Rack and Pinion Steering Conversions for Early Mustangs and Classic Fords

Also available in right-hand-drive configuration.

US Patents: 6,457,375 & D440,240

Six Keys to a Successful Rack and Pinion Conversion

Six distinct features are mandatory for a successful conversion to rack and pinion steering. Tires must turn as far as factory system. Steering column must provide adequate header clearance. Correct steering geometry must be maintained. Installation must not decrease ground clearance. Frame stiffening crossmember is required. System must allow comfortable road feel. Our patented line of superior components is the only system on the market that provides all of these features.

1 - Tires Must Turn as Far as Factory System

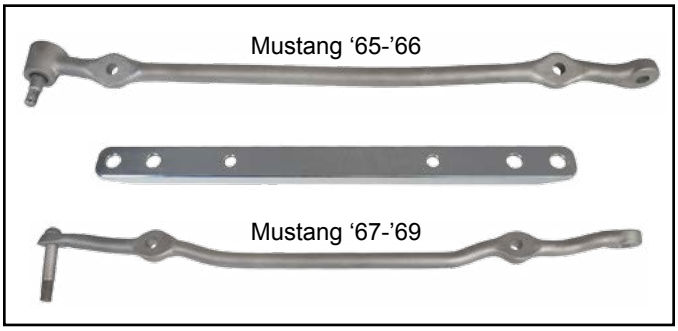
One of the most important characteristics of a steering system is steering box travel. The amount of travel directly affects the vehicles ability to turn sharp enough to maneuver in tight places. The TCP rack and pinion duplicates the factory system travel of 6-3/8".

OEM manufacturer's rack and pinions are generally designed for later vehicles with shorter steering arms which have a shorter travel requirement, typically 5-1/2". Consequently, most late model racks are not built with adequate travel for a classic application. Using an OEM rack in a classic application will increase vehicle turning radius.

2 - Steering column must provide adequate header clearance

Our unique, patented rack design positions the gearbox against the drivers frame rail similar to the original steering box. Steering shaft and universal joints remain close to the frame rail providing much more header clearance than a conversion kit using an OEM style rack. OEM style kits put the steering box connection beside the oil pan greatly increasing header installation problems. We offer the most available room for aftermarket headers and exhaust systems of any available steering conversion for classic Fords.

3 - Correct steering geometry must be maintained



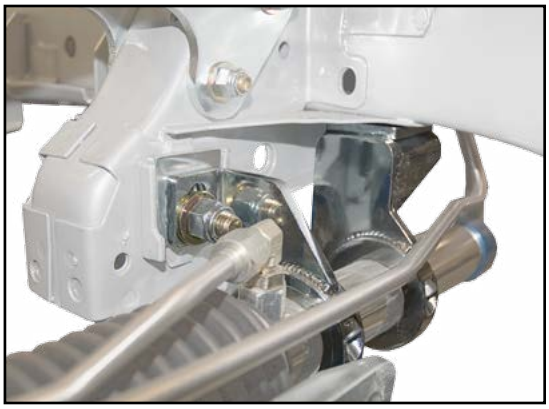
Correct center link position is extremely critical to steering geometry and any deviation from this position will result in "Ackerman" problems and "bump steer". Ackerman is a difference in steering angle between the front wheels, with the inside tire turning at a sharper angle to follow a tighter radius. Incorrect Ackerman geometry leads to excessive tire wear and poor cornering. Bump steer is a change in toe during suspension travel due to incorrectly placed tie rod pivot points. Avoiding these problems can only be accomplished by using a center-take-off rack, which uses a center link as the inner tie rod attachment point. This is the only style of rack that allows the exact duplication of the stock inner tie rod positions. The physical limitations of standard OEM end take off racks, which position the inner tie rods outboard of the gear box, do not allow duplication of the required dimensions.

4 - Installation must not decrease ground clearance

In a successful effort to maximize ground clearance our rack takes the place of the factory tubular cross-member at the rear of the oil pan. Different length brackets are used depending upon engine type to keep the rack above the lowest portion of the oil pan sump but allow clearance above for high capacity aftermarket pans. Other rack conversions decrease ground clearance and actually are the lowest point of the car. This would allow the rack to touch the ground when going over speed bumps or in the event of a flat tire.

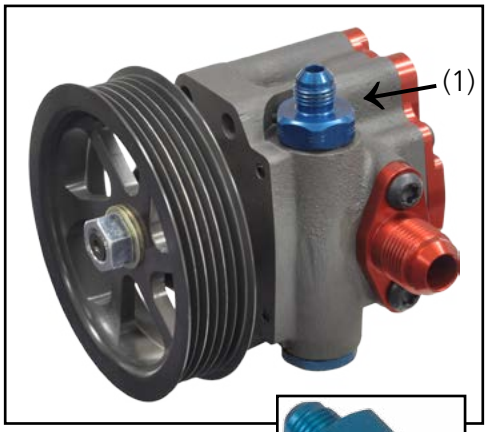
5 - Frame stiffening crossmember is required

Once installed, the rack replaces the factory structural crossmember and provides an improvement over the original design. Our rack and pinions main structure is a straight length of steel tubing, 20% larger in diameter than the original factory brace; stronger in both compression and torsion. The rack tube in other racks were not designed as structural components and are not strong enough to act as a crossmember. Four mounting brackets secure to the original frame rail location and directly to the lower control arm mounts. Joining the vertical and horizontal mounting planes through the rack improves consistency of the lower control arm suspension and inner tie rod steering geometries.

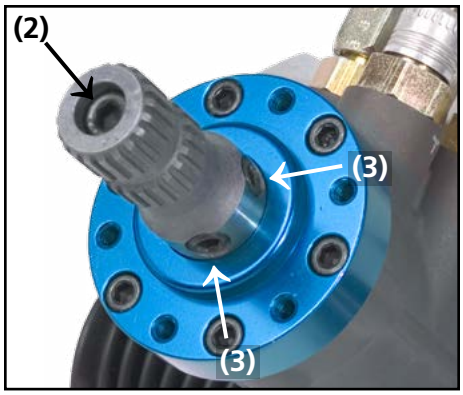


6 - System must allow comfortable road feel

The TCP rack and pinion offers superior road feel over factory and other aftermarket steering systems due to its simple and efficient design. A key difference is the use of straight-cut gears as opposed to helical (angled) gears found in OEM racks. Straight-cut gear teeth have the benefit of directly driving the rack gear in the desired direction. Helical gears use a sliding action across multiple contact surfaces that increase friction and wear. This contact angle also wastes some of your steering effort into forcing the pinion gear in and out of the gear box, which adds additional friction and wear.

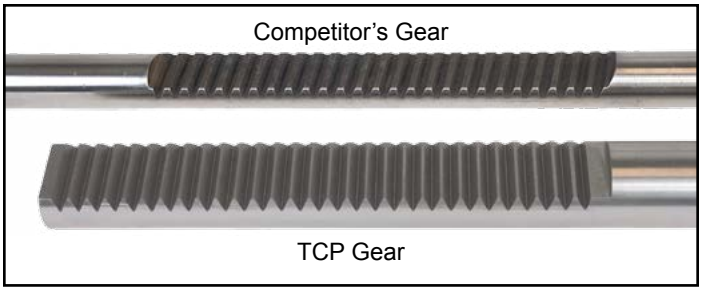


Three elements of our power steering system enable the level of assist to be varied to meet individual driver needs. The system can be adjusted to have low effort at the steering wheel for easy maneuvering in mostly low speed conditions. For high speed driving and racing the steering effort can be increased to give the driver improved road feel through increased feedback. Initially set at the middle of our required range, the power steering pump output flow valve (1) can be easily changed to provide eight additional assist levels. Settings outside the range of the flow valves can be accomplished by changing the internal torsion bar (2), shifting the base point of the tuning range. Many vehicles have a tendency to drift right or left while going straight. The causes for this are numerous and many cannot be resolved. To solve this problem, steering bias can be adjusted to perfectly center itself with a simple adjustment on the servo (3).



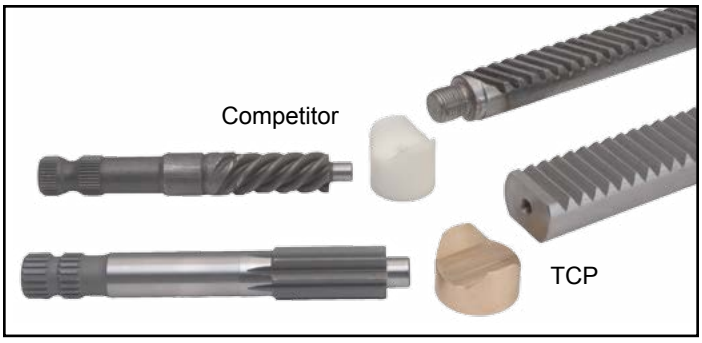
Additional Exclusive Features

Unmatched Component Strength



The rack and pinions internal components were designed to exceed durability levels of competitor and OEM steering systems. The overall strength of the gears is greatly increased by using a 30° pressure angle. This difference creates a 60% broader gear tooth base and avoids undercutting the pinion gear teeth common on OEM racks. For ultimate strength and wear resistance, pinion gears are manufactured from 4150 chrome-molybdenum alloy steel. Rack gears are built from high-quality alloy steel and feature a 25% larger diameter than any OEM or aftermarket rack in our immediate market. As a result the gear tooth contact surfaces are also increased in size and load capability.

True Performance Steering



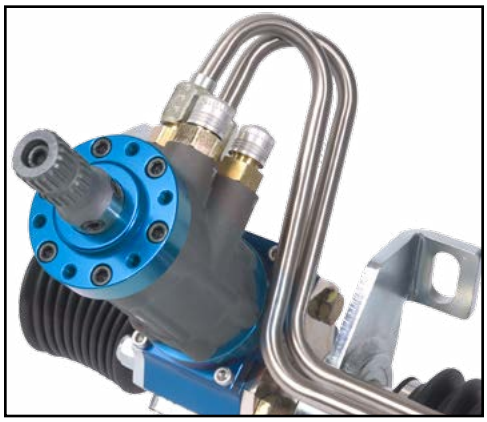
The TCP rack and pinion boasts the quickest steering ratio in our market with a responsive 2.09" per turn and three turns lock-to-lock. A 25-50% increase in travel per turn is realized over the factory standard 4-5/8 turn and performance 3-3/4 turn systems. Steering response is more in-line with that of a modern sports car truly bringing enjoyment to the act of driving your classic.

To maintain precise gear lash a unique springless system is used. Standard OEM racks use spring pressure against a plastic bushing to remove any slack between gears. This constant pressure adds friction and increases component wear. Our system uses a bronze bearing for reduced wear and minimal friction. The bearing is positioned by an adjustable mechanism to precisely maintain correct gear lash without adding resistance to the steering. This method is superior in efficiency, wear and support against gear separation.

Center Link Stability

Fastened directly into the rack gear is the billet steel center link, by means of two specially machined studs. To create a stable attachment area, spacing between the studs is increased to nearly four times the spacing found on competitors' adapted center-take-off racks. Forces from the tie rods produce torque centered on the center link attachment points. Center links with closely mounted studs provide little support allowing deflection in the steering system and reduced responsiveness. The distance between the TCP studs is greater than the unsupported length of the center link and reduces the mechanical leverage of the tie-rods.

Perfect Power Steering



The complete power steering system is designed with matched fluid volumes, flow rates and pressure requirements to deliver a tight, responsive feel with adequate feedback. This balance of feedback and assist is not possible with any combination of OEM pumps or steering units. OEM flow rates and pump output response curves provide over-assisted non-linear steering. All hydraulic components with the exception of the pump and reservoir are integral to the rack and pinion assembly; completely eliminating externally mounted units and leaky flexible hoses. Fluid is transferred through stainless steel hardlines to the internal hydraulic cylinder minimizing any loss of pressure from hose flex. All fittings and lines are routed on top of the rack and pinion to reduce risk of damage from road debris.

Included Components for Factory Columns

Vehicle specific installation kits are available for use of factory or aftermarket steering columns.

Non-collapsible steering columns were in use from 1960 through early 1967. Most vehicle's column tube and steering shaft were supported directly by the steering box. Rack installation requires the column tube be shortened, steering shaft replaced and the addition of a firewall mount. The remaining early 1967 vehicles featured a shortened column tube, factory firewall mount and rag-joint but remained non-collapsible. These applications are supplied a correct length steering shaft with roller bearing assembly (Photo 1) and pivoting firewall mount with factory seal (Photo 2). Non-collapsible tilt or swing-away columns must upgrade to factory collapsible or aftermarket columns.

Late 1967 through 1970 steering columns feature a slip-fit collapsible steering shaft and can be identified by measuring the 1" diameter shaft above the rag-joint. A replacement lower slip shaft, roller bearing assembly and firewall seal (Photo 3) is provided.

All installations also receive an intermediate steering shaft kit with needle bearing universal joints. Various u-joint sets are available to accommodate major aftermarket column manufacturers and high-misalignment applications (Photo 4).

Photo 1

Photo 2

Photo 3

Photo 4

Rack & Pinion Applications

Model	Year
Comet	1960-1965
Cougar	1967-1973
Falcon	1960-1965
Mustang	1964-1973
Ranchero	1960-1965

Part Number	Description
TCP RCKMS-FD	Manual Rack for Stock (OEM) Column
TCP RCKMA-FD	Manual Rack for/with Aftermarket Column
TCP RCKPS-FD	Power Rack for Stock (OEM) Column
TCP RCKPA-FD	Power Rack for/with Aftermarket Column
7900-210	Replacement Boot Set w/ Stainless Tie Wraps

1967 only:

Early: Column tube covers steering shaft completely or exposed shaft above rag joint is 3/4" diameter. Tilt and swing-away columns must upgrade to 1968 or later column.

Late: Exposed shaft above rag joint is 1" diameter.

Components

Power Steering Pump Kit

Our aluminum body power steering pump offers consistent output throughout the entire RPM range unlike OEM pumps whose output increases with RPM's. Direct bolt-on kits are available for rack and pinion supported vehicles equipped with standard OEM engines. Alternate engine combinations can be supplied with a universal mounting bracket blank that requires machining prior to installation.

For more information regarding the pump and available options please refer to Power Steering Pump Kits Data Sheet (PSP_DS).

Engine Family	Specific Block
Windsor	260, 289, 302, 351W
Cleveland	351C, 400
FE	390, 427, 428
Universal	6" x 6" blank bracket

Kits Includes:

Pump: with V-belt or Serpentine pulley
Bracket: 289, 302, 351W, 351C, 400, 390, 427, 428, Universal
Hoses: Stainless Braided
Hose Ends: Steel Field Attachable
Reservoir: Welded or Billet Aluminum

Aftermarket Tilt Columns

Aftermarket, five-position, tilt steering columns are optional with the rack and pinion package. Column lengths are specific to our rack and pinion installation and provide improved universal joint alignment compared to competitors aftermarket columns. All columns have the stock Ford steering wheel spline, 11/16-36. The spline at the steering column shaft is 3/4-36. Columns are available in three finfishes, paintable, black powder coated or chrome plated. Electrical connectors and floor mounts are also included.

Columns can also be purchased separately for use with the rack and pinion call for part numbers.

Paintable Steel

(1964-1966 shown)

Chrome Plated Steel

(1967 shown)

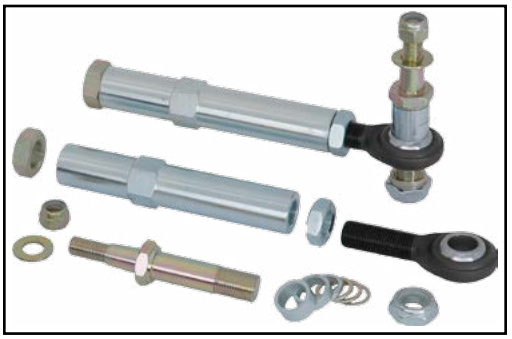
Black Powder Coat

(1968-1969 shown)

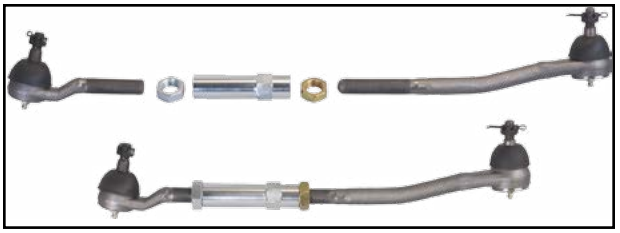
Application	Description
1964-1966 Mustang	Paintable Tilt Column Stock Steering Wheel Spline
1967 Mustang/Cougar	Paintable Tilt Column Stock Steering Wheel Spline
1968-69 Mustang/Cougar	Paintable Tilt Column Stock Steering Wheel Spline
OPTIONS	Black Powder Coated
	Chrome Plated
Note	Aftermarket columns are not compatible with Rally-Pac gauge pod.

Billet Adjuster Sleeve and Bump Steer Options

Tie Rod Adjuster Sleeve Kits are offered as an option when purchasing the rack and pinion. Kits can also be purchased separately for use with stock steering systems. Each kit features our heavy duty billet tie rod adjuster sleeve which replaces the factory stamped steel, split tube design. The seamless sleeve features a 1" hex to facilitate precise toe adjustment and tightening of the zinc plated jam nuts.



Bump Steer Kits feature an extended billet adjusting sleeve, high strength 4130-body rod end, and a selection of shims. The shims enable vertical adjustment of the outer tie rod pivot point at the steering arm. This added adjustment variable allows the vehicles suspension travel toe-in characteristics to be altered for improved steering predictability.



Additional OEM steering system applications are listed on their respective data sheets.

Model	Year	Bump Steer Outer Only	Bump Steer Inner & Outer		Adjuster Sleeve Only*	Billet Sleeve with Inner & Outer	
			For OEM Spindle	For TCP Spindle		For OEM Spindle	For TCP Spindle
Comet	1960-1962	TIER-08	TIER-11[1]	TIER-14[1]	-	TIER-05[1]	TIER-16[1]
	1963-1964	TIER-08	TIER-11[1]	TIER-14[1]	TIER-04	TIER-05[1]	TIER-16[1]
	1965	TIER-08	TIER-11[1 or 2]	TIER-14[1 or 2]	TIER-04	TIER-05[1 or 2]	TIER-16[1 or 2]
Cougar	1967-1969	TIER-09	TIER-12	TIER-15	TIER-04	TIER-06	TIER-17
	1967-1969 (Eliminator)	TIER-10	TIER-13	TIER-13	TIER-04	TIER-07	TIER-07
	1970-1973	TIER-10	TIER-13	TIER-13	TIER-04	TIER-07	TIER-07
Cyclone	1964	TIER-08	TIER-11[1]	TIER-14[1]	-	TIER-05[1]	TIER-16[1]
	1965	TIER-08	TIER-11[1 or 2]	TIER-14[1 or 2]	TIER-04	TIER-05[1 or 2]	TIER-16[1 or 2]
Falcon	1960-1962	TIER-08	TIER-11[1]	TIER-14[1]	-	TIER-05[1]	TIER-16[1]
	1963-1964	TIER-08	TIER-11[1]	TIER-14[1]	TIER-04	TIER-05[1]	TIER-16[1]
	1965	TIER-08	TIER-11[1 or 2]	TIER-14[1 or 2]	TIER-04	TIER-05[1 or 2]	TIER-16[1 or 2]
Mustang	1964	TIER-08	TIER-11[1]	TIER-14[1]	-	TIER-05[1]	TIER-16[1]
	1965-1966	TIER-08	TIER-11[1 or 2]	TIER-14[1 or 2]	TIER-04	TIER-05[1 or 2]	TIER-16[1 or 2]
	1967-1969	TIER-09	TIER-12	TIER-15	TIER-04	TIER-06	TIER-17
	1969 (Boss)	TIER-10	TIER-13	TIER-13	TIER-04	TIER-07	TIER-07
	1970-1973	TIER-10	TIER-13	TIER-13	TIER-04	TIER-07	TIER-07
Ranchero	1960-1961	TIER-08	TIER-11[1]	TIER-14[1]	-	TIER-05[1]	TIER-16[1]
	1962-1964	TIER-08	TIER-11[1]	TIER-14[1]	TIER-04	TIER-05[1]	TIER-16[1]
	1965	TIER-08	TIER-11[1 or 2]	TIER-14[1 or 2]	TIER-04	TIER-05[1 or 2]	TIER-16[1 or 2]

Footnotes	
All	Not for use with Granada spindles.
*	Verify each shaft diameter and sleeve length prior to ordering. (Shaft = .688"; sleeve = 4.7")
1	Installation requires TCP rack and V8 spindles
2	V8 with OEM manual steering

All prices subject to change. Current pricing available at www.cachassisworks.com.

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