VECTOR FAQ

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DESIGN GOALS

Quoting Air Power:

- It has to be Accurate. Consistently accurate. Firearms accurate.
- It has to mimic a Military MP5 style assault rifle.
- It has to be balanced.
- It has to break down without any tools for "normal" cleaning.
- It has to withstand 1800psi and a completely liquid system.

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STOCK FEATURES

One of the Vector's greatest strengths is that it is already 'tricked out' right out of the box Here is all you get without paying the man at the shop a penny more:

- 4 way valve (full pneumatic recocking)
- 100 psi regulated action (recocks until tanks is down to < 120 psi)
- Anti-chop bolt (95% effective against chops)
- Quick-release barrel
- Velocity adjustment
- Ball detent
- Raised site rail
- 1/16 of an inch trigger pull
- Wide trigger
- Safety
- Zero problems with liquid
- Rate of fire outruns a shredder
- OPEN bolt design

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GOOD POINTS

- Accuracy: best accuracy for any semi - Vectors with stock barrels have won the 5-man and 10-man target shoots at all american opens (that's four in a row, and counting...)
- Stability: the gun barely twitches when you pull the trigger
- Eats liquid or gas CO2, and nitrogen (nitro requires a regulator, of course)
- Trigger pull is 1/16", (really!) and SNAPS when you pull (no grind)
- Rate of fire is amazing: it will outrun any finger, and any hopper.
- 4-way prevents "short stroking" (gun both fires AND recocks when trigger is pulled; no waiting for trigger to be released)
- Anti-pinch is about 95% effective in preventing ball-chops
- Reliability: it cocks itself, (no bolt pin to pull) and since it uses 100psi regulated action, will recock even in the coldest weather (although 10degF froze the tank rather quickly...)
- Precision construction -- it's hard to find the seams!
- The barrel releases at the press of a button, which completely exposes the bolt for cleaning
- The bolt and valve can both be removed without tools for easy cleaning
- Stock barrel is very well polished, and quite accurate
- Unique bolt construction forms a vacuum when fired, sucks the next ball into the chamber
- Very short -- most of the action and pneumatics are below the barrel, rather than behind it, which makes for a fairly small gun, considering its 13" barrel
- Stock vel adj can get you proper velocity even into cold weather
- Works with very low pressure. (you CAN play in cold weather! really!) AP claims the gun will cycle (although not shoot very far...) at _80_ psi. If you're running out of air, your opponants can't tell unless they see the balls dropping. (no more "VM-68 crying for death" sounds)
- Gas efficiency (summer) is estimated at 65 shots/oz. giving 455/7 585/9 785/12 1300/20

nice.
- Shortest trigger pull in the industry (I'm told there is a mod for the mag that is shorter, but as I understand, so modified guns have a nasty habbit of shooting by themsleves while you're running...)

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QUESTIONABLES

- Great stability does not agitate the hopper; needs a VL-2000 badly
- If the anti-pinch is tripped, you must reset it (takes only a quarter- second, but some people want paint NOW regaurdless if it means chops) But, if you really *want* to void the anti-chop, just sharpen the curves of the bolt, or put a lighter spring in the built-in regulator.

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BAD POINTS

- Very loud. silencer does not help too much. Air Power says the main air charge nears Mach 1 going around the second corner when the gun is fired, and creates massive turbulance. Since the gun itself is conducting the sound, silencers/barrels can only reduce sound about 50-60%
- Tank must be removed to adjust velocity (a regulator overcomes this)
- The gun may fire once when you put on the tank, regaurdless of safety (this is documented in the manual) Put your hopper on AFTER your CO2, and a barrel plug while gassing up is _always_ a good idea, for any gun. (placing the safety OFF when gassing up seems to avoid this problem)
- All-aluminum body seems a target for stripped threads. (caution is given several places in the manual against over-tightening) Use common sense when assembling
- The Adapter Body has two very very thin o-rings that seal it in, which are very easy to slice when removing to oil. Recommend ordering a few spares. You will probably never need to remove the adapter body anyway.
- High pressure feed line to the regulator has been known to leak on the valve side; this is a free repair
- Almost every pin and screw is untreated steel -- oil them often, or the rust monster cometh!
- Heavy - 3 1/3 lbs without tank or paint
- Cannot remove barrel release button for cleaning (although you CAN just dunk the whole gun in the suds after removing the action) This is however, the ONLY item not easily removed, and is not exactly what you would call a "critical system" of the gun. ;-)
- Customer service is not four star. The main complaint is time -- some Vectors have a month or more of turnaround time. AP is working to fix this. (see updates at bottom)

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PASSED THE TESTS

These are a few things that AP, myself, or someone else has done to their Vector, (accidentally or on purpose) and what happened to their gun: (don't try these unless you own a Vector!)

- Paint in the airway... so much paint it was oozing out the 4-way's vents.
  = Result: lots of paint in the barrel of course, but still firing away.
- Finger in the chamber when the gun was fired.
  = Result: anti-pinch was 'tripped', owner kept his finger
- Low pressure line hooked to gun instead of high pressure CO2
  Result: Vector continued to cycle properly at pressures as low as 80 psi
- Siphon tank attached
  = Result: big, big, BIG CO2 cloud, big increase in velocity. Frost was noted on the Action/Power Unit, Regulator, and Adapter Body. Vel adjust was then adjusted, cut the cloud down to size and returned to 300 fps. No problems. Siphon it if you wish, for superior winter performance.

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BOLT DESIGNS AND RANGE/ACCURACY

Many people have heard the P.R. about the Vector being very accurate and long ranged, and assume that it must be a closed-bolt design. (closed- bolt means that the gun's chamber is closed with the ball loaded _before_ you pull the trigger) The Vector is actually open-bolt. In addition, the bolt does not even have an o-ring on it to seal the chamber. When I discussed this with AP, I was told that the Vector's original design called for a closed-bolt system to help save gas. ('93 Vectors were total gashogs) AP found that by removing the o-ring, the Vector's gas efficiency dropped only slightly, but the rate of fire was increased by at least one shot per second. This was due to the pneumatics not having to pull the bolt out of the barrel and getting dragged down by the o-ring's friction with the barrel.

I have heard several people argue that a closed-bolt design introduces less ball-deformation and turbulance during firing, and that this deformation and turbulance are responsible for decreased accuracy and range. No proof of either of these claims has been offered, and I remain skeptical.

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AIR POWER TOYS

- Bottom line: designed to mimic the Smart Parts style mount for compatibility, should now be available
- Shorter barrel: 8" effective, 5" less than stock. cost $75
- NRG: Non-Restricted Gravity barrel, feed port is on TOP, comes with side mount site rail, rate of fire tested at 8-10 shots per second (this is for real) Site rail mounts on barrel, upward at 45 degrees, right or left side. (tapped for both) cost $75

- Thruster: inline regulator/velocity adjuster $125 (includes power stock)
- Parts kit: Includes at least 1 of every seal, O-ring, and screw (see below) cost $35.
- Power Stock: screws in where your tank goes. Must have a remote line with quick disconnect (it comes with male end on a 1' line) price: $49
- Nitro system: I have been told 3rd party that AP now offers a nitro system - anyone have info on this?

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OTHER AFTERMARKET PRODUCTS

- J&J: thread your stock barrel and include one of their hardchrome rifled barrels, all for $95 (this is reportedly low quality work, and is not as accurate as stock barrel)
- Pro-Team is working on a new receiver portion that will take any Illustrator-type threaded barrel; still on the "drawing board" though
- BoA offers two custom barrels
- Standard barrel, and "conceiler" barrel that comes with custom 5" silencer
- Neither has the "NRG" design
- Options include brass/chrome, color anodizing, muzzle brake
- Both are the same 15" as the stock Vector barrel
- Base price is $65, plus extras, and if you get all the goodies, it's about $135.
- Barrels DO NOT include the front mount or the detent; you must remove them from your stock barrel and place them on the BoA. (holes and such are pre-machined though)
- Accuracy is reported as equal with stock, but obviously the conceiler has its added value if quiet is your thing
- Feed port is enlarged to better than 2", which may help increase feed speed (and get the hopper well out of the way of a nice big site)
- This barrel does not have quite the "professional" look to it, but reportedly delivers the goods.
- Call BoA at (216) 878-6309 for details.
- Hardwood Maple grips are being made to order by a private individual. (they also include a bottom line bracket) Contact Dave Lavictoire at 'dlavicto@chat.carleton.ca' for information.
- Smart Parts now offers a barrel for the Vector. They do about the same thing as J&J does, by taking an existing barrel, chopping off the end, and putting their own type of barrel on the end. This barrel is reported to quiet the Vector about 25% and to be even more accurate than the stock barrel.
- Pro-Team *used* to make barrels for the '93 Vectors, but have not continued to offer them for the '94 version, due to low demand.

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AFTERMARKET REGULATORS

Adding an external regulator can make velocity adjustment easier, and also improve velocity stability. Vectors require far less pressure than most markers though - 850psi is where you'd set

one for a 'mag, bug the Vector is looking for around 450psi. Too much input pressure in cold weather may slip off a low pressure hose.
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PAINT

The Vectors were designed and tested using ProBall, but don't have any "incompatibilities" with any brand of paint. All Vectors come with a ball detent built into the barrel. Replacement barrels may not come with ball detents - check when ordering.
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ANTI-PINCH FEATURE EXPLAINED

Many people want to know more about the anti-pinch feature, so here is how it works: You're firing away and a deformed ball drops down your elbown and halfway into the chamber and stops. When you pull the trigger, the bolt moves forward, powered by a 100psi burst from the 4-way. About 95% of the time the bolt will stop before breaking/ slicing the ball. The gun will not fire, and will appear to be completely out of CO2.
With your index finger, just flip on the safety (a lever right above and forward of the trigger, on the side of the gun) and you'll hear a slight whoosh as the gun recocks and resets Flip down the safety (off) and fire again. When the gun recocked, the ball should have fallen into the chamber. This resetting procedure takes about 1/2 second if you know what you are doing
I have experienced some gator balls so badly deformed that they actually got jammed in the port, and kept tripping the anti- pinch. To clear this nasty jam, you've got to pull off the hopper and push the ball into the chamber.
On an average day with average paint and high rate of fire, expect to reset your Vector 4-5 times. Don't think of it as four resets; think of it as zero ball chops, zero hooks/slices.
Oddly enough, this was not a design goal, but rather came as a side effect when they dropped the regulated pressure to 100psi. AP has never marketed the 'anti-pinch' feature, even though it has really gotten around. Some Autococker mods lower the regulated pressure down near that of the Vector, and with the proper bolt, they too can have this anti-pinch feature.
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VELOCITY ADJUSTMENT

The Vector limits its velocity by varying the distance the cup seal can move from the valve seat, which effects how long the valve stays open. Adustment is done by removing the tank, (bummer) and turning a set screw in the adapter body with an allen wrench. The manual states you have 6-8 turns to work with. Mine has four and a half.
To set the Vector at maximum velocity it is not necessary to back the screw all the way out.

Back the screw out until it is flush with the adapter body. Now slowly twist it in until you feel a slight resistance. (it will be several turns) When you feel this resistance, you have just hit the piston. Turning further will push the piston forward and compress the valve spring. When the valve spring is fully compressed, the pin can barely move, and the cup will not put any air in your barrel. This adjustment in no way affects the air going to the regulator and its 100 psi for the action.
This in effect changes the spring size in your valve. Note when installing a regulator, you need to fully open the valve system. Remove the set screw and the piston, and put them in a bag with some oil in case you need them later. Failure to remove these items will result in a maximum velocity below 300 fps. This procedure is not covered in your regulator booklet/manual unless you bought a Thruster. It may also be necessary to replace the main spring, which is included with both the Thruster and the parts kit. Vectors sold as "Thruster-Ready" have already had the piston and set screw removed. Make sure you get them with the gun though, or you'll have a "Thruster ONLY gun."
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THRUSTER

All Thrusters are shipped complete with a manual and a special valve spring. If you did not get a manual and spring, AP will send you replacements free of charge.

If you cannot get the velocity set to 300 fps, check:
(a) Piston or adjustment screw not removed from valve
(b) Valve spring not changed
(c) Main spring not changed
(d) Incorrect internal assembly of Thruster. Internal washers should alternate like ()()(), not like ((((((, with the flat washer nearest the outside.
(e) Adjustment nut tightened too far, washer(s) may be damaged (full range of adjustment may be as little as one complete turn)

Velocity range is reported to be 0-320 fps. Adjustment of springs may be necessary to get higher velocity. (lighter valve spring)

In case you bought someone else's regulator instead of a Thruster,

Thruster Manual Instructions

Remove the main spring from your Vector; refer to the General Maintenance and Cleaning Disassembly section of you owners manual, replace with the Thruster main spring.

Step 1: Unscrew the seat from the adapter body. Warning: do not scar adapter body. Scratches can cause irreparable damage. Always hold seat with a tool, not the adapter body to prevent damage.
Step 2: Remove the shaft form seat.
Step 3: Remove the spring from adapter body.
Step 4: Remove the velocity piston.
Step 5: Remove adjuster screw. The piston, adjuster screw, and return spring can be stored for

future use should you desire to shoot the Vector on siphon without the Thruster.
Step 6: Install the Thruster valve shaft return spring.
Step 7: Install valve shaft into seat.
Step 8: Lubricate o-rings and interior of adapter body. Screw valve seat into adapter body.
NOTE: be carful not to slice o-rings when assembling.
Step 9: Inspect o-rings for damage. Adapter body is now ready for insertion into Vector.
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BARRELS

The stock barrel for the Vector is reported to be the most accurate produced so far. BoA makes a ported barrel that has about equal accuracy, with a good silencing action. J&J makes a lower quality barrel. Stock barrel's rate of fire is 7-8 shots per second. This barrel has neither ports nor a brake; just a wildly polished tube.

The NRG barrel has the port moved to the top for increased rate of feed. This required the raised site rail to be removed and replaced with a side-mount scope rail. Rate of fire is tested at 8-10 shots per second, depending on whose finger is on the trigger. Better get a Shredder, too. The NRG barrel is tapped and the site rail actually moved ONTO the barrel itself at about 45 degrees from vertical. You pick the side.

AP also offers a shorter barrel, which lowers the effective length from 13" to 8", and reduces the overhang of the barrel from 6" to 1". Reduced accuracy is expected, but not confirmed. It is neither ported nor braked. All AP barrels (regular, NRG, short) cost $75.
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SPARE PARTS

This is the stated price for all parts shown in the breakdown in the manual.

Barrel (any)	$ 75	Site Base	$ 20	HP Line	$ 25
Barrel Mount	$ 45	Adapter Pin	$ 4	HP Line Cover	$ 20
Drive Pin	$ 4	Bolt Head Slider	$ 20	Action Power Unit	$200
Hammer	$ 25	Receiver **	CALL	Valve Seat **	$ 30
Valve Shaft	$ 20	Return Spring	$ 2	Velocity Piston	$ 5
Adapter Body **	$ 40	4-Way Valve	$100	Valve Arm **	$ 20
Trigger Sear	$ 20	Trigger Assembly	$ 30	Side Cover **	$ 30
ForeGrip	$ 27	Pistol Grip	$ 25	Parts Kit	$ 40

Notes:

- The "Return Spring" is the valve spring
- Valve Seat must be matched to Adapter Body
- Side Cover must be matched to Receiver
- Valve arm must be matched to rest of action
- Action Power Unit includes the regulator, ram, main spring, and hammer
- Prices rounded up to nearest dollar

- Total cost (without receiver) is $827, spare parts are marked up about 50% from total cost of gun (reciever not included in total)
- Parts are sometimes cheaper than listed when you actually order them

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PARTS KIT

These items are included in the parts kit, $35 + $10 ship from AP:

```
O-rings (black rubber)
--- -----------------
1:  6.5 x 2  OD x width
2:  7.5 x 2   (in mm)
1:  8.0 x 2   (+/- .3mm)
2: 11.5 x 2
2: 18.0 x 2
1: 20.0 x 2 <-- adapter body
1: 24.0 x 2
```

```
screws
------- ---------------  --------  ------
1:  2.5 x 3.0 coarse   thread length x width
4:  4.5 x 3.0 course    (in mm)
2:  6.0 x 3.5 fine      (+/- .5mm)
2:  9.0 x 3.5 fine
2: 15.5 x 3.5 fine
2: 19.0 x 3.0 coarse
```

```
springs
------- ---------------------
1: 15 x  5.5 x 0.8  (height x
1: 19 x  8.7 x 1.0   turns x
1: 45 x 11.0 x 1.4   wire OD
1: 52 x 10.7 x 1.2   in mm)
```

```
wrenches
------- -------- -- --
1: 1.5 short  (in mm)
1: 2.0 long
1: 2.5 long
1: 3.0 short
```

```
washer (firing)
- ---------  ---
1: 13 x 8 x 1.25
(OD x ID x width)
(in mm)
(clear teflon?)
```

All this comes in a very nice yellow parts case, with pleanty of room for any other tools or extras you might want to throw in. I suggest requesting several additional adapter body o-rings with your kit.

Notably Missing:

- Detent spring (although you have a detent screw...)
- 1st or 2nd trigger spring (watch the little one when assembling/ disassembling)
- Barrel release spring
- Cup seal

AP: "Only items prone to breakage or loss are included in the parts kit."

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COMMON PROBLEMS AND ANSWERS

- Trigger pulls but gun doesnt fire:
  a) Reset safety
  b) Check sear spring
- Air leaks near where adapter body meets block
  a) Bad adapter body O-ring
- Adapter body O-rings getting chopped frequently
  a) Oil them before inserting adapter body
  b) Allow the gun to "cool down" for about 15 minutes before removing the adapter body

(to let the o-rings "relax")
c) Why are you removing the adapter body?

- Air leaks from right of "Vector" nameplate
  a) High pressure line o-ring not seated properly
  b) HP line's seal with its plate is bad - free repair, but superglue or (preferrably) rubber cement works. (just make sure the line is positioned correctly before gluing)
- Air leaks out the barrel
  a) Bad cup seal
  b) Dirt on cup seal - clean and oil lightly
  c) Cup seal not seated properly - fire several shots
- Low accuracy, hooking and slicing
  a) Check barrel for paint
  b) Check and clean paint from bolt
  c) Check hopper for broken balls, dump, clean, and reload if necessary
- Low velocity after installing an inline regulator
  a) Remove piston and set screw (see Thruster above)
- Barrel seems to wobble a bit (rotate, not shift side to side)
  a) Barrel is designed to float. This is not a problem.
- Air leaks from/near where high pressure line and regulator meet
  a) O-rings in regulator dry - pull the HP line, oil, and re-attach
  b) O-ring inside regulator dry/bad. Remove regulator, unscrew aluminum fitting, check o-ring at end of fitting. Also oil the series of smaller o-rings and washers inside.
  c) Excessive oil on o-rings on inlet. You have to keep them oiled, but too much oil will make it leak. There should be noticable friction when you slide the regulator onto the HP line, and you should be able to feel when each of the two o-rings is met by the line.
- Small air leak comming from 4-way, where green body meets aluminum block
  a) 4-way is designed to vent a tad while gassed up, this is normal
- Vector fires but bolt does not return (open) or opens slowly; 4-way may hiss excessively
  a) 4-way "moved". Loosen both bolts holding 4-way, hold 4-way toward the trigger, and re-tighten screws. Use a large mount of force when holding the 4-way against the trigger assembly, and tighten both screws VERY tight. They are tapped into almost one inch of aluminum for this very reason. If the 4-way is a PAPER'S WIDTH from its correct place, the above problem will result.
- Vector leaks air down the barrel and not running remote; if not running siphon, pointing Vector upward and firing stops the leak a) The cup seal is getting old. Liquid in the system will sneak around a worn cup seal. Cup seals should be replaced every 1-2 years.
- Drop in velocity, inconsistent firing under rapid fire, chambers a ball but does not fire it) and failure to fire at all. (progressive) a) Hammer is corroded and sticking to ram's forward tube. Remove hammer, wrap fine sandpaper around eraser end of pencil and sand inside diameter of hammer slightly to remove corrosion.

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SUGGESTED IMPROVEMENTS

Some Vector owners would like a modification that would...

- Make the anti-chop feature able to be shut off if wanted
- If you don't like it... sharpen the edges of the bolt! (buy a spare; they're cheap and can be

changed by hand)
- Make the trigger flip the safety instead of firing if it's tripped
- AP, "this cannot be done"
- Make the safety on the other side for 'lefties'
- AP, "not cost-effective, not enough lefties"
- Make an auto-response/double-trouble trigger
- AP has no plans to make one
- Offer a lightened/milled out block (possibly top on the "wish list")
- AP claims most of the weight is in the action, and does not plan to offer this
- Make teflon o-rings for the valve body
- AP is the ONLY source of the regular rubber o-rings, but is considering making a composition change. Until then, users are advised to remove the adapter body only when necessary.

***** Ideas below have been done by individuals, with positive results *****
- Mill out the adapter body more and use a larger, sturdier, more easily obtainable pair of o-rings
- AP has no plans to do this
- One owner (with great trust in his machinist) had his adapter body lathed a bit to make room for larger teflon o-rings, and reports great success. I would expect the valve body's maximum pressure rating to have been lowered below the 1800psi set by AP, which may not be wise. Since the pin holds the back end in, no injuries would result, but it might still ruin your hot summer day.

- Replace the fragile adapter body o-rings with common 18 x 1 (mm) o-rings. One Vector owner reports great success with these commonly available o-rings, but says you'll have to stretch them a bit...
- Mill out the opening around the safety, to make resetting the anti-pinch faster/easier
- The safety has a spring that is held in by a set screw, blocked by the 4-way. It can be accessed there, and trimmed or adjusted to change the "stiffness" of the safety. See "common problems" for information on re-installing the 4-way.
- Round out the catch on the trigger arm to make the trigger pull smooth instead of snappy (but still keep its 1/16" pull)
  NOTE: '93 Vectors had a tendency to wear down the trigger arm and make this happen for awhile (until at last it wore too much)

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MAINTENANCE

Here are the things I do when returning from the field:
- Remove and clean barrel, bolt, and bolt pin
- Dab the bottom of the bolt slider with a little white lithium grease (great stuff!) Don't use too much or you'll hurt your velocity
- Put it all back in
- Wipe off any paint on the outside
- Put a drop of oil on all exposed screws

"Twice yearly" maintenance:

- Remove, check, and oil all three (2 sm, 1 lg) o-rings inside regulator's aluminum fitting
- Oil all trigger parts
- Remove action/power unit. Clean and oil. NO grease. Thoroughly clean out hammer where ram's tube goes in.
- Remove adapter body and open valve. Check/oil cup seal and both o-rings. Oil piston (if still there, removed if you have a regulator)
  NOTE: have a pair of AB o-rings on hand, replace 'em
- Check all low pressure hoses, make sure they have not slipped off a bit
- Tighten pommel (grip) screws

The 4-way could probably use some lubrication, but it looks sealed fairly well, and its price tag has (so far) kept my screwdriver off it. Remember, the 4-way is *designed* to hiss just a tad while powered up, so don't worry. If it hisses too much for your taste, it may be just a hair off it's mark; try loosening it and re-placing it. (see above about the 4-way "moving")

You may want to remove the adapter body (valve) well-after using the Vector. If you don't give it a good 15 minutes of "cool down" time after removing the CA, you increase the risk of damaging the adapter body o-ring on removal of the adapter body. When removing, twist a lot, pull a little, and oil well before re-insterting.

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BEHIND THE SCENES

Things start with the Vector cocked:

- Hammer is locked onto ram by hammer sear, power spring compressed
- Hammer/ram are back (next to valve)
- Bolt is open (above ram)
- Trigger sear is holding valve arm
- Valve arm is holding 4-way closed

Here is what happens when you pull the trigger:

- Trigger is pulled
- Trigger arm presses past trigger sear
- Trigger sear pivots, releases valve arm (safety holds valve arm if on)
- Valve arm pivots, 4-way opens
- 4-way stops pushing on ram, now pulls ram, hammer, and bolt forward (this is where the anti-pinch stops the cycle)
- Bolt pushes ball into barrel
- Hammer sear reaches sear roller
- At the same time:
- Sear roller pivots hammer sear
  AND ram pivots valve arm
- Hammer sear releases hammer from ram
  AND valve arm closes 4-way
- Main spring pushes hammer back
  AND trigger sear catches valve arm

- Hammer hits valve
- Very short, high volume air charge released from valve, travels up power tube and fires the ball
- Ram compresses main spring and catches on hammer sear (Vector has cycled completely)
- User releases trigger
- Trigger arm slides back over trigger sear

Vector is now recocked and ready to fire again

If a ball stops the bolt from moving forward, the action stops. The 4-way is still open, therefore the Action Power Unit is still pulling the ram, bolt, and hammer forward. Leaving the Vector in this state for long could eventually pinch the ball in half. (and fire the gun) Flipping the safety pivots the sear, (normally done by the ram just as the hammer strikes the valve and fires the gun) and causes the 4-way to close and the trigger sear to catch it. When the 4-way closes, the ram just goes back to the valve along with the hammer, and opens the bolt, and the ball should then drop into the chamber. Don't forget to flip the safety off. In addition to chopping the ball in time, the slider that the bolt is on is being stressed quite a lot, and could eventually fail at the pin. This may be a 'weak spot' in the design - bolt sliders typically look a bit curved/bent after a month or so of use. (although they are confined in a groove, which limits how much they may bend)

If the trigger is pulled with the safety on, the valve arm will not pivot, and the gun will remain in its cocked state. There is very little difference in the "feel" of the trigger pull of a Vector on safety or not.

One of the reasons for the high rate of fire is that the gun does not have to wait for the user to release the trigger to complete recocking. The Vector relies on its own internal timing to complete the firing cycle as fast as possible. No short stroking.

If the user pulls the trigger faster than the Vector cycles, (!) the Vector will cycle normally except for the hammer, which will not release from the ram, and will not fire the air charge. Depending on how early the trigger was pulled, either it will just cycle, trip the anti-pinch, or a second ball will be chambered. (the last being the least-likely)

It is quite possible to pull the trigger faster than the BALLS can fall into the chamber. (NRG barrels make this a lot more difficult to do) If you do pull faster than they fall, you'll just trip the anti-pinch more than usual.

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Physical Specs:

Weight: 3 1/3 lbs
Length: 18 1/4" (15" w/o barrel)
Height: 8"
Width: 2 1/2"
Color: jet/matte black

Barrel:
Length, total 15 1/2" _this is for the "long" (standard) barrel
Length, effective 13" /
VERY well honed, no coating (just aluminum)
Not rifled
Not braked
Not ported

Construction

Plastic: handgrip, foregrip

Anodized aluminum: barrel, body, sight rail, CA adapter, cover plates, trigger, power tube, body, valve body

Untreated aluminum: hammer (with steel striker imbedded)

Steel: action, pins/screws, valve mech, hammer striker, sear

Heat-treated TOOL steel: all internal trigger parts

(Apparently they aren't "tough as nails" -- they're tough as HAMMERS)
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NEW from Air Power

On about September 1, 1995, AP will be shipping Vectors complete with a minimal parts kit and a video!

Also, AP has responded to the problems of customer service, and is in the process of re-vamping their computer tracking system, installing a 1-800 customer service line, and....

LIFETIME WARRENTY on parts and servce! yea!

AP is also now "factory direct". i.e. order your Vector, parts, or goodies directly from Air Power if you wish.
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WHY TO BUY...

Another semi over a Vector:

- Quieter
- Lighter

- Smaller
- More aftermarket stuff available
- Balances better with a bottom line
- Can turn off the ball feed
- Costs $150-350 less (without mods and toys!)
- Don't play in weather below 60 degrees

A Vector over another semi:

- No short-stroking
- No freeze-ups (never 'goes liquid')
- Stock barrel is already extremely accurate
- No foamies!
- No need for power-feed
- Easier cleaning
- Balance is perfect with a '20 on the back
- No breakdowns
- No shoot-downs
- Still works in November, December, and January
- No chops
- No high pressure seals (except the cup seal of course)
- Cycles faster than any loader currently available can drop balls
- Has no need for expansion chambers
- Can run siphon for exceptional velocity stability in all seasons

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THE BIG PICTURE

Out of the box it's big, heavy, fast, loud, accurate, reliable, and complete.

For the best info, call Nick Lotuaco, president of Air Power. Ask for him at Air Power @ (804) 486-8114. (it's still a 'small business', but it's nice to be able to talk to the big guy when you need answers)

You can also contact Air Power here on the internet: AirPower@infi.Net (I have not had great success getting replies here)

Please let me know if I've missed anything here - I'm always trying to improve and keep this FAQ current! Vamp@Vampiresinc.com

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Vector FAQ

Revision 2.0
November 4, 1994
Maintained by: Nathan Fisher (fisherN3485@uni.edu)
Html conversion by: Jim Burke (jburke@bates.edu)
Text version also available.

Index:

Design Goals

Quoting Air Power:
- It has to be Accurate. Consistently accurate. Firearms accurate.
- It has to mimic a Military MP5 style assault rifle.
- It has to be balanced.
- It has to break down without any tools for "normal" cleaning.
- It has to withstand 1800psi and a completely liquid system.

Stock Features

- 4 way valve
- 100 psi regulated action
- anti-pinch/chop bolt
- removable barrel
- velocity adjust
- ball detent
- raised sight rail
- back-mounted bottle

Good Points

- accuracy -- best I've seen in any semi. with any barrel.
- stability -- the gun barely twitches when you pull the trigger
- eats liquid or gas
- trigger pull is 1/16", (really!) and SNAPS when you pull (no grind)´
- rate of fire is right there with a *worked* cocker
- 4-way prevents "short stroking" (gun both fires AND recocks when trigger is pulled; no waiting for trigger to be released)
- anti-pinch is about 95% effective in preventing ball-chops
- reliability -- it cocks itself, (no bolt pin to pull) and since it uses 100psi regulated action, will recock even in the coldest weather
- precision construction -- it's hard to find the seams!
- the barrel releases at the press of a button, which completely exposes the bolt for cleaning
- the bolt and valve can both be removed without tools for easy cleaning
- stock barrel is very well polished, and quite accurate
- unique bolt construction forms a vacuum when fired, sucks the next ball into the chamber
- very short -- most of the action and pneumatics are below the barrel, rather than behind it, which makes for a fairly small gun, even with its 13" barrel
- stock vel adj can get you good velocity even into cold weather -- normal temps require the adjustment to be almost fully closed.
- works with very low pressure. (you CAN play in cold weather! really!) AP claims the gun will cycle (although not shoot very far...) at _80_ psi. If you're running out of air, your opponants can't tell unless they see the balls dropping. (no more "VM-68 crying for death" sounds)
- gas efficiency (with or without Thruster) is estimated at 65 shots/oz. giving [455/7] [585/9] [785/12] [1300/20] nice.

Questionable Points

- great stability does not agitate the hopper; needs a VL-2000 badly
- if the anti-pinch is tripped, you must reset it (takes only a quarter- second, but some people want paint NOW regaurdless if it means chops)
- if you remove your barrel while your hopper is attached, and forget to turn the gun upside-down, you'll be dropping balls all over the ground. (feed port is part of the barrel)
- difficult to turn the gun down far without Thruster -- common range is about 260-370 fps in 70 degree weather. (some indoor fields want 200- 250)

Bad Points

- very loud. silencer does not help too much. Air Power says the main air charge nears Mach 1 going around the second corner when the gun is fired. Since the gun itself is creating the sound, silencers/barrels can't really fix this.
- tank must be removed to adjust velocity (Thruster overcomes this)
- the gun may fire once when you put on the tank, regaurdless of safety (this is documented in the manual) Put your hopper on AFTER your CO2.
- spare parts are expensive, and 5 of them are "custom fit" (send gun in)
- all-aluminum body seems a target for stripped threads. (caution is given several places in the manual against over-tightening, threatening "irreperable damage")
- the Adapter Body has two very very thin o-rings that seal it in, which are very easy to slice when removing to oil. Recommend ordering spares, especially if you lube the gun often. $0.50 ea
- high pressure feed line to the regulator has been known to leak on the valve side; this is a free repair.
- almost every pin and screw is untreated steel -- oil them often, or the rust monster cometh!
- heavy - 3 1/3 lbs without tank or paint
- cannot remove barrel release button for cleaning

Air Power Toys

- bottom line (not yet avail) -- replaces grip assembly, includes a Thruster
- shorter barrel
- gravity power feed (not yet available) Supposed to even further increase rate of fire for those who want it most (8-9/sec possible??!)
- "Thruster" inline regulator/velocity adjuster $149 NOTE: do not overtorque adjustment, damage can result to rings
- parts kit $35. Includes at least 1 of every seal, O-ring, and screw (see below)
- "Power Stock" - waiting for more info on this...

Other Aftermarket Products

- J&J: thread your stock barrel and include one of their hardchrome rifled barrels, all for $95 (this is reportedly low quality work)
- Pro-Team is working on a new receiver portion that will take any Illustrator-type threaded barrel; still on the "drawing board" though
- BoA reportedly has two custom barrels with power feeds. More info? call (216) 878-6309 for details

1993 and 1994 Vectors

If you see a used Vector, check the button that attaches the barrel. If it's round, it's the old version and may need some upgrades. If it's square, you've got all the latest updates. (the "94")

The upgrade is free of charge, but will take awhile. I was quoted at eight weeks to perform the upgrade. For an additional $49, you can get another year's worth of warranty on your rebuilt Vector.

1993 Vector Problems

- VERY low gas efficiency -- 29 rnds/oz (580 rnds/20 oz)
- unstable velocity
- high cycle pressure (>600 psi)
- very long gas flow path (from valve to barrel)
- pressure rise during cycle was very inefficient

- velocity regulator set screw put stress on power tube, causes power tube failure in < 10k rounds

1994 Vector Upgrades

- increased efficiency
- more stable velocity (Thruster makes it *rock solid*)
- low cycle pressure - 100 psi
- very short gas flow path
- pressure rise changed from triangular to near square - very efficient and stable (this is where the gun got so loud)
- velocity adjustment re-designed, power tube strengthened

Anti-Pinch Feature Explained

Many people want to know more about the anti-pinch feature, so here is how it works: You're firing away and a deformed ball drops down your elbown and halfway into the chamber and stops. When you pull the trigger, the bolt moves forward, powered by a 100psi burst from the 4-way. About 95% of the time the bolt will stop before breaking/ slicing the ball. The gun will not fire, and will appear to be not hooked up to any CO2.

With your index finger, just flip on the safety (a lever right above and forward of the trigger, on the side of the gun) and you'll hear a slight whoosh as the gun recocks and resets. Flip down the safety (off) and fire again. When the gun recocked, the ball should have fallen into the chamber. This resetting procedure takes about 1/2 second if you know what you are doing.

I have heard of balls so badly deformed that they will not drop when reset -- to clear this jam, you have to either pop off the barrel, (press a button and pull) or pull off your hopper. (note: some tourneys are changing rules so that barrel removal is forbidden)

On an average day with average paint and high rate of fire, expect to reset your Vector 4-5 times a day. Don't think of it as four resets; think of it as zero ball chops/barrel bursts.

Velocity Adjustment

The Vector limits its velocity by varying the distance the cup seal can move from the valve seat, which effects how long the valve stays open. Adustment is done by removing the tank, (bummer) and turning a set screw in the adapter body with an allen wrench. The manual states you have 6-8 turns to work with. Mine has four and a half.

To set the Vector at maximum velocity it is not necessary to back the screw all the way out. Back the screw out until it is flush with the adapter body. Now slowly twist it in until you feel a slight resistance. (it will be several turns) When you feel this resistance, you have just hit the piston. Turning firther will push the piston forward and compress the valve spring. When the valve spring is fully compressed, the pin can barely move, and the cup will not put hardly any air in your barrel. This adjustment in no way effects the air going to the regulator and it's 100 psi for the action.

This in effect changes the spring size in your valve. Note when installing a regulator, you need to fully open the valve system. Remove the set screw and the piston. Put them in a bag with some oil in case you need them later. Failure to remove these items will result in a maximum velocity below 300 fps. This procedure is not covered in your regulator booklet/manual unless you bought a Thruster.

Barrels

The stock barrel for the Vector is believed to be the most accurate produced so far. BoA makes a ported barrel that has about equal accuracy, with a good silencing action. J&J makes a lower quality barrel. Stock rate of fire is 7-8 shots per second. This barrel has neither ports nor a brake. Just a wildly polished tube.

The NRG barrel has the port moved to the top for increased rate of feed. This required the raised site rail to be removed and replaced with a side-mount scope rail. Rate of fire is tested at 8-10 shots per second, depending on whose finger is on the trigger.

AP also offers a shorter barrel, which lowers the effective length from 13" to 8", and reduces the overhang of the barrel from 6" to 1". Reduced accuracy is expected, but not confirmed. It is neither ported nor braked.

Accuracy of the Vector with its stock 13" barrel is apparently unmatched, as the Vector has never lost a 5-man or 10-man target shoot. (at the American Opens)

Spare Parts

This is the stated price for all parts shown in the breakdown in the manual.

Barrel	$ 75
Site Base	$ 20
HP Line	$ 25
Barrel Mount	$ 45
Adapter Pin	$ 4
HP Line Cover	$ 20
Drive Pin	$ 4
Bolt Head Slider	$ 20
Action Power Unit	$200
Hammer	$ 25
Receiver **	CALL
Valve Seat **	$ 30
Valve Shaft	$ 20
Return Spring	$ 2
Velocity Piston	$ 5
Adapter Body **	$ 40
4-Way Valve	$100
Valve Arm **	$ 20
Trigger Sear	$ 20
Trigger Assembly	$ 30
Side Cover **	$ 30
ForeGrip	$ 27
Pistol Grip	$ 25
Parts Kit	$ 40

Notes:
- the "Return Spring" is the valve spring
- Valve Seat must be matched to Adapter Body
- Side Cover must be matched to Receiver
- Valve arm must be matched to rest of action
- prices rounded up to nearest dollar
- parts are typically cheaper when you actually order them
- Action Power Unit includes the regulator, ram, main spring, and hammer
- total cost (without receiver) is $827, spare parts are marked up about 50% from total cost of gun

Parts Kit

These items are included in the parts kit, $35 + $10 ship from AP:

```
O-rings (black rubber)
--------  -----------
1:  6.5 x 2  OD x width
2:  7.5 x 2    (in mm)
1:  8.0 x 2    (+/- .3mm)
2: 11.5 x 2
2: 18.0 x 2
1: 20.0 x 1 (adapter body)
1: 24.0 x 2

Screws
---  ------------------------------------
1:  2.5 x 3.0 coarse   thread length x width
4:  4.5 x 3.0 course     (in mm)
2:  6.0 x 3.5 fine       (+/- .5mm)
2:  9.0 x 3.5 fine
2: 15.5 x 3.5 fine
2: 19.0 x 3.0 coarse

Springs
------  --------------------
1: 15 x  5.5 x 0.8  (height x
1: 19 x  8.7 x 1.0   turns x
1: 45 x 11.0 x 1.4   wire OD
1: 52 x 10.7 x 1.2   in mm)

Wrenches
----------  ----------
1: 1.5 short  (in mm)
1: 2.0 long
1: 2.5 long
1: 3.0 short

Washer (firing)
--------   ------
1: 13 x 8 x 1.25
        (OD x ID x width)
        (in mm)
        (clear Teflon®?)
```

All this comes in a very nice yellow parts case, with pleanty of room for any other tools or extras you might want to throw in.

IMHO, $35 is too much to pay for this stuff. Just order the list below and get anything else you need at the hardware store:
- all springs
- four or more of [20.0 x 1] O-ring (for the adapter body, only $.50 ea)
- clear washer (seals valve port with power tube assy, hard to see if dropped)

Not Included:
- detent spring (although you have a detent screw...)
- 1st or 2nd trigger spring (watch the little one when assembling/ disassembling)
- barrel release spring

Common Problems and Answers

1993 Vector only

- Gun fires but gas leaks down the barrel:
  a) Power tube seal is bad.
  b) Power tube spring is weak

- Gas excessively leaks down the barrel:
  a) broken or cracked power tube.

- Difficult or impossible to adjust velocity (without Thruster):
  a) Power tube spring is weak
  b) Power tube needs to be lubed
  c) power tube is cracked

- Trigger does not pull back
  a) broken trigger sear

1993 and 1994 Vector

- Trigger pulls but gun doesn't fire:
  a) reset safety
  b) check sear spring
  c) check hopper for broken balls, dump and reload if necessary

- Air leaks near where tank meets adapter body
  a) bad adapter body O-ring(s)

- Air leaks from behind "Vector" nameplate
  a) high pressure line o-ring not seated properly
  b) high pressure line leaking, warranty repair

Suggested Improvements

some Vector owners would like a modification that would...

- make the anti-chop feature able to be shut off if wanted
  - AP, "this cannot be done"
- make the trigger flip the safety instead of firing if it's tripped
  - AP, "this cannot be done"
- make an auto-response/double-trouble trigger
  - AP has no plans to make one
- offer a lightened/milled out block (possibly top on the "wish list")
  - AP claims most of the weight is in the action, and does not plan to offer this
- make Teflon® o-rings for the valve body
  - AP is the ONLY source of the regular rubber o-rings, but is considering making a composition change. Until then, users are advised to remove the adapter body only when necessary.

- include a minimal parts kit with the gun

Maintenance

Here are the things I do when returning from the field:
- remove and clean barrel, bolt, and bolt pin
- put it all back in
- wipe off any paint on the outside
- put a drop of oil on all exposed screws
- dab the bottom of the bolt slider with a little white lithium grease (great stuff!)

(gee that was tough, eh?)

When things are really bad, (like the day I took five gun hits to the elbow.....) I do the above, plus:
- remove front handgrip
- remove trigger plate
- remove pommel
- clean paint from grip, pommel, plate, and block
- put a drop of oil on each of the trigger parts
- reassemble

You'll only need to pull the action maybe once every other month to clean and grease it up. Follow the instructions in the manual, they're pretty good. I recommend not removing the 4-way though -- you can still remove the AP unit without unplugging hoses or removing the 4-way. Taking the action out is harder than putting it back in, and watch out for that trigger spring!

Behind the Scenes

Things start with the Vector cocked:
- hammer is locked onto ram by sear, power spring compressed
- hammer/ram are next to valve
- bolt is open (above ram)
- 4-way is closed
- valve arm is held by trigger lever

Here is what happens when you pull the trigger:
(forgive the lack of technical terms, my manual is at home)
- trigger is pulled
- trigger arm presses past trigger lever
- trigger lever pivots, releases valve arm (safety holds valve arm if on)
- valve arm pivots, 4-way opens
- 4-way sends air charge to action/power unit
- AP unit pulls ram/hammer/bolt back
- bolt pushes ball into barrel
- hammer reaches sear roller
- at the same time:
- - sear roller pivots sear
- - sear pivots valve arm
- - sear releases ram
- - 4-way closes

- hammer pushes away from ram powered by main spring, towards valve
- 4-way sends 2nd air charge to AP unit (different line and port)
- hammer hits valve
- AP unit begins to move ram/bolt forward (yes the ball has not fired yet)
- very short, high volume air charge released from valve, travels up power tube and fires the ball
- AP unit continues to push ram/bolt and compress main spring
- main spring fully compressed, sear locks hammer and ram together
- user releases trigger

Vector is now recocked and ready to fire again

If a ball stops the bolt from moving forward, the action stops. The 4-way is still open, therefore the Action Power Unit is still pulling the ram, bolt, and hammer forward. Leaving the Vector in this state for long could eventually pinch the ball in half. (and fire the gun) Flipping the safety on pivots the valve arm (normally done by the ram) and causes the 4-way to close and the trigger sear to catch it. When the 4-way closes, the ram just goes back to the valve along with the hammer, and opens the bolt, and the ball should then drop into the chamber. Don't forget to flip the safety off.

If the trigger is pulled with the safety on, the valve arm will not pivot, and the gun will remain in its cocked state. There is very little difference in the "feel" of the trigger pull of a Vector on safety or not.

One of the reasons for the high rate of fire is that the gun does not have to wait for the user to release the trigger to complete recocking. The Vector relies on its own internal timing to complete the firing cycle as fast as possible. No short stroking.

Another factor is that the gun CANNOT be fired faster than the mechanism works. If you rig up a machine to pull the trigger faster than the Vector can cycle, the vector will simply not cycle during those times the trigger is pulled and it is not ready. No ball chops or jams.

If you are looking for a *reliable* gun, the Vector is for you. Besides something outright breaking, the only thing that can break down on a Vector is if the 4-way "moves". This means the 4-way's position relative to the valve arm has changed. (it's adjustable for timing reasons) To reset this, you must remove 6 screws and adjust two more, all with the same allen wrench. To date, I have not heard of anyone needing to make this adjustment.

(how many mags have you seen break down? how many cockers? Ever seen a "bad cocker day" on your field? ;-) not a pretty sight!)

Physical Specs

Weight: 3 1/3 lbs
Length: 18 1/4" (15" w/o barrel)
Height: 8"
Width: 2 1/2"
Color: jet black
Barrel length total: 15 1/2", effective: 13"
Construction:
- plastic:
    - handgrip, foregrip

- aluminum:

    - barrel, body, sight rail, CA adapter, cover plates, trigger, power tube, all black anodized, hammer, normal (the body is one solid block of machined aluminum)

- steel:

    - action, trigger mech, pins/screws, valve mech, hammer striker, sear

Why to Buy

An Automag over a Vector:
- quieter
- lighter
- more aftermarket barrels available
- balances better with a bottom line
- can turn off the ball feed
- costs $150-200 less (without mods and toys)
- has no need for a regulator

A Vector over an Automag:
- no short-stroking
- no freeze-ups
- stock barrel is already accurate
- no foamies!
- no need for power-feed
- easier cleaning
- balance is perfect with a '20 on the back
- no breakdowns
- no shoot-downs
- still works in November, December, and January
- no chops
- no HP seals (except the cup seal of course)
- shoots faster, even w/trigger job on the mag
- has no need for expansion chambers

The Big Picture

Out of the box it's accurate, fast, and reliable, but... treat it like a VM68 and you will be seeing some big repair bills.

For the best info, call Nick Lotuaco, president of Air Power. Ask for him at Air Power @ (804) 486-8114.

Where to Buy

Best price I've seen, as of Oct. 4, 1994 was from Central Ohio Paintball. They offer the '94 Vector with VL-2000 and a 12oz tank for $499. Compare at $549-599 elsewhere.

Update! Best price is at Draco - Vector with 12 oz tank for $490.
10/26/94

®Teflon is a registered trademark of DuPont

Trouble Shooting Guide
For The Vector

Contents

Record of Changes

Ammended changes within a page are identifiable by being underlined. This emphasis will only indicate a change from the immediately preceding version.

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APP 4-2 1.1 3/14/97
APP 4-3 1.0
Abbreviations:

ABDS Adapter Body Disassembly Steps in Owner's Manual

AS Assembly Steps in Owner's Manual

CCW Counter-clockwise

CW Clockwise

DS Disassembly Steps in Owner's Manual

FOD Foreign Object or Debris

MS Maintenance Steps in this guide. See appendix.

SFR Submit For Repair

PartsBrkdn # Vector Parts Breakdown item number pictured on pages 9 and 10 of the owner's manual.

Introduction

This guide is organized by symptoms, followed by a progression of probable causes. The steps to determine a problem are:

1. Consult the Major Categories section of the Trouble Shooting Outline on page 2.
2. After determining which Category best describes the problem, refer to it again in the Sub-Major Categories of the same page.
3. Determine which sub-paragraph best describes the problem.
4. Refer to subject paragraph in the Trouble Shooting Guide.

This guide will help determine "what" is wrong, not necessarily "how" to repair the problem. This is why the Owner's Manual (OM) is referred to heavily throughout this guide. There are numerous references to disassembly steps (DS). This will allow you access to the problem area with the least amount of labor. These steps are listed as "[DS: #]." The numbers within the brackets refer to the steps themselves. Ensure not to confuse the assembly steps (AS) of the OM with those of the disassembly.

Descriptions referring to left and right are from the perspective of you looking at the gun with its barrel to

your left and the pistol grip pointing down, similar to the position of the Vector on pages 9 and 10 of the OM. Check the glossary of this guide for assistance in locating a particular part.

If your Vector requires factory repair and is under warranty, please ensure it is registered. If you are requesting warranty covered parts, return the broken parts and provide your serial number. If your Vector is not registered, accompany the repair with a completed warranty card or a copy of the sales receipt. We will register it.

Your suggestions and comments are strongly desired. The collective experiences of all owners place you in a position to be exposed to predicaments we have not imagined or experienced. Please provide any feedback you may have regarding the contents of this guide or problems not listed.

Air Power
509 Viking Drive, Suite E
Virginia Beach, VA 23452

Hours of Operation: 9:00 A.M. until 5:00 P.M. (eastern)
Telephone: (757) 486-8114
Facsimile: (757) 486-8177

Trouble Shooting Outline

MAJOR CATEGORIES

1. Firing 5. Gas leak
2. Action (abnormal bolt motion) 6. Safety
3. Trigger 7. Fitting of parts
4. Velocity

SUB-MAJOR CATEGORIES

1. Firing
1.1 Cycles but does not fire.
1.2 Fires gas but not a ball.
1.3 Ball breakage.

2. Action
2.1 Rapidly oscillates (vibrates, buzzes, chatters) in the forward position.
2.2 Slow cycle* motion.
2.3 Partial cycle* (motion from rear to front.) Gun may fire once and no more after a trigger pull or gas charge.
2.4 No cycle*.

3. Trigger

4. Velocity
4.1 Low velocity.
4.2 High velocity.
4.3 Erratic velocity.

5. Gas leaks from the:

5.1 Adapter.
5.2 Barrel mount, bolt, and barrel.
5.3 Trigger area.
5.4 Left exterior side of the receiver.
5.5 Foregrip area.

6. Safety switch.
6.1 Too difficult to operate.
6.2 Too easy to operate.

7. Fitting of parts.
7.1 Barrel.
7.11 Loose.
7.12 Difficult to remove or mount.
7.2 Side cover.

Trouble Shooting Guide

1. Firing

1.1 Cycles but does not fire.

DS: 1, 5

1.11 Cylinder mount screw loose or missing.

DS: 8

1.12 Sear roller missing.

DS: 6, 7, 9-19

1.13 Hammer sear.
1.131 Sear pin damage.
1.132 Sear latch face worn.
1.133 The sear has caused wear on the hammer. This causes the front half of the sear to be positioned higher (inward to the hammer). It is unable to rotate down (CCW) far enough to latch to the bolt carrier.
1.14 The end of the main spring has broken off and is preventing the hammer from latching.
1.141 Remove the broken end. Because the springs are grounded flat at the ends for perpendicular ends, some are thinner than others and will break away a partial coil. This does not diminish the performance of the spring. Instead, it would be preferable to continue to use this spring since it will not repeat this malfunction. Install the spring with the broken facing front and the flush end to the rear to bear upon the hammer. If it is replaced, designate whether your Vector is back-bottle or external regulator (Thruster) configured. There are different springs for each.
1.142 Rotate the bolt carrier while viewing it from the rear. Look for any eccentricity in rotation of its extension tube. If it is off-center, the bolt carrier must be replaced. (SFR)

1.2 Fires gas but not a ball.

DS: 1

1.21 Drive slider pin missing.
1.22 Ball jam in feeder, feeder tube, or barrel feed tube. Check for paint, shell or FOD in these areas.

1.3 Ball breakage.

DS: 1

1.31 Breaking in the breech.
1.311 Drive slider pin is missing.
1.312 The ball is too large or out of round to be loaded.
1.32 Breaking in the barrel.
1.321 Debris within barrel.
1.322 Attributable to the paintball (Too large, too small, out of round, thin shelled, soft spots, dimpled, flat spots, etc).

2. Action

Note: References to the term "cycle" refers to the observable motion of the bolt (slider pin installed.)

2.1 The bolt oscillates (vibrates, buzzes, chatters) in the forward position when the trigger is pulled.
The disconnector guide pin is of the wrong diameter or missing. (SFR)

2.2 Slow motion cycle.

DS: 1, 2

2.21 Check for ease of motion by manually moving slider. If resistent to movement, then go to following sub-para graphs.
2.211 Bent slider.
2.212 Slider guide grooves are obstructed.
DS: 5
2.213 Upper foregrip screws are too tight.
2.22 Kinked plastic (low pressure) lines. The line from the regulator to the four-way valve is purposely cut long and looped. This loop should be in an upward position. If position down, then the floor of the foregrip may press against it and restrict pressure in the line.
2.23 Four-way valve end plate cracked or loose.
2.24 Four-way valve screws are loose. AS: 15, 17
2.25 Mis-alignment between four-way valve pin and trigger valve arm.
DS: 8, 9
Connect gas to the gun and operate the valve pin by hand. If action is normal then the problem was alignment. Perform AS 15, 16, 17 and test fire.

DS: 6, 7, 10-13, 15-19

2.26 Receiver bore requires cleaning and lubrication.

2.3 Partial cycle (motion from rear to front). Gun may fire once and no more after a trigger pull or gas charge.

DS 1, 5, 8

2.31 Trigger sear spring missing.
2.32 Disconnector guide pin missing (SFR)*.
2.33 Disconnector plunger or plunger spring missing.
2.34 Trigger spring missing.
2.35 Interference to the motion of the piston within the regulator (Carty's Syndrome). Remove the regulator bonnet. Inspect interior for FOD. (It is known of where a piece of an adapter body o-ring had traveled from the adapter into the regulator).
2.36 The bolt carrier is mis-positioned on the pneumatic cylinder piston arm. The trigger valve arm on the reset portion of the action cycle pushes the 4-way valve pin to the front by rotating clockwise. This motion is delivered by the carrier as it passes over the top of the valve arm. The carrier must be in a precise position on the cylinder arm to properly make contact with valve arm. Input pressure to the gun and operate. See if the valve arm is being reset. (SFR)

2.4 No cycle.

If the bolt is in the forward position also refer to paragraph 2.3.

DS: 1, 2

2.41 Check for ease of motion by manually moving slider. If resistent to movement, then go to following sub-paragraphs.
2.411 Bent slider.
2.412 Slider guide grooves are obstructed.
DS: 5
2.413 Upper foregrip screws are too tight.
2.42 Kinked plastic (low pressure) lines. The line from the regulator to the four-way valve is cut long and purposely looped. This loop should be positioned in an upward position. If position down, then the floor of the foregrip may press against it and restrict pressure in the line.
2.43 Check the four-way valve end plate for loosness are damage. Tighten if loose. Replace if damaged.

DS: 8

2.44 Trigger sear not rotating clockwise enough to disen gage from the trigger valve arm (Hunt's Syndrome). Apply pressure to the gun and operate. Observe the motion, if any, of the sear.

DS: 9, 10

2.45 Four-way pin motion is hampered. Loosen pin guide enough to slightly reposition, tighten it back, and test motion of pin. Repeat this procedure several times if necessary. If pin motion is still impeded, then remove four-way valve pin guide, pin bushing, and pin. Inspect for FOD and clean.
2.46 Place safety switch in the fire position. Pull the trigger and look for clockwise motion on the trigger sear. SFR if the sear does not move.

DS: 6, 7, 11-19

2.47 The receiver bore, bolt carrier, or hammer requires cleaning.
2.48 The main spring has a broken end which may have jammed the action.
2.481 Remove the broken end. Because the springs are grounded flat at the ends for perpendicular ends, some are thinner than others and will break away a partial coil. This does not diminish the performance of the spring. Instead, it would be preferable to continue to use this spring since it will not repeat this malfunction. Install the spring with the broken end facing front and the flush end to the rear to bear upon the hammer. If it is replaced, designate whether your Vector is back-bottle or external regulator (Thruster) configured. There are different springs for each.
2.482 Rotate the bolt carrier while viewing it from the rear. Look for any eccentricity in rotation of its extension tube. If it is off-center, the bolt carrier must be replace. (SFR)
2.49 The hammer sear pin has broken.

2.5 Jams.

2.51 Paintballs are too large or out of round.
2.52 Debris is interfering with the drop or feed of the ball.
2.53 Extreme rapid shooting. Ball drop rate is insufficient.
2.531 Use a feeder with an agitator.
2.532 Use an elbow with a larger bend diameter.
2.533 Use a zero degree (top, center) feed barrel a opposed to the 45 degree feed. This allows a high ball drop rate. Available at Air Power.
2.54 Barrel mount extension tube projects into ball drop area: Inspect the breech by looking through the barrel feed port. The barrel mount tube should not extend into the area where the ball drops. It may be flush in line with the rear wall of the feed port. Ensure your view is in-line with the wall of the port.

3 Trigger

[DS: 1, 5, 8

3.1 Stiff or immovable.
3.11 Disconnector position is too high on the trigger sear.
3.12 Side cover screws are too tight.
3.13 Corrosion.

3.2 Trigger remains in its rear most position.
Missing or broken trigger spring.

4 Velocity

4.1 Low velocity.

4.11 CO2 source is limited or restricted.
4.111 Low bottle pressure.
4.1111 Tank is nearly empty.
4.1112 Ambient temperatures has the pressure.
4.1113 Intensive shooting has lowered tank temper
atures which have in turn lowered the pressure.
4.1114 A heat shield is in place, such as a neo
preme cover, blocking ambient air from warming the tank.
4.112 Faulty bottle valve. Submit to your local gun-
smith for repair.
4.1121 Retraction of the pin is hindered by
debris, corrosion, or the pin seal has worn or shifted.
4.1122 Height of exposed pin is too low. Sits well
below the flat surface of the end of the valve.

DS: 4a, 4b

4.12 Seat valve hole is not aligned with gas exhaust hole of the adapter.

ABDS: 1, 2, 3

4.13 Cup problem.
4.131 Plastic sealing element worn.
Inspect condition of the seal. If deeply or irregu larly grooved, replace the sealing element or both the element and cup.
4.132 Cup is loose or mis-positioned on valve shaft.
Note: When a cup becomes loose it is possible. for the shaft to be driven back into the cup. Hidden damage may be present on the threads. The flange of the shaft should be flush against the face of the cup.
4.14 Valve shaft damaged.
4.15 Return spring.
Incorrect spring. Spring with internal velocity control has 5.5 coils, whereas the one used with external regula tors such as Thrusters has 8.5 coils.
DS: 1, 5-13, 15-19

4.16 Hammer motion has slowed.
4.161 Hammer cavity has build up of old oil.
4.162 Too heavy of a lubricant being used.
4.163 Little if any lubricant is present.
4.164 Incorrect main spring.
Spring with internal velocity control has 10.8 coils and is 1 3/4 ins (47mm) long. Whereas, the one used with external regulators such as the Thruster has 10.7 coils and is 2 ins (52mm) long.
4.165 Hammer sear pin is out of position and dragging on interior wall of the receiver.
4.17 External regulator (Thruster) in use.
The seal may be worn on the regulator. If a pressure
gauge is available check for controllable output which remains steady after each setting. A bad seal would show a slow rise after each setting or not allow control of the pressure output to change. (SFR)
4.18 Internal velocity control in use (back-bottle config uration): The alignment of velocity piston to the adjust ing screw is incorrect. The rear edge of the piston has to areas which are cut deeper than the rest of the rear surface. The proper alignment requires the adjustment
screw to make contact with the piston in any one of these cut-outs.

4.2 High velocity.

4.21 Liquid CO2 entering gun.
4.211 Bottle directly connected to adapter body and
Vector pointed in a less than 90 degree angle.
4.212 Siphon bottle in use.
4.213 Back bottle set-up in a horizontal angle such as a player in a prone position.
4.214 Rapid shooting has cooled the CO2 system to the point where the liquid can not expand to gas.
4.215 Climatic temperatures are of such that CO2 will not expand into gas from a liquid state.
ABDS: 1, 2, 3

4.22 Loose cup.
Inspect the cup's position in relation to the valve
shaft. Look for exposed threads on the shaft. The cup
should be flush against the flared shoulder of the shaft. If required, reset the cup on the shaft as instructed by [MS: Cup]. Thread damage is possible. When a cup comes off within an internal velocity adjustment setup it is possible for it to be jammed back onto the shaft threads.
4.23 Internal velocity control in use - back-bottle
configuration.
4.231 Velocity adjustment screw missing.
4.232 Velocity piston missing.
4.24 Springs.
The main or return spring could be of the wrong type
regarding the set-up of the Vector.
4.241 Return spring.
Spring with internal velocity control has 5.5 coils. Whereas, the one used with an external regulator such as Thrusters has 8.5 coils.

DS: 1, 5-13

4.242 Main spring.
Spring with internal velocity control has 10.8 coils and is 1 3/4 ins (47mm) long. Whereas, the one used with external regulators such as the Thruster has 10.7 coils and is 2 ins (52mm) long.
4.25 External regulator (Thruster) in use.
The seal may be worn on the regulator. If a pressure
gauge is available check for controllable output which remains steady after each setting. A bad seal would show a slow rise after each setting or not allow control of the pressure output to change. (SFR)

4.3 Erratic velocity

4.31 Springs. See paragraph 4.24.
4.32 Valve cup. See paragraph 4.13.
4.33 External regulator (Thruster) in use. See paragraph 4.25.

4.4 Unalterable velocity

4.41 External regulator (Thruster) in use. See paragraph 4.25.
4.42 Velocity piston. See paragraph 4.23.

4.5 Higher than normal pressure required from an external regulator to achieve acceptable velocities.

See paragraph 4.1 Low Velocity.

5 Gas Leak

5.1 Adapter

5.11 Leaks from the rear where CO2 bottle valve or line fits into adapter.
5.111 Check o-ring on bottle valve, stock connector or line connector. If damaged, check both female and male threads for burrs, disfigurement, or debris
before installing a replacement.
5.112 Top edge of bottle valve, stock connector, or line connector may be damaged. Submit any damaged bottle valve to a competent paintball gun-smith for
repair.
5.113 The pin of the bottle valve is positioned too high above the surface of the valve. Submit bottle to a competent paintball gun-smith for repair.
5.12 Leaks from the seam of the adapter and receiver or from the base of the adapter pin. Check the rear adapter o- ring for damage. [DS: 4a, 4b]. Before installing a
replacement o-ring, inspect the left wall of receiver
cavity. Look for burring around the high pressure block screw holes or the extension of those screws into the
cavity. Such extension is caused by over-torquing.

5.2 Barrel mount-bolt-barrel area.

5.21 Forcefully leaks through the barrel when charging the system. Pull the trigger a few times. If nothing else is wrong, the leak will stop. Refer to the charge up procedures in this guide.
5.22 Low pressure.
5.221 Low quantity of gas in source tank.
5.222 Low temperature (CO2 as the propellent).
5.2221 Low ambient temperature.
5.2222 The temperature of the tank has been reduced by a great deal of rapid shooting.
5.2223 An external regulator is either set too low or not operating properly. See paragraph 4.17.

DS: 4a, 4b

5.23 Valve shaft assembly.
5.231 Valve shaft motion.
Check for uneven motion on the short back and forth action of the valve shaft. If it moves freely go to next paragraph. If not, then lubricate and check again. If still resistive, perform [ABDS 1, 2]. Check for FOD and corro- sion on the shaft and its course within the seat.
ABDS: 1
5.232 Damaged or missing rear valve seat o-ring.
ABDS: 2
5.233 Seat lip may be nicked or chipped.
5.234 Loose or mis-positioned cup.
Inspect the cup's position in relation to the valve shaft. Look for exposed threads on the shaft. The cup should be flush against the flared shoulder of the shaft. If required, reset the cup on the shaft as instructed in [MS: Cup]. It is possible, with an internal velocity adjustment set-up, that the cup may have came off and then jammed back onto the shaft, damaging threads in the process.
5.235 Cup seal (the plastic inlay within the cup.)
5.2351 Cold temperatures can cause a poor seal. Not only does the plastic become harder but the pressure

of the CO2 drops and exerts less force on the cup along the seal. In most cases firing a few shots will enable a seal. If not, try some gun oil on the seal.
5.2352 Worn seal. Inspect condition of the seal. If deeply or irregularly grooved, replace the sealing element or both the element and cup. [MS: Cup].
5.2353 FOD may become imbedded on the seal. Because it can be very small, a good light and magnifying glass would be useful. Carefully try to remove the FOD with a slender pick or pointed tweezers without damaging the surface of the seal.
5.2354 Hard seals: Some elements are too hard at first to allow a proper seal by the seat **Important:** Check for FOD (see paragraph above.) If the results are negative, then fire gun repeatedly to work the seat into the plastic to form a seal. To do this without prior checking for FOD on the seal runs the risk of irreparably fixing the FOD deeper into the seal.

5.3 Trigger area.

(Leaks from the bottom of the receiver in the area of the trigger.)

DS: 1, 2, 4a, 4b

5.31 Forward adapter o-ring damaged.
Before installing a replacement o-ring, inspect the left wall of receiver cavity. Look for burring around the high pressure block screw holes or the extension of those screws into the cavity. Extension such as this is caused by over-torquing.

ABDS: 1, 2

5.32 Seat o-rings damaged.

5.4 Left exterior side of the receiver.

DS: 1, 5-7, 14

5.41 Leaks from around the edges of the high pressure line block. [DS: 1,5,6,7]. Replace o-ring located behind the high pressure block.
5.42 Leaks from the junction of the high pressure line and line block. (SFR). Return either the gun or the high pressure line assembly.

5.5 Foregrip area.

DS: 1, 5

5.51 Leaking stops when the foregrip is removed. Contact by the interior bottom of the foregrip against a plastic line is the initial cause of the leak.
5.511 Gently press upward the brass low pressure outlet lead at the bottom of the regulator. Look for leakage where it is joined. The sealant at the base of the lead can fail. (SFR)
5.512 Check the ends of all plastic lines. Look for splitting or a shallow fit.
5.52 Leaks from where the high pressure line enters the line fitting at the rear of the regulator.
5.521 Check the fitting for looseness. Hand tighten if so. If access is difficult:

DS: 6, 7, 14

5.523 If leaking continues after tightening the fitting, check for FOD underneath it.
5.5231 Unscrew the fitting and remove. Remove from
the fitting three o-rings and two backing rings (spacers).
5.5232 Inspect for and remove any FOD from the
interior of fitting, o-rings, spacers, and female threads of the regulator.
5.53 Leaks from where the low pressure outlet lead is joined to the regulator. (SFR)
5.54 Low pressure plastic line not connected to brass leads.
5.541 Plastic line may have had a shallow attachment to
a brass lead. Reattach and work the line up and over a generous portion of the lead.
5.542 Not enough of the line was placed beyond the end of the lead.
5.543 The line has split ends or has been stretched to
a larger diameter to where it no longer fits tightly.
5.544 The line continuously separates from a lead.
5.5441 Remove forward housing (bonnet) from the
regulator by unscrewing it.
5.5442 Remove regulator spring and piston from the bonnet. The piston should come out with ease.
a. The piston is difficult to remove. (SFR).
(Seven Vectors were made with oversize pistons causing too much pressure to exit the regulator and the lines to come off. This problem would be apparent when the gun is new.
b. Check for and remove debris on the piston
shaft seal (white plastic plug). Check seal's position by pushing it into the shaft. If there is movement of the seal then replace it.
c. Check the condition of the two shaft o-
rings and replace if necessary.
5.55 Leaks from within the regulator [rare event]. Unscrew
the bonnet from the regulator. Remove the piston and check the condition of its two o-rings. Replace if necessary.
5.56 Four way valve. Note: The four-way valve is designed to vent gas from the forward right aperture on top of the manifold. Normally, this is a very low sound. The rate of this venting is approximately an eighth to quarter ounce per hour. In some cases the sound may vary or increase. CO2 liquid or a change of pressure within the system may be the cause. A higher venting rate may indicate a 4-way valve malfunction (SFR). Evidence of this would be lower shots available per tank-full or immoderate weight lost. First, determine that there is no other source of leaks. Fill the tank and attach to the system and weight it. Set aside an weigh it again. Remember the maximum allowable venting rate is 1/4 ounce per hour.

5.561 Check the front, black plastic end cap for
either cracks or looseness (both rare.) A cracked cap should be replaced. If loose, tighten with caution. Over tightening may cause a corner of the cap to crack.
5.562 Leaks from between the manifold (rectangular
silver plate on top) and the valve. (SFR)

6. Safety Switch

DS: 5, 7, 9

6.1 Too difficult to operate.
The safety tension screw may be exerting too much tension on the switch. It is located on the lower front of the receiver body. The four-way valve when installed conceals it. Vary the position of the screw to alter the tension on the switch.

6.2 Too easy to operate.
6.21 The safety tension screw may be exerting too little
tension on the switch. It is located on the lower front of the receiver body. The four-way valve when installed conceals it. Vary the position of the screw to alter the tension on the switch.
6.22 The safety tension spring or ball bearing may be
missing. Remove the tension screw and check for their presence.

7. Fitting of parts.

7.1 Barrel (loose or tight).
The regulator mount has a hole at top center which receives the pin of the barrel lug. By loosening the screw on the non- split side of the mount and then placing the wrench into the head of the other screw you may use the wrench as a lever to turn the regulator mount either CW or CCW. Test fit the barrel to determine if the adjustment has been enough.
7.2 Side cover.
If the side cover is difficult to position onto the receiver block, loosen the screw forward of the trigger guard. Position the side cover and tighten the trigger gaurd back into place.

Appendix 1

Maintenance Hints

Cup
Unscrew the cup from the shaft. If the cup will not turn, breakdown the adhesion of the Loc-tite by applying a flame, such as from a cigarette lighter to the rear of the cup. Do this until it begins to smoke. Remove the cup. Clean and apply a small amount of Loc-Tite retaining compound 680 to the threads of the shaft and screw on another cup and seal using firm torque. Wipe away any excess compound, particularly on the surface of the seal. Allow to set for three hours before exposing the Loc-Tite to CO2 temperatures. Seal alone can be replaced but must be press fitted into the cup. A vice with smooth wall inserts placed within the jaws may suffice for a press.

Trouble Shooting Under Power
The Vector can be operated while the side cover and the foregrip are removed. The action of the hammer can be observed by the motion of the hammer sear. Of course, the pieces of the trigger assembly can be easily viewed along with the motion of the four-way valve pin. To isolate the trigger assembly from any test, remove the two four-way valve screws and allow the valve to hang loosely by its plastic hoses. The valve can be operated by hand by pressing the valve pin in and allowing its spring to push it out.

VR3500 Regulator Installation and Adjustment
The output pressure adjustment for the VR3500 is located underneath the hexed shaped cap which is called the tournament cap. The altering of the output pressure will affect the velocity of the marker. It is not necessary for the regulator to be positioned into the adapter body where it is tight or comes to a stop.

Rather, turn the regulator in until it stops and then back out until the input line is in a non-binding position and the gauge is readable from the right side.
The Vector's ideal pressure input is normally between 450 to 600 psi. For setting the velocity for the first time, start with the adjustment screw at its most outward position. Fairly low pressure will be indicated, usually 400 psi or less. In small increments of 1/4 to 1/2 clockwise turns adjust the setting. Once pressure reached 450 psi began taking samples of ball speed over a chronograph. Discount the first shot after an adjustment. The second will be more reflective of previous adjustment. Continue this until you have reached the desired velocity.

Installation of Internal Velocity Adjustment to the Vector

The following components are required to convert the Vector for internal velocity adjustment:

- Velocity piston
- Screw 13, velocity adjustment
- Spring 08, main
- Spring 12A, return
- 5/64 hex wrench

Perform the following disassembly steps as described in the Vector Owner's Manual:

Steps 1 through 13 of "General Maintenance and Cleaning Disassembly"
Step 1 and 3 of "Adapter Body Disassembly"

The rear of the velocity piston has a flat ("closed") surface with two ports on the rim. The "open" end of this cup shaped component faces toward the front of the Vector. Insert the piston into the adapter body. Align the ports with the two holes at the back of the adapter. Install the adjustment screw into the tapped hole on the right. The screw is to make contact with the piston at a port. Low velocity will be the results if the screw contacts the piston any where else. Install the valve shaft into the seat and place the return spring on the back of the cup. Insert into the adapter and screw the seat into place.
Replace the main spring, pictured on page six in picture thirteen.
For adjustment of velocity refer to the instructions on page 16 of the Vector Owner's Manual.

Push Button Safety Installation For The Vector

Material Required:
Pin, spring, and "push-button" safety (PBS) switch.

1. DS1 Remove barrel
2. DS5 Remove foregrip
3. DS8 Remove side cover
4. DS9 Remove the two four-way valve (FWV) screws
5. DS10 Remove FWV away from the receiver housing.
6. The FWV fits into a recessed area of the receiver housing. On the rear half wall of this area is a set screw. Remove it.
7. Underneath the screw is a spring and ball bearing. Remove them. Do not use this spring with the PBS.
8. Remove the safety switch from the receiver.
9. Install PBS into its receptacle. Note the groove.
10. Install the pin into the hole from which you removed the screw, spring, and bearing.
11. Align the pin and PBS so that the pin will engage with the groove.
12. Install the FWV. It will be the back-stop for the pin.
13. On the interior end of the PBS is a hole. Place the spring which accompanied the PBS into it. The side cover will act as its back-stop.
14. Reassemble Vector.

15. Caution: Whenever the side cover is off, be aware that the PBS spring can slip out of the switch if the housing is held up or turned over. Also be aware of the retention pin whenever the FWV is removed.

Adapter Body O-rings

Removal of the adapter body should be considered only by a maintenance requirement. The o-rings are susceptible to damage if the adapter body is removed soon after gas has been exposed to its o-rings. These o-rings will absorb the gas and increase in their size. If possible, reframe from removing the adapter from the receiver block without first allowing fifteen to twenty minutes to pass. This should be sufficient time to allow for the o-rings to dissipate the gas. If it is necessary to remove the adapter before allowing this much time to elapse, do so gently. Carefully, pull the body out while slowly rotating it back forth in forty-five degree arcs or less. The most critical moments in the life of these rings is when inserting the adapter back into the receiver. Either replace the swollen rings and set them aside to be used later or lubricate with a small amount of oil. In either case, be gentle the insertion of the adapter.

Appendix 2

Charge up Procedure

Appendix 3

Operating Description

The Vector can be operated with the side cover and foregrip removed. This will assist in an understanding of the operation of the system.

Primed Conditions

Gas pressure in the adapter body forces the front of the cup against the seat to create a seal. This pressure is also directed forward by the high pressure line to the regulator and reduced to 100 psi. Exiting the regulator from the bottom rear, the pressure is passed on to the center lead of the manifold. Its two outer outlet leads presents either negative or positive pressure at either end of the pneumatic cylinder.

When pressure is present the gun is ready to cycle. A paintball is in the breech and held in place by the detente spring. This ensures that the next ball stacked above does not have a presence within the core of the breech. The cylinder piston is fully extended out to the rear, placing the bolt and bolt carrier at their most rearward position. The hammer sear is latched to the carrier. The main spring is compressed between the carrier and the hammer. The trigger sear is latched to the trigger valve arm preventing it from moving CCW.

Firing Actions

When the trigger is pulled it rotates CCW causing the disconnector to push against the bottom of the trigger sear. As the trigger sear rotates CW it presents a different posture to the disconnector. The disconnector then slips past the sear and comes to a stop against the disconnector guide pin. The CW motion of the sear causes it to pull away from the top of the valve arm. The arm will rotate CCW because the four way valve pin spring within the valve is pushing the pin to the rear against the arm.

This rearward position (extended) of the four-way valve pin causes a reversal of pressure at each outlet of

the manifold and in turn at each end of the pneumatic cylinder. The cylinder piston moves forward pulling the bolt carrier, slider pin, compressed main spring, hammer and hammer sear. The drive pin pulls the slider and bolt forward which chambers the ball into the bore. As the rear of the hammer sear drags over the hammer sear roller, the sear rotates CCW. This releases its hold on the carrier allowing the main spring to thrust the freed hammer to the rear where it strikes the valve shaft.

When the valve shaft is struck it moves to the rear pushing the cup away from its contact with the seat. This action opens the valve. Gas flows into the rear of the seat and passes upwards into the barrel mount. From there it flows through the mount's extension tube and through the hollowed bolt to impact against the chambered paintball.

Reset Actions

The pressure within the adapter body again forces the cup against the seat shutting off the flow of gas used to propel the ball.

At the forward end of the bolt carrier's stroke, it makes contact with the top of the valve arm and causes it to rotate CW. This motion moves the latching tab of the arm in line with the latching recess of the trigger sear. The sear, no longer blocked by the arm, is pushed CCW by the sear spring causing it to latch to the arm. The trigger spring resets the disconnector and trigger.

The valve arm also pushes forward the valve pin causing a reversal of pressure at each of the manifolds outputs. This causes the cylinder piston to reverse direction to the rear pushing the bolt carrier, slider pin, slider, bolt, and main spring. The main spring pushes against the hammer against the valve shaft. The pressure within the adapter body prevents the shaft from being pushed rearward thus stopping the hammer. Motion of the bolt carrier continues to the rear now causing the main spring to compress. The extension tube on the rear of the carrier acts a guide for the spring compression to prevent buckling which would be unwanted resistance. The hollow within the hammer allows it to accommodate the tube and be positioned closely to the carrier. The hammer sear, at its full CW by the pushing of the sear spring, makes contact with the inclined face of the carrier's latching shoulder. This contact and continued motion of the carrier imparts a CCW motion on the sear until it reaches the peak of the shoulder. Here the shoulder drops away allowing the sear spring to move the sear CW and become latched to the carrier.

The next ball to be chambered is sitting on top of the bolt. When the bolt moves to the rear it passes clear of the ball which drops into the breech. The detent spring prevents the ball from rolling forward which would allow another ball to enter either partially or fully into the breech.

Appendix 4

Glossary

Adapter (body) - PartsBkdn #16

Adapter O-ring - Adapter Body Assy Step 6.

Barrel Feed Port - The extension from the barrel providing the paintball passage-way from the feeder elbow to the breech.

Barrel Lug - Positioned on the bottom center of the barrel.

Barrel Mount Extension Tube - PartsBkdn #4 (left part of barrel mount)

Barrel Mount - PartsBkdn #4

Bolt - PartsBkdn #8

Bolt Carrier - See Assy Step 9a.

Cup - PartsBkdn #13. Cup is attached to the right end of the shaft.

Cup Seal - Plastic inlay within the cup.

Cylinder Piston - Not pictured. Located between pneumatic cylinder and bolt carrier. Moves in and out of cylinder and has carreier attached to its end.

Detente Spring - Locate barrel on page 10. Spring is located at rear of barrel just after the feed tube.

Disconnector - Disassembly Step 12. Pictured at the upper left of the trigger.

Disconnector Guide Pin - Disassembly Step 12. Pictured at the lower left of the disconnector.

Disconnector Plunger Pin - Disassembly Step 12. Located between the disconnector and the trigger. It retracts into the trigger.

Disconnector Plunger Pin Spring - Located underneath the pin within the trigger.

Extension Tube, bolt carrier - Connected to the rear of the bolt carrier. See Assy Step 9a. Tube is within the left end of the spring.

Feed Port - See Barrel Feed Port

Foregrip - PartsBkdn #22.
Four-way Valve - PartsBkdn #17.

Four-way Valve End Plate - Black plastic cover on the front of the valve.

Four-way Valve Pin - Located on the rear of the valve.

Hammer - PartsBkdn #10.

Hammer Sear - Attached to the bottom of the hammer. See PartsBkdn #10.

Hammer Sear Pin - A roll pin attaching the hammer sear to the hammer.

High Pressure Block - PartsBrkdn #3. Located at the right end of the line.

High Pressure Line - The brass tube of PartsBrkdn #3.

High Pressure Line Fitting - Disassembly Step 14. Located at the rear center of the regulator. The front

end of the high pressure line is connected to it.

Line Fitting - See High Pressure Line Fitting.

Low Pressure Line - Plastic lines that interconnect the regulator, 4-way valve, and pneumatic piston.

Main Spring - Located between the bolt carrier and hammer. See spring left of PartsBkdn #10.

Manifold - PartsBkdn #17. Located on top of the 4-way valve.

Pneumatic Cylinder - Underneath PartsBkdn #6 and to the left. It is what the serial number label is attached.

Pneumatic Cylinder Piston Arm - The narrow rod which cycles back and forth from the rear of the pneumatic cylinder. The bolt carrier is attached to it.

Receiver - PartsBrkdn #11.

Receiver Bore - The round cavity passing through the length of the Receiver.

Regulator - PartsBkdn #9. Located under the figure nine.

Regulator Bonnet - The front half of the regulator.

Regulator Exhaust Lead - Disassembly Step 11. The brass lead at the rear bottom of the regulator. Is connected to the 4-way valve by a plastic line.

Regulator Low Pressure Outlet Lead - Assembly Step 9C. At the rear bottom of the regulator a brass tube is attached. In this picture it is positioned over the small finger.

Regulator Mount - Positioned on top of the regulator and at the front of the cylinder. Two screws passing through it from top to bottom allows the regulator to be mounted.

Return Spring - PartsBkdn #14.

Screw, Upper Foregrip - See PartsBkdn #20. The screw would be the one just below the lower tip of the trigger.

Sear Pin - Attaches the hammer sear to the hammer. See PartsBkdn #10.

Sear Roller - Disassembly Step 15. PartsBkdn #20 (located immedi- ately above the trigger.

Seat Lip, Valve - Located at the rear of the seat. The raised area encircling the shaft/gas passage orifice. The portion of the seat which makes contact with the cup seal.

Seat - See Valve Seat.

Side Cover - PartsBkdn #21.

Slider - PartsBkdn #8.

Slider Pin - PartsBkdn #7.

Trigger - PartsBkdn #20.

Trigger Sear - PartsBkdn #19.

Trigger Sear Spring - PartsBkdn #19. Located left of the sear.

Trigger Spring - PartsBkdn #20. Located at the upper right of the trigger.

Trigger Valve Arm - PartsBkdn #18.

Valve Seat - PartsBkdn #12.

Valve Shaft - PartsBkdn #13. On the left under the figure "1" of the number 13. That is the cup attached to the right.