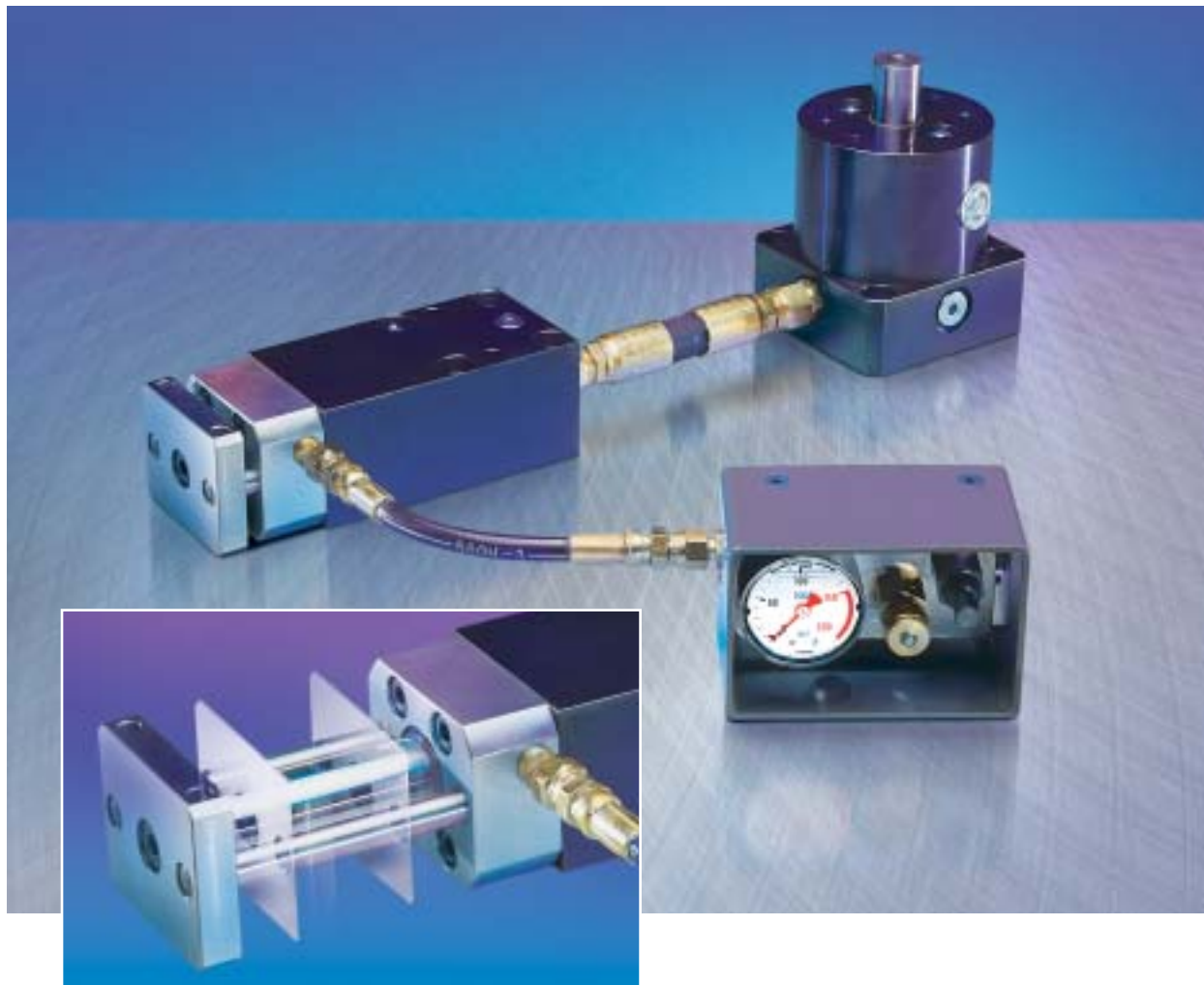


HYDROCAM[®]



HYDROCAM[®] System Serial No. _____

It is important that this manual is read thoroughly prior to removing the HYDROCAM[®] system from its shipping container, begin installation in the tool or operating this product.

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HYDROCAM CATALOG	Added to the back of this Manual

General Description

HYDROCAM[®] systems incorporate patented products and processes that are reshaping the way metal stamping dies are designed and operated, leading to fewer dies required for part manufacture. **HYDROCAM**[®] is simple to design, install and operate. **HYDROCAM**[®] removes complexity from piercing/forming and replaces it with simplicity.

HYDROCAM[®] transfers the vertical action of the press into a precise cam action using patented hydraulic technology. Standard components combine into systems, easing installation in

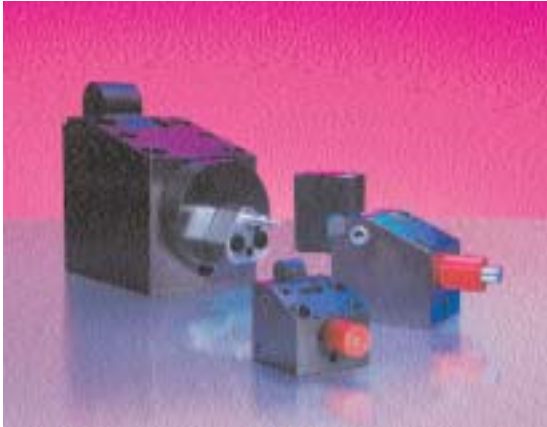
the tool. The **H2** Piercing/Forming unit can be provided with a machinable front plate that simplifies custom applications.

HYDROCAM[®] action results from the lowering of the press ram/slide, to activate the **H1** Pump's piston rod. Hydraulic pressure or force is transferred through high pressure hose(s) to one or multiple **H2** Piercing/Forming units, extending the **H2** unit's piston rod. The **H2** unit has an adjustable return force using proven nitrogen technology.



*NOTE: **HYDROCAM**[®]'s unique design eliminates the thrusting force of the ram/slide from the cam station, allowing the use of standard L-GIBS to position and guide the station. Providing a guidance system for a **HYDROCAM**[®] driven cam station is the responsibility of the customer. Neither, the H2 unit's piston rod, nor its front mounting plate assembly is designed to provide cam station guidance. Contact your representative for application support.*

Cam Systems



Currently we offer two types of cam systems: **CAMDRIVE®** and **HYDROCAM®**. With both systems, we eliminate the need for bulky, complicated custom mechanical cams. With our standard **HYDROCAM®** systems, you can achieve any angle of movement. In addition, the designer has greater flexibility in the component placement with any **HYDROCAM®** system.

Hydraulic oil provides for the continuous performance and long life of the **HYDROCAM®** system. The oil automatically lubricates the cylinder wall on every stroke of the press, reducing friction on the **H1** Pump and **H2** unit's cylinder seals. Reduced friction increases seal life and decreases downtime. **HYDROCAMs®** use of any premium ISO **V-32** series hydraulic oil extends maintenance-free service, far superior to any other mechanical cam system on the market.

With **HYDROCAM®**, there are no off-die tanks, hoses or safety problems that result from their use. Also, there is no wasted time required to assemble, dismantle, store and find tanks, valves, fittings and hoses.



Important Receiving Information

NOTE: Some **HYDROCAM®** systems are shipped pre-assembled with the hydraulic oil already added. With these systems, make sure that the **H1**Pump is kept upright at all times. Failure to do so may result in the loss of hydraulic oil.

Check the contents of your shipment against the packing list! Make sure that all items are accounted for before discarding the container and packaging material.

Otherwise, field-assembled parts, accessories or requested spare parts could be discarded with the packaging material. In case of damage, advise the carrier who delivered the shipment. File a claim with that carrier immediately!

Do not return damaged components for repair or replacement unless you have contacted your local branch or distributor for instructions and obtained a "Returned Goods" (R.G.) number.

How To Select a *HYDROCAM*[®] System for Your Application

Basic Selection:

1. Determine tonnage required (piercing or forming force, plus stripping force), per unit to perform the necessary work. Note when using urethane or other mechanical methods for stripping, please add the appropriate stripping force.
2. After you calculate the forces, select the correct **H-2** unit(s) required to do the work. Do not exceed 90% of the **H-2** unit's available de-rated force (rated force, less return system force) from the chart below. Include the proper stroke length needed for each unit.
3. Determine the correct size and number of **H-1** pump(s). Group identical **H-2** units together (tonnage and stroke), performing identical work (piercing, forming of flanging). One **H-1** pump can operate up to four identical **H-2** piercing/forming units (see chart on page 6).

Force of H2 Piercing/Forming Unit

This chart shows the effect of a nitrogen or oil return system on the force rating of each **H2** unit.

Standard Rate equals the effect of standard (minimum) return force at 100 bar (1,450 psi) on the **H2** unit's force. Ideal for piercing applications that use a customer-provided stripper.

Maximum Rate equals the effect of maximum return force at 150 bar (2,175 psi) on the **H2** unit's force. Ideal for multiple piercing applications, special shape piercing, all forming and flanging.

H-2		Model 2	Model 3.2	Model 5	Model 7.8	Model 12.5	Model 20	Model 31
Std. Rate	daN	1,787	2,885	4,545	7,094	11,319	18,819	28,817
	Metric tons	1.8	2.9	4.5	7	11.3	18.8	28.8
Std. Rate	lbf.	3,932	6,346	10,002	15,611	24,906	41,440	63,439
	USA tons	2	3.2	5	7.8	12.5	20.7	31.7
Max Rate	daN	1,698	2,728	4,319	6,740	10,742	18,230	27,727
	Metric tons	1.7	2.7	4.3	6.7	10.7	18.2	27.7
Max Rate	lbf.	3,732	5,993	9,494	14,815	23,609	40,115	60,989
	USA tons	1.9	3	4.7	7.4	11.8	20	30

Working Example: To pierce two holes, 0.250 inch diameter, through 0.125 thick mild steel, with 50,000 psi minimum tensile strength. We selected a 25mm stroke length for this example. (The working example uses piercing as the *HYDROCAM* application. *HYDROCAM* is also ideal for forming, flanging and other applications.)

Step 1 Calculate the force.

$$\text{Force} = (\text{Hole } \varnothing \times (\pi = 3.1416) \times \text{material thickness} \times \text{material tensile strength}) + \text{recommended 10\% stripping force}$$

English example: (.250 in. X 3.1416 X .125 in. X 50,000 psi) + 10% = 4,909 lbs. + 491 lbs. = 5400 lbs. (÷ 2000 lbs. = 2.7 U.S. tons)

Metric example: (6mm X 3.1416 X 3mm X 40 daN per mm²) + 10% = 2,262 daN + 226 daN = 2,488 daN (÷ 1000 N = 2.5 metric tons)

Step 2 Select the rate. In this example use the standard rate for piercing.

Step 3 Apply the Rule of Ninety: Never exceed 90% of the rated force. 5400 lbs. ÷ 0.90 = 6000 lbs.

Step 4 Read across the above chart until the rated force exceeds your Rule of Ninety value. In this example 6,346 lbs. exceeds 6000 lbs.

Step 5 Read up to the column heading. This is the H2 model you need. In this example, H2 model 3.2.

Example Chart

H-2		Model 2	Model 3.2
Std. Rate	daN	1,787	2,885
	Metric tons	1.8	2.9
Std. Rate	lbf.	3,932	6,346
	USA tons	2	3.2
Max Rate	daN	1,698	2,728
	Metric tons	1.7	2.7
Max Rate	lbf.	3,732	5,993
	USA tons	1.9	3

Annotations: **Step 2** points to the 'Std. Rate' row. **Step 4** points to the '6,346' value. **Step 5** points to the 'Model 3.2' column header.

FORCE WARRANTY: The minimum force that a **H2** Piercing/Forming unit is warranted to provide is listed in the maximum rate column. If the customer's determined application force for a cam station's tonnage exceeds 90% of the maximum rate force, the next larger or multiple **H2** unit(s) must be selected.

HYDROCAM® H1 Pump Selection Chart

This chart determines the appropriate **H1** Pump for the **H2** unit(s) selected. The chart also lists the **H1** Pump's piston rod travel (mm) next to the number of identical **H2** units served.

You need to know the **H2** model number, the number of **H2** units required and the **H2** stroke length before using this chart.

Always use the Rule of Ninety. The chart is based on using ninety percent of the total volume (VT) of the **H1** Pumps listed, in determining the number of identical **H2** units that can be supplied by an **H1** pump.

Different stroke lengths or different **H2** models may not be used with the same **H1** Pump. No more than four **H2** units may operate off a single **H1** Pump.

When two or more identical **H2** units are used to extend a gang pierce bar or forming pad, each **H2** unit must have its own **H1** Pump.

NOTE: Piston rod travel may vary slightly. This results from normal variations in connecting hose length(s), and the number and style of the turning fittings.

Use only approved hose and fittings.

Working Example:

H-2	H-1	Model 5
Model 2	25 mm	1 (12.99) 2 (18.49) 3 (23.98)
	50 mm	1 (18.49)
Model 3.2	25 mm	1 (16.47) 2 (25.44)
	50 mm	1 (25.44)
	75 mm	

Step 1 points to Model 3.2, Step 2 points to 25 mm, Step 3 points to 1 (16.47), and Step 4 points to Model 5.

Step 1 and 2 Locate the **H2** unit and its stroke. In this example: model 3.2, stroke 25mm.

Step 3 Locate the number of **H2** units to the right of the stroke length. The **H1** Pump's piston rod travel (in millimeters) is listed next to that number in parentheses.

Step 4 Read up to the column heading. This is the **H1** model you need. In this example: **H1**, model 5.

H-2	H-1	Model 5	Model 8	Model 13	Model 20	Model 40	Model 66
Model 2	25 mm	1 (12.99) 2 (18.49) 3 (23.98)	4 (22.26)				
	50 mm	1 (18.49)	2 (22.26)	3 (29.64) 4 (37.02)			
Model 3.2	25 mm	1 (16.47) 2 (25.44)	3 (25.57)	4 (31.60)			
	50 mm	1 (25.44)	1 (19.55)	2 (31.60)	3 (22.79) 4 (27.88)		
	75 mm		1 (25.57)	1 (25.57)	2 (22.79) 3 (30.43)	4 (25.59)	
Model 5	25 mm	1 (21.63)	2 (26.48)	3 (35.96)	4 (23.55)		
	50 mm		1 (26.48)	1 (26.48)	2 (23.55)	3 (21.74) 4 (26.49)	
	75 mm			1 (35.96)	1 (19.54)	2 (21.74) 3 (28.86)	4 (35.99)
Model 7.8	25 mm		1 (22.33)	2 (37.17)	3 (26.32)	4 (22.35)	
	50 mm			1 (37.17)	1 (20.05)	2 (22.35) 3 (29.77)	4 (37.19)
	75 mm				1 (26.32)	2 (29.77)	3 (40.90) 4 (52.04)
Model 12.5	25 mm			1 (30.92)	2 (27.31)	3 (25.08) 4 (30.94)	
	50 mm				1 (27.31)	2 (30.94)	3 (42.65)
	75 mm					1 (25.08)	2 (42.65)
	100mm					1 (30.94)	1 (30.94)
Model 20	25 mm				1 (23.52)	2 (26.45)	3 (35.93) 4 (45.41)
	50 mm					1 (26.45)	2 (45.41)
	75 mm					1 (35.93)	1 (35.93)
	100mm						1 (45.41)
Model 31	25 mm					1 (22.29)	2 (37.08) 3 (51.87)
	50 mm						1 (37.08)
	75 mm						1 (51.87)
	100mm						special

Here is what you need to order:

QTY	PRODUCT DESCRIPTION
2	H-2-3.2 Piercing unit with 25mm stroke and front plate
1	H-1-5 Pump with stroke gauge ring
1	RT-2175-CP Nitrogen Control Panel
2	RT701810670-6 Hydraulic Hose 6 foot long with swivel fittings (specify lengths up to 6 foot)
2	RT52041JC55-6 Nitrogen Hose 6 foot long with swivel fittings (specify lengths up to 6 foot)

Note:

- Nitrogen return is standard, oil return can be specified as an option.
- Front plate is standard, direct punch can be specified as an option.
- Straight fittings will be supplied to connect the hoses when ordered as a system, elbow fittings can be specified as an option.

Pre-Installation Guide

Selecting the Correct H2 Piercing/Forming Unit

1. Determine required cam station tonnage (piercing or forming force, plus total stripping force, plus nitrogen or oil return force). Do not exceed 90% of the **H2** unit's rated force (listed force, less return system force). See page 5.
2. Determine the number of **H2** unit's needed for that tool's applications.
3. Select the **H2** unit's stroke from those offered. A longer stroke could require a larger **H2** unit.
4. Group identical **H2** unit's together (tonnage and stroke). Group identical cam actions together (number, size or shape piercing units, forming, flanging, notching).
5. Determine timing for the extension, dwell and retracting of the **H2** unit's piston rod.
6. Ball Lock Punch applications; Select a 50 mm or longer stroke **H2** unit to provide additional space to remove the punch.

Selecting the Mounting Location for the H2 Piercing/Forming Unit(s).

1. Locate the **H2** unit(s) in any three dimensional orientation, perpendicular to the work.
2. Provide for hose access to the back and right front side of the **H2** unit. Custom porting is not available.
3. Provide a mounting platform that will support three times the total working force of the **H2** unit. Locate the **H2** unit against a thrust key.
4. The **H2** unit is designed to provide force, not guidance.
5. The **H2** unit's Piston Rod is designed to extend fully.

NOTE: HYDROCAM®'s unique design eliminates the thrusting force of the ram/slide from the cam station, allowing the use of standard L-GIBS to position and guide the station. Providing a guidance system for a HYDROCAM® driven cam station is the responsibility of the customer. Neither, the H2 unit's piston rod, nor its front mounting plate assembly is designed to provide cam station guidance. Contact your representative for application support.

Selecting the Correct H1 Pump

1. The **H1** Pump is selected by using the information developed while selecting the **H2** unit(s). (See calculation pages in the **HYDROCAM®** catalogue.) See page 5.

2. Select an **H1** Pump that provides the **H2** unit's volume total within 90% of the **H1** Pump's total volume. Do not exceed 90%. See page 6.
3. The stroke gauge ring can be provided with the **H1** Pump to develop the customer-supplied driver (kiss block) thickness and to ensure precise travel of the **H1** Pump's piston rod.

Note: Machining tolerances may cause the mounting surfaces of the **H1** Pump and/or driver to differ from the drawings. Determine the driver thickness from the finished surfaces, not the drawings.
4. One **H1** Pump may serve up to a maximum of four identical **H2** units.

Selecting the Mounting Location for the H1 Pump

1. The **H1** Pump's piston rod must be up and perpendicular to the ram/slide. Do not mount the **H1** Pump in an inclined press or an inclined special machine.
2. Locate the **H1** Pump's oil supply ports above the **H2** unit's vent port elevation. See page 11.
3. Locate the **H1** Pump anywhere in the die, under the ram/slide, that provides balance and simple hose access to the **H2** unit(s). Avoid areas using spray lubrication.
4. Locate the **H1** Pump within 2 meters (six feet) of the **H2** unit(s).
5. Rotate the **H1** Pump prior to mounting to ensure access and viewing of the Pump's sight gauge.

NOTE: As with any air, hydraulic or nitrogen cylinder, neither the H1 Pump nor the H2 unit is designed to withstand side-thrust forces. Properly guiding the tool and cam station minimize wear to the cylinders and increase seal life.

Special Timing of the H2 Unit's Piston Rod Extension, Dwell and Retraction.

Request the help of your representative to select a;

1. Larger **H1** Pump to begin cam extension later in the stroke.
2. Nitrogen cushion to begin cam extension earlier in the stroke.
3. Sequenced Solenoid Technology (SST) for special timing requirements.

Pre-Installation (continued)

4. Hydraulic or air cylinder, pressure system for special machine applications.

Connecting the H1 Pump, H2 Piercing/Forming Unit(s) and Nitrogen Return Control Panel. See page 11.

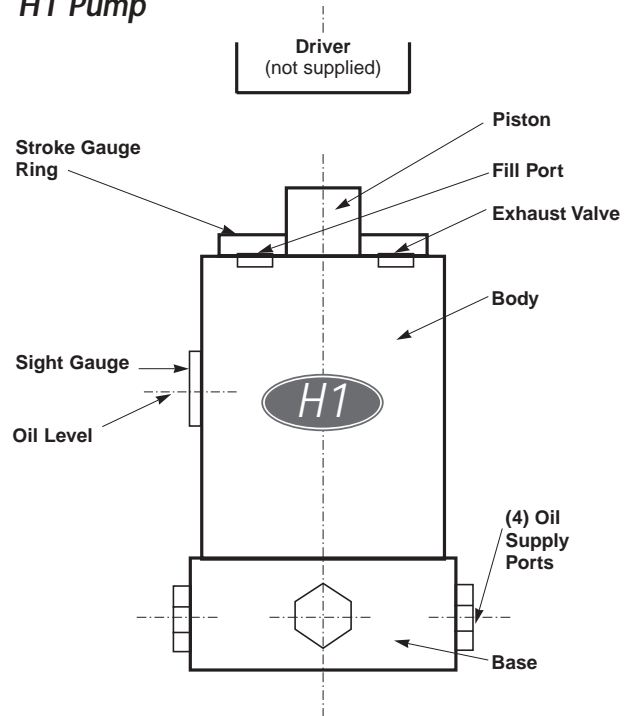
1. Minimize the number of fittings in the hose system.
2. Do not use a hose system that involves a fitting - to fitting - to fitting series of connections.
3. Hose each identical H2 unit to a H1 Pump with its own hose. Do not hose in series. Provide simple access for hose routing. Use only approved hose and fittings.
4. Provide additional hose length to ensure appropriate radius and safe routing. Avoid high spots in the oil hose route that will trap and create air pockets.
5. Maximum hose length is 2 meters (six feet). Do not substitute the supplied hydraulic hose with a smaller or lighter duty hose.
6. Rotating the H1 Pump 45° may simplify hose routing.
7. Avoid turning fittings. If a hose turn requires a turning fitting, select a 45° fitting as a first choice and a 90° fitting second. Use only BSPP-style fittings.

Nitrogen Return System

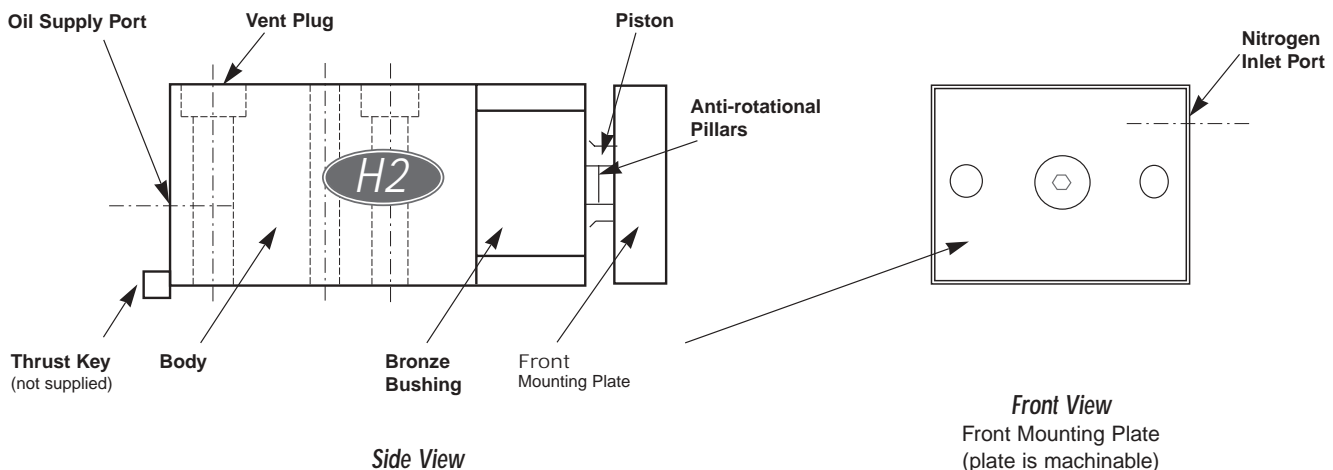
1. Always use a control panel.
2. For each H1 Pump, use at least one control panel that connects that H1's associated H2 units.
3. Use O-ring style hose fittings.

Note: We understand that a few applications will exceed this guide. Contact your representative for application support.

H1 Pump



H2 Unit



Installation

Before attempting to install or service, READ THIS MANUAL THOROUGHLY.

PROVIDING A GUIDANCE SYSTEM FOR THE PIERCING OR FORMING STATION IS THE RESPONSIBILITY OF THE CUSTOMER. NEITHER THE H2 PIERCING/FORMING UNIT'S PISTON ROD NOR ITS FRONT MOUNTING PLATE ASSEMBLY IS DESIGNED TO PROVIDE CAM GUIDANCE.

Installation Warnings

1. **HYDROCAM's® H1** Pump must be set in the die or press in a vertical position with the piston rod up and perpendicular to a horizontal ram/slide.
2. Never stroke a **HYDROCAM®** system unless all components are properly mounted and nitrogen is added to the return system.
3. **HYDROCAM's® H1** Pump must be set above the elevation of **H2** Piercing/Forming unit(s). See page 10.
4. The tool must include stop blocks to prevent over-travel of the **HYDROCAM's® H1** Pump's piston rod.
5. Never store the tool in a die closed position or depress the piston rod of the **HYDROCAM's® H1** Pump(s) during storage.
6. Never loosen a hose fitting if the return system is under nitrogen pressure or the **H2** unit's piston rod is extended.

Installation Procedure - H1 Pump's Piston Rod Driver

The **H1** Pump's piston rod travel is critical to the successful operation of the **HYDROCAM®** system.

1. Machine smooth and parallel, the tool's mounting surfaces for the **H1** Pump (lower) and the customer-supplied driver (upper). The diameter of the driver's contact surface is a minimum of twice the diameter of the **H1** Pump's piston rod. This contact surface must be smooth and parallel with no mounted holes. Use a Rockwell 45C plate for the driver.
- 2a. If the **H1** Pump's, stroke gauge ring is available, mount and use it to develop the travel of the **H1** Pump's piston rod. The measurement from the base of the **H1** Pump, to the top of the mounted stroke gauge ring determines the die-closed position of the customer-supplied driver's contact surface. Use this measurement to calculate the length of the customer-supplier driver. We recommend that the stroke gauge ring be removed

and stored on the tool prior to stroking the **H1** Pump.

OR ...

- 2b. Use the formula (Calculating the **H1** Piston Rod Travel) from the **HYDROCAM®** catalogue to determine the length of the **H1** Pump's piston rod travel. See page 6 for the **H1** selection and travel of piston. The measured height from the base of the **H1** Pump, to the top of the piston rod extended, less the calculated piston rod travel, locates the die closed position of the contact surface of the customer-supplied driver. Use this measurement to calculate the length of the driver.

Installation Procedure - Pre-Assembled HYDROCAM® Systems

Installation of a PRE-ASSEMBLED SYSTEM is the same as the procedure for installing a NON-ASSEMBLED SYSTEM.

Begin at step 2. of that section, noting that the hydraulic oil has previously been added to the system. With the nitrogen pressure fully discharged, the **H2** unit's piston rod may be extended by carefully depressing the **H1** Pump's piston rod with a manual press.

Installation Procedure - Non-Assembled HYDROCAM® Systems, Nitrogen Return

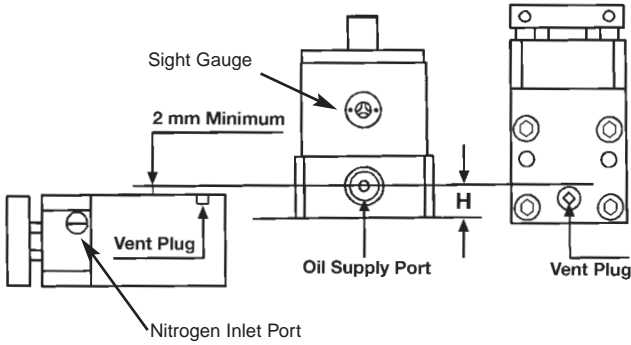
1. Check to see that the system's **H1** Pump, **H2** Piercing/Forming unit(s), hose assemblies and system accessories are not pre-assembled (see above).
2. Locate the **H2** unit in the desired position. The part number RTAUX-1000 Hand/Fill pump can be connected to the **H2** unit's hydraulic oil port to move the piston rod, easing the alignment of the customer-provided piercing or forming station and guidance system. Locate the **H2** unit against a thrust key.
3. When alignments are correct, set and tighten four mounting bolts and two dowels in the holes provided on the **H2** unit. Follow the same procedure for each additional **H2** unit. Note: If access to the **H2** unit is limited, final mounting can wait until after hydraulic oil has been added to the system.
4. Locate the **H1** Pump in the desired position, then set and tighten four mounting bolts. The **H1** Pump must be located at a higher elevation than the **H2** unit. Note: If access to the **H1** Pump is limited, final mounting may wait until after hydraulic oil has been added to the system. Rotate the **H1** Pump prior to mounting to ensure access and viewing of the Pump's sight gauge. See page 11.

Installation (continued)

5. Connect the **H1** Pump and the **H2** unit(s) with hose and fittings, providing additional hose length to assure appropriate radius and safe routing. Do not allow high spots in the hose routing. Use Blue lock-tite™ on all threads and tie-downs on the hose(s).
 6. With the **H2** unit's piston rod in the full-back (die-open) position, slowly charge the **H2** unit(s) with 100 bar (1450 psi) of nitrogen using the control panel or the RTUAL-04.0-QDM service tool. To install the control panel, the cover plug and inlet valve must be removed before installing the adapter fitting on the front (bronze) bushing of the **H2** unit(s).
 7. Adding ISO V-32 Series Hydraulic Oil to the System:
 - A. To prevent contamination from entering the hydraulic system, loosen the fill port plug on top of the **H1** Pump, but do not fully remove it. Then, loosen the vent port plug on top of the associated **H2** unit(s), but do not fully remove it. Remove the plugs only when hydraulic oil is being added or air is being bled. Depending on the location of the **H1** Pump and its **H2** unit(s), two people may be needed to complete the following tasks.
 - B. With a squeeze bottle or the RTAUX-1000 Hand/Fill pump, fill the system slowly with the hydraulic oil, through the fill port on top of the **H1** Pump. While one person is adding the hydraulic oil, the other will open fully, the lowest mounted **H2** units' vent port until a continuous flow of pure hydraulic oil (no air bubbles) flows from the vent port, then replace the port plug. Repeat the same with any additional **H2** units(s), moving from the lowest to the highest mounted. After all **H2** vent plugs are in place, add hydraulic oil until it centers in the **H1** Pump's sight gauge. Do not over-fill the system with hydraulic oil.
 - C. Beginning with the lowest mounted, separately and carefully, reopen the vent ports on each **H2** unit. Let it open until no air bubbles rise out of the vent port. If the hose assembly was properly laid-out, subsequent to adding hydraulic oil, all air bubbles are now out of the system. If care was not taken to ensure the smooth fall and rise of the hose assembly, the hose system must be adjusted and the process repeated.
 - D. Check the **H1** Pump's sign gauge and add hydraulic oil, if needed. Do not overfill the **H1** Pump. Center the hydraulic oil in the sight gauge, replace and tighten the **H1** fill port plug.
 - E. Check alignments and check to be certain all fittings are tightened.
 8. Stroke the **H1** Pump three times, ensuring that the **H2** unit's piston rod fully extends, and at the die open position, the hydraulic oil level is centered in the **H1** Pump's sight gauge. Also, check that the **H2** unit's piston rod returns to its full-back (die open) position. Add additional hydraulic oil, if need, as stated in step 7.
- Your hydrocam system is now ready for production.
- ### **HYDROCAM systems with the H2-2 unit(s) or systems with very long Hydraulic Drive Hose Assemblies can be more difficult to fill.**
- The following will assist:
- a. First, discharge the nitrogen return system. With a pry bar, carefully cause the front mounting plate to move it forward about 3 mm (1/8"). It is not necessary, nor recommended that the front mounting plate be moved open any farther.
 - b. Complete Steps A-D listed above, understanding that these systems will take longer to fill. Setting the **H1** Pump much higher than the **H2** unit(s) while adding hydraulic oil to the system will aid in filling these systems. After completing Step D above, return and complete Step c, listed below.
 - c. With the **H1** Pump's fill port open, push the **H2** unit's front mounting plate(s) back into the full-back (die open) position. Next, charge the nitrogen return system. With the **H2** unit's front mounting plate(s) fullback, check the oil level in the **H1** Pump's sight gauge. The oil level may be too high. Drain excess oil from the system. Complete Step E listed above.
- Complete assistance is available should the need arise. contact your representative for details.
- ### **THE MOST COMMON HYDROCAM® OPERATING PROBLEM IS AIR CAUGHT IN THE HOSE SYSTEM. ENSURE THAT YOU HAVE PROPERLY MOUNTED THE H1 PUMP, AVOIDED HIGH SPOTS IN THE HOSE SYSTEM AND BLED THE SYSTEM OF AIR.**

Installation (continued)

Required position of *H1* as compared to *H2*

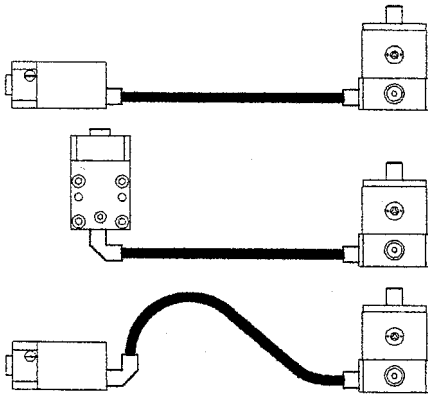


MODEL	H DIMENSION
HYDROCAM H1-5	21 mm (0.83 in)
HYDROCAM H1-8	25 mm (0.98 in)
HYDROCAM H1-13	25 mm (0.98 in)
HYDROCAM H1-20	25 mm (0.98 in)
HYDROCAM H1-40	30 mm (1.18 in)
HYDROCAM H1-66	40 mm (1.57 in)

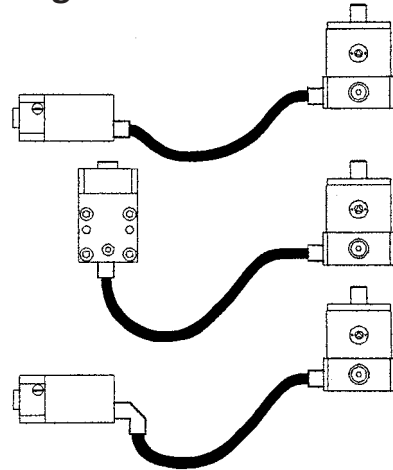
NOTE: We understand that a few applications will exceed this guide. Contact your representative for application support.

Hose Connection *H1* to *H2*

Wrong



Right



NOTES:

Operation

Standard **HYDROCAM**[®] systems operate using a simple hydraulic driven extension with a nitrogen return and require no special conditions or procedures to operate them. Ensure that the PRE-INSTALLATION GUIDE and INSTALLATION sections of this manual have been followed prior to operation.

During normal operation, occasionally inspect the hydraulic oil level by viewing the sight gauge on the **H1** Pump's body. The oil level should be centered in the sight gauge. In addition, check the nitrogen pressure 100 bar (1450 psi) in the **H2** Piercing/Forming unit's front (bronze) bushing on the control panel or with the RTUAL-04.0-QDM service tool. (Note: The installation of the RTUAL-04.0-QDM service tool will automatically lower the nitrogen pressure in the **H2** unit as the nitrogen fills the additional volume in the service tool.)

As with any air, hydraulic or nitrogen cylinder, neither the **H1** Pump nor the **H2** unit is designed to withstand side-thrust forces. Properly guiding the tool and cam station will limit damage to the cylinders and increase seal life.

THE MOST COMMON CAUSE OF A HYDROCAM[®] SYSTEM NOT OPERATING IS AIR CAUGHT IN THE HOSE SYSTEM. ENSURE THAT YOU HAVE PROPERLY MOUNTED THE H1 PUMP, AVOIDED HIGH SPOTS IN THE HOSE SYSTEM AND BLED THE SYSTEM OF AIR.

Complete engineering assistance, seminars and service support are available should a need arise for any of our full line of metal forming products. Contact your representative for details.

Hazard Warnings

- **ONLY PERSONNEL WITH THOROUGH KNOWLEDGE OF HYDRAULIC AND/OR NITROGEN CYLINDER SYSTEMS SHOULD ATTEMPT TO SERVICE OR REPAIR THIS SYSTEM.**
- **BEFORE ATTEMPTING TO CHARGE OR EXHAUST THIS OR ANY SYSTEM USING HIGH PRESSURE NITROGEN, HYDRAULICS, OR USE OTHER EQUIPMENT CONTROLLING OR STORING ANY COMPRESSED GAS. ALWAYS USE APPROVED EYE AND EAR PROTECTION.**
- **SLOWLY EXHAUST ALL NITROGEN FROM THIS SYSTEM BEFORE SERVICING. MAKE SURE ALL PRESSURE HAS BEEN COMPLETELY EXHAUSTED BEFORE ATTEMPTING TO REMOVE ANY FITTINGS, HOSES, H1 PUMP, H2 PIERCING/FORMING UNIT(S), CONTROL PANEL OR OTHER COMPONENTS.**
- **EXCEPT FOR AN EMERGENCY, ALWAYS SLOWLY CHARGE OR EXHAUST THIS OR ANY NITROGEN SYSTEM. RAPIDLY CHARGING OR EXHAUSTING A NITROGEN SYSTEM COULD RESULT IN DAMAGE TO EQUIPMENT AND/OR INJURY TO PERSONNEL.**
- **DO NOT SUBSTITUTE ANY COMPONENT IN THIS SYSTEM! IMPROPER SUBSTITUTIONS MAY RESULT IN PERFORMANCE PROBLEMS AND/OR SAFETY HAZARDS.**
- **DO NOT ATTEMPT TO REUSE ANY COMPONENT THAT IS, OR APPEARS TO BE DAMAGED. THIS CAN RESULT IN POTENTIAL PERFORMANCE PROBLEMS AND/OR SAFETY HAZARDS.**
- **USE ONLY A PREMIUM ISO V-32 SERIES HYDRAULIC OIL.**

Troubleshooting Tips

THE MOST COMMON CAUSE OF A HYDROCAM® SYSTEM NOT OPERATING IS AIR CAUGHT IN THE HOSE SYSTEM. ENSURE THAT YOU HAVE PROPERLY MOUNTED THE H1 PUMP, AVOIDED HIGH SPOTS IN THE HOSE SYSTEM AND BLED THE SYSTEM OF AIR.

NOTE: (***) Indicates repair of the component is in question. **HYDROCAM®** components must be replaced with an exact duplicate part. Failure to do so may result in serious injury, as well as cause damage to the **HYDROCAM®** system or tool.

PROBLEM: H2 Unit's Piston Rod is not Extending to its Full Stroke.

CAUSE: There is air in the hose system. Air has not been bled from the system. There is a high spot in the hose system trapping air. The **H1** Pump is not mounted above the **H2** unit(s). Adjust and bleed the air from the system. See pages 10 and 11.

CAUSE: Multiple **H2** units are hoses in series. Re-hose using a single hose from each **H2** unit to its own **H1** Pump port. An excessive number of fittings have been used. Eliminate or reduce the number of turning fittings. The supplied hose was substituted with a smaller ID hose. Use only approved hose and fittings.

CAUSE: The **H1** Pump's hydraulic oil level is not correct. The oil level should be centered in the **H1** Pump's sight gauge, add or remove excess oil and bleed air from system.

CAUSE: The **H1** Pump's piston rod is not being travelled the correct distance. Recheck using the stroke gauge ring that the **H1** Pump's piston rod travel is correct. Adjust (lengthen or shorten) the **H1** Pump's piston rod travel. Contact your representative for support. See page 6.

CAUSE: There is an internal nitrogen leak in the **H2** unit causing the hydraulic oil in the system to foam. Rebuild the **H2** unit.

CAUSE: The **H2** unit is undersized for this application. Check that the required force (piercing or forming force + stripping force + return force) is not beyond 90% of the maximum rated tonnage capacity of **H2** unit. See page 5.

CAUSE: The **H1** Pump is undersized. Volume Total of the **H2** unit(s) is greater than 90% of the **H1**'s Total Volume. See page 6.

CAUSE: The **H1** Pump's piston rod has been continuously over-stroked, weakening the safety relief valve. Contact your representative!

PROBLEM: H2 Unit's Piston Rod is not Returning to its Full-Back (Die-Open) Position.

CAUSE: The cam station does not have a guidance system causing the station to bind the **H2** unit's piston rod. Install a cam station guidance system. The **H2** unit is designed to provide force not guidance! See page 7.

CAUSE: Check the nitrogen pressure, 100 bar (1,450 psi). If the nitrogen pressure is low, charge the system to 100 bar (1,450 psi) and check for nitrogen leaks in the system. If nitrogen pressure is very low and/or frequent charging is required. Rebuild the **H2** unit with the appropriate seal kit.*** If the **H2** unit is self-contained and the inlet valve is leaking, replace it with new.*** If the nitrogen pressure is 100 bar (1,450 psi), check the **H1** Pump (see below).

CAUSE: The **H1** Pump's hydraulic oil level is too high. The oil level should be centered in the **H1** Pump's sight gauge. Remove excess oil and bleed air from the system.

PROBLEM: H1 Pump's Piston Rod is not Returning to a Full-Up (Die-Open) Position.

CAUSE: The **H1** Pump's hydraulic oil level is too high. The oil level should be centered in the **H1** Pump's sight gauge. Remove excess oil and bleed air from the system.

CAUSE: **H1** Pump's piston rod is being over-travelled causing the 400 bar (5,802 psi) safety relief valve to activate on each stroke, resulting in hydraulic oil not returning back into the **H1** Pump's lower chamber. With the stroke gauge ring, adjust (shorten) the **H1** Pump's piston rod travel and bleed air from the system. See page 6.

Troubleshooting Tips (continued)

CAUSE: Hydraulic oil has filled the **H1** Pump's upper chamber because the tool was stored in a die-closed position. See Installation Warnings, page 9. Carefully remove the fill port plug and exhaust valve on top of the **H1** Pump using a 5mm hex wrench and an 11mm thin-wall socket wrench, then *slowly* pull the piston rod up using a dowel puller (M8 for a **H1-5** Pump, M10 for the **H1-8** and **H1-13** Pumps, M16 for a **H1-20** Pump, M20 for the **H1-40** and **H1-66** Pumps). Check that the hydraulic oil level is centered in the **H1** Pump's sight gauge. Replace and tighten the fill port plug and exhaust valve.

CAUSE: Hydraulic oil is by-passing the **H1** Pump base's green O-ring seal. Rebuild the **H1** Pump. *** See page 16.

CAUSE: The **H1** Pump's piston rod return spring is weak, damaged or undersized. Replace with a new, unpainted return spring. ***

PROBLEM: *Loss of Hydraulic Oil.*

CAUSE: Hydraulic oil was accidentally drained. The oil level should be centered in the **H1** Pump's sight gauge, add oil and bleed air from system.

CAUSE: Hydraulic oil fitting(s) is leaking or breaking. The hose fitting(s) was never tightened or over-tightened during assembly. Replace any leaking hose or fitting with new. Use Blue lock-tite™ on all threads and tie-downs on the hose(s). An excessive number of fittings have been used. Eliminate or reduce the number of turning fittings. Use only approved hose and fittings.

CAUSE: Scratched **H1** or **H2** piston rod, damaged components, seals, hoses or fittings are causing a leak. Follow standard leak tests to determine the location of leak. **H1** Pump or **H2** unit rebuilt using the wrong or damaged seal kit components causing leaks. ***

PROBLEM: *Loss of Nitrogen Pressure.*

CAUSE: Nitrogen pressure is low, resulting from the normal loss following the installation of the RTUAL-04.0-QDM service tool. Recharge system.

CAUSE: Nitrogen pressure was accidentally reduced. Recharge system.

CAUSE: If the **H2** is self-contained and the inlet valve is leaking, replace it with new. Note: Nitrogen return systems that use a control panel do not have an inlet valve in the **H2** unit!

CAUSE: Nitrogen fitting(s) is leaking or breaking. The hose fitting(s) was never tightened or over-tightened during assembly. Replace any leaking hose or fitting with new. Use O-ring style hose fittings. Use Blue lock-tite™ on all threads and tie-downs on the hose(s). An excessive number of fittings have been used. Eliminate or reduce the number of fittings. Use only approved hose and fittings.

CAUSE: Scratched **H2** unit piston rod, damaged and/or leaking components, seals, hoses, fittings or components on the control panel. Follow standard leak tests to determine location of the leak. Replace any damaged or leaking part with new. **H2** unit was rebuilt using the wrong or damaged seal kit components. *** System is in need of general overhaul. ***

PROBLEM: *Rupture Plug Failure.*

CAUSE: Nitrogen pressure charged too high, maximum pressure is 150 bar (2175 psi). A hose has been crushed or has too tight a radius. Defective, weakened or incorrect rupture plug. *** Die lubricant has entered the system (see below). Eliminate source and rebuild system.

PROBLEM: *Hydraulic Oil Level in H1 Sight Gauge Appears to be Rising.*

CAUSE: Die lubricant is entering the system through the **H1** Pump or **H2** unit(s). Eliminate source of the die lubricant and rebuild system.

PROBLEM: *The Nitrogen Charge Pressure Indicator on the Control Panel does not rise when the ram/slide is set at Die-Closed Position.*

CAUSE: The Inlet valve was not removed from the **H2** unit during installation of the nitrogen return system's hose assembly. Using the RTUAL-04.0-QDM service tool, exhaust all nitrogen from the **H2** unit and remove the inlet valve.

Overhaul

Before attempting any service, read the sections on INSTALLATION and HAZARD WARNINGS and THIS MANUAL THOROUGHLY.

Disassembly

1. WITH THE CONTROL PANEL OR THE RTUAL-04.0-QDM SERVICE TOOL, SLOWLY EXHAUST ALL NITROGEN FROM THE SYSTEM BEFORE SERVICING OR HANDLING. ENSURE COMPLETE DISCHARGE OF PRESSURE BEFORE ATTEMPTING TO REMOVE ANY **H1** PUMP, **H2** UNIT(S), CONTROL PANEL, HOSES, FITTINGS, OR ANY OTHER SYSTEM COMPONENTS.
2. To begin disassembly of the **HYDROCAM**[®] system, locate and remove hydraulic oil hose fittings and port plug(s) from the **H1** Pump and **H2** unit(s). Drain the hydraulic oil completely out of the system. CAUTION: Do not allow the hydraulic oil to drain on to the floor, as it is extremely slippery. Do not reuse the hydraulic oil, as it may be contaminated. Consult the MSDS form for the ISO **V-32** series hydraulic oil that you are using for additional handling information. For cylinder disassembly refer to the instructions included in this manual, see **H1** Pump or **H2** unit's seal kit section, pages 16 and 18.

Cleaning the System

1. Always remove all plugs, fittings and accessories before cleaning the components. Using solvent, thoroughly clean the disassembled **H1** Pump, **H2** unit(s) and system components. Carefully blow-dry the components with filtered compressed air. Inspect them for wear as described in the seal kit instructions. If in doubt, replace a worn component rather than have a premature failure in a newly rebuilt system.
2. When one major part of the system needs to be rebuilt, rebuild them all, to assure maximum service life and minimum downtime.

Assembly

1. Rebuild the **H1** Pump and **H2** unit(s) according to the instructions included in this manual. See the **H1** Pump or **H2** unit's seal kit section, pages 16 and 18.
2. Refer to the PRE-INSTALLATION GUIDE and INSTALLATION sections in this manual for proper

guidelines to reinstall a **HYDROCAM**[®] system. Prior to installation, make sure that all seals, sealing surfaces and O-rings are lubricated. Leave the two **H1** Pump valves on top of the pump body loose so that ISO **V-32** series hydraulic oil can be added to the Pump. Failure to follow the INSTALLATION section will result in damage to the **HYDROCAM**[®] system.

3. The **H1** Pump was designed to operate in a very specific orientation (vertical). To avoid loss of hydraulic oil, damage to equipment and/or injury to personnel, never operate this **HYDROCAM**[®] component in any other position.
4. Use only a premium ISO **V-32** series hydraulic oil. Substitution can cause performance problems and/or safety hazards.
5. Prior to operation, follow standard leak tests to determine if there is any nitrogen or hydraulic oil leaks.
6. Never stroke a **HYDROCAM**[®] system until all components are properly mounted and tightened.

NOTES:

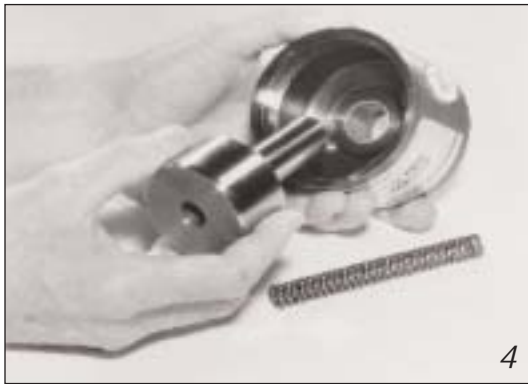
HYDROCAM® Rebuild



H1 Pump Seal Kit Instruction

BEFORE ATTEMPTING TO SERVICE OR REPAIR A **HYDROCAM®** SYSTEM, READ THE INSTALLATION AND SERVICE MANUAL THOROUGHLY. PLACING SPECIAL ATTENTION TOWARD THE HAZARD AND SAFETY WARNINGS LOCATED THROUGHOUT THE MANUAL. IF YOU DO NOT HAVE THIS MANUAL, CONTACT YOUR REPRESENTATIVE.

Before disassembly of the **H1** Pump, verify that the correct seal kit is on-hand and that it is complete. Thoroughly review the instruction and drawings included with this seal kit.



1. Disconnect the hose fitting(s) and/or port plug(s) attached to the four pump base sides. Using an 11mm thin-wall socket wrench and a 5mm hex wrench, remove the exhaust valve and fill port plug on top of the pump body. Empty the remaining hydraulic oil.
2. After carefully removing the sight gauge, use a pin spanner wrench to unscrew the pump body from the pump base. If a strap wrench is used, place it very close to the top of the pump body. Placing a strap wrench close to the pump base will exert greater force on the threads making removal difficult.
3. Carefully guide the piston rod out the bottom of the pump body. Taking care not to damage the piston rod or the pump body bore.

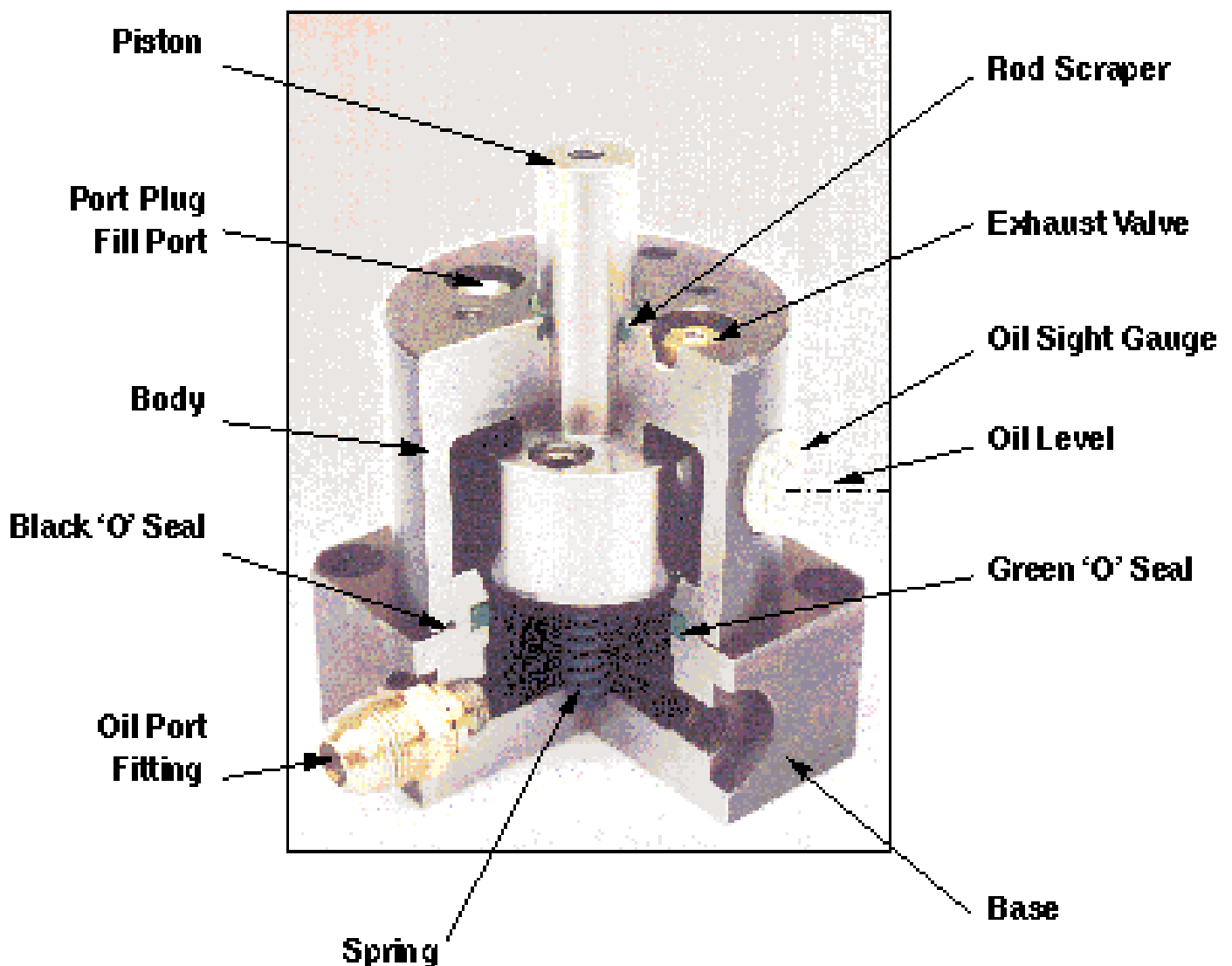


4. Note the colour, size, orientation and location of each seal. Remove all seals from the pump body and pump base, taking care not to damage the sealing surfaces.
5. High-pressure wash or solvent-clean the components that will be reused. Carefully blow-dry the components with filtered compressed air. Visually inspect the piston rod, pump body and pump base sealing surfaces. Replace any part that is damaged, worn, scratched or contains imperfections.
6. Carefully install the new seals in their proper location and orientation. Make sure that all seals, O-rings and sealing surfaces are lubricated before installation.

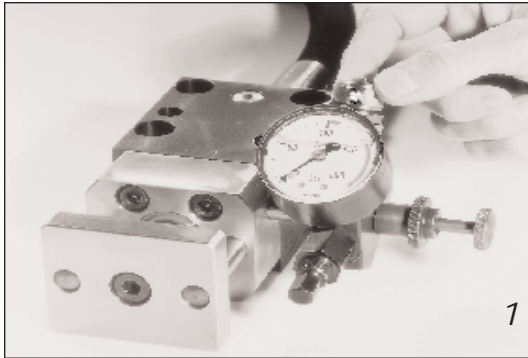
HYDROCAM® H1 Pump Rebuild (continued)

7. Lubricate with oil and carefully guide the piston rod fully into the pump body. Install the unpainted return spring in the base of the piston rod and install the pump body assembly on the pump base and tighten firmly. Install the two **H1** Pump valves on top of the pump body loosely, so that hydraulic oil can be added during tool installation. Carefully install the sight gauge.
8. Refer to the PRE-INSTALLATION GUIDE, INSTALLATION and OVERHAUL sections of the INSTALLATION AND SERVICE MANUAL for proper guidelines to reinstall this **HYDROCAM®** component. Failure to follow those guidelines will result in performance problems, damage to the **HYDROCAM®** system, equipment and/or injury to personnel.

H1 Pump

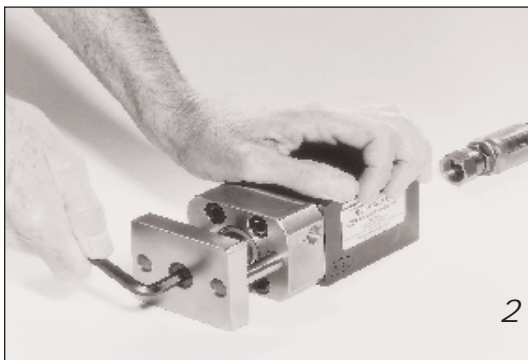


HYDROCAM® Rebuild

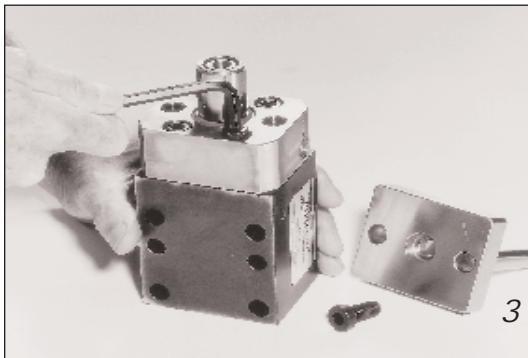


H2 Piercing/Forming Unit Seal Kit Instruction

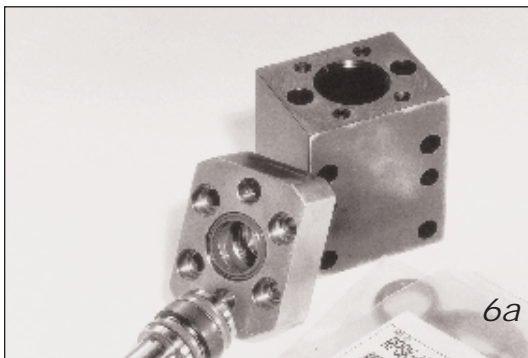
BEFORE ATTEMPTING TO SERVICE OR REPAIR A **HYDROCAM®** SYSTEM, READ THE INSTALLATION AND SERVICE MANUAL THOROUGHLY, PLACING SPECIAL ATTENTION TOWARD THE HAZARD AND SAFETY WARNINGS LOCATED THROUGHOUT THE MANUAL. IF YOU DO NOT HAVE THIS MANUAL CONTACT YOUR REPRESENTATIVE.



Before disassembly of the **H2** unit(s), verify that the correct seal kit is on-hand and that it is complete. Thoroughly review the instruction and drawings included with this seal kit.



1. Completely discharge the nitrogen from return system using the control panel or the RTUAL-04.0-QDM service tool. If using a control panel with a nitrogen return system remove from the **H2** unit's seal kit, the inlet valve and discard it.
2. Disconnect the hose fitting(s) and vent plugs attached to the **H2** Body and front (bronze) bushing. Remove the front plate with its columns by removing the metric socket cap screw centered on the front plate.
3. Remove the four metric socket cap screws on the front of the (bronze) bushing and carefully separate the front bushing from the body. Take care not to damage the piston rod or sealing surfaces while the body, front bushing and piston rod are separated.
4. Note the colour, size, orientation and location of each seal. Remove the seals from the piston rod, body and front bushing, taking care not to damage the sealing surfaces.

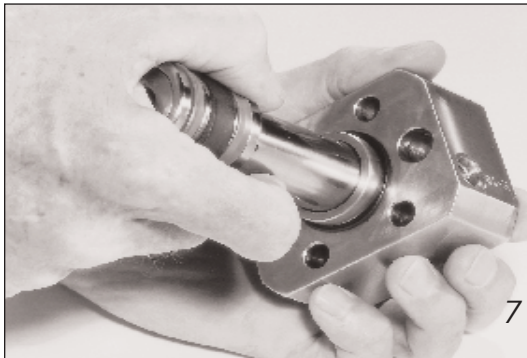


5. High-pressure wash or solvent-clean the components that will be reused. Carefully blow-dry the components with filtered compressed air. Visually inspect the piston rod, body and front bushing sealing surfaces. Replace any part that is damaged, worn, scratched or contains imperfections.
6. Carefully install the new seals from the seal kit in their proper location and orientation. Check to see that all seals, guide rings, O-rings and sealing surfaces are lubricated before installation. Place the front U-cup seal in the front (top) of the front bushing's seal chamber. Place grease on the U-cup seal, leaving the lower portion of the seal chamber open.

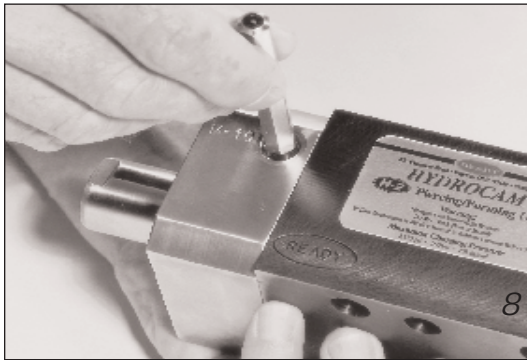
HYDROCAM® H2 Unit Rebuild (continued)



PISTON ROD SEAL INSTALLATION TIP: Immerse the U-cup seals to be installed on the piston rod in hot hydraulic oil for several minutes prior to placing them on the piston rod. This will simplify the expansion of the U-cup seal as it slides onto the piston rod and into its seal chamber. (Note: Check that the orientation of the U-cup seal is correct prior to placing it on the piston rod. The two U-cup seals sit on either side of the piston guide ring and must be in opposing directions.)



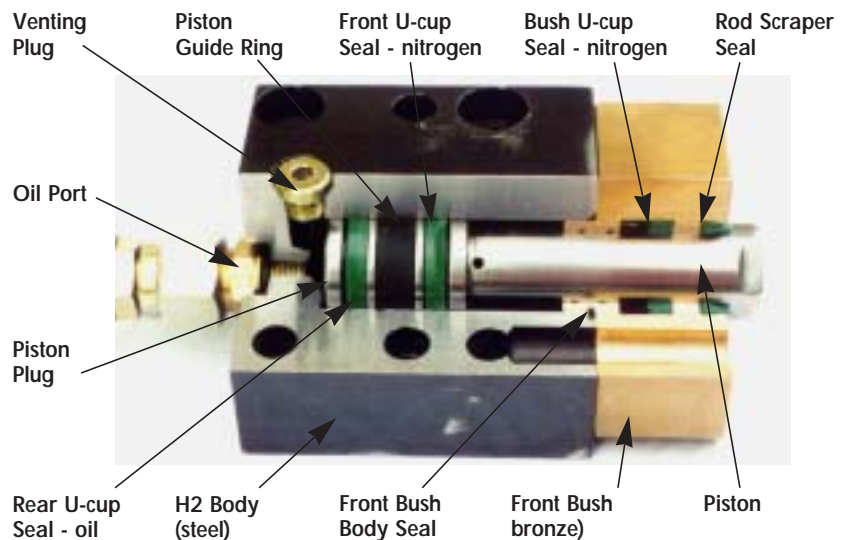
7. Lubricate with oil and carefully guide the piston rod into the front bushing and install the bushing assembly in the base. Install the four metric socket cap screws in the front of the bushing, then install the front plate with its columns. Align the columns by indicating them parallel to each other. Recheck the parallelism of the columns prior to torquing the metric socket cap screws on the front bushing and centered on the front plate. Use blue Lock-tite™ on all threads.



8. If the **H2** unit is using a self-contained nitrogen return and charged using the RTUAL-04.0-QDM service tool or using the optional oil return system, install a new inlet valve in the front bushing's nitrogen port. Do not install an inlet valve if the **H2** unit will be used with a nitrogen return control panel.

9. Refer to the PRE-INSTALLATION GUIDE, INSTALLATION and OVERHAUL sections of the INSTALLATION AND SERVICE MANUAL for proper guidelines to reinstall this **HYDROCAM®** component in the tool or press. Failure to follow those guidelines will result in performance problems, damage to the **HYDROCAM®** system, equipment and/or injury to personnel

H2 Unit





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