

# Kioti CK 35 3rd Function



## The Sinatra Method 2.0

By Stephen Crook

## Forward

This write-up started as a post on Tractorbynet.com as not so much a “How-To”, but more as a “How I did”. Along the life of the post I made updates as I fixed things I did “less than correct” the first time or things I didn’t get finished in the first write-up. Being an on-line medium, I opted to use a photo hosting site that shall not be named (but they let you put all your **Photos** in one central place, kinda like a **Bucket**) that at some point thereafter decided it would be a good thing for me to pay \$400 a year to host my photos. I disagreed.

Since having a write-up that makes references to pictures that you can’t see anymore is about as helpful as a cookbook without the ingredients, I decided to take everything I had and put it all together in a revised, condensed write-up (with pictures) and publish it in a PDF format so as to be viewable by all and unaffected by picture hosting bandits. So what follows is not an exact copy of the original version but rather a compilation of everything in one new, big spiel. Things I added or re-did after the first write-up will now be included and noted along the way.

So without further ado ...

# Kiote CK 35 3rd Function - The Sinatra Method 2.0

I started out on this project thinking I could do this cheaper than buying the W.R. Long kit. At the end of the day I did come in slightly cheaper in terms of actual dollars spent (I came in even better if you deduct for things I have included in my cost that aren't in the pre-made kit, like hose protector, mounting blocks, etc). But what I learned is that the dollars you save may not offset the sweat you spend & you can't put a price on the learning curve of "On-the-fly" designing. If I had it to do over again there are a few things I would do different but I still think I'd build rather than buy. After all, the experience & knowledge I gained has value too.

Initially I went with NPT fittings almost exclusively thinking it would be the easiest to replace if I ever had an issue going forward. This was before I located a great local hydraulic shop (now my new favorite hydraulic shop) that can make pretty much anything I need. I found said shop because, after the initial assembly, I found out I had an engineering flaw and needed to re-do one of the hydraulic lines (more on this later). This is when I ended up going with JIC fittings for the new line. For the rest of the write-up I have tried to annotate where I would have done things differently had I known then what I know now. Hopefully this makes your life easier.

A short note on terminology before we get into things; I have tried to use the following terms consistently for the remainder of the document when referring to hydraulic plumbing & components.

**Adapter** - any standalone plumbing piece that changes thread/connector type, size, or direction.

**Fitting** - connector that is affixed to the end of the hose in such a fashion as to consider it a portion of the hose.

## The Grip

I opted to use the John Deer grip as well & used the parts list from **Speedex** thread on his 3rd function build here: <http://www.tractorbynet.com/forums/h...ml#post4317876>

Qty	P/N	Desc
2	LVA12162	NUT
*2	37M7356	SCREW
2	37M7355	SCREW
2	21H1486	SCREW
1	LVU16650	GRIP HALF
1	LVU16701	GRIP HALF
1	LVA17501	WIRING HARNESS

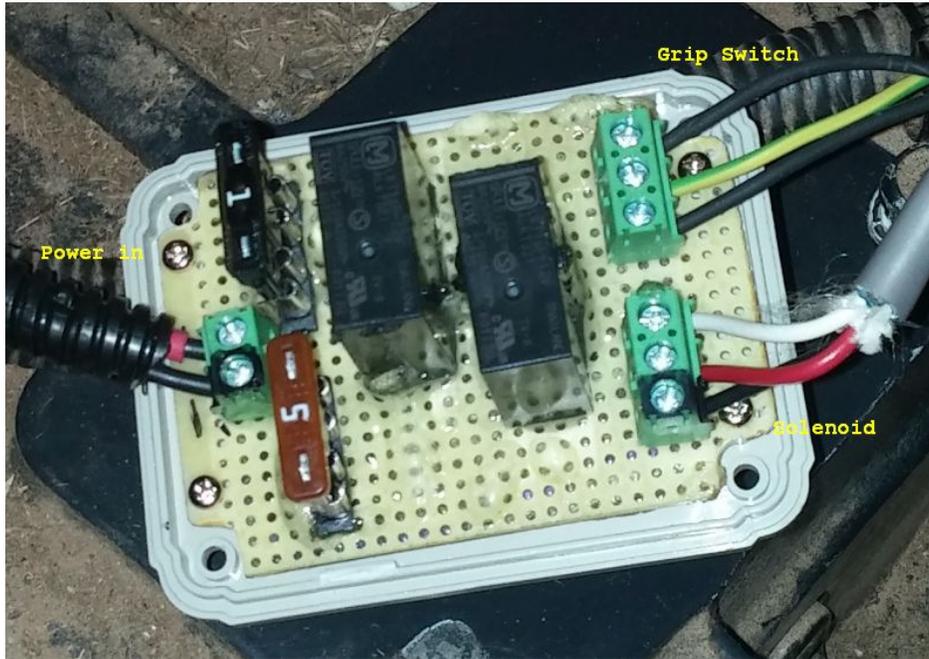
\*Note - not sure if his list is wrong or if the design changed but I ended up with an extra 37M7356 screw that I didn't need.

I bought all my parts from greenfarmparts.com and (with a 5% off discount code I found) the total cost w/ shipping was \$75.38

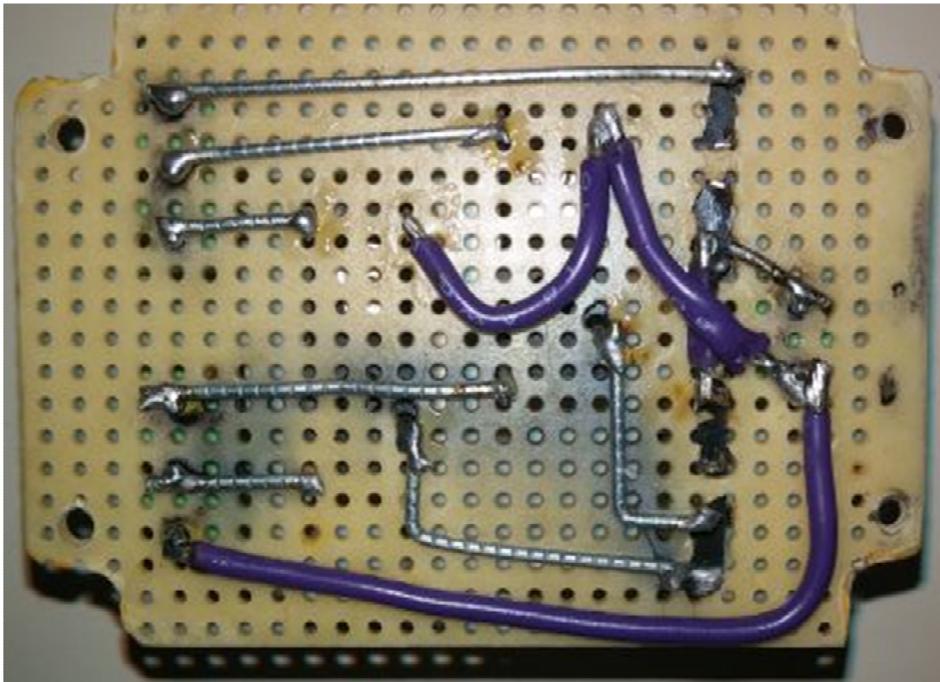


## The Controller Card

As **Speedex** mentioned in his post, the switches in the JD grip will not withstand the high current the solenoid requires. Rather than use standard automotive relays (which push the limits of the switches) I opted to build my own relay module. I purchased all the parts from DigiKey.com for \$16.06 w/ shipping and assembled the card myself. If I had it to do over again, instead of the screw terminals I think I would just install pig tails w/ 2 & 3 pin connectors on them. It would have made the board smaller & easier to layout and installing would have been easier as well. It should be noted that Speedex has been using said automotive relays for several years and reports no problems so consider this part optional.



Not shown here but I covered the back side in epoxy to help insulate & secure all the jumpers.



## The "Idiot Switch"

In a thread started by my father (referenced below under The Infamous Adapters) **countrybumpkin** stated he added a master cut off switch to his set-up to avoid any inadvertent operation of the solenoid when nothing is connected to the 3rd function (thus dead heading the system). We liked the idea so I added one to our set-up also.



Lowes - \$9.00 for weatherproof toggle switch (could have gotten cheaper from digi-key but it was a "need it right now item") Servalite Model #: 884415 - Lowes Item #: 75678

## The Solenoid

I did a fair bit of Google Searching and found this one from Fremont Industrial Supply (fremontindustrialsupply.com) for \$118.43 shipped

D03 hydraulic solenoid valve 4 way 3 position, P open to Tank with ports A & B blocked 12 VOLT DC  
SKU: HD-3C6-G02-LW-F-DC12\*

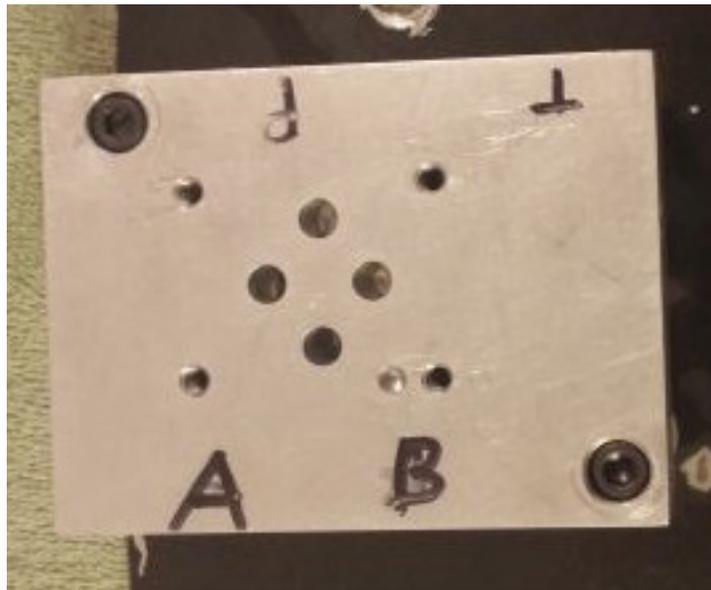


## The Subplate

Here's where things got interesting. Even before we knew exactly where we were going to mount it, we knew space & hose routing was going to be an issue. For that reason I wanted a subplate that had the ports on 2 sides (Side Ported) instead of one with 1 port per side (Perimeter ported)

As you can imagine these were not quite as easy to come by, and once I did find it due to the amount of extra material & machining required to get the ports on 2 sides - it wasn't cheap. I have seen lots of other setups using perimeter ported subplates (which are fairly inexpensive) and then add 3 or 4 fittings per port to get everything routed on the same direction. I figured at the end of the day the extra cost of the subplate was on par with the cost of all the fittings and just looked cleaner.

I found what I wanted at [magnaloy.com](http://magnaloy.com) - D03 Side Ported Subplate. PN: SP-A03P6-1/Z \$71.24 w/ Shipping



I went with 3/8" NPT ports (P6) rather than 1/2" (P8) because P6 was an in stock size and P8 was special order with a 2 week lead time. The actual internal orifices of the plate are significantly smaller than the 3/8" ports and given the very short period of time the fluid passes through here, the overall friction loss is negligible. Therefore I really saw no need for the larger 1/2" ports even though I use 1/2" hose on the P & T side. Whichever you decide, just remember how it will affect your fitting and adapter selections later.

[Tractor Supply](#) - \$3.67 for the Tee Nuts, bolts, and washers for mounting the Subplate

## The Hoses

Here is the scariest part of the project where a small error can cost you several dollars.

I bought all the hoses locally (not from my new favorite hydraulic shop). I expected local to be higher than mail order & in hind sight probably should have shopped around a bit more (might have found my favorite shop a lot sooner). I am trying to avoid the feeling I got "taken" but I think I got taken.

\$362.59 total (w/ tax) for the following (all Parker Branded and all w/ hose protection installed)

From the Loader Valve Power Beyond port to the P port on the subplate.

(1) 24" long 1/2" hose w/ 1/2" NPT Male 90 deg elbow swivel on one end and 3/8" NPT Male swivel on the other (\$53).

**This is the line that I had to later replace that prompted me to switch to JIC fittings**

From the T port on the Subplate to the 3PT / Rear Bulkhead

(1) 24" long 1/2" hose w/ 1/2" NPT Male on one end and 3/8" NPT Male swivel on the other (\$35.63)

**For the JIC option use straight 1/2" JIC fittings on both ends.**

I went with 1/2" on those two hoses because that was roughly the same size at the hard line I was replacing & because these lines see full constant flow of the hydraulic system to the rear of the tractor, however I have read some people have used 3/8" hose instead. For me the slight extra cost was worth peace of mind knowing I wasn't restricting anything or heating up the fluid unnecessarily with extra friction loss.

From the A and B ports on the subplate to the quick disconnects on the loader tower.

(1 ea) 76" & 74" long 3/8" hose with 3/8" NPT Male 90 deg swivel on one end and 3/8" JIC Female 45 deg elbow on the other (76" was \$72.85 and 74" was \$71.98)

On these you have to be cautious of the orientation of the fittings when they are crimped. With the 90 deg NPT pointing **LEFT** and the hose coming **TOWARD** you, the 45 deg JIC fitting should point **DOWN**. This gives the correct angle at the loader tower once the hoses are attached to the subplate and routed.

**Coming off the subplate you're going to have to make some 90 deg turns somehow to route all the hoses. Although the P port to the rear of the tractor you might get by without a turn depending on your hose routing**

**For the total JIC solution you have a couple options for fittings / adapters on the subplate end (both have a 45 deg angled fitting on the loader tower end.):**

- 1) Using a 90 deg angled adapter on the subplate and a straight fitting on the hoses. This method alleviates the orientation issue mentioned in the NPT solution because the whole hose is allowed to rotate until the 45 deg JIC fitting on the opposite end is in the correct alignment & then tightened. However the 90deg adapter itself can only be oriented for hose routing based on how far you screw it into the subplate.**
- 2) Using a straight adapter on the subplate and a 90 deg angled fitting on the hose allows you to snug the adapter and then rotate the fitting as needed to route the hose but now the same orientation issue**

between the two hose ends as the NPT solution applies. Also this might end up sticking out from the subplate a little farther so watch your clearances.

Either way you will still need (2) 3/8" JIC Male to 3/8" NPT Male adapters (\$1.92 each) for the 45 deg JIC end to the Quick Couplers on the loader tower.

From the loader tower to the front bulkhead on the loader cross bar.

(2) 88" long 3/8" hose with 3/8" NPT Male on both ends (\$53.52 each)

The quick couplers and fittings at both ends already have NPT threads so no point in making these hoses JIC. It just adds extra adapters you don't really need.

### The Infamous Adapters

Boy was this ever the biggest part of the learning curve ever - mostly due to my own stubbornness.

On the CK35 (and others in the series I presume) there is a hard line from the Power Beyond port on the loader valve to the rear 3pt lift. This line has Banjo style fittings on both ends. I didn't want to have the tractor down for a day (or longer) to actually pull one of the bolts and take it around to see what it was (and always trying to save a buck I wanted to order online). You can follow the hijinks if this adventure on Dad's thread here if you're really bored. <http://www.tractorbynet.com/forums/k...-function.html>

Cliff Notes version - this thread is a Metric M18 x 1.5 which will require an adapter fitting to your favorite flavor of threads.

For the NPT version use either of these for both the loader valve and the 3PT / Rear bulkhead ends and get NPT fittings on your hoses (depending on what size hose you choose to go with).

M18x1.5 Metric Male x 1/2" NPTF Female DiscountHydraulicHose.com - 9235-18-08	M18x1.5 Metric Male x 3/8" NPTF Female DiscountHydraulicHose.com - 9235-18-06
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If you want to go the JIC route you'll need:

For the loader valve end

(1) 1/2" JIC Male x M18x1.5 Metric Male Adj. 90 deg  
DiscountHydraulicHose.com - 9069-08-18

For the 3PT / Rear bulkhead end

(1) 1/2" JIC Male x M18x1.5 Metric Male w/ seal  
DiscountHydraulicHose.com - 9068-08-18

For the subplate P and T ports (Using 1/2" hose – your choice of straight or 90 deg adapter)

(2) 1/2" JIC Male x 3/8" NPTF Male (Straight) DiscountHydraulicHose.com - 2404-08-06	(2) 1/2" JIC Male x 3/8" NPTF Male Pipe 90 deg DiscountHydraulicHose.com - 2501-08-06
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For the subplate A and B ports (Using 3/8" hose – your choice of straight or 90 deg adapter)

(2) 3/8" JIC Male x 3/8" NPTF Male (Straight) DiscountHydraulicHose.com - 2404-06-06	(2) 3/8" JIC Male x 3/8" NPTF Male Pipe 90 deg DiscountHydraulicHose.com - 2501-06-06
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### **Misc Hardware and fittings**

All from discounthydraulicchase.com (\$82.45 w/ shipping and after deducting for wrong BSP fittings that were sent back)

(1) 3AGF3-AG3F3 | Set of 3/8" Couplers with 3/8" NPTF Threads - \$13.58

- Standard Ag couplers for bulkhead on loader

(4) 5409-06 | 3/8" NPTF Hex Socket Plug - \$0.88

- Just bought these to help keep crud out of the subplate during fabrication, not \*needed\* and probably could have just used painters tape

(2) 5502-06-06 | 3/8" Male NPTF x 3/8" Female NPTF 90 Deg - \$5.30

- 90 deg fittings for bulkhead mount

(2) 600-06-06S | Set of 3/8" Hydraulic Quick Disconnects (Steel) - \$37.20

- These match the Kioti factory disconnects at the loader tower. Used these for interoperability. Could substitute something cheaper.

(3) BE-T3075 | Twin Support Clamp, OD = 0.750" - \$11.19

- Hose clamps for loader arm

### **The Fabrication & Assembly process**

The factory grip knob is molded on. Take a razor knife and split it as deep as you can along the seam front & back, then peel it open.



Next grind the sides of the flat to be the same width as the rest of the shaft and the JD grip will drop right over it. The top hole of the grip lines up with the existing hole and all you need to do is drill a new second hole. It's still a slight bit "wobbly" and I may go back and add a piece of rubber tubing as a bushing but it's really not noticeable when you're working.



Once I was done here I ran the wires down the stick and (rather than mess with the inner workings of the base) I routed the wires under the 3pt & rear remote control cover by milling a small notch in it with the dremel tool (I did remove it for this). I was planning on wrapping the wiring and the stick in one big piece of split loom but I didn't have any w/ large enough diameter.



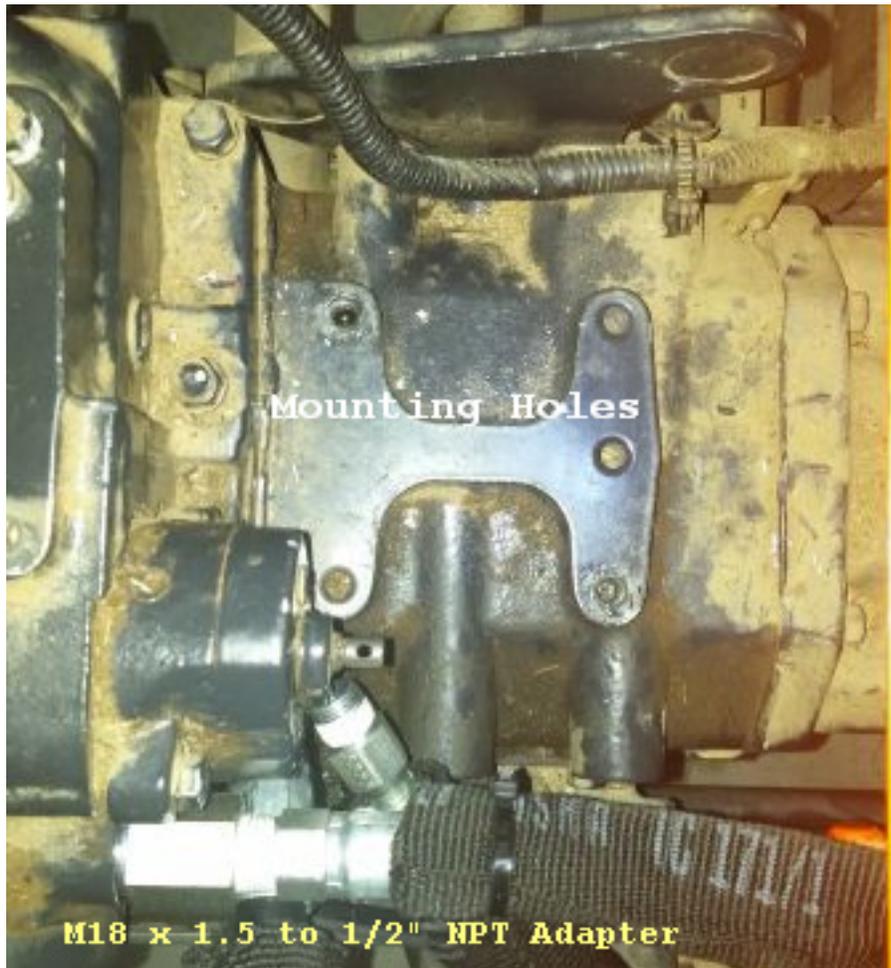
From here I pulled power for the circuit board from the Customer Use connector talked about in this thread. [www.tractorbynet.com/forums/kioti-owning-operating/162860-customer-use-fuse-ck27-where.html](http://www.tractorbynet.com/forums/kioti-owning-operating/162860-customer-use-fuse-ck27-where.html)

I cut off the connector and spliced in to the wires. The 12V + sided runs over to the "idiot switch" and back then along with the ground wire over to the controller box. Everything is enclosed in 1/4" wire loom.



Now we need a place to mount the solenoid & subplate.

I already knew I wanted someplace protected and had ruled out mounting under the tractor near the loader valve already, but once the solenoid & subplate arrived I knew I was going to need a lot of space. SO... off came the seat. I still think that the bracket holding the hydraulic filter would have been a good location but honestly we just don't have the "heavy duty" tools one would need to drill into steel that thick (not to mention how much more disassembly would be needed to gain good access to that area) - so we opted to use the space on top of the transmission housing.



We ended up using the existing threaded holes already in the housing and fabricated a metal mounting plate for the subplate & solenoid to set on. The initial plan was for the subplate to sit directly on this plate but (as you will see) it ended up needing to be spaced up a bit. This means our initial mounting plate is too thin & allows too much flexing so we are in the process of fabricating a thicker one.

I didn't think to get this shot until after a lot of work had started so if you look you can see the Metric to NPT adapter & hose already in for the 3pt side. More on this guy later, but since we're already talking about the adapters, lets jump over to the loader valve and install the one there next.

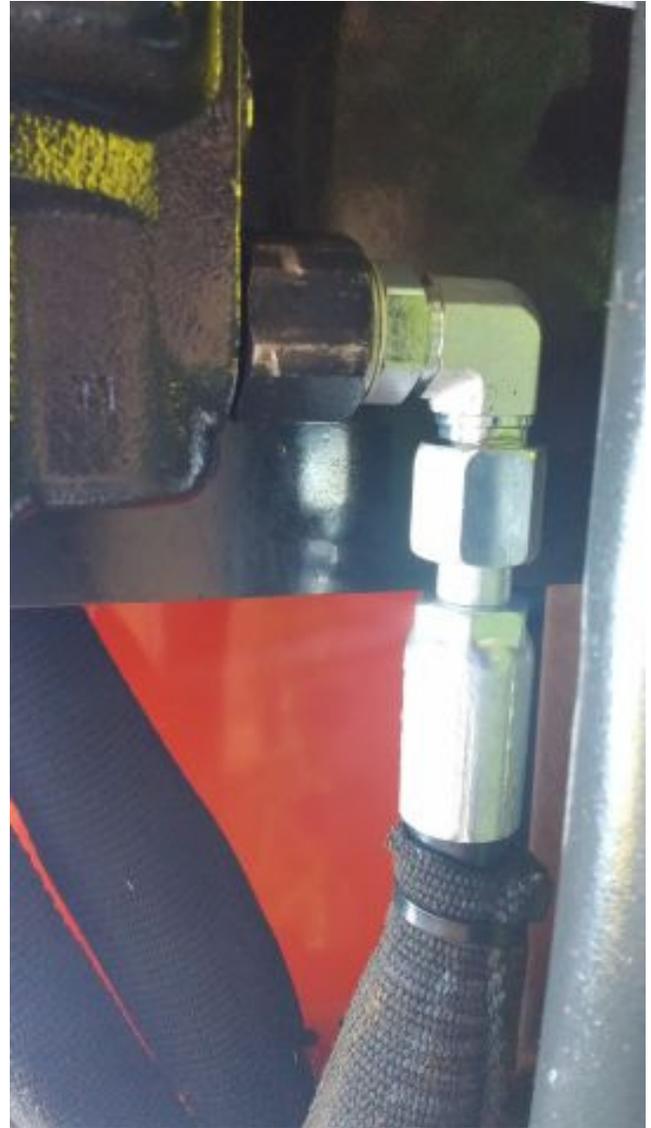
I went with the adapter and a 1/2" NPT 90 Deg swivel fitting on this end of the hose. In case you can't tell from the picture, it's tight in there. Very very tight in there. I ended up installing the adapter into the loader valve and then I pulled the three bolts holding it to the mount loose so I could wiggle the valve out ever so slightly to allow the swivel fitting to squeeze in and line up. Once everything is tightened up there is just enough clearance to keep anything from rubbing but a little re-design in this area could be a good thing.

Here is where I ended up switching over to the 90 Degree Metric to JIC fitting. As you can hopefully see in the picture on the right, it made a great deal of difference and was also much easier to install. It's hard to see due to the different angles but the Grey/Black fitting the hose is connected to on the right IS present on the left as well.

M18 x 1.5 to 1/2" NPT Adapter and  
1/2" 90 dev NPT Swivel

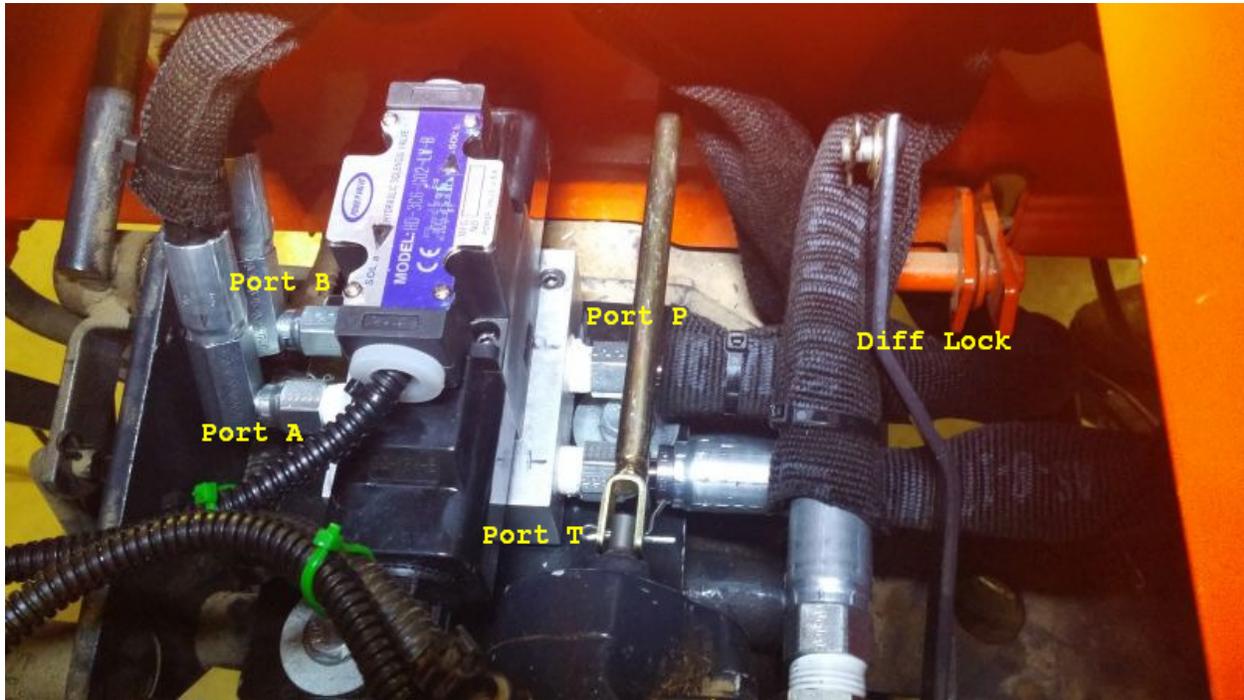


M18 x 1.5 to 1/2" JIC 90 deg Adapter and  
1/2" JIC Fitting



The other end isn't much to write home about so I didn't get a picture. It's a 3/8" NPT to 1/2" JIC 45 deg elbow into the P port of the block. The only "cool" trick I did was bought the hose 3' long and only had them crimp ONE end. I took it home & fit everything and THEN marked where to cut / crimp the other end. (Have I mentioned this is my new favorite hydraulic store? And it's less than 5 minutes from where I work!! Bonus!)

Ok - time to play let's connect the hoses. Here's where the learning curve gets steep.

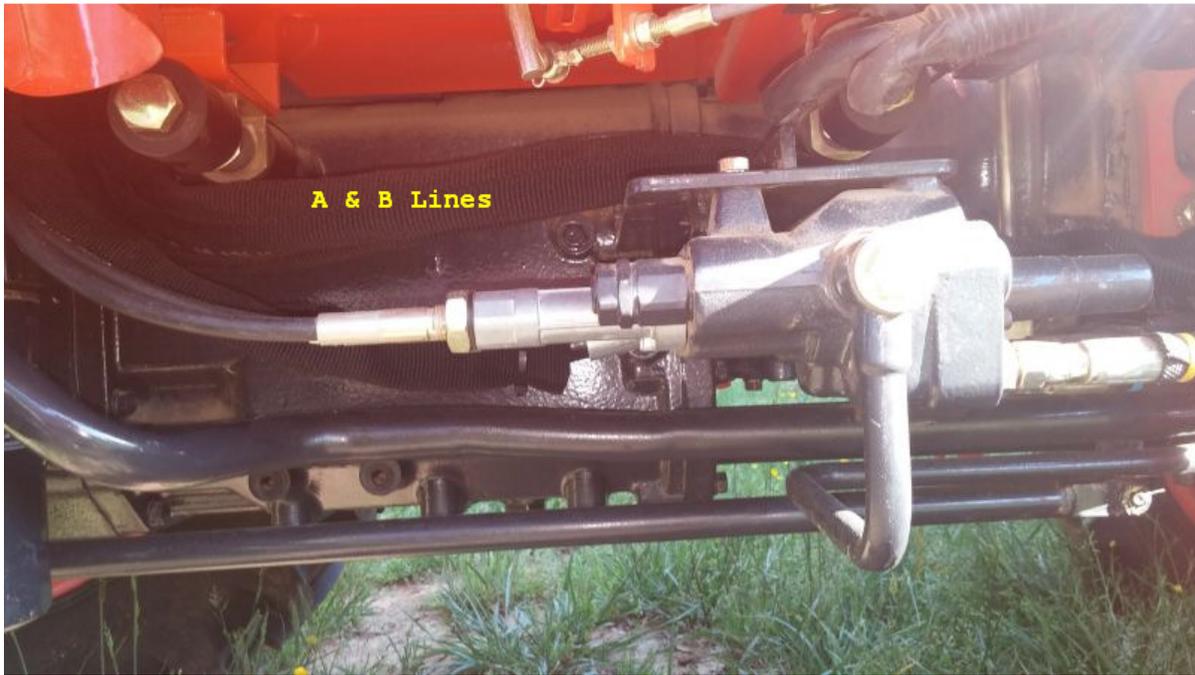


This is a view from the rear of the tractor looking forward. Just so we all have our bearings, the left side of the subplate is the A (rear) and B (front) ports and the right side is the T (rear) and P (front) ports. If you can't tell (or aren't familiar with the model) the Diff lock linkage is disconnected from the pedal because it's in the way of the hose from the loader valve to the P port.

Next the line from the T port to the 3pt connection. If you opt to follow this, take my advice and at a minimum put a swivel on the 1/2" end. **If I had used JIC fittings and the related Metric & NPT Adapters then a swivel isn't needed and the hose assembly gets cheaper.** Also with a little more time & engineering this could be replaced by a hard line but without being able to fabricate on site or transport the tractor to a shop - I didn't want to even begin to attempt this via trial & error. So I ended up using the "clover leaf" method.

Next the A & B lines. The 90 deg swivels on this end made life a LOT easier. The hoses just make a quick up and over and right back out along the side of the tractor. **Again if I had gone JIC here this would have been cleaner, easier, and probably cheaper.**

Here they are running over the loader valve and then they follow the existing lines up the loader tower.



They are zip tied in for now. I went with JIC on this end because the ultimate plan is to fabricate a new plate that will hold all 6 disconnects and the 45 JIC made the cleanest bend & mimicked what was already in place. Also I used the same disconnects here to match the kioti factory ones.



The hoses running up the loader arms are a tad long but it's easier to cut & re-crimp than it is to stretch so I allowed extra when I measured. Once we get the other hoses mounted in place I'll have these re-done.

So obviously I wasn't very thrilled with just having these disconnects at the loader tower just hanging in space or zip tied to the existing hoses so I set forth on a mini side project - Make a new bracket. Now our sheet metal working tools consist of a vice, a big hammer, a grinder, and a welder so I figured I should let a pro handle this one.

I talked to 2 different shops and both wanted > \$100 to fabricate a whole new bracket. Obviously if I wanted like a thousand of them, the per unit price would go down but I wasn't really ready to corner the market on these just yet.

The second shop (which is now my new favorite fabricators shop) the guy & I discussed cheaper options. Conversation went kind of like this:

Guy: Why don't you just weld a piece on the side and punch 2 more holes in it?

Me: [Thinking - if I could do that I wouldn't be here.] How much would that run me?

Guy: I'd probably have to get at least \$35

Me: Can you have it ready by Friday?

Friends let me just tell you, for \$35 the finished product was NOT what I expected. I expected the old bracket with a big ole weld down it and a square piece of discolored grey metal sticking off the side with a couple holes in it.

This is what I got instead.



Welded, ground, holes punched, corners radiused, and the entire thing primed for paint (I had said something about painting it when we talked before so he primed it for me too. Did I mention this is my new favorite fabrication shop? )

A little quick love with a rattle can and re-mount all the fittings and re-connect all the hoses...

And re-connect all the couplings and presto!



As a refresher, this is what it looked like before.



I was also going to shorten & re-crimp the hoses going up the loader arm but they really don't look that bad so I don't think I'm going to go through the trouble of taking them off and unhooking everything.

So what about the other ends? The ends where the magic happens?

Well the lines just follow the existing hoses and are zip-tied in place for now. I had planned on mounting hose clamp blocks on the loader arm but after looking again I don't think I'm going to bother. I know zip-ties don't have a great lifespan in the sun so I'll probably replace them with universal hose clamps at some point and call it a day.

As for the bulkhead...A couple 3/8" elbows, some washers, a set of standard 3/8" Ag couplers, and a couple pieces of scrap metal and ..viola Bulkhead.



Even after this revision I'm still chasing the "better bungee system". I'm now looking at mounting one of the spring loaded hose savers to the grapple but I have a couple other bungee tricks I want to try before I finally break down and do that.

Well I know this was a pretty tedious write up. I wasn't intending for it to be step by step instructions but I wanted to share more than just a couple quick snaps. Hopefully this will help the next person that's on the fence and afraid to "do it yourself" and my learning curve will make things a little easier.

I want to thank the many members of TractorByNet.com for their help & advice along the way along with my favorite hydraulic shop **Roanoke Hose & Fittings Inc.** and my new favorite machine shop **Willis Welding & Machine Company Inc.** both of whom gave me great advice and were patient with all my dumb questions along the way.