

Aviation Fuel Filtration Update

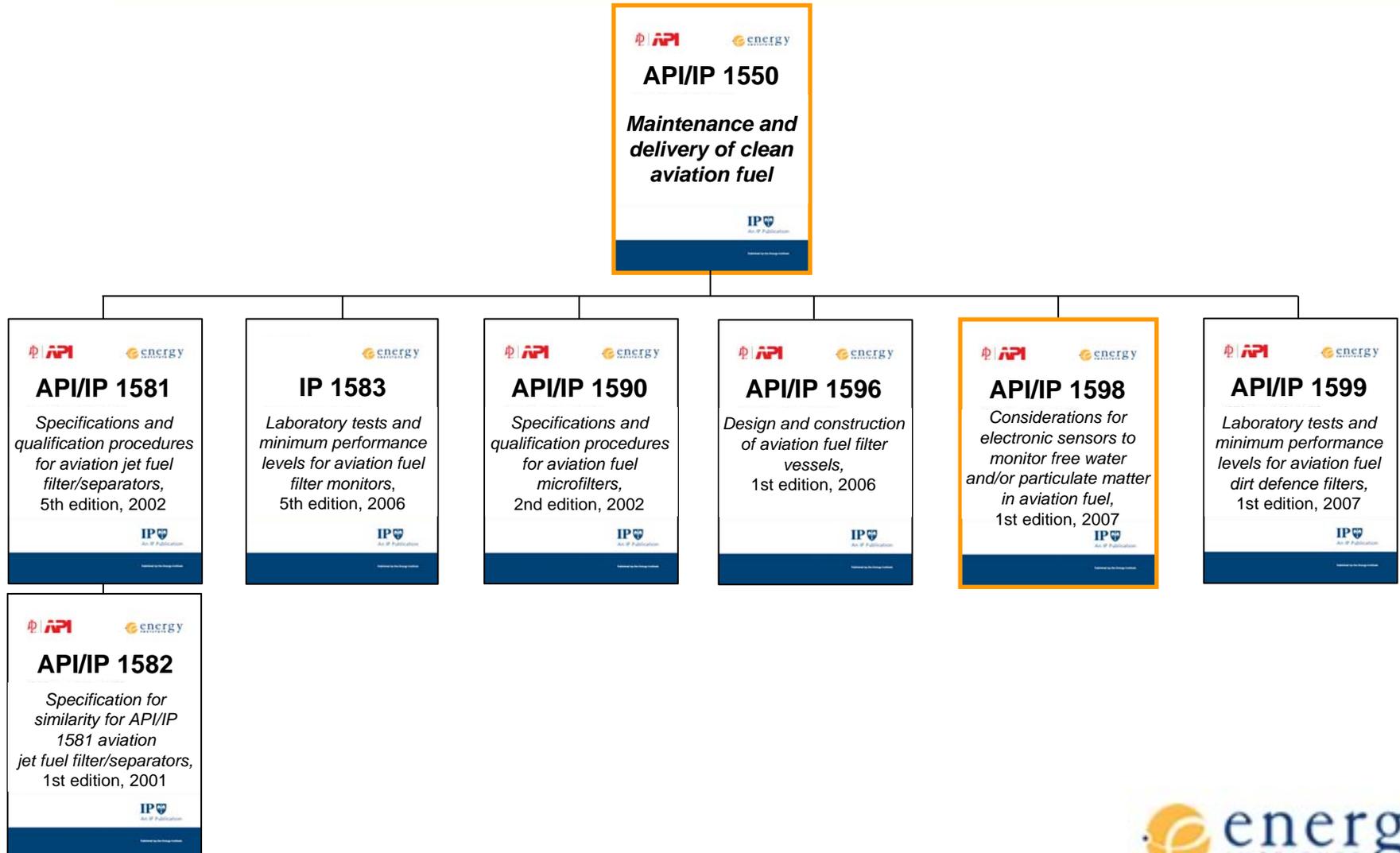
Phil Rugen,
Chairman, API/EI Aviation Fuel
Filtration Committee

IATA Aviation Fuel Forum
Miami, USA - 22nd May 2007



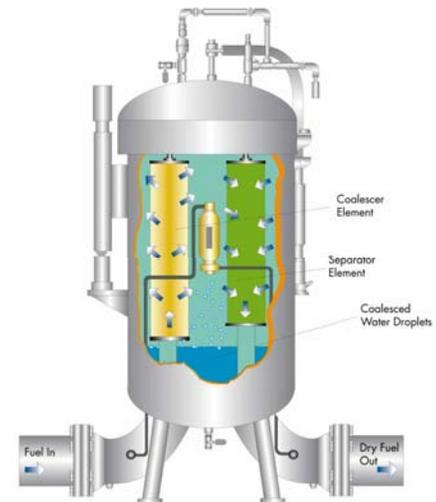
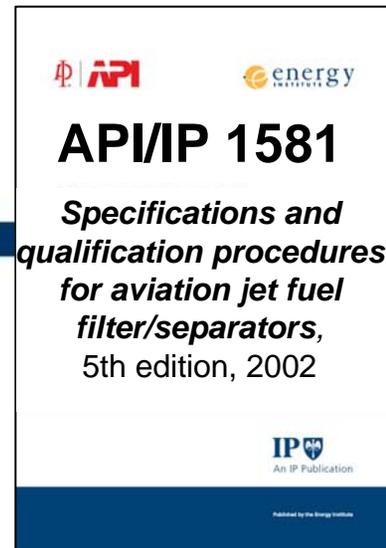
*“Providing industry with cost effective
value added scientific and technical knowledge on
key current and future issues”*

API/IP and IP aviation fuel cleanliness publications



Filter/Water Separators

- Addendum issued 20 Dec 06
- Provides new Type of filter/coalescer S-LW (testing with 0.5% water addition, rather than 3%)
- Intended for “*conditions where there is limited potential for water contamination (e.g. systems with independent water detection)*”
- S-LW systems smaller and lighter so easier to use in mobile applications
- Not intended for, and should not be used in, fixed applications
- 1581 5th edition (and 1582) to be reaffirmed in 2007



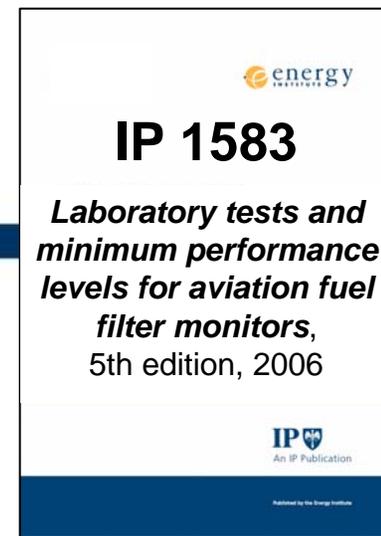
Filter Monitors – performance degradation

Key observations:

- Water slug removal performance degradation confirmed
- Degree of degradation is variable between elements, supportive of mechanism being ‘an event’
- No clear correlation between fuel throughput or time in service
- No difference in performance between ‘dry elements’ and those partially water-wetted.
- Elevated levels of salt can impair the performance of the super absorbent media
- Filter monitors not suitable for FSII dosed fuel

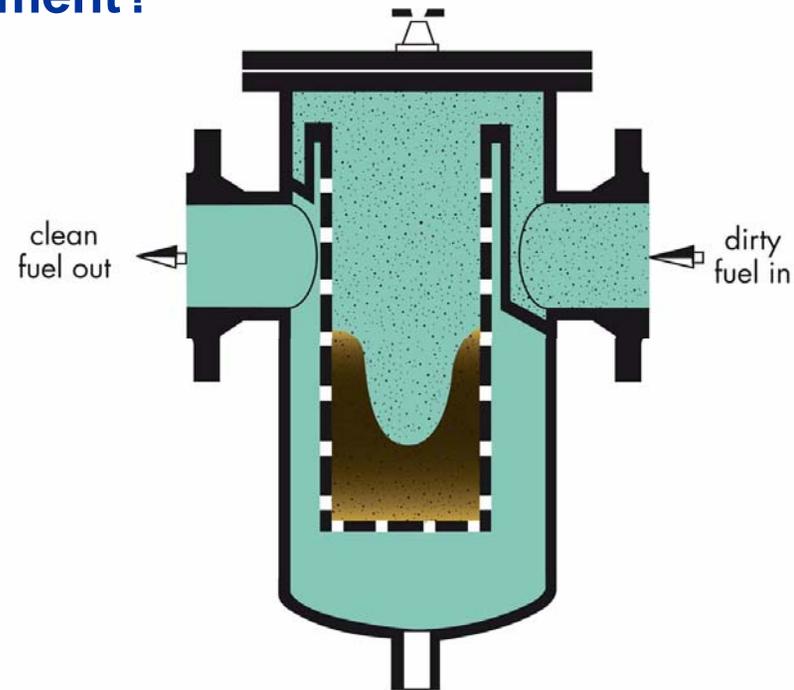
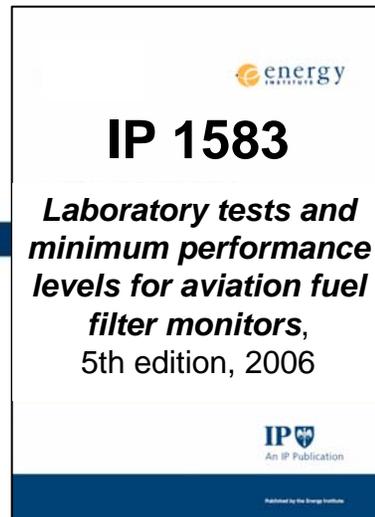
Filter Monitors – IP 1583 5th edition

- **IP Draft Standard 1583 5th edition (issued Nov 06) valid until 1st Nov 2008 (Note supersedes 4th edition)**
- **Includes salt challenge for water removal tests**
- **New water absorbent media/super-absorbent polymer (SAP) migration test - Requirement for none to be detected**
- **Provides new categories to assist manufacturers in product development (to prevent water absorbent media migration)**
- **Emphasis that filter monitors should be considered as only one component in a comprehensive system to protect aviation fuel quality, and cannot be considered as ‘fail-safe’**



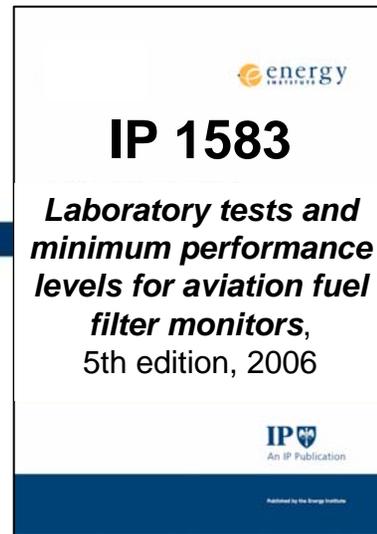
What is EI doing about SAP migration?

- Need to quantify amount
- Understand when it is happening, e.g. after start up, progressive throughout life of element?
- Which element types are most prone: 2" or 6", which flow format?
- Laboratory test protocols developed with manufacturers to measure SAP migration from new elements using downstream bag filter

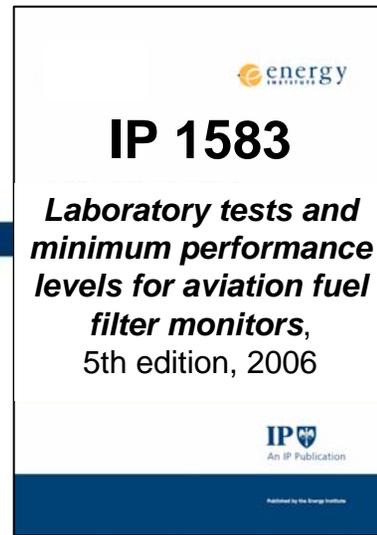


What is EI doing about SAP migration?

- Co-ordinated rig testing by manufacturers
- Contracted an independent test house to conduct rig testing of each model of 2” element
- Contracted Southwest Research Institute to conduct rig testing of each model of 6” in-to-out flow format element



SAP migration – initial findings



2” monitors

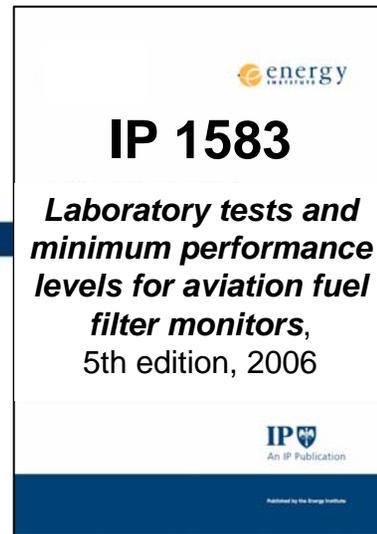
- Trace levels of SAP migration from all elements
- Majority appears to be manufacturing debris (most removed in first 5 minutes)
- Manufacturers actively pursuing improved manufacturing techniques resulting in >80% reduction in initial SAP migration
- Manufacturer’s advisory bulletins awaited

6” monitors

- Trace levels of SAP migration from all elements with inside-to-outside flow format
- Work to be concluded by end May 07

SAP migration – 2007 plan

- Repeat migration tests with new 2” elements from improved manufacturing techniques
- Conclude rig testing of 6” in-to-out flow format elements
- Contract rig testing of 6” out-to-in flow format
- Continue to work with manufacturers to minimise SAP migration
- Review position when complete data set available, end 2Q 07



Dirt defence filters

- Provides an option for retrofitting current filter monitor vessels
- API/IP 1599 1st edition published March 2007
- Aligned with low level dirt testing requirements of IP 1583
- No testing for water removal (some water tolerance)
- (both 2” and 6” out-to-in flow only) if necessary
- Recommended to only be used with a water removal or water detection device
- No qualified products yet available



API/IP 1599

Laboratory tests and minimum performance levels for aviation fuel dirt defence filters, 1st edition, 2007

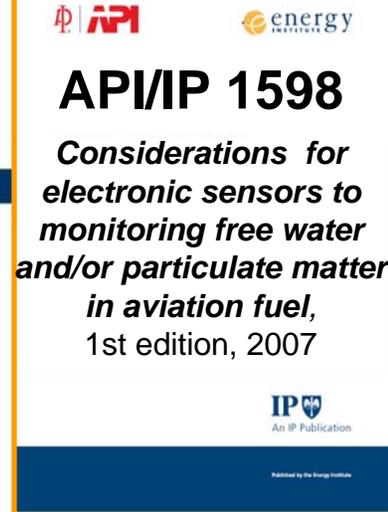


An IP Publication

Published by the Energy Institute

Electronic sensors

- Draft Standard 1598 anticipated before end 2Q 2007
- Applicable to any type of sensor for detection of particulate matter and free water.
- Primarily intended for into-plane fuelling in conjunction with filtration
- Describes key operational parameters of fuel handling system (into-plane) and minimum design requirements (general safety)
- Intended to encourage manufacturers of sensors for other fluid cleanliness applications to consider suitability for aviation application
- 1st edition will not include qualification tests for performance verification – sensors may be ‘compliant with’ API/IP 1598, but not ‘qualified to’ it
- Testing protocols under development



Maintenance and delivery of clean aviation fuel

- Intended to provide information based on experience to aviation fuel filter users/system designers
- Will identify key points to consider in application/use of different filter components in the aviation fuel handling system
- Identifies options for end user to combine current and future technologies
- Draft available for review June 07 (mh@energyinst.org.uk)
- Publication anticipated 3Q 07
- New ways of distribution being considered

Maintenance and delivery of clean aviation fuel

Chapter 4 Description of components

This chapter is intended to provide a general description of the components used for fuel cleanliness control, especially those that are within the scope of API/IP publications.

Table 4 highlights certain design features of components within the scope of API/IP and IP publications.

Table 4: Design features of components used for fuel cleanliness control

Component	API/IP or IP spec	Particulate matter removal	Dispensed water removal	Bulk water removal	Typical location applied
FWS Type S	API/IP 1581/1582	High capacity	Intermediate capacity	Low capacity	Into and out of airport storage
FWS Type S-LD	API/IP 1581/1582	Low capacity	Intermediate	Low	Out of airport storage
FWS Type S-LW	API/IP 1581/1582	High capacity	Low	None	Into-plane only
Filter Monitor	IP 1583	Low capacity	Low capacity	Blocks filter	Into-plane (refueller and hydrant service)
Microfilter	API/IP 1590	High capacity	None	None	Upstream of FWS
Dirt defence filter	API/IP 1599	Low capacity	None	None	Into-plane (refueller and hydrant service)
Electronic sensor	API/IP 1598	None	None	None	Downstream of filter vessel

Note: The filters listed above have to be housed in a filter vessel. The recommended minimum requirements for vessels are included in API/IP 1596 Design and construction of aviation fuel filter vessels.

Filter/water separator (FWS) (API/IP 1581 and API/IP 1582)

A FWS is a vessel containing two types of element: filter/coalescers and separators, see Figures 6 to 9. A FWS is designed to continuously remove particulate matter and water from aviation fuel to levels acceptable for servicing modern aircraft. As the workhorse of aviation fuel filtration, the FWS can be used in any filtration application anywhere in the fuel manufacturing, distribution and supply network.

Chapter 5 Relating API/IP specifications to end use of filters

How do specifications relate to end use of filters?

Figure 17 shows the recommended process that should be followed in the adoption of equipment/components used in aviation fuel handling systems.

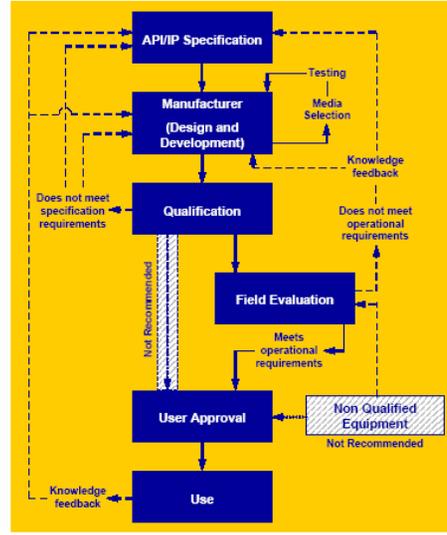
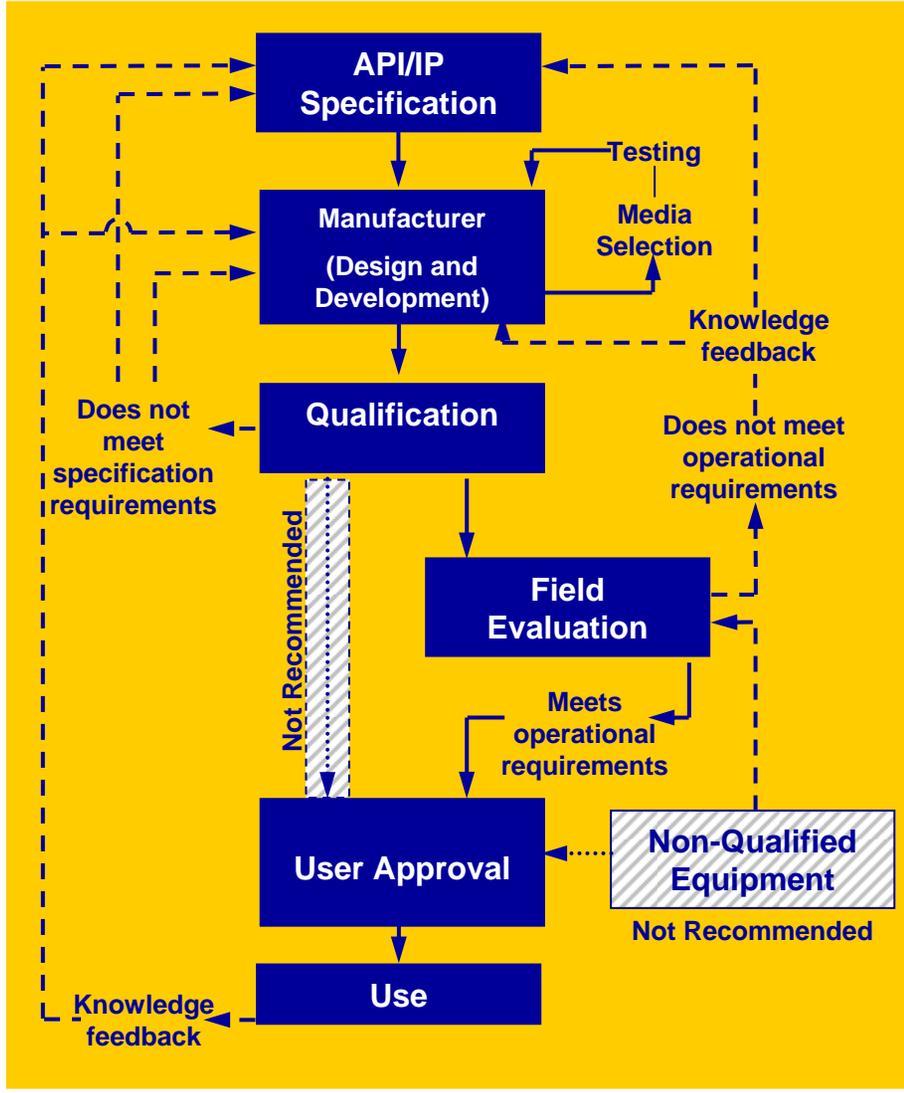


Figure 17: Relationship between API/IP specifications and end use of filters

Maintenance and delivery of clean aviation fuel

API/IP 1550

Maintenance and delivery of clean aviation fuel, Q3 2007



Aviation Fuel Handling Activities Update

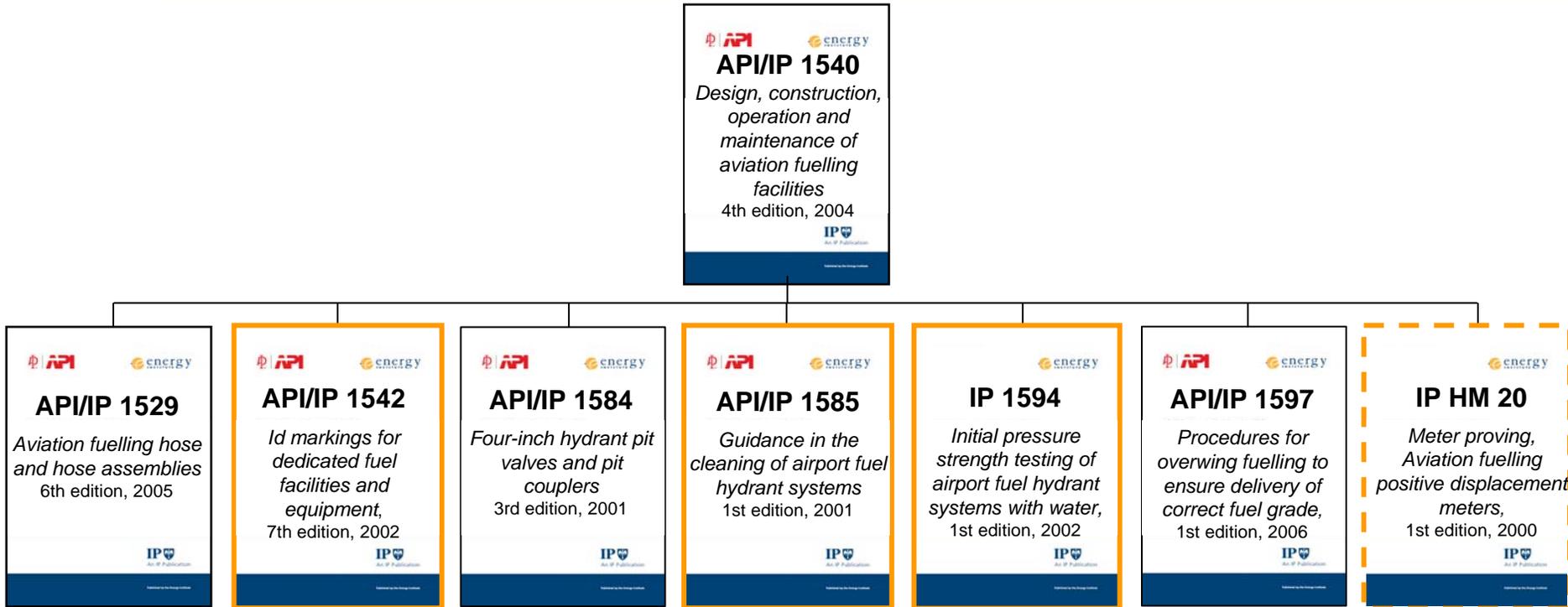
Chris Jones,
Chairman, API/EI Aviation Committee

IATA Technical Fuel Group,
22 May 2007



*“Providing industry with cost effective
value added scientific and technical knowledge on
key current and future issues”*

API/IP and IP aviation fuel handling publications (not filtration)



Aviation Fuel Handling Publications – Revisions in 2007

- API/IP 1541 – *Performance requirements for coatings for jet fuel tanks and piping*. New publication being drafted. Publication expected 3Q 2007
- API/IP 1542 – *Identification markings for dedicated facilities and equipment handling different types and grades of aviation fuel*. Minor revisions being made to new edition. Publication expected 3Q 2007
- API/IP 1585 – *Guidance in the cleaning of airport hydrant systems*. New edition being prepared. Publication expected 4Q 2007.
- IP 1594 – *Initial pressure strength testing of airport fuel hydrant systems with water*. New edition being prepared. Publication expected 4Q 2007.
- Drafts of each of the above available for technical review by interested stakeholders prior to publication, from Martin Hunnybun at EI (mh@energyinst.org.uk)

Aviation Fuel Handling Publications – 2007 continued

- IP research report – *Technical review of sequence of bonding during hydrant dispenser fuelling*. Report completed. Publication due 2Q 2007.
- Work to commence later in 2007 on revising existing API and IP meter proving publications. Intention for a single joint publication in 2008.