EMC LABORATORY
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Tel: 905-952-1242

IMMUNITY TO TRANSIENTS ON POWER LINES PULSE #5 TEST PROCEDURE

ISO-7637-2:2004 PULSE #5A, #5B & OEM EQUIVALENT

1. PURPOSE

1.1. To provide specific test method setup configuration instructions in full compliance with OEM specifications and international standards.

2. SCOPE

2.1. To establish consistency and repeatability in test method results using the equipment and technical resources available in EMC laboratory inventory.

3. RESPONSABILITY

3.1. EMC laboratory authorized personnel.
See **201709** *EMC LAB TEST EQUIPMENT COMPETENCY MATRIX* and **201705** *EMC LAB COMPETENCY MATRIX*.

4. EQUIPMENT & MATERIALS

4.1. All test equipment that requires calibration shall be within its calibration period and shall be traceable to A2LA certified labs. EMC lab personnel must ensure that certificates of calibration are obtained when equipment is sent out for calibration or repair. *(See REFERENCES section in document for equipment specific internal procedures and records).*

4.2. **Power supply**
* Ri of less than 0,01 Ω d.c.
* Zi = Ri for frequencies less than 400 Hz.
* output deviation =< 1 V from 0 to maximum load (including inrush current) and shall recover 63% of its maximum excursion within 100 µs.
* superimposed ripple voltage Ur =< 0,2 V peak-to-peak and shall have a minimum frequency of 400 Hz.
* simulates the low internal impedance of the battery
* battery voltages 13,5 V and 27 V, respectively.

4.3. **Oscilloscope:**
* digitizing oscilloscope (single sweep sampling rate >=2 GHz/s, bandwidth 400 MHz, input sensitivity: at least 5 mV/div.)
* analog storage oscilloscope may be used if:
  - bandwidth d.c. to at least 400 MHz;
  - writing speed of at least 100 cm/µs;
  - input sensitivity of at least 5 mV/division.

4.4. **Voltage probe:**
* attenuation of 100/1,
* maximum input voltage of at least 1 kV,
* input impedance Z and capacitance C according to Table 2 ;
* maximum probe cable length of 3 m;
* maximum probe ground length of 0,13 m.

f[MHz]	z[kΩ]	C[pF]
1	>40	<4
10	>4	<4
100	>0.4	<4

4.5. **Test pulse generator:**
* peak voltage U_s tolerance of +10% / -0%
* timing (t) tolerance of ± 20%
* internal resistance (Ri) tolerance of ± 20%

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Fig.4-1

Model Configuration	
LD 200 B1	ISO Pulse 5 and 7 SAE J1113-11 Pulse 5a SAE J1113-11 Pulse 5b (Zener Diode is required) Chrysler PF 9326 Ford CI 240
Pulse specification	
Open circuit voltage	U = 20V – 200V ± 10%
Internal resistor	selectable 0.5Ω, 1Ω, 2Ω, 10Ω as option EXTERN $R_i = R_i$,min + R_i,ext.
Polarity	Positive (Load Dump) Negative (Field decay)
ISO Pulse 5 and 7	
Rise time tr (10 - 90%)	5 – 10ms
Pulse duration td (10 - 10%)	50 – 400ms
Internal resistor	0.5Ω, 1Ω, 2Ω, 10Ω
Repetition rate	All 45s or slower

Ford ES-XW7T – 1A278AB REV B CI 240	
Open circuit voltage	60V ± 10%
Rise time tr (10 - 90%)	1 – 10ms
Pulse duration td (10 - 10%)	300ms
Pulse on a 0.7Ω load	30V ± 10%
Rise time tr (10 - 90%)	1 – 10ms
Pulse duration td (10 - 10%)	150ms ± 10%
Internal resistor	0.5Ω
Polarity	Positive
Repetition rate	3 pulses all 30s min

Chrysler PF 9326	
Open circuit voltage	91.5V ± 10%
Rise time tr (10 - 90%)	5 – 10ms
Pulse duration td (10 - 10%)	300ms
Pulse on a 0.5Ω load	45.75V ± 10%
Rise time tr (10 - 90%)	5 – 10ms
Pulse duration td (10 - 10%)	>95 ms
Internal resistor	0.5Ω and external source impedance
Polarity	Positive
Repetition rate	120s min

Tbl.4-1

Idx	Equipment Description	Model	Maker	INV#
1.	Coupling Network	CNA200B2	EMTEST	2167
2.	Load Dump Pulse Generator	LD200B1	EMTEST	2168
3.	Power Supply 0V – 60V, 0A – 50A	VDS200B2	EMTEST	2171
4.	Oscilloscope	TDS784A	TEKTRONIX	2161
5.	Voltage probe	CNA200B2	TEKTRONIX	2167
6.	ISMISO software	Rev 4.22	EMTEST	2176

5. SUMMARY OF TEST METHOD

5.1. Evaluates DUT's immunity from conducted transients on power and control circuits connected directly to the vehicle's battery or indirectly by a switch or load (e.g. pull-up resistor).

5.2. The switching of inductive loads connected to the battery supply of vehicles creates both positive and negative pulses which electronics connected to the battery supply must be able to withstand. An example of transient would be the release of stored energy during the operation of a relay and/or other loads connected to the battery while starting and/or turning off the vehicle.

6. SAFETY PRECAUTIONS

6.1. Only EMC laboratory personnel mentioned in 201709 EMC LAB TEST EQUIPMENT COMPETENCY MATRIX is allowed to handle the EMTEST equipment.

7. TEST PLAN

7.1. For FlexAutomotive products the EMC test plan is generated using LMS004 and OEM template.

7.2. The test plan should indicate:
1) DUT, harness, I/O loads configuration and position relative to ground plane.
2) DUT activation and monitoring method, expected FPSC, and pass/fail criteria.

7.3. In the absence of an EMC test plan use information provided by the test requester in 201696 INTERNAL TEST REQUEST FORM. This approach is applicable for "engineering development" testing.

8. RECORDS

8.1. **Test reports** including plots and data files are saved over over the LAN in a dedicated folder:
\\nmknt062\apps\e-ecn\emclab\tresult\project#\job#\test group
Example of grouping test results per job#: CTI, CTE, RE, CE, BCI, ESD, TP, PT, TRENDS.

8.2. In a similar manner the EMC **test plans** (TP), **proficiency testing** (PT), **trends** are stored under a **project#\job#** folder.

8.3. The intranet application EMC LAB SCHEDULER database is used to maintain and provide fast access to testing related records. The application is available via this link: **http://nmknt063/emclab/labscheduler/**

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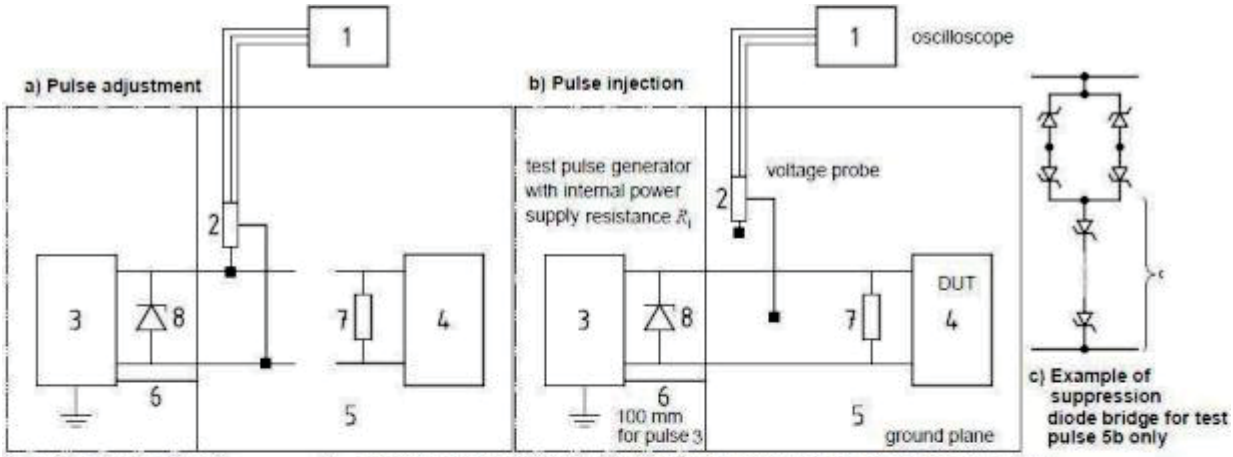
9. TEST SETUP

9.1. Prior to start testing all samples must be labeled per 900712 EMC LAB LABELS. The default list of required equipment is pull-out at the time the test method is selected (721179 EMC LAB, TEST REPORTS DATABASE).

9.2. A default list of required equipment is pull-out at the time the test method is selected (721179 EMC LAB, TEST REPORTS DATABASE).

9.3. The EMC test operator must ensure the testing is carried out based on the latest OEM specifications. In case of conflict the following documents may over-ride this procedure in order:
1) The latest revision of OEM specification (including corrections).
2) OEM approved EMC test plan, which can over-ride the OEM specification.

Fig.9-1



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10. ISO-7637-2:2004 PULSES #5A & #5B

10.1. Pulse #5 is a simulation of load dump transient, occurring in the event of a discharged battery being disconnected while the alternator is generating charging current and with other loads remaining on the alternator circuit at this moment; the load dump amplitude depends on the alternator speed and on the level of the alternator field excitation at the moment the battery is disconnected. The load dump pulse duration depends essentially on the time constant of the field excitation circuit and on the pulse amplitude (see Annex F). In most new alternators, the load dump amplitude is suppressed (clamped) by the addition of the limiting diodes. Load dump may occur on account of a battery being disconnected as a result of cable corrosion, poor connection or of intentional disconnection with the engine running.

10.2. ISO-7637-2 does not mention for pulse#1 to place the DUT and/or harness on an insulator 5 cm above the ground plane.

10.3. U_A = 13.5 ± 0.5 V (12 V system), 27 ± 1 V (24 V system).

Fig.10-1

Figure 11 — Test pulse 5a

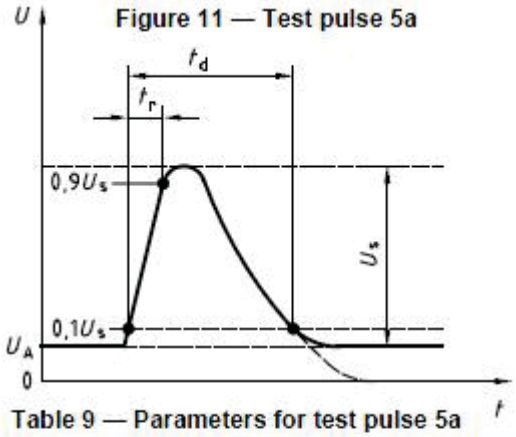

Table 9 — Parameters for test pulse 5a

Parameter	12 V system	24 V system
U_s	65 V to 87 V	123 V to 174 V
R_i	0,5 Ω to 4 Ω	1 Ω to 8 Ω
t_d	40 ms to 400 ms	100 ms to 350 ms
t_r	$(10\ ^{0}_{-5})$ ms	

Figure 12 — Test pulse 5b

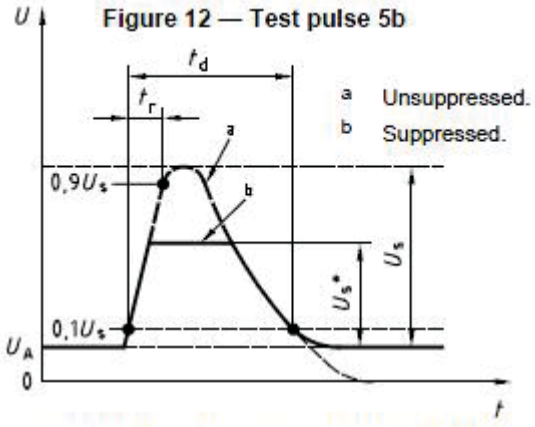

Table 10 — Parameters for test pulse 5b

Parameter	12 V system	24 V system
U_s	65 V to 87 V	123 V to 174 V
U_s*	As specified by customer	
t_d	Same as unsuppressed value	

11. DC10614:2005 (LOAD DUMP PULSE NOT LISTED)

11.1. N/A

12. DC11224:2007 (LOAD DUMP PULSE NOT LISTED)

12.1. N/A

13. DC-10615:2007 LOAD DUMP PULSE

13.1. The DUT is subjected to the load dump voltage transient test pulse illustrated in DC-10615:2007 Figure 5 simultaneously on each supply voltage input. The test pulse defined in Figure 5 and Table 7 represents alternators or generators with integral load dump protection. The DUT operation is monitored during the test. Return the DUT to 13.5 V and confirm normal functioning after each test pulse. The test consists of 5 pulses a minimum of 2 minutes apart.

13.2. Required Functional Performance is Status II for all Functional Groups. No spurious or undesirable action or response on the part of the DUT is allowed.

13.3. Load Dump is required for all Component Categories: P, A, A/B, ECM, BCM, R.

Fig.13-1

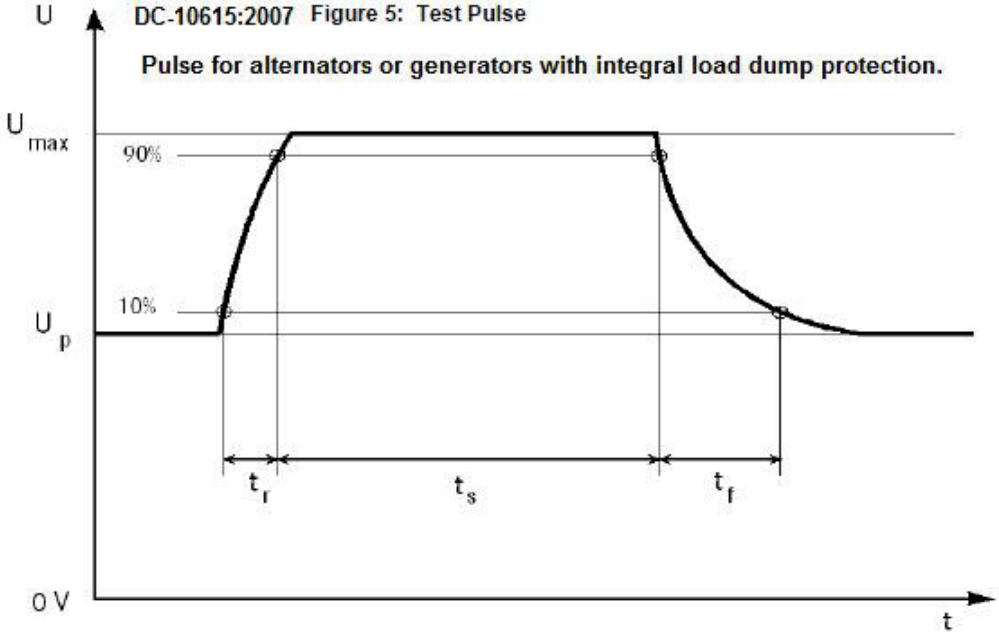

Table 7: Load Dump Test Pulse Parameters

Parameter	Value
U_p in V	13.5
U_{max} in V	32
t_r in ms	≤ 10
t_s in ms	400
t_f in ms	≤ 50
R_i in Ω	≤ 0.5
Test pulses	5

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14. CS-11809:2009 LOAD DUMP PULSE

14.1. The test shall consist of 5 pulses a minimum of 2 minutes apart.

Fig.14-1

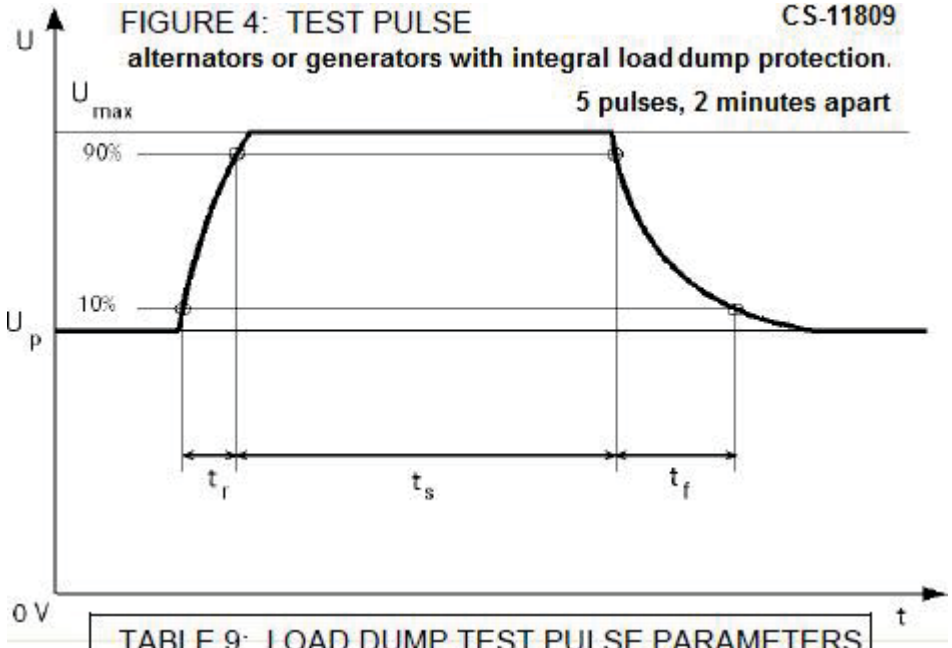

TABLE 9: LOAD DUMP TEST PULSE PARAMETERS

Parameter	Value
U_p in V	13.5
U_{max} in V	32
t_r in ms	≤ 10
t_s in ms	400
t_f in ms	≤ 50
R_i in Ω	≤ 0.5
Test pulses	5

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PULSE #5 TEST PROCEDURE

15. EMC-CS-2009:2010 LOAD DUMP PULSES #G1 & #G2

15.1. Pulse G1 represents the transient produced due to sudden disconnection of the battery from the alternator. The test pulse is equivalent to Test Pulse 5a delineated in ISO 7637-2 (2004-06-15). Apply 5 pulses.

15.2. Pulse G2 represents a voltage clamped transient produced due to sudden disconnection of the battery from an alternator fitted with Central Load Dump (CLD) Protection. Apply 5 pulses. 0.5 ohm connected externally across the Test Pulse Generator.

Fig.15-1

Pulse G1 - Parameters

Open Circuit Conditions	
U_p	13.5 V
U_s	60.V
t_r	10 (-5 /+0) ms
t_d	300 ms +/-20%
R_i	0.5 Ohms

Loaded Conditions ($R_L = R_i$)	
U_p	13.5 V
U_s	30 V
t_r	10 (-5 /+0) ms
t_d	150 mS +/-20%
R_i	0.5 Ohms

Waveform voltage begins and ends at **Up**
All voltage values are with respect to 0 volts unless otherwise specified.

Figure D-9: CI 220 Pulse G1 Characteristics

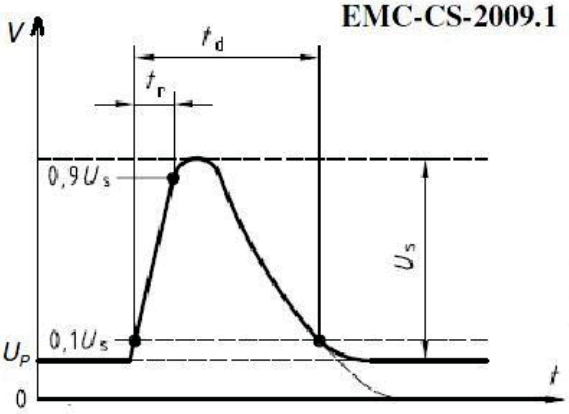


Figure 16-5: CI 220
Test Setup for Application of Pulse G1

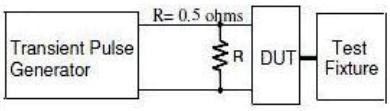
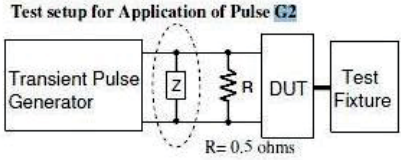


Figure 16-6: CI 220
Test setup for Application of Pulse G2



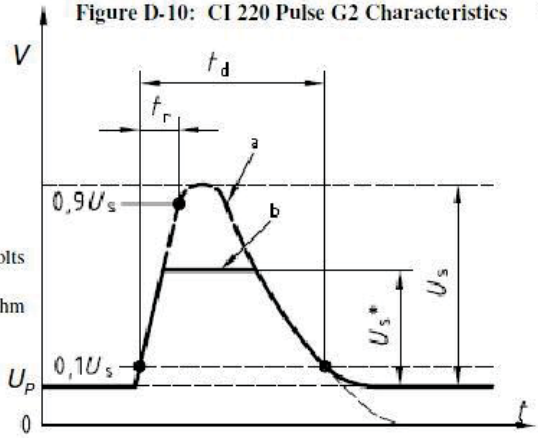
Pulse G2 Parameters

U_p	13.5 V
U_s	30 V
U_s^*	21.5 (-1/+0) V
t_r	10 (-5 /+0) ms
t_d	150 mS +/-20%
R_i	0.5 Ohms

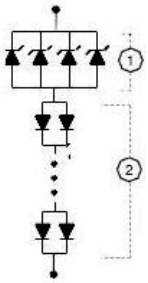
All voltage values are with respect to 0 volts unless otherwise specified.
Voltage values listed are across a 0.5 ohm resistive load (*see section 16.3*).

a: Unsuppressed pulse
b: Suppressed pulse

Figure D-10: CI 220 Pulse G2 Characteristics



"Z"



1. Zener diode: MR 2535L
2. Diode: 1N 5404

16. CS-11979:2010 PULSE #E

16.1. Test carried out with a suppressor at Load Dump generator output clamping the pulse (Us=70V according Figure 11 of ISO 7637-2:2004) to +40V peak (ISO 5b).

Fig.16-1 CS-11979, Change A, 2010-04-13

TABLE 26: TRANSIENT IMMUNITY PULSE REQUIREMENTS

#	Reference	Internal generator resistance Ri	Amplitude Vs (Us)	Pulse parameter	MINIMUM Number of pulses (MINIMUM test time)	Permitted behavior
A	**Pulse 1 : generated at key-off with inductive loads present (ISO 1)**	10 Ω	-100 V	td=2 ms	500 pulses	M1(1)
A1	**Pulse 1b : generated at key-off with inductances in series with loads or electrical motors running**	10 Ω	+43.5 V	td=2 ms tr=0.001ms t_1=5s	500 pulses	M1
B	**Pulse 2 : generated at key-off with inductances in series with loads or electrical motors running (ISO 2a)**	2 Ω	+100 V	td=0,05 ms	500 pulses	M1
C	**Pulse 3a : generated by bounces and/or arcs at activation of** switches or relays (ISO 3a)	50 Ω	-150 V	tr=5 ns td=100 ns t1=0,1 ms t4=10ms t5=100ms	15 min	M1
D	**Pulse 3b :** generated by bounces and/or arcs at activation of switches or relays (ISO 3b)	50 Ω	+100 V	tr=5 ns td= 100 ns t1=0,1 ms t4=10ms t5=100ms	15 min	M1
E	**Pulse 5b :** generated by a disconnected battery terminal while current is supplied from generator to battery (load-dump) (ISO 5b)	1 Ω	+ 40 V(2)	td=400 ms	15 pulses	M1, M2(3)

NOTE 1: Operation M3 permissible during negative portion of pulse.
NOTE 2: Test shall be carried out with a suppressor at Load Dump generator output clamping the pulse (Us=70V according Figure 11 of ISO 7637-2:2004) to +40V peak (ISO 5b).
NOTE 3: Where required, M1 operating mode to be ensured.

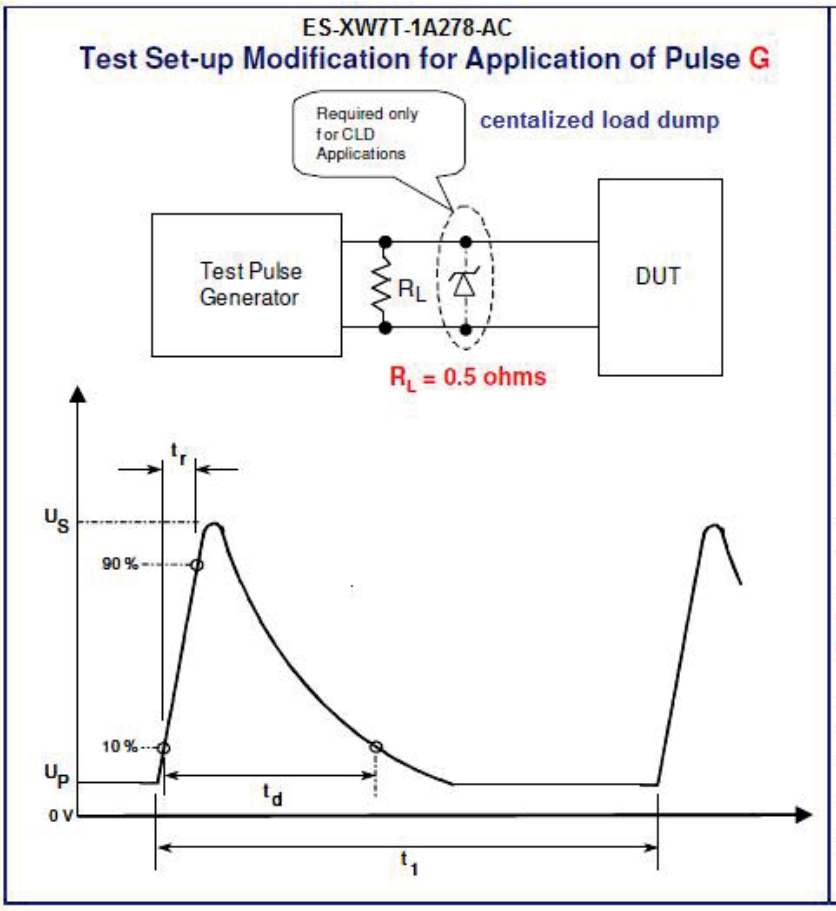
NOTE: The test duration in Table 26 is the minimum for testing against damage. It is responsibility of the supplier to test thoroughly against functional sensitivity to these types of disturbances.

17. ES-XW7T-1A278-AC:2003 LOAD DUMP PULSE #G

17.1. Pulse #F is the equivalent for ISO-7637-2:2004 Pulse #2a

17.2. Adjust the transient generator to voltage levels with the DUT disconnected (open circuit condition).
Prior to application of Pulse 5, connect the 0.5 ohm resistor across the Transient Pulse Generator. Connect the optional diode for CLD applications only (the default condition excludes the diode). Pulse 5 is be applied simultaneously to all power and control circuits.

Fig.17-1



Test pulse G simulates the transient produced due to sudden disconnection of the electrical load from the alternator. The pulse shall be applied to all power supply and control circuits with switched or direct connection to battery. The test pulse is equivalent to Test Pulse 5 delineated in ISO 7637-2.

Test pulse G - Parameters

Open Circuit Conditions	
U_P	13.5 V
U_S	73.5 V
t_r	1 – 10 ms
t_d	300 ms +/- 20%
t_1	30 s
R_i	0.5
Loaded Conditions ($R_L = R_i$)	
U_p	13.5 V
U_s	43.5 V
t_r	1 – 10 ms
t_d	150 ms –/+20%
t_1	30 s

Waveform voltage begins and ends at Up

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IMMUNITY TO TRANSIENTS ON POWER LINES
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18. GMW3097:2006 LOAD DUMP PULSE #5B

18.1. GMW3097:2006 3.5.2 CI, Transients on Power Lines applies to battery+ (B+) and switched battery lines (e.g. Ignition, Accessory). It also applies to I/O lines that are connected to an inductive load, where that load is fed by B+ or switched battery. The test pulses shall be applied to B+, each switched battery line and I/O lines fed by either B+ or switched battery separately. In addition, B+ and switched battery lines and I/O lines fed by either B+ or switched battery shall be tested simultaneously.

18.2. Test Pulse 5b, Suppressed Load Dump. Use the test setup in accordance with ISO 7637-2.
- Use 2 ohms as the source resistance (Ri)
- Remove the suppression network and verify that the open circuit unsuppressed load dump voltage waveform per Tbl-16.
- Connect the suppression network and verify that the open circuit suppressed voltage waveform per Tbl-16.
- Connect the 2 Ω load and verify that the suppressed loaded open circuit voltage waveform per Tbl-17.
- Replace the 2 Ω load with the DUT and begin test.

Fig.18-1

GMW3097:2006 Table 18: Requirements Levels for the Immunity to Transients on Power Lines

Pulse No.	Level	Minimum Number of Pulses or Application Time	Pulse Cycle Time (min.) default	Pulse Cycle Time (max.)	Comments
1	-150 Vpeak	500 pulses	0.5 s Note 1	5 s	One or more functions of the DUT can go beyond specified tolerance as long as all functions return within normal limits after the exposure is removed. Memory functions shall perform as designed
2a	+50 Vpeak	500 pulses	0.5 s	5 s	2Ω transient generator internal source impedance
2b	+10 Vpeak	10 pulses	0.5 s Note 1	5 s	There shall be 10 pulses, beginning at 200 ms pulse width, then increasing pulse width by 200 ms steps until 2000 ms is achieved
3a	-200 Vpeak	10 minutes	90 ms	110 ms	Injection level established into a 50 ohm load (as opposed to the open-circuit measurement as specified in ISO 7637-2)
3b	+100 Vpeak	10 minutes	90 ms	110 ms	Injection level established into a 50 ohm load (as opposed to the open-circuit measurement as specified in ISO 7637-2)
4	See Table 19	1 pulse of each severity level	0.5 s	15 s	Voltage levels and Performance Criterion for Pulse 4 (crank pulse) see Table 19.
5b	(34 +0/-1) Vpeak	10 pulses	15 s	2 min	No permanent DUT performance deviations shall be observed after exposure to a load dump pulse with a suppressed open circuit voltage of (34 +0/-1) V, Ri=2 Ω
7	-50 Vpeak	500 pulses	0.5 s	5 s	2 Ω transient generator internal source impedance

Note 1: the minimum time must be long enough for the DUT's return to normal operation.

Table 16: Open Circuit Load Dump Pulse Parameters Specifications

Parameter	Unsuppressed	Suppressed
Transient Amplitude	+100 V ± 10%, (U_a + U_s)	(+34 +0/-1) V, (U_a + $U_{s'}$)
t_d	400 ms ± 30%	400 ms ± 30%
t_r	≤ 10 ms	≤ 10 ms

Table 17: Two Ohm Loaded Load Dump Voltage Pulse Parameter Specifications

Parameter	Suppressed
$U_a + U_s'$	(+34 +0/-1) V

Figure 4: Setup for Pulse 7 (Simulation of Wiper Motor Switching Transient)

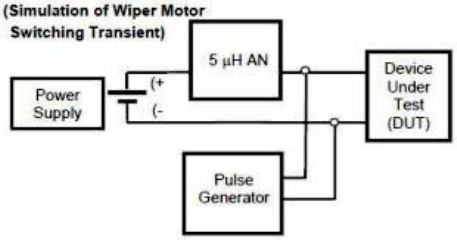


Table 19: Requirements Levels for the Immunity to Pulse 4: Crank Pulse

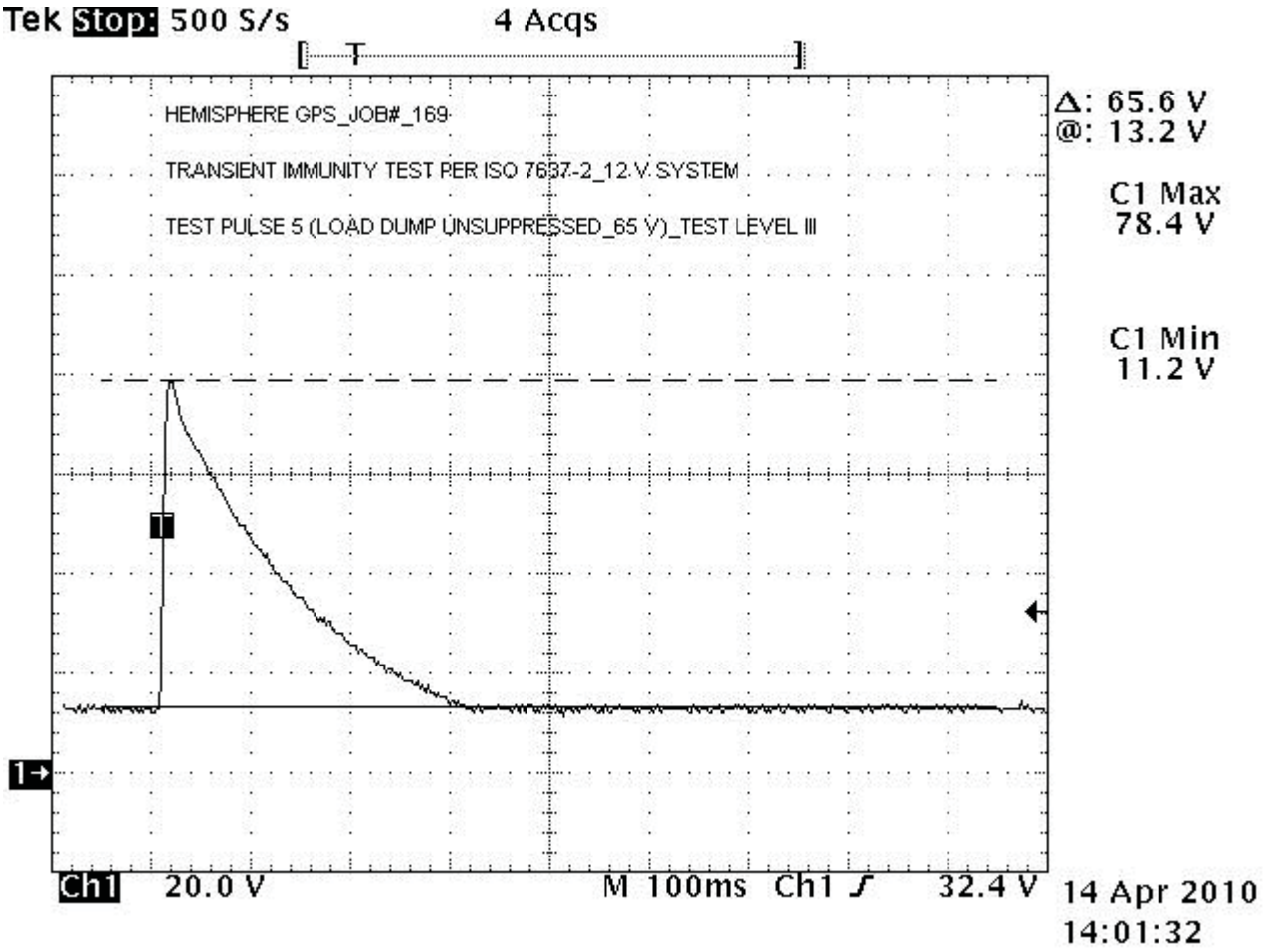
Pulse Severity	U_s Note 1	U_a Note 1	t_6 Note 1	t_{11} Note 1	Performance Criterion
I	4 V	2.5V	1 s	40 ms	One or more functions of the DUT can go beyond specified tolerance as long as all functions automatically return within normal limits after the exposure is removed. Memory functions and functions required to start an engine shall perform as designed.
II	5 V	3 V, 2.5 V	2 s	60 ms	
III	6 V	4 V, 3 V, 2.5 V	5 s	80 ms	
IV	7 V	5 V, 4 V, 3 V, 2.5 V	10 s	100 ms	

t_{10}, t_6 and t_7 as defined in ISO 7637-2. Default value for t_7 shall be 15 ms.
Default value for t_6 shall be 50 ms. All severity levels shall be tested.
Note 1: As defined in ISO 7637-2.

19. REPORT

19.1. Report pulse parameters, severity level, and DUT FPSC response. Include pulse verification waveform (no load, U_A = 13.5 ± 0.5 V) acquired prior to test and test setup pictures, order of injection for each of the waveform amplitudes, number (repetitions) of the pulse applied, pulse period (interval between pulses), any deviation from a standard pulse waveform, point of application of pulse (pin number, letter, or name), exact characteristics of any disturbance during injection of the pulse.

Fig.19-1



Tbl.19-1

	Parameter (Pulse #5a)	12V system	Tolerance
1.	U_s	65.6 V	65V TO 87V
2.	R_i	2 Ω	0.5 Ω to 4 Ω
3.	t_d	300 ms	40ms to 400ms
4.	t_r	10 ms	10 (+0/-0.5) ms

20. PROFICIENCY TESTING

20.1. Follow instructions and scheduler provided in LMS011 EMC LAB PROFICIENCY TESTING PROGRAM and ISO-7637-2:2004 Annex-D (Test pulse generator verification procedure).

20.2. U_A = 0V. The pulse #5 (12V) is calibrated at a test level of 100 V, a pulse width of 400 ms and a source impedance of Ri = 2 Ω into a 2 Ω terminating resistor. A terminating resistor of 2 Ω is regarded an optimum (no influence of losses due to cables and connectors).

Tbl.20-1

	Pulse Verification	U_s	t_r	t_d
1.	Pulse 5 - No load (12 V system)	+ 100 V ± 10 V	1 (+0/– 0,5) ms	400 ms ± 80 ms
2.	Pulse 5 - 2 Ω load (12 V system)	+ 50 V ± 10 V	-	200 ms ± 40 ms
3.	Pulse 5 - No load (24 V system)	+ 200 V ± 20 V	1 (+0/– 0,5) ms	350 ms ± 70 ms
4.	Pulse 5 - 2 Ω load (24 V system)	+ 100 V ± 20 V	-	175 ms ± 35 ms

21. TRENDS

21.1. Follow instruction provided in 721179 EMC LAB, TEST REPORTS DATABASE and 721186 EMC LAB, TRENDS AND STATISTICS.

22. DEFINITIONS

22.1. Use definitions per ISO 7637-1.

22.2. **FPSC** = Function Performance Status Classification

22.3. **CLD** = Centralized Load Dump.

22.4. **Component** = reference for active electronic modules, electric motors, passive and inductive devices

22.5. **DUT** = Device(s) Under Test. Any electrical or electronic component, module, motor, filter, etc being tested

22.6. **Fail-Safe Mode** = a predictable operating mode intended to minimize adverse effects by restricting or shutting down operation when a significant stimulus has made operation unreliable. Operation shall recover after the stimulus is removed without permanent loss of function or corruption of stored data or diagnostic information.

22.7. **Function** = the intended operation of an electrical or electronic module for a specific purpose. The module can provide many different functions, which are, defined (functional group and acceptable performance) by the module specification.

REFERENCES

LMS007			*EMC LAB, EQUIPMENT CONTROL*
LMS011			*EMC LAB, PROFICIENCY TESTING PROGRAM*
201707			*EMC LAB, APPROVED EQUIPMENT SUPPLERS LIST*
201711			*EMC LAB, EQUIPMENT INVENTORY*
201728			*EMC LAB, APPROVED CALIBRATION SUPPLIERS LIST*
201709			*EMC LAB, TEST EQUIPMENT COMPETENCY MATRIX*
201705			*EMC LAB, COMPETENCY MATRIX*
201696			*INTERNAL TEST REQUEST FORM*
900712			*EMC LAB LABELS*
721179			*EMC LAB, TEST REPORTS DATABASE*
721186			*EMC LAB, TRENDS AND STATISTICS*
201724			*CALIBRATION SUPPLIER EVALUATION FORM*
ISO 7637-1	2-nd Ed	Mar 15, 2002	*Road vehicles - Electrical disturbances from conduction and coupling - Part 1: Definitions and general considerations*
ISO 7637-2	2-nd Ed	Jun 15, 2004	*Road vehicles — Electrical disturbances from conduction and coupling — Part 2: Electrical transient conduction along supply lines only*
DC-10614	B	Dec 1, 2005	*EMC Performance Requirements --- Components*
DC-11224	A	Jun 1, 2007	*EMC Performance Requirements --- Components*
CS-11809	A	May 29, 2009	*ELECTRICAL AND EMC PERFORMANCE REQUIREMENTS - E/E COMPONENTS*
CS-11979	A	Apr 13, 2010	*CHRYSLER/FIATELECTRICAL AND EMC PERFORMANCE REQUIREMENTS - E/E COMPONENTS*
ES-XW7T-1A278-AC & corrections	AC	Oct 10, 2003	*Component and Subsystem Electromagnetic Compatibility, Worldwide Requirements and Test Procedures*
EMC-CS-2009.1	1	Feb 11, 2010	*Electromagnetic Compatibility Specification For Electrical/Electronic Components and Subsystems*
SAE J1113-11		Jun 2007	*Immunity to Conducted Transients on Power Leads*
DC-10615	E	Dec 4, 2007	*Electrical System Performance Requirements for Electrical and Electronic Components*

REVISION CHANGES

Dec 14, 2009	A	Release		Christian Rosu
Apr 16, 2010	B	Updated references & CS-11979 addition		Christian Rosu
Apr 22, 2010	C	Updated Test Setup section.		Christian Rosu

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IMMUNITY TO TRANSIENTS ON POWER LINES PULSE #5 TEST PROCEDURE

END-USER FEEDBACK

○ very satisfied ○ satisfied ○ neutral ○ dissatisfied ○ very dissatisfied

Please rate your overall satisfaction with this LMS document and input your suggestions or comments.
Your opinion is very important for us.

Survey Date