GrudgeBox

MADE IN THE USA

BAKER DRIVETRAIN

GRUDGEBOX TRANSMISSION KIT

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ABOUT YOUR NEW GRUDGEBOX

INTRODUCTION

The GrudgeBox is an all spur 6-speed overdrive transmission that delivers uncompromised performance in all gears and significantly more torque capacity than the stock unit. The primary impetus for the design was performance, but the GrudgeBox was also designed for those who spend a lot of time in the saddle looking for that extra gear on the highway. 6th gear is a true overdrive that is numerically mild to yield a 250 RPM drop as compared to the stock unit. The gearset fits into the stock transmission case with no modifications. It has earned its BAKER pedigree with extensive highway testing and many merciless passes at the dragstrip.

FITMENT

- 2006 – 2017 Dyna
- 2007 – Later Softail & Touring Models

BREAK-IN

The GrudgeBox requires no break-in schedule. However, we do recommend that you take it easy for the first 20 miles to confirm that there are no issues related to basic function of the transmission and the reassembly of the motorcycle. You will notice that the transmission will shift smoother and operate quieter after about 2500 miles. Like any machine, scheduled oil changes are key to years of trouble-free service. Log your transmission oil changes at the recommended intervals on page 25. General maintenance can be logged on page 26.

FLUIDS

The GrudgeBox requires 24-28 oz. of transmission fluid. We recommend Spectro 6-speed transmission oil that has long chain polymers that stand up to the harsh environment that this high-performance transmission can deliver. Please follow the recommended oil change intervals on page 25 and document your transmission service history. The exception to the stated intervals is winter storage. If the bike is stored in an environment that has significant temperature fluctuations, there will be water condensation inside the transmission. The oil should be changed immediately when it comes out of storage and is put back into service.

WARRANTY

This product includes a 5-year, 50,000-mile warranty. All steps in these instructions must be completed as outlined for the warranty to remain valid.

FEATURES AND GEAR RATIOS

FEATURES

The GrudgeBox is the most innovative, well executed, robust transmission we have ever endeavored to design and manufacture. Significant GrudgeBox features include:

1. **6-Speed overdrive design**. The 5th gear ratio of the GrudgeBox is 1:1 which is equivalent to the stock transmission 6th gear ratio. The overdriven 6th gear ratio offers a 250 RPM reduction for highway cruising.
2. **Straight cut (spur) gears**. Gear School 101. Helical gears are used in most motorcycles and cars these days because they are quieter than spur gears. However, there's a cost for noise reduction because helical gears give up horsepower. The amount of horsepower given up is proportional to the angle of the helix on a given gear pair. The stock transmission has helical gears in 2nd through 6th. The GrudgeBox is configured with all spur gears and no sacrificed horsepower.
3. **Gear width.** Stock transmission gear engagement is typically .500", GrudgeBox is .700" in 1st through 4th with nearly twice the circumferential tooth thickness. Generally speaking, torque capacity of a transmission is the product of the gearset center distance, gear engagement width, and circumferential tooth thickness at the pitch line.
4. **Tapered roller main drive gear bearing.** We replaced the problematic self-aligning stock main drive gear bearing with a tried-n-true opposing tapered roller bearing pair; patent pending. We did this because any transmission is only as strong as its weakest link.
5. **Dog tooth engagement.** The dog teeth on the stock 3rd and 4th gears have roughly .200" axial engagement with a less-than 1° undercut. This is a formula for gear hop-out. For the GrudgeBox we chose 4° undercuts with .250" axial engagement in all positions to guarantee NO gear hop-out or missed shifts, which translates into NO lost revenue if you are a Grudge hustler.
6. **Direct acting shifter pawl.** Upshifting with the stock 07-later shifter pawl is much like pushing on a rope. To make upshifts crisp and precise, we developed a direct acting pawl that engages the drum pins with negligible free play and no ropes.

GEAR RATIOS

GrudgeBox	Stock H-D
1st – 3.15	1st – 3.34
2nd – 2.20	2nd – 2.31
3rd – 1.59	3rd – 1.72
4th – 1.23	4th – 1.39
5th – 1.00	5th – 1.19
6th – 0.92	6th – 1.00

GRUDGEBOX TRANSMISSION KIT

REQUIRED PARTS, TOOLS, & REFERENCE MATERIALS

To install the GrudgeBox Transmission Kit, the following is required:

- Factory Service Manual for your year and model motorcycle
- Common hand tools (allen wrenches, sockets, retaining ring pliers, etc.)
- Breaker bar, 1/2" drive
- Torque wrenches, 3/8” & 1/2” drive
- 1-3/16” socket, 6 pt, 1/2” drive
- Red and blue threadlocker
- A new primary cover gasket
- Dial indicator (.0005” increments)
- MAP/Propane gas or heat gun
- Main drive gear & bearing service tool
    - BAKER TOOLA-07
    - H-D equivalent 35316C
- Inner primary race service tool
    - BAKER TOOLB-56
    - H-D equivalent 34902B
- Pulley locking tool
    - BAKER TOOLC-56
    - H-D equivalent 46282
- Pulley nut socket
    - BAKER TOOLD-07
    - H-D equivalent 47910
- Countershaft bearing service tool
    - BAKER TOOLE-07
- Primary drive locking tool
    - H-D-48219 (Touring models)
    - H-D-47977 (Softail/Dyna)
- Primary fluid, 40 oz. (Touring models) or 46 oz. (Softail/Dyna)
    - BAKER recommends Spectro Heavy Duty Primary Chain Case Oil; R.HDPCO
- Transmission fluid, 28-32 oz.
    - BAKER recommends Spectro Heavy Duty Platinum 6 Speed Transmission Oil; BD-75140-32

HIGHLY RECOMMENDED ADDITIONAL PART

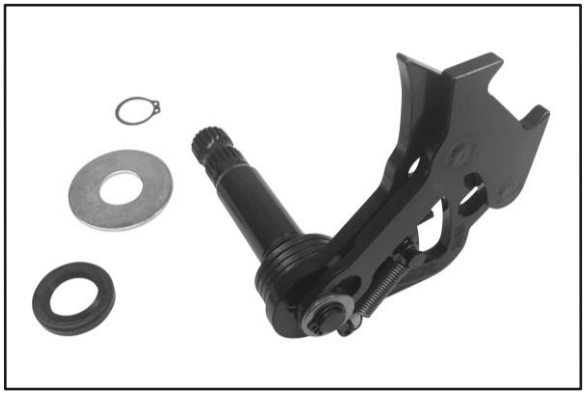
Baker Drivetrain highly recommends that the automatic chain tensioner be replaced with a Baker Attitude Adjuster (figure 1). Extensive testing and durability miles have proven that our Attitude Adjuster (P/N 177-67K) puts less shear stress load on the motor sprocket shaft and the transmission mainshaft, thereby extending the life of the drivetrain components.

NOTE: DOES NOT FIT 2018-LATER SOFTAILS WITH MID CONTROLS

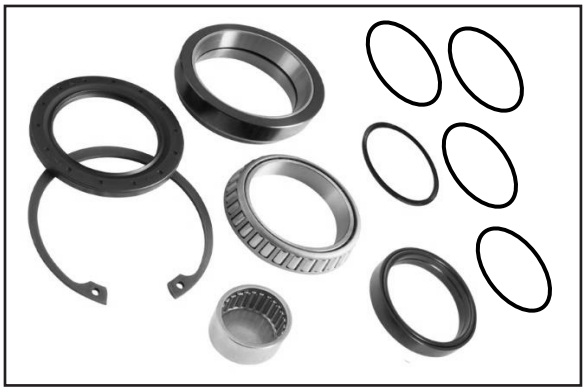
FIGURE 1 | BAKER ATTITUDE ADJUSTER

WHAT'S INCLUDED IN MY KIT?

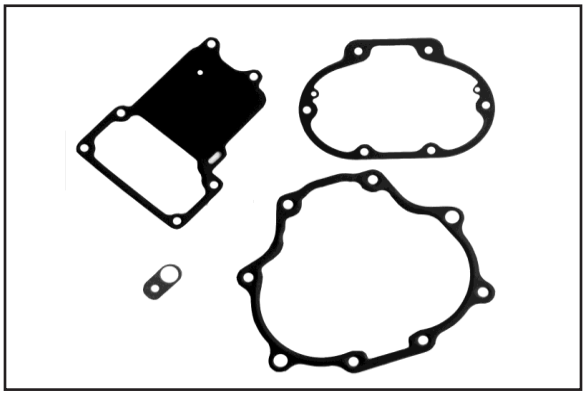
GrudgeBox gearset w/ shift system
5/16"-18 SHCS, stainless, 73497
Washers, stainless, 6100



Shifter pawl, GB6-555A
Shifter pawl washer, 6497HW
Shifter pawl retaining ring, 68010
Shifter pawl seal, 37101-84B



Countershaft bearing, 8963
Tapered roller bearing, HR32910J
Tapered roller bearing adapter, 11610-GB
Pulley spacer w/ O-ring, 33334-GB | OR568M52
Main drive gear seal, 12074-67
85mm beveled internal retaining ring, VHO-334STPA
.098" bearing spacer, 11600-GB, orange (shown)
.100" bearing spacer, 11605-GB, yellow (shown)
.102" bearing spacer, 11615-GB, white (pre-installed on MDG)
.104" bearing spacer, 11620-GB, green (shown)
.106" bearing spacer, 11625-GB, blue (shown)
.108" bearing spacer, 11630-GB, red (shown)



Bearing door gasket, 35654-67
Top cover gasket, 34917-06-F (shown)
25700453 (M8)
Side cover gasket, 36805-06-F
Speed sensor spacer, 132-56R

Bearing adapter installation cup, T855-GB
Inner primary bearing, P205PP-H
Inner primary bearing seal, 25X52X07ADL

Side cover emblem, EMBLEM-GB

BEARING DOOR EXPLODED VIEW

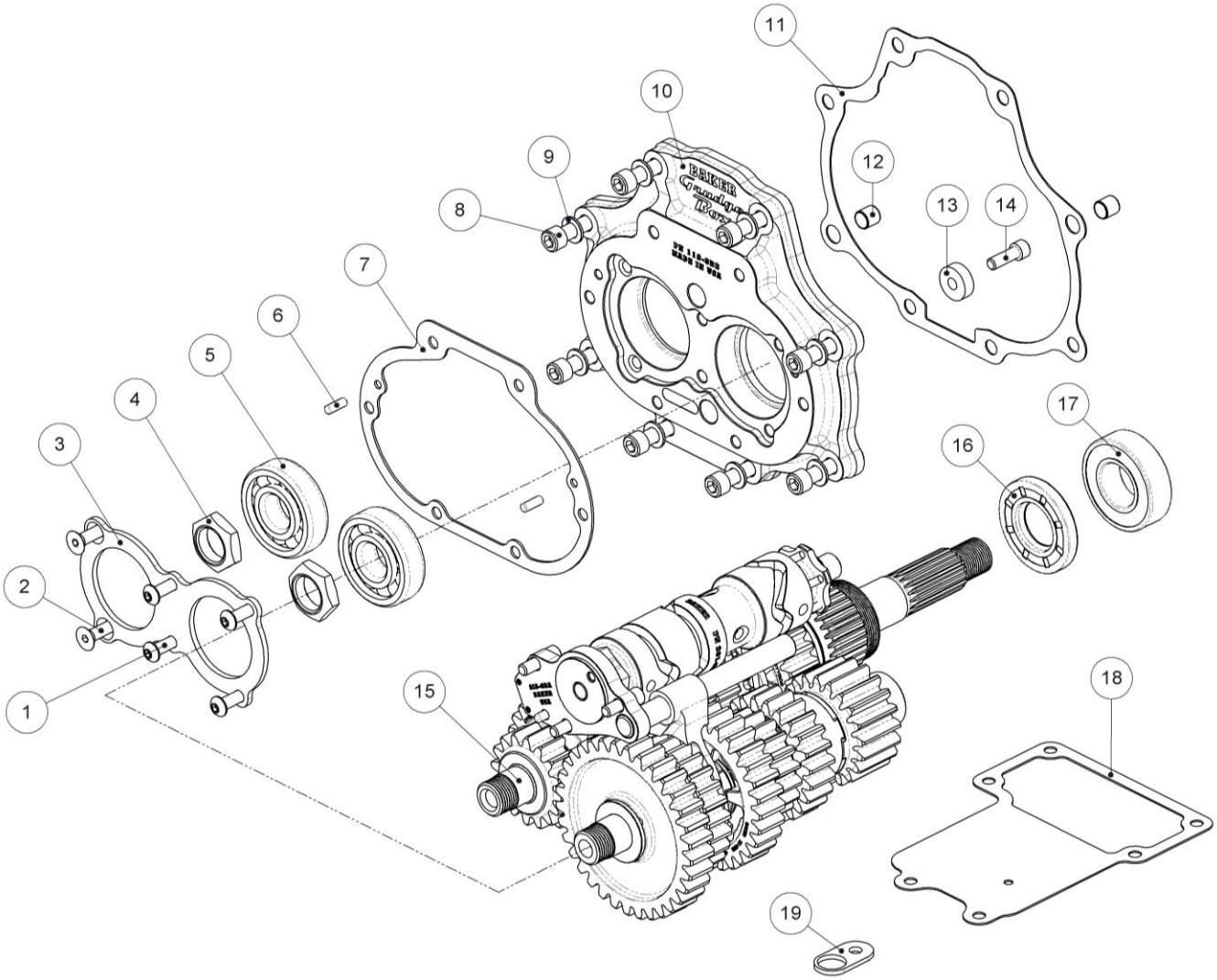


FIGURE 2 | EXPLODED VIEW, BEARING DOOR

BEARING DOOR PARTS LIST

ITEM	P/N	QTY	DESCRIPTION
1	24050	4	Button head cap screw, 1/4"-20 x .625”
2	25C62KFC	2	Flat head cap screw, 1/4"-20 x .625”
3	481C-6	1	Retainer plate, door bearings
4	7340BD	2	Nut, 1-1/8" socket, mainshaft & countershaft
5	6304	2	Bearing, radial ball, 52mm
6	26735	2	Dowel, 3/16” x .500”
7	36805-06F	1	Gasket, side cover
8	73497	8	Socket head cap screw, stainless, 5/16”-18 x 1.500”
9	6100	8	Washer, stainless, .341” x .560” x .058”
10	GB6-11802	1	Bearing door, GrudgeBox, polished
	GB6-118022	1	Bearing door, GrudgeBox, CVO charcoal w/ highlight
	GB6-11803	1	Bearing door, GrudgeBox, wrinkle black w/ highlight
11	35654-67	1	Gasket, bearing door
12	16583-67	2	Hollow dowel, 10mm x .375”
13	F1409	1	Magnet, .265” x .750” x .250”
14	25C75KCS	1	Socket head cap screw, 1/4"-20 x .750”
15	N/A	1	GrudgeBox gearset w/ shift system
16	25X52X07ADL	1	Seal, inner primary, 25 x 52 x 7mm
17	P205PP-H	1	Bearing, inner primary, 25 x 52 x 15mm
18	34917-06F	1	Gasket, top cover, 2006/07 – Later
	25700453	1	Gasket, top cover, 2017/18 – Later M8
19	132-56R	1	Spacer, speed sensor, .100”

GEARSET EXPLODED VIEW

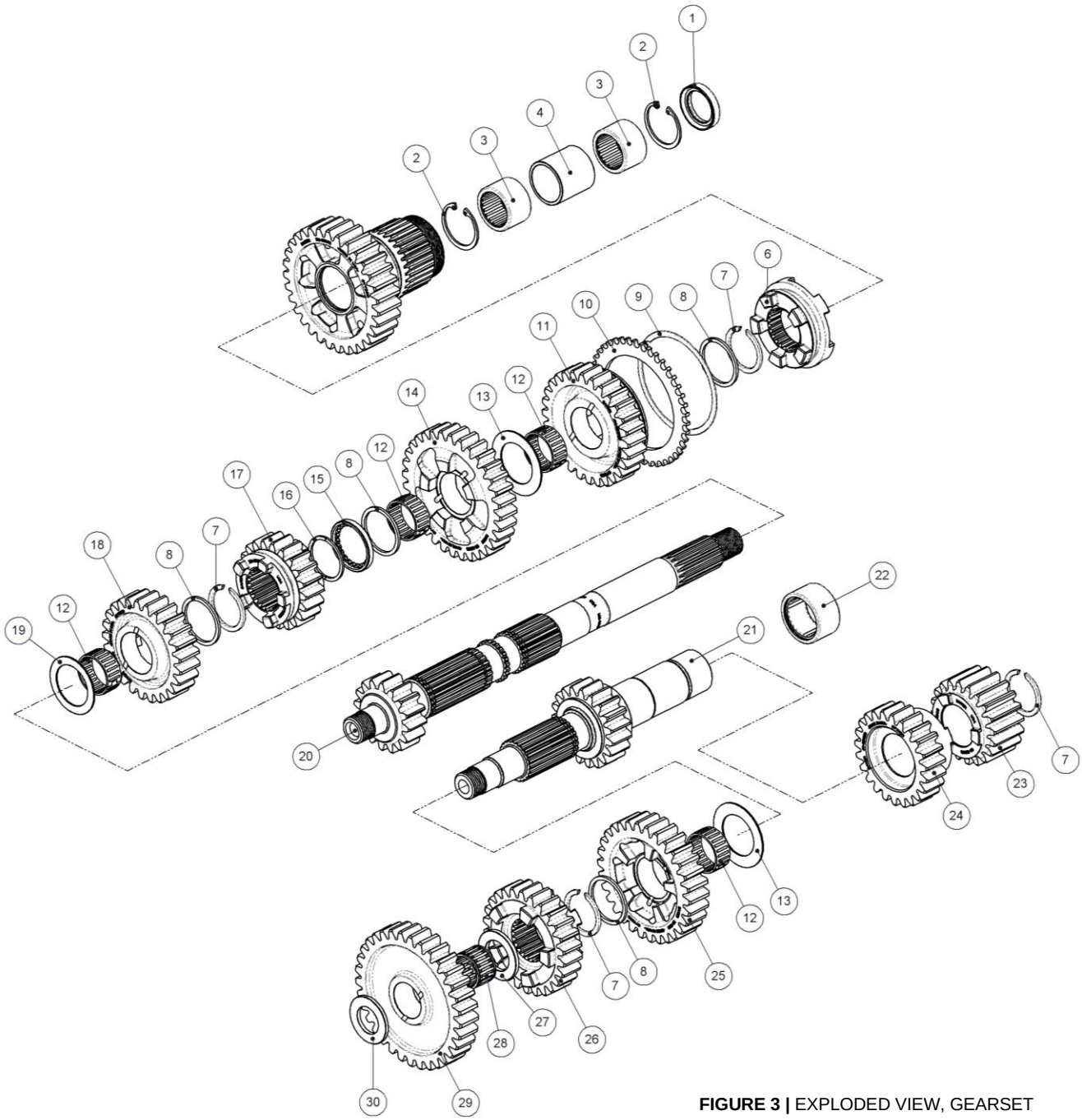


FIGURE 3 | EXPLODED VIEW, GEARSET

GEARSET PARTS LIST

ITEM	P/N	QTY	DESCRIPTION
1	12035B	1	Seal, main drive gear, 25 x 32 x 6mm
2	125RRBI	2	Retaining ring, internal, 1.250”
3	HK2520	2	Bearing, drawn cup needle, 25 x 32 x 20mm
4	11599-90	1	Spacer, main drive gear, 1.060” x 1.250” x 1.225”
5	GB6-5M	1	5th gear, mainshaft, 29T, spur
6	GB6-DC45	1	Dog clutch, 4th-5th gear, GrudgeBox, all
7	11067	5	Retaining ring, external, eaton style, 30mm
8	6003B	4	Thrust washer, 1.185” x 1.380” x .071”
9	VS-275	1	Retaining ring, external, 2.750”
10	BD-7242	1	Reluctor ring, 42T
11	GB6-4M	1	4th gear, mainshaft, 26T, spur
12	8876A	4	Bearing, split cage needle, 26 x 30 x 13mm
13	AS3047	2	Thrust washer, 1.185” x 1.843” x .039”
14	GB6-6M	1	6th gear, mainshaft, 30T, spur
15	BD-11081	1	Thrust washer, splined, 1.185” x 1.430” x .125”
16	11082	2	Segment ring, 1.102” x 1.280” x .056”
17	GB6-2M	1	2nd gear, mainshaft, 18T, spur
18	GB6-3M	1	3rd gear, mainshaft, 23T, spur
19	BD-3042	1	Thrust washer, 1.185” x 1.645” x .039”
20	GB6-MS	1	Mainshaft & 1st gear, 15T, spur
21	GB6-CS	1	Countershaft & 6th gear, 18T, spur
22	8963	1	Bearing, drawn cup needle, 30 x 37 x 21mm
23	GB6-5C	1	5th gear, countershaft, 19T, spur
24	GB6-4C	1	4th gear, countershaft, 21T, spur
25	GB6-2C	1	2nd gear, countershaft, 26T, spur
26	GB6-3C	1	3rd gear, countershaft, 24T, spur
27	TWD1423	1	Thrust washer, .883” x 1.420” x .125”
28	K22X26X17	1	Bearing, caged needle, 22 x 26 x 17mm
29	GB6-1C	1	1st gear, countershaft, 31T, spur
30	BD-2035	1	Thrust washer, .791” x 1.361” x .107”

TAPERED BEARING EXPLODED VIEW AND PARTS LIST

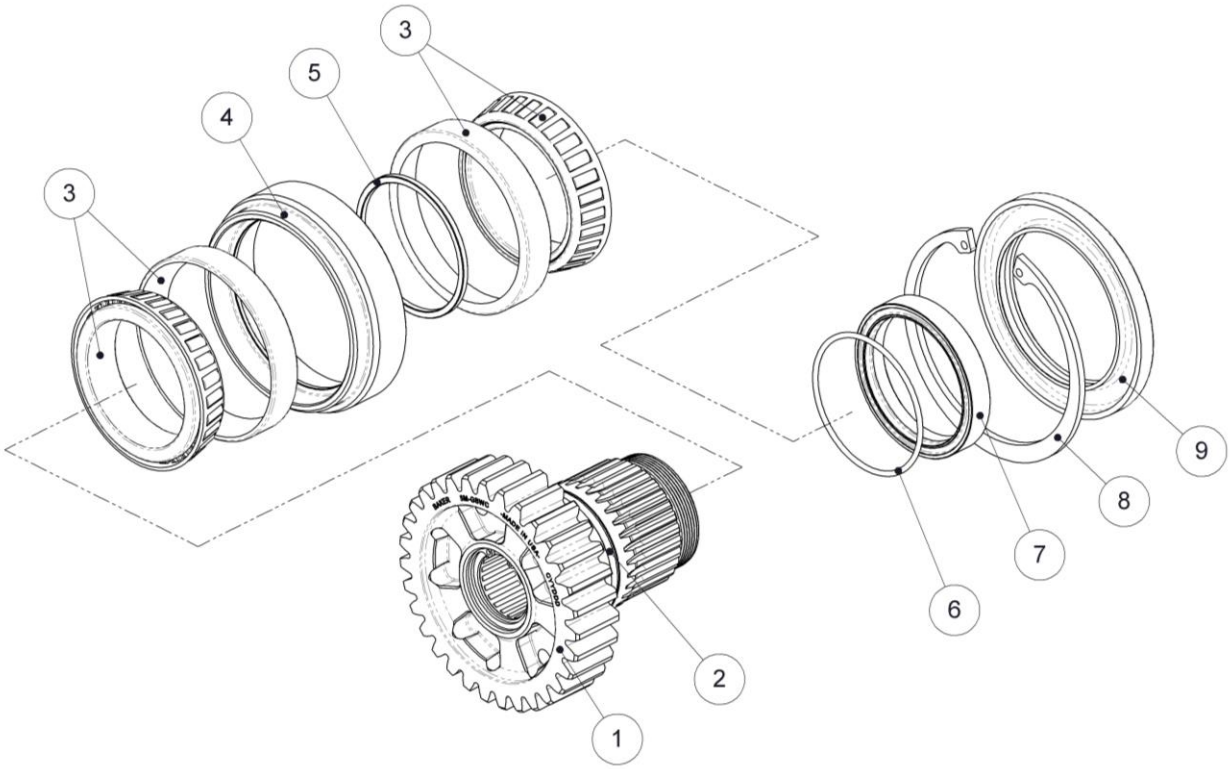


FIGURE 4 | EXPLODED VIEW, TAPERED ROLLER BEARING

ITEM	P/N	QTY	DESCRIPTION
1	GB6-5M	1	5th gear, mainshaft, 29T, spur
2	OR568132	1	O-ring, Buna #132
3	HR32910J	2	Bearing, tapered roller, 50 x 72 x 15mm
4	11610-GB	1	Adapter, tapered roller bearings
5*	11600-GB	1	Spacer, tapered roller bearings, .098”, orange
	11605-GB	1	Spacer, tapered roller bearings, .100”, yellow
	11615-GB	1	Spacer, tapered roller bearings, .102”, white
	11620-GB	1	Spacer, tapered roller bearings, .104”, green
	11625-GB	1	Spacer, tapered roller bearings, .106”, blue
	11630-GB	1	Spacer, tapered roller bearings, .108”, red
6	OR568M52	1	O-ring, pulley / sprocket spacer, 52mm
7	33334-GB	1	Spacer, pulley / sprocket
8	1302-334PP	1	Retaining ring, beveled internal, 85mm
9	12074-67	1	Seal, main drive gear, 2.380” x 3.375” x .285”

***See pages 17-18 for tapered roller bearing setup and spacer explanation**

SHIFT SYSTEM EXPLODED VIEW AND PARTS LIST

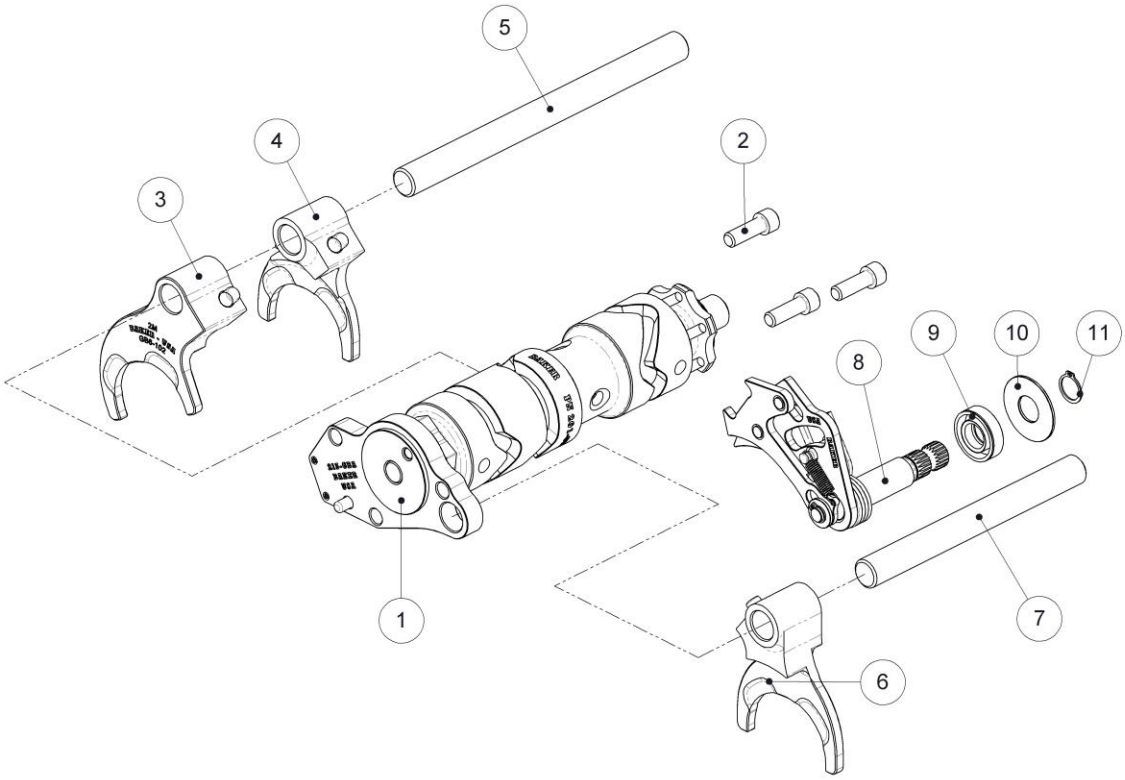


FIGURE 5 | EXPLODED VIEW, SHIFT SYSTEM

ITEM	P/N	QTY	DESCRIPTION
1	200-GB-A	1	Shift system, standard pattern
	200-GBN1-A	1	Shift system, N1 pattern
	200-GBN1RK-A	1	Shift system, reverse N1 pattern w/ kill
	200-GB17-A	1	Shift system, standard pattern, M8 models
	200-GB17N1-A	1	Shift system, N1 pattern. M8 models
	200-GB17N1RK-A	1	Shift system, reverse N1 pattern w/ kill, M8 models
2	23205	3	Socket head cap screw, 1/4"-20 x .750”
3	GB6-102	1	Shift fork, 2nd gear, mainshaft
4	GB6-101	1	Shift fork, 4-5 dog clutch, mainshaft
5	35224-GB	1	Fork rod, mainshaft, 6.285”
6	GB6-103	1	Shift fork, 3rd Gear, countershaft
7	35222-67	1	Fork rod, countershaft, 4.825”
8	GB6-555A	1	Shifter pawl
9	37101-84B	1	Seal, shifter pawl, .500” x .750” x .170”
10	6497HW	1	Washer, .459” x 1.125” x .045”
11	68010	1	Snap ring, external, .4375

GRUDGEBOX TRANSMISSION KIT

BEFORE YOU BEGIN

The transmission is a component in the powertrain of your motorcycle. As such, its function is highly dependent on other components in the powertrain to perform as designed. If the clutch, clutch actuator, primary, or shift linkage is worn, tired, or compromised in any way, the transmission will not perform as designed. The process of installing the GrudgeBox is the perfect time to assess and freshen up these components to ensure the transmission gives you years of trouble-free service.

TORQUE SPECIFICATIONS

THREAD	APPLICATION	TORQUE VALUE	THREADLOCKER
1/4"-20	Side cover, top cover, derby cover, outer primary, VSS, pulley locking plate	132 – 156 in-lb	Blue recommended
5/16”-18	Bearing door, inner primary	22 – 25 ft-lb	Blue recommended
5/16”-24	Shift arm pinch bolt	18 – 22 ft-lb	Blue recommended
9/16”-12	Comp sprocket bolt	See Factory Service Manual	Red required
3/4”-18	Clutch nut	70 – 80 ft-lb	Red required
1-3/4”-20	Pulley/sprocket nut	100 ft-lb, loosen 1 full turn, then 35 ft-lb + 35° – 40°	Red required
9/16”-18	Neutral switch	120 – 180 in-lb	None
3/4”-16	Transmission dipstick	25 – 75 in-lb	None
1/2”-20	Transmission drain plug	14 – 21 ft-lb	None
1/2”-20	Primary drain plug	14 – 21 ft-lb	None

STOCK COMPONENT REMOVAL

Refer to your Factory Service Manual for detailed instructions on how to remove your stock gearset, main drive gear, bearings, shifter pawl, and speed sensor from the transmission case. Softails, Dynas, and Touring models are all different configurations and require different methods to accomplish the removal. Ensure that you have the correct Factory Service Manual for your year and model of motorcycle.

THE COUNTERSHAFT CUP BEARING MUST BE REMOVED FROM THE TRANSMISSION CASE AT THIS TIME. USE BAKER TOOLE-07 OR EQUIVALENT.

A REPLACEMENT IS PROVIDED IN YOUR KIT, BUT IT WILL BE INSTALLED AFTER THE TAPERED BEARING ADAPTER.

BERT TIPS:

Apply heat to the comp sprocket bolt head prior to removal. Failure to do so could result in mangled sprocket shaft threads and halt the installation of your GrudgeBox.

Remove the dipstick prior to removing the gearset from the transmission case. Failure to do so will result in a broken dipstick and a trip to the nearest H-D dealer.

BEFORE INSTALLING YOUR GRUDGEBOX

TRANSMISSION CASE CLEARANCE

The transmission case on most Softail and some Touring Milwaukee-Eight models must be modified to provide clearance for the shifter pawl. Included in Softail M8 kits is a special tool (pn T1833-GB) that, when used in combination with a drill makes the modification fast and easy. You may use a die grinder or Dremel in place of this tool, but use caution! The transmission case has a finite thickness, so it is best to grind very small amounts at a time and check for clearance often. You may also need to add clearance for the 2C gear (Figure 6). This is most common with M8 FX models (Dynas, Breakouts) but other models may be affected as well.

1. Make sure that all components other than the shifter pawl sleeve and centering screw have been removed from the transmission case.
2. Coat both the entire tool and the inside of the shifter pawl sleeve with a light oil. Insert the tool into the sleeve with the cutting portion inside the transmission case. Tighten the drill chuck on the tool shank sticking out of the transmission case.
3. From the drill user's perspective, spin the drill at medium RPM counterclockwise and pull slowly toward the shifter pawl sleeve. You will feel the tool begin to cut more material as you go on. Stop when the undercut shoulder of the tool contacts the sleeve.
4. Remove the tool and all metal shavings from the transmission case and the shifter pawl sleeve. The area should look similar to that shown in figure 7 upon completion of the modification.
5. Fully insert the shifter pawl into the transmission case, making sure that the undercut shoulder of the shifter pawl is contacting the sleeve as shown in figure 8. Do not install the washer (pn 6497HW), retaining ring (pn 68010), or seal (pn 37101-84B) at this time.
6. Check for clearance between the shifter pawl return spring and the transmission case in the neutral position as shown in figure 8. Rotate the shifter pawl all the way to the bottom of a downshift (clockwise when viewed from the right side of the motorcycle) and check again for clearance. There should be a visible air gap during a full sweep of the shifter pawl from neutral to downshift.
7. Remove the shifter pawl and proceed to the deep cleaning required prior to bearing installation.

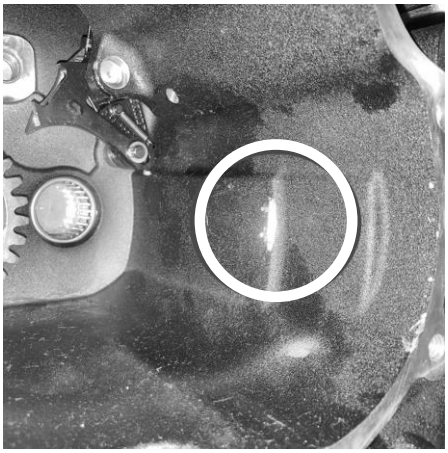


FIGURE 6 | TRANSMISSION CASE CLEARANCE FOR 2C GEAR

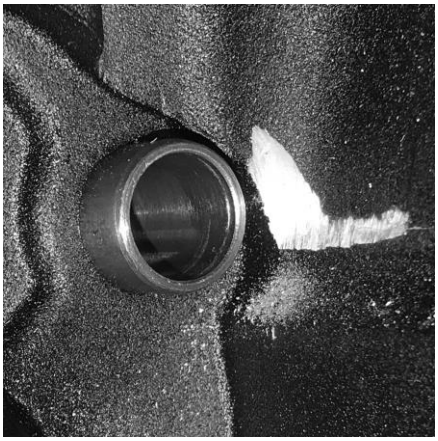


FIGURE 7 | TRANSMISSION CASE AFTER CLEARANCE CUT WITH TOOL PN T1833-GB

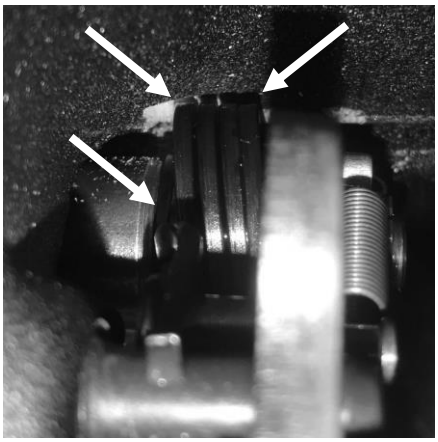


FIGURE 8 | SHIFTER PAWL FULLY INSTALLED IN TRANSMISSION CASE AFTER CLEARANCE CUT; NOTE AIR GAP BETWEEN RETURN SPRING AND WALL OF TRANSMISSION CASE

BEFORE INSTALLING YOUR GRUDGEBOX

TRANSMISSION CASE PREPARATION

Surgically clean the left side of the transmission case in preparation for installing the new GrudgeBox main drive gear and gearset. This surgical cleansing includes the main drive gear and countershaft bearing boss areas, the three inner primary mount bosses, and the shifter pawl boss. See figure 9.

The bearing boss areas must be clean to ensure that no dirt or debris scores the bearing bores during the removal of old bearings and installation of new ones. The three inner primary mount bosses need to be clean so that the tool plate registers flat on the left side transmission case.

FIGURE 9 | SURGICALLY CLEAN THE LEFT SIDE OF THE TRANSMISSION CASE IN THE AREAS INDICATED ABOVE

CAUTIONARY NOTE

There are special tools available from other manufacturers that remove and install the countershaft cup bearing, but they all have one fundamental error – they push on the inside of the cup (from right to left in the motorcycle) for removal and installation. THIS IS WRONG! Cup bearings require that the installation force be applied to the outside of the cup (from left to right). BAKER TOOLE-07 (sold separately) applies removal and installation forces in the proper direction.

VISIT THE BAKER DRIVETRAIN YOUTUBE CHANNEL AND WATCH CLASS #4. IN THIS VIDEO, WE SHOW YOU HOW TO INSTALL THE TAPERED ROLLER BEARING ADAPTER AND MAIN DRIVE GEAR. WATCHING THE VIDEO AHEAD OF TIME WILL GIVE YOU THE TIPS, TRICKS, AND KNOWLEDGE TO ENSURE A PROPER INSTALLATION.

INSTALLING THE TAPERED BEARING ADAPTER

TAPERED BEARING ADAPTER INSTALLATION

1. Apply a thin coating of oil to the outer diameter of the tapered bearing adapter. Do the same to the main drive gear bearing bore in the transmission case.

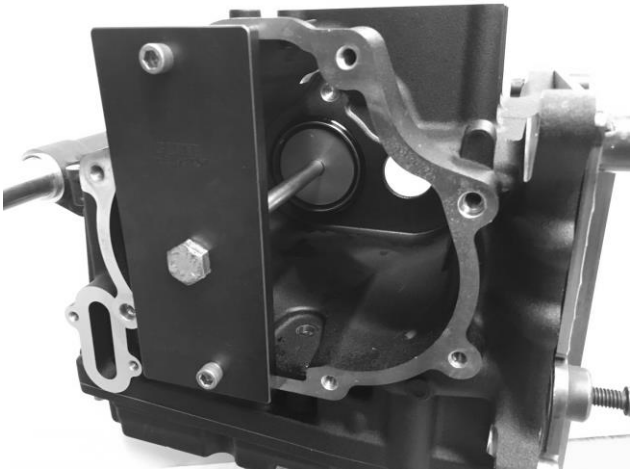


FIGURE 10 | TAPERED BEARING ADAPTER TOOL SETUP, RIGHT SIDE VIEW

2. Use the aluminum cup provided in your kit in combination with the main drive gear installation tool (BAKER TOOLA-07 or H-D equivalent 35316C) to install the tapered bearing adapter. Refer to the section on installing the main drive gear bearing in your Factory Service Manual. The tool will be set up in a similar manner, but with a few key differences. The tapered bearing adapter will take the place of the traditional main drive gear bearing, and the included aluminum cup will take the place of the bearing driver. See figures 10 and 11 for the proper tool setup.

FIGURE 11 | TAPERED BEARING ADAPTER TOOL SETUP, LEFT SIDE VIEW

3. Assemble the tool with the stepped down portion of the tapered bearing adapter facing toward the inside of the case; see figure 12. **Make sure that the adapter is square to the bearing bore** and snug the tool nut. If the adapter is not square to the bore, loosen the nut and realign the adapter.

   Leave the nut snug. Do not press the adapter into the case.

FIGURE 12 | TAPERED BEARING ADAPTER ORIENTATION IN CASE, TOP VIEW

INSTALLING THE TAPERED BEARING ADAPTER

4. The tapered bearing adapter has a tighter press fit into the transmission case than the stock bearing. To ensure successful installation of the tapered bearing adapter and longevity of the installation tool, you must heat the transmission case as shown in figure 13. Use a MAP/propane torch or a heat gun as shown in figure 14.

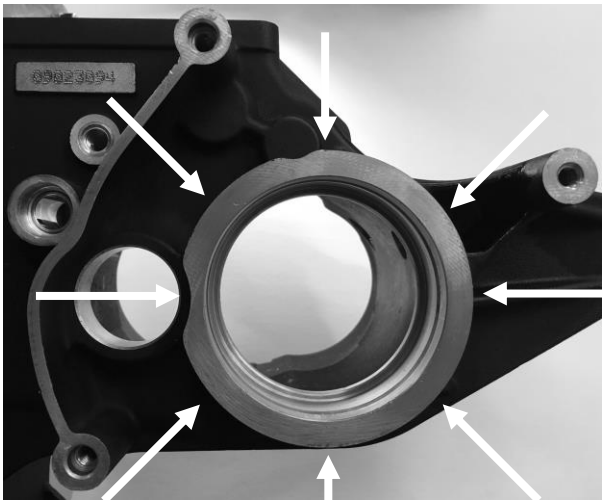


FIGURE 13 | APPLY HEAT AROUND THE MAIN DRIVE GEAR BEARING BOSS AREA

5. Apply heat evenly around the boss of the main drive gear bearing bore from the outside of the case as shown in figure 13. DO NOT heat the boss from the inside of the case and keep heat away from the tapered bearing adapter that is staged and ready for installation. The bearing bore boss should be heated to at least 200°F. BAKER recommends using an infrared thermometer to verify that the case is adequately heated; see figure 15.

FIGURE 14 | USE MAP/PROPANE GAS OR A HEAT GUN TO HEAT THE CASE

BERT TIP:
You may see some discoloration where the case is heated. Restore color by rubbing a little bit of WD-40® or another thin oil into the powdercoat.

FIGURE 15 | USE AN INFRARED THERMOMETER TO VERIFY THAT THE CASE IS HEATED TO AT LEAST 200° F

INSTALLING THE TAPERED BEARING ADAPTER

6. Immediately after the case is heated, tighten the tool nut to draw the tapered bearing adapter into the case. This operation must be done quickly with no interruptions while the case is hot. If the support plate on the other side of the case starts to bend, stop, loosen the nut slightly, and reheat the case. The aluminum cup should be about flush with the bearing boss when the tapered bearing adapter is fully seated; see figure 16.

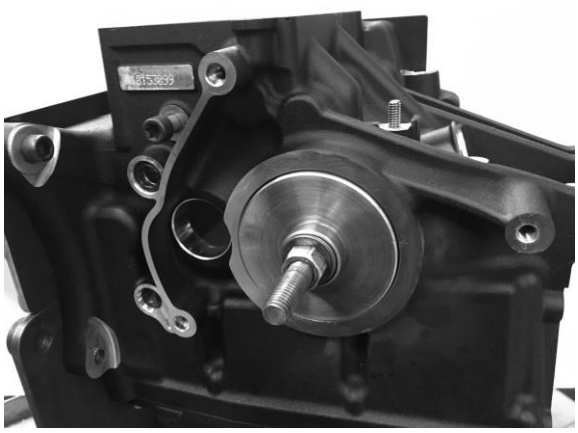


FIGURE 16 | TAPERED BEARING ADAPTER FULLY SEATED IN CASE

BERT TIP:
Do not over tighten the nut after the tapered bearing adapter is bottomed out. Doing so may damage the tool or main drive gear bearing bore landing in the case.

7. Remove the installation tool. You will know the tapered bearing adapter is seated into the bore when the beveled retaining ring groove is fully visible; see figure 17.

FIGURE 17 | TAPERED BEARING ADAPTER VISUAL INSPECTION

8. Install the beveled retaining ring (VHO-334STPA) with the bevel facing outward. Make sure that the retaining ring fully seats into the groove; see figure 18.

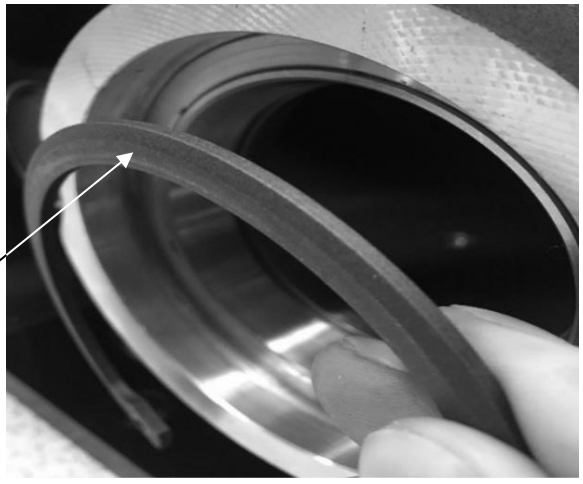


FIGURE 18 | BEVELED RETAINING RING WITH BEVEL FACING OUTWARD

INSTALLING THE C/S BEARING & MAIN DRIVE GEAR

COUNTERSHAFT BEARING INSTALLATION

1. It is now time to install the new countershaft bearing that was provided in your kit. It is important that this step be done AFTER installing the tapered bearing adapter. This is to avoid cooking your new countershaft bearing while heating the case in that step.

2. Wipe out the countershaft bearing bore with a clean rag. Apply a thin coating of oil to both the bearing bore and the outer diameter of the countershaft bearing.

3. Use a countershaft bearing tool (BAKER TOOLE-07 or equivalent) to press the bearing into the transmission case. You want to press on the outside of the 'cup', just as you did during removal. See the appropriate tool instructions and your Factory Service Manual for details.

MAIN DRIVE GEAR INSTALLATION

1. Before installing the main drive gear, apply a thin coating of transmission oil to the tapered bearing races and the main drive gear O-ring; see figure 19. A thicker oil could give you a false reading when checking endplay.

FIGURE 19 | LIGHTLY OIL BEARING RACES BEFORE INSTALLING THE MAIN DRIVE GEAR

2. Each kit comes with six spacers for setting up end play in the tapered roller bearings: .098" (orange), .100" (yellow), .102" (white), .104" (green), .106" (blue), and .108" (red) thick. The most commonly used spacer (.102", white) is pre-installed on the main drive gear. The other spacers are included for cases where bearing end play is outside of the acceptable range with the pre-installed .102" spacer; see figure 20.

   Apply a thin coating of transmission oil to the main drive gear O-ring each time you change the spacer.

FIGURE 20 | MAIN DRIVE GEAR WITH PRE-INSTALLED SPACER AND TWO OF FIVE EXTRA SPACERS SHOWN; LUBE O-RING EACH TIME SPACER IS CHANGED

INSTALLING THE MAIN DRIVE GEAR

3. Follow the Factory Service Manual to install the main drive gear using BAKER TOOLA-07 or H-D equivalent 35316C. If the H-D equivalent tool is used, you will need to use pulley spacer 33334-GB from your kit for extra spacing while pressing the tapered bearings together.

   If you need to use the pulley spacer (33334-GB), temporarily remove the O-ring. Remember to re-install it after the end play is set.

FIGURE 21 | IF USING H-D TOOLING, THE PULLEY SPACER IS NEEDED TO EXTEND THE LENGTH OF THE INSTALLATION CUP

4. Gently slide the assembled main drive gear through the case. Take the loose tapered roller bearing (HR32910J) and slide it over the main drive gear, letter side facing out. Slide the pulley spacer onto the gear if needed (O-ring groove facing bearing), followed by the remaining press tools; see figure 21.

   BERT TIP:
   Apply pressure to the main drive gear during this step by reaching your left hand through the top of the transmission case. Failure to do so (i.e. allowing the gear to flop around) will damage the bearing races.

5. With the tooling installed, snug the assembly by hand while making sure the installation tool cup is properly aligned and not skewed to the side of the tapered bearing. Hold the bolt on the inside of the case using the proper socket and ratchet. Tighten the main drive gear tooling on the primary side of the bike until it is fully seated and tight. Refer to the main drive gear tool instructions and figure 22.

FIGURE 22 | INSTALLING THE MAIN DRIVE GEAR

INSTALLING THE MAIN DRIVE GEAR

6. Do not remove the installation tool yet; leave everything tight. Measure the amount of end play in the main drive gear assembly using a dial indicator with .0005" increments as shown in figure 23. **Total axial end play (pulling / pushing on the gear) must be between .0005" and .002".** It is extremely important that your bearing end play is within this range, as anything too tight or too loose may lead to transmission failure.

   Measuring end play is tricky. The end play measurement can easily be skewed if radial or rotational forces are applied, so try to keep all movement in the axial direction (parallel to the mainshaft). A correctly set up tapered roller bearing should be very tight. When your measurement is between .0005" – .002", try spinning the main drive gear. If it spins freely with no drag and no excessive noise, setup is complete and you may proceed to the next step.

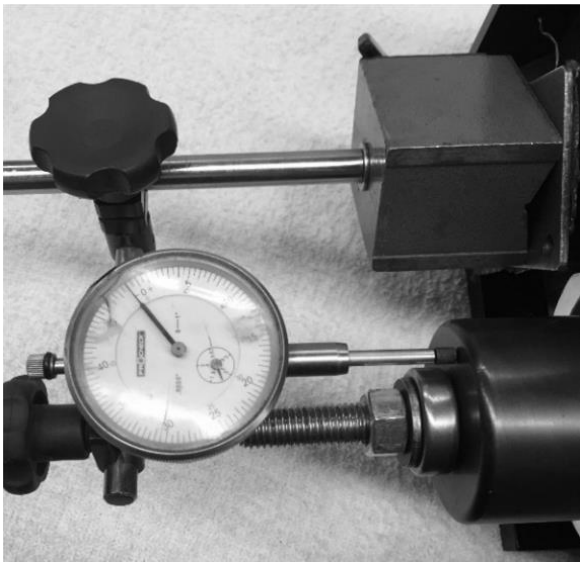


FIGURE 23 | CHECKING AXIAL END PLAY IN THE MAIN DRIVE GEAR TAPERED ROLLER BEARING

Watch Class #4 on the BAKER Drivetrain YouTube channel for a video tutorial on setting up end play in the main drive gear bearing.

IF YOUR SETUP IS TOO TIGHT (UNDER .0005"), REMOVE THE MAIN DRIVE GEAR FROM THE CASE USING THE PROPER TOOLING. REMOVE THE O-RING FROM THE 'SNOUT' OF THE MAIN DRIVE GEAR FOLLOWED BY THE SPACER. INSTALL A THICKER SPACER, REPLACE THE O-RING, AND GO BACK TO STEP 4.

IF YOUR SETUP IS TOO LOOSE (OVER .002"), REMOVE THE MAIN DRIVE GEAR FROM THE CASE USING THE PROPER TOOLING. REMOVE THE O-RING FROM THE 'SNOUT' OF THE MAIN DRIVE GEAR FOLLOWED BY THE SPACER. INSTALL A THINNER SPACER, REPLACE THE O-RING, AND GO BACK TO STEP 4.

7. Remove the tooling used to install the main drive gear along with pulley spacer if you had to use it. If necessary, reinstall the O-ring (OR568M52) that you removed from the pulley spacer in step 3.

INSTALLING THE MAIN DRIVE GEAR

8. Put some transmission fluid on the outer diameter and O-ring of the pulley spacer. Install it onto the main drive gear with the O-ring facing inward (toward the bearing); see figure 24.

FIGURE 24 | INSTALLING THE PULLEY SPACER AND THE MAIN DRIVE GEAR SEAL

9. Put some transmission fluid on the lip of the main drive gear seal and install it. Make sure the seal is flush with the transmission case all the way around the bearing boss; see figure 25.

FIGURE 25 | MAIN DRIVE GEAR SEAL INSTALLED FLUSH WITH CASE

INSTALLING THE GEARSET

SHIFTER PAWL INSTALLATION

1. If you removed the stock centering pin to clean the case, reinstall it with red threadlocker. Install the GrudgeBox shifter pawl along with the new seal, washer, and 7/16” retaining ring just like a stock shifter pawl is installed. Do not remove the zip tie because it is placed on the pawl to keep the active plate retracted during gearset installation into the case; see figure 26.

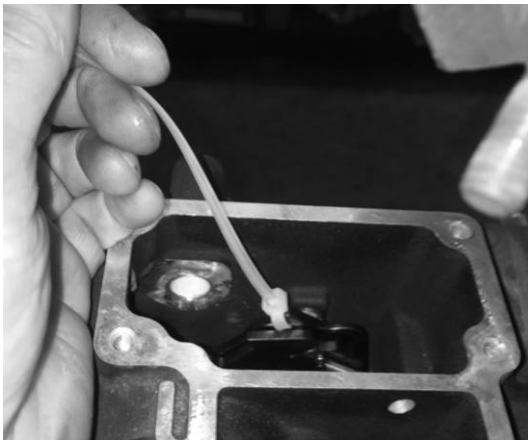


FIGURE 26 | LEAVE THE ZIP TIE ON THE SHIFTER PAWL UNTIL AFTER THE GEARSET IS INSTALLED AND THE BOLTS ARE TORQUED

HIGH TORQUE BEARING INSTALLATION

2. Your GrudgeBox builder’s kit includes a high torque inner primary bearing to replace the stock H-D inner primary bearing and race. Install the high torque bearing into the inner primary. DO NOT install the bearing race from the stock transmission onto the GrudgeBox mainshaft.

GEARSET INSTALLATION

3. The time has come to stuff the gearset (figure 27) into the transmission case. Before that is done, take time to ensure no debris or tarantulas have found their way into the case. Check that the two bearing door dowels came out of the case with old bearing door. Locate the new bearing door gasket onto the dowels of the GrudgeBox bearing door.

   Generously apply transmission lube to the last 6” of the mainshaft, end of the countershaft, countershaft bearing, tapered roller bearings, and the bearings/seal in the main drive gear. Do not remove the black rubber cap from the end of the mainshaft. Its function is to protect the seal in the main drive gear as the gearset is installed.

FIGURE 27 | GRUDGEBOX GEARSET READY FOR INSTALLATION INTO THE CASE

INSTALLING THE GEARSET

4. Carefully install the gearset into the transmission case. It is helpful to have a second set of hands on the left side of the motorcycle to grab onto the mainshaft as it passes through the main drive gear. The person on the left side can help the process along by gently rotating the main drive gear back and forth; this helps the 5th gear on the countershaft find home with the main drive gear.

   It is rare, but sometimes the fork rods need to be jostled to find home on the left side of the transmission case.

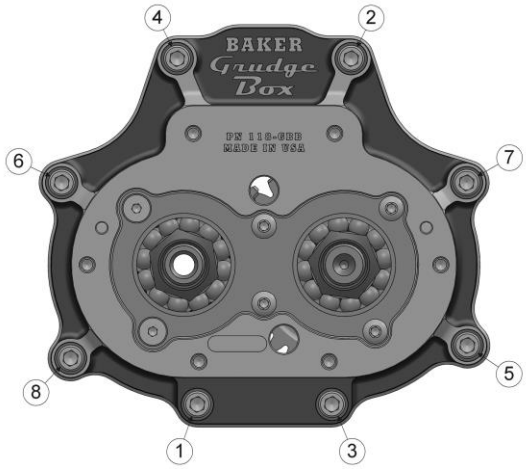


FIGURE 28 | TORQUE SEQUENCE FOR GRUDGEBOX BEARING DOOR BOLTS

5. Install the eight stainless steel cap screws and washers (rounded side down) onto the bearing door using blue threadlocker. Be sure to replace the exhaust bracket beneath the bottom inner bolts. Torque to 22 – 25 ft-lb using the torque sequence in figure 28. You may remove the zip tie from the shifter pawl and the black rubber cap from the mainshaft at this time.

6. Locate the speed sensor that was removed from the transmission case during stock component removal. Remove the O-ring from the speed sensor, install the provided spacer (132-56R), and re-install the O-ring. The speed sensor with spacer can now be placed back into the transmission case. Torque the bolt to 125 – 135 in-lb with blue threadlocker.

7. With the new side cover gasket in place, re-install the side cover and torque the bolts to 125 – 135 in-lb with blue threadlocker. Go to the other side of the motorcycle and re-install the drive pulley or sprocket onto the main drive gear. Use BAKER TOOLD-07 or H-D equivalent to torque the pulley / sprocket nut to 35 ft-lb + 35° – 45° with red threadlocker. Refer to your Factory Service Manual for details.

TRANSMISSION FLUID

8. Re-install the transmission drain plug and torque it to 14 – 21 ft-lb. Re-install the transmission dipstick* and torque it to 25 – 75 in-lb.
   *Note: The stock transmission dipstick on Milwaukee Eight Softail models interferes with the GrudgeBox and must be replaced with the included 13102-56 dipstick cap w/ o-ring.

9. Put 25-27 oz. transmission fluid (75-85W140 synthetic gear oil) into the transmission by pouring it through the top cover cavity onto the main drive gear and shifter pawl. Make sure to coat as much of the gearset components as possible with the fluid.

FINISH LINE

FINAL STEPS

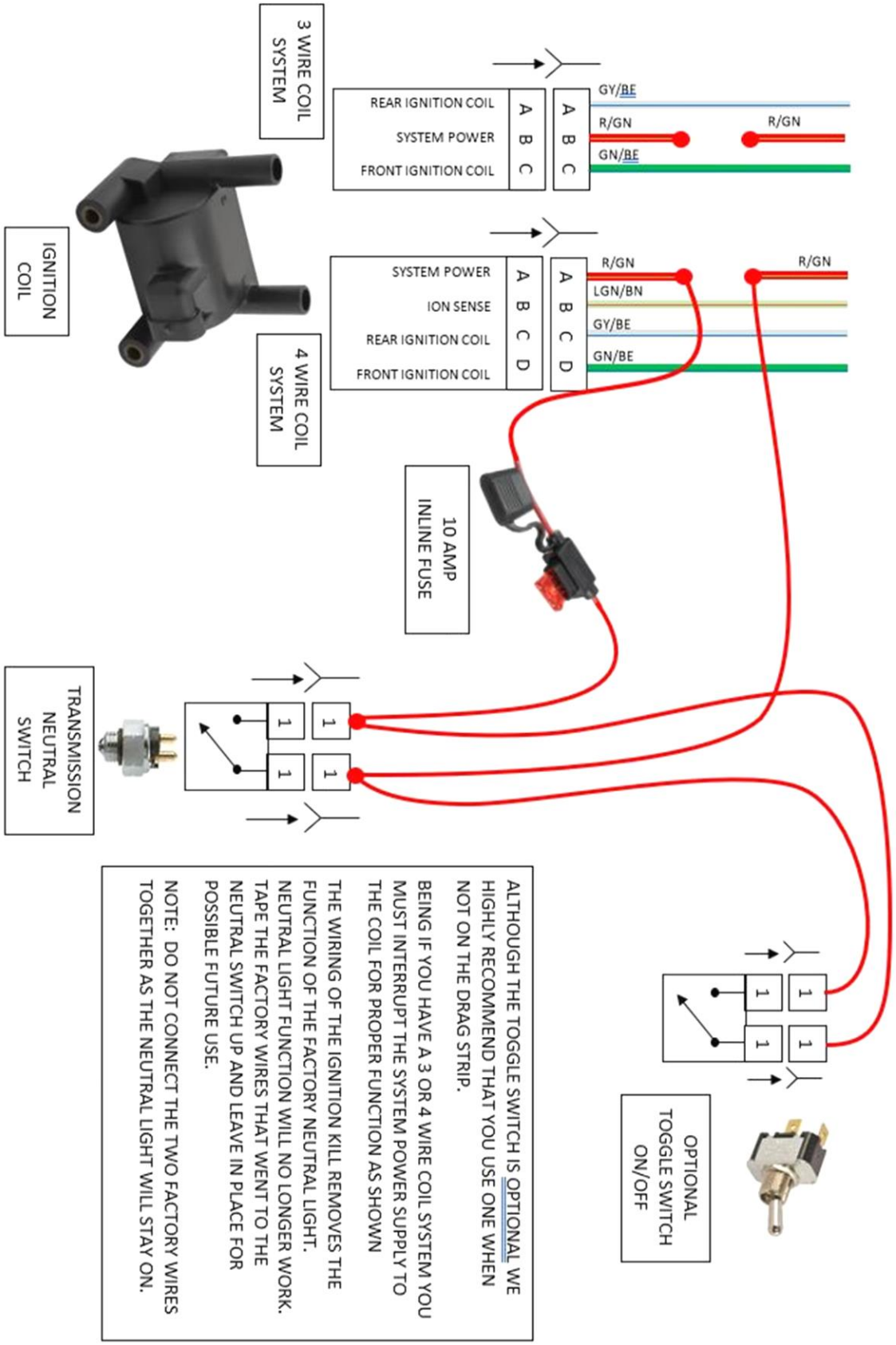
1. Re-install the top cover with the new gasket provided. Button up the primary, exhaust, shift linkage, and floorboards/footpegs per your Factory Service Manual. Make sure to re-install the primary drain plug and fill the primary with fluid.

2. You have successfully completed the installation of your new transmission. Be observant of basic transmission function and overall vehicle operation during the first 20 miles. Check for leaks after your first ride. Provided there are no issues, ride on and enjoy your new BAKER GrudgeBox.

SPEEDOMETER, GEAR INDICATOR, & CRUISE CONTROL

The GrudgeBox has different gear ratios than the stock transmission (except GrudgeBox 5th gear is the same as stock 6th gear, 1:1). This changes the input to the ECM. The 42-tooth reluctor ring in the GrudgeBox compensates to correct the speedometer within ± 2 mph with no re-flash to the ECM. However, the gear indicator and cruise control may only operate in 5th gear. To correct the gear indicator in all gears and enable cruise control in 3rd, 4th, and 6th, an ECM re-flash is required.

WIRING DIAGRAM FOR IGNITION KILL SHIFT DRUMS



TRANSMISSION OIL CHANGE LOG

DATE	ODOMETER	OIL USED	SERVICED BY
	500		
	2,500		
	7,500		
	12,500		
	17,500		
	22,500		
	27,500		
	32,500		
	37,500		
	42,500		
	47,500		
	52,500		
	57,500		
	62,500		
	67,500		
	72,500		
	77,500		
	82,500		
	87,500		
	92,500		

GENERAL MAINTENANCE LOG

DATE	ODOMETER	WORK PERFORMED	SERVICED BY

NOTES

TERMS & CONDITIONS

LIMITED WARRANTY

NOTE: Warranty card must be returned within 45 days of purchase for your warranty to be valid.

BAKER™ transmission assemblies and transmission builder 's kits, are guaranteed to the original purchaser to be free of manufacturing defects in materials and workmanship for a period of 5 years from the date of purchase or up to 50,000 miles, whichever occurs first. All other BAKER products are guaranteed to the original purchaser to be free of manufacturing defects in materials and workmanship for a period of 2 years from the date of purchase or up to 24,000 miles, whichever occurs first, except for the following; Warranty does not cover clutch plate wear, throw out bearing failures or mainshaft breakage due to improper clutch nut installation.

Electrical components carry a 30-day warranty; cosmetic finishes (chrome plating, hard anodizing, powder coating) are covered for 60 days. Certain promotional products may carry a shorter warranty as specified at the time of purchase. If the product is found by BAKER to be defective, such products will, at the option of BAKER, be replaced or repaired at cost to BAKER .

In the event warranty service is required, the original purchaser must call or write BAKER immediately with a description of the problem. If it is deemed necessary for BAKER to make an evaluation to determine whether the transmission assembly or transmission kit or accessory is defective, the entire transmission assembly, whether originally purchased as an assembly or kit, **must be properly packaged and returned prepaid to BAKER with a copy of the original purchase invoice. If after evaluation by BAKER a defect in materials and/or workmanship is found, BAKER will, at their option, repair or replace the defective part of the assembly.**

RETURNS AND EXCHANGES

Any merchandise returned for any reason (exchange, credit or modification) must be accompanied by a Return Goods Authorization (RGA) number or it will be refused. **Call BAKER to obtain this number prior to returning goods for any reason. There is a 15% re-stocking fee for all returned items.**

BAKER is not liable for any shipping

ADDITIONAL WARRANTY PROVISIONS

NOTE: Limited warranty does not cover labor or other costs or expenses incidental to the repair and or replacement of BAKER products.

This warranty does not apply if **one or more of the following situations is judged by BAKER to be relevant:** BAKER OEM transmissions ; (these are subject to the OEM manufacturers warranty only), Improper installation , accident, modification (including but not limited to use of unauthorized parts, transmission oils or lubricants), racing, high performance application, mishandling , misapplication, neglect (including but not limited to improper maintenance), or improper repair

BAKER shall not be liable for any consequential or incidental damages arising out of or in connection with a BAKER transmission assembly, transmission kit, component or part. Consequential damages shall include without limitation , loss of use, income or profit, or losses sustained as the result of injury (including death) to any person or loss of or damage to property.

BAKER transmissions, transmission kits and accessories are designed exclusively for use in American V-Twin

motorcycles . BAKER shall have no warranty or liability obligation if BAKER parts are used in any other application .

If it is determined that a BAKER product has been disassembled during the warranty period for any reason, this limited warranty will no longer apply unless you were instructed to do so by a BAKER Drivetrain technician for diagnostic purposes.