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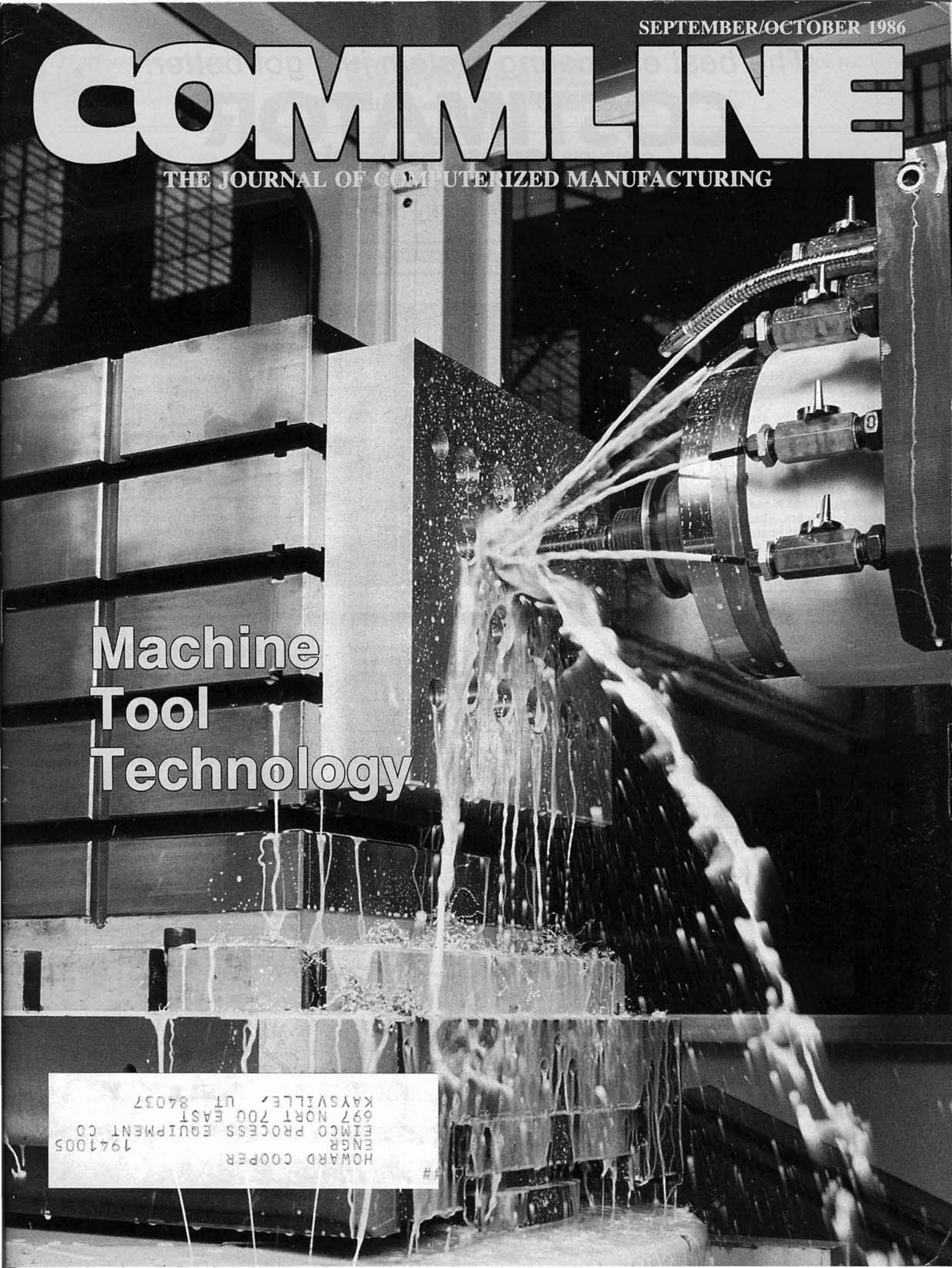

Machine Tool Technology

Field reports

A goal of every company today is to contain costs and raise productivity without increasing personnel. As more automation equipment is installed, a key to reaching this goal is to increase reliability and productivity of automation equipment, not people. Here are responses from some companies that indicate typical improvements by using a transient voltage surge suppression (TVSS) program developed by AMEMCO. The goal of such a program is to remove the stresses that cause component failure. Look for signs of reduced need for spare parts.

Colt Industries, Fairbanks Morse Div., diesel generator manufacture. "We just finished evaluating the results...on all 32 NC and CNC machine tools over the past year....We have reduced electronic failures by 92%. This easily paid for installing AMEMCO recommendations, but larger savings have come from increased machine utilization. Problems we had of occasional malfunctions and losing memory are a thing of the past."

Borg-Warner Inc., metal parts machining. "We had frequent problems with our main-frame business computer during brownouts and a high circuit board failure rate in 25 NC and CNC machines. Also, there were frequent complaints from our word processing department of things like system lockup and loss of data. Now we see none of these problems. We have not lost a circuit board in over a year and a half. And we have an estimated 80 to 90% reduction in equipment downtime."

Baker/EIMCO-PEC, industrial filter media and drives manufacture. "Implementation resulted in an estimated decreased NC machine downtime of 100 hours per month from eight machines, an annual savings in downtime of $61,680. We reduced circuit board failure from three or four per month to three or four per year. We also saw a 50% reduction of overall electrical and mechanical maintenance downtime."

"100% or ZERO SPARE PARTS?"

(A Maintenance Engineering Method)

By Howard C. Cooper

Today's economy poses special problems and unique opportunities in maintenance and maintenance engineering. With growing numbers of quickly designed computer equipment and computer controlled systems, but with tight budgets and reduced technical staffs, the question of spare parts is frequently ignored or deliberately avoided. These parts are becoming more electronically sophisticated and expensive. The proliferating number staggers popular conservative budgets and makes new systems requisition appropriations unattractively high.

Why did we buy complete spare parts kits for earlier large computer control systems? What happens if systems go down without spare parts? Should we stock 100% or Zero Spare Parts?

The purpose of spare parts is to minimize system downtime and corporate losses in cases of system malfunctions and failures. Spare parts also help, in some cases, troubleshooting and system diagnostics. One thing is sure. Once a board or component becomes defective, equipment will not return to a productive mode until this defective part is replaced.

Based on these facts this writer, maintenance engineer, started his career, recommending 100% spare parts, yet today he recommends near zero spare parts inventory. From 1974 through 1979 he served as chief electronic maintenance engineer for John Deere Co. in Dubuque, IA, responsible for reducing "down time" on that company's 100 computer numerical control machine tools, programmable controls and other electronic industrial controls.

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100%

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He spent over $300,000 in two years on spare parts and received positive corporate recognition based on the results. However today he operates his own company, AMEMCO, which provides maintenance engineering products and services helping many companies reduce downtime. Yet today he recommends near zero spare parts inventory. Why? How?

First let's consider what economically justifies having expensive electronic modules, boards and components sitting on shelf after shelf after shelf, doing nothing. Would you stock spare parts if you knew they were quickly available just across the street?

Justifying Spare Parts

By properly establishing a "value" for each spare part, we can better decide to stock or not to stock and how many to stock. The formula for establishing a value for each part is given as:

VALUE = Cost of Part * $D.T. / Availability * MTBF

Where: $D.T. = total system hourly cost of Down Time.
and MTBF = Mean Time Between Failures

As "cost of part" goes up, so does part complexity. Chances of repairing it in-plant go down. Therefore, the "value" of having it on hand goes up. If the system hourly downtime dollar figure ($D.T.) is high this will multiply or increase the "value" of stocking spare parts. However, in the formula, "availability" factor is divided into "cost of part" times "$D.T." because if availability is high (across the street) then the "value" of stocking a spare goes down. Use for "availability" a figure from 1 to 100, where 1 indicates least available, hardest to get parts and where 100 indicates easy to get, very available. If your plant is in an out of the way location where all parts take several days to get, then the formula suggests a higher "value" on stocking spares. And, lastly we must consider MTBF if Mean Time Between Failures is low, indicating frequent failure of this particular part or board, "value" of a spare goes up. If MTBF is high counted in months between failures, then multiplied to high or good availability, then divided into "costs," "value" of a spare goes down. After calculating "value" for several spares, the comparison of "values" will let one see which spares are of higher value than others.

Efforts are commonly made by maintenance engineers to make spares more available to maintenance and to assist maintenance in "putting out fires" faster, to get equipment running and productive again. In these efforts they are at best "spinning their wheels" and not progressing toward their purpose and opportunity as maintenance engineers.

Proper Objective for Maintenance Engineering

The main purpose of a maintenance engineer should be to reduce down time. This means his first effort should be to prevent or eliminate downtime by eliminating stresses which cause malfunction and failure. He is then like a "fire prevention bear" whereas maintenance technicians and personnel are "the fire department." Secondly if a maintenance engineer can help maintenance fight fires better and faster, he has partially accomplished his purpose of reducing downtime. But, would it not have been better if he could have prevented the fire, by having earlier eliminated the stress or stresses which caused the fire.

Repair lab no longer needed... circuit boards no longer fail.

What Causes System Failures

If you do away with Heat, Oxygen, and Fuel you *can not have any future fires*. If you do away with the five stresses which cause electronic malfunction and failure you *can not have future electronic system failures*. Look then one last time at the spare parts value formula. As you effect a MTBF figure nearing infinity (no system failures), the "value" of spare parts approaches zero. You should then stock near zero spare parts. If your systems never break down, why would you want to stock spare parts?

What then are these five stresses which cause electronic and computer equipment malfunction and failure?

1. Power line surges and transients
2. Heat
3. Physical vibration
4. Oxidation and corrosion
5. Dirt build-up

These are simply listed and it is easily understood that if these stresses are eliminated from your systems, they can no longer cause malfunctions and failures. AMEMCO has fine tuned methods over the past 5 years, helping many companies achieve 90 to 95% reduction in circuit board failures, eliminating computer malfunctions such as: system lock-up, data errors, lose of memory, and increasing system MTBF or reliability to a level where spare parts can hardly be justified. It is easy to understand then why this writer has moved from recommending 100% spares to recommending near zero spare parts.

Howard Cooper has a BS degree in Electronic Technology from Southern Utah State, graduating Magna Cum Laude and has done graduate work at BYU. He has worked the past twelve years in Manufacturing Industries specializing in Industrial Electronics. Mr. Cooper worked five years for John Deere Company pioneering their Numerical Control Maintenance Engineering program, and four years for Baker EIMCO-PEC as Electronic Engineer. He has enjoyed consulting, nation-wide, since January 1981. He has been honorary member of the National Advisory Board for "Electronics" Magazine, has presented papers at national conventions for the Society of Manufacturing Engineers and in Trade Magazines on "Maintenance and Reliability of Electronic Controls". He presently is participating on IEEE committees to establish guides for application and testing of transient surge protective devices.