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# NIRSPEC

UCLA Astrophysics Program

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## NIRSPEC Cryomechanics Application Note 07.00 Dual Filter Wheel Mechanism

Note-Clean room gloves of some type should be used when following this or any other internal Nirspec procedure.

### Changing Filters (Mechanism is not removed from Nirspec)

Filters can be removed and installed with the mechanism in situ. The Lyot stops are mounted in these wheels in the same manner and can also be removed/installed using the following procedures but extreme care must be used in handling as they are extremely delicate. Access is provided to wheel #1 or #2 (see Illus. I) through individual ports. The covers on these ports are attached with three (3) 4-40 socket head cap screws. These screws are **not captive** and care must be taken in their removal. (See Figure 1).

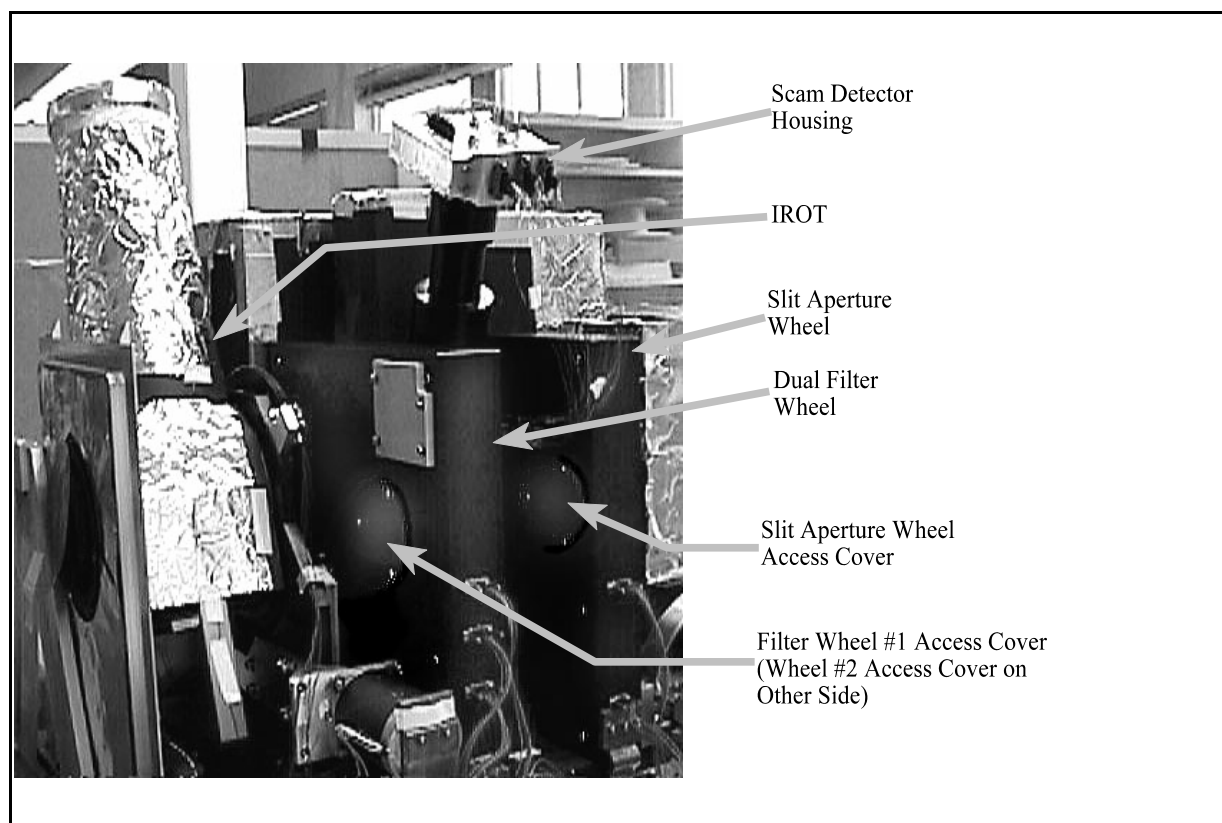


Figure 1 ; Wheel Mechanisms

The access port is 180 deg. away from the observing position so the accessed filter's identity can be determined relative to the "in-position" filter. (See Table I)

Filter Wheel #1

Pos. #	<b>FILTER</b>	<b>PAIRS</b>	Pos. #
1	Open + Nominal Lyot Stop	HeI + PK50	7
2	Thin PK-50 + Nominal Lyot Stop	Pa-Beta + PK50	8
3	Thick PK-50 + Nominal Lyot Stop	FeII + PK50	9
4	L'	H2 + PK50	10
5	M'	M <sub>wide</sub>	11
6	KL	Blank	12

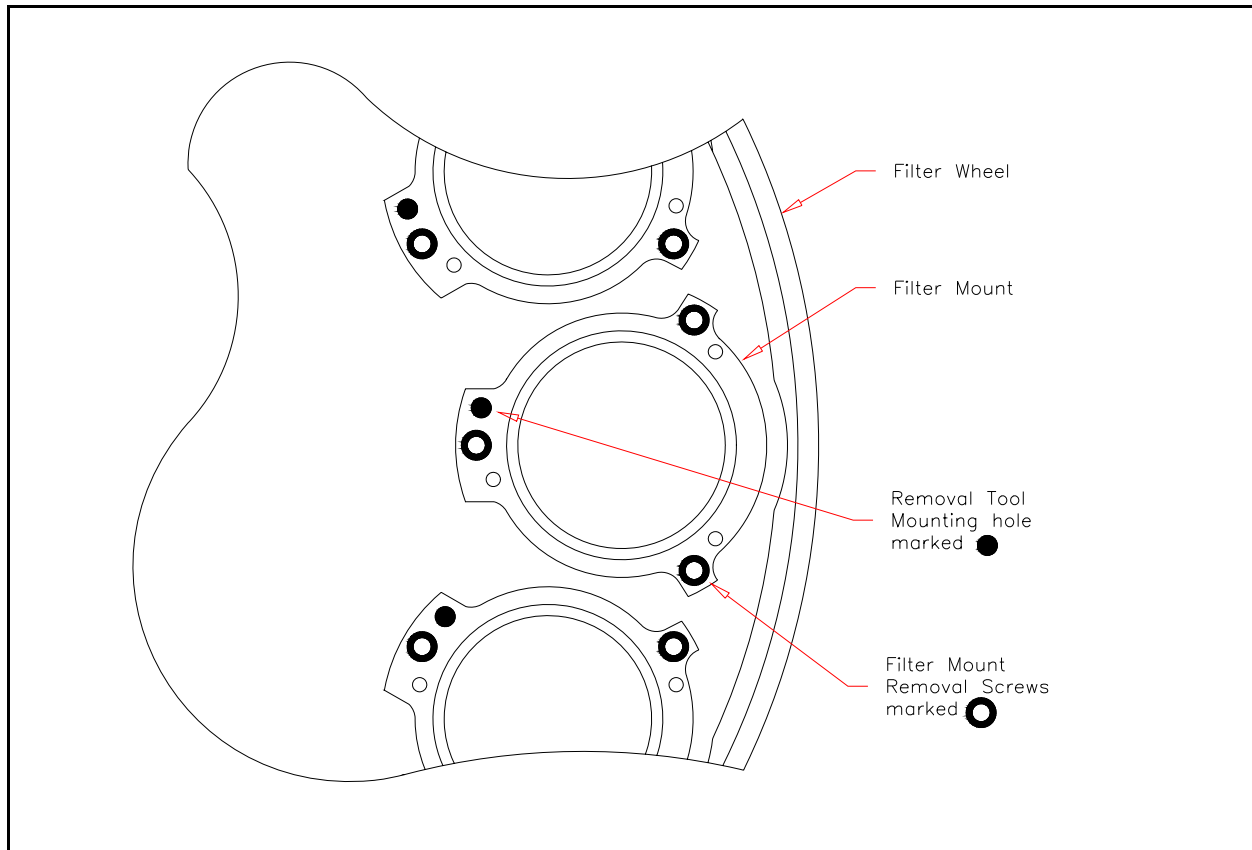
Filter Wheel #2

Pos. #	<b>FILTER</b>	<b>PAIRS</b>	Pos. #
1	N1	N7	7
2	N2	Br-Gamma	8
3	N3	CO	9
4	N4	K	10
5	N5	K'	11
6	N6	Open + Inscribed Lyot Stop	12

**Table 1; Relative Filter Positions**

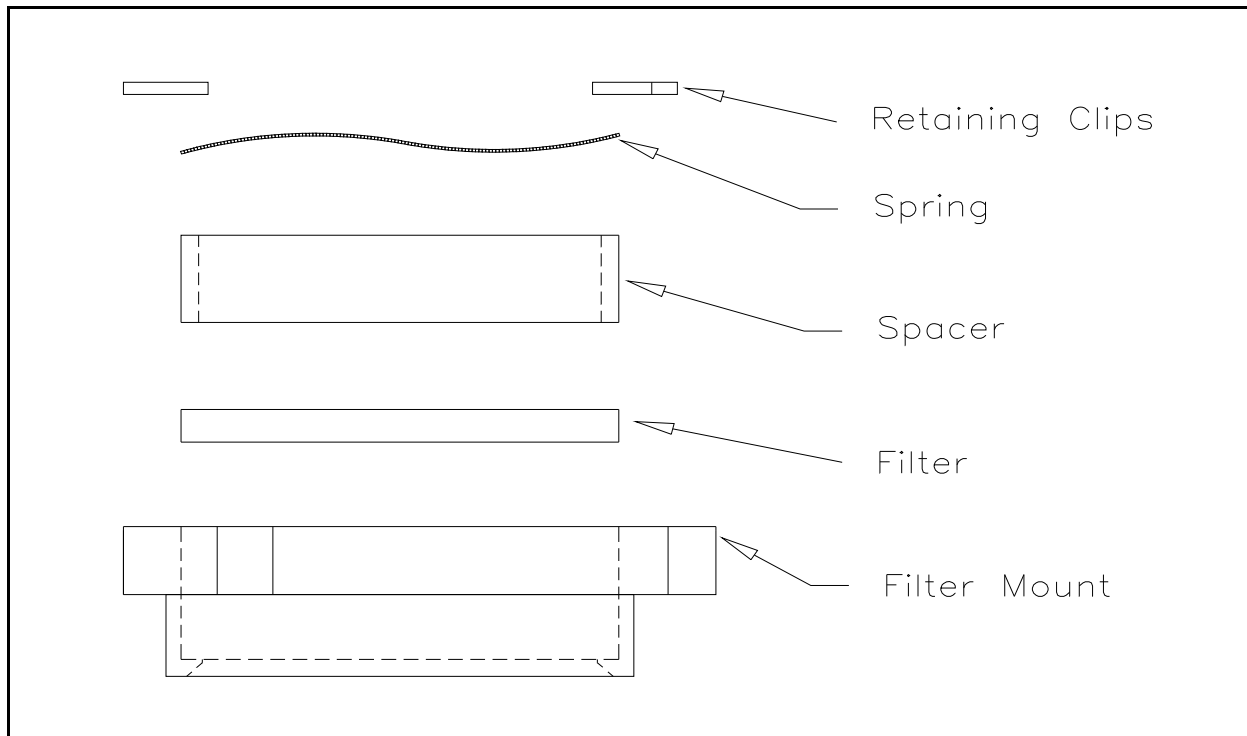
The filters are mounted in a sub-assembly (“filter mount”) which is removed from the wheel as a unit. The filter mount attaches to the wheel with three (3) **captive** 4-40 socket head cap screws. A tapped hole is provided to attach a removal tool (essentially a temporary handle to hold the filter mount). In order to remove a filter mount follow these steps:  
(See Figure 2)

- ! Screw in the removal tool until finger tight. Hold with one hand..
- ! Loosen the three screws, alternating between them with about one turn each time until the mount disengages, and pull out the assembly with the removal tool.
- ! Reverse these steps to install a filter mount assembly.



**Figure 2; Filter Mount Removal Detail**

Each filter mount assembly consists of a mount, filter, wave spring, spacer, and three (3) retaining clips. (See Figure 3) The spacer is chosen in order to provide 0.010"-0.030" of compression on the springs. Spacers can be stacked if necessary.

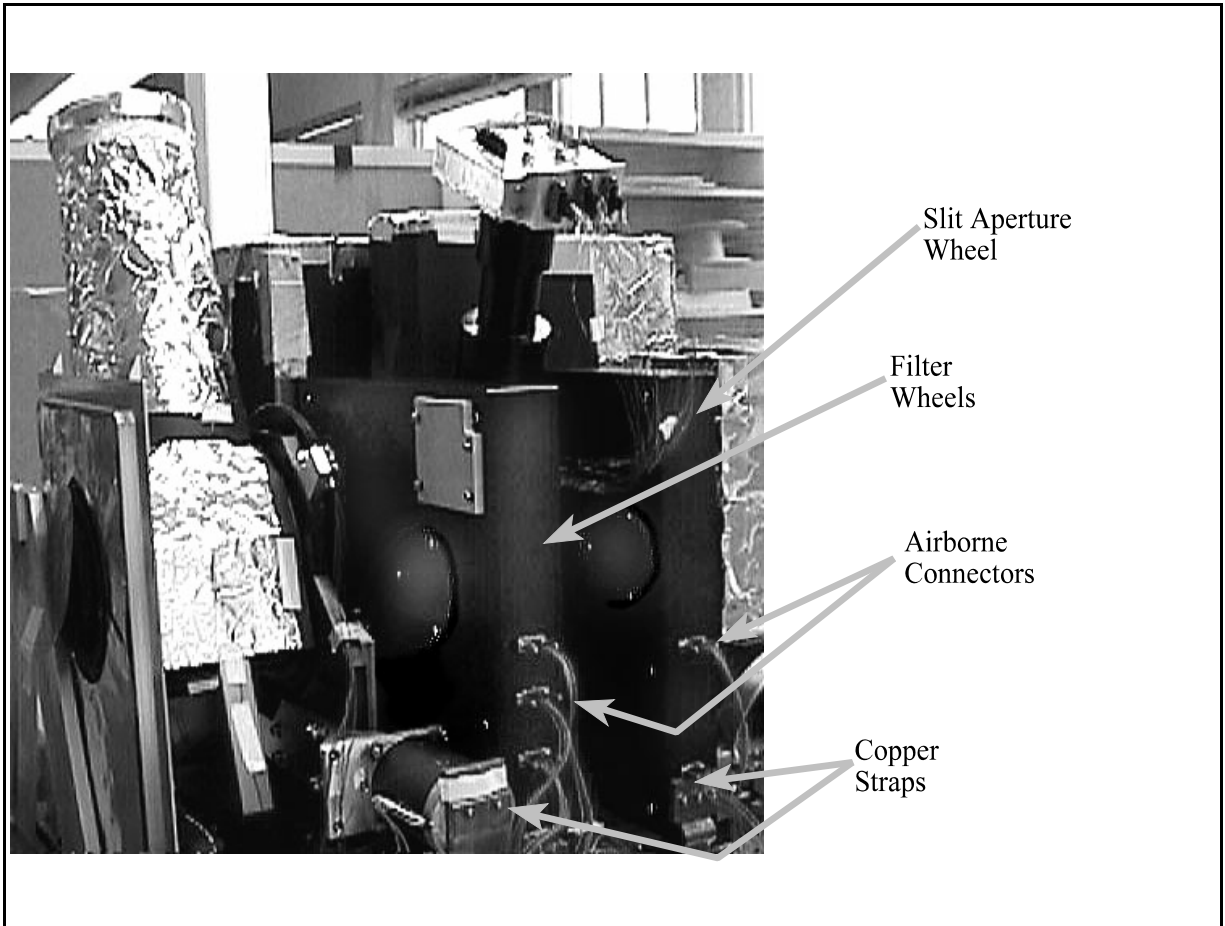


**Figure 3; Filter Mount Assembly**

### Removing Mechanism from Nirspec

The following procedures should only be necessary at major maintenance intervals (4-5 YRS.?) when stepper motors are replaced. Refer to Figure 4 for this procedure.

- ! Check that instrument power is off.
- ! Remove copper thermal strap connecting Image Rotator motor to optical plate. The strap is connected at both ends with cap screws and Belleville washers. This is necessary to allow clearance for dual wheel mechanism removal.
- ! Remove copper thermal strap connecting wheel mechanism to optical plate. The strap is connected at both ends with cap screws and Belleville washers.
- ! There is a threaded baffle hood that extends from the wheel mechanism to the image rotator with a “tongue in groove” termination. The operational position of this hood is one turn short of making contact with the matching groove in the image rotator. For filter wheel mechanism removal this hood has to be screwed, or withdrawn, away from the image rotator until it stops against the wall of the wheel mechanism



**Figure 4; Wheel Removal**

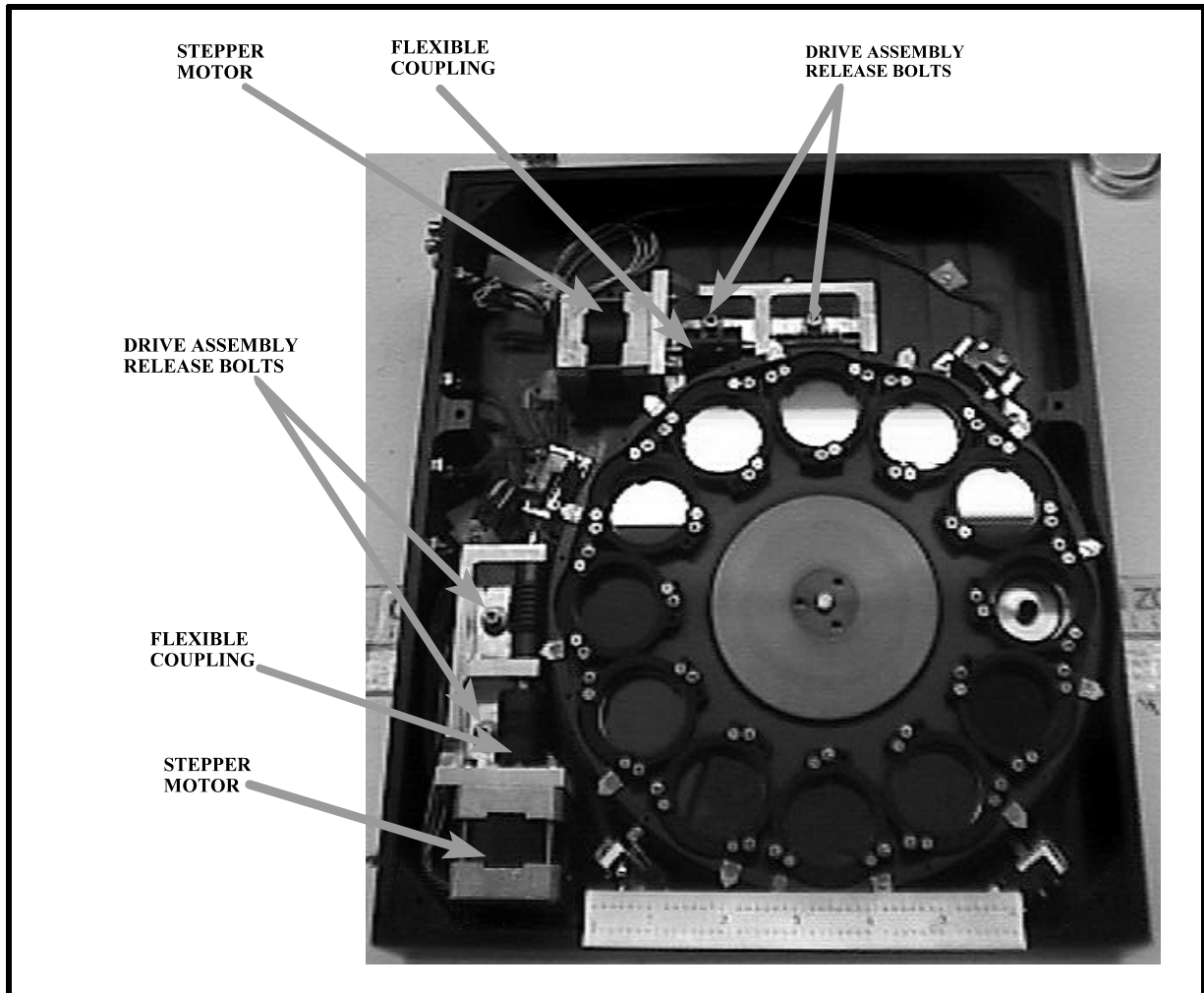
- ! Dis-connect the Airborne connectors at the rear of the mechanism.
- ! The mechanism's three (3) mounting feet are bolted to the "mini-bench" with three (3) 10-32 socket head cap screws and Belleville washers. A special extended hex wrench (provided) is necessary to reach one of these screws . Long tweezers can also be useful for removing the screws. These screws are **not captive**.
- ! *(It is helpful to have two (2) people for the next steps)* The dual filter wheel mechanism's position is referenced to the system through the use of two dowel pins located on the "mini-bench", two matching grooves in two of the mechanism's mounting feet, and a "tongue and groove" interface to the k-mirror/f-converter assembly. The operational position of the mechanism is hard up against the k-mirror. To dis-engage the mechanism slide it along the grooves, away from the K-mirror assembly and towards the Image Rotator, as far as it will travel (approximately 1/8").
- ! To remove the mechanism, raise it far enough to just clear the pins and then pull it away until the rear mounting foot clears the bottom of the Image Rotator Motor. It can then be raised up and out of the instrument, *Clearances are tight and contact between surfaces during removal is unavoidable.*

! To re-install mechanism, locate grooves onto pins and slide mechanism towards K-mirror until “tongue and groove” make contact. Bolt down mounting feet and reverse the previous steps.

### Stepper Motor Replacement

I recommend that once the wheel mechanism is removed from the instrument it should be taken off the summit to complete this procedure as it requires no small amount of finesse.

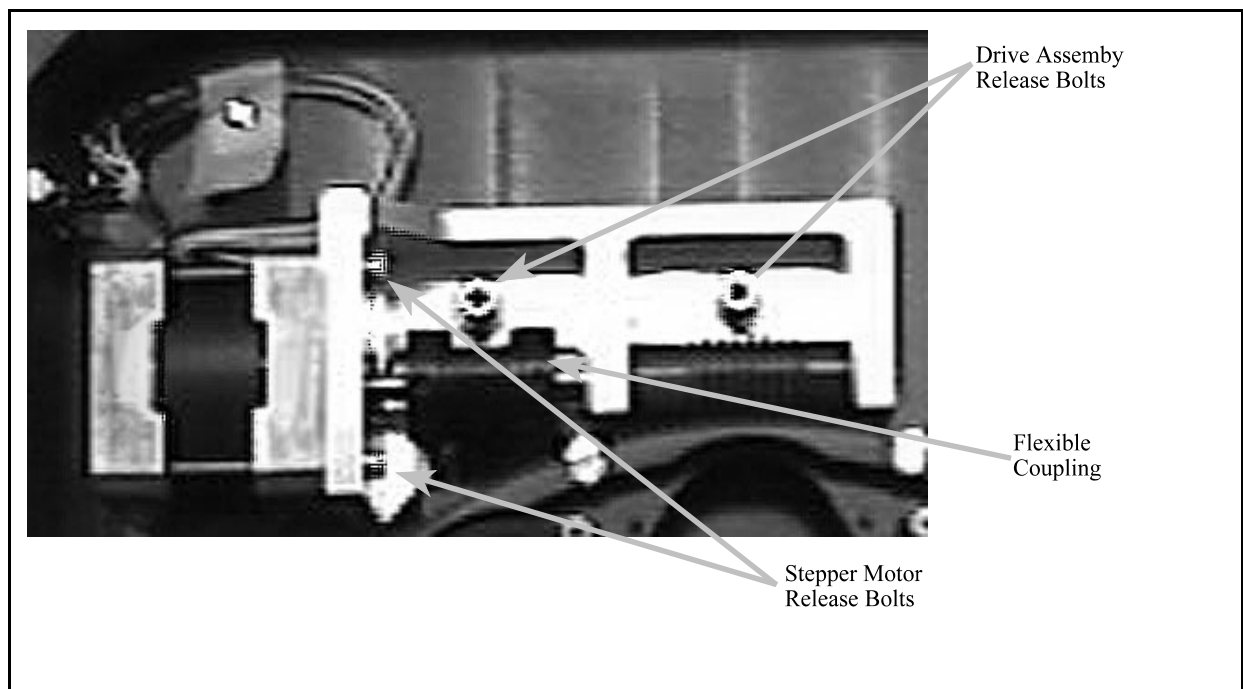
! Remove cover plate. The cover plate is attached with six (6) 8-32 socket head cap screws



**Figure 5; Dual Filter Wheel  
Internal Detail**

and Belleville washers. One is hidden by a mounting foot. Loosen this foot and rotate 180 deg. to expose the sixth bolt. Temporarily tighten the foot down in this position. Remove the screws and lift the cover away.

- ! Remove Airborne bulkhead connectors from bulkheads. Small wrenches and tweezers are necessary.
- ! Using feeler gauges, calipers, etc., reference motor assembly(ies) to adjacent casing walls and record measurements.
- ! The motor assemblies are attached to the casing with two (2) 8-32 socket head cap screws and belleville washers. Remove these two screws and lift the motor assembly out of casing.
- ! The motor shaft is locked to a flexible coupling with a set screw and a clamp screw (see Figure 5). Remove the set screw and loosen the clamp screw.
- ! The motor is attached to the assembly with four (4) 4-40 socket head cap screws. Remove them and pull the motor away from the coupling.
- ! Slide the replacement motor into the coupling. Line up the holes in the shaft and coupling for the set screw.
- ! Let the shaft assembly align the motor and re-install the screws holding the motor.
- ! Replace the set screw and tighten the clamp screw.
- ! Using the position measurements, re-locate the motor assembly relative to the wheel and bolt to casing.
- ! Re-install connectors into bulkheads
- ! Re-install cover plate
- ! Loosen and rotate mounting foot back into position. Use any flat surface (flat edge, etc) to insure it is flush with case edges and tighten down



**Figure 6; Drive Assembly**