SixPackCuda

The Dana/Spicer 60 Rear Axle

Specifications and Applications
by Paul M. Pitcher

Introduction

The Dana/Spicer 60 rear axle was used in 3/4 ton Dodge trucks from 1961 (or earlier), in 3/4 ton B-series vans, and in high- performance Dodge and Plymouth passenger cars beginning in 1966. Applications for the Dana 60 in Chrysler passenger cars were all Hemi and 440 cars with 4-speed manual transmission. 3/4 ton trucks and vans are distinguished as having 8-lug hubs and full-floating axle shafts. The Dana 60 can be distinguished from other axles used in Chrysler Corp vehicles by its large size, straight (non- tapered) axle tubes, and the shape of the differential cover (assymmetrical side-to-side) which is attached by 10 bolts. Also, in most housings, "60" is cast into one of the reinforcing gussets. Axles manufactured for trucks (Full Float Design in Figure 1) have different tube ends than those for passenger cars (Semi-Float Design in Figure 1) and do not have provisions for a bolt-on pinion snubber. Truck axles can be converted for passenger car use by changing the tube ends, but unless the rear suspension is modified, controlling pinion angle in high horsepower applications may be difficult because of lack of provisions for a pinion snubber.

Differentials

Use Figure 1 as an aid to identification of Dana 60 differential units. Several differentials were used in Dana 60 axles. The 'open' differential (at lower left of Figure 1) can be distinguished from the early limited slip units (Powr-Lok, upper left of Figure 1) by the shape - Powr-Lok units are cylindrical with bolts securing the two differential case halves. Open differentials have windows through which gear teeth can be seen. Junkyard tip: these features can be felt by inserting a finger through the oil fill hole in the cover. This is probably the easiest way to distinguish between differentials in intact vehicles. Powr-Lok limited slip units were used exclusively until 1970. There are two pinion shafts (part 53 in Figure 1) in a Powr- Lok differential which cross in the center. In Powr-Loks for passenger cars, there is a hole through the pinion shafts where they cross. Thrust buttons fit in this hole and the inboard ends of the axle shafts contact the thrust buttons, allowing adjustment of axle end-play. Powr-Loks for trucks do not have this feature. Clutches and Belleville plates are imposed between the differential gear on each side and the differential case itself to limit the slip of one axle shaft relative to the other.

During the 1970 model year, the Trac-Lok differential (upper right in Figure 1) replaced the Powr-Lok. Early 1970 model-year passenger cars were still being equipped with Powr-Lok differentials. And, in trucks and vans, the Powr-Lok was not phased out until midway in the 1971 model year. Trac-Lok differentials are distinguished by a single pinion shaft, somewhat conical one-piece construction, and windows through which the pinion gears can be seen. Those in-the-know sometimes refer to the Trac-Lok as "Crack-Lok"! This author has never seen a failed Trac- Lok, but he has seen two failed Auburn units for Chrysler 8-3/4" axles - also a single pinion design. Similar to the Powr-Lok, Trac-Lok clutches are located between the differential gears and the differential case. Note that Trac-Lok flat plates have 2 ears, Powr-Lok flat plates have 4 ears. Powr-Lok clutch packs currently sold by Mopar Performance come with

composite material bonded to the flate plates (part 57 in Figure 1). Earlier Powr-Lok clutch packs do not (see Part Numbers below).

There are two Powr-Lok differentials, one for 4.10:1 and lower ratios (10 or more teeth on the drive pinion), and another for 4.33:1 and higher ratios (9 or fewer teeth on the drive pinion). The Powr-Lok unit for high ratios is distinguished by determining that the plane to which the ring gear bolts is located 1/8" closer to the drive pinion centerline, as installed. This is difficult to measure, but is obvious if the two Powr-Loks are placed side by side. The Powr-Lok for high ratios is to accommodate the smaller diameter of the 7, 8, and 9 tooth drive pinions.

All differentials interchange between Dana 60 housings. Furthermore, differentials supplied by Spicer to Ford and used in 3/4 ton trucks from the late 1950s and later will fit in housings supplied to Chrysler Corp.

Specifications and Applications

All Dana 60 housings are marked with a "Bill of Materials" number and a date code (Figure 2). BoM numbers are found on the back of the right axle tube, 2-3 inches outboard of the center section. All Dana 60 differentials are also marked with a date code. The 'font' for these stampings is a sans serif style and the characters are about 1/8" high. Particularly for the axle tubes, the stampings are faint, so it is important to clean the area well and to visualize them in good light. The BoM number is a 6-digit number with a one or two digit suffix separated by a dash: XXXXXX- X. Date codes are found on both housing and differential and are formatted MM DD Y. Date codes are found inboard of the BoM number on the housing, and on the side of the cylindrical part of the differential. The year code on housings is always one digit and on differentials can be two digits. Housing date codes are followed by a letter (A, B, or C) which may indicate the work shift or factory line. Some differential stampings also show this letter suffix. Zeros are not used in month and day codes. Wide variation in spacing of the components of the date code is seen, and it is not unheard of to see two date codes stamped into a housing, one above the other. These two date codes are usually within a few weeks of one another.

Bill of Materials Numbers:

68-69	B body	3.54	Powr-Lok	602957-1, -2, -3, -4
		4.10	Powr-Lok	602957-5, -6
69.5-72	B body	3.54	Powr-Lok	603109-1, -2
		4.10	Powr-Lok	603109-3, -5
		4.56	Powr-Lok	603109-6, -7, -8
70-72	B body	3.54	Trac-Lok	603222-1, -2
		4.10	Trac-Lok	603222-3
		4.56	Trac-Lok	603222-4
75-77	B body	5.13	Powr-Lok	603347-2
		5.38	Powr-Lok	603347-1
69-71	E body	3.54	Powr-Lok	603080-1, -2, -4
		4.10	Powr-Lok	603080-3, -5
		4.56	Powr-Lok	603080-6, -7
70-72	E body	3.54	Trac-Lok	603226-1, -2
		4.10	Trac-Lok	603226-4
74	E body	5.38	Powr-Lok	603425-1
77-78	Retail Maint.	4.10	Trac-Lok	603831-1
67-70	D200/W200	Std		602423
68.5-70	D200/W200	Std, Powr-Lok		602010
69.5-72	D200/W200	Std, Powr-Lok, Trac-Lok		603016
71.5-75	D200/W200	Std, Trac-Lok		603236
76	D200/W200	Std, Trac-Lok		603769
77	D200/W200	Std, Trac-Lok		603775
78	D200/W200	Std, Trac-Lok		603892

71-75	D200/W200HD	Std, Trac-Lok	603237
76-78	D200/W200HD	Std, Trac-Lok	603647
70-71	B300/M300	Std, Powr-Lok, Trac-Lok	603160
71.5-74	B300/M300	Std, Trac-Lok	603313
74.5-75	B300/M300	Std, Trac-Lok	603516
76	B300/M300	Std, Trac-Lok	603645
76.5	B300/M300	Std, Trac-Lok	603768
77-78	B300/M300	Std, Trac-Lok	603774
78	B300 Maxi	Std	603832

The higher ratio gearsets shown in the table of BoM numbers may be Pro-Stock applications. Also, the application years shown seem to be calendar year, not model year (there were no '69 E bodies).

Axle shaft dimensions vary in Dana 60 axles. Dimensions of semi- floating (passenger car type) axles shafts are shown below. Shaft lengths are measured from the outer flange face to the inboard end of the shaft. Note that the right axle shaft is always shorter than the left, so unlike the Chrysler 8 3/4" axle, Dana 60 axle shafts will not interchange side-to-side.

BoM	Dia.-splines	L shaft	R shaft
602957	1-1/2"-23	29-21/32"	28-9/32"
603109	1-1/2"-35	29-21/32"	28-9/32"
603222	1-1/2"-35	31-5/64"	29-11/16"
603347	1-1/2"-35	28-7/16"	27-1/16"
603080	1-1/2"-35	30-7/16"	29-1/16"
603226	1-1/2"-35	30-7/16"	29-1/16"
603425	1-1/2"-35	24-7/16"	23-1/16"
603831	1-5/16"-30	32-5/8"	32-5/8"

Gear ratios commonly available in Dana 60 axles were (ring gear tooth count/drive pinion tooth count): 3.54 (46/13), 3.73 (41/11), 4.10 (41/10), 4.33 (39/9), 4.56 (41/9), 4.88 (39/8), 5.13 (41/8), 5.38 (43/8), and 5.86 (41/7). Ratios in use in passenger cars were 3.54 or 4.10.

All Dana 60 axles have a 9-3/4" diameter ring gear. The drive pinion diameter of 1-3/4" is the same as that used in the Chrysler 8-3/4" axle, but the major spline diameter of the Dana 60 where the yoke mounts is 0.070" larger at 1.25", so yokes do not interchange between the two axles. Dana 60 yokes are retained by a 7/8"-14 NF thread nut. A 1-5/16" socket fits this nut. Spline patterns used are the same as the Chrysler 8 3/4" axle - 10 spline in early gear sets, 29 spline later. The changeover from 10 spline to 29 spline seems to be abrupt in trucks, between 1968 and 1969. This author cannot comment on passenger cars, except to say that 29 spline yokes were in use by late 1969.

Chrysler 7290 yokes and universal joints were used on passenger car Dana 60s. Chrysler 7260 joints were used in D200 (3/4 ton 2WD) trucks from 1969, and the big Chrysler 5380 joint was used in W200 (3/4 ton 4WD) trucks in 1968 and earlier. A 7260 joint coarse spline yoke is not available. Spicer 1310 joint coarse spline yokes are available for the Dana 60. Mopar Performance sells a fine spline Spicer 1330 yoke (P3690771) and joint (P3690773) for Dana 60. Also, a U-bolt fine spline 7290 yoke is sold for Dana 60 (P4120714).

Dana 60 Gear sets

Standard Series	
P4529919	4.10:1
P4529920	4.56:1
P4529921	4.88:1
P4529922	5.13:1
P4529923	4.38:1
P4529924	5.57:1
P4529925	5.86:1
P4529926	6.17:1

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Pro Series 9310 High Strength Material
P4529927   4.10:1
P4529928   5.13:1
P4529929   5.38:1
P4529930   5.57:1
P4529931   5.86:1
P4529932   6.17:1
P4529933   6.50:1

Part Numbers

382S       Differential bearing cup
387A       Differential bearing cone
HM88510    Drive pinion outer bearing cup
HM88542    Drive pinion outer bearing cone
HM803110   Drive pinion inner bearing cup
HM803146   Drive pinion inner bearing cone
18888      Drive pinion seal
18891      Drive pinion seal (Differs in configuration of lip)
P4529485   Powr-Lok Diff. Clutch kit (Flat Plates with composite)
2852523    Powr-Lok Diff. Clutch kit (plain steel Flat Plates)
P3571032   Differential Bearing Adjustment Shim Package
P3571030   Drive Pinion Front Bearing Shim Package
P3571031   Drive Pinion Rear Bearing Shim Package
P5249453   Shim Kit (Includes 030, 031, and 032 Packages)
P4529488   Ring Gear Bolt Package
RDS6095    Cover gasket (Felpro)
A7         Axle bearing
A7LK       Axle seal and retainer kit, left side
A7RK       Axle seal and retainer kit, right side (discontinued as
           of March, 2001)
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The Dana/Spicer 60 Axle: Rebuilding
by Paul M. Pitcher

It is probably impossible to do a good job of rebuilding a Dana 60 axle if it is not removed from the vehicle and placed on a benchtop or on sawhorses. So, the first step in rebuilding is to remove the entire axle from the vehicle. However, prior to removing the axle from the vehicle, it is a good idea to loosen the drive pinion nut. Set the parking brake and use a long breaker bar (or impact wrench) and 1-5/16" socket to loosen the nut.

When tearing down a Dana 60 axle for rebuilding, is it very important to record the thickness of the shim packs that were originally used. This data will be used in selecting proper shim packs for the rebuild. Shims are used in 4 places to set up a Dana 60 axle: under each differential bearing cone (part 21 in Figure 1, locate differential and provide bearing preload), in the housing under the inner pinion bearing cup (part 4 in Figure 1, sets drive pinion depth), and on the drive pinion, under the outer drive pinion bearing cone (part 6 in Figure 1, sets drive pinion bearing preload).

The axle shafts are removed and the differential is removed from the housing after the cover and main caps are removed. Prior to removing the differential from the case, runout of the differential should be checked with a dial indicator while turning the differential. Less than 0.006" is satisfactory. Before removing the main caps, their relationship to the housing should be observed or freshly marked. Typically, a letter is stamped into the upper or lower end of each cap (same letter on both caps). This stamping will either be oriented horizontally, or vertically, with the two caps being different. In the cover sealing lip of the housing adjacent to the main caps, the same letter should be stamped. The orientation of the stamping in the cap and adjacent housing lip should be the same and is used to distinguish between left and right caps. The caps are to be replaced so that the stamping in the cap and housing have the same

orientation and are adjacent to each other. Once the main caps are removed, the differential can be pried from the housing using two bars, one at the top of the housing and one at the bottom.

The next step is to remove the drive pinion. First, the nut is removed from the forward end of the drive pinion, and a puller is used to remove the yoke. The pinion seal is removed. Between the yoke and the outer pinion bearing is an oil slinger (part 8 in Figure 1) which should be saved for reuse. On drive pinions with fine splines, the outer pinion bearing is not pressed on and so will slide off the drive pinion easily. At this point, the fine spline drive pinion will fall into the housing for removal. The outer pinion bearing cone is pressed onto coarse spline drive pinions (not a very tight fit). A coarse spline drive pinion must be driven out of the housing, using a suitable soft metal pad between the hammer and the end of the drive pinion to avoid damaging the threads (7/8"-14 NF). Collect and record the thickness of bearing preload shims that were between the outer drive pinion bearing cone and the shoulder on the drive pinion.

Once the drive pinion and differential are removed from the housing, the bearings can be removed from them. Inner drive pinion bearing cones and differential bearing cones are pressed on, so a bearing puller must be used to remove them. Be sure to collect and measure the shim packs beneath the differential bearings. Left and right side packs will be different in thickness.

To rebuild the differential, it is a straightforward procedure to remove the bolts holding the two Powr-Lok case halves together (7/16" NC RH thread), and replace the clutches, being sure to install them in the correct sequence (see Figure 1). Be sure to mark the case halves so that they can be reassembled in the same orientation to each other. A dished plate (part 60 in Figure 1) rides against each differential case half and a dished disk (part 59 in Figure 1) is inboard of each dished plate. The concave side of the dished plates and disks faces outboard. The rest of the plates (parts 57) and disks (parts 58) are flat. When installing truck differentials in cars, it is usually necessary to replace the differential gears which the axle shaft splines engage (part 55 in Figure 1). These are readily available for 1-1/2"x35 spline axle shafts as are the pinion gears and shafts (parts 53 and 54 in Figure 1). In older Powr-Loks, the differential gear ring (part 56 in Figure 1) is splined as well as the differential gear (part 55 in Figure 1). If this is the case, it is critical that the splines in each of these parts are aligned before the differential case bolts are tightened. If not, it will be impossible to install the axle shafts. To align the splines, install the axle shafts before tightening the differential case bolts.

Next, the drive pinion bearing cups can be punched from the housing, using a long brass drift. Sometimes, but not always, a baffle is placed beneath the inner drive pinion cup (part 5 in Figure 1). Baffles are typically used in Dana 60 front axles, presumably to control lubricant. In front axles, the rotation of the drive pinion tends to cause the teeth to force lubricant against the pinion seal when the vehicle is moving forward. Again, be sure to collect and measure the thickness of the shim pack beneath the inner drive pinion bearing cup (part 4 in Figure 1).

Prior to reassembly, the inside of the housing tubes should be cleaned. This author has had excellent and rapid results using a 2" bronze wire wheel (to avoid sparks) rigged with a 3-foot length of 3/8" threaded rod. Pour a pool of solvent in the tube, chuck the threaded rod in a drill, and work the wire wheel back and forth in the tube to remove the grunge. Should be like new after only a few passes. Flush tubes and housing with clean solvent.

If the gear set is to be changed, it is important to compare the markings on the ends of both old and new drive pinions. It is also important to see that the drive pinion and ring gear of the new gearset match. They should have some stamping, engraving, or paint mark in common. On its end, at the 12 o'clock position, each drive pinion should have a mark something like 0, +1, -2. This is the deviation of that particulars drive pinion from ideal pinion depth in the housing. The markings on both drive pinions (old and new) are subtracted, and the difference is added or subtracted from the drive pinion depth shim pack to be placed beneath the inner drive pinion bearing cup. For example, if the old drive pinion was marked "-2" and the new drive pinion is marked "0", one would remove 0.002" from the drive pinion depth shim pack - the old pinion was 0.002" below the ideal drive pinion depth so the original shim pack was made

0.002" thicker to compensate - because the new pinion in this example is expected to be exactly at the ideal depth.

The corrected drive pinion depth shim pack is placed in the housing and the new inner drive pinion cup is driven into place with a long brass drift. The new outer drive pinion cup can be driven into place at this time as well. It is not useful to chill the drive pinion bearing cups, because freezer temperatures will not contract them enough to ease installation.

Next, the differential bearing shim packs must be determined. This step can be omitted if the original differential is to be reused - the original shim pack thicknesses should be used for the first trial. To ease the trial-and-error process of determining correct differential bearing shim packs, dummy or test bearings should be produced. Two new differential bearing cones are modified by hand- grinding a small amount from the inner diameter of the inner race. A minute or two with a medium-grade tootsie roll in a die grinder will be sufficient. Grind just enough out so that the bearings slip into place with no pressing required, but do not grind so much that the bearings wobble when in place. The first trial is to determine total differential shim pack thickness. Install 0.040" shims beneath each of the dummy differential bearings, and then place the differential into the housing with the differential bearing cups. It is not essential to install the main caps at this stage. Set up a dial indicator to allow measurement of differential end-play in the housing. Move the differential to the left and right while observing the dial indicator for the measurement. Take care not to cock the differential and produce a false reading. Remove the differential from the housing. Add the measurement just taken to the total shim pack thickness (0.080") previously installed. This is defined as thickness A. Now, compare this number to the thickness of the original shim pack that was removed, minus 0.015". If the two numbers are within a few thousandths, install the original shim packs (left and right) on the differential. If there is more than a few thousandths difference, the right and left shim pack thicknesses must be independently determined. To do this, the drive pinion must be installed in the housing.

For checking the setup, the drive pinion is installed without preload shims under the outer drive pinion bearing cone. The pinion seal and slinger should be left out at this stage as well. If the drive pinion has coarse splines, a dummy outer drive pinion bearing cone should be produced to ease the setup procedures, as was done for differential dummy bearings. Install the drive pinion in the housing, install the outer pinion bearing cone and yoke, and torque the pinion nut just snug. Now, tap each end of the drive pinion to seat the bearing cones in the housing. Do not tap hard enough to damage the bearing cups or cones. At this point, the drive pinion should be difficult to turn. If it is easy to turn, apply additional torque to the pinion nut. Now, reinstall the differential with 0.040" of shim under the left (driver's) differential bearing cone. Set up the dial indicator, and check endplay between the left side of the housing and the drive pinion. In other words, push the differential to the left and right. When pushing it to the right, the pinion against the ring gear will stop its movement. The dial indicator measurement added to the 0.040" of shim is the desired shim pack thickness for the left differential bearing (thickness B). To determine the right differential bearing shim pack thickness, subtract thickness B from thickness A and then add 0.015" (for differential bearing preload). This is the desired shim pack thickness for the right differential bearing.

Once the desired differential bearing shim packs are installed, reinstall the differential in the housing, still using the dummy differential cones and cups. Installation will be a tight fit. Factory procedures call for use of a case spreader at this stage (Miller Tool W-129). However, use of this tool is somewhat dangerous to the integrity of the housing, and is not essential to successful setup. Careful tapping on the differential bearing cups using a wood block or brass drift, back and forth from the left bearing to the right and back, will ease the differential into the housing. Once the differential is in place, install main caps and torque to 40-50 ft-lbs.

Next, set up the dial indicator to measure lash. This should be taken on a tangent to the outer edge of the ring gear, and parallel with the ring gear mounting plane. The measurement should be taken at 4 places, 90 degrees apart. There should be no more than 0.002" difference in the 4 lash measurements and the lash should average between 0.008" and 0.010". The factory service manuals call for 0.004" to 0.009" average lash, but a loose lash is preferred over a tight lash for satisfactory performance. The runout measurement

taken on the ring gear before the differential was first removed should be rechecked with the new ring gear. If unsatisfactory, the ring gear can be moved on the differential in an attempt to remove the runout. If the lash measurement is close to what is desired, one can proceed to checking the mesh pattern. If not, the differential shim pack thicknesses should be adjusted by moving shims from one side of the differential to the other. Each 0.003" of shim moved will change lash about 0.002".

To check the mesh, mark 8-10 teeth on the ring gear with marking compound. White latex interior house paint works fine. Now, turn the drive pinion while applying drag to the differential with a bar or stick pried against its side. Turn the drive pinion both ways through the marked teeth. Observe the pattern where the paint is rubbed off the surface of the teeth. The pattern should be well- centered on both sides of each tooth. If the wiped area is not centered, the drive pinion depth shim pack must be changed. Use Figure 3 as an aid to determining the action required. Bear in mind that, if pinion depth is decreased by removing shims, the differential shim packs will need to be changed to move the ring gear closer to the pinion. And, if the pinion depth is increased by adding shims, the opposite action on the differential shim pack thicknesses is required. For each 0.010" of pinion depth change, the differential needs to move about 0.008". This is the most tedious aspect of Dana 60 axle setup - the trial-and-error process of simultaneously arriving at correct mesh and lash. The second axle is always easier than the first!

Once the pinion depth and differential bearing setup is complete, the dummy differential bearings can be replaced with new bearings. These bearings can be pressed into place, being careful to preserve the shim pack thicknesses so painstakingly determined. This author has found that heating the bearings in a 400F degree oven for 10 minutes will expand them enough that they slip into place with ease. This procedure also works well for the inner drive pinion bearing cone, and for the outer drive pinion bearing cone on coarse spline drive pinions, as well as for axle bearings. The drive pinion, differential, or axle should be cooled prior to bearing installation, or even stored in a freezer for a few hours.

The final aspect of Dana 60 axle setup is determining drive pinion bearing preload shim pack thickness. Remove the drive pinion from the case and install shims beneath the outer drive pinion bearing cone equal to the drive pinion depth shim pack plus 0.010". Reinstall the drive pinion in the housing with the yoke, again torquing the pinion nut. This time, while torquing check for bind of the drive pinion. If none is detected, torque the pinion nut to at least 100 ft-lbs. If bind is detected, more shims must be added beneath the inner drive pinion bearing cone. There should be obvious end-play in the drive pinion at this stage. Set the dial indicator up and measure this end-play. Remove the drive pinion from the housing to adjust the preload shim pack thickness. Subtract the end-play measurement from the drive pinion bearing preload shim pack and subtract an additional 0.001" to 0.002" to provide the preload. Reinstall the drive pinion with corrected pinion bearing preload shim pack and reinstall outer drive pinion bearing. This time, before installing the yoke, install the pinion seal and oil slinger. Install yoke and torque pinion nut to 250 ft-lbs.

Reinstall the differential in the housing, and recheck lash once more. Lash may decrease a couple of thousandths when the new differential bearings are installed. Lash should increase a little as the bearings seat, but this is another reason to set lash on the loose side to start. If lash is satisfactory, the cap bolts can be torqued to 80 ft-lbs with loc-tite. This author uses new Grade 9 cap bolts torqued to 100 ft-lbs for final assembly.

At this stage, setup is complete. All that is left is to reinstall the cover and fill with lube.

Don't forget the Sure Grip Additive!