

AS FILED WITH THE SECURITIES AND EXCHANGE COMMISSION ON MARCH 2, 1999

REGISTRATION NO. 333-71363

SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

AMENDMENT NO. 1

TO

FORM S-1
REGISTRATION STATEMENT
UNDER
THE SECURITIES ACT OF 1933

MKS INSTRUMENTS, INC.
(EXACT NAME OF REGISTRANT AS SPECIFIED IN ITS CHARTER)

MASSACHUSETTS
(STATE OR OTHER JURISDICTION OF
INCORPORATION OR ORGANIZATION)

3823
(PRIMARY STANDARD INDUSTRIAL
CLASSIFICATION CODE NUMBER)

04-2277512
(I.R.S. EMPLOYER
IDENTIFICATION NUMBER)

SIX SHATTUCK ROAD
ANDOVER, MA 01810
(978) 975-2350
(ADDRESS, INCLUDING ZIP CODE, AND TELEPHONE NUMBER,
INCLUDING AREA CODE, OF REGISTRANT'S PRINCIPAL EXECUTIVE OFFICES)

JOHN R. BERTUCCI
CHAIRMAN, CHIEF EXECUTIVE OFFICER, AND PRESIDENT
MKS INSTRUMENTS, INC.
SIX SHATTUCK ROAD
ANDOVER, MA 01810
(978) 975-2350
(NAME, ADDRESS, INCLUDING ZIP CODE, AND TELEPHONE
NUMBER, INCLUDING AREA CODE, OF AGENT FOR SERVICE)

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APPROXIMATE DATE OF COMMENCEMENT OF PROPOSED SALE TO THE PUBLIC: As soon as practicable after the effective date hereof.

If any of the securities being registered on this Form are to be offered on a delayed or continuous basis pursuant to Rule 415 under the Securities Act of 1933, check the following box. []

If this Form is filed to register additional securities for an offering pursuant to Rule 462(b) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. []

If this Form is a post-effective amendment filed pursuant to Rule 462(c) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. []

If this Form is a post-effective amendment filed pursuant to Rule 462(d) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering. []

If delivery of the prospectus is expected to be made pursuant to Rule 434, please check the following box: []

CALCULATION OF REGISTRATION FEE

TITLE OF EACH CLASS OF SECURITIES TO BE REGISTERED	AMOUNT TO BE REGISTERED(1)	PROPOSED MAXIMUM OFFERING PRICE PER SHARE	PROPOSED MAXIMUM AGGREGATE OFFERING PRICE	AMOUNT OF REGISTRATION FEE(2)
Common Stock, no par value per share.....	7,475,000 shares	\$17.00	\$127,075,000	\$35,327

(1) Includes 975,000 shares which the underwriters have the option to purchase from the company to cover over-allotments, if any. See "Underwriting."

(2) Pursuant to Rule 457(o) under the Securities Act of 1933, as amended, \$27,800 of the registration fee was paid in connection with the initial filing of the Registration Statement on January 28, 1999.

THE REGISTRANT HEREBY AMENDS THIS REGISTRATION STATEMENT ON SUCH DATE OR DATES AS MAY BE NECESSARY TO DELAY ITS EFFECTIVE DATE UNTIL THE REGISTRANT SHALL FILE A FURTHER AMENDMENT WHICH SPECIFICALLY STATES THAT THIS REGISTRATION STATEMENT SHALL THEREAFTER BECOME EFFECTIVE IN ACCORDANCE WITH SECTION 8(a) OF THE SECURITIES ACT OF 1933 OR UNTIL THE REGISTRATION STATEMENT SHALL BECOME EFFECTIVE ON SUCH DATE AS THE COMMISSION, ACTING PURSUANT TO SECTION 8(a), MAY DETERMINE.

The information contained in this prospectus is not complete and may be changed. The underwriters may not confirm sales of these securities until the registration statement filed with the Securities and Exchange Commission becomes effective. This prospectus is not an offer to sell these securities, and is not soliciting an offer to buy these securities in any state where the offer or sale is not permitted.

SUBJECT TO COMPLETION, DATED MARCH 2, 1999

6,500,000 SHARES

[MKS LOGO]

COMMON STOCK

MKS Instruments, Inc. is offering 6,000,000 shares of its common stock and the selling stockholders are selling an additional 500,000 shares. This is MKS's initial public offering and no public market currently exists for its shares. We have applied for approval for quotation on the Nasdaq National Market under the symbol "MKSI" for the shares we are offering. We estimate that the initial public offering price will be between \$15.00 and \$17.00.

INVESTING IN OUR COMMON STOCK INVOLVES A HIGH DEGREE OF RISK. SEE "RISK FACTORS" BEGINNING ON PAGE 7.

	Per Share	Total
	-----	-----
Public Offering Price	\$	\$
Discounts and Commissions to Underwriters	\$	\$
Proceeds to MKS	\$	\$
Proceeds to the Selling Stockholders	\$	\$

NEITHER THE SECURITIES AND EXCHANGE COMMISSION NOR ANY STATE SECURITIES COMMISSION HAS APPROVED OR DISAPPROVED OF THESE SECURITIES OR DETERMINED IF THIS PROSPECTUS IS TRUTHFUL OR COMPLETE. ANY REPRESENTATION TO THE CONTRARY IS A CRIMINAL OFFENSE.

MKS has granted the underwriters a 30-day option to purchase up to an additional 975,000 shares of common stock to cover over-allotments.

NATIONSBANC MONTGOMERY SECURITIES LLC
DONALDSON, LUFKIN & JENRETTE

LEHMAN BROTHERS

The date of this prospectus is _____, 1999

MKS INSTRUMENTS, INC.
PROSPECTUS COVER
JANUARY 28, 1999

INSIDE FRONT COVER (PG. 2):

This page is produced in four-color process. Amidst a dark background, the MKS logo appears at the top right of the page, and to the top left is the phrase "A Wide Range of Products Made Using MKS Process Control Instruments." Two paragraphs describing the role MKS plays in complex advanced materials manufacturing processes also appear on this page, and are as follows:

(first paragraph) "MKS Surrounds the Process. Technologically complex, gas-related manufacturing processes are used to create such products as semiconductor devices, flat panel displays, fiber optic cables, solar panels, magnetic and optical storage media, and gas lasers. These processes build up very thin layers of materials, step by step, through the interaction of specific gases and materials inside tightly controlled process chambers. Maintaining control of these complex steps throughout the entire manufacturing process is critical to maximizing uptime, yield and throughput (second paragraph) MKS's process control instruments are integrated into many gas-related processes--managing the flow rates of gases entering and exiting the process chamber; controlling the gas composition and pressure inside the chamber; analyzing and monitoring the composition of the gases; and isolating the gases from the outside environment."

In the center of the page is a photo montage, displaying images of semiconductor devices, flat panel displays, fiber optic cables, solar panels, magnetic and optical storage media and gas lasers. Each of these images has a text label adjacent to it.

MKS, MKS Instruments, Baratron and ORION are trademarks of MKS. This prospectus contains trademarks, service marks and trade names of companies and organizations other than MKS.

INSIDE SPREAD (PGS. 3 AND 4):

These pages are produced in four-color process. The main focus of the spread is the illustration of a typical process chamber, with numerous MKS products surrounding the chamber. At the top of the illustration, centered across the two pages, is the title "MKS Instruments...Surrounding the Process." Each product is described in a brief paragraph, and the paragraphs appear on both sides of the illustration--left and right columns. The paragraphs are as follows:

DIRECT LIQUID INJECTION SUBSYSTEMS

For use in the delivery of a wide variety of new materials to the process chamber that cannot be delivered using conventional thermal-based mass flow controllers.

AUTOMATIC PRESSURE CONTROLLERS WITH INTEGRATED BARATRON(R) PRESSURE TRANSDUCERS

A compact, integrated measurement and control package for use in controlling upstream or downstream process chamber pressure.

ULTRA-CLEAN MASS FLOW CONTROLLERS

For the precise measurement and control of mass flow rates of inert or corrosive gases and vapors into the process chamber.

ULTRA-CLEAN MINI-BARATRON(R) PRESSURE TRANSDUCERS

For use in gas cabinets to feed ultra-pure gases to critical process systems.

PRESSURE CONTROL VALVES

To precisely control the flow of gases to a process chamber in a wide range of flow rates.

GAS BOX RATE OF RISE CALIBRATORS

For fast verification of mass flow controller accuracy and repeatability during a process.

DIGITAL COLD CATHODE IONIZATION AND CONVECTION VACUUM GAUGES

A variety of indirect pressure gauges for measuring very low chamber pressures and conveying information digitally to host computers.

ORION(R) PROCESS MONITORS AND RESIDUAL GAS ANALYZERS

For the analysis of the composition of background and process gases inside the process chamber.

PRESSURE SWITCHES

Provide protection of vacuum equipment and processes by signaling when atmospheric pressure has been achieved.

BARATRON(R) PRESSURE MEASURING INSTRUMENTS

For the accurate measurement and control of a wide range of process pressures.

IN-SITU DIAGNOSTICS ACCESS VALVE

Enables accurate calibration and diagnostics of vacuum gauges and pressure transducers while directly mounted on the process chamber.

EXHAUST THROTTLE VALVES AND AUTOMATIC PRESSURE CONTROLLERS

For isolation and downstream control of process chamber pressures and pressure control within the exhaust systems.

HIGH VACUUM VALVES

To isolate the process chamber from both the pumps and atmospheric gases.

HEATED PUMPING LINES

To reduce contaminants in the vacuum pump and pump exhaust stream.

VAPOR SUBLIMATION TRAP

To collect by-products and particulates that could otherwise contaminate devices in the process chamber and damage vacuum pumps.

Prices of products shown above range from \$200 to \$80,000.

The above graphic depicts a generalized process chamber with a number of MKS's manufactured products shown.

YOU SHOULD RELY ONLY ON THE INFORMATION CONTAINED IN THIS PROSPECTUS. WE HAVE NOT AUTHORIZED ANYONE TO PROVIDE YOU WITH INFORMATION DIFFERENT FROM THAT CONTAINED IN THIS PROSPECTUS. WE ARE OFFERING TO SELL, AND SEEKING OFFERS TO BUY, SHARES OF COMMON STOCK ONLY IN JURISDICTIONS WHERE OFFERS AND SALES ARE PERMITTED. THE INFORMATION CONTAINED IN THIS PROSPECTUS IS ACCURATE ONLY AS OF THE DATE OF THIS PROSPECTUS, REGARDLESS OF THE TIME OF DELIVERY OF THIS PROSPECTUS OR OF ANY SALE OF OUR COMMON STOCK. IN THIS PROSPECTUS, "MKS," "WE," "US" AND "OUR" REFER TO MKS INSTRUMENTS, INC. (UNLESS THE CONTEXT OTHERWISE REQUIRES).

UNTIL _____, 1999, ALL DEALERS THAT BUY, SELL OR TRADE OUR COMMON STOCK, WHETHER OR NOT PARTICIPATING IN THIS OFFERING, MAY BE REQUIRED TO DELIVER A PROSPECTUS. THIS REQUIREMENT IS IN ADDITION TO THE DEALERS' OBLIGATION TO DELIVER A PROSPECTUS WHEN ACTING AS UNDERWRITERS AND WITH RESPECT TO THEIR UNSOLD ALLOTMENTS OR SUBSCRIPTIONS.

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PROSPECTUS SUMMARY

This summary highlights information contained elsewhere in this prospectus. You should read this entire prospectus carefully. Unless otherwise indicated, all information contained in this prospectus assumes that the underwriters will not exercise their over-allotment option. This prospectus contains forward-looking statements, which involve risks and uncertainties. MKS's actual results could differ materially from those anticipated in these forward-looking statements as a result of certain factors, including those set forth under "Risk Factors" and elsewhere in this prospectus. All information contained in this prospectus reflects an amendment to MKS's Articles of Organization to be effected prior to the closing of this offering to convert the shares of Class A common stock and Class B common stock into a single class of common stock.

MKS INSTRUMENTS, INC.

We are a leading worldwide developer, manufacturer and supplier of instruments and components used to measure, control and analyze gases in semiconductor manufacturing and similar industrial manufacturing processes. We sold products to over 4,000 customers in 1998. In addition to semiconductors, our products are used in processes to manufacture a diverse range of products, such as flat panel displays, solar cells, gas lasers, fiber optic cables, diamond thin films and coatings for food packagings.

The ability of semiconductor device manufacturers to offer integrated circuits with smaller geometries and greater functionality at higher speeds requires continuous improvements in semiconductor process equipment and process controls. Manufacturing a semiconductor, or a similar industrial product, requires hundreds of process steps, many of which involve the precise measurement and control of gases. In the fabrication of semiconductors, for example, these process steps take place within a process chamber. Specific gas mixtures at precisely controlled pressures are used in the process chamber to control the required process atmosphere and are used as a source of material to manufacture a semiconductor.

Given the complexity of the semiconductor manufacturing process, the value of the products manufactured and the significant cost of semiconductor manufacturing equipment and facilities, significant importance is placed upon:

- uptime, which is the amount of time that semiconductor manufacturing equipment is available for processing

- yield, which is the ratio of acceptable output to total output

- throughput, which is the aggregate output that can be processed per hour

The design and performance of instruments that control the pressure or flow of gases are becoming more critical to the semiconductor manufacturing process since they directly affect uptime, yield and throughput. In addition, the increasing sophistication of semiconductor devices requires an increase in the number of components and subsystems used in the design of semiconductor manufacturing process tools. To address manufacturing complexity, improve quality and reliability, and ensure long-term service and support, semiconductor device manufacturers and semiconductor capital equipment manufacturers are increasingly seeking to reduce their supplier base and are, therefore, choosing to work with suppliers that provide a broad range of integrated, technologically advanced products backed by worldwide service and support.

We believe that we offer the widest range of pressure and vacuum measurement and control products serving the semiconductor industry. Our products measure pressures from as low as one trillionth of atmospheric pressure to as high as two hundred times atmospheric pressure. Our objective is to be the leading worldwide supplier of instruments and components used to measure, control and analyze gases in semiconductor and other advanced thin-film processing applications and to help semiconductor device manufacturers achieve improvements in their return on investment capital. Our strategy to accomplish this objective includes:

- extending our technology leadership
- continuing to broaden our comprehensive product offering
- building upon our close working relationships with customers
- expanding the application of our existing technologies to related markets
- leveraging our global infrastructure and world class manufacturing capabilities

For over 25 years, we have focused on satisfying the needs of semiconductor capital equipment manufacturers and semiconductor device manufacturers. As a result, we have established long-term relationships with many of our customers. We sell our products primarily to:

- semiconductor capital equipment manufacturers
- semiconductor device manufacturers
- industrial manufacturing companies
- university, government and industrial research laboratories

Our customers include Applied Materials, Inc., Lam Research Corporation, Novellus Systems, Inc., Tokyo Electron Limited, Inc., Air Products and Chemicals, Inc. and Motorola, Inc. We sell our products primarily through our direct sales force located in 22 offices worldwide.

MKS Instruments, Inc. is a Massachusetts corporation organized in June 1961. Our principal executive offices are located at Six Shattuck Road, Andover, MA 01810, and our telephone number is (978) 975-2350.

THE OFFERING

Common stock offered by MKS..... 6,000,000 shares

Common stock offered by the selling
stockholders..... 500,000 shares

Common stock to be outstanding after
this offering..... 24,053,167 shares

Use of proceeds..... For distributions to current
stockholders and general corporate
purposes. See "Use of Proceeds" and "S
Corporation and Termination of S
Corporation Status."

Proposed Nasdaq National Market
symbol..... MKSI

The common stock to be outstanding after this offering is based on shares outstanding as of December 31, 1998 and excludes 2,132,575 shares of common stock issuable upon the exercise of options outstanding as of such date at a weighted average exercise price of \$5.19 per share. See "Capitalization" and Note 8 of Notes to Consolidated Financial Statements.

SUMMARY CONSOLIDATED FINANCIAL DATA

MKS has been treated as an S corporation for federal income tax purposes since July 1, 1987. As an S corporation, MKS has not been subject to federal, and certain state, income taxes. The pro forma net income reflects the provision for income taxes that would have been recorded had MKS been a C corporation, assuming an effective tax rate of 38.0%. As a result of terminating its S corporation status upon the closing of this offering, MKS will record a one-time non-cash credit to historical earnings for additional deferred taxes. If this credit to earnings had occurred at December 31, 1998, the amount would have been approximately \$3.9 million. This amount is expected to increase through the closing of this offering and is excluded from pro forma net income. See Notes 2 and 9 of Notes to Consolidated Financial Statements.

Pro forma balance sheet data set forth below reflects the liability for the distribution of an estimated \$35.9 million, calculated as of December 31, 1998, of cumulative undistributed S corporation taxable income for which stockholders of record prior to the closing of this offering have been or will be taxed. The pro forma net income per share and weighted average common shares outstanding which are set forth below reflect the effect of an assumed issuance of sufficient shares to fund this distribution as of January 1, 1998. The distribution will be made out of the proceeds of this offering. The actual amount to be distributed is expected to increase based upon taxable earnings for the period January 1, 1999 through the closing of this offering, subject to certain limitations. See "S Corporation and Termination of S Corporation Status." The pro forma as adjusted balance sheet data reflects the sale of 6,000,000 shares of common stock at an assumed initial public offering price of \$16.00 per share, after deducting the estimated underwriting discount and offering expenses payable by MKS.

	YEAR ENDED DECEMBER 31,				
	1994	1995	1996	1997	1998
	(IN THOUSANDS, EXCEPT PER SHARE DATA)				
STATEMENT OF INCOME DATA:					
Net sales.....	\$106,829	\$157,164	\$170,862	\$188,080	\$139,763
Gross profit.....	47,016	69,461	68,854	80,474	55,979
Income from operations.....	12,087	24,106	16,068	23,963	9,135
Net income.....	\$ 10,003	\$ 21,658	\$ 12,503	\$ 20,290	\$ 7,186
PRO FORMA STATEMENT OF INCOME DATA(1):					
Pro forma net income.....					\$ 5,044
Pro forma net income per share:					
Basic.....					\$ 0.25
Diluted.....					\$ 0.24
Pro forma weighted average common shares outstanding:					
Basic.....					20,295
Diluted.....					20,780

DECEMBER 31, 1998

PRO FORMA

	ACTUAL	PRO FORMA	AS ADJUSTED
	-----	-----	-----
	(IN THOUSANDS)		
BALANCE SHEET DATA:			
Cash and cash equivalents.....	\$ 11,188	\$ 11,188	\$ 63,942
Working capital (deficit).....	31,493	(4,433)	84,247
Total assets.....	96,232	96,232	148,986
Short-term obligations.....	12,819	12,819	12,819
Long-term obligations, less current portion.....	13,786	13,786	13,786
Stockholders' equity.....	54,826	18,900	107,580

 (1) Data is computed on the same basis as Note 2 of Notes to Consolidated Financial Statements.

RISK FACTORS

You should consider carefully the risks described below before you decide to buy our common stock. The risks and uncertainties described below are not the only ones facing us. Additional risks and uncertainties that we do not presently know about or that we currently believe are immaterial may also adversely impact our business operations. If any of the following risks actually occur, our business, financial condition or results of operations would likely suffer. In such case, the trading price of our common stock could fall, and you may lose all or part of the money you paid to buy our common stock.

This prospectus contains forward-looking statements that involve risks and uncertainties. These forward-looking statements are usually accompanied by words such as "believes," "anticipates," "plans," "expects" and similar expressions. Our actual results may differ materially from the results discussed in the forward-looking statements because of factors such as the Risk Factors discussed below.

OUR PERFORMANCE IS AFFECTED BY THE CYCLICALITY OF THE SEMICONDUCTOR INDUSTRY

We estimate that approximately 60% of our sales during 1997 and 1998 were to semiconductor capital equipment manufacturers and semiconductor device manufacturers, and we expect that sales to such customers will continue to account for a substantial majority of our sales. Our business depends substantially upon the capital expenditures of semiconductor device manufacturers, which in turn depend upon the demand for semiconductors and other products utilizing semiconductors. Periodic reductions in demand for the products manufactured by semiconductor capital equipment manufacturers and semiconductor device manufacturers may adversely affect our business, financial condition and results of operations. Historically, the semiconductor market has been highly cyclical and has experienced periods of overcapacity, resulting in significantly reduced demand for capital equipment. For example, in 1996 and 1998 the semiconductor industry experienced a significant decline, which caused a number of our customers to reduce their orders. We cannot be certain that the current semiconductor downturn that began in 1998 will not continue. A further decline in the level of orders as a result of any future downturn or slowdown in the semiconductor industry could have a material adverse effect on our business, financial condition and results of operations.

OUR NET SALES AND RESULTS OF OPERATIONS CAN BE ADVERSELY AFFECTED BY THE INSTABILITY OF ASIAN ECONOMIES

The financial markets in Asia, one of our principal international markets, have experienced significant turbulence. Turbulence in the Asian markets can adversely affect our net sales and results of operations. Our direct net sales to customers in Asian markets have been approximately 17% to 18% of total net sales for the past three years. Our sales include both direct sales to the semiconductor industry in Asia, as well as to semiconductor capital equipment manufacturers that derive a significant portion of their revenue from sales to the Asian semiconductor industry. Turbulence in the Asian markets began to adversely affect the semiconductor device manufacturers and semiconductor capital equipment manufacturers in the fourth quarter of 1997 and continued to adversely affect them in 1998. We expect the turbulence in the Asian markets will continue to adversely affect sales of semiconductor capital equipment manufacturers for at least the first quarter of 1999. As a result, for at least the first quarter we currently expect that our 1999 quarterly net sales and net income will be less than net sales and net income for the comparable quarter of 1998.

THE JUST-IN-TIME NATURE OF OUR BUSINESS COULD CAUSE SUBSTANTIAL FLUCTUATIONS IN OUR QUARTERLY OPERATING RESULTS

A substantial portion of our shipments occur shortly after an order is received and therefore we operate with a low level of backlog. As a consequence of the just-in-time nature of shipments and the low level of backlog, a decrease in demand for our products from one or more customers could occur with limited advance notice and could have a material adverse effect on our results of operations in any particular period.

OUR FIXED COSTS MAY LEAD TO FLUCTUATIONS IN OPERATING RESULTS IF OUR NET SALES ARE BELOW EXPECTATIONS

A significant percentage of our expenses are relatively fixed and based in part on expectations of future net sales. The inability to adjust spending quickly enough to compensate for any shortfall would magnify the adverse impact of a shortfall in net sales on our results of operations. Factors that could cause fluctuations in our net sales include:

- - the timing of the receipt of orders from major customers
- - customer cancellations or shipment delays
- - disruption in sources of supply
- - seasonal variations of capital spending by customers
- - production capacity constraints
- - specific features requested by customers
- - our or our competitors' introduction or announcement of new products

For example, we were in the process of increasing production capacity when the semiconductor capital equipment market began to experience a significant downturn in 1996. This downturn had a material adverse effect on our operating results in the second half of 1996 and the first half of 1997. After an increase in business in the latter half of 1997, the market experienced another downturn in 1998, which had a material adverse effect on our 1998 operating results. As a result of the factors discussed above, it is likely that we will in the future experience quarterly or annual fluctuations and that, in one or more future quarters, our operating results will fall below the expectations of public market analysts or investors. In any such event, the price of our common stock could decline significantly.

OUR FIVE LARGEST CUSTOMERS HAVE HISTORICALLY ACCOUNTED FOR A SIGNIFICANT PORTION OF OUR NET SALES

Our five largest customers in 1996, 1997 and 1998 accounted for approximately 26%, 32% and 24%, respectively, of our net sales. The loss of a major customer or any reduction in orders by such customers, including reductions due to market or competitive conditions, would likely have a material adverse effect on our business, financial condition and results of operations. During 1998, one customer, Applied Materials, Inc., accounted for approximately 16% of our net sales. While we have entered into a purchase contract with Applied Materials, Inc. which expires in 2000 unless it is extended by mutual agreement, none of our significant customers, including Applied Materials, Inc., has entered into an agreement requiring it to purchase any minimum quantity of our products. The demand for our products from our semiconductor capital equipment customers depends in part on orders received by them from their semiconductor device manufacturer customers.

Attempts to lessen the adverse effect of any loss or reduction through the rapid addition of new customers could be difficult because 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
- the success of our customers in creating demand for their capital equipment products which incorporate our products

INCREASED COMPETITION MAY RESULT IN PRICE REDUCTIONS AND DECREASED DEMAND FOR OUR PRODUCTS

The markets for our products are highly competitive. Although no one competitor competes with us across all product lines, our competitors could consolidate and/or form alliances to offer a broader array of products to compete against us. Growing competition may result in price reductions of our products and services, reduced net sales and gross margins and loss of market share, any one of which could have a material adverse effect on our business, financial condition and results of operations. We currently encounter substantial competition in each of our product lines from a number of competitors, including:

- competitors with greater financial and other resources
- small competitors with well-established specific product niches
- customers who develop in-house products that serve the functions of and replace our products

In some cases, particularly with respect to mass flow controllers, semiconductor device manufacturers may direct semiconductor capital equipment manufacturers to use a specified supplier's product in their equipment. Accordingly, for such products, our success will depend in part on our ability to have semiconductor device manufacturers specify that our products be used at their semiconductor fabrication facilities. In addition, we may encounter difficulties in changing established relationships of competitors with a large installed base of products at such semiconductor fabrication facilities. We cannot be sure that our competitors will not develop products that offer price or performance features superior to those of our products. To the extent that our products do not achieve performance or other advantages over products offered by our competitors, we are likely to experience increased price competition or loss of market share with respect to such products.

OUR SUCCESS DEPENDS ON OUR ABILITY TO DEVELOP NEW AND ENHANCED PRODUCTS FOR THE SEMICONDUCTOR INDUSTRY

Our markets are subject to rapid technological changes. If we fail to develop products and enhancements for general acceptance by our customers in a timely manner, our business, financial condition and results of operations could be materially adversely affected. For example, the semiconductor manufacturing industry, our principal market, is currently undergoing an evolution from the manufacturing of 200mm wafers to 300mm wafers and from 0.25 micron to 0.18 micron line-widths. Semiconductor manufacturers are beginning to establish pilot production lines and specifications for the use of 300mm wafers and the production of less than 0.18 micron devices. We have developed, and are developing, new products and product enhancements to address the expected increasing demand for equipment capable of handling these new wafer sizes and line-widths. We have supplied pre-production equipment to be incorporated into semiconductor capital equipment manufacturers' 300mm pre-production semiconductor wafer process equipment, which is expected to be included in pilot production lines of semiconductor device manufacturers. We have also developed equipment that is being used by research laboratories for devices using less than 0.18 micron line-widths. However, we cannot be certain that our new products and enhancements will be designed into production lines by our customers.

FAILURE BY US TO IDENTIFY AND REMEDIATE ALL MATERIAL YEAR 2000 RISKS COULD ADVERSELY AFFECT US

We have implemented a multi-phase Year 2000 project consisting of assessment and remediation, and testing following remediation. We cannot, however, be certain that we have identified all of the potential risks. Failure by us to identify and remediate all material Year 2000 risks could adversely affect our business, financial condition and results of operations. We have identified the following risks you should be aware of:

- we cannot be certain that the entities on whom we rely for certain goods and services that are important for our business will be successful in addressing all of their software and systems problems in order to operate without disruption in the year 2000 and beyond
- our customers or potential customers may be affected by Year 2000 issues that may, in part:
 - cause a reduction, delay or cancelation of customer orders
 - cause a delay in payments for products shipped
 - cause customers to expend significant resources on Year 2000

compliance matters, rather than investing in our products

- we have not developed a contingency plan related to the failure of our or a third-party's Year 2000 remediation efforts and may not be prepared for such an event

Further, while we have made efforts to notify our customers who have purchased potential non-compliant products, we cannot be sure that customers who purchased such products will not assert claims against us alleging that such products should have been Year 2000 compliant at the time of purchase, which could result in costly litigation and divert management's attention.

WE INTEND TO EXPAND OUR BUSINESS OUTSIDE THE SEMICONDUCTOR INDUSTRY AND OUR BUSINESS COULD BE MATERIALLY ADVERSELY AFFECTED IF WE FAIL TO SUCCESSFULLY PENETRATE ADDITIONAL MARKETS

We plan to build upon our experience in manufacturing and selling gas measurement, control and analysis products used by the semiconductor industry by designing and selling such products for applications in other industries which use production processes similar to those used in the semiconductor industry. Any failure by us to penetrate additional markets would limit our ability to reduce our vulnerability to downturns in the semiconductor industry and could have a material adverse effect on our business, financial condition and results of operations.

We have limited experience selling our products in certain markets outside the semiconductor industry. We cannot be certain that we will be successful in the expansion of our business outside the semiconductor industry. Our future success will depend in part on our ability to:

- identify new applications for our products
- adapt our products for such applications
- market and sell such products to customers

DIFFICULTY IN EXPANDING OUR MANUFACTURING CAPACITY COULD REDUCE OUR MARKET SHARE

During 1999, we plan to add manufacturing capacity to our Austin, Texas operations and further equip our cleanroom facilities in Andover and Methuen, Massachusetts. Our ability to increase sales of certain products depends in part upon our ability to expand our manufacturing capacity for such products in a timely manner. If we are unable to expand our manufacturing capacity on a timely basis or to manage such expansion effectively, our customers could seek such products from others and our market share could be reduced. Because the semiconductor industry is subject to rapid demand shifts which are difficult to foresee, we may not be able to increase capacity quickly enough to respond to a rapid increase in demand in the semiconductor industry. Additionally, capacity expansion could increase our fixed operating expenses and if sales levels do not increase to offset the additional expense levels associated with any such expansion, our business, financial condition and results of operations could be materially adversely affected.

OUR SALES AND RESULTS OF OPERATIONS COULD BE ADVERSELY AFFECTED BY DOWNTURNS IN ECONOMIC CONDITIONS IN COUNTRIES OUTSIDE OF THE UNITED STATES

International sales, which include sales by our foreign subsidiaries, but exclude direct export sales which were less than 10% of our total net sales, accounted for approximately 30% of net sales in 1996, 27% of net sales in 1997 and 32% of net sales in 1998. We anticipate that international sales will continue to account for a significant portion of our net sales. In addition, certain of our key domestic customers derive a significant portion of their revenues from sales in international markets. Therefore, our sales and results of operations could be adversely affected by economic slowdowns and other risks associated with international sales.

EXCHANGE RATE FLUCTUATIONS COULD ADVERSELY AFFECT OUR NET SALES AND RESULTS OF OPERATIONS

Exchange rate fluctuations could have an adverse effect on our net sales and results of operations and we could experience losses with respect to our hedging activities. Unfavorable currency fluctuations could require us to increase prices to foreign customers which could result in lower net sales by us to such customers. Alternatively, if we do not adjust the prices for our products in response to unfavorable currency fluctuations, our results of operations could be adversely affected. In addition, sales made by our foreign subsidiaries are denominated in the currency of the country in which these products are sold and the currency we receive in payment for such sales could be less valuable at the time of receipt as a result of exchange rate fluctuations. While we enter into forward exchange contracts and local currency purchased options to reduce currency exposure arising from these sales and associated intercompany purchases of inventory, we cannot be certain that our efforts will be adequate to protect us against significant currency fluctuations or that such efforts will not expose us to additional exchange rate risks.

WE NEED TO RETAIN AND ATTRACT KEY PERSONNEL SKILLED WITH KNOWLEDGE OF INSTRUMENTS AND COMPONENTS USED IN SEMICONDUCTOR AND INDUSTRIAL MANUFACTURING PROCESSES

Our success depends to a large extent upon the efforts and abilities of a number of key employees and officers, particularly those with expertise in the semiconductor manufacturing and similar industrial manufacturing industries. The loss of key employees or officers could have a material adverse effect on our business, financial condition and results of operations. We believe that our future success will depend in part on our ability to attract and retain highly skilled technical, financial, managerial and marketing personnel. Competition for such personnel is intense, and we cannot be certain that we will be successful in attracting and retaining such personnel. We are the beneficiary of key-man life insurance policies on John R. Bertucci, Chairman, Chief Executive Officer and President, in the amount of \$7.2 million.

OUR BUSINESS COULD BE ADVERSELY AFFECTED IF WE ARE UNABLE TO PROTECT OUR PROPRIETARY TECHNOLOGY

Although we seek to protect our intellectual property rights through patents, copyrights, trade secrets and other measures, we cannot be certain that:

- we will be able to protect our technology adequately
- competitors will not be able to develop similar technology independently
- any of our pending patent applications will be issued
- intellectual property laws will protect our intellectual property rights
- third parties will not assert that our products infringe patent, copyright or trade secrets of such parties

PROTECTION OF OUR INTELLECTUAL PROPERTY RIGHTS MAY RESULT IN COSTLY LITIGATION

Litigation may be necessary in order to enforce our patents, copyrights or other intellectual property rights, to protect our trade secrets, to determine the validity and scope of the proprietary rights of others or to defend against claims of infringement. Such litigation could result in substantial costs and diversion of resources and could have a material adverse effect on our business, financial condition and results of operations.

TRADING IN OUR SHARES COULD BE SUBJECT TO EXTREME PRICE FLUCTUATIONS AND YOU COULD HAVE DIFFICULTY TRADING YOUR SHARES

The market for shares in newly public technology companies is subject to extreme price and volume fluctuations. These broad market fluctuations may materially and adversely affect the market price of our common stock. In addition, although our common stock will be quoted on the Nasdaq National Market, an active trading market may not develop and be sustained after this offering.

YOU WILL EXPERIENCE AN IMMEDIATE AND SUBSTANTIAL DILUTION IN THE BOOK VALUE OF YOUR INVESTMENT

Purchasers of common stock in this offering will incur immediate and substantial dilution of \$11.53 in the pro forma net tangible book value per share of common stock from the assumed initial public offering price of \$16.00 per share.

AFTER THIS OFFERING ONE STOCKHOLDER, ALONG WITH MEMBERS OF HIS FAMILY, WILL HAVE CONTROLLING INTEREST IN MKS

Upon consummation of this offering, John R. Bertucci, Chairman, Chief Executive Officer and President of MKS, and members of his family will, in the aggregate, beneficially own approximately 70% of our outstanding common stock. As a result, these stockholders, acting together, will be able to take any of the following actions without the approval of our public stockholders:

- amend our Articles of Organization in certain respects or approve a merger, sale of assets or other major corporate transaction
- defeat any non-negotiated takeover attempt that may be beneficial to our public stockholders
- determine the amount and timing of dividends paid to themselves and to our public stockholders
- otherwise control our management and operations and the outcome of all matters submitted for a stockholder vote, including the election of directors

CERTAIN PROVISIONS OF OUR ARTICLES OF ORGANIZATION, OUR BY-LAWS AND MASSACHUSETTS LAW COULD DISCOURAGE POTENTIAL ACQUISITION PROPOSALS AND COULD DELAY OR PREVENT A CHANGE IN CONTROL OF MKS

Anti-takeover provisions could diminish the opportunities for stockholders to participate in tender offers including tender offers at a price above the then current market value of the common stock. Such provisions may also inhibit increases in the market price of the common stock that could result from takeover attempts. For example, while we have no present plans to issue any preferred stock, the 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 MKS. The issuance of preferred stock could adversely affect the voting power of the holders of common stock including the loss of voting control to others. In addition, our By-Laws will provide for a classified Board of Directors consisting of three classes. This classified board could also have the effect of delaying, deterring or preventing a change in control of MKS.

FUTURE SALES BY OUR EXISTING STOCKHOLDERS COULD ADVERSELY AFFECT THE MARKET PRICE OF OUR COMMON STOCK

Sales of our common stock in the public market following this offering could adversely affect the market price of the common stock. All of the shares offered under this prospectus will be freely tradable in the open market, and

- 17,553,165 additional shares may be sold after the expiration of 180-day lock-up agreements
- approximately 1,100,000 additional shares may be sold upon the exercise of stock options after the expiration of 180-day lock-up agreements

S CORPORATION AND TERMINATION OF S CORPORATION STATUS

MKS has been treated as an S corporation for federal income tax purposes since July 1, 1987. As a result, MKS currently pays no federal, and certain state, income tax, and all of the earnings of MKS are subject to federal, and certain state, income taxation directly at the stockholder level. MKS's S corporation status will terminate upon the closing of this offering, at which time MKS will become subject to corporate income taxation under Subchapter C of the Internal Revenue Code and applicable state income taxation law. Pro forma statement of income data set forth in this prospectus has been adjusted to include pro forma income tax provisions as if MKS had been a C corporation during the relevant periods.

As soon as practicable following the closing of this offering, MKS intends to make a distribution to the holders of record on the day prior to the closing of this offering in an amount equivalent to the "accumulated adjustments account," as defined in Section 1368(a)(1) of the Internal Revenue Code. As of December 31, 1998, the outstanding balance of the accumulated adjustments account was estimated to be approximately \$35.9 million, and such balance is expected to increase in the period from January 1, 1999 through the closing of this offering. The accumulated adjustments account is cumulatively equal to financial reporting income, adjusted for differences between the methods of accounting used for financial accounting and for federal income tax purposes from July 1, 1987 through the date of termination of MKS's S corporation status, that has not been previously distributed. Investors purchasing shares in this offering will not receive any portion of the distribution.

MKS expects to enter into a Tax Indemnification and S Corporation Distribution Agreement with its existing stockholders providing for, among other things, the indemnification of MKS by such stockholders for any federal and state income taxes, including interest, incurred by MKS if for any reason MKS is deemed to be treated as a C corporation during any period in which it reported its taxable income as an S corporation. The tax indemnification obligation of the existing stockholders is limited to the amount of any reduction in their tax liability as a result of any such determination. This agreement also provides for the cross-indemnification by MKS of each existing stockholder for any losses or liabilities with respect to certain additional taxes, including interest and penalties, resulting from MKS's operations during the period in which it was an S corporation. The agreement further provides for the payment, with interest, by the existing stockholders or MKS, as the case may be, for the difference between the amount to be distributed and the actual amount of accumulated adjustments account on the day immediately preceding the closing of this offering. The actual amount of the accumulated adjustments account on the day prior to the closing of this offering cannot be determined until MKS calculates the amount of its taxable income for the year ending December 31, 1999. Purchasers of common stock in this offering will not be parties to the Tax Indemnification and S Corporation Distribution Agreement.

USE OF PROCEEDS

The net proceeds we will receive from the sale of the 6,000,000 shares of common stock offered by us are estimated to be \$88,680,000 (\$103,188,000 if the underwriters' over-allotment option is exercised in full), after deducting the estimated underwriting discount and offering expenses payable by us and assuming an initial public offering price of \$16.00 per share. We will not receive any of the proceeds from the sale of shares by the selling stockholders.

We will use proceeds from this offering to pay current stockholders our undistributed S corporation earnings through the closing of this offering. The undistributed S corporation earnings were estimated to be approximately \$35.9 million at December 31, 1998, and are expected to increase from January 1, 1999 to the closing of this offering. See "S Corporation and Termination of S Corporation Status." We expect to use the remainder of the net proceeds for general corporate purposes, including working capital, product development and capital expenditures.

A portion of the net proceeds after the S corporation distribution may also be used for the acquisition of businesses, products and technologies that are complementary to those of MKS. There are currently no active negotiations, commitments or agreements with respect to any acquisition. Pending such uses, we intend to invest the net proceeds from this offering in short-term, investment-grade, interest-bearing securities.

DIVIDEND POLICY

We currently intend, subject to our contractual obligations under the Tax Indemnification and S Corporation Distribution Agreement, to retain earnings for the continued development of our business. Restrictions or limitations on the payment of dividends may be imposed in the future under the terms of credit agreements or under other contractual provisions. In the absence of such restrictions or limitations, the payment of any dividends will be at the discretion of our Board of Directors.

CAPITALIZATION

The following table sets forth the capitalization of MKS (1) as of December 31, 1998, (2) on a pro forma basis to reflect distributions and adjustments in connection with MKS's S corporation status and (3) as adjusted to reflect the sale of 6,000,000 shares of common stock by MKS at an assumed initial public offering price of \$16.00 per share and the application of the net proceeds therefrom. See "Use of Proceeds."

The pro forma data reflects the liability for distribution of an estimated \$35.9 million, calculated as of December 31, 1998, of cumulative undistributed S corporation taxable income for which stockholders of record prior to the closing of this offering have been or will be taxed. The actual amount to be distributed is expected to increase based upon taxable earnings for the period from January 1, 1999 through the closing of this offering, subject to certain limitations. See "S Corporation and Termination of S Corporation Status" and Notes 2 and 9 of Notes to Consolidated Financial Statements. The pro forma as adjusted numbers have been adjusted to reflect the issuance of 6,000,000 shares of common stock at an assumed initial public offering price of \$16.00 per share, after deducting the estimated underwriting discount and offering expenses payable by MKS. The remaining balance in retained earnings represents accumulated earnings prior to MKS's conversion from a C corporation to an S corporation in 1987, accumulated income in overseas subsidiaries and differences between book and tax accumulated income.

	DECEMBER 31, 1998		
	ACTUAL	PRO FORMA	PRO FORMA AS ADJUSTED
	(IN THOUSANDS, EXCEPT SHARE DATA)		
Long-term obligations, less current portion.....	\$13,786	\$13,786	\$ 13,786
Stockholders' equity:			
Common stock, no par value; 30,000,000 shares authorized, 18,053,167 shares issued and outstanding (actual and pro forma); 24,053,167 shares issued and outstanding (pro forma as adjusted).....	113	113	113
Additional paid-in capital.....	48	48	88,728
Retained earnings.....	52,479	16,553	16,553
Accumulated other comprehensive income.....	2,186	2,186	2,186
Total stockholders' equity.....	54,826	18,900	107,580
Total capitalization.....	\$68,612	\$32,686	\$121,366

The common stock to be outstanding after this offering is based on shares outstanding as of December 31, 1998 and excludes 2,132,575 shares of common stock issuable upon the exercise of options outstanding as of such date at a weighted average exercise price of \$5.19 per share. See Note 8 of Notes to Consolidated Financial Statements.

DILUTION

As of December 31, 1998, MKS had a net tangible book value of \$54,826,000, or \$3.04 per share of common stock. After taking into account the sale of the shares offered hereby by MKS, the pro forma net tangible book value as of December 31, 1998 would have been \$107,580,000, or \$4.47 per share. The pro forma net tangible book value assumes that the proceeds to MKS, net of offering expenses and commissions, will be approximately \$52,754,000. This number has also been adjusted to take into account the distribution to current stockholders of the accumulated undistributed S corporation taxable income for which such taxpayers have been or will be taxed as of December 31, 1998. That amount is estimated to be \$35.9 million. No other changes occurring after December 31, 1998 have been taken into account. Based on the foregoing, there would be an immediate increase in net tangible book value to existing stockholders attributable to new investors of \$2.92 per share and the immediate dilution of \$11.53 per share to new investors. The following table illustrates this per share dilution:

Assumed initial public offering price per share.....		\$16.00
Net tangible book value per share at December 31, 1998....	\$ 3.04	
Decrease per share attributable to the S corporation distribution.....	(1.49)	
Increase per share attributable to new investors.....	2.92	

Pro forma net tangible book value per share after this offering.....		4.47

Dilution per share to new investors.....		\$11.53
		=====

The following table sets forth, on a pro forma basis as of December 31, 1998, (1) the number of shares of common stock purchased from MKS, (2) the total consideration paid to MKS and (3) the average price paid per share by existing stockholders and by the new investors purchasing shares of common stock in this offering, at an assumed initial public offering price of \$16.00 per share. Underwriting discounts, commissions and other estimated offering expenses have not been deducted. Shares owned by existing stockholders will be reduced by the number of shares sold by them in this offering.

	SHARES PURCHASED		TOTAL CONSIDERATION		AVERAGE PRICE PER SHARE
	NUMBER	PERCENT	AMOUNT	PERCENT	
	-----	-----	-----	-----	-----
Existing stockholders.....	18,053,167	75.1%	\$ 161,000	0.2%	\$0.009
New investors.....	6,000,000	24.9	96,000,000	99.8	\$16.00
	-----	-----	-----	-----	-----
Total.....	24,053,167	100.0%	96,161,000	100.0%	
	=====	=====	=====	=====	

As of December 31, 1998, there were options outstanding to purchase a total of 2,132,575 shares of common stock, at a weighted average exercise price of \$5.19 per share and 2,401,793 additional shares reserved for future grants of issuances under MKS's stock option and stock purchase plans. To the extent that any of these options are exercised, there will be further dilution to new investors.

SELECTED CONSOLIDATED FINANCIAL DATA

The following selected financial data as of December 31, 1997 and 1998 and for the years ended December 31, 1996, 1997 and 1998 have been derived from MKS's financial statements, included elsewhere in this prospectus, which have been audited by PricewaterhouseCoopers LLP, independent accountants, as indicated in their report. The selected financial data as of December 31, 1994, 1995 and 1996 and for the years ended December 31, 1994 and 1995 are derived from financial statements, which were also audited by PricewaterhouseCoopers LLP, not included herein. The data should be read in conjunction with the Consolidated Financial Statements, including the Notes thereto, and with "Management's Discussion and Analysis of Financial Condition and Results of Operations" included elsewhere in this prospectus.

MKS has been treated as an S corporation under the applicable provisions of the Internal Revenue Code since July 1, 1987. As an S corporation, MKS has not been subject to federal, and certain state, income taxes. The pro forma net income set forth below reflects the provision for income taxes that would have been recorded had MKS been a C corporation, assuming an effective tax rate of 38.0%. As a result of terminating its S corporation status upon the closing of this offering, MKS will record a one-time non-cash credit to historical earnings for additional deferred taxes. If this credit to earnings had occurred at December 31, 1998, the amount would have been approximately \$3.9 million. This amount is expected to change through the closing of this offering and is excluded from pro forma net income. See Notes 2 and 9 of Notes to Consolidated Financial Statements. Pro forma balance sheet data reflects the liability for the distribution of an estimated \$35.9 million, calculated as of December 31, 1998, of cumulative undistributed S corporation taxable income for which stockholders of record prior to the closing of this offering have been or will be taxed. The actual amount to be distributed is expected to increase based upon taxable earnings for the period January 1, 1999 through the closing of this offering, subject to certain limitations. Pro forma net income per share reflects the effect of an assumed issuance of sufficient shares to fund the distribution, as of January 1, 1998. See "S Corporation and Termination of S Corporation Status" and Note 2 of Notes to Consolidated Financial Statements.

	YEAR ENDED DECEMBER 31,				
	1994	1995	1996	1997	1998
	(IN THOUSANDS)				
STATEMENT OF INCOME DATA:					
Net sales.....	\$106,829	\$157,164	\$170,862	\$188,080	\$139,763
Cost of sales.....	59,813	87,703	102,008	107,606	83,784
Gross profit.....	47,016	69,461	68,854	80,474	55,979
Research and development.....	8,036	10,935	14,195	14,673	12,137
Selling, general and administrative.....	26,893	34,420	37,191	41,838	34,707
Restructuring.....	--	--	1,400	--	--
Income from operations.....	12,087	24,106	16,068	23,963	9,135
Interest expense, net.....	1,284	1,448	2,286	1,861	1,187
Other income (expense), net.....	--	--	(479)	166	187
Income before income taxes.....	10,803	22,658	13,303	22,268	8,135
Provision for income taxes.....	800	1,000	800	1,978	949
Net income.....	\$ 10,003	\$ 21,658	\$ 12,503	\$ 20,290	\$ 7,186

YEAR ENDED
DECEMBER 31, 1998

(IN THOUSANDS, EXCEPT
PER SHARE DATA)

PRO FORMA STATEMENT OF INCOME DATA (UNAUDITED):

Historical income before income taxes.....	\$8,135
Pro forma provision for income taxes.....	3,091

Pro forma net income.....	\$5,044
	=====
Pro forma net income per common share:	
Basic.....	\$ 0.25
	=====
Diluted.....	\$ 0.24
	=====

	DECEMBER 31,				DECEMBER 31, 1998	
	1994	1995	1996	1997	ACTUAL	PRO FORMA
	-----				-----	
	(IN THOUSANDS)					
BALANCE SHEET DATA:						
Cash and cash equivalents.....	\$ 4,059	\$ 3,650	\$ 3,815	\$ 2,511	\$ 11,188	\$ 11,188
Working capital (deficit).....	25,078	32,202	22,404	30,321	31,493	(4,433)
Total assets.....	72,320	104,511	95,000	106,536	96,232	96,232
Short-term obligations.....	9,246	15,192	16,124	13,852	12,819	12,819
Long-term obligations, less current portion.....	14,948	20,462	18,899	15,624	13,786	13,786
Stockholders' equity.....	37,272	48,392	45,498	52,848	54,826	18,900

MANAGEMENT'S DISCUSSION AND ANALYSIS OF
FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following discussion contains forward-looking statements that involve risks and uncertainties. MKS's actual results could differ materially from those discussed in the forward-looking statements as a result of certain factors including those set forth under "Risk Factors" and elsewhere in this prospectus. The following discussion and analysis should be read in conjunction with "Selected Consolidated Financial Data" and the Consolidated Financial Statements and Notes thereto appearing elsewhere in this prospectus.

OVERVIEW

MKS was founded in 1961. MKS develops, manufactures and supplies instruments and components used to measure, control and analyze gases in semiconductor manufacturing and similar industrial manufacturing processes. During 1997 and 1998, MKS estimates that approximately 60% of its net sales were to semiconductor capital equipment manufacturers and semiconductor device manufacturers. MKS expects that sales to such customers will continue to account for a substantial majority of its sales. MKS's customers include semiconductor capital equipment manufacturers, semiconductor device manufacturers, industrial manufacturing companies and university, government and industrial research laboratories. In 1996, 1997, and 1998, sales to MKS's top five customers accounted for approximately 26%, 32% and 24%, respectively, of MKS's net sales. During 1998, Applied Materials, Inc. accounted for approximately 16% of MKS's net sales. MKS typically enters into contracts with its semiconductor equipment manufacturer customers that provide for quantity discounts. MKS recognizes revenue, and accrues for anticipated returns and warranty costs, upon shipment.

In the third quarter of 1996, as a result of the downturn in the semiconductor industry, MKS recorded a restructuring charge of \$1.4 million. The charge was primarily related to a reduction of personnel and the closure of certain facilities and included the cost of severance, lease commitments and the write-off of leasehold improvements. During 1998, as a result of the downturn in the semiconductor industry, MKS reduced its staffing levels by approximately 30% from its year-end 1997 levels.

A significant portion of MKS's sales are to operations in international markets. International sales by MKS's foreign subsidiaries, located in Japan, Korea, Europe, and Canada, were 27.3% and 32.4% of net sales for 1997 and 1998, respectively. Sales by MKS's Japan subsidiary comprised 15.0% and 15.1% of net sales in 1997 and 1998, respectively. MKS does not classify export sales made directly by MKS as international sales. Such export sales have generally been less than 10% of net sales. MKS currently uses, and plans to continue to use, forward exchange contracts and local currency purchased options to reduce currency exposure arising from foreign denominated sales associated with the intercompany purchases of inventory. Gains and losses on derivative financial instruments that qualify for hedge accounting are classified in cost of sales. Gains and losses on derivative financial instruments that do not qualify for hedge accounting are marked-to-market and recognized immediately in other income. See Note 3 to Notes to Consolidated Financial Statements.

MKS has been treated as an S corporation for federal income tax purposes since July 1, 1987. MKS's S corporation status will terminate upon the closing of this offering, at which time MKS will become subject to federal, and certain state, income taxation as a C corporation. The pro forma net income reflects a pro forma effective tax rate of 38.0% to reflect federal and state income taxes which would have been payable for 1998 had MKS been taxed as a C corporation. See "S Corporation and Termination of S Corporation Status."

RESULTS OF OPERATIONS

The following table sets forth for the periods indicated the percentage of total net sales of certain line items included in MKS's consolidated statement of income data:

	YEAR ENDED DECEMBER 31,		
	1996	1997	1998
	-----	-----	-----
Net sales.....	100.0%	100.0%	100.0%
Cost of sales.....	59.7	57.2	59.9
	-----	-----	-----
Gross profit.....	40.3	42.8	40.1
Research and development.....	8.3	7.8	8.7
Selling, general and administrative.....	21.8	22.3	24.9
Restructuring.....	0.8	--	--
	-----	-----	-----
Income from operations.....	9.4	12.7	6.5
Interest expense, net.....	1.3	1.0	0.8
Other income (expense), net.....	(0.3)	0.1	0.1
	-----	-----	-----
Income before income taxes.....	7.8	11.8	5.8
Provision for income taxes.....	0.5	1.0	0.7
	-----	-----	-----
Net income.....	7.3%	10.8%	5.1%
	=====	=====	=====
Pro forma data:			
Historical income before income taxes.....			5.8%
Pro forma provision for income taxes.....			2.2

Pro forma net income.....			3.6%
			=====

Year Ended 1998 Compared to 1997

Net Sales. Net sales decreased 25.7% to \$139.8 million for 1998 from \$188.1 million for 1997. International net sales were approximately \$45.3 million in 1998 or 32.4% of net sales and \$51.4 million in 1997 or 27.3% of net sales. The decrease in net sales was primarily due to decreased sales volume of MKS's existing products in the United States and in Asia caused by the 1998 downturn in the semiconductor capital equipment market.

Gross Profit. Gross profit as a percentage of net sales decreased to 40.1% for 1998 from 42.8% in 1997. The change was primarily due to manufacturing overhead costs being a higher percentage of net sales due to lower sales volume in 1998.

Research and Development. Research and development expenses decreased 17.3% to \$12.1 million or 8.7% of net sales for 1998 from \$14.7 million or 7.8% of net sales for 1997. The decrease was due to reduced spending for development materials primarily related to certain projects that were completed during 1998.

Selling, General and Administrative. Selling, general and administrative expenses decreased 17.0% to \$34.7 million or 24.9% of net sales for 1998 from \$41.8 million or 22.3% of net sales for 1997. The decrease was due primarily to a decrease of approximately \$4.2 million in compensation expense resulting from the reduction in personnel during 1998 and reduced incentive compensation. Additionally, expenses were reduced as a result of lower spending on advertising, travel, and other selling and administrative costs.

Interest Expense, Net. Net interest expense decreased to \$1.2 million for 1998 from \$1.9 million for 1997 primarily due to lower debt outstanding during 1998.

Other Income (Expense), Net. Other income of \$0.2 million in 1998 primarily represents foreign exchange translation gains on intercompany payables of \$1.0 million offset by \$0.7 million for costs associated with MKS's planned initial public offering in early 1998 which was postponed. Other income of \$0.2 million in 1997 represents gains of \$1.2 million from foreign exchange contracts that did not qualify for hedge accounting, offset by a foreign exchange translation loss on an intercompany payable.

Pro Forma Provision for Income Taxes. The pro forma provision for income taxes for 1998 reflects the estimated tax expense MKS would have incurred had it been subject to federal and state income taxes as a C corporation under the Internal Revenue Code. The pro forma provision reflects a pro forma tax rate of 38.0%, which differs from the federal statutory rate due primarily to the effects of state and foreign taxes and certain tax credits.

Year Ended 1997 Compared to 1996

Net Sales. Net sales increased 10.1% to \$188.1 million for 1997 from \$170.9 million for 1996. International net sales were approximately \$51.4 million in both 1997 and 1996 and were 27.3% of net sales in 1997 and 30.1% of net sales in 1996. The increase in net sales was primarily due to increased sales volume of MKS's existing products in the United States.

Gross Profit. Gross profit as a percentage of net sales increased to 42.8% for 1997 from 40.3% for 1996. The change was due primarily to the reduction in fixed costs resulting from the restructuring effected in the third quarter of 1996 and the resulting increase in operational efficiencies.

Research and Development. Research and development expenses increased 3.4% to \$14.7 million or 7.8% of net sales for 1997 from \$14.2 million or 8.3% of net sales for 1996. The increase was primarily due to an increase in staffing throughout 1997 for certain development projects.

Selling, General and Administrative. Selling, general and administrative expenses increased 12.5% to \$41.8 million or 22.3% of net sales for 1997 from \$37.2 million or 21.8% of net sales for 1996. The increase was due to increased compensation expense resulting from increased salaries and wages and incentive compensation.

Restructuring. In the third quarter of 1996, as a result of the downturn in the semiconductor industry, MKS recorded a restructuring charge of \$1.4 million. The charge included \$0.4 million of severance pay, \$0.7 million of lease commitments, and \$0.3 million for the write-off of leasehold improvements.

Interest Expense, Net. Net interest expense decreased to \$1.9 million for 1997 from \$2.3 million for 1996 primarily due to lower debt outstanding during 1997.

Other Income (Expense), Net. Other expense for 1996 and other income for 1997 reflect losses and gains of \$0.5 million and \$1.2 million, respectively, from foreign exchange contracts that did not qualify for hedge accounting, and a foreign exchange translation loss on an intercompany payable from MKS's Korean subsidiary of \$1.0 million related to the devaluation of the Korean won in the fourth quarter of 1997.

Selected Quarterly Operating Results

The following tables present unaudited consolidated financial information for the eight quarters ended December 31, 1998. In the opinion of management, this information has been presented on the same basis as the audited Consolidated Financial Statements appearing elsewhere in this prospectus. All adjustments which management considers necessary for a fair presentation of the results of such periods have been included to present fairly the unaudited quarterly results when read in conjunction with MKS's Consolidated Financial Statements and Notes thereto. The results for any quarter are not necessarily indicative of future quarterly results of operations.

	QUARTER ENDED							
	MARCH 31, 1997	JUNE 30, 1997	SEPT. 30, 1997	DEC. 31, 1997	MARCH 31, 1998	JUNE 30, 1998	SEPT. 30, 1998	DEC. 31, 1998
	(IN THOUSANDS)							
STATEMENT OF INCOME DATA:								
Net sales.....	\$40,520	\$45,749	\$48,360	\$53,451	\$46,163	\$34,026	\$28,834	\$30,740
Cost of sales.....	24,277	26,413	27,766	29,150	26,757	20,265	18,140	18,622
Gross profit.....	16,243	19,336	20,594	24,301	19,406	13,761	10,694	12,118
Research and development.....	2,994	3,563	3,779	4,337	3,794	3,107	2,568	2,668
Selling, general and administrative.....	9,612	10,321	10,816	11,089	10,112	9,045	7,808	7,742
Income from operations.....	3,637	5,452	5,999	8,875	5,500	1,609	318	1,708
Interest expense, net.....	494	527	445	395	375	337	234	241
Other income (expense), net.....	275	(447)	632	(294)	(281)	123	77	268
Income before income taxes.....	3,418	4,478	6,186	8,186	4,844	1,395	161	1,735
Provision for income taxes.....	289	378	523	788	565	163	19	202
Net income.....	\$ 3,129	\$ 4,100	\$ 5,663	\$ 7,398	\$ 4,279	\$ 1,232	\$ 142	\$ 1,533

	QUARTER ENDED							
	MARCH 31, 1997	JUNE 30, 1997	SEPT. 30, 1997	DEC. 31, 1997	MARCH 31, 1998	JUNE 30, 1998	SEPT. 30, 1998	DEC. 31, 1998
PERCENTAGE OF NET SALES:								
Net sales.....	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Cost of sales.....	59.9	57.7	57.4	54.5	58.0	59.6	62.9	60.6
Gross profit.....	40.1	42.3	42.6	45.5	42.0	40.4	37.1	39.4
Research and development.....	7.4	7.8	7.8	8.1	8.2	9.1	8.9	8.6
Selling, general and administrative.....	23.7	22.6	22.4	20.8	21.9	26.6	27.1	25.2
Income from operations.....	9.0	11.9	12.4	16.6	11.9	4.7	1.1	5.6
Interest expense, net.....	1.2	1.1	0.9	0.7	0.8	1.0	0.8	0.8
Other income (expense), net.....	0.6	(1.0)	1.3	(0.6)	(0.6)	0.4	0.3	0.8
Income before income taxes.....	8.4	9.8	12.8	15.3	10.5	4.1	0.6	5.6
Provision for income taxes.....	0.7	0.8	1.1	1.5	1.2	0.5	0.1	0.6
Net income.....	7.7%	9.0%	11.7%	13.8%	9.3%	3.6%	0.5%	5.0%

MKS's quarterly operating results have varied significantly and are likely to continue to vary significantly due to a number of factors including:

- specific economic conditions in the industries in which MKS's customers operate, particularly the semiconductor industry
- the timing of the receipt of orders from major customers
- customer cancellations or shipment delays
- price competition
- disruption in sources of supply

- seasonal variations of capital spending by customers

- production capacity constraints

- specific features requested by customers

- exchange rate fluctuations
- the introduction or announcement of new products by MKS or its competitors
- other factors, many of which are beyond MKS's control

MKS's net sales have fluctuated over the past eight quarters primarily due to the decline in the semiconductor capital equipment market and the semiconductor device market in 1998 that adversely affected sales of MKS's products in each of the quarters of 1998. MKS expects that the decline in worldwide semiconductor capital equipment orders in the second half of 1998 and the instability of the Asian markets will continue to adversely affect sales of semiconductor capital equipment manufacturers for at least the first quarter of 1999. As a result, for at least the first quarter we currently expect that our 1999 quarterly net sales and net income will be less than net sales and net income for the comparable quarter of 1998.

Gross profit as a percentage of net sales increased in each quarter of 1997 primarily as a result of fuller utilization of existing manufacturing capacity as a result of increased net sales. Gross profit as a percentage of net sales decreased in each of the first three quarters of 1998 as a result of manufacturing overhead costs becoming a higher percentage of net sales due to lower sales volume.

The increase in research and development expenses for the second, third and fourth quarters of 1997 was primarily due to increased staffing levels. The decrease in research and development expenses for the first, second, and third quarters of 1998 was due to reduced spending for development materials primarily related to certain projects that were completed during 1998.

Selling, general and administrative expenses increased in the second, third and fourth quarters of 1997 primarily due to increased compensation expense and the write-off of certain abandoned assets. The decrease in selling, general and administrative expenses in the first, second, and third quarters of 1998 was primarily due to a decrease in compensation expense along with other selling related expenses.

Other income primarily represents gains and losses on foreign exchange contracts and a foreign exchange translation loss on an intercompany payable from MKS's Korean subsidiary of \$1.0 million in the fourth quarter of 1997 related to the devaluation of the Korean won. Other expenses in the first quarter of 1998 include \$0.7 million for costs associated with MKS's planned initial public offering in early 1998 which was postponed.

LIQUIDITY AND CAPITAL RESOURCES

MKS has financed its operations and capital requirements through a combination of cash provided by operations, long-term real estate financing, capital lease financing and short-term lines of credit.

Operations provided cash of \$26.3 million, \$16.8 million and \$23.0 million for 1996, 1997 and 1998, respectively, primarily impacted in each period by net income, depreciation and changes in the levels of inventory and accounts receivable. Investing activities utilized cash of \$10.2 million, \$3.3 million and \$2.1 million in 1996, 1997 and 1998, respectively, primarily for the purchase of property and equipment in each period. Financing activities utilized cash of \$15.6 million, \$16.2 million and \$11.8 million in 1996, 1997 and 1998, respectively, primarily for stockholder distributions in each period. Cash flows from financing activities for each period were primarily from short-term and long-term borrowings.

Working capital was \$31.5 million as of December 31, 1998. MKS has a combined \$30.0 million line of credit with two banks, expiring December 31, 1999, all of which is available. Interest on future borrowings under the line of credit would be payable monthly at a rate based on LIBOR, which was 7.131% at December 31, 1998. MKS also has lines of credit through its foreign subsidiaries with several financial institutions totaling \$15.0 million at December 31, 1998. The total unused balance under these lines of credit was \$5.3 million at December 31, 1998. The interest rates on borrowings outstanding as of December 31, 1998 on these lines of credit ranged from 1.3% to 1.7%. Interest on future borrowings under the unused balance of these lines of credit would be at rates ranging from 1.5% to 7.85%. These lines generally expire and are renewed at six month intervals. In addition, MKS has outstanding term loans and

mortgage loans from banks totaling \$12.0 million (net of the current portion) at December 31, 1998. See Notes 6 and 13 of Notes to Consolidated Financial Statements.

In 1997 and 1998, MKS distributed \$12.4 million and \$6.2 million, respectively, of undistributed S corporation earnings to its stockholders. As soon as practicable following the closing of this offering, MKS intends to make a distribution to the holders of record on the day prior to the closing of this offering in an amount equivalent to the accumulated adjustments account. The accumulated adjustments account is cumulatively equal to financial reporting income, adjusted for differences between the methods of accounting used for financial accounting and for federal income tax purposes from July 1, 1987 through the date of termination of MKS's S corporation status, that has not been previously distributed. Investors purchasing shares in this offering will not receive any portion of the distribution. As of December 31, 1998, the outstanding balance of the accumulated adjustments account was estimated to be approximately \$35.9 million, and such balance is expected to increase in the period from January 1, 1999 through the closing of this offering.

MKS believes that the net proceeds from this offering, together with the cash anticipated to be generated from operations and funds available from existing credit facilities, will be sufficient to satisfy its estimated working capital and planned capital expenditure requirements through at least the next 24 months.

EFFECT OF CURRENCY EXCHANGE RATES AND EXCHANGE RATE RISK MANAGEMENT

A significant portion of MKS's business is conducted outside of the United States through its foreign subsidiaries. The foreign subsidiaries maintain their accounting records in their local currencies. Consequently, period to period comparability of results of operations is affected by fluctuations in exchange rates. MKS derives a significant portion of its cash flows from foreign denominated revenue. To the extent the dollar value of foreign denominated revenue is diminished as a result of a strengthening U.S. dollar, MKS's results of operations and cash flows could be adversely affected.

The primary currencies to which MKS has exposure are the Japanese yen and the German mark. The nature of this exposure is from MKS selling inventory to its overseas subsidiaries for resale in local currency. Consequently, the cash flows from the overseas subsidiaries are affected by exchange rate fluctuations. To reduce the risks associated with foreign currency rate fluctuations, MKS has entered into forward exchange contracts and local currency purchased options on a continuing basis in amounts and timing consistent with the underlying currency exposures.

The factors MKS considers in determining whether forward exchange contracts or purchased options qualify for hedge accounting include:

- whether the notional amounts of the derivatives offset the underlying currency exposures in terms of timing and amounts
- for forward exchange contracts, whether the underlying transactions being hedged are pursuant to firm commitments
- for local currency purchased options, whether it is probable that the underlying hedging transaction will occur

Gains on forward exchange contracts and local currency purchased options, qualifying for hedge accounting, amounted to \$2.5 million, \$1.2 million and \$0.3 million for the years ended December 31, 1996, 1997 and 1998, respectively, and are classified in cost of sales. Losses of \$0.5 million, gains of \$1.2 million and losses of \$0.2 million on forward exchange contracts that did not qualify for hedge accounting were recognized in earnings for 1996, 1997 and 1998, respectively, and are classified in other income (expense), net. These amounts are net of a foreign exchange translation loss of \$1.0 million and a gain of \$1.0 million on intercompany payables from its subsidiaries in 1997 and 1998 respectively. Foreign exchange translation gains and losses from unhedged intercompany balances were not material in 1996. While MKS does not issue or hold derivative financial instruments for trading purposes, there can be no

assurance that any losses realized on such instruments will be fully offset by gains on the underlying exposure. Prospectively, MKS plans to continue to use forward exchange contracts and local currency purchased options to seek to mitigate the impact of exchange rate fluctuations. See Notes 2 and 3 of Notes to Consolidated Financial Statements.

MARKET RISK AND SENSITIVITY ANALYSIS

Foreign Exchange Rate Risk

The potential fair value loss for a hypothetical 10% adverse change in forward currency exchange rates on MKS's forward exchange contracts at December 31, 1998 would be \$949,000. The potential loss was estimated by calculating the fair value of the forward exchange contracts at December 31, 1998 and comparing that with those calculated using the hypothetical forward currency exchange rates.

The value of the local currency purchased options at December 31, 1998 was immaterial. Any loss related to the local currency purchased options is limited to the unamortized premium of \$155,000 at December 31, 1998.

At December 31, 1998, MKS had \$9,687,000 related to short-term borrowings denominated in Japanese yen. The carrying value of these short-term borrowings approximates fair value due to their short period to maturity. Assuming a hypothetical 10% adverse change in the Japanese yen to U.S. dollar year end exchange rate, the fair value of these short-term borrowings would increase by \$1,077,000. The potential increase in fair value was estimated by calculating the fair value of the short-term borrowings at December 31, 1998 and comparing that with the fair value using the hypothetical year end exchange rate.

Interest Rate Risk

MKS is exposed to fluctuations in interest rates in connection with its variable rate term loans. In order to minimize the effect of changes in interest rates on earnings, MKS entered into an interest rate swap that fixed the interest rate on its variable rate term loans. Under the swap agreement, MKS pays a fixed rate of 5.85% on the notional amount and receives LIBOR. At December 31, 1998, the notional amount of the interest rate swap was equal to the principal amount of the variable rate term loans. The potential increase in the fair value of term loans when adjusting for the interest rate swap paying at a fixed rate resulting from a hypothetical 10% decrease in interest rates was not material.

RECENTLY ISSUED ACCOUNTING PRONOUNCEMENTS

See Note 2 of Notes to Consolidated Financial Statements for a discussion of the impact of recently issued accounting pronouncements.

YEAR 2000 COMPLIANCE

The Year 2000 problem stems from the fact that many currently installed computer systems include software and hardware products that are unable to distinguish 21st century dates from those in the 20th century. As a result, computer software and/or hardware used by many companies and governmental agencies may need to be upgraded to comply with Year 2000 requirements or risk system failure or miscalculations causing disruptions to normal business activities.

State of Readiness

MKS designed and began implementation of a multi-phase Year 2000 project which consists of:

- assessment of the corporate systems and operations including both information technology and non-information technology that could be affected by the Year 2000 problem
- remediation of non-compliant systems and components
- testing of systems and components following remediation

MKS, under the guidance of its Information Technology Steering Committee, has focused its Year 2000 review on four areas:

- internal computer software and hardware
- product compliance
- facilities and manufacturing equipment
- third-party compliance

Internal Computer Software and Hardware. MKS uses information technology for its internal infrastructure, which consists of its main enterprise systems which include the systems used, in part, for purchase orders, invoicing, shipping and accounting, and individual workstations, including personal computers, and its network systems.

Because MKS's business and manufacturing systems, such as its main enterprise systems, are essential to its business, financial condition and results of operations, MKS began its assessment of these systems prior to its other non-critical information technology systems. MKS began its assessment in the fall of 1997, and in November 1997, MKS developed a remediation plan for all identified noncompliant business and manufacturing systems. This remediation plan was implemented in January 1998. By July 1998, MKS had installed new systems or upgraded existing systems. Based upon post-implementation testing and review, management believes that all business and manufacturing systems within its manufacturing operations are Year 2000 compliant.

One of MKS's international subsidiaries is currently undergoing conversion of its business systems in order to become Year 2000 compliant. Management believes that these systems will be operational by June 1999. This phase of the Year 2000 project is currently on schedule.

MKS's personal computer based systems were assessed in early 1998. MKS believes that all non-compliant hardware and software was identified by March 1998, at which time it made a list prioritizing databases to be remedied. Critical databases were identified and were scheduled for remediation prior to other databases. Remediation plans to convert the databases were initiated in November 1998. MKS anticipates that it will complete its critical and non-critical conversions by June 1999. This phase of the Year 2000 project is currently on schedule.

Product Compliance. Throughout 1998, MKS assessed and addressed the Year 2000 compliance of its products. This assessment resulted in the identification of MKS's products that were compliant and non-compliant. The substantial majority of MKS's products were deemed to be compliant.

The date related functions of all non-compliant products, other than certain residual gas analysis products, are believed by MKS to be non-critical in that such noncompliance would not affect the independent performance of the product; would not cause the MKS product to cease operating on any particular date; and independently would not pose a safety risk. MKS believes that Year 2000 problems associated with non-compliant residual gas analysis products will also be non-critical. However, these products contain components of other manufacturers and cannot be tested and therefore it is possible that such products could cause unanticipated performance problems. The non-compliant features of our other products primarily relate to non-essential functions such as date displays. MKS made available to its customers a list which describes Year 2000 readiness of its products. This phase of the Year 2000 project is currently on schedule.

Facilities and Manufacturing Equipment. Some aspects of MKS's facilities and manufacturing equipment may include embedded technology, such as microcontrollers. The Year 2000 problem could cause a system failure or miscalculation in such facilities or manufacturing equipment which could disrupt MKS's operations. Affected areas include security systems, elevator controls, voice mail and phone systems, clean room environmental controls, numerically controlled production machinery and computer based production equipment. MKS organized a team of experienced managers in November 1998 to assess the potential problems in these areas. An assessment of all facilities and manufacturing equipment was conducted through December 1998, and a remediation plan was developed in January 1999. MKS

anticipates completion of all corrective actions by June 1999 with testing and review of corrected items to occur in the summer of 1999. This phase of the Year 2000 project is currently on schedule.

Third-Party Compliance. MKS has relationships with third-parties including customers and vendors and suppliers of goods, services and computer interfaces. The failure of such persons to implement and execute Year 2000 compliance measures in a timely manner, if at all, could, among other things:

- adversely affect MKS's ability to obtain components in a timely manner
- cause a reduction in the quality of components obtained by MKS
- cause a reduction, delay or cancellation of customer orders received by MKS or a delay in payments by its customers for products shipped
- result in the loss of services that would be necessary for MKS to operate in the normal course of business

MKS assessed which of these third-party goods, services and interfaces were critical to its operations and developed and mailed a standard survey to each third-party deemed critical in January 1998. By March 1998, MKS had reviewed most responses received. To date, the responses received indicate that the third-parties are either in the process of developing remediation plans, or are compliant. MKS anticipates further assessment to continue through March 1999 and plans to conduct reviews at that time. A remediation plan is expected to be in place by June 1999 with all critical third-parties achieving satisfactory compliance by August 1999. This phase of the Year 2000 project is currently on schedule.

Costs

MKS's costs to date associated with assessment, remediation and testing activities concerning the Year 2000 problem have been approximately \$1,500,000. MKS estimates that an additional \$1,500,000, the major portion of which will be capitalized and expensed over the life of the assets, will be required to complete the replacement or modification of its facilities, manufacturing equipment, computer software and products and to address the noncompliance of key third-parties. MKS has funded and will continue to fund these activities principally through cash provided by operations and existing leasing lines of credit. It is not possible for MKS to completely estimate the costs incurred in its remediation effort as many of its employees have focused and will continue to focus significant efforts in evaluating MKS's Year 2000 state of readiness and in remediating problems that have arisen, and will continue to arise, from such evaluation.

Contingency Plan

To date, MKS has not formulated contingency plans related to the failure of its or a third-party's Year 2000 remediation efforts. Contingency plans for the failure to implement compliance procedures have not been completed because it is the intent of MKS to complete all required modifications and to test modifications thoroughly prior to December 31, 1999. However, as discussed above, MKS is engaged in ongoing assessment, remediation and testing activities and the internal results as well as the responses received from third-parties will be taken into account in determining the nature and extent of any contingency plans if necessary.

BUSINESS

MKS is a leading worldwide developer, manufacturer and supplier of instruments and components used to measure, control and analyze gases in semiconductor manufacturing and similar industrial manufacturing processes. MKS offers a comprehensive line of products which are used to manufacture, among other things:

- - semiconductors
- - flat panel displays
- - magnetic and optical storage devices and media, including:
 - compact disks
 - hard disk storage devices
 - magnetic devices for reading disk data
 - digital video disks
- optical storage disks or laser readable disks
- - solar cells which convert light into electrical current
- - fiber optic cables for telecommunications
- - optical coatings, such as eyeglass coatings
- - coatings for architectural glass
- - hard coatings to minimize wear on cutting tools
- - diamond thin films

Our products include:

- - instruments used to measure, control and analyze:
 - gas pressure
 - gas flow
 - gas composition
- - vacuum technology products:
 - vacuum gauges
 - vacuum valves and components

For over 25 years, MKS has focused on satisfying the needs of semiconductor capital equipment manufacturers and semiconductor device manufacturers and has established long-term relationships with many of its customers. Over 4,000 customers worldwide purchased products from MKS during 1998 including:

- semiconductor capital equipment manufacturers
- semiconductor device manufacturers
- industrial manufacturing companies
- university, government and industrial research laboratories

MKS's customers include Applied Materials, Inc., Lam Research Corporation, Novellus Systems, Inc., Tokyo Electron Limited, Inc., Air Products and Chemicals, Inc. and Motorola, Inc. MKS sells its products primarily through its sales force which consists of 118 employees, as of December 31, 1998, in 22 offices in France, Germany, Japan, Korea, The Netherlands, Singapore, Taiwan, the United Kingdom and the United States.

INDUSTRY BACKGROUND

In the past 40 years, significant advances in materials science and processing technologies have made possible the manufacture of products ranging from highly complex microprocessor chips to simple but effective airtight coatings for food packagings. In many materials processing applications, specific gas mixtures at precisely controlled pressures are used:

- to create and maintain the required process atmosphere
- as a source of materials to be deposited on a surface, such as a silicon wafer
- to remove or etch materials from a surface to form a circuit pattern

The largest commercial application employing materials science and processing technologies is the manufacture of semiconductors. Worldwide semiconductor sales have increased as the use of semiconductors has expanded beyond personal computers and computer systems to a wide array of additional applications such as telecommunications and data communications systems, automotive products, consumer goods, medical products and household appliances. In large part, this growth has been facilitated by the ability of semiconductor device manufacturers to produce increasingly fast, more complex, higher performance semiconductors while steadily reducing cost per function, power consumption requirements and size of these products to meet end-user and system designer requirements. These improvements in the ratio of price to performance have been enabled by advancements in semiconductor processing technologies, which have facilitated the ability to reduce circuit pattern sizes and subsequently increase the number of individual semiconductor circuits on a silicon wafer. These trends have driven the need for increasingly complex and sophisticated semiconductor device manufacturing processes, process equipment and process controls.

Semiconductor Manufacturing Process

The manufacturing of semiconductors requires hundreds of process steps. Many steps involve the controlled application or removal of layers of materials to or from a surface referred to as a substrate. These process steps take place within a process chamber, which provides a controlled environment for the fabrication of semiconductor devices. Most of the key processes used in the production of semiconductors require precise automatic control of gas pressure, flow and composition in the process chamber.

To ensure the integrity and performance of the manufacturing process, semiconductor device manufacturers require sophisticated instruments that can provide precise automated control of all major process variables within the process chamber. The process steps required to produce circuit patterns involve the control of multiple gases flowing into the process chamber at specified intervals, and at controlled pressure and vacuum levels. In a typical process step, the process chamber is evacuated to a base pressure established by a vacuum pumping system and measured with vacuum gauges. Automatic shut-off valves are sequenced to protect pumps and process instruments from exposure to atmospheric pressure. Chamber leak integrity may be checked by gas analyzers scanning for the presence of undesirable atmospheric gases or water vapor. Mass flow controllers automatically control the flow rates of multiple gases into the process chamber. Simultaneously, the automatic pressure control system for the process chamber measures the pressure in the chamber and controls it at the desired level by electronically adjusting the position of a control valve located between the process chamber and the vacuum pump. Downstream of the process chamber, heated lines, particle traps, and vacuum valves and switches are used to prevent contamination of the process chamber as a result of the backstream of particles and exhaust gases back into the process chamber. This improves circuit quality, reduces maintenance and prolongs vacuum pump life.

The pressures used in semiconductor manufacturing processes range from as low as one trillionth of atmospheric pressure to as high as two hundred times atmospheric pressure. The following table shows the wide range of pressures required for typical semiconductor manufacturing processes:

[PRESSURE RANGES OF TYPICAL SEMICONDUCTOR MANUFACTURING PROCESSES CHART]

[This table graphically depicts, using graybars, the gas pressure ranges, from one trillionth of atmospheric pressure to two hundred times atmospheric pressure used in various typical semiconductor manufacturing process steps (introduction of gases into process chamber, deposition of materials and thin films on to substrates, introduction of gases to etch circuit patterns, deposition of conductive metal layers onto substrates and implantation of positively charged atoms into substrates).

The fabrication of a semiconductor circuit requires varying flow rates, pressures and gases. A typical process step uses from three to five different gases.

Uptime, yield and throughput are critical semiconductor manufacturing concepts. Uptime is the amount of time that the semiconductor processing tool is available for processing. Yield is the ratio of acceptable circuits to total circuits processed. Throughput is the number of wafers that can be processed per hour. Uptime, yield, and throughput depend in major part upon:

- precise repeatable measurement and control of the specific gas pressure, flow rates and composition
- the maintenance of the vacuum integrity of the process chamber
- the prevention of wafer contamination from particles entering the chamber

Pressure variations of as little as one one-hundred-thousandth of atmospheric pressure can change process yields significantly and errors in gas flow rates and composition may impair circuit performance. Atmospheric contamination and particle contamination can produce defects that significantly reduce wafer yields and the time required to remove contaminates reduces uptime and throughput. The speed of response and precision of the automatic control systems directly affects uptime, throughput of wafers and process yields.

Other Similar Industrial Manufacturing Processes

Many of the same processes used to manufacture semiconductors are also used to manufacture: flat panel displays; magnetic and optical storage devices and media; solar cells; fiber optic cables for telecommunications; optical coatings; coatings for architectural glass; hard coatings to minimize wear on cutting tools; and diamond thin films.

Trends in Semiconductor Manufacturing

The ability of semiconductor device manufacturers to offer integrated circuits with smaller geometries and greater functionality at higher speeds requires continuous improvements in semiconductor process equipment and process controls. The transition to smaller circuit patterns, such as 0.18 micron and smaller line-widths, requires more process steps. It is also leading to the introduction of new materials such as copper for conductors and a whole new class of organic and inorganic materials for insulators. These in turn require new technologies for delivery of gases and vapors to the process chamber. In addition, the introduction of advanced processes such as high density plasma is leading to a need for lower pressures, which are more difficult to measure and control than higher pressures. These trends, along with increased wafer sizes, which result in higher circuit value per wafer, are leading to the need for increased sophistication of semiconductor processing equipment, a heightened emphasis on uptime, yield and throughput and the need for more precise process controls. As a result, the design and performance of instruments that control pressure or the flow of gases, or analyze the composition of gases, are becoming even more critical to the semiconductor manufacturing process.

To address the increasing complexity of semiconductor devices, semiconductor device manufacturers typically develop processes to create particular device features using specific manufacturing equipment. The process for each feature is then documented and may be subsequently replicated for use in multiple fabrication facilities around the world. The precision, repeatability and reliability of the measurement and control instrumentation used for each process is critical to providing uptime, high yield and throughput on manufacturing equipment at all facilities employing such processes. Semiconductor device manufacturers are placing increasing importance on uptime, yield, throughput and process consistency throughout their facilities to minimize:

- capital equipment expenditures
- facility construction costs
- overall ongoing operating costs

The increasing sophistication of semiconductor devices requires an increase in the number of components and subsystems used in the design of semiconductor manufacturing process tools. To reduce manufacturing complexity, improve quality and reliability and ensure long-term service and support, semiconductor capital equipment manufacturers and semiconductor device manufacturers are increasingly seeking to establish relationships with a smaller group of broad-based suppliers that meet their needs on a worldwide basis and provide:

- advanced technological capabilities to address the increasing complexities of the semiconductor manufacturing process
- instrument and component designs that ensure repeatable processes around the world
- value-added, integrated instruments and components
- a worldwide sales, service and support infrastructure

MKS SOLUTION AND STRATEGY

MKS's objective is to be the leading worldwide supplier of instruments and components used to measure, control and analyze gases in semiconductor and other advanced thin-film materials processing applications and to help semiconductor device manufacturers achieve improvements in their return on invested capital. The principal elements of MKS's solution and strategy to achieve this objective are set forth below:

Technology Leadership. MKS's products incorporate leading-edge technologies to control and monitor increasingly complex gas-related semiconductor manufacturing processes, thereby enhancing

uptime, yield and throughput which can improve the investment return on capital equipment and facilities. The instruments and components in MKS's product offering provides the required capabilities through:

- high precision operation over the extreme and variable pressure ranges required for semiconductor processes
- precise, consistent and repeatable measurement and control performance that allows processes to be replicated in manufacturing facilities around the world
- advanced control technologies which enhance uptime, yield and throughput
- multiple, diverse and alternative technologies for controlling the flow rate and composition of gases and vapors needed for new classes of advanced materials for next generation semiconductor devices
- innovative vacuum technology subsystems that reduce atmospheric and particle contamination, thereby enhancing uptime, yield and throughput

MKS's products have continuously advanced as its customers' needs have evolved. MKS seeks to extend its technological leadership by applying its expertise in vacuum, pressure, flow and gas composition measurement control and analysis technologies to develop advanced products that meet the critical gas-related process requirements of semiconductor and advanced thin-film materials manufacturers.

MKS has introduced technological innovations including:

- corrosion-resistant pressure and vacuum sensors
- automatic pressure and vacuum control systems
- compact single unit gas composition analyzers to replace bulky multi-component systems

MKS has developed, and continues to develop, new products to address emerging industry trends such as the transition from the use of 200mm wafers to 300mm wafers and the shrinking of integrated circuit line-widths from 0.25 micron to 0.18 micron and smaller. MKS has supplied pre-production equipment to be incorporated into semiconductor capital equipment manufacturers' 300mm pre-production semiconductor wafer process equipment, which is expected to be included in pilot production lines of device manufacturers.

MKS has also developed equipment that is being used by research laboratories for semiconductor devices using less than 0.18 micron line-widths. In addition, MKS has developed, and continues to develop, materials delivery systems for new classes of materials, such as copper for conductors, titanium nitride for barriers and a class of organic and inorganic dielectric materials that are beginning to be used in small geometry manufacturing.

MKS has been a leader in making its products compatible with emerging digital network standards, such as DeviceNet. DeviceNet enables components used in semiconductor manufacturing processes to transmit self-diagnostic and other information on a digital host network. This reduces system complexity and space requirements.

To ensure that MKS maintains its leading-edge position, MKS aligns its research and development program to the Semiconductor Industry Association Technology Roadmap. The Semiconductor Industry Association Technology Roadmap identifies technological developments, as well as obstacles, required to produce future generations of semiconductor devices. MKS also maintains associations with leading universities to anticipate future semiconductor production needs three to seven years in advance.

Comprehensive Product Offering. MKS currently offers, and intends to continue to offer, the widest range of pressure and vacuum measurement and control products serving the semiconductor manufacturing and similar industrial manufacturing industries. MKS offers a full line of products including a wide range of gas pressure, flow and composition analysis measurement and control instruments and vacuum gauges, valves and components.

Since the development of its original Baratron laboratory-based pressure measurement instrument in 1961, MKS has continuously enhanced and expanded its product offerings in response to the evolving needs of its customers. For example, MKS recently introduced the Micro Baratron instrument, a significantly smaller version of its pressure measurement product, and a new low vapor

delivery system. MKS plans to introduce new products throughout 1999, including a line of mass flow calibrators and process monitoring hardware and software for gas analysis.

MKS's products are designed to meet the increasingly complex needs of its customers. With the increasing sophistication of semiconductor capital equipment leading to an increasing number of components and subsystems in semiconductor manufacturing process tools, MKS delivers products that reduce equipment size and improve process performance. MKS's subsystem products combine several components into single integrated solutions. MKS's integrated solutions deliver higher performance at a lower cost than similar subsystems built from discrete components. Additionally, MKS's integrated solutions are easier to install and configure, further reducing the overall cost to the customer.

MKS plans to continue to expand its product lines through both internal development and acquisitions of complementary businesses, products and technologies. MKS's comprehensive product offering enables MKS to meet a broad range of customer needs and provide a single source of solutions for semiconductor device and semiconductor capital equipment manufacturers as they seek to consolidate their supplier relationships to a smaller select group.

Close Working Relationships with Customers. MKS has focused on satisfying the needs of semiconductor device manufacturers and semiconductor capital equipment manufacturers for over 25 years and has established long-term relationships with many of its customers. MKS works with its customers at the pre-design and design stage to identify and respond to their requests for current and future generations of products. These close working relationships allow MKS to understand and address the cost and performance expectations of its customers. MKS plans to enhance its relationships with its major customers and identify opportunities to develop similar relationships with additional semiconductor capital equipment manufacturers and semiconductor device manufacturers.

Applications in Related Markets. MKS is leveraging its accumulated expertise in the semiconductor industry by developing products for applications that employ production processes similar to semiconductor fabrication processes in their reliance upon gases and vacuum-based production technologies. Applications served by MKS outside the semiconductor industry include vacuum freeze-drying of pharmaceuticals and foods, sterilization of medical appliances, and applications that involve advanced thin-film manufacturing such as flat panel displays, magnetic and optical storage media, solar cells, fiber optic cables and optical coatings. MKS plans to continue to identify and develop products that address advanced materials processing applications where gas management plays a critical role.

Global Infrastructure and World Class Manufacturing Capabilities. As semiconductor device manufacturers have become increasingly global, they have required that suppliers offer comprehensive local repair service and close customer support. Manufacturers require close support to enable them to calibrate, repair, modify, upgrade and retrofit their equipment to improve process consistency, uptime, yield and throughput. To meet these market requirements, MKS maintains a global sales and support organization with 22 offices worldwide. MKS currently manufactures its products at nine facilities in the United States and abroad. MKS continues to devote significant resources to expand and maintain its worldwide production and service capabilities to meet the global demand for gas measurement, control and analysis instruments and vacuum technology components. MKS opened a sales and support facility in Singapore in 1998 and during 1999 plans to add manufacturing capabilities to its Austin, Texas facility and further equip its cleanroom facilities in Andover and Methuen, Massachusetts.

MKS believes that the ability to manufacture reliable instruments and components in a cost-effective manner is critical to meet the demanding just-in-time delivery requirements of semiconductor capital equipment manufacturers and semiconductor device manufacturers. MKS's worldwide production and manufacturing facilities provide MKS with the ability to manufacture reliable gas measurement, control and analysis instruments and components in a timely and cost-effective manner. With a total of approximately 250,000 square feet of manufacturing capacity in five locations in the United States and four others in Germany, Japan, the United Kingdom and Korea, MKS has implemented world class practices in quality and delivery techniques. MKS's manufacturing facilities in the United States, the United Kingdom and Germany are ISO 9001 certified.

PRODUCTS

MKS offers a full line of instruments and components that are used to measure, control and analyze gases in semiconductor manufacturing and other advanced thin-film manufacturing processes. MKS supplies products in two principal areas:

- measurement and control instrumentation products

- vacuum technology products

The following schematic shows where MKS products are used in a typical semiconductor manufacturing process.

[CHART]
[Schematic showing where MKS products are used in a typical semiconductor manufacturing process.]

MEASUREMENT AND CONTROL INSTRUMENTATION PRODUCTS. MKS designs and manufactures a wide range of gas pressure, flow and composition analysis measurement and control instrumentation. Each product line consists of products which are designed for a variety of pressure, flow and composition ranges and accuracies.

Baratron Pressure Measurement Products. MKS's Baratron pressure measurement products are high precision, pressure measurement instruments. MKS has five Baratron product families that range from high accuracy digital output instruments to simple electronic switches. These products are typically used to measure the pressure of the gases being distributed upstream of the process chambers, to measure process chamber pressures and to measure pressures between process chambers, vacuum pumps and exhaust lines. Baratron instruments measure pressures at ranges from two hundred times atmospheric pressure to one billionth of atmospheric pressure. MKS believes it offers the widest range of gas pressure measurement instruments in the semiconductor and advanced thin-film materials processing industries.

A key feature of Baratron instruments is the ability to measure pressure independent of gas composition, which is critical for precise pressure control of semiconductor processes that involve gas mixtures. In these processes, there is a need to control both pressure and gas mixture, but the pressure measurement instrument must measure only the pressure of the sum of the gases in the chamber, independent of gas composition. The Baratron instruments enable users to achieve a highly precise, accurate and repeatable measurement of gas pressure. Pressure measurement, independent of gas composition, is also useful during process steps used to remove atmospheric gases as well as those used to introduce specific amounts of various types of gases. Such processes are used to manufacture fluorescent bulbs and to fabricate gas lasers.

The following table shows MKS's principal Baratron pressure measurement product lines:

BARATRON PRESSURE MEASUREMENT PRODUCTS

PRODUCT LINES	DESCRIPTION	RANGES OF LIST PRICES
High precision, high accuracy pressure and vacuum measurement instruments	Instruments with built-in temperature stabilization features, for high precision, high accuracy and high temperature operation	\$2,900-\$6,400
General purpose pressure and vacuum measurement instruments	Rugged instruments with and without built-in temperature stabilization features, for reliable, precise and accurate process measurement	\$450-\$4,200
Ultra-clean high pressure and vacuum measurement instruments	Instruments with ultra-clean surfaces exposed to gas, for precise, high purity applications	\$550-\$1,050
General purpose "MINI" pressure and vacuum measurement instruments	Small footprint instruments for precise, accurate, general purpose process measurement	\$650-\$1,400
Electronic pressure and vacuum switches	Economical, stable instrument providing "go/no-go" output for precise pressure trip-points and alarms	\$350-\$750

MKS's list prices for its Baratron measurement products vary depending upon precision, accuracy, pressure range, operating temperature range, stability and gas purity specifications.

Automatic Pressure and Vacuum Control Products. MKS's automatic pressure control products consist of analog and digital automatic pressure and vacuum control electronic instruments and valves. These products enable precise control of process pressure by electronically actuating valves which control the flow of gases in and out of the process chamber to minimize the difference between desired and actual pressure in the chamber. The electronic controllers vary from simple analog units with precise manual tuning capability to state-of-the-art self-tuning, digital signal processing controllers. The valve products vary from small gas inlet valves to large exhaust valves.

In most cases, MKS's Baratron pressure measurement instruments provide the pressure input to the automatic pressure control device. Together, these components create an integrated automatic pressure control system. MKS's pressure control products can also accept inputs from other measurement instruments, enabling the automatic control of gas input or exhaust based on parameters other than pressure.

AUTOMATIC PRESSURE AND VACUUM CONTROL PRODUCTS

PRODUCT LINES	DESCRIPTION	RANGES OF LIST PRICES
Automatic throttle control valve controllers	Analog controllers, self-tuning digital controllers and displayless self-tuning controllers	\$800-\$2,650
Throttle control valves	Non-sealing and sealing valves; high speed sealing throttle control valves; automatic, microprocessor-based smart throttle control valves	\$1,400-\$8,800
Automatic solenoid control valve controllers	Stand-alone control electronics packages or integrated sensor, valve and control electronics packages	\$1,850-\$2,900
Solenoid control valves	Elastomer and all-metal-sealed solenoid control valves	\$450-\$1,500

MKS has recently introduced a line of integrated pressure controllers that combine the functions of its Baratron pressure measurement instrument, flow measurement instrument, control electronics and valve into a four-inch long instrument which can be placed directly on a gas line to control pressure downstream of the instrument while indicating the gas flow rate. This addresses the need for smaller components, saving valuable clean room space.

Flow Measurement and Control Products. MKS's flow measurement products include gas, vapor and liquid flow measurement products based upon thermal conductivity, pressure and direct liquid injection technologies. The flow control products combine the flow measuring device with valve control elements based upon solenoid, piezo-electric and piston pump technologies. The products measure and automatically control the mass flow rate of gases and vapors into the process chamber. MKS's broad product lines include products that allow the precise, automatic flow control of inert or corrosive gases, the automatic control of low vapor pressure gases and heated liquid source materials, and the automatic control of delicate, advanced technology liquid sources and vaporized solid sources for next generation devices.

MKS's line of thermal-based mass flow controllers, which control gas flow based on the molecular weight of gases, includes all-metal-sealed designs and ultra-clean designs for semiconductor applications, and general purpose controllers for applications where all-metal-sealed construction is not required. MKS has also developed pressure-based mass flow controllers, based on Baratron pressure instrument measurement and control technology, which use flow restrictors in the gas line to transform pressure control into mass flow control.

FLOW MEASUREMENT AND CONTROL PRODUCTS

PRODUCT LINES	DESCRIPTION	RANGES OF LIST PRICES
Direct liquid injection subsystem	Pumps and vaporizes liquid precursors for metals and dielectrics into process chamber	\$8,500-\$24,900
Gas box rate of rise calibrator	Measures pressure increase with time in a known volume	\$8,100-\$11,800
Pressure-based vapor delivery systems	Measures and controls flow of low pressure vapors into chamber	\$4,900-\$12,400
Pressure-based mass flow controllers	Gas flow controller consisting of Baratron sensor, control valve, orifice and electronics	\$2,700
Ultra-clean, all-metal-sealed thermal mass flow controllers	Gas flow controller consisting of sensor, control valve and electronics	\$1,400-\$9,500
General purpose elastomer-sealed mass flow controllers	Gas flow controller consisting of sensor, control valve and electronics	\$1,050-\$2,450

Certain new materials required for the next generation of semiconductor devices are difficult to control using traditional thermal mass flow technology. To control these new materials, MKS has designed a direct liquid injection subsystem which pumps a precise volume of liquid into a vaporizer, which in turn supplies a controlled flow of vapor into the process chamber. The direct liquid injection subsystem pump and vaporizer are presently used principally for research and development applications for next generation semiconductor device conductors, diffusion barriers and insulators, such as copper, titanium nitride and dielectric materials.

MKS's flow measurement products also include a calibration system which independently measures mass flow and compares this measurement to that of the process chamber mass flow controller. The demand for the MKS calibration system is driven by the increasingly stringent process control needs of the semiconductor industry and the need to reduce costly downtime resulting from stopping operations to address mass flow controller problems.

Gas Composition Analysis Instruments. MKS's gas analysis instruments are sold primarily to the semiconductor industry. The residual gas analysis product lines include a quadrapole mass spectrometer sensor, which is a device that separates gases based on molecular weight. MKS's quadrapole mass spectrometer sensors include built-in electronics to analyze the composition of background and process gases in the process chamber. MKS's ORION process monitoring system is a sophisticated quadrapole mass spectrometer process analyzer for statistical process monitoring of manufacturing processes operating from very low pressures to atmospheric pressure. These instruments are provided both as portable laboratory systems and as process gas monitoring systems used in the diagnosis of semiconductor manufacturing process systems and are sold at prices ranging up to \$80,000. The gas monitoring systems can indicate out-of-bounds conditions, such as the presence of undesirable atmospheric gases, water vapor or out-of-tolerance amounts of specific gases in the process chamber, enabling operators to diagnose and repair faulty equipment. MKS's gas sampling systems provide a turn-key solution for withdrawing gases from chambers at relatively high pressures for introduction into the low pressure gas analyzers. Next generation semiconductor manufacturing processes, with smaller circuit patterns and larger wafer sizes, are expected to require sophisticated gas analysis instruments and/or monitoring equipment to ensure tighter process control and earlier diagnosis of equipment malfunction.

VACUUM TECHNOLOGY PRODUCTS. MKS designs and manufactures a wide variety of vacuum technology products, including vacuum gauges, vacuum valves and components.

Vacuum Gauging Products. MKS offers a wide range of vacuum instruments consisting of vacuum measurement sensors and associated power supply and readout units. These vacuum gauges measure phenomena that are related to the level of pressure in the process chamber and downstream of the process chamber between the chamber and the pump. Unlike Baratron pressure measurement instruments, vacuum gauges do not measure pressure directly. These gauges are used to measure vacuum at pressures lower than those measurable with a Baratron pressure measurement instrument or to measure vacuum in the Baratron pressure measurement instrument range where less accuracy is required. MKS's indirect pressure gauges use thermal conductivity and ionization gauge technologies to measure pressure from atmospheric pressure to one trillionth of atmospheric pressure. MKS's Baratron pressure measurement instruments, together with its vacuum gauges, are capable of measuring the full range of pressures used in semiconductor and other thin-film manufacturing processes from two hundred times atmospheric pressure to one trillionth of atmospheric pressure.

MKS also manufactures a wide range of vacuum gauge instruments in which the associated electronics are packaged with the vacuum sensor, reducing panel space and installation cost. MKS offers both analog and digital versions of these vacuum gauge transducers.

Vacuum Valves and Components. MKS's vacuum valves are used on the gas lines between the process chamber and the pump downstream of the process chamber. MKS's vacuum components consist of flanges, fittings, traps and heated lines that are used downstream from the process chamber to provide leak free connections and to prevent condensable materials from depositing particles near or back into the chamber. The manufacture of small circuit patterns cannot tolerate contamination from atmospheric leaks or particles. MKS's vacuum components are designed to minimize such contamination and thus increase yields and uptimes.

VACUUM TECHNOLOGY PRODUCTS

PRODUCT LINES	DESCRIPTION	RANGES OF LIST PRICES
Cold cathode and hot filament vacuum gauges	Electronic gauges to measure pressure down to one trillionth of atmospheric pressure	\$600-\$6,200
Convection gauges	Electronic gauges to measure from one atmosphere down to one millionth of atmospheric pressure	\$200-\$700
Right-angle and in-line shut-off valves	High vacuum rapid action poppet valves	\$250-\$4,500
Vapor sublimation traps	Contaminant particle trap	\$1,800-\$4,600
Other vacuum components	Flanges, fittings, valves and heated lines	\$50-\$3,050

MARKETS AND APPLICATIONS

MKS estimates that approximately 60% of its sales in 1998 were made to the semiconductor industry. MKS's products are also used in other markets and applications including the manufacture of, among other things:

- flat panel displays
- magnetic and optical storage devices and media
- solar cells which convert light into electrical current
- fiber optic cables for telecommunications
- optical coatings, such as eyeglass coatings
- coatings for architectural glass
- hard coatings to minimize wear on cutting tools
- diamond thin films

MKS sells its products primarily through its direct sales force in 22 offices in France, Germany, Japan, Korea, The Netherlands, Singapore, Taiwan, the United Kingdom and the United States. This direct sales force is supplemented by sales representatives and agents in Canada, China, India, Israel, and Italy and in selected U.S. cities. The major markets for MKS's products include:

Semiconductor Manufacturing

MKS's products are sold to semiconductor capital equipment manufacturers and semiconductor device manufacturers. MKS's products are used in the major semiconductor processing steps such as:

- depositing materials on to substrates
- etching circuit patterns
- implanting positively charged atoms into a substrate to alter electrical characteristics

MKS's products are also used for process facility applications such as gas distribution, pressure control and vacuum distribution in clean rooms where semiconductor manufacturing takes place. MKS anticipates that the semiconductor manufacturing market will continue to account for a substantial portion of its sales. While the semiconductor device manufacturing market is global, the major semiconductor capital equipment manufacturers are concentrated in the United States, Japan and Europe.

Flat Panel Display Manufacturing

MKS's products are used in the manufacture of flat panel displays, which require the same or similar fabrication processes as semiconductor manufacturing. MKS sells its products both to flat panel original equipment manufacturers and to end-users in the flat panel display market. The transition to larger panel size and higher definition is driving the need for defect reduction which requires tighter process controls. The major manufacturers for flat panel displays and flat panel display equipment are concentrated in Japan.

Magnetic and Optical Storage Devices and Media

MKS's products are used in the manufacture of:

- magnetic storage media which store and read data magnetically
- optical storage media which store and read data using laser technology
- compact disks
- hard disks
- data storage devices
- digital video or versatile disks

The transition to higher density storage capacity requires manufacturing processes incorporating tighter process controls. While storage media manufacturing is global, the major manufacturers are concentrated in Japan and the Asia-Pacific region and storage media capital equipment manufacturers are concentrated in the United States, Japan and Europe.

Optical Fiber and Optical Coating

MKS's products are used in optical fiber and optical thin-film coating processes. MKS's products are sold both to coating equipment manufacturers and to manufacturers of products made using optical thin-film coating processes. Optical fibers used for data transmission are manufactured using processes to deposit chemical vapors which are similar to those used in semiconductor manufacturing. The requirement for greater data transmission is driving the need for tighter control of optical fiber coating processes. Optical thin films for eyeglasses, solar panels and architectural glass are deposited using processes to deposit chemical vapors and gaseous metals similar to those used in semiconductor manufacturing. Optical fiber manufacturing and optical thin-film processing are concentrated in the United States, Japan and Europe.

Other Coating Markets

MKS's pressure and flow measurement and control instruments are also used in processes for the application of thin films to harden tool bit surfaces, in the production of diamond thin films, coatings for food container packagings and coatings for jewelry and ornaments. The major equipment and process providers are concentrated in the United States, Japan and Europe.

MKS estimates that the flat panel display, magnetic and optical storage media, optical fiber, optical coating markets and other coating markets combined, accounted for approximately 12% and 14% of net sales for 1997 and 1998, respectively.

Other Markets

MKS's pressure measurement and control instruments and vacuum components are used in plasma processes used to sterilize medical instruments, in vacuum freeze drying of pharmaceuticals, foods and beverages, and in vacuum processes involved in light bulb and gas laser manufacturing. MKS's products are also sold to government, university and industrial laboratories for vacuum applications involving research and development in materials science, physical chemistry and electronics materials. The major equipment and process providers and research laboratories are concentrated in the United States, Japan and Europe.

CUSTOMERS

MKS's largest customers are leading semiconductor capital equipment manufacturers such as Applied Materials, Lam Research, Novellus and Tokyo Electron, semiconductor device manufacturers such as Motorola, and specialty gas providers such as Air Products and Chemicals. In 1996, 1997, and 1998, sales to MKS's top five customers accounted for approximately 26%, 32% and 24%, respectively, of MKS's net sales. During the same periods, international sales represented approximately 30%, 27% and 32% of total net sales, respectively. During 1998, Applied Materials accounted for approximately 16% of MKS's net sales. Applied Materials purchases products from MKS under the terms of an agreement, with no minimum purchase requirements, that expires in 2000.

SALES, MARKETING AND SUPPORT

MKS's worldwide sales, marketing and support organization is critical to its strategy of maintaining close relationships with semiconductor capital equipment manufacturers and semiconductor device manufacturers. MKS sells its products primarily through its direct sales force. As of December 31, 1998, MKS had 118 sales employees in 22 offices in France, Germany, Japan, Korea, The Netherlands, Singapore, Taiwan, the United Kingdom and the United States. This direct sales force is supplemented by sales representatives and agents in Canada, China, India, Israel, and Italy and in selected U.S. cities. MKS maintains a marketing staff, which as of December 31, 1998, consisted of 14 employees, to identify customer requirements, assist in product planning and specifications and to focus on future trends in the semiconductor and other markets.

As semiconductor device manufacturers have become increasingly sensitive to the significant costs of system downtime, they have required that suppliers offer comprehensive local repair service and close customer support. Manufacturers require close support to enable them to repair, modify, upgrade and retrofit their equipment to improve yields and adapt new materials or processes. To meet these market requirements, MKS maintains a worldwide sales and support organization with offices in 22 locations. Technical support is provided by applications engineers located at offices in Arizona, California, Colorado, Massachusetts, Oregon and Texas, as well as Canada, France, Germany, India, Israel, Italy, Japan, Korea, The Netherlands, Singapore, Taiwan and the United Kingdom. Repair and calibration services are provided at 14 service depots located worldwide. MKS provides warranties from one to three years, depending upon the type of product. In addition, MKS offers training programs for its customers in a wide range of vacuum and gas processing technologies.

MANUFACTURING

MKS believes that the ability to manufacture reliable gas management instruments and components in a cost-effective manner is critical to meeting the demanding requirements of semiconductor capital equipment manufacturers and semiconductor device manufacturers. MKS monitors and analyzes product lead times, warranty data, process yields, supplier performance, field data on mean time between failures, inventory turns, repair response time and other indicators so that it may continuously improve its manufacturing processes. MKS has adopted a total quality management process. MKS's manufacturing facilities in the United States, the United Kingdom and Germany are ISO 9001 certified.

MKS is devoting significant financial and management resources to maintain and expand its worldwide production and service capabilities to meet the global demand for gas management instruments and components. MKS believes that the ability to manufacture reliable instruments and components in a cost-effective manner is critical to meet the demanding just-in-time delivery requirements of semiconductor capital equipment manufacturers and semiconductor device manufacturers. Due to the short time between the receipt of orders and shipments, MKS normally operates with a level of backlog that is not significant. MKS currently manufactures its products at nine facilities in the United States and abroad. MKS plans to add manufacturing capabilities in 1999 to its Austin, Texas facilities and further equip its cleanroom facilities in Andover and Methuen, Massachusetts.

MKS's principal manufacturing activities consist of precision assembly, test, calibration, welding and machining activities. MKS subcontracts a portion of its assembly, machining and printed circuit board assembly and testing. All other assembly, test and calibration functions are performed by MKS. Critical assembly activities are performed in cleanroom environments at MKS's facilities.

RESEARCH AND DEVELOPMENT

MKS's research and development efforts are directed toward developing and improving MKS's gas management instruments and components for semiconductor and advanced thin-film processing applications and identifying and developing products for new applications for which gas management plays a critical role. MKS has undertaken an initiative to involve its marketing, engineering, manufacturing and sales personnel in the concurrent development of new products in order to reduce the time to market for new products. MKS's employees also work closely with its customers' development personnel. These relationships help MKS identify and define future technical needs on which to focus its research and development efforts. In addition, MKS participates in SEMI/SEMATECH, a consortium of semiconductor equipment suppliers, to assist in product development and standardization of product technology, and it supports research at academic institutions targeted at advances in materials science and semiconductor process development.

As of December 31, 1998, MKS employed a research and development staff of 89 employees. In 1996, 1997 and 1998, MKS's research and development expenditures were approximately \$14.2 million, \$14.7 million and \$12.1 million, respectively, representing approximately 8.3%, 7.8% and 8.7% of net sales, respectively.

COMPETITION

The market for MKS's products is highly competitive. Principal competitive factors include:

- historical customer relationships
- product quality, performance and price
- breadth of product line
- manufacturing capabilities
- customer service and support

While MKS believes that it competes favorably with respect to these factors, there can be no assurance that it will continue to do so.

MKS encounters substantial competition in each of its product lines from a number of competitors, although no one competitor competes with MKS across all product lines. Certain of MKS's competitors have greater financial and other resources than MKS. In some cases, the competitors are smaller than MKS, but well-established in specific product niches. Millipore Corporation offers products that compete with MKS's pressure and flow products. Aera Corporation, STEC (Horiba Ltd.), and Unit Instruments, Inc., each offer products that compete with MKS's mass flow control products. Nor-Cal Products, Inc. and MDC Vacuum Products, Inc., each offer products that compete with MKS's vacuum components. Leybold-Inficon, Inc., offers products that compete with MKS's vacuum measuring and gas analysis products. Helix Technology Corporation offers products that compete with MKS's vacuum gauging products. Spectra International LLC offers products that compete with MKS's gas analysis products.

In some cases, particularly with respect to mass flow controllers, semiconductor device manufacturers may direct semiconductor capital equipment manufacturers to use a specified supplier's product in their equipment. Accordingly, MKS's success depends in part on its ability to have semiconductor device manufacturers specify that its products be used at their fabrication facilities and MKS may encounter difficulties in changing established relationships of competitors with a large installed base of products at such customers' fabrication facilities. In addition, MKS's competitors can be expected to continue to improve the design and performance of their products. There can be no assurance that competitors will not develop products that offer price or performance features superior to those of MKS's products.

PATENTS AND OTHER INTELLECTUAL PROPERTY RIGHTS

MKS relies on a combination of patent, copyright, trademark and trade secret laws and license agreements to establish and protect its proprietary rights. MKS has 49 U.S. patents and 8 pending U.S. patent applications. Foreign counterparts of certain of these applications have been filed or may be filed at the appropriate time. While MKS believes that certain patents may be important for certain aspects of its business, MKS believes that its success depends more upon close customer contact, innovation, technological expertise, responsiveness and worldwide distribution.

MKS requires each of its employees, including its executive officers, to enter into standard agreements pursuant to which the employee agrees to keep confidential all proprietary information of MKS and to assign to MKS all inventions made while in the employ of MKS.

EMPLOYEES

As of December 31, 1998, MKS employed 821 persons, including 486 in manufacturing, 89 in research and development, 246 in marketing, sales, support and general and administrative activities. Management believes that MKS's ongoing success depends upon its continued ability to attract and retain highly skilled employees. None of MKS's employees is represented by a labor union or party to a collective bargaining agreement. MKS believes that its employee relations are good.

FACILITIES

MKS sells its products primarily through its direct sales force in 22 offices in France, Germany, Japan, Korea, The Netherlands, Singapore, Taiwan, the United Kingdom and the United States. The direct sales force is supplemented by sales representatives and agents in Canada, China, India, Israel, and Italy and in selected U.S. cities. MKS's corporate headquarters are located in Andover, Massachusetts. Manufacturing and other operations are conducted in a number of locations worldwide. MKS's minimum payments for leased real estate for the year ending December 31, 1999 are expected to be \$1,484,000. MKS believes that the current facilities along with the planned addition for 1999 will be adequate and suitable to meet its needs for the foreseeable future. The following table provides information concerning MKS's principal and certain other owned and leased facilities:

LOCATION	SQ. FT.	ACTIVITY	PRODUCTS MANUFACTURED	LEASE EXPIRES
Andover, Massachusetts	82,000	Headquarters, Manufacturing, Customer Support and Research & Development	Baratron pressure measurement products	(1)
Boulder, Colorado	86,000	Manufacturing, Customer Support, Service and Research & Development	Vacuum gauges, valves and components	(2)
Methuen, Massachusetts	85,000	Manufacturing, Customer Support, Service and Research & Development	Pressure control and flow measurement and control products	(1)
Lawrence, Massachusetts	40,000	Manufacturing	Baratron pressure measurement products	(1)
Tokyo, Japan	20,700	Manufacturing, Sales, Customer Support, Service and Research & Development	Mass flow measurement and control products	(3)
Santa Clara, California	15,600	Sales, Customer Support and Service	Not applicable	(4)*

LOCATION -----	SQ. FT. -----	ACTIVITY -----	PRODUCTS MANUFACTURED -----	LEASE EXPIRES -----
Richardson, Texas	14,600	Manufacturing, Sales, Customer Support and Service	Subassemblies	8/31/01
Munich, Germany	14,100	Manufacturing, Sales, Customer Support, Service and Research & Development	Mass flow measurement and control products	(1)
Le Bourget, France	13,700	Sales, Customer Support and Service	Not applicable	(1)
Austin, Texas	8,200	Sales, Customer Support and Service	Not applicable	1/30/03
Seoul, Korea	4,760	Manufacturing, Sales, Customer Support and Service	Mass flow measurement and control products	5/30/00**
Manchester, U.K.	2,200	Manufacturing, Sales, Customer Support and Service	Mass flow measurement and control products	10/5/09
Singapore	2,050	Sales, Customer Support and Service	Not applicable	3/25/01
Taiwan	2,050	Sales, Customer Support and Service	Not applicable	12/31/01

(1) This facility is owned by MKS.

(2) MKS leases one facility which has 39,000 square feet of space and a lease term which expires 10/31/01 and owns a second and third facility with 28,000 and 19,000 square feet of space, respectively.

(3) MKS leases a facility which has 14,000 square feet of space and a lease term which expires 4/30/99 and owns another facility with 6,700 square feet of space.

(4) MKS leases one facility with 4,000 square feet of space on a month-to-month basis, a second facility of 4,000 square feet with a lease term which expires on 1/30/00 and a third facility of 2,600 square feet with a lease term which expires 6/30/99. MKS owns a fourth facility of 5,000 square feet.

* MKS has an option to extend its leases at this location for a period of 18 months.

** MKS has an option to extend this lease for a period of two years.

In addition to manufacturing and other operations conducted at the foregoing leased or owned facilities, MKS provides worldwide sales, customer support and services from various other leased facilities throughout the world not listed in the table above. See "Business -- Sales, Marketing and Support."

LEGAL PROCEEDINGS

MKS is not a party to any material legal proceedings.

MANAGEMENT

EXECUTIVE OFFICERS AND DIRECTORS

The executive officers and directors of MKS as of December 31, 1998 are as follows:

NAME ----	AGE ---	POSITION -----
John R. Bertucci.....	58	Chairman, Chief Executive Officer and President
Ronald C. Weigner.....	53	Vice President and Chief Financial Officer
John J. Sullivan.....	63	Executive Vice President of Technology
William D. Stewart.....	54	Corporate Vice President and General Manager, Vacuum Products
Joseph A. Maher, Jr.....	51	Corporate Vice President and General Manager, Measurement and Control Products
Leo Berlinghieri.....	45	Corporate Vice President, Customer Support Operations
Richard S. Chute(1).....	60	Director
Owen W. Robbins(2).....	69	Director
Robert J. Therrien.....	64	Director
Louis P. Valente(1)(2).....	68	Director

(1) Member of Compensation Committee.

(2) Member of Audit Committee.

Mr. Bertucci has served as President and a Director of MKS since 1974 and has been Chairman of the Board of Directors and Chief Executive Officer since November 1995. From 1970 to 1974, he was Vice President and General Manager. Mr. Bertucci has an M.S. in Industrial Administration and a B.S. in Metallurgical Engineering from Carnegie-Mellon University. Mr. Bertucci is also a director of Applied Science and Technology Corporation and Intellisense Corporation.

Mr. Weigner has served as Vice President and Chief Financial Officer of MKS since November 1995. From September 1993 until November 1995, he was Vice President and Corporate Controller and from 1980 to 1993 he was Corporate Controller. Mr. Weigner is a certified public accountant and has a B.S. in Business Administration from Boston University.

Mr. Sullivan has served as Executive Vice President of Technology of MKS since March 1995. From 1982 to March 1995, he was Vice President of Marketing, and from 1975 to 1982, he was Vice President of Sales and Marketing. Mr. Sullivan has an M.S. and a B.S. in Physics from Northeastern University.

Mr. Stewart has served as Corporate Vice President of MKS and General Manager of Vacuum Products since November 1997. From October 1986 to November 1997, he was President of HPS Vacuum Products group, which MKS acquired in October 1986. Mr. Stewart co-founded HPS in 1976. Mr. Stewart has an M.B.A. from Northwestern University and a B.S. in Business Administration from the University of Colorado. Mr. Stewart also serves on the board of directors of the Janus Fund.

Mr. Maher has served as Corporate Vice President of MKS and General Manager of Measurement and Control Products since November 1997. From March 1997 through November 1997, he served as Vice President of the Process Control Instrumentation Group. Mr. Maher was a Vice President of Lam Research Corporation from 1993 through 1996, and from 1980 through 1993, he was Executive Vice President of Drytek Corporation, which was purchased by Lam Research Corporation in 1993. Mr. Maher has a B.S. in Electrical Engineering from Northeastern University.

Mr. Berlinghieri has served as Corporate Vice President, Customer Support Operations of MKS since November 1995. From 1980 to November 1995, he served in various management positions at MKS, including Manufacturing Manager, Production & Inventory Control Manager, and Director of Customer

Support Operations. Mr. Berlinghieri is also Treasurer of the TQM-BASE Council, Inc., a non-profit quality management consortium comprised of Boston-area semiconductor capital equipment manufacturers.

Mr. Chute has served as a director of MKS since 1974. Mr. Chute has been a member of the law firm of Hill & Barlow, a professional corporation, since November 1971.

Mr. Robbins has served as a director of MKS since February 1996. Mr. Robbins was Executive Vice President of Teradyne, Inc., a manufacturer of electronic test systems and backplane connection systems used in the electronics and telecommunications industries from March 1992 to May 1997, and its Chief Financial Officer from February 1980 to May 1997. Mr. Robbins has served on the board of directors of Teradyne, Inc. since March 1992 and was its Vice Chairman from January 1996 to May 1997.

Mr. Therrien has served as a director of MKS since February 1996. Mr. Therrien has been President and Chief Executive Officer of Brooks Automation, Inc., a manufacturer of semiconductor processing equipment, since 1989.

Mr. Valente has served as a director of MKS since February 1996. Mr. Valente has been Chairman and Chief Executive Officer of Palomar Medical Technologies, Inc., a company which designs, manufactures and markets cosmetic lasers, since September 1997. He has been a director of Palomar Medical Technologies, Inc. since February 1997 and was its President and Chief Executive Officer from May 1997 to September 1997. Mr. Valente was a Senior Vice President of Acquisitions, Mergers and Investments of EG&G, Inc. from 1991 until July 1995. Mr. Valente is also a director of Micrion Corporation.

Executive officers of MKS are elected by the Board of Directors on an annual basis and serve until their successors are duly elected and qualified. There are no family relationships among any of the executive officers of MKS.

COMMITTEES OF THE BOARD OF DIRECTORS

The Compensation Committee consists of Messrs. Chute and Valente. The Compensation Committee reviews and evaluates the salaries, supplemental compensation and benefits of all officers of MKS, reviews general policy matters relating to compensation and benefits of employees of MKS and makes recommendations concerning these matters to the Board of Directors. The Compensation Committee also administers MKS's stock option and stock purchase plans. See "-- Stock Plans."

The Audit Committee consists of Messrs. Robbins and Valente. The Audit Committee reviews with MKS's independent auditor the scope and timing of its audit services, the auditor's report on MKS's financial statements following completion of its audit and MKS's policies and procedures with respect to internal accounting and financial controls. In addition, the Audit Committee will make annual recommendations to the Board of Directors for the appointment of independent auditors for the ensuing year.

DIRECTOR COMPENSATION

Directors of MKS are reimbursed for expenses incurred in connection with their attendance at Board of Directors and committee meetings. Directors who are not employees of MKS are paid an annual fee of \$10,000 and \$1,000 for each Board of Directors meeting they attend and \$500 for each committee meeting they attend which is not held on the same day as a Board of Directors meeting. Messrs. Chute, Robbins, Therrien and Valente, MKS's four non-employee directors, have each been granted options, under MKS's 1996 Director Stock Option Plan (under which no further grants will be made), to purchase 8,592 shares of common stock at a weighted average exercise price of \$4.81 per share. Each has also been granted options to purchase 6,000 shares of common stock at an exercise price of \$14.40 per share under the 1997 Director Stock Option Plan.

COMPENSATION COMMITTEE INTERLOCKS AND INSIDER PARTICIPATION

The Compensation Committee is currently comprised of Messrs. Chute and Valente. No member of the Compensation Committee was at any time an employee of MKS. No executive officer of MKS serves as a member of the Board of Directors or Compensation Committee of any other entity which has one or more executive officers serving as a member of MKS's Board of Directors or Compensation Committee.

EXECUTIVE COMPENSATION

The following table sets forth information with respect to the compensation of MKS's Chief Executive Officer and each of the four other most highly compensated executive officers for the year ended December 31, 1998 (the "Named Executive Officers").

SUMMARY COMPENSATION TABLE FOR 1998

NAME AND PRINCIPAL POSITION	ANNUAL COMPENSATION			LONG-TERM COMPENSATION AWARDS	ALL OTHER COMPENSATION (1)
	SALARY	BONUS	OTHER ANNUAL COMPENSATION	SECURITIES UNDERLYING OPTIONS (#)	
John R. Bertucci..... Chief Executive Officer and President	\$337,440	--	--	--	\$12,264
Ronald C. Weigner..... Vice President and Chief Financial Officer	164,257	--	--	60,000	8,000
Joseph A. Maher, Jr..... Corporate Vice President and General Manager, Measurement and Control Products	161,307	--	--	60,000	8,000
William D. Stewart..... Corporate Vice President and General Manager, Vacuum Products	173,893	--	--	60,000	8,000
Leo Berlinghieri..... Corporate Vice President, Customer Support Operations	152,559	--	--	60,000	3,200

(1) Includes a premium of \$4,264 paid on a life insurance policy and estimated payments of \$8,000 paid into a 401(k) plan for Mr. Bertucci, and estimated payments paid into a 401(k) plan for Messrs. Weigner, Maher, Stewart and Berlinghieri.

STOCK OPTION GRANTS

The following table contains information concerning the grants of options to purchase MKS's common stock made to each of the Named Executive Officers for the year ended December 31, 1998. Stock options are generally granted at 100% of the fair value of MKS's common stock as determined by the Board of Directors on the date of grant. In reaching the determination of fair value at the time of each grant, the Board of Directors considers a range of factors, including MKS's current financial position, its recent revenues, results of operations and cash flows, its assessment of MKS's competitive position in its markets and prospects for the future, the status of MKS's product development and marketing efforts, current valuations for comparable companies and the illiquidity of an investment in MKS's common stock.

OPTION GRANTS IN 1998

NAME	INDIVIDUAL GRANTS				POTENTIAL REALIZABLE VALUE AT ASSUMED ANNUAL RATES OF STOCK PRICE APPRECIATION FOR OPTION TERM (2)	
	NUMBER OF SECURITIES UNDERLYING OPTIONS GRANTED (1)	PERCENT OF TOTAL OPTIONS GRANTED TO EMPLOYEES IN FISCAL YEAR	EXERCISE OR BASE PRICE PER SHARE	EXPIRATION DATE	5%	10%
John R. Bertucci.....	--	--	--	--	--	--
Ronald C. Weigner.....	60,000	9.47%	\$6.67	7/9/08	\$251,684	\$637,816
Joseph A. Maher, Jr.	60,000	9.47	6.67	7/9/08	251,684	637,816
William D. Stewart.....	60,000	9.47	6.67	7/9/08	251,684	637,816
Leo Berlinghieri.....	60,000	9.47	6.67	7/9/08	251,684	637,816

(1) These options become exercisable with respect to 20% of the shares granted on July 9, 1999 and with respect to the remainder of the shares on a quarterly basis during the following four years.

(2) Amounts represent hypothetical gains that could be achieved for the respective options if exercised at the end of the option term. These gains are based on assumed rates of stock price appreciation of 5% and 10% compounded annually from the date the respective options were granted to their expiration date. These numbers are calculated based on rules promulgated by the Securities and Exchange Commission and do not reflect MKS's estimate of future stock price growth. Actual gains, if any, on stock option exercises and common stock are dependent on the timing of such exercise and the future performance of the common stock.

OPTION EXERCISES AND HOLDINGS

The following table sets forth information concerning option exercises and option holdings for the fiscal year ended December 31, 1998 with respect to each of the Named Executive Officers.

AGGREGATED OPTION EXERCISES IN 1998
AND YEAR-END OPTION VALUES

NAME	NUMBER OF SHARES UNDERLYING UNEXERCISED OPTIONS AT YEAR-END		VALUE OF UNEXERCISED IN-THE-MONEY OPTIONS AT YEAR-END (1)	
	EXERCISABLE	UNEXERCISABLE	EXERCISABLE	UNEXERCISABLE
John R. Bertucci.....	--	--	--	--
Ronald C. Weigner.....	75,961	110,639	\$757,331	\$ 968,671
Joseph A. Maher, Jr.	44,310	142,290	441,771	1,284,231
William D. Stewart.....	75,961	110,639	757,331	968,671
Leo Berlinghieri.....	75,961	110,639	757,331	968,671

(1) Values are based on the difference between the fair market value of the underlying shares at December 31, 1998 (\$14.40 per share) and the exercise price of each option listed (between \$4.43 and \$6.67 per share).

STOCK PLANS

1995 Stock Incentive Plan

MKS's Amended and Restated 1995 Stock Incentive Plan (the "1995 Stock Plan") provides for the grant of incentive stock options, nonstatutory stock options, stock appreciation rights, performance shares and awards of restricted stock and unrestricted stock. An aggregate of 3,750,000 shares of common stock may be issued pursuant to the 1995 Stock Plan (subject to adjustment for certain changes in MKS's capitalization). No award may be made under the 1995 Stock Plan after November 30, 2005.

The 1995 Stock Plan is administered by the Board of Directors and the Compensation Committee. The Board of Directors has the authority to grant awards under the 1995 Stock Plan and to accelerate, waive or amend certain provisions of outstanding awards. The Board of Directors has authorized the Compensation Committee to administer certain aspects of the 1995 Stock Plan and has authorized the Chief Executive Officer of MKS to grant awards to non-executive officer employees. The maximum number of shares represented by such awards may not exceed 450,000 shares in the aggregate or 30,000 shares to any one employee.

Incentive Stock Options and Nonstatutory Options. Optionees receive the right to purchase a specified number of shares of common stock at some time in the future at an option price and subject to such terms and conditions as are specified at the time of the grant. Incentive stock options and options that the Board of Directors or Compensation Committee intends to qualify as performance-based compensation under Section 162(m) of the Internal Revenue Code may not be granted at an exercise price less than the fair market value of the common stock on the date of grant (or less than 110% of the fair market value in the case of incentive stock options granted to optionees holding 10% or more of the voting stock of MKS). All other options may be granted at an exercise price that may be less than, equal to or greater than the fair market value of the common stock on the date of grant.

Stock Appreciation Rights and Performance Shares. A stock appreciation right is based on the value of common stock and entitles the holder to receive consideration to the extent that the fair market value on the date of exercise of the shares of common stock underlying the right exceeds the fair market value of the underlying shares on the date the right was granted. A performance share award entitles the recipient to acquire shares of common stock upon the attainment of specified performance goals.

Restricted and Unrestricted Stock. Restricted stock awards entitle recipients to acquire shares of common stock, subject to the right of MKS to repurchase all or part of such shares at their purchase price from the recipient in the event that the conditions specified in the applicable stock award are not satisfied prior to the end of the applicable restriction period established for such award. MKS may also grant (or sell at a purchase price not less than 85% of the fair market value on the date of such sale) to participants shares of common stock free of any restrictions under the 1995 Stock Plan.

All of the employees, officers, directors, consultants and advisors of MKS and its subsidiaries who are expected to contribute to MKS's future growth and success are eligible to participate in the 1995 Stock Plan.

Section 162(m) of the Internal Revenue Code disallows a tax deduction to public companies for certain compensation in excess of \$1.0 million paid to a company's chief executive officer or to any of the four other most highly compensated executive officers. Certain compensation, including "performance-based compensation," is not included in compensation subject to the \$1.0 million limitation. The 1995 Stock Plan limits to 1,350,000 the maximum number of shares of common stock with respect to which awards may be granted to any employee in any calendar year. This limitation is intended to preserve the tax deductions to MKS that might otherwise be unavailable under Section 162(m) with respect to certain awards.

Prior to the date of this prospectus, MKS plans to grant options (to vest 20% after one year and 5% per quarter thereafter) to purchase approximately 350,000 shares of common stock to certain employees of MKS, at an exercise price equal to the initial public offering price.

1999 Employee Stock Purchase Plan

MKS's 1999 Employee Stock Purchase Plan (the "Purchase Plan") authorizes the issuance of up to an aggregate of 450,000 shares of common stock to participating employees. MKS will make one or more offerings to employees to purchase common stock under the Purchase Plan. Offerings under the Purchase Plan commence on June 1 and December 1 and terminate, respectively on November 30 and May 31. During each offering, the maximum number of shares which may be purchased by a participating employee is determined on the first day of this offering period under a formula whereby 85% of the market value of a share of common stock on the first day of this offering period is divided into an amount equal to 10% of the employee's annualized compensation (or such lower percentage as may be established by the Compensation Committee) for the immediately preceding six-month period. An employee may elect to have up to 10% deducted from his or her regular salary (or such lower percentage as may be established by the Compensation Committee) for this purpose. The price at which an employee's option is exercised is the lower of (1) 85% of the closing price of the common stock on the Nasdaq National Market on the day that this offering commences or (2) 85% of the closing price on the day that this offering terminates.

The Purchase Plan is administered by the Board of Directors and the Compensation Committee. With certain exceptions, all eligible employees, including directors and officers, regularly employed by MKS for at least six months on the applicable offering commencement date are eligible to participate in the Purchase Plan. The Purchase Plan is intended to qualify as an "employee stock purchase plan" as defined in Section 423 of the Internal Revenue Code.

1997 Director Stock Option Plan

MKS's 1997 Director Stock Option Plan (the "1997 Director Plan") authorizes the issuance of up to an aggregate of 300,000 shares of common stock. The 1997 Director Plan is administered by MKS's Board of Directors. Options are granted under the 1997 Director Plan only to directors of MKS who are not employees of MKS. Under the 1997 Director Plan, prior to the date of this prospectus each existing eligible director will receive an option to purchase 10,500 shares of common stock at an exercise price equal to the initial public offering price and future non-employee directors will receive an option to purchase 11,250 shares of common stock upon their initial election to the Board of Directors. Each initial option will vest over a three-year period in 12 equal quarterly installments following the date of grant. On the date of each annual meeting of the stockholders, options will be automatically granted to each eligible director who has been in office for at least six months prior to the date of the annual meeting of the stockholders. Each annual option will entitle the holder to purchase 6,000 shares of common stock. Each annual option will become exercisable on the day prior to the first annual meeting of stockholders following the date of grant, or if no such meeting is held within 13 months after the date of grant, on the 13-month anniversary of the date of grant. The exercise price of all options granted under the 1997 Director Plan is equal to the fair market value of the common stock on the date of grant. Options granted under the 1997 Director Plan terminate upon the earlier of three months after the optionee ceases to be a director of MKS or ten years after the grant date. In the event of a change in control of MKS, the vesting of all options then outstanding would be accelerated in full and any restrictions on exercising outstanding options would terminate.

The Company's 1996 Director Stock Option Plan, under which options have been granted to, and may still be exercised by, four non-employee directors of MKS, has been terminated. See "-- Director Compensation."

Employment Agreements

MKS entered into an employment agreement with each of Messrs. Stewart, Maher, Berlinghieri and Weigner. The provisions of each agreement are substantially the same.

The term of employment for each is from month to month with termination:

- upon the death of the employee
- at the election of MKS if the employee fails or refuses to perform
- at the election of MKS if the employee commits any acts not in MKS's best interest

Payment by MKS upon termination depends on how employment is terminated:

- if employment is terminated after the expiration of a 30 day notice period, MKS has no further obligation for compensation
- if employment is terminated by death, MKS must pay the employee's estate the compensation owed to him at the end of the month of his death
- if employment is terminated at the election of MKS, MKS must pay the employee through the last day of actual employment

Each of the agreements contains non-competition provisions during the term of employment and for the period one year after termination of employment. Under these provisions, Messrs. Stewart, Maher, Berlinghieri and Weigner may not:

- engage in any competitive business or activity
- for the 12 months subsequent to termination, work for, employ, become a partner with, or cause to be employed any employee, officer or agent of MKS
- for the 12 months subsequent to termination, give, sell or lease any competitive services or goods to any customer of MKS
- have any financial interest in or be a director, officer, stockholder, partner, employee or consultant to any competitor of MKS

CERTAIN TRANSACTIONS

Mr. Chute, a director of MKS, MKS's clerk, and a co-trustee of certain of the Bertucci Family Trusts (see "Principal Stockholders") and Mr. Thomas H. Belknap, a co-trustee of certain of the Bertucci Family trusts, are attorneys at the law firm of Hill & Barlow, a professional corporation. Hill & Barlow has provided legal services to MKS during the calendar year ended December 31, 1998 for which it was compensated by MKS in the aggregate amount of \$183,000.

Mr. Stewart, Corporate Vice President and General Manager of Vacuum Products, is the general partner of Aspen Industrial Park Partnership. On October 12, 1989, MKS entered into a lease with Aspen, which has been periodically extended, for certain facilities occupied by MKS's Vacuum Products group in Boulder, Colorado. MKS currently pays Aspen approximately \$350,000 annually to lease such facilities.

MKS has been treated as an S corporation for federal income tax purposes since July 1, 1987. As a result, MKS currently pays no federal, and certain state, income tax and all of the earnings of MKS are subject to federal, and certain state, income taxation directly at the stockholder level. MKS's S corporation status will terminate upon the closing of this offering, at which time MKS will become subject to corporate income taxation under Subchapter C of the Internal Revenue Code. In 1997 and 1998, MKS distributed \$12.4 million and \$6.2 million, respectively, of undistributed S corporation earnings to its stockholders. As soon as practicable following the closing of this offering, MKS intends to make a distribution to the holders of record on the day prior to the closing of this offering in an amount equivalent to the accumulated adjustments account. As of December 31, 1998, the outstanding balance of the accumulated adjustments account was approximately \$35.9 million and such balance is expected to increase in the period from January 1, 1999 through the closing of this offering. See "S Corporation and Termination of S Corporation Status."

MKS believes that the transactions listed above were made on terms no less favorable to the Company than could have been obtained from unaffiliated third parties. Commencing on the effective date of this offering, all future transactions between MKS and its officers, directors or other affiliates must (1) be approved by a majority of the members of the Board of Directors and a majority of the disinterested members of the Board; and (2) be on terms no less favorable to MKS than could be obtained from unaffiliated third parties.

PRINCIPAL AND SELLING STOCKHOLDERS

The following table sets forth certain information regarding beneficial ownership of MKS's common stock as of December 31, 1998, and as adjusted to reflect the sale of shares offered hereby, by (1) each of the directors of MKS, (2) each of the Named Executive Officers, (3) each person known to MKS to own beneficially more than 5% of MKS's common stock and (4) all directors and executive officers as a group.

Unless otherwise indicated, each person named in the table has sole voting power and investment power or shares such power with his or her spouse with respect to all shares of capital stock listed as owned by such person. Beneficial ownership is determined in accordance with the rules of the Securities and Exchange Commission and includes voting or investment power with respect to the securities. The number of shares of common stock outstanding used in calculating the percentage for each listed person includes any shares the individual has the right to acquire within 60 days of December 31, 1998.

All of the shares being offered by the selling stockholders are owned by trusts for the benefit of Mr. Bertucci and members of his family.

NAME OF BENEFICIAL OWNER	SHARES BENEFICIALLY OWNED PRIOR TO OFFERING		NUMBER OF SHARES OFFERED	SHARES BENEFICIALLY OWNED AFTER OFFERING	
	NUMBER	PERCENT		NUMBER	PERCENT
John R. Bertucci.....	17,261,915 (1)	95.6%	500,000	16,761,915	69.7%
Ronald C. Weigner.....	82,291 (2)	*	--	82,291	*
John J. Sullivan.....	614,010 (3)	3.4	--	614,010	2.6
Joseph A. Maher, Jr.....	44,310 (2)	*	--	44,310	*
William D. Stewart.....	82,291 (2)	*	--	82,291	*
Leo Berlinghieri.....	82,291 (2)	*	--	82,291	*
Richard S. Chute.....	2,766,852 (4)	15.3	300,000	2,466,852	10.3
Owen W. Robbins.....	8,027 (2)	*	--	8,027	*
Robert J. Therrien.....	8,027 (2)	*	--	8,027	*
Louis P. Valente.....	8,027 (2)	*	--	8,027	*
Thomas H. Belknap.....	2,331,902 (5)	12.9	200,000	2,131,902	8.9
All executive officers and directors as a group.....	18,199,216	99.0%	500,000	17,699,216	72.6%

* Less than 1% of outstanding common stock.

(1) Includes 6,046,208 shares held directly by Mr. Bertucci, 6,124,980 shares held directly by Mr. Bertucci's wife, and 5,090,727 shares held by Bertucci family trusts for which either Mr. or Mrs. Bertucci serves as a co-trustee.

(2) Comprised solely of options exercisable within 60 days of December 31, 1998.

(3) Includes 316,500 shares held in a grantor retained annuity trust.

(4) Includes 2,758,825 shares held by certain of the Bertucci family trusts for which Mr. Chute serves as a co-trustee and 8,027 shares subject to options held by Mr. Chute exercisable within 60 days of December 31, 1998.

(5) Represents shares held by certain of the Bertucci family trusts for which Mr. Belknap serves as a co-trustee.

DESCRIPTION OF CAPITAL STOCK

The authorized capital stock of MKS will consist of 50,000,000 shares of common stock, no par value per share, and 2,000,000 shares of preferred stock, \$.01 par value per share, after giving effect to the amendment and restatement of MKS's Restated Articles of Organization which will be filed with the Secretary of State of The Commonwealth of Massachusetts prior to the closing of this offering.

COMMON STOCK

As of December 31, 1998, there were 18,053,167 shares of common stock outstanding and held of record by twenty-three stockholders.

Upon the closing of this offering, all holders of common stock shall be entitled to one vote for each share held on all matters submitted to a vote of stockholders and will not have cumulative voting rights. Accordingly, holders of a majority of the shares of common stock entitled to vote in any election of directors may elect all of the directors standing for election. Holders of common stock are entitled to receive ratably such dividends, if any, as may be declared by the Board of Directors out of funds legally available therefor, subject to any preferential dividend rights of any outstanding preferred stock. Upon the liquidation, dissolution or winding up of MKS, the holders of common stock are entitled to receive ratably the net assets of MKS available after the payment of all debts and other liabilities, subject to the prior rights of any outstanding preferred stock. Holders of the common stock have no preemptive, subscription, redemption or conversion rights. The outstanding shares of common stock are, and the shares offered by MKS in this offering made by this prospectus will be, when issued and paid for, fully paid and nonassessable. The rights, preferences and privileges of holders of common stock are subject to, and may be adversely affected by, the rights of the holders of shares of any series of preferred stock that MKS may designate and issue in the future. There are no shares of preferred stock outstanding.

PREFERRED STOCK

The Articles of Organization authorize the Board of Directors, subject to certain limitations prescribed by law, without further stockholder approval, from time to time to issue up to an aggregate of 2,000,000 shares of preferred stock in one or more series and to fix or alter the designations, preferences and rights, and any qualifications, limitations or restrictions thereof, of the shares of each such series, including the number of shares constituting any such series and the dividend rights, dividend rates, conversion rights, voting rights, terms of redemption (including sinking fund provisions), redemption price or prices and liquidation preferences thereof. The issuance of preferred stock may have the effect of delaying, deferring or preventing a change in control of MKS. MKS has no present plans to issue any shares of preferred stock.

MASSACHUSETTS LAW AND CERTAIN PROVISIONS OF MKS'S RESTATED ARTICLES OF ORGANIZATION AND BY-LAWS

MKS intends to amend and restate its By-Laws prior to the closing of this offering. The By-Laws will include a provision excluding MKS from the applicability of Massachusetts General Laws Chapter 110D, entitled "Regulation of Control Share Acquisitions." In general, this statute provides that any stockholder of a corporation subject to this statute who acquires 20% or more of the outstanding voting stock of a corporation may not vote such stock unless the stockholders of the corporation so authorize. The Board of Directors will be able to amend the By-Laws at any time to subject MKS to this statute prospectively.

Massachusetts General Laws Chapter 156B, Section 50A generally requires that publicly-held Massachusetts corporations have a classified board of directors consisting of three classes as nearly equal in size as possible, unless the corporation elects to opt out of the statute's coverage. The By-Laws will contain provisions which give effect to Section 50A.

The By-Laws will require that nominations for the Board of Directors made by a stockholder of a planned nomination must be given not less than 30 and not more than 90 days prior to a scheduled meeting, provided that if less than 40 days' notice is given of the date of the meeting, a stockholder will

have ten days within which to give such notice. The stockholder's notice of nomination must include particular information about the stockholder, the nominee and any beneficial owner on whose behalf the nomination is made. MKS may require any proposed nominee to provide such additional information as is reasonably required to determine the eligibility of the proposed nominee.

The By-Laws will also require that a stockholder seeking to have any business conducted at a meeting of stockholders give notice to MKS not less than 60 and not more than 90 days prior to the scheduled meeting, provided in certain circumstances that a ten-day notice rule applies. The notice from the stockholder will be required to describe the proposed business to be brought before the meeting and include information about the stockholder making the proposal, any beneficial owner on whose behalf the proposal is made, and any other stockholder known to be supporting the proposal. The By-Laws will require MKS to call a special stockholders meeting at the request of stockholders holding at least 40% of the voting power of MKS.

The Articles of Organization will provide that the directors and officers of MKS shall be indemnified by MKS to the fullest extent authorized by Massachusetts law, as it now exists or may in the future be amended, against all expenses and liabilities reasonably incurred in connection with service for or on behalf of MKS. In addition, the Articles of Organization will provide that the directors of MKS will not be personally liable for monetary damages to MKS for breaches of their fiduciary duty as directors, unless they violated their duty of loyalty to MKS or its stockholders, acted in bad faith, knowingly or intentionally violated the law, which could include securities laws, authorized illegal dividends or redemptions or derived an improper personal benefit from their action as directors.

The Articles of Organization will provide that any amendment to the Articles of Organization, the sale, lease or exchange of all or substantially all of MKS's property and assets, or the merger or consolidation of MKS into or with any corporation may be authorized by the approval of the holders of a majority of the shares of each class of stock entitled to vote thereon, rather than by two-thirds as otherwise provided by statute, provided that the transactions have been authorized by a majority of the members of the Board of Directors and the requirements of any other applicable provisions of the Articles of Organization have been met.

The Articles of Organization will contain a provision excluding MKS from the applicability of Massachusetts General Laws Chapter 110F, entitled "Business Combinations with Interested Shareholders." In general, Chapter 110F places limitations on a Massachusetts corporation's ability to engage in business combinations with certain stockholders for a period of three years, unless the corporation elects to opt out of the statute's coverage by including such a provision in its Articles of Organization.

TRANSFER AGENT AND REGISTRAR

The Transfer Agent and Registrar for the common stock is BankBoston, N.A.

SHARES ELIGIBLE FOR FUTURE SALE

Prior to this offering, there has been no public market for the securities of MKS. Upon completion of this offering, based upon the number of shares outstanding at December 31, 1998, there will be _____ shares of common stock of MKS outstanding assuming the underwriters do not exercise their over-allotment option, and no options are exercised. Of these shares, the 6,500,000 shares sold in this offering will be freely tradable without restriction or further registration under the Securities Act, except that any shares purchased by "affiliates" of MKS, as that term is defined in Rule 144 under the Securities Act, may generally only be sold in compliance with the limitations of Rule 144 described below.

SALES OF RESTRICTED SHARES

The outstanding shares of common stock not sold in this offering will be deemed "restricted securities" under Rule 144 under the Securities Act. Of these shares, 17,553,165 are subject to 180-day lock-up agreements with the representatives. Upon expiration of the lock-up agreements 180 days after the date of this prospectus, all such shares will be available for sale in the public market, subject to the provisions of Rule 144.

Stockholders who are parties to the lock-up agreement have agreed that for a period of 180 days after the date of this prospectus, they will not sell, offer, contract or grant any option to sell, pledge, transfer, establish an open put equivalent position or otherwise dispose of any shares of common stock, any options to purchase shares of common stock or any shares convertible into or exchangeable for shares of common stock, owned directly by such persons or with respect to which they have the power of disposition, without the prior written consent of NationsBanc Montgomery Securities LLC.

In general, under Rule 144, beginning 90 days after the effective date of this prospectus, a stockholder who has beneficially owned his or her restricted securities for at least one year will be entitled to sell, within any three-month period, a limited number of such shares. The number of shares may not exceed the greater of 1% of the then outstanding shares of common stock or the average weekly trading volume in the common stock during the four preceding calendar weeks. In addition, under Rule 144(k), if a period of at least two years has elapsed since the date restricted securities were acquired from MKS, a stockholder who is not an affiliate of MKS at the time of sale and has not been an affiliate of MKS for at least three months prior to the sale will be entitled to sell the shares immediately without restriction.

Securities issued in reliance on Rule 701, such as shares of common stock acquired upon exercise of certain options granted under MKS's stock plans, are also restricted and, beginning 90 days after the effective date of this prospectus, may be sold by stockholders other than affiliates of MKS subject only to the manner of sale provisions of Rule 144 and by affiliates under Rule 144 without compliance with its one-year holding period requirement.

OPTIONS

As of December 31, 1998 there were options outstanding to purchase an aggregate of 2,132,575 shares of MKS's common stock, of which options to purchase an aggregate of 804,701 shares were exercisable. Of these, 802,009 shares were subject to lock-up agreements. The option to purchase the remaining 2,692 shares has since expired. MKS intends to file registration statements on Form S-8 under the Securities Act to register all shares of common stock issuable under each of the 1995 Stock Plan, Purchase Plan, the 1997 Director Plan and the 1996 Director Stock Option Plan promptly following the consummation of this offering. Shares issued pursuant to such plans shall be, after the effective date of the Form S-8 registration statements, eligible for resale in the public market without restriction, subject to Rule 144 limitations applicable to affiliates and the lock-up agreements noted above, if applicable.

UNDERWRITING

MKS, the selling stockholders and the underwriters named below have entered into an underwriting agreement with respect to the shares being offered. Subject to certain conditions, each underwriter has severally agreed to purchase the number of shares indicated in the following table. NationsBanc Montgomery Securities LLC, Donaldson, Lufkin & Jenrette Securities Corporation and Lehman Brothers Inc., are the representatives of the underwriters.

UNDERWRITER -----	NUMBER OF SHARES -----
NationsBanc Montgomery Securities LLC.....	
Donaldson, Lufkin & Jenrette Securities Corporation.....	
Lehman Brothers Inc.	

Total.....	6,500,000 =====

Shares sold by the underwriters to the public will initially be offered on the terms set forth on the cover page of this prospectus. The underwriters may allow to selected dealers a concession of not more than \$ per share, and the underwriters may allow, and any other dealers may reallow, a concession of not more than \$ per share to certain other dealers. If all the shares are not sold at the initial public offering price, the underwriters may change the offering price and the other selling terms. The common stock is offered subject to receipt and acceptance by the underwriters and to certain other conditions, including the right to reject orders in whole or in part.

If the underwriters sell more shares than the total number set forth in the table above, they have an option to buy up to a maximum of 975,000 additional shares from MKS to cover such sales. They may exercise that option for 30 days. If any shares are purchased pursuant to this option, the underwriters will severally purchase shares in approximately the same proportion as set forth in the table above.

All stockholders prior to this offering, as well as certain holders of options to purchase common stock, and MKS have agreed with the underwriters not to dispose of or hedge any of their common stock or securities convertible into or exchangeable for shares of common stock during the period from the date of this prospectus continuing through the date 180 days after the date of this prospectus without the prior written consent of NationsBanc Montgomery Securities LLC which may, in its sole discretion and at any time without notice, release all or any portion of the securities subject to these lock-up agreements.

The underwriting agreement provides that MKS and the selling stockholders will indemnify the underwriters against certain liabilities, including civil liabilities, under the Securities Act, or will contribute to payments the underwriters may be required to make in respect thereof.

In connection with this offering, the underwriters may purchase and sell shares of common stock in the open market. These transactions may include short sales, stabilizing transactions and purchases to cover positions created by short sales. Short sales involve the sale by the underwriters of a greater number of shares than they are required to purchase in this offering. Stabilizing transactions consist of certain bids or purchases made for the purpose of preventing or retarding a decline in the market price of the common stock while this offering is in progress.

The underwriters also may impose a penalty bid. This occurs when a particular underwriter repays to the underwriters a portion of the underwriting discount received by it because the representatives have repurchased shares sold by or for the account of such underwriter in stabilizing or short covering transactions.

These activities by the underwriters may stabilize, maintain or otherwise affect the price of the common stock, including over-allotment, stabilization, syndicate covering transactions and imposition of penalty bids. As a result, the price of the common stock may be higher than the price that otherwise might exist in the open market. If these activities are commenced, they may be discontinued by the underwriters at any time. These transactions may be effected on the Nasdaq National Market, in the over-the-counter market or otherwise, and, if commenced, may be discontinued at any time.

The underwriters do not expect sales to discretionary accounts to exceed 5% of the total number of shares of common stock offered hereby.

Prior to this offering, there has been no public market for the common stock of MKS. The initial public offering price will be negotiated among MKS, the selling stockholders and the underwriters. Among the factors to be considered in such negotiations are the history of, and prospects for, MKS and the industry in which it competes, an assessment of MKS's management, the present state of MKS's development, the prospects for future earnings of MKS, the prevailing market conditions at the time of this offering, market valuations of publicly traded companies that MKS and the representatives believe to be comparable to MKS, and other factors deemed relevant.

LEGAL MATTERS

The validity of the common stock offered hereby will be passed upon for MKS by Hale and Dorr LLP, Boston, Massachusetts. Certain legal matters in connection with this offering will be passed upon for the underwriters by Ropes & Gray, Boston, Massachusetts.

EXPERTS

The consolidated balance sheets of MKS Instruments, Inc. at December 31, 1997 and 1998 and the consolidated statements of income, stockholders' equity and cash flows for each of the three years in the period ended December 31, 1998 included in this prospectus have been included herein in reliance on the report of PricewaterhouseCoopers LLP, independent accountants, given upon the authority of that firm as experts in accounting and auditing.

ADDITIONAL INFORMATION

MKS has filed with the Securities and Exchange Commission, a registration statement on Form S-1 under the Securities Act with respect to the common stock offered hereby. This prospectus, which constitutes part of the registration statement, does not contain all of the information set forth in the registration statement, certain parts of which are omitted in accordance with the rules and regulations of the Securities and Exchange Commission. For further information with respect to MKS and the common stock offered hereby, reference is made to the registration statement. Statements contained in this prospectus as to the contents of any contract or other document filed as an exhibit to the registration statement are not necessarily complete, and in each instance reference is made to the copy of such document filed as an exhibit to the registration statement, each such statement being qualified in all respects by such reference. The registration statement (and all amendments, exhibits and schedules thereto) may be inspected without charge at the principal office of the Securities and Exchange Commission in Washington, D.C. and copies of all or any part of which may be inspected and copied at the public reference facilities maintained by the Securities and Exchange Commission at 450 Fifth Street, N.W., Judiciary Plaza, Room 1024, Washington, D.C. 20549, and at the Securities and Exchange Commission's regional offices located at Citicorp Center, 500 West Madison Street, Suite 1400, Chicago, Illinois 60661-2511 and 7 World Trade Center, Suite 1300, New York, New York 10048. Copies of such material can also be obtained at prescribed rates by mail from the Public Reference Section of the Securities and Exchange Commission at 450 Fifth Street, N.W., Washington, D.C. 20549. In addition, the Securities and Exchange Commission maintains a website (<http://www.sec.gov>) that contains reports, proxy and information statements and other information regarding registrants that file electronically with the Securities and Exchange Commission.

MKS intends to distribute to its stockholders annual reports containing audited consolidated financial statements.

MKS INSTRUMENTS, INC.

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REPORT OF INDEPENDENT ACCOUNTANTS

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

In our opinion, the accompanying consolidated balance sheets and related consolidated statements of income, stockholders' equity and cash flows present fairly, in all material respects, the financial position of MKS Instruments, Inc. and its subsidiaries at December 31, 1997 and 1998 and the results of their operations and their cash flows for each of the three years in the period ended December 31, 1998, in conformity with generally accepted accounting principles. These financial statements are the responsibility of the Company's management; our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits of these statements in accordance with generally accepted auditing standards which require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for the opinion expressed above.

PRICEWATERHOUSECOOPERS LLP

Boston, Massachusetts

January 22, 1999, except for the

information in the first and second

paragraph of Note 13 as to which the date

is January 28, 1999 and February 24, 1999,

respectively

MKS INSTRUMENTS, INC.

 CONSOLIDATED BALANCE SHEETS
 (IN THOUSANDS, EXCEPT SHARE DATA)

	DECEMBER 31, 1997	DECEMBER 31, 1998	
		ACTUAL	PRO FORMA (NOTE 2) (UNAUDITED)
ASSETS			
Current assets:			
Cash and cash equivalents.....	\$ 2,511	\$11,188	\$11,188
Marketable equity securities.....	614	538	538
Trade accounts receivable, net of allowance for doubtful accounts of \$610 and \$656 at December 31, 1997 and 1998, respectively.....	32,439	20,674	20,674
Inventories.....	29,963	24,464	24,464
Deferred tax asset.....	682	698	698
Other current assets.....	1,670	971	971
	-----	-----	-----
Total current assets.....	67,879	58,533	58,533
Property, plant and equipment, net.....	33,976	32,725	32,725
Other assets.....	4,681	4,974	4,974
	-----	-----	-----
Total assets.....	\$106,536	\$96,232	\$96,232
	=====	=====	=====
LIABILITIES AND STOCKHOLDERS' EQUITY			
Current liabilities:			
Short-term borrowings.....	\$ 10,721	\$ 9,687	\$ 9,687
Current portion of long-term debt.....	2,070	2,058	2,058
Current portion of capital lease obligations.....	1,061	1,074	1,074
Accounts payable.....	7,433	3,677	3,677
Accrued compensation.....	7,501	3,985	3,985
Other accrued expenses.....	6,883	5,280	5,280
Income taxes payable.....	1,889	1,279	1,279
Distribution payable.....	--	--	35,926
	-----	-----	-----
Total current liabilities.....	37,558	27,040	62,966
Long-term debt.....	13,748	12,042	12,042
Long-term portion of capital lease obligations.....	1,876	1,744	1,744
Deferred tax liability.....	133	117	117
Other liabilities.....	373	463	463
Commitments and contingencies (Note 7)			
Stockholders' equity:			
Common Stock, Class A, no par value; 11,250,000 shares authorized, 7,766,910 issued and outstanding.....	40	40	40
Common Stock, Class B (non voting) no par value; 18,750,000 shares authorized; 10,286,255 and 10,286,257 shares issued and outstanding at December 31, 1997 and 1998, respectively.....	73	73	73
Additional paid-in capital.....	48	48	48
Retained earnings.....	51,443	52,479	16,553
Accumulated other comprehensive income.....	1,244	2,186	2,186
	-----	-----	-----
Total stockholders' equity.....	52,848	54,826	18,900
	-----	-----	-----
Total liabilities and stockholders' equity.....	\$106,536	\$96,232	\$96,232
	=====	=====	=====

The accompanying notes are an integral part of the consolidated financial statements.

MKS INSTRUMENTS, INC.

CONSOLIDATED STATEMENTS OF INCOME
(IN THOUSANDS, EXCEPT PER SHARE DATA)

	YEAR ENDED DECEMBER 31,		
	1996	1997	1998
Net sales.....	\$170,862	\$188,080	\$139,763
Cost of sales.....	102,008	107,606	83,784
Gross profit.....	68,854	80,474	55,979
Research and development.....	14,195	14,673	12,137
Selling, general and administrative.....	37,191	41,838	34,707
Restructuring.....	1,400	--	--
Income from operations.....	16,068	23,963	9,135
Interest expense.....	2,378	2,132	1,483
Interest income.....	92	271	296
Other income (expense), net.....	(479)	166	187
Income before income taxes.....	13,303	22,268	8,135
Provision for income taxes.....	800	1,978	949
Net income.....	\$ 12,503	\$ 20,290	\$ 7,186
Pro forma data (unaudited):			
Historical income before income taxes.....			\$ 8,135
Pro forma provision for income taxes.....			3,091
Pro forma net income.....			\$ 5,044
Pro forma net income per share:			
Basic.....			\$ 0.25
Diluted.....			\$ 0.24
Pro forma weighted average common shares outstanding:			
Basic.....			20,295
Diluted.....			20,780

The accompanying notes are an integral part of the consolidated financial statements.

MKS INSTRUMENTS, INC.

CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
FOR THE YEARS ENDED DECEMBER 31, 1996, 1997 AND 1998
(IN THOUSANDS, EXCEPT SHARE DATA)

	COMMON STOCK				ADDITIONAL PAID-IN CAPITAL	RETAINED EARNINGS
	CLASS A		CLASS B			
	SHARES	AMOUNT	SHARES	AMOUNT		
Balance at December 31, 1995.....	7,766,910	\$40	10,286,255	\$73	\$48	\$45,550
Distributions to stockholders.....						(14,500)
Comprehensive income:						
Net income.....						12,503
Other comprehensive income:						
Foreign currency translation adjustment.....						
Unrealized loss on investments.....						
Comprehensive income.....						
Balance at December 31, 1996.....	7,766,910	40	10,286,255	73	48	43,553
Distributions to stockholders.....						(12,400)
Comprehensive income:						
Net income.....						20,290
Other comprehensive income:						
Foreign currency translation adjustment.....						
Unrealized gain on investments.....						
Comprehensive income.....						
Balance at December 31, 1997.....	7,766,910	40	10,286,255	73	48	51,443
Distributions to stockholders.....						(6,150)
Issuance of common stock.....			2			
Comprehensive income:						
Net income.....						7,186
Other comprehensive income:						
Foreign currency translation adjustment.....						
Unrealized loss on investments.....						
Comprehensive income.....						
Balance at December 31, 1998.....	7,766,910	\$40	10,286,257	\$73	\$48	\$52,479

	ACCUMULATED OTHER COMPREHENSIVE INCOME	COMPREHENSIVE INCOME	TOTAL STOCKHOLDERS' EQUITY
	-----	-----	-----
Balance at December 31, 1995.....	\$2,681		\$ 48,392
Distributions to stockholders.....			(14,500)
Comprehensive income:			
Net income.....		\$12,503	12,503
Other comprehensive income:			
Foreign currency translation adjustment.....	(766)	(766)	(766)
Unrealized loss on investments.....	(131)	(131)	(131)
Comprehensive income.....		\$11,606	
Balance at December 31, 1996.....	1,784		45,498
Distributions to stockholders.....			(12,400)
Comprehensive income:			
Net income.....		20,290	20,290
Other comprehensive income:			
Foreign currency translation adjustment.....	(786)	(786)	(786)
Unrealized gain on investments.....	246	246	246
Comprehensive income.....		\$19,750	
Balance at December 31, 1997.....	1,244		52,848
Distributions to stockholders.....			(6,150)
Issuance of common stock.....			
Comprehensive income:			
Net income.....		7,186	7,186
Other comprehensive income:			
Foreign currency translation adjustment.....	992	992	992
Unrealized loss on investments.....	(50)	(50)	(50)
Comprehensive income.....		\$ 8,128	
Balance at December 31, 1998.....	\$2,186		\$ 54,826

The accompanying notes are an integral part of the consolidated financial statements.

MKS INSTRUMENTS, INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS
(IN THOUSANDS)

	YEAR ENDED DECEMBER 31,		
	1996	1997	1998
Cash flows from operating activities:			
Net income.....	\$ 12,503	\$ 20,290	\$ 7,186
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization of property, plant, and equipment.....	5,920	5,712	6,242
Loss on disposal of property, plant and equipment....	--	552	48
Deferred taxes.....	(277)	(145)	(32)
Provision for doubtful accounts.....	(20)	258	253
Forward exchange contract loss (gain) realized.....	302	132	(1,211)
Stock option compensation.....	--	95	--
Changes in operating assets and liabilities:			
(Increase) decrease in trade accounts receivable.....	6,119	(12,509)	12,908
(Increase) decrease in inventories.....	4,145	(5,930)	6,479
(Increase) decrease in other current assets.....	3,239	(1,261)	554
Increase (decrease) in accrued compensation.....	(220)	2,386	(3,516)
Increase (decrease) in other accrued expenses.....	(1,520)	3,312	(1,602)
Increase (decrease) in accounts payable.....	(4,221)	2,638	(3,682)
Increase (decrease) in income taxes payable.....	331	1,283	(647)
Net cash provided by operating activities.....	26,301	16,813	22,980
Cash flows from investing activities:			
Purchases of property, plant and equipment.....	(9,417)	(3,269)	(3,137)
Proceeds from sale of property, plant and equipment.....	--	203	60
Increase in other assets.....	(443)	(123)	(270)
Cash received (used) to settle forward exchange contracts.....	(302)	(132)	1,211
Net cash used in investing activities.....	(10,162)	(3,321)	(2,136)
Cash flows from financing activities:			
Net (payments) borrowings on demand notes payable....	224	(1,875)	--
Proceeds from short-term borrowings.....	11,025	24,110	15,242
Payments on short-term borrowings.....	(9,628)	(22,938)	(17,569)
Proceeds from long-term debt.....	400	--	--
Principal payments on long-term debt.....	(2,093)	(2,217)	(2,057)
Cash distributions to stockholders.....	(14,500)	(12,400)	(6,150)
Principal payments under capital lease obligations...	(982)	(870)	(1,257)
Net cash used in financing activities.....	(15,554)	(16,190)	(11,791)
Effect of exchange rate changes on cash and cash equivalents.....	(420)	1,394	(376)
Increase (decrease) in cash and cash equivalents.....	165	(1,304)	8,677
Cash and cash equivalents at beginning of period.....	3,650	3,815	2,511
Cash and cash equivalents at end of period.....	\$ 3,815	\$ 2,511	\$ 11,188
Supplemental disclosure of cash flow information:			
Cash paid during the period for:			
Interest.....	\$ 2,363	\$ 2,030	\$ 1,526
Income taxes.....	\$ 770	\$ 1,078	\$ 1,608
Noncash transactions during the period:			
Equipment acquired under capital leases.....	\$ 2,074	\$ 145	\$ 1,138

The accompanying notes are an integral part of the consolidated financial statements.

MKS INSTRUMENTS, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS
(TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

1. DESCRIPTION OF BUSINESS:

MKS Instruments, Inc. (the "Company") is a worldwide developer, manufacturer, and supplier of instruments and components that are used to measure, control and analyze gases in semiconductor manufacturing and similar industrial manufacturing processes. The Company's products include pressure and flow measurement and control instruments; vacuum gauges, valves and components; and gas analysis instruments. The Company is subject to risks common to companies in the semiconductor industry including, but not limited to, the highly cyclical nature of the semiconductor industry leading to recurring periods of over supply, development by the Company or its competitors of new technological innovations, dependence on key personnel and the protection of proprietary technology.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES:

BASIS OF PRESENTATION

The consolidated financial statements include the accounts of the Company and its subsidiaries. All significant intercompany accounts and transactions have been eliminated in consolidation. The Company has reflected the approximately 77.5% owned foreign subsidiaries as wholly-owned subsidiaries pursuant to common control accounting. Upon the closing of this offering for which these financial statements are being prepared, the shares of the foreign subsidiaries owned directly by the ultimate stockholders will be contributed to the Company.

PRO FORMA BALANCE SHEET PRESENTATION (UNAUDITED)

The Company intends to distribute the balance of its accumulated and undistributed S corporation earnings from the proceeds of this offering for which this registration statement is being prepared. The unaudited pro forma balance sheet has been prepared assuming an estimated \$35,926,000 distribution was payable as of December 31, 1998. The remaining balance in retained earnings represents accumulated earnings prior to the Company converting from a C corporation to an S corporation in 1987, accumulated income in overseas subsidiaries and differences between book and tax accumulated income.

PRO FORMA NET INCOME PER SHARE (UNAUDITED)

The Company computes basic and diluted earnings per share in accordance with Statement of Financial Accounting Standards No. 128 ("SFAS 128") "Earnings per Share." SFAS 128 requires both basic earnings per share, which is based on the weighted average number of common shares outstanding, and diluted earnings per share, which is based on the weighted average number of common shares outstanding and all dilutive potential common equivalent shares outstanding. The dilutive effect of options 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 where the effect of their inclusion would be dilutive.

Historical net income has been adjusted for the pro forma provision for income taxes calculated assuming the Company was subject to income taxation as a C corporation, at a pro forma tax rate of 38.0%. In accordance with a regulation of the Securities and Exchange Commission, pro forma net income per share has been presented for the year ended December 31, 1998 to reflect the effect of the assumed issuance of 2,242,272 shares of common stock of the Company necessary to be sold at the mid-point of the estimated initial public offering price in order to fund the intended distribution of the accumulated and undistributed S corporation earnings as of January 1, 1998.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
 (TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

Historical net income per share is not presented as it is not meaningful based upon the Company's planned conversion from an S corporation to a C corporation upon the closing of this offering for which these financial statements are being prepared.

The following is a reconciliation of basic to diluted pro forma net income per share:

	FOR THE YEAR ENDED DECEMBER 31, 1998 -----
Pro forma net income.....	\$ 5,044 =====
Shares used in pro forma net income per common share -- basic.....	20,295
Effect of dilutive securities:	
Employee and director stock options.....	485 -----
Shares used in pro forma net income per common share -- diluted.....	20,780 =====
Pro forma net income per common share -- basic.....	\$ 0.25 =====
Pro forma net income per common share -- diluted.....	\$ 0.24 =====

FOREIGN EXCHANGE

The functional currency 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 for the year. The resulting translation adjustments are included in accumulated other comprehensive income in consolidated stockholders' equity.

REVENUE RECOGNITION

The Company recognizes revenue upon shipment. The Company accrues for anticipated returns and warranty costs upon shipment.

CASH AND CASH EQUIVALENTS

All highly liquid investments with an original maturity of three months or less at the date of purchase are considered to be cash equivalents. Cash equivalents consist of money market instruments.

INVESTMENTS

The appropriate classification of investments in debt and equity securities is determined at the time of purchase. Debt securities that the Company has both the intent and ability to hold to maturity are carried at amortized cost. Debt securities that the Company does not have the intent and ability to hold to maturity or equity securities are classified either as "available-for-sale" or as "trading" and are carried at fair value. Marketable equity securities are carried at fair value and classified either as available-for-sale or trading. Unrealized gains and losses on securities classified as available-for-sale are included in accumulated other comprehensive income in consolidated stockholders' equity. Unrealized gains and losses on securities classified as trading are reported in earnings.

INVENTORIES

Inventories are stated at the lower of cost or market. Cost is determined on the first-in, first-out method.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
(TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment are stated at cost. Equipment acquired under capital leases is recorded at the present value of the minimum lease payments required during the lease period. 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 20 years for buildings and three to five years for machinery and equipment. Leasehold improvements are amortized over the shorter of the lease term or the estimated useful life of the lease.

RESEARCH AND DEVELOPMENT

Research and development costs are expensed as incurred.

NEW ACCOUNTING PRONOUNCEMENTS

In March 1998, the American Institute of Certified Public Accountants issued Statement of Position (SOP) 98-1, "Accounting for the Costs of Software Developed or Obtained for Internal Use" which provides guidance on the accounting for the costs of software developed or obtained for internal use. SOP 98-1 is effective for fiscal years beginning after December 15, 1998. The Company does not expect the SOP 98-1 to have a material impact on its financial position or results of operations.

In June 1998, the Financial Accounting Standards Board issued Statement of Financial Accounting Standards (SFAS) No. 133, "Accounting for Derivative Instruments and Hedging Activities." SFAS No. 133 requires that all derivative instruments be recorded on the balance sheet at their fair value. Changes in the fair value of derivatives are recorded each period in current earnings or other comprehensive income, depending on whether a derivative is designated as part of a hedge transaction and, if it is, the type of hedge transaction. The statement is effective for all fiscal quarters of all fiscal years beginning after June 15, 1999. The Company has not yet determined the impact that the adoption SFAS No. 133 will have on its financial position or results of operations.

USE OF ESTIMATES

The preparation of financial statements in conformity with generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the dates of the financial statements and the reported amounts of revenues and expenses during the reporting periods. Actual results could differ from those estimates.

RECLASSIFICATION OF PRIOR YEAR BALANCES

Certain reclassifications have been made to prior years' consolidated financial statements to conform to the current presentation.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
(TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

3. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT:

FOREIGN EXCHANGE RISK MANAGEMENT

The Company uses forward exchange contracts and local currency purchased options in an effort to reduce its exposure to currency fluctuations on future U.S. dollar cash flows derived from foreign currency denominated sales associated with the intercompany purchases of inventory. The Company has entered into forward exchange contracts and local currency purchased options to hedge a portion of its probable anticipated, but not firmly committed transactions. The anticipated transactions whose risks are being hedged are the intercompany purchases of inventory by the foreign subsidiaries from the U.S. parent for resale in their local currency. The time period of the anticipated transactions that are hedged generally approximate one year. The Company has also used forward exchange contracts to hedge firm commitments. Market value gains and losses on forward exchange contracts are recognized immediately in earnings unless a firm commitment exists. Market value gains and premiums on local currency purchased options on probable anticipated transactions and market value gains and losses on forward exchange contracts hedging firm commitments are recognized when the hedged transaction occurs. These contracts, which relate primarily to Japanese and European currencies generally have terms of twelve months or less. The Company does not hold or issue derivative financial instruments for trading purposes.

Realized and unrealized gains and losses on forward exchange contracts and local currency purchased options that qualify for hedge accounting are recognized in earnings in the same period as the underlying hedged item. Realized and unrealized gains and losses on forward exchange contracts and local currency purchased option contracts that do not qualify for hedge accounting are recognized immediately in earnings. Forward exchange contracts receive hedge accounting on firmly committed transactions when they are designated as a hedge of the designated currency exposure and are effective in minimizing such exposure. Options receive hedge accounting on probable anticipated transactions when they are designated as a hedge of the currency exposure and are effective in minimizing such exposure. The cash flows resulting from forward exchange contracts and local currency purchased options that qualify for hedge accounting are classified in the statement of cash flows as part of cash flows from operating activities. Cash flows resulting from forward exchange contracts and local currency purchased options that do not qualify for hedge accounting are classified in the statement of cash flows as investing activities.

Forward exchange contracts with notional amounts totaling none, \$9,800,000, and \$8,000,000 to exchange foreign currencies for U.S. dollars, were outstanding at December 31, 1996, 1997, and 1998, respectively. Of such forward exchange contracts \$6,900,000 and \$7,800,000 to exchange Japanese yen for U.S. dollars, were outstanding at December 31, 1997 and 1998, respectively. The forward exchange contracts with notional amounts outstanding at December 31, 1998 totaling \$8,000,000 do not qualify for hedge accounting and accordingly are marked to market and recognized immediately in earnings. Local currency purchased options with notional amounts totaling \$3,722,000, \$12,738,000, and \$10,221,000 to exchange foreign currencies for U.S. dollars were outstanding at December 31, 1996, 1997, and 1998, respectively.

Foreign exchange losses of \$479,000, foreign exchange gains of \$1,166,000 and foreign exchange losses of \$168,000 on forward exchange contracts that did not qualify for hedge accounting were recognized in earnings during 1996, 1997 and 1998, respectively, and are classified in Other income (expense), net. Gains on forward exchange contracts that qualify for hedge accounting of \$978,000 were deferred and classified in other accrued expenses at December 31, 1996. Gains on local currency purchased options deferred at December 31, 1996 that qualify for hedge accounting of \$200,000 were deferred in other accrued expenses. Gains on forward exchange contracts and local currency purchased options that qualify

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
(TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

for hedge accounting are classified in cost of goods sold and totaled \$2,476,000, \$1,178,000, and \$310,000 for the years ended December 31, 1996, 1997, and 1998, respectively.

The fair value of forward exchange contracts at December 31, 1998, determined by applying period end currency exchange rates to the notional contract amounts, amounted to a loss of \$349,000. The fair values of local currency purchased options at December 31, 1997 and 1998 which were obtained through dealer quotes were immaterial.

The Company recorded a foreign exchange translation loss on intercompany payables of \$1,000,000 and a foreign exchange translation gain on intercompany payables of \$1,000,000 in Other income (expense), net in 1997 and 1998, respectively. Foreign exchange translation gains and losses from unhedged intercompany balances were not material in 1996.

The market risk exposure from forward exchange contracts is assessed in light of the underlying currency exposures and is controlled by the initiation of additional or offsetting foreign currency contracts. The market risk exposure from options is limited to the cost of such investments. Credit risk exposure from forward exchange contracts and local currency purchased options are minimized as these instruments are contracted with a major financial institution. The Company monitors the credit worthiness of this financial institution and full performance is anticipated.

INTEREST RATE RISK MANAGEMENT

The Company utilizes an interest rate swap to fix the interest rate on certain variable rate term loans in order to minimize the effect of changes in interest rates on earnings. In 1998, the Company entered into a four-year interest rate swap agreement on a declining notional amount basis which coincides with the scheduled principal payments with a major financial institution for the notional amount of \$10,528,000 equal to the term loans described in Note 6. Under the agreement, the Company pays a fixed rate of 5.85% on the notional amount and receives LIBOR. The interest differential payable or accruable on the swap agreement is recognized on an accrual basis as an adjustment to interest expense. The criteria used to apply hedge accounting for this interest rate swap is based upon management designating the swap as a hedge against the variable rate debt combined with the terms of the swap matching the underlying debt including the notional amount, the timing of the interest reset dates, the indices used and the paydates. At December 31, 1998, the fair value of this interest rate swap, which represents the amount the Company would receive or pay to terminate the agreement, is a net payable of \$151,000, based on dealer quotes. The variable rate received on the swap at December 31, 1998 was 5.5%.

The market risk exposure from the interest rate swap is assessed in light of the underlying interest rate exposures. Credit risk exposure from the swap is minimized as the agreement is with a major financial institution. The Company monitors the credit worthiness of this financial institution and full performance is anticipated.

CONCENTRATIONS OF CREDIT RISK

The Company's significant concentrations of credit risk consist principally of cash and cash equivalents and trade accounts receivable. The Company maintains cash and cash equivalents with financial institutions including the bank it has borrowings with. Concentrations of credit risk with respect to trade accounts receivable are limited due to the large number of geographically dispersed customers. Credit is extended for all customers based on financial condition and collateral is not required.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
 (TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

FAIR VALUE OF FINANCIAL INSTRUMENTS

The fair value of the term loans, including the current portion, approximates its carrying value given its variable rate interest provisions. The fair value of mortgage notes is based on borrowing rates for similar instruments and approximates its carrying value. For all other balance sheet financial instruments, the carrying amount approximates fair value because of the short period to maturity of these instruments.

4. INVENTORIES:

Inventories consist of the following:

	DECEMBER 31,	
	1997	1998
Raw material.....	\$ 9,981	\$ 7,544
Work in process.....	7,241	5,718
Finished goods.....	12,741	11,202
	-----	-----
	\$29,963	\$24,464
	=====	=====

5. PROPERTY, PLANT AND EQUIPMENT:

Property, plant and equipment consist of the following:

	DECEMBER 31,	
	1997	1998
Land.....	\$ 8,350	\$ 8,834
Buildings.....	26,241	26,020
Machinery and equipment.....	24,861	27,394
Furniture and fixtures.....	9,697	10,578
Leasehold improvements.....	882	1,814
	-----	-----
	70,031	74,640
Less: accumulated depreciation and amortization.....	36,055	41,915
	-----	-----
	\$33,976	\$32,725
	=====	=====

6. DEBT:

CREDIT AGREEMENTS AND SHORT-TERM BORROWINGS

In February 1996, the Company entered into loan agreements with two banks, which provide access to a revolving credit facility. These agreements have since been amended. The revolving credit facility, as amended, provides for uncollateralized borrowings up to \$30,000,000, which expires on December 31, 1999. Interest on borrowings is payable quarterly at either the banks' base rate or the LIBOR Rate, as defined in the agreement, at the Company's option. At December 31, 1997 and 1998, the Company had no borrowings under this revolving credit facility.

Additionally, certain of the Company's foreign subsidiaries have lines of credit and short-term borrowing arrangements with various financial institutions which provide for aggregate borrowings as of December 31, 1998 of up to \$15,003,000, which generally expire and are renewed at six month intervals. At December 31, 1997 and 1998, total borrowings outstanding under these arrangements were \$10,721,000, and \$9,687,000, respectively, at interest rates ranging from 1.3% to 1.6%, and 1.3% to 1.7%, respectively. Foreign short-term borrowings are generally collateralized by certain trade accounts receivable and are guaranteed by a domestic bank.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
 (TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

LONG-TERM DEBT

Long-term debt consists of the following:

	DECEMBER 31,	
	1997	1998
Term loans.....	\$12,194	\$10,528
Mortgage notes.....	3,624	3,572
Total long-term debt.....	15,818	14,100
Less: current portion.....	2,070	2,058
Long-term debt less current portion.....	\$13,748	\$12,042
	=====	=====

On November 1, 1993, the Company entered into a term loan agreement with a bank, which provided for borrowings of \$10,000,000. Principal payments are payable in equal monthly installments of \$56,000 through October 1, 2000, with the remaining principal payment due on November 1, 2000. The loan is collateralized by certain land, buildings, and equipment. Interest is payable monthly at either the bank's base rate, at a rate based on the long-term funds rate, or at the LIBOR Rate, as defined in the agreement, at the Company's option.

On October 31, 1995, the Company also entered into a term loan agreement with the same bank, which provided additional uncollateralized borrowings of \$7,000,000. Principal payments are payable in equal monthly installments of \$83,000 through June 1, 2002, with the remaining principal payment due on June 30, 2002. Interest is payable monthly at either the bank's base rate or at the LIBOR Rate, as defined in the agreement, at the Company's option.

At December 31, 1997 and 1998, the interest rates in effect for the term loan borrowings were 6.975% and 7.131%, respectively.

The terms of the revolving credit facility and term loan agreements, as amended, contain, among other provisions, requirements for maintaining certain levels of tangible net worth and other financial ratios. The agreement also contains restrictions with respect to acquisitions. Under the most restrictive covenant, the operating cash flow to debt service ratio for a fiscal quarter shall not be less than 1.25 to 1.0. In the event of default of these covenants or restrictions, any obligation then outstanding under the loan agreement shall become payable upon demand by the bank. See Note 13 for subsequent event.

The Company has loans outstanding from various foreign banks in the form of mortgage notes at interest rates ranging from 2.0% to 6.2%. Principal and interest are payable in monthly installments through 2010. The loans are collateralized by mortgages on certain of the Company's foreign properties.

Aggregate maturities of long-term debt over the next five years are as follows:

YEAR ENDING DECEMBER 31,	AGGREGATE MATURITIES
-----	-----
1999.....	\$ 2,058
2000.....	7,343
2001.....	1,405
2002.....	1,329
2003.....	422
Thereafter.....	1,543

	\$14,100
	=====

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
 (TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

7. LEASE COMMITMENTS:

The Company leases certain of its facilities and machinery and equipment under capital and operating leases expiring in various years through 2002 and thereafter. Generally, the facility leases require the Company to pay maintenance, insurance and real estate taxes. Rental expense under operating leases totaled \$2,487,000, \$2,478,000, and \$2,388,000 for the years ended December 31, 1996, 1997, and 1998, respectively.

Minimum lease payments under operating and capital leases are as follows:

YEAR ENDING DECEMBER 31, -----	OPERATING LEASES		CAPITAL
	REAL ESTATE	EQUIPMENT	LEASES
	-----	-----	-----
1999.....	\$1,484	\$437	\$1,202
2000.....	882	251	974
2001.....	660	130	537
2002.....	153	36	333
2003.....	84	13	116
Thereafter.....	51	42	--
	-----	-----	-----
Total minimum lease payments.....	\$3,314	\$909	\$3,162
	=====	=====	=====
Less: amounts representing interest.....			344

Present value of minimum lease payments.....			2,818
Less: current portion.....			1,074

Long-term portion.....			\$1,744
			=====

8. STOCKHOLDERS' EQUITY:

COMMON STOCK

The Company has two classes of common stock. Stockholders of Class A common stock are entitled to voting rights with one vote for each share of common stock. Stockholders of Class B common stock are not entitled to voting rights.

Upon the closing of this offering for which this Registration Statement is being prepared each outstanding share of Class A and Class B common stock of the Company will be converted into an aggregate of 18,053,167 shares of common stock.

STOCK OPTION PLANS

On January 9, 1998, the stockholders of the Company approved the following: (1) an increase in the number of shares that may be granted under the 1995 Stock Incentive Plan to 3,750,000 shares of common stock; (2) the adoption of the 1997 Director Stock Option Plan pursuant to which options may be granted to purchase up to an aggregate of 300,000 shares of common stock; (3) the adoption of the 1997 Employee Stock Purchase Plan pursuant to which the Company may issue up to an aggregate of 450,000 shares of common stock; and (4) that 3,750,000 shares, 300,000 shares, and 450,000 shares of common stock be reserved for issuance under the 1995 Stock Incentive Plan, the 1997 Director Stock Option Plan, and the 1997 Employee Stock Purchase Plan, respectively.

The Company grants options to employees under the 1995 Stock Incentive Plan (the "Plan") and to directors under the 1996 Director Stock Option Plan (the "Director Plan").

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
 (TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

At December 31, 1998 options to purchase 1,651,793 shares of the Company's common stock were reserved for issuance under the Plan. At December 31, 1998, under the Director Plan, options to purchase 28,932 shares of common stock were reserved for issuance. Stock options are granted at 100% of the fair value of the Company's common stock as determined by the Board of Directors on the date of grant. In reaching the determination of fair value at the time of each grant, the Board of Directors considered a range of factors, including the Company's current financial position, its recent revenues, results of operations and cash flows, its assessment of the Company's competitive position in its markets and prospects for the future, the status of the Company's product development and marketing efforts, current valuations for comparable companies and the illiquidity of an investment in the Company's common stock. Generally, stock options under the Plan vest 20% after one year and 5% per quarter thereafter, and expire 10 years after the grant date. Under the Director Plan, the options granted in 1996 vest over three years and options granted in 1997 and later vest at the earlier of (1) the next annual meeting, (2) 13 months from date of grant or (3) the effective date of an acquisition as defined in the Director Plan.

The following table presents the activity for options under the Plan.

	YEAR ENDED DECEMBER 31, 1996		YEAR ENDED DECEMBER 31, 1997		YEAR ENDED DECEMBER 31, 1998	
	OPTIONS	WEIGHTED AVERAGE EXERCISE PRICE	OPTIONS	WEIGHTED AVERAGE EXERCISE PRICE	OPTIONS	WEIGHTED AVERAGE EXERCISE PRICE
Outstanding -- beginning of period...	608,270	\$11.06	810,442	\$4.43	1,564,449	\$4.50
Granted.....	810,442	4.43	785,657	4.57	629,969	6.80
Exercised.....	--	--	--	--	(2)	4.43
Forfeited or Expired.....	(608,270)	11.06	(31,650)	4.43	(96,209)	4.43
Outstanding -- end of period.....	810,442	\$ 4.43	1,564,449	\$4.50	2,098,207	\$5.20
Exercisable at end of period.....	114,782	\$ 4.43	476,451	\$4.43	778,473	\$4.46

At December 31, 1998, Plan options included 1,436,588, 566,669, and 94,950 shares outstanding at exercise prices of \$4.43, \$6.67, and \$8.00 per share. The weighted average remaining contractual life of these options was 8.2 years.

During 1996, 27,128 options were granted at an exercise price of \$4.43 per share under the Director Plan and were outstanding at December 31, 1996. Of these options, 4,524 were exercisable at December 31, 1996. During 1997, options for 3,620 shares were granted under the Director Plan at an exercise price of \$4.43 per share. Of these options, 30,748 were outstanding with 13,564 exercisable at the \$4.43 per share price at December 31, 1997. During 1998, options for 3,620 shares were granted under the Director Plan at an exercise price of \$8.00 per share. Of these options, 34,368 were outstanding with 26,228 exercisable at the \$4.43 per share price at December 31, 1998.

The Company has adopted the disclosure-only provisions of Statement of Financial Accounting Standards No. 123 (SFAS No. 123), "Accounting for Stock-Based Compensation." The Company has chosen to continue to account for stock-based compensation using the intrinsic value method prescribed in Accounting Principles Board Opinion No. 25, "Accounting for Stock Issued to Employees" and related interpretations. Accordingly, compensation cost for stock options is measured as the excess, if any, of the fair value of the Company's stock at the date of grant over the amount an employee must pay to acquire the stock.

The disclosures required under SFAS No. 123 have been omitted as they are not meaningful based upon the Company's planned conversion from an S corporation to a C corporation upon the closing of this offering for which these financial statements are being prepared. Had the fair value based method prescribed in SFAS No. 123 been used to account for stock-based compensation cost, there would have

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
 (TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

been no change in pro forma net income and pro forma earnings per share from that reported based on the following assumptions: dividend yield of 8%, risk free interest rate of 5.44% and an expected life of 8 years.

9. INCOME TAXES:

The Company has elected to be taxed as an S corporation for federal and certain states income tax purposes and, as a result, is not subject to Federal taxation but is subject to state taxation on income in certain states. The stockholders are liable for individual Federal and certain state income taxes on their allocated portions of the Company's taxable income.

The components of income before income taxes and the historical related provision for income taxes consist of the following:

	YEAR ENDED DECEMBER 31,		
	1996	1997	1998
Income before income taxes:			
United States.....	\$11,953	\$21,858	\$6,169
Foreign.....	1,350	410	1,966
	-----	-----	-----
	13,303	22,268	8,135
Current taxes:			
State.....	285	1,331	197
Foreign.....	792	792	784
	-----	-----	-----
	1,077	2,123	981
Deferred taxes:			
State.....	(156)	(72)	(39)
Foreign.....	(121)	(73)	7
	-----	-----	-----
	(277)	(145)	(32)
Provision for income taxes.....	\$ 800	\$ 1,978	\$ 949
	=====	=====	=====

As the Company is not subject to Federal income taxes, a reconciliation of the effective tax rate to the Federal statutory rate is not meaningful.

At December 31, 1996, 1997, and 1998 the components of the deferred tax asset and deferred tax liability were as follows:

	DECEMBER 31,		
	1996	1997	1998
Deferred tax assets (liabilities):			
Inventories.....	\$234	\$344	\$265
Intercompany profits.....	160	214	152
Compensation.....	72	77	127
Investment booked under the equity method.....	(28)	(41)	(59)
Other.....	(34)	(45)	96
	-----	-----	-----
Total.....	\$404	\$549	\$581
	=====	=====	=====

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
(TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

10. 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 from 1% up to 12% of their compensation. The Company, at its discretion, may provide a matching contribution which will generally match up to the first 2% of each participant's compensation, plus 25% of the next 4% of compensation. At the discretion of the Board of Directors, the Company may also make additional contributions for the benefit of all eligible employees. The Company's contributions are generally paid annually, and were \$2,170,000 and \$2,500,000 for the years ended December 31, 1996 and 1997. Approximately \$1,400,000 has been accrued as the estimated Company contribution for the year ended December 31, 1998 and is included in accrued compensation.

The Company maintains a bonus plan which provides cash awards to key employees, at the discretion of the Compensation Committee of the Board of Directors, based upon operating results and employee performance. Bonus expense to key employees was none, \$1,425,000, and none for the years ended December 31, 1996, 1997, and 1998, respectively.

11. RESTRUCTURING:

In 1996, the Company recorded a restructuring charge of \$1,400,000, primarily related to reduction of personnel and the closure of facilities in Phoenix, AZ and San Jose, CA. These charges include \$425,000 of severance pay, \$710,000 of lease commitments, and \$265,000 for the write-off of leasehold improvements. The facilities closure concluded during 1997. The remaining balance of approximately \$126,000 for lease commitments is included in Other accrued expenses in the accompanying balance sheet at December 31, 1998.

12. GEOGRAPHIC FINANCIAL INFORMATION AND SIGNIFICANT CUSTOMER:

See Note 1 for a brief description of the Company's business. The Company is organized around two similar product lines domestically and by geographic locations internationally and has three reportable segments: North America, Far East, and Europe. Net sales to unaffiliated customers are based on the location in which the sale originated. Transfers between geographic areas are at negotiated transfer prices and have been eliminated from consolidated net sales. Income from operations consists of total net sales less operating expenses and does not include either interest income, interest expense or income taxes. The Company had one customer comprising 15%, 22% and 16% of net sales for the years ended December 31, 1996, 1997, and 1998, respectively. This data is presented in accordance with SFAS 131, "Disclosures About Segments of an Enterprise and Related Information," which the Company has retroactively adopted for all periods presented.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS -- (CONTINUED)
 (TABLES IN THOUSANDS, EXCEPT PER SHARE DATA)

	YEAR ENDED DECEMBER 31, 1998			
	NORTH AMERICA	FAR EAST	EUROPE	TOTAL
Net sales to unaffiliated customers...	\$ 95,607	\$23,902	\$20,254	\$139,763
Intersegment net sales.....	26,657	290	1,015	27,962
Depreciation and amortization.....	5,627	210	405	6,242
Income from operations.....	6,319	1,298	1,518	9,135
Segment assets.....	65,560	20,768	9,904	96,232
Long-lived assets.....	28,960	5,655	3,084	37,699
Capital expenditures.....	2,635	179	323	3,137
	YEAR ENDED DECEMBER 31, 1997			
Net sales to unaffiliated customers...	\$138,186	\$31,559	\$18,335	\$188,080
Intersegment net sales.....	35,429	225	749	36,403
Depreciation and amortization.....	5,096	259	357	5,712
Income from operations.....	22,847	886	230	23,963
Segment assets.....	77,302	19,906	9,328	106,536
Long-lived assets.....	30,738	4,904	3,015	38,657
Capital expenditures.....	2,899	128	242	3,269
	YEAR ENDED DECEMBER 31, 1996			
Net sales to unaffiliated customers...	\$121,061	\$31,066	\$18,735	\$170,862
Intersegment net sales.....	34,100	199	1,426	35,725
Depreciation and amortization.....	5,145	388	387	5,920
Income from operations.....	14,534	653	881	16,068
Segment assets.....	66,593	18,524	9,883	95,000
Long-lived assets.....	33,402	5,554	3,551	42,507
Capital expenditures.....	8,332	208	877	9,417

Included in North America are the United States and Canada. Net sales to unaffiliated customers from the United States were \$119,423,000, \$136,653,000 and \$94,449,000 for the years ended December 31, 1996, 1997 and 1998, respectively. Long-lived assets within the United States amounted to \$33,315,000, \$30,667,000 and \$28,902,000 at December 31, 1996, 1997, and 1998, respectively.

Included in the Far East are Japan, Korea and Singapore. Included in Europe are Germany, France and the United Kingdom. Net sales to unaffiliated customers from Japan were \$28,242,000, \$28,184,000 and \$21,153,000 for the years ended December 31, 1996, 1997 and 1998, respectively. Long-lived assets within Japan amounted to \$5,141,000, \$4,792,000 and \$5,431,000 at December 31, 1996, 1997 and 1998, respectively.

13. SUBSEQUENT EVENTS:

On January 28, 1999, the Company amended its revolving credit facility and its term loan agreements described in Note 6. The amendments include revised quarterly cash flow to debt service ratios. The most restrictive covenant is the cash flow to debt service ratio of 1.25 to 1.0 in the fourth quarter of 1999 and thereafter.

On February 24, 1999 the Company effected a 3-for-2 stock split, in the form of a stock dividend of its common stock and increased the number of authorized shares of common stock to 30,000,000. Accordingly, all share data has been restated to reflect the common stock split.

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INSIDE BACK COVER (PG.5):

The inside back cover graphically depicts MKS's message of being a worldwide provider of process control solutions. It is produced in four-color process. In the center of the page is a photo of the Earth, with the tag line "Providing Solutions Around the Process, Around the World" wrapping around the photo. The word "Solutions" is highlighted with slightly larger type size. The background of the page is dark, with the MKS logo appearing at the top right, knocking out to white. Photos of MKS's products surround the photo of the Earth and include MKS Baratron Capacitance Manometers, a Throttling Poppet Valve, a Pressure Controller, Mass Flow Controllers, an In-Situ Flow Verifier, a Direct Liquid Injection Subsystem and a Residual Gas Analyzer.

6,500,000 SHARES

LOGO

COMMON STOCK

Prospectus
 , 1999

NationsBanc Montgomery Securities LLC

Donaldson, Lufkin & Jenrette

Lehman Brothers

Until , 1999 (25 days after the date of this prospectus), all dealers effecting transactions in the common stock, whether or not participating in this distribution, may be required to deliver a prospectus. This is in addition to the obligation of dealers to deliver a prospectus when acting as underwriters and with respect to their unsold allotments or subscriptions.

PART II

INFORMATION NOT REQUIRED IN PROSPECTUS

ITEM 13. OTHER EXPENSES OF ISSUANCE AND DISTRIBUTION.

Estimated expenses payable in connection with the sale of the common stock offered hereby are as follows:

SEC Registration Fee.....	\$ 35,327
NASD Filing Fee.....	\$ 12,708
Printing, Engraving and Mailing Expenses.....	\$120,000
Nasdaq Listing Fee.....	\$ 95,000
Legal Fees and Expenses.....	\$150,000
Accounting Fees and Expenses.....	\$150,000
Blue Sky Fees and Expenses.....	\$ 7,500
Transfer Agent and Registrar Fees.....	\$ 10,000
Miscellaneous.....	\$ 19,465

Total.....	\$600,000
	=====

 The Company will bear all expenses shown above.

ITEM 14. INDEMNIFICATION OF DIRECTORS AND OFFICERS.

Section 67 of Chapter 156B of the Massachusetts General Laws provides that a corporation may indemnify its directors and officers to the extent specified in or authorized by (1) the articles of organization; (2) a by-law adopted by the stockholders; or (3) a vote adopted by the holders of a majority of the shares of stock entitled to vote on the election of directors. In all instances, the extent to which a corporation provides indemnification to its directors and officers under Section 67 is optional. In its Amended and Restated Articles of Organization (the "Articles of Organization"), the Registrant has elected to commit to provide indemnification to its directors and officers in specified circumstances. Generally, Article 6 of the Registrant's Articles of Organization provides that the Registrant shall indemnify directors and officers of the Registrant against liabilities and expenses arising out of legal proceedings brought against them by reason of their status as directors or officers or by reason of their agreeing to serve, at the request of the Registrant, as a director or officer with another organization. Under this provision, a director or officer of the Registrant shall be indemnified by the Registrant for all costs and expenses (including attorneys' fees), judgments, liabilities and amounts paid in settlement of such proceedings, even if he is not successful on the merits, if he acted in good faith in the reasonable belief that his action was in the best interests of the Registrant. The Board of Directors may authorize advancing litigation expenses to a director or officer at his request upon receipt of an undertaking by any such director or officer to repay such expenses if it is ultimately determined that he is not entitled to indemnification for such expenses.

Article 6 of the Registrant's Articles of Organization eliminates the personal liability of the Registrant's directors to the Registrant or its stockholders for monetary damages for breach of a director's fiduciary duty, except to the extent Chapter 156B of the Massachusetts General Laws prohibits the elimination or limitation of such liability.

The Underwriting Agreement, a form of which is filed at Exhibit 1.1 to this Registration Statement on Form S-1 (the "Underwriting Agreement"), provides that the underwriters are obligated under certain circumstances to indemnify directors, officers and controlling persons of the Registrant against certain liabilities, including liabilities under the Securities Act of 1933, as amended (the "Securities Act"). Reference is made to the form of Underwriting Agreement.

The Company has obtained directors and officers liability insurance for the benefit of its directors and certain of its officers.

ITEM 15. RECENT SALES OF UNREGISTERED SECURITIES.

In the three years preceding the filing of this Registration Statement, the Registrant sold 2 shares of its common stock for total proceeds of \$6.64 to an employee. The registrant awarded options to purchase 837,570 shares of common stock at a weighted average exercise price of \$4.43 per share and 789,277 shares of common stock at a weighted average exercise price of \$4.57 per share, in 1996 and 1997, respectively, to employees and directors of the Company.

In 1998, the registrant awarded options to purchase shares of common stock to employees and directors of the Company on the dates, in the amounts, and at the exercise price set forth below:

DATE -----	NUMBER OF OPTIONS -----	EXERCISE PRICE PER SHARE -----
January 9, 1998.....	3,620	\$8.00
January 26, 1998.....	31,650	\$8.00
March 31, 1998.....	31,650	\$8.00
July 9, 1998.....	450,000	\$6.67
November 10, 1998.....	116,669	\$6.67

The grant of options were exempt from registration under the Securities Act by virtue of the provisions of Section 4(2) of the Securities Act or Rule 701 thereunder.

ITEM 16. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES.

(a) Exhibits:

EX. NO. -----	DESCRIPTION -----
+1.1	Form of Underwriting Agreement
3.1	Restated Articles of Organization, as amended
3.2	Form of Amended and Restated Articles of Organization
+3.3	By-Laws, as amended
3.4	Form of Amended and Restated By-Laws
+4.1	Specimen certificate representing the common stock
*5.1	Opinion of Hale and Dorr LLP
+10.1	Amended and Restated 1995 Stock Incentive Plan
+10.2	1996 Amended and Restated 1996 Director Stock Option Plan
+10.3	1997 Director Stock Option Plan
10.4	1999 Employee Stock Purchase Plan
+10.5	Amended and Restated Employment Agreement dated as of December 15, 1995 between Leo Berlinghieri and the Registrant
+10.6	Amended and Restated Employment Agreement dated as of December 15, 1995 between John J. Sullivan and the Registrant
+10.7	Amended and Restated Employment Agreement dated as of December 15, 1995 between Ronald C. Weigner and the Registrant
+10.8	Amended and Restated Employment Agreement dated as of December 15, 1995 between William D. Stewart and the Registrant
10.9	Loan Agreement dated as of October 31, 1995, as last amended January 28, 1999, by and between the First National Bank of Boston and the Registrant
+10.10	Lease Agreement dated as of October 12, 1989, as extended November 1, 1998, by and between Aspen Industrial Park Partnership and the Registrant
10.11	Loan Agreement dated as of November 1, 1993, as last amended January 28, 1999, between the First National Bank of Boston and the Registrant

EX. NO.	DESCRIPTION
-----	-----
+10.12	Lease dated as of September 21, 1995 by and between General American Life Insurance Company and the Registrant
10.13	Loan Agreement dated as of February 23, 1996, as last amended January 28, 1999, between the BankBoston, N.A., Chemical Bank and the Registrant
+10.14	Revolving Credit Note (\$8,000,000) dated February 23, 1996 between Chemical Bank, The First National Bank of Boston and the Registrant
+10.15	Revolving Credit Note (\$12,000,000) dated February 23, 1996 between Chemical Bank, The First National Bank of Boston and the Registrant
+10.16	Promissory Note dated as of August 1990 between Jefferson National Life Insurance Company and the Registrant
**10.17	Comprehensive Supplier Agreement #982812 dated October 23, 1998 by and between Applied Materials, Inc. and the Registrant
**10.18	Management Incentive Program
+10.19	Lease dated as of December 21, 1989, as last amended December 1996, between Walpole Park South II Trust and the Registrant
+10.20	Lease dated as of January 1, 1996 between MiFuji Kanzai Co. Ltd. and the Registrant (covering Floor 5)
+10.21	Lease dated as of April 21, 1997 between MiFuji Kanzai Co. Ltd. and the Registrant (covering Floors 1 and 2)
+10.22	Split-Dollar Agreement dated as of September 12, 1991 between the Registrant, John R. Bertucci and Claire R. Bertucci and Richard S. Chute, Trustees of the John R. Bertucci Insurance Trust of January 10, 1986
+10.23	Split-Dollar Agreement dated as of September 12, 1991 between the Registrant, John R. Bertucci and John R. Bertucci and Thomas H. Belknap, Trustees of the Claire R. Bertucci Insurance Trust of January 10, 1986
*10.24	Form of Tax Indemnification and S Corporation Distribution Agreement
+10.25	Employment Agreement dated March 7, 1997 between Joseph Maher and the Registrant
*10.26	Contribution Agreement
+21.1	Subsidiaries of the Registrant
*23.1	Consent of Hale and Dorr LLP (contained in Exhibit 5.1)
23.2	Consent of PricewaterhouseCoopers LLP
+24	Power of Attorney (included on Page II-5)
27	Financial Data Schedule

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* To be filed by amendment.

** Confidential materials omitted and filed separately with the Securities and Exchange Commission.

+ Previously filed.

(b) FINANCIAL STATEMENTS SCHEDULES

Report of Independent Accountants on Schedule II -- Valuation and Qualifying Accounts

Schedule II -- Valuation and Qualifying Accounts

ITEM 17. UNDERTAKINGS.

Insofar as indemnification for liabilities arising under the Securities Act of 1933 may be permitted to directors, officers and controlling persons of the registrant pursuant to the foregoing provisions, or otherwise, the registrant has been advised that in the opinion of the Securities and Exchange Commission such indemnification is against public policy as expressed in the Act and is, therefore, unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the registrant of expenses incurred or paid by a director, officer or controlling person of the registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer and controlling person in connection with the securities being registered, the registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the questions whether such indemnification by it is against public policy as expressed in the Act and will be governed by the final adjudication of such issue.

The undersigned registrant hereby undertakes that:

(1) For purposes of determining any liability under the Securities Act of 1933, the information omitted from the form of prospectus filed as part of a registration statement in reliance upon Rule 430A and contained in the form of prospectus filed by the registrant pursuant to Rule 424(b)(1) or (4) or 497(h) under the Securities Act shall be deemed to be part of this registration statement as of the time it was declared effective.

(2) For the purpose of determining any liability under the Securities Act of 1933, each post-effective amendment that contains a form of prospectus shall be deemed to be a new registration statement relating to the securities offer therein, and this offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.

The undersigned registrant hereby further undertakes to provide to the underwriters at the closing specified in the underwriting agreements, certificates in such denominations and registered in such names as required by the underwriters to permit prompt delivery to each purchaser.

SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, the Registrant has duly caused this amendment to the Registration Statement (File No. 333-71363) to be signed on its behalf by the undersigned, thereunto duly authorized, in the City of Andover, Commonwealth of Massachusetts, on this day of March 2, 1999.

MKS INSTRUMENTS, INC.

By: /s/ RONALD C. WEIGNER

RONALD C. WEIGNER

VICE PRESIDENT AND CHIEF FINANCIAL OFFICER

(PRINCIPAL FINANCIAL AND ACCOUNTING OFFICER)

POWER OF ATTORNEY

KNOWN ALL MEN BY THESE PRESENTS that each individual whose signature appears below constitutes and appoints each of John R. Bertucci, Ronald C. Weigner and Mark G. Borden such person's true and lawful attorney-in-fact and agent with full power of substitution and resubstitution, for such person and in such person's name, place and stead, in any and all capacities, to sign any and all amendments (including post-effective amendments) to this Registration Statement (or to any other registration statement for the same offering that is to be effective upon filing pursuant to Rule 462(b) under the Securities Act), and to file the same, with all exhibits thereto, and all documents in connection therewith, with the Securities and Exchange Commission, granting unto each said attorney-in-fact and agent full power and authority to do and perform each and every act and thing requisite and necessary to be done in and about the premises, as fully to all intents and purposes as such person might or could do in person, hereby ratifying and confirming all that any said attorney-in-fact and agent, or any substitute or substitutes of any of them, may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Act of 1933, this Registration Statement has been signed by the following persons in the capacities and on the dates indicated.

SIGNATURES -----	TITLE -----	DATE ----
/s/ JOHN R. BERTUCCI* ----- JOHN R. BERTUCCI	Chairman of the Board of Directors, President and Chief Executive Officer (Principal Executive Officer)	March 2, 1999
/s/ RONALD C. WEIGNER* ----- RONALD C. WEIGNER	Vice President and Chief Financial Officer (Principal Financial and Accounting Officer)	March 2, 1999
/s/ RICHARD S. CHUTE* ----- RICHARD S. CHUTE	Director	March 2, 1999
/s/ OWEN W. ROBBINS ----- OWEN W. ROBBINS	Director	March 2, 1999
/s/ ROBERT J. THERRIEN* ----- ROBERT J. THERRIEN	Director	March 2, 1999
/s/ LOUIS P. VALENTE* ----- LOUIS P. VALENTE	Director	March 2, 1999

*By: /s/ RONALD C. WEIGNER

RONALD C. WEIGNER
ATTORNEY-IN-FACT

REPORT OF INDEPENDENT ACCOUNTANTS

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

Our audits of the consolidated financial statements referred to in our report dated January 22, 1999, except for the information in the first and second paragraph of Note 13 as to which the date is January 28, 1999 and February 24, 1999, respectively, of MKS Instruments, Inc. also included an audit of the consolidated financial statement schedule listed in Item 16(b) herein. In our opinion, this consolidated financial statement schedule presents fairly, in all material respects, the information set forth therein when read in conjunction with the related consolidated financial statements.

PRICEWATERHOUSECOOPERS LLP

Boston, Massachusetts
January 22, 1999

S-1

SCHEDULE II

MKS INSTRUMENTS, INC.

VALUATION AND QUALIFYING ACCOUNTS
(IN THOUSANDS)

	BALANCE AT BEGINNING OF PERIOD -----	PROVISION CHARGED TO EXPENSE -----	ACCOUNTS WRITTEN OFF -----	BALANCE AT END OF PERIOD -----
YEAR ENDED DECEMBER 31, 1996				
Allowance for Doubtful Accounts.....	\$542	(20)	40	\$482
YEAR ENDED DECEMBER 31, 1997				
Allowance for Doubtful Accounts.....	\$482	258	130	\$610
YEAR ENDED DECEMBER 31, 1998				
Allowance for Doubtful Accounts.....	\$610	253	207	\$656

EXHIBIT INDEX

EX. NO.	DESCRIPTION	SEQUENTIALLY NUMBERED PAGE
-----	-----	-----
+1.1	Form of Underwriting Agreement	
3.1	Restated Articles of Organization, as amended	
3.2	Form of Amended and Restated Articles of Organization	
+3.3	By-Laws, as amended	
3.4	Form of Amended and Restated By-Laws	
+4.1	Specimen certificate representing the common stock	
*5.1	Opinion of Hale and Dorr LLP	
+10.1	Amended and Restated 1995 Stock Incentive Plan	
+10.2	1996 Amended and Restated 1996 Director Stock Option Plan	
+10.3	1997 Director Stock Option Plan	
10.4	1999 Employee Stock Purchase Plan	
+10.5	Amended and Restated Employment Agreement dated as of December 15, 1995 between Leo Berlinghieri and the Registrant	
+10.6	Amended and Restated Employment Agreement dated as of December 15, 1995 between John J. Sullivan and the Registrant	
+10.7	Amended and Restated Employment Agreement dated as of December 15, 1995 between Ronald C. Weigner and the Registrant	
+10.8	Amended and Restated Employment Agreement dated as of December 15, 1995 between William D. Stewart and the Registrant	
10.9	Loan Agreement dated as of October 31, 1995, as last amended January 28, 1999, by and between the First National Bank of Boston and the Registrant	
+10.10	Lease Agreement dated as of October 12, 1989, as extended November 1, 1998, by and between Aspen Industrial Park Partnership and the Registrant	
10.11	Loan Agreement dated as of November 1, 1993, as last amended January 28, 1999, between the First National Bank of Boston and the Registrant	
+10.12	Lease dated as of September 21, 1995 by and between General American Life Insurance Company and the Registrant	
10.13	Loan Agreement dated as of February 23, 1996, as last amended January 28, 1999, between the BankBoston, N.A., Chemical Bank and the Registrant	
+10.14	Revolving Credit Note (\$8,000,000) dated February 23, 1996 between Chemical Bank, The First National Bank of Boston and the Registrant	
+10.15	Revolving Credit Note (\$12,000,000) dated February 23, 1996 between Chemical Bank, The First National Bank of Boston and the Registrant	
+10.16	Promissory Note dated as of August 1990 between Jefferson National Life Insurance Company and the Registrant	
**10.17	Comprehensive Supplier Agreement #982812 dated October 23, 1998 by and between Applied Materials, Inc. and the Registrant	
**10.18	Management Incentive Program	
+10.19	Lease dated as of December 21, 1989, as last amended December 1996, between Walpole Park South II Trust and the Registrant	

SEQUENTIALLY
NUMBERED
PAGE

EX. NO.	DESCRIPTION	PAGE
+10.20	Lease dated as of January 1, 1996 between MiFuji Kanzai Co. Ltd. and the Registrant (covering Floor 5)	
+10.21	Lease dated as of April 21, 1997 between MiFuji Kanzai Co. Ltd. and the Registrant (covering Floors 1 and 2)	
+10.22	Split-Dollar Agreement dated as of September 12, 1991 between the Registrant, John R. Bertucci and Claire R. Bertucci and Richard S. Chute, Trustees of the John R. Bertucci Insurance Trust of January 10, 1986	
+10.23	Split-Dollar Agreement dated as of September 12, 1991 between the Registrant, John R. Bertucci and John R. Bertucci and Thomas H. Belknap, Trustees of the Claire R. Bertucci Insurance Trust of January 10, 1986	
*10.24	Form of Tax Indemnification and S Corporation Distribution Agreement	
+10.25	Employment Agreement dated March 7, 1997 between Joseph Maher and the Registrant	
*10.26	Contribution Agreement	
+21.1	Subsidiaries of the Registrant	
*23.1	Consent of Hale and Dorr LLP (contained in Exhibit 5.1)	
23.2	Consent of PricewaterhouseCoopers LLP	
+24	Power of Attorney (included on Page II-5)	
27	Financial Data Schedule	

- -----

* To be filed by amendment.

** Confidential materials omitted and filed separately with the Securities and Exchange Commission.

+ Previously filed.

LM

The Commonwealth of Massachusetts

EXHIBIT 3.1

Examiner

MICHAEL JOSEPH CONNOLLY
Secretary of State
ONE ASHBURTON PLACE, BOSTON, MASS. 02108

FEDERAL IDENTIFICATION No. 04-2277512

RESTATED ARTICLES OF ORGANIZATION

General Laws, Chapter 156B, Section 74

This certificate must be submitted to the Secretary of the Commonwealth within sixty days after the date of the vote of stockholders adopting the restated articles of organization. The fee for filing this certificate is prescribed by General Laws, Chapter 156B, Section 114. Make check payable to the Commonwealth of Massachusetts.

We, John R. Bertucci, President, and
Richard S. Chute, Clerk of

MKS Instruments, Inc.

(Name of Corporation)

located at 34 Third Avenue, Burlington, Massachusetts 01803

do hereby certify that the following restatement of the articles of organization of the corporation was duly adopted and authorized by unanimous written consent of all the Directors dated January 15, 1982.

1. The name by which the corporation shall be known is:
MKS Instruments, Inc.
2. The purposes for which the corporation is formed are as follows:
See Continuation Sheets 2A and 2B.

Note: If the space provided under any article or item on this form is insufficient, additions shall be set forth on separate 8 1/2 x 11 sheets of paper leaving a left hand margin of at least 1 inch for binding. Additions to more than one article may be continued on a single sheet so long as each article requiring each such addition is clearly indicated.

3. The total number of shares and the par value, if any, of each class of stock which the corporation is authorized to issue is as follows:

CLASS OF STOCK -----	WITHOUT PAR VALUE	WITH PAR VALUE	
	NUMBER OF SHARES -----	NUMBER OF SHARES -----	PAR VALUE -----
Preferred	None	None	None
Class A Common	10,000	None	None
Class B Common	10,000	None	None

- *4. If more than one class is authorized, a description of each of the different classes of stock with, if any, the preferences, voting powers, qualifications, special or relative rights or privileges as to each class thereof and any series now established:

See Continuation Sheet 4A.

- *5. The restrictions, if any, imposed by the articles of organization upon the transfer of shares of stock of any class are as follows:

See Continuation Sheets 5A, 5B, 5C and 5D.

- *6. Other lawful provisions, if any, for the conduct and regulation of the business and affairs of the corporation, for its voluntary dissolution, or for limiting, defining, or regulating the powers of the corporation, or of its directors or stockholders, or of any class of stockholders:

See Continuation Sheet 6A.

*If there are no such provisions state "None".

2. The purposes for which the corporation is formed are as follows:

To design, manufacture, sell, lease and license instruments of all kinds, including electromechanical, electronic and mechanical gauges for the measurement of pressure, temperature, acceleration, flow and level of liquids and gases; to design, manufacture, sell, lease and license control systems incorporating measuring devices, and control systems separate from measuring devices, for the control of production processes and operations of all kinds; to design, manufacture, sell, lease and license instrumentation for military use; to design, manufacture, sell, lease and license instrumentation for use in research laboratories, in industry, in educational institutions, for medical purposes and for use elsewhere and for other purposes; and in general to design, manufacture, sell, lease and license electro-mechanical, electronic and mechanical devices of all kinds.

To buy and sell at wholesale and retail, or otherwise, to manufacture, produce, adapt, repair, dispose of, export, import and in any other manner to deal in goods, wares, merchandise, articles and things of manufacture or otherwise of all materials, supplies and other articles and things necessary or convenient for use in connection with any of said businesses or any other business or any part thereof; and to manufacture, repair, purchase, sell, lease, dispose of and otherwise deal in machinery, tools, and appliances which are or may be used in connection with the purchase, sale, production, adaptation, repair, disposition of, export, import or other dealings in said goods, wares, merchandise, articles and things.

To purchase, lease or otherwise acquire as a going concern or otherwise all or any part of the franchises, rights, property, assets, business, good will or capital stock of any persons, firm, corporation, trust or association engaged in whole or in part in any business in which this corporation is empowered to engage, or in any other business; to pay for the same in whole or in part in cash, stock, bonds, notes, securities or other evidence of indebtedness of this corporation or in any other manner; to assume as part of the consideration or otherwise any and all debts, contracts or liabilities, matured or unmatured, fixed or contingent, of any such person, firm or corporation, trust or association; and to operate, manage, develop and generally to carry on the whole or any part of any such business under any name or names which it may select or designate.

To construct, lease, hire, purchase or otherwise acquire and hold or maintain, and to rebuild, enlarge, improve, furnish, equip, alter, operate and dispose of warehouses, factories, offices and other buildings, real estate, structures or parts thereof, and appliances for the preparation, manufacture, purchase, sale and distribution of goods, wares, merchandise, things, and articles of all kinds.

To acquire, hold, use, sell, assign, lease, grant licenses in respect of, mortgage, or otherwise dispose of franchises, letters patent of the United States or of any foreign country, patent rights, licenses and privileges, inventions, improvements and processes, systems, copyrights, trade-marks and trade names, relating to, or useful in connection with, any business of this corporation.

To buy or otherwise acquire, to sell, assign, pledge, or otherwise dispose of and deal in stocks, bonds, securities, notes and other obligations of any person, firm or corporation, including this corporation, organized for or engaged in similar or cognate purposes; also stocks, bonds, securities, notes, and other obligations of any person, firm, or corporation, including this corporation, which it may be found or deemed necessary, valuable, or convenient for this corporation to acquire and deal in, in pursuance or furtherance of or in connection with the businesses herein specified, or any other business.

To borrow money and contract indebtedness for all proper corporate purposes, to issue bonds, notes, and other evidences of indebtedness, to secure the same by pledge, mortgage, or lien on all or any part of the property of the corporation, tangible or intangible; and to assume or guarantee or secure in like manner or otherwise, the leases, contracts, or other obligations, fixed or contingent, or the payment of any dividends on any stock or shares or of the principal or interest on any bonds, notes, or other evidences of indebtedness of any person, firm, corporation, trust, or association in which this corporation has a financial interest.

To enter into, make, and perform contracts of every name, nature, and kind with any person, firm, association, or corporation which may be deemed valuable, expedient, or convenient for this corporation in pursuance of or in furtherance of or in connection with any of the objects of incorporation of this corporation or in connection with any of the businesses or purposes herein specified.

The enumeration of specific powers herein shall not be construed as limiting or restricting in any way the general powers herein set forth, but nothing herein contained shall be construed as authorizing the business of banking.

4. If more than one class is authorized, a description of each of the different classes of stock with, if any, the preferences, voting powers, qualifications, special or relative rights or privileges as to each class thereof and any series now established:

The holders of shares of Class B Common stock of the corporation shall not be entitled to vote for the election of Officers or Directors or with respect to any other aspect of the business of the corporation, or any matter or thing which may come or be brought before any meeting of the Stockholders of the corporation; and said Class B Common stock shall not be deemed to be a class of stock entitled to vote for any purpose whatsoever. In all other respects, however, the Class B Common stock and the Class A Common stock of the corporation, and the respective rights and preferences thereof shall be equal, and neither class shall have any priority over the other with respect to the payment of dividends or to distributions in liquidation.

5. The restrictions, if any, imposed by the articles of organization upon the transfer of shares of stock of any class are as follows:

Section 5. Restrictions. None of the corporation's stock, of any class, may be transferred except as hereinafter provided:

(a) Before making any proposed disposition of any of the corporation's stock, the holder of the stock shall give written notice to the Board of Directors specifying in detail the nature of the proposed disposition and its terms, the class and number of the shares involved, and the consideration for the proposed disposition, if any. Such notice shall constitute an offer by the holder to sell the shares involved to the corporation at their Agreed Value, as determined hereunder, or, if such proposed disposition is one for a pecuniary consideration less than the Agreed Value of the shares involved, such notice shall constitute an offer to sell the shares to the corporation for such proposed pecuniary consideration.

(b) Within thirty days after receipt of such notice, the Board of Directors shall give written notice to the offering holder stating whether the corporation accepts or rejects the holder's offer. If the offer is accepted, such notice by the corporation shall state the price to be paid for the shares and shall specify whether the corporation elects to pay a part of the purchase price by means of the corporation's note, as provided for in subsection (d) hereof. The offering holder of such shares shall deliver the shares to the corporation, suitably endorsed, within ten days after receipt of the corporation's notice of acceptance, and upon receipt of the shares, the corporation shall make payment therefor in the manner hereinafter provided.

If such offer is rejected by the corporation, the Directors shall transmit forthwith such offer to the record owners of the Class A Common Stock of the corporation who shall, subject to the provisions of this subsection (b), have the right to purchase the offered shares, in amounts proportionate to their respective holdings of said Class A Common stock, upon all of the same terms and conditions upon which the corporation might have purchased said offered shares, except that payment for offered shares shall be made in cash unless otherwise agreed upon between the parties. Each such owner to whom such shares are offered shall have the right within thirty (30) days of such offer to purchase the entire number of shares apportioned to him as above or to purchase none, and such acceptance shall be extended by written notice to the Board of Directors given within such time. If any owner of Class A Common stock shall

not accept such offer, the Board of Directors shall forthwith notify the remaining shareholders of Class A Common stock that they may purchase in proportion to their respective holdings of such stock the shares which such owner was entitled to purchase. Each such shareholder to whom such shares are offered shall have the right within ten (10) days of such offer to purchase the entire number of shares apportioned to him as above or to purchase none. Within three days after the expiration of said ten-day period the Board of Directors shall give written notice to the offering holder advising him in detail of the elections made with respect to the offered shares by the owners of the Class A Common stock. If the offer has been accepted with respect to all of the offered shares, then the offering holder of such shares shall deliver the same to the corporation, suitably endorsed, for the account of the accepting owners, within ten days after receipt of said last-mentioned notice from the Board of Directors and upon receipt of the shares by the corporation the accepting owners of the Class A Common stock shall make payment therefor in accordance with the terms of their respective acceptances.

If such offer is rejected by the corporation and if such offer to the holders of the Class A Common stock is rejected, in whole or in part, the offering shareholder, at any time within six months after receipt of any such notice of rejection, may effect the disposition of the shares which was set forth in such offering shareholder's notice to the Board.

(c) The Agreed Value of the stock of the corporation shall be such as may from time to time be determined by the unanimous agreement in writing of the holders of the corporation's Class A Common stock, such determination to be reviewed and either confirmed or adjusted at reasonable intervals. The Agreed Value of the Class B Common stock shall be ninety (90) percent of the Agreed Value of the Class A Common stock, to reflect the fact that the Class B Common stock is not entitled to vote.

The Agreed Value of the stock of the corporation shall be reviewed as herein provided at six-month intervals following the adoption of this by-law and at the expiration of any such six-month period, if no agreement is arrived at, any owner of stock may demand from the owners of Class A Common stock that an agreement be reached and in the absence of such agreement within ten days thereafter, such value shall be determined by an arbitrator appointed by the President, or by some other appropriate official, of the American Arbitration Association, upon written request for such appointment made by any owner of stock of the corporation. The decision of such arbitrator shall be binding upon the parties, and may be enforced by any court having jurisdiction, but each owner of stock of the corporation shall

be entitled to appear before such arbitrator, to be represented by counsel, and to present evidence. The expenses of arbitration, other than expenses for counsel and witnesses, shall be borne pro rata, according to the number of shares held, by the owners of the stock of the corporation.

(d) In the event the corporation shall elect to accept the offer of the holder of its stock, as herein provided, the corporation may pay the full purchase price for such stock in cash at the time of the delivery of the stock to the corporation or, at the corporation's sole election, it may pay said purchase price partly in cash and partly in the form of an unsecured note of the corporation. If the corporation shall make the latter election, then in such event the corporation shall pay at least one-third (1/3) of the purchase price for the stock at the time the stock is delivered to the corporation, and the corporation shall then deliver to the selling shareholder the note of the corporation for the unpaid balance of the purchase price for the stock, bearing interest at the rate of 6% per annum on the unpaid principal balance and payable in or within two years from its date.

(e) Each share of stock of the corporation is subject to the requirements and restrictions upon the transfer of such shares set forth in this Section 5, and the same shall constitute a contract of each shareholder with the corporation, shall be binding upon each shareholder and his heirs, assigns, executors, administrators, or other legal representatives and upon all other persons succeeding to or standing in the place of or holding under the shareholder, whether by act of the shareholder or by operation of law. These provisions shall not be discharged by any transfer of shares which may be made in compliance with the provisions hereof, but shall apply anew to such shares in the hands of the new holder thereof. These provisions shall not restrict the making of a bona fide pledge of any shares to secure an indebtedness, but shall apply fully with respect to any proposed transfer from the name of the shareholder pursuant to such pledge, whether upon foreclosure or otherwise and whether to the pledgee or to any other person. These provisions shall not restrict the transfer of shares, without consideration, to the transferor's spouse or to the transferor's issue or to the spouses or the transferor's issue, or any of them (or to a form of joint ownership between the transferor and the transferees described next above, or any of them, or to a trust for the sole benefit of the transferor and the transferees described next above or any of them), but shall apply fully with respect to any proposed disposition by any such transferee, except as provided in this and the preceding sentence.

Continuation Sheet 5D

(f) The determination of the Board of Directors under the provisions of this Section 5 shall be made by majority vote except that no waiver of the provisions of this Section 5 in the case of any proposed disposition of stock shall be granted by the vote of less than eighty (80) percent of the members of the Board of Directors. No Director shall be disqualified from voting on any matter arising under the provisions of this Section 5 by reason of such Director's ownership of stock of the corporation which might, directly or indirectly, be affected by such vote.

(g) In the event of any breach of any of the provisions of this Section 5 by any holder of any of the corporation's stock, none of the rights or privileges attaching to such stock (including, without limitation, voting rights and rights to dividends) may be exercised or enjoyed with respect to such stock by such holder or by any purported transferee from such holder while such breach shall continue, but nothing herein contained shall be deemed to preclude lawful action by the corporation to enforce the provisions of this Section 5.

6. Other lawful provisions, if any, for the conduct and regulation of the business and affairs of the corporation, for its voluntary dissolution, or for limiting, defining, or regulating the powers of the corporation, or of its directors or stockholders, or of any class of stockholders:

Pre-Emptive Rights. No stockholder shall, by reason of ownership of stock of the corporation, have any pre-emptive right to purchase unissued stock of the corporation, or to subscribe to stock of the corporation, or to purchase stock of the corporation previously issued and held in the treasury of the corporation, and, subject to the provisions of applicable law, the authorized and unissued stock of the corporation shall be issued to such person, firm, corporation or other legal entity, in such amounts, at such times, and for such consideration as a majority of the Board of Directors may from time to time determine.

*We further certify that the foregoing restated articles of organization effect no amendments to the articles of organization of the corporation as heretofore amended,

None

(*If there are no such amendments, state "None".)

Briefly describe amendments in space below:

None

IN WITNESS WHEREOF AND UNDER THE PENALTIES OF PERJURY, we have hereto signed our names this 15th day of January in the year 1982.

/s/ John R. Bertucci
----- President
John R. Bertucci

/s/ Richard S. Chute
----- Clerk
Richard S. Chute

THE COMMONWEALTH OF MASSACHUSETTS

RESTATED ARTICLES OF ORGANIZATION

(General Laws, Chapter 156B, Section 74)

I hereby approve the within restated articles of organization and, the filing fee in the amount of \$15.00 having been paid, said articles are deemed to have been filed with me this 19th day of January, 1982.

/s/ Michael Joseph Connolly

MICHAEL JOSEPH CONNOLLY
Secretary of State

TO BE FILLED IN BY CORPORATION
PHOTOCOPY OF RESTATED ARTICLES OF ORGANIZATION TO BE SENT

TO: Richard S. Chute, Esquire
Hill & Barlow
225 Franklin Street
Boston, Massachusetts 02110
Telephone 617/423-6200

Copy Mailed [SEAL OF WILLIAM FRANCIS GALVIN
SECRETARY OF THE COMMONWEALTH
DATED 2/20/96]

THE COMMONWEALTH OF MASSACHUSETTS

MICHAEL JOSEPH CONNOLLY
SECRETARY OF STATE

CG

EXAMINER

ONE ASHBURTON PLACE
BOSTON, MASS. 02108

FEDERAL IDENTIFICATION
NO. 04-2277512

ARTICLES OF
MERGER OF PARENT AND SUBSIDIARY CORPORATIONS
PURSUANT TO GENERAL LAWS, CHAPTER 156B, SECTION 82

The fee for filing this certificate is
prescribed by General Laws, Chapter 156B, Section 114.
Make check payable to the Commonwealth of Massachusetts.

We, John R. Bertucci and Richard S. Chute, President*/and Clerk*/ of
MKS Instruments, Inc. 042277512

name of corporation
organized under the laws of the Commonwealth of Massachusetts and herein called
the parent corporation, do hereby certify as follows:

1. That the subsidiary corporation(s) to be merged into the parent
corporations is as follows*:

Name	State of Organization	Date of Organization
MKS Disc, Inc. 046311363	Massachusetts	10/31/72

2. That the parent corporation owns at least ninety per cent of the outstanding
shares of each class of the stock of each subsidiary corporation to be merged
into the parent corporation.

3.

*Delete the inapplicable words. In case the parent corporation is organized
under the laws of a state other than Massachusetts these articles are to be
signed by officers having corresponding powers and duties.

4. That at a meeting of the directors of the parent corporation the following vote, pursuant to subsection (a) of General Laws, Chapter 156B, Section 82, was duly adopted:

VOTED: That MKS Disc, Inc., a Massachusetts corporation and a wholly-owned subsidiary corporation of the Corporation, be merged with and into the Corporation in accordance with the provisions of Section 82 of the Massachusetts Business Corporation Law, the effective date of the merger to be the date of filing of the Articles of Merger of Parent and Subsidiary Corporations with the State Secretary of the Commonwealth of Massachusetts; that the President and Clerk of the Corporation be and hereby are authorized in the name and on behalf of the Corporation to execute the Articles of Merger of Parent and Subsidiary Corporations attached hereto (the "Articles of Merger") and to file the Articles of Merger with the State Secretary of the Commonwealth of Massachusetts; and in furtherance thereof that the President, any Vice President, Treasurer, Clerk, and Assistant Clerk of the Corporation or any one or more of them be and hereby are authorized in the name and on behalf of the Corporation to execute and deliver any and all documents and instruments and to take any and all action as they or any one or more of them may deem necessary or appropriate to effectuate the merger of MKS Disc, Inc. with and into the Corporation.

5. The effective date of the merger as specified in the vote set out under Paragraph 4 is the date of filing of these articles of merger of parent and subsidiary corporations.

6.

IN WITNESS WHEREOF and under the penalties of perjury we have hereto signed our names this 15th day of December, 1986.

/s/ John R. Burtucci President*

/s/ Richard S. Chute Clerk*

*Delete the inapplicable words. In case the parent corporation is organized under the laws of a state other than Massachusetts these articles are to be signed by officers having corresponding powers and duties.

COMMONWEALTH OF MASSACHUSETTS

ARTICLES OF MERGER OF PARENT AND SUBSIDIARY CORPORATIONS
(General Laws, Chapter 156B, Section 82)

I hereby approve the within articles of merger of parent and subsidiary corporations and, the filing fee in the amount of \$200.00 having been paid, said articles are deemed to have been filed with me this 15th day of December, 1986.

/s/ Michael J. Connolly

MICHAEL JOSEPH CONNOLLY
Secretary of State

TO BE FILLED IN BY CORPORATION
Photo Copy of Merger To Be Sent

TO: Richard S. Chute, Esquire

Hill & Barlow

225 Franklin Street

Boston, MA 02110

Telephone 617-423-6200

Copy Mailed [SEAL OF WILLIAM FRANCIS GALVIN
SECRETARY OF THE COMMONWEALTH
DATED 2/20/96]

THE COMMONWEALTH OF MASSACHUSETTS

MICHAEL JOSEPH CONNOLLY

FEDERAL IDENTIFICATION

Secretary of State

NO. 04-2277512

ONE ASHBURTON PLACE, BOSTON, MASS. 02108

ARTICLES OF AMENDMENT

GENERAL LAWS, CHAPTER 156B, SECTION 72

This certificate must be submitted to the Secretary of the Commonwealth within sixty days after the date of the vote of stockholders adopting the amendment. The fee for filing this certificate is prescribed by General Laws, Chapter 156B, Section 114. Make check payable to the Commonwealth of Massachusetts.

We, John R. Bertucci, President and
Richard S. Chute, Clerk of

MKS Instruments, Inc.

(Name of Corporation)

located at 34 Third Avenue, Burlington, Massachusetts 01803

Name do hereby certify that the following amendment to the restated
Approved articles of organization of the corporation was duly adopted by
written consent dated December 15, 1986, by vote of
2454 shares of Class A Common out of 2454 shares outstanding,
(Class of Stock)

CROSS OUT being all of each class outstanding and entitled to vote thereon.(2)
INAPPLICABLE
CLAUSE

C / /

P / /

M / /

- (1)For amendments adopted pursuant to Chapter 156B, Section 70.
- (2)For amendments adopted pursuant to Chapter 156B, Section 71.

Note: If the space provided under any Amendment or item on this form
is insufficient, additions shall be set forth on separate 8 1/2 - 11
sheets of paper leaving a left hand margin of at least 1 inch for
binding. Additions to more than one Amendment may be continued on a
single sheet so long as each Amendment requiring each such addition
is clearly indicated.

FOR INCREASE IN CAPITAL FILL IN THE FOLLOWING:

	(-----shares preferred) with par value
	(-----shares common)
The total amount of capital stock		:
already authorized is	(-----shares preferred) without par value
	(-----shares common)
	(-----shares preferred) with par value
	(-----shares common)
The amount of additional capital		:
stock authorized is	(-----shares preferred) without par value
	(-----shares common)

Voted: That the Restated Articles of Organization of the Corporation be and hereby are amended by deleting and striking in their entirety the restrictions upon the transfer of shares of stock contained in article 5. of the Restated Articles of Organization of the Corporation so that there are no restrictions imposed by the articles of organization of the Corporation upon the transfer of shares of stock of any class of the Corporation; that the President and Clerk of the Corporation be and hereby are authorized in the name and on behalf of the Corporation to execute Articles of Amendment to effectuate such amendment of the Restated Articles of Organization of the Corporation, a copy of which is attached hereto (the "Articles of Amendment"), and to file the Articles of Amendment with the State Secretary of the Commonwealth of Massachusetts; and in furtherance thereof that the President, any Vice President, Treasurer, Clerk, and Assistant Clerk of the Corporation or any one or more of them be and hereby are authorized in the name and on behalf of the Corporation to execute and deliver any and all documents and instruments and to take any and all action as they or any one or more of them may deem necessary or appropriate to effectuate such amendment of the Restated Articles of Organization of the Corporation.

The foregoing amendment will become effective when these articles of amendment are filed in accordance with Chapter 156B, Section 6 of The General Laws unless these articles specify, in accordance with the vote adopting the amendment, a later effective date not more than thirty days after such filing, in which event the amendment will become effective on such later date.

IN WITNESS WHEREOF AND UNDER THE PENALTIES OF PERJURY, we have hereto signed our names this 15th day of December, in the year 1986

/s/ John R. Bertucci President

John R. Bertucci

/s/ Richard S. Chute Clerk

Richard S. Chute

THE COMMONWEALTH OF MASSACHUSETTS

ARTICLES OF AMENDMENT

(General Laws, Chapter 156B, Section 72)

I hereby approve the within articles of amendment
and, the filing fee in the amount of \$75.00
having been paid, said articles are deemed to have
been filed with me this 16th
day of December, 1986.

/s/ Michael Joseph Connolly

MICHAEL JOSEPH CONNOLLY
Secretary of State

TO BE FILLED IN BY CORPORATION
PHOTO COPY OF AMENDMENT TO BE SENT

TO: Richard S. Chute
Hill & Sarlow

225 Franklin Street

Boston, MA 02110

Telephone 617-423-6200

Copy Mailed

[STATE SEAL]

THE COMMONWEALTH OF MASSACHUSETTS
OFFICE OF THE MASSACHUSETTS SECRETARY OF STATE
MICHAEL JOSEPH CONNOLLY, Secretary
ONE ASHBURTON PLACE, BOSTON, MASS. 02180

FEDERAL IDENTIFICATION
NO. 04-2277512

EXAMINER

N/A

Name
Approved

C []
P []
M []

4

P.C.

ARTICLES OF AMENDMENT

General Laws, Chapter 156B, Section 72

This certificate must be submitted to the Secretary of the Commonwealth within sixty days after the date of the vote of stockholders adopting the amendment. The fee for filing this certificate is prescribed by General Laws, Chapter 156B, Section 114. Make check payable to the Commonwealth of Massachusetts.

We, John R. Bertucci, President and
Richard S. Chute, Clerk of

MKS Instruments, Inc.

(Name of Corporation)

located at Six Shattuck Road, Andover, Massachusetts 01810

do hereby certify that the following amendment to the restated articles of organization of the corporation was duly adopted by written consent dated January 8, 1987, by vote of

2454 shares of Class A Common out of 2454 shares outstanding,

(Class of Stock)

3250 shares of Class B Common out of 3250 shares outstanding,

(Class of Stock)

being all of each class outstanding and entitled to vote thereon and of each class of series of stock whose rights are adversely affected thereby:

- (1) for amendments adopted pursuant in Chapter 156B, Section 70.
- (2) for amendments adopted pursuant to Chapter 156B, Section 71.

Note: If the space provided under any Amendment or item on this form is insufficient, additions shall be set forth on separate 8 1/2 x 11 sheets of paper leaving a left hand margin of at least 1 inch for binding. Additions to more than one Amendment may be continued on a single sheet so long as each Amendment requiring each such addition is clearly indicated

TO CHANGE the number of shares and the par value, if any, of each class of stock within the corporation fill in the following:

The total presently authorized is:

KIND OF STOCK	NO PAR VALUE NUMBER OF SHARES	WITH PAR VALUE NUMBER OF SHARES	PAR VALUE
COMMON			
PREFERRED			

CHANGE the total to:

KIND OF STOCK	NO PAR VALUE NUMBER OF SHARES	WITH PAR VALUE NUMBER OF SHARES	PAR VALUE
COMMON			
PREFERRED			

VOTED: That the Restated Articles of Organization of the Corporation be and hereby are amended by adding the following provision to article 6 of the Restated Articles of Organization of the Corporation so that article 6 of the Restated Articles of Organization of the Corporation shall contain the following provision:

"A director of the corporation shall not be personally liable to the corporation or its stockholders for monetary damages for breach of fiduciary duty as a director notwithstanding any provision of law imposing such liability, except for liability (i) for any breach of the director's duty of loyalty to the corporation or its stockholders, (ii) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (iii) under Section 61 or 62 of the Massachusetts Business Corporation Law, or (iv) for any transaction from which the director derived an improper personal benefit.

If the Massachusetts Business Corporation Law is amended, after approval by the stockholders of the corporation of this provision, to authorize corporate action further eliminating or limiting the personal liability of directors, then the liability of a director of the corporation shall be eliminated or limited to the fullest extent permitted by the Massachusetts Business Corporation Law, as so amended. Any amendment, repeal, or modification of this provision by the stockholders of the corporation shall not adversely affect any right or protection of a director of the corporation existing at the time of such amendment, repeal, or modification."

; that the President and Clerk of the Corporation be and hereby are authorized in the name and on behalf of the Corporation to execute Articles of Amendment to effectuate such amendment of the Restated Articles of Organization of the Corporation, a copy of which is attached hereto (the "Articles of Amendment"), and to file the Articles of Amendment with the State Secretary of the Commonwealth of Massachusetts; and in furtherance thereof that the President, any Vice President, Treasurer, Clerk, and Assistant Clerk of the Corporation or any one or more of them be and hereby are authorized in the name and on behalf of the Corporation to execute and deliver any and all documents and instruments and to take any and all action as they or any one or more of them may deem necessary or appropriate to effectuate such amendment of the Restated Articles of Organization of the Corporation.

The foregoing amendment will become effective when these articles of amendment are filed in accordance with Chapter 156B, Section 6 of The General Laws unless these articles specify, in accordance with the vote adopting the amendment, a later effective date not more than thirty days after such filing, in which event the amendment will become effective on such later date.

IN WITNESS WHEREOF AND UNDER THE PENALTIES OF PERJURY, we have hereto signed our names this 9th day of February, in the year 1987.

/s/ John R. Bertucci President

John R. Bertucci

/s/ Richard S. Chute Clerk

Richard S. Chute

THE COMMONWEALTH OF MASSACHUSETTS

ARTICLES OF AMENDMENT

(General Laws, Chapter 156B, Section 72)

I hereby approve the within articles of amendment and, the filing fee in the amount of \$75.00 having been paid, said articles are deemed to have been filed with me this 11th day of February, 1987.

/s/ Michael J. Connolly

MICHAEL JOSEPH CONNOLLY
Secretary of State

TO BE FILLED IN BY CORPORATION

PHOTO COPY OF AMENDMENT TO BE SENT

TO: Richard S. Chute, Esq.
Hill & Barlow

225 Franklin Street
Boston, MA 02110

Telephone (617) 423-6200

Copy Mailed

[SEAL OF WILLIAM FRANCIS GALVIN,
SECRETARY OF THE COMMONWEALTH
DATED 2/20/96]

The Commonwealth of Massachusetts
WILLIAM FRANCIS GALVIN
Secretary of the Commonwealth
ONE ASHBURTON PLACE
BOSTON, MASS. 02108

FEDERAL IDENTIFICATION NO. 004-2277512

ARTICLES OF
MERGER OF PARENT AND SUBSIDIARY CORPORATIONS
PURSUANT TO GENERAL LAWS, CHAPTER 156B, SECTION 82

The fee for filing this certificate is prescribed by
General Laws, Chapter 156B, Section 114.
Make check payable to the Commonwealth of Massachusetts.

* * * *

We, John R. Bertucci and Richard S. Chute, President* and Clerk* of
MKS Instruments, Inc.

name of corporation

organized under the laws of Massachusetts and herein called the parent
corporation, do hereby certify as follows:

1. That the subsidiary corporation(s) to be merged into the parent
corporations are/is as follows:

Name	State of Organization	Date of Organization
UTI Instruments Company	CA	09/26/73

2. That the parent corporation owns at least ninety per cent of the
outstanding shares of each class of the stock of each subsidiary corporation to
be merged into the parent corporation.

3. That in the case of each of the above-named corporations the laws of
the state of its organization, if other than Massachusetts, permit the merger
herein provided for and that all action required under the laws of each such
state in connection with this merger has been duly taken. (If all the
corporations are organized under the laws of Massachusetts and if General Laws,
Chapter 156B is applicable to them, then Paragraph 3 may be deleted.)

* Delete the inapplicable words. In case the parent corporation is organized
under the laws of a state other than Massachusetts these articles are to be
signed by officers having corresponding powers and duties.

4. That at a meeting of the directors of the parent corporation the following vote, pursuant to subsection (a) of General Laws, Chapter 156B, Section 82, was duly adopted:

VOTED: That the Corporation merge into itself UTI
----- Instruments Company, a California corporation,
 with the Corporation surviving the merger
 (the "Merger"), in accordance with the
 provisions of Section 82 of Chapter 156B of the
 Massachusetts General Laws.

FURTHER
VOTED: That the effective date of the Merger shall be
----- the date of filing of appropriate Articles of
 Merger with the Secretary of State of Massachusetts.

FURTHER
VOTED: That any officer of the Corporation, acting singly,
----- be and he hereby is, authorized and directed to
 take any further actions, and to execute and deliver
 any further documents and certificates, which may
 be necessary or appropriate to effectuate the Merger
 described herein.

5. The effective date of the merger as specified in the vote set out under Paragraph 4 is

IN WITNESS WHEREOF and under the penalties of perjury we have hereto signed our names this 17th day of November, 1995.

/s/ John R. Bertucci
----- President*
John R. Bertucci

/s/ Richard S. Chute
----- Clerk*
Richard S. Chute

* Delete the inapplicable words. In case the parent corporation is organized under the laws of a state other than Massachusetts these articles are to be signed by officers having corresponding powers and duties.

COMMONWEALTH OF MASSACHUSETTS
ARTICLES OF MERGER OF PARENT AND SUBSIDIARY CORPORATIONS
(General Laws, Chapter 156B, Section 82)

I hereby approve the within articles of merger of parent and subsidiary corporations and, the filing fee in the amount of \$250 having been paid, said articles are deemed to have been filed with me this 17th day of November, 1995.

/s/ William Francis Galvin
William Francis Galvin
Secretary of the Commonwealth

TO BE FILLED IN BY CORPORATION
Photo Copy of Merger To Be Sent

TO: Terrence W. Mahoney, Esq.
Hill & Barlow

One International Place

Boston, MA 02110

Telephone 617-428-3000

THE COMMONWEALTH OF MASSACHUSETTS
WILLIAM FRANCIS GALVIN
Secretary of the Commonwealth
One Ashburton Place, Boston, Massachusetts 02108-1512

ARTICLES OF AMENDMENT
(General Laws, Chapter 156B, Section 72)

We, John R. Bertucci, *President,

and Richard S. Chute, *Clerk,

of MKS Instruments, Inc.,

(Exact name of corporation)

located at Six Shattuck Road, Andover, MA 01810

(Street address of corporation in Massachusetts)

certify that these Articles of Amendment affecting articles numbered: 3

3

(Number those articles 1, 2, 3, 4, 5 and/or 6 being amended)

of the Articles of Organization were duly adopted at a meeting held on
January 9, 1998 by vote of:

2,454 shares of Class A Common of 2,454 shares outstanding,

(type, class & series, if any)

3,250 shares of Class B Common of 3,250 shares outstanding,

(type, class & series, if any)

and

shares of of shares outstanding,

(type, class & series, if any)

(1)**being all and of each type, class or series of stock whose rights are
adversely affected thereby:

*Delete the inapplicable words. **Delete the inapplicable clause.

(1)For amendments adopted pursuant to Chapter 156B, Section 70.

(2)For amendments adopted pursuant to Chapter 156B, Section 71.

Note: If the space provided under any article or item on this form is
insufficient, additions shall be set forth on one side only of separate 8 1/2 x
11 sheets of paper with a left margin of at least 1 inch. Additions to more
than one article may be made on a single sheet so long as each article
requiring each addition is clearly indicated.

To change the number of shares and the par value (if any) of any type, class or series of stock which the corporation is authorized to issue, fill in the following:

The total presently authorized is:

WITHOUT PAR VALUE STOCKS			WITH PAR VALUE STOCKS		
TYPE	NUMBER OF SHARES		TYPE	NUMBER OF SHARES	PAR VALUE
Common:	Class A	10,000	Common:	None	None
	Class B	10,000		None	None
Preferred:	None		Preferred:	None	None

Change the total authorized to:

WITHOUT PAR VALUE STOCKS			WITH PAR VALUE STOCKS		
TYPE	NUMBER OF SHARES		TYPE	NUMBER OF SHARES	PAR VALUE
Common:	Class A	6,000,000	Common:	None	None
	Class B	10,000,000		None	None
Preferred:	None		Preferred:	None	None

VOTED: To amend the Restated Articles of Organization, as amended, to increase the authorized Class A Common Stock, no par value per share, of the Corporation from 10,000 shares to 6,000,000 shares and to increase the authorized Class B Common Stock, no par value per share of the Corporation from 10,000 shares to 10,000,000 shares, so that after the effective date of such amendment the total authorized capital stock of the Corporation shall consist of 6,000,000 shares of Class A Common Stock, no par value per share, and 10,000,000 shares of Class B Common Stock, no par value per share.

The foregoing amendment(s) will become effective when these Articles of Amendment are filed in accordance with General Laws, Chapter 156B, Section 6 unless these articles specify, in accordance with the vote adopting the amendment, a later effective date not more than thirty days after such filing, in which event the amendment will become effective on such later date.

Later effective date: _____.

SIGNED UNDER THE PENALTIES OF PERJURY, this 14th day of January, 1998,

/s/ John R. Bertucci, *President

/s/ Richard S. Chute, *Clerk

*Delete the inapplicable words.

THE COMMONWEALTH OF MASSACHUSETTS

ARTICLES OF AMENDMENT
(GENERAL LAWS, CHAPTER 156B, SECTION 72)

=====

I hereby approve the within Articles of Amendment and, the filing fee in the amount of \$15,980 having been paid, said articles are deemed to have been filed with me this 14th day of January 1998.

Effective date: January 14, 1998

WILLIAM FRANCIS GALVIN
Secretary of the Commonwealth

TO BE FILLED IN BY CORPORATION
PHOTOCOPY OF DOCUMENT TO BE SENT TO:

Richard N. Kimball, Esq.

Hale and Dorr LLP
60 State Street

Boston, MA 02109

Tel: (617) 526-6000

THE COMMONWEALTH OF MASSACHUSETTS
William Francis Galvin
Secretary of the Commonwealth
One Ashburton Place, Boston, Massachusetts 02108-1512

ARTICLES OF AMENDMENT
(GENERAL LAWS, CHAPTER 156B, SECTION 72)

We, Ronald C. Weigner, Vice President

and Richard S. Chute, Clerk

of MKS Instruments, Inc.

(exact name of corporation)

located at Six Shattuck Road, Andover, Massachusetts 01810,

certify that these Articles of Amendment affecting articles numbered:

3

(Number those articles 1,2,3,4,5 and/or 6 being amended)

of the Articles of Organization were duly adopted at a meeting held on
February 17, 1999, by vote of:

5,177,940 shares of Class A Common out of 5,177,940 shares outstanding,
(type, class & series, if any)

6,857,500 shares of Class B Common out of 6,857,501 shares outstanding, and
(type, class & series, if any)

_____ shares of _____ out of _____ shares outstanding,
(type, class & series, if any)

C []

P []

M []

RA []

Note: If the space provided under any article or item on this form is
insufficient, additions shall be set forth on separate 8 1/2 x 11
sheets of paper leaving a left hand margin of at least 1 inch for
binding. Additions to more than one article may be continued on a
single sheet so long as each article requiring each such addition
is clearly indicated.

To change the number of shares and the par value (if any) of any type, class or series of stock which the corporation is authorized to issue, fill in the following:

The total presently authorized is:

TYPE	WITHOUT PAR VALUE STOCKS		WITH PAR VALUE STOCKS	
	NUMBER OF SHARES		NUMBER OF SHARES	PAR VALUE
Common:	Class A	6,000,000	None	None
	Class B	10,000,000	None	None
Preferred:	None		None	None

Change the total authorized to:

TYPE	WITHOUT PAR VALUE STOCKS		WITH PAR VALUE STOCKS	
	NUMBER OF SHARES		NUMBER OF SHARES	PAR VALUE
Common:	Class A	11,250,000	None	None
	Class B	18,750,000	None	None
Preferred:	None		None	None

VOTED: To amend the Restated Articles of Organization, as amended, to increase the authorized Class A Common Stock, no par value per share, of the Corporation from 6,000,000 shares to 11,250,000 shares and to increase the authorized Class B Common Stock, no par value per share, of the Corporation from 10,000,000 shares to 18,750,000 shares, so that after the effective date of such amendment the total authorized capital stock of the Corporation shall consist of 11,250,000 shares of Class A Common Stock, no par value per share, and 18,750,000 shares of Class B Common Stock, no par value per share.

The foregoing amendment(s) will become effective when these Articles of Amendment are filed in accordance with General Laws, Chapter 156B, Section 6 unless these articles specify, in accordance with the vote adopting the amendment, a later effective date not more than thirty days after such filing, in which event the amendment will become effective on such later date.

Later effective date:_____.

SIGNED UNDER THE PENALTIES OF PERJURY, this 24th day of February, 1999,

/s/ Ronald C. Weigner Vice President,

/s/ Richard S. Chute Clerk

THE COMMONWEALTH OF MASSACHUSETTS
ARTICLES OF AMENDMENT
(General Laws, Chapter 156B, Section 72)

=====

I hereby approve the within Articles of Amendment and, the filing fee in the amount of \$_____ having been paid, said articles are deemed to have been filed with me this ____ day of _____ 19__.

Effective date:_____

WILLIAM FRANCIS GALVIN
Secretary of the Commonwealth

TO BE FILLED IN BY CORPORATION
PHOTOCOPY OF DOCUMENT TO BE SENT TO:

Emma R. Petty, Corporate Paralegal

Hale and Dorr
60 State Street

Boston, MA 02109

FORM CD-74-10M-10-79-152328

THE COMMONWEALTH OF MASSACHUSETTS
 MICHAEL JOSEPH CONNOLLY FEDERAL IDENTIFICATION
 Secretary of State No. 04-2277512
 ONE ASHBURTON PLACE, BOSTON, MASS: 02108
 SECOND
 AMENDED AND RESTATED ARTICLES OF ORGANIZATION
 GENERAL LAWS, CHAPTER 156B, SECTION 74

 We, John R. Bertucci, President and
 Richard S. Chute, Clerk
 MKS Instruments, Inc.

 (Name of Corporation)

located at SIX SHATTUCK ROAD, ANDOVER, MASSACHUSETTS 01810 do hereby certify that the following amendment and restatement of the articles of organization of the corporation was duly adopted by a vote of the stockholders on February 17, 1999, by vote of

_____ shares of _____ out of _____ shares outstanding,
 (Class of Stock)

_____ shares of CLASS A COMMON out of _____ shares outstanding, and
 (Class of Stock)

_____ shares of CLASS B COMMON out of _____ shares outstanding,
 (Class of Stock)

being at least two-thirds of each class of stock outstanding and entitled to vote and of each class or series of stock adversely affected thereby:-

1. The name by which the corporation shall be known is: --
 MKS Instruments, Inc.

2. The purposes for which the corporation is formed are as follows: --

C [] See Continuation Sheets 2A and 2B.

P []

M []

RA []

Note: If the space provided under any article or item on this form is insufficient, additions shall be set forth on separate 8 1/2 x 11 sheets of paper leaving a left hand margin of at least 1 inch for binding. Additions to more than one article may be continued on a single sheet so long as each article requiring each such addition is clearly indicated.

CONTINUATION SHEET 2A

2. THE PURPOSES FOR WHICH THE CORPORATION IS FORMED ARE AS FOLLOWS:

To design, manufacture, sell, lease and license instruments of all kinds, including electromechanical, electronic and mechanical gauges for the measurement of pressure, temperature, acceleration, flow and level of liquids and gases; to design, manufacture, sell, lease and license control systems incorporating measuring devices, and control systems separate from measuring devices, for the control of production processes and operations of all kinds; to design, manufacture, sell, lease and license instrumentation for military use; to design, manufacture, sell, lease and license instrumentation for use in research laboratories, in industry, in educational institutions, for medical purposes and for use elsewhere and for other purposes; and in general to design, manufacture, sell, lease and license electro-mechanical, electronic and mechanical devices of all kinds.

To buy and sell at wholesale and retail, or otherwise, to manufacture, produce, adapt, repair, dispose of, export, import and in any other manner to deal in goods, wares, merchandise, articles and things of manufacture or otherwise of all materials, supplies and other articles and things necessary or convenient for use in connection with any of said businesses or any other business or any part thereof; and to manufacture, repair, purchase, sell, lease, dispose of and otherwise deal in machinery, tools, and appliances which are or may be used in connection with the purchase, sale, production, adaption, repair, disposition of, export, import or other dealings in said goods, wares, merchandise, articles and things.

To purchase, lease or otherwise acquire as a going concern or otherwise all or any part of the franchises, rights, property, assets, business, good will or capital stock of any persons, firm, corporation, trust or association engaged in whole or in part in any business in which this corporation is empowered to engage, or in any other business; to pay for the same in whole or in part in cash, stock, bonds, notes, securities or other evidence of indebtedness of this corporation or in any other manner; to assume as part of the consideration or otherwise any and all debts, contracts or liabilities, matured or unmatured, fixed or contingent, of any such person, firm or corporation, trust or association; and to operate, manage, develop and generally to carry on the whole or any part of any such business under any name or names which it may select or designate.

CONTINUATION SHEET 2B

To construct, lease, hire, purchase or otherwise acquire and hold or maintain, and to rebuild, enlarge, improve, furnish, equip, alter, operate and dispose of warehouses, factories, offices and other buildings, real estate, structures or parts thereof, and appliances for the preparation, manufacture, purchase, sale and distribution of goods, wares, merchandise, things, and articles of all kinds.

To acquire, hold, use, sell, assign, lease, grant licenses in respect of, mortgage, or otherwise dispose of franchises, letters patent of the United States or of any foreign country, patent rights, licenses and privileges, inventions, improvements and processes, systems, copyrights, trade-marks and trade names, relating to, or useful in connection with, any business of this corporation.

To buy or otherwise acquire, to sell, assign, pledge, or otherwise dispose of and deal in stocks, bonds, securities, notes and other obligations of any person, firm or corporation, including this corporation, organized for or engaged in similar or cognate purposes; also stocks, bonds, securities, notes, and other obligations of any person, firm, or corporation, including this corporation, which it may be found or deemed necessary, valuable, or convenient for this corporation to acquire and deal in, in pursuance or furtherance of or in connection with the businesses herein specified, or any other business.

To borrow money and contract indebtedness for all proper corporate purposes, to issue bonds, notes, and other evidences of indebtedness, to secure the same by pledge, mortgage, or lien on all or any part of the property of the corporation, tangible or intangible; and to assume or guarantee or secure in like manner or otherwise, the leases, contracts, or other obligations, fixed or contingent, or the payment of any dividends on any stock or shares or of the principal or interest on any bonds, notes, or other evidences of indebtedness of any person, firm, corporation, trust, or association in which this corporation has a financial interest.

To enter into, make, and perform contracts of every name, nature, and kind with any person, firm, association, or corporation which may be deemed valuable, expedient, or convenient for this corporation in pursuance of or in furtherance of or in connection with any of the objects of incorporation of this corporation or in connection with any of the businesses or purposes herein specified.

The enumeration of specific powers herein shall not be construed as limiting or restricting in any way the general powers herein set forth, but nothing herein contained shall be construed as authorizing the business of banking.

3. The total number of shares and the par value, if any, of each class of stock which the corporation is authorized to issue as follows:

CLASS OF STOCK	WITHOUT PAR VALUE	WITH PAR VALUE	
	NUMBER OF SHARES	NUMBER OF SHARES	PAR VALUE
Preferred		2,000,000	\$.01
Common	50,000,000		none

- *4. If more than one class is authorized, a description of each of the different classes of stock with, if any, the preferences, voting powers, qualifications, special or relative rights or privileges as to each class thereof and any series now established:

See Continuation Sheets 4A, 4B and 4C

- *5. The restrictions, if any, imposed by the articles of organization upon the transfer of shares of stock of any class are as follows:

None.

- *6. Other lawful provisions, if any, for the conduct and regulation of the business and affairs of the corporation, for its voluntary dissolution, or for limiting, defining, or regulating the powers of the corporation, or of its directors or stockholders, or of any class of stockholders:

See Continuation Sheets 6A, 6B, 6C, 6D, 6E, 6F and 6G

*If there are no such provisions, state "None".

CONTINUATION SHEET 4A

The total number of shares of all classes of stock which the corporation shall have authority to issue is 52,000,000 shares, consisting of (i) 50,000,000 shares of Common Stock, no par value per share ("Common Stock"), and (ii) 2,000,000 shares of Preferred Stock, \$.01 par value per share ("Preferred Stock"). Upon the filing of the corporation's Amended and Restated Articles of Organization on _____, 1999 (the "Mandatory Conversion Date") each share of Class A Common Stock, no par value per share, and each share of Class B Common Stock, no par value per share (together with the Class A Common Stock, the "Class Common Stock"), shall be converted into one share of Common Stock, no par value per share. All holders of record of shares of Class Common Stock shall be given written notice of the Mandatory Conversion Date and the place designated for mandatory conversion of all such shares of Class Common Stock pursuant to this provision. Such notice need not be given in advance of the occurrence of the Mandatory Conversion Date. Such notice shall be sent by first class or registered mail, postage prepaid, to each record holder of Class Common Stock at such holder's address last shown on the records of the transfer agent for the Class Common Stock (or the records of the corporation, if it serves as its own transfer agent). Upon receipt of such notice, each holder of shares of Class Common Stock shall surrender his or its certificate or certificates for all such shares to the corporation at the place designated in such notice, and shall thereafter receive certificates for the number of shares of Common Stock equal to the number of shares of Class Common Stock represented by such certificates. On the Mandatory Conversion Date, all rights with respect to the Class Common Stock so converted, including the rights, if any, to receive notices and vote (other than as a holder of Common Stock) will terminate, except only the rights of the holders thereof, upon surrender of their certificate or certificates therefor, to receive certificates for the number of shares of Common Stock into which such Class Common Stock has been converted, and payment of any declared but unpaid dividends thereon. If so required by the corporation, certificates surrendered for conversion shall be endorsed or accompanied by written instrument or instruments of transfer, in form satisfactory to the corporation, duly executed by the registered holder or by his or its attorney duly authorized in writing. As soon as practicable after the Mandatory Conversion Date and the surrender of the certificate or certificates for Class Common Stock, the corporation shall cause to be issued and delivered to such holder, or on his or its written order, a certificate or certificates for the number of full shares of Common Stock issuable on such conversion in accordance with the provisions hereof.

All certificates evidencing shares of Class Common Stock which are required to be surrendered for conversion in accordance with the provisions hereof shall, from and after the Mandatory Conversion Date, be deemed to have been retired and cancelled and the shares of Class Common Stock represented thereby converted into Common Stock for all purposes, notwithstanding the failure of the holder or holders thereof to surrender such certificates on or prior to such date.

CONTINUATION SHEET 4B

The following is a statement of the designation and the powers, privileges and rights, and the qualifications, limitations or restrictions thereof in respect of each class of capital stock of the corporation.

A. COMMON STOCK.

1. GENERAL. The voting, dividend and liquidation rights of the holders of the Common Stock are subject to and qualified by the rights of the holders of the Preferred Stock of any series as may be designated by the Board of Directors upon any issuance of the Preferred Stock of any series.

2. VOTING. The holders of the Common Stock are entitled to one vote for each share held at all meetings of stockholders (and written actions in lieu of meetings). There shall be no cumulative voting.

3. DIVIDENDS. Dividends may be declared and paid on the Common Stock from funds lawfully available therefor as and when determined by the Board of Directors and subject to any preferential dividend rights of any then outstanding Preferred Stock.

4. LIQUIDATION. Upon the dissolution or liquidation of the corporation, whether voluntary or involuntary, holders of Common Stock will be entitled to receive all assets of the corporation available for distribution to its stockholders, subject to any preferential rights of any then outstanding Preferred Stock.

B. PREFERRED STOCK.

Preferred Stock may be issued from time to time in one or more series, each of such series to have such terms as stated or expressed herein and in the resolution or resolutions providing for the issue of such series adopted by the Board of Directors of the corporation as hereinafter provided. Any shares of Preferred Stock which may be redeemed, purchased or acquired by the corporation may be reissued except as otherwise provided by law. Different series of Preferred Stock shall not be construed to constitute different classes of shares for the purposes of voting by classes unless expressly provided.

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Authority is hereby expressly granted to the Board of Directors from time to time to issue the Preferred Stock in one or more series, and in connection with the creation of any such series, by resolution or resolutions providing for the issue of the shares thereof, to determine and fix such voting powers, full or limited, or no voting powers, and such designations, preferences and relative participating, optional or other special rights, and qualifications, limitations or restrictions thereof, including without limitation thereof, dividend rights, conversion rights, redemption privileges and liquidation preferences, as shall be stated and expressed in such resolutions, all to the full extent now or hereafter permitted by Chapter 156B of the Massachusetts General Laws. Without limiting the generality of the foregoing, the resolutions providing for issuance of any series of Preferred Stock may provide that such series shall be superior or rank equally or be junior to the Preferred Stock of any other series to the extent permitted by law. No vote of the holders of the Preferred Stock or Common Stock shall be a prerequisite to the issuance of any shares of any series of the Preferred Stock authorized by and complying with the conditions of the Articles of Organization, the right to have such vote being expressly waived by all present and future holders of the capital stock of the corporation.

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6A. LIMITATION OF DIRECTOR LIABILITY

Except to the extent that Chapter 156B of the Massachusetts General Laws prohibits the elimination or limitation of liability of directors for breaches of fiduciary duty, no director of the corporation shall be personally liable to the corporation or its stockholders for monetary damages for any breach of fiduciary duty as a director, notwithstanding any provision of law imposing such liability. No amendment to or repeal of this provision shall apply to or have any effect on the liability or alleged liability of any director of the corporation for or with respect to any acts or omissions of such director occurring prior to such amendment.

6B. INDEMNIFICATION

1. ACTIONS, SUITS AND PROCEEDINGS. The corporation shall indemnify each person who was or is a party or is threatened to be made a party to any threatened, pending or completed action, suit or proceeding, whether civil, criminal, administrative or investigative, by reason of the fact that he is or was, or has agreed to become, a director or officer of the corporation, or is or was serving, or has agreed to serve, at the request of the corporation, as a director or officer of, or in a similar capacity with, another organization or in any capacity with respect to any employee benefit plan of the corporation (all such persons being referred to hereafter as an "Indemnitee"), or by reason of any action alleged to have been taken or omitted in such capacity, against all expenses (including attorneys' fees), judgments and fines incurred by him or on his behalf in connection with such action, suit or proceeding and any appeal therefrom, unless the Indemnitee shall be finally adjudicated in such action, suit or proceeding not to have acted in good faith in the reasonable belief that his action was in the best interests of the corporation or, to the extent such matter relates to service with respect to an employee benefit plan, in the best interests of the participants or beneficiaries of such employee benefit plan. Notwithstanding anything to the contrary in this Article, except as set forth in Section 6 below, the corporation shall not indemnify an Indemnitee seeking indemnification in connection with a proceeding (or part thereof) initiated by the Indemnitee unless the initiation thereof was approved by the Board of Directors of the

CONTINUATION SHEET 6B

corporation. Notwithstanding anything to the contrary in this Article, the corporation shall not indemnify an Indemnitee to the extent such Indemnitee is reimbursed from the proceeds of insurance, and in the event the corporation makes any indemnification payments to an Indemnitee and the Indemnitee is subsequently reimbursed from the proceeds of insurance, such Indemnitee shall promptly refund such indemnification payments to the corporation to the extent of such insurance reimbursement.

2. SETTLEMENTS AND COMPROMISE. The right to indemnification conferred in this Article shall include the right to be paid by the corporation for amounts paid in settlement or compromise of any such action, suit or proceeding and any appeal therefrom, and all expenses (including attorneys' fees) incurred in connection with such settlement or compromise, pursuant to a consent decree or otherwise, unless and to the extent it is determined pursuant to Section 5 below that the Indemnitee did not act in good faith in the reasonable belief that his action was in the best interests of the corporation or, to the extent such matter relates to service with respect to an employee benefit plan, in the best interests of the participants or beneficiaries of such employee benefit plan.

3. NOTIFICATION AND DEFENSE OF CLAIM. As a condition precedent to his right to be indemnified, the Indemnitee must notify the corporation in writing as soon as practicable of any action, suit, proceeding or investigation involving him for which indemnity will or could be sought. With respect to any action, suit, proceeding or investigation of which the corporation is so notified, the corporation will be entitled to participate therein at its own expense and/or to assume the defense thereof at its own expense, with legal counsel reasonably acceptable to the Indemnitee. After notice from the corporation to the Indemnitee of its election so to assume such defense, the corporation shall not be liable to the Indemnitee for any legal or other expenses subsequently incurred by the Indemnitee in connection with such claim, other than as provided below in this Section 3. The Indemnitee shall have the right to employ his own counsel in connection with such claim, but the fees and expenses of such counsel incurred after notice from the corporation of its assumption of the defense thereof shall be at the expense of the Indemnitee unless (i) the employment of counsel by the Indemnitee has been authorized by the corporation, (ii) counsel to the Indemnitee shall have reasonably concluded that there may be a conflict of interest or position on any significant issue

CONTINUATION SHEET 6C

between the corporation and the Indemnitee in the conduct of the defense of such action or (iii) the corporation shall not in fact have employed counsel to assume the defense of such action, in each of which cases the fees and expenses of counsel for the Indemnitee shall be at the expense of the corporation, except as otherwise expressly provided by this Article. The corporation shall not be entitled, without the consent of the Indemnitee, to assume the defense of any claim brought by or in the right of the corporation or as to which counsel for the Indemnitee shall have reasonably made the conclusion provided for in clause (ii) above.

4. ADVANCE OF EXPENSES. Subject to the provisions of Section 5 below, in the event that the corporation does not assume the defense pursuant to Section 3 of this Article of any action, suit, proceeding or investigation of which the corporation receives notice under this Article, any expenses (including attorneys' fees) incurred by an Indemnitee in defending a civil or criminal action, suit, proceeding or investigation or any appeal therefrom shall be paid by the corporation in advance of the final disposition of such matter; PROVIDED, HOWEVER, that the payment of such expenses incurred by an Indemnitee in advance of the final disposition of such matter shall be made only upon receipt of an undertaking by or on behalf of the Indemnitee to repay all amounts so advanced in the event that it shall ultimately be determined that the Indemnitee is not entitled to be indemnified by the corporation as authorized in this Article. Such undertaking shall be accepted without reference to the financial ability of the Indemnitee to make such repayment.

5. PROCEDURE FOR INDEMNIFICATION. In order to obtain indemnification or advancement of expenses pursuant to Section 1, 2 or 4 of this Article, the Indemnitee shall submit to the corporation a written request, including in such request such documentation and information as is reasonably available to the Indemnitee and is reasonably necessary to determine whether and to what extent the Indemnitee is entitled to indemnification or advancement of expenses. Any such indemnification or advancement of expenses shall be made promptly, and in any event within 60 days after receipt by the corporation of the written request of the Indemnitee, unless the corporation determines within such 60-day period that the Indemnitee did not meet the applicable standard of conduct set forth in Section 1 or 2, as the case may be. Such determination shall be made in each instance by (a) a majority vote of a quorum of the directors of the corporation, (b) a majority vote of a

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quorum of the outstanding shares of stock of all classes entitled to vote for directors, voting as a single class, which quorum shall consist of stockholders who are not at that time parties to the action, suit or proceeding in question, (c) independent legal counsel (who may, to the extent permitted by law, be regular legal counsel to the corporation), or (d) a court of competent jurisdiction.

6. REMEDIES. The right to indemnification or advances as granted by this Article shall be enforceable by the Indemnitee in any court of competent jurisdiction if the corporation denies such request, in whole or in part, or if no disposition thereof is made within the 60-day period referred to above in Section 5. Unless otherwise required by law, the burden of proving that the Indemnitee is not entitled to indemnification or advancement of expenses under this Article shall be on the corporation. Neither the failure of the corporation to have made a determination prior to the commencement of such action that indemnification is proper in the circumstances because the Indemnitee has met the applicable standard of conduct, nor an actual determination by the corporation pursuant to Section 5 that the Indemnitee has not met such applicable standard of conduct, shall be a defense to the action or create a presumption that the Indemnitee has not met the applicable standard of conduct. The Indemnitee's expenses (including attorneys' fees) incurred in connection with successfully establishing his right to indemnification, in whole or in part, in any such proceeding shall also be indemnified by the corporation.

7. SUBSEQUENT AMENDMENT. No amendment, termination or repeal of this Article or of the relevant provisions of Chapter 156B of the Massachusetts General Laws or any other applicable laws shall affect or diminish in any way the rights of any Indemnitee to indemnification under the provisions hereof with respect to any action, suit, proceeding or investigation arising out of or relating to any actions, transactions or facts occurring prior to the final adoption of such amendment, termination or repeal.

8. OTHER RIGHTS. The indemnification and advancement of expenses provided by this Article shall not be deemed exclusive of any other rights to which an Indemnitee seeking indemnification or advancement of expenses may be entitled under any law (common or statutory), agreement or vote of stockholders or directors or otherwise, both

CONTINUATION SHEET 6E

as to action in his official capacity and as to action in any other capacity while holding office for the corporation, and shall continue as to an Indemnitee who has ceased to be a director or officer, and shall inure to the benefit of the estate, heirs, executors and administrators of the Indemnitee. Nothing contained in this Article shall be deemed to prohibit, and the corporation is specifically authorized to enter into, agreement with officers and directors providing indemnification rights and procedures different from those set forth in this Article. In addition, the corporation may, to the extent authorized from time to time by its Board of Directors, grant indemnification rights to other employees or agents of the corporation or other persons serving the corporation and such rights may be equivalent to, or greater or less than, those set forth in this Article.

9. PARTIAL INDEMNIFICATION. If an Indemnitee is entitled under any provision of this Article to indemnification by the corporation for some or a portion of the expenses (including attorneys' fees), judgments, fines or amounts paid in settlement or compromise actually and reasonably incurred by him or on his behalf in connection with any action, suit, proceeding or investigation and any appeal therefrom but not, however, for the total amount thereof, the corporation shall nevertheless indemnify the Indemnitee for the portion of such expenses (including attorneys' fees), judgments, fines or amounts paid in settlement or compromise to which the Indemnitee is entitled.

10. INSURANCE. The corporation may purchase and maintain insurance, at its expense, to protect itself and any director, officer, employee or agent of the corporation or another organization or employee benefit plan against any expense, liability or loss incurred by him in any such capacity, or arising out of his status as such, whether or not the corporation would have the power to indemnify such person against such expense, liability or loss under Chapter 156B of the Massachusetts General Laws.

11. MERGER OR CONSOLIDATION. If the corporation is merged into or consolidated with another corporation and the corporation is not the surviving corporation, the surviving corporation shall assume the obligations of the corporation under this Article with respect to any action, suit, proceeding or investigation arising out of or relating to any actions, transactions or facts occurring prior to the date of such merger or consolidation.

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12. SAVINGS CLAUSE. If this Article or any portion hereof shall be invalidated on any ground by any court of competent jurisdiction, then the corporation shall nevertheless indemnify each Indemnitee as to any expenses (including attorneys' fees), judgments, fines and amounts paid in settlement or compromise in connection with any action, suit, proceeding or investigation, whether civil, criminal or administrative, including an action by or in the right of the corporation, to the fullest extent permitted by any applicable portion of this Article that shall not have been invalidated and to the fullest extent permitted by applicable law.

13. SUBSEQUENT LEGISLATION. If the Massachusetts General Laws are amended after adoption of this Article to expand further the indemnification permitted to Indemnitees, then the corporation shall indemnify such persons to the fullest extent permitted by the Massachusetts General Laws, as so amended.

6C. OTHER PROVISIONS

(a) The directors may make, amend, or repeal the By-Laws in whole or in part, except with respect to any provision of such By-Laws which by law or these Articles of Organization or the By-Laws requires action by the stockholders.

(b) Meetings of the stockholders of the corporation may be held anywhere in the United States.

(c) The corporation shall have the power to be a partner in any business enterprise which this corporation would have the power to conduct by itself.

(d) The corporation, by vote of at least sixty-six and two-thirds percent (66 2/3%) of the stock outstanding and entitled to vote thereon (or if there are two or more classes of stock entitled to vote as separate classes, then by vote of at least sixty-six and two-thirds percent (66 2/3%) of each such class of stock outstanding), may (i) authorize any amendment to its Articles of Organization pursuant to Section 71 of Chapter 156B of the Massachusetts General Laws, as amended from time to time, (ii) authorize the sale, lease or exchange of all or substantially all of its property and assets, including its goodwill, pursuant to Section 75 of Chapter 156B of the Massachusetts

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General Laws, as amended from time to time, and (iii) approve an agreement of merger or consolidation pursuant to Section 78 of Chapter 156B of the Massachusetts General Laws, as amended from time to time; PROVIDED, however, that if any such (i) amendment to its Articles of Organization, (ii) sale, lease, or exchange or (iii) merger or consolidation (each as more fully described above) has been approved by a majority of the Board of Directors of the corporation, then the corporation may authorize or approve such action by vote of a majority of the stock outstanding and entitled to vote thereon (or if there are two or more classes of stock entitled to vote as separate classes, then by vote of a majority of each such class outstanding).

(e) Chapter 110F of the Massachusetts General Laws, as it may be amended from time to time, shall not apply to the corporation.

*We further certify that the foregoing restated articles of organization effect no amendments to the articles of organization of the corporation as heretofore amended, except amendments to the following articles 3, 4 and 6.

(*If there are no such amendments, state "None".)

Briefly describe amendments in space below:

- Article 3. Is amended to: (i) eliminate authorized shares of Class A Common Stock, no par value per share ("Class A Common Stock"), and Class B Common Stock, no par value per share ("Class B Common Stock"); (ii) increase the authorized number of shares of Common Stock, no par value per share ("Common Stock") to 50,000,000 shares and; (iii) authorize issuance of up to 2,000,000 shares of Preferred Stock.
- Article 4. Is amended to: (i) delete any and all provisions describing or relating to rights and preferences of Class A Common Stock and Class B Common Stock; (ii) provide that each outstanding share of Class A Common Stock and Class B Common Stock has been converted into one share of Common Stock; (iii) provide a statement of the designation and the powers, privileges and rights, and the qualification, limitations or restrictions thereof in respect of each class of capital stock of the corporation; and (iv) authorize the Board of Directors to issue Preferred Stock in one or more series and create any such series of Preferred Stock without requiring a vote of the holders of Preferred Stock or Common Stock as a prerequisite to the issuance of any shares of any such Preferred Stock and restate Article 4 in its entirety.
- Article 6. Is amended to (i) delete the provision relating to limitation of director liability and replace it with Section 6A, "Limitation of Director Liability;" (ii) add Section 6B "Indemnification;" and (iii) add Section 6C "Other Provisions."

AMENDED AND RESTATED

BY-LAWS

OF

MKS INSTRUMENTS, INC.

ARTICLE I

NAME, LOCATION, CORPORATE SEAL, AND FISCAL YEAR

Section 1. NAME. The name of the corporation is MKS Instruments, Inc.

Section 2. LOCATION. The principal office of the corporation in Massachusetts shall be located at the place set forth on the form of the Articles of Organization or on a certificate filed with the State Secretary. The Board of Directors may change the location of the principal office in Massachusetts and establish such other offices as it deems appropriate.

Section 3. CORPORATE SEAL. Except as otherwise determined from time to time by the Board of Directors, the fiscal year of the corporation shall in each year end on December 31.

ARTICLE II

STOCKHOLDERS

Section 1. ANNUAL MEETING. The annual meeting of stockholders shall be held within six months after the end of each fiscal year of the corporation on a date to be fixed by the Board of Directors or the President (which date shall not be a legal holiday in the place where the meeting is to be held) at the time and place to be fixed by the Board of Directors or the President and stated in the notice of the meeting. The purposes for which the annual meeting is to be held, in addition to those prescribed by law, by the Articles of Organization or by these By-Laws, may be specified by the Board of Directors or the President. If no annual meeting is held in accordance with the foregoing provisions, a special meeting may be held in lieu of the annual meeting, and any action taken at that special meeting shall have the same effect as if it had been taken at the annual meeting, and in such case all references in these By-Laws to the annual meeting of stockholders shall be deemed to refer to such special meeting.

Section 2. BUSINESS AT ANNUAL MEETINGS. Except as otherwise provided by law, at an annual meeting of the stockholders, only such business shall be conducted as shall have been properly brought before the meeting. To be properly brought before an annual meeting, business must be (a) specified in the

notice of Directors, (b) otherwise properly brought before the meeting by or at the direction of the Board of Directors, or (c) otherwise properly brought before the meeting by a stockholder.

For business to be properly brought before an annual meeting by a stockholder, the stockholder must give timely notice thereof in writing to the Clerk of the corporation. To be timely, a stockholder's notice must be delivered to or mailed and received at the principal executive offices of the corporation not less than 60 days nor more than 90 days prior to the meeting; PROVIDED, HOWEVER, that in the event that less than 40 days' notice or prior public disclosure of the date of the meeting is given or made to stockholders, notice by the stockholder to be timely must be so received not later than the close of business on the 10th day following the day on which such notice of the date of the annual meeting was mailed or such public disclosure was made. A stockholder's notice to the Clerk shall set forth as to each matter the stockholder proposes to bring before the annual meeting (a) a brief description of the business desired to be brought before the annual meeting and the reasons for conducting such business at the annual meeting, (b) the name and address, as they appear on the corporation's books, of the stockholder proposing such business, (c) the class and number of shares of the corporation which are beneficially owned by the stockholder, and (d) any material interest of the stockholder in such business. No later than the tenth day following the date of receipt of a stockholder notice pursuant to this Section 2, the Chairman of the Board of Directors of the corporation shall, if the facts warrant, determine and notify in writing the stockholder submitting such notice that such notice was not made in accordance with the time limits and/or other procedures prescribed by these By-Laws. If no such notification is mailed to such stockholder within such ten-day period, such stockholder notice containing a matter of business shall be deemed to have been made in accordance with the provisions of this Section 2. Notwithstanding anything in these By-Laws to the contrary, no business shall be conducted at an annual meeting except in accordance with the procedures set forth in this Section 2.

Section 3. SPECIAL MEETINGS. Special meetings of stockholders may be called by the President or by the Board of Directors. In addition, upon written application of one or more stockholders who are entitled to vote and who hold at least the Required Percentage (as defined below) of the capital stock entitled to vote at the meeting, special meetings shall be called by the Clerk, or in case of the death, absence, incapacity or refusal of the Clerk, by any other officer.

For purposes of this Section 3, the "Required Percentage" shall be (i) 10% at any time at which the corporation shall not have a class of voting stock registered under the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and (ii) 40% at any time at which the corporation shall have a class of voting stock registered under the Exchange Act.

Any request for a call of a special meeting of stockholders (a "Call") by the holders of the Required Percentage of the capital stock entitled to vote at the meeting (the "Voting Stock") shall be governed by and subject to the following:

(a) Any stockholder of record seeking to solicit requests for a Call pursuant to this Section 3 shall so notify the corporation in writing to the Clerk of the corporation and such written notification shall set forth the reason or reasons for the Call and the purpose of such special meeting.

(b) No solicitation of stockholder requests for a Call (a "Call Solicitation") may be commenced (i) before the Call Request Record Date (as defined in paragraph (c) of this Section 3) or (ii) during the period of 90 days following the most recent meeting of the stockholders of the corporation.

(c) In order that the corporation may determine the stockholders entitled to request a Call, the Board of Directors of the corporation shall fix a record date (the "Call Request Record Date"). Any stockholder of record seeking to solicit stockholder requests for a Call shall, with delivery to the corporation of the written information specified in paragraph (a), request in writing that the Board of Directors fix the Call Request Record Date. The Board of Directors shall, within 10 days after the date on which such request is received, adopt a resolution fixing the Call Request Record Date and such Call Request Record Date shall be not more than 10 days after the date upon which such resolution is adopted by the Board of Directors.

(d) All requests for a Call and revocations thereof shall be delivered to the corporation no later than the 30th day (the "Delivery Date") after the Call Request Record Date.

(e) Any stockholder may revoke a prior request for a Call or opposition to a Call by an instrument in writing delivered prior to the Delivery Date.

(f) Promptly after the Delivery Date, requests for a Call and revocations thereof shall be counted and verified by an independent party selected by the corporation.

(g) If, in response to any Call Solicitation, the holders of record of the Required Percentage of the Voting Stock as of the Call Request Record Date submit valid and unrevoked requests for a Call no later than the Delivery Date, the Board of Directors of the corporation shall fix a record date pursuant to Section 6 of Article V hereof and a meeting date for the special meeting; PROVIDED that the date to be fixed for such meeting shall be no earlier than 60 days or later than 90 days after the Delivery Date; and PROVIDED FURTHER that the Board of Directors shall not be obligated to fix a meeting date or to hold any meeting of stockholders within 60 days of the next scheduled meeting of the stockholders of the corporation.

(h) In the absence of a quorum at any special meeting called pursuant to a Call Solicitation, such special meeting may be postponed or adjourned from time to time only by the officer of the corporation entitled to preside at such meeting.

Section 4. TIME AND PLACE OF MEETINGS. All meetings of stockholders shall be held at a suitable time at the principal office of the corporation or at such other suitable place within Massachusetts or, to the extent permitted by the Articles of Organization, elsewhere in the United States, as shall be selected by the President or the Board of Directors in the case of an annual meeting and, in the case of a special meeting, by the President, the Board of Directors or the applying stockholders calling such meeting.

Section 5. NOTICE OF MEETINGS. A written notice of each meeting of stockholders containing the place, date and hour, and the purposes for which it is to be held, shall be given by the Clerk or, in the case of the death, absence, incapacity, or refusal of the Clerk, by any other officer, at least seven days before the date of the meeting, to each stockholder entitled to vote at the meeting and to each stockholder who is otherwise entitled by law or by the Articles of Organization or these By-Laws to such notice, by leaving such notice with him or at his residence or usual place of business or by mailing it postage prepaid and addressed to each stockholder at his address as it shall appear in the stock and transfer records of the corporation. Notice of a meeting need not be given to a stockholder if a written waiver of notice, executed before or after the meeting by such stockholder or his attorney thereunto authorized, is filed with the records of the meeting.

Section 6. QUORUM. The holder or holders of a majority in interest of all stock issued, outstanding, and entitled to vote at a meeting, present in person or represented by proxy, shall constitute a quorum, but the majority of a lesser interest so present may, from time to time, postpone to a new time or place any meeting and the postponed meeting may be held without further notice.

Section 7. VOTING AND PROXIES. Each stockholder entitled to vote shall have one vote, to be exercised in person or by proxy, for each share of stock held by him, and a proportionate vote for a fractional share. When a quorum is present at any meeting the vote of the holders of a majority in interest of the stock represented which is entitled to vote and voting shall decide any matter properly brought before the meeting, except in the case of elections by stockholders, which shall be decided by a plurality of the votes cast by stockholders entitled to vote at the election, and except when a larger vote is required by law, the Articles of Organization or these By-Laws. No vote need be taken by ballot unless so requested by any stockholder entitled to vote thereon. Proxies must be in writing and filed with the clerk of the meeting before being voted. The person named in a proxy may vote at any

adjournment of the meeting for which the proxy was given, but the proxy shall terminate after final adjournment of the meeting. No proxy dated more than six months before the meeting named in it shall be valid. A proxy purporting to be executed by or on behalf of a stockholder shall be deemed valid unless challenged at or prior to its exercise and the burden of proving invalidity shall rest on the challenger. A proxy with respect to stock held in the name of two or more persons shall be valid if executed by any one of them unless at or prior to the exercise of the proxy the corporation receives a specific notice to the contrary from any one of them. Inspectors of election, if any, shall be appointed by the Board of Directors or, in the absence of such appointment, by the officer presiding at any meeting of the stockholders.

Section 8. ACTION BY CONSENT. Any action required or permitted to be taken by stockholders may be taken without a meeting if all stockholders entitled to vote on the matter consent in writing to the action and such written consents are filed with the records of the meetings of stockholders. Such consents shall be treated for all purposes as a vote at a meeting.

ARTICLE III

THE BOARD OF DIRECTORS

Section 1. NUMBER, ELECTION AND QUALIFICATION. The number of directors which shall constitute the whole Board of Directors shall be determined by vote of the stockholders or the Board of Directors, but shall consist of not less than three directors (except that whenever there shall be only two stockholders the number of directors shall be not less than two and whenever there shall be only one stockholder or prior to the issuance of any stock, there shall be at least one director). The number of directors may be decreased at any time and from time to time either by the stockholders or by a majority of the directors then in office, but only to eliminate vacancies existing by reason of the death, resignation, removal or expiration of the term of one or more directors. The directors shall be elected at the annual meeting of stockholders by such stockholders as have the right to vote on such election. No director need be a stockholder of the corporation.

Notwithstanding the foregoing provisions, if the corporation is a "registered corporation" within the meaning of Section 50A of the Massachusetts Business Corporation Law, as amended, and has not elected, pursuant to paragraph (b) of such Section 50A, to be exempt from the provisions of Paragraph (a) of such Section 50A, then:

(i) In accordance with paragraph (d), clause (iv) of such Section 50A, the number of directors shall be fixed only by vote of the Board of Directors.

(ii) In accordance with paragraph (a) of such Section 50A, the directors of the corporation shall be classified with respect to the time for which they severally hold office, into three classes, as nearly equal in number as possible; the term of office of those of the first class ("Class I Directors") to continue until the first annual meeting following the date the corporation becomes subject to such paragraph (a) and until their successors are duly elected and qualified; the term of office of those of the second class ("Class II Directors") to continue until the second annual meeting following the date the corporation becomes subject to such paragraph (a) and until their successors are duly elected and qualified; and the term of office of those of the third class ("Class III Directors") to continue until the third annual meeting following the date the corporation becomes subject to such paragraph (a) and until their successors are duly elected and qualified. At each annual meeting of the corporation, the successors to the class of directors whose term expires at that meeting shall be elected to hold office for a term continuing until the annual meeting held in the third year following the year of their election and until their successors are duly elected and qualified.

Section 2. ENLARGEMENT OF THE BOARD. The number of directors may be increased at any time and from time to time by a majority of the directors then in office. Notwithstanding the foregoing provisions, if the directors of the corporation are classified with respect to the time for which they severally hold office pursuant to paragraph (a) of Section 50A of the Massachusetts Business Corporation Law, as it may be amended from time to time, the Board of Directors may be enlarged only in accordance with the provisions of paragraph (d) of such Section 50A.

Section 3. TENURE. Except as otherwise provided by law, these By-Laws or the Articles of Organization, each director shall hold office until the next annual meeting of stockholders and until his successor is elected and qualified, or until his earlier death, resignation or removal.

Section 4. VACANCIES. Unless and until filled by the stockholders, any vacancy in the Board of Directors, however occurring, including a vacancy resulting from an enlargement of the Board, may be filled by vote of a majority of the directors present at the meeting of directors at which a quorum is present. Each such successor shall hold office for the unexpired term of his predecessor and until his successor is chosen and qualified or until his earlier death, resignation or removal. Notwithstanding the foregoing provisions, if the directors of the corporation are classified with respect to the time for which they severally hold office pursuant to paragraph (a) of Section 50A of the Massachusetts Business Corporation Law, as it may be amended from time to time, any vacancy in the Board of Directors, however occurring, shall be filled solely in accordance with the provisions of paragraph (d) of such Section 50A.

Section 5. RESIGNATION. Any director may resign by delivering his written resignation to the corporation at its principal office or to the President or Clerk. Such resignation shall be effective upon receipt unless it is specified to be effective at some other time or upon the happening of some other event.

Section 6. REMOVAL. A director may be removed from office with or without cause by vote of the holders of a majority of the shares entitled to vote in the election of directors. However, the directors elected by the holders of a particular class or series of stock may be removed from office with or without cause only by vote of the holders of a majority of the outstanding shares of such class or series. In addition, a director may be removed from office for cause by vote of a majority of the directors then in office. A director may be removed for cause only after reasonable notice and opportunity to be heard before the body proposing to remove him. Notwithstanding the foregoing provision, if the directors of the corporation are classified with respect to the time for which they severally hold office pursuant to paragraph (a) of Section 50A of the Massachusetts Business Corporation Law, as it may be amended from time to time, directors may only be removed for cause pursuant to paragraph (c) of such Section 50A.

Section 7. NOMINATION OF DIRECTORS. Only persons who are nominated in accordance with the procedures set forth in this Section 7 shall be eligible for election as directors. Nominations of persons for election to the Board of Directors of the corporation may be made at a meeting of stockholders of the corporation entitled to vote for the election of directors at the meeting who complies with the notice procedures set forth in this Section 7. Any such nomination by a stockholder shall be made pursuant to timely notice in writing to the Clerk of the corporation. To be timely, a stockholder's notice shall be delivered to the principal executive offices of the corporation not less than 30 days nor more than 90 days prior to the date of the meeting; PROVIDED, HOWEVER, that in the event that less than 40 days' notice or prior public disclosure of the date of the meeting is given or made to stockholders, timely notice by the stockholder must be received not later than the close of business on the 10th day following the day on which such notice of the date of the meeting was mailed or such public disclosure was made. Such stockholder's notice shall set forth (a) as to each person whom the stockholder proposes to nominate for election or re-election as a director, (i) the name, age, business address and residence address of such person (ii) the principal occupation or employment of such person, (iii) the class and number of shares of the corporation which are beneficially owned by such person and (iv) any other information relating to such person that is required to be disclosed in solicitations of proxies for election of directors or is otherwise required in each case pursuant to Regulation 14A under the Securities Exchange Act of 1934, as amended (including without limitation such person's written consent to being named in the proxy statement as a nominee and to serving as a director if elected); and (b) as to the stockholder giving the notice, (i) the

name and address, as they appear on the corporation's books, of such stockholder and (ii) the class and number of shares of the corporation which are beneficially owned by such stockholder. At the request of the Board of Directors, any person nominated by the Board of Directors for election as a director shall furnish to the Clerk of the corporation that information required to be set forth in a stockholder's notice of nomination which pertains to the nominee. No later than the tenth day following the date of receipt of a stockholder nomination submitted pursuant to this Section 7, the Chairman of the Board of Directors of the corporation shall, if the facts warrant, determine and notify in writing the stockholder making such nomination that such nomination was not made in accordance with the time limits and/or other procedures prescribed by these By-Laws. If no such notification is mailed to such stockholder within such ten-day period, such nomination shall be deemed to have been made in accordance with the provisions of this Section 7.

Section 8. POWERS. The business of the corporation shall be managed by a Board of Directors, who may exercise all the powers of the corporation except as otherwise provided by law, by the Articles of Organization or by these By-Laws. In the event of a vacancy in the Board of Directors, the remaining Directors, except as otherwise provided by law, may exercise the powers of the full Board until the vacancy is filled.

Section 9. CHAIRMAN OF THE BOARD AND VICE-CHAIRMAN OF THE BOARD. The Board of Directors may appoint a Chairman of the Board. If the Board of Directors appoints a Chairman of the Board, he shall perform such duties and possess such powers as are assigned to him by the Board of Directors. If the Board of Directors appoints a Vice-Chairman of the Board, he shall, in the absence or disability of the Chairman of the Board, perform the duties and exercise the powers of the Chairman of the Board and shall perform such other duties and possess such other powers as may from time to time be vested in him by the Board of Directors.

Section 10. REGULAR MEETINGS. Regular meetings of the Directors may be held without call or notice at such places, within or without Massachusetts, and at such times as the Directors may from time to time determine, provided that any Director who is absent when such determination is made shall be given notice of the determination. A regular meeting of the Directors may be held without a call or notice immediately after and at the same place as the annual meeting of stockholders.

Section 11. SPECIAL MEETINGS. Special meetings of the Directors may be held at any time and place, within or without Massachusetts, designated in a call by the Chairman of the Board, President, Treasurer, two or more Directors or by one Director in the event that there is only a single Director in office.

Section 12. MEETINGS BY TELEPHONE CONFERENCE CALLS. Directors or members of any committee designated by the Board of Directors may participate

in a meeting of the Board of Directors or such committee by means of a conference telephone or similar communications equipment by means of which all persons participating in the meeting can hear each other at the same time and participation by such means shall constitute presence in person at a meeting.

Section 13. NOTICE OF SPECIAL MEETINGS. Notice of any special meeting of the Board of Directors shall be given to each director by the Clerk or by the officer or one of the directors calling the meeting. Notice shall be duly given to each director (i) by notice given to such director in person or by telephone at least 24 hours in advance of the meeting, (ii) by sending a telegram or telex, or by delivering written notice by hand, to his last known business or written notice to his last known business or home address at least 72 hours in advance of the meeting. Notice need not be given to any director if a written waiver of notice, executed by him before or after the meeting, is filed with the records of the meeting, or to any director who attends the meeting without protesting prior to the meeting or at its commencement the lack of notice to specify the purposes of the meeting. If notice is given in person or by telephone, an affidavit of the Clerk, officer or director who gives such notice that the notice has been duly given shall, in the absence of fraud, be conclusive evidence that such notice was duly given.

Section 14. QUORUM. At any meeting of the Board of Directors, a majority of the directors then in office shall constitute a quorum. Less than a quorum may adjourn any meeting from time to time without further notice.

Section 15. ACTION AT MEETING. At any meeting of the Board of Directors at which a quorum is present, the vote of a majority of those present shall be sufficient to take any action, unless a different vote is specified by law, by the Articles of Organization or by these By-Laws.

Section 16. ACTION BY CONSENT. Any action required or permitted to be taken at any meeting of the Board of Directors may be taken without a meeting if all of the directors consent to the action in writing and such consents are filed with the records of the meetings of the Board of Directors. Such consents shall be treated for all purposes as a vote at a meeting.

Section 17. COMMITTEES. The Board of Directors may, by vote of a majority of the directors then in office, elect from their number an executive committee or other committees and may by like vote delegate to committees so elected some or all of their powers to the extent permitted by law. Except as the Board of Directors may otherwise determine, any such committee may make rules for the conduct of its business, but unless otherwise provided by the directors or in such rules, its business shall be conducted as nearly as possible in the same manner as is provided by these By-Laws for the directors. The Board of Directors shall have the power at any time to fill vacancies in any such committee, to change its membership

or to discharge the committee.

Section 18. COMPENSATION OF DIRECTORS. Directors may be paid such compensation for their services and such reimbursement for expenses of attendance at meetings as the Board of Directors may from time to time determine. No such payment shall preclude any director from serving the corporation in any other capacity and receiving compensation therefor.

ARTICLE IV

OFFICERS

Section 1. DESIGNATION AND QUALIFICATION. The officers of the corporation shall consist of a President, a Treasurer, a Clerk, and such other officers including one or more Vice Presidents, Assistant Treasurers and Assistant Clerks as the Board of Directors may elect. No officer need be a stockholder or a director. The Clerk shall be a resident of The Commonwealth of Massachusetts unless the corporation has a resident agent appointed to accept service of process. A person may hold more than one office at the same time provided that the President and Clerk may not be the same person except when there is only one stockholder. Any officer may be required by the Board of Directors to give bond for the faithful performance of his duties to the corporation in such amount and with such sureties as the Board of Directors may determine.

Section 2. ELECTION AND TERM. The President, Treasurer and Clerk shall be elected annually by the Board of Directors at the annual meeting of the Board of Directors and shall hold office until the next annual meeting of the Board of Directors and until their respective successors are chosen and qualified. All other officers may be elected by the Board of Directors at any time and shall hold office for such term as the Board of Directors determines.

Section 3. PRESIDENT. The President shall be the chief executive officer of the corporation, except as the Board of Directors may otherwise provide, and shall have general supervision and control of the business of the corporation subject to the direction of the Board of Directors. The President shall also have such other powers and duties as the Board of Directors may decide. It shall be his duty, and he shall have the power, to see that all orders and resolutions of the directors are carried into effect. Unless the Board of Directors provides otherwise, the President or his designee shall preside at all meetings of the stockholders and at all meetings of the Board of Directors. Unless otherwise directed by the Board of Directors, the President may on behalf of the corporation vote or consent to any action with respect to or in connection with any interest that the corporation may hold or have in any other corporation or in any partnership, joint venture, association, trust, proprietorship, business entity or common undertaking whatsoever, and may appoint

any other person or persons to act as proxy or attorney-in-fact for the corporation, with or without power of substitution. The Board of Directors may from time to time confer like powers upon any other officer.

Section 4. VICE PRESIDENT. The Vice President or Vice Presidents, if any, shall have such powers and perform such duties as may be assigned to them by the Board of Directors or the President. In the absence of the President or in the event of his inability to act, the Vice President, if any, or, if there is more than one Vice President, the First Vice President, or, if no First Vice President has been designed, the Vice President senior in office, shall have and may exercise all the powers and duties of the President.

Section 5. TREASURER AND ASSISTANT TREASURERS. The Treasurer shall have, subject to the direction of the Board of Directors, general charge of the financial affairs of the corporation and shall keep full and accurate records thereof, which shall always be open to the inspection of the President or of any director. He shall render to the President or to the Board of Directors, whenever either may require it, a statement of the accounts of his transactions as Treasurer and of the financial condition of the corporation. The Treasurer shall perform such duties and have such powers additional to the foregoing as the directors may designate.

Any Assistant Treasurer shall have such powers and duties as the Board of Directors may decide.

Section 6. CLERK AND ASSISTANT CLERKS. The Clerk shall record in books kept for that purpose all votes, consents and the proceedings of all meeting of the stockholders and of the Board of Directors. Record books of stockholders' meetings shall be open at all reasonable times to the inspection of any stockholder. The Clerk shall notify the stockholders and directors of all meetings in accordance with the By-Laws.

In the absence of the Clerk from any meeting of the stockholders or from any meeting of the directors, the Assistant Clerk, if one be elected, or, if there be more than one, the one designated for the purpose by the directors, and otherwise a temporary clerk designated by the person presiding at the meeting, shall perform the duties of the Clerk.

Any Assistant Clerk shall have such other powers and duties as the Board of Directors may decide.

Section 7. VACANCIES. A vacancy in any office may be filled by the Board of Directors by the election of a successor to hold office for the unexpired term of the officer whose place is vacant and until his successor is chosen and qualified.

Section 8. REMOVAL. All officers may be removed from their respective offices with or without cause by vote of a majority of the directors then in office. An officer may be removed for cause only after a reasonable notice and opportunity to be heard before the Board of Directors.

Section 9. RESIGNATION. Any officer may at any time resign his office by delivering a written resignation to the Board of Directors, the President or the Clerk. Such resignation, unless a later date is specified therein, shall take effect upon receipt by the addressee or at the principal office of the corporation, and acceptance thereof shall not be necessary to make it effective.

Section 10. SALARIES. Officers of the corporation shall be entitled to such salaries, compensation or reimbursement as shall be fixed or allowed from time to time by the Board of Directors.

ARTICLE V

CAPITAL STOCK

Section 1. CERTIFICATES OF STOCK. Each stockholder shall be entitled to a certificate of the form approved by the Board of Directors stating the number, class, and designation of series, if any, of the shares held by him. Such certificate shall be signed by the President or a Vice President and by the Treasurer or an Assistant Treasurer. Such signatures may be facsimiles if the certificate is countersigned by a transfer agent, or by a registrar of transfers, other than a director, officer or employee of the corporation. In case any officer who has signed or whose facsimile signature has been placed on such certificate shall have ceased to be such officer before such certificate is issued, it may be issued by the corporation with the same effect as if he was such officer at the time of its issue.

Every certificate for shares of stock subject to any restriction on transfer pursuant to the Articles of Organization, these By-Laws, or any agreement to which the corporation is a party shall have the restriction noted conspicuously on the certificate and shall also set forth on the face or back either in full text of the restriction or a statement of the existence of such restriction and a statement that the corporation will furnish a copy to the holder of such certificate upon written request and without charge. If the corporation is authorized to issue more than one class or series of stock, every certificate issued shall set forth on its face or back either the full text of the preferences, voting powers, qualifications and special and relative rights of the shares of each class and series authorized to be issued or a statement of the existence of such preferences, powers, qualification and rights, and a statement that the corporation will furnish a copy thereof to the holder of such certificate upon written request and without charge.

Section 2. TRANSFER. Shares of stock shall be transferred of record on the books of the corporation only upon the surrender to the corporation or its transfer agent of the certificate therefor properly endorsed for transfer (or accompanied by a written assignment and power of attorney properly executed for transfer; and only upon compliance with provisions, if any, respecting restrictions on transfer contained in the Articles of Organization, these By-Laws or any agreement to which the corporation is a party. The corporation may require proof of the genuineness of the signature and the capacity of the party presenting the certificate for transfer.

It shall be the duty of each stockholder to notify the corporation of his post office address and of his taxpayer identification number.

Section 3. INTEREST NOT RECOGNIZED. The corporation shall be entitled to treat the holder of record of any share or shares of stock as the holder in fact thereof and shall not be bound to recognize any other claim to or interest in such share or shares on the part of any other person except as may be otherwise expressly provided by law.

Section 4. LOST, MUTILATED, OR DESTROYED CERTIFICATES. Subject to Section 8-405 of the Massachusetts Uniform Commercial Code, as amended from time to time, the Board of Directors may determine the conditions upon which a new certificate of stock may be issued in place of any certificate alleged to have been lost, mutilated or destroyed. It may, in its discretion, require the owner of a lost, mutilated or destroyed certificate, or his legal representative, to give a bond, with or without surety, sufficient in its opinion to indemnify the corporation against any loss, claim or expense which may arise by reason of the issuance of a new certificate in place of such lost, mutilated or destroyed stock certificate.

Section 5. TRANSFER AGENT AND REGISTRAR. The Board of Directors may appoint a transfer agent or a registrar, or both, and require all stock certificates to bear the signature or facsimile thereof of any such transfer agent or registrar. Unless the Board of Directors shall appoint a transfer agent, registrar or other officer or officers for the purpose, the Clerk shall be charged with the duty of keeping, or causing to be kept, accurate records of all stock outstanding, stock certificates issued, and stock transfers. Subject to any other rules which may be adopted from time to time by the Board of Directors, such records may be kept solely in the stock certificate books.

Section 6. SETTING RECORD DATE AND CLOSING TRANSFER RECORDS. The Board of Directors may fix in advance a time not more than sixty days before (i) the date of any meeting of the stockholders or (ii) the date for the payment of any dividend or the making of any distribution to stockholders or (iii) the last day on which the consent or dissent of stockholders may be effectively expressed for any purpose, as the record date for determining the stockholders having the right

to notice of, and to vote at such meeting or any adjournment thereof, or the right to receive such dividend or distribution, or the right to give such consent or dissent. If a record date is fixed by the Board of Directors, only stockholders of record on such date shall have such rights notwithstanding any transfer of stock on the records of the corporation after such date. Without fixing such record date, the Board of Directors may close the transfer records of the corporation for all or any part of such sixty-day period.

If no record date is fixed and the transfer books are not closed, then the record date for determining stockholders having the right to notice of or to vote at a meeting of stockholders shall be at the close of business on the date next preceding the day on which notice is given, and the record date for determining stockholders for any other purpose shall be at the close of business on the date on which the Board of Directors acts with respect thereto.

Section 7. ISSUE OF STOCK. Unless otherwise voted by the stockholders, the whole or any party of any unissued balance of the authorized capital stock of the corporation or the whole or any part of the capital stock of the corporation held in its treasury may be issued or disposed of by vote of the Board of Directors, in such manner, for such consideration and on such terms as the directors may determine.

ARTICLE VI

INSPECTION OF RECORDS

The original, or attested copies of the Articles of Organization, By-Laws and records of all meetings of the incorporators and stockholders, and the stock and transfer records, which shall contain the names of all stockholders and the record address and the amount of stock held by each, shall be kept in the Commonwealth of Massachusetts at the principal office of the corporation, or at any office of its transfer agent or of the Clerk or of its resident agent. Said copies and records need not all be kept in the same office. They shall be available at all reasonable times to the inspection of any stockholder for any proper purpose but not so secure a list of stockholders for the purpose of selling said list or copies thereof or of using the same for a purpose other than in the interest of the applicant, as a stockholder, relative to the affairs of the corporation.

ARTICLE VII

CHECKS, NOTES, DRAFTS AND OTHER INSTRUMENTS

Checks, notes, drafts and other instruments for the payment of money drawn or endorsed in the name of the corporation may be signed by any officer or officers or person or persons authorized by the directors to sign the same. No officer or

person shall sign any such instrument as aforesaid unless authorized by the directors to do so.

ARTICLE VIII

AMENDMENTS

These By-Laws may be amended by vote of the holders of at least sixty-six and two-thirds percent (66 2/3%) of the shares of each class of the capital stock at the time outstanding and entitled to vote at any annual or special meeting of stockholders, if notice of the substance of the proposed amendment is stated in the notice of such meeting. If authorized by the Articles of Organization, the Board of Directors, by a majority of their number then in office, may also make, amend or repeal these By-Laws, in whole or in part, except with respect to (a) the provisions of these By-Laws governing (i) the removal of directors and (ii) the amendment of these By-Laws and (b) any provision of these By-Laws which by law, the Articles of Organization or these By-Laws requires action by the stockholders.

Not later than the time of giving notice of the meeting of stockholders next following the making, amending or repealing by the Board of Directors of any ByLaw, notice stating the substance of such change shall be given to all stockholders entitled to vote on amending the By-Laws.

ARTICLE IX

MISCELLANEOUS PROVISIONS

Section 1. TRANSACTIONS WITH INTERESTED PARTIES.

(a) A director who has a financial, family or other interest in a contract or other transaction may be counted for purposes of establishing the existence of a quorum at a meeting of the Board of Directors (or of a committee of the Board of Directors) at which action with respect to the transaction is taken and may vote to approve the transaction and any related matters.

(b) A contract or other transaction in which a director or officer has a financial, family or other interest shall not be void or voidable for that reason, if any one of the following is met:

(1) The material facts as to the director's or officer's interest are disclosed or are known to the Board of Directors or committee of the Board of Directors acting on the transaction, and the Board of Directors or committee authorities, approves or ratifies the transaction by the affirmative vote of a majority of the disinterested directors (or, if applicable, the sole disinterested

director) on the Board of Directors or committee, as the case may be, even though the disinterested directors be less than a quorum; or

(2) The material facts as to the director's or officer's interest are disclosed or are known to the holders of the shares of the corporation's capital stock then entitled to vote for directors and such holders, voting such shares as a single class, by a majority of the votes cast on the question, specifically authorize, approve or ratify the transaction; or

(3) The transaction was fair to the corporation as of the time it was entered into by the corporation.

A failure to meet any of the requirements in subparagraphs (1), (2) or (3) shall not create an inference that the transaction is void or voidable for that reason.

Section 2. MASSACHUSETTS CONTROL SHARE ACQUISITION ACT. The provisions of Chapter 110D of the Massachusetts General Laws shall not apply to the corporation.

Section 3. EVIDENCE OF AUTHORITY. A certificate by the Clerk or an Assistant Clerk or a temporary Clerk as to any action taken by the stockholders, the Board of Directors, any committee or any officer or representative of the corporation shall as to all persons who rely on the certificate in good faith be conclusive evidence of such action.

Section 4. ARTICLE OF ORGANIZATION. All references in these By-Laws to the Articles of Organization shall be deemed to refer to the Articles of Organization of the corporation, as amended and in effect from time to time.

Section 5. SEVERABILITY. Any determination that any provision of these By-Laws is for any reason inapplicable, illegal or ineffective shall not affect or invalidate any other provision of these By-Laws.

Section 6. PRONOUNS. All pronouns used in these By-Laws shall be deemed to refer to the masculine, feminine or neuter, singular or plural, as the identity of the person or persons may require.

Approved as Amended and Restated by
the Board of Directors on February 10,
1999

Approved as Amended and Restated by
the Stockholders on February 17, 1999

MKS INSTRUMENTS, INC.

1999 EMPLOYEE STOCK PURCHASE PLAN

The purpose of this Plan is to provide eligible employees of MKS Instruments, Inc. (the "Company") and certain of its subsidiaries with opportunities to purchase shares of the Company's Common Stock, no par value per share (the "Common Stock"), commencing on June 1, 1999; provided, that at such time the Company's Common Stock shall be listed for trading on the Nasdaq National Market or a national securities exchange. Four hundred fifty thousand (450,000) shares of Common Stock in the aggregate have been approved for this purpose. This Plan is intended to qualify as an "employee stock purchase plan" as defined in Section 423 of the Internal Revenue Code of 1986, as amended (the "Code") and the regulations promulgated thereunder, and shall be interpreted consistent therewith. All share amounts set forth in this Plan reflect the 3-for-2 stock split approved by the Board of Directors of the Company on February 10, 1999 (the "1999 Stock Split").

1. ADMINISTRATION. The Plan will be administered by the Company's Board of Directors (the "Board") or by a Committee appointed by the Board (the "Committee"). The Board or the Committee has authority to make rules and regulations for the administration of the Plan and its interpretation and decisions with regard thereto shall be final and conclusive.

2. ELIGIBILITY. All employees of the Company, including Directors who are employees, and all employees of any subsidiary of the Company (as defined in Section 424(f) of the Code) designated by the Board or the Committee from time to time (a "Designated Subsidiary"), other than employees of the Company or any designated Subsidiary who are "highly compensated" within the meaning of Section 414(q) of the Code, are eligible to participate in any one or more of the Offerings (as defined in Section 9) to purchase Common Stock under the Plan provided that:

(a) they are customarily employed by the Company or a Designated Subsidiary for more than 20 hours a week and for more than six months in a calendar year; and

(b) they have been employed by the Company or a Designated Subsidiary for at least six months prior to enrolling in the Plan; and

(c) they are employees of the Company or a Designated Subsidiary on the first day of the applicable Plan Period (as defined below).

No employee may be granted an option hereunder if such employee, immediately after the option is granted, owns 5% or more of the total combined voting power or value of the stock of the Company or any subsidiary. For purposes of the preceding sentence, the attribution rules of Section 424(d) of the Code shall apply in determining the stock ownership of an employee, and all stock which the employee has a contractual right to purchase shall be treated as stock owned by the employee.

3. OFFERINGS. The Company will make one or more offerings ("Offerings") to employees to purchase stock under this Plan. Offerings will begin each June 1 and December 1, or the first business day thereafter (the "Offering Commencement Dates"). Each Offering Commencement Date will begin a six (6) month period (a "Plan Period") during which Payroll deductions will be made and held for the purchase of Common Stock at the end of the Plan Period. The Board or the Committee may, at its discretion, choose a different Plan Period of twelve (12) months or less for subsequent Offerings.

4. PARTICIPATION. An employee eligible on the Offering Commencement Date of any Offering may participate in such Offering by completing and forwarding a payroll deduction authorization form to the employee's appropriate payroll office at least 30 days prior to the applicable Offering Commencement Date. The form will authorize a regular payroll deduction from the Compensation, as defined below, received by the employee during the Plan Period. Unless an employee files a new form or withdraws from the Plan, his deductions and purchases will continue at the same rate for future Offerings under the Plan as long as the Plan remains in effect. The term "Compensation" means the amount of money reportable on the employee's Federal Income Tax Withholding Statement, excluding overtime, shift premium, incentive or bonus awards, allowances and reimbursements for expenses such as relocation allowances for travel expenses, income or gains on the exercise of Company stock options or stock appreciation rights, and similar items, whether or not shown on the employee's Federal Income Tax Withholding Statement, but including, in the case of salespersons, sales commissions to the extent determined by the Board or the Committee.

5. DEDUCTIONS. The Company will maintain payroll deduction accounts for all participating employees. With respect to any Offering made under this Plan, an employee may authorize a payroll deduction in any whole percent amount up to a maximum of 10% (or such lower percentage as may be established by the Board or the Committee) of the Compensation he or she receives during the Plan Period or such shorter period during which deductions from payroll are made. The minimum payroll deduction is such percentage of compensation as may be established from time to time by the Board or the Committee.

No employee may be granted an Option (as defined in Section 9) which permits his rights to purchase Common Stock under this Plan and any other employee stock purchase plan (as defined in Section 423(b) of the Code) of the Company and its subsidiaries, to accrue at a rate which exceeds \$25,000 of the fair market value of such Common Stock (determined at the Offering Commencement Date of the Plan Period) for each calendar year in which the Option is outstanding at any time.

6. DEDUCTION CHANGES. An employee may decrease, subject to section 5 hereof or discontinue his payroll deduction once during any Plan Period, by filing a new payroll deduction authorization form. However, an employee may not elect to increase his payroll deduction during a Plan Period. If an employee elects to

discontinue his payroll deductions during a Plan Period, but does not elect to withdraw his funds pursuant to Section 8 hereof, funds deducted prior to his election to discontinue will be applied to the purchase of Common Stock on the Exercise Date (as defined below).

7. INTEREST. Interest will not be paid on employee accounts.

8. WITHDRAWAL OF FUNDS. An employee may at any time prior to the close of business on the last business day in a Plan Period and for any reason permanently draw out the balance accumulated in the employee's account and thereby withdraw from participation in an Offering. Partial withdrawals are not permitted. The employee may not begin participation again during the remainder of the Plan Period. The employee may participate in any subsequent Offering in accordance with terms and conditions established by the Board or the Committee.

9. PURCHASE OF SHARES. On the Offering Commencement Date of each Plan Period, the Company will grant to each eligible employee who is then a participant in the Plan an option ("Option") to purchase on the last business day of such Plan Period (the "Exercise Date"), at the Option Price hereinafter provided for, the largest number of whole shares of Common Stock of the Company as does not exceed the number of shares determined by multiplying \$2,083 by the number of full months in the Offering Period and dividing the results by the closing price (as defined below) on the Offering Commencement Date of such Plan Period.

The purchase price for each share purchased will be 85% of the closing price of the Common Stock on (i) the first business day of such Plan Period or (ii) the Exercise Date, whichever closing price shall be less. Such closing price shall be (a) the closing price on any national securities exchange on which the Common Stock is listed, (b) the closing price of the Common Stock on the Nasdaq National Market or (c) the average of the closing bid and asked prices in the over-the-counter-market, whichever is applicable, as published in The Wall Street Journal. If no sales of Common Stock were made on such a day, the price of the Common Stock for purposes of clauses (a) and (b) above shall be the reported price for the next preceding day on which sales were made.

Each employee who continues to be a participant in the Plan on the Exercise Date shall be deemed to have exercised his Option at the Option Price on such date and shall be deemed to have purchased from the Company the number of full shares of Common Stock reserved for the purpose of the Plan that his accumulated payroll deductions on such date will pay for, but not in excess of the maximum number determined in the manner set forth above.

Any balance remaining in an employee's payroll deduction account at the end of a Plan Period will be automatically refunded to the employee, except that any balance which is less than the purchase price of one share of Common Stock will be carried forward into the employee's payroll deduction account for the following

Offering, unless the employee elects not to participate in the following Offering under the Plan, in which case the balance in the employee's account shall be refunded.

10. ISSUANCE OF CERTIFICATES. Certificates representing shares of Common Stock purchased under the Plan may be issued only in the name of the employee, in the name of the employee and another person of legal age as joint tenants with rights of survivorship, or (in the Company's sole discretion in the name of a brokerage firm, bank or other nominee holder designated by the employee. The Company may, in its sole discretion and in compliance with applicable laws, authorize the use of book entry registration of shares in lieu of issuing stock certificates.

11. RIGHTS ON RETIREMENT, DEATH OR TERMINATION OF EMPLOYMENT. In the event of a participating employee's termination of employment prior to the last business day of a Plan Period, no payroll deduction shall be taken from any pay due and owing to an employee and the balance in the employee's account shall be paid to the employee or, in the event of the employee's death, (a) to a beneficiary previously designated in a revocable notice signed by the employee (with any spousal consent required under state law) or (b) in the absence such a designated beneficiary, to the executor or administrator of the employee's estate or (c) if no such executor or administrator has been appointed to the knowledge of the Company, to such other person(s) as the Company may, in its discretion, designate. If, prior to the last business day of the Plan Period, the Designated Subsidiary by which an employee is employed shall cease to be a subsidiary of the Company, or if the employee is transferred to a subsidiary of the Company that is not a Designated Subsidiary, the employee shall be deemed to have terminated employment for the purposes of this Plan.

12. OPTIONEES NOT STOCKHOLDERS. No employee shall have any rights as a stockholder with respect to any shares of Common Stock to be distributed with respect to an Option until becoming the record holder or such shares. Notwithstanding the foregoing, in the event the Company effects a split of the Common Stock by means of a stock dividend (and the exercise price of and the number of shares subject to such Option are adjusted as of the date of the distribution of the dividend rather than as of the record date for such dividend), then an optionee who is deemed to have exercised an Option between the record date and the distribution date for such stock dividend shall be entitled to receive, on the distribution date, the stock dividend with respect to the shares of Common Stock.

13. RIGHTS NOT TRANSFERABLE. Rights under this Plan are not transferable by a participating employee other than by will or the laws of descent and distribution, and are exercisable during the employee's lifetime only by the employee.

14. APPLICATION OF FUNDS. All funds received or held by the Company under this Plan may be combined with other corporate funds and may be used for any corporate purpose.

15. ADJUSTMENT IN CASE OF CHANGES AFFECTING COMMON STOCK. In the event, at any time after the 1999 Stock Split, of a subdivision of outstanding shares of Common Stock, or the payment of a dividend in Common Stock, the number of shares approved for this Plan, and the share limitation set forth in Section 9, shall be increased proportionately, and such other adjustment shall be made as may be deemed equitable by the Board or the Committee. In the event of any other change affecting the Common Stock, such adjustment shall be made as may be deemed equitable by the Board or the Committee to give proper effect to such event.

16. MERGER. If the Company shall at any time merge or consolidate with another corporation and the holders of the capital stock of the Company immediately prior to such merger or consolidation continue to hold at least 80% by voting power of the capital stock of the surviving corporation ("Continuity of Control"), the holder of each Option then outstanding will thereafter be entitled to receive at the next Exercise Date upon the exercise of such Option for each share as to which such Option shall be exercised the securities or property which a holder of one share of the Common Stock was entitled to upon and at the time of such merger or consolidation, and the Board or the Committee shall take such steps in connection with such merger or consolidation as the Board or the Committee shall deem necessary to assure that the provisions of Section 15 shall thereafter be applicable, as nearly as reasonably may be, in relation to the said securities or property as to which such holder of such Option might thereafter be entitled to receive thereunder.

In the event of a merger or consolidation of the Company with or into another corporation which does not involve Continuity of Control, or of a sale of all or substantially all of the assets of the Company while unexercised Options remain outstanding under the Plan, all outstanding Options shall be cancelled by the Board or the Committee as of the effective date of any such transaction, provided that notice of such cancellation shall be given to each holder of an Option, and each holder of an Option shall have the right to exercise such Option in full based on payroll deductions then credited to his account as of a date determined by the Board or the Committee, which date shall not be less than ten (10) days preceding the effective date of such transaction.

17. AMENDMENT OF THE PLAN. The Board may at any time, and from time to time, amend this Plan in any respect, except that (a) if the approval of any such amendment by the shareholders of the Company is required by Section 423 of the Code, such amendment shall not be effected without such approval, and (b) in no event may any amendment be made which would cause the Plan to fail to comply with Section 423 of the Code.

18. INSUFFICIENT SHARES. In the event that the total number of shares of Common Stock specified in elections to be purchased under any Offering plus the number of shares purchased under previous Offerings under this Plan exceeds the maximum number of shares issuable under this Plan, the Board or the Committee will allot the shares then available on a pro rata basis.

19. TERMINATION OF THE PLAN. This Plan may be terminated at any time by the Board. Upon termination of this Plan all amounts in the accounts of participating employees shall be promptly refunded.

20. GOVERNMENTAL REGULATIONS. The Company's obligation to sell and deliver Common Stock under this Plan is subject to listing on a national stock exchange or quotation on the Nasdaq National Market and the approval of all or sale of such stock.

21. GOVERNING LAW. The Plan shall be governed by Massachusetts law except to the extent that such law is preempted by federal law.

22. ISSUANCE OF SHARES. Shares may be issued upon exercise of an Option from authorized but unissued Common Stock, from shares held in the treasury of the Company, or from any other proper source.

23. NOTIFICATION UPON SALE OF SHARES. Each employee agrees, by entering the Plan, to promptly give the Company notice of any disposition of shares purchased under the Plan where such disposition occurs within two years after the date of grant of the Option pursuant to which such shares were purchased or one year after the date of exercise of the Option.

24. EFFECTIVE DATE AND APPROVAL OF STOCKHOLDERS The Plan shall take effect on June 1, 1999 if at such time the Common Stock is listed for trading on the Nasdaq National Market or a national securities exchange, subject to approval by the stockholders of the Company as required by Section 423 of the Code, which approval must occur within twelve months of the adoption of the Plan by the Board.

Adopted by the Board of Directors
on February 10, 1999
Approval by the Stockholders on
February 17, 1999

LOAN AGREEMENT

This Loan Agreement (the "Agreement") is entered into as of the 31st day of October, 1995, by and between The First National Bank of Boston ("Lender") and MKS Instruments, Inc., a Massachusetts corporation ("Borrower").

PREMISES:

WHEREAS, the Borrower has requested that the Lender make loans to it; and

WHEREAS, the Lender is willing to lend funds to the Borrower on the terms and conditions hereinafter set forth;

NOW, THEREFORE, in consideration of the premises and for other good and valuable consideration, the adequacy and receipt of which are hereby acknowledged, the parties hereto hereby agree as follows:

ARTICLE I

DEFINITIONS

1.1 Definitions. In addition to terms defined elsewhere in this Agreement, the following terms shall have the meanings indicated, which meanings shall be equally applicable to both the singular and plural forms of such terms:

1.1.1 "Affiliate" of any Person shall mean any other Person which, directly or indirectly, controls, or is controlled by, or is under common control with, such Person. For purposes of this definition, "control" of any Person shall mean the power, directly or indirectly, either to (i) vote 10% or more of the securities having ordinary voting power for the election of directors of such Person or (ii) direct the management and policies of such Person, whether by contract or otherwise. As to the Borrower, the term "Affiliate" shall include, without limitation, any partnership or joint venture of which the Borrower or any Affiliate of the Borrower is a general partner or is a limited partner with more than a ten percent (10%) interest, and any director or executive officer of the Borrower.

1.1.2 "Base Rate" shall mean the rate of interest announced by the Lender at its head office from time to time as its "Base Rate".

1.1.3 "Base Rate Loan" shall mean a portion of the Term Loan as to which the Borrower elects to pay interest at the Base Rate as provided in Section 2.2.

1.1.4 "Business Day" shall mean a day on which commercial banks are required to be open for business in Boston, Massachusetts.

1.1.5 "Cash Flow Ratio" shall have the meaning set forth in Section 7.7(c).

1.1.6 "Closing Date" shall mean the date of this Agreement.

1.1.7 "Compliance Certificate" shall have the meaning set forth in Section 6.1(c).

1.1.8 "Consolidated Debt Service" shall mean for any period the sum (without duplication) of Interest Expense, the interest portion of Financing Lease Obligations and required principal payments on long-term debt of the Borrower and its Subsidiaries, determined on a consolidated basis.

1.1.9 "Consolidated Indebtedness" shall mean the Indebtedness of the Borrower and its Subsidiaries, determined on a consolidated basis.

1.1.10 "Consolidated Net Income" shall mean for any period the net income (or loss) for such period (before extraordinary items and excluding the net income of any business entity that is not a Subsidiary in which the Borrower or one of its Subsidiaries has an ownership interest unless such net income shall have actually been received by such company in the form of cash distributions) of the Borrower and its Subsidiaries after deducting all operating expenses, depreciation and amortization, Interest Expense, the interest portion of Financing Lease Obligations, all taxes in respect of income and profits paid or payable (including accrued Sub S distributions required to make shareholder tax payments) and all other proper deductions, all determined on a consolidated basis.

1.1.11 "Consolidated Operating Cash Flow" shall mean for any period, the net income (or loss) for such period (before extraordinary items and excluding the net income of any business entity that is not a Subsidiary in which the Borrower or one of its Subsidiaries has an ownership interest unless such net income shall have actually been received by such company in the form of cash distributions) of the Borrower and its Subsidiaries before deducting Interest Expense and taxes and after restoring thereto depreciation of real and personal property and leasehold improvements and amortization and after deducting cash taxes paid, Sub S distributions required to make shareholder tax payments, and capital expenditures incurred, provided that capital expenditures shall not include real estate purchases funded by debt.

1.1.12 "Consolidated Tangible Net Worth" shall mean, at any time, net stockholders' equity of the Borrower and its Subsidiaries determined in accordance with generally accepted accounting principles including the book amount of all minority interests in MKS International, Inc. but excluding the book amount of all minority interests in other Affiliates and any foreign exchange translation adjustment, with no upward adjustments due to a reevaluation of assets (other than any such upward adjustment as may be required under generally accepted accounting principles in connection with the acquisition by the Borrower or any Subsidiary of another company or entity) minus the following items (without duplication of deductions) appearing on the balance sheet of the Borrower and its Subsidiaries:

(a) the book amount of all assets (including, without limitation, goodwill, patents, trademarks, copyrights, organizational expense and unamortized debt discount) that would be treated as intangibles under generally accepted accounting principles;

(b) treasury stock; and

(c) any write-up in the book amount of any asset or Investment subsequent to the Closing Date, resulting from a reevaluation or reappraisal thereof from the amount entered in accordance with generally accepted accounting principles by the Borrower or any Subsidiary on its books with respect to its acquisition of the asset or Investment.

1.1.13 "Costs" shall have the meaning set forth in Section 9.4.

1.1.14 "Debt-to-Net Worth Ratio" shall have the meaning set forth in Section 7.7(b).

1.1.15 "Default" shall mean any event that, with the lapse of time, the giving of notice, or both, would become an Event of Default hereunder.

1.1.16 "Event of Default" shall have the meaning set forth in Section 8.1 hereof.

1.1.17 "Financing Lease" shall mean any lease of the Borrower or a Subsidiary, as lessee, that is shown or is required to be shown in accordance with generally accepted accounting principles as a liability on the balance sheet of the lessee thereunder.

1.1.18 "Financing Lease Obligation" shall mean for any period the monetary obligation of the lessee under a Financing Lease. The amount of a Financing Lease Obligation at any date is the amount at which the lessee's liability under the Financing Lease would be required to be shown on its balance sheet at such date.

1.1.19 "Hazardous Substances" shall mean any hazardous waste, as defined by 42 U.S.C. Section 6903(5), any hazardous substances, as defined by 42 U.S.C. Section 9601(14), any pollutant or contaminant, as defined by 42 U.S.C. Section 9601(33), or any toxic substance, oil or hazardous materials or other chemicals or substances regulated by any laws or regulations relating to the discharge of air pollutants, water pollutants or processed wastewater.

1.1.20 "Indebtedness" shall mean, for any Person, (a) all obligations of such Person that in accordance with generally accepted accounting principles would be reflected on the balance sheet of such Person as a liability, (b) all obligations of any other Person the payment or collection of which such Person has guaranteed (except by reason of endorsement for collection in the ordinary course of business) or in respect of which such Person is liable, contingently or otherwise, including, without limitation, liable by way of agreement to purchase, to provide funds for payment, to supply funds to or otherwise to invest in such other Person, or otherwise to assure a creditor against loss, (c) all obligations of any other Person for borrowed money or for the deferred purchase price of property or services secured by (or for which the holder of such indebtedness has an existing right, contingent or otherwise, to be secured by) any mortgage, or other encumbrance upon or in property (including, without limitation, accounts and contract rights) owned by such Person, whether or not such Person has assumed or become liable for the payment of such indebtedness or obligations, and (d) Financing Lease Obligations of such Person.

1.1.21 "Interest Expense" shall mean for any period the aggregate amount of interest recorded, in accordance with generally accepted accounting principles, on the financial statements for that period by the Borrower and its Subsidiaries in respect of Consolidated Indebtedness incurred for borrowed money.

1.1.22 "Interest Period" shall mean the period designated by the Borrower as such in the Interest Rate Change Notice for any portion of the Term Loan pursuant to and subject to the limitations set forth in Section 2.2.

1.1.23 "Interest Rate Change Notice" shall have the meaning set forth in Section 2.2.

1.1.24 "Interest Rate Determination Date" shall mean the third Business Day prior to the first day of the related Interest Period for a LIBOR Loan.

1.1.25 "Interim Maturity Date" shall mean the last day of any Interest Period.

1.1.26 "Investments" shall have the meaning set forth in Section 7.4.

1.1.27 "LIBOR Loan" shall mean a portion of the Term Loan as to which the Borrower elects to pay interest using the LIBOR Rate as provided in Section 2.2.

1.1.28 "LIBOR Rate" shall mean for any Interest Rate Determination Date, the rate obtained by dividing (i) the quotation offered by the Lender in the interbank Eurodollar market for U.S. dollar deposits of amounts in immediately available funds comparable to the portion of the Term Loan for which the LIBOR Rate is being determined with a maturity comparable to the Interest Period for which such LIBOR Rate will apply as of approximately noon (Boston time) three Business Days prior to the commencement of such Interest Period by (ii) a percentage equal to 100% minus the stated maximum rate of all reserves required to be maintained against "Eurocurrency liabilities" as specified in Regulation D (or against any other category of liabilities that includes deposits by reference to which the interest rate on LIBOR Loans is determined) as applicable on such date to any member bank of the Federal Reserve System.

1.1.29 "Licenses" shall have the meaning set forth in Section 4.8.

1.1.30 "Lien" shall mean any interest in property securing an obligation owed to, or a claim by, a Person other than the owner of the property, whether the interest is based on common law, statute or contract (including the security interest lien arising from a mortgage, encumbrance, pledge, conditional sale or trust receipt or a lease, consignment or bailment for security purposes). For the purposes of this Agreement, the Borrower or a subsidiary shall be deemed to be the owner of any property that it has acquired or holds subject to a Financing Lease or a conditional sale agreement or other arrangement pursuant to which title to the property has been retained by or vested in some other Person for security purposes, and such retention or vesting shall be deemed to be a Lien.

1.1.31 "Loan Documents" shall mean each of this Agreement, the Note, and any other document or instrument executed by the Borrower in favor of the Lender in connection with the transactions contemplated hereby.

1.1.32 "Obligations" shall mean, without limitation, any and all liabilities, debts, and obligations of the Borrower to the Lender, of each and every kind, nature and description, including but not limited to those arising under this Agreement, any other Loan Document, the Loan Agreement between the Borrower and the Lender dated as of November 1, 1993, as amended, the Foreign Exchange Agreement between the Lender and the Borrower dated June 14, 1991, and any

interest rate swap agreement, whether now existing or hereafter incurred. "Obligations" also means, without limitation, any and all obligations of the Borrower to act or to refrain from acting in accordance with the terms, provisions and covenants of this Agreement or of any other Loan Document.

1.1.33 "Permitted Liens" shall have the meaning set forth in Section 7.2.

1.1.34 "Person" shall mean any natural person, corporation, unincorporated organization, trust, joint-stock company, joint venture, association, company, partnership or government, or any agency or political subdivision of any government.

1.1.35 "Subsidiary" shall mean any Person of which the Borrower at the time owns, directly or indirectly, through another Subsidiary or otherwise, 50% or more of the equity interests.

1.1.36 "Term Loan" shall have the meaning set forth in Section 2.1.

1.1.37 "Term Loan Maturity Date" shall mean June 30, 2002.

1.1.38 "Term Note or Note" shall have the meaning set forth in Section 2.1.

1.1.39 "Term Loan Account" shall mean the account on the books of the Lender in the name of the Borrower in which the following shall be recorded: the principal outstanding and interest accrued under the Term Loan; all Costs with respect to the Term Loan; all payments made by the Borrower on account of indebtedness evidenced by the Term Note; and other appropriate debits and credits.

1.2 Accounting Terms. Accounting terms not specifically defined in this Agreement shall have the meanings given to them under generally accepted accounting principles.

1.3 Other Definitional Provisions. The words "hereof," "herein" and "hereunder," and words of similar import when used in this Agreement shall refer to this Agreement as a whole and not any particular provision of this Agreement. Any Article, Section, Exhibit or Schedule references are to this Agreement unless otherwise specified.

ARTICLE II

TERM LOAN

2.1 The Lender hereby agrees to make a seven-year term loan (the "Term Loan") in the principal amount of \$7,000,000 to the Borrower. The Term Loan shall be evidenced by a term note (the "Term Note") payable to the Bank in the form of Exhibit A hereto. Amortization of the Term Note shall be calculated on the basis of a 7-year schedule of level monthly payments of principal with the entire unpaid principal balance and all accrued and unpaid interest absolutely due and payable on the Maturity Date.

2.2 Interest.

2.2.1 Borrower agrees to pay interest in respect of the unpaid principal amount of the Term Loan from the date of this Agreement until paid in full as follows. The Term Loan shall bear interest at the Base Rate unless the Borrower desires to pay interest on all or a portion of the Term Loan at the following rate:

(i) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio not in excess of 1.35 to 1:

(a) and a Cash Flow Ratio of from 1.35 to 1 to and including 1.75 to 1, the LIBOR Rate plus 1.60%;

(b) and a Cash Flow Ratio of from 1.76 to 1 to and including 2.0 to 1, the LIBOR Rate plus 1.30%;

(c) and a Cash Flow Ratio of from 2.01 to 1 to and including 3.0 to 1, the LIBOR Rate plus 1.10%; or

(d) and a Cash Flow Ratio in excess of 3.0 to 1, the LIBOR Rate plus .90%; or

(ii) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio of 1.35 to 1 or more or a Cash Flow Ratio of less than 1.35 to 1, the LIBOR Rate plus 2.00%.

2.2.2 Whenever the Borrower desires to obtain the LIBOR Rate, it may request that the Lender provide quotes as of any specified Interest Rate Determination Date as to the LIBOR Rate for any or all Interest Periods, and the Lender shall promptly provide such quotes. The Borrower shall give the Lender prior telecopied or telephone notice (given not later than 10:00 a.m. (Boston time)) at least three Business Days prior to the day the Interest Period is to begin with respect to use of the LIBOR Rate. Each such notice (each an "Interest Rate Change Notice") shall specify the desired interest rate, the amount of the Term Loan to which such interest rate shall apply and the initial Interest Period applicable thereto. If such notice is given by telephone, it shall be immediately confirmed in writing.

2.2.3 Upon the Interim Maturity Date of any LIBOR Loan, unless the Borrower shall have given the Lender an Interest Rate Change Notice in accordance with Section 2.2.2 requesting a new LIBOR Loan be made on such Interim Maturity Date, the Borrower shall be deemed to have elected to pay interest on such amount of the Term Loan at the Base Rate.

2.2.4 At the time the Borrower gives any Interest Rate Change Notice, the Borrower shall elect the Interest Period for which the interest rate elected shall apply, which Interest Period shall, at the option of the Borrower, be a period of one, two, three, four, five or six months (as to a LIBOR Loan). Notwithstanding anything to the contrary contained herein:

(i) if any Interest Period begins on a day for which there is no numerically corresponding day in the calendar month at the end of such Interest Period, such Interest Period shall end on the last Business Day of such calendar month;

(ii) if any Interest Period would otherwise expire on a day that is not a Business Day, such Interest Period shall expire on the next succeeding Business Day; provided that if any Interest Period would otherwise expire on the day that is not a Business Day but is a day of the month after which no further Business Day occurs in such month, such Interest Period shall expire on the next preceding Business Day;

(iii) no Interest Period shall extend beyond the Term Loan Maturity Date.

2.3 Term Loan Account. The principal and the amounts of all payments on the Term Note shall be recorded by the Lender in the Term Loan Account of the Borrower. All statements regarding the Term Loan Account shall be deemed to be accurate absent manifest error or unless objected to by the Borrower within 30 days after receipt. The Borrower agrees to review each such statement promptly after receipt and to bring any errors or discrepancies to the Lender's attention promptly.

ARTICLE III

ADDITIONAL TERMS

3.1 Payments.

3.1.1 The Borrower shall have the right to prepay the Note, in whole at any time or in part from time to time, without premium or penalty, provided that, except as set forth in Section 3.3, no portion of the Term Loan may be prepaid on the first day of an Interest Period with respect thereto. The Borrower shall give notice (by telex or telecopier, or by telephone (confirmed in writing promptly thereafter)) to the Lender of each proposed prepayment hereunder prior to 10:00 a.m. (Boston time), (x) with respect to Base Rate Loans, upon the Business Day of the proposed prepayment and (y) with respect to LIBOR Loans, at least three Business Days prior to the Business Day of the proposed prepayment, which notice in each case shall specify the proposed prepayment date (which shall be a Business Day), the aggregate principal amount of the proposed prepayment and which portions of the Term Loan are to be prepaid. LIBOR Loans that are voluntarily prepaid before the last day of the applicable Interest Period shall be subject to the additional compensation requirements set forth in Section 3.3, and each prepayment of a LIBOR Loan shall be in an aggregate principal amount of not less than the total principal amount outstanding at such time under such LIBOR Loan.

3.1.2 All payments of principal and interest due under the Note (including prepayments), and any other amounts owing to the Lender under this Agreement, shall be made by the Borrower not later than 3:00 p.m., Boston time, on the day due in lawful money of the United States of America, to the Lender at its Boston, Massachusetts office in immediately available funds. The Borrower hereby authorizes the Lender to charge such payments as they become due, if not otherwise paid by the Borrower, to any account of the Borrower with the Lender as the Lender may elect.

3.1.3 Whenever any payment to be made hereunder or under any other Loan Document shall be stated to be due on a day that is not a Business Day, such payment may be made on the next succeeding Business Day, and such extension of time shall in such case be included in computing interest or other fees or charges provided for under this Agreement or any other Loan Document; provided, however, that with respect to LIBOR Loans, if the next succeeding Business Day falls in another calendar month, such payment shall be made on the next preceding Business Day.

3.1.4 All payments made by the Borrower on the Note shall be applied by the Lender (a) first, to the payment of Costs with respect to the Note, (b) second, to the payment of accrued and unpaid interest on the Note, in such order as the Borrower shall direct, until all such accrued interest has been paid, and (c) third, to the payment of the unpaid principal amount of the Note in such order as the Borrower shall direct.

3.2 Capital Adequacy.

3.2.1 If, after the date of this Agreement, the Lender shall have reasonably determined in good faith that the adoption or effectiveness after the date hereof of any applicable law, rule or regulation regarding capital adequacy, or any change therein, or any change in the interpretation or administration thereof by any governmental authority, central bank or comparable agency charged with the interpretation or administration thereof, or compliance by the Lender with any request or directive regarding capital adequacy (whether or not having the force of law) of any such authority, central bank or comparable agency, has or would have the effect of materially reducing the rate of return on the Lender's capital or assets as a consequence of its commitments or obligations hereunder to a level below that which the Lender could have achieved but for such adoption, effectiveness, change or compliance (taking into consideration the Lender's then current policies with respect to capital adequacy), then from time to time, subject to Section 3.2.2, within 15 days after demand by the Lender the Borrower shall pay to the Lender such additional amount or amounts as will compensate the Lender for such reduction (after the Lender shall have allocated the same fairly and equitably among all of its customers or any class generally affected thereby).

3.2.2 The Lender will notify the Borrower of any event occurring after the date of this Agreement that will entitle the Lender to any additional payment under this Section 3.2 as promptly as practicable and shall be entitled to such payment (a) in the case of a Base Rate Loan, only for costs incurred from and after the date that the Lender gives such notice, and (b) in the case of a LIBOR Loan, only for costs incurred in connection with Loans made pursuant to an Interest Rate Change Notice issued after the date that the Lender gives such notice. The Lender will furnish to the Borrower with such notice a certificate signed by an officer thereof certifying that the Lender is entitled to payment under this Section 3.2 and setting forth the basis (in reasonable detail) and the amount of each request by the Lender for any additional payment pursuant to this Section 3.2.

3.3 Special Provisions Governing LIBOR Loans. Notwithstanding any other provisions of this Agreement, the following provisions shall govern with respect to LIBOR Loans as to the matters covered:

3.3.1 Increased Costs, Illegality etc. (a) In the event that the Lender shall have determined (which determination shall, if made in good faith and absent manifest error, be final, conclusive and binding upon all parties):

(i) on any Interest Rate Determination Date, that by reason of any changes arising after the date of this Agreement affecting the interbank Eurodollar market, adequate and fair means do not exist for ascertaining the applicable interest rate on the basis provided for in the definition of LIBOR Rate; or

(ii) at any time during any Interest Period, that the Lender shall incur increased costs or reductions in the amounts received or receivable hereunder with respect to a LIBOR Loan by reason of (x) any change since the Interest Rate Determination Date for the Interest Period in question in any applicable law or governmental rule, regulation, guideline or order (or any interpretation thereof and including the introduction of any new law or governmental rule, regulation, guideline or order) (such as, for example but not limited to, a change in official reserve requirements, but excluding reserve requirements that have been included in calculating the LIBOR Rate for such Interest Period) and/or (y) other circumstances affecting the Lender, the interbank Eurodollar market or the position of the Lender in the relevant market; or

(iii) at any time, that the making or continuance of any LIBOR Loan has become unlawful by compliance by the Lender in good faith with any law, governmental rule, regulation, guideline or order, or has become impracticable as a result of a contingency occurring after the date of this Agreement;

then and in any such event, the Lender shall promptly after making such determination give notice (by telephone confirmed in writing) to the Borrower of such determination. Thereafter (x) in the case of clause (i) above, any Interest Rate Change Notice given by the Borrower with respect to a LIBOR Loan that has not yet been incurred shall be deemed rescinded by the Borrower and LIBOR Loans shall no longer be available until such time as the Lender notifies the Borrower that the circumstances giving rise to such notice no longer exist or that, notwithstanding such circumstances, LIBOR Loans will again be made available hereunder, (y) in the case of clause (ii), the Borrower shall pay to the Lender, upon written demand therefor (but only with respect to any LIBOR Loan made pursuant to an Interest Rate Change Notice issued after the giving of the written notice that LIBOR Loans will again be made available hereunder referred to in clause (x) above), such additional amounts (in the form of an increased rate of, or a different method of calculating, interest or otherwise as the Lender in its sole discretion shall determine) as shall be required to compensate the Lender for such increased cost or reduction in amount received (a written notice as to additional amounts owed the Lender, showing the basis for such calculation thereof, shall be given to the Borrower by the Lender and shall, absent manifest error, be final, conclusive and binding upon the parties hereto), and (z) in the case of clause (iii), the Borrower shall take one of the actions specified in Section 3.3.1(b) as promptly as possible and, in any event, within the time period required by law.

(a) At any time that any LIBOR Loan is affected by the circumstances described in Section 3.3.1(a)(ii) or (iii), the Borrower may (and in the case of a LIBOR Loan affected pursuant to Section 3.3.1(a)(iii) shall) either (x) if the affected LIBOR Loan is then being made, withdraw the related Interest Rate Change Notice by giving the Lender telephonic (confirmed in writing) notice thereof on the same date that the Borrower was notified by the Lender pursuant to Section 3.3.1(a), or (y) if the affected LIBOR Loans are then outstanding, upon at least three Business Days' written notice to the Lender, require the Lender to convert each LIBOR Loan so affected into a Base Rate Loan.

3.3.2 Compensation. The Borrower shall compensate the Lender, upon its written request (which request shall set forth the basis for requesting such amounts), for all reasonable losses, expenses and liabilities (including, without limitation, any interest paid by the Lender to lenders of funds borrowed by it to make or carry its LIBOR Loans to the extent not recovered by the Lender in connection with the re-employment of such funds) and any loss sustained by the Lender in connection with the re-employment of the funds (including, without limitation, a return on such re-employment that would result in the Lender's receiving less than it would have received had such LIBOR Loan remained outstanding until the last day of the Interest Period applicable to such LIBOR Loan) that the Lender may sustain: (i) if for any reason (other than a default by or negligence of the Lender) a LIBOR Loan is not advanced on a date specified therefor in an Interest Rate Change Notice (unless timely withdrawn pursuant to Section 3.3.1(b)(x) above), (ii) if any payment or prepayment of any LIBOR Loans occurs for any reason whatsoever (including, without limitation, by reason of Section 3.3.1(b)) on a date that is prior to the last day of an Interest Period applicable thereto, (iii) if any prepayment of any of its LIBOR Loans is not made on the date specified in a notice of payment given by the Borrower pursuant to Section 3.1 or (iv) as a consequence of an election made by the Borrower pursuant to Section 3.3.1(b)(y) .

ARTICLE IV

REPRESENTATIONS AND WARRANTIES OF THE BORROWER

In order to induce the Lender to enter into this Agreement and to make the loans provided for herein, the Borrower makes the following representations and warranties to the Lender, all of which shall survive the execution and delivery of this Agreement and the Note.

4.1 Organization, Existence and Power. The Borrower is duly incorporated, validly existing and in good standing under the laws of the jurisdiction of its incorporation. The Borrower has the corporate power necessary to conduct the business in which it is engaged, to own the properties owned by it and to

consummate the transactions contemplated by the Loan Documents. The Borrower is duly qualified or licensed to transact business in all places where the nature of the properties owned by it or the business conducted by it makes such qualification necessary and where the failure to be so qualified or licensed would have a material adverse effect upon the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole.

4.2 Authorization of Loan Documents; Binding Effect. The execution and delivery of this Agreement and the other Loan Documents and the performance of the transactions contemplated hereby and thereby have been duly authorized by all necessary corporate actions of the Borrower. Each of the Loan Documents constitutes the legal, valid and binding obligation of the Borrower that is a party thereto, enforceable against the Borrower in accordance with its terms.

4.3 Authority. The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under the Loan Documents. Neither the authorization, execution, delivery, or performance by the Borrower of this Agreement or of any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

4.4 Capital Structure. The number of shares of stock of which the Borrower's authorized capital stock consists, the par value per share of such stock, the number of shares of such stock that have been issued and are outstanding and the number of shares that have been issued and are held by the Borrower as treasury shares are all disclosed on the Disclosure Schedule. Set forth in the Disclosure Schedule is a complete and accurate list of all Subsidiaries of the Borrower. The Disclosure Schedule indicates the jurisdiction of incorporation or organization of each of the Subsidiaries, the number of shares or units of each class of capital stock or other equity of the Subsidiaries authorized, and the number of such shares or units outstanding and the percentage of each class of such equity owned (directly or indirectly) by the Borrower. No shares of stock or units of equity interests of the Borrower or any of its Subsidiaries are covered by outstanding options, warrants, rights of conversion or purchase or similar rights granted or created by the Borrower except as set forth on the Disclosure Schedule. All the outstanding capital stock of the Borrower has been validly issued and is fully paid and nonassessable. All the stock or units of equity interests of the Borrower's Subsidiaries that are owned by the Borrower or any Subsidiary of the Borrower are owned free and clear of all

mortgages, deeds of trust, pledges, liens, security interests and other charges or encumbrances.

4.5 Financial Condition. The audited consolidated balance sheet of the Borrower and its Subsidiaries dated as of December 31, 1994 and the audited statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for and as of the end of the period ending on that date, including any related notes (the "Audited Financial Statements"), and the unaudited consolidated financial statements of the Borrower and its Subsidiaries (the "Unaudited Financial Statements") dated as of July 1, 1995 (the "Balance Sheet Date"), all of which (collectively, the "Financial Statements") were heretofore furnished to the Lender, are true, correct and complete in all material respects and fairly present in all material respects the financial condition of the Borrower and its Subsidiaries as of the date of each such statement and have been prepared in accordance with generally accepted accounting principles (subject, in the case of the Unaudited Financial Statements, to the addition of notes and to normal year-end adjustments that individually and in the aggregate are not expected to be material) consistently applied throughout the periods involved. Other than as reflected in such Financial Statements and except for liabilities incurred in the ordinary course of business since the date thereof, the Borrower has no Indebtedness that is or would be material to the financial condition of the Borrower, nor any material unrealized or unanticipated losses from any commitments. Since the Balance Sheet Date there has been no material adverse change in the consolidated financial condition (as set forth in the Unaudited Financial Statements) or results of operations of the Borrower and its Subsidiaries taken as a whole.

4.6 Pending Litigation. Except as set forth in the Disclosure Schedule, there are no suits or proceedings pending or, to the knowledge of the Borrower, threatened before any court or arbitration tribunal or by or before any governmental or regulatory authority, commission, bureau or agency or public regulatory body against the Borrower that if adversely determined would have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole.

4.7 Certain Agreements; Material Contracts. The Borrower is not a party to any agreement or instrument or subject to any court order or governmental decree adversely affecting in any material respect the business, properties, assets or financial condition of the Borrower and its Subsidiaries taken as a whole.

4.8 Authorization, Etc. All authorizations, consents, approvals, accreditations, certifications and licenses required under the corporate charter or by-laws of the Borrower or under applicable law or regulation for the ownership or operation of the property owned or operated by the Borrower or the conduct of any business or activity conducted by the Borrower, including provision of services for

which reimbursement is made by third party payors, other than authorizations, consents, approvals, accreditations, certifications or licenses the failure to obtain and/or maintain which would not have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole (collectively, "Licenses") have been duly issued and are in full force and effect. The Borrower has fulfilled and performed all of its material obligations with respect to such Licenses (to the extent now required to be fulfilled or performed) and no event has occurred that would allow, with or without the passage of time or the giving of notice or both, revocation or termination thereof or would result in any other material impairment of the rights of the holder of any such License. All filings or registrations with any governmental or regulatory authority required for the conduct of the business or activity conducted by the Borrower have been made, other than any such filings or registrations as to which the failure to make same would not have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries, taken as a whole. Except as expressly contemplated hereby, no approval, consent or authorization of or filing or registration with any governmental commission, bureau or other regulatory authority or agency is required with respect to the execution, delivery or performance of any of the Loan Documents.

4.9 No Violation. The execution, delivery and performance by the Borrower of the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower. The Borrower is not in default, nor has any event occurred that with the passage of time or the giving of notice, or both, would constitute a default, in the performance, observance or fulfillment of any of the obligations, covenants or conditions contained in any agreement, instrument or other document to which the Borrower is a party, which default would have a material adverse effect on the consolidated assets, financial condition or results of operations of the Borrower and its Subsidiaries, taken as a whole. The Borrower is not in violation of any applicable federal, state or local law, rule or regulation or any writ, order or decree, which violation would have a material adverse effect on the consolidated assets, financial condition or results of operations of the Borrower and its Subsidiaries, taken as a whole. Except as otherwise set forth in the Disclosure Schedule under the caption "Litigation," the Borrower has not received notice of any violation of any federal, state or local environmental law, rule or regulation or assertion that the Borrower has any obligation to clean up or contribute to the cost of cleaning up any waste or pollutants.

4.10 Payment of Taxes. The Borrower and its Subsidiaries have properly prepared and filed or caused to be properly prepared and filed all federal tax returns and all material state and local tax returns that are required to be filed and have paid all taxes shown thereon to be due and all other taxes, assessments and governmental charges or levies imposed upon the Borrower and its Subsidiaries, their income or

profits or any properties belonging to the Borrower. No extensions of any statute of limitations are in effect with respect to any tax liability of the Borrower or any Subsidiary of the Borrower. No deficiency assessment or proposed adjustment of the federal income taxes of the Borrower or any Subsidiary of the Borrower is pending and the Borrower has no knowledge of any proposed liability of a substantial nature for any tax to be imposed upon any of its properties or assets.

4.11 Transactions With Affiliates, Officers, Directors and 1% Shareholders. Except as set forth on the Disclosure Schedule, the Borrower has no Indebtedness to or material contractual arrangement or understanding with any Affiliate, officer or director of the Borrower, nor any shareholder holding of record at least 1% of the equity of the Borrower nor, to the best of the Borrower's knowledge (without independent inquiry), any of their respective relatives.

4.12 ERISA. The Borrower has never established or maintained any funded employee pension benefit plan as defined under Section 3(2) (A) of the Employee Retirement Income Security Act of 1974, as amended and in effect on the date hereof ("ERISA"), other than the plans described on the Disclosure Schedule. No employee benefit plan established or maintained, or to which contributions have been made, by the Borrower or any Subsidiary of the Borrower that is subject to Part 3 of Title I-B of ERISA, had an accumulated funding deficiency (as such term is defined in Section 302 of ERISA) as of the last day of the fiscal year of such plan ended most recently prior to the date hereof, or would have had an accumulated funding deficiency (as so defined) on such day if such year were the first year of the plan to which Part 3 of Title I-B of ERISA applied. No material liability to the Pension Benefit Guaranty Corporation has been incurred or is expected by the Borrower to be incurred by it or any Subsidiary of the Borrower with respect to any such plan or otherwise. The execution, delivery and performance of this Agreement and the other Loan Documents will not involve on the part of the Borrower any prohibited transaction within the meaning of ERISA or Section 4975 of the Internal Revenue Code. The Borrower has never maintained, contributed to or been obligated to contribute to any "multiemployer plan," as defined in Section 3(37) of ERISA. The Borrower has never incurred any "withdrawal liability" calculated under Section 4211 of ERISA, and there has been no event or circumstance that would cause it to incur any such liability.

4.13 Ownership of Properties; Liens. The Borrower has good and marketable title to all its material properties and assets, real and personal, that are now carried on its books, including, without limitation, those reflected in the Financial Statements (except those disposed of in the ordinary course since the date thereof), and has valid leasehold interests in its properties and assets, real and personal, which it purports to lease, subject in either case to no mortgage, security interest, pledge, lien, charge, encumbrance or title retention or other security agreement or arrangement of any nature whatsoever other than Permitted Liens and those specified in the Disclosure

Schedule. All of the Borrower's material leasehold interests and material obligations with respect to real property are described on the Disclosure Schedule.

4.14 Employment Matters. Except as set forth on the Disclosure Schedule, there are no material grievances, disputes or controversies pending or, to the knowledge of the Borrower, threatened between the Borrower and its employees, nor is any strike, work stoppage or slowdown pending or threatened against the Borrower.

4.15 Insurance. The Borrower maintains in force fire, casualty, comprehensive liability and other insurance covering its properties and business that is adequate and customary for the type and scope of its properties and business.

4.16 Indebtedness. Except as reflected in the Financial Statements or set forth in the Disclosure Schedule, and other than Indebtedness incurred in the ordinary course of business since the Balance Sheet Date, the Borrower has no outstanding Indebtedness.

4.17 Securities Law Compliance. The Borrower is not an "investment company" as defined in the Investment Company Act of 1940, as amended. All of the Borrower's outstanding stock was offered, issued and sold in compliance with all applicable state and federal securities laws.

4.18 Accuracy of Information. None of the information furnished to the Lender by or on behalf of the Borrower for purposes of this Agreement or any Loan Document or any transaction contemplated hereby or thereby contains, and none of such information hereinafter furnished will contain, any material misstatement of fact, nor does or will any such information omit any material fact necessary to make such information not misleading at such time.

ARTICLE V

CONDITIONS TO TERM LOAN

The obligations of the Lender to fund the Term Loan are subject to the following conditions precedent, each of which shall have been met or performed on or before the Closing Date:

5.1 No Default. No Default or Event of Default shall have occurred and be continuing or will occur upon the making of the Term Loan.

5.2 Correctness of Representations. The representations and warranties made by the Borrower in this Agreement shall be true and correct with the same force and effect as though such representations and warranties had been made on

and as of the Closing Date (i) except to the extent that the representations and warranties set forth in Article IV of this Agreement are untrue as a result of circumstances that have changed subsequent to the date hereof, which change has caused no non-compliance by the Borrower with the covenants, conditions and agreements in this Agreement and (ii) except that the references in Section 4.5 of this Agreement to the financial statements and the term "Balance Sheet Date" are deemed to refer to the most recent financial statements (inclusive of consolidated balance sheets and statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries) furnished to the Lender pursuant to Section 6.1(a) and (b) of this Agreement and the date of such financial statements, respectively.

5.3 No Litigation; Certain Other Conditions. There shall be no suit or proceeding (other than suits or proceedings disclosed on the Disclosure Schedule on the date of this Agreement) pending or threatened before any court or arbitration tribunal or by or before any governmental or regulatory authority, commission, bureau or agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, is reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole.

5.4 No Material Adverse Change. There shall have been no material adverse change in the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole since the Balance Sheet Date.

5.5 Loan Documents. All Loan Documents shall be in full force and effect.

5.6 Opinion of Counsel. The Lender shall have received from independent counsel to the Borrower an opinion or opinions, in form and substance satisfactory to the Lender and its counsel.

5.7 Certificates of Legal Existence and Authority to do Business. The Borrower shall have delivered to the Lender certificates as to its legal existence and good standing under the laws of The Commonwealth of Massachusetts, and the Borrower shall have delivered to the Lender certificates as to its authority to do business as a foreign corporation in the States of California, Colorado, Connecticut, Florida, Illinois, Maryland, Michigan, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Texas, and Arizona, each dated as of a recent date.

5.8 Clerk's Certificate. The Borrower shall have delivered to the Lender a certificate of its Clerk as to (i) its charter documents and by-laws, as amended, (ii) corporate votes authorizing the execution and delivery of the Loan Documents, and (iii) incumbency of the officers authorized to execute the Loan Documents on behalf of the Borrower.

5.9 Note. The Term Note, duly executed by the Borrower and otherwise completed, shall have been delivered to the Lender.

5.10 Borrower's Certificate. The Borrower shall have furnished to the Lender a certificate duly executed by the Borrower's chief financial officer dated the Closing Date to the effect that each of the conditions set forth in this Article V has been met as of such date.

5.11 Insurance. The Borrower shall have furnished to the Lender copies of all its property insurance policies.

5.12 Environmental Site Assessment. The Borrower shall have delivered to the Lender an environmental site assessment, in form and substance acceptable to the Lender, from a consulting firm acceptable to the Lender, in which the consultant shall have certified and opined that for the foreseeable future the condition of the property in Methuen, Massachusetts that the Borrower has purchased poses no significant risk to human health or the environment and no further remedial action or investigation is necessary in accordance with federal and state laws.

5.13 Merger Agreement. The Borrower shall have delivered to the Lender a copy of a fully-executed Merger Agreement between the Borrower and UTI Instruments Company.

5.14 All Proceedings Satisfactory. All corporate and other proceedings taken prior to or on the Closing Date in connection with the transactions contemplated by this Agreement, and all documents and exhibits related thereto, shall be reasonably satisfactory in form and substance to the Lender and its counsel.

5.15 Additional Documents. The Borrower shall have delivered to the Lender all additional opinions, documents and certificates that the Lender or its counsel may reasonably require.

ARTICLE VI

AFFIRMATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Note and payment and performance of all other Obligations:

6.1 Reporting Requirements. The Borrower shall, unless the Lender shall otherwise consent in writing, furnish to the Lender:

(a) As soon as available and in any event within sixty days after the end of each of the first three quarters of each fiscal year of the Borrower and its Subsidiaries, (i) a consolidated and consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such quarter and (ii) consolidated and consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for the period commencing at the end of the previous fiscal year and ending with the end of such quarter, all in reasonable detail and duly certified by the chief financial officer of the Borrower as having been prepared in accordance with generally accepted accounting principles consistently applied (subject to addition of notes and ordinary year-end audit adjustments), together with a certificate of the chief financial officer of the Borrower stating that no Default or Event of Default has occurred and is continuing or, if a Default or an Event of Default has occurred and is continuing, a statement as to the nature thereof and the action that the Borrower proposes to take with respect thereto;

(b) As soon as available and in any event within ninety days after the end of each fiscal year of the Borrower, the audited consolidated balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the audited consolidated statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year, in each case accompanied by the unqualified opinion with respect thereto of the Borrower's independent public accountants and a certification by such accountants stating that they have reviewed this Agreement and whether, in making their audit, they have become aware of any Default or Event of Default and if so, describing its nature, along with the related unaudited consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the unaudited consolidating statements of operations, cash flows' and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year;

(c) Not later than sixty days following the end of each fiscal quarter a certificate signed by the chief financial officer of the Borrower substantially in the form of Exhibit 6.1(c) hereto (the "Compliance Certificate");

(d) Not later than thirty days after the end of each fiscal year of the Borrower, the Borrower's representative forecast for the next fiscal year on a consolidated basis, including, at a minimum, projected statements of profit and loss and projected cash flow, prepared in accordance with generally accepted accounting principles consistently applied;

(e) Promptly upon receipt thereof, one copy of each other report submitted to the Borrower or any Subsidiary by independent accountants in connection with any annual, interim or special audit made by them of the books of the Borrower or any Subsidiary;

(f) Promptly after the commencement thereof, notice of all actions, suits and proceedings before any court, arbitration tribunal or governmental regulatory authority, commission, bureau, agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, would be reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole;

(g) As soon as possible, and in any event within five days after the Borrower shall know of the occurrence of any Default or Event of Default, the written statement of the chief financial officer of the Borrower setting forth details of such Default or Event of Default and action that the Borrower proposes to take with respect thereto;

(h) As soon as possible, and in any event within five days after the occurrence thereof, written notice as to any other event of which the Borrower becomes aware that with the passage of time, the giving of notice or otherwise, is reasonably likely to result in a material adverse change in the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole; and

(i) Such other information respecting the business or properties or the condition or operations, financial or otherwise, of the Borrower as the Lender may from time to time reasonably request.

6.2 Loan Proceeds. The Borrower shall use the proceeds of the Term Loan only for general corporate purposes including, but not limited to, funding the acquisition of UTI Instruments Company and refinancing the purchase of certain real property located in Methuen, Massachusetts.

6.3 Maintenance of Business and Properties; Insurance.

(a) The Borrower will continue to engage in business of the same general nature as the business currently engaged in by the Borrower. The Borrower will at all times maintain, preserve and protect all material franchises and trade names and preserve all the Borrower's material tangible property used or useful in the conduct of its business and keep the same in good repair, working order and condition, ordinary wear and tear excepted, and from time to time make all needful and proper repairs, renewals, replacements, betterments, and improvements thereto so that the business carried on in connection therewith may be conducted properly and advantageously at all times.

(b) The Borrower will keep all of its insurable properties now or hereafter owned adequately Insured at all times against loss or damage by fire or

other casualty to the extent customary with respect to like properties of companies conducting similar businesses and to the extent available at commercially reasonable rates; and will maintain public liability and workmen's compensation insurance insuring the Borrower to the extent customary with respect to companies conducting similar businesses and to the extent available at commercially reasonable rates, all by financially sound and reputable insurers. All property insurance policies shall name the Lender as a loss payee and shall contain a provision requiring at least 15 days' written notice to the Lender prior to the cancellation or modification of each such policy. The Borrower shall furnish to the Lender from time to time at the Lender's request copies of all such insurance policies and certificates evidencing such insurance coverage. Notwithstanding the foregoing, the Borrower may self-insure workmen's compensation to the extent permitted by law and may also self-insure other risks to the extent reasonably deemed prudent by the Borrower.

6.4 Payment of Taxes. The Borrower shall pay and discharge, or cause to be paid and discharged, all material taxes, assessments, and governmental charges or levies imposed upon the Borrower and its Subsidiaries or their income or profits, or upon any other properties belonging to the Borrower prior to the date on which penalties attach thereto, and all lawful claims that, if unpaid, might become a lien or charge upon any material properties of the Borrower, except for such taxes, assessments, charges, levies or claims as are being contested by the Borrower in good faith by appropriate proceedings promptly initiated and diligently prosecuted, for which adequate book reserves have been established in accordance with generally accepted accounting principles, as to which no foreclosure, distraint, sale or other similar proceedings shall have been commenced, or, if commenced, have been effectively stayed.

6.5 Compliance with Laws, etc. The Borrower shall comply with the requirements of all applicable laws, rules, regulations and orders of any governmental authority, and obtain or maintain all Licenses required under applicable law or regulation for the operation of the Borrower's business, where noncompliance or failure to obtain or maintain would have a material adverse effect on the consolidated financial condition, assets, or results of operations of the Borrower and its Subsidiaries taken as a whole; provided, however, that such compliance or the obtaining of such Licenses may be delayed while the applicability or validity of any such law, rule, regulation or order or the necessity for obtaining any such License is being contested by the Borrower in good faith by appropriate proceedings promptly initiated and diligently prosecuted.

6.6 Books, Records and Accounts. The Borrower shall keep true and correct books, records and accounts, in which entries will be made in accordance with generally accepted accounting principles consistently applied, and that shall comply with the requirements of the Foreign Corrupt Practices Act of 1977 to the extent applicable to the Borrower. The Lender or its representatives shall upon reasonable

notice to the Borrower be afforded, during normal business hours, access to and the right to examine and copy any such books, records and accounts and the right to inspect the Borrower's premises and business operations. All financial and other information with respect to the Borrower and/or any of its Subsidiaries now or hereafter obtained by the Lender under this Agreement or otherwise in connection with any of the transactions contemplated hereunder shall be held in confidence and shall not be released or made available to any other Person, except (i) to governmental agencies (and examiners employed by same) having oversight over the affairs of the Lender, (ii) pursuant to subpoena or similar process issued by a court or governmental agency of competent jurisdiction, or (iii) as otherwise directed by order of any court or governmental agency of competent jurisdiction.

6.7 Further Assurances. The Borrower shall execute and deliver, at the Borrower's expense, all notices and other instruments and documents and take all actions, including, but not limited to, making all filings and recordings, that the Lender shall reasonably request in order to assure to the Lender all rights given to the Lender hereby or under any other Loan Document.

6.8 Bank Accounts. The Borrower shall maintain with the Lender a deposit account and, at the written request of the Lender, shall give the Lender written notice of any other accounts maintained by the Borrower, including the types of accounts and names and addresses of the institutions with which such accounts are maintained.

ARTICLE VII

NEGATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Note and payment and performance of all other Obligations:

7.1 Sale of Assets; Mergers, Etc.

(a) Sale of Assets. The Borrower will not, except in the ordinary course of business, sell, transfer, or otherwise dispose of, to any Person any assets (including the securities of any Subsidiary).

(b) Mergers, Etc. Other than the merger of a Subsidiary into UTI Instruments Company, neither the Borrower nor any Subsidiary will consolidate with or merge into any other Person or permit any other Person to consolidate with or merge into it, or acquire all or substantially all of the assets of any Person, or sell, assign, lease or otherwise dispose of (whether in one transaction or in a series of transactions) all or substantially all of its assets to any Person, except that

(1) a Subsidiary may consolidate with or merge into the Borrower or another Subsidiary; and

(2) the Borrower or any of its Subsidiaries may acquire all or substantially all of the assets of any Person provided the aggregate purchase price liability, including all contingent liabilities, when aggregated with all such acquisitions and any Investments permitted under Section 7.4(2) shall not exceed a total of \$5,000,000 in each calendar year during the term of this Agreement beginning with calendar year 1995.

7.2 Liens and Encumbrances.

(a) Neither the Borrower nor any Subsidiary will (a) cause or permit or (b) agree or consent to cause or permit in the future (upon the happening of a contingency or otherwise), any of its real or personal property, whether now owned or subsequently acquired, to be subject to any Lien other than Liens described below (which may herein be referred to as "Permitted Liens"):

(1) Liens securing the payment of taxes, assessments or governmental charges or levies or the demands of suppliers, mechanics, carriers, warehousemen, landlords and other like Persons, which payments are not yet due and payable or (as to taxes) may be paid without interest or penalty; provided, that, if such payments are due and payable, such Liens shall be permitted hereunder only to the extent that (A) all claims that the Liens secure are being actively contested in good faith and by appropriate proceedings, (B) adequate book reserves have been established with respect thereto to the extent required by generally accepted accounting principles, and (C) such Liens do not in the aggregate materially interfere with the owning company's use of property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(2) Liens incurred or deposits made in the ordinary course of business (A) in connection with worker's compensation, unemployment insurance, social security and other like laws, or (B) to secure the performance of letters of credit, bids, tenders, sales contracts, leases, statutory obligations, surety, appeal and performance bonds and other similar obligations, in each case not incurred in connection with the borrowing of money, the

obtaining of advances or the payment of the deferred purchase price of property;

(3) Liens not otherwise described in Section 7.2(a)(1) or (2) that are incurred in the ordinary course of business and are incidental to the conduct of its business or ownership of its property, were not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property and do not in the aggregate materially detract from the value of, or materially interfere with the owning company's use of, property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(4) Liens in favor of the Lender or any of its affiliates;

(5) Judgment liens or attachments that shall not have been in existence for a period longer than 30 days after the creation thereof, or if a stay of execution shall have been obtained, for a period longer than 30 days after the expiration of such stay or if such an attachment is being actively contested in good faith and by appropriate proceedings, for a period longer than 30 days after the creation thereof;

(6) Liens existing as of the Closing Date and disclosed on the Disclosure Schedule hereto;

(7) Liens provided for in equipment or Financing Leases (including financing statements and undertakings to file financing statements) provided that they are limited to the equipment subject to such leases and the proceeds thereof;

(8) Leases or subleases with third parties or licenses and sublicenses granted to third parties not interfering in any material respect with the business of the Borrower or any Subsidiary of the Borrower;

(9) Any Lien on any asset of any corporation existing at the time such corporation is merged into or consolidated with the Borrower or a Subsidiary of the Borrower and not created in contemplation of such event;

(10) Any Lien existing on any asset prior to the acquisition thereof by the Borrower or any Subsidiary of the Borrower and not created in contemplation of such event;

(11) Liens in respect of any purchase money obligations for tangible property used in its business that at any time shall not exceed \$2,000,000, provided that any such encumbrances shall not extend to property and assets of the Borrower or any Subsidiary not financed by such a purchase money obligation;

(12) Easements, rights of way, restrictions and other similar charges or Liens relating to real property and not interfering in a material way with the ordinary conduct of its business; and

(13) Liens on its property or assets created in connection with the refinancing of Indebtedness secured by Permitted Liens on such property, provided that the amount of Indebtedness secured by any such Lien shall not be increased as a result of such refinancing and no such Lien shall extend to property and assets of the Borrower or any Subsidiary not encumbered prior to any such refinancing.

(b) In case any property is subjected to a Lien in violation of Section 7.2(a), the Borrower will make or cause to be made provision whereby the Note will be secured equally and ratably with all other obligations secured by such property, and in any case the Note shall have the benefit, to the full extent that the holders may be entitled thereto under applicable law, of an equitable Lien equally and ratably securing the Note. Such violation of Section 7.2(a) shall constitute an Event of Default hereunder, whether or not any such provision is made pursuant to this Section 7.2(b);

7.3 Sales and Leasebacks. The Borrower and its subsidiaries will not sell or transfer any of their property and become, directly or indirectly, liable as the lessee under a lease of such property (other than such transactions between Subsidiaries).

7.4 Investments. Neither the Borrower nor any Subsidiary will make or maintain any investments, made in cash or by delivery of property or assets, (a) in any Person, whether by acquisition of capital stock, Indebtedness, or other obligations or securities, or by loan or capital contribution, or otherwise, or (b) in any property, whether real or personal, (items (a) and (b) being herein called "Investments"), except the following:

(1) Investments in direct obligations of, or guaranteed by, the United States government, its agencies or any public instrumentality thereof and backed by the full faith and credit of the United States government with maturities not to exceed (or an unconditional right to compel purchase within) one year from the date of acquisition;

(2) Investments in or to any Subsidiary or other Person provided any such Investment when aggregated with all such other Investments permitted under this Section 7.4(2) and any acquisitions permitted under Section 7.1(b) shall not exceed a total of \$5,000,000 in each calendar year during the term of this Agreement beginning with calendar year 1993;

(3) Investments and obligations issued by any state of the United States or any political subdivision of any such state or any public instrumentality thereof with maturities not to exceed (or an unconditional right to compel purchase within) 180 days of the date of acquisition that are rated in one of the top two rating classifications by at least one nationally recognized rating agency;

(4) Investments in demand and time deposits with, Eurodollar deposits with, certificates of deposit issued by, or obligations or securities fully backed by letters of credit issued by (x) any bank organized under the laws of the United States, any state thereof, the District of Columbia or Canada having combined capital and surplus aggregating at least \$100,000,000, or (y) any other bank organized under the laws of a state that is a member of the European Economic Community (or any political subdivision thereof), Japan, the Cayman Islands, or British West Indies having as of any date of determination combined capital and surplus of not less than \$500,000,000 or the equivalent thereof (determined in accordance with generally accepted accounting principles) ("Permitted Banks");

(5) Shares of money market mutual funds registered under the Investment Company Act of 1940, as amended;

(6) Foreign currency swaps and hedging arrangements entered into in the ordinary course of business to protect against currency losses, and interest rate swaps and caps entered into in the ordinary course of business to protect against interest rate exposure on Indebtedness bearing interest at a variable rate;

(7) Investments in publicly traded companies and mutual funds (other than money market mutual funds) that in the aggregate shall not exceed \$5,000,000; and

(8) Other Investments existing on the Closing Date and listed on the Disclosure Schedule.

7.5 Transactions with Affiliates. Neither the Borrower nor any Subsidiary will enter into any transaction (including the purchase, sale or exchange of property or the rendering of any service) with any Affiliate except upon fair and reasonable terms that are at least as favorable to the Borrower or the Subsidiary as would be obtained in a comparable arm's-length transaction with a non-Affiliate.

7.6 ERISA Compliance. Neither the Borrower nor any of its Subsidiaries will at any time permit any employee pension benefit plan (as such term is defined in Section 3 of ERISA) maintained the Borrower or any of its Subsidiaries or in which employees of the Borrower or any of its Subsidiaries is entitled to participate to:

(a) engage in any "prohibited transaction" as such term is defined in Section 4975 of the Internal Revenue Code of 1986, as amended, or described in Section 406 of ERISA;

(b) incur any "accumulated funding deficiency" as such term is defined in Section 302 of ERISA, whether or not waived; or

(c) terminate under circumstances that could result in the imposition of a Lien on the property of the Borrower or any Subsidiary of the Borrower pursuant to Section 4068 of ERISA.

7.7 Financial Covenants. The Borrower covenants and agrees that:

(a) Consolidated Tangible Net Worth. The Consolidated Net Worth as of the end of each fiscal quarter of the Borrower shall not be less than the sum of (i) \$30,777,703, and (ii) 50% of Consolidated Net Income (excluding losses) for each consecutive fiscal quarter of the Borrower beginning with the quarter ending September 30, 1995, on a cumulative basis.

(b) Consolidated Indebtedness. The ratio ("Debt-to-Net Worth Ratio") of the Consolidated Indebtedness (excluding all guaranties except guaranties with respect to borrowed money) as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending September 30, 1995 to its Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending September 30, 1995 shall not exceed 1.5 to 1.

(c) Consolidated Debt Service. The ratio (the "Cash Flow Ratio") as of the end of each fiscal quarter of the Borrower of (i) Consolidated Operating Cash Flow for the four consecutive fiscal quarters then ended to (ii)

Consolidated Debt Service determined for the four consecutive fiscal quarters then ended shall not be less than 1.25 to 1.00.

7.8 Contracts Prohibiting Compliance with Agreement. The Borrower will not without the prior written consent of the Lender enter into any contract or other agreement that would prohibit or in any way restrict the ability of the Borrower to comply with any provision of this Agreement.

ARTICLE VIII

EVENTS OF DEFAULT

8.1 Default. If any one of the following events ("Events of Default") shall occur:

(a) Any representation or warranty made by the Borrower herein or in any other Loan Document, or in any certificate or report furnished by the Borrower hereunder or thereunder, shall prove to have been incorrect in any material respect when made;

(b) Payment of any principal or interest due under the Note shall not be made on or before the date due;

(c) A final judgment in excess of \$2,000,000 shall be rendered against the Borrower or any of its Subsidiaries for the payment of money that, after deducting the amount of any insurance proceeds paid or payable to or on behalf of the Borrower or its Subsidiary in connection with such judgment, is in excess of \$2,000,000, and the same shall remain undischarged for a period of thirty (30) days, during which period execution shall not effectively be stayed. If a dispute exists with respect to the liability of any insurance underwriter under any insurance policy of the Borrower or its Subsidiary, no deduction under this subsection shall be made for the insurance proceeds that are the subject of such dispute;

(d) The Borrower or any Subsidiary shall (1) voluntarily terminate operations or apply for or consent to the appointment of, or the taking of possession by, a receiver, custodian, trustee or liquidator of such Person or of all or a substantial part of the assets of such Person, (2) admit in writing its inability, or be generally unable, to pay its debts as the debts become due, (3) make a general assignment for the benefit of its creditors, (4) commence a voluntary case under the Federal Bankruptcy Code (as now or hereafter in effect), (5) file a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts, (6) fail to controvert in a timely and appropriate manner, or acquiesce in writing to, any petition filed against it in an involuntary case under the Federal Bankruptcy Code or applicable state bankruptcy

laws or (7) take any corporate action for the purpose of effecting any of the foregoing;

(e) Without its application, approval or consent, a proceeding shall be commenced, in any court of competent jurisdiction, seeking in respect of the Borrower or any Subsidiary: the liquidation, reorganization, dissolution, winding-up, or composition or readjustment of debt, the appointment of a trustee, receiver, liquidator or the like of such Person or of all or any substantial part of the assets of such Person, or other like relief in respect of such Person under any law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts; and, if the proceeding is being contested in good faith by such Person, the same shall continue undismissed, or unstayed and in effect for any period of 45 consecutive days, or an order for relief against such Person shall be entered in any case under the Federal Bankruptcy Code or applicable state bankruptcy laws;

(f) Any foreclosure or other proceedings shall be commenced to enforce, execute or realize upon any lien, encumbrance, attachment, trustee process, mortgage or security interest for payment of an amount in excess of \$250,000 against the Borrower or any Subsidiary;

(g) Default shall be made in the due observance or performance of any covenant or agreement under Article VII;

(h) Default shall be made in the due observance or performance of any covenant or agreement contained herein (and not constituting an Event of Default under any other clause in this Article VIII) or in any other Loan Document or in any other agreement between the Lender and the Borrower evidencing or securing borrowed monies and such default shall continue and shall not have been remedied within thirty days after the date on which such default occurred;

(i) The Borrower or any of its Subsidiaries shall fail to make any payment of principal or interest beyond the period of grace contained in any instrument or agreement evidencing any indebtedness (other than to the Lender) for money borrowed in excess of \$100,000 (unless such default is the result of a good faith dispute arising under such agreement or instrument and the other party or parties thereto have not accelerated the maturity of such indebtedness), or default shall be made by the Borrower or any of its Subsidiaries in the performance of any other covenant or agreement contained in any such agreement or instrument as a result of which the other party thereto proceeds to accelerate the maturity of the indebtedness of such Person under such agreement or instrument;

(j) There shall occur any material adverse change in the financial condition of the Borrower;

(k) There shall occur any Event of Default under the Loan Agreement between the Borrower and the Lender dated as of November 1, 1993;

then, in the case of any such event, other than an event described in subsection (d) or (e) of this Section 8.1, the Lender may, at its option immediately declare any Obligations to it not otherwise due and payable at such time to be forthwith due and payable, whereupon the same shall become forthwith due and payable without further presentment, demand, protest, or other notice of any kind, all of which are hereby expressly waived, anything contained herein or in the Note to the contrary notwithstanding; and, in the case of any event described in subsection (d) or (e) of this Section 8.1, any Obligation not otherwise due and payable at such time shall become immediately due and payable without presentment, demand, protest, or other notice of any kind, all of which are hereby expressly waived, anything contained herein or in the Note to the contrary notwithstanding; and, further, in each and every such occurrence the Lender may proceed to protect and enforce its rights by suit in equity, action at law and/or other appropriate proceedings either for specific performance of any covenant or condition contained in this Agreement or in any instrument delivered to the Lender pursuant to this Agreement, or in aid of the exercise of any power granted in this Agreement or any such instrument.

8.2 Lender's Further Rights and Remedies. Upon the occurrence and during the unremedied continuation of an Event of Default, the Lender shall have the right to require the Borrower to provide the Lender with cash collateral or other collateral of a type and value satisfactory to the Lender in an amount equal to the Borrower's outstanding Obligations to the Lender. With respect to such collateral (the "Collateral"), the Lender shall have the rights and remedies of a secured party under the Uniform Commercial Code ("UCC") and the Borrower agrees to execute and deliver to the Lender such security agreements and financing statements under the UCC as the Lender may require, and to pay the cost of filing the same. Any deposits or other sums at any time credited by or due from the Lender to the Borrower shall at all times constitute Collateral for the Obligations. The Lender may apply the net proceeds of any disposition of Collateral or set-off to the Obligations in such order as the Lender may determine, whether or not due. With respect to Obligations not yet due, including contingent Obligations, the Lender may at its option hold Collateral (including any proceeds thereof) until all such Obligations have been paid in full.

ARTICLE IX

MISCELLANEOUS

9.1 No Waiver, Remedies Cumulative. No failure on the part of the Lender to exercise and no delay in exercising any right hereunder shall operate as a waiver

thereof, nor shall any single or partial exercise of any right hereunder preclude any other or further exercise thereof or the exercise of any other right. The remedies herein provided are cumulative and are not exclusive of any remedies provided by law. Any condition or restriction imposed in this Agreement with respect to the Borrower may be waived, modified or suspended by the Lender but only on the Lender's prior action in writing and only as so expressed in such writing and not otherwise.

9.2 Survival of Representations, Etc. All representations, warranties and covenants made herein or in any Loan Document shall survive the delivery of the Note and the consummation of all other transactions contemplated hereby or thereby.

9.3 Right of Setoff. In addition to any rights now or hereafter granted under applicable law or otherwise and not by way of limitation of any such rights, upon the occurrence and during the unremedied continuation of an Event of Default, the Lender is hereby authorized at any time or from time to time, without presentment, demand, protest or other notice of any kind to the Borrower or to any other Person, any such notice being hereby expressly waived, to set off and to appropriate and apply any and all deposits (general or special) and any other indebtedness at any time held or owing by the Lender to or for the credit or the account of the Borrower against and on account of the Obligations and liabilities of the Borrower to the Lender under this Agreement or under any of the other Loan Documents, and all other claims of any nature or description arising out of or connected with this Agreement or any other Loan Document, irrespective of whether or not the Lender shall have made any demand hereunder and although said Obligations, liabilities or claims, or any of them, shall be contingent or unmatured.

9.4 Indemnity; Costs, Expenses and Taxes. The Borrower hereby agrees to indemnify the Lender and its legal representatives, successors, assigns and agents against, and agrees to protect, save and keep harmless each of them from and to pay upon demand, any and all liabilities, obligations, taxes (including any and all stamp and other taxes payable or determined to be payable in connection with the execution and delivery of any Loan Documents), liens, charges, losses, damages, penalties, claims, actions, suits, costs, indemnities, expenses and disbursements (including, without limitation, reasonable legal fees, costs and expenses, including without limitation reasonable costs of attending and preparing for depositions and other court proceedings), of whatsoever kind and nature, imposed upon, incurred by or asserted against such indemnified party in any way relating to or arising out of any of the transactions contemplated hereunder or in any of the Loan Documents (all of the foregoing, collectively, "Costs") except to the extent arising by reason of the Lender's gross negligence, misconduct or breach hereof. Without limiting the foregoing, the Borrower agrees to pay on demand (a) all out-of-pocket costs and expenses of the Lender in connection with the preparation, execution and delivery of this Agreement and any other Loan Documents, including without limitation the reasonable fees and

out-of-pocket expenses of Foley, Hoag & Eliot, special counsel for the Lender, with respect thereto, as well as (b) the reasonable fees and all out-of-pocket expenses of legal counsel, independent public accountants and other outside experts retained by the Lender in connection with any request by the Borrower for consents, waivers or other action or forbearance by the Lender hereunder, for the modification or amendment hereof, or other like matters relating to the administration of this Agreement; and (c) all reasonable costs and expenses, if any, of the Lender incurred after the occurrence of any Event of Default hereunder in connection with the enforcement of any of the Loan Documents or the protection of any of the Lender's rights thereunder, including, without limitation, any internal costs, including personnel costs of the Lender incurred in connection with such administration and enforcement or protection.

9.5 Notices.

(a) Unless telephonic notice is specifically permitted pursuant to the terms of this Agreement, any notice or other communication hereunder to any party hereto shall be by telegram, telecopier, telex, delivery in hand or by courier, or registered or certified mail (return receipt requested) and shall be deemed to have been given or made when telegraphed, telexed, telecopied (and confirmed received), delivered in hand or by courier, or three days after being deposited in the mails, postage prepaid, registered or certified, addressed to the party as follows (or at any other address that such party may hereafter specify to the other parties in writing):

(a) If to the Lender:

The First National Bank of Boston
100 Federal Street
Boston, Massachusetts 02110
Attn: Ms. Sharon A. Stone, Director
Telecopier No. (617) 434-4048

with a copy to:

Arlene L. Bender, Esq.
Foley, Hoag & Eliot
One Post Office Square
Boston, Massachusetts 02109
Telecopier No. (617) 832-7000

(b) If to the Borrower:

MKS Instruments, Inc.
Six Shattuck Road
Andover, Massachusetts 01810
Attn: Mr. Robert F. O'Brien, Treasurer
Telecopier No. (508) 975-3756

with a copy to:

Richard S. Chute, Esq.
Hill & Barlow
One International Place
Boston, Massachusetts 02110
Telecopier No. (617) 428-3500

9.6 MASSACHUSETTS LAW. THIS AGREEMENT AND EACH OF THE LOAN DOCUMENTS SHALL BE DEEMED A CONTRACT MADE UNDER THE LAW OF THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE GOVERNED BY, AND CONSTRUED AND ENFORCED IN ACCORDANCE WITH, THE INTERNAL LAWS OF SAID STATE (WITHOUT REGARD TO ITS PRINCIPLES OF CONFLICT OF LAWS).

9.7 Successors and Assigns. This Agreement shall be binding upon and shall inure to the benefit of the Borrower and the Lender, and their respective legal representatives, successors and assigns; provided that the Lender may assign its rights hereunder, but the Borrower may not assign any of its rights hereunder.

9.8 Counterparts. This Agreement may be executed in any number of counterparts and by different parties hereto in separate counterparts, each of which when so executed and delivered shall be deemed an original and all of which when taken together shall constitute one and the same instrument.

9.9 JURISDICTION, SERVICE OF PROCESS.

(a) ANY SUIT, ACTION OR PROCEEDING AGAINST THE BORROWER WITH RESPECT TO ANY OF THE LOAN DOCUMENTS OR ANY JUDGMENT ENTERED BY ANY COURT IN RESPECT OF ANY THEREOF SHALL BE BROUGHT IN THE COURTS OF THE COMMONWEALTH OF MASSACHUSETTS LOCATED IN SUFFOLK COUNTY OR IN THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF MASSACHUSETTS, AS THE LENDER (IN ITS SOLE DISCRETION) MAY ELECT, AND THE BORROWER HEREBY ACCEPTS THE EXCLUSIVE JURISDICTION OF SUCH COURTS FOR THE PURPOSE OF ANY SUIT,

ACTION OR PROCEEDING AND AGREES NOT TO ASSERT ANY CLAIM THAT IT IS NOT PERSONALLY SUBJECT TO THE JURISDICTION OF SUCH COURTS.

(b) IN ADDITION, THE BORROWER HEREBY IRREVOCABLY WAIVES, TO THE FULLEST EXTENT PERMITTED BY LAW, ANY OBJECTION IT MAY NOW OR HEREAFTER HAVE TO THE LAYING OF VENUE OF ANY SUIT, ACTION OR PROCEEDING ARISING OUT OF OR RELATING TO ANY OF THE LOAN DOCUMENTS OR ANY JUDGMENT ENTERED BY ANY COURT IN RESPECT THEREOF BROUGHT IN SUFFOLK COUNTY IN THE COMMONWEALTH OF MASSACHUSETTS, AND HEREBY FURTHER IRREVOCABLY WAIVES ANY CLAIM THAT ANY SUIT, ACTION OR PROCEEDING BROUGHT IN SUFFOLK COUNTY IN THE COMMONWEALTH OF MASSACHUSETTS HAS BEEN BROUGHT IN AN INCONVENIENT FORUM.

9.10 Limit on Interest. It is the intention of the Lender and the Borrower to comply strictly with all applicable usury laws; and, accordingly, in no event and upon no contingency shall the Lender ever be entitled to receive, collect, or apply as interest under the Note any interest, fees, charges or other payments equivalent to interest, in excess of the maximum rate that the Lender may lawfully charge under applicable statutes and laws from time to time in effect; and, in the event that the Lender ever receives, collects or applies as interest on the Note, any such excess, such amount that, but for this provision, would be excessive interest shall be applied to the reduction of the principal amount of the indebtedness evidenced by the Note; and, if the principal amount of indebtedness evidenced by the Note, and all lawful interest thereon, is paid in full, any remaining excess shall forthwith be paid to the Borrower, or other party lawfully entitled thereto. In determining whether or not the interest paid or payable, under any specific contingency exceeds the highest contract rate permitted by applicable law from time to time in effect, the Borrower and the Lender shall, to the maximum extent permitted under applicable law, characterize any non-principal payment as a reasonable loan charge, rather than as interest. Any provision of the Note, or of any other agreement between the Lender and the Borrower, that operates to bind, obligate, or compel the Borrower to pay interest in excess of such maximum lawful contract rate shall be construed to require the payment of the maximum rate only. The provisions of this Section 9.10 shall be given precedence over any other provisions contained in the Note or in any other agreement between the Lender and the Borrower that is in conflict with the provisions of this Section 9.10.

9.11 Amendments, Modifications, Waivers. Any term of this Agreement or of the Note may be amended and the observance of any term of this Agreement or of the Note may be waived (either generally or in a particular instance and either

retroactively or prospectively) only with the written consent of the Borrower and the Lender.

9.12 Headings. The headings of this Agreement are for convenience only and are not to affect the construction of or to be taken into account in interpreting the substance of this Agreement.

9.13 WAIVER OF NOTICE, ETC. THE BORROWER WAIVES DEMAND, NOTICE, PROTEST, NOTICE OF ACCEPTANCE OF THIS AGREEMENT, NOTICE OF LOANS MADE, CREDIT EXTENDED, COLLATERAL RECEIVED OR DELIVERED OR OTHER ACTION TAKEN IN RELIANCE HEREON AND ALL OTHER DEMANDS AND NOTICE OF ANY DESCRIPTION, EXCEPT AS REQUIRED HEREBY. WITH RESPECT BOTH TO THE OBLIGATIONS AND COLLATERAL, THE BORROWER ASSENTS TO ANY EXTENSION OR POSTPONEMENT OF THE TIME OF PAYMENT OR ANY OTHER INDULGENCE, TO ANY SUBSTITUTION, EXCHANGE OR RELEASE OF COLLATERAL, TO THE ADDITION OR RELEASE OF ANY PARTY OR PERSONS PRIMARILY OR SECONDARILY LIABLE, TO THE ACCEPTANCE OF PRETRIAL PAYMENT THEREON AND THE SETTLEMENT, COMPROMISING OR ADJUSTING OF ANY THEREOF, ALL IN SUCH MANNER AND AT SUCH TIME OR TIMES AS THE LENDER MAY DEEM ADVISABLE. THE BORROWER AGREES THAT NO ACTIONS TAKEN BY ANY PERSON EXCEPT THE LENDER SHALL IMPAIR OR OTHERWISE AFFECT ITS OBLIGATIONS HEREUNDER UNTIL ALL OBLIGATIONS OF THE BORROWER HEREUNDER ARE SATISFIED IN FULL.

9.14 WAIVER OF TRIAL BY JURY. THE BORROWER WAIVES ANY AND ALL RIGHTS THAT IT MAY HAVE TO A TRIAL BY JURY ON ANY CLAIM OR ACTION, OF ANY NATURE WHATSOEVER, RELATING TO OR ARISING OUT OF THIS AGREEMENT OR ANY OF THE OTHER LOAN DOCUMENTS.

9.15 Severability. In the event that any one or more of the provisions contained in this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision of this Agreement, but this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

9.16 Entire Agreement. This Agreement and the other Loan Documents constitute the full and entire understanding and agreement between the parties with regard to the subject matter hereof and thereof and shall supersede all prior agreements and understandings, whether written or oral, between the parties with respect to the subject matter hereof and thereof.

9.17 Compliance with Covenants. All computations determining compliance with Sections 6 and 7 shall utilize accounting principles in conformity with those used in the preparation of the financial statements referred to in Section 4.5. If any subsequent financial reports of the Borrower shall be prepared in accordance with accounting principles different from those used in the preparation of the financial statements referred to in Section 4.5, the Borrower shall inform the Lender of the changes in accounting principles and shall provide to the Lender with such reports, such supplemental reconciling financial information as may be required to ascertain compliance by the Borrower with the covenants contained in this document.

9.18 Termination. This Agreement may be terminated by the Borrower at any time upon written notice of such termination to Lender; provided, however, that, unless and until the Term Loan made by the Lender hereunder and all other obligations hereunder of the Borrower to the Lender existing (whether or not due as of the time of the receipt of such notice by the Lender shall have been paid in full, such termination shall in no way affect the rights and powers granted to the Lender in connection with this Agreement, and until such payment in full all rights and powers hereby granted to the Lender hereunder shall be and remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as an agreement under seal as of the date first above written.

MKS INSTRUMENTS, INC.

Witness:

/s/ Richard S Chute

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

MKS INSTRUMENTS, INC.

FIRST AMENDMENT

TO LOAN AGREEMENT

This First Amendment (the "Amendment") dated as of February 23, 1996 amends the Loan Agreement dated as of October 31, 1995, as amended (the "Loan Agreement"), between MKS Instruments, Inc. (the "Borrower") and The First National Bank of Boston (the "Lender"), capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower, the Lender and Chemical Bank shall enter into a loan agreement (the "1996 Loan Agreement") on the date hereof; and

WHEREAS, the Lender and the Borrower agree that certain terms of the Loan Agreement should be made consistent with similar terms in the 1996 Loan Agreement;

NOW, THEREFORE, the Lender and the Borrower agree as follows:

Section 1. Amendment to the Loan Agreement.

(a) Section 3.2.2. of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

3.2.2. The Lender will notify the Borrower of any event occurring after the date of this Agreement that will entitle the Lender to any additional payment under this Section 3.2 as promptly as practicable. The Lender will furnish to the Borrower with such notice a certificate signed by an officer of the Lender certifying that the Lender is entitled to payment under this Section 3.2 and setting forth the basis (in reasonable detail) and the amount of each request by the Lender for any additional payment pursuant to this Section 3.2. Such certificate shall be conclusive in the absence of manifest error. The Borrower shall not be obligated to compensate the Lender pursuant to this Section for amounts accruing prior to the date that is 180 days before the Lender notifies the Borrower of its obligations to compensate the Lender for such amounts.

(b) Sections 6.1(a) and 6.1(c) of the Loan Agreement are hereby amended by replacing the word "sixty" in each with the word "forty-five".

(c) Section 7.1(b) of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

7.1(b) Mergers, Etc. Neither the Borrower nor any Subsidiary will consolidate with or merge into any other Person or permit any other Person to consolidate with or merge into it, or acquire all or substantially all of the assets of any Person, or sell, assign, lease or otherwise dispose of (whether in one transaction or in a series of transactions) all or substantially all of its assets to any Person, except that

(1) a Subsidiary may consolidate with or merge into the Borrower or another Subsidiary; and

(2) the Borrower or any of its Subsidiaries may acquire all or substantially all of the assets of any Person provided (i) such Person is engaged in a line of business substantially similar to one or more of Borrower's existing lines of business, (ii) the aggregate purchase price liability incurred in any calendar year, including all contingent liabilities, when aggregated with all such acquisitions and any Investments permitted under Section 7.4(2) in any calendar year shall not exceed 25% of Consolidated Tangible Net Worth as of the end of the most recent fiscal quarter or, if 80% or more of the purchase price is paid in capital stock of the Borrower, 40% of Consolidated Tangible Net Worth as of the end of the most recent fiscal quarter and (iii) based on a pro forma calculation of the ratios set forth in Section 7.7 as of the date such acquisition is closed, assuming consolidation of the acquired business with the Borrower for the four full fiscal quarters ended immediately preceding such closing and pro forma debt and debt service payments based on scheduled principal payments, including acquisition borrowings, if any, and pro forma interest on total debt at then prevailing borrowing rates, Borrower is in compliance with the financial covenants set forth in Section 7.7.

(d) Section 7.2 of the Loan Agreement is hereby amended by deleting the existing clause (11) and substituting the following:

(11) Liens in respect of any purchase money obligations for tangible property used in its business, which obligations shall not at any time exceed 5% of Consolidated Tangible Net Worth, provided that any such encumbrances shall not extend to property and assets of the Borrower or any Subsidiary not financed by such a purchase money obligation;

(e) Section 7.3 of the Loan Agreement is hereby amended by adding the following words to the end thereof prior to the close parenthesis: "and transfers of capital equipment that will be leased pursuant to Financing Leases".

(f) Section 7.4 of the Loan Agreement is hereby amended by deleting the existing clause (2) and substituting the following:

(2) Investments in or to any Subsidiary or other Person, provided Borrower remains in compliance with Section 7.1(b);

and by deleting from clause (4) the word "\$100,000,000" and replacing it with the word "\$500,000,000".

(g) Section 7.7 of the Loan Agreement is hereby amended by deleting subsection (a) and replacing it with the following:

(a) Consolidated Tangible Net Worth. The Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower shall:

(A) prior to an IPO, not be less than the sum of (i) \$38,000,000, and (ii) 50% of Consolidated Net Income (excluding losses) for each consecutive fiscal quarter of the Borrower beginning with the quarter ending March 31, 1996, on a cumulative basis; and

(B) after an IPO, not be less than the sum of (i) the amount required by clause (A) above immediately prior to such IPO plus (ii) the net proceeds to the Borrower of the IPO less (iii) the Sub S Dividends.

For purposes of the foregoing, the following terms shall have the meanings indicated:

"IPO" shall mean the initial underwritten public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, covering the offer and sale of the Borrower's Common Stock for the account of the Borrower.

"Sub S Dividends" shall mean one or more distributions by the Borrower to its shareholders who were shareholders prior to the IPO in an aggregate amount equal to the Borrower's "accumulated adjustments account", as defined in Section 1368(a)(1) if the Internal Revenue Code of 1986, as of the date of the IPO.

(h) Section 8.1 of the Loan Agreement is hereby amended by replacing existing clause (i) with the following:

(i) There shall occur any default under any instrument or agreement evidencing any indebtedness for money borrowed in excess of \$100,000 by the Borrower or any of its Subsidiaries;

and by adding the following clauses (l) and (m) after clause (k):

(l) There shall occur any Event of Default under any other loan or credit agreement to which the Borrower and the Lender are parties;

(m) The transfer by John R. Bertucci and/or his Affiliates of securities of the Borrower or the voting power related to such securities as a result of which the power to elect, appoint or cause the election or appointment of at least a majority of the members of the board of directors of the Borrower shall no longer be held by John R. Bertucci and/or his Affiliates;

Section 2. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Amendment and the performance of this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 3. Conditions to Effectiveness. The effectiveness of this Amendment is conditioned on the following:

(a) The Borrower and the Lender shall each have executed and delivered a counterpart of this Amendment;

(b) The representations and warranties contained in Article IV of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof; and

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing.

Section 4. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or the words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF BOSTON

By: /s/ Sharon A. Stone

Title: Director

MKS INSTRUMENTS, INC.
WAIVER AND FOURTH AMENDMENT
TO LOAN AGREEMENT

This Waiver and Fourth Amendment (the "Waiver and Amendment") dated as of January 28, 1999 concerns the Loan Agreement dated as of October 31, 1995 (the "Loan Agreement"), between MKS Instruments, Inc. (the "Borrower") and BankBoston, N.A. (f/k/a The First National Bank of Boston, the "Lender"), as amended on February 23, 1996, February 4, 1997 and February 3, 1998. Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower has requested that the Lender waive certain Events of Default and agree to change certain financial covenants in the Loan Agreement; and

WHEREAS, the Lender is willing, on the terms, subject to the conditions and to the extent set forth below, to grant such a waiver and amend the Loan Agreement to effect such changes;

NOW, THEREFORE, the Lender and the Borrower agree as follows:

Section 1. WAIVER. The Lender hereby waives the Events of Default under Section 8.1(g), (j), (k) and (l) of the Loan Agreement resulting from Borrower's failure to meet the financial covenant set forth in Section 7.7(c) of the Loan Agreement as of the end of the fiscal quarter ended December 31, 1998.

Section 2. AMENDMENT OF THE LOAN AGREEMENT.

(a) Section 2.2.1. of the Loan Agreement is hereby amended by adding the following sentences at the end thereof:

Notwithstanding the preceding clauses (i) and (ii), from the date hereof through the date on which the effect of a change resulting from the Borrower's delivery of its financial statements and Compliance Certificate for the quarter ending June 30, 1999 will take effect, the only alternative to the Base Rate shall be the LIBOR Rate plus 1.65%.

The effect of any change to the Borrower's Debt-to-Net Worth Ratio or Cash Flow Ratio on the interest rate available pursuant to Section 2.2.1(i) or (ii) shall take effect on the first day of the month immediately following the month in which the Borrower delivers its financial statements pursuant to Section 6.1(a) or (b) and Compliance Certificate pursuant to Section 6.1(c).

(b) Section 7.7(c) of the Loan Agreement is hereby amended by adding the following clause at the end thereof:

provided, however, that as of the end of each of the fiscal quarters listed below, the Cash Flow Ratio shall not be less than the ratio stated directly below such quarter:

Q4 1998	Q1 1999	Q2 1999	Q3 1999
-----	-----	-----	-----
.6 to 1	.5 to 1	.5 to 1	1.1 to 1

provided, however, that, the foregoing notwithstanding, if the Cash Flow Ratio for the first fiscal quarter of 1999 is less than 1 to 1, then the Cash Flow Ratio for the second fiscal quarter of 1999 shall not be less than 1 to 1 and further, that the Cash Flow Ratio for the first and second fiscal quarters of 1999 shall mean the ratio as of the end of each such quarter of (i) Consolidated Operating Cash Flow for such fiscal quarter ended on such date to (ii) Consolidated Debt Service for such quarter and that the Cash Flow Ratio for the third fiscal quarter of 1999 shall mean the ratio as of the end of such quarter of (i) Consolidated Operating Cash Flow for the first three fiscal quarters of 1999 ended on such date to (ii) Consolidated Debt Service for such quarters.

(c) Section 7.7 of the Loan Agreement is hereby amended by adding the following subsection (d):

(d) EBIT-TO-INTEREST RATIO. The ratio of the sum of Consolidated Net Income plus Interest Expense, the interest portion of Financing Lease Obligations and all taxes in respect of income and profits paid or payable (including accrued Sub S distributions required to make shareholder tax payments) as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ended December 31, 1998 to Interest Expense during such quarter shall not be less than 2 to 1 for the fiscal quarters ending December 31, 1998 and March 31, 1999 and 3 to 1 for the fiscal quarters ending June 30, 1999 and September 30, 1999.

Section 3. FEES. The Borrower shall pay to the Lender a fee of \$5,000 on the date of this Waiver and Amendment.

Section 4. REPRESENTATIONS AND WARRANTIES. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Waiver and Amendment and the performance of this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated

hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Waiver and Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Waiver and Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 5. LOAN DOCUMENTS. This Waiver and Amendment shall be a Loan Document for all purposes.

Section 6. CONDITIONS TO EFFECTIVENESS. The effectiveness of this Waiver and Amendment is conditioned on the following:

(a) The Borrower and the Lender shall each have executed and delivered a counterpart of this Waiver and Amendment;

(b) The representations and warranties contained in Article IV of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof;

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing other than the Events of Default described in Section 1 hereof;

(d) The Lender shall have received, in form and substance satisfactory to the Lender:

(i) an opinion of independent counsel to the Borrower with respect to this Waiver and Amendment;

(ii) a certificate as to the Borrower's legal existence and good standing under the laws of The Commonwealth of Massachusetts and;

(iii) a certificate of the Borrower's Clerk as to (x) no changes in its charter documents and by-laws as amended, (y) corporate votes authorizing the execution and delivery of this Waiver and Amendment and (z) incumbency of the officers authorized to execute this Waiver and Amendment on behalf of the Borrower.

(e) The Borrower's audited consolidated financial statements for the year ended December 31, 1998 (the "1998 Statements") shall not differ in any materially adverse respect from the Borrower's unaudited consolidated financial statements for the year ended December 31, 1998, which the Borrower has provided to the Lender and upon which the Lender has relied in agreeing to this Waiver and Amendment and the Borrower shall deliver the 1998 Statements to the Lender no later than 30 days after the date of this Waiver and Amendment.

(f) The conditions set forth in Sections 5.2-5.5 of the Loan Agreement shall have been met as of the date hereof, provided that for purposes thereof and Section 4.5 of the Loan Agreement, the "Balance Sheet Date" shall mean December 31, 1998 and the financial statements referred to therein shall mean the unaudited statements for the year ended December 31, 1998, that have been furnished to the Lender.

Section 7. MISCELLANEOUS.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Waiver and Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Waiver and Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Waiver and Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ William P. Donlan

Title: Treasurer

BANKBOSTON, N.A.

By: /s/ Sharon A. Stone

Title: Director

LOAN AGREEMENT

This Loan Agreement (the "Agreement") is entered into as of the 1st day of November, 1993, by and between The First National Bank of Boston ("Lender") and MKS Instruments, Inc., a Massachusetts corporation ("Borrower").

PREMISES:

WHEREAS, the Borrower has requested that the Lender make loans to it; and

WHEREAS, the Lender is willing to lend funds to the Borrower on the terms and conditions hereinafter set forth;

NOW, THEREFORE, in consideration of the premises and for other good and valuable consideration, the adequacy and receipt of which are hereby acknowledged, the parties hereby agree as follows:

ARTICLE I

DEFINITIONS

1.1 Definitions. In addition to terms defined elsewhere in this Agreement, the following terms shall have the meanings indicated, which meanings shall be equally applicable to both the singular and plural forms of such terms:

1.1.1. "Advance" shall mean the drawing down by the Borrower of a Base Rate Loan, a LIBOR Loan or a Money Market Rate Loan on any given Advance Date.

1.1.2. "Advance Date" shall mean the date as of which an Advance is consummated.

1.1.3. "Affiliate" of any Person shall mean any other Person which, directly or indirectly, controls, or is controlled by, or is under common control with, such Person. For purposes of this definition, "control" of any Person shall mean the power, directly or indirectly, either to (i) vote 10% or more of the securities having ordinary voting power for the election of directors of such Person or (ii) direct the management and policies of such Person, whether by contract or otherwise. As to the Borrower, the term "Affiliate" shall include, without limitation, any partnership or joint venture of which the Borrower or any Affiliate of the Borrower is a general partner or is a limited partner with more than a ten percent (10%) interest, and any director or executive officer of the Borrower.

1.1.4. "Base Rate" shall mean the rate of interest announced by the Lender at its head office from time to time as its "Base Rate".

1.1.5. "Base Rate Loan" shall mean an Advance that is specified as such in the Notice of Borrowing with respect to such Advance and that bears interest as provided in Section 2.4.1 or a portion of the Term Loan as to which the Borrower elects to pay interest at the Base Rate as provided in Section 3.2.

1.1.6. "Borrowing" shall mean the incurrence of one or more Advances on a given date.

1.1.7. "Business Day" shall mean a day on which commercial banks are required to be open for business in Boston, Massachusetts.

1.1.8. "Cash Flow Ratio" shall have the meaning set forth in Section 8.7(c).

1.1.9. "Closing Date" shall mean the date of this Agreement.

1.1.10. "Compliance Certificate" shall have the meaning set forth in Section 7.1(c).

1.1.11. "Consolidated Debt Service" shall mean for any period the sum (without duplication) of Interest Expense, the interest portion of Financing Lease Obligations and required principal payments on long-term debt of the Borrower and its Subsidiaries, determined on a consolidated basis.

1.1.12. "Consolidated Indebtedness" shall mean the Indebtedness of the Borrower and its Subsidiaries, determined on a consolidated basis.

1.1.13. "Consolidated Net Income" shall mean for any period the net income (or loss) for such period (before extraordinary items and excluding the net income of any business entity that is not a Subsidiary in which the Borrower or one of its Subsidiaries has an ownership interest unless such net income shall have actually been received by such company in the form of cash distributions) of the Borrower and its Subsidiaries after deducting all operating expenses, depreciation and amortization, Interest Expense, the interest portion of Financing Lease Obligations, all taxes in respect of income and profits paid or payable (including accrued Sub S distributions required to make shareholder tax payments) and all other proper deductions, all determined on a consolidated basis.

1.1.14. "Consolidated Operating Cash Flow" shall mean for any period, the net income (or loss) for such period (before extraordinary items and excluding the net income of any business entity that is not a Subsidiary in which the Borrower or one of its Subsidiaries has an ownership interest unless such net income shall have actually been received by such company in the form of cash distributions) of the

Borrower and its Subsidiaries before deducting Interest Expense and taxes and after restoring thereto depreciation of real and personal property and leasehold improvements and amortization and after deducting cash taxes paid, Sub S distributions required to make shareholder tax payments, and capital expenditures incurred.

1.1.15. "Consolidated Tangible Net Worth" shall mean, at any time, net stockholders' equity of the Borrower and its Subsidiaries determined in accordance with generally accepted accounting principles including the book amount of all minority interests in MKS International, Inc. but excluding the book amount of all minority interests in other Affiliates and any foreign exchange translation adjustment, with no upward adjustments due to a reevaluation of assets (other than any such upward adjustment as may be required under generally accepted accounting principles in connection with the acquisition by the Borrower or any Subsidiary of another company or entity) minus the following items (without duplication of deductions) appearing on the balance sheet of the Borrower and its Subsidiaries:

(a) the book amount of all assets (including, without limitation, goodwill, patents, trademarks, copyrights, organizational expense and unamortized debt discount) that would be treated as intangibles under generally accepted accounting principles;

(b) treasury stock; and

(c) any write-up in the book amount of any asset or Investment subsequent to the Closing Date, resulting from a reevaluation or reappraisal thereof from the amount entered in accordance with generally accepted accounting principles by the Borrower or any Subsidiary on its books with respect to its acquisition of the asset or Investment.

1.1.16. "Costs" shall have the meaning set forth in Section 10.4.

1.1.17. "Debt-to-Net Worth Ratio" shall have the meaning set forth in Section 8.7(b).

1.1.18. "Default" shall mean any event that, with the lapse of time, the giving of notice, or both, would become an Event of Default hereunder.

1.1.19. "Event of Default" shall have the meaning set forth in Section 9.1 hereof.

1.1.20. "Financing Lease" shall mean any lease of the Borrower or a Subsidiary, as lessee, that is shown or is required to be shown in accordance with

generally accepted accounting principles as a liability on the balance sheet of the lessee thereunder.

1.1.21. "Financing Lease Obligation" shall mean for any period the monetary obligation of the lessee under a Financing Lease. The amount of a Financing Lease Obligation at any date is the amount at which the lessee's liability under the Financing Lease would be required to be shown on its balance sheet at such date.

1.1.22. "Hazardous Substances" shall mean any hazardous waste, as defined by 42 U.S.C. Section 6903(5), any hazardous substances, as defined by 42 U.S.C. Section 9601(14), any pollutant or contaminant, as defined by 42 U.S.C. Section 9601(33), or any toxic substance, oil or hazardous materials or other chemicals or substances regulated by any laws or regulations relating to the discharge of air pollutants, water pollutants, or processed wastewater.

1.1.23. "Indebtedness" shall mean, for any Person, (a) all obligations of such Person that in accordance with generally accepted accounting principles would be reflected on the balance sheet of such Person as a liability, (b) all obligations of any other Person the payment or collection of which such Person has guaranteed (except by reason of endorsement for collection in the ordinary course of business) or in respect of which such Person is liable, contingently or otherwise, including, without limitation, liable by way of agreement to purchase, to provide funds for payment, to supply funds to or otherwise to invest in such other Person, or otherwise to assure a creditor against loss, (c) all obligations of any other Person for borrowed money or for the deferred purchase price of property or services secured by (or for which the holder of such indebtedness has an existing right, contingent or otherwise, to be secured by) any mortgage, or other encumbrance upon or in property (including, without limitation, accounts and contract rights) owned by such Person, whether or not such Person has assumed or become liable for the payment of such indebtedness or obligations, and (d) Financing Lease Obligations of such Person.

1.1.24. "Interest Expense" shall mean for any period the aggregate amount of interest recorded, in accordance with generally accepted accounting principles, on the financial statements for that period by the Borrower and its Subsidiaries in respect of Consolidated Indebtedness incurred for borrowed money.

1.1.25. "Interest Period" shall mean the period designated by the Borrower as such in the Notice of Borrowing with respect to any LIBOR Loan or Money Market Rate Loan pursuant to and subject to the limitations set forth in Section 2.5 or in the Interest Rate Change Notice for any portion of the Term Loan pursuant to and subject to the limitations set forth in Section 3.2.

1.1.26. "Interest Rate Change Notice" shall have the meaning set forth in Section 3.2.

1.1.27. "Interest Rate Determination Date" shall mean the third Business Day prior to the first day of the related Interest Period for a LIBOR Loan and the first day of the related Interest Period for a Money Market Rate Loan or the determination of the Long Term Funds Rate.

1.1.28. "Interim Maturity Date" shall mean the last day of any Interest Period.

1.1.29. "Investments" shall have the meaning set forth in Section 8.4.

1.1.30. "LIBOR Loan" shall mean an Advance that is specified as such in the Notice of Borrowing with respect to such Advance and that bears interest at the rate provided in Section 2.4.2. or a portion of the Term Loan as to which the Borrower elects to pay interest using the LIBOR Rate as provided in Section 3.2.

1.1.31. "LIBOR Rate" shall mean for any Interest Rate Determination Date, the rate obtained by dividing (i) the quotation offered by the Lender in the interbank Eurodollar market for U.S. dollar deposits of amounts in immediately available funds comparable to the principal amount of the LIBOR Loan or the portion of the Term Loan for which the LIBOR Rate is being determined with a maturity comparable to the Interest Period for which such LIBOR Rate will apply as of approximately noon (Boston time) three Business Days prior to the commencement of such Interest Period by (ii) a percentage equal to 100% minus the stated maximum rate of all reserves required to be maintained against "Eurocurrency liabilities" as specified in Regulation D (or against any other category of liabilities that includes deposits by reference to which the interest rate on LIBOR Loans is determined) as applicable on such date to any member bank of the Federal Reserve System.

1.1.32. "Licenses" shall have the meaning set forth in Section 5.8.

1.1.33. "Lien" shall mean any interest in property securing an obligation owed to, or a claim by, a Person other than the owner of the property, whether the interest is based on common law, statute or contract (including the security interest lien arising from a mortgage, encumbrance, pledge, conditional sale or trust receipt or a lease, consignment or bailment for security purposes). For the purposes of this Agreement, the Borrower or a Subsidiary shall be deemed to be the owner of any property that it has acquired or holds subject to a Financing Lease or a conditional sale agreement or other arrangement pursuant to which title to the property has been retained by or vested in some other Person for security purposes, and such retention or vesting shall be deemed to be a Lien.

1.1.34. "Loan Documents" shall mean each of this Agreement, the Notes, the Mortgage and any other document or instrument executed by the Borrower in favor of the Lender in connection with the transactions contemplated hereby.

1.1.35. "Long Term Funds Loan" shall mean the portion of the Term Loan as to which the Borrower elects to pay interest using the Long Term Funds Rate as provided in Section 3.2.

1.1.36. "Long Term Funds Rate" shall mean for any Interest Rate Determination Date, the rate of interest quoted by the Lender in Boston on such date in its sole discretion (it being understood that the Lender is under no obligation to quote such rates) to the Borrower as the fixed rate of interest at which it is willing to make a Long Term Funds Loan in the amount equal to the portion of the Term Loan for which this rate is requested by the Borrower with a maturity equal to the Interest Period requested.

1.1.37. "Money Market Rate" shall mean for any Interest Rate Determination Date, the rate of interest quoted by the Lender in Boston on such date in its sole discretion (it being understood that the Lender is under no obligation to quote such rates) to the Borrower as the fixed rate of interest at which it is willing to make a Money Market Rate Loan in the amount and for the Interest Period requested by the Borrower.

1.1.38. "Money Market Rate Loan" shall mean an Advance that is specified as such in the Notice of Borrowing with respect to such Advance and that bears interest at the rate provided in Section 2.4.3 hereof.

1.1.39. "Notes" shall mean the Revolving Credit Note and the Term Note.

1.1.40. "Mortgage" shall have the meaning set forth in Section 6.2.

1.1.41. "Notice of Borrowing" shall have the meaning set forth in Section 2.2.1.

1.1.42. "Obligations" shall mean, without limitation, any and all liabilities, debts, and obligations of the Borrower to the Lender, of each and every kind, nature and description, under this Agreement, any other Loan Document, the Foreign Exchange Agreement, and any interest rate swap agreement, whether now existing or hereafter incurred. "Obligations" also means, without limitation, any and all obligations of the Borrower to act or to refrain from acting in accordance with the terms, provisions and covenants of this Agreement or of any other Loan Document.

1.1.43. "Permitted Liens" shall have the meaning set forth in Section 8.2.

1.1.44. "Person" shall mean any natural person, corporation, unincorporated organization, trust, joint-stock company, joint venture, association, company, partnership or government, or any agency or political subdivision of any government.

1.1.45. "Property" shall have the meaning set forth in Section 6.2(f).

1.1.46. "Revolver Termination Date" shall mean June 30, 1994 or any subsequent anniversary thereof if the Revolving Credit Loan shall have been renewed by the Lender.

1.1.47. "Revolving Credit Loan" shall mean the demand discretionary revolving credit loan in an amount up to the amount of \$7,000,000 extended or to be extended by the Lender to the Borrower on the terms and conditions set forth herein.

1.1.48. "Revolving Credit Note" shall have the meaning set forth in Section 2.3.

1.1.49. "Revolving Loan Account" shall mean the account on the books of the Lender in the name of the Borrower in which the following shall be recorded: Advances made by the Lender to and for the account of the Borrower pursuant to Section 2 of this Agreement; all other charges, expenses and other items properly chargeable to the Borrower with respect to such Advances; all Costs with respect to such Advances; all payments made by the Borrower on account of indebtedness evidenced by the Revolving Credit Note; and other appropriate debits and credits.

1.1.50. "Subsidiary" shall mean any Person of which the Borrower at the time owns, directly or indirectly, through another Subsidiary or otherwise, 50% or more of the equity interests.

1.1.51. "Term Loan" shall have the meaning set forth in Section 3.1.

1.1.52. "Term Loan Maturity Date" shall mean the seventh anniversary of the date of this Agreement.

1.1.53. "Term Note" shall have the meaning set forth in Section 3.1.

1.1.54. "Term Loan Account" shall mean the account on the books of the Lender in the name of the Borrower in which the following shall be recorded: the principal outstanding and interest accrued under the Term Loan; all Costs with

respect to the Term Loan; all payments made by the Borrower on account of indebtedness evidenced by the Term Note; and other appropriate debits and credits.

1.2 Accounting Terms. Accounting terms not specifically defined in this Agreement shall have the meanings given to them under generally accepted accounting principles.

1.3 Other Definitional Provisions. The words "hereof," "herein" and "hereunder," and words of similar import when used in this Agreement shall refer to this Agreement as a whole and not any particular provision of this Agreement. Any Article, Section, Exhibit or Schedule references are to this Agreement unless otherwise specified.

ARTICLE II

REVOLVING CREDIT LOAN

2.1 Revolving Credit. Subject to the terms and conditions of this Agreement, the Lender hereby agrees to make Advances from time to time to the Borrower during the period from the date hereof to the Revolver Termination Date (or such earlier date on which the Lender shall have demanded payment of the Revolving Credit Note) in an aggregate outstanding amount not to exceed at any time \$7,000,000. The Lender shall have the absolute discretion to make such Advances as it deems appropriate and to demand re-payment of Advances at any time. Each Advance shall, at the option of the Borrower, be a Base Rate Loan, a LIBOR Loan or a Money Market Rate Loan provided, however, that no LIBOR Loan or Money Market Rate Loan shall be made at any time in a principal amount of less than \$1,000,000.

2.2 Notice of Borrowing.

2.2.1. Whenever the Borrower desires to obtain a LIBOR Loan or a Money Market Rate Loan hereunder, it may request that the Lender provide quotes as of any specified Interest Rate Determination Date as to the LIBOR Rate and/or the Money Market Rate for any or all Interest Periods, and the Lender shall promptly provide such quotes. The Borrower shall give the Lender prior telecopied or telephone notice (given not later than 10:00 a.m. (Boston time)) on the day of any Borrowing with respect to a Base Rate Loan or a Money Market Rate Loan and at least three Business Days prior to, the day of any Borrowing with respect to a LIBOR Loan. Each such notice (each a "Notice of Borrowing") shall specify the principal amount of each Advance to be made, the date of the Borrowing (which shall be a Business Day), whether each Advance being made is to be initially maintained as a Base Rate Loan, a LIBOR Loan or a Money Market Rate Loan and, in the case of a LIBOR Loan or Money Market Rate Loan, the initial Interest Period applicable

thereto. If such notice is given by telephone, it shall be immediately confirmed in writing. No more than one Base Rate Loan shall be outstanding at any time, but the Borrower may increase the principal amount of any Base Rate Loan at any time by giving a Notice of Borrowing as set forth above.

2.2.2. Upon the Interim Maturity Date of any LIBOR Loan or Money Market Rate Loan, unless the Borrower (i) shall have given the Lender a Notice of Borrowing in accordance with Section 2.2.1 requesting that a new LIBOR Loan or Money Market Rate Loan be made on such Interim Maturity Date or (ii) shall have repaid such LIBOR Loan or Money Market Rate Loan on such Interim Maturity Date, the Borrower shall be deemed to have requested that the Lender make a Base Rate Loan to the Borrower on such Interim Maturity Date in an aggregate principal amount equal to the aggregate principal amount of the LIBOR Loan or Money Market Rate Loan maturing on such Interim Maturity Date.

2.3 Revolving Loan Account. The Advances made by the Lender from time to time to the Borrower under this Agreement shall be evidenced by the Revolving Credit Note in the form of Exhibit A hereto (the "Revolving Credit Note"). The Advances and the amounts of all payments on the Revolving Credit Note shall be recorded by the Lender in the Revolving Loan Account of the Borrower. The debit balance of the Revolving Loan Account shall represent the amount of the Borrower's indebtedness to the Lender from time to time by reason of Advances and other appropriate charges hereunder. All statements regarding the Revolving Loan Account shall be deemed to be accurate absent manifest error or unless objected to by the Borrower within 30 days after receipt. The Borrower agrees to review each such statement promptly after receipt and to bring any errors or discrepancies to the Lender's attention promptly.

2.4 Interest.

2.4.1. The Borrower agrees to pay interest in respect of the unpaid principal amount of each Base Rate Loan from the date the proceeds thereof are made available to the Borrower until maturity (whether by acceleration, voluntary prepayment or otherwise) at a rate per annum that shall be the Base Rate in effect from time to time.

2.4.2. The Borrower agrees to pay interest in respect of the unpaid principal amount of each LIBOR Loan from the date the proceeds thereof are made available to the Borrower until maturity (whether by acceleration, voluntary prepayment or otherwise) at a rate per annum equal to the LIBOR Rate plus 1.25%.

2.4.3. The Borrower agrees to pay interest in respect of the unpaid principal amount of each Money Market Rate Loan from the date the proceeds thereof are made available to the Borrower until maturity (whether by acceleration,

voluntary prepayment or otherwise) at a rate per annum equal to the Money Market Rate.

2.4.4. Overdue principal and (to the extent permitted by law) overdue interest in respect of each Base Rate Loan, each LIBOR Loan and each Money Market Rate Loan (to the extent not converted into a Base Rate Loan) shall bear interest, payable on demand, after as well as before judgment, at a rate per annum equal to the Base Rate in effect from time to time plus 3% per annum.

2.4.5. Interest shall accrue from and including the date of any Advance and shall be payable by the Borrower monthly in arrears on the last day of each month and on any prepayment (on the amount prepaid), at maturity (whether by acceleration, voluntary prepayment or otherwise), and after such maturity, on demand. Interest shall be calculated on the basis of actual days elapsed and a 360-day year.

2.5 Interest Periods. At the time it gives any Notice of Borrowing with respect to a LIBOR Loan or a Money Market Rate Loan, the Borrower shall elect the Interest Period applicable to the related Advance, which Interest Period shall, at the option of the Borrower, be a period of 30, 60, 90, 120, 150 or 180 days (as to a LIBOR Loan) or any period up to 90 days (as to a Money Market Rate Loan). Notwithstanding anything to the contrary contained herein:

(i) if any Interest Period begins on a day for which there is no numerically corresponding day in the calendar month at the end of such Interest Period, such Interest Period shall end on the last Business Day of such calendar month;

(ii) if any Interest Period would otherwise expire on a day that is not a Business Day, such Interest Period shall expire on the next succeeding Business Day; provided that if any Interest Period would otherwise expire on the day that is not a Business Day but is a day of the month after which no further Business Day occurs in such month, such Interest Period shall expire on the next preceding Business Day;

(iii) no Interest Period shall extend beyond the Revolver Termination Date.

2.6 Termination of Existing Loans. On the Closing Date the letter agreement between the Borrower and the Lender dated as of July 15, 1992, as amended, shall terminate and be of no further force and effect.

ARTICLE III

TERM LOAN

3.1 Refinancing. The Lender shall refinance its existing loans to the Borrower evidenced by Floating Rate Mortgage Notes dated May 20, 1987, January 6, 1988 and January 30, 1989, under which a total of \$9,550,090.75 in principal plus accrued but unpaid interest is currently outstanding by converting such Loans into a seven-year term loan (the "Term Loan") in the principal amount of \$10,000,000. The Lender shall advance the difference between \$10,000,000 and \$9,432,124.08 to the Borrower on the Closing Date. The Term Loan shall be evidenced by a term note (the "Term Note") payable to the Bank in the form of Exhibit B hereto. Amortization of the Term Note shall be calculated on the basis of a 15-year schedule of level monthly payments of principal with the entire unpaid principal balance and all accrued and unpaid interest absolutely due and payable on the Maturity Date.

3.2 Interest.

3.2.1. The Borrower agrees to pay interest in respect of the unpaid principal amount of the Term Loan from the date of this Agreement until paid in full as follows. The Term Loan shall bear interest at the Base Rate unless the Borrower desires to pay interest on all or a portion of the Term Loan at one of the following rates:

(i) During any period in which the Borrower maintains a Cash Flow Ratio in excess of 1.35 to 1 and a Debt-to-Net Worth Ratio not in excess of 1.35 to 1:

- (a) the LIBOR Rate Plus 1.75% or
- (b) the Long Term Funds Rate plus 1.75%.

(ii) During any period in which the Borrower maintains a Cash Flow Ratio of 1.35 to 1 or less or a Debt-to-Net Worth Ratio-of 1.35 to 1 or more:

- (a) the LIBOR Rate plus 2.10% or
- (b) the Long Term Funds Rate plus 2.10%.

3.2.2. Whenever the Borrower desires to obtain an interest rate other than the Base Rate, it may request that the Lender provide quotes as of any specified Interest Rate Determination Date as to the LIBOR Rate and/or the Long Term Funds

Rate for any or all Interest Periods, and the Lender shall promptly provide such quotes. The Borrower shall give the Lender prior telecopied or telephone notice (given not later than 10:00 a.m. (Boston time)) on the day the Interest Period is to begin with respect to use of the Long Term Funds Rate and at least three Business Days prior to the day the Interest Period is to begin with respect to use of the LIBOR Rate. Each such notice (each an "Interest Rate Change Notice") shall specify the desired interest rate, the amount of the Term Loan to which such interest rate shall apply and the initial Interest Period applicable thereto. If such notice is given by telephone, it shall be immediately confirmed in writing.

3.2.3. Upon the Interim Maturity Date of any LIBOR Loan or Long Term Funds Loan, unless the Borrower shall have given the Lender an Interest Rate Change Notice in accordance with Section 3.2.2 requesting a new LIBOR Loan or Long Term Funds Loan be made on such Interim Maturity Date, the Borrower shall be deemed to have elected to pay interest on such amount of the Term Loan at the Base Rate.

3.2.4. At the time the Borrower gives any Interest Rate Change Notice, the Borrower shall elect the Interest Period for which the interest rate elected shall apply, which Interest Period shall, at the option of the Borrower, be a period of 30, 60, 90, 120, 150 or 180 days (as to a LIBOR Loan) or any period (as to a Long Term Funds Loan). Notwithstanding anything to the contrary contained herein, the provisions set forth in subparagraphs (i) - (iii) of Section 2.5 shall apply to the determination of an Interest Period.

3.3 Term Loan Account. The principal and the amounts of all payments on the Term Note shall be recorded by the Lender in the Term Loan Account of the Borrower. All statements regarding the Term Loan Account shall be deemed to be accurate absent manifest error or unless objected to by the Borrower within 30 days after receipt. The Borrower agrees to review each such statement promptly after receipt and to bring any errors or discrepancies to the Lender's attention promptly.

ARTICLE IV

ADDITIONAL TERMS

4.1 Payments.

4.1.1. The Borrower shall have the right to prepay the Notes, in whole at any time or in part from time to time, without premium or penalty, provided that, no Money Market Loan may be prepaid and, except as set forth in Section 4.3, no other Advance, either in whole or in part, may be prepaid on the Advance Date of such Advance and no portion of the Term Loan may be prepaid on the first day of an Interest Period with respect thereto. The Borrower shall give notice (by telex or

telecopier, or by telephone (confirmed in writing promptly thereafter)) to the Lender of each proposed pre-payment hereunder prior to 10:00 a.m. (Boston time), (x) with respect to Base Rate Loans and Long Term Funds Loans, upon the Business Day of the proposed prepayment and (y) with respect to LIBOR Loans, at least three Business Days prior to the Business Day of the proposed prepayment, which notice in each case shall specify the proposed prepayment date (which shall be a Business Day), the aggregate principal amount of the proposed prepayment and which Advances or portions of the Term Loan, as the case may be, are to be prepaid. LIBOR Loans and Long Term Funds Loans that are voluntarily prepaid before the last day of the applicable Interest Period shall be subject to the additional compensation requirements set forth in Sections 4.3 and 4.4, and each prepayment of a LIBOR Loan or a Long Term Funds Loan shall be in an aggregate principal amount of not less than the total principal amount outstanding at such time under such Loan. If at any time the outstanding principal amount of the Advances exceeds \$7,000,000, the Borrower will immediately prepay the Advances by the amount of such excess.

4.1.2. All payments of principal and interest due under the Notes (including prepayments), and any other amounts owing to the Lender under this Agreement shall be made by the Borrower not later than 3:00 p.m., Boston time, on the day due in lawful money of the United States of America to the Lender at its Boston, Massachusetts office in immediately available funds. The Borrower hereby authorizes the Lender to charge such payments as they become due, if not otherwise paid by the Borrower, to any account of the Borrower with the Lender as the Lender may elect.

4.1.3. Whenever any payment to be made hereunder or under any other Loan Document shall be stated to be due on a day that is not a Business Day, such payment may be made on the next succeeding Business Day, and such extension of time shall in such case be included in computing interest or other fees or charges provided for under this Agreement or any other Loan Document; provided, however, that with respect to LIBOR Loans, if the next succeeding Business Day falls in another calendar month, such payment shall be made on the next preceding Business Day.

4.1.4. All payments made by the Borrower on each Note shall be applied by the Lender (a) first, to the payment of Costs with respect to such Note, (b) second, to the payment of accrued and unpaid interest on such Note, in such order as the Borrower shall direct, until all such accrued interest has been paid, and (c) third, to the payment of the unpaid principal amount of such Note in such order as the Borrower shall direct.

4.2 Capital Adequacy.

4.2.1. If, after the date of this Agreement, the Lender shall have reasonably determined in good faith that the adoption or effectiveness after the date

hereof of any applicable law, rule or regulation regarding capital adequacy, or any change therein, or any change in the interpretation or administration thereof by any governmental authority, central bank or comparable agency charged with the interpretation or administration thereof, or compliance by the Lender with any request or directive regarding capital adequacy (whether or not having the force of law) of any such authority, central bank or comparable agency, has or would have the effect of materially reducing the rate of return on the Lender's capital or assets as a consequence of its commitments or obligations hereunder to a level below that which the Lender could have achieved but for such adoption, effectiveness, change or compliance (taking into consideration the Lender's then current policies with respect to capital adequacy), then from time to time, subject to Section 4.2.2, within 15 days after demand by the Lender the Borrower shall pay to the Lender such additional amount or amounts as will compensate the Lender for such reduction (after the Lender shall have allocated the same fairly and equitably among all of its customers or any class generally affected thereby).

4.2.2. The Lender will notify the Borrower of any event occurring after the date of this Agreement that will entitle the Lender to any additional payment under this Section 4.2 as promptly as practicable and shall be entitled to such payment (a) in the case of a Base Rate Loan, only for costs incurred from and after the date that the Lender gives such notice, and (b) in the case of a Money Market Rate Loan, LIBOR Loan or Long Term Funds Loan, only for costs incurred in connection with Loans made pursuant to a Notice of Borrowing or Interest Rate Change Notice issued after the date that the Lender gives such notice. The Lender will furnish to the Borrower with such notice a certificate signed by an officer thereof certifying that the Lender is entitled to payment under this Section 4.2 and setting forth the basis (in reasonable detail) and the amount of each request by the Lender for any additional payment pursuant to this Section 4.2.

4.3 Special Provisions Governing LIBOR Loans. Notwithstanding any other provisions of this Agreement, the following provisions shall govern with respect to LIBOR Loans as to the matters covered:

4.3.1. Increased Costs, Illegality. etc.

(a) In the event that the Lender shall have determined (which determination shall, if made in good faith and absent manifest error, be final, conclusive and binding upon all parties):

(i) on any Interest Rate Determination Date, that by reason of any changes arising after the date of this Agreement affecting the interbank Eurodollar market, adequate and fair means do not exist for ascertaining the applicable interest rate on the basis provided for in the definition of LIBOR Rate; or

(ii) at any time during any Interest Period, that the Lender shall incur increased costs or reductions in the amounts received or receivable hereunder with respect to a LIBOR Loan by reason of (x) any change since the Interest Rate Determination Date for the Interest Period in question in any applicable law or governmental rule, regulation, guideline or order (or any interpretation thereof and including the introduction of any new law or governmental rule, regulation, guideline or order) (such as, for example but not limited to, a change in official reserve requirements, but excluding reserve requirements that have been included in calculating the LIBOR Rate for such Interest Period) and/or (y) other circumstances affecting the Lender, the interbank Eurodollar market or the position of the Lender in the relevant market; or

(iii) at any time, that the making or continuance of any LIBOR Loan has become unlawful by compliance by the Lender in good faith with any law, governmental rule, regulation, guideline or order, or has become impracticable as a result of a contingency occurring after the date of this Agreement;

then and in any such event, the Lender shall promptly after making such determination give notice (by telephone confirmed in writing) to the Borrower of such determination. Thereafter (x) in the case of clause (i) above, any Notice of Borrowing given by the Borrower with respect to a LIBOR Loan that has not yet been incurred shall be deemed rescinded by the Borrower and LIBOR Loans shall no longer be available until such time as the Lender notifies the Borrower that the circumstances giving rise to such notice no longer exist or that, notwithstanding such circumstances, LIBOR Loans will again be made available hereunder, (y) in the case of clause (ii), the Borrower shall pay to the Lender, upon written demand therefor (but only with respect to any LIBOR Loan made pursuant to a Notice of Borrowing issued after the giving of the written notice that LIBOR Loans will again be made available hereunder referred to in clause (x) above), such additional amounts (in the form of an increased rate of, or a different method of calculating, interest or otherwise as the Lender in its sole discretion shall determine) as shall be required to compensate the tender for such increased cost or reduction in amount received (a written notice as to additional amounts owed the Lender, showing the basis for such calculation thereof, shall be given to the Borrower by the Lender and shall, absent manifest error, be final, conclusive and binding upon the parties hereto), and (z) in the case of clause (iii), the Borrower shall take one of the actions specified in Section 4.3.1(b) as promptly as possible and, in any event, within the time period required by law.

(b) At any time that any LIBOR Loan is affected by the circumstances described in Section 4.3.1(a) (ii) or (iii), the Borrower may (and in the case of a LIBOR

Loan affected pursuant to Section 4.3.1(a)(iii) shall either (x) if the affected LIBOR Loan is then being made, withdraw the related Notice of Borrowing by giving the Lender telephonic (confirmed in writing) notice thereof on the same date that the Borrower was notified by the Lender pursuant to Section 4.3.1(a), or (y) if the affected LIBOR Loans are then outstanding, upon at least three Business Days' written notice to the Lender, require the Lender to convert each LIBOR Loan so affected into a Base Rate Loan.

4.3.2. Compensation. The Borrower shall compensate the Lender, upon its written request (which request shall set forth the basis for requesting such amounts), for all reasonable losses, expenses and liabilities (including, without limitation, any interest paid by the Lender to lenders of funds borrowed by it to make or carry its LIBOR Loans to the extent not recovered by the Lender in connection with the re-employment of such funds) and any loss sustained by the Lender in connection with the re-employment of the funds (including, without limitation, a return on such re-employment that would result in the Lender's receiving less than it would have received had such LIBOR Loan remained outstanding until the last day of the Interest Period applicable to such LIBOR Loan) that the Lender may sustain: (i) if for any reason (other than a default by or negligence of the Lender) a LIBOR Loan is not advanced on a date specified therefor in a Notice of Borrowing (unless timely withdrawn pursuant to Section 4.3.1(b)(x) above), (ii) if any payment or prepayment of any LIBOR Loans occurs for any reason whatsoever (including, without limitation, by reason of Section 4.3.1(b)) on a date that is prior to the last day of an Interest Period applicable thereto, (iii) if any prepayment of any of its LIBOR Loans is not made on the date specified in a notice of payment given by the Borrower pursuant to Section 4.1 or (iv) as a consequence of an election made by the Borrower pursuant to Section 4.3.1(b)(y).

4.4 Special Provisions Governing Money Market Rate Loans and Long Term Funds Loans. Notwithstanding other provisions of this Agreement, the following provisions shall govern with respect to Money Market Rate Loans and Long Term Funds Loans as to the matters covered:

4.4.1. Costs of Lender. In the event that at any time the Money Market Rate or the Long Term Funds Rate does not reflect the cost to the Lender of the maintenance of reserves in respect of any Money Market Rate Loan or Long Term Funds Loan, as the case may be (including, without limitation, any marginal, emergency, supplemental, special or other reserves but excluding reserves required under Regulation D to the extent included in the computation of such interest rate), then upon delivery of a certificate signed by an officer of the Lender certifying that the Lender is entitled to payment under this Section 4.4.1 and showing the basis in reasonable detail for the Lender's request, the Borrower shall pay to the Lender with respect to any Money Market Rate Loan or Long Term Funds Loan made pursuant to a Notice of Borrowing or Interest Rate Change Notice, as the case may be, issued

after the date of delivery of such certificate additional interest in such amounts as shall be required to compensate the Lender for the additional cost as determined by the Lender with respect to such Money Market Rate Loan or Long Term Funds Loan. A certificate of the Lender as to any amount payable pursuant to this paragraph shall, absent manifest error, be final, conclusive and binding upon all parties hereto.

4.4.2. Compensation. The Borrower shall compensate the Lender, upon written request by the Lender (which request shall set forth the basis for requesting such compensation), for all reasonable losses, expenses and liabilities (including, without limitation, any loss, expense or liability incurred by reason of the liquidation or reemployment of deposits or other funds required by the Lender to fund its Money Market Rate Loans and/or Long Term Funds Loans to the Borrower), which the Lender may sustain with respect to Money Market Rate Loans and/or Long Term Funds Loans to the Borrower: (i) if for any reason (other than a default by the Lender) a borrowing of any Money Market Rate Loan or Long Term Funds Loan does not occur on a date specified therefor in a Notice of Borrowing or Interest Rate Change Notice, as the case may be (whether or not withdrawn by the Borrower or because an Event of Default is then in existence), (ii) if any repayment or conversion of any Money Market Rate Loan or Long Term Funds Loan occurs on a date that is prior to the last day of the Interest Period applicable to that Loan, or (iii) if any prepayment of any Long Term Funds Loan is not made on any date specified in a notice of prepayment given by the Borrower.

ARTICLE V

REPRESENTATIONS AND WARRANTIES OF THE BORROWER

In order to induce the Lender to enter into this Agreement and to make the loans provided for herein, the Borrower makes the following representations and warranties to the Lender, all of which shall survive the execution and delivery of this Agreement and the Notes.

5.1 Organization, Existence and Power. The Borrower is duly incorporated, validly existing and in good standing under the laws of the jurisdiction of its incorporation. The Borrower has the corporate power necessary to conduct the business in which it is engaged, to own the properties owned by it and to consummate the transactions contemplated by the Loan Documents. The Borrower is duly qualified or licensed to transact business in all places where the nature of the properties owned by it or the business conducted by it makes such qualification necessary and where the failure to be so qualified or licensed would have a material adverse effect upon the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole.

5.2 Authorization of Loan Documents; Binding Effect. The execution and delivery of this Agreement and the other Loan Documents and the performance of the transactions contemplated hereby and thereby have been duly authorized by all necessary corporate actions of the Borrower. Each of the Loan Documents constitutes the legal, valid and binding obligation of the Borrower that is a party thereto, enforceable against the Borrower in accordance with its terms.

5.3 Authority. The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under the Loan Documents. Neither the authorization, execution, delivery, or performance by the Borrower of this Agreement or of any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

5.4 Capital Structure. The number of shares of stock of which the Borrower's authorized capital stock consists, the par value per share of such stock, the number of shares of such stock that have been issued and are outstanding and the number of shares that have been issued and are held by the Borrower as treasury shares are all disclosed on the Disclosure Schedule. Set forth in the Disclosure Schedule is a complete and accurate list of all Subsidiaries of the Borrower. The Disclosure Schedule indicates the jurisdiction of incorporation or organization of each of the Subsidiaries, the number of shares or units of each class of capital stock or other equity of the Subsidiaries authorized, and the number of such shares or units outstanding and the percentage of each class of such equity owned (directly or indirectly) by the Borrower. No shares of stock or units of equity interests of the Borrower or any of its Subsidiaries are covered by outstanding options, warrants, rights of conversion or purchase or similar rights granted or created by the Borrower except as set forth on the Disclosure Schedule. All the outstanding capital stock of the Borrower has been validly issued and is fully paid and nonassessable. All the stock or units of equity interests of the Borrower's Subsidiaries that are owned by the Borrower or any Subsidiary of the Borrower are owned free and clear of all mortgages, deeds of trust, pledges, liens, security interests and other charges or encumbrances.

5.5 Financial Condition. The audited consolidated balance sheet of the Borrower and its Subsidiaries dated as of December 31, 1992 and the audited statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for and as of the end of the period ending on that date, including any related notes (the "Audited Financial Statements"), and the unaudited consolidated

financial statements of the Borrower and its Subsidiaries (the "Unaudited Financial Statements") dated as of July 3, 1993 (the "Balance Sheet Date"), all of which (collectively, the "Financial Statements") were heretofore furnished to the Lender, are true, correct and complete in all material respects and fairly present in all material respects the financial condition of the Borrower and its Subsidiaries as of the date of each such statement and have been prepared in accordance with generally accepted accounting principles (subject, in the case of the Unaudited Financial Statements, to the addition of notes and to normal year-end adjustments that individually and in the aggregate are not expected to be material) consistently applied throughout the periods involved. Other than as reflected in such Financial Statements and except for liabilities incurred in the ordinary course of business since the date thereof, the Borrower has no Indebtedness that is or would be material to the financial condition of the Borrower, nor any material unrealized or unanticipated losses from any commitments. Since the Balance Sheet Date there has been no material adverse change in the consolidated financial condition (as set forth in the Audited Financial Statements) or results of operations of the Borrower and its Subsidiaries taken as a whole.

5.6 Pending Litigation. Except as set forth in the Disclosure Schedule, there are no suits or proceedings pending or, to the knowledge of the Borrower, threatened before any court or arbitration tribunal or by or before any governmental or regulatory authority, commission, bureau or agency or public regulatory body against the Borrower that if adversely determined would have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole.

5.7 Certain Agreements; Material Contracts. The Borrower is not a party to any agreement or instrument or subject to any court order or governmental decree adversely affecting in any material respect the business, properties, assets or financial condition of the Borrower and its Subsidiaries taken as a whole.

5.8 Authorization, Etc. All authorizations, consents, approvals, accreditations, certifications and licenses required under the corporate charter or by-laws of the Borrower or under applicable law or regulation for the ownership or operation of the property owned or operated by the Borrower or the conduct of any business or activity conducted by the Borrower, including provision of services for which reimbursement is made by third party payors, other than authorizations, consents, approvals, accreditations, certifications or licenses the failure to obtain and/or maintain which would not have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole (collectively, "Licenses") have been duly issued and are in full force and effect. The Borrower has fulfilled and performed all of its material obligations with respect to such Licenses (to the extent now required to be fulfilled or performed) and no event has occurred that would allow, with or without the passage

of time or the giving of notice or both, revocation or termination thereof or would result in any other material impairment of the rights of the holder of any such License. All filings or registrations with any governmental or regulatory authority required for the conduct of the business or activity conducted by the Borrower have been made, other than any such filings or registrations as to which the failure to make same would not have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries, taken as a whole. Except as expressly contemplated hereby, no approval, consent or authorization of or filing or registration with any governmental commission, bureau or other regulatory authority or agency is required with respect to the execution, delivery or performance of any of the Loan Documents.

5.9 No Violation. The execution, delivery and performance by the Borrower of the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower. The Borrower is not in default, nor has any event occurred that with the passage of time or the giving of notice, or both, would constitute a default, in the performance, observance or fulfillment of any of the obligations, covenants or conditions contained in any agreement, instrument or other document to which the Borrower is a party, which default would have a material adverse effect on the consolidated assets, financial condition or results of operations of the Borrower and its Subsidiaries, taken as a whole. The Borrower is not in violation of any applicable federal, state or local law, rule or regulation or any writ, order or decree, which violation would have a material adverse effect on the consolidated assets, financial condition or results of operations of the Borrower and its Subsidiaries, taken as a whole. Except as otherwise set forth in the Disclosure Schedule under the caption "Litigation," the Borrower has not received notice of any violation of any federal, state or local environmental law, rule or regulation or assertion that the Borrower has any obligation to clean up or contribute to the cost of cleaning up any waste or pollutants.

5.10 Payment of Taxes. The Borrower and its Subsidiaries have properly prepared and filed or caused to be properly prepared and filed all federal tax returns and all material state and local tax returns that are required to be filed and have paid all taxes shown thereon to be due and all other taxes, assessments and governmental charges or levies imposed upon the Borrower and its Subsidiaries, their income or profits or any properties belonging to the Borrower. No extensions of any statute of limitations are in effect with respect to any tax liability of the Borrower or any Subsidiary of the Borrower. No deficiency assessment or proposed adjustment of the federal income taxes of the Borrower or any Subsidiary of the Borrower is pending and the Borrower has no knowledge of any proposed liability of a substantial nature for any tax to be imposed upon any of its properties or assets.

5.11 Transactions With Affiliates, Officers, Directors and 1% Shareholders. Except as set forth on the Disclosure Schedule, the Borrower has no Indebtedness to or material contractual arrangement or understanding with any Affiliate, officer or director of the Borrower, nor any shareholder holding of record at least 1% of the equity of the Borrower nor, to the best of the Borrower's knowledge (without independent inquiry), any of their respective relatives.

5.12 ERISA. The Borrower has never established or maintained any funded employee pension benefit plan as defined under Section 3(2)(A) of the Employee Retirement Income Security Act of 1974, as amended and in effect on the date hereof ("ERISA"), other than the plans described on the Disclosure Schedule. No employee benefit plan established or maintained, or to which contributions have been made, by the Borrower or any Subsidiary of the Borrower that is subject to Part 3 of Title I-B of ERISA, had an accumulated funding deficiency (as such term is defined in Section 302 of ERISA) as of the last day of the fiscal year of such plan ended most recently prior to the date hereof, or would have had an accumulated funding deficiency (as so defined) on such day if such year were the first year of the plan to which Part 3 of Title I-B of ERISA applied. No material liability to the Pension Benefit Guaranty Corporation has been incurred or is expected by the Borrower to be incurred by it or any Subsidiary of the Borrower with respect to any such plan or otherwise. The execution, delivery and performance of this Agreement and the other Loan Documents will not involve on the part of the Borrower any prohibited transaction within the meaning of ERISA or Section 4975 of the Internal Revenue Code. The Borrower has never maintained, contributed to or been obligated to contribute to any "multiemployer plan," as defined in Section 3(37) of ERISA. The Borrower has never incurred any "withdrawal liability" calculated under Section 4211 of ERISA, and there has been no event or circumstance that would cause it to incur any such liability.

5.13 Ownership of Properties; Liens. The Borrower has good and marketable title to all its material properties and assets, real and personal, that are now carried on its books, including, without limitation, those reflected in the Financial Statements (except those disposed of in the ordinary course since the date thereof), and has valid leasehold interests in its properties and assets, real and personal, which it purports to lease, subject in either case to no mortgage, security interest, pledge, lien, charge, encumbrance or title retention or other security agreement or arrangement of any nature whatsoever other than Permitted Liens and those specified in the Disclosure Schedule and other than those granted, or to be granted, to the Lender hereunder. All of the Borrower's material leasehold interests and material obligations with respect to real property are described on the Disclosure Schedule.

5.14 Employment Matters. Except as set forth on the Disclosure Schedule, there are no material grievances, disputes or controversies pending or, to the knowledge of the Borrower, threatened between the Borrower and its employees, nor

is any strike, work stoppage or slowdown pending or threatened against the Borrower.

5.15 Insurance. The Borrower maintains in force fire, casualty, comprehensive liability and other insurance covering its properties and business that is adequate and customary for the type and scope of its properties and business.

5.16 Indebtedness. Except as reflected in the Financial Statements or set forth in the Disclosure Schedule, and other than Indebtedness incurred in the ordinary course of business since the Balance Sheet Date, the Borrower has no outstanding Indebtedness.

5.17 Securities Law Compliance. The Borrower is not an "investment company" as defined in the Investment Company Act of 1940, as amended. All of the Borrower's outstanding stock was offered, issued and sold in compliance with all applicable state and federal securities laws.

5.18 Accuracy of Information. None of the information furnished to the Lender by or on behalf of the Borrower for purposes of this Agreement or any Loan Document or any transaction contemplated hereby or thereby contains, and none of such information hereinafter furnished will contain any material misstatement of fact, nor does or will any such information omit any material fact necessary to make such information not misleading at such time.

ARTICLE VI

CONDITIONS TO ADVANCES AND TERM LOAN

The Lender shall not be obligated to make any Advance or to fund the Term Loan unless the following conditions have been satisfied:

6.1 Each Advance and Funding of Term Loan. The obligations of the Lender to make each Advance and to fund the Term Loan are subject to the following conditions precedent, each of which shall have been met or performed on or before the Advance Date or the Closing Date, as the case may be:

(a) No Default. No Default or Event of Default shall have occurred and be continuing or will occur upon the making of the Advance or the Term Loan.

(b) Correctness of Representations. The representations and warranties made by the Borrower in this Agreement shall be true and correct with the same force and effect as though such representations and warranties had been made on and as of the Advance Date (i) except to the extent that the representations and warranties set forth in Article V of this Agreement are untrue as a result of

circumstances that have changed subsequent to the date hereof, which change has caused no non-compliance by the Borrower with the covenants, conditions and agreements in this Agreement and (ii) except that the references in Section 5.5 of this Agreement to the financial statements and the term "Balance Sheet Date" are deemed to refer to the most recent financial statements (inclusive of consolidated balance sheets and statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries) furnished to the Lender pursuant to Section 7.1(a) and (b) of this Agreement and the date of such financial statements, respectively.

(c) No Litigation; Certain Other Conditions. There shall be no suit or proceeding (other than suits or proceedings disclosed on the Disclosure Schedule on the date of this Agreement) pending or threatened before any court or arbitration tribunal or by or before any governmental or regulatory authority, commission, bureau or agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, is reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole.

(d) No Material Adverse Change. There shall have been no material adverse change in the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole since the Balance Sheet Date.

(e) Loan Documents. All Loan Documents shall be in full force and effect.

6.2 First Advance and Funding of Term Loan. The obligations of the Lender to make the first Advance and to fund the Term Loan are subject to the following additional conditions precedent, each of which shall have been met or performed on or before the Closing Date:

(a) Opinion of Counsel. The Lender shall have received from independent counsel to the Borrower an opinion or opinions, in form and substance satisfactory to the Lender and its counsel.

(b) Certificates of Legal Existence and Authority to do Business. The Borrower shall have delivered to the Lender certificates as to its legal existence and good standing under the laws of The Commonwealth of Massachusetts, and the Borrower shall have delivered to the Lender certificates as to its authority to do business as a foreign corporation in the States of California, Colorado, Connecticut, Florida, Illinois, Maryland, Michigan, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Texas, Arizona, Minnesota and North Carolina, each dated as of a recent date.

(c) Clerk's Certificate. The Borrower shall have delivered to the Lender a certificate of its Clerk as to (i) its charter documents and by-laws, as amended, (ii) corporate votes authorizing the execution and delivery of the Loan Documents, and (iii) incumbency of the officers authorized to execute the Loan Documents on behalf of the Borrower.

(d) Notes. A Revolving Credit Note and a Term Note, each duly executed by the Borrower and otherwise completed, shall have been delivered to the Lender.

(e) Borrower's Certificates. The Borrower shall have furnished to the Lender a certificate duly executed by the Borrower's chief financial officer dated the Advance Date or Closing Date, as the case may be, to the effect that each of the conditions set forth in the foregoing Section 6.1 has been met as of such date.

(f) Mortgage. A mortgage (the "Mortgage") in the form attached hereto as Exhibit C with respect to the real property located in The Commonwealth of Massachusetts that is owned by the Borrower (the "Property"), duly executed by the Borrower and otherwise completed, shall have been delivered to the Lender and recorded. A title insurance policy in favor of the Lender issued by a title insurance company reasonably satisfactory to the Lender insuring title to the Property on terms and subject to conditions reasonably satisfactory to the Lender shall have been obtained.

(g) Insurance. The Borrower shall have furnished to the Lender copies of all its property insurance policies.

(h) All Proceedings Satisfactory. All corporate and other proceedings taken prior to or on the Closing Date in connection with the transactions contemplated by this Agreement, and all documents and exhibits related thereto, shall be reasonably satisfactory in form and substance to the Lender and its counsel.

(i) Additional Documents. The Borrower shall have delivered to the Lender all additional opinions, documents and certificates that the Lender or its counsel may reasonably require.

ARTICLE VII

AFFIRMATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Notes and payment and performance of all other Obligations:

7.1 Reporting Requirements. The Borrower shall, unless the Lender shall otherwise consent in writing, furnish to the Lender:

(a) As soon as available and in any event within sixty days after the end of each of the first three quarters of each fiscal year of the Borrower and its Subsidiaries, (i) a consolidated and consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such quarter and (ii) consolidated and consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for the period commencing at the end of the previous fiscal year and ending with the end of such quarter, all in reasonable detail and duly certified by the chief financial officer of the Borrower as having been prepared in accordance with generally accepted accounting principles consistently applied (subject to addition of notes and ordinary year-end audit adjustments), together with a certificate of the chief financial officer of the Borrower stating that no Default or Event of Default has occurred and is continuing or, if a Default or an Event of Default has occurred and is continuing, a statement as to the nature thereof and the action that the Borrower proposes to take with respect thereto;

(b) As soon as available and in any event within ninety days after the end of each fiscal year of the Borrower, the audited consolidated balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the audited consolidated statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year, in each case accompanied by the unqualified opinion with respect thereto of the Borrower's independent public accountants and a certification by such accountants stating that they have reviewed this Agreement and whether, in making their audit, they have become aware of any Default or Event of Default and if so, describing its nature, along with the related unaudited consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the unaudited consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year;

(c) Not later than sixty days following the end of each fiscal quarter a certificate signed by the chief financial officer of the Borrower substantially in the form of Exhibit 7.1(c) hereto (the "Compliance Certificate");

(d) Not later than thirty days after the end of each fiscal year of the Borrower, the Borrower's representative forecast for the next fiscal year on a consolidated basis, including, at a minimum, projected statements of profit and loss and projected cash flow, prepared in accordance with generally accepted accounting principles consistently applied;

(e) Promptly upon receipt thereof, one copy of each other report submitted to the Borrower or any Subsidiary by independent accountants in

connection with any annual, interim or special audit made by them of the books of the Borrower or any Subsidiary;

(f) Promptly after the commencement thereof, notice of all actions, suits and proceedings before any court, arbitration tribunal or governmental regulatory authority, commission, bureau, agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, would be reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole;

(g) As soon as possible, and in any event within five days after the Borrower shall know of the occurrence of any Default or Event of Default, the written statement of the chief financial officer of the Borrower setting forth details of such Default or Event of Default and action that the Borrower proposes to take with respect thereto;

(h) As soon as possible, and in any event within five days after the occurrence thereof, written notice as to any other event of which the Borrower becomes aware that with the passage of time, the giving of notice or otherwise, is reasonably likely to result in a material adverse change in the consolidated financial condition or results of operations of the Borrower; and

(i) Such other information respecting the business or properties or the condition or operations, financial or otherwise, of the Borrower as the Lender may from time to time reasonably request.

7.2 Loan Proceeds. The Borrower shall use the proceeds of the Advances only for the purpose of general working capital, including, but not limited to, for the purpose of acquisitions for which the aggregate cost may not exceed \$2,500,000 per annum.

7.3 Maintenance of Business and Properties; Insurance.

(a) The Borrower will continue to engage in business of the same general nature as the business currently engaged in by the Borrower. The Borrower will at all times maintain, preserve and protect all material franchises and trade names and preserve all the Borrower's material tangible property used or useful in the conduct of its business and keep the same in good repair, working order and condition, ordinary wear and tear excepted, and from time to time make all needful and proper repairs, renewals, replacements, betterments, and improvements thereto so that the business carried on in connection therewith may be conducted properly and advantageously at all times.

(b) The Borrower will keep all of its insurable properties now or hereafter owned adequately insured at all times against loss or damage by fire or other casualty to the extent customary with respect to like properties of companies conducting similar businesses and to the extent available at commercially reasonable rates; and will maintain public liability and workmen's compensation insurance insuring the Borrower to the extent customary with respect to companies conducting similar businesses and to the extent available at commercially reasonable rates, all by financially sound and reputable insurers. All property insurance policies shall name the Lender as a loss payee and shall contain a provision requiring at least 15 days' written notice to the Lender prior to the cancellation or modification of each such policy. The Borrower shall furnish to the Lender from time to time at the Lender's request copies of all such insurance policies and certificates evidencing such insurance coverage. Notwithstanding the foregoing, the Borrower may self-insure workmen's compensation to the extent permitted by law and may also self-insure other risks to the extent reasonably deemed prudent by the Borrower.

7.4 Payment of Taxes. The Borrower shall pay and discharge, or cause to be paid and discharged, all material taxes, assessments, and governmental charges or levies imposed upon the Borrower and its Subsidiaries or their income or profits, or upon any other properties belonging to the Borrower prior to the date on which penalties attach thereto, and all lawful claims that, if unpaid, might become a lien or charge upon any material properties of the Borrower, except for such taxes, assessments, charges, levies or claims as are being contested by the Borrower in good faith by appropriate proceedings promptly initiated and diligently prosecuted, for which adequate book reserves have been established in accordance with generally accepted accounting principles, as to which no foreclosure, distraint, sale or other similar proceedings shall have been commenced, or, if commenced, have been effectively stayed.

7.5 Compliance with Laws, etc. The Borrower shall comply with the requirements of all applicable laws, rules, regulations and orders of any governmental authority, and obtain or maintain all Licenses required under applicable law or regulation for the operation of the Borrower's business, where noncompliance or failure to obtain or maintain would have a material adverse effect on the consolidated financial condition, assets, or results of operations of the Borrower and its Subsidiaries taken as a whole; provided, however, that such compliance or the obtaining of such Licenses may be delayed while the applicability or validity of any such law, rule, regulation or order or the necessity for obtaining any such License is being contested by the Borrower in good faith by appropriate proceedings promptly initiated and diligently prosecuted.

7.6 Books, Records and Accounts. The Borrower shall keep true and correct books, records and accounts, in which entries will be made in accordance with generally accepted accounting principles consistently applied, and that shall comply

with the requirements of the Foreign Corrupt Practices Act of 1977 to the extent applicable to the Borrower. The Lender or its representatives shall upon reasonable notice to the Borrower be afforded, during normal business hours, access to and the right to examine and copy any such books, records and accounts and the right to inspect the Borrower's premises and business operations. All financial and other information with respect to the Borrower and/or any of its Subsidiaries now or hereafter obtained by the Lender under this Agreement or otherwise in connection with any of the transactions contemplated hereunder shall be held in confidence and shall not be released or made available to any other Person, except (i) to governmental agencies (and examiners employed by same) having oversight over the affairs of the Lender, (ii) pursuant to subpoena or similar process issued by a court or governmental agency of competent jurisdiction, or (iii) as otherwise directed by order of any court or governmental agency of competent jurisdiction.

7.7 Further Assurances. The Borrower shall execute and deliver, at the Borrower's expense, all notices and other instruments and documents and take all actions, including, but not limited to, making all filings and recordings, that the Lender shall reasonably request in order to assure to the Lender all rights given to the Lender hereby or under any other Loan Document.

7.8 Bank Accounts. The Borrower shall maintain with the Lender a deposit account and, at the written request of the Lender, shall give the Lender written notice of any other accounts maintained by the Borrower, including the types of accounts and names and addresses of the institutions with which such accounts are maintained.

ARTICLE VIII

NEGATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Notes and payment and performance of all other Obligations:

8.1 Sale of Assets; Mergers, Etc.

(a) Sale of Assets. The Borrower will not, except in the ordinary course of business, sell, transfer, or otherwise dispose of, to any Person any assets (including the securities of any Subsidiary).

(b) Mergers, Etc. Neither the Borrower nor any Subsidiary will consolidate with or merge into any other Person or permit any other Person to consolidate with or merge into it, or acquire all or substantially all of the assets of any Person, or sell, assign, lease or otherwise dispose of (whether in one transaction

or in a series of transactions) all or substantially all of its assets to any Person, except that

(1) a Subsidiary may consolidate with or merge into the Borrower or another Subsidiary; and

(2) the Borrower or any of its Subsidiaries may acquire all or substantially all of the assets of any Person provided the aggregate purchase price liability, including all contingent liabilities, when aggregated with all such acquisitions and any Investments permitted under Section 8.4(2) shall not exceed a total of \$5,000,000 in each calendar year during the term of this Agreement beginning with calendar year 1993.

8.2 Liens and Encumbrances.

(a) Neither the Borrower nor any Subsidiary will (a) cause or permit or (b) agree or consent to cause or permit in the future (upon the happening of a contingency or otherwise), any of its real or personal property, whether now owned or subsequently acquired, to be subject to any Lien other than Liens described below (which may herein be referred to as "Permitted Liens"):

(1) Liens securing the payment of taxes, assessments or governmental charges or levies or the demands of suppliers, mechanics, carriers, warehousemen, landlords and other like Persons, which payments are not yet due and payable or (as to taxes) may be paid without interest or penalty; provided, that, if such payments are due and payable, such Liens shall be permitted hereunder only to the extent that (A) all claims that the Liens secure are being actively contested in good faith and by appropriate proceedings, (B) adequate book reserves have been established with respect thereto to the extent required by generally accepted accounting principles, and (C) such Liens do not in the aggregate materially interfere with the owning company's use of property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(2) Liens incurred or deposits made in the ordinary course of business (A) in connection with worker's compensation, unemployment insurance, social security and other like laws, or (B) to secure the performance of letters of credit, bids, tenders, sales contracts, leases, statutory obligations, surety, appeal and performance bonds and other similar obligations, in each case not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property;

(3) Liens not otherwise described in Section 8.2(a)(1) or (2) that are incurred in the ordinary course of business and are incidental to the conduct of its business or ownership of its property, were not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property and do not in the aggregate materially detract from the value of, or materially interfere with the owning company's use of, property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(4) Liens in favor of the Lender or any of its affiliates;

(5) Judgment liens or attachments that shall not have been in existence for a period longer than 30 days after the creation thereof, or if a stay of execution shall have been obtained, for a period longer than 30 days after the expiration of such stay or if such an attachment is being actively contested in good faith and by appropriate proceedings, for a period longer than 30 days after the creation thereof;

(6) Liens existing as of the Closing Date and disclosed on the Disclosure Schedule hereto;

(7) Liens provided for in equipment or Financing Leases (including financing statements and undertakings to file financing statements) provided that they are limited to the equipment subject to such leases and the proceeds thereof;

(8) Leases, subleases, licenses and sublicenses granted to third parties not interfering in any material respect with the business of the Borrower or any Subsidiary of the Borrower;

(9) Any Lien on any asset of any corporation existing at the time such corporation is merged into or consolidated with the Borrower or a Subsidiary of the Borrower and not created in contemplation of such event;

(10) Any Lien existing on any asset prior to the acquisition thereof by the Borrower or any Subsidiary of the Borrower and not created in contemplation of such event;

(11) Liens in respect of any purchase money obligations for tangible property used in its business that at any time shall not exceed \$2,000,000, provided that any such encumbrances shall not extend to

property and assets of the Borrower or any Subsidiary not financed by such a purchase money obligation;

(12) Easements, rights of way, restrictions and other similar charges or Liens relating to real property and not interfering in a material way with the ordinary conduct of its business; and

(13) Liens on its property or assets created in connection with the refinancing of Indebtedness secured by Permitted Liens on such property, provided that the amount of Indebtedness secured by any such Lien shall not be increased as a result of such refinancing and no such Lien shall extend to property and assets of the Borrower or any Subsidiary not encumbered prior to any such refinancing.

(b) In case any property is subjected to a Lien in violation of Section 8.2(a), the Borrower will make or cause to be made provision whereby the Notes will be secured equally and ratably with all other obligations secured by such property, and in any case the Notes shall have the benefit, to the full extent that the holders may be entitled thereto under applicable law, of an equitable Lien equally and ratably securing the Notes. Such violation of Section 8.2(a) shall constitute an Event of Default hereunder, whether or not any such provision is made pursuant to this Section 8.2(b).

8.3 Sales and Leasebacks. The Borrower and its Subsidiaries will not sell or transfer any of their property and become, directly or indirectly, liable as the lessee under a lease of such property (other than such transactions between the Subsidiaries).

8.4 Investments. Neither the Borrower nor any Subsidiary will make or maintain any investments, made in cash or by delivery of property or assets, (a) in any Person, whether by acquisition of capital stock, Indebtedness, or other obligations or securities, or by loan or capital contribution, or otherwise, or (b) in any property, whether real or personal, (items (a) and (b) being herein called "Investments"), except the following:

(1) Investments in direct obligations of, or guaranteed by, the United States government, its agencies or any public instrumentality thereof and backed by the full faith and credit of the United States government with maturities not to exceed (or an unconditional right to compel purchase within) one year from the date of acquisition;

(2) Investments in or to any Subsidiary or other Person provided any such Investment when aggregated with all such other Investments permitted under this Section 8.4(2) and any acquisitions

permitted under Section 8.1(b) shall not exceed a total of \$5,000,000 in each calendar year during the term of this Agreement beginning with calendar year 1993;

(3) Investments and obligations issued by any state of the United States or any political subdivision of any such state or any public instrumentality thereof with maturities not to exceed (or an unconditional right to compel purchase within) 180 days of the date of acquisition that are rated in one of the top two rating classifications by at least one nationally recognized rating agency;

(4) Investments in demand and time deposits with, Eurodollar deposits with, certificates of deposit issued by, or obligations or securities fully backed by letters of credit issued by (x) any bank organized under the laws of the United States, any state thereof, the District of Columbia or Canada having combined capital and surplus aggregating at least \$100,000,000, or (y) any other bank organized under the laws of a state that is a member of the European Economic Community (or any political subdivision thereof), Japan, the Cayman Islands, or British West Indies having as of any date of determination combined capital and surplus of not less than \$500,000,000 or the equivalent thereof (determined in accordance with generally accepted accounting principles) ("Permitted Banks");

(5) Shares of money market mutual funds registered under the Investment Company Act of 1940, as amended;

(6) Foreign currency swaps and hedging arrangements entered into in the ordinary course of business to protect against currency losses, and interest rate swaps and caps entered into in the ordinary course of business to protect against interest rate exposure on Indebtedness bearing interest at a variable rate;

(7) Investments in publicly traded companies and mutual funds (other than money market mutual funds) that in the aggregate shall not exceed \$5,000,000; and

(8) Other Investments existing on the Closing Date and listed on the Disclosure Schedule.

8.5 Transactions with Affiliates. Neither the Borrower nor any Subsidiary will enter into any transaction (including the purchase, sale or exchange of property or the rendering of any service) with any Affiliate except upon fair and reasonable

terms that are at least as favorable to the Borrower or the Subsidiary as would be obtained in a comparable arm's-length transaction with a non-Affiliate.

8.6 ERISA Compliance. Neither the Borrower nor any of its Subsidiaries will at any time permit any employee pension benefit plan (as such term is defined in Section 3 of ERISA) maintained by the Borrower or any of its Subsidiaries or in which employees of the Borrower or any of its Subsidiaries is entitled to participate to:

(a) engage in any "prohibited transaction" as such term is defined in Section 4975 of the Internal Revenue Code of 1986, as amended, or described in Section 406 of ERISA;

(b) incur any "accumulated funding deficiency" as such term is defined in Section 302 of ERISA, whether or not waived; or

(c) terminate under circumstances that could result in the imposition of a Lien on the property of the Borrower or any Subsidiary of the Borrower pursuant to Section 4068 of ERISA.

8.7 Financial Covenants. The Borrower covenants and agrees that:

(a) Consolidated Tangible Net Worth. The Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower shall not be less than the sum of (i) \$26,000,000, and (ii) beginning with the year ending December 31, 1994, 50% of Consolidated Net Income (excluding losses) for each consecutive fiscal year of the Borrower beginning with the year ending December 31, 1994, on a cumulative basis.

(b) Consolidated Indebtedness. The ratio ("Debt-to-Net Worth Ratio") of the Consolidated Indebtedness (excluding all guaranties except guaranties with respect to borrowed money) as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending December 31, 1993 to its Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending December 31, 1993 shall not exceed 1.5 to 1.

(c) Consolidated Debt Service. The ratio (the "Cash Flow Ratio") as of the end of each fiscal quarter of the Borrower of (i) Consolidated Operating Cash Flow for the four consecutive fiscal quarters then ended to (ii) Consolidated Debt Service determined for the four consecutive fiscal quarters then ended shall not be less than 1.25 to 1.00.

8.8 Contracts Prohibiting Compliance with Agreement. The Borrower will not without the prior written consent of the Lender enter into any contract or other

agreement that would prohibit or in any way restrict the ability of the Borrower to comply with any provision of this Agreement.

ARTICLE IX

EVENTS OF DEFAULT

9.1 Default. If any one of the following events ("Events of Default") shall occur:

(a) Any representation or warranty made by the Borrower herein or in any other Loan Document, or in any certificate or report furnished by the Borrower hereunder or thereunder, shall prove to have been incorrect in any material respect when made;

(b) Payment of any principal or interest due under any Note shall not be made on or before the date due;

(c) A final judgment for in excess of \$2,000,000 shall be rendered against the Borrower or any of its Subsidiaries for the payment of money that, after deducting the amount of any insurance proceeds paid or payable to or on behalf of the Borrower or its Subsidiary in connection with such judgment, is in excess of \$2,000,000, and the same shall remain undischarged for a period of thirty (30) days, during which period execution shall not effectively be stayed. If a dispute exists with respect to the liability of any insurance underwriter under any insurance policy of the Borrower or its Subsidiary, no deduction under this subsection shall be made for the insurance proceeds that are the subject of such dispute;

(d) The Borrower or any Subsidiary shall (1) voluntarily terminate operations or apply for or consent to the appointment of, or the taking of possession by, a receiver, custodian, trustee or liquidator of such Person or of all or a substantial part of the assets of such Person, (2) admit in writing its inability, or be generally unable, to pay its debts as the debts become due, (3) make a general assignment for the benefit of its creditors, (4) commence a voluntary case under the Federal Bankruptcy Code (as now or hereafter in effect), (5) file a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts, (6) fail to controvert in a timely and appropriate manner, or acquiesce in writing to, any petition filed against it in an involuntary case under the Federal Bankruptcy Code or applicable state bankruptcy laws or (7) take any corporate action for the purpose of effecting any of the foregoing;

(e) Without its application, approval or consent, a proceeding shall be commenced, in any court of competent jurisdiction, seeking in respect of the

Borrower or any Subsidiary: the liquidation, reorganization, dissolution, winding-up, or composition or readjustment of debt, the appointment of a trustee, receiver, liquidator or the like of such Person or of all or any substantial part of the assets of such Person, or other like relief in respect of such Person under any law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts; and, if the proceeding is being contested in good faith by such Person, the same shall continue undismissed, or unstayed and in effect for any period of 45 consecutive days, or an order for relief against such Person shall be entered in any case under the Bankruptcy Code or applicable state bankruptcy laws;

(f) Any foreclosure or other proceedings shall be commenced to enforce, execute or realize upon any lien, encumbrance, attachment, trustee process, mortgage or security interest for payment of an amount in excess of \$250,000 against the Borrower or any Subsidiary;

(g) Default shall be made in the due observance or performance of any covenant or agreement under Article VIII;

(h) Default shall be made in the due observance or performance of any covenant or agreement contained herein (and not constituting an Event of Default under any other clause in this Article IX) or in any other Loan Document or in any other agreement between the Lender and the Borrower evidencing or securing borrowed monies and such default shall continue and shall not have been remedied within thirty days after the date on which such default occurred;

(i) The Borrower or any of its Subsidiaries shall fail to make any payment of principal or interest beyond the period of grace contained in any instrument or agreement evidencing any indebtedness (other than to the Lender) for money borrowed in excess of \$100,000 (unless such default is the result of a good faith dispute arising under such agreement or instrument and the other party or parties thereto have not accelerated the maturity of such indebtedness), or default shall be made by the Borrower or any of its Subsidiaries in the performance of any other covenant or agreement contained in any such agreement or instrument as a result of which the other party thereto proceeds to accelerate the maturity of the indebtedness of such Person under such agreement or instrument;

(j) There shall occur any material adverse change in the financial condition of the Borrower;

then, in the case of any such event, other than an event described in subsection (d) or (e) of this Section 9.1, the Lender may, at its option immediately declare any Obligations to it not otherwise due and payable at such time to be forthwith due and payable, whereupon the same shall become forthwith due and payable without further presentment, demand, protest, or other notice of any kind, all of which are

hereby expressly waived, anything contained herein or in the Notes to the contrary notwithstanding; and, in the case of any event described in subsection (d) or (e) of this Section 9.1, any Obligation not otherwise due and payable at such time shall become immediately due and payable without presentment, demand, protest, or other notice of any kind, all of which are hereby expressly waived, anything contained herein or in any Note to the contrary notwithstanding; and, further, in each and every such occurrence the Lender may proceed to protect and enforce its rights by suit in equity, action at law and/or other appropriate proceedings either for specific performance of any covenant or condition contained in this Agreement or in any instrument delivered to the Lender pursuant to this Agreement, or in aid of the exercise of any power granted in this Agreement or any such instrument.

9.2 Lender's Further Rights and Remedies. Upon the occurrence and during the unremedied continuation of an Event of Default, the Lender shall have the right to require the Borrower to provide the Lender with cash collateral or other collateral of a type and value satisfactory to the Lender in an amount equal to the Borrower's outstanding Obligations to the Lender. With respect to such collateral (the "Collateral"), the Lender shall have the rights and remedies of a secured party under the Uniform Commercial Code ("UCC") and the Borrower agrees to execute and deliver to the Lender such security agreements and financing statements under the UCC as the Lender may require, and to pay the cost of filing the same. Any deposits or other sums at any time credited by or due from the Lender to the Borrower shall at all times constitute Collateral for the Obligations. The Lender may apply the net proceeds of any disposition of Collateral or set-off to the Obligations in such order as the Lender may determine, whether or not due. With respect to Obligations not yet due, including contingent Obligations, the Lender may at its option hold Collateral (including any proceeds thereof) until all such Obligations have been paid in full.

ARTICLE X

MISCELLANEOUS

10.1 No Waiver, Remedies Cumulative. No failure on the part of the Lender to exercise and no delay in exercising any right hereunder shall operate as a waiver thereof, nor shall any single or partial exercise of any right hereunder preclude any other or further exercise thereof or the exercise of any other right. The remedies herein provided are cumulative and are not exclusive of any remedies provided by law. Any condition or restriction imposed in this Agreement with respect to the Borrower may be waived, modified or suspended by the Lender but only on the Lender's prior action in writing and only as so expressed in such writing and not otherwise.

10.2 Survival of Representations, etc. All representations, warranties and covenants made herein or in any Loan Document shall survive the making of any Advance hereunder and the delivery of the Notes and the consummation of all other transactions contemplated hereby or thereby.

10.3 Right of Setoff. In addition to any rights now or hereafter granted under applicable law or otherwise and not by way of limitation of any such rights, upon the occurrence and during the unremedied continuation of an Event of Default, the Lender is hereby authorized at any time or from time to time, without presentment, demand, protest or other notice of any kind to the Borrower or to any other Person, any such notice being hereby expressly waived, to set off and to appropriate and apply any and all deposits (general or special) and any other indebtedness at any time held or owing by the Lender to or for the credit or the account of the Borrower against and on account of the Obligations and liabilities of the Borrower to the Lender under this Agreement or under any of the other Loan Documents, and all other claims of any nature or description arising out of or connected with this Agreement or any other Loan Document, irrespective of whether or not the Lender shall have made any demand hereunder and although said Obligations, liabilities or claims, or any of them, shall be contingent or unmatured.

10.4 Indemnity: Costs, Expenses and Taxes. The Borrower hereby agrees to indemnify the Lender and its legal representatives, successors, assigns and agents against, and agrees to protect, save and keep harmless each of them from and to pay upon demand, any and all liabilities, obligations, taxes (including any and all stamp and other taxes payable or determined to be payable in connection with the execution and delivery of any Loan Documents), liens, charges, losses, damages, penalties, claims, actions, suits, costs, indemnities, expenses and disbursements (including, without limitation, reasonable legal fees, costs and expenses, including without limitation reasonable costs of attending and preparing for depositions and other court proceedings), of whatsoever kind and nature, imposed upon, incurred by or asserted against such indemnified party in any way relating to or arising out of any of the transactions contemplated hereunder or in any of the Loan Documents, including but not limited to all costs of investigation, monitoring, legal representation, remedial response, removal, restoration, or permit acquisition that may now or in the future be undertaken, suffered, paid, awarded, assessed or otherwise incurred as a result of the presence of, release or threatened release of Hazardous Substances on, in, under or near the Property (all of the foregoing, collectively, "Costs") except to the extent arising by reason of the Lender's gross negligence, misconduct or breach hereof. Without limiting the foregoing, the Borrower agrees to pay on demand (a) all out-of-pocket costs and expenses of the Lender in connection with the preparation, execution and delivery of this Agreement and any other Loan Documents, including without limitation the reasonable fees and out-of-pocket expenses of Foley, Hoag & Elliot, special counsel for the Lender, with respect thereto, as well as (b) the reasonable fees and all out-of-pocket expenses of legal counsel, independent public

accountants and other outside experts retained by the Lender in connection with any request by the Borrower for consents, waivers or other action or forbearance by the Lender hereunder, for the modification or amendment hereof, or other like matters relating to the administration of this Agreement; and (c) all reasonable costs and expenses, if any, of the Lender incurred after the occurrence of any Event of Default hereunder in connection with the enforcement of any of the Loan Documents or the protection of any of the Lender's rights, thereunder, including, without limitation, any internal costs, including personnel costs of the Lender incurred in connection with such administration and enforcement or protection.

10.5 Notices.

(a) Unless telephonic notice is specifically permitted pursuant to the terms of this Agreement, any notice or other communication hereunder to any party hereto shall be by telegram, telecopier, telex, delivery in hand or by courier, or registered or certified mail (return receipt requested) and shall be deemed to have been given or made when telegraphed, telexed, telecopied (and confirmed received), delivered in hand or by courier, or three days after being deposited in the mails, postage prepaid, registered or certified, addressed to the party as follows (or at any other address that such party may hereafter specify to the other parties in writing):

(i) If to the Lender:

The First National Bank of Boston
100 Federal Street
Boston, Massachusetts 02110
Attn: Ms. Sharon A. Stone, Director
Telecopier No. (617) 434-4048

with a copy to:

Arlene L. Bender, Esq.
Foley, Hoag & Eliot
One Post Office Square
Boston, Massachusetts 02109
Telecopier No. (617) 482-7347

(ii) If to the Borrower:

Six Shattuck Road
Andover, Massachusetts 01810
Attn: Mr. Robert F. O'Brien, Treasurer
Telecopier No. (508) 975-3756

with a copy to:

Richard S. Chute, Esq.
Hill & Barlow
One International Place
Boston, Massachusetts 02110
Telecopier No. (617) 439-3580

10.6 MASSACHUSETTS LAW. THIS AGREEMENT AND EACH OF THE LOAN DOCUMENTS SHALL BE DEEMED A CONTRACT MADE UNDER THE LAW OF THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE GOVERNED BY, AND CONSTRUED AND ENFORCED IN ACCORDANCE WITH, THE INTERNAL LAWS OF SAID STATE (WITHOUT REGARD TO ITS PRINCIPLES OF CONFLICT OF LAWS).

10.7 Successors and Assigns. This Agreement shall be binding upon and shall inure to the benefit of the Borrower and the Lender, and their respective legal representatives, successors and assigns; provided that the Lender may assign its rights hereunder, but the Borrower may not assign any of its rights hereunder.

10.8 Counterparts. This Agreement may be executed in any number of counterparts and by different parties hereto in separate counterparts, each of which when so executed and delivered shall be deemed an original and all of which when taken together shall constitute one and the same instrument.

10.9 JURISDICTION, SERVICE OF PROCESS.

(a) ANY SUIT, ACTION OR PROCEEDING AGAINST THE BORROWER WITH RESPECT TO ANY OF THE LOAN DOCUMENTS OR ANY JUDGMENT ENTERED BY ANY COURT IN RESPECT OF ANY THEREOF SHALL BE BROUGHT IN THE COURTS OF THE COMMONWEALTH OF MASSACHUSETTS LOCATED IN SUFFOLK COUNTY OR IN THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF MASSACHUSETTS, AS THE LENDER (IN ITS SOLE DISCRETION) MAY ELECT, AND THE BORROWER HEREBY ACCEPTS THE EXCLUSIVE JURISDICTION OF SUCH COURTS FOR THE PURPOSE OF ANY SUIT, ACTION OR PROCEEDING AND AGREES NOT TO ASSERT ANY CLAIM THAT IT IS NOT PERSONALLY SUBJECT TO THE JURISDICTION OF SUCH COURTS.

(b) IN ADDITION, THE BORROWER HEREBY IRREVOCABLY WAIVES, TO THE FULLEST EXTENT PERMITTED BY LAW, ANY OBJECTION IT MAY NOW OR HEREAFTER HAVE TO THE LAYING OF VENUE OF ANY SUIT, ACTION OR PROCEEDING ARISING OUT OF OR RELATING TO ANY

OF THE LOAN DOCUMENTS OR ANY JUDGMENT ENTERED BY ANY COURT IN RESPECT THEREOF BROUGHT IN SUFFOLK COUNTY IN THE COMMONWEALTH OF MASSACHUSETTS, AND HEREBY FURTHER IRREVOCABLY WAIVES ANY CLAIM THAT ANY SUIT, ACTION OR PROCEEDING BROUGHT IN SUFFOLK COUNTY IN THE COMMONWEALTH OF MASSACHUSETTS HAS BEEN BROUGHT IN AN INCONVENIENT FORUM.

10.10 Limit on Interest. It is the intention of the Lender and the Borrower to comply strictly with all applicable usury laws; and, accordingly, in no event and upon no contingency shall the Lender ever be entitled to receive, collect, or apply as interest under any Note any interest, fees, charges or other payments equivalent to interest, in excess of the maximum rate that the Lender may lawfully charge under applicable statutes and laws from time to time in effect; and, in the event that the Lender ever receives, collects or applies as interest on the Notes, any such excess, such amount that, but for this provision, would be excessive interest shall be applied to the reduction of the principal amount of the indebtedness evidenced by the Notes; and, if the principal amount of indebtedness evidenced by the Notes, and all lawful interest thereon, is paid in full, any remaining excess shall forthwith be paid to the Borrower, or other party lawfully entitled thereto. In determining whether or not the interest paid or payable, under any specific contingency exceeds the highest contract rate permitted by applicable law from time to time in effect, the Borrower and the Lender shall, to the maximum extent permitted under applicable law, characterize any non-principal payment as a reasonable loan charge, rather than as interest. Any provision of any Note, or of any other agreement between the Lender and the Borrower, that operates to bind, obligate, or compel the Borrower to pay interest in excess of such maximum lawful contract rate shall be construed to require the payment of the maximum rate only. The provisions of this Section 10.10 shall be given precedence over any other provisions contained in the Notes or in any other agreement between the Lender and the Borrower that is in conflict with the provisions of this Section 10.10.

10.11 Amendments, Modifications, Waivers. Any term of this Agreement or of the Notes may be amended and the observance of any term of this Agreement or of the Notes may be waived (either generally or in a particular instance and either retroactively or prospectively) only with the written consent of the Borrower and the Lender.

10.12 Headings. The headings of this Agreement are for convenience only and are not to affect the construction of or to be taken into account in interpreting the substance of this Agreement.

10.13 WAIVER OF NOTICE, ETC. THE BORROWER WAIVES DEMAND, NOTICE, PROTEST, NOTICE OF ACCEPTANCE OF THIS AGREEMENT, NOTICE OF LOANS MADE, CREDIT EXTENDED, COLLATERAL RECEIVED OR

DELIVERED OR OTHER ACTION TAKEN IN RELIANCE HEREON AND ALL OTHER DEMANDS AND NOTICE OF ANY DESCRIPTION, EXCEPT AS REQUIRED HEREBY. WITH RESPECT BOTH TO THE OBLIGATIONS AND COLLATERAL, THE BORROWER ASSENTS TO ANY EXTENSION OR POSTPONEMENT OF THE TIME OF PAYMENT OR ANY OTHER INDULGENCE, TO ANY SUBSTITUTION, EXCHANGE OR RELEASE OF COLLATERAL, TO THE ADDITION OR RELEASE OF ANY PARTY OR PERSONS PRIMARILY OR SECONDARILY LIABLE, TO THE ACCEPTANCE OF PRETRIAL PAYMENT THEREON AND THE SETTLEMENT, COMPROMISING OR ADJUSTING OF ANY THEREOF, ALL IN SUCH MANNER AND AT SUCH TIME OR TIMES AS THE LENDER MAY DEEM ADVISABLE. THE BORROWER AGREES THAT NO ACTIONS TAKEN BY ANY PERSON EXCEPT THE LENDER SHALL IMPAIR OR OTHERWISE AFFECT ITS OBLIGATIONS HEREUNDER UNTIL ALL OBLIGATIONS OF THE BORROWER HEREUNDER ARE SATISFIED IN FULL.

10.14 WAIVER OF TRIAL BY JURY. THE BORROWER WAIVES ANY AND ALL RIGHTS THAT IT MAY HAVE TO A TRIAL BY JURY ON ANY CLAIM OR ACTION, OF ANY NATURE WHATSOEVER, RELATING TO OR ARISING OUT OF THIS AGREEMENT OR ANY OF THE OTHER LOAN DOCUMENTS.

10.15 Severability. In the event that any one or more of the provisions contained in this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision of this Agreement, but this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

10.16 Entire Agreement. This Agreement and the other Loan Documents constitute the full and entire understanding and agreement between the parties with regard to the subject matter hereof and thereof and shall supersede all prior agreements and understandings, whether written or oral, between the parties with respect to the subject matter hereof and thereof.

10.17 Compliance with Covenants. All computations determining compliance with Sections 7 and 8 shall utilize accounting principles in conformity with those used in the preparation of the financial statements referred to in Section 5.5. If any subsequent financial reports of the Borrower shall be prepared in accordance with accounting principles different from those used in the preparation of the financial statements referred to in Section 5.5, the Borrower shall inform the Lender of the changes in accounting principles and shall provide to the Lender with such reports, such supplemental reconciling financial information as may be required to ascertain compliance by the Borrower with the covenants contained in this Agreement.

10.18 Termination. This Agreement may be terminated by the Borrower at any time upon written notice of such termination to the Lender; provided, however, that, unless and until all loans made by the Lender hereunder and all other Obligations hereunder of the Borrower to the Lender existing (whether or not due) as of the time of the receipt of such notice by the Lender shall have been paid in full, such termination shall in no way affect the rights and powers granted to the Lender in connection with this Agreement, and until such payment in full all rights and powers hereby granted to the Lender hereunder shall be and remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as an agreement under seal as of the date first above written.

Witness: MKS INSTRUMENTS, INC.

/s/ Arlene L. Bender

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

EXHIBIT A

DEMAND REVOLVING CREDIT NOTE

November 1, 1993

\$7,000,000

Boston, Massachusetts

FOR VALUE RECEIVED, MKS Instruments, Inc. (the "Company"), a Massachusetts corporation, hereby promises to pay to the order of The First National Bank of Boston, a national banking association (the "Payee"), at the offices of the Payee at 100 Federal Street, Boston, Massachusetts, or such other address as the Payee shall designate in a written notice to the Company, on demand, the sum of \$7,000,000 or such lesser sum as may from time to time be outstanding, together with interest (calculated on the basis of a 360 day year and the actual number of days elapsed in any period) at the annual rate determined as provided in the Loan Agreement between the Company and the Payee dated as of the date hereof (the "Loan Agreement").

Payments of interest shall be made monthly in arrears beginning December 1, 1993 and on the first Business Day of each month thereafter on the balance of the principal amount outstanding hereunder until this Note is paid in full. Funds paid hereunder shall be applied first to accrued and unpaid interest and then to the unpaid principal balance.

Overdue principal and interest shall bear interest at a rate of 3% per annum over the Base Rate, payable on demand.

This Note is issued by the Company pursuant to, and is governed by and subject to the terms and conditions of, the Loan Agreement. All capitalized terms used in this Note that are not defined herein, but that are defined in the Loan Agreement, shall have the meanings assigned to them therein.

Nothing contained in this Note, the Loan Agreement or the instruments securing this Note shall be deemed to establish or require the payment of a rate of interest in excess of the amount legally enforceable. In the event that the rate of interest so required to be paid exceeds the maximum rate legally enforceable, the rate of interest so required to be paid shall be automatically reduced to the maximum rate legally enforceable, and any excess paid over such maximum enforceable rate shall be automatically credited on account of the principal hereof without premium or penalty.

This Note may be prepaid in whole or in part only to the extent provided in the Loan Agreement.

Notices to the Company shall be by telegram, telecopy, telex, delivery in hand or by courier, or registered or certified mail (return receipt requested) and shall be deemed to have been given or made when telegraphed, telecopied (and confirmed received), telexed, delivered in hand or by courier, or three days after being deposited in the United States mails postage prepaid, registered or certified, return receipt requested, to the Company at Six Shattuck Road, Andover, Massachusetts 01810, marked "Attention: Robert F. O'Brien", Telecopier No. (508) 975-3756 or at such other address specified by the Company in accordance herewith to the holder.

No delay or omission on the part of the Payee in exercising any right hereunder shall operate as a waiver of such right or of any other right of the Payee, nor shall any delay, omission or waiver on any one occasion be deemed a bar to or waiver of the same or any other right on any future occasion. Every maker, endorser and guarantor of this Note or the obligations represented hereby waives presentment, demand, notice, protest and all other demands and notices in connection with the delivery, acceptance, performance, default or enforcement of this Note, assents to any extension or postponement of the time of payment or any other indulgence, to any substitution, exchange or release of collateral and to the addition or release of any other party or person primarily or secondarily liable.

IN WITNESS WHEREOF, the undersigned has executed this Note as an instrument under seal, as of the date first above written.

MKS INSTRUMENTS, INC.

By: _____

Title: _____

EXHIBIT B

TERM NOTE

November 1, 1993

\$10,000,000

Boston, Massachusetts

FOR VALUE RECEIVED, MKS Instruments, Inc. (the "Company"), a Massachusetts corporation, hereby promises to pay to the order of The First National Bank of Boston, a national banking association (the "Payee"), at the offices of the Payee at 100 Federal Street, Boston, Massachusetts, or such other address as the Payee shall designate in a written notice to the Company, the principal amount of \$10,000,000 and to pay interest (calculated on the basis of a 360 day year and the actual number of days elapsed in any period) monthly in arrears beginning on December 1, 1993 and on the first Business Day of each month thereafter on the balance of such principal amount remaining unpaid from time to time from the date hereof until such principal amount shall have become due and payable, whether at maturity, by prepayment or otherwise, at the annual rate determined as provided in the Loan Agreement between the Company and the Payee dated as of the date hereof (the "Loan Agreement").

Payments of principal shall be made monthly in the aggregate fixed amount of \$55,555.56 beginning December 1, 1993 and on the first Business Day of each month thereafter until maturity. The entire unpaid principal balance and all accrued and unpaid interest hereunder shall be absolutely due and payable in full on November 1, 2000. Funds paid hereunder shall be applied first to accrued and unpaid interest and then to the unpaid principal balance.

Overdue principal and interest shall bear interest at a rate of 3% per annum over the Base Rate, payable on demand.

This Note is issued by the Company pursuant to, and is governed by and subject to the terms and conditions of, the Loan Agreement. This Note may become due and payable and matured upon the occurrence of an Event of Default. All capitalized terms used in this Note that are not defined herein, but that are defined in the Loan Agreement, shall have the meanings assigned to them therein.

Nothing contained in this Note, the Loan Agreement or the instruments securing this Note shall be deemed to establish or require the payment of a rate of interest in excess of the amount legally enforceable. In the event that the rate of interest so required to be paid exceeds the maximum rate legally enforceable, the rate of interest so required to be paid shall be automatically reduced to the maximum rate legally enforceable, and any excess paid over such maximum enforceable rate shall be automatically credited on account of the principal hereof without premium or penalty.

This Note may be prepaid in whole or in part only to the extent provided in the Loan Agreement.

This Note is secured by a Commercial Real Estate Mortgage dated the date hereof (the "Mortgage") from the maker hereof, as mortgagor, to the Payee hereof, as mortgagee. The Mortgage constitutes a lien on certain property, more particularly described therein, located in Andover and Lawrence, Massachusetts.

Notices to the Company shall be by telegram, telecopy, telex, delivery in hand or by courier, or registered or certified mail (return receipt requested) and shall be deemed to have been given or made when telegraphed, telecopied (and confirmed received), telexed, delivered in hand or by courier, or three days after being deposited in the United States mails postage prepaid, registered or certified, return receipt requested, to the Company at Six Shattuck Road, Andover, Massachusetts 01810, marked "Attention: Robert F. O'Brien", Telecopier No. (508) 975-3756 or at such other address specified by the Company in accordance herewith to the holder.

No delay or omission on the part of the Payee in exercising any right hereunder shall operate as a waiver of such right or of any other right of the Payee, nor shall any delay, omission or waiver on any one occasion be deemed a bar to or waiver of the same or any other right on any future occasion. Every maker, endorser and guarantor of this Note or the obligations represented hereby waives presentment, demand, notice, protest and all other demands and notices in connection with the delivery, acceptance, performance, default or enforcement of this Note, assents to any extension or postponement of the time of payment or any other indulgence, to any substitution, exchange or release of collateral and to the addition or release of any other party or person primarily or secondarily liable.

IN WITNESS WHEREOF, the undersigned has executed this Note as an instrument under seal, as of the date first above written.

MKS INSTRUMENTS, INC.

By: _____

Title: _____

EXHIBIT C

AMENDED AND RESTATED
COMMERCIAL REAL ESTATE MORTGAGE

This AMENDED AND RESTATED COMMERCIAL REAL ESTATE MORTGAGE (as amended from time to time, this "Mortgage") is made this 1st day of November, 1993, by and from MKS Instruments, Inc., a Massachusetts corporation having its principal place of business at Six Shattuck Road, Andover, Massachusetts 01810 ("Mortgagor"), to THE FIRST NATIONAL BANK OF BOSTON, a national banking association having its principal office at 100 Federal Street, Boston, Massachusetts 02110 (the "Bank").

Whereas, the parties have entered into the following two mortgages: that certain Mortgage and Security Agreement dated January 6, 1988 recorded at Essex North Registry of Deeds at Book 2660, Page 050 and that certain Mortgage and Security Agreement dated May 20, 1987 recorded at said Deeds at Book 2500, Page 022 (collectively, the "Prior Mortgages");

Now, therefore, for valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree to amend and restate the Prior Mortgages in their entirety as follows:

1. Mortgage, Obligations and Future Advances.

1.1 Mortgage. For valuable consideration paid, the receipt and sufficiency of which are hereby acknowledged, Mortgagor hereby grants to the Bank, with MORTGAGE COVENANTS, the "Property" described in Section 1.4, below, to secure the prompt payment and performance of any and all obligations of Mortgagor (and if more than one Mortgagor of any of them) to the Bank, whether direct or indirect, absolute or contingent, primary or secondary, due or to become due, now existing or hereafter arising or acquired, pursuant to the following (the "Obligations"):

(a) all obligations under a certain Promissory Note of even date herewith from Mortgagor payable to the order of the Bank in the original principal amount of \$10,000,000 as the same may be further amended or extended (the "Note"); and

(b) all covenants and other obligations contained in this Mortgage or contemplated hereby, including without limitation Mortgagor's obligations under Section 7.1 hereof.

1.2 Security Interest in Property. As continuing security for the Obligations, Mortgagor hereby pledges, assigns and grants to the Bank a security interest in any of the Property (as defined in Section 1.4 below) constituting fixtures, (i.e., Building Service Equipment as defined in the Prior Mortgages). This Mortgage shall be

deemed to be a security agreement and financing statement pursuant to the terms of the Uniform Commercial Code of Massachusetts.

1.3 Collateral Assignment of Leases and Rents. Mortgagor hereby assigns to the Bank as collateral security for the Obligations all of Mortgagor's rights and benefits under any and all Leases (as defined in Section 1.4 below) and any and all rents and other amounts now or hereafter owing with respect to the Leases or the use or occupancy of the Property. This collateral assignment shall be absolute and effective immediately, but Mortgagor shall continue to collect rents owing under the Leases until an Event of Default (as defined in Section 6.1 below) occurs and the Bank exercises its rights and remedies to collect such rents as set forth in Section 6.2(c) hereof.

1.4 Property. The term "Property", as used in this Mortgage, shall mean those certain parcels of land and the structures and improvements now or hereafter thereon located at Six Shattuck Road, Andover, Massachusetts, and 17-23 Ballard Way, Lawrence, Massachusetts, as more particularly described in Exhibit A attached hereto, together with: (i) all rights now or hereafter existing, belonging or pertaining thereto; (ii) all fixtures, now owned or hereafter acquired, that are located on the Property; (iii) all of the rights and benefits of Mortgagor under any present or future leases and agreements relating to the Property, or the use or occupancy thereof together with any extensions and renewals thereof, specifically excluding all duties or obligations of Mortgagor of any kind arising thereunder (the "Leases"); and (iv) all contracts, permits and licenses respecting the use, operation or maintenance of the Property.

1.5 Cross-Collateral and Future Advances. It is the express intention of the Mortgagor that this Mortgage secure payment and performance of all of the Obligations, whether now existing or hereinafter incurred by reason of future advances by the Bank or otherwise. Notice of the continuing grant of this Mortgage shall not be required to be stated on the face of any document evidencing any of the Obligations, nor shall such documents be required to otherwise specify that they are secured hereby.

2. Representations, Warranties, Covenants.

2.1 Representations and Warranties. Mortgagor represents and warrants that:

(a) (i) Mortgagor is a corporation duly organized and validly existing under the laws of Massachusetts, (ii) Mortgagor has all requisite capacity to own the Property and conduct its business as now conducted and as presently contemplated, to execute and deliver this Mortgage and convey the Property as contemplated hereby and to grant the security interests and assignment of Leases contained herein,

(iii) the execution, delivery and performance of this Mortgage have been authorized by all necessary proceedings of the Mortgagor and do not contravene any provision of any law, rule or regulation applicable to Mortgagor or any agreement, instrument, order or undertaking binding on Mortgagor or by which the Property is bound or affected, (iv) this Mortgage has been duly executed and delivered by Mortgagor and is the legal, valid and binding obligation of Mortgagor enforceable in accordance with its terms except as limited by bankruptcy, insolvency, reorganization, moratorium and other laws affecting the enforcement of creditors' rights generally;

(b) Mortgagor is the sole legal and equitable owner of the Property, holding good and marketable fee simple title to the Property, subject to no liens, encumbrances, leases, security interests or rights of others except as set forth in the title insurance policy issued by Ticor Title Insurance Company of even date in favor of Mortgagee;

(c) Mortgagor is the sole legal and equitable owner of the entire lessor's interest in the Leases and Mortgagor has not executed any other assignment of the Leases or any of the rights or rents arising thereunder; and

(d) Each Obligation is a commercial obligation and does not represent a loan used for personal, family or household purposes and is not a consumer transaction, or to Mortgagor's knowledge otherwise subject to the provisions of M.G.L. Chapter 140D, the Federal Truth in Lending Act or Federal Reserve Board Regulation Z, or other consumer statutes or regulations and restrictions.

2.2 Recording: Further Assurances. Mortgagor covenants that it shall, at its sole cost and expense and upon the request of the Bank, cause this Mortgage, and each amendment, modification or supplement hereto, to be recorded and filed in such manner and in such places, and shall at all times comply with all such statutes and regulations, as may be required by law in order to establish, preserve and protect the interest of the Bank in the Property and the rights of the Bank under this Mortgage. Upon the written request of the Bank, and at the sole expense of Mortgagor, the Mortgagor will promptly execute and deliver such further instruments and documents and take such further actions as the Bank may deem desirable to obtain the full benefits of this Mortgage and of the rights and powers herein granted, including, without limitation, filing any financing statement under the Uniform Commercial Code, and obtaining any consents or estoppel certificates of lessees under the Leases that the Bank deems appropriate. Mortgagor authorizes the Bank to file any such financing statement without the signature of the Mortgagor to the extent permitted by applicable law, and to file a copy of this Agreement in lieu of a financing statement.

2.3 Restrictions on Mortgagor. Mortgagor covenants that it will not, directly or indirectly, without the prior written approval of the Bank in each instance:

(a) Sell, convey, assign, transfer, mortgage, pledge, hypothecate or dispose of all or any part of any legal or beneficial interest in the Property or any part thereof or permit any of the foregoing, except as expressly permitted by the terms of this Mortgage; or

(b) Permit to be created or suffer to exist any mortgage, lien, security interest, attachment, or other encumbrance or charge on the Property or any part thereof or interest therein, including, without limitation, (i) any lien arising under any federal, state or local statute, rule, regulation or law pertaining to the release or clean-up of Hazardous Substances and (ii) any mechanics' or materialmen's lien, except as permitted by the Loan Agreement of even date herewith between Mortgagor and Bank. Mortgagor further agrees to give the Bank prompt written notice of the imposition of any lien referred to in this Section 2.3(b) and to take any action necessary to secure the prompt discharge or release of the same. Mortgagor agrees to defend its title to the Property and the Bank's interest therein against the claims of all persons and, unless the Bank requests otherwise, to appear in and diligently contest, at Mortgagor's sole cost and expense, any action or proceeding which purports to affect Mortgagor's title to the Property or the priority or validity of this Mortgage or the Bank's interest hereunder.

2.4 Operation of Property. Mortgagor covenants and agrees as follows:

(a) Mortgagor will not permit the Property to be used for any unlawful or improper purpose, will at all times comply with all federal, state and local laws, ordinances and regulations, and will obtain and maintain all governmental or other approvals, relating to Mortgagor, the Property or the use thereof, including without limitation, any applicable zoning or building codes or regulations and any laws or regulations relating to the handling, storage, release or clean-up of Hazardous Substances, and will give prompt written notice to the Bank of (i) any violation of any such law, ordinance or regulation by Mortgagor or relating to the Property, (ii) receipt of notice from any federal, state or local authority alleging any such violation and (iii) the release on the Property of any Hazardous Substances. As used in this Mortgage, the term "Hazardous Substances" shall mean any oil or other material or substance constituting hazardous waste or hazardous materials or substances under any applicable federal or state law, regulation or rule;

(b) Mortgagor will at all times keep the Property insured for such losses or damage, for such periods and amounts, on such terms and by such companies as may be required by law or which the Bank may from time to time reasonably require. All policies regarding such insurance shall name the Bank as mortgagee, loss payee and additional insured, and provide that no cancellation or

material modification of such policies shall occur without fifteen days prior written notice to the Bank. Mortgagor will furnish to the Bank upon request such copies of original policies, certificates of insurance, or other evidence of the foregoing as is acceptable to the Bank;

(c) Mortgagor will not enter into or modify the Leases without the prior written consent of the Bank, such consent not to be unreasonably withheld or delayed. Mortgagor may consent to a sublease under or the assignment of any Lease upon written notice to the Bank, provided that Mortgagor does not release the lessee from liability. Mortgagor will not accept any rentals under any Lease for more than one month in advance, and will at all times perform and fulfill every term and condition of the Leases;

(d) Mortgagor will at all times (i) maintain accurate records and books regarding the Property in accordance with generally accepted accounting principles; (ii) permit the Bank and the Bank's agents, employees and representatives, at such reasonable times as the Bank may request, to enter and inspect the Property and such books and records; and (iii) promptly upon request provide to the Bank such financial statements and information regarding Mortgagor, the Property and the Leases as the Bank may request;

(e) Mortgagor will at all times keep the Property in good and first rate repair and condition (reasonable wear and tear excepted but damage from casualty not excepted) and will not commit or permit any strip, waste, impairment, deterioration or alteration of the Property or any part thereof; and

(f) Mortgagor shall comply with, and not modify the terms and conditions of, any prior mortgage affecting the Property or any note or other obligation secured thereby and shall not permit the holder of any such prior mortgage to advance any additional sums pursuant to such mortgage which would constitute a lien superior to the lien of this Mortgage except with the prior written consent of the Bank.

2.5 Payments. The Mortgagor covenants to pay when due:

(a) All federal, state or other taxes, betterment assessments and other governmental levies, water rates, sewer charges, insurance premiums, and other charges on the Property, this Mortgage or any Obligation secured hereby or that could, if unpaid, result in a lien on the Property or on any interest therein; and

(b) All amounts when due under the Note and each other instrument evidencing, securing or relating to any of the Obligations and under any agreement to which Mortgagor is a party or by which Mortgagor is bound, including without limitation, any mortgage encumbering the Property.

Mortgagor shall have the right to contest any notice, lien, encumbrance, claim, tax, charge, betterment assessment or premium filed or asserted against or relating to the Property; provided that it contests the same diligently and in good faith and by proper proceedings and, at the Bank's request, provides the Bank with adequate security, in the Bank's reasonable judgment, against the enforcement thereof. Mortgagor shall furnish to the Bank the receipted real estate tax bills or other evidence of payment of real estate taxes for the Property within ten (10) days prior to the date from which interest or penalty would accrue for nonpayment thereof as well as evidence of all other payments referred to above within fifteen (15) days after written request therefor by the Bank. If the Mortgagee fails to furnish such evidence of payment then the Bank may, at the Mortgagor's expense, apply for and obtain municipal lien certificates, and other evidence of real estate tax payments.

2.6 Notices: Notice of Default. Mortgagor will deliver to the Bank, promptly upon receipt of the same, copies of all notices or other documents it receives that materially affect the Property or its use or claim that the Mortgagor is in default in the performance or observance of any of the terms hereof or that the Mortgagor or any tenant is in default of any terms of the Leases. The Mortgagor further agrees to deliver to the Bank written notice promptly upon the occurrence of any Event of Default hereunder, or event which with the giving of notice or lapse of time or both would constitute an Event of Default.

3. Takings. In case of any condemnation for public use of, or any damage by reason of the action of any public or governmental entity or authority to, all or any part of the Property (a "Taking"), or the commencement of any proceedings or negotiations that might result in a Taking, Mortgagor shall promptly give written notice to the Bank, describing the nature and extent thereof. The Bank may, at its option, appear in any proceeding for a Taking or any negotiations relating to a Taking and Mortgagor shall promptly give to the Bank copies of all notices, pleadings, determinations and other papers relating thereto. The Mortgagor shall in good faith and with due diligence and by proper proceedings file and prosecute its claims for any award or payment on account of any Taking. The awards of damages on account of any Taking shall be paid to the Mortgagor. Such awards shall be applied to or toward the restoration (within a reasonable time) of that part of the Property that remains or towards the Obligations.

4. Insurance Proceeds. Mortgagor shall have the right to apply the proceeds of any insurance resulting from any loss with respect to the Property to repair (within a reasonable time) the damaged part of the Property. Any excess insurance proceeds shall be applied to the Obligations in such order as the Bank may determine.

5. Certain Rights of Bank.

5.1 Advances. If Mortgagor fails to pay or perform any of its obligations hereunder then, after 10 days notice (except in an emergency) to Mortgagor, the Bank may in its sole discretion do so. Such payments may include, but are not limited to, payments for taxes, assessments and other governmental levies, water rates, insurance premiums, maintenance, repairs or improvements constituting part of the Property. Notwithstanding the foregoing, the Bank shall not make any payment described in Section 2.5 so long as the Mortgagor is then in compliance with that Section and no Event of Default exists.

5.2 Legal Proceedings. The Bank shall have the right, but not the duty, to intervene or otherwise participate in any legal or equitable proceeding that, in the Bank's reasonable judgment, might affect the Property or any of the rights created or secured by this Mortgage. The Bank shall have such right whether or not there shall have occurred an Event of Default hereunder.

6. Defaults and Remedies.

6.1 Events of Default. Any Event of Default under and as defined in the Loan Agreement between the Bank and Mortgagor dated as of the date hereof shall constitute an "Event of Default" under this Mortgage.

6.2 Remedies. On the occurrence of any Event of Default the Bank may, at any time thereafter, at its option and, to the extent permitted by applicable law, without notice, exercise any or all of the following remedies:

(a) Declare the Obligations due and payable, and the Obligations shall thereupon become immediately due and payable, without presentment, protest, demand or notice of any kind, all of which are hereby expressly waived by Mortgagor;

(b) Take possession of the Property (including all records and documents pertaining thereto) and exclude Mortgagor therefrom, and operate the Property as a mortgagee in possession with all the powers as could be exercised by a receiver or as otherwise provided herein or by applicable law;

(c) Receive and collect all rents, income and profits from the Property, including as may arise under the Leases, and Mortgagor appoints the Bank as its true and lawful attorney with the power for the Bank in its own name and capacity to demand and collect such rents, income and profits and take any action that Mortgagor is authorized to take under the Leases. Lessees under the Leases are hereby authorized and directed, following notice from the Bank, to pay all amounts due Mortgagor under the Leases to the Bank, whereupon such lessees shall be

relieved of any and all duty and obligation to Mortgagor with respect to such payments so made;

(d) Sell the Property or any part thereof or interest therein pursuant to exercise of its STATUTORY POWER OF SALE or otherwise at public auction on terms and conditions as the Bank may determine or otherwise foreclose this Mortgage in any manner permitted by law, and upon such sale, Mortgagor shall execute and deliver such instruments as the Bank may request in order to convey and transfer all of Mortgagor's interest in the Property, and the same shall operate to divest all rights, title and interest of Mortgagor in and to the Property. In the event this Mortgage shall include more than one parcel of property or subdivision (each hereinafter called a "portion"), the Bank shall, in its sole and exclusive discretion, be empowered to foreclose upon any such portion without impairing its right to foreclose subsequently upon any other portion or the entirety of the Property from time to time thereafter;

(e) Cause one or more environmental assessments to be taken, arrange for the clean-up of any Hazardous Substances, or otherwise cure Mortgagor's failure to comply with any statute, regulation or ordinance relating to the presence or clean-up of Hazardous Substances; provided that the exercise of any of such remedies shall not be deemed to have relieved Mortgagor from any responsibility therefor or given the Bank "control" over the Property or cause the Bank to be considered to be a mortgagee in possession, "owner" or "operator" of the Property for purposes of any applicable law, rule or regulation pertaining to Hazardous Substances; and

(f) Take such other actions or proceedings as the Bank deems necessary or advisable to protect its interest in the Property and ensure payment and performance of the Obligations including, without limitation, appointment of a receiver (and Mortgagor hereby waives any right to object to such appointment) and exercise of any of the Bank's remedies provided in the Note or in any document evidencing, securing or relating to any of the Obligations or available to a secured party under the Uniform Commercial Code of Massachusetts or under other applicable law.

This Mortgage is upon the STATUTORY CONDITION, for any breach of which the Bank shall have the STATUTORY POWER OF SALE and any other remedies provided by applicable law including, without limitation, the right to pursue a judicial sale of the Property or any portion thereof by deed, assignment or otherwise. Mortgagor agrees and acknowledges that the acceptance by the Bank of any payments from Mortgagor after the occurrence of any Event of Default, the exercise by the Bank of any remedy set forth herein or the commencement of foreclosure proceedings against the Property shall not waive the Bank's right to foreclose or operate as a bar or estoppel to the exercise of any other rights or remedies of the Bank. Mortgagor agrees and acknowledges that the Bank, by making

payments or incurring costs described herein, shall be subrogated to any right of Mortgagor to seek reimbursement from any third parties including without limitation, any predecessor in interest to Mortgagor's title or other party who may be responsible under any law, regulation or ordinance relating to the presence or clean-up of Hazardous Substances.

6.3 Cumulative Rights and Remedies. All of the foregoing rights, remedies and options are cumulative and in addition to any rights the Bank might otherwise have, whether at law or by agreement and may be exercised separately or concurrently. Mortgagor further agrees that the Bank may exercise any or all of its rights or remedies set forth herein without having to pay Mortgagor any sums for use or occupancy of the Property.

6.4 Mortgagor's Waiver of Certain Rights. To the extent permitted by applicable law, Mortgagor hereby waives the benefit of all present and future laws (i) providing for any appraisal before sale of any portion of the Property or (ii) in any way extending the time for the enforcement of the collection of the Obligations or creating or extending a period of redemption from any sale made hereunder.

7. Miscellaneous.

7.1 Payments by the Bank. To the extent permitted by applicable law, Mortgagor shall pay to the Bank, on demand, all reasonable expenses, (including reasonable attorneys' fees and expenses and reasonable consulting, accounting, appraisal, brokerage and similar professional fees and charges) actually incurred by the Bank, in connection with the Bank's exercise, preservation or enforcement of any of its rights, remedies and options set forth in this Mortgage (including without limitation any amounts expended pursuant to Sections 5.1 and 6.2(e) hereof) and in connection with any litigation, proceeding or dispute whether arising hereunder or otherwise relating to the Obligations, together with interest thereon to the extent permitted by applicable law until paid in full by Mortgagor at a rate per annum equal to three percent (3 %) above the rate of interest per annum announced from time to time by The First National Bank of Boston at its head office as its Base Rate. Any amounts owed by Mortgagor hereunder shall be, until paid, part of the Obligations, and the Bank shall be entitled, to the extent permitted by law, to receive and retain such amounts in any action for a deficiency against or redemption by the Mortgagor, or any accounting for the proceeds of a foreclosure sale or of insurance proceeds. All references to "attorneys" in this Section 7 and elsewhere in this Mortgage shall include without limitation any attorney or law firm engaged by the Bank and the Bank's in-house counsel, and all references to "fees and expenses" in this Mortgage shall include without limitation any fees of such attorney or law firm and any allocated charges and allocation costs of the Bank's in-house counsel. The obligations of Mortgagor under this Section 7.1 shall survive any payment or satisfaction of any of the other Obligations.

7.2 No Waiver or Release. No failure of the Bank to exercise or delay by the Bank in exercising any right or remedy or option provided for herein or otherwise shall be deemed to be a waiver of that right, remedy or option or of any other right, remedy or option. No sale of all or any of the Property, no forbearance on the part of the Bank, no release or partial release of any of the Property, and no extension of the time for the payment of the whole or any part of any of the obligations or any other indulgence given by the Bank to the Mortgagor or any other person or entity, shall operate to release or in any manner affect the lien of this Mortgage or the original liability of the Mortgagor except to the extent specifically provided in any written instrument signed by the Bank accomplishing any of the foregoing. Notice of any such extensions or indulgences is waived by the Mortgagor. This Mortgage may not be waived, changed or discharged orally, but only by an agreement in writing signed by the Bank, and any oral waiver, change or discharge of any provision of this Mortgage shall be without authority and of no force and effect. A waiver on any one occasion shall be limited to its express terms and conditions and the circumstances giving rise to such waiver and shall not be construed to be a bar to or waiver of any right on any future occasion.

7.3 Notices. Any notice or other communication hereunder to any party hereto shall be by telegram, telecopy, telex, delivery in hand or by courier, or registered or certified mail (return receipt requested) and shall be deemed to have been given or made when telegraphed, telexed, telecopied (and confirmed received), delivered in hand or by courier, or three days after being deposited in the mails, postage prepaid, registered or certified, addressed to each party as follows (or at any other address that such party may hereafter specify to the other parties in writing):

(a) If to the Bank:

The First National Bank of Boston
100 Federal Street
Boston, Massachusetts 02110
Attn: Ms. Sharon A. Stone, Director
Telecopier No. (617) 434-4048

with a copy to:

Arlene L. Bender, Esq.
Foley, Hoag & Eliot
One Post Office Square
Boston, Massachusetts 02109
Telecopier No. (617) 482-7347

(b) If to the Mortgagor:

Six Shattuck Road
Andover, Massachusetts 01810
Attn: Mr. Robert F. O'Brien, Treasurer
Telecopier No.

with a copy to:

Richard S. Chute, Esq.
Hill & Barlow
One International Place
Boston, Massachusetts 02110
Telecopier No. (617) 439-3580

7.4 Mortgagor's Waivers. Mortgagor waives presentment, demand, notice, protest, and all other demands and notices in connection with the delivery, acceptance, performance, default or enforcement of this Mortgage (except for such demands and notices as are specifically required to be provided to Mortgagor under this Mortgage) and assents to any extension or postponement of the time of payment or performance or any other indulgence with respect to any of the Obligations, to any substitution, exchange or release of any collateral for any of the Obligations and/or to the addition or release of any other party or person primarily or secondarily liable hereunder or in connection with any of the Obligations.

7.5 Entire Agreement; Severability; Captions. The terms and conditions of this Mortgage constitute the entire agreement, and supersede all prior agreements and understandings, both written and oral, with respect to the subject matter hereof. The invalidity of any provisions of this Mortgage shall in no way affect the validity of any other provision hereof. The failure of the Bank to perfect its lien on or security interest in any of the Property shall not affect its rights in the remainder of the Property. Section and subsection captions are for convenience of reference only, are not a part of this Mortgage and shall not affect the interpretation hereof.

7.6 Successors. This Mortgage shall be binding upon each of the parties executing this Mortgage and their respective successors, administrators and assigns, and shall inure to the benefit of the parties hereto and the successors and assigns of the Bank. The term "Bank" shall include any subsequent holder of this Mortgage by assignment or otherwise.

7.7 Joint and Several Liability. If more than one party executes this Mortgage the term "Mortgagor" shall mean each and every one of them, and each of them shall be jointly and severally liable hereunder.

7.8 Governing Law Jurisdiction. This Mortgage shall take effect as a contract executed under seal and shall be interpreted in accordance with and governed by the laws of The Commonwealth of Massachusetts (other than its rules governing choice or conflicts of laws). Each party signing this Mortgage submits to personal jurisdiction in The Commonwealth of Massachusetts and waives any and all rights to object to such jurisdiction. Each such party agrees that service of process may be made and personal jurisdiction obtained by serving Mortgagor at any location provided in Section 7.3 hereof.

7.9 JURY WAIVER. THE BANK (BY ITS ACCEPTANCE OF THIS MORTGAGE) AND THE MORTGAGOR AGREE THAT NEITHER OF THEM, INCLUDING ANY ASSIGNEE OR SUCCESSOR SHALL SEEK A JURY TRIAL IN ANY LAWSUIT, PROCEEDING, COUNTERCLAIM, OR ANY OTHER LITIGATION PROCEDURE BASED UPON, OR ARISING OUT OF, THIS MORTGAGE, ANY RELATED INSTRUMENTS, ANY COLLATERAL OR THE DEALINGS OR THE RELATIONSHIP BETWEEN OR AMONG ANY OF THEM. NEITHER THE BANK NOR THE MORTGAGOR SHALL SEEK TO CONSOLIDATE ANY SUCH ACTION WITH ANY OTHER ACTION IN WHICH A JURY TRIAL CANNOT BE OR HAS NOT BEEN WAIVED. THE PROVISIONS OF THIS PARAGRAPH HAVE BEEN FULLY DISCUSSED BY THE BANK AND THE MORTGAGOR, AND THESE PROVISIONS SHALL BE SUBJECT TO NO EXCEPTIONS. NEITHER THE BANK NOR THE MORTGAGOR HAS AGREED WITH OR REPRESENTED TO THE OTHER THAT THE PROVISIONS OF THIS PARAGRAPH WILL NOT BE FULLY ENFORCED IN ALL INSTANCES.

EXECUTED under seal as of the date first above written.

MORTGAGOR:

MKS INSTRUMENTS, INC.

By: _____

Title: _____

Suffolk, ss.

November __, 1993

Then personally appeared the above named _____ of
MKS Instruments, Inc., and acknowledged that the foregoing is the free act and
deed of said corporation, before me,

Notary Public
Name:
My commission expires:

AGREEMENT REGARDING LOST PROMISSORY NOTES

In consideration of the execution and delivery to the First National Bank of Boston (the "Bank") by MKS Instruments, Inc. (the "Company") of replacement notes with respect to the Term Note dated November 1, 1993 in the principal amount of \$10,000,000 payable to the order of the Bank and the Demand Revolving Credit Note dated November 1, 1993 in the principal amount of \$7,000,000 payable to the order of the Bank (the "Original Notes"), the Bank and the Company hereby agree as follows:

1. The Bank has been unable to locate the Original Notes, which were delivered by the Company to the Bank on November 1, 1993. The Bank has made or caused to be made diligent efforts to find and recover the Original Notes, but has been unable to do so, and accordingly believes the Original Notes are lost or misplaced.

2. The Bank is, and has been, the rightful and unconditional owner of the Original Notes at all times since issuance of the Original Notes to it on November 1, 1993. The Original Notes have not been endorsed by the Bank for transfer or sold, assigned, pledged, hypothecated, transferred, or deposited under any agreement by the Bank, and no instrument or document authorizing such transfer, sale, assignment, pledge, hypothecation, or deposit of the Original Notes has been executed by or on behalf of the Bank.

3. The Bank agrees that if the Original Notes shall ever be found to be in the custody and control of the Bank or recovered by the Bank, the Bank will immediately and without consideration surrender the Original Notes to the Company or its successor for cancellation.

4. The Bank agrees to indemnify and hold harmless the Company and its successors and assigns (collectively, "Indemnitees") from and against any and all liability, obligation, loss, damage and expense (including reasonable attorneys' fees) arising from or on account of the sale, assignment, transfer, hypothecation, pledge or other disposition of the Original Notes, by operation of law or otherwise, by or for the Bank to any person other than the Company. The Company agrees (i) that it will give prompt notice to the Bank upon presentation to the Company of either Original Note or after receiving a claim in writing against it of any claim against it as to which recovery may be sought against the Bank under the foregoing indemnity and (ii) if such claim shall arise from the claim of a third party, that it will permit the Bank to assume the defense of any such claim or any litigation resulting from such claim. If the Bank assumes the defense of such claim or any litigation resulting therefrom, the obligations of the Bank hereunder as to such claim shall be to take all steps that the Bank in its sole discretion deems necessary in the defense, compromise or settlement of such claim or litigation and to pay or reimburse the Company for the amount of any settlement approved by the Bank or any judgment in connection with such claim or litigation and all costs and expenses of the Company associated therewith. The Company shall cooperate fully to make available to the Bank, at the

Bank's expense, all pertinent information and witnesses under its control. A final determination of any such action, suit, proceeding, claim, demand or assessment through legal proceedings shall be binding and conclusive upon the parties hereto as to the validity or invalidity, as the case may be, of such claim against the Bank.

5. The Bank agrees to keep this Agreement as an official record of the Bank and to maintain a copy of this Agreement in the loan file for the Company.

6. The Bank represents and warrants that this Agreement has been duly authorized by all necessary action on the part of the Bank.

IN WITNESS WHEREOF, the undersigned have executed this Agreement under seal as of the 8th day of March, 1994.

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

MKS INSTRUMENTS, INC.

FIRST AMENDMENT

TO LOAN AGREEMENT

This First Amendment (this "Amendment") dated as of June 30, 1994 amends the Loan Agreement dated as of November 1, 1993 (the "Loan Agreement"), between MKS INSTRUMENTS, INC. (the "Borrower") and THE FIRST NATIONAL BANK OF BOSTON (the "Bank"). Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower and the Bank have executed the Loan Agreement providing for a revolving credit facility for borrowings by the Borrower in amounts up to \$7,000,000; and

WHEREAS, the Borrower has requested, and the Bank has agreed, to extend the maturity of the credit facilities for an additional one-year period, on the terms and conditions set forth below;

NOW, THEREFORE, the Bank and the Borrower agree as follows:

Section 1. Amendment to the Loan Agreement. Section 1.1.46 of the Loan Agreement is hereby amended by deleting the date "June 30, 1994" appearing therein in the definition of "Revolver Termination Date" and substituting therefor the date "June 30, 1995".

Section 2. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Amendment and the performance of this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of

the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 3. Conditions to Effectiveness. The effectiveness of this Amendment is conditioned on the following:

(a) the Borrower and the Bank shall each have executed and delivered a counterpart of this Amendment;

(b) the representations and warranties contained in Article V of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof; and

(c) no Default or Event of Default under the Loan Agreement shall have occurred and is continuing.

Section 4. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

IN WITNESS WHEREOF, the parties have caused this Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

MKS INSTRUMENTS, INC.

SECOND AMENDMENT

TO LOAN AGREEMENT

This Second Amendment (this "Amendment") dated as of October 27, 1994 amends the Loan Agreement dated as of November 1, 1993, as amended by the First Amendment dated as of June 30, 1994 (as so amended, the "Loan Agreement"), between MKS INSTRUMENTS, INC. (the "Borrower") and THE FIRST NATIONAL BANK OF BOSTON (the "Bank"). Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower and the Bank have executed the Loan Agreement providing for the Term Loan in the original principal amount of \$10,000,000; and

WHEREAS, the Borrower has requested, and the Bank has agreed, to amend the interest rate applicable to the Term Loan from time to time, and modify certain of the provisions with respect to the payment of interest thereon, on the terms and conditions set forth below;

NOW, THEREFORE, the Bank and the Borrower agree as follows:

Section 1. Amendments to the Agreement.

(a) Section 2.5 of the Loan Agreement is hereby amended by deleting the phrase "30, 60, 90, 120, 150 or 180 days" and substituting therefor the phrase "one, two, three, four, five or six months".

(b) Section 3.2 of the Loan Agreement whereby amended as follows:

(1) by deleting Section 3.2.1(i) and replacing it with the following:

"(i) During any period in which the Borrower maintains a Cash Flow Ratio in excess of 1.35 to 1 but less than 1.75 to 1 and a Debt-to-Net Worth Ratio in excess of 1.35 to 1:

- (a) the LIBOR Rate plus 1.75% or
- (b) the Long Term Funds Rate plus 1.75%."; and

(2) adding new a Section 3.2.1(iii) as follows:

"(iii) During any period in which the Borrower maintains a Cash Flow Ratio in excess of 1.75 to 1 and a Debt-to-Net Worth Ratio not in excess of 1.35 to 1:

- (a) the LIBOR Rate plus 1.40% or
- (b) the Long Term Funds Rate plus 1.40%."

(c) Section 3.2.4 of the Loan Agreement is hereby amended by deleting the phrase "30, 60, 90, 120, 150 or 180 days" and substituting therefor the phrase "one, two, three, four, five or six months".

Section 2. Representations and Warranties.

(a) The execution and delivery of this Amendment and the performance of this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 3. Conditions to Effectiveness. The effectiveness of this Amendment is conditioned on the following:

(a) the Borrower and the Bank shall each have executed and delivered a counterpart of this Amendment;

(b) the representations and warranties contained in Article V of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof; and

(c) no Default or Event of Default under the Loan Agreement shall have occurred and is continuing.

Section 4. Miscellaneous.

(a) On and after the date hereof; each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof; and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

IN WITNESS WHEREOF, the parties have caused this Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Vice President and Director

MKS INSTRUMENTS, INC.

THIRD AMENDMENT

TO LOAN AGREEMENT

This Third Amendment (this "Amendment") dated as of June 30, 1995 amends the Loan Agreement dated as of November 1, 1993, as amended (the "Loan Agreement"), between MKS INSTRUMENTS, INC. (the "Borrower") and THE FIRST NATIONAL BANK OF BOSTON (the "Bank"). Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower and the Bank have executed the Loan Agreement providing for a revolving credit facility for borrowings by the Borrower in amounts up to \$7,000,000; and

WHEREAS, the Borrower has requested, and the Bank has agreed, to extend the maturity of the credit facilities for an additional ninety (90) day period, on the terms and conditions set forth below;

NOW, THEREFORE, the Bank and the Borrower agree as follows:

Section 1. Amendment to the Loan Agreement. Section 1.1.46 of the Loan Agreement is hereby amended by deleting the date "June 30, 1995" appearing therein in the definition of "Revolver Termination Date" and substituting therefore the date "September 30, 1995".

Section 2. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Amendment and the performance of this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby

or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 3. Conditions to Effectiveness. The effectiveness of this Amendment is conditioned on the following:

(a) the Borrower and the Bank shall each have executed and delivered a counterpart of this Amendment;

(b) the representations and warranties contained in Article V of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof; and

(c) no Default or Event of Default under the Loan Agreement shall have occurred and is continuing.

Section 4. Miscellaneous.

(a) On and after the date hereto, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

IN WITNESS WHEREOF, the parties have caused this Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

July 27, 1995

MKS Instruments, Inc.
Six Shattuck Road
Andover, MA 01810

Attention: Robert F. O'Brien, Treasurer

Ladies and Gentlemen:

WHEREAS, MKS Instruments, Inc. a Massachusetts corporation ("Borrower") and The First National Bank of Boston ("Lender") are parties to that certain Loan Agreement dated November 1, 1993, as amended (the "Loan Agreement"); and

WHEREAS, Borrower has signed a letter of intent dated May 17, 1995 (the "Letter of Intent") which sets forth Borrower's intention to acquire through merger UTI Instruments Company ("UTI"); and

WHEREAS, Borrower has requested a waiver of Section 8.1(b) of the Loan Agreement which restricts mergers to allow Borrower, or a wholly-owned subsidiary of Borrower, to merge with UTI pursuant to the terms of the Letter of Intent, and Lender has agreed to do so as set forth herein;

NOW, THEREFORE, the Bank hereby waives compliance with Section 8.1(b) of the Loan Agreement to permit the merger of Borrower, or a wholly-owned subsidiary of Borrower, with UTI pursuant to the terms of the Letter of Intent. This waiver is subject to Borrower, or a wholly-owned subsidiary of Borrower, completing the merger with UTI on or before September 30, 1995.

This waiver herein given shall not operate as a waiver of any other Default or Event of Default, if any, now existing or hereafter arising. Borrower represents that as of the date hereof all of the representations and warranties set forth in Article V of the Loan Agreement are true and correct.

In consideration of the foregoing, Borrower acknowledges that it has no claims, counterclaims, offsets, or defenses against Lender with respect to the Loan Agreement or otherwise.

IN WITNESS WHEREOF, Lender has caused this document to be executed as a document under seal by its duly authorized officer as of this 27th day of July, 1995.

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

ASSENTED TO:

MKS INSTRUMENTS

By: /s/ Robert F. O'Brien

Title: Treasurer

Date: _____

September 25, 1995

MKS Instruments, Inc.
Six Shattuck Road
Andover, MA 01810

RE Loan Agreement dated November 1, 1993 by and between MKS
Investments, Inc. a Massachusetts corporation ("Borrower") and
The First National Bank of Boston ("Lender")

Attention: Robert F. O'Brien, Treasurer

Ladies and Gentlemen:

In a letter dated July 27, 1995 the Lender agreed, provided the merger was completed on or before September 30, 1995, to waive Section 8.1 (b) to allow the Borrower to merge with UTI Instruments Company.

The Borrower has requested that the Lender extend the time period for completion of the merger from September 30, 1995 to October 31, 1995 and the Lender hereby so agrees.

This waiver herein given shall not operate as a waiver of any other Default or Event of Default, if any, now existing or hereafter arising. The Borrower represents that as of the date hereof all of the representations and warranties set forth in Article V of the Loan Agreement are true and correct.

In consideration of the foregoing, Borrower acknowledges that it has no claims, counterclaims, offsets, or defenses against Lender with respect to the Loan Agreement or otherwise.

IN WITNESS WHEREOF, Lender has caused this document to be executed as a document under seal by its duly authorized officer as of this 25th day of September, 1995.

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

ASSENTED TO:

MKS INSTRUMENTS

By: /s/ Robert F. O'Brien

Title: Treasurer

Date: 9/26/95

MKS INSTRUMENTS, INC.

FOURTH AMENDMENT

TO LOAN AGREEMENT

This Fourth Amendment (this "Amendment") dated as of September 30, 1995 amends the Loan Agreement dated as of November 1, 1993, as amended (the "Loan Agreement"), between MKS INSTRUMENTS, INC. (the "Borrower") and THE FIRST NATIONAL BANK OF BOSTON (the "Lender"). Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower and the Lender have executed the Loan Agreement providing for a revolving credit facility for borrowings by the Borrower in amounts up to \$7,000,000; and

WHEREAS, the Borrower has requested, and the Lender has agreed, to extend the maturity of the credit facilities on the terms and conditions set forth below;

NOW, THEREFORE, the Bank and the Borrower agree as follows:

Section 1. Amendment to the Loan Agreement.

(a) Section 1.1.46 of the Loan Agreement is hereby amended by deleting the date "September 30, 1995" appearing therein in the definition of "Revolver Termination Date" and substituting therefore the date "June 30, 1996".

(b) Section 1.1.34 of the Loan Agreement is hereby amended by adding "the Letter of Credit Agreements" after "the Notes,".

(c) Section 2.1 of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

2.1.1 Subject to the terms and conditions of this Agreement, the Lender hereby agrees to make Advances from time to time to the Borrower during the period from the date hereof to the Revolver Termination Date (or such earlier date on which the Lender shall have demanded payment of the Revolving Credit Note) in an aggregate outstanding amount not to exceed at any time \$7,000,000, less the face amount of outstanding Letters of Credit plus unpaid LC Draws (as defined in Section 2.1.2). The Lender shall have the absolute discretion to make such Advances as it deems appropriate and to demand repayment of Advances at any time. Each Advance shall, at the option of the Borrower, be a Base Rate Loan, a LIBOR Loan or a Money Market Rate Loan provided, however, that no LIBOR Loan or Money Market Rate Loan shall be made at any time in a principal amount of less than \$1,000,000.

2.1.2 Subject to the execution and delivery by the Borrower of a letter of credit application and agreement and related documents in form satisfactory to the Lender (each such "Letter of Credit Agreement"), and subject to the terms of this Agreement, the Lender agrees to issue for the account of the Borrower one or more standby letters of credit (the "Letters of Credit") from time to time, from and after the date hereof with expiration dates not later than the earlier of one year from the date of issuance or the Revolver Termination Date, provided the sum of the aggregate face amount of outstanding Letters of Credit plus unpaid LC Draws shall not exceed \$250,000 after giving effect to such issuance. The Lender shall have absolute discretion to issue such Letters of Credit. The Borrower shall pay to the Lender upon the issuance of each Letter of Credit, a Letter of Credit fee equal to 1.25% per annum of the face amount of such Letter of Credit (pro-rated for the number of days such Letter of Credit is outstanding). The Borrower shall also pay to the Lender, on demand from time to time, such fees and expenses as are customarily charged by the Bank in connection with the opening, amendment, negotiation and administration of each Letter of Credit. The Borrower shall pay the Lender for draws made on the Letters of Credit ("LC Draws") and other amounts relating to the Letters of Credit due from time to time in accordance with the Letter of Credit Agreements. If at any time the sum of the aggregate amount of Revolving Credit Loans plus the aggregate face amount of outstanding Letters of Credit and unpaid LC Draws shall exceed the Revolving Credit Loan, the Borrower shall immediately pay cash to the Lender in such amount as shall be necessary to eliminate such excess.

(d) Section 9.2 of the Loan Agreement is hereby amended by adding the following:

Upon the Revolver Termination Date, or the acceleration of the Revolving Credit Note, the Borrower hereby agrees to pay to the Lender an amount equal to the face amount of the then outstanding Letters of Credit, which amount shall be held by the Lender as cash collateral for all LC Draws. The Borrower hereby grants to the Bank a security interest in and pledge of such cash collateral to secure all such LC Draws and other Obligations relating to the Letters of Credit.

Section 2. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Amendment and the performance of this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 3. Conditions to Effectiveness. The effectiveness of this Amendment is conditioned on the following:

(a) the Borrower and the Bank shall each have executed and delivered a counterpart of this Amendment;

(b) the representations and warranties contained in Article V of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof; and

(c) no Default or Event of Default under the Loan Agreement shall have occurred and is

Section 4. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

IN WITNESS WHEREOF, the parties have caused this Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

FIFTH AMENDMENT TO LOAN AGREEMENT

This Fifth Amendment to Loan Agreement is entered into as of the 31st day of October, 1995, by and between The First National Bank of Boston ("Lender") and MKS Instruments, Inc., a Massachusetts corporation ("Borrower").

WHEREAS, the Lender and the Borrower entered into a Loan Agreement as of November 1, 1993 and have subsequently amended such Loan Agreement (as amended, the "Loan Agreement");

WHEREAS, the Lender and the Borrower desire to amend the Loan Agreement;

NOW, THEREFORE, in consideration of the premises and for other good and valuable consideration, the adequacy and receipt of which are hereby acknowledged, the parties hereto hereby agree as follows:

1. The Loan Agreement is hereby amended by deleting Section 1.1.14. (the definition of Consolidated Operating Cash Flow) and replacing it with the following:

1.1.14. "Consolidated Operating Cash Flow" shall mean for any period, the net income (or loss) for such period (before extraordinary items and excluding the net income of any business entity that is not a Subsidiary has an ownership interest unless such net income shall have actually been received by such company in the form of cash distributions) of the Borrower and its Subsidiaries before deducting Interest Expense and taxes and after restoring thereto depreciation of real and personal property and leasehold improvements and amortization and after deducting cash taxes paid, Sub S distributions required to make shareholder tax payments, and capital expenditures incurred, provided that capital expenditures shall not include real estate purchases funded by debt.

2. The Loan Agreement is hereby amended by deleting Section 3.2.1. and replacing it with the following:

3.2.1. Borrower agrees to pay interest in respect of the unpaid principal amount of the Term Loan from the date of this Agreement until paid in full as follows. The Term Loan shall bear interest at the Base Rate unless Borrower desires to pay interest on all or a portion of the Term Loan at one of the following rates:

(i) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio not in excess of 1.35 to 1:

(a) and a Cash Flow Ratio of from 1.35 to 1 to and including 1.75 to 1, the LIBOR Rate plus 1.60%;

(b) and a Cash Flow Ratio of from 1.76 to 1 to and including 2.0 to 1, the LIBOR Rate plus 1.30%

(c) and a Cash Flow Ratio of from 2.01 to 1 to and including 3.0 to 1, the LIBOR Rate plus 1.10%;

(d) and a Cash Flow Ratio in excess of 3.0 to 1, the LIBOR Rate plus .90%; or

(e) the Long Term Funds Rate plus 1.75%; or

(ii) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio of 1.35 to 1 or more or a Cash Flow Ratio of less than 1.35 to 1:

(a) the LIBOR Rate plus 2.00%; or

(b) the Long Term Funds Rate plus 1.75%.

3. The Loan Agreement is hereby amended by adding the following clause (k) to Section 9.1 after clause (j) thereof;

(k) There shall occur any Event of Default under the Loan Agreement between the Borrower and the Lender dated as of October 31, 1995;

4. As hereby amended, the Loan Agreement is hereby ratified and confirmed.

IN WITNESS WHEREOF, the parties hereto have caused this Fifth Amendment to Loan Agreement to be executed as an agreement under seal as of the date first above written.

Witness: MKS INSTRUMENTS, INC.

/s/ Richard S. Chute

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

October 11, 1995

Robert F. O'Brien
Treasurer
MKS Instruments, Inc.
Six Shattuck Road
Andover, MA 01810

RE: Loan Agreement dated November 1, 1993, by and between MKS Instruments, Inc, a Massachusetts corporation ("Borrower") and The First National Bank of Boston ("Lender"), as amended.

Dear Bob:

The purpose of this letter is to confirm our discussion regarding MKS's potential acquisition of UTI Instruments Company, Inc ("UTI"). The Loan Agreement restricts the use of the proceeds of Advances to general working capital purposes, including acquisitions less than \$2,500,000 per annum. You have indicated that you plan to use the proceeds of Advances to temporarily fund the acquisition of UTI for an amount to exceed \$2,500,000. We hereby agree that the proceeds of Advances may temporarily fund the UTI acquisition with permanent funding to be in place on or before March 31, 1996. This agreement is subject to satisfactory review of the Merger Agreement between MKS Instruments, Inc. and UTI Instruments Company, Inc.

All other terms and conditions of the Loan Agreement shall remain in full force and effect, including, without limitation, the Lender's absolute discretion to make Advances and to demand repayment of Advances at any time.

Nothing contained in this letter shall operate as a waiver of any other Default or Event of Default, if any, now existing or hereafter arising. The Borrower represents that as of the date hereof all of the representations and warranties set forth in Article V of the Loan Agreement are true and correct.

In consideration of the foregoing, Borrower acknowledges that it has no claims, counterclaims, offsets, or defenses against Lender with respect to the Loan Agreement or otherwise.

If the foregoing correctly states our understanding, please sign the enclosed copy of this letter where indicated.

Very truly yours,

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Sharon A. Stone, Director

ASSENTED TO AND ACCEPTED this 16th day of October:

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

MKS INSTRUMENTS, INC.

SIXTH AMENDMENT

TO LOAN AGREEMENT

This Sixth Amendment (the "Amendment") dated as of February 23, 1996 amends the Loan Agreement dated as of November 1, 1993, as amended (the "Loan Agreement"), between MKS Instruments, Inc. (the "Borrower") and The First National Bank of Boston (the "Lender"). Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower, the Lender and Chemical Bank shall enter into a loan agreement (the "1996 Loan Agreement") on the date hereof; and

WHEREAS, the Lender and the Borrower agree that certain terms of the Loan Agreement should be made consistent with similar terms in the 1996 Loan Agreement;

NOW, THEREFORE, the Lender and the Borrower agree as follows:

Section 1. Amendment to the Loan Agreement.

(a) Section 4.2.2. of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

4.2.2. The Lender will notify the Borrower of any event occurring after the date of this Agreement that will entitle the Lender to any additional payment under this Section 4.2 as promptly as practicable. The Lender will furnish to the Borrower with such notice a certificate signed by an officer of the Lender certifying that the Lender is entitled to payment under this Section 4.2 and setting forth the basis (in reasonable detail) and the amount of each request by the Lender for any additional payment pursuant to this Section 4.2. Such certificate shall be conclusive in the absence of manifest error. The Borrower shall not be obligated to compensate the Lender pursuant to this Section for amounts accruing prior to the date that is 180 days before the Lender notifies the Borrower of its obligations to compensate the Lender for such amounts.

(b) Sections 7.1(a) and 7.1(c) of the Loan Agreement are hereby amended by replacing the word "sixty" in each with the word "forty-five".

(c) Section 8.1(b) of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

8.1(b) Mergers, Etc. Neither the Borrower nor any subsidiary will consolidate with or merge into any other Person or permit any other Person to consolidate with or merge into it, or acquire all or substantially all of the assets of any Person, or sell, assign, lease or otherwise dispose of (whether in one transaction or in a series of transactions) all or substantially all of its assets to any Person, except that

(1) a Subsidiary may consolidate with or merge into the Borrower or another Subsidiary; and

(2) the Borrower or any of its Subsidiaries may acquire all or substantially all of the assets of any Person provided (i) such Person is engaged in a line of business substantially similar to one or more of Borrower's existing lines of business, (ii) the aggregate purchase price liability incurred in any calendar year, including all contingent liabilities, when aggregated with all such acquisitions and any Investments permitted under Section 8.4(2) in any calendar year shall not exceed 25% of consolidated Tangible Net Worth as of the end of the most recent fiscal quarter or, if 80% or more of the purchase price is paid in capital stock of the Borrower, 40% of Consolidated Tangible Net Worth as of the end of the most recent fiscal quarter and (iii) based on a pro forma calculation of the ratios set forth in Section 8.7 as of the date such acquisition is closed, assuming consolidated of the acquired business with the Borrower for the four full fiscal quarters ended immediately preceding such closing and pro forma debt and debt service payments based on scheduled principal payments, including acquisition borrowings, if any, and pro forma interest on total debt at then prevailing borrowing rates, Borrower is in compliance with the financial covenants set forth in Section 8.7.

(d) Section 8.2 of the Loan Agreement is hereby amended by deleting the existing clause (11) and substituting the following:

(11) Liens in respect of any purchase money obligations for tangible property used in its business, which obligations shall not at any time exceed 5% of Consolidated Tangible Net Worth, provided that any such encumbrances shall not extend to property and assets of the Borrower or any subsidiary not financed by such a purchase money obligation;

(e) Section 8.3 of the Loan Agreement is hereby amended by adding the following words to the end thereof prior to the close parenthesis: "and transfers of capital equipment that will be leased pursuant to Financing Leases".

(f) Section 8.4 of the Loan Agreement is hereby amended by deleting the existing clause (2) and substituting the following:

(2) Investments in or to any Subsidiary or other Person, provided Borrower remains in compliance with Section 8.1(b);

and by deleting from clause (4) the word "\$100,000,000" and replacing it with the word "\$500,000,000".

(g) Section 8.7 of the Loan Agreement is hereby amended by deleting subsection (a) and replacing it with the following:

(a) Consolidated Tangible Net Worth. The Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower shall:

(A) prior to an IPO, not be less than the sum of (i) \$38,000,000, and (ii) 50% of Consolidated Net Income (excluding losses) for each consecutive fiscal quarter of the Borrower beginning with the quarter ending March 31, 1996, on a cumulative basis; and

(B) after an IPO, not be less than the sum of (i) the amount required by clause (A) above immediately prior to such IPO plus (ii) the net proceeds to the Borrower of the IPO less (iii) the Sub S Dividends.

For purposes of the foregoing, the following terms shall have the meanings indicated:

"IPO" shall mean the initial underwritten public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, covering the offer and sale of the Borrower's Common Stock for the account of the Borrower.

"Sub S Dividends" shall mean one or more distributions by the Borrower to its shareholders who were shareholders prior to the IPO in an aggregate amount equal to the Borrower's "accumulated adjustments account", as defined in Section 1368(a)(1) if the Internal Revenue Code of 1986, as of the date of the IPO.

(h) Section 9.1 of the Loan Agreement is hereby amended by replacing existing clause (i) with the following:

(i) There shall occur any default under any instrument or agreement evidencing any indebtedness for money borrowed in excess of \$100,000 by the Borrower or any of its Subsidiaries;

and by adding the following clauses (l) and (m) after clause (k):

(l) There shall occur any Event of Default under any other loan or credit agreement to which the Borrower and the Lender are parties:

(m) The transfer by John R. Bertucci and/or his Affiliates of securities of the Borrower or the voting power related to such securities as a result of which the power to elect, appoint or cause the election or appointment of at least a majority of the members of the board of directors of the Borrower shall no longer be held by John R. Bertucci and/or his Affiliates;

Section 2. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Amendment and the performance of this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 3. Conditions to Effectiveness. The effectiveness of this Amendment is conditioned on the following:

(a) The Borrower and the Lender shall each have executed and delivered a counterpart of this Amendment;

(b) The representations and warranties contained in Article V of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof; and

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing.

Section 4. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts.

(d) This Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

WAIVER

This Waiver (the "Waiver") dated as of October 18, 1996 concerns the Loan Agreement dated as of November 1, 1993, as amended (the "1993 Loan Agreement"), between MKS Instruments, Inc. (the "Borrower") and The First National Bank of Boston (the "Lender") and the Loan Agreement dated as of October 31, 1995, as amended (the "1995 Loan Agreement") between the Borrower and the Lender. Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the 1993 and 1995 Loan Agreements.

The Lender hereby waives the Events of Default under Section 9.1(g), (k) and (l) of the 1993 Loan Agreement and under Section 8.1 (g), (k), and (l) of the 1995 Loan Agreement resulting from (1) Borrower's failure to meet the financial covenants set forth in Section 8.7(b) and (c) of the 1993 Loan Agreement and Section 7.7 (b) and (c) of the 1995 Loan Agreement as of the end of the fiscal quarter ended June 30, 1996 and (2) the Event of Default that has occurred under Section 8.1(g), (k) and (l) of the Loan Agreement dated as of February 23, 1996 among the Borrower, the Lender and the Chase Manhattan Bank (f/k/a Chemical Bank) as a result of Borrower's failure to meet the financial covenants set forth in Section 7.7(b) and (c) of such Loan Agreement as of the end of the fiscal quarter ended June 30, 1996.

Except for the above waiver, the 1993 and 1995 Loan Agreements are in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

IN WITNESS WHEREOF, the Lender has caused this Waiver to be duly executed as of the date and the year first above written.

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

MKS INSTRUMENTS, INC.
WAIVER AND SEVENTH AMENDMENT
TO LOAN AGREEMENT

This Waiver and Seventh Amendment (the "Wavier and Amendment") dated as of February 4, 1997 concerns the Loan Agreement dated as of November 1, 1993 (the "Loan Agreement"), between MKS Instruments, Inc. (the "Borrower") and The First National Bank of Boston (the "Lender"). Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower has requested that the Lender waive certain Events of Default; and

WHEREAS, the Lender is willing, on the terms, subject to the conditions and to the extent set forth below, to grant such a wavier;

NOW, THEREFORE, the Lender and the Borrower agree as follows:

Section 1. Waiver. The Lender hereby waives the Events of Default under Section 9.1(g), (j), (k) and (l) of the Loan Agreement resulting from Borrower's failure to meet the financial covenant set forth in Section 8.7(c) of the Loan Agreement as of the end of the fiscal quarters ended September 30 and December 31, 1996.

Section 2. Amendment to the Loan Agreement.

(a) Section 3.2.1. of the Loan Agreement is hereby amended by adding the following at the end thereof:

Notwithstanding the preceding clauses (i) and (ii), from June 30, 1996 through June 30, 1997, the only alternative to the Base Rate shall be the LIBOR Rate plus 2.00%.

(b) Section 8.7(c) of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

(c) Cash Flow Ratio. The ratio ("Cash Flow Ratio") of Consolidated Operating Cash Flow to Consolidated Debt Service:

(1) for the Borrower's fiscal quarter ending March 31, 1997, shall not be less than 1.25 to 1.00;

(2) for the Borrower's two consecutive fiscal quarters ending June 30, 1997, shall not be less than 1.00 to 1.00;

(3) for the Borrower's three consecutive fiscal quarters ending September 30, 1997, shall not be less than 1.25 to 1.00; and

(4) for the Borrower's four consecutive fiscal quarters ending December 31, 1997 and for each series of four consecutive fiscal quarters of the Borrower ending after December 31, 1997, shall not be less than 1.25 to 1.00.

Section 3. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Waiver and Amendment and the performance of this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Waiver and Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Waiver and Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 4. Loan Documents. This Waiver and Amendment shall be a Loan Document for all purposes.

Section 5. Conditions to Effectiveness. The effectiveness of this Waiver and Amendment is conditioned on the following:

(a) The Borrower and the Lender shall each have executed and delivered a counterpart of this Waiver and Amendment;

(b) The representations and warranties contained in Article of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof;

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing other than the Events of Default described in Section 1 hereof; and

(d) The Borrower's audited consolidated financial statements for the year ended December 31, 1996 shall not differ in any materially adverse respect from the Borrower's unaudited consolidated financial statements for the year ended December 31, 1996, which the Borrower has provided to the Lender and upon which the Lender has relied in agreeing to this Waiver and Amendment.

Section 6. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Waiver and Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Waiver and Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Waiver and Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF
BOSTON

By: _____
Title: _____

IN WITNESS WHEREOF, the parties have caused this Waiver and Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: _____

Title: _____

THE FIRST NATIONAL BANK OF
BOSTON

By: /s/ Sharon A. Stone

Title: Director

MKS INSTRUMENTS, INC.
WAIVER AND NINTH AMENDMENT
TO LOAN AGREEMENT

This Waiver and Ninth Amendment (the "Waiver and Amendment") dated as of January 28, 1999 concerns the Loan Agreement dated as of November 1, 1993 (the "Loan Agreement"), between MKS Instruments, Inc. (the "Borrower") and BankBoston, N.A. (f/k/a The First National Bank of Boston; the "Lender"), as amended. Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower has requested that the Lender waive certain Events of Default and agree to change certain financial covenants in the Loan Agreement; and

WHEREAS, the Lender is willing, on the terms, subject to the conditions and to the extent set forth below, to grant such a waiver and amend the Loan Agreement to effect such changes;

NOW, THEREFORE, the Lender and the Borrower agree as follows:

Section 1. WAIVER. The Lender hereby waives the Events of Default under Section 9.1(g), (j), (k) and (l) of the Loan Agreement resulting from Borrower's failure to meet the financial covenant set forth in Section 8.7(c) of the Loan Agreement as of the end of the fiscal quarter ended December 31, 1998.

Section 2. AMENDMENT OF THE LOAN AGREEMENT.

(a) Section 3.2.1 of the Loan Agreement is hereby amended by adding the following sentences at the end thereof:

Notwithstanding the preceding clauses (i) and (ii), from the date hereof through the date on which the effect of a change resulting from the Borrower's delivery of its financial statements and Compliance Certificate for the quarter ending June 30, 1999 will take effect, the only alternative to the Base Rate shall be the LIBOR Rate plus 1.65%.

The effect of any change to the Borrower's Debt-to-Net Worth Ratio or Cash Flow Ratio on the interest rate available pursuant to Section 3.2.1(i) or (ii) shall take effect on the first day of the month immediately following the month in which the Borrower delivers its financial statements pursuant to Section 7.1(a) or (b) and Compliance Certificate pursuant to Section 7.1(c).

(b) Section 8.7(c) of the Loan Agreement is hereby amended by adding the following clause at the end thereof:

provided, however, that as of the end of each of the fiscal quarters listed below, the Cash Flow Ratio shall not be less than the ratio stated directly below such quarter:

Q4 1998	Q1 1999	Q2 1999	Q3 1999
-----	-----	-----	-----
.6 to 1	.5 to 1	.5 to 1	1.1 to 1

provided, however, that, the foregoing notwithstanding, if the Cash Flow Ratio for the first fiscal quarter of 1999 is less than 1 to 1, then the Cash Flow Ratio for the second fiscal quarter of 1999 shall not be less than 1 to 1 and further, that the Cash Flow Ratio for the first and second fiscal quarters of 1999 shall mean the ratio as of the end of each such quarter of (i) Consolidated Operating Cash Flow for such fiscal quarter ended on such date to (ii) Consolidated Debt Service for such quarter and that the Cash Flow Ratio for the third fiscal quarter of 1999 shall mean the ratio as of the end of such quarter of (i) Consolidated Operating Cash Flow for the first three fiscal quarters of 1999 ended on such date to (ii) Consolidated Debt Service for such quarters.

(c) Section 8.7 of the Loan Agreement is hereby amended by adding the following subsection (d):

(d) EBIT-TO-INTEREST RATIO. The ratio of the sum of Consolidated Net Income plus Interest Expense, the interest portion of Financing Lease Obligations and all taxes in respect of income and profits paid or payable (including accrued Sub S distributions required to make shareholder tax payments) as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ended December 31, 1998 to Interest Expense during such quarter shall not be less than 2 to 1 for the fiscal quarters ending December 31, 1998 and March 31, 1999 and 3 to 1 for the fiscal quarters ending June 30, 1999 and September 30, 1999.

Section 3. FEES. The Borrower shall pay to the Lender a fee of \$10,000 on the date of this Waiver and Amendment.

Section 4. REPRESENTATIONS AND WARRANTIES. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Waiver and Amendment and the performance of this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated

hereby and thereby, have each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Waiver and Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Waiver and Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 5. LOAN DOCUMENTS. This Waiver and Amendment shall be a Loan Document for all purposes.

Section 6. CONDITIONS TO EFFECTIVENESS. The effectiveness of this Waiver and Amendment is conditioned on the following:

(a) The Borrower and the Lender shall each have executed and delivered a counterpart of this Waiver and Amendment;

(b) The representations and warranties contained in Article V of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof;

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing other than the Events of Default described in Section 1 hereof; and

(d) The Lender shall have received, in form and substance satisfactory to it:

(i) an opinion of independent counsel to the Borrower with respect to this Waiver and Amendment;

(ii) a certificate as to the Borrower's legal existence and good standing under the laws of The Commonwealth of Massachusetts; and

(iii) a certificate of the Borrower's Clerk as to (x) no changes in its charter documents and by-laws as amended, (y) corporate votes authorizing the execution and delivery of this Waiver and Amendment and (z) incumbency of the officers authorized to execute this Waiver and Amendment on behalf of the Borrower;

(e) The Borrower's audited consolidated financial statements for the year ended December 31, 1998 (the "1998 Statements") shall not differ in any materially adverse respect from the Borrower's unaudited consolidated financial statements for the year ended December 31, 1998, which the Borrower has provided to the Lender and upon which the Lender has relied in agreeing to this Waiver and Amendment and the Borrower shall deliver the 1998 Statements to the Lender no later than 30 days after the date of this Waiver and Amendment.

(f) The conditions set forth in clauses (b) - (e) of Section 6.1 of the Loan Agreement shall have been met as of the date hereof, provided that for purposes thereof and Section 5.5 of the Loan Agreement, the "Balance Sheet Date" shall mean December 31, 1998 and the financial statements referred to therein shall mean the unaudited statements for the year ended December 31, 1998, that have been furnished to the Lender.

Section 7. MISCELLANEOUS

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Waiver and Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Waiver and Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Waiver and Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ William P. Donlan

Title: Treasurer

BANKBOSTON, N.A.

By: /s/ Sharon A. Stone

Title: Director

LOAN AGREEMENT

by and among

MKS INSTRUMENTS, INC.,
as Borrower,THE FIRST NATIONAL BANK OF BOSTON,
As Agent and as Lender,

and

CHEMICAL BANK,
as Lender,

February 23, 1996

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LOAN AGREEMENT

This Loan Agreement (the "Agreement") is entered into as of the 23rd day of February, 1996, by and among The First National Bank of Boston ("Bank of Boston"), Chemical Bank ("Chemical"; hereinafter Bank of Boston and Chemical may be referred to individually as a "Lender" or collectively as the "Lenders"), The First National Bank of Boston in its capacity as agent for the Lenders (in such capacity, together with any successor agent appointed in accordance with the terms of Section 9.8, the "Agent"), and MKS Instruments, Inc., a Massachusetts corporation ("Borrower").

PREMISES:

WHEREAS, the Borrower has requested that the Lenders make available to it a revolving credit facility of up to \$20,000,000; and

WHEREAS, the Lenders are willing to make such revolving credit facility available to the Borrower on the terms and conditions hereinafter set forth;

NOW, THEREFORE, in consideration of the premises and for other good and valuable consideration, the adequacy and receipt of which are hereby acknowledged, the parties hereto hereby agree as follows:

ARTICLE I

DEFINITIONS

1.1. Definitions. In addition to terms defined elsewhere in this Agreement, the following terms shall have the meanings indicated, which meanings shall be equally applicable to both the singular and plural forms of such terms:

2.4.1. "Adjusted LIBOR Rate" shall have the meaning set forth in Section

"Advance" shall mean the drawing down by the Borrower of a Base Rate Loan or a LIBOR Loan on any given Advance Date.

"Advance Date" shall mean the date as of which an Advance is consummated.

"Affiliate" of any Person shall mean any other Person which, directly or indirectly, controls, or is controlled by, or is under common control with, such Person. For purposes of this definition, "control" of any Person shall mean the power, directly or indirectly, either to (i) vote 10% or more of the securities having ordinary voting power for the election of directors of such Person or (ii) direct the management and policies of such Person, whether by contract or otherwise. As to

the Borrower, the term "Affiliate" shall include, without limitation, any partnership or joint venture of which the Borrower or any Affiliate of the Borrower is a general partner or is a limited partner with more than a ten percent (10%) interest, and any director or executive officer of the Borrower.

"Applicable Commitment Percentage" shall mean, with respect to each Lender at any time, a fraction, the numerator of which shall be such Lender's Revolving Credit Commitment and the denominator of which shall be the Total Revolving Credit Commitment, which Applicable Commitment Percentage for each Lender as of the Closing Date is as set forth in Exhibit A; provided, however, that the Applicable Commitment Percentage of each Lender shall be increased or decreased to reflect any assignments to or by such Lender effected in accordance with Section 10.1.

"Assignment and Acceptance" shall mean an Assignment and Acceptance in the form of Exhibit B (with blanks appropriately filled in) delivered to the Agent in connection with an assignment of a Lender's interest under this Agreement pursuant to Section 10.1.

"Base Rate" shall mean the higher of (a) the annual rate of interest announced from time to time by the Bank of Boston at the Bank of Boston's office at 100 Federal Street, Boston, Massachusetts, as its "base rate" or (b) one-half of one percent (1/2%) above the Federal Funds Effective Rate. For the purposes of this definition, "Federal Funds Effective Rate" shall mean, for any day, the rate per annum equal to the weighted average of the rates on overnight federal funds transactions with members of the Federal Reserve System arranged by federal funds brokers, as published for such day (or, if such day is not a Business Day, for the next preceding Business Day) by the Federal Reserve Bank of New York, or if such rate is not so published for any day that is a Business Day, the average of the quotations for such day on such transactions received by the Bank of Boston from three funds brokers of recognized standing selected by the Bank of Boston.

"Base Rate Loan" shall mean an Advance that is specified as such in the Notice of Borrowing with respect to such Advance and that bears interest at the Base Rate.

"Borrowing" shall mean the incurrence of one or more Advances on a given date.

"Business Day" shall mean a day on which commercial banks are required to be open for business in Boston, Massachusetts.

"Cash Flow Ratio" shall have the meaning set forth in Section 7.7(c).

"Closing Date" shall mean the date of this Agreement.

"Compliance Certificate" shall have the meaning set forth in Section 6.1(c).

"Consolidated Debt Service" shall mean for any period the sum (without duplication) of Interest Expense, the interest portion of Financing Lease Obligations and required principal payments on long-term debt of the Borrower and its Subsidiaries, determined on a consolidated basis.

"Consolidated Indebtedness" shall mean the Indebtedness of the Borrower and its Subsidiaries, determined on a consolidated basis.

"Consolidated Net Income" shall mean for any period the net income (or loss) for such period (before extraordinary items and excluding the net income of any business entity that is not a Subsidiary in which the Borrower or one of its Subsidiaries has an ownership interest unless such net income shall have actually been received by such company in the form of cash distributions) of the Borrower and its Subsidiaries after deducting all operating expenses, depreciation and amortization, Interest Expense, the interest portion of Financing Lease Obligations, all taxes in respect of income and profits paid or payable (including accrued Sub S distributions required to make shareholder tax payments) and all other proper deductions, all determined on a consolidated basis.

"Consolidated Operating Cash Flow" shall mean for any period, the net income (or loss) for such period (before extraordinary items and excluding the net income of any business entity that is not a Subsidiary in which the Borrower or one of its Subsidiaries has an ownership interest unless such net income shall have actually been received by the Borrower or Subsidiary, as the case may be, in the form of cash distributions) of the Borrower and its Subsidiaries before deducting Interest Expense and taxes and after restoring thereto depreciation of real and personal property and leasehold improvements and amortization and after deducting cash taxes paid, Sub S distributions required to make shareholder tax payments, and capital expenditures incurred, provided that capital expenditures shall not include real estate purchases funded by debt.

"Consolidated Tangible Net Worth" shall mean, at any time, the stockholders' equity of the Borrower and its Subsidiaries determined in accordance with generally accepted accounting principles including the book amount of all minority interests in MKS International, Inc. but excluding the book amount of all minority interests in other Affiliates and any foreign exchange translation adjustment, with no upward adjustments due to a reevaluation of assets (other than any such upward adjustment as may be required under generally accepted accounting principles in connection with the acquisition by the Borrower or any Subsidiary of another company or entity) minus the following items (without duplication of deductions) appearing on the balance sheet of the Borrower and its Subsidiaries:

(a) the book amount of all assets (including, without limitation, goodwill, patents, trademarks, copyrights, organizational expense and unamortized debt discount) that would be treated as intangibles under generally accepted accounting principles;

(b) treasury stock; and

(c) any write-up in the book amount of any asset or Investment subsequent to the Closing Date, resulting from a reevaluation or reappraisal thereof from the amount entered in accordance with generally accepted accounting principles by the Borrower or any Subsidiary on its books with respect to its acquisition of the asset or Investment.

"Costs" shall have the meaning set forth in Section 10.4.

"Debt-to-Net Worth Ratio" shall have the meaning set forth in Section 7.7(b).

"Default" shall mean any event that, with the lapse of time, the giving of notice, or both, would become an Event of Default hereunder.

"Event of Default" shall have the meaning set forth in Section 8.1 hereof.

"Existing Loan Agreements" shall mean the Loan Agreements between the Borrower and the Bank of Boston dated November 1, 1993 and October 31, 1995, respectively.

"Financing Lease" shall mean any lease of the Borrower or a Subsidiary, as lessee, that is shown or is required to be shown in accordance with generally accepted accounting principles as a liability on the balance sheet of the lessee thereunder.

"Financing Lease Obligation" shall mean for any period the monetary obligation of the lessee under a Financing Lease. The amount of a Financing Lease Obligation at any date is the amount at which the lessee's liability under the Financing Lease would be required to be shown on its balance sheet at such date.

"Hazardous Substances" shall mean any hazardous waste, as defined by 42 U.S.C. Section 6903(5), any hazardous substances, as defined by 42 U.S.C. Section 601(14), any pollutant or contaminant, as defined by 42 U.S.C. Section 9601(33), or any toxic substance, oil or hazardous materials or other chemicals or substances regulated by any laws or regulations relating to the discharge of air pollutants, water pollutants, or processed wastewater.

"Indebtedness" shall mean, for any Person, (a) all obligations of such Person that in accordance with generally accepted accounting principles would be reflected on the balance sheet of such Person as a liability, (b) all obligations of any other Person the payment or collection of which such Person has guaranteed (except by reason of endorsement for collection in the ordinary course of business) or in respect of which such Person is liable, contingently or otherwise, including, without limitation, liable by way of agreement to purchase, to provide funds for payment, to supply funds to or otherwise to invest in such other Person, or otherwise to assure a creditor against loss, (c) all obligations of any other Person for borrowed money or for the deferred purchase price of property or services secured by (or for which the holder of such indebtedness has an existing right, contingent or otherwise, to be secured by) any mortgage, or other encumbrance upon or in property (including, without limitation, accounts and contract rights) owned by such Person, whether or not such Person has assumed or become liable for the payment of such indebtedness or obligations, and (d) Financing Lease Obligations of such Person.

"Interest Expense" shall mean for any period the aggregate amount of interest recorded, in accordance with generally accepted accounting principles, on the financial statements for that period by the Borrower and its Subsidiaries in respect of Consolidated Indebtedness incurred for borrowed money.

"Interest Period" shall mean the period designated by the Borrower as such in the Notice of Borrowing with respect to any LIBOR Loan pursuant to and subject to the limitations set forth in Section 2.5.

"Interest Rate Determination Date" shall mean the third Business Day prior to the first day of the related Interest Period for a LIBOR Loan.

"Interim Maturity Date" shall mean the last day of any Interest Period.

"Investments" shall have the meaning set forth in Section 7.4.

"IPO" shall mean the initial underwritten public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, covering the offer and sale of the Borrower's Common Stock for the account of the Borrower.

"LIBOR Loan" shall mean an Advance that is specified as such in the Notice of Borrowing with respect to such Advance and that bears interest at the adjusted LIBOR Rate.

"LIBOR Rate" shall mean for any Interest Rate Determination Date, the rate obtained by dividing (i) the quotation offered by the Agent in the interbank Eurodollar market for U.S. dollar deposits of amounts in immediately available funds

comparable to the principal amount of the LIBOR Loan for which the LIBOR Rate is being determined with a maturity comparable to the Interest Period for which such LIBOR Rate will apply as of approximately noon (Boston time) three Business Days prior to the commencement of such Interest Period by (ii) a percentage equal to 100% minus the stated maximum rate of all reserves required to be maintained against "Eurocurrency liabilities" as specified in Regulation D (or against any other category of liabilities that includes deposits by reference to which the interest rate on LIBOR Loans is determined) as applicable on such date to any member bank of the Federal Reserve System.

"Licenses" shall have the meaning set forth in Section 4.8.

"Lien" shall mean any interest in property securing an obligation owed to, or a claim by, a Person other than the owner of the property, whether the interest is based on common law, statute or contract (including the security interest lien arising from a mortgage, encumbrance, pledge, conditional sale or trust receipt or a lease, consignment or bailment for security purposes). For the purposes of this Agreement, the Borrower or a Subsidiary shall be deemed to be the owner of any property that it has acquired or holds subject to a Financing Lease or a conditional sale agreement or other arrangement pursuant to which title to the property has been retained by or vested in some other Person for security purposes, and such retention or vesting shall be deemed to be a Lien.

"Loan Documents" shall mean each of this Agreement, the Notes and any other document or instrument executed by the Borrower in favor of the Lenders in connection with the transactions contemplated hereby.

"Note" shall mean a Revolving Credit Note.

"Notice of Borrowing" shall have the meaning set forth in Section 2.2.1.

"Obligations" shall mean, without limitation, any and all liabilities, debts, and obligations of the Borrower to each of the Lenders, of each and every kind, nature and description, arising under this Agreement or any other Loan Document, whether now existing or hereafter incurred. "Obligations" also means, without limitation, any and all obligations of the Borrower to act or to refrain from acting in accordance with the terms, provisions and covenants of this Agreement or of any other Loan Document.

"Permitted Liens" shall have the meaning set forth in Section 7.2.

"Person" shall mean any natural person, corporation, unincorporated organization, trust, joint-stock company, joint venture, association, company, partnership or government, or any agency or political subdivision of any government.

"Required Lenders" shall mean, as of any date, Lenders on such date having Credit Exposures (as defined below) aggregating at least 66-2/3% of the aggregate Credit Exposures of all the Lenders on such date. For purposes of the preceding sentence, the "Credit Exposure" of each Lender shall mean the aggregate principal amount of the Advances owing to such Lender plus the aggregate unutilized amounts of such Lender's Revolving Credit Commitment.

"Revolver Termination Date" shall mean June 30, 1999 or any subsequent anniversary thereof if the Total Revolving Credit Commitment shall have been renewed by the Lenders.

"Revolving Credit Commitment" means, with respect to each Lender, the obligation of such Lender to make Advances to the Borrower up to an aggregate principal amount at any one time outstanding equal to such Lender's Applicable Commitment Percentage of the Total Revolving Credit Commitment.

"Revolving Credit Facility" shall mean the loan arrangement described in Article II of this Agreement, subject to all other applicable terms of this Agreement.

"Revolving Credit Note" shall have the meaning set forth in Section 2.3.

"Revolving Credit Outstandings" means, as of any date of determination, the aggregate principal amount of all Advances then outstanding and all interest accrued thereon.

"Revolving Loan Account" shall mean the account on the books of the Agent in the name of the Borrower in which the following shall be recorded: Advances made by the Lenders to and for the account of the Borrower pursuant to Section 2 of this Agreement; all other charges, expenses and other items properly chargeable to the Borrower with respect to such Advances; all Costs with respect to such Advances; all payments made by the Borrower on account of Indebtedness evidenced by the Revolving Credit Notes; and other appropriate debits and credits.

"Subsidiary" shall mean any Person of which the Borrower at the time owns, directly or indirectly, through another Subsidiary or otherwise, 50% or more of the equity interests.

"Sub S Dividends" shall mean one or more distributions by the Borrower to its shareholders who were shareholders prior to the IPO in an aggregate amount equal to the Borrower's "accumulated adjustments account," as defined in Section 1368(a)(1) of the Internal Revenue Code of 1986, as of the date of the IPO.

"Total Revolving Credit Commitment" shall mean a principal amount equal to \$20,000,000.

1.2. Accounting Terms. Accounting terms not specifically defined in this Agreement shall have the meanings given to them under generally accepted accounting principles.

1.3. Other Definitional Provisions. The words "hereof," "herein" and "hereunder," and words of similar import when used in this Agreement shall refer to this Agreement as a whole and not any particular provision of this Agreement. Any Article, Section, Exhibit or Schedule references are to this Agreement unless otherwise specified.

ARTICLE II

REVOLVING CREDIT FACILITY

2.1. Revolving Credit. Subject to the terms and conditions of this Agreement, each Lender severally agrees to make Advances from time to time to the Borrower during the period from the date hereof to the Revolver Termination Date on a pro rata basis as to the total Borrowing requested by the Borrower on any day determined by such Lender's Applicable Commitment Percentage up to but not exceeding the Revolving Credit Commitment of such Lender, provided, however, that the Lenders will not be required and shall have no obligation to make any such Advance (i) so long as a Default or an Event of Default has occurred and is continuing or (ii) if the Agent has accelerated the maturity of any of the Notes as a result of an Event of Default; provided further, however, that immediately after giving effect to each such Advance, the aggregate principal amount of Revolving Credit outstandings shall not exceed the Total Revolving Credit Commitment. Within such limits and subject to the terms and conditions hereof, the Borrower may borrow, repay and reborrow under the Revolving Credit Facility on any Business Day from the Closing Date until, but (as to borrowings and reborrowings) not including, the Revolver Termination Date. All Advances shall be due and payable no later than the Revolver Termination Date. Each Advance shall, at the option of the Borrower, be a Base Rate Loan or a LIBOR Loan provided, however, that no LIBOR Loan having an Interest Period of 2, 3 or 6 months shall be made at any time in a principal amount of less than \$1,250,000 and no LIBOR Loan having an Interest Period of 1 month shall be made at any time in a principal amount of less than \$1,000,000.

2.2. Advances.

2.2.1. Whenever the Borrower desires to obtain a LIBOR Loan hereunder, it may request that the Agent provide quotes as of any specified Interest Rate Determination Date as to the LIBOR Rate for any or all Interest Periods, and the Agent shall promptly provide such quotes. The Borrower shall give the Agent prior telecopied or telephone notice (given not later than 11:00 a.m. (Boston time)) on the day of any Borrowing with respect to a Base Rate Loan and at least three Business Days prior to the day of any Borrowing with respect to a LIBOR Loan. Each such notice (each a "Notice of Borrowing") shall specify the principal amount of each Advance to be made, the date of the Borrowing (which shall be a Business Day), whether each Advance being made is to be initially maintained as a Base Rate Loan or a LIBOR Loan and, in the case of a LIBOR Loan, the initial Interest Period applicable thereto. If such notice is given by telephone, it shall be immediately confirmed in writing. Notice of receipt of a Notice of Borrowing, together with the amount of each Lender's portion of an Advance requested thereunder, shall be provided by the Agent to each Lender by facsimile transmission with reasonable promptness on the day the Agent receives the Notice of Borrowing. No more than one Base Rate Loan shall be outstanding at any time, but the Borrower may increase the principal amount of any Base Rate Loan at any time by giving a Notice of Borrowing as set forth above.

2.2.2. No later than 3:00 p.m. on the Advance Date, each Lender shall, pursuant to the terms and subject to the conditions of this Agreement, make the amount of the Advance or Advances to be made by it on such day available by wire transfer to the Agent in the amount of its pro rata share, determined according to such Lender's Applicable Commitment Percentage of the Advance or Advances to be made on such day. Such wire transfer shall be directed to the Agent and shall be in the form of Dollars constituting immediately available funds. The amount so received by the Agent shall, subject to the terms and conditions of this Agreement, promptly be made available to the Borrower on the date so specified by delivery of the proceeds thereof to the Revolving Loan Account or otherwise as shall be directed in the applicable Notice of Borrowing and reasonably acceptable to the Agent.

2.2.3. Upon the Interim Maturity Date of any LIBOR Loan, unless the Borrower (i) shall have given the Agent a Notice of Borrowing in accordance with Section 2.2.1 requesting that a new LIBOR Loan be made on such Interim Maturity Date or (ii) shall have repaid such LIBOR Loan on such Interim Maturity Date, the Borrower shall be deemed to have requested that the Lenders make a Base Rate Loan to the Borrower on such Interim Maturity Date in an aggregate principal amount equal to the aggregate principal amount of the LIBOR Loan maturing on such Interim Maturity Date.

2.3. Revolving Loan Account. The Advances made by each Lender from time to time to the Borrower under this Agreement shall be evidenced by a Revolving Credit Note in the form of Exhibit C hereto (each, a "Revolving Credit Note") in the amount of such Lender's Revolving Credit Commitment. The Advances and the amounts of all payments on the Revolving Credit Notes shall be recorded by the Agent in the Revolving Loan Account of the Borrower. The debit balance of the Revolving Loan Account shall represent the amount of the Borrower's indebtedness to the Lenders from time to time by reason of Advances and other appropriate charges hereunder. All statements regarding the Revolving Loan Account shall be deemed to be accurate absent manifest error or unless objected to by the Borrower within 30 days after receipt. The Borrower agrees to review each such statement promptly after receipt and to bring any errors or discrepancies to the Agent's attention promptly.

2.4. Interest.

2.4.1. The Borrower agrees to pay interest in respect of the unpaid principal amount of each Advance from the date the proceeds thereof are made available to the Borrower until maturity (whether by acceleration, voluntary prepayment or otherwise) as follows. Each Advance shall bear interest at the Base Rate in effect from time to time unless the Borrower elects and qualifies to pay interest on such Advance at the following rate (the "Adjusted LIBOR Rate"):

(i) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio of less than 1 to 1:

(a) and a Cash Flow Ratio of less than 1.75 to 1, the LIBOR Rate plus 1.125%;

(b) and a Cash Flow Ratio of 1.75 to 1 or greater up to and including 2.5 to 1, the LIBOR Rate plus .875%; or

(c) and a Cash Flow Ratio in excess of 2.5 to 1, the LIBOR Rate plus .625%;

(ii) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio of 1 to 1 or more but less than or equal to 1.5 to 1:

(a) and a Cash Flow Ratio of less than 1.75 to 1, the LIBOR Rate plus 1.25%;

(b) and a Cash Flow Ratio of 1.75 to 1 or greater up to and including 2.5 to 1, the LIBOR Rate plus 1.00%; or

(c) and a Cash Flow Ratio in excess of 2.5 to 1, the LIBOR Rate plus .75%.

2.4.2. Overdue principal and (to the extent permitted by law) overdue interest in respect of each Base Rate Loan and each LIBOR Loan (to the extent not converted into a Base Rate Loan) shall bear interest, payable on demand, after as well as before judgment, at a rate per annum equal to the Base Rate in effect from time to time plus 3% per annum.

2.4.3. Interest shall accrue from and including the date of any Advance and shall be payable by the Borrower on each Advance in arrears on the last day of each of the Borrower's fiscal quarters, on any prepayment (on the amount prepaid), on any maturity date (whether by acceleration or otherwise), and after such maturity, on demand. Interest shall be calculated on the basis of actual days elapsed and a 360-day year.

2.5. Interest Periods. At the time it gives any Notice of Borrowing with respect to a LIBOR Loan, the Borrower shall elect the Interest Period applicable to the related Advance, which Interest Period shall, at the option of the Borrower, be a period of 1, 2, 3 or 6 months. Notwithstanding anything to the contrary contained herein:

(i) if any Interest Period begins on a day for which there is no numerically corresponding day in the calendar month at the end of such Interest Period, such Interest Period shall end on the last Business Day of such calendar month;

(ii) if any Interest Period would otherwise expire on a day that is not a Business Day, such Interest Period shall expire on the next succeeding Business Day; provided that if any Interest Period would otherwise expire on the day that is not a Business Day but is a day of the month after which no further Business Day occurs in such month, such Interest Period shall expire on the next preceding Business Day;

(iii) no Interest Period shall extend beyond the Revolver Termination Date.

2.6. Unused Commitment Fee. For the period beginning on the Closing Date and ending on the Revolver Termination Date, the Borrower agrees to pay to the Agent, for the pro rata benefit of the Lenders based on their Applicable Commitment Percentages, an unused commitment fee equal to 0.25% per annum multiplied by the average daily amount by which (a) the Total Revolving Credit Commitment exceeds (b) the Revolving Credit Outstandings less all accrued and unpaid interest. Such fees shall be due in arrears on the last Business Day of each March, June, September and December commencing March 29, 1996 to and on the Revolver Termination Date. Notwithstanding the foregoing, so long as any Lender fails to make available any portion of its Revolving Credit Commitment when

requested, such Lender shall not be entitled to receive payment of its pro rata share of such fee for so long as such Lender shall not have made available such portion. Such fee shall be calculated on the basis of a year of 360 days for the actual number of days elapsed.

2.7. Deficiency Advances. No Lender shall be responsible for any default of any other Lender in respect to such other Lender's obligation to make any Advance nor shall the Revolving Credit Commitment of any Lender hereunder be increased as a result of such default of any other Lender. Without limiting the generality of the foregoing, in the event any Lender shall fail to advance funds to the Borrower as herein provided, the Agent may in its discretion, but shall not be obligated to, advance under the Revolving Credit Note in its favor as a Lender all or any portion of such amount or amounts (each, a "deficiency advance") and shall thereafter be entitled to payments of principal of and interest on such deficiency advance in the same manner and at the same interest rate or rates to which such other Lender would have been entitled had it made such advance under its Revolving Credit Note; provided that, upon payment to the Agent from such other Lender of the entire outstanding amount of each such deficiency advance, together with accrued and unpaid interest thereon, from the most recent date or dates interest was paid to the Agent by the Borrower on each Advance comprising the deficiency advance at the rate of interest payable by the Borrower and payment by such other Lender to Agent of customary late fees, then such payment shall be credited against the applicable Revolving Credit Note of the Agent in full payment of such deficiency advance and the Borrower shall be deemed to have borrowed the amount of such deficiency advance from such other Lender as of the most recent date or dates, as the case may be, upon which any payments of interest were made by the Borrower thereon.

2.8. Termination of Existing Facilities. The outstanding Advances, if any, under the Loan Agreement between the Borrower and Bank of Boston dated November 1, 1993 (the "1993 Agreement") shall be replaced on the date hereof by one or more Advances under this Agreement and Borrower shall have no further right to obtain, and Lender shall have no obligation to make, Advances under the 1993 Agreement. The \$3,000,000 demand unsecured revolving credit facility made available to the Borrower by Chemical Bank as set forth in a letter agreement dated August 23, 1995 shall terminate on the date hereof.

ARTICLE III
ADDITIONAL TERMS

3.1. Payments.

3.1.1. The Borrower shall have the right to prepay the Notes, in whole at any time or in part from time to time, without premium or penalty, provided that, except as set forth in Section 3.3, no Advance, either in whole or in part, may be prepaid on the Advance Date of such Advance. The Borrower shall give notice (by telex or telecopier, or by telephone (confirmed in writing promptly thereafter)) to the Agent of each proposed prepayment hereunder prior to 11:00 a.m. (Boston time), (x) with respect to Base Rate Loans, upon the Business Day of the proposed prepayment and (y) with respect to LIBOR Loans, at least three Business Days prior to the Business Day of the proposed prepayment, which notice in each case shall specify the proposed prepayment date (which shall be a Business Day), the aggregate principal amount of the proposed prepayment and which Advances are to be prepaid. LIBOR Loans that are voluntarily prepaid before the last day of the applicable Interest Period shall be subject to the additional compensation requirements set forth in Section 3.3, and each prepayment of a LIBOR Loan shall be in an aggregate principal amount of not less than the total principal amount outstanding at such time under such LIBOR Loan. If at any time the outstanding principal amount of the Advances exceeds \$20,000,000, the Borrower will immediately prepay the Advances by the amount of such excess.

3.1.2. All payments of principal and interest due under the Notes (including Prepayments), and any other amounts owing to the Lenders under this Agreement shall be made by the Borrower not later than 2:30 p.m., Boston time, on the day due in lawful money of the United States of America to the Agent at its Boston, Massachusetts office in immediately available funds. The Borrower hereby authorizes the Agent to charge such payments as they become due, if not otherwise paid by the Borrower, to any account of the Borrower with the Agent as the Agent may elect.

3.1.3. Whenever any payment to be made hereunder or under any other Loan Document shall be stated to be due on a day that is not a Business Day, such payment may be made on the next succeeding Business Day, and such extension of time shall in such case be included in computing interest or other fees or charges provided for under this Agreement or any other Loan Document; provided, however, that with respect to LIBOR Loans, if the next succeeding Business Day falls in another calendar month, such payment shall be made on the next preceding Business Day.

3.1.4. All payments made by the Borrower on the Notes shall be applied by the Agent (a) first, to the payment of Costs with respect to the Notes, (b)

second, to the payment of accrued and unpaid interest on the Notes, until all such accrued interest has been paid, and (c) third, to the payment of the unpaid principal amount of the Notes. Except as otherwise provided herein, (a) each payment on account of the principal of and interest on the Notes and the fees described in Section 2.6 shall be made to the Agent for the account of the Lenders pro rata based on their Applicable Commitment Percentages, (b) all payments to be made by the Borrower for the account of each of the Lenders on account of principal, interest and fees, shall be made without diminution, setoff, recoupment or counterclaim, and (c) the Agent will promptly distribute to the Lenders in immediately available funds payments received in fully collected, immediately available funds from the Borrower.

3.2. Capital Adequacy.

3.2.1. If, after the date of this Agreement, a Lender shall have reasonably determined in good faith that the adoption or effectiveness after the date hereof of any applicable law, rule or regulation regarding capital adequacy, or any change therein, or any change in the interpretation or administration thereof by any governmental authority, central bank or comparable agency charged with the interpretation or administration thereof, or compliance by such Lender with any request or directive regarding capital adequacy (whether or not having the force of law) of any such authority, central bank or comparable agency, has or would have the effect of materially reducing the rate of return on such Lender's capital or assets as a consequence of its commitments or obligations hereunder to a level below that which such Lender could have achieved but for such adoption, effectiveness, change or compliance (taking into consideration such Lender's then current policies with respect to capital adequacy), then from time to time, subject to Section 3.2.2, within 15 days after demand, the Borrower shall pay to the Agent for the account of such Lender such additional amount or amounts as will compensate such Lender for such reduction (after such Lender shall have allocated the same fairly and equitably among all of its customers or any class generally affected thereby).

3.2.2. The Agent will notify the Borrower of any event occurring after the date of this Agreement that will entitle a Lender to any additional payment under this Section 3.2 as promptly as practicable. The Agent will furnish to the Borrower with such notice a certificate signed by an officer of the Lender requesting payment certifying that such Lender is entitled to payment under this Section 3.2 and setting forth the basis (in reasonable detail) and the amount of each request by such Lender for any additional payment pursuant to this Section 3.2. Such certificate shall be conclusive in the absence of manifest error. The Borrower shall not be obligated to compensate such Lender pursuant to this Section for amounts accruing prior to the date that is 180 days before such Agent notifies the Borrower of its obligations to compensate such Lender for such amounts.

3.3. Special Provisions Governing LIBOR Loans. Notwithstanding any other provisions of this Agreement, the following provisions shall govern with respect to LIBOR Loans as to the matters covered:

3.3.1. Increased Costs, Illegality, etc. (a) In the event that the Agent shall have determined (which determination shall, if made in good faith and absent manifest error, be final, conclusive and binding upon all parties):

(i) on any Interest Rate Determination Date, that by reason of any changes arising after the date of this Agreement affecting the interbank Eurodollar market, adequate and fair means do not exist for ascertaining the applicable interest rate on the basis provided for in the definition of LIBOR Rate; or

(ii) at any time during any Interest Period, that the Lenders shall incur increased costs (including taxes) or reductions in the amounts received or receivable hereunder with respect to a LIBOR Loan by reason of (x) any change since the Interest Rate Determination Date for the Interest Period in question in any applicable law or governmental rule, regulation, guideline or order (or any interpretation thereof and including the introduction of any new law or governmental rule, regulation, guideline or order) (such as, for example but not limited to, a change in official reserve requirements, but excluding reserve requirements that have been included in calculating the LIBOR Rate for such Interest Period) and/or (y) other circumstances affecting any Lender, the interbank Eurodollar market or the position of any Lender in the relevant market; or

(iii) at any time, that the making or continuance of any LIBOR Loan has become unlawful by compliance by the Lenders in good faith with any law, governmental rule, regulation, guideline or order, or has become impracticable as a result of a contingency occurring after the date of this Agreement;

then and in any such event, the Agent shall promptly after making such determination give notice (by telephone confirmed in writing) to the Borrower of such determination. Thereafter (x) in the case of clause (i) above, any Notice of Borrowing given by the Borrower with respect to a LIBOR Loan that has not yet been incurred shall be deemed rescinded by the Borrower and LIBOR Loans shall no longer be available until such time as the Agent notifies the Borrower that the circumstances giving rise to such notice no longer exist or that, notwithstanding such circumstances, LIBOR Loans will again be made available hereunder, (y) in the case of clause (ii), the Borrower shall pay to the Agent, upon written demand therefor (but only with respect to any LIBOR Loan made pursuant to a Notice of Borrowing issued

after the giving of the written notice that LIBOR Loans will again be made available hereunder referred to in clause (x) above), such additional amounts (in the form of an increased rate of, or a different method of calculating, interest or otherwise as the Agent in its sole discretion shall determine) as shall be required to compensate the Lenders for such increased cost or reduction in amount received (a written notice as to additional amounts owed the Lenders, showing the basis for such calculation thereof, shall be given to the Borrower by the Agent and shall, absent manifest error, be final, conclusive and binding upon the parties hereto), and (z) in the case of clause (iii), the Borrower shall take one of the actions specified in Section 3.3.1(b) as promptly as possible and, in any event, within the time period required by law.

(b) At any time that any LIBOR Loan is affected by the circumstances described in Section 3.3.1(a)(ii) or (iii), the Borrower may (and in the case of a LIBOR Loan affected pursuant to Section 3.3.1(a)(iii) shall) either (x) if the affected LIBOR Loan is then being made, withdraw the related Notice of Borrowing by giving the Agent telephonic (confirmed in writing) notice thereof on the same date that the Borrower was notified by the Agent pursuant to Section 3.3.1(a), or (y) if the affected LIBOR Loans are then outstanding, upon at least three Business Days' written notice to the Agent, require the Agent to convert each LIBOR Loan so affected into a Base Rate Loan.

3.3.2. Compensation. The Borrower shall compensate the Lenders, upon the Agent's written request (which request shall set forth the basis for requesting such amounts), for all reasonable losses, expenses and liabilities (including, without limitation, any interest paid by the Lender to lenders of funds borrowed by it to make or carry its LIBOR Loans to the extent not recovered by the Lenders in connection with the re-employment of such funds) and any loss sustained by any Lender in connection with the re-employment of the funds (including, without limitation, a return on such re-employment that would result in such Lender's receiving less than it would have received had such LIBOR Loan remained outstanding until the last day of the Interest Period applicable to such LIBOR Loan) that such Lender, may sustain: (i) if for any reason (other than a default by or negligence of any Lender) a LIBOR Loan is not advanced on a date specified therefor in a Notice of Borrowing (unless timely withdrawn pursuant to Section 3.3.1(b)(x) above), (ii) if any payment or prepayment of any LIBOR Loans occurs for any reason whatsoever (including, without limitation, by reason of Section 3.3.1(b)) on a date that is prior to the last day of an Interest Period applicable thereto, (iii) if any prepayment of any of its LIBOR Loans is not made on the date specified in a notice of payment given by the Borrower pursuant to Section 3.1 or (iv) as a consequence of an election made by the Borrower pursuant to Section 3.3.1(b)(y).

3.4. Taxes. All payments made by the Borrower under this Agreement and any Notes shall be made free and clear of, and without deduction or withholding for or on account of, any present or future income, stamp or other taxes, levies, imposts,

duties, charges, fees, deductions or withholdings, now or hereafter imposed, levied, collected, withheld or assessed by any governmental authority, excluding net income taxes and franchise taxes (imposed in lieu of net income taxes) imposed on any Lender as a result of a present or former connection between such Lender and the jurisdiction of the governmental authority imposing such tax or any political subdivision or taxing authority thereof or therein (other than any such connection arising solely from such Lender's having executed, delivered or performed its obligations or received a payment under, or enforced, this Agreement or any Note). If any such non-excluded taxes, levies, imposts, duties, charges, fees deductions or withholdings ("Non-Excluded Taxes") are required to be withheld from any amounts payable to the Lenders hereunder or under any Note, the amounts so payable to the Lenders shall be increased to the extent necessary to yield to the Lenders (after payment of all Non-Excluded Taxes) interest or any such other amounts payable hereunder at the rates or in the amounts specified in this Agreement. Whenever any Non-Excluded Taxes are payable by the Borrower, as promptly as possible thereafter the Borrower shall send to the Agent a certified copy of an original official receipt received by the Borrower showing payment thereof. If the Borrower fails to pay any Non-Excluded Taxes when due to the appropriate taxing authority or fails to remit to the Agent the required receipts or other required documentary evidence, the Borrower shall indemnify the Lenders for any incremental taxes, interest or penalties that may become payable to any Lenders as a result of any such failure. The agreements in this subsection shall survive the termination of this Agreement and the payment of the Advances and all other amounts payable hereunder.

ARTICLE IV

REPRESENTATIONS AND WARRANTIES OF THE BORROWER

In order to induce the Lenders to enter into this Agreement and to make the loans provided for herein, the Borrower makes the following representations and warranties to the Lenders, all of which shall survive the execution and delivery of this Agreement and the Notes.

4.1. Organization, Existence and Power. The Borrower is duly incorporated, validly existing and in good standing under the laws of the jurisdiction of its incorporation. The Borrower has the corporate power necessary to conduct the business in which it is engaged, to own the properties owned by it and to consummate the transactions contemplated by the Loan Documents. The Borrower is duly qualified or licensed to transact business in all places where the nature of the properties owned by it or the business conducted by it makes such qualification necessary and where the failure to be so qualified or licensed would have a material adverse effect upon the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole.

4.2. Authorization of Loan Documents; Binding Effect. The execution and delivery of this Agreement and the other Loan Documents and the performance of the transactions contemplated hereby and thereby have been duly authorized by all necessary corporate actions of the Borrower. Each of the Loan Documents constitutes the legal, valid and binding obligation of the Borrower, enforceable against the Borrower in accordance with its terms.

4.3. Authority. The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under the Loan Documents. Neither the authorization, execution, delivery, or performance by the Borrower of this Agreement or of any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

4.4. Capital Structure. The number of shares of stock of which the Borrower's authorized capital stock consists, the par value per share of such stock, the number of shares of such stock that have been issued and are outstanding and the number of shares that have been issued and are held by the Borrower as treasury shares are all disclosed on the Disclosure Schedule. Set forth in the Disclosure Schedule is a complete and accurate list of all Subsidiaries of the Borrower. The Disclosure Schedule indicates the jurisdiction of incorporation or organization of each of the Subsidiaries, the number of shares or units of each class of capital stock or other equity of the Subsidiaries authorized, and the number of such shares or units outstanding and the percentage of each class of such equity owned (directly or indirectly) by the Borrower. No shares of stock or units of equity interests of the Borrower or any of its Subsidiaries are covered by outstanding options, warrants, rights of conversion or purchase or similar rights granted or created by the Borrower except as set forth on the Disclosure Schedule. All the outstanding capital stock of the Borrower has been validly issued and is fully paid and nonassessable. All the stock or units of equity interests of the Borrower's Subsidiaries that are owned by the Borrower or any Subsidiary of the Borrower are owned free and clear of all mortgages, deeds of trust, pledges, liens, security interests and other charges or encumbrances.

4.5. Financial Condition. The audited consolidated balance sheet of the Borrower and its Subsidiaries dated as of December 31, 1995 (the "Balance Sheet Date") and the audited statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for and as of the end of the period ending on that date, including any related notes (the "Financial Statements"), all of which were

heretofore furnished to the Lenders, are true, correct and complete in all material respects and fairly present in all material respects the financial condition of the Borrower and its Subsidiaries as of the date of each such statement and have been prepared in accordance with generally accepted accounting principles consistently applied throughout the periods involved. Other than as reflected in such Financial Statements and except for liabilities incurred in the ordinary course of business since the date thereof, the Borrower has no Indebtedness that is or would be material to the financial condition of the Borrower, nor any material unrealized or unanticipated losses from any commitments. Since the Balance Sheet Date there has been no material adverse change in the consolidated financial condition (as set forth in the Financial Statements) or results of operations of the Borrower and its Subsidiaries taken as a whole.

4.6. Pending Litigation. Except as set forth in the Disclosure Schedule, there are no suits or proceedings pending or, to the knowledge of the Borrower, threatened before any court or arbitration tribunal or by or before any governmental or regulatory authority, commission, bureau or agency or public regulatory body against the Borrower that if adversely determined would have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole.

4.7. Certain Agreements; Material Contracts. The Borrower is not a party to any agreement or instrument or subject to any court order or governmental decree adversely affecting in any material respect the business, properties, assets or financial condition of the Borrower and its Subsidiaries taken as a whole.

4.8. Authorization, Etc. All authorizations, consents, approvals, accreditations, certifications and licenses required under the corporate charter or by-laws of the Borrower or under applicable law or regulation for the ownership or operation of the property owned or operated by the Borrower or the conduct of any business or activity conducted by the Borrower, including provision of services for which reimbursement is made by third party payors, other than authorizations, consents, approvals, accreditations, certifications or licenses the failure to obtain and/or maintain which would not have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries taken as a whole (collectively, "Licenses") have been duly issued and are in full force and effect. The Borrower has fulfilled and performed all of its material obligations with respect to such licenses (to the extent now required to be fulfilled or performed) and no event has occurred that would allow, with or without the passage of time or the giving of notice or both, revocation or termination thereof or would result in any other material impairment of the rights of the holder of any such License. All filings or registrations with any governmental or regulatory authority required for the conduct of the business or activity conducted by the Borrower have been made, other than any such filings or registrations as to which the failure to make same would not

have a material adverse effect on the consolidated financial condition, assets or results of operations of the Borrower and its Subsidiaries, taken as a whole. Except as expressly contemplated hereby, no approval, consent or authorization of or filing or registration with any governmental commission, bureau or other regulatory authority or agency is required with respect to the execution, delivery or performance of any of the Loan Documents.

4.9. No Violation. The execution, delivery and performance by the Borrower of the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower. The Borrower is not in default, nor has any event occurred that with the passage of time or the giving of notice, or both, would constitute a default, in the performance, observance or fulfillment of any of the obligations, covenants or conditions contained in any agreement, instrument or other document to which the Borrower is a party, which default would have a material adverse effect on the consolidated assets, financial condition or results of operations of the Borrower and its Subsidiaries, taken as a whole. The Borrower is not in violation of any applicable federal, state or local law, rule or regulation or any writ, order or decree, which violation would have a material adverse effect on the consolidated assets, financial condition or results of operations of the Borrower and its Subsidiaries, taken as a whole. Except as otherwise set forth in the Disclosure Schedule under the caption "Litigation," the Borrower has not received notice of any violation of any federal, state or local environmental law, rule or regulation or assertion that the Borrower has any obligation to clean up or contribute to the cost of cleaning up any waste or pollutants.

4.10. Payment of Taxes. The Borrower and its Subsidiaries have properly prepared and filed or caused to be properly prepared and filed all federal tax returns and all material state and local tax returns that are required to be filed and have paid all taxes shown thereon to be due and all other taxes, assessments and governmental charges or levies imposed upon the Borrower and its Subsidiaries, their income or profits or any properties belonging to the Borrower. No extensions of any statute of limitations are in effect with respect to any tax liability of the Borrower or any Subsidiary of the Borrower. No deficiency assessment or proposed adjustment of the federal income taxes of the Borrower or any Subsidiary of the Borrower is pending and the Borrower has no knowledge of any proposed liability of a substantial nature for any tax to be imposed upon any of its properties or assets.

4.11. Transactions With Affiliates, Officers, Directors and 1% Shareholders. Except as set forth on the Disclosure Schedule, the Borrower has no Indebtedness to or material contractual arrangement or understanding with any Affiliate, officer or director of the Borrower, nor any shareholder holding of record at least 1% of the equity of the Borrower nor, to the best of the Borrower's knowledge (without independent inquiry), any of their respective relatives.

4.12. ERISA. The Borrower has never established or maintained any funded employee pension benefit plan as defined under Section 3(2)(A) of the Employee Retirement Income Security Act of 1974, as amended and in effect on the date hereof ("ERISA"), other than the plans described on the Disclosure Schedule. No employee benefit plan established or maintained, or to which contributions have been made, by the Borrower or any Subsidiary of the Borrower that is subject to Part 3 of Title I-B of ERISA, had an accumulated funding deficiency (as such term is defined in Section 302 of ERISA) as of the last day of the fiscal year of such plan ended most recently prior to the date hereof, or would have had an accumulated funding deficiency (as so defined) on such day if such year were the first year of the plan to which Part 3 of Title I-B of ERISA applied. No material liability to the Pension Benefit Guaranty Corporation has been incurred or is expected by the Borrower to be incurred by it or any Subsidiary of the Borrower with respect to any such plan or otherwise. The execution, delivery and performance of this Agreement and the other Loan Documents will not involve on the part of the Borrower any prohibited transaction within the meaning of ERISA or Section 4975 of the Internal Revenue Code. The Borrower has never maintained, contributed to or been obligated to contribute to any "multiemployer plan," as defined in Section 3(37) of ERISA. The Borrower has never incurred any "withdrawal liability" calculated under Section 4211 of ERISA, and there has been no event or circumstance that would cause it to incur any such liability.

4.13. Ownership of Properties; Liens. The Borrower has good and marketable title to all its material properties and assets, real and personal, that are now carried on its books, including, without limitation, those reflected in the Financial Statements (except those disposed of in the ordinary course since the date thereof), and has valid leasehold interests in its properties and assets, real and personal, which it purports to lease, subject in either case to no mortgage, security interest, pledge, lien, charge, encumbrance or title retention or other security agreement or arrangement of any nature whatsoever other than Permitted Liens and those specified in the Disclosure Schedule. All of the Borrower's material leasehold interests and material obligations with respect to real property are described on the Disclosure Schedule.

4.14. Employment Matters. Except as set forth on the Disclosure Schedule, there are no material grievances, disputes or controversies pending or, to the knowledge of the Borrower, threatened between the Borrower and its employees, nor is any strike, work stoppage or slowdown pending or threatened against the Borrower.

4.15. Insurance. The Borrower maintains in force fire, casualty, comprehensive liability and other insurance covering its properties and business that is adequate and customary for the type and scope of its properties and business.

4.16. Indebtedness. Except as reflected in the Financial Statements or set forth in the Disclosure Schedule, and other than Indebtedness incurred in the

ordinary course of business since the Balance Sheet Date, the Borrower has no outstanding Indebtedness.

4.17. Securities Law Compliance. The Borrower is not an "investment company" as defined in the Investment Company Act of 1940, as amended. All of the Borrower's outstanding stock was offered, issued and sold in compliance with all applicable state and federal securities laws.

4.18. Accuracy of Information. None of the information furnished to the Lenders by or on behalf of the Borrower for purposes of this Agreement or any Loan Document or any transaction contemplated hereby or thereby contains, and none of such information hereinafter furnished will contain any material misstatement of fact, nor does or will any such information omit any material fact necessary to make such information not misleading at such time.

ARTICLE V

CONDITIONS TO ADVANCES

The Lenders shall not be obligated to make any Advances unless the following conditions have been satisfied:

5.1. Each Advance. The obligations of the Lenders to make each Advance are subject to the following conditions precedent, each of which shall have been met or performed on or before the Advance Date or the Closing Date, as the case may be:

(a) No Default. No Default or Event of Default shall have occurred and be continuing or will occur upon the making of the Advance.

(b) Correctness of Representations. The representations and warranties made by the Borrower in this Agreement shall be true and correct with the same force and effect as though such representations and warranties had been made on and as of the Advance Date (i) except to the extent that the representations and warranties set forth in Article IV of this Agreement are untrue as a result of circumstances that have changed subsequent to the date hereof, which change has caused no non-compliance by the Borrower with the covenants, conditions and agreements in this Agreement and (ii) except that the references in Section 4.5 of this Agreement to the financial statements and the term "Balance Sheet Date" are deemed to refer to the most recent financial statements (inclusive of consolidated balance sheets and statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries) furnished to the Lenders pursuant to Section 6.1(a) and (b) of this Agreement and the date of such financial statements, respectively.

(c) No Litigation; Certain Other Conditions. There shall be no suit or proceeding (other than suits or proceedings disclosed on the Disclosure Schedule on the date of this Agreement) pending or threatened before any court or arbitration tribunal or by or before any governmental or regulatory authority, commission, bureau or agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, is reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole.

(d) No Material Adverse Change. There shall have been no material adverse change in the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole since the Balance Sheet Date.

(e) Loan Documents. All Loan Documents shall be in full force and effect.

5.2. First Advance. The obligations of the Lenders to make the first Advance are subject to the following additional conditions precedent, each of which shall have been met or performed on or before the Closing Date:

(a) Deliveries. The Agent shall have received, in form and substance satisfactory to the Agent and Lenders, the following:

(i) an opinion or opinions of independent counsel to the Borrower with respect to the Loan Documents and the transactions contemplated thereby;

(ii) certificates as to the Borrower's legal existence and good standing under the laws of The Commonwealth of Massachusetts, and certificates as to the Borrower's authority to do business as a foreign corporation in the States of Arizona, California, Colorado, Connecticut, Florida, Illinois, Maryland, Michigan, New Jersey, New Mexico, New York, Oregon, Pennsylvania and Texas, each dated as of a recent date;

(iii) a certificate of the Borrower's Clerk as to (i) its charter documents and by-laws, as amended, (ii) corporate votes authorizing the execution and delivery of the Loan Documents, and (iii) incumbency of the officers authorized to execute the Loan Documents on behalf of the Borrower;

(iv) a Revolving Credit Note to the order of each Lender, each duly executed by the Borrower and otherwise appropriately completed;

(v) a certificate duly executed by the Borrower's chief financial officer dated the Advance Date or Closing Date, as the case may be, to the

effect that each of the conditions set forth in the foregoing Section 5.1 has been met as of such date.

(b) All Proceedings Satisfactory. All corporate and other proceedings taken prior to or on the Closing Date in connection with the transactions contemplated by this Agreement, and all documents and exhibits related thereto, shall be reasonably satisfactory in form and substance to the Agent and the Lenders.

(c) Additional Documents. The Borrower shall have delivered to the Agent all additional opinions, documents and certificates that the Agent or any Lender may reasonably require.

ARTICLE VI

AFFIRMATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Notes and payment and performance of all other Obligations, unless the Required Lenders shall otherwise consent in writing:

6.1. Reporting Requirements. The Borrower shall furnish to the Lenders:

(a) As soon as available and in any event within forty-five days after the end of each of the first three quarters of each fiscal year of the Borrower and its Subsidiaries, (i) a consolidated and consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such quarter and (ii) consolidated and consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for the period commencing at the end of the previous fiscal year and ending with the end of such quarter, all in reasonable detail and duly certified by the chief financial officer of the Borrower as having been prepared in accordance with generally accepted accounting principles consistently applied (subject to addition of notes and ordinary year-end audit adjustments), together with a certificate of the chief financial officer of the Borrower stating that no Default or Event of Default has occurred and is continuing or, if a Default or an Event of Default has occurred and is continuing, a statement as to the nature thereof and the action that the Borrower proposes to take with respect thereto;

(b) As soon as available and in any event within ninety days after the end of each fiscal year of the Borrower, the audited consolidated balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the audited consolidated statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year, in each case accompanied by the

unqualified opinion with respect thereto of the Borrower's independent public accountants and a certification by such accountants stating that they have reviewed this Agreement and whether, in making their audit, they have become aware of any Default or Event of Default and if so, describing its nature, along with the related unaudited consolidating balance sheet of the Borrower and its Subsidiaries as of the end of such fiscal year and the unaudited consolidating statements of operations, cash flows and stockholders' equity of the Borrower and its Subsidiaries for such fiscal year;

(c) Not later than forty-five days following the end of each fiscal quarter a certificate signed by the chief financial officer of the Borrower substantially in the form of Exhibit D hereto (the "Compliance Certificate");

(d) Not later than thirty days after the end of each fiscal year of the Borrower, the Borrower's representative forecast for the next fiscal year on a consolidated basis, including, at a minimum, projected statements of profit and loss and projected cash flow, prepared in accordance with generally accepted accounting principles consistently applied;

(e) Promptly upon receipt thereof, one copy of each other report submitted to the Borrower or any Subsidiary by independent accountants in connection with any annual, interim or special audit made by them of the books of the Borrower or any Subsidiary;

(f) Promptly after the commencement thereof, notice of all actions, suits and proceedings before any court, arbitration tribunal or governmental regulatory authority, commission, bureau, agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, would be reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole;

(g) As soon as possible, and in any event within five days after the Borrower shall know of the occurrence of any Default or Event of Default, the written statement of the chief financial officer of the Borrower setting forth details of such Default or Event of Default and action that the Borrower proposes to take with respect thereto;

(h) As soon as possible, and in any event within five days after the occurrence thereof, written notice as to any other event of which the Borrower becomes aware that with the passage of time, the giving of notice or otherwise, is reasonably likely to result in a material adverse change in the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole; and

(i) Such other information respecting the business or properties or the condition or operations, financial or otherwise, of the Borrower as any Lender may from time to time reasonably request.

6.2. Loan Proceeds. The Borrower shall use the proceeds of the Advances only for the purpose of general working capital, acquisitions not prohibited hereby and capital expenditures.

6.3. Maintenance of Business and Properties; Insurance.

(a) The Borrower will continue to engage in business of the same general nature as the business currently engaged in by the Borrower. The Borrower will at all times maintain, preserve and protect all material franchises and trade names and preserve all the Borrower's material tangible property used or useful in the conduct of its business and keep the same in good repair, working order and condition, ordinary wear and tear excepted, and from time to time make all needful and proper repairs, renewals, replacements, betterments, and improvements thereto so that the business carried on in connection therewith may be conducted properly and advantageously at all times.

(b) The Borrower will keep all of its insurable properties now or hereafter owned adequately insured at all times against loss or damage by fire or other casualty to the extent customary with respect to like properties of companies conducting similar businesses and to the extent available at commercially reasonable rates; and will maintain public liability and workmen's compensation insurance insuring the Borrower to the extent customary with respect to companies conducting similar businesses and to the extent available at commercially reasonable rates, all by financially sound and reputable insurers. The Borrower shall furnish to the Agent from time to time at the Agent's request copies of all such insurance policies and certificates evidencing such insurance coverage. Notwithstanding the foregoing, the Borrower may self-insure workmen's compensation to the extent permitted by law and may also self-insure other risks to the extent reasonably deemed prudent by the Borrower.

6.4. Payment of Taxes. The Borrower shall pay and discharge, or cause to be paid and discharged, all material taxes, assessments, and governmental charges or levies imposed upon the Borrower and its Subsidiaries or their income or profits, or upon any other properties belonging to the Borrower prior to the date on which penalties attach thereto, and all lawful claims that, if unpaid, might become a lien or charge upon any material properties of the Borrower, except for such taxes, assessments, charges, levies or claims as are being contested by the Borrower in good faith by appropriate proceedings promptly initiated and diligently prosecuted, for which adequate book reserves have been established in accordance with generally accepted accounting principles, as to which no foreclosure, distraint, sale or other

similar proceedings shall have been commenced, or, if commenced, have been effectively stayed.

6.5. Compliance with Laws, etc. The Borrower shall comply with the requirements of all applicable laws, rules, regulations and orders of any governmental authority, and obtain or maintain all Licenses required under applicable law or regulation for the operation of the Borrower's business, where noncompliance or failure to obtain or maintain would have a material adverse effect on the consolidated financial condition, assets, or results of operations of the Borrower and its Subsidiaries taken as a whole; provided, however, that such compliance or the obtaining of such Licenses may be delayed while the applicability or validity of any such law, rule, regulation or order or the necessity for obtaining any such License is being contested by the Borrower in good faith by appropriate proceedings promptly initiated and diligently prosecuted.

6.6. Books, Records and Accounts. The Borrower shall keep true and correct books, records and accounts, in which entries will be made in accordance with generally accepted accounting principles consistently applied, and that shall comply with the requirements of the Foreign Corrupt Practices Act of 1977 to the extent applicable to the Borrower. Each Lender or its representatives shall upon reasonable notice to the Borrower be afforded, during normal business hours, access to and the right to examine and copy any such books, records and accounts and the right to inspect the Borrower's premises and business operations. All financial and other information with respect to the Borrower and/or any of its Subsidiaries now or hereafter obtained by any Lender under this Agreement or otherwise in connection with any of the transactions contemplated hereunder shall be held in confidence and shall not be released or made available to any other Person, except (i) to governmental agencies (and examiners employed by same) having oversight over the affairs of such Lender, (ii) pursuant to subpoena or similar process issued by a court or governmental agency of competent jurisdiction, or (iii) as otherwise directed by order of any court or governmental agency of competent jurisdiction.

6.7. Further Assurances. The Borrower shall execute and deliver, at the Borrower's expense, all notices and other instruments and documents and take all actions, including, but not limited to, making all filings and recordings, that any Lender shall reasonably request in order to assure to the Lenders all rights given to the Lenders hereby or under any other Loan Document.

6.8. Bank Accounts. The Borrower shall maintain its principal operating accounts with the Agent.

ARTICLE VII

NEGATIVE COVENANTS OF THE BORROWER

The Borrower covenants and agrees that from the date of execution of this Agreement and until the payment in full of the principal of and interest upon the Notes and payment and performance of all other Obligations, unless the Required Lenders shall otherwise consent in writing:

7.1. Sale of Assets; Mergers, Etc.

(a) Sale of Assets. The Borrower will not, except in the ordinary course of business, sell, transfer, or otherwise dispose of, to any Person any assets (including the securities of any Subsidiary).

(b) Mergers, Etc. Neither the Borrower nor any Subsidiary will consolidate with or merge into any other Person or permit any other Person to consolidate with or merge into it, or acquire all or substantially all of the assets of any Person, or sell, assign, lease or otherwise dispose of (whether in one transaction or in a series of transactions) all or substantially all of its assets to any Person, except that

(1) a Subsidiary may consolidate with or merge into the Borrower or another Subsidiary; and

(2) the Borrower or any of its Subsidiaries may acquire all or substantially all of the assets of any Person provided (i) such Person is engaged in a line of business substantially similar to one or more of Borrower's existing lines of business, (ii) the aggregate purchase price liability incurred in any calendar year, including all contingent liabilities, when aggregated with all such acquisitions and any Investments permitted under Section 7.4(2) in any calendar year shall not exceed 25% of Consolidated Tangible Net Worth as of the end of the most recent fiscal quarter or, if 80% or more of the purchase price is paid in capital stock of the Borrower, 40% of Consolidated Tangible Net Worth as of the end of the most recent fiscal quarter and (iii) based on a pro forma calculation of the ratios set forth in Section 7.7 as of the date such acquisition is closed, assuming consolidation of the acquired business with the Borrower for the four full fiscal quarters ended immediately preceding such closing and pro forma debt and debt service payments based on scheduled principal payments, including acquisition borrowings, if any, and pro forma interest on total debt at then prevailing borrowing rates, Borrower is in compliance with the financial covenants set forth in Section 7.7.

7.2. Liens and Encumbrances.

(a) Neither the Borrower nor any Subsidiary will (a) cause or permit or (b) agree or consent to cause or permit in the future (upon the happening of a contingency or otherwise), any of its real or personal property, whether now owned or subsequently acquired, to be subject to any Lien other than Liens described below (which may herein be referred to as "Permitted Liens"):

(1) Liens securing the payment of taxes, assessments or governmental charges or levies or the demands of suppliers, mechanics, carriers, warehousemen, landlords and other like Persons, which payments are not yet due and payable or (as to taxes) may be paid without interest or penalty; provided, that, if such payments are due and payable, such Liens shall be permitted hereunder only to the extent that (A) all claims that the Liens secure are being actively contested in good faith and by appropriate proceedings, (B) adequate book reserves have been established with respect thereto to the extent required by generally accepted accounting principles, and (C) such Liens do not in the aggregate materially interfere with the owning company's use of property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(2) Liens incurred or deposits made in the ordinary course of business (A) in connection with worker's compensation, unemployment insurance, social security and other like laws, or (B) to secure the performance of letters of credit, bids, tenders, sales contracts, leases, statutory obligations, surety, appeal and performance bonds and other similar obligations, in each case not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property;

(3) Liens not otherwise described in Section 7.2(a)(1) or (2) that are incurred in the ordinary course of business and are incidental to the conduct of its business or ownership of its property, were not incurred in connection with the borrowing of money, the obtaining of advances or the payment of the deferred purchase price of property and do not in the aggregate materially detract from the value of, or materially interfere with the owning company's use of, property necessary or material to the conduct of the business of the Borrower and its Subsidiaries taken as a whole;

(4) Liens in favor of the Agent for the benefit of the Lenders;

(5) Liens permitted under Existing Loan Agreements;

(6) Judgment liens or attachments that shall not have been in existence for a period longer than 30 days after the creation thereof, or if a stay of execution shall have been obtained, for a period longer than 30 days after the expiration of such stay or if such an attachment is being actively contested in good faith and by appropriate proceedings, for a period longer than 30 days after the creation thereof;

(7) Liens existing as of the Closing Date and disclosed on the Disclosure Schedule hereto;

(8) Liens provided for in equipment or Financing Leases (including financing statements and undertakings to file financing statements) provided that they are limited to the equipment subject to such leases and the proceeds thereof;

(9) Leases or subleases with third parties or licenses and sublicenses granted to third parties not interfering in any material respect with the business of the Borrower or any Subsidiary of the Borrower;

(10) Any Lien on any asset of any corporation existing at the time such corporation is merged into or consolidated with the Borrower or a Subsidiary of the Borrower and not created in contemplation of such event;

(11) Any Lien existing on any asset prior to the acquisition thereof by the Borrower or any Subsidiary of the Borrower and not created in contemplation of such event;

(12) Liens in respect of any purchase money obligations for tangible property used in its business, which obligations shall not at any time exceed 5% of consolidated Tangible Net Worth, provided that any such encumbrances shall not extend to property and assets of the Borrower or any Subsidiary not financed by such a purchase money obligation;

(13) Easements, rights of way, restrictions and other similar charges or Liens relating to real property and not interfering in a material way with the ordinary conduct of its business; and

(14) Liens on its property or assets created in connection with the refinancing of Indebtedness secured by Permitted Liens on such property, provided that the amount of Indebtedness secured by any such Lien shall not be increased as a result of such refinancing and no

such Lien shall extend to property and assets of the Borrower or any Subsidiary not encumbered prior to any such refinancing.

(b) In case any property is subjected to a Lien in violation of Section 7.2(a), the Borrower will make or cause to be made provision whereby the Notes will be secured equally and ratably with all other obligations secured by such property, and in any case the Notes shall have the benefit, to the full extent that the holders may be entitled thereto under applicable law, of an equitable Lien equally and ratably securing the Notes. Such violation of Section 7.2(a) shall constitute an Event of Default hereunder, whether or not any such provision is made pursuant to this Section 7.2(b).

(c) Neither the Borrower nor any Subsidiary will agree with any third party not to cause or permit any of its real or personal property, whether now owned or subsequently acquired, to be subject to Liens (with or without exceptions).

7.3. Sales and Leasebacks. The Borrower and its Subsidiaries will not sell or transfer any of their property and become, directly or indirectly, liable as the lessee under a lease of such property (other than such transactions between the Subsidiaries and transfers of capital equipment that will be leased pursuant to Financing Leases).

7.4. Investments. Neither the Borrower nor any Subsidiary will make or maintain any investments, made in cash or by delivery of property or assets, (a) in any Person, whether by acquisition of capital stock, Indebtedness, or other obligations or securities, or by loan or capital contribution, or otherwise, or (b) in any property, whether real or personal, (items (a) and (b) being herein called "Investments"), except the following:

(1) Investments in direct obligations of, or guaranteed by, the United States government, its agencies or any public instrumentality thereof and backed by the full faith and credit of the United States government with maturities not to exceed (or an unconditional right to compel purchase within) one year from the date of acquisition;

(2) Investments in or to any Subsidiary or other Person, provided Borrower remains in compliance with Section 7.1(b);

(3) Investments and obligations issued by any state of the United States or any political subdivision of any such state or any public instrumentality thereof with maturities not to exceed (or an unconditional right to compel purchase within) 180 days of the date of acquisition that are rated in one of the top two rating classifications by at least one nationally recognized rating agency;

(4) Investments in demand and time deposits with, Eurodollar deposits with, certificates of deposit issued by, or obligations or securities fully backed by letters of credit issued by (x) any bank organized under the laws of the United States, any state thereof, the District of Columbia or Canada having combined capital and surplus aggregating at least \$500,000,000, or (y) any other bank organized under the laws of a state that is a member of the European Economic Community (or any political subdivision thereof), Japan, the Cayman Islands, or British West Indies having as of any date of determination combined capital and surplus of not less than \$500,000,000 or the equivalent thereof (determined in accordance with generally accepted accounting principles);

(5) Shares of money market mutual funds registered under the Investment Company Act of 1940, as amended;

(6) Foreign currency swaps and hedging arrangements entered into in the ordinary course of business to protect against currency losses, and interest rate swaps and caps entered into in the ordinary course of business to protect against interest rate exposure on Indebtedness bearing interest at a variable rate;

(7) Investments in publicly traded companies and mutual funds (other than money market mutual funds) that in the aggregate shall not exceed \$5,000,000; and

(8) Other Investments existing on the Closing Date and listed on the Disclosure Schedule.

7.5. Transactions with Affiliates. Neither the Borrower nor any Subsidiary will enter into any transaction (including the purchase, sale or exchange of property or the rendering of any service) with any Affiliate except upon fair and reasonable terms that are at least as favorable to the Borrower or the Subsidiary as would be obtained in a comparable arm's-length transaction with a non-Affiliate.

7.6. ERISA Compliance. Neither the Borrower nor any of its Subsidiaries will at any time permit any employee pension benefit plan (as such term is defined in Section 3 of ERISA) maintained by the Borrower or any of its Subsidiaries or in which employees of the Borrower or any of its Subsidiaries is entitled to participate to:

- (a) engage in any "prohibited transaction" as such term is defined in Section 4975 of the Internal Revenue Code of 1986, as amended, or described in Section 406 of ERISA;

- (b) incur any "accumulated funding deficiency" as such term is defined in Section 302 of ERISA, whether or not waived; or
- (c) terminate under circumstances that could result in the imposition of a Lien on the property of the Borrower or any Subsidiary of the Borrower pursuant to Section 4068 of ERISA.

7.7. Financial Covenants. The Borrower covenants and agrees that:

(a) Tangible Net Worth Test. The Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower shall:

(A) prior to an IPO, not be less than the sum of (i) \$38,000,000, and (ii) 50% of Consolidated Net Income (excluding losses) for each consecutive fiscal quarter of the Borrower beginning with the quarter ending March 31, 1996, on a cumulative basis; and

(B) after an IPO, not be less than the sum of (i) the amount required by clause (A) above immediately prior to such IPO plus (ii) the net proceeds to the Borrower of the IPO less (iii) the Sub S Dividends.

(b) Debt-to-Net Worth Ratio. The ratio ("Debt-to-Net Worth Ratio") of the Consolidated Indebtedness (excluding all guaranties except guaranties with respect to borrowed money) as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending December 31, 1995 to its Consolidated Tangible Net Worth as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ending December 31, 1995 shall not exceed 1.5 to 1.

(c) Cash Flow Ratio. The ratio (the "Cash Flow Ratio") as of the end of each fiscal quarter of the Borrower of (i) Consolidated Operating Cash Flow for the four consecutive fiscal quarters then ended to (ii) Consolidated Debt Service for the four consecutive fiscal quarters then ended shall not be less than 1.25 to 1.00.

7.8. Contracts Prohibiting Compliance with Agreement. The Borrower will not enter into any contract or other agreement that would prohibit or in any way restrict the ability of the Borrower to comply with any provision of this Agreement.

ARTICLE VIII

EVENTS OF DEFAULT

8.1. Default. If any one of the following events ("Events of Default") shall occur:

(a) Any representation or warranty made by the Borrower herein or in any other Loan Document, or in any certificate or report furnished by the Borrower hereunder or thereunder, shall prove to have been incorrect in any material respect when made;

(b) Payment of any principal or interest due under any Note shall not be made on or before the date due;

(c) A final judgment or settlement for in excess of \$2,000,000 shall be rendered against or agreed to by the Borrower or any of its Subsidiaries for the payment of money that, after deducting the amount of any insurance proceeds paid or payable to or on behalf of the Borrower or its Subsidiary in connection with such judgment or settlement, as the case may be, is in excess of \$2,000,000, and such judgment shall remain undischarged for a period of thirty (30) days, during which period execution shall not effectively be stayed, or such settlement shall remain unpaid for a period of thirty days after the agreed payment date unless such delay has been agreed to by the other party. If a dispute exists with respect to the liability of any insurance underwriter under any insurance policy of the Borrower or its Subsidiary, no deduction under this subsection shall be made for the insurance proceeds that are the subject of such dispute;

(d) The Borrower or any Subsidiary shall (1) voluntarily terminate operations or apply for or consent to the appointment of, or the taking of possession by, a receiver, custodian, trustee or liquidator of such Person or of all or a substantial part of the assets of such Person, (2) admit in writing its inability, or be generally unable, to pay its debts as the debts become due, (3) make a general assignment for the benefit of its creditors, (4) commence a voluntary case under the Federal Bankruptcy Code (as now or hereafter in effect), (5) file a petition seeking to take advantage of any other law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts, (6) fail to controvert in a timely and appropriate manner, or acquiesce in writing to, any petition filed against it in an involuntary case under the Federal Bankruptcy Code or applicable state bankruptcy laws or (7) take any corporate action for the purpose of effecting any of the foregoing;

(e) Without its application, approval or consent, a proceeding shall be commenced, in any court of competent jurisdiction, seeking in respect of the Borrower or any Subsidiary: the liquidation, reorganization, dissolution, winding-up, or composition or readjustment of debt, the appointment of a trustee, receiver, liquidator or the like of such Person or of all or any substantial part of the assets of such Person, or other like relief in respect of such Person under any law relating to bankruptcy, insolvency, reorganization, winding-up, or composition or adjustment of debts; and, if the proceeding is being contested in good faith by such Person, the same shall continue undismissed, or unstayed and in effect for any period of 45

consecutive days, or an order for relief against such Person shall be entered in any case under the Bankruptcy Code or applicable state bankruptcy laws;

(f) Any foreclosure or other proceedings shall be commenced to enforce, execute or realize upon any lien, encumbrance, attachment, trustee process, mortgage or security interest for payment of an amount in excess of \$250,000 against the Borrower or any Subsidiary;

(g) Default shall be made in the due observance or performance of any covenant or agreement under Article VII;

(h) Default shall be made in the due observance or performance of any covenant or agreement contained herein (and not constituting an Event of Default under any other clause in this Article VIII) or in any other Loan Document or in any other agreement between any Lender and the Borrower evidencing or securing borrowed monies and such default shall continue and shall not have been remedied within thirty days after the date on which such default occurred;

(i) There shall occur any default under any instrument or agreement evidencing any indebtedness for money borrowed in excess of \$100,000 by the Borrower or any of its Subsidiaries;

(j) The transfer by John R. Bertucci and/or his Affiliates of securities of the Borrower or the voting power related to such securities as a result of which the power to elect, appoint or cause the election or appointment of at least a majority of the members of the board of directors of the Borrower shall no longer be held by John R. Bertucci and/or his Affiliates;

(k) There shall occur any material adverse change in the financial condition of the Borrower;

(l) There shall occur any Event of Default under either of the Existing Loan Agreements;

then, and in any such event and at any time thereafter, if such Event of Default or any other Event of Default shall have not been waived, any or all of the following actions may be taken: (i) the Agent (A) with the consent of the Required Lenders, may, and at the direction of the Required Lenders shall, declare any obligation of the Lenders to make further Advances terminated, whereupon the obligation of each Lender to make further Advances hereunder shall terminate immediately, and (B) the Agent shall at the direction of the Required Lenders, at their option, declare by notice to the Borrower any or all of the Obligations to be immediately due and payable, and the same, including all interest accrued thereon and all other obligations of the Borrower to the Agent and the Lenders, shall forthwith become immediately due and

payable without presentment, demand, protest, notice or other formality of any kind, all of which are hereby expressly waived, anything contained herein or in any instrument evidencing the Obligations to the contrary notwithstanding; provided, however, that notwithstanding the above, if there shall occur an Event of Default under clause (d) or (e) above, then the obligation of the Lenders to make Advances shall automatically terminate and any and all of the Obligations shall be immediately due and payable without the necessity of any action by the Agent or the Required Lenders or notice to the Agent or the Lenders; and (ii) the Agent and each of the Lenders shall have all of the rights and remedies available under each of the Loan Documents or under any applicable law.

8.2. Agent to Act. In case any one or more Events of Default shall occur and not have been waived, the Agent may, and at the direction of the Required Lenders shall, proceed to protect and enforce their rights or remedies either by suit in equity or by action at law, or both, whether for the specific performance of any covenant, agreement or other provision contained herein or in any other Loan Document, or to enforce the payment of the Obligations or any other legal or equitable right or remedy.

8.3. Cumulative Rights. No right or remedy herein conferred upon the Lenders or the Agent is intended to be exclusive of any other rights or remedies contained herein or in any other Loan Document, and every such right or remedy shall be cumulative and shall be in addition to every other such right or remedy contained herein and therein or now or hereafter existing at law or in equity or by statute, or otherwise.

8.4. No Waiver. No course of dealing between the Borrower and any Lender or the Agent or any failure or delay on the part of any Lender or the Agent in exercising any rights or remedies under any Loan Document or otherwise available to it shall operate as a waiver of any rights or remedies and no single or partial exercise of any rights or remedies shall operate as a waiver or preclude the exercise of any other rights or remedies hereunder or of the same right or remedy on a future occasion.

8.5. Allocation of Proceeds. If an Event of Default has occurred and not been waived, and the maturity of the Notes has been accelerated pursuant to this Article VIII, all payments received by the Agent hereunder, in respect of any principal of or interest on the Obligations or any other amounts payable by the Borrower hereunder, shall be applied by the Agent in the following order:

- (a) amounts due to the Lenders pursuant to Sections 2.6 and 10.4;
- (b) amounts due to the Agent pursuant to Section 9.10;

(c) payments of interest on Notes to be applied for the ratable benefit of the Lenders;

(d) payments of principal of Notes to be applied for the ratable benefit of the Lenders;

(e) payments of all other amounts due under any of the Loan Documents, if any, to be applied for the ratable benefit of the Lenders; and

(f) any surplus remaining after application as provided for herein, to the Borrower or otherwise as may be required by applicable law.

ARTICLE IX

THE AGENT

9.1. Appointment. Each Lender hereby irrevocably designates and appoints Bank of Boston as the Agent for the Lenders under this Agreement, and each of the Lenders hereby irrevocably authorizes Bank of Boston as the Agent for such Lender, to take such action on its behalf under the provisions of this Agreement and the other Loan Documents and to exercise such powers as are expressly delegated to the Agent by the terms of this Agreement and such other Loan Documents, together with such other powers as are reasonably incidental thereto. The Agent shall not have any duties or responsibilities, except those expressly set forth herein, or any fiduciary relationship with any of the Lenders, and no implied covenants, functions, responsibilities, duties, obligations or liabilities shall be read into this Agreement or any other Loan Document or otherwise exist against the Agent.

9.2. Limitation on Liability. Neither the Agent nor any of its officers, directors, employees, agents or attorneys-in-fact shall be liable to the Lenders for any action lawfully taken or omitted to be taken by it or them under or in connection with the Loan Documents except for its or their own gross negligence or willful misconduct. Neither the Agent nor any of its affiliates shall be responsible in any manner to any of the Lenders for any recitals, statements, representations or warranties made by the Borrower or any officer or representative thereof contained in any Loan Document, or in any certificate, report, statement or other document referred to or provided for in or received by the Agent under or in connection with any Loan Document, or for the value, validity, effectiveness, genuineness, enforceability or sufficiency of any Loan Document, or for any failure of the Borrower to perform its obligations under any Loan Document, or for any recitals, statements, representations or warranties made, or for the value, validity, effectiveness, genuineness, enforceability or sufficiency of any collateral. The Agent shall not be under any obligation to any of the Lenders to ascertain or to inquire as to the

observance or performance of any of the terms, covenants or conditions of any Loan Document on the part of the Borrower or to inspect the properties, books or records of the Borrower or its Subsidiaries.

9.3. Reliance. The Agent shall be entitled to rely, and shall be fully protected in relying, upon any Note, writing, resolution, notice, consent certificate, affidavit, letter, cablegram, telegram, telefacsimile or telex message, statement, order or other document or conversation reasonably believed by it to be genuine and correct and to have been signed, sent or made by the proper Person or Persons and upon advice and statements of legal counsel (including, without limitation, counsel to the Borrower), independent accountants and other experts selected by the Agent. The Agent may deem and treat the payee of any Note as the owner thereof for all purposes unless an Assignment and Acceptance shall have been filed with and accepted by the Agent. The Agent shall be fully justified in failing or refusing to take any action under this Agreement unless it shall first receive advice or concurrence of the Lenders or the Required Lenders as provided in this Agreement or it shall first be indemnified to its satisfaction by the Lenders against any and all liability and expense that may be incurred by it by reason of taking or continuing to take any such action. The Agent shall in all cases be fully protected in acting, or in refraining from acting, under the Loan Documents in accordance with a request of the Required Lenders, and such request and any action taken or failure to act pursuant thereto shall be binding upon all the Lenders and all present and future holders of the Notes.

9.4. Notice of Default. The Agent shall not be deemed to have knowledge or notice of the occurrence of any Default or Event of Default hereunder unless the Agent has received notice from a Lender or the Borrower referring to this Agreement, describing such Default or Event of Default and stating that such notice is a "notice of default." In the event that the Agent receives such a notice, the Agent shall promptly give notice thereof to the Lenders. The Agent shall take such action with respect to such Default or Event of Default as shall be reasonably directed by the Required Lenders; provided that, unless and until the Agent shall have received such directions, the Agent may (but shall not be obligated to) take such action, or refrain from taking such action, with respect to such Event of Default as it shall deem advisable in the best interests of the Lenders.

9.5. No Representations. Each Lender expressly acknowledges that neither the Agent nor any of its affiliates has made any representations or warranties to it and that no act by the Agent hereafter taken, including any review of the affairs of the Borrower or its Subsidiaries, shall be deemed to constitute any representation or warranty by the Agent to any Lender. Each Lender represents to the Agent that it has, independently and without reliance upon the Agent or any other Lender, and based on such documents and information as it has deemed appropriate, made its own appraisal of and investigation into the financial condition, creditworthiness, affairs, status and nature of the Borrower and made its own decision to enter into

this Agreement. Each Lender also represents that it will, independently and without reliance upon the Agent or any other Lender, and based on such documents and information as it shall deem appropriate at the time, continue to make its own credit analysis, appraisals and decisions in taking or not taking action under the Loan Documents and to make such investigation as it deems necessary to inform itself as to the status and affairs, financial or otherwise, of the Borrower or its Subsidiaries. Except for notices, reports and other documents expressly required to be furnished to the Lenders by the Agent hereunder, the Agent shall not have any duty or responsibility to provide any Lender with any credit or other information concerning the affairs, financial condition or business of the Borrower or its Subsidiaries which may come into the possession of the Agent or any of its Affiliates.

9.6. Indemnification. Each of the Lenders agrees to indemnify the Agent in its capacity as such (to the extent not reimbursed by the Borrower and without limiting any obligations of the Borrower to do so), ratably according to the respective principal amount of the Notes held by them (or, if no Notes are outstanding, ratably in accordance with their respective Applicable Commitment Percentages as then in effect) from and against any and all liabilities, obligations, losses (excluding any losses suffered by the Agent as a result of Borrower's failure to pay any fee owing to the Agent), damages, penalties, actions, judgments, suits, costs, expenses or disbursements of any kind or nature whatsoever that may at any time (including without limitation at any time following the payment of the Notes) be imposed on, incurred by or asserted against the Agent in any way relating to or arising out of any Loan Document or any other Document contemplated by or referred to therein or the transactions contemplated thereby or any action taken or omitted by the Agent under or in connection with any of the foregoing; provided that no Lender shall be liable for the payment of any portion of such liabilities, obligations, losses, damages, penalties, actions, judgments, suits, costs, expenses or disbursements resulting from the Agent's gross negligence or willful misconduct. The agreements in this subsection shall survive the payment of the Obligations and the termination of this Agreement.

9.7. The Agent in its Individual Capacity. With respect to its Advances made or renewed by it and any Note issued to it, the Agent shall have the same rights and powers under this Agreement as any Lender and may exercise the same as though it were not the Agent, and the terms "Lender" and "Lenders" shall, unless the context otherwise indicates, include the Agent in its individual capacity. The Agent and its Affiliates may make loans to, accept deposits from and generally engage in any kind of business with the Borrower as though the Agent were not the Agent hereunder. The Agent may apply any amount obtained by it through exercise of a right of banker's lien, set-off, counterclaim or otherwise to satisfaction of any obligations owed it by the Borrower whether under this Agreement or any Existing Loan Agreement and shall have the right to determine the order in which amounts are applied to such obligations.

9.8. Resignation. If the Agent shall resign as Agent under this Agreement, then the Required Lenders may appoint, with the consent, so long as there shall not have occurred and be continuing a Default or Event of Default, of the Borrower, which consent shall not be unreasonably withheld, a successor Agent for the Lenders, which successor Agent shall be a commercial bank organized under the laws of the United States or any state thereof, having a combined surplus and capital of not less than \$500,000,000, whereupon such successor Agent shall succeed to the rights, powers and duties of the former Agent and the obligations of the former Agent shall be terminated and canceled, without any other or further act or deed on the part of such former Agent or any of the parties to this Agreement; provided, however, that the former Agent's resignation shall not become effective until such successor Agent has been appointed and has succeeded of record to all right, title and interest in any collateral held by the Agent; provided, further, that if the Required Lenders and, if applicable, the Borrower cannot agree as to a successor Agent within ninety (90) days after such resignation, the Agent shall appoint a successor Agent that satisfies the criteria set forth above in this Section 9.8 for a successor Agent and the parties hereto agree to execute whatever documents are necessary to effect such action under this Agreement or any other Document executed pursuant to this Agreement; provided, however, that in such event all provisions of the Loan Documents shall remain in full force and effect. After any retiring Agent's resignation hereunder as Agent, the provisions of this Article IX shall inure to its benefit as to any actions taken or omitted to be taken by it while it was Agent under this Agreement.

9.9. Sharing of Payments, Etc. Each Lender agrees that if it shall, through the exercise of a right of banker's lien, set-off, counterclaim or otherwise, obtain payment with respect to its Obligations (other than pursuant to Article V) that results in its receiving more than its pro rata share of the aggregate payments with respect to all of the Obligations (other than any payment pursuant to Section 3.2 or 3.3), then (a) such Lender shall be deemed to have simultaneously purchased from the other Lenders a share in their Obligations so that the amount of the Obligations held by each of the Lenders shall be pro rata and (b) such other adjustments shall be made from time to time as shall be equitable to insure that the Lenders share such payments ratably; provided, however, that for purposes of this Section 9.9, the term "pro rata" shall be determined with respect to the Revolving Credit Commitment after subtraction of amounts, if any, by which any such Lender has not funded its share of the outstanding Advances and Obligations. If all or any portion of any such excess payment is thereafter recovered from the Lender that received the same, the purchase provided in this Section 9.9 shall be rescinded to the extent of such recovery, without interest. The Borrower expressly consents to the foregoing arrangements and agrees that each Lender so purchasing a portion of the other Lenders' Obligations may exercise all rights of payment (including, without limitation, all rights of set-off, banker's lien or counterclaim) with respect to such portion as fully as if such Lender were the direct holder of such portion.

9.10. Fees. The Borrower agrees to pay to the Agent, for its individual account, an annual Agent's fee as from time to time agreed to by the Borrower and Agent in writing.

ARTICLE X

MISCELLANEOUS

10.1. Assignments and Participations. (a) At any time after the Closing Date each Lender may, with the prior consent of the Borrower (so long as no Event of Default has occurred and is continuing) and the Agent, which consents shall not be unreasonably withheld, assign to one or more banks or financial institutions all or a portion of its rights and obligations under the Loan Documents (including, without limitation, all or a portion of any Note payable to its order); provided, that (i) each such assignment shall be of a constant and not a varying percentage of all of the assigning Lender's rights and obligations hereunder, (ii) for each assignment involving the issuance and transfer of a Note, the assigning Lender shall execute an Assignment and Acceptance and the Borrower hereby agrees to execute a replacement Note to give effect to the assignment, (iii) the minimum aggregate amount of a Revolving Credit Commitment that shall be assigned is \$5,000,000, (iv) such assignee shall have an office located in the United States, and (v) no consent of the Borrower or the Agent shall be required in connection with any assignment by a Lender to another Lender or to an Affiliate of any Lender. Upon such execution, delivery, approval and acceptance, from and after the effective date specified in each Assignment and Acceptance, (x) the assignee thereunder shall be a party hereto and, to the extent that rights and obligations hereunder or under any such Note have been assigned or negotiated to it pursuant to such Assignment and Acceptance, have the rights and obligations of a Lender hereunder and a holder of such Note and (y) the assignor thereunder shall, to the extent that rights and obligations hereunder or under such Note have been assigned or negotiated by it pursuant to such Assignment and Acceptance, relinquish its rights and be released from its obligations under this Agreement.

(b) By executing and delivering an Assignment and Acceptance, the Lender assignor thereunder and the assignee thereunder confirm to and agree with each other and the other parties hereto as follows: (i) the assignment made under such Assignment and Acceptance is made under such Assignment and Acceptance without recourse; (ii) such assigning Lender makes no representation or warranty and assumes no responsibility with respect to the financial condition of the Borrower or its Subsidiaries or the performance or observance by the Borrower of any of its obligations under any Loan Document or any other instrument or Document furnished pursuant hereto; (iii) such assignee confirms that it has received a copy of this Agreement, together with copies of the financial statements delivered pursuant to

Section 4.5 or Section 6.1, as the case may be, and such other Loan Documents and other documents and information as it has deemed appropriate to make its own credit analysis and decision to enter into such Assignment and Acceptance; (iv) such assignee will, independently and without reliance upon the Agent, such assigning Lender or any other Lender and based on such documents and information as it shall deem appropriate at the time, continue to make its own credit decisions in taking or not taking action under any Loan Document; (v) such assignee appoints and authorizes the Agent to take such action as agent on its behalf and to exercise such powers under the Loan Documents as are delegated to the Agent by the terms hereof and thereof, together with such powers as are reasonably incidental thereto; and (vi) such assignee agrees that it will perform in accordance with their terms all of the obligations that by the terms of the Loan Documents are required to be performed by it as a Lender and a holder of a Note.

(c) The Agent shall maintain at its address referred to herein a copy of each Assignment and Acceptance delivered to and accepted by it.

(d) Upon its receipt of an Assignment and Acceptance executed by an assigning Lender, the Agent shall give prompt notice thereof to Borrower.

(e) Nothing herein shall prohibit any Lender from pledging or assigning, without notice to or consent of the Borrower, any Note to any Federal Reserve Bank in accordance with applicable law.

(f) Each Lender may sell participations at its expense to one or more banks or other entities as to all or a portion of its rights and obligations under this Agreement; provided, that (i) such Lender's obligations under this Agreement shall remain unchanged, (ii) such Lender shall remain solely responsible to the other parties hereto for the performance of such obligations, (iii) such Lender shall remain the holder of any Note issued to it for the purpose of this Agreement, (iv) the Borrower, the Agent and the other Lenders shall continue to deal solely and directly with such Lender in connection with such Lender's rights and obligations under this Agreement and with regard to any and all payments to be made under this Agreement and (v) the sale of any such participations that require Borrower to file a registration statement with the Securities and Exchange Commission or under the securities regulations or laws of any state shall not be permitted.

(g) The Borrower may not assign any rights, powers, duties or obligations under this Agreement or the other Loan Documents without the prior written consent of all the Lenders.

10.2. Survival of Representations, Etc. All representations, warranties and covenants made herein or in any Loan Document shall survive the making of any

Advance hereunder and the delivery of the Notes and the consummation of all other transactions contemplated hereby or thereby.

10.3. Right of Setoff. In addition to any rights now or hereafter granted under applicable law or otherwise and not by way of limitation of any such rights, upon the occurrence and during the unremedied continuation of an Event of Default, the Agent and each Lender is hereby authorized at any time or from time to time, without presentment, demand, protest or other notice of any kind to the Borrower or to any other Person, any such notice being hereby expressly waived, to set off and to appropriate and apply any and all deposits (general or special) and any other indebtedness at any time held or owing by the Agent or any Lender to or for the credit or the account of the Borrower against and on account of the Obligations, and all other claims of any nature or description arising out of or connected with this Agreement or any other Loan Document, irrespective of whether or not such Agent or Lender shall have made any demand hereunder and although said Obligations, liabilities or claims, or any of them, shall be contingent or unmatured.

10.4. Indemnity; Costs, Expenses and Taxes. The Borrower hereby agrees to indemnify the Lenders and their legal representatives, successors, assigns and agents against, and agrees to protect, save and keep harmless each of them from and to pay upon demand, any and all liabilities, obligations, taxes (including any and all stamp and other taxes payable or determined to be payable in connection with the execution and delivery of any Loan Documents), liens, charges, losses, damages, penalties, claims, actions, suits, costs, indemnities, expenses and disbursements (including, without limitation, reasonable legal fees, costs and expenses, including without limitation reasonable costs of attending and preparing for depositions and other court proceedings), of whatsoever kind and nature, imposed upon, incurred by or asserted against such indemnified party in any way relating to or arising out of the execution, delivery, enforcement, performance and administration of this Agreement or any other Loan Documents (all of the foregoing, collectively, "Costs") except to the extent arising by reason of any Lender's gross negligence, misconduct or breach hereof. Without limiting the foregoing, the Borrower agrees to pay on demand (a) all out-of-pocket costs and expenses of the Agent in connection with the preparation, execution and delivery of this Agreement and any other Loan Documents, including without limitation the reasonable fees and out-of-pocket expenses of Foley, Hoag & Eliot, special counsel for the Agent, with respect thereto, as well as (b) the reasonable fees and all out-of-pocket expenses of legal counsel, independent public accountants and other outside experts retained by the Lenders in connection with any request by the Borrower for consents, waivers or other action or forbearance by the Lenders hereunder, for the modification or amendment hereof, or other like matters relating to the administration of this Agreement; and (c) all reasonable costs and expenses, if any, of the Lenders incurred after the occurrence of any Event of Default hereunder in connection with the enforcement of any of the Loan Documents or the protection of any of the Lenders' rights thereunder, including, without limitation, any internal

costs, including personnel costs of the Lenders incurred in connection with such administration and enforcement or protection.

10.5. Notices.

(a) Unless telephonic notice is specifically permitted pursuant to the terms of this Agreement, any notice or other communication hereunder to any party hereto shall be by telegram, telecopier, telex, delivery in hand or by courier, or registered or certified mail (return receipt requested) and shall be deemed to have been given or made when telegraphed, telexed, telecopied (and confirmed received), delivered in hand or by courier, or three days after being deposited in the mails, postage prepaid, registered or certified, addressed to the party as follows (or at any other address that such party may hereafter specify to the other parties in writing):

(a) If to the Agent:

The First National Bank of Boston
100 Federal Street
Boston, Massachusetts 02110
Attn: Ms. Sharon A. Stone, Director
Telecopier No. (617) 434-4426

with a copy to:

Arlene L. Bender, Esq.
Foley, Hoag & Eliot
One Post Office Square
Boston, Massachusetts 02109
Telecopier No. (617) 832-7000

(b) If to the Borrower:

MKS Instruments, Inc.
Six Shattuck Road
Andover, Massachusetts 01810
Attn: Mr. Robert F. O'Brien, Treasurer
Telecopier No. (508) 975-3756

with a copy to:

Richard S. Chute, Esq.
Hill & Barlow
One International Place
Boston, Massachusetts 02110
Telecopier No. (617) 428-3500

(c) if to the Lenders:

At the addresses set forth on the signature pages hereof
and on the signature page of each Assignment and
Acceptance.

10.6. MASSACHUSETTS LAW. THIS AGREEMENT AND EACH OF THE LOAN DOCUMENTS SHALL BE DEEMED A CONTRACT MADE UNDER THE LAW OF THE COMMONWEALTH OF MASSACHUSETTS AND SHALL BE GOVERNED BY, AND CONSTRUED AND ENFORCED IN ACCORDANCE WITH, THE INTERNAL LAWS OF SAID STATE (WITHOUT REGARD TO ITS PRINCIPLES OF CONFLICT OF LAWS).

10.7. Counterparts. This Agreement may be executed in any number of counterparts and by different parties hereto in separate counterparts, each of which when so executed and delivered shall be deemed an original and all of which when taken together shall constitute one and the same instrument.

10.8 JURISDICTION, SERVICE OF PROCESS.

(a) ANY SUIT, ACTION OR PROCEEDING AGAINST THE BORROWER WITH RESPECT TO ANY OF THE LOAN DOCUMENTS OR ANY JUDGMENT ENTERED BY ANY COURT IN RESPECT OF ANY THEREOF SHALL BE BROUGHT IN THE COURTS OF THE COMMONWEALTH OF MASSACHUSETTS LOCATED IN SUFFOLK COUNTY OR IN THE UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF MASSACHUSETTS, AS THE LENDERS (IN THEIR SOLE DISCRETION) MAY ELECT, AND THE BORROWER HEREBY ACCEPTS THE EXCLUSIVE JURISDICTION OF SUCH COURTS FOR THE PURPOSE OF ANY SUIT, ACTION OR PROCEEDING AND AGREES NOT TO ASSERT ANY CLAIM THAT IT IS NOT PERSONALLY SUBJECT TO THE JURISDICTION OF SUCH COURTS.

(b) IN ADDITION, THE BORROWER HEREBY IRREVOCABLY WAIVES, TO THE FULLEST EXTENT PERMITTED BY LAW, ANY OBJECTION

IT MAY NOW OR HEREAFTER HAVE TO THE LAYING OF VENUE OF ANY SUIT, ACTION OR PROCEEDING ARISING OUT OF OR RELATING TO ANY OF THE LOAN DOCUMENTS OR ANY JUDGMENT ENTERED BY ANY COURT IN RESPECT THEREOF BROUGHT IN SUFFOLK COUNTY IN THE COMMONWEALTH OF MASSACHUSETTS, AND HEREBY FURTHER IRREVOCABLY WAIVES ANY CLAIM THAT ANY SUIT, ACTION OR PROCEEDING BROUGHT IN SUFFOLK COUNTY IN THE COMMONWEALTH OF MASSACHUSETTS HAS BEEN BROUGHT IN AN INCONVENIENT FORUM.

10.9. Limit on Interest. It is the intention of the Lenders and the Borrower to comply strictly with all applicable usury laws; and, accordingly, in no event and upon no contingency shall the Lenders ever be entitled to receive, collect, or apply as interest under any Note any interest, fees, charges or other payments equivalent to interest, in excess of the maximum rate that the Lenders may lawfully charge under applicable statutes and laws from time to time in effect; and, in the event that the Lenders ever receive, collect or apply as interest on the Notes, any such excess, such amount that, but for this provision, would be excessive interest shall be applied to the reduction of the principal amount of the indebtedness evidenced by the Notes; and, if the principal amount of indebtedness evidenced by the Notes, and all lawful interest thereon, is paid in full, any remaining excess shall forthwith be paid to the Borrower, or other party lawfully entitled thereto. In determining whether or not the interest paid or payable, under any specific contingency exceeds the highest contract rate permitted by applicable law from time to time in effect, the Borrower and the Lenders shall, to the maximum extent permitted under applicable law, characterize any non-principal payment as a reasonable loan charge, rather than as interest. Any provision of any Note, or of any other agreement between the Lenders and the Borrower, that operates to bind, obligate, or compel the Borrower to pay interest in excess of such maximum lawful contract rate shall be construed to require the payment of the maximum rate only. The provisions of this Section 10.9 shall be given precedence over any other provisions contained in the Notes or in any other agreement between the Lenders and the Borrower that is in conflict with the provisions of this Section 10.9.

10.10. Amendments. No amendment, modification or waiver of any provision of any Loan Document and no consent by the Lenders to any departure therefrom by the Borrower shall be effective unless such amendment, modification or waiver shall be in writing and signed by the Agent, shall have been approved by the Required Lenders through their written consent, and the same shall then be effective only for the period and on the conditions and for the specific instances and purposes specified in such writing; provided, however, that, no such amendment, modification or waiver

(i) that changes, extends or waives any provision of Section 3.1.4, Section 9.9 or this Section 10.10, the amount of or the due date of any scheduled principal installment of or the rate of interest payable on or fees

payable with respect to any Obligation, that changes the definition of Required Lenders, that permits an assignment by the Borrower of its Obligations under any Loan Document, that reduces the required consent of the Lenders provided hereunder, that increases, decreases (other than pursuant to the express terms hereof) or extends (other than pursuant to the express terms hereof) the Revolving Credit Commitment of any Lender or the Total Revolving Credit Commitment or that waives any condition to the making of any Advance, shall be effective unless in writing and signed by each of the Lenders; or

(ii) that affects the rights, privileges, immunities or indemnities of the Agent shall be effective unless in writing and signed by the Agent.

Notwithstanding any provision of the other Loan Documents to the contrary, as between the Agent and the Lenders, execution by the Agent shall not be deemed conclusive evidence that the Agent has obtained the written consent of the Required Lenders. No notice to or demand on the Borrower in any case shall entitle the Borrower to any other or further notice or demand in similar or other circumstances, except as otherwise expressly provided herein. No delay or omission on any Lender's or the Agent's part in exercising any right, remedy or option shall operate as a waiver of such or any other right, remedy or option or of any Default or Event of Default.

10.11. Headings. The headings of this Agreement are for convenience only and are not to affect the construction of or to be taken into account in interpreting the substance of this Agreement.

10.12. WAIVER OF NOTICE, ETC. THE BORROWER WAIVES DEMAND, NOTICE, PROTEST, NOTICE OF ACCEPTANCE OF THIS AGREEMENT, NOTICE OF LOANS MADE, CREDIT EXTENDED, COLLATERAL RECEIVED OR DELIVERED OR OTHER ACTION TAKEN IN RELIANCE HEREON AND ALL OTHER DEMANDS AND NOTICE OF ANY DESCRIPTION, EXCEPT AS REQUIRED HEREBY. WITH RESPECT BOTH TO THE OBLIGATIONS AND COLLATERAL, THE BORROWER ASSENTS TO ANY EXTENSION OR POSTPONEMENT OF THE TIME OF PAYMENT OR ANY OTHER INDULGENCE, TO ANY SUBSTITUTION, EXCHANGE OR RELEASE OF COLLATERAL, TO THE ADDITION OR RELEASE OF ANY PARTY OR PERSONS PRIMARILY OR SECONDARILY LIABLE, TO THE ACCEPTANCE OF PRETRIAL PAYMENT THEREON AND THE SETTLEMENT, COMPROMISING OR ADJUSTING OF ANY THEREOF, ALL IN SUCH MANNER AND AT SUCH TIME OR TIMES AS THE LENDERS MAY DEEM ADVISABLE. THE BORROWER AGREES THAT NO ACTIONS TAKEN BY ANY PERSON EXCEPT THE LENDERS SHALL IMPAIR OR OTHERWISE AFFECT ITS OBLIGATIONS

HEREUNDER UNTIL ALL OBLIGATIONS OF THE BORROWER HEREUNDER ARE SATISFIED IN FULL.

10.13. Severability. In the event that any one or more of the provisions contained in this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision of this Agreement, but this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

10.14. Entire Agreement. This Agreement and the other Loan Documents constitute the full and entire understanding and agreement between the parties with regard to the subject matter hereof and thereof and shall supersede all prior agreements and understandings, whether written or oral, between the parties with respect to the subject matter hereof and thereof.

10.15. Compliance with Covenants. All computations determining compliance with Articles 6 and 7 shall utilize accounting principles in conformity with those used in the preparation of the financial statements referred to in Section 4.5. If any subsequent financial reports of the Borrower shall be prepared in accordance with accounting principles different from those used in the preparation of the financial statements referred to in Section 4.5, the Borrower shall inform the Agent of the changes in accounting principles and shall provide the Agent with such reports, such supplemental reconciling financial information as may be required to ascertain compliance by the Borrower with the covenants contained in this Agreement.

10.16. Termination. This Agreement may be terminated by the Borrower at any time upon written notice of such termination to the Agent; provided, however, that, unless and until all loans made by the Lenders hereunder and all other Obligations hereunder of the Borrower to any Lender existing (whether or not due) as of the time of the receipt of such notice by the Agent shall have been paid in full, such termination shall in no way affect the rights and powers granted to the Lenders in connection with this Agreement, and until such payment in full all rights and powers hereby granted to the Lenders hereunder shall be and remain in full force and effect.

10.17. WAIVER OF TRIAL BY JURY. THE BORROWER WAIVES ANY AND ALL RIGHTS THAT IT MAY HAVE TO A TRIAL BY JURY ON ANY CLAIM OR ACTION, OF ANY NATURE WHATSOEVER, RELATING TO OR ARISING OUT OF THIS AGREEMENT OR ANY OF THE OTHER LOAN DOCUMENTS.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as an agreement under seal as of the date first above written.

Witness: MKS INSTRUMENTS, INC.

/s/ Richard S. Chute By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF BOSTON

By: /s/ Sharon A. Stone

Title: _____
Address: 100 Federal Street
Boston, MA 02110

CHEMICAL BANK

By: /s/ Joseph Sachs

Title: Vice President

Address: c/o Chemical Connecticut
Corporation
3 Landmark Square, Suite 401
Stamford, CT 06901

EXHIBIT A

Lender -----	Revolving Credit Commitment -----	Applicable Commitment Percentage -----
The First National Bank of Boston	\$12,000,000	60%
Chemical Bank	\$ 8,000,000	40%
	-----	-----
	\$20,000,000	100%

EXHIBIT B

FORM OF ASSIGNMENT AND ACCEPTANCE

DATED _____, _____

Reference is made to the Loan Agreement dated as of February __, 1996 (the "Agreement") among MKS Instruments, Inc., a Massachusetts corporation (the "Borrower"), the Lenders (as defined in the Agreement), and The First National Bank of Boston as Agent for the Lenders ("Agent"). Unless otherwise defined herein, terms defined in the Agreement are used herein with the same meanings.

_____ (the "Assignor") and _____ (the "Assignee") agree as follows:

1. The Assignor hereby sells and assigns to the Assignee, and the Assignee hereby purchases and assumes from the Assignor, WITHOUT RECOURSE, a _____%(1) interest in and to all of the Assignor's rights and obligations under the Agreement as of the Effective Date (as defined below), including, without limitation, such percentage interest in the Advances owing to the Assignor on the Effective Date and evidenced by the Revolving Credit Note held by the Assignor.

2. The Assignor (i) represents and warrants that, as of the date hereof, the aggregate principal amount of Advances owing to it (without giving effect to the assignments thereof which have not yet become effective) is \$_____ under a Revolving Credit Note dated _____, 19__ in the principal amount of \$_____; (ii) represents and warrants that it is the legal and beneficial owner of the interest being assigned by it hereunder and that such interest is free and clear of any adverse claim; (iii) makes no representation or warranty and assumes no responsibility with respect to any statements, warranties or representations made in or in connection with the Agreement or any of the Loan Documents or the execution, legality, validity, enforceability, genuineness, sufficiency or value of the Agreement or any of the Loan Documents or any other instrument or document furnished pursuant thereto; (iv) makes no representation or warranty and assumes no responsibility with respect to the financial condition of the Borrower or any Subsidiary or the performance or observance by the Borrower of any of its obligations under any of the Loan Documents or any other instrument or document furnished pursuant thereto and (v) attaches hereto the Revolving Credit Note referred to in Paragraph 1 above and requests that the Agent exchange such Note for replacement Notes as follows: a Revolving Credit Note dated _____, 19__ in the principal amount of \$_____, payable to the order of the Assignor, and a Revolving Credit

(1) Specify percentage in no more than 4 decimal points. The minimum Revolving Credit Commitment that shall be assigned is \$5,000,000.

Note, dated _____ 19__, in the principal amount of \$ _____, payable to the order of the Assignee.

3. The Assignee (i) confirms that it has received a copy of the Agreement, together with copies of the financial statements referred to in Section 4.5 thereof and such other documents and information as it has deemed appropriate to make its own credit analysis and decision to enter into this Assignment and Acceptance; (ii) agrees that it will, independently and without reliance upon the Agent, the Assignor, or any other Lender and based on such documents and information as it shall deem appropriate at the time, continue to make its own credit decisions in taking or not taking action under the Agreement; (iii) appoints and authorizes the Agent to take such actions on its behalf and to exercise such powers under the Loan Documents as are delegated to the Agent by the terms thereof, together with such powers as are reasonably incidental thereto; (iv) will perform all of the obligations that by the terms of the Agreement are required to be performed by the Lender; and (v) specifies as its address for notices the office set forth beneath its name on the signature pages hereof.

4. The effective date for this Assignment and Acceptance shall be _____ (the "Effective Date"). Following the execution of this Assignment and Acceptance, it will be delivered to the Agent for approval and acceptance and recording by the Agent.

5. Upon such acceptance and recording, as of the Effective Date, (i) the Assignee shall be a party to the Agreement and, to the extent provided in this Assignment and Acceptance, have the rights and obligations of a Lender thereunder and under the Loan Documents and (ii) the Assignor shall, to the extent provided in this Assignment and Acceptance, relinquish its rights and be released from its obligations under the Agreement and the other Loan Documents.

6. Upon such acceptance and recording, from and after the Effective Date, the Agent shall make all payments under the Agreement and Note in respect of the interest assigned hereby (including, without limitation, all payments of principal, interest and fees with respect thereto) to the Assignee. The Assignor and Assignee shall make all appropriate adjustments in payments under the Agreement and the Note for periods prior to the Effective Date directly between themselves.

7. This Assignment and Acceptance shall be governed by and construed in accordance with, the laws of the State of _____.

[NAME OF ASSIGNOR)

By: _____
Name: _____
Title: _____

Notice Address: _____

After the Effective Date
Outstanding Advances: \$ _____

[NAME OF ASSIGNEE)

By: _____
Name: _____
Title: _____

Notice Address/Lending Office

Wire transfer Instructions:

After the Effective Date
Outstanding Advances: \$ _____

Accepted this ____ day of _____, 19__

THE FIRST NATIONAL BANK OF BOSTON,
as Agent

By: _____
Name: _____
Title: _____

Consented to:

MKS INSTRUMENTS, INC.

By: _____
Name: _____
Title: _____

EXHIBIT C

REVOLVING CREDIT NOTE

\$ _____

Boston, Massachusetts

February __, 1996

FOR VALUE RECEIVED, MKS INSTRUMENTS, INC., a Massachusetts corporation having its principal place of business located in Andover, Massachusetts (the "Borrower"), hereby promises to pay to the order of

_____ (the "Lender"), in its individual capacity, at the office of THE FIRST NATIONAL BANK OF BOSTON, as agent for the Lender (the "Agent"), located at 100 Federal Street, Boston, Massachusetts (or at such other place or places as the Agent may designate in writing) at the times set forth in the Loan Agreement dated as of February __, 1996 among the Borrower, the financial institutions party thereto (collectively, the "Lenders") and the Agent (the "Agreement" -- all capitalized terms not otherwise defined herein shall have the respective meanings set forth in the Agreement), in lawful money of the United States of America, in immediately available funds, the principal amount of _____ DOLLARS (\$_____) or, if less than such principal amount, the aggregate unpaid principal amount of all Advances made by the Lender to the Borrower pursuant to the Agreement, on the Revolver Termination Date or such earlier date as may be required pursuant to the terms of the Agreement, and to pay interest from the date hereof on the unpaid principal amount hereof, in like money, at said office, on the dates and at the rates provided in the Agreement. All or any portion of the principal amount of Advances may be prepaid as provided in the Agreement.

If payment of all sums due hereunder is accelerated under the terms of the Agreement or under the terms of the other Loan Documents executed in connection with the Agreement, the then remaining principal amount and accrued but unpaid interest shall bear interest, which shall be payable on demand, at the rate per annum set forth in Section 2.4.2 of the Agreement. Further, in the event of such acceleration, this Revolving Credit Note shall become immediately due and payable, without presentation, demand, protest or notice of any kind, all of which are hereby waived by the Borrower.

In the event this Revolving Credit Note is not paid when due at any stated or accelerated maturity, the Borrower agrees to pay, in addition to the principal and interest, all costs of collection, including reasonable attorneys' fees, and interest thereon at the rates set forth above.

Interest hereunder shall be computed as provided in the Agreement.

This Revolving Credit Note is one of the Revolving Credit Notes in the aggregate principal amount of \$20,000,000 referred to in the Agreement and is issued pursuant to and entitled to the benefits of the Agreement to which reference is hereby made for a more complete statement of the terms and conditions upon which the Advances evidenced hereby were or are made and are to be repaid. This Revolving Credit Note is subject to certain restrictions on transfer or assignment as provided in the Agreement.

No delay or omission on the part of the Lender in exercising any right hereunder shall operate as a waiver of such right or of any other right of the Lender, nor shall any delay, omission or waiver on any one occasion be deemed a bar to or waiver of the same or any other right on any future occasion. Every maker, endorser and guarantor of this Revolving Credit Note or the obligations represented hereby waives presentment, demand, notice, protest and all other demands and notices in connection with the delivery, acceptance, performance, default or enforcement of this Revolving Credit Note, assents to any extension or postponement of the time of payment or any other indulgence, to any substitution, exchange or release of collateral and to the addition or release of any other party or person primarily or secondarily liable.

IN WITNESS WHEREOF, the Borrower has caused this Revolving Credit Note to be made, executed and delivered by its duly authorized representative under seal as of the date and year first above written.

MKS INSTRUMENTS, INC.

WITNESS:

By: _____
Name: _____
Title: _____

EXHIBIT D

FORM OF COMPLIANCE CERTIFICATE

The First National Bank of Boston, as Agent
100 Federal Street
Boston, Massachusetts 02110
Attn: Ms. Sharon A. Stone, Director

Ladies and Gentlemen:

Pursuant to the provisions of Section 6.1(c) of the Loan Agreement (the "Agreement") dated as of February __, 1996 by and between MKS Instruments, Inc. (the "Borrower"), the Lenders (as defined in the Agreement) and The First National Bank of Boston as Agent for the Lenders, the undersigned hereby certifies in the name and on behalf of the Borrower as follows:

- (A) (1) The Borrower has performed and maintained all of its obligations under the Agreement;
- (2) The undersigned has caused the provisions of the Agreement to be reviewed and there is no Default or Event of Default thereunder, other than as set forth on the Disclosure Schedule attached hereto;
- (3) No new action, suit or proceeding has been commenced, or threatened before any court, arbitration tribunal or governmental regulatory authority, commission, bureau, agency or public regulatory body that, if determined adversely to the Borrower or any Subsidiary of the Borrower, would be reasonably likely to have a material adverse effect on the consolidated financial condition or results of operations of the Borrower and its Subsidiaries taken as a whole, except as set forth on the Disclosure Schedule attached hereto;
- (4) All of the representations and warranties set forth in the Agreement other than Sections 4.5 and 4.6 are true and correct except as a result of the changes in circumstances set forth on the Disclosure Schedule attached hereto;
- (5) Since the end of the last fiscal year of the Borrower, there has been no material adverse change in the financial condition, business or results of operations of the Borrower and its Subsidiaries taken as a whole, except as set forth on the Disclosure Schedule attached hereto;

(6) The financial statements submitted herewith are in compliance with the applicable provisions of Section 6.1 of the Agreement; and

(7) Said financial statements have been prepared in accordance with generally accepted accounting principles consistent with those applied in the preparation of the most recent annual financial statements furnished to the Lenders pursuant to Section 6.1 of the Agreement, present fairly in all material respects the information contained therein and the financial condition of the Borrower, and are correct in all material respects, subject in the case of statements furnished under Section 6.1(a) to normal year-end adjustments and the absence of certain footnotes required under generally accepted accounting principles.

(B) The following calculations demonstrate that, based upon the financial statements of the Borrower submitted herewith, the Borrower is in compliance with all covenants set forth in Section 7.7 of the Agreement.

1. Section 7.7(a) -- Tangible Net Worth Test

(a) Consolidated Tangible Net Worth	=	\$ _____
(b) 50% of Consolidated Net Income (excluding losses) for each fiscal quarter beginning with the fiscal quarter ending March 31, 1996, up to and including the fiscal quarter last ended	=	\$ _____
(c) prior to an IPO: (b) + \$38,000,000 (which does not exceed Consolidated Tangible Net Worth)	=	\$ _____
(d) after an IPO: (c) + the net proceeds of the IPO - the Sub S Dividend (which does not exceed Consolidated Tangible Net Worth)	=	\$ _____

2. Section 7.7(b) -- Debt-to-Net Worth Ratio

(a) Consolidated Indebtedness (excluding all guaranties except guaranties with respect to borrowed money) as of the end of the fiscal quarter last ended = \$ _____

(b) Consolidated Tangible Net Worth as of the end of the fiscal quarter last ended = \$ _____

(c) Ratio of (a) to (b) (which is not more than 1.5 to 1) = _____

3. Section 7.7(c) -- Cash Flow Ratio

(a) Consolidated Operating Cash Flow for the four consecutive fiscal quarters last ended = \$ _____

(b) Consolidated Debt Service for the four consecutive fiscal quarters last ended = \$ _____

(c) Ratio of (a) to (b) (which is not less than 1.25 to 1.0) = \$ _____

Terms defined in the Agreement and not otherwise expressly defined herein are used herein with the meanings set forth in the Agreement.

In witness whereof, the undersigned has executed this Certificate on this ____ day of _____, 19__.

MKS INSTRUMENTS, INC.

By: _____

Name: _____

Title: Chief Financial Officer

DISCLOSURE SCHEDULE

(1) 4.4 Capital Structure.

a. Capital Stock.

Class	Authorized Capital Stock	Issued and Outstanding Capital Stock	Treasury Stock
-----	-----	-----	-----
Class A common	10,000, no par value	2,454	0
Class B common	10,000, no par value	3,250	0

b. Subsidiaries of Borrower.

- (i) MKS International, Inc.; Jurisdiction of Incorporation: Massachusetts; Authorized Capital Stock: 300,000, \$.01 par value; Issued and Outstanding Capital Stock: 19,013; Percentage of Equity Owned by Borrower: 70%
- (ii) MKS East, Inc.; Jurisdiction of Incorporation: Massachusetts; Authorized Capital Stock: 300,000, \$.01 par value; Issued and Outstanding Capital Stock: 1,000; Percentage of Equity Owned by Borrower: 77.5%
- (iii) MKS Japan, Inc.; Jurisdiction of Incorporation: Japan; Authorized Capital Stock: 2,000, Y50,000 par value; Issued and Outstanding Capital Stock: 707; Percentage of Equity Owned by Borrower: 77.5%
- (iv) MKS Instruments Canada Limited; Jurisdiction of Incorporation: Canada; Authorized Capital Stock: unlimited number; Issued and Outstanding Capital Stock: 1,100; Percentage of Equity Owned by Borrower: 77.5%
- (v) MKS Instruments Deutschland GmbH; Jurisdiction of Incorporation: Germany; Authorized Capital Stock: 1,200,000 DM; Issued and Outstanding Capital Stock: 1,200,000 DM; Percentage of Equity Owned by Borrower: 77.5%

- (vi) MKS Instruments France, S.A.; Jurisdiction of Incorporation: France; Authorized Capital Stock: 5,000; Issued and Outstanding Capital Stock: 5,000; Percentage of Equity Owned by Borrower: 77%
- (vii) MKS Korea Co., Ltd.; Jurisdiction of Incorporation: Republic of Korea; Authorized Capital Stock: 20,000; Issued and Outstanding Capital Stock: 5,000; Percentage of Equity Owned by Borrower: 77.5%
- (viii) MKS Instruments, UK Limited; Jurisdiction of Incorporation: United Kingdom; Authorized Capital Stock: 100; Issued and Outstanding Capital Stock: 100; Percentage of Equity Owned by Borrower: 75.0%
- (ix) MKS FSC, Inc.; Jurisdiction of Incorporation: Barbados; Authorized Capital Stock: 1,000; Issued and Outstanding Capital Stock: 1,000; Percentage of Equity Owned by Borrower: 77.5%

c. Outstanding Options, Etc.

On November 30, 1995, the Borrower adopted the MKS Instruments, Inc. 1995 Stock Incentive Plan (the "Plan") pursuant to which options to purchase 192.1863 shares of Class B Common Stock of the Borrower have been granted. The option grants will not be effective until the Plan is adopted by the stockholders of the Borrower which has not yet occurred. The MKS Instruments, Inc. Stock Appreciation Plan, as amended, was terminated in its entirety, effective September 30, 1995.

(2) 4.6 Pending Litigation.

None.

(3) 4.11 Transactions with Affiliates, Etc.

John R. Bertucci and Paul Utz, as lessors, lease on a month-to-month basis to the Borrower, as lessee, certain real estate in Santa Clara, California used by the Borrower as a sales and service facility. The current rent is approximately \$57,696 per year.

(3) 4.12 ERISA.

MKS Instruments, Inc. Profit-Sharing and Retirement Savings Plan

(4) 4.13 Ownership of Properties; Liens.

(a) Liens -- Borrower.

- (i) Mortgage liens and security interests granted to Bank of Boston on real property, fixtures, and certain other assets of the Borrower.
- (ii) Security interests granted to BancBoston Leasing, Inc. in equipment leased by the Borrower.
- (iii) Security interests granted to certain lessors of equipment to the Borrower, including Taylor of New England, Inc., Leasametric, Inc., Xerox Corporation, Pitney Bowes Credit Corporation, and IBM Credit Corporation.
- (iv) Liens granted to Leasing Associates, Inc. in certain automobiles leased by the Borrower.
- (v) Mortgage liens and security interests granted to Jefferson National Life Insurance Company in connection with land owned by Borrower in Boulder, Colorado.
- (vi) Liens granted by UTI Instruments Company in its copying machines and telephone system (UTI Instruments Company was merged with and into the Borrower on November 17, 1995)

(b) Liens -- Subsidiaries.

Liens granted by MKS Instruments France, S.A., MKS Investments Deutschland GmbH, and MKS Japan, Inc. on their respective land and buildings.

(c) Borrower's Material Leasehold Interests, Etc. See attachment.

(5) 4.14 Employment Matters.

None.

(6) 4.16 Indebtedness.

(a) Indebtedness under the Existing Loan Agreements

- (b) Loan Agreement with Chemical providing the Borrower with a revolving line of credit up to \$3,000,000
- (c) International Foreign Exchange Master Agreement dated as of June __, 1995 by and between the Borrower and Chemical
- (d) Guaranties as follows:
 - (i) Guaranty by the Borrower of Indebtedness of MKS Japan, Inc. to Fuji Bank and to Sanwa Bank.
 - (ii) Guaranty by the Borrower of Indebtedness of MKS Instruments Deutschland GmbH to Bank of Boston.
 - (iii) Guaranty by the Borrower of Indebtedness of MKS Korea Co., Ltd. to Bank of Boston.

(7) 7.4 Investments.

- (a) 45,000 shares of common stock of Sycon Instruments, Inc.
- (b) 6,000 shares of common stock of Vacuum Technology, Inc.
- (c) 5,512 shares of Fuji Bank
- (d) 35,000 shares of common stock of Applied Science and Technology, Inc.

MKS Instruments Inc.
Property Summary

Location	Lease/Own	Size (sq. ft.)	Landlord	Lease Expires	Annual Rent
DOMESTIC LEASED					
100 Washington Street North Haven, CT	Lease	500	Candid Associates	Month-to-Month	\$13,800
500 North Red Street St. 300 Tampa, FL	Lease	250	Centers of West Shore	Month-to-Month	\$6,678
St. 409, 11350 McCormick Rd. Hunt Valley, MD	Lease	845	Hill Management	7/31/97	\$18,455
St. 100C, 100 Roessler Road Pittsburgh, PA	Lease	250	Executive Secretarial Service Inc.	9/30/98	\$7,740
St. 111, 113, 789 Grove St. Richardson, TX	Lease	14,627	General America Life Ins. Group	8/31/98	\$65,822
St. 101, 6700 SW 105th Beaverton, OR	Lease	415	Go Co Realty	1/12/96	\$6,078
5601B Midway Park Place Albuquerque, NM	Lease	3,400	Singer Development Partnership	5/31/96	\$25,542
St. 311, 6650 Highland Road Waterford, MI	Lease	300	Superior Contracting Corp.	Month-to-Month	\$7,200
St. 215, 3019 Alvin Devane Blvd. Austin, TX	Lease	4,144	H.R.C. Joint Venture L.P. & Austin Bell Tower Investment Co.	6/30/98	\$35,814
Bldg. 3, 3350 Scott Blvd. Santa Clara, CA	Lease	4,000	Utz/Bertucci	4/30/98	\$57,696
24 Walpole Park South Dr. Walpole, MA	Lease	20,084	Walpole Park South II Trust	3/31/97	\$100,420
Unit A, 13341 Southwest Hwy. Orland Park, IL	Lease	300	Southwest Investment	8/31/97	\$6,420
Mill Building 7,250 Canal St. Lawrence, MA	Lease	4,000	Andrea Management	4/30/98	\$8,000
5330 Sterling Drive Boulder, CO	Lease	39,032	Aspen Industrial Park Partnership	10/31/98	\$341,530
3844 E. University Drive Phoenix, AZ	Lease	15,457	The Hewson Company	7/31/00	\$115,000
119 Main Street Flemington, NJ	Lease	272	Large Sammell & Danziger	Month-to-Month	\$4,200
1815 W. First Ave. Suite 119 Mesa, AZ	Lease	1,523	Tri-City Commerce Center	06/30/96	\$7,070
550 N. Reo Street Tampa, FL	Lease	300	JFG Associates	Month-to-Month	\$6,678
7978 Victor-Pittsford Road Victor, NY	Lease	300	Eastview Office Park WBW Assoc.	10/31/96	\$6,000

Location	Lease/Own	Size (sq. ft.)	Landlord	Lease Expires	Annual Rent
10220 SW Nimbus Portland, OR	Lease	2,168	Petula Assoc. Ltd. & Koll Portland Assoc.	12/31/98	\$26,928
DOMESTIC LEASED					
2030 Fortune Drive Suite C San Jose, CA	Lease	35,873	South Bay/Copley Assoc. III	2/14/98	\$277,656
3722 Lehigh Street Suite 410 Whitehall, PA	Lease	1,055	Jason C. and Marcus K. Danweber	12/31/96	\$8,440
DOMESTIC OWED					
3189 E. Airway Ave. Costa Mesa, CA	Own	3,500			
3350 Scott Blvd. Bldg. 4 Santa Clara, CA	Own	5,000			
Six Shattuck Road Andover, MA	Own	82,000			
651 Lowell Street Methuen, MA	Own	85,000			
17 Ballard Way Lawrence, MA	Own	40,000			
FOREIGN LEASED					
4c Jingnuin Bldg. Shanghai, China	LEASE	156.9 SM	Silicon Int'l Ltd.	04/10/96	\$66,000
174 Cleopatra Drive Nepean, Ontario, Canada K2G5X2	Lease	100		Month-to- Month	C\$1,540
2nd flr. Zeus Bldg. 3-16 Yangjag Dong Seocho-Ku, Seoul Korea	Lease	123.57 SM		10/31/96	₩7,200,000
988-1 Bangbac - Dong Seocho-Ku, Seoul Korea	Lease	112 SM		12/11/96	₩1,608,000
2 St. Georges Ct. Altincham, Cheshire, England	Lease	2191			(pound sterling) 17,500
Rudower Chaussee 5 D-12484 Berlin, Germany	Lease	43 SM		09/99	DM8,000
Kalfjeslaan 40 NL-2623 AJ Delft, Germany	Lease	135 SM		12/97	DM30,000
5-17-13 Narita-higeshi Suginami-ku, Tokyo, Japan	Lease	10,481			(Yen) 50,160,480
4-1-45, Miyahara Yodogawa-ku, Osaka-shi, Osaka, Japan	Lease	1,722			(Yen) 7,158,600
1-14-3 Hakataeki East, Hakata-ku Fukuoka-shi, Fukuoka, Japan	Lease	1,250			(Yen) 5,136,000
1-34-6 Izumicyo, Izumi-ku Sendel-shi, Miyagi, Japan	Lease	610			(Yen) 2,162,160
1-1-14 Fujishirodal Suita-shi, Osaka, Japan	Lease	992			(Yen) 2,172,000

Location	Lease/Own	Size (sq. ft.)	Landlord	Lease Expires	Annual Rent
1-4-6 Honcho Aoba-ku Sendai-shi, Miyagi	Lease	484			(Yen)1,029,600
FOREIGN OWNED					
108-30 Concourse Gate Nepean, Ontario, Canada K2E7U7	Own	1,700			C\$6,060 Condo fees
43 Rue Du Cdt Rolland 93350 - Le Bourget	Own	13,680			
Schatzbogen 43 D-81829 Munchen, Germany	Own	1,310 SM			
1-20-32, Miyamae Suginami-ku, Tokyo	Own	6,671			

MKS INSTRUMENTS, INC.
WAIVER AND FIRST AMENDMENT
TO LOAN AGREEMENT

This Waiver and First Amendment (the "Waiver and Amendment") dated as of October 18, 1996 concerns the Loan Agreement dated as of February 23, 1996 (the "Loan Agreement"), among MKS Instruments, Inc. (the "Borrower"), The First National Bank of Boston and The Chase Manhattan Bank (f/k/a Chemical Bank) (together, the "Lenders"). Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower has requested that the Lenders waive certain Events of Default; and

WHEREAS, the Lenders are willing, on the terms, subject to the conditions and to the extent set forth below, to grant such a waiver;

NOW, THEREFORE, the Lenders and the Borrower agree as follows:

Section 1. Waiver. The Lenders hereby waive the Events of Default under Section 8.1(g), (k) and (l) of the Loan Agreement resulting from Borrower's failure to meet the financial covenants set forth in Section 7.7(b) and (c) of the Loan Agreement as of the end of the fiscal quarter ended June 30, 1996.

Section 2. Amendment to the Loan Agreement.

(a) Section 2.4.1. of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

2.4.1. The Borrower agrees to pay interest in respect of the unpaid principal amount of each Advance from the date the proceeds thereof are made available to the Borrower until maturity (whether by acceleration, voluntary prepayment or otherwise) as follows. Each Advance shall bear interest at the Base Rate in effect from time to time unless the Borrower elects and qualifies to pay interest on such Advance at the following rate (the "Adjusted LIBOR Rate"):

(i) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio of less than 1 to 1:

(a) and a Cash Flow Ratio of less than 1.40 to 1, the LIBOR Rate plus 1.65%;

(b) and a Cash Flow Ratio of 1.40 to 1 or greater but less than 1.75 to 1, the LIBOR Rate plus 1.125%;

(c) and a cash Flow Ratio of 1.75 to 1 or greater up to and including 2.5 to 1, the LIBOR Rate plus .875%; or

(d) and a Cash Flow Ratio in excess of 2.5 to 1, the LIBOR Rate plus .625%;

(ii) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio of 1 to 1 or more but less than or equal to 1.5 to 1:

(a) and a Cash Flow Ratio of less than 1.40 to 1, the LIBOR Rate plus 1.65%;

(b) and a Cash Flow Ratio of 1.40 to 1 or greater but less than 1.75 to 1, the LIBOR Rate plus 1.25%;

(c) and a Cash Flow Ratio of 1.75 to 1 or greater up to and including 2.5 to 1, the LIBOR Rate plus 1.00%; or

(d) and a Cash Flow Ratio in excess of 2.5 to 1, the LIBOR Rate plus .75%.

Section 3. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Waiver and Amendment and the performance of this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Waiver and Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other

document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Waiver and Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 4. Loan Documents. This Waiver and Amendment shall be a Loan Document for all purposes.

Section 5. Conditions to Effectiveness. The effectiveness of this Waiver and Amendment is conditioned on the following:

(a) The Borrower and the Lenders shall each have executed and delivered a counterpart of this Waiver and Amendment;

(b) The representations and warranties contained in Article IV of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof; and

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing other than the Events of Default described in Section 1 hereof.

Section 6. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Waiver and Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Waiver and Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Waiver and Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF BOSTON

By: /s/ Sharon A. Stone

Title: Director

THE CHASE MANHATTAN BANK

By: [illegible]

Title: Vice President

WAIVER

This Waiver (the "Waiver") dated as of October 18, 1996 concerns the Loan Agreement dated as of November 1, 1993, as amended (the "1993 Loan Agreement"), between MKS Instruments, Inc. (the "Borrower") and The First National Bank of Boston (the "Lender") and the Loan Agreement dated as of October 31, 1995, as amended (the "1995 Loan Agreement") between the Borrower and the Lender. Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the 1993 and 1995 Loan Agreements.

The Lender hereby waives the Events of Default under Section 9.1(g), (k) and (l) of the 1993 Loan Agreement and under Section 8.1(g), (k) and (l) of the 1995 Loan Agreement resulting from (1) Borrower's failure to meet the financial covenants set forth in Section 8.7(b) and (c) of the 1993 Loan Agreement and Section 7.7(b) and (c) of the 1995 Loan Agreement as of the end of the fiscal quarter ended June 30, 1996 and (2) the Event of Default that has occurred under Section 8.1(g), (k) and (l) of the Loan Agreement dated as of February 23, 1996 among the Borrower, the Lender and The Chase Manhattan Bank (f/k/a Chemical Bank) as a result of Borrower's failure to met the financial covenants set forth in Section 7.7(b) and (c) of such Loan Agreement as of the end of the fiscal quarter ended June 30, 1996.

Except for the above waiver, the 1993 and 1995 Loan Agreements are in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

IN WITNESS WHEREOF, the Lender has caused this Waiver to be duly executed as of the date and the year first above written.

THE FIRST NATIONAL BANK OF BOSTON

By: /s/ Sharon A. Stone

Title: Director

MKS INSTRUMENTS, INC.

WAIVER AND SECOND AMENDMENT

TO LOAN AGREEMENT

This Waiver and Second Amendment (the "Waiver and Amendment") dated as of February 4, 1997 concerns the Loan Agreement dated as of February 23, 1996 (the "Loan Agreement"), among MKS Instruments, Inc. (the "Borrower"), The First National Bank of Boston and The Chase Manhattan Bank (f/k/a Chemical Bank) (together, the "Lenders"). Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower has requested that the Lenders waive certain Events of Default; and

WHEREAS, the Lenders are willing, on the terms, subject to the conditions and to the extent set forth below, to grant such a waiver;

NOW, THEREFORE, the Lenders and the Borrower agree as follows:

Section 1. Waiver. The Lenders hereby waive the Events of Default under Section 8.1(g), (k) and (l) of the Loan Agreement resulting from Borrower's failure to meet the financial covenant set forth in Section 7.7(c) of the Loan Agreement as of the end of the fiscal quarters ended September 30 and December 31, 1996.

Section 2. Amendment to the Loan Agreement.

(a) Section 2.4.1. of the Loan Agreement is hereby amended by adding the following at the end thereof:

Notwithstanding the preceding clauses (i) and (ii), from June 30, 1996 through June 30, 1997, the Adjusted LIBOR Rate shall be the LIBOR Rate plus 1.65%.

(b) Section 7.7(c) of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

(c) Cash Flow Ratio. The ratio ("Cash Flow Ratio") of Consolidated Operating Cash Flow to Consolidated Debt Service:

(1) for the Borrower's fiscal quarter ending March 31, 1997, shall not be less than 1.25 to 1.00;

(2) for the Borrower's two consecutive fiscal quarters ending June 30, 1997, shall not be less than 1.00 to 1.00;

(3) for the Borrower's three consecutive fiscal quarters ending September 30, 1997, shall not be less than 1.25 to 1.00; and

(4) for the Borrower's four consecutive fiscal quarters ending December 31, 1997 and for each series of four consecutive fiscal quarters of the Borrower ending after December 31, 1997, shall not be less than 1.25 to 1.00.

Section 3. Fees. The Borrower shall pay to the Agent, for the pro rata benefit of the Lenders based on their Applicable Commitment Percentages, a fee of \$25,000 on the date of this Waiver and Amendment. If the parties agree to another amendment of the Loan Agreement prior to the date 180 days after the date of this Waiver and Amendment, the Lenders agree to reduce by \$8,000 the fee that would otherwise be required to induce the Lenders to agree to such amendment.

Section 4. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Waiver and Amendment and the performance of this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Waiver and Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Waiver and Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 5. Loan Documents. This Waiver and Amendment shall be a Loan Document for all purposes.

Section 6. Conditions to Effectiveness. The effectiveness of this Waiver and Amendment is conditioned on the following:

(a) The Borrower and the Lenders shall each have executed and delivered a counterpart of this Waiver and Amendment;

(b) The representations and warranties contained in Article IV of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof;

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing other than the Events of Default described in Section 1 hereof; and

(d) The Borrower's audited consolidated financial statements for the year ended December 31, 1996 shall not differ in any materially adverse respect from the Borrower's unaudited consolidated financial statements for the year ended December 31, 1996, which the Borrower has provided to the Lenders and upon which the Lenders have relied in agreeing to this Waiver and Amendment.

Section 7. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Waiver and Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Waiver and Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Waiver and Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

THE FIRST NATIONAL BANK OF BOSTON

By: /s/ Sharon A. Stone

Title: Director

THE CHASE MANHATTAN BANK

By: [illegible]

Title: Vice President

MKS INSTRUMENTS, INC.

THIRD AMENDMENT

TO LOAN AGREEMENT

This Third Amendment (the "Amendment") dated as of February 2, 1998 concerns the Loan Agreement dated as of February 23, 1996 (the "Loan Agreement"), among MKS Instruments, Inc. (the "Borrower"), BankBoston, N.A. (f/k/a/ The First National Bank of Boston) and The Chase Manhattan Bank (f/k/a/ Chemical Bank) (together, the "Lenders"), and BankBoston, N.A. in its capacity as agent for the Lenders (in such capacity, the "Agent") as amended on October 18, 1996 and February 4, 1997. Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower has requested that the Lenders increase the Total Revolving Credit Commitment and make certain other changes to the Loan Agreement;

WHEREAS, the Lenders are willing, on the terms, subject to the conditions and to the extent set forth below, to amend the Loan Agreement to effect such changes;

NOW, THEREFORE, the Lenders and the Borrower agree as follows:

Section 1. Amendment of the Loan Agreement.

(a) Section 1.1 of the Loan Agreement is hereby amended by deleting the paragraphs setting forth the definitions of "Revolver Termination Date" and "Total Revolving Credit Commitment" and replacing them with the following paragraphs:

"Revolver Termination Date" shall mean December 31, 1999 or any subsequent anniversary thereof if the Total Revolving Credit Commitment shall have been renewed by the Lenders.

"Total Revolving Credit Commitment" shall mean a principal amount equal to \$30,000,000.

(b) Section 2.4.1 of the Loan Agreement is hereby amended by deleting the existing language and substituting the following:

2.4.1. The Borrower agrees to pay interest in respect of the unpaid principal amount of each Advance from the date the proceeds thereof are made available to the Borrower until maturity (whether by acceleration,

voluntary prepayment or otherwise) as follows. Each Advance shall bear interest at the Base Rate in effect from time to time unless the Borrower elects and qualifies to pay interest on such Advance at the following rate (the "Adjusted LIBOR Rate"):

(i) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio of less than 1.25 to 1:

(a) and a Cash Flow Ratio of less than 1.75 to 1, the LIBOR Rate plus 1.125%;

(b) and a Cash Flow Ratio of 1.75 to 1 or greater up to and including 2.5 to 1, the LIBOR Rate plus .875%; or

(c) and a Cash Flow Ratio in excess of 2.5 to 1, the LIBOR Rate plus .625%;

(ii) During any period in which the Borrower maintains a Debt-to-Net Worth Ratio greater than 1.25 to 1 but less than 1.5 to 1:

(a) and a Cash Flow Ratio of less than 1.75 to 1, the LIBOR Rate plus 1.25%;

(b) and a Cash Flow Ratio of 1.75 to 1 or greater up to and including 2.5 to 1, the LIBOR Rate plus 1.00%; or

(c) and a Cash Flow Ratio in excess of 2.5 to 1, the LIBOR Rate plus .75%;

(c) Section 2.6 of Loan Agreement is hereby amended by replacing "0.25%" set forth therein with "0.1875%".

Section 2. Representations and Warranties. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Amendment and the performance of this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 3. Loan Documents. This Amendment and the additional Revolving Credit Notes referred to in Section 4(d) below shall be Loan Documents for all purposes.

Section 4. Conditions to Effectiveness. The effectiveness of this Amendment is conditioned on the following:

(a) The Borrower and the Lenders shall each have executed and delivered a counterpart of this Amendment;

(b) The representations and warranties contained in Article IV of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof;

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing; and

(d) The Agent shall have received, in form and substance satisfactory to the Agent and the Lenders:

(i) an opinion of independent counsel to the Borrower with respect to this Amendment and the additional Revolving Credit Notes referred to below;

(ii) a certificate as to the Borrower's legal existence and good standing under the laws of The Commonwealth of Massachusetts;

(iii) a certificate of the Borrower's Clerk as to (x) no changes in its charter documents and by-laws as amended, (y) corporate votes authorizing the execution and delivery of this Amendment and the replacement Revolving Credit Notes referred to below and (z) incumbency of the officers authorized to execute this Amendment and such replacement Revolving Credit Notes on behalf of the Borrower; and

(iv) a Revolving Credit Note to the order of each Lender, in the aggregate amount of \$30,000,000, each duly executed by the Borrower and otherwise appropriately completed, in replacement of the currently outstanding Notes.

In addition, the Borrower hereby represents that the conditions set forth in clauses (a) - (e) of Section 5.1 of the Loan Agreement have been met as of the date hereof, provided that the "Balance Sheet Date" for purposes thereof shall mean September 27, 1997 and the financial statements referred to in Section 4.5 of the Loan Agreement are not audited.

Section 5. Miscellaneous.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ Robert F. O'Brien

Title: Treasurer

BANKBOSTON, N.A.,
Individually and as Agent

By: /s/ Sharon A. Stone

Title: Director

THE CHASE MANHATTAN BANK

By: _____
Title: _____

BANKBOSTON, N.A.,
Individually and as Agent

By: _____
Title: _____

THE CHASE MANHATTAN BANK

By: /s/ Illegible Signature

Title: Vice President

December 29, 1997

MKS Instruments, Inc.
Six Shamrock Road
Andover, MA 01890

Attention: Robert F. O'Brien, Treasurer

Re: Proposed Credit Facilities

Ladies and Gentlemen:

BankBoston, N.A. (f/k/a The First National Bank of Boston) (the "Agent") is pleased to inform you of the commitment of BankBoston, N.A. and The Chase Manhattan Bank (f/k/a/ Chemical Bank) (together, the "Lenders") to amend the Loan Agreement dated as of February 23, 1996, as amended (the "Loan Agreement") among you (the "Borrower") and the Lenders per the terms and conditions set forth on the attached Term Sheet and the terms and conditions set forth in this letter. Please understand that the Term Sheet does not purport to include all of the terms and conditions which will be contained in the definitive documents for this transaction. Therefore, this commitment is subject to the execution of loan documentation containing terms and conditions customary in bank financing documents in transactions of this type and, in any event, satisfactory to the Lenders and their counsel. In connection therewith, the Borrower agrees to provide the Lenders and their counsel with all such documents, certificates, opinions, assurances and other materials, and take such further actions, as we may reasonably request. Additionally, all closing costs, legal or otherwise, are the Borrower's responsibility, whether or not the financing actually closes.

The Lenders' commitment under this letter is based on their review of certain historical financial statements, projections and other information provided to the Lenders by you. At the Lenders' election, their commitment under this letter shall terminate if, at any time: (a) any information submitted to the Lenders or any material representation, warranty or statement made to the Lenders by or on behalf of the Borrower in connection with the commitment shall prove to have been inaccurate, incomplete or misleading in any material respect, (b) any material adverse change occurs after, or any additional information is disclosed to or discovered by the Lenders which the Lenders reasonably deem to be materially adverse, with respect to the condition (financial or otherwise), business, operations, assets, liabilities or prospects of the Borrower or (c) any condition to lending set forth in this letter or the Term Sheet is not or cannot be satisfied.

In consideration of the Lenders' commitment, the Borrower agrees, whether or not the contemplated financing actually closes, to reimburse the Lenders promptly upon request for any and all reasonable out-of-pocket costs, expenses and fees (including without limitation reasonable attorneys' fees and expenses) heretofore or hereafter incurred by the Lenders in connection with the negotiation, preparation and/or execution and delivery of the Term Sheet and this letter and the definitive loan documentation, if any, relating thereto.

Please review the attached Term Sheet at your convenience. If this commitment is acceptable to you, please sign and return the enclosed copy of this letter to the attention of Sharon Stone, on or before

January 10, 1998. This commitment shall expire (a) as of such date, if the Agent has not received your signed acceptance, and (b) in any event, following such acceptance, on February 28, 1998, unless by such date the contemplated financing shall have been consummated.

This letter (a) shall be governed by the internal laws of the Commonwealth of Massachusetts, (b) represents the entire agreement among the parties hereto and supersedes all prior correspondence and dealings, (c) is not assignable to any other party and (d) may only be amended or modified in a written instrument signed by the parties.

We are pleased to make this financing available and look forward to a continuation of our relationship with you.

Very truly yours,

BANKBOSTON, N.A.

By: /s/ Sharon A. Stone

Sharon A. Stone, Director

AGREED:
THE CHASE MANHATTAN BANK

By: -----
Title: -----

ACCEPTED AND AGREED:
MKS INSTRUMENTS, INC.

By: /s/ Robert J. O'Brien

Title: Treasurer

Date: 12/31/97

January 10, 1998. This commitment shall expire (a) as of such date, if the Agent has not received your signed acceptance, and (b) in any event, following such acceptance, on February 28, 1998, unless by such date the contemplated financing shall have been consummated.

This letter (a) shall be governed by the internal laws of the Commonwealth of Massachusetts, (b) represents the entire agreement among the parties hereto and supersedes all prior correspondence and dealings, (c) is not assignable to any other party and (d) may only be amended or modified in a written instrument signed by the parties.

We are pleased to make this financing available and look forward to a continuation of our relationship with you.

Very truly yours,

BANKBOSTON, N.A.

By: _____
Sharon A. Stone, Director

AGREED:
THE CHASE MANHATTAN BANK

By: /s/ Illegible Signature

Title: Vice President

ACCEPTED AND AGREED:
MKS INSTRUMENTS, INC.

By: _____
Title: _____
Date: _____

Confidential

[BankBoston Logo]

MKS Instruments, Inc.

Term Sheet
December 29, 1997Resolving Credit
Commitment:

Increase the Total Revolving Credit Commitment from \$20,000,000 to \$30,000,000. The Applicable Commitment Percentage of each Lender would remain the same with BankBoston's Revolving Credit Commitment increasing to \$18,000,000 and Chase's Revolving Credit Commitment increasing to \$12,000,000.

Maturity:

Extend the Revolver Termination Date from June 30, 1999 to December 31, 1999.

Interest Rates:

Amend the interest rates as follows:

The Agent's Base Rate or LIBOR plus the Applicable Margin determined quarterly in accordance with the following Pricing Grid:

For Debt-to-Net Worth Ratio greater than 1.25:1, but less than 1.5:1:

Level		Alt. Base +	LIBOR +
-----		-----	-----
I.	Cash Flow Ratio > 2.5	0	75 bp
II.	Cash Flow Ratio 1.75 - 2.5	0	100 bp
III.	Cash Flow Ratio < 1.75	0	125 bp

For Debt-to-Net Worth Ratio less than 1.25:1:

Level		Alt. Base +	LIBOR +
-----		-----	-----
I.	Cash Flow Ratio > 2.5	0	62.5 bp
II.	Cash Flow Ratio 1.75 - 2.5	0	87.5 bp
III.	Cash Flow Ratio < 1.75	0	112.5 bp

Unused

Commitment Fee: Reduce the Unused Commitment Fee to 3/16% per annum.

All other terms and conditions of the existing Loan Agreement will remain in full force and effect.

MKS INSTRUMENTS, INC.
WAIVER AND FIFTH AMENDMENT
TO LOAN AGREEMENT

This Waiver and Fifth Amendment (the "Waiver and Amendment") dated as of January 28, 1999 concerns the Loan Agreement dated as of February 23, 1996 (the "Loan Agreement"), among MKS Instruments, Inc. (the "Borrower"), BankBoston, N.A. (f/k/a The First National Bank of Boston) and The Chase Manhattan Bank (f/k/a Chemical Bank) (together, the "Lenders"), and BankBoston, N.A. in its capacity as agent for the Lenders (in such capacity, the "Agent") as amended on October 18, 1996, February 4, 1997, February 2, 1998 and February 3, 1998. Capitalized terms used herein but not otherwise defined shall have the meanings assigned to them in the Loan Agreement.

WHEREAS, the Borrower has requested that the Lenders waive certain Events of Default and agree to change certain financial covenants in the Loan Agreement;

WHEREAS, the Lenders are willing, on the terms, subject to the conditions and to the extent set forth below, to grant such waiver and amend the Loan Agreement to effect such changes;

NOW, THEREFORE, the Lenders and the Borrower agree as follows:

Section 1. WAIVER. The Lenders hereby waive the Events of Default under Section 8.1(g), (k) and (l) of the Loan Agreement resulting from Borrower's failure to meet the financial covenant set forth in Section 7.7(c) of the Loan Agreement as of the end of the fiscal quarter ended December 31, 1998.

Section 2. AMENDMENT OF THE LOAN AGREEMENT.

(a) Section 2.4.1. of the Loan Agreement is hereby amended by adding the following sentences at the end thereof:

Notwithstanding the preceding clauses (i) and (ii), from the date hereof through the date on which the effect of a change resulting from the Borrower's delivery of its financial statements and Compliance Certificate for the quarter ending June 30, 1999 will take effect, the only alternative to the Base Rate shall be the LIBOR Rate plus 1.65%.

The effect of any change to the Borrower's Debt-to-Net Worth Ratio or Cash Flow Ratio on the interest rate available pursuant to Section 2.4.1(i) or (ii) shall take effect on the first day of the month immediately following the month in

which the Borrower delivers its financial statements pursuant to Section 6.1(a) or (b) and Compliance Certificate pursuant to Section 6.1(c).

(b) Section 7.7(c) of the Loan Agreement is hereby amended by adding the following clause at the end thereof:

provided, however, that as of the end of each of the fiscal quarters listed below, the Cash Flow Ratio shall not be less than the ratio stated directly below such quarter:

Q4 1998	Q1 1999	Q2 1999	Q3 1999
-----	-----	-----	-----
.6 to 1	.5 to 1	.5 to 1	1.1 to 1

provided, however, that, the foregoing notwithstanding, if the Cash Flow Ratio for the first fiscal quarter of 1999 is less than 1 to 1, then the Cash Flow Ratio for the second fiscal quarter of 1999 shall not be less than 1 to 1 and further, that the Cash Flow Ratio for the first and second fiscal quarters of 1999 shall mean the ratio as of the end of each such quarter of (i) Consolidated Operating Cash Flow for such fiscal quarter ended on such date to (ii) Consolidated Debt Service for such quarter and that the Cash Flow Ratio for the third fiscal quarter of 1999 shall mean the ratio as of the end of such quarter of (i) Consolidated Operating Cash Flow for the first three fiscal quarters of 1999 ended on such date to (ii) Consolidated Debt Service for such quarters.

(c) Section 7.7 of the Loan Agreement is hereby amended by adding the following subsection (d):

(d) EBIT-TO-INTEREST RATIO. The ratio of the sum of Consolidated Net Income plus Interest Expense, the interest portion of Financing Lease Obligations and all taxes in respect of income and profits paid or payable (including accrued Sub S distributions required to make shareholder tax payments) as of the end of each fiscal quarter of the Borrower beginning with the fiscal quarter ended December 31, 1998 to Interest Expense during such quarter shall not be less than 2 to 1 for the fiscal quarters ending December 31, 1998 and March 31, 1999 and 3 to 1 for the fiscal quarters ending June 30, 1999 and September 30, 1999.

Section 3. FEES. The Borrower shall pay to the Agent, for the pro rata benefit of the Lenders, based on their Applicable Commitment Percentages, a fee of \$45,000 on the date of this Waiver and Amendment.

Section 4. REPRESENTATIONS AND WARRANTIES. The Borrower hereby represents and warrants as follows:

(a) The execution and delivery of this Waiver and Amendment and the performance of this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents, and the transactions contemplated hereby and thereby, have been authorized by all necessary corporate actions of the Borrower. This Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents constitute the legal, valid and binding obligations of the Borrower, enforceable against the Borrower in accordance with their respective terms.

(b) The Borrower has all requisite corporate power and authority to execute, deliver and perform its obligations under this Waiver and Amendment, the Loan Agreement as amended hereby and each of the other Loan Documents. Neither the authorization, execution, delivery or performance by the Borrower of this Waiver and Amendment nor the performance of the Loan Agreement as amended hereby or any other Loan Document nor the performance of the transactions contemplated hereby or thereby violates or will violate any provision of the corporate charter or by-laws of the Borrower, or does or will, with the passage of time or the giving of notice or both, result in a breach of or a default under, or require any consent under or result in the creation of any lien, charge or encumbrance upon any property or assets of the Borrower pursuant to, any material instrument, agreement or other document to which the Borrower is a party or by which the Borrower or any of its properties may be bound or affected.

(c) The execution and delivery by the Borrower of this Waiver and Amendment and the performance by the Borrower of the Loan Agreement as amended hereby and the Loan Documents do not and will not violate any provision of law or regulation applicable to the Borrower, or any writ, order or decree of any court or governmental or regulatory authority or agency applicable to the Borrower.

Section 5. LOAN DOCUMENTS. This Waiver and Amendment shall be a Loan Document for all purposes.

Section 6. CONDITIONS TO EFFECTIVENESS. The effectiveness of this Waiver and Amendment is conditioned on the following:

(a) The Borrower and the Lenders shall each have executed and delivered a counterpart of this Waiver and Amendment;

(b) The representations and warranties contained in Article IV of the Loan Agreement shall be true and correct in all material respects as of the date hereof as though made on and as of the date hereof;

(c) No Default or Event of Default under the Loan Agreement shall have occurred and be continuing other than the Events of Default described in Section 1 hereof;

(d) The Agent shall have received, in form and substance satisfactory to the Agent and the Lenders:

(i) an opinion of independent counsel to the Borrower with respect to this Waiver and Amendment;

(ii) a certificate as to the Borrower's legal existence and good standing under the laws of The Commonwealth of Massachusetts; and

(iii) a certificate of the Borrower's Clerk as to (x) no changes in its charter documents and by-laws as amended, (y) corporate votes authorizing the execution and delivery of this Waiver and Amendment and (z) incumbency of the officers authorized to execute this Waiver and Amendment on behalf of the Borrower;

(e) The Borrower's audited consolidated financial statements for the year ended December 31, 1998 (the "1998 Statements") shall not differ in any materially adverse respect from the Borrower's unaudited consolidated financial statements for the year ended December 31, 1998, which the Borrower has provided to the Lenders and upon which the Lenders have relied in agreeing to this Waiver and Amendment and the Borrower shall deliver the 1998 Statements to the Lenders no later than 30 days after the date of this Waiver and Amendment.

(f) The conditions set forth in clauses (b) - (e) of Section 5.1 of the Loan Agreement shall have been met as of the date hereof, provided that for purposes thereof and Section 4.5 of the Loan Agreement, the "Balance Sheet Date" shall mean December 31, 1998 and the financial statements referred to therein shall mean the unaudited statements for the year ended December 31, 1998, that have been furnished to the Lenders.

Section 7. MISCELLANEOUS.

(a) On and after the date hereof, each reference in the Loan Agreement to "this Agreement" or words of like import shall mean and be deemed to be a reference to the Loan Agreement as amended hereby.

(b) Except as amended and modified hereby, the Loan Agreement is in all respects ratified and confirmed as of the date hereof, and the terms, covenants and agreements therein shall remain in full force and effect.

(c) This Waiver and Amendment and the modifications to the Loan Agreement set forth herein shall be deemed to be a document executed under seal and shall be governed by and construed in accordance with the laws of The Commonwealth of Massachusetts.

(d) This Waiver and Amendment may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have caused this Waiver and Amendment to be duly executed as of the date and the year first above written.

MKS INSTRUMENTS, INC.

By: /s/ William P. Donlan

Title: Treasurer

BANKBOSTON, N.A.
Individually and as Agent

By: /s/ Sharon A. Stone

Title: Director

THE CHASE MANHATTAN BANK

By: /s/ Joan Considine

Title: Vice President

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

COMPREHENSIVE SUPPLIER AGREEMENT #982812

This Agreement dated October 23, 1998 is by and between Applied Materials, Inc., ("Applied"), a Delaware corporation, having its place of business in Santa Clara, California and Austin, Texas and MKS Instruments, (MKS), a Massachusetts corporation, having its place of business in Andover, Massachusetts.

The parties agree as follows:

Definitions

The following capitalized terms will have the following meanings:

- A. "Applied" means Applied Materials, Inc., including all of its domestic and international divisions and subsidiaries.
- B. MKS means MKS Instruments, including all of its divisions and subsidiaries (except HPS).
- C "Item" or "items" means the good(s) or service(s) that MKS is to provide to Applied under this Agreement, including all Applied Materials purchase orders and related agreements that are governed by this CSA, as specified from time to time by Applied and set forth in Attachment 1 and any amendments to Attachment 1.
- D. "Applied's Standard Terms and Conditions of Purchase" means the terms and conditions contained in Exhibit 1 to this Agreement.
- E. "Additional Provisions" means all requirements contained in this Comprehensive Supplier Agreement.
- F. "Agreement" means this Comprehensive Supplier Agreement and/or the Applied's Purchase Order, and other Exhibits or Attachments to the Comprehensive Supplier Agreement and/or Purchase Order together with any Nondisclosure Agreement defined below as "NDA".
- G. "Comprehensive Supplier Agreement" means the Comprehensive Supplier Agreement No.982812, including Exhibit 1, the Applied Terms and Conditions of Purchase.
- H. "NDA" means any and all Nondisclosure Agreement(s) between Applied and MKS and any specific Nondisclosure Agreement that may be attached to this Agreement.
- I. "Will" or "shall" have the same meaning and are used to convey an affirmative duty or obligation (i.e., a requirement).
- J. "Release," or "release" means individual purchase orders, spot buys, pick cards or other orders for items issued by Applied to MKS under this Agreement
- K. "Proprietary Information" means the Proprietary Information, as that term is defined by the NDA, of Applied.
- L. "Confidential Information" means the Confidential Information, as that term is defined by the NDA, of Applied.

1. SCOPE

1.1 INTENTION/DESCRIPTION OF COMPREHENSIVE SUPPLIER AGREEMENT PRINCIPLES

This Comprehensive Supplier Agreement ("CSA") serves as a tool to manage the items Applied purchases from MKS as well as sub-assemblies MKS processes for Applied. Attachment 1 lists the items covered by this Agreement. Any modifications to this document will include a current list of the items covered by this CSA.

This Agreement defines the relationship and requirements between Applied and MKS to ensure a consistent supply of material that meets Applied's specifications. Decisions regarding future purchases from MKS will be based upon MKS' performance under this CSA as stated in Section 6, and their achievement toward Applied's business objectives, e.g. Hoshin goals.

1.2 MKS DETAILS

MKS Instruments Account Manager: John Kranik
Six Shattuck Road Sales Manager: Jeff Peters:
Andover, MA 01810 Customer Service Representative: Barbara Guthrie
Phone: (978)975-2350 Engineering Manager: Joe Maher
Fax: (978)975-0093

1.3 ENTIRE AGREEMENT

This CSA, including the Applied Standard Terms and Conditions of Purchase (Exhibit 1) and any other Exhibits or Attachments which are incorporated by reference into this CSA, together with any NDA sets forth the entire understanding and agreement of the parties as to the subject matter of this CSA and supersedes all prior agreements, understandings, negotiations and discussions between the parties as to the subject matter. No amendment to or modification of this CSA will be binding unless in writing and signed by a duly authorized representative of both parties. In the event of any conflict between the terms of the CSA and the terms of the Exhibits and Attachments, the order of precedence shall be given first to the CSA, followed by the Applied Standard Terms and Conditions of Purchase, drawings, specifications or other technical documents.

The following lists all of the Exhibits and Attachments referenced in this agreement:

Exhibit/Attachment	Revision	Release Date
Exhibit 1	no revision	10/23/98
Attachment 1	A	10/23/98
Attachment 2	no revision	10/15/97
Attachment 3	no revision	
Attachment 4	no revision	any example - will be in contract

Exhibit/Attachment	Revision	Release Date
Attachment 5	A	4/27/98
Attachment 6	K	6/15/98
Attachment 7	no revision	
Attachment 8	n/a	
Attachment 9	n/a	
Attachment 10	no revision	
Attachment 11	no revision	
Attachment 12	no revision	
Attachment 13	no revision	
Attachment 14	n/a	
Attachment 15	n/a	
Attachment 16	no revision	
Attachment 17	no revision	8/27/98

1.4 ITEMS COVERED

In general, all Items supplied to Applied by MKS will be covered by this agreement. The list of Items covered by this CSA is shown in Attachment 1. New Items may be added to Attachment 1 upon mutual agreement between Applied and MKS. Items may be removed by Applied from Attachment 1 from time to time in accordance with this Agreement. MKS may recommend or Applied may implement removal for the following reasons without limitations:

- a. Specification changes that MKS is unable to comply with
- b. Quality or delivery default
- c. Obsolete Items
- d. Outsourcing of the parent assembly

1.5 DURATION OF AGREEMENT

This Agreement commences on and as of the date of the latter of the two signatures shown in Section 9, Effective Date, when each party has executed and delivered one or more counterparts of this CSA to the other (the "Effective Date") and will remain in effect through October 23, 2000 (the "Initial Term"). Provided that MKS has complied with all contract requirements and

specifically those requirements identified in section 6.0 (Performance Management), both parties may mutually agree to expand the term of the agreement up to 24 months from the conclusion of the initial term. Any extension of this agreement will be subject to all terms and conditions of this agreement.

1.6 RESPONSIBILITIES

1.6.1 Applied Responsibilities

Applied agrees to:

- Provide demand signals to MKS as defined in section 2.5.1;
- Provide updated twenty-six week rolling forecasts to MKS;
- Measure inventory levels and scoring compliance to days-of-supply metric as stated in Section 6;
- Receive and inspect Items from MKS and measuring quality for quality metric as stated in Section 6;
- Notify MKS of any discrepancies;
- Provide suggestions on how MKS can improve its operation of this agreement;
- Make recommendations as to how MKS might reduce costs and improve the quality of Items purchased from MKS;
- Respond to any of MKS' inquiries;
- Identify, in conjunction with MKS, possible solutions to resolve any exceptions that might arise;
- Write and record action plans to resolve exceptions;
- Provide MKS with MKS performance reports;
- Meet with MKS quarterly to review its performance;

1.6.2 MKS Responsibilities

MKS agrees to fully perform all requirements of this Agreement MKS obligations include but are not limited to:

- Produce high quality and high reliability Items;
- Deliver Items on time to Applied;
- Respond in a timely manner to any of Applied's inquiries and requests;
- Continuously improve MKS' operations to better serve Applied's needs and support Applied's business objectives, e.g. Hoshin goals;
- Work with Applied to improve operation of this agreement;
- Work with Applied to reduce costs and improve the quality for all Items MKS produces for Applied;
- Review regularly the updated forecasts to adjust MKS operation for changes in Applied's plans;
- Work with Applied to resolve any exceptions that may arise;
- Complete any tasks assigned to resolve exceptions on time;
- Meet with Applied quarterly to review performance;
- Monitor and report to Applied the finished goods inventory levels of the Items listed in Attachment 1 of this Agreement.

2. LOGISTICS FRAMEWORK

2.1 OPERATION OF CSA

2.1.1 Operating calendar & holidays

This CSA operates by Applied fiscal year calendar, shown in Attachment 2. Recognized holidays are those holidays shown on Applied fiscal year calendar. Should any discrepancies between the operating calendars of Applied and MKS arise, MKS must make provisions so that Applied's operations are unaffected.

2.1.2 Flowchart of day to day operations (Reserved)

2.1.3 Forecasts

MKS' production of Items will be guided by Applied's most current 26 week rolling forecast, as provided by Applied to MKS on a weekly basis ("Applied's Forecast"). MKS will plan, manufacture, and stock inventory to meet Applied's forecast. MKS will keep each of Applied's forecasts for audit purposes for a minimum of six (6) months and may be asked to present this document for verification of authorized inventory levels. Applied's forecast is Proprietary Information to be used only by MKS to meet its obligations to Applied under this Agreement.

2.1.4 Releases

Applied may require a part or Items on an accelerated basis, either in addition to or in place of Items forecast for release or scheduled for delivery at a later date. If feasible, as determined by Applied and MKS, such Items will be provided by MKS to meet Applied's requirements. Unless otherwise agreed to by Applied, such accelerated deliveries will not affect the delivery schedule of any Items currently allocated for forecast requirements. Lead times for each accelerated release will be agreed upon by both parties. If MKS and Applied are unable to agree on delivery schedule or other terms affecting Items for accelerated delivery, Applied shall have the right to purchase or procure affected Items from other persons, without obligation to MKS.

2.1.5 Delivery Guidelines

2.1.5.1 General Delivery

MKS will exercise all efforts to meet Applied's delivery requirements on time. Shipments to Applied by MKS will be delivered in the right quantities ordered by Applied.

For part orders issued via a separate purchase order form ("Spot Buy"), deliveries will be accepted on the requested date or up to 2 days before the requested date. For Spot Buy purchases for spares, deliveries will be accepted on the requested date or up to two days before the requested date.

2.1.6 Replenishment Approach

MKS will be expected to supply Items using one or more of the following replenishment approaches:

- Bus Route
- Spot Buy

The replenishment methodology to be used for a particular Items are defined on Attachment 1. Specific delivery mechanics are outlined on Attachment 3.

2.1.7 Electronic Commerce

MKS is required to communicate with Applied using EDI ANSI X.12 standards and encouraged to use either GELS or EDICT software.

2.1.8 Changes to Logistics

Applied may on occasion change any aspect of any logistics requirement. Applied will expect MKS to accommodate these changes to the best of its ability. MKS will be given at least three weeks notification prior to the change being implemented. Applied will then consider all claims for pricing adjustment due to the change in the logistics framework if made within the three week notification period.

2.2 SERVICE LEVELS

2.2.1 Inventory Levels

MKS, if involved in supporting lean manufacturing, is expected to have Finished Goods Inventory ("FGI") of the Items on Attachment 1 in order to manage demand fluctuations. MKS will maintain a minimum FGI of 4 weeks and a maximum of 6 weeks of each Item, for each Item identified in Attachment 1 as requiring FGI, to meet Applied's needs based on the most recent rolling forecast (see Attachment 4 for example of forecast). After MKS exhibits ability to decrease cycle times, both parties will agree to lower FGI requirements.

MKS may present a claim for "non-purchase" for payment of inventory manufactured in response to a valid Applied purchase order, or an authorized demand signal, as explained in Section 2.5.1, if Applied has not taken delivery of the FGI within 6 months from date of manufacture. This claim must be made within thirty (30) days from the end of the 6 months time frame. Applied is not responsible for payment to MKS for FGI built without a valid Applied purchase order, an authorized demand signal (as explained in Section 2.5.1), or Applied's Forecast (as explained in Section 2.1.3).

Applied will not hold any financial responsibility for FGI consisting of "off-the-shelf" Items that MKS is able to sell to other customers.

2.2.1.1 WIP Tracking

MKS is expected to monitor, track, and report their Work-In-Process ("WIP") inventory (dollars). In the future, Applied will implement regular reporting mechanisms which MKS will be expected to participate in.

2.2.1.2 Excess and Obsolete Items

Applied will not be responsible for excess and obsolete parts other than to the amounts specified above in Section 2.2.1, and in any event MKS must make all efforts to mitigate claims for "non- purchase".

In the event that MKS desires to submit a claim for reimbursement of costs associated with obsolete Applied unique build-to-print parts, MKS shall submit its claim to Applied's authorized purchasing representative within 90 days from the date Applied designated the part as obsolete. MKS' claim proposal shall be submitted in accordance with Section 26, Termination for Convenience, of Applied's Standard Terms and Conditions of Purchase.

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

MKS agrees to physically dispose of the excess and obsolete parts as directed by Applied's authorized purchasing representative. Parts that are to be delivered to Applied's facilities must be delivered in accordance with the requirements of this Agreement and/or any supplemental instructions provided by Applied's authorized purchasing representative. With regard to Applied unique build-to-print parts, in lieu of delivery to Applied, Applied may elect to request MKS to destroy or otherwise scrap these parts such that these parts are non-functional MKS agrees to destroy or otherwise scrap these parts in a manner that is satisfactory to Applied and to provide Applied with a certification of destruction and/or evidence that the parts have been properly disposed of.

2.2.2 Response Requirements

Responses to the following types of inquiries are expected within the time periods in the tables below.

2.2.2.1 MKS Response Time

Inquiry Type	MKS Response Time	MKS Contact
Lead-time	1 business day	Master Planner
Technical	1 business day	Manufacturing Engineer
Quotations	1 business day	Customer Service Representative
Quality	1 business day	Quality Engineer
Price/invoice	1 business day	Customer Service Representative
Component failure & field safety	3 hours	Quality Engineer
Product Problems	1 business day	Account Manager

2.2.2.2 Applied Response Time

Inquiry Type	MKS Response Time	MKS Contact
Lead-time	1 business day	MKS Account Team Lead/Member
Technical	1 business day	MKS Account Team Lead/Member
Quality	1 business day	MKS Account Team Lead/Member
Price/invoice	1 business day	MKS Account Team Lead/Member

2.2.3 Flexibility Requirements

MKS is expected to perform regular capacity planning and to demonstrate reasonable upside/downside manufacturing flexibility in case of demand volume changes at Applied. For Bus Route Items, MKS shall be capable of manufacturing to unplanned sustained increases/decreases in demand above/below Applied's forecast as defined below. For Spot Buy Items, MKS allows the following increases/decreases to Purchase Order Quantities above/below the quantities originally requested:

Weeks until Delivery Date	[**]	[**]	[**]	[**]	[**]
Flexibility +/-	[**]	[**]	[**]	[**]	[**]

2.2.4 On-site support requirements

As determined by Applied, MKS may be asked to provide logistics, quality engineering, and new product development support on-site at Applied's facilities. At the appropriate juncture, Applied will require MKS to execute the On-site Representative Agreement prior to issuing a building badge to MKS' representatives.

2.2.5 Global Support

For the Items listed in Attachment 1, and all other Items that MKS provides to Applied, MKS will provide support globally for Applied and Applied's customers.

Technical assistance and product support services shall be provided at no additional charge during normal business hours. MKS must have an established and deployed global service capability. The required support services must be available globally, however, MKS may utilize a MKS distributor, or other -fled entity designated by MKS to meet this requirement MKS is expected to use best efforts to provide a resolution to requests for assistance.

2.2.6 Turn-around time for Repairs

MKS will supply Applied with repair Items under warranty within [**] business days from receipt of product. The [**] day cycle is not guaranteed if Applied ships repair Items in unreasonable batch sizes. MKS will supply Applied with repair Items not under warranty within [**] business days from receipt of product.

2.3 INFORMATION

2.3.1 Applied Planning Systems

MKS may be given electronic access to Applied's planning data. This access, if granted, should only be used to facilitate production and delivery of Items to support Applied's requirements. MKS' access to, and utilization of, Applied's planning data is subject to the confidentiality terms of this Agreement and any NDA.

2.3.3 Applied New Product Plans

MKS will on occasion and at Applied's discretion, be invited to forums in which Applied's new product plans are shared. Any Applied new product plans provided to MKS is subject to the confidentiality provisions of this Agreement and any NDA.

2.4 PACKAGING AND TRANSPORTATION

2.4.1 Packaging and Shipment

MKS will have all Items packaged "ready for use" in accordance with Applied's packaging specification (Attachment 6). MKS will mark and identify every item in compliance with Applied's part identification specifications and requirements (reference Attachment 6).

2.4.2 Bar Coding

All shipments should be bar coded to Applied's specifications (Attachment 5).

2.4.3 Transportation Mode

Items will be transported, FOB Origin, Freight Collect in accordance with Attachment A of Applied's Corporate Transportation Routing Guide which is provided in Attachment 7.

2.5

PAYMENT

2.5.1 Demand Signal

BUS ROUTE

Each day by 10:00 a.m., Applied sends via EDI transmission an order sheet to MS containing Applied's material requirements information. This information is organized at the part-number level and represents Applied's daily purchase from MKS. This EDI transmission constitutes an authorized demand signal.

SPOT BUY

As needed, Applied sends via fax an order sheet to MKS containing Applied's material requirements information. This information is organized at the part number level and represents an Applied purchase from MKS. This fax constitutes an authorized demand signal.

2.5.2 Invoices

Invoices shall contain the following information: purchase order number, item number, description of goods, sizes, quantities, unit prices, and extended totals in addition to any other information requested. Applied's payment of invoice does not represent unconditional acceptance of items and will be subject to adjustment for errors, shortages, or defects. Applied may at any time set off any amount owed by Applied to MKS against any amount owed by MKS or any of its affiliated companies to Applied.

All invoices must be sent directly to Accounts Payable in Austin:

Accounts Payable
Applied Materials
9700 US Highway 290 East M/S 4500
Austin, TX 78724-1199

2.5.3 Cash Discounts

Payment will be made net thirty (30) days from receipt of:

- a. invoice, in form and substance acceptable to Applied, or
- b. delivery and acceptance of the invoiced Item(s), whichever is later.

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

If payment is made within ten (10) days of the later of either (a) or (b) above, Applied may [*] from the invoice total as a prompt payment discount.

2.6 DISASTER RECOVERY PLAN

MKS is expected to develop and provide to Applied, upon request, reasonable information describing (provide evidence of a disaster recovery plan that includes emergency back up capacity and appropriate record protection and recovery. Furthermore, MKS represents that its information systems are year 2000 compatible and hereby grants Applied the right to verify MKS' internal processes for ensuring compliance with this provision. MKS agrees to include this same requirement in its purchase orders to its supply base and to provide reasonable efforts to verify its supply base is compliant with the requirements herein.

2.7 MANAGING EXCEPTIONS

2.7.1 Identifying constraints

MKS is responsible for anticipating inability to perform its obligations and limitations on manufacturing, delivery and other performance to meeting CSA objectives, informing Applied when those constraints occur, and initiating action plans to resolve the Constraints might typically include, but not be limited to:

- a. Consumption over forecast
- b. Consumption under forecast
- c. Quality problems
- d. Capacity/production problems
- e. Secondary supplier supply-chain management problems
- f. Other business issues

2.7.2 Process for Exceptions

Applied will work with MKS to determine the impact of an exception and approve and execute or disapprove the action plans in accordance with Section 24, Changes, of Applied's Standard Terms and Conditions of Purchase. MKS will notify the MKS Account Team Lead as soon as exceptions are identified.

3. QUALITY FRAMEWORK

3.1 SUPPLIER NON-CONFORMANCES AND CORRECTIVE ACTION

MKS' quality must meet all applicable Applied specifications as stated elsewhere in the Agreement (including all technical specifications and detailed drawings). MKS is required to replace or repair defective Items at MKS' expense in a timely manner. MKS are required to use the most expeditious manner possible to affect the corrections including the use of overnight delivery

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

services for shipment of Items; at Applied's request, in certain circumstances, MKS may be asked to provide new Items in lieu of repairing a part to ensure immediate corrective action.

MKS will be notified of defects with a corrective action form, Attachment 10, to which they are expected to respond appropriately. A corrective action process to resolve non-conformances will be documented and used. In addition, MKS will participate in continuous improvement plans and programs as defined by Applied and MKS.

Should MKS fail to conform to the specifications established in this Agreement, Applied may purchase comparable items in the open market as necessary to meet its requirements. Applied may at its option charge MKS with any reasonable cost differential between the contract price and the price paid in the open market. This cost may include premium costs for expedited delivery, administrative costs incurred to process replacement purchase orders.

3.2 APPLIED NON-CONFORMANCES AND CORRECTIVE ACTION

Applied will return Items at Applied's expense that do not conform to Applied's requirements due to Applied errors. These Items will be returned for potential rework. Applied and MKS will agree in advance on "standard" repair costs (labor, Items and freight) on items not covered under warranty; the standard repair costs will be identified in the Items list (Attachment 1B).

To the extent that a "standard" repair cost has not been established, MKS will assess rework costs and timing and inform Applied before work is performed. The parties agree that MKS will inform Applied if the total price charged for repairing a part will exceed 40% of the current purchase price stated in Attachment 1.

MKS agrees to repair and return all Items within [**] business days from receipt of damaged Item. Applied shall have the right to designate certain Items for "Same Day" or "24 Hour" repair turnaround. Any premium charges for "Same Day" or "24 Hour" repair turnaround will not exceed [**] per Item.

Prior to return of repaired items to Applied, MKS will mark Items with Applied's part number, serial number, RMA number, purchase order number, range and gas (ff applicable). Applied shall bear the risk of loss or damage during transit of Items whether or not the Items meets warranty requirements.

In addition, as stated below in the quality assurance section, a corrective action process to resolve non-conformance(s) will be documented and used.

3.3 QUALITY ASSURANCE

All Items purchased under this CSA will be subject to inspection and test by Applied at appropriate time and place, including the period of manufacture and anytime prior to final acceptance. If inspection or test is made by Applied on MKS' premises, MKS will provide all reasonable facilities and assistance for the safety and convenience of Applied's inspectors at no charge to Applied. No preliminary inspection or test shall constitute acceptance. Records of all inspection work shall be kept complete and available to Applied during the performance of this order and for such further period as Applied may determine.

Certificate of Conformance (COC): MKS agrees to certify that Items have passed all production acceptance tests and configuration requirements and provide a "Certificate of Conformance" (see Attachment 16) and a Calibration Data Report that will be included with each product during shipment.

With regard to repair services, MKS shall maintain documentation evidencing that all test inspections have been performed. The documentation shall indicate the nature and number of observations made, the quantities approved and rejected as well as the nature of the corrective action take MKS' service centers shall be responsible for submitting this data for Applied's review of the delivery summaries. The data shall be submitted monthly not later than five days after the close of each of Applied's fiscal months to Applied's Contract Specialist and Applied's IBSS Repairs Purchasing Group.

At Applied's request, MKS will provide a certificate and/or a copy of the final inspection records showing compliance to applicable specifications, contract requirements and any other required documents stipulated in Applied's repair authorization. MKS also agrees to provide Applied with copies of its current procedures relative to repairs, range change and warranty repairs.

Through MKS' internal Quality Service organization, MKS will track and maintain its internal manufacturing reject rate by percentage of assemblies, and/or part per million ("TPM"). Trend reporting and corrective actions shall be furnished to Applied as requested by Applied Purchasing or Quality representatives. MKS will provide quality data in the format, as shown in Attachment 11, and as received by Applied MKS may also be required to provide reasonable additional data to support qualification and certification programs.

3.4 WARRANTY

MKS warrants that all Items delivered to Applied will be free from defects in workmanship, material, and manufacture; will comply with the requirements of this Agreement, and, where design is MKS' responsibility, will be free from defects in design. All services will be performed in a competent, professional and workmanlike manner, free from defects and in accordance with best professional practices or the like. MKS FURTHER WARRANTS ALL ITEMS PURCHASED OR REPAIRED WILL BE OF MERCHANTABLE QUALITY AND WILL BE FIT AND SUITABLE FOR THE PURPOSE INTENDED BY APPLIED. THESE WARRANTIES ARE IN ADDITION TO ALL OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED, AND WILL SURVIVE ANY DELIVERY, INSPECTION, ACCEPTANCE, OR PAYMENT BY APPLIED. If any Items delivered by MKS do not meet the warranties specified herein or otherwise applicable, Applied may, at its option:

- (i) require MKS to correct at no cost to Applied any defective or non-conforming Items by repair or replacement, or
- (ii) return such defective or non-conforming Item at MKS' expense to MKS and recover from MKS the order price thereof, or
- (iii) correct the defective or non-conforming Item itself or through a mutually approved third party and charge MKS with the cost of such correction
- (iv) cancel the balance of the undelivered non-conforming Item and/or this CSA in accordance with Section 25, Termination for Default, of Applied's standard Terms and Conditions of Purchase.

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

All warranties will run to Applied and to its customers. Applied's approval of MKS' material or design will not relieve MKS of the warranties established in this agreement. In addition, if Applied waives any drawing or specification requirement for one or more of the goods, it will not constitute a waiver of all requirements for the remaining goods to be delivered unless stated by Applied in writing.

3.5 OTHER QUALITY PROGRAMS

3.5.1 MKS' Quality System

MKS' quality system must be in compliance with ISO 9000. If MKS is not currently ISO 9000 certified, MKS must provide their documented plans to achieve certification with a tune that is mutually agreeable to both parties. MKS also agrees to participate in the SSQA development and implementation plan.

3.5.2 MKS' Process Quality

Applied Materials requirements and workmanship standards shall be integrated into MKS' processes and identified accordingly. MKS shall identify the critical processes effecting the product quality and develop a validated list of the critical processes by discussing with Applied Materials. All data generated as a result of the critical manufacturing processes shall be collected, processed and used for process control and continuous improvement Evidence of process control of critical processes is a requirement and the presence of control charts and statistical process control is required. Processes not exhibiting a Cpk of 1.33 will require a formal corrective action plan to achieve the required process control. The critical manufacturing processes on pressure transducers, flow products and electronic products are:

[**]

[**]

[**]

[**]

[**]

3.5.3 Part quality containment and corrective action

When Applied Materials identifies a product non-conformance on a piece part and requests MKS to implement containment action on the part failure, MKS shall respond within [**] with a documented containment plan and shall have implemented the plan. MKS shall provide follow up to this containment plan with a closed loop corrective action identifying the root cause, a permanent fix and tune line to implement the corrective action. Applied Materials may perform a follow up audit to verify the effective implementation of the corrective action and approve the closure of the corrective action.

Applied Materials may develop or request MKS to develop Inspection Standard Sheets on identified part numbers for deployment in MKS' operation. ISS's will be deployed in final

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inspection, completed and records maintained as part of MKS' quality system. Template will be provided by Applied Materials supplier quality organization.

3.5.4 MKS Audits

Applied Materials will conduct the following audits, as required, to ensure a high level of quality of parts and assemblies purchased from MKS.

3.5.4.1 Source Inspection

Applied Materials may conduct source inspection at MKS' site at any time. Performance of source inspection does not waive MKS responsibility for any defects that might subsequently be identified by Applied Materials or its customers.

3.5.4.2 Piece part audits

Piece part audits may be performed at MKS' site or at Applied Materials. MKS shall identify the failure and respond commitment to contain the part failure within [**] from notification. MKS shall also perform the root cause analysis of the failure for containment and corrective action. MKS shall agree to inform Applied Materials about the root cause, corrective action, its implementation plan and schedule within the time period agreed upon.

3.5.4.3 Process audits

When a systemic failure trend is observed in the piece part or assembly supplied, Applied Materials or MKS shall identify the process which are causing the failure and audit the processes at MKS' site. Any deficiencies or opportunities for improvements identified from the audit will be discussed with MKS and a closed loop corrective action will be established, specifying the correction action required with a specified timeline for implementation. MKS shall agree to work on the corrective action and provide closure to all deficiencies within the time period agreed upon.

3.5.4.4 System assessment

Applied Materials, at any time may decide to perform a quality system audit at MKS' site. Any deficiencies or opportunities for improvements identified from the audit will be discussed with MKS and a closed loop corrective action will be established, specifying the corrective action required with a specified timeline for implementation. MKS shall agree to work on the corrective action and provide closure to all deficiencies within the time period agreed upon.

3.5.5 MKS' control over their subcontractors

MKS shall demonstrate control over the selection of subtier suppliers and maintain a controlled Approved Suppliers List that is supported by on site audits and completed corrective actions prior to selection and periodically to ensure the highest quality of procured parts and assemblies. MKS is required to provide Applied Materials with a quality plan for

the selection, control and maintenance of subtier suppliers and will include periodic testing performed by MKS to ensure compliance to Applied Materials specifications. Quality records of MKS' subtier suppliers shall be made available, upon request, to Applied Materials for review.

3.5.6 MKS communication

MKS agrees to send a report on their quality performance on either a weekly or monthly basis the frequency and content of which is to be mutually agreed to between the quality engineering representatives from each party. Applied's quality engineer may schedule a periodic meeting with the MKS representative managing the quality to discuss the contents of MKS' quality report, parts containment, closed loop corrective action, audit findings or any other issues related to quality. MKS agrees to develop, with the help and approval of Applied Materials, a pro-active quality road map to improve their part quality to meet the Applied Materials quality goals. And the status of the effectiveness of the implementation plan will be monitored by MKS and reviewed with Applied Materials on a periodic basis.

3.5.7 Formal Quality Plan

A formal quality plan will be developed jointly by MKS and Applied Materials and will contain part and process specific requirements identified to ensure the manufacture of high quality parts. MKS will conform to all requirements of the plan. Periodic assessments of the quality plan will be performed by the Applied supplier quality engineer to ensure conformance to all requirements. The completed plan will be an attachment to this contract.

3.5.8 Pro-active Action Plans

MKS is advised to work with Applied Materials in a pro-active way on the following.

1. Work with the Quality Engineers on the manufacturing floor to receive the DMR parts as soon as possible.
2. Work with the WMO/PBG buyers in reversing the PPMs from MKS fault to Applied Materials' fault in applicable cases.

4. PRICING FRAMEWORK

4.1 PRICING BY PART NUMBER

The pricing for the Items are shown in Attachments 1A (part numbers) and 1B (service and repair). Any modifications to these must be made in accordance with Section 7 of this Agreement. MKS commits to on-going cost improvement during the period of this Agreement in accordance with Section 6.

At the time of the Agreement Effective Date, the remaining balance of undelivered items on all open purchase orders will be revised to the agreement price.

Specific circumstances may result in a review of the agreement terms, including prices. These include, but are not limited to:

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- a. Volume increases resulting in an increase in agreement value of over [**] (subsequent to completion of negotiations on the existing prices);
- b. Addition of Items to the agreement increasing the value of the Agreement over [**]
- c. Cost reductions(savings over and above those committed in the MKS performance plan.;
- d. Price reductions in accordance with Section 6,[**], of Applied's standard Terms and Conditions of Purchase.

4.2 COOPERATIVE PRICING MODELS/FORMULAS

SEE ATTACHMENT 1

4.3 VOLUME

MKS will be provided a range of potential volume that may be purchased. Applied does not commit to buy a specific volume of a part number from a MKS. Applied does not limit its ability to buy the same part number from multiple sources.

4.4 EXPORT PRICING

MKS should quote Applied in unit prices based upon delivery FCA Free carrier. MKS is expected to prepare the export paperwork and be the exporter of record. MKS must utilize Applied's preferred carriers to arrange the export of the goods. Applied will pay the freight charges based on Applied's rates with its preferred carriers. Applied will be responsible for importing the goods into the destination country.

4.5 CURRENCY

All prices are quoted in US dollars; prices for foreign manufactured Items will not be adjusted to reflect changes in the exchange rate. MKS is encouraged to obtain any necessary currency exchange protection it deems appropriate.

Notwithstanding the agreement to quote product in U.S. Dollars, the parties agree that any Applied entity operating in the same country as MKS's manufacturing plant or sales and service depots may issue orders for MKS's products using the local currency for the purposes of effecting payment. The prices will be converted to local currency as follows:

PARTS MANUFACTURED EXCLUSIVELY OUTSIDE OF THE UNITED STATES:

The U.S. Dollar prices in Attachment 1 will be converted to local currency, on a quarterly basis, using the official exchange rate listed in Bloomberg(TM) or Olsen(TM) publications. The exchange rate shall be the mid point between the bid and ask price listed at the close of the following days: January 2nd, April 1st, July 1st, October 1st.

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PARTS MANUFACTURED EXCLUSIVELY WITHIN THE UNITED STATES:

The various packaging, shipping, export and import costs associated with parts manufactured exclusively within the United States and offered for sale outside the United States will be paid by MKS as part of its normal operating expenses. In consideration for said costs, Applied agrees that MKS may increase the U.S. Dollar prices in Attachment 1 by not more than [**] prior to converting the U.S. price to the local currency price using the official exchange rate listed in Bloomberg(TM) or OIsen(TM) publications. The exchange rate shall be the mid point between the bid and ask price listed at the close of the following days: January 2nd, April 1st, July 1st, October 1st.

4.6 PROTOTYPES

MKS is committed to price all Items consistent with contract prices.

MKS agrees to provide prototype Items priced considering the total value of Applied's business with MKS. This may be accomplished in several ways, including:

- a. a specific number of prototype Items may be provided free of charge
- b. Items may be priced at production levels

4.7 ADVANCES FOR RAW MATERIALS

Applied does not provide advance payments for the purchase of raw materials.

5. TECHNICAL FRAMEWORK

5.1 ENGINEERING CHANGE ORDERS

Applied may change its drawings, design, and specifications at any time in accordance with Section 25, Changes, of Applied's Standard Terms and Conditions of Purchase. Applied Supplier Engineer will review with MKS all proposed Engineering Change Orders (ECO's) that impact the form, fit, or function of Items. Applied will, in writing, provide approved ECO's (refer to Attachment 12) and state the effective dates of all changes. Unless otherwise notified, Applied Receiving Inspection will inspect to the latest revision in effect at the time of receipt

MKS may request engineering changes via a MKS Problem Sheet (refer to Attachment 13). This form should be submitted to Applied Supplier Engineer. Changes shall not be implemented by MKS until written permission to proceed is given by Applied's authorized purchasing representative and the agreement is modified accordingly. Applied will consider claims for adjustment in the terms of this Agreement if made before the implementation of the changes.

5.2 TOOLING

Unless otherwise agreed to in writing, special dies, tools, patterns and drawings used in the manufacture of Items shall be furnished by and at the expense of, MKS.

5.3 DESIGN CHANGES AND RESOLUTION

For the term of this Agreement, MKS will not make changes to the design of any part that may alter form, fit, function or a significant manufacturing process without a documented engineering change request and prior written approval from Applied's authorized purchasing representative and the agreement is modified accordingly.

If Applied's design changes impact the pricing, delivery, lead-time, or other terms and conditions of this Agreement, and agreement upon alternate terms cannot be reached with MKS, then Applied may remove the subject Items from this Agreement without affecting the remaining Items.

5.4 PROCESS CHANGES AND RESOLUTION

MKS is expected to inform Applied of process and MKS changes to include changes in specifications, manufacturing locations, even when specifications are met. MKS must receive written approval in writing from Applied before implementing changes. MKS must use the specified Applied "approved" list of secondary process suppliers, where designated. The use of Applied approved secondary process suppliers does not relieve MKS of the responsibility for management of the subtier supplier and for ensuring the quality of parts received.

5.5 SUBCONTRACTING

MKS shall not subcontract for completed or substantially completed components and processes supplied to Applied without prior written approval of Applied. MKS will ensure that all subcontractors to MKS that have access (directly or indirectly) to Applied specifications must be covered by a NDA that is similar in form and substance to Applied's NDA.

5.6 FIRST ARTICLES

A new Item, Item with revised drawings, or other changes as delineated above, must have a first article evaluated and accepted by Applied (a "First Article"). An Item will not be authorized for deliveries until acceptance of the First Article by Applied. MKS will maintain First Article qualifications/evidence data file with content as defined by Applied for the specific part. First Article data is to be made available to Applied upon request and shall be retained by MKS during the performance of this Agreement or subsequent agreements.

5.7 OUTSOURCING

Applied may at its discretion elect to outsource an assembly or module to a third party ("Subassembler") and if the selected assembly or module includes any Item under this CSA (an "affected Item"), Applied will advise MKS of the Subassembler, unless precluded from doing so by confidentiality or other requirements. MKS understands that the selection and responsibility for sourcing any affected Items will generally be the responsibility of the Subassembler. If MKS is not selected as the source for an affected Item, any affected items or applicable quantities of affected Items may, at Applied's discretion, be removed from this Agreement.

5.8 PRODUCT SUPPORT

MKS agrees to provide Items, and technical and service support to Applied for all of the Items for a minimum of ten years from the date of final shipment of a part to Applied.

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Alternatively, the parties may agree to establish a product support period less than ten years provided that MKS agrees to grant to Applied a non-exclusive license to make, have made, use, sell, and support the Items in a form and on terms acceptable to Applied.

5.9 COMMODITY SPECIFIC ISSUES

Reserved

5.10 TECHNOLOGY ROADMAP

Reserved

6. PERFORMANCE MANAGEMENT

6.1 SUPPLIER PERFORMANCE PLAN

As part of this Comprehensive Supplier Agreement, Applied and MKS agree to jointly develop a Supplier Performance Plan. Attachment 15 outlines the performance plan.

6.2 SUPPLIER PERFORMANCE MANAGEMENT

6.2.1 Metrics and Targets

MKS agrees to target the operational performance targets defined below. Performance targets for FY2000 are listed. Intermediate performance targets are established in the Supplier Performance Management Plan. The following defines how Applied and MKS will measure performance metrics:

Measure	Definition	Calculation	FY 1999 End Target	FY 2000 End Target
Quality ppm	Number of quality discrepancies detected prior to shipping a completed system to an end customer, expressed as parts per million	Quantity of parts with recorded DMR occurrences provided by the supplier over the prior 13-week period, divided by the total quantity of parts received from that supplier over the same period, multiplied by 1 million	[**]	[**]
Supplier Fault DMRs	Number of DMR transactions for part quality discrepancies detected in-house prior to system installation in the field	Number of DMR occurrences recorded against the supplier accumulated over the prior 13-week period	[**]	[**]

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Measure	Definition	Calculation	FY 1999 End Target	FY 2000 End Target
Late Delivery ppm	Number of parts delivered later than the agreed upon commit date	Quantity of parts received one day or more after the commit date, accumulated for each supplier over a rolling 13-week period, divided by the total quantity of parts received over the same period, multiplied by 1 million	[**]	[**]
Early Delivery ppm	Number of parts received three or more days before the commit date	Quantity of parts received three or more days before the commit date, accumulated over a rolling 13-week period, divided by the total quantity of parts received over the same period, multiplied by 1	[**]	[**]
Average Lead Time of Production Parts (Order Fulfillment Cycle Time)				
Source Cycle Time (supplier reported)	Average of the total times, from placement of an order through receipt at Applied Materials, of parts supplied to volume production (including transportation time)	The average of the number of days between order date and receipt date for all production parts recorded for the supplier, based on Austin volume production activity.	[**]	[**]
Make Cycle Time (supplier reported)	Total cycle time to source all materials required to produce an order, based on contracted parts supplied to volume production	Elapsed time, as determined through process audits and supplier self-assessments	[**]	[**]

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Measure	Definition	Calculation	FY 1999 End Target	FY 2000 End Target
Cost Reduction	Total production time required to fulfill an order, including manufacturing order release and build time, based on contracted parts supplied to volume production	Elapsed time, as determined through process audits and supplier self-assessments	[**]	[**]
	Percentage difference between the average unit price paid for materials in the prior year and price paid in the current year	Calculated for each contract by the SAT, using the method accepted by the SMO commodity group (see Attachment 17)	[**]	[**]

7. AMENDMENTS AND MODIFICATIONS

This CSA may be revised by the mutual consent of Applied and MKS. Revisions to this CSA must be in writing, signed by both Applied and MKS duly authorized representatives, traced by revision numbers and attached to this original agreement. A change to one attachment of this agreement will constitute a revision level change. The master copy of this CSA and any revisions are to be maintained by Applied.

Updates to Section 2.2, Service levels, and changes may be communicated via memos sent by mail, fax or e-mail.

8. GLOSSARY

TBD

9. ACCEPTANCE

Accepted:

/s/ Michael Berkaw

 Applied Materials, Inc.
 Michael Berkaw
 Contract Specialist
 Chemical Delivery SMO

Date: 10/22/98

/s/ Leo Berlinghieri

 MKS
 Leo Berlinghieri
 VP of Customer Service
 MKS Instruments

10/22/98

APPLIED MATERIALS TERMS AND CONDITIONS OF PURCHASE

1 Acceptance

The terms and conditions stated in these Applied Materials Standard Terms and Conditions of Purchase become the agreement between the parties covering the purchase of the goods or services (collectively referred to as "Items") ordered in the Purchase Agreement/Comprehensive Supplier Agreement/Basic Supplier Agreement of which these Terms and Conditions are a part when this Agreement is accepted by acknowledgment or commencement of performance. This Agreement can be accepted only in these terms and conditions. Additional or different terms proposed by Supplier will not be applicable unless accepted in writing by the Buyer. No change, modification, or revision of this Agreement will be effective unless in writing and signed by duly authorized representative of Buyer.

2. Confidential and Proprietary Information

Supplier will observe and is bound by the terms and conditions of any and all Non-Disclosure Agreements (NDAs) executed by Supplier with or for the benefit of Buyer, whether now or hereafter in effect. In addition, all schematics, drawings, specifications and manuals, and all other technical and business information provided to Supplier by Buyer during the term of, or in connection with the negotiation, performance or enforcement of this Agreement shall be deemed included in the definition (subject to any applicable exclusions therefrom) of "Proprietary Information" for purposes of this Agreement.

Supplier may use Buyer's Proprietary Information only for the purpose of providing Items, parts or components of Items or services to Buyer. Supplier will not discuss and further will not use any of Buyer's Proprietary Information, directly or indirectly, for any other purpose including, without limitation, (a) developing, designing, manufacturing, refurbishing, selling or offering for sale parts or components of Items or parts, or providing services, for or to any party other than Buyer, and (b) assisting any third party, in any manner, to perform any of the activities described herein. All Proprietary Information shall (a) be clearly marked by Supplier as Buyer's property and segregated when not in use, and (b) be returned to Buyer promptly upon request.

Supplier acknowledges and agrees that Buyer would suffer irreparable harm for which monetary damages would be an inadequate remedy if Supplier were to breach its obligations under this provision. Supplier further acknowledges and agrees that equitable relief, including injunctive relief, would be appropriate to protect Buyer's rights and interests if such a breach were to arise, or threatened, or were asserted.

Supplier will use reasonable efforts to notify Buyer of any third party requests to engage in any of the activities prohibited by this Article.

3. Intellectual Property

Nothing in this Agreement shall be deemed to grant to Supplier any license or other right under any of Buyer's intellectual property (including, without limitation, Buyer's patents, copyrights, trade and service marks, trade secrets, and Proprietary Information) for Supplier's own benefit or to provide or offer Items to any party other than Buyer.

All Items supplied by Supplier and the sale of Items by Supplier and, as applicable, use thereof by Buyer or its subsequent purchasers or transferees will be free from liability for or claim by any persons of royalties, patent rights, copyright, trademark, mechanics' liens or other encumbrances, and trade secrets or confidential or proprietary intellectual property rights (collectively "rights" and "encumbrances"), and Supplier shall defend, indemnify and hold harmless Buyer against all claims, demands, costs and actions for actual or alleged infringements of patent, copyright, trademark or trade secret rights or other rights and encumbrances in the use, sale or re-sale of any Item which are valid at the time of or after the effective date of this Agreement; except to the extent that the infringement was unavoidably caused by Supplier's compliance with a detailed design furnished and required by Buyer or by Buyer's non-compliance with Supplier's prior written advice or warning of a possible and likely infringement

At the request of Buyer, Supplier will provide to Buyer the most current and complete specifications and drawings (the "Drawings") for each Item manufactured or produced for Buyer that is based on Buyer's design or Drawings showing the complete specifications and design for the Item as manufactured or produced by Supplier. All Drawings are the sole property of Buyer.

Upon termination of this Agreement, Supplier will return all Applied Proprietary Information and documentation to Buyer. Notwithstanding this requirement, Supplier may request Buyer approval to destroy any Proprietary Information of Buyer that has become obsolete or outdated (e.g., financial projections, forecasts, et cetera); provided that Supplier certifies to Buyer the destruction of such Proprietary Information.

4. Patent License

Supplier, as part consideration for this Agreement and without further cost to Buyer, hereby grants to Buyer an irrevocable, non-exclusive, paid-up world-wide right and license to make, have made, use, and sell any inventions derivative works, improvements, enhancements, or intellectual property (the "Inventions") made by or for Supplier in the performance of this Agreement. Supplier shall cause any employee, consultant, contractor or other persons who provides work for hire to Supplier to assign to Supplier for licensing as above of any such inventions. In addition, Buyer shall be entitled to license Buyer's customers to use such inventions during the operation of Buyer's products.

5. Press Releases/Public Disclosure Not Authorized

Supplier will not, without the prior written approval of Buyer, issue any press releases, advertising, publicity, public statements or in any way engage in any other form of public disclosure that indicates the terms of this Agreement, Buyer's relationship with Supplier or implies any endorsement by Buyer of Supplier or Supplier's products or services. Supplier further agrees not to use, without the prior written consent of Buyer, the name or trademarks (including, but not limited to Buyer's corporate symbol). Any requests under this Section must be made in writing and submitted to the parties designated by Buyer for the review and authorization of such matters.

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6. [**]

Supplier does not presently sell or offer any Item that is similar in form, fit or function to any Item to any third party for prices and terms and conditions of sale (including, without limitation, warranties, services or other benefits) (collectively, "Benefits") [**] to Buyer in this Agreement. If during the term of this Agreement, [**] for any Item than those available to Buyer under this Agreement (a "Third Party Arrangement"), Supplier will notify Buyer [**], Supplier will notify Buyer [**] and this Agreement will be deemed [**]. However, Buyer, at its option, may [**]. If any [**], Supplier will [**] that Buyer [**] from the effective date [**] shall be [**] of the effective date [**]. In no event shall Supplier quote prices to Buyer that would be unlawfully discriminatory under any applicable law.

7. Duty Drawback

Supplier will provide Buyer with U.S. Customs entry data, including information and receipts for duties paid directly or indirectly on all Items that are either imported or contain imported parts or components, that Buyer determines is necessary for Buyer to qualify for duty drawback ("Duty Drawback Information"). This data will be provided to Buyer within fifteen (15) days after each calendar quarter (or fiscal year quarter of Buyer, and be accompanied by a completed Certificate of Delivery of Imported Merchandise or Certificate of Manufacture and Delivery of Imported Merchandise (Customs Form 331) as promulgated pursuant to 19 CFR 191.

8. ODC Elimination

In the event Supplier's goods are manufactured with or contain Class I ODCs as defined under Section 602 of the Federal Clean Air Act (42 USE Section 7671 a) and implementing regulations, or if Supplier suspects that such a condition exists, Supplier shall notify Buyer prior to performing any work against this Agreement. Buyer reserves the right to: (a) terminate all Agreements for such goods without penalties, (b) to return any and all goods delivered which are found to contain or have been manufactured with Class I ODCs, or (c) to terminate any outstanding Agreements for such goods without penalties. Supplier shall reimburse Buyer all monies paid to Supplier and all additional costs incurred by Buyer in purchasing and returning such goods.

9. Compliance With Laws

Supplier warrants that no law, rule, or ordinance of the United States, a state, any other governmental agency, or that of any country has been violated in supplying the goods or services ordered herein.

10. Equal Employment Opportunity

Supplier represents and warrants that it is in compliance with Executive Agreement 11246, any amending or supplementing Executive Agreements, and implementing regulations unless exempted.

11. Applicable Law, Consent to Jurisdiction, Venue

This Agreement shall be governed by, be subject to, and be construed in accordance with the internal laws of the State of California, excluding conflicts of law rules. The parties agree that any suit arising out of this Agreement, for any claim or cause of action, whether in contract, in tort, statutory, at law or in equity, shall exclusively be brought in the United States District Court for the Northern District of California or in the Superior or Municipal Courts of Santa Clara County, California, or in the United States District Court for the Western District of Texas, Austin Division, or the Texas State District Courts of Travis County, Texas, provided that such court has jurisdiction over the subject matter of the action. Each party agrees that each of the named courts shall have personal jurisdiction over it and consents to such jurisdiction. Supplier further agrees that venue of any suit arising out of this Agreement is proper and appropriate in any of the courts identified above; Supplier consents to such venue therein as Buyer selects and to any transfer of venue that Buyer may seek to any of such courts, without respect to the initial forum.

With respect to transactions to which the 1980 United Nations Convention of Contracts for the International Sale of Goods would otherwise apply, the rights and obligations of the parties under the Agreement, including these terms and conditions, shall not be governed by the provisions of the 1980 United Nations Convention of Contracts for the International Sale of Goods; instead' applicable laws of the State of California, including the Uniform Commercial Code as adopted therein (but exclusive of such 1980 United Nations Convention) shall govern.

12. Notice of Labor Disputes

Whenever an actual or potential labor dispute, or any government embargoes, regulatory or tribunal proceedings relating thereto is delaying or threatens to delay the timely performance of this Agreement, Supplier will immediately notify Buyer of such dispute and furnish all relevant details regardless of whether said dispute arose directly, or indirectly, as a result of an actual or potential dispute within the Supplier's subtier supply base or its own operations.

13. Taxes

Unless otherwise specified, the agreed prices include all applicable federal, state, and local taxes. All such taxes shall be stated separately on Supplier's invoice.

14. Responsibility for Goods; Risk of Loss

Notwithstanding any prior inspections, Supplier shall bear all risks of loss, damage, or destruction to the Items called for hereunder until final acceptance by Buyer at Buyer's facility(s) delivery destination specified in the Agreement, which risk of loss shall not be altered by statement of any at F.O.B. point here. These Supplier responsibilities remain with respect to any Items rejected by Buyer provided, however, that in either case, Buyer shall be responsible for any loss occasioned by the gross negligence of its employees acting within the scope of their employment. Items are not accepted by reason of any preliminary inspection or test, at any location.

15. Insurance

A. Supplier shall maintain (i) comprehensive general liability insurance covering bodily injury, property damage, contractual liability, products liability and completed operations, (ii) Workers Compensation and employer's liability insurance, and (iii) auto

insurance, in such amounts as are necessary to insure against the risks to Supplier's operations.

- B. Minimally, Supplier will obtain and keep in force, insurance of the types and in the amounts set forth below:

Insurance -----	Minimum Limits of Liability -----
Worker's Compensation	Statutory
Employer's Liability	\$1,000,000
Automobile Liability	\$1,000,000 per occurrence
Comprehensive General Liability (including Products Liability)	\$1,000,000 per occurrence
Umbrella/Excess Liability	\$1,000,000 per occurrence

All policies must be primary and non-contributing, and shall include Buyer as an additional insured. Supplier also waives all rights of subrogation. Supplier will also require and verify that each of its subcontractors carry at least the same insurance coverage and minimum limits or insurance as Supplier carries under this Agreement. Supplier shall notify Buyer at least thirty (30) days prior to the cancellation of or implementation of any material change in the foregoing policy coverage that would affect the Buyer's interests. Upon request, Supplier shall furnish to Buyer as evidence of insurance a certificate of insurance stating that the coverage would not be canceled or materially altered without thirty (30) days prior notice to the Buyer.

16. Change of Control

Supplier will notify Buyer immediately of any change of control or change (including any change in person or persons with power to direct or cause the direction of management or policies of Seller) or any change (35% or more) in the ownership of Supplier, or of any materially adverse change in Supplier's financial condition or in the operation of Supplier's business, including, but not limited to, Supplier's net worth, assets, production capacity, properties, obligations or liabilities (fixed or contingent) (collectively, a "change of control").

17. Assignments

- A. No right or obligation under this Agreement shall be assigned by Supplier without the prior written consent of Buyer, and any purported assignment without such consent shall be void.
- B. Buyer may assign this Agreement in whole or part at any time if such assignment is considered necessary by Buyer in connection with a sale of Buyer's assets, or a transfer of any of its contracts or obligations under such contracts, or a transfer to a third party of manufacturing activities previously conducted by Buyer.

18. Gratuities

Supplier warrants that it has not offered or given and will not offer or give any gratuity to induce this or any other agreement. Upon Buyer's written request, an officer of Supplier shall certify in writing that Supplier has complied with and continues to comply with this Section. Any breach of this warranty shall be a material breach of each and every agreement and contract between Buyer and Supplier.

19. Insolvency

The insolvency of Supplier, the filing of a voluntary or involuntary petition for relief by or against Supplier under any bankruptcy, insolvency or like law, or the making of an assignment for the benefit of creditors, by Supplier, shall be a material breach hereof and default.

20. Waiver

In the event Buyer fails to insist on performance of any of the terms and conditions, or fails to exercise any of its rights or privileges hereunder, such failure shall not constitute a waiver of such terms, conditions, rights or privileges.

21. Disclaimer and Limitation of Liability

In no event shall Buyer be liable for any special, indirect, incidental, consequential, or contingent damages (the foregoing being collectively called "Damages"), whether or not Buyer has been advised of the possibility of such damages, for any reason. Buyer excludes and Supplier waives any liability of Buyer for any "Damages", as so defined.

22. Indemnity by Supplier

Supplier shall defend, indemnify and hold harmless Buyer from and against, and shall solely and exclusively bear and pay, any and all claims, suits, losses, penalties, damages (whether actual, punitive, consequential or otherwise) and all liabilities and the associated costs and expenses (including attorney's fees, expert's fees, and costs of investigation (all of the foregoing being collectively called "Indemnified Liabilities")), caused in whole or in part by Supplier's breach of any term or provision of this Agreement, or in whole or in any part by any negligent, grossly negligent or intentional acts, errors or omissions by Supplier, its employees, officers, agents or representatives in the performance of this Agreement or that are for, that are in the nature of, or that arise under, strict liability or products liability with respect to or in connection with the Items. The indemnity by Supplier in favor of Buyer shall extend to Buyer, its officers, directors, agents, and representatives and shall include and is intended to include Indemnified Liabilities which arise from or are caused by, in whole or in part, the concurrent negligence, including negligence or gross negligence of Supplier but shall not extend to Indemnified Liabilities to the extent such are caused by the negligence or willful misconduct of Buyer. Supplier assumes no liability under this warranty for system failures, personal injury or property damage resulting from improper operation, improper maintenance, abuse or modifications from the original product specifications or configuration on the part of Buyer, its customers, agents and other third parties.

23. Force Majeure

A failure by either party to perform due to causes beyond the control and without the fault or negligence of the party is deemed excusable during the period in which the cause of the failure persists. Such causes may include, but not be limited to, acts of God or the public

enemy, acts of the Government in either sovereign or contractual capacity, fires, floods, epidemics, strikes, freight embargoes and unusually severe weather. If the failure to perform is caused by the default of a subcontractor, and such default arises out of causes beyond the control of both the Supplier and subcontractor, and without the fault or negligence of either of them, the Supplier will not be liable for any excess cost for failure to perform, unless the supplies or services to be furnished by the subcontractor were obtainable from other sources in sufficient time to permit the Supplier to meet the required delivery releases. When Supplier becomes aware of any potential force majeure condition as described in this Agreement, Supplier shall immediately notify Buyer of the condition and provide relevant details.

24. Changes

Buyer may at anytime, by a written order and without notice to sureties or assignees, suspend performance hereunder, increase or decrease the Agreement quantities, or make changes within the general scope of this Agreement in any one or more of the following:

- (a) applicable drawings, designs, or specification;
- (b) method of shipment or packing, and/or;
- (c) place and date of delivery;
- (d) place and date of inspection or acceptance.

If any such change causes an increase or decrease in the cost of or time required for performance of the Agreement, an equitable adjustment shall be made in the Agreement price or delivery schedule, or both, and the Agreement shall be modified in writing accordingly. No claim by Supplier for adjustment hereunder shall be valid unless asserted within thirty (30) days from the date of receipt by Supplier of the notification of change, provided, however, that such period may be extended upon the written approval of Buyer. However, nothing in this clause shall excuse Supplier from proceeding with the Agreement as changed or amended.

25. Termination for Default

- (a) Buyer may, by notice, terminate this Agreement in whole or in part (i) if Supplier fails to deliver goods or services on agreed delivery schedules or any installments thereof strictly within the time specified; (ii) if Supplier fails to replace or correct defective goods or services; (iii) if Supplier fails to comply strictly with any provision of, or repudiates this agreement, or (iv) Supplier defaults under, or any event or condition stated to be a default occurs under, any provision of the Agreement, including these Applied Materials Standard Terms and Conditions of Purchase.
- (b) In the event of termination pursuant to this Section:
 - (i) Supplier shall continue to supply any portion of the Items contracted for under this Agreement that are not terminated;
 - (ii) Supplier shall be liable for additional costs, if any, for the purchase of such similar goods and services to cover such default;
 - (iii) At Buyer's request Supplier will transfer title and deliver to Buyer (1) any completed goods, (2) any partially completed goods and (3) all unique

materials. Prices for partially completed goods and unique materials so accepted shall be negotiated. However, such prices shall not exceed the Agreement price per item.

- (c) Buyer's rights and remedies herein or otherwise stated in this Agreement, any Purchase Order, Comprehensive Supplier Agreement or Basic Supplier Agreement are in addition to and shall not limit or preclude resort to any other rights and remedies provided by law or in equity. Termination under this Agreement shall constitute "cancellation" under the Uniform Commercial Code.

26. Termination for convenience

- (a) Buyer may terminate, for convenience, work under this Agreement in whole or in part, at any time by written or electronic notice. Upon any such termination Supplier shall, to the extent and at the time specified by Buyer, stop all work on this Agreement, place no further orders hereunder, terminate work outstanding hereunder, assign to Buyer all Supplier's interests under terminated subcontracts and Agreements, settle all claims thereunder after obtaining Buyer's approval, protect all property in which Buyer has or may acquire an interest, and transfer title and make delivery to Buyer of all Items, materials, work in process, or other things held or acquired by Supplier in connection with the terminated portion of this Agreement. Supplier shall proceed promptly to comply with Buyer's directions respecting each of the foregoing without awaiting settlement or payment of its termination claim.
- (b) Within six (6) months from such termination, Supplier may submit to Buyer its written claim for termination charges, in the form and with supporting data and detail prescribed by Buyer. Failure to submit such claim within the prescribed time frame and with such items shall constitute a waiver of all claims and a release of all Buyer's liability arising out of such termination.
- (c) The parties may agree upon the amount to be paid Supplier for such termination. If they fail to agree, Buyer shall pay Supplier the amount due for Items delivered prior to termination and in addition thereto but without duplication, shall pay the following amounts:
- (i) The contract price for all Items completed in accordance with this Agreement and not previously paid for;
- (ii) The actual costs for work in process incurred by Supplier which are properly allocable or apportionable under Generally Accepted Accounting Principles (GAAP) to the terminated portion of this Agreement and a sum constituting a fair and reasonable profit on such costs. The Supplier agrees to keep true, complete, and accurate records in compliance with GAAP for the purpose of determining allocability of Suppliers costs under this agreement. Such records shall contain sufficient detail to permit a determination of the accuracy of the costs; Independent nationally recognized accountants (the "Auditor") designated by Buyer and reasonably acceptable to Supplier shall have the right, at Buyer's expense and upon reasonable notice, to conduct audits of all of the relevant books and records of Supplier in order to determine the accuracy and allocability of costs submitted by Supplier to Buyer under this provision.

- (iii) The reasonable costs of Supplier in making settlement hereunder and in protecting Items to which Buyer has or may acquire an interest.
- (d) Payments made under subparagraphs (c)(i) and (c)(ii) shall not exceed the aggregate price specified in this Agreement, less payment otherwise made or to be made. Buyer shall have no obligation to pay for Items lost, damaged, stolen or destroyed prior to delivery to Buyer.
- (e) The foregoing paragraphs (a) to (d) inclusive, shall be applicable only to a termination for Buyer's convenience and shall not affect or impair any right of Buyer to terminate this Agreement for Supplier's default in the performance hereof.

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

ATTACHMENT 1A
FIXED PRICING

PART NO -----	PART DESCRIPTION -----	UNIT PRICE -----
0010-00744	HE PRESSURE CONTROL (20SCCM) ASSY	\$ [**]
0010-13150	ASSY, IHC CAMBER D \$ SHC (20SCCM)	\$ [**]
0010-13152	ASSY, IHC CHAMBERD D & SHC (50 SCCM)	\$ [**]
0010-35404	IHC ASSY, 5200 MCVD CENTURA	\$ [**]
0010-35650	ASSY, INDEPENDENT HELIUM CONTROL	\$ [**]
0010-40240	IHC ASSY, 5300 W/RSTR	\$ [**]
0010-76952	ASSY, IHC CHAMBER A, B, AND C, (50 SCCM)	\$ [**]
0190-18037	ASSEMBLY, DUAL IHC	\$ [**]
0224-01921	XDCR, MKS, 0-100 PSI 1/4FVCR 12-32VDC 15P-D 5RA	\$ [**]
0224-42759	XDUCER, PRESSUER -MKS 850 5RA G223	\$ [**]
0225-10104	1 TORR VCR MONOMETER	\$ [**]
0225-10105	100 TR VCR MONOMETER	\$ [**]
0225-33295	XDCR, PRESS 0-10TORR, 1/2 VCR	\$ [**]
0226-09052	45D BARATRON W/VCR FTG, 10 TORR 10948-1	\$ [**]
0226-10754	EXDCR PRESSURE 0-10TORR, 1/2 VCR 0222-	\$ [**]
0226-40111	TRANSDUCER, THRU TUBE, MKS TYPE 852, F-F, BENDIX	\$ [**]
0226-41024	CABLE METER XDCR 0-100PSI 15PIN-D 27IN.L	\$ [**]
0226-41187	XDCR PRESS 0-100 PSIG 1/4 VCR F/F 13-32VDC 10RA	\$ [**]
0226-41188	METER XDCR 3-1/2 LCD 0-100 PSIG 13-32VDC 15 PIN-D	\$ [**]
05-88029-00	CABLE SHLD W/RT ANG CON	\$ [**]

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ATTACHMENT 1A
FIXED PRICING

PART NO -----	PART DESCRIPTION -----	UNIT PRICE -----
0620-01022	CABLE ASSY 12 COND 22AWG SHIELDED MUTLI-COLOR	\$ [**]
0620-02563	CABLE ASSY SENSOR HEAD - BARATRON	\$ [**]
0690-01954	BRKT SENSOR HEAD MTG	\$ [**]
1040-01092	METER XDCR 3-1/2LCD 0-60PSI 12-32VDC 15PIN-D	\$ [**]
1350-01005	XDCR PRESS 1TORR 8VCO-F +/-15VDC @ 250MA 45C	\$ [**]
1350-01011	XDCR PRESS 0-10 TORR VCO D CONNECTOR	\$ [**]
1350-01016	XDCR PRESS 10TORR 8VCO-F +/-15VDC @ 250 MA 45C	\$ [**]
1350-01019	XDCR PRESS 0-10TORR 8 VCR WIRE STRIP CONN SP	\$ [**]
1350-01021	XDCR PRESS 100MTORR 8VCR-F +/-15VDC @ 250MA 45C	\$ [**]
1350-01025	XDCR PRESS 100TORR 8VCR-F +/-14VDC @ 250MA 45C	\$ [**]
1350-01035	XDCR PRESS 0-100 TORR VCR D CONN	\$ [**]
1350-01036	XDCR PRESS 0-1 TORR VCR D CONNECTOR	\$ [**]
1350-01045	XDCR PRESS 10TORR 8VCR-F +/-15VDC @ 250MA 45C	\$ [**]
1350-01051	XDCR PRESS BARATRON, HEATED 10 TORR	\$ [**]
1350-01052	XDCR PRESS BARATRON, HEATED 100 TORR	\$ [**]
1350-01055	XDCR PRESS 10 TORR CAJON 8 VCR FEMALE FTG .12%	\$ [**]
1350-01072	XDCR PRESS 1000TORR 8VCR-F +/-15VDC @ 250MA 45C	\$ [**]

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ATTACHMENT 1A
FIXED PRICING

PART NO -----	PART DESCRIPTION -----	UNIT PRICE -----
1350-01075	XDCR PRESS 0-100TORR SHRT 8FVCR TERM-STRIP +/-15V	\$ [**]
1350-01078	XDCR PRESS 0-250PSIA 1/4VCR-M/M 0-10VDC 6'PIGTAIL	\$ [**]
1350-01079	XDCR PRESS 2TORR 8VCR-F +/-15VDC @ 250MA 45DED-C	\$ [**]
1350-01083	XDCRPRESS 0-60PSIA 1/4VCR-M 12-32VDC 50DEGC 10RA	\$ [**]
1350-01086	XDCR PRESS 0-1000TORR 1/4VCR-M 12-32VDC 50C 10RA	\$ [**]
1350-01089	XDCR PRESS 100MTORR 1/8FVCR .25%ACC 100C 15-PDSUB	\$ [**]
1350-01092	XDCR PRESS 1TORR 1/2FVCR .12%ACC 45DEG-C 15P-DSUB	\$ [**]
1350-01098	XDCR PRESS 1TOR 1/2FVCR .25%ACC 100C 150-DSUB	\$ [**]
1350-01101	XDCR PRESS 2-100TORR 1/2VCR-F .5%ACC +/-15VDC	\$ [**]
1350-01102	XDCR PRESS 10TORR 8FVCR DCONN +/-15VDC@35MA .93"L	\$ [**]
1350-01121	XDCR PRESS 0-20TORR 45C 15VDC 15P D-CONN 1/2"VCO	\$ [**]
1350-01143	XDCR PRESS 1TORR RF FLTR 8FVCR +/-15VDC@250MA 45C	\$ [**]
1400-01217	SNSR HEAD 1 TORR 1/4VCR W/ THERMAL BLANKER	\$ [**]
3030-01050	MFC 1159 50SCCM HE 1/4VCR VITON N/C 15P-DSUB SST	\$ [**]

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ATTACHMENT 1A

FIXED PRICING

PART NO -----	PART DESCRIPTION -----	UNIT PRICE -----
3030-01172	MFC 1159 20SCCM HE 1/4VCR VITON N/C 9P-DSUB SST	\$ [**]
3870-01463	VALVE EXHAUST THROTTLE 1 3/8IDXKF40 W/KEMREZ ORING	\$ [**]
3870-02311	VALVE BUTTERFLY THROTTLE W/KF 40 FLANGE	\$ [**]

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ATTACHMENT 1A
AUSTIN BUSROUTE

PARTNO -----	PARTDESC -----	UNITPRICE -----
0010-00744	HE PRESSURE CONTROL (20SCCM) ASSY	\$ [**]
0010-13150	ASSY, IHC CHAMBER D \$ SHC (20SCCM)	\$ [**]
0010-13152	ASSY, IHC CHAMBER D & SHC (50SCCM)	\$ [**]
0010-35404	IHC ASSY, 5200 MCVD CENTURA	\$ [**]
0010-35650	ASSY, INDEPENDENT HELIUM CONTROL	\$ [**]
0010-37643	ASSY, INDEPENDENT HELIUM CONTROL, DPS WOUT/FILTER	\$ [**]
0010-40240	ICH ASSY, 5300 W/RSTR	\$ [**]
0010-76952	ASSY, IHC CHAMBER A, B, AND C, (50 SCCM)	\$ [**]
0190-18037	ASSEMBLY, DUAL IHC	\$ [**]
0620-02211	CABLE ASSY TRANSDUCER 27" LG 15P-D CONN	\$ [**]
1040-01093	METER XDCR 3.1/2 LCD 0-100 PSI 13032VDC 15PIN-D	\$ [**]
1350-01012	XDCR PRESS 0-100 TORR VCO D CONNECTION	\$ [**]
1350-01025	XDCR PRESS 100TORR 8VCR-F +/-15VDC @ 250MA 45C	\$ [**]
1350-01026	XDCR PRESS 1TORR 8VCR-F +/-15VDC @ 250MA 45C	\$ [**]
1350-01027	XDCR PRESS 0-1000 TORR W/FEM #8 VCO D CONN	\$ [**]
1350-01028	XDCR PRESS 2-1000 TORR CAJON 8 VCR FEM FTG	\$ [**]
1350-01039	XDCR 0-10 TORR CAP MANO 1/2 VCR D-CONN	\$ [**]
1350-01045	XDCR PRESS 10TORR 8VCR-F +/-15VDC @ 250MA 45C	\$ [**]
1350-01067	XDCR PRESS 100MTORR 45C 15VDC 8VCR FEM FTG VERTCL	\$ [**]

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Securities and Exchange Commission. Asterisks denote omissions.

ATTACHMENT 1A
AUSTIN BUSROUTE

PARTNO -----	PARTDESC -----	UNITPRICE -----
1350-01091	XDCR PRESS 100TORR 1/2FVCR .12%ACC 45C 15P-DSUB	\$ [**]
1350-01110	XDCR PRESSURE 100TORR 1/2FVCR 15P-DSUB W/OVERPRES	\$ [**]
1350-01121	XDCR PRESS 0-20TORR 45C 15VDC 15P D-CONN 1/2" VCO	\$ [**]
1350-01124	XDCR PRESS SPEC CALIBRTN 10/100MTORR 1/8FVCR 1%AC	\$ [**]
1350-01133	XDCR PRESS 0-100PSI 1/4VCR F/F 15P D 13-32VDC 10RA	\$ [**]
1350-01138	XDCR PRESS 0-10TORR 1/2VCR FEMALE 2SET POINTS	\$ [**]
1350-01141	XDCR PRESS 0-100TORR 0-10VDC OUT 1/4VCR 1% 9PD	\$ [**]
1350-01143	XDCR PRESS 1TORR RF FLTR 8FVCR +/-15VDC@250MA 45C	\$ [**]
1350-01212	XDCR PRESS 1TORR 1/2FVCR .12%ACC 45C HORIZ 15P-D	\$ [**]
3030-01113	MFC1159 50SCCM HE 1/4VCR VITON N/C 15P-DSUB SST	\$ [**]
3030-02284	MFC 1159 2SLM AR 1/4VCR VITON N/C 15P-DSUB SST	\$ [**]
3870-02373	VALVE EXH THROT 1-3/9ID X KF40 W/CHMRZ ORING 15P-D	\$ [**]
3920-01278	CNTRL PRESS 640 SER 10T 1/4VCR VITON CAJON MALE	\$ [**]

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ATTACHMENT 1A
SANTA CLARA BUSROUTE

PARTNO -----	PARTDESC -----	UNITPRICE -----
0010-37643	ASSY, INDEPENDENT HELIUM CONTROL, DPS WOUT/FILTER	\$ [**]
0620-02211	CABLE ASSY TRANSDUCER 27"LG 15P-D CONN	\$ [**]
0720-03620	CONN ADPTR 15P-D TO 9P-HEX 1FT CABLE	\$ [**]
1040-01012	METER SENSOR 0-10VDC 50/60HZMULTI-RANGE	\$ [**]
1040-01092	METER XDCR 3-1/2LCD 0-60PSI 12-32VDC 15PIN-D	\$ [**]
1040-01093	METER XDCR 3.1/2 LCD 0-100 PSI 13-32VDC 15PIN-D	\$ [**]
1270-01803	SW PRESS FLOWTHRU -25TORR GUAGE SP 1/4MVCR 9P-D	\$ [**]
1350-01012	XDCR PRESS 0-100 TORR VCO D CONNECTOR	\$ [**]
1350-01026	XDCR PRESS 1TORR 8VCR-F +/-15VDC @ 250MA 45C	\$ [**]
1350-01027	SDCR PRESS 0-1000 TORR W/FEM #8VCO D CONN	\$ [**]
1350-01028	XDCR PRESS 2-1000 TORR CAJON 8 VCR FEM FTG	\$ [**]
1350-01035	XDCR PRESS 0-100 TORR VCR D CONN	\$ [**]
1350-01039	XDCR 0-10 TORR CAP MANO 1/2 VCR D-CONNN	\$ [**]
1350-01054	XDCR PRESS 1000MMHG 1/8FVCR .12%ACC 45C W/SET-PT	\$ [**]
1350-01055	XDCR PRESS 10 TORR CAJON 8 VCR FEMALE FTG .12%	\$ [**]
1350-01067	XDCR PRESS 100MTORR 45C 15VDC 8VCR FEM FTG VERTCL	\$ [**]
1350-01068	XDCR PRESS 1--,TPRR 45C 15VDC 9VCR FE, FTG HORIZT	\$ [**]

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ATTACHMENT 1A
SANTA CLARA BUSROUTE

PARTNO -----	PARTDESC -----	UNITPRICE -----
1350-01090	XDCR PRESS 10TORR 1/8FVCR .25%ACC 100C 15P-DSUB	\$ [**]
1350-01093	XDCR PRESS 1000TORR 1/4FVCR +/-12-32V 0-10VDC 9PD	\$ [**]
1350-01096	XDCR PRESS 10TORR 1/4VCR-F +/-14VDC 15P-D SET-PT	\$ [**]
1350-01097	XDCR PRESS 10-100TORR 1/4VCR-F +/-15VDC 15P-D	\$ [**]
1350-01103	XDCR PRESS 0-60PSIA 1/4VCR-F/F 15D 12-32VDC 10RA	\$ [**]
1350-01124	XDCR PRESS SPEC CALIBRTN 10/100MTORR 1/8FVCR 1%AC	\$ [**]
1350-01131	XDCRPRESS 1000 TORR 1/4VCR 1% 9PIN DSUB	\$ [**]
1350-01133	XDCR PRESS 0-100PSI 1/4VCR F/F 15P D 13032VDC 10RA	\$ [**]
1350-0113893	XDCR PRESS 0-10TORR 1/2VCR FEMALE 2SET POINTS	\$ [**]
1350-01140	XDCR PRESS 10TORR 8VCR-F +/-15VDC @ 35MA 50C	\$ [**]
1350-01163	XDCR PRESS 10-100 TORR 1/4VCR-F +/-15VDC	\$ [**]
3030-01113	MFC1159 50SCCM HE 1/4VCR VITON N/C 15P-DSUB SST	\$ [**]
3030-01172	MFC 1159 20SCCM HE 1/4VCR VITON N/C 9P-DSUB SST	\$ [**]
3870-01470	VALVE THROTTLE TVC 100MM SMART NW50 W/CNTRL HITEMP	\$ [**]
3870-01512	VALVE THROTTLE TVC 50MM SMART NW50 W/CNTRL HI-TEMP	\$ [**]

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ATTACHMENT 1A
SANTA CLARA BUSROUTE

PARTNO -----	PARTDESC -----	UNITPRICE -----
3870-01817	VALVE EXH THRTL NW160 8.9PDX5.879ID 2CTR-BORE-HOL	\$ [**]
3920-01278	CNTRL PRESS 640 SER 107 1/4VCR VITON CAJON MALE	\$ [**]

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ATTACHMENT 1B

SERVICE AND REPAIR

AMAT PARTNO	ITEM DESCRIPTION	MKS PARTNO	CAL PRICE	REBUILD PRICE
010-00744	HE PRESSURE CONTROL (20SCCM) ASSY	121002-G1	[**]	[**]
010-13150	ASSY, IHC CHAMBER D \$ SHC (20SCCM)	121002-G2	[**]	[**]
01110-13152	ASSY, IHC CHAMBER D & SHC (50 SCCM)	1210-02-G4	[**]	[**]
010-35404	IHC ASSY, 5200 MCVD CENTURA	202407	[**]	[**]
010-35650	ASSY, INDEPENDENT HELIUM CONTROL	202258	[**]	[**]
010-37643	ASSY, INDEPENDENT HELIUM CONTROL, DPS WOUT/FILTER	120657-G2	[**]	[**]
010-40240	IHC ASSY, 5300 W/RSTR	190094-G1	[**]	[**]
010-76952	ASSY, IHC CHAMBER A, B, AND C 50 SCCM)	121002-G3	[**]	[**]
190-18037	ASSEMBLY, DUAL IHC	202406	[**]	[**]
224-01921	XDCR, MKS, 0-100 PSI 1/4FVCR 12-32VDC 15P-5RA	852B-13384	[**]	[**]
224-42759	XDUCER, PRESSURE -MKS 850 5RA G223	850A-12951	[**]	[**]
225-10104	1 TORR VCR MONOMETER	127A-00001B	[**]	[**]
225-10105	100 TR VCR MONOMETER	127A-00100B	[**]	[**]
225-33295	XDCR, PRESS 0-10TO44,1/2VCR	122BA-00010BB	[**]	[**]
226-09052	45D BARATRON W/VCR FTG, 10 TORR 10948-1	127BA-00010BB	[**]	[**]
226-10754	EXDCR PRESSURE 0-10TORR, 1/2VC 0222-	127A-11356	[**]	[**]
226-40111	TRANSDUCER, THRU TUBE, MKS TYPE 852, F-F, BENDIX	852B61PCJ4GH	[**]	[**]
226-41024	CABLE METER XDCR 0-100PSI 15PIN-D27IN.L	CB852-5-2.5	[**]	[**]

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

226-41187	XDCR PRESS 0-100 PSIG 1/4 VCR F/F 13-32VDC 10RA	842B12PCJ2GC	[**]	[**]
226-41188	METER XDCR 3-1/2 LCD 0-100 PSIG 13-32VDC 15 PIN-D	LDM-A12PB2CC1	[**]	[**]
6-88029-00	CABLE SHLD W/RT ANG CON	CB036-11075	[**]	[**]
620-01022	CABLE ASSY 12 COND 22AWG SHIELDED MULTI-COLOR	CB036-11016	[**]	[**]
620-02211	CABLE ASSY TRANSDUCER 27"LG 15P-D CONN	CB852-5-2.5	[**]	[**]
620-02563	CABLE ASSY SENSOR HEAD - BARATRON	CB036-11016	[**]	[**]
690-01954	BRKT SENSOR HEAD MTG		[**]	[**]
720-03620	CONN ADPTR 15P-D TO 9P-HEX 1FT CABLE	CB6551-31-1	[**]	[**]
040-01012	METER SENSOR 0-10VDC 50/60HZMULTI-RANGE	170M-6C	[**]	[**]
040-01092	METER XDCR 3-1/2CD 0-60PSI 12-32VDC 15PIN-D	LDM-A61PA2CC1	[**]	[**]
040-01093	METER XDCR 3.1/2 LCD 0-100 PSI 13-32VDC 15PIN-D	LDM-A12PA2CC1	[**]	[**]
270-01803	SW PRESS FLOWTHRU -25 TORR GAUGE SP 1/4MVCR 9P-D	42A13DCH2AA025	[**]	[**]
350-01005	XDCR PRESS 1TORR 8VCO-F +/-15VDC @ 250MA 45C	127A-00001E	[**]	[**]
350-01011	XDCR PRESS 0-10 TORR VCO D CONNECTOR	122BA-00010EB	[**]	[**]
350-01012	XDCR PRESS 0-100 TORR VCO D CONNECTOR	122BA-0010EB	[**]	[**]
350-01016	XDCR PRESS 10TORR 8VCO-F +/-15VDC @ 250MA 45C	127AA-00010E	[**]	[**]
350-01019	XDCR PRESS 0-10 TORR 8 VCR WIRE STRIP CONN SP	122A-116063	[**]	[**]
350-01021	XDCR PRESS 100MTORR 8VCR-F +/-15VDC @ 250MA 45C	127AA-000.1B	[**]	[**]
350-01025	XDCR PRESS 100TORR 8VCR-F +/-15VDC @ 250MA 45C	127A-00100B	[**]	[**]

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

350-01026	XDCR PRESS 1TORR 8VCR-F +/- 15VDC @ 250MA 45C	127A-00001B	[**]	[**]
350-01027	XDCR PRESS 0-1000 TORR W/FEM #8 VCO D CONN	122BA-0100EB	[**]	[**]
350-01028	XDCR PRESS 2-1000 TORR CAJON 8 VCR FEM FTG	124AA010000BB	[**]	[**]
350-01035	XDCR PRESS 0-100 TORR VCR D CONN	122BA-00100BB	[**]	[**]
350-01036	XDCR PRESS 0-1 TORR VCR D CONNECTOR	122BA-00001BB	[**]	[**]
350-01039	XDCR 0-10 TORR CAP MANO1/2VCR D-CONN	122B-11411	[**]	[**]
350-01045	XDCR PRESS 10TORR 8VCR-F +/-15 VDC @ 250MA 45C	127A-00010B	[**]	[**]
350-01051	XDCR PRESS BARATRON, HEATED 10 TORR	621C11TBFHC	[**]	[**]
350-01052	XDCR PRESS BARATRON, HEATED 1000 TORR	621C13TBFH	[**]	[**]
350-01054	XDCR PRESS 1000MMHG 1/8FVCR.12%ACC 45C W/SET-PT	624A13TBC	[**]	[**]
350-01055	XDCR 10 TORR CAJON 8 VCR FEMALE FTC.12%	627A11TBC	[**]	[**]
350-01067	XDCR PRESS 100MTORR 45C 15VDC 8VCR FEM FTG VERTCL	627A.1TBD	[**]	[**]
350-01068	XDCR PRESS 100MTORR 45C 15VDC 8VCR FEM FTG HORIZT	627A-11985	[**]	[**]
350-01072	XDCR PRESS 1000TORR 8VCR-F +/-15VDC @ 250MA 45C	127AA-0100B	[**]	[**]
350-01075	XDCR PRESS 0-100TORR SHRT 8FVCR TERM-STRIP +/-15V	122A-11064	[**]	[**]
350-01078	XDCR PRESS 0-250PSIA 1/4VCR-M/M 0-10VDC 6"PIGTAIL		[**]	[**]
350-01079	XDCR PRESS 2TORR 8VCR-F +/-15VDC @ 250MA 45DED-C	127AA-00002B	[**]	[**]
350-01083	XDCR PRESS 0-60PSIA 1/4VCR-M 12-32VDC 50DECG 10RA	852B61PCA2NC	[**]	[**]
350-01086	XDCR PRESS 0-1000TORR 1/4 VCR-M12-32VDC 50C 10RA	852BA13TCA2NC	[**]	[**]

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10/23/98

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350-01089	XDCR PRESS 100MTORR 1/8FVCR .25%ACC 100C 15P-DSUB	628A.1TBE	[**]	[**]
350-01090	XDCR PRESS 10TORR 1/8FVCR .25%ACC 100C 15P-DSUB	628A12TBC	[**]	[**]
350-01091	XDCR PRESS 100TORR 1/2FVCR .12%ACC 45C 15P-DSUB	627A12TBC	[**]	[**]
350-01092	XDCR PRESS 1TORR 1/2FVCR .12%ACC 45DEG-C 15P-DSUB	627A01TBC	[**]	[**]
350-01093	XDCR PRESS 1000TORR 1/4FVCR +/-12-32V 0-10VDC 9PD	751A-12772	[**]	[**]
350-01096	XDCR PRESS 10TORR 1/4VCR-F +/-15VDC 15P-D SET-PT	R750B11TCD2GC	[**]	[**]
350-01097	XDCR PRESS 10-100TORR 1/RVCR-F +/-15VDC 15P-D	CV7527A-01	[**]	[**]
350-01098	XDCR PRESS 1TOR 1/2FVCR .25%ACC 100C 15P-DSUB	628A01TBE	[**]	[**]
350-01101	XDCR PRESS 2-100TORR 1/2VCR-F .5%ACC +/-15VDC	124AA-00100BB	[**]	[**]
350-01102	XDCR PRESS 10TORR 8FVCR DCONN +/-15VDC@35MA .93"L	122B-12773	[**]	[**]
350-01103	XDCR PRESS 0-60PSIA 1/4VCR-F/F 15D 12-32VDC 15RA	852B61PCJ2GC	[**]	[**]
350-01110	XDCR PRESSURE 100TORR 1/2FVCR 15P-DSUB W/OVERPRE	624A-13092	[**]	[**]
350-01121	XDCR PRESS 0-20TORR 45C 15VDC 15P D-CONN 1/2"VCO	627A-13267	[**]	[**]
350-01124	XDCR PRESS SPEC CALIBRTN 10/100MTORR 1/8FVCR 1%AC	628A-13114	[**]	[**]
350-01131	XDCRPRESS 1000 TORR 1/4VCR 1% SPIN DSUB	750B13TCD2GA	[**]	[**]
350-01133	XDCR PRESS 0-100PSI 1/4VCR F/F 15P D 13-32VDC 10RA	852B12TCJ2GC	[**]	[**]
350-01138	XDCR PRESS 0-10TORR 1/2VCR FEMALE 2SET POINTS	625A-13127	[**]	[**]
350-01140	XDCR PRESS 10TORR 8VCR-F +/-15VDC @ 35MA 50C	626A11TBE	[**]	[**]

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350-01141	XDCR PRESS 0-100TORR 0-10VDC OUT 1/4VCR 1% 9PD	750B12TCD2GA	[**]	[**]
350-01143	XDCR PRESS 1TORR RF FLTR 8FVCR +/-15VDC@250MA 45C	127A-13608	[**]	[**]
350-01163	XDCR PRESS 10-100 TORR 1/4VCR-F +/-15VDC	CV7627A-05	[**]	[**]
350-01212	XDCR PRESS 1TORR 1/2FVCR .125ACC 45C HORIZ 15P-D	627A-14974	[**]	[**]
400-01217	SNSR HEAD 1 TORR 1/4VCR W/THERMAL BLANKER		[**]	[**]
3030-01050	MFC 1159 50SCMM HE 1/4VCR VITON N/C 15P-DSUB SST	1159B-00059SV-S	[**]	[**]
3030-01113	MFC1159 50SCCM HE 1/4VCR VITON N/C 15[-DSUB SST	1159B-00050RV-sp	[**]	[**]
3030-01172	MFC 1159 20SCCM HE 1/4VCR VITON N/C 9[-DSUB SST	1159B-00020RV-S	[**]	[**]
3030-02284	MFC 1159 2SLM AR 1/4VCR VITON N/C 15P-DSUB SST	1159B-02000RV-S	[**]	[**]
3870-01463	VALVE EXHAUST THROTTLE 1 3/8DXKF40 W/KEMREZ ORING	253B-11203	[**]	[**]
3870-01470	VALVE THROTTLE TVC 100MM SMART NW50 W/CINTRL HITEM	153C-1-100-2	[**]	[**]
3870-01512	VALVE THROTTLE TVC 50MM SMART NW50 W/CNTRL HI-TEM	153C-2-50--2	[**]	[**]
3870-01817	VALVE EXH THRTL NW160 8.9ODX5.87691D 2CTR-BORE-HOL	653B-13071	[**]	[**]
3870-02311	VALVE BUTTERFLY THROTTLE W/KF 40 FLANGE	253B-02311	[**]	[**]
3870-02373	VALVE EXH THROT 1-3/81D X KF40 W/CHMRZ ORIGN 15P-D	253B-11203	[**]	[**]
3920-01278	CNTRL PRESS 640 SER 10T 1/4VCR VITON CAJON MALE	640A12TW1V12-S	[**]	[**]

ATTACHMENT 2

APPLIED MATERIALS, Inc.

CORPORATE FISCAL CALENDAR 1998

	M	T	W	T	F	S	S		M	T	W	T	F	S	S	
WK	1ST QUARTER								3RD QUARTER							WK
	NOVEMBER								MAY							
1	27	28	29	30	31	1	2	27	28	29	30	1	2	3	27	
2	3	4	5	6	7	8	9	4	5	6	7	8	9	10	28	
3	10	11	12	13	14	15	16	11	12	13	14	15	16	17	29	
4	17	18	19	20	21	22	23	18	19	20	21	22	23	24	30	
5	24	25	26	[27]	[28]	29	30									
	DECEMBER								JUNE							
6	1	2	3	4	5	6	7	[25]	26	27	28	29	30	31	31	
7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	32	
8	15	16	17	18	19	20	21	8	9	10	11	12	13	14	33	
9	22	23	24	[25]	/26/	27	28	15	16	17	18	19	20	21	34	
	JANUARY								JULY							
10	/29/	/30/	/31/	[1]	/2/	3	4	22	23	24	25	26	27	28	35	
11	5	6	7	8	9	10	11	29	30	1	2	[3]	4	5	36	
12	12	13	14	15	16	17	18	6	7	8	9	10	11	12	37	
13	19	20	21	22	23	24	25	13	14	15	16	17	18	19	38	
	2ND QUARTER								4TH QUARTER							
	FEBRUARY								AUGUST							
14	26	27	28	29	30	31	1	27	28	29	30	31	1	2	40	
15	2	3	4	5	6	7	8	3	4	5	6	7	8	9	41	
16	9	10	11	12	13	14	15	10	11	12	13	14	15	16	42	
17	[16]	17	18	19	20	21	22	17	18	19	20	21	22	23	43	
	MARCH								SEPTEMBER							
18	23	24	25	26	27	28	1	24	25	26	27	28	29	30	44	
19	2	3	4	5	6	7	8	31	1	2	3	4	5	6	45	
20	9	10	11	12	13	14	15	[7]	8	9	10	11	12	13	46	
21	16	17	18	19	20	21	22	14	15	16	17	18	19	20	47	
	APRIL								OCTOBER							
22	23	24	25	26	27	28	29	21	22	23	24	25	26	27	48	
23	30	31	1	2	3	4	5	28	29	30	1	2	3	4	49	
24	6	7	8	9	10	11	12	5	6	7	8	9	10	11	50	
25	13	14	15	16	17	18	19	12	13	14	15	16	17	18	51	
26	20	21	22	23	24	25	26	19	20	21	22	23	24	25	52	

[] = HOLIDAYS
(US ONLY)

/ / = SHUTDOWN
(US ONLY)

| | = HOLIDAYS
(AMJ ONLY)

APPLIED MATERIALS CONFIDENTIAL

ATTACHMENT 3

DELIVERY MECHANICS

TYPE 1 PURCHASE ORDER (P.O) RELEASE

Releases against this Agreement will be made by issuing purchase orders. Delivery dates shall refer to dates of receipt at Buyer's facility. Seller will not deliver items more than five (5) calendar days in advance of Buyer's required delivery dates without prior approval.

TYPE 5 JUST-IN-TIME/BUS ROUTE MECHANICS

- A. This Agreement authorizes Seller to create and maintain inventory, subject to the terms of this Agreement, for the Bus Route Program in accordance to and subject to Article 5 of the Master Purchase Order and Sales Agreement. Items to be included in the Bus Route Program are found in Attachment 1 of the Master Purchase Order and Sales Agreement.
- B. Buyer will notify Seller of requirements via facsimile or EDI transmission. (Requirements may be released twice a day, seven days week, no later than 6:00 a.m. and 3:00 p.m.).
- C. Seller will attach all "pick cards" to the requested material prior to shipment for easy identification by Buyer.
- D. Seller shall have all items ready for pick up by Buyer's truck within three hours of receipt of requirements. Or. Seller can deliver parts to Buyer by 9:00 a.m. for morning requirements and 6:00 p.m. for afternoon requirements.
- E. If the "pick card" requirement cannot be filled, Seller shall return to Buyer the pick card indicating a back order.
- F. For back ordered items Seller will receive a new "pick card" the following day which will have "Back Order" written on it. The Seller should attach the material to this "pick card" with a red dot which identifies the item as a filled back order to the Buyer.
- G. Seller will be paid based on Buyer's CMR Transaction Summary, and in accordance with the following, depending on Buyer's Bus Route location:
- For Austin, Texas Bus Route:
- THE END DATE OF EACH TRANSACTION WEEK WILL BE USED AS THE INVOICE NUMBER FOR PAYMENT OF AUSTIN BUS ROUTE INVOICES, I.E. FRIDAY, APRIL 1, 1995 WOULD BE INVOICE #040195A.
- For Santa Clara, California Bus Route:
- THE PRINT DATE OF THE CMR TRANSACTION SUMMARY DOCUMENT WILL BE USED AS THE INVOICE NUMBER FOR PAYMENT OF SANTA CLARA BUS ROUTE INVOICES, I.E. FRIDAY, APRIL 1, 1995 WOULD BE INVOICE #040195A.
- H. Seller will maintain records of all Items shipped to Buyer to verify against Buyer's weekly accumulated usage report which will be faxed to Seller each Monday morning.
- I. Buyer will make changes (quantity/price) to the transaction summary of discrepancies that occur and are validated. These changes/adjustments will be reflected on the transaction summary the following week for payment.
1. If discrepancies in pricing or quantity are found, SELLER will modify the report accordingly, and fax the corrected copy to BUYER/PLANNER.
 2. If no discrepancies are found, no further action is required by SELLER, and payment will be made accordingly.
- J. Buyer shall make payment to Seller in accordance with the terms established in this agreement.

Attachment 4

CONFIDENTIAL MATERIALS OMITTED AND FILED SEPARATELY
WITH THE SECURITIES AND EXCHANGE COMMISSION

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Attachment 5

Title: Spot Buy Receiving Label Specification Rev.: B Page 1 of 43
Part No. 0250-00098 Date: 4/30/97

APPLIED MATERIALS

Packaging Specification

Revision	Change ECO #	Originator/Approver	Date
F	ECO #3684	JKK	
G	ECO #A6452	L.U.	
H	ECO #A6920	L.U.	
J	ECO #24033	Z.A.	10/16/96
K	ECO #30186	B.T.	4/30/97

Information contained in this document is considered confidential and proprietary and cannot be used in any manner without the expressed written consent of Applied Materials Inc.

APPLIED MATERIALS
3050 Bowers Ave., Santa Clara, CA 95054

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DEFINITIONS & ACRONYMS

AMAT	Applied Materials, Inc.
AMINE-FREE	In reference to anti-static materials, amine-free means those materials that do not contain ethoxylated fatty amines, and most likely contain ethoxylated fatty amides. Amine-free materials do not cause crazing (cracking) damage to polycarbonate based products.
ANTI-STATIC	The general term used to describe materials that minimize charge buildup when rubbed against or separated from themselves or other similar materials.
ASTM	American Society for Testing and Materials
CONDUCTIVE	Materials that have a surface resistivity [**].
CRITICAL SURFACE PART	Parts that have a finish that is functional (e.g. process parts, reflective surfaces, valves, seals, etc.) or cosmetic (i.e. AMAT Cosmetic Specification 0250-01019, greater than Class III-C) in nature and may be damaged by abrasion and shock impacts.
ELECTROSTATIC DISCHARGE (ESD)	A transfer of electrostatic charge between bodies at different electrostatic potentials caused by direct contact or induced by an electrostatic field.
ELECTROSTATIC DISCHARGE SENSITIVE	Device whose physical or electrical characteristics are altered as a result of an electrostatic discharge through or across the surface of the part.
ELECTROSTATIC SHIELDING	Materials that have surface resistivities [**].

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ESD	Electrostatic Discharge
ESDS	Electrostatic Discharge Sensitive
FARADAY CAGE	An enclosure made of anti-static and conductive materials to shield ESDS items from electrostatic fields.
FIT FOR USE	Materials delivered to it's point of use ready for consumption with minimal/ no detrashing.
IBSS	Installed Base Support Services
IC	Integrated Circuit
INSULATIVE	Materials that have surface resistivities [**].
IPA	Isopropyl alcohol
ISTA	International Safe Transit Association
KANBAN	The manufacturing line replenishment size. The KRO is a multiple of this quantity.
KGS.	Kilograms
KRO	Kanban Replenishment Order, the size of order that suppliers will ship to Applied Material's re-supply area
LB.	Pound
LBS.	Pounds
LEAN MANUFACTURING	[**].
MIL.	One thousandth of an inch (.001)
OHMS PER SQUARE	Surface resistivity is expressed as ohms per square. The term is used to describe the resistance between two opposite sides of a square and is independent of the size of the square or its dimensional units.
PACKAGE	The packaging material together with the product/part
PACKAGING	The material that contains the product/part

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PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
STATIC DISSIPATIVE	Materials that have a surface resistivity [**].

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1. PREFACE

This document provides packaging specifications for all shippers of parts to and from Applied Materials including internal shipments to the IBSS spares divisions. This specification is in conformance with all local, federal, and international rules and regulations governing the packaging and safe transportation of materials.

Readers of this document who wish to submit comments, suggestions, or who have questions should contact Applied Materials; Corporate Packaging Engineering Department.

2. SCOPE

This specification provides the general and commodity specific requirements for packaging and packing materials to be used to ship parts, products, and materials to and from all Applied Materials manufacturing, warehousing, and distribution facilities.

3. STANDARD MAINTENANCE

The Corporate Packaging Engineering Department is responsible for maintaining and revising this document.

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4. APPLICABLE DOCUMENTS

The following specifications are applicable documents and may be specifically referenced within this specification.

4.1 Applied Materials Specifications

0250-09954 AMAT Workmanship Standard

0250-60124 Applied Materials Unit Package Marking and Labeling Vendor Requirements Specification

0250-70700 Lean Manufacturing Packaging Requirements

0190-75034 Applied Materials Receiving Bar Code Specification

4.2 Third Party Specifications

ASTM D 1974 Standard Practice for Methods of Closing, Sealing, and Reinforcing Fiberboard Containers

ASTM D 4169 Standard Practice for Performance Testing of Shipping Containers and Systems

ASTM D 4727 Standard Specification for Corrugated and Solid Fiberboard Sheet Stock (Container Grade) and Cut Shapes

CFR 49 PARTS 106-180 Code of Federal Regulations, Title 49, Parts 106-180

EIA-541 Electronics Industries Association, Packaging Materials Standards for ESN Sensitive Items

FED-STD-209 Federal Standard Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones

ISO 780 International Standards Organization, Packaging - Pictorial Marking for Handling of Goods

ISTA Procedure 1/1A International Safe Transit Association, Pre-Shipment Test Procedures

JSCM 5322 Johnson Space Center, Contamination Control Requirements

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MIL-B-131 Military Specification Barrier Materials, Water Vaporproof, Greaseproof, Flexible, Heat Sealable

MIL-B-26195 Military Specification Boxes, Wood-Cleated, Skidded, Load-Bearing Base

MIL-B-81705 Military Specification Barrier Materials, Flexible, Electrostatic Protective, Heat Sealable

MIL-D-3464 Military Specification Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification

MIL-P-116 Military Specification Preservation, Methods of

PPP-B-601 Federal Specification Boxes, Wood, Cleated-Plywood

PPP-B-621 Federal Specification Boxes, Wood, Nailed and Lock-Center

5. CONFORMANCE PRIORITY

The order of supercession is as follows: contracts, purchase orders, drawings, and/or specifications.

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6. CONVERSION TABLE

This section is intended to help users determine the proper method of packaging for the part/product they are shipping. Readers of this document must read all sections to ensure compliance with the entire document.

The following table is intended to assist in the identification of the appropriate packaging section.

Figure 6.1. Commodity Code Reference Table

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7. GENERAL PACKAGING REQUIREMENTS

7.1. General

This Applied Materials document does not eliminate or supersede any shipper's packaging responsibility. It is the shipper's obligation to make sure that the package and/or palletizing comply with all local, federal, and international laws and regulations. These rules and laws include transportation requirements and regulations pertaining to hazardous materials.

The following are the minimum requirements that apply to all inbound and outbound shipments to and from Applied Materials:

- 7.1.1. It is the shipper's responsibility to determine the method of packaging, consistent with these guidelines, unless otherwise specifically instructed. Special packaging requirements which conflict with this specification shall take precedence.
- 7.1.2. IT IS THE SHIPPER'S RESPONSIBILITY TO PACKAGE AND LOAD PARTS IN SUCH A MANNER AS TO ENSURE DAMAGE FREE DELIVERY OF BOTH THE CONTAINER AND ITS CONTENTS.
- 7.1.3. Previously used containers [**].
- 7.1.4. Recyclability is [**].
- 7.1.5. All items are to be packaged individually [**].
- 7.1.6. Matched sets and kits are to be packaged together.
- 7.1.7. Multiple parts that make one Applied Materials part number must be identified as one set or one unit and must be consolidated to prevent separation. (One set per container.)
- 7.1.8. All parts must be clean (free of dust, corrosion, shavings, contaminants, etc.) prior to packaging. It is essential that cleanliness levels attained during parts fabrication are not degraded by the packaging being used.

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- 7.1.9. All parts must be adequately separated to prevent entanglement with one another.
- 7.1.10. All parts must [**].
- 7.1.11. Voids should be filled as required, [**].
- 7.1.12. Packages [**].
- 7.1.13. Protect all bagged items [**].
- 7.1.14. Heavier parts, [**].
- 7.1.15. Do not [**].
- 7.1.16. Use proper labeling to mark packages such as "FRAGILE", "HANDLE WITH CARE", "THIS END UP", "DO NOT STACK", as required.
- 7.1.17. Package closure shall [**].
- 7.1.18. Ensure that no package is unsafe to the environment or personnel. (i.e., protruding staples, nails, loose banding, etc.)
- 7.1.19. The use of staples [**].
- 7.1.20. All pallets shall [**].
- 7.1.21. Overhang [**].
- 7.1.22. When the center of gravity [**].
- 7.1.23. All ground studs [**].
- 7.1.24. All packaging materials must [**].
- 7.1.25. Same parts must be [**].
- 7.1.26. All inbound and outbound shipments are [**].

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7.2. Package Performance

Package performance is critical to maintaining part integrity during the distribution cycle. Applied Materials requires that the packaging shipped to and from Applied Materials be able to withstand the normal hazards seen during the distribution environment. Applied Materials [**].

Applied Materials, Inc. has recognized ASTM D 4169, Standard Practice for Performance Testing of Shipping Containers and Systems, and ISTA Pre-Shipment Test Procedures I/1A as good methods for determining adequate product protection.

The typical testing that occurs using these test procedures includes [**].

The following describes the typical hazards that may be encountered during the distribution cycle. There are other hazards that a package may see during the distribution cycle, and these must also be accounted for. Distribution systems vary in their specific hazard elements and should be carefully studied by the shipper in order to determine the packaging necessary to deliver damage free goods to Applied Materials.

7.2.1. Vibration

Vibration is the one hazard element that will occur during every transportation phase of a distribution cycle. [**].

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7.2.2. Drops

[**].

Chart

Figure 7.1. Drop Height

The product should be [**].

7.2.3. There are two different types of compression, static compression and dynamic compression. Static comprehensive comes from warehousing and storage while dynamic compression is due to compressive forces incurred during transportation and material handling.

[**].

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7.2.4. Impacts

Impacts can be regarded as horizontal shocks. These impacts are common to the rail industry during rail care coupling and in other environments during the sorting of packages. The package should be designed to withstand impacts normally incident to the distribution environment. Special attention should be placed [**].

7.3. Handling Requirements

All shipments to and from Applied Materials, Inc. must incorporate handling devices into their packagings as outlined in the following table. The following table shows the type of handling devices that must be incorporated into the packaging based on size and weight of the packaged product. The type of handling that the devices will need to facilitate is also noted. The size calculated by adding the length, width, and depth of the packaged product ($L + W + D = \text{size}$).

Chart

*All packages weighing [**] or greater must have heavy labels, part number 0060-76154, or equivalent, located on the top of the package.

Figure 7.2. Handling Requirements

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Illustration

Figure 7.3. Heavy Label

7.4. Size & Weight Limitations

The following chart is a guidelines for determining the outer box style to be used for a specific shipment. The chart references size and weight to determine the box style required. The size is calculated by adding the length, width, and depth of the packaged product (L / W / D = size). This chart shows suggested outer container requirements. The product that is being shipped may require a stronger box to ensure that the product arrives damage free at its destination point.

Chart

Note: If the weight exceeds [**].

Figure 7.4. Size & Weight Limitations

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- 7.4.1. The following figure is a guideline for box sealing of typical regular slotted container style boxes. The box sealing that is used must perform adequately during its intended distribution cycle.

Illustration

Loads [**] or less

Loads over [**]

Figure 7.5. Regular Slotted Container Box Sealing

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7.5. Small Parts

This section describes the packaging requirements for small parts.

- 7.5.1. Small Parts that meet the commodity description and size criteria listed below must be packaged as indicated in this section. For all parts that do not fall into these categories, refer to the commodity sections in this manual for appropriate packaging requirements.
- 7.5.2. If you are currently packaging or receiving parts from your supplier packaged as 1-each, do not change current packaging practices.
- 7.5.3. All small parts listed below that are sold in "sets" must be packaged in individual sets (1-set per 1 package).
- 7.5.4. Refer to the following Charts for the part size and commodity type for proper packaging requirements. All Bags and Cartons must be properly identified with the AMAT Part Number and Quantity.

Chart

Chart

Chart

Chart

Figure 7.6. Small Parts Packaging Requirements

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7.6. Unitizing

All unitized loads must be secured pallet. The pallet must have [**].

Securement to the pallet shall be made by [**]. To help with load stability, [**] is recommended. The product shall be protected from damage [**].

[**].

Figures 7.7, 7.8, and 7.9 show proper load securement while Figure 7.10 shows inappropriate load securement. In Figure 7.10, the load should be separated into 2 separate squared off pallets or 1 squared off pallet and separately shipped boxes.

Illustration

Figure 7.7 4-Way Strapping of Load

Illustration

Figure 7.8. 2-Way Strapping Of Load

Illustration

Figure 7.9. Four-Way And Girth Strapping Of Load

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Illustration

Figure 7.10. Incorrect, Load Not Squared Off

7.7. Inter-Divisional Movements

All inter-divisional shipments between manufacturing and storage facilities in Austin, Texas and in Santa Clara, California must have the products packaging conform to the requirements of this specification except as noted in this section.

- 7.7.1. All [**]. If applicable, [**]. Use caution [**].
- 7.7.2. Verify that all documents pertaining to the shipment are attached and identified as required by appropriate departments.
- 7.7.3. All packages and subassemblies that are not on casters must not be pushed, pulled, or moved without the proper equipment (i.e. pallet jack, trolleys, carts, etc.)
- 7.7.4. All parts, products, and assemblies moving between buildings and divisions will require more than one person to handle should be placed on a skid or require the use of appropriate handling equipment. Refer to section 7.3 for handling requirements.

7.8. Labeling

All shipments to Applied Materials, excluding those to IBSS, must be labeled in accordance with 0190-75034, Applied Materials Receiving Bar Code Specification, or its successor specification, as revised from time to time. All shipments to Applied Materials IBSS division and all shipments made directly to end users at the request of Applied Materials ("Requested Direct Shipments") must be labeled in accordance with 0250-60124, Applied Materials Unit Package Marking and Labeling

Vendor Requirements Specification. To assist in the determination of labeling requirements, refer to the table to below.

Supplier shall not place any marks, telephone numbers or other information on packaging identifying supplier as the source of the items shipped. Exemptions from this requirement will be granted on a case by case basis.

Chart

Figure 7.11. Labeling Requirements

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7.9. Cleanroom Packaging

Clean packaging is required [**].

7.9.1. Cleaning

If cleaning is required, the method of cleaning will be specified on the drawing, purchase order, or contact

7.9.2. Handling

7.9.2.1. Once parts and assemblies have been cleaned, they can only be handled [**]. See 0250-70699, Cleanroom Approved Materials.

7.9.2.2. [**].

7.9.3. Packaging

7.9.3.1. Verify that all parts are completely dry before packaging.

7.9.3.2. Painted, plated or finished surfaces must be protected to prevent abrasion, nicks, scratches or dents.

7.9.3.3. Sharp protrusions must be protected from puncturing bags.

7.9.3.4. The part shall be sealed [**].

7.9.3.5. Attached a label that states "PACKAGED IN CLASS XXXX CLEANROOM" to the inner bag (replace XXXX with appropriate class level. i.e., 100, 1000, 10,000). All labeling must be placed on the inner bag. If it is not visible through the outer bag, the labeling must be placed on the outer bag also.

7.9.4. Overboxing

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When plastic corrugate boxes are specified on the contract, purchase order or drawing, the part will only be required [**].

7.9.5. Cleanroom Acceptable Materials

Reference 0250-70699, Cleanroom Approved Materials.

7.10. Electrostatic Discharge Sensitive Items

Electrostatic discharge (ESD) sensitive items have become a significant concern for most electronics companies. Related hazards include electromagnetic interference (EMI) and radio frequency interference (RFI). [**].

All items susceptible to EMI, and RFI damage will need [**].

7.11. Environmentally Sensitive Parts

This section describes the packaging requirements for protecting parts/products against environmental hazards. The main environmental hazards are [**].

[**].

7.11.1. Desiccant

Desiccants are typically the primary material used [**].

[**].

Chart

Figure 7.12. Desiccant Chart

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7.11.2. Vapor Corrosion Inhibitors

Vapor Corrosion Inhibitors (VCI's) are those products that emit a vapor that creates a very thin film barrier on a part/product that acts as a barrier between the part/product and water molecules. [**].

7.11.3. Non-Reactive Gas Purge

Purging the packaging with a non-reactive gas will [**].

7.11.4. Ultra Violet Light Degradation

Notwithstanding chemical additives [**].

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7.12. Kit Packaging

Kit packaging is defined as the over-boxing of any two or more individual parts, assemblies, matched sets, or bulk hardware parts. The over-box must conform to all the requirements of the general packaging requirements of this specification.

When kit packaging is specified, the individual parts, assemblies, matched sets, and bulk hardware items must be protected from each other [**].

The parts shall be over-boxed into a single box when at all possible. The over-box shall be appropriately sized to accommodate all parts in the kit.

All voids in the over-box shall be filled [**].

7.13. Reusable Containers

When specified, reusable containers shall be used. Reusable containers are containers that will be used to facilitate the shipment of product from one facility to another and will then be forwarded back to the original shipper or a third party to be specified. Mark all reusable containers on a minimum of two adjacent sides with the following statement; "REUSABLE CONTAINER, RETURN TO (SHIPPER'S NAME)." Unless limited by space, all verbiage shall be two inches in height minimum.

7.14. Hazardous Materials

All materials that meet the definition of hazardous material as defined in the Code of Federal Regulations Title 49 (CFR 49), must conform to all requirements of CFR 49 and the applicable regulations governing the mode of transportation, by which the material will be shipped, for shipments originating in or destined to the United States of America.

CFR 49 specifies all of the required shipping paper documentation, marking, labeling, packaging, and performance tests required for a shipment of hazardous material. The following is a list of applicable documents, that have specific modal requirements:

- International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air
- International Air Transport Association (IATA) Dangerous Goods Regulations
- International Maritime Dangerous Goods (IMDG) Code
- United Nations Recommendations on the Transport of Dangerous Goods

7.15. Lean Manufacturing Packaging

When parts are to be delivered Fit For Use in a Lean Manufacturing line at Applied Materials, packaging must meet the requirements of 0250-70700, Lean Manufacturing Packaging Requirements.

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8. MINIMUM COMMODITY PACKAGING REQUIREMENTS

8.1. Ceramics, Quartz, Glass, Graphite

This section provides the method of packaging ceramics, quartz, glass and graphite for distribution.

NOTE: THESE ITEMS ARE EXTREMELY FRAGILE AND SHOULD BE HANDLED WITH GREAT CARE TO PREVENT DAMAGE.

[**].

[**].

[**].

8.1.1. Materials Requirements

See 0250-70699, Cleanroom Approved Materials.

8.1.2. Packaging Requirements

The part shall be sealed [**].

8.1.3. Overboxing

When plastic corrugate boxes are specified as the outer container on the contract, purchase order or drawing, [**].

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8.1.4. Labeling Requirements

The following are special labeling requirements in addition to those found in section 7.8.

- 8.1.4.1. Labeling on the inner bag should read "PACKAGED IN CLASS XXX CLEANROOM" (replace XXXX with appropriate class level. i.e., 100, 1,000, 10,000).
- 8.1.4.2. If labeling on the inner bag is not legible through the outer bag, place the same label on the outer bag. Mark the exterior of the carton with a "FRAGILE" label.

8.2. Printed Circuit Board Assemblies (PCBA's)

8.2.1. General Packaging Requirements

- 8.2.1.1. For all ESDS parts [**].
- 8.2.1.2. Sharp protrusions must be protected from puncturing bags.
- 8.2.1.3. Fragile parts must be cushioned.
- 8.2.1.4. Desiccant may be specified [**].
- 8.2.1.5. When a box is required, [**].
- 8.2.1.6. Mark the unit carton according to the requirements of section 7.8, Labeling.
- 8.2.1.7. References Applied Materials Workmanship Standard 0250-09954 for specific handling requirements.
- 8.2.1.8. The ideal method of packaging ESD sensitive parts and assemblies is to [**].

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8.2.2. Components, Integrated Circuits and Chips Packaging Requirements

8.2.2.1. Integrated circuits may be packaged
[**].

Illustration

Figure 8.1. IC Tube Packaging

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8.2.2.2. Integrated circuits may be placed [**].

Illustration

Figure 8.2. IC Conductive Foam Packaging

8.2.2.3. Bag parts individually [**].

8.2.2.4. Place bagged part [**].

8.2.3. Printed Circuit Boards Packaging Requirements

Note: See workmanship Standard 0250-09954, ESD Control, for proper handling procedures.

8.2.3.1. Bag parts [**].

8.2.3.2. If the part has prongs or pins [**].

8.2.3.3. Place bagged part [**].

8.2.4. Wrapping, Bagging, and Boxing Procedures

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- 8.2.4.1. See 0250-70699, Cleanroom Acceptable Materials, for acceptable wrapping materials.
- 8.2.4.2. The following is a list of bagging requirements:
 - All parts must be [**].
 - Bag opening shall be [**].

Illustration

Figure 8.3. PCBA Packaging

- 8.2.4.3. If the bagged part [**].

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8.3. Process Gas Lines, Vent Lines and Differential Pumping Lines

This section describes the requirements for packaging of process gas lines, vent lines and differential pumping lines.

8.3.1. The gas lines shall be [**].

8.3.2. [**].

8.3.2.1. [**].

8.3.2.2. [**].

8.3.2.3. [**].

8.3.2.4. Follow section 7.9, Cleanroom Packaging Procedures.

8.3.3. Sealed bags [**].

8.3.3. To help prevent possible damage [**].

8.4. UHV Lines (Vacuum Lines, Exhaust Lines, Fore Lines, Roughing Lines, Etc.)

This section describes the method of packaging vacuum lines, exhaust lines, and fore lines. [**].

8.4.1. Protect all [**]. Follow cleanroom packaging requirements, section 7.9, as required.

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8.4.2. Double bag [**].

8.4.3. Sealed bags [**].

8.4.4. Label the inside bag [**].

8.4.5. Individually box [**].

8.5. Tubing, Hoses, Wires, And Cables (Flexible)

This section describes the method of packaging flexible tubing, wires, and cables. All flexible tubing, hoses, wires, and cables shall be packaged in such a manner as to prevent damage, taking special care to prevent kinking, bending, or crimping.

8.5.1. Protect all [**].

8.5.2. If the tubing, hose, wire, or cable is [**].

8.5.3. If the tubing, hose, wire, or cable is [**].

8.5.4. Each part shall [**].

8.5.5. The single bagged part [**].

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8.6. Seals, Gaskets, O-Rings And Foam (Cure Dated Items)

This section describes the packaging requirements for all seals, gaskets, o-rings, foams and natural rubber items that are cure dated.

8.6.1. Cure Dated Items

Note: Cure dated items are heat and light sensitive, care should be taken to protect these parts from these particular elements.

- 8.6.1.1. Cure dated items must be [**].
- 8.6.1.2. Cleanroom cure dated items must be packaged per the following:
 - These items shall be [**].
 - [**] cleanroom bag shall be marked as follows: "PACKAGED IN CLASS XXXX CLEANROOM" (replace XXXX with appropriate class level. i.e., 100, 1000, 10,000).
 - The part [**]
- 8.6.1.3. Cure dated items must be bagged.
- 8.6.1.4. The exterior bag should contain the following special information:
 - [**]
 - [**]
 - [**]
- 8.6.1.5. See Figure 0250-70699, Cleanroom Approved Materials, for acceptable bagging materials.
- 8.6.1.6. All seals with an outside diameter [**].
- 8.6.1.7. Place the bagged item [**].

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8.7. Critical Surface Parts

This section describes the packaging requirements for all parts that have a finish that is functional or cosmetic in nature and may be damaged by abrasion and shock impacts.

8.7.1. Packaging Requirements

- 8.7.1.1. Wrap/cover [**].
- 8.7.1.2. When applicable, [**].
- 8.7.1.3. Wrap part [**].
- 8.7.1.4. Place (1 each) [**].

8.8. Assemblies

This section describes the packaging requirements for assemblies, and pump assemblies.

8.8.1. Assembly Packaging

This section covers all assemblies such as Complex motors, Actuators, Modules, etc.

- 8.8.1.1. Follow all the applicable requirements of section 7., General Packaging Requirements. [**].

8.8.2. IBSS Requirements for Stand Alone Vacuum Pump Packaging

This section covers all roughing and backing vacuum pumps shipping to IBSS.

- 8.8.2.1. The unit must be properly [**].
- 8.8.2.2. [**].

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- 8.8.2.3. Bag shall [**].
- 8.8.2.4. The unit must [**].
- 8.8.2.5. The unit must [**].
- 8.8.2.6. The cap should include: "Applied Materials Part Number", Gross Weight (lbs. & kgs.), and Cube Size (inches & centimeters). [**].
- 8.8.3. Stand Alone Vacuum Pump Packaging
 - 8.8.3.1. [**].
 - 8.8.3.2. The unit must be [**].
 - 8.8.3.3. Wrap or cover [**].
- 8.8.4. Frame Assembly Packaging
 - 8.8.4.1. Frames must be [**].
 - 8.8.4.2. Frames must be [**].
 - 8.8.4.3. Frames must be [**].
 - 8.8.4.4. [**].
- 8.9. Hardware (Screws, Bolts, Washers, Etc.)

This section describes the packaging requirements for all hardware items (nuts, bolts, screws, washers, etc.)

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- 8.9.1. All parts must have [**]
- 8.9.2. All silver-plated hardware shall [**]
- 8.9.3. Place like parts (same part numbered items) into a bag. [**]
- 8.9.4. Bulk items [**].
- 8.9.5. Place the bag [**].

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Attachment 6

Title: Spot Buy Receiving Label Specification Rev.: B Page 1 of 17
Part No. 0190-75034 Date: 07/15/97

APPLIED MATERIALS

Spot Buy Receiving Label Specification

Revision	Change ECO #	Originator/Approver	Date
A	24447	A.Makeriv	11-12-96
B		R.Stern	07-15-97

Information contained in this document is considered confidential and proprietary and cannot be used in any manner without the expressed written consent of Applied Materials Inc.

APPLIED MATERIALS
3050 Bowers Ave., Santa Clara, CA 95054

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PURPOSE AND SCOPE OF THIS SPECIFICATION

The purpose of this specification is to communicate Applied Materials standard practices and requirements for its suppliers to print and apply labels on shipping containers.

This specification addresses only those shipping container labels used to receive Spot Buy material at Applied Materials. Suppliers shall comply with a different specification 0250-06387 Applied Materials Bus Route Receiving Label Specification for their Bus Route material.

The standard practices and requirements of this document are Applied Materials interpretation of the latest version of the following standards: Electronic Industries Association Outer Shipping Container Bar Code Label Standard (EIA 556-A); product package Bar Code Label Standard (EIA 624, [PN 3133]); and the American National Standards Data Application Identifiers for Material Handling (ANSI/MH 10.8 M- 1993), which is a Data Identifier guideline.

This specification is intended to be a building block for Applied Materials to streamline its flow of materials. This specification is intended to be flexible enough to accommodate change and facilitate innovations within our industry.

REFERENCES

EIA 556-A Electronic Industries Association Outer Shipping Container Bar Code Label EIA 624, [PN 3133] Product Package Bar Code Label Standard ANSI/MH 10.8 M-1993 American National Standards Data Application Identifiers for Material Handling 0250-00098 Applied Materials Packaging Specification 0250-06387 Applied Materials Bus Route Receiving Label Specification

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DEFINITIONS

ALPHANUMERIC The character set that contains letters, numbers, and usually other characters such as punctuation marks.

AMAT Applied Materials

BAR The darker element of a bar code symbol.

BAR CODE An array of parallel rectangular bars and spaces that represent an individual letter, number, punctuation mark or other symbol.

BAR DENSITY CODE The number of data characters that can be represented in a linear unit of measure. Bar code density is often expressed in characters per inch (CPI). CPI is a function of the "X" dimension, element width ratio, and intercharacter gap.

BAR CODE SCANNER A device user for machine reading of a bar code. Scanners may employ hand held wands, fixed optical beams, moving laser beams, or hand-held moving laser beams.

BAR HEIGHT The bar dimension perpendicular to the bar width. Also called bar length.

BUS ROUTE A JIT delivery system from supplier to AMAT

CODE [**]

CUSTOMER PRODUCT ID A combination of alphanumeric characters used by a customer or buyer (i.e. applied Materials) to identify a product.

DATA FIELD The specific portion or area of a label designated to contain human readable, bar code, or graphic information

DATA IDENTIFIER [**]

DEPTH OF FIELD The difference between the minimum and maximum horizontal distance from the aperture of the bar code reader throughout which the bar code can be read.

EIA Electronic Industries Association, Engineering Dept., 2001 Pennsylvania Ave. NW, Washington., DC 20006 Telephone (800) 854-7179

ELEMENT In a bar code symbol, a single bar or space.

FACT Federation of Automated Coding Technologies, 634 Alpha Drive, Pittsburgh, PA 15238-2802, Phone (412) 963-8588.

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INTERCHARACTER GAP The space between the last element of one character and the first element of the adjacent character of a discrete bar code symbol.

INTERMEDIATE CONTAINER A container which is overpacked into an oversized container for consolidation upon shipping.

JIT DELIVERY SYSTEM [**]

LABEL A card, strip of paper, etc. marked and attached to an object to indicate its nature, contents, ownership, destination, etc.

LADDER MODE Bar code oriented with respect to the longer side of a label.

MANDATORY DATA FIELD A data field that must always contain data.

MASTER PACK A number of filled transport packages or other items that are held together by one or more means such as a pallet, slip sheet, strapping, interlocking, glue, shrink wrap, stretch wrap or net wrap to make them suitable for transportation, stacking, and storage as a unit. Sometimes referred to as a Unitized or Unite Load.

MAY Used in this document, this word designates a suggested or acceptable method of complying with a requirement.

MIXED LOAN LABEL A label or tag used to designate a pack or shipping container or non-identical items.

MULTI ORDER LABEL A label or tag used to designate a pack or shipping container of identical products which fulfills multiple AMAT orders.

MULTI ORDER/MIXED LOAD LABEL A label or tag used to designate a pack or shipping container of non-identical products which fulfills multiple AMAT orders.

MUST Used in this document, this word designates a requirement.

OVERPACK A container used to consolidate other packages for the shipping process. Examples of this type are a pallet with shrink wrapping or an oversized corrugated cardboard box.

PACKAGE OR SHIPPING CONTAINER The package or shipping container is the final container that is sufficiently strong to be used in commerce for packing or storing and transporting products.

PICKET FENCE MODE Bar codes oriented with respect to the shorter side of a label.

PO - Purchase Order - A document which legally binds a commitment for materials, facilities, or services.

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PRODUCT PACKAGE LABEL The product package is the first tied, wrapped, or bagged container applied to a single product or multiple thereof or group identical products.

QUIET ZONE A clear space, which precedes the start character of a bar code symbol and follows the stop character. Sometimes called the "Clear Area".

REFLECTANCE [**]

SHALL Used in this document, this word designates a requirement

SHOULD Used in this document, this word designates a standard practice that is not required but is either desired by Applied Materials, recommended by Applied Materials or both.

SHIPPING CONTAINER LABEL Label that identifies the contents and "ship-to" address of a shipping pack.

SHIPPING PACK A package, shipping container, or final container that is of sufficient strength to be used in commerce for packing, storing, and transporting products.

SINGLE LABEL A label or tag used to identify and summarize the total contents of a package or shipping container.

SINGLE ORDER LABEL A transaction label or tag used to designate a package or container of identical products resulting from a single order.

SPOT BUY A purchase made for material on a one-time basis using a PO.

START AND STOP CHARACTERS Distinct characters or patterns used at the beginning and end of each bar code symbol that provide initial timing references and direction-of-read information to the decoding logic.

SUPPLIER OR MANUFACTURER ID CODE A code that uniquely identifies a supplier or manufacturer.

SUPPLIER OR MANUFACTURER PRODUCT IDENTIFICATION CODE A combination of alphanumeric characters used by a supplier or manufacturer to identify a product (part number).

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TRANSACTION IDENTIFICATION NUMBER A combination of alphanumeric characters assigned by the customer to the transaction.

UNIFORM CODE COUNCIL An organization that assigns product and supplier or manufacturer identification numbers. 8163 Old Yankee Road, Suite J, Dayton, Ohio 45458, Telephone (513) 435-3870

GRAPH

Bar Code Characteristics

X dimension (width of the narrow line)	[**]

Symbology	[**]

Density	[**]

Element Width Ratio	[**] [**]

Orientation	[**]

Print Quality	[**]

Data Character Set	[**] [**]

Human readable character height (mandatory)	[**] [**]

Quiet zones (mandatory)	[**] [**]

continued on next page

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Bar Code Specifications (continued)

Each bar code shall [**].
The human readable text for a bar code shall [**].
The human readable information is [**].

Human readable text example:
[**]

Scanning the bar code that corresponds to this human readable information [**]
should result in the following:
[**]

Physical characteristics of label

Label material Label material shall [**]

Adhesive types [**]

Recyclability When possible, the label material and adhesive should [**]

Environmental These labels are intended for indoor use and normal
considerations transportation conditions. Care should be taken to [**].

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Overall Label Dimensions

The illustrations below depict the acceptable dimensions for each field on a label. The labels are not shown to scale. This depiction is known as Vertical or "Picket Fence" orientation.

illustration

Legend

- -----
- A = FROM
- B = SHIP TO:
- C = PACKAGE COUNT
- D = PACKAGE WEIGHT
- E = PKG ID:
- F = AMAT ORDER NO:
- G = AMAT PART NO:
- H = QUANTITY
- I = RESUPPLY LOCN:
- J = DESCRIPTION
- K = DIV. CODE
- *when bar code is required

Drawing not to scale

	PREFERRED	MINIMUM	MAXIMUM
a	[**]	[**]	[**]
b	[**]	[**]	[**]
c	[**]	[**]	[**]
d	[**]	[**]	[**]
e	[**]	[**]	[**]
f	[**]	[**]	[**]
m	[**]	[**]	[**]

Bar codes shall be [**]

there are two types of labels described in this document: the (3S) shipping Container Label and the (5S) Outerpack Label. The above dimensions apply to both.

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(3S) Shipping Container Label

Function This label is [**]

Features Recommended label size[**].

Recyclability Label material and adhesives should [**].

Placement Label should be placed [**].

 Label shall [**].

 Label shall [**].

 Label shall [**].

 Care shall [**].

 Where parts are packaged in accordance with
 0250-00098 Packaging Specification [**].

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(3S) Shipping Container Label

Minimum Required Bar Coded
Data Fields:

Data Identifier	Field Title	Definition
3(S)	PKG ID:	This field value [**]. The second segment shall [**]. The supplier or manufacturer shall [**].
(K)	AMAT ORDER NO:	This field value [**].
(P)	AMAT PART NO:	This field value [**].
(1P)		Supplier [**].
(Q)	QUANTITY:	This field value [**].
(2Z)	RESUPPLY LOCN:	This field is [**].

* (p) AMAT Product ID shall be used for AMAT PART NO.
(1P) Is used for orders when AMAT's part number is not available.

(3S) Shipping Container Label (continued)

Minimum Required
Human Readable Only
Data Fields:

Field Title	Definition
FROM:	Shall be address from which the shipment was sent.
SHIP TO:	Shall be address to which the shipment is being sent.
DESCRIPTION:	Shall be AMAT description for material provided. this value may be truncated if it does not fit in the space allowed.
DIV. CODE:	This field is reserved for use on Bus Route shipping container labels. On a Spot Buy label, this field should contain the field title only.
PACKAGE WEIGHT:	Should be the weight of the filled package the label is attached to even pound integrators. Weights less than 1 lb should be shown as 1 lb. May be hand written clearly with permanent ink.
PACKAGE COUNT:	For Spot buy labels this field should indicate package "1 of 1". The field indicates which one of several packages this package is. The set of packages includes all those covered by a single packing slip shipped to complete delivery of a single part number on a single AMAT PO. For Spot buys this should be only one shipping container or master pack.

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(3S) Shipping Container Label (continued)

Example:

See table above
and on previous
page for data
field definitions.

illustration

Vertical Format. (not to scale)

Confidential Property of Applied Materials

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

(5S) OUTERPACK LABEL

Function This label is [**]

The (5S) label shall be used for the following:

- - A single order number with multiple part numbers in an overpack container.
- - Multiple order numbers with a single part number in an overpack container.
- - Multiple order numbers with multiple part numbers in an overpack container.

Features [**]

Recyclability Label material and adhesives should [**]

Placement Label should be placed [**]

Label shall be placed [**].

Label shall [**].

Care shall be taken [**].

Where parts are packaged in accordance with 0250-00098 Packaging Specification and do not have a suitable flat surface, the bar coded shipping container label may be placed on a card stock tag that is then tied or taped by a string to the container.

Confidential Property of Applied Materials

BAR CODE LABELING REQUIREMENTS

EACH UNIQUE PART NUMBER ITEMIZED ON THE AMAT PURCHASE ORDER MUST BE PACKAGED IN A SEPARATE SHIPPING CONTAINER OR MASTER PACK WITH ITS OWN PACKING SLIP.

- - Where there are multiple deliver dates for the line item, this is required each time the part is shipped.
- - In observing this requirement, the following rules shall apply

All packaging shall be in compliance with 0250-00098 Applied Materials Packaging Specification.

If the quantity of the part can be placed in one shipping container, supplier shall place one (3S) label and one packing slip on the shipping container. The (3S) label shall specify the quantity of the part contained in that shipping container. The package count is "1 of 1" for that shipping container.

Supplier may bundle together multiple master packs and/or multiple shipping containers (that meet the requirements above) into a single overpack container. If supplier bundles multiple master packs and/or shipping containers in an overpack container, supplier shall place one (5S) outerpack label on the overpack container.

Confidential Property of Applied Materials

5S Outerpack Label Description (continued)
-----Minimum Required
Human Readable Only
Data Fields:

FIELD TITLE	DEFINITION
FROM:	Shall be [**].
SHIP TO:	Shall be [**].
DIV. CODE:	This field is [**].
PACKAGE WEIGHT:	Should be the weight of [**]
PACKAGE COUNT:	[**].

Examples:

Graph

Bar Code Labeling Requirements

Each unique part number itemized on the AMAT purchase order must be packaged in a separate shipping container or master pack with its own packing slip.

- Where there are multiple delivery dates for the lien item, this is required each time the part is shipped.
- In observing this requirement, the following rules shall apply:

All packaging shall be in compliance with 0250-00098 Applied Materials Packaging Specification.

If the quantity of the part can be placed in one shipping container, supplier shall [**].

If multiple shipping containers are required for [**].

Supplier may [**].

Image

Confidential Property of Applied Materials

Attachment 7

APPLIED MATERIALS CORPORATE ROUTING GUIDE ATTACHMENT A

TRANSPORTATION AND SHIPPING REQUIREMENTS

Applied Materials Corporate Traffic Department has established excellent pricing and service programs with various transportation carriers. Using these approved carrier programs, when Applied Materials is responsible for the freight charges, will contribute to our freight cost reduction goals while continuing to provide a high level of customer satisfaction. Everyone has a responsibility to control and reduce unnecessary expenses.

Requirements for transportation and shipping are as follows:

- - All freight collect shipments to Applied Materials must be routed via the appropriate Applied Materials approved carrier, see general routing instructions within the United States.
- - An Applied Materials department of division number must be referenced on the carrier documentation.
- - All shipments consigned to a third party at the direction of Applied Materials and Applied Materials is paying the freight charges must be routed by an approved Applied Materials carrier. All shipping documentation must indicate billing to third party (Applied Materials).
- - For freight routed prepaid by third party, FOB origin, the third party will assume all risk in transit when approved Applied Materials carrier is used.
- - Materials must be suitable packaged to withstand normal freight handling and movement while in transit.
- - Multiple order shipping by the same carrier and service level, on the same day, must be consolidated into one shipment on one carrier document.
- - Material for each purchase order must be packaged separately with it's own packing list.
- - Packing lists must be attached to the outside surface of the package and visible from any position (do not hide from view if multiple packages are pelletized).
- - When consolidating multiple purchase orders in one overpack carton, all inside orders must be attached to the overpack carton. Overpack carton must be clearly label to indicate multiple orders are packed inside. Each carton within the overpack must be clearly labeled.

Attachment 7

- - DO NOT DECLARE VALUE or request insurance on any freight collect shipment or third party shipments where Applied Materials is paying the freight charges unless specifically authorized.
- - Materials must be shipped in time to meet the due date shown on the purchase order. Materials will not be accepted/received earlier than three (3) days of the due date, unless specifically authorized. Materials shipped earlier will be refused and possibly returned at your expense.
- - Only use air freight at the requested level of service when specifically instructed and authorized in writing by Applied Materials.
- - Suppliers must specifically state or indicate Emergency/Overnight service on the airbill or truck bill of lading to ensure expedited delivery, and only when instructed and authorized in writing by Applied Materials.
- - All shipping documents and package address labels must reference the complete purchase order number(s) for the material included in the package(s) and shipment. When freight codes are provided they must also show on all documents.
- - Any question concerning third party billing or carrier recommendations anywhere within the United States should be addressed to Corporate Traffic Operations:

Santa Clara, California

(408) 235-6053

Outside Santa Clara, California

Toll Free 1-888-TOO-SHIP
(1-888-866-7447)

ATTACHMENT 7

APPLIED MATERIALS - ROUTING GUIDE

GENERAL ROUTING INSTRUCTIONS WITHIN THE US

COMMON CARRIER (LTL) TRANSPORTATION UP TO 7,500 LBS.

WEIGHT	AMAT LOCATION OR SERVICE AREA	CARRIER
1-100 lbs.	All points.	Federal Express - Express Saver
Over 100 lbs.	All interstate shipments.	CF Motor Freight
Over 100 lbs.	Intrastate AZ, CA, & OR	Viking Freight System
Over 100 lbs.	Intrastate Tx, except Augtin & Dallas area	Federal Express - Express Saver Freight
1-50 lbs.	Austin & Dallas area	Sonic Air
Over 50 lbs.		Federal Express - Express Saver
Over 100 lbs.	Intrastate MA, NY, & PA	Federal Express - Express Saver Freight

Please provide 48 hour advance notice when your shipment is over 7,500 lbs., or on shipments that require special equipment. This will enable sufficient time to schedule the carrier that will provide the most economical and timely service. Contact Corporate Traffic 1-888-TOO-SHIP (866-7447).

HIGH VALUE PRODUCTS, AIR RIDE OR PADDED VAN SERVICE

TWI Mayflower Call traffic (408) 235-6053, for scheduling and transit time details.

NEXT FLIGHT OUT, MESSENGER, AND/OR COURIER SERVICE WITHIN THE US

All weights Sonic Air call the local office, if no local office call 1-800-528-6070

AIR FREIGHT WITHIN THE US

WEIGHT	SERVICE	CARRIER
1 - 70 lbs.	Priority Overnight - 10:30 AM Next Day Priority Overnight - 3:00 PM Next Day Economy Service - 4:30 PM Second Day	Federal Express
Over 70 lbs.	Priority Overnight - 10:30 AM Next Day Standard Overnight - 4:00 PM Next Day Two Day - 4:00 PM Second Day Deferred Air - 3-5 day delivery	Eagle USA Air Freight

GENERAL ROUTING INSTRUCTIONS FOR ALL INTERNATIONAL LOCATIONS

WEIGHT	SERVICE	CARRIER
1 - 50 Kgs.	Regular Air	Federal Express
All Weights	Next Flight Out or Courier Service	Schenker International*
Over 50 Kgs.	Regular Air or Consolidation	

* Shipments over 50 Kgs. to or from Japan must be routed via Nippon Express.

ATTACHMENT 7

TRANSIT TIMES FOR U.S. CARRIERS

SELECT CARRIER BY REFERRING TO GUIDANCE PROVIDED ON PAGE ONE. USE TABLE BELOW TO ENSURE TRANSIT TIME OF SERVICE MEETS DELIVERY REQUIREMENTS.

US TIMETABLE	SHIPMENT SIZE	SAME-DAY	1 DAY	2 DAYS	3 DAYS	4 DAYS	5 DAYS	6 DAYS
Sonicair Courier Next Flight Out	All - see f.	Nationwide	Nationwide					
Sonicair Ground Courier Local	All - see e.	50 miles of AMAT Sites						
Federal Express Express Saver	1-100 lbs, see d.		Up to 350 miles of origin	350 to 1,000 miles of origin	Over 1,000 miles of origin			
Federal Express Express Saver Freight	Over 151 lbs., see d.		Up to 350 miles of origin	350 to 1,000 miles of origin	Over 1,000 miles of origin			Federal Express Express Saver Service commitment by 4:30 PM or by close of business.
Viking Freight Sys. Between CA, AZ, OR.	Over 100 lbs.		All points in CA ex Calexico. Reno, NV	CA to metro areas in AZ, NV, OR, Denver, CO	Colorado Springs, CO			
CF Motor Freight Between Santa Clara and States	Over 100 lbs.				AZ, ID, NV, OR, WA	CO, MT, NM, UT	IL, IN, KS, KY, LA, MI, MN, MO, ND, NE, OH, OK, SD, TN, WI, WY	DC, DE, FL, GA, LA, MA, MD, ME, MS, NC, NH, NJ, NY, PA, RI, SC, TX, VA, VT, WV
CF Motor Freight between Austin and States	Over 100 lbs.				AR, LA, NM, OK	AL, CO, FL, GA, IA, IL, IN, KS, KY, MI, MS, NC, SC, UT, WI, WY	AZ, CT, DC, DE, ID, MA, MD, ME, MN, MO, MT, ND, NE, NH, NJ, NV, NY, OH, OR, PA, RI, SD, TN, VA, VT, WA, WV	

- a. General guidelines call 1-888-TOSHIP for additional information.
- b. Viking Freight Systems use for all intrastate California LTL. Can be used for Western States Listed.
- c. Express Saver Freight Program should be used for all appropriate non-local intra Texas shipments.
- d. Express Saver program should be used for appropriate packages under 100 lbs.
- e. Sonic Ground Courier Service can be used for sameday shipments in local area of AMAT sites in Santa Clara, Milpitas, Austin, Dallas, Phoenix, and Boston.
- f. Next Flight Out service is used for extremely urgent shipments. Check with carrier for delivery commitment. Consider Federal Express or Eagle if commitment is after 10:30 AM next day.

Attachment 8
Intentionally Omitted

Attachment 9

Intentionally Omitted

ATTACHMENT 10

Applied Materials Incorporated

PRELIMINARY QNRR FORM

SUPPLIER NAME: _____ DATE: _____

P/N: _____ SQE: _____

=====
QNRR Number: _____

=====
Levels: Please check one
See Page 3 of 3 for level descriptions
1. Critical []
2. Major []
3. Minor []
=====

Brief Description:

=====
* This QNR requires corrective action (CA). Please return this form with signature to within _____ working days.
1. CA Approved: [];
Applied Materials must sign page 2 of 3 to confirm approval.

2. CA Disapproved: [];
Explain below

Applied Materials Explain Briefly:

* Applied Materials to review CA and Approve or Disapprove based on fact. Applied Materials must inform supplier by returning this form with status checked and explained within fourteen working days.

=====

=====
CA to correct Discrepancy: Explain

=====
Preventative Measures Described:

=====
Scheduled Completion Date: _____
Supplier Signature: _____
Applied Materials Approval Signature: _____
=====

ATTACHMENT 10

Applied Materials Incorporated

LEVELS OF CORRECTIVE ACTION

LEVEL -----	NATURE -----
1. CRITICAL	HAZARDOUS TO HUMAN SAFETY; OR VITAL TO FUNCTIONALITY OF END PRODUCT THUS NON-CONFORMANCE IN MEETING THE REQUIRED SPECIFICATIONS AND CONTRACTUAL AGREEMENTS. EXAMPLES: IMPROPER HEAT TREATMENT OF CERAMIC MECHANICAL MOTOR MECHANISM, INOPERATIVE BRAKING SYSTEM, EXPLOSIVE COMPONENTS, ETC.
2. MAJOR	A NON-CONFORMANCE RELATED TO THE REQUIRED FUNCTIONALITY SPECIFICATIONS AND/OR NON-CONFORMANCE TO CONTRACTUAL AGREEMENTS. EXAMPLES: CHEMICAL REACTION (RUST), INOPERATIVE MECHANISM, PCBAS.
3. MINOR	A NON-CONFORMANCE TO THE FUNCTIONALITY OF PARTS/MECHANISMS WHICH ARE NOT SHOW STOPPERS. EXAMPLES: CHEMICAL REACTION (RUST), DENTS, SCRATCHES, LOOSE HINGE.

ATTACHMENT 13

APPLIED MATERIALS

SUPPLIER PROBLEM SHEET 95-0957

 Date Vendor Originator Telephone No.

 Part Number Part Description

 Contract/Spot Buy (circle one) Purchase Order No.

 PROBLEM

 APPLIED ACTION

 PROBLEM NAME DATE RETURN
 WILL BE RESPONSE TO
 RESOLVED ORIGINATOR
 BY: WITHIN 24
 HOURS

Attachment 14

Intentionally Omitted

Attachment 15

Intentionally Omitted

Attachment 16

CERTIFICATE OF CONFORMANCE

"I certify that on _____ the _____ furnished the supplies or services called for under the Applied Materials' Purchase Contract Number _____ via _____ on _____ in accordance with all applicable requirements. I further certify that the supplies or services are of the quality specified and conform in all respects with the contract requirements, including specifications, drawings, preservation, packaging, packing, marking requirements and physical item identification (part number), and are in the quantity shown on this or on the attached acceptance document."

Date of Execution:

Signature:

Name & Title:

Instructions:

The ____ signed certificate shall be attached to or included on the top copy of the inspection or receiving report provided to Applied Materials at the time of delivery. In addition, a copy of the signed completed certificate shall also be maintained at the ____ facility and will be made available to Applied Materials' representatives upon request.

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

Attachment 17

[**] CALCULATION

[**]

NONDISCLOSURE AGREEMENT
Applied Materials, Inc.

APPLIED MATERIALS, INC., a Delaware corporation (including its subsidiaries, "Applied"), having its principal offices in Santa Clara, California and MKS Instruments, Inc., a Massachusetts corporation, ("Recipient") having its principal offices in Andover, Massachusetts, hereby agree as follows:

I. IDENTIFICATION OF CONFIDENTIAL INFORMATION

A. Applied may disclose to Recipient the following types of information: SEE ATTACHMENT 1.

B. The information described in A. above shall be deemed "Confidential Information" if:

(1) in the case of a written disclosure, Applied affixes to the document an appropriate legend, such as "Proprietary" or "Confidential", and

(2) in the case of an oral or visual disclosure, Applied makes a contemporaneous oral statement or delivers to Recipient a written statement within thirty (30) days to the effect that such disclosure is confidential or the like.

C. "Confidential Information" does not include information that:

(1) becomes a matter of public knowledge through no fault of Recipient, (2) is rightfully received by Recipient from a third party without restriction on disclosure, (3) is independently developed by Recipient without the use of Applied's Confidential Information or (4) is in the possession of Recipient prior to its disclosure by Applied.

D. Each party's Nondisclosure Agreement ("NDA") Coordinator serve as the principal contact for the disclosure or receipt of Confidential Information. Applied's NDA Coordinator will be MICHAEL BERKLAW and Recipient's NDA Coordinator will be LEO BERLINGHIERI.

II. USE OF CONFIDENTIAL INFORMATION

Recipient shall use the Confidential Information only for the purpose of (1) determining whether to enter into a transaction with Applied, (2) purchasing or using products or services supplied by Applied or (3) providing products or services to Applied. Absent a written agreement to the contrary, all information generated or derived by Recipient in connection with any such transaction or provisions of goods or services shall be deemed Confidential Information for purposes of this Agreement.

III. RESPONSIBILITIES OF RECIPIENT

A. Recipient agrees (1) to disclose Confidential Information only to those of its employees who have a need to know such information, are informed of its confidential nature and agree to comply with this Agreement, (2) not to disclose Confidential Information to any third party, except pursuant to a lawful judicial, administrative or governmental order after providing Applied an opportunity to avoid or limit such disclosure, (3) to protect the Confidential Information with at least the degree of care with which it protects its own confidential information, but in no case with less than a reasonable degree of care and (4) to notify Applied promptly of any breach of this Agreement.

B. Within thirty (30) days of a written request by Applied, Recipient shall (1) destroy or return to Applied all documents received from Applied that contain Confidential Information, all documents it may have created that reveal or are based on any Confidential Information, and all copies of the foregoing (except for one copy which may be kept by Recipient's legal department or outside attorneys for archival purposes only), and (2) deliver to Applied a certificate stating that Recipient has complied with such requests.

IV. DISCLOSURE PERIOD AND CONFIDENTIALITY PERIOD

A. The period during which Applied may disclose Confidential Information under this Agreement shall begin on the date of the first disclosure of Confidential Information (which may be prior to the date of this Agreement) and shall end on _____ (if no date is specified, the period shall end three (3) years from the date this Agreement was signed). Either party may terminate the Agreement by giving the other party ten (10) days' written notice.

B. The obligations set forth in Articles II and III shall (1) termination five (5) years from the date of this Agreement and (2) survive the termination or expiration of this Agreement.

V. MISCELLANEOUS

A. Recipient shall not acquire intellectual property rights from Applied other than by a separate written agreement. Nothing in this Agreement shall be deemed to create any obligation to disclose Confidential Information. The Confidential Information is accepted "as is" by Recipient without any warranty of noninfringement or of any other sort by Applied or any of Applied's agents, advisers, consultants or contractors.

B. This Agreement does not create any partnership, joint venture or agency between the parties.

C. Before exporting or reexporting any Confidential Information, Recipient must comply with all applicable regulations of the U.S. Department of Commerce Office of Export Administration and/or other applicable agencies.

D. This Agreement is the complete and exclusive statement of the understanding between the parties regarding the subject matter hereof and supersedes all prior or contemporaneous communications. It may be amended only by a writing signed by both parties.

E. This Agreement shall be interpreted and enforced according to the laws of the State of California (exclusive conflict of law rules).

APPLIED MATERIALS, INC.

MKS INSTRUMENTS, INC.
(Print Name of Recipient)

By: /s/ Joe Cestari

Name (print) Joe Cestari
Title: Sr. Director-Chemical Delivery
SMO Operations

By: /s/ Leo Berlinghieri

Name (print) Leo Berlinghieri
Title: Corporate VP, Customer
Support

Date: 10/23/98

Date: 12-22-98

Please circle one: Customer
Supplier Consultant

Confidential Materials omitted and filed separately with the Securities and Exchange Commission. Asterisks denote omissions.

EXHIBIT 10.18

PERSONAL & CONFIDENTIAL
MEMORANDUM

TO:
FROM: George Manning
DATE:
SUBJECT: 1999 Management Incentive Program

The amount of bonus you may be eligible to earn under the Management Incentive Program in 1999 will be dependent on the consolidated net income achieved by the Corporation for calendar year 1999. Consolidated net income means the consolidated net profits of the Corporation and its subsidiaries after payment by the Corporation of bonuses to all employees of the Corporation, contributions by the Corporation to the Retirement Plan on behalf of all employees of the corporation (in the United States who are eligible to participate in the Retirement Plan), and before payment by the Corporation of all income taxes.

If our consolidated net income for 1999 ends up less than *****, you will not earn a bonus. If the consolidated net income is ***** or greater, you will earn a bonus in the amount shown on the attached table. However, in no event can your bonus exceed 200% of your targeted bonus for 1999.

In order to receive a payout under this Plan, we must be successful in keeping our non-direct employment at current levels and maintaining tight controls over our spending. In addition, our 1999 net sales must meet or exceed ***** net sales. For example, if our annual net sales for 1999 were approximately equal to our annual net sales for 1998, you could receive approximately 10% of your targeted bonus amount. If we were able to grow our net 1999 sales to approximately *** more than our net 1998 sales, you could receive approximately 50% of your targeted bonus amount. And at *** growth over last year, with good cost control measures in place, you could expect to receive your full targeted bonus amount. The consolidated net income objectives are based on current financial conditions. Significant changes in those conditions could cause our net income objectives to be appropriately revised based on new circumstances.

In order to participate in this management Incentive Program, you must be actively employed by MKS Instruments, Inc. as of December 31, 1999.

THIS INFORMATION IS EXTREMELY CONFIDENTIAL AND SHOULD BE TREATED AS SUCH. YOU SHOULD NOT DIVULGE THIS INFORMATION INSIDE OR OUTSIDE OF MKS INSTRUMENTS, INC.

GM: 99-4200:jg
Attachments

logo

Six Shattuck Road, Andover, MA 01810
Telephone (978) 975-2350 Fax (978) 975-3756

CONFIDENTIAL MATERIALS OMITTED AND FILED SEPARATELY WITH THE SECURITIES AND EXCHANGE COMMISSION. ASTERISKS DENOTE OMISSIONS.
PERSONAL & CONFIDENTIAL

1999 MANAGEMENT INCENTIVE PROGRAM
CALENDAR YEAR 1999 CONSOLIDATED NET PROFIT TABLE
(JANUARY 1 - DECEMBER 31, 1999)

YOUR TARGET BONUS IS 40% OF YOUR 1999 BASE COMPENSATION, WHICH WILL BE FULLY ACHIEVED IF CONSOLIDATED NET INCOME BEFORE TAXES REACHES *****M. AT *****M CONSOLIDATED NET INCOME BEFORE TAXES, YOU WOULD RECEIVE 200% OF YOUR TARGET BONUS, WHICH WOULD BE 80% OF YOUR 1999 BASE COMPENSATION.

Consolidated Net Income %*	Percent of Target Bonus Earned
-----	-----
< \$*****	0%
\$*****	10%
\$*****	25%
\$*****	35%
\$*****	50%
\$*****	65%
\$*****	75%
\$*****	90%
\$*****	100%
\$*****	125%
\$*****	150%
\$*****	175%
>\$*****	200%

*Consolidated net income worldwide, before taxes.

THIS INFORMATION IS EXTREMELY CONFIDENTIAL AND SHOULD BE TREATED AS SUCH. YOU SHOULD NOT DIVULGE THIS INFORMATION INSIDE OR OUTSIDE OF MKS INSTRUMENTS, INC.

CONSENT OF INDEPENDENT ACCOUNTANTS

We consent to the inclusion in this Amendment No. 1 to the registration statement on Form S-1 (File No. 333-71363) of our report dated January 22, 1999, except for the information in the first and second paragraph of Note 13, as to which the date of January 28, 1999 and February 24, 1999, respectively, on our audit of the consolidated financial statements and our report dated January 22, 1999 on our audit of the financial statement schedule of MKS Instruments, Inc. We also consent to the references to our firm under the captions "Experts" and "Selected Consolidated Financial Data."

/s/ PRICEWATERHOUSECOOPERS LLP

PRICEWATERHOUSECOOPERS LLP

Boston, Massachusetts

February 26, 1999

12-MOS

	DEC-31-1998	
	JAN-01-1998	
	DEC-31-1998	
		11,188
		538
		20,674
		656
		24,464
	58,533	
		74,640
	41,915	
	96,232	
27,040		
		13,786
0		
		0
		113
		54,713
96,232		
		139,763
	139,763	
		83,784
		83,784
		46,361
		253
	1,483	
		8,135
		949
7,186		
		0
		0
		0
		7,186
		0.25
		0.24