



Kinetics Controls & Innovation Ltd

Cairn Energy
Valve Sealing (Block & Bleed)
Flow Line Manifold Sangu A Platform
Project / Product / Procedure Review
08-03-2005
Reference AB116

The following is based on limited information available at the time of this evaluation

Overview:

To provide satisfactory double block and bleed isolations to safely complete new well flow line tie-ins to the Sangu A Platform systems, located in the bay of Bengal, 20 miles off the coast of Chittagong Bangladesh.

The valves requiring attention are installed on existing flow line manifolds. These valves have been eroded by sand and are internally passing preventing double block and bleed.

KCI will provide sealant products and services (Mac-Pac & APS -Gel) in support of obtaining a safe and effective barrier to complete this project.

The valves are manufactured by Pibivienne, ANSI CLASS 900.

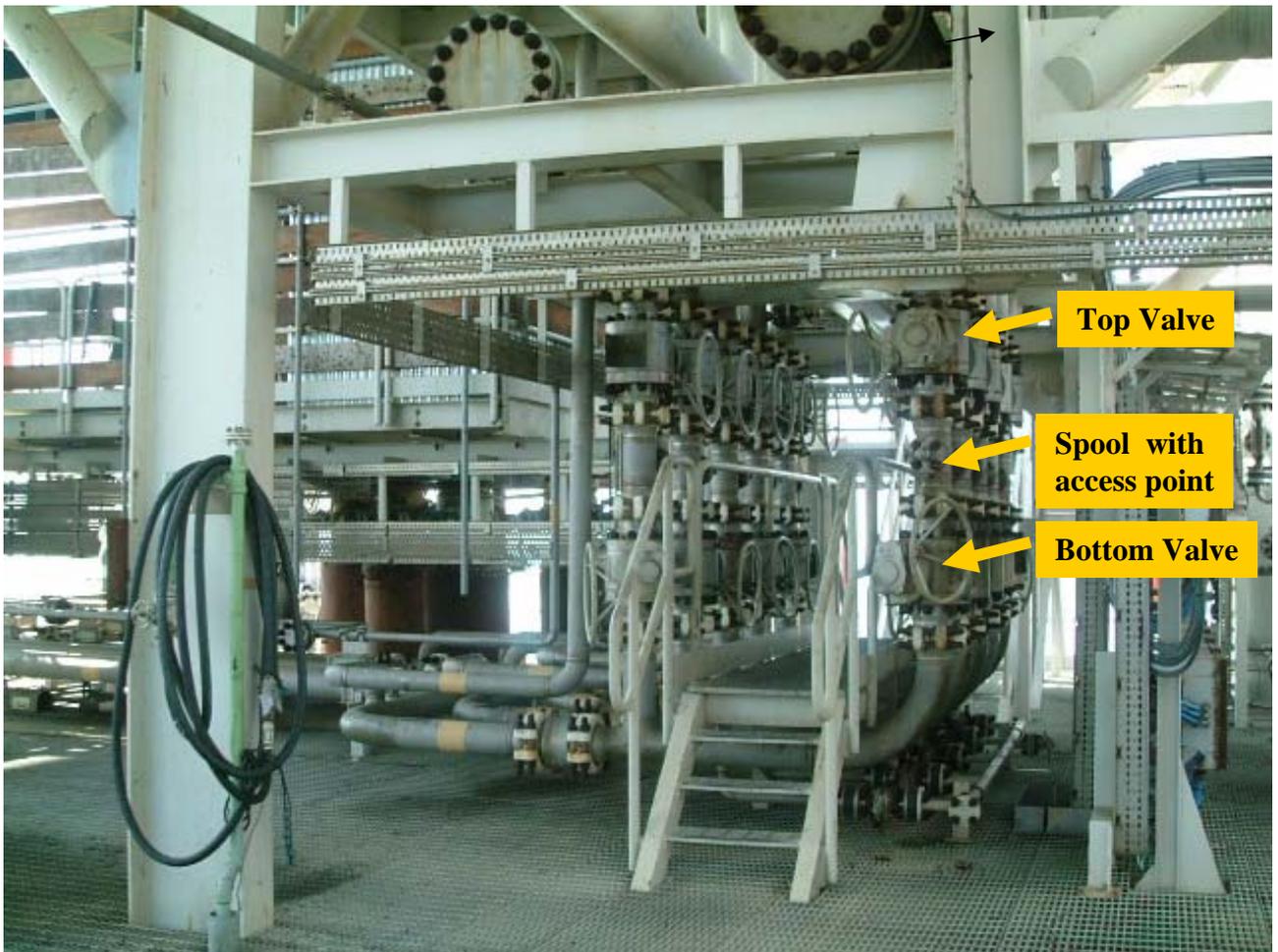
- There are a total of 8 valves on two wellhead manifolds in pairs, separated by a pup piece fitted with a Double Block and Bleed vent point.
- Existing grease fittings (special interface)
- Grease fittings have no physical obstructions for access
- Worksite will be classified as Zone 2, drilling completions will be in progress.
- All operations will be controlled through permit to work system.
- The valves have no external leakage, the valves pass internally.

The flow line product is multi-phase gas & condensate, No H₂S, 2000 mg/ltr chlorides, present operating pressure 50barg. The valves will be subject to full system pressure after isolation, and subsequent tie-in to the new flow lines from new wells. Expected operating pressures up to 139.5Barg, but should be fully rated as per 900# valves.

The ball in the photo is from a valve removed from the onshore system, the DP across this valve was 40bar+, the offshore manifold valves won't have had this level of DP.



Damaged Ball Valve



Wellhead Manifold

The intention is to inject APS Gel into the cavity between both valves. To support this we will also inject our Mac-Pac compound in and around both seat pockets. These products will be injected under existing closed in line pressure.

Installation overview:

Close valve up stream (monitor pressure build up) 50 Bar..

Bottom Valve closed

Inject seat areas with Mac-Pac, (500mls) both top and bottom seats

Half open top valve, inject KCI APS Gel through the existing block & bleed valve at the spool between both valves. Injection port estimated to be 20 litres.

Close top valve and inject Mac-Pac (500mls) into both top and bottom seats

Inject the Mac-Pac into stem seal ports if required

The APS –Gel requires 12 hours to set.

Open upstream valve slowly.

Notes:

The Mac-Pac compound can be injected under pressure up to 5,000psi with the KCI deployment tool. The Mac-Pac will pig out existing sealing products. Opening and closing the valve during injection will support sealant displacement. More than 500mls may be used if required to support the APS-Gel. Pressure increase during deployment is expected confirming pack-off capabilities.

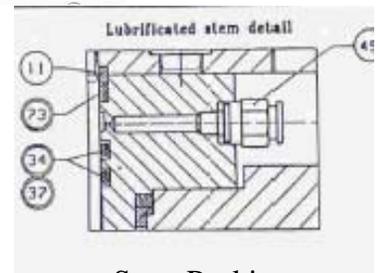
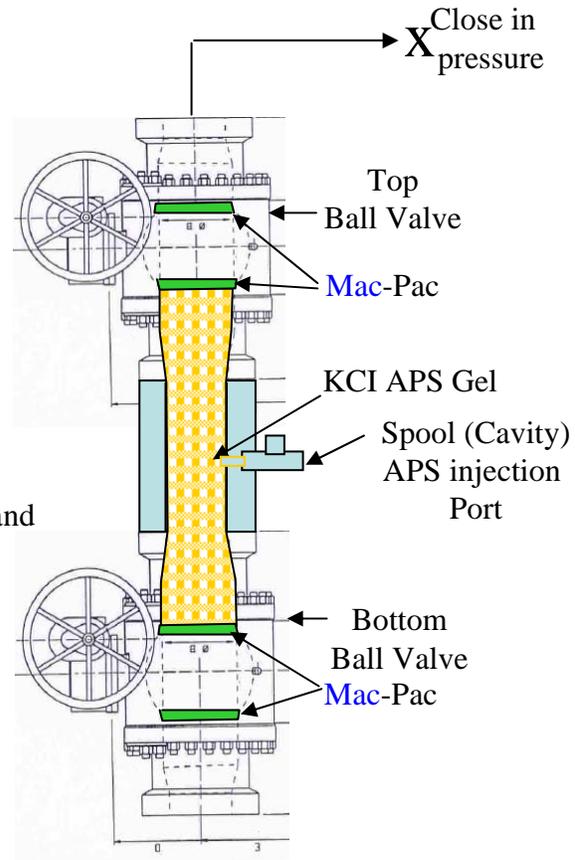
The KCI APS-Gel is a two-part mix which is deployed as a fluid injected through the Spool access point. The APS-Gel converts to solid gel after a 12hours setting time.

Removal APS-Gel:

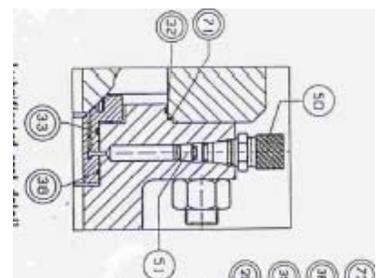
Open top valve.

Open bottom valve

Pressure below will pig the APS Gel into a slug catcher or the test separator.



Stem Packing
Injection Fitting



Seat Injection
Fitting

Estimated APS gel volume per system

To provide the most effective seal we would recommend deploying 20litres per system. This will not effect the removal when pigging.

Position of ball valves during deployment

Bottom valve closed and packed with Mac-Pac on both seat areas.

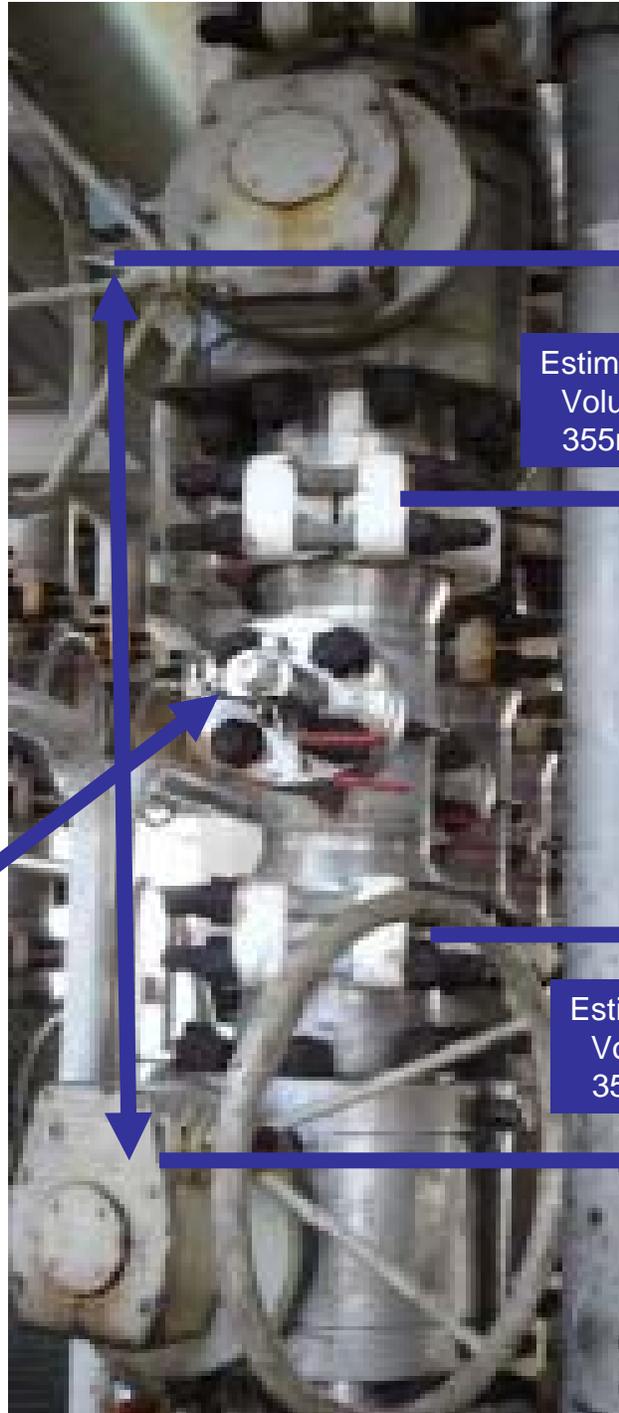
Top valve half open until full APS volume has been deployed.

Close and pack off both seat areas with Mac-Pac.

The APS-Gel will set within 6 to 8 hours

1 metre

Deployment through ½ " NPT port.



Ball Valve Lower seat area

Estimated Volume 355mm

4.300litres

500mm = 9.600litres

Estimated Volume 355mm

4.300litres

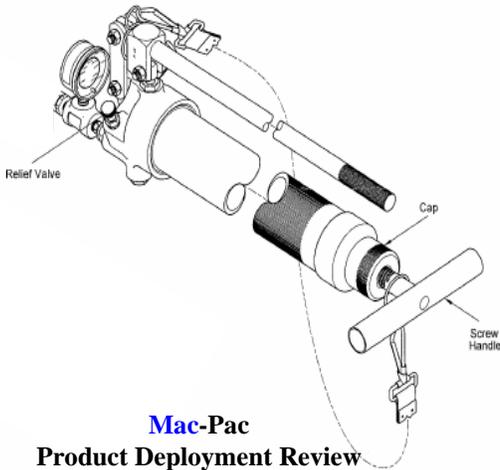
Ball Valve top seat area

Product information:

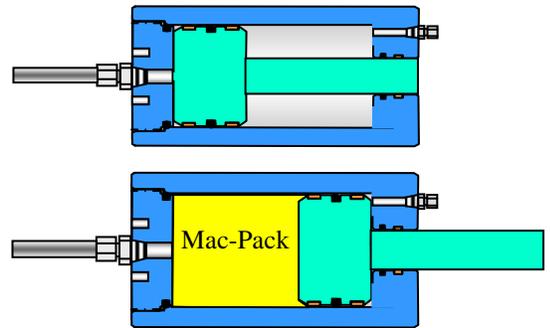
The **Mac-Pac** was developed to support ball valve and gate valve stem packing and seat sealing areas. The **Mac-Pac** originates from the KCI family of **Mac-Seal** products.

The **Mac-Pac** compound is designed to provide high temperature stability with ease of injection against pressure.

The **Mac-Pac** is provided in sticks, 500mls, 1litres and 5litre tubs and is deployed with the KCI deployment tool (s).



Mac-Pac
Product Deployment Review
Screw Hand Pump 10K-500mls
Part No KCI-SHP-10-500



KCI Mac-Pac Deployment Tool
250mls to 1litre with visual indicator
10,000psi W.P.

The KCI APS- Gel has been designed to provide a chemical/mechanical barrier as an alternative to other types of valve and pipeline interventions systems. The APS-Gel is deployed as a fluid and converts to a solid gel which can be sheared, pigged or returned to a fluid.



Pigging APS through
a 2" Gate Valve



APS Gel
Deployment Pump

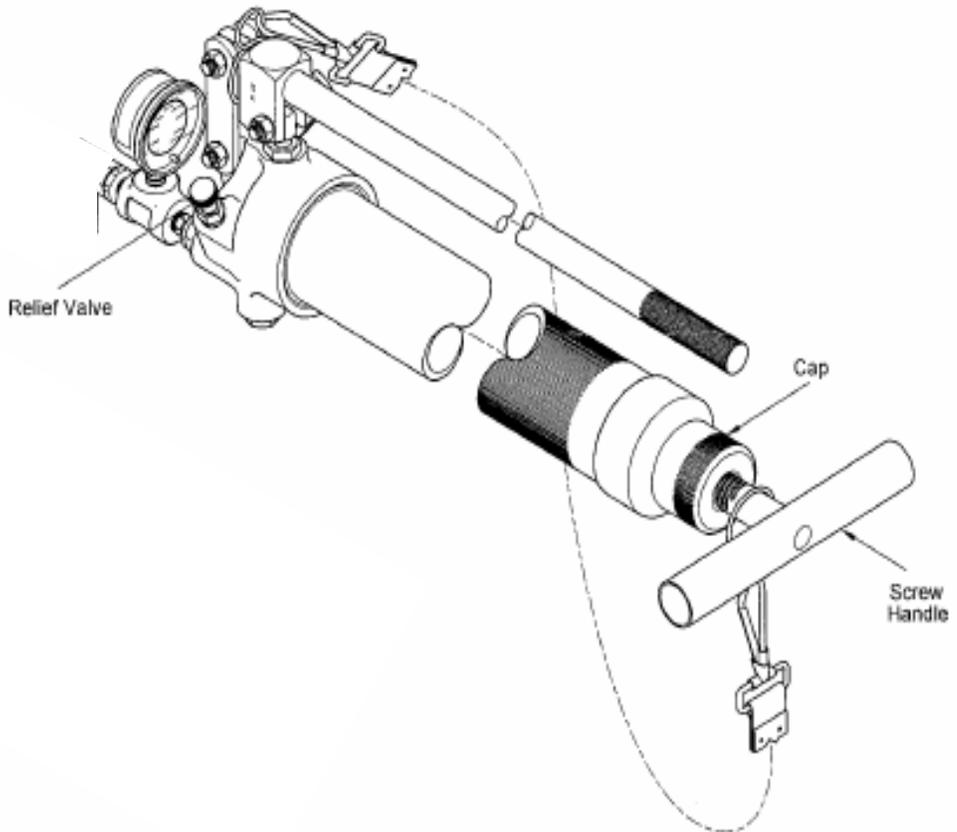


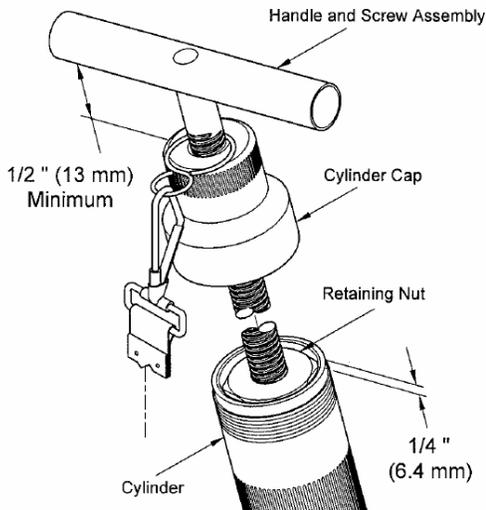
Valve shearing
APS Gel



Kinetics Controls & Innovation Ltd

Mac-Seal & Mac-Pac
Product Deployment Review
Screw Hand Pump 10K-500mls
Part No KCI-SHP-10-500





Remove the cylinder cap and screw assembly

Note: The **Mac-Pac** is supplied as a stick packaged in the tub. Once removed roll the product on a flat surface to provide the shape to meet the cylinder.

Remember to remove the plastic wrapper.

Position and retain the tool (in a vice if possible) at a reasonable position for filling.

Open the Cylinder vent valve.

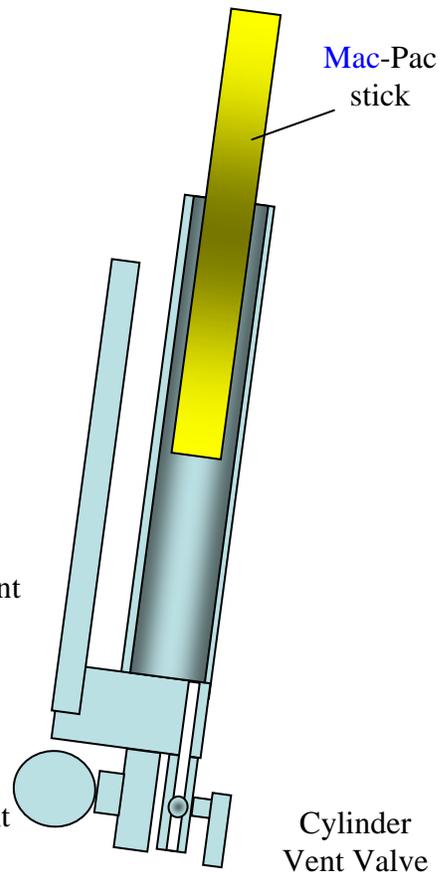
Place the **Mac-Pac** stick into the cylinder.

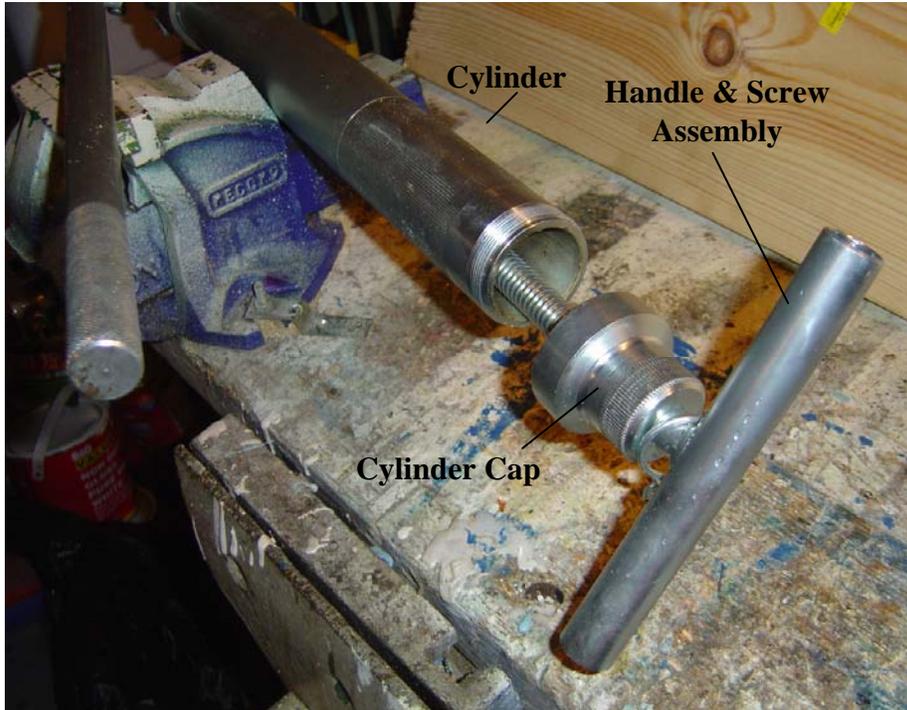
When installing the screw / piston assembly allow any excess air/ sealant to be displaced through the cylinder vent valve.

Screw the support piston until all air is vented from the cylinder through the Vent Valve (close valve)

Connect the tool to the feed line and confirm displacement of **Mac-Pac** compound prior to connecting to the access point. Please keep the feed line as short as possible

Screw in the support piston as far as possible and then operate the hand pump. Once hand pump pressure has been depleted, screw in the support piston and continue this process until the tool is empty or the specified volume has been displaced.





The screw assembly is removed to fill the cylinder



The piston assembly is designed with spring support to provide limited but continuous pressure feed to the pump. Note: The screw assembly feeds the hand pump device and will need to be functioned ever 15 to 20 strokes.

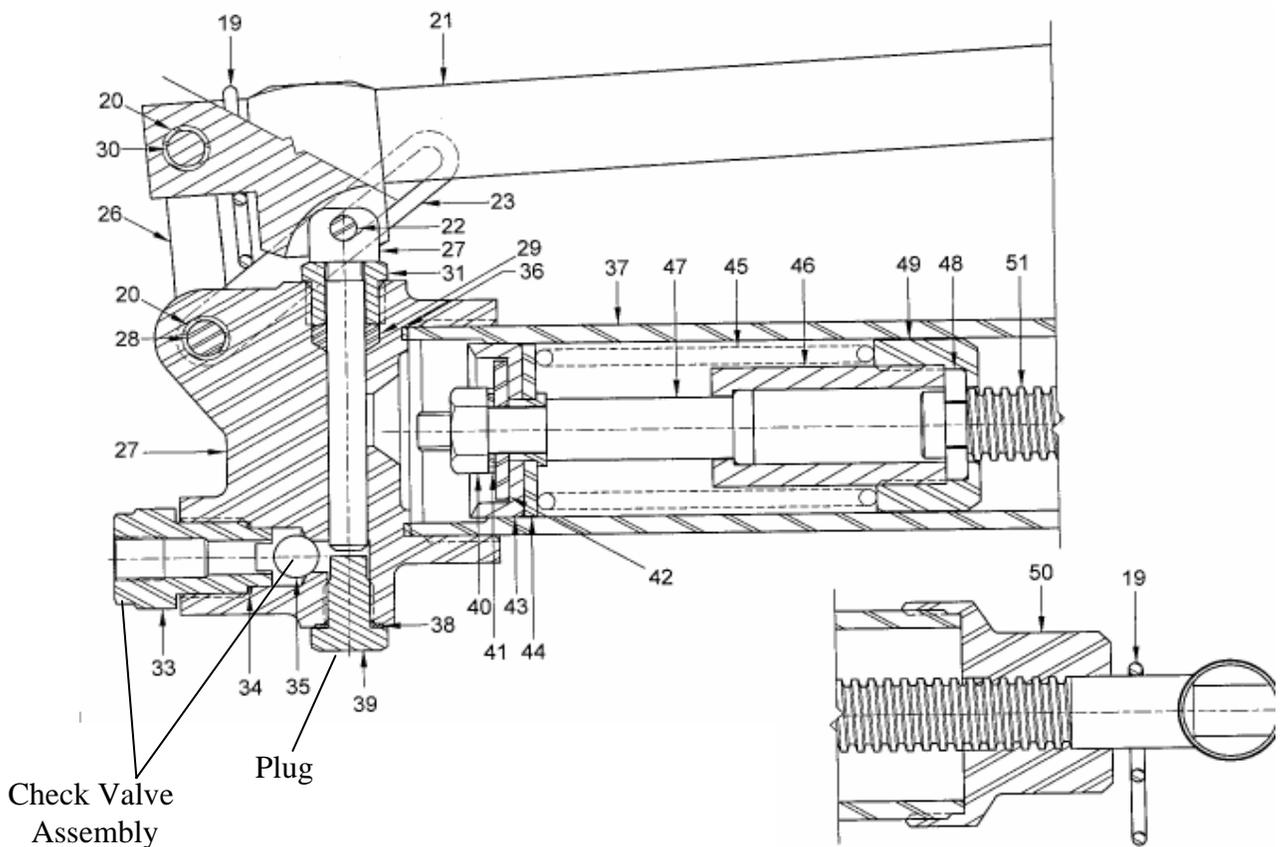
Deployment

Notes: both compound and tool can be deployed against pressure i.e. oil or gas up to 10,000psi. DO NOT EXCEED OPERATIONAL PRESSURE LIMITATIONS i.e. fittings, casing etc.

Due to the viscosity of this product the operator may experience a high deployment pressure at the tool. Once filled close vent port and remove the tool.

Note: Higher operating pressure will be experienced if this product is deployed through existing check valves.

Note: compound can be left in the tool.



APS-Gel Mixing & Deployment Instruction:

It is important to recognise that the setting time of this product can vary subject to temperature at deployment. To meet this it is recommended to contact KCI to seek advise as to hardener volume at time of application.

The APS-Gel is a two part mix consisting of APS gel and Hardener. Once the hardener volume has been determined empty contents into the APS container (Tub) and mix through.

The deployment tool is an air drive barrel / stem pump and is simply inserted into the tub with the APS-Gel and pumped direct through a feed line.

Once the APS-Gel has been deployed it it important to flush out the tool with water.



Service Guide

331380-
A5, B5,
E1, M1, N1

*SPA8344

High-Pressure Stripped Pump

Description

The major components of the 331380 series pumps consist of a reciprocating air motor and a double-acting pump tube.

These high-pressure (50:1 ratio) pumps are designed to deliver a range of light to heavy lubricants directly from an original container.

Models 331380-A5, B5, E1, M1, and N1

Each pump model is designed with a pump tube length to accommodate different size containers. See Figure 1.

The difference in the length of the pump tubes for the two 12.5 kg models is due to the design of the cover.

Model 331380-N1 bolts to a cover with a flat design (obsolete). Model 331380-E1 mounts to a cover with a bung adapter. See the section entitled **Accessories** for details.

Specifications

Air Motor

Piston Diameter x Stroke		Air Inlet	Max. Air Pressure	
Inches	Centimeters		psi	Bars
2-7/16 x 1-5/8	6.2 x 4.1	1/4" NPTF (f)	150	10.3

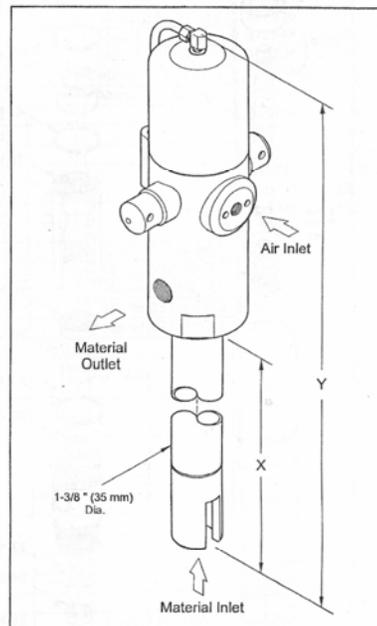
For information on the air motor, refer to Service Guide SER 324300-5

Pump Tube

Material Outlet	Max. Material Pressure		Max. Delivery/Minute (Approximate)*		Displacement per Cycle	
	psi	Bars	Ounces	Grams	in ³	cm ³
3/8" NPTF (f)	7500	517	40	1136	0.277	4.54

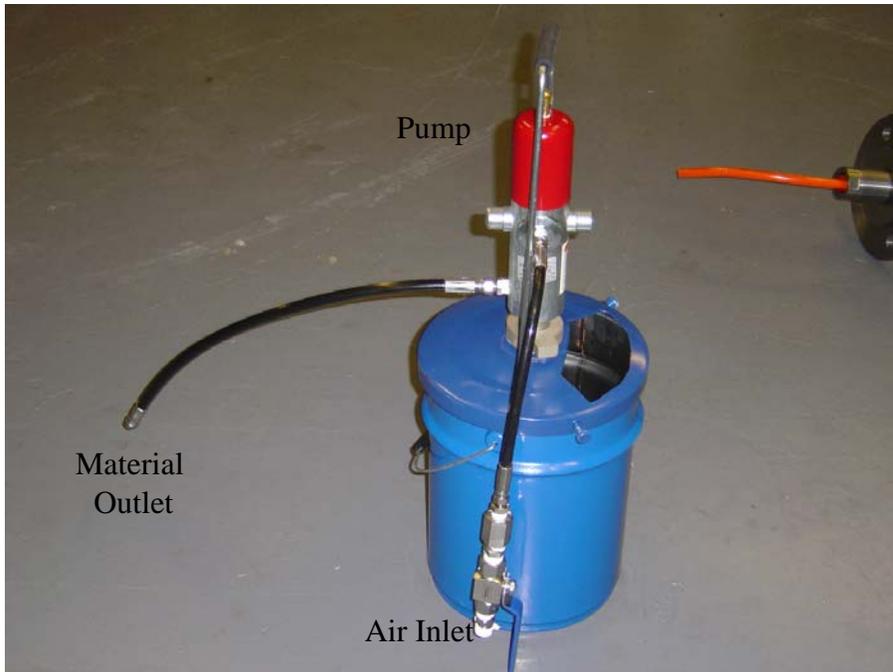
* For detailed information, refer to Figure 4

Table 1 Model 331380 Series Specifications



Pump Model	Container Size		X		Y	
	lbs	kg	Inches	Cm	Inches	Cm
331380-A5	120	50	27-3/4	70.5	38-1/8	96.8
331380-B5	400	180	37	94	47-3/8	120.3
* 331380-E1	-	12.5	15-1/4	38.7	26-5/8	67.6
331380-M1	-	20	19	48.3	29-3/8	74.6
331380-N1	-	12.5	12	30.5	22-3/8	56.8

Figure 1 High-Pressure Stripped Pump Model 331380 Series



APS-Pump Assembly

The assembly also includes a pressure gauge / manifold (not shown in this picture). The Assembly is also supported by an air regulator which is currently set at 2,500psi. This can be adjusted but ensure that the operator is aware of any pressure limiting fittings etc.

Interface Procedure:

Use water to establish the interface and access capabilities prior to mixing APS -Gel

The connection is a 1/2" NPT female thread at the bleed & block valve assembly attached to the spool

The pump feed line assembly terminates with a male 1/2" NPT fitting.

Prior to connecting displace water through the feed line (Confirmation that the pump is functioning).

Connect feed line to block & bleed assembly and pressure test against closed block and bleed valve to 1,000psi. if successful bleed down to system pressure and open block & bleed valve.

Continue to pump water to through interface to establish access and note system pressure.

Stop pump, close block & bleed valve, mix APS. transfer pump to APS -Gel

Open block & bleed valve , start pump and deploy 20litres.

On completion, stop pump, close block & bleed valve and vent pump / feed line and remove assembly.

Flush through pump assembly with water and then a small amount of oil (if available).

Please note that procedures may change in accordance with the application but safety is paramount and procedures should be agreed to by all parties prior to commencing work.