# CHECKLIST FOR SELECTING
# NEW EQUIPMENT OR NEW PROCESSES

*Refer to specification 12100 for the definition of a new equipment and a new process.*

| | |
|---|---|
| **Equipment:** | **IVS 130/135** |
| **Process:** | **Overlay Metrology in Fab 2** |
| **Responsible engineer:** | **Leo Schlegel/ Filip Rigole** |
| **Date:** | **24-10-2003** |

| | value/OK/ attach |
|---|---|
| **1. Process requirements** | |
| • Technology and reliability requirements | |
| List the physical parameters (thickness, resistivity, ...) describing the process | |
| • Defect density requirements | |
| Allowed machine added defects/wfr | 5 /# > 0.1 micron |
| Expected edge of wafer effects, Si utilization | NA |
| Defect measurement method (KLA, Surfscan, ...) | Surfscan |
| **2. Productivity** | |
| • Naked throughput | 90 WPH |
| • Set-up/conditioning method and time | |
| • Equipment monitoring method and time | |
| • Process monitoring method and time | |
| **3. Availability** | |
| • Mean Wafer Between Cleans (MWBC) | |
| • Mean Time Between Failure (MTBF) | 1500 hours |
| • Mean Time To Repair (MTTR) | 4 hours |
| • Scheduled downtime | < 1 % |
| • Unscheduled downtime | < 2 % |
| • Wafer breakage : | |

| | |
|---|---|
| Typical frequency | 10.000 # |
| Recovery procedure and time | 0.5 hours |
| • Power dip | |
| Sensitivity | |
| Recovery procedure | 0.5 hours |

## 4. Safety aspects

*Provide this information to the safety manager!*

List the safety considerations that have to be made:

| | |
|---|---|
| • Is the new tool CE compliant?<br>If not, who will do the CE marking? | Yes |
| • Do you have a signed copy of the CE certificate of conformity? | |
| • Does the tool use ionising radiation? | No |
| • Does the equipment or process use chemicals or gases ?<br>If yes, what chemicals or gases ?<br>Is a recent MSDS or CPI card available of the chemicals or gases ? | No |
| • Does the tool contain or process liquid chemicals ?<br>If yes, is the tool made out of non-combustible material ?<br>Specify material:<br>If not or if flammable liquids are processed, does the tool have an automatic extinguishing system ? | No |

## 5. Environmental aspects

*Provide all this information to the environmental officer!*

List all special environmental aspects that have to be considered:

| | |
|---|---|
| • Does the equipment or process have an impact on the water usage? | No |
| Does the tool or process require DI-water? If yes, how much? | No |
| At the maximum capacity, what is the estimated quantity of waste water discharged? | |
| List expected constituents in waste water | |
| What's the expected pH of the waste water, acid or base? | |
| • Does the equipment or process require gases? | No |
| What gases are needed? | |
| At maximum capacity, what volume is needed of every gas in 1 yr? | |
| Will the amount of stored gases change? If yes, how much will be added or removed? | |
| Does the new tool or the tool where the new process is added have abatement (scrubber)? | |
| • Does the equipment or process require liquid chemicals? | No |

| | |
|---|---|
| What liquid chemicals are needed? | |
| At maximum capacity, what volume is needed of every liquid chemical in 1 yr? | |
| At maximum capacity, estimate the quantity of each type of hazardous waste expected? | |

## 6. Fab Layout

| | |
|---|---|
| Define the location of new equipment in Fab taking into account production, maintenance and facilities considerations | Litho Fab 2 |

## 7. Facility and bypack requirements

- List the required facilities:

| | |
|---|---|
| Floorspace (measurement unit + operator console dimensions) | 124.5 cm x 94 cm + 62.5 cm x 83.8 cm |
| Weight | 453.5 kg |
| Vibration requirements :<br>2 microns peak to peak below 7 Hz<br>0.5 microns peak to peak 7 Hz to 150 Hz<br>2.0 microns peak to peak above 150 Hz | Similar to stepper vibration system |
| Power requirements | 115 V 50/60 Hz, 20 Amp, single phase |
| Heat dissipation | NA |
| Exhaust | NA |
| DI-water | NA |
| City water | NA |
| Cooling water | NA |
| Vacuum | -24 to –27 in HG, 0.8 cfm, hose fitting ¼ in OD |
| Clean Compressed Air | 90 psi 2cfm, hose fitting ¼ inch |
| Chemical distribution system | NA |
| Gases | NA |
| Detection (gas, fire, leak) | NA |
| Drain | NA |
| Waste treatment | NA |

| | |
|---|---|
| • List the required bypack equipment | |
| Vacuum pumps | NA |
| Heat exchangers | NA |
| Gas scrubbers/environmental requirements | NA |
| Transformers | |

## 8. Maintainability

| | |
|---|---|
| • Spares: typical set (cost & lifetime) & common spares with existing equipment | 31 K $ |
| • PM kits/swap kits: kit of parts required for a specific PM | |
| • Documentation: | |
| Spare parts list | |
| Exploded mechanical drawings | |
| Schematics (electronics, gas distribution, ...) | |
| Maintenance manual procedures and frequency | |
| • Support, possibility to have: | |
| On-site support for set-up and maintenance | YES |
| Training at vendor site (process-operator / maintenance) | YES |
| Expert training from field experts on site | YES |

## 9. Manufacturing integration

| | |
|---|---|
| • Back-up scenarios from and to other equipment | YES |
| • Possibility of retrofitting other technologies | YES |
| • Reclaim procedure for monitor and conditioning wafers | NA |
| • Link with CIM infrastructure | Extra cost |
| - automation/LIS/data communication | |
| • compatibility with other wafer sizes | 4 to 8 inch |

## 10. Cost

| | |
|---|---|
| • Investments: | |
| Equipment (incl. options) | |
| Facilities | |
| Safety/environment (precautions/adaptations) | NA |
| Bypack | |
| Spare kits | 31 k $ |
| • Expenses: | |

| | |
|---|---|
| Consumables / raw materials per waferpass | NA |
| Cost of maintenance (PM + cleaning) (incl. bypack) | |
| Maintenance contract | NA |
| Monitoring and conditioning (wafers and consumables) | |
| Cost of facilities (incl. waste treatment) | |

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February 27, 2004

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Farid Askary
President
MetroBoost

## Measurement System analysis Data Sheet

| | | | | | |
|---|---|---|---|---|---|
| Measurement System : | IVS | Date : | **25-Feb-04** | Performed by : | Soluris |
| Measurement Program : | HIMQN\180\OVERLAY Y direction | | | | |

| Operation number : | 3537 | LSL : | -0.18 | USL : | 0.18 |
|---|---|---|---|---|---|

| operator | A | | | | B | | | | C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | T1 | T2 | T3 | R | T1 | T2 | T3 | R | T1 | T2 | T3 | R |
| 1 | -0.0652 | -0.0646 | -0.0649 | 0.0006 | -0.0686 | -0.0581 | -0.0671 | 0.0105 | -0.0625 | -0.0638 | -0.0681 | 0.0056 |
| 2 | -0.0287 | -0.0249 | -0.026 | 0.0038 | -0.0264 | -0.028 | -0.0286 | 0.0022 | -0.0285 | -0.0239 | -0.0247 | 0.0046 |
| 3 | -0.0396 | -0.0398 | -0.0406 | 0.001 | -0.0396 | -0.0396 | -0.0427 | 0.0031 | -0.0408 | -0.0374 | -0.039 | 0.0034 |
| 4 | -0.0159 | -0.0192 | -0.0157 | 0.0035 | -0.0163 | -0.0158 | -0.0178 | 0.002 | -0.0148 | -0.0177 | -0.0165 | 0.0029 |
| 5 | -0.0367 | -0.0398 | -0.0362 | 0.0036 | -0.0353 | -0.0376 | -0.0305 | 0.0071 | -0.0345 | -0.0341 | -0.0344 | 0.0004 |
| 6 | -0.0127 | -0.0089 | -0.0138 | 0.0049 | -0.0138 | -0.0117 | -0.0113 | 0.0025 | -0.0162 | -0.0133 | -0.0135 | 0.0029 |
| 7 | -0.0223 | -0.0222 | -0.0249 | 0.0027 | -0.0211 | -0.0229 | -0.0243 | 0.0032 | -0.026 | -0.0239 | -0.0228 | 0.0032 |
| 8 | -0.003 | -0.0006 | 0.0005 | 0.0035 | -0.0026 | -0.0007 | -0.0032 | 0.0025 | -0.0014 | -0.0031 | 0.0005 | 0.0036 |
| 9 | -0.0239 | -0.0248 | -0.0247 | 0.0009 | -0.0253 | -0.0231 | -0.0249 | 0.0022 | -0.0254 | -0.0274 | -0.0248 | 0.0026 |
| 10 | 0.0097 | 0.0113 | 0.0108 | 0.0016 | 0.0077 | 0.0115 | 0.0101 | 0.0038 | 0.0104 | 0.0097 | 0.0094 | 0.001 |
| 11 | | | | 0 | | | | 0 | | | | 0 |
| 12 | | | | 0 | | | | 0 | | | | 0 |
| 13 | | | | 0 | | | | 0 | | | | 0 |
| 14 | | | | 0 | | | | 0 | | | | 0 |
| 15 | | | | 0 | | | | 0 | | | | 0 |

| Totals | -0.238 | -0.234 | -0.236 | 0.026 | -0.241 | -0.226 | -0.240 | 0.039 | -0.240 | -0.235 | -0.234 | 0.030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 10 | | | N | 10 | | | N | 10 | | | |
| Trials | 2 | | | Oper. | 3 | | | | | | | |

| | |
|---|---|
| T1 | -0.238 |
| T2 | -0.234 |
| T3 | -0.236 |
| SUM | -0.707 |
| Xav | -0.024 |
| Rav | 0.003 |

| | |
|---|---|
| T1 | -0.241 |
| T2 | -0.226 |
| T3 | -0.240 |
| SUM | -0.708 |
| Xav | -0.024 |
| Rav | 0.004 |

| | |
|---|---|
| T1 | -0.240 |
| T2 | -0.235 |
| T3 | -0.234 |
| SUM | -0.709 |
| Xav | -0.024 |
| Rav | 0.003 |

| | |
|---|---|
| Raverage | 0.003 |
| UCLrange | 0.010 |

| | |
|---|---|
| $d_2$ | 1.128 |
| D2s | 1.910 |
| D4 | 3.267 |

| | | |
|---|---|---|
| Xmax | -0.024 | |
| Xmin | -0.024 | |
| Xdelta | 0.000 | 0.000 |

| | | |
|---|---|---|
| Repeatability : | **0.017** | Variation in measurement when one operator uses the same instrument and measures the same parts |
| Reproducability : | **0.000** | Variation in measurement due to different operators or instruments, measuring the same parts |
| R&R : | **0.017** | Total variation due to repeatability and reproducibility |
| R&R % : | **4.70** | Percent of the tolerance that is taken up by measurement error |

## Measurement System analysis Data Sheet

| | | | | | |
|---|---|---|---|---|---|
| Measurement System : | IVS | Date : | **25-Feb-04** | Performed by : | Soluris |
| Measurement Program : | HIMQN\180\OVERLAY X direction | | | | |

| Operation number : | 3537 | LSL : | -0.18 | USL : | 0.18 |
|---|---|---|---|---|---|

| operator | A | | | | B | | | | C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | T1 | T2 | T3 | R | T1 | T2 | T3 | R | T1 | T2 | T3 | R |
| 1 | 0.0228 | 0.0215 | 0.0197 | 0.0031 | 0.0224 | 0.0201 | 0.0234 | 0.0033 | 0.0216 | 0.0224 | 0.021 | 0.0014 |
| 2 | 0.0547 | 0.0527 | 0.056 | 0.0033 | 0.0536 | 0.0555 | 0.053 | 0.0025 | 0.0538 | 0.0556 | 0.0534 | 0.0022 |
| 3 | 0.0292 | 0.0275 | 0.0296 | 0.0021 | 0.0284 | 0.0279 | 0.0298 | 0.0019 | 0.0284 | 0.0273 | 0.0283 | 0.0011 |
| 4 | 0.0567 | 0.0569 | 0.0571 | 0.0004 | 0.0547 | 0.0565 | 0.0563 | 0.0018 | 0.0562 | 0.0568 | 0.0555 | 0.0013 |
| 5 | 0.0442 | 0.0424 | 0.0394 | 0.0048 | 0.0409 | 0.0418 | 0.0411 | 0.0009 | 0.0429 | 0.0412 | 0.0396 | 0.0033 |
| 6 | 0.0525 | 0.0496 | 0.0498 | 0.0029 | 0.052 | 0.0496 | 0.0502 | 0.0024 | 0.0525 | 0.0498 | 0.0524 | 0.0027 |
| 7 | 0.007 | 0.0084 | 0.0073 | 0.0014 | 0.0063 | 0.0074 | 0.0078 | 0.0015 | 0.0081 | 0.0081 | 0.0076 | 0.0005 |
| 8 | 0.0373 | 0.0377 | 0.0365 | 0.0012 | 0.0361 | 0.036 | 0.0358 | 0.0003 | 0.0369 | 0.0355 | 0.0343 | 0.0026 |
| 9 | 0.0227 | 0.0238 | 0.0241 | 0.0014 | 0.024 | 0.0234 | 0.0232 | 0.0008 | 0.0241 | 0.0238 | 0.0225 | 0.0016 |
| 10 | 0.0157 | 0.0163 | 0.0154 | 0.0009 | 0.0168 | 0.0147 | 0.0168 | 0.0021 | 0.0155 | 0.0162 | 0.0157 | 0.0007 |
| 11 | | | | 0 | | | | 0 | | | | 0 |
| 12 | | | | 0 | | | | 0 | | | | 0 |
| 13 | | | | 0 | | | | 0 | | | | 0 |
| 14 | | | | 0 | | | | 0 | | | | 0 |
| 15 | | | | 0 | | | | 0 | | | | 0 |

| Totals | 0.343 | 0.337 | 0.335 | 0.022 | 0.335 | 0.333 | 0.337 | 0.018 | 0.340 | 0.337 | 0.330 | 0.017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 10 | | | N | 10 | | | N | 10 | | | |
| Trials | 2 | | | Oper. | 3 | | | | | | | |

| | |
|---|---|
| T1 | 0.343 |
| T2 | 0.337 |
| T3 | 0.335 |
| SUM | 1.015 |
| Xav | 0.034 |
| Rav | 0.002 |

| | |
|---|---|
| T1 | 0.335 |
| T2 | 0.333 |
| T3 | 0.337 |
| SUM | 1.006 |
| Xav | 0.034 |
| Rav | 0.002 |

| | |
|---|---|
| T1 | 0.340 |
| T2 | 0.337 |
| T3 | 0.330 |
| SUM | 1.007 |
| Xav | 0.034 |
| Rav | 0.002 |

| | |
|---|---|
| Raverage | 0.002 |
| UCLrange | 0.006 |

| | |
|---|---|
| $d_2$ | 1.128 |
| D2s | 1.910 |
| D4 | 3.267 |

| | | |
|---|---|---|
| Xmax | 0.034 | |
| Xmin | 0.034 | |
| Xdelta | 0.000 | 0.000 |

| | | |
|---|---|---|
| Repeatability : | **0.010** | Variation in measurement when one operator uses the same instrument and measures the same parts |
| Reproducability : | **0.000** | Variation in measurement due to different operators or instruments, measuring the same parts |
| R&R : | **0.010** | Total variation due to repeatability and reproducibility |
| R&R % : | **2.78** | Percent of the tolerance that is taken up by measurement error |

## Measurement System analysis Data Sheet

| | | | | | |
|---|---|---|---|---|---|
| Measurement System : | IVS | Date : | **25-Feb-04** | Performed by : | Soluris |
| Measurement Program : | CECFN\140\OVERLAY Y direction | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Operation number : | 3534 | LSL : | -0.15 | USL : | 0.15 |

| operator | A | | | | B | | | | C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | T1 | T2 | T3 | R | T1 | T2 | T3 | R | T1 | T2 | T3 | R |
| 1 | -0.0199 | -0.0216 | -0.0197 | 0.0019 | -0.0216 | -0.021 | -0.0217 | 0.0007 | -0.0219 | -0.0224 | -0.0223 | 0.0005 |
| 2 | -0.0121 | -0.0126 | -0.0135 | 0.0014 | -0.0136 | -0.014 | -0.012 | 0.002 | -0.0138 | -0.0133 | -0.0135 | 0.0005 |
| 3 | -0.015 | -0.0164 | -0.0169 | 0.0019 | -0.0174 | -0.0157 | -0.0167 | 0.0017 | -0.0162 | -0.0175 | -0.017 | 0.0013 |
| 4 | -0.0345 | -0.0342 | -0.0343 | 0.0003 | -0.0332 | -0.0347 | -0.0334 | 0.0015 | -0.0345 | -0.0341 | -0.0339 | 0.0006 |
| 5 | -0.0327 | -0.0326 | -0.0335 | 0.0009 | -0.034 | -0.0325 | -0.0336 | 0.0015 | -0.0328 | -0.0339 | -0.033 | 0.0011 |
| 6 | -0.0248 | -0.0249 | -0.0249 | 1E-04 | -0.0258 | -0.0261 | -0.0255 | 0.0006 | -0.0255 | -0.0257 | -0.0255 | 0.0002 |
| 7 | -0.0149 | -0.0159 | -0.0165 | 0.0016 | -0.0163 | -0.0164 | -0.0165 | 0.0002 | -0.0165 | -0.0169 | -0.0165 | 0.0004 |
| 8 | -0.0067 | -0.0069 | -0.0069 | 0.0002 | -0.0075 | -0.0072 | -0.0072 | 0.0003 | -0.008 | -0.0075 | -0.0082 | 0.0007 |
| 9 | -0.017 | -0.0158 | -0.0164 | 0.0012 | -0.0174 | -0.0163 | -0.0175 | 0.0012 | -0.0173 | -0.018 | -0.0177 | 0.0007 |
| 10 | -0.0307 | -0.0308 | -0.0307 | 1E-04 | -0.0315 | -0.0311 | -0.0316 | 0.0005 | -0.0295 | -0.0313 | -0.0309 | 0.0018 |
| 11 | | | | 0 | | | | 0 | | | | 0 |
| 12 | | | | 0 | | | | 0 | | | | 0 |
| 13 | | | | 0 | | | | 0 | | | | 0 |
| 14 | | | | 0 | | | | 0 | | | | 0 |
| 15 | | | | 0 | | | | 0 | | | | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Totals | -0.208 | -0.212 | -0.213 | 0.010 | -0.218 | -0.215 | -0.216 | 0.010 | -0.216 | -0.221 | -0.219 | 0.008 |
| N | 10 | | | N | 10 | | | N | 10 | | | |
| Trials | 2 | | | Oper. | 3 | | | | | | | |

| | |
|---|---|
| T1 | -0.208 |
| T2 | -0.212 |
| T3 | -0.213 |
| SUM | -0.633 |
| Xav | -0.021 |
| Rav | 0.001 |

| | |
|---|---|
| T1 | -0.218 |
| T2 | -0.215 |
| T3 | -0.216 |
| SUM | -0.649 |
| Xav | -0.022 |
| Rav | 0.001 |

| | |
|---|---|
| T1 | -0.216 |
| T2 | -0.221 |
| T3 | -0.219 |
| SUM | -0.655 |
| Xav | -0.022 |
| Rav | 0.001 |

| | |
|---|---|
| Raverage | 0.001 |
| UCLrange | 0.003 |

| | |
|---|---|
| $d_2$ | 1.128 |
| D2s | 1.910 |
| D4 | 3.267 |

| | | |
|---|---|---|
| Xmax | -0.021 | |
| Xmin | -0.022 | |
| Xdelta | 0.001 | 0.000 |

| | | |
|---|---|---|
| Repeatability : | **0.005** | Variation in measurement when one operator uses the same instrument and measures the same parts |
| Reproducability : | **0.002** | Variation in measurement due to different operators or instruments, measuring the same parts |
| R&R : | **0.005** | Total variation due to repeatability and reproducibility |
| R&R % : | **1.76** | Percent of the tolerance that is taken up by measurement error |

## Measurement System analysis Data Sheet

| | | | | | |
|---|---|---|---|---|---|
| Measurement System : | IVS | Date : | **25-Feb-04** | Performed by : | Soluris |
| Measurement Program : | CECFN\140\OVERLAY X direction | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Operation number : | 3534 | LSL : | -0.15 | USL : | 0.15 |

| operator | A | | | | B | | | | C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | T1 | T2 | T3 | R | T1 | T2 | T3 | R | T1 | T2 | T3 | R |
| 1 | 0.0882 | 0.0878 | 0.0869 | 0.0013 | 0.087 | 0.0879 | 0.0872 | 0.0009 | 0.0872 | 0.0866 | 0.0869 | 0.0006 |
| 2 | 0.1071 | 0.1076 | 0.1073 | 0.0005 | 0.1072 | 0.1073 | 0.1081 | 0.0009 | 0.1072 | 0.1073 | 0.1076 | 0.0004 |
| 3 | 0.0722 | 0.0716 | 0.0724 | 0.0008 | 0.0729 | 0.0722 | 0.0724 | 0.0007 | 0.0727 | 0.0728 | 0.072 | 0.0008 |
| 4 | 0.0691 | 0.0695 | 0.0695 | 0.0004 | 0.0704 | 0.07 | 0.0704 | 0.0004 | 0.0692 | 0.0693 | 0.0687 | 0.0006 |
| 5 | 0.0915 | 0.0897 | 0.091 | 0.0018 | 0.0903 | 0.0907 | 0.0916 | 0.0013 | 0.0905 | 0.0892 | 0.0917 | 0.0025 |
| 6 | 0.0859 | 0.0856 | 0.0858 | 0.0003 | 0.0864 | 0.0858 | 0.0849 | 0.0015 | 0.0856 | 0.0862 | 0.0862 | 0.0006 |
| 7 | 0.1253 | 0.1258 | 0.1262 | 0.0009 | 0.1263 | 0.1247 | 0.1258 | 0.0016 | 0.1246 | 0.1254 | 0.1249 | 0.0008 |
| 8 | 0.089 | 0.0888 | 0.0892 | 0.0004 | 0.0892 | 0.0886 | 0.0892 | 0.0006 | 0.0887 | 0.0888 | 0.0897 | 0.001 |
| 9 | 0.0628 | 0.0632 | 0.0635 | 0.0007 | 0.0636 | 0.0628 | 0.0632 | 0.0008 | 0.0623 | 0.0642 | 0.0625 | 0.0019 |
| 10 | 0.0592 | 0.0589 | 0.0594 | 0.0005 | 0.0591 | 0.0595 | 0.0597 | 0.0006 | 0.0593 | 0.0593 | 0.0599 | 0.0006 |
| 11 | | | | 0 | | | | 0 | | | | 0 |
| 12 | | | | 0 | | | | 0 | | | | 0 |
| 13 | | | | 0 | | | | 0 | | | | 0 |
| 14 | | | | 0 | | | | 0 | | | | 0 |
| 15 | | | | 0 | | | | 0 | | | | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Totals | 0.850 | 0.849 | 0.851 | 0.008 | 0.852 | 0.850 | 0.853 | 0.009 | 0.847 | 0.849 | 0.850 | 0.010 |
| N | 10 | | | N | 10 | | | N | 10 | | | |
| Trials | 2 | | | Oper. | 3 | | | | | | | |

| | |
|---|---|
| T1 | 0.850 |
| T2 | 0.849 |
| T3 | 0.851 |
| SUM | 2.550 |
| Xav | 0.085 |
| Rav | 0.001 |

| | |
|---|---|
| T1 | 0.852 |
| T2 | 0.850 |
| T3 | 0.853 |
| SUM | 2.554 |
| Xav | 0.085 |
| Rav | 0.001 |

| | |
|---|---|
| T1 | 0.847 |
| T2 | 0.849 |
| T3 | 0.850 |
| SUM | 2.547 |
| Xav | 0.085 |
| Rav | 0.001 |

| | |
|---|---|
| Raverage | 0.001 |
| UCLrange | 0.003 |

| | |
|---|---|
| $d_2$ | 1.128 |
| D2s | 1.910 |
| D4 | 3.267 |

| | | |
|---|---|---|
| Xmax | 0.085 | |
| Xmin | 0.085 | |
| Xdelta | 0.000 | 0.000 |

| | | |
|---|---|---|
| Repeatability : | **0.005** | Variation in measurement when one operator uses the same instrument and measures the same parts |
| Reproducability : | **0.000** | Variation in measurement due to different operators or instruments, measuring the same parts |
| R&R : | **0.005** | Total variation due to repeatability and reproducibility |
| R&R % : | **1.58** | Percent of the tolerance that is taken up by measurement error |

## Measurement System analysis Data Sheet

| | | | | | |
|---|---|---|---|---|---|
| Measurement System : | IVS | Date : | **25-Feb-04** | Performed by : | Soluris |
| Measurement Program : | CECFN\090\OVERLAY Y direction | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Operation number : | 3527 | LSL : | -0.1 | USL : | 0.1 |

| operator | A | | | | B | | | | C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | T1 | T2 | T3 | R | T1 | T2 | T3 | R | T1 | T2 | T3 | R |
| 1 | -0.0204 | -0.0214 | -0.021 | 0.001 | -0.0216 | -0.0213 | -0.0205 | 0.0011 | -0.0223 | -0.02 | -0.0207 | 0.0023 |
| 2 | -0.013 | -0.0124 | -0.0128 | 0.0006 | -0.0121 | -0.0129 | -0.0127 | 0.0008 | -0.0136 | -0.0116 | -0.0115 | 0.0021 |
| 3 | 0.0091 | 0.0081 | 0.0068 | 0.0023 | 0.0079 | 0.009 | 0.0082 | 0.0011 | 0.0086 | 0.0074 | 0.0082 | 0.0012 |
| 4 | 0.0037 | 0.0039 | 0.005 | 0.0013 | 0.0051 | 0.0045 | 0.0048 | 0.0006 | 0.0046 | 0.0043 | 0.0042 | 0.0004 |
| 5 | -0.0253 | -0.0255 | -0.0249 | 0.0006 | -0.0263 | -0.0258 | -0.0289 | 0.0031 | -0.0262 | -0.0255 | -0.0275 | 0.002 |
| 6 | -0.0028 | -0.0007 | -0.0008 | 0.0021 | -0.0006 | -0.0023 | -0.0021 | 0.0017 | -0.0011 | -0.0018 | -0.0011 | 0.0007 |
| 7 | -0.0406 | -0.0399 | -0.0424 | 0.0025 | -0.0398 | -0.0407 | -0.0413 | 0.0015 | -0.042 | -0.0409 | -0.0406 | 0.0014 |
| 8 | -0.029 | -0.0279 | -0.0284 | 0.0011 | -0.0281 | -0.0289 | -0.0278 | 0.0011 | -0.0299 | -0.0283 | -0.028 | 0.0019 |
| 9 | -0.0111 | -0.008 | -0.0105 | 0.0031 | -0.0082 | -0.008 | -0.0086 | 0.0006 | -0.0085 | -0.0094 | -0.0085 | 0.0009 |
| 10 | -0.0097 | -0.0101 | -0.0095 | 0.0006 | -0.0105 | -0.01 | -0.0092 | 0.0013 | -0.0106 | -0.0088 | -0.0107 | 0.0019 |
| 11 | | | | 0 | | | | 0 | | | | 0 |
| 12 | | | | 0 | | | | 0 | | | | 0 |
| 13 | | | | 0 | | | | 0 | | | | 0 |
| 14 | | | | 0 | | | | 0 | | | | 0 |
| 15 | | | | 0 | | | | 0 | | | | 0 |
| Totals | -0.139 | -0.134 | -0.139 | 0.015 | -0.134 | -0.136 | -0.138 | 0.013 | -0.141 | -0.135 | -0.136 | 0.015 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| N | 10 | | N | 10 | | N | 10 | |
| Trials | 2 | | Oper. | 3 | | | | |

| | |
|---|---|
| T1 | -0.139 |
| T2 | -0.134 |
| T3 | -0.139 |
| SUM | -0.412 |
| Xav | -0.014 |
| Rav | 0.002 |

| | |
|---|---|
| T1 | -0.134 |
| T2 | -0.136 |
| T3 | -0.138 |
| SUM | -0.409 |
| Xav | -0.014 |
| Rav | 0.001 |

| | |
|---|---|
| T1 | -0.141 |
| T2 | -0.135 |
| T3 | -0.136 |
| SUM | -0.412 |
| Xav | -0.014 |
| Rav | 0.001 |

| | |
|---|---|
| Raverage | 0.001 |
| UCLrange | 0.005 |

| | |
|---|---|
| $d_2$ | 1.128 |
| D2s | 1.910 |
| D4 | 3.267 |

| | | |
|---|---|---|
| Xmax | -0.014 | |
| Xmin | -0.014 | |
| Xdelta | 0.000 | 0.000 |

| | |
|---|---|
| Repeatability : | **0.008** |
| Reproducability : | **0.000** |
| R&R : | **0.008** |
| R&R % : | **3.80** |

Variation in measurement when one operator uses the same instrument and measures the same parts

Variation in measurement due to different operators or instruments, measuring the same parts

Total variation due to repeatability and reproducibility

Percent of the tolerance that is taken up by measurement error

## Measurement System analysis Data Sheet

| | | | | | |
|---|---|---|---|---|---|
| Measurement System : | IVS | Date : | **25-Feb-04** | Performed by : | Soluris |
| Measurement Program : | CECFN\090\OVERLAY X direction | | | | |

| Operation number : | 3527 | LSL : | -0.1 | USL : | 0.1 |
|---|---|---|---|---|---|

| operator | A | | | | B | | | | C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | T1 | T2 | T3 | R | T1 | T2 | T3 | R | T1 | T2 | T3 | R |
| 1 | -0.0479 | -0.0499 | -0.05 | 0.0021 | -0.0501 | -0.0502 | -0.0491 | 0.0011 | -0.0497 | -0.0494 | -0.0498 | 0.0004 |
| 2 | 0.0401 | 0.0407 | 0.0413 | 0.0012 | 0.0407 | 0.0414 | 0.0398 | 0.0016 | 0.0407 | 0.0396 | 0.0392 | 0.0015 |
| 3 | -0.0504 | -0.0499 | -0.05 | 0.0005 | -0.0529 | -0.0533 | -0.0507 | 0.0026 | -0.0511 | -0.0507 | -0.0508 | 0.0004 |
| 4 | 0.0525 | 0.0529 | 0.0524 | 0.0005 | 0.0531 | 0.0519 | 0.053 | 0.0012 | 0.052 | 0.0527 | 0.0531 | 0.0011 |
| 5 | -0.0558 | -0.0555 | -0.0548 | 0.001 | -0.0551 | -0.0568 | -0.0548 | 0.002 | -0.0557 | -0.0557 | -0.0577 | 0.002 |
| 6 | 0.0694 | 0.0693 | 0.0695 | 0.0002 | 0.0685 | 0.069 | 0.0697 | 0.0012 | 0.0697 | 0.0702 | 0.07 | 0.0005 |
| 7 | -0.0287 | -0.0289 | -0.0281 | 0.0008 | -0.0286 | -0.0281 | -0.0296 | 0.0015 | -0.0288 | -0.0295 | -0.0294 | 0.0007 |
| 8 | 0.0611 | 0.0627 | 0.0617 | 0.0016 | 0.0619 | 0.0617 | 0.0624 | 0.0007 | 0.0618 | 0.0628 | 0.0624 | 0.001 |
| 9 | -0.0197 | -0.0208 | -0.0208 | 0.0011 | -0.0205 | -0.0208 | -0.0211 | 0.0006 | -0.0207 | -0.0197 | -0.0205 | 0.001 |
| 10 | 0.073 | 0.0708 | 0.0714 | 0.0022 | 0.0732 | 0.0727 | 0.0719 | 0.0013 | 0.0721 | 0.0726 | 0.0733 | 0.0012 |
| 11 | | | | 0 | | | | 0 | | | | 0 |
| 12 | | | | 0 | | | | 0 | | | | 0 |
| 13 | | | | 0 | | | | 0 | | | | 0 |
| 14 | | | | 0 | | | | 0 | | | | 0 |
| 15 | | | | 0 | | | | 0 | | | | 0 |

| Totals | 0.094 | 0.091 | 0.093 | 0.011 | 0.090 | 0.088 | 0.092 | 0.014 | 0.090 | 0.093 | 0.090 | 0.010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 10 | | | N | 10 | | | N | 10 | | | |
| Trials | 2 | | | Oper. | 3 | | | | | | | |

| | |
|---|---|
| T1 | 0.094 |
| T2 | 0.091 |
| T3 | 0.093 |
| SUM | 0.278 |
| Xav | 0.009 |
| Rav | 0.001 |

| | |
|---|---|
| T1 | 0.090 |
| T2 | 0.088 |
| T3 | 0.092 |
| SUM | 0.269 |
| Xav | 0.009 |
| Rav | 0.001 |

| | |
|---|---|
| T1 | 0.090 |
| T2 | 0.093 |
| T3 | 0.090 |
| SUM | 0.273 |
| Xav | 0.009 |
| Rav | 0.001 |

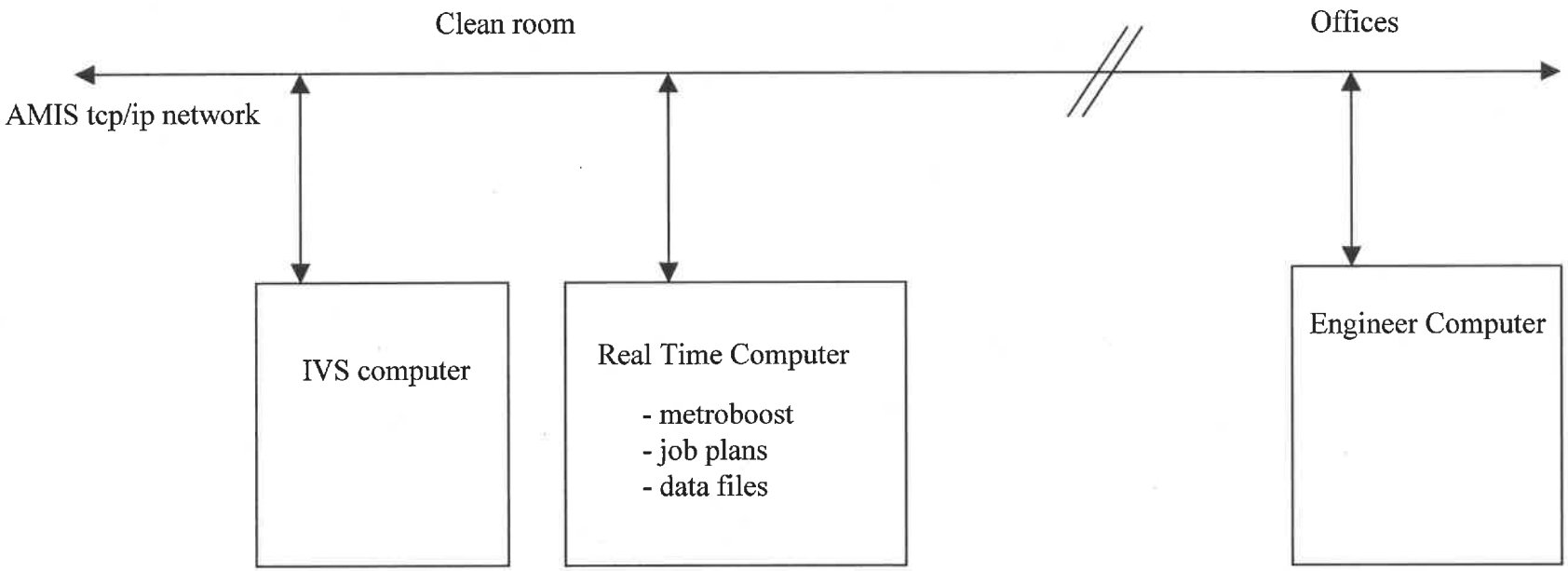
| | |
|---|---|
| Raverage | 0.001 |
| UCLrange | 0.004 |

| | |
|---|---|
| $d_2^*$ | 1.128 |
| D2s | 1.910 |
| D4 | 3.267 |

| | | |
|---|---|---|
| Xmax | 0.009 | |
| Xmin | 0.009 | |
| Xdelta | 0.000 | 0.000 |

| | | |
|---|---|---|
| Repeatability : | **0.006** | Variation in measurement when one operator uses the same instrument and measures the same parts |
| Reproducability : | **0.000** | Variation in measurement due to different operators or instruments, measuring the same parts |
| R&R : | **0.006** | Total variation due to repeatability and reproducibility |
| R&R % : | **3.09** | Percent of the tolerance that is taken up by measurement error |

**IVS 130 Networking configuration**




- IVS computer will send data file to real time computer to get Overlay Booster analysis
- IVS job plans and data files can be stored on real time computer : from the office you can open, analyze data files from engineer computer

February 10, 2004

SOLURIS


# IVS 130

# Factory Qualification Test

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Revision 1.0

SOLURIS

## Table of Contents

## I. Wafer Handling

The IVS 130 will transfer 1500 monitor wafers in a dynamic mode including: transferring wafers to the pre-aligner; finding the flat/notch; transferring the wafers to the stage; and replacing the wafers in the cassette. This test shall be performed allowing for no more than one failure. A failure will result with a handler system error code in the printed data. This test will be divided into three sessions with 500 wafers per cassette platform (3 x 500 = 1500 total wafers).

| CASSETTE PLATFORM | WAFERS CYCLED | LOAD ANGLE MIN | LOAD ANGLE MAX | LOAD ANGLE RANGE | NUMBER OF FAILURES | SPEC. (percent) |
|---|---|---|---|---|---|---|
| A | **500** | 0.0450 | 0.2500 | 0.2050 | **0** | **99.0** |
| B | **500** | -0.0410 | 0.2030 | 0.2440 | **0** | **99.0** |
| C | **500** | -0.0640 | 0.1350 | 0.1990 | **0** | **99.0** |

## II. Metrology

### A. Overlay Registration Test – Precision

The precision of the system overlay registration performance shall be demonstrated on four standard production layers as described below. This test will be performed using optimized job plans. These wafers will be selected from Customer standard production lots. One mutually acceptable wafer shall be provided for each of the registration test layers.

*Test Procedure:* This test shall include measuring box-in-box, box-in-frame, or bar-in-bar overlay registration marks on 5 fields, 2 sites per field, at agreed to locations across the wafers described. It is assumed the targets will be equivalent to IVS' standard specification for box-in-box feature dimensions which are: 10 microns for the inner box and 20 microns for the outer box. As a general rule, the inner edge of the outer box should have a dimension which is twice that of the inner box dimension. Ten dynamic mode measurements (wafer load/unload between measurements) for each site shall be taken.

*Specification:* Pooled 3 Sigma Standard Deviation $\leq$ 2.5 nanometers for each wafer. Worst Case 3 Sigma Standard Deviation $\leq$ 6.0 nanometers for any given site. It should be noted that system performance may be affected by: extremely grainy films, targets distorted by CMP, film thickness variations and edge slope variations more than +/-10% in the targeted measurement area

| SLOT | WAFER ID | X – POOLED 3σ in nm | Y – POOLED 3σ in nm | SPEC. 3σ in nm |
|---|---|---|---|---|
| 1 | APSC_N/10vs5/rg | | | 2.5 |
| 3 | HIMQ_N/180vs160/rg | | | 2.5 |
| 5 | CECF_N/90vs60/rg | | | 2.5 |
| 7 | CECF_N/140vs130/rg | | | 2.5 |

## B. Overlay Registration Test – Tool Induced Shift:

The system Tool Induced Shift (TIS) performance shall be demonstrated on the wafers from Section II.A.

*Test Procedure:* This test shall include measuring ten box-in-box overlay registration marks at agreed to locations across the wafer described. Ten static mode measurements for each site shall be taken. This test shall be run after IVS has performed the RG180 calibration process. TIS shall be calculated as follows: ((reg. measurement means for x, y axes with the notch or flat at 0 degrees) + (reg. measurement means for x, y axes with the ***notch or*** flat at 180 degrees))/2.

*Specification:* Mean Value of TIS (for both x and y axis) ≤ ±2 nanometers
Worst Case Value of TIS (for both x and y axis) ≤ ±5 nanometers

It should be noted that system performance may be affected by: extremely grainy films, targets distorted by CMP, film thickness variations and edge slope variations more than +/-10% in the targeted measurement area.

| SLOT | WAFER ID | X AXIS TIS Average In nm | Y AXIS TIS Average In nm | SPEC. In nm |
|---|---|---|---|---|
| 1 | APSC_N/10vs5/rg | | | ±2.00 |
| 3 | HIMQ_N/180vs160/rg | | | ±2.00 |
| 5 | CECF_N/60vs90/rg | | | ±2.00 |
| 7 | CECF_N/140vs130/rg | | | ±2.00 |

## C. Critical Dimension Test - Precision

The precision of the system CD performance shall be demonstrated on four standard production layers as described below. One mutually acceptable wafer shall be provided for each of the four CD test layers defined. This specification addresses the 100x lens. Specifications for measurements using the 5x, 20x, 50, and 150x lenses will be quoted upon request.

*Test Procedure:* This test shall include measuring an agreed to nominal greater than or equal to 1.0 micron line at five CD sites across the wafers described. Ten dynamic mode measurements (wafer load/unload between measurements) for each site shall be taken.

*Specification:* Pooled 3 Sigma Standard Deviation ≤12 nanometers, or 1%, whichever is greater.

| SLOT | WAFER ID | POOLED 3σ in nm | SPEC. 3σ in nm |
|---|---|---|---|
| 19 | J454_O/125/CD | 4.87 | 13.9 |
| 21 | CORA_O/160M/CD | 2.18 | 12.0 |
| 23 | AGDA_N/9/CD | 11.20 | 12.0 |
| 25 | CORA_O/160R/CD | 9.29 | 14.4 |

## D. Pitch – Accuracy and Precision

The accuracy and precision of the tool shall be demonstrated on at least 1 VLSI wafer. Pitch measurements shall be made on 2 and 4 um targets.

*Test Procedure:* This test shall include measuring a VLSI certified pitch standard. The 2.0 and 4.0 um pitch targets shall be measured ten times dynamically, and their mean and precision values shall be taken.

| SLOT | WAFER ID | PITCH in um | POOLED 3σ in nm |
|---|---|---|---|
| 16 | LWS-2620 2um | 1.996 | 2.4 |
| 16 | LWS-2620 4 um | 3.981 | 3.3 |
| 25 | LWS-2620 2um | 1.985 | 1.5 |
| 25 | LWS-2620 4 um | 3.987 | 2.7 |
| 19 | LWS-2620 2um | 1.992 | 3.0 |
| 19 | LWS-2620 4 um | 3.981 | 3.0 |

## III. Focus and Pattern Recognition:

The IVS 130 shall be able to focus and perform the pattern recognition function successfully 98% of the time on the production wafer layers defined in Section II.A and II.C. If a failure occurs, the system must continue to process wafers unassisted. A failure will result with a focus or pattern recognition system error code in the data. No wafers with known pattern defects shall be used in the testing.

| SLOT | WAFER ID | NUMBER OF SITE LOCATES | PATTERN RECOGNITION (percent) | SPEC. (percent) |
|---|---|---|---|---|
| 1 | APSC_N/10vs5/rg | 10 | | 98.0 |
| 3 | HIMQ_N/180vs160/rg | 10 | | 98.0 |
| 5 | CECF_N/60vs90/rg | 10 | | 98.0 |
| 7 | CECF_N/140vs130/rg | 10 | | 98.0 |
| 19 | J454_O/125/CD | 5 | 100.0 | 98.0 |
| 21 | CORA_O/160M/CD | 5 | 100.0 | 98.0 |
| 23 | AGDA_N/9/CD | 5 | 100.0 | 98.0 |
| 25 | CORA_O/160R/CD | 5 | 100.0 | 98.0 |

## IV. System Throughput Test:

### A. Throughput Test - 5 die/wafer; 1 site/die:

System throughput shall include measuring one registration feature in the x and y axes at each of five sites per wafer. The test will measure one layer type and will use a single job. IVS' Edge Focus method along with the grey scale pattern recognition method shall be used. System throughput shall be measured starting at the beginning of the vacuum sensing of the first wafer on the stage and ending with the tenth wafer from the stage at vacuum sense off. In the event that 10 wafers are not provided, one wafer shall be measured 10 times, and throughput shall be measured starting at the beginning of the vacuum sensing of the wafer on the stage and ending when the wafer is taken from the stage and the vacuum sensing turns off.

*Specification:* The system shall measure 90 wafers per hour performed on ten wafers using one of the standard production layers identified in section II.A.

| RUN | WAFER ID | Wafer Time In Sec. | Throughput In WPH | SPEC. In WPH |
|---|---|---|---|---|
| 1 | | 40 | 90.0 | |
| 2 | | 39 | 92.3 | |
| 3 | | 40 | 90.0 | |
| 4 | | 40 | 90.0 | |
| 5 | | 39 | 92.3 | |
| 6 | | 41 | 87.8 | |
| 7 | | 39 | 92.3 | |
| 8 | | 41 | 87.8 | |
| 9 | | 40 | 90.0 | |
| 10 | | 40 | 90.0 | |
| Average: | | | 90.3 | 90 |

## V. Particle Count:

The IVS 130 shall not add more than 10 particles, per pass per eight inch wafer, 0.1 microns in size or larger. Five test wafers and five control wafers shall be measured for particulates before the test. The test wafers shall: transfer from the cassette to the flat finder; transfer the wafer to the stage; rotate objectives; and then be replaced in the cassette. The control wafers shall be set on top of the IVS 130 to establish a background particulate level. This procedure shall be repeated five times for each wafer. The test and control wafers shall be particulate tested after completion of the ten passes. The environment around the system shall be isolated and/or be controlled for this test.

Particles per wafer, per pass, shall defined as:

PWP = W x n x ($PG_{test}$ – $PG_{control}$)

PWP = Particles per Wafer per Pass

W = Number of wafers measured

n = Number of passes through the system

PG = (Particles measured after the test) - (Particles measured before the test)

It is expected that the particle test will be run within a reasonable period of time in comparison to when the rest of the system acceptance tests are run.

| SLOT | WAFER ID | CHANGE – CONTROL WAFERS | AVERAGE PARTICLE COUNT | SPEC. (Particles ) |
|---|---|---|---|---|
| 1 | Sample | | | ≤10.0 |
| 2 | Control | | | |
| 3 | Sample | | | ≤10.0 |
| 4 | Control | | | |
| 5 | Sample | | | ≤10.0 |
| 6 | Control | | | |
| 7 | Sample | | | ≤10.0 |
| 8 | Control | | | |
| 9 | Sample | | | ≤10.0 |
| 10 | Control | | | |

***To be performed at installation only***

## VI. Software

The system software will operate according to the description in the User's Manual. Any software releases will be accompanied by a set of Release Notes which will detail the changes to the system software and operations. This documentation will be provided in a format similar to the User's Manual which will allow for the material to be added as an addendum to the manual.

In the event the optional GEM communications package is purchased, the package shall function as described in the SEMI E30-94 document excluding the limits monitoring capability. Soluris will quote modifications to this package upon request.

In the event the optional SECS II communications package is purchased, the package shall function in accordance with Soluris' specifications.

In the event the Metroboost Overlay Booster Stepper Optimization Package is purchased, the package shall provide the functionality associated with v2.38 and higher, and will be in accordance with the Overlay Booster User Guide. Soluris will quote additions and modifications to this package upon request.

In the event the optional Monolith Stepper Analysis package is purchased with real-time capability, the package shall function in accordance with the NVS Monolith manual. Soluris will quote additions and modifications to this package upon request.

## VII. Miscellaneous:

The above acceptance test specification is subject to Soluris' pre-examination of the wafers that will be used for this test. It should be noted that system performance may be affected by: extremely grainy films, film thickness variations and edge slope variations more than +/-10% in the targeted measurement area. After Soluris has reviewed the wafers submitted for the Acceptance Test, a final commitment will be made concerning the actual system performance specifications.

The system shall be considered accepted by **AMIS**, and warranty shall begin: 1. After successful completion of the agreed-to acceptance test, and sign-off by **AMIS** OR upon beneficial use by **AMIS** Beneficial use is defined as using the system for something other than testing, including but not limited to pilot production, engineering test lots, production, and device prototyping. In cases where the facility and/or utilities are not ready as committed by customer, customer is liable for revisit expenses.

The equipment shall be available and fully operational 95% of the time. A call reporting that the equipment is down must be made to Soluris before system down time can begin. Soluris Customer Service provides on-site technical support during normal business hours, which are Monday through Friday, 8:30 am to 5:30 PM local time (exclusive of Soluris Holidays) during the Warranty period. Soluris also provides Answering Service support 7 days per week, 24 hours per day. This service will route your incoming calls accordingly. Wafers for the above tests shall be provided to Soluris as soon as possible although no later than six weeks prior to the scheduled shipment date. These wafers shall be used for the factory acceptance and the final acceptance testing at the customer facility.

## VIII. System Facory Acceptance Testing

The IVS 130 has successfully demonstrated the capability expected by the customer for Source Acceptance. Shipment from Soluris is authorized.

SOLURIS

| | |
|---|---|
| **John Podlesny**<br>Applications Group Leader<br>Soluris Inc. | Date |
| **Leo Schlegel**<br>Sr. Process Engineer<br>AMI Semiconductor Belgium BVBA | Date |

February 27, 2004

SOLURIS


# IVS 130

# On site Qualification Test

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Revision 1.0

SOLURIS

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## I. Wafer Handling

The IVS 130 will transfer 1500 monitor wafers in a dynamic mode including: transferring wafers to the pre-aligner; finding the flat/notch; transferring the wafers to the stage; and replacing the wafers in the cassette. This test shall be performed allowing for no more than one failure. A failure will result with a handler system error code in the printed data. This test will be divided into three sessions with 500 wafers per cassette platform (3 x 500 = 1500 total wafers).

| CASSETTE PLATFORM | WAFERS CYCLED | LOAD ANGLE MIN | LOAD ANGLE MAX | LOAD ANGLE RANGE | NUMBER OF FAILURES | SPEC. (percent) |
|---|---|---|---|---|---|---|
| A | **500** | 0.1090 | 0.2740 | 0.1650 | **0** | **99.0** |
| B | **500** | 0.0510 | 0.2260 | 0.1750 | **0** | **99.0** |
| C | **500** | 0.0500 | 0.2210 | 0.1710 | **0** | **99.0** |

## II. Metrology

### A. Overlay Registration Test – Precision

The precision of the system overlay registration performance shall be demonstrated on four standard production layers as described below. This test will be performed using optimized job plans. These wafers will be selected from Customer standard production lots. One mutually acceptable wafer shall be provided for each of the registration test layers.

*Test Procedure:* This test shall include measuring box-in-box, box-in-frame, or bar-in-bar overlay registration marks on 5 fields, 2 sites per field, at agreed to locations across the wafers described. It is assumed the targets will be equivalent to IVS' standard specification for box-in-box feature dimensions which are: 10 microns for the inner box and 20 microns for the outer box. As a general rule, the inner edge of the outer box should have a dimension which is twice that of the inner box dimension. Ten dynamic mode measurements (wafer load/unload between measurements) for each site shall be taken.

*Specification:* Pooled 3 Sigma Standard Deviation $\leq$ 2.5 nanometers for each wafer. Worst Case 3 Sigma Standard Deviation $\leq$ 6.0 nanometers for any given site. It should be noted that system performance may be affected by: extremely grainy films, targets distorted by CMP, film thickness variations and edge slope variations more than +/-10% in the targeted measurement area

| SLOT | WAFER ID | X – POOLED 3σ in nm | Y – POOLED 3σ in nm | SPEC. 3σ in nm |
|---|---|---|---|---|
| 1 | APSC_N/10vs5/rg | 1.9 | 3.2 | 4.0 |
| 3 | HIMQ_N/180vs160/rg | 3.1 | 5.3 | 6.0 |
| 5 | CECF_N/90vs60/rg | 2.0 | 2.3 | 2.5 |
| 7 | CECF_N/140vs130/rg | 1.6 | 1.9 | 2.5 |

## B. Overlay Registration Test – Tool Induced Shift:

The system Tool Induced Shift (TIS) performance shall be demonstrated on the wafers from Section II.A.

*Test Procedure:* This test shall include measuring ten box-in-box overlay registration marks at agreed to locations across the wafer described. Ten static mode measurements for each site shall be taken. This test shall be run after IVS has performed the RG180 calibration process. TIS shall be calculated as follows: ((reg. measurement means for x, y axes with the notch or flat at 0 degrees) + (reg. measurement means for x, y axes with the ***notch or*** flat at 180 degrees))/2.

*Specification:* Mean Value of TIS (for both x and y axis) ≤ ±2 nanometers
Worst Case Value of TIS (for both x and y axis) ≤ ±5 nanometers

It should be noted that system performance may be affected by: extremely grainy films, targets distorted by CMP, film thickness variations and edge slope variations more than +/-10% in the targeted measurement area.

| SLOT | WAFER ID | X AXIS TIS Average In nm | Y AXIS TIS Average In nm | SPEC. In nm |
|---|---|---|---|---|
| 1 | APSC_N/10vs5/rg | 0.2 | 0.3 | ±2.00 |
| 3 | HIMQ_N/180vs160/rg | -0.9 | 0.2 | ±2.00 |
| 5 | CECF_N/60vs90/rg | 0.2 | 0.2 | ±2.00 |
| 7 | CECF_N/140vs130/rg | 0.6 | 0.7 | ±2.00 |

## C. Critical Dimension Test - Precision

The precision of the system CD performance shall be demonstrated on four standard production layers as described below. One mutually acceptable wafer shall be provided for each of the four CD test layers defined. This specification addresses the 100x lens. Specifications for measurements using the 5x, 20x, 50, and 150x lenses will be quoted upon request.

*Test Procedure:* This test shall include measuring an agreed to nominal greater than or equal to 1.0 micron line at five CD sites across the wafers described. Ten dynamic mode measurements (wafer load/unload between measurements) for each site shall be taken.

*Specification:* Pooled 3 Sigma Standard Deviation ≤12 nanometers, or 1%, whichever is greater.

| SLOT | WAFER ID | POOLED 3σ in nm | SPEC. 3σ in nm |
|---|---|---|---|
| 19 | J454_O/125/CD | 5.0 | 13.9 |
| 21 | CORA_O/160M/CD | 1.9 | 12.0 |
| 23 | AGDA_N/9/CD | 11.8 | 12.0 |
| 25 | CORA_O/160R/CD | 8.4 | 14.3 |

### D. Pitch – Accuracy and Precision

The accuracy and precision of the tool shall be demonstrated on at least 1 VLSI wafer. Pitch measurements shall be made on 2 and 4 um targets.

*Test Procedure:* This test shall include measuring a VLSI certified pitch standard. The 2.0 and 4.0 um pitch targets shall be measured ten times dynamically, and their mean and precision values shall be taken.

| SLOT | WAFER ID | PITCH in um | POOLED 3σ in nm |
|---|---|---|---|
| 16 | LWS-2640 2um | 2.0011 | 2.5 |
| 16 | LWS-2640 4 um | 3.9989 | 4.2 |

## III. Focus and Pattern Recognition:

The IVS 130 shall be able to focus and perform the pattern recognition function successfully 98% of the time on the production wafer layers defined in Section II.A and II.C. If a failure occurs, the system must continue to process wafers unassisted. A failure will result with a focus or pattern recognition system error code in the data. No wafers with known pattern defects shall be used in the testing.

| SLOT | WAFER ID | NUMBER OF SITE LOCATES | PATTERN RECOGNITION (percent) | SPEC. (percent) |
|---|---|---|---|---|
| 1 | APSC_N/10vs5/rg | 10 | 100.0 | 98.0 |
| 3 | HIMQ_N/180vs160/rg | 10 | 100.0 | 98.0 |
| 5 | CECF_N/60vs90/rg | 10 | 100.0 | 98.0 |
| 7 | CECF_N/140vs130/rg | 10 | 100.0 | 98.0 |
| 19 | J454_O/125/CD | 5 | 100.0 | 98.0 |
| 21 | CORA_O/160M/CD | 5 | 100.0 | 98.0 |
| 23 | AGDA_N/9/CD | 5 | 100.0 | 98.0 |
| 25 | CORA_O/160R/CD | 5 | 100.0 | 98.0 |

## IV. System Throughput Test:

### A. Throughput Test - 5 die/wafer; 1 site/die:

System throughput shall include measuring one registration feature in the x and y axes

at each of five sites per wafer. The test will measure one layer type and will use a single job. IVS' Edge Focus method along with the grey scale pattern recognition method shall be used. System throughput shall be measured starting at the beginning of the vacuum sensing of the first wafer on the stage and ending with the tenth wafer from the stage at vacuum sense off. In the event that 10 wafers are not provided, one wafer shall be measured 10 times, and throughput shall be measured starting at the beginning of the vacuum sensing of the wafer on the stage and ending when the wafer is taken from the stage and the vacuum sensing turns off.

*Specification:* The system shall measure 90 wafers per hour performed on ten wafers using one of the standard production layers identified in section II.A.

| RUN | WAFER ID | Wafer Time In Sec. | Throughput In WPH | SPEC. In WPH |
|---|---|---|---|---|
| 1 | | 39 | 92.3 | |
| 2 | | 40 | 90.0 | |
| 3 | | 39 | 92.3 | |
| 4 | | 38 | 94.7 | |
| 5 | | 40 | 90.0 | |
| 6 | | 39 | 92.3 | |
| 7 | | 41 | 87.8 | |
| 8 | | 40 | 90.0 | |
| 9 | | 40 | 90.0 | |
| 10 | | 40 | 90.0 | |
| Average: | | | 90.9 | 90 |

## V. Particle Count:

The IVS 130 shall not add more than 10 particles, per pass per eight inch wafer, 0.1 microns in size or larger. Five test wafers and five control wafers shall be measured for particulates before the test. The test wafers shall: transfer from the cassette to the flat finder; transfer the wafer to the stage; rotate objectives; and then be replaced in the cassette. The control wafers shall be set on top of the IVS 130 to establish a background particulate level. This procedure shall be repeated five times for each wafer. The test and control wafers shall be particulate tested after completion of the ten passes. The environment around the system shall be isolated and/or be controlled for this test.

Particles per wafer, per pass, shall defined as:

PWP = W x n x ($PG_{test}$ – $PG_{control}$) = 5x5x-2=-50

PWP = Particles per Wafer per Pass

W = Number of wafers measured

n = Number of passes through the system

PG = (Particles measured after the test) - (Particles measured before the test)

It is expected that the particle test will be run within a reasonable period of time in comparison to when the rest of the system acceptance tests are run.

| SLOT | WAFER ID | PARTICLE BEFORE TEST | PARTICLE AFTER TEST | Delta | SPEC. (Particles) |
|---|---|---|---|---|---|
| 1 | Sample | 1 | 1 | 0 | ≤10.0 |
| 2 | Control | 6 | 7 | 1 | |
| 3 | Sample | 0 | 0 | 0 | ≤10.0 |
| 4 | Control | 12 | 12 | 0 | |
| 5 | Sample | 2 | 2 | 0 | ≤10.0 |
| 6 | Control | 3 | 4 | 1 | |
| 7 | Sample | 1 | 1 | 0 | ≤10.0 |
| 8 | Control | 6 | 8 | 2 | |
| 9 | Sample | 8 | 6 | –2 | ≤10.0 |
| 10 | Control | 5 | 6 | 1 | |

## VI. Software

The system software will operate according to the description in the User's Manual. Any software releases will be accompanied by a set of Release Notes which will detail the changes to the system software and operations. This documentation will be provided in a format similar to the User's Manual which will allow for the material to be added as an addendum to the manual.

In the event the optional GEM communications package is purchased, the package shall function as described in the SEMI E30-94 document excluding the limits monitoring capability. Soluris will quote modifications to this package upon request.

In the event the optional SECS II communications package is purchased, the package shall function in accordance with Soluris' specifications.

In the event the Metroboost Overlay Booster Stepper Optimization Package is purchased, the package shall provide the functionality associated with v2.38 and higher, and will be in

accordance with the Overlay Booster User Guide. Soluris will quote additions and modifications to this package upon request.

In the event the optional Monolith Stepper Analysis package is purchased with real-time capability, the package shall function in accordance with the NVS Monolith manual. Soluris will quote additions and modifications to this package upon request.

## VII. Miscellaneous:

The above acceptance test specification is subject to Soluris' pre-examination of the wafers that will be used for this test. It should be noted that system performance may be affected by: extremely grainy films, film thickness variations and edge slope variations more than +/-10% in the targeted measurement area. After Soluris has reviewed the wafers submitted for the Acceptance Test, a final commitment will be made concerning the actual system performance specifications.

The system shall be considered accepted by **AMIS**, and warranty shall begin: 1. After successful completion of the agreed-to acceptance test, and sign-off by **AMIS** OR upon beneficial use by **AMIS** Beneficial use is defined as using the system for something other than testing, including but not limited to pilot production, engineering test lots, production, and device prototyping. In cases where the facility and/or utilities are not ready as committed by customer, customer is liable for revisit expenses.

The equipment shall be available and fully operational 95% of the time. A call reporting that the equipment is down must be made to Soluris before system down time can begin. Soluris Customer Service provides on-site technical support during normal business hours, which are Monday through Friday, 8:30 am to 5:30 PM local time (exclusive of Soluris Holidays) during the Warranty period. Soluris also provides Answering Service support 7 days per week, 24 hours per day. This service will route your incoming calls accordingly. Wafers for the above tests shall be provided to Soluris as soon as possible although no later than six weeks prior to the scheduled shipment date. These wafers shall be used for the factory acceptance and the final acceptance testing at the customer facility.

SOLURIS

## VIII. System Facory Acceptance Testing

The IVS 130 has successfully demonstrated the capability expected by the customer for Source Acceptance. Shipment from Soluris is authorized.

Feb. 27, 2004

**Marc Poulingue**
Applications Engineer
Soluris Inc.

Date

Feb. 27, 2004

**Leo Schlegel**
Sr. Process Engineer
AMI Semiconductor Belgium BVBA

Date

## Measurement System analysis Data Sheet

| Measurement System : | IVS | Date : | 25-Feb-04 | Performed by : | Soluris |
|---|---|---|---|---|---|
| Measurement Program : | APSCN/010/OVERLAY - Y direction | | | | |

| Operation number : | nwell I2T | LSL : | -0.3 | USL : | 0.3 |
|---|---|---|---|---|---|

| operator | A | | | | B | | | | C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | T1 | T2 | T3 | R | T1 | T2 | T3 | R | T1 | T2 | T3 | R |
| 1 | -0.0066 | -0.0064 | -0.0058 | 0.0008 | -0.0049 | -0.0044 | -0.0042 | 0.0007 | -0.0062 | -0.0072 | -0.0065 | 0.001 |
| 2 | 0.0193 | 0.0177 | 0.0176 | 0.0017 | 0.0194 | 0.0204 | 0.0195 | 0.001 | 0.0191 | 0.0191 | 0.0177 | 0.0014 |
| 3 | -0.0043 | -0.0055 | -0.0075 | 0.0032 | -0.005 | -0.0049 | -0.0055 | 0.0006 | -0.0056 | -0.0054 | -0.0068 | 0.0014 |
| 4 | 0.0013 | -0.0008 | -0.0002 | 0.0021 | 0.0013 | 0.0006 | -0.0004 | 0.0017 | 0.0026 | -0.0012 | -0.0003 | 0.0038 |
| 5 | -0.0032 | -0.0035 | -0.0057 | 0.0025 | -0.0036 | -0.0063 | -0.0031 | 0.0032 | -0.0062 | -0.0046 | -0.005 | 0.0016 |
| 6 | -0.0113 | -0.0088 | -0.0088 | 0.0025 | -0.0091 | -0.0068 | -0.0085 | 0.0023 | -0.008 | -0.0084 | -0.0081 | 0.0004 |
| 7 | -0.0005 | -0.0016 | -0.0011 | 0.0011 | -0.0032 | -0.0017 | -0.0019 | 0.0015 | -0.0026 | -0.0015 | -0.0005 | 0.0021 |
| 8 | 0.0148 | 0.0126 | 0.0158 | 0.0032 | 0.0129 | 0.0141 | 0.0139 | 0.0012 | 0.015 | 0.0144 | 0.0138 | 0.0012 |
| 9 | 0.0211 | 0.0213 | 0.0224 | 0.0013 | 0.0206 | 0.0226 | 0.0234 | 0.0028 | 0.021 | 0.0203 | 0.0225 | 0.0022 |
| 10 | -0.0014 | 0.0005 | -0.0013 | 0.0019 | -0.0006 | -0.0012 | -0.0004 | 0.0008 | -0.0022 | -0.0022 | 0.0009 | 0.0031 |
| 11 | | | | 0 | | | | 0 | | | | 0 |
| 12 | | | | 0 | | | | 0 | | | | 0 |
| 13 | | | | 0 | | | | 0 | | | | 0 |
| 14 | | | | 0 | | | | 0 | | | | 0 |
| 15 | | | | 0 | | | | 0 | | | | 0 |

| Totals | 0.029 | 0.026 | 0.025 | 0.020 | 0.028 | 0.032 | 0.033 | 0.016 | 0.027 | 0.023 | 0.028 | 0.018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 10 | | | N | 10 | | | N | 10 | | | |
| Trials | 2 | | | Oper. | 3 | | | | | | | |

| | |
|---|---|
| T1 | 0.029 |
| T2 | 0.026 |
| T3 | 0.025 |
| SUM | 0.080 |
| Xav | 0.003 |
| Rav | 0.002 |

| | |
|---|---|
| T1 | 0.028 |
| T2 | 0.032 |
| T3 | 0.033 |
| SUM | 0.093 |
| Xav | 0.003 |
| Rav | 0.002 |

| | |
|---|---|
| T1 | 0.027 |
| T2 | 0.023 |
| T3 | 0.028 |
| SUM | 0.078 |
| Xav | 0.003 |
| Rav | 0.002 |

| | |
|---|---|
| Raverage | 0.002 |
| UCLrange | 0.006 |

| | |
|---|---|
| $d_2$ | 1.128 |
| D2s | 1.910 |
| D4 | 3.267 |

| | | |
|---|---|---|
| Xmax | 0.003 | |
| Xmin | 0.003 | |
| Xdelta | 0.001 | 0.000 |

| | |
|---|---|
| Repeatability : | **0.010** |
| Reproducability : | **0.000** |
| R&R : | **0.010** |
| R&R % : | **1.60** |

Variation in measurement when one operator uses the same instrument and measures the same parts

Variation in measurement due to different operators or instruments, measuring the same parts

Total variation due to repeatability and reproducibility

Percent of the tolerance that is taken up by measurement error