

Horstman Axle Clutch Owners Manual

P/N 140000 and 140002

Introduction

This clutch is engineered for use with 2 cycle race kart engines up to 150cc. Features include CNC billet materials and superior carbon fiber friction material for outstanding performance on Road Race tracks with gear ratio range 3.20:1 to 5.50:1. The clutch is designed to be used with 8mm HTD belt drive system.

Read manual carefully before mounting and adjusting stall speed.

Contents

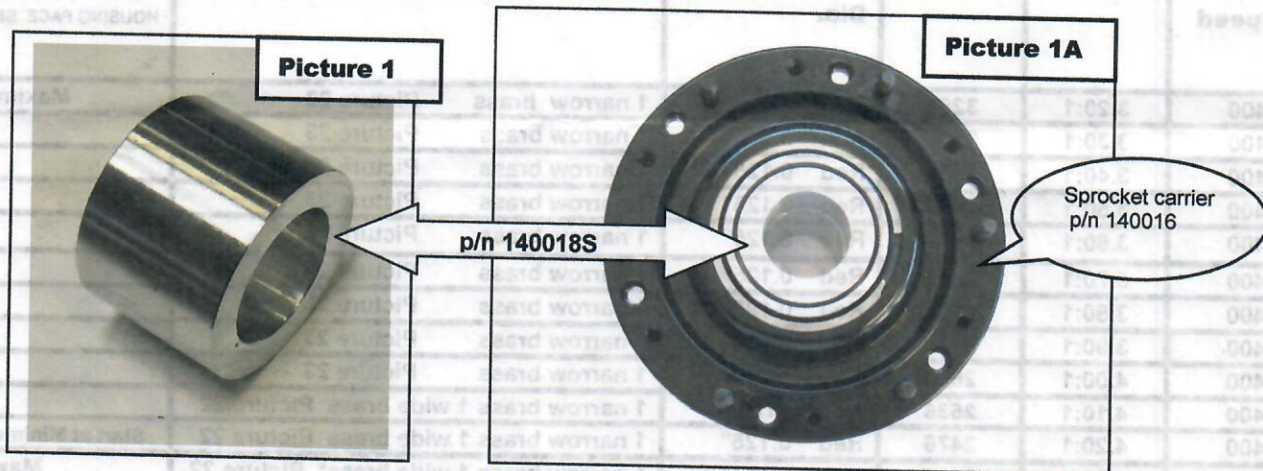
- 1x Clutch for fitment to 1.250" axle 50MM Hub available
- 1 x Aluminum spacer P/N 140018S *not supplied or required with 50MM Hub*
- 24x Brass weights (installed)
- 12x loc nuts 10-32
- 6x springs high tension 0.125" wire Ø color red
- 6x springs medium tension (installed) 0.117" wire Ø color silver
- 6x springs low tension 0.105" wire Ø color blue
- 1x Tool for setting spring height
- 1x 6 oz bottle of Nytro clutch oil



INSTALLATION

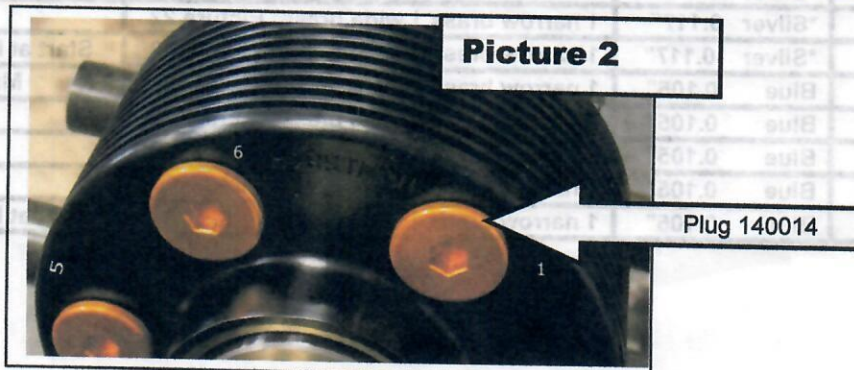
The clutch is fully assembled less oil and ready to mount. The clutch is bi-directional therefore mount for best alignment with engine as well as clearance for oil fill and stall speed adjustment. Locking collars needed on both sides of clutch(not provided). Install aluminum spacer into carrier side of clutch hub. **Picture 1 & 1A** Clutch must slide freely onto axle. Remove any burrs or nicks from axle and file 1/4" key(not provided) if necessary for slip fit. Axle key may require grinding for mounting clutch on 50mm axle.

Do not use chain for power transmission with this clutch.



Oil Fill

The clutch must have oil at all times to cover internal friction surfaces for smooth chatter free engagement as well as thermal conductivity for cooling. To add oil rotate clutch until plug #1 is near the top of the clutch. Remove plug and insert 6 oz of Nytro oil. Additional Nytro oil is available in Quart bottles direct from Horstman. **Do not use gear oil or engine oil as clutch performance will be compromised as they contain anti-friction and extreme pressure additives.** Change oil after two race weekends to insure contaminants from shearing action are removed. Check oil level frequently and add oil if necessary. 5/16" hex key required to remove plug See **Picture 2**



Operation Theory

The Horstman axle clutch is an automatic design. Rotation of the clutch housing causes 12 cam action levers to apply force against a pressure plate. As revs increase the pressure plate moves in an axial direction to clamp multiple friction discs that are attached to the splined hub of the clutch and kart will move forward. Full engagement (lock up) is controlled by six compression springs in the clutch. The tension of the springs must be adjusted to increase or decrease opposing force of the levers until desired stall speed is reached. Once the desired stall speed is reached the clutch locks up and stays locked up until the engine revs drops below the stall speed. Since the clutch is not mounted to the engine the gear ratio determines the clutch rpm. Brass weights are attached to the levers to control lock up. Three spring rates are provided to cover the wide range of axle speeds in Road Racing. It may be necessary to remove some of the brass weights depending on gear ratio. The chart below is for reference to show the relationship between engine revs and axle revs.

STALL SPEED

Stall speed is the rpm the clutch hooks up solid. Stall speed is measured by a tachometer reading of the engine rpm. Before going to track adjust the stall speed as close to peak torque of the engine as possible to establish a base line. At the track the optimum stall speed must be determined by observing performance when accelerating out of the tightest radius corner. If the engine bogs more than 100 rpm when the clutch hooks up it indicates that stall speed must be increased. If the engine over revs off the same corner the stall speed must be decreased. Your set up may require a stall speed as low as 8500 or as high as 10,800 depending on engine size and power curve. Fastest lap should occur when stall speed adjustment is finalized provided the correct gear ratio installed. Note: The stall speed must be adjusted after a change of gear ratio as axle RPM will change.

Stall Speed Adjustment Chart

Use as a guide only

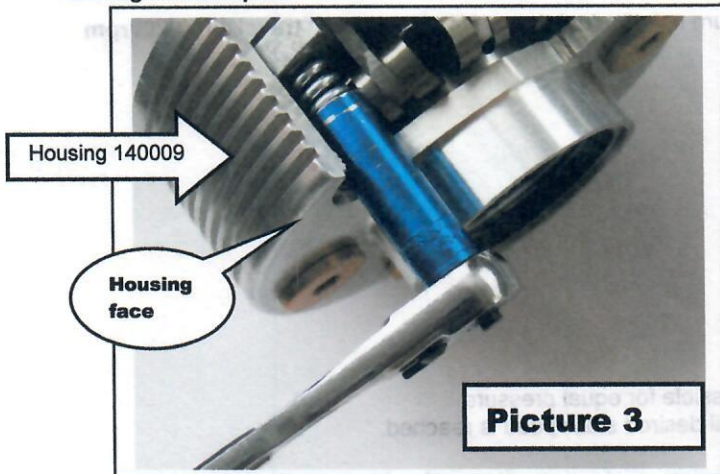
Engine RPM at Clutch Stall Speed	Gear Ratio	Axle RPM	Spring Color /Wire Dia.	Weight required on each lever	SPRING ADJUSTMENT MEASUREMENT DISTANCE FROM TOP OF NUT TO HOUSING FACE SEE PICTURE 4
10,400	3.20:1	3250	Red 0.125"	1 narrow brass Picture 23	Maximum .515"
10,400	3.30:1	3151	Red 0.125"	1 narrow brass Picture 23	.485"
10,400	3.40:1	3058	Red 0.125"	1 narrow brass Picture 23	.480"
10,400	3.50:1	2971	Red 0.125"	1 narrow brass Picture 23	.475"
10,400	3.60:1	2888	Red 0.125"	1 narrow brass Picture 23	.470"
10,400	3.70:1	2810	Red 0.125"	1 narrow brass Picture 23	.465"
10,400	3.80:1	2736	Red 0.125"	1 narrow brass Picture 23	.460"
10,400	3.90:1	2666	Red 0.125"	1 narrow brass Picture 23	.455"
10,400	4.00:1	2600	Red 0.125"	1 narrow brass Picture 23	.450"
10,400	4.10:1	2536	Red 0.125"	1 narrow brass 1 wide brass Picture 22	.445"
10,400	4.20:1	2476	Red 0.125"	1 narrow brass 1 wide brass Picture 22	Start at Minimum 440"
10,400	4.30:1	2418	*Silver 0.117"	1 narrow brass 1 wide brass* Picture 22	Maximum.545"
10,400	4.40:1	2363	*Silver 0.117"	1 narrow brass 1 wide brass* Picture 22	.510"
10,400	4.50:1	2311	*Silver 0.117"	1 narrow brass 1 wide brass* Picture 22	.505"
10,400	4.60:1	2260	*Silver 0.117"	1 narrow brass 1 wide brass* Picture 22	.500"
10,400	4.70:1	2212	*Silver 0.117"	1 narrow brass 1 wide brass* Picture 22	.495"
10,400	4.80:1	2166	*Silver 0.117"	1 narrow brass 1 wide brass* Picture 22	.490"
10,400	4.90:1	2122	*Silver 0.117"	1 narrow brass 1 wide brass* Picture 22	.480"
10,400	5.00:1	2080	*Silver 0.117"	1 narrow brass 1 wide brass* Picture 22	Start at Minimum .470"
10,400	5.10:1	2039	Blue 0.105"	1 narrow brass 1 wide brass* Picture 22	Maximum .545"
10,400	5.20:1	2000	Blue 0.105"	1 narrow brass 1 wide brass* Picture 22	.515"
10,400	5.30:1	1962	Blue 0.105"	1 narrow brass 1 wide brass* Picture 22	.500"
10,400	5.40:1	1925	Blue 0.105"	1 narrow brass 1 wide brass* Picture 22	.485"
10,400	5.50:1	1890	Blue 0.105"	1 narrow brass 1 wide brass* Picture 22	Start at Minimum .470"

* Factory Installed see Picture22

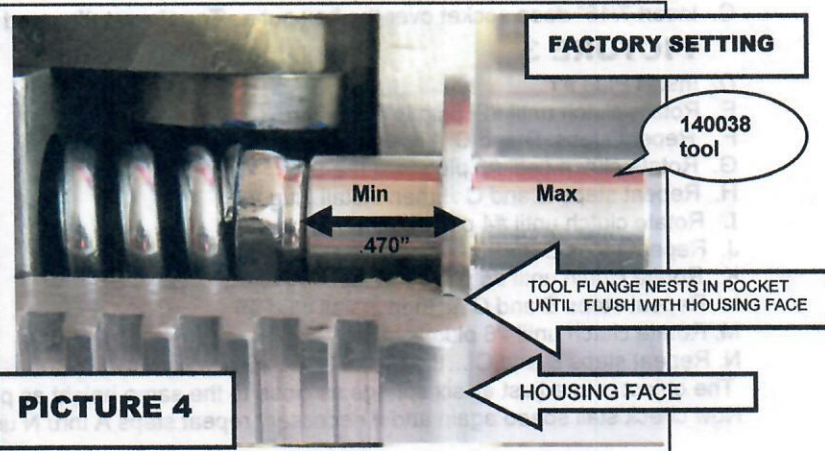
STALL SPEED ADJUSTMENT

Initial adjustment of stall speed should be made before going to track as spring changes or removing weight from levers is time consuming. A tachometer is mandatory to obtain correct engine stall speed. The clutch can be adjusted without removing from axle. Behind each plug is a compression spring held in place by a 1/4-28 nyloc nut ... a 7/16" hex extended socket is required to fit over the nut to adjust the spring height. **PICTURE 3**

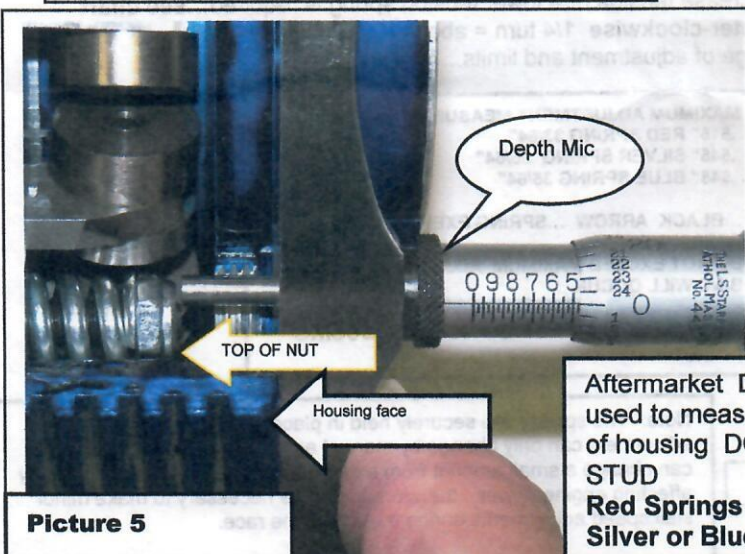
1. Install gearing and belt as close to the ratio you expect to use at the race event.
2. Note: *Silver springs and double brass weights are factory installed for most application with gear ratios between 4.10:1 and 5.00:1
3. Silver springs are preset at the factory at the minimum gauge setting of .470" **PICTURE 4** (a gauge tool p/n 140038 is supplied for initial setting of silver or blue springs, the tool is marked "min" on the short side and "max" on the long side ... they are the limits for adjusting springs... However the red springs have a different min and max and a gauge or scale is required for initial setting (**Picture 5** and **6**) .. As nut is adjusted clockwise the gauge tool measurement increases because spring is compressed more to provide higher tension and higher stall speed



Picture 3



PICTURE 4



Picture 5

PICTURE 4 ↑

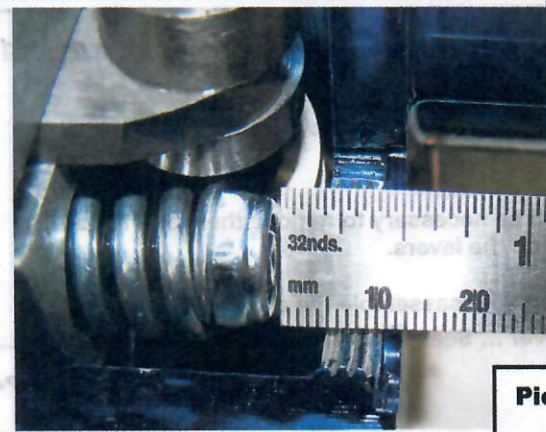
MINIMUM ADJUSTMENT HEIGHT

Silver or Blue Spring .470" from top of nut to flange of tool .. see black arrow above ..

Adjust nut until tool flange flush with face of clutch housing... At this setting the spring will exert its lowest pressure for a safe starting point for initial stall speed test

Aftermarket Depth Mic can also be used to measure from top of nut to face of housing DO NOT MEASURE FROM STUD

Red Springs minimum is .440"
Silver or Blue Springs Min is .470"



Picture 6

ALSO A MACHINISTS SCALE CAN BE USED TO SET ADJUSTMENT DEPTH

4. Don't forget to add clutch oil before starting kart to perform test,
5. Warm up engine then apply rear brake and go full throttle for about 1-2 seconds while viewing tach to see max rpm
6. The rpm that was reached will be the stall speed
7. If the stall speed is close to the prescribed number for your engine no adjustment is needed until first track session.
8. If the stall speed is too low then the springs in the clutch must be adjusted as follows:

RAISING STALL SPEED....Springs must be adjusted to increase tension

Adjust all six springs as equal as possible as follows:

A. Rotate clutch until #1 plug is at the top **PICTURE 2**

B. Remove plug

C. Insert 7/16" deep socket over the hex nut ... To raise stall speed turn nut clockwise 1/4 turn = .009" travel =100-200rpm

PICTURE 3

D. Install Plug #1

E. Rotate clutch until #2 plug is at the top

F. Repeat steps B and C ... then install plug #2

G. Rotate clutch until #3 plug is at the top

H. Repeat steps B and C ...then install plug #3

I. Rotate clutch until #4 plug is at top

J. Repeat steps B and C ... then install plug #4

K. Rotate clutch until #5 plug is at top

L. Repeat steps B and C ... then install plug #5

M. Rotate clutch until #6 plug is at top

N. Repeat steps B and C ...then install plug #6

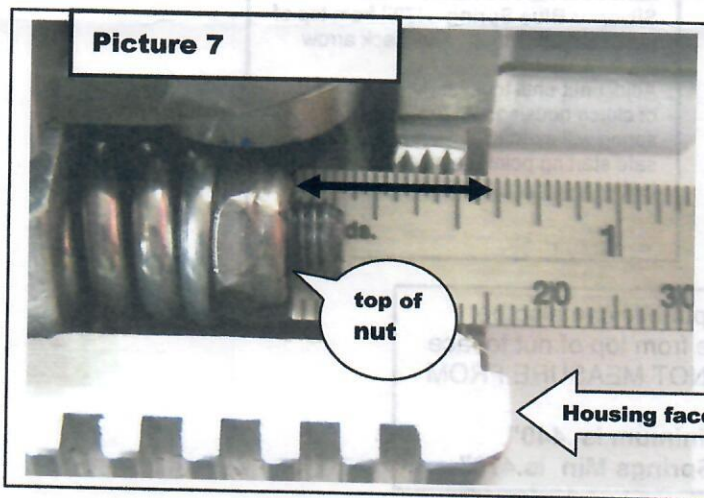
The object is to adjust all six springs as close to the same height as possible for equal pressure.

Now check stall speed again and if necessary repeat steps A thru N until desired stall speed is reached.

9. If stall speed is too high the springs must be adjusted to decrease tension or a lower tension spring is required...see chart

To lower stall speed turn each of the six nuts equally counter-clockwise 1/4 turn = about 100 -200rpm stall

10. Picture 4 , Picture 5, Picture 6, and Picture7 show range of adjustment and limits...follow carefully



MAXIMUM ADJUSTMENT MEASUREMENT

.515" RED SPRING 33/64"
.545" SILVER SPRING 35/64"
.545" BLUE SPRING 35/64"

...BLACK ARROW ...SPRING EXERTS HIGHEST PRESSURE...
DO NOT EXCEED MAXIMUM ADJUSTMENT AS COIL BIND WILL OCCUR...

MEASURE FROM TOP OF NUT TO HOUSING FACE

Note: The springs are securely held in place by lock nuts ... adjustment can only change by manual action ...however stall speed can change a small amount from external conditions , mainly air density affecting engine power...therefore it may be necessary to make minor stall speed adjustments during the day of the race.

Note: Measurements on chart are for guide only... it may be necessary to change springs and or weights to obtain desired stall speed for your specific application...

If maximum adjustment limit is reached with BLUE springs installed it will be necessary to remove them and install the SILVER springs and also keep the narrow and wide brass weights on the levers. **Picture 23**

If maximum adjustment limit is reached with SILVER springs installed it will be necessary to remove them and install the stronger RED springs and also keep both the narrow and wide brass weights on the levers.

If maximum adjustment limit is reached with RED springs it will be necessary to disassemble the clutch and remove the wide brass weight from each lever and leave the narrow weight fastened to lever ... See **Picture 24**
Re install Red Springs.



Adjustment Limits Warning !!!

Compression springs have limits of travel before coil bind. **PICTURE 7** ... Coil bind of the springs will prevent the clutch levers from pivoting and exerting force against the pressure plate. When the pressure plate is prevented from moving in the axial direction to clamp the discs the clutch will not lock up and transmit the engines power. Coil binding of the springs will therefore cause extreme slip resulting in burned up friction discs and warped floaters in the clutch. *In fact coil binding of the springs can quickly result in total destruction of the clutch.* Also the limits in the Chart consider the spring travel commensurate with the amount of air gap in the clutch.

Coil binding only happens when the springs are adjusted below the prescribed maximum limit as listed on Picture 7 or listed in Adjustment Chart on Page 2

COIL BIND!!!!

OCCURS WHEN SPRING FULLY COMPRESSED BECAUSE ADJUSTMENT MADE BEYOND MAXIMUM LIMIT

TOP OF NUT

DO NOT TAKE MEASUREMENT FROM STUD AS STUD IS FIXED LENGTH

Lever

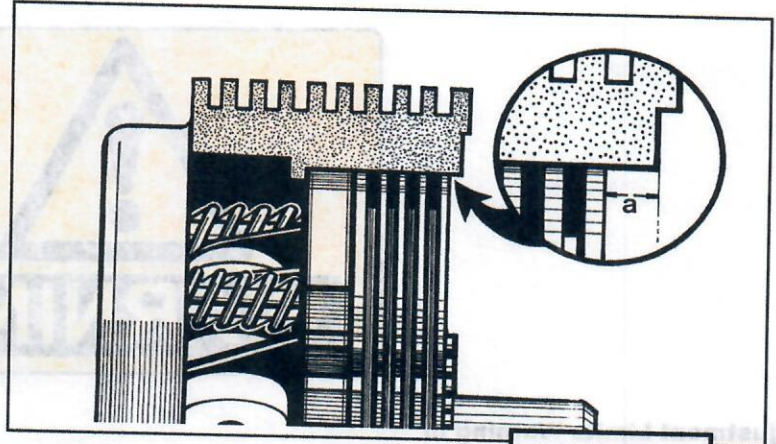
PRESSURE PLATE

AIR GAP

Air gap is required to allow a neutral starting position for the engine. Air Gap also enables the levers to pivot and push against the pressure plate as revs increase for a smooth yet firm acceleration. Clutches are assembled at the factory with air gap at $.045" \pm .003"$ (insert "a")

Picture 8... For optimum performance keep the air gap below $.055"$... When friction discs wear the air gap will increase. The 3 Friction discs start at $.095" \pm .002"$ ea and when worn to $.090"$ ea the air gap will exceed the maximum. By removing one $.040"$ floater and replacing it with an optional $.050"$ floater the air gap will be reduced to original tolerance. The wear rate of the friction discs is very low and need only be checked at 25-30 hours of track time unless clutch subjected to severe overheating or low oil level.

Also the floaters have a lifespan up to 100 hrs unless subjected to severe overheating from overslip or low oil level as they may warp.

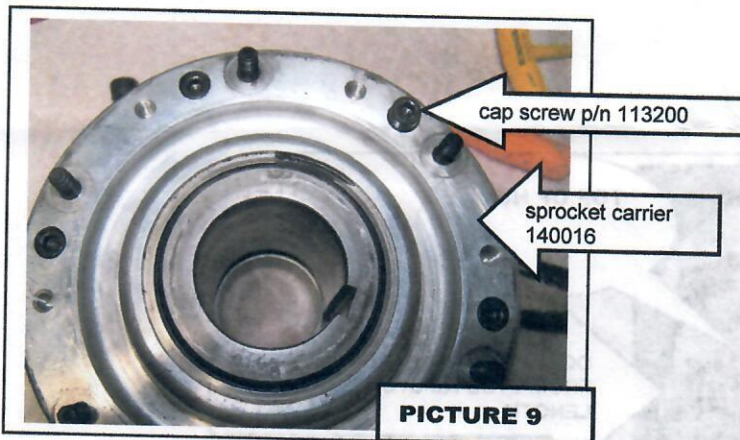


PICTURE 8

Disassembly Steps

- Step 1. Drain oil
- Step 2. Remove six flange nuts and aftermarket 8MM gear.
- Step 3. Remove the six cap screws from sprocket carrier with 3/16 hex wrench

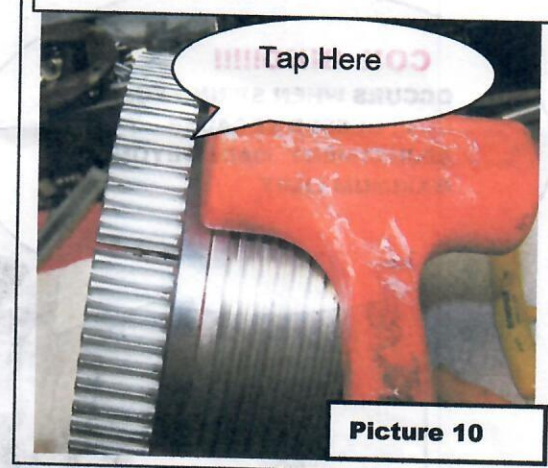
Picture 9



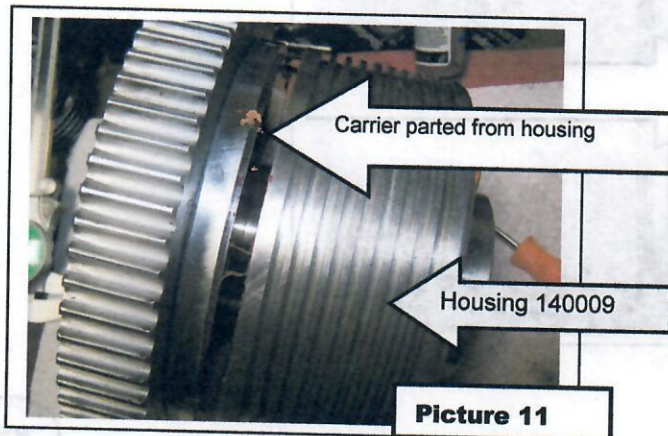
PICTURE 9

- Step 4. Fasten gear onto sprocket carrier and tap towards back side of gear 360° evenly with rubber mallet until carrier parted from housing

Picture 10 and Picture 11



Picture 10



Picture 11

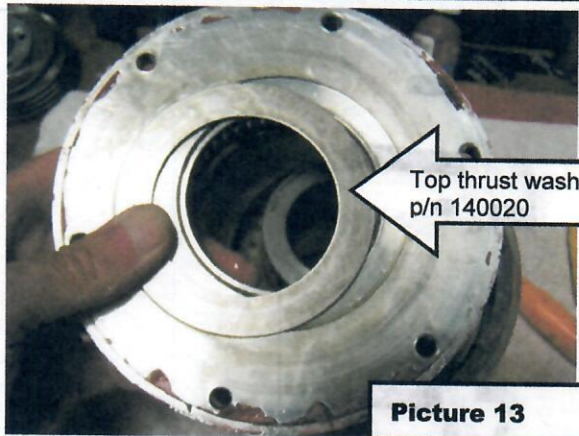
- Step 5 Remove carrier by lifting off clutch hub

Picture 12



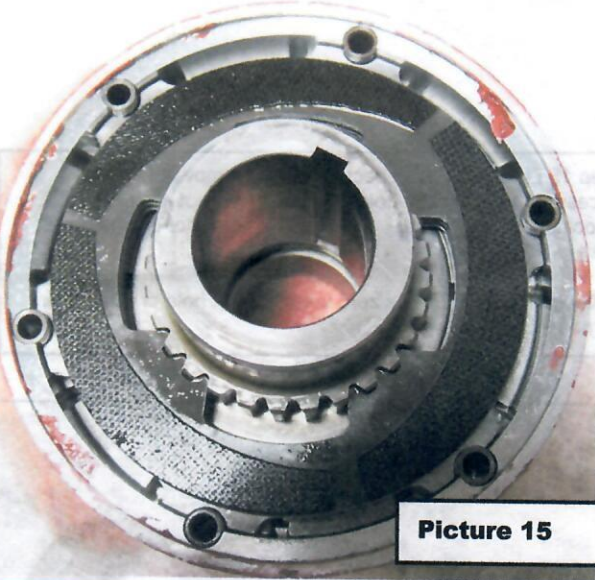
Picture 12

Step 6 Remove Top Thrust Washer **Picture 13**



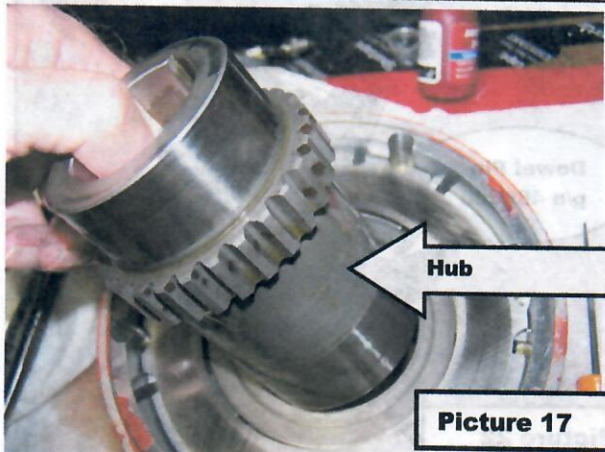
Picture 13

Step 8 Remove all remaining friction discs and floaters
Picture 15
There are 3 steel floaters and 3 friction discs total



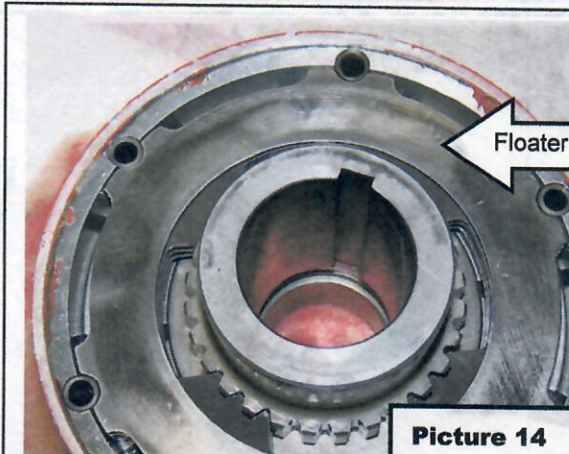
Picture 15

Step 10 Remove Hub **Picture 17**



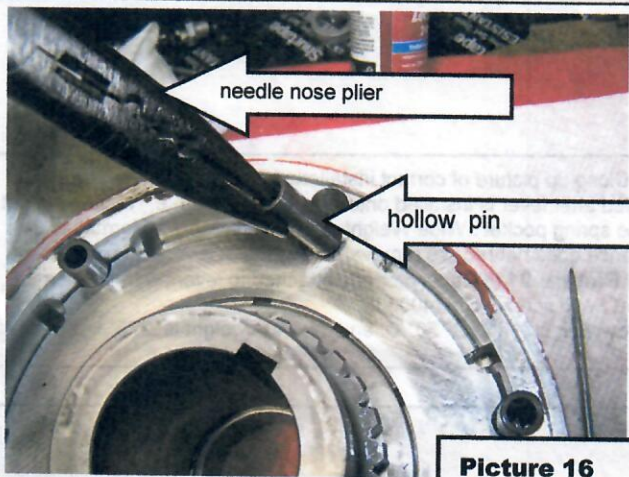
Picture 17

Step 7 Remove Steel Floater **Picture 14**



Picture 14

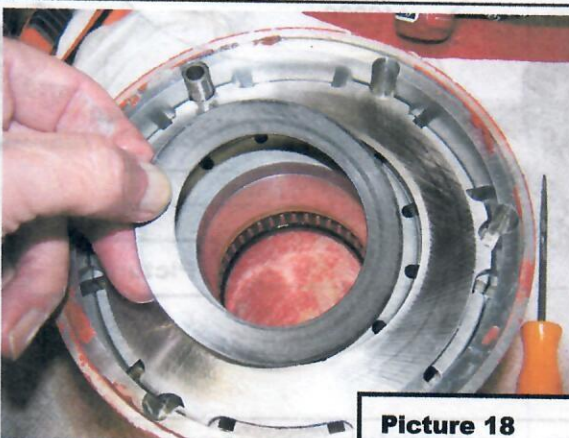
Step 9 Remove all six Hollow Pins by lifting upward
Picture 16



Picture 16

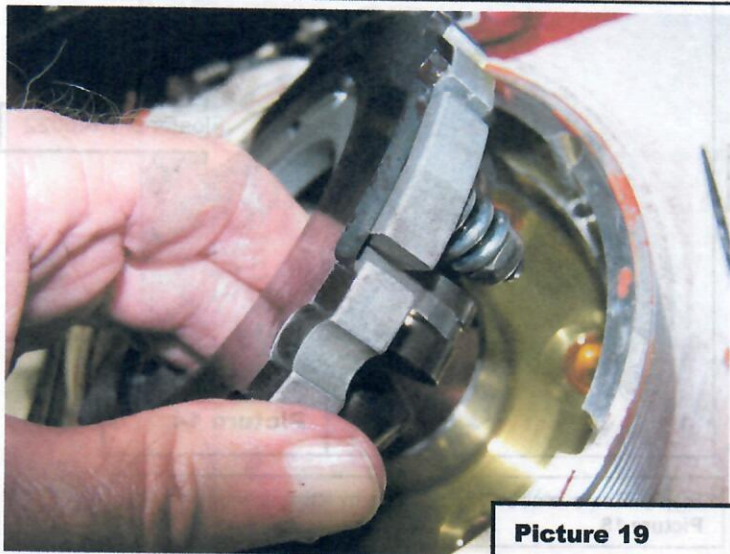
Step 11 Bottom thrust washer is held in place with epoxy and should not be removed **Picture 18**

Note: a thrust washer on each side of the involute spline of hub is necessary to also provide correct free play between hub and housing components...thrust washers also reduce wear and friction.



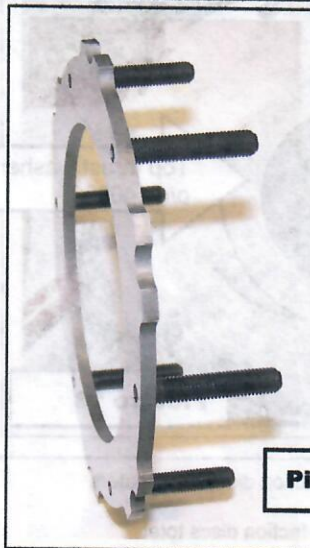
Picture 18

Step 12 Remove Pressure Plate & Lever Assembly
Lift Straight Upward by hand do not pry or force **Picture 19**



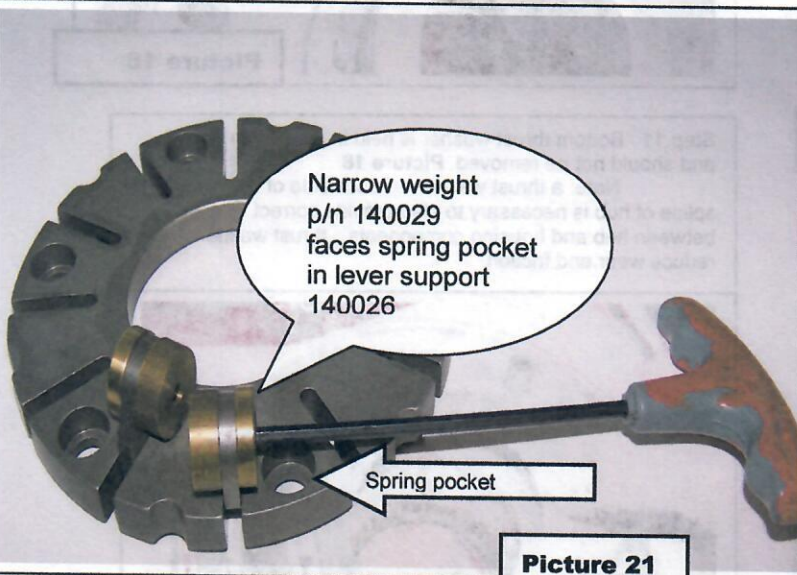
Picture 19

Step 13 Pressure Plate can be removed from lever support by
removing springs **Picture 20**



Picture 20

Step 14 Close up picture of correct installation of weights... Weights must
be installed after lever is installed onto lever support Note: Narrow Weight
must face spring pocket ..Wide Weights face each other ... Normal
maintenance does not require removal of weights or levers from lever
support. **Picture 21** Weights properly attached to levers with 10-32 x 5/8
flat socket head screws p/n 140033...
The narrow weight .175" x .750" Ø and the wide weight is .275" x .750" Ø



Picture 21

Step 15 Lever can be inspected without removal. Look for
excessive wear in pivot hole... replace when oval shaped
...look for wear at nose ...replace when flat spot occurs on
nose

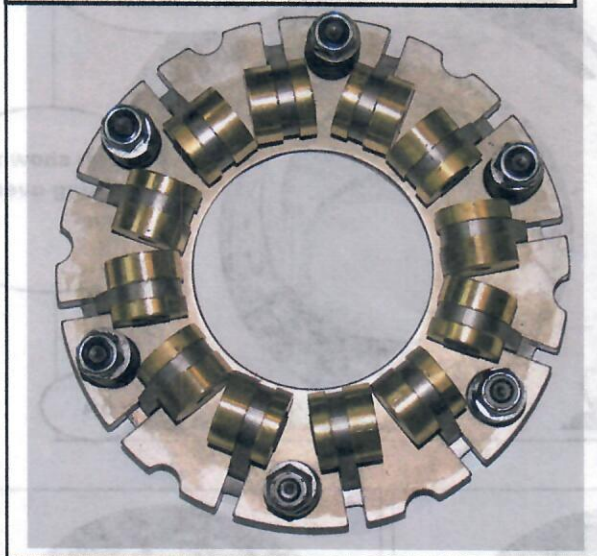
Lever in **Picture 22** has zero wear in pivot hole or nose after
10 hours track time



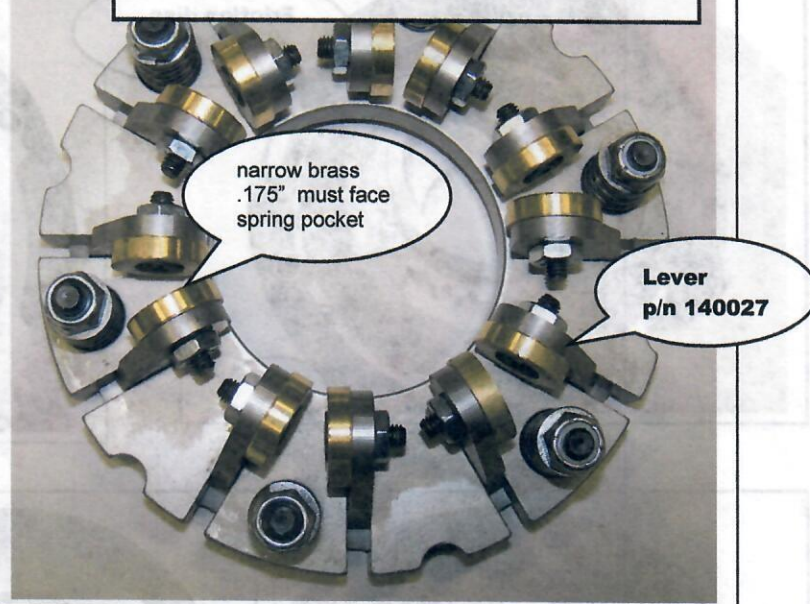
Picture 22

Step 16 Last step... inspect seals for leakage and bearing for damage and
replace if necessary... a low cost seal removal tool is recommended

**Picture 23 double brass on each lever
narrow brass must face spring**



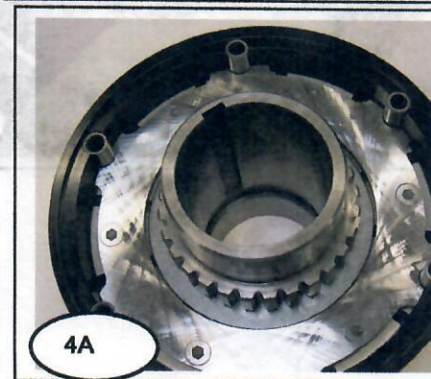
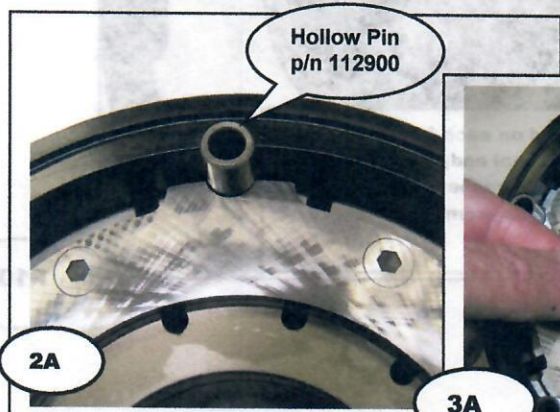
**Picture 24 Narrow Brass only with
10-32 flat head screw and lock nut**

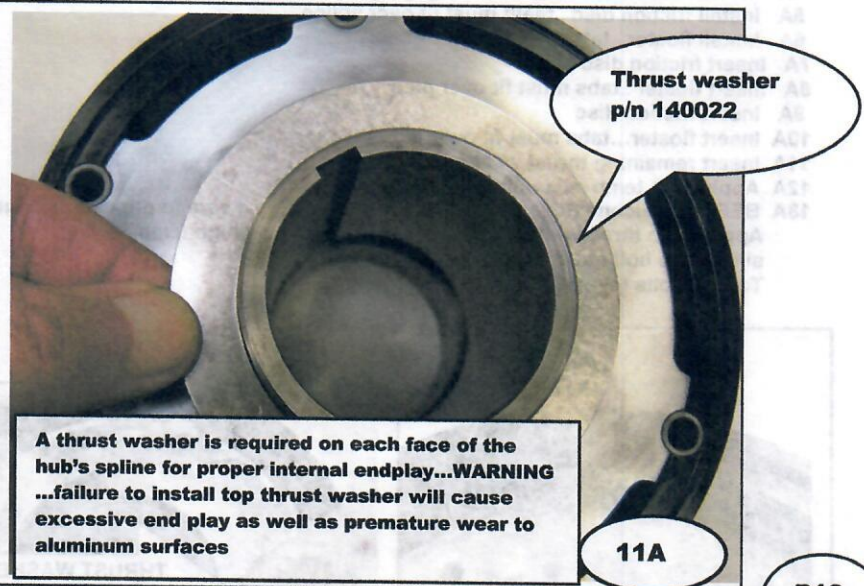
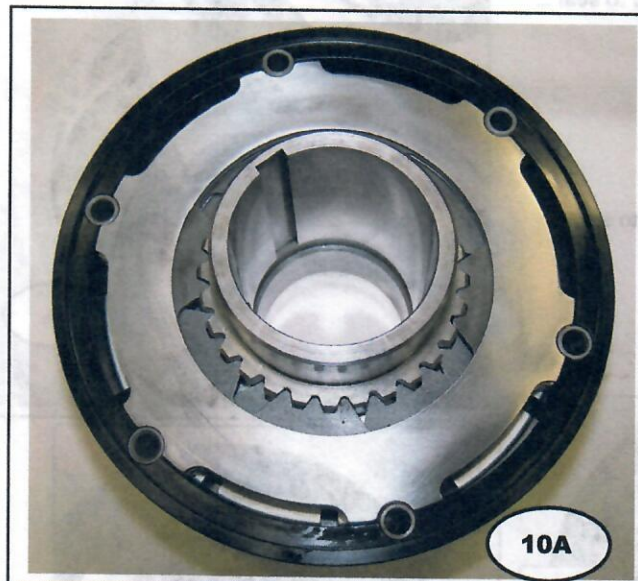
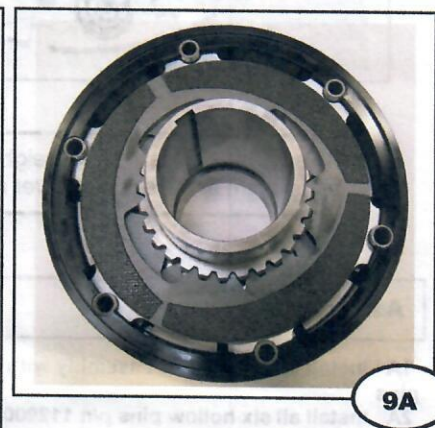
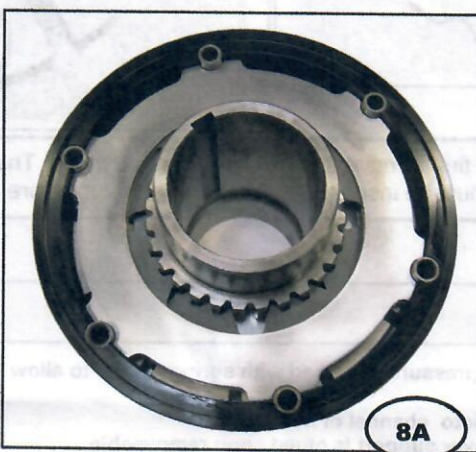
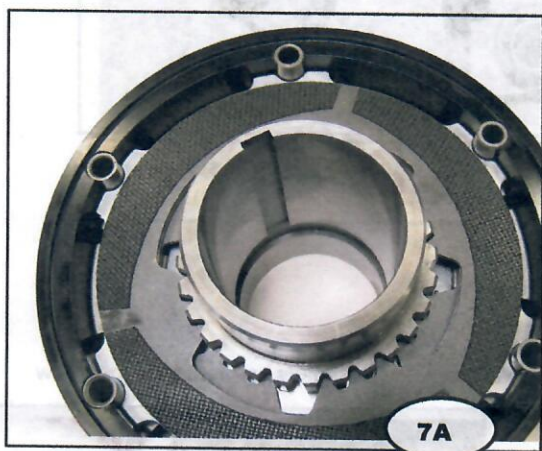
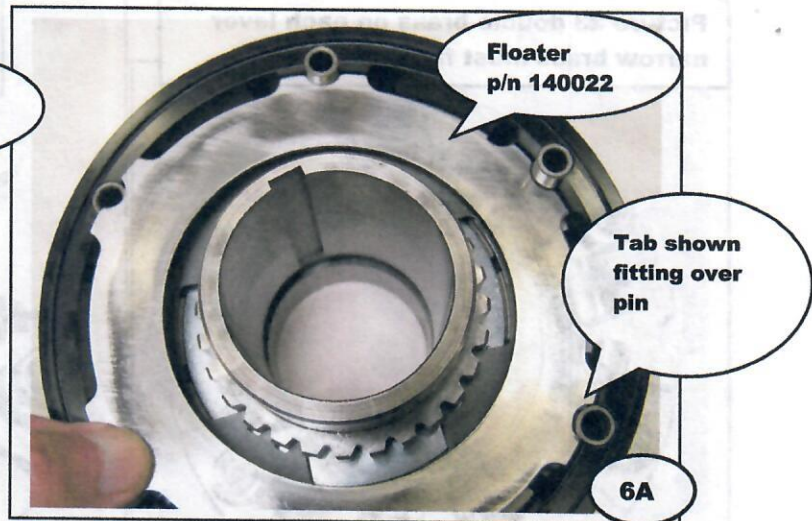
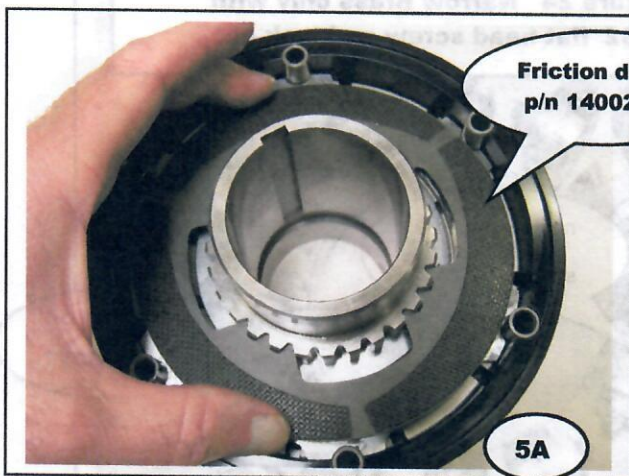


When adding or removing weight first remove springs and pressure plate. The lever will not go onto the lever support with weight attached. The lever must be inserted into the lever support before adding weight.

Assembly

- 1A Install lever support assembly with pressure plate and with springs loose to allow easy alignment of channels before inserting hollow pins
- 2A Install all six hollow pins p/n 112900 into channel of housing
- 3A The thrust washer in the pocket of lever support is glued ..non removeable
- 4A Insert Hub. Rotate hub when engaging seal and push gently to avoid damage to seal ...
- 5A Install friction disc ..teeth must fit over spline
- 6A Install floater ..tabs must fit over pins
- 7A Insert friction disc
- 8A Insert floater ..tabs must fit over pins
- 9A Insert friction disc
- 10A Insert floater...tabs must fit over pins
- 11A Insert remaining thrust washer over hub
- 12A Apply high temp silicon to top of housing
- 13A BEFORE silicone dries install carrier onto hub ..use care to prevent damage to seal
Apply oil to threads of bolts $\frac{1}{4}$ -20 x 1 $\frac{1}{4}$ " and apply high temp silicone to bolt head to prevent leakage
Torque bolts to 120 inch lbs





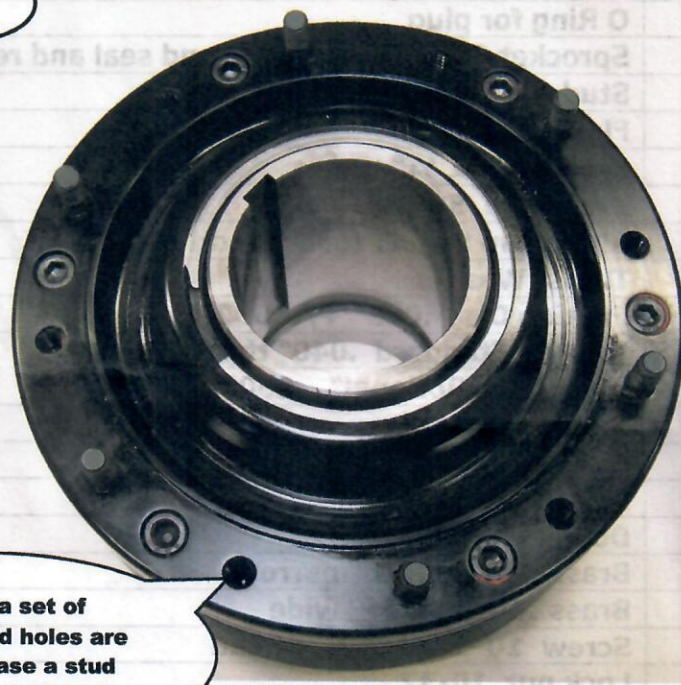


12A



P/N
113200

13A



**Note: an extra set of
threaded blind holes are
provided in case a stud
is stripped or broken ...**

140000 and 140002 Parts List

P / /N	Description	Units Required
140000	Axle Clutch Complete, fitment to 1.250" axle	
140002	Axle Clutch Complete, fitment to 50MM axle	
140009	Housing w/bearing , oil seal, and retaining ring	1
112900	Hollow Pins	6
140011	Retaining Ring	2
140012	Seal	2
140013	Bearing	2
140014	Plug for housing	6
140015	O Ring for plug	6
140016	Sprocket Carrier w/bearing and seal and retaining ring	1
140017	Stud	6
114400	Flange Nut	6
140018	Drive Hub 1 1/4" axle	1
140019	Drive Hub 50MM axle	1
140018S	Aluminum Spacer for 1 1/4" drive hub	1
140020	Thrust Washer	2
140021	Friction Disc .095" +/- .002"	3
140022	Floater, Standard .040" thick	3
140023	Floater , "Optional" .050" thick	
140024	Pressure Plate	1
140026	Lever Support	1
140027	Lever	12
480086	Dowel Pin	12
140029	Brass Weight .175" narrow	12
140030	Brass Weight .275" wide	12
140033	Screw 10-32x 5/8 Flat head	12
140033A	Lock nut 10-32	12
140034	Spring High Tension "Red" .125" wire diameter	6
140035	Spring Medium Tension "Silver" .117" wire diameter	6
140036	Spring Low Tension "Blue" .105" wire diameter	6
140037	1/4-28 Loc Nut , adjustment of spring	6
113200	Housing Bolts 1/4-20 x 1 3/4"	6
140038	Adjustment gauge tool	1
330125A	Nyro Oil, 6 oz	1
330125	Nyro Oil, Quart	optional
140041	Tungsten Weight, .170 optional for ratio above 5.30:1	12