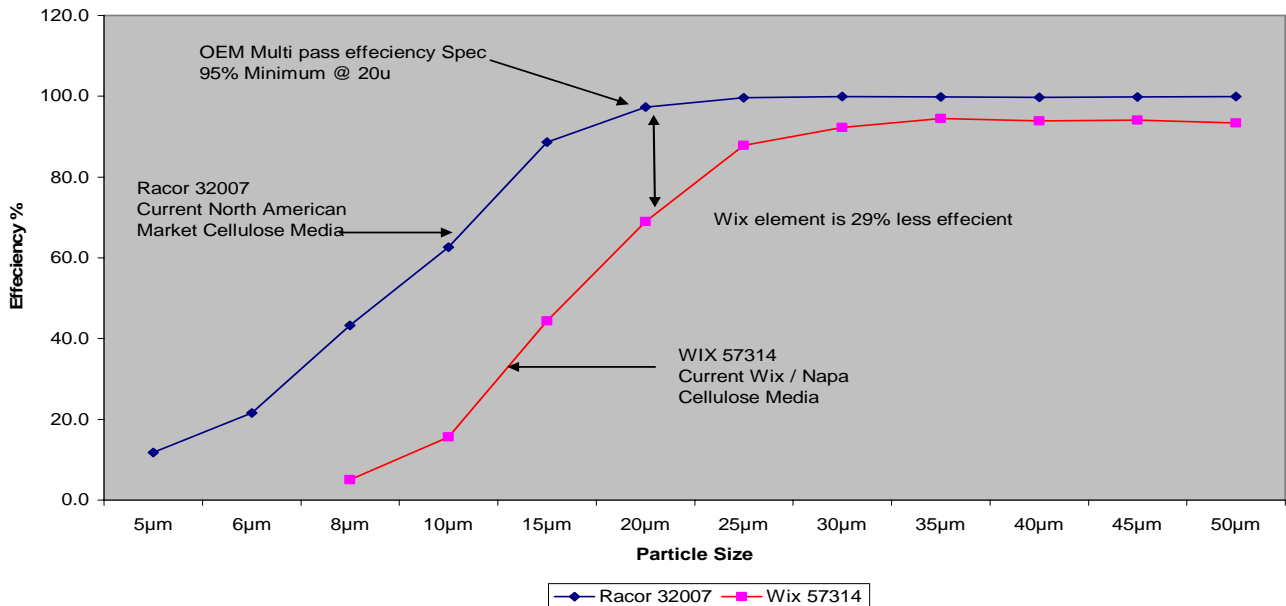


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Racor PF L2016 / 32007  
 Patent #6,086,763 / 6,554,139 B1 / 6,986,426, B2 / 6,983,851, B2  
 Wix 57314 Element  
 March 10, 2006  
 Test Performed by Bonavista Technologies, Inc  
 An Independent Laboratory

Element	Over all Height	Element Height	Pleat Count	Pleat Length	Pleat Height	Total Area Sq.”	Media area Difference %	Efficiency @ 10 micron	Efficiency @ 20 micron	Element Restriction
Racor	6.875	6.5	52	6.375	0.687	497	10% more	63.20%	97.80%	1.3 psid Avg. Diff.
Wix	6.875	6.25	68	6.125	0.5	446		15.60%	69%	5.2 psid 75% Higher

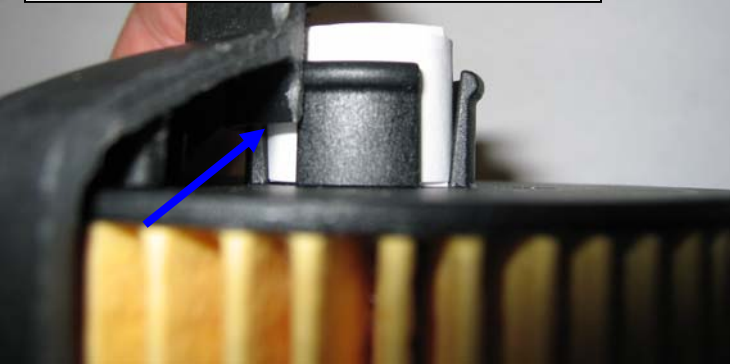
**PERFORMANCE**  
 ITEC Specification: 95% @ 20 Micron  
 Racor Efficiency: 97.4% @ 20 Micron  
 Wix Efficiency 69% @ 20 Micron



## Critical Features

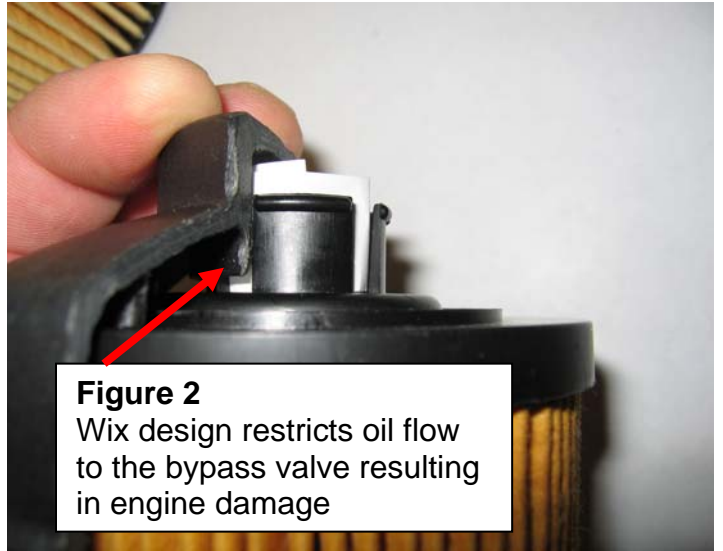
**Figure 1**

Racor end cap engineered to fit properly in screw cap to allow oil flow to bypass valve for engine protection



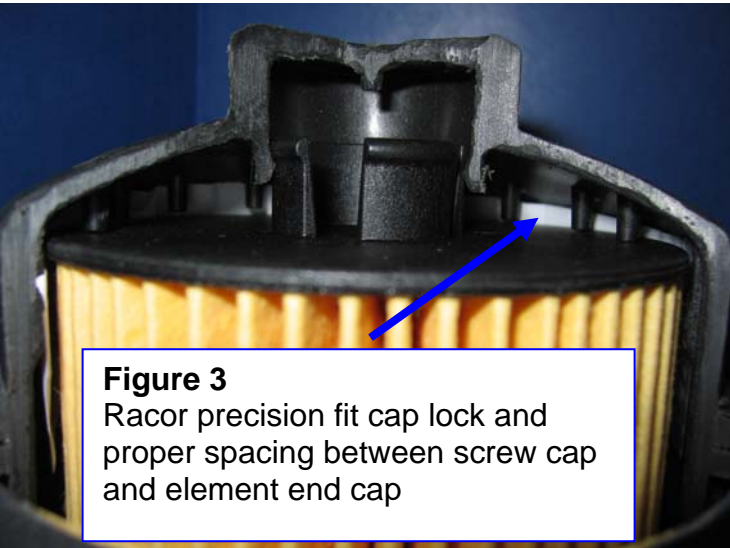
**Figure 2**

Wix design restricts oil flow to the bypass valve resulting in engine damage



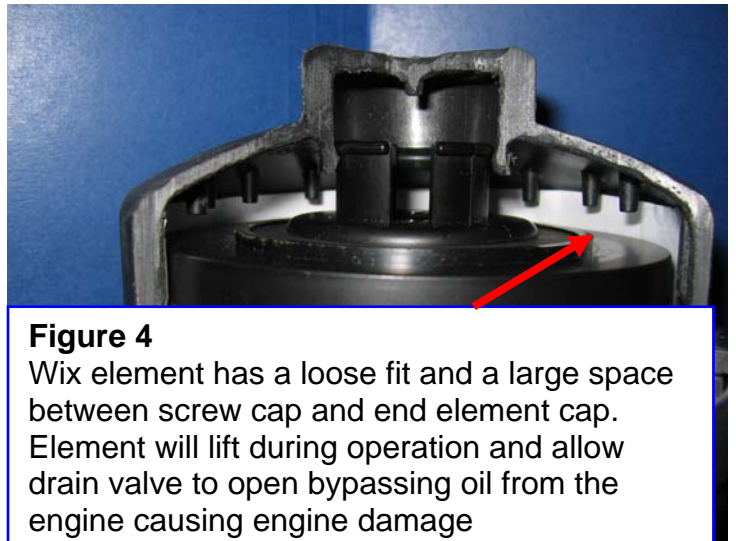
**Figure 3**

Racor precision fit cap lock and proper spacing between screw cap and element end cap

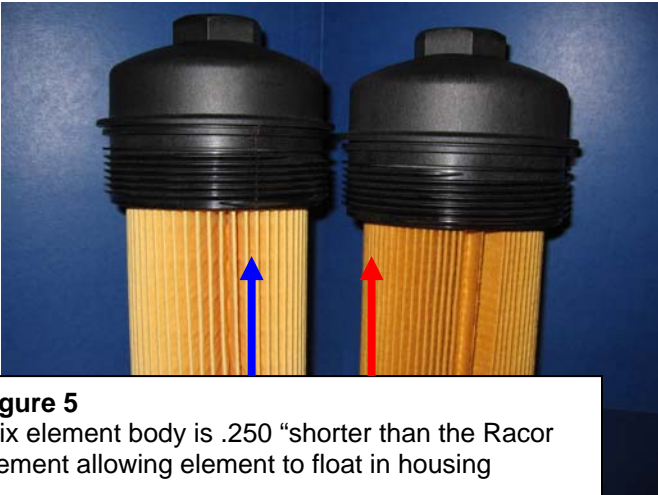


**Figure 4**

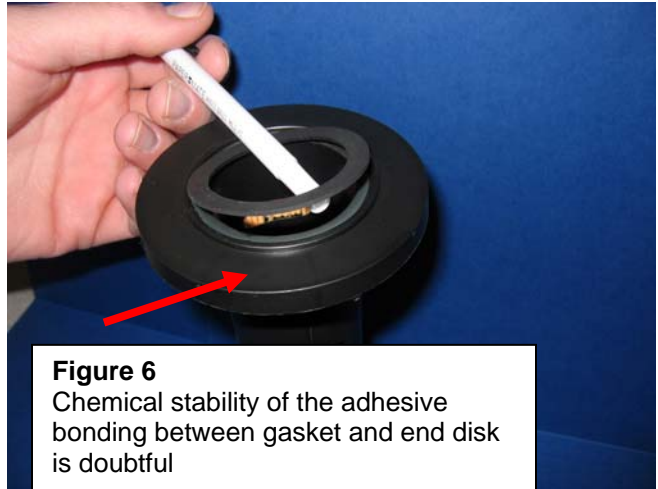
Wix element has a loose fit and a large space between screw cap and end element cap. Element will lift during operation and allow drain valve to open bypassing oil from the engine causing engine damage



## Fit and Function

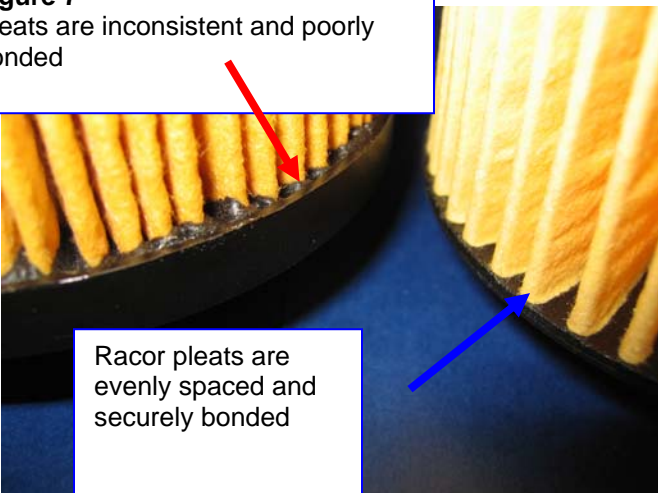


**Figure 5**  
Wix element body is .250 "shorter than the Racor element allowing element to float in housing



**Figure 6**  
Chemical stability of the adhesive bonding between gasket and end disk is doubtful

**Figure 7**  
Pleats are inconsistent and poorly bonded



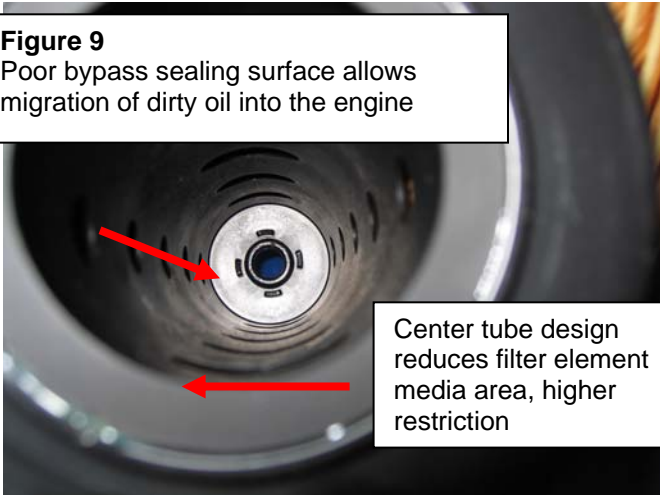
Racor pleats are evenly spaced and securely bonded



**Figure 8**  
Glued element bottom seal may come unglued when removing the filter for service leaving the seal in the housing

**Figure 9**

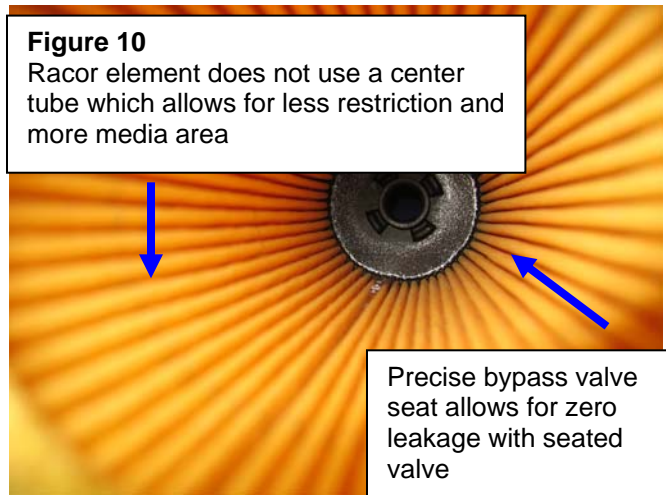
Poor bypass sealing surface allows migration of dirty oil into the engine



Center tube design reduces filter element media area, higher restriction

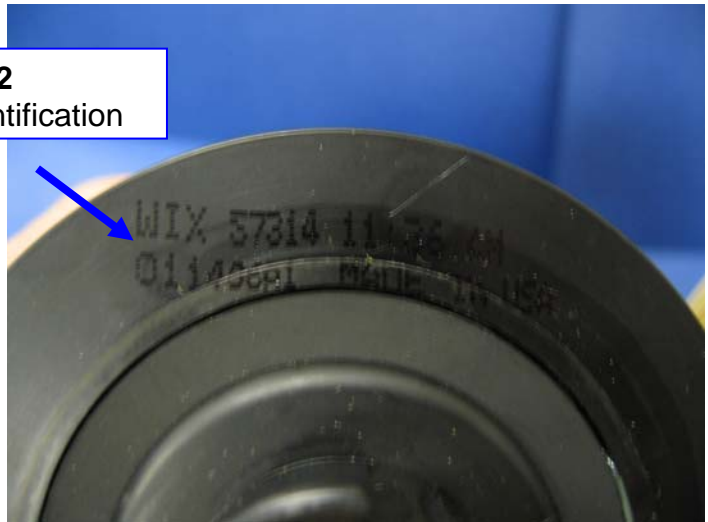
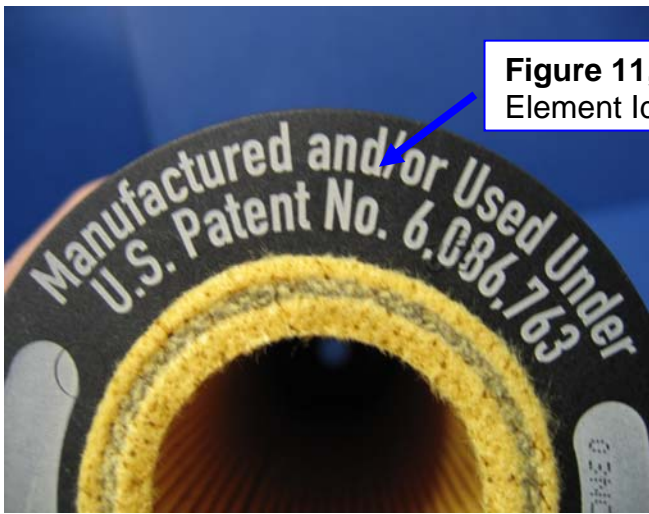
**Figure 10**

Racor element does not use a center tube which allows for less restriction and more media area



Precise bypass valve seat allows for zero leakage with seated valve

**Figure 11, 12**  
Element Identification



## Noted Areas of Concern

Feature	Racor 32007	Wix 57314	Consequence
Center tube protrusion above the top end cap	Flat end cap, no restriction of flow to bypass valve for engine protection	Center tube protrudes .156 above top end cap closing off flow of oil to the bypass valve	<b>Reduced oil pressure resulting in severe engine damage or catastrophic engine failure</b>
Element and screw cap fit	The element clips tightly in the screw cap with out vertical movement	The element clips loose in the screw cap allowing for vertical movement	<b>When the element lifts during operation the drain valve could be open allowing loss of engine oil pressure causing catastrophic engine damage</b>
O-ring (service pack)	ACM 70	NBR 70	- lower temperature stability
end disk	PA6GF30	PA 66	- lower mechanical stability
clips	PA6GF30	PA 66	- lower mechanical stability  - forces between screw cap and clips (23 – 30 N) of the end disk can be insufficient to remove filter element from housing
center tube	- - -	PA 66	- has no function since there is a center tube in the filter housing that supports the pleats  - causes possibly additional differential pressure
gasket, lower end disk	Polyimid-felt	- NBR 70  - fixed with adhesive	- less temperature stability than required  - chemical stability of the adhesive bonding between gasket and end disk is doubtful
filter area	ca. 3200 / 497 cm <sup>2</sup> / sq in	ca. 3000 / 465 cm <sup>2</sup> / sq in	- less filter area  - not significant
filter media	Cellulose / Microglasfiber	Cellulose / Microglasfiber	- equal concerning the chemical constituent parts
pore size	ca. 14 μm	ca. 13 – 14 μm	- equal as measured

**Annotation:**

1. The Racor filter housing includes a patented element bypass valve in the center tube that operates as the differential pressure across the element increases either during cold starts or as the element becomes restricted through normal use. The design of the Racor element is engineered to fit in the screw cap to allow the proper amount of oil to pass across the top of the element and flow through the element bypass valve under certain conditions, supplying an adequate amount of oil to the engine and components for normal operation.
2. The Wix element center tube design protrudes upward into the flow path of the oil to the bypass valve which will restrict or completely shut off the oil under cold starts or when the element becomes restricted during normal use. The result of the lack of lubrication under these circumstances will be component and or severe engine damage.
3. Because of the poor fit of the Wix element in the screw cap the element will rise up during operation and possibly allow the auto drain valve to open and direct engine lube oil to the sump. This will result in loss of oil pressure to the engine causing severe engine damage.
4. The retention required by NAVISTAR (retention 95%@20 $\mu$ m) is not met by the NAPA filter element.
5. Inconsistent differential pressure. The NAPA filter element has a higher differential pressure. This causes the bypass valve to open more often and permits more unfiltered oil to get on the clean side of the filter element. Lower differential pressure and lower efficiency's were also noted.
6. The Wix element does not have the required retention.
7. Due to the weaker material used for the end disc and clips, the filter element may not under certain circumstances be disassembled together with the screw cap at time of service.
8. Less chemical stability of the gaskets.