



*CERTIFIED • OEM QUALITY • RELIABILITY*

# **SUCCESS IN** FUEL DELIVERY SYSTEMS **FUEL PUMP MODULES**



PN: 79-708

[usmwpro.com](http://usmwpro.com)

## **OE REPLACEMENT FUEL PUMP MODULES**

### **USMW Professional Series**

*Fuel pump modules are manufactured with quality components*

- A.** POM plastic used for strength and durability
- B.** Thicker connector pins for increased reliability
- C.** Teflon insulated wires for superior chemical resistance
- D.** Nitrile or Viton used for rubber components for long life and fuel resistance
- E.** Stainless steel used for all metal components
- F.** Foam fuel float for increased reliability over molded type
- G.** Dual strainers for superior filtration  
Mounted internally and externally

### **OE Style Internal Fuel Pumps**

*USMW uses OE style fuel pumps rather than less expensive turbine units (where applicable). This ensures quality and performance that meets or exceeds OE standards.*

### **Palladium Silver Fuel Level Sensor**

- A.** The palladium silver is resistant to corrosion from ethanol and ethanol blended fuels
- B.** Level sensors also feature bifurcated contacts for long life and accurate fuel reading



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## FOREWORD

The purpose of this booklet is to provide a basic overview of the automotive fuel system with focus on the fuel pump/fuel pump module. This includes information on how to avoid common causes for fuel system failures as well as best practices for fuel pump replacement. Information in this booklet can also assist in determining the possible causes and validity of a warranty claim on an automotive fuel pump.

**A. Can**

High quality conversion coating used for superior resistance to corrosion

**B. Permanent Magnet**

Alnico, neodymium, or tombarthite permanent magnets for the best performance and resistance to temperature

**C. Armature**

Pure copper windings and soldered connections for best performance

**D. Commutator**

Pure copper commutator for gasoline applications and carbon commutator for ethanol applications

**E. Brushes**

High quality carbon brushes for long life and optimum performance

**F. Brush Springs**

High silicon steel coil springs that are specifically wound to prevent binding

**G. RF Suppressor**

OE style RF suppression to prevent radio noise and sensor interference

**H. Inlet Housing**

Precision molded plastic with brass jet port for durability

**I. Pump Mechanism**

Powerful OE style pump mechanisms for maximum performance and life. Roller vane gerotor, turbine, and peripheral styles available

**J. Flux Ring**

Internal steel flux ring concentrates the magnetic field from the permanent magnets

**K. Brush Holder**

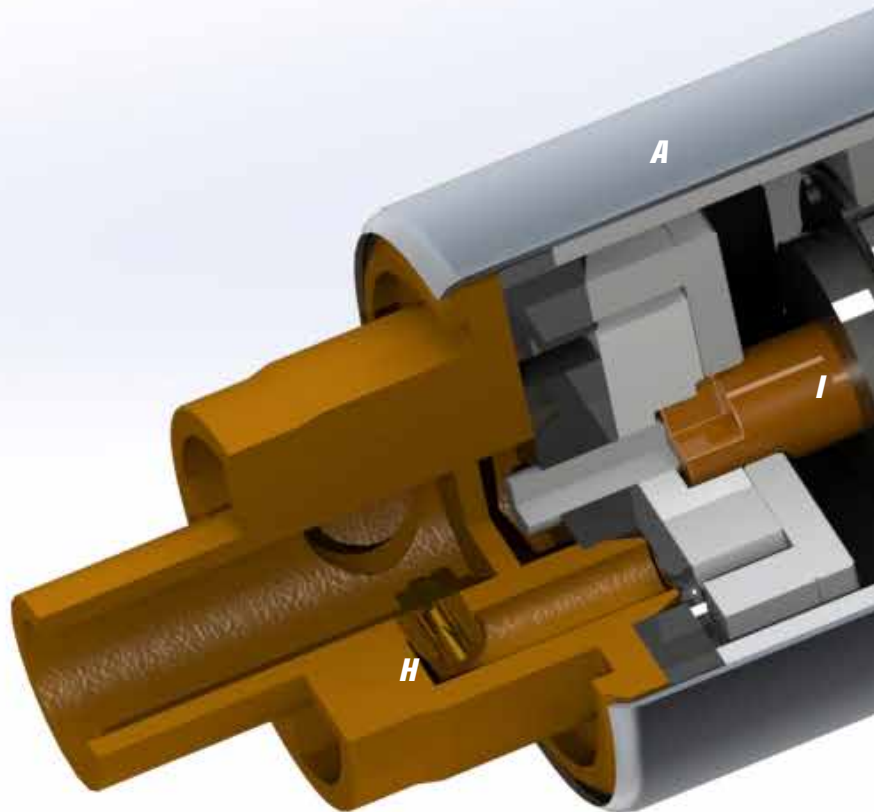
Precision molded brush holder for perfect brush alignment. Made from high temperature plastic

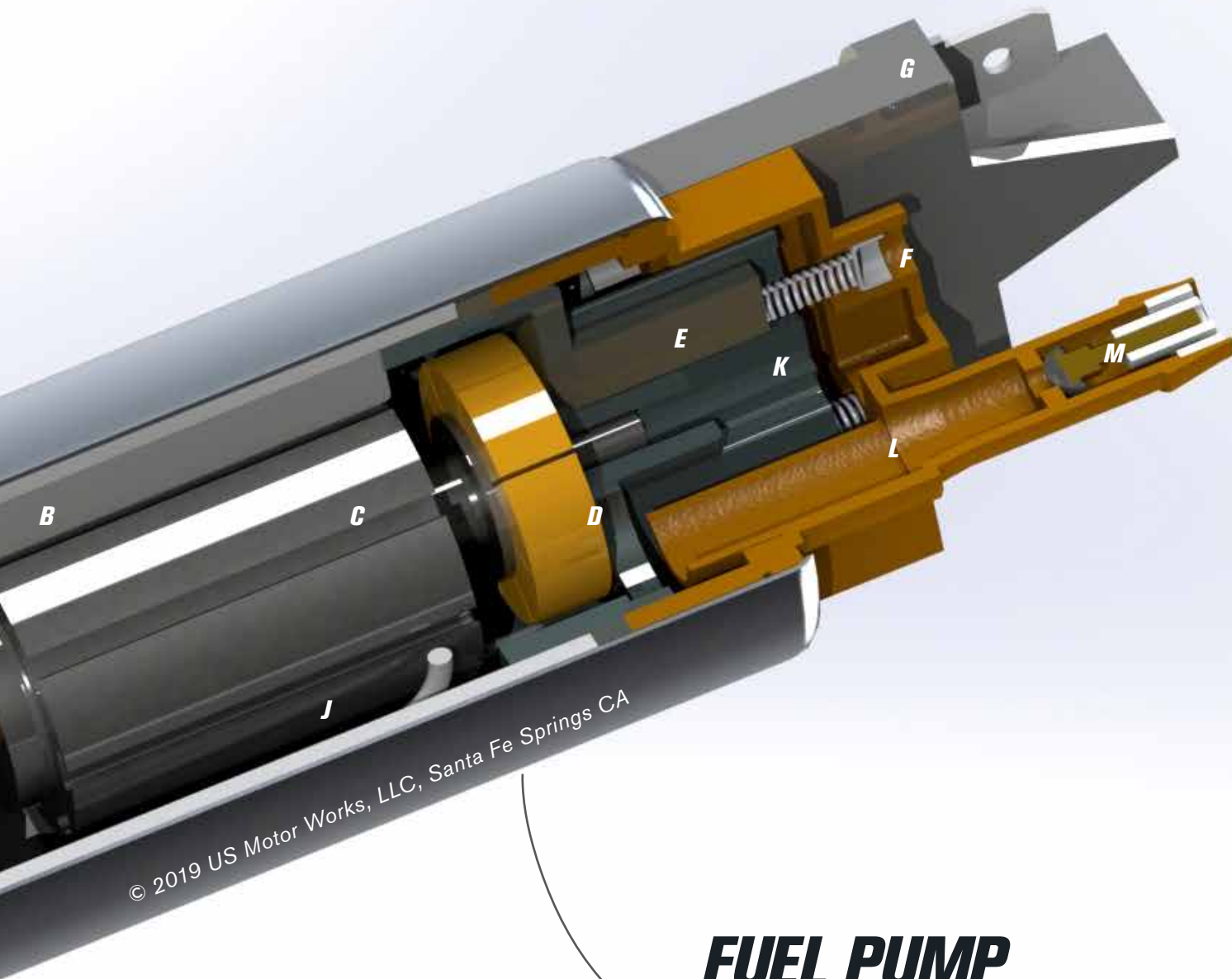
**L. Outlet Manifold**

Precision molded outlet manifold with polarity markings for proper wiring identification

**M. Check Valve**

Metal check valve for best performance and long life





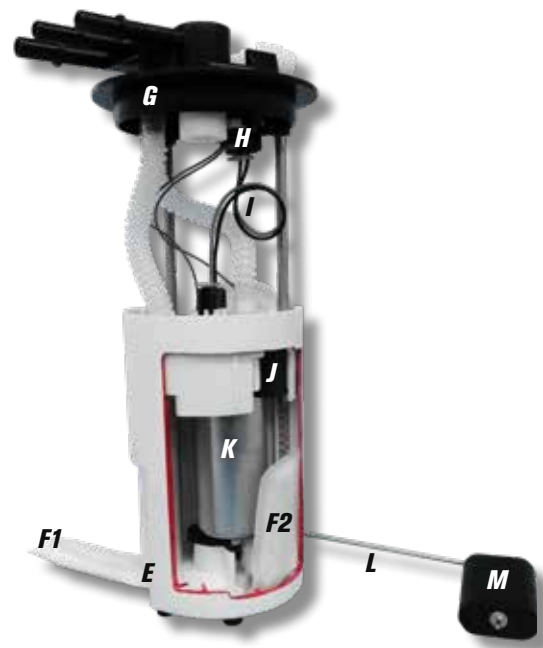
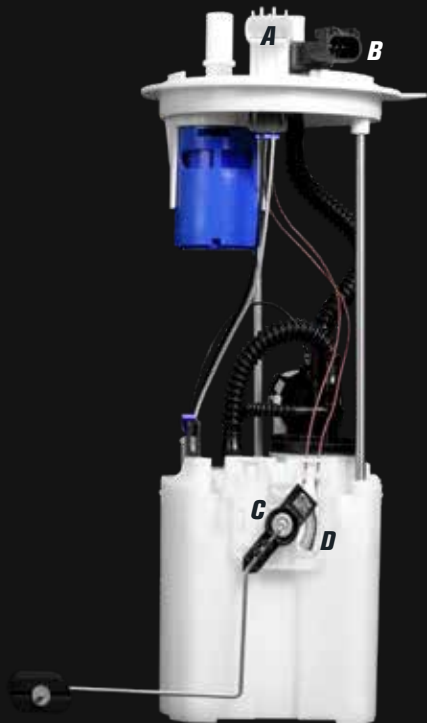
## **FUEL PUMP**

A fuel pump consists of up to 200 individual components that have to work correctly in order for proper function. This diagram shows the critical components inside a fuel pump.

## FUEL PUMP MODULES

Fuel pump modules include a fuel pump inside a housing that usually has the fuel float sensor attached. General items found in a standard module are shown in the diagrams.

- A.** Upgraded "Flat-4" connectors on all GM modules for increased reliability and longevity. Mating Pigtail harness included with all upgraded connectors
- B.** Hybrid circuit pressure sensor for increased reliability in harsh conditions
- C.** Bifurcated (split) contacts used on fuel level sensor wiper for low friction and increased lifespan
- D.** Palladium silver alloy used on fuel level sensors for increased reliability in ethanol and ethanol blend fuels



- E.** Rubber vibration dampers to decrease noise
- F.** Dual strainers for superior filtration. Internal and externally mounted
- G.** POM plastic used for strength and durability
- H.** Increased thickness connector pins used for increased reliability
- I.** Teflon insulated wires for superior chemical resistance
- J.** Nitrile or Viton used for all rubber components for long life and fuel resistance
- K.** Robust 2 stage turbine or roller vane internal pump (depending on application)
- L.** Stainless steel used for all metal components
- M.** Foam fuel float for increased reliability over molded type



# ***INTERNAL PUMP TYPES***



## ***Roller Vane***

This pump uses a steel rotating disk with sliding rollers that move outward and suck fluid through the pump. Roller vane pumps can tolerate fuel contamination much better than other pumps but create more noise.



## ***Gerotor***

This pump has a steel gear type pumping mechanism. Gerotor is quieter than roller vane but cannot tolerate fuel contamination.



## ***Turbine (single and double stage)***

The spinning of the turbine causes fluid to flow through the fins moving the fuel through this pump. The turbine turns at a higher speed than the other pump types and requires tighter tolerances to operate. Because of the tight tolerances required on turbine pumps, they are very susceptible to debris and fuel contamination.

# COMMON REASONS FOR FAILURE

- A.* Low quality fuel
- B.* Fuel system contamination
- C.* Clogged strainers/filters
- D.* Low fuel levels
- E.* Overheating

**A****B****C**





*D*

*E*

## LOW QUALITY FUEL

**Fuel quality** is important for proper function and longevity of your fuel pump. High quality fuels from top tier supplies include additive packages that help lubricate and cool the internal components of the fuel pump and fuel system.



Low quality fuels do not lubricate the fuel pump properly and if excessive moisture is present, will also cause premature failure of many fuel system components such as the fuel pump, fuel level sensor, fuel pressure regulator, fuel injectors, etc.

Low quality fuel can also be contaminated with small particles that will quickly clog and damage an in-tank fuel pump.



## ***FUEL SYSTEM CONTAMINATION***

***Fuel system contamination*** is usually a problem with older vehicles and vehicles used in rough terrain.

Contaminants can enter the automotive fuel system when filling the tank or from the breakdown of fuel system components such as fuel lines and fuel tank liners.

***Did You Know?*** If you do not clean your fuel system when replacing your fuel pump that there is a 90% chance that the fuel pump will fail under 30 days.

*Drain & clean your fuel tank every time you replace a fuel pump!!*



## ***CLOGGED FILTER OR STRAINER***

A fuel pump must pull fuel through a strainer attached to its inlet and push it through an external fuel filter. If either of these are clogged and cannot support the flow-rate required by the engine, there will be bogging and vehicle hesitation as well as increased strain on the fuel pump causing it to eventually fail.

**All USMW fuel pump kits and modules include a strainer, and all modular units with an integrated primary filter include a new filter assembly.**



### ***Did You Know?***

A clogged strainer and filter will decrease flow-rate and require a fuel pump to work harder to make the proper pressure and flow. These conditions overheat the fuel pump causing it to fail. Always install a new strainer and fuel filter when replacing a fuel pump.





# ***Low* fuel levels**

Running your vehicles on low levels of fuel for extended periods

is extremely bad for the fuel system. Fuel is used to cool and lubricate the internals of the fuel pump and if the tank is allowed to frequently run low, the cooling ability is compromised because the fuel heats up much faster.

## ***Did You Know?***

Frequently running on low fuel levels allows a large amount of air to remain in the fuel tank causing potential for condensation. This will cause the internal tank liners to break down much quicker over time.



# ***OVER HEATING***

Overheating of fuel pumps occurs when the pump is subjected to severe loads with minimal cooling. This can occur when the pump flow is restricted or if foreign debris gets jammed in the pump mechanisms. Overheating can cause damage to fuel pump connectors and associated wiring and electrical components. In severe cases, the fuel pump armatures can get so hot that the plastic armature material can melt.

## ***Did You Know?***

To prevent connector overheating, it is always recommended to replace the wiring connector when replacing a fuel pump. This is especially important for vehicles over 10 years old. USMW assemblies include improved harnesses and pigtail connectors to replace the OE harness when required.



# WARRANTY EXCLUSIONS

USMW Professional Series a brand of US Motor Works, LLC warrants products to be free from defects in material and manufacturing, under normal use and service. The following images are indications of damage caused by improperly maintained systems and modifications.

- A.** Modified parts
- B.** Broken parts
- C.** Dark, clogged, or contaminated strainers
- D.** Units with corrosion, rust, or discoloration from contamination
- E.** Units with burned wiring or connector



**A1**

**A2**



**B1**



**B2**



**C1**



**D1**



**D2**



**E1**



**E2**

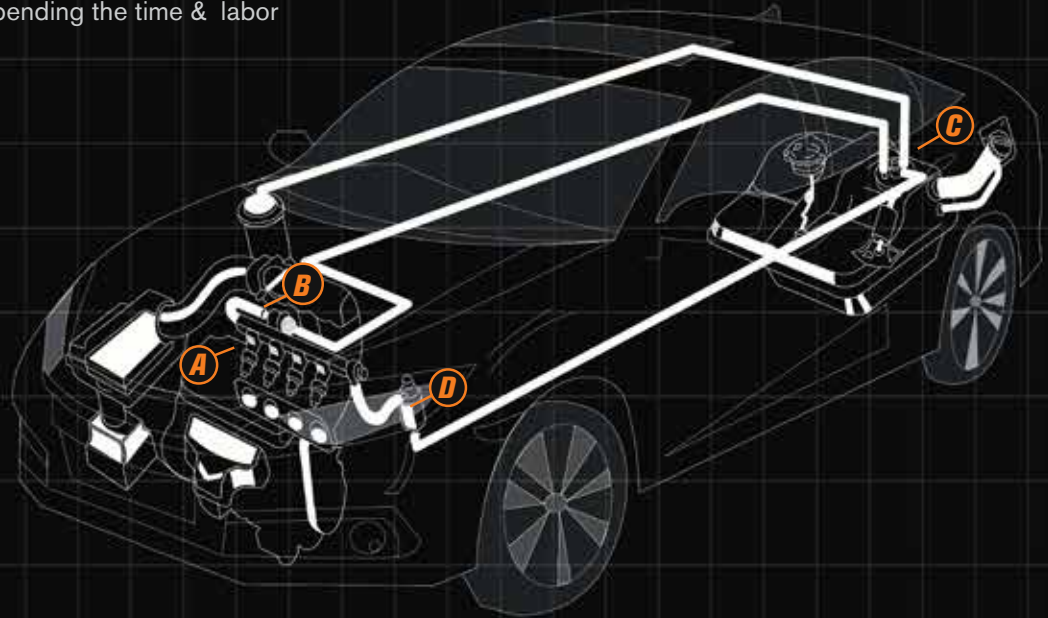


## BEST PRACTICES

### TROUBLESHOOTING YOUR FUEL SYSTEM & REPLACING YOUR FUEL PUMP

Low fuel pressure and low fuel flow-rate at the engine are the most common characteristics that are found in a faulty fuel system. It is a common misconception that these are caused by a faulty fuel pump or fuel pump module, which is usually not the case. The automotive fuel system is made up of several components that should be checked and tested before expending the time & labor to replace the fuel pump.

- A.** Fuel injectors
- B.** Fuel pressure regulator
- C.** Fuel pump
- D.** Fuel filter



### Fuel System Overview

The fuel system begins with **Voltage**.

Without battery/alternator voltage an electric fuel pump will not operate.

This voltage is normally switched on by a **relay** or controlled directly by the **ECU**.

The **wires** from the relay or ECU carry the power to the fuel pump.

These wires may be connected through several **connectors** before actually reaching the fuel pump.

The **fuel pump** is the heart of the fuel system. Its job is to deliver fuel from the tank to the engine.

The fuel pump sends fuel out of the **fuel tank** at the proper flow-rate and correct pressure for the engine to run at all RPMs and throttles positions.

Depending on the type of fuel system that the vehicle has, (return vs. non-return) there will be differences in configuration at this point.

For return type fuel systems, the fuel will be sent out through **fuel lines** and normally through an **external fuel filter** before reaching the engine.

For non-return type systems the fuel would be sent through a **pressure regulator** and then through the **fuel lines** and **external fuel filter** before reaching the engine.

Once at the engine the fuel is normally fed into the **fuel rails** that supply the fuel to each individual **fuel injector**. At this point we will also see additional differences between a return and non-return type fuel system.

For a return type fuel system, the **fuel pressure regulator** will be found after the fuel rail.

An **additional fuel line** will "return" bypassed fuel from the pressure regulator back to the fuel tank.

On a non-return fuel system, there will only be a **feed line** to the fuel rail.

There is no additional return line back to the tank since the fuel pressure has already been regulated at the fuel pump or fuel tank before reaching the engine.

## ***SAFETY FIRST!***

- A.** Work on a level surface
- B.** Use safety stands for support, not a jack
- C.** Keep an ABC fire extinguisher close by
- D.** Wear approved safety glasses
- E.** Work in a well-ventilated area
- F.** Do not smoke or allow open flames near vehicle
- G.** Disable fuel pump before servicing by removing fuse or battery cables
- H.** Relieve fuel system pressure before servicing pump

## ***WARNING!***

Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas appliance is located. Gasoline is also carcinogenic, take the proper precautions and wear latex gloves when spills are possible. If fuel does come into contact with your skin, rinse it off immediately with soap and water. Mop up all fuel spills and do not store any fuel-soaked rags where they could ignite.

## ***FUEL***

This is the first thing you should check if you are having problems with your fuel delivery system. Make sure that your gas tank is at least ½ full of fuel when diagnosing any fuel delivery problems.

## ***VOLTAGE***

This is the second thing to check when you are having issues with fuel delivery. Without the proper voltage reaching the fuel pump you will immediately have a low or no flow and/or pressure situation. It is important to check the voltage drop directly at the fuel pump connector. There should be less than .5 volt voltage drop from the battery to the positive fuel pump terminal.

### ***Things to check if you find no or low voltage at the pump connector:***

- A.** Check that battery and alternator are in proper working condition
- B.** Verify that ECU is properly functioning
- C.** Check fuel pump fuse
- D.** Check fuel pump and/or ASD relay for proper function
- E.** Check wiring harness for loose or broken connections
- F.** Check fuel pump ground location for good contact

## ***FLOW***

Next thing to check is to see that the fuel pump is actually sending fuel out of the tank. You can verify this by removing the test port cover from the fuel rail or disconnecting the fuel line from the in-line filter. Switch the ignition to the "ON" position and the fuel pump should operate for a few seconds. At this time you can look at the disconnected fuel line or open test port to verify if there is any flow from the fuel pump.

### ***Some common causes of low or no flow other than a faulty fuel pump are:***

- A.** Leak in the fuel line
- B.** Clogged fuel line
- C.** Clogged in-line filter
- D.** Crimped or smashed metal fuel lines

## ***PRESSURE***

After you have confirmed that you have flow in the fuel system then you can move on to checking if there is proper pressure in the system. The best way to check fuel pump output pressure is to connect a pressure gauge to the fuel pump output line before the in-line fuel filter. This will allow you to test the direct output pressure of the fuel pump without additional components in the system such as a fuel pressure regulator.

### ***Some common reasons for low pressure other than a faulty fuel pump are:***

- A.** Low voltage at the pump
- B.** Bad fuel pressure regulator
- C.** Clogged in-line fuel filter
- D.** Leaking injectors
- E.** Leaking fuel line connectors
- F.** Clogged or damaged fuel lines



## 18 Keep your work area clean!

The number 1 cause of fuel pump failures is from fuel pump contaminants such as dirt, rust, & moisture. If the fuel system is not cleaned, then these contaminants will cause the replacement fuel pump to fail prematurely. Make sure to clean your fuel tank & keep your work area clean to prevent this type of contamination.



## UNIVERSAL FUEL PUMPS

Our universal fuel pumps are compatible with a range of modern fuels, for carbureted and fuel injection applications.

## FUEL PUMP KITS

USMW uses OE style fuel pumps rather than less expensive turbine units (where applicable). This ensures quality and performance that meets or exceeds OE standards.

- A.** New wiring
- B.** New strainer
- C.** New fuel lines



## FUEL PUMP MODULES

- A.** Drop-in replacement
- B.** OE style internal fuel pumps
- C.** Palladium silver fuel level sensor
- D.** Made with modern materials that are compatible with today's fuel blends

## STRAINERS

Quality made strainers help protect your fuel pump from contamination, this helps ensure longer lasting fuel pump performance.

## MECHANICAL FUEL PUMPS

All mechanical fuel pump kits include gaskets and hardware necessary for installation.







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