

ENERJET[®]

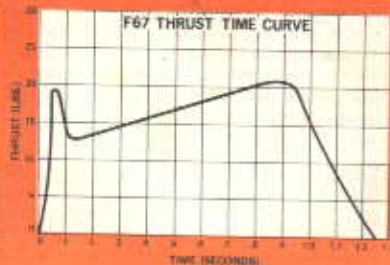
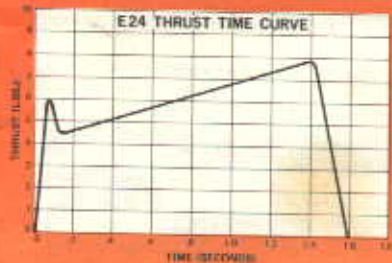
P.O. Box 400, Phoenix, Arizona 85001

A subsidiary of Ceriani Engineering Co.

OPERATING MANUAL

AND FLYING INSTRUCTIONS FOR ALL ENERJET "E" AND "F" TYPE
MODEL ROCKET MOTORS FOR ADVANCED ROCKETEERS.

READ THIS OPERATING MANUAL CAREFULLY BEFORE LAUNCHING!!!



ALL ENERJET MOTORS ARE MANUFACTURED TO STANDARDS SET FORTH BY THE NATIONAL ASSOCIATION OF ROCKETRY (NAR)

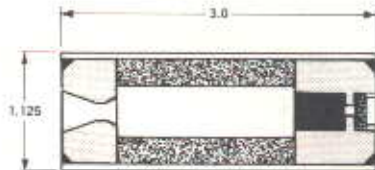
MOTOR DESIGN & OPERATION

Model rockets are designed to be launched only from standard remote-controlled electrical launch systems. Always use the recommended motors and recovery wadding. Comply with all Federal, State and local laws. (Especially the Federal Aviation Administration maximum weight limits of 4 oz. propellant and 16 oz. total lift-off weight.)

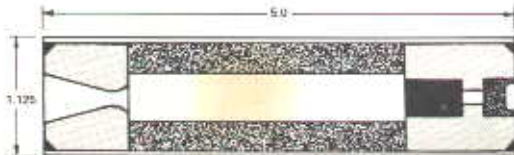
All Enerjet motors (both E and F types) have a "port" or center burning solid propellant grain. As shown in the motor diagrams these motors when properly ignited produce immediate high level thrust. The initial thrust drops slightly and then starts to build again until burnout. This high initial thrust serves to impart stabilizing velocity to your rocket immediately upon lift-off from the launcher.

The case bonded, center-core burning, APP60 solid propellant is an extremely clean burning polyurethane/ammonium perchlorate composite. During motor firing, the exhaust is virtually smokeless. This propellant is relatively insensitive to shock and moisture. Performance is stable over long periods of storage.

ENERJET "E" TYPE



ENERJET "F" TYPE



SAFETY PRECAUTIONS

WARNING – FLAMMABLE KEEP OUT OF REACH OF SMALL CHILDREN

Model rocket motors, no matter how small, should be handled and used with caution and respect. Use only under adult supervision and in full compliance with applicable laws.

Construct your model rocket vehicle of lightweight, non-metallic materials such as laminated papers, balsa wood, plastic, or fiberglass. Never launch a model rocket without a recovery device, such as a parachute, which will return the model slowly back to Earth after flight.

STORAGE AND HANDLING

Store Enerjet motors in a dry place . . . at normal room temperature . . . and away from heaters, open flames, or other sources of heat. Do not smoke near rocket motors.

Never point the nozzle end of the motors toward the face. Never subject a rocket motor to a temperature greater than 150°F. Do not in any way tamper with or alter the motors. Never attempt to reload an expended engine case. Never drop a motor or use one that has been damaged.

When in doubt, don't take unnecessary chances. Destroy as indicated on back cover.

NOTICE OF RESPONSIBILITY

These motors are intended for experimental and educational usage only. ENERJET, INC. shall not be held responsible for any personal injury or property damage resulting from handling, storage or use of such motors. The buyer assumes all risks and liabilities therefrom and accepts and uses these motors on these conditions. No warranty, either expressed or implied, is made regarding the reliability or performance of these rocket motors.

ENERJET KIT/MOTOR SELECTION

Enerjet-powered rockets generally reach considerably higher altitudes than conventional 1/8A through D powered rockets.

The least powerful recommended motors should be used for first test flights, until you have gained experience observing and tracking higher flights. Even the "small" E-24 motors will produce flights that seem to go out of sight, to the untrained eye.

The following Enerjet motors may be used in the typical Enerjet rocket kits listed below.

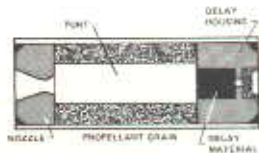
NIKE RAM
E24-10, F52-12, F67-14

PTERODACTYL/AERODART
E24-4, F52-5, F67-6

NIKE SMOKE, EGG CRATE
E24-7, F52-8, F67-9

AERODART, ATHENA
E24-7, F52-8, F67-9

The built-in coast-time "delay charge" (which starts acting at the instant of propellant "burnout") allows the momentum of the fast moving rocket to be used up in climbing on to maximum altitude. At this point, the ejection charge "goes off", pressurizing the forward compartment of the rocket vehicle. This action pushes the nose cone off and "ejects" the parachute or streamer.



The recommended motors allow the rocket to reach optimum altitude before chute ejection. Use common sense in selecting motor delays, to avoid premature or late ejection.

NOTE: ALL THE FOLLOWING MOTORS ARE SAFETY CERTIFIED AND
CONTEST CERTIFIED BY THE NATIONAL ASSOCIATION OF ROCKETRY.

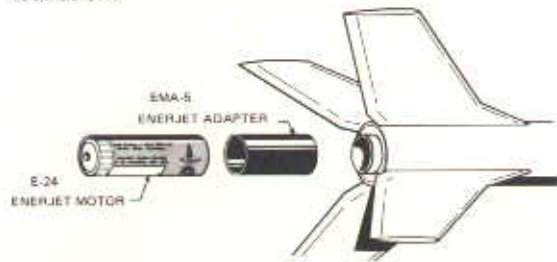


ENERJET ROCKET MOTOR SPECIFICATIONS

Catalog No. & NAR Code	Total Impulse		Average Thrust		Thrust Duration	Maximum Thrust		Initial Weight		Propellant Wt.		Delay Time
	Lb.-Sec.	N-Sec.	Pounds	Newtons		Pounds	Newtons	Ounces	Grams	Pounds	Grams	
E24-4	8.96	40	5.4	24	1.6 sec	7.6	33.8	2.5	74	.048	21.8	4 sec
E24-7	8.96	40	5.4	24	1.6 sec	7.6	33.8	2.5	74	.048	21.8	7 sec
E24-10	8.96	40	5.4	24	1.6 sec	7.6	33.8	2.5	74	.048	21.8	10 sec
F52-5	10.4	46	11.7	52	0.9 sec	16.0	71.3	3.4	93	.054	24.9	5 sec
F52-8	10.4	46	11.7	52	0.9 sec	16.0	71.3	3.4	93	.054	24.9	8 sec
F52-12	10.4	46	11.7	52	0.9 sec	16.0	71.3	3.4	93	.054	24.9	12 sec
F67-6	17.9	80	15.1	67	1.2 sec	21.6	96.1	4.0	112	.095	43.0	6 sec
F67-9	17.9	80	15.1	67	1.2 sec	21.6	96.1	4.0	112	.095	43.0	9 sec
F67-14	17.9	80	15.1	67	1.2 sec	21.6	96.1	4.0	112	.095	43.0	14 sec

ENERJET "E" ADAPTERS

E type motors are ideally suited to power most Enerjet kit models* shown in Enerjet's catalog. E-24 motors are the exact same diameter as F motors. However, as the E motors are shorter than F motors, an adapter must be inserted into the motor mount ahead of the Enerjet motor. (See below)

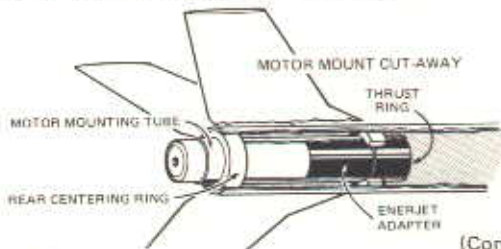


*Enerjet Adapters are included with most models.

MOUNTING "ENERJETS"

A motor mount is required to hold the motor in place, and to align the motor with the rocket's long axis. Mounts should be made of strictly non-metallic material such as balsa, plastic, foam, or laminated fiber.

Enerjet offers three special Motor Mounts which, with adapters, will accurately mount all Enerjet motors into #13, #16, and #20 body tubes. See catalog.



(Cont.)

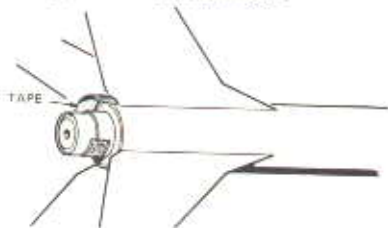
Referring to illustration at left, you will note that the motor should extend 1/2" to 3/4" out beyond the rear of the rocket. This extension serves to prevent scorching of the fins by the motor exhaust.

Make sure the "thrust ring" and the "centering rings" of the mounts are glued securely to the mounting tube and body tube as these points must withstand the full thrust forces of the motor.

SECURING THE MOTOR IN THE MOUNT

The ejection charge built into each Enerjet motor is designed to pressurize the forward end of the body tube, push off the nose cone, and eject the parachute. When this ejection charge is used to expell such a recovery device, it is necessary to secure the motor in place so that it does not, instead, kick itself rearward out of the body tube when the charge ignites. Rearward ejection of the motor results in escape of the pressure necessary to push off the cone and eject the recovery device. This means simply that if the motor kicks out backwards, the parachute might not deploy.

The most common method of securing the motor is to simply wrap a band of masking tape around the motor and the protruding end of the motor tube.



Applying tape around the middle of the motor for a pressure fit should be avoided. The high motor temperature might cause tape to melt, thus bonding motor in place.

MULTI-STAGING & CLUSTERING

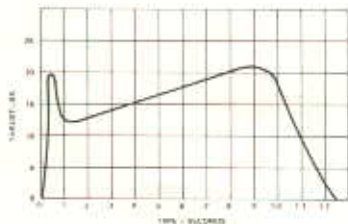
Enerjet motors are designed for single motor and single-stage use only. "Multi-staging" and "clustering" of these motors not generally recommended.

IGNITING ENERJET MOTORS

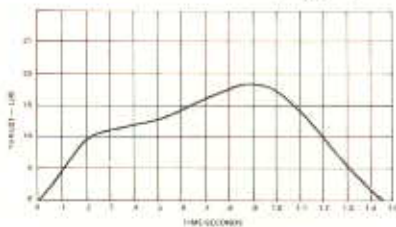
IMPORTANCE OF PROPER IGNITION

When properly ignited, the Enerjets will produce the thrust time as shown in the graph on the near right. If the igniter is improperly prepared or installed, the motor may fail to ignite, or may ignite "sluggishly" (see the graph to far right). Sluggish lift-off may result in an unstable flight. Therefore, it is important to prepare and install the igniter exactly as shown. Read the following instructions carefully.

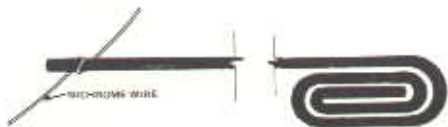
PROPER IGNITION



POOR IGNITION (sluggish)



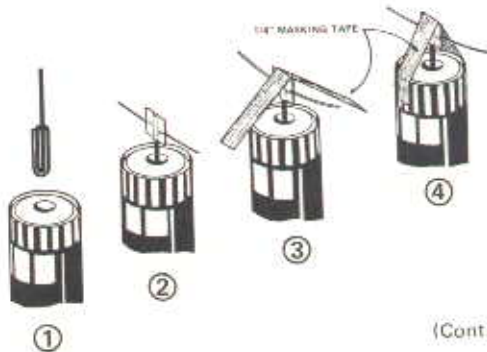
2. Wrap the piece of nichrome wire tightly around the other end of the wick.



3. Fold the adhesive strip over the end of the igniter. **IMPORTANT:** Press the adhesive firmly down over the nichrome/fuse connection.



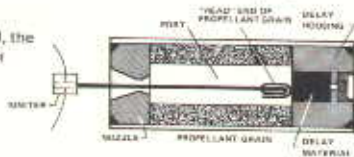
4. Insert the igniter into the motor. Push the igniter into the motor as far as it will go. Using a piece of narrow masking tape, secure the igniter to the motor (as shown).



(Cont.)

You will note that the "folded-over" end of the wick is pushed all the way up to "head-end" of the motor. Enerjet motors must be ignited at the top or "head-end" of the propellant grain. This folded-over portion of the wick provides the high concentration of heat at the "head-end" of the port required to properly ignite the propellant.

When properly installed, the igniter, inside the motor would look like this.



EFFECT OF TEMPERATURE ON MOTOR PERFORMANCE

Temperature of the rocket motor (propellant) effects ignition and performance of Enerjet motors. The colder the propellant, the more difficult the ignition and the slower burning the propellant. Allow about three hours at room

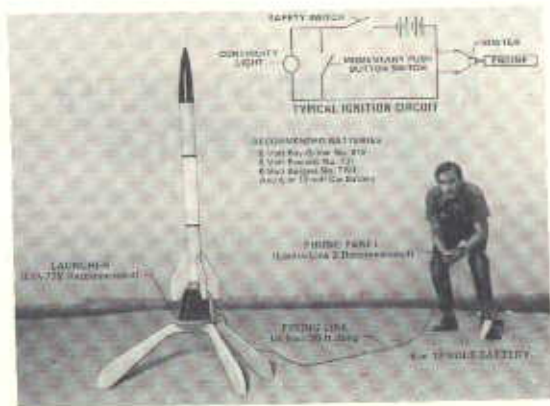
temperature to warm up a motor before launching. DO NOT place near a heater to warm up quickly.

RECOMMENDED LAUNCHER & IGNITION SYSTEM

Your rocket should be launched from a restraining guide-rod type launcher which will keep the rocket in a verticle flight direction until sufficient stabilizing velocity is reached. Never attempt to launch a model rocket without a restraining type launcher.

Enerjet powered rockets should be launched from a "rod" type launcher, such as Enerjet's LIA-77E. It should be equipped with a full 1/8" diameter steel launch rod at least 36" in length.

To prevent scorching or burning of the rocket fins, the launcher has a steel exhaust deflector to guide the hot exhaust away from the launcher (and the rocket).



Always launch your rockets electrically . . . with an ignition circuit such as shown above. In addition to a "safety" switch, the circuit should contain a "momentary contact" push button type firing switch. Use a 6 or 12 volt battery (either dry cell or car battery) for ignition power.

LAUNCHING CONDITIONS

Distance from Launcher

Do not stand near a rocket motor while it is firing. During an actual launching, the individual in control of the firing switch should never stand closer than 15 feet from the rocket, while all other assistants and spectators should stand at least 100 feet away. This provides the onlookers a much better view of lift-off.

Selecting the Launch Site

Launch your rocket from an unpopulated area, away from houses, airports or airlines, highways, and trees. Select a cleared launching site - away from dried grass or other dense foliage that might present a fire hazard. Model rockets generally require a launch and recovery area with a width of at least half the expected altitude to be reached by the rocket. In other words, a rocket expected to reach 2000 feet altitude should be launched from the center of an open field measuring about 1000 feet by 1000 feet. Never attempt to launch from a yard or in the street.

Launching Weather

Always launch on clear, fair days. Overcast skies may cause you to lose sight of your rocket. Avoid launching in windy or overcast weather, as recovery under these conditions will be difficult if not impossible. A model rocket which is launched in winds over 20 mph may weathercock and travel directly into the wind. Remember, that a slight wind on the ground usually indicates much faster winds at higher altitudes. Such a wind will cause your chute to drift and land your rocket a considerable distance from the launcher.

RECOVERY TIPS

After the experience of launching and tracking Enerjet-powered rockets, you may wish to consider the following options. Either of these techniques will decrease the tendency of chute-recovered rockets to drift away.

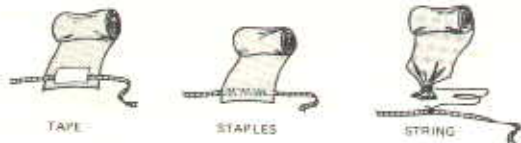
Reefed Chutes

Gathering and tying the chute shroud lines several inches above the knot will decrease chute diameter, giving a more direct descent.



Attaching Streamer to Shock Cord

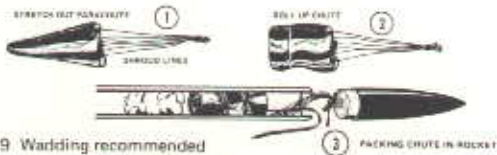
On many lighter rockets a lightweight streamer (such as crepe paper) may be substituted for the chute. Use at least 36 square inches of streamer for each ounce of ejected weight (rocket and expended motor).



LAUNCH PREPARATION

When using a parachute in your rocket, it is necessary to protect the chute from being "scorched" by the hot gases of the motor's ejection charge. This is done by placing a "wad" of flameproof cotton,* crepe paper, or fiberglass insulation material between the motor and the parachute.

Insert a piece of flameproof wadding about the size of a large egg, into the body tube first. Next, roll up the parachute as shown and wrap the shroud lines around the rolled parachute. Then insert shock cord into the rocket, followed by the folded parachute and nose cone.



*PW-19 Wadding recommended

1. Disconnect battery from ignition circuit, turn all switches to "OFF" position. Remove safety key.
2. Attach clips as close as possible to the igniter, being careful that they do not touch each other. Also make sure that both clips are not touching the metal deflector at the same time as this would "short" out circuit and prevent ignition).
3. Return to firing position and connect battery leads.
4. Safety check the area. "HOLD" on launching until any aircraft or unsuspecting personnel have passed, and ground area is "CLEAR".
5. Insert safety key in firing panel and turn to "ON". Check for "continuity". (Panel light should go on.)
6. Begin "COUNTDOWN" 5-4-3-2-1-"FIRE". Press the firing button and hold until motor ignites.
7. Turn all switches to "OFF" and remove safety key.

TROUBLE SHOOTING TIPS

If the motor does not ignite, wait at least 1 full minute.

Remove the entire rocket away from the launcher and set in a safe place. Back at the launcher, connect a short test piece of nichrome wire (about 1" long) between the micro-clips, close all firing switches and watch for the nichrome to glow red.

CHECK "A"

If the nichrome wire glows red hot, your problem lies in the igniter installation. Remove the igniter from the motor carefully and re-install according to the instructions.

CHECK "B"

Should the nichrome not glow at all, or glow very faintly, your problem is in the ignition circuit. Any one or more of the following conditions could result in failure of the ignition circuit:

PROBLEM CONDITION & SOLUTION

- | | |
|--------------------------------|--|
| Micro-clips bent or dirty --- | Straighten and clean with emery. |
| Battery connections loose ---- | Clean and tighten. |
| Battery weak or dead - - - - - | Replace or recharge. |
| Switches not closing - - - - - | Bend contacts or test switch in another circuit. |
| Loose wiring connections ---- | Check all connections - look at solder joints. |

Now, connect up the test piece of nichrome again, close all switches, and watch for the wire to glow red hot. If the wire heats OK, begin the launch procedure again.

If the test nichrome fails to glow, repeat check "B" until problem is located.

SPECIAL SAFETY PRECAUTIONS

ROCKET ENGINE AFTER FIRING: Always allow a motor to cool down and contract, then remove with pliers. Remember that the motor nozzle acts as a "heat sink" and touching the nozzle too soon after firing may result in a burned finger. The nozzle will normally cool off somewhat during descent after a flight.

ENGINE EXHAUST: Avoid the exhaust fumes . . . which can be pungent and irritating. Never test fire an Enerjet motor indoors.

FIRST AID: If propellant is taken internally, induce vomiting and consult a doctor immediately. For mild exterior burns use first-aid burn ointment. For severe burns, see a doctor immediately.

FIRES: Use ordinary water to combat any fire in which these rocket motors might be involved. Foam and CO₂ will not extinguish propellant.

TO DISPOSE OF UNFIRED MOTOR: Drill out nozzle with 1/4" drill. Pack motor firmly in hole in ground and ignite electrically from a safe distance. Propellant will burn until completely consumed.

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