# Consistent Test Program Procedure, Proposal

A problem identified at the kick-off meeting, is the possibility of 'overlap' of tests between different TGs. Some examples of overlap:

- Most TGs will need static test results to compare them to fatigue strength, residual strength, strength under extreme conditions;
- Residual strength test results will be needed to develop models for variable amplitude;
- Block tests should be done at the same stress levels tested in the residual strength tests;
- …

The procedure below is proposed to create a consistent test programme, avoid duplications, and to allocate tests to TGs:

*A number of tables is contained in this document*

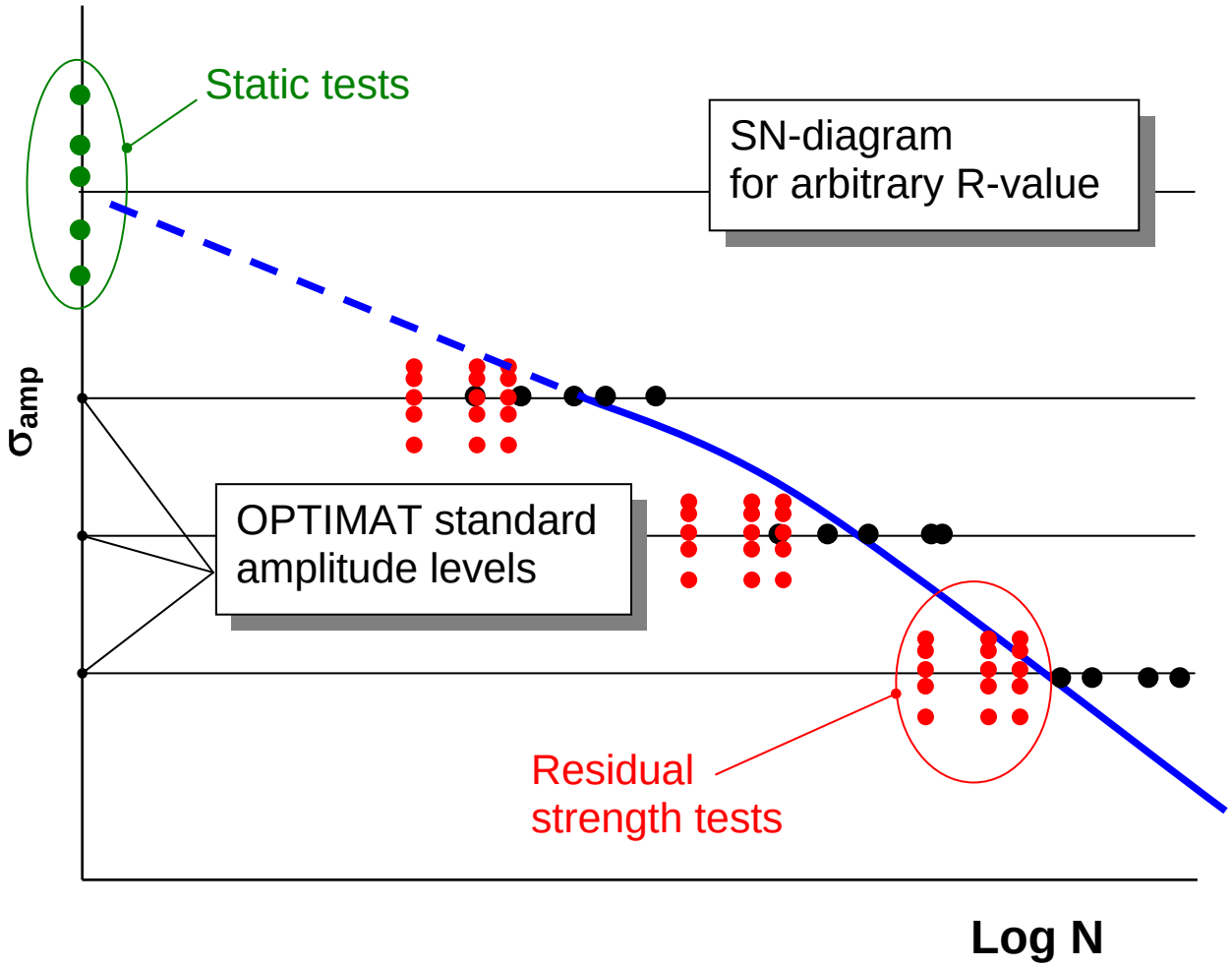
1. *TL identifies tests which are deemed necessary within TG→TL writes TG number*
2. *TL adds tests that are missing*
3. *TL notes unclarities/remarks/comments*
4. *TL sends tables to TC*

*The chairman of the TC identifies overlaps in the tables and sends the proposed test allocation to the TC for approval.*

For consistency, 3 standard amplitude levels will be defined in the CA fatigue tests. The target stress levels per SN-curve will be determined from CA tests to establish a preliminary SN-curve for that R-ratio. Then the load levels will be chosen such that the target $N_f$ will be $10^3$, $10^5$, $10^7$ cycles, respectively.

***It is proposed that only the combinations of R-value and amplitude which have been tested in the basic SN-curve determination will be used in the variable amplitude-, complex loading-, extreme condition-, thick laminates- and residual strength test programmes.***

As a consequence, if a TL wishes to test other combinations of R-values and amplitudes etc., he should indicate this when sending the table(s) to the TC.


Static tests
SN-diagram
for arbitrary R-value
σamp
OPTIMAT standard
amplitude levels
Residual
strength tests
Log N

| explanation | |
|---|---|
| NA | Not applicable |
| UD with [+/-45º] | Uni-Directional specimen with +/-45º face layers |
| MD | Multi-Directional laminate |
| T | Tension static |
| C | Compression static |
| IPS | In-plane Shear |
| CA | Constant amplitude |
| UCS | Ultimate Compressive Strength |
| UTS | Ultimate Tensile Strength |
| T-T | Tension-Tension fatigue |
| T-C | Tension-Compression fatigue |
| C-C | Compression-Compression fatigue |
| W | WISPER standard loading sequence |
| WX | WISPERX standard loading sequence |
| RW | Reversed WISPER |
| RWX | Reversed WISPERX |
| NW | New WISPER |
| NWX | New WISPERX |
| HL | $1^{st}$ block = high amplitude, $2^{nd}$ = low amplitude (block tests with $2^{nd}$ block to failure) |
| LH | $1^{st}$ block = low amplitude, $2^{nd}$ = high amplitude (block tests with $2^{nd}$ block to failure) |
| AB, BA | Denotes possible sequence variations in 2 block tests with $2^{nd}$ block to failure, e.g. $1^{st}$ block R=0.1, $2^{nd}$ block R=0.5 and vice versa. |

| Static 1 | | Standard Optimat Specimen | | |
|---|---|---|---|---|
| | | UD with [+/-45º] | MD | +/-45º (shear properties) |
| axial | T | … | … | … |
| | C | … | … | NA |
| transverse | T | … | … | NA |
| | C | … | … | NA |
| … | … | … | … | … |

*5 tests per cell OK?*

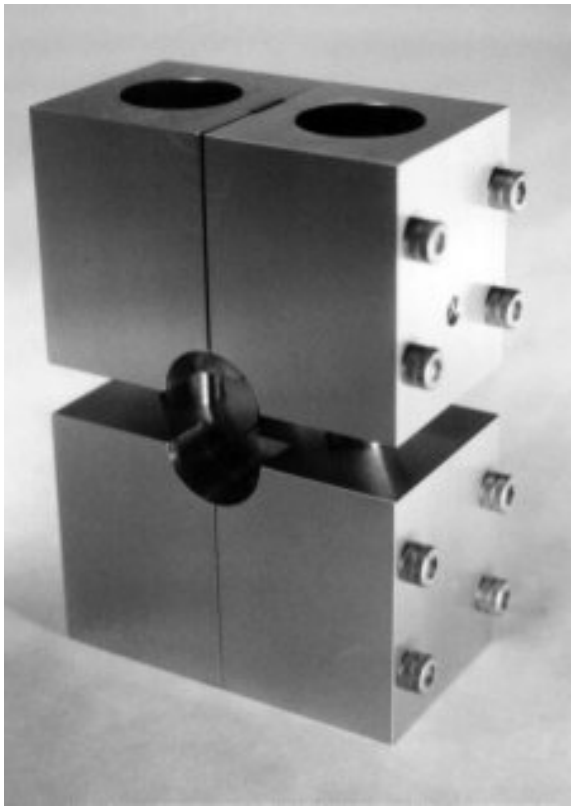
| Static 2 | | Standard ISO/ASTM Tests | | | |
|---|---|---|---|---|---|
| | | UD with [+/-45º] | MD | +/-45º (shear properties) | Pure UD (ply properties) |
| axial | T | … | … | … | … |
| | C | … | … | NA | … |
| transverse | T | … | … | NA | … |
| | C | … | … | NA | … |
| shear | IPS | … | … | NA | … |
| … | … | … | … | NA | … |

*5 tests per cell OK?*

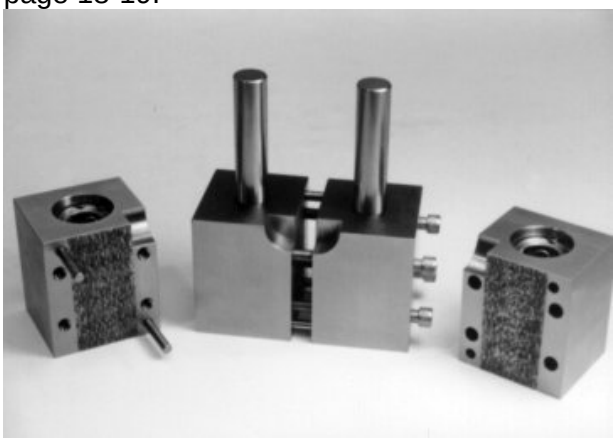
As mentioned in the test specimen proposal, and within discussions within task groups, we also need standard tests to relate the static test results with the Standard Optimat Specimen to standard tests.

We propose to use:

- ISO 527-4 for tension
- Iosipescu for shear
- ASTM D 6641 (the combined Wyoming test equipment) for compression.



See also:
http://wyomingtestfixtures.com/products.htm
page 18-19.



| CA fatigue (SN-curve definition) | | Standard Optimat Specimen | | | |
|---|---|---|---|---|---|
| | | R-value | UD with [+/-45º] | MD | +/-45º (shear properties) |
| axial | T-T | 0.1 | … | … | … |
| | | 0.5 | … | … | … |
| | T-C | -0.4 | … | … | … |
| | | -1 | … | … | … |
| | | -2.5 | … | … | … |
| | C-C | 10 | … | … | … |
| | | 2 | … | … | … |
| transverse | T-T | 0.1 | … | … | NA |
| | T-C | -1 | … | … | NA |
| | C-C | 10 | … | … | NA |
| … | … | … | … | … | … |

*3 stress levels per R-value; 5 tests per stress level =15 test per cell OK?*

| Residual Strength Testing= | | Standard Optimat Specimen | | | |
|---|---|---|---|---|---|
| | | R-value | UD with [+/-45º] | MD | +/-45º (shear properties) |
| axial | T-T | 0.1 | | … | … |
| | | 0.5 | | … | … |
| | T-C | -0.4 | | | |
| | | -1 | | … | … |
| | | -2.5 | | … | … |
| | C-C | 10 | | … | … |
| | | 2 | | … | … |
| transverse | T-T | 0.1 | | … | NA |
| | T-C | -1 | | … | NA |
| | C-C | 10 | | … | NA |
| … | … | … | … | … | … |

*5 compression- and 5 tension static tests at 20%, 50%, 80% of the lifetime as found in CA fatigue, at 3 selected stress levels from CA S-N curve= 90 tests per cell (!) OK?*