Imagine the time savings and greater productivity you will achieve by being able to clamp everything with the simple turn of a valve. Plus, unclamping is just as fast.

The information in this brochure is intended to introduce you to the basics of power workholding. We have discovered that successfully implementing a power workholding system is a Team effort. This collaboration consists of: Team Vektek, possibly an outside fixture designer, and you...the customer.

Team Vektek is here to assist in any way to see that your move to Power Workholding is easy, effective and profitable.

Easier, Better Clamping with...

THE CHOICE IS YOURS...
Many nuts to tighten - OR - One valve to clamp everything.

Spend Less Time, Get It Right Every Time!

Increasing the accuracy and repeatability of a manufacturing process will produce a higher-quality product, reduce scrap, and achieve the ultimate goal...profit.

Hydraulic workholding devices provide a consistent, repeatable force in a relatively small weight and size envelope. This means that in today’s manufacturing environment, the workpiece can be secured in less time and more accurately while conserving valuable fixture space. Hydraulic power clamping precisely controls the force on your parts with the touch of a single valve.

Learn the basic descriptions of Vektek workholding components.

Types of Vektek POWER Supplies for POWER Workholding.

What is a Palletized Fixture?

Vektek Quality & Support

Basic steps to PLAN YOUR Power Workholding System.

LEARN HOW-TO PROFIT...
A simplified return on investment approach can get you started.
TuffCam™ Swing Clamps
t
Swing clamps are designed to meet the growing demand for high-speed, precise positioning, and heavy arm applications. TuffCam™ is a three cam design that will accurately swing, position and clamp in less than one second.

Vektek Offers Standard and TuffCam™ Swing Clamps

Standard Swing Clamp Models

ADAPTABLE PLUNGER
Right Swing, Left Swing or Straight Pull

Size
Vektek swing clamps come in a variety of sizes and cylinder capacities, from 2 kN to 33 kN.

Single or Double Acting
Swing clamps are either single or double acting. Single acting clamps use hydraulic pressure to clamp the plunger/arm and a spring extends it. Double acting devices increase reliability and use hydraulic pressure to clamp and to extend the plunger/arm.

Optional Mounting
Vektek Top Flange and Bottom Flange swing clamps can be manifold mounted to eliminate external plumbing.

The most versatile mounting options on the market!

TuffCam™ Swing Clamps

TuffCam™ Swing Clamps were designed to meet the growing demand for high-speed, precise positioning, and heavy arm applications. TuffCam™ is a three cam design that will accurately swing, position and clamp in less than one second. TuffCam™ swing clamps are dedicated left swing or right swing only and must be specified when ordering. They also have the patented Cam Follower Ball Seat and patented Vektek V-Groove.

VEKTEK
The Productivity Devices Company

CALL OUR CUSTOMER SUPPORT TEAM TODAY TO DISCUSS HOW TO PUT VEKTEK PRODUCTS TO WORK FOR YOU!

Factory Direct: +1-913-365-1045
China: +86-21-58683679
India: +91-40-27844279

TuffCam™ Swing Clamp Models

DEDICATED PLUNGER
Right Swing OR Left Swing
**WORK SUPPORTS**

The basics of 3-2-1 fixturing require three points to define the plane of part location. When machining, a part often requires additional support in that “Z” plane. A floating support, such as a work support, is an easy solution. You can use a work support anywhere a “jack screw” can be used. A work support will position faster, without distortion of the part and without dependence on “operator feel”.

In applications where part distortion, chatter, ringing or poor surface finish is a result of part movement or vibration, a work support can decrease or eliminate the problem.

Vekttek work supports are available in these styles:

**Spring Advance Work Supports**

Available in four capacities from 4.4 kN to 55.6 kN, these work supports adapt to support fragile parts, deflection prone areas of heavy parts and are well fitted to heavy material removal applications. Spring extended plungers maintain contact with the part during loading exerting only spring force against the part. As hydraulic pressure is applied, the plunger “freezes” and does not exert any additional force on the part.

**Air Advance Work Supports**

Available in four capacities from 4.4 kN to 55.6 kN, these work supports are ideally suited to use in harsh environments or on fragile parts where pre-support contact forces must be adjusted to prevent part distortion. A continuous flow of air can serve as an “air spring” and can be left connected during machining. This “air curtain” or “purge” can help keep harsh contaminants from getting between the plunger and sleeve.

**Fluid Advance Work Supports**

Fluid Advance supports are available in three capacities: 4.4 kN, 11 kN, and 17 kN. An internal piston in a fluid advance work support advances a spring which in turn lifts the plunger to contact the workpiece. Hydraulic pressure automatically sequences, “freezing” the plunger properly against the workpiece surface. This is accomplished with a single hydraulic line.

**LINK CLAMPS**

Link clamps contain the beam mechanism preferred by some users. The link clamp lever accommodates hard-to-reach or hard-to-hit clamping points. This self-contained beam eliminates the need to build or design a clamp mechanism as part of the fixture. Vekttek’s unique single piece body and pivot design, on the high pressure model, provides the least side-to-side axial deflection and the most rigid product on the market today.

**High Pressure Link Clamp**

Available in five sizes from 1.5 kN to 22 kN capacities at 350 bar (35 MPa). High pressure Link clamps can be mounted using the top flange, which may be manifold mounted, or using the threaded body.

**Low Pressure Link Clamp**

Available in three sizes from 2.5 kN, 5 kN and 10 kN capacities at 70 bar (7 MPa). Low Pressure Link Clamp lever position is adjustable to left, forward, or right. These top flange mount clamps come in double acting only and include manifold ports.

www.vektek.com
Most clamping cylinders are intended for pushing against a part and holding it in place. They are not intended to move a load, as in power cylinder applications, where punching, bending or forming are performed.

Cylinders are the least costly form of hydraulic clamping available. Good fixturing principles recommend clamping opposite fixed locators and transmitting cutter forces into the stationary locators.

Push/Pull Cylinders

Push/Pull Cylinders are used to actuate a remote workholding mechanism, pulling on clamp plates, or may be used to reach through a hole and pull a removable “C” washer (shown illustrated above).

Available in threaded and block body styles.

Pull-Down Clamps

Pull-Down Clamps, Concentric and Eccentric

With Vektex’s Pull-Down Clamps, 5-sided machining can be carried out safely without clamp interference. Clamping sleeves are segmented and serrated to form and grip the clamping hole. These Pull-Down Clamps also serve as a support surface and “Z” locator for the workpiece.

Edge Clamp

Downward clamping angle of the blade yields both horizontal and vertical force pushing your part firmly against locators and the work surface. Low profile allows slab milling over the clamp on most parts.
Vektek offers a variety of pre-configured power supplies designed to provide optimal functionality for most power clamping applications.

**Electric/Hydraulic**

Electric power supplies consist of a pump configured with the necessary valves and controls. The pump motor is controlled by a pressure switch, which will shut off the pump when a preset pressure has been reached. If pressure should fall below the reset point of the pressure switch, the pump motor will kick on and replenish the system’s pressure.

**Air/Hydraulic**

A pneumatic power supply drives an air motor to create hydraulic fluid flow and pressure. As the hydraulic flow in the system becomes restricted (pressure increase), the pump cycle rate decreases until the system’s pressure completely restricts and stalls the air motor.

**Manual Screw Pump**

An inexpensive manually operated power supply for small systems. This pump can be driven by a “nut runner” for fast and precise actuation. The Vektek screw pump has a maximum working pressure of 350 bar (35 MPa) and an oil capacity of 26 cm³.

Please refer to the Vektek product catalog or website for specific details about power supplies.  
[www.vektek.com](http://www.vektek.com)

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### Decoupled or Live Hydraulic Fixtures?

A palletized or tombstone fixture is a workholding mechanism that can be run with live (connected) hydraulic power or disconnected from the power source during machining.

#### Palletized (Decoupled) Tombstone Fixtures

A decoupled fixture’s disconnection is achieved using a pallet decoupler. A pallet decoupler serves as the interface between the stationary pump and the moving pallet. It is the point where the hydraulic hoses from the pump are connected and disconnected. The decoupler stays on the pallet/tombstone and its accumulator is the source of reserve pressurized fluid for the clamping circuit while it is disconnected from the pump.

A decoupler includes a shutoff valve to contain pressurized fluid within the clamping circuit. It must also contain a quick disconnect for connecting the hoses and an accumulator. Filter screens to minimize the amount of contamination that enters the pallet hydraulic circuit are recommended to extend the life of your devices. A decoupler may also include a pressure gauge and an over-pressure relief valve.

There are two basic types of decouplers, automatic shutoff and manual shutoff.

- **In Manual Shutoff Valve Decouplers**, the operator manually closes and opens the shutoff valve. Most Manual Shutoff Valve Decouplers are used with single acting clamp systems, but some can be configured for double acting use.

- **An Automatic Shutoff Valve Decoupler** is actuated by Clamp and Unclamp pressure from the power supply. This leaves the operator free to connect hoses and control only the pump, not the valves. Automatic Shutoff Decouplers are used with both single and double acting circuits with equal ease.
Vektek accessory valve designs are specifically intended for use in hydraulic clamping systems. Manufactured with steel components and hardened operating parts, these valves are suited to the low flow demands of workholding. Vektek accessory valves prevent system damage and erratic operation frequently experienced when using valves designed for high flow general industrial applications.

**Sequence Valves**
Sequence valves operate as pressure sensitive, normally closed (N/C), elements in a clamping system. When fluid first enters the system at low pressure, the valve is closed, blocking the flow of fluid to devices downstream. After the other devices have moved into position, pressure begins to increase and overcomes the spring force holding the valve closed. This forces the poppet off its seat and allows fluid to flow through the valve until maximum pressure is reached. They are highly effective multiple function timing controls. Vektek sequence valves are precise metering devices and less sensitive to contaminants than other brands.

**Pressure Reducing Valves (PRV)**
The Pressure Reducing Valve is a Normally Open (N/O) pressure control device. The valve remains open and fluid flows freely to downstream devices until the pressure in the valve reaches the pressure set-point (adjustable). At the set-point pressure the valve closes, blocking further flow and pressure to the downstream devices. If there is a sufficient downstream pressure loss (from the valve to devices), the PRV will re-open, allowing fluid to pass through the valve until the pressure again reaches the valve set-point. The PRV is designed for use in both single and double acting systems.

**Waterproof Pressure Switch**
A pressure switch is used for hydraulic logic. When in-line pressure reaches the pre-set limit (adjustable from 55 (5.5 MPa) to 350 (35 MPa) bar) the internal switch is activated. Reset deadband is approximately 5% of the set pressure. The switch is available with an M8 connector for easy connection and replacement.

**Standard Gauges**
Vektek analog gauges conform to ANSI standard B40.1, Grade B. Available in 350 or 700 bar. To extend the life of a pressure gauge, it is recommended to run your system at 75% of the gauge scale limit.

**Check Valves**
Check Valves allow flow through the valve in one direction only. When the inlet flow is stopped the valve will close and blocks the passage preventing the return, or backward flow of fluid.

**In-line Filter**
These small In-line Filters help keep your system clean, protecting sensitive valves and devices. Available in 10 and 25 micron filter ratings. Vektek In-line Filters are serviceable for cleaning or screen replacement.
Quality Vektek Products

Vektek products are not just another “me too” product. Vektek does exhaustive research, design, development and testing to insure our products set the workholding standard.

Vektek has developed BHC™, a special black hard coating, to make device bodies extra durable. This high tech surface hardening process virtually eliminates the bore scoring and scratching that is the most common reason for seal failures and leakage in many cylinders.

Extensive use of Hard Chrome provides improved durability of load bearing surfaces where it is critical to device life. Special seals and wipers prevent leaks and keep contaminants out.

Warranty is an indication of a manufacture’s confidence in the ability of the product to run “trouble-free” for a specified time. Our hydraulic products are warranted to be free of defects for one year from the date of shipment.

Please compare the durability and long life of our devices with that of our competitors. Prove it to yourself. We welcome any head-to-head challenge.

Product Availability

We do our best to have products in stock. We keep adequate shelf stock to be ready to ship orders quickly. We normally ship next day or same day if necessary to help you out.

Vektek Services

• A trained sales staff to assist you
• Technical advice and support
• Fixture concepts at no charge
• Technically trained field reps

VEKTEK QUALITY & SUPPORT

DIRECTIONAL CONTROL VALVES

A Vektek directional control valve function is the extension and retraction control for your hydraulic cylinders. It provides a flow path from the pump to the cylinders and a return path from the cylinders to the fluid reservoir. Whether manual or solenoid operated, they are specifically designed to control workholding fixture circuits.

All Vektek directional control valves are rated at 350 bar (35 MPa) working pressure. They typically incorporate international standard mounting and fluid flow patterns.

Standardized mounting patterns also mean that valve operation can easily be upgraded from manual to electric without having to change system plumbing.

Vektek’s Website:
www.vektek.com

• Order Online - Use the “Sign-Up” link on our homepage to register your account. Sign up today and your account will be ready to use within a day or so.
• PDF catalog
• CAD 2 D & 3D drawings
• Parts Lists
• Site Search
• Local Reps

Repair and Maintenance Service

At times repairs are required, our repair team is ready to service and return clamps to you promptly.

For those who do not wish to perform maintenance on their devices, Vektek offers a repair service. Contact us for details and scheduling.
Successful powered workholding does not just happen. Like any other manufacturing process, it must be carefully planned. But, that does not mean that you need to be a hydraulics engineer to implement a powered workholding system.

Designing a system involves a common-sense application of a few basic workholding concepts. Applications for power workholding fall into two categories:

- **Retrofits**
  Replacing and upgrading clamps on existing fixtures.

- **New Fixture**
  Designed from the beginning with power workholding.

In both cases, you must keep in mind the forces that can be generated by power workholding devices. A single device that you can hold in your hand can generate five tons of clamping force.

In replacing existing manual bolt and nut clamping or toggle clamps it is imperative the fixture or machine tool base will withstand the forces. Do not risk damaging a machine bed by tying a 30kN clamp into a T-slot that can only withstand 15 kN of force.

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?

Select “realistic” cycle times, the shorter the cycle time, the larger the power source required.

**Example:** A pump with 1/3 horsepower electric motor may reach clamping pressure on a given system in three seconds. To accomplish the same task in one second it would require a 1 horsepower electric motor - a considerable increase in initial expense and operating costs.

Double acting devices will assure full, timely retraction even in systems where restrictions such as small orifices or long tubing runs have been introduced.

**Step 1:**

First, determine the nature of the operation to be performed, the number of parts to be processed per cycle, and whether operations will be 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, chuck 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 work-flow. 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 our catalog.

**Step 2:**

Prepare an outline of the sequence of events that will take place during the manufacturing cycle. This will assist you in determining the number of sequence valves that you might need, as well as 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 in such a case 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.

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 stops to resist the majority of cutting forces and to ensure correct location of the workpiece. Using the primary part stops will add stability to the workpiece. It is also recommended that cutter forces be calculated as a precaution in such a case to ensure that workholding devices are sized and positioned to provide adequate holding.

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, in many applications, 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 on the fixture or machine table.

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 as the need arises during the manufacturing sequence. This will require additional valves be used 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’ve selected.

Step 9: To help determine the capacity of the power source you’ll 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 will operate the system within your clamping time constraints by working out the following formulas:

\[
\text{Device Capacity} = \frac{\text{Low Pressure Flow}}{\text{Position Time}}
\]

Where...

- Device capacity is total device oil capacity expressed in cubic centimeters. Low Pressure flow is low pressure pump oil volume expressed in cu. cm. per minute. Position time is time to position expressed in decimal parts of a minute. (Sequence valves in your circuit will affect this time.)
- To the result obtained above, add the result of the following calculation to find total estimated clamping time.

\[
[(\text{System Capacity}) ÷ (\text{High Pressure Flow})] × 0.01 (\text{System Operating Pressure ÷ 70}) = \text{Pressurize Time}
\]

Where...

- High Pressure flow is high-pressure pump oil volume expressed in cu. cm per minute. System capacity is total system oil capacity, the workholding device capacity plus the internal volume of any associated tubing, hoses, manifolds, etc. (For small systems, the plumbing volume may be so small as to be negligible. However, for systems with long runs of tubing or hose, their volume may be of such magnitude as to materially affect the time it takes for operating pressure to be reached.)
- The expression .01 x (System Operating Pressure ÷ 70) takes into account the slight compressibility of oil and system elasticity, which influence the length of time required to pressurize a system. Pressurize time is the total time to reach pressure expressed in decimal parts of a minute. If the total estimated clamping time is not within the cycle time requirements you’ve targeted but is within device limitations, a larger power source is required — one with greater capacity. Select such a source and repeat the above calculations to ensure that it will provide the clamping cycle times required.

If the total estimated clamping time in the initial calculation is significantly less than the time allowed, your first power source selection may have been too large. In such a case, select a smaller power source and repeat the above calculations to ensure that it will provide the clamping cycle times you will need. Additional factors you should consider when selecting a power source include a shop floor plan and/or machine layout and your own preference for the type of power source (shop air vs electric). If desired, large electrical power sources may be used to supply several workholding systems, each operating independently at several machines. In this case, the timing and sequence of operations for each individual system must be calculated as shown above to arrive at a size for the power source.

Step 10: Select valves and other control components to accomplish the sequence of operations you outlined in Step 2. See the valve sections in our 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: Let us take a look. 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.
Where Do I Start?

TRANSFORMING A MANUAL STRAP CLAMP FIXTURE INTO A HYDRAULIC POWERED FIXTURE

Let’s take a common manual strap clamp fixture found in most any machine shop, similar to the one illustrated above right, and convert it to a Hydraulic Power Fixture.

As you can see in the illustration at right, the heels have been replaced with Vektek Block Cylinders. The studs have been double nutted to a desired location. Now, all that is required is connecting the plumbing and power source to the block cylinders.

Air/hydraulic boosters are an inexpensive way to power single acting systems.

DOLLAR SAVINGS POTENTIAL PER CLAMP CYCLE

<table>
<thead>
<tr>
<th>LABOR RATE</th>
<th>2 CLAMPS</th>
<th>4 CLAMPS</th>
<th>8 CLAMPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$25 per hour</td>
<td>$0.14</td>
<td>$0.34</td>
<td>$0.72</td>
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<tr>
<td>Payback Cycles</td>
<td>9,272</td>
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<tr>
<td>Payback Cycles</td>
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<td>1,126</td>
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<tr>
<td>$100 per hour</td>
<td>$0.56</td>
<td>$1.33</td>
<td>$2.89</td>
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<tr>
<td>Payback Cycles</td>
<td>2,318</td>
<td>1,060</td>
<td>563</td>
</tr>
</tbody>
</table>

TIME SAVINGS:

2 CLAMPS / 1 PART
MANUAL CLAMPING TIME 35 SECONDS
POWER CLAMPING TIME 15 SECONDS
SAVINGS OF 20 SECONDS

4 CLAMPS / 1 PART
MANUAL CLAMPING TIME 68 SECONDS
POWER CLAMPING TIME 20 SECONDS
SAVINGS OF 48 SECONDS

8 CLAMPS / 2 PARTS
MANUAL CLAMPING TIME 130 SECONDS
POWER CLAMPING TIME 26 SECONDS
SAVINGS OF 104 SECONDS

Calculations based on:

MANUAL - Time to load part, position clamps, tighten clamp nuts with a break-over torque wrench, loosen clamps and unload part.

POWER - Time to load part, position clamps, activate hydraulic power source, build to pressure, release pressure and unload part.

PAYBACK CYCLES - Based on system cost including number of powered clamping cylinders, Air/Hydraulic Booster, Hoses, Fittings and allowing $15 per clamp for tool modification and for installation. Actual may vary.
Faster, Better Clamping!
Some possibilities to enhance or fully automate a manual strap clamp fixture with hydraulic power.

TYPICAL STEPS TO YOUR POWER WORKHOLDING PURCHASE

After several conversations with a Vektek sales representative, you may uncover an application where hydraulic clamping will pay for itself in a very short time. The next step would be to call and discuss your fixture concept with one of our Application Engineers. They may ask you to send information about your current fixture, part(s), machine and processes to study and propose a clamping concept similar to what you see at the left. So you know what to expect, we do not “design” the fixture, we provide a concept. With the concept, we can provide a Bill of Materials, if you request one.

To aid in your fixture design, CAD files for each product are available online at www.vektek.com or by requesting a CD from your sales representative.

After your design is complete, call us to place your order. We will deliver your components promptly. The relationship does not end here. We want your fixture to work right and keep on working.
Machine Parts Better, Faster, and MORE Consistently

WITH POWER WORKHOLDING

- Achieve Greater Repeatability
- Use Higher Cutting Speeds
- Faster Clamping
- Produce Less Scrap

DETAILS INSIDE