NEW & IMPROVED KNUCKLE SANDWICH

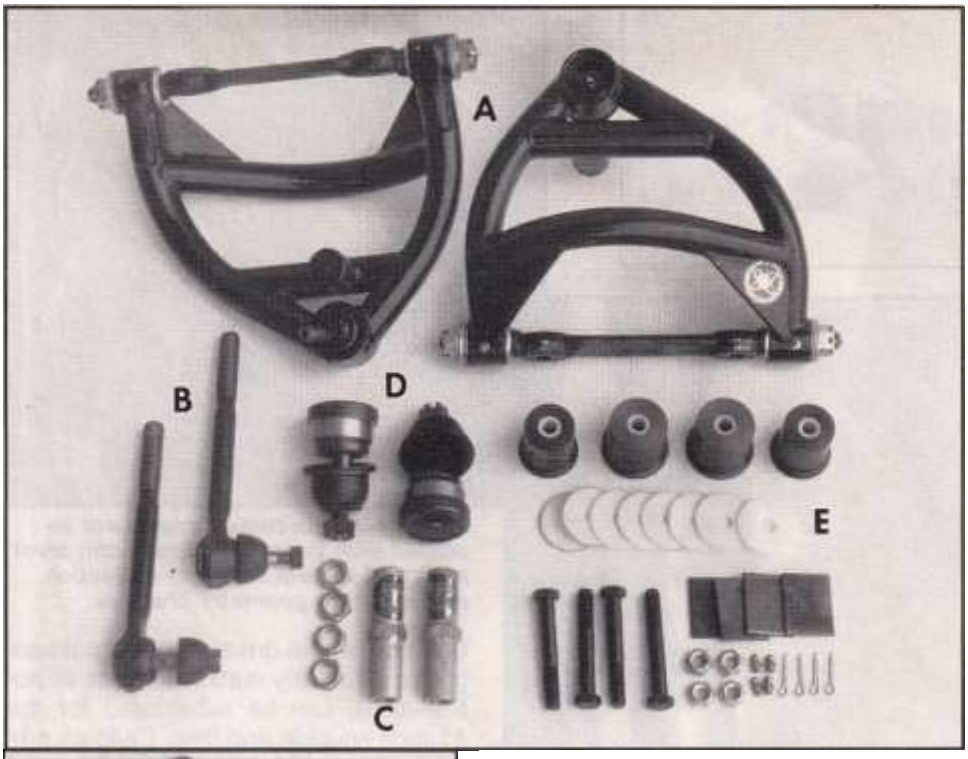
By Marlan Davis

Advances in automotive high performance, like those in the world at large, are evolutionary in nature, with each successive step forward building on the work and accomplishments of those that have come before. That's how planes fly higher, and cars continually run faster and handle better. Back in 1987, the aftermarket made its first serious attempt to modernize the '64-'72 General Motors intermediate (A-chassis) front suspension. Components were offered to adapt the '70-'81 Camaro/Firebird (F-car) front steering knuckle (spindle) and disc-brake components to the early intermediate chassis, thereby providing a relatively inexpensive front-disc-brake conversion while also improving the car's front-suspension geometry due to the later knuckle's taller height (See "Knuckle Sandwich,'" HRM June '87). When combined with the proper shocks, springs, sway bars, and wheel/tire package, this conversion offered dramatic A-car handling gains and represented a real step forward in updating an obsolescent chassis. However, as good as the upgrade was, resultant field experience with the product showed that there was still room for improvement.

GLOBAL WEST'S NEGATIVE-ROLL SUSPENSION FOR EARLY GM INTERMEDIATES

The original approach retained the A-car upper and lower control arms, utilizing unmodified F-car upper and lower ball joints to attach the F-car steering knuckle to them. But when mated with the late knuckle, the old Acar upper arm was really too long to produce desirable alignment specs without an excessive shim pack. Often this required a longer attaching bolt, and the bolt and/or shims inevitably interfered with headers and power-steering components, especially on big block Chevy-equipped vehicles. Plus, because the car still wouldn't "roll negative' in the corners (see sidebar), relatively harsh spring rates and/or large amounts of negative camber settings were still needed to achieve high cornering rates.

Enter Global West Suspension Components' Doug Norrdin. A pioneer of the "negative-roll" concept, the firm has just introduced a uniquely shaped upper control arm that clears all obstructions, permits near-zero static camber settings for optimum tire-wear characteristics under highway cruise conditions, and—in conjunction with body roll—generates progressively more negative camber as the severity of cornering loads increases. Constructed from heli-arc-welded, .125-inch-wall, 1020 mild-steel seamless tubing, the new arm features an integral bump stop and comes with an "overkill" press-fit Monza V8 lower ball joint already installed. As a concession for those desiring optimum ride comfort, the new arm is designed to accept the stock Acar rubber upper-arm pivot bushings. However, those interested in optimum performance can have Global install its lifetime-warranted billet - aluminum bushings with Del-A-Lum in the new arms, which combine the superior deflection-eliminating characteristics of solid metal



In addition to Global's negative-roll control arms, we also installed a set of Koni gas-pressure shocks, front and rear, to complement the dramatic handling improvement.

You can order the skeletal-like upper arms without the trick bushings and shaft installed, but the Vega/Monza V8 lower ball joint comes standard. Designed for a load-carrying lower-arm application, its use in the less-stressful upper position means that the new upper joint will probably outlast the car! Note the integral bumpstop (arrow).

Global West's deluxe '64-'72 A-car front-end upgrade includes: new upper arms with ball joint, shaft, and billet bushings with Del-A-Lum already installed(A);'75½-'81 F-body outer tierod ends(B);special tie-rod-end adjusting sleeves and jam nuts(C);modified '70-'81 F-car lower control-arm ball joints(D);and lower control-arm Del-ALum billet bushing and reinforcement package(E).

bushings with a synthetic inner liner to prevent harsh vibration, noise, or excessive wear.

To eliminate a possible over-tight condition caused by installing the late F-car ball joint into the A-car lower arm, Global West's kit also includes F-car ball joints remachined to the correct tolerances needed for a proper interference fit in the early arm. Also included are '75½-'81 Firebird outer tie-rod ends for mating the F-car knuckle to the existing A-car steering linkage. Because of a difference in tie-rod-end stud diameters, installing these tie-rod ends on '70 and earlier A-cars will also require replacement of the existing stock tie-rod adjusting sleeves with Global West's special tubular tie-rod adjustment sleeves, which have the requisite dissimilar threads on each end. The existing stock sleeves used on '71-'72 A-chassis will accept the F-car tie-rod end; for those desiring the added beef, Global West does offer a tubular sleeve for these later models that has the same diameter threads on each end. Finally, as an added option, Global West offers kits for installing the billet bushings with Del-A-Lum in those lower arms originally equipped with round (not oval-shaped) bushings (see chart).

As with the original conversion, the customer must still supply the '70-'81 Camaro/Firebird knuckle, disc-brake caliper, and 11-inch rotor assemblies. The parts needed to

A-CAR NEGATIVE-ROLL-SUSPENSION RECOMMENDED ALIGNMENT SPECS
(SET W/DRIVER IN CAR)

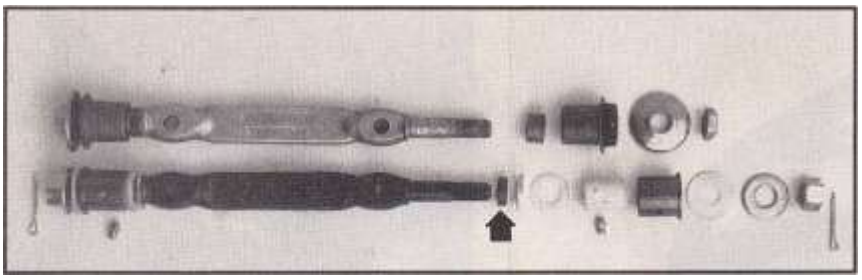
SPECIFICATION	LEFT HAND	RIGHT HAND
CAMBER	0 to -½°	0 to -½°
CASTER	+3°	+3½°
TOE-IN	1/32 inch	1/32 inch

* To compensate for road crown

GLOBAL WEST '64-'72 GM A-CAR NEGATIVE-ROLL-SUSPENSION COMPONENTS

PART NO.	DESCRIPTION	CONTENTS
CNR 12	NEGATIVE ROLL KIT, '71-'72 GM A *(Use w/production-type A-car rubber bushings)* *	Global West upper control arms w/ball joints, modified Moog K-6145 lower control-arm ball joints, weld-on stud ends for production upper shaft, Moog ES-427R tie-rod ends, assorted installation hardware
CNR 12B	NEGATIVE ROLL KIT, '71-'72 GM A *(w/billet bushings)*	Global West upper control arms w/ball joints, shaft, and Billet Del-A-Lum Bushings, modified Moog K-6145 lower control-arm ball joints, Moog ES-427R tie-rod ends, assorted installation hardware
CNR 40	NEGATIVE ROLL KIT, '64-'70 GM A *(use w/production type A-car rubber bushings)* *	Same as kit CNR 12, plus tubular tie-rod adjustment sleeves and jam nuts w/dissimilar threads added
CNR 40B	NEGATIVE ROLL KIT, '64-'70 GM A *(w/billet bushings)*	Same as kit CNR 12B, plus tubular tie-rod adjustment sleeves and jam nuts w/dissimilar threads added
ADJ 3	TIE-ROD ADJUSTING SLEEVE KIT, '71-'72 GM A *(optional)*	Tubular sleeves w/jam nuts, similar threads each end
1011	LOWER-ARM BILLET BUSHING KIT, '64-'66 Chevelle/'64-'72 Tempest *(optional)*	Two each 1.900 and 1.625-inch round Billet Bushings w/Del-A-Lum, weld-on arm-strengthening plates
1013	LOWER-ARM BILLET BUSHING KIT, '65-'72 F85/'66-'72 Buick Special *(optional)*	Two each 1.625 and 1.300-inch round Billet Bushings w/Del-A-Lum, weld-on arm-strengthening plates

* Upgrade to Moog offset shaft kit K-5250 recommended.



Use of stock bushings with the new arm** (top) **requires the installation of spacers and a special, short lock nut in place of the original, stock castle nut to ensure adequate clearance; the bushings press on in a normal manner. When the billet bushings with Del-A-Lum** (bottom) **are ordered, they come pre-assembled in the arm. If re-assembly is ever needed, install in the order shown (spacer,** arrow**, goes on one side only) and limit up-per-arm torque to five lb.•ft. to avoid binding the bushing.

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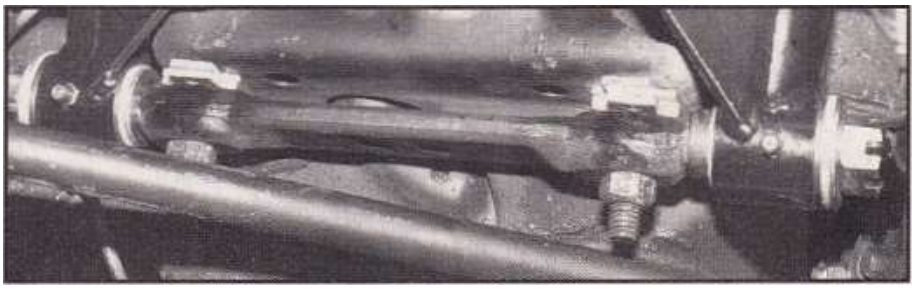
assemble an integrated system are still available new from GM or are easily found in the boneyards. Besides its use on the pony cars, the knuckle and brake assembly is also found on '75-'79 X-car compacts (Nova and "clones"), '73-'76 A-cars, and those '77-up rear-drive, full-size GM cars utilizing a 5-on-4¾ wheel-mounting bolt pattern. Because of minor variations, try to get all the parts from the same car if shopping the boneyards.

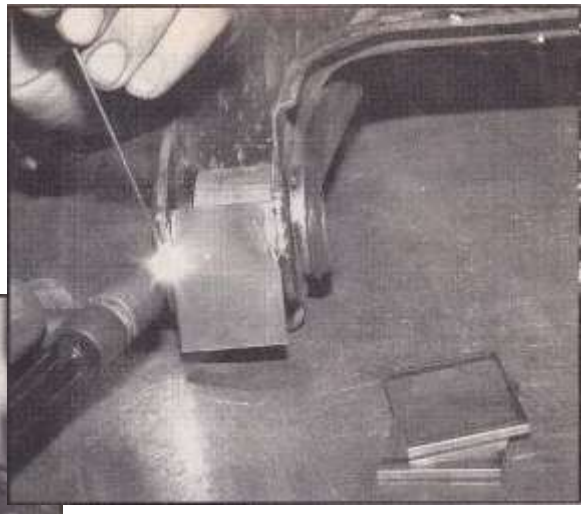
For even more braking improvement, a larger 12-inch rotor and its associated knuckle, as used on some '77-up GM rear-wheel-drive, full-size passenger cars (usually station wagons or police cars), can be substituted for the 11-inch knuckle and disc. Calipers and splash shields used in 11- and 12-inch assemblies in any given year are the same, the main braking improvement being generated by the greater leverage or stopping force exerted by the caliper on the rotor, as well as its improved heat dissipation. A different knuckle with revised-caliper mounting bolt-hole locations is required to clear the larger rotor.

A press is required to install the lower billet bushings with Del-A-Lum. Global West uses a thin coating of red Loctite on the outside of the bushing for initial installation lubrication and as a retention aid. Limit the retaining nut torque to 15 lbs.-ft. on the lower billet bushing.

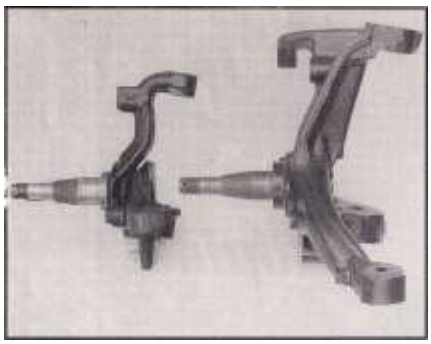
The '70-'78 11-inch and '77 12-inch knuckles use the same inner and outer wheel bearings as the '64-'72 A-car. The '79 11-inch and '78-'79 12-inch rotor knuckles use a larger outer wheel bearing, which also requires a different rotor; '80-up 11- and 12-inch rotor knuckles additionally feature a beefed-up steering-arm portion of the knuckle. All these variations will accept the Global West-specified ball joints and tie-rod ends used in this swap. When used on the big cars, the 12-inch rotors come drilled for the big-car "5-on-5" wheel-lug-mounting pattern



The revised shorter arm is also designed to generate three degrees of positive caster, so proper suspension alignment with today's modern tires can now be achieved with only 1/8-to-3/16-inch worth of shims.



Weld-on reinforcement plates are included with the special lower-arm pivot bushings to help minimize deflection and resultant geometry changes.



Not only is the '70-'81 F-car disc-brake steering knuckle(right)much beefier than the old GM intermediate drum brake knuckle, but it's also about 1¼ inches taller. Being taller, it alters the upper A-arm angle, thereby allowing negative camber curves when used with Global West's properly designed upper control arm.

The new arm will accept the stock pivot shaft, although those O.E.M. shafts in which the stock bushings are retained by bolts must either be modified with Global West's weld-on stud ends or replaced by a Moog or TRW shaft with integral stud ends.

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and must be redrilled to the compact/intermediate "5-on-4¾" pattern. However, the new

One-inch-bore manual master cylinders from '70-'8O F-cars work well for non-power-brake setups. Whether power or manual, you'll need to install either a factory '67-'72 A-car disc-brake proportioning valve (no longer available new) or this aftermarket, externally adjustable universal unit sold by Mopar Performance, Ford Motorsport, and GM heavy-duty parts.

'89-'90 Camaro heavy-duty (1LE) brake-option 12-inch rotor already has the right 5-on-4¾ pattern and may be directly substituted for the original big car rotor.

When swapping to disc brakes, safety considerations mandate the use of the appropriate disc-brake-compatible dual master cylinder and proportioning valve. For a nonpower-front-disc/rear drum setup, use a '70-'79 Camaro/Firebird nonpower-brake master cylinder. With power brakes, the first choice would be a stock '64-'72 A-car power booster, followed by a '71-'79 booster from any of the cars utilizing the desired knuckle, brake, and rotor assembly; for a power-brake-compatible master cylinder, use a front-disc/rear-drum unit from a '67-'72 A-car or pre-'81 Camaro/Firebird. Do not use: (a) a nonpower-brake master cylinder with power brakes, or vice versa; (b) a master cylinder designed only for drum brakes; or (c) '81-up "aluminum-bodied" quick-take-up master cylinders, unless the associated

Any '70-'81 Camaro/Fire-bird spindle, caliper, and rotor can be used, although the '80-'81 version is the strongest. Special tubular sleeves (and associated jam nuts) with dissimilar threads in each side are needed to mate the supplied '75½-'81 Firebird outer tie-rod ends with the existing '64-'70 inner tie rods (not required on '71-72 models).

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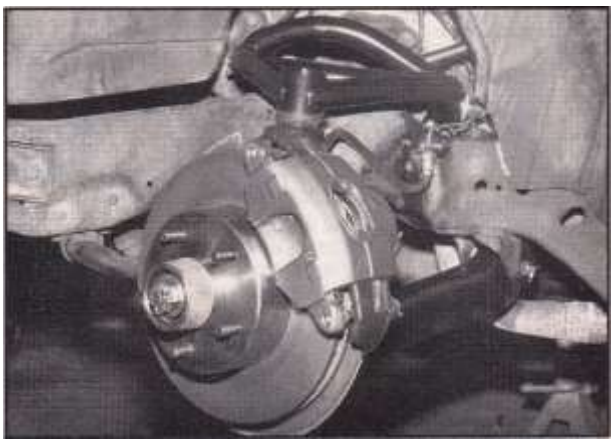
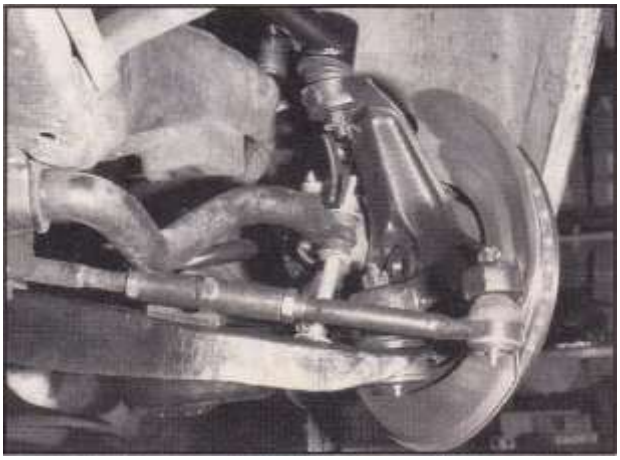




booster, prop valve, and calipers are also of "quick-take-up" design.

Realizing the arm's full benefits requires the right front and rear antisway bars, springs, and shocks. The exact parts vary per year and intended application, but Global West will be happy to recommend a coordinated combination that best suits the customer's needs. Generally, the negative-roll concept requires less severe spring and roll-bar rates for any given application than has previously been the norm in order to generate the required amount of body roll to generate the negative camber curve.

Besides its bulk and rather long wheelbase, the only real remaining deficiency in the old A-car after installing Global West's new arm is its rear-suspension geometry; namely, the existing location and geometry of the stock four-link control arms. But Global West hopes to have a solution for that, too, in the near future. Future extensions of Global West's influence involve an assault on first-generation ('67-'69) F-cars—they've been wanting a knuckle sandwich for a long time now, and Global West is more than ready to provide the beef.

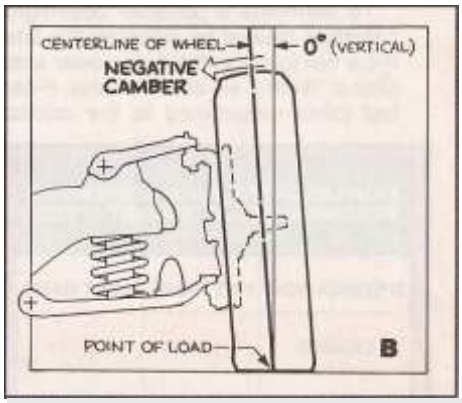
Each "great leap forward," while improving on earlier technology, often brings with it new, unforeseen glitches or "contradictions" that in turn call for further refinement. Darwin may have called this never-ending process of change and advancement "evolution," but we call it hot rodding.

WHEN A NEGATIVE BECOMES A POSITIVE

Imagine you're a football wide receiver. charging full speed down-field, and the pattern you're running calls for a sharp cut to the left. To make this cut, you wouldn't draw your right foot closer to your body—that action would generate so much instability that you'd fall on your face when it came time to make the turn. On the contrary, you'd plant your outside (right) foot outward to add leverage and stability as you pivoted left.

The same principle holds true when it comes to front-suspension geometry—ideally, you want to "plant": the loaded (outside) tire/wheel. Unfortunately, the vast majority of production cars do exactly the opposite. As shown in illustration A, cars such as stock Chevelles generate positive camber in a turn—the top of the tire tilts toward the outer fender, which lifts the tire contact patch on the pavement and reduces the tire's -ability to hold the road. The harder you 'try to corner, the more pronounced the body roil becomes, in turn generating additional outer wheel tilt and resulting in greater and greater amounts of positive camber—and worse and 'worse handling. In a handling application, at the cost of increased ride harshness, production cars "crutch" things to a point by running high spring rates and large-diameter antisway bars to slow body roll and inhibit the severe, positive camber change. To reduce the amount of end-result positive camber under cornering conditions, you could also dial in negative-static (straight-ahead) camber, but because most street driving is just boulevard or highway cruising, the inevitable result is accelerated tire- tread. wear in everyday use.

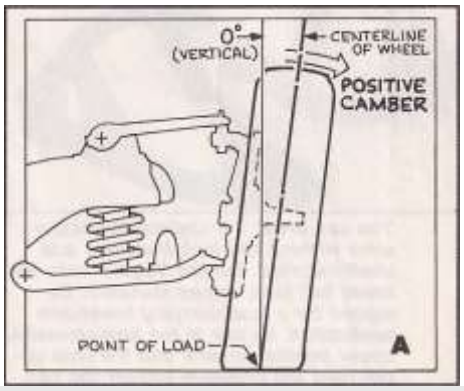
The alternative is to induce negative camber in a turn (illustration B). Now the top of the loaded (outside) tire will tilt toward the frame, just like the wide receiver planting his outside foot. This allows the tire contact patch to dig into the pavement instead of rolling over it.



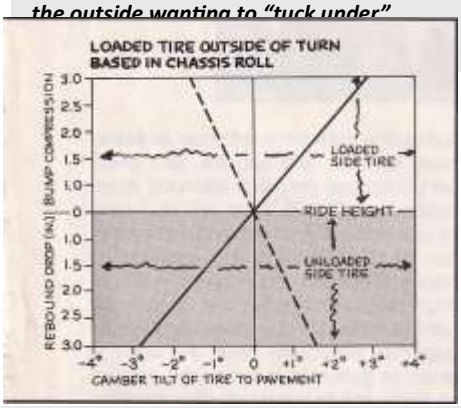
Global West's geometry induces negative camber under cornering conditions, resulting in more efficient outside tire-contact patch.

The tire is now being more evenly used. As a result, cornering ability goes up strictly because the tire is being held flatter on the pavement. Tire life is increased both because of the more even footprint and because it's no longer necessary to dial in large amounts of static negative camber. Some body roll is now acceptable, as the roll is generating increasingly negative (instead of positive) camber; consequently, spring rates no longer need to be as high. Instead, springs, bars, and shock rates can be easily dialed in for various road or track conditions without body roll control becoming the predominant selection factor.

If negative roll offers such a great advantage, why aren't cars built that way? Mainly to keep amateur drivers out of trouble. A car that rolls positive is an inherently understeering car (it "pushes"), and as such enables the novice to save his behind if he goes into a corner too hot. Detroit isn't about to offer separate front-suspension geometries for the same car lines' base and sporty models, so it designs in your basic -understeering front end and then uses springs, shocks, and bar rates to provide acceptable handling on the hi-po models. Global West corrects these deficiencies, but even its packages vary, depending on the application. For example, most Chevelle owners aren't going to use the long-wheelbase cars for serious slalom action or canyon carving, so the negative roll curve's progression is less severe



Most stock suspension geometries generate positive camber in a turn, resulting in the outside wanting to "tuck under"



Cars with independent front Suspensions actually have a Progressive camber "curve" that changes according to he. amount of body roll (which in turn varies as a factor of cornering load).
As shown in this graph, a traditional suspension's outside tire sees progressively more positive camber under increasing bump (compression of the spring) conditions, while the inside tire goes negative under rebound—exactly the opposite of what's desirable. Global West's new arm totally reverses the undesirable curve.

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than on Global West's more aggressive, competition-handling optimized Mustang or upcoming early Camaro packages. Instead, the Chevelle curve is optimized for ride comfort and long tire life

CUSTOMER SUPPLIED COMPONENTS

As related in the text, the customer must supply a new or used '70-'81 Camaro/Firebird front-steering knuckle and disc brake assembly. The parts below are typical of an integrated assembly for which all parts are still available new from GM. They include the latest (best) available knuckle and complementary brake components needed to construct either an 11-inch or 12-inch rotor system. The rotor and master cylinder are nonquick-take-up components, which interface best with earlier cars; some individual components are dimensioned in the metric system. Part Nos. are current service part No. applications and may differ in appearance and breadth of listed application from original components found in a salvage yard.

CAR LINE ABBREVIATION KEY: A = intermediate chassis (Chevelle and clones); B = full-size passenger car; F = Camaro/Firebird compact chassis (Nova and clones).

GROUP	DESCRIPTION	STOCK SERVICE APPLICATION	PART NO.	AR
4.650	CYLINDER, Brake Master (manual)	'76F, X (exc .power brakes); '77-'78B, F, X (exc .power brakes); '79-'80F (exc .power brakes); '79X (exc .power brakes)	18005271	1
	CYLINDER, Brake Master (power)[1]	'70-'74F (w /power brakes);'71-'74 A, B (w /power brakes);'75A, B, F, X (w /power brakes)	18008884	1
4.665	CALIPER, Front Brake -LH2	'77A; '77-'79X; '77-'80B, F	18003760	1
	CALIPER, Front Brake -RH2		18003761	1
4.671	BOLT, Front Brake Hose	'78all	473042	2
	WASHER, Front Brake Hose	'78-'81all	14000172	4
4.680	HOSE, Front Brake	'77A, F, X; '78F, X	9760403	2
4.690	VALVE, Rear Brake Pressure Regulator	"Off -road "adjustable	14044822	1
5.002	GASKET, Front Disc Splash Shield to Steering Knuckle	'70-'81F; '71-upB; '73-'81A; '75-'79X	3966202	2
	SHIELD, Front Disc Brake Splash -LH	'70-'81F; '71-upB; '73-'81A; '75-'79X	344023	1
	SHIELD, Front Disc Brake Splash -RH		344024	1
5.809	ROTOR, w /Hub &Bolts, Front (11-inch OD)	'79-upB, '79X, '79-'81F	14008640	2
	ROTOR, w /Hub &Bolts, Front (12-inch OD)	'88-'90F w /1LE(heavy -duty)brake system[3]	18016035	2
6.020	KNUCKLE, Steering -LH (use w /11-inch rotor)	'80-upB, '80-'81F	14012595	1
	KNUCKLE, Steering -RH (use w /11-inch rotor)		14012596	1
	KNUCKLE, Steering -LH (use w /12-inch rotor)	'80-upB w /HD brakes	14012589	1
	Knuckle, Steering -RH (use w /12-inch rotor)		14012490	1
6.311	BEARING, Front Wheel, Inner (Complete)	'64-'68all; '69-'75A, F, X; '76-'81 A, F, H; '76-'79X; '77-upB; '88-'90 F w /1LEbrakes	457196	2
6.313	BEARING, Front Wheel, Outer (Complete)	'78B w /12-inch rotor; '79X; '79-'81F, '79-upB; '88-'90F w /1LEbrakes	457049	2

1. Use w/original power booster-later boosters may require modifications.
2. Complete assembly w/all internal parts, plus mounting bolts, sleeves, bushings, brake shoes (pads), and anti-rattle spring.
3. Unlike original B-car heavy-duty brake system rotor, this part is already drilled for the correct 5-on-4¾ bolt pattern.