

Exclusion of Warranty

The items in this catalog are intended for use in motorsport competition, i.e. AUTO RACING. No warranty of these components, express or implied, is offered by Woodward Machine Corporation or its subsidiaries, for the following reasons, among others:

(1) Motorsport is inherently dangerous. The conditions of end use of the components are normally hazardous and unpredictable, and are entirely beyond our control; and

(2) The decision as to the suitability of said components for a particular manner of use, or in a particular installation, is made by the user and is likewise beyond our control; and

(3) The application of said components is therefore understood to be experimental.

Liability of Woodward Machine Corporation is therefore limited to the replacement or repair, at our option, of any of our products that we find, upon our inspection, to be defective in materials or workmanship, specifically excluding items damaged as a result of collision, misuse, or neglect.

Warning: The approval of your state department of motor vehicles or your country's Ministry of Transport or other relevant authority, for the use of racing equipment on the public highways should not be assumed. Woodward Machine Corporation does not support nor participate in efforts to obtain such approval. The end user is responsible for not utilizing Woodward racing components in any manner which may contravene local law.

Original Equipment Manufacturers installing Woodward components in vehicles licensed for use on the public highways are responsible for complying with all applicable safety standards.

Purchasers of Woodward equipment for use in race cars subject to homologation by a sanctioning body, e.g. FIA, NASCAR, IMSA, SCCA, etc. are responsible for ensuring that the equipment does in fact conform to current rules.

DOMESTIC AND INTERNATIONAL PRICING:

The prices published in this catalog are in US Dollars and apply to all purchases made with Visa, Mastercard, Discover, or American Express cards, whether issued by US or foreign banks.

Surcharges, previously necessitated by unpredictable and exorbitant fees charged by the credit card brands for processing sales across international borders, no longer apply.

Credit card sales are invoiced and shipped by our subsidiary Racor, Inc.

Business-to-business purchases arranged directly with Woodward Machine Corporation are payable by bank wire transfer.

Please note that any customs duties or clearance fees imposed by the destination country are the responsibility of the recipient. We will gladly include your VAT registration number on the shipping documents but we do not collect or remit taxes.



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PACKAGING FOR INTERNATIONAL SHIPMENT:

In some cases, international air freight imposes more stringent requirements for packaging. Should this be necessary, any extra cost will be included in our freight quote.

OUR STANDARD FREIGHT CARRIERS AND INSURANCE:

We ship via Federal Express or United Parcel Service, FOB our plant in Mills, Wyoming. Next Day Air and Early AM delivery are available at extra cost for most ZIP codes in the continental US, as is Saturday delivery. Freight insurance is provided free by the carrier up to USD100.00 value, and rises on a very reasonable sliding scale. We ship everything insured for its full value. We can also ship freight collect on your FedEx or UPS account. *We do not ship via Postal Service, as delivery cannot be guaranteed and if your parcel is lost or undelivered it is difficult or impossible to obtain compensation.*

Orders for parts in stock will generally ship the same day if received before noon Mountain Standard Time.

USING OTHER CARRIERS:

Alternatively, we can hold for pickup by the carrier of your choice. However, in these cases we cannot create waybills or submit the export declaration electronically. If your carrier requires that we manually complete their shipping documents we will have to charge for the time. Also, you should be aware that freight companies not having a base of operations in the US will subcontract the pickup to UPS or FedEx and sometimes this can add a week or more before the parcel can actually be placed in transit.

RETURNS OF MERCHANDISE, DOMESTIC:

Returned parts may be subject to a charge of up to 20% to defray the cost of inspection, restocking, and repackaging. Returned merchandise must be unused, unmarked and not over 30 days old. We will make adjustment via exchange or credit only. Special order parts, damaged or rusted parts, or "basket cases" are not returnable except in connection with repair orders.

RETURNS OF MERCHANDISE, INTERNATIONAL:

Make absolutely sure to specify in the customs declaration that you are returning goods *manufactured in the U.S.* If this is not done and we receive a bill for import duties, it will be charged to your account.

SPECIAL ORDER PARTS:

Most of the parts in this catalog section are manufactured on a made-to-order basis. Please note that parts built or assembled to customer specifications are generally specialized enough to be otherwise unsalable, and consequently these are not returnable.

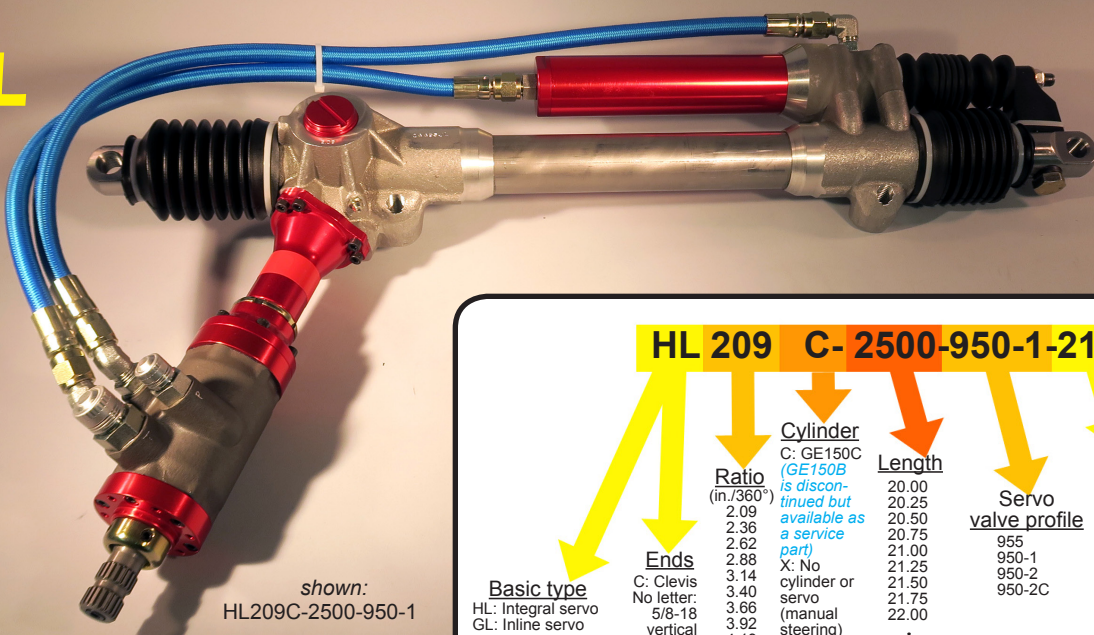
Type GL and HL Power Racks, lengths 20 inches and up

Power steering with **integral** or **inline** servo; **road racing** and **custom car** applications

HL and GL racks are functionally identical, but the integral-servo configuration of an HL eliminates the extra u-joint and coupler needed with an inline servo. In cases of component interference, the servo can be easily separated from an HL rack and mounted inline. The VA900 series servo is supplied as standard.

Standard rack lengths range from 20.00 inches up to 31.50 inches in .25 inch steps. The "length" of a rack and pinion steering is defined as THE DISTANCE BETWEEN THE SPHERICAL CENTERS OF THE INNER TIE ROD ENDS. This dimension is one of the most critical on an automobile. If it is incompatible with the car's front end geometry, or if the rack is mislocated, suspension travel will cause the car to steer without input from the driver. This should be thoroughly researched before specifying the rack length. The housing is always proportional to the rack length, i.e. the housing of a 25.50 inch rack will be .50 longer than the housing of a 25.00 rack.

Gear ratio choices are 2.09, 2.36, 2.62, 2.88, 3.14, 3.40, 3.66, 3.92, 4.19 and 4.45 per 360°. If the full 6 inches travel is to be used, these would be divided into 6 to get the number of turns lock to lock, e.g. a 2.09 gearset will give 6/2.09, or 2.87 turns, a 3.14 gearset 6/3.14 or 1.91 turns.

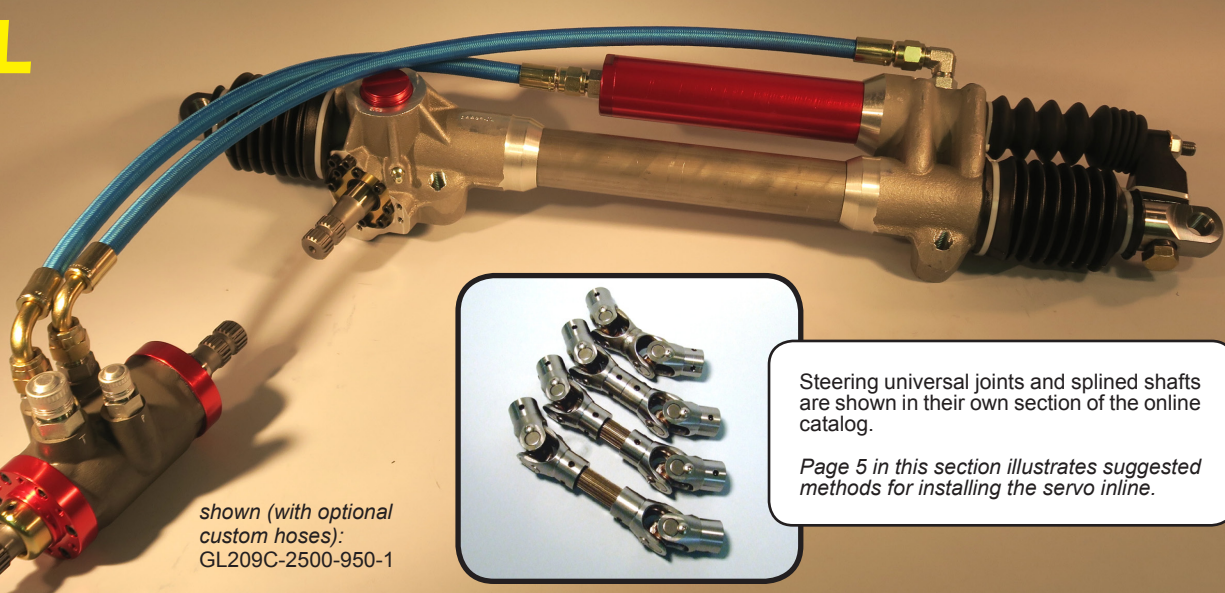


Type HL

shown:
HL209C-2500-950-1


HL 209 C- 2500-950-1-210

	Ratio (in./360°)	Cylinder C: GE150C <i>(GE150B is discontinued but available as a service part)</i>	Length	Servo valve profile	Servo torsion bar
<p>Basic type HL: Integral servo GL: Inline servo</p>	<p>Ends C: Clevis No letter: 5/8-18 vertical hole</p>	<p>X: No cylinder or servo (manual steering)</p>	<p>20.00 20.25 20.50 20.75 21.00 21.25 21.50 21.75 22.00 31.50</p>	<p>955 950-1 950-2 950-2C</p>	<p>TB180 TB185 TB190 TB195 TB200 TB205 TB210 TB215 TB220 TB225 TB230 TB240</p>



Type GL

shown (with optional custom hoses):
GL209C-2500-950-1



Steering universal joints and splined shafts are shown in their own section of the online catalog.

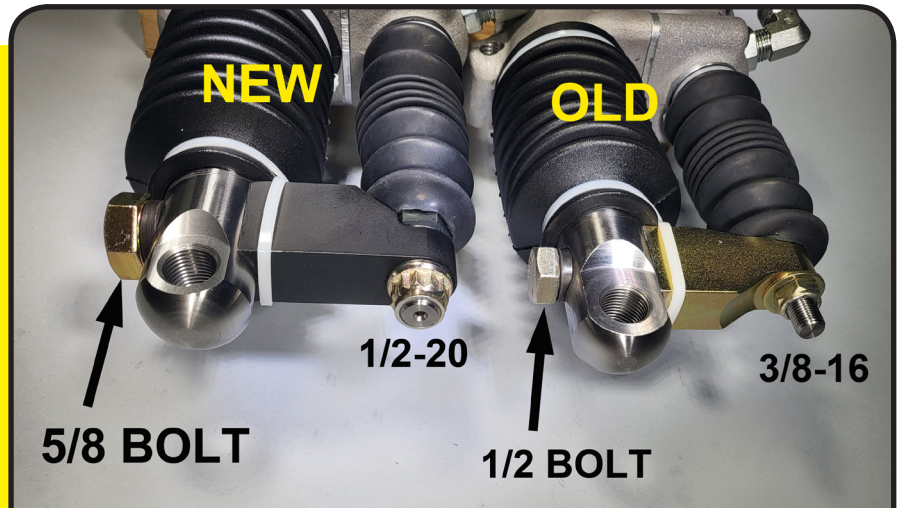
Page 5 in this section illustrates suggested methods for installing the servo inline.

Rack End Styles:

Vertical 5/8 bolt

The old "standard" vertical bolt hole has been updated to a much stronger design capable of handling elevated pump pressure. The end of the rackshaft is now thicker to accommodate a thicker rod bracket and larger 5/8 through bolt.

The cylinder is now the same as that used on clevis racks, with the larger 1/2-20 threaded end. The boot is retained by a flanged nut with an internal taper which locks it squarely to the piston rod for very high rigidity.



Ratios typically used for road racing:

GL209C-2100 thru -3150.....	1559.58	HL209C-2100 thru -3150.....	1610.58
GL236C-2100 thru -3150.....	1559.58	HL236C-2100 thru -3150.....	1610.58
GL262C-2100 thru -3150.....	1559.58	HL262C-2100 thru -3150.....	1610.58
GL288C-2100 thru -3150.....	1559.58	HL288C-2100 thru -3150.....	1610.58
GL314C-2100 thru -3150.....	1559.58	HL314C-2100 thru -3150.....	1610.58

Quick ratios for autocross:

GL340C-2100 thru -3150.....	1581.00	HL340C-2100 thru -3150.....	1632.00
GL366C-2100 thru -3150.....	1581.00	HL366C-2100 thru -3150.....	1632.00
GL392C-2100 thru -3150.....	1581.00	HL392C-2100 thru -3150.....	1632.00
GL419C-2100 thru -3150.....	1581.00	HL419C-2100 thru -3150.....	1632.00
GL445C-2100 thru -3150.....	1581.00	HL445C-2100 thru -3150.....	1632.00

Slotted Clevis

More conveniently adjustable for bump steer than the vertical bolt and solid standoff spacer, slotted clevises are normally supplied "SLOT UP," with one inch adjustment above center and 3/16 below center, but are also available with one or both ends inverted.

When ordering, specify SLOT UP or SLOT DOWN for left, right, or both ends. Clevis racks are complete with 5/8 RH rod ends using 1/2 inch bolts and hat spacers.

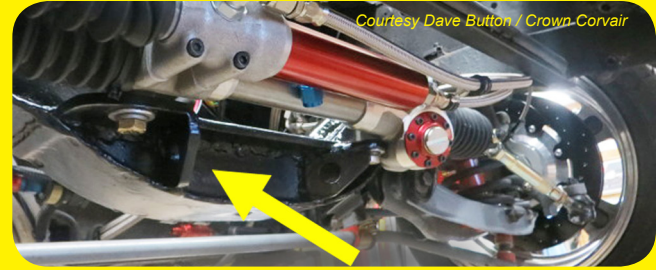
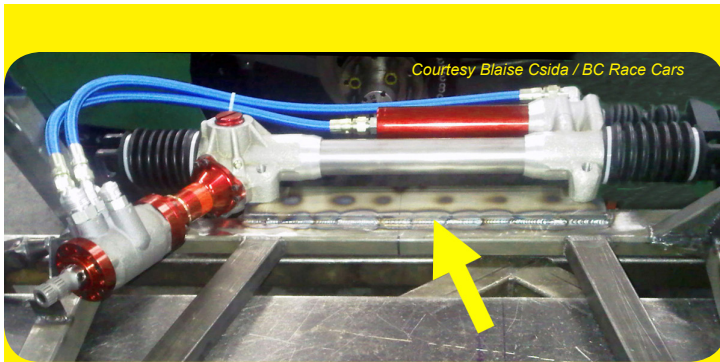


Ratios typically used for road racing:

GLC209C-2100 thru -3150.....	1636.08	HLC209C-2100 thru -3150.....	1687.08
GLC236C-2100 thru -3150.....	1636.08	HLC236C-2100 thru -3150.....	1687.08
GLC262C-2100 thru -3150.....	1636.08	HLC262C-2100 thru -3150.....	1687.08
GLC288C-2100 thru -3150.....	1636.08	HLC288C-2100 thru -3150.....	1687.08
GLC314C-2100 thru -3150.....	1636.08	HLC314C-2100 thru -3150.....	1687.08

Quick ratios for autocross:

GLC340C-2100 thru -3150.....	1657.50	HLC340C-2100 thru -3150.....	1708.50
GLC366C-2100 thru -3150.....	1657.50	HLC366C-2100 thru -3150.....	1708.50
GLC392C-2100 thru -3150.....	1657.50	HLC392C-2100 thru -3150.....	1708.50
GLC419C-2100 thru -3150.....	1657.50	HLC419C-2100 thru -3150.....	1708.50
GLC445C-2100 thru -3150.....	1657.50	HLC445C-2100 thru -3150.....	1708.50

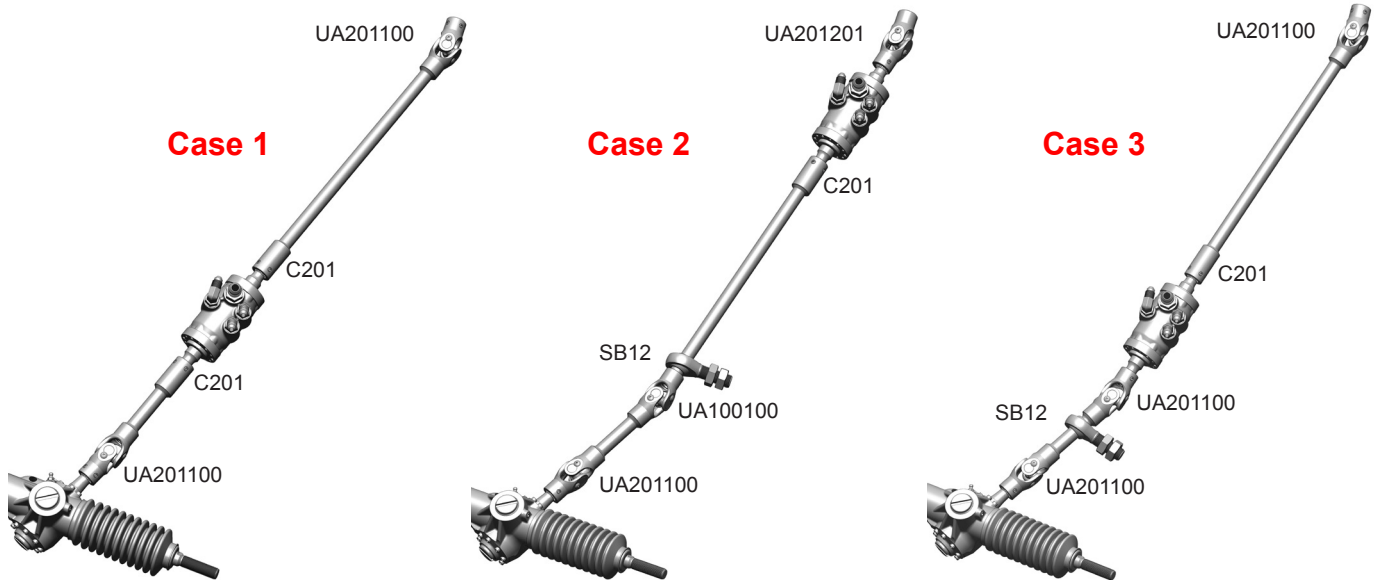


Mounting HL and GL Power Racks:

Shown above are two excellent examples of rack mount fabrication. Type GL/HL power steering racks feature highly convenient attachment with two 1/2-13 bolts screwed directly into the housing from underneath. Unlike their manual counterparts, however, these racks are capable of applying tremendous force in the axial direction, much like a "Porta-Power" body and frame straightening jack. In any application requiring high-powered steering, the chassis attachment pads should be heavy enough to prevent the rack from elongating the bolt holes. Reinforcing the individual tabs may not be enough, as these racks have been known to stretch a lightweight crossmember. If not restrained by the structure of the chassis a GL or HL can actually force itself apart. To prevent the power assist from overpowering its own chassis attachment, use a single 3/8" plate with two holes (above left) or connect the tabs with a 3/8" bar (above right).

Installing a servo inline:

As opposed to having it bolted directly to the rack, placing the servo in the steering shaft has the advantage of (1) relocating its weight farther to the rear, and (2) clearing otherwise unavoidable obstacles such as a left-side fuel pump or dry-sump oil pump, or just a forward-mounted engine with a wide pan rail. Separate and integral servos function identically. Because the servo uses steering shaft torque to open its spring-loaded valve and control the power assist, it can from a strictly mechanical viewpoint be located at any point between the pinion and the steering wheel. From a safety aspect, however, since it and its hoses contain hot pressurized oil it should always be isolated from the driver—preferably by a sealed firewall. The following are three proven installation schemes (hoses, firewall bearing, etc. are removed for clarity):



The simplest way to install a servo inline is to couple it into the intermediate shaft at any convenient point between the firewall bearing and the pinion. Since all the parts between the two u-joints are rigidly clamped together, the servo should be considered a solid part of the shaft.

It is not necessary to bolt the servo housing to the chassis nor restrain it against rotation; its torque reaction is internal.

Since the two u-joints in this case are at opposite ends of what is essentially a single shaft, their yokes should be *in phase*, i.e., aligned like the opposite ends of a driveshaft.

If it is impossible to reach the pinion in a straight line from the firewall bearing, the intermediate shaft can be divided with a third universal joint. Because this u-joint is not connected to a fixed object (such as the firewall or the steering gear) it must be stabilized—as close to the joint as possible. In this instance an SB12 bearing is used on the upper section, but it could just as well be used on the lower, depending on which location were easiest to provide with a suitable mounting tab.

Note that the u-joint yokes on the lower shaft section are in phase. The servo is effectively part of the upper shaft section and its u-joint yokes should also be in phase.

Here the Servo is again part of the upper section of a two-piece intermediate shaft, but is placed at its lower end, alongside the engine block. In this instance an SB12 bearing stabilizes the u-joint from the lower shaft section because the servo occupies the upper section.

Again, note that the u-joint yokes on the lower shaft section are in phase. The servo in this case remains part of the upper shaft section, and those u-joints should also be in phase.