

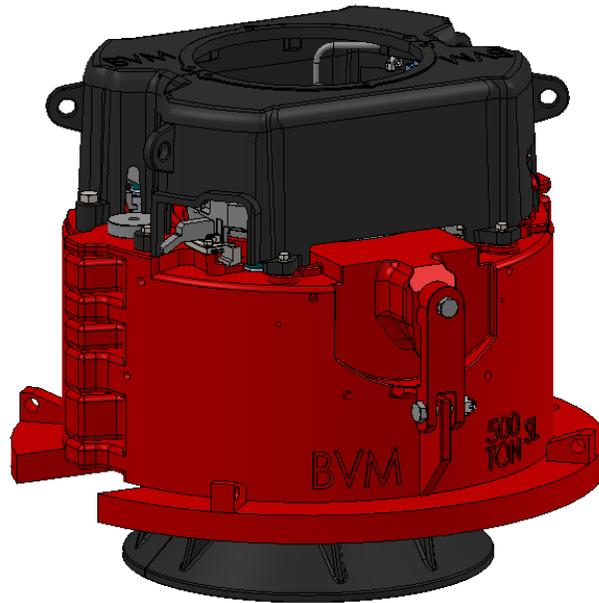
BVM Corporation Maintenance Manual

4 1/2 – 24 1/2” CASING SPIDER / ELEVATOR

350 & 500 Tons

Part number: _____

Serial Number: _____



Safety

CAUTION: Practice safety in the operation and maintenance and use only approved safety methods, materials and tools. Keep hands away from any pinch point or undesignated areas; use only the provided handles for operating the spider / elevator. The lifting procedures should be observed carefully and carried out according to this manual. BVM equipment is designed for specific functions and application and should be used only for its intended purpose, which is limited to vertical lifting / driving tubular goods, making up and breaking out tubular connections and must not be used for any other purpose.

WARNING: Elevators which have experienced wear beyond established wear criteria set by OEM, or are found to have cracks must be replaced or repaired by a BVM authorized repair facility.

WARNING: Only original BVM parts may be used. Elevators are produced from cast alloy heat treated steel and must not be welded in the field. Improper welding can cause cracks and brittleness in heat-affected areas which can result in dramatic weakening of the part and possible failure. Repairs involving welding and/or machining should be performed only by a BVM authorized repair facility. Using an Elevator that has been improperly welded or repaired is dangerous.

NOTE: The owner and user together with the manufacturer should jointly develop and update inspection, maintenance, repair and remanufacture procedures consistent with equipment application, loading, work environment, usage and other operational conditions. These factors may change from time to time as a result of new technology, equipment history, product improvements, new maintenance techniques and changes in service conditions. Alternatively, BVM recommends using the Periodic inspection and maintenance Categories and Frequencies as mentioned in API RP8B Table 1.

Load test

WARNING: BVM elevators are load tested after manufacture or repair. Load testing is mandatory on elevators which have not been load tested before. Load testing is required on elevators which have been overloaded, for example jarring operations or operations that have induced elevators to high accelerations or high impact loads. In addition, after the load test, an annual inspection should be performed.

Confidentiality Statement

This document contains proprietary and confidential information, which is the property of BVM Corporation. No use or disclosure is to be made without the express written consent of BVM Corporation.

Note: Original Instructions are published in English; in the event the end-user may wish to obtain a translation of these in the official language of the country in which the machinery is to be used please contact your local BVM representative or BVM directly. Please note that this service may not be free of charge. Original Instruction can be downloaded from www.bvmcorp.com

Contents

Safety	1
Purpose	3
Description.....	3
Specifications.....	4
Installation	6
Operation	11
Lubrication.....	13
Inspection.....	14
Disassembly	19
Assembly	20
Wear Data	21
Troubleshooting.....	24
Risk Assessment According to EN-ISO 12100:2010.....	24
Recommended Spares.....	25
Assembly drawing and List of Parts.....	26

Purpose

This manual contains operation and service instructions for 350 & 500 ton casing spider / elevator. This manual provides a guide for assembly, disassembly, inspection, and repair.

Description

The BVM 350 and 500 Ton Casing Elevator/Spider units are pneumatically-operated power tools capable of handling casing sizes up to 24.5 inches. The 350 ton unit has a capacity of 700,000 pounds and 1,000,000 pounds for the 500 ton.

The main body of these units can be dressed as a casing elevator or spider. The upper unit is dressed as an elevator, using a bottom guide and a bell guide. The lower unit is dressed as a spider, using a top guide to aid in centering the casing.

The elevator is attached to the derrick traveling block and hook with 350 or 500 ton standard API links. The spider can be located directly on the master bushing (with the insert bowls removed). If the rated load capacity of the rotary table does not exceed the capacity of the elevator/spider unit, or if the rotary table surface is not flat, an adaptor plate may be used.

Air pressure (70 to 125 psi) applied to the cylinders when the control lever is actuated, picks up a fine oil mist in the lubricator. The oil serves to keep the cylinder lubricated. When the control lever is moved, air pressure in the cylinders causes the leveling beams to change position – moving up to release, or down to set.

When the control lever is moved down, the four slips are lowered into the tapered bowl and forced inward radially to center and grip the casing. When set; the slips hold casing securely, without damage. The direct air lift and lock mechanism enables instant actuation of the slips. In offshore or land operations this allows the rig hands to raise and lock, or lower and set the slips instantly.

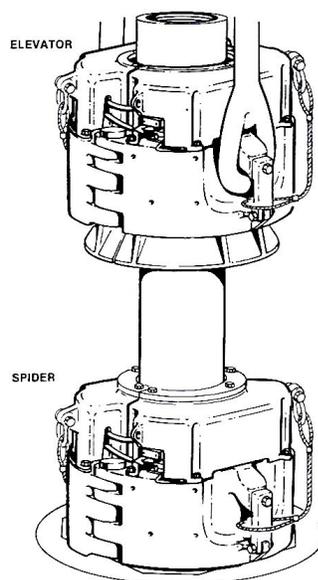


Figure 1: Elevator and Spider (500 ton unit shown)

Specifications

	350 Ton		500 Ton			
	English	Metric	English	Metric	English	Metric
Casing Size Range	4 1/2 thru 14 in	114 thru 365 mm	4 1/2 thru 14 in	114 thru 365 mm	16 thru 24 1/2 in	406 thru 622 mm
Max. Safe Hook Load	700,000 lbs	317,518 kg	1,000,000 lbs	455,000 kg	1,000,000 lbs	455,000 kg
Approximate Weight						
Elevator/spider (Less Guides and Slips)	3,900 lbs	1,769 kg	5,000 lbs	2,268 kg	6,320 lbs	2,867 kg
Bell Guide Kit	400 lbs	181 kg	400 lbs	181 kg	500 lbs	230 kg
Adaptor Plate	700 lbs	318 kg	700 lbs	318 kg	1230 lbs	558 kg
Operating Pressure						
Normal	70 to 80 psi, 483 to 552 kPa					
Maximum	125 psi, 861 kPa					
Approximate Cycle Time						
To Set Slips	One Second					
To Release Slips	Two Seconds					
Minimum Temperature						
	-20°C (-4°F), unless specified otherwise					
Maximum Temperature						
	55°C (131°F)					
Maximum Humidity	100% RH					
Use limits	Trained persons only (Users responsibility)					
Design life	20 years					

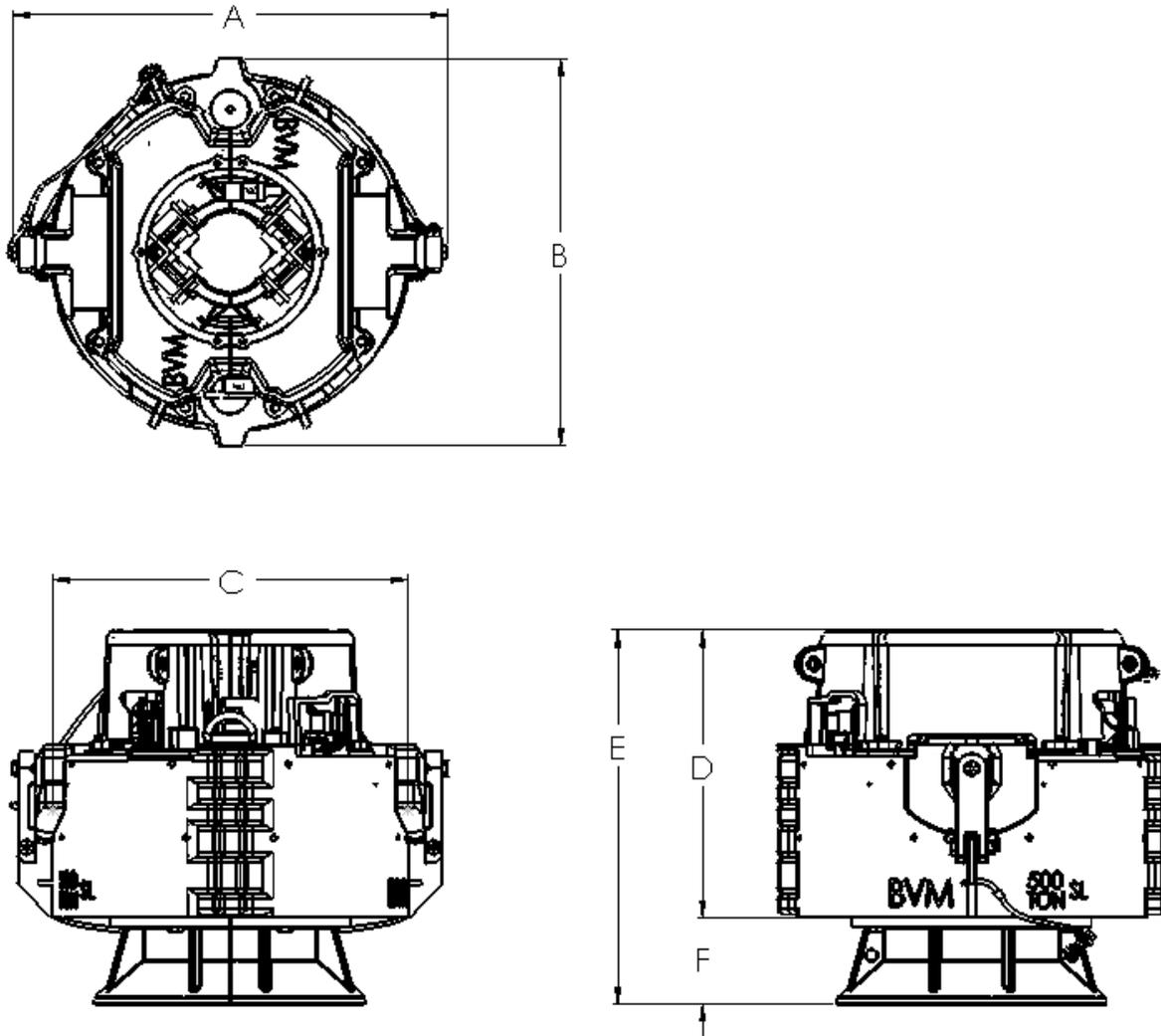


Figure 2: Elevator/Spider dimensions

Dimension	350 Ton		500 Ton 14"		500 Ton 24.5"	
	inch	mm	inch	mm	inch	mm
A	46	1168	51	1295	62	1575
B	43	1092	45.5	1156	55	1397
C	38	965	41	1041	51	1295
D	29	737	34	864	38.5	978
E	39	991	44	1118	45	1143
F	10	254	10	254	6.5	165

CE Marking (if applicable):



Installation

The elevator/spider units are shipped as illustrated in Figure 3. A specified set of slip segments and guide rings are shipped installed. The slip set and guide rings must correspond to casing diameter or damage to slips and casing will result (Pages 26 - 27).

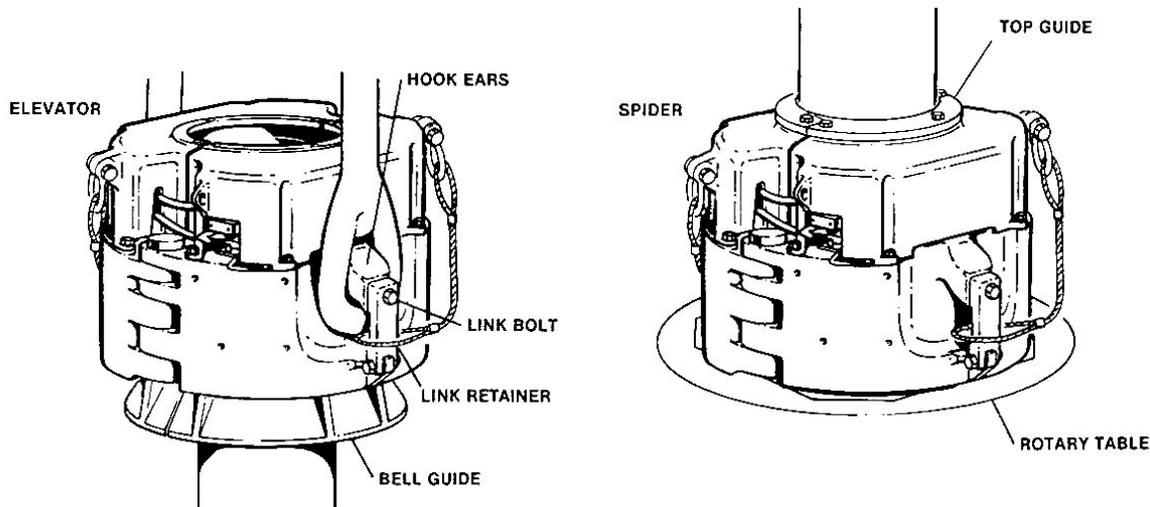


Figure 3: Elevator (Left) and Spider (Right) installed

Installation Preparation

Clean, dry air, filtered and regulated to 70 – 125 psi is required to operate these units.

Spider Installation:

Note: If an adapter plate is used, check to be certain it is level, so the spider will be in line with the borehole. Install the adapter plate with centering lugs facing up. These stops help to keep the spider centered. If an adapter plate is not used, check with rotary table manufacturer to be certain it will support spider unit.

- 1) Hoist Spider into position over borehole.
- 2) Lubricate as indicated (Page 17)
- 3) Connect air line (Page 7)

Elevator Installation:

Note: Be certain links and rig hook are capable of supporting the load indicated on the body of the unit (350 or 500 tons).

- 1) Open elevator link retainers and slide the bottom eyes of the links capable of supporting the maximum limit of the elevator, over the lifting lugs.
- 2) Close and secure the link retainers. Be certain the elevator control handle is on the side facing the stabbing board, so the derrick man will have access.
- 3) Lubricate as indicated (Page 17)
- 4) Connect air line (Page 7)

Regulator/Filter and Hose Installation

A shutoff valve should be installed on the end of the pipe before installing the regulator/filter. This valve will serve to cut off the air supply in the event that maintenance must be performed on the system.

- 1) Mount the regulator/filter near the air supply line, in an area that allows easy access for service.
- 2) Close the shutoff valve. Connect the regulator/filter to the shutoff valve.
- 3) Run one 50-foot section of air hose up the derrick. Try to prevent damage and keep it clear of the working area. Connect a second 50-foot section to the first and connect its other end to the elevator.
- 4) Connect a 25-foot section of air hose to the regulator/filter and the spider.
- 5) Open the shutoff valve on the air supply line and adjust the regulator to deliver 70 to 80 psi to the elevator and spider.

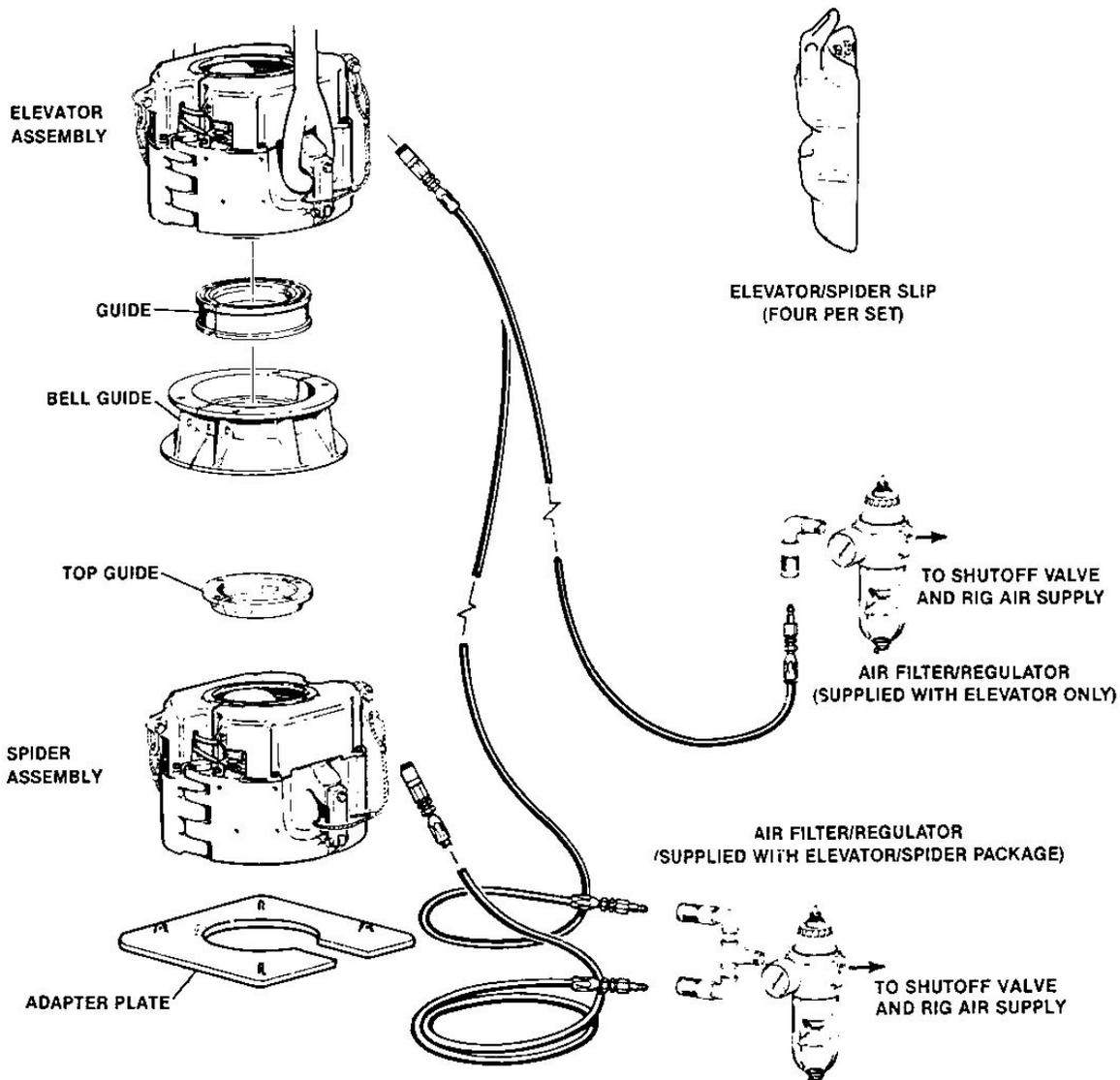


Figure 4: Elevator/Spider Installation

Note: If tools will not remain permanently with the rig, use two 50-foot air lines (Figure 5). Tie one 50-foot section of the hose 45-feet above floor near casing stabber. Attach second section of hose to first hose with the other end to elevator. If tools will remain permanent with the rig, an air supply line can be run (plumbed) up the derrick. Attach a 50-foot section of hose from the elevator directly to the upper air supply line outlet.

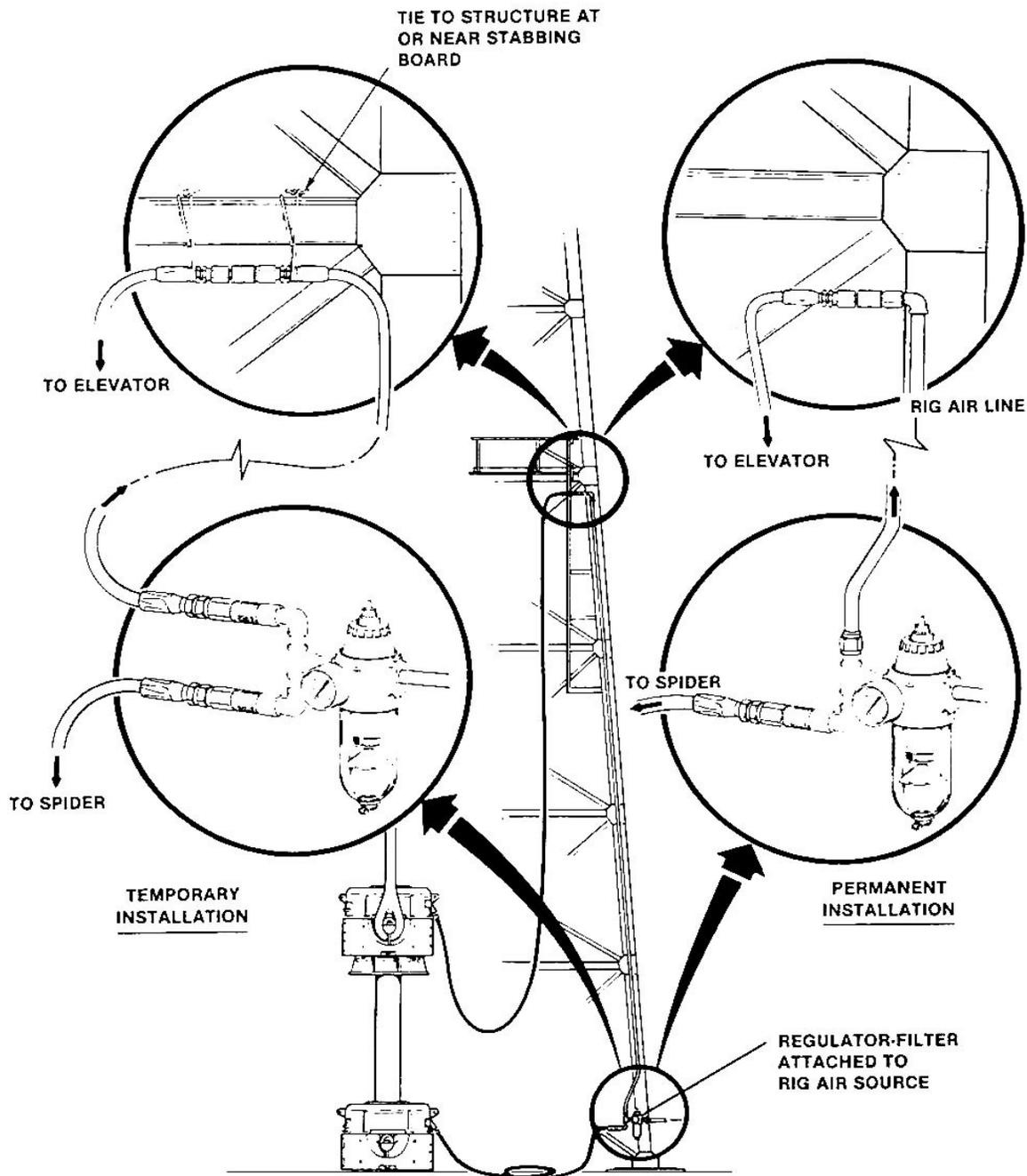


Figure 5: Regulator/Filter and Hose Installation

Warning:

- The load rating of the elevator should never be exceeded. Both the static and dynamic loads must be calculated to ensure safe working loads.
- Make sure the casing spider / elevators are used with the correct size, tubing or pipe (per specifications). Undersized or oversized pipe could cause uneven stress distribution. Inadequate load-bearing area, and possible elevator failure.

- Elevators are made from cast alloy steel and should not be welded in the field. Improper welding can cause cracks and brittleness in repaired area and can result in drastic weakening of the Elevator and Parts and possible Failure.
- Repairs which involve welding and or machining by others that is not authorized by BVM will void the warranty.
- Using an Elevator which has been improperly welded can result in serious bodily harm and property damage.
- Never use the elevator other than what it is intended for: size and tonnage, which is clearly marked on elevator.
- Only use the elevator within the specified temperature rating, which is -4°F to 131°F unless otherwise specified.

Note: If an elevator is used despite the above warnings BVM voids all warranties.

Operation

Operation of both the elevator and spider is identical. Push the control lever down and the slips will set. Pull the control lever up and the slips will release.

Note: If an air pressure failure occurs, the slips can be set by hand:

- a. Place a 5 foot pry-bar into the manual lift lever.
- b. Push down on the bar and move control lever to the “up” position (this moves the latch to hold the slips up).
- c. Set slips by moving the control lever down.

Note: Slips and guide ring in both the elevator and spider must match the casing size being run.

Running Casing

- 1) With the pipe string held by the spider, pick up the next joint of pipe with a single joint pickup elevator.
- 2) Hoist the add on stand of pipe and stab it into the pipe string.
- 3) Make up the joint.
- 4) Set the elevator slips.
- 5) Pick up the weight of the casing string with elevator.
- 6) Release spider and lower the pipe string, stopping the elevator guide bell approximately 6 inches (15 cm) above the spider.
- 7) Set the spider slips to grip the pipe and then release the elevator slips.
- 8) Pick up the elevator to clear the joint of pipe.
- 9) Repeat above steps for the next joint.

Pulling out of hole (POOH)

- 1) Lower the elevator over the tool joint, stopping the elevator guide bell approximately 6 inches (15 cm) above the spider.
- 2) Set the slips.
- 3) PU the string slowly.
- 4) Raise the spider slips.
- 5) PU the string as far as required.
- 6) While lowering the string slightly, set the slips of the spider.
- 7) B/O the joint.
- 8) Remove the stand of pipe and repeat above steps for the next joint.

Changing Slips

- 1) Removing Slips (Figure 6)
 1. Remove top covers and apply air pressure to raise the slips.
 2. With the overhead hoist attached to the slip lifting eye, pick up enough to take up the weight of the slip.
 3. With the slip weight eased, remove lynch pin and slip hanger pin. Hoist slip from body.
 4. Repeat steps 1-3 for remaining slips

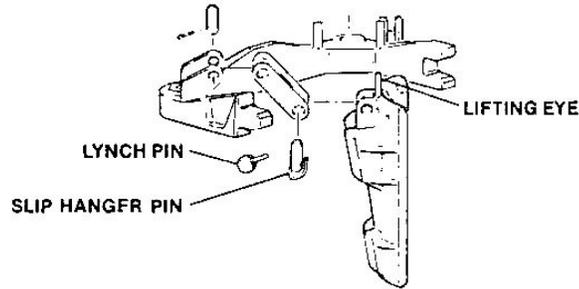


Figure 6: Changing slips

2) Installing Slips

1. Clean bowl of all dirt and old grease.
2. Be sure that replacement slips are clean and the correct size for the casing being run.
3. Liberally coat the inner body and the backs of the slips with grease (Page 13).
 Caution: Do not use tool joint compound (Dope), it is not a lubricant
4. Hoist slip into place and install the slip hanger pin, manipulating the slip with the hoist as necessary to allow the pin to slide all the way in.
5. Install the lynch pin and lip its ring over the end of the slip hanger pin.
6. Repeat steps 3-5 for the remaining slips.

Changing Elevator Bottom Guide

- 1) Using the bail, hoist the removable hinge pin from the body. Swing the body halves apart.
- 2) Remove bolts and guide keepers. Remove guide halves from both body halves.
- 3) Thoroughly clean the guide groove.
- 4) Be certain that replacement guide is the correct size for the casing being run (Pages 26 - 27).
- 5) Install guide halves and retain with guide keepers and bolts (Figure 7).
- 6) Swing body halves closed and install removable hinge pin.

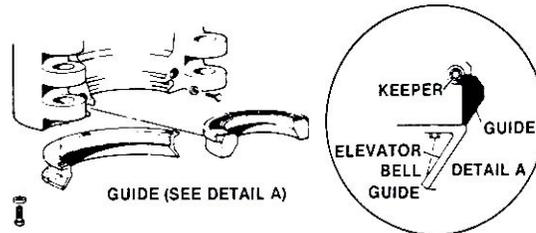


Figure 7: Elevator Bottom Guide Installation

Changing Spider Top Guide

- 1) Remove top guide retainer bolts. Remove guide halves from both body halves.
- 2) Be certain that replacement guide is the correct size for the casing being run (Pages 26 - 27).
- 3) Install guide halves and retain with bolts.

Lubrication

See below for BVM recommendations for grease / lubricants:

General

Use extreme pressure, lithium based, multi-purpose grease classification according to ISO 6743-9:2003 Lubricants, industrial oil and related products (class L) – Classification – Part 9: Family X (greases) or equivalent

Slot Coating

Coat the insert slot with a corrosion preventative ISO-L-REE according to ISO 6743-8:1987.

Air Tool Lubricant

It is recommended to use a proper air tool lubricant according to ISO 6743-11:1990 Lubricants, industrial oils and related products (class L) - Classification - Part 11: Family P (Pneumatic tools), classified as PAB and PBB. These fluids do not contain harmful additives that can cause damage or corrosion to components.

Temperature range	Lube oil type	Note
-40° to +20°C	ISO 5	
-30° to +30°C	ISO 10	
-8° to +64°C	ISO 32	Spider/Elevator shipped with this oil unless otherwise specified
-2° to +73°C	ISO 46	
+4° to +84°C	ISO 68	

Inspection (PER API-RP8B)

Caution: Wear proper personal safety protection like safety glasses, hard hats, etc. as applicable while performing maintenance and inspection tasks.

Daily Inspection (when in use)

Category I:

This category involves observing the equipment during operation for indications of inadequate performance. When in use, equipment shall be visually inspected on a daily basis for cracks, loose fits or connections, elongation of parts, and other signs of wear, corrosion or overloading. Any equipment found to show cracks, excessive wear, etc., shall be removed from service for further examination. The equipment shall be visually inspected by a person knowledgeable in that equipment and its function.

Category II:

This is Category I inspection plus further inspection for corrosion, deformation, loose or missing components, deterioration, proper lubrication, visible external cracks, and adjustment.

Observe and repair when needed (cat I + II)

1. Observe equipment during operations for indications of inadequate performance.
2. Set and raise the slips 5 times. Slips should set and raise completely at each cycle, check for a flawless movement of the slips.

Visually inspect and repair when needed (cat I + II)

1. Check for worn and damaged parts
2. Check for loose and missing parts
3. Check for any pneumatic leakage
4. Check hoses for signs of cracks, wear, or abrasion
5. Check the proper locking of:
 - a. Bolts and nuts
 - b. Safety chains
 - c. Slotted nuts and cotter pins
 - d. Roll pins and dowel pins
 - e. Snap rings
 - f. Cotter pins
 - g. Locking rings
6. Inspect bottom guides and guide keepers (Page 16)

6 Month Inspection (when in use)

Category III:

This is Category II inspection plus further inspection, which should include NDT of critical areas and may involve some disassembly to access specific components and to identify wear that exceeds the manufacturer's allowable tolerances.

1. Disassemble the elevator/spider to make a dimensional check possible of the following parts (see Wear Data – page 21)

- a. Hinge pins
- b. Hinge pin holes
- c. Link ear height
2. MPI the following critical areas as per MPI procedure
 - a. Link ears
3. Check condition of the filters
4. Check condition of the cylinder
5. Conduct a pressure test (Page 18)

Annual Inspection (when in use)

Category IV:

This is Category III inspection plus further inspection for which the equipment is disassembled to the extent necessary to conduct NDT of all primary-load-carrying components as defined by manufacturer. Equipment shall be:

- Disassembled in a suitably-equipped facility to the extent necessary to permit full inspection of all primary-load-carrying components and other components that are critical to the equipment & Inspected for excessive wear, cracks, flaws and deformations.
 - Corrections shall be made in accordance with the manufacturer's recommendations. Prior to Category III and Category IV inspections, all foreign material such as dirt, paint, grease, oil, scale, etc. shall be removed from the concerned parts by a suitable method (e.g. paint-stripping, steam-cleaning, grit-blasting).
1. MPI inspect the following parts (See Critical Area Drawings – page 22):
 - Hinge Pins
 - Elevator/Spider bodies
 - Elevator/Spider slips

Magnetic Particle Inspection (MPI)

Carry out MPI according to ASTM E709 or ASME BPVC sub section A, article 7 and subsection B, article 25; determine the type of defects and the degree by comparing defects to ASTM E125 reference photographs to the acceptance criteria.

Only cracks may develop and as such need to be reviewed. All other indication types have been addressed by the manufacturer during production. As such, the elevator has left the factory with indication (if at all) which were deemed acceptable. All cracks which have developed in service are relevant and need to be examined.

Evaluation of indications:

Relevant indications: Only those indications with major dimensions greater than 1/16 Inch (1.6mm) and associated with a surface rupture shall be considered relevant. Relevant indications are indications that results from, discontinuities within the test part. Non relevant indications are indications that results from excessive magnetizing current, structural design or permeability variances within the test parts. Any indication believed to be non-relevant shall be regarded as

relevant and shall be re-examined to determine whether an actual defect exists. Linear indications shall be considered as those having a length of more than three times the width. Rounded indications shall be considered as those having a length less than three times the width. A lined indication shall be considered as a group of three more indications which touch an imaginary straight line connecting any two of the group.

For equipment certified in accordance with API 8A & 8C PSL 1:

Maximum Allowable Degree			
Type	Discontinuity Descriptions	Critical Areas	Non-critical Areas
I	Hot tears, cracks	None	Degree 1
II	Shrinkage	Degree 2	Degree 2
III	Inclusions	Degree 2	Degree 2
IV	Internal chills, chaplets	Degree 1	Degree 1
V	Porosity	Degree 1	Degree 2

For equipment certified in accordance with API 8A & 8C PSL 2:

Maximum Allowable Degree			
Type	Discontinuity Descriptions	Critical Areas	Non-critical Areas
I	Hot tears, cracks	None	None
II	Shrinkage	None	Degree 1
III	Inclusions	Degree 1	Degree 2
IV	Internal chills, chaplets	None	Degree 1
V	Porosity	Degree 1	Degree 2

Note: Only BVM authorized repair facilities are allowed to repair elevators with indications outside the acceptance criteria.

Inspection of Bottom Guides and Guide Keepers

1. When the guide is placed and the guide keeper is placed, the guide should be positioned hard to the left side of the E/S body half.
2. On the right side, the guide keeper should have an overlap of a minimum of 1/8".
3. The guide should then be pushed hard to the right side of the body and the overlap of the guide keeper on the left side should be checked.
4. Repeat this procedure for the other body half.

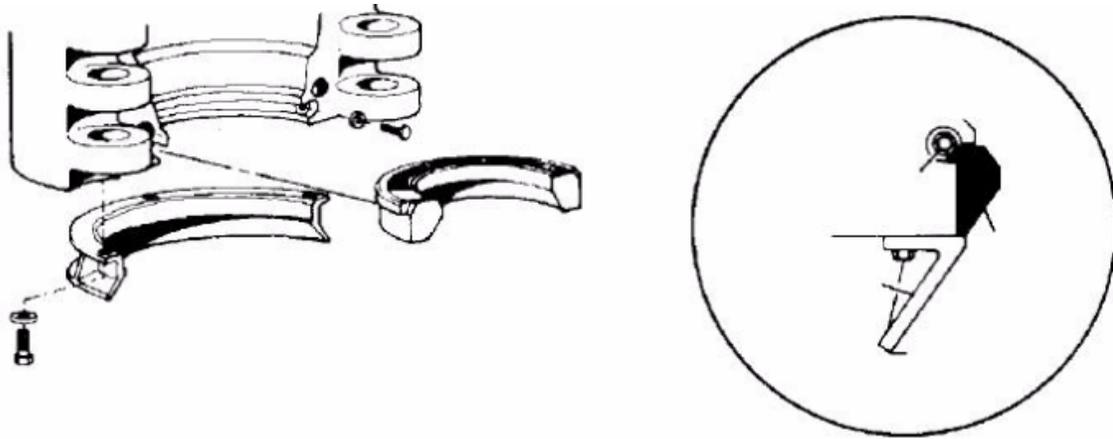


Figure 8: Bottom guide

Lubricator Maintenance

Note: Have spill kit nearby in case of spill while performing this maintenance operation.

1. Close shutoff valve.
2. Remove self-venting fill plug.
3. Fill reservoir to within ¼” (6 mm) of top of bowl with industrial type ISO air tool lubricant (Page 13).
4. Install fill plug.
5. Open shutoff valve one turn.

Regulator/Filter Maintenance

1. Open petcock at bottom of the bowl and drain accumulated water.
2. Remove filter element and clean every 3 months or more often if required.

Caution: Plastic bowl can be damaged and fail if strong solvents are used for cleaning.

3. Use soap and warm water to clean the filter bowl.

General Lubrication (when in use)

Carry out the lubrication as follows:

Ref. #	Item	Qty	Application	Lube Cycle
1	Bowl/Slip Surfaces	16 or 24	Multi-Purpose Water-Resistant Grease	*
2	Cylinder Assemblies	4	Multi-Purpose Water-Resistant Grease	Before Each Job
3	Hinge Pins	2	Multi-Purpose Water-Resistant Grease	Before Each Job
4	Control Valve & Latch	3	Multi-Purpose Water-Resistant Grease	Weekly
5	Link Pins	8 or 12	Multi-Purpose Water-Resistant Grease	Weekly
6	Lubricator	-	ISO lubricant	Daily

*Lubricate after every 50 joints of casing run or more frequently if necessary to prevent slips from sticking in the Elevator or Spider Body. To lubricate properly the slips should be in the set position without any casing load on unit.

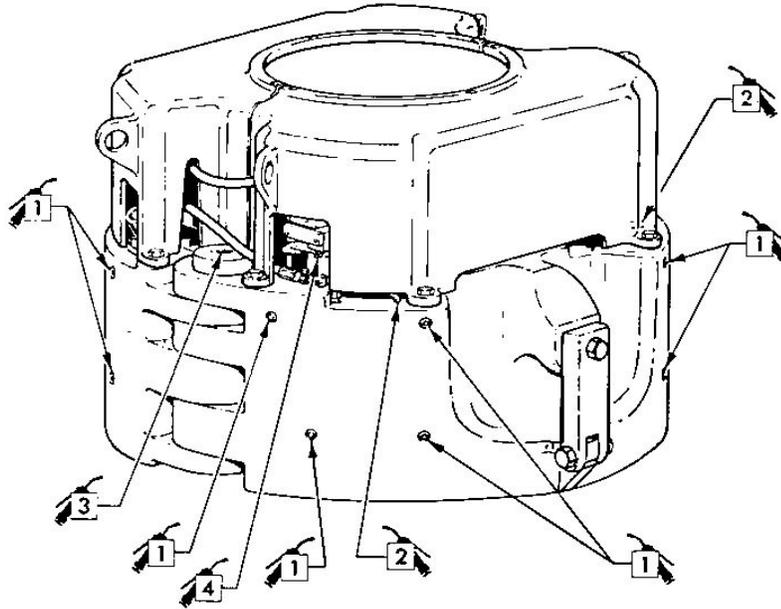


Figure 9: Lubrication points

Pressure Test

Conduct a pressure test to verify the integrity of the air circuit and the condition of the cylinder seals as follows:

1. Add a ball valve and pressure gauge to the air supply line according to schematic below:

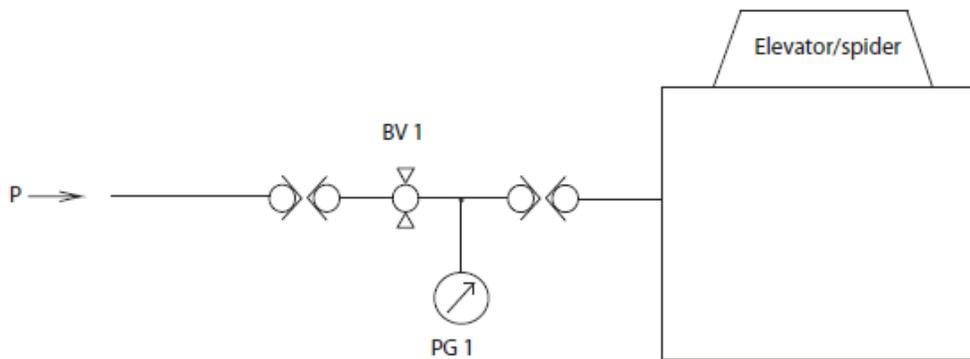


Figure 10: Pressure test schematic

2. Dress the elevator/spider with slips.
3. Raise the slips to their full UP position.
4. Close the ball valve BV1 to isolate the elevator/spider from the air supply.
5. The pressure drop must not be more than 25 psi over a time of 5 minutes, the slips must be kept in their full UP position.
6. At any higher pressure loss or observed sagging of the slips, inspect the tool for air leakage and repair.
7. Repeat the pressure test.

Disassembly

Elevator/Spider disassembly

1. Raise slips to the up (release) position.
2. Use an overhead lift to remove cover halves, after removing hex head bolts and lock washers.
3. Remove slip segments.
4. Remove upper link pins and cotter pins to remove links.
5. Remove air lines to control valve, lubricator and air cylinders.
6. Remove lubricator and pipe nipple that attaches it to mounting bracket.
7. Remove bolts and lock washers holding lubricator mounting bracket in position.
8. Remove bolts and lock washers holding control valve in position.
9. Remove nut, lock washer and flat washer from each air cylinder rod.
10. Remove both leveling beams.
11. Remove hex head bolts, lock washers and cylinder retainers.
12. Remove hinge pin and open elevator/spider body.
13. Remove guides.

ITEM	LIMITS
Leveling beam	Check for distortion, bent or worn bracket supports.
Links, link pins, and pivot pins	Check for galling and out-of-round in pivot pins. (Pins should be capable of being rolled on a flat surface without evidence of out-of-round).
Slip segments	Check for worn inserts, cracked or distorted slip body and worn link pin mating surface.
Bell guide	Check that elevator bell guide bolts are tight.
Grease fittings	Check that grease fittings are not plugged and threads are not stripped or damaged.
Hinge pins	Check for bent or otherwise damaged hinge pins. Check that bail on removable pin is securely attached.

Valve and latch disassembly

1. Remove grease fittings.
2. Remove screws and lock washers that retain spring cover.
3. Remove latch plate springs, roll pins, valve link, valve handle and latch plate.
4. Remove screws and lock washers that retain the holding plate.
5. Remove screws, nuts and lock washers that retain the air control valve.
6. Remove screws and Hi-collar lock washers that hold the lock spring retainer and spring.

ITEM	LIMITS
Latch plate springs	Check that springs have equal length and will return to 3 inches after being fully compressed. Check broken or distorted coils.
Valve mechanism	Check for smooth lever action and slip operation without binding or malfunction.

Assembly

Note: All assembly should be performed in a dry, dirt free area.

Valve and latch assembly

1. Insert dowel pin in lock down and install in valve bracket.
2. Insert spring into lock down and cover with lock spring retainer. Attach retainer with screws and Hi-collar lock washers.
3. Attach air control valve with screws, nuts and lock washers.
4. Attach holding plate with screws and lock washers.
5. Attach valve link to valve handle with roll pin.
6. Install latch plate and valve handle with valve link and retain roll pin through valve handle body.
7. Install latch plate springs and retain with spring cover, screws and Hi-collar lock washers.
8. Install grease fittings.

Elevator/Spider assembly

1. With stationary hinge pin in place, open body halves.
2. Install the four cylinders, with air and grease fittings, into the elevator/spider body. Secure in position with bolts, lock washers and cylinder retainers.
3. Install leveling beams with the valve mounting plate positioned at the stationary hinge side of the body. Locate dowel pin in cylinder rod end with slots in leveling beam.
4. Install valve and latch mechanism and attach with bolts and lock washers. Position lever in down position.
5. Install manual lift assembly with bolts and lock washers.
6. Install lubricator, pipe nipple and bracket with bolts and lock washers.
7. Attach leveling beams to air cylinder rods with nuts (torque to 100 - 180 ft-lbs), lock washers and flat washers. Be certain that cylinder rod dowels are engaged in slots in leveling beams.
8. Install pneumatic lines.
9. Install slip support links with upper link pins and cotter pins.
10. Attach cover halves with bolts and lock washers and then install the safety sling.

Wear Data

The inspection data and maximum wear tolerances are only valid if the equipment is in otherwise good condition and has not been misused, does not exhibit excessive wear, cracks or other defects. Additionally any weld repairs – not done at a BVM authorized repair facility – shall require examination and re-certification by a BVM authorized repair facility before being used further. These data and tolerances only apply to certain critical components and cannot on their own determine the overall condition of the equipment or its suitability for continued use. These data and tolerances are what is required to retain 100% ratings.

Table 1: Wear table

Rated Capacity (Tons)	350	500	500
Part Number	11776	13800	15740-1
Size (")	4.5 - 14	4.5 – 14	16 – 24.5
Hinge Clearance (A)	0.040	0.050	0.050
D (Min worn)	4.500	7.125	7.5
E (Nominal)	18.625	19.150	25.56
R (Min worn)	1.75	0.75	1.75

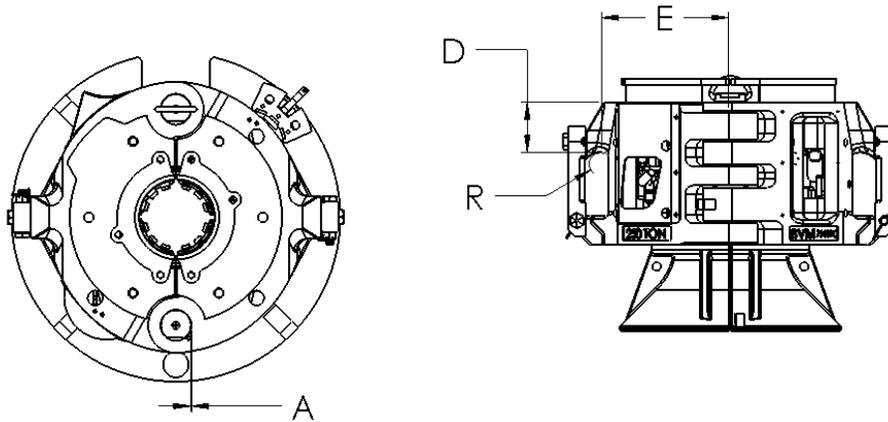


Figure 11: Wear variables

Critical Area Drawings

- The entire Hinge Pin is critical

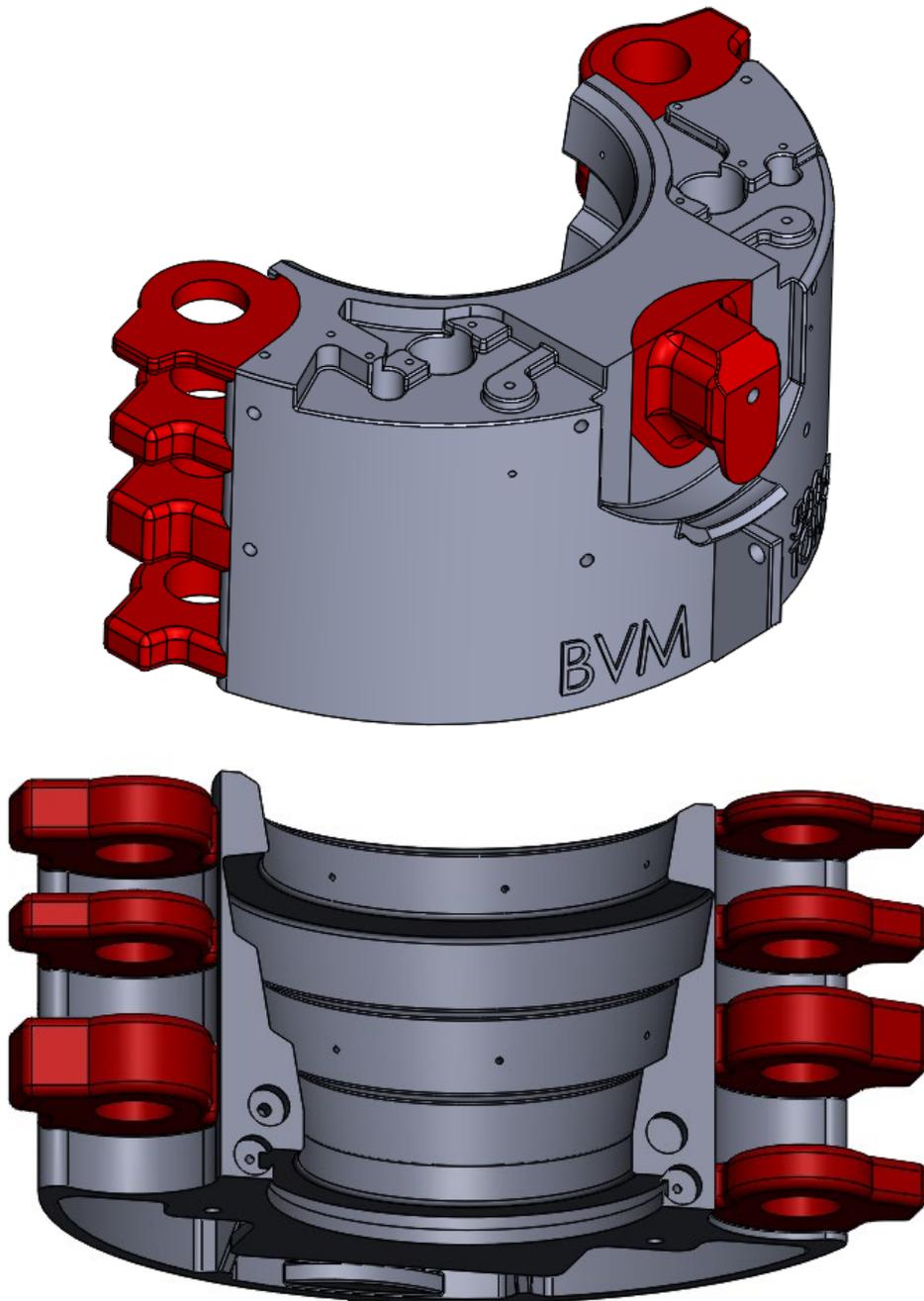


Figure 12: Body critical areas shown in red

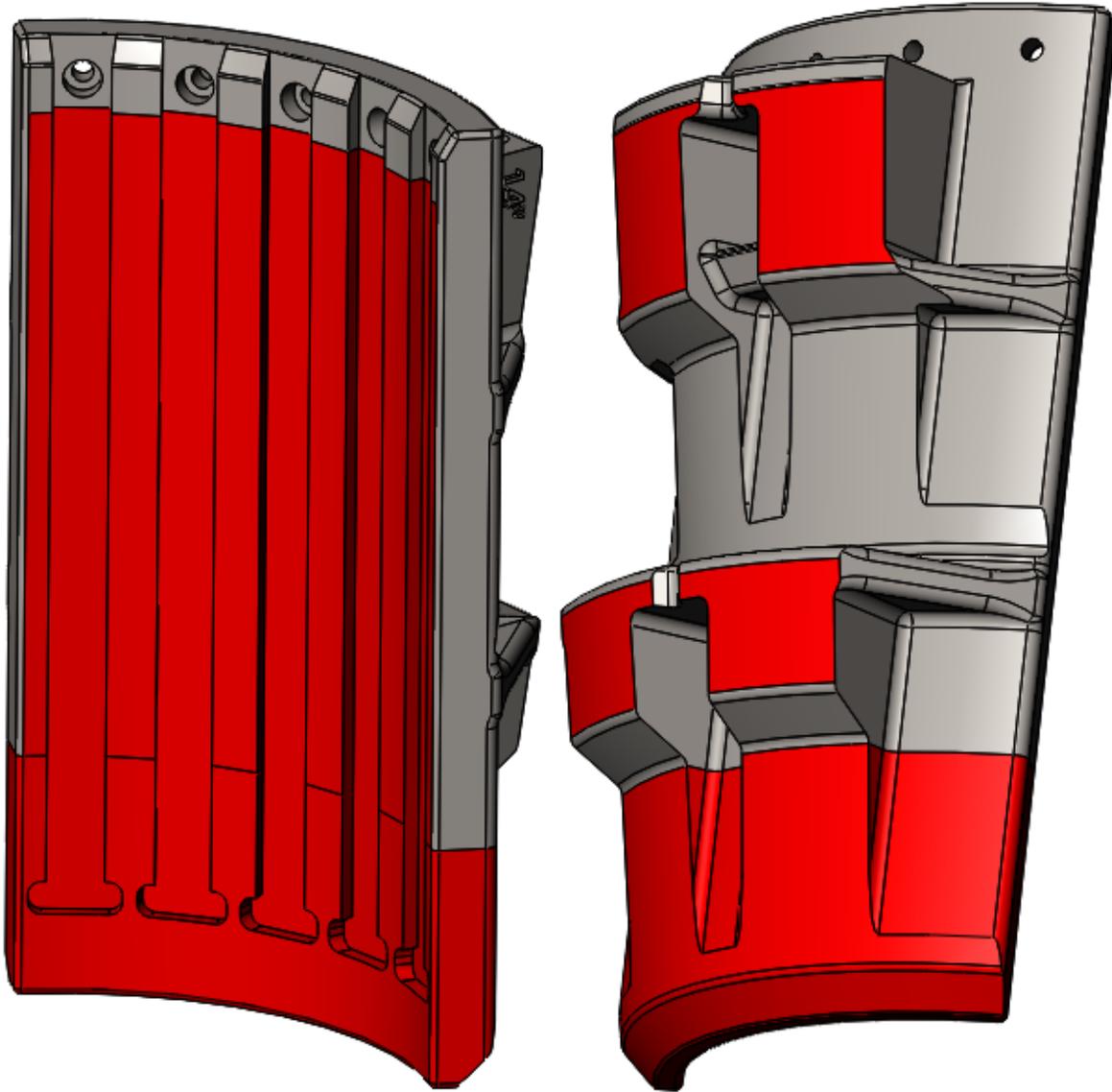


Figure 13: Slip critical areas shown in red

Troubleshooting

When problems cannot be solved, contact an authorized BVM repair facility.

Prior to troubleshooting a problematic spider/elevator, perform check based on PCAL-rule:

P	Check available P ressure after the filter fitted before the hook up manifold is 85 psi (585 kPa).
C	Check that all hoses and quick disconnects are properly C onected.
A	Check if there is A ir leakage at manifold block, operation panel, quick disconnects, or hoses.
L	Check L ubrication status of tool.

Overview possible problems:

Problem	Possible Cause	Possible Solution
Slips do not operate or operate slowly in both directions.	Air pressure supply too low.	Check air pressure at regulator. Adjust as necessary.
	Airline kinked or leaking.	Straighten or replace.
	Lubricator oil level low.	Fill (page 17).
	Incorrect oil/grease used	Use appropriate viscosity/grade oil/grease
	Control valve faulty*.	Replace.
	Defective cylinder seal.	Replace.
Casing slides thru set slips or casing is damaged.	Incorrect slip segments or inserts mixed with correct slip segments or insert.	Install correct slip segments or inserts.
	Worn or re-sharpened inserts.	Replace with new inserts.
Slips sticking in bowls.	Inadequate Lubrication.	Clean backs of slips and inside of bowl.
		Lubricate (page 17)

*Air escaping from the control valve does not necessarily mean that the control valve is faulty. If there is a defective cylinder O-ring seal, the air leaking through the cylinders will be released back through the control valve. If control valve leakage is suspected, remove valve from unit and test. If valve is not leaking, inspect cylinder assemblies for defective seals. Consider replacing cylinder or returning to BVM for redress.

Risk Assessment According to EN-ISO 12100:2010

The conclusion of the risk assessment is that in general, the crew must:

- Wear person safety protection like safety glasses, hard hats, etc.
- Follow instructions as stated in the manual.
- Have knowledge of rig procedures.
- Must have been instructed for safe use of the tool.
- Always use secondary retention as established and implemented by BVM.

Recommended Spares

PN by Rating			Description	Qty
350 Ton	500 Ton 14"	500 Ton 24.5"		
10402	10402	42041	Safety Sling	1
B216P-8	B216P-8	B216P-8	Hex pipe nipple	1
B207P-2	B207P-2	B207P-2	Coupling	1
6020F-00	6020F-00	6020F-00	Hex nut	2
6420C-00	6816C-00	6816C-00	Castle nut	2
940308-1	940308-1	940308-1	Grease fitting	16
30040-24	30030-16	30030-16	Cotter pin	2
30030-12	30030-12	30030-12	Cotter pin	8
26120-00	26120-00	26120-00	Hi-collar lock washer	1
20200-00	20200-00	20200-00	Lock washer	2
20100-00	20100-00	20100-00	Lock washer	4
20120-00	20120-00	20120-00	Lock washer	6
20080-00	20080-00	20080-00	Lock washer	8
22200-00	22200-00	22200-00	Flat washer	2
1212C-16-8	1212C-16-8	1212C-16-8	Socket head screw	1
-	79805	79805	Upper link block screw	2
B13536	79261	79261	Link block screw	2
24080-00	24080-00	24080-00	Fender washer	2
B18269	B18269	42026-1	Lower Hose Assembly	1
B18268	B18268	42026-4	Upper Hose Assembly	1
B11989	B11989	B11989	Lower link pin	2
79882	79882	79882	Register button	1
B11849	B11849	B11849	Cylinder retainer	2
B7887	B7887	B7887	Lynch pin	4
B11800	B11800	42025	Air cylinder assembly	2
1412C-14	1412C-14	1412C-14	Hex cap screw	6
1410C-24	1410C-24	1410C-24	Hex cap screw	4
1408C-08	1408C-08	1408C-08	Hex cap screw	2
1408C-12	1408C-12	1408C-12	Hex cap screw	6

Assembly drawing and List of Parts

Table 2: 350 Ton Elevator/Spider and Component Part Numbers

350 TON		PART NUMBERS			
Elevator/Spider Less Slips and Guides		11776			
Bell Guide Kit		11798			
Spider Adapter Plate		19276			
350 Ton Link Set (Lengths)					
84 inch (2134 mm)		27584			
96 inch (2348 mm)		27596			
108 inch (2743 mm)		275108			
132 inch (3553 mm)		275132			
240 inch (6096 mm)		275240			
<hr/>					
Casing Size (inches)	Elevator Bottom Guide P/N	Spider Top Guide P/N	Slip Set P/N	Insert Set* P/N	Slip Body Size (in.)
4-1/2	11787	18419-1	11865	2168-16B-24	5-1/2
5	11788	18419-2	11864	2169-16B-24	5-1/2
5-1/2	11789	18419-3	11863	2170-40	5-1/2
6-5/8	11791	18419-4	11861	2632-24B-36	7-5/8
7	11791	18419-4	11860	2623-24B-36	7-5/8
7-5/8	11792	18419-5	11859	2633-60	7-5/8
7-3/4	11792	18519-5	71592-1	2649-60	7-5/8
8-5/8	11793	18419-6	11857	2640-32B-48	9-5/8
8-3/4	11793	18419-6	71591-3	2650-32B-48	9-5/8
9-5/8	11794	18419-7	11856	2633-80	9-5/8
9-3/4	71231	18419-15	71591-2	2649-80	9-5/8
9-7/8	71231	18419-15	71591-1	2649-80	9-5/8
10-3/4	11795	18419-8	11854	2640-40B-60	11-3/4
10-7/8	11795	18419-8	71590-1	2650-40B-60	11-3/4
11-3/4	11796	18419-9	11853	2637-100	11-3/4
11-7/8	11796	18419-9	71590-2	2651-100	11-3/4
13-3/8	11797	18419-10	70732-5	2637-100	14
13-1/2	71228	18419-12	70732-4	2652-40B-60	14
13-5/8	71228	18419-12	70732-3	2653-40B-60	14
13-3/4	71228	18419-12	70732-2	2655-40B-60	14
14	15939	18419-11	70732-1	2635-100	14

*Numbers followed by the letter “B” indicate beveled inserts (required at top and bottom of each slot).

Table 3: 500 Ton Elevator/Spider and Component Part Numbers

500 TON			PART NUMBERS		
Elevator/Spider Less Slips and Guides			13800		
Bell Guide Kit			11798		
Spider Adapter Plate			19276		
500 Ton Link Set (Lengths)					
132 inch (3353 mm)			350132		
144 inch (3658 mm)			350144		
160 inch (4064 mm)			350160		
264 inch (6705 mm)			350240		
Casing Size (inches)	Elevator Bottom Guide P/N	Spider Top Guide P/N	Slip Set P/N	Insert Set* P/N	Slip Body Size (in.)
4-1/2	11787	18419-1	13842-3	2168-16B-32	5-1/2
5	11788	18419-2	13842-2	2169-16B-32	5-1/2
5-1/2	11789	18419-3	13842-1	2170-48	5-1/2
6-5/8	11791	18419-4	13841-3	2632-24B-48	7-5/8
7	11791	18419-4	13841-2	2623-24B-48	7-5/8
7-5/8	11792	18419-5	13841-1	2633-72	7-5/8
7-3/4	11792	18519-5	13841-4	2649-72	7-5/8
8-5/8	11793	18419-6	13840-3	2640-32B-64	9-5/8
8-3/4	11793	18419-6	13840-5	2650-32B-64	9-5/8
9-5/8	11794	18419-7	13840-1	2633-96	9-5/8
9-3/4	71231	18419-15	13840-4	2649-96	9-5/8
9-7/8	71231	18419-15	13840-2	2649-96	9-5/8
9-7/8	71231	18419-15	13843-1	2655-96	10-1/8
10	71231	18419-15	13843-2	2669-96	10-1/8
10-1/8	71231	18419-15	13843-3	2637-96	10-1/8
10-1/4	71231	18419-15	13843-4	2651-96	10-1/8
10-3/4	11795	18419-8	13839-3	2640-40B-80	11-3/4
10-7/8	11795	18419-8	13839-4	2650-40B-80	11-3/4
11-3/4	11796	18419-9	13839-2	2637-120	11-3/4
11-7/8	11796	18419-9	13839-1	2651-120	11-3/4
12-3/4	11797-1	18419-13	70794-7	2657-40B-80	14
13-3/8	11797	18419-10	70734-5	2636-40B-80	14
13-1/2	71228	18419-12	70734-4	2652-40B-80	14
13-5/8	71228	18419-12	70734-3	2653-40B-80	14
13-3/4	71228	18419-12	70734-2	2655-40B-80	14
14	15939	18419-11	70734-1	2635-120	14

*Numbers followed by the letter “B” indicate beveled inserts (required at top and bottom of each slot).

Table 4: 500 Ton 24.5” Elevator/Spider and Component Part Numbers

500 TON			PART NUMBERS		
Elevator/Spider Less Slips and Guides			15740-1		
Bell Guide Kit			19001		
Spider Adapter Plate			16552		
<hr/>					
Casing Size (inches)	Elevator Bottom Guide P/N	Spider Top Guide P/N	Slip Set P/N	Insert Set* P/N	Slip Body Size (in.)
16	16184	73138	15790-4	2635-180	16
16-3/4	16184-1	73138-1	15790-5	2635-180	16-3/4
17	15795	73139	15790-6	2635-180	17
18-5/8	15794	73137	15790-3	2668-180	18-5/8
20	15793	73136	15790-2	2635-180	20
22	15796	73140	15790-7	2635-180	22
24	15792	73135	15790-1	2635-180	24

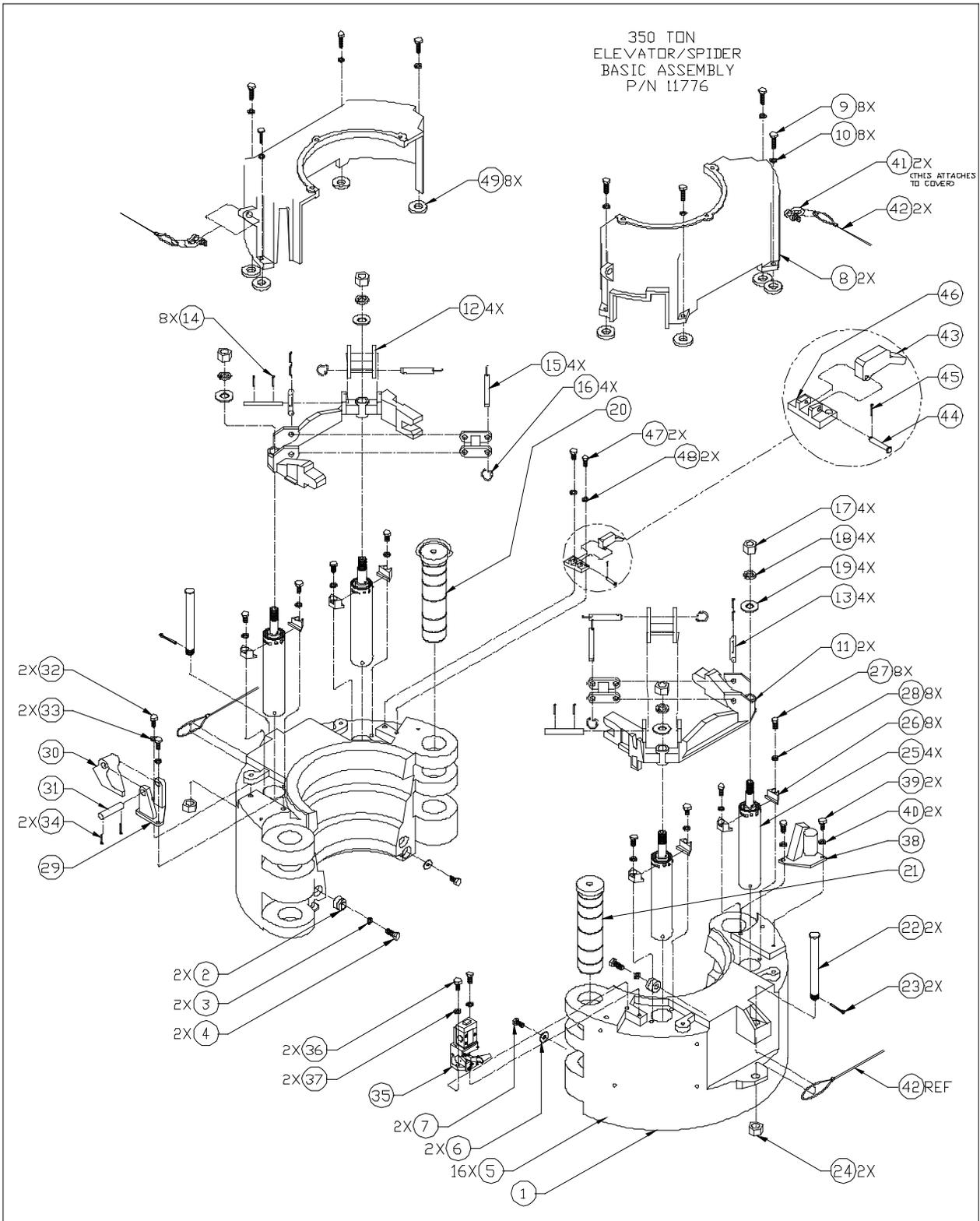


Figure 14: 350 Ton Elevator/Spider Assembly (Part 1 of 2)

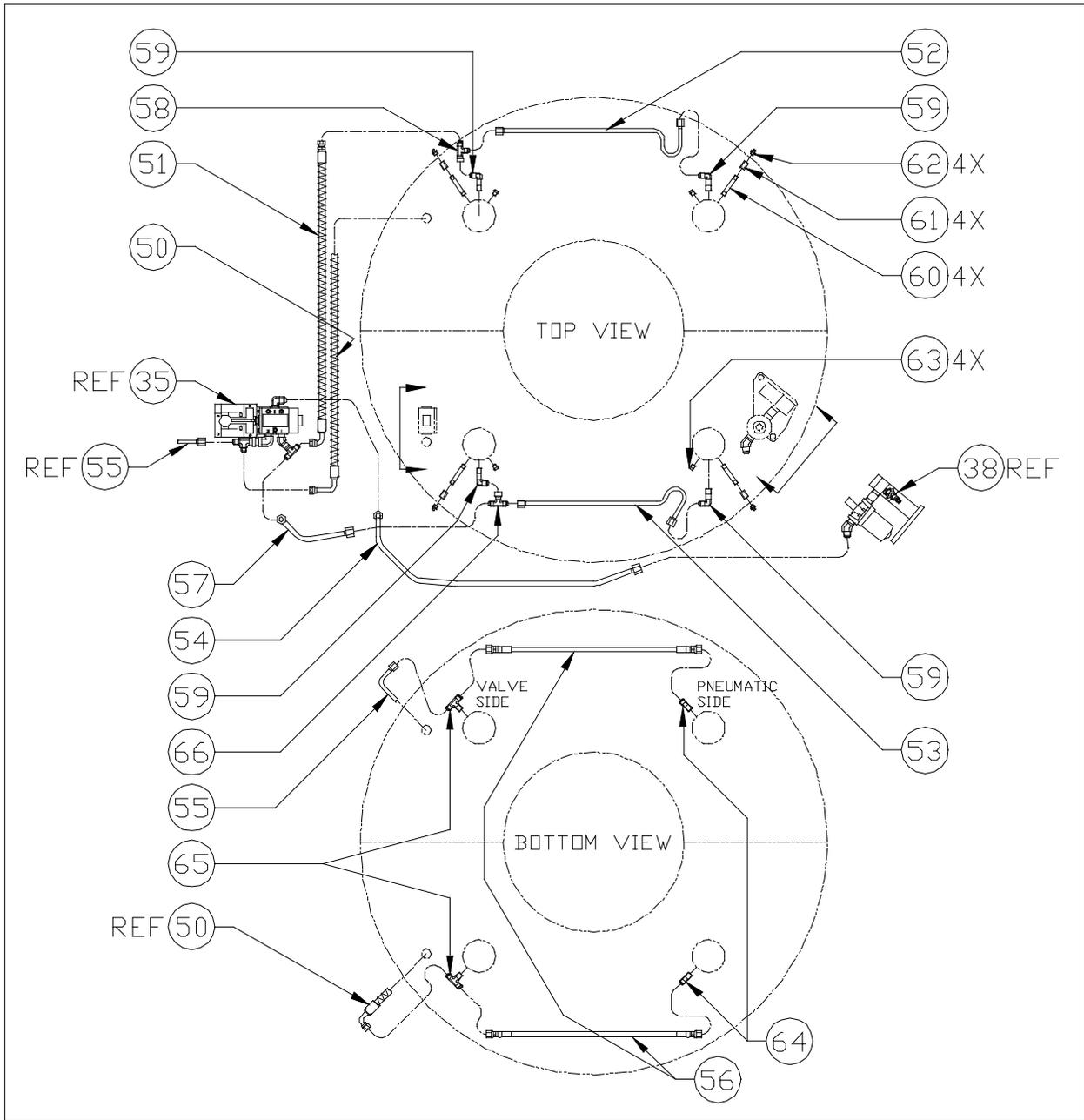


Figure 15: 350 Ton Elevator/Spider Assembly (Part 2 of 2)

Table 4. 350 Ton Elevator/Spider Parts List Index

ITEM #	BVM PART #	DESCRIPTION	QTY/ UNIT
-	B11776	ELEVATOR/SPIDER ASSY, 350 Ton	Ref.
1	B11780-1	BODY.....	2
2	79882	BUTTON, Register.....	2
3	26120-00-0	LOCKWASHER, Hi-Collar.....	2
4	1212C-24-8	SCREW, Socket Head.....	2
5	940308-1	FITTING, Grease.....	16
6	B12896	KEEPER, Guide.....	4
7	1408C-08-5	SCREW, Hex Head.....	4
8	B17913	COVER, Top.....	2
9	1410C-18-5	SCREW.....	8
10	20100-00-0	LOCKWASHER.....	8
11	B11783	BEAM, Leveling.....	2
12	B11877	LINK.....	4
13	B11878	PIN, Upper Link.....	4
14	30030-12-0	PIN, Cotter.....	8
15	B11989	PIN, Lower Link.....	4
16	B7887	PIN, Lynch.....	4
17	6020F-00-0	NUT, Hex.....	4
18	20200-00-0	LOCKWASHER.....	4
19	22200-00-0	WASHER, Flat.....	4
20	B11845	PIN, Removable Hinge.....	1
21	B11844	PIN, Stationary Hinge.....	1
22	B13536	SCREW, Link Retainer.....	2
23	30040-24-0	PIN, Cotter.....	2
24	6420C-00-0	NUT, Hex.....	2
25	B11800	AIR CYLINDER ASSEMBLY (Figure 19)	4
26	B11849	RETAINER, Cylinder.....	8
27	1408C-12-5	SCREW, Hex Head.....	8
28	20080-00-0	LOCKWASHER.....	8
29	B11840	BRACKET, Manual Lift.....	1
30	B11842	SOCKET, Manual Lift.....	1
31	B11870	PIN, Pivot.....	1
32	1408C-12-5	SCREW, Hex Head.....	2
33	20080-00-0	LOCKWASHER.....	2
34	30030-12-0	PIN, Cotter.....	2
35	B16822	VALVE AND LATCH ASSEMBLY (Figure 21).....	1
36	1408C-12-5	SCREW, Socket Head.....	2
37	20080-00-0	LOCKWASHER.....	2
38	10401	AIR INLET ASSEMBLY (Figure 22).....	1
39	1408C-12-5	SCREW, Hex Head.....	2
40	20080-00-0	LOCKWASHER.....	2
41	B5417	SHACKLE, Anchor.....	2
42	B18122	SLING, Safety.....	2
43	B18720	LATCH, Retainer.....	1

44	B56406-18-C	PIN, Clevis.....	1
45	50AB0-07-0	PIN, Cotter.....	2
46	B18719	BRACKET, Latch.....	1
47	1408C-12-5	SCREW, Hex Head.....	2
48	20080-00-0	LOCKWASHER.....	2
49	10434	SPACER UNDER COVER.....	8
50	B18269	HOSE ASSEMBLY, Lower.....	1
51	B18268	HOSE ASSEMBLY, Upper.....	1
52	B12632	TUBE, Upper Right.....	1
53	B12632L	TUBE, Upper Left.....	1
54	B18270	TUBE, Inlet.....	1
55	B18267	TUBE, Lower Connector.....	1
56	B12633	TUBE, Lower Rubber.....	2
57	B12634	TUBE, Upper Connector.....	1
58	B6-R6X-S	SWIVEL NUT RUN TEE.....	1
59	B6-CCTX-S	LONG MALE ELBOW.....	4
60	B215PNL-2-25	LONG NIPPLE.....	4
61	B207P-2	COUPLING.....	4
62	940308-1	GREASE FITTING.....	4
63	B218P-2	HEX HEAD PLUG.....	4
64	B6-FTX-S	MALE CONNECTOR.....	2
65	B6-STX-S	MALE BRANCH TEE.....	2
66	B6-S6X-S	SWIVEL NUT BRANCH TEE.....	1

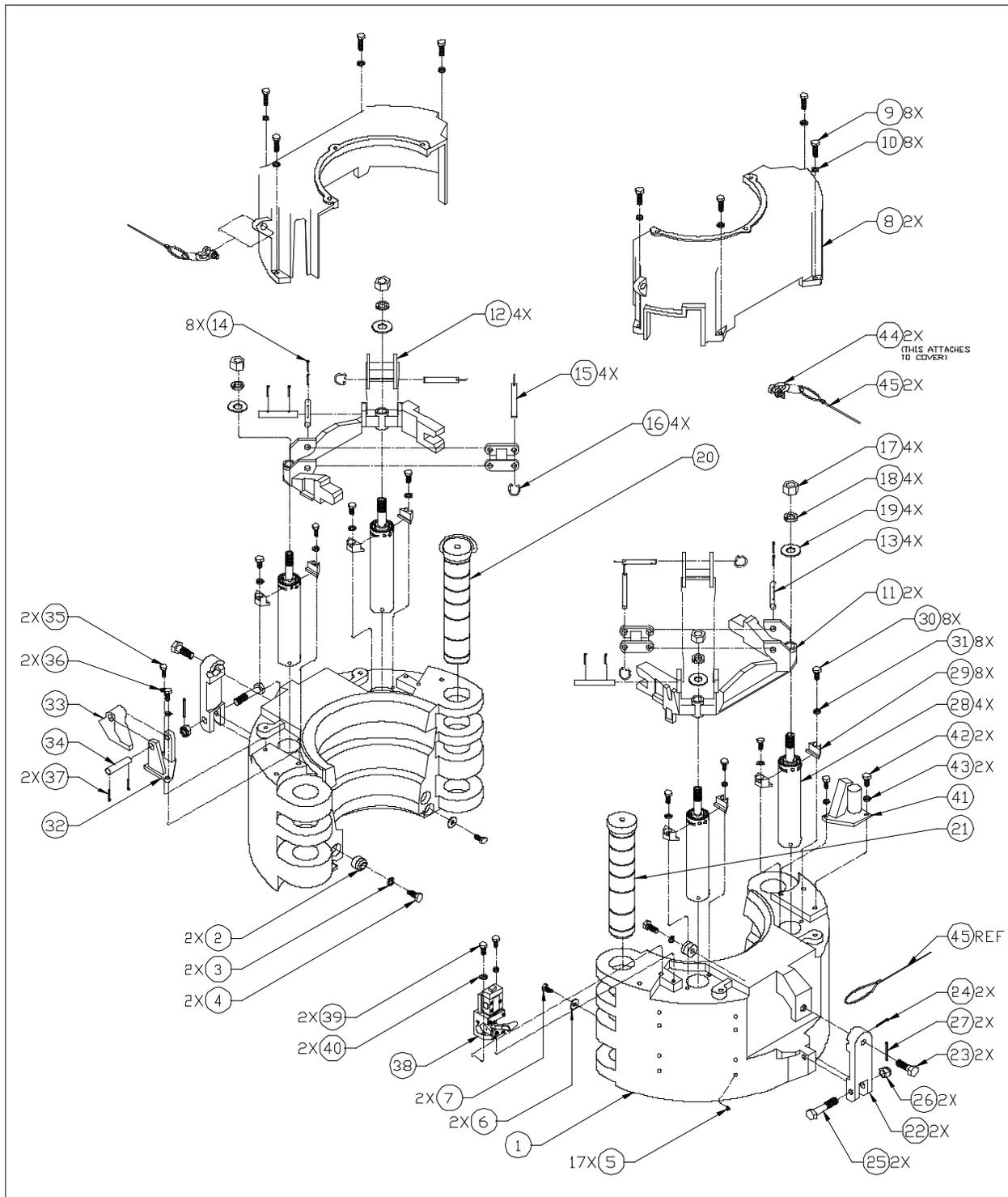


Figure 16: 500 Ton 14" Elevator/Spider Assembly (Part 1 of 2)

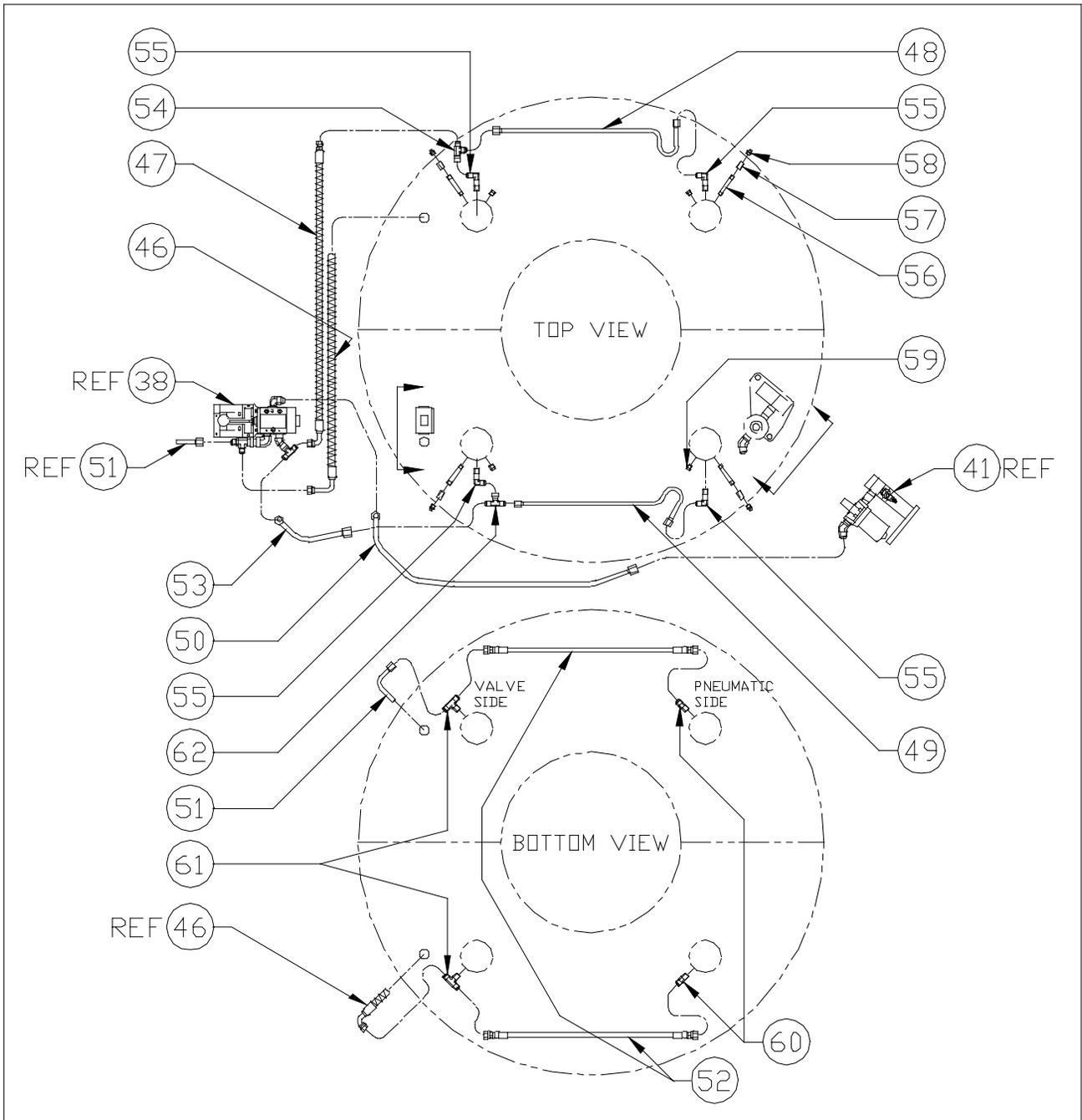
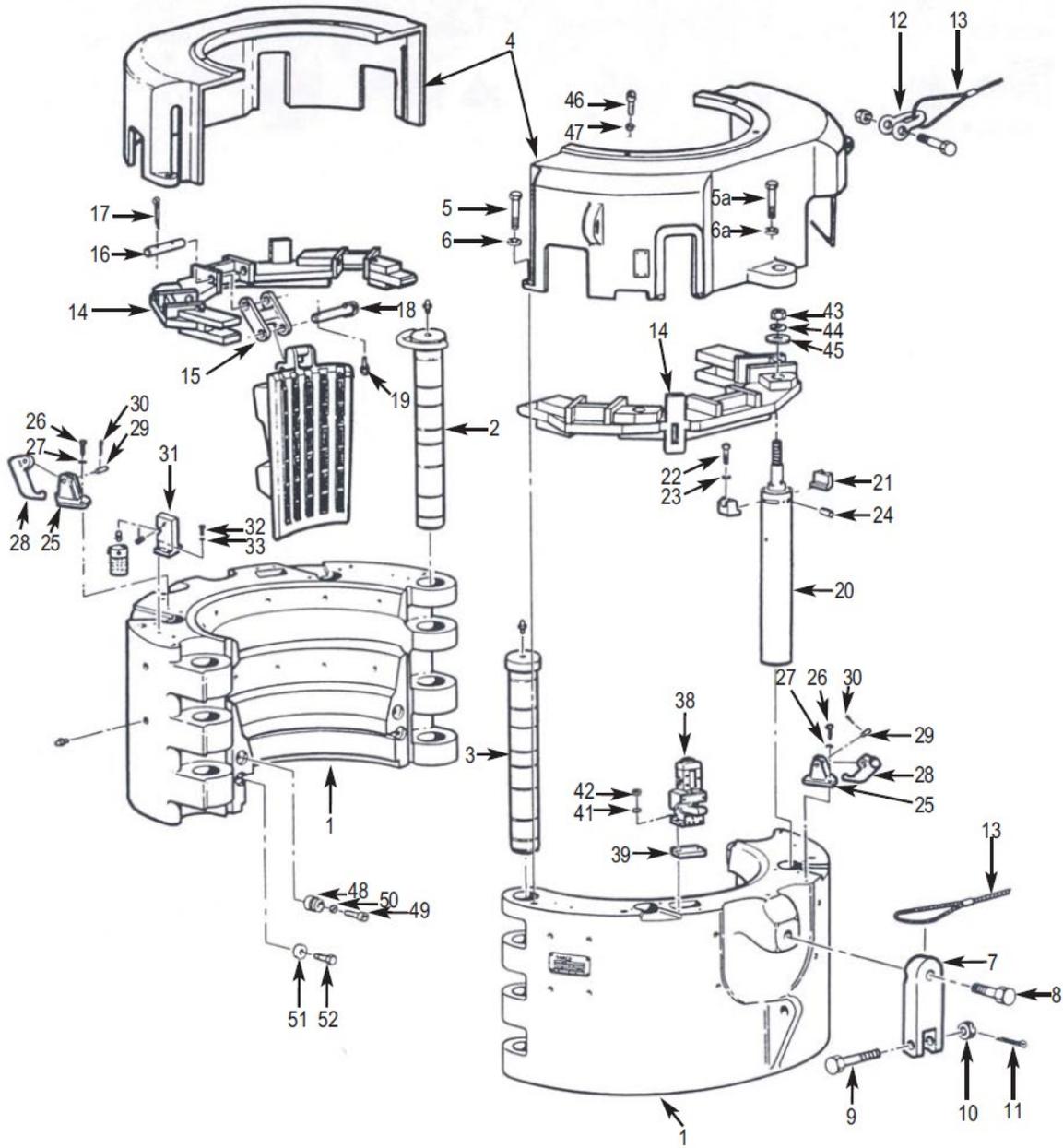


Figure 17: 500 Ton 14" Elevator/Spider Assembly (Part 2 of 2)

Table 5. 500 Ton 14" Elevator/Spider Parts List Index

ITEM #	BVM PART #	DESCRIPTION	QTY/UNIT
-	B13800	ELEVATOR/SPIDER ASSY, 500 Ton	Ref.
1	B13802-1	BODY.....	2
2	79882	REGISTER BUTTON.....	2
3	26120-00-0	LOCKWASHER, Hi-Collar.....	2
4	1212C-16-8	SCREW.....	2
5	940308-1	GREASE FITTING.....	16
6	B12896	GUIDE KEEPER.....	4
7	1408C-08-5	SCREW.....	4
8	B17913	COVER, Top.....	2
9	1410C-24-5	SCREW, Hex Head.....	8
10	20100-00-0	LOCKWASHER.....	8
11	B11783	LEVELING BEAM.....	2
12	B11877	LINK.....	4
13	B11878	PIN, Upper Link.....	4
14	30030-12-0	PIN, Cotter.....	8
15	B11989	PIN, Lower Link.....	4
16	B7887	PIN, Lynch.....	4
17	6020F-00-0	NUT, Hex.....	4
18	20200-00-0	LOCKWASHER.....	4
19	22200-00-0	FLAT WASHER.....	4
20	B13506	PIN, Removable Hinge.....	1
21	B13507	PIN, Stationary Hinge.....	1
22	79803	LINK BLOCK.....	2
23	79805	SCREW, Cap Modified.....	2
24	30030-24-0	COTTER PIN.....	2
25	79261	SCREW, Cap Modified.....	2
26	6816C-00-0	NUT.....	2
27	30030-16-0	COTTER PIN.....	2
28	B11800	AIR CYLINDER ASSEMBLY (Figure 19).....	4
29	B11849	CYLINDER RETAINER.....	8
30	1408C-12-5	SCREW.....	8
31	20080-00-0	LOCKWASHER.....	8
32	B11840	MANUAL LIFT BRACKET.....	1
33	B11842	MANUAL SOCKET.....	1
34	B11870	PIN, Pivot.....	1
35	1408C-12-5	SCREW, Hex Head.....	2
36	20080-0-0	LOCKWASHER.....	2
37	30030-12-0	COTTER PIN.....	2
38	B16822	VALVE AND LATCH ASSEMBLY (Figure 21).....	1
39	1408C-12-5	SCREW, Socket Head.....	2
40	20080-00-0	LOCKWASHER.....	2
41	10401	AIR INLET ASSEMBLY (Figure 22)	1
42	1408C-12-5	SCREW, Hex Head.....	2

43	20080-00-0	LOCKWASHER.....	2
44	B5417	SHACKLE, Anchor.....	2
45	B18122	SLING, Safety.....	2
46	B18269	HOSE ASSEMBLY, Lower.....	1
47	B18268	HOSE ASSEMBLY, Upper.....	1
48	B12632	TUBE, Upper Right.....	1
49	B12632L	TUBE, Upper Left.....	1
50	B18270	TUBE, Inlet.....	1
51	B18267	TUBE, Lower Connector.....	1
52	B12633	TUBE, Lower Rubber.....	2
53	B12634	TUBE, Upper Rubber.....	1
54	B6-R6X-S	SWIVEL NUT RUN TEE.....	1
55	B6-CCTX-S	LONG MALE ELBOW.....	4
56	B215PNL-2-25	LONG NIPPLE.....	4
57	B207P-2	COUPLING.....	4
58	79201	FITTING, Grease.....	4
59	B218P-2	HEX HEAD PLUG.....	4
60	B6-FTX-S	MALE CONNECTOR.....	3
61	B6-STX-S	MALE BRANCH TEE.....	2
62	B6-S6X-S	SWIVEL NUT BRANCH TEE.....	1



ALTERNATE VIEW:

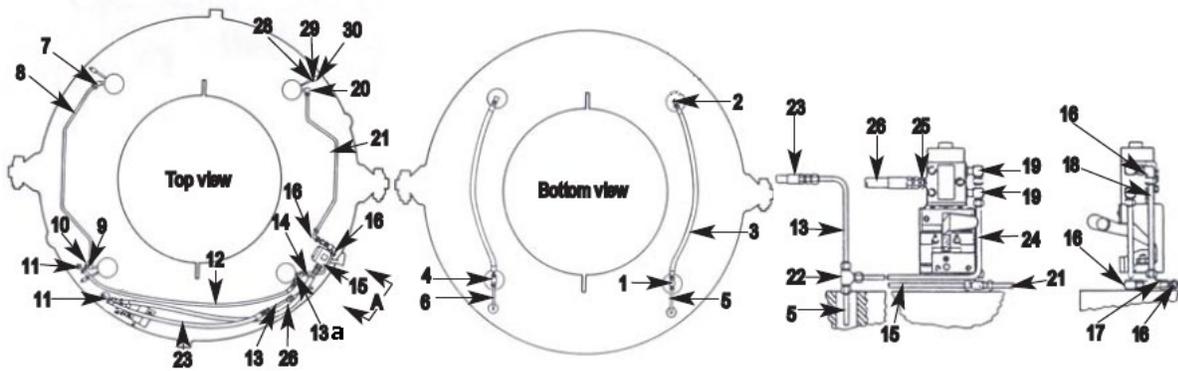


Figure 18: 500 Ton 24.5" Elevator/Spider Assembly

Table 6. 500 Ton 24.5" Elevator/Spider Parts List Index

ITEM #	BVM PART #	DESCRIPTION	QTY/UNIT
-	15740-1	ELEVATOR/SPIDER ASSY, 500 Ton	Ref.
1	42001	BODY.....	2
2	42005R	REMOVABLE HINGE PIN.....	1
3	42005B	STATIONARY HINGE PIN.....	1
4a	42010L	TOP COVER LEFT.....	1
4b	42010R	TOP COVER RIGHT.....	1
5	1416C-24-5	SCREW.....	4
5a	1408C-18-5	SCREW.....	2
6	20160-00-0	LOCKWASHER.....	4
6a	20080-00-0	LOCKWASHER.....	2
7	79803	LINK RETAINER.....	2
8	79805	SCREW.....	2
9	79261	SCREW.....	2
10	6416C-00-5	NUT.....	2
11	30030-16-0	COTTER PIN.....	2
12	B5417	SHACKLE.....	2
13	42041	SAFETY SLING.....	4
14	42040	LEVELING BEAM.....	2
15	B11877	SLIP LINK.....	6
16	B11878	UPPER LINK PIN.....	6
17	30030-12-0	COTTER PIN.....	12
18	B11989	LOWER LINK PIN.....	6
19	B7887	LYNCH PIN.....	6
20	42025	AIR CYLINDER ASSEMBLY.....	4
21	B11849	CYLINDER RETAINER.....	8
22	1408C-12-5	SCREW.....	8
23	20080-00-0	LOCKWASHER.....	8
24	B218P-2	PIPE PLUG.....	4
25	42009	MANUAL LIFT BRACKET.....	2
26	1408C-12-5	SCREW.....	4
27	20080-00-0	LOCKWASHER.....	4
28	B11842	MANUAL LIFT SOCKET.....	2
29	B11870	PIVOT PIN.....	2
30	30030-12-0	COTTER PIN.....	4
31	60401-1	AIR INLET ASSEMBLY.....	1
32	1408C-12-5	SCREW.....	2
33	20080-00-0	LOCKWASHER.....	2
38	B16822	VALVE AND LATCH ASSEMBLY (Figure 21).....	1
39	42006	SPACING BLOCK.....	1
41	20080-00-0	LOCKWASHER.....	1
42	1408C-24-5	SCREW, Hex Head.....	2
43	6020F-00-0	NUT.....	4
44	20200-00-0	LOCKWASHER.....	4
45	22200-00-0	FLAT WASHER.....	4

46	1412C-16-5	SCREW.....	6
47	20120-00-0	LOCKWASHER.....	6
48	79882	REGISTER BUTTON.....	2
49	1212C-16-0	SCREW.....	2
50	2612-00-0	HIGH COLLAR LOCKWASHER.....	2
51	24080-00-0	GUIDE KEEPER.....	4
52	1408C-08-5	SCREW.....	4
53	940308-1	GREASE FITTING.....	24

ALTERNATE VIEWS:

ITEM #	BVM PART #	DESCRIPTION	QTY/ UNIT
1	B6-STX-S	MALE BRANCH TEE.....	1
2	B6-CCTX-S	90° ELBOW.....	2
3	42026-2	LOWER HOSE ASSEMBLY.....	2
4	B6-STX-S	MALE BRANCH TEE.....	1
5	42045-10	TUBE.....	1
6	42025-7	TUBE.....	1
7	B6-6-VTX-S	45° ELBOW.....	1
8	42045-1	TUBE.....	1
9	B6-RTX-S	TEE.....	1
10	42045-4	TUBE.....	1
11	B6-HTX-S	UNION.....	2
12	42026-4	HOSE ASSEMBLY.....	1
13	42045-5	TUBE.....	1
13a	42045-6	TUBE.....	1
14	B6-RTX-S	TEE.....	1
15	42045-3	TUBE.....	1
16	B6-C6X-S	90° ELBOW, SWIVEL.....	3
17	B6-JTX-S	TEE.....	1
18	42045-2	TUBE.....	1
19	B6-6-CTX-S	90° ELBOW.....	2
20	B6-CCTX-S	90° ELBOW.....	1
21	42045-8	TUBE.....	1
22	B6-JTX-S	TEE.....	1
23	42026-1	HOSE ASSEMBLY.....	1
24	42045-9	TUBE.....	1
25	B8-FTX-S	UNION.....	1
26	42026-3	HOSE ASSEMBLY.....	1
28	B215PNL-2-25	LONG NIPPLE.....	4
29	B207P-2	COUPLING.....	4
30	940308-1	GREASE FITTING.....	4

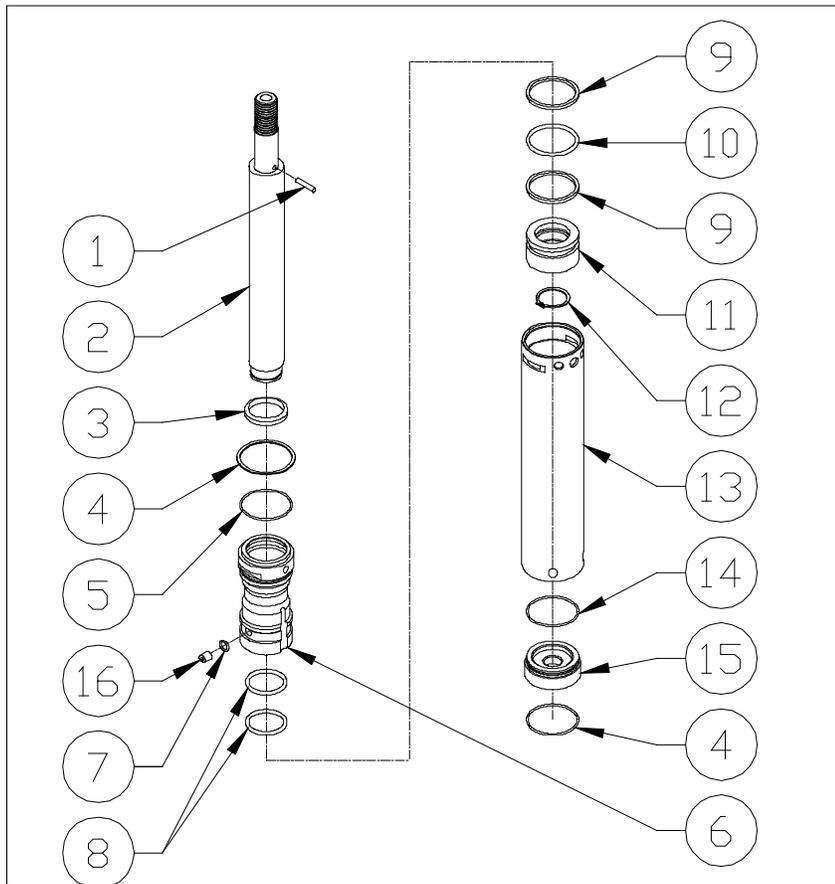


Figure 19: 350 Ton & 500 Ton 14" Air Cylinder Assembly

Table 6. Air Cylinder Parts List Index

ITEM #	BVM PART #	DESCRIPTION	QTY/UNIT
-	B11800	AIR CYLINDER ASSEMBLY.....	Ref.
1	50040-12-0	PIN, Dowel.....	1
2	B11806	ROD, Piston.....	1
3	B11751	RING, Wiper.....	1
4	B11809	RING, Spiral Retaining.....	2
5	B51300-149-B	SEAL, O-Ring.....	1
6	B14703	GLAND, Cylinder.....	1
7	B51300-112-B	SEAL, O-Ring.....	1
8	B51300-329-B	SEAL, O-Ring.....	2
9	B51301-334	RING, Back-Up.....	2
10	B51300-334-B	SEAL, O-Ring.....	1
11	B11804	HEAD, Piston.....	1
12	B53600-175	RING, External Retainer.....	1
13	B11807	BARREL.....	1
14	B51300-149-B	SEAL, O-Ring.....	1
15	B11805	BLANK END, Cylinder.....	1
16	10483	RETAINER, O-Ring.....	1

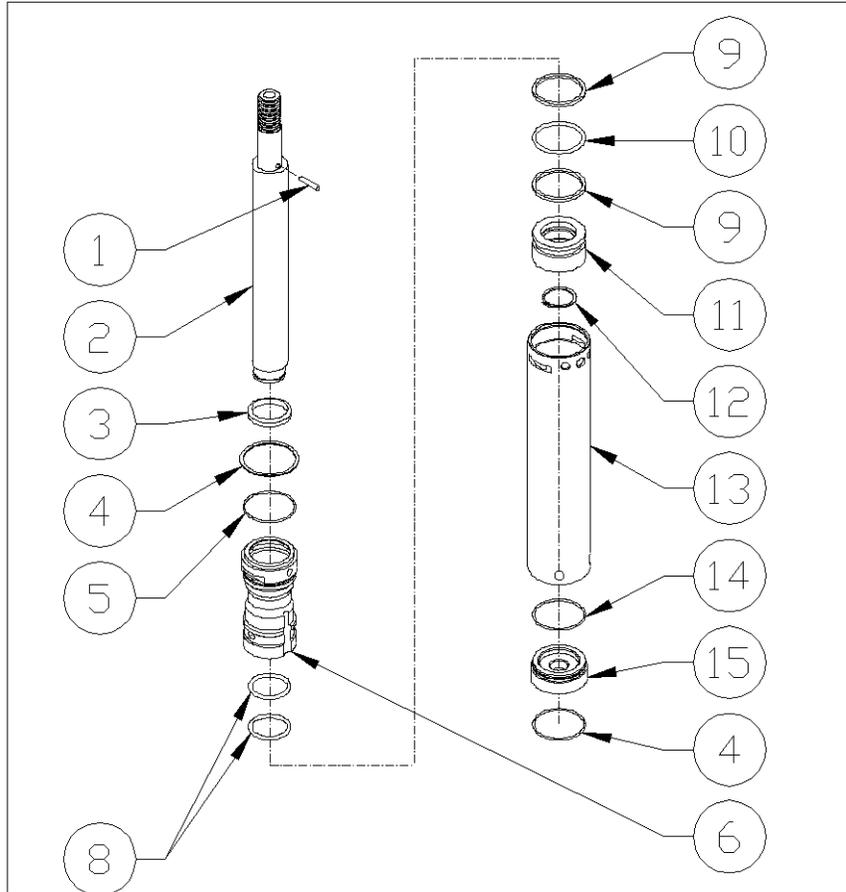


Figure 20: 500 Ton 24.5" Air Cylinder Assembly

Table 6. Air Cylinder Parts List Index

ITEM #	BVM PART #	DESCRIPTION	QTY/ UNIT
-	42025	AIR CYLINDER ASSEMBLY.....	Ref.
1	40040-16-0	PIN, Roll.....	1
2	42025-2	ROD, Piston.....	1
3	B11751	RING, Wiper.....	1
4	B11809	RING, Spiral Retaining.....	2
5	B51300-149-B	SEAL, O-Ring.....	1
6	42025-3	GLAND, Cylinder.....	1
7	42025-6	CYLINDER STOP.....	1
8	B51300-329-B	SEAL, O-Ring.....	2
9	B51301-334	RING, Back-Up.....	2
10	B51300-334-B	SEAL, O-Ring.....	1
11	42025-4	HEAD, Piston.....	1
12	B53600-175	RING, External Retainer.....	1
13	42025-1	BARREL.....	1
14	B51300-149-B	SEAL, O-Ring.....	1
15	42025-5	BLANK END, Cylinder.....	1

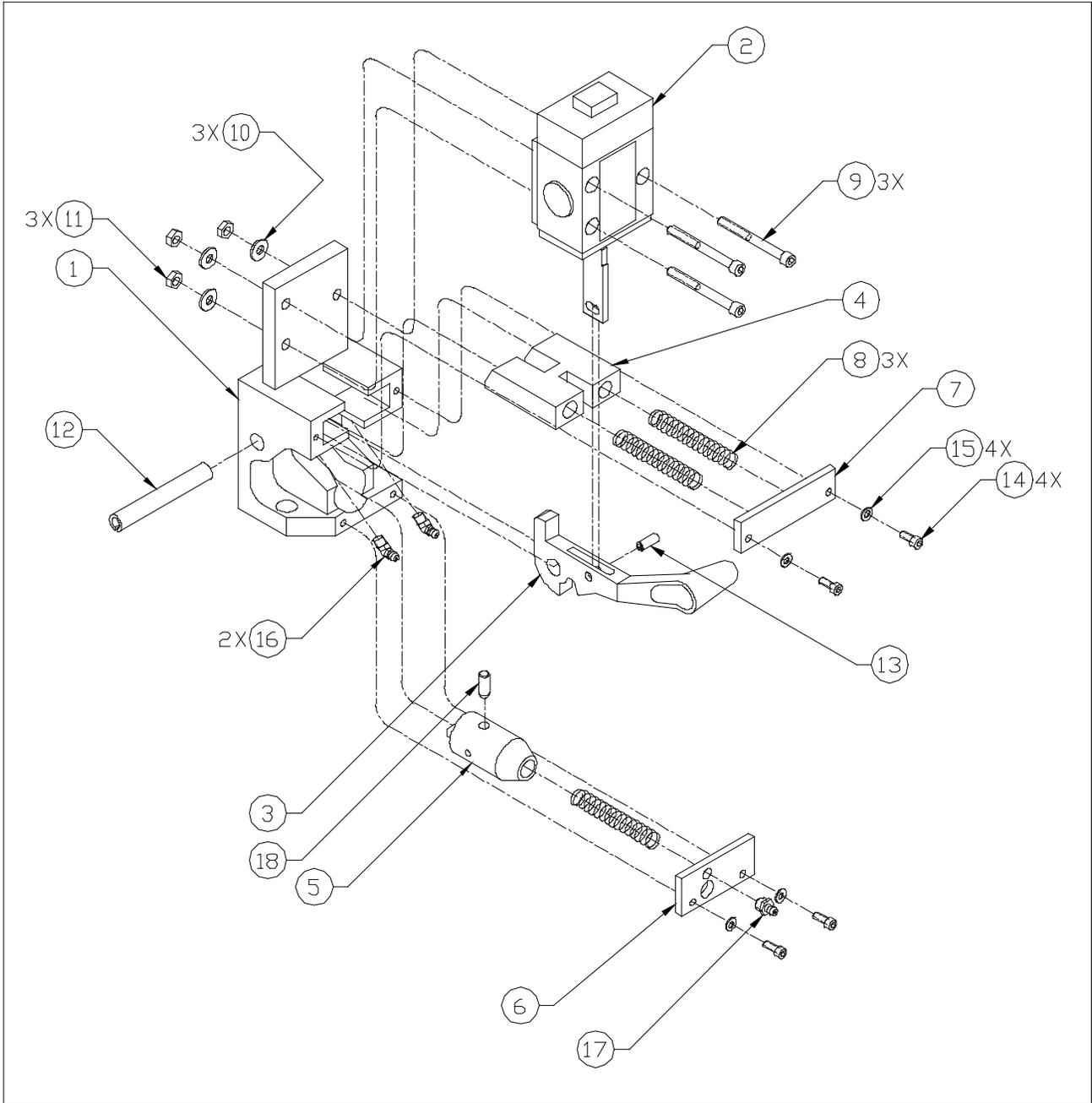


Figure 21: Valve & Latch Assembly

Table 7. Valve & Latch Parts List Index

ITEM #	BVM PART #	DESCRIPTION	QTY/ UNIT
-	B16822	VALVE & LATCH ASSEMBLY.....	Ref.
1	B16824	BRACKET, Valve.....	1
2	10400	VALVE ASSEMBLY (Figure 23).....	1
3	B13088	HANDLE, Valve.....	1
4	B13032	PLATE, Latch.....	1
5	B16826	DOWN, Lock.....	1
6	B16828	RETAINER, Lock Spring.....	1
7	B11888	COVER, Spring.....	1
8	B12001	SPRING.....	3
9	1204C-20-8	SCREW, Socket Head.....	3
10	20040-00-0	LOCKWASHER.....	3
11	6004C-00-0	NUT, Hex.....	3
12	40080-00-0	PIN, Roll.....	1
13	40040-05-0	PIN, Roll.....	1
14	120JC-05-8	SCREW, Socket Head.....	4
15	260J0-00-0	LOCKWASHER, Hi-Collar.....	4
16	79202	FITTING, 45 Deg Grease.....	2
17	940308-1	FITTING, Grease.....	1
18	50050-04-0	PIN, Dowel.....	1

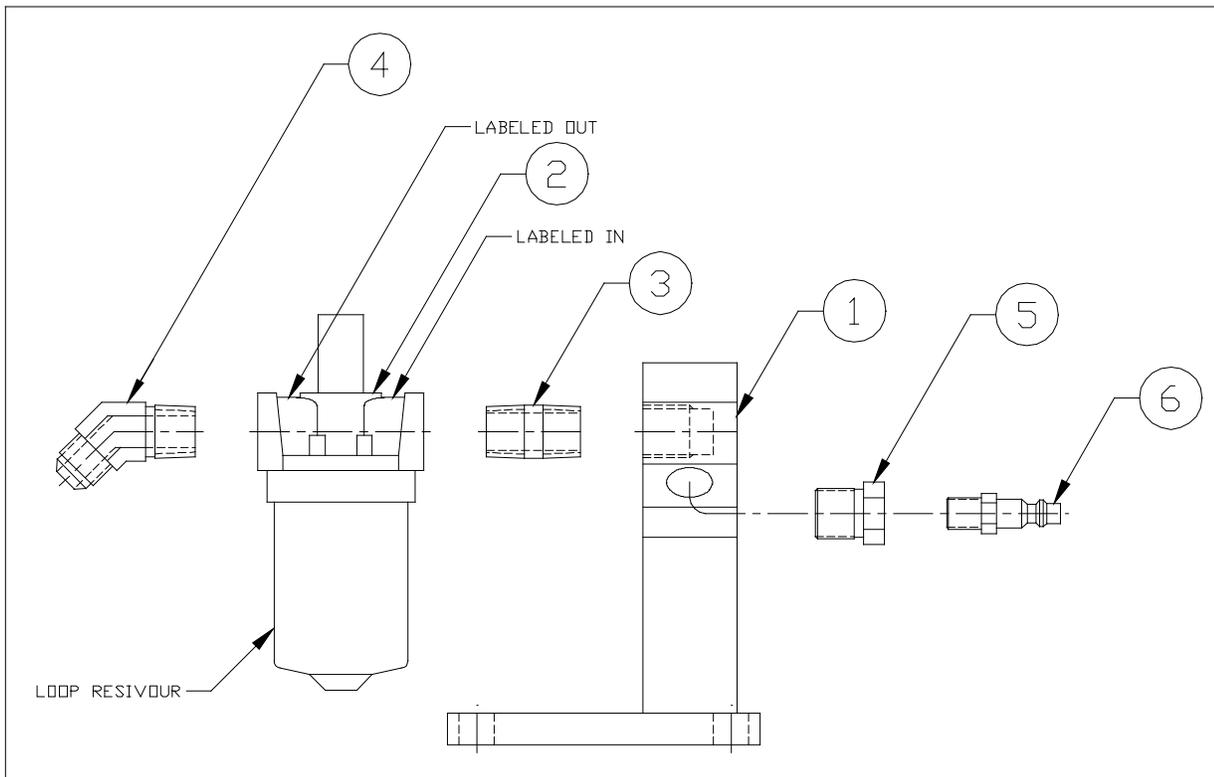


Figure 22: Air Inlet Assembly

Table 8. Air Inlet Parts List Index

ITEM #	BVM PART #	DESCRIPTION	QTY/ UNIT
-	10401	AIR INLET ASSEMBLY.....	Ref.
1	B11838	BRACKET, Lube Mounting.....	1
2	10528	PNEUMATIC LUBRICATOR.....	1
3	B216P-8	NIPPLE.....	1
4	B8-8-VTX-S	45° ELBOW.....	1
5	11881-8	BUSHING.....	1
6	BH2E	NIPPLE, Coupler (Quick Disconnect Fitting).....	1

ITEM #	BVM PART #	DESCRIPTION	QTY/ UNIT
-	60401-1	AIR INLET ASSEMBLY.....	Ref.
1	42007	BRACKET, Lube Mounting.....	1
2	10528	PNEUMATIC LUBRICATOR.....	1
3	B216P-8	NIPPLE.....	1
4	B8-CTX-S	90° ELBOW.....	1
5	11881-8	BUSHING.....	1
6	BH2E	NIPPLE, Coupler (Quick Disconnect Fitting).....	1

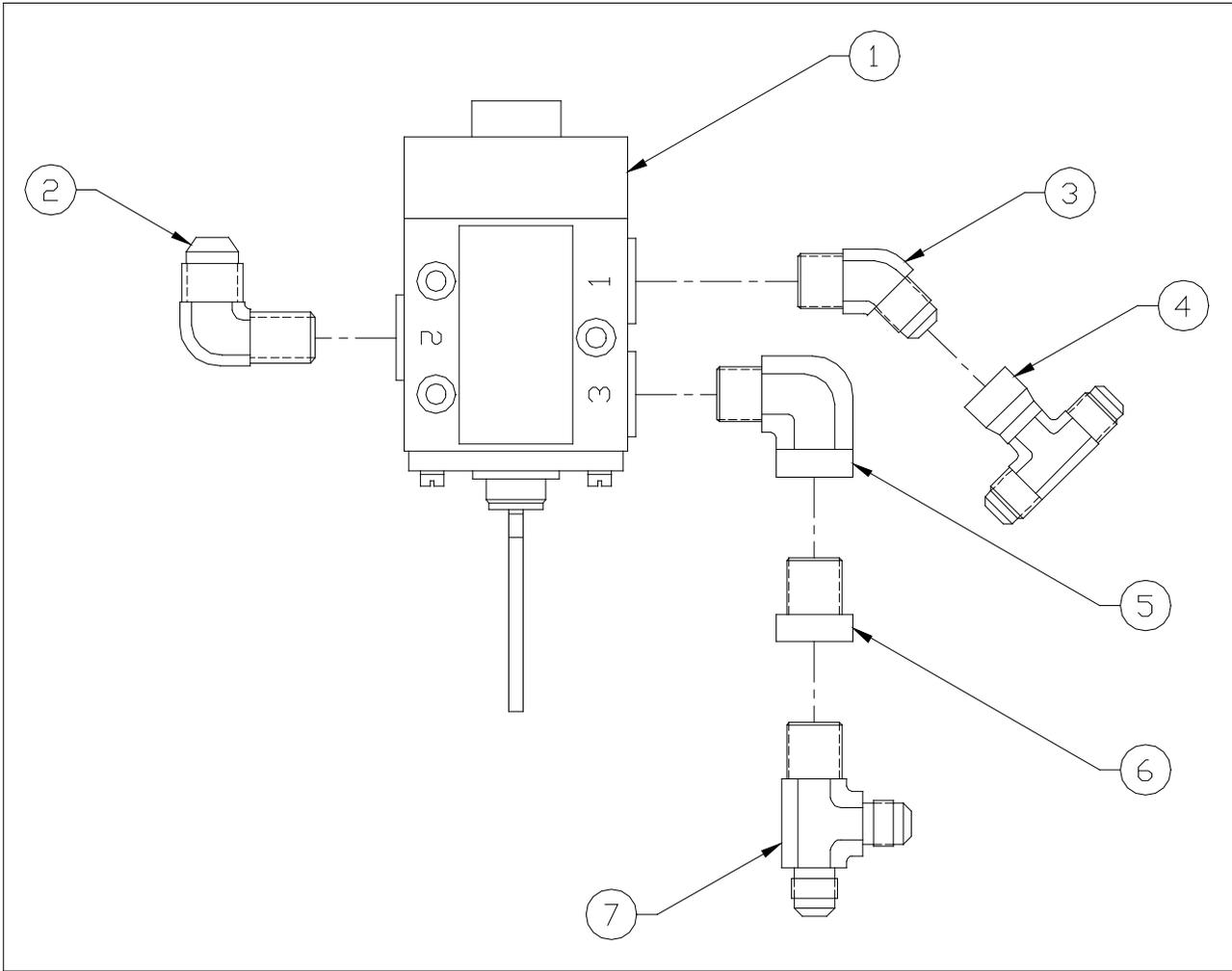


Figure 23: Valve Assembly

Table 9. Valve Parts List Index

ITEM #	BVM PART #	DESCRIPTION	QTY/ UNIT
-	10400	VALVE ASSEMBLY.....	Ref.
1	10405	PNEUMATIC DIRECTION VALVE.....	1
2	B8-CTX-SS	MALE ELBOW.....	1
3	B6-6-VTX-SS	45 DEG MALE ELBOW.....	1
4	B6-S6X-SS	SWIVEL NUT BRANCH TEE.....	1
5	B3/8 CD-SS	STREET ELBOW.....	1
6	BPTR-S	REDUCER.....	1
7	B6-RTX-SS	MALE RUN TEE.....	1