WHITE PAPER:

Drum Testing

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The drum test is one of the most common and informative tests performed in the caster industry today. If you have ever wondered what the primary function of the drum test machine is and why its test results are some of the most crucial in determining product viability, this paper will serve to answer your questions. There are several tests that can be performed with this machine and in this paper, we will discuss each one and why they are important to the end user. The three main tests are a Two Hour Usage Test, an Endurance Test and an Obstacle Test. But first we will discuss the machine itself and how it works.

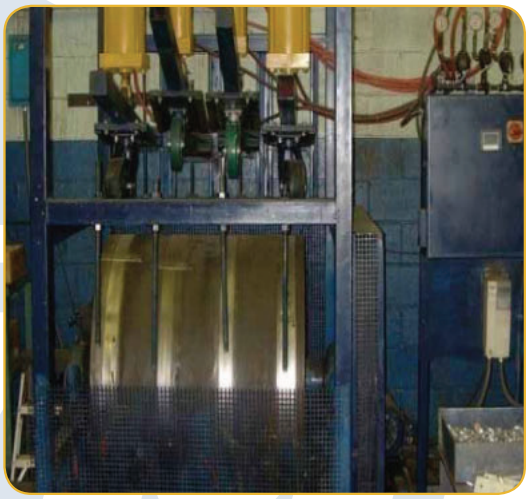
Figure 1: RWM Drum Testing machine

From the start, the RWM Drum Tester was designed to serve multiple purposes and test any number of different wheel and caster rig combinations. There are four positions on the machine, each equipped with either a five inch or eight inch diameter pneumatic ram. Each of these rams can be set independently of each other via the pressure regulators mounted on top of the control box just to the right of the machine. The casters are lowered into contact with a 42" rotating drum that is powered by a variable speed electric motor. Rotation speed can be set via a touch screen interface on the control box and may go as high as twelve miles per hour. During a test, the pneumatic pistons apply pressure to the test caster via a pivoting load arm. These arms allow for the consistent placement of the caster on the drum while being able to simulate an on-duty/off-duty situation for the caster rig and wheel. Each position has a stop that prevents the caster rig from impacting the drum should a wheel fail during a test.

The first test we will discuss is the Two Hour Usage Test. This test is designed to simulate two hours of regular usage in a plant or facility with a 75% duty cycle at the caster's full rated capacity. To achieve the duty cycle, the caster will spend three minutes engaged on the drum and one minute disengaged. A PLC inside the control box keeps track of the time and issues commands to the machine itself by opening and closing solenoid valves attached to each piston. The speed of the drum is set depending on the size of the wheel being tested. If the wheel is six inches in diameter or smaller, the drum speed is set to three miles per hour. Should the wheel be larger than six inches in diameter, the drum speed is set to five miles per hour. The reason for this is spinning a small wheel very fast can lead to premature bearing failure as the revolutions the bearing sees are greater than they would be if the wheel diameter were larger. The idea behind the test is to simu-

late an end user moving a cart around their facility and making periodic stops along their path. During the test, temperature measurements are taken and recorded at the hub of the wheel as well as the tread surface. These temperature readings are taken using a non-contact infrared thermometer and are performed during the off-duty periods in the testing cycle, spaced approximately fifteen minutes apart. The test is monitored between temperature readings by a member of the quality control or engineering staff so that any failures can be observed and recorded as they occur. For example, a urethane wheel can reach a temperature at which it will begin to melt and debond from its core. This is usually preceded by the observation of small bits of urethane being ejected from the tread. Figure 2 below shows a typical example of this sort of failure.

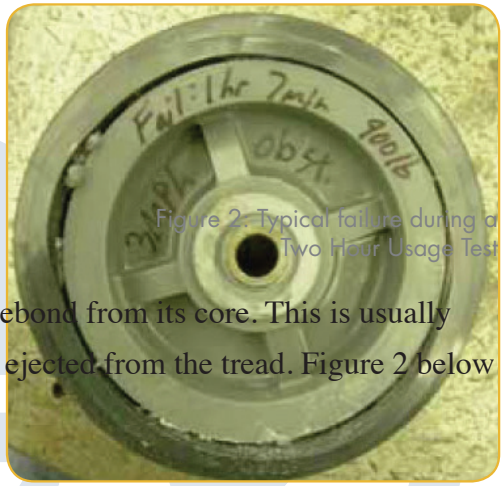

Figure 2: Typical failure during a Two Hour Usage Test

The next type of test is the Endurance Test. The purpose of this test is to find the limits of what the given wheel can take. This test is similar in setup to the Two Hour Usage Test, but has no set time limit and uses a 100% duty cycle at maximum rated capacity. As with the previous test, this test is done at three miles per hour for six inch and smaller wheels and five miles per hour for larger wheels. The test pauses every fifteen minutes so temperature readings can be taken using the non-contact infrared thermometer and are done as quickly as possible in order to give as little respite as possible. It is not uncommon for this test to continue for eight hours or more. While the two hour test simulates a typical facility floor usage, this test simulates a constant usage situation similar to what might be found in an assembly line. Failure modes seen during this test are similar to those seen during a Two Hour Usage Test and are often the result of sustained high temperatures.

The last test type that we perform on this piece of equipment is the Obstacle Test. This is the most harsh test performed and could be categorized as a destructive test. The speed and load applied use the same criteria as the other two tests, but this test is designed to simulate a caster hitting a sizable obstruction out in the field - such as an expansion joint in a floor or bridge, a rough concrete surface, factory door sills or metal cover plates for

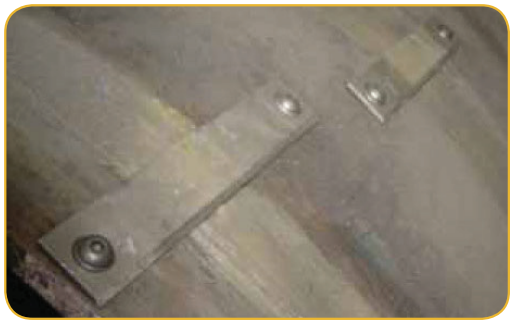
Figure 3: Obstacle plates attached to the drum

unused equipment pits or raceways. The way we simulate this is to have two metal plates bolted, 180 degrees apart, onto the drum in the path of the caster. Each obstruction is approximately 2% of the diameter of the wheel being tested and has a chamfered edge on the impacting side. See the image below to get a better idea of the obstacles used.

This test is a two hour test and the wheel is engaged in a 75% duty cycle (three minutes on, one minute off). By the end of the two hours, there should be no evidence of excessive wear, cutting, tearing, scuffing or detachment on the surface of the wheel. The wheel bearing should also be in satisfactory condition. As with the other tests, temperature readings are taken every fifteen minutes during the test. Figure 4 shows one mode of failure common to the test.

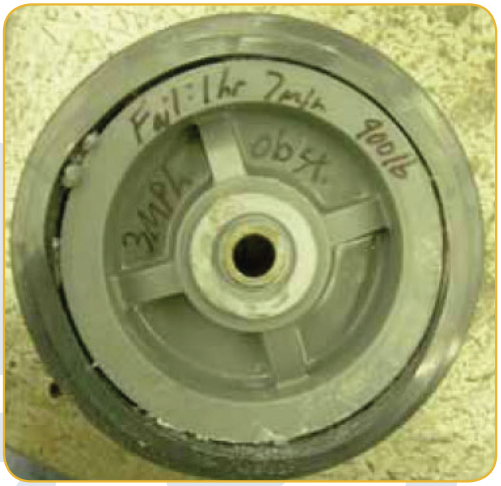

Figure 4: Typical Failure during an Obstacle Test

As you can see, the RWM Drum Tester allows us to simulate a great many situations that our wheels and casters could conceivably encounter while in real-world use by our customers. This allows us to see how RWM and competitor products perform when stressed and know ahead of time exactly how different setups will behave instead of wondering or guessing if the solution provided will work or not. We want our customers to know that the wheels they buy from us will hold up and perform as needed even in the worst conditions and that we have done all the necessary leg work ahead of time to ensure our products perform to the highest standards time and time again.