



AEROSPACE RECOMMENDED PRACTICE

ARP6344™

Issued

2020-09

Standard Test Procedure and Limit Value for Shutoff
Surge Pressure for Fixed Pressure Fuel Dispensing Systems

RATIONALE

This SAE Aerospace Recommended Practice (ARP) is needed to establish a recommended test procedure for fixed aircraft refueling systems. This is a companion document to ARP5918, which addresses the testing of mobile aircraft refueling systems. This ARP replaces AS1284, which has been stabilized.

1. SCOPE

The test procedure and related limit value are intended to apply to new, previously untested designs of fixed ground pressure fuel dispensing systems.

1.1 Purpose

This recommended practice establishes a test procedure and related limit value for shutoff surge pressure of fixed ground pressure fuel dispensing systems.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

ARP5918 Standard Test Criteria for Aircraft Refuelers

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2020 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
 Tel: +1 724-776-4970 (outside USA)
 Fax: 724-776-0790
 Email: CustomerService@sae.org
 <http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE ARP6344

For more information on this standard, visit
<https://www.sae.org/standards/content/ARP6344>

Documents
Document Sharing Hub

3. TEST EQUIPMENT

3.1 For Systems with Single Dispensing Line

The test apparatus as shown in Figure 1 shall be connected at the dispensing system pressure fueling nozzle. The test adapter, line segments, and valves shall have flow areas at least equal to that of the dispensing system flow line. The length of the line segment between the refueling adapter and the test (surge) shutoff valve (inlet line segment; item 4, Figures 1 and 2) shall not exceed 30 pipe diameters. The test (surge) shutoff valve (item 6, Figures 1 and 2) closure time shall be defined based on the primary use of the fixed ground refueling equipment (see 3.1.1). It is recommended that the shutoff valve have a digital position output to allow recording of its shutoff characteristics. However, at a minimum, the shutoff valve shall be equipped with a means of verifying the valve closure time to within 0.1 second and an error no greater than 10%. To assure that dispensing system flow is not abnormally restricted, the pressure drop of the test (surge) shutoff valve, in its full open position, shall not be greater than that length equivalent to 50 pipe diameters of inlet line segments.

Pressure transducers (items 1 and 5, Figures 1 and 2) shall be connected to a high response recording device which records at a minimum of 600 Hz. The pressure transducers and recording device shall have a pressure range appropriate to the test being conducted and a minimum frequency response capable of recording the pressure surges generated by the test (surge) shutoff valve as evident by a clear and consistent increase and decrease in pressure (peak maximum pressure). It shall be verified by static pressure calibration that the error of the transducer and recording device at 120 psig (827 kPa) is not greater than $\pm 1\%$. In addition, a minimum of two additional pressure calibration points, one below and one above 120 psig (827 kPa), shall be verified before conducting testing. At a minimum, the pressure transducer shall be capable of recording pressures up to 150 psig (1034.2 kPa).

NOTE: Pressures above 150 psig (1034.2 kPa) may be possible; the pressure transducer range should be selected to capture an accurate peak pressure.

The flow control valve (item 8, Figures 1 and 2) shall provide readily adjustable throttling and shall have a maximum pressure drop, in its full open position, not greater than that length equivalent to 50 pipe diameters of discharge line segment. The total length of the discharge line segments shall not exceed 50 pipe diameters. Discharge line should return to an operation representative catch tank.

Flow rate shall be measured using a calibrated flow meter (this can be the flow meter that is part of the dispensing flow system or a separate temporary flow meter). If a temporary flow meter is used, the pressure drop shall not exceed 50 pipe diameters. If the flow meter is a quantity meter rather than a rate meter, flow rate normally will be obtained by the "time rate of change of quantity" method. The error for flow rate measurement shall not exceed $\pm 5\%$.

Electrostatic bonding shall be provided for the system elements as necessary to eliminate sparking and fire hazard.

3.1.1 Primary Use of Fixed Ground Refueling Equipment

3.1.1.1 Refueling Commercial Aircraft

The test (surge) shutoff valve (item 6, Figures 1 and 2) shall be capable of closing in 1.5 seconds ± 0.5 second with a linear time rate of change of flow area, $\pm 5\%$, from full open to zero flow area.

3.1.1.2 Refueling Military Aircraft

The test (surge) shutoff valve (item 6, Figures 1 and 2) shall be capable of closing in 0.5 second ± 0.05 second with a linear time rate of change of flow area, $\pm 5\%$, from full open to zero flow area.

3.2 For Systems with Multiple Dispensing Lines

Test apparatus shall be as shown in Figure 2. Requirements concerning the test apparatus shall be as stated in 3.1.

4. SURGE TEST PROCEDURE

4.1 System with Single Dispensing Lines

4.1.1 Preparation

Prior to commencing the surge test, it shall be verified that the dispensing system pressure regulator is adjusted to its prescribed no-flow pressure. With the test shutoff valve (item 6, Figure 1) in its full open position, the flow control valve (item 8, Figure 1) shall be slowly opened to full until the nozzle back pressure is at a minimum. The flow rate through the dispensing system shall be the maximum obtainable but no greater than the rated value. This shall be determined by repeated trial. During each trial, as nozzle pressure (shown by the gage item 1, Figure 1) is decreased by progressive opening of the flow control valve, the highest nozzle pressure at which the maximum flow rate occurs shall also be observed. For the surge test, the flow control valve shall be opened just to the extent necessary to produce the maximum flow rate and nozzle pressure found previously by trial. The maximum flow rate and the corresponding nozzle pressure shall be recorded.

NOTES:

1. If the flow rate continues to increase as nozzle pressure is decreased (by progressive opening of the flow control valve shown in Figure 1), rather than to stabilize at some maximum value (or automatically shut-off) before nozzle pressure falls below 40 psig (275.8 kPa), the system shall be considered as not having flow rate limiting mechanisms. Flow rate limiting mechanisms, which act only to prevent the exceeding of some prescribed maximum flow rate, are usually provided as a secondary control mechanism.
2. The maximum allowable fueling nozzle pressures for commercial and military aircraft are found in Appendix A.
3. The maximum fueling nozzle pressure for equipment solely intended for pressure refueling rotary wing aircraft is determined by the type of refueling adapter used on the aircraft—single point refueling (SPR) adapter or closed circuit refueling (CCR) adapter. For rotary wing aircraft equipped with only a CCR adapter, the maximum refueling nozzle pressure, measured at the nozzle outlet, is 15 psig (103.4 kPa). For rotary wing aircraft equipped with only an SPR adapter, or with both SPR and CCR adapters, the maximum refueling nozzle pressure, measured at the SPR nozzle inlet is 50 psig (344.7 kPa) for commercial rotary wing aircraft or 55 psig (379.2 kPa) for military rotary wing aircraft.
4. When deviation is required from the test preparation guidance of this section due to the specific nature of the refueling equipment and/or aircraft being fueled, and no other aircraft type is expected to use the refueling equipment being tested, then the maximum fueling nozzle pressure is that specified by the aircraft manufacturer.

4.1.2 Surge Test

Subsequent to establishment of the maximum refueling pressure and associated flow condition, the test (surge) shutoff valve shall be closed. The test shutoff valve closing time, time rate of change of flow area, and pressure at the pressure transducer shall be recorded.

Prior to closure of the test (surge) shutoff valve, flow should be reduced until the first indication of back pressure. The maximum refueling pressure and associated flow condition should be stabilized for 60 seconds.

The test (surge) shutoff valve should remain closed prior to reopening for a period of 30 seconds or pressure stabilization ($\pm 5\%$) for 5 seconds.

Before initiating a subsequent surge test, ensure that the maximum refueling pressure and associated flow condition are reestablished for a minimum of 20 seconds.

A minimum of three surge tests should be performed for each piece of refueling equipment under test.

4.1.3 Acceptable Result

The maximum surge pressure in the inlet line segment shall not exceed 120 psig (827 kPa) total pressure during the course of three replicated tests.