



TECHNICAL SERVICE INFORMATION BULLETIN

TSIB 09-03, rev A		December 22, 2009
TO:	All Operators	
TITLE:	ATG Articulated Joint Maintenance	
APPLICABILITY:	All ATG 60ft New Flyer Buses	

It has come to the attention of New Flyer Customer Service, that some transit operations are not adhering to the mandatory articulated joint preventative maintenance. This bulletin will supercede any related information found within your present Service manual schedules and has been approved by ATG Autotechnik GMBH. New Flyer considers these guidelines mandatory and will void warranty if not followed. It is highly recommended this bulletin be visible in the shops and reviewed by the personnel working with the joint components. This bulletin includes the following sections:


- Maintenance Interval Table
- Lubrication
- Procedures and Intervals
- Hydraulic System Test
- Electrical System Test
- Bolt Torques
- Special Tools

Note – The bolt torques will vary depending on the configuration of your 60-foot coach. The artic joint configurations will either include a transition plate (also referred to as a flexplate) or not. The transition plate was introduced to eliminate excessive vibration which is present in some coaches depending on the roof weight distribution. This transition plate attaches the ATG joint and rear chassis.

It is New Flyer's expectation that all our customers are properly maintaining the articulated joint in accordance with this Technical Service Information Bulletin.

Direct all inquires regarding this bulletin to:

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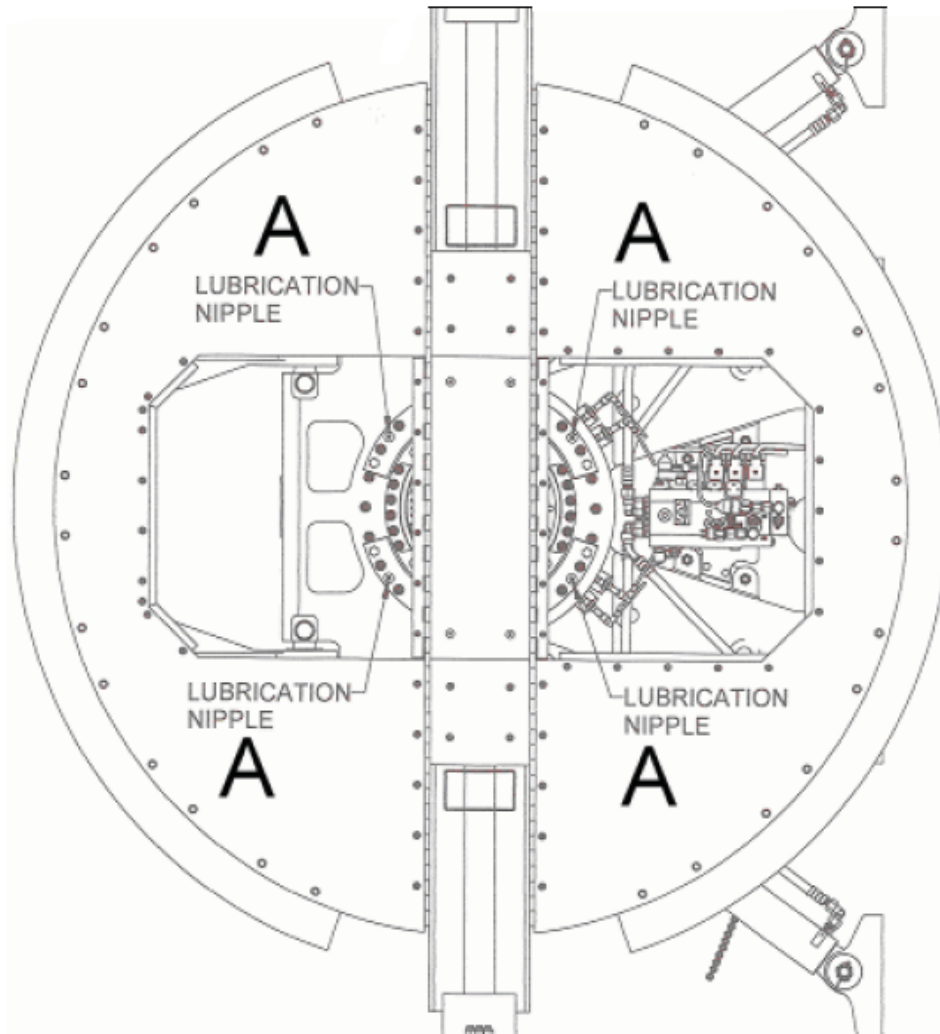


SECTION 1 – ARTIC JOINT PREVENTATIVE MAINTENANCE TABLE

ARTIC JOINT PREVENTATIVE MAINTENANCE GUIDE		
DESCRIPTION	INTERVAL	SECTION
Lubricate joint cover plate	Monthly or every 5,000 miles (whichever comes first)	2.0
Lubricate shafts for hoop beam rollers with spray lubricant	Monthly or every 5,000 miles (whichever comes first)	2.0
Clean joint area	Monthly or every 5 000 miles (whichever comes first)	3.1
Check the bellows mounting cable and seal to ensure that they are firmly seated in the mounting J-channel	Every 7,500 miles	3.2
Lubricate roof struts shafts	Every 6 months or 15,000 miles (whichever comes first)	2.0
Lubricate the main bearing assembly through the recessed holes on the yoke plates	Every 6 months or 15,000 miles (whichever comes first)	2.0
Electrical system - visual check	Every 6 months or 15,000 miles (whichever comes first)	4.0
Clean artic joint bellows	Every 6 months	3.16
Inspect the wrist joints	Yearly or if the driver complains of noise coming from the turntable area when driving thru a dip in the road	3.4
Inspect main bearing	Yearly or every time a visual check of the bolted connections is carried out (whichever comes first)	3.11
Electrical system - functional check	Yearly or every 30,000 miles (whichever comes first)	4.0
Hydraulic system visual and system pressure checks	Yearly or every 30,000 miles (whichever comes first)	5.0
Inspect bump stops for wear	Yearly	3.3
Replace lock bolt	Yearly	3.5
Inspect the wear plates on the cover doors and replace as required	Yearly	3.6
Check the centre hoop elastic bearings for rubber deterioration	Yearly	3.7
Check steering gears	Yearly	3.8
Check hoses for deterioration, dents or kinks	Yearly	3.9
Inspect center hoop bearing rollers	Yearly	3.10
Check torque stripe alignment on chassis connection bolts	Yearly	6.0
Replace center hoop bearing rollers	Every 90,000 miles	3.10
Check main bearing play	Every 3 years or 90,000 miles (whichever comes first)	3.12
Retorque bolts	Every 3 years	6.0
Replace wear plates	Every 150,000 miles	3.17
Replace hydraulic oil	Every 5 years or 150,000 miles (whichever comes first)	5.0
Inspect center hoop bearing	Every 240,000 miles	3.15
Replace wrist joints	Every 240,000 - 300,000 miles	3.14

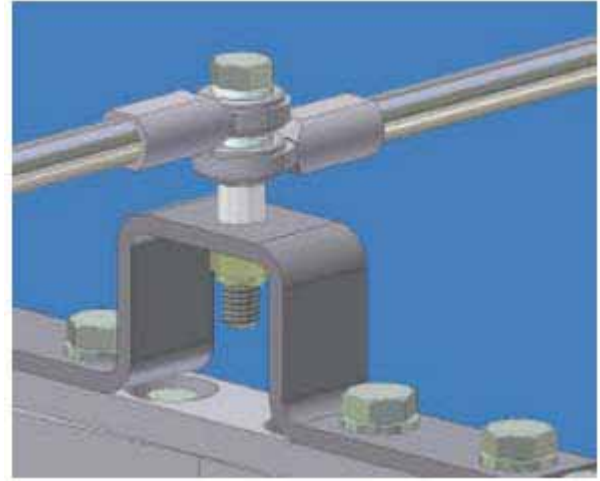
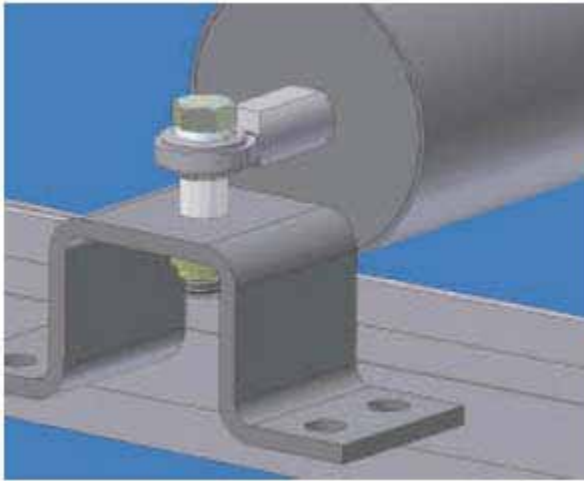
SECTION 2 – LUBRICANTS

The following illustration shows the greasing points. The articulation has four lubrication points. These are all located in recessed holes on the yoke plate. These points can be reached through the open trap doors in the aluminum cover plates. The joint should be lubricated every 6 months or 15,000 miles (whichever comes first).



In addition the roof struts cylinders that hold the top of the center hoop in the middle position when the articulation goes through a vertical angle are located on the roof. The internal workings of the struts are maintenance free. The strut rods may require lubrication to prevent them from squeaking. The strut manufacturer does not specify any particular lubricant. ATG recommends using a grease with the consistency classification NLGI 2, which is water resistant. The roof struts must be lubricated every 6 months or 15,000 miles (whichever comes first).

The end shafts for the hoop beam rollers should be lubricated with a spray lubricant monthly or every 5,000 miles whichever comes first. Make sure no lubricant comes in contact with the roller or surface that the roller slides on.

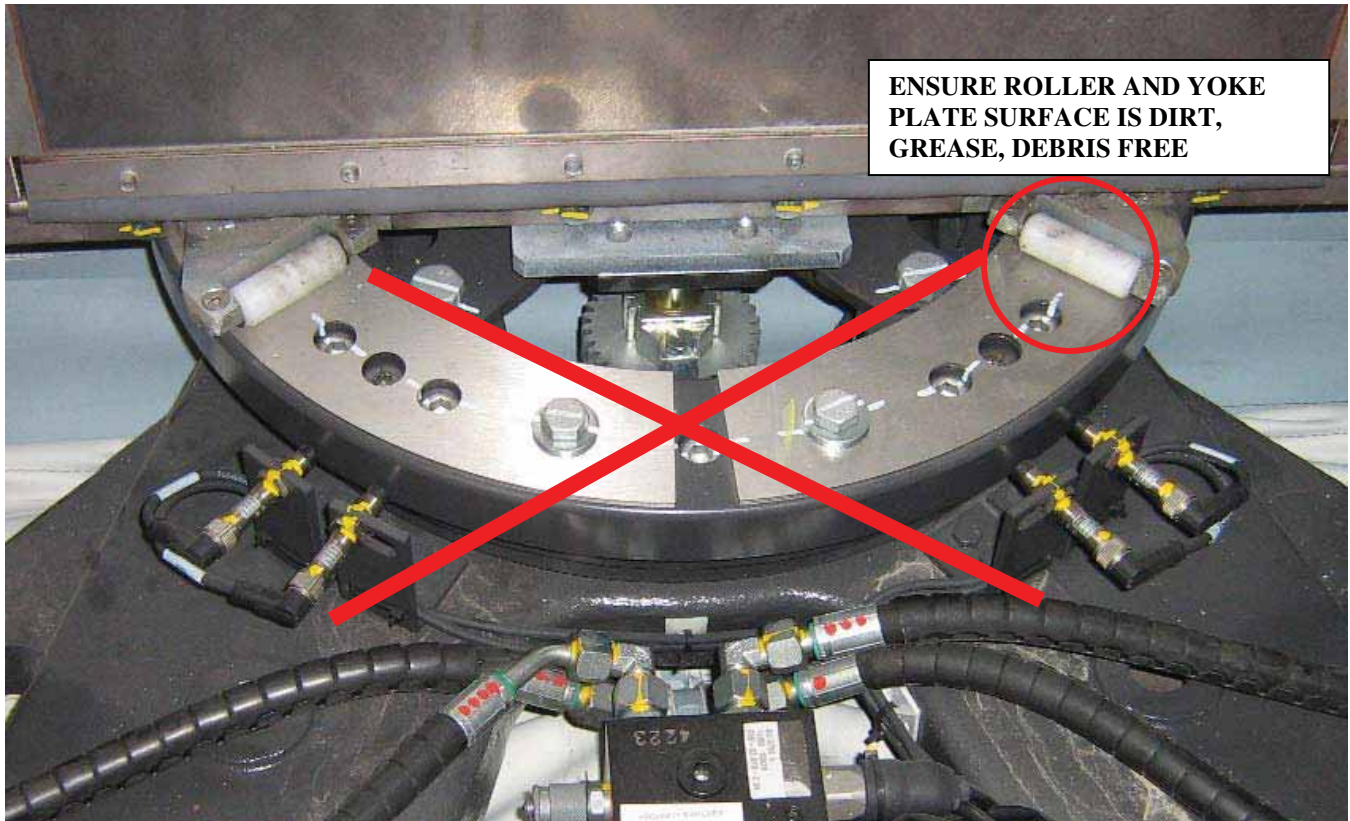


Grease or equivalent needs to be applied to the flooring grooves where the cover plate wear plates slide, as shown in the figure below.



JOINT COVER PLATE LUBRICATION INTERVAL: MONTHLY OR EVERY 5,000 MILES (WHICHEVER COMES FIRST)

DO NOT GREASE THE YOKE PLATES WHERE THE ROLLERS MAKE CONTACT



The following tables include all the approved lubricants.

APPROVED LUBRICANTS	
LUBRICANT	MANUFACTURER
Aralub HLP2	ARAL
Rhus L 474/2	MOTUL/BECHEM
Energrease LS-EP2	BP
Grease LMX	CASTROL
Epexa 2/Epexelf 2	ELF
Beacon EP2	ESSO
Mobilux EP2	MOBIL
Calithia EP2	SHELL
Lubriplate No. 1200-2	LUBRIPLATE
SPHEEROL EPL 2	CASTROL

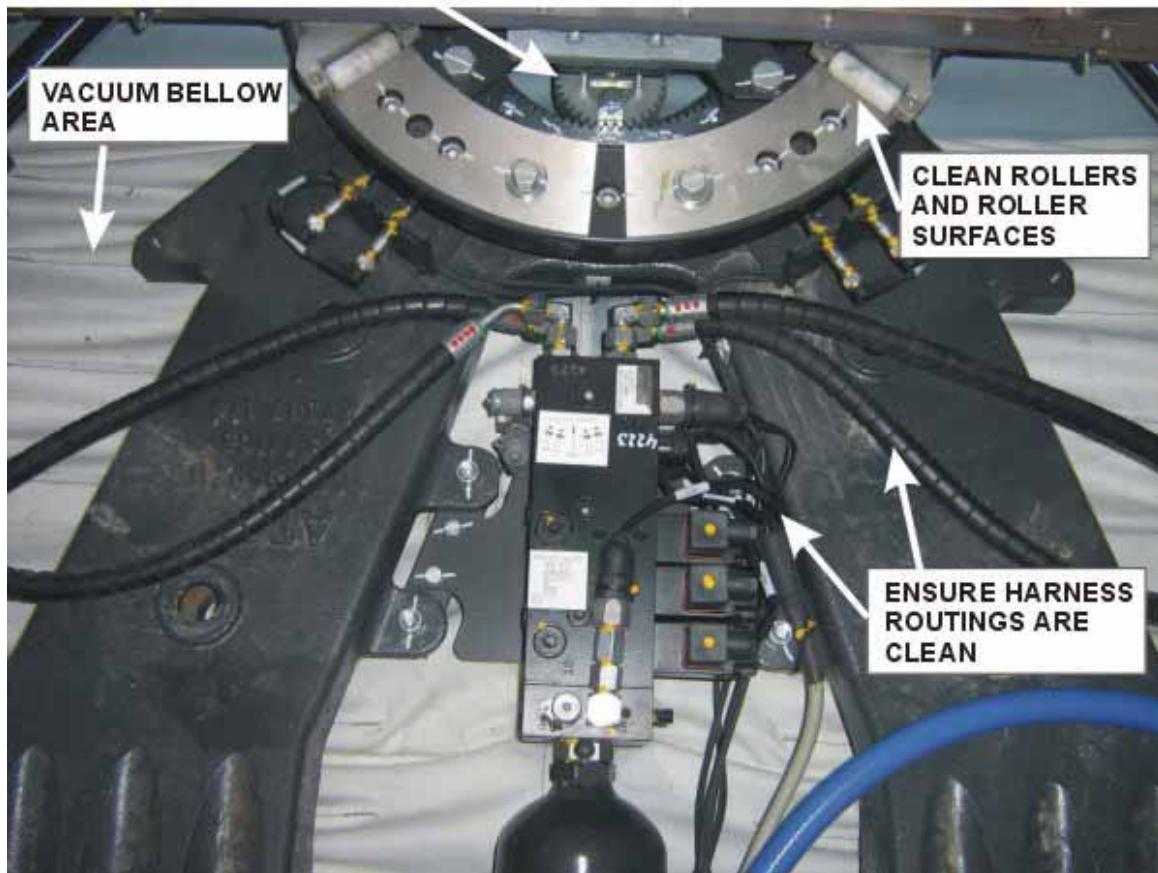
SECTION 3 – PROCEDURES AND INTERVALS

SECTION 3.1 – CLEAN JOINT AREA

Interval: Monthly or every 5,000 miles (whichever comes first)

- 1) Open the front and rear access doors on the joint cover plates.
- 2) Clean any dirt and debris on the gear wheels, yoke plates and surrounding areas.
- 3) Ensure nylon rollers are clean, rolling freely and making contact with the yoke plates.

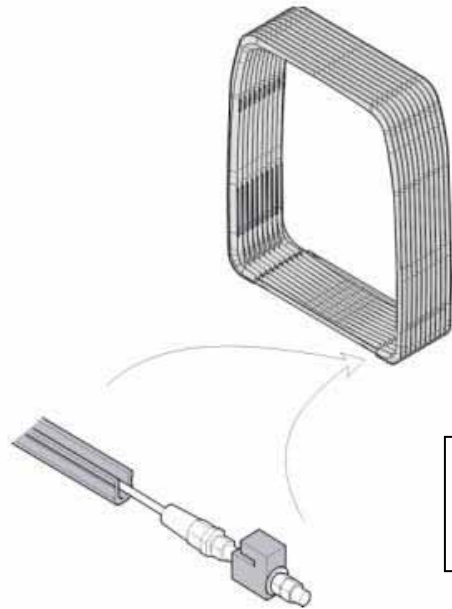
CLEAN GEARS



SECTION 3.2 – INSPECT BELLOWS MOUNTING CABLE AND SEAL

Interval: Every 7,500 miles

Check the bellows mounting cable and seal to ensure that they are firmly seated in the mounting J-channel and center hoop J-channel. Check stud terminal nuts at each end of the bellows mounting cable stud terminal for looseness. These checks can be performed from outside the coach.



**J-CHANNEL AND LOCKING
NUT CAN BE OBSERVED
FROM THE OUTSIDE**

SECTION 3.3 – INSPECT BUMP STOP FOR WEAR

Interval: Yearly

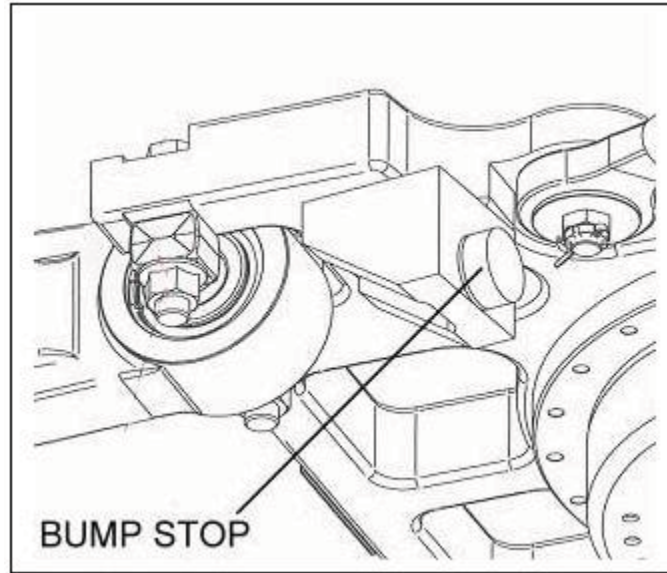
The maximum horizontal angle is limited by a mechanical bump stops which are located on the yoke plate behind the wrist joints. These bump stops are equipped with replaceable rubber stoppers. These are held in place with a lock nut. These are wear parts and need to be replaced when worn.

Inspecting bump stop

- 1) Drive the bus over a pit or hoist into the air.
- 2) Remove the bottom section of the bellows.
- 3) Check both sides of each bushing.

Replacing a bump stop

- 1) Drive the bus over a pit or hoist into the air.
- 2) Remove the bottom section of the folding bellows.
- 3) Remove the lock nut that holds the bump stop to the yoke plate.
- 4) Apply Loctite to the threads on the new bump stop and tighten the nut to 20 Nm.

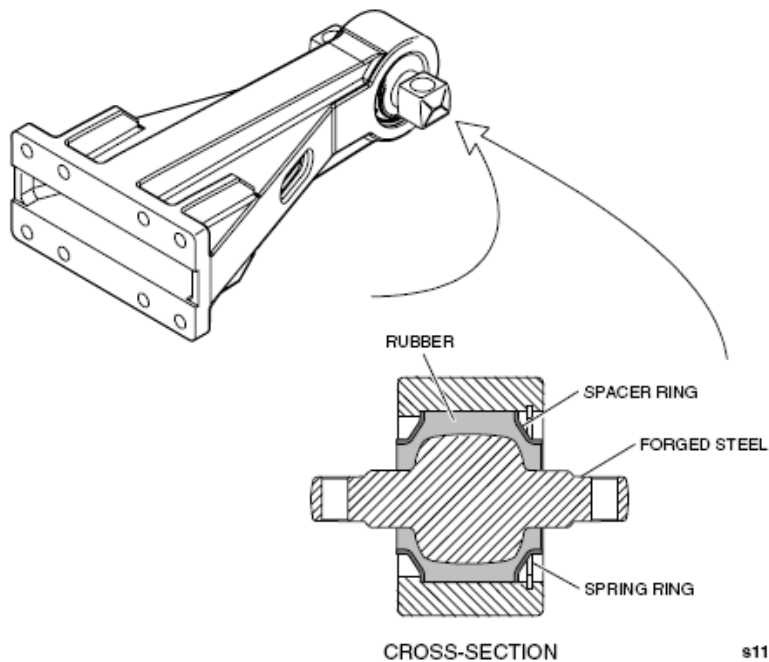


SECTION 3.4 – INSPECT WRIST JOINTS

Interval: Yearly*

* The wrist joints should be inspected once a year and if the bus operator complains of noise coming from the turntable when driving through a dip in the road or over the brow of a hill.

- 1) Drive the bus over a pit or hoist into the air
- 2) Remove the bottom section of the bellows
- 3) Check both sides of each bushing
- 4) If the spring ring is damaged or missing, or the rubber has deteriorated replace the wrist joint

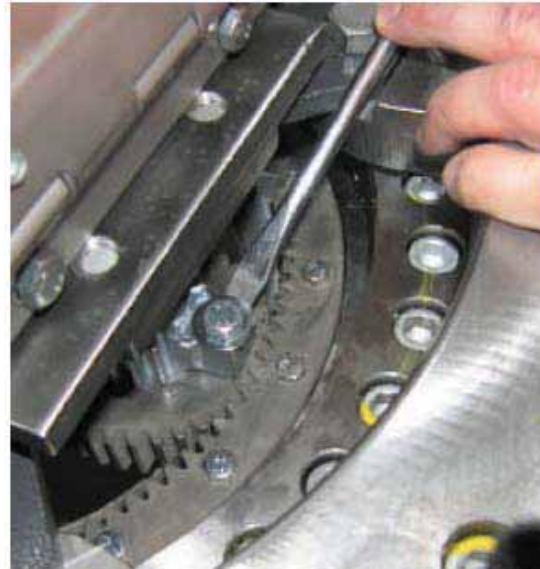


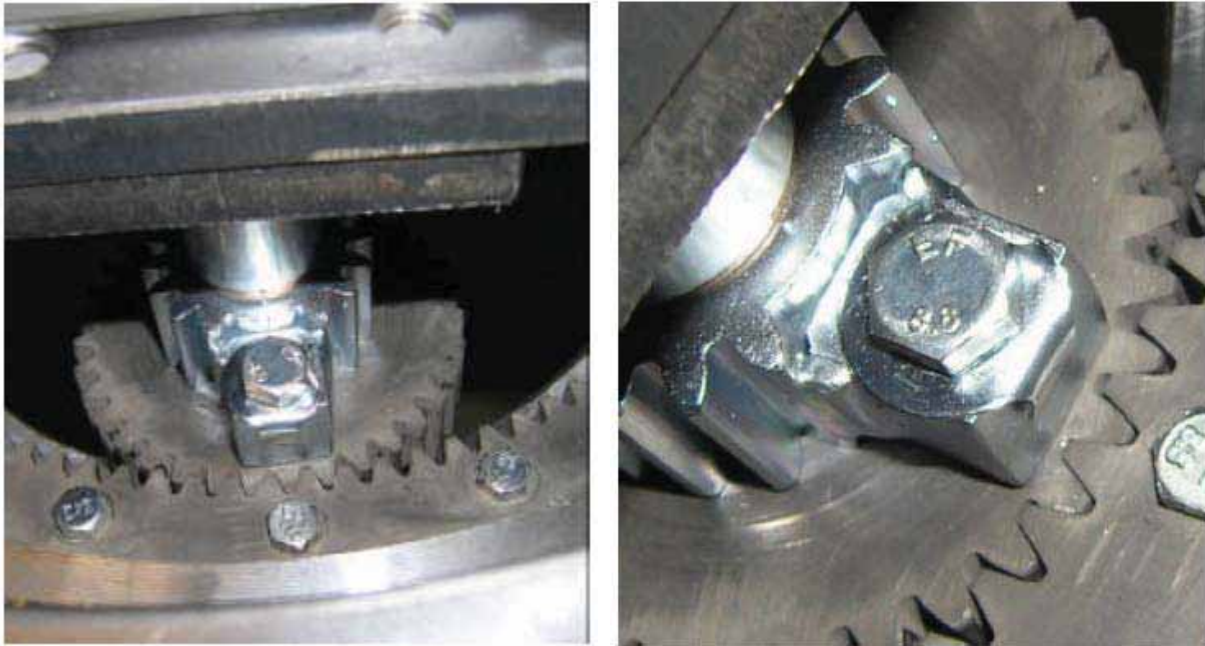
SECTION 3.5 – REPLACE LOCK BOLT

Interval: Yearly

If the lock bolt shears, the center hoop and turntable cover plates will not be centered on the articulation. The articulation should be straight before attempting to replace the bolt.

- 1) Open the access flap on the rear cover plate.
- 2) Access the hexagonal head of the bolt by bending down the side of the lock washer that prevents the bolt from backing its way out.
- 3) Align both gear wheels by centering the center hoop beam.
- 4) It may be necessary to use a punch to drive the bottom half of the pin from the lower gear wheel.
- 5) Before inserting a new lock bolt check that the gear wheels engage smoothly by pushing the center hoop back and forth as far as the folding bellows will allow. Gear wheels that bind or show signs of damage should be replaced
- 6) Torque bolt to 15ft-lb.



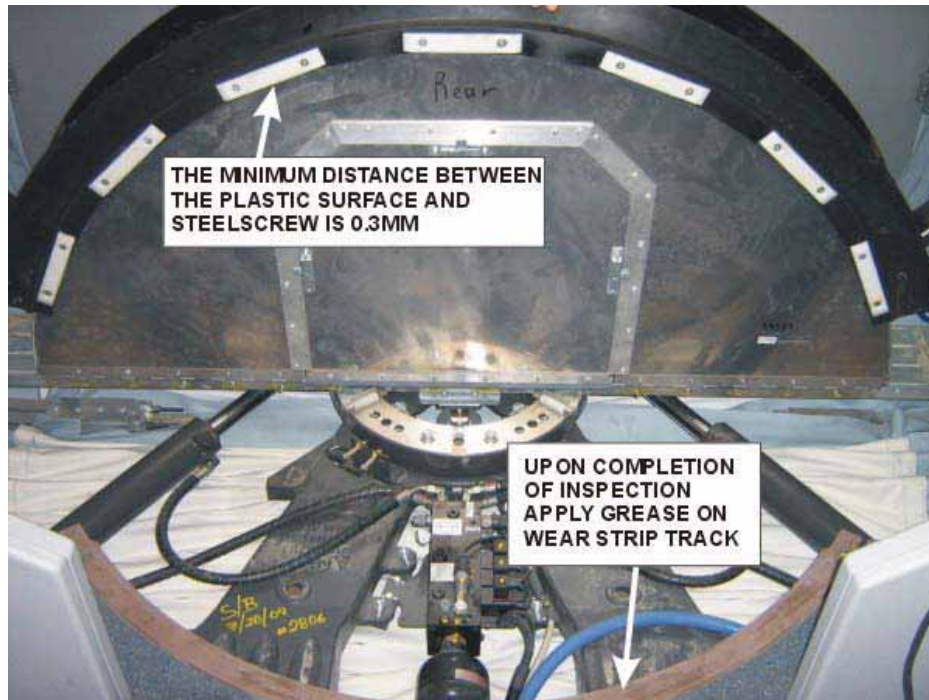


SECTION 3.6 – INSPECT THE WEAR PLATES ON THE ACCESS COVER DOORS

Interval: Yearly

To inspect the wear plates on the backside of the joint access doors:

- 1) Remove the turntable joint seats.
- 2) Remove the screws holding the bellows to the side half walls
- 3) Pull bellows in together, and raise access joint cover.
- 4) Inspect the backsides of cover plates. If the strips have worn down to the head of the mounting screw, they should be replaced. The minimum distance between the plastic surface and steel screw is 0.3mm.



SECTION 3.7 – CHECK THE CENTER HOOP ELASTIC BEARINGS

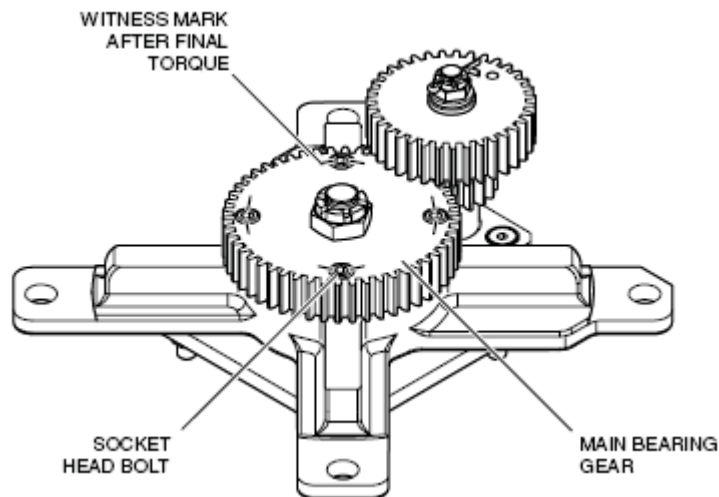
Interval: Yearly

These bearings should be checked once a year. If the rubber shows signs of deterioration, replace the bearings.

SECTION 3.8 – CHECK STEERING GEARS

Interval: Yearly

Steering gears should be checked for cleanliness, broken teeth, proper gear meshing and torque mark existence on the gears. Gears can be serviced by opening the joint access cover.





SECTION 3.9 – CHECK HOSES FOR DETERIORATION, DENTS OR KINKS

Interval: Yearly

The hoses should be checked for wear. Hoses that show signs of deterioration should be replaced. The hoses should not have dents or kinks. Hoses can be checked by opening the false ceiling at the hoop.



SECTION 3.10 – CHECK CENTER HOOP ROLLERS

Interval: Inspect yearly and replace every 90,000 miles

Clean and inspect the center hoop rollers and ensure they are performing properly

Replacing the center hoop rollers

- 1) Remove the seats from the turntable
- 2) Place two bottle jacks under the center hoop. The jacks should be located inside the radius of the corners of the hoop
- 3) Remove the four counter sunk screws that hold the center of the cover plate to the center hoop beam
- 4) Remove the aluminum cover plate from the center hoop beam
- 5) Loosen the four lock nuts that hold the center hoop crossbeam to the steering assembly. Loosen to the point where the plastic part of the lock nut is no longer engaged with the thread. Do not remove the nuts
- 6) Open both access flaps and secure them in the open position using a cable tie wrap
- 7) Ensure that the center hoop and the turntable cover plates are not loaded before proceeding.
- 8) Jack up the center hoop 5 mm (1/5") with the bottle jacks. The hoop only needs to be raised enough so that the plastic rollers can be turned easily by hand
- 9) Do not walk through the articulation when the hoop is raised, use the bus doors to get from one side of the turntable to the other. Kneel on the car end bodies to perform the following steps
- 10) The axles that hold the rollers onto the hoop are equipped with spacer plates to compensate for tolerances associated with the production (welding) of the center hoop beam. There are two spacer types, a 0.1 mm spacer and a 0.5 mm spacer. The total spacer thickness is stamped onto the housing near the roller
- 11) Loosen the inboard counter sunk screw. Remove the outboard counter sunk screw.
- 12) Swivel the axle with the roller free of the housing, take care not to loose the spacers between the axle and the housing. These spacers sometimes stick to the housing
- 13) Remove the inboard screw

- 14) Once the screw has been removed turn the axle through 90° to avoid loosing the spacers. There are four washers mounted on the axles, two per side between the roller and the housing.
- 15) Ensure that these washers are reused with the replacement roller
- 16) Pick up the axle and place two washers on the shaft. Lubricate the axle with a high performance/ high pressure grease
- 17) Place the new roller onto the axle shaft and then the remaining two washers.
- 18) Place the correct number of spacers onto the inboard side of the axle
- 19) Carefully maneuver the shaft with spacers under the inboard mounting hole and insert the screw. Do not tighten home
- 20) Place the correct number of spacers onto the outboard side of the axle and slide into place
- 21) Line up the spacers using a suitable tool Insert the screw and then hand tighten both screws
- 22) Drop the hoop beam back down onto the yoke plate and remove the bottle jacks from below the center hoop
- 23) Tighten down the four lock nuts that clamp the center hoop beam to the steering gear. Torque the nuts to 60 Nm
- 24) Remove the lock screw from the steering gear
- 25) Rotate the hoop assembly back and forth by applying pressure to the seat mounting posts. The wheels should roll smoothly on the yoke plate
- 26) Once the hoop has been set so that all four wheels have contact and rotate freely when the hoop is turned replace the lock screw and secure with the lock washer



Section 3.10 - Step 1



Section 3.10 – Step 4



Section 3.10 – Step 5



Section 3.10 – Step 11



Section 3.10 – Step 14



Section 3.10 – Step 16



Section 3.10 – Step 20



Section 3.10 – Step 24

SECTION 3.11 – INSPECT MAIN BEARING

Interval: Yearly or every time a visual check of the bolted connections is carried out (whichever comes first)

Bus should be hoisted with the bottom section of the bellows removed, enough to have full visibility of the outside ring of the bearing between the support frame and yoke plate. The bearing seal between the inside and outside rings should be visible too. After greasing the bearing, take a rag and remove the excess grease and dirt from outside the bearing. Check the outside circumference of the bearing for signs of material deterioration or cracking. Ensure that the grease seal is not damaged or missing. Check the condition of the inside ring of the bearing by viewing through the access doors in the cover plates and check for area around the filling points for cracks. If the bearing shows any signs of deterioration, then the bearing play must be checked (Section 3.12).

SECTION 3.12 – CHECK MAIN BEARING PLAY

Interval: Every 3 years or 90,000 miles (whichever comes first)

- 1) Lift the bus on a hoist and open the bellows under the support frame.
- 2) Wipe off all of the grease around the gap between the outside (top) and inside (bottom) bearing rings.
- 3) Inspect the outside bearing ring for deformation in the area around the gap. The inside ring should have square edges.
- 4) **If the bearings show any sign of deformation the bearing must be replaced.**
- 5) Lower the bus to the ground.
- 6) Apply a bottle jack to the front of the support frame.
- 7) Install a dial gauge between the top of yoke plate and the top of the inside ring of the main bearing.
- 8) Jack up the cast frame using the bottle jack. Note the bearing movement on the dial gauge.
- 9) Lower the bottle jack and reposition to a point under the yoke plate without interfering with the dial gauge.
- 10) Jack up the yoke plate with the bottle jack. Note the bearing movement, if any on the dial gauge.
- 11) Return the bottle jack to the first lifting point under the cast frame and jack it up once again.
- 12) If the total movement noted on the dial gauge exceeds 0.007in the **bearing must be replaced.**
- 13) Remove the bottle jack.
- 14) Lubricate the main bearing by applying grease to the four lube zerks that are located on the top of the yoke plate. Keep applying grease until it escapes from the gap between the main bearing rings.
- 15) Scrape a sample of the escaping grease from the bearing and check its consistency. **If it is rusty in color and/or has the consistence of rubbing compound the bearing must be replaced.**
- 16) In order to ensure a thorough greasing of the bearing, re grease the four lube points with the articulation at maximum angle left and at maximum angle right



Section 3.12 – Step 2



Section 3.12 – Step 6



Section 3.12 – Step 12

SECTION 3.13 – REPLACE MAIN BEARING

Interval: Only required if the main bearing failed the criterion in Section 3.12

- 1) The bus should be parked on a flat surface in the workshop, preferably over a pit.
- 2) Support the rear section of the bus with two floor jacks located at the bulkhead behind the turntable and two further floor jacks behind the rear axle as close to the rear bumper as possible
- 3) Remove the bolt that connects the two roof struts to the center hoop on the roof of the bus. *Retain the spacer and take care to reinstall in the correct position when re assembling.*
- 4) Swivel the roof struts through 180° so that they rest on the roof of the front and rear car bodies.
- 5) Remove the folding bellows, false ceiling, removing the hip boots, remove the flexible floor kit, loosen the cable and release from the mounting channel, removing the bellows and seal from the mounting channel
- 6) Remove the false ceiling strut from the center hoop by disconnecting it from the angle brackets. Leave the angle brackets connected to the hoop.
- 7) Disconnect the clamp from the center hoop by removing the nut at the bottom of the bracket. Note the number and position (top or bottom) of washers before removing the lock nut.
- 8) Leave the hoses fixed in the clamp. Mark the hoses to identify which ends are facing the front.
- 9) Disconnect all lines at the bulkheads at both ends of the articulation.
- 10) Remove the complete hose assembly and clamp from the bus, seal up the hose ends and the bulkhead connectors to prevent dirt intrusion.
- 11) Remove the turntable seats. The seats are connected to the center hoop cross beam with 8 bolts
- 12) Flip open the cover plates and remove the shear screw. **Replace the screw before the bus is put back into service**
- 13) Remove the bolts that hold the cover plate hinges to the center hoop cross beam.
- 14) Remove the lock nuts from the threaded studs and remove the cover plates. **The plates are not symmetrical check that they are clearly marked FRONT and REAR before removing**
- 15) Remove the center aluminum section which is bolted to the hoop cross beam with four counter sunk screws
- 16) Disconnect the bottom strut from the center hoop. This is the part of the hoop located directly below the articulation
- 17) Disconnect the clamps that hold the elastic bushings to the center hoop cross beam. Remove the air hose from the center hoop cross beam. Remove the center hoop assembly from the bus
- 18) Remove the four lock nuts that hold the center hoop cross beam to the steering gear. These bolts can be accessed through holes in the top of the cross beam near the center of the articulation. Pull the cross beam clear of the articulation and replace the nuts on the studs to protect the threads.
- 19) Bleed off the hydraulic system pressure. Open the four bleed valves on the cylinders and connect bleed lines between the valves and a container to catch the oil
- 20) Remove the pins holding the cylinder rams to the yoke plate.
- 21) Extract the cotter pin from the castle nut and pull the pin free of the yoke plate.
- 22) Pull the cylinders free of the yoke plate, compress them completely to protect the rams and tie down to the protruding sections of the cast frame.

- 23) Remove the plastic caps from the wrist joint – yoke bolts (only mounted on the outside bolt heads) and then remove the bolts
- 24) Remove the 24 socket head bolts that connect the yoke plate to the bearing
- 25) Lift the yoke plate off the bearing. 2 man job
- 26) Remove the o rings from the grease gangways on the top of the bearing
- 27) Remove the 24 socket head bolts that hold the bearing to the cast support frame
- 28) Lift the bearing clear of the cast support frame
- 29) Thoroughly clean the bearing seat on the cast support frame
- 30) Unpack the new bearing and clean the mating surfaces
- 31) Carefully place the new bearing onto the cast support frame, line up the holes in the outside ring of the bearing with the tapped holes in the cast support frame
IMPORTANT: DO NOT REUSE THE SOCKETHEAD BOLTS THAT CONNECT THE BEARING TO THE CAST SUPPORT FRAME AND TO THE YOKE PLATE
- 32) Installation: Follow the above procedure in reverse
- 33) Ensure that the o rings are in place and not damaged when replacing the yoke plate
- 34) See Section 6 for bolt torque information and bolt tightening sequence



Section 3.13 – Step 20



Section 3.13 – Step 24



Section 3.13 – Step 24



Section 3.13 – Step 33



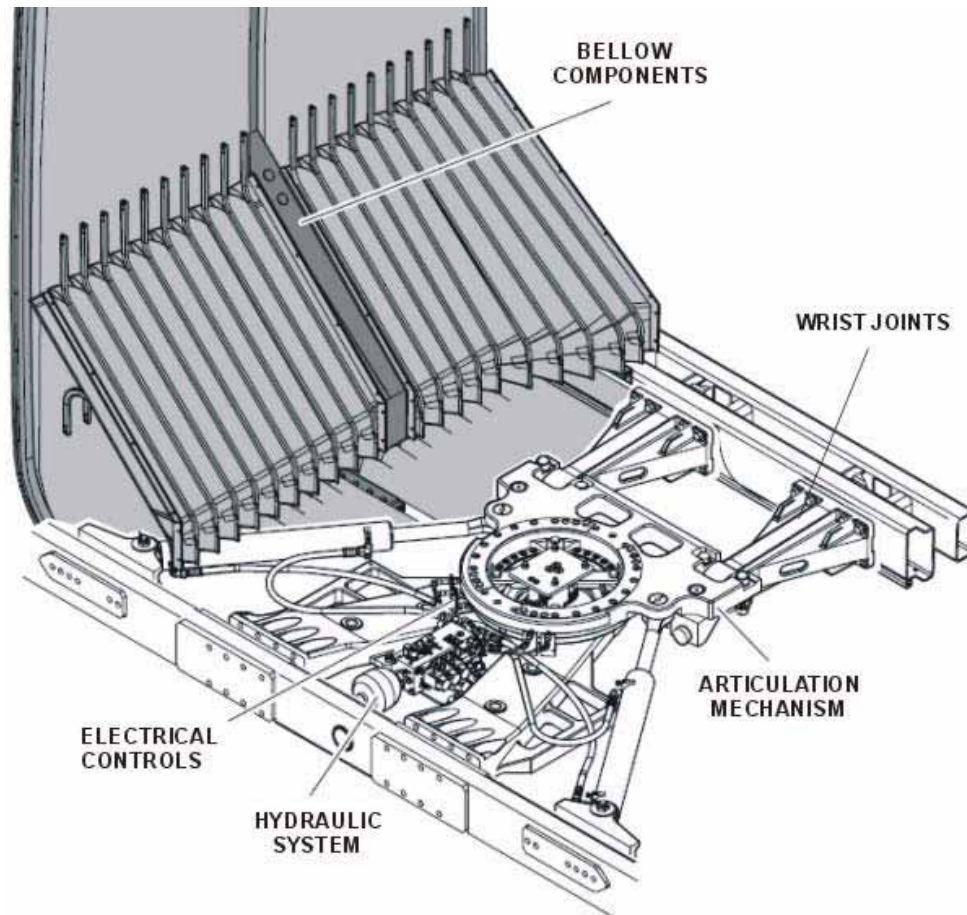
Section 3.13 – Step 33

SECTION 3.14 – REPLACE WRIST JOINTS

Interval: Every 240,000 to 300,000 miles

The wrist joints should be replaced in pairs.

- 1) Bleed off the hydraulic system pressure.
- 2) Remove the pins that hold the hydraulic cylinders to the body brackets. A cylinder pin holder (NF PN 6353636) can be used to hold the pins when removing the castle nuts.
- 3) Remove the cylinders from the body brackets and use tie wraps to tie to the articulation, position the cylinders so that the eye bolts can be screwed into the cast frame. It is not necessary to remove the cylinders on articulations where the cylinder body brackets are bolted to the main cast support frame.
- 4) Disconnect the electric harness from the hydraulic block and the position switches. All electrical connections are labeled, these labels should be checked and if any are found to be missing the connections should be marked to allow correct reassembly.
- 5) Connect eye bolts (NF PN 6357775) to the four lifting points on the articulation. Support the articulation by connecting a suitable hoist to the eye bolts
- 6) **IMPORTANT** The rear vehicle should not hang from the hoist. It should still rest on the floor jacks.
- 7) Remove the front bellows from the center hoop. It is not necessary to remove the rear bellows from the center hoop. The roof mounted hoses can remain installed.
- 8) Remove the shear bolt from the steering gear, is very important that the pin is replaced after the work has been completed.
- 9) Open and remove the front aluminum cover plate
- 10) Support the wrist assembly from below before removing the mounting bolts
- 11) Remove the bolts that hold the wrist joint to the yoke plate. The outside bolts have plastic protective covers. These covers must be replaced when re-assembling
- 12) Remove the bolts that hold the wrist joint to the front bulkhead and remove the wrist joint assembly from the bus
- 13) Installation: Reverse the above procedure.



SECTION 3.15 – INSPECT CENTER HOOP BEARING

Interval: Every 240,000 miles

1. Remove the steering gear assembly from the vehicle.
2. Remove the 50-tooth main bearing gear.
3. Clean all of the existing grease that is packed into the bearing housing.
4. Inspect the bearing for wearing or damage.
5. Replace the bearing only if worn, corroded, or damaged, otherwise repack the bearing housing with new grease.

Note: The center hoop bearing itself is sealed and cannot be lubricated.

SECTION 3.16 – CLEAN ARTIC JOINT BELLOWS

Interval: Every 6 months

Open and remove the flexible floor and clean out debris or dirt. Use common household, non-bleach cleaning solutions like simple green.

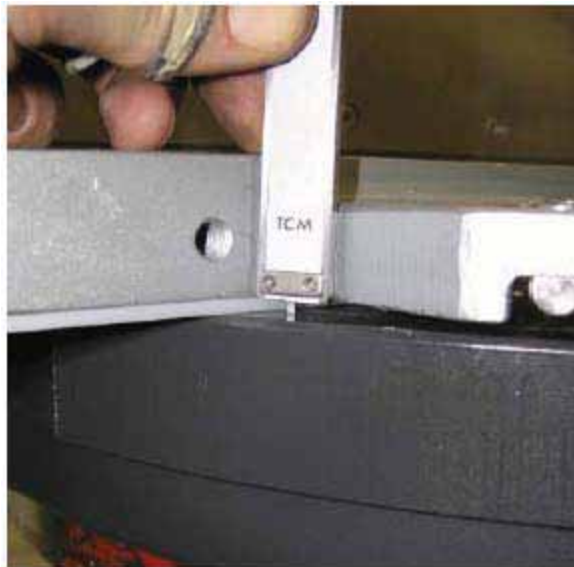


SECTION 3.17 – REPLACE THE WEAR PLATES

Interval: Every 150,000 miles

The rate of wear is dependent on the service conditions; the presence of fine sand in the bus will accelerate the wear. Check the wear by measuring the thickness of the wear plate between the centre hoop crossbeam and the yoke plate. The wear plates are made from 2.9mm thick plastic and the minimum thickness is 1.5mm and should be replaced if below this value.

1. Drive the bus over a pit.
2. Remove the seats, the front and rear aluminum cover plates and the aluminum centre piece that is bolted to the centre hoop cross beam.
3. Remove the lock/shear bolt that holds the centre hoop steering together. The bolt is located at the rear of the turntable inside the main bearing and is equipped with a lock washer to prevent accidental loosening.
4. Loosen the four lock nuts that hold the cross beam to the joint assembly. These nuts are accessible through four holes in the top of the beam. Do not remove the nuts completely.
5. Support the centre hoop from below at each side where the centre section is bolted in using two bottle jacks. Rise up the hoop (by maximum 5 mm) until the centre hoop is stopped by the lock nuts. Do not force the hoop any higher.
6. Remove the worn wear plates by removing the bolts that clamp them to the underside of the centre hoop beam.
7. The wear plates have five holes. The two large holes are to be lined up under the access holes in the hoop beam that allow the yoke bearing –support frame bolts to be torqued.
8. Slip the strips between the hoop and yoke plate, align up the large holes in the strips below the holes in the hoop beam.
9. Replace the bolts that clamp the wear plates to the centre hoop beam. Torque to 20 Nm.
10. Lower the hoop onto the yoke plate by removing the supports below the centre hoop. Retighten the 4 lock nuts, Torque 60Nm.
11. Replace the aluminum cover plates; close up the bellows, re insert the lock/shear bolt and lock washer, close up the access flaps and re mount the seats.



SECTION 3.18 – SETTING THE CENTER HOOP BEARING

Interval: As required

It is important that the center hoop bearing is set to the correct height. If the center beam is clamped too tightly to the yoke plate, the wear rollers will wear out prematurely, the lock bolt will break continuously and the gear wheels may fail.

If any of the following components are replaced the center hoop bearing has to be set:

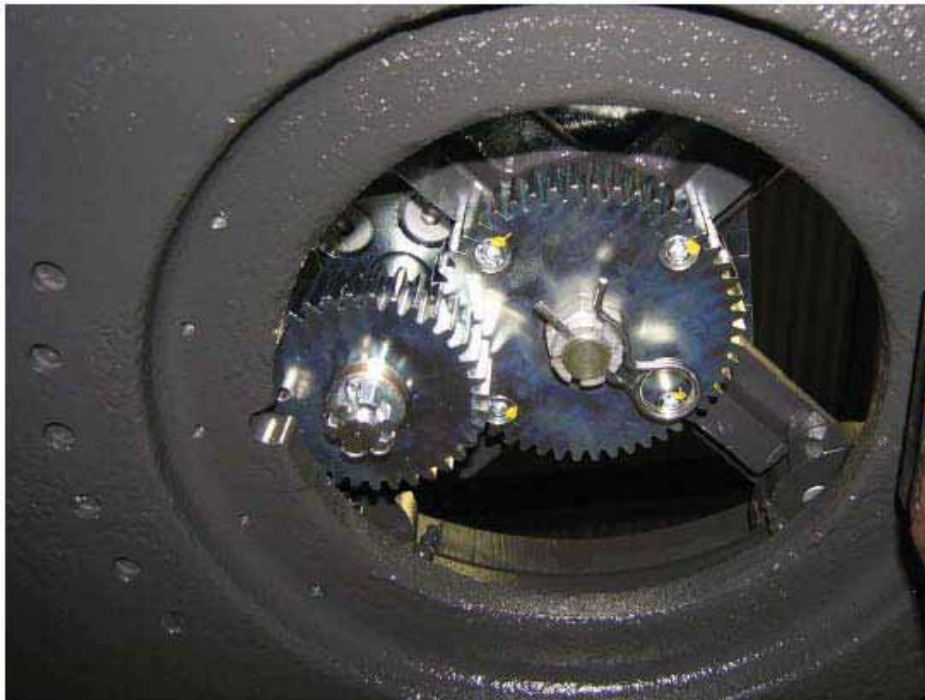
- The center hoop beam
- The center hoop bearing
- Any of the center hoop control components
- The yoke plate
- The wear plates or the wear rollers on the center hoop beam

The bus should be straight and level. Measure the distance between the end of the front car body and the front of the rear car body at the same height from the ground level on both sides of the bus, this dimension should be the same for both sides.

Setting the Bearing

Ensure that the lock bolt is not installed and that the center hoop can be rotated. Apply a vertical force to the edge of the center hoop from outside the vehicle. If the hoop can be rocked back and forth across the wear plates on the yoke plate then the bearing must be adjusted.

It should be possible to turn the centre hoop back and forth (when the lock bolt is not installed) by applying a small force on the turntable seats. If this is not possible, the bearing must be adjusted. The castle nut that clamps the centre hoop bearing is located in the centre of the gear wheel below the centre of the articulation. The castle nut can be accessed through the front turntable flap. Place a mirror on the bellows directly below the centre of the articulation.





Remove the clip pin from the castle nut, inspect and reuse if it is not damaged. If the bearing is too loose, it is possible to rock the hoop back and forth on the yoke plate. Carefully tighten the castle nut in small intervals, check the play in the bearing at each step by applying a vertical force to the edge of the centre hoop from outside the vehicle. If the hoop can be rocked back and forth the yoke can be tightened further. If the bearing is too tight the hoop does not slide easily over the yoke plate and the rollers slide instead of rolling. Carefully loosen the castle nut, check that the bearing is not loosened to the extent that the hoop rocks.

Once the best position for the castle nut has been found, tighten just far enough to be able insert the clip pin. Recheck the play of the hoop on the yoke plate if the hoop does not turn easily then loosen the castle nut back a notch and re insert the clip pin. Return the centre hoop to the straight position and replace the lock bolt and secure with the lock washer.

IF THE BOLT IS NOT SECURED WITH THE LOCK WASHER IT MAY BACK OUT AND THEN HIT THE BEARING HOUSING WHEN TURNING AND THIS WILL CAUSE THE RELAY BEARING SHAFT TO FAIL.



SECTION 4 – THE ELECTRICAL SYSTEM

VISUAL CHECK

Interval: Every 6 months or 15,000 miles (whichever comes first)

Use the following check list:

- 1) Position switches and their connectors.
 - 2) Wiring harness for switches.
 - 3) Electrical connectors on hydraulic block, especially Pressure switch connectors
- The correct function of the hydraulic and electrical control systems should be checked once a year.

FUNCTIONAL CHECK

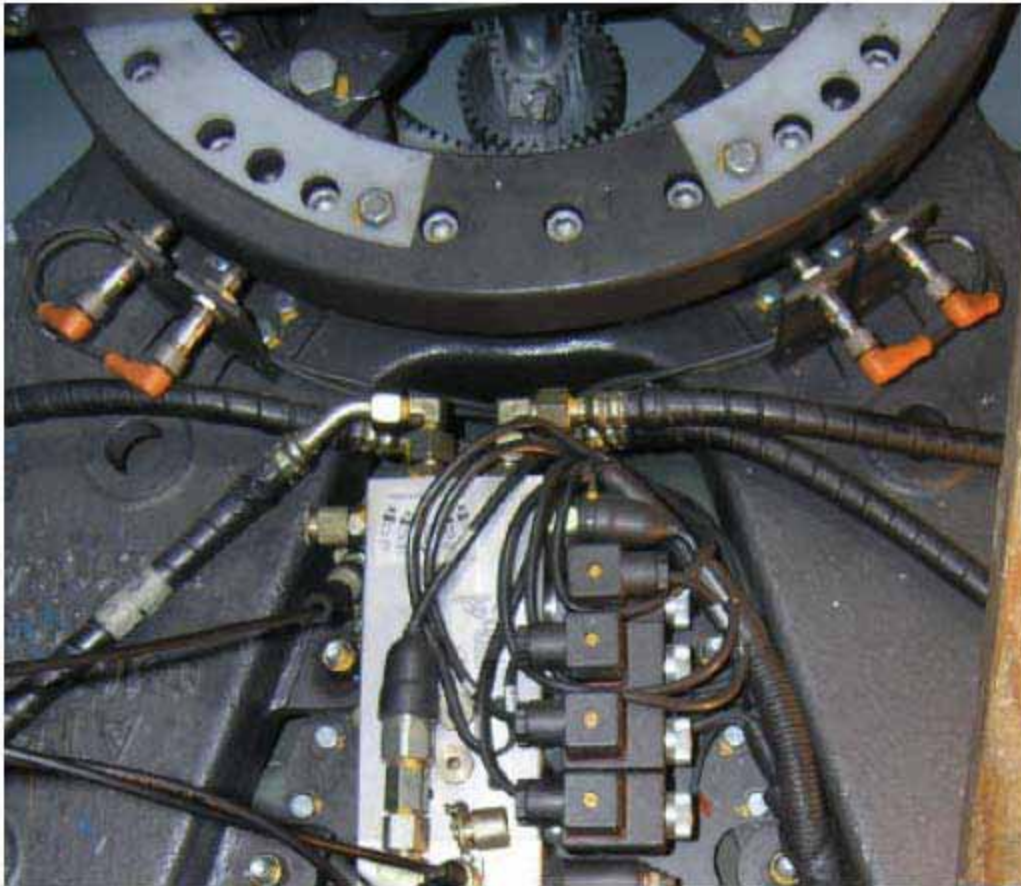
Interval: Yearly or every 30,000 miles (whichever comes first)

- 1) Open the access flap in the rear turntable cover plate.
- 2) Check the system pressure and return to 20.7 bar before proceeding.
- 3) Connect two 250 bar pressure gauges to the test connections MR and ML on the hydraulic control block.
- 4) Open the access flap behind the turntable to access the Vansco unit and connect a lap top to the PLC
- 5) Disconnect the power plug at the Vansco unit. The joint fail alarm should light up.
- 6) Check that the four position switches are not damaged. If the bus is straight all four switches should be activated, both red and green LED on switch housing are lighting.
- 7) Reverse the vehicle into maximum angle left.
- 8) At 49°: The vehicle brakes should be activated and the system pressure should rise (as the lock valve SPL is activated).
- 9) Reverse the vehicle into maximum angle right.
- 10) At 49°: The vehicle brakes should be activated and the system pressure should rise (as the lock valve SPR is activated).
- 11) Test drive the bus.
- 12) At speeds above 43 Km/h, the damping valve HD is activated
- 13) At speeds above 80 Km/h, the damping valve HHD is activated.
- 14) Check using solenoid tester to ensure that the solenoid is active and use pressure gauges to ensure that the hydraulic block is working.
- 15) Pressure changes when lane changing, the faster and more brutal the lane change the higher the pressure (up to 200 bar).

THE POSITION SWITCHES

There are four position switches located between the main bearing and the hydraulic block. The switches are activated by the yoke plate. When the articulation is straight, all four switches are activated. When the relevant switching angle is reached the switches are no longer activated

The four position switches, 39° left and 39° right, maximum angle left and right, are inductive proximity switches. There are no moving parts in this switch, it sets up a magnetic field around the top of the switch. A green LED near the plug connector at the base of the switch lights when the switch is connected and working correctly. When the magnetic field around the top of the switch is disturbed by the intrusion of magnetic material, as is the case when the articulation is straight, the switch switches and a second LED lights up red on the switch.



THE JOINT FAIL INDICATOR

This is activated when

- 1) There is no communication with the joint
- 2) Override switch fail
- 3) There is no power getting to the control system
- 4) There is a loss of pressure in the hydraulic system
- 5) There is an internal fault in the connected sensors or inputs (speed signal)
- 6) There is an illogical combination of signal inputs

The controller is programmed to limit the vehicle speed to 30 mph and can be programmed to shut down the engine within 60 seconds of a safety related failure, should the driver ignore the warning signals.



SECTION 5 – HYDRAULIC SYSTEM

VISUAL CHECK

Interval: Yearly or 30,000 miles (whichever comes first)

Use the following checklist:

- 1) Chrome on cylinder rods damaged.
- 2) Hose connections to cylinders tight.
- 3) Hoses show no signs of wear.
- 4) Bellows under cylinders dry.
- 5) Hose connections to hydraulic block tight.
- 6) Hydraulic block dry.
- 7) Bleed valves on block and cylinders do not leak.

CHECK SYSTEM PRESSURE (FLUID LEVEL)

Interval: Yearly or 30,000 miles (whichever comes first)

- 1) Open the rear cover plate to access the hydraulic block.
- 2) Connect a 60 bar pressure gauge to the test connection M1 on the hydraulic block near the accumulator.
- 3) If the pressure has fallen below 20.7 bar, refill with hydraulic pump

FUNCTIONAL CHECK

See procedure for electrical system.

REPLACE HYDRAULIC OIL

Interval: Every 5 years or 150,000 miles (whichever comes first)

This is necessary to ensure a long life for the seals on the hydraulic cylinders.

- 1) Drive the bus over a pit and disconnect the batteries.
- 2) Open the rear cover plate to access the hydraulic block.
- 3) Release the pressure in the hydraulic system by bleeding through the bleed valve between the accumulator and the control block. Close the bleed valve.
- 4) Open the folding bellows below the Turntable
- 5) Each cylinder end has two ports, bleed valves are installed in the top ports. The lower ports are sealed with bolts. Attach transparent hoses to 4 extra bleed valves. Remove the lower bolts and immediately install a bleed valve with the hose leading to a container to catch the escaping oil.
- 6) After connecting the hoses open the bleed valve between the accumulator and the hydraulic block together with the bleed valves on the top ports of the cylinders.
- 7) Allow enough time for the oil to drain from the system.
- 8) Close all bleed valves except one chamber. Rinse out the chamber by filling **filtered (10 micron)** Shell Tellus T10 oil through the top port. Connect air pressure to the top port and blow out through the bottom port.
- 9) Repeat this procedure on all chambers.
- 10) Re-screw the bolts with new copper seals into the lower ports of the cylinders.
- 11) Re fill the hydraulic system with the approved oils below.

The pump for filling the system must be equipped with a pressure filter (10 microns).



APPROVED OILS

The following oils are the only approved oils that can be used in the Articulated Joint:

Chevron Rykon 15
Chevron Rando HDZ 15
Shell Tellus DO 10
Shell Tellus T 15

Note: Hydraulic oils of different types should not be mixed. When changing the oil type, purge the system completely.



SECTION 6 – BOLT TORQUE

The following bolted connections are to be checked after the turntable has been installed. These connections should be retorqued before the bus is delivered to the customer, if the bus is driven to the customer, or after the first 500 – 1,500 miles in service:

- The wrist joint yoke plate connection
- The bolt that connect the yoke plate to the main bearing
- The bolts that connect the main bearing to the support frame

A complete visual check of all the witness marks on the remaining bolts must be done at this time

- These marks should be checked and bolts retightened if they show signs of movement
- The wrist joint yoke plate connecting bolt has witness marks at both ends and both ends should be checked.

Torque stripe alignment check on the chassis connected bolts is recommended once a year. Any bolts where the torque stripes do not line up need to be removed and replaced.

A complete bolt retorque of the system is recommended every 3 years. This procedure is simply a torque check using a wrench.

COACHES WITH TRANSITION PLATES

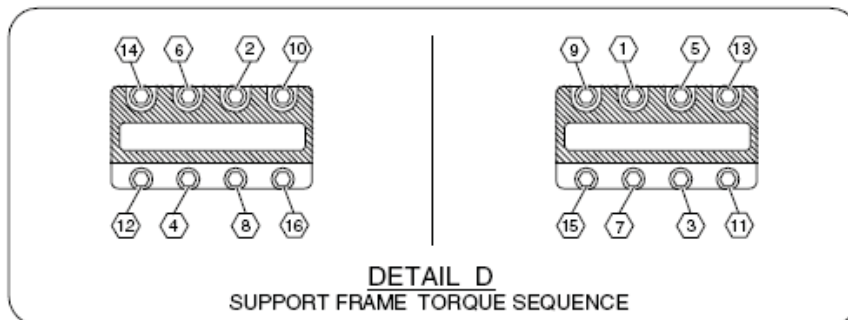
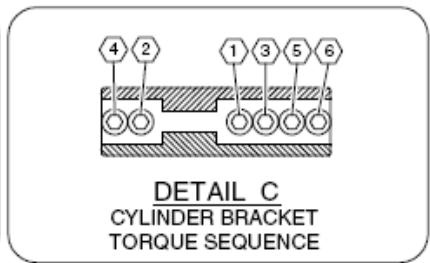
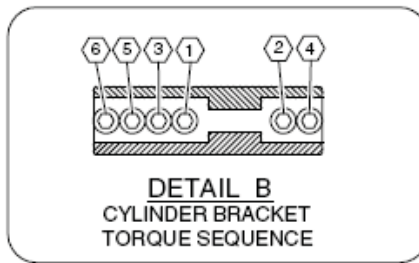
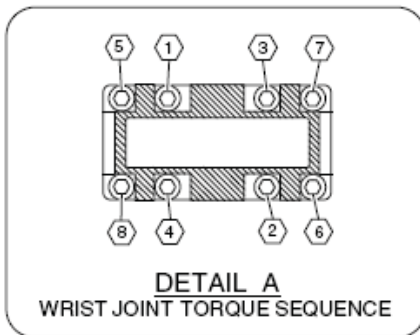
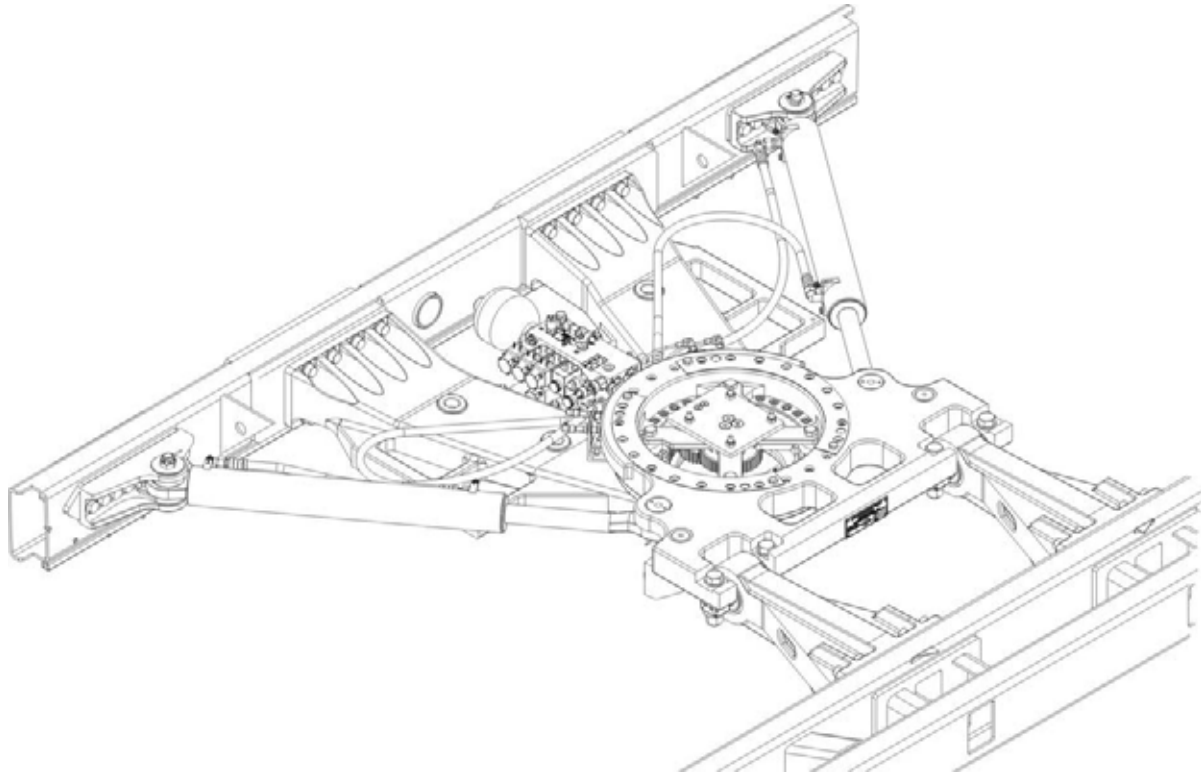
ARTICULATED JOINT TORQUE SPECIFICATIONS					
ITEM	DESCRIPTION	QTY	FASTENER	TORQUE	NOTES
1	Main Bearing to Yoke	24	M12 x 1.5	74 ft-lb. (100 Nm)	Follow torque sequence.
2	Main Bearing to Support Frame	24	M12 x 1.5	74 ft-lb. (100 Nm)	Follow torque sequence.
3	Wrist Joint to Yoke Plate	4	M22 x 1.5	520ft-lb. (705 Nm)	Applyl Never-Seez, follow torque sequence.
4	Cylinder Bracket to Rear Chassis	12	5/8 - 11 UNC Lock Nut	First Stage: 135 ft-lb. (183 Nm) Final Stage: 185 ft-lb (251 Nm)	Apply Never-Seez, torque in two stages and follow torque sequence.
5	Support Frame to Transition Plate	16	5/8 - 18 UNF Socket Head Screw	First Stage: 135 ft-lb. (183 Nm) Final Stage: 240 ft-lb. (325 Nm)	Apply Never-Seez, torque in two stages and follow torque sequence.
6	Wrist Joint to Front Chassis	16	5/8 - 11 UNC Socket Head Screw	First Stage: 135 ft-lb. (183 Nm) Final Stage: 220 ft-lb. (298 Nm)	Apply Never-Seez, torque in two stages and follow torque sequence.
7	Transition Plate to Rear Chassis	8	7/8-14 UNF	520ft-lb. (705 Nm)	Applyl Never-Seez, follow torque sequence.
8	Cylinder Pin	4	M20 x 1.5 Castle Nut	74 ft-lb. (100 Nm)	Torque to specification then tighten until pin hole is aligned



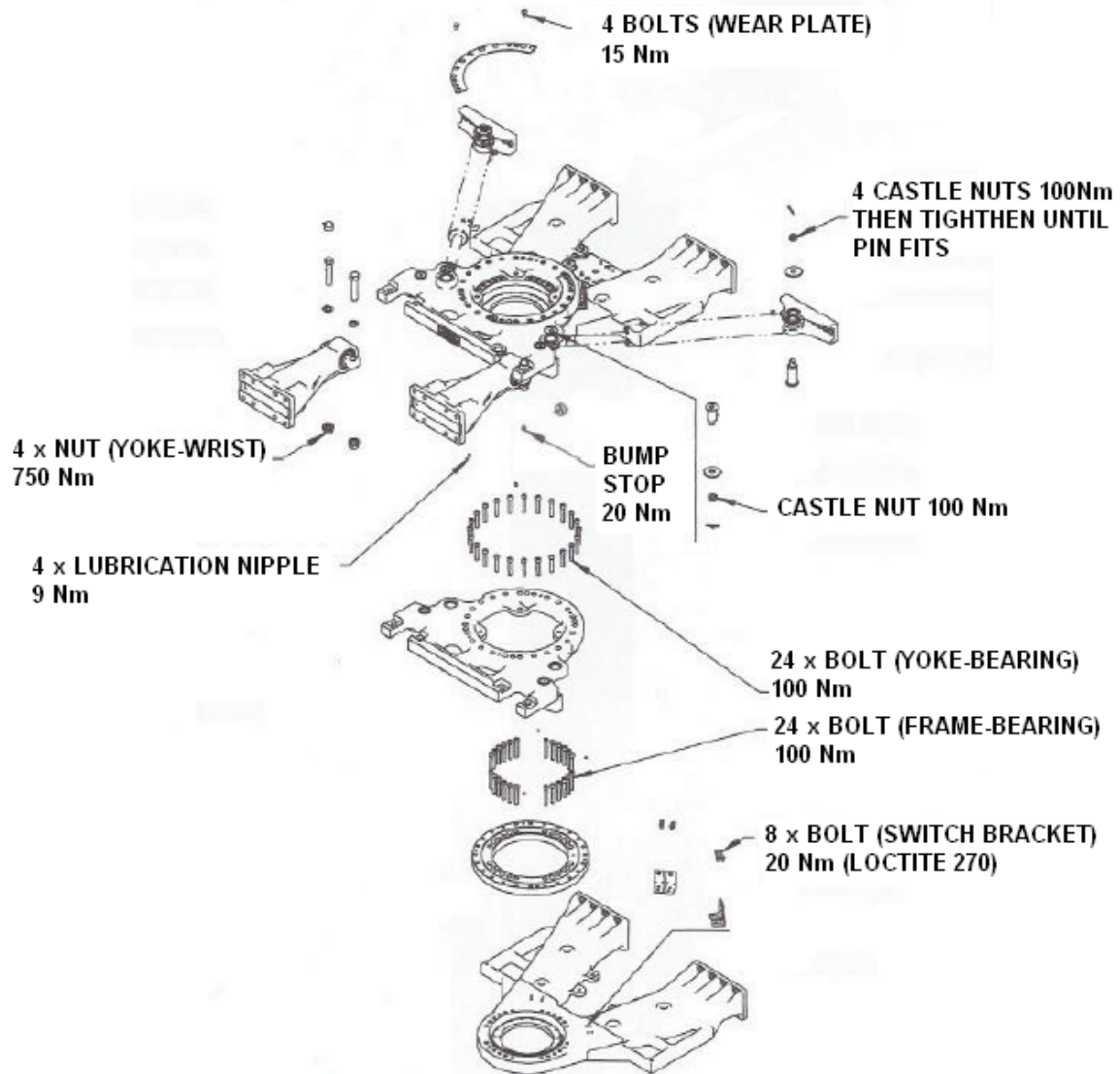
COACHES WITHOUT A TRANSITION PLATE

ARTICULATED JOINT TORQUE SPECIFICATIONS					
ITEM	DESCRIPTION	QTY	FASTENER	TORQUE	NOTES
1	Main Bearing to Yoke	24	M12 x 1.5	74 ft-lb. (100 Nm)	Follow torque sequence.
2	Main Bearing to Support Frame	24	M12 x 1.5	74 ft-lb. (100 Nm)	Follow torque sequence.
3	Wrist Joint to Yoke Plate	4	M22 x 1.5	520 ft-lb. (705 Nm)	Apply Never-Seez, follow torque sequence.
4	Cylinder Bracket to Rear Chassis	12	5/8 - 11 UNC Lock Nut	First Stage: 135 ft-lb. (183 Nm) Final Stage: 185 ft-lb (251 Nm)	Apply Never-Seez, torque in two stages and follow torque sequence.
5	Support Frame to Rear Chassis	16	5/8 - 11 UNC Socket Head Screw	First Stage: 135 ft-lb. (183 Nm) Final Stage: 220 ft-lb. (298 Nm)	Apply Never-Seez, torque in two stages and follow torque sequence.
6	Wrist Joint to Front Chassis	16	5/8 - 11 UNC Socket Head Screw	First Stage: 135 ft-lb. (183 Nm) Final Stage: 220 ft-lb. (298 Nm)	Apply Never-Seez, torque in two stages and follow torque sequence.
7	Cylinder Pin	4	M20 x 1.5 Castle Nut	74 ft-lb. (100 Nm)	Torque to specification then tighten until pin hole is aligned

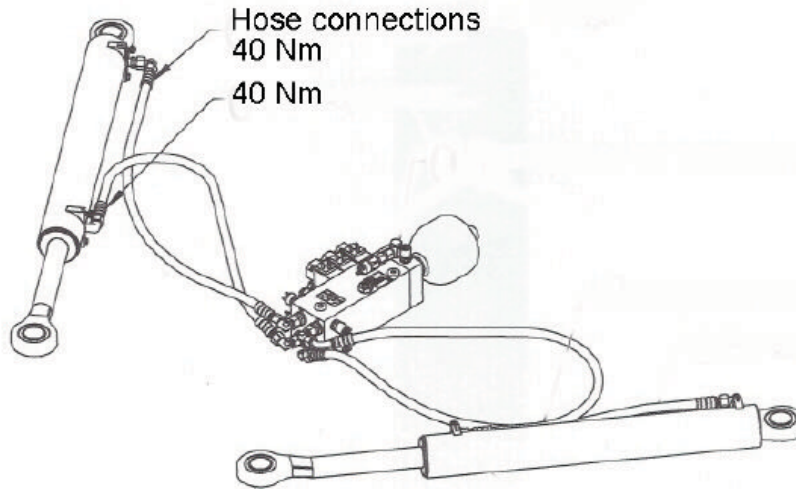
MAIN CHASSIS CONNECTIONS



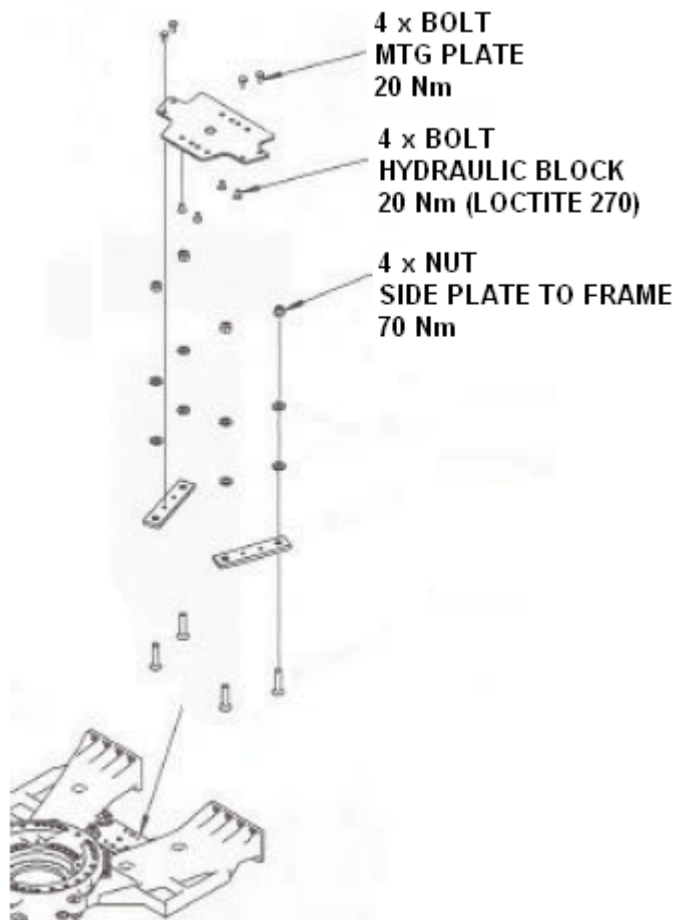
MAIN BEARING ASSEMBLY



HYDRAULIC PARTS



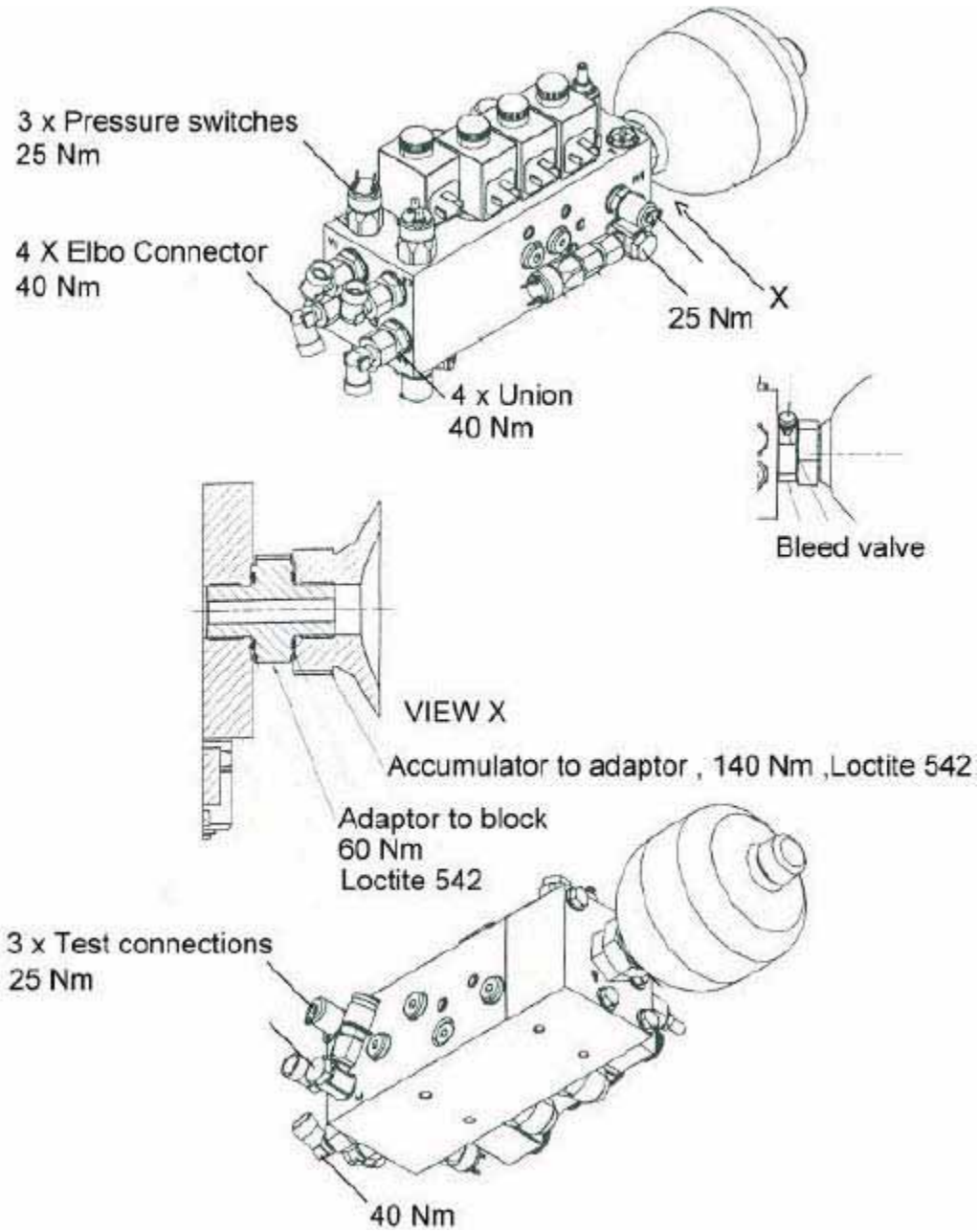
HYDRAULIC BLOCK BRACKET INSTALLATION



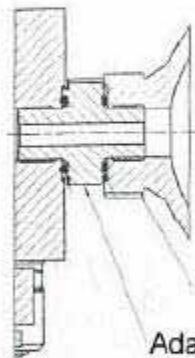
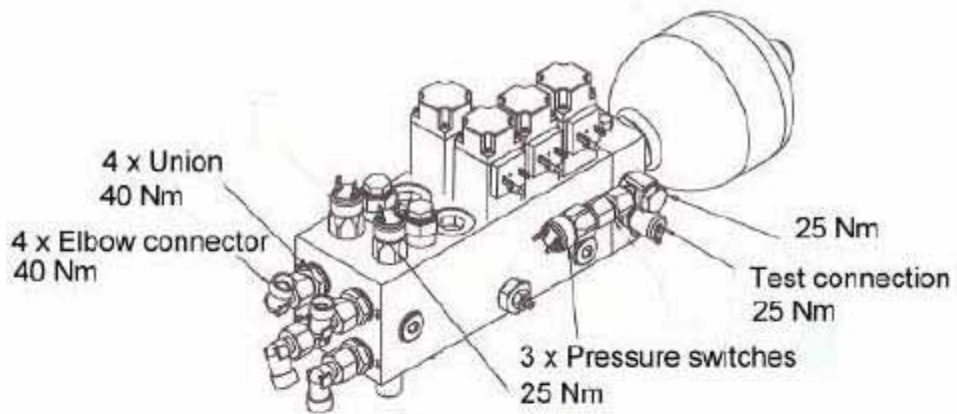


NEW FLYER

HYDRAULIC BLOCK COMPONENTS

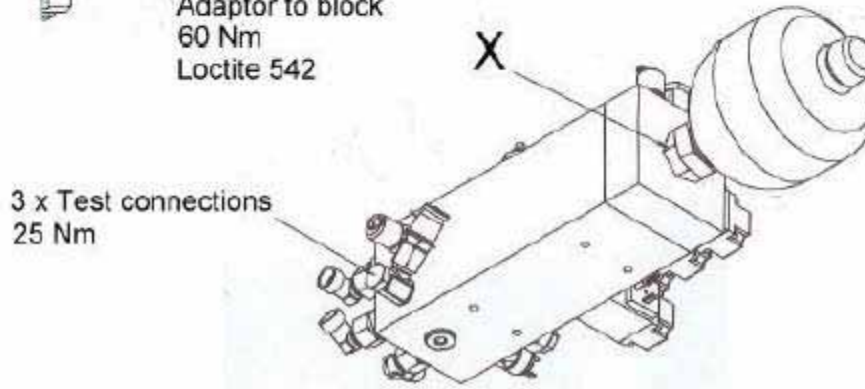


STEEL HYDRAULIC BLOCK COMPONENTS

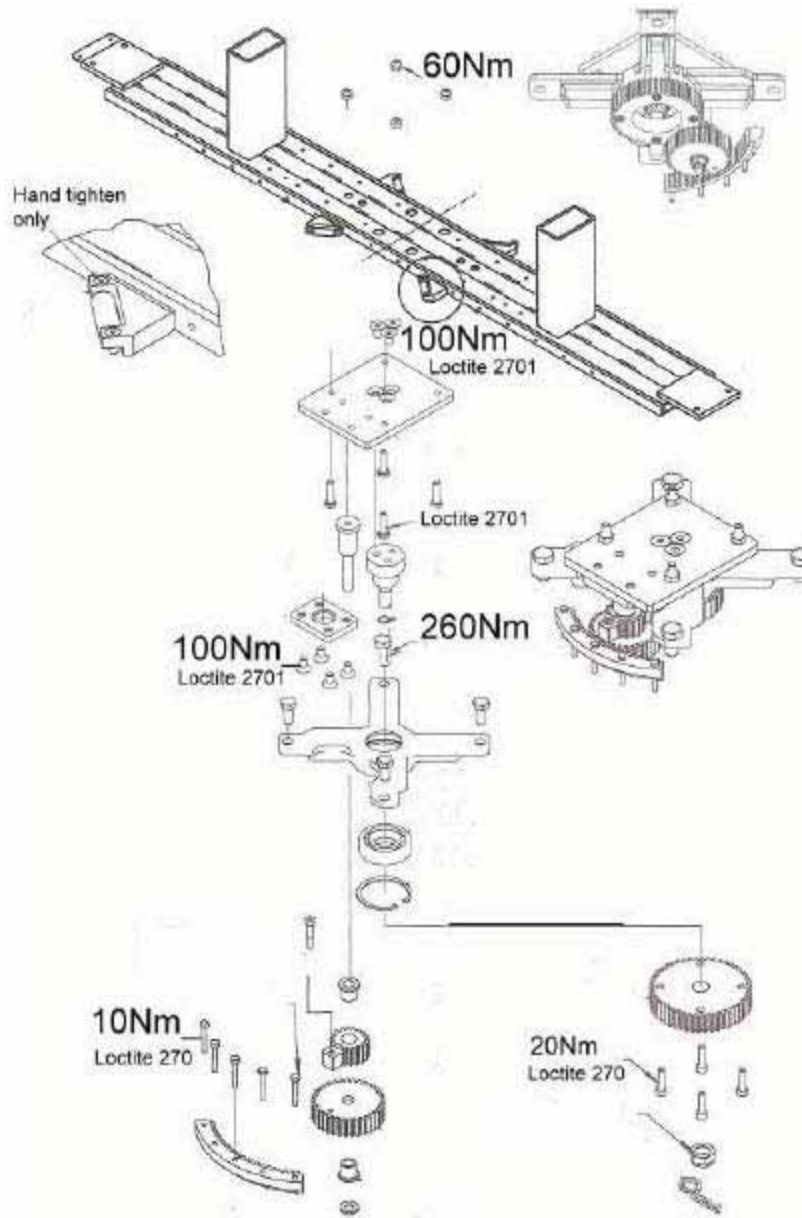


Accumulator to adaptor , 140 Nm , Loctite 542

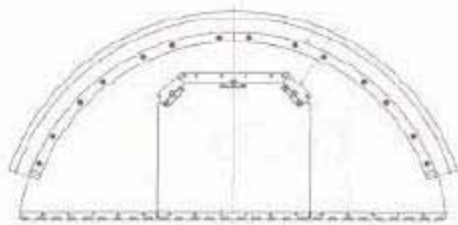
Adaptor to block
60 Nm
Loctite 542



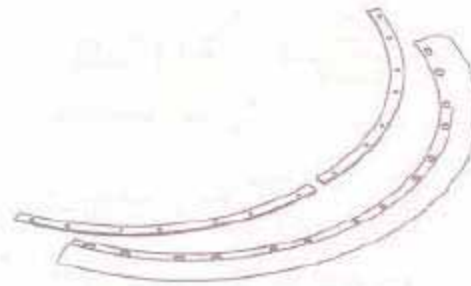
CENTER HOOP SUPPORT BEAM / CENTER HOOP CONTROL



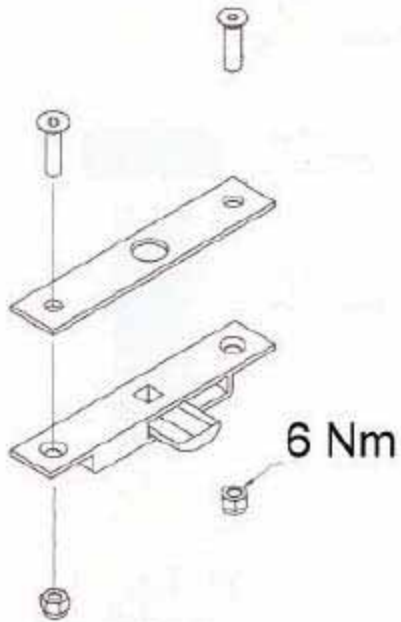
ALUMINUM COVER PLATES ASSEMBLY



Cover plate

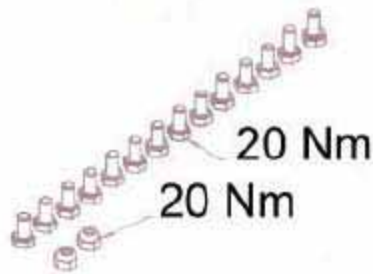


Cover plate repair kit



6 Nm

Cover plate lock

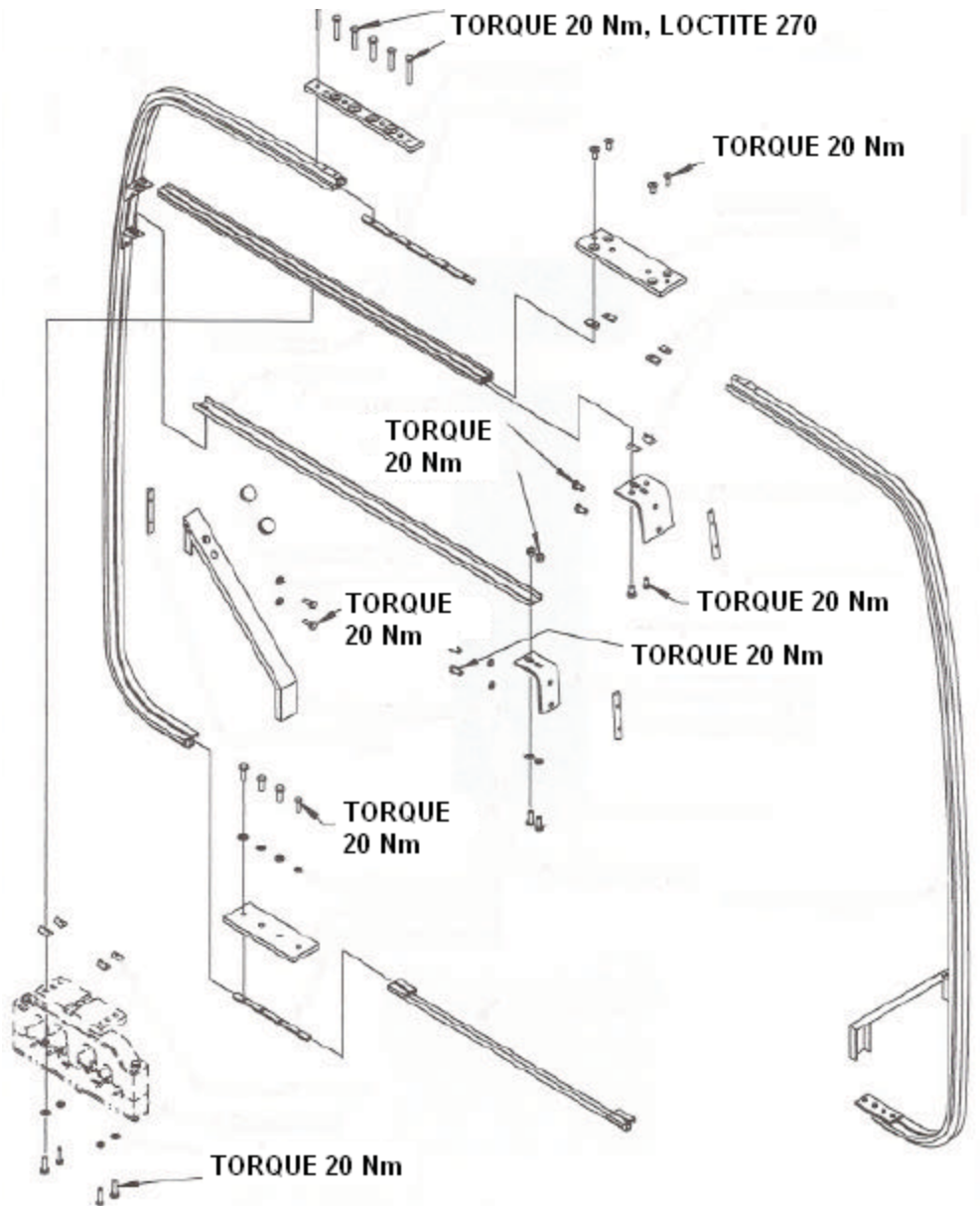


20 Nm

20 Nm

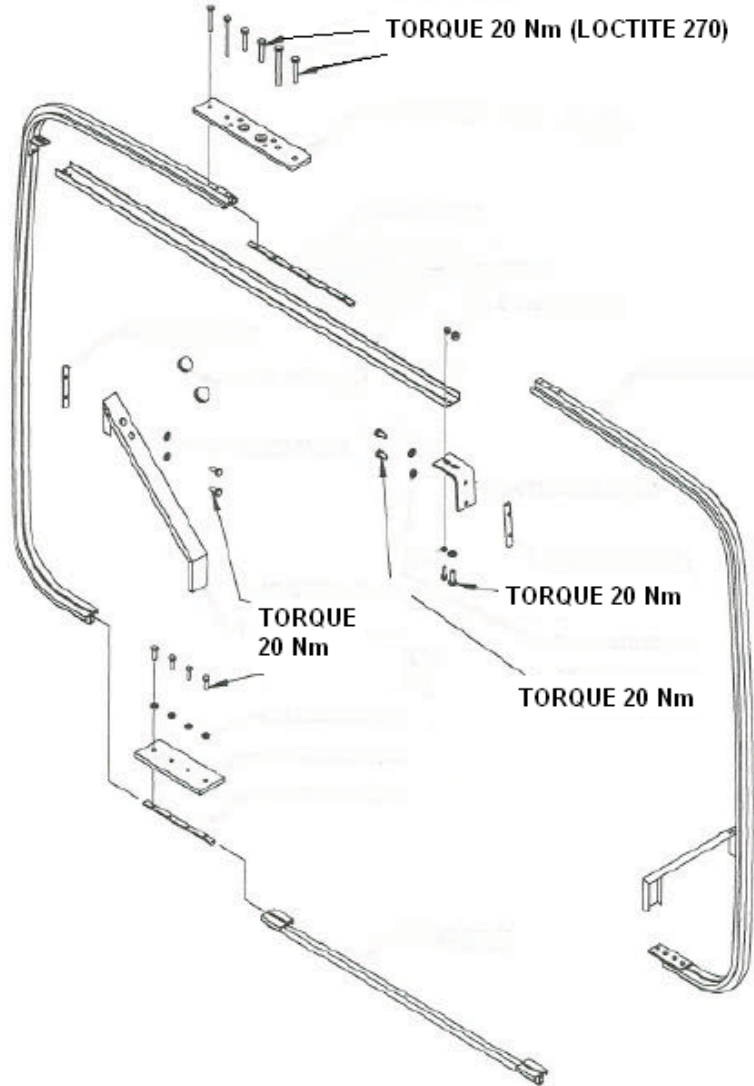
Cover plate mounting bolts

BRT ALUMINUM CENTER HOOP

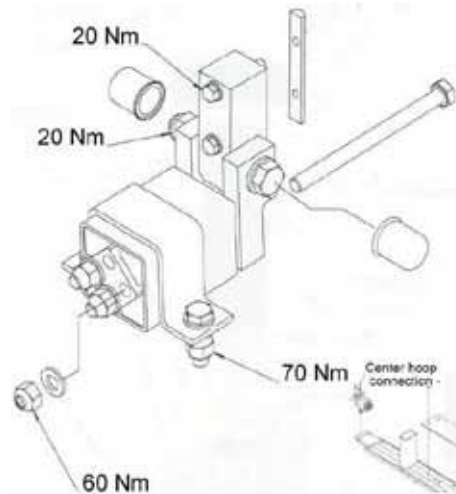




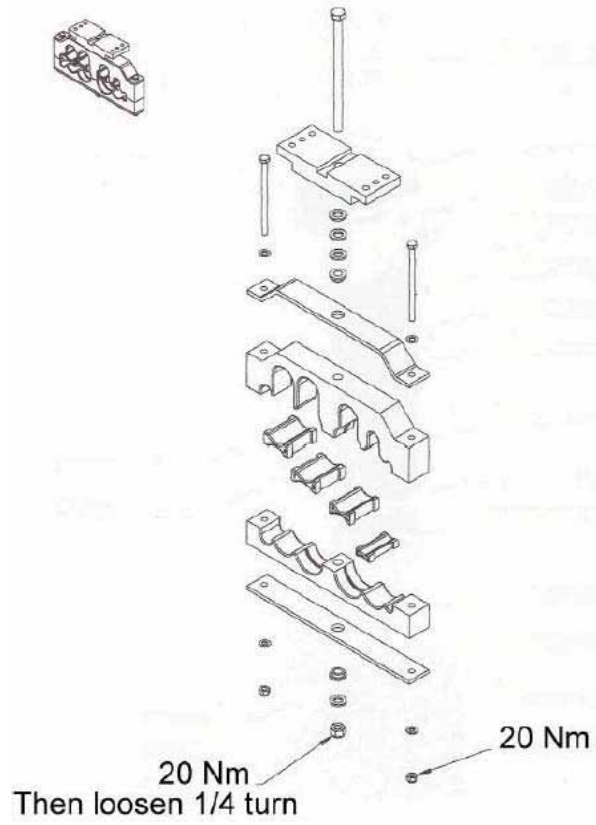
LOW FLOOR ALUMINUM CENTER HOOP



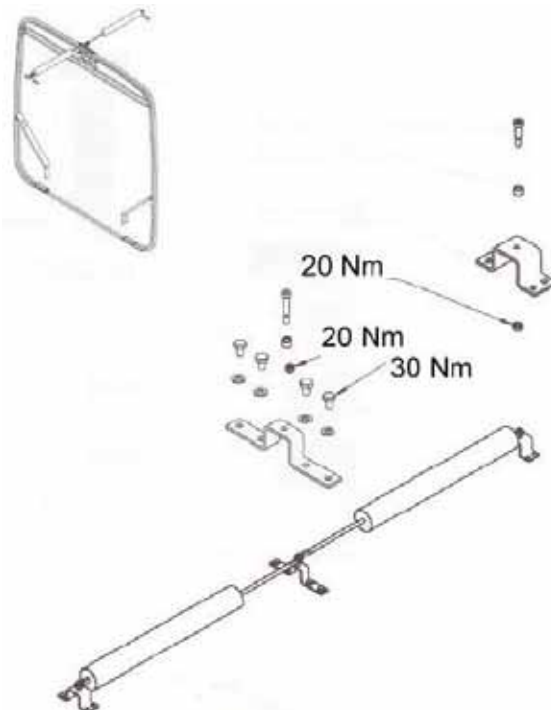
CENTER HOOP CONNECTION



HOSE CLAMP

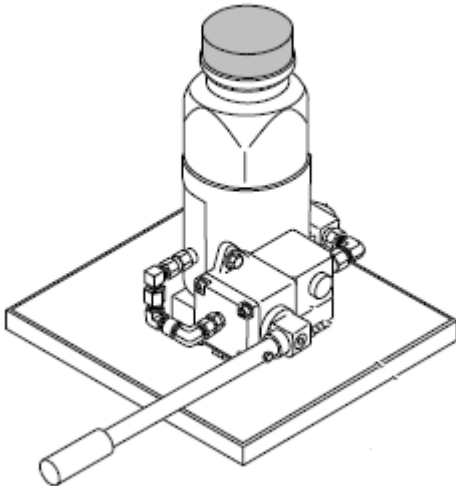


ROOF STRUTS



SECTION 7 – SPECIAL TOOLS

The following tools are required to be purchased to maintain your ATG Articulated Joint System



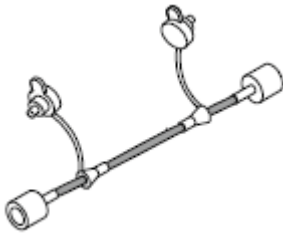
**Pump Assembly w/ Lever
6332288**



**2 Meter Hose
6311781**



**1 Meter Hose
6332285**



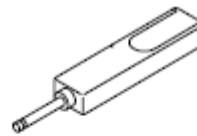
**0.2 Meter Hose
6332286**



**4.5 Meter Bleed line
6358965**



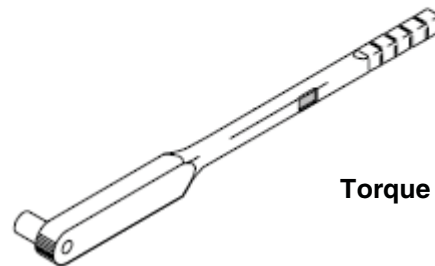
Gauge & Adapter 106804



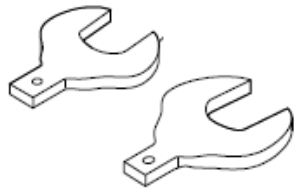
**Solenoid Tester
6332290**



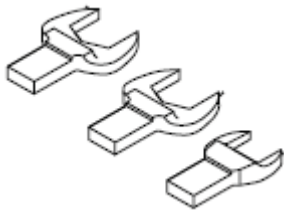
Gauge & Adapter 6317341



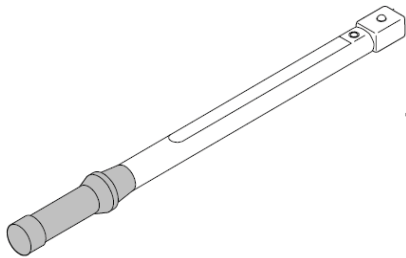
**Torque Wrench 140-760 Nm
6329444**



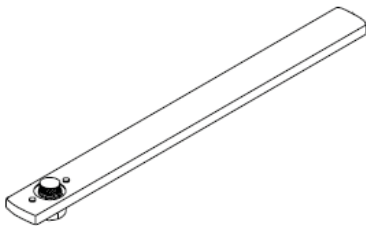
36mm Spanner Open 6353629
41mm Spanner Open 6353628



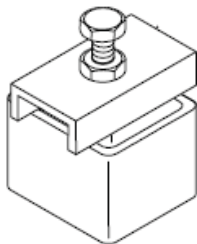
24mm Spanner Open 6353630
22mm Spanner Open 6353631
19mm Spanner Open 6353632



Torque Wrench 20 – 200Nm



Cylinder Pin Holder
6353636



Cylinder Pin Extractor
6353637