



API/EI 1585

Guidance in the cleaning of
aviation fuel hydrant systems at airports

2nd edition

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AVIATION FUEL HYDRANT SYSTEMS
AT AIRPORTS

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November 2007

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FOREWORD

This publication has been prepared jointly by the Energy Institute's (EI) Aviation Committee and the API Aviation Technical Services Sub-Committee. It is intended to provide the industry with guidance in the cleaning of existing fuel hydrant systems that are showing signs of having become contaminated with water, particulate material and/or microbiological activity. It also gives guidance to ensure that the construction and commissioning of a system does not cause subsequent adverse effects on fuel quality. In addition, it contains some operational guidelines to assist in the maintenance of continued cleanliness.

A fuel hydrant system is a custom designed item and is very site specific. No one set of conditions can be applied to all systems. Users of this publication should amend the guidance given to suit local conditions. Local and regional law and regulations should also be reviewed with respect to specific circumstances.

The EI and API are not undertaking to meet duties of employers, manufacturers or suppliers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local and regional laws and regulations.

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Although it is hoped and anticipated that this publication will assist those responsible for designing, constructing, commissioning, operating and maintaining aviation fuel hydrant systems, the EI and the API cannot accept any responsibility, of whatever kind, for damage or loss, or alleged damage or loss, arising or otherwise occurring as a result of the application of the guidance contained herein.

Suggested revisions are invited and should be submitted to the Director of Standards, API, 1220 L Street, N.W., Washington, D.C. 20005, or the Technical Department, The Energy Institute, 61 New Cavendish Street, London, W1G 7AR.

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INTRODUCTION

This publication is intended to give operators of airport fuel hydrant systems guidance in:

- (a) Determining the state of cleanliness of existing hydrant systems and possible causes of contamination.
- (b) Methods of cleaning hydrant systems that are showing signs of contamination with particulate material, water and microbiological material.
- (c) Methods to be followed during construction of new systems or extensions to existing systems to prevent the entry of unwanted materials.
- (d) Commissioning procedures.
- (e) Operational practices to maintain the system in a clean condition.
- (f) The design of hydrant systems to aid cleaning.

If the hydrant system is clean when placed in service and adequate filtration is given to the fuel entering it, the hydrant should remain clean in service. In general, only if users are experiencing shorter than normal fuelling vehicle filter element life, or are obtaining unsatisfactory samples upstream of their filters, need action be taken. It should be recognised that sub-micronic particulate will never settle and will eventually

be carried to the users' vehicles. On the other hand, larger debris may never come out so ensuring that none is present is the best way of preventing problems. Such material in the system may provide an environment to trap moisture and promote microbiological growth.

The key to successful cleaning of supply lines and hydrant systems is to fully understand the subject facilities and to develop a detailed implementation plan with objectives, expected results and how the results will be measured. Hydrant operators should formulate their own procedures, which should be incorporated in manuals and operating procedures. In order to assist, it is essential that 'as built' drawings and associated records are produced after initial construction and that these are kept up-to-date following any subsequent modification.

Training is very important; hydrant operators should be properly trained to recognise signs of trouble and to act upon information and advice regarding fuel quality and the state of pits etc. from hydrant users.

It cannot be too strongly stressed that the key is to ensure that the hydrant system is clean in the first place.

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REFERENCED PUBLICATIONS

The following publications are cited in this publication, the latest available edition of each applies:

API/EI

API/EI 1540 *Design, construction, maintenance and operation of aviation fuelling facilities* (EI Model Code of Safe Practice, Part 7) (hereinafter referred to as API/EI 1540)

API/EI 1581 *Specifications and qualification procedures for aviation jet fuel filter/separators*

API/EI 1590 *Specifications and qualification*

procedures for aviation fuel microfilters

API/EI 1594 *Initial pressure strength testing of airport fuel hydrant systems with water*

EI

Model Code of Safe Practice, Part 21, *Guidelines for the control of hazards arising from static electricity*

Guidelines for the investigation of the microbial content of petroleum fuels and for the implementation of avoidance and remedial strategies

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DEFINITIONS AND ABBREVIATIONS

3.1 DEFINITIONS

The following terms are used within this publication:

cleaning sledge: hydrant device designed and patented by a major joint venture hydrant operating company.

contaminant: any material that has, or could have, an adverse effect on the quality of aviation fuel and its fitness for use in aircraft engines. This may take the form of free water, solids in particulate matter form, construction debris and microbiologically formed materials.

critical flow: flow greater than *laminar* but less than *turbulent*. It may be taken as having a mean *Reynolds number* of between 2 000 and 4 000.

laminar flow: flow that is orderly and even in pattern; the velocity is at its maximum at the pipe axis and decreases sharply to zero at the wall. It may be taken as having a mean *Reynolds number* of less than 2 000.

Reynolds number: a dimensionless combination of the pipe diameter, the density and dynamic viscosity of the flowing fluid, and the velocity of flow. It may be considered as the ratio of the dynamic forces of mass flow to the shear stress due to viscosity.

soak test: the period of time between the initial filling

of the hydrant system with fuel and the taking of samples to check that the fuel has not been affected by the hydrant system. See API/EI 1540 Section 5.8.

turbulent flow: flow that is greater in velocity than *critical flow*. It may be taken as having a *Reynolds number* greater than 4 000 and is characterised by random eddy flow patterns.

3.2 ABBREVIATIONS

The following abbreviations have been used in this publication:

µm	micrometre (micron)
CCTV	closed circuit television
ft/sec	feet per second
in.	inch
m ³	cubic metre
m/sec	metres per second
mg/L	milligram per litre
pS/m	picosiemens per metre

Although it is usual to denote litres by l, in order to prevent any confusion or misunderstanding when, in certain fonts l and I may be misread, litres is denoted by L in this publication.

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DETERMINING THE LEVEL OF CLEANLINESS OF A FUEL HYDRANT SYSTEM

4.1 It is not always obvious that there is a dirt or water problem within a hydrant system. Experience has shown that despite clean samples being obtained from low points and pit valves, systems can be contaminated with particulate matter, free water, construction debris or microbiological material, or a combination of these.

4.2 Into-plane operators should be encouraged to report to the hydrant operator, any less than satisfactory samples taken during or after fuelling. It is incumbent on the hydrant operator to properly investigate such reports without undue delay. With the use of fuel filter monitors in fuelling vehicles, the condition of the hydrant fuel is that shown on samples taken from the inlet side of the vessel, as this fuel has not passed through the on-board filter.

4.3 Into-plane operators may experience slugs of water and sediment but later sampling by the hydrant operator may not identify the presence of such material. Monitoring the sumps of into-hydrant filter water separators and other points, from which water and solids can be detected and removed, should be meticulously carried out at a frequency that accords with industry agreed procedures. The presence of water should be investigated to find the source.

4.4 When taking low point and hydrant pit valve flushing samples, especially if a contamination problem is being investigated, the initial quantity of fuel flushed

should be visually checked for the presence of any solids or water droplets before these are flushed into the tank of the servicing vehicle or unit. The vehicle pipework system should be designed to facilitate the examination of the samples flushed from the low point. Frequent inspection of the flushing tank should be carried out to check on contents. If an unusual amount of particulate and water is noted, the records should be checked to see which other low points and pit valves have been flushed. Repeat flushing of some pits to determine which have produced the material may be required. Note: it is important that the tank of any flushing unit used for this type of investigation is itself flushed and cleaned before the hydrant flushing is undertaken to ensure that the samples obtained are representative.

4.5 If less than normal element life in into-hydrant filters is experienced, or depot tank samples or inspections show evidence of unusual sediment, particulate or water, the matter should be investigated. If necessary, the fuel supplier should be notified.

4.6 When circulation of the hydrant system back to depot tanks is undertaken, the condition of the tank before and after should be noted. Any increase in sediment or water will indicate that the hydrant system contained such material. Further action should be assessed.

4.7 One difficulty in assessing the condition of a hydrant system is lack of entry capability. It is recommended that whenever major work is undertaken and, for example, block or sectioning valves are removed, the inside of the pipework should be examined as far as is practicable. For this adequate lighting will be required and all due precautions taken to ensure safe working conditions and equipment. A record should be made of the examination including the cleanliness or otherwise of the pipe, and where used, the condition of the internal lining.

Wherever investigations are undertaken to determine the extent and type of contamination, it is essential to maintain good records of the locations checked and the results of sampling or other examinations. For instance, maintaining a record of the quantity and description of any solid matter flushed from low points or through hydrant pits on a plan of the hydrant may help locate or narrow down the source. If the hydrant system is looped, then the flow pattern may

also need to be carefully studied to determine the most likely direction that any contamination may be moved around the piping network. Where the flow has been changed (for instance, due to hydrant maintenance or extension works), then close monitoring for any changes in quantity or type of contaminants retrieved from the flushing samples is required.

4.8 Closed circuit television (CCTV) survey can be a very helpful tool in determining the state of the hydrant system. One benefit of CCTV is that it shows the current condition and, by recording this on videotape, a visual record of the condition of the system checked can be established. This may be useful in assessing the build-up of unwanted material over a period.

Note: CCTV technology may be of limited availability in some regions. If CCTV is to be used, it must be suitable for the conditions that will be encountered (in flammable liquids, atmosphere etc.).