

## Don't underestimate the impact of test socket performance on test cost!

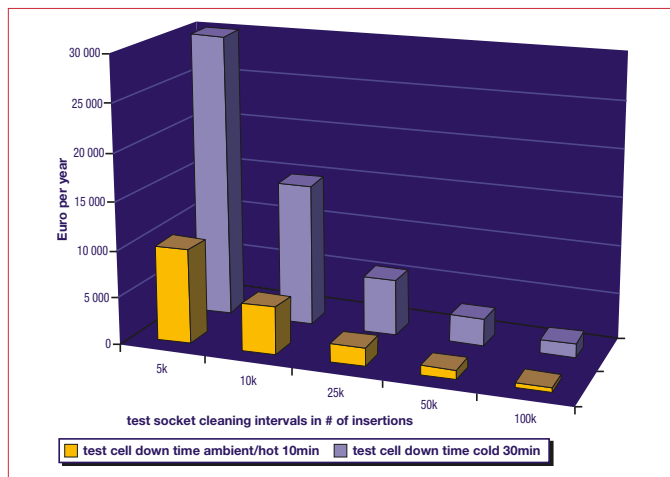
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Although the test socket itself is a very small part of the test cell and only requires a small investment compared to the test head and test handler, it can have significant impact on the test cell's overall equipment efficiency (OEE).

With a comparable spares price, the only determinant is the spare parts consumption per year—the lifespan. In the example with two seconds test time, increasing the lifespan from 50,000 insertions to one million reduces spare parts cost by 95 percent. For shorter test times this will become even more significant.

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1. Graphic shows how cleaning intervals affect downtime.

Core OEE parameters—test cell yield and test cell availability—are influenced by test socket cleaning cycles, the lifespan of the contact spring and contact resistance. Considering this, the test socket quality becomes much more important than the original purchase price.

### TEST SOCKET CLEANING CYCLES

Each test socket cleaning will lead to a test-cell downtime. Figure 1 relates test-cell downtimes caused by test socket cleaning to the capital depreciation cost of the test cell (example: €1 million investment, five-year depreciation).

Improving the cleaning cycles from 5,000 insertions to 100,000 insertions will lead to substantial cost savings.

In the example, the cost savings will be €9,500 (\$12,484\*)/year for a single site ambient/hot application. For cold applications and/or higher parallel test, this effect becomes even more dramatic.

### SOCKET LIFESPAN

Premature wear and shortened lifespan have a direct influence on cost, as they require either spare parts or complete replacement of the sockets. Figure 2 shows the spare parts cost for one year at 70 percent OEE with an assumed spare price of €200/\$262.

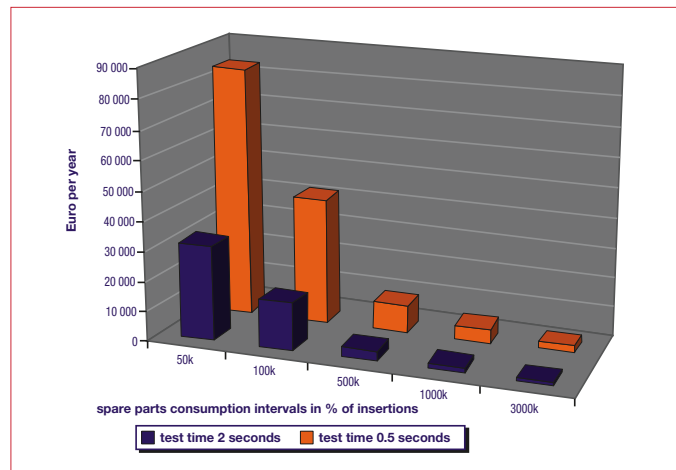
### TEST-SOCKET-RELATED YIELD LOSS

Worn out or contaminated contact springs will result in low test yields. Figure 3 shows the loss in dollars and euro for an IC with a price of €-0.1 in relation to a reduction of the overall test yield caused by deteriorating contacting performance without retest.

### OPTIMIZING PARAMETERS

There are several constraints the ideal test socket must meet:

- ▶ The contact spring has to be resistant against premature wear;
- ▶ The spring tip has to be protected against material transfer and accumulation from the tested ICs;
- ▶ The spring has to be able to remove/protrude-through (oxide) barriers;
- ▶ The contact spring must not impact the IC lead plating;
- ▶ The test socket needs to ensure repeatable electrical behavior, contact resistance, current capability, signal fidelity, etc.



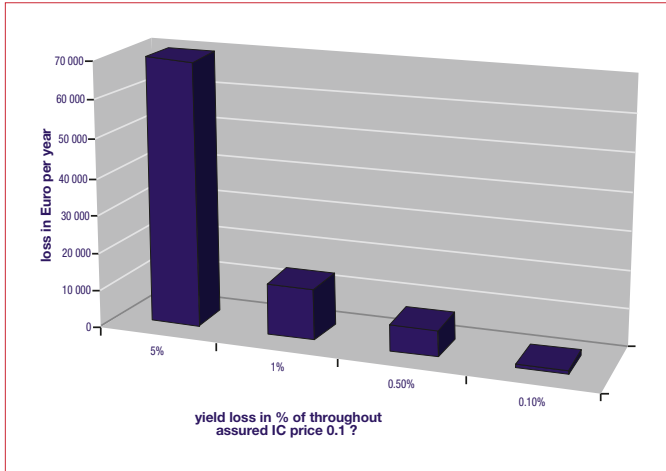
2. Chart illustrates spare parts cost for one year at 70 percent OEE and an assumed €200 spares price.

## Don't underestimate the impact . . .

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Typical approaches are to increase the contact force per spring to find the optimum plating or surface, as well as to change the spring-tip geometry and the spring design.

Given these constraints, optimization cannot be done by improving single features of the test socket. To ensure real and consistent performance improvement, all of the socket feature parameters need to be reviewed, optimized and synchronized against each other.



3. Chart shows the loss in euro for an IC priced at €-0.1 compared to a reduction of the overall test yield caused by deteriorating contact performance without retest.

## TEST SOCKET PARAMETERS

- ▶ force
- ▶ coatings & platings
- ▶ bulk material
- ▶ scrub (relative movements of the contact spring against the IC lead /pad)
- ▶ geometry
- ▶ surface quality

Experience shows that performance improvement cannot be done in a classical R&D situation.

Field studies take too long and unacceptably extend the time-to-market; therefore, a procedure and set-up is needed that allows for test socket characterization in a situation as close as possible to a true high-volume production environment.

The more realistic these characterizations, the greater the benefits in a realtime test environment.

(\*€ converted at the rate of 1€=1.314 USD)

*Mr. Gschwendtberger earned a Dipl. Ingenieur from the University of Applied Sciences, Rosenheim. He is an experienced mechanical design engineer and has served at Multitest for nearly 14 years, currently as business unit manager for contactors. He holds several patents in the test socket area.*