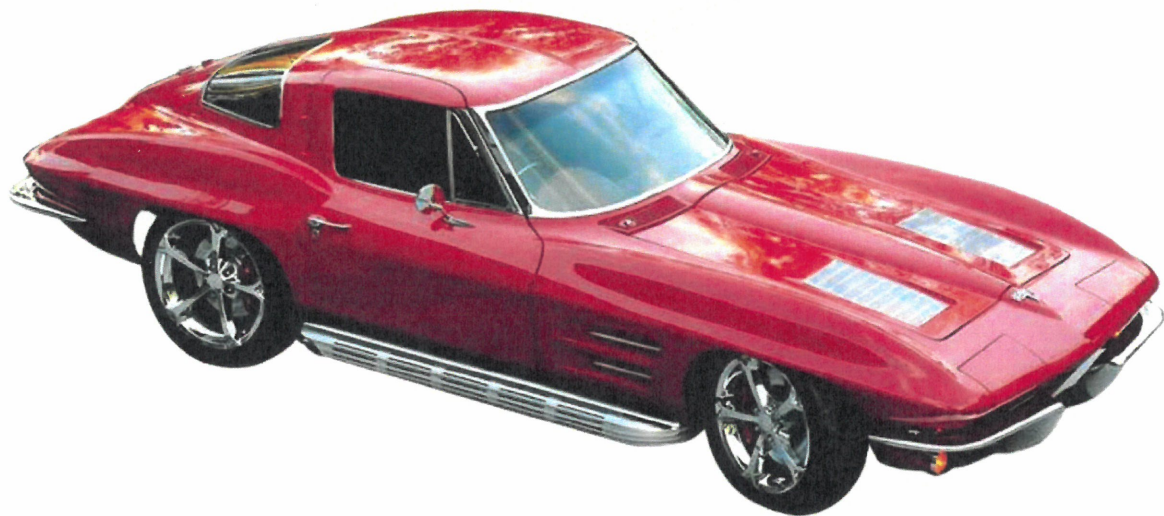


MAVAL

MAVAL INDUSTRIES, LLC
POWER STEERING UNITS & PUMPS
PRODUCT PERFORMANCE & DIAGNOSTIC GUIDE



STEERING OUR WAY ACROSS AMERICA

MAVAL

COMPANY HIGHLIGHTS



MAVAL Headquarters in Twinsburg, Ohio

Established in 1987 by four former TRW Automotive executives, **MAVAL INDUSTRIES, LLC** has positioned itself as a market leader in the remanufacturing and manufacturing of steering systems and related components for the automotive, off-road, performance and specialty vehicle markets.

Within the marketplace for remanufactured automotive steering systems, particularly the “import” service market, **the MAVAL brand is recognized for providing the highest levels of quality, reliability and performance.** Within the off-road, performance and specialty vehicle markets, **MAVAL has grown to become the largest custom steering system manufacturer in North America.**

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COMPANY HIGHLIGHTS

- First independent remanufacturer to be awarded QS9000/ISO-9001 Quality System Certification.
- Largest specialty steering system supplier in North America: Remanufactured “import”, custom & new off-road steering system applications.
- Current/past quality approvals & supply agreements with the following vehicle & parts manufacturers



• 250 Employees



• 135,000 sq. ft. production/warehouse facility in Ohio, along with production facilities in China & India.



• All remanufactured parts produced in Ohio

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The logo consists of the word "MAVAL" in white, bold, sans-serif capital letters, centered within a solid green rectangular background.

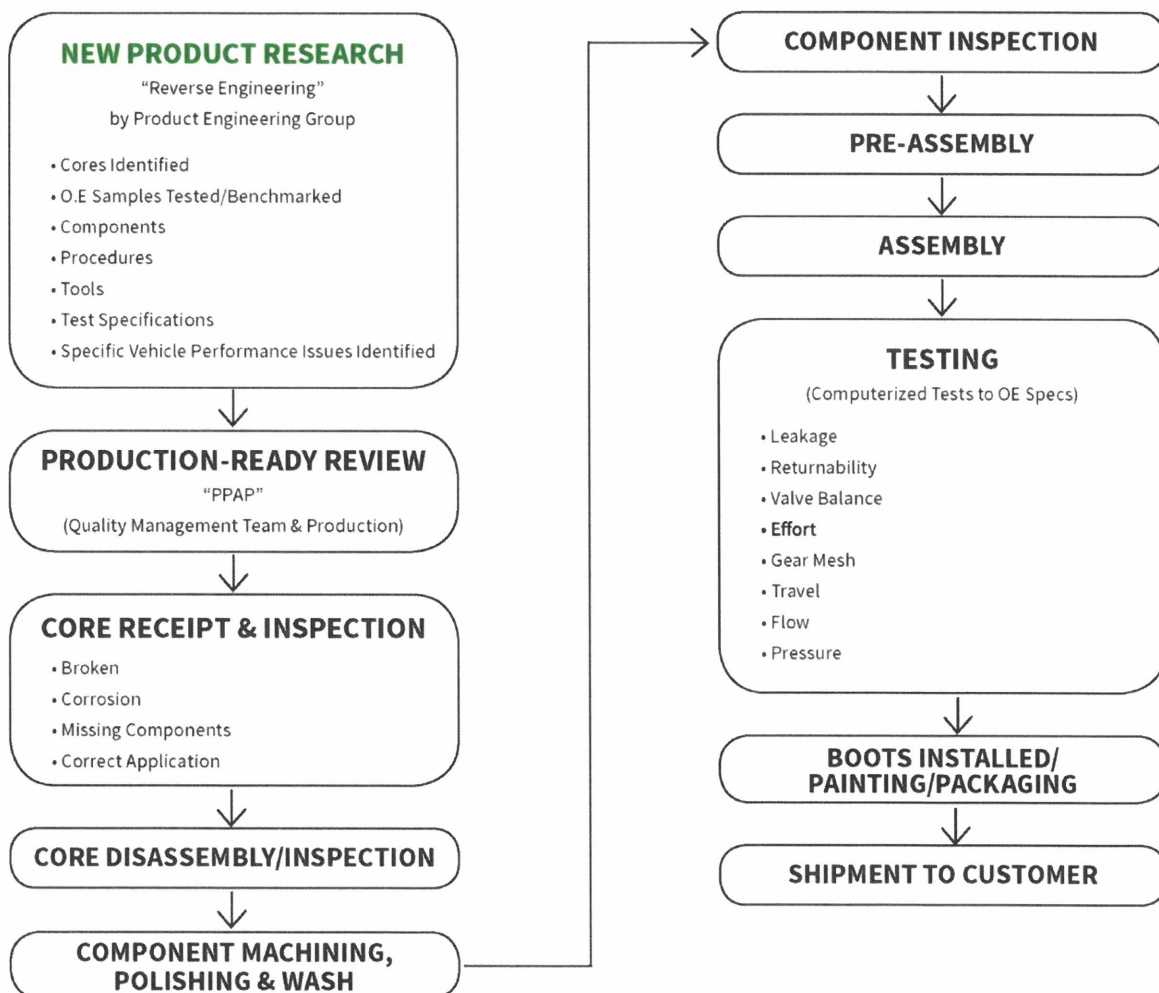
PRODUCTS PRODUCED & SUPPLIED

- Remanufactured Power Rack & Pinion Steering Units
- Remanufactured Power Steering Pumps
- Remanufactured Power Steering Gear Boxes
- New and Remanufactured Manual Steering Units
- Specialty Performance Steering Units (Power & Manual)
- Steering Shafts & Columns
- New Power Steering Pumps
- Electric Power Assist Units (New & Remanufactured)
- Steering Linkage Components
- Miscellaneous Components/Systems

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REMANUFACTURED PARTS PROCESS SUMMARY

"TOTAL QUALITY SYSTEM"



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TARGET QUALITY MEASUREMENTS

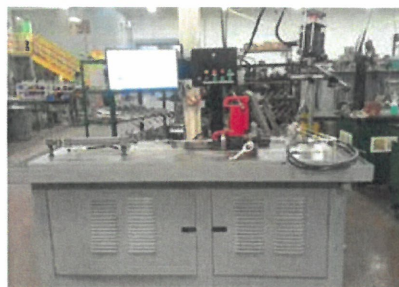
REMANUFACTURED STEERING SYSTEMS (SERVICE PARTS)

- External Leakage
- Internal Leakage
- Returnability
- Valve Balance
- Effort
- Gear Mesh
- Travel
- Flow
- Pressure



NEW STEERING SYSTEMS (OE PRODUCTION)

- Gear Mesh
- Ratio/Travel
- Overall Length
- Mounting Bracket/Bolt Alignment
- Center Position
- Inner End Torque
- Spline Condition
- Weld Integrity
- Phasing



All tests on remanufactured steering units are performed with and without hydraulic fluid on computerized test stands. All units are tested to the OE Performance specifications with results stored by serial number.

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WARRANTY CLAIM ANALYSIS

ANALYSIS RESULTS

% OF UNITS RETURNED

Fluid contamination – <i>no power assist</i>	21.5%
No problem found – <i>noise related to air in system</i>	18.1%
Not a MAVAL unit	17.5%
Never out of box/not installed	13.1%
Disassembled	11.2%
Missing components	8.2%
Broken solenoids	5.2%
Lines reversed/stripped port threads	3.1%
MAVAL error	2.1%

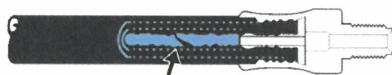
Results/findings based upon a 100% visual re-inspection and sample size re-test of units returned under warranty in 2017.

CONTAMINATION FLUSHING PROCEDURE

- Contamination in the hydraulic fluid and air in the system are the primary reasons for a lack of power assist and noise in steering systems.
- Given the average age of vehicles on the road, a complete inspection for contamination throughout the hydraulic system is required in order to insure proper service and product performance.
Contamination anywhere in the system will restrict the flow of hydraulic fluid, resulting in clogged pinion valve orifices and sticky pump valves, ultimately leading to system failure.
- To assess the level of contamination in the system, pour some of the hydraulic fluid through a napkin or coffee filter. If metal particles are seen, it is highly recommended that both the steering unit and pump be replaced, particularly if the system has been run dry.
- Inspect the condition of the hydraulic lines. It is recommended that any lines more than 10 years old be replaced, particularly if rubber particles have been discovered during inspection of the fluid. Moving “old” lines around during service can break off debris within the lines and re-contaminate the system.
- Disable the ignition to avoid possible damage to the starter motor and engine module during service.
- Disconnect the return line from the reservoir and place it into a drain pan. Fill the reservoir with new hydraulic fluid and crank the engine over slowly turning the steering wheel full cycle, making sure not to let the reservoir run dry. Always use the OE-recommended power steering fluid.
- Fill the reservoir several times with new fluid, running the fluid through a filter to insure the system is clean. If the fluid is not clean, continue the flushing process or replace the steering system components originally left on the vehicle that could still be contaminated.
- Reconnect the ignition and return line to the reservoir and proceed to bleeding the system of air.

HYDRAULIC LINE INSPECTION

POTENTIAL HYDRAULIC LINE ISSUES



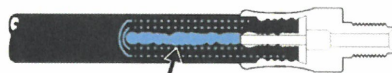
Peeling Inner Lining

Source of fluid contamination



Blisters

Pressure failure or slow loss of fluid.



Deteriorated or Dirty Inner Lining

Restricted flow of fluid.



Exterior Cracks or Deterioration

Pressure failure or slow loss of fluid.



Leaking Fitting

Slow loss of fluid, pressure failure.



Exterior Wear

Pressure failure or slow loss of fluid.

AIR BLEEDING PROCEDURE

- Many vehicles are equipped with a relatively small reservoir, along with a relatively long system of hydraulic lines between the steering unit and pump. In this configuration, particularly when the system has been depleted of fluid, it could appear that the reservoir level is correct, when in fact, due to pockets of air in the system, additional fluid is required.

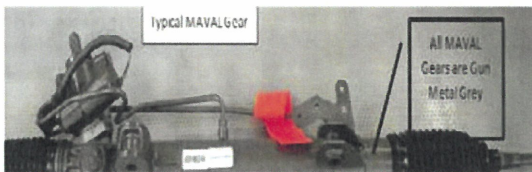
- In order to prevent aeration of the system from cavitation of the hydraulic fluid, **after the steering unit and/or pump have been installed, but prior to starting the vehicle**, the following steps must be taken:

- 1) Fill the power steering fluid reservoir.
- 2) Start the vehicle, **BUT DO NOT TURN THE STEERING WHEEL.**
- 3) You will note that the fluid level in the reservoir decreases. Re-fill the reservoir.
- 4) Slowly start to turn the steering wheel in both directions, monitoring the fluid level in the reservoir and adding fluid as necessary.
- 5) After all the air has been purged from the system, check the fluid level one last time and re-fill if necessary.

- Failure to follow the procedure outlined above will result in a lack of power assist and/or noise after the steering unit is serviced. If there is a lack of power assist and/or noise, let the car sit for a period of time then re-perform the steps outlined above.

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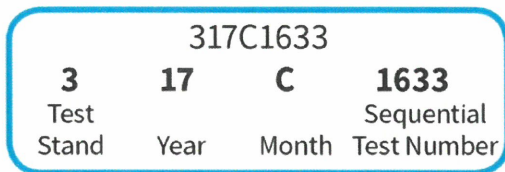
MAVAL PRODUCT IDENTIFICATION



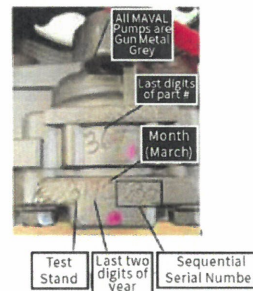
All units painted
Gun Metal Grey



MAVAL part number
etched into housing



MAVAL test serial number
etched into housing



Multi-color inspection/
process patches



“Remanufactured” warning and customer
part number labels

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MISC. TECHNICAL/ SERVICE ISSUES

SYMPTOM/ISSUE

POSSIBLE DIAGNOSIS

Never out of box/ Not Installed

Many vehicle manufacturers make running design changes within a given model year. This can result in minor appearance **differences between the unit on the vehicle and the one to be used in service.** Consult the instruction sheets included in each box. **Part number consolidations, appearance differences and specific installation tips** are outlined.

Disassembled/Missing Components

All components needed to install any service unit on the vehicle are included in every box. No credit will be issued for parts disassembled and/or missing components.

Broken Solenoids

Many vehicles are equipped with electronic solenoids that help govern the amount of assist generated for the vehicle. If these components are missing and/or broken, the unit will not perform properly.

Where the OE solenoid connectors are not available, MAVAL uses **a universal solenoid connector design that may look different, but performs just as the OE connector.** Consult the instruction sheet included in each box.

Lines Reversed/Stripped

Many vehicles have the same size pressure port threads and return lines. If the lines are reversed, the upper pinon seal will blow when the vehicle is started. All line fittings should be torqued to the proper OE specifications. Over tightening will strip the port threads and result in leakage from the lines. Consult the instruction sheets and warning labels included in each box.

TECH TIPS

- In order to prevent damage to the sensors, air bags or clock spring, make sure the steering wheel is locked in the straight ahead position before removing the input shaft coupler.
- After installation of a steering unit and the recommended wheel alignment, if so equipped, recalibrate the steering angle sensor and torque angle sensor. Refer to the OE Service Manual to confirm the procedures.



COMPETITOR PRODUCT COMPARISON

BENCHMARK QUESTIONS	MAVAL	PRODUCT A	PRODUCT B	PRODUCT C
Are all products produced using OE components or sourced through an OE supplier?	YES	?	?	?
Are all seals, O-rings, Teflon rings, bellows and rubber components new?	YES	?	?	?
Are all salvaged components inspected and machined to the OE specification using statistical process controls?	YES	?	?	?
Are all products tested to the OE performance specifications?	YES	?	?	?
Are all individual unit test results stored in a computer database for traceability?	YES	?	?	?
Do all units include solenoids and other related components required to insure proper performance on the vehicle?	YES	?	?	?
Do all units have a uniform, clean appearance in and out of the box?	YES	?	?	?
Has the supplier produced new steering systems for use in OE vehicle production?	YES	?	?	?
Does the supplier have multiple quality approvals from OE vehicle Manufacturers?	YES	?	?	?
Is the product produced in the US?	YES	?	?	?

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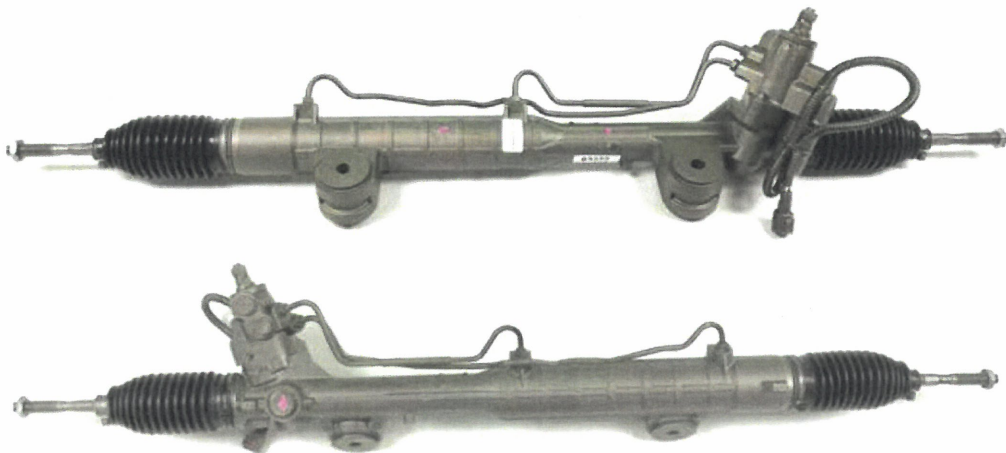
TOLL FREE TECHNICAL ASSISTANCE

1-866-943-2748

Extensions: 237 or 240

Instruction Sheets & Technical Service Tips available on our Website:

www.MavalGear.com



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