JAR INTENSIFIERS

Instruction Manual 4019

Jar Intensifiers

NATIONAL OILWELL VARCO

One Company | Unlimited Solutions

INDEX

Jar Intensifiers

The designs and specifications for the tools described in this instruction manual were in effect at the time this manual was approved for printing. National Oilwell Varco, whose policy is one of continuous improvement, reserves the right to discontinue models at any time, or to change designs and specifications without notice or without incurring obligation.

Twenty-second Printing, September 2005

General Description

The **Bowen Jar Intensifier** is designed to be run in conjunction with the Type Z Bowen Oil Jar. Its function is to supply acceleration to the collars and the upper portion of the Hydraulic Rotary Jar during its (jarring) free stroke.

Each Bowen Jar Intensifier is designed to match a corresponding Type Z Bowen Oil Jar. The Bowen Jar Intensifier is essentially a hydraulic fluid spring which stores energy when a strain is pulled on the running string. When the strain is removed by the free stroke of the Jar, this stored energy is released, accelerating the drill collars and jar upward until a blow of high impact is struck.

Use

During conventional jarring operations with either mechanical or hydraulic jars, the intensity of the blow struck is a function of, and proportional to the accelerated rapid movement of the entire running string above the jar. This accelerated movement will often be considerably diminished by friction of the running string against the wall of the hole. In such cases much of the energy will be lost. Also, at very shallow depth, the lack of available stretch in the running string causes a great loss in the effectiveness of expected acceleration, due to very small amount of stretch in the running string being available.

The Bowen Jar Intensifer provides the means to store the required energy immediately above the jar and drill collars, to effectively offset the loss of stretch in, or drag on the running string.

An important secondary contribution of the Bowen Jar Intensifer is to utilize its contained hydraulic fluid to cushion the shock of the running string as it rebounds, after each jarring stroke. This reduces the inherent tendency to cause shock-damage to the tool and running string to a minimum.

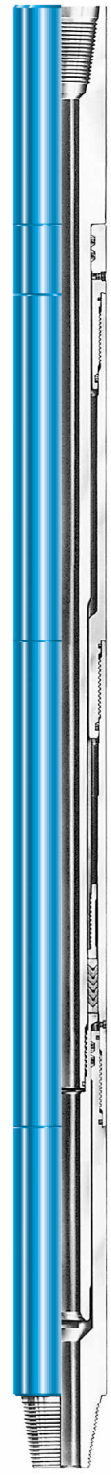
Use of the Bowen Jar Intensifer allows less drill collars to be used in a specific case than would otherwise be possible. This is particularly true at shallow operating depths, where excessive numbers of drill collars are sometimes used, to utilize mass in place of available stretch. Use of too many drill collars with their great mass is often damaging to the tools and the running string, and should be avoided.

Construction

The Bowen Jar Intensifer is composed essentially of a Mandrel Assembly (or Top Sub and Mandrel), Mandrel Body Insert, Mandrel Body, Middle Body, Washpipe Body, Washpipe, Knocker and Piston Assembly. The tool is completely filled between the Mandrel Body Insert and Washpipe Body, with silicone fluid of high compressibility index.

The Mandrel has a ruggedly built splined section near its lower end, which is always engaged with matching splines in the lower end of the Mandrel Body. This allows torque to be transmitted in either direction and at all times, whether open, closed or in any position of stroke.

The high pressures produced within the Bowen Jar Intensifier during operation, are maintained by the same patented Bowen Non-Extrusion Seal Ring Assemblies which are used in the Bowen Hydraulic Rotary Jar. Use of these assemblies prevents radical rupture of seal rings, and keeps wear to an absolute minimum.



Bowen Jar Intensifier

The Piston Assembly is composed of a Top Adapter, Bottom Adapter and a set of Chevron Packing Rings, usually five rings per set. This Piston Assembly is assembled on the lower end of the Mandrel, between the Knocker and Washpipe. The Piston Assembly is moderately pre-compressed at its ID against the mandrel and at its OD against the middle body. This forms a leak-proof, continuous, sliding seal.

In operation, the fluid is compressed as tension is applied by the running string, by the travel upward of the Piston in the Middle Body. When the jar reaches its free stroke and trips, the sudden release of stored energy in the Intensifier accelerates the drill collars upward at tremendous and intensifying velocity. When the jar reaches its maximum travel, a blow of high impact is delivered directly to the fish. The action is essentially independent of the running string. The Intensifier tends to confine movement primarily to the drill collars, and does not rely on movement of the entire running string. This confines the impact of the jar and drill collars to the fish, where it is most effective and least damaging; regardless of depth.

It should be noted that there is no hazard in filling or using the Bowen Jar Intensifier since the tool is filled with fluid, and under only the low hand pump pressure required to fill it.

Operation

Prior to operation, the Bowen Jar Intensifier should be examined to assure that it is completely assembled and in good working order.

The Jar Intensifier should be located in the running string immediately above the drill collars; just below the running string lower end. The jar should be located immediately below the drill collars and just above the fishing tools. The sequence from the fish upward should be: fishing tool, jar, drill collars, Jar Intensifier and running string.

The fishing operation should be run in conventional manner; the fish is engaged by the fishing tool, and a strain is pulled on the fishing string. This will cause the Jar Intensifier to stroke 6" to 13", depending on size, compressing the hydraulic fluid and storing energy at the Intensifier. This stored energy will cause the jar to operate. When the jar trips, the Intensifier imparts its stored energy to the drill collars and jar mandrel, in the form of acceleration, causing the jar to strike a blow of very high impact value.

This procedure is repeated as many times as is required to free the fish.

For complete detailed instructions on Type Z Bowen Oil Jars, see Bowen Instruction Manual 5/4065.

Maintenance

Maintenance of the Bowen Jar Intensifier is minimal, but important. The primary maintenance is normally confined to complete inspection and redressing after each use. Magnetic particle inspection of stressed components should be performed after each use.

Filling with Fluid

Proper filling of the Bowen Jar Intensifier requires the use of both Fill Plugs; in the Mandrel Body Insert. Proceed as follows:

1. Thoroughly clean and inspect all parts. Give special attention to the seals, replacing any that show signs of damage, wear or too pronounced a “permanent set.”
2. Assemble all parts except the fill plugs. Refer to “Complete Assembly” for detailed assembly instructions.
3. Clamp the Intensifier in a vise at approximately 30° angle with the mandrel end up. Fill plug holes should be oriented vertically to each other.
4. Attach the fill hose from the fill pump to the fill plug hole on bottom. Attach the exhaust hose to the fill plug hole on top.
5. Pump the Intensifier full of fluid. Operate hand pump at moderate speed until bubble-free flow comes through the clean exhaust hose.
6. As the tool fills, oil will begin to flow out the exhaust hose. Air bubbles will be observed in the exhaust oil. Continue to pump until all air bubbles cease to appear in the outflowing oil.
7. When air bubbles cease, detach exhaust hose and insert fill plug. Detach the volume pump hose and install fill plug.
8. Tighten the fill plugs to specifications. Test the tool in an appropriate tester.

Testing

Test the action of the Intensifier in a Bowen Jar Tester or other suitable test rack which has a readout for the applied pull load. The tool should be pulled open to its full stroke in the tester. The pull load required to open the tool should be within 2,000 pounds, plus or minus, of the load value listed in the data sheet for the specific intensifier.

CAUTION: Do not stand beside tool during tests. Extremely high pressures develop and metal body failure could cause serious injury.

When the applied load is removed, the tool should close within 1 1/2" of complete closure (measured where the Mandrel Shoulder meets the Mandrel Body Insert).

If the recommended pull load is not reached or the tool remains open more than 1 1/2", repeat filling procedure.

CAUTION: Before removing Intensifier from Jar tester, push the Intensifier in the complete closed position. (Mandrel and Mandrel Body Insert shoulders must be touching.)

It should be noted that no harm to the tool will result if it remains open slightly, either during service or in the shop. The only effect is a slight loss of effective stroke when in use. The loss of stroke should not be considered important unless it is greater than 1 1/2" inch.

NOTE: Use only Bowen Liquid Spring Intensifier Fluid in the Bowen Intensifier. It is specially compounded to perform properly. Any attempt to use a substitute fluid will result in no performance and almost certain failure of the Intensifier.

The entrance of small amounts of lubricating oil into the Intensifier Fluid, such as might be used to oil the parts of the tool, will not be harmful, but should be kept to a practical minimum.

The operator will note too, that during service the fluid will become discolored by traces of brown or amber stain. This is caused by bleeding of seals, while under high pressure, and from thread dope, where this is used on the connections. These traces of discoloration are not detrimental to the fluid or to the tool, unless the concentration is heavy enough to include solid particles such as small slivers of rubber.

Bowen Liquid Spring Intensifier Fluid should be kept clean and as free of contamination as possible. It is a special purpose fluid, and relatively expensive.

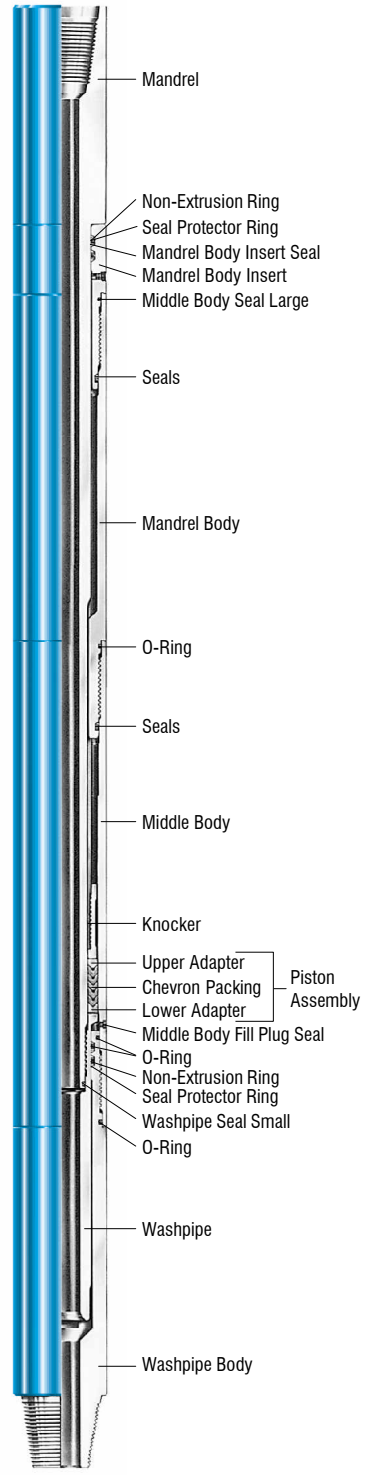
Bowen Jar Intensifer Fluid Bleeding Prior to Field Use

If the anticipated bottom hole temperature is greater than 180° F (82°C), then it is necessary to bleed a small amount of Intensifier Fluid from the tool, following testing, and prior to running it in the well. This insures that the internal pressures will not damage the tool at operating temperatures and rated loads.

WARNING: The Intensifier must be in the "Closed" position. This will insure that little or no pressure is in the tool when the Fill Plug is removed.

CAUTION: Before bleeding any fluid from the Intensifier, it must have been completely filled and tested. If any appreciable amount of air is in the tool at this time, the final amount of fluid in the tool will be less than required for the Jar to operate properly.

1. **Place the Intensifier in the tester. Rotate the Intensifier until one of the Fill Plugs in the Mandrel Body is straight up.**
2. **After making sure the Intensifier is in the closed position, remove the top Fill Plug.**
3. **Slowly pull open the Intensifier about 1/2" to 1". A small amount of Intensifier fluid should bleed out.**
4. **Replace and tighten Fill Plug.**



Bowen Jar Intensifier

Complete Disassembly

Complete disassembly of the Bowen Jar Intensifier should proceed as follows:

1. Secure the Jar in a Pipe vice, 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 cause possible injury or damage.

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. 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 Assembly 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.
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 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 the illustration below.

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 the 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 OD, ID, 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.

    The Intensifier Fluid which was drained from the tool may be re-used, provided it is clean. Before it is re-used, it should be filtered through several thicknesses of clean small-mesh cheese cloth or filter paper.

Complete Assembly

Complete assembly of the Bowen Jar Intensifier should proceed as follows:

1. Assure that all parts are thoroughly clean and applied with a coat of good grade light oil as they are assembled.
2. Clamp the Mandrel in a vise, clamping on the tool joint connection portion.
3. Assemble the Seals, Seal Protector Rings and Non-Extrusion Rings in the Mandrel Body Insert. Refer to detailed instructions for this on page 8. Slide the Mandrel Body Insert over the Mandrel (seal end first) and slide it up against the Mandrel shoulder.
4. Assemble the Seals, Seal Protector Rings and Non-Extrusion Rings onto the Mandrel Body. Slide the Mandrel Body over the Mandrel (female end first), engage the Mandrel splines and screw the Mandrel Body Insert into the Mandrel Body. Buck them up tight.
5. Assemble the Knocker onto the lower end of the Mandrel and buck it up tight.
6. Assemble the Piston on the lower end of the Mandrel. Assemble the Upper Adapter on the Mandrel, the flat face against the Knocker. Follow this with the several Chevron Packing Rings, with their lips toward the Upper Adapter. Follow the Packing Rings with the Lower Adapter, its lips against the Packing Rings.

    Use caution to assure that the Piston Assembly is not assembled upside-down. So assembled, the tool can be opened, but will not function, nor can it be closed.
7. Assemble the Seal on the lower end of the Mandrel, followed by the Washpipe. Buck the Washpipe up tight, wrenching, only on the surface provided at its small end.
8. Slide the Middle Body over the Mandrel, with the fill plug end down, and make it up onto the Mandrel Body and buck it up tight.
9. The assembly should be re-clamped at the Middle Body. Assemble the Seals, Seal Protector Rings and Non-Extrusion Rings into the Washpipe Body, and thread the Washpipe Body into the lower end of the Middle Body. Buck it up tight.
10. Fill the Intensifier with Bowen Liquid Spring as described under “Filling with Fluid” on page 4, steps 3 thru 8.
11. Test the Intensifier’s operation and pressure test the seals, as outlined under “Testing” on page 5.

    The Tool is now ready for service or storage.

    If the tool is to be stored for future service or shipping, the tool joints should be applied with a good grade of thread dope, and thread protectors should be installed. The outside of the tool should be cleaned and painted, or a heavy coat of grease applied. If the climate is very damp or salty, the bores through the tool should be greased.

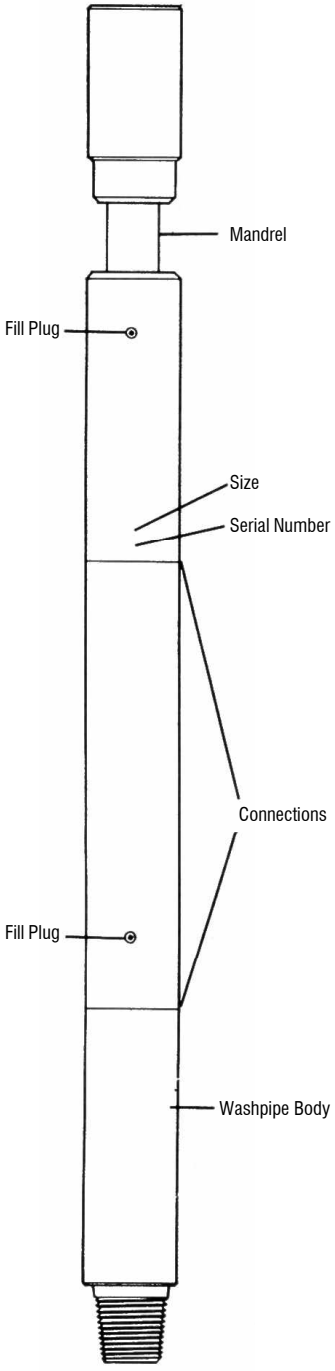


Figure 1
Hold Non-Extrusion Ring between thumbs and forefingers as shown.

Figure 2
Overlap ends until diameter is small enough to fit inside body.

Figure 3
Place edge of Ring opposite the split into the lower groove and spread from center toward ends. Be sure beveled side of ring matches beveled groove side.

Figure 4
Using Thumbs, press Ring into groove until ends match up and ring is firmly seated in groove.

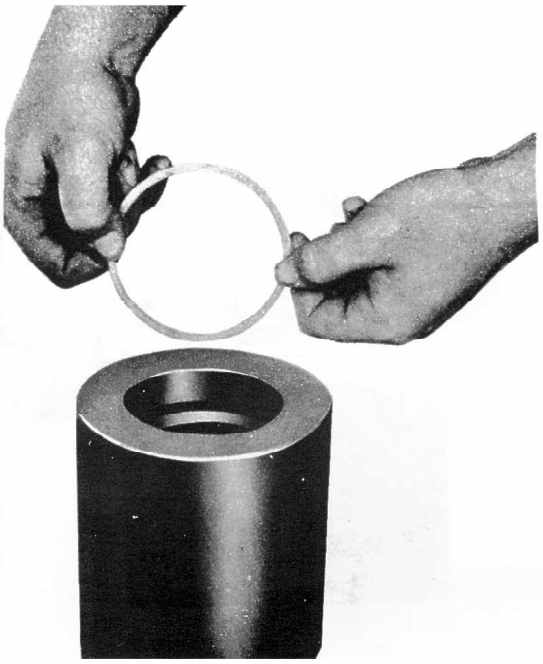


Figure 5
Ring shown before being bent. It will look like this after it is properly installed in the groove.

Figure 6
Bend the Ring until it is small enough to allow entry into bore.

Figure 7
Insert one edge in groove. Then insert the opposite edge and press down until entire ring is in place.

Figure 8
Use Seal Protector Ring installation tool to straighten and flatten ring by pressing against ring as shown.

Figure 9
O-Ring Packing before installation.

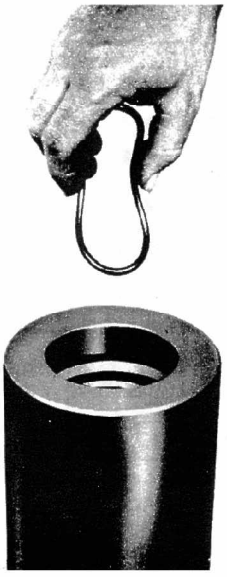


Figure 10
Bend O-Ring as shown to insert into groove.

Figure 11
Insert O-Rings between Seal Protection Rings in each groove.

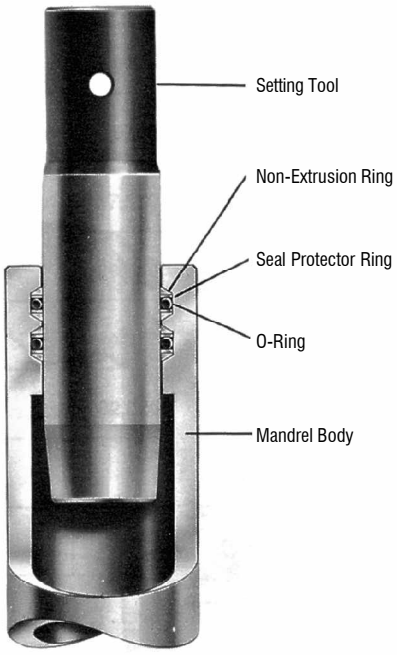


Figure 12
This illustration shows the O-Ring Seal Assemblies in place iside the Mandrel Body. The Setting Tool is shown in position as it is being driven into the bore to conform the copper rings to the proper size. If plastic seals are used, a setting tool is not required.

Figure 13
Use this setting tool from the accessory kit to seat the ring seal assemblies after installation. (Not required with black nylon rings.)

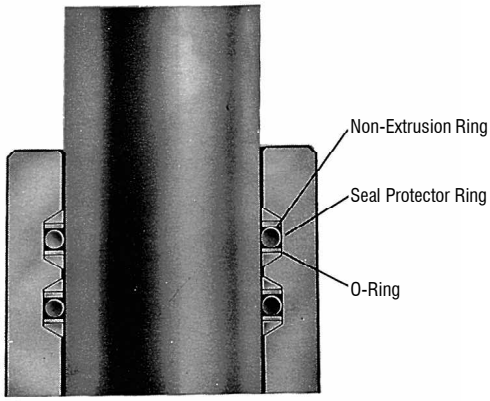


Figure 14
This illustration shows the location of parts of the pateneted Bowen Seal Ring Assembly after proper assembly.

Figure 15
Insert the setting tool as shown. Use any convenient rod or bar to hold the tool.

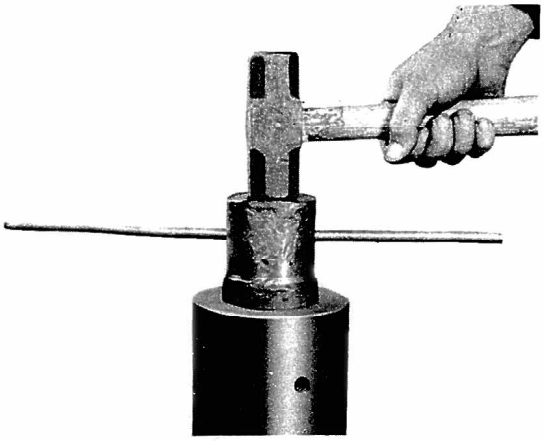


Figure 16
Drive in as shown and tap several times around the periphery of the tool to set the rings. Continue until both ring assemblies are seated. Then remove the tool and continue assembly of the sub.

Bowen Jar Intensifier Maximum Recommended Tightening Torque Specifications

Jar Assembly No.	Jar OD x ID (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)	Mandrel Body Insert to Mandrel Body Extn. (ft-lb)	Mandrel Body Extn. to Mandrel Body (ft-lb)
70957	1-5/8 x 1/4	130	—	80	320	150	270	—	—
64460	1-13/16 x 5/16	170	—	100	300	350	520	—	—
50640	2-1/4 x 3/8	—	30	150	670	900	1,050	—	—
68262	2-29/32 x 1	1,130	—	800	—	1,950	2,070	1,450	1,570
55867	3-1/8 x 1	—	200	690	2,030	2,030	2,030	—	—
55895	3-3/4 x 1-1/4	—	300	1,140	3,820	3,820	3,820	—	—
55747	3-3/4 x 1-1/2	2,670	—	890	3,570	3,570	3,570	—	—
50660	3-3/4 x 1-7/8	1,490	—	410	3,570	3,570	3,570	—	—
55664	4-1/4 x 1-15/16	—	500	1,880	4,960	4,960	4,960	—	—
50708	4-1/2 x 2-3/8	—	500	1,930	5,580	5,580	5,580	—	—
50700	4-3/4 x 1-1/2	—	700	2,130	9,210	9,770	9,210	—	—
55812	4-3/4 x 2	—	500	2,010	6,800	9,750	8,600	—	—
55860	6 x 2	—	2,200	4,990	11,500	17,530	17,160	—	—
55905	6-1/4 x 2-1/4	—	2,000	5,460	13,700	20,340	20,340	—	—
50720	6-3/4 x 2-3/8	—	1,900	7,260	17,400	24,330	24,330	—	—
55910	7-3/4 x 3-1/16	—	3,200	11,680	32,020	32,020	32,010	—	—
66372	9 x 3-3/4	—	6,200	21,540	39,000	57,760	46,130	—	—

Note: Tightening torque values are in ft-lbs. The above make up torques are the maximum recommended make up torques for each connection.
They are set at 50% of the calculated theoretical yield torque.

Bowen Super Intensifier Maximum Recommended Tightening Torque Specifications

Assembly No.	OD (in)	ID (in)	Top Sub to Mandrel (ft-lb)	Mandrel to Washpipe (ft-lb)	Mandrel Body to Spline Body (ft-lb)	Spline Body to Connector Body (ft-lb)	Connector Body to Pressure Body (ft-lb)	Pressure Body to Washpipe Body (ft-lb)	Mandrel Extn. to Washpipe (ft-lb)	Mandrel to Mandrel Extn. (ft-lb)
78964 **	7-3/4	3-1/16	26,350	—	33,850	33,850	33,850	39,500	7,360	9,520

Note: Tightening torque values are in ft-lbs. The above make up torques are the maximum recommended make up torques for each connection.
They are set at 50% of the calculated theoretical yield torque.

** The Super Intensifer is used with the Super Fishing Jar ONLY.
Information concerning disassembly, assembly, operation, etc. for the Super Intensifier will be provided upon request.

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 substantially less than rated loads. Rotation and bending together can lead to fatigue.

Bowen Jar Intensifiers Strength Data

Intensifier Assembly No.	O.D.	I.D.	Connection	Stroke	Recommended Drill Collar Weight Range (lbs)	Pull Load to Open Fully	Minimum Pull Req'd. (Above Weight of String and Collars) To Obtain Effective Blow (lbs)	Calculated Strength Data			Fluid Capacity (gal)	Used with Jar No.	Used with Super Fishing Jar No.
								Tensile @Yield in lbs*	Torque (ft/lbs) Max. Operating	Torque (ft/lbs) At Yield			
70957	1-5/8	1/4	Per Order	6	1,100 to 1,400	14,000	8,400	43,200 46,300	130	260	.13	70822	—
64460	1-13/16	5/16	1-13/16 Wilson F.J.	6	1,360 to 1,800	18,100	10,800	59,400	170	340	.195	74223 21150 78074	— —
50640	2-1/4	3/8	1-1/4 A.PI. Reg.	8	1,560 to 2,100	20,700	13,800	118,500	900	1,800	.211	18775 54020	—
68262	2-29/32	1	2-3/8 PH-6	12-3/4	2,200 to 3,000	37,000	24,600	194,800	1,130	2,260	.692	68010	—
55867	3-1/8	1	2-3/8 A.PI. Reg.	8-3/4	2,400 to 3,300	30,000	21,000	229,200	2,034	4,068	.375	42736 52504	72888
55895	3-3/4	1-1/4	2-7/8 A.PI. Reg.	8-1/4	4,200 to 5,700	52,000	36,000	345,000	3,820	7,640	.82	38040 13255 52506	145737
55747	3-3/4	1-1/2	2-3/8 A.PI. I.F.	7-7/8	3,400 to 4,600	43,500	30,000	299,700	2,670	5,340	.63	37406 52528	—
50660	3-3/4	1-7/8	2-3/8 E.U.E.	7-5/8	3,500 to 4,700	43,000	30,000	179,500	1,490	2,980	.613	41355 20150 52497	—
55664	4-1/4	1-15/16	2-7/8 A.PI. I.F.	8-5/8	3,500 to 4,700	43,000	30,000	430,300	4,960	9,920	.92	44483 13640 52502	80468
50708	4-1/2	2-3/8	2-7/8 E.U.E.	10-3/8	3,600 to 4,900	49,000	32,000	375,000	5,580	11,160	1.15	35849 52653	—
50700	4-3/4	1-1/2	3-1/2 A.PI. F.H.	8-7/8	6,300 to 8,500	78,000	54,000	591,900	9,210	18,420	1.0	25960 52530	—
55812	4-3/4	2	3-1/2 A.PI. F.H. I.F.	10-1/8	5,600 to 7,500	63,000	43,000	468,800	8,600	17,200	1.35	38110 52500	79789
55860	6	2	4-1/2 A.PI. F.H.	8-5/8	10,200 to 13,800	128,500	77,000	937,000	17,160	34,320	1.57	14710 52498	145484
55905	6-1/4	2-1/4	4-1/2 A.PI. I.F.	13	11,800 to 16,000	147,000	102,000	917,400	20,340	40,680	4.24	12370 52544	79691
50720	6-3/4	2-3/8	5-1/2 A.PI. Reg.	13	13,000 to 17,500	172,900	102,000	1,013,800	24,330	48,660	3.45	11130 52680	145440
55910	7-3/4	3-1/16	6-5/8 A.PI. Reg.	13	11,000 to 15,000	126,000	88,000	1,587,900	32,010	64,020	4.65	15160 52711	—
78964 **	7-3/4	3-1/16	6-5/8 A.PI. Reg.	12	12,100 to 20,500	220,000	123,000	1,600,000	26,350	52,700	—	—	72978
66372	9	3-3/4	7-5/8 A.PI. Reg.	13	12,000 to 16,000	200,000	100,000	1,621,000	46,130	92,260	3.2	66346	—

* The above tensile strengths are calculated theoretical yield strengths and are considered accurate to ±20%.

The above operating torque is set at 50% of calculated theoretical yield torque and is the maximum recommended operating torque.

** Bowen Super Intensifier — information provided on request.

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

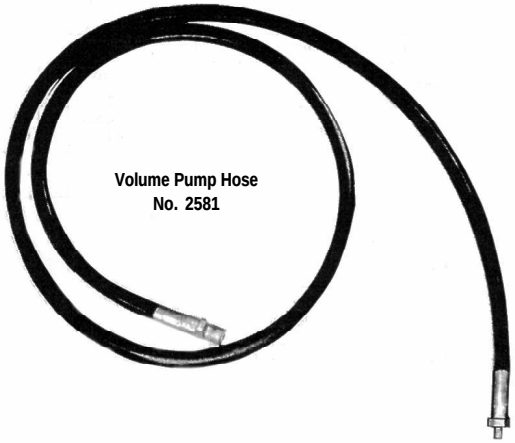
Users of jars and bumper subs should be aware that milling or drilling operations may develop stresses in these tools that are more complex than the simple torsional and tensile values listed in Bowen strength data. If unstabilized, the weight necessary for milling can induce bending forces that combine 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.

NOTE: WEIGHT CONSISTING OF COLLARS, SINKER BARS, HEAVY WEIGHT, ETC., SHOULD NOT BE RUN ABOVE AN INTENSIFIER FOR AT LEAST 1,000 FEET.

Intensifier Service Kit

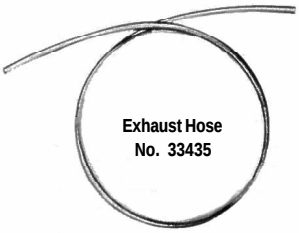
A **Service Kit** is necessary to properly service the Intensifier. These Kits are identical for every size of Intensifier, so one kit may be used for any number of Intensifiers. The kit does not include any Seal Setting Tool, two of which are required for each size of Intensifier. These tools must be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



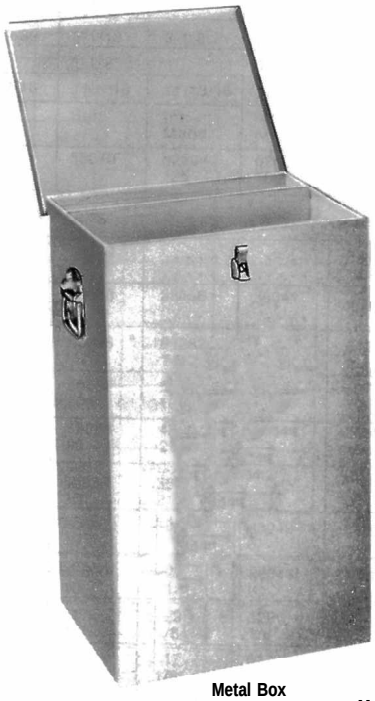
Volume Pump Hose
No. 2581

Volume Pump
No. 2580

Piston Ring Pliers
No. 69248



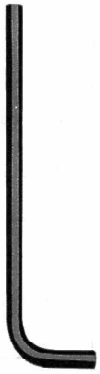
Exhaust Hose
No. 33435



Metal Box
No. 1995

Seal Protector Ring
Installation Tool
No. 625

O-Ring
Installation Tool
No. 626



Mandrel Body
Fill Plug Wrench
No. 359, No. 546,
and 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 Jar Intensifiers for Hydraulic Jars

Connections		Per Order	1-13/16" Wilson F.J.	1-1/4" A.PI. Reg.	2-3/8" PH-6	2-3/8" A.PI. Reg.	2" A.PI. I.F.	6-5/8" A.PI.	2-7/8" A.PI. Reg.	2-7/8" A.PI. I.F.
Outside Diameter - Inches		1-5/8	1-13/16	2-1/4	2-29/32	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	1-1/2	1-7/8	1-1/4	1-15/16
		70822	21150	54020	68010	52504	52528	52497	52506	52502
Jars Used with:		—	74723	18775	—	42736	37406	20150	38040	44483
Total Stroke To Solid - Inches		6	6	6	12-3/4	8-3/4	7-7/8	7-5/8	8-1/4	8-5/8
Complete Assembly	**Part No.**	70957	64460	50640	68262	55867	55747	50660	55895	55664
	Weight	40	48	80	—	117	154	241	199	222

Replacement Parts

Top Sub	**Part No.**	70823	21156	—	68015	—	37412	20156	—	—
	Weight	3	3	—	—	—	12	18	—	—
Mandrel	**Part No.**	70959	64461	50641	68267	55869	55749	50661	55897	55769
	Weight	6	10	18	—	53	60	70	72-1/2	123-1/2
Piston Assembly	**Part No.**	—	64455	64317	68268	64234	64211	64330	64248	64206
	Weight	—	—	—	—	—	—	—	—	—
Mandrel Body Insert	**Part No.**	71254	50634	50642	68266	50650	50283	50283	50591	49412
	Weight	5	6	8	—	12	9-1/2	9-1/2	9-1/2	11
Mandrel Body	**Part No.**	—	—	—	68265	—	—	—	—	—
Extension	**Weight**	—	—	—	55	—	—	—	—	—
Mandrel Body	**Part No.**	70958	50635	50643	68264	50651	50284	50284	50589	50371
	Weight	9	11	12	—	12-1/2	30	30	28	38
Middle Body	**Part No.**	70960	50636	50644	68263	55870	55748	55748	55898	55660
	Weight	8	9	12	—	29	26	26	30	39
Washpipe Body	**Part No.**	70829	21151	18776	68011	38064	37407	20151	38045	44487
	Weight	19	22	20	—	21	14	30	50	50
Washpipe	**Part No.**	70828	21154	18779	68016	42738	37410	64339	38046	44488
	Weight	1-1/2	1-1/2	3	—	10-1/2	12-1/2	12	12-1/2	20
Knocker	**Part No.**	—	—	18781	—	38060	—	—	38049	51185
	Weight	—	—	1	—	1	—	—	5-1/2	5
Mandrel Body Insert	**Part No.**	617T	617T	329T	617T	329T	329T	329T	329T	329T
Fill Plug (2 Req'd.)	**Weight**	1/8	1/8	1/8	—	1/8	1/8	1/8	—	1/8
Middle Body Fill Plug	**Part No.**	10641	10641	617T	10641	617T	617T	617T	617T	617T
	Weight	1/8	1/8	1/8	—	1/8	1/8	1/8	1/8	1/8
M.B. Insert Non-	**Part No.**	8-024	—	56542	—	—	—	—	—	—
Extrusion Ring (2 Req'd.)	**Weight**	1/8	—	1/8	—	—	—	—	—	—
M.B. Insert Seal	**Part No.**	568-024	8-027	227-2725	—	—	—	—	—	—
Ring (2 Req'd.)	**Weight**	1/4	1/4	1/4	—	—	—	—	—	—
Mandrel & W.P. Non-	**Part No.**	365-16	365-17	365-24	365-30.5	365-32	365-36	365-36	365-35	365-40
Extrusion Ring	**No. Req'd.**	4	4	4	10	8	8	6	8	8
	Weight	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Mandrel & W.P. Seal	**Part No.**	375-16	375-17	375-24	375-30.5	375-32	375-36	375-36	375-35	375-40
Protector Ring	**No. Req'd.**	4	4	4	10	8	8	6	8	8
	Weight	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
Packing Set*	**Part No.**	70961	50638	50835	68272	55873	55816	55497	55902	55666
	Weight	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
Intensifier Fluid	**Gals. Req'd.**	.13	.195	.211	.692	.375	.63	.613	.82	.92

Extra

Mandrel Body Setting Tool	**Part No.**	22709-16	22709-17	22709-24	22709-30.5	22709-32	22709-36	22709-36	22709-35	22709-40
Service Kit	**Part No.**	—	55403	Only one Service Kit required for all sizes of intensifiers - Does not include any						
	Weight	—	75	Seal Setting Tool, which must be ordered seperately as required for each tool.						

Extra for all Sizes of Tools

	Part No.	50529-A	1 Gallon
	Weight	10	
	Part No.	50529-B	2 Gallon
Intensifier Fluid	**Weight**	19	
	Part No.	50529-C	5 Gallon
	Weight	50	
	Part No.	50529-D	30 Gallon
	Weight	225	
Intensifier Fluid	**Part No.**	52152	
Transfer & Filter Unit	**Weight**	50	

* Packing Sets include all Seals necessary to dress the tool; Non-Extrusion Rings, Seal Protector Rings and Back-Up Rings are NOT included, and must be ordered separately.

Bowen Jar Intensifiers for Hydraulic Jars (Continued)

Complete Assembly	Part No.	70957	64460	50640	68262	55867	55747	50660	55895	55664

Replacement Parts (Continued)

Piston Assembly	Part No.	—	64455	64317	—	64234	64211	64330	64248	64206
Consists of:	Weight	—	3/4	1	—	1	1-1/2	1-1/2	2	2-1/2
	Part No.	—	64456	64318	68270	64236	64213	64331	64250	64208
Upper Adapter	Weight	—	1/4	1/4		1/4	1/2	1/2	3/4	1
Packing	Part No.	—	64458	64320	—	64237	64214	64333	64251	64209
(5 Pcs./Set)	Weight	—	1/4	1/2	—	1/2	1/2	1/2	1/2	1/2
	Part No.	—	64457	64319	68271	64235	64212	64332	64249	64207
Lower Adapter	Weight	—	1/4	1/4		1/4	1/2	1/2	3/4	1
	Part No.	77514	—	—	—	—	—	—	—	—
Cone	Weight	1/8	—	—	—	—	—	—	—	—
	Part No.	77513	—	—	—	—	—	—	—	—
By-pass Body	Weight	1/16	—	—	—	—	—	—	—	—
	Part No.	77515	—	—	—	—	—	—	—	—
Seal Body	Weight	1/8	—	—	—	—	—	—	—	—
	Part No.	2-019	—	—	—	—	—	—	—	—
O-Ring Seal	Weight	1/16	—	—	—	—	—	—	—	—
O-Ring Packing Set	Part No.	—	50638	50835	68272	55873	55816	55497	55902	55666
Consisting of:	Weight	—	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
Washpipe Seal	Part No.	568211	568115	568210	568224	568220	568224	568227	568222	568227
Mandrel & W.P. Seal	Part No.	568015	568212	568219	568328	568329	568333	568333	568332	568327
		1 Req'd.	2 Req'd.	4 Req'd.	5 Req'd.	4 Req'd.	4 Req'd.	3 Req'd.	4 Req'd.	4 Req'd.
Mandrel Body & Middle		568016	568219	568224	568036	568231	568235	568235	568235	568239
Body Seal	Part No.	3 Req'd.	3 Req'd.	3 Req'd.	4 Req'd.	3 Req'd.	3 Req'd.	3 Req'd.	3 Req'd.	3 Req'd.
Mandrel Body & M.B.		568214	568027	568222	568035	568228	568233	568233	568233	568237
Seal - Small	Part No.	3 Req'd.	3 Req'd.	3 Req'd.	8 Req'd.	5 Req'd.	5 Req'd.	5 Req'd.	5 Req'd.	5 Req'd.
Mandrel Body Insert										
F.P. Seal (2 Req'd.)	Part No.	568001	—	568006	568005	568006	568006	568006	568006	568006
Middle Body F. P. Seal	Part No.	—	568005	568005	—	568005	568005	568005	568005	568005

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) Seal Body Setting Tool

Bowen Jar Intensifiers for Hydraulic Jars

Connections		2-7/8" E.U.E.	3-1/2" A.P.I. F.H. Or I.F.	3-1/2" A.P.I. F.H. or I.F.	4-1/2" A.P.I. F.H.	4-1/2" A.P.I. I.F.	5-1/2" A.P.I. Reg.	6-5/8" A.P.I. Reg.	6-5/8" A.P.I. Reg.	7-5/8" A.P.I. Reg.
Outside Diameter - Inches		4-1/2	4-3/4	4-3/4	6	6-1/4	6-3/4	7-3/4	7-3/4	9
Inside Diameter - Inches		2-3/8	1-1/2	2	2	2-1/4	2-3/8	3-1/16	3-1/16	3-3/4
		52653	52530	52500	52498	52544	52680	52711	72978**	66346
Jars Used with:		35849	25960	36110	14710	12370	11130	15160	. . . . .	. . . . .
Total Stroke To Solid - Inches		10-3/8	8-7/8	10-1/8	8-5/8	13	13	13	12	13
Complete Assembly	**Part No.**	50708	50700	55812	55860	55905	50720	55910	78964**	66372
	Weight	356	446	460	653	820	928	1248	. . . . .	1870

Replacement Parts

Top Sub	**Part No.**	—	—	—	—	—	—	—	72986	—
	Weight	—	—	—	—	—	—	—	—	—
Mandrel	**Part No.**	50709	50701	55817	55862	55908	50721	50146	72983	66376
	Weight	128	127-3/4	150	268	337	285	564	—	791
Piston Assembly	**Part No.**	64340	64995	64264	64268	64272	64240	64276	—	66382
	Weight	—	—	—	—	—	—	—	—	—
Mandrel Body Insert	**Part No.**	50710	50702	49394	49635	50598	50722	50149	—	66380
	Weight	10	11	12	25	25	35	47	—	60
Mandrel Body	**Part No.**	50711	50703	50374	49634	50597	50723	50147	78266	66377
	Weight	45	66	62	92	103	143	160	—	310
Middle Body	**Part No.**	50712	50704	55814	55863	55920	50724	55911	78705	66373
	Weight	50	60	51	85	92	102	142	—	130
Washpipe Body	**Part No.**	35854	25961	38111	14711	12371	701	15164	78707	66350
	Weight	67	85	66	145	170	220	250	—	383
Washpipe	**Part No.**	64344	25964	38114	14714	55907	704	55912	73058	66349
	Weight	22	25	21	36	47	56	64	—	135
Knocker	**Part No.**	35857	25966	38116	14717	12377	11134	50150	—	66348
	Weight	5	5	4	9-1/2	9-1/2	9-1/2	10	—	34
Mandrell Body Insert Fill Plug	**Part No.**	329T	329T	329T	508	508	508	508	—	508
(2 Req'd.)	**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	617T	329T	329T	329T	329T	329T	—
	Weight	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	—
Mandrell & Washpipe	**Part No.**	365-42	365-40	365-41	453	365-48	708	365-59	—	365-65
Non-Extrusion Ring (8 Req'd.)	**Weight**	1/8	1/8	1/8	1/8	1/8	1/8	1/8	—	1/8
Mandrell & Washpipe Seal	**Part No.**	365-42	365-40	365-41	449	365-48	708	365-59	—	365-65
Protector Ring (8 Req'd.)	**Weight**	1/8	1/8	1/8	1/8	1/8	1/8	1/8	—	1/8
O-Ring Packing Set*	**Part No.**	50840	50841	55815	55866	55919	50842	55921	—	66383
	Weight	1/4	1/2	1/2	3/4	3/4	3/4	1	—	1-1/2
Intensifier Fluid – gallons	**Req'd.**	1.15	1	1.35	1.57	4.24	3.45	4.65	—	3.2

Extra

Mandrell Body Setting Tool	**Part No.**	22709-42	22709-40	22709-41	448	22709-48	22709-51	22709-59	—	22709-65
Service Kit	**Part No.**	55403	55403	55403	55403	55403	55403	55403	145213	55403
	Weight	75	75	75	75	75	75	75	—	75

Intensifier Fluid	**Part No.**	50529-A	1 Gallon			**Part No.**	49842-A	1 Gallon
	Weight	10				**Weight**	8-1/2	
	Part No.	50529-B	2 Gallon	**Only For**		**Part No.**	49842-B	5 Gallon
	Weight	19		**Assembly No. 78964**		**Weight**	40	
	Part No.	50529-C	2 Gallon	**Hydraulic Jar Oil 49842**		**Part No.**	49842-C	20 Gallon
	Weight	50				**Weight**	248	
	Part No.	50529-D	30 Gallon	**Bowen Super Intensifier**		**Part No.**	49842-D	55 Gallon
	Weight	225		**(Complete Assembly No. 78964)**		**Weight**	455	
Intensifier Fluid	**Part No.**	52152		**Uses Approved ISO Grade 22 Hydraulic Oil ONLY.**				
Transfer & Filter Unit	**Weight**	50						

* Packing Sets include all Seals necessary to dress the tool.
Non-Extrusion Rings, Seal Protector Rings and Back-Up Rings are NOT included, and must ordered separately.

** Super Intensifier used with Super Fishing Jar ONLY.
Information concerning disassembly, assembly, operation, etc., for the Super Intensifier provided on request.

Bowen Jar Intensifiers for Hydraulic Jars (Continued)

Complete Assembly	Part No.	50708	50700	55812	55860	55905	50720	55910	78964	66372
Replacement Parts (Continued)										
Piston Assembly Consists of:	Part No.	64340	64995	64264	64268	64272	64240	64276	—	66382
	Weight	2	2-1/4	2-1/2	3	4	4	5	—	15
Upper Adapter	Part No.	64341	64997	64266	64269	64273	64242	64277	—	66378
	Weight	3/4	3/4	1	1	1-1/2	1-1/2	2	—	2
Packing	Part No.	64343	64998	64267	64271	64275	64243	64279	—	66384
	Weight	1/2	1/2	1/2	1	1	1	1	—	1
	Pcs/Set	5	5	5	4	4	5	5	—	5
Lower Adapter	Part No.	64342	64996	64265	64270	64274	64241	64278	—	66379
	Weight	3/4	1	1	1	1-1/2	1-1/2	2	—	2
O-Ring Packing Set Consists of:	Part No.	50840	50841	55815	55866	55919	50842	55921	—	66383
	Weight	1/4	1/2	1/2	3/4	3/4	3/4	3/4	—	7/8
Washpipe Seal	Part No.	568233	568228	568228	568234	568232	568235	568242	568296	568296
Mandrel & Washpipe Seal (4 Req'd.)	Part No.	568339	568337	568338	568344	568345	568349	568432	—	568438
Mandrel Body & Middle Body Seal (3 Req'd.)	Part No.	568241	568241	568241	568248	568252	568256	568261	—	568265
Mandrel Body & Middle Body Seal - Small	Part No.	568239	568239	568239	568246	568250	568254	568437	—	568263
		5 Req'd.	5 Req'd.	5 Req'd.	5 Req'd.	5 Req'd.	5 Req'd.	4 Req'd.		
Mandrel Body Insert Fill Plug Seal (2 Req'd.)	Part No.	568006	568006	568006	568011	568011	568011	568011	—	568011
Middle Body Fill Plug Seal	Part No.	568005	568006	568005	568005	568005	568005	568006	568005	—
Mandrel Body Insert Seal Small (4 Req'd.)	Part No.	—	—	—	—	—	—	—	—	568441
Spline Body	Part No.	—	—	—	—	—	—	—	72979	—
Mandrel Body (Wiper)	Part No.	—	—	—	—	—	—	—	72982	—
Mandrel Body I.D. Seal	Part No.	—	—	—	—	—	—	—	568452	—
Back Up Ring for Mandrel Body I.D. Seal	Part No.	—	—	—	—	—	—	—	72981	—
Mandrel Body Seal - Large (O-Ring)	Part No.	—	—	—	—	—	—	—	568260	—
Mandrel Body Seal - Small (O-Ring)	Part No.	—	—	—	—	—	—	—	568258	—
Mandrel Seal - Upper	Part No.	—	—	—	—	—	—	—	568247	—
Mandrel Seal - Middle	Part No.	—	—	—	—	—	—	—	568428	—
Back Up Ring for Mandrel Middle Seal (2 Req'd.)	Part No.	—	—	—	—	—	—	—	72984	—
Mandrel Wiper	Part No.	—	—	—	—	—	—	—	72985	—
Mandrel Seal - Lower	Part No.	—	—	—	—	—	—	—	568240	—
Top Sub Seal	Part No.	—	—	—	—	—	—	—	568253	—
Connector Body	Part No.	—	—	—	—	—	—	—	72987	—
Connector Body Seal - Small	Part No.	—	—	—	—	—	—	—	568258	—
Connector Body Seal - Large (2 Req'd.)	Part No.	—	—	—	—	—	—	—	568260	—
Connector Body Wiper	Part No.	—	—	—	—	—	—	—	72988	—
Back Up Ring for Connector Body I.D. Seal	Part No.	—	—	—	—	—	—	—	72989	—
Connector Body Packing Set (I.D.)	Part No.	—	—	—	—	—	—	—	148643	—
Connector Body Packing Set (O.d.)	Part No.	—	—	—	—	—	—	—	148644	—
Connector Body Packing Retainer (O.D.)	Part No.	—	—	—	—	—	—	—	72992	—
Connector Body Packing Retainer Ring (O.D.)	Part No.	—	—	—	—	—	—	—	78427	—
Mandrel Extension	Part No.	—	—	—	—	—	—	—	78706	—
Mandrel Extension Seal - Lower	Part No.	—	—	—	—	—	—	—	568240	—
Mandrel Extension Seal - Upper	Part No.	—	—	—	—	—	—	—	568246	—
Mandrel Ext. Packing Set (O.D.)	Part No.	—	—	—	—	—	—	—	78946	—
Mandrel Ext. Packing Retainer	Part No.	—	—	—	—	—	—	—	78960	—
Washpipe Body Seal - Small	Part No.	—	—	—	—	—	—	568259	568255	—
Washpipe Body Seal - Large	Part No.	—	—	—	—	—	—	—	568260	—
Washpipe Body Packing Set (I.D.)	Part No.	—	—	—	—	—	—	—	148643	—
Extra										
O-Ring Packing Set	Part No.	—	—	—	—	—	—	—	78966	—
Complete Packing Set	Part No.	—	—	—	—	—	—	—	78967	—

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) Seal Body Setting Tool

NATIONAL OILWELL VARCO

Corporate Headquarters

10000 Richmond Avenue
Houston, Texas 77042
United States
Phone: 713 346 7500
Fax: 713 346 7959

Alaska
4111 Ingra
Anchorage, Alaska 99503
United States
Phone: 907 563 5253
Fax: 907 561 0071

California
4117 Atlas Court
Bakersfield, California 99308
United States
Phone: 661 395 0165
Fax: 661 328 1827

Louisiana
108 Nova Drive
Broussard, Louisiana 70518
United States
Phone: 337 839 2400
Fax: 337 839 2211

190 Thompson Road
Houma, Louisiana 70363
United States
Phone: 985 851 1111
Fax: 985 851 1117

Mississippi
2930 Industrial Blvd.
Laurel, Mississippi 39440
United States
Phone: 601 649 8671
Fax: 601 649 8673

New Mexico
#14 CR 5860
Farmington, New Mexico 87401
United States
Phone: 505 326 4303
Fax: 505 326 4304

North Dakota
3202 1st Avenue West
Williston, North Dakota 58801
United States
Phone: 701 774 0091
Fax: 701 774 0092

Oklahoma
3800 Thomas Road
Oklahoma City, Oklahoma 73179
United States
Phone: 405 677 2484
Toll Free: 877 760 1711
Fax: 405 677 2457

Texas
1249 Commerce Road
Alice, Texas 78332
United States
Phone: 361 664 8013
Fax: 361 664 0462

8411 Irvington Boulevard*
Houston, Texas 77022
United States
Phone: 713 691 7800
Fax: 713 691 7807

2810 Highway 135 North
Kilgore, Texas 75662
United States
Phone: 903 984 2553
Fax: 903 984 7170

10720 West I-20 East
Odessa, Texas 79765
United States
Phone: 432 563 1173
Fax: 432 563 1182

30444 Southwest Freeway
Rosenberg, Texas 77471
United States
Phone: 281 341 5365
Fax: 281 344 1986

Utah
1553 East Highway 40
Vernal, Utah 84078
United States
Phone: 435 789 0670
Fax: 435 789 6568

West Virginia
Route 2, Murphy Run Road
Clarksburg, West Virginia 26301
United States
Phone: 304 622 4303
Fax: 304 623 2174

Wyoming
1283 N. Derrick Drive
Unit 1, Box 2
Casper, Wyoming 82604
United States
Phone: 307 237 3100
Fax: 307 237 2546

Canada
9120 – 34A Avenue
Edmonton, Alberta T6E 5P4
Canada
Phone: 780 702 5209
Fax: 780 463 2348

3550 93 Street*
Edmonton, Alberta T6E 5N3
Canada
Phone: 780 944 3929
Fax: 780 430 0760

1100 540 5th Avenue SW (Mailing)
1010 540 5th Avenue SW (Office)
Calgary, Alberta T2P 0M2
Canada
Phone: 403 250 8000
Fax: 403 294 5790

England
2 Isbourne Way
Winchcombe
Cheltenham
Glos, GL54 5NS
England
Phone: 44 (0) 1242 603975
Fax: 44(0) 1242 602614

Dubai
Nr. R/A 13, Daimler Chrysler Street
P.O. Box 61490
Jebel Ali Free Zone
Dubai
UAE
Phone: 971 4 8838776
Fax: 971 4 8838795

Indonesia
Cilandak Commercial Estate Unit 105
Jl. Raya Cilandak KKO
P.O. Box 7541
Jakarta, 12560
Indonesia
Phone: 62 21 782 6088
Fax: 62 21 782 6086

Scotland
10 Kirkton Avenue
Pitmedden Road Industrial Estate
Dyce, Aberdeen AB21 0BF
Scotland
Phone: 441 224 334800
Fax: 441 224 723034

Singapore
9 Tuas Avenue 5
Singapore, 639335
Singapore
Phone: 65 68611566
Fax: 65 68610728

Germany
Edesser Straße 1
31234 Edemissen Berkhöpen
Postfach 31232
Germany
Phone: 49 5176 97670
Fax: 49 5176 9767 22

* Denotes Manufacturing and Engineering facilities

Downhole Solutions

Drilling Solutions

Engineering and Project Management Solutions

Lifting and Handling Solutions

Production Solutions

Supply Chain Solutions

Tubular and Corrosion Control Solutions

Well Service and Completion Solutions

PDF/0905
MANUAL NO. 4019 R6

www.nov.com
corporatemarketing@nov.com