Excalibur Operator's Manual

Warnings and Important Safety Guidelines

Warning! The Excalibur paintball marker is not a toy! Careless or improper use, including failure to follow instructions contained within this manual, may result in injury or death.

Read Operator's Manual before use and comply with all safety instructions. Do not fire this, or any marker, at a person when at a close range. Observe all local laws, regulations, and ordnances when using this marker. Use only at paintball fields where safety codes are strictly enforced.

You must be at least 18 years of age to purchase this marker. Users under the age of 18 must do so only under adult supervision. Use only bottles approved for Nitrogen, compressed air, or CO2. Make sure all bottles are hydro-tested according to DOT regulations.

Use only .68 caliber paintballs in this marker. Do not attempt to fire foreign objects from this marker. Use an approved barrel blocking device when your marker is not in use. Always disconnect air source and switch off power source when not in use. Never shoot at velocities in excess of 300 FPS. Never put your fingers or foreign objects in the feed tube of the marker.

Never expose battery to open flame or heat source. When connecting or disconnecting the battery, take care not to short out the battery.

Always wear eye protection when adjusting, servicing, or using your marker. When doing any work to your maker, make sure the power and air source have been disconnected. Be sure all paintballs have been removed. Seek professional assistance if you unsure of anything.

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Introduction

This manual is a work in progress and will be continously updated as needed. If you see an area that needs work, contact us thru e-mail and let us know. If you have sugestions or a different method of doing something that pertains to the Excalibur and its components, write us with your suggestions. We decided to place the manual on disk for the simplicty of keeping it up to date and to eliminate paper waste. The manual was written in HTML so it will be compatible with well over 95% of the computers people use in their day-to-day life. A PDF version of this document is also included on this disk for users who prefer to print out their own hard copy of the manual.

The ground work for the very first ideas of the Excalibur were laid down back in 1988 as I was working on my apprenticeship in the family machine shop - Leads Metal Products, Inc. Leads Metal Product's other division, Endeco Soldering and Desoldering, had just finished developing an electronically-controlled power vacuum desoldering station which used solenoids and 4-way solenoid valves to actuate the mechanism. Endeco had been manufacturing and selling soldering and desoldering irons since the late fifties.

At the time of the development of the new power vacuum desoldering station, I had developed several paintball gun prototypes, several blow back guns, and one pneumatic blow forward. I had an idea and added a 4-way solenoid valve from the desoldering stations to one of my paintball gun designs. It worked great, but the 4-way solenoid valves at the time were far too big to make a portable paintball gun. I continued to develop the idea but later shelved it when I went off to college in 1990.

In October 1998, after hearing many complaints about the electronic markers available at that time, AKALMP decided to build a paintball gun that would hold up to the punishment that any paintball gun endures. Most electronic markers are based on an inexpensive blow-back semi-auto open bolt marker which limits their performance. The Excalibur's(tm) (pat pend) design makes it the most advanced integrated paintball marker in the world. The electronics are state-of-the-art but have been kept simple for durability and longevity. The mechanical components of the Excalibur(tm)(pat pend) have been designed to give many years of flawless operation with very little maintenance. The whole marker was designed around the "KISS" (Keep It Simple Stupid) principal. The design is very simple and rugged but is, at the same time, very advanced. The outside of the Excalibur(tm)(pat pend) may not look fancy, but the inside is what is adavnced. The Excalibur(tm)(pat pend) is built more like a high performance tank. We leave the decoration up to customers and airsmiths. In addition, we wanted to provide a warranty that was simple, not long and complicated.

With many years of design and manufacturing knowledge outside of paintball to draw from, AKALMP, Inc. and LEADS METAL PRODUCTS, Inc. bring the paintball community the finest paintball products available. AKALMP has the finest products with the highest performance ratings which will not be compromised.

President AKALMP, Inc.

Aaron K. Alexander

Specifications

Model: Excalibur(tm)(pat pend)

Version:1300-B **Caliber:** .68

Action: Closed Bolt Electo-pneumatic Operation

Gas Source: Compressed air, Nitrogen or CO2

Power Supply: 9 Volt battery **ROF (Cyclic Rate):** 13 BPS(MAX)

Standard Barrel Length: 12.0" Javelin (Cocker Threads)

Length: 8.125 inches

Height: 8.4 inches (Top of feed tube to bottom of grip)

Width: 1.75 inches

Weight: 3. lbs (Without battery & barrel)

Operating Pressure: 140-180 PSI @ 280 FPS (depending on paint size)

Input PSI to Sidewinder: 400-800 PSI

Pneumatics Pressure: 90-100 PSI

Features:

Tornado(tm)(Pat# 5791328) Valve Low Pressure, High Efficiency Lightning(tm) Bolt(delrin) with Quick Release Pin Javelin (tm) Barrel 45 Grip Ball Detent Built-In Vertical Mount Sidewinder(tm)(pat pend) Vertical Pressure Reg. Threaded Vertical Feed Adjustable Trigger (3 adjustment points) Adjustable operating software, includes,

hammer drive, hammer release, bolt drive, bolt release,

Adjustable ROF, Warp feed drive, Ball drop sensor optional, plus more. Adjustable Low Pressure Pneumatics Reg. Pull Through Cleaning Easy Disassembly & Low Maintenance Rugged Design Barrel Plug Carrying Case

Power Source

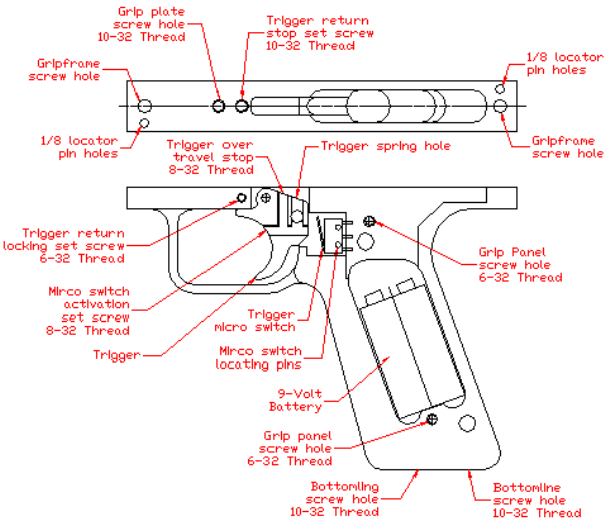
The Excalibur(tm)(pat pend) uses a 9-volt battery stored in the grip as its power supply. For maximum number of shots and velocity stability you should only use high capacity rechargeable batteries or lithium batteries. The Excalibur's(tm)(pat pend) circuit board is designed with a special voltage regulator system to allow the use standard alkaline batteries. For best performance it is still better to use rechargeable or lithium batteries. We are currently using high capacity Nickel-Metal Hydride batteries, with great success. The velocity and the feeding consistency of the Excalibur(tm)(pat pend) can start to vary if the paintball maker is fired using a low battery.

Installing a Battery:

Step 1: Make sure the marker is unloaded, de-gassed and turned off. Remove one of the two screws holding the grip panel on the left side of the marker. Rotate the panel out of the way. Remove the 9-volt battery from the battery cable. Make sure not to pull the battery cable apart.

Step 2: Install the new 9-volt battery on the battery cable and place it back into the grip frame. Make sure no wires on the battery cable are pinched. Gently loop the wiring and lay it on the side of the battery.

Step 3: Rotate the grip panel back into place. Then replace the grip panel screw. Your Excalibur(tm)(pat pend) is now powered and ready to use.



Air Supply

The Excalibur(tm)(pat pend) is designed to operate on nitrogen, compressed air, and CO2. It requires a high flow of CLEAN gas. (Over the many years I have played I have never had a problem with CO2 being dirty, only the compressed air at some tournaments.) Most nitrogen systems, including preset regulators, will work well. The Excalibur(tm)(pat pend) is supplied with a Sidewinder (tm)(pat pend) regulator which has been designed to work at the low pressure range in which the Excalibur(tm)(pat pend) operates. The input pressure to the Sidewinder(tm)(pat pend) regulator should be from 500 to 800 psi.

Air supplied at fields and tournaments is often dirty. Scuba air is not always clean either. This dirty air is one reason for paintball gun and regulator failure. Next time your gun or regulator fails at a tournament, stop - before blaming the manufacturer of the paintball gun or regulator, and check your air supply. Some of this dirt eventually ends up in the marker. Electronic markers with solenoid valves are particularly vulnerable to dirt. For this reason, we recommend a portable filter such as the Guardian(tm) when filling your tank, even if your tank has a built-in filter.

The Sidewinder(tm)(pat pend) regulator is designed for a maximum input pressure of 800 psi. It has been designed specificaly for use with the Excalibur(tm)(pat pend). It also works well with many other paintball guns. Refer to the Sidewinder(tm)(pat pend) Reg. section of this manual for more information. If you change out the Sidewinder regulator, you will quickly discover that the Sidewinder regulator is currently one of only two regs that will keep up with the low operating pressure and high flow demands of the Excalibur(tm)(pat pend). The Palmer Stablizer is the only other regulator that will work.

Use only steel braided hose and stainless steel quick disconnects or Macro-line. Micro-line is inappropriate and unsafe for use in paintball.

When attaching the air line make sure to blow the line out with air before attaching it to the marker to make sure the air line is clear of debris.

DO NOT USE TEFLON TAPE.

The use of pro-connects and fittings like those can cause a drop in efficiency and can cause drop off problems while firing the Excalibur(tm)(pat pend). They are not a good fitting for low pressure guns.

When using CO2 it is a MUST that you keep liquid CO2 out of the Excalibur(tm)(pat pend).

If running CO2 on the Excalibur(tm)(pat pend) you must use a tank with an anti-siphon tube. It is best to double regulate by using a secondary regulator attached to the bottom of the grip. AKALMP recommends the Palmer Stabilizer. The Stabilizer's output should be set at 500-550 psi running into the Sidewinder(tm)(pat pend) regulator which controls the velocity. Liquid must be kept out of the Excalibur(tm)(pat pend).

Excalibur Notes

AKALMP is continuosly refining the Excalibur to push its performance to the extreme. Here is a list of things that have changed between the different batchs of markers. This manual covers most things on the Excalibur but be careful becuase there may be a change that is not in this version of the manual yet. AKALMP reserves the right to revise and improve its products as it sees fit.

Serial numbers: 0 thru 57.

These are original production units. They have had the circuit board and ram upgraded to the current version. These Excaliburs also used the Spyder style ball detent and non-threaded feed tubes.

Serial numbers: 58 thru 159.

Are equiped with the new circuit board and ram. They have the new threaded feed tubes and other small adjustments to set screw sizes to make assemble easier. This version Excalibur uses the F-4 wire nubbin.

Serial numbers: 160 to present.

The barrel was moved back farther into the body by about .125 to allow the paintball to be seated in the barrel better. Set screw sizes were finalized. A few small adjustments were made to the sizes of the air passages to make the pneumatics more efficient. The bodies are now completely finalized. The only thing left for the body is the ball drop sensor which is being worked on. Any tuning will now be in the cartridges themselves.

Febuary 21, 2001

A change in the Excaliburs valve spring was made. We have changed it from a spyder style valve spring to a 98 cocker length spring. We have found this to help effeciency and also lower the sound signature of the marker more.

Notes:

As adjustments were made during production a few set screw size changes, so be careful if you have to replace one. Make sure it is the same size as the one removed.

The tube section of the valve chamber endcap is fine the way it is, some may want to cut the sides out of the tube section. We've tested that all ready and there was no change in performance. Theres no need to cut the sides out.

There is no need to cut grooves on the outside of the ram and hammer cartridge. The air flow around the cartridge is already high enough, if you cut grooves around the outside you will only be slowing them down.

When the Excalibur is new the pneumatics reg needs to be set at 90 to 100 psi. Once the Excalibur has had a few cases of paint through it you can adjust the pneumatics reg down around 70 to 80 psi.

Firing the Excalibur

Turning the Excalibur "ON" and airing it up:

Step 1: After making sure the marker is unloaded and de-gassed, push the bolt fully forward.

Step 2: Turn the marker "ON" using the recesed power switch. The raised screw on the back of the grip plate next to the power switch indicates the "ON" position for the switch. There is no LED light to indicate the marker is on.

Step 3: Turn on the air source. If the bolt is not in its forward postion it will now move forward closing the breech. If air comes out of the barrel gently hold the bolt back - this will allow the valve to seal.

Step 4: The paintball marker is now ready to use.

Step 5: Firmly grasp the grip, simply point and pull the trigger

****Always keep your finger out of the trigger well when you are not firing the paintball marker.****

Velocity Adjustment

The velocity of the Excalibur(tm)(pat pend) is controlled directly through the Sidewinder(tm)(pat pend) regulator mounted vertically in front of the trigger frame.

The Sidewinder(tm)(pat pend) regulator that comes with the Excalibur(tm)(pat pend) is adjusted in this fashion:

1. Turning the adjuster screw clockwise will lower the pressure, thus lowering the velocity.

2. Turning the adjuster screw counter-clockwise will increase the pressure raising the velocity.

When making velocity adjustments you should use extremely fine adjustments so as not to go past the desired velocity. If you are unsure where your operating pressure is, simply turn the pressure down until the velocity drops to about 200 fps then slowly turn the pressure back up.

Do not exceed a velocity of 300 FPS

Cleaning and Maintenance

The barrel on the Excalibur(tm)(pat pend) can be cleaned during a game by either unscrewing the barrel from the marker or by removing the bolt and swabbing through the marker and the barrel.

The bolt can be field-stripped from the Excalibur(tm)(pat pend) while the marker is pressurized with gas. This allows you to clean the marker and oil the bolt when needed.

The Excalibur(tm)(pat pend) should be cleaned externally using a cotton cloth and window cleaner or a 50% alcohol/water mixture.

All external and internal moving parts should be lubricated using a light synthetic oil only. Oil can be added by placing a few drops in the input quick disconnect on the Sidewinder(tm)(pat pend) regulator and then dry firing the gun. A few drops should also be placed on the o-rings on the Lightning bolt. **This should be done every time you play, and the bolt should be oiled throughout the day of play.**

Recommended lubricants: Extreme-lube from AKALMP or Palmer Pursuits paintball gun oil.

****Under no circumstances should you use Vaseline, WD-40, Grease of any kind, Engine Oil, 3-in-1, gun oils, and any similar oils. If you have a question about the type of paintball gun oil you are using e-mail us.****

The electronics are protected against moisture, but the Excalibur's(tm)(pat pend) electronic compontents should never be immersed in water or damage may occur.

All the threads on the Excalibur(tm)(pat pend) are American threads. All set screws are American sizes.

Excalibur(tm)(pat pend) maintenance schedule:

Though the Excalibur(tm)(pat pend) was designed to be virtually maintenance free the Excalibur(tm)(pat pend) will give you many years of use if normal maintenance is done to the marker. Even if the Excalibur(tm)(pat pend) does not need it, good maintenance will keep it running properly for many years. Every time you play, put a few drops of oil into the input quick disconnect on the Sidewinder (tm)(pat pend) regulator.

Once a month, remove the cartridges and clean the marker.

Every 25,000 cycles or 3 months:

Check the output pressure of the Pneumatics Reg.

Every 50,000 cycles or 6 months:

Inspect, and replace if needed, the Ram and hammer o-rings.

Inspect the regulator seat on the pneumatics regulator and the Sidewinder(tm)(pat pend) regulator for wear.

Inspect the Urethane bumper on the Ram and Hammer for wear.

Every 75,000 cycles or 9 months:

Inspect, and replace if needed, the Ram and hammer o-rings.

Inspect the regulator seat on the pneumatics regulator and the Sidewinder(tm)(pat pend) regulator for wear.

Inspect the Urethane bumper on the Ram and Hammer for wear.

Every 100,000 cycles or once a year:

Inspect the whole marker for any signs of problems that could be starting.

If the Excalibur(tm)(pat pend) is to be stored for more then two months, remove the valve spring. This will increase the spring's lifespan. It is a good idea to do this with both hammer and valve springs on any paintball gun that is to be stored for a long time.

Troubleshooting

Excalibur(tm)(pat pend) will not fire

Is there a battery in the Excalibur(tm)(pat pend)?
- See Power Supply.

Is there air/nitrogen or CO2 gas present?
- See Air Supply.

Was the compressed air or nitrogen clean?

Is the Excalibur(tm)(pat pend) turned on?
- See Power Supply.

Is the trigger adjusted correctly?
- See Trigger Adjustment.

Is the bolt jammed?

Is the pneumatics regulator working?
- See Pneumatics Reg.

Is the circuit board working?
- See Electronics.

Is the hammer dwell set correctly?
- See Electronics. Check for damaged wiring.

Velocity too Low or too High

Is output pressure from Sidewinder regulator set correctly?
- See Sidewinder Reg.

Is hammer dwell adjustment set correctly?
- See Electronics.

Is hammer piston o-ring in good shape?
- See Hammer.

Is the pneumatics regulator set correctly?
- See Pneumatics Reg.

Is the battery fresh and new?
- See Power Supply.

Chopping paintballs

Is your hopper working correctly?

Is your bolt “OPEN” dwell set correctly
- See Electronics.

Is your ball detent working?
- See Ball Detent.

Is the pneumatics regulator set correctly?
- See Pneumatics Reg.

Is the battery fresh and new?
- See Power Supply.

Firing too slow

Is your rate of fire (ROF) set correctly?
- See Electronics.

Are the dwell settings correct?
- See Electronics.

Is the pneumatics regulator set correctly?
- See Pneumatics Reg.

Is the battery fresh and new?
- See Power Supply.

Excessive gas consumption

Is hammer dwell set correctly?
- See Electronics.

Is there a leak?

Gas leaking

Leaking from Tornado(tm)(pat # 5791328) valve?
- See Tornado Valve.

Leaking from Ram (pneumatic cylinder)?
- See Ram.

Leaking from Pneumatics Regulator?
- See Pneumatics Reg.

Leaking from Sidewinder(tm)(pat pend) Regulator?
- See Sidewinder Reg.

Leaking from Solenoid valves?

Electronic problems

Check battery power level.
- See Power Supply.

Check for damaged wiring.

Check circuit board dwell settings.
- See Electronics.

Custom Work

For the customers that want splash, custom color anodizing and have custom mill work, there are versions of the Excalibur(tm)(pat pend) available through our **authorized airsmiths** that can be made into custom markers. These markers are still covered under factory warranty if the work is done by an authorized airsmith. AKALMP will be doing a limited number of custom Excaliburs. A complete list of our authorized airsmiths can be found on our web site, akalmp.com.

If you wish to do the work yourself, or have non-factory authorized airsmith do the work, please be careful. The factory warranty will be void. When doing custom colors, do not strip the hard anodized bodies, bare aluminum bodies are available from AKALMP. The hammer tube, hammer endcap, pneumatics regulator tube, ram tube and ram endcap should not be stripped of their hard anodizing. Doing so can cause wear. Striping the anodizing from these pieces will void the factory warranty on these pieces.

When doing custom mill work to the body of the Excalibur be aware there are a few area that you should stay away from and a few areas that have critical depths. In the **schematics** section of this manual there are drawings that specify the areas to be careful of when doing custom mill work.

If you have a custom shop build a custom milled and anodized Excalibur(tm)(pat pend) the gun body and feed tube should be anodized seperately. Then use blue Loctite when you screw the feedtube and body together.

On the rear of the Excalibur(tm)(pat pend) there are two set screws, the lower of which is the hanging screw hole for anodizing. Because anodizing requires an electrical charge, the second set screw hole is provided for a threaded electrode. The upper set screw is the plug hole for the air passage.

Accessories

Warp Feed adapter:

This adapter replaces the standard threaded feed tube with a new feed tube that will allow you to attach the feed adapter for the warp feed system.

Part number: (available soon)

Programmer cable:

The adaptor that hooks to the Excalibur(tm)(pat pend) and to your PC or laptop so you can adjust the timing settings.

Part number: (available soon)

Tool Kit:

The tool kit contains the necessary specialty tools for properly disassembling the Excalibur(tm)(pat pend).

Part Description:	Part Number:
Pneumatics reg removal wrench	
Hammer spanner wrench	
Pneumatics reg tester	
Pressure gauge	

Ball Detent

The Excalibur(tm)(pat pend) has been supplied with a ball detent to keep paintballs from double feeding. Since the Excalibur(tm)(pat pend) is an electronically controlled system, it does not require a ball detent but we thought it would be a nice back up.

Replacement of ball detent:

The ball detent may become worn or broken over time. This is normal. The standard Excalibur(tm)(pat pend) uses an F4 wire nubbin. They are available through your local airsmiths. Some custom Excaliburs(tm)(pat pend) may have a different ball detent.

To replace the detent.

1. Remove the two 4-40 button head screws.

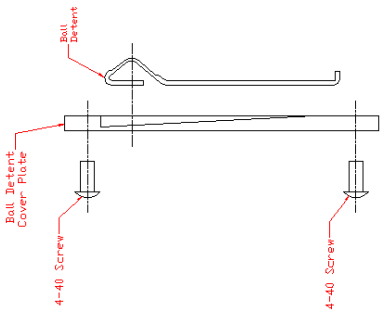
2. Lift the cover plate away from the body of the Excalibur(tm)(pat pend).

3. Remove the detent and replace with a new one.

4. Re-install the cover plate and the two screws. Do not over tighten, just snug them down.

Ball Detent Parts Chart:

Part Description:	Qty:	Part Number:
Ball detent cover plate	1	
F4 ball detent	1	
4-40 button head screws	2	

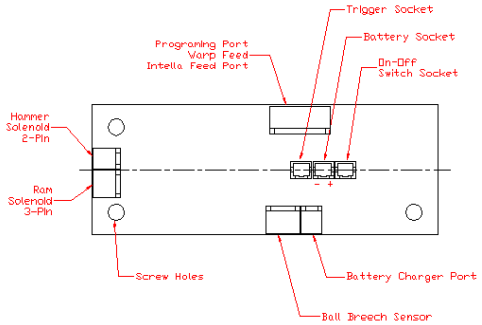


Electronics

The Excalibur(tm)(pat pend) is controlled by a state of the art software driven computer board. The newer design runs the Excalibur(tm)(pat pend) at its true fire rate capability unlike the original circuit board in the first 40 Excaliburs(tm)(pat pend). The board is equipped with many features that are not found on other electronic paintball markers. First the board is equipped with a special voltage regulator system that will increase the life span of the battery. The board is made with connectors for every attachment necessary. No soldering of wires is needed. If the trigger micro switch goes bad just unplug it and replace with a new one. The same goes for the battery plug, the on-off switch, and the solenoid valves. There is also a programming port and a recharging port. When using rechargeable batteries you don't have to remove the battery just use an adaptor and recharge the battery. There is also a port that will support a ball breech sensor, Warp Feed and an Intella feed system. The circuit board is protected against moisture,but do not immerse the Excalibur(tm)(pat pend) in water. The Excalibur(tm)(pat pend) is tournament legal, as the board operates in semi-automatic mode only.

*****Warning any tampering with the circuit board will cause it to erase the program from the computer chip. The board would then have to be reprogramed at the factory.*****

Circuit board schematics:



Rate of Fire adjustment:

The only way for the Excalibur(tm)(pat pend) parameters to be changed is through adjusting the software via a computer. This does four things:

First, it allows for very fine adjustment to the dwell settings. You can adjust each parameter a milliscond at a time if you like.

Second, the gun can never go out of time because the software cannot change during use.

Third, whenever there is an update, instead of having to change the board you can just download the new software.

Fourth, it makes the marker completely tournament legal since there is no physical way on the board to adjust the firing parameters.

The factory settings for the Excalibur(tm)(pat pend) make the gun run at 10 BPS (balls per second). The marker is capable of running 13 BPS but to run at 12-13 BPS without any chance of ball breaks it will be best to wait until the ball breech sensor is ready. With the sensor option installed, the bolt will stay open only long enough to allow a ball to drop into the breech. This will allow maximum ROF (rate of fire) and eliminate any chances of pinching balls at any ROF.

The factory dwell parameters:

Hammer drive: 12ms

The HAMMER DRIVE is the total amount of time that the hammer solenoid stays turned on pushing the hammer forward against the Tornado(tm)(Pat # 5791328) valve thus also opening the valve and releasing air to shoot the paintball.

Hammer release: 5ms

The HAMMER RELEASE is the amount of time after the hammer is fired before the bolt is activated. It delays the activation of the bolt, thus allowing the ball to clear the barrel and eliminates blow back through the feed tube.

Bolt drive: 55ms

The BOLT DRIVE is the amount of time that the bolt solenoid stays turned on, thus controlling the time that the bolt stays open allowing a ball to drop into the breech. When the breech sensor is installed the sensor will over-ride the bolt drive setting and close the bolt as soon as a ball is detected in the breech.

Bolt release: 25ms

The BOLT RELEASE is the amount of time after the bolt solenoid has turned off. This setting allows the bolt to completely close and seal the ball into the barrel of the marker. If this time is set too short the marker may skip during high ROF's and the effectiveness of the ball shot will drop off. You should never have to change this setting.

We have found that these numbers work the best and will achieve around 11 rps. The bolt release dwell is not a number that should be changed. If it is lowered you will find that the marker will start over-lapping on the bolt closing and the firing sequence of the marker.

The software will calculate the max rate of fire with the dwell settings you have choosen. Then you have the option of choosing a different rate of fire that falls within the parameters of the max rate of fire. We are working on pushing these numbers farther to make the marker even faster. These numbers control the rate of fire of the

Excalibur(tm)(pat pend). You can change these numbers directly or set them and then change the rate of fire control.

Dwell adjustments:

To change the firing parameters of the Excalibur(tm)(pat pend), first make sure the marker is unloaded, de-gassed and turned off. Plug the programmer cable into your computer. Then remove the cover plate on the left side of the grip plate. Gently plug the cable into the connector on the circuit board. Load the manual and start the “parameters adjusting” program. Turn the Excalibur(tm)(pat pend) back on. Change the dwell settings you want and load the new dwell settings into the Excalibur’s(tm)(pat pend) circuit board. Turn the Excalibur(tm)(pat pend) off. Unplug the marker from the computer cable and test the marker to make sure that the settings are working the way you want them to.

Warp Feed and Intella feed:

The Warp Feed and Intella Feed port allows you to attach the Warp Feed system from Air Guns Deisgns and/or an Intella Feed style system. If a second board is designed to go into a VL loader that will use the same signal as the Warp Feed system but run the VL loader off of its own power supply this will give you an Intella-feed system.

Trouble shooting:

Most circuit board problems can be traced back to the installation of the wrong software when adjusting the marker’s settings. If after adjusting the settings you encounter slow or no cycling, double check circuit board to make sure you haven’t selected the wrong marker setting.

Removing the circuit board:

To remove the circuit board simply remove the two screws holding the grip frame and grip plate onto the marker body. Then carefully pull the grip assembly straight away from the marker body. There are two locating pins in the grip plate so the grip plate and grip cannot move sideways. This is why the grip assembly must be pulled straight away from the marker. Then carefully unplug the two solenoid valves from the connector sockets on the circuit board. Place the marker body to the side. Remove the three plastic screws that hold the circuit board to the grip plate. Carefully lift the circuit board out of the grip plate. Unplug the three plugs from the connector sockets that are for the trigger switch, battery connector and on-off switch.

When plugging the connectors back in, the order from the back end of the board moving forward is as follows. The on-off switch, then the battery, and finally the trigger switch.

When connecting the solenoids the three pin connector is the bolt and the two pin connector is the hammer.

Be careful not to pinch or bind the wires. On the battery cable it is best to make a loop and then lay the loop on the side of the battery. This will reduce the movement of the battery and keep the wires from getting damaged.

Hammer

Mechanical Hammer adjustment:

There is no mechanical adjustment to the hammer itself. Simply screw the hammer cartridge in until it stops against the body.

Hammer maintenace:

The o-ring on the hammer piston is sized to maintain a constant fricton to the inside of the bore of the hammer cartridge. Keeping a constant fricton on the bore is important to keep a consistent velocity. If the o-ring wears out, the fricton will change and in turn change the consistency of force with which the hammer strikes the valve. So, it is important to keep that o-ring in good order and properly oiled.

To pull the hammer cartridge out of the marker: Use a 5/32 allen wrench and unscrew the hammer cartridge. Then gently pull it out the back of the Excalibur(tm)(pat pend).

Use the hammer spanner wrench and an allen wrench to loosen the hammer endcap. Unscrew the endcap from the hammer cartridge and gently pull pieces apart. You can now replace the majority of o-rings and u-cups. Re-assemble in reverse order.

Carefully re-install everything and tighten down the hammer endcap. Be careful not to over-tighten. Make sure the -013 o-ring on the endcap is in good condition. It will keep the nose from coming loose. You will also want to put a small drop of BLUE Loctite on the threads as you re-assemble the hammer cartridge.

Trouble shooting:

Air leaking from solenoid:

1. Check the solenoid valve, it may need to be replaced.

2. Check the hammer piston o-ring. Air may be leaking around it. If air is leaking around it, replace the hammer piston o-ring.

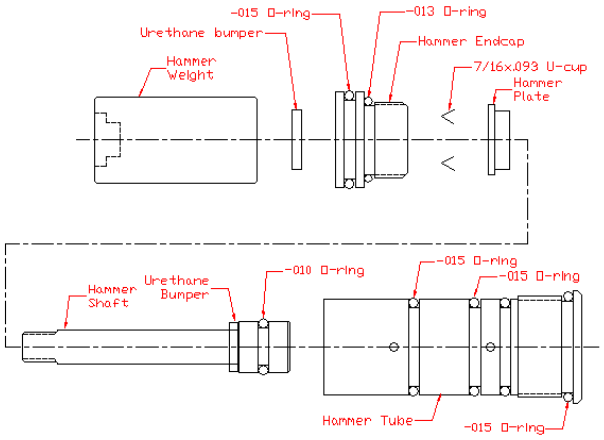
Air leaking around the front of the hammer:

1. Check the u-cup. It may need to be replaced.

2. Check the o-rings on the outside of the cartridge.

Hammer Parts Chart:

Part:	Qty:	Part Number:
Hammer Weight	1	
Hammer Endcap	1	
Urethane bumper	1	
-013 o-ring	1	
-015 o-ring	1	
7/16x.093 u-cup	1	
Hammer Plate	1	
Hammer Shaft	1	
-010 o-ring	1	
Urethane bumper	1	
Hammer tube	1	
-015 o-ring	4	
5/16-24	1	



Lightning Bolt

The only part on the Excalibur(tm)(pat pend) that may experience any possiblity of wear is the Lightning bolt and pull pin. That is the intended design of the bolt. The bolt is made of Delrin to help save wear and tear on the gun body. Paintball gelatin is actually very abrasive and can cause wear on the bolt. The pull pin is designed with two flats milled on it. These two flats fit into the H-bar on the ram, this design reduces wear on the pin.

To remove the bolt:

Pull the bolt pull pin knob straight up from the bolt and gun body. The pin is designed to stay in the bolt. Then, slide the bolt out the back of the marker. To install the bolt, slide it all the way forward into the marker; then

push the bolt pull pin down until it latches into the H-bar.

The screw in the back of the bolt adjusts the tension and locking of the bolt pull pin. You should not have to adjust this. But, if you do, adjust the ball plunger in until you cannot pull the bolt pull pin up. Then slowly back it off until the pin moves at the desired tension. Do not adjust the tension too far out or the pin can come loose.

Trouble shooting:

Pull Pin stuck:

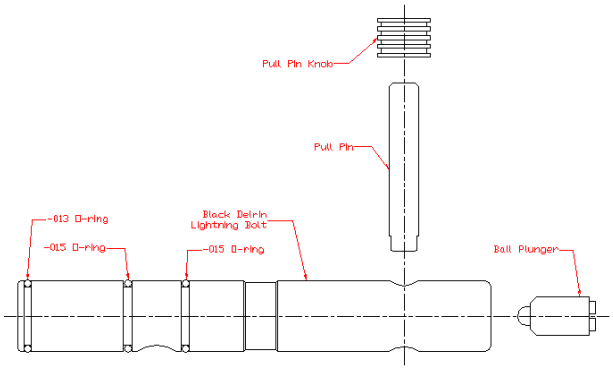
1. Check the ball plunger in the back of the bolt, it may be stuck.

Bolt not sliding smoothly:

1. Check the o-rings on the bolt to make sure they are not swollen. Replace them or properly oil them.

Bolt Parts Chart:

Part Description:	Qty:	Part Number:
Black delrin L. bolt	1	
-015 o-rings	2	
-013 o-ring	1	
ball plunger	1	
pull pin	1	
pull pin knob	1	



Other Component Parts

Vertical Feed Tube:

Excaliburs(tm)(pat pend) with serial numbers from 0 to 57 have press-fit feed tubes. The early Excalibur(tm)(pat pend) feed tubes are held in with GREEN Loc-tite.

Excaliburs(tm)(pat pend) from serial number 58 and up have a new threaded feed tube. AKALMP designed a new threaded feed tube that would hold up to the stresses of playing paintball. The new threaded feed tubes are held in place with BLUE Loc-tite. They have a different thread pattern than the Angel feed tubes.

The Excalibur uses a short feed tube that does not have any problems feeding paint at a high rate of fire as long as you hopper is fast enough. If you want a long feed tube you can order one from your local airmsith or from AKALMP.

Lightning bolt Pull Pin Knob

The knob on the pull pin is machined from aluminum and pressed onto the stainless steel pin. This allows the knob to be anodized to the same color as the gun.

Air Passage Set Screws

The set screws on the air passages should be secured with GREEN Loc-tite so they stay in place under pressure. All threads on the Excalibur(tm)(pat pend) are American thread sizes.

Pnuematics Regulator

The pneumatics regulator controls the air pressure fed to the solenoid valves, which in turn operate the rest of the gun. The maximum operating pressure of the solenoid valves is 120 psi., but the components of the Excalibur(tm)(pat pend) need only 90-100 psi to operate. Use of the pneumatics regulator keeps the solenoid valves from receiving too high a pressure, and will keep them operating properly for many years.

The pneumatics regulator is preset to 90-100 psi at the factory and should not need adjustment. If a replacement regulator is installed you need to check the pressure, but it should be at 90-100 psi from the factory. The regulator cartridge can be removed from the Excalibur(tm)(pat pend) without causing the pressure settings to change. The adjuster screw is on the front side of the regulator and should never be adjusted on the field or by a non-qualified person.

****This regulator stores air in the marker when the gas source is shut off. The stored gas is enough to cycle the gun one or two times.****

****The pneumatics regulator should be set at 90-100 psi. output.****

****Do not adjust the pressure without a gauge, you can easily over- pressurize the system and damage the solenoid valves.****

****Do not install an external adjusting knob, this is an illegal way of adjusting the velocity. If an Excalibur(tm)(pat pend) is sent in for repairs with an external adjusting knob installed, it will be removed and you will be charged for replacement of the pneumatics regulator core. THE KNOB WILL NOT BE SENT BACK.****

To adjust the regulator:

1. De-gas the marker.

2. Unscrew the hammer cartridge from the back of the marker.

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To adjust the regulator:

1. De-gas the marker.

2. Unscrew the hammer cartridge from the back of the marker.

3. Install the pneumatics regulator test chamber into the hammer tube. Then install the low pressure gauge on the test chamber.

4. Gas up the gun to 200 psi from the Sidewinder(tm)(pat pend) regulator and check the pressure. Using an allen wrench, adjust the regulator core clockwise to lower the pressure and counter clockwise to raise the pressure. You will have to cycle the marker while you adjust the regulator to get the pressure to change. The adjustment is very sensitive.

5. Once the correct pressure is achieved, turn the air on and off and cycle the marker several times to make sure the pneumatics regulator stays at the new setting.

Disassembly of the Pneumatics Reg:

1. Using the pneumatics reg. removal tool, unscrew the pneumatic reg from the front of the Excalibur(tm)(pat pend).

2. Gently clamp the Pn-reg body between the two pieces of wood.

3. Use the pneumatic reg removal tool and a wrench and break the BLUE Loc-tite seal between the two halves.

4. Unscrew the pn-reg endcap. Remove the reg-washer and o-ring from the end of the pn-reg body. You can also unscrew the reg core from the pn-reg endcap through the back of it, but not through the front.

5. Using snap ring pliers remove the snap ring from the end of the pn-reg body.

6. Gently push the reg psiton and spring out of the pn-reg body using something soft like a plastic ball point pen which will not damage the sealing area of the regulator piston.

7. You can now replace all o-rings and springs, if needed, and reassemble in reverse.

****There are two sides to snap rings and it is important which side faces out of the pn-reg body. One side has squared off, sharp edges and one side has edges that are rolled over. When installing the snap ring make sure the sharp square edge faces to the outside of the pn-reg body.****

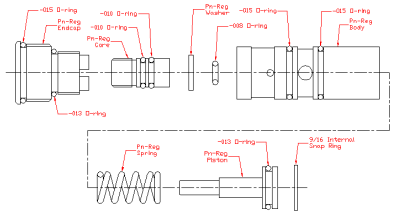
Trouble shooting:

Air leaking from the front of the regulator:

1. Check the o-rings around the reg-core.

Pneumatics Reg Parts Chart:

Part:	Qty:	Part Number:
Reg endcap	1	
-015 o-ring	1	
-013 o-ring	1	
Reg core	1	
-010 o-ring	2	
10-32 set screw	1	
Reg washer	1	
Reg body end	1	
-008 o-ring	1	
-015 o-ring	2	
Reg piston	1	
reg spring	1	
-013 o-ring	1	
9/16 internal snap ring	1	



Pneumatic Ram

Removal of Pneumatic Cyclinder (ie: the Ram):

De-gas the marker and remove all paint. Remove the bolt, the body endcap, and pneumatics regulator. Then remove the set screw pin that holds the ram in place. Using a 1/2" dia wood dowel rod, gently push the ram out through the back of the marker body.

Disassembly.

Insert a 1/4" dia metal rod in the set screw pin hole. You may have to polish the 1/4" rod just a little to get it to fit properly. Then, using an adjustable wrench, unscrew the front nose from the ram tube by using the 1/4" dia rod to turn the ram tube. Pull the two halves apart. You can now replace most of the O-rings and U-cups if need be. To remove the H-Bar use the end of the pneumatics reg tool that fits holes on the H-bar and clamp the back end of the ram between two pieces of wood or in a 3/8" collet. Reassemble in reverse and tighten down gently. You must use a small drop of BLUE Loctite on the threads to keep everything tight. When you re-install the ram it is a must that you use BLUE loc-tite on the ram retaining pin threads to keep it from coming loose when the gun is in use. Do not over-tighten the pin.

****Be careful not to damage the ram piston o-ring when you re-install the ram shaft into the ram tube.****

Trouble shooting:

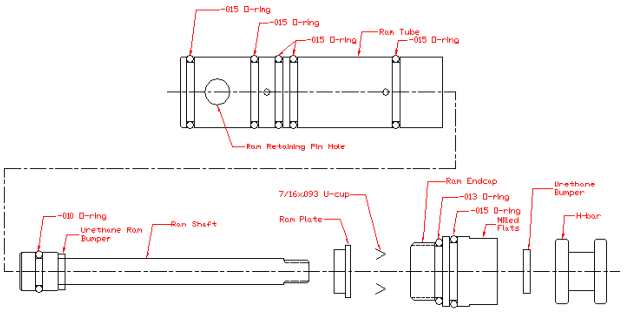
Air leaking from solenoid:

1. Check the solenoid valve, it may need to be replaced.

2. Check the ram piston o-ring. Air may be leaking around it. If air is leaking around it, replace the ram piston o-ring.

Ram Parts Chart:

Part Description:	Qty:	Part Number:
Ram tube	1	
-015 o-ring	5	
Ram Shaft	1	
Urethane bumper	1	
-010 o-ring	1	
Ram Plate	1	
Ram Encap	1	
-015 o-ring	1	
7/16x.093 u-cup	1	
-013 o-ring	1	
Urethane bumper	1	
H-bar	1	
Ram Retaining Pin	1	



Screws and O-Rings

Serial # 0 thru to present.
3.5x.9mm
-008
-010
-013
-015
7/16x.093 u-cup

Sidewinder o-rings:
-008
-010
-015
-017
-113

Excalibur Screws & Pins:
Serial # 0 to 57.
Quanity.....Type
3.....5/16-24 x .250 Set screws (endcaps)
1.....5/16-24 x .3125 set screws (valve)
2.....10-32 x 1.150 Button head (grip)
4.....6-32 x .250 Button head (grip panels)
1.....10-32 x .375 set screws (trigger stop)
1.....8-32 x .625 Set screws (trigger stop)
1.....8-32 x .437 set screw (trigger stop)
1.....6-32 x .250 set screw (trigger stop lock)
1.....10-32 x .375 button head (grip plate/ frame)
4.....4-40 x .5 button head (solenoid valves)
2.....4-40 x .250 button head (detent cover plates)
4.....4-40 x .187 button head (electronics cover plates)
2.....10-32 x .1875 set screw (air passage plug, pn-reg core)
1.....5/16-24 x 1.125 set screw (ram pin)
3.....4-40 x .250 plastic flat head screws (circuit board)
3.....2-56 x .1875 cap head screws (on-off switch)
1.....6-32 x .500 set screw (air passage plug)
1.....1/4-28 x .1875 set screw (anodize hole plug)
1.....1/4-28 x .500 set screw (air passage plug)
2.....1/8 x .750 pins (grip alignment pins)
1.....1/8 x .750 pin knurled on end (trigger pivot pin)

2.....6-32 x .125 set screw (air passage plug)
1.....6-32 x .500 set screw (air passage plug)
1.....1/4-28 x .1875 set screw (anodize hole plug)
1.....1/4-28 x .500 set screw (air passage plug)
2.....1/8 x .750 pins (grip alignment pins)
1.....1/8 x .750 pin knurled on end (trigger pivot pin)
2.....2x18mm pins (micro-switch pins)

Serial # 58 to 159.
Quanity.....Type
2.....5/16-24 x .250 Set screws (endcaps)
2.....5/16-24 x .3125 set screws (endcaps and valve)
2.....10-32 x 1.000 Button head (grip)
4.....6-32 x .250 Button head (grip panels)
1.....10-32 x .375 set screws (trigger stop)
1.....8-32 x .625 Set screws (trigger stop)
1.....8-32 x .437 set screw (trigger stop)
1.....6-32 x .250 set screw (trigger stop lock)
1.....10-32 x .375 button head (grip plate/frame)
4.....4-40 x .5 button head (solenoid valves)
2.....4-40 x .250 button head (detent cover plates)
4.....4-40 x .187 button head (electronics cover plates)
2.....10-32 x .1875 set screw (air passage plug, pn-reg core)
1.....5/16-24 x 1.125 set screw (ram pin)
3.....4-40 x .250 plastic flat head screws (circuit board)
3.....2-56 x .1875 cap head screws (on-off switch)
2.....8-32 x .125 set screw (air passage plug)
1.....6-32 x .500 set screw (air passage plug)
1.....1/4-28 x .1875 set screw (anodize hole plug)
1.....1/4-28 x .500 set screw (air passage plug)
2.....1/8 x .750 pins (grip alignment pins)
1.....1/8 x .750 pin knurled on end (trigger pivot pin)
2.....2x18mm pins (micro-switch pins)

Serial # 160 thru to present.
Quanity.....Type
4.....5/16-24 x .3125 set screws (endcaps & valve)
2.....10-32 x 1.000 Button head (grip)
4.....6-32 x .250 Button head (grip panels)
1.....10-32 x .375 set screws (trigger stop)
1.....8-32 x .625 Set screws (trigger stop)
1.....8-32 x .437 set screw (trigger stop)
1.....6-32 x .250 set screw (trigger stop lock)
1.....10-32 x .375 button head (grip plate/frame)
4.....4-40 x .5 button head (solenoid valves)
2.....4-40 x .250 button head (detent cover plates)
4.....4-40 x .187 button head (electronics cover plates)
2.....10-32 x .1875 set screw (air passage plug, pn-reg core)
1.....5/16-24 x 1.125 set screw (ram pin)
3.....4-40 x .250 plastic flat head screws (circuit board)
3.....2-56 x .1875 cap head screws (on-off switch)
2.....8-32 x .125 set screw (air passage plug)
1.....8-32 x .500 set screw (air passage plug)
1.....1/4-20 x .1875 set screw (anodize hole plug)
1.....1/4-28 x .500 set screw (air passage plug)
2.....1/8 x .750 pins (grip alignment pins)
1.....1/8 x .750 pin knurled on end (trigger pivot pin)
2.....2x18mm pins (micro-switch pins)

Sidewinder Regulator

The Sidewinder(tm)(Pat Pend) regulator was designed specificaly for use on the Excalibur(tm)(pat pend) because of its extremely low operating pressure of aproximately 140-150 psi. This regulator will work well on other guns,also. The design of the regulator permits the air hose to be connected to the gun in any location the user wishes within a 360 degree circle around the base of the reg, while still allowing the regulator to be externally adjusted from the bottom. The top endcap of the regulator can be replaced with different length ones to allow the user to adjust total length of the reg.

****If you change out the Sidewinder(tm)(pat pend) regulator, you will quickly discover that it is currently one of only two regs that will keep up with the low operating pressure and high flow demands of the Excalibur(tm)(pat pend). Currently the Palmer Stablizer is the only other regulator that will work. ****

Sidewinder(tm)(pat pend) Specifications:
Model: Sidewinder(tm)(pat pend)
Version:B
Gas Source: Compressed air, Nitrogen or CO2
Length: 4.875 inches
Width: 1.00 dia main body/1.125 dia swivel sleeve
Weight: .308 lbs (With quick disconnect)
Externally Adjustable Output Pressure: 0-700 PSI
Input pressure: 400-800 PSI

Adjusting the Sidewinder(tm)(pat pend) Regulator:

Decrease output:

Looking at the regulator from the bottom, turn the allen wrench clockwise to decrease the pressure.

Increase output:

Looking at the regulator from the bottom, turn the allen wrench counter clockwise to increase the pressure.

Dead Zone:

Since the Sidewinder(tm)(pat pend) regulator was designed to go down to zero psi output, there is space after it reaches zero that the adjuster screw can be turned farther. If you turn the adjuster screw gently until it bottoms out, then it will be 4 to 5 turns counter clockwise until the pressure starts to rise again. This is the dead zone.

Side Notes and Trouble Shooting:

Remember to shoot the gun several times after any adjustment to the Sidewinder(tm)(pat pend) regulator so you can make sure the velocity stabilizes.

If the regulator creeps in pressure range, check to make sure there is not a piece of debris inbetween the regulator seat and the regulator piston. If it continues to creep replace the reg core.

When using the Sidewinder(tm)(pat pend) with CO2 you will have to oil the regulator on a more regular basis. The CO2 carries the oil away from the moving parts quicker then nitrogen does.

Make sure the vent hole on the side of regulator body middle is open and clean. If it is plugged the regulator will not fuction properly.

The Sidewinder(tm)(pat pend) regulator is only designed for a maximum input pressure of 800 psi.

Use only steel braided hose and stainless steel quick disconnects. Mirco-line and Macro-line is inappropriate and unsafe for use in paintball.

When using CO2 it is a must that you keep liquid CO2 out of the Excalibur(tm)(pat pend).

Disassembly of Sidewinder(tm)(pat pend) Regulator:

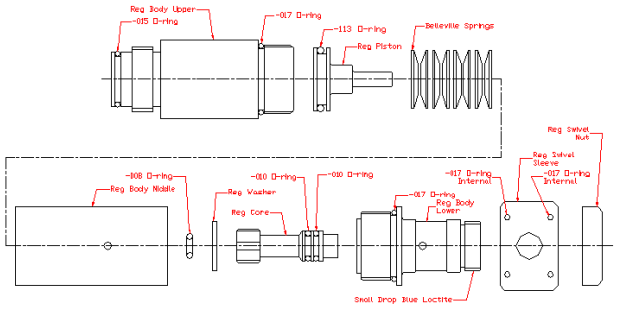
To properly disassemble the Sidewinder(tm)(pat pend) regulator and not scratch the outside, you will need a few items: Two pieces of 2x4s about 4 inchs long, a cloth strap wrench which can purchased at a hardware or automotive store, a bench vise, a good adjustable wrench and a set of allen wrenches. The strap wrench can be used on many different things outside of paintball so its handy to have around. Just follow the instructions and it will be easy.

1. Remove all air sources. 2. Clamp the reg. body upper and reg. middle between the two pieces of wood. The wood will keep the regulators outside surface from getting scratched up. 3. Using the adjustable wrench on the swivel nut un-screw the swivel assembly from the bottom of the regulator. Once loose, unscrew the two pieces. Be careful not to lose the reg. washer that is inside this portion of the regulator. 4. Reclamp the regulator between the two peices of wood, clamp on the reg. body upper. Using the strap wrench loosen the reg. body middle from the reg. body upper. Inspect the o-rings for damage or wear. Replace if needed. 5. Once the two halves are separated you can remove the piston and springs from the regulator body middle. Be careful not to damage the piston or the o-rings. Remember in what order the parts came out of the regulator. Replace o-rings or springs if needed. 6. To disassemble the swivel joint, clamp the threaded end of the swivel between the two pieces of wood. Use the adjustable wrench to loosen the swivel nut. The swivel nut is BLUE LOCTITED in place. 7. Using a gentle twisting action gently pull the swivel sleeve from the regulator body lower. Inspect the o-rings for damage or wear. Replace if needed. 8. Use an allen wrench and unscrew the regulator core from the regulator body lower. The core comes out through the front of the regulator body lower. Do not try backing it out. Be careful not to damage any o-rings. If needed replace the o-rings or if the reg. seat is damaged replace the whole core assembly. 9. You can now replace the major components to the regulator if needed. The regulator goes back together easily. Use the strap wrench to tighten. Do not over-tighten, just snug down and use a drop of blue loc-tite on the threads of the swivel nut to keep it tight.

Sidewinder(tm)(pat pend) Parts Chart:

Sidewinder(tm)(pat pend) Regulator:

Part:	Qty:	Part Number:
Sidewinder(tm)(pat pend) Reg	1	
Regulator body upper	1	
-017 o-ring	1	
-015 o-ring	1	
Regulator body middle	1	
-008 o-ring	1	
Regulator piston	1	
-113 o-ring	1	
Belleville springs	8	
Regulator washer	1	
Regulator Sleeve	1	
-017 o-ring	2	
Male Quick Disconnect	1	
Regulator body lower	1	
-017 o-ring	1	
Regulator core	1	
-010 o-ring	2	
10-32 cap screw	1	



Solenoid Valves

Removal of the solenoid valves:

Remove the grip frame and grip plate as one piece. Carefully pull the grip and grip plate straight away from the body. The grip plate locates on two pins in the marker body.

Carefully unplug the solenoid valves from the circuit board. Using an allen wrench, remove the screws holding solenoid valve you want to replace. Lift the valve straight out of the marker body. Be careful not to lose the small o-rings that seal the solenoid to the body.

Place the o-rings back into the o-ring grooves on the body. Place the correct solenoid valve on the solenoid valve mounting bosses and tighten down screws. The hammer solenoid valve cannot be installed in the bolt socket and the bolt solenoid valve cannot be installed in the hammer socket. **Do not over tighten the screws.**

Plug the solenoid valve back into the circuit board and gently put the grip frame back onto the marker making sure not to pinch any wires. Re-install the grip frame screws.

The solenoid valves used in the Excalibur(tm)(pat pend) are a custom version of an off the shelf valve and have been thoroughly tested for long life and durability. A set of valves used in the Excalibur(tm)(pat pend) paintball marker have been tested to over 5,500,000 cycles and are still running. 5,500,000 cycles is equivalent to shooting 2750 cases of paint if the cases were 2000rd boxes each. One randomly picked valve cycled over 20,000,000 times.

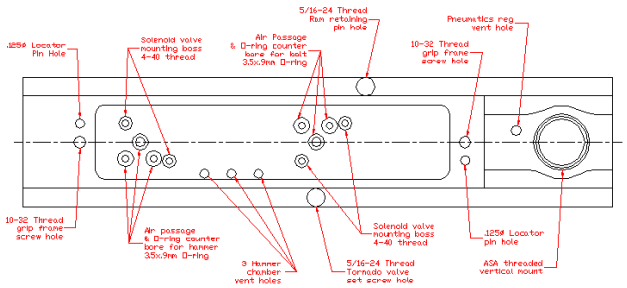
Do not try to work on the solenoid valves. Do not try to exchange parts from one solenoid to another. The parts on the solenoid valves are matched to each other when they are assembled at the factory and can not be mixed with other valves. If the solenoid valves parts are mixed they may not work properly.

Trouble shooting:

Air leaking from the solenoid valve:

1. Check the o-rings sealing the valve to the body.

2. Check to see if the air is leaking through the solenoid valve. If air is leaking through the valve, replace the valve or check the o-rings of the hammer or ram.



Trigger Frame

Adjusting the trigger pull:

There are 3 set screws for adjusting the total trigger movement: (1) forward stop, (1) rearward stop and (1) mirco-switch activation screw.

When adjusting the trigger, start with the forward and rearward trigger stops. Adjust the trigger until you have the amount of movement you want. Then adjust the mirco-switch screw until it activates the mirco-switch during the trigger pull. Make sure to use a small amount of BLUE Loc-tite to keep the set screws from coming loose. Whenever you make any adjustments to the trigger you should always make sure the mico-switch activates when you pull the trigger.

****Do not remove the trigger spring. Always leave a spring in the trigger to provide positive trigger return.****

When adjusting the spring tension on the trigger, it is best to leave the tension a little high so normal movement during play will not accidentally activate the trigger. The spring can be interchanged with those used on Autococker trigger plates so you can personalize it to your own spring tension.

****Do not cut the trigger guard off.****

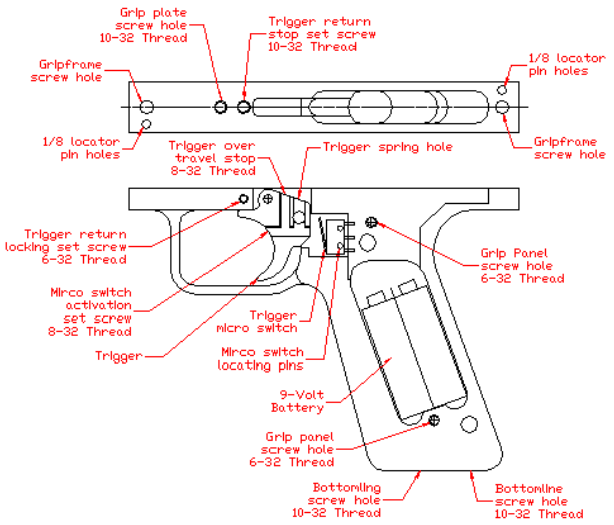
Double triggers and frames are available from AKALMP / Leads Metal Products Inc. There is no difference in the cost of the Excalibur(tm)(pat pend) for single or double trigger frames. The two style of frames can be inter-changed without any modifications to the gun.

Trouble shooting:

1. The electronics are on but the gun won't fire. Check to make sure that none of the trigger set screws have moved out of adjustment.

Grip frame and trigger Parts Chart:

Part:	Qty:	Part Number:
Grip frame (single trig.)	1	
single trigger	1	
6-32 set screw	1	
8-32 set screw	2	
10-32 set screw	1	
1/8 dia pin	3	
6-32 button head screws	4	
10-32 button head screw	1	
grip panels	2	
Grip Frame (double trig.)	1	
double trigger	1	



Tornado Valve

The valve used in the Excalibur(tm)(pat pend) is also used in the Merlin body kits and other future markers. The valve is a bigger, stronger Tornado(tm)(pat #5791328) valve which was orginally designed for the cockers. The Tornado(tm)(pat #5791328) valve has a lifetime warrenty that covers replacement of the valve unless you modifiy the valve.

Valve removal and maintenance:

Remove the valve chamber plug by unscrewing it from the marker body using an allen wrench. Then slide it out. The valve spring and valve stem should come out with it. This will allow you to change the valve stem if there is a problem.

To remove the valve body:

With the valve chamber plug, valve spring and valve stem removed. Unscrew the hammer from the back of the Excalibur(tm)(pat pend). Then unscrew the set screw on the side of the marker that holds the valve body in place. Using a wood dowel rod, gently push the valve body out either end of the marker. When reinstalling the valve body, use a drop of BLUE Loc-tite on the set screw that holds the valve body in the marker.

Trouble shooting:

Air leaking down the barrel:

1. Check the valve stem, it may need to be replaced.

2. Air may be leaking by the o-ring on the valve body. Take the correct size allen wrench and loosen the valve retaining set screw about a 1/4 of a turn. If the leak stops, tighten the screw back. What happens is that the o-ring sometimes shifts just a little and loosening the screw allows it to shift back.

Tornado Valve(tm)(Patent #5791328) Parts Chart:

Part:	Qty:	Part Number:
Valve Chamber endcap	1	
-015 o-ring	1	
5/16-24 set screw	1	
Valve Spring	1	
Valve Stem	1	
Valve Body	1	
-015 o-ring	2