6.0.0 WHEEL TRUCK BALANCING

6.1.0 INTRODUCTION

- Smoother road surfaces, higher speeds, lighter, more sophisticated suspension / wheel connection systems, tighter allowances on the part of the vehicle's constructor and better informed, more demanding users/drivers are all factors which are helping to increase the demand for higher levels of tyre uniformity

- Tyre uniformity is essentially a manufacturing and production factor, but tyre maintenance and appropriate attention to all the aspects relating to duty and use are equally important

- It is therefore important that the tyre dealer and the user's maintenance staff should be suitably trained and aware that all shortcomings in mounting/maintenance might lead to or aggravate tyre uniformity problems

The wheel of a motor vehicle consist essentially of a disc, a rim and a tyre.
Even if these three parts are manufactured with care and each of them is balanced separately, the wheel as a whole will generally show unacceptable unbalances which should be balanced by the vehicle manufacturer before fitting the wheel onto vehicle.

The purpose of wheel balancing is to eliminate wheel vibrations, or at least to reduce them to an acceptable limit, thus eliminating the many consequential inconveniences and type of damage, such as premature tyre wear, early bearing and knuckle wear, damage to shock absorbers and other steering parts.

Balancing is achieved by applying masses of suitable weight in certain position so as to avoid practically all vibrations.
Such masses, normally called counterweight, balance the unbalances which inevitably exist in a wheel, as any wheel, complete with its tyre, even if manufactured and fitted onto the vehicle with the utmost care, is practically always unbalanced if it is not subjected to a final balancing operation.

6.2.0 WHEEL UNBALANCES

- STATIC UNBALANCE

If we add a mass (m1) to the barycentric plane transverse to the shaft axis of a supposedly perfectly balanced wheel, a static unbalance will be generated, which will generate a centrifugal force rotating on the barycentric plane transverse to the axis of rotation when the wheel is turning.
Static unbalance can be detected by means of gravity equipment or, with more precision, by spinning the wheel in such a way as to generate and measure the centrifugal force caused by the unbalance.

- COUPLE UNBALANCE

If two equal masses (m1 and m2), are applied to a perfectly balanced wheel, displaced 180° and on two symmetrical planes with respect to the transverse barycentric plane, this will cause a couple unbalance which, when the wheel rotates, will generate two equal centrifugal forces opposite each other and lying on two parallel planes, whose distance from each other will be equal to the wheel's width.
Also in this case, the reaction of the suspension transmit vibrations to the vehicle of various amplitude and in various directions, depending on the different elasticity of the various components and, further, a marked shimmy effect.
A couple unbalance can be detected only by spinning the wheel in such a way as to generate the two centrifugal forces caused by the unbalances.

- DYNAMIQUE UNBALANCE

A dynamique unbalance is obtained by superimposing a static and a couple unbalance ona wheel.(The definition of static, couple and dynamique unbalance are according to ISO International Standard Organisation) This is the most general and common type of unbalance found in motor vehicle wheels, as it is very rare to find a wheel with only static or couple unbalance.

6.3.0 WHEEL BALANCING

- HOW TO COMPENSATE UNBALANCES

Wheel balancing is the operation whereby certain masses are applied to the two sides of the wheel, of a value and in a position such as to compensate for all existing unbalance, whose real position, value and quality are generally unknown and indeterminable.

To achieve correct balancing, it is necessary and sufficientto use TWO masses: one for each side of the wheel.

6.4.0 “OFF-VEHICLE” WHEEL BALANCING

- OBTAINABLE RESULT

Using this method, it is possible to balance a wheel completely, as it brings the wheel’s inertia axis into coincidence with the wheel’s rotation axis, such that the wheel turns freely about its axis without presenting any uncompensated force or consequently any vibration.

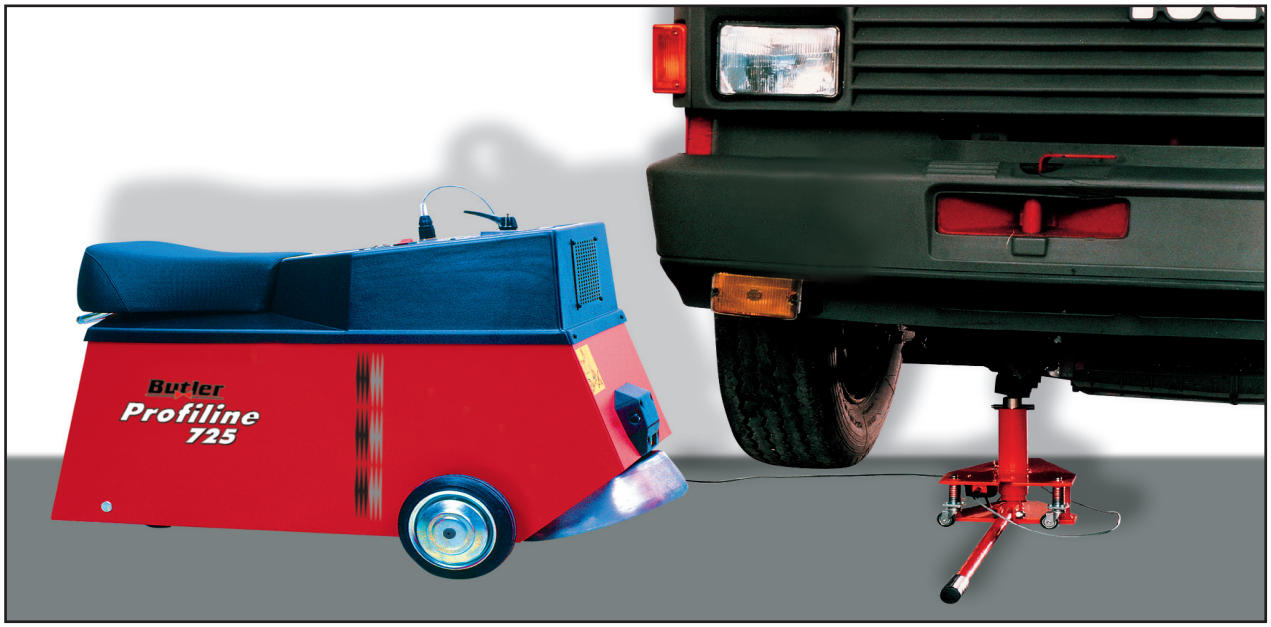
The balancing machine (in figure BUTLER PROFILINE 792) consists essentially of a group of bearing with special characteristic of elasticy and of a motor-driven shaft on which the wheel is fitted, by means of special adaptors (flanges).

6.5.0 "ON-VEHICLE" WHEEL BALANCING

- OBTAINABLE RESULT

Using this method, it is possible to reduce or eliminate the vibrations generate by the unbalances and transmitted from the wheel to the vehicle but, in a stricly technical sense, the wheel itself will not generally be fully balanced.

Using the on-vehicle method, it is possible to obtain also an optimal balancing, if the wheel has been balanced previously on a balancing machine.



The balancing machine (in figure BUTLER PROFILINE 725) consists essentially of motor-driven bell which operate by contact to the tyre and a infrared device which read the position and quantity of counterweight to put on the wheel.

6.6.0 BALANCING PROBLEMS

Wheel not perfectly centred due to:

- Poor workmanship
- Centring hub out of tolerance range
- Wheel hole diameter out of tolerance range

Checking procedure

- Remove the wheel from the adapter, turn through 180° and 90° respectively and then check the unbalance again in these two positions
- All readings should be less than 10 g. per side

Incorrect separation of the wheel's upper/lower planes

- Faulty machinery

Checking procedure

- Balance the wheel at 0 g. (or near to this) on both sides
- Apply 300 g. of weights in a position chosen at random on one of the wheel's planes
- Check whether the machine is able to identify this artificial imbalance in the given position