



EI 1582 Specification for similarity for EI 1581 aviation jet fuel filter/water separators, 2nd Edition

Addendum 4 October 2013

Page 13: Figure A.1 – Blank EI 1582 Similarity Sheet (first page)

The figure is replaced by the following:

1	Insert Filter Company Logo and/or Name and Address Here					
2	EI 1582 2nd edition Similarity Sheet Reference Number/ID Code:		Insert ID here			
3	1581 Qualification Report Number:	Insert report number here	Prepared for:		Insert customer name here	
4	Parameter	Select Units	Qualified Vessel	Candidate Vessel	Pass/Fail	Notes
5	Vessel Manufacturer					
6	Vessel Model Number					
7	Vessel Serial Number					
8	EI 1581 Category (2.6)				Fail	Category must be the same
9	EI 1581 Type (2.6)				Fail	Type must be the same or Qualified = S
10	Number of Element Stages	EA			Fail	Stages must be the same
11	Vessel configuration					
12	Orientation (2.2a)				Fail	Orientation must be the same
13	Vessel Inside Diameter					
14	Element Layout (2.2b & 2.4)				Fail	Layout must be the same
15	Sump					
16	Location (2.2c)				Fail	Location must be the same
17	Volume (2.2c)				*	* Pass, but requires water defence system per 1581 5th ed. 3.2.4.5
18	Inlet Connection Position (2.2d)				Fail	Inlets must be in the same location
19	Outlet Connection Position (2.2e)				Fail	Outlet must be in the same location
20	Element mounting positions (2.2f)				Fail	Location must be the same
21	Water Defense System Present?					
22	Rated flow of vessel (2.5)				Fail	Candidate must be < or = to Qualified or when qualified is at max (9464 litres, 2500 USG) candidate must be <= 2 times
23	1st Stage (filter/coalescer element)					
24	Model Number (2.6)					Model/Series/Family = Qualified
25	Quantity	EA				
26	Number of Elements/Cartridges in Stack	EA				
27	Element/Cartridge Overall Length					
28	Element/Cartridge Effective Media Length					
29	Outside Diameter					
30	Number of filter/coalescer plugs and their part number	EA				
31	Spacing					
32	Between 1st Stage Elements (2.3a)				Fail	Candidate must be > or = to Qualified
33	Between 1st & 2nd Stage Elements (2.3c)				Fail	Candidate must be > or = to Qualified
34	Between 1st Stage Elements & Vessel (2.3d)				Fail	Candidate must be > or = to Qualified
35	Mean Linear Flowrate (2.7)				Fail	Candidate must be < or = to Qualified
36	Volume					
37	2nd Stage (separator element)					
38	Model Number (2.6)					Model/Series/Family = Qualified
39	Quantity	EA				
40	Number of Elements/Cartridges in Stack	EA				
41	Element/Cartridge Overall Length					
42	Element/Cartridge Effective Media Length					
43	Outside Diameter					
44	Number of separator plugs and their part number	EA				
45	Spacing					
46	Between 2nd Stage Elements (2.3b)				Fail	Candidate must be > or = to Qualified
47	Between 2nd Stage Elements & Vessel (2.3d)				Fail	Candidate must be > or = to Qualified
48	Length/Outside Diameter (L/D) Ratio (2.6)				Fail	Candidate must be < or = to Qualified
49	Liquid Entrance Velocity (2.8)				Fail	Candidate must be < or = to Qualified
50	Volume					Volume of all 2nd Stage Elements
51	3rd Stage (filter monitor elements in separators)					
52	Model Number					
53	Quantity	EA				
54	Quantity per 2nd Stage Separator	EA				
55	Vessel					
56	Length of Vessel					Deck plate to lid opening
57	Vessel Volume					Volume inside of the vessel
58	Vessel Void Volume					Empty space not occupied by elements
59	Positive water drainage (2.10)				Fail	Candidate must have positive water drainage
60	Area Ratio					
61	Void Volume Ratio (2.9)				Fail	Candidate must be > or = to Qualified
62	$\Sigma S_{Ae}/A_{cv}$ (2.9a) Side-by-side		N/A	N/A		Candidate must be < or = to Qualified
63	$\Sigma A_e/A_{cv}$ (All elements to vessel) (2.9b) End opposed		N/A	N/A		Candidate must be < or = to Qualified
For the candidate system to meet EI 1581 by similarity, each entry is required to produce a pass in the pass/fail column. Data are not required in any cells shaded grey. The passes above confirm that the candidate vessel meets all requirements of EI 1582 2nd edition, and therefore is qualified to EI 1581 5th edition						
Name:		Company:				
Signed:		Date:				

Page 14: Figure A.2 – Blank EI 1582 Similarity Sheet (second page)

The figure is replaced by the following:

2	EI 1582 2nd edition Similarity Sheet Reference Number/ID Code:		Unique identifier on sheet which should also be found on removable name/data plate on vessel
3	1581 Qualification Report Number:	The unique number given on the report of the filter/water separator system qualification, against which the candidate vessel/system is being compared	
4	Parameter	Notes	
5	Vessel Manufacturer	Fabricators name, normally different than the Filter company supplying elements	
6	Vessel Model Number	Located on the original data plate fixed to the vessel	
7	Vessel Serial Number	Located on the original data plate fixed to the vessel	
8	EI 1581 Category (2.6)	Three EI 1581 Categories, C (Commercial), M (Military), or M100 (Military Thermal Enhanced).	
9	EI 1581 Type (2.6)	3 types: S significant levels dirt/water, S-LD low dirt/significant amount of water, S-LW significant levels dirt/low water, for mobile applications only. If Qualified = S , the Candidate can be S , S-LD or S-LW	
10	Number of Element Stages	Two possibilities: a 2 stage (filter/coalescer + separator) or 3 Stage (filter/coalescer, separators and monitors)	
11	Vessel configuration		
12	Orientation (2.2a)	Vertical or Horizontal vessel orientation	
13	Vessel Inside Diameter		
14	Element Layout (2.2b & 2.4)	Two groups of element layouts: Side-by-Side - filter/coalescers and separators are fixed to the same end of the vessel, and End-Opposed - fixed to opposite ends. 'Side-by-side, side-to side' candidate systems can qualify against 'Side-by-side, engaged' systems	
15	Sump		
16	Location (2.2c)	Sump location for candidate shall be in relatively the same location as the qualified vessel	
17	Volume (2.2c)	Need not scale with flow rate if Water defence present. Otherwise calculate vol/flow.	
18	Inlet Connection Position (2.2d)	Inlet location for candidate shall be in relatively the same location as the qualified vessel	
19	Outlet Connection Position (2.2e)	Outlet location for candidate shall be in relatively the same location as the qualified vessel	
20	Element Mounting Positions (2.2f)	Element mounting positions shall be in relatively the same location as the qualified vessel	
21	Water Defense System Present?	Float valve or electronic water sensor that alarms or shuts off flow when water detected	
22	Rated flow of vessel (2.5)	Candidate flow rate shall be less than or equal to qualified system or when qualified vessel at max flow (9464 litres, 2500 USG) candidate must be <= two times qualified flow rate.	
23	1st Stage (filter/coalescer element)	The filter/coalescer acts to stop dirt and remove free water from the fuel, inside to outside flow	
24	Model Number (2.6)	Manufacturers model/series/family number. Candidate shall be the same generic family as qualified. May vary in length and type of fitting (end cap)	
25	Quantity	The total number of filter/coalescer elements/cartridges in the vessel	
26	Number of Elements/Cartridges in Stack	Some filter/coalescers are stacked on top of each other, two 20" stacked = one 40" filter/coalescer	
27	Element/Cartridge Overall Length	Linear length from end cap to end cap	
28	Element/Cartridge Effective Media Length	Linear length without the end caps	
29	Outside Diameter		
30	Number of filter/coalescer plugs and their part number	Number of filter/coalescer plugs in Candidate is not directly compared with those in Qualified. Note part number.	
31	Spacing		
32	Between 1st Stage Elements (2.3a)	Closest distance between filter/coalescers, 1581 5th ed. requires at least 0.5" spacing for new vessels	
33	Between 1st & 2nd Stage Elements (2.3c)	Closest distance between a filter/coalescer and a separator	
34	Between 1st Stage Elements & Vessel (2.3d)	Closest distance between a filter/coalescer and the vessel wall	
35	Mean Linear Flowrate (2.7)	The mean flow per linear inch of the effective filter/coalescer length	
36	Volume	Total volume of the filter/coalescers, used to calculate the remaining empty space in the vessel	
37	2nd Stage (separator element)	Separator stage allows fuel to pass into the outlet but not water	
38	Model Number (2.6)	Manufacturers model/series/family number. Candidate shall be the same generic family as qualified. May vary in length and type of fitting (end cap)	
39	Quantity	The total number of separators in the vessel, normally less than half the number of filter/coalescers	
40	Number of Elements/Cartridges in Stack	Rarely separators are stacked on top of each other, two 20" stacked = one 40" separator	
41	Element/Cartridge Overall Length	Linear length from end cap to end cap	
42	Element/Cartridge Effective Media Length	Linear length without the end caps	
43	Outside Diameter		
44	Number of separator plugs and their part number	Number of separator plugs in Candidate is not directly compared with those in Qualified. Note part number	
45	Spacing	1581 5th ed requires at least 0.5" spacing	
46	Between 2nd Stage Elements (2.3b)	Closest distance between separators	
47	Between 2nd Stage Elements & Vessel (2.3d)	Closest distance between a separator and the vessel wall	
48	Length/Outside Diameter (L/D) Ratio (2.6)	Ratio of the total length/outside diameter must be less than or equal to qualified ratio (each stack when stacked)	
49	Liquid Entrance Velocity (2.8)	The mean liquid entrance velocity at the surface of the separator	
50	Volume	Total volume of the separators, used to calculate the remaining empty space in the vessel	
51	3rd Stage (filter monitor elements in separators)	Normally monitor elements located inside the separators. Not to be used with Cat M or M100.	
52	Model Number	Manufacturers model number	
53	Quantity	Total number of monitor elements in the vessel	
54	Quantity per 2nd Stage Separator	Normally 5 per each separator	
55	Vessel		
56	Length of Vessel	Linear length from deckplate to lid opening	
57	Vessel Volume	The total volume of a vessel measured from deckplate to lid opening	
58	Vessel Void Volume	Vessel volume minus the volume of all elements; > empty space = easier performance	
59	Positive water drainage (2.10)	Water shall be able to drain freely from the entire vessel and sump of the candidate vessel. If it cannot, the FWS system cannot qualify to 1581 5th edition	
60	Area Ratio		
61	Void Volume Ratio (2.9)	Void vol/vessel vol candidate must >= qualified; > void vol ratio = easier performance	
62	$\Sigma S_{Ae}/A_{cv}$ (2.9a) Side-by-side	Ratio of the effective element surface areas to cross sectional area (CSA) of the vessel	
63	$\Sigma A_e/A_{cv}$ (All elements to vessel) (2.9b) End opposed	Ratio of the CSA of the elements to the inside CSA of the vessel	

Table A.1 – Logical functions used in the spreadsheet to calculate an entry for another parameter

Logical functions for the following row numbers are amended to:

Similarity Sheet Row Number	Parameter	Logical Function Used in 'Qualified Vessel' Column	Logical Function Used in 'Candidate Vessel' Column
36 (formerly row 35)	Volume for filter/coalescer element	=IF(AND(G25<>"", G26<>"", G27<>"", G29<>""), (G25*G26*G27*3.141592*(G29/2)^2)/Calculations!A4, "")	=IF(AND(H25<>"", H26<>"", H27<>"", H29<>""), (H25*H26*H27*3.141592*(H29/2)^2)/Calculations!A4, "")
50 (formerly row 48)	Separator volume	=IF(AND(G39<>"", G40<>"", G41<>"", G43<>""), (G39*G40*G41*3.141592*(G43/2)^2)/Calculations!A4, "")	=IF(AND(H39<>"", H40<>"", H41<>"", H43<>""), (H39*H40*H41*3.141592*(H43/2)^2)/Calculations!A4, "")
Notes: 'Calculations!A3' refers to '=IF('EI 1582 Similarity Sheet'!F4="SI units",1,1)' 'Calculations!A4' refers to '=IF('EI 1582 Similarity Sheet'!F4="SI units",1,1)'			

Table A.2 – Logical functions used to Generate 'Pass' or 'Fail' statements in the spreadsheet

Logical functions for the following row numbers are amended to:

Similarity Sheet Row Number	Parameter	Logical Function Used to Generate 'Pass' or 'Fail'
20	Element mounting positions (2.2f)	=IF(OR(AND(H20=G20,G20<>"",H20<>""),AND(G20="Horizontal – side-by-side, engaged with separators at the top",H20="Horizontal – side-by-side, side-to-side with separators at the top"),AND(G20="Vertical – side-by-side, engaged",H20="Vertical – side-by-side, side-to-side"),AND(G20="Vertical – side-by-side, engaged",H20="Vertical – side-by-side, concentric")),"Pass","Fail")
22	Rated flow of vessel (2.5)	=IF(OR(AND(F4="SI Units",G22=9464),AND(F4="US customary units",G22=2500)),IF((H22/G22)<=2,"Pass","Fail"),IF(AND(H22<=G22,G22<>"",H22<>""),"Pass","Fail"))

EI 1582

Specification for similarity for EI 1581
aviation jet fuel filter/water separators

EI 1582

SPECIFICATION FOR SIMILARITY FOR EI 1581 AVIATION JET FUEL FILTER/WATER SEPARATORS

2nd edition

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FOREWORD

This publication, prepared by the Energy Institute (EI) Aviation Committee, is intended to provide the industry with a specification for the qualification by similarity of filter/water separators used in systems that handle jet fuel.

These specifications are for the convenience of purchasers in ordering, and manufacturers in fabricating, filter/water separators. They are not in any way intended to prohibit either the purchase or manufacture of filter/water separators meeting other requirements.

Any manufacturer wishing to offer filter/water separators conforming to these specifications is responsible for complying with all the mandatory provisions of these specifications.

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Although it is hoped and anticipated that this publication will assist both the manufacturers and purchasers of filter/water separators, the EI 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 specifications contained herein.

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1 INTRODUCTION AND SCOPE

1.1 INTRODUCTION

Laboratory testing to qualify the performance of filter/water separator systems is specified in EI 1581. A critical performance test specified in EI 1581 is the single element test. This is a test of the intrinsic ability of filtration system components to remove particulate matter and free water from jet fuel. A second critical test is the full-scale test. This is a test of the ability of systems of components, which meet single element test criteria, to remove particulate matter and water under the flow conditions present in commercial-scale systems. Because the scale and complexity of full-scale testing place significant demands on testing resources, it is desirable to minimise the number of full-scale tests required to qualify a range of filter/water separator systems.

Similarity is the methodology developed to minimize the number of full-scale tests. The concept is that full-scale testing is not needed if a candidate filtration system can be shown to be sufficiently similar to a system already qualified (by full-scale testing) to support the expectation that full-scale testing would meet EI 1581 requirements. Such a system is said to be 'qualified to EI 1581 by similarity'.

Similarity is also the methodology used to confirm that the performance of a filter/water separator system is not compromised when different system components are used in service by operators. This recognises that the configuration, layout and operation of a filter/water separator system are critical to its water and particulate matter removal performance in service. This also ensures that the system remains qualified to EI 1581. For further information see EI 1550.

1.2 SCOPE

This publication specifies the minimum requirements for a filter/water separator system to qualify to the free water and particulate matter removal performance requirements of EI 1581 by similarity.

This publication applies to two-stage (filter/coalescer and separator) and the filter/water separator stages of multi-stage filter/water separator systems. This publication does not apply to monitor and/or microfilter stages that may be present in multi-stage systems.

1.3 REFERENCED PUBLICATIONS

The following publications are cited in this publication; the latest available edition applies:

EI 1550 *Handbook on equipment used for the maintenance and delivery of clean aviation fuel*
EI 1581 *Specification and qualification procedures for aviation jet fuel filter/separators*

1.4 ABBREVIATIONS

The following abbreviations are used within this publication:

ft/s	feet per second
gpm	U.S. gallons per minute
lps	litres per second
m/s	metres per second

1.5 DEFINITIONS

The following terms are used within this publication:

$\Sigma S_{A_e}/A_{cv}$ the ratio of the sum of the effective (without end caps) surface areas of all elements to the inside cross-sectional area of the vessel.

$\Sigma A_e/A_{cv}$ the ratio of the sum of the cross-sectional areas of all elements to the inside cross-sectional area of the filtration vessel.

candidate system: the subject of this specification. A candidate system has not been tested to EI 1581 latest edition. The proper application of this specification documents that a candidate system either qualifies to EI 1581 by similarity or fails to qualify to EI 1581.

element layout: general arrangements of filter/coalescer and separator elements as defined in 2.4.

filter/water separator system: a filtration system compliant with EI 1581 that contains at least filter/coalescer elements (that have both particulate matter filtration and free water coalescence functions) and separator elements (whose function is to intercept water droplets that are of a size that will not readily fall to the bottom of the vessel, and thus prevent them from passing downstream of the vessel with the fuel).

mean linear flow rate: the 'flow per inch' for filter/coalescer elements.

qualified system: a filtration system tested to and meeting EI 1581 latest edition requirements.

sump volume: for vertical and horizontal vessels, this is the volume that activates a water defence system when present, or else the volume up to the lowest separator stool, filter/coalescer stool, or element, whichever is smaller.

vessel volume: the volume of a vessel calculated from the internal vessel length and its internal diameter, excluding both its sump volume and the volume inside domed covers.

void volume: the volume of a vessel minus the volume of all elements. Elements are considered as solid objects for this purpose.

void volume ratio: the ratio of vessel void volume to vessel volume.

Note: The sump volume and the volume inside domed covers shall be excluded from the vessel volume when calculating void volume ratio. For horizontal vessels the portion of the sump volume inside the main vessel cylinder shall be included.