Butler Parachute Systems, Inc.

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Service Guidance for BPS Parachute Systems for UAV Applications

Parachute systems manufactured by Butler Parachute Systems, Inc. (BPS) are operated all over the world and thus encounter many environmental and operational conditions. This document provides basic, ***non-binding, guidance*** to users of BPS recovery systems concerning basic configurations, service life limitations and inspection and repack intervals of these parachute systems under various circumstances.

> **NOTE:** This document is primarily concerned with parachute systems that are used only for emergency flight termination or recovery. Parachute systems used as the primary means of recovery are, of course, limited by the accumulated damage on any particular component. All items must be inspected after each use and repaired or replaced as necessary.

Recovery System Configurations

BPS parachute systems for unmanned air vehicles (UAVs) are typically configured in one of the following ways (note that the configuration numbers are used later in this document):

1. **"sub-system components only"** would generally indicate that we have supplied only a canopy, or perhaps a canopy and risers for a particular customer. In this case, the configuration (as completed by the customer) would still generally fall into one of the categories below.
2. **"loose packs"** are systems in which canopies (typically with a deployment device) are stowed into some part of the aircraft with no protective lining between the chute and the compartment. It is very important in this case for the compartment to be smooth. This will typically work well only on very small UAVs with a clear deployment path for the parachute.
3. **"soft packs"** are generally shaped specifically for, and inserted into, a stowage compartment or cavity in the aircraft structure and are covered by a frangible/removable aircraft panel. This type will usually provides the lightest total system weight but it is a bit awkward to install in the aircraft.. The soft pack itself serves to protect the delicate canopy fabric from the aircraft stowage compartment and (somewhat) from the elements. If a high pack density is required for a soft pack, it must be shipped and stored in a rigid transfer container (which is usually combined with a packing fixture for pressure packing). The transfer container should be retained for re-use. If used, the rocket motor mount must be separately mounted to the aircraft structure; the rocket mounts provided by BPS will direct the exhaust gases out of the fuselage.
4. **"hard packs"** are rigid containers which are not environmentally sealed but are packaged as a unit for easy insertion into the aircraft; they are typically protected with a frangible/removable aircraft panel. These rigid containers are usually aluminum for short production runs & carbon, or other composite, for longer runs. They typically will have a soft top flap or an open top with the deployment bags and other components exposed to the elements except for the protection provided by the aircraft panel. These do not generally require any special handling for shipment and storage. If used, the rocket motor mount can be integrated with the parachute pack or separately mounted to the aircraft structure; in either case, the rocket mounts provided by BPS will direct the exhaust gases out of the fuselage.

5. **"environmentally sealed hard packs"** are packs, containers or canisters which are sealed against the elements without further protection by aircraft panels. These rigid containers are usually aluminum for short production runs & carbon or other composite for longer runs. These containers may be exposed directly to the elements but it is generally preferable to have a frangible/removable panel on the aircraft for this type. These will have some type of mechanism to release a rigid lid or break open a membrane seal on the parachute. These do not generally require any special handling for shipment and storage. If used, the rocket motor mount can be integrated with the parachute pack or separately mounted to the aircraft structure; in either case, the rocket mounts provided by BPS will direct the exhaust gases out of the fuselage.

Parachute Service Life and Inspection/Repack Intervals:

Based on industry experience in general, and on operational experience with some systems in particular, the following, non-binding, guidance is provided on service life and inspection/repack intervals:

Configuration	Service Life (estimated)	Inspection Interval	* Repack Interval	Comments
1 Subsystem	10 yr.	1 yr.	1 yr.	Primarily determined by total system configuration. Aircraft specific.
2 loose pack	10 yr.	1 yr.	1 yr.	Primarily determined by total system configuration. Aircraft specific.
3 soft pack	10 yr.	2.5 yr.	2.5 / 5 yr.	Primarily determined by environmental conditions. Upon satisfactory inspection repack can be extended to 5 years in similar operation conditions.
4 hard pack	15 yr.	5 yr.	2.5 / 5 yr.	Primarily determined by environmental conditions. Upon satisfactory inspection repack can be extended to 5 years in similar operation conditions.
5 env. sealed	20 yr.	5 yr.	5 yr./10 yr.	Environmental seal must be intact at 5 year to extend repack to 10 years. A broken seal at any time would move system to configuration 4 status.

NOTE: Keep in mind that these systems are used on ***unmanned aircraft*** and that some procedures applicable to UAV operations are not appropriate for personnel parachute systems. The inspection and repack intervals shown are for guidance only and may be extended or waived by operational commanders as required. However, unless dictated by severe operational necessity, the recommended service intervals should not be exceeded by more than 50% without specific guidance from BPS. Total service life should not be exceeded by more than one year without inspection and repacking by BPS.

Service Life of Pyrotechnic Devices:

All of the above parachute configurations can, in turn, include various types of pyrotechnic components used for time delays, line severance, ground/water release devices, rocket motors, etc. Based on industry experience with these devices, the service life of :

- pyrotechnic time-delay devices, small gas generators, and ignitors is generally 10 years.
- most small rocket motors (under 2000 N-s) is generally 5 years.

Some rocket motors can have the grain replaced at about half the cost of a complete new motor. However, given the difficulty in shipping rocket motors (class 1.3c), careful consideration should be given to service cycle timing for these components. Most of the other components can be shipped as class 1.4s which is much less restrictive.