility, the “Credit Facilities”), with the commitments under each of the foregoing facilities subject to increase from time to time subject to certain conditions. The USD Tranche A was repaid in January 2024, as described below. The Revolving Facility has a maturity date in August 2027 while the USD Tranche B and Euro Tranche B have a maturity date in August 2029.

Borrowings under the Credit Facilities bear interest at a rate per annum equal to, at our option, any of the following, plus, in each case, an applicable margin: (a) with respect to the USD Tranche A, the Revolving Facility and, prior to the effectiveness of the First Amendment (as defined below), the USD Tranche B, (x) a base rate determined by reference to the highest of (1) the federal funds effective rate plus 0.50%, (2) the prime rate quoted in *The Wall Street Journal*, or (3) a forward-looking term rate based on the variable secured overnight financing rate (“Term SOFR”) (plus an applicable credit spread adjustment) for an interest period of one month, plus 1.00%; and (y) a Term SOFR rate (plus an applicable credit spread adjustment) for the interest period relevant to such borrowing, subject to a rate floor of (I) with respect to the USD Tranche B, 0.50% and (II) with respect to the USD Tranche A and the Revolving Facility, 0.0%; and (b) with respect to the Euro Tranche B, a Euro Interbank Offered Rate (“EURIBOR”) rate determined by reference to the costs of funds for Euro deposits for the interest period relevant to such borrowing adjusted for certain additional costs, subject to a EURIBOR rate floor of 0.0%. The USD Tranche A was issued with original issue discount of 0.25% of the principal amount thereof. The 2022 USD Tranche B and the Euro Tranche B were issued with original issue discount of 2.00% of the principal amount thereof. The applicable margin for borrowings under the USD

Tranche A is 1.50% with respect to base rate borrowings and 2.50% with respect to Term SOFR borrowings. Prior to the effectiveness of the First Amendment, the applicable margin for borrowings under the USD Tranche B was 1.75% with respect to base rate borrowings and 2.75% with respect to Term SOFR borrowings. The applicable margin for borrowings under the Euro Tranche B is 3.00%. The applicable margin for borrowings under the Revolving Facility is 1.50% with respect to base rate borrowings and 2.50% with respect to Term SOFR borrowings.

In addition to paying interest on outstanding principal under the Credit Facilities, we are required to pay a commitment fee in respect of the unutilized commitments under the Revolving Facility. The initial commitment fee is 0.375% per annum. Commencing with the delivery of financial statements with respect to the first quarter ending after the closing of the Credit Agreement, the commitment fee is subject to downward adjustment based on our first lien net leverage ratio as of the end of the preceding quarter. We must also pay customary letter of credit fees and agency fees.

On October 3, 2023 (the “First Amendment Effective Date”), we entered into the First Amendment to Credit Agreement (the “First Amendment”), which refinanced all of the \$3.56 billion outstanding 2022 USD Tranche B (such refinanced loans, the “2023 USD Tranche B”) to (i) decrease the applicable margin for the USD Tranche B from 1.75% to 1.50% with respect to base rate borrowings and from 2.75% to 2.50% with respect to Term SOFR borrowings and (ii) remove the credit spread adjustments applicable to borrowings of the USD Tranche B based on Term SOFR. The 2023 USD Tranche B were issued with original issue discount of 0.25% of the principal amount thereof.

On October 31, 2023, we made a voluntary prepayment of \$100 million aggregate principal amount on the USD Tranche A.

We incurred \$242 million of deferred financing fees and original issue discount related to the term loans under the Term Loan Facility funded on the Effective Date, which are included in long-term debt, net in the accompanying consolidated balance sheets and are being amortized to interest expense over the estimated life of the term loans using the effective interest method. A portion of the deferred financing fees and original issue discount was accelerated in connection with the extinguishment of our previously existing term loan facility concurrently with our entry into the Term Loan Facility.

We incurred \$11 million of deferred financing fees and original issue discount related to the term loans under the 2023 USD Tranche B funded on the First Amendment Effective Date, of which \$9 million is included in long-term debt, net in the accompanying consolidated balance sheets and is being amortized to interest expense over the estimated life of the term loans using the effective interest method. We recorded an \$8 million loss on extinguishment of debt in connection with the First Amendment of the 2022 USD Tranche B.

In connection with the various prepayments in 2022 and 2023, we wrote off a portion of the deferred financing costs related to the prepayments.

Under the Credit Agreement, we are required to prepay outstanding term loans, subject to certain exceptions, with portions of our annual excess cash flow as well as with the net cash proceeds of certain of our asset sales, certain casualty and condemnation events and the incurrences or issuances of certain debt.

If at any time the aggregate amount of outstanding loans, unreimbursed letter of credit drawings and undrawn letters of credit under the Revolving Facility exceeds the aggregate commitments under the Revolving Facility, we are required to repay outstanding loans and/or cash collateralize letters of credit, with no reduction of the commitment amount.

We may voluntarily prepay outstanding loans under the Credit Facilities from time to time, subject to certain conditions, without premium or penalty other than customary “breakage” costs with respect to Term SOFR or EURIBOR loans; provided, however, that subject to certain exceptions, (i) if on or prior to the date that was twelve months after the Effective Date, we prepaid any loans under the 2022 USD Tranche B or the Euro Tranche B in connection with a repricing transaction, we would have been required to pay a prepayment premium of 1.00% of the aggregate principal amount of the loans so prepaid and (ii) if on or prior to the date that is six months after the First Amendment Effective Date, we prepaid any loans under the 2023 USD Tranche B in connection with a repricing transaction, we must pay a prepayment premium of 1.00% of the aggregate principal amount of the loans so prepaid. Additionally, we may voluntarily reduce the unutilized portion of the commitment amount under the Revolving Facility.

We are required to make scheduled quarterly payments each equal to 1.25% of the original principal amount of the USD Tranche A (increasing to 1.875% in years 3 and 4 and 2.50% in year 5), 0.25% of the original principal amount of the Euro Tranche B and 0.25% of the original principal amount of the 2023 USD Tranche B, with the balance due thereunder on the fifth anniversary of the closing date in the case of the USD Tranche A and the seventh anniversary of the closing date in the case of the USD Tranche B and the Euro Tranche B.

There is no scheduled amortization under the Revolving Facility. Any principal amount outstanding under the Revolving Facility is due and payable in full on the fifth anniversary of the closing date.

We incurred \$7 million of costs in connection with the Revolving Facility, which were capitalized and included in other assets in the accompanying consolidated balance sheets and are being amortized to interest expense over the estimated life of four

years. As a result of the termination of our previously existing revolving credit facility concurrently with our entry into the Revolving Facility, we wrote off an immaterial amount of previously capitalized debt issuance costs.

All obligations under the Credit Facilities are guaranteed by certain of our wholly-owned domestic subsidiaries and are required to be guaranteed by certain of our future wholly-owned domestic subsidiaries, and are secured by substantially all of our assets and the assets of such subsidiaries, subject to certain exceptions and exclusions.

Under the Credit Agreement, we have the ability to incur additional incremental debt facilities in an amount up to (x) the greater of (1) \$1.01 billion and (2) 75% of consolidated EBITDA, plus (y) an amount equal to the sum of all voluntary prepayments of term loans under the Term Loan Facility, plus (z) an additional unlimited amount subject to pro forma compliance with certain leverage ratio tests (based on the security and priority of such incremental debt).

Under the USD Tranche A and the Revolving Facility, so long as any USD Tranche A loans (or commitments in respect thereof) are outstanding as of the end of any fiscal quarter, we may not allow our total net leverage ratio as of the end of such fiscal quarter to be greater than 5.25 to 1.00 for the fiscal quarters ending December 31, 2023 through September 30, 2024, with an annual step-down of 0.25:1.00 and subject to a step-up of 0.50:1.00 for the four full fiscal quarter period following any material acquisition, not to exceed 5.50 to 1.00.

In addition, in the event there are no loans outstanding under the USD Tranche A, as of the end of any fiscal quarter of ours when the aggregate amount of loans outstanding under the Revolving Facility (net of (a) all letters of credit (whether cash collateralized or not) and (b) unrestricted cash of ours and our restricted subsidiaries) exceeds 35% of the aggregate amount of all commitments under the Revolving Facility in effect as of such date, we may not allow its first lien net leverage ratio as of the end of each such fiscal quarter to be greater than 6.00 to 1.00.

The USD Tranche B and the Euro Tranche B are not subject to financial maintenance covenants.

The Credit Agreement contains a number of negative covenants that, among other things and subject to certain exceptions, restrict our ability and each of our subsidiaries to: incur additional indebtedness; pay dividends on its capital stock or redeem, repurchase or retire its capital stock or its subordinated indebtedness; make investments, loans and acquisitions; create restrictions on the payment of dividends or other amounts to ourselves from our restricted subsidiaries or restrictions on the ability of our restricted subsidiaries to incur liens; engage in transactions with its affiliates; sell assets, including capital stock of its subsidiaries; materially alter the business it conducts; consolidate or merge; incur liens; and engage in sale-leaseback transactions.

The Credit Agreement also contains customary representations and warranties, affirmative covenants and provisions relating to events of default. If an event of default occurs, the lenders under the Credit Facilities will be entitled to take various actions, including the acceleration of amounts due under the Credit Facilities and all actions permitted to be taken by a secured creditor. As of December 31, 2023, we were in compliance with all covenants under the Credit Agreement.

The proceeds of the Term Loan Facility were used on the Effective Date, among other things, to fund a portion of the consideration payable in connection with the Atotech Acquisition and to refinance the existing term loan and revolving credit facilities of ours and certain indebtedness of Atotech. We also paid certain customary fees to and expenses of JPMorgan Chase Bank, N.A., Barclays Bank PLC, BofA Securities, Inc., Citibank, N.A., HSBC Securities (USA) Inc. and Mizuho Bank, Ltd. in their respective capacities as lead arrangers and bookrunners in connection with the Credit Facilities. The proceeds of the 2023 USD Tranche B were used on the First Amendment Effective Date to refinance the 2022 USD Tranche B. We also paid certain customary fees to and expenses of JPMorgan Chase Bank, N.A. in its capacity as lead arranger in connection with the 2023 USD Tranche B.

As of December 31, 2023, after total principal prepayments of \$200 million and regularly scheduled principal payments of \$109 million, the aggregate outstanding principal amount of the Term Loan Facility was \$4.95 billion and the weighted average interest rate was 7.7%. As of December 31, 2023, there were no borrowings under the Revolving Facility.

2024 Amendments and Prepayment of Credit Facilities

On January 22, 2024 (the “Second Amendment Effective Date”), we entered into the Second Amendment to Credit Agreement (the “Second Amendment”), which amended the Credit Agreement. Pursuant to the Second Amendment, we (i) borrowed additional USD Tranche B (as defined below) loans (the “Incremental USD Tranche B Loans”) in an aggregate principal amount of \$490 million, (ii) borrowed additional Euro Tranche B (as defined below) loans (the “Incremental Euro Tranche B Loans”) and together with the Incremental USD Tranche B Loans, the “Incremental Tranche B Loans”) in an aggregate principal amount of €250 million and (iii) used a portion of the proceeds of the Incremental Tranche B Loans to prepay our USD Tranche A (as defined below) in full in an aggregate principal amount of \$744 million. Remaining proceeds of the Incremental Tranche B Loans were used to pay fees and expenses in connection with the Second Amendment and will be used for working capital and general corporate purposes. The Incremental USD Tranche B Loans and the Incremental Euro Tranche B Loans have identical terms to our existing USD Tranche B and Euro Tranche B loans (collectively, together with the Incremental Tranche B

Loans, the “Tranche B Loans”), respectively, under the Credit Agreement. Additionally, pursuant to the Second Amendment, the 1.00% prepayment premium applicable to any Tranche B Loans prepaid in connection with certain repricing transactions was extended for a period of six months following the Second Amendment Effective Date. The Incremental Tranche B Loans were issued with original issue discount of 0.25%. In connection with the execution of the Second Amendment, we paid customary fees and expenses to JPMorgan Chase Bank, N.A.

On February 5, 2024, we made a voluntary prepayment of \$50 million aggregate principal amount on the USD Tranche B.

On February 13, 2024, we entered into the Third Amendment to Credit Agreement (the “Third Amendment”). Pursuant to the Third Amendment, we increased the available borrowing capacity under our Revolving Facility by \$175 million (the “Incremental Revolving Commitments”), from \$500 million to \$675 million. In connection with the execution of the Third Amendment, we paid customary fees and expenses to the lenders providing the Incremental Revolving Commitments and to JPMorgan Chase Bank, N.A.

Lines of Credit and Borrowing Arrangements

Certain of our Japanese subsidiaries have lines of credit and a financing facility with various financial institutions, many of which generally expire and are renewed at three-month intervals, with the remaining having no expiration date. The lines of credit and financing facility provided for aggregate borrowings as of December 31, 2023 and December 31, 2022 of up to an equivalent of \$14 million and \$27 million, respectively. There were no borrowings outstanding under these arrangements at December 31, 2023 or December 31, 2022.

Derivatives

We enter into derivative instruments for risk management purposes only, including derivatives designated as hedging instruments and those utilized as economic hedges. We operate internationally, and in the normal course of business, are exposed to fluctuations in interest rates and foreign exchange rates. These fluctuations can increase the costs of financing, investing and operating our business. We have used derivative instruments, such as foreign exchange forward contracts and options, to manage certain foreign currency exposure, and interest rate swaps and caps to manage certain interest rate exposure.

By nature, all financial instruments involve market and credit risks. We enter into derivative instruments with a diversified group of major investment grade financial institutions and no collateral is required. We have policies to monitor the credit risk of these counterparties. While there can be no assurance, we do not anticipate any material non-performance by any of these counterparties.

Interest Rate Swap and Interest Rate Cap Agreements

We have various interest rate swap agreements that exchange a forward-looking term rate based on Term SOFR paid on the outstanding balance of our Term Loan Facility, to a fixed rate. We acquired USD London Interbank Offered Rate (“USD LIBOR”) based interest rate cap agreements as a result of the Atotech Acquisition and had utilized these agreements to offset Term SOFR on our Term Loan Facility. Effective June 30, 2023, our USD LIBOR based interest rate caps were converted to Term SOFR. We also had two USD LIBOR based swaps that were converted to Term SOFR, effective June 30, 2023. The conversions from USD LIBOR to Term SOFR did not have a material impact on our results of operations.

The table below summarizes interest rate swaps and interest rate caps outstanding at December 31, 2023 and December 31, 2022:

(Dollars in millions)

Effective Date	Maturity	Fixed Rate	Notional Amount at Effective Date	Notional Amount at December 31, 2023	Years Ended December 31,	
					2023	2022
					Fair Value Asset (Liability)	Fair Value Asset
<i>Interest Rate Swaps</i>						
April 5, 2019	March 31, 2023	2.309%	\$ 300	\$ —	\$ —	\$ 1
June 30, 2023	February 28, 2025	0.391%	200	200	9	16
June 30, 2023	February 28, 2025	0.543%	300	300	14	22
September 30, 2022	September 30, 2026	3.156%	350	350	5	8
January 2, 2024	January 31, 2028	2.841%	250	—	7	5
September 30, 2022	September 30, 2027	3.198%	350	350	5	8
January 2, 2024	January 31, 2029	2.986%	250	—	6	4
September 30, 2022	September 30, 2026	3.358%	600	600	5	10
December 28, 2023	December 31, 2027	4.550%	500	500	(10)	—
			<u>3,100</u>	<u>2,300</u>	<u>41</u>	<u>74</u>
<i>Interest Rate Caps</i>						
June 30, 2023	January 31, 2024	0.805%	350	350	1	15
June 30, 2023	January 31, 2024	0.805%	350	350	2	15
			<u>700</u>	<u>700</u>	<u>3</u>	<u>30</u>
			<u>\$ 3,800</u>	<u>\$ 3,000</u>	<u>\$ 44</u>	<u>\$ 104</u>

The interest rate swaps are recorded at fair value on the consolidated balance sheets and changes in the fair value are recognized in accumulated OCI. To the extent these arrangements are no longer effective hedges, the hedging relationship will be discontinued and changes in the fair value of the hedging instruments from the last assessment period that were effective up to the current period will be recorded immediately in earnings. Amounts previously recorded in OCI will remain in OCI and will be reclassified to earnings when the interest payments impact consolidated earnings. If we determine that the interest payments are unlikely to occur, amounts previously recorded in OCI will be reclassified to earnings immediately. Changes in the fair value of interest rate caps are recorded immediately in earnings, as we have not designated these instruments as hedges and therefore these instruments do not qualify for hedge accounting.

Foreign Exchange Contracts and Net Investment Hedge

We hedge a portion of our forecasted foreign currency denominated intercompany sales of inventory, over a maximum period of eighteen months, using foreign exchange forward contracts accounted for as cash-flow hedges. To the extent these derivatives are effective in offsetting the variability of the hedged cash flows, and otherwise meet the hedge accounting criteria, changes in the derivatives' fair value are not included in current earnings but are included in accumulated OCI in stockholders' equity. These changes in fair value will subsequently be reclassified into earnings, as applicable, when the forecasted transaction occurs. To the extent that a previously designated hedging transaction is no longer an effective hedge, any ineffectiveness measured in the hedging relationship is recorded immediately in earnings in the period it occurs. The cash flows resulting from foreign exchange forward contracts are classified in the consolidated statements of cash flows as part of cash flows from operating activities. We do not enter into derivative instruments for trading or speculative purposes.

We also enter into foreign exchange forward contracts to hedge against changes in the consolidated balance sheets for certain subsidiaries to mitigate the risk associated with certain foreign currency transactions in the ordinary course of business. These derivatives are not designated as cash flow hedging instruments and gains or losses from these derivatives are recorded immediately in other expense, net.

We had foreign exchange forward contracts with notional amounts totaling \$266 million outstanding at December 31, 2023, which included \$71 million outstanding to exchange U.S. dollars to Euro, \$70 million outstanding to exchange South Korean won to U.S. dollars and \$65 million outstanding to exchange Japanese yen to U.S. dollar. We had foreign exchange forward contracts with notional amounts totaling \$702 million outstanding at December 31, 2022, which included \$485 million outstanding to exchange U.S. dollars to Euro and \$75 million outstanding to exchange South Korean won to U.S. dollars.

As of December 31, 2023, the unrealized loss that will be reclassified from OCI to earnings over the next twelve months is immaterial. Gains and losses on foreign exchange forward contracts that qualify for hedge accounting are classified in cost of products in 2023 and 2022 and totaled gains of \$7 million and \$18 million, respectively. There were no ineffective portions of the derivatives recorded in 2023 and 2022.

We hedge certain intercompany accounts receivable and intercompany loans with foreign exchange forward contracts. Typically, as these derivatives hedge existing amounts that are denominated in foreign currencies, the derivatives do not qualify for hedge accounting. Realized and unrealized gains and losses on foreign exchange forward contracts that do not qualify for

hedge accounting are recognized immediately in earnings. The net foreign exchange losses on these derivatives were \$31 million and \$8 million in 2023 and 2022, respectively. Foreign currency gains or losses are classified in other expense, net. The cash flows resulting from foreign exchange forward contracts are classified in our consolidated statements of cash flows as part of cash flows from operating activities. We do not hold or issue derivative financial instruments for trading purposes.

On January 1, 2023, we designated certain Euro-denominated debt as a net investment hedge to hedge a portion of our net investments in certain of our entities with functional currencies denominated in the Euro. As of December 31, 2023, we designated as a net investment hedge €593 million in aggregate principal amount of our Euro Tranche B issued in August 2022. For these nonderivative instruments, we defer recognition of the foreign currency remeasurement gains and losses within the foreign currency translation adjustment component of OCI. There was no net investment hedge designated in 2022 and all remeasurement gains and losses went directly to the statement of operations.

Contractual Obligations

As of December 31, 2023, we are a party to purchase commitments for certain inventory components and other equipment and services used in our normal operations totaling approximately \$562 million. The majority of these purchase commitments covered by these arrangements are for periods of less than one year.

In addition, we have various operating leases for real estate and non-real estate items. The non-real estate leases are mainly comprised of automobiles but also include office equipment and other lower-valued items. We also have a small number of finance leases for real estate.

Future payments related to operating and finance leases are as follows:

<i>(Dollars in millions)</i>	Operating Leases	Finance Leases
Year Ending December 31,		
2024	\$ 32	\$ 6
2025	25	6
2026	21	6
2027	18	3
2028	14	3
Thereafter	135	21
Total lease payments	245	45
Less: imputed interest	44	11
Total lease liabilities	<u>\$ 201</u>	<u>\$ 34</u>

Contractual maturities of our debt obligations as of December 31, 2023 are as follows:

<i>(Dollars in millions)</i>	Amount
Year	
2024	\$ 93
2025	110
2026	116
2027	586
2028	43
Thereafter	4,005

We have a number of defined benefit pension plans, which cover some of our employees outside the United States. In addition, we have certain pension assets and liabilities relating to our former employees in the United Kingdom. As of December 31, 2023, our estimated benefit payments over the next 10 years amount to \$101 million. The majority of the benefit payments covered by these arrangements occurs after 2028.

Recent Accounting Pronouncements

Segment Reporting (Topic 280): Improvements to Reportable Segment Disclosures

In November 2023, the Financial Accounting Standards Board (“FASB”) issued Accounting Standard Update (“ASU”) No. 2023-07, Segment Reporting (Topic 280): Improvements to Reportable Segment Disclosures, which requires a public entity to disclose significant segment expenses and other segment items on an annual and interim basis and provide in interim periods all disclosures about a reportable segment’s profit or loss and assets that are currently required annually. Additionally, it requires a public entity to disclose the title and position of the Chief Operating Decision Maker. The ASU does not change how a public entity identifies its operating segments, aggregates them, or applies the quantitative thresholds to determine its reportable

segments. The new standard is effective for fiscal years beginning after December 15, 2023, and interim periods within fiscal years beginning after December 15, 2024, with early adoption permitted. A public entity should apply the amendments in this ASU retrospectively to all prior periods presented in the financial statements. We are currently evaluating the impact of this ASU on our disclosures within the consolidated financial statements.

Income Taxes (Topic 740): Improvements to Income Tax Disclosures

In December 2023, the FASB issued ASU No. 2023-09, Income Taxes (Topic 740): Improvements to Income Tax Disclosures, which focuses on the rate reconciliation and income taxes paid. ASU No. 2023-09 requires a public business entity (“PBE”) to disclose, on an annual basis, a tabular rate reconciliation using both percentages and currency amounts, broken out into specified categories with certain reconciling items further broken out by nature and jurisdiction to the extent those items exceed a specified threshold. In addition, all entities are required to disclose income taxes paid, net of refunds received disaggregated by federal, state/local, and foreign and by jurisdiction if the amount is at least 5% of total income tax payments, net of refunds received. For PBEs, the new standard is effective for annual periods beginning after December 15, 2024, with early adoption permitted. An entity may apply the amendments in this ASU prospectively by providing the revised disclosures for the period ending December 31, 2025 and continuing to provide the pre-ASU disclosures for the prior periods, or may apply the amendments retrospectively by providing the revised disclosures for all period presented. We are currently evaluating the impact of this ASU on our consolidated financial statements and related disclosures.

Item 7A. Quantitative and Qualitative Disclosures about Market Risk

Market Risk and Sensitivity Analysis

Our primary exposures to market risks include fluctuations in interest rates on our Term Loan Facility, as defined and as described further in Item 7 of this Annual Report on Form 10-K, and investment portfolio, as well as fluctuations in foreign currency exchange rates.

Foreign Exchange Rate Risk

Our currency risk consists primarily of foreign currency denominated firm commitments, forecasted foreign currency denominated intercompany and third-party transactions, and net investments in certain subsidiaries. We use both nonderivative and derivative instruments to manage our earnings and cash flow exposure to changes in currency exchange rates.

We mainly enter into foreign exchange forward contracts to reduce currency exposure arising from intercompany sales of inventory. We also enter into foreign exchange forward contracts to reduce foreign exchange risks arising from the change in fair value of certain foreign currency denominated assets and liabilities.

We had foreign exchange forward contracts with notional amounts totaling \$266 million outstanding and a net fair value liability of \$3 million at December 31, 2023. We had foreign exchange forward contracts with notional amounts totaling \$702 million outstanding and a net fair value liability of \$1 million at December 31, 2022. The potential fair value loss for a hypothetical 10% adverse change in the currency exchange rate on our foreign exchange forward contracts at December 31, 2023 and 2022 would be immaterial.

On January 1, 2023, we designated certain Euro-denominated debt as a net investment hedge to hedge a portion of our net investments in certain of our entities with functional currencies denominated in the Euro. As of December 31, 2023, we designated as a net investment hedge €93 million in aggregate principal amount of our Euro Tranche B issued in August 2022. For these nonderivative instruments, we defer recognition of the foreign currency remeasurement gains and losses within the foreign currency translation adjustment component of OCI. There was no net investment hedge designated in 2022 and all remeasurement gains and losses went directly to the statement of operations.

Interest Rate Risk

We hold our cash, cash equivalents and short-term investments for working capital purposes. Some of the securities we invest in are subject to market risk. This means that a change in prevailing interest rates may cause the principal amount of such investments to fluctuate. To minimize this risk, we maintain our portfolio of cash, cash equivalents and short-term investments in a variety of securities, including money market funds and government debt securities. Due to the short-term nature of these instruments, we believe that we do not have any material exposure to changes in the fair value of our investment portfolio as a result of changes in interest rates. Declines in interest rates, however, would reduce future interest income. The effect of a hypothetical 10% increase or decrease in overall interest rates would not have had a material impact on our operating results or the total fair value of our portfolio.

We have various interest rate swap and cap agreements as described further in “Management's Discussion and Analysis of Financial Condition and Results of Operations—Critical Accounting Policies and Estimates—Derivatives” that exchange the variable Term SOFR interest rate to a fixed rate in order to manage the exposure to interest rate fluctuations associated with the variable Term SOFR interest rate paid on the outstanding balance of the Term Loan Facility. We acquired USD LIBOR interest rate cap agreements as a result of the Atotech Acquisition and had utilized these agreements to offset the variable Term SOFR rate on our Term Loan Facility. Effective June 30, 2023, our USD LIBOR based interest rate caps were converted to Term SOFR. We also had two USD LIBOR based swaps that were converted to Term SOFR, effective June 30, 2023. The conversions from USD LIBOR to Term SOFR did not have a material impact on our results of operations.

We are exposed to market risks related to fluctuations in interest rates related to our Term Loan Facility. As of December 31, 2023, the principal outstanding on our Term Loan Facility was \$4.95 billion, at a weighted average interest rate of 7.7%. A 10% increase or decrease in the weighted average interest rate as of December 31, 2023 would increase or decrease annual interest expense by approximately \$26 million, excluding the effect of our interest rate hedges. Because the notional amount of our interest rate hedges as of December 31, 2023 equals approximately 61% of the principal outstanding on our Term Loan Facility, the resulting net impact to interest expense would be approximately \$13 million.

Item 8. Financial Statements and Supplementary Data

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Stockholders of MKS Instruments, Inc.

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of MKS Instruments, Inc. and its subsidiaries (the “Company”) as of December 31, 2023 and 2022, and the related consolidated statements of operations and comprehensive (loss) income, of stockholders’ equity and of cash flows for each of the three years in the period ended December 31, 2023, including the related notes and schedule of valuation and qualifying accounts for each of the three years in the period ended December 31, 2023 appearing after Item 16 (collectively referred to as the “consolidated financial statements”). We also have audited the Company's internal control over financial reporting as of December 31, 2023, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2023 and 2022, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2023 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2023, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the COSO.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in Management’s Report on Internal Control over Financial Reporting appearing under Item 9A. Our responsibility is to express opinions on the Company’s consolidated financial statements and on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company’s internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company’s internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company’s assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that (i) relates to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Interim and Annual Goodwill Impairment Assessments – Equipment Solutions (ESB), Electronics (EL) and General Metal Finishing (GMF) Reporting Units

As described in Notes 3 and 13 to the consolidated financial statements, the Company's net goodwill balance was \$2,554 million as of December 31, 2023, and the goodwill associated with the ESB, EL and GMF reporting units was \$87 million, \$1,401 million and \$318 million, respectively. Management assesses goodwill for impairment on an annual basis as of October 31 or more frequently when events and circumstances occur indicating that the recorded goodwill may be impaired. During the quarter ended June 30, 2023, management concluded there was a triggering event at each of its ESB, EL and GMF reporting units. The interim goodwill impairment test as of June 30, 2023 resulted in impairment charges of \$372 million, \$826 million and \$428 million at the ESB, EL and GMF reporting units, respectively. The annual goodwill impairment test resulted in impairment charges of \$13 million and \$48 million at the ESB and EL reporting units, respectively. In the quantitative assessment, management compares the fair value of the reporting unit to its carrying amount, which includes goodwill. If the fair value exceeds the carrying value, no impairment loss exists. If the fair value is less than the carrying amount, a goodwill impairment loss is measured and recorded. For each of the three reporting units, management performed a quantitative assessment of goodwill using a weighting of an income approach and market approach. The income approach was based upon projected future cash flows that were discounted to present value and an assumed terminal growth rate. The key underlying assumptions included forecasted revenues, which incorporated external market data, terminal growth rate, gross profit and operating expenses, as well as an applicable discount rate for each reporting unit. The market approach for each of the three reporting units incorporated observed multiples of guideline public companies. The market approach for the EL and GMF reporting units also incorporated multiples from guideline transactions.

The principal considerations for our determination that performing procedures relating to the interim and annual goodwill impairment assessments of the ESB, EL and GMF reporting units is a critical audit matter are (i) the significant judgment by management when developing the fair value estimate of the ESB, EL and GMF reporting units; (ii) a high degree of auditor judgment, subjectivity, and effort in performing procedures and evaluating management's significant assumptions related to forecasted revenues, gross profits, operating expenses, terminal growth rates, discount rates, and multiples of guideline public companies for ESB, EL and GMF, and multiples from guideline transactions for EL and GMF; and (iii) the audit effort involved the use of professionals with specialized skill and knowledge.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to management's goodwill impairment assessments, including controls over the valuation of the Company's ESB, EL and GMF reporting units. These procedures also included, among others, (i) testing management's process for developing the fair value estimate of the ESB, EL and GMF reporting units; (ii) evaluating the appropriateness of the income and market approaches used by management; (iii) testing the completeness and accuracy of underlying data used in the income and market approaches; and (iv) evaluating the reasonableness of the significant assumptions used by management related to forecasted revenues, gross profits, operating expenses, terminal growth rates, discount rates, and multiples as applicable to the valuation approach and reporting units described above. Evaluating management's assumptions related to forecasted revenues, gross profits, operating expenses, and terminal growth rates involved evaluating whether the assumptions used by management were reasonable considering (i) the current and past performance of the ESB, EL and GMF reporting units, (ii) the consistency with external market and industry data, and (iii) whether these assumptions were consistent with evidence obtained in other areas of the audit. Professionals with specialized skill and knowledge were used to assist in evaluating (i) the appropriateness of the income and market approaches and (ii) the reasonableness of the discount rates and multiples assumptions.

/s/ PricewaterhouseCoopers LLP
Boston, Massachusetts
February 27, 2024

We have served as the Company's auditor since 1981.

MKS Instruments, Inc.
Consolidated Balance Sheets
(in millions, except per share data)

	December 31,	
	2023	2022
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 875	\$ 909
Short-term investments	—	1
Trade accounts receivable, net of allowance for doubtful accounts of \$6 and \$11 at December 31, 2023 and 2022, respectively	603	720
Inventories	991	977
Other current assets	227	187
Total current assets	2,696	2,794
Property, plant and equipment, net	784	800
Right-of-use assets	225	234
Goodwill	2,554	4,308
Intangible assets, net	2,619	3,173
Other assets	240	186
Total assets	<u>\$ 9,118</u>	<u>\$ 11,495</u>
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Short-term debt	\$ 93	\$ 93
Accounts payable	327	426
Other current liabilities	428	433
Total current liabilities	848	952
Long-term debt, net	4,696	4,834
Non-current deferred taxes	640	783
Non-current accrued compensation	151	138
Non-current lease liability	205	215
Other non-current liabilities	106	90
Total liabilities	6,646	7,012
Commitments and contingencies (Note 24)		
Stockholders' equity:		
Preferred stock, \$0.01 par value, 2 shares authorized; none issued and outstanding	—	—
Common stock, no par value, 200 shares authorized; 66.9 and 66.6 shares issued and outstanding at December 31, 2023 and 2022, respectively	—	—
Additional paid-in capital	2,195	2,142
Retained earnings	373	2,272
Accumulated other comprehensive (loss) income	(96)	69
Total stockholders' equity	2,472	4,483
Total liabilities and stockholders' equity	<u>\$ 9,118</u>	<u>\$ 11,495</u>

The accompanying notes are an integral part of the Consolidated Financial Statements.

MKS Instruments, Inc.
Consolidated Statements of Operations and Comprehensive (Loss) Income
(in millions, except per share data)

	Years Ended December 31,		
	2023	2022	2021
Net revenues:			
Products	\$ 3,200	\$ 3,119	\$ 2,579
Services	422	428	371
Total net revenues	3,622	3,547	2,950
Cost of revenues:			
Products	1,748	1,774	1,371
Services	232	226	199
Total cost of revenues (exclusive of amortization shown separately below)	1,980	2,000	1,570
Gross profit	1,642	1,547	1,380
Research and development	288	241	200
Selling, general and administrative	675	488	385
Acquisition and integration costs	16	52	30
Restructuring	20	10	11
Fees and expenses related to repricing of Term Loan Facility	2	—	—
Amortization of intangible assets	295	146	55
Goodwill and intangible asset impairments	1,902	—	—
Gain on sale of long-lived assets	(2)	(7)	—
(Loss) income from operations	(1,554)	617	699
Interest income	(17)	(4)	—
Interest expense	356	177	25
Loss on extinguishment of debt	8	—	—
Other expense, net	27	11	9
(Loss) income before income taxes	(1,928)	433	665
(Benefit) provision for income taxes	(87)	100	114
Net (loss) income	<u>\$ (1,841)</u>	<u>\$ 333</u>	<u>\$ 551</u>
Other comprehensive (loss) income, net of tax:			
Changes in value of financial instruments designated as cash flow hedges			
	\$ (24)	\$ 50	\$ 20
Foreign currency translation adjustments	(83)	18	(31)
Change in net investment hedge	(25)	—	—
Unrecognized pension (loss) gain	(9)	12	—
Unrealized loss on investments	(23)	—	—
Total comprehensive (loss) income	<u>\$ (2,005)</u>	<u>\$ 413</u>	<u>\$ 540</u>
Net (loss) income per share:			
Basic	\$ (27.54)	\$ 5.57	\$ 9.95
Diluted	\$ (27.54)	\$ 5.56	\$ 9.90
Weighted average common shares outstanding:			
Basic	66.8	59.7	55.4
Diluted	66.8	59.9	55.7

The accompanying notes are an integral part of the Consolidated Financial Statements.

MKS Instruments, Inc.
Consolidated Statements of Stockholders' Equity
(in millions, except per share data)

	Common Stock		Additional Paid-In Capital	Retained Earnings	Accumulated Other Comprehensive (Loss) Income	Total Stockholders' Equity
	Shares	Amount				
Balance at December 31, 2020	55.2	\$ 0.1	\$ 873	\$ 1,487	\$ —	\$ 2,360
Net issuance under stock-based plans	0.3		(4)			(4)
Stock-based compensation			37			37
Cash dividend (\$0.86 per common share)				(47)		(47)
Comprehensive income (net of tax):						
Net income				551		551
Other comprehensive loss					(11)	(11)
Balance at December 31, 2021	55.5	0.1	907	1,991	(11)	2,887
Net issuance under stock-based plans	0.4		5			5
Shares issued for Atotech Acquisition	10.7		1,186			1,186
Stock-based compensation			45			45
Cash dividend (\$0.88 per common share)				(52)		(52)
Comprehensive income (net of tax):						
Net income				333		333
Other comprehensive income					80	80
Balance at December 31, 2022	66.6	0.1	2,142	2,272	69	4,483
Net issuance under stock-based plans	0.3		(1)			(1)
Stock-based compensation			54			54
Cash dividend (\$0.88 per common share)				(59)		(59)
Comprehensive loss (net of tax):						
Net loss				(1,841)		(1,841)
Other comprehensive loss					(164)	(164)
Balance at December 31, 2023	66.9	\$ 0.1	\$ 2,195	\$ 373	\$ (96)	\$ 2,472

The accompanying notes are an integral part of the Consolidated Financial Statements.

MKS Instruments, Inc.
Consolidated Statements of Cash Flows
(in millions)

	Years Ended December 31,		
	2023	2022	2021
Cash flows from operating activities:			
Net (loss) income	\$ (1,841)	\$ 333	\$ 551
Adjustments to reconcile net (loss) income to net cash provided by operating activities:			
Depreciation and amortization	397	216	104
Amortization of inventory step-up to fair value	—	52	—
Goodwill and intangible asset impairments	1,902	—	—
Unrealized loss (gain) on derivatives not designated as hedging instruments	32	13	(4)
Amortization of debt issuance costs and original issue discount	33	56	2
Loss on extinguishment of debt	8	—	—
Gain on sale of long-lived assets	(2)	(7)	—
Stock-based compensation	54	45	37
Provision for excess and obsolete inventory	64	21	16
Deferred income taxes	(234)	(46)	2
Other	5	3	4
Changes in operating assets and liabilities, net of acquired assets and liabilities:			
Trade accounts receivable	114	(4)	(53)
Inventories	(76)	(236)	(92)
Other current and non-current assets	50	28	—
Accounts payable	(99)	61	56
Current and non-current accrued compensation	(5)	(31)	17
Income taxes payable	(64)	19	1
Other current and non-current liabilities	(19)	6	(1)
Net cash provided by operating activities	319	529	640
Cash flows from investing activities:			
Acquisitions of businesses, net of cash acquired	—	(4,473)	(268)
Purchases of investments	—	(1)	(497)
Maturities of investments	—	77	478
Sales of investments	—	—	169
Proceeds from sale of long-lived assets	3	9	—
Purchases of property, plant and equipment	(87)	(164)	(87)
Net cash used in investing activities	(84)	(4,552)	(205)
Cash flows from financing activities:			
Proceeds from borrowing	216	5,237	1
Payments of borrowings	(403)	(962)	(15)
Payments of deferred financing fees	(9)	(249)	—
Dividend payments	(59)	(52)	(47)
Net payments related to employee stock awards	(1)	(1)	(4)
Other financing activities	(3)	(2)	—
Net cash (used in) provided by financing activities	(259)	3,971	(65)
Effect of exchange rate changes on cash and cash equivalents	(10)	(5)	(12)
(Decrease) increase in cash and cash equivalents	(34)	(57)	358
Cash and cash equivalents at beginning of period	909	966	608
Cash and cash equivalents at end of period	\$ 875	\$ 909	\$ 966
Supplemental disclosure of cash flow information:			
Cash paid during the period for:			
Interest	\$ 305	\$ 110	\$ 23
Income taxes	\$ 180	\$ 133	\$ 110

The accompanying notes are an integral part of the Consolidated Financial Statements.

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
(in millions, except per share data)

(1) Business Description

MKS Instruments, Inc. (“MKS” or the “Company”) was founded in 1961 and enables technologies that transform the world. The Company delivers foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging, and specialty industrial applications. The Company applies its broad science and engineering capabilities to create instruments, subsystems, systems, process control solutions and specialty chemicals technology that improve process performance, optimize productivity and enable unique innovations for many of the world’s leading technology and industrial companies. The Company’s solutions are critical to addressing the challenges of miniaturization and complexity in advanced device manufacturing by enabling increased power, speed, feature enhancement and optimized connectivity. These solutions are also critical to addressing ever-increasing performance requirements across a wide array of specialty industrial applications.

(2) Basis of Presentation

The Consolidated Financial Statements include the accounts of MKS and its wholly owned subsidiaries. All intercompany accounts and transactions have been eliminated in consolidation. Certain prior period amounts have been reclassified to conform to current period presentation. As a result of rounding, there may be immaterial differences in amounts presented and certain calculations may not sum to the total number expressed in each category or tie to a corresponding schedule.

The Consolidated Financial Statements have been prepared in accordance with accounting principles generally accepted in the United States of America (“U.S. GAAP”). The preparation of these financial statements requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. On an ongoing basis, management evaluates its estimates and judgments, including those related to revenue recognition and allowance for doubtful accounts, inventory valuation, warranty costs, pension plan valuations, stock-based compensation, intangible assets, goodwill, other long-lived assets, in-process research and development (“IPR&D”) and income taxes. Management bases its estimates and judgments on historical experience and on various other factors that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

The Company has three reportable segments: the Vacuum Solutions Division (“VSD”), the Photonics Solutions Division (“PSD”) and the Materials Solutions Division (“MSD”) as described in Note 22.

(3) Summary of Significant Accounting Policies

Revenue from Contracts with Customers

The Company accounts for revenue using Accounting Standards Codification (“ASC”) 606, “Revenue from Contracts with Customers” (“ASC Topic 606”). The Company applies ASC Topic 606 using the following steps:

- Identify the contract with a customer
- Identify the performance obligations in the contract
- Determine the transaction price
- Allocate the transaction price to performance obligations in the contract
- Recognize revenue when or as the Company satisfies a performance obligation

Revenue is recognized when or as obligations under the terms of a contract with a customer have been satisfied and control has transferred to the customer. The majority of the Company’s performance obligations, and associated revenue, are transferred to customers at a point in time, generally upon shipment of a product to the customer or receipt of the product by the customer and without significant judgments. The Company recognizes revenue over time for contracts relating to the manufacturing, modifications and retrofits of its plating equipment, as the equipment is

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built to customer specification, and the Company has an enforceable right to payment for the performance completed to date. For these sales, the Company uses the cost-to-cost input method to measure progress. In cases, where cost-to-cost is not proportionate to its progress in satisfying the performance obligation because of uninstalled materials, the Company adjusts the measure of progress and recognizes revenue to the extent of cost incurred to satisfy the performance obligation under the contract. Revenue from customized products with no alternative future use to the Company, and that have an enforceable right to payment for performance completed to date, is also recorded over time. The Company considers this to be a faithful depiction of the transfer to the customer of revenue over time as the work is performed or service is delivered. Adjustments for custom products were not material for 2023, 2022 or 2021.

Installation services, other than those related to the Company's plating equipment, are not significant, are usually completed in a short period of time and, therefore, are recorded at a point in time when the installation services are completed, rather than over time, as they are not material. Extended warranty, service contracts, and repair services, which are transferred to the customer over time, are recorded as revenue as the services are performed. For repair services, the Company makes an accrual at each quarter end based upon historical repair times within its product groups to record revenue based upon the estimated number of days completed to date, which is consistent with ratable recognition.

Revenue is measured as the amount of consideration the Company expects to receive in exchange for transferring goods or providing services. Performance obligations promised in a contract are identified based on the products or services that will be transferred to the customer that are both capable of being distinct, whereby the customer can benefit from the product or service either on its own or together with other resources that are readily available from third parties or from the Company, and are distinct in the context of the contract, whereby the transfer of the product or service is separately identifiable from other promises in the contract. Sales tax, value add tax, and other taxes the Company collects concurrent with revenue-producing activities are excluded from revenue. The Company's normal payment terms are 30 to 60 days, but vary by the type and location of its customers and the products or services offered. The time between invoicing and when payment is due is not significant. For certain products and services and customer types, the Company requires payment before the products are delivered to, or the services are performed for, the customer. None of the Company's contracts in each of the periods presented contained a significant financing component.

Contracts with Multiple Performance Obligations

The Company periodically enters into contracts with its customers in which a customer may purchase a combination of goods and or services, such as products with installation services or extended warranties. These contracts include multiple deliverables that the Company evaluates to determine if the deliverables are separate performance obligations. Once the Company determines the performance obligations, the Company then determines the transaction price, which includes estimating the amount of variable consideration to be included in the transaction price, if any. To the extent the transaction price includes variable consideration, the Company estimates the amount of variable consideration that should be included in the transaction price utilizing either the expected value method or the most likely amount method, depending on the method the Company expects to better predict the amount of consideration to which it will be entitled. There are no constraints on the variable consideration recorded. The Company then allocates the transaction price to each performance obligation in the contract based on a relative stand-alone selling price charged separately to customers or using an expected cost-plus-margin method. The corresponding revenues are recognized when or as the related performance obligations are satisfied, which are noted above. The impact of variable consideration was immaterial in each of the periods presented.

The Company's standard assurance warranty period is normally 12 to 24 months. The Company sells separately priced service contracts and extended warranty contracts related to certain of its products, in particular related to our plating and laser-based products. The separately priced contracts generally range from 12 to 60 months. The Company normally receives payment at the inception of the contract and recognizes revenue over the term of the agreement in proportion to the costs expected to be incurred in satisfying the obligations under the contract. The Company has elected to use the practical expedient related to disclosing the remaining performance obligations as of December 31, 2023 and 2022, as the majority have a duration of less than one year.

MKS INSTRUMENTS, INC.
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Costs to Obtain and Fulfill a Contract

The Company expenses sales commissions when incurred because the amortization period would have been one year or less. These costs are recorded within selling, general and administration expenses. The Company has elected to recognize the costs for freight and shipping when control over products has transferred to the customer as an expense in cost of sales.

Accounts Receivable Allowances

Accounts receivable allowances include sales returns and bad debt allowances. The Company monitors and tracks the amount of product returns and reduces revenue at the time of shipment for the estimated amount of such future returns, based on historical experience. The Company makes estimates evaluating its allowance for doubtful accounts. The Company continuously monitors collections and payments from its customers and maintains a provision for estimated credit losses based upon its historical experience, current economic conditions and any specific customer collection issues that it has identified.

Research and Development

Research and development costs are expensed as incurred and consist mainly of compensation-related expenses and project materials. The Company's research and development efforts include numerous projects, which generally have a duration of 3 to 36 months. Acquired IPR&D expenses, if acquired in a business combination, are capitalized at fair value as an intangible asset until the related project is completed, and are then amortized over the estimated useful life of the product. The Company monitors projects and, if they are abandoned, the Company writes them off.

Advertising Costs

Advertising costs are expensed as incurred and were immaterial in 2023, 2022 and 2021.

Leases

The Company accounts for leases under ASC Topic 842, "Leases" ("ASC Topic 842"). Under ASC Topic 842, a contract is or contains a lease when the Company has the right to control the use of the identified asset. The Company determines if an arrangement is a lease at inception of the contract, which is the date on which the terms of the contract are agreed to and the agreement creates enforceable rights and obligations. The commencement date of the lease is the date that the lessor makes an underlying asset available for use.

The Company determines if the lease is an operating or finance lease at the lease commencement date based upon the terms of the lease and the nature of the asset. The lease term used to calculate the lease liability includes options to extend or terminate the lease when it is reasonably certain that the option will be exercised.

The Company measures the lease liability as the present value of future lease payments, discounted using the discount rate for the lease at the commencement date. The Company is typically unable to determine the implicit interest rate, so it uses an incremental borrowing rate based on the lease term and economic environment at commencement date. The right-of-use ("ROU") asset is initially measured as the amount of the lease liability, adjusted for any initial lease costs, prepaid lease payments and reduced by any lease incentives.

The Company's contracts often include non-lease components such as common area maintenance. MKS has elected the practical expedient to account for the lease and non-lease components as a single lease component. For leases with a term of one year or less the Company has elected not to record the lease asset or liability. The lease payments are recognized in the consolidated statements of operations and comprehensive (loss) income on a straight-line basis over the lease term. The Company includes lease costs within cost of revenues and operating expenses.

Stock-Based Compensation

The accounting for share-based compensation expense requires the measurement and recognition of compensation expense for all share-based payment awards made to employees and directors based on estimated fair values. For restricted stock units ("RSUs"), the fair value is measured on the date of grant and expensed normally over a three-

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year period. The Company does not include a forfeiture rate in the fair value measurement at the date of grant. The Company also provides certain employees with the opportunity to purchase shares through its 2014 Employee Stock Purchase Plan ("2014 ESPP"). The Company estimates the fair value of shares issued under the 2014 ESPP using the Black-Scholes pricing model, which incorporates a number of complex and subjective variables, including expected stock price volatility over the term of the awards, expected life, risk-free interest rate and expected dividends.

Management determined that blended volatility, a combination of historical and implied volatility, is more reflective of market conditions and a better indicator of expected volatility than historical or implied volatility alone. The assumptions used in calculating the fair value of share-based payment awards represent management's best estimates, but these estimates involve inherent uncertainties and the application of management judgment. As a result, if factors change and the Company uses different assumptions, stock-based compensation expense could be materially different in the future.

Accumulated Other Comprehensive (Loss) Income

For foreign subsidiaries where the functional currency is the local currency, assets and liabilities are translated into U.S. dollars at the current exchange rate on the consolidated balance sheets date. Revenue and expenses are translated at average rates of exchange prevailing during the year. Translation adjustments resulting from this process are recorded to accumulated Other Comprehensive (Loss) Income ("OCI"). Unrealized gains and losses on securities classified as available-for-sale and unrecognized pension gains and losses are included in OCI in consolidated stockholders' equity. For derivative instruments designated as cash-flow hedges and interest rate swap hedges, the effective portion of the derivative's gain (loss) is initially reported as a component of OCI and is subsequently recognized in earnings when the hedged exposure is recognized in earnings.

Net (Loss) Income Per Share

Basic net (loss) income per share is based on the weighted average number of common shares outstanding and diluted net (loss) income per share is based on the weighted average number of common shares outstanding and all potential dilutive common equivalent shares outstanding. The dilutive effect of equity awards is determined under the treasury stock method using the average market price for the period. Common equivalent shares are included in the per share calculations when the effect of their inclusion would be dilutive. In periods in which a net loss is recognized, common equivalent shares are not included as they are antidilutive.

Cash and Cash Equivalents and Investments

All highly liquid investments with a maturity date of three months or less at the date of purchase are considered to be cash equivalents. The appropriate classification of investments in securities is determined at the time of purchase. Debt securities that the Company does not have the intent and ability to hold to maturity are classified as "available-for-sale" and are carried at fair value.

The Company classifies investments with maturity dates greater than twelve months in short-term investments rather than long-term investments. This method classifies these securities as current based on the nature of the securities and the availability for use in current operations. The Company believes this method is preferable because it is more reflective of the Company's assessment of its overall liquidity position.

The Company reviews its investment portfolio on a quarterly basis to identify and evaluate individual investments that have indications of possible impairment. The factors considered in determining whether a loss is other-than-temporary include: the length of time and extent to which fair market value has been below the cost basis, the financial condition and near-term prospects of the issuer, credit quality, and the Company's ability to hold the investment for a period of time sufficient to allow for any anticipated recovery in fair value.

Concentrations of Credit Risk

The Company's significant concentrations of credit risk consist principally of cash and cash equivalents, foreign exchange forward contracts, interest rate swaps and trade accounts receivable. The Company maintains cash and cash equivalents with financial institutions, including some banks with which it has borrowings. The Company enters into

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foreign exchange forward contracts with high credit-quality financial institutions in order to minimize credit risk exposure.

The Company's largest customers are primarily concentrated in the semiconductor industry, and a limited number of these customers account for a significant portion of the Company's revenues. The Company regularly monitors the creditworthiness of its customers and believes it has adequately provided for potential credit loss exposures. Credit is extended for all customers based primarily on financial condition, and collateral is not required.

During 2023, 2022 and 2021, approximately 41%, 58%, and 62% of the Company's net revenues, respectively, were from sales to customers in the semiconductor market. No single customer represented greater than 10% of the Company's accounts receivable balance as of December 31, 2023 or 2022.

Inventories

Inventories are stated at the lower of cost or net realizable value, cost being determined using a standard costing system that approximates actual cost, based on a first-in, first-out method. The Company regularly reviews inventory quantities on hand and records a provision to write-down excess and obsolete inventory to its estimated net realizable value, if less than cost, based primarily on its estimated forecast of product demand.

Property, Plant and Equipment

Property, plant and equipment are stated at cost. Expenditures for major renewals and betterments that extend the useful lives of property, plant and equipment are capitalized. Expenditures for maintenance and repairs are charged to expense as incurred. When assets are sold or otherwise disposed of, the cost and related accumulated depreciation are eliminated from the accounts and any resulting gain or loss is recognized in earnings.

Depreciation is provided on the straight-line method over the estimated useful lives of ten to fifty years for buildings and building improvements, and three to eighteen years for machinery and equipment, furniture and fixtures, office equipment and software. Leasehold improvements are amortized over the shorter of the lease term or the estimated useful life of the leased asset.

Acquisition Accounting

The fair value of the consideration exchanged in a business combination is allocated to tangible assets and identifiable intangible assets acquired and liabilities assumed at acquisition date fair value. Goodwill is measured as the excess of the consideration transferred over the net fair value of identifiable assets acquired and liabilities assumed. The accounting for an acquisition involves a considerable amount of judgment and estimation. Cost, income, market or a combination of approaches may be used to establish the fair value of consideration exchanged, assets acquired, and liabilities assumed, depending on the nature of those items. The valuation approach is determined in accordance with generally accepted valuation methods. Key areas of estimation and judgment may include the selection of valuation approaches, cost of capital, market characteristics, cost structure, impacts of synergies, and estimates of terminal value, among other factors.

While the Company uses estimates and assumptions as part of the purchase price allocation process to estimate the value of assets acquired and liabilities assumed, estimates are inherently uncertain and subject to refinement. During the measurement period, which may be up to one year from the acquisition date, the Company may record adjustments to the assets acquired and liabilities assumed, with a corresponding offset to goodwill, to the extent that adjustments are identified to the preliminary purchase price allocation. Upon conclusion of the measurement period, or final determination of the value of the assets acquired and liabilities assumed, whichever comes first, any subsequent adjustments are recorded to results of operations.

Intangible Assets

Intangible assets resulting from the acquisitions of businesses are estimated by management based on the fair value of assets acquired. These include acquired customer lists, completed technology, patents, trademarks, trade names, backlog and IPR&D. Intangible assets, other than IPR&D, are amortized from one to eighteen years on a straight-line basis, which represents the estimated periods of benefit and the expected pattern of consumption. IPR&D is not subject to amortization until reclassification into completed technology. Upon completion of a project, the Company

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expects the corresponding IPR&D intangible assets to be amortized over an estimated useful life of eight to nine years.

Goodwill

Goodwill is the amount by which the cost of acquired net assets exceeded the fair value of those net assets on the date of acquisition. The Company allocates goodwill to reporting units at the time of acquisition or when there is a change in the reporting structure and bases that allocation on which reporting units will benefit from the acquired assets and liabilities. Reporting units are defined as operating segments or one level below an operating segment, referred to as a component. The Company assesses goodwill for impairment on an annual basis as of October 31 or more frequently when events and circumstances occur indicating that the recorded goodwill may be impaired.

The estimated fair value of the Company's reporting units is based on discounted cash flow models derived from internal earnings and internal and external market forecasts. Determining fair value requires the exercise of significant judgment, including judgments about appropriate discount and terminal growth rates, as well as forecasted revenue, gross profit and operating expenses. Discount rates are based on a weighted average cost of capital ("WACC"), which represents the average rate a business must pay its providers of debt and equity. The WACC used to test goodwill is derived from a group of comparable companies. Assumptions in estimating future cash flows are subject to a high degree of judgment and complexity. The Company makes every effort to forecast these future cash flows as accurately as possible with the information available at the time the forecast is developed.

In performing the Company's annual goodwill impairment test, the Company is permitted to first assess qualitative factors to determine whether it is more likely than not that the fair value of the Company's reporting unit exceeds its carrying amount, including goodwill. In performing the qualitative assessment, the Company considers certain events and circumstances specific to the reporting unit and to the entity as a whole, such as macroeconomic conditions, industry and market considerations, overall financial performance and cost factors when evaluating whether it is more likely than not that the fair value of the reporting unit exceeds its carrying amount. The Company is also permitted to bypass the qualitative assessment and proceed directly to the quantitative assessment. If the Company chooses to undertake the qualitative assessment and concludes that it is more likely than not that the fair value of the reporting unit is less than its carrying amount, the Company would then proceed to the quantitative impairment assessment. In the quantitative assessment, the Company compares the fair value of the reporting unit to its carrying amount, which includes goodwill. If the fair value exceeds the carrying value, no impairment loss exists. If the fair value is less than the carrying amount, a goodwill impairment loss is measured and recorded.

Impairment of Long-Lived Assets

The Company evaluates the recoverability of its long-lived assets whenever events and changes in circumstances indicate that the carrying amount of an asset may not be fully recoverable. This periodic review may result in an adjustment of estimated depreciable lives or asset impairment. When indicators of impairment are present, the carrying values of the asset are evaluated in relation to their operating performance and future undiscounted cash flows of the underlying business. If the future undiscounted cash flows are less than their carrying value, impairment exists. The impairment is measured as the difference between the carrying value and the fair value of the underlying asset. Fair values are based on estimates of market prices and assumptions concerning the amount and timing of estimated future cash flows and assumed discount rates, reflecting varying degrees of perceived risk.

Foreign Exchange

The functional currency of the majority of the Company's foreign subsidiaries is the applicable local currency. For those subsidiaries, assets and liabilities are translated to U.S. dollars at year-end exchange rates. Income and expense accounts are translated at the average exchange rates prevailing during the year. The resulting translation adjustments are included in OCI in consolidated stockholders' equity. Foreign exchange transaction gains and losses are classified in other expense, net in the statement of operations and comprehensive (loss) income.

In 2022, published official exchange rates for Turkey indicated that the three-year cumulative inflation rate exceeded 100% and therefore is considered to be a hyper inflationary economy. Accordingly, the Company has changed the functional currency of its subsidiary in Turkey from the Turkish lira to the U.S. dollar, which is the consolidated

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group's reporting currency. The required remeasurement of assets and liabilities denominated in Turkish lira into U.S. dollar did not have a material impact on the Company's results of operations.

Net foreign exchange losses resulting from re-measurement were \$30, \$5, and \$9 for the years ended December 31, 2023, 2022, and 2021, respectively, and are included in other expense, net. These amounts do not reflect the corresponding gain (loss) from foreign exchange forward contracts, which are included in cost of sales. See Note 9 regarding foreign exchange forward contracts.

Employee Benefit Plans

The majority of the Company's employees participate in defined contribution plans, whereby the Company, at its discretion, makes certain matching contributions based on participating employees' annual contribution to the plan and their total compensation.

The Company also has defined benefit retirement plans at certain of its foreign subsidiaries. The Company accounts for these plans based on the provisions of ASC Topic 715, "Compensation-Retirement Benefits." Some of the key assumptions used to calculate the pension expense and projected benefit obligation include the discount rate, rate of forecasted salary increases, the expected long-term rate of return on plan assets and expected mortality. The obligation for these claims and the related periodic costs are measured using actuarial techniques and assumptions. Actuarial gains and losses are deferred and amortized over future periods.

Income Taxes

The Company records income taxes using the asset and liability method. Deferred income tax assets and liabilities are recognized for the future tax consequences attributable to differences between the financial statement carrying amounts of existing assets and liabilities and their respective income tax bases, and also for operating loss and tax credit carryforwards. On a quarterly basis, the Company evaluates both the positive and negative evidence that affects the realizability of net deferred tax assets and assesses the need for a valuation allowance. The future benefit to be derived from its deferred tax assets is dependent upon its ability to generate sufficient future taxable income in each jurisdiction of the right type to realize the assets. The Company records a valuation allowance to reduce its net deferred tax assets to the amount that is expected to be realized. To the extent the Company establishes a valuation allowance an expense will be recorded as a component of the provision for income taxes on the statement of operations.

Accounting for income taxes requires a two-step approach to recognize and measure uncertain tax positions. The first step is to evaluate the tax position for recognition by determining if, based on the technical merits, it is more likely than not that the position will be sustained upon audit, including resolutions of related appeals or litigation processes, if any. The second step is to measure the tax benefit as the largest amount that is more than 50% likely of being realized upon ultimate settlement. The Company re-evaluates these uncertain tax positions on a quarterly basis. This evaluation is based on factors including, but not limited to, changes in facts or circumstances, changes in tax law, effectively settled issues under audit and new audit activity. Any change in these factors could result in the recognition of a tax benefit or an additional charge to the tax provision.

Income tax effects resulting from changes in tax law are accounted for by the Company in the period in which the law is enacted and the effects are recorded as a component of provision for income taxes from continuing operations.

Derivatives

As a result of the Company's global operating activities and variable interest rate borrowings, the Company is exposed to market risks from changes in foreign currency exchange rates and interest rates, which may adversely affect its operating results and financial position. The Company enters into derivative instruments for risk management purposes only, including derivatives designated as hedging instruments and those utilized as economic hedges. The Company does not enter into derivative instruments for trading or speculative purposes.

The Company used derivative instruments, such as foreign exchange forward contracts and options, to manage certain foreign currency exposure, and interest rate swaps and interest rate caps to manage certain interest rate exposure. Changes in fair value of derivative instruments are recognized in the consolidated statement of operations or, if hedge accounting is applied, in OCI for the effective portion of the changes in fair value. The cash flows resulting from

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foreign exchange forward contracts are classified in the consolidated statements of cash flows as part of cash flows from operating activities. All derivatives are stated at fair value in the consolidated balance sheets.

Accounting principles for qualifying hedges require detailed documentation that describes the relationship between the hedging instrument and the hedged item, including, but not limited to, the risk management objectives and hedging strategy and the methods to assess the effectiveness of the hedging relationship. The Company assesses the hedging relationships, both at the inception of the hedge and on an ongoing basis, using either the critical terms matching approach or a regression analysis approach to determine whether the designated hedging instrument is highly effective in offsetting changes in the value of the hedged item.

By nature, all financial instruments involve market and credit risks. The Company enters into derivative instruments with major investment grade financial institutions, for which no collateral is required. The Company has policies to monitor the credit risk of these counterparties. While there can be no assurance, the Company does not anticipate any material non-performance by any of these counterparties.

(4) Recent Accounting Pronouncements

Segment Reporting (Topic 280): Improvements to Reportable Segment Disclosures

In November 2023, the Financial Accounting Standards Board (“FASB”) issued Accounting Standard Update (“ASU”) No. 2023-07, Segment Reporting (Topic 280): Improvements to Reportable Segment Disclosures, which requires a public entity to disclose significant segment expenses and other segment items on an annual and interim basis and provide in interim periods all disclosures about a reportable segment’s profit or loss and assets that are currently required annually. Additionally, it requires a public entity to disclose the title and position of the Chief Operating Decision Maker (“CODM”). The ASU does not change how a public entity identifies its operating segments, aggregates them, or applies the quantitative thresholds to determine its reportable segments. The new standard is effective for fiscal years beginning after December 15, 2023, and interim periods within fiscal years beginning after December 15, 2024, with early adoption permitted. A public entity should apply the amendments in this ASU retrospectively to all prior periods presented in the financial statements. The Company is currently evaluating the impact of this ASU on its disclosures within the consolidated financial statements.

Income Taxes (Topic 740): Improvements to Income Tax Disclosures

In December 2023, the FASB issued ASU No. 2023-09, Income Taxes (Topic 740): Improvements to Income Tax Disclosures, which focuses on the rate reconciliation and income taxes paid. ASU No. 2023-09 requires a public business entity (“PBE”) to disclose, on an annual basis, a tabular rate reconciliation using both percentages and currency amounts, broken out into specified categories with certain reconciling items further broken out by nature and jurisdiction to the extent those items exceed a specified threshold. In addition, all entities are required to disclose income taxes paid, net of refunds received disaggregated by federal, state/local, and foreign and by jurisdiction if the amount is at least 5% of total income tax payments, net of refunds received. For PBEs, the new standard is effective for annual periods beginning after December 15, 2024, with early adoption permitted. An entity may apply the amendments in this ASU prospectively by providing the revised disclosures for the period ending December 31, 2025 and continuing to provide the pre-ASU disclosures for the prior periods, or may apply the amendments retrospectively by providing the revised disclosures for all period presented. The Company is currently evaluating the impact of this ASU on its consolidated financial statements and related disclosures.

(5) Acquisitions

Atotech

On August 17, 2022 (the “Effective Date”), the Company completed the acquisition of Atotech Limited (“Atotech” and such transaction, the “Atotech Acquisition”), through the acquisition of the entire issued share capital of Atotech by Atotech Manufacturing, Inc. (“Bidco”), a Delaware corporation and indirect wholly owned subsidiary of the Company. The Atotech Acquisition was implemented by means of a scheme of arrangement under the laws of Jersey

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(the “Scheme”) pursuant to the definitive agreement entered into by the Company and Atotech on July 1, 2021 (as amended, the “Implementation Agreement”).

Atotech, which the Company operates as the Materials Solutions Division (“MSD”), develops leading process and manufacturing technologies for advanced surface modification, electroless and electrolytic plating, and surface finishing. Applying a comprehensive systems-and-solutions approach, Atotech's portfolio includes chemistry, equipment, software, and services for innovative and high-technology applications in a wide variety of end markets. Atotech further broadens the Company’s capabilities by bringing leadership in critical chemistry solutions for electronics and packaging and specialty industrial applications.

On the Effective Date, pursuant to the Scheme and in accordance with the terms and conditions of the Implementation Agreement, Bidco acquired each issued and outstanding ordinary share of Atotech in exchange for per share consideration of \$16.20 in cash and 0.0552 of a share of Company common stock. The Company funded the payment of the aggregate cash consideration with a combination of cash on hand and the proceeds from the Term Loan Facility, as defined in Note 15. As a result of the Atotech Acquisition, the Company issued an aggregate of 10.7 shares of Company common stock to the former Atotech shareholders.

The purchase price of Atotech consisted of the following:

Cash consideration to Atotech stockholders, net	\$	2,886
Value of MKS shares issued		1,186
Repayment of Atotech senior secured term loans		1,545
Settlement of accelerated Atotech share-based awards		47
Total purchase price, net of cash and cash equivalents acquired	<u>\$</u>	<u>5,664</u>

Under the acquisition method of accounting, the total purchase price was allocated to the acquired tangible and intangible assets and assumed liabilities of Atotech based on their fair values as of the Effective Date, except for contract assets and liabilities, which remain at book value in accordance with ASC Topic 606, Revenue from Contracts with Customers. Any excess of the acquisition consideration over the fair value of assets acquired and liabilities assumed was allocated to goodwill and none of this goodwill or intangible assets will be deductible for tax purposes. The Company believes the amount of goodwill relative to identifiable intangible assets relates to several factors, including (1) broadening its position in key electronics and industrial markets to offer complementary solutions, and (2) leveraging component and systems expertise to provide robust solutions to meet its customers’ evolving technology needs.

The following table summarizes the allocation of the purchase price to the fair values assigned to assets acquired and liabilities assumed at the Effective Date inclusive of immaterial measurement period adjustments:

Cash and cash equivalents	\$	238
Accounts receivable		283
Inventories		244
Other current assets		104
Property, plant and equipment		381
Intangible assets		2,726
Goodwill		3,054
Other assets		131
Total assets acquired		<u>7,161</u>
Accounts payable		194
Other current liabilities		166
Non-current deferred taxes		719
Non-current accrued compensation		99
Other non-current liabilities		81
Total liabilities assumed		<u>1,259</u>
Fair value of assets acquired and liabilities assumed		5,902
Less: Cash and cash equivalents acquired		(238)
Total purchase price, net of cash and cash equivalents acquired	<u>\$</u>	<u>5,664</u>

The fair value of the acquired intangible assets was determined using the income approach. In performing these valuations, the key underlying assumptions used included the appropriate discount rates as well as forecasted revenue

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growth rates, gross profit and operating expenses. Fair value estimates are based on a complex series of judgments about future events and uncertainties and rely heavily on estimates and assumptions. The judgments used to determine the estimated fair value assigned to each class of assets acquired and liabilities assumed, as well as asset lives, can materially impact the Company's results of operations.

The valuations were based on the information that was available during the one-year measurement period that existed as of the Effective Date and the expectations and assumptions that have been deemed reasonable by the Company's management. The size and breadth of the Atotech Acquisition necessitated the use of this measurement period to adequately analyze and assess a number of the factors used in establishing the fair value of certain tangible and intangible assets acquired and liabilities assumed as of the Effective Date and the related tax impacts of any changes made. The measurement period is now complete.

The following table reflects the allocation of the acquired intangible assets and related estimate of useful lives at the Effective Date:

Customer relationships	\$	1,756	11-14 years
Completed technology		595	8-9 years
Trade names		145	16 years
Backlog		40	1.5 years
In-process research and development		190	
	\$	<u>2,726</u>	

The acquired intangible assets are being amortized on a straight-line basis, which approximates the economic use of the assets over their estimated useful lives. Upon completion of the related projects, the Company expects the IPR&D intangible asset to be amortized over its estimated useful life of eight to nine years.

During the fourth quarter of 2022, the Company recorded adjustments to balances reported as of, and for the period ended, September 30, 2022, resulting from foreign currency translation of the preliminary allocation of intangible assets and goodwill from the Atotech Acquisition in August 2022 and the related effect on cumulative translation adjustment and deferred tax liabilities. The adjustments recorded were to correct an overstatement of goodwill of \$43, intangible assets, net of \$56, and non-current deferred tax liabilities of \$38, and an understatement of both accumulated OCI and OCI of \$61. These adjustments that the Company recorded did not affect net income, earnings per share or the consolidated statements of cash flows. The Company assessed these adjustments in accordance with SEC Staff Accounting Bulletin ("SAB") No. 99 and SAB No. 108 and determined they were not material to the interim financial statements taken as a whole.

Pro Forma Results

The following unaudited pro forma financial information presents the combined results of operations of the Company as if the Atotech Acquisition had occurred on January 1, 2021. The unaudited pro forma financial information is not necessarily indicative of what the Company's consolidated results of operations actually would have been had the acquisition occurred on the assumed date. In addition, the unaudited pro forma financial information does not attempt to project the future results of operations of the combined Company.

	Years Ended December 31,	
	2022	2021
Total net revenues	\$ 4,450	\$ 4,450
Net income	\$ 197	\$ 292

The unaudited pro forma information for the year ended December 31, 2022 and 2021 give effect primarily to the following:

- applying the Company's accounting policies;
- incremental interest expense related to the Term Loan Facility;
- incremental amortization of acquired intangible assets related to the estimated fair value from the purchase price allocation;
- the exclusion of inventory step-up amortization in 2022 and the addition of this amortization to 2021;

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- incremental depreciation of acquired property, plant and equipment related to the estimated fair value from the purchase price allocation;
- incremental compensation expense for share-based compensation arrangements; and
- the estimated tax impact of the above adjustments.

Photon Control

On July 15, 2021, the Company completed its acquisition of Photon Control Inc. (“Photon Control”), a Canadian corporation (the “Photon Control Acquisition”), pursuant to a definitive agreement (the “Arrangement Agreement”). Photon Control designs, manufactures and distributes a wide range of optical sensors and systems to measure temperature and position used in semiconductor wafer fabrication. At the effective time of the Photon Control Acquisition and pursuant to the terms and conditions of the Arrangement Agreement, each share of Photon Control’s common stock issued and outstanding as of immediately prior to the effective time of the Photon Control Acquisition, was converted into the right to receive CAD 3.60 per share in cash, without interest and subject to deduction for any required withholding tax. The Company funded the payment of the aggregate consideration with available cash on hand. Photon Control is included in the Company’s PSD segment.

The purchase price of Photon Control consisted of the following:

Cash paid for outstanding shares	\$	302
Less: Cash and cash equivalents acquired		(34)
Total purchase price, net of cash and cash equivalents acquired	\$	<u>268</u>

Under the acquisition method of accounting, the total estimated acquisition consideration is allocated to the acquired tangible and intangible assets and assumed liabilities of Photon Control based on their fair values as of the acquisition date. Any excess of the acquisition consideration over the fair value of assets acquired and liabilities assumed is allocated to goodwill. None of the goodwill or intangible assets will be deductible for tax purposes. The Company believes the amount of goodwill relative to identifiable intangible assets relates to enhancing the Company’s Surround the Wafer® offering by adding optical sensors for temperature control for critical etch and deposition applications in semiconductor wafer fabrication.

The following table summarizes the allocation of the purchase price to the fair values assigned to assets acquired and liabilities assumed at the date of the Photon Control Acquisition:

Current assets	\$	51
Intangible assets		121
Goodwill		168
Other non-current assets		9
Total assets acquired		<u>349</u>
Current liabilities		14
Non-current deferred taxes		32
Other long-term liabilities		1
Total liabilities assumed		<u>47</u>
Fair value of assets acquired and liabilities assumed		302
Less: Cash and cash equivalents acquired		(34)
Total purchase price, net of cash and cash equivalents acquired	\$	<u>268</u>

The acquired intangible assets are being amortized on a straight-line basis, which approximates the economic use of the assets over their estimated useful lives.

The following table reflects the allocation of the acquired intangible assets and related estimate of useful lives:

Completed technology	\$	110	9 years
Customer relationships		9	10 years
Backlog		2	1.5 years
	\$	<u>121</u>	

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The fair value of the acquired intangible assets was determined using the income approach. In performing these valuations, the key underlying assumptions used included the appropriate discount rates as well as forecasted revenue growth rates, gross profit and operating expenses. Fair value estimates are based on complex series of judgments about future events and uncertainties and rely heavily on estimates and assumptions. The valuations were based on the information that was available as of the acquisition date and the expectations and assumptions that have been deemed reasonable by the Company's management. There are inherent uncertainties and management judgment required in these determinations. This acquisition resulted in a purchase price that exceeded the estimated fair value of tangible and intangible assets, the excess amount of which was allocated to goodwill.

The results of operations of the Photon Control business from the Photon Control Acquisition closing date of July 15, 2021 through December 31, 2021, were not material to the Company's results of operations.

(6) Revenue from Contracts with Customers

Contract assets as of December 31, 2023 and 2022 were \$26 and \$46, respectively, and were included in other current assets.

A roll forward of the Company's deferred revenue and customer advances is as follows:

	2023	2022
Beginning balance, January 1 ⁽¹⁾	\$ 96	\$ 40
Assumed deferred revenue and customer advances from Atotech Acquisition	—	36
Additions to deferred revenue and customer advances	167	180
Amount of deferred revenue and customer advances recognized in income	(184)	(160)
Ending balance, December 31 ⁽²⁾	<u>\$ 79</u>	<u>\$ 96</u>

⁽¹⁾ Beginning deferred revenue and customer advances as of January 1, 2023 included \$94 of current deferred revenue and customer advances, and \$2 of long-term deferred revenue. Beginning deferred revenue and customer advances as of January 1, 2022 included \$37 of current deferred revenue and customer advances, and \$3 of long-term deferred revenue. The majority of the beginning balance in 2023 and 2022 was recognized in each year.

⁽²⁾ Ending deferred revenue and customer advances as of December 31, 2023 included \$77 of current deferred revenue and customer advances, and \$2 of long-term deferred revenue. Ending deferred revenue and customer advances as of December 31, 2022 included \$94 of current deferred revenue and customer advances, and \$2 of long-term deferred revenue.

Revenue from certain custom products, including MSD plating equipment, and revenue from certain service contracts are recorded over time. Remaining product and services revenues are recorded at a point in time.

Disaggregation of Revenue

The following table summarizes revenue from contracts with customers:

	Year Ended December 31, 2023			
	VSD	PSD	MSD	Total
Net revenues:				
Products	\$ 1,186	\$ 860	\$ 1,154	\$ 3,200
Services	218	152	52	422
Total net revenues	<u>\$ 1,404</u>	<u>\$ 1,012</u>	<u>\$ 1,206</u>	<u>\$ 3,622</u>
	Year ended December 31, 2022			
	VSD	PSD	MSD	Total
Net revenues:				
Products	\$ 1,720	\$ 913	\$ 486	\$ 3,119
Services	246	151	31	428
Total net revenues	<u>\$ 1,966</u>	<u>\$ 1,064</u>	<u>\$ 517</u>	<u>\$ 3,547</u>

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	Year Ended December 31, 2021			
	VSD	PSD	MSD	Total
Net revenues:				
Products	\$ 1,629	\$ 950	\$ —	\$ 2,579
Services	233	138	—	371
Total net revenues	<u>\$ 1,862</u>	<u>\$ 1,088</u>	<u>\$ —</u>	<u>\$ 2,950</u>

Refer to Note 22 for revenue by reportable segment, geography and groupings of similar products.

(7) Investments

For both short-term and long-term investments, the cost approximates the fair value. For the years ended December 31, 2023 and 2022, the gross unrealized gains and losses were immaterial. Management has the ability, if necessary, to liquidate any of its investments in order to meet the Company's liquidity needs in the next 12 months. Accordingly, those investments with contractual maturities greater than one year from the date of purchase are classified as short-term on the accompanying consolidated balance sheets.

Interest income is accrued as earned. Dividend income is recognized as income on the date the security trades "ex-dividend." Realized gains or losses are reflected in income and were not material in 2023, 2022 and 2021.

(8) Fair Value Measurements

In accordance with the provisions of fair value accounting, a fair value measurement assumes that the transaction to sell an asset or transfer a liability occurs in the principal market for the asset or liability or, in the absence of a principal market, the most advantageous market for the asset or liability and defines fair value based upon an exit price model.

The fair value measurement guidance establishes a fair value hierarchy, which requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. The guidance describes three levels of inputs that may be used to measure fair value:

- Level 1 Quoted prices in active markets for identical assets or liabilities as of the reporting date. Active markets are those in which transactions for the asset or liability occur in sufficient frequency and volume to provide pricing information on an ongoing basis.
- Level 2 Observable inputs other than Level 1 prices, such as quoted prices for similar assets or liabilities; quoted prices in markets that are not active; or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities. Level 2 assets and liabilities include debt securities with quoted prices that are traded less frequently than exchange-traded instruments or securities or derivative contracts that are valued using a pricing model with inputs that are observable in the market or can be derived principally from or corroborated by observable market data.
- Level 3 Unobservable inputs that are supported by little or no market activity and that are significant to the fair value of the assets or liabilities. Level 3 assets and liabilities include financial instruments whose value is determined using pricing models, discounted cash flow methodologies, or similar techniques, as well as instruments for which the determination of fair value requires significant management judgment or estimation.

In certain cases, the inputs used to measure fair value may fall into different levels of the fair value hierarchy. In such cases, the Company categorizes such assets and liabilities based on the lowest level input that is significant to the fair value measurement in its entirety. The Company's assessment of the significance of a particular input to the fair value measurement in its entirety requires judgment and considers factors specific to the asset.

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Assets and liabilities of the Company measured at fair value on a recurring basis as of December 31, 2023, are summarized as follows:

Description	December 31, 2023	Fair Value Measurements at Reporting Date Using		
		Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets:				
Cash equivalents:				
Money market funds	\$ 356	\$ 356	\$ —	\$ —
Time deposits	12	—	12	—
Available-for-sale securities:				
Group insurance contracts	6	—	6	—
Derivatives				
Foreign exchange forward contracts	2	—	2	—
Interest rate hedge - current	3	—	3	—
Interest rate hedge - non-current	41	—	41	—
Pension and deferred compensation plan assets	19	—	19	—
Total assets	<u>\$ 439</u>	<u>\$ 356</u>	<u>\$ 83</u>	<u>\$ —</u>
Liabilities:				
Derivatives				
Foreign exchange forward contracts	\$ 5	\$ —	\$ 5	\$ —
Total liabilities	<u>\$ 5</u>	<u>\$ —</u>	<u>\$ 5</u>	<u>\$ —</u>
Reported as follows:				
Assets:				
Cash and cash equivalents ⁽¹⁾	\$ 368	\$ 356	\$ 12	\$ —
Other current assets	5	—	5	—
Total current assets	<u>\$ 373</u>	<u>\$ 356</u>	<u>\$ 17</u>	<u>\$ —</u>
Other assets	<u>\$ 66</u>	<u>\$ —</u>	<u>\$ 66</u>	<u>\$ —</u>
Liabilities:				
Other current liabilities	<u>\$ 5</u>	<u>\$ —</u>	<u>\$ 5</u>	<u>\$ —</u>

⁽¹⁾ The cash and cash equivalents amount presented in the table above does not include cash of \$507 as of December 31, 2023.

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Assets and liabilities of the Company measured at fair value on a recurring basis as of December 31, 2022, are summarized as follows:

Description	December 31, 2022	Fair Value Measurements at Reporting Date Using		
		Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets:				
Cash equivalents:				
Money market funds	\$ 60	\$ 60	\$ —	\$ —
Available-for-sale securities:				
Time deposits and certificates of deposit	1	—	1	—
Group insurance contracts	6	—	6	—
Derivatives				
Foreign exchange forward contracts	7	—	7	—
Interest rate hedge-non-current	104	—	104	—
Pension and deferred compensation plan assets	17	—	17	—
Total assets	<u>\$ 195</u>	<u>\$ 60</u>	<u>\$ 135</u>	<u>\$ —</u>
Liabilities:				
Derivatives				
Foreign exchange forward contracts	\$ 8	\$ —	\$ 8	\$ —
Total liabilities	<u>\$ 8</u>	<u>\$ —</u>	<u>\$ 8</u>	<u>\$ —</u>
Reported as follows:				
Assets:				
Cash and cash equivalents ⁽¹⁾	\$ 60	\$ 60	\$ —	\$ —
Short-term investments	1	—	1	—
Other current assets	8	—	8	—
Total current assets	<u>\$ 69</u>	<u>\$ 60</u>	<u>\$ 9</u>	<u>\$ —</u>
Other assets	<u>\$ 126</u>	<u>\$ —</u>	<u>\$ 126</u>	<u>\$ —</u>
Liabilities:				
Other current liabilities	<u>\$ 8</u>	<u>\$ —</u>	<u>\$ 8</u>	<u>\$ —</u>

⁽¹⁾ The cash and cash equivalents amount presented in the table above does not include cash of \$849 as of December 31, 2022.

Other Fair Value Disclosures

The estimated fair value and carrying value of the Company's debt as of December 31, 2023 and 2022 is as follows:

	2023		2022	
	Carrying Value	Fair Value	Carrying Value	Fair Value
Total debt, excluding deferred financing costs	<u>\$ 4,953</u>	<u>\$ 4,965</u>	<u>\$ 5,122</u>	<u>\$ 5,071</u>

The estimated fair value of the Company's debt was determined using available market information based on recent trades or activity of debt instruments with substantially similar risks, terms and maturities, which fall within Level 2 under the fair value hierarchy.

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Money Market Funds

Money market funds are cash and cash equivalents and are classified within Level 1 of the fair value hierarchy.

Pension and Deferred Compensation Plan Assets

The pension and deferred compensation plan assets represent investments in mutual funds, exchange traded funds, government securities and other time deposits. These investments are set aside for retirement benefits of certain of the Company's subsidiaries.

Derivatives

As a result of the Company's global operating activities, the Company is exposed to market risks from changes in foreign currency exchange rates and variable interest rates, which may adversely affect its operating results and financial position. When deemed appropriate, the Company minimizes its risks from foreign currency exchange rate and interest rate fluctuations through the use of derivative financial instruments. The principal market in which the Company executes its foreign exchange forward contracts, options and interest rate swaps is the institutional market in an over-the-counter environment with a relatively high level of price transparency. The market participants usually are large commercial banks. The foreign exchange forward contracts, options and interest rate hedge are valued using broker quotations, or market transactions and are classified within Level 2 of the fair value hierarchy.

(9) Derivatives and Net Investment Hedge

Foreign Exchange Forward Contracts

The Company hedges a portion of its forecasted foreign currency-denominated intercompany sales of inventory, over a maximum period of eighteen months, using foreign exchange forward contracts accounted for as cash-flow hedges. To the extent these derivatives are effective in offsetting the variability of the hedged cash flows, and otherwise meet the hedge accounting criteria, changes in the derivatives' fair value are not included in current earnings but are included in OCI in stockholders' equity. These changes in fair value will subsequently be reclassified into earnings, as applicable, when the forecasted transaction occurs. To the extent that a previously designated hedging transaction is no longer an effective hedge, any ineffectiveness measured in the hedging relationship is recorded in earnings in the period it occurs. The cash flows resulting from foreign exchange forward contracts are classified in the consolidated statements of cash flows as part of cash flows from operating activities. The Company does not enter into derivative instruments for trading or speculative purposes.

The Company also enters into foreign exchange forward contracts to hedge against changes in the consolidated balance sheets for certain subsidiaries to mitigate the risk associated with certain foreign currency transactions in the ordinary course of business. These derivatives are not designated as cash flow hedging instruments and gains or losses from these derivatives are recorded immediately in other expense, net.

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The following tables provide a summary of the primary net hedging positions and fair values of foreign exchange forward contracts outstanding as of December 31, 2023 and 2022:

Currency Hedged (Buy/Sell)	December 31, 2023	
	Net Notional Value	Fair Value Liability
U.S. dollar/Japanese yen	\$ 65	\$ —
U.S. dollar/South Korean won	70	(3)
U.S. dollar/Taiwan dollar	22	—
U.S. dollar/Singapore dollar	1	—
U.S. dollar/Chinese renminbi	8	—
Euro/U.S. dollar	71	—
Euro/Chinese renminbi	4	—
Euro/Canadian dollar	1	—
U.S. dollar/Mexican peso	5	—
U.K. pound sterling/U.S. dollar	19	—
Total	<u>\$ 266</u>	<u>\$ (3)</u>

Currency Hedged (Buy/Sell)	December 31, 2022	
	Net Notional Value	Fair Value (Liability) Asset
U.S. dollar/Japanese yen	\$ 57	\$ —
U.S. dollar/South Korean won	75	(4)
U.S. dollar/Taiwan dollar	33	1
U.S. dollar/U.K. pound sterling	7	—
U.S. dollar/Singapore dollar	1	—
U.S. dollar/Chinese renminbi	9	—
Euro/U.S. dollar	485	1
Euro/Chinese renminbi	31	1
U.K. pound sterling/Euro	4	—
Total	<u>\$ 702</u>	<u>\$ (1)</u>

The following table provides a summary of the net (losses) gains on derivatives designated as cash flow hedging instruments:

Forward exchange contracts:	Years Ended December 31,		
	2023	2022	2021
Net (losses) gains recognized in OCI, net of tax	\$ (24)	\$ 50	\$ 20
Net gains (losses) reclassified from accumulated OCI into income	\$ 7	\$ 18	\$ (2)

The net amount of existing (losses) gains as of December 31, 2023 expected to be reclassified from OCI into earnings within the next 12 months is immaterial.

Net Investment Hedge

On January 1, 2023, the Company designated certain Euro-denominated debt as a net investment hedge to hedge a portion of its net investments in certain of its entities with functional currencies denominated in the Euro. As of December 31, 2023, the Company designated as a net investment hedge €93 million in aggregate principal amount of its Euro Tranche B issued in August 2022. For these net investment hedges, the Company defers recognition of the foreign currency remeasurement gains and losses within the foreign currency translation adjustment component of OCI. There was no net investment hedge designated in 2022 and all remeasurement gains and losses were recorded to the consolidated statements of operations and comprehensive (loss) income.

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Interest Rate Agreements

The Company has various interest rate swap agreements that exchange a forward-looking term rate based on the variable secured overnight financing rate (“Term SOFR”) paid on the outstanding balance of its Term Loan Facility, as defined and further described in Note 15, to a fixed rate. The Company acquired USD London Interbank Offered Rate (“USD LIBOR”) interest rate cap agreements as a result of the Atotech Acquisition and had utilized these agreements to offset the variable Term SOFR on its Term Loan Facility. Effective June 30, 2023, the Company’s USD LIBOR based interest rate caps were converted to Term SOFR. The Company also had two USD LIBOR based swaps that were converted to Term SOFR, effective June 30, 2023. The conversions from USD LIBOR to Term SOFR did not have a material impact on the Company’s results of operations.

The table below summarizes interest rate swaps and interest rate caps outstanding at December 31, 2023 and December 31, 2022:

Effective Date	Maturity	Fixed Rate	Notional Amount at Effective Date	Notional Amount at December 31, 2023	Years Ended December 31,	
					2023	2022
					Fair Value Asset (Liability)	Fair Value Asset
<i>Interest Rate Swaps</i>						
April 5, 2019	March 31, 2023	2.309%	\$ 300	\$ —	\$ —	\$ 1
June 30, 2023	February 28, 2025	0.391%	200	200	9	16
June 30, 2023	February 28, 2025	0.543%	300	300	14	22
September 30, 2022	September 30, 2026	3.156%	350	350	5	8
January 2, 2024	January 31, 2028	2.841%	250	—	7	5
September 30, 2022	September 30, 2027	3.198%	350	350	5	8
January 2, 2024	January 31, 2029	2.986%	250	—	6	4
September 30, 2022	September 30, 2026	3.358%	600	600	5	10
December 28, 2023	December 31, 2027	4.550%	500	500	(10)	—
			3,100	2,300	41	74
<i>Interest Rate Caps</i>						
June 30, 2023	January 31, 2024	0.805%	350	350	1	15
June 30, 2023	January 31, 2024	0.805%	350	350	2	15
			700	700	3	30
			\$ 3,800	\$ 3,000	\$ 44	\$ 104

The interest rate swaps are recorded at fair value on the consolidated balance sheets and changes in the fair value are recognized in OCI. To the extent these arrangements are no longer effective hedges, the hedging relationship will be discontinued and changes in the fair value of the hedging instruments from the last assessment period that were effective up to the current period will be recorded immediately in earnings. Amounts previously recorded in OCI will remain in OCI and will be reclassified to earnings when the interest payments impact consolidated earnings. If the Company determines that the interest payments are unlikely to occur, amounts previously recorded in OCI will be reclassified to earnings immediately. Changes in the fair value of interest rate caps are recorded immediately in earnings, as the Company has not designated these instruments as hedges and therefore these instruments do not qualify for hedge accounting.

The following table provides a summary of (losses) gains on derivatives not designated as cash flow hedging instruments:

	Years Ended December 31,		
	2023	2022	2021
Net (losses) gains recognized in income	\$ (32)	\$ (8)	\$ 5

Currency Option Agreements

In connection with financing the Atotech Acquisition, the Company issued Euro denominated term loan debt. In anticipation of entering into these Euro denominated loans, the Company purchased foreign currency option contracts

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in 2021 to fix the conversion of €300 into U.S. dollars. The options settled on January 31, 2022 and the Company recorded a gain of \$5, net of premiums, which is included in other expense, net.

In conjunction with the Photon Control Acquisition, which closed in July 2021, the Company entered into a foreign currency contract to hedge the Canadian dollar purchase price. In 2021, the Company recorded a fair value realized loss of \$10, which is included in other expense, net.

(10) Inventories

Inventories consist of the following:

	Years Ended December 31,	
	2023	2022
Raw material	\$ 740	\$ 689
Work-in-process	94	115
Finished goods	157	173
Total	<u>\$ 991</u>	<u>\$ 977</u>

Inventory-related excess and obsolete charges of \$64, \$21 and \$16 were recorded in cost of products and services in the years ended December 31, 2023, 2022 and 2021, respectively.

(11) Property, Plant and Equipment

Property, plant and equipment consist of the following:

	Years Ended December 31,	
	2023	2022
Land	\$ 76	\$ 75
Buildings and building improvements	335	330
Machinery and equipment	670	611
Furniture and fixtures, office equipment and software	207	214
Leasehold improvements	174	157
Construction in progress	60	75
	<u>1,522</u>	<u>1,462</u>
Less: accumulated depreciation	738	662
Total	<u>\$ 784</u>	<u>\$ 800</u>

Depreciation of property, plant and equipment totaled \$102, \$70 and \$49 for the years ended 2023, 2022 and 2021, respectively.

(12) Leases

The Company has various operating leases for real estate and non-real estate items. The non-real estate leases are mainly comprised of automobiles but also include office equipment and other lower-valued items.

The elements of lease expense were as follows:

	Years Ended December 31,	
	2023	2022
Operating lease ⁽¹⁾	\$ 31	\$ 27
Finance lease costs	9	3
Short-term lease	12	10
Total lease cost	<u>\$ 52</u>	<u>\$ 40</u>

⁽¹⁾ Operating lease expense includes an immaterial amount of variable expenses, offset by certain sublease rental income.

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Supplemental cash flow information related to leases was as follows:

	Years Ended December 31,	
	2023	2022
Cash paid for amounts included in measurement of liabilities:		
Operating cash flows used for operating leases ⁽¹⁾	\$ 34	\$ 28
Operating cash flows used for finance leases	1	—
Financing cash flows used for finance leases	4	2
ROU assets obtained in exchange for new lease liabilities		
Operating leases	25	7
Finance leases	1	3

⁽¹⁾ Operating cash flows used for operating leases for the year ended December 31, 2023 and 2022 include an immaterial amount of tenant improvement allowance receipts.

The weighted average remaining terms for all leases were as follows:

	Years Ended December 31,	
	2023	2022
Weighted-average remaining lease term—operating leases	\$ 12.3	\$ 13.4
Weighted-average remaining lease term—finance leases	11.3	11.3
Weighted-average discount rate—operating leases	3.3%	3.0%
Weighted-average discount rate—finance leases	5.2%	3.9%

Future lease payments under non-cancelable leases as of December 31, 2023 are detailed as follows:

Year Ending December 31,	Operating Leases	Finance Leases
2024	\$ 32	\$ 6
2025	25	6
2026	21	6
2027	18	3
2028	14	3
Thereafter	135	21
Total lease payments	245	45
Less: imputed interest	44	11
Total lease liabilities	<u>\$ 201</u>	<u>\$ 34</u>

Amounts presented above do not include payments relating to immaterial leases excluded from the consolidated balance sheets as well as leases with terms of less than twelve months.

(13) Goodwill and Intangible Assets

Goodwill

The Company's methodology for allocating the purchase price of an acquisition is determined through established and generally accepted valuation techniques. Goodwill is measured as the excess of the cost of the acquisition over the sum of the amounts assigned to tangible and identifiable intangible assets acquired less liabilities assumed. The Company assigns assets acquired (including goodwill) and liabilities assumed to one or more reporting units as of the date of acquisition. If the products obtained in an acquisition are assigned to multiple reporting units, the goodwill is distributed to the respective reporting units as part of the purchase price allocation process.

Goodwill and intangible assets with indefinite useful lives are not amortized but are reviewed for impairment annually during the fourth quarter of each fiscal year or whenever events or changes in circumstances indicate that the carrying value of an asset may not be recoverable. To measure impairment, the Company compares the fair value of the reporting unit to its carrying amount, which includes goodwill. If the fair value of the reporting unit exceeds the carrying value of the reporting unit, no impairment exists. If the fair value of the reporting unit is less than the carrying value of the reporting unit, a goodwill impairment is recorded.

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Amortizable intangible assets and other long-lived assets are also subject to an impairment test if there is an indicator of impairment. When the Company determines that the carrying value of intangible assets or other long-lived assets may not be recoverable based upon the existence of one or more indicators of impairment, the Company uses the projected undiscounted cash flow method to determine whether an impairment exists, and then measures the impairment using discounted cash flows.

The process of evaluating the potential impairment of goodwill, intangible assets and other long-lived assets requires significant judgment. The Company regularly monitors current business conditions and other factors, including, but not limited to, adverse industry or economic trends, restructuring actions and lower projections of profitability that may impact future operating results. The Company's stock price and any estimated control premium are factors affecting the assessment of the fair value of the Company's underlying reporting units for purposes of performing any goodwill impairment assessment.

During the quarter ended June 30, 2023, the Company identified softer industry demand, particularly in the personal computer and smartphone markets, and concluded there was a triggering event at each of its electronics ("EL") and general metal finishing reporting ("GMF") units, which together constitute MSD, and the equipment solutions business ("ESB") reporting unit of PSD. For MSD, the Company concluded information on the softening of industry demand as of the filing date of the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2023 did not exist as of the Effective Date.

For each of the three reporting units, the Company performed a quantitative assessment of goodwill using a weighting of an income approach and market approach. The income approach was based upon projected future cash flows that were discounted to present value and an assumed terminal growth rate. The key underlying assumptions included forecasted revenues, which incorporated external market data, terminal growth rate, gross profit and operating expenses, as well as an applicable discount rate for each reporting unit. The market approach for each of the three reporting units incorporated observed multiples of guideline public companies. The market approach for the EL and GMF reporting units also incorporated multiples from guideline transactions.

Fair value estimates are based on complex series of judgments about future events and uncertainties and rely heavily on estimates and assumptions that have been deemed reasonable by the Company's management. There are inherent uncertainties and management judgment required in these determinations.

This quantitative assessment during the quarter ended June 30, 2023 resulted in the following:

Reporting Unit	Goodwill Impairment	Remaining Goodwill
Electronics	\$ 826	\$ 1,420
General Metal Finishing	428	307
Equipment Solutions Business	372	100

In addition, the Company used an income approach to determine the fair value of the long-lived and indefinite-lived intangible assets within these reporting units (Level 3 within the fair value hierarchy). These valuations resulted in a \$20 fair value and \$152 impairment of completed technology within the ESB reporting unit and a \$72 fair value and \$49 impairment of IPR&D within the EL reporting unit. After evaluating forecast updates and carrying values, the Company did not identify impairments at any other of its reporting units.

For the completed technology valuation within the ESB reporting unit, the forecasted future undiscounted cash flows were consistent with the Company's goodwill analysis, using an approximate 7 year useful life, an 8% weighted-average forecasted revenue growth rate, and a discount rate of 13.5%. For the IPR&D intangible asset within the EL reporting unit, the forecasted undiscounted future cash flows utilized were consistent with the Company's goodwill analysis, with estimated time to complete in-process projects of up to 2 years, and a discount rate of 12.5%.

During the quarter ended September 30, 2023, the Company identified a further decrease in demand and an increase in the discount rate at the ESB reporting unit. The Company performed a quantitative assessment of goodwill using an income approach that was based upon projected future cash flows that were discounted to present value and an assumed terminal growth rate. The key underlying assumptions included forecasted revenues, which incorporated external market data, terminal growth rate, gross profit and operating expenses, as well as the discount rate. The Company concluded that there was no goodwill or intangible asset impairment at the ESB reporting unit in the third quarter. The Company also considered other quantitative and qualitative considerations, including the decline in public market capitalization since June 30, 2023, and determined there were no triggering events for its other reporting units or asset groups in the third quarter.

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As of October 31, 2023, the Company performed its annual goodwill and intangible asset impairment assessment by bypassing the qualitative assessment and using a quantitative assessment for all its reporting units. For the EL, GMF and ESB reporting units, the Company performed a quantitative assessment of goodwill using an equal weighting of an income approach and market approach and for the VSD and remaining PSD reporting units used an income approach. The income approach was based upon projected future cash flows that were discounted to present value and an assumed terminal growth rate. The key underlying assumptions included forecasted revenues, which incorporated external market data, terminal growth rate, gross profit and operating expenses, as well as an applicable discount rate for each reporting unit. The market approach incorporated observed multiples of guideline public companies. The market approach for the EL and GMF reporting units also incorporated multiples from guideline transactions.

Fair value estimates are based on complex series of judgments about future events and uncertainties and rely heavily on estimates and assumptions that have been deemed reasonable by the Company's management. There are inherent uncertainties and management judgment required in these determinations.

This quantitative assessment during the quarter ended December 31, 2023 resulted in the following:

Reporting Unit	Goodwill Impairment	Remaining Goodwill
Electronics	\$ 48	\$ 1,401
General Metal Finishing	—	318
Equipment Solutions Business	13	87

There was no goodwill impairment at any of the Company's other reporting units. The Company will continue to monitor for future triggering events which could result in an impairment charge. The Company's stock price and any estimated control premium are factors affecting the assessment of the fair value of the Company's underlying reporting units for purposes of performing any goodwill impairment assessment.

In addition, the Company used an income approach to determine the fair value of the long-lived and indefinite-lived intangible assets within these reporting units (Level 3 within the fair value hierarchy). These valuations resulted in a \$14 impairment of IPR&D within the EL reporting unit as it was determined that there was no remaining fair value in its remaining projects. After evaluating forecast updates and carrying values, the Company did not identify impairments at any other of its reporting units.

The changes in the carrying amount of goodwill and accumulated impairment losses were as follows:

	2023			2022		
	Gross Carrying Amount	Accumulated Impairment Loss	Net	Gross Carrying Amount	Accumulated Impairment Loss	Net
Beginning balance at January 1	\$ 4,454	\$ (146)	\$ 4,308	\$ 1,374	\$ (146)	\$ 1,228
Impairment of goodwill	—	(1,687)	(1,687)	—	—	—
Acquired goodwill	—	—	—	3,064	—	3,064
Foreign currency translation and measurement period adjustments	(67)	—	(67)	16	—	16
Ending balance at December 31	\$ 4,387	\$ (1,833)	\$ 2,554	\$ 4,454	\$ (146)	\$ 4,308

During the twelve months ended December 31, 2022, the Company recorded goodwill related to the Atotech Acquisition. See Note 5.

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Intangible Assets

The Company's intangible assets are comprised of the following:

As of December 31, 2023	Gross	Accumulated Impairment Charges	Accumulated Amortization	Foreign Currency Translation and Measurement Period Adjustments	Net
Completed technology	\$ 1,268	\$ (152)	\$ (405)	\$ (4)	\$ 707
Customer relationships	2,072	(1)	(335)	(17)	1,719
Patents, trademarks, trade names and other	381	(63)	(118)	(7)	193
	<u>\$ 3,721</u>	<u>\$ (216)</u>	<u>\$ (858)</u>	<u>\$ (28)</u>	<u>\$ 2,619</u>

During the twelve months ended December 31, 2023, \$117 of IPR&D included with patents, trademarks, trade names and other was reclassified into completed technology.

As of December 31, 2022	Gross	Accumulated Impairment Charges	Accumulated Amortization	Foreign Currency Translation	Net
Completed technology	\$ 1,151	\$ —	\$ (303)	\$ 4	\$ 852
Customer relationships	2,072	(1)	(190)	11	1,892
Patents, trademarks, trade names and other	498	—	(71)	2	429
	<u>\$ 3,721</u>	<u>\$ (1)</u>	<u>\$ (564)</u>	<u>\$ 17</u>	<u>\$ 3,173</u>

Aggregate amortization expense related to acquired intangible assets for 2023, 2022 and 2021 was \$295, \$146 and \$55, respectively. Aggregate net amortization expense related to acquired intangible assets for future years is:

<u>Year</u>	<u>Amount</u>
2024	\$ 251
2025	250
2026	246
2027	245
2028	245
Thereafter	1,326

The Company excluded from the above table intangible assets of \$56 of indefinite-lived trademarks and trade names, which were not subject to amortization.

(14) Product Warranties

The Company provides for the estimated costs to fulfill customer warranty obligations upon the recognition of the related revenue. The Company's warranty obligations are affected by shipment volume, product failure rates, utilization levels, material usage and supplier warranties on parts delivered to the Company. Should actual product failure rates, utilization levels, material usage, or supplier warranties on parts differ from the Company's estimates, revisions to the estimated warranty liability would be required. The Company engages in extensive product quality programs and processes, including actively monitoring and evaluating the quality of its component suppliers.

Product warranty activities were as follows:

	<u>Years Ended December 31,</u>	
	<u>2023</u>	<u>2022</u>
Beginning balance	\$ 27	\$ 21
Provision for product warranties	11	31
Assumed product warranty liability from Atotech Acquisition	—	5
Direct and other charges to warranty liability	(16)	(30)
Ending balance	<u>\$ 22</u>	<u>\$ 27</u>

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Short-term product warranties of \$15 and long-term product warranties of \$7, each as of December 31, 2023, are included within other current liabilities and other non-current liabilities, respectively, within the accompanying consolidated balance sheets. Short-term product warranties of \$19 and long-term product warranties of \$8, each as of December 31, 2022, are included within other current liabilities and other non-current liabilities, respectively, within the accompanying consolidated balance sheets.

(15) Debt

The Company's outstanding debt is as follows:

	December 31, 2023	December 31, 2022
Short-term debt:		
Term Loan Facility	\$ 93	\$ 93
Long-term debt:		
Term Loan Facility, net	\$ 4,696	\$ 4,834

Long-term debt is net of remaining deferred financing fees, original issuance discount and repricing fees in the aggregate of \$164 and \$195 as of December 31, 2023 and 2022, respectively.

Credit Facilities

In connection with the completion of the Atotech Acquisition, the Company entered into a credit agreement with JPMorgan Chase Bank, N.A., as administrative agent and collateral agent, Barclays Bank PLC, and the lenders from time to time party thereto (the "Credit Agreement"). The Credit Agreement provides for (i) a senior secured term loan facility comprised of three tranches: a \$1,000 loan (the "USD Tranche A"), a \$3,600 loan (the "2022 USD Tranche B" and together with the 2023 USD Tranche B (as defined below), as the context may require, the "USD Tranche B") and a €600 loan (the "Euro Tranche B" and together with the USD Tranche A and the USD Tranche B, the "Term Loan Facility"), each of which were borrowed in full on the Effective Date, and (ii) a senior secured revolving credit facility of \$500 (the "Revolving Facility" and, together with the Term Loan Facility, the "Credit Facilities"), with the commitments under each of the foregoing facilities subject to increase from time to time subject to certain conditions. The USD Tranche A and the Revolving Facility have a maturity date in August 2027 while the USD Tranche B and Euro Tranche B have a maturity date in August 2029.

Borrowings under the Credit Facilities bear interest at a rate per annum equal to, at the Company's option, any of the following, plus, in each case, an applicable margin: (a) with respect to the USD Tranche A, the Revolving Facility and, prior to the effectiveness of the First Amendment (as defined below), the USD Tranche B, (x) a base rate determined by reference to the highest of (1) the federal funds effective rate plus 0.50%, (2) the prime rate quoted in *The Wall Street Journal*, or (3) a forward-looking term rate based on Term SOFR (plus an applicable credit spread adjustment) for an interest period of one month, plus 1.00%; and (y) a Term SOFR rate (plus an applicable credit spread adjustment) for the interest period relevant to such borrowing, subject to a rate floor of (I) with respect to the USD Tranche B, 0.50% and (II) with respect to the USD Tranche A and the Revolving Facility, 0.0%; and (b) with respect to the Euro Tranche B, a Euro Interbank Offered Rate ("EURIBOR") rate determined by reference to the costs of funds for Euro deposits for the interest period relevant to such borrowing adjusted for certain additional costs, subject to a EURIBOR rate floor of 0.0%. The USD Tranche A was issued with original issue discount of 0.25% of the principal amount thereof. The 2022 USD Tranche B and the Euro Tranche B were issued with original issue discount of 2.00% of the principal amount thereof. The applicable margin for borrowings under the USD Tranche A is 1.50% with respect to base rate borrowings and 2.50% with respect to Term SOFR borrowings. Prior to the effectiveness of the First Amendment, the applicable margin for borrowings under the USD Tranche B was 1.75% with respect to base rate borrowings and 2.75% with respect to Term SOFR borrowings. The applicable margin for borrowings under the Euro Tranche B is 3.00%. The applicable margin for borrowings under the Revolving Facility is 1.50% with respect to base rate borrowings and 2.50% with respect to Term SOFR borrowings.

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In addition to paying interest on outstanding principal under the Credit Facilities, the Company is required to pay a commitment fee in respect of the unutilized commitments under the Revolving Facility. The initial commitment fee is 0.375% per annum. Commencing with the delivery of financial statements with respect to the first quarter ending after the closing of the Credit Agreement, the commitment fee is subject to downward adjustment based on the Company's first lien net leverage ratio as of the end of the preceding quarter. The Company must also pay customary letter of credit fees and agency fees.

On October 3, 2023 (the "First Amendment Effective Date"), the Company entered into the First Amendment to Credit Agreement (the "First Amendment"), which refinanced all of the \$3,564 outstanding 2022 USD Tranche B (such refinanced loans, the "2023 USD Tranche B") to (i) decrease the applicable margin for the USD Tranche B from 1.75% to 1.50% with respect to base rate borrowings and from 2.75% to 2.50% with respect to Term SOFR borrowings and (ii) remove the credit spread adjustments applicable to borrowings of the USD Tranche B based on Term SOFR. The 2023 USD Tranche B were issued with original issue discount of 0.25% of the principal amount thereof.

On October 31, 2023, the Company made a voluntary prepayment of \$100 aggregate principal on the USD Tranche A. On December 12, 2022, the Company made a voluntary prepayment of \$100 aggregate principal on the USD Tranche A.

The Company incurred \$242 of deferred financing fees and original issue discount related to the term loans under the Term Loan Facility funded on the Effective Date, which are included in long-term debt, net in the accompanying consolidated balance sheets and are being amortized to interest expense over the estimated life of the term loans using the effective interest method. A portion of the deferred financing fees and original issue discount was accelerated in connection with the extinguishment of the Company's previously existing term loan facility concurrently with the Company's entry into the Term Loan Facility.

The Company incurred \$11 of deferred financing fees and original issue discount related to the term loans under the 2023 USD Tranche B funded on the First Amendment Effective Date, of which \$9 is included in long-term debt, net in the accompanying consolidated balance sheets and is being amortized to interest expense over the estimated life of the term loans using the effective interest method. The Company recorded an \$8 loss on extinguishment of debt in connection with the First Amendment of the 2022 USD Tranche B.

In connection with the various voluntary prepayments in 2022 and 2023, the Company wrote off a portion of the deferred financing costs related to the prepayments.

Under the Credit Agreement, the Company is required to prepay outstanding term loans, subject to certain exceptions, with portions of its annual excess cash flow as well as with the net cash proceeds of certain of its asset sales, certain casualty and condemnation events and the incurrence or issuances of certain debt.

If at any time the aggregate amount of outstanding loans, unreimbursed letter of credit drawings and undrawn letters of credit under the Revolving Facility exceeds the aggregate commitments under the Revolving Facility, the Company is required to repay outstanding loans and/or cash collateralize letters of credit, with no reduction of the commitment amount.

The Company may voluntarily prepay outstanding loans under the Credit Facilities from time to time, subject to certain conditions, without premium or penalty other than customary "breakage" costs with respect to Term SOFR or EURIBOR loans; provided, however, that subject to certain exceptions, (i) if on or prior to the date that was twelve months after the Effective Date, the Company prepaid any loans under the 2022 USD Tranche B or the Euro Tranche B in connection with a repricing transaction, the Company would have been required to pay a prepayment premium of 1.00% of the aggregate principal amount of the loans so prepaid and (ii) if on or prior to the date that is six months after the First Amendment Effective Date, the Company prepaid any loans under the 2023 USD Tranche B in connection with a repricing transaction, the Company must pay a prepayment premium of 1.00% of the aggregate principal amount of the loans so prepaid. Additionally, the Company may voluntarily reduce the unutilized portion of the commitment amount under the Revolving Facility.

The Company is required to make scheduled quarterly payments each equal to 1.25% of the original principal amount of the USD Tranche A (increasing to 1.875% in years 3 and 4 and 2.50% in year 5), 0.25% of the original principal amount of the Euro Tranche B and 0.25% of the original principal amount of the 2023 USD Tranche B, with the balance due thereunder on the fifth anniversary of the closing date in the case of the USD Tranche A and the seventh anniversary of the closing date in the case of the USD Tranche B and the Euro Tranche B.

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There is no scheduled amortization under the Revolving Facility. Any principal amount outstanding under the Revolving Facility is due and payable in full on the fifth anniversary of the closing date.

The Company incurred \$7 of costs in connection with the Revolving Facility, which were capitalized and included in other assets in the accompanying consolidated balance sheets and are being amortized to interest expense over the estimated life of four years. As a result of the termination of the Company's previously existing revolving credit facility concurrently with the Company's entry into the Revolving Facility, the Company wrote off an immaterial amount of previously capitalized debt issuance costs.

All obligations under the Credit Facilities are guaranteed by certain of the Company's wholly-owned domestic subsidiaries and are required to be guaranteed by certain of the Company's future wholly-owned domestic subsidiaries, and are secured by substantially all of the Company's assets and the assets of such subsidiaries, subject to certain exceptions and exclusions.

Under the Credit Agreement, the Company has the ability to incur additional incremental debt facilities in an amount up to (x) the greater of (1) \$1,011 and (2) 75% of consolidated EBITDA, plus (y) an amount equal to the sum of all voluntary prepayments of term loans under the Term Loan Facility, plus (z) an additional unlimited amount subject to pro forma compliance with certain leverage ratio tests (based on the security and priority of such incremental debt).

Under the USD Tranche A and the Revolving Facility, so long as any USD Tranche A loans (or commitments in respect thereof) are outstanding as of the end of any fiscal quarter, the Company may not allow its total net leverage ratio as of the end of such fiscal quarter to be greater than 5.25 to 1.00 for the fiscal quarters ending December 31, 2023 through September 30, 2024, with an annual step-down of 0.25:1.00 and subject to a step-up of 0.50:1.00 for the four full fiscal quarter period following any material acquisition, not to exceed 5.50 to 1.00.

In addition, in the event there are no loans outstanding under the USD Tranche A, as of the end of any fiscal quarter of the Company when the aggregate amount of loans outstanding under the Revolving Facility (net of (a) all letters of credit (whether cash collateralized or not) and (b) unrestricted cash of the Company and its restricted subsidiaries) exceeds 35% of the aggregate amount of all commitments under the Revolving Facility in effect as of such date, the Company may not allow its first lien net leverage ratio as of the end of each such fiscal quarter to be greater than 6.00 to 1.00.

The USD Tranche B and the Euro Tranche B are not subject to financial maintenance covenants.

The Credit Agreement contains a number of negative covenants that, among other things and subject to certain exceptions, restrict the ability of the Company and each of its subsidiaries to: incur additional indebtedness; pay dividends on its capital stock or redeem, repurchase or retire its capital stock or its subordinated indebtedness; make investments, loans and acquisitions; create restrictions on the payment of dividends or other amounts to the Company from the Company's restricted subsidiaries or restrictions on the ability of the Company's restricted subsidiaries to incur liens; engage in transactions with its affiliates; sell assets, including capital stock of its subsidiaries; materially alter the business it conducts; consolidate or merge; incur liens; and engage in sale-leaseback transactions.

The Credit Agreement also contains customary representations and warranties, affirmative covenants and provisions relating to events of default. If an event of default occurs, the lenders under the Credit Facilities will be entitled to take various actions, including the acceleration of amounts due under the Credit Facilities and all actions permitted to be taken by a secured creditor. As of December 31, 2023, the Company was in compliance with all covenants under the Credit Agreement.

The proceeds of the Term Loan Facility were used on the Effective Date, among other things, to fund a portion of the consideration payable in connection with the Atotech Acquisition and to refinance the existing term loan and revolving credit facilities of the Company and certain indebtedness of Atotech. The Company also paid certain customary fees to and expenses of JPMorgan Chase Bank, N.A., Barclays Bank PLC, BofA Securities, Inc., Citibank, N.A., HSBC Securities (USA) Inc. and Mizuho Bank, Ltd. in their respective capacities as lead arrangers and bookrunners in connection with the Credit Facilities. The proceeds of the 2023 USD Tranche B were used on the First Amendment Effective Date to refinance the 2022 USD Tranche B. The Company also paid certain customary fees to and expenses of JPMorgan Chase Bank, N.A. in its capacity as lead arranger in connection with the 2023 USD Tranche B.

As of December 31, 2023, after total principal prepayments of \$200 and regularly scheduled principal payments of \$109, the aggregate outstanding principal amount of the Term Loan Facility was \$4,953 and the weighted average interest rate was 7.7%. As of December 31, 2023, there were no borrowings under the Revolving Facility.

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Lines of Credit and Borrowing Arrangements

Certain of the Company's Japanese subsidiaries have lines of credit and a financing facility with various financial institutions, many of which generally expire and are renewed at three-month intervals with the remaining having no expiration date. The lines of credit and financing facility provided for aggregate borrowings as of December 31, 2023 and December 31, 2022 of up to an equivalent of \$14 and \$27, respectively. There were no borrowings outstanding under these arrangements at December 31, 2023 or December 31, 2022.

Contractual maturities of the Company's debt obligations as of December 31, 2023 are as follows:

<u>Year</u>	<u>Amount</u>
2024	\$ 93
2025	110
2026	116
2027	586
2028	43
Thereafter	4,005

(16) Other Current Liabilities

Other current liabilities consisted of the following:

	<u>December 31, 2023</u>	<u>December 31, 2022</u>
Accrued compensation and other employee-related obligations	\$ 159	\$ 162
Deferred revenue and customer advances	77	94
Income taxes payable	57	51
Lease liabilities	30	26
Other	105	100
Total other current liabilities	<u>\$ 428</u>	<u>\$ 433</u>

(17) Income Taxes

A reconciliation of the Company's effective tax rate to the U.S. federal statutory rate is as follows:

	<u>Years Ended December 31,</u>		
	<u>2023</u>	<u>2022</u>	<u>2021</u>
U.S. federal income tax statutory rate	21.0%	21.0%	21.0%
Goodwill impairment	(18.4)	—	—
Federal tax credits	0.9	(1.5)	(0.7)
State income taxes, net of federal benefit	0.5	(0.3)	1.5
Effect of foreign operations taxed at various rates	0.9	(6.8)	(4.5)
Executive compensation	(0.1)	1.5	0.9
Foreign derived intangible income deduction	0.6	(4.8)	(1.7)
Global intangible low taxed income, net of foreign tax credits	(0.5)	3.6	0.5
Stock-based compensation	(0.4)	0.3	(0.5)
Deferred tax asset valuation allowance	(0.1)	(0.4)	(0.8)
Change in income tax reserves (including interest)	(0.5)	0.8	(0.6)
Withholding taxes on foreign dividends, net of foreign tax credits	(0.4)	10.7	1.5
Other	1.0	(1.0)	0.4
	<u>4.5%</u>	<u>23.1%</u>	<u>17.1%</u>

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The components of (loss) income before income taxes and the related (benefit) provision for income taxes consist of the following:

	Years Ended December 31,		
	2023	2022	2021
(Loss) income before income taxes:			
United States	\$ (760)	\$ (90)	\$ 249
Foreign	(1,168)	523	416
	<u>\$ (1,928)</u>	<u>\$ 433</u>	<u>\$ 665</u>
Current taxes:			
United States	\$ 21	\$ 40	\$ 38
State	6	7	10
Foreign	120	99	64
	<u>147</u>	<u>146</u>	<u>112</u>
Deferred taxes:			
United States	(130)	(68)	5
State	(18)	(8)	2
Foreign	(86)	30	(5)
	<u>(234)</u>	<u>(46)</u>	<u>2</u>
(Benefit) provision for income taxes	<u>\$ (87)</u>	<u>\$ 100</u>	<u>\$ 114</u>

The significant components of the deferred tax assets and deferred tax liabilities are as follows:

	December 31,	
	2023	2022
Deferred tax assets:		
Interest, loss, and credit carryforwards	\$ 278	\$ 224
Capitalized research and development	98	31
Inventory and warranty reserves	54	50
Lease liability	51	55
Accrued expenses and other reserves	23	22
Stock-based compensation	4	3
Loan costs	—	9
Other	11	5
Total deferred tax assets	<u>519</u>	<u>399</u>
Valuation allowance	(190)	(181)
Net deferred tax assets	<u>\$ 329</u>	<u>\$ 218</u>
Deferred tax liabilities:		
Acquired intangible assets and goodwill	\$ (637)	\$ (781)
Depreciation and amortization	(56)	(62)
Right-of-use asset	(49)	(55)
Foreign withholding taxes	(50)	(56)
Loan costs	(24)	—
Unrealized gain	—	(14)
Total deferred tax liabilities	<u>(816)</u>	<u>(968)</u>
Net deferred tax liabilities	<u>\$ (487)</u>	<u>\$ (750)</u>

As of December 31, 2023, the Company had U.S. federal and state as well as foreign gross research and other tax credit carryforwards of \$41. Included in the total carryforwards are \$11 of credits that can be carried forward indefinitely while the remaining credits expire at various dates through 2037. The Company also had U.S. federal and state as well as foreign gross net operating loss and capital loss carryforwards of \$349. Included in the total carryforwards are \$55 of losses that can be carried forward indefinitely while the remaining losses expire at various dates through 2041. The Company has \$688 of foreign interest carryforwards that can be carried forward indefinitely.

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Although the Company believes that its tax positions are consistent with applicable U.S. federal, state and international laws, it maintains certain income tax reserves as of December 31, 2023 in the event its tax positions were to be challenged by the applicable tax authority and additional tax assessed upon audit.

A reconciliation of the beginning and ending amount of gross unrecognized tax benefits, excluding interest and penalties, is as follows:

	Years Ended December 31,		
	2023	2022	2021
Balance at beginning of year	\$ 83	\$ 43	\$ 47
Increases (decreases) for tax positions taken during prior years	(5)	35	—
Increases for tax positions taken during the current year	12	9	2
Reductions related to expiration of statutes of limitations and audit settlements	(4)	(4)	(6)
Balance at end of year	<u>\$ 86</u>	<u>\$ 83</u>	<u>\$ 43</u>

The net increase in gross unrecognized tax benefits in 2023 was primarily due to the addition of unrecognized U.S. federal tax credits.

The Company accrues interest and, if applicable, penalties for any uncertain tax positions. Interest and penalties are classified as a component of income tax (benefit) expense. As of December 31, 2023, 2022 and 2021, the Company accrued interest on unrecognized tax benefits of approximately \$7, \$6 and \$1, respectively.

Over the next 12 months, it is reasonably possible that the Company may recognize approximately \$12 of previously net unrecognized tax benefits, excluding interest and penalties, related to various U.S. federal and state as well as foreign tax positions, primarily due to the expiration of statutes of limitations.

The Company is subject to examination by U.S. federal and state as well as foreign tax authorities. The U.S. federal statute of limitations remains open for tax years 2020 through the present. The statute of limitations for the Company's tax filings in other jurisdictions varies between fiscal years 2017 through present. The Company also has certain U.S. federal and state as well as foreign tax loss and credit carryforwards that are open for examination for tax years 2003 to the present. In addition, the 2017 U.S. federal transition tax remains open for examination.

On a quarterly basis, the Company evaluates both positive and negative evidence that affects the realizability of its net deferred tax assets and assesses the need for a valuation allowance. The future benefit to be derived from its deferred tax assets is dependent upon its ability to generate sufficient future taxable income to realize the assets.

During 2023, the Company increased its valuation allowance by \$9, primarily related to the valuation allowance recorded in connection with foreign interest and net operating loss carryforwards. During 2022, the Company increased its valuation allowance by \$155, primarily related to the valuation allowance recorded for foreign interest and net operating loss carryforwards associated with the Atotech Acquisition.

Deferred taxes have been recorded related to historical outside basis differences, primarily unremitted earnings, of certain of the Company's foreign subsidiaries. During 2023, the Company recorded a tax benefit of \$3 related to such taxes for prior periods.

(18) Stock-Based Compensation

Employee Stock Purchase Plans

The 2014 ESPP was adopted by the Board of Directors on February 10, 2014 and approved by the Company's stockholders on May 5, 2014. The 2014 ESPP authorizes the issuance of up to an aggregate of 2.5 shares of common stock to participating employees. Offerings under the 2014 ESPP commence on June 1 and December 1 and terminate on November 30 and May 31, respectively. Under the 2014 ESPP, eligible employees can purchase shares of common stock through payroll deductions up to 10% of their compensation, up to a defined maximum annual amount. The price at which an employee's purchase option is exercised for each offering period is the lower of (1) 90% of the closing price of the common stock on the Nasdaq Global Select Market on the day that the offering commences, or (2) 90% of the closing price of the common stock on the day that the offering terminates. The Company issued 0.1 shares of common stock during each of 2023, 2022 and 2021 to employees who participated in the 2014 ESPP at exercise

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prices of \$74.95 and \$74.30 per share in 2023, \$111.15 and \$75.47 per share in 2022, and \$126.00 and \$136.94 per share in 2021. As of December 31, 2023 there were 1.4 shares reserved for future issuance under the 2014 ESPP.

Equity Incentive Plans

Prior to May 10, 2022, the Company granted RSUs to employees and directors under the 2014 Stock Incentive Plan (the “2014 Plan”). Following shareholder approval of the 2022 Stock Incentive Plan (the “2022 Plan,” and together with the 2014 Plan, the “Plans”) on May 10, 2022, the Company discontinued granting RSUs to employees and directors under the 2014 Plan and began granting them under the 2022 Plan. The Plans are administered by the Compensation Committee of the Company’s Board of Directors. The Plans are intended to attract and retain employees and directors, and to provide an incentive for these individuals to assist the Company to achieve long-range performance goals and enable these individuals to participate in the long-term growth of the Company. Up to 6.6 shares of common stock (subject to adjustment in the event of stock splits and other similar events) may be issued pursuant to awards granted under the 2022 Plan. The Company may grant options, RSUs, restricted stock, stock appreciation rights (“SARs”) and other stock-based awards to employees, officers, directors, consultants and advisors under the 2022 Plan. Any full-value awards granted under the 2022 Plan will be counted against the shares reserved for issuance under the 2022 Plan as 1.91 shares for each share of common stock subject to such award. Any award granted under the 2022 Plan that is not a full-value award (including, without limitation, any option or SAR) will be counted against the shares reserved for issuance under the plan on a one-for-one basis of common stock subject to such award. “Full-value award” means any restricted stock, RSUs, or other stock-based award with a per share price or per unit purchase price lower than 100% of fair market value on the date of grant. To the extent an award that is not a full-value award is returned to the 2022 Plan, the share reserve under the 2022 Plan will be credited with one share. To the extent that a full-value award is returned to the 2022 Plan, the share reserve under the 2022 Plan will be credited with 1.91 shares. As of December 31, 2023, there were 4.6 shares reserved for future issuance under the 2022 Plan.

Time-based RSUs granted to employees generally vest 33% per year beginning on the first anniversary of the date of grant. Performance-based RSUs granted to the Company’s executive officers in 2023, 2022 and 2021 were based on the Company’s achievement of adjusted EBITDA for each respective year, defined as GAAP operating income excluding any charges or income not related to the operating performance of the Company plus depreciation and stock compensation expense, set at varying revenue levels. The final number of performance-based RSUs that vest varies based on the level of performance achieved from 0% to 200% of the underlying target shares granted in 2023, 2022 and 2021. The performance-based RSUs earned generally vest 33% per year beginning on the first anniversary of the date of grant. RSUs granted to certain employees who meet certain retirement eligibility requirements will vest in full upon each such employee’s retirement and are expensed immediately. RSUs granted to directors generally vest at the earliest of (1) one day prior to the next annual meeting, (2) 13 months from date of grant, or (3) the effective date of a change in control of the Company.

In connection with the Atotech Acquisition, all Atotech time-based RSUs and performance-based RSU awards outstanding immediately prior to the completion of the Atotech Acquisition were cancelled and replaced with the Company’s time-based RSUs under the 2022 Plan in accordance with the Implementation Agreement. These RSUs are subject to the terms and conditions of the 2022 Plan and the related RSU agreements.

The following tables present the activity for the RSUs under the Plans:

	Year ended December 31, 2023	
	RSUs	Weighted Average Grant Date Fair Value
RSUs — beginning of period	0.8	\$ 118.96
Granted	0.7	\$ 87.03
Vested	(0.5)	\$ 117.10
RSUs — end of period	1.0	\$ 98.36

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	Year ended December 31, 2022	
	RSUs	Weighted Average Grant Date Fair Value
RSUs — beginning of period	0.5	\$ 127.93
RSUs issued in Atotech Acquisition	0.1	\$ 110.30
Granted	0.5	\$ 111.60
Vested	(0.3)	\$ 118.06
RSUs — end of period	<u>0.8</u>	<u>\$ 118.96</u>

Stock-Based Compensation Expense

The Company recognized the full impact of its share-based payment plans in the consolidated statements of operations and comprehensive income. The following table reflects the effect of recording stock-based compensation:

	Years Ended December 31,		
	2023	2022	2021
Stock-based compensation expense by type of award:			
RSUs	\$ 51	\$ 42	\$ 34
Employee stock purchase plan	3	3	3
Total stock-based compensation	54	45	37
Windfall tax effect on stock-based compensation	2	(1)	(5)
Net effect on net (loss) income	<u>\$ 56</u>	<u>\$ 44</u>	<u>\$ 32</u>
Effect on net (loss) earnings per share:			
Basic	\$ 0.84	\$ 0.74	\$ 0.58
Diluted	<u>\$ 0.84</u>	<u>\$ 0.73</u>	<u>\$ 0.58</u>

The pre-tax effect within the consolidated statements of operations and comprehensive (loss) income of recording stock-based compensation was as follows:

	Years Ended December 31,		
	2023	2022	2021
Cost of revenues	\$ 6	\$ 5	\$ 4
Research and development expense	7	6	5
Selling, general and administrative expense	41	34	28
Total pre-tax stock-based compensation expense	<u>\$ 54</u>	<u>\$ 45</u>	<u>\$ 37</u>

Valuation Assumptions

The Company determines the fair value of RSUs based on the closing market price of the Company's common stock on the date of the award and estimates the fair value of employee stock purchase plan rights using the Black-Scholes valuation model. Such values are recognized as expense on a straight-line basis for time-based awards and using the accelerated graded vesting method for performance-based awards, both over the requisite service periods.

The weighted average fair value per share of employee stock purchase plan rights granted in 2023, 2022 and 2021 was \$20.88, \$29.68, and \$33.55, respectively. The fair value of employee stock purchase plan rights was estimated using the Black-Scholes option-pricing model with the following weighted average assumptions:

	Years Ended December 31,		
	2023	2022	2021
Employee stock purchase plan rights:			
Expected life (years)	0.5	0.5	0.5
Risk-free interest rate	5.0%	0.9%	0.1%
Expected volatility	44.5%	41.9%	39.3%
Expected annual dividends per share	\$ 0.88	\$ 0.88	\$ 0.88

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Expected volatilities are based on a combination of implied and historical volatilities of the Company's common stock; the expected life represents the weighted average period of time that options granted are expected to be outstanding giving consideration to vesting schedules and the Company's historical exercise patterns; and the risk-free interest rate is based on the U.S. Treasury yield curve in effect at the time of grant for periods corresponding with the expected life of the option.

The total fair value of RSUs vested during 2023, 2022 and 2021 was approximately \$40, \$40 and \$57, respectively. An immaterial value of SARs was included in 2022 and 2021. As of December 31, 2023, the unrecognized compensation cost related to RSUs was approximately \$46 and will be recognized over an estimated weighted average amortization period of 1 year.

(19) Stockholders' Equity

Share Repurchase Program

On July 25, 2011, the Company's Board of Directors approved a share repurchase program for the repurchase of up to an aggregate of \$200 of its outstanding common stock from time to time in open market purchases, privately negotiated transactions or through other appropriate means. The timing and quantity of any shares repurchased will depend upon a variety of factors, including business conditions, stock market conditions and business development activities, including, but not limited to, merger and acquisition opportunities. These repurchases may be commenced, suspended or discontinued at any time without prior notice. The Company has repurchased approximately 2.6 shares of common stock for approximately \$127 pursuant to the program since its adoption. During 2023, 2022 and 2021, there were no repurchases of common stock.

Cash Dividends

Holders of the Company's common stock are entitled to receive dividends when they are declared by the Company's Board of Directors. The Company's Board of Directors declared a cash dividend of \$0.22 per share during each quarter of 2023, which totaled \$59 or \$0.88 per share. The Company's Board of Directors declared a cash dividend of \$0.22 per share during each quarter of 2022, which totaled \$52 or \$0.88 per share.

On February 5, 2024, the Company's Board of Directors declared a quarterly cash dividend of \$0.22 per share to be paid on March 8, 2024 to Stockholders of record as of February 26, 2024.

Future dividend declarations, if any, as well as the record and payment dates for such dividends, are subject to the final determination of the Company's Board of Directors.

(20) Employee Benefit Plans

The Company has a 401(k) profit-sharing plan for U.S. employees meeting certain requirements, in which eligible employees may contribute between 1% and 50% of their annual compensation to this plan, and, with respect to employees who are age 50 and older, certain specified additional amounts, limited by an annual maximum amount determined by the Internal Revenue Service. The Company, at its discretion, makes certain matching contributions to this plan based on participating employees' annual contribution to this plan and their total compensation. The Company's contributions were \$9, \$10 and \$8 for 2023, 2022 and 2021, respectively.

The Company also has a number of defined contribution plans at some of its foreign locations. The Company's contributions were immaterial for 2023, 2022 and 2021.

The Company maintains a bonus plan which provides cash awards to certain employees, at the discretion of the Compensation Committee of the Company's Board of Directors, based upon the Company's operating results. In addition, certain of the Company's foreign locations also have various bonus plans based upon local operating results and employee performance. The total bonus expense was \$63, \$48 and \$76 for 2023, 2022 and 2021, respectively.

Defined Benefit Pension Plans

The Company has a number of defined benefit pension plans at many of its foreign location, which cover most of its full-time employees at these respective locations. In addition, the Company has certain pension assets and liabilities

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relating to its former employees in the United Kingdom. One of the Company's German pension plans is unfunded, as permitted under the plan and applicable laws.

As a result of the Atotech Acquisition, the Company assumed all assets and liabilities of Atotech's defined benefit pension plans.

For financial reporting purposes, the Company obtained actuarial reports supporting the calculation of net periodic pension costs that used a number of actuarial assumptions, including a discount rate for plan obligations, an assumed rate of return on pension plan assets and an assumed rate of compensation increase for employees covered by the various plans. The Company reviewed these actuarial assumptions and concluded they were reasonable based upon management's judgment, considering known trends and uncertainties. Actual results that differ from these assumptions would impact future expense recognition and the cash funding requirements of the Company's pension plans.

The net periodic benefit costs for the defined benefit plans included the following components:

	Year Ended December 31,	
	2023	2022
Service cost	\$ 2	\$ 1
Interest cost on projected benefit obligations	5	2
Expected return on plan assets	(1)	—
Amortization of actuarial net loss	—	1
	<u>\$ 6</u>	<u>\$ 4</u>

The changes in projected benefit obligations and plan assets, as well as the ending balance sheet amounts for the Company's defined benefit plans, were as follows:

	Year Ended December 31,	
	2023	2022
Change in projected benefit obligations:		
Projected benefit obligations, beginning of year	\$ 144	\$ 34
Liabilities assumed through Atotech Acquisition	—	122
Service cost	2	1
Interest cost	5	2
Actuarial loss (gain)	9	(17)
Benefits paid	(7)	(3)
Currency translation adjustments	1	5
Projected benefit obligations, end of year	<u>\$ 154</u>	<u>\$ 144</u>
Change in plan assets:		
Fair value of plan assets, beginning of year	31	12
Assets assumed through Atotech Acquisition	—	24
Company contributions	3	1
Gain (loss) on plan assets	2	(5)
Benefits paid	(3)	(1)
Currency translation adjustments	1	—
Fair value of plan assets, end of year	<u>34</u>	<u>31</u>
Net underfunded status	<u>\$ (120)</u>	<u>\$ (113)</u>

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As of December 31, 2023, the estimated benefit payments for the Company's defined benefit plans for the next 10 years were as follows:

	Estimated benefit payments
2024	\$ 6
2025	8
2026	10
2027	15
2028	9
2029-2033	53
	<u>\$ 101</u>

The Company expects to contribute less than \$1 to the plans during 2024.

The weighted-average rates used to determine the net periodic benefit costs were as follows:

	December 31, 2023	December 31, 2022
Discount rate	3.3%	3.7%
Rate of increase in salary levels	3.1%	3.1%
Expected long-term rate of return on assets	2.7%	2.6%

In determining the expected long-term rate of return on plan assets, the Company considers the relative weighting of plan assets, the historical performance of total plan assets and individual asset classes, and economic and other indicators of future performance.

Plan assets were held in the following categories as a percentage of total plan assets:

	December 31, 2023		December 31, 2022	
	Amount	Percentage	Amount	Percentage
Debt securities	\$ 18	54%	\$ 20	65%
Equity securities	9	24	7	22
Cash	3	10	—	—
Other	4	12	4	13
	<u>\$ 34</u>	<u>100%</u>	<u>\$ 31</u>	<u>100%</u>

In general, the Company's asset management objectives include maintaining an adequate level of diversification to reduce interest rate and market risk, while providing adequate liquidity to meet immediate and future benefit payment requirements.

The Company's Israeli plans account for the deferred vested benefits using the shut-down method of accounting, which resulted in assets of \$19 and vested benefit obligations of \$22 as of December 31, 2023 and assets of \$19 and vested benefit obligations of \$22 as of December 31, 2022. Under the shut-down method, the liability is calculated as if it were payable as of the balance sheet date, on an undiscounted basis.

Other Pension-Related Assets

As of December 31, 2023 and 2022, the Company had assets with an aggregate market value of \$6 for each period, for one of its German pension plans. These assets are invested in group insurance contracts through the insurance companies administering these plans, in accordance with applicable pension laws. These group insurance contracts have a guaranteed minimum rate of return ranging from 2.0% to 4.25%, depending on the contract. Because these assets were not separate legal assets of the pension plan, they were not included in the Company's plan assets shown above. However, the Company has designated such assets to pay pension benefits. Such assets are included in other assets in the accompanying consolidated balance sheet.

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(21) Net (Loss) Income Per Share

The following is a reconciliation of basic to diluted net (loss) income per share:

	Years Ended December 31,		
	2023	2022	2021
Numerator:			
Net (loss) income	\$ (1,841)	\$ 333	\$ 551
Denominator:			
Shares used in net (loss) income per common share – basic	66.8	59.7	55.4
Effect of dilutive securities	—	0.2	0.3
Shares used in net (loss) income per common share – diluted	66.8	59.9	55.7
Net (loss) income per common share:			
Basic	\$ (27.54)	\$ 5.57	\$ 9.95
Diluted	\$ (27.54)	\$ 5.56	\$ 9.90

Basic earnings per share (“EPS”) is computed by dividing income available to holders of the Company’s common stock by the weighted-average number of common shares outstanding during the period. The computation of diluted EPS is similar to the computation of basic EPS except that the denominator is increased to include the number of additional common shares that would have been outstanding (using the treasury stock method) if securities containing potentially dilutive common shares had been converted to such common shares, and if such conversion is dilutive. In periods in which a net loss is recognized, the impact of RSUs is not included as they are antidilutive.

In 2022 and 2021, the Company had an immaterial quantity of RSUs that were antidilutive and were excluded from the computation of diluted weighted-average shares.

(22) Business Segment, Geographic Area, Product Information and Significant Customer Information

Reportable Segments and Products

The Company’s CODM, which is the Company’s Chief Executive Officer, utilizes financial information to make decisions about allocating resources and assessing performance for the entire Company, which is used in the decision-making process to assess performance. The Company has a diverse base of customers across its three end markets, semiconductor, electronics and packaging, and specialty industrial. The CODM utilizes total gross profit for the purposes of making decisions about allocating resources and assessing performance.

The Company has three reporting segments, VSD, PSD and MSD as described below.

VSD delivers foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging and specialty industrial applications. VSD products are derived from the Company’s core competencies in pressure measurement and control, flow measurement and control, gas and vapor delivery, gas composition analysis, electronic control technology, reactive gas generation and delivery, power generation and delivery, and vacuum technology.

PSD provides a full range of solutions including lasers, beam measurement and profiling, precision motion control, vibration isolation systems, photonics instruments, temperature sensing, opto-mechanical components, optical elements, systems for flexible PCB laser processing, laser-based systems for high-density interconnect PCB and package manufacturing.

MSD develops leading process and manufacturing technologies for advanced surface modification, electroless and electrolytic plating, and surface finishing. Applying a comprehensive systems-and-solutions approach, MSD’s portfolio includes chemistry, equipment, software, and services for innovative and high-technology applications in a wide variety of end-markets.

The Company derives its segment results directly from the manner in which results are reported in its management reporting system. The accounting policies that the Company uses to derive reportable segment results are substantially the same as those used for external reporting purposes. The Company groups its product offerings by its reportable segments, VSD, PSD, and MSD. For each reportable segment, the Company also provides services relating to the maintenance and repair of its products, installation services and training.

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The following table sets forth net revenues by reportable segment:

	Years Ended December 31,		
	2023	2022	2021
VSD	\$ 1,404	\$ 1,966	\$ 1,862
PSD	1,012	1,064	1,088
MSD	1,206	517	—
	<u>\$ 3,622</u>	<u>\$ 3,547</u>	<u>\$ 2,950</u>

The following table sets forth a reconciliation of segment gross profit to consolidated net income:

	Years Ended December 31,		
	2023	2022	2021
Gross profit by reportable segment:			
VSD	\$ 580	\$ 856	\$ 868
PSD	442	499	512
MSD	620	192	—
Total gross profit by reportable segment	1,642	1,547	1,380
Operating expenses:			
Research and development	288	241	200
Selling, general and administrative	675	488	385
Acquisition and integration costs	16	52	30
Restructuring	20	10	11
Fees and expenses related to repricing of Term Loan Facility	2	—	—
Amortization of intangible assets	295	146	55
Goodwill and intangible asset impairment	1,902	—	—
Gain on sale of long-lived assets	(2)	(7)	—
(Loss) income from operations	(1,554)	617	699
Interest income	(17)	(4)	—
Interest expense	356	177	25
Loss on extinguishment of debt	8	—	—
Other expense, net	27	11	9
(Loss) income before income taxes	(1,928)	433	665
(Benefit) provision for income taxes	(87)	100	114
Net (loss) income	<u>\$ (1,841)</u>	<u>\$ 333</u>	<u>\$ 551</u>

The following table set forth capital expenditures by reportable segment:

	Years Ended December 31,		
	2023	2022	2021
VSD	\$ 25	\$ 96	\$ 37
PSD	30	40	50
MSD	32	28	—
Total capital expenditures	<u>\$ 87</u>	<u>\$ 164</u>	<u>\$ 87</u>

The following table sets forth depreciation and amortization by reportable segment:

	Years Ended December 31,		
	2023	2022	2021
VSD	\$ 29	\$ 24	\$ 23
PSD	74	88	81
MSD	294	104	—
Total depreciation and amortization	<u>\$ 397</u>	<u>\$ 216</u>	<u>\$ 104</u>

Total income tax expense is not presented by reportable segment because the necessary information is not available or used by the CODM.

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The following table sets forth segment assets by reportable segment:

	Accounts receivable, net	Inventory	Total
December 31, 2023			
VSD	\$ 178	\$ 542	\$ 720
PSD	174	294	468
MSD	251	155	406
Total segment assets	<u>\$ 603</u>	<u>\$ 991</u>	<u>\$ 1,594</u>

	Accounts receivable, net	Inventory	Total
December 31, 2022			
VSD	\$ 270	\$ 491	\$ 761
PSD	194	296	490
MSD	256	190	446
Total segment assets	<u>\$ 720</u>	<u>\$ 977</u>	<u>\$ 1,697</u>

The Company adjusted the accounts receivable, net balances as of December 31, 2022 to correct for immaterial errors in the segments.

The following is a reconciliation of segment assets to consolidated total assets:

	December 31,	
	2023	2022
Total segment assets	\$ 1,594	\$ 1,697
Cash and cash equivalents and short-term investments	875	910
Other current assets	227	187
Property, plant and equipment, net	784	800
Right-of-use assets	225	234
Goodwill and intangible assets, net	5,173	7,481
Other assets and long-term assets	240	186
Consolidated total assets	<u>\$ 9,118</u>	<u>\$ 11,495</u>

Geographic Area

Information about the Company's operations by geographic region is presented in the tables below. Net revenues from unaffiliated customers are based on the location in which the sale originated. Intercompany sales between geographic areas are at tax transfer prices and have been eliminated from consolidated net revenues.

	Years Ended December 31,		
	2023	2022	2021
Net revenues:			
United States	\$ 1,227	\$ 1,450	\$ 1,259
China	680	506	355
South Korea	343	361	386
Japan	254	220	197
Germany	236	243	144
Other	882	767	609
	<u>\$ 3,622</u>	<u>\$ 3,547</u>	<u>\$ 2,950</u>

The Company adjusted the net revenues by geographic area balances as of December 31, 2022 to correct for immaterial errors by location.

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
(in millions, except per share data)

Long-lived assets include property, plant and equipment, net, right-of-use assets, and certain other assets, and exclude goodwill, intangible assets and long-term tax-related accounts.

	December 31,	
	2023	2022
Long-lived assets:		
United States	\$ 459	\$ 508
Germany	149	160
China	163	175
Other	326	343
	<u>\$ 1,097</u>	<u>\$ 1,186</u>

Goodwill associated with each of the Company's reportable segments is as follows:

Reportable segment:	VSD	PSD	MSD	Total
Gross goodwill, at December 31, 2022	\$ 336	\$ 1,031	\$ 3,087	\$ 4,454
Foreign currency translation and measurement period adjustments	(1)	—	(66)	(67)
Gross goodwill, at December 31, 2023	335	1,031	3,021	4,387
Accumulated goodwill impairment, at December 31, 2022	(141)	(5)	—	(146)
Impairment charge	—	(385)	(1,302)	(1,687)
Accumulated goodwill impairment, at December 31, 2023	(141)	(390)	(1,302)	(1,833)
Goodwill, net of accumulated impairment, foreign currency translation and measurement period adjustments, at December 31, 2023	<u>\$ 194</u>	<u>\$ 641</u>	<u>\$ 1,719</u>	<u>\$ 2,554</u>

The Company sells products and services to thousands of customers worldwide, in a wide range of end markets. Revenues from its top ten customers accounted for 30%, 42% and 46% of net revenues for 2023, 2022, and 2021, respectively.

For the year ended December 31, 2023, no customer represented 10% or more of the Company's net revenues. For the year ended December 31, 2022, the Company had one customer that represented 14% and one customer that represented 10% of net revenues. For the year ended December 31, 2021, the Company had one customer that represented 15% and one customer that represented 11% of net revenues.

(23) Restructuring

Restructuring costs were \$20 in 2023, related to severance costs due to global cost-saving initiatives. Restructuring costs were \$10 in 2022, primarily related to severance costs due to a global cost-saving initiative, the closure of two facilities in Europe, the movement of certain products to low-cost regions as well as executive payments related to the Atotech Acquisition.

The activity related to the Company's restructuring accrual is shown below:

	2023	2022
Balance at January 1	\$ 3	\$ 3
Charged to expense	20	10
Payments and adjustments	(14)	(10)
Balance at December 31	<u>\$ 9</u>	<u>\$ 3</u>

MKS INSTRUMENTS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
(in millions, except per share data)

(24) Commitments and Contingencies.

As of December 31, 2023, the Company has entered into purchase commitments for certain inventory components and other equipment and services used in its normal operations. The majority of the purchase commitments covered by these arrangements are for periods of less than one year and aggregate to approximately \$562.

The Company is subject to various legal proceedings and claims that have arisen in the ordinary course of business. In the opinion of management, the ultimate disposition of these matters, will not have a material adverse effect on the Company's results of operations, financial condition or cash flows.

(25) Subsequent Events

On January 22, 2024 (the "Second Amendment Effective Date"), the Company entered into the Second Amendment to Credit Agreement (the "Second Amendment"). Pursuant to the Second Amendment, the Company (i) borrowed additional USD tranche B loans (the "Incremental USD Tranche B Loans") in an aggregate principal amount of \$490, (ii) borrowed additional Euro Tranche B loans (the "Incremental Euro Tranche B Loans" and together with the Incremental USD Tranche B Loans, the "Incremental Tranche B Loans") in an aggregate principal amount of €250 and (iii) used a portion of the proceeds of the Incremental Tranche B Loans to prepay the Company's USD Tranche A in full in an aggregate principal amount of \$744. Remaining proceeds of the Incremental Tranche B Loans were used to pay fees and expenses in connection with the Second Amendment and will be used for working capital and general corporate purposes. The Incremental USD Tranche B Loans and the Incremental Euro Tranche B Loans have identical terms to the Company's existing USD Tranche B and Euro Tranche B loans (collectively, together with the Incremental Tranche B Loans, the "Tranche B Loans"), respectively, under the Credit Agreement. Additionally, pursuant to the Second Amendment, the 1.00% prepayment premium applicable to any Tranche B Loans prepaid in connection with certain repricing transactions was extended for a period of six months following the Second Amendment Effective Date. The Incremental Tranche B Loans were issued with original issue discount of 0.25%. In connection with the execution of the Second Amendment, the Company paid customary fees and expenses to JPMorgan Chase Bank, N.A.

On February 5, 2024, the Company made a voluntary prepayment of \$50 aggregate principal amount on the USD Tranche B.

On February 13, 2024, the Company entered into the Third Amendment to Credit Agreement (the "Third Amendment"). Pursuant to the Third Amendment, the Company increased the available borrowing capacity under the Revolving Facility by \$175 million (the "Incremental Revolving Commitments"), from \$500 million to \$675 million. In connection with the execution of the Third Amendment, the Company paid customary fees and expenses to the lenders providing the Incremental Revolving Commitments and to JPMorgan Chase Bank, N.A.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure

None.

Item 9A. Controls and Procedures

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our Chief Executive Officer and Chief Financial Officer, evaluated the effectiveness of our disclosure controls and procedures as of December 31, 2023. The term “disclosure controls and procedures,” as defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, as amended (the “Exchange Act”), means controls and other procedures of an issuer that are designed to ensure that information required to be disclosed by the issuer in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the Securities and Exchange Commission’s (“SEC”) rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by an issuer in the reports that it files or submits under the Exchange Act is accumulated and communicated to the issuer’s management, including its principal executive and principal financial officers, or persons performing similar functions as appropriate to allow timely decisions regarding required disclosure. Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on that evaluation, our Chief Executive Officer and Chief Financial Officer concluded that, as of December 31, 2023, our disclosure controls and procedures were effective to provide reasonable assurance that information required to be disclosed by us in reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in SEC rules and forms and is accumulated and communicated to our management, including our Chief Executive Office and Chief Financial Officer, as appropriate to allow timely decisions regarding required disclosure.

Management’s Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act as a process designed by, or under the supervision of our Chief Executive Officer and Chief Financial Officer, and effected by our Board of Directors, management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles and includes those policies and procedures that:

- Pertain to the maintenance of records that in reasonable detail accurately and fairly reflect the transactions and dispositions of the assets of the Company;
- Provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that our receipts and expenditures of the Company are being made only in accordance with authorization of our management and directors of the Company; and
- Provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of our assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Under the supervision and with the participation of our management including our Chief Executive Officer and Chief Financial Officer, we conducted an assessment of the effectiveness of our internal control over financial reporting as of December 31, 2023. In making this assessment, we used the criteria set forth in the *Internal Control-Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. Based on this evaluation, our management concluded that, as of December 31, 2023, our internal control over financial reporting was effective.

Our internal control over financial reporting as of December 31, 2023 has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in its report, which appears in Item 8 of this Annual Report on Form 10-K.

Changes in Internal Control over Financial Reporting

Our management concluded that a material weakness existed as of December 31, 2022, as previously disclosed in “Item 9A—Controls and Procedures of our Annual Report on Form 10-K for the year ended December 31, 2022, as we did not maintain sufficient information technology (“IT”) controls to prevent or detect, on a timely basis, unauthorized access to the Company’s financial reporting systems. Specifically, we did not design and maintain effective controls with regard to our financial reporting systems related to access authentication, intrusion detection and response capability, and backup and restoration such that recovery from a cybersecurity incident could be performed in a more timely manner. This material weakness did not result in a misstatement to the annual or interim consolidated financial statements previously filed or included in this Annual Report on Form 10-K. However, it could have resulted in a material misstatement to the annual or interim consolidated financial statements that would not have been prevented or detected. Subsequently, the Company has taken corrective action to remediate and address the IT control deficiencies that aggregated to the noted material weakness. The Company added in its systems various new controls and enhanced existing controls to strengthen our cybersecurity. Based on testing performed by management, implemented controls are designed to operate, and are operating, effectively and the material weakness has been remediated as of December 31, 2023.

Except for the changes noted above in connection with the initiatives to remediate the material weakness, there was no other change in our internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act) during our fourth fiscal quarter that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. *Other Information*

For the three months ended December 31, 2023, none of our directors or officers (as defined in Rule 16a-1(f) under the Exchange Act) adopted or terminated a trading arrangement for the sale or purchase of Company securities that is either (1) a contract, instruction or written plan intended to satisfy the affirmative defense conditions of Rule 10b5-1(c) or (2) a “non-Rule 10b5-1 trading arrangement” (as defined in Item 408(c) of Regulation S-K).

Item 9C. *Disclosure Regarding Foreign Jurisdictions that Prevent Inspections*

Not applicable.

PART III

Item 10. *Directors, Executive Officers and Corporate Governance*

The information required by this item will be set forth under the captions “Proposal One — Election of Directors,” “Directors,” “Corporate Governance,” “Executive Officers,” “Corporate Governance — Code of Business Conduct and Ethics” and “Corporate Governance — Board of Directors Meetings and Committees of the Board of Directors — Audit Committee” in our definitive proxy statement for the 2024 Annual Meeting of Stockholders, to be filed with the Securities and Exchange Commission (“SEC”) no later than 120 days after the end of our fiscal year, and is incorporated herein by reference.

We are also required under Item 405 of Regulation S-K to provide information concerning delinquent filers of reports under Section 16 of the Securities and Exchange Act of 1934, as amended. This information will be set forth under the caption “Delinquent Section 16(a) Reports,” if applicable, in our definitive proxy statement for the 2024 Annual Meeting of Stockholders, to be filed with the SEC no later than 120 days after the end of our fiscal year, and is incorporated herein by reference.

Item 11. *Executive Compensation*

The information required by this item will be set forth under the captions “Executive Officers,” “Executive Compensation – Compensation Discussion and Analysis,” “Corporate Governance – Board of Director Meetings and Committees of the Board of Directors – Compensation Committee - Compensation Committee Interlocks and Insider Participation,” “Compensation Committee Report” and “Director Compensation” in our definitive proxy statement for the 2024 Annual Meeting of Stockholders, to be filed with the SEC no later than 120 days after the end of our fiscal year, and, other than the information required by Item 402(v) of Regulation S-K, is incorporated herein by reference.

Item 12. *Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters*

The information required by Item 403 of Regulation S-K will be set forth under the caption “Security Ownership of Certain Beneficial Owners and Management” in our definitive proxy statement for the 2024 Annual Meeting of Stockholders, to be filed with the SEC no later than 120 days after the end of our fiscal year, and is incorporated herein by reference.

The information required by Item 201(d) of Regulation S-K will be set forth under the caption “Equity Compensation Plan Information” in our definitive proxy statement for the 2024 Annual Meeting of Stockholders, to be filed with the SEC no later than 120 days after the end of our fiscal year, and is incorporated herein by reference.

Item 13. *Certain Relationships and Related Transactions and Director Independence*

The information required by this item will be set forth under the captions “Corporate Governance – Board Independence” and “Corporate Governance – Transactions with Related Persons” in our definitive proxy statement for the 2024 Annual Meeting of Stockholders, to be filed with the SEC no later than 120 days after the end of our fiscal year, and is incorporated herein by reference.

Item 14. *Principal Accountant Fees and Services*

The information required by this item will be set forth under the caption “Audit and Financial Accounting Oversight — Principal Accountant Fees and Services” in our definitive proxy statement for the 2024 Annual Meeting of Stockholders, to be filed with the SEC no later than 120 days after the end of our fiscal year, and is incorporated herein by reference.

PART IV

Item 15. Exhibits and Financial Statement Schedules

(a) The following documents are filed as a part of this Annual Report on Form 10-K:

1. *Financial Statements.* The following Consolidated Financial Statements are included under Item 8 of this Annual Report on Form 10-K.

INDEX TO CONSOLIDATED FINANCIAL STATEMENTS

Financial Statements:

Report of Independent Registered Public Accounting Firm (PCAOB ID 238)	63
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Consolidated Statements of Operations and Comprehensive (Loss) Income for the years ended December 31, 2023, 2022 and 2021	66
Consolidated Statements of Stockholders' Equity for the years ended December 31, 2023, 2022 and 2021	67
Consolidated Statements of Cash Flows for the years ended December 31, 2023, 2022 and 2021	68
Notes to Consolidated Financial Statements	69

2. *Financial Statement Schedules.* The following consolidated financial statement schedule is included in this Annual Report on Form 10-K.

Schedule II – Valuation and Qualifying Accounts

Schedules other than those listed above have been omitted since they are either not required or information is otherwise included.

3. *Exhibits.* The following exhibits are filed as part of this Annual Report on Form 10-K.

Exhibit No.	Title
+3.1(1)	Restated Articles of Organization of the Registrant
+3.2(2)	Articles of Amendment to Restated Articles of Organization, as filed with the Secretary of State of Massachusetts on May 18, 2001
+3.3(3)	Articles of Amendment to Restated Articles of Organization, as filed with the Secretary of State of Massachusetts on May 16, 2002
+3.4(4)	Amended and Restated By-Laws of the Registrant
+4.1(5)	Specimen certificate representing the Common Stock
+4.2(5)	Description of Capital Stock Registered Under Section 12 of the Exchange Act
+10.1(6)	Credit Agreement, dated as of August 17, 2022, by and among the Registrant, the lenders and letter of credit issuers party thereto and JPMorgan Chase Bank, N.A., as administrative agent and collateral agent
+10.2(7)	First Amendment to Credit Agreement, dated as of October 3, 2023, by and among the Registrant, as parent borrower, the other loan parties party thereto, JPMorgan Chase Bank, N.A., as administrative agent, and each lender party thereto
+10.3(8)	Second Amendment to Credit Agreement, dated as of January 22, 2024, by and among the Registrant, as parent borrower, the other loan parties party thereto, JPMorgan Chase Bank, N.A., as administrative agent, and each lender party thereto

Exhibit No.	Title
+10.4(9)	Third Amendment to Credit Agreement, dated as of February 13, 2024, by and among the Registrant, as parent borrower, the other loan parties party thereto, JPMorgan Chase Bank, N.A., as administrative agent, and each lender and letter of credit issuer party thereto
+10.5(10)*	2022 Stock Incentive Plan
+10.6(11)*	Form of Restricted Stock Unit Agreement for Non-Employee Directors under the 2022 Stock Incentive Plan
+10.7(11)*	Form of Restricted Stock Unit Agreement for Employees under the 2022 Stock Incentive Plan for 2022
+10.8(12)*	Form of Restricted Stock Unit Agreement for Employees under the 2022 Stock Incentive Plan for 2023
10.9*	Form of Restricted Stock Unit Agreement for Employees under the 2022 Stock Incentive Plan for 2024 (Standard)
10.10*	Form of Restricted Stock Unit Agreement for Employees under the 2022 Stock Incentive Plan for 2024 (rTSR)
+10.11(4)*	2014 Stock Incentive Plan
+10.12(4)*	2014 Employee Stock Purchase Plan
+10.13(13)*	Form of Restricted Stock Unit Agreement for Employees under the 2014 Stock Incentive Plan
+10.14(14)*	Employment Agreement, dated October 22, 2013, between Gerald G. Colella and the Registrant
+10.15(15)*	Amendment, dated March 27, 2018, to Employment Agreement, dated as of October 22, 2013, between Gerald G. Colella and the Registrant
+10.16(16) *	Second Amendment, dated October 29, 2018, to Employment Agreement, dated as of October 22, 2013, between Gerald G. Colella and the Registrant
+10.17(17)*	Employment Agreement, dated as of November 18, 2019, between John T.C. Lee and the Registrant
+10.18(18)*	Employment Agreement, effective August 1, 2016, between Seth Bagshaw and the Registrant
+10.19(16)*	Amendment, dated October 29, 2018, to Employment Agreement, effective August 1, 2016, by and between Seth Bagshaw and the Registrant
+10.20(19)*	Employment Agreement, effective August 1, 2016, between Kathleen Burke and the Registrant, as amended on October 29, 2018
+10.21(5)*	Employment Agreement, effective September 16, 2019, between James A. Schreiner and the Registrant
+10.22(20)*	Amendment, dated October 25, 2021, to Employment Agreement, effective September 16, 2019, between James A. Schreiner and the Registrant
+10.23(21)*	Employment Agreement, effective February 18, 2021, between Mark Gitin, the Registrant and Newport Corporation
+10.24(21)*	Employment Agreement, effective January 1, 2020, between David Henry and the Registrant
+10.25(21)*	Employment Agreement, effective February 17, 2021, between Eric Taranto and the Registrant
+10.26(22)*	Management Incentive Plan
21.1	Subsidiaries of the Registrant
23.1	Consent of PricewaterhouseCoopers LLP
31.1	Certification of Principal Executive Officer pursuant to Rule 13a-14(a)/Rule 15d-14(a) of the Securities Exchange Act of 1934
31.2	Certification of Principal Financial Officer pursuant to Rule 13a-14(a)/Rule 15d-14(a) of the Securities Exchange Act of 1934
32.1	Certification of Chief Executive Officer and Chief Financial Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002

Exhibit No.	Title
97.1	Dodd-Frank Compensation Recovery Policy
101.INS**	Inline XBRL Instance Document - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document.
101.SCH**	Inline XBRL Taxonomy Extension Schema with Embedded Linkbase Documents
104	Cover Page Interactive Data File (formatted as inline XBRL with applicable taxonomy extension information contained in Exhibits 101)

+ Previously filed

* Management contract or compensatory plan arrangement

** Filed with this Annual Report on Form 10-K for the year ended December 31, 2023 are the following documents formatted in iXBRL (Inline Extensible Business Reporting Language): (i) the Consolidated Balance Sheets; (ii) the Consolidated Statements of Operations and Comprehensive (Loss) Income; (iii) the Consolidated Statements of Stockholders' Equity; (iv) the Consolidated Statements of Cash Flows; and (v) the Notes to Consolidated Financial Statements.

The following materials from MKS Instruments, Inc.'s Annual Report on Form 10-K for the year ended December 31, 2023, are formatted in XBRL (Extensible Business Reporting Language): (i) the Consolidated Balance Sheets, (ii) the Consolidated Statements of Operations and Comprehensive (Loss) Income, (iii) the Consolidated Statements of Stockholders' Equity, (iv) the Consolidated Statements of Cash Flows, and (v) Notes to Consolidated Financial Statements.

- (1) Incorporated by reference to the Registration Statement on Form S-4 (File No. 333-49738), filed with the Securities and Exchange Commission on November 13, 2000.
- (2) Incorporated by reference to the Registrant's Quarterly Report on Form 10-Q for the quarter ended June 30, 2001 (File No. 000-23621), filed with the Securities and Exchange Commission on August 14, 2001.
- (3) Incorporated by reference to the Registrant's Quarterly Report on Form 10-Q for the quarter ended June 30, 2002 (File No. 000-23621), filed with the Securities and Exchange Commission on August 13, 2002.
- (4) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on May 6, 2014.
- (5) Incorporated by reference to the Registrant's Annual Report on Form 10-K for the year ended December 31, 2019 (File No. 000-23621), filed with the Securities and Exchange Commission on February 28, 2020.
- (6) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on August 17, 2022.
- (7) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on October 3, 2023.
- (8) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on January 22, 2024.
- (9) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on February 14, 2024.
- (10) Incorporated by reference to the Registration Statement on Form S-8 (File No. 333-264817), filed with the Securities and Exchange Commission on May 10, 2022.
- (11) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on May 11, 2022.
- (12) Incorporated by reference to the Registrant's Annual Report on Form 10-K for the year ended December 31, 2022 (File No. 000-23621), filed with the Securities and Exchange Commission on March 14, 2023.
- (13) Incorporated by reference to the Registrant's Annual Report on Form 10-K for the year ended December 31, 2018 (File No. 000-23621), filed with the Securities and Exchange Commission on February 26, 2019.
- (14) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on October 24, 2013.

- (15) Incorporated by reference to the Registrant's Quarterly Report on Form 10-Q for the quarter ended March 31, 2018 (File No. 000-23621), filed with the Securities and Exchange Commission on May 8, 2018.
- (16) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on November 1, 2018.
- (17) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on November 20, 2019.
- (18) Incorporated by reference to the Registrant's Quarterly Report on Form 10-Q for the quarter ended June 30, 2016 (File No. 000-23621), filed with the Securities and Exchange Commission on August 3, 2016.
- (19) Incorporated by reference to the Registrant's Quarterly Report on Form 10-Q for the quarter ended June 30, 2019 (File No. 000-23621), filed with the Securities and Exchange Commission on August 7, 2019.
- (20) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on October 29, 2021.
- (21) Incorporated by reference to the Registrant's Annual Report on Form 10-K for the year ended December 31, 2020 (File No.000-23621), filed with the Securities and Exchange Commission on February 23, 2021.
- (22) Incorporated by reference to the Registrant's Current Report on Form 8-K (File No. 000-23621), filed with the Securities and Exchange Commission on February 11, 2022.

(b) Exhibits

MKS hereby files as exhibits to its Annual Report on Form 10-K those exhibits listed in Item 15(a) above.

Item 16. Form 10-K Summary

Not applicable.

MKS INSTRUMENTS, INC.
SCHEDULE II - VALUATION AND QUALIFYING ACCOUNTS
(in millions)

Description	Balance at Beginning of Year	Additions			Deductions & Write-offs	Balance at End of Year
		Acquisition Beginning Balance	Charged to Costs and Expenses	Charged to Other Accounts		
Allowance for doubtful accounts:						
Years ended December 31,						
2023	\$ 11	\$ —	\$ —	\$ —	\$ (5)	\$ 6
2022	\$ 4	\$ 10	\$ 2	\$ —	\$ (5)	\$ 11
2021	\$ 2	\$ —	\$ 1	\$ —	\$ 1	\$ 4

Description	Balance at Beginning of Year	Additions			Deductions & Write-offs	Balance at End of Year
		Acquisition Beginning Balance	Charged to Costs and Expenses	Charged to Other Accounts		
Allowance for sales returns:						
Years ended December 31,						
2023	\$ 1	\$ —	\$ —	\$ —	\$ —	\$ 1
2022	\$ 2	\$ —	\$ (1)	\$ —	\$ —	\$ 1
2021	\$ 1	\$ —	\$ 1	\$ —	\$ —	\$ 2

Description	Balance at Beginning of Year	Additions			Deductions	Balance at End of Year
		Acquisition Beginning Balance	Charged to Costs and Expenses	Charged to Other Accounts		
Valuation allowance on deferred tax asset:						
Years ended December 31,						
2023	\$ 181	\$ —	\$ 12	\$ —	\$ (3)	\$ 190
2022	\$ 26	\$ 156	\$ —	\$ —	\$ (1)	\$ 181
2021	\$ 31	\$ —	\$ 2	\$ —	\$ (7)	\$ 26

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this annual report on Form 10-K for the fiscal year ended December 31, 2023 to be signed on its behalf by the undersigned, thereunto duly authorized on the 27th day of February 2024.

MKS INSTRUMENTS, INC.

By: /s/ John T.C. Lee
 John T.C. Lee
 President and Chief Executive Officer
 (Principal Executive Officer)

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the date indicated.

<u>SIGNATURES</u>	<u>TITLE</u>	<u>DATE</u>
<u>/s/ Gerald G. Colella</u> Gerald G. Colella	Chairman of the Board of Directors	February 27, 2024
<u>/s/ John T.C. Lee</u> John T.C. Lee	President, Chief Executive Officer and Director (Principal Executive Officer)	February 27, 2024
<u>/s/ Seth H. Bagshaw</u> Seth H. Bagshaw	Executive Vice President, Chief Financial Officer and Treasurer (Principal Financial and Accounting Officer)	February 27, 2024
<u>/s/ Rajeev Batra</u> Rajeev Batra	Director	February 27, 2024
<u>/s/ Peter J. Cannone III</u> Peter J. Cannone III	Director	February 27, 2024
<u>/s/ Joseph B. Donahue</u> Joseph B. Donahue	Director	February 27, 2024
<u>/s/ Jacqueline F. Moloney</u> Jacqueline F. Moloney	Director	February 27, 2024
<u>/s/ Elizabeth A. Mora</u> Elizabeth A. Mora	Director	February 27, 2024
<u>/s/ Michelle M. Warner</u> Michelle M. Warner	Director	February 27, 2024

Board of Directors

Gerald G. Colella

Chairman
MKS Instruments, Inc.

Rajeev Batra

President
Siemens Industry Inc.
and Member, Siemens
U.S. Managing Board

Peter J. Cannone III

Chairman and
Chief Executive Officer
Demand Science Group, LLC

Joseph B. Donahue

Former Executive Vice President
and Chief Operating Officer
TE Connectivity Ltd.

John T.C. Lee

President and
Chief Executive Officer
MKS Instruments, Inc.

Jacqueline F. Moloney

Chancellor Emerita and Professor
University of Massachusetts Lowell

Elizabeth A. Mora

Former Chief Administrative Officer
The Charles Stark Draper
Laboratory, Inc.

Michelle M. Warner

Executive Director
CEO Perspectives
Corporate Leadership Center, NFP

Management

John T.C. Lee

President and
Chief Executive Officer

Madhuri A. Andrews

Executive Vice President
and Chief Information Officer

Seth H. Bagshaw

Executive Vice President,
Chief Financial Officer
and Treasurer*

Sally Ann Bouley

Executive Vice President
and Chief Human Resources Officer

Kathleen F. Burke

Executive Vice President,
General Counsel and Secretary

Henry C. Chang

Senior Vice President
and General Manager, Asia

Mark M. Gitin

Executive Vice President
and General Manager,
Photonics Solutions Division

David P. Henry

Executive Vice President,
Operations and
Corporate Marketing

James A. Schreiner

Executive Vice President and
Chief Operating Officer,
Materials Solutions Division

Eric R. Taranto

Executive Vice President
and General Manager,
Vacuum Solutions Division

**Retiring effective April 1, 2024.*

Corporate Headquarters

MKS Instruments, Inc.
2 Tech Drive, Suite 201
Andover, MA 01810
Telephone: +1.978.645.5500

Outside Counsel

Wilmer Cutler Pickering Hale
and Dorr LLP
Boston, MA

Independent Auditors

PricewaterhouseCoopers LLP
Boston, MA

Stock Listing

Nasdaq Global Select Market
Symbol: MKSI

Transfer Agent

Equiniti Trust Company, LLC
48 Wall Street, Floor 23
New York, NY 10005
Telephone:
US: +1.800.937.5449
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Shareholders may also direct inquiries to:

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Annual Meeting of Shareholders

May 7, 2024, 10:00 a.m. EDT
MKS Instruments, Inc.
2 Tech Drive, Suite 201
Andover, MA 01810



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www.mks.com

