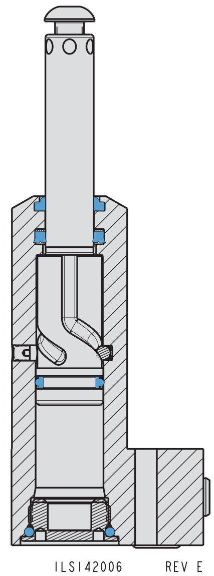
TuffCam™ Swing Clamps

Bottom Flange Long Stroke

Double Acting Long Stroke

- Available in 1,100 and 2,600 lb. capacities.
- More than double the vertical clamping stroke for maximum part deviation allowance and swing clearance.
- Three cams for accurate arm positioning, smoother rotation and lower per cam surface contact pressure.
- Patented ball seat for improved rotary function, cam follower contact, and reduced dynamic and static friction.
- Fluorocarbon wipers are standard for improved coolant compatibility.
- Tungsten Carbide ball material for strength and wear.
- TuffCam™ Clocking feature (page C-2) uses standard length Vektek arm.
- Arms sold separately – see section O.



Swing Clamp plunger shown in the Extended Left Cam Position

U. S. Patent No. 7,032,897

Model No.*	Clamp Swing Direction	Cylinder Capacity (lb.)**	Vertical Clamp Stroke (in.)***	Total Stroke (Swing + Vertical)	Standard Arm Length **	Effective Piston Area (sq. in.) Retract	Oil Capacity (cu. in.)**** Extend	Oil Capacity (cu. in.)**** Retract	Optional Flow Control Model No. *****
Double Acting (D/A)						Cylinders, actuated hydraulically both directions			
14-2209-10-R	Right	1100	0.75	1.21	1.50	0.295	0.73	0.36	70-2037-73
14-2209-10-L	Left								
14-2213-10-R	Right	2600	1.34	2.00	2.00	0.626	2.45	1.25	70-2037-73
14-2213-10-L	Left								

WARNING! Never allow swing arm to contact workpiece or fixture during arm rotation.

* 2600 lb. Long Stroke may not be interchangeable with TuffCam™ or Standard Swing Clamp models. Check overall dimensions for correct mounting in fixture.

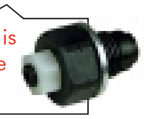
** Cylinder capacities are listed at 5,000 psi maximum operating pressure, with a standard length VektorFlo® arm installed. Minimum operating pressure is 750 psi for single acting, 500 psi for double acting. The clamping force is adjustable by varying the hydraulic system pressure. To determine the approximate output force for your application, divide the cylinder capacity shown above by 5,000, and multiply the Resultant Number by Your System Operating Pressure to obtain the approximate clamping force for your application. (Actual force will vary slightly due to internal cantilever loading, friction loss and/or return springs.)

*** To allow for piece part height variations, it is recommended that the vertical travel be set at about 50% of the vertical stroke.

**** To ensure maximum service life and trouble-free operation, restrict fluid flow per table on C-2.

***** In-port flow control requires the use of manifold mount ports.

Optional in-port flow control is a meter-in device with reverse free flow check valve.



Dimensions

Model No. Left Swing	Model No. Right Swing	Capacity (lb.)	A	B	C	D	E	F	G	H	J
Double Acting (D/A)											
14-2209-10-L	14-2209-10-R	1100	1.49	6.97	6.62	4.53	4.70	1.25	0.63	0.625	3/8-24 x 0.625
14-2213-10-L	14-2213-10-R	2600	1.87	9.84	9.34	6.10	6.34	1.25	0.63	0.875	1/2-20 x 0.750

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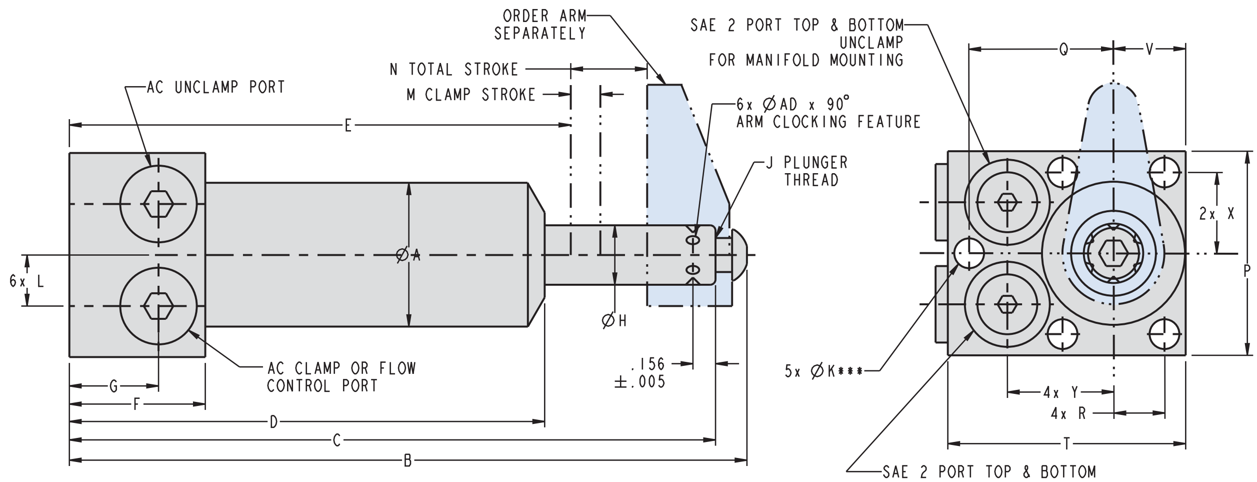

SWING CLAMP PLUNGER SHOWN IN THE EXTENDED LH CAM POSITION

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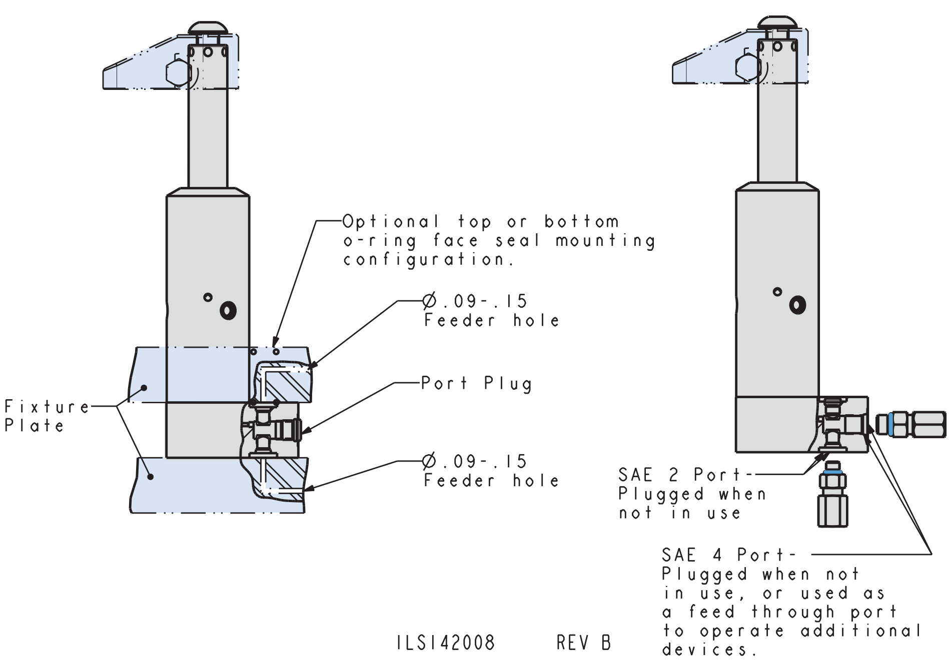
For proper sealing, mating surface must be flat within 0.003 in. with a maximum 63 μin. R_a surface finish.

DRAWING NOTES:

All ports (except breather) are shipped with removable steel plugs installed.

*** When used as manifold mounted, all 5 mounting bolts must be used to assure proper o-ring face sealing.



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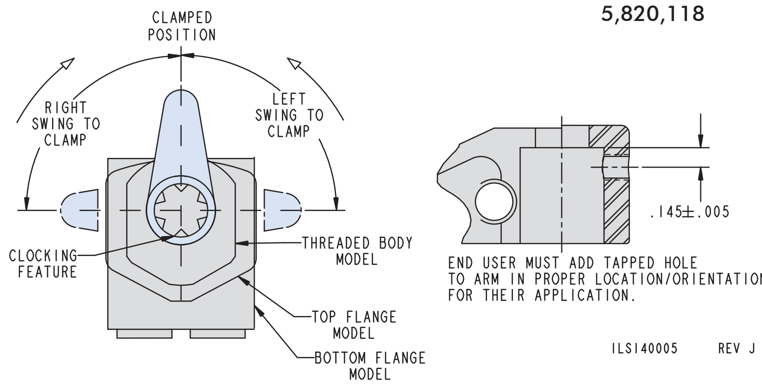
	K	L	M	N	P	Q	R	T	V	X	Y	AC	AD
Cylinders, actuated hydraulically both directions													
	0.28	0.56	0.75	1.21	2.00	0.99	0.56	2.48	0.75	0.81	1.13	SAE 4	0.19
	0.34	0.75	1.34	2.00	2.50	1.21	0.69	2.98	0.94	1.00	1.25	SAE 4	0.19

Features, Clocking, Clamp Time and Flow Rates

TuffCam™ Swing Clamps were developed to meet your demand for high-speed, precise positioning and/or heavy arm applications. These tri-cam design clamps can position and clamp in less than one second and handle larger arms than standard Swing Clamps. One of the keys to this innovation is the patented Cam Follower Ball Seat that was developed to improve strength and wear. Using the patented Vektek V-Groove technology, a Tungsten Carbide ball for strength and wear, and an elastomer spring, these clamps have reduced static friction for improved clamp breakaway and reduced dynamic friction for improved life.

- Available in these body configurations
  - Threaded Body
  - Top Flange
  - Top Flange Long Stroke
  - Bottom Flange
  - Bottom Flange Long Stroke
  - Cartridge Mount
  - Rod Position Sensing
  - Magnetic Position Sensing
  - Low Profile Top Flange
  - Low Profile Bottom Flange
  - Low Profile Rod Position Sensing
  - Low Profile Magnetic Position Sensing
- Single and double acting (position sensing are double acting only).
- Three cams for more accurate arm positioning, smoother rotation, and lower per cam surface contact pressure.
- Patented ball seat for improved rotary function, cam follower contact, and reduced dynamic and static friction.
- BHC™ (Black Hard Coating) on the cylinder bodies helps prevent scoring and scratching.
- Standard fluorocarbon wipers for improved coolant compatibility.
- Arm clocking feature uses standard Vektek arms.
- Same mounting envelope as Standard VektorFlo® Swing Clamps.

U. S. Patent Nos.
7,032,897
5,820,118



TuffCam™ Swing Clamp Arm Clocking Feature
Drill points shown in the clamped position.
6 Clocking features 60° apart.

TuffCam™ Clamp Time and Fluid Flow Rates

Swing Clamp Capacity (lb.)	Standard Arm: Fastest Allowable Clamp Time (sec.)	Standard Arm: Max. Permissible Flow Rate (cu. in./min)	Extended Arm: Fastest Allowable Clamp Time (sec.)	Extended Arm: Max. Permissible Flow Rate (cu. in./min)
450	0.2	17	0.5	7
1100	0.3	47	0.7	20
2600	0.4	109	0.8	54
5000	0.5	235	1.0	117
Low Profile TuffCam™				
5000	0.5	155	1.0	78
7500	0.5	251	1.0	126

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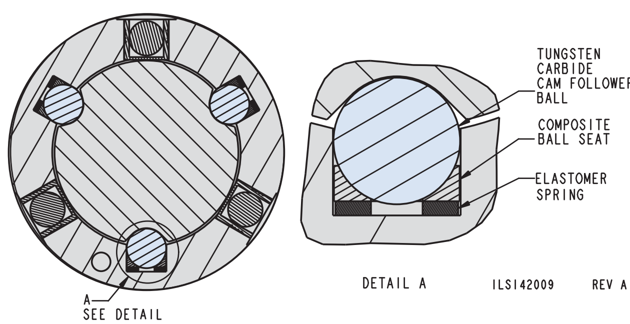
The flows in the table are maximum recommendations and clamp times are minimum recommendations.

- For upreach and double arms, use extended arm flows and times.
- When using custom arms the extended arm flows and times are to be considered the limiting factor.
- The actual time to position the clamp will vary by custom arm configuration and may require customer testing in specific application to establish limits.



TuffCam™ Cam Follower Design

- Three cams for more accurate arm positioning, smoother rotation, and lower per cam surface contact pressure
- Composite ball seat improves rotary function, cam follower contact, and reduces friction
- Tungsten carbide ball material

NOTE: Arm Length and Pressure Limitation Graphs on page O-3

Frequently Asked Questions

When do you recommend the use of TuffCam™ Swing Clamps over the standard product?

Applications where speed is essential, massive arms are required, or position sensing is necessary, use the TuffCam™ design most effectively.

When speed is essential, standard Swing Clamps (which last millions of cycles in ordinary applications) may not live up to life cycle expectations. If a standard Swing Clamp is damaged early in its life due to speed abuse, replacement with a TuffCam™ Swing Clamp may be a way to maintain speed requirements and lengthen device life.

Where arm mass damages the swing mechanism of standard Swing Clamps, the tri-cam design of TuffCam™ strengthens the ball and cam link. The beefier design, capacity, and reinforced rotation mechanism of the TuffCam™ could be your best solution.

Can I run the TuffCam™ Swing Clamp at any speed I want?

No, there are restrictions. TuffCam™ Swing Clamps are capable of approximately two times the speed of standard Swing Clamps in prolonged use without damage. In the event that you need faster speeds or larger arms, please understand that the life of even TuffCam™ Swing Clamps is reduced. Consult the **Clamp Time and Flow Rate** chart on page C-2 to determine the maximum speed for your application.

What makes the cam follower ball seat so special in these units?

The three cams and cam balls guide the rotation of the plunger providing greater support and directional stability. The patented cam follower design is unique in the industry and uses solid carbide balls and composite ball seats. The ball seat design assures that the ball rolls in the cam rather than jamming and scraping resulting in wear on both the cam track and ball.

The demands on my fixture have changed and I am considering your TuffCam™ Swing Clamps. Can I switch out TuffCam™ for your standard product?

Yes, the TuffCam™ Swing Clamps have the same mounting envelope as their standard swing clamp counterparts.

I want to use Work Supports with TuffCam™ Swing Clamps. Will the Work Supports cycle fast enough to keep up with the part change outs?

There will be some lag between the unclamp of Swing Clamps and the full release of pressure in any work support circuit. This is critical with fluid advance supports. The circuit must have time to evacuate under low pressure to allow the plungers to retract for reloading the fixture.

If speed is the issue in support retraction coordinating with TuffCam™, an air advance support must be used with the air circuit released prior to hydraulic circuit release. When the hydraulic circuit is released, the support will begin to immediately retract pushing only the air from the line rather than the higher viscosity hydraulic fluid.

I'm using a high-volume pump and it is "blowing out" my Swing Clamps. Will TuffCam™ Swing Clamps take care of this problem?

High-volume pumps often incorporate high-volume accumulators. An accumulator will yield excessive flow, approaching instantaneous infinite flow, and is intended for dynamic loads. Hydraulic clamps are used to hold static loads. Excessive flow may continue to damage clamps, even TuffCam™ clamps. We recommend changing to a pump designed for clamping applications restrict flow to the table on page C-2.

My applications requires clamps to hit my part in the exact place every time. Should I use your TuffCam™ Swing Clamps?

TuffCam™ Swing Clamps will be more precise in their point of contact. Keep in mind that any draft angle or side forces will ultimately damage the cam tracks of any Swing Clamp and result in loss of precision. In the case of precision positioning, guide pins are recommended and may be implemented with a single-ended or double-ended arm.

What defines a TuffCam™ Swing Clamp?

The single direction, tri-cam design of TuffCam™ produces the strength and reliability to support faster speeds and larger arms. This design also delivers noticeably better accuracy and repeatability over other brands. The clocking feature, included on all styles, dramatically reduces the time it takes to change arms for maintenance, replacement or design setup.

How can I measure the clamp speed?

The maximum speed of a Swing Clamp is applicable to both clamp and unclamp function, as the momentum on the cam track and cam follower apply to both movements. To approximate the speed of your application:

* Look down the centerline of the swing clamp, perpendicular to the arm.
* Actuate your clamping system while watching the arm "swing" into position.
* The eye can track speed of movement at roughly 1/16 second. If while looking directly into the end of the Swing Clamp, you can observe the arm move through its swing, the positioning time should be somewhere around ½ second or longer. See flow rates and clamping time on page C-2.
* If, while looking directly into the end of the Swing Clamp, you cannot observe the arm move, or it is unclamped and the next thing you can see is the device is in the clamped position, the positioning time is something substantially less than 1/2 second. Your standard model clamp is at risk of premature failure. However, the TuffCam™ Swing Clamps can actuate at a faster speed. See flow rates and clamping time on page C-2.
* It is possible to approximate the clamp time by adding the total active volume of devices in the specific control branch of your system, and dividing that volume (cubic inches) by your pump's output volume (cubic inches per minute) and then multiply that number by 60 (60 seconds per minute). This will give you the theoretical calculated time to move a device through its stroke, but does not account for flow loss due to restrictions in the system.

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*TuffCam™ is a trademark of Vektek LLC