

TECHNICAL NOTE 14-01
WATER RESTRAINT SYSTEM
Clutch adjustment for
Rotary Joint Gearbox
December 18, 2001

Introduction

This technical note provides maintenance instructions for adjusting internal clutches of a cannon-subassembly rotary joint of the Water Restraint System.

Clutch adjustment is needed when a rotary joint does not track smoothly through its stop-limited range of motion. The most notable symptom of an improperly adjusted clutch is a loud “clacking” noise emitted by the rotary joint when tracking between stop limits.

The drive train for each of the two rotary joints includes a 24-vdc electric motor, a reduction gearbox, and a worm gearbox. See Photos 1 and 2 below.



Photo 1. WRS Horizontal and Vertical Rotary Joints

The reduction gearbox transfers torque from the electric drive motor to the shaft of the rotary-joint worm gear. The gearbox also features a ball-clutch mechanism to prevent drive-motor jamming.

This technical note provides instructions for adjusting and servicing the reduction gearbox and clutch of the cannon subassembly.

Description

Both WRS rotary joints are powered by a 24-vdc electric motor. Motor torque is applied to the rotary joint through a reduction gearbox and a worm gear. See Photo 2 below.

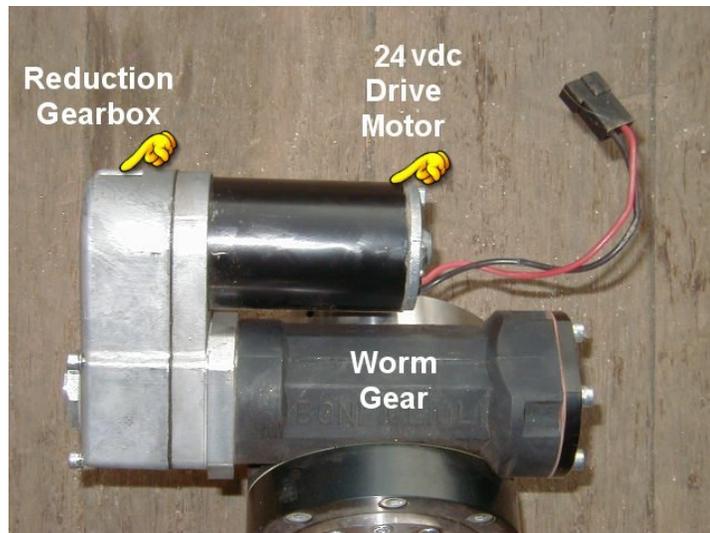


Photo 2. Rotary Joint Drive-Train Components

The reduction gearbox is enclosed within a removable cover that is secured with four 5/32-inch Allen-Head screws and one #25 Torx screw. See Photo 3 below.



Photo 3. Cover of Reduction Gearbox

The reduction gear train consists of a drive gear, an idler gear, a clutch gear, two thrust washers, and a shaft key. See Photos 4 and 5 below.

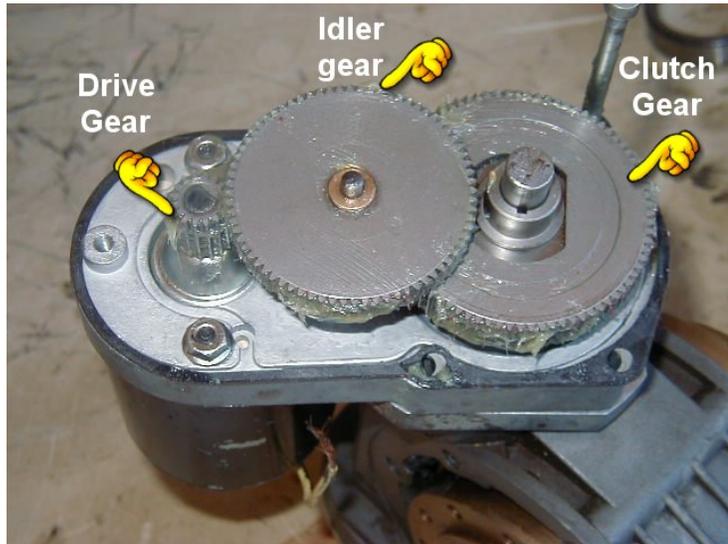


Photo 4. Reduction Gears



Photo 5. Gearbox Parts

Stop rings are used to limit the range of rotation for the WRS horizontal and vertical rotary joints. As a result a clutch mechanism is needed to absorb drive-motor torque when joint rotation is constrained by the stop rings. The adjustable clutch mechanism is integral to the clutch gear. Figure 6, 7, and 8 below offer an overall view of the clutch gear and clutch mechanism.



Figure 6. Clutch Mechanism, Rear View



Figure 7. Clutch Mechanism, Front View



Figure 8. Clutch Mechanism, Side View

The clutch is an adjustable ball-bearing detent mechanism. Cupped pressure washers apply the force needed to seat six steel balls into six detent holes. An adjusting screw and keyed lock washer provides a means to squeeze the cupped washers against the steel balls and thus vary the torque needed to index the balls around the circular array of detent holes. Photo 9 below shows the clutch parts.

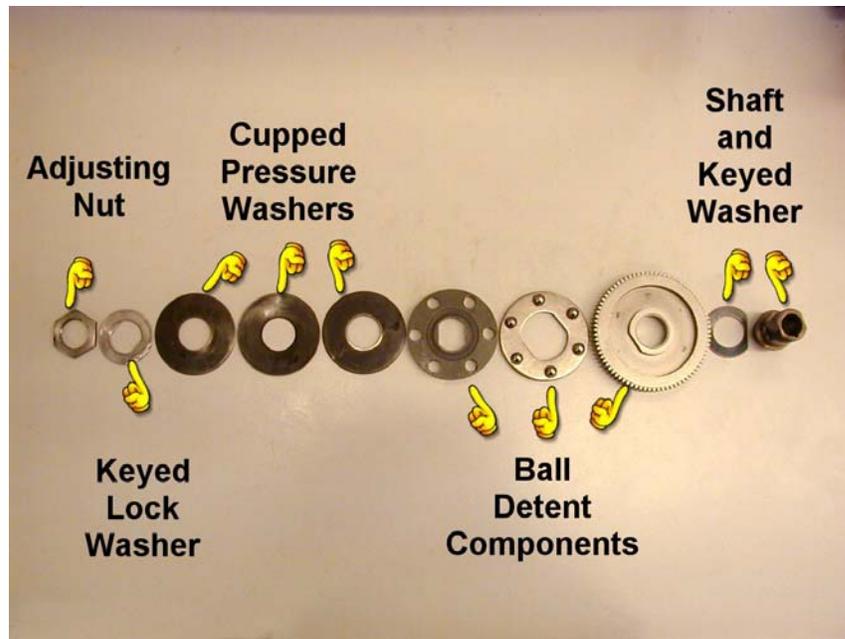


Photo 9. Clutch Gear Parts

Clutch Adjustment

The clutch mechanism of the reduction gearbox can be adjusted to either increase or decrease rotary joint torque.

With proper adjustment the rotary joints will track smoothly through the entire range of motion allowed by rotary-joint stop rings even as the water cannon is being fired. Firing the cannon while tracking a rotary joint does demand slightly more clutch torque.

When constrained by the rotary-joint stop rings the clutch of the reduction gear will slip and emit a noticeable “clacking” noise. The clutch noise results from the set of detent bearings that are being advanced into new positions around a circular array of detent holes. Force is applied to the detent bearings by a loaded set of cupped washers.

The load on the cupped washers of the clutch is varied by tightening or by loosening a large lock nut of the clutch mechanism. This load nut is locked by bending-up the edge of a keyed washer to interfere with a flat of the load nut. See Photo 10 below.

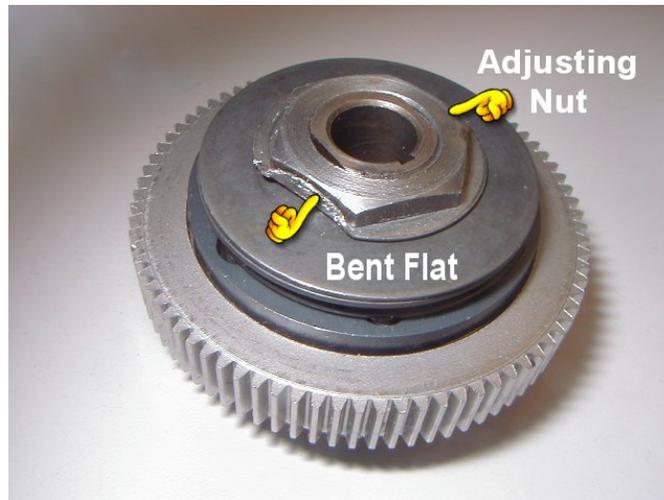


Photo 10. Adjusting Nut and Bent Lock Washer

Clutch adjustment procedure:

- a. Fire a continuous stream of water through the cannon nozzle while rotating the cannon through horizontal and vertical ranges of motion.
- b. Note any clutch “clacking” noise while the rotary joint is in motion.

NOTE: Ignore the normal “clacking” noise associated with motion constraints of the rotary-joint stop rings.

- c. Remove the gearbox cover and then slip the idler and clutch gear off of the associated shafts.

NOTE: The clutch gear is keyed to the shaft. Experience shows that it is easy to drop and lose the shaft key.

- d. Flatten the bent flat of the keyed lock washer to free the adjusting nut.

- e. Place an adjustable wrench on the adjusting nut and tighten the lock nut by three wrench flats. Fold the edge of the lock washer up against a flat of the adjusting nut. Photo 11 below.



Photo 11. Clutch Adjustment

- f. Reassemble the gearbox and repeat the clutch-adjustment procedure as needed to eliminate clutch noise as described in Step b above.
- g. Finally, make certain that the clutch does emit the “clacking” noise when against the rotary-joint stop rings. If this condition exists then back off the adjustment nut as needed to allow proper clutch operation when constrained by the rotary-joint stop rings.

Gearbox Lubrication

Clean the gearbox components and then apply a uniform coat of medium weight, water resistant gear grease to all clutch parts, to shafts, and to gear teeth.

Logistic Support

For replacement parts and further technical assistance call Hydro-Force (619) 478-2600 voice or (619) 478-2555 facsimile.