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Front Covers and Studs

Staying Connected

We recently had reason to review our long experience with stud welding. Several weeks ago a customer called to say he had a problem with what he thought was one of our Ford billet covers. He had rebuilt both the transmission and torque converter; it had been in service for about six months when all six converter studs failed. The vehicle was a stock Ford F250 extended cab, 4WD truck, used on a farm, with a fuel tank in the back.

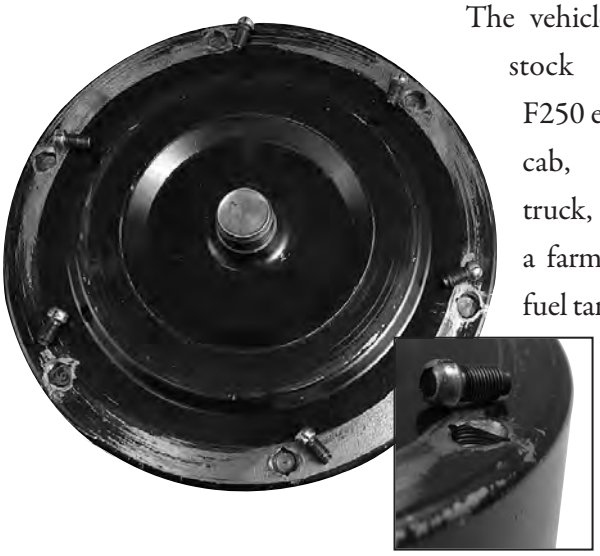

Figure 1 - Failed Front Cover

The customer was unsure if the converter had previously been in the truck or a core pulled from the core pile and rebuilt. When we got the failed cover (***Figure 1***), it was easy to spot that the billet cover was not ours by looking at the studs. These were threaded into the cover and secured by dowel pins to prevent the threaded studs from backing out. Sonnax studs are welded to the front cover (***Figure 2***).

It appears that the studs separated from the failed cover due to stress on the soft cover material. The holes in the cover are only .250" deep so the thread engagement is a maximum of .200" (***Figure 3***). This does not provide an adequate design safety factor. The length of the thread engagement securing the stud to the cover is about half that recommended to achieve full thread strength. Calculations show the shear stress area of the soft cover threads is greater than the 3/8-24 stud. The numbers appear adequate for pure shear applications; however, the short thread engagement and minimal safety factor may not stand up under harsh applications with diesel engines which can induce high torque oscillations. Whenever threads experience high cyclical loads, what starts

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as vibration can cause minute distortion or thread wear, and the process of self-destruction begins.

In comparing a Sonnax cover (***Figure 2***) to an intact version of the failed cover (***Figure 3***), key differences appear, especially in the critical contact area between cover and studs. Sonnax covers and studs are of higher grade steels for greater strength. The Sonnax threads are roll formed adding even greater strength to the threads. The stud welding process Sonnax has developed results in a high strength attachment that can only be achieved through melting/combining and quenching the cover and stud materials.

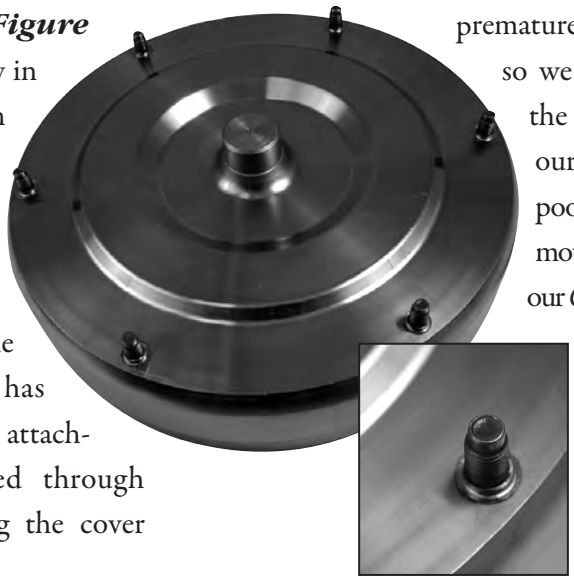

Figure 2 - Sonnax Front Cover

After welding, Sonnax machines the excess molten metal around the outer diameter of the stud to a .030" radius, which helps reduce the stress concentration at the base of the stud. This process also helps avoid any possible interference that might prevent the flex plate from mounting flush with the cover.

The final step in the Sonnax stud mounting process involves testing. We test 2 studs on every 5th cover we make to 40 ft-lbs to ensure quality without permanently deforming or stressing the studs. In addition, once or twice a day we test a sample to determine when failure occurs. Our torque test to failure requirement is a minimum of 60 ft-lbs. Failure during this test typically occurs above 90 ft-lbs, often well above it. We attempted to perform the same tests on studs in ***Figure 3***. All of the studs tested suffered premature thread stripping at 45-50 ft-lbs so we were never able to determine if the stud cross-sectional strength met our minimal requirement. Given the poor thread strength, it is likely a mounted cover assembly would fail below our 60 ft-lb minimum requirement.

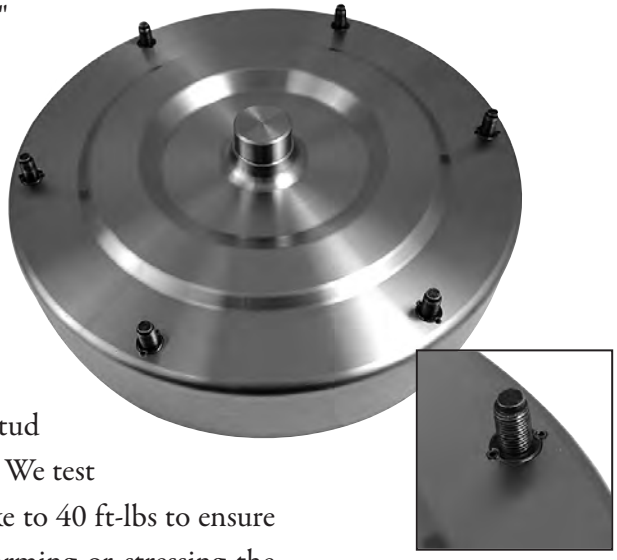

Figure 3 - Intact Version of Failed Front Cover

On completing our cover failure analysis, we spoke with the customer. We explained the differences in studs, threads, and stud attachment process between a Sonnax cover and what he had used. His comment wassimple: "If only I'd known!"❖