

**FLORIDA DEPARTMENT OF TRANSPORTATION**

**AIR CONDITIONING PULL-DOWN TEST PROCEDURE**

VERSION 8

*Prepared for:* The TRIPS program (Transit-Research-Inspection-Procurement-Services)

*By:* Robert E. Westbrook, Erin Schepers., Cecil H. Carter, Leroy E. Edwards,  
Carlton C. Allen

## **OVERVIEW**

This test is the air conditioning and performance standard for all transit equipment purchased through Florida Vehicle Procurement Program contracts. The FDOT desires to have the test performed in an environment that simulates severe duty transit operation. To do this, the FDOT must test in a non-controlled environment. The FDOT will test one or more buses from each contract within the first year of a contract agreement. If a bus fails to meet the performance test, the FDOT reserves the right to suspend placement of further orders or terminate the contract. The FDOT also reserves the right to randomly test new buses at any time during the contract period, to ensure compliance.

## **TEST CONDITIONS / EQUIPMENT**

The test will be performed on an asphalt parking lot in direct sunlight. The vehicle will be surrounded by a wall five (5) feet high, fifteen (15) feet wide and the length adjusted to the length of the bus. The minimum ambient temperature must be 94 degrees plus or minus 3 degrees Fahrenheit with a minimum 60% relative humidity. All temperature measurements will be recorded in degrees of Fahrenheit using a Measurement Computing, MCC Data Acquisition Software TracerDAQ configuration. MCC Data Acquisition is calibrated using InstaCal Software. Pressure readings are taken using a Yellow Jacket 686800 Manifold gauges. Voltage readings are taken using a Fluke model 78 automotive multi-meter. Amperage readings are taken using a Fluke model 336 True RMS Clamp Meter.

# TEST PROCEDURE

Perform a complete ultrasonic leak detection test of the air conditioning system. If the system fails the leak detection test do not proceed any further.

Check to see that all windows and doors are closed properly, with no gaps or leaks. Check interior engine cover for a proper seal. Connect all test equipment. Heat soak the bus under test conditions for a minimum of two hours. Record the date, time of day, vehicle identification number and location.

The test reading locations are as follows:

- C0 Ambient air temperature; take outside of the vehicle, away from mechanical and radiant heat sources, using an Omega Engineering J-Type 5 Position Fine Wire Thermocouple.
- C1 Bus interior temperature; take reading 48 inches to 52 inches from the rear wall, four feet above the floor surface, using an Omega Engineering J-Type 5 position Fine Wire Thermocouple.
- C2 Bus interior temperature; take reading at the center line of the bus interior, four feet above the floor surface, using an Omega Engineering J-Type 5 Position Fine Wire Thermocouple.
- C3 Bus interior temperature; take reading at the first row of seats, four feet above the floor surface, using an Omega Engineering J-Type 5 Position Fine Wire Thermocouple.
- C4 Rear evaporator core temperature; take reading near the center of the core, using an Omega Engineering J-Type ICSS Thermocouple.
- C5 Bus engine compartment temperature; take reading above engine near the fire wall, using an Omega Engineering J-Type 5 Position Fine Wire Thermocouple.
- C6 Condenser core temperature; take reading near the center at the air in side, using an Omega Engineering J-Type ICSS Thermocouple.
- C7 Condenser air temperature; take reading near the center at the air out side, using an Omega Engineering J-Type 5 Position Fine Wire Thermocouple.

Take pressure readings at the service ports of add on/second stage A/C system, using a Yellow Jacket 686800 manifold gauges.

Take voltage readings at the battery or batteries using a Fluke Model 78 automotive multimeter.

Take amperage readings at the positive cable from the battery or batteries using a Fluke model 336 True RMS Clamp Meter. Amperage draw of the A/C system will be checked after the pull down test is complete.

With the vehicle in park, all doors and windows closed, start the engine, turn on the air conditioning system; set a/c system to maximum cooling positions; turn on all interior and exterior lights and let it run with the high idle on, (approximately 1200 RPM on diesel engines and approximately 1500 RPM on gasoline engines). If the high idle is designed to automatically turn off after the first 15 minutes the driver's door will be opened and the high idle turned back on for the last 15 minutes, this will not make the test invalid. All temperature readings shall be recorded every 15 seconds.

Pressure readings and voltage readings shall be recorded at the start of the test and every 10 minutes.

## SYSTEM TEST RESULTS

During the test, the interior temperature of the bus should lower uniformly throughout and should lower the interior temperature within the given time limit.

The vehicle will fail the test if;

- a. The temperature difference between C1, C2, and C3 varies more than two degrees during each 15 second reading during the last 15 minutes of the test.
- b. The system fails to lower the interior temperature to 70 degrees Fahrenheit + or - 2 degrees (measured at C1), or lower, by the end of the 30 minute test while maintaining an ambient temperature of 94 degrees Fahrenheit + or - 3 degrees (measured at C0) with 60% relative humidity.
- c. The voltage readings at the batteries fall below 12.9 volts at any time during the test.
- d. In addition to pass or fail, systems will be given a star rating (\*\*\*\*) for systems that achieve 70 degrees in the quickest amount of time, with the lowest amperage draw.

The remaining readings are taken for informational purposes only and do not indicate a pass or fail status. These readings are used in system comparisons. This information enables FDOT to determine each tested systems fastest pull-down time, lowest head pressure reading, highest voltage output, and lowest amperage draw.

# INVALID TEST

The test will be deemed invalid if;

- a. If at any point during the test a temperature probe is detached from its measuring point.
- b. If a refrigerant leak is detected prior to, or during the test.
- c. If the ambient temperature is not maintained at the required setting or if the specified test conditions change.
- d. If at any point during the test, a door or window is opened, with the exception, if the high idle is designed to automatically turn off after the first 15 minutes, the driver's door will be opened and the high idle turned back on.