Tehran Urban & Suburban Railway Operation Company

Metro Cars Propulsion Design & Production Project

Test Specification TCMS standstill tests

JDEVS-MPDP-TS-SP-507-02

CONFIDENTIAL

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1.Introduction

1.1. Aim

This document describes how the standstill test is carried out in Tehran National Metro Project.

The standstill test is done with one train set on a test track with 750 Volt line voltage available at choice. The standstill test shall verify that the interaction between the VCU software and the electrical part of the control system work as intended.

1.2. Requirement tool

The following equipment is required to perform the following tests:

- Portable PC (laptop)
- M12-RJ45 cable

1.3. References

[1]	TCMS SW & HW Architecture Description	JDEVS-MPDP-TS-SP-508-01
[2]	VFDD Computer & Communication	JDEVS-MPDP-TS-SP-519-01
[3]	VFDD Propulsion	JDEVS-MPDP-TS-SP-511-02
[4]	VFDD Train Operation	JDEVS-MPDP-TS-SP-510-03
[5]	VFDD TDS	JDEVS-MPDP-TS-SP-513-01
[6]	VFDD Brake	JDEVS-MPDP-TS-SP-515-01
[7]	VFDD Battery	JDEVS-MPDP-TS-SP-516-01
[8]	VFDD High Voltage	JDEVS-MPDP-TS-SP-509-02
[9]	VFDD Door	JDEVS-MPDP-TS-SP-517-01
[10]	VFDD HVAC	JDEVS-MPDP-TS-SP-518-02
[11]	VFDD Information	JDEVS-MPDP-TS-SP-512-00
[12]	I/O Signal List	JDEVS-MPDP-TS-SP-522-00
[13]	Event Indication Signal Description	JDEVS-MPDP-TS-SP-523-02

1.4. Definitions and Abbreviations

DDIO	Driver Desk Input/Output
DX	Digital Input/Output
DCU/x	DCU of Motor/Auxiliary Converter Module
DCUM	Drive Control Unit of MCM
DCUA	Drive Control Unit of ACM
MCM	Motor Converter Module
ACM	Auxiliary Cinverter Module
IDU	Inteligent Display Unit
ETB	Ethernet Train Backbone
VCU	Vehicle Control Unit
CIU	Communication Interface Unit
MCI	Master Controller Interface
VFDD	Vehicle Functional Design Description
ATP	Automatic Train Protection
LCB	Line Circuit Breaker

2.Hardware and Software

For an overview of the control and communication system topography, see Figure 2.1.

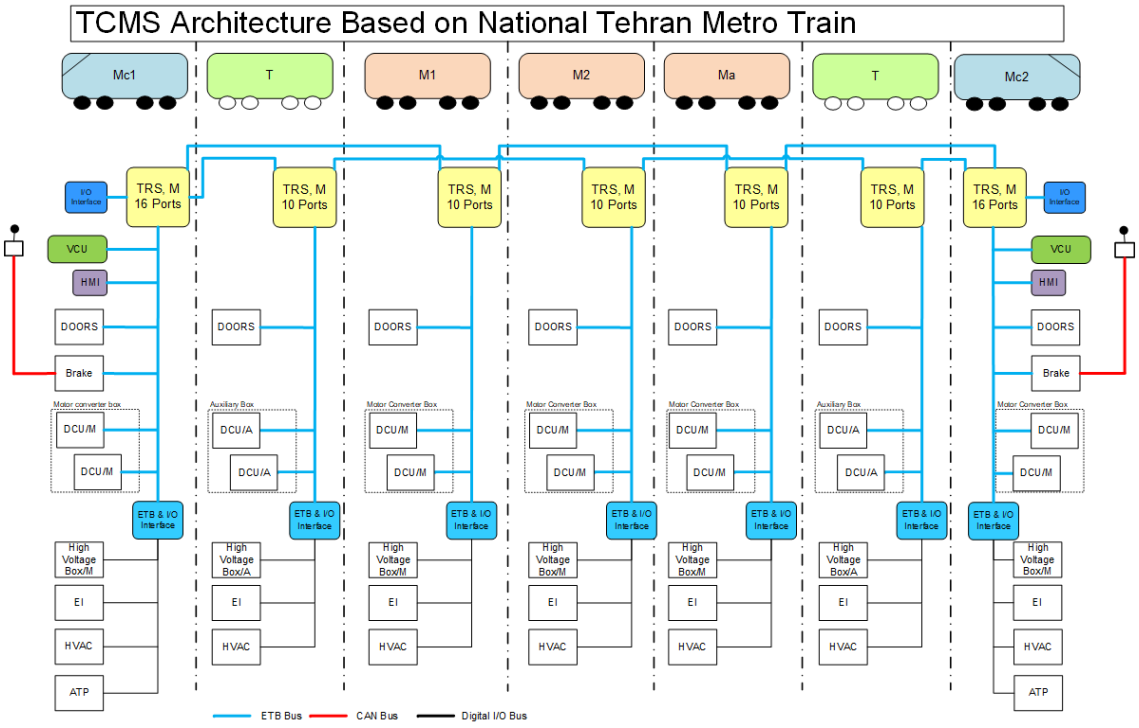

Figure 2.1: TCMS Architecture

3.Software Version Check

Check the software versions that are installed on vehicle during the routine test.

The IDU can be used for this in the Software Version menu.

Car	Computer	Software Version	Date of SW version
1	VCU1		
	IDU1		
	DCUM11		
	DCUM12		
	ioPAC1		
	CIU1		
	MCI1		
2	ioPAC2		
	DCUA21		
	DCUA22		
3	ioPAC3		
	DCUM31		
	DCUM32		
4	ioPAC4		
	DCUM41		
	DCUM42		
5	ioPAC5		
	DCUM51		
	DCUM52		
6	ioPAC6		
	DCUA61		
	DCUA62		
7	VCU7		
	IDU7		
	ioPAC7		
	DCUM71		
	DCUM72		
	CIU7		
	MCI7		

4.Stand Still Tests

4.1. General

Tests that will be performed of the train are to validate the functions of the Tehran National Metro Project computer system which are described below. These tests are called the "standstill test". According to Test Specifications, each software module in the VCU/IDU and DCU/x has been checked to fulfill the requirements described in the corresponding VFDDs. The complete load module(s) has been tested during the integration test. At battery power on it shall be no event/faults showed on the IDU related to the train computer itself, such as IDU, DCU/x, ioPAC (DX), or Iologik (DDIO).

The standstill test will include the following functions:

- **Battery system:**
  - Battery Supervision
- **Train Operation:**
  - Cab activation.
  - Master controller interface
  - Driving direction control
  - Power/brake reference selection
- **High voltage:**
  - Selector switch supervision
  - Line voltage detection
  - Line circuit breaker control
- **Propulsion:**
  - Charge of DC link and activation of the MCM and ACM
  - Drive direction
  - Cut-out, protective shutdown and isolation of the converters
  - Traction safe
  - Inhibit close of auxiliary load contactor
- **Brake:**
  - Main compressor Control
  - Load weight compensation of brake
  - Friction brake performance calculation
  - Emergency brake

  - Parking brake
  - Brake interface signals
- **Information:**
  - Control of the IDU
- **Doors:**
  - Status of doors and event reporting
- **HVAC:**
  - HVAC status and event reporting

4.2. Battery system

4.2.1. Battery supervision

1- Battery voltage level status shall be shown on IDU in “Car Status” menu
Verify the value (voltage measurement) according to actual value.

Verified _____

4.3. Train Operation

4.3.1. Cab activation/deactivation, Train configuration

1- Activate a cab, i.e. move the Drivers Key from Off position.

a. Check that the IDU lights up, if it was blank previously.

Verified _____

b. Check that the train configuration is updated in the configuration row.

Verified _____

c. Check that the correct littra numbers are shown on the IDUs.

Verified _____

2- Deactivate a cab, i.e. move the Drivers Key to Off position.
Check that the IDU goes blank.

Verified _____

4.3.2. Double cab activation

1- Activate a cab and when the configuration is done then activate the other cab as well.

a. Verify that only the first cab is activated as Master.

Verified _____

b. Verify that event 8200 is presented in the Slave cab.
Train has with hardware blocked the input signals for Drivers key on in slave.
In wait position event 8200 should be presented.

Verified _____

4.3.3. Master controller interface

1- Set the master controller in full brake.
Verify that full brake is received

Verified _____

2- Set the master controller in half brake.
Verify that full brake is received

Verified _____

3- Set the master controller in coasting.
Verify that coasting is received

Verified _____

4- Set the master controller in half propulsion.
Verify that full brake is received

Verified _____

5- Set the master controller in full propulsion.
Verify that full propulsion is received

Verified _____

6- Set the master controller in Emergency brake.
Verify that Emergency brake is received

Verified _____

7- Activate the Dead man function on the Master controller.
Verify that the dead man function is received

Verified _____

4.3.4. Driving direction

1- Set the driving direction to forward.
   a. Verify that the driving direction is set to Forward in the Train

Verified _____

2- Set the driving direction to reverse
   a. Verify that the driving direction is set to reverse in the Train

Verified _____

3- Set the Master controller in NOT full brake and change the direction
   Verify that the driving direction can not be changed.

Verified _____

4.3.5. Power/Brake reference selection

Before this test deactive P/B ref signal from VCU down to the Converters to avoid driving.

1- Set the Master controller in coasting.
   Verify that P/B reference is 0.

Verified _____

2- Set ATP Emergency brake
   Verify that the P/B reference is set to 0.

Verified _____

3- Set ATP Full service brake
   Verify that the P/B reference is set to -1000.

Verified _____

4- Set the Master controller in propulsion.
   Verify that P/B reference is positive.

Verified _____

5- Set the Master controller in brake.
   Verify that P/B reference is negative.

Verified _____

6- Set ATP Propulsion cut off
   Verify that the P/B reference is set to 0.

Verified _____

Active P/B ref signal from VCU down to the Converters.

4.3.6. Activation of motor converter

1- Set the master controller in propulsion shortly
Verify that the motor converter is activated.

Verified _____

4.3.7. Traction safe

1- Set all conditions for traction safe true
Verify that traction safe is set.

Verified _____

2- Activate the different conditions one at a time
   - Emergency stop
   - Emergency brake
   - Deactivate the cab

Verify that Traction safe is set low Verified _____

3- Set tractions safe true and open one door
Verify that Traction safe is set low Verified _____

4- Set Traction block override – Doors
Verify that Traction safe is true and Iologik1 output DO2 is true

Verified _____

5- Set traction safe true and set parking brake
Verify that Traction safe is set low Verified _____

6- Set Traction block override – Parking brake
Verify that Traction safe is true and Iologik1 output DO2 is true

Verified _____

4.3.8. Depot power supply

1- Connect the train in Depot supply
Verify that the train is set in Depot supply.

Verified _____

2- Give a propulsion order
Verify that the event 8219 is presented on the IDU.
Remove the propulsion order.

Verified _____

3- Set the train in washing mode
Verify that the train is set in washing mode

Verified _____

4- Give a propulsion order
Verify that no event is set and that the train starts to move

Verified _____

4.4. Information

4.4.1. Activation of the IDU

1- Check that the IDUs screen saver will be disabled when someone touches the screen in a slave cab (Drivers key is in position Off).

Verified _____

2- Check that the IDU activates when the driver's key is set to On.
Check that the configuration (vehicle number) is up to date on the IDU.

Verified _____

4.5. High Voltage

4.5.1. Selector switch supervision

1- Set selector switch in normal position in one motor car
Verify that the LCB can close and the MCM can be charged.

Verified _____

2- Set selector switch in normal position in T-car
Verify that the ACM can be charged.

Verified _____

3- Set selector switch in zero position in one motor car
   a. Verify that the LCB can't close and the MCM can't be charged.

Verified _____

   b. Verify that an event is generated on the IDU.

Verified _____

4- Set selector switch in zero position in one trailer car

a. Verify that the ACM can't be charged.

Verified _____

b. Verify that an event is generated on the IDU.

Verified _____

5- Set selector switch in Workshop supply position in one motor car

a. Verify that the LCB can't close and the MCM can be charged.

Verified _____

b. Verify that an event is generated on the IDU.

Verified _____

6- Set selector switch in Workshop supply position in one trailer car

a. Verify that the ACM can be charged.

Verified _____

b. Verify that an event is generated on the IDU.

Verified _____

4.5.2. Line circuit breaker control

1- Give a close the LCB order
Verify that all LCB closes.

Verified _____

2- Give a open the LCB order
Verify that all LCB opens.

Verified _____

3- Close the LCB and then activate emergency stop
Verify that all LCB opens.

Verified _____

4.5.3. Enable start of DC system

1- Deactivate DC system and then set the selector switch in workshop supply
Verify that DC system is enabled.

Verified _____

2- Deactivate DC system and then set the selector switch in normal position, LCB closed and line voltage is OK.
Verify that the DC system is enabled.

Verified _____

4.5.4. Enable start of Auxiliary system

1- When line voltage is low
Verify that auxiliary system is disabled.

Verified _____

2- When line voltage is high.
Verify that the Auxiliary system is enabled.

Verified _____

3- Connect workshop supply.
Verify that the Auxiliary system is enabled.

Verified _____

4.5.5. LCB status

1- No request to close the LCB is given
Verify that Iologik2 output DO2 is high and check lamp on driver's desk is lit

Verified _____

2- Give an order to close the LCB.
Verify that Iologik2 output DO2 is oscillating (1Hz) until all LCB's in train are closed and then it's set low.

Verified _____

4.6. Propulsion

4.6.1. ETB communication fault

1- Set DCUM/11 in test mode
   a. Verify that a ETB communication event is reported on the IDU.

Verified _____

b. Verify that MCM11 is isolated and a protective shutdown is ordered.

Verified _____

c. Repeat for all DCU's.

Verified _____

4.6.2. Charge of DC link and activate MCM

1- Activate MCM and charge DC link
Verify that all MCM's are activated in the correct sequence.

Verified _____

4.6.3. Charge of DC link and activate ACM

1- Activate ACM and charge DC link
Verify that the ACM's is activated in the correct sequence.

Verified _____

4.6.4. Driving direction to MCM's

1- Set the driving direction forward
Verify that the direction sent down to all MCM's is correct.

Verified _____

2- Set the driving direction reverse
Verify that the direction sent down to all MCM's is correct.

Verified _____

4.6.5. Converter cut-out

1- Cut-out MCM11
Verify that MCM11 is cut-out and an event is presented on the IDU.

Verified _____

a. Verify that MCM11 can't be activated

Verified _____

2- Cut-out MCM12

a. Verify that MCM12 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that MCM12 can't be activated

Verified _____

3- Cut-out ACM21

a. Verify that ACM21 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that ACM21 can't be activated

Verified _____

4- Cut-out ACM22

a. Verify that ACM22 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that ACM22 can't be activated

Verified _____

5- Cut-out MCM31

a. Verify that MCM31 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that MCM31 can't be activated

Verified _____

6- Cut-out MCM32

a. Verify that MCM32 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that MCM32 can't be activated

Verified _____

7- Cut-out MCM41

a. Verify that MCM41 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that MCM41 can't be activated

Verified _____

8- Cut-out MCM42

a. Verify that MCM42 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that MCM42 can't be activated.

Verified _____

9- Cut-out MCM51

Verify that MCM51 is cut-out and an event is presented on the IDU.

Verified _____

a. Verify that MCM51 can't be activated

Verified _____

10- Cut-out MCM52

a. Verify that MCM52 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that MCM52 can't be activated

Verified _____

11- Cut-out ACM61

a. Verify that ACM61 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that ACM61 can't be activated

Verified _____

12- Cut-out ACM62

a. Verify that ACM62 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that ACM62 can't be activated

Verified _____

13- Cut-out MCM71

a. Verify that MCM71 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that MCM71 can't be activated

Verified _____

14- Cut-out MCM72

a. Verify that MCM72 is cut-out and an event is presented on the IDU.

Verified _____

b. Verify that MCM72 can't be activated

Verified _____

15- Cut-in all MCM's and ACM's again

a. Verify that all converters are cut-in and that the events disappear.

Verified _____

b. Verify that all converters can be activated.

Verified ____

4.6.6. Inhibit close of auxiliary load contactor

Activate line voltage or workshop supply

1- Cut-out ACM21

a. Verify that ACM21 faulty signal is set, D201 output 1, after 10 seconds.

Verified _____

b. Verify that the extended power supply contactor D211 input 14 goes high.

Verified _____

2- Cut-in ACM21

a. Verify that the Inhibit close of auxiliary load contactor signal is set high

Verified _____

b. Verify that ACM21 faulty signal still is set for 5 minutes

Verified _____

c. Verify that ACM21 faulty signal goes low after 5 minutes

Verified _____

d. Verify that the extended power supply contactor D211 input 14 goes low.

Verified _____

e. Verify that the both ACM's is shortly disabled for 2 seconds.

Verified _____

f. Verify that the Inhibit close of auxiliary load contactor signal goes low.
Verified _____

3- Cut-out ACM22

a. Verify that ACM22 faulty signal is set, D201 output 2, after 10 seconds.
Verified _____

b. Verify that the extended power supply contactor D211 input 14 goes high.
Verified _____

4- Cut-in ACM22

a. Verify that the Inhibit close of auxiliary load contactor signal is set high
Verified _____

b. Verify that ACM22 faulty signal still is set for 5 minutes
Verified _____

c. Verify that ACM22 faulty signal goes low after 5 minutes
Verified _____

d. Verify that the extended power supply contactor D211 input 14 goes low.
Verified _____

e. Verify that the both ACM's is shortly disabled for 2 seconds.
Verified _____

f. Verify that the Inhibit close of auxiliary load contactor signal goes low.
Verified _____

5- Cut-out both ACM21 and ACM22 at the same time
Verify that none of the ACM faulty signals are set high
Verified _____

6- Cut-out ACM61

a. Verify that ACM61 faulty signal is set, D601 output 1, after 10 seconds.
Verified _____

b. Verify that the extended power supply contactor D611 input 14 goes high.
Verified _____

7- Cut-in ACM61

a. Verify that the Inhibit close of auxiliary load contactor signal is set high
Verified _____

b. Verify that ACM61 faulty signal still is set for 5 minutes
Verified _____

c. Verify that ACM61 faulty signal goes low after 5 minutes
Verified _____

d. Verify that the extended power supply contactor D611 input 14 goes low.
Verified _____

e. Verify that the both ACM's is shortly disabled for 2 seconds.
Verified _____

f. Verify that the Inhibit close of auxiliary load contactor signal goes low.
Verified _____

8- Cut-out ACM62

a. Verify that ACM62 faulty signal is set, D601 output 2, after 10 seconds.
Verified _____

b. Verify that the extended power supply contactor D211 input 15 goes high.
Verified _____

9- Cut-in ACM62

a. Verify that the Inhibit close of auxiliary load contactor signal is set high
Verified _____

b. Verify that ACM62 faulty signal still is set for 5 minutes

Verified _____

c. Verify that ACM62 faulty signal goes low after 5 minutes

Verified _____

d. Verify that the extended power supply contactor D611 input 14 goes low.

Verified _____

e. Verify that the both ACM's is shortly disabled for 2 seconds.

Verified _____

f. Verify that the Inhibit close of auxiliary load contactor signal goes low.

Verified _____

10- Cut-out both ACM61 and ACM62 at the same time

Verify that none of the ACM faulty signals are set high

Verified _____

4.7. Doors

4.7.1. Door status on the IDU

1- Open one door on each side in every car.

Verify that the correct doors are indicated open/closed on the IDU.

Verified _____

2- Close all doors.

a. Verify that all doors are indicated closed on the IDU.

Verified _____

b. Verify that all doors are indicated closed in the Train status view on the ID.

Verified _____

3- Activate a door emergency unlocked.

Verify that an event is presented on the IDU.

Verified _____

4.8. Brake

4.8.1. Compressor control

1- Start the compressor.
Verify that the compressor switch on order is received in T1 & T2 car.

Verified _____

2- Build up a MR pressure in T1 & T2 car
Verify that the MR pressure from T1 & T2 car is received in Ma-car.

Verified _____

4.8.2. Load weight compensation

1- Get the correct car weights from TWM.
Verify that the EBCU gives the correct car weight.

Verified _____

4.8.3. Friction brake

1- Set the Friction brake indication bits in different states from the EBCU.
Verify that the correct state is indicated on the IDU.

Verified _____

4.8.4. Parking brake

1- Set the Parking brake indication bits in different states from the EBCU.
Verify that the correct state is indicated on the IDU.

Verified _____

4.8.5. Emergency brake

1- Activate emergency brake in one car at a time.

a. Verify emergency brake is received from EBCU and then set to whole train.

Verified _____

b. Verify that emergency brake status can be seen on the IDU.

Verified _____