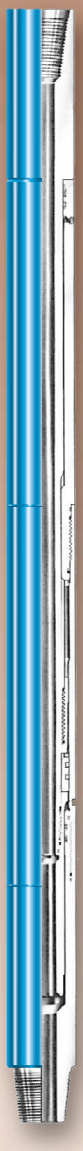
TYPE Z™ OIL JARS

Instruction Manual 4065



Type Z™ Oil Jars

NATIONAL OILWELL VARCO

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INDEX

Type Z Oil Jars

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Twenty-fifth Printing, September 2005

General Description

The **Bowen Type Z Oil Jar** is a straight-pull operated jar which employs a patented combination of proven principles of hydraulics and mechanics. This jar is unique in design and operation and is simple to assemble and easy to operate.

No setting or adjustment is required before going in the hole, or after the fish has been engaged. This tool does not interfere with the free operation of fishing tools, formation testers, safety joints, reversing tools, etc. The Bowen Type Z Oil Jar is designed to permit the operator to easily and simply control the intensity of the jarring blow within a wide range, from a very light impact to a blow of very high impact.

Because of the Jar's closed hydraulic system, the hydraulic fluid within the jar cannot escape and well fluids cannot enter the tool. The hydraulic fluid within the tool constantly lubricates the internal working parts, thus promoting long wear life of the parts.

The unique impact control of the Bowen Hydraulic Jar is made possible by the metering action of the patented piston assembly. As pull is applied to the Jar, fluid is metered from one cavity to another through this piston assembly. By being forced through a restricted passage, the fluid is retarded in such a manner that the stroke is delayed until the operator has ample time to take the necessary stretch in the running string (and Intensifier, when it is used) to strike a blow of given impact.

An important feature of the Bowen Type Z Oil Jar is the ease of closing or resetting the tools. Only sufficient weight to overcome friction is required; only a few hundred pounds. Closing is free of any danger of damage to the tool, since the aforementioned metering action does not take place during re-setting.

During re-setting, large ports are opened in the piston assembly, allowing unimpeded flow of fluid from one cavity to the other.

Other important features are: The ability to transmit full torque at all times during operation, in either direction; the ability of the operator to control the intensity of the blow of the Jar at will, without prior adjustment, and to deliver a rapid series of blows when desired, the only limitation being the time required to raise and lower the fishing string the short distance required to make each stroke.

Use

Fishing

When used in fishing operations, a Bowen Type Z Oil Jar should be installed immediately below a string of drill collars. See the chart on page 18 for approximate weights of collars. For maximum effectiveness of jarring, a Bowen Jar Intensifier should be installed in the fishing string. The Intensifier should be located in the fishing string about four drill collars above the Jar.

Formation Testing

The Bowen Type Z Oil Jar is commonly used in drill stem testing, since the Jar does not interfere with the testing equipment and does not cause the test to be lost when jarring becomes necessary. The packing used in the Bowen Jar is designed to withstand much higher pressures than would be encountered in drill stem testing.

In drill stem testing, from three to fifteen drill collars are usually installed just above the Jar, depending on conditions of operation. When a Bowen Jar Intensifier is used in conjunction with the Jar, it permits the use of fewer drill collars.

Figure 1
Jar in Closed Position

When an open-hole or hook-wall packer sticks enough to require jarring, one or two moderate blows is usually sufficient to loosen the packer. The hook-wall packer sticks less often than the open-hole type, but requires heavier jarring action to release it.

Coring

The Bowen Type Z Oil Jar is often run just above a diamond core barrel. As in drill stem testing, from three to fifteen drill collars are placed in the string, just above the Jar. Breaking a core without a Jar in the string is often awkward and often requires that considerable pull load be taken in the drill pipe. When a Jar is in the string, moderate pull load is all that is required to deliver a comparatively light blow which is usually sufficient to break the core.

Construction

The Bowen Type Z Oil Jar consists essentially of a Mandrel-Piston assembly whichslides within a Cylinder assembly. Refer to the illustrations on pages 3 and 5.

The Mandrel-Piston assembly is composed of a Mandrel (or Top Sub), Piston Assembly, Washpipe, Knocker and Seal Ring Assemblies.

The Cylinder assembly is composed of a Mandrel Body, Middle Body, Washpipe Body, Fill Plugs and Seal Assemblies.

The patented Seal Assemblies which are located in high differential pressure areas, are composed of a standard O-Ring Seal, a Seal Protector Ring and a Non-Extrusion Ring. Where the seal is subject to high pressure in both directions, two Seal Protector and two Non-Extrusion Rings are utilized with the O-Ring Seal. Refer to the illustration on Page 10.

The Piston Assembly is composed of a Piston, (2) Piston Rings, a Seal, a Non-Extrusion Ring and a Seal Protector Ring.

When the Piston is properly assembled in the jar, the Piston is located between the shoulders of the Washpipe upper end and the Knocker or Mandrel lower end. The Piston must be assembled with its o ring seal (i.d.) nearest its upper end and the by-pass relief ports above the Piston Rings. The Seal Non-Extrusion Ring will be located below the Seal, toward the Washpipe.

During the operation, the Piston Rings will always be in contact with the bore of the Middle Body. The Piston Rings are free to move up and down a short distance in the grooves of the Piston. During the pull stroke, the Piston Rings are forced down against the bottom of their grooves, forming a positive metal-to-metal seal, while the o.d. of the Piston Rings are sealed against the bore of the Middle Body. The Piston Assembly is thus sealed against the flow of fluid from the upper cavity to the lower cavity, except through the gaps left in each Piston Ring through which the fluid is metered by design.

As the fluid meters through the Piston Rings, the Piston-Mandrel Assembly moves slowly upward with relation to the body parts, until the Piston reaches a point in the Middle Body which has a series of internal splines (grooves) which suddenly allow unobstructed flow of fluid, bypassing the Piston Assembly. This comparatively unimpeded flow of fluid allows the Piston to move upward at a continuously accelerating velocity, until the Knocker strikes the bottom of the Mandrel Body, delivering the desired, sharp impact blow. During the impeded portion of the pull stroke (before the free-stroke is reached), the operator will have ample time to apply sufficient strain to the running string to strike a blow of the desired intensity.

Figure 2
Piston Has Just Cleared Cylinder

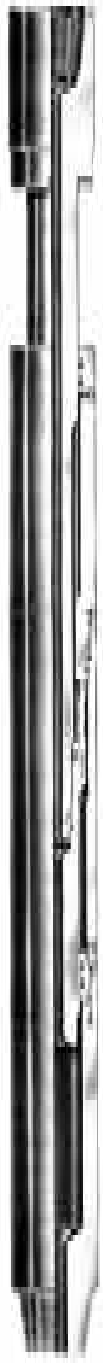


Figure 3
Jar in Open Position

When the Piston-Mandrel assembly is lowered to reset the tool to deliver another blow, the Piston Rings move upward in their grooves, exposing a series of by-pass relief ports in the Piston, which permits a comparatively unrestricted flow of fluid from the lower to the upper cavity. The tool can thus be reset with very little resistance.

Operation

Prior to use, the Bowen Type Z Oil Jar should be carefully examined to assure that it is properly assembled and filled with hydraulic fluid. The tool should be tested in a Bowen Jar Tester if one is available, to assure proper performance.

Check the threaded connections between the Mandrel Body and Middle Body, and between the Middle Body and Washpipe Body, to assure that they are made up as tight as the joints in the running string. Do not tong on the threaded connections; tong at least 4 inches from the joint.

Assemble the Jar in the string below the drill collars to be used. It is recommended that a Bowen Jar Intensifier be run with the Jar for maximum effectiveness; particularly in shallow holes or in very deep or crooked holes. When the Intensifier is run, it should be located in the string about four drill collars above the Jar.

NOTE: See Instruction Manual No. 4019 for recommended weights to be run with Bowen Jar Intensifier.

To strike the initial blow, raise the string sufficient to take the stretch judged necessary to produce the required impact; set the brake, and wait for the jar to hit. The first blow may take from a few seconds to several minutes, depending on circumstances. The variables are depth of operation, amount of stretch in the string, whether an accelerator is used, downhole temperature and mechanical condition of the hole.

For example, when a crooked hole prevents a uniform stretch over the entire string, it is impossible to exert as much pull at the Jar as would be exerted if the hole were straight.

The operator should use caution in applying pull load to the Jar, to not exceed the safe working load for the particular Jar being used. Especially on the first pull, the tendency is to speed the action by applying additional load. Determine the maximum safe working load for the Jar (refer to the Calculated Strength Chart, next to last column, on page 18), and never exceed this load during operation.

The velocity, and the relative impact load of the blow is controlled by the amount of stretch taken in the running string and the weight of the drill collars installed above the Jar.

After a stroke has been made, it is only necessary to close the Jar and then to take the necessary stretch in the string to strike the next blow. Several blows per minute, at any desired intensity, may be struck, even in a crooked hole.

CAUTION: The Jar will usually be brought out of the hole in the open position. It should be closed, taken from the string and laid on the derrick floor. Once closed, the Jar should not be left suspended from the elevators, especially with any appreciable weight suspended below it. The Jar can open, dropping the length of its travel and may cause damage to the rig or injury to a crewman.

Operational difficulties are sometimes encountered by operators, some of which are listed below along with corrective procedures.

1. If not able to hit the first blow:
   a. Pull up to the desired stretch in the string and set the brake. Hold this position until the Jar strikes its blow.
   b. Increase the tension in the running string if possible, but do not exceed the allowable working load on the Jar.
2. If unable to hit the second blow, lower the string farther, as the Jar is probably not closing sufficiently.
3. If the time required for the Jar to strike seems excessive, do not allow the Jar to close completely, by not lowering the string quite as far as on the previous pull. Also, if the Piston Ring gap is plugged by contaminated oil, the Jar would hit too hard or not pull open at all. This would require that the Jar be taken from the hole, disassembled, cleaned and refilled with clean oil.
4. If the blows being struck are not as heavy as desired:
   a. Be sure that the Jar is fully closed.
   b. Pull the running string up faster.
   c. Increase the number of drill collars installed above the Jar.
   d. Install a Jar Intensifier above the drill collar.
5. If the Jar still does not hit hard enough:
   a. The Piston Rings may be worn excessively requiring replacement of the rings.
   b. The seals of the tool may be damaged requiring that the Jar be taken from the hole, disas sembled, all sealing elements replaced, and the Jar cleaned and filled with clean oil.

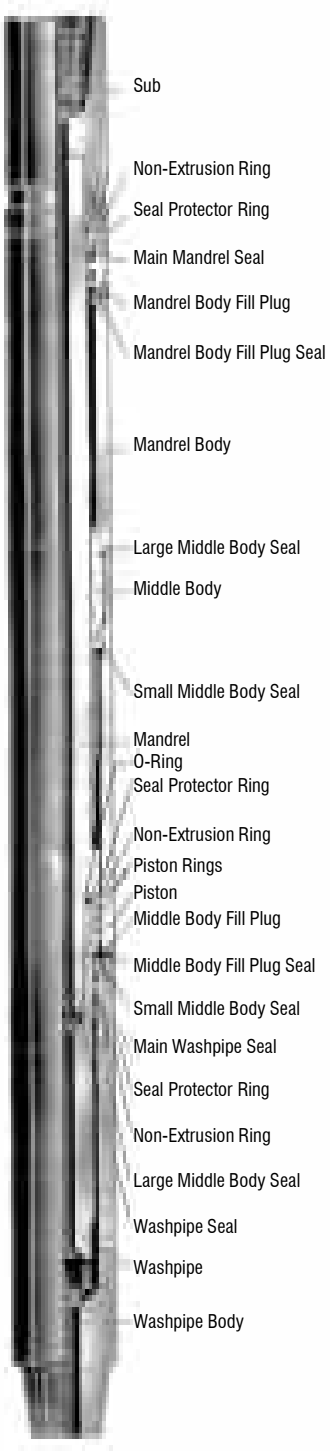


Figure 4
Sub Type Jar

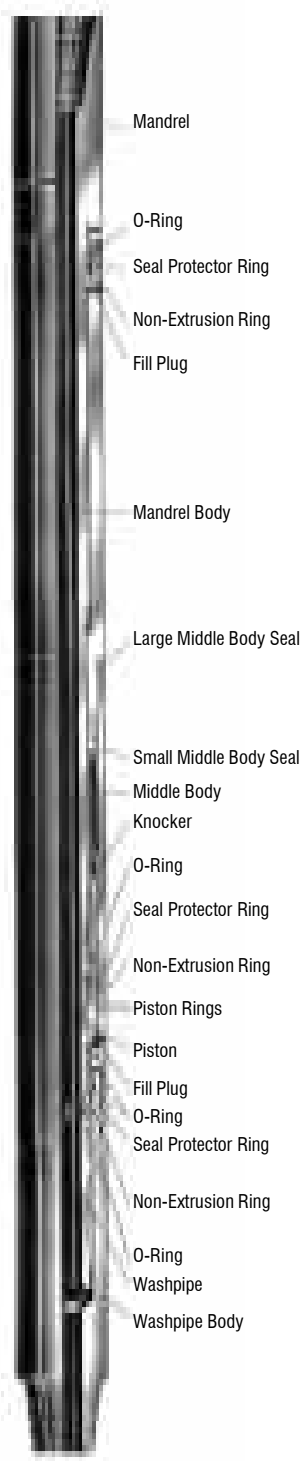


Figure 5
Integral Mandrel Jar

Before Running in Hole

Check both connections shown in Figure 6. These joints should be as tight as the tool joints in the string.

Rig Floor Maintenance

After moderate use on a short job and when the Jar is to be kept at the rig site, it will require only minor maintenance which in most cases may be done on the rig floor.

Immediately after removal from the fishing string, flush all mud from the bore especially in the Washpipe Body and around the Washpipe. The Mandrel seal surface should be cleaned, well greased to prevent rust, and then the Jar should be pushed into the closed position until its next use.

Before storing coat box and pin threads with Bowen Itcolube (anti-gall grease) to prevent corrosion and to aid make-up in next use. The Jar should be stored with the Mandrel end up or horizontally on a suitable rack.

Dressing Area Maintenance

After prolonged and/or hard use, the Bowen Type Z Oil Jar should be taken to an adequate dressing area to be completely disassembled, cleaned, inspected, repaired as required and reassembled.

Complete Disassembly

1. Secure the Jar in a Pipe vise, at approximately the center of the Middle Body.

CAUTION: Do not remove the fill plugs until the tool is fully disassembled. The possibility of trapped residual pressure exists and can cause possible damage or injury.

2. Break the connections at the Washpipe Body and the Mandrel Body.
3. Place an open-mouthed container below the joint of the Washpipe Body.
4. Back off the Washpipe Body until the oil runs out of the tool, past the threads, allowing the oil to drain into the open container. This oil should not be re-used in the Jar. Remove the Washpipe Body and lay it aside.

CAUTION: The washpipe body must be secured firmly during removal due to the possibility of trapped residual pressure.

5. Re-clamp the tool on the Mandrel Body.
6. Loosen and remove the Washpipe. Place the wrench only on the wrench surface provided at the lower (small) end of the Washpipe.
7. Remove the Middle Body, allowing the oil to drain in a container.
8. Remove the Piston. If necessary, drive the blade of a thin screwdriver between the upper end of the Piston and the Knocker or mandrel shoulder to loosen the Piston. Take care not to mar the parts in doing this.
9. Loosen and remove the Knocker, using the wrench flats provided.
10. Re-clamp the tool on the tool joint end of the Mandrel.
11. Slide the Mandrel Body off the Mandrel and lay it aside.
12. Remove the Seal from the small (washpipe) end of the Mandrel.
13. Unclamp the Mandrel from the vise and lay it aside. Use care in handling to prevent marring or denting the Mandrel seal surface.

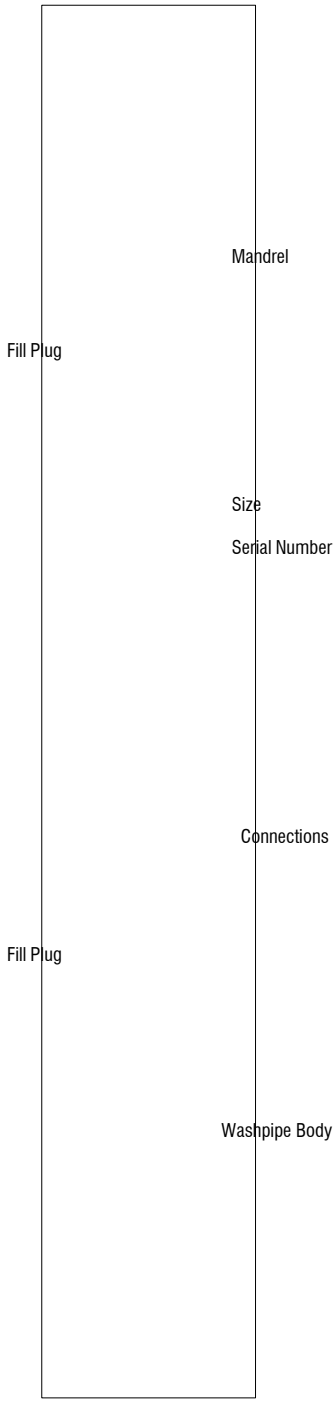


Figure 6

Piston Ring Removal

Using Piston Ring Pliers (see Figure 7), carefully spread each ring at the gap until their inner diameters are larger than the piston O.D. and lift them off. **Do not spread more than necessary. Excessive spreading may distort the rings.**

14. Remove the two Seals from the O.D. of the Mandrel Body and from the Washpipe Body.

15. Remove the two Seal Assemblies from the inside upper end of the Mandrel Body. To remove upper end of the mandrel Body. To remove these seals, proceed as follows: Using either a 625 (or 626) tool, or a bent screwdriver, carefully insert the tip of the blade between the O-Ring and the Seal Protector Ring. Then lift out the O-Ring, taking care to not damage or mar the Seal Protector Rings or Non-Extrusion Rings. Do not run the tool around the groove under the rings, which tends to mar the groove by scratching the surface. Refer to Figure 8.

Figure 7
Piston Ring Removal

Figure 8
Seal Assembly Removal

16. With the O-Ring removed, visually examine the Seal Protector Rings and Non-Extrusion Rings for any indication of damage, burrs or advanced wear. Remove any such damaged rings. If the Seal Protector Rings and Non-Extrusion Rings are in good condition, they need not be removed.

17. Check the similar Seal Assemblies in the Washpipe Body and the Piston Seal Body.

18. Carefully clean all the disassembled parts with solvent and wipe them dry with a lint-free, clean cloth, then thoroughly oil all the parts with a good grade of light, clean oil.

19. Check all parts for defects. Examine the polished surfaces for pits or scratches. Any abrasions on these surfaces will damage the O-Ring seals, resulting in loss of fluid during the operation of the tool. Any rough, shallow pits, or burrs, may be removed by use of fine emery cloth. Parts with major pits or deep scratches and grooves must be replaced.

20. Check the splines on the Mandrel and in the Mandrel Body for burrs or upsets. Upsets may be carefully ground away with a grinder or a small hand file and afterwards polished with emery cloth.

21. Examine the Middle Body bore for signs of scratches or galls. Minor damage of this nature may be smoothed out with emery cloth, or if very minor, may be disregarded. Any deep scratches in the smooth bore of the Middle Body will render it unfit for further service.

22. Carefully examine the Piston. Polish off any abrasions, nicks, galls or burrs at the outer diameter, inner diameter, or faces. Use a small hand file or emery cloth. Any damage to the Piston Ring seating surface will render the Piston unusable.

23. Carefully check the tool joint threads for nicks or burrs, removing any found.

24. Remove the Fill Plugs and install new Fill Plug O-Ring Seals on the Fill Plugs.

Complete Reassembly

Non-Extrusion Ring Assemblies

Prior to assembly, the parts should all be thoroughly cleaned, dried and oiled, after which, the Bowen Non-Extrusion Seal Ring Assemblies should be installed in the Mandrel Body; Washpipe Body and Piston Seal Body. Refer to the following step-by-step sequence of illustrations.

1. Non-Extrusion Rings are first installed, with their beveled faces conforming to the beveled surfaces of the seal ring groove. The Seal Protector Rings are next installed, being first slightly deformed to permit entry into the body. Once in place the Seal Protector Rings are

straightened and flattened by use of tool No. 625. After the Non-Extrusion Rings and Seal Protector Rings are in place, the rubber O-Ring is inserted into the middle of the assembly between the two Seal Protector Rings. The complete assembly is then properly set with a Ring Setting Tool.

NOTE: Some newer Non-Extrusion Rings made from black reinforced nylon will not require a setting tool.

2. After the Non-Extrusion Ring Seal Assemblies have been installed in the Mandrel Body, secure the Mandrel horizontally in a vise, clamping on the tool joint end.

3. Assembly the Seal in the groove at the lower end of the Mandrel.

4. Slide the Mandrel Body over the Mandrel with its seal end toward the tool joint (up), using care to prevent any damage to the seal Assemblies. Rotate the Mandrel Body until the splines in the Mandrel Body align with those on the Mandrel and slide the Mandrel Body all the way up to the face of the Mandrel Ring. Assemble the two O-Rings and the Seal Protector and Non-Extrusion Ring on the outer diameter of the Mandrel Body lower end.

5. Use Bowen Itcolube on all threads to aid make up and next break out. Screw the Knocker on the Mandrel lower end and buck it up tight. The Knocker is provided with wrench flats. Avoid wrenching on the ends or major outside diameters of the Knocker. Remove any burrs or steel slivers which may be produced by wrenching. This is important; if these burrs or slivers are allowed to enter the tool and come loose, they may cause great damage to the tool, or plug the by-pass orifice of the Piston, preventing it from operating.

6. Assemble the Piston Rings on the Piston as follows:

Piston Ring Installation

Most of these rings have a slight bevel on the O.D. which makes one side appear wider than the other. The wide side should always be toward the seal face (see Figure 26).

Position the Piston so the bypass relief holes in the grooves are up. Position the gap of each ring in Piston Ring Pliers (see Figure 7) with the narrow side up (see Figure 25). Spread gap until Ring I.D. is slightly more than Piston O.D. and lower into appropriate groove.

Assemble the Piston on the Mandrel. Slide the assembled Piston on the Mandrel with the Seal Assembly and thinner inside wall up toward the Knocker (or Knocker shoulder). Refer to Figure 26. Use caution to assemble the Piston properly; it can be assembled upside-down, but if so, it will not function.

7. Screw the Washpipe onto the bottom of the Mandrel. Using the wrench surface at the lower end of the Washpipe, buck it up tight.

   Note: Excessive torque on the Washpipe on small, thin Jars can distort the Piston.

   The Jar Piston Rings effect a metal-to-metal seal against the Middle Body cylinder. When strain is taken, and fluid under pressure tries to flow from above the piston to below, it is restricted in its flow to the Ring gaps. This allows a sufficient strain to be built up to enable a blow of desired intensity to be struck. However, when resetting for another stroke, relatively unrestricted movement is made possible by the Jar's unique one-way by-pass system. On the closing stroke, fluid flowing from below the Piston to above opens the by-pass relief ports, permitting unobstructed fluid flow and thus easy re-entry of the Piston into its cylinder.

8. Slide the Middle Body over the Mandrel-Washpipe assembly and screw it onto the Mandrel Body. Be sure the larger I.D. is uppermost and the fill plug end is down. Tighten the Middle Body.

9. Assemble the Seals on the O.D. of the Washpipe Screw it into the Middle Body and tighten it up.

Filling the Jar

Bowen Part Number 49842 Hydraulic Oil is recommended but any ISO Grade 22 hydraulic oil having the required properties can be used, such as Sunvis 722 or Rando HD22.

Filling Procedure

The Jar may be filled in either the open or closed position but open is usually more convenient. To fill, place the Jar in a pipe vise loosely, allowing the Washpipe to drop down until the Jar is resting at approximately a 30° angle. The Mandrel Body Fill Plug hole should be on the upper side of the tool. Attach the volume hose to the Middle Body, Body Fill Plug hole and its opposite end to the Volume Pump. Attach the exhaust hose to the Mandrel Body Fill Plug hole and drop its free end into the filler opening of the Volume Pump.

Operate the hand pump at moderate speed. Hydraulic fluid will enter the tool, forcing the Piston Rings to travel far enough to open the bypass ports, allowing unimpeded flow of oil into the tool.

Occasionally the Jar will pump open if it is being filled in a closed position during this time but this is normal and no cause for alarm.

Continue pumping at a moderate speed. As the Jar fills, oil will flow out through the exhaust hose, which can be seen by the operator. Continue pumping slowly until all air bubbles cease to appear in the outflowing oil. When all air bubbles cease, detach the exhaust hose with fittings and immediately insert the Mandrel Body Fill Plug. Do not over tighten this plug.

Place the Jar back in a level position in the vise and rotate until the Middle Body Fill Plug is on the upper side of the tool. Detach the volume hose and immediately insert and tighten the Middle Body Fill Plug.

If the Jar was filled in the open position, it should be closed prior to transporting it and running it in the hole. In most instances the Jar may be closed by one or two men pushing on the Mandrel, by hand. A very large Jar may require the application of several hundred pounds of weight while in vertical position. The Jar may readily be closed at the well head by applying the weight of the drill string.

Testing the Jar

After the Jar has been completely assembled, it should be tested in a Bowen Jar Tester if one is available.

To proof load test a Jar in a Bowen Jar Tester. Use the chart on page 16 as a guide and use the following procedure:

1. Using the accompanying chart as a guide, set the pull of the Jar Tester to the figure shown in the chart under “Low Pull” heading. This pull is found in the horizontal column adjacent to the Jar as listed by symbol number.
2. Actuate the Jar in the pull stroke. Observe the movement of the Jar during this time to assure that it is opening properly. Movement should be slow but steady without any jerks or stops. If the Jar does not open as required, it is permissible to close the Jar and start the pull stroke again.
3. If the Jar still does not pull com pletely through its stroke without stopping, the “Low Pull” load may be set 2,000 lbs. higher than shown in the chart and the test repeated. If this test is not successful, the Jar should be redressed to eliminate possible contaminated hydraulic oil or anything which might contribute to excessive friction.
4. Repeat Low Pull Test 4 to 6 times to assure uniform action.
5. Reset the Jar Tester to 20% above the maximum load listed in the chart under the heading of “Testing Pull Load Lbs.”
6. Test pull the Jar 8 to 10 times, recording the load of each pull, and use the average.
7. If the average actual load requirement for the stroke does not exactly match the loads shown, it should not be alarming. These listed loads are a median for most Jars but they all vary somewhat. They should be considered as a nominal figure and are meant only as a guide.
8. Carefully inspect the tool for any leaks during the testing pull, particularly around the Mandrel Seals and the Mandrel Body Fill Plug.

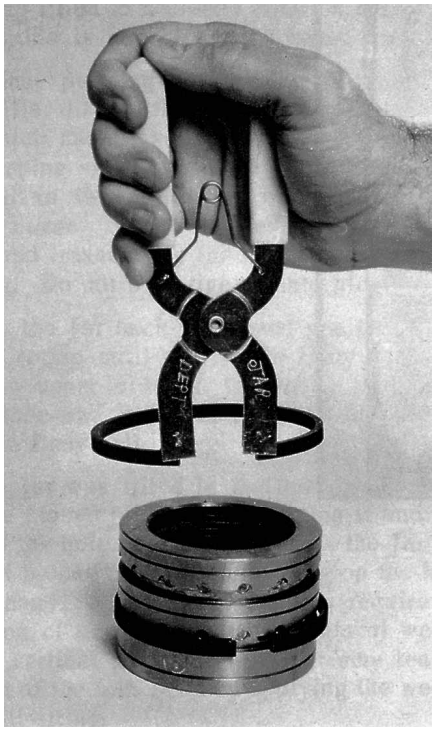


Figure 25
Piston Ring Installation

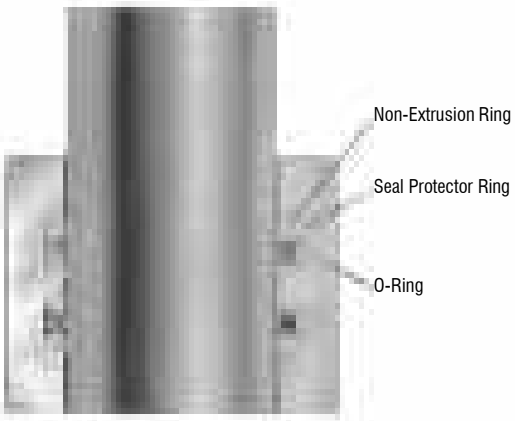


Figure 9
This illustration shows the location of parts of the patented Bowen Seal Ring Assembly.

Figure 10
Hold the Non-Extrusion Ring between thumbs and forefingers as shown.

Figure 11
Overlap the ends until the diameter is small enough to fit inside the body.

Figure 12
Place edge of ring opposite th split into the lower groove and spread from center towads ends. Be sure the beveled side of the ring matches the beveled groove side.

Figure 13
Using thumbs, press ring into groove until ends match up and ring is firmly seated in the groove.

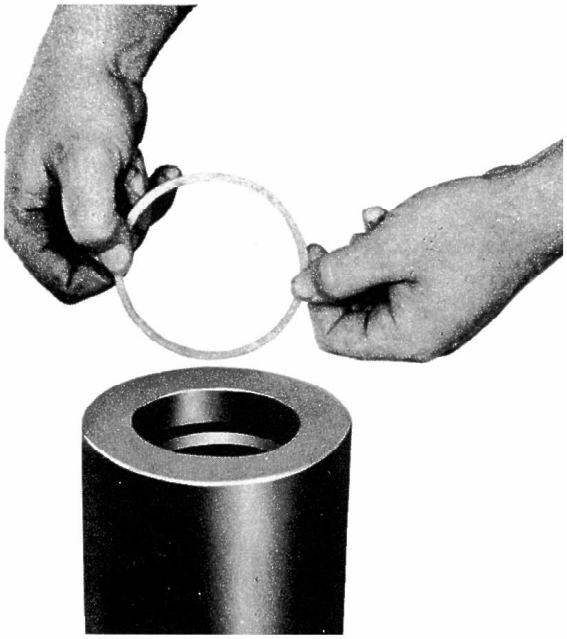


Figure 14
Ring is shown before being bent. It will look like this after it is properly installed in the groove.

Figure 15
Bend the ring until it is small enough to allow entry into bore.

Figure 16
Insert one edge into the groove. Then insert the opposite edge and press down until the entire ring is in place.

Figure 17
Use a Seal Protector Ring Installation Tool to straighten and flatten the ring by pressing against the ring as shown.

Figure 18
O-Ring Packing before installation.

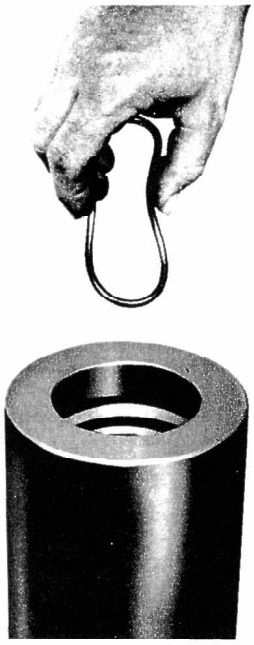


Figure 19
Bend the O-Ring as shown to insert into the groove.

Figure 20
Insert O-Rings between Seal Protection Rings in each groove.

Figure 21
Use this setting tool from the accessory kit to seat the ring seal assemblies after installation. (Not required with black nylon rings.)

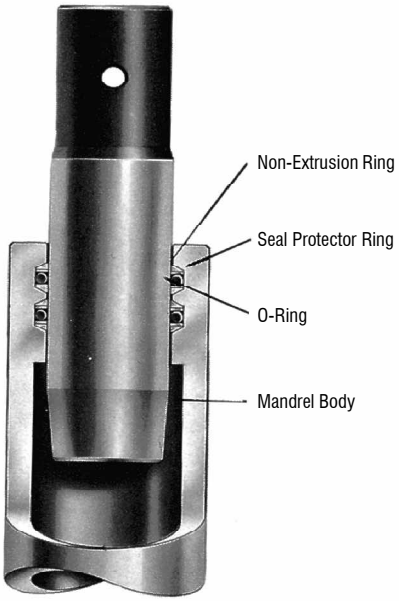


Figure 22
The above illustration shows the O-Ring Seal Assemblies in place in the mandrel body. The setting tool is shown in position as it is being driven into the bore to conform the copper rings to proper bore size.

Figure 23
Insert the setting tool as shown. Use any convenient rod or bar to hold the tool.

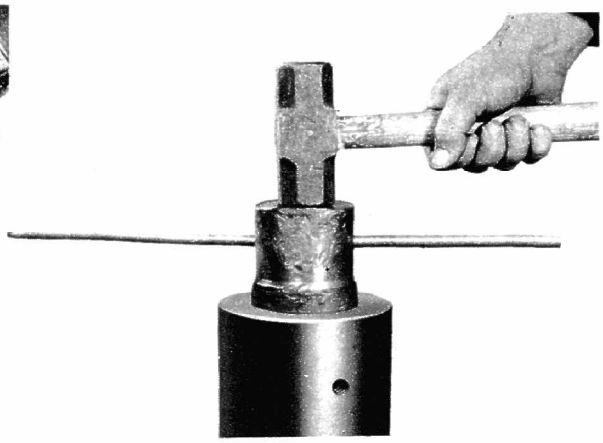
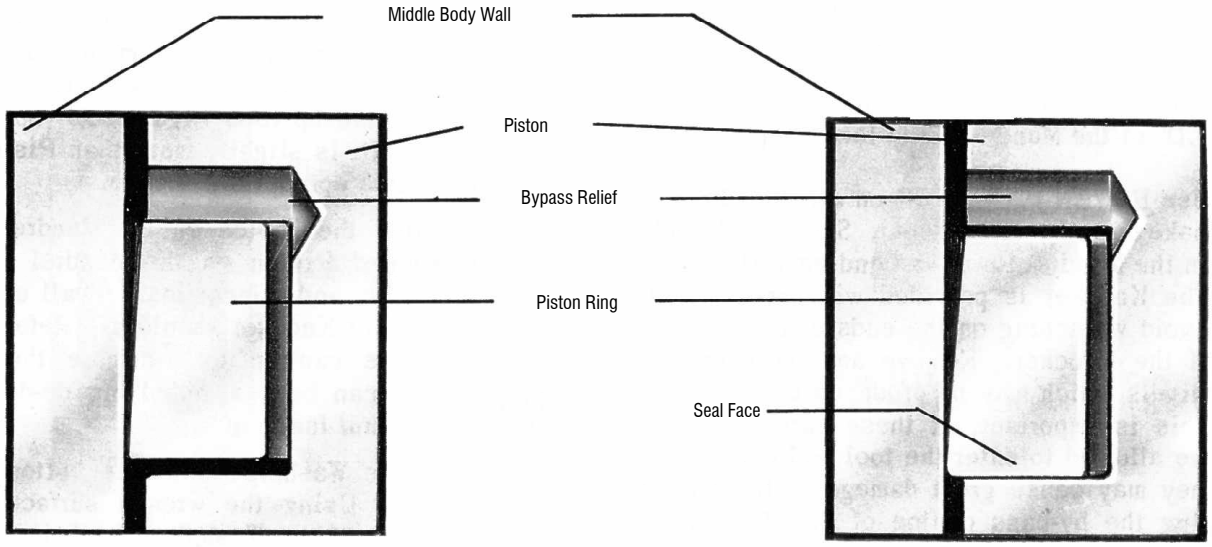


Figure 24
Drive in as shown and tap several times around the periphery of the tool to set the rings. Continue until both ring assemblies are seated. Then remove the tool and continue assembly of the sub.



Position of Ring During Reset Stroke

Position of Ring During Jarring Stroke

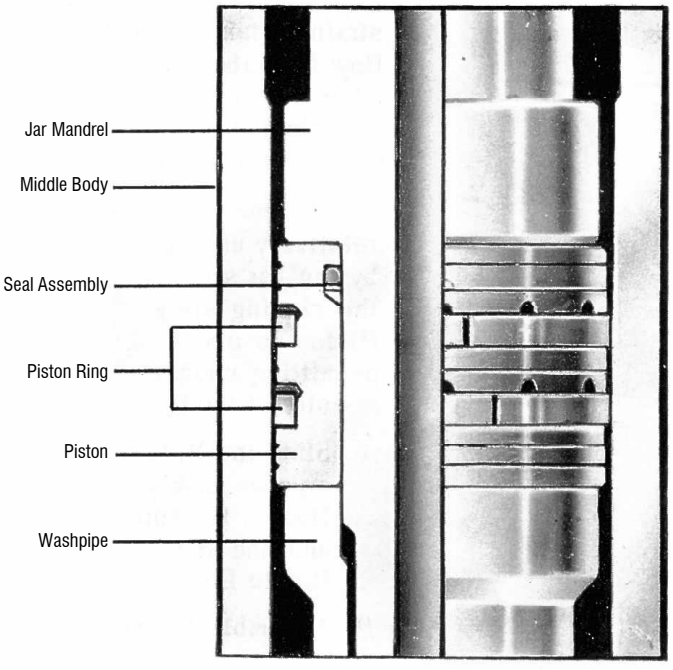


Figure 26
Piston Ring Installation

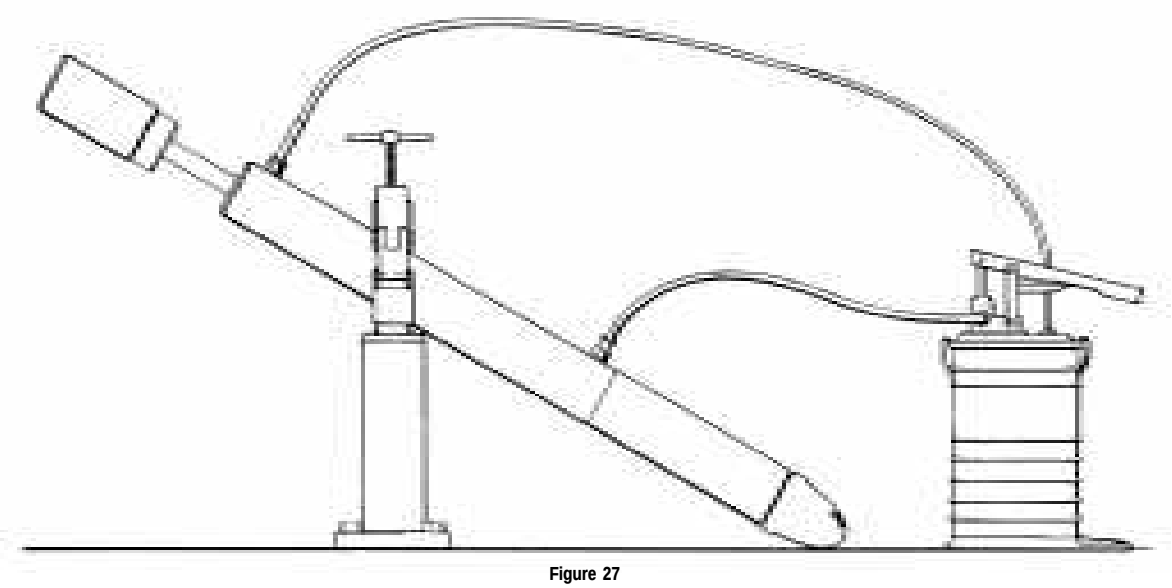


Figure 27

Filling the Jar

Recommended Test Loads for Bowen Type Z Hydraulic Jars

Assembly No.	Jar Size	O.D. (in)	I.D. (in)	Testing Pull Load (lbs)*	Maximum Allowable Load – (lbs) Jarring In Hole	Low Pull (lb)
70822	1" M.T.	1-5/8	1/4	5,000 – 8,500	15,400	4,000
74723	1-13/16 WFJ	1-13/16	5/16	6,000 – 10,000	18,000	4,000
54020	1-1/4 REG	2-1/4	3/8	7,200 – 12,000	21,000	4,000
68010	2-3/8 PH-6	2-29/32	1	12,600 – 19,000	35,400	6,000
55670	2-3/8 EUE	3-1/16	1-1/2	12,000 – 16,000	27,800	6,000
52504	2-3/8 REG	3-1/8	1	15,000 – 23,000	32,400	7,000
52528	2-3/8 IF	3-3/4	1-1/2	15,000 – 26,000	46,000	8,000
52497	2-3/8 EUE	3-3/4	1-7/8	15,000 – 26,000	46,500	8,000
52506	2-7/8 REG	3-3/4	1-1/4	18,000 – 26,000	56,500	8,000
52502	2-7/8 IF	4-1/4	1-15/16	18,000 – 28,000	46,700	8,000
52653	2-7/8 EUE	4-1/2	2-3/8	18,000 – 28,000	49,000	8,000
52530	3-1/2 FH	4-3/4	1-1/2	28,000 – 45,000	85,000	10,000
52500	3-1/2 FH	4-3/4	2	28,000 – 45,000	74,500	10,000
52498	4-1/2 FH	6	2	41,000 – 62,000	136,400	10,000
52544	4-1/2 IF	6-1/4	2-1/4	55,000 – 80,000	159,000	12,000
52680	5-1/2 REG	6-3/4	2-3/8	62,000 – 110,000	172,800	12,000
52711	6-5/8 REG	7-3/4	3-1/16	63,000 – 100,000	149,000	12,000
66346	7-5/8 REG	9	3-3/4	80,000 – 120,000	214,000	14,000

* These figures are based on a Tester speed of 2.50 feet per minute.
Full speed to reach maximum allowable load, approximately 6-1/2 feet per minute.
** See calculated strengths table for warnings and notes.

Bowen Type Z Oil Jars

Maximum Recommended Tightening Torque for Threaded Connections

Jar Assembly No.	Jar O.D. x I.D. (in)	Top Sub to Mandrel (ft-lb)	Knocker to Mandrel (ft-lb)	Mandrel to Washpipe (ft-lb)	Mandrel Body Insert to Mandrel Body (ft-lb)	Mandrel Body to Middle Body (ft-lb)	Middle Body to Washpipe Body (ft-lb)
70822	1-5/8 x 1/4	130		80	320	150	270
74723	1-13/16 x 5/16	170		100		350	520
54020	2-1/4 x 3/8		30	150		900	1050
68010	2-29/32 x 1	1130		800		1950	2070
55670	3-1/16 x 1-1/2	1100		690		2100	2100
52504	3-1/8 x 1		200	690		2030	2030
52506	3-3/4 x 1-1/4		300	1140		3820	3820
52528	3-3/4 x 1-1/2	2670		890		3570	3570
52497	3-3/4 x 1-7/8	1490		410		3570	3570
52502	4-1/4 x 1-15/16		500	1880		4960	4960
52653	4-1/2 x 2-3/8		500	1930		5580	5580
52530	4-3/4 x 1-1/2		700	2130		9770	9210
52500	4-3/4 x 2		500	2010		9750	8600
52498	6 x 2		2200	4990		17,530	17,160
52544	6-1/4 x 2-1/4		2000	5460		20,340	20,340
52680	6-3/4 x 2-3/8		1900	7260		24,330	24,330
52711	7-3/4 x 3-1/16		3200	11,680		32,020	32,010
66346	9 x 3-3/4		6200	21,540		57,760	46,130

The above make up torques are the maximum recommended make up torques for each connection.
They are set at 50% of the calculated theorectical yield torque.

Torques this high are not required for all fishing jobs, and lower values will result in less wear and tear on the threads.

The tightening torques above are based on use of Itcolube or similar zinc-based grease on all threads and shoulders.

Warning

All jarring and pulling loads shown in this manual assume that the force is acting alone and is essentially along the major axis of the tool. If torque and tension or bending and tension are used together, the resulting combined stresses may lead to failure at subsequently less than rated loads. Rotation and bending together can lead to fatigue.

Bowen Type Z Oil Jars - Calculated Strengths

Jar Assembly No.	Jar Type	Jar O.D. (in)	Jar I.D. (in)	Recommended Maximum Jarring Load (lbs)	Lift Load After Jarring Tensile @ Yield (lbs)	Torque @ Yield (ft-lbs)	Recommended Weight of Collars Above Jar** (lbs)
70822	Sub Type	1-5/8	1/4	15,400	46,300	260	1100 - 1450
74723	Sub Type	1-13/16	5/16	18,000	59,400	340	1360 - 1800
54020	Integral Mandrel	2-1/4	3/8	21,000	118,500	1,800	1560 - 2100
68010	Sub Type	2-29/32	1	35,400	194,800	2,260	2200 - 3000
55670	Sub Type	3-1/16	1-1/2	27,800	160,200	2,200	2300 - 3100
52504	Integral Mandrel	3-1/8	1	32,400	229,200	4,060	2400 - 3300
52506	Integral Mandrel	3-3/4	1-1/4	56,500	345,000	7,640	4200 - 5700
52528	Sub Type	3-3/4	1-1/2	46,000	299,700	5,340	3400 - 4600
52497	Sub Type	3-3/4	1-7/8	46,500	179,500	2,980	3500 - 4700
52502	Integral Mandrel	4-1/4	1-15/16	46,700	430,300	9,920	3500 - 4700
52653	Integral Mandrel	4-1/2	2-3/8	49,000	375,000	11,160	3600 - 4900
52530	Integral Mandrel	4-3/4	1-1/2	85,000	591,900	18,420	6300 - 8500
52500	Integral Mandrel	4-3/4	2	74,500	468,800	17,200	5600 - 7500
52498	Integral Mandrel	6	2	136,400	937,000	34,320	10200 - 13800
52544	Integral Mandrel	6-1/4	2-1/4	159,000	917,400	40,680	11800 - 16000
52680	Integral Mandrel	6-3/4	2-3/8	172,800	1,013,800	48,660	13000 - 17500
52711	Integral Mandrel	7-3/4	3-1/16	149,000	1,587,900	64,020	11000 - 15000
66346	Integral Mandrel	9	3-3/4	214,000	1,621,000	92,260	14300 - 19600

* The above tensile strengths are calculated theorecrical yield strengths and are considered accurate to ±20%.
** Optimum weights can be determined only by calculation and only if sufficient well data is available.

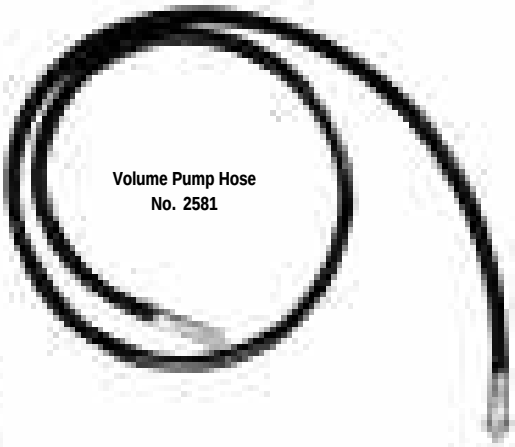
THESE FIGURES DO NOT CONSTITUTE A GUARANTEE, ACTUAL OR IMPLIED. THEY ARE MEANT TO SERVICE AS A GUIDE ONLY, AND APPROPRIATE ALLOWANCE MUST BE MADE IN USE, AS A SAFETY FACTOR.

Users of jars and bumper subs should be aware that milling operations may develop stresses in these tools that are more complex than the simple torsional and tensile values listed in Bowen strength data. If unstabilized, the weight necessary for milling can induce bending forces that combine with torsional forces to generate very high stresses in some areas of the tool. Rotating in a deviated hole condition or with the tool in a neutral point may have the same effect. The necessity for milling is recognized and this is not intended to advise against such operations, but merely to caution the user of possible dangers when rotating under the conditions described.

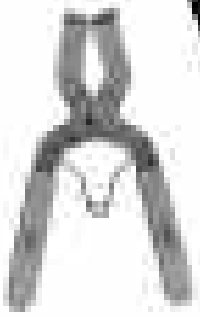
Jar Service Kit

A **Jar Service Kit** is necessary to properly service the Oil Jar. These Kits are identical for every size Jar, so one kit may be used for any number of Jars. The kit does not include any Seal Setting Tool, two of which are required for each size Jar. These tools must be ordered separately. They are usually stored in the Service Kit.

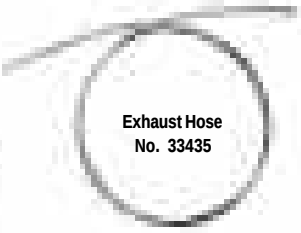
Volume Pump
No. 2580



Volume Pump Hose
No. 2581



Piston Ring Pliers
No. 69248

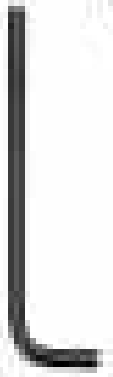


Exhaust Hose
No. 33435

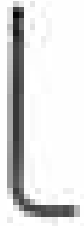
Metal Box
No. 1995

Seal Protector Ring
Installation Tool
No. 625

O-Ring
Installation Tool
No. 626

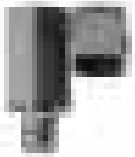


Mandrel Body
Fill Plug Wrench
No. 359

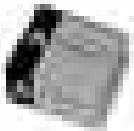


Middle Body
Fill Plug Wrench
No. 620

Nipple
No. 36953



Reducing Right-
Angle Adapter
No. 56564



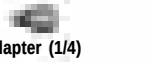
Volume Pump
Repair Kit
No. 53266
(extra)

Male
Coupler
No. 656

Adapter (3/8)
No. 657-A

Female
Coupler
No. 655

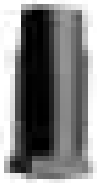
Sub
No. 2582



Adapter (1/4)
No. 657-B

Adapter
No. 674-A

Adapter
No. 674-B



Line Filter
No. 56565

Bushing
No. 56563

Filter Element
No. 56566
(extra)

Tube Fitting
33436

Bowen Type Z Oil Jars Specifications

Size Connections		7/8 Sucker Rod Conn	1-13/16 Wilson FJ	1-1/4 API Reg.	2-3/8 PH6 5.9# Hyd. Bx.	2-3/8 EUE	2-3/8 API Reg	2-7/8 API Reg	2-3/8 API IF	2-3/8 EUE	2-7/8 API IF
Outside Diameter - Inches		1-5/8	1-13/16	2-1/4	2-29/32	3-1/16	3-1/8	3-3/4	3-3/4	3-3/4	4-1/4
Inside Diameter - Inches		1/4	5/16	3/8	1	1-1/2	1	1-1/4	1-1/2	1-7/8	1-15/16
Total Stroke - Inches		7-1/16	7	6-15/16	11-7/16	11-9/16	11-13/16	11-13/16	12-1/8	10-1/8	11-13/16
Type Jar		Sub	Special Sub	Int. Mand.	Sub	Sub	Int. Mand.	Int. Mand.	Sub	Sub	Int. Mand.
Complete Assembly	Part No.	70822	74723	54020	68010	55670	52504	52506	52528	52497	52502
	Weight	41	60	50	108		125	168	119	158	220

Replacement Parts

Top Sub	Part No.	70823	21156	—	68015	55889	—	—	37412	20156	—
	Weight	2	3	—	10	12	—	—	12	18	—
Mandrel	Part No.	70825	21155	18780	68014	55888	38056	38041	37411	20155	44484
	Weight	9	12	16	25	25	—	—	29	34	—
Piston Assembly	Part No.	70853	74725	59585	68019	56368	61282	68128	61288	61285	68420
Ring Type Standard	Weight	3/4	3/4	3/4	1-1/2	—	1-1/2	2-1/4	1-1/2	1-3/4	2-1/2
Mandrel Body	Part No.	70824	21153	56571	68013	55887	52764	52770	52771	52772	52780
	Weight	6	11	9	25	20	13	28	30	22	28
Middle Body	Part No.	70826	74724	18777	68012	55886	42737	38044	20152	20152	41840
	Weight	5	9	9	26	20	29	30	26	26	39
Washpipe Body	Part No.	70829	21151	18776	68011	55885	38064	38045	37407	20151	44487
	Weight	15	6	10	27	30	21	50	14	30	50
Knocker	Part No.	—	—	18781	—	—	38060	38049	—	—	44490
	Weight	—	—	4	—	—	1	6	—	—	5
Washpipe	Part No.	70828	21154	18779	68016	55890	42738	38046	37410	20154	44488
	Weight	2	1-1/2	4	10	10	11	6	13	12	20
Mandrel Body Fill Plug	Part No.	617T	689T	329T	617T	617T	329T	329T	329T	329T	329T
	Weight	2 Req'd.	2 Req'd.	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Middle Body Fill Plug	Part No.	—	—	689T	10641	10641	617T	617T	617T	617T	617T
	Weight	—	—	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Packing Set †	Part No.	70961	74802	18793	68017	55924	44622	38048	37415	20163	44491
	Weight	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
Mandrel Non-Extrusion Ring	Part No.	365-16	365-17	365-24	365-30.5	364-32.5	365-32	365-35	365-36	365-36	365-40
(8 Req'd.)	Weight	4 Req'd.	4 Req'd.	4 Req'd.	1/8 (10 Req'd)	1/8	1/8	1/8	1/8	1/8	1/8
Mandrel Seal Protector Ring	Part No.	375-16	375-17	375-24	375-30.5	375-32.5	375-32	375-35	375-36	375-36	375-40
(8 Req'd.)	Weight	4 Req'd.	4 Req'd.	4 Req'd.	1/8 (10 Req'd)	1/8	1/8	1/8	1/8	1/8	1/8
Mandrel Body Non-Extrusion Ring	Part No.	—	—	56542	—	—	—	—	—	—	—
	Weight	—	—	1/8	—	—	—	—	—	—	—
Mandrel Body Insert	Part No.	71254	—	—	—	—	—	—	—	—	—
Mandrel Body Seal Protector Ring	Part No.	—	—	227-27.25	—	—	—	—	—	—	—
	Weight	—	—	1/8	—	—	—	—	—	—	—
Seal Body	Part No.	—	74728	—	68021	55892	—	—	—	—	—
By-pass Body	Part No.	—	74727	—	—	—	—	—	—	—	—
Cone	Part No.	—	74726	—	68020	55891	—	—	—	—	—

NOTES:
(1) Piston Seals are listed with Piston Assemblies and Packing Sets and are included with both, when ordering seperately.
(2) Part breakdowns of Sub-Assemblies are shown on following page.
† Packing Sets include all Seals necessary to dress the Jar. Non-Extrusion Rings and Seal Protector Rings are not included, and must be ordered seperately.

Bowen Type Z Oil Jars Replacement Parts (Continued)

Complete Assembly	Part No.	70822	74723	54020	68010	55670	52504	52506	52528	52497	52502
Ring Type Piston Assembly	Part No.	70853	74725	59585	68019	56368	61282	68128	61288	61285	68420
Consists of:	Weight	3/4	3/4	3/4	1-1/2	—	1-1/2	2	1-1/2	2	2-1/2
Piston	Part No.	70827	—	59586	—	—	61283	68127	61289	61286	68413
	Weight	3/4	—	1/2	—	—	1	1	1-1/4	1-3/4	2-1/4
Wave Spring	Part No.	66164	—	—	—	—	—	—	—	—	—
(2 Req'd.)	Weight	1/32	—	—	—	—	—	—	—	—	—
Piston Ring	Part No.	—	—	18783	—	—	61284	61287	61287	61287	68414
	Weight	—	—	1/8	—	—	1/8	1/8	1/8	1/8	1/8
	No. Req'd.	—	—	2	—	—	4	2	4	4	3
Seal	Part No.	—	—	568214	—	—	568223	568226	568228	568230	568231
Non-Extrusion Ring	Part No.	—	—	365-19	370-1.5	370-3.5	370-1	370-4	370-6	52495	370-9
Seal Protector Ring	Part No.	—	—	375-19	376-1.5	376-3.5	376-1	376-4	376-6	52496	376-9
Complete Packing Set	Part No.	70961	74802	18793	68017	55924	44622	38048	37415	20163	44491
Consists of:	Weight	—	1/4	1/4	—	1/4	1/4	1/4	1/4	1/4	1/4
Main Mandrel & Washpipe Seal	Part No.	568211	568212	568219	568328	568330	568329	568332	568333	568333	568337
	Weight	—	1/16	1/16	—	1/16	1/16	1/16	1/16	1/16	1/16
	No. Req'd.	2	2	4	5	4	4	4	4	4	4
Large Middle Body Seal	Part No.	568216	568219	568224	568036	568038	568231	568235	568235	568235	568239
(2 Req'd.)	Weight	—	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Small Middle Body Seal	Part No.	568214	568027	568222	568035	568036	568228	568233	568233	568233	568237
	Weight	—	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
	No. Req'd.	2	3	3	4	3	3	3	3	3	3
Washpipe Seal	Part No.	—	568115	568210	568224	568226	568220	568222	568224	568227	568227
	Weight	—	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Mandrel Body Fill Plug Seal	Part No.	568005	568005	568006	568005	568006	568006	568006	568006	568006	568006
	Weight	—	—	—	1/8	—	—	—	—	—	—
Middle Body Fill Plug Seal	Part No.	—	—	568005	—	—	568005	568005	568005	568005	568005
Piston Seal	Part No.	—	—	568214	—	—	568223	568226	568228	568230	—
	Weight	—	—	1/8	—	—	1/8	1/8	1/8	1/8	—
Back-up Rings	Part No.	8-024	—	—	—	—	—	—	—	—	—
Mandrel Seal	Part No.	568015	—	—	—	—	—	—	—	—	—
Mandrel Body Seal (2 Req'd.)	Part No.	568024	—	—	—	—	—	—	—	—	—
Seal Body Seal	Part No.	—	568020	—	568224	568226	—	—	—	—	—

Optional – Extra

Mandrel Body Setting Tool	Part No.	22709-16	22709-17	22709-24	22709-29.5	22709-32.5	22709-32	22709-35	22709-36	22709-36	22709-40
Piston Setting Tool	Part No.	—	—	22709-19	22709-30.5	22709-31.5	22709-29	22709-32	22709-34	54922	22709-37
Service Kit	Part No.	21279	55403	55403	Only one Service Kit is required for all sizes of tools except for 1-5/8 O.D. size.						
	Weight	60	75	75	It does **not** include any Seal Setting Tool, which must be ordered separately as required for each tool, at extra cost.						
Hi-Temp O-Ring Packing Set		—	148845	148774	—	148247	73659	80004	—	—	78330
Hydraulic Jar Oil	Part No.	49842									

Miscellaneous O-Ring Seals are normally furnished in sealed plastic bags of 10, 25, or 100 pieces each to prevent deterioration. Other quantities will be furnished in unsealed packages. Packing Sets, however, will always be furnished in sealed plastic bags.

How to Order

Specify:

(1) Name and number of assembly or part
(2) Size and type of connections, if other than standard
(3) Outside diameter, if other than standard
(4) Any spares or extras desired, by name and number

RECOMMENDED SPARE PARTS:

(1) 1 Service Kit
(2) 1 Washpipe
(3) 2 Piston Assemblies
(4) 16 Non-Extrusion Rings
(5) 16 Seal Protector Rings
(6) 4 Mandrel Body Fill Plugs
(7) 4 Middle Body Fill Plugs
(8) 8 Packing Sets
(9) 1 Mandrel Body Setting Tool
(10) 1 Piston Setting Tool
(11) 4 Mandrel Body Non-Extrusion Rings
(12) 4 Mandrel Body Seal Protector Rings

Bowen Type Z Oil Jar Specifications

Size Connections		2-7/8 EUE	3-1/2 API FH	3-1/2 API FH	4-1/2 API FH	4-1/2 API IF	5-1/2 API Reg.	6-5/8 API Reg.	7-5/8 API Reg.
Outside Diameter - Inches		4-1/2	4-3/4	4-3/4	6	6-1/4	6-3/4	7-3/4	9
Inside Diameter - Inches		2-3/8	1-1/2	2	2	2-1/4	2-3/8	3-1/16	3-3/4
Total Stroke - Inches		12-1/4	11-13/16	13-5/16	11-7/16	14-3/8	14-11/16	14-3/8	13-13/16
Type Jar		Int. Mand.	Int. Mand.	Int. Mand.	Int. Mand.	Int. Mand.	Int. Mand.	Int. Mand.	Int. Mand.
Complete Assembly	Part No.	52653	52530	52500	52498	52544	52680	52711	66346
	Weight	202	325	285	590	640	757	800	1700

Replacement Parts

Top Sub	Part No.	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	—	—	—	—
Piston Assembly	Part No.	68421	55285	55193	55246	55212	55335	68924	66355
Ring Type Standard	Weight	2-3/4	2-3/4	3-1/4	3-1/4	6	6-1/2	6-1/2	70
Mandrel Body	Part No.	52815	52749	52833	52834	52835	52836	53088	66354
	Weight	52	66	62	92	102	143	164	202
Middle Body	Part No.	35853	25962	38112	14712	12372	11133	15158	66347
	Weight	45	60	51	85	92	102	142	397
Washpipe Body	Part No.	35854	25961	38111	14711	12371	701	15164	66350
	Weight	40	85	66	145	170	220	250	300
Knocker	Part No.	35857	25966	38116	14717	12377	11134	15159	66348
	Weight	4	5	4	10	10	10	10	34
Washpipe	Part No.	35855	25964	38114	14714	12374	704	15163	66349
	Weight	17	25	21	36	47	56	65	135
Mandrel Body Fill Plug	Part No.	329T	329T	329T	508	508	508	508	508
	Weight	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Middle Body Fill Plug	Part No.	617T	329T	329T	329T	329T	329T	329T	508
	Weight	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Packing Set †	Part No.	35858	25892	38120	14720	12383	9738	20980	66359
	Weight	1/4	1/2	1/2	3/4	3/4	3/4	1	1
Mandrel Non-Extrusion Ring	Part No.	365-42	365-40	365-41	453	365-48	708	365-59	365-65
(8 Req'd.)	Weight	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Mandrel Seal Protector Ring	Part No.	375-42	375-40	375-41	449	375-48	709	375-59	375-65
(8 Req'd.)	Weight	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Non-Extrusion Ring	Part No.	—	—	—	—	—	—	—	216-68
	Weight	—	—	—	—	—	—	—	1/8
Seal Protector Ring	Part No.	—	—	—	—	—	—	—	227-68
	Weight	—	—	—	—	—	—	—	1/8

NOTES:
(1) Piston Seals are listed with Piston Assemblies and Packing Sets and are included with both, when ordered separately.
(2) Part breakdowns of Sub-Assemblies are shown on following page.

† Packing Sets include all Seals necessary to dress the jar.
Non-Extrusion Rings and Seal Protector Rings are not included,and must be ordered separately.

Bowen Type Z Oil Jars Replacement Parts (Continued)

Complete Assembly	Part No.	52653	52530	52500	52498	52544	52680	52711	66346
Mandrel	Part No.	35850	25965	38115	14715	12375	11131	15156	66352
	Weight	52	100	74	200	200	224	254	511
Ring Type Piston Assembly	Part No.	68421	55285	55193	55246	55212	55335	68924	66355
Consists of:	Weight	3	3	3-1/2	4	6	7	7	70
Piston	Part No.	68415	55286	55194	55247	55213	55339	68925	66357
	Weight	2-3/4	2-3/4	3-1/4	3-3/4	5-1/2	6-1/2	6-1/2	48
Piston Ring	Part No.	68416	25968	25293	1999	12379	719	15162	66356
	Weight	1/8	1/8	1/8	1/8	1/4	1/4	1/4	1/4
	No. Req'd.	3	2	2	2	2	2	4	5
Seal	Part No.	568233	568231	568232	568236	568237	568239	568426	568430
Non-Extrusion Ring	Part No.	370-11	370-8.5	370-10	370-13.75	370-15	370-17	365-53	365-57
Seal Protector Ring	Part No.	376-11	376-8.5	376-10	376-13.75	376-15	376-17	375-53	375-57
Complete Packing Set	Part No.	35858	25892	38120	14720	12383	9738	20980	66359
Consists of:	Weight	1/4	1/2	1/2	3/4	3/4	3/4	1	1
Main Mandrel and Washpipe Seal	Part No.	568339	568337	568338	568344	568345	568348	568432	568438
(4 Req'd.)	Weight	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Large Middle Body Seal	Part No.	568241	568241	568241	568248	568252	568256	568261	568265
(2 Req'd.)	Weight	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Small Middle Body Seal	Part No.	568239	568239	568239	568246	568250	568254	568259	568263
(3 Req'd.)	Weight	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Washpipe Seal	Part No.	568233	568228	568228	568234	568235	568235	568242	568246
	Weight	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Mandrel Body Fill Plug Seal	Part No.	568006	568006	568006	568011	568011	568011	568011	568011
Middle Body Fill Plug Seal	Part No.	568005	568006	568006	568006	568006	568006	568006	568011
Piston Seal	Part No.	568233	568231	568232	568236	568237	568239	568426	568430
	Weight	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Middle Body - Mandrel Body Seal -	Part No.	—	—	—	—	—	—	—	568441
Small	Weight	—	—	—	—	—	—	—	1/16

Optional – Extra

Mandrel Body Setting Tool	Part No.	22709-42	22709-40	22709-41	448	22709-48	715	22709-59	22709-6
Piston Setting Tool	Part No.	22709-39	22709-36.5	22709-38	22709-41.75	54309	22709-45	22709-53	22709-57
Service Kit	Part No.	55403	Only one Service Kit required for all sizes of tools. It does **not** include any Seal Setting Tool.						
	Weight	75	Seal Setting Tools must be ordered separately as required for each tool, at extra cost.						
Hi-Temp O-Ring Packing Set	Part No.	—	80115	80005	148246	79015	9738/006	20980/006	—
						147932		20980/007	

Miscellaneous O-Ring Seals are normally furnished in sealed plastic bags of 10, 25, or 100 pieces each to prevent deterioration. Other quantities will be furnished in unsealed packages. Packing Sets, however, will always be furnished in sealed plastic bags.

How to Order

Specify:

(1) Name and number of assembly or part
(2) Size and type of connections, if other than standard
(3) Outside diameter, if other than standard
(4) Any spares or extras desired, by name and number

RECOMMENDED SPARE PARTS:

(1) 1 Service Kit
(2) 1 Washpipe
(3) 2 Piston Assemblies
(4) 16 Non-Extrusion Rings
(5) 16 Seal Protector Rings
(6) 4 Mandrel Body Fill Plugs
(7) 4 Middle Body Fill Plugs
(8) 8 Packing Sets
(9) 1 Mandrel Body Setting Tool
(10) 1 Piston Setting Tool

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* Denotes Manufacturing and Engineering facilities

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