Technical Bulletin 01-2019 SRF3

Tilton Cover / Kevlar Clutch Disc

To fully understand how we have arrived where we are with our GEN3 clutch, we need to know some of the initial history. There are several custom parts made for the GEN3 kit, all built around the idea of being as affordable as possible without major compromise. The clutch is one of those. At the PRI show Erik and I talked with all the major clutch companies a year before our first prototype GEN3 car was assembled (my personal spec racer). Tilton seemed to have the best plan at the most reasonable cost.

At this point numerous people asked why we even needed a Tilton or aftermarket clutch. The answer was to allow us to continue using the escort 5 speed transmission. In the planning stages we consulted Ford drivetrain engineers to help determine if this was a mistake. The 1.6 runs at a higher rpm, with peak torque in the same ball park, everyone agreed that it should be fine.

The reason we need the 180MM clutch is the starter and revolves around the relief in the bell housing vs the mounting pad on the engine block. The flywheel needs to be small enough for the starter to engage the ring gear where there is no budge or relief in the bell housing. On a side note, the Fiesta 5 SPD shifter apparatus would have interfered with our frame. Not needing to change the frame or engine mounts was a high priority in the GEN3 kit development.

Initially Tilton thought this was going to be a simple project. It turned out not to be the case. Tilton produced custom parts for our project, 2 to reduce the shock to the driveline. This included the clutch disc, diaphragm spring and release bearing.

We tested 3 different disc designs: metal (most common in racing), ceramic puck (most common in rally & HP street cars) and full organic (most common in OEM). We settled on the full organic disc. Tilton has since made 4 different versions of that disc. The current part is not bullet proof and is still fairly harsh to the driveline.

When it was apparent, we needed to take further action to lessen the shock to the driveline, we began searching for an alternate clutch company. We didn't want to start over from scratch, so we were in search of a custom disc with a forgiving friction material and a dampened hub that would fit under the Tilton clutch cover. Three companies later we have what we hope to be the final clutch disc.

The current dampened hub prototypes have been working well for the most part. We are having short/small run production problems with both the custom Kevlar friction facings and custom dampened hub. It's very difficult to hold the tight tolerances needed. These tolerances are required to operate with existing components.

To date we have experienced two recurring problems with the dampened Kevlar discs: some discs are not releasing 100% in neutral and a fewer number are slipping under full power.

To fully understand why this is occurring we need to keep in mind that the Tilton clutch cover is a racing design, meaning it is meant to release and lock quickly. It is also less forgiving to wear, meaning there is a very narrow window to maintain torque clamping capacity.

I measured new covers on hand and generated an average to establish a base line. I also measured a few used clutch covers, ones that clamped slowly or slipped a little under full load.

Tilton's guidelines for our clutch are somewhere between .030 /.040" "total wear", that means all parts of the complete clutch, including the organic disc. We throw a curve ball in the mix with our Kevlar friction material. The Kevlar material has a lower friction coefficient rating, along with a higher wear & heat index. This is the direction we need to go, making it more forgiving and providing a longer life. Note: Wear limit could be closer to .030" with the Kevlar material.

Another change incorporated in the new disc design is the Waffle or Marcel plate between the two friction material rings. This is how OEM discs are designed and is one more step progressive or forgiving. This is where the stack of production tolerances of all components come into play.

We have a maximum release window of about .305/.308" uncompressed disc thickness.

We need the compressed disc thickness to be in the .275 /.295" range for the Tilton clutch cover to clamp the GEN3 torque output. Assuming the rest of the components are in the operation window.

**Side note: a couple of people have told me they have used a disc at about .312/.314" uncompressed thickness and experienced only a little bit of neutral drag which went away after a couple of events. This is due to the Waffle or Marcel plate compressing and a couple thousands of friction material wear as it beds into the flywheel and pressure plate. **

Another thing to understand is the diaphragm spring VS clutch pedal stroke. The more you compress the diaphragm spring, the more it deforms or collapses and shortens its service life. When setting up the clutch pedal travel, keep it to a minimum. This is typically about 3 to 3.375" of pedal travel after the hydraulic free play is taken up. Measured at the center of the clutch pedal pad, hold a measuring tape in a horizonal plane. The limit is about 3.8 to 4.0" or you run the risk of pushing the release bearing piston out of the body. "using the spec .750 master cylinder"

The first measurements A & B are to gage the deformation of the diaphragm spring, check the gap between the spring fingers and the underside of the billet aluminum cover. "A". Use feeler gauges for this exercise.

Measure the distance from the surface that rests on the flywheel to the surface that puts load on the clutch disc "B"

Measure the total thickness of the pressure plate. Also measure the step built into it, "C"

The clutch disc thickness compressed and uncompressed “D”

The step on the Flywheel “E” (flywheel min weight 7lb 3oz)

The latest batch of Kevlar disc are in “good” not perfect range for our use.

Uncompressed thickness of about .316” +/- .003”

Compressed thickness of about .290” +/- .003”

We have produced .012” clutch cover shim. One needs to be placed under each leg of the clutch cover leg or bolt location. This puts the disc in an optimum operating range. If service to the engine or transmission is needed, the disc can be checked. If the uncompressed disc thickness is less than .305” the shims should be removed. Compressed thickness should be greater than .275”

Notes on shimming the clutch cover: while this may seem very foreign, it’s necessary due to the narrow operating window of the clutch cover, combined with the OEM style disc.

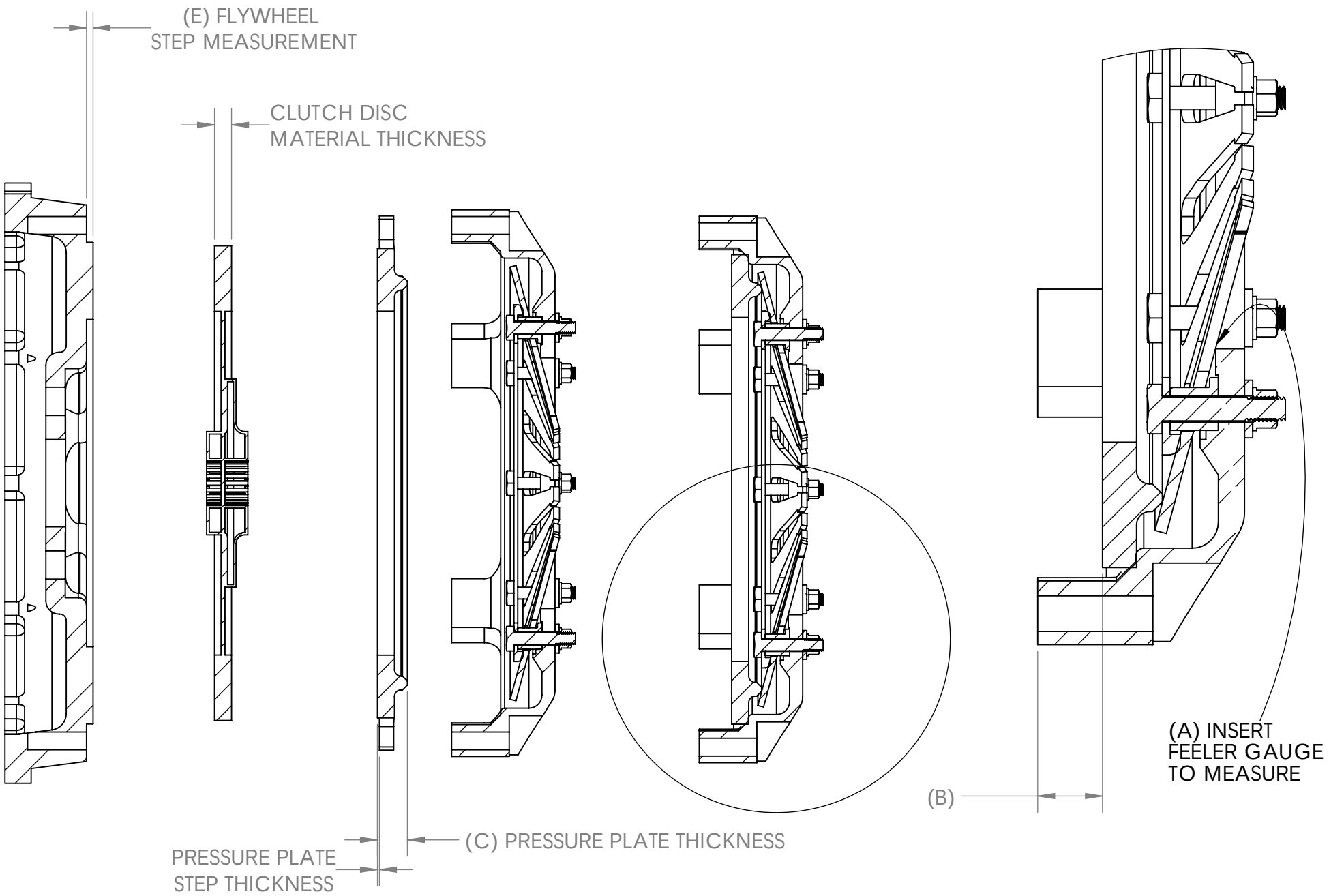
There may not always be a perfect uncompressed versus compressed thickness, the goal is to be free in neutral without over compressing the diaphragm spring and shorting the service life. All while maintaining the load on the compressed clutch disc to clamp GEN3 torque output.

We do have one more possible update to the clutch cover, Tilton has a rebuild service, where they inspect the billet aluminum body and change the diaphragm spring and hardware. They developed the “W” spring for our project, we could use the “BF” spring in our clutch package. There is a drawback, it increases load on the crankshaft thrust bearing surface.

Measurements *see illustrations*

New parts on hand *very worn unusable samples in the field.*

	New	Limit	
A	.034”	.070”	
B	.278”	.288”	
C	.455”		
Step	.014”		
D	.295 MAX	.275” MIN	compressed
	.300” / .305” Ideal	.330” MAX	uncompressed / shims needed
E	.102	.098”	


(E) FLYWHEEL
STEP MEASUREMENT
CLUTCH DISC
MATERIAL THICKNESS
(A) INSERT
FEELER GAUGE
TO MEASURE
(B)
(C) PRESSURE PLATE THICKNESS
PRESSURE PLATE
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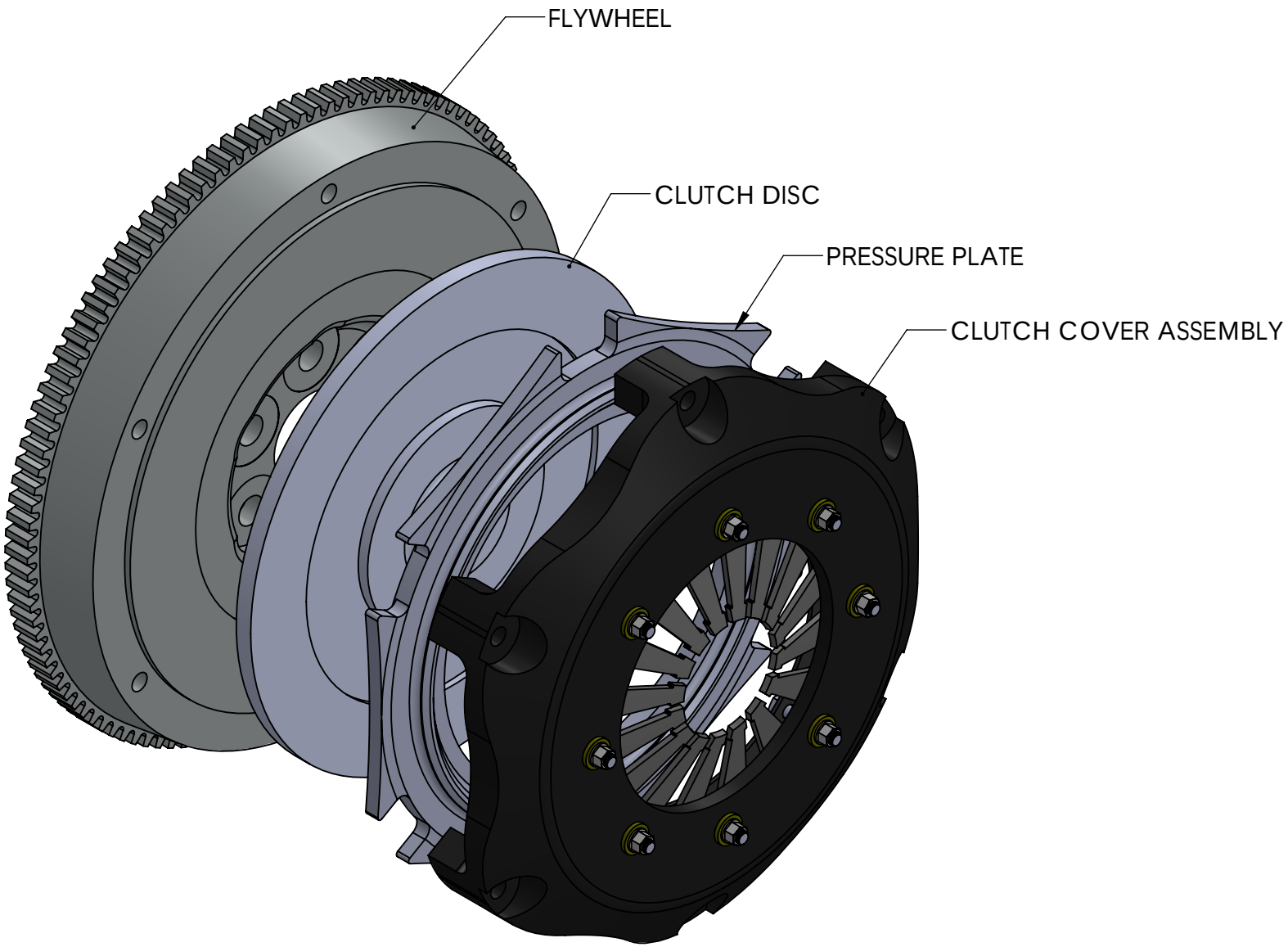
FLYWHEEL
CLUTCH DISC
PRESSURE PLATE
CLUTCH COVER ASSEMBLY