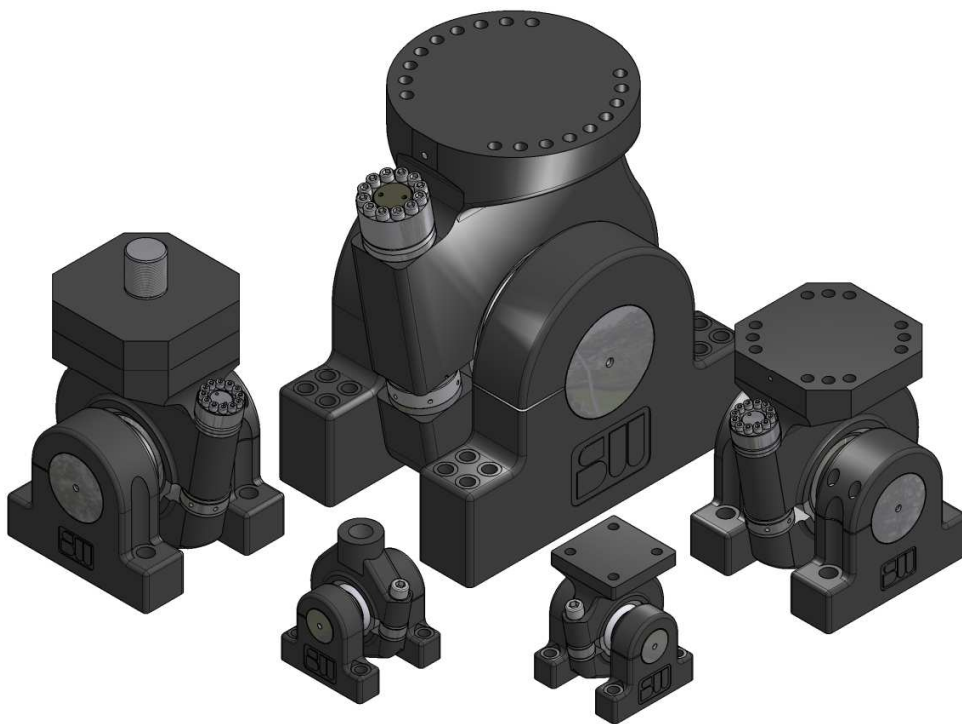


User Manual

Swivels

Models 980 thru 999



This manual contains information proprietary to Shore Western Manufacturing, Inc. and is provided for the operation and maintenance of the equipment described. This manual is not to be reproduced or used for any other purpose without written authorization.

Table of Contents

Introduction	3
General Information	3
Specifications	5
Base End Swivels	5
Rod End Swivels.....	6
Handling	7
Installation	8
Maintenance	10
General	10
Swivel bearing backlash adjustment	10
<i>Checking swivel bearing backlash using system feedback:</i>	10
<i>Swivel bearing backlash adjustment procedure:</i>	11
Swivel Pin Assembly Replacement	12
<i>General</i>	12
<i>Disassembly</i>	12
<i>Assembly</i>	13
<i>Bolt Torque Values</i>	14
Contact Information	15
Addendum	15

Introduction

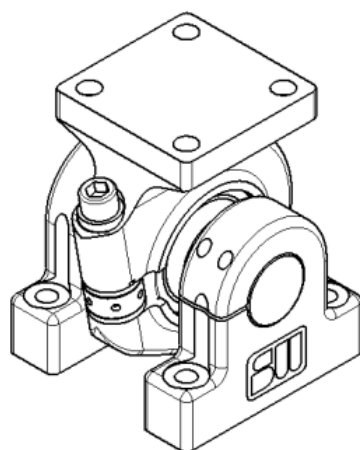
This manual contains operating and maintenance instructions for the Shore Western Manufacturing, Inc. product(s) listed on the front cover. All instructions in this manual should be followed and performed as written to prevent premature wear or damage to the product(s) covered by this manual.

Information specific to an individual model is included in the appendix. If your equipment has nonstandard accessories and/or options, supplemental information is normally included in other documentation; other O&M manuals, vendor manuals and data sheets, etc.

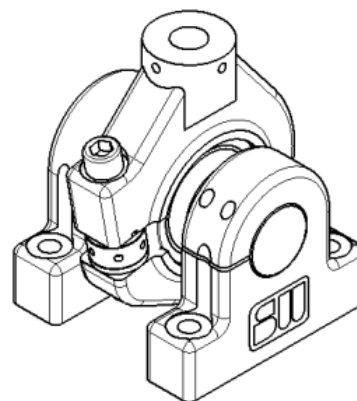
While every effort is made to ensure the accuracy of the information contained in this manual, Shore Western Manufacturing, Inc. will not, under any circumstances be held liable for any inaccuracies or the consequences thereof.

General Information

Shore Western 98X and 99X swivel joints allow pivoting movement around a spherical center with backlash free reversing load capacity. They are available in force ratings from 5.5 kip up to 550 kip in both base end and rod end configurations. If more tilt angle is required, high tilt versions are also available for most models. All swivels use a maintenance free spherical bearing, eliminating the need for grease fittings and periodic lubrication.

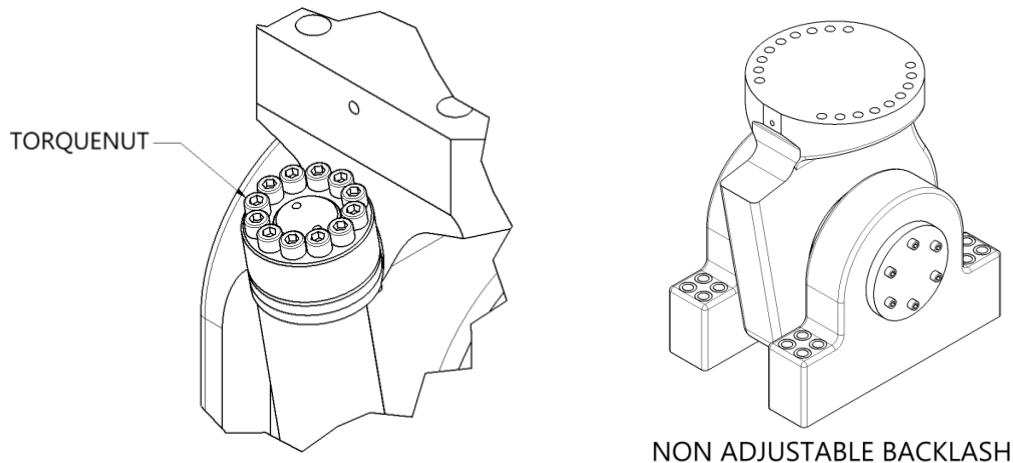


BASE END

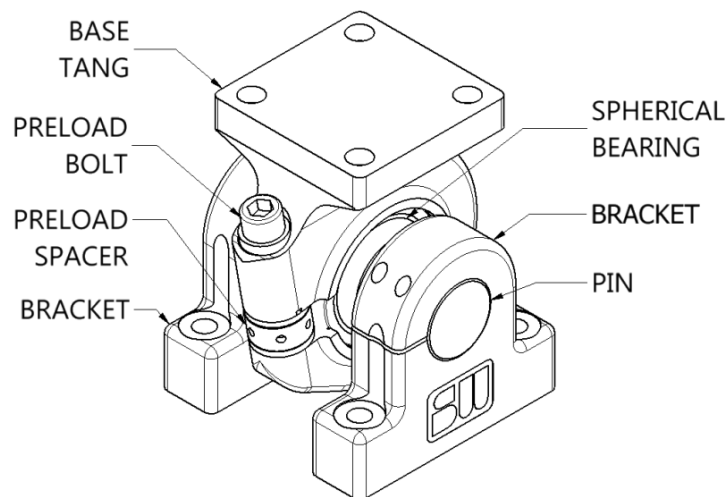


ROD END

Shore Western 98X and 99X swivels allow for backlash adjustment to eliminate clearance between the bearing and housing. A single bolt is used to preload the bearing on swivels rated up to 75 kip. Swivels rated above 75 kip use a multi-jackbolt tensioner (torquenut) with multiple smaller jack bolts to obtain the high clamp loads required. Swivels rated at 110 kip and above are also available without backlash adjustment. These swivels are an economical alternative for applications without fully reversing loads.



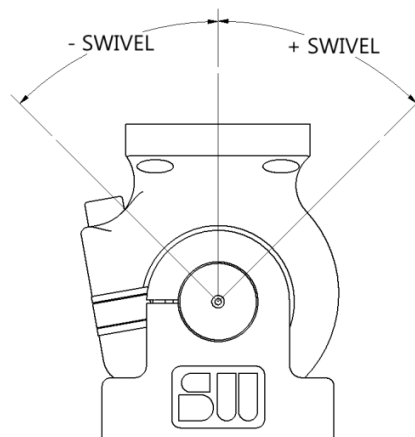
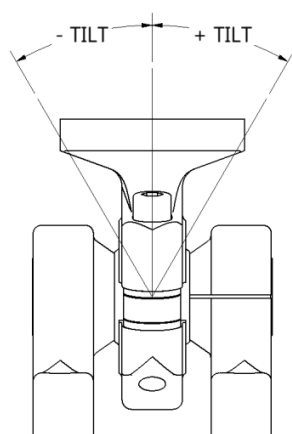
All Shore Western swivels contain the same basic parts shown below. The brackets allow mounting to a fixed base, while the tang is mounted to an actuator or strut. The pin and spherical bearing are one piece, eliminating backlash between them. The preload bolt and spacer are used to adjust backlash. Swivels without backlash adjustment do not contain a preload bolt or preload spacer.



Specifications

Base End Swivels

Model Number	Force Rating Kip (KN)	Tilt Angle Degrees	Swivel Angle Degrees	Weight lbs (kg)
990	3.3 (14)	±10	-70, +90	4 (1.8)
991-1	5.5 (24)	±7	-80, +90	8 (3.6)
991-2	7.5 (30)	±18	-25, +90	10 (4.5)
992	15 (65)	±17	-90, +90	25 (11.5)
993	35 (150)	±17	-80, +90	65 (29.5)
994	75 (333)	±14	-90, +90	140 (63.5)
995	110 (500)	±6	-35, +90	310 (141)
995 HT	110 (500)	±14	-35, +90	330 (150)
996	170 (750)	±7	-30, +90	550 (250)
996 HT	170 (750)	±16	-30, +90	550 (250)
997	220 (1000)	±8	-30, +90	800 (363)
997 HT	220 (1000)	±16	-25, +70	800 (363)
998	330 (1500)	±7	-30, +90	1250 (567)
998 HT	330 (1500)	±14	-30, +90	1350 (613)
999	550 (2500)	±7	-25, +90	3300 (1497)
999 HT	550 (2500)	±15	-25, +90	3500 (1588)



Rod End Swivels

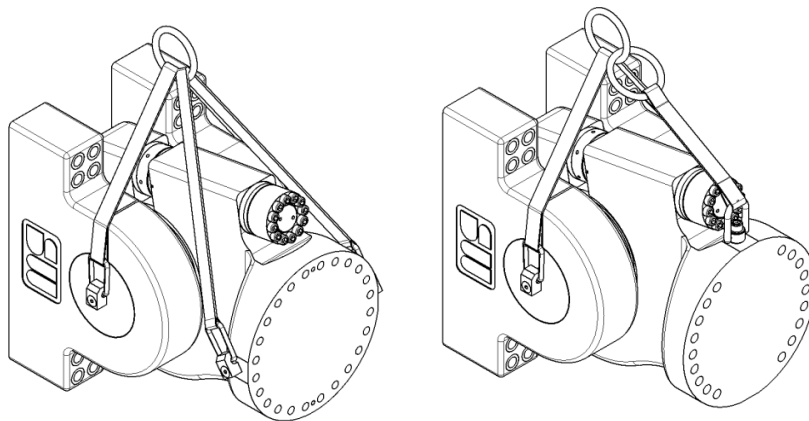
Model Number	Force Rating Kip (KN)	Tilt Angle Degrees	Swivel Angle Degrees	Weight Lbs (kg)
980	3.3 (14)	±10	-70, +90	4 (1.8)
981-1	5.5 (24)	±7	-80, +90	6 (2.7)
981-2	7.5 (30)	±18	-25, +90	6 (2.7)
982	15 (65)	±17	-90, +90	21 (9.5)
983	35 (150)	±17	-80, +90	56 (25.5)
984	75 (333)	±14	-90, +90	120 (55)
985	110 (500)	±6	-35, +90	330 (150)*
985 HT	110 (500)	±14	-35, +90	350 (159)*
986	170 (750)	±7	-30, +90	635 (288)*
986 HT	170 (750)	±16	-30, +90	635 (288)*
987	220 (1000)	±8	-30, +90	950 (431)*
987 HT	220 (1000)	±16	-25, +70	950 (431)*
988	330 (1500)	±7	-30, +90	1500 (681)*
988 HT	330 (1500)	±14	-30, +90	1600 (726)*
989	550 (2500)	±7	-25, +90	3300 (1497)
989 HT	550 (2500)	±15	-25, +90	3500 (1588)

* includes flange adapter and preload stud

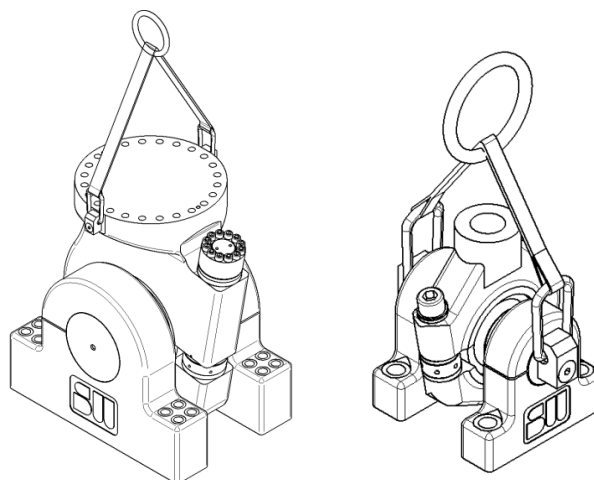
Handling

Shore Western swivels with a 15 kip rating and below are small and can be handled without lifting holes. Swivels with a 35 kip rating and above have threaded lifting holes in the end of the pins to aid in lifting. Larger sizes also have additional lifting holes in the tang.

When lifting the swivel, at least two lifting locations should be used. If lifting the swivel from a horizontal position (shown below), the two pin hoist ring locations as well as the tang lifting locations should be used. This will keep the swivel's tang level while lifting. Depending on the model, the tang lifting locations may be different. A sling may be used around the tang if using the tang lifting locations is not possible.



If the swivel is standing vertically, use the two hoist ring locations in the tang. The 35kip and 75 kip rated swivels only have hoist ring locations in the pin.



Refer to the supplied installation drawings for model specific thread sizes and hoist ring locations. Use caution when lifting swivels as the mounting brackets may tilt/swivel.

Shore Western Manufacturing Inc.

225 W. Duarte Rd. Monrovia, CA 91016

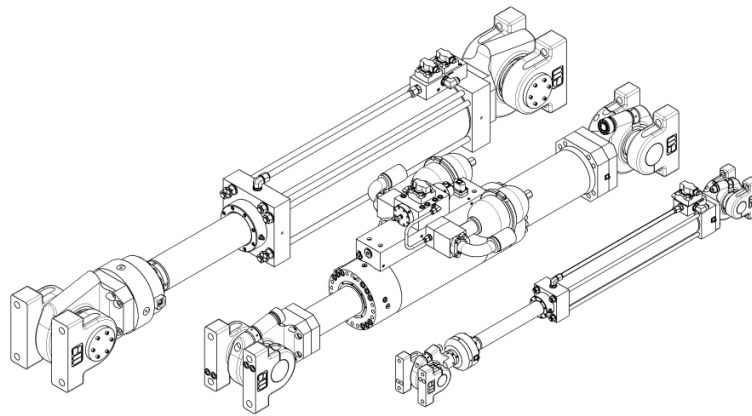
telephone 626-357-3251

www.shorewestern.com

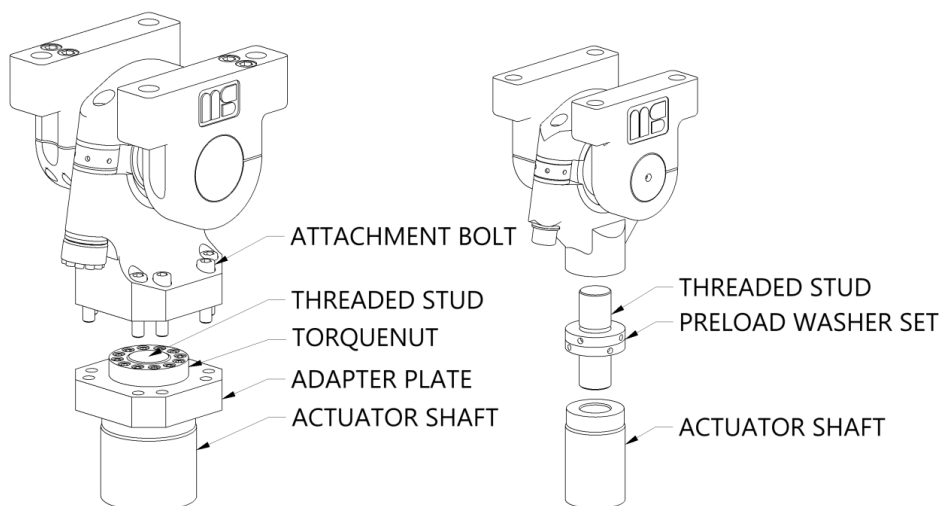
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Installation

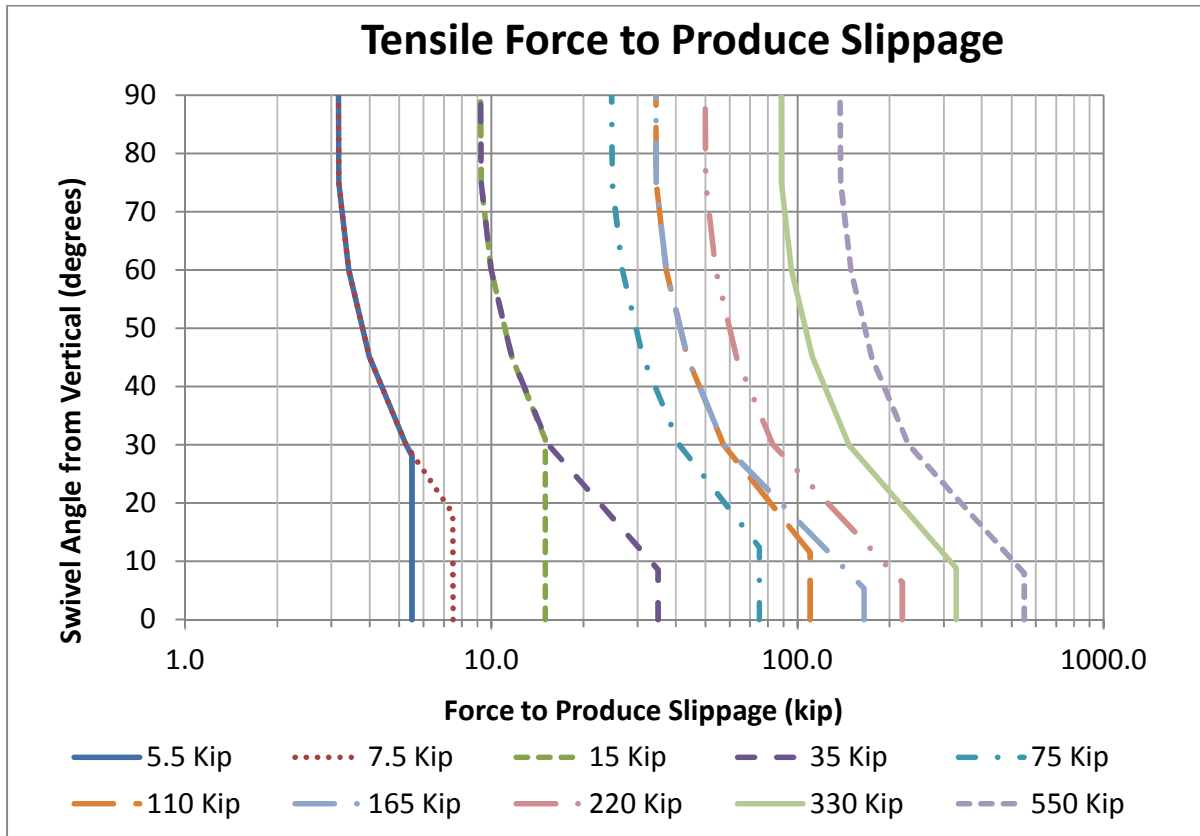
Shore Western 98X and 99X swivels are commonly installed on actuator assemblies. Generally, hydraulic actuators are shipped with the rod end and base end swivels already installed and preloaded. Thus the only installation required is to bolt the mounting brackets to a rigid support and/or testing rig. Models up to 220 kip are mounted using four socket head bolts. Above 220 kip, eight and sixteen socket head bolts are used to secure the mounting brackets.



Base end swivels are bolted to the actuator or object using through holes in the tang. Rod end swivels up to 75 kip require a stud, ramp washer set, and a way to preload the stud. With a preload force applied to the stud (usually an actuator pulling a tension load), the ramp washers are tightened to eliminate any clearance caused by the stud stretching under load. The preload force is then removed while the ramp washers maintain the preload in the stud.



If large swivel angles under load are encountered retaining plates may be required to stop the brackets from slipping. Determine the maximum angle and load for the swivel application and use the graph below to determine if slippage will occur.



Maintenance

General

Maintenance consists of periodic checks and adjustment of backlash. If the backlash is not properly adjusted, rapid bearing wear and inconsistent performance will occur. The bearings do not need to be lubricated as they are maintenance free.

Swivel bearing backlash adjustment

A 98X and 99X swivel mount utilizes a spherical bearing with a split outer race. Clearance (backlash) in the bearing is reduced by compressing the outer race inwards towards the inner spherical ball. The swivel is preloaded correctly when all clearance is removed and the outer race is lightly loaded against the spherical ball. Excessive preload or excessive backlash will cause premature wear and may affect test profile fidelity. For slow reversing loads or for tension only or compression only operation a small amount of backlash may be acceptable.

Checking swivel bearing backlash without system feedback:

1. Install the actuator in a test rig capable of actuator tension/compression loading.
2. Cycle the actuator from tension to compression load and observe the swivel.
3. The reversing actuator load will cause any backlash to shift from one side of the spherical bearing to the opposite side. If movement between the spherical bearing inner ball and outer race can be heard, seen, or felt, the swivel requires adjustment.

Checking swivel bearing backlash using system feedback:

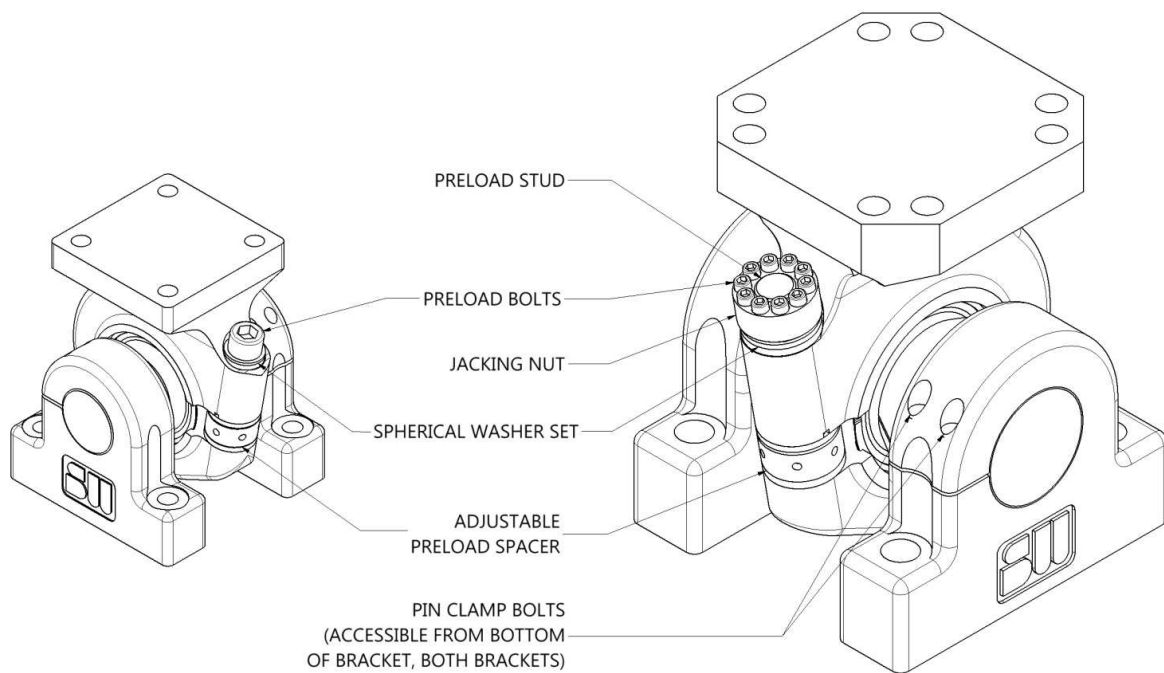
1. A load cell installed in the actuator line of force or an accelerometer mounted on the swivel tang under test is required for system feedback.
2. Install the actuator in a test rig capable of actuator tension/compression loading.
3. Cycle the actuator between tension and compression loading using a sine wave command and observe the load cell or accelerometer feedback signal.
4. Backlash in the load cell waveform will present as a flat line at load reversal. Backlash in the accelerometer waveform will present as a spike at load reversal.
5. If the feedback signal distortion is unacceptable the swivel requires adjustment.

NOTE: Excessive preload causes high friction and heat in the swivel bearing and cannot be checked by the above procedures. If excessive preload is suspected the swivel bearing backlash should be adjusted.

Swivel bearing backlash adjustment procedure:

1. Install the actuator in a test rig capable of actuator tension/compression loading.
2. Loosen the bearing preload bolt. If a torquenut is used, progressively loosen the jacking bolts in a star pattern so that one jack bolt isn't taking the entire load.
3. Adjust the bearing preload spacer to provide clearance between the spacer and swivel tang.
4. Tighten the preload bolt or torquenut to an initial value of 20% of full torque.
5. Expand preload spacer firmly against the swivel tang and the spherical washer set to remove clearance in the spacer threads.
6. Tighten the preload bolt or torquenut to full torque value. If a torquenut is used, progressively tighten the jacking bolts in a star pattern until all jacking bolts are at full torque value when checked more than once.
7. Check the swivel bearing backlash using a method listed above.
8. Repeat the backlash adjustment procedure increasing the preload bolt initial torque value in 10% increments until desired backlash is achieved.

NOTE: If backlash cannot be eliminated when tightening the preload bolt to an initial value of 70% of full torque, the bearing is worn and needs to be replaced.



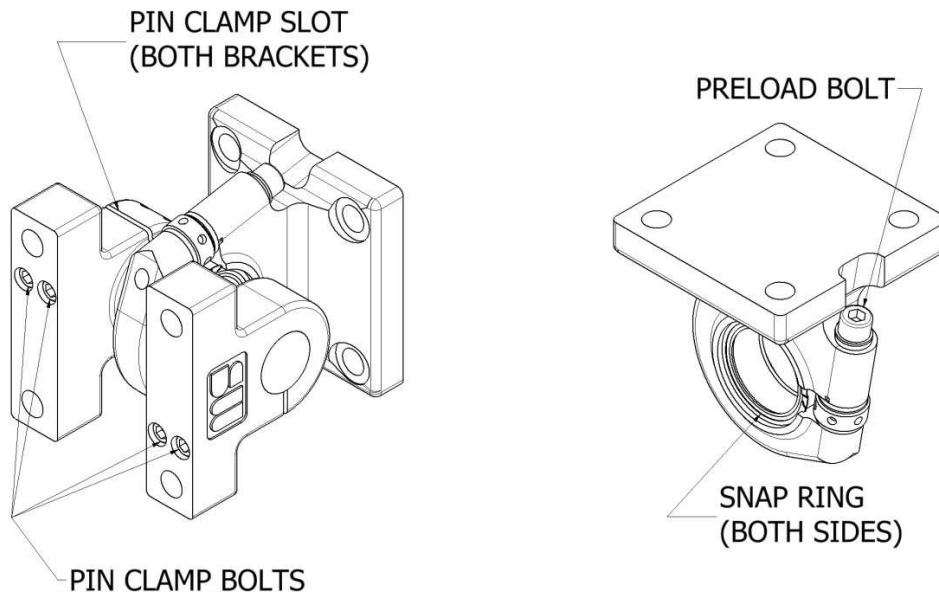
Swivel Pin Assembly Replacement

General

To replace the spherical bearing and pin assembly, both brackets will need to be removed from the pin and the bearing will need to be removed from the tang. After the installation of the new spherical bearing and pin assembly, the bearing backlash will have to be readjusted.

Disassembly

1. Remove the swivel from the force train (ie actuator, struts...).
2. Remove the preload on the spherical bearing by loosening the preload bolt.
3. Remove the pin clamp bolts located on the bottom both brackets. The brackets can then be gently tapped off with a hammer. If the brackets don't move, a wedge can be tapped into the pin clamp slots to loosen the pin in the bracket. Caution should be used to ensure the wedge isn't so long it can make contact with the pin as the pin may be damaged.



4. With the both brackets removed, remove both snap rings located on either side of the spherical bearing in the tang.
5. The spherical bearing and pin assembly should be gently tapped out of the tang. If the assembly doesn't move, the preload spacer can be adjusted using a spanner wrench to increase the clearance to allow the spherical bearing and pin assembly to be removed.

Assembly

1. Install one of the snap rings back into one of the two grooves in the tang.
2. Install the new spherical bearing and pin assembly into the tang from the opposite side of installed snap ring. The assembly should be pressed in until it seats against the installed snap ring. Once seated, the remaining snap ring can be installed.
3. Tap the brackets back on the spherical bearing and pin assembly ensuring that the cone side of the bracket is facing the spherical bearing. Each bracket should seat against the spherical bearing. Wedges may be used to make installation of the brackets easier. Caution should be used to ensure the wedge does not contact the pin as the pin can be damaged.
4. Once both brackets are seated against the spherical bearing, the pin clamp bolts can be installed from the bottom of the brackets. Anti-seize should be applied to the bolts before installation. All the bolts should be installed and snug before final tightening to grade 5 torque specs.
5. The preload bolt can be snugged down before being reinstalled into the force train. The bearing backlash will have to be adjusted.

Bolt Torque Values			
	Tang Preload Bolts	Pin Clamp Bolts	Force required for swivel motion ¹
Model Number	Torque Value lb-ft (N-m)	Torque Value lb-ft (N-m)	Torque Value lb-ft (N-m)
990	10 (13.5)	N/A	N/A
991-1	34 (46)	6 (8)	25 (34)
991-2	34 (46)	6 (8)	25 (34)
992	80 (108)	20 (27)	55 (75)
993	285 (386)	55 (75)	90 (122)
994	675 (915)	110 (149)	345 (468)
995	25 (34)*	300 (407)	600 (814)
995 HT	25 (34)*	300 (407)	600 (814)
996	45 (61)*	475 (644)	775 (1050)
996 HT	45 (61)*	475 (644)	775 (1050)
997	57 (77)*	600 (813)	1550 (2100)
997 HT	57 (77)*	600 (813)	1550 (2100)
998	152 (206)*	1000 (1355)	-
998 HT	152 (206)*	1000 (1355)	-
999	205 (278)*	850 (1152)	-
999 HT	205 (278)*	850 (1152)	-

Note: Torque values given for bolts lubricated with anti-seize.

* Torque values are for jacking bolts with anti-seize.

¹ Torque values are after backlash adjustment for motion in swivel axis around pin centerline and can vary depending on system requirements.

Contact Information

Shore Western Manufacturing, Inc.
225 West Duarte Road
Monrovia, CA 91016

Phone: 626-357-3251
Fax: 626-303-1582

support@shorewestern.com

info@shorewestern.com

Addendum

See attached addendum sheet