

MODEL ROCKET ENGINE INSTRUCTIONS



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PENROSE, COLO. 81240

WARNING FLAMMABLE

STORAGE: Store engines in a cool, dry place. Never expose to temperatures greater than 150° Fahrenheit.

IN CASE OF FIRE: Fires near or among model rocket engines should be extinguished in a normal manner. Water or foam is recommended for preventing ignition of engines.

DISPOSAL: Damaged, defective or unwanted engines should be destroyed by soaking in water.

FIRST AID: For minor burns use first-aid burn ointment. For severe burns consult a physician. In case propellant is swallowed, induce vomiting and call a physician.

ROCKET ENGINE SELECTION:

Consult the current Estes catalog or the instructions which came with your model rocket kit for the recommended engines to use in the model. Always follow the model manufacturer's recommendations when mounting the engine in the model.

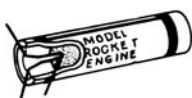
IGNITER INSTALLATION:

Launch model rockets by electrical means only. Estes electrical igniters are supplied in strips. Cut the igniters apart with scissors midway between the coated sections. Bend the igniter at the middle as shown and push it into the engine as far as it will go. To operate properly, the igniter must touch the propellant. Spread the leads and apply a square of masking tape to the nozzle and leads as illustrated. The eraser on the end of a pencil is good for pressing the tape securely into place. Remember that the igniter leads must not touch each other or the engine will not ignite.

1 BEND IGNITER



2 INSERT IGNITER



IGNITER MUST TOUCH PROPELLANT

3 SECURE IGNITER WITH MASKING TAPE

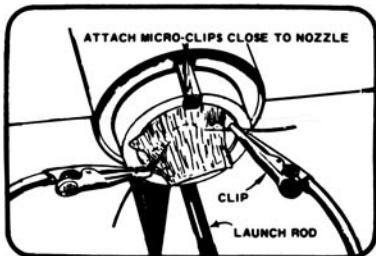


4 CONTINUE WITH COUNTDOWN CHECKLIST

NOTE: TO PREVENT FAILURE DO NOT
HANDLE ENGINE BY IGNITER LEADS

PREPARING FOR LAUNCHING:

Always double-check the recovery system of your model before launching. Parachute and streamer recovered models should have enough wadding between the engine and recovery system to prevent scorching the parachute or streamer and assure positive ejection. Usually the wadding should fill the tube for a distance of at least 1-1/2 body tube diameters. Lower the rocket into position on the launch rod or rail. Clean the micro-clips, then clip one to each lead of the igniter. The clips must not touch each other and the igniter leads must not cross. The rocket may be supported with a scrap of wood or an empty engine casing to make it easier to attach the clips and to keep the clips from short circuiting.



COUNTDOWN:

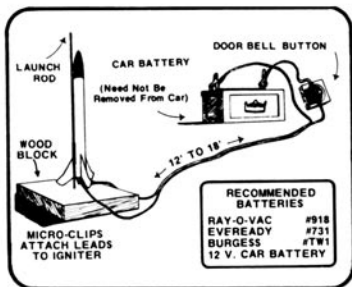
Give a countdown before launching your rocket. First arm the launch panel. Then begin counting: "5-4-3-2-1- Launch." Press the switch at "launch." If the batteries are strong the engine will ignite immediately. As the batteries weaken there will be a short delay before ignition. Disarm the panel as soon as the rocket takes off.

MISFIRES: Occasionally the igniter will heat and burn in two without igniting the engine. This is almost always caused by a failure to install it correctly. Disarm the launch panel, remove the model, clean the igniter residue from the nozzle and install a new igniter. Follow the launching procedure again.

If the batteries are weak or the electrical system is defective the igniter may not operate. After removing the model, connect the clips to a piece of #30 nichrome wire or a light-bulb of the correct voltage and check all contacts until the wire or light glows. If all contacts check out and

the launcher still does not deliver power, try fresh batteries. The batteries must be strong enough to force at least two amperes of current through the igniter. If the current is low it will take the igniter several seconds to heat. The power supply should produce at least six volts to do the job quickly and efficiently.

LAUNCH SYSTEMS: An Estes electrical launch system is recommended for all model rocket launching. Some rocketeers, however, prefer to design and build their own launching systems. A simple home-made launching system is illustrated. This system requires at least 12 feet of 18 gauge, 2 conductor wire, a spring return switch (a door bell button will work), a suitable launching stand with a 36" long 1/8" diameter launching rod to guide the model as it lifts off, two battery clips, two micro-clips and a heavy capacity 6 or 12 volt battery. Car batteries are recommended for this type of system. When using a car

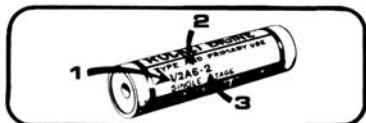


battery it is not necessary to remove it from the car.

CLUSTERS: A cluster consists of two or more engines which are ignited at the same time. For information on cluster ignition and building techniques read Estes Industries Technical Report TR-6, Cat. 651-TR-6, (25¢).

MULTI-STAGING: Estes multi-stage models are designed to ignite their upper stages automatically. Full information on multi-stage techniques is contained in Technical Report TR-2, Cat. 651-TR-2, (25¢).

ENGINE CLASSIFICATION



Estes engines are stamped with a code designation which gives important data on the engine's performance capabilities. Here's how to read this coding: (Refer to engine illustration above.)

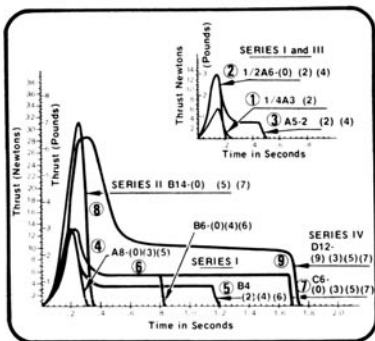
1 This portion indicates the "total impulse" or total power produced by the engine as shown in the chart.

Engine Type	Total Impulse		Average Thrust		Propellant Weight	Thrust Curve Number
	Pound-seconds	Newton seconds	Pounds	Newtons		
1/4A3-	0.14	0.625	0.70	3.0	0.00172 lb.	1
1/4A6-	0.28	1.25	1.35	5.8	0.00344 lb.	2
A5-	0.56	2.50	1.12	4.9	0.00687 lb.	3
A8-	0.56	2.50	1.80	7.7	0.00918 lb.	4
B4-	1.12	5.00	0.90	4.15	0.01836 lb.	5
B6-	1.12	1.35	1.35	5.8	0.01374 lb.	6
B14-	1.12	5.00	3.15	14.0	0.01374 lb.	8
C6-	2.25	10.00	1.35	5.8	0.02748 lb.	7
D-12	4.48	20.00	2.66	11.8	0.05496 lb.	9

2 This portion is the engine's average thrust in Newtons (1 Newton equals 0.224 pounds). For normal flying an average thrust of 3 to 7 Newtons is recommended.

3 This number gives the delay in seconds between burnout and ejection charge activation. Engines with "0" have no delay charge, and are for use in booster stages only.

The label color of Estes engines indicates the recommended use. **GREEN** engines are for use in single stage models; **PURPLE** engines for the top stages of multi-stage rockets, and **RED** engines for all booster and intermediate stages of multi-stage models.



Time/Thrust Curves

Series III engines are identical in performance to the corresponding Series I engines. Series III engines are identified by the final "S" in their code.



Adult supervision recommended for those under 12 years of age when launching model rockets.

"N.A.R. Safety Certified"