Qualification table for ESX-3XL, C-sample

Environmental Tests

Standard	***Description***	***Testparameter***	***Result***
EN 60529:2000-09, DIN 40050-9:1993-05	IP Protection classes	IP 67, IP 69K	Passed
ISO16750-4:2006 (IEC 60068-2-1:1995-03)	Environmental testing: Cold (storage and operational)	24h with -40 °C	Passed
ISO16750-4:2006 (IEC 60068-2-2/A2 1995-01)	Environmental testing: Dry heat (storage and operational)	96h with +85 °C	Passed
ISO16750-4:2006 (IEC 60068-2-78:2002-09)	Environmental testing: Damp heat constant	21 days with 40 °C and 93% r. h.	Tbt
IEC 60068-2-6:1996-05	Environmental testing: Vibration sinusoidal	10 Hz to 2000 Hz / 1 Okt./min with 5g 10 sweeps bidirectional	Tbt
ISO16750-4:2006 (IEC 60068-2-14:2000-08)	Environmental testing: Change of temperature Na	-40 °C --> +85 °C, 100cycles, duration time 1h, temp. change 30 s	Passed
ISO 16750-3:2007-08	Road vehicles - Environmental conditions and testing for electrical and electronic equipment: Mechanical loads - Random vibration – Test VII	10Hz-2000Hz, 32h for each plane	Passed
ISO16750-4:2006 (IEC 60068-2-14:2000-08)	Environmental testing: Change of temperature Nb	-40 °C --> +85 °C, 30 cycles	Passed
ISO16750-3:2006 (IEC 60068-2-27:1995-03)	Environmental testing: Shock	50g/11ms, sine wave, 10 shocks/axis	Passed
IEC 60068-2-29:1995-03	Environmental testing: Bump	Bump, 30g/6ms, sine wave, 1000 shocks/axis	Passed
ISO16750-4:2006 (IEC 60068-2-38 –Z/AD:2000-02)	Environmental testing: Damp heat cyclic	+25 °C to 65 °C with 96% r. h. 10 cycles (each cycle 24 h), five cycles with freeze phase (-10°C)	Tbt
ISO16750-3:2006	Environmental testing: Free fall	1 m free fall on steelplate, 6 axis	Tbt
EN ISO 6270-2:2007-10	Paints and varnishes - Determination of resistance to humidity	8h/16h cyclic, 4d	Passed
ISO16750-4:2006 (IEC 60068-2-52:2000-02)	Sodium chloride	5% NaCl, Level 5, Testduration 28days	Passed
ISO 16750-5:2003-12	Road vehicles - Environmental conditions and testing for electrical and electronic equipment: Chemical loads	Gas/petrol, diesel, cleaner solvent, antifreezer, urea, battery fluid, brake fluid, engine oil, hydraulic oil,	Passed
ISO16750-4:2006 (IEC 60068-2-60:1995-12)	Flowing mixed gas corrosion test	Sulfur dioxide SO_2, Hydrogen sulfide H_2S, Nitrous oxide NO_2, Chlorine Cl_2	Passed

Electrical Tests

Standard	***Description***	***Testparameter***	***Result***
EN 60204-1:2008-01	Safety of machinery – electr. Equipment of machines	Air and creeping distances	Passed
Company standard STW	Power supply	Function at Umax and Umin, 1h	Passed (B-sample)
Company standard STW	Over voltage	5 Min. at (Umax + 3%)	Passed (B-sample)
Company standard STW	Under voltage	5 Min. at Umin	Passed (B-sample)
Company standard STW	Cable break at power lines	UB, UE, GND, 1min	Passed (B-sample)
Company standard STW	Short circuit protection at signal and communication lines (except RS232)	Short circuit at Ubmin and Ubmax, 1min	Passed (B-sample)
Company standard STW	Reverse polarity	5 Min at Ubmax	Passed (B-sample)
Company standard STW	Standby current	<1mA	Passed (B-sample)
Company standard STW	Data preservation	10 years	Passed (B-sample)
Company standard STW	Stress test	24h at Tmin: first 12h without operation, last 12h with operation (Imax at Umin); 48h at Tmax: Imax at Umax	Tbt
ISO16750-2:2006	Superimposed alternating voltage	Severity 3: Upp=10V, 5sweeps	Passed
	Slow decrease and increase of supply voltage	Decrease and increase supply voltage with (0,5V±0,1)V per minute	Passed
	Momentary drop in supply voltage	Single voltage drop to 4,5V (12V Systems) and to 9V (24V Systems)	Passed
	Reset behaviour at voltage drop	Voltage drops in 5% steps until to 0V, drop duration 5s	Passed
	Starting profile	Supply voltage cranking, Level I, II, III, IV for code B devices	Passed

Electromagnetic Emission and Immunity (road vehicles)

Standard	***Description***	***Ranges***	***Result***
2005/83/EG:2005-11 (Base: 72/245/EWG), 75/322/EEC:1975-06, ISO 11452-5:2002-04, ISO 11452-2:2000-03, DIN 40839-4:1992-10	Emission	150kHz to 3GHz, 1m, 120kHz bandwidth	Passed
	Immunity	Stripline: 10kHz-400MHz, 200V/m, 80%AM sine wave 1kHz; absorber lined chamber: 400MHz-3GHz, 200V/m, AM, PM t_{ON} 577µs, period 4600µs	Passed
ISO 7637-2:2004-09, DIN 40839-1:1992-10	Road vehicles, electrical disturbance by conduction and coupling Testlevel 4 for 24V Systems	Voltage transient emissions	Passed
		Pulse 1: -600V, 50 Ohms, 5000 pulses	Passed
		Pulse 2a: +50V, 2 Ohms, 5000 pulses	Passed
		Pulse 2b: +20V, 10 pulses	Passed
		Pulse 3a: -200V, 1h	Passed
		Pulse 3b: +200V, 1h	Passed
		Pulse 4: -16V, 2 pulse	Passed
		Pulse 5a: +70V, 100ms, 2 Ohms, 2 pulses	Passed
	Road vehicles, electrical disturbance by conduction and coupling Testlevel 4 for 12V Systems	Pulse 1: -300V, 10 Ohms, 5000pulses	
		Pulse 2b: 10V, 10 pulses	
		Pulse 4: -7V, 2 pulses	
ISO 7637-3:1995, DIN 40839-1:1992-10	Road vehicles, electrical disturbance by conduction and coupling (data, signal), Testlevel 4	Pulse a: -80V, 1h	Passed
		Pulse b: +80V, 1h	Passed
ISO 10605:2001-12	Electrostatic Discharge (automotive) Testlevel 4,	2kΩ/150pF, 2kΩ/330pF Contact: +/-8kV, Air: +/-15kV	Passed
		Packaging and handling: Contact: +/-8kV, Air: +/-15kV	Passed
IEC/CISPR 25:2002, EN 55025:2003-11, DIN VDE 0879-2:1999-03	Limits and methods of measurement of radio disturbance; characteristics for the protection of receivers used on board vehicles	0.15MHz to 108MHz Without extensions boards: Class 3 With extensions boards: Class2	Passed
ISO 13766:2006-05	Earth-moving machinery - Electromagnetic compatibility		Certified
DIN EN 13309:2000-11	Construction machinery - Electromagnetic compatibility of machines with internal electrical power supply		Certified
DiN EN ISO 14982:14982	Agricultural and forestry machines - Electromagnetic compatibility - Test methods and acceptance criteria		Certified

Electromagnetic Emission and Immunity (CE mark)

Standard	***Description***	***Ranges***	***Result***
EN 55011:2003-08, IEC/CISPR 11:A2 2002, EN 61000-6-3:2005-06 (former 50081-1)	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments (CE mark)	150kHz – 1GHz Group 1 Class A (with extension boards, class B limits exceeded only at 400kHz and 650kHz) 150KHz – 1GHz Group 1 Class B (without extension borads)	Passed
EN 61000-6-2:2006-03 (former EN 50082-2)	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards: Immunity for industrial environments (CE mark)	ESD (EN 61000-4-2) 330Ohms / 150pF, Contact: +/- 4kV, Air: +/- 8kV	Passed
		Radio frequency (EN 61000-4-3) 80MHz-2700MHz, 10V/m, AM, horizontal + vertical	Passed
		Burst (EN 61000-4-4) Supply: +/- 2kV; 5/50 ns; 5kHz Signal: +/- 2kV; 5/50 ns; 5kHz	Passed
		Surge (EN 61000-4-5) Supply: +/- 0.5kV; 1.2/50 µs Signal: +/- 1kV; 1.2/50 µs	Passed
		Conducted disturbance (EN 61000-4-6) 0.15MHz – 80MHz, 10V, 80%AM sine wave 1kHz	Passed
FCC: 2007	47 CFR Part 15 Subpart B	Class A	Certified

Functional Safety

Standard	***Description***	***Testparameter***	***Result***
EN 13849-1:2008-12 (former EN 954-1:1997-03)	Safety of machinery Safety-related parts of control systems	ESX-3XL safety: PL d detection of 1 error	Concept passed
DIN EN 61508:2002:11, IEC 61508:1998	Functional safety of electrical/electronic/programmable electronic safety-related systems	Safety integrity level SIL 2 with hardware fault tolerance 0 and high demand mode of operation	Concept passed

Tbt: To be tested in final sample phase (series) - in the development phase tests were partly passed in STW-labs (non accredited)