Methods of cable testing

- Drag chain tests
- Torsional stress tests
- Bending tests
- Flame tests
- Media resistant tests
Drag chain test facilities

- Due to the increasing quality and life time requirements, the cables have to withstand extreme long-term stresses in order to certify their durability.

- In LEONI's new testing facility, the cables will be tested in regards to these extreme conditions over a long period.
Drag chain test equipment

- Traverse path: 50 m
- Velocity: up to 5 m/s
- Acceleration: up to 2.5 m/s²
- Bending radius: 75 to 260 mm
- Cycles per day: approx. 3,400
- Chains: max. 8
Drag chain test equipment

- Traverse path: 20 m
- Velocity: up to 5 m/s
- Acceleration: up to 10 m/s²
- Bending radius: 260 mm
- Cycles per day: approx. 8,600
- Chains: max. 8
Drag chain equipment

- Traverse path: 10 m
- Velocity: up to 6 m/s
- Acceleration: up to 9 m/s²
- Bending radius: 200 mm
- Cycles per day: approx. 1,000
- Chains: max. 8
Drag chain test equipment

- Traverse path: 4.5 m
- Velocity: up to 5 m/s
- Acceleration: up to 30 m/s²
- Bending radius: 200 mm
- Cycles per day: approx. 35,000
- Chains: max. 8
Drag chain test equipment

- Traverse path: 2 m
- Velocity: up to 5 m/s
- Acceleration: up to 50 m/s²
- Bending radius: 170 mm
- Cycles per day: approx. 34,000
- Chains: max. 4
Drag chain monitoring system

- Cable monitoring in regards to short circuit and break
- Recording of the test cycles
- Various test programs with documentation
- Continuous measurements of the conductor resistance
- Measurement cycles are adjustable
- Break of the single conductor wires will be analysed by resistance increase
- Circular measurement of RF-parameters
Trailing cables

- LEONI offers a wide range of cables for trailing applications. These cables are tested on various test fixtures.
- The flexible laying, harsh environments and high flexible stresses all require a high quality special cable.
- LEONI trailing cables are characterised by an extreme high life expectancy combined with smallest possible bending radii.
Torsional test facilities

- The torsion test certifies the cable’s capability concerning rotation and tensile strength around its own axis.
- Cables can be subjected to torsional motion up to ±360°.
Torsional test equipment

- Test according to VDE
- Sample length: 200–1200 mm
- Angle (in 15° steps): up to ±360°
- Cycles per day: approx. 90,000
- Cables: max. 8
Torsional bending equipment

- Sample length: acc. to cable diameter
- Angle (adjustable): up to ±200°
- Cycles per day: approx. 35,000
- Samples: max. 2

Methods of cable testing
Torsional test equipment

- Sample length: 20 to 120 cm
- Cable diameter: 4 to 20 mm
- Torsion adjustable: max. ±220°
- Cycles per day: max. 60,000
- Samples: 2 × 2
Torsional stress cables

- Industrial Ethernet CAT 5e
- PROFINET
- PROFIBUS
- DeviceNet
Bending test equipment

- This test method enables to check, if the cable withstands frequent direction changes
- Variable roll diameter of 20 mm to 250 mm
S-shaped bending test equipment

- Sample length: 5 m
- Angle: S-shaped
- Velocity: up to 12 cycles/min
- Bending radius: up to 200 mm
- Cycles per day: approx. 17,000
- Samples: 1
- Tests according to VDE and IEC
Bending test equipment

- Sample length: 1.2 m
- Angle: ±90°
- Velocity: up to 35 cycles/min
- Bending radius: 20 to 250 mm
- Cycles per day: approx. 50,000
- Samples: max. 10

Tests according to VDE
Bending stress cables

- PSFD-cable
- Hybrid cable
- Carbon Fiber
- Industrial Ethernet CAT 6

Methods of cable testing
- Bending tests
- Torsional stress tests
- Drag chain tests
- Flame tests
- Media resistant tests
Flame tests

- The tests on flammability are performed according to IEC, UL, CSA, EN, VDE, NF.
- The corresponding tests provide information of:
  - the flammability of the non metallic elements present in the cable
  - the flame propagation on the cable
Single cable flame tests

Vertical flame tests
- IEC 60332-1-2 and EN 60332-1-2
- IEC 60332-2-2 and EN 60332-2-2
- UL 1581, Sec. 1061 Cable flame
- UL 2556 Sec. 9.4 VW-1
- UL 2556, Sec. 9.3 FT1

Horizontal flame tests
- UL 1581, Sec. 1090
- UL 2556 Sec. 9.1 FT2

The methods of testing in the USA and Europe are different concerning experiment set up and test duration.
Large scale flame tests

- IEC 60332-3 and EN 60332-2-3
- UL 1685 Vertical tray and UL 2556, Sec. 9.6 (UL method)
- UL 1685 FT4 / IEEE 1202 / UL 2556, Sec. 9.6 (CSA method)
- NFPA262 FT 6 Steiner tunnel
- NF C32-070 2.2 C1
- UL 1666 Riser

Methods of cable testing

- Bending tests
- Torsional stress tests
- Drag chain tests
- Flame tests
- Media resistant tests
Media resistance tests

These include:
- Oil resistance tests
- Mud resistance tests
Oil resistance tests

European standards:

- Performance of the oil resistance tests for cable jackets (insulations) according to DIN EN 60811-2-1, EN and IEC 60811-2-1
  - EN 50525-1 (DIN VDE 0281-1) for PVC-jackets
    Test duration: 7 days / 90 °C
  - EN 50525-2-21 (DIN VDE 0282-10) for TPU-jackets
    Test duration: 7 days / 100 °C

The test oil ASTM No. 2 alternate oil IRM 902 according to ASTM D471 will be generally used.
North American standards

Performance of the oil resistance tests for cable jackets (insulations) according to UL 2556 Sec. 4.2.8.3 (CSA C22.2 No. 2556)
- UL 758 Sec. 15 (for AWM-products)
  Test duration varies: 4 days / 100 °C
  60 days / 80 °C
  7 days / 60 °C
- UL 13 Sec. 40 for Power Limited tray cables (PLTC)
  Test duration varies: 4 days / 100 °C
  60 days / 75 °C

Performance of the oil resistance tests for cable jackets (insulations) according to CSA C 22.2 No. 03
- CSA C22.2 No. 210 for AWM products
  Test duration: 4 days / 100 °C
- CSA C 22.2 No. 127 for Equipment und Lead wires
  Test duration: 4 days / 100 °C
  4 hours / 70 °C

Shipbuilding standards

Performance of the oil resistance tests for cable jackets (insulations) according to DIN EN 60811-2-1, EN resp. IEC 60811-2-1
- IEC 60092-359 (for SHF2 types)
  Test duration: 1 day / 100 °C
- IEC 60092-350
  Test duration: 7 days / 100 °C
Mud resistance tests

- Mud resistance according to NEK 606 oil based (Carbo Sea®) and water based (Calcium-Bromide-Brine)
- Mud resistance according to IEC 60092-360 (Petro Free®)

Requirements of the test procedures:

- Temperature: 70 °C
- Test period: 56 days (= 1344 hours)
- Alteration of the tensile strength and elongation of break max ±25 %
- Volume change: max. ±20 %
- Mass change: max. ±15 %