



Economic Commission for Europe**Inland Transport Committee****Working Party on the Transport of Perishable Foodstuffs****Eighty-first session**

Geneva, 29 October – 1 November 2024

Item 5 (b) of the provisional agenda

**Proposals of amendments to ATP:
new proposals****Additional test methodology to verify compliance of in
service multi-temperature multi-compartment (MTMC)
equipment****Transmitted by the Government of the United Kingdom of Great
Britain and Northern Ireland****Introduction**

1. With the current test methodology for verifying the effectiveness of thermal appliances of equipment in service (annex 1, appendix 2, part 6.2) there is a potential for the examination to last longer than one working day. This has significant impact, economically and operationally, for companies whose vehicles require the inspection.
2. Representatives of numerous Contracting Parties have expressed a desire to expedite the procedure. This proposal details a methodology which would be added as an option with the appointed experts selecting the most applicable inspection procedure for the considered equipment. It is anticipated that this procedure will be most useful for two compartment equipment, however it would not be limited by the number of compartments. The methodology has been briefly discussed by a working group started at the eightieth session and now requires input from other parties.
3. Multi-temperature multi-compartment (MTMC) thermal appliances with a single compressor have a common compressor suction line as per annex 1, appendix 2, part 7.1.(b), along with a common condenser and other associated high-side components. Should each evaporator be verified to function correctly (step three below) then only the highest demand needs to be tested to verify the thermal appliance's refrigerating capacity. If the compressor is able to pump enough refrigerant along with the condenser being able to reject the heat from the refrigerant and compressor, then the system as whole will also be able to do this for any lesser refrigerating capacity requirement.
4. For a typical MTMC semi-trailer suppose a maximum host compartment length of 9 metres and a movable transverse bulkhead with a GRP floor. At 30 °C ambient, host -20 °C, remote 0 °C a total of 2455 W cooling must be done. For this example, the maximum length



of the remote compartment from the original conformity declaration is 6 metres. Now, with 30 °C ambient, 0 °C host and -20 °C remote the total refrigerating requirement is 2210 W.

5. Given, from step three below, we know that the remote evaporator works, we know from the conformity declaration that remote evaporator is capable of the compartment requirement multiplied by the safety factor 1.75 and from steps four and five below we know that the considered system is capable of extracting a greater amount of heat ($2455 > 2210$). It is then beyond reasonable doubt that the system still conforms with no less certainty than the basis for the initial certificate to have been issued.

Step one

6. Visually inspect the vehicle prior to instrumentation — if acceptable proceed.
7. This step checks that the equipment is in satisfactory condition as is currently performed for mono-temperature in-service inspections.

Step two

8. Instrument the equipment with appropriate external sensors. Each compartment should have at least one temperature sensor on the outlet of the evaporator (“supply” / “delivery” air) and at least two temperature sensors measuring the compartment temperature. Position the bulkheads in such a way that each evaporator has its own compartment and that the worst case scenario (WCS) from the original conformity declaration is achieved requiring the most refrigerating capacity.
9. This step ensures that equipment and instrumentation is correctly set for the remaining steps and that no manual intervention is required inside the equipment.

Step three

10. Conduct the test prescribed in annex 1, appendix 2 part 6.2.1.i simultaneously for all compartments.
11. Measurements shall be taken until the warmest temperature measured by one of the two sensors located inside each compartment is at or below the class temperature.
12. Check temperature readings. This step shows that each compartment is capable of being brought to the class temperature. If the refrigerating appliance is working correctly, the sensor measuring the outlet of the evaporator should be noticeably cooler than the two compartment temperature sensors. This proves that each evaporator is working correctly.
13. The plots below show host and remote evaporator pull downs by way of example. The difference between supply air and internal temperature is obvious for a correctly functioning system. The plots are examples only and not from concurrent operation. Both systems were operating on electric standby during the period shown; the difference between supply air and internal temperatures would be more pronounced operating on diesel given the extra refrigerating capacity.

Figure 1
Host evaporator compartment pull down and control

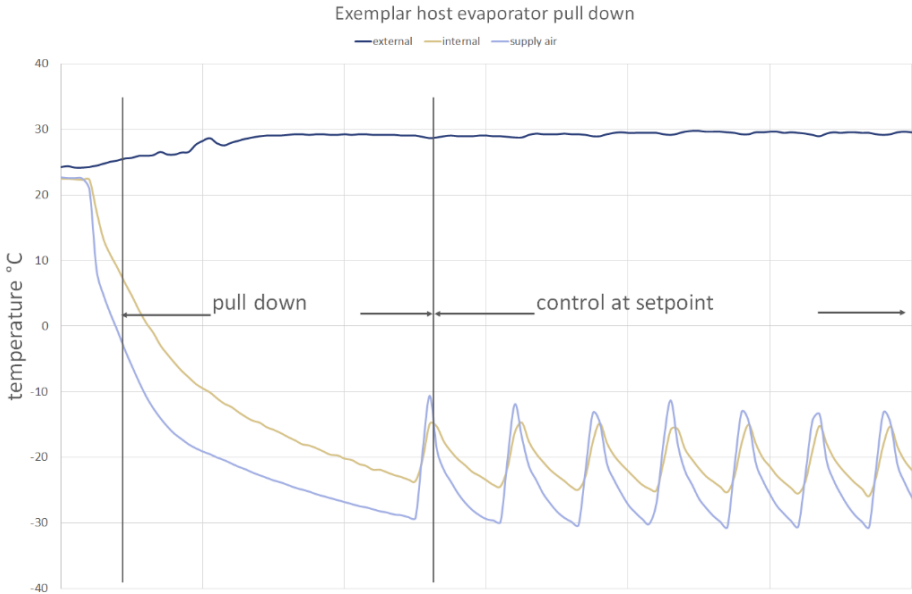
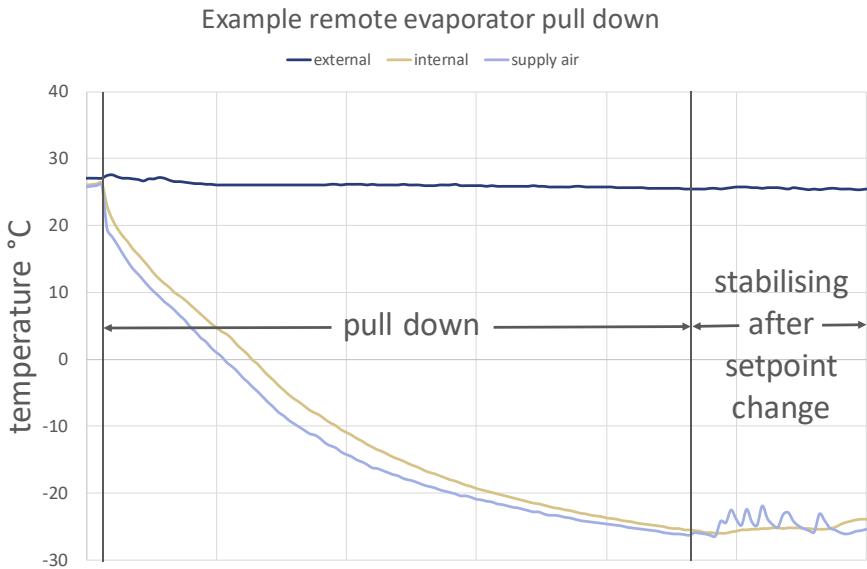


Figure 2
Remote evaporator pull down and operational change



Step four

14. Change all of the compartment setpoints to match those declared in the WCS. Allow the system to run under control of the thermostats in each compartment, and stabilise to the expert’s satisfaction.

15. This step shows that the system is capable of operating and controlling at the MTMC test conditions of annex 1, appendix 2, section 7 as it was originally tested for compliance.

Step five

16. Change the setpoint(s) of the frozen evaporator(s) to the lowest possible setting and confirm reduction of the compartment temperature(s).

17. This step ensures that there is excess capacity whilst in MTMC operation.

End of test procedure

18. The appointed experts may choose to verify the effectiveness of thermal appliances of equipment in service by testing each evaporator individually or by the empirically proven scientific logic outlined above.

Proposed amendment to annex 1, appendix 2, paragraph 6.2.1

19. Insert bold text into existing text:

“(iii) Multi-compartment equipment

The appointed experts may choose a method from the procedures below.

Procedure 1:

The test prescribed in (i) shall be conducted simultaneously for all compartments...”

20. Insert new text above the line “The equipment shall be considered compliant if:”

“Procedure 2:

The test prescribed in (i) shall be conducted simultaneously for all compartments. During the tests, if the dividing walls are movable, they should be positioned such that compartment volumes match the maximum multi-temperature multi-compartment refrigeration demand as described by the equipment’s declaration of conformity.

Measurements shall be taken until the warmest temperature measured by one of the two sensors located inside each compartment matches the class temperature. A third temperature measurement shall be made at the outlet of the evaporator. It shall be verified that the temperature at the outlet of the evaporator(s) is lower than the compartment temperature during temperature reduction.

Change the compartment setpoints to match the maximum multi-temperature multi-compartment refrigeration demand as described by the equipment’s declaration of conformity and check for satisfactory operation.

The frozen compartments shall be made to run without the thermostat in operation. Confirm the temperature measured at the outlet of the evaporator(s) reduces.”

Technical impact

21. There would be no loss of integrity for the vast majority of systems with a significant amount of time saved. The experts may choose whichever procedure they deem more satisfactory for each considered system.

Economic impact

22. The proposed methodology reduces the time taken for the test. This reduces all costs relating to conducting the test incurred by a test station and therefore does not need to be covered by the operator paying for the test. A shorter test duration lessens the burden of removing a vehicle from service, along with the associated driver logistics, for the duration of the test and also the energy required to get the vehicle to and from the test site.

Environmental impact

23. Less energy is required to conduct the test. The appliance being tested consume less energy as do the environmental conditioning and data acquisition equipment.
