



Division of RCS Rocket Motor Components, Inc.

HIGH POWER MOTOR INSTRUCTIONS

WARNING-FLAMMABLE: Read Instructions Before Use.

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

READ AND FOLLOW all instructions before and during use. Use these rocket motors only in accordance with these instructions. AEROTECH High-Power Rocket Motors are NOT toys! Handle with care and respect.

GENERAL INFORMATION

AEROTECH High-Power Rocket Motors are the most technically advanced high-power rocket motors in the world. AEROTECH motors use the same propellant as America's space boosters. Pound for pound, this propellant delivers nearly 3 times the power of black powder used in other high-power rocket motors. AEROTECH High-Power Rocket Motors allow you to fly larger rockets, heavier payloads, and achieve higher altitudes than ever before!

MOTOR CLASSIFICATION

Each AEROTECH High-Power Rocket Motor is identified with a code (e.g. H124-10J) which gives important information about the motor's performance. The first letter indicates the total impulse (in Newton-seconds) produced by the motor. Each succeeding letter indicates a power level up to twice that indicated by the previous letter. For example, an "I" motor can be twice as powerful as an "H" motor. The number following the letter code indicates the motor's average thrust in Newtons. The next number of the code shows the time delay in seconds between propellant burnout and the firing of the ejection charge. A "P" indicates the motor is "plugged", with no ejection charge. Plugged motors must be used only in rockets fitted with an altimeter, timer or radio-activated parachute deployment system. The letter following the time delay code shows the type of propellant formulation used in the motor. "W" for WHITE LIGHTNING™, "T" for BLUE THUNDER™, and "J" for BLACK JACK™.

STORAGE AND HANDLING

Store AEROTECH High-Power Rocket Motors in a dry place where the temperature will remain between 45°F and 100°F. Do not cut, saw, attempt to alter the size, attempt to disassemble, attempt to modify, or drop an AEROTECH High-Power Rocket Motor. Do not use an AEROTECH High-Power Rocket Motor that you believe has been damaged in any way. Do not ignite an AEROTECH High-Power Rocket Motor indoors. Do not breathe fumes from the rocket motor exhaust.

USE

Use AEROTECH High-Power Rocket Motors only in high-power rockets designed and built for them.

IGNITION AND LAUNCHING

1. Insert a FireStar™ or other suitable igniter into the motor's nozzle, coated end first. If necessary, rotate the motor to allow the igniter to slide into the propellant core space. Push the igniter as far as it will easily go to the forward end of the motor propellant core space. Failure to insert the igniter completely as described may result in low-thrust ignition of the motor.

2. Bend the protruding end of the igniter back over the nozzle end.

3. Secure the igniter to the motor nozzle with masking tape.

4. Insert the AEROTECH High-Power Rocket Motor into your rocket. If your rocket does not have a motor mount with a motor hook or motor block or has a motor block deeper than the motor length, simply wrap a layer of 1" wide masking tape tightly around the nozzle end of the motor to a thickness equal to that of the motor tube. Wrap a layer of masking tape around the motor tube/motor junction to secure the motor in the rocket and to prevent motor ejection when the ejection charge fires. NEVER friction fit an AEROTECH High-Power Rocket Motor into the motor mount.

5. Prepare the recovery system of your rocket. Make sure that all elements of the recovery system are in good working order.

6. Slide the rocket onto the rod or rail of your launch pad. High-power rockets powered by AEROTECH High-Power Rocket Motors must be flown from a launch pad having a launch rod or rail at least 60 inches long or two-thirds the combined length of the rocket body and nose cone, whichever is greater. Do not launch a high-power rocket powered by an AEROTECH High-Power Rocket Motor from any launch rod or rail shorter than that specified in the rocket kit assembly and use instructions.

Forward End of Core Space

7. Make sure the electrical launch controller is disarmed and then attach the igniter clips to the igniter. Use only an electrical launch controller to initiate the igniter of an AEROTECH High-Power Rocket Motor. Test the electrical launch controller for proper safe operation before each flying session.

8. Stand at least 100 feet (but no less than the minimum distance specified in the High-Power Rocket Safety Code for your rocket and motor combination) from the launch pad when flying a high-power rocket powered by an AEROTECH High-Power Rocket Motor. Do not allow spectators to stand less than 150 feet (but again no less than the minimum distance specified in the High-Power Rocket Safety Code for your rocket and motor combination) from the launch pad. After arming the electrical launch controller give a loud, audible five second countdown before pressing the launch button.

9. Read and follow the High-Power Rocket Safety Code of the National Association of Rocketry (NAR) and the Tripoli Rocketry Association (TRA) and comply with all federal, state and local laws and ordinances in all activities with high-power rockets.

MISFIRES

If a misfire occurs and an AEROTECH High-Power Rocket Motor does not ignite for any reason within five seconds of pressing the launch button, release the launch button and remove the safety key from the electrical launch controller. WAIT ONE MINUTE before approaching or allowing anyone else to approach the rocket. Keep your fingers and hands out from underneath the rocket and away from the possible path of the exhaust jet. Do not place any part of your body over the launch pad. Disconnect the igniter clips from the igniter. Carefully remove the rocket from the launch pad. Keeping the motor nozzle pointed away from your face and body - and away from any other person's face or body - remove the red plastic cap or tape and the igniter, and repeat the motor preparation and launching process.

CAUTION: The nozzle and casing of an AEROTECH High-Power Rocket Motor remain hot for several minutes after operation. Do not touch any part of the motor for at least five minutes after operation. Remove an expended motor casing from a high-power rocket with pliers.

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 High-Power Rocket Motor contains a propellant that consists primarily of ammonium perchlorate and a rubber-like plastic elastomer.

DISPOSAL

Damaged, defective, or unwanted motors should be disposed of in the following manner. Pack the motor firmly in the ground, with just the nozzle showing, away from buildings, people, animals, and flammable materials. Be sure the nozzle is pointing straight up and is clear. Ignite electrically, per ignition instructions, from a distance of 50 feet or more. Propellant, delay, and ejection charge will burn until consumed. Do not approach for at least five minutes after the firing. Do not put any part of your body over the motor during the process. Dispose of spent motor in inert trash. **WARNING:** Remember that the motor will be very hot after firing. Allow time for it to cool down!

FIRE SAFETY

Controlled tests show that AEROTECH High-Power Rocket Motors will not explode in fires and normally will not ignite if subjected to intense, sustained fires for two minutes or less. Use water to fight fires in which AEROTECH High-Power Rocket Motors may become involved; direct the water at the AEROTECH High-Power Rocket Motors to keep them between their 550°F auto-ignition temperature. Foam and carbon dioxide fire extinguishers will NOT extinguish burning propellant of the type used in AEROTECH High-Power Rocket Motors.

MOTOR PERFORMANCE DATA

MOTOR TYPE	PROPELLANT WEIGHT		TOTAL IMPULSE		AVERAGE THRUST		
	oz.	gms	lb-sec	N-sec	lbs	N	
29mm H55W	3.27	92.8	38.2	170.0	12.4	55.0	
	3.60	102.0	45.0	200.0	15.7	70.0	
	H124J	5.76	164.7	51.7	230.0	27.9	124.0
H125W	5.32	150.7	71.9	320.0	28.1	125.0	
38mm H45W	6.56	186.1	71.9	320.0	10.1	45.0	
	12.81	363.3	143.9	640.0	29.7	132.0	
54mm I65W	13.33	378.0	143.9	640.0	14.6	65.0	
	25.41	720.5	287.8	1280.0	28.1	125.0	
	K250W	50.45	1397.0	575.5	2560.0	56.2	250.0
	K1050W	48.16	1365.3	575.5	2560.0	236.1	1050.0

MAXIMUM RECOMMENDED LIFTOFF WEIGHT

Maximum liftoff weight is a recommendation that is provided only as a general guideline and should not be used as the exclusion of overall considerations of rocket flight stability, recovery and safety. Use the following formula for estimating maximum liftoff weights. For short delay motors use a 0.1 average thrust-to-weight ratio (B:1 for long burn motors). For medium delay motors use a 12:1 average thrust-to-weight ratio. For long delay motors use a 15:1 average thrust-to-weight ratio.

HIGH POWER ROCKETRY SAFETY CODE FROM NFPA 1127

1. **User Certification.** A person shall operate or fly a high power rocket only if that person is a certified user.

2. **Operating Clearances.** A person shall fly a high power rocket only in compliance with:
(a) This code;
(b) United States Code, Title 49, Section 1348, "Airspace Control and Facilities," 72 Statute 749, Section 307, Federal Aviation Act of 1958, covering Federal Aviation Administration Regulations, from Code of Federal Regulations, Title 14, Chapter 1, Subchapter F, Part 101, Paragraph 101.1 (a)(3)(ii)(a) through (d) or later revisions or amendments thereto; and
(c) Other applicable federal, state, and local laws, rules, regulations, statutes, and ordinances.

3. **Preflight Inspection.** A person shall fly a high power rocket only if it has been inspected and approved for operation immediately prior to flight by a safety monitor. The safety monitor shall confirm the rocket's compliance with the applicable provisions of this code and shall ascertain that the rocket will fly in a safe manner.

4. High Power Rocket Motors and Components.

4.1 A person shall use only commercially manufactured certified high power rocket motors or motor reloading kits or components.

4.2 No person shall dismantle, reload, or alter a single-use high power rocket motor. No person shall alter the components of a reloadable high power rocket motor or use the contents of a reloadable rocket motor reloading kit for a purpose other than those specified by the manufacturer in the rocket motor or reloading kit instructions.

5. **Rocket Construction.** A high power rocket shall be constructed in such a manner and with suitable materials to withstand the operating stresses and retain structural integrity under conditions expected or known to be encountered in flight.

6. **Rocket Airframe Materials.** A high power rocket vehicle intended to be propelled by one or more high power rocket motors shall be constructed using lightweight materials such as paper, wood, rubber, plastic, fiberglass, or, when necessary, ductile metal so that the rocket conforms to the other requirements of this code.

7. **Stability.** A person intending to operate a high power rocket shall determine its stability before flight. This person shall provide documentation of the location of the center of pressure and the center of gravity of the high power rocket to the safety monitor if the safety monitor requests same.

8. Weight and Power Limits.

8.1 A person intending to operate a high power rocket shall ensure that it weighs less than the rocket motor manufacturer's recommended maximum liftoff weight for the rocket motor(s) used for the flight. This person shall present documented proof of compliance with this requirement if it is requested by the safety monitor during preflight inspection.

8.2 A person shall not install in a high power rocket a rocket motor or combination of rocket motors that will produce more than 40,360 Newton-seconds of total impulse (4.45 Newtons equals 1.0 lb).

9. Recovery.

9.1 A person shall fly a high power rocket only if it contains a recovery system that will return all parts of its safety to the ground so it can be flown again.

9.2 The person preparing the high power rocket for flight shall install only flame-resistant recovery wadding if wadding is necessary by the design of the rocket.

9.3 A person shall not attempt to catch a high power rocket as it approaches the ground.

9.4 A person shall not attempt to retrieve a high power rocket from a hazardous area. The person flying the rocket shall attempt as soon as practicable to notify the utility company or other appropriate authority if the high power rocket becomes entangled in a power line when descending.

10. Payloads.

10.1 A person shall not install or incorporate in a high power rocket a payload that is intended to be flammable or explosive or to cause harm.

10.2 A person shall not fly a vertebrate animal in a high power rocket.

11. Launching Devices.

11.1 A person operating a high power rocket shall launch it from a stable device that provides rigid guidance until the rocket has reached a speed adequate to ensure a safe flight path.

11.2 The person launching the high power rocket shall ensure that the launcher incorporates a jet deflector device if necessary to prevent the rocket motor exhaust from impinging directly on flammable materials.

11.3 A launching device shall not be used to launch a high power rocket at an angle more than 20 degrees from vertical.

11.4 A person operating a high power rocket shall place the end of the launch rod or rail above eye level or cap it to prevent accidental eye injury. A person shall store a launch rod or rail so it is capped, cased, or left in a condition where it cannot cause injury.

12. Ignition Systems.

12.1 A person launching a high power rocket shall use an ignition system that is remotely controlled, is electrically operated, and contains a launching switch that will return to "off" when released.

12.2 The ignition system shall contain a removable safety interlock device in series with the launch switch.

12.3 The launch system and igniter combination shall be designed, installed, and operated so the liftoff of the rocket shall occur within 3 seconds of actuation of the launch system. If the rocket is propelled by a cluster of rocket motors designed to be ignited simultaneously, the person operating the rocket shall install an ignition scheme that either has been previously tested or has a demonstrated capability of igniting all rocket motors intended for launch ignition within 1 second following ignition system activation.

12.4 A person shall install an ignition device in a high power rocket motor at the launcher or within the area designated by the safety monitor. The rocket shall be pointed in a safe direction during and after installation of the ignition device.

12.5 No firing circuits shall be armed with the rocket in other than a launching position.

13. Launch Site.

13.1 A person shall launch a high power rocket only in an outdoor area where tall trees, power lines, and buildings will not present a hazard, in the opinion of the safety monitor, to the safe flight operation of a high power rocket.

13.2 A person shall not locate a launcher closer to the edge of the launch site than one-half the minimum launch site dimension stated in Table 2-13.2.

Table 13.2 Launch Site Dimensions

Installed Total Impulse (N-sec)	Equivalent Motor Type	Minimum Site Dimensions (ft)	Minimum Site Dimensions (m)	Equivalent (ft)	Equivalent (km)
160.01 - 320.00	H	1500	0.3	457	0.5
320.01 - 640.00	I	3000	0.6	914	1.0
640.01 - 1280.00	J	5280	1.0	1609	1.6
1280.01 - 2560.00	K	5280	1.0	1609	1.6
2560.01 - 5120.00	L	10560	2.0	3219	3.2
5120.01 - 10240.00	M	15840	3.0	4828	4.8
10240.01 - 20480.00	N	21120	4.0	6437	6.4
20480.01 - 40960.00	O	26400	5.0	8047	8.0

NOTE: For a circular area, the minimum launch site dimension is the diameter in feet; for a rectangular area, it is the shortest side in feet.

13.3 The launch site shall be at least as large as that stated in Table 13.2.

13.4 As an alternative to the launch site dimensions, the size of the launch site shall be established as no less than one-half the maximum altitude expected, calculated, simulated, or granted (by FAA waiver/authority having jurisdiction) for the particular flight in question. In no case shall the minimum launch site dimension be less than 1500 ft (457 m).

13.5 In no case shall the minimum site dimension be less than one-half the estimated maximum altitude of the high power rocket.

14. Launcher Location.

14.1 The launch site shall contain no occupied buildings or public highways on which traffic flow exceeds ten vehicles per hour.

14.2 The person launching a high power rocket shall ensure that the ground for a radius of 10 ft (3 m) around the launcher is clear of brown grass, dry weeds, or other easy-to-burn materials that could be ignited during launch by the exhaust of the rocket motor.

14.3 The person intending to launch a high power rocket shall locate the launcher more than 1500 ft (457 m) from any occupied building or public highway on which traffic flow exceeds ten vehicles per hour.

15. Safe Distances.

15.1 No person shall be closer to the launch of a high power rocket than the person actually launching the rocket and those authorized by the safety monitor.

15.2 All spectators shall remain within an area determined by the safety monitor and shall remain behind the safety monitor and the person launching the rocket.

15.3 A person shall not be closer to the launch of a high power rocket than the applicable minimum safe distance set forth in Table 15.3.

Table 15.3 Safe Distances

Installed Total Impulse (N-sec)	Equivalent Motor	Minimum Safe Distance (ft)	Minimum Safe Distance (m)	Minimum Safe Distance (Complex Rocket) (ft)	Minimum Safe Distance (Complex Rocket) (m)
160.00 - 320.00	H	100	30	200	61
320.01 - 640.00	J	100	30	200	61
640.01 - 1280.00	I	100	30	200	61
1280.01 - 2560.00	K	200	61	300	91
2560.01 - 5120.00	L	300	91	500	152
5120.01 - 10240.00	M	500	152	1000	305
10240.01 - 20480.00	N	1000	305	1500	457
20480.01 - 40960.00	O	1500	457	2000	610

A "complex" high power rocket is one that is multistaged or propelled by a cluster of motors.

16. Launch Operations.

16.1 A person shall not ignite and launch a high power rocket horizontally, at a target, or so the rocket's flight path goes into clouds or beyond the boundaries of the launch site.

16.2 A person shall not launch a high power rocket if the surface wind at the launcher is more than 20 m.p.h. (32 km/hr).

16.3 A person shall not operate a high power rocket in a manner that is hazardous to aircraft.

17. Launch Control.

17.1 A person shall launch a high power rocket only with the immediate knowledge, permission, and attention of the safety monitor.

17.2 All persons in the launching, prepping, spectator, and parking areas during a countdown and launch shall be standing and facing the launcher if requested to do so by the safety monitor. Exception: Those individuals that have mobility restrictions.

17.3 The person launching a high power rocket shall precede the launch with a 5 second countdown audible throughout the launching, spectator, and parking areas. This countdown shall be given by the person launching the rocket, the safety monitor, or other flying site operating personnel.

17.4 No person shall approach a high power rocket that has misfired until the safety interlock has been removed or the battery has been disconnected from the ignition system, 1 minute has passed, and the safety monitor has given permission for only a single person to approach the misfired rocket to inspect it.

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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