FAA Approved
Aircraft Flight Manual Supplement
for the BRS-172 in
Cessna 172 Aircraft

Aircraft Registration No. _____

BRS-172 Serial No. 72011

BRS-172 Mfg. Date 6/03

This document must be carried in the aircraft when a BRS-172 is installed in accordance with STC # SA01679CH.

When the BRS-172 is installed in an aircraft that has an FAA Approved Airplane Flight Manual or a Pilot's Operating Handbook and FAA Approved Flight Manual, this document serves as the FAA Approved Flight Manual Supplement. The information contained herein supplements or supersedes the basic manual only in those areas listed. For limitations, procedures, and performance information not contained in this document, consult the basic Airplane Flight Manual.

When the BRS-172 is installed in an aircraft that does not have an FAA Approved Flight Manual, this document serves as the FAA Approved Supplementary Airplane Flight Manual. This document supplements or supersedes the basic placards and markings only in those areas listed.

FAA APPROVED: Joseph C Moss

DATE: MAY 07 2003

REVISION PAGE

Rev	ECO	Date	Page	Description	Approval
A		3/15/02	All	Initial Release	On File
B	1005	10/8/02	7-3, 7-4, 8-1, 8-3	Add handle pull drawings, Change service cycle to 10 yrs, Add rear window warning.	On File
C	1063	3/15/03	2-2, 8-2	Add line cutter exp. date to data placard; revise to match ICAW limitations (see BRS Doc 19815, Sect 2)	

TABLE OF CONTENTS

SECTION 1 - GENERAL

1.1 Introduction

The BRS-172 is a rocket deployed emergency parachute system for use on Cessna 172 type aircraft. It is designed to recover the aircraft in life threatening emergency situations, bringing the aircraft and occupants down together safely. The BRS-172 is activated by pulling the T-shaped handle mounted in a protective box on the floor just ahead of the pilot/copilot on the airplane centerline.

This manual supplement is a general guideline for the maintenance and operation of the BRS-172 system. It is **absolutely mandatory** that pilots of a BRS-172 equipped aircraft read and understand this manual thoroughly and in its entirety before operating an aircraft with a BRS-172 installed.

> ⚠ **WARNING**
>
> **Failure to comply with this instruction could result in an accident causing extensive property damage and serious or even fatal injuries to the pilot, passenger and other people on the ground!**

SECTION 2 - LIMITATIONS

2.1 Introduction

Installation of the BRS-172 does not change the standard operating limitations necessary for the safe operation of the airplane. The following limitations apply to use of the BRS-172 in emergency situations.

2.2 Airspeed and Attitude Limitations

BRS-172 activation is approved for deployment by the FAA up to 163 knots. Deployment in inverted flight has not been demonstrated and could result in a complete or partial failure of inflation. All efforts to right the airplane should be made **if time and altitude permits!** However, if these actions cannot be made in a timely manner, the BRS-172 should be activated!

2.3 Altitude Limitations

The BRS-172 was designed to decelerate and stabilize the airplane with an altitude loss of 300 to 800 feet. However, the actual altitude loss during BRS-172 parachute deployment will be dependent on the airplane's speed and attitude at activation.

2.4 Placards

The following information must be presented in the form of placards when the airplane is equipped with a BRS-172.

1. On the rear window:

⚠ WARNING

craft is equipped with a ballistic parachute recovery system. motor is installed under cover. Remain clear. Factory sealed unit, open or disassemble. See Airplane Flight Manual Supplement or BRS ors Manual for inspection procedures.

2. On the side of the BRS-172 parachute canister in the cabin:

	Model: ***BRS-172***
NEVER POINT CHUTE DISCHARGE TOWARD ANYONE AT ANY TIME - ACCIDENTAL DISCHARGE CAN CAUSE DEATH OR SERIOUS INJURY. TREAT LIKE A LOADED GUN.	FOR INSTALLATION IN APPROVED CESSNA MODEL 172 AIRCRAFT ONLY, STC: SA01679CH
IF YOU ARE NOT THE ORIGINAL OWNER OF THIS BRS UNIT, CONTACT BRS INC. FOR PERTINENT PRODUCT ADVISORIES. •BRS INC. • 300 Airport Rd.• •SOUTH ST. PAUL, MN 55075•USA	BRS Inc. S. St. Paul, MN 55075 USA Recovery System, BRS-172 S/N:XXXXX C-172 FAA-PMA P/N:9004 Mfg. Date:XX/XX Repack Due:XX/XX Line Cutter Replacement Due: XX/XX
U.S. PATENT PROTECTED COMPONENTS, PATENT • 4,863,119	

2. On the BRS-172 activation handle box cover:

⚠ WARNING

This aircraft is equipped with a parachute recovery system. Use for extreme emergencies only. Refer to the FAA Approved Airplane Flight Manual Supplement for operating instructions. Seat belt and shoulder harness must be worn at all times. Improper use could result in injury or death!

ACTIVATION PROCEDURES

1. **Fuel Mixture Control ..... Idle Cut-Off**
2. **Activation Handle Cover ..... Remove**
3. **Activation Handle ....Pull Hard Continuously**
4. **Fuel Selector Switch ..... Off**
5. **Master Switch ..... Off**
6. **Restraint System ..... Secure**
7. **Assume Emergency Landing Body Position**

SECTION 3 - EMERGENCY PROCEDURES

3.1 Introduction

This section identifies the situations for which the system should be activated, outlines the proper activation procedures, describes the deployment environment, and describes post activation procedures.

3.2 BRS-172 Activation Procedures

An operational checklist and amplified procedures for activation of the BRS-172 are presented below. As with any aircraft emergency situation, it is essential to practice simulated activation procedures, so that a sequence of pilot actions comes naturally. During an extreme emergency, the pilot's senses and faculties will be highly stressed. In some emergency situations extreme forces may be acting on the aircraft, thereby impairing spatial orientation and physical motion and increasing reaction times. The violence associated with the breakup of an aircraft's structure, a midair collision, or other similar disasters are strenuous enough to force the need for robust emergency procedures.

Procedures in the following operational checklist are immediate action items, which should be committed to memory.

1- FUEL MIXTURE CONTROL..... IDLE CUT-OFF
2- ACTIVATION HANDLE COVER..... REMOVE
3- HANDLE..... PULL HARD CONTINUOUSLY
4- FUEL SELECTOR SWITCH..... OFF
5- MASTER SWITCH..... OFF
6- RESTRAINT SYSTEM..... SECURE
7- ASSUME EMERGENCY LANDING BODY POSITION

The following amplified procedures elaborate upon the operational checklist. These procedures include information not readily adaptable to a checklist format, and material to which the pilot could not be expected to refer in resolution of a specific emergency.

Pulling the fuel mixture control - It is very important to shut down the engine before deploying the BRS to reduce parachute inflation forces.

Removing the activation handle cover - Look at and locate the handle of the activation handle box cover. Pull the cover off to expose the activation handle.

Pulling the activation handle - Look at and locate the activation handle. Grasp the handle firmly and pull out. While only a few inches of motion is required to arm and fire the rocket, **DO NOT** limit the pulling motion to this distance! Pull as hard and as far as physically possible!

Turning fuel selector switch off - Shutting off the fuel supply to the engine will reduce the chances of a fire resulting from impact at touchdown.

Turning the master switch off - Turning the master switch off will reduce the chances of a fire resulting from impact at touchdown.

Occupant protection - Before touchdown, the recommended emergency landing body position, illustrated in Figure 1, must be assumed by all occupants.

Both hands should be placed behind the head with the fingers locked together. The elbows should be pulled forward to protect the side of the head and face. The upper torso should be erect.

⚠ WARNING

All occupants should have their seat belts and shoulder harness securely fastened and their seat position locked in place before takeoff.

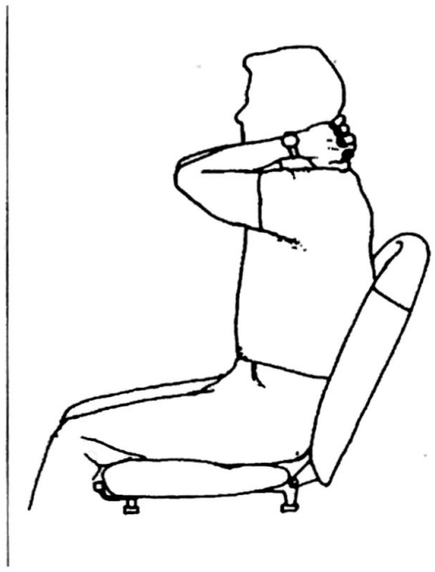


Figure 1.
Emergency Landing Body Position

3.3 Aircraft Attitude After Deployment

Once the handle is pulled and the rocket launches, the parachute will be extracted upward and rearward due to relative wind influences. It will be less than two seconds before the first of two parachute inflation forces is felt.

The first force will occur when the parachute is fully extracted and begins to inflate. The second force will occur when the parachute "disreefs" or inflates to its full diameter. Reefing is described in detail in Section 7, System Description. As the parachute inflates, the aircraft will decelerate rather quickly. The nose of the aircraft will also be raised rather abruptly, as if the control yoke had been pulled back forcefully.

The aircraft's forward speed will drop rapidly and the aircraft will begin to hang below the canopy. Following the rapid slowing of the aircraft, an oscillation may follow. This is a period when the aircraft swings in a pendulum manner until it stabilizes directly below the canopy. While it will generally be more stable once the initial oscillation ceases, continued movements could occur due to adverse weather conditions and the airflow disturbance around the aircraft as it flows upward to the parachute.

Some control of the aircraft may still be present, but directional control should not be expected. In some cases the ailerons may offer some directional control—assuming control surfaces are intact and receiving enough airflow. The ground speed will be dictated by the wind. Were the engine still running, the parachute could be towed somewhat, but it should still be shut down before touchdown. Only use the towing capability in a life-threatening situation, and then shut down again!

3.4 Touchdown Conditions

In addition to vertical velocity, the aircraft may still be oscillating, and the wind may be causing significant amounts of drift. If the speed was high at deployment, the oscillations may last several minutes. If the altitude at deployment was low, 300 to 800 feet AGL, these oscillations may not cease before the aircraft reaches the ground. The aircraft may strike the ground in an unusual attitude, which could result in injury to occupants. To reduce chances of injury, it is important for the occupants to maintain the protective body position prior to touchdown.

In addition, high ground winds could drag the aircraft a considerable distance after touchdown. To reduce chances of injury, it is important for the occupants to maintain the protective body position until a safe exit can be made.

Once the aircraft has come to a complete stop, plan to exit quickly and move upwind of the aircraft immediately. The aircraft motion could resume with the weight of the occupants removed.

If the aircraft or parachute should end up in power lines (carrying electrical current), do not, under any circumstances, touch any metal parts. Relay this precaution to anyone attempting to help. If a rescuer touches a metal part of the aircraft while standing on the ground,

electrocution could result. Movements should be confined until qualified personnel can come to your assistance.

3.5 Potential BRS-172 Activation Scenarios

The following scenarios describe situations in which activation of the BRS-172 may be the only means to save the airplane occupants from serious injury or fatality. These scenarios do not represent all possible situations nor do they represent situations in which activation of the BRS-172 is the only option.

> ⚠ **WARNING**
>
> **The BRS-172 is intended to be used only in an extreme emergency in which recovery of the occupants of the airplane using the EMERGENCY PROCEDURES described in the Cessna 172 AFM is not possible. If the airplane is controllable and structurally capable of flying to a safe landing site, the BRS-172 SHOULD NOT BE ACTIVATED. If the airplane is uncontrollable and/or a forced landing on extreme inhospitable terrain cannot be avoided, the BRS-172 SHOULD BE ACTIVATED.**

The extreme emergency in which the BRS-172 must be activated requires that it be activated in a timely manner. Do not wait until the airplane has exceeded the BRS-172 airspeed and load factor operating envelope, is at an altitude which does not allow the BRS-172 to fully deploy prior to ground impact, or is in an extreme attitude.

The BRS-172 is not intended to be a substitute for good pilot judgment, skills and training, proper preflight planning, proper aircraft maintenance and preflight inspections, and safe aircraft operations.

Mid-air collision - A mid-air collision could render the aircraft un-flyable. Most mid-air collisions occur at relatively low altitudes or in the landing traffic pattern. If a mid-air collision occurs, the pilot must immediately determine if the airplane is controllable and

structurally capable of flying to a landing site and do so subject to selecting a safe landing site. Otherwise, the pilot should activate the BRS immediately.

Structural failure - A structural failure can result from many conditions: encountering a severe gust at speeds above the aircraft's structural cruising speed, exceeding design load factor at speeds above the aircraft's maneuvering speed, wake turbulence or a degrading and/or defective aircraft structure. If a structural failure occurs, the pilot must determine if the airplane is controllable and structurally capable of flying to a landing site. If it is not, the pilot should activate the BRS immediately.

Loss of control - Loss of control could result from a control system failure, wake turbulence, severe airframe icing or pilot disorientation. If control can be recovered before the aircraft is in danger of ground impact, the pilot should do so and not deploy the BRS. If the airplane cannot be controlled, the pilot should activate the BRS immediately.

Engine out over hostile terrain - An engine out emergency should not be a reason to deploy the BRS unless the terrain below will not accommodate a safe landing. If the surface is extremely rough, a safe landing may be impossible. At night or in ground fog conditions, visibility may not permit a safe landing approach. If a safe landing is not possible, the pilot should activate the BRS.

Pilot incapacitation - Passengers should be briefed on the BRS location and operation prior to take-off. If the pilot is incapacitated and cannot fly the airplane to a safe landing and the passenger does not have the training or skills to fly the airplane to a safe landing, the passenger should activate the BRS.

Some situations provide scenarios where BRS use is not desirable. These have a central theme: if the aircraft can still be controlled, continue flying the airplane to a safe landing.

Out of fuel, with landing areas within reach - If a landing area is available and if the aircraft is controllable the airplane should be flown to a normal landing.

Lost, with fuel remaining - Getting lost, or being uncertain of control of flight, may seem a life threatening situation. If sufficient fuel remains and if the airplane is controllable, the airplane should be flown to a safe landing.

SECTION 4 - NORMAL PROCEDURES

4.1 Introduction

Installation of the BRS-172 does not change the normal procedures necessary for safe operation of the airplane. The following preflight procedures should be added to the normal aircraft preflight procedures.

4.2 BRS-172 Preflight Checklist:

Remember, a live rocket motor is mounted adjacent to the parachute box under the right half of the rear window. Remain clear of the rocket and parachute exit point and take appropriate precautions to see that other persons do not tamper with the BRS-172.

External inspection -

1. Looking through the rear window, inspect the parachute and rocket covers for holes or cracks.

2. The exterior harness straps should lay flush against the cabin top skin. Visually inspect the seal around the perimeter of the harness strap fairings for cracks or peeling to ensure that the fairings are not separating from the aircraft.

Internal inspection -

1. Check the parachute box for visible damage.

2. Check the service date placard on the side of the parachute container. If the system is out of date, it must be serviced in accordance with factory recommendations.

3. Ensure that nothing is placed on top of the parachute and rocket canisters. The clear Lexan shield should be securely attached to prevent this from occurring.

3. The activation handle box cover should fit snugly around the perimeter of the activation handle box. The warning label on the cover should be legible.

4. Check that all seat belts and shoulder harnesses are securely fastened before take-off.

4.3 Passenger Briefing:

1. Instruct passengers on the use of the BRS-172 in the event of pilot incapacitation.

SECTION 5 - PERFORMANCE

Installation of the BRS-172 does not change the performance of the airplane.

SECTION 6 - WEIGHT AND BALANCE, EQUIPMENT LIST

6.1 Introduction

The approximate total weight and moment arm of the BRS-172 is 79 lbs and 7938 lb-in. The actual weight and moment for a particular installation is included in the airplane weight and balance data.

It is the responsibility of the pilot to ensure that the airplane is loaded properly. Operation outside of prescribed weight and balance limitations could result in an accident and serious or fatal injury.

SECTION 7 - SYSTEM DESCRIPTION

7.1 GENERAL SYSTEM DESCRIPTION

The BRS-172 parachute and rocket motor are enclosed in containers mounted in the forward baggage compartment as shown in Figure 2. The parachute is attached to the airplane primary structure with a three-point harness assembly fabricated of flexible woven Kevlar straps. Two of the harness straps are routed through a slot in the rear window and across the top skin to the front wing attachment points as illustrated in Figure 3. A third harness strap is attached to the aft cabin primary structure and stowed internally. When the system is activated, the rocket motor will penetrate the rear window and extract the parachute away from the airplane, peeling the two forward attachment harness straps away from the aircraft top skin and extracting the aft harness strap from inside the aircraft.

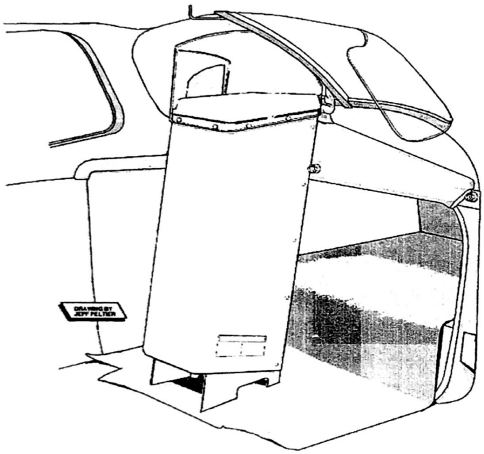


Figure 2.
BRS-172 Installation

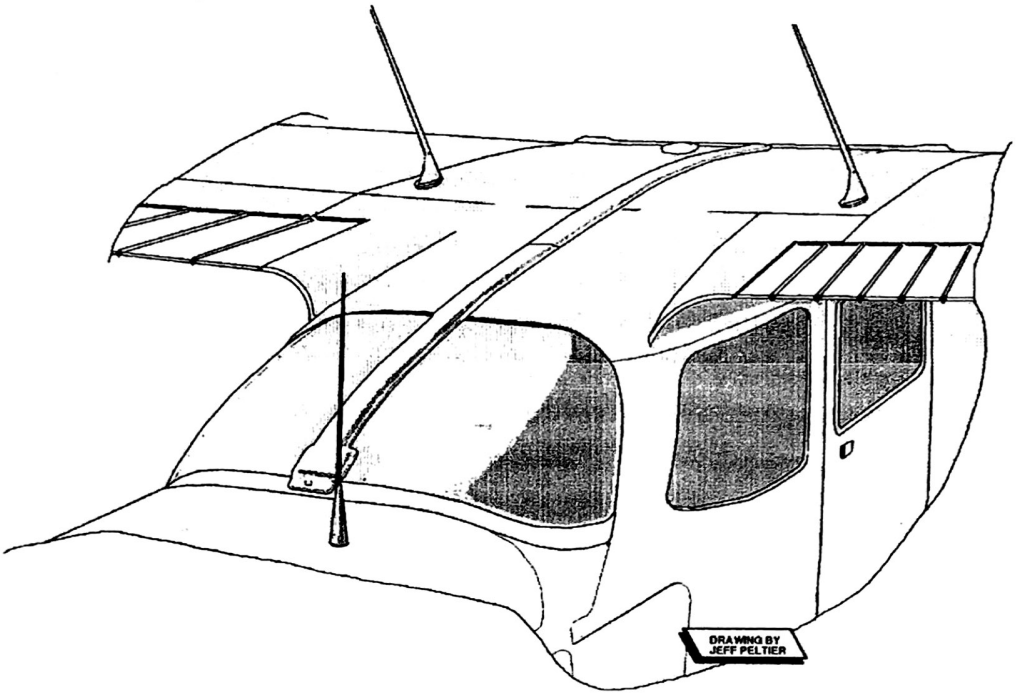


Figure 3.
BRS-172 Aircraft Attachment Harness

Pulling an activation handle mounted in a protective box on the floor between and slightly forward of the pilot/copilot activates the rocket motor. The handle, the only part of the system accessible to the pilot in flight, is protected with a cover to prevent it from being pulled accidentally. A placard on the cover identifies the system, presents the actions required to deploy it, provides appropriate warnings and references the Airplane Flight Manual (AFM) Supplement.

Two separate and deliberate actions are required for activation. First, the protective cover must be removed from the activation handle box as shown in Figure 4. Second, the handle must be pulled out several inches as shown in Figure 5. The handle activates the rocket motor via a stainless steel cable routed through a Teflon lined housing. The first few inches of motion deliberately take up slack within the cable housing. The remaining motion both arms the rocket motor igniter and fires it. The rocket motor igniter, a mechanical device that requires no electrical source, is unarmed in the normal configuration. Approximately 40 to 70 lbs of force is required to activate the system.

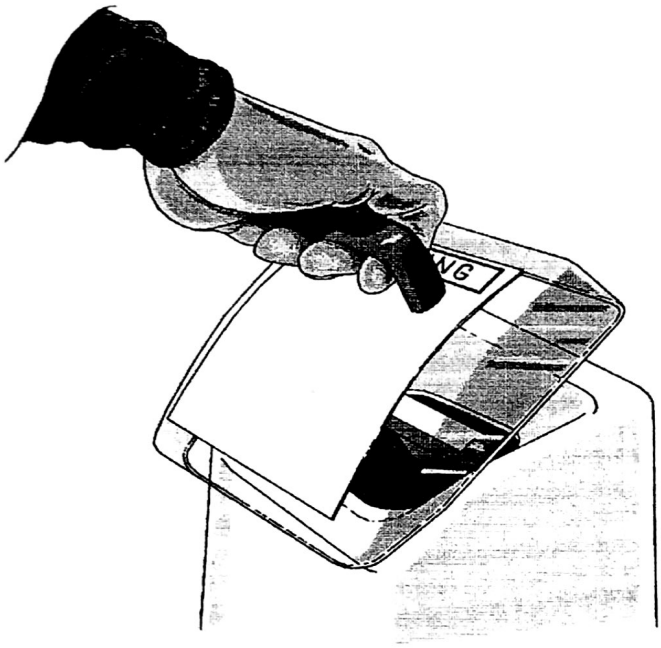


Figure 4.
BRS-172 Activation (Cover Removal)

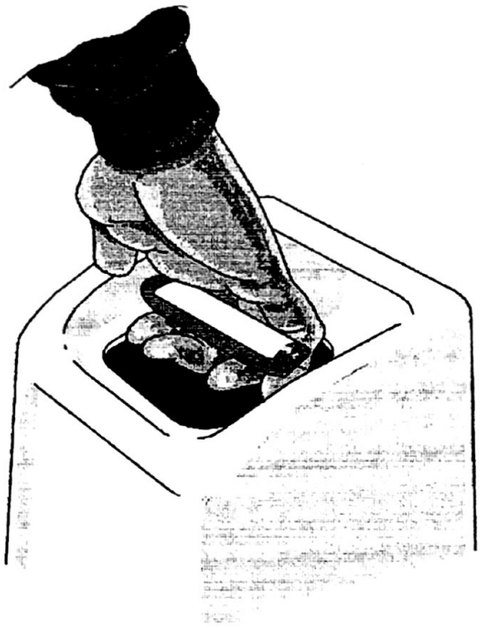


Figure 5.
BRS-172 Activation (Handle Pull)

The parachute assembly is pressure packed and stowed in a deployment bag designed to stage the deployment. The deployment bag creates an orderly deployment sequence by allowing the canopy to inflate only after the rocket motor has pulled the aircraft attachment harness, riser and suspension lines taut as shown in Figure 6. This prevents any slack or uneven tension in the suspension lines during canopy inflation that could possibly result in an entanglement.

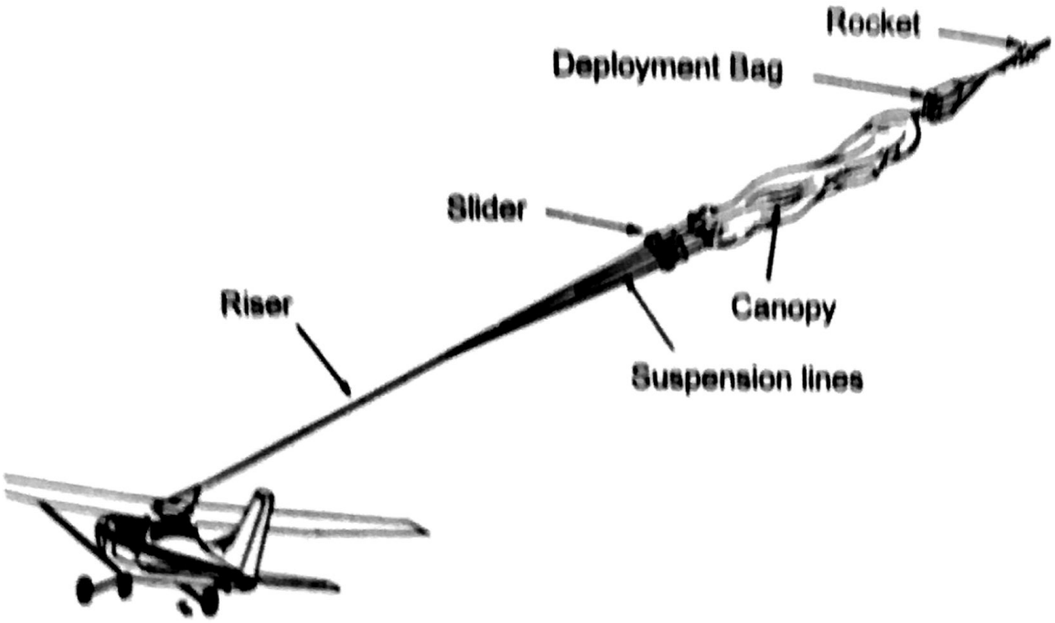
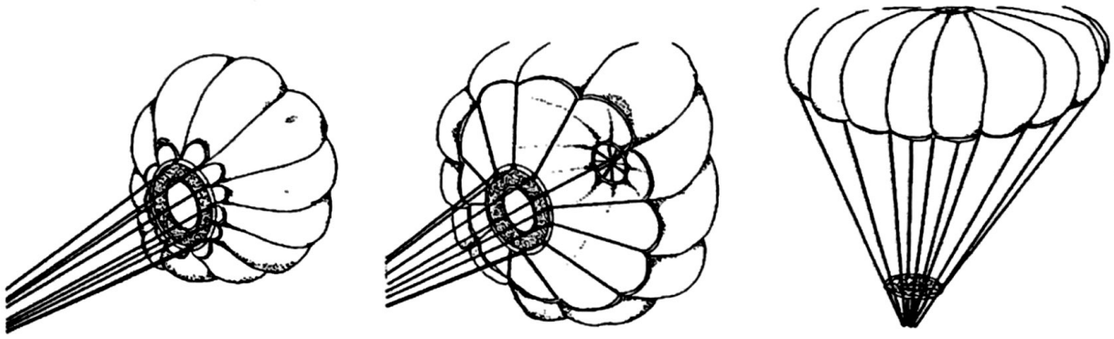


Figure 6.
BRS-172 Rocket Extraction

The 2400 ft^2 parachute utilizes a slider for aerodynamic reefing. Reefing is a means of controlling canopy inflation rate. The slider is an annular shaped fabric panel with metal grommets along its perimeter. The parachute suspension lines are routed through the grommets such that the slider is free to move along the suspension lines. The parachute is packed with the slider positioned at the top of the suspension lines. Since the diameter of the slider is significantly less than the open diameter of the canopy, it limits the initial open diameter of the parachute and the rate at which the canopy inflates (Figure 7). The geometry of the canopy/slider configuration has been designed to provide a deployment-operating envelope consistent with the flight envelope of the Cessna 172 airplane.



Reefed Condition | Disreefing | Inflated

Figure 7.
Slider Reefing Sequence

SECTION 8 - HANDLING, SERVICING, AND MAINTENANCE

8.1 Introduction

This section contains factory recommended procedures for proper handling and routine servicing of the BRS-172. It also identifies certain inspection and maintenance requirements, which must be followed if the BRS-172 is to retain its ability to function properly in an emergency situation.

8.2 Servicing

Installation and removal of the BRS-172 must be performed by FAA licensed Airframe and Powerplant mechanics in accordance with BRS-172 Installation Instructions. Annual/100 hr inspections must be performed by FAA licensed Airframe and Powerplant mechanics in accordance with the instructions outlined in this specification.

In addition to the annual/100 hr inspections, the BRS-172 must be removed from the aircraft for inspection and repacking every ten (10) years. The rocket motor must also be replaced or recharged every ten (10) years. The pyrotechnic line cutter must be replaced every five (5) years. These service dates are printed on placards on the sides of the parachute box and rocket. Any repairs, repacking, or recharging of the BRS-172 must be performed by the factory or BRS Authorized Service Center. Inspections and line cutter replacement may be performed by FAA licensed Airframe and Powerplant mechanics at the designated intervals.

Using the BRS-172 for an actual in flight emergency will render the aircraft and the BRS-172 un-airworthy. The parachute assembly is intended for (1) use only. If the BRS-172 is used; BRS wants to know about it as soon as possible. The company tracks all uses of BRS units with keen interest to see how and why it was used, what the results were, what injuries or damage may have resulted, and if any improvements to the device are possible, once the learning experience is gained.

Please notify BRS immediately following any use of the BRS-172 system!

8.3 Alteration of factory installation specifications

Unauthorized personnel should not attempt to modify, repair, or disassemble the BRS-172 system at any time. BRS Inc. has gone to

considerable effort to assure that the system will function reliably. Any change in its installation may render the system incapable of proper operation in an emergency. Modification of any component part of the BRS unit, or failure to strictly follow the procedures and directions set forth in this manual, can result in deployment failure and personal injury or death to the pilot and passenger aboard the aircraft.

Treat the BRS-172 like a loaded gun. Take all appropriate precautions to see that other persons cannot tamper with the BRS-172. The rocket ignition unit is not armed until the handle is pulled, and will not fire until the handle is pulled somewhat further from the housing. However, most children can accomplish this pull, and actions should be taken to prevent tampering. The label on the handle box cover should warn most people against tampering. Use added care to inform passengers who cannot read or do not understand the placard to be careful around the activation handle and cover. Always make sure the activation handle box cover is in good shape and that the warning text is still legible.

Do not "experiment" with the BRS-172 or fire it on the ground just to see if it works. People may be injured or property damaged and thousands of dollars of expense will be incurred to repack the parachute and replace the rocket. In addition, firing the BRS-172 experimentally will render it and the aircraft unusable and uncertified until the factory has serviced it.

It should also be noted that the BRS-172 was tested and certified with the production rear window. Substituting a rear window with a thicker or different material could prevent the deployment.

8.4 Preventive Maintenance

A thorough preflight is mandatory to maintain the airworthiness of the BRS-172. Circumstances for which the BRS-172 must be removed and serviced by the factory or BRS authorized service center are summarized below.

The BRS-172 is installed internally in the aircraft, which provides protection from rain and other elements of nature. The parachute container and cover also provide protection for the parachute system. However, should the parachute box be damaged or the cover integrity compromised, the extraction of the parachute may be adversely affected during deployment.

The harness straps for the parachute system are covered by fiberglass fairings that protect the straps. These fairings are held in place and sealed with silicone. In addition, the straps are routed through slots in the rear window and sealed with silicone. During all preflight inspections, the silicone seals should be inspected to assure that the seals have maintained their integrity.

If the structural or functional integrity of any of the BRS-172 components are questionable, please contact the factory or BRS authorized service center for maintenance instructions.