



**NAVAL AIR SYSTEMS COMMAND
FUELS & LUBRICANTS DIVISION
AIR-4.4.5**

Test Report

**TEST & EVALUATION OF SUSPECTED UNQUALIFIED
COALESCER RECEIVED FROM DOD SUPPLY SYSTEM**

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Introduction:

The Air Force Petroleum Office requested the Naval Air Systems Command (NAVAIR) Fuels Team (AIR 4.4.5) conduct a Single Element Test (SET) on a generic 40-inch long coalescer element that they received from the Department of Defense stock system and suspected of not being a qualified product. The element in question arrived without any distinguishable markings or labels. The element was tested in accordance with API Publication 1581, 3rd Edition, Group II, Class B, Series 3. The only major difference between the test conducted and the API 1581 3rd edition, Group II, Class B, Series 3 protocol was that the fuel was recirculated from a 5000 gallon tank (actual volume of fuel, 4650 gallons) and not run single pass during the test. The purpose of this test was to evaluate the performance of the suspect coalescer against the API specification.

Discussion:

Prior to testing, the JP-5 was water washed, cleaned, and clay treated before the additives were added. Table 1 is a list of additives and concentrations that were added to the fuel prior to testing.

Table 1: API 3rd Edition Additive Package

Additive	Concentration
Stadis 450	3.5 mg/L
Hitec E580	2.9 mg/L

The coalescer was tested in accordance with API 3rd Edition, Group II, Class B, Series 3. The testing protocol is outlined in Table 2. Fisher Scientific Company, #I-116 red iron oxide (RIO) was used for the solids portion of the test. Distilled water was used for the 0.01% water injection, while filtered potable tap water was utilized for the 3.0% water injection portion of testing.

Table 2: API 3rd Edition Test Protocol

Test Phase	Duration	Effluent Determination Method
Element Conditioning	45 minutes	ASTM D-2276
Solids Injection (133 mg/gpm)	75 minutes	ASTM D-2276
Water Injection (0.01%)	60 minutes	ASTM D-3240
Water Injection (3.0%)	30 minutes	ASTM D-3240

The API 1581 effluent test requirements and results for the element tested are shown in Table 3. The element tested failed to meet the requirements of API 1581 3rd edition by passing greater than 0.26 mg/l of solids into the effluent fuel stream. The free water requirements at first look appear to be satisfactory, but the true effluent free water levels could not be ascertained because the RIO passing through the element was collecting on the AquaGlo pad and interfering with the results. The RIO interfered with the fluorescence of the pad, ultimately giving incorrect low readings.

In addition, the fuel flow rate could not be maintained at 40 gpm during the last 10 minutes of the test because the differential pressure was too great across the housing. The RIO passing through the coalescer element had begun to clog the separator and overpressure the housing. The flow rate had to be lowered to half the initial test flow rate in order to maintain a safe pressure in the housing.

Table 3: Effluent Specification Limits and Results

Test Phase	Specification Limit	Maximum Observed Value
Media Migration	10 Fibers/l	0.12 fibers/l
Total Solids (Solids Injection)	0.26 mg/l	1.0 mg/l
Total Solids (0.01% Water)	0.26 mg/l	0.8 mg/l
Total Solids (3.0% Water)	0.26 mg/l	6.3 mg/l
Free Water (0.01%)	15 ppm	3.5 ppm*
Free Water (3.0%)	15 ppm	6.0 ppm**
Differential Pressure (Clean)	10 psid	8.0 psid
Differential Pressure (2/3 Dirt)	15 psid	14.0 psid
Differential Pressure (Full Spec)	40 psid	18.0 psid

* False low free water readings: AquaGlo pads had slight pink color from RIO in effluent stream

** False low free water readings: AquaGlo Pads were covered from RIO in effluent stream

Photos 1 through 5 document the various stages of testing. Photo 1 was taken during the element conditioning period. Photo 2 was taken immediately after a stop/start during the dirt injection portion of testing. Photos 3 and 4 were taken during the water injection segments of testing at the 0.01% water injection rate and 3.0% water injection rate, respectively. Photo 5 shows the element after testing was complete.

Conclusions:

The element failed to meet the specification requirements of API 1581 3rd edition when tested in accordance with the Group II, Class B, Series 3 test method. The effluent solids were significantly greater than the 0.26 mg/l allowed by the specification. The high effluent solids interfered with the determination of the effluent free water causing false low Aquaglo free water measurements.

Recommendations:

- a. The manufacturer and part number of the coalescer element tested should be identified.
- b. All similar coalescer elements (manufacturer's part number) currently in service should be removed and replaced with qualified products.
- c. The Defense Logistics Agency should be instructed to remove all similar coalescer elements from the National Stock System immediately.
- d. The process of how this apparently unqualified element got into the National Stock System should be investigated and corrected to avoid this problem in the future.



Photo 1: Clean Element



Photo 2: Dirt Injection Stop/Start



Photo 3: 0.01% Stop/Start



Photo 4: 3.0% Water Injection



Photo 5: Element after Test Completion