

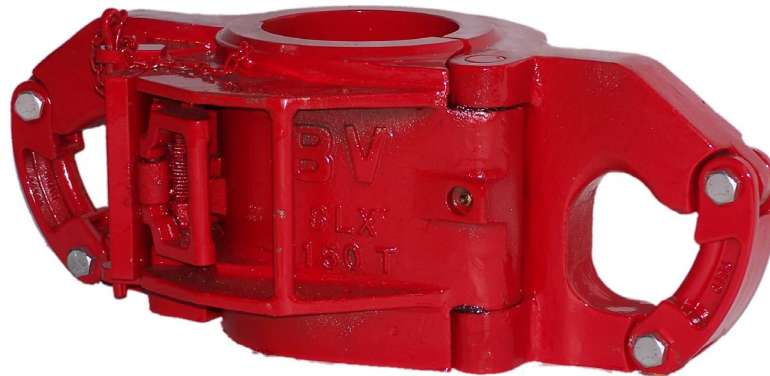
# BVM Corporation Maintenance Manual

## Side Door Elevator – Type “SX” & “SLX”

### 100, 150, 250, 350, 500 & 750 Ton

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 undesigned areas; use only the provided handles for operating the elevator.

**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](http://www.bvmcorp.com)

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## Purpose

This manual contains operation and service instructions for SX & SLX Elevators – 100, 150, 250, 350, 500, & 750 Ton. This manual provides a guide for assembly, disassembly, inspection, and repair.

## Description

The BVM side door elevator is used for handling plain or upset collar drill pipe, casing, and tubing. The BVM elevator comes in sizes ranging from 2-3/8” through 36”, with a capacity of

100, 150, 250, 350, 500, & 750 tons. The elevators are made from alloy steel; load tested and are magnetic particle inspected.

**CE Marking (if applicable):**



**Operation**

The latch and safety latch lock of the SLX and SX elevators lock automatically when the elevator is closed around the pipe. To open the elevator, simply pull the safety pin and then pull the latch lock handle out and swing the elevator halves apart. Proper inspection, operation, and assembly are key to prevent dropped objects.

**Installation:**

- 1) Remove cotter pin and nut from link block bolt and remove link block bolt.
- 2) Lift the bottom of the link block and hook the small end to the link through the link block and link arm.
- 3) Lower the link block and re-install the link block bolt, nut and cotter pin.
- 4) Repeat this procedure on the other link block.
- 5) To remove, simply reverse the installation process.

**Warning:**

- Elevators are manufactured to operate only in a vertical direction and should NEVER be used for laying down on the ground for picking up pipe or tubing.
- The load rating of the elevator should never be exceeded. Both the static and dynamic loads must be calculated to ensure safe working loads.
- NEVER use a Type SLX/SX Elevator for clamping around a taper pipe by using the taper to hold the string of pipes.
- Check the latch and latch lock for full engagement when closed around the pipe.
- Make sure the SLX/SX elevators are used with the correct size, tubing or pipe (per specifications). Oversized pipe could result in the elevator latching partially or not at all. 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, including size and tonnage, which is clearly marked on elevator.
- Only use the elevator within the specified temperature rating, which is -4°F to 150°F unless otherwise specified.

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

## **Maintenance**

Safety should be practiced at all times when servicing the equipment always use BVM Corporation, approved safety methods, material and tools. Always wear protective gear for eyes, head, hands, and feet.

1. Check for worn hinge pin, latch pin, latch lock pin, and their mating parts. These may hinder proper opening and closing of door, latch and latch lock.
2. Check for proper operating of latch stop mechanism. Latch should not stop against the body when engaged.
3. Open elevator and check hinge pin for wear by checking the radial play between the body and door.
4. Check latch pin for wear by checking the radial play between the latch and body. Close elevator and check that the latch and latch lock mechanisms function properly. Open and close elevator several times, check for proper latch and latch lock function each time. Check for proper operation of latch stop mechanism.

### **Caution:**

- Do not use any elevator if the Latch and Latch lock do not function properly.
- Use only parts manufactured and sold by BVM Corporation
- Re-machining of parts should be performed only at BVM Corporation. Improper machining could result in increased stress (Decreased Load carrying capability) or improper alignment of component parts. Either condition could be hazardous to personnel and equipment.
- Bodies and Doors are matched by trained BVM personnel. For this reason, a body or door from one elevator should never be exchanged with a body or door from another elevator.
- Always wear gloves and eye protection when grinding, striking or handling parts.
- Do not use any elevator with wear in hinge pin, latch pin, and lock pin areas. Wear in these areas will cause latch and latch lock to function improperly and may cause failure.

## **Lubrication**

Lubricate the Elevator regularly during usage and storage to prevent corrosion. Use an extreme pressure, multipurpose, lithium-based grease of No. 1 or No 2 consistency and multi-weight motor oil.

1. Lubricate on a regular basis when in use.
2. Oil or grease hinge, latch and latch lock pin
3. Grease hinge and latch pin through grease nipples.
4. Grease underside of link arms.
5. Grease springs.
6. Grease link retainer fasteners.

7. Lubricate regularly during usage and storage to prevent corrosion from attacking any part of the elevators operating mechanism.

## **Inspection** (PER API-RP8B)

### Daily Inspection (Cat. II – elevator in use)

1. Check for any worn and damaged parts.
2. Check for loose and missing parts.
3. Check condition of the latch spring and the latch lock spring.
4. Check for wear of the hinge pins for vertical play between latch, body and door
5. Open and close the elevator 5 times slowly and 5 times quickly. Check that the elevator works flawlessly without interference
6. Check state of lubrication
7. Check for any visible cracks
8. Check for any corrosion
9. Verify safety pin is straight, if not, replace
10. Check good condition of all primary and secondary retention

### Semi-annual inspection (Category III)

1. Try to open the latch by prying the latch between roller (SLX) / door (SX) and latch with a steel bar or screw driver, the latch lock must prevent the latch from being opened
2. Open and close the elevator 5 times slowly and 5 times quickly. Check that the elevator works flawlessly without interference
3. Check that the latch is not forced outward when elevator body is wedged – top and bottom.
4. Check latch and lug faces make contact and are parallel.
5. Perform measurements and compare to wear limits.
6. Disassemble and perform Magnetic Particle Inspection (MPI) on the lifting ears.

### Annual Inspection (Category IV)

1. Conduct Category III inspection.
2. Disassemble and perform Magnetic Particle Inspection (MPI) on the following parts (See critical areas drawings for cast parts):
  - Body
  - Door
  - Hinge Pin
  - Latch Pin
  - Latch

## **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:

<b>Maximum Allowable Degree</b>			
<b>Type</b>	<b>Discontinuity Descriptions</b>	<b>Critical Areas</b>	<b>Non-critical Areas</b>
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:

<b>Maximum Allowable Degree</b>			
<b>Type</b>	<b>Discontinuity Descriptions</b>	<b>Critical Areas</b>	<b>Non-critical Areas</b>
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.

## Wear data

The inspection data and maximum wear tolerances are only valid if the equipment is in otherwise good condition and has not been mis-used, 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.

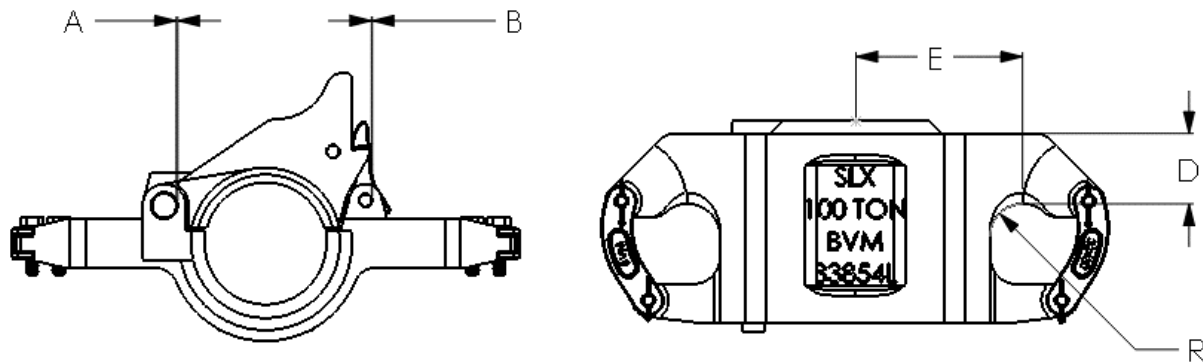
**Table 1: Wear table for SLX Elevators**

<b>Rated Capacity (Ton)</b>	<b>100</b>	<b>150</b>	<b>150</b>	<b>150</b>	<b>150</b>	<b>150</b>	<b>150</b>
Part Number	33854	31239	33950	33982	33632	33175	33180
Size	2 3/8 - 5 1/2	3 1/2 - 8 5/8	9 1/2 - 10 3/4	11 3/4 - 13 3/8	16 - 20	24 - 30	36
Hinge Clearance (A)	0.025	0.030	0.030	0.035	0.035	0.045	0.045
Latch Clearance (B)	0.030	0.030	0.030	0.030	0.035	0.035	0.035
D (Min Worn)	2.875	3.545	3.7	3.5	3.156	3.375	4.625
E (Nominal)	7.75	10.298	11.47	14.125	17.438	23	26
R (Min Worn)	1	1	1.25	1.5	1.5	1.5	1.5

<b>Rated Capacity (Ton)</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>
Part Number	43239	43950	43982	43632	43175	43180
Size	3 1/2 - 8 5/8	9 5/8 - 10 3/4	11 3/4 - 14	16 - 24	24 - 30	36
Hinge Clearance (A)	0.035	0.035	0.035	0.045	0.045	0.045
Latch Clearance (B)	0.030	0.030	0.035	0.035	0.035	0.035
D (Min Worn)	4	3.7	3.98	3.5	3.5	4.625
E (Nominal)	9.875	12.875	13.5	17.438	23	26
R (Min Worn)	1.25	1.75	1.75	1.75	2	2

**Table 2: Wear table for SX Elevators**

Rated Capacity (Ton)	350	350	500	500	750
Part Number	29965	29966	29964	30729	46950
Size	5 1/2 - 13 3/8	16 - 20	6 5/8 - 13 3/8	16 - 20	7 5/8 - 13 3/8
Hinge Clearance (A)	0.045	0.045	0.045	0.045	0.045
Latch Clearance (B)	0.035	0.035	0.035	0.035	0.035
D (Min Worn)	5.125	5.25	5.25	5.375	6.875
E (Nominal)	15.61	18.35	15.61	18.35	18
R (Min Worn)	1.875	1.875	1.875	2	2.5



**Figure 1: Wear variables for Tables 1-2**



**Center bore wear:**

Caution: wear data are applicable for lifting casing & tubing with regular coupling with dimensions and tolerances according to API 5-CT.

**Tubing Wear Data**

Size (in)	Style	Bore Code	Max wear (in)
2.375	Plain	158	2.512
2.375	Upset	159	2.781
2.875	Plain	160	3.013
2.875	Upset	161	3.344
3.5	Plain	162	3.639
3.5	Upset	163	4.016
4	Plain	164	4.139
4	Upset	165	4.516
4.5	Plain	166 (129)	4.640
4.5	Upset	167	5.016

**Casing Wear Data**

Size (in)	Bore Code	Max wear (in)
4.75	130	4.913
5	131	5.168
5.5	132	5.676
5.75	133	5.931
6	134	6.185
6.625	135	6.821
7	136	7.203
7.625	137	7.838
7.75	705	7.966
8.625	139	8.856
9	140	9.238
9.625	141	9.873
9.875	649	10.128
10.75	142	11.018
11.75	143	12.036
12.75	850	13.053
13.375	144	13.664
13.625	596	13.918
14	690	14.300
16	145	16.335
16.75	175	17.098
18	723	18.370
18.625	146	19.006
20	147	20.405
21.5	148	21.925
22	688	22.431
24	630	24.456
24.5	149	24.962
26	650	26.481
28	693	28.506
30	644	30.531
36	660	36.606

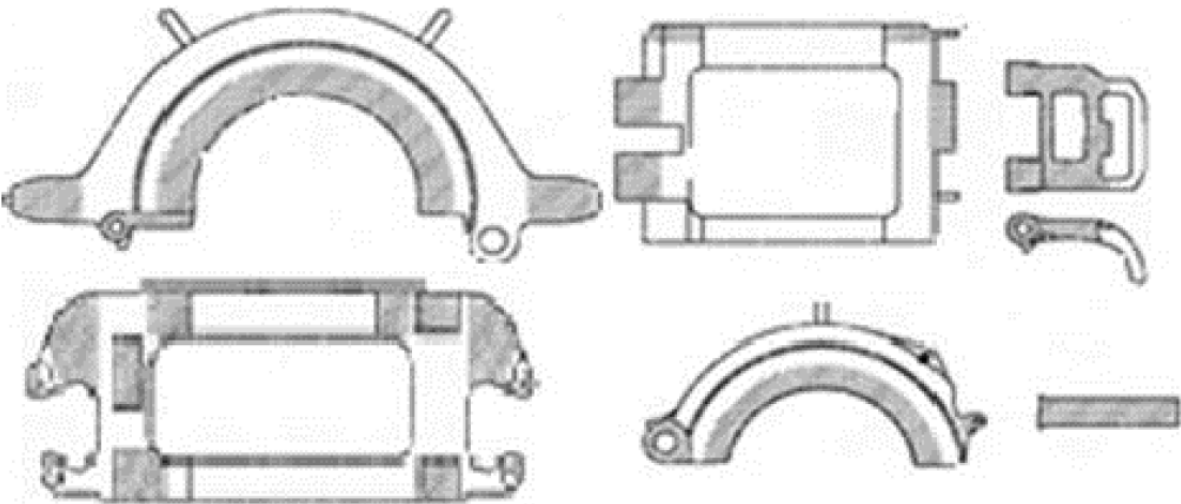
**Drill Collars with Zip Lift Recess**

Collar OD	Bore Code	Max Wear (in)
4.125	177	3.844
4.750	435	4.406
5.250	179	4.906
5.500	180	5.156
5.750	181	5.313
6.000	362	5.563
6.250	337	5.813
6.500	373	6.063
6.750	387	6.250
7.000	361	6.500
7.250	357	6.750
7.500	188	7.000
7.750	339	7.250
8.000	336	7.500
8.250	422	7.750
8.500	426	8.000
9.000	427	8.438
9.500	370	8.938
9.750	367	9.188
10.000	195	9.438
10.750	527	10.188
11.000	419	10.438
11.250	196	10.688

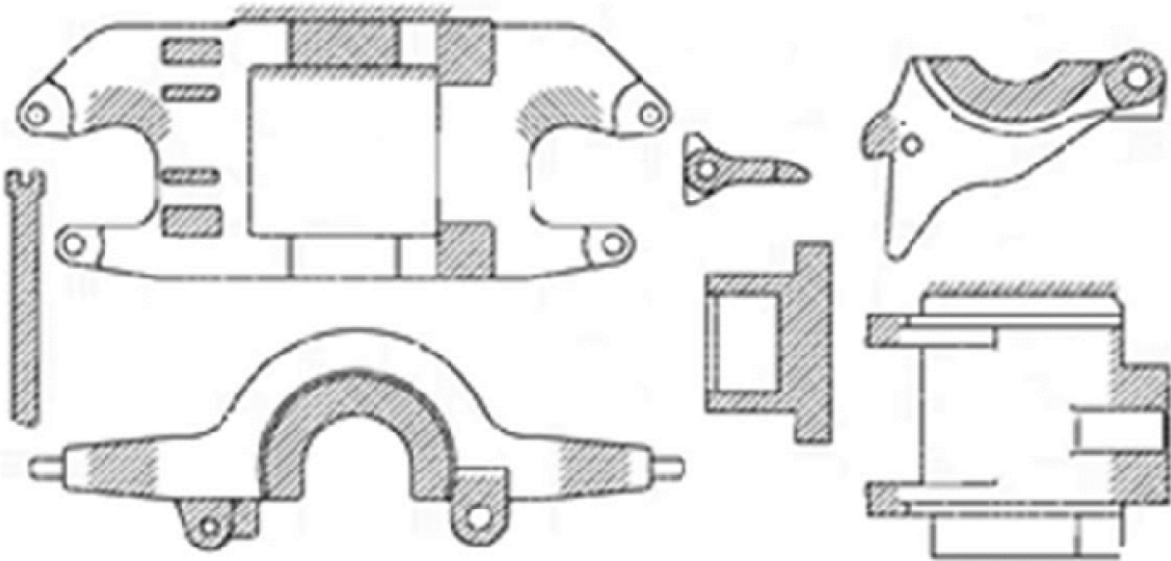
**Plain Drill Collars with Lift Plug**

Collar OD	Bore Code	Max Wear (in)
2 7/8	824	3.062
3	205	3.188
3 1/8	206	3.313
3 1/4	207	3.438
3 1/2	209	3.688
3 3/4	211	3.938
4	213	4.188
4 1/8	519	4.313
4 1/4	548	4.438
4 1/2	215	4.688
4 3/4	354	4.969
5	552	5.219
5 1/4	219	5.469
5 1/2	411	5.719
5 3/4	222	6.031
6	349	6.281
6 1/4	348	6.531
6 3/8	331	6.656
6 1/2	135	6.781
6 3/4	338	7.063
7	372	7.313
7 1/4	335	7.563
7 1/2	137	7.813
7	550	8.063
8	334	8.313
8 1/4	347	8.563
8 1/2	580	8.844
8 3/4	226	9.094
9	356	9.344
9 1/4	227	9.594
9 1/2	346	9.844
10	228	10.406
10 1/2	229	10.906
11	230	11.406
11 3/4	621	12.157
14	679	14.407

**Critical Area Drawings**



**Figure 2: SX critical area drawings**



**Figure 3: SLX critical area drawings**

## **Troubleshooting**

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

Overview possible problems:

<b>Problem</b>	<b>Possible cause</b>	<b>Possible solution</b>
Elevator does not close or is difficult to close	Parts bent or damaged.	Check elevator.
	Pipe too big	Use different size elevator
Elevator does not hang level	Length of links not equal	Use same length slings
Elevator does not open	Yielding due to overload	Replace Elevator
	Elevator corroded	Open elevator by force, clean and lubricate. Check elevator for excessive wear.
Bent pins	Elevator was overloaded	Replace Elevator
Elongated holes	Elevator was overloaded	Replace Elevator
	Elevator holes worn	Check amount of wear. If within acceptance criteria use as is; when over acceptance criteria, replace Elevator

## **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.
- Do not rely on visual signals “elevator closed and latched” from deckhand.

### **Applicable standards:**

- EN-ISO 12100:2010 Safety of machinery – Basic concepts, general principles for design – Risk assessment and risk reduction
- Machinery Directive: 2006/42/EC
- API 8C

## Recommended Spares for 1 year of Operation

<b>Rating</b>	100	150	150	150	150	150	150	
<b>Assembly PN</b>	33854	31239	33950	33982	33632	33175	33180	
<b>Spare Part kit</b>	33854-SP	31239-SP	33950-SP	33982-SP	33632-SP	33175-SP	33180-SP	
<b>Component</b>	<b>Qty</b>	<b>Part Number</b>						
Hinge pin	1	34613-1	34611	33953-1	33985	33646-3	34179-3	34179-2
Hinge pin retainer	2	40040-16-0	-	40040-26-0	-	40040-32-0	40040-32-0	40040-32-0
Latch	1	33813	31331	31331	31331	33634	33634	33634
Latch pin	1	29980-4	32424-3	32424-3	32424-3	33645-1	33645-1	33645-2
Latch spring	1	33818	31383	31383	31383	33657	33657	33657
Latch lock	1	33812	31332	31332	31332	33635	33635	33635
Latch lock pin	1	29980-3	29980-4	50713-1	29980-5	50713-1	50713-1	29980-6
Latch lock spring	2	33816	31404	31404	31404	33658	33658	33658
Roller	2	31407	31407	31407	31407	31407	31407	31407
Roller pin	2	31584	31584	31584	31584	31584	31584	31584
Link block	2	32430	9519	9519	9519	9519	9519	9519
Grease fitting	2	940308-1	940308-1	940308-1	940308-1	940308-1	940308-1	940308-1
Pin & Chain assembly	1	10571-1	10571-2	10571-3	10571-2	10571-4	10571-4	10571-4

<b>Rating</b>	250	250	250	250	250	250	
<b>Assembly PN</b>	43239	43950	43982	43632	43175	43180	
<b>Spare Part kit</b>	43239-SP	43950-SP	43982-SP	43632-SP	43175-SP	43180-SP	
<b>Component</b>	<b>Qty</b>	<b>Part Number</b>					
Hinge pin	1	33646-2	33646-2	33646-4	34179	34179-3	34179-2
Hinge pin retainer	2	-	-	40040-24-0	-	40040-32-0	40040-32-0
Latch	1	31331	31331	33634	33634	33634	33634
Latch pin	1	33645	32424-3	33645-2	33645-1	33645-1	33645-2
Latch spring	1	31383	33657	33657	33657	33657	33657
Latch lock	1	31332	31332	33635	33635	33635	33635
Latch lock pin	1	29980-4	29980-5	50713-1	29980-5	50713-1	29980-6
Latch lock spring	2	31404	33658	33658	33658	33658	33658
Roller	2	31407	31407	31407	31407	31407	31407
Roller pin	2	31584	31584	31584	31584	31584	31584
Link block	2	9519	9519	9519	9519	9519	9519
Grease fitting	2	940308-1	940308-1	940308-1	940308-1	940308-1	940308-1
Pin & Chain assembly	1	10571-3	10571-4	10571-4	10571-4	10571-4	10571-4

<b>Rating</b>		350	350	500	500	750
<b>Assembly PN</b>		29965	29966	29964	30729	46950
<b>Spare Part kit</b>		29965-SP	29966-SP	29964-SP	30729-SP	46950-SP
<b>Component</b>						
<b>Component</b>	<b>Qty</b>	<b>Part Number</b>				
Hinge pin	1	29956	29956	29956	29956	38115
Latch	1	29945	29945	29945	30597-2	38130
Latch pin	1	29951	29951	29951	30696	38125
Latch lock	1	6021	6021	6021	6021	6021
Latch lock pin	1	6027	6027	6027	6027	6027
Latch spring	1	30657	30657	30657	30657	30657
Hinge pin set screw	2	939565-143	939565-143	939565-143	939565-143	7008F-06
Link block	2	9519	9519	9519	9519	63009-1
Grease fitting	2	940308-1	940308-1	940308-1	940308-1	940308-1
Pin & Chain assembly	1	10550	10550	10550	10550	10550

## **Assembly drawing and List of Parts**

See data sheet at [www.bvmcorp.com](http://www.bvmcorp.com).