

HIGH-POWER RMS-PLUS™ Assembly and Operation Instructions

READ THIS BEFORE YOU BEGIN:

• Study the illustrations and sequence of assembly. **THE SEQUENCE OF ASSEMBLY IS EXTREMELY IMPORTANT. READ ALL INSTRUCTIONS BEFORE USE. USE RMS™ MOTORS AND RELOAD KITS ONLY IN ACCORDANCE WITH ALL INSTRUCTIONS.** Review the parts list and become familiar with all parts before assembly. **IF ANY PARTS ARE MISSING OR DAMAGED, CONTACT RCS AT 1-435-865-7100 OR EMAIL AT warranty@aerotech-rocketry.com.**

• **DO NOT USE ANY PARTS OF THE RMS™ SYSTEM THAT ARE DAMAGED IN ANY WAY.** If in doubt, contact RCS at the number above for assistance.

• **DO NOT MODIFY THE MOTOR IN ANY WAY.** Modification of the motor or the reload kit parts could result in motor failure, lead to the destruction of both your rocket and motor and may cause personal injury, death and/or property damage. Modification of the motor or reload kit in any way will invalidate your motor warranty.

• **USE ONLY AEROTECH/RCS RMS™ RELOAD KITS AND MOTOR PARTS TO REFURBISH YOUR RMS™ MOTOR.** The AeroTech/RCS reload kits have been designed specifically for use in your particular AeroTech/RCS RMS™ motor. Use of imitation components may destroy your motor, rocket and payload and will invalidate your motor warranty. Only use AeroTech/RCS RMS™ reload kits intended for your specific AeroTech/RCS RMS™ motor. **DO NOT INTERCHANGE PARTS!** Do not use AeroTech/RCS RMS™ reload kits or motor components for any other purpose than to refurbish an AeroTech/RCS RMS™ motor.

• **DO NOT REUSE ANY OF THE DISPOSABLE PARTS OF THE RMS™ RELOAD KIT.** This includes the liner, nozzle and o-rings. These components have been designed for one use only and must be discarded after firing. Reuse can result in motor failure during subsequent operation and will invalidate your motor warranty.

• Motors are hot after firing. Although the RMS™ operates at a lower temperature than most disposable motors, the higher thermal conductivity of the aluminum motor parts may make it seem otherwise. If necessary to handle a motor before it has cooled down, use a rag or similar article.

• Read and follow the safety code of the Tripoli Rocketry Association (TRA) and comply with all federal, state and local laws in all activities involving high power rockets.

DO NOT OPEN RELOAD KIT UNTIL READY TO USE.

PARTS:

RMS™ HARDWARE

54mm aft closure	1
54/852 Case (J250FJ)	1
54/1280 Case (J401FJ)	1
54/1706 Case (K513FJ)	1
54mm forward closure (std. reg. length or plugged reg. length)	1

RELOAD KIT

Nozzle (black plastic part)	1
Liner (2" O.D. black plastic tube)	1
Propellant grains	2, 3, or 4
Fwd & Aft O-rings (1/8" thick X 2" O.D.)	2
Liner O-ring (1/16" thick X 2" O.D.)	1
Forward insulator (2" O.D. washer)	1
Ejection charge cap (adhesive paper disk)	1
RMS-Plus™ delay element (short solid part)	1
Delay insulator (1-1/8" O.D. paper tube)	1
Delay o-ring (1/8" thick X 1-1/8" O.D.)	1
Aft delay spacer (short colored paper ring)	1
Forward delay spacer (1-1/8" O.D. neoprene washer)	1

ITEMS NEEDED FOR USE:

- Synco™ Super Lube™ or other grease
- Hobby knife
- FFFFG black powder
- Wet wipes or damp paper towels

SAVE THE RELOAD KIT PLASTIC BAG FOR THE USED RELOAD PARTS. DISPOSE OF BAG AND PARTS PROPERLY.

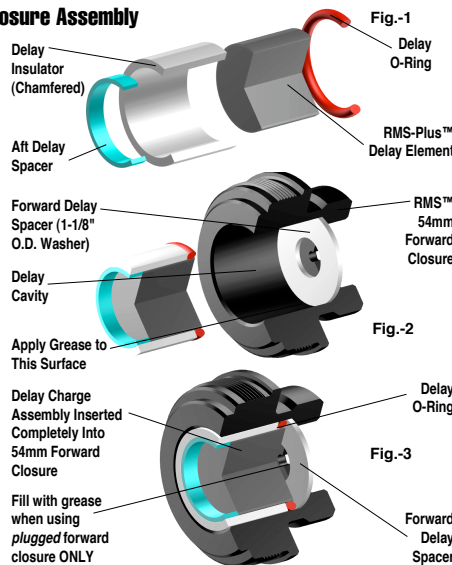
Chapter 1. Forward Closure Assembly

1-1. Apply a light coat of Synco™ Super Lube™ or other grease to all threads and all 4 o-rings. This will facilitate assembly and prevents the threads from seizing.

1-2. **Fig.-1:** Chamfer both inner edges of the delay insulator with your fingernail. Assemble the RMS-Plus delay element, delay insulator, aft delay spacer and delay o-ring as shown. **NOTE:** It is **not** necessary to tape the delay element or delay insulator, the hot gas seal is provided by the delay o-ring alone.

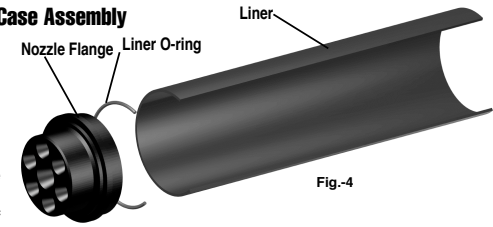
1-3. **Fig.-2:** Insert the forward delay spacer (1-1/8" O.D. neoprene washer) into the delay cavity until it is seated against the forward end of the cavity. Apply a **light film** of grease to the inner circumference of the delay cavity (but **not** the forward end of the cavity).

1-4. **Fig.-3:** Insert the delay charge assembly shown in Fig.-1 into the delay cavity, o-ring end first, until it is seated against the forward delay spacer. **NOTES:** When using a **plugged forward closure ONLY**, fill the opening in the forward delay spacer with grease prior to installing the delay charge assembly, and install the delay charge components in this order: Forward delay spacer, delay o-ring, delay element, delay insulator and aft delay spacer.

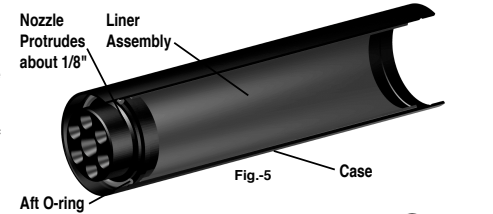


Chapter 2. Case Assembly

2-1. **Fig.-4:** Place the greased liner (1/16" thick X 2" O.D.) o-ring over the large end of the nozzle insert until it rests against the nozzle flange. **NOTE:** Multi-throat "Medusa" nozzles shown in all illustrations. The nozzle used in the K513FJ reload kit has a single throat.

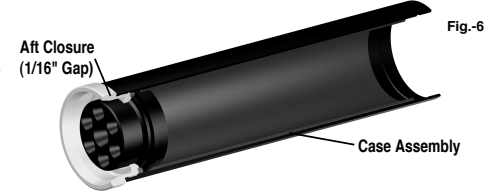


2-2. **Fig.-4:** Using a hobby knife or similar tool, remove the burr (rough, raised edge) from both inside ends of the liner tube. Insert the nozzle assembly into one end of the liner tube until the liner o-ring is seated against the liner.



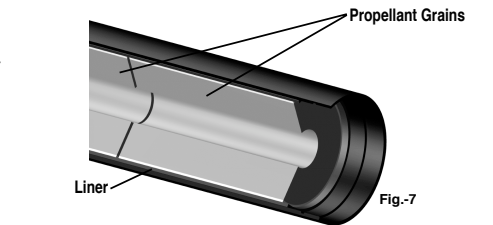
2-3. **Fig.-5:** Push the liner assembly, open end first, into the motor case until the nozzle protrudes from the case about 1/8". There will be some resistance as the liner o-ring passes into the motor case. **NOTE:** A light coat of grease on the outside surface of the liner will facilitate installation and casing cleanup after motor firing.

2-4. **Fig.-5:** Place the greased aft (1/8" thick X 2" O.D.) o-ring into the groove in the nozzle insert.

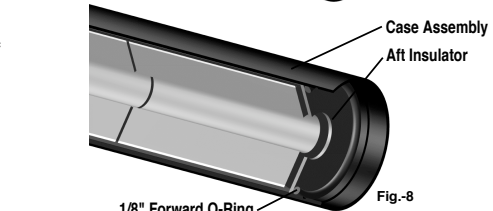


2-5. **Fig.-6:** Thread the aft (gold) closure into the motor case by hand until about 1/16" gap remains between the case and the closure. **NOTE:** Final tightening will be done after the other motor components are loaded into the case.

2-6. **Fig.-7:** Install the propellant grains into the liner. **NOTE:** Only two grains are shown in some illustrations for simplicity. RMS-54/852 motors use two (2) grains, RMS-54/1280 motors use three (3) grains and RMS-54/1706 motors use four (4) grains.

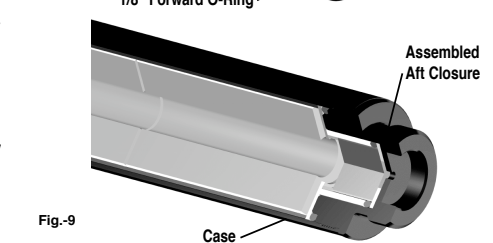


2-7. **Fig.-8:** Place the forward insulator (2" O.D. washer) into the motor case until it is seated against the end of the liner.



2-8. **Fig.-8:** Place the greased forward (1/8" thick X 2" O.D.) o-ring into the case, seated against the forward insulator.

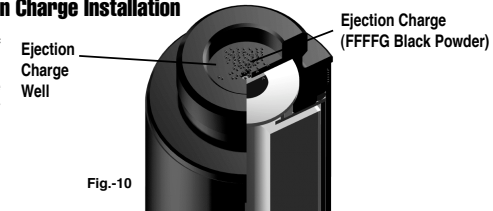
2-9. **Fig.-9:** With the motor case held in a horizontal position, thread the completed forward closure assembly into the open end of the motor case by hand until it is seated against the case.



2-10. Finish tightening the aft (gold) closure by hand until it is seated against the case. **NOTE:** There will be some resistance to threading in the closure during the last 1/32" to 1/16" of travel. It is normal if a slight gap remains between the closure and the case after tightening and the grains rattle slightly inside the liner.

Chapter 3. Ejection Charge Installation

3-1. **Fig.-10:** Thoroughly clean the outside of the motor of any grease or other residue. Dispense enough ejection charge (FFFG Black Powder) into the ejection charge well of the forward closure to fill the well approximately 3/4 full. **NOTE:** For 6" and larger diameter rockets, fill the well **completely**.



Chapter 3. Ejection Charge Installation (Cont'd)

- 3-2. **Fig.-11:** Apply the ejection charge cap (adhesive paper disk) to the center of the end of the forward closure. With the motor held in a **NOZZLE DOWN** position, gently shake the motor to settle the ejection charge into the cavity above the delay element.

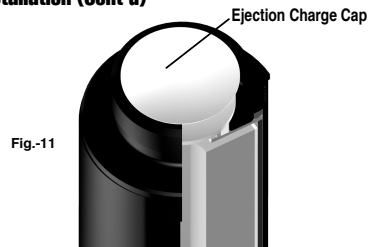


Fig.-11

Chapter 4. Preparation For Flight

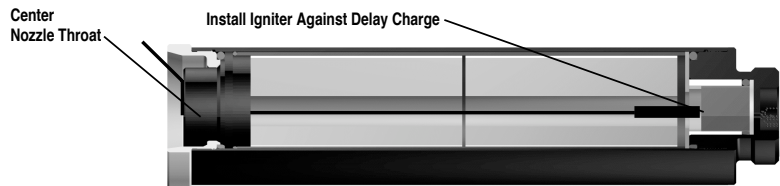


Fig.-12

- 4-1. **Fig.-12:** Insert the coated end of a FirstFire™, Firestar™ or other igniter through the center nozzle throat until it stops against the delay charge element.
- 4-2. Secure the igniter to the nozzle with a piece of masking tape.
- 4-3. Install the motor into the rocket's motor mount tube. Ensure that the motor is securely retained in the rocket by using positive mechanical means to prevent it from being ejected during recovery system deployment.
- 4-4. Prepare the rocket's recovery system and then launch the rocket in accordance with the Tripoli Rocketry Association (TRA) Safety Code and National Fire Protection Association (NFPA) Code 1127.

Chapter 5. Post-Recovery Cleanup

NOTE: Perform motor clean-up as soon as possible after motor firing. Propellant and delay charge residues become difficult to remove after 24 hours and can lead to corrosion of the metal parts. Place the spent motor components in the reload kit plastic bag and dispose of properly.

- 5-1. After the motor has cooled down, unthread and remove the forward and aft closures.
- 5-2. Remove the delay charge assembly components from the forward closure and discard. Using wet wipes or damp paper towels, remove all delay charge and propellant residue from the closures. **WARNING: FAILURE TO COMPLETELY REMOVE DELAY CHARGE RESIDUE FROM THE INSIDE OF THE FORWARD CLOSURE CAN LEAD TO GAS LEAKAGE ON A SUBSEQUENT FLIGHT AND DAMAGE TO YOUR RMS MOTOR FORWARD CLOSURE AND ROCKET VEHICLE.** NOTE: Use of a plugged forward closure will eliminate the possibility of this failure mode.
- 5-3. Remove and discard the forward and aft o-rings from the motor case. Remove the liner, forward insulator, nozzle and liner o-ring from the casing by pushing on the nozzle end and discard. Using wet wipes or damp paper towels, wipe the inside of the casing to remove all propellant residue.
- 5-4. Apply a light coat of grease to all threads and the inside of the motor case. Reassemble metal parts and store motor in a dry place.

AeroTech Division
RCS Rocket Motor Components, Inc.
Cedar City, UT 84720
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Chapter 6. First Aid

For a minor burn, apply a burn ointment. For a severe burn, immerse the burned area in ice water at once and see a physician as quickly as possible. In the unlikely event of oral ingestion of the propellant, induce vomiting and see a physician as quickly as possible. The AeroTech/RCS composite propellant consists primarily of ammonium perchlorate and a rubber-like plastic elastomer.

Chapter 7. Disposal

Damaged or defective reload kits should be returned to RCS.

Chapter 8. Fire Safety

Tests show that the pyrotechnic components of RMS™ reload kits will not explode in fires and normally will not ignite unless subjected to direct flame and then will burn slowly. Use water to fight any fires in which AeroTech/RCS RMS™ reload kit pyrotechnic components may become involved: Direct the water at the AeroTech/RCS RMS™ reload kit pyrotechnic components to keep them below their 550 deg. F autoignition temperature. Foam and carbon dioxide fire extinguishers will NOT extinguish burning propellants of the type used in RMS™ reload kit pyrotechnic components. Keep reload kit pyrotechnic components away from flames, sources of heat and flammable materials.

Disclaimer and Warranty

NOTICE: As we cannot control the storage and use of our products, once sold we cannot assume any responsibility for product storage, transportation or usage. RCS shall not be held responsible for any personal injury or property damage resulting from the handling, storage or use of our product. The buyer assumes all risks and liabilities therefrom and accepts and uses AeroTech/RCS products on these conditions. No warranty either expressed or implied is made regarding AeroTech/RCS products, except for replacement or repair, at RCS's option, of those products which are proven to be defective in manufacture within one year from the date of original purchase. For repair or replacement under this warranty, please contact RCS. Proof of purchase will be required. Note: Your state may provide additional rights not covered by this warranty.

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HIGH-POWER RMS™

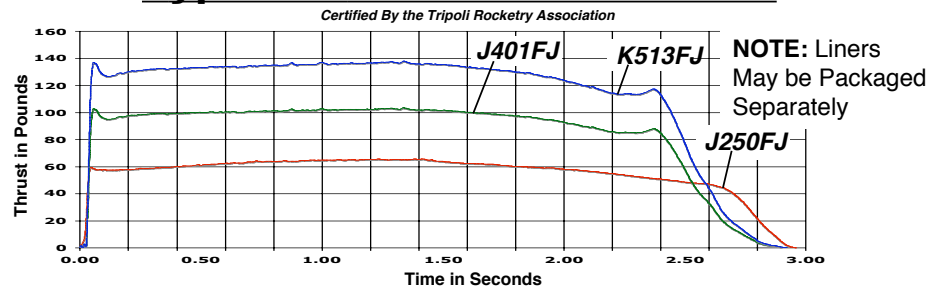
Reloadable Motor System

With **RMS PLUS™** Advanced Delay Sealing System

RMS™ 54/852-1706 BLACK MAX™

DO NOT OPEN RELOAD KIT UNTIL READY TO USE

Typical Time-Thrust Curves:



NOTE: RMS-54/852-1706 reload kits do not include ejection charge. Use FFFFG black powder.

THIS PACKAGE CONTAINS ONE RMS-PLUS™ RELOAD KIT:

- J250FJ-L** (54/852) **J401FJ-L** (54/1280) **K513FJ-L** (54/1706)

NOTE: This reload kit is sold in a "long" delay configuration ONLY. For other delays, use one of the appropriate AeroTech Reload Delay Kits (RDK's) for the delay time desired. Please refer to the RDK cross-reference list on back of the reload kit header card for proper RDK selection.

FJ = Black Max™ Short = approx. 6 sec, Medium = approx. 10 sec., Long = approx. 14 sec., Extra-Long = approx. 18 sec.

The reload kits shown above are **ONLY** for use in AeroTech/RCS, Dr. Rocket™ or Rouse-Tech™ RMS-54 high-power motors.

RMS-54/852-1706 BLACK MAX RELOAD KIT DATA

Hardware Desig.	Performance Desig.	Total Impulse (Typ.)	Propellant Wt.	Loaded Motor Wt.
RMS™-54/852	<i>J250FJ</i>	731 N-sec	487 g (1.07 lb)	907 g (2.00 lb)
RMS™-54/1280	<i>J401FJ</i>	1094 N-sec	730 g (1.61 lb)	1267 g (2.79 lb)
RMS™-54/1706	<i>K513FJ</i>	1467 N-sec	974 g (2.15 lb)	1647 g (3.63 lb)

RMS-54/852-1706 HARDWARE DATA

Hardware Designation	Motor Diameter	Motor Length	Hardware Weight	Reload Used
<i>RMS™-54/852</i>	2.125" (54mm)	9.49"	278 g (0.612 lb)	J250FJ
<i>RMS™-54/1280</i>	2.125" (54mm)	12.82"	338 g (0.744 lb)	J401FJ
<i>RMS™-54/1706</i>	2.125" (54mm)	16.15"	399 g (0.879 lb)	K513FJ

NOTE: Total impulse shown is typical. Motor lengths are measured from end of aft closure to end of forward closure.

NOTE: SALE TO PERSONS UNDER 21 YEARS OF AGE PROHIBITED BY FEDERAL LAW. WARNING-FLAMMABLE: Read Instructions Before Use. KEEP OUT OF REACH OF CHILDREN. FOR USE ONLY BY CERTIFIED HIGH-POWER USERS 21 YEARS OF AGE OR OLDER. DO NOT SMOKE when loading these motors or use in the vicinity of open flames.