HOW LUCKY ARE YOU?

Back in May 1983, Morris Habif of APD Transmission Parts in Atlanta came into the Stewart-Warner Industrial Balancer booth at the Southern Automotive Show and said, "Why doesn't someone make a balancing machine for torque converters?" We explained that the tooling was just too complicated, however this didn't satisfy him. We agreed to look into the problem and he offered his help.

Sometime later we rounded up eight remanufactured torque converters and jury rigged tooling to balance them. We obtained the following out of balance readings: (1) 1.87 oz. in., (2) 6.51 oz. in., (3) 5.35 oz. in., (4) 2.3 oz. in. (5) 4.6 oz. in., (6) 3.2 oz. in., (7) 17 oz. in. and (8) 25. oz. in. We were amazed, and now knew why Morris Habif was so interested in checking and balancing remanufactured torque converters.

In case you aren't familiar with the above data, ounce inches are the most commonly used units of measuring unbalance. Unbalance is always expressed in weight times distance such as ounce inches, pound feet, gram centimeters, gram inches, etc. Each term gives both a weight and a distance. In Figure #1, a one ounce weight has been added at a five inch radius on a disc. If the disc was in balance before adding the weight, it now would be said to be five ounce inches out of balance. To convert the same unbalance to gram inches, you change ounces to grams by multiplying by 28.35 grams per ounce and get 141.75 gram inches.

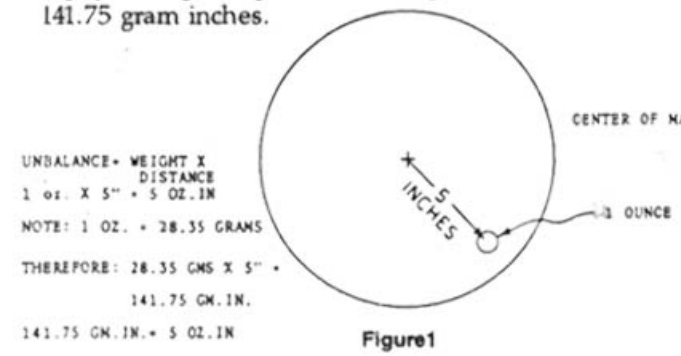


Figure1

With the OEMs claiming to balance down to .5 ounce inches, you can see why Habif knew a problem existed. Incidentally, converters #7 and #8 were Chrysler 360 converters which should have a 20.6 oz. in. unbalance counter weight. However, these were both the same part and were eight oz. in. apart. We later have found that a tolerance of one to two oz. in. is satisfactory on most remanufactured torque converters. More than that may call for the transmission shop to do some fancy talking or even require the converter to be replaced at their expense. Oddly enough, we found when talking to remanufacturers, they have very few balancing problems, however most of the transmission shops report numerous vibration complaints.

Assuming that new OE converters are in balance, what causes these remanufactured converters to be out of balance?

1. The new hub is not in the center of the converter.
2. The halves are put back in a different position and the original balance weights are in a different position.
3. The weld varies and may double up or overlap at the start stop position.

Basically, unbalance results when the center of mass of the converter is different from the axis of rotation (See Figure 2).

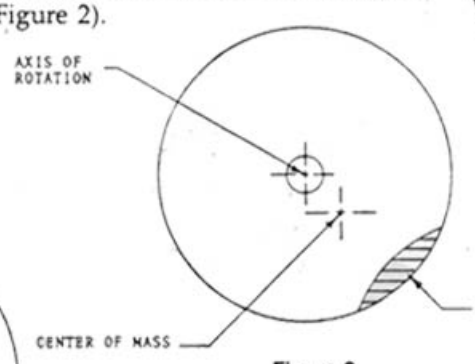
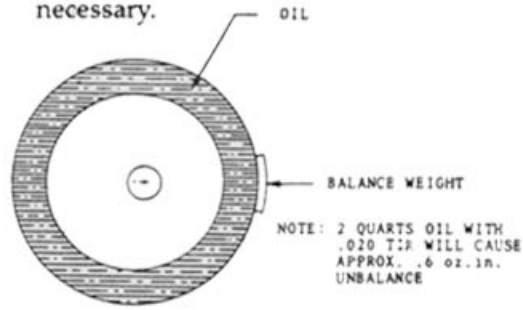


Figure 2

The converter's axis of rotation by design is the pilot and the hub. Now that we know what unbalance is and what units it is measured in, let's see what happens if we take a typical converter weighing 30 lbs., assume that it was closely balanced by the manufacturer but slightly off center. For this example, let's say we move it off center .010 inch. This would move one half of the converter off .010, so we will use one half of the weight. One half of 30 pounds is 15 pounds. Convert this to ounces; 15 x 16 ounces/pound = 240 ounces. Unbalance is weight times distance, so 340 ounces times .010 inches = 2.4 oz. in. Let's be realistic, .010 isn't much. An undersized pilot can cause the same problem. This also explains why we don't balance down to zero. It would be of no value because pilot diameters, etc. cannot practically be held to such close tolerances. Many of the remanufacturers now have good, modern equipment and try desperately to hold close tolerances, however one chip is all it takes to produce a vibrator. Balancing is the bottom line to check the converter and correct it if necessary.



Balancing with or without oil is a very controversial subject. Oil definitely affects converter balance, however we feel this condition is within practical limits. There are two common conditions where oil affects the quality of balance. Figure 3 shows a converter badly off center with a weight correcting the center of mass to the center axis of rotation. The oil, when added, is also off center and causes unbalance. Keep in mind how-

ever, that a cubic inch of steel weighs approximately 132 grams, but the same amount of oil weighs only 15 grams. The steel is almost nine times heavier than the oil. Imagine the results on this converter if the steel hadn't been brought to balance around the axis of rotation.

The second situation is illustrated in Figure 4. Here the cover has not been properly positioned prior to welding. You can see where the volume of oil is greater on one side than the other, and therefore it will cause unbalance.

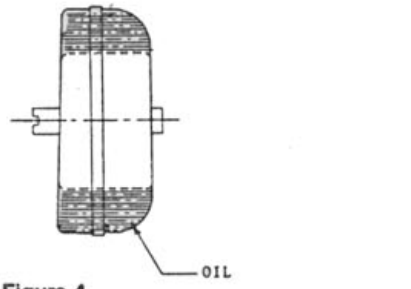
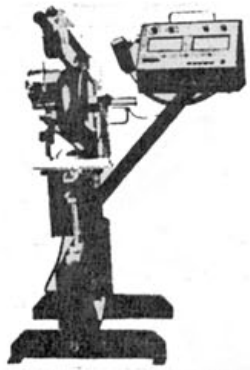


Figure 4

NOTE: 2 QUARTS OIL WITH .025 DIFFERENCE IN WIDTH WILL CAUSE APPROX. .55 oz.in. UNBALANCE

The third problem is where converter wall thickness varies. This would only be present where problems existed in the original manufacturer's stamping process. It could affect oil volume and therefore, unbalance.

Calculations and tests have led us to the conclusion that oil is not needed for balancing if the converter runout and converter width is held to reasonable tolerances. Calculations are shown in the figures. Although tests also were run with the converter full of oil, we found that two quarts of oil produced the most significant amount of unbalance.



Stewart-Warner TC-100 Balancer

The Stewart-Warner TC-100 Balancer, developed by Stewart-Warner with application assistance from APD, supports the torque converter by the pilot and the neck. This is how it rotates in the vehicle. For tooling, a turbine and stator are held together, inserted into the converter and then clamped by the machine tooling. When the torque converter is spun, the internal parts remain stationary.

This method of mounting and spining the torque converter also gives you a visual check of how the converter will run and make you aware of any objectionable, internal noise. The balancing machine will tell you how much weight and where to place it to correct the unbalance in the converter. The proper weight is then welded on to the converter. The converter then is respun to determine if it is within tolerance. Keep in mind that no weights are required on some converters, however the unbalance condition has been checked ok.

Now that you know a little about converter unbalance, do you still feel lucky using a remanufactured converter that has not been checked for unbalance?●