FORD STARTER / FLYWHEEL TECH TIPS

There seems to be a bit of confusion as to the interchangeability of the Ford's early and late model (mini PMGR) starters.

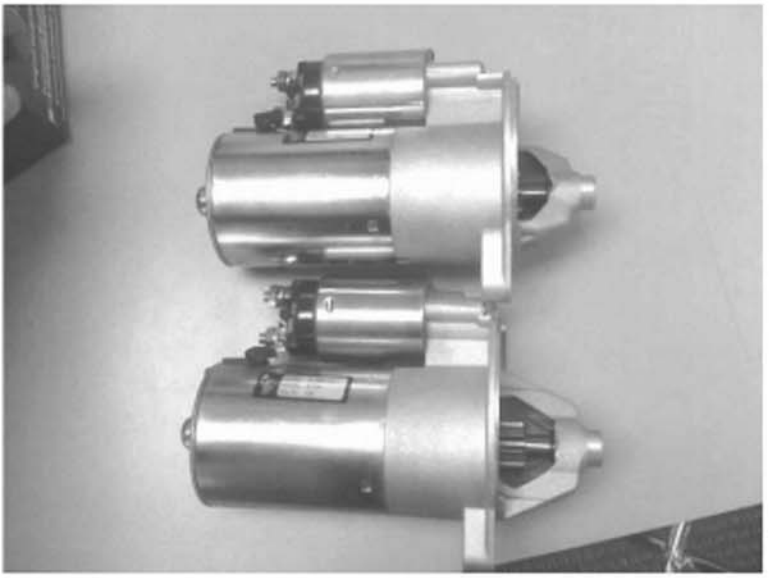
The proper starter is based on the type and diameter of the flywheel (manual transmissions) or flex plate (automatic) you are using.

The EB typically uses the 14 1/8" dia. 164 tooth fly wheel plate. Here is where the plot thickens.

The big difference is the depth of engagement of the starter drive. The **MANUAL** starter drive gear is actually recessed into the starter mount housing. The **AUTO** starter drive protrudes 3/8" deeper into the bellhousing than the **MANUAL** starter This is because the starter ring gear on the flywheel/auto trans flexplate is positioned farther aft into the bellhousing (away from the engine) than does the starter ring on the larger manual transmission flywheels. The reason for this was to be able to use a larger/deeper pressure plate.

Notice in this photo of the flywheels (placed crank end down), the difference in ring gear positioning. The larger 164 tooth flywheel is on the right. The starter ring gear is located toward the engine side of the flywheel. On the 157 tooth flywheel on the left, the ring gear is spaced more toward the transmission side of the flywheel.

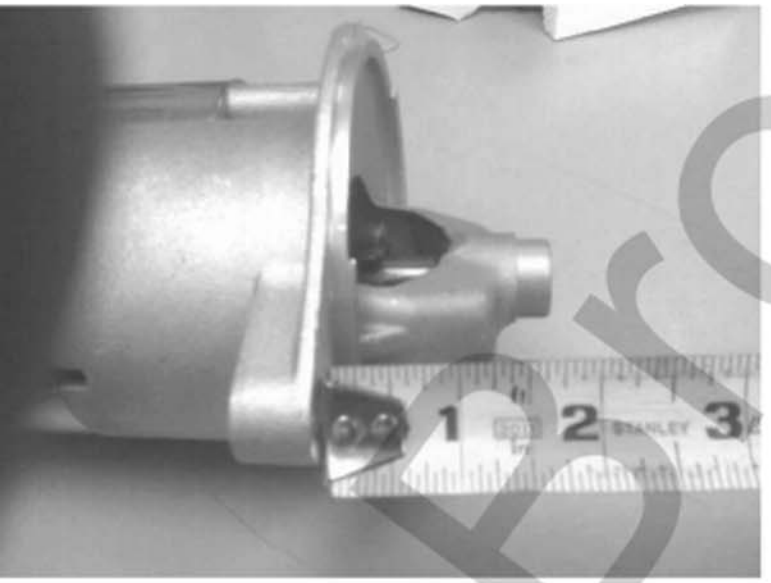
Since the 164 tooth flywheel's ring gear is in a different position than the smaller 157 tooth flywheel/flexplate, the "short nosed" starter is needed. The automatic's flex plate will use the longer "long nose" starter and these starters are **NOT** interchangeable. And to further complicate matters the nose diameter between the two starters is slightly different. The **automatic** starter's (long) nose (where it mates with the motor spacer plate) is 4.09" dia. and the **manual** starter's (short) nose is 4.14 dia.



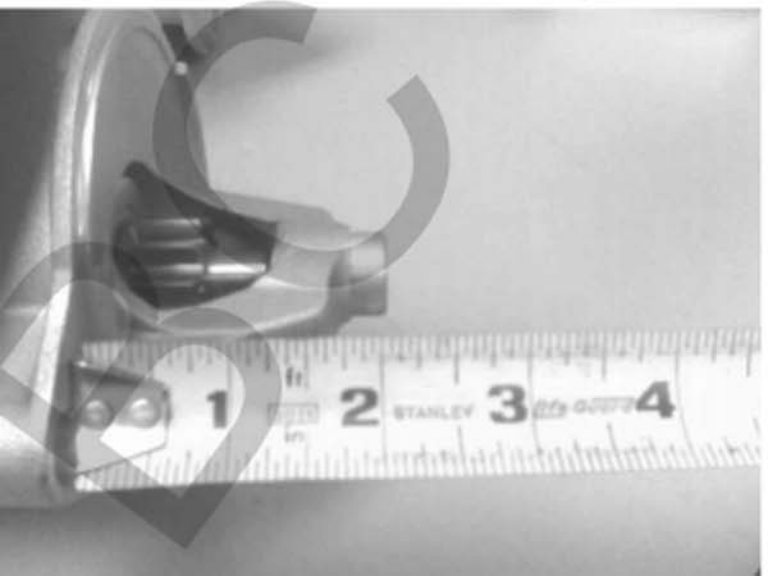
Manual starter

NOTE the position of the starter gear

Auto starter



164 tooth manual flywheel starter



157 tooth manual flywheel / automatic flexplate starter

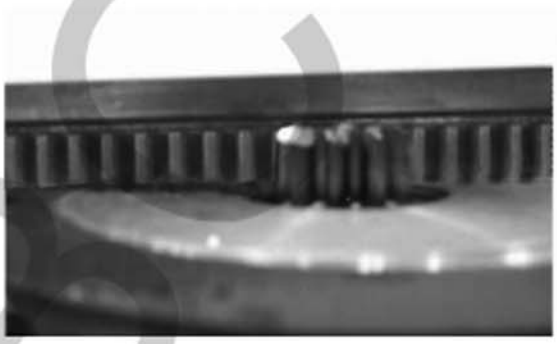
However, the big difference is the depth of engagement of the starter drive. The **AUTO** starter drive protrudes 3/8" deeper into the bellhousing than the **MANUAL** starter. The **MANUAL** starter drive is actually recessed into the starter mount housing. This is because the starter ring gear on the auto trans flexplate is positioned farther aft into the bellhousing (away from the engine) than does the starter ring on the larger manual transmission flywheels.

For the manual transmission starters the dimension from the back of the engine block to the aft edge of the ring gear on the flywheel is .420 in, the starter ring is still .375, which leaves the forward edge of the ring gear only .050 aft of the engine block. HOWEVER, this only applies to the old large diameter (14 1/8" dia) 164 tooth flywheels! On the small diameter (13¼" dia) 157 tooth flywheels the backspacing is the same as with auto trans flexplate. So, a starter for manual transmissions will not work with the 157 tooth manual transmission flywheel, even though it could be bolted to the engine.

The majority of the late model applications using the T-5 five speed transmission used the small 157 tooth flywheel, hence we see starters designated for a "5 speed manual trans", it is not actually the transmission, but the diameter of the flywheel (and subsequent ring gear backspacing) that dictates the **AUTO** starter be used. It has nothing to do with a 3,4,5 or 10 speed trans, it is all about the flywheel that they are using. If a customer is using the complete T-5 setup from some late model application (flywheel, clutch, bellhousing, and trans) then they will need the **AUTO** starter.

This is an example of the **AUTO** starter and its correct relationship to a 157 tooth flywheel.

This is an example of the **MANUAL** starter and its correct relationship to a 164 tooth flywheel.



If the **AUTO** starter is installed with a 164 tooth manual flywheel, the starter will be continuously engaged with the flywheel, and will destroy the starter as soon as the engine starts.

If the **MANUAL** starter is used with the small 157 tooth flywheel (or flexplate) the opposite will occur. The teeth will not engage the flywheel ring, or if it does engage it will only catch the very ends of the teeth and cause damage to the flywheel.

PMGR is short for **P**ermanent **M**agnet **G**ear **R**eduction. What exactly does that have to do with an upgrade? Well, it means that when retrofitting the older positive engagement starters it provides a 50% weight reduction (8 Lbs. vs. 20 Lbs.) and requires less cranking amps. And because the PMGR starter is a smaller size, it will provide better header clearance and reduces the effects of a hot start. Your vehicle will be easier to jump start too. The only down side is that these starters cost more than the old style starters.

I6 and V8 Applications (Small Block)

For **automatic transmissions**, the Ford part numbers are E9SZ-11002-A, F7SU-11000-AB, F7SZ-11002-AA. Lester No's: 3205, 3268 (Retrofits Lester No's: 3124, 3153, 3168, 3180). This part number will retrofit most small block 302/351W applications from 68-91.

Also Used On:
(1996-92) Ford Bronco 4.9L, 5.0L, 5.8L w/ AT
(2002-92) Ford E Series 4.2L, 4.9L, 5.0L, 5.8L
(1998-92) Ford F Series 4.2L, 4.9L, 5.0L, 5.8L
(1991-90) Ford LTD Crown Victoria, Mercury Grand Marquis 5.0L
(2004-94) Ford Mustang 3.8L
(1995-92) Ford Mustang 5.0L
(1997-90) Ford Thunderbird 3.8L, 5.0L
(1992-90) Lincoln Mark VII 5.0L
(1990) Lincoln Town Car 5.0L
(1997-89) Mercury Cougar 3.8L, 5.0L
Also retrofits
(1991-82) Ford Mustangs 5.0L (302 CID) All
(1979-68) Ford Mustangs 5.0L (302 CID) w/ AT
(1973-69) Ford Mustangs 5.8L (351 CID) w/ AT

For **manual transmissions**, the Ford part numbers are F2TU-11000-AA, F2TZ-11002-A, F7PU-11000-FA, F7PZ-11002-FA.

This part is used on 92-97 Ford Bronco, F Series 4.9L, 5.0L, 5.8L w/ MT. Lester No's: 3223, 3241 (Retrofits 3132, 3176, 3185).

Note: manual transmission model made after 1979 may need Lester part #3205.

This part number will retrofit most I6 221/240 and small block 260/289/302/351W from 62-79.

Installation and Wiring

Installation is actually somewhat simple. After replacing the starter, the rest is just simple wiring. On the starter solenoid, move the starter cable from its current location to the constant hot terminal (where the battery cable hooks up). The new wire is a length of 12 gauge wire from the stud on the fender mounted unit where the starter cable previously was attached, to the start terminal on the starter mounted solenoid. Just add the appropriate connector to each end of this new wire. The starter end connection could be either a 1/4 inch spade or a M6x1.0 post. The conversion is done!

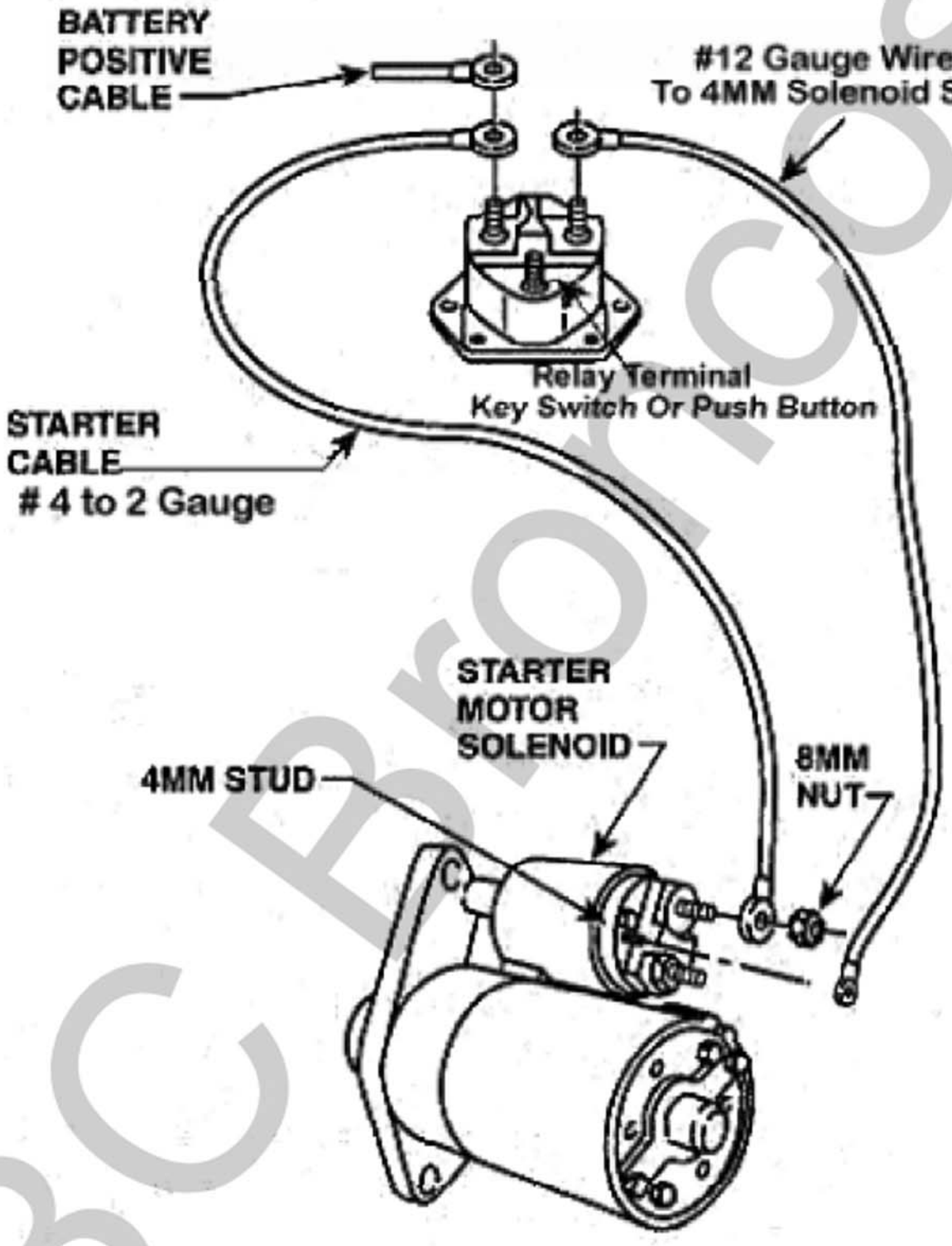
WARNING - Do not install a jumper wire from the battery terminal stud to the solenoid activation stud on the starter in order to avoid installing the 12 gauge wire from the solenoid activation lug from the starter relay. This will cause the starter to stay engaged once the solenoid is activated. This will severely damage the starter and/or flywheel.

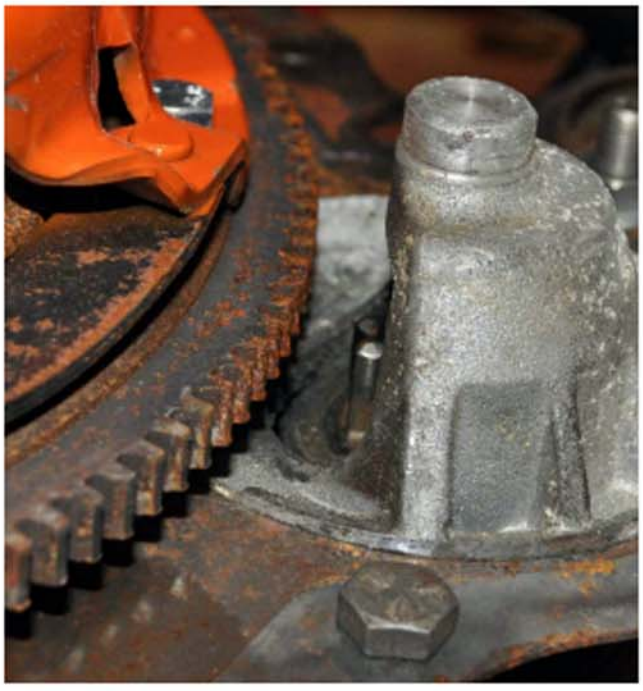
A couple of noteworthy functional differences with the PMGR starter.

First, is that the starter may seem to "run on" after the switch is released. This is an installation issue. This is a common complaint on Ford permanent magnet starters, although it can occur on any permanent magnet starter in the right conditions. This situation develops when the ignition terminal on the starter is "jumpered" to the battery terminal on the starter and a remote solenoid is used. Permanent magnet starters can actually produce power if they are driven from an outside source (i.e. the starter will act like an alternator once the engine fires and starts spinning). The current produced in the starter for this second or so will flow from the starter's battery terminal to the starter's ignition terminal and hold the solenoid in. This will cause the one to two second delay in the solenoid release and an irritating noise. The solution is to wire the starter per the instruction sheet, which will ensure that the ignition switch terminal goes dead the instance the key is released.

The second issue is that the pinion does not retract when it is released. It is normal for a gear reduction starter to hang in the ring gear when the engine is cranked, and yet does not start. Direct drive starters do not do this because they can rotate the small amount necessary to retract the pinion. Gear reduction starters do not retract in this situation because of the resistance of the gears. The tiny amount of rotation necessary to retract the pinion is amplified in the gear ratio inside the starter, requiring four to five times the rotation inside the starter. All of this gear movement results in the pinion remaining in the ring gear until the engine fires.

Ford (PMGR) Starter Wiring Instructions

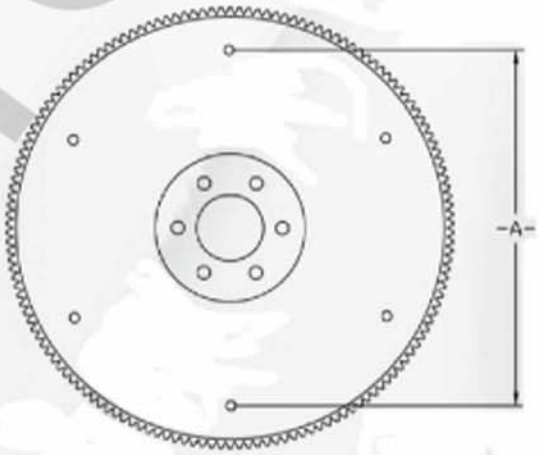




This is a 157 tooth flywheel in place of a 164 tooth flywheel. Notice the wide gap between the ring gear and the starter pinion.

CLUTCH BOLT PATTERN PAGE

TYPE 1
3 GROUPS OF 2 BOLT PATTERN
MEASURE BETWEEN 1 GROUP FROM BOLT HOLE CENTERS



TYPE 2
EVENLY SPACED BOLT PATTERN
MEASURE BOLT HOLES DIRECTLY ACROSS FROM BOLT HOLE CENTERS

CLUTCH PATTERN	TYPE	DIMENSION "A"	BOLT SIZE	DOWEL PINS
8-1/2" FORD	2	9-11/16"	5/16" X 18	
10" - 10-1/2" FORD	1	3-1/8"	5/16" X 18	
11" FORD	1	3-3/8"	5/16" X 18	
11-1/2" - 12" FORD	1	3-9/16"	5/16" X 18	
10.4" MUSTANG 1986 - UP	2	11-3/8"	8mm X 1.25	YES
11" FORD DIAPHRAGM	2	12-3/8"	3/8" X 16	