Planning Your Power Workholding System . . .

Successful power workholding does not just happen. Like any other manufacturing process, it must be carefully planned. That does not mean that you need to be a hydraulics engineer to implement a power workholding system. Designing a system involves common-sense application of a few basic workholding concepts and a basic understanding of fixtures.

Applications for power workholding fall into two categories: Retrofits to replace and upgrade clamping on existing fixtures and New Fixtures designed from the outset with power workholding. In both cases it is imperative that you keep in mind the forces that can be generated by power workholding devices. A single device, small enough to hold in your hand, can generate five tons of clamping force. If you are replacing existing manual bolt and nut clamping or toggle clamps, make sure that the fixture or machine tool base will withstand the forces. Don’t risk damaging a machine bed because you tried to tie a 10,000 pound clamp into a T-slot that would only withstand 5,000 pounds of force.

Using power workholding does not in any way invalidate the principles of sound fixture design. The 3-2-1 concept, as it relates to the location of the workpiece in three planes, is just as applicable when using power workholding devices as when using manual methods.

Workholding devices should be positioned in such a way as to ensure firm contact between the workpiece and locating buttons, pins, or surfaces. Begin the planning process by asking yourself the following:

- What do you want your system to accomplish?
- What sort of operation will use this system?
- What clamping “speed” is appropriate for the speed at which your production line runs?

You should select “realistic” cycle times. The shorter the cycle time, the larger the power source required. For example, a pump with a 1/3 HP electric motor may be satisfactory to reach clamping pressure on a given system in three seconds. However, to accomplish the same task in one second may require a pump with a 1 HP electric motor, at a considerable increase in both initial expense and operating costs. So before you specify “instantaneous” cycling, be sure the increased clamping speed is really worth the higher costs for your particular installation. Ask yourself if you can productively utilize the seconds saved.

With this in mind, let’s proceed step-by-step through a plan of attack for designing your system.

For information on workholding product used in Metric applications, call your Vektek Customer Support Specialists and request our Metric Hydraulic catalog.
Planning

Steps 1-13

Step 1:
First, determine the nature of the operation to be performed, the number of parts to be processed per cycle and whether operations are performed on more than one surface of each part. Also determine the time that should be allowed for part loading, unloading and clamping.

Consult your machine tool file to determine the available work space on the machine table, bed, or other surface, as applicable. Be sure that the space available will accommodate the part or quantity of parts to be processed according to your manufacturing workflow. If space is not available, revise your plan.

In the initial phases of system planning, include adequate measures and devices to ensure the safety of workers and equipment. For more information, see the Safety section on the back inside cover of this catalog.

Step 2:
Prepare an outline of the sequence of events that are taking place during the manufacturing cycle. This will assist you in determining the number of sequence valves that you might need and any external control (such as a tie-in with machine controls) that your application may require.

Step 3:
Determine the cutting forces generated in the machining process and note the direction that these forces tend to act on the workpiece. It is recommended that cutter forces be calculated as a precaution to ensure that workholding devices are sized and positioned to provide adequate holding. The operation manuals of many machine tools contain tables that list machining forces or simple formulas for calculating these forces. If you are planning a retrofit of a manual clamping system, the torque values of your current application may be helpful in determining how much clamp force you are already using. If you can’t find the information, give us a call. We’ll be glad to get you started.

Step 4:
Plan your fixture(s) with positive fixed stops to resist the majority of cutting forces and to ensure correct location of the workpiece using the primary part locating features.

Step 5: (Optional)
Thanks to the two-stage design of VektorFlo® hydraulic power sources, the low-pressure high-flow first stage will move clamping devices into position around the workpiece and generate sufficient force to settle the workpiece against fixture stops before high pressure clamping forces are generated. Additionally, the nature of the fixture itself will ensure that the part is located closely enough to eliminate the need for positioning devices as a separate fixture element. However, consideration should be given to the need to overcome weight and positioning friction.

Step 6:
After you have determined the machine cutting forces, assess the clamping force required to hold the workpiece.

Step 7:
Determine where clamps should contact the part to hold or support it securely and avoid interference with machine operations. If clamps cannot be located to avoid interference with manufacturing operations, it will be necessary to use an external control device to move the clamps out of the way during the manufacturing sequence. This will require additional valves to control the offending devices separately.

Step 8:
Determine the type and number of workholding devices you need based on the total clamping force required and clamping positions you have selected.

Step 9:
To help determine the capacity of the power source, you will need the total oil displacement requirements for the devices you have selected. Then choose a power source with equal or greater capacity and determine if it operates the system within your clamping time constraints by completing the “Calculate the Approximate Clamping Time of a Fixture” worksheet.

Step 10:
Select valves and other control components to accomplish the sequence of operations you outlined in Step 2. See the valve sections of this catalog for guidance.

Step 11:
Select appropriate safety control mechanisms for your fixture. All VektorFlo® electrical power modules have a hydraulic pressure switch as standard equipment to ensure that consistent forces are maintained at all times. However, when a power source is used to power several separate individual systems, each system should also have its own pressure monitor.

Step 12:
Finally, select the plumbing components required to connect the power source to the valves and devices. Simply review your system specifications and layout to determine what you need in terms of fittings, sizes and lengths.

Step 13:
Call us for help. Our application engineers do not design fixtures. Their job is to help you use hydraulic clamps successfully. Whether you are retrofitting existing fixtures, need a concept idea for clamping a new part or want a quick review of your design, we are here to help.

Call
800-992-0236
(Toll Free)
Or E-mail us at sales@vektek.com
for everything you need in power clamping.

Discover how easy, economical and efficient power clamping can be — with one toll free call. We’ll be glad to answer your questions, provide concepts or advice and give you a quote.

Please visit us at www.vektek.com to download our most current CAD files.
Calculate the Approximate Clamping Time of a Fixture

1. Anticipated system operating pressure = ________________ (psig)

2. For each non-sequenced branch of a system:
   A. [Effective area per device __________ (in²)] x [stroke used __________ (in)] = ________________ (in³)
   B. Total number of devices = ________________
   C. Multiply line (2-A) x (2-B) = ________________ (in³)
   D. Repeat steps (2-A) thru (2-C) for each different device and/or stroke length: = ________________ (in³)
   E. Total non-sequenced volume = lines (2-C) + (2-D) = ________________ (in³)

3. First stage pump flow rate (faster - in³/min, lower pressure) from the corresponding pump specifications page or Vektek catalog = ________________ (in³/min)

4. Approximate time to achieve low pressure function = [line (2-E) ÷ line (3)] x (60) = ________________ (seconds)

5. For each circuit branch with a sequence valve [if no sequence valves are used, skip to line (5-J) and enter -0-]:
   F. [Effective area per device __________ (in²)] x [stroke used __________ (in)] = ________________ (in³)
   G. Total number of devices = ________________
   H. Multiply line (5-F) x (5-G) = ________________ (in³)
   I. Repeat steps (5-F) thru (5-H) for each different device and/or stroke length: = ________________ (in³)
   J. Total sequenced volume = line (5-H) + (5-I) = ________________ (in³)

6. Estimate the approximate accumulator volume (if no accumulator is used, enter -0-) = .0007 x system pressure ________________ (in³)
   K. 10-1016-XX ≈ .00065 x ________________ (system pres.)
   L. 10-1014-XX ≈ .00200 x ________________ (system pres.)

7. Estimate the approximate flex hose expansion volume (*below) from the Vektek or supplier catalog:
   M. Flex hose expansion volume (in³ / ft.) = ________________ (in³)
   N. Total length of hose used (feet) = ________________
   O. Multiply line (7-M) x (7-N) = ________________ (in³)
   P. Repeat steps (7-M) thru (7-O) for each different sized hose = ________________ (in³)
   Q. Total expansion volume for flex hoses = line (7-O) + (7-P) = ________________ (in³)

8. Low flow volume of devices in the system = line (5-J) + line (6K or 6L) + line (7-Q) = ________________ (in³)

9. Estimate the anticipated volume of oil in the plumbing lines of the system:
   R. Steel tubing: 1/4” O.D. x .049” wall = (.218 in³ / ft) x (______ ft) = ________________ (in³)
   S. Steel tubing: 3/8” O.D. x .065” wall = (.566 in³ / ft) x (______ ft) = ________________ (in³)
   T. Flexible Hose: 5/64” I.D. = .058 in³ / ft) x (______ ft) = ________________ (in³)
   U. Flexible Hose: 3/16” I.D. = .331 in³ / ft) x (______ ft) = ________________ (in³)
   V. Flexible Hose: 3/8” I.D. = (1.325 in³ / ft) x (______ ft) = ________________ (in³)
   W. Total of lines (9-R) thru (9-V) = ________________ (in³)

10. Approximate total fluid volume = lines (2-E) + (5-J) + (6K or 6L) + (7-Q) + (9-W) = ________________ (in³)

11. Approximate fluid compression factor = [line (10) x line (1)] ÷ 250,000] = ________________ (in³)

12. Second stage pump flow rate (slower - in³/min, higher pressure) from the corresponding pump specifications page or Vektek catalog: = ________________ (in³/min)

13. Approximate time to achieve high pressure function = [line (8) + line (11)] ÷ 12 x 60 = ________________ (seconds)

14. Estimated position and clamp time {** below} = line (4) + line (13) + 1.25 (motor control performance factor for on demand pumps such as Vektek offers) = ________________ (seconds)

Notes:
* Values listed in this chart are approximate for VektorFlo® hoses. Not all manufacturers provide this information, therefore, some logical assumptions must be made to accommodate additional volume needed (you may assign 10% of the value of our Ø 3/16” hose for use of our Ø 5/64” hose).
  Consult your individual supplier if using hoses not supplied by Vektek (may be as much as 2 times the volume of Vektek hoses).
** Flow rates will be additionally influenced by the style and number of fittings, control valves, specialty valves, manifolds, hose connectors and quick connects. Final positioning and clamping time can vary slightly from the above calculated times due to actual physical plumbing installation.
Planning

Frequently Asked Questions

This list of questions was developed by listening to customers just like you when they asked, “Why didn’t I know that?” Before you order devices, build your fixture or even consider your design complete, we suggest you run through this checklist to check for some common problems.

Should I use or at least consider using double acting cylinders?

Double acting cylinders will assure full cylinder retraction on a timely basis even in systems where restrictions such as small orifices or long tubing runs have been introduced. The use of double acting cylinders is especially important if “return” time is critical (as in some CNC systems). We also recommend use of double acting cylinders in systems operating below 800 psi.

Note: Minimum operating pressure for Vektek single acting devices is 750 psi and for double acting devices is 500 psi.

If single acting cylinders must be used: Have I reduced the number of fittings (orifices), length of tubing and restrictions as much as possible? Are all of these properly sized?

Some fittings and hoses which are locally available (not from Vektek) have extremely small orifices which restrict flow. The use of 1/8 or similar size fittings can have this effect on a system. This restriction is even more pronounced when introduced at a main feed line. This can happen with some fittings and many hoses.

Excessive tubing length can create a “column” of oil which is very long. Friction created by moving oil through tubing and hose will slow response times because of the inertia of the column of oil and increased backpressure of returning oil. If single acting springs are all of the column of oil and increased backpressure will slow response times because of the inertia created by moving oil through tubing and hose “column” of oil which is very long. Friction happen with some fittings and many hoses.

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How do I tell if my plumbing is free of obstructions and contaminants?

Tubing must always be flushed after cutting. Even if not cut in your shop, it was cut before it came to you. Chips, burrs, dirt and other contaminants have collected inside your tubing and drilled passages. These contaminants can cut device seals, damage valve sealing surfaces, cause erratic operation and reduce service life if not cleaned prior to fixture start up.

The use of improper fittings can also cause obstructions and restrictions. Some people have adopted fittings which they had to use in SAE ports. Yes, the threads are the same on SAE and JIC flare fittings. The body length may be different. In one case the use of JIC fittings in an SAE port made a metal-to-metal seal at the bottom of the device inlet port. Obviously the “clamps didn’t work.” Be sure you haven’t created obstructions by using non-standard parts.

Is my pump of appropriate size? It is rated for gpm, or cu. in. per minute.

For most normal size fixtures, a pump rated in gpm (gallons per minute) is not recommended. If your pump is rated much more than 1 gpm, call us; we’d rather give you sound advice now than have you damage your clamps. Be sure that you do not exceed the recommended flow rates for your system. If you aren’t sure, ask us.

My pump runs continuously. Is it the right type of pump?

Call us. It can often be made to work. Some modifications will probably be necessary. If you have a VektorFlo® pump which runs continuously, call us immediately (they are not set up to run continuously).

I’ve been using a dump pump (builds to pressure, shuts off and releases pressure automatically). Is this pump suitable for hydraulic workholding components?

It can be. It will work if the circuitry is properly designed. It may require special circuit modifications or a special pallet decoupler to work properly.

I want to make a cut directly against (into) a clamp. Is this possible?

Yes, but it will require special design considerations. We encourage that cutter forces always be directed toward a fixed stop. A fixed stop is designed to prevent part movement. A clamp is designed to position and force a part against a fixed stop. In order to machine “into” a clamp, the clamp must be sufficiently sized to resist all cutter and machine forces or the part will tend to shift.

When I use a dial indicator on my part, it bends when it is clamped. Why?

Clamps should be positioned directly opposite a fixed locator, hydraulic support or other supporting element. This element may be a part of the fixture, a solid portion of a rigid part or a properly sized floating locator such as a hydraulic work support. If your clamp is putting force into your part which is not transmitted directly into a solid stop, it may distort the part. Clamping on draft angles or “mushrooming” the part with excessive force can also cause part distortion.

Send us a print of your fixture design; we’ll be pleased to evaluate it and make suggestions.

I hold all four corners of my part on solid locators. When unclamped, it seems to “spring” back into a different shape. Why?

First, holding all four locating points in exactly the same plane on your fixture is virtually impossible. (See your favorite text on fixture design for an explanation of 3-2-1 principles.)

Second, because your part can’t have all four of these points in the same plane, your part is distorting when clamped. Other factors such as stress relief may cause the part to change its “free” shape after machining.

My pump turns on and off approximately every 3-5 seconds. Why?

There could be several causes. A “spool” valve when used with a demand pump will cause it to turn on and off as its internal leakage bleeds off pressure. Use of spool valves voids warranties on VektorFlo® pumps. We suggest the use of “zero leak” poppet or shear seal type valves (see Section N).

Industrial type double acting cylinders (even high quality ones are not designed for clamping) can have significant leakage across their internal seals. This leakage will not normally be externally visible. Internal leaks from one side of the piston to the other cause pumps to cycle excessively.

NOTE: These cylinders should be avoided in all palletized applications as they may cause pressure loss or backpressure quick disconnects.
All leaks at fittings, seals or other typical leak points will eventually cause a pump to cycle. If your VektorFlo® pump cycles more often than you feel appropriate (more than once per minute without a valve being shifted), call us. We will gladly offer advice.

I want to limit the pressure into a sequenced hydraulic circuit. Which valve do I install first?

We recommend that you avoid putting one special function valve behind another if possible. If you must, put the pressure limiting valve after the sequence valve. This avoids the limiting valve being shut off before the sequenced circuit is fully actuated.

I want several sequenced operations to happen on my fixture. Can I put three or four sequence valves in series?

We do not recommend it. Our sequence valves operate better if run directly from the main hydraulic supply line and set at different pressures. We recommend at least 500 psi differential for ease of setup.

My company uses a lot of brass fittings on our product. Can I use these to connect my hydraulic clamps?

No, brass fittings and some aluminum or steel fittings are for low pressures. Be sure that locally sourced fittings are rated for 5,000 psi operation. All of our fittings are rated for at least 5,000 psi. We do not recommend the use of lower pressure fittings. We understand you may have a local source for high pressure O-Ring style fittings, but also want you to know that suitable fittings are available from us.

I need to disconnect my fixture from the pump. I also need double acting clamps. How can I do this?

Vektek has designed several configurations in Automatic and Manual ShutOff Valve Decouplers to fit your application. VektorFlo® automatic valve decouplers work with either single or double acting devices.

Manual decouplers, originally designed for single acting systems, include an auxiliary port that can be used for double acting systems. By adding a second quick disconnect to the auxiliary port of the manual decoupler (we suggest female), connecting a second line and employing appropriate valves you can decouple your fixture from the power supply for machining.

(Top plates or manual decouplers with self-closing valves are not designed for use with double acting circuits.)

We use anti-freeze, not hydraulic fluid in our plant. Will this affect our clamps?

Yes, our warranty specifically excludes the use of non-standard hydraulic fluids. While there are some good fluids out there, our approved fluids (or equivalent) are on page J-1. If you must use another fluid and it has good lubricity and corrosion resistance, we can tell you whether it is likely to cause problems or not. Some fluids may provide adequate long term service; we will offer advice upon request. We do not approve of the use of these fluids but may be able to recommend compatible seals.

We run a fixture for 3 months, store it for 6 months, then bring it back on line. How can we keep everything working?

Preventive maintenance. Before you store your fixtures, be sure that they are free of coolants, coolant buildup, clean and dry. A light coating of corrosion protection may help. Be sure to store in a cool, dry, clean environment. We encourage the use of double acting clamps on fixtures which will be stored for extended periods.

Our clamps are used for cast iron grinding. Our coolants also seem to be corrosive (our fixture plates rust). Will your clamps stand up in this environment?

Better than other brands. Nothing is going to be 100% foolproof. Our extensive use of hard chrome plating, stainless steel and our corrosion resistant BHC™ will give you the best possible resistance to corrosion. Our processes will allow our clamps to run longer with less problems even in this destructive environment.

Preventive maintenance is essential to keep hydraulic systems and components running at peak performance through millions of cycles. Be sure to flush your entire system at least once a year and more frequently in high contamination environments.

When I undclamp my single acting clamps, a “spurt” of coolant comes out of the vent port. I am running flood coolant and the clamps are covered during the entire machine cycle. Can I eliminate this problem?

Maybe. We suggest you run a vent line to fresh air from each breather port. This can be done in copper or plastic tubing. If you can’t get to fresh air, a trap in the tubing or protected vent inlet area will reduce the amount of coolant entering the cylinders. Keeping the coolant out will reduce the chance of corrosion in the cylinders. It will also keep the cylinders from having to expel the coolant as they return causing sluggish return. Our Swing Clamps are now available with “bottom” venting to allow them to breathe dry air from protected areas under the fixture.

When I look at my clamps, there are threaded holes in them. What do the labels “P”, “ADVANCE” and “RETRACT” mean?

These threaded holes are called “ports”. The label “P” or “ADVANCE” ports are normally used to clamp the part, “RETRACT” indicates the port normally used to unclamp or retract the clamp.

My local chemical representative has recommended the use of “water-glycol” hydraulic fluid. What are the benefits of this fluid and should I use it?

Water-glycol is a non-traditional hydraulic fluid. This fluid was developed for use where petroleum based fluids are not allowed. They are commonly used in areas requiring “flameproof” fluid. They often cause problems with device seals, valves and pumps. We do not recommend water-glycol fluids. We may, in some cases, be able to provide devices with seal compounds acceptable for use in this environment. We cannot recommend or warrant their use in any Vektek pump or directional control valve.
Frequently Asked Questions

Planning

What about using seals made of Viton®?
Seals made of fluorocarbon, such as Viton®, can be a good answer for high heat applications, up to 350°F, however, fluid type is also important. It may be acceptable in most fluids at lower pressures, but fluorocarbon is not the universal remedy for all fluid problems. There are other acceptable seal compounds for use in water-glycol and other unusual fluids. Our staff can help direct you to a seal that is best suited to perform in your application. Because seals made of fluorocarbon may work in your application, we offer this as an option on many of our cylinders; call for details.

How hot is too hot to run hydraulic fluid?
Anything above 350°F is considered too hot for most hydraulic fluids and seals. Our standard seals are rated to operate at temperatures from 40°F to 160°F. Even seals made of fluorocarbon are not recommended above 350°F. For advice on high heat applications, please contact Vektek’s Engineering Department.

I notice that in your fitting section you have both flareless and 37° flare fittings; why?
We do stock both 37° and flareless fittings. You may also notice that we do not stock the nuts for 37° fittings. We recommend that you connect tubing with flareless fittings. They are proven to work well and be somewhat more forgiving than flared tubing. A good flare tubing connection is very reliable. Should you happen to cut it 1/8” short, it is difficult to stretch. A flareless fitting has some built in forgiveness. We suggest that you use 37° fittings to attach hoses to devices or feed fluid to your fixtures.

I have my cylinder hooked up to a pump. It extended but won’t retract. What have I done wrong?
Is there a directional control valve in the circuit? If not, one is required. Is the cylinder single or double acting? Can you provide a schematic or simple hand sketch for us to troubleshoot? We are glad to help.

My cylinder is hooked to the air line and it won’t hold the 5,000 pounds your book listed, why?
Is it an air cylinder? We do not manufacture 5,000 lbs air cylinder. We do manufacture 5,000 psi and 5,000 lbs capacity hydraulic cylinders. If you have a cylinder with an effective piston area of 1 square inch and you are putting 5,000 psi into it, your effective clamping force will be 5,000 lbs. Call us, we would be happy to calculate the force for you.

NOTE: Work Supports cannot be adapted to lock on air pressure.

I want to run my clamps on air. I really don’t need much force. Since these cylinders are being used to position workpieces, is it Okay to use air?
Some of our cylinders (but not Work Supports) can be run on air; others may be adapted. If air will provide adequate force and you are happy, so are we. In some cases, straight line cylinders and Work Supports have been run successfully using high pressure gas. Swing Clamps may not be used on high pressure gas. Please call our factory for information on our pneumatic clamping line, specifically designed for workholding.

I need some type of retractable locator. After my part is loaded, I want it to “disappear.” Do you have anything to do this?
Block pull cylinders or any double acting cylinder may be used in this way. If highly precise location is required, please be sure to use a guide bushing to provide more precise location.

When I called in, my salesperson referred to a “breather”. What is it and what does it do?
A “breather” is a port designed to let captured air vent to atmosphere when a cylinder is actuated or a work support plunger is moved. This lets the trapped air “breathe” into the room. Breathers will sometimes “inhale” coolant and it is often preferable to plumb them to clean, dry air space rather than allow them to suck coolant. Cylinder malfunction will occur if breathers are plugged. Vektek cylinders are all designed with stainless steel springs to reduce the possibility of corrosion from this coolant contamination.

How do I read my gauge and what does it mean?
First, release all pressure on the system. Check the gauge for proper operation. Check to be sure that the gauge is returning to “zero”, pressurize the system and read the gauge. The current psi reading from the gauge indicates the clamped pressure of your system unless there is a pressure limited circuit branch. (The entire system equalizes at this pressure, \( \Delta P \) is negligible when under static clamp conditions.)

I need a clamp just like your 15-0109-08 except it needs a 6” long plunger. Can you help me?
Maybe. We do entertain specials from time to time. Please ask us. We often find that “special” requests coincide with our ongoing new product development. If you have a special need, it is worth asking. We may decide to do your special as a development project. We may not be able to produce it (actually you may not want it) because of cost. It may be something we have done before and will be relatively easy.

The danger involved in using “specials” is that we do not stock replacement on special parts. When your machine crashes (when, not if) and you need a rush spare, special parts have to be made from scratch. You will need to order spares at the time of the original order. The cost of a single replacement on a complicated special can often be 5-10 times the cost paid in the beginning. A little foresight will be very beneficial if you must have a special.

If you have questions you’d like answered, call, write, fax or email us. We would be glad to help you use VektorFlo® products more effectively.

800-992-0236

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VektorFlo® Hydraulic Fixture Setup Documentation and Troubleshooting Worksheet

Fixture Designed By: _________________________  
Fixture Built By: ____________________________  
Built For:  _______________________________  
Fixture Serial #:  ___________________________

1. All pressure gauge readings checked and verified at “0” operating pressure.______ Yes ______ No
2. Main system operating pressure read from the gauge mounted on the clamping system pump ______ psi or 
inlet air pressure from air gauge on boosters ______ psi, booster ratio ______:______.
4. Fixture operating pressure read at fixture gauge ______psi, side A______psi, side B
5. Pressure limit circuits pressure checked:
   Side A ______ psi Components & location:________________________________________
   Side A ______ psi Components & location:________________________________________
   Side A ______ psi Components & location:________________________________________
   Side B ______ psi Components & location:________________________________________
   Side B ______ psi Components & location:________________________________________
   Side B ______ psi Components & location:________________________________________
6. Sequence operations set to:
   Side A ______ psi Components & location:________________________________________
   Side A ______ psi Components & location:________________________________________
   Side A ______ psi Components & location:________________________________________
   Side B ______ psi Components & location:________________________________________
   Side B ______ psi Components & location:________________________________________
   Side B ______ psi Components & location:________________________________________
7. Fittings checked, secure, no leaks, proper type, not restrictive.______ Yes ______ No
8. Schematic diagram attached.

For troubleshooting assistance contact your Designer/Builder or, complete steps 1-9 above and fax this sheet with all additional pages to 816-364-0471. We are pleased to be of service.

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Fixture Building Tips

General Tips

- When Manifold mounting VektorFlo® components, the proper seal mating surface must be flat within 0.003 in with a maximum 63 µ in.R surface finish (unless otherwise noted in the catalog).
- Fluorocarbon seals are available for most components (except power supplies) that do not include them in the device design. These items may be ordered online or on fax orders by adding an “F” as the last digit of the model number. When ordering with one of our Order Entry Specialists, please mention that you would like fluorocarbon seals.
- Unless otherwise noted in our catalog, VektorFlo® devices require a minimum pressure of 500 psi for double-acting components and 750 psi for single acting components.
- Maximum system flow rate is 1.5 gpm (346.5 cu. in/minute) for all VektorFlo® special function valves. Excess flow voids warranty.
- Deburring of pockets or cavities is extremely important to avoid leaks from damaged seals.
- Fluid filtration to catch chips will prevent leaks and extend the life of your components.
- Preventive maintenance is essential to keep hydraulic systems and components running at peak performance through millions of cycles. Be sure to flush your entire system at least once a year and more frequently in high contamination environments.
- To extend the life of Pressure Gauges run your system at 75% of the gauge scale.

Work Support Tips

- Length of thread engagement on Fluid Advance work support contact bolt determines the spring contact force.
- Tighten with a six point socket only. Other types of wrenches may damage the work support.

Swing Clamp Tips

- Never allow Swing Clamp arm to contact the workpiece during arm rotation.
- Use of optional bottom porting on all single acting Swing Clamp models may significantly reduce contamination potential. Contact your Vektek Customer Service representative for details on the bottom porting option.
- Swing restrictors are available in 30, 45 and 60 degree angles. Order from your Vektek Sales Representative or Order Entry Specialist. Other swing restricting angles are available upon request as a special.

Plumbing Tips

- Use of standard rubber hoses and end fittings can hamper the action of many devices due to excessive end fitting restrictions. If you choose to purchase hoses from another supplier, be sure that hose diameters and end fittings are not causing excessive restrictions.
- Not all VektorFlo® rotary unions are manifold mountable. Confirm that your rotary union selection fits application mounting needs. Refer to the Miscellaneous Plumbing section of the catalog.
- Solidly bolt into place either the shaft or the housing component. Mount the opposing component using a cableway or similar anti-rotation device that allows for some movement.

Power Supplies

- Hydraulic pumps:
  * Hydraulic fluid should be changed and the reservoir cleaned out annually
  * If you operate a full production schedule (one shift) change fluid twice annually
  * Two shifts daily: change fluid three times annually
  * Three shifts: four times annually
  * In very dirty conditions (foundries): change hydraulic fluid monthly
  * We recommend the use of the return line filter kit (Section J) with our Medium Capacity Pumps in medium to extreme contamination environments.

- Pump Selection:
  1. Flow Rate : Time Requirement?

- 2. Power Supply:

- 3. System Requirements:
  - SINGLE-ACTING, DOUBLE-ACTING, CONTINUOUSLY COUPLED, DECOUPLED or PALLETIZED

Speed Control

- Flow controls are often required to make swing clamps and work supports function at appropriate speeds. Swing clamps may be damaged by swinging large mass arms at a greater distance from the clamp centerline than recommended on the catalog pages. Work supports may advance with speed faster than expected, bounce off of the intended part surface and become locked before the spring can mechanically re-extend them.
- In cases where speed control is necessary, all workholding devices should be flow controlled with “meter-in” devices like our in-line or in-port flow controls with free-flow return. Needle valves or “meter-out” flow controls, as are often used in pneumatics, should not be used to prevent a pressure intensification which may occur on “meter-out” hydraulic applications.

Arms/Levers

- When installing a Swing Clamp arm, restrict the arm to prevent rotational torque to the plunger and potential internal cam damage. You may then tighten the cap screw to specification without damage to your clamp.
Are you using a bolt as a clamp on your manual fixture and want to know how much clamping force is being produced?

Follow these instructions to calculate the bolt pull force in your application.

Step 1  What is your bolt size and torque?
Step 2  Look in the table to find the max recommended torque and pull force of your bolt size.

\[
\text{Force in your application} = \left( \frac{\text{Your Torque (ft-lbs)}}{\text{Max Torque from Table (ft-lbs)}} \right) \times \text{Pull Force generated at Max Torque (lbs)}
\]

Example: A 3/8-16 bolt is being torqued to 50 ft-lbs, what pull force is generated?

From the table, the max torque for a 3/8 UNRC is 62 ft-lbs and the pull force generated is 12,535 lbs. Enter these values along with your torque into the equation above.

\[
\text{Pull Force} = \left( \frac{50 \text{ ft-lbs}}{62 \text{ ft-lbs}} \right) \times 12,535 \text{ lbs} = 10,109 \text{ lbs}
\]

The Pull Force is 10,109 lbs when a 3/8-16 bolt is torqued to 50 ft-lbs.

How do I choose a cylinder that produces the same force as my bolt?

Sizing a hydraulic cylinder to produce the same pull force as a bolt force is easy, it’s simple physics:

\[
\text{Force (lbs)} = \left( \frac{\text{Pressure (psi)}}{\text{Piston Area (in²)}} \right)
\]

By varying pressure and area, any force can be produced.

See the Cylinder or Push/Pull Cylinder sections for the many cylinder options Vektek provides.

### Clamp Force Output From Strap Clamps

- **Bolt Force:** 9,000 lbs
  - Clamp Force: 4,500 lbs
  - 1/2
- **Bolt Force:** 9,000 lbs
  - Clamp Force: 6,000 lbs
  - 1/3
  - 2/3
- **Bolt Force:** 3,000 lbs
  - Clamp Force: 4,500 lbs
  - 1/2