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Definition of Pressure Surge Test and Measurement Methods for Receiver Aircraft

FOREWORD

Changes in this revision are format/editorial only.

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1. SCOPE:

The test procedure applies to the refueling manifold system connecting the receiver aircraft fuel tanks to the refueling source fuel pump(s) for both ground and aerial refueling. The test procedure is intended to verify that the limit value for surge pressure specified for the receiver fuel system is not exceeded when refueling from a refueling source which meets the requirements of AS1284 (reference 2). This recommended practice is not directly applicable to surge pressure developed during operation of an aircraft fuel system, such as initiating or stopping engine fuel feed or fuel transfer within an aircraft, or the pressure surge produced when the fuel pumps are first started to fill an empty fuel manifold.

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1.1 Purpose:

The need for large fuel loads requires high refueling rates for both ground and aerial refueling to minimize refueling time. Stopping the high refueling fuel velocity in a short period of time causes a pressure in the refueling system (both aircraft systems and refueling equipment) higher than the normal operating pressure. This higher pressure, called surge pressure, or water hammer, is described in reference 1, section 3.10, “Fluid Transients.” The intensity of the surge pressure is dependent upon the interaction between the aircraft refueling system and the refueling source system. This document establishes a standard procedure for testing an aircraft refueling system when combined with a refueling source (refueling truck, hose cart, hydrant system, or aerial refueling tanker) to verify that the surge pressure within the receiver aircraft does not exceed the value specified for the system.

2. REFERENCES:

1) Aerospace Fluid Components Designer’s Handbook, Revision C, Technical Documentary Report No. RPL-TDR-64-25, November 1968.

2) AS1284, Standard Test Procedure and Limit Value for Shutoff Surge Pressure of Pressure Fuel Dispensing Systems

3) Coordinating Research Council (CRC) Aviation Handbook, Fuels and Fuel Systems, NAVAIR 06-5-504, dated 1 May 1967

4) MIL-F-87154 (USAF), Fuel Systems, General Design Specification, dated 15 Aug 80.

5) MIL-F-17874B, Fuel Systems: Aircraft Installation and Test of; dated 20 Aug 65

6) MIL-T-83219 (USAF), Truck Tank A/S32R-9

7) Fuel Transient Analysis (FUELTRAN) Computer Program Technical Memorandum, ENFEF-TM-81-03, dated March 1981.

8) Aircraft Hydraulic System Transient Analysis (HYTRAN) Report MDCA3060, Revision A, dated 3 March 1975.

3. CRITICAL PARAMETERS:

3.1 Refueling Source:

1. Refueling source pump(s) characteristics (pressure versus flow) measured at the inlet of the refueling nozzle or refueling coupling.

2. Pressure or flow regulator characteristics (if applicable).

3. Surge damper characteristics (if applicable).

4. Check valve characteristics (if applicable).

3.2 Receiver Aircraft:

1. Pressure drop versus flow characteristics (including pressure drop versus flow of refueling source nozzle or coupling).

2. Shutoff or level control valve characteristics (closure time versus flow rate at beginning of closure and rate of flow area change during closure).

3. Surge damper characteristics (if applicable).

4. Pressure or flow regulator characteristics (if applicable).

5. Check valve characteristics (if applicable).