HIGH PERFORMANCE PARTS AND MODIFICATIONS

INDEX

FEDERAL LAWS ON EMISSION CONTROL ARE SPECIFIC AND SALE OF THE FOLLOWING DOES NOT CONSTITUTE APPROVAL TO SUBSTITUTE WHERE CONTRADICTIONS TO THE LAW WOULD BE ENCOUNTERED VOIDING CERTIFICATION ON STREET VEHICLES MANUFACTURED CONFORMING TO THE LAWS

GENERAL INFORMATION

Data contained in this brochure is intended as an aid in establishing basic engine specifications for special purpose events. The specifications listed are intended as suggestions only; however, all are proven.

Small Block V-8 Series Engines

302-327-350-365-400 Cu. In. Displacement

The 1968-69 302 and 1970 350 cu. in. RPO Z-28 and LT-1 engines are of high performance design featuring: Four bolt main bearing caps, forged high compression pistons, heat treated crankshafts with 8-inch harmonic balancers, selected high quality connecting rods, large port cylinder heads with 2.02" dia. inlet valves and 1.6" dia. exhaust valves, aluminum tuned runner design inlet manifold, 800 CFM Holley 4-barrel carburetor, special oil pan baffling, deep groove belt pulleys, and a mechanical lifter camshaft with special push rods and rocker arms.

BASIC INTERCHANGEABILITY FEATURES OF THE SMALL BLOCK SERIES

Since 1968 when all small displacement engines were brought to a common main and connecting rod journal size (2.45 and 2.1" respectively) there has been a basic interchangeability in components that allows building of five (5) engine displacements out of two blocks and three crankshafts. They are as follows:

283	3 7/8" Bore	3" Stroke
307	3 7/8" Bore	3 1/4" Stroke
302	4" Bore	3" Stroke
327	4" Bore	3 1/4" Stroke
350	4" Bore	3.48" Stroke

In 1969, the 4" bore block was updated to incorporate four bolt main bearing caps and increased thickness main bearing webs. Since this is the block of primary interest, the 283 and 307 displacement engines will not be considered in the text.

THE 400 CU. IN. SMALL BLOCK

In 1970, a 4 1/8" bore block was introduced in regular production as a 2 barrel carbureted regular fuel engine at 400 cu. in. displacement. This block features siamesed cylinder bores, (no cooling water between bores) four (4) bolt main bearing caps, and an increase in main bearing diameter to 2.65". It also uses a nodular iron crankshaft and 5.565" length connecting rod (vs. 5.7" for all other small block engines).

Because of the potential for larger displacements and new bore/stroke ratios from the 400 cu. in. block, a great deal of interest has been shown by engine builders in using it. Some parts common to other engines such as camshafts, cylinder heads and intake manifolds are interchangeable. Due to the lack of suitable crankshafts, connecting rods and pistons, no instructions are included on this engine except as follows:

In the event you should attempt to build a high performance engine using the new 4 1/8" bore block, the following cautions should be observed:

1. This engine, at 3.75 stroke, in production is externally balanced with an unbalanced torsional damper and flywheel. These parts or similarly unbalanced parts may be necessary to achieve final engine balance.

2. Because of the siamesed cylinder bores, steam holes are drilled through the cylinder block between

cylinders above and below the siamesed joint. For good cooling water circulation and to relieve steam and air pockets, it is necessary that these holes be matched with similar holes in the head gasket and cylinder heads.

3. To prevent head gasket overhanging into the cylinder bore, the production or other large bore head gasket should be used.

   The 4-1/8" bore bare block is available.

TWO BASIC POSSIBILITIES FOR CONSTRUCTING A 365 CID ENGINE:

1. CHEAP & EASY: Use a 4" bore block, 350 CID 3.48" stroke crankshaft, 350 CID forged pistons, (.030 O.S.) and small journal pre-1968 connecting rods. Other specialty rods could be used also.
   a. Block should be bored to 4.030.
   b. Crankshaft should be reground for 3-9/16" stroke and small journal "302" rods.
   c. Cut piston tops to establish correct deck height or purchase connecting rods with special length.
   d. Remainder of parts common to previous special high performance small block V-8 engines.

2. BETTER & MORE EXPENSIVE: Use a 4-1/8" bore block (400 CID) and have a special crank made from a forging to fit the large journal mains and rods of the "400" block (2.1" rod journals and 3.4" stroke).
   a. Obtain and use 4.125" forged pistons.
   b. Obtain and use specialty rods of correct length for pistons involved.
   c. Use red composition cylinder head gaskets and drill steam holes in cylinder heads to match holes in block.
   d. Same as in (d.) above.

Large Block M-4 Series Engines

396-427-454 CU. IN. Displacement

To build a 396 cu. in. heavy duty engine, it is necessary to start with an RPO L-78 engine which has 4 bolt main bearing caps and oil cooler provisions in the cylinder case. This engine is built with the same large port cylinder heads and inlet manifold as high performance 427's. The RPO L-78 was rated at 375 H.P. in production, and parts for increased performance are available from the heavy duty parts list.

In 1970, the RPO L-78 engine was increased in displacement to 402 cu. in. by increasing the bore size to 4.125" from 4.094" In addition, the engine is now equipped with a low profile aluminum intake manifold for improved hood clearance.

To build a 427 cu. in. heavy duty engine, start with an RPO L-88 engine assembly which comes with aluminum cylinder heads, or an RPO L-88 short block. This includes: 12.5:1 compression ratio piston, connecting rods with 7/16" bolts which are 100% magnafluxed and coplated at the pin end for floating wrist pins and chain drive camshaft. If a complete engine assembly is used, obtain 7/16" diameter pushrods and guide plates.

To build a 454 cu. in. heavy duty engine, start with an engine assembly which has aluminum cylinder heads or use a 427 bare block and build-up. This includes: 12.5:1 compression ratio pistons, connecting rods with 7/16" bolts which are 100% magnafluxed and coplated at the pin end for floating wrist pins and chain driven camshaft. Use 7/16" pushrods as described above for the 427.

The 427 RPO L-88 features "open" combustion chamber aluminum heads introduced first in 1969. The 1968 and earlier aluminum heads and all cast iron heads will not fit on these engines due to piston to head interference.

Available for 1970 was the RPO LS-6 454 cu. in. engine featuring 11:1 compression ratio forged pistons with pressed pins, mechanical valve lifters and high performance conventional combustion chamber cast iron heads; a low profile aluminum intake manifold is included.

Any 427 cu. in. engine with four bolt main bearing caps can be upgraded to RPO L-88 427, or 454 cu. in. heavy duty specifications by using components listed in this brochure and the Corvette Parts Catalog.

NOTE: Caution should be exercised in increasing displacement to 454 cu. in. Additional connecting rod clearance may be required in the block and the proper torsional damper and flywheel should be used to obtain correct engine balance.

LS-7 "454" Heavy Duty Engines were not produced on the assembly line. Those in existence were built-up from service parts.

Aluminum engines have been manufactured in three basic configurations as follows.

The 4.25 bore 356 alloy with cast iron dry cylinder liners. Built and sold from 1969 to date, originally as complete engine assembly and partial engine; currently available as bare block only, Part #3952318. Standard displacements are 427 CID with a 3.76" stroke crankshaft and 454 CID with a 4" stroke crank.

The 4.440 bore 356 alloy with cast iron dry cylinder liners. Built and sold from 1969 to date as bare cylinder block only, Part #3990238. Standard displacements are 430 CID with a 3.47" stroke crank, 465 CID with a 3.76" stroke crank, and 495 CID with a 4" stroke crankshaft.

The 4.440 bore 390 alloy with no cylinder liners (pistons run directly on cylinder bores and must be iron plated for compatibility). Available as a bare cylinder block only starting in 1972, Part #3965755. Due to piston availability, the engine can only be built as 430 or 441 CID (with a .060 overbore), and 495 or 509 CID (with a .060 overbore) using 3.47" or 4" strokes respectively.

CAMSHAFT

	OPTION SMALL BLOCK V-8 3927140	PRODUCTION LARGE BLOCK M-4 3925535	PRODUCTION LARGE BLOCK M-4 3925533	PRODUCTION LARGE BLOCK A1. M-4 3959180	PRODUCTION SMALL BLOCK V-8 3849346	PRODUCTION SMALL BLOCK V-8 3972178
LIFT (ZERO LASH)						
INLET	.492	.562		.579	.4850	.458
EXHAUST	.512	.584		.620	.4850	.485
VALVE TIMING						
INL. OPENING BTC	53°	61°		62°	60°50'	42°40'
INL. CLOSING ABC	100°	113°		105°	105°23'	94°20'
INL. DURATION	333°	354°			346°13'	317°
INL. OVERLAP						
LASH	.022	.024 CAST IRON HEADS .022 ALUMINUM HEADS		.022	.030	.024
EXH. OPENING BBC	101°	108°		106°	108°50'	112°50'
EXH. CLOSING ATC	65°	72°		73°	57°23'	53°23'
EXH. DURATION	346°	360°			346°13'	346°14'
EXH. OVERLAP						
LASH	.024	.026 CAST IRON HEADS .024 ALUMINUM HEADS		.024	.030	.030

	OPTION LARGE BLOCK M-4 3994094	OPTION SMALL BLOCK V-8 3965754	PRODUCTION LARGE BLOCK M-4 3863143
LIFT (ZERO LASH)			
INLET	.623	.512	.5197
EXHAUST	.621	.536	.5197
VALVE TIMING			
INL. OPENING BTC	72°	49°	44°
INL. CLOSING ABC	108°	95°	92°
INL. DURATION	364°	324°	316°
INL. OVERLAP	148°	105°	80°
LASH	.020	.022	.024
EXH. OPENING BBC	110°	98°	86°
EXH. CLOSING ATC	76°	56°	36°
EXH. DURATION	362°	334°	302°
EXH. OVERLAP	148°		80°
LASH	.020	.024	.028

Due to thermal expansion of the aluminum blocks, there is considerable valve lash change between cold and hot engine conditions. Valves should be lashed cold at .012 Int. and .014 Exh. If hot valve lash is desired, it should be done only with engine thoroughly warmed up and set to .002 Int. and .024 Exh.

CYLINDER HEAD

	Z-28 302 3991492	L-88 427 3919838	427-454-430 3994025 C.I. 3946072 AL.	LT-1 Z-28 350 3987376	F.I. 327 3958604	LF-6 400-V-8 3977544	LS6 454 CID 3964287
COMBUSTION CHAMBER VOL.	62.07CC	107.09CC	116.8CC	62.07CC	62.07CC	75.81CC	109.03CC

VALVE SPRINGS

	Z-28 3927142 DUAL	L-88 ZL-1 3916164 1ST DESIGN TRIPLE	L-88 ZL-1 3989354 2ND DESIGN TRIPLE	FOR USE W/CAMSHAFT .512/.536 LIFT	
				INTAKE	EXHAUST
CLOSED OUTER		75 @ 1.88"	88 @ 1.90"	105 @ 1.725	105 @ 1.725
OPEN OUTER		193 @ 1.32"	226 @ 1.30"	220 @ 1.213	226 @ 1.189
OPEN INNER		101 @ 1.22"	100 @ 1.20"	100 @ 1.200	104 @ 1.176
CLOSED INNER		41 @ 1.78"	40 @ 1.80"	30 @ 1.712	30 @ 1.712
CLOSED	110 @ 1.7"				
OPEN	260 @ 1.25"				

VALVES

	L-88/ZL-1 3969815	L-88 *3879618	L-88 *3879619	L-88/ZL-1 3946077	302-350 3849814	302-350 3849818
HEAD SIZE	2.195	2.305	1.845	1.885	2.023	1.605
TYPE	INT.	INT.	EXH.	EXH.	INT.	EXH.

*NOT RECOMMENDED FOR ALUMINUM HEADS

CARBURETORS

	3957869	3955205	3965736
THROTTLE BORE	1-9/16 T-BORE	1-3/4 T-BORE	1-11/16 T-BORE
CFM	600	850	830
TYPE	DUAL PUMP	DUAL PUMP	DUAL PUMP

RECOMMENDED CLEARANCES FOR SMALL BLOCK V-8 ENGINES

Piston to Bore:	.0055 - .0065" measured at centerline of wrist pin hole, perpendicular to pin. Finish bores with #500 grit stones or equivalent (smooth).
Wrist Pin:	.0004 - .0008" in piston, (.0005 - .0007" in rod for floating pin. 0 - .005" end play preferred).
Rod Bearing:	.002 - .0025", side clearance .010-.020"
Main Bearing:	.002 - .003" minimum preferred, .005 - .007" end play.
Piston to Top of Block: (Deck Height)	.012 - .015" average below deck. No part of piston except dome to be higher than deck of block. Deck height specified is for a .020" steel head gasket. If a thicker head gasket is used, a piston to cylinder head clearance of .035 should be considered minimum.
Valve to Piston:	.010 Intake, .020 Exhaust checked at zero lash during valve overlap cycle. These are absolute minimum clearances to allow for heat expansion only and will not accommodate valve float from overrevving. Oversized pistons are available through Dealer Parts and Service if needed to restore proper piston to bore clearance when rebuilding.

NOTE: Additional specifications are available in the Dealer Shop Manuals.

RECONDITIONING SPECIFICATIONS:

Connecting rod bearing bore diameter - $\frac{2.2247}{2.2252}$ inch (302-327-350 exc 400)

Main bearing bore diameter - $\frac{2.6406}{2.6415}$ inch (302-327-350 exc 400)

RECOMMENDED BOLT TORQUE FOR SMALL BLOCK V-8 ENGINES

		Torque	Apply the following before installation of part involved
Main Bearing	Bolts	Inner 70 ft. lb.	Molykote
		Outer 65	Molykote
Conn. Rod Bolt 3/8"		45-50 ft. lb. (.006" stretch preferred)	Oil
Cylinder Head Bolt		65 ft. lb.	Sealant
Rocker Arm Stud (1970 Head)		50	Sealant
Camshaft Sprocket		20	Oil
Intake Manifold		25	Oil
Flywheel		60	Oil
Spark Plugs		25	Dry
Exhaust Manifold		25	Antiseize
Oil Pan Bolt		165 in. lb.	Oil
Front Cover Bolt		75 in. lb.	Oil
Rocker Cover		25 in. lb.	Oil

RECOMMENDED CLEARANCES FOR LARGE BLOCK M-4 ENGINES

Piston to Bore:	.0065-.0075" (except w/aluminum block) measured at centerline of wrist pin hole, perpendicular to pin. Finish bores with #500 grit stones or equivalent (smooth). .005-.006" w/aluminum block using 356 alloy (steel sleeve) .004-.005" w/aluminum block using 390 alloy (no sleeve)
Piston Ring:	Minimum end clearance Top - .022; Second - .016; Oil - .016
Wrist Pin:	.0004-.0008" in piston, .0005-.0007" in rod. End play 0-.005" preferred.
Rod Bearing:	.002-.003", side clearance .015-.025" minimum preferred.
Main Bearing:	.002-.003", minimum preferred, .005-.007" end play.
Piston to Top of Block: (Deck Height)	.0-.005" average above deck, with piston centered in bore. Deck height specified is for a .040" (compressed) Victor composition head gasket. If thinner head gasket is used, deck height may be reduced accordingly. For best results, piston deck to cylinder head clearance should be established at .035-.040" with piston centered in bore.
Valve to Piston Clearance:	.020" exhaust, .015" intake at 0 valve lash. Note: These are to be considered absolute minimum clearances for an engine to run below the valve train limiting speed of 7600 RPM. If you intend to run up to valve train limiting speed, more clearance should be allowed. It is common practice to allow .100" intake and exhaust valve minimum clearance measured during valve overlap.

NOTE: Additional specifications are available in the Dealer Shop Manuals.

RECONDITIONING SPECIFICATIONS:

Connecting Rod Bearing Bore Diameter 2.3247 - 2.3252 Inch

Main Bearing Bore Diameter 2.9371 - 2.9380 Inch

RECOMMENDED BOLT TORQUE FOR LARGE BLOCK M-4 ENGINES

			Torque	Apply the following before installation of part involved
Main Bearing (w/cast iron block)	Studs	Inner	110 ft. lb.	Molykote
		Outer	110 ft. lb.	Molykote
Main Bearing (w/al. block)	Studs	Inner/Outer (NF THD)	100 ft. lb.	Oil
	Bolts	Inner	100 ft. lb.	Molykote
		Outer	100 ft. lb.	Molykote
Cylinder Head (w/al. block)	Bolts	Long	70	Sealant
		Short	60	Sealant
	Studs	Valley (4)	50-55	Oil
	Studs	Long	65 (7/16" NF)	Oil
		Short	55 (7/16" NF)	Oil
Cylinder Head (w/cast iron block)	Bolts	Long	75	Sealant
		Short	65	Sealant
Conn. Rod	Bolt	3959186 7/16"	60-65 ft. lb. (.007" stretch preferred)	Oil
	Bolt	3969864 7/16"	67-73 ft. lb. (.009" stretch)	Oil
Rocker Arm Stud			50	Oil
Camshaft Sprocket			20	Oil
Intake Manifold			25	Oil
Flywheel			60	Oil
Spark Plugs			25	Antiseize
Exhaust Manifold			20	Antiseize
Oil Pan Bolt			165 in. lb.	Oil
Front Cover			75 in. lb.	Oil
Rocker Cover			25 in. lb.	Antiseize
Bell Housing			25 in. lb.	Antiseize

The aluminum block used for the above is special. No relationship with the "427" exists. The bore is 4.44.

:-:-:

It is a good thing to know, the "430" utilizes a special Crank and new longer rods, the "465" utilizes an L-88 Crank and L-88 Rods, the "495" builds-up with a "454" Crank and L-88 Rods.

:-:-:

The "430" Crankshaft has a stroke of 3.470.

:-:-:

The "430"-"465"-"495" bare blocks come without finish hone on the bores. Because of the proximity of the head bolt holes to the cylinders, bore distortion occurs when head bolt closest to the bores are torqued. It is recommended prior to honing 7/16 NC thd. bolts and washers (not regular head bolts) be installed and bolts torqued to 60 ft. lbs. Hone bores, with bolts and washers installed, to a #500 grit (smooth) finish.

:-:-:

Some head bolt holes have been counterbored 1/4" on each bank requiring the new extra long bolts.

:-:-:

The "430"-"465"-"495" head gasket has a stainless wire rolled inside the head around each hole opening and functions as an "O" ring. Additional reworking of the block for an "O" ring is not required nor recommended with the gasket.

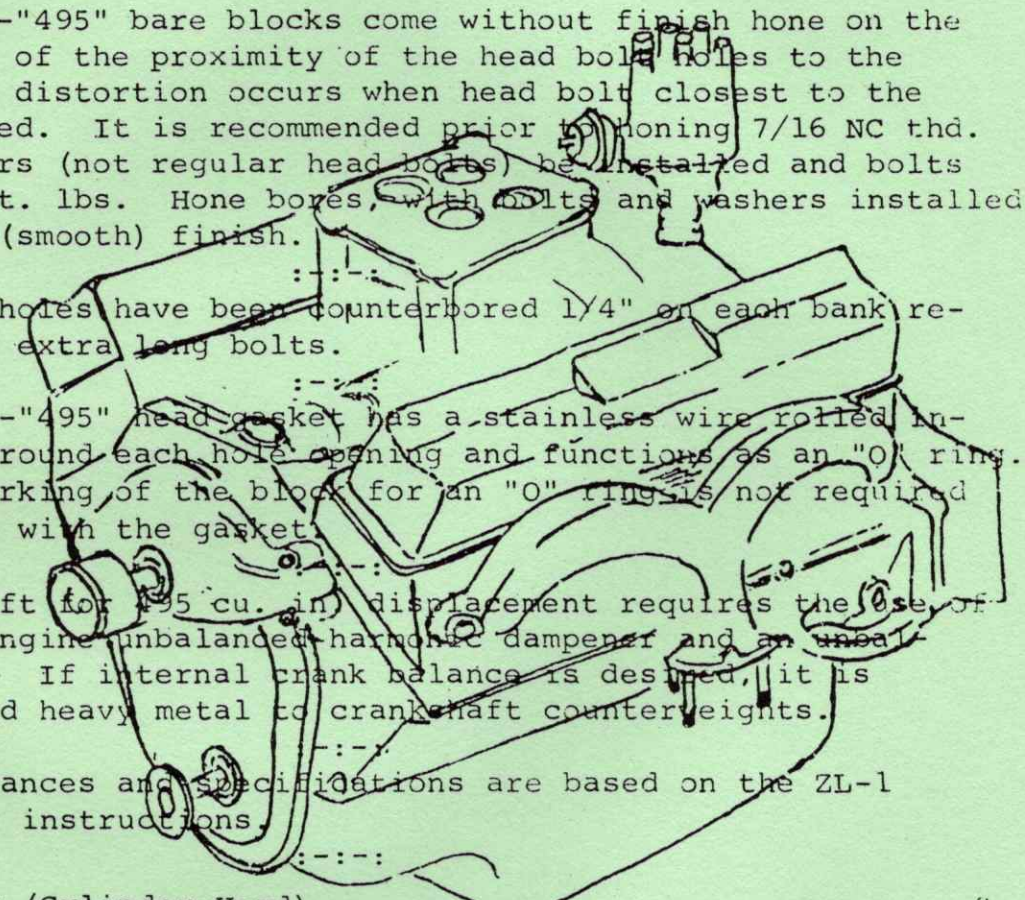
:-:-:

The 4" crankshaft for 495 cu. in. displacement requires the use of a 454 cu. in. engine unbalanced harmonic dampener and an unbalanced flywheel. If internal crank balance is desired, it is necessary to add heavy metal to crankshaft counterweights.

:-:-:

All other clearances and specifications are based on the ZL-1 aluminum engine instructions.

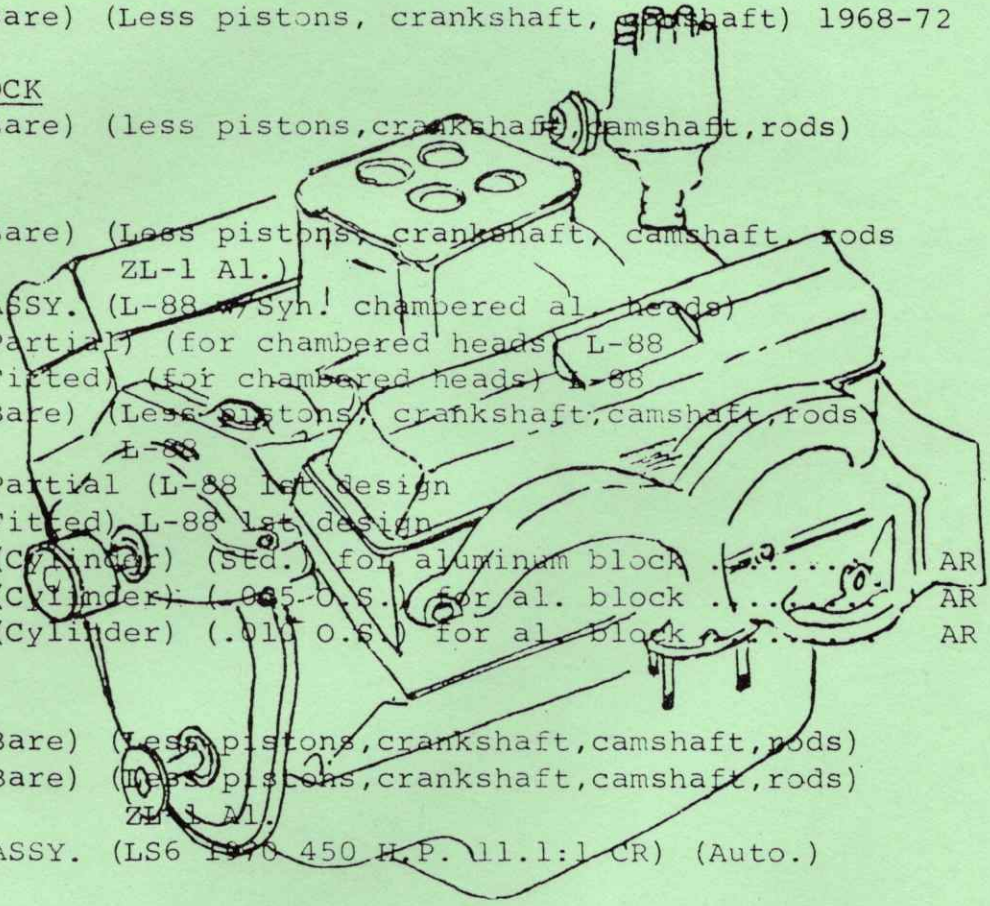
:-:-:



3976081	GASKET (Cylinder Head)	2
3976082	BOLT (Cylinder Head)	10
3965746	CRANKSHAFT (Semi-Finished, Center Points & Main Journals Machined) (430)	1
3963642	ROD (Connecting) (6.404-6.406 C/L Crank to C/L Pin) .	8
3992043	PISTON (Std.) (430-495)	8
3992044	PISTON (.001 O.S.) (430-495)	8
3992045	PISTON (.005 O.S.) (430-495)	8
3992051	PISTON (Std.) (465)	8
3992052	PISTON (Std. Hi Limit) (465)	8
3992053	PISTON (.005 O.S.) (465)	8
3992061	RING UNIT (Piston) (Std.)	8
3992062	RING UNIT (Piston) (.005 O.S.)	8
3964238	RETAINER (Piston Pin) (for Floating Pin)	AR

6263745 SLEEVE (Cylinder) (Std.) Aluminum Block ..... AR
6263746 SLEEVE (Cylinder) (.005 O.S.) Aluminum Block ..... AR
6263747 SLEEVE (Cylinder) (.010 O.S.) Aluminum Block ..... AR

ENGINES & BLOCKS



350 CID
3965748 ENGINE ASSY. (370 H.P. 4 bolt mains) (LT-1 & Z-28 11.1:1 CR) (Ign. Dist. less Tach Drive)
3966921 ENGINE (Partial) (370 H.P.)
3966920 BLOCK (Fitted) (370 H.P.)
3970016 BLOCK (Bare) (Less pistons, crankshaft, camshaft) 1968-72

400 CID SMALL BLOCK
3951510 BLOCK (Bare) (less pistons,crankshaft,camshaft,rods)

427 CID
3952318 BLOCK (Bare) (Less pistons, crankshaft, camshaft, rods ZL-1 Al.)
3935499 ENGINE ASSY. (L-88 w/Syn! chambered al. heads)
3970699 BLOCK (Partial) (for chambered heads) L-88
3970688 BLOCK (Fitted) (for chambered heads) L-88
3963516 BLOCK (Bare) (Less pistons, crankshaft,camshaft,rods) L-88
3974228 BLOCK (Partial (L-88 1st design
3974227 BLOCK (Fitted) L-88 1st design
3992009 SLEEVE (Cylinder) (Std.) for aluminum block ..... AR
3992010 SLEEVE (Cylinder) (.005 O.S.) for al. block ..... AR
3992011 SLEEVE (Cylinder) (.010 O.S.) for al. block ..... AR

454 CID
3963516 BLOCK (Bare) (Less pistons,crankshaft,camshaft,rods)
3952318 BLOCK (Bare) (Less pistons,crankshaft,camshaft,rods) ZL-1 Al.
3981000 ENGINE ASSY. (LS6 1970 450 H.P. 11.1:1 CR) (Auto.)

302 CID
3970647 BLOCK (Fitted) 1968-70
3970016 BLOCK (Bare) 1968-72
3970162 BLOCK (Partial) 1967
3970657 BLOCK (Partial) 1968-70
3959588 BLOCK (Bare) 1967 & earlier (w/small journals)

327 CID
3970016 BLOCK (Bare) 1968-72
3959588 BLOCK (Bare) 1967 & earlier (w/small journals)

4 CYL.-3.5000-3.5005 BORE
331134 BLOCK (Bare) Aluminum 1

SLEEVE REPLACEMENT PROCEDURE

FOR ALUMINUM BLOCKS

When replacing a sleeve (liner) in an aluminum block, it is necessary to bore-out the damaged sleeve or cut a slot the full length of the sleeve side wall to relieve the press-fit.

Remove the damaged sleeve without harming the block bore and discard.

The item contained in this package should have been selected on the basis of block bore measurements for size, taper and out of round. Measurements should have been taken at room temperature. Allow .003 - .005 for interference fit of sleeve to block.

Before attempting to install sleeve, pack it in crushed dry ice for approximately two hours. Drop temperature to -30° to -40°F.

Also, heat cylinder wall of bore involved for approximately two hours. Raise temperature slowly to 200° - 300°F. (Infra red lamps are recommended). Then apply a thin film of oil to the walls being serviced.

Now, install sleeve by hammering on a piece of wood placed against the top of the sleeve. This operation should be done quickly to avoid too much temperature change in the parts.

Sleeve (liner) should be +.001 above surface of block. Machine as required.

Bore and hone I.D. of sleeve, now in block, to accept piston selected.

:-:-:

Some aluminum blocks are known to have been bored to a .030 overbore. This exhausts the potential of the block and it has to be resleeved.

ALUMINUM CYLINDER BLOCK DATA

On 4.440 bore linered engines it is recommended cylinder bore honing be done using a steel deck plate with cap screws in head bolt holes torqued to 50 ft-lb. This will simulate the bore distortion caused by the head bolts when the engine is assembled and give better piston ring sealing. This procedure is not required for 4.25 bore engines or 390 alloy cylinder blocks. NOTE: Main bearing bore alignment may change under high power outputs for long periods. Main bearing bores should be measured to determine any out of round condition on each rebuild with an accurate dial bore gauge. Any variation should be corrected by reline-boring the block.

CYLINDER BORE SIZING & REFINISHING - 390 ALLOY

The 390 aluminum alloy contains a distribution of free silicon particles which provides the hard surface for the cylinder bore.

In order to achieve complete bore compatability, the pistons are iron plated so that a hard iron skirt surface is opposite the silicon of the block to prevent scuffing.

In the event that bores are excessively scored or worn, they can be honed in the conventional manner with either manual or machine honing equipment for oversize pistons, however, the finishing step must be a silicon lapping process to achieve the finished bore surface required.

The silicon lap is used to remove a sufficient amount of aluminum leaving pure silicon particles prominent to form the bore wear surfaces.

1. Honing Procedures:

   Conventional honing equipment-either manual or machine-can be used. The manufacturers of this equipment are familiar with the requirements and can supply the required information and material for their equipment. Use only a fatty base honing oil (Sunnen MAN-845 or equivalent). Do not use mineral seal type oil. Use commercially available manual honing equipment which will operate at approximately 350 RPM.

2. Roughing Operation:

   Use a 280 grit roughing stone set (manual-Sunnen MM33-J63, machine-Sunnen C30-A53-81; or equivalent). Stock removal rate will be approximately .0035" per minute. Hone to within .003" of finished size; surface finish will be approximately 25-30 micro inches. During the honing operation, flood cylinder with honing oil, using a continual spray pump or apply continuously with an oil squirt can.

Use a 400 grit finishing stone set (manual-Sunnen MM33-J85, machine-Sunnen C30-J84-81; or equivalent). Stock removal rate will be approximately .002" per minute. Remove approximately .002" stock, surface finish will be approximately 20-25 micro inches. Flood with honing oil same as during roughing operation.

4. Polishing Operation:

Prior to this operation, be sure that all traces of the previous finishing operation abrasives are removed. Use a 600 grit polishing stone set (manual Sunnen MM33-C05, machine-Sunnen C30-81; or equivalent). Stock removal rate is approximately .0007" per minute with a maximum surface finish of 8 micro inches. Keep stone tension against cylinder wall fairly tight and remove approximately .001". Flood bore with honing oil.

5. Silicon Lap:

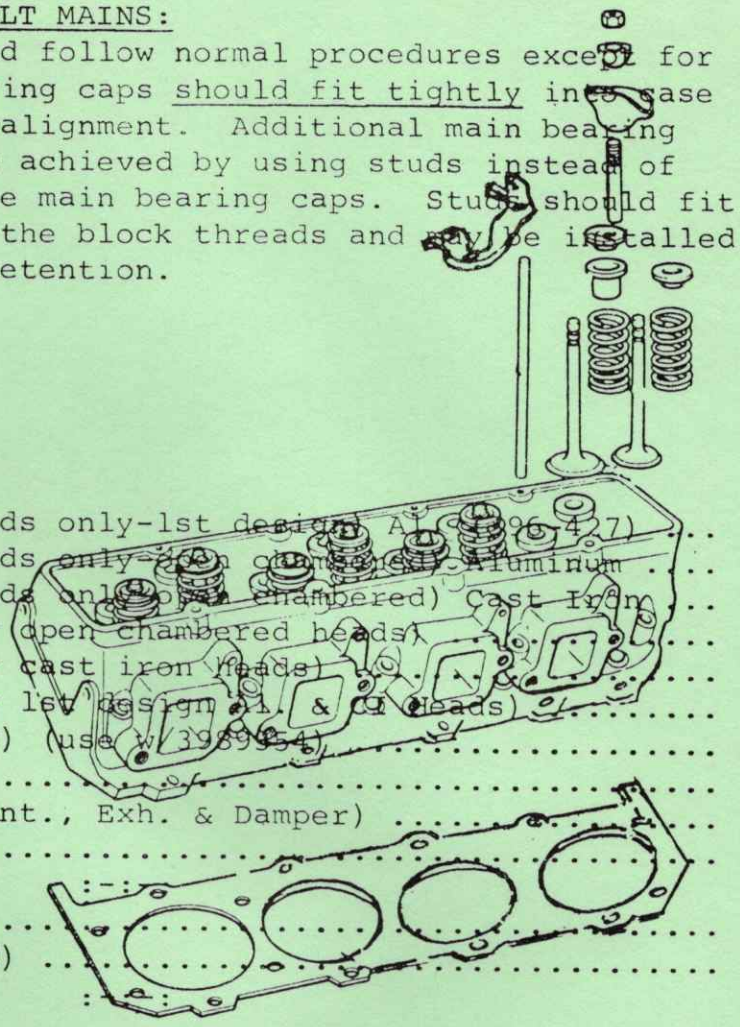
For silicon lapping, mount felt lapping pads in hone in place of stones. Remove guides or replace with lapping compound (Sunnen MM33 or equivalent). Tighten pinion adjustment as snugly as possible with fingers. Lap for two minutes using no oil. Surface finish will be approximately 12-35 micro inches. There will be no significant stock removal during the lapping operation. Carefully clean block of all abrasive material and lapping compound.

NOTE: It should be re-emphasized that the final operation is a silicon lap. The roughing, finishing, and polishing operations leave a surface finish consisting of both silicon particles and aluminum. The silicon lap removes all surface aluminum leaving pure silicon particles to form the bore wear surfaces.

The Sunnen Products Company, 7910 Manchester, St. Louis, Missouri 63143, has a complete honing procedure including stones, holders and machine settings for Sunnen equipment for the 390 alloy.

CYLINDER BLOCK WITH TWO BOLT MAINS:

Inspect, clean, de-burr and follow normal procedures except for bore finishing. Main bearing caps should fit tightly in case notches to prevent cap misalignment. Additional main bearing bulkhead durability may be achieved by using studs instead of bolts in the 3 intermediate main bearing caps. Studs should fit snugly the full length of the block threads and may be installed with Loc-Tite for better retention.



396-427-454 CID

3919838	HEAD ASSY. (w/Studs only-1st design All (396-427)	2
3946072	HEAD ASSY. (w/Studs only-open chambered) Aluminum	2
3994025	HEAD ASSY. (w/Studs only-open chambered) Cast Iron	2
3946077	VALVE (Exh.) (For open chambered heads)	8
3879618	VALVE (Int.) (For cast iron heads)	8
3879619	VALVE (Exh.) (For 1st design all & all heads)	8
3989353*	CAP (Valve Spring) (use w/3989354)	16
3947880	KEY (Valve Stem)	32
3989354	SPRING (Valve) (Int., Exh. & Damper)	16
3891521	SHIM (Spring)	AR
3969865	GASKET (Head)	2
3974218	GASKET UNIT (Head)	1
3959182	ARM (Rocker)	16
3899622	BALL (Rocker Arm)	16
3921912	STUD (Rocker Arm)	16
3942415	ROD (Push) Exh	8
3942416	ROD (Push) Int	8
3879620	GUIDE (Push Rod)	8

302-350 CID

3965742	HEAD ASSY. (w/studs) (casting beefed-up at valve seat area-relocated spark plug holes)	2
3916336	GASKET (Head) (Stainless Steel)	2
3927142	SPRING (Valve-Int. & Exh.)	16

*NOTE: Use PC type seal with clamp on valve guide or use Cap & Seal Assy. 3879613 instead.

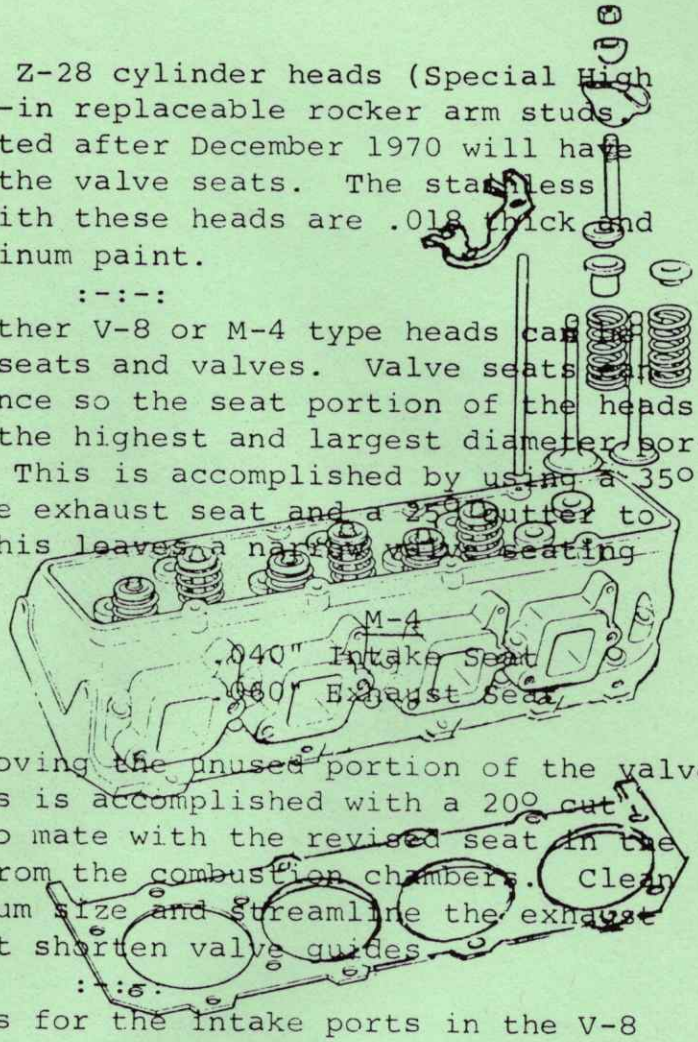
CYLINDER HEADS:

The 1970 and 1971 LT-1 and Z-28 cylinder heads (Special High Performance) feature screw-in replaceable rocker arm studs. Also, any castings fabricated after December 1970 will have the beefed-up area around the valve seats. The stainless steel beaded gasket used with these heads are .018 thick and should be sealed with aluminum paint.

:-:-:

Improved performance of either V-8 or M-4 type heads can be attained by reworking the seats and valves. Valve seats can be increased in circumference so the seat portion of the heads mates with valve faces at the highest and largest diameter portions of the valve faces. This is accomplished by using a 35° stone cutter to develop the exhaust seat and a 25° cutter to develop the inlet seat. This leaves a narrow valve seating surface for:

V-8	M-4
.030" Intake Seat	.040" Intake Seat
.050" Exhaust Seat	.060" Exhaust Seat



Valves are modified by removing the unused portion of the valve face and "underhead". This is accomplished with a 20° cut narrowing the valve face to mate with the revised seat in the head. Remove all ridges from the combustion chambers. Clean out exhaust ports to maximum size and streamline the exhaust valve guide bosses. Do not shorten valve guides.

:-:-:

Repeat the above operations for the intake ports in the V-8 heads, only.

:-:-:

On the M-4 aluminum heads the intake ports are not enlarged. Fillets should be blended and sharp edges removed, only.

:-:-:

Refer to chart on Page 8 for related parts and specifications.

:-:-:

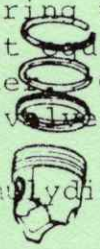
Cylinder head porting and preparation is extremely important in extracting the maximum power from the small block engine.

:-:-:

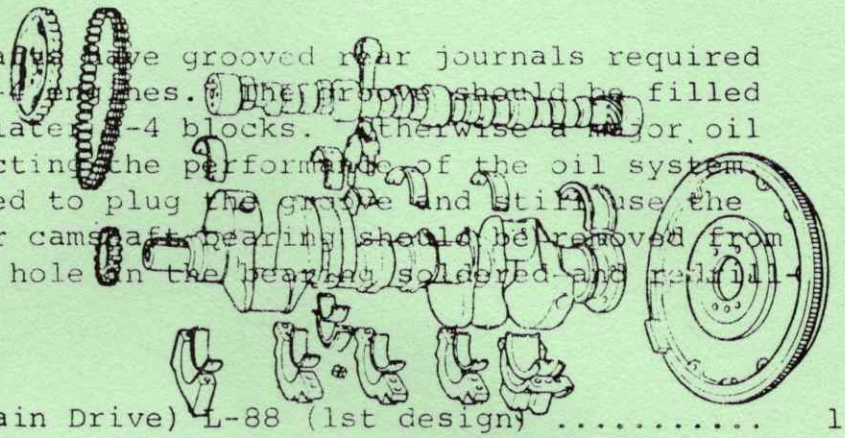
Aluminum 2nd design M-4 heads should have the holes in the underside of the two intake ports plugged when <u>not</u> used in conjunction with the aluminum blocks.

CAMSHAFT:

Camshaft timing can be checked by measuring valve lift on overlap cycle. Both valves should be at equal lift four (4) crankshaft degrees before top dead center. Check lift at valve lifter or with .020 lash on both valves.



It is recommended "molykote" or other molydisulfide based EP lubricant be used on camshaft lobes.



The M-4 service camshafts have grooved rear journals required for 1966 or earlier M-4 engines. The groove should be filled when used in 1967 or later M-4 blocks. Otherwise a major oil leak would occur affecting the performance of the oil system. Where it is not desired to plug the groove and still use the later blocks, the rear camshaft bearing should be removed from the block and the oil hole in the bearing soldered and refilled to .060".

396-427-454 CID

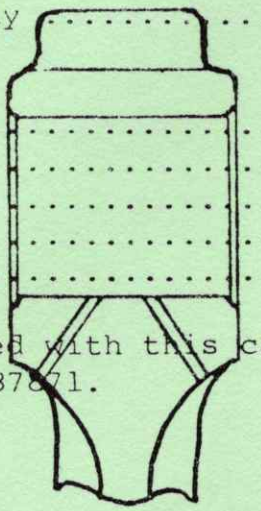
3925535	CAMSHAFT (Chain Drive) L-88 (1st design)	1
3925533*	CAMSHAFT (Gear Drive) L-88	1
3959180	CAMSHAFT (Chain Drive) ZL-1 (2nd design)	1
3994094	CAMSHAFT (Chain Drive) (3rd design)	1
	:-:-:	
3887871	BEARING UNIT THRUST (Gear Drive Cam)	1

302-327-350 CID

3927144	CAMSHAFT & SPRING UNIT	1
3927140	CAMSHAFT	1
3965754	CAMSHAFT	1

396-427 CID

3856351	GEAR (Camshaft)	1
3856356	SPROCKET (Camshaft)	1
3817006	BOLT (Camshaft Gear) (1/4-20x7/16)	2
3860036	CHAIN (Camshaft Timing)	1
3887871	THRUST UNIT (Camshaft) Gear Drive Only	1



ALUMINUM BLOCK ONLY ZL-1

3975949	SHIM (Camshaft Sprocket)	1
3952319	PLUG (Camshaft RR Brg.)	1
3952320	LOCK (Camshaft RR Brg. Plug)	1
3783948	SEAL (Camshaft RR Brg. Plug)	1
180020	BOLT (Camshaft RR Brg. Plug Lock)	2

*NOTE: Ball Bearing Distributor should be used with this cam. Also, use with Thrust Bearing Unit 3887871.

VALVE TRAIN:

The small V-8 engines use push rods having hardened steel inserted tips on one end, and should be installed with this end up. M-4 push rods are hardened at both ends.

:-:-:

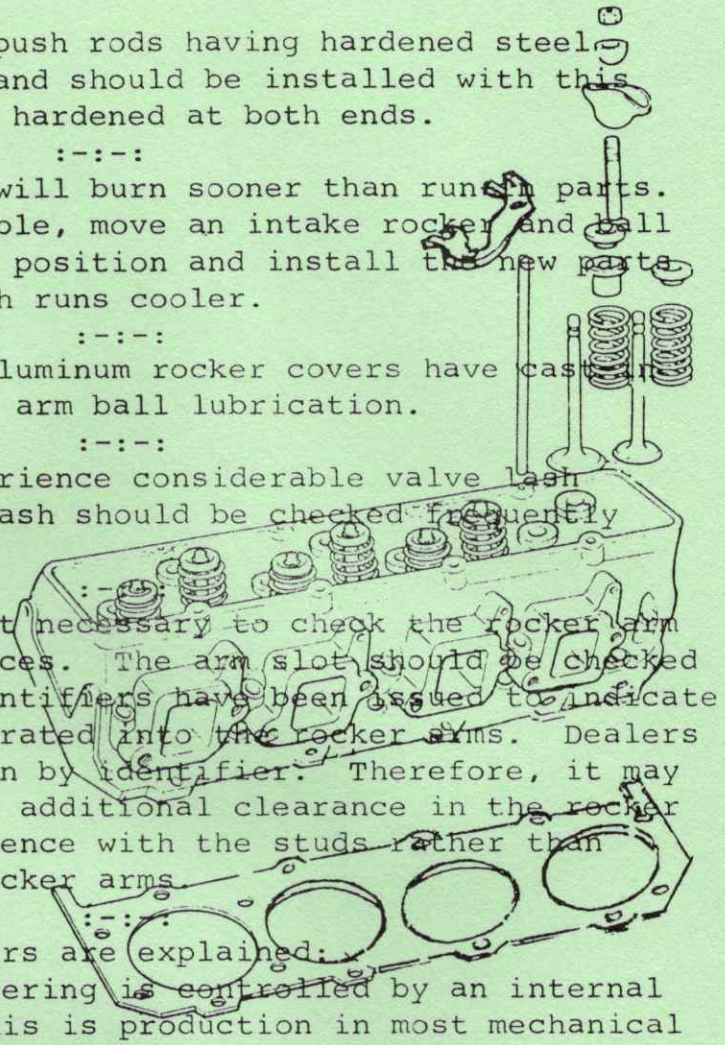
New rocker arms and balls will burn sooner than run-in parts. If no used ones are available, move an intake rocker and ball over to the burned exhaust position and install the new parts on an intake position which runs cooler.

:-:-:

The small block V-8 cast aluminum rocker covers have cast-in drippers to improve rocker arm ball lubrication.

:-:-:

New valve train parts experience considerable valve lash change during run-in and lash should be checked frequently until stabilized.



:-:-:

High lift camshafts make it necessary to check the rocker arm to rocker arm stud clearances. The arm slot should be checked at maximum lift. Many identifiers have been issued to indicate the latest changes incorporated into the rocker arms. Dealers have no means for selection by identifier. Therefore, it may be necessary to grind some additional clearance in the rocker arm slot to avoid interference with the studs rather than attempt to locate newer rocker arms.

:-:-:

Two mechanical valve lifters are explained: #5232695 over-head oil metering is controlled by an internal inertia flapper valve. This is production in most mechanical lifter engines.

#5231585 meters over-head oil on the basis of lifter to bore clearance orificing and has several desirable features not available with the piddle valve lifter. Lifter #5231585 effects a 10-20% reduction in <u>total</u> oil circulation rate due to its design. This can be a considerable benefit in dry sump and restricted oil pan capacity installations.

:-:-:

If conventional rocker arms are used, it is necessary to grind a .003-.005 flat on one side of each lifter between the oil feed hole and the existing annular groove around the lifter body. This increases over-head oil to adequately lubricate the production valve train.

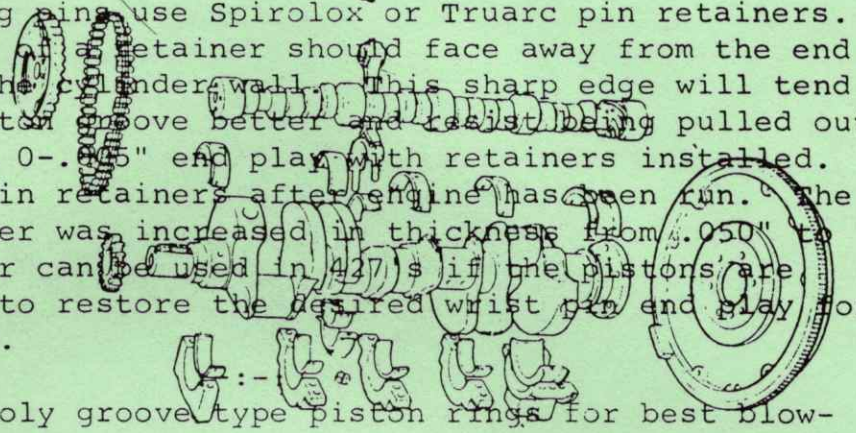
:-:-:

It is recommended "Molykote" or other molydisulfide based EP lubricant be used on lifters for proper break-in. Also, valve lifters will be more compatible with the camshaft should the tappet contact surface be polished with #600 grit paper. Good used tappets are more desirable.

PISTONS:

Remove sharp edges from head surface of piston. For installation of rods using pressed-in wrist pins, it is necessary to heat the rod small end and install the pins quickly in a fixture. Most automotive machine shops are equipped to make this assembly. It is necessary to have at least .001" or preferably .0012" press fit between wrist pins and rods to insure that pins will not loosen and move during running.

Pistons with floating pins use Spirolox or Truarc pin retainers. The squared off edge of a retainer should face away from the end of the pin towards the cylinder wall. This sharp edge will tend to bite into the piston groove better and resist being pulled out. Make sure there is a 0-.005" end play with retainers installed. Do not reuse wrist pin retainers after engine has been run. The 1970 Spirolox Retainer was increased in thickness from .050" to .072". This retainer can be used in 427's if the pistons are carefully regrovved to restore the desired wrist pin end play for increased durability.



:-:-:

Run the production Moly groove type piston rings for best blow-by control and minimum friction.

:-:-:

For Heavy Duty operation, it is good practice to allow more than the minimum piston to valve clearances to allow for occasional valve float. A .100" clearance is generally acceptable minimum.

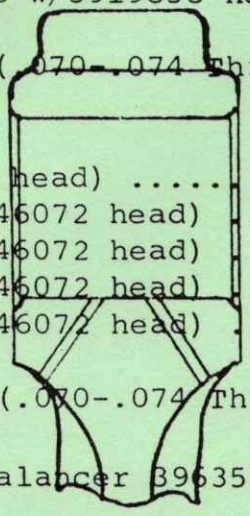
396-427-454 CID

427 CID

3959105	PISTON (Std.) floating pin (use w/3946072 head)	8
3909857	PISTON (Std.) floating pin (use w/3919838 head)	8
3909858	PISTON (.001 O.S.) floating pin (use w/3919838 head)..	8
3959106	PISTON (.001 O.S.) floating pin (use w/3946072 head)..	8
3981891	PISTON (.005 O.S.) floating pin (use w/3946072 head)..	8
3909859	PISTON (.030 O.S.) floating pin (use w/3919838 head)..	8
3959107	PISTON (.030 O.S.) floating pin (use w/3946072 head)..	8
3909860	PISTON (.060 O.S.) floating pin (use w/3919838 head)..	8

:-:-:

3964238	RETAINER (Piston Pin) floating pin (.070-.074 Thick)..	AR



454 CID

3976014*	PISTON (Std.) forged (use w/3946072 head)	8
3976018	PISTON (.001 O.S.) forged (use w/3946072 head)	8
3976022	PISTON (.020 O.S.) forged (use w/3946072 head)	8
3976026	PISTON (.030 O.S.) forged (use w/3946072 head)	8
3981075	PISTON (.060 O.S.) forged (use w/3946072 head)	8

:-:-:

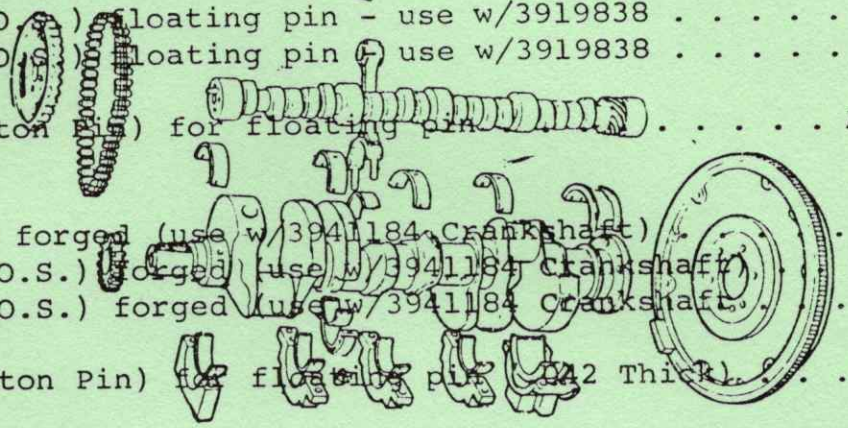
3964238	RETAINER (Piston Pin) floating pin (.070-.074 Thick)..	AR

*NOTE: Also, use with Crankshaft 3963524, Balancer 3963530 and Flywheel 3963537.

3993830	RING UNIT (Piston) (.030 O.S.)	1 per cyl.
3993831	RING UNIT (Piston) (.060 O.S.)	1 per cyl.

396 CID

3916147	PISTON (Std.) floating pin - use with 3919838	8
3916150	PISTON (.001 O.S.) floating pin - use w/3919838	8
3916152	PISTON (.030 O.S.) floating pin - use w/3919838	8
3916154	PISTON (.060 O.S.) floating pin - use w/3919838	8
3942423	RETAINER (Piston Pin) for floating pin	AR



350 CID

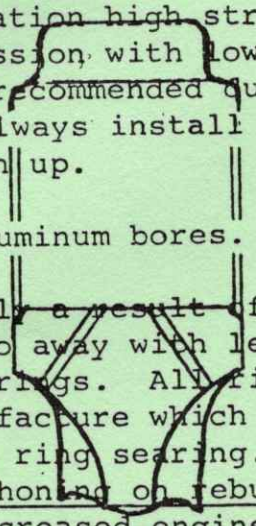
3942541	PISTON (Std.) forged (use w/3941184 Crankshaft)	8
3942542	PISTON (.001 O.S.) forged (use w/3941184 Crankshaft) . . .	8
3942543	PISTON (.030 O.S.) forged (use w/3941184 Crankshaft) . . .	8
3946848	RETAINER (Piston Pin) for floating pin (.042 Thick) . . .	AR

302-327-350 CID

3995664	RING UNIT (Piston) (Std.) (Low Tension)	1 per cyl.
3995665	RING UNIT (Piston) (.005 O.S.) (Low Tension) . .	1 per cyl.
3995666	RING UNIT (Piston) (.020 O.S.) (Low Tension) . .	1 per cyl.
3995667	RING UNIT (Piston) (.030 O.S.) (Low Tension) . .	1 per cyl.

Piston Rings: Service piston ring sets for all cast iron liner engines are high strength iron, moly-filled, radius faced, 1/16" top and second with 3/16", 3 piece oil rings. Some ring sets are available with .005 oversized compression rings and must be filled to adjust size to the recommended end gaps. In all cases, end gaps should be measured when installing rings. Always install compression rings with the manufacturers identification up.

Rings for 390 alloy bores are special configuration high strength, chromed, top and plain cast iron second compression with low tension 3/16 oil ring. Minimum end gaps of .005" are recommended due to increased bore expansion of aluminum bores. Always install compression rings with the manufacturers identification up.

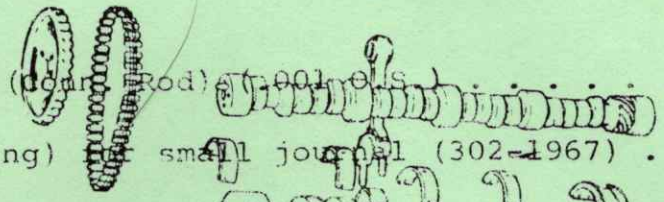


NOTE: Do not use standard molyring sets in aluminum bores.

The smooth bore finish currently used is largely a result of modern ring manufacturing techniques that virtually do away with lengthy run-in time on new engines to seat the piston rings. All rings are lapped in hardened steel cylinders during manufacture which eliminates the need for a rough bore finish to accomplish ring searing. Elimination of rough bores on initial build, and rehoning on rebuild, results in a sizeable power increase due to decreased engine friction.

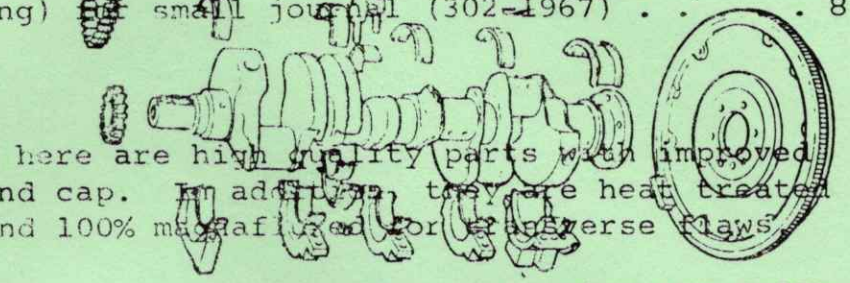
396-427-454 CID

3969804	ROD (Connecting) for floating pin 7/16" bolt	8
3909846	ROD (Connecting) for floating pin 3/8" bolt	8
3893260	ROD (Connecting) for pressed pin 3/8" bolt	8
3965716	BEARING UNIT (Conn. Rod) (.001 O/S)	AR
3969864	BOLT (Conn. Rod) (7/16 - 20)	AR
3942410	NUT (Conn. Rod Bolt) (7/16 - 20)	AR



302-327-350 CID

3965720	BEARING UNIT (Conn. Rod) (.001 O/S)	AR
3927145	ROD (Connecting) for small journal (302-1967)	8



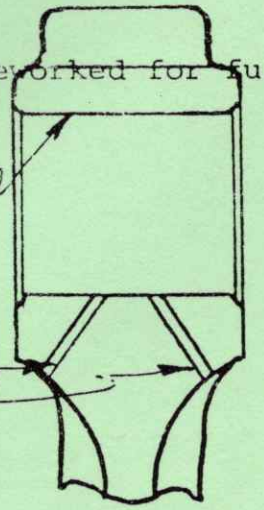
CONNECTING RODS:

Connecting Rods listed here are high quality parts with improved surfaces between rod and cap. In addition, they are heat treated to a higher hardness and 100% magnafluxed for transverse flaws.

Connecting rod durability can be improved by performing the following operations: Round all sharp edges on I-beam of rod and grind off excess flash at forging parting line. It is not necessary to remove all this flash or polish the rod; but, all grinding should be lengthwise of the rod and finish ground very smooth. Round all sharp edges around the rod bolt head and nut seats, and smooth out any nicks in the radius of the bolt and nut seats with a small grinder. Have entire rod, including bolt and nut seats, shot peened. Qualify rod cap similarly. Have big end of rod carefully reconditioned in a rod reconditioner. Install with new magnafluxed bolts and nuts.

A satisfactory shot peening specification for connecting rods is .012-.015" Allmen "A" Arc height using #230 cast steel shot. It is also good practice to hardness test all rods, rod bolts and nuts to insure proper heat threat has been performed at time of manufacture.

Connecting Rods used for pressed pins can be reworked for full floating pin assemblies as follows.



Hone pin hole for .0005 to .0007 clearance

Drill 2 3/32" oil holes and chamfer lower ends

396 CID

3887114 CRANKSHAFT (3/8 Conn. Rod Bolts).....1

427 CID

3879621 CRANKSHAFT (3/8 Conn. Rod Bolts).....1

3967811 CRANKSHAFT (7/16 Conn. Rod Bolts).....1

:-:-:

3879623 DAMPER (Crankshaft).....1

:-:-:

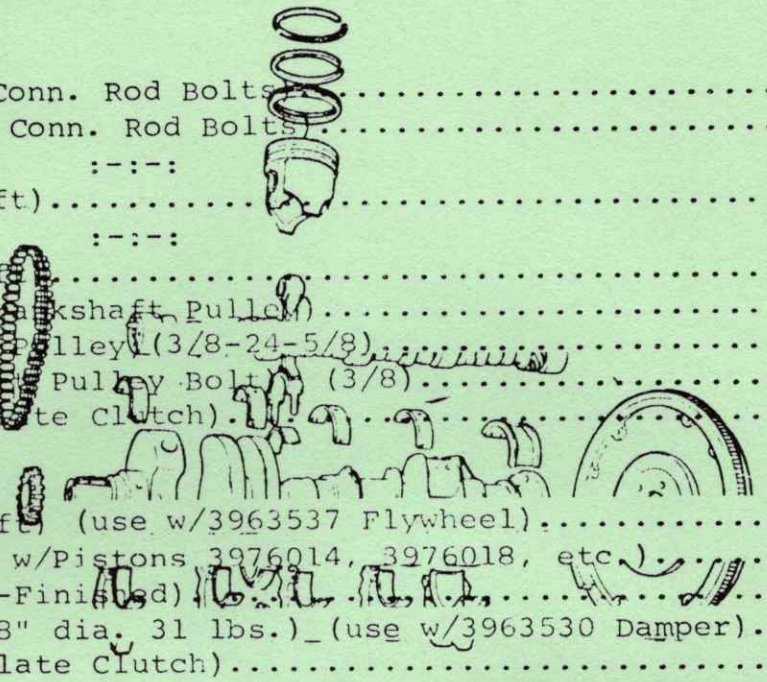
3899660 PULLEY (Crankshaft).....1

3879625 REINFORCEMENT (Crankshaft Pulley).....1

181629 BOLT (Crankshaft Pulley) (3/8-24-5/8).....1

138542 WASHER (Crankshaft Pulley Bolt) (3/8).....1

3955151 FLYWHEEL (Dual Plate Clutch).....1



454 CID

3963530 DAMPER (Crankshaft) (use w/3963537 Flywheel).....1

3963524 CRANKSHAFT (use w/Pistons 3976014, 3976018, etc.).....1

3965753 CRANKSHAFT (Semi-Finished).....1

3963537 FLYWHEEL (12 7/8" dia. 31 lbs.) (use w/3963530 Damper)....1

3992094 FLYWHEEL (Dual Plate Clutch).....1

302 CID

3817173 DAMPER (Crankshaft).....1

3965727 CRANKSHAFT (Semi-Finished).....1

3941178 CRANKSHAFT (Forging).....1

302-396-427 CID

3992094 FLYWHEEL (Dual Plate Clutch) (24 lbs.).....1

3991406 FLYWHEEL (12 7/8" dia. 15.8 lbs.).....1

350 CID

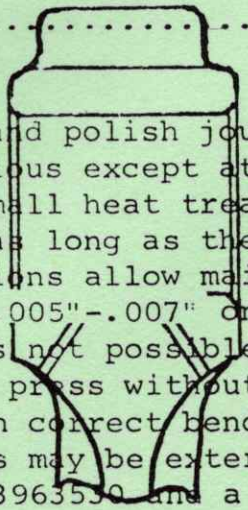
3941184 CRANKSHAFT (use w/Pistons 3942541-2-3).....1

3997748 CRANKSHAFT (Semi-Finished).....1

3941182 CRANKSHAFT (Forging).....1

400 CID

3941182 CRANKSHAFT (Forging).....1



CRANKSHAFT:

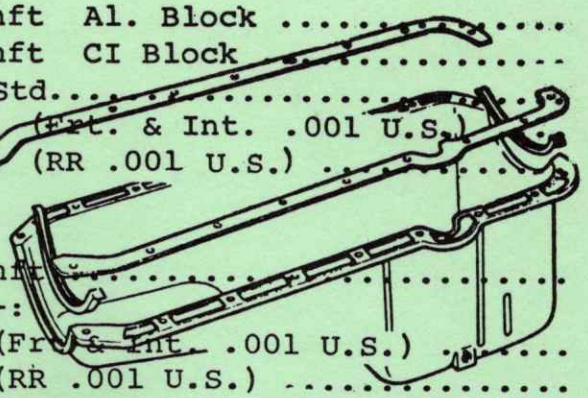
Remove any burrs from oil holes and passages and polish journals with #400 sandpaper. Tufftride cracks are not serious except at radii to "throws". Magnaflux inspection may show small heat treat cracks around oil holes. These are not detrimental as long as they do not extend into journal fillet radii. Specifications allow main journal runout (or bend) in the finished crankshaft; .005"-.007" on large block M-4 and .001" on small block V-8. It is not possible to straighten tufftrided cranks with a hydraulic press without causing serious cracks. Reputable specialty shops can correct bend by a peening process. Four-inch stroke crankshafts may be externally balanced using the 454 CID harmonic dampener 3963530 and a 454 flywheel, or they may be internally balanced with the addition of heavy metal to the end counterweights. Several crank balancing shops are experienced in internally balancing 4" stroke cranks.

396-427-454 CID

3952322	STUD (Bearing Cap) Crk/shft Al. Block	4
3902885	STUD (Bearing Cap) Crk/shft CI Block	4
3885380	BEARING UNIT (Crk/shft) Std.	4
3965715	BEARING UNIT (Crankshaft) (Frt. & Int. .001 U.S.)	4
3965717	BEARING UNIT (Crankshaft) (RR .001 U.S.)	1

302-327-350 CID

3960312	STUD (Bearing Cap) Crk/shft	5
	:-:-:	
3965718	BEARING UNIT (Crk/shft) (Frt. & Int. .001 U.S.)	4
3965719	BEARING UNIT (Crk/shft) (RR .001 U.S.)	1

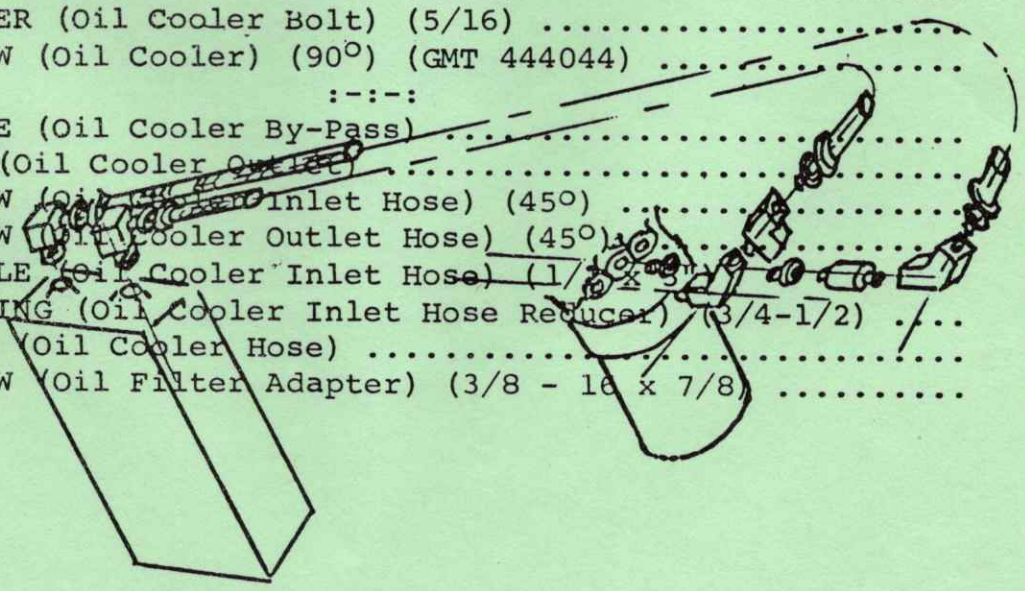


396-427-454 CID

3860086	GEAR (Crankshaft)	1
3860035	SPROCKET (Crankshaft)	1
3860036	CHAIN (Timing)	1

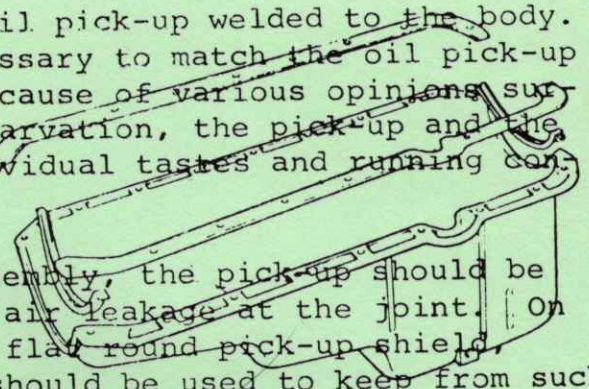
302-396-427-454 CID

3886066	PLATE (Clutch Cover & Pressure) (use w/3739423 or 3866735)	1
3886059	PLATE (Clutch Driven)	1
3959175	PLATE (Clutch Cover & Pressure) (Dual Plate Clutch)	1
3959176	PLATE (Clutch Driven) (Dual Plate Clutch)	2
	:-:-:	
3157804	COOLER (Engine Oil)	1
3881803	BRACKET (Oil Cooler)	1
3879938	HOSE (Oil Cooler)	2
443899	BOLT (Oil Cooler)	8
180016	BOLT (Oil Cooler)	4
3958324	NUT (Oil Cooler Bolt) ("J" 5/16 - 18)	8
124818	NUT (Oil Cooler Bolt) (Jam 1/4 - 20)	4
120386	WASHER (Oil Cooler Bolt) (5/16)	8
120638	WASHER (Oil Cooler Bolt) (5/16)	8
	ELBOW (Oil Cooler) (90°) (GMT 444044)	2
	:-:-:	
5575416	VALVE (Oil Cooler By-Pass)	1
3879940	TEE (Oil Cooler Outlet)	1
444215	ELBOW (Oil Cooler Inlet Hose) (45°)	1
444058	ELBOW (Oil Cooler Outlet Hose) (45°)	1
9417840	NIPPLE (Oil Cooler Inlet Hose) (1/2 x 3")	1
144042	BUSHING (Oil Cooler Inlet Hose Reducer) (3/4-1/2)	1
3825416	CLIP (Oil Cooler Hose)	1
217911	SCREW (Oil Filter Adapter) (3/8 - 16 x 7/8)	2



OIL PUMP:

Pumps usually are sold with the oil pick-up welded to the body. This technique is considered necessary to match the oil pick-up with the sump of the oil pan. Because of various opinions surrounding oil pressures and oil starvation, the pick-up and the sump can be modified to suit individual tastes and running conditions.



When reworking a pump pick-up assembly, the pick-up should be welded to the pump body to avoid air leakage at the joint. On the lower end of pick-up tube, a flat round pick-up shield, similar to standard production, should be used to keep from sucking in air along with oil. In some situations, the pick-up should be to the right side of the pan and in others it should be to the rear of the pan. Position and location depend on the specific use the engine will see.

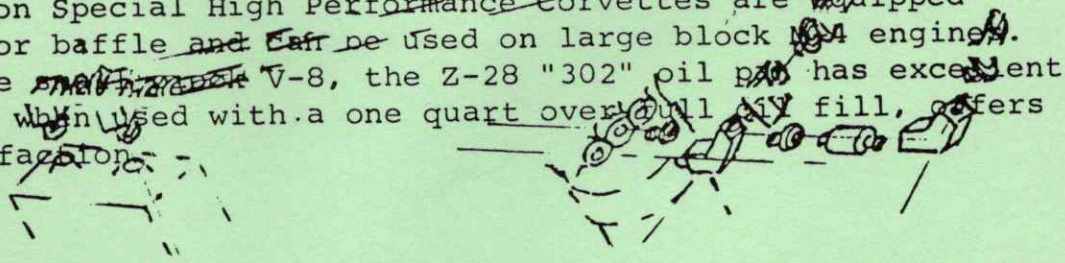
Oil pump pressures should be greater than 50 PSI at speed to be sufficient for heavy duty use. In any case, pressure should not be greater than 80 PSI.

Some pumps develop the necessary pressure even with a remote oil filter and cooler; some might not. To alleviate the problem, it is common practice to insert shims between the oil pressure regulator spring and valve both being located in the pump cover. The shims help stiffen the spring and this causes the oil pressure to be increased.

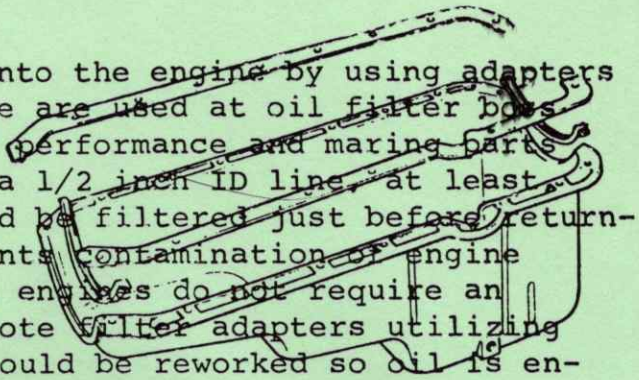
OIL PAN:

An upper oil pan baffle, attached to the block bearing cap studs, should be used.

As mentioned in the Oil Pump write-up above, oil pans can be modified at will. With this in mind, some small block V-8 pans require an additional horizontal baffle attached to the lower step to retard oil sloshing on brake stops. Otherwise, oil pans such as utilized on Special High Performance Corvettes are equipped with trap door baffle and can be used on large block V-8 engines. Also, for the small block V-8, the Z-28 "302" oil pan has excellent baffling and when used with a one quart over-full dry fill, offers proven satisfaction.



OIL COOLER:



An oil cooler can be plumbed into the engine by using adapters for the small block V-8. These are used at oil filter bases and are available through high performance and maring parts distributors. On all engines a 1/2 inch ID line, at least, should be used. The oil should be filtered just before returning to the engine. This prevents contamination of engine bearings. The large block M-5 engines do not require an adapter. "In-and-out" and remote filter adapters utilizing an oil filter by-pass valve should be reworked so oil is entirely filtered.

OIL PRESSURE GAUGE:

Oil pressure gauge line should be a minimum of 1/8 inch ID to get good gauge response and help detect any oil pressure losses quickly. NOTE: The majority of engine bearing failures are a direct result of oil pressure loss due to the oil pump picking up air while the car is negotiating turns at racing speeds. This occurs at a time when the driver is busiest and may go unreported, or be reported as a slight drop in oil pressure in the turns. Good gauge response is necessary to trouble shoot this problem; and, the gauge should be mounted as close to the drivers line of vision as is practical.

Oil pressure loss in turns is aggravated by three things:

1. Insufficient oil level or capacity.
2. High engine oil flow rates due to excessive bearing clearances, or higher than necessary oil pressure.
3. Improper oil pan baffling, usually over-baffling which prevents the engine oil from properly draining back into the oil pan while the car is in a turn.

DRY SUMP SYSTEM:

Special purpose engines are being used in installations where a dry sump oiling system is desirable or mandatory. The following tips should assist set-up with any commercially available dry sump unit:

1. If possible, eliminate the engine oil pump completely. On small block V-8, install a non-bypassing in-and-out adaptor to the oil filter pad at the rear of the engine. On the large block M-4, install plugs in the rear oil cooler holes in the block and rear by-pass valve position.

2. The scavenger pump should have three times the capacity of the pressure pump, preferably three stages.

3. Two scavenger stages should scavenge the oil pan and one stage connect to the rear outside of the rocker cover on the predominant outboard side of the car. (This depends on the course and whether it is run clockwise or counter-clockwise).

4. Do not run scavenged oil through the engine oil cooler, return it directly from scavenger pumps to supply tank. Use at least a #12 or 3/4" line.

5. Use a #12 or 3/4" inlet line to the pressure pump from the supply tank. You may wish to install a coarse screen aircraft filter in this line to keep from getting contaminants into the pressure pump and pressure by-pass valve.

6. Pass the oil from the pressure pump through the engine oil cooler(s) and remote oil filter and then into the engine. It is no longer possible to use the original oil filter. Make every effort to reduce restriction in the oil cooler circuit. DO NOT connect oil coolers in series. If more than one oil cooler is used, they should be connected in parallel (i.e. tee the oil line and pass the oil into and out of both coolers simultaneously).

7. Do not try to run more than 55-60 PSI oil pressure hot. This will aggravate oil aereation and scavenging. Oil pressure over 55 PSI is not necessary for good bearing life.

8. Run a full length semi-circular tray baffle under the crankshaft with louvers to draw the oil away from the crank.

9. Design the oil supply tank as tall and as small in diameter as possible, space permitting. It is recommended the tank hold a minimum of 8 quarts of oil with enough air space above the oil to effect oil-air separation.

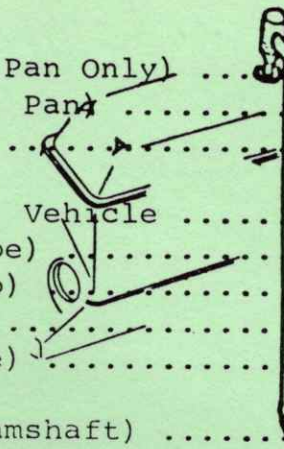
10. Build the engine with the proper lifters, rocker arms, rear cam bearing and clearances to require a minimum of oil flow. This is the greatest asset to a properly functioning dry sump.

11. Do not over cool the oil. Racing oil requires about 200°F to flow properly. Measure oil temperature between the oil coolers and the engine and try to keep it between 180° and 240° when thoroughly warmed.

12. Vent both the engine and the supply tank, or vent the engine to a properly vented supply tank. Keep vent lines of adequate size (1 #12 or 2 #10 size lines) to keep from causing any pressure build up in the crankcase. This is a common mistake. Breather holes in the engine rocker covers are an excellent place from which to vent. Most covers have oil separators located under the vent holes. These should remain in position.

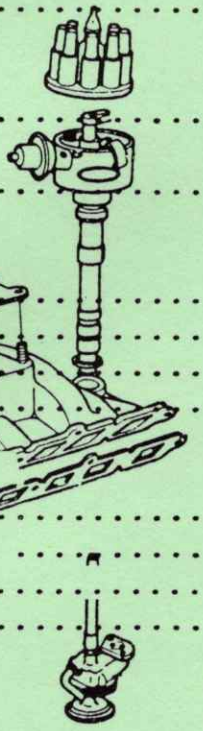
396-427-454 CID

3964255	PUMP ASSY. (Oil) (Deep Oil Pan Only)	1
3969870	PUMP ASSY. (Oil) ZL-1 (Std. Pan)	1
3865886	SHAFT (Dist. to Oil Pump)	1
	:-:-:	
3879941	TUBE (Crankcase Vent) Pass. Vehicle	1
3989347	GROMMET (Crankcase Vent Tube)	1
3894337	GROMMET (Crankcase Vent Cap)	1
6421868	CAP (Crankcase Vent)	1
120383	WASHER (Crankcase Vent Tube)	1
	:-:-:	
3581998	BLADE (Fan) (Gear Driven Camshaft)	1
454384	BOLT (Fan Blade)	4
3876828	SPACER (Fan Blade)	1
120638	WASHER (Fan Blade Bolt)	4
	:-:-:	
3878292	BELT (Fan & Gen.)	1
1352212	BELT (Fan & Water Pump)	1
	:-:-:	
3007436	RADIATOR (Aluminum)	1
	:-:-:	
3879633	PAN (Oil) (6 qt.)	1
3879640	BAFFLE (Oil Pan) (Upper)	1
9422297	NUT (Oil Pan Bolt)	4
120382	WASHER (Oil Pan Bolt)	4
120394	WASHER (Oil Pan Bolt)	4
180120	BOLT (Oil Pan)	4



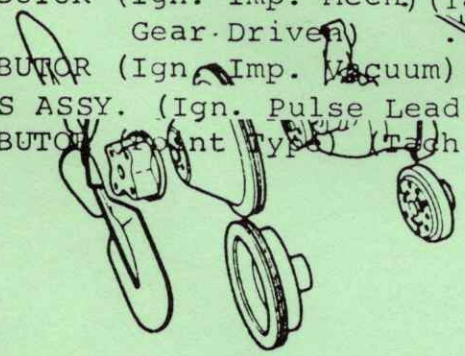
302 CID

3953864	TUBE (Oil Filler) (2 x 4 BL Intake)	1
	:-:-:	
1111267	DISTRIBUTOR (Ignition Impulse)	1



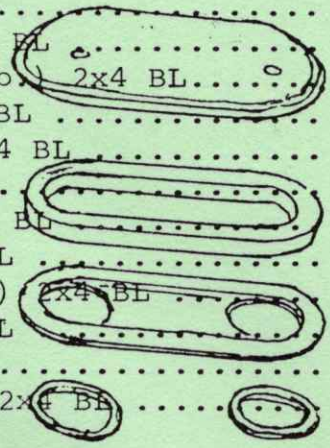
396-427-454 CID

1966379	CAP & GASKET (Starting Motor Solenoid)	1
6287111	WIRE (Coil to Dist.)	1
6298887	WIRE UNIT (Spark Plug)	1
5613161	PLUG (Spark) (AC 41-XL)	1
	:-:-:	
1111263	DISTRIBUTOR (Ign. Imp. Mech.) (Tach. Dr. Gear Driven)	1
1111927	DISTRIBUTOR (Ign. Imp. Vacuum) (Tach. Dr.)	1
6297688	HARNESS ASSY. (Ign. Pulse Lead)	1
1111069	DISTRIBUTOR (Point Type) (Tach. Dr.)	1



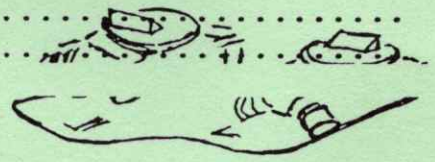
302 CID

3941128	MANIFOLD (Half) (Upper) 2x4 BL	1
3942594	BLOCK (Manifold Fuel) 2x4 BL	1
3941132	GASKET (Intake Man.) 2x4 BL	1
3931600	GASKET UNIT (Intake) 2x4 BL	1
3942593	PIPE (Fuel Pump to Fuel Block) 2x4 BL	1
3942595	PIPE (Fuel Block to RR or Frt. Carb.) 2x4 BL	2
3942596	PIPE (Fuel Block to RR Carb.) 2x4 BL	1
3942597	PIPE (Fuel Block to Frt. Carb.) 2x4 BL	1
3941168	CABLE (Accel. to Carb.) 2x4 BL	1
3941160	ROD (Frt. to RR Carb. Control) 2x4 BL	1
3942592	BRACKET (Accel. Cont. Cable) 2x4 BL	1
3942587	SPACER (Frt. to RR Carb. Rod Lever) 2x4 BL	1
3942584	SCREW (Frt. to RR Carb. Rod) 2x4 BL	1
3939748	SPRING (Accel. Pull Back) 2x4 BL	1
3946801	BRACKET (Accel. Pull Back Spring) 2x4 BL	1



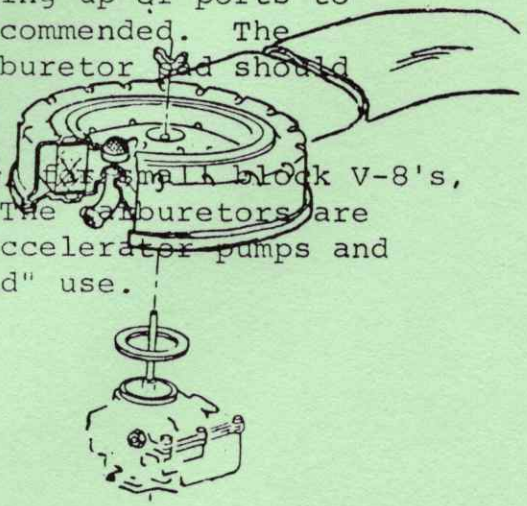
396-427 CID

3947083	MANIFOLD (Intake) Single Quad	1
3931093	GUARD (Oil Splash)	1
3955528	GASKET UNIT (Intake)	1



INTAKE MANIFOLDS:

The manifold on "302" engines was an aluminum high rise tuned runner-type for a single 4 BL Holley Carburetor. Any size Holley from 500-960 CFM airflow can be mounted. A 780 CFM Model 4053 or 3943 carburetor was used as "stock" on the 302's. No manifold porting is necessary, but opening-up of ports to match manifold gasket and head ports is recommended. The center divider in the plenum below the carburetor pad should not be removed to a greater depth than 1".



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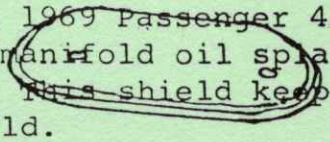
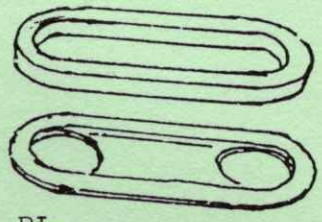
The latest designed 2x4 BL Intake Manifold for small block V-8's, utilizes two 600 CFM Holley Carburetors. The carburetors are equipped with both primary and secondary accelerator pumps and are jetted satisfactorily for "off-the-road" use.

INTAKE MANIFOLDS CONT'D.

The manifold on the L-88 and ZL-1 Engines was a high rise open plenum type for a single quad carburetor. A 850 CFM Model R-296-A Holley Carburetor with accelerator pumps on both the primary and secondary barrels was used as "stock" on L-88 and ZL-1's. The open plenum of the intake manifold offers a power increase over the divided type. For better torque in the 4000-5200 RPM range, the intake used on the 1969 Passenger 425 H.P. engine should be utilized. An intake manifold oil splash shield is recommended for the M-4 engines. This shield keeps the hot oil off the underside of the manifold.

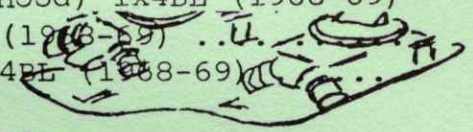




302 CID

6484665	CLEANER ASSY. (To Fire-wall) 1 x 4 BL	1
3916621	DUCT (Air Cleaner to Fire-wall) 1 x 4 BL	1
6422544	ELEMENT (A/Cl.)	1

:-:-:

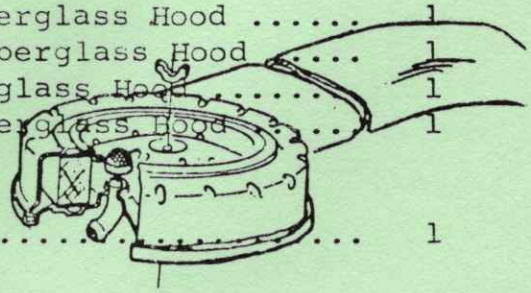


6485788	CLEANER ASSY. (To Fiberglass Hood) 1x4BL (1968-69)	1
6421746	ELEMENT (Air Cleaner) 1x4 BL (1968-69)	1
3963822	SEAL (Air Cleaner to Hood) 1x4BL (1968-69)	1

:-:-:

3941146	COVER (Top) A/Cl. (2x4BL) No Plenum	1
3941144	PLATE (Base) A/Cl. (2x4BL) No Plenum	1
3942572	ELEMENT (A/Cl.) (2x4BL) No Plenum	1
3869954	STUD (A/Cl.) (2x4 BL)	1
219281	NUT (A/Cl. Stud) (2x4 BL)	2
3969843	GASKET (A/Cl.) (2x4 BL)	2
3927732	GASKET (Base Plate to Carb. Hose Conn.) (2x4 BL) ..	1

:-:-:



3941146	COVER (Top) A/Cl. (2x4 BL) w/Fiberglass Hood	1
3963824	PLATE (Base) A/Cl. (2x4 BL) w/Fiberglass Hood	1
3963825	ELEMENT (A/Cl.) (2x4 BL) w/Fiberglass Hood	1
3963823	SEAL (Air Cleaner to Hood) w/Fiberglass Hood	1

396-427-454 CID

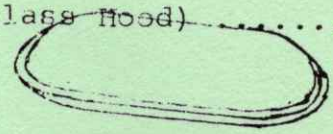
3881804	DUCT (Air Cleaner to Fire-wall)	1

396-427-454 CID

6422373	CLEANER ASSY. (To Fire-Wall) (1 x 4 BL)	1
6422544	ELEMENT (A/Cl.)	1
3873852	STUD (A/Cl.) (1/4-20-20 x 1 1/2)	1
273697	SCREW (A/Cl.) (#10-12 x 3/4)	6

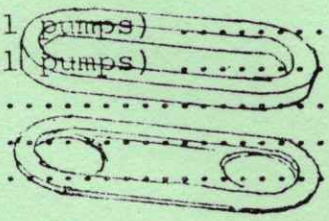
:-:-:

3965700	ADAPTER (Plate Hood) (1 x 4 BL) (w/Fiberglass Hood)..	1
3965710	PLATE (A/Cl. Base) (1 x 4 BL) (w/Fiberglass Hood) ...	1
6421832	COVER (A/Cl.) (1 x 4 BL) (w/Fiberglass Hood)	1



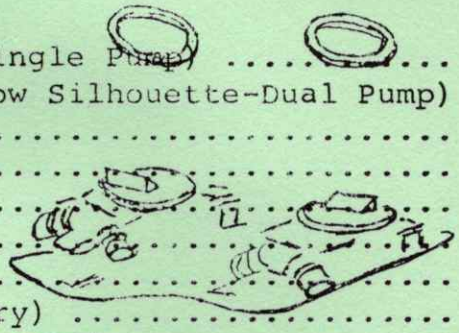
302-350 CID

3957859	CARBURETOR ASSY. (2 x 4 BL) (w/dual pumps)	2
3965736	CARBURETOR ASSY. (1 x 4 BL) (w/dual pumps)	1
3964569	GASKET UNIT (Carb.)	1
3964570	REPAIR UNIT (Carb.) (Major)	1
3964571	REPAIR UNIT (Carb.) (Minor)	1



396-427-454 CID

3887147	CARBURETOR ASSY. (1x4 BL) (Single Pump)	1
3955205	CARBURETOR ASSY. (1x4 BL) (Low Silhouette-Dual Pump)	1
3881847	GASKET (Carb.) (1x4 BL)	1
3901072	REPAIR UNIT (Carb.) (Major)	1
3901073	REPAIR UNIT (Carb.) (Minor)	1
3901071	GASKET UNIT (Carburetor)	1
3917925	BODY ASSY. (Carb. Throttle)	1
3898993	BODY PLUGS (Carb. Main Primary)	1
3898994	BODY & PLUGS (Carb. Main Secondary)	1
3898995	ROD (Carb.) (Choke)	1
3889776	SHAFT (Carb.) (Choke)	1
3898990	JET (Carb.) (Main)	1
3917927	SPRING (Carb.) (Fuel Pump Diaphram)	1
3904603	VALVE ASSY. (Carb.) (Power)	1
6415748	PUMP ASSY. (Fuel)	1

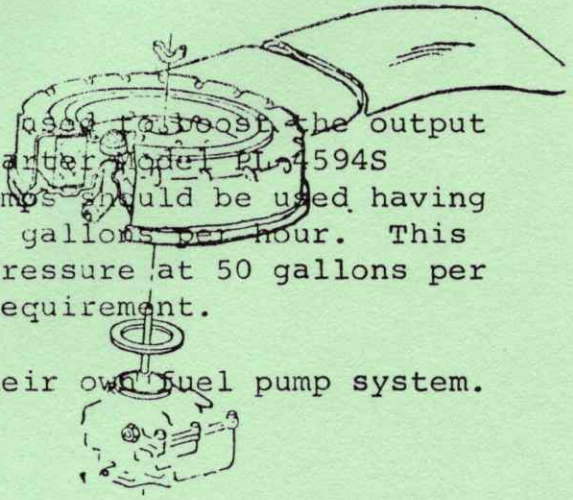


FUEL PUMP:

Where desired, electric fuel pumps can be used to boost the output of the engine's mechanical pump. (Ref: Carter Model PL-4594S Electric). Single or a combination of pumps should be used having an advertised free flow capacity of 75-80 gallons per hour. This is necessary for a 3-4 PSI minimum fuel pressure at 50 gallons per hour typical of the maximum engine fuel requirement.

:-:-:

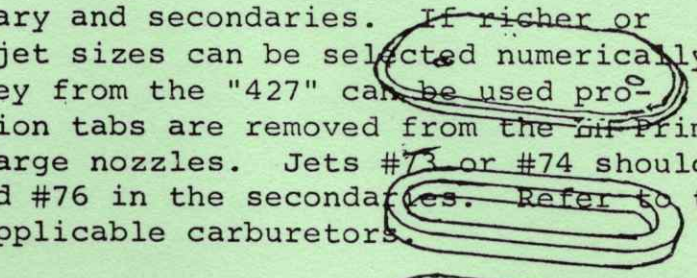
Fuel Injection systems usually require their own fuel pump system.



CARBURETORS:

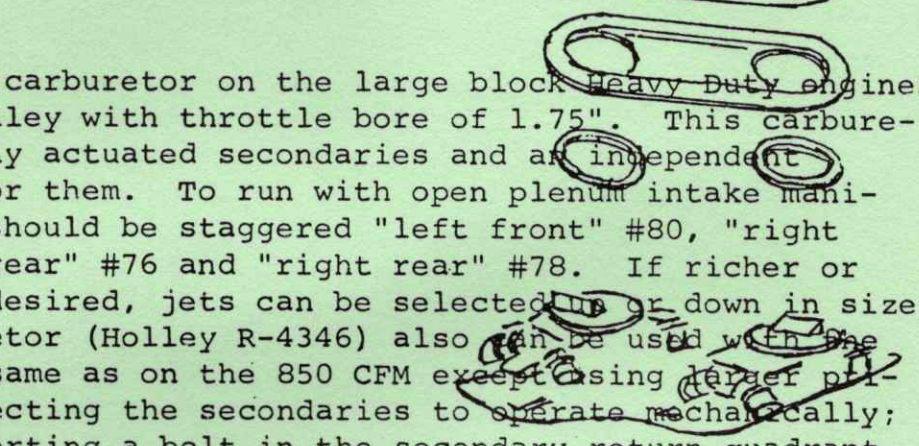
302-350

The stock 1 x 4 BL carburetors on the small block 302-350 Special High performance engines are 780-800 Holley's. Throttle bores are 1-11/16". Satisfactory jetting for most running conditions is the #73 jets in the primary and secondaries. If richer or leaner mixture is desired, jet sizes can be selected numerically up or down. A 850 CFM Holley from the "427" can be used provided the mixture distribution tabs are removed from the RH Primary and RH Secondary main discharge nozzles. Jets #73 or #74 should be used in the primaries and #76 in the secondaries. Refer to the chart on page 8 for other applicable carburetors.



396-427-454

The stock 1 x 4 BL carburetor on the large block Heavy Duty engines was the 850 CFM Holley with throttle bore of 1.75". This carburetor has mechanically actuated secondaries and an independent accelerator pump for them. To run with open plenum intake manifold, the jetting should be staggered "left front" #80, "right front" #76, "left rear" #76 and "right rear" #78. If richer or leaner mixture is desired, jets can be selected up or down in size. The 800 CFM carburetor (Holley R-4346) also can be used with the jetting staggered same as on the 850 CFM except using larger primary jets and connecting the secondaries to operate mechanically; can be done by inserting a bolt in the secondary return quadrant located on the left side of the carburetor.



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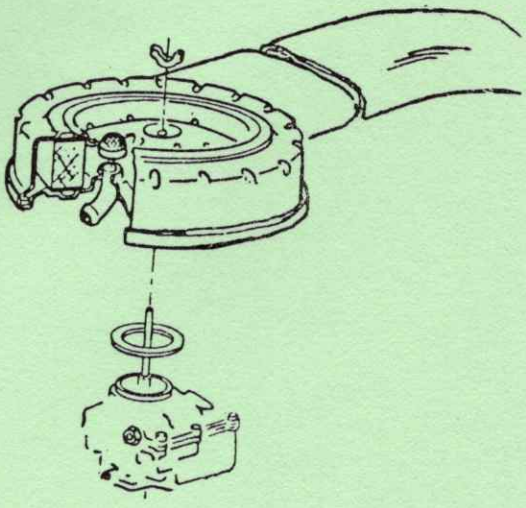
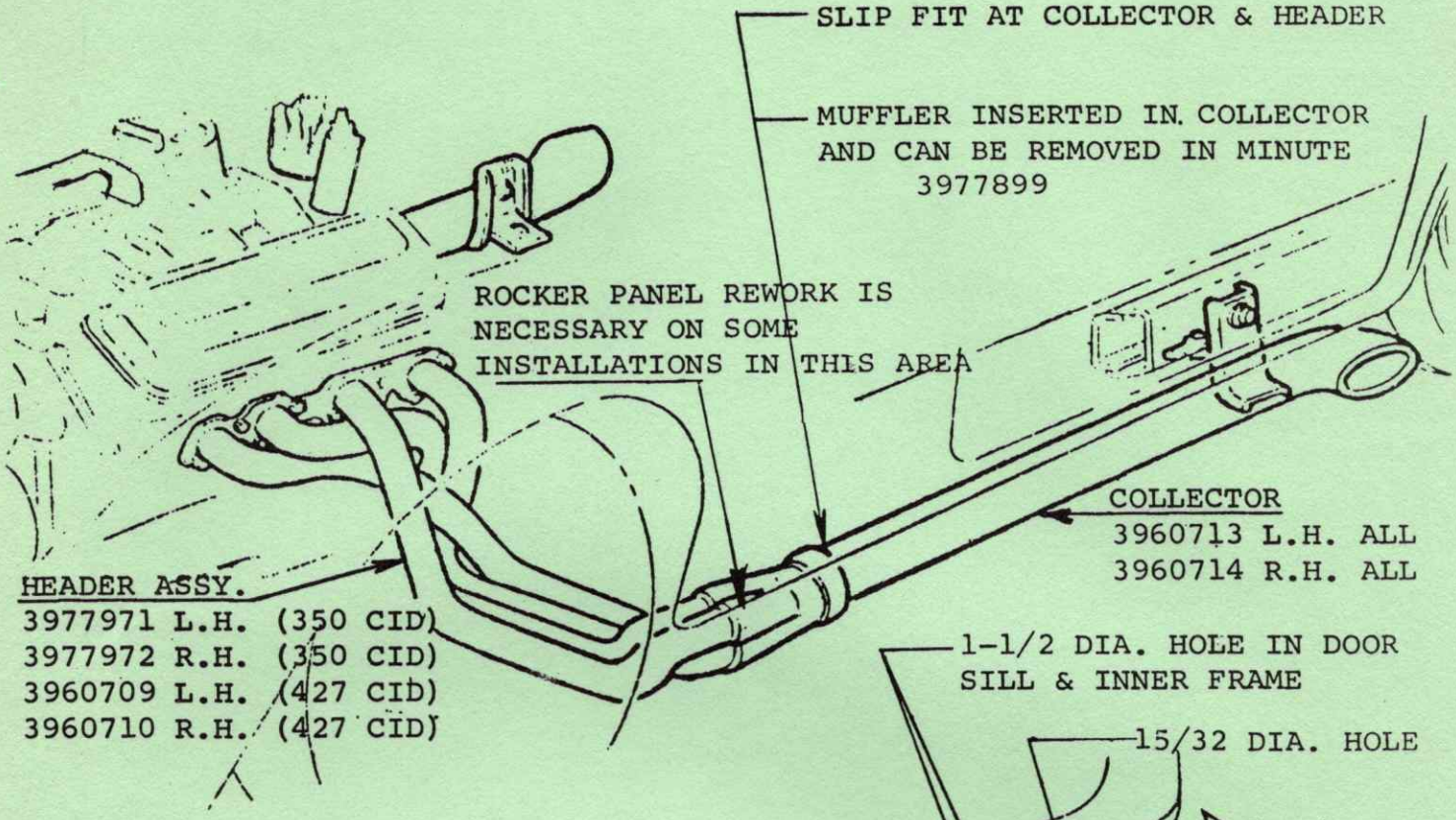
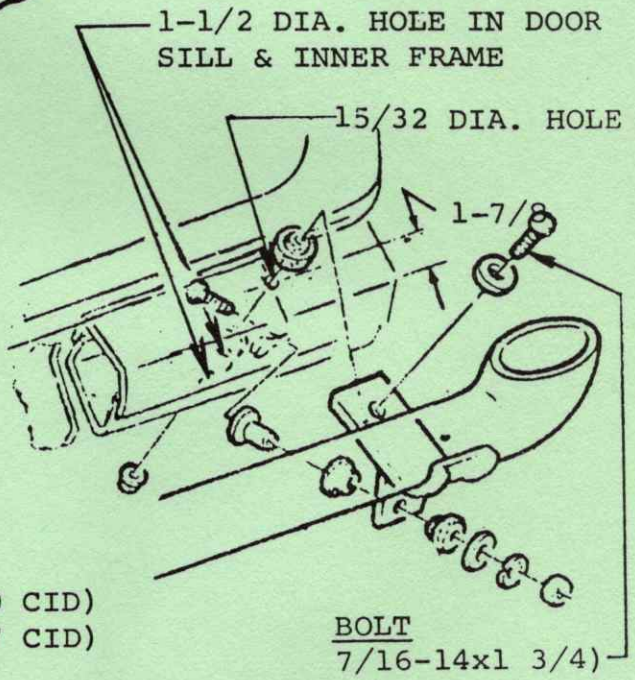
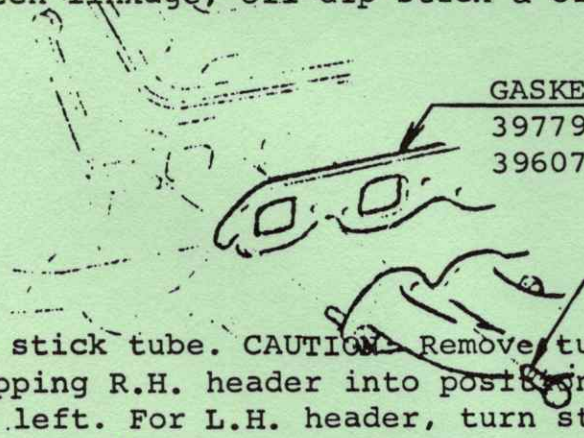
Bronze fuel filters located at the carburetor fuel inlet should be removed and discarded. Instead, use a separate filter unit with replaceable paper element. Fuel pressure drop occurs with bronze filters and is not detectable because of the gauge location. Many engine difficulties can be attributed to filters.







Headers must be installed from the bottom up. The following items should be removed before installation: L.H. & R.H. exhaust manifolds, complete exhaust system, alternator, spark plugs & spark plug heat shields, clutch linkage, oil dip stick & oil



dip stick tube. CAUTION: Remove tube carefully to avoid crushing. When slipping R.H. header into position, turn steering wheel all the way to the left. For L.H. header, turn steering wheel all the way to the right. Install all items previously removed except exhaust system. When tightening header to cylinder head start with center bolts and work towards the outside. After engine has been run for between fifteen minutes to one hour, retighten bolts to be sure gasket has not shrunk from heat. CAUTION: Failure to retighten at this time may cause the gasket to "blow out".

PART NO. 3983339 L.H. 3983340 R.H. "350
3981591 L.H. 3981592 R.H. "427

396-427 CID

3981591	HEADER & PIPE UNIT (side mount system) (Corvette)	1
3981592	HEADER & PIPE UNIT (side mount system) (Corvette)	2
3960709	HEADER ASSY., L.H. (side mount system) (Corvette)	1
3960710	HEADER ASSY., R.H. (side mount system) (Corvette)	1
3960713	COLLECTOR ASSY., L.H. (use w/3960709) (Corvette)	1
3960714	COLLECTOR ASSY., R.H. (use w/3960710) (Corvette)	1
3977899	MUFFLER (EXH.) (side mount system) (Corvette)	1
3960712	GASKET (Header to Block) (Corvette)	2
3960711	BOLT (Header) (Corvette)	16

327-350 CID

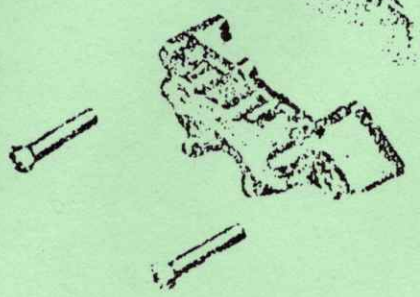
3983339	HEADER & PIPE UNIT, L.H.(side mount system) (Corvette) ...	1
3983340	HEADER & PIPE UNIT, R.H.(side mount system) (Corvette) ..	1
3977971	HEADER ASSY., L.H. (side mount system) (Corvette)	1
3977972	HEADER ASSY., R.H. (side mount system) (Corvette)	1
3960713	COLLECTOR ASSY., L.H. (use w/3977971) (Corvette)	1
3960714	COLLECTOR ASSY., R.H. (use w/3977972) (Corvette)	1
3977899	MUFFLER (EXH.) (side mount system) (Corvette)	2
3977970	GASKET (Header to Block)	2
3960711	BOLT (Header)	16

EXHAUST SYSTEM:

A satisfactory tuned open exhaust system is mandatory for extracting maximum torque and horsepower from engines.

Small Block V-8 uses 1-3/4" O.D. x 30" head pipes collected in a group into 3-1/4" to 3-1/2" collector or tailpipe. Fuel injected or Weber carbureted engines respond favorably to 1-u/8" O.D. x 32" to 34" head pipes and 3-1/2" to 4" tailpipe.

Large Block M 4 uses 2" O.D. x 36" head pipes collected in a group into 3-1/2" to 4" collector or tailpipe. Four inch tailpipes are preferable where the tailpipe is more than 36" long. Fuel injected engines respond favorably to 2-1/8" O.D. x 36" to 40" head pipes.



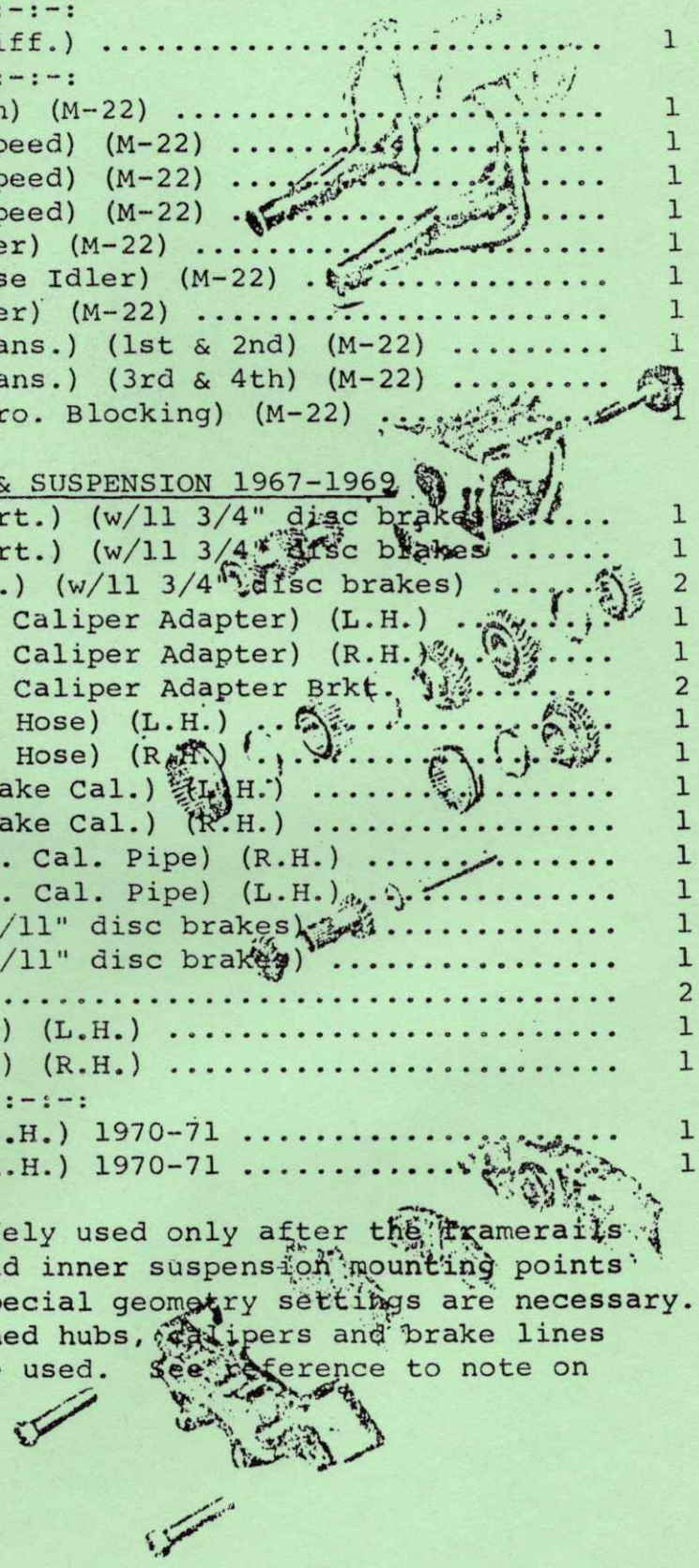
302-327-350-396-427-454 CID

3968012	TRANSMISSION ASSY. (4 Speed) (H.D.) (M-22) (Coarse 10 Spline Input Shaft	1
	:-:-:	
1051024	LUBRICANT (Trans. & Diff.)	1 gal
	:-:-:	
3925691	GEAR (Trans.) (Clutch) (M-22)	1
3879999	GEAR (Trans.) (2nd Speed) (M-22)	1
3880845	GEAR (Trans.) (3rd Speed) (M-22)	1
3924796	GEAR (Trans.) (1st Speed) (M-22)	1
3905466	GEAR (Trans.) (Counter) (M-22)	1
3879997	GEAR (Trans.) (Reverse Idler) (M-22)	1
3864850	SHAFT (Trans.) (Counter) (M-22)	1
3924112	SYNCHRONIZER UNIT (Trans.) (1st & 2nd) (M-22)	1
3924113	SYNCHRONIZER UNIT (Trans.) (3rd & 4th) (M-22)	1
3880850	RING (Trans.) (Synchro. Blocking) (M-22)	1

CAMARO FRONT BRAKES, STEERING & SUSPENSION 1967-1969

5463775	CALIPER ASSY. L.H. (Frt.) (w/11 3/4" disc brakes)	1
5463776	CALIPER ASSY. R.H. (Frt.) (w/11 3/4" disc brakes	1
3991041	HUB & DISC ASSY. (Frt.) (w/11 3/4" disc brakes)	2
3947289	BRACKET (Frt.) (Brake Caliper Adapter) (L.H.)	1
3947290	BRACKET (Frt.) (Brake Caliper Adapter) (R.H.)	1
3945125	SUPPORT (Frt.) (Brake Caliper Adapter Brkt.	2
3947283	BRACKET (Frt.) (Brake Hose) (L.H.)	1
3947284	BRACKET (Frt.) (Brake Hose) (R.H.)	1
3947037	PIPE ASSY. (Frt.) (Brake Cal.) (L.H.)	1
3947038	PIPE ASSY. (Frt.) (Brake Cal.) (R.H.)	1
5463856	CONNECTOR (Frt.) (Brk. Cal. Pipe) (R.H.)	1
5463857	CONNECTOR (Frt.) (Brk. Cal. Pipe) (L.H.)	1
5468886	CALIPER ASSY. L.H. (w/11" disc brakes)	1
5468887	CALIPER ASSY. R.H. (w/11" disc brakes)	1
3966151	KNUCKLE (Steering)	2
3916237	ARM (Steering Knuckle) (L.H.)	1
3916238	ARM (Steering Knuckle) (R.H.)	1
	:-:-:	
3965737*	KNUCKLE (Steering) (L.H.) 1970-71	1
3965738*	KNUCKLE (Steering) (R.H.) 1970-71	1

*NOTE: The knuckles can be safely used only after the framerails have been properly reworked and inner suspension mounting points correctly relocated. Also, special geometry settings are necessary. Related items such as redesigned hubs, calipers and brake lines listed in this catalog must be used. See reference to note on Front Springs.



CAMARO FRONT BRAKES, STEERING & SUSPENSION 1967-1969 CONT'D.

9748406	STUD (Strg. Knuckle Upper Control Arm Ball)	2
3875067	STUD (Strg. Knuckle Lower Control Arm Ball)	2
	:-:-:	
3930028	SOCKET ASSY. (Tie Rod Inner)	1
3930030	SOCKET ASSY. (Tie Rod Outer)	1
3958493	ROD (Steering Relay)	2
	:-:-:	
9777477	BOLT (Wheel Hub)	10
	:-:-:	
5468882	PAD (Brake) (w/Disc Brakes)	1
5470991	PAD (Brake) (w/Disc Brakes)	1
	:-:-:	
3927510	HUB & DISC (Front Wheel)	1
	:-:-:	
5464591	FLUID (Hydraulic Brake #550)	1 gal.
	:-:-:	
3962799	SHAFT (Front Stabilizer) (1 1/16")	1
3962795	SHAFT (Front Stabilizer) (3/4")	1
3962796	SHAFT (Front Stabilizer) (7/8")	1
3961763	SHAFT (Front Stabilizer) (1")	1
3962797	SHAFT (Front Stabilizer) (15/16")	1
3935743	BRACKET (Front Stabilizer Shaft)	2
3927506	BUSHING (Front Stabilizer Shaft)	2
	:-:-:	
9791593	ABSORBER (Front Shock)	2
	:-:-:	
3948989	SPRING (Front) (Load/rate 506 lb. in.)	2
3948984	SPRING (Front) (Load/rate 561 lb. in.)	2
3935784	SPRING (Front) (Load/rate 615 lb. in.)	2
3935785	SPRING (Front) (Load/rate 723 lb. in.)	2
3948988	SPRING (Front) (Load/rate 777 lb. in.)	2

CORVETTE

3986032	SPRING (Front) (Load/rate 860 lb. in.)	2

FRONT SPRINGS: CAMARO

The 1967-1969 average load/rate for base front springs is 340 lbs. Comparison can be made with the following special springs.

* The 1970-71 off-the-road front springs are to be fabricated by the customer using .75 diameter wire. Coil spring to a 5.58" O.D. and 7.67 coils at a free height of 12.17"; load/rate will be 650 lb. in. An optional spring already fabricated can be obtained from independent sources. This optional spring has a load/rate of 600 lb. in., 5.50" diameter, 8 coils and a free height of 12.50". Adjust bump rubber height to limit spring travel so tie rod does not contact frame.

*Should be used with related components as noted on Page 41 and referenced to the knuckles.

CAMARO REAR AXLE, BRAKES & SUSPENSION 1967-69 CONT'D.

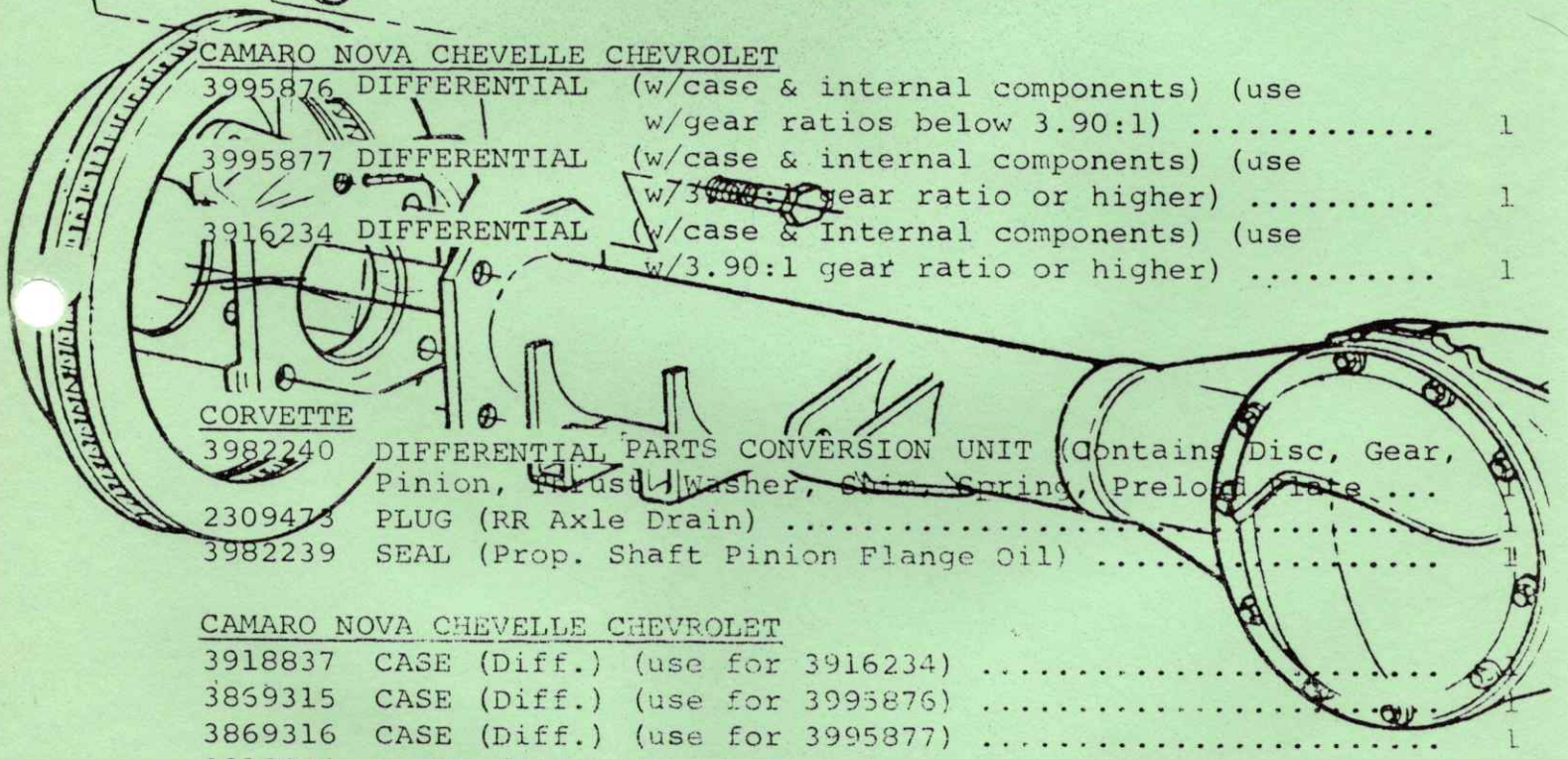
3945131	AXLE (Rear) (3.73:1 Ratio) (w/Disc Brakes)	1
	:-:-:	
3953697	HOUSING (RR Axle) (w/Disc Brakes)	1
3945184	SHAFT (RR Axle) (w/RR Whl. Disc Brakes)	2
3927508	SHAFT (RR Axle) (w/Drum Brakes)	2
3959068	LOCK (Shaft) (.155 Thick) (w/RR Disc Brakes)	2
3959067	LOCK (Shaft) (.160 Thick) (w/RR Disc Brakes)	2
3945189	SPACER (Caliper) (w/RR Disc Brakes)	2
3945186	FLANGE PLATE (Parking Brake RR) (w/RR Disc Brakes)	2
3865905	DISC (RR Brake) (11 3/4")	2

CORVETTE CAMARO

5469499	CALIPER ASSY. (RR Brake)	2
5470991	PAD (Brake) (w/Disc RR Brakes)	1

CAMARO NOVA CHEVELLE CHEVROLET

3995876	DIFFERENTIAL (w/case & internal components) (use w/gear ratios below 3.90:1)	1
3995877	DIFFERENTIAL (w/case & internal components) (use w/3.90:1 gear ratio or higher)	1
3916234	DIFFERENTIAL (w/case & Internal components) (use w/3.90:1 gear ratio or higher)	1



CORVETTE

3982240	DIFFERENTIAL PARTS CONVERSION UNIT (Contains Disc, Gear, Pinion, Thrust Washer, Shim, Spring, Preload Plate ...	1
2309473	PLUG (RR Axle Drain)	1
3982239	SEAL (Prop. Shaft Pinion Flange Oil)	1

CAMARO NOVA CHEVELLE CHEVROLET

3918837	CASE (Diff.) (use for 3916234)	1
3869315	CASE (Diff.) (use for 3995876)	1
3869316	CASE (Diff.) (use for 3995877)	1
3918834	PLATE (Diff. Clutch Press) (use for 3916234)	AR
3957939	SPRING (Diff. Pinion Pin)	4
3957941	PLATE (Diff. Clutch Press) (use for 3995876-7)	AR
3880140	PINION (Diff.) (use for 3916234)	2
3957938	PINION (Diff.) (use for 3995876-7)	2
3880141	WASHER (Diff. Pinion Thrust) (use for 3916234)	AR
3957940	WASHER (Diff. Pinion Thrust) (use for 3995876-7)	AR
3918831	GEAR (Diff.) (use for 3916234)	2
3957937	GEAR (Diff.) (use for 3995876-7)	2
3998514	PLATE (Diff. Clutch)	AR

REAR AXLE:

For the 1970 Camaro, a full size passenger car axle with 8 7/8" ring gear should be used. The unit can be modified for disc brakes and to utilize the 1969 springs. Refer to sketches that follow.

:-:-:

Axle assemblies without parking brake provisions must not be installed in vehicles that will be driven on public highways or streets. State laws in many States will hold the vehicle operator responsible for operating his vehicle without parking brakes in addition to the regular service brakes.

CAMARO-NOVA-CHEVELLE-CHEVROLET CONT'D.

3961407	GEAR UNIT (Ring & Pinion) (3.07:1)	1
3931564	GEAR UNIT (Ring & Pinion) (3.25:1)	1
3961405	GEAR UNIT (Ring & Pinion) (3.31:1)	1
3931565	GEAR UNIT (Ring & Pinion) (3.42:1)	1
3961406	GEAR UNIT (Ring & Pinion) (3.55:1)	1
3961408	GEAR UNIT (Ring & Pinion) (3.73:1)	1
3961429	GEAR UNIT (Ring & Pinion) (3.90:1)	1
3917971	GEAR UNIT (Ring & Pinion) (4.10:1)	1
3961430	GEAR UNIT (Ring & Pinion) (4.33:1)	1
3917973	GEAR UNIT (Ring & Pinion) (4.56:1)	1
3917972	GEAR UNIT (Ring & Pinion) (4.88:1)	1
3961192	GEAR UNIT (Ring & Pinion) (4.88:1) (R-50 Hi-Impact)	1
3961422	GEAR UNIT (Ring & Pinion) (5.13:1)	1
3961196	GEAR UNIT (Ring & Pinion) (5.13:1) (R-50 Hi-Impact)	1

CORVETTE

3963840	GEAR UNIT (Ring & Pinion) (4.88:1)	1
3970552	GEAR UNIT (Ring & Pinion) (5.13:1)	1

CAMARO

3948986	SPRING (Rear) (Load/rate 200 lb. in.)	2
3948985	SPRING (Rear) (Load/rate 250 lb. in.)	2
3953673	SPRING (Rear) (Load/rate 300 lb. in.)	2
3935792	STUD (RR Spring Locating)	2
3889964	"U" BOLT (RR Spring)	4
3927507	SPACER (RR Spring)	2
3976852	SEAT (RR Spring)	2

CORVETTE

6258056	SPRING (Rear) (6 leaf) (Design load 1325 lbs. at -.330 camber)	2

REAR SPRINGS:

The 1967-69 average load/rate for base rear springs is 125 lb. in. See following sketches for adaptation of 1969 Springs to the 1970-1971 Camaros.

SUBFRAME PREPARATION - CAMARO 1970-71:

The front subframe should be removed from the car for preparation. Thoroughly clean (sand blast preferably) subframe and weld all seams not completely welded. If regulations permit, reinforcement of the spring seat and the upper control arm mounting bracket should be done. Check shock absorber clearance hole in the upper spring seat to insure adequate clearance around the shock absorbers.

Eliminate the rubber body mounts and make aluminum or steel spacers to space the subframe in its normal position relative to the unit body. Some regulations prohibit bolting or welding the subframe solidly against the body. It is very important to use the metal spacers to eliminate flexing between the subframe and body for improved handling and safety.

1970 subframe is modified to accept heavy duty coil spring and to provide control arm clearance.

FRONT SUSPENSION - CAMARO 1970-71:

Each orgnization allows different changes in the front suspension mounting points or other dimensions. Check with individual organizations for specific rulings in this area.

It is recommended that all rubber control arm bushings be replaced with bronze, aluminum or high density plastic bushings to eliminate suspension compliance under cornering loads. This will allow you to achieve better tire contact from both front wheels while cornering. Care must be taken in the design of such bushings to prevent clearance from developing through wear. High quality ball joints and tie rod ends are listed in the HD Parts List as well as Tufftride heat treated knuckles (pre 1970) which have proven their durability. For 1970, service knuckles are available which allow use of Corvette disc and caliper.

Some method should be used to retain the lower ball joint in addition to the press fit in the lower control arm. A retaining strap across the bottom or tack welding have been used successfully. Front wheel alignment settings are listed in a separate section. Optional size anti-sway bars are available up to 1-1/16" OD (pre 1970). Satisfactory handling has been achieved with these bars in production rubber mounting bushings and with production rubber cushioned links. For 1970, no H.D. anti-sway bars are available. The front ride height should be roughly 9-1/2" from ground to inner forward a-arm bolt C/L (pre 1970). For 1970, minimum ground clearance to subframe cross member should be 3-1/2". Care should be taken to assure enough bump travel at this height.

REAR SUSPENSION:

Several rear spring rates are available from the Heavy Duty Parts List. Pre 1970 optional rear springs can be used in 1970 cars. Forward and rear spring eye bushings should be of monoballs, aluminum or delrin, rather than rubber to help properly position the rear axle and reduce axle tramp under braking.

The rear axle should be attached to the springs with U-bolts available in the HD Parts List. Rear body height may be adjusted with lowering blocks or by having the spring re-arched in a spring shop. Lowering blocks can be eliminated and an improvement in rear axle tramp under braking can be achieved by having the front spring eyes re-rolled so that center line of eye is on center line of main leaf. This also can be done by most spring shops. In any event, allow at least 3" bump travel measured from the top of the axle to the bottom of the underbody where the axle will hit under severe jounce.

There are no heavy duty rear anti-roll bars offered as service parts. Panhard rods, Watts linkages, and traction bars of radius rods are allowed by most organizations. The need for these items must be determined by the chassis builder and is subject to driver preference.

The preceding refers to the H.D. rear axle for pre 1970 cars. For 1970 there is no optional disc brake rear axle. Illustrations for the conversion of full size Passenger Car Axle (with 8 7/8" ring gear) for use with Corvette discs and calipers. This conversion will result in a rear tread width of 64.00" with zero offset wheels. Shot peening of axles and frequent magnifluxing is necessary.

Quick change axles are allowed and floater hubs are required by various organizations.

Rear axle temperatures should be monitored and a cooler with auxiliary pump should be incorporated if temperature exceeds 325°F.

For satisfactory gear life, 50 to 100 miles of light load break-in running is mandatory. D. A. Speed Sport 90W gear lube has been used with satisfactory results.

SPRING AND SWAY BAR RATES:

Spring rates as follows work well and are a good starting combination:

Front: 500-600 lb/in with 7/8" or 15/16" or 1" sway bar

Rear: 200-250 lb/in

For high "G" load, the following combination should be satisfactory:

Front: 725 lb/in with 7/8" sway bar

Rear: 300 lb/in

As a general rule of thumb, if the front end pushes or understeers excessively, the front roll rate should be decreased by the use of softer springs or a small sway bar; or the rear roll rate increased by installation of stiffer rear springs or sway bar (if one is used). Conversely, if the car oversteers or tends to spin out too readily, installation of softer rear springs or higher rate front springs or sway bar is called for. Some degree of understeer control can be achieved by camber changes. More negative camber reduces understeer.

General consensus is that a slightly understeering car that requires some application of power to achieve oversteer is the most satisfactory balance for good handling and maximum speed.

When selecting spring rates, keep in mind that under no anticipated cornering loads should the suspension or shock absorbers bottom out. This will cause immediate oversteer or understeer depending on whether the rear or front bottoms and a wild ride, if not complete loss of control. Trimming or removal of bump stops will increase suspension travel over production limits and may be accompanied by bump stops on the shock absorbers.

WHEELS:

For pre-1970, offset to retain maximum rear tread width with minimum fender rework is .20-.25" positive offset. For the front wheels, negative .20-.25 offset will give improved wheel bearing life, easier steering, and minimum fender rework.

1/2" x 20 x 1-3/4" wheel stud bolts are available for improved durability under Part No. 3849110 for front wheels and may also be used for rear hubs if the splines are shortened to .40 inches length. (Rear brake disc should not ride on the splined section of the wheel stud bolts).

Alternate wheel stud bolts are available under Part No. 3819780. These are 2-7/8" long and 1/2 x 20 bolts. It is necessary to shorten the spline on these bolts as required to fit hubs. Use of these bolts and special lug nuts (available from wheel manufacturers) will facilitate quick wheel changes with power wrenches.

FRONT END GEOMETRY AND CHASSIS BALANCE:

Recommended front wheel geometry settings are:

Camber: 2-3 1/2° negative - all models

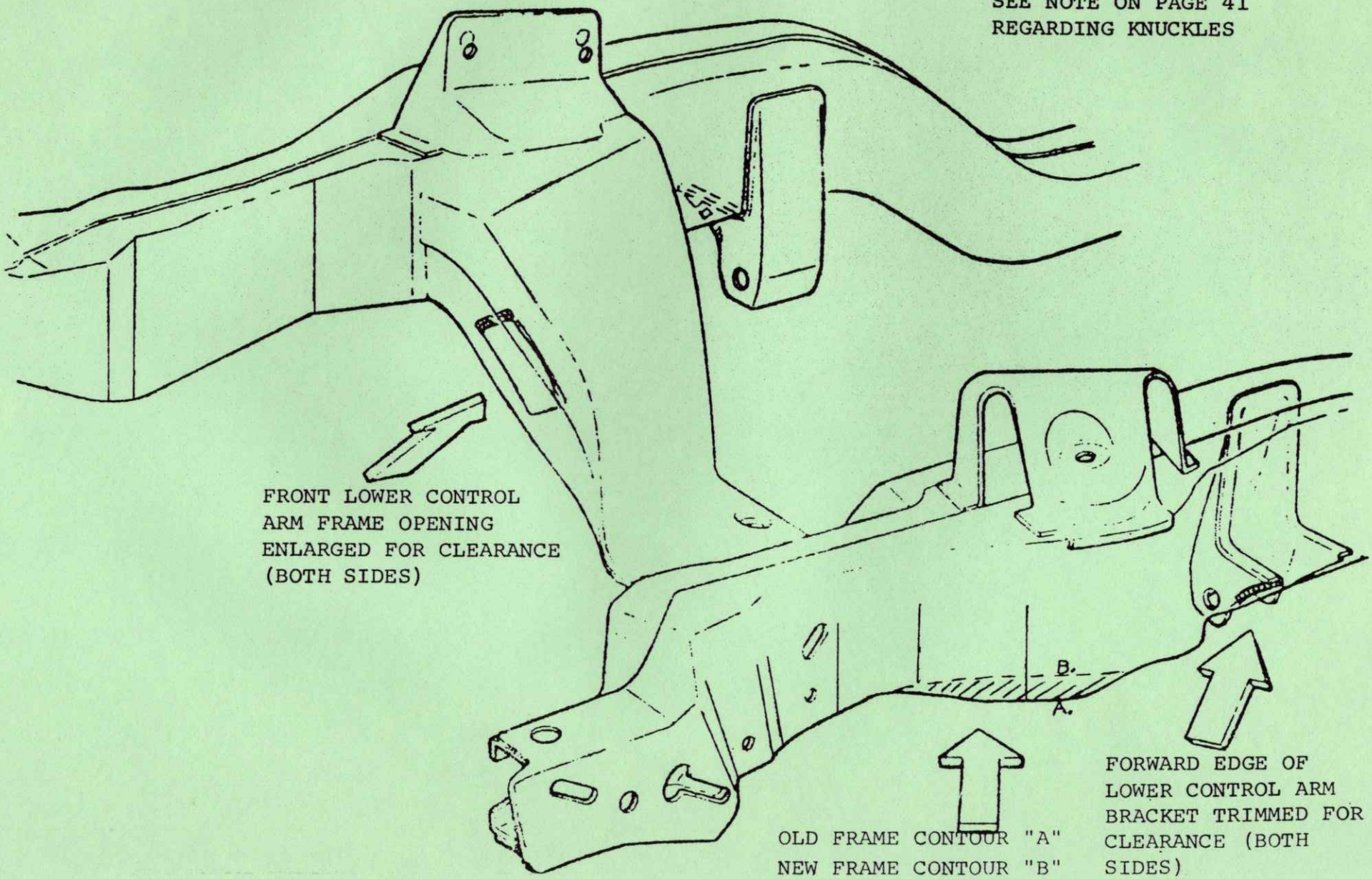
Caster: 3-5° positive - pre 1970, 2-3° positive 1970

Toe: 1/16-1/8 Toe-Out - all models

The chassis should be adjusted to provide approximately equal weight on both rear wheels with the driver seated in the car. This can be accomplished with various length rear spring shackles or by shimming or trimming the front springs. This measurement and adjustment should be accomplished with the anti-roll bars unhooked. Anti-roll bars should be reconnected in such a manner that they do not preload the chassis.

UI NTROL ARM BOLT
HOLL RELOCATED (BOTH SIDES)

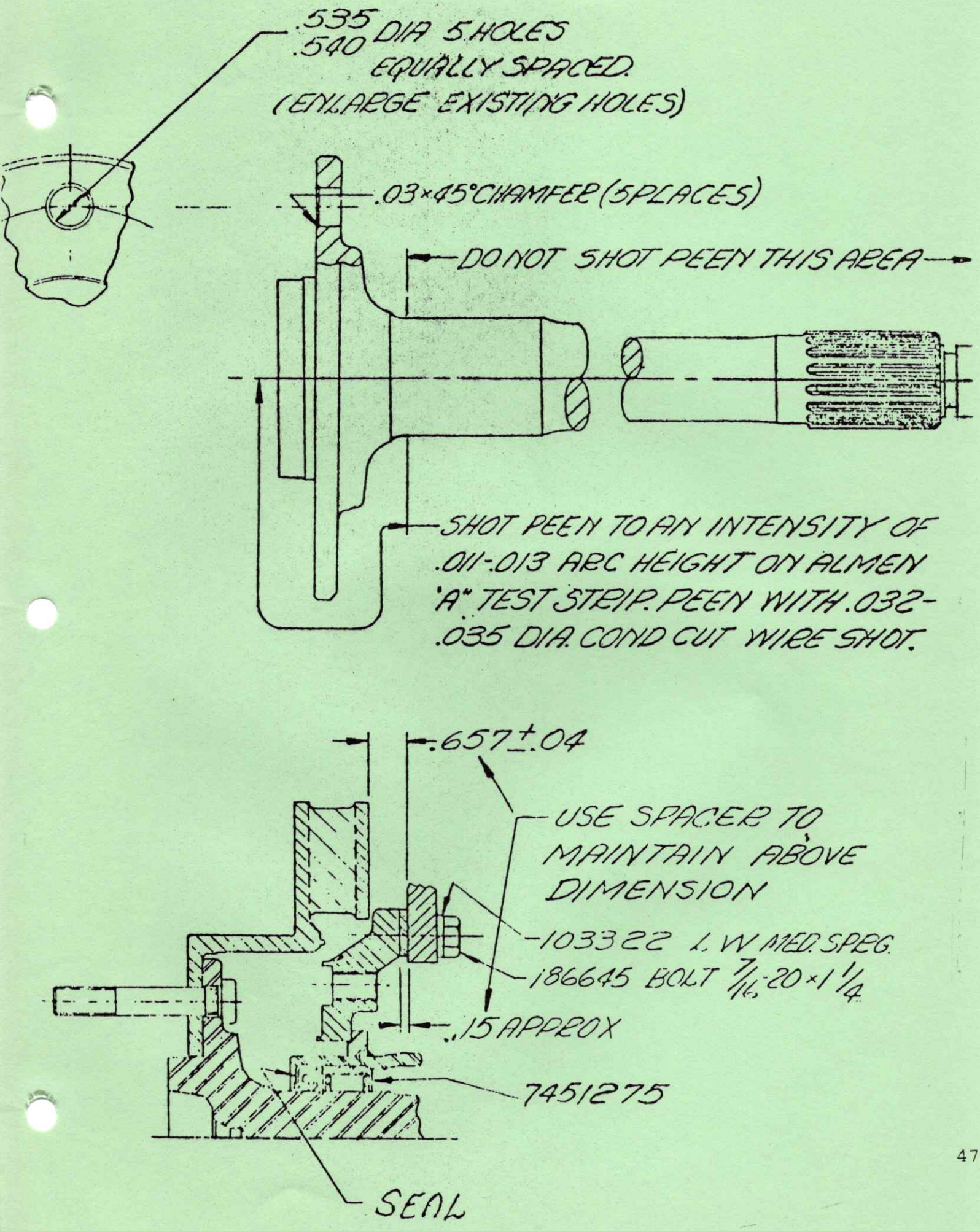
SEE NOTE ON PAGE 41
REGARDING KNUCKLES



FRONT LOWER CONTROL
ARM FRAME OPENING
ENLARGED FOR CLEARANCE
(BOTH SIDES)

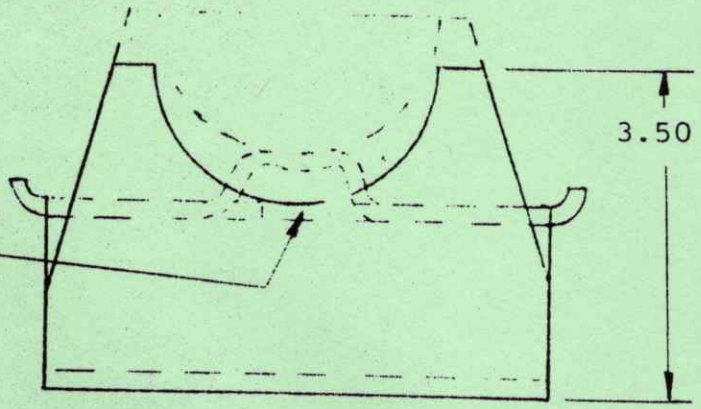
OLD FRAME CONTOUR "A"
NEW FRAME CONTOUR "B"

FORWARD EDGE OF
LOWER CONTROL ARM
BRACKET TRIMMED FOR
CLEARANCE (BOTH
SIDES)

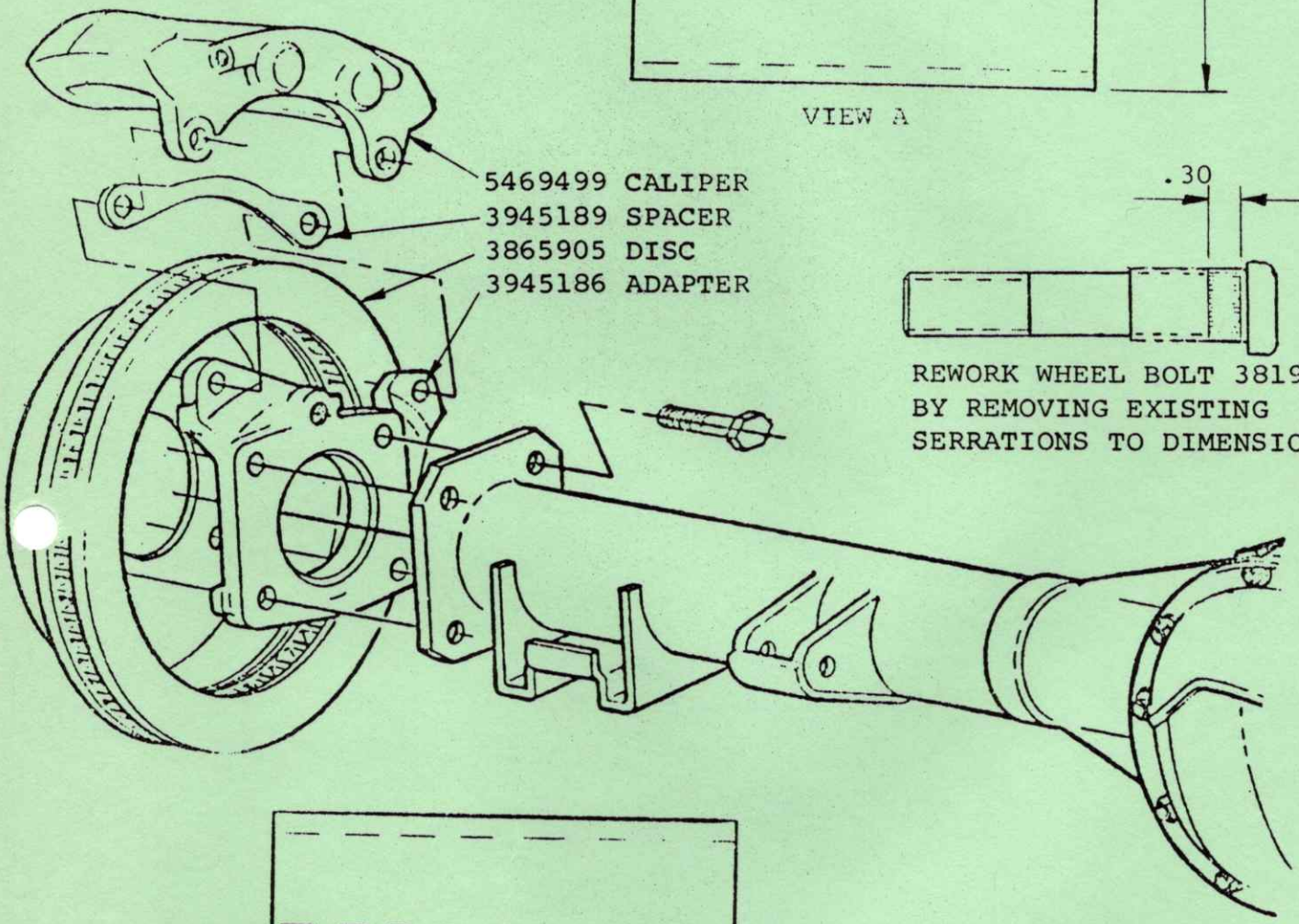

.535
.540 DIA 5 HOLES
EQUALLY SPACED.
(ENLARGE EXISTING HOLES)
.03 x 45° CHAMFER (5 PLACES)
DO NOT SHOT PEEN THIS AREA
SHOT PEEN TO AN INTENSITY OF
.011-.013 ARC HEIGHT ON ALMEN
"A" TEST STRIP. PEEN WITH .032-
.035 DIA. COND CUT WIRE SHOT.
.657 ± .04
USE SPACER TO
MAINTAIN ABOVE
DIMENSION
103322 L. W. MED. SPEG.
186645 BOLT 7/16-20 x 1 1/4
.15 APPROX
7451275
SEAL

1.50 R
1.52

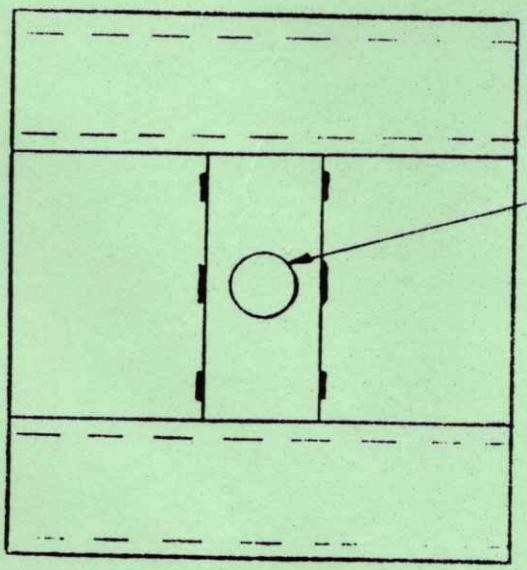
SPRING LOCATING
HOLE IN HANGER
3976852
SEE VIEW "B" BELOW



VIEW A



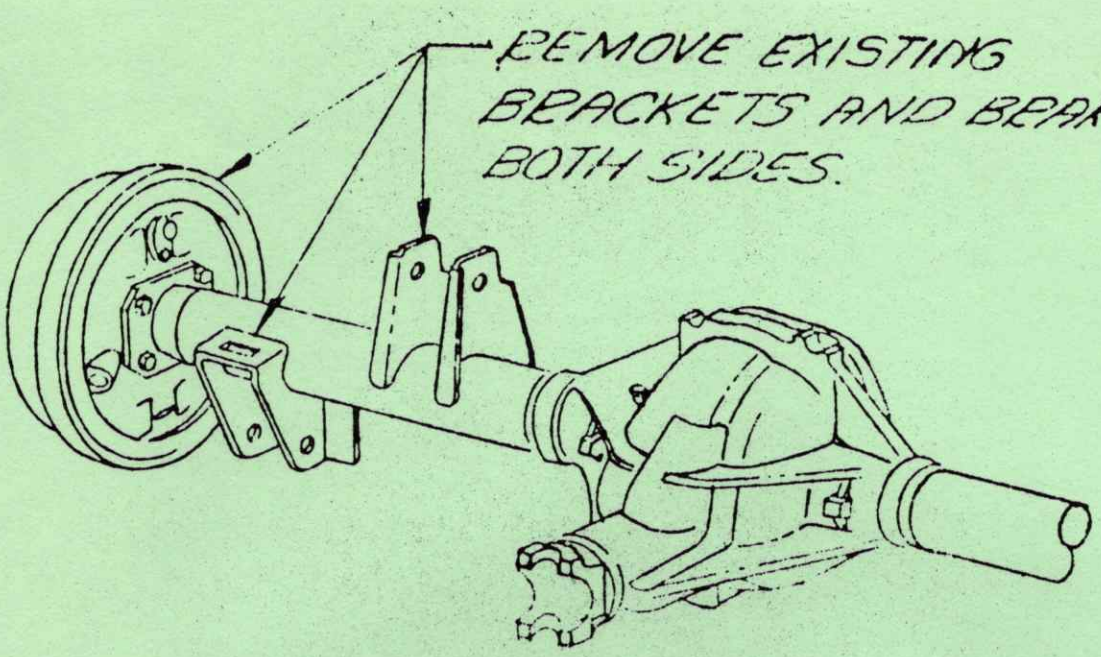
REWORK WHEEL BOLT 3819780
BY REMOVING EXISTING
SERRATIONS TO DIMENSION SHOWN



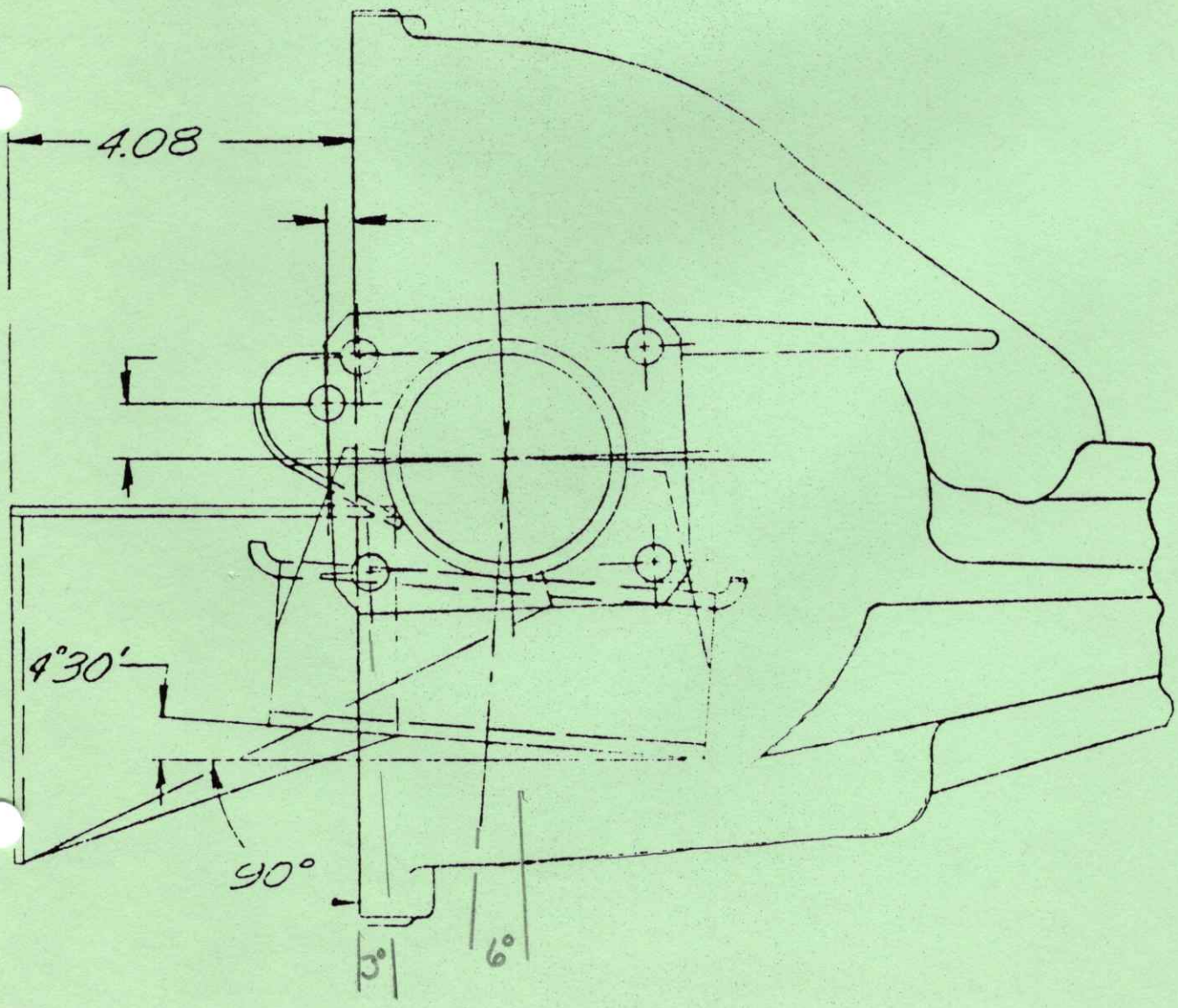
REPLACE SPRING LOCATING
HOLE 1/2" DIA. AS SHOWN
FOR SPRING HANGER 3976852
SEE VIEW "A" ABOVE

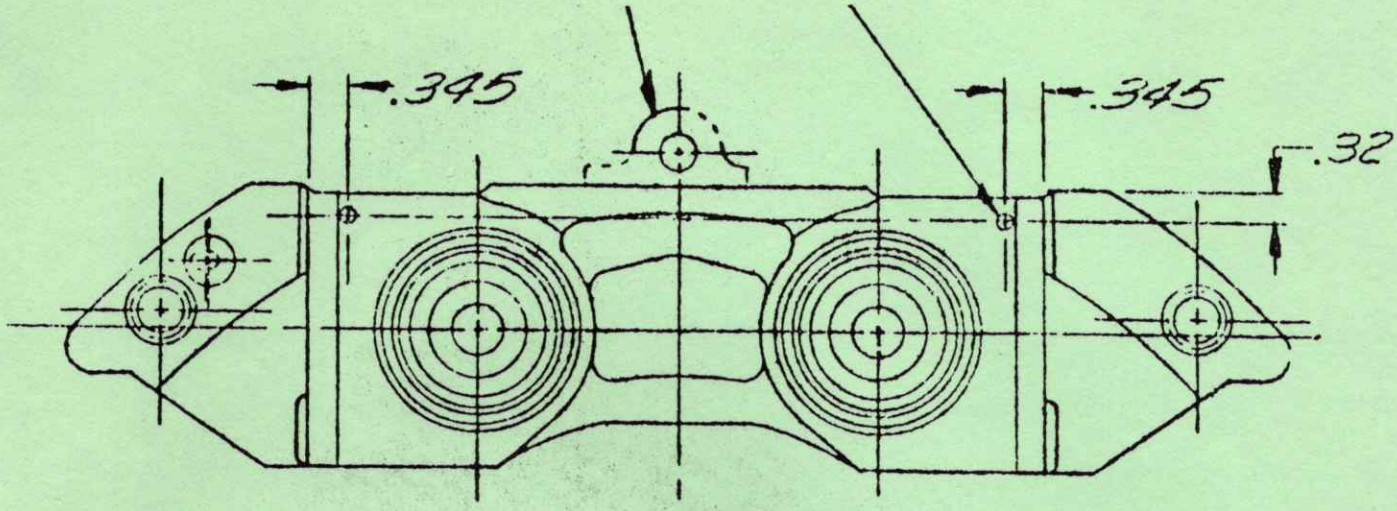
VIEW B

SEE NOTE ON PAGE 42
REGARDING LAW

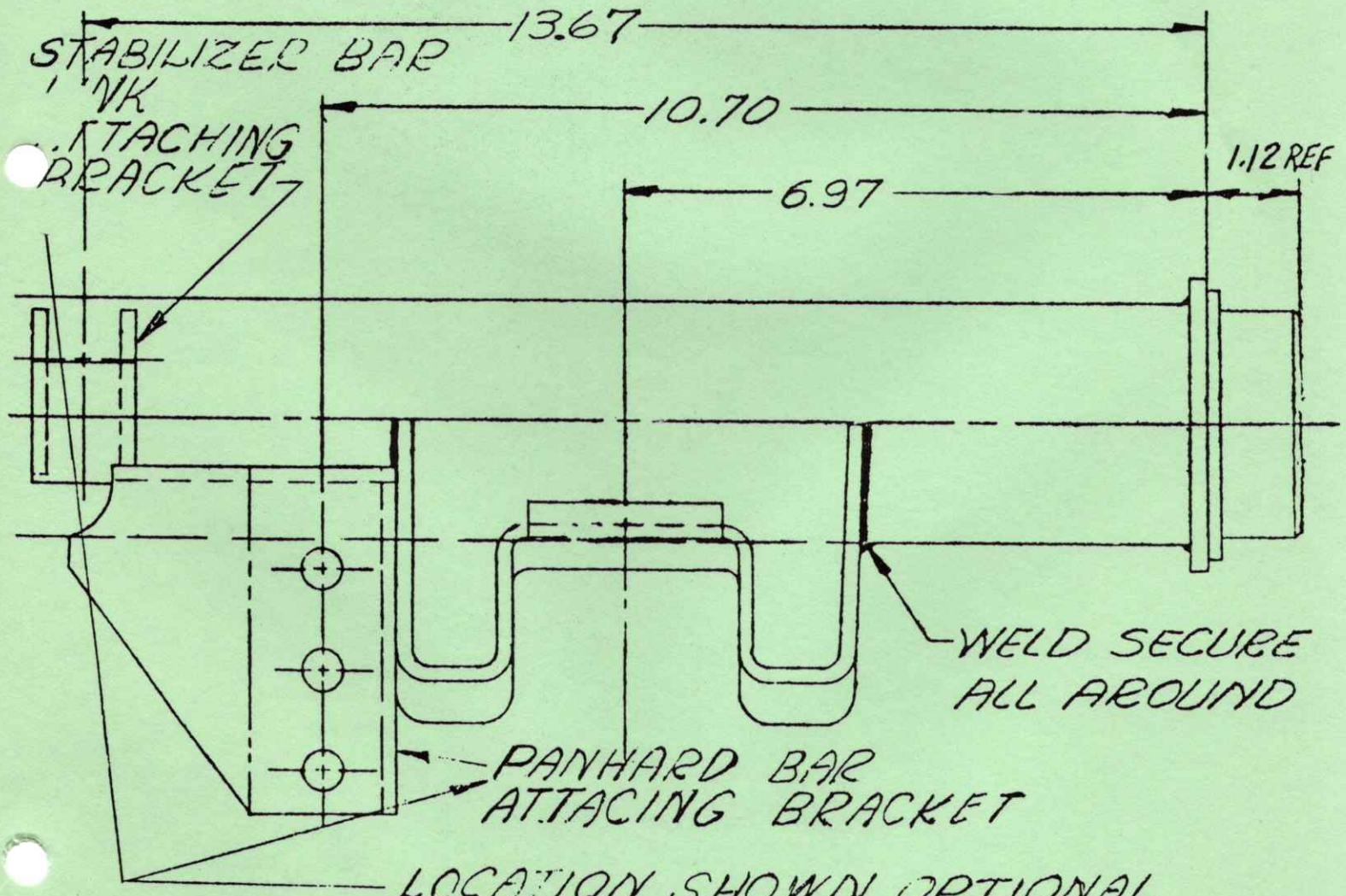


1969-70 FULL SIZE PASSENGER AXLE WITH 8.875 DIA RING GEAR





REWORK CALIPER AS SHOWN FOR USE WITH 5470991 SHOE ASS'Y. (H.D.)



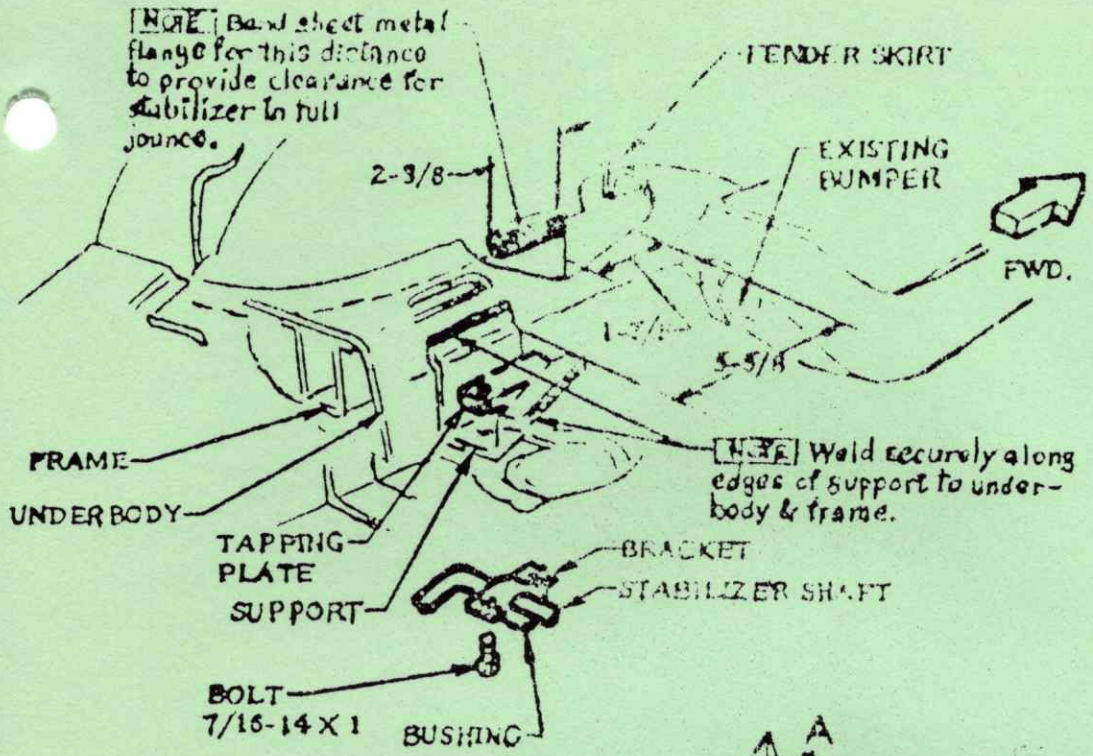
REAR

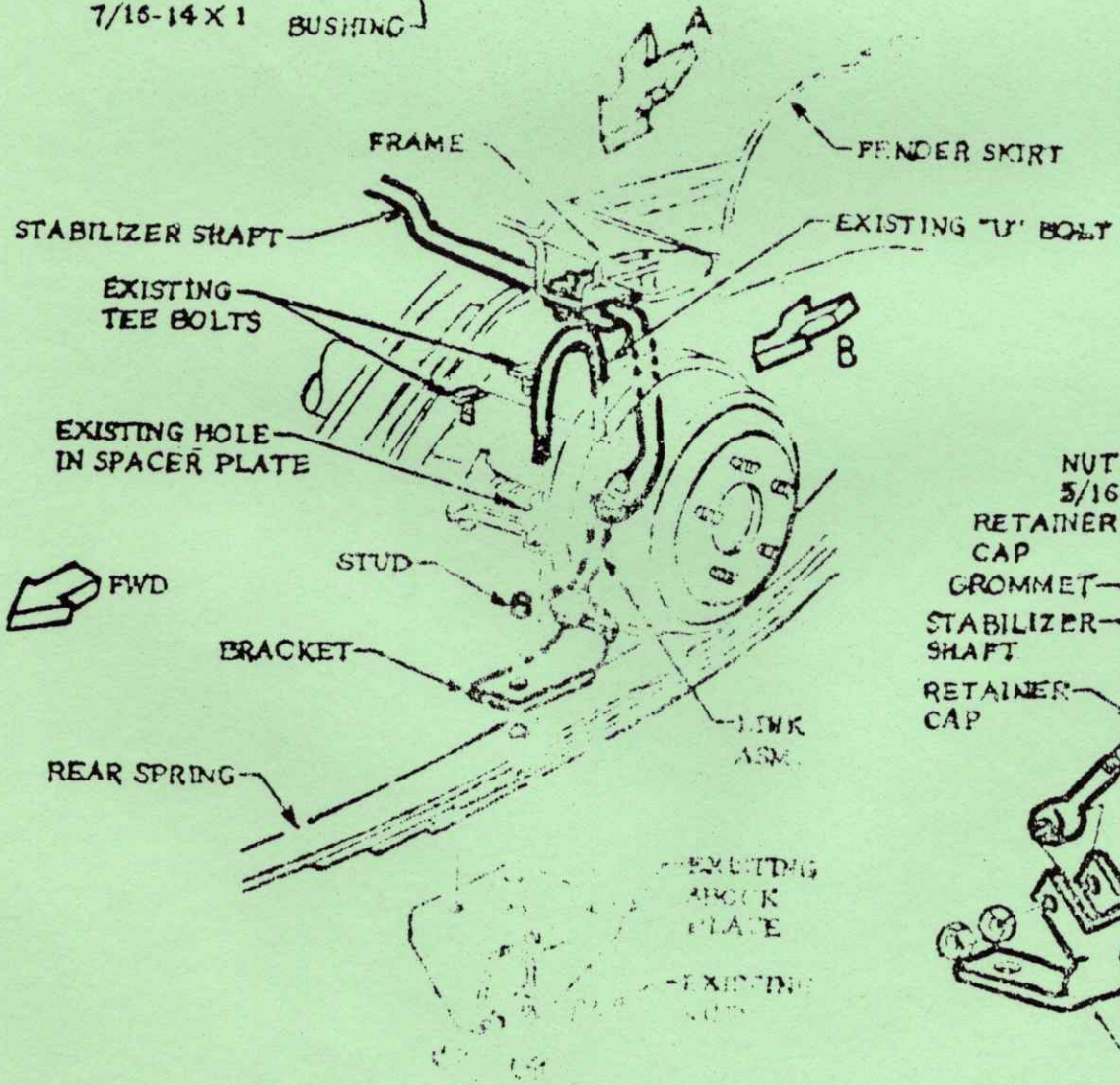
STABILIZER

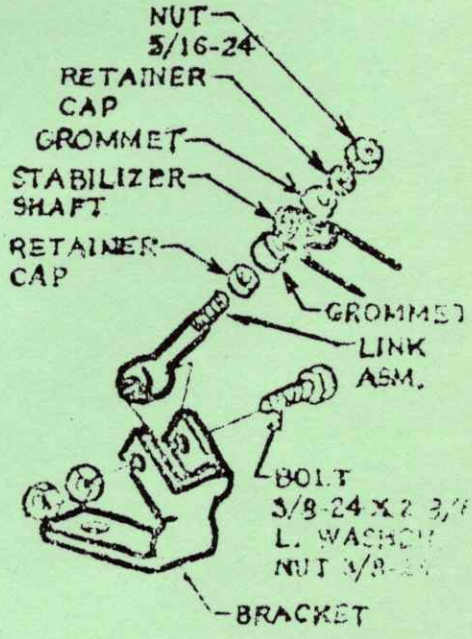
SHAFT

1967 - 1969

CAMARO





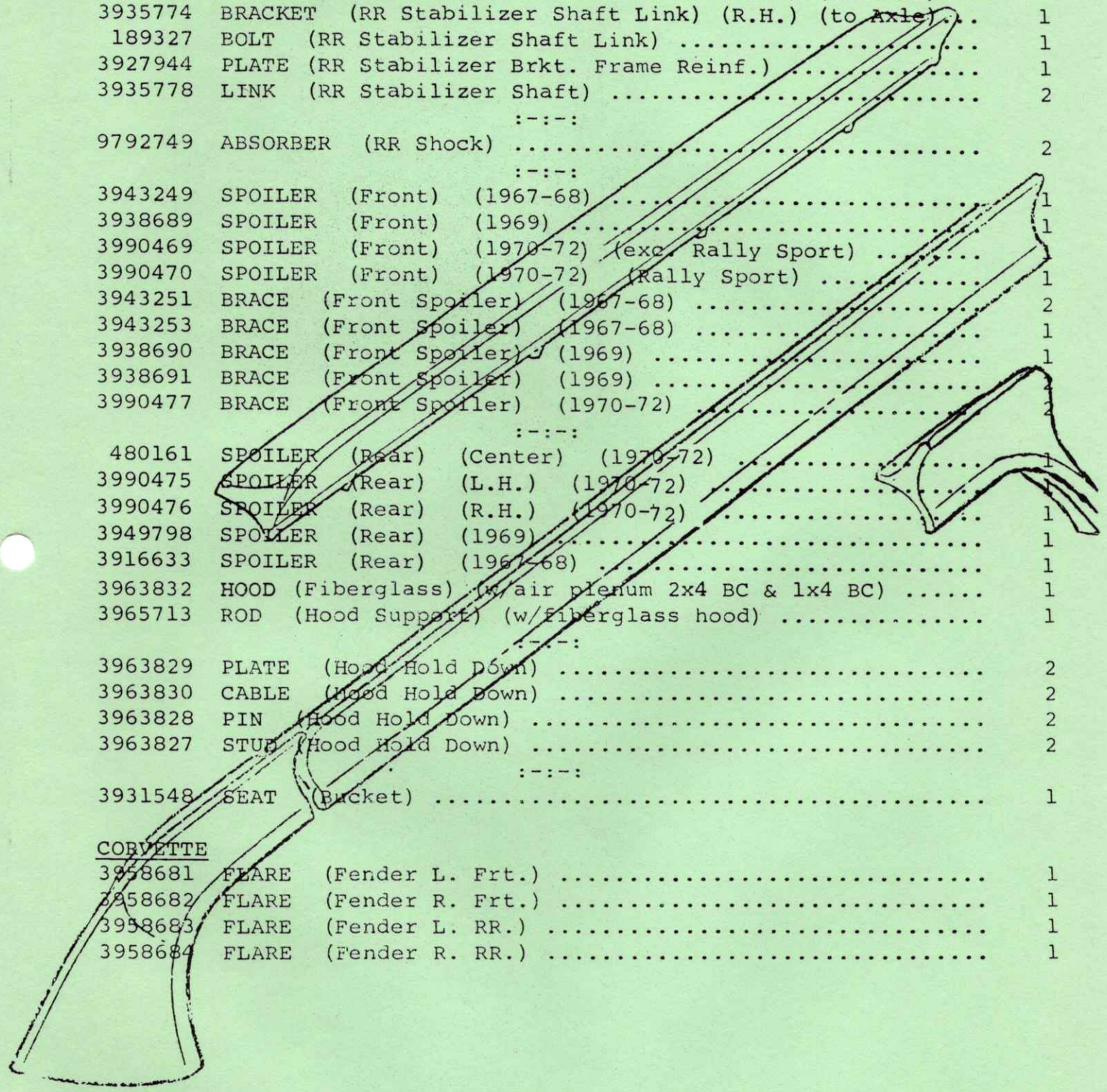


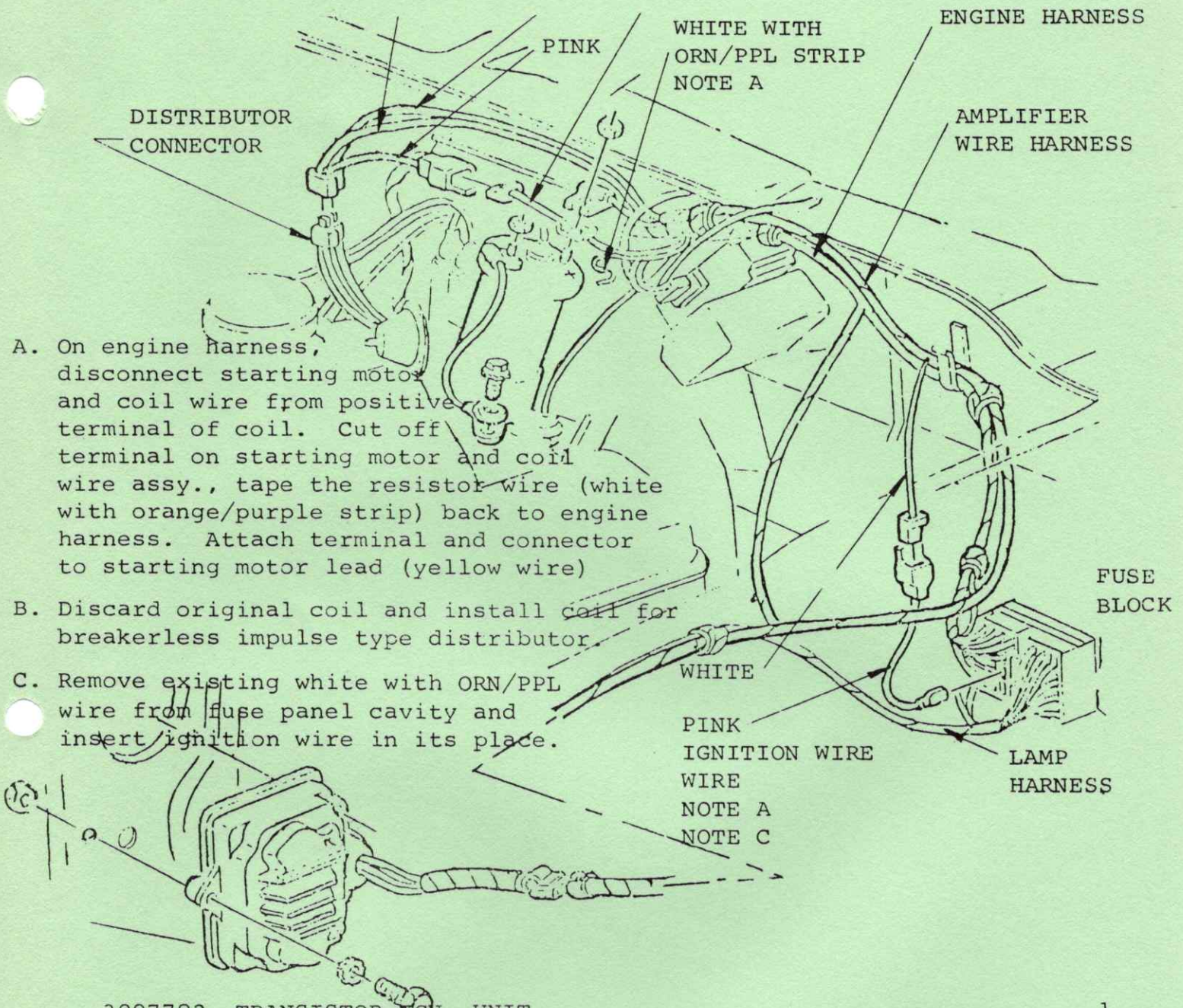
CAMARO 1967-69

3935776	SHAFT (RR Stabilizer) (5/8")	1
3935771	SUPPORT (RR Stabilizer Shaft) (L.H.)	1
3935772	SUPPORT (RR Stabilizer Shaft) (R.H.)	1
3935773	BRACKET (RR Stabilizer Shaft Link) (L.H.) (to Axle)...	1
3935774	BRACKET (RR Stabilizer Shaft Link) (R.H.) (to Axle)...	1
189327	BOLT (RR Stabilizer Shaft Link)	1
3927944	PLATE (RR Stabilizer Brkt. Frame Reinf.)	1
3935778	LINK (RR Stabilizer Shaft)	2
	:-:-:	
9792749	ABSORBER (RR Shock)	2
	:-:-:	
3943249	SPOILER (Front) (1967-68)	1
3938689	SPOILER (Front) (1969)	1
3990469	SPOILER (Front) (1970-72) (exc. Rally Sport)	1
3990470	SPOILER (Front) (1970-72) (Rally Sport)	1
3943251	BRACE (Front Spoiler) (1967-68)	2
3943253	BRACE (Front Spoiler) (1967-68)	1
3938690	BRACE (Front Spoiler) (1969)	1
3938691	BRACE (Front Spoiler) (1969)	1
3990477	BRACE (Front Spoiler) (1970-72)	2
	:-:-:	
480161	SPOILER (Rear) (Center) (1970-72)	1
3990475	SPOILER (Rear) (L.H.) (1970-72)	1
3990476	SPOILER (Rear) (R.H.) (1970-72)	1
3949798	SPOILER (Rear) (1969)	1
3916633	SPOILER (Rear) (1967-68)	1
3963832	HOOD (Fiberglass) (w/air plenum 2x4 BC & 1x4 BC)	1
3965713	ROD (Hood Support) (w/fiberglass hood)	1
	:-:-:	
3963829	PLATE (Hood Hold Down)	2
3963830	CABLE (Hood Hold Down)	2
3963828	PIN (Hood Hold Down)	2
3963827	STUD (Hood Hold Down)	2
	:-:-:	
3931548	SEAT (Bucket)	1

CORVETTE

3958681	FLARE (Fender L. Frt.)	1
3958682	FLARE (Fender R. Frt.)	1
3958683	FLARE (Fender L. RR.)	1
3958684	FLARE (Fender R. RR.)	1



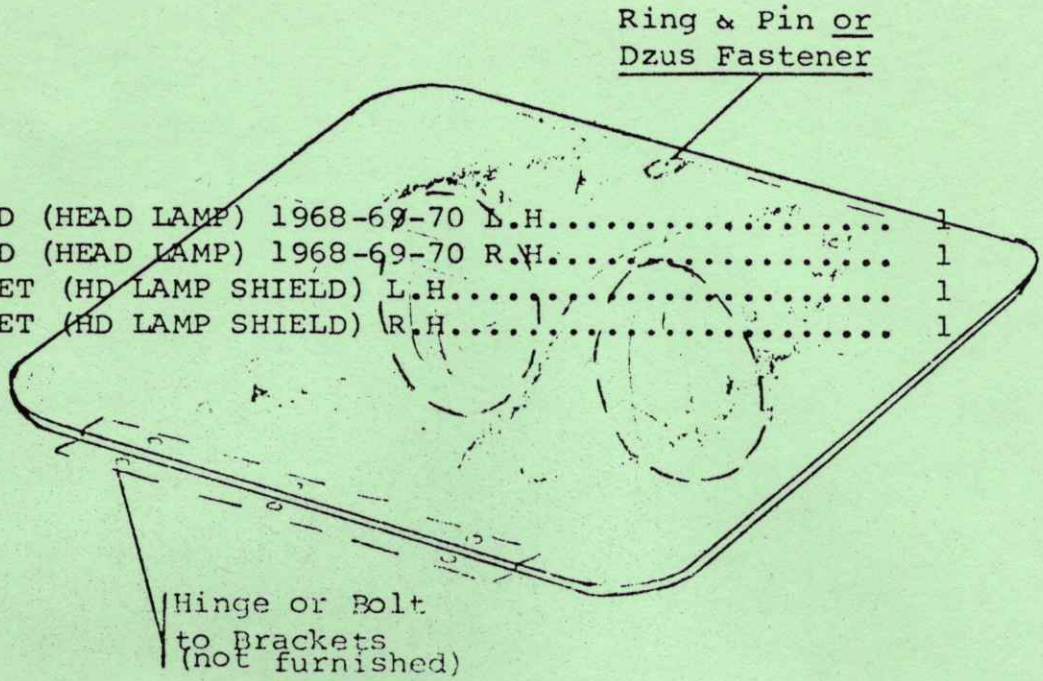


A. On engine harness, disconnect starting motor and coil wire from positive terminal of coil. Cut off terminal on starting motor and coil wire assy., tape the resistor wire (white with orange/purple strip) back to engine harness. Attach terminal and connector to starting motor lead (yellow wire)

B. Discard original coil and install coil for breakerless impulse type distributor.

C. Remove existing white with ORN/PPL wire from fuse panel cavity and insert ignition wire in its place.

3997782	TRANSISTOR IGN. UNIT	1
3955511	AMPLIFIER (Impulse) (Part of 3997782)	1
1115207	COIL (Ignition) (Part of Unit 3997782)	1
2977253	CONNECTOR (Amp. Ign. Wire)	1
6297688	HARNESS ASSEMBLY (Ignition Pulse Amp.)	1
8901973	WIRE ASSEMBLY (Pulse Amp. Ignition Feed)	1
2965142	TERMINAL	1



CORVETTE

3961465	SHIELD (HEAD LAMP) 1968-69-70 L.H.....	1
3961466	SHIELD (HEAD LAMP) 1968-69-70 R.H.....	1
3961463	BRACKET (HD LAMP SHIELD) L.H.....	1
3961464	BRACKET (HD LAMP SHIELD) R.H.....	1

1972 BODY SHELLS

Body Assemblies are as follows:

Unprimed - less solder - less filler - less insulation - tack welded only.

Synchromesh/column shift floor pan - less seat hold-down brackets.

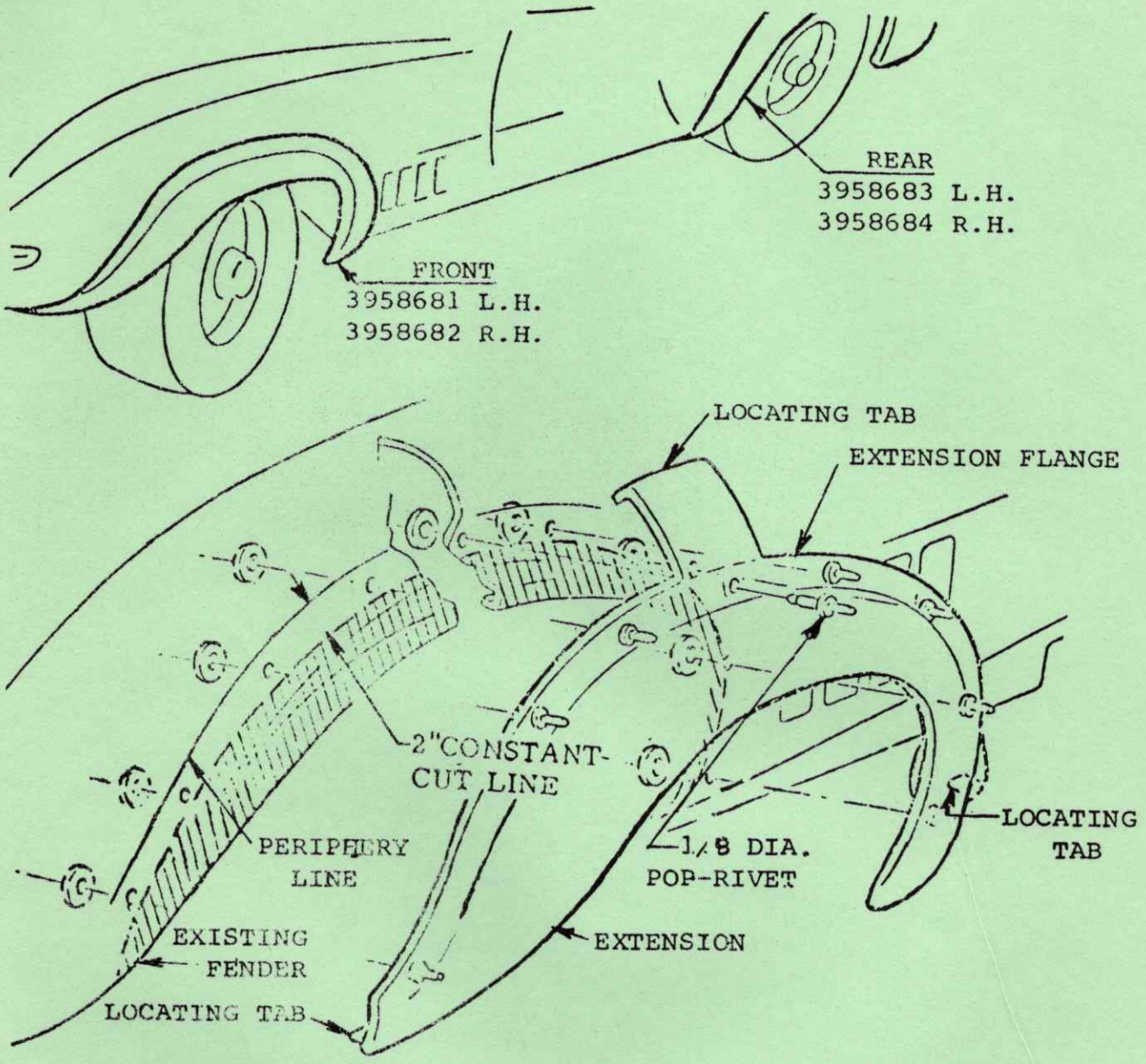
Doors and deck lid - hinges - seals - less side glass - less lock mechanism.

Less interior and exterior trim - less windshield and rear window glass.

Clutch and brake to instrument panel brackets

Less rear package shelf and vertical seat panel

Monte Carlo	Body 13857	Part No. 9653652
Chevelle	Body 13437	Part No. 9653873
Vega	Body 14177	Part No. 9653653
Camaro	Body 12487	Part No. 9653651
Nova	Body 11427	Part No. 9653650



Locate Fender Extension Tabs on body, use extension as template to mark periphery.

Scribe line 2 inches inside of periphery line, cut away unwanted portion of fender.

Apply suitable bond to entire length of extension flange after locating on body with tabs and drilling holes.

Then rivet, starting at top center, each side until all attachments are made.

After bond has set, remove locating tabs.

Apply bond or resin filler to blend with normal fender surface. Finish, sand and prepare body for paint.