ITEM 20
Other Complete Subsystems

Other Complete Subsystems

Complete subsystems as follows, usable in systems in Item 19, but not in systems in Item 1, as well as specially designed "production facilities" and "production equipment" therefor:
(a) Individual rocket stages
(b) Solid or liquid propellant rocket engines, having a total impulse capacity of 8.41×10^5 Ns (1.91×10^5 lb-s) or greater, but less than 1.1×10^6 Ns (2.5×10^5 lb-s).

Produced by companies in

- Brazil
- China
- France
- Germany
- India
- Iran
- Iraq
- Israel
- Italy
- Japan
- North Korea
- Pakistan
- Russia
- South Korea
- Spain
- Ukraine
- United Kingdom
- United States

Nature and Purpose: Solid rocket stages and rocket motors used in systems falling under Item 19 are similar in every respect except perhaps size to those described in Item 2. They operate identically to larger motors; they look the same except for their smaller size, and they use the same packaging methods. Some Category I and II solid rocket motors are shown in Figure 20-1. A wooden shipping crate for four Category II solid rocket motors from the side and end views, respectively, is shown in Figures 20-2 and 20-3.

Figure 20-1: On the right, solid rocket motors controlled under Category II. Motors on the left are large enough to be controlled under Item 2, Category I.

Figure 20-2: Side view of a shipping container containing four Category II solid rocket motors.

Figure 20-3: End view of a shipping container containing four Category II solid rocket motors.

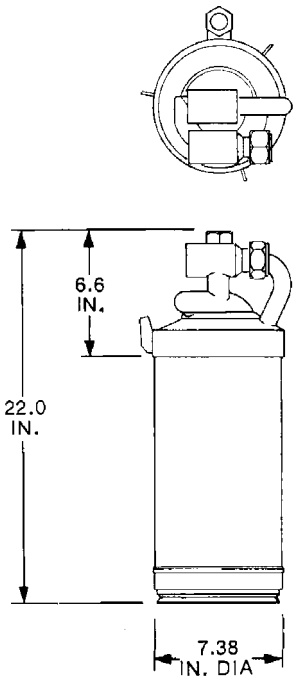

Figure 20-4: A sounding rocket sustainer engine that develops 1.8×10^4 N of thrust for approximately 51 seconds.

Liquid engines meeting the requirements of Item 20 are relatively rare. They tend to be either large propulsion engines or small reaction control engines designed to adjust a spacecraft's trajectory outside the atmosphere. An example of a relatively small propulsion engine for a sounding rocket sustainer is shown schematically in Figure 20-4. Reaction control engines are not really suitable for rocket propulsion because they operate at low levels of thrust. But since they can typically operate for several minutes, they can exceed the impulse allowed under Item 20. An example of such an engine is shown in Figure 20-5, a reaction control engine used in a space launch program. It can generate 440 N of thrust for up to 2,000 seconds. Furthermore, all liquid rocket engines can produce greater impulse simply by increasing the size of the propellant tanks.

Production facilities and equipment here are similar to those discussed in Item 2. These facilities and equipment may be indistinguishable from those for larger items but may be smaller in size.

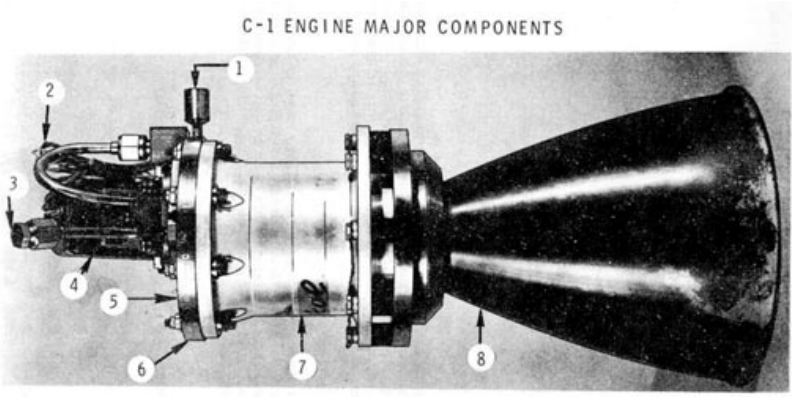

Figure 20-5: A reaction control engine that can generate 100 lbs. of thrust for up to 2,000 seconds.