Acceptance Test Plan: v0.2

Greg Flynn

This document outlines all of the tests required to deliver LFEV-Y5. The plan is presented as an overview with the ATP number next to the test. This refers to the document that describes the test procedure. The requirements are from the SoW for 2017

ATPs

None of these tests can be viewed as completed until appropriate documentation has been uploaded to the webpage.

Item	Item description	Demonstrated Requirements	Successful Test Criteria	Verification Method
ATP-01	Accumulator integration	R001a R001c R001d R001e R002a R002c R004a (TSV part) R005a R005b (Manual)	Packs power motor and all telemetry is recorded by VSCADA. Control by using the throttle. Verify by accelerating and looking at dash, pack screens, and log files remotely	Test
ATP-02	Accumulator charging	R001b R001g R002b R002h	Packs charge by the charging port and open the safety loop VSCADA reacts correctly Verify by looking at the dash	Test
ATP-03	CAN Bus link	R002a R002c R002d R002e R002f R002g R002j R002k R003a(8) R003d R004a (CAN Bus part) R005a (CAN Bus part) R005c (CAN Bus part) R007c R007d	DAQ by VSCADA of TSI, GLV, TSV, Cooling. Verify by looking at cell phone and looking at dash and remote computer in each mode of VSCADA	Test
ATP-04	Safety loop	R001g R002b R002c R002d R002k	Fault by: Crashing BRB IMD Cooling	Test

		R002m R003b R003c R003d R004a (Safety loop part) R005c (IMD fault) R007b	VSCADA limit Pack fault Throttle fault Brake fault User defined limit (warn) User defined limit (halt) Pack charging Verify by looking at the dash, the remote computer and the cellphone	
ATP-05	Cruise Control	R002l R005b (Software)	Motor can maintain desired speed Verify by checking motor speed compared to target	Test
ATP-06	24h endurance test	GPR006	At the end of all other tests leave the car running for 24h	Test
ATP-07	Shutdown	R002k R002i	VSCADA works after unexpected GLV shutdown All hardware in safe state Packs stop powering motor with GLV shutdown	Test

Compliance Matrix

All requirements should also have a QA by each subsystem.

Requirement	Test(s) to demonstrate acceptance
R001a	ATP-01
R001b	ATP-02 OR https://sites.lafayette.edu/ece492-sp16/files/2016/05/QAR001b.pdf
R001c	ATP-01
R001d	ATP-01
R001e	ATP-01
R001f	https://sites.lafayette.edu/ece492-sp16/files/2016/05/QAR001e.pdf
R001g	ATP-02
R002a	ATP-01 or ATP-03
R002b	ATP-02
R002c	ATP-01 OR ATP-03 OR ATP-04

R002d	ATP-01 OR ATP-03 OR ATP-04
R002e	ATP-03
R002f	ATP-03
R002g	ATP-03
R002h	ATP-02 OR ATP-03
R002i	ATP-02
R002j	ATP-03
R002k	ATP-03
R002l	ATP-08
R002m	ATP-04
R003a(1)	Any ATP
R003a(2)	QA by GLV
R003a(3)	QA by GLV
R003a(4)	QA by GLV
R003a(5)	QA by GLV
R003a(5)	QA by GLV
R003a(6)	QA by GLV
R003a(7)	QA by GLV
R003a(8)	ATP-03
R003b	ATP-04
R003c	QA by GLV
R003d	ATP-03
R004a	ATP-01 AND ATP-03 AND ATP-04
R004b	QA by Interconnect
R005a	ATP-01 AND ATP-03
R005b	ATP-01 AND ATP-07
R005c	ATP-04
R005d	QA by TSI
R006	Any ATP
R007a	QA by Cooling
R007b	ATP-04
R007c	ATP-03
R007d	ATP-03
R007e	Waived
R007f	QA by Cooling
R007g	QA by Cooling

Waived or modified requirements and questions

Requirement	Reason
R003a(4)	Cannot tell if GLV is from the battery or 24VDC
R002h	Cannot tell if GLV is from the battery or 24VDC
R007e	Waived
R005d	We've changed the switches

ATP-01 intermediate steps

1. Packs provide 96V to motor
   1.1. Each pack provides 24VDC
   1.2. Packs can provide up to 200A.
   1.3. Each Pacman monitors pack status correctly
2. Throttle pedal controls motor
   2.1. Increasing throttle causes motor speed to increase
   2.2. Decreasing throttle leads to motor deceleration
3. VSCADA is aware about drive mode
   3.1. VSCADA view is the drive view
   3.2. VSCADA dashboard is updating appropriately
      3.2.1. Value for speed is updating continuously
      3.2.2. TSV SOC is updating periodically.
      3.2.3. Pack temperatures are updating periodically
4. Remote computer is aware about drive mode
   4.1. Remote computer display indicates drive mode
   4.2. Remote computer display of all parameters updates appropriately
5. Cell phone is aware about drive mode
   5.1. Cell phone displays appropriate drive mode view
   5.2. Drive mode parameters update on the screen appropriately

ATP-02 intermediate steps

1. Packs charge and perform safety checks
   1.1. Packs take charge, and are able to charge up to 100%
   1.2. Packs do not overcharge
   1.3. Safety loop opens when charging
2. VSCADA is aware about charging
   2.1. VSCADA charging view is set as the current view while charging
3. Remote computer is aware about charging
4. Cell phone is aware about charging

ATP-03 intermediate steps

1. With CAN line connected to the following individual sub-system only, VSCADA acquires and reports the *same* values as reported on the individual system for all sensors:
   1.1. TSV (all 4 packs)
   1.2. Dyno
   1.3. Motor Controller
   1.4. Cooling
2. With CAN line connected to all systems, VSCADA acquires and reports the *same* values as reported on the individual system for the given sensors:

Sensor values to be monitored

Test	Seen on VSCADA	Seen on Remote	Seen on Cell
Cell Temperature			
Cell Voltage			
Pack Current			
Pack SoC			
Pack Status			
Pack Voltage			
GLV Voltage			
GLV SoC			
GLV Current			
GLV Temperature			
Safety loop status			
RPM gauge (Dyno)			
Strain gauge			
Throttle position			
Brake status			
IMD status			
FWD/REV status			
Precharge status			
MC temp			
MC current			
Cooling temp in			
Cooling flow			
Cooling temp out			
TSI temp			
Speed			
Safety loop status			

ATP-04 intermediate steps

1. Each of the following conditions trip the safety loop properly
   1.1. When the safety loop is closed, the condition opens the loop
   1.2. This opening is seen on the appropriate view
   1.3. When the safety loop is open due to another condition, the setting of a new open condition keeps the safety loop from closing (as appropriate)

Safety loop conditions

Fault	Safety loop trip	Seen on VSCADA	Seen on Remote	Seen on Cell
Driver resettable BRB				
Non driver resettable BRB				
Crash protection				
Over temperature cooling				
Under flow cooling				
IMD fault				
Cell overtemp				
Cell overcurrent				

Cell overvoltage				
Cell undervoltage				
Brake overtravel				
VSCADA defined violation				

ATP-05 intermediate steps

1. TSI has the hardware to control the throttle
   1.1. TSI Throttle control demonstrated (without cruise control)
   1.2. Desired motor speed can be attained through TSI throttle manually
2. Physics model simulated in MATLAB
   2.1. Model simulation is accurate for all speeds – low and high.
   2.2. All speeds tested meet accuracy requirements in simulation
3. Physics model implemented on TSI
   3.1. VSCADA microcontroller implements the cruise control algorithm
   3.2. VSCADA has ability to communicate to TSI on cruise control throttle control
   3.3. TSI interfaces correctly to VSCADA cruise control commands
   3.4. TSI correctly relays SCADA commands to throttle control
4. TSI can hold a throttle position
   4.1. In cruise control mode, TSI can maintain a steady speed for all speeds – low and high
   4.2. Cruise control speed maintenance meets accuracy requirements (for all speeds)

ATP-06 intermediate steps

1. Run system for 24h, under the following conditions:
   1.1. High voltage off
   1.2. All systems interfaced with GLV power are running off of 24VDC power supply, instead of GLV battery
2. Test requirements
   2.1. VSCADA:
      2.1.1. VSCADA does not crash
      2.1.2. Data is logged into database for entire 24h period
      2.1.3. Server remains up and running
      2.1.4. Communication with all sub-systems endures
      2.1.5. Appropriate errors are logged
   2.2. GLV:
      2.2.1. Safety loop is monitored continuously
      2.2.2. Communication to VSCADA remains intact
   2.3. TSV:
      2.3.1. All 4 pacman boards remain up and running
      2.3.2. Communication with VSCADA remains intact.
   2.4. TSI:
      2.4.1. TSI board remains up and running
      2.4.2. TSI communication with VSCADA remains intact

2.5. Cooling:
    2.5.1. Cooling controller system remains up and running
    2.5.2. Communication remains intact with VSCADA

ATP-07 intermediate steps

1. VSCADA reboots after shutdown
    1.1. Upon reboot, VSCADA restarts to a fully operational status without requiring user interaction
    1.2. Upon reboot after an unexpected shutdown, an error message is logged appropriately
2. Packs disengage from the motor with loss of power
    2.1. Safety loop is opened
    2.2. Interfaces record the fault condition
3. VSCADA safely shuts down
    3.1. Unexpected shutdown does not cause failure
    3.2. No data is lost or corrupted during an unexpected shutdown
    3.3. Predefined faults allow VSCADA to shut down the car
4. Packs safely shutdown
    4.1. Safe shutdown causes a ‘configurable’ error
    4.2. Pack high voltage disengages
5. Cooling safely shuts down
    5.1. The cooling system powers off all components during a shut down
6. TSI safely shuts down
    6.1. TSI powers off all components during a shut down
7. GLV safely shuts down
    7.1. GLV shutdown causes all GLV components to be powered off
    7.2. Safety loop is opened during a shut down