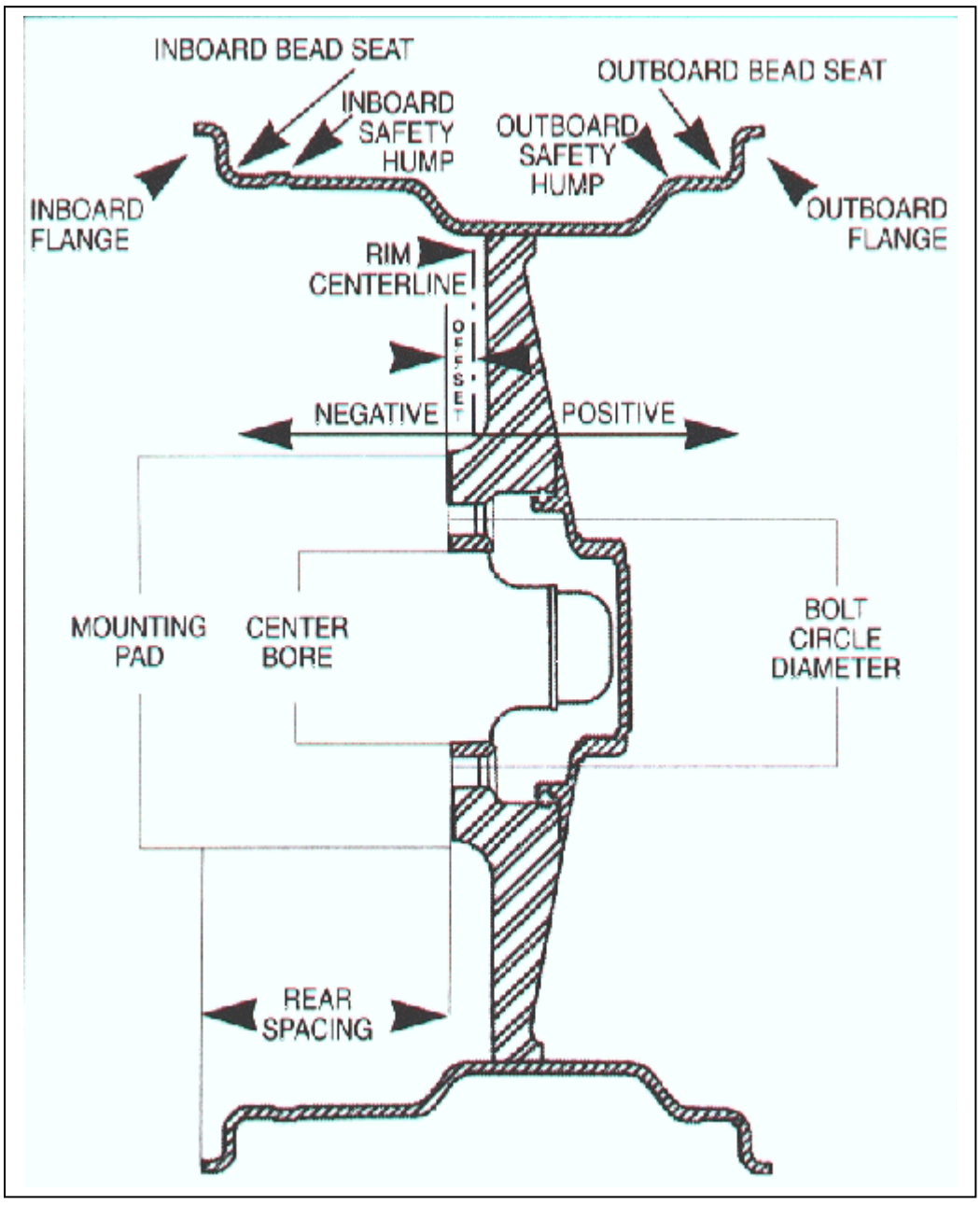
ALUMINUM WHEEL BASICS

TECHNOLOGY

Wheel technology is a complicated science. It is not necessary for wheel straightening technicians to know the engineering behind these elements. However, it is essential to know how to properly inspect a wheel for damage and how to mount and torque a wheel properly. As professionals, you should also be aware of some technology basics.

TERMINOLOGY



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BOLT CIRCLE DIAMETER
Although Pitch Circle Diameter is actually the correct term, BCD is a more descriptive term for our use in wheel technology. It is the diameter of the center of the bolt hole pattern. It also can be described as twice the distance from the center of the wheel to the center of one bolt hole.

> ***ESTIMATING BOLT CIRCLE DIAMETER***
> *If a customer wanted to order some custom wheels and asked you how to determine his bolt circle diameter, you can help him with a simple estimate method. It is very difficult to estimate the center of a large hole, such as the center bore of a wheel. However, it is not as difficult to estimate the center of a lug hole. Such accuracy is sufficient for estimations. To get the BCD of a 4, 6 or 8 lug wheel, simply measure the holes directly opposite each other across center. For a 5-lug wheel, measure the distance from the back of the 12 o'clock lug hole to the center of the 5 o'clock hole.*

BACKSIDE SETTING/REAR SPACING
The measurement from the mounting pad to the inner edge of the wheel.

BEAD SEAT
The position where the tire rests and seals on the inside of the rim.

CENTER BORE
The hole in the center of the wheel machined to match the hub of specified vehicles with hub-centric wheels and machined to a generic size with lug centric wheels.

HUB CENTRIC
The center bore hole of a wheel matches the hub diameter of the vehicle. This centers the wheel via the center hole rather than the lug nuts.

HUB CENTRIC RING(S)
A nylon insert for the center bore of the wheel that keeps the wheel concentric to the vehicle's hub during installation. This is sometimes referred to as the pilot bushing.

LUG CENTRIC
When the wheel is centered by the bolt holes/ lug nuts of the wheel, rather than by the center bore. Lug centric wheels should be balanced from the bolt holes.

MOUNTING PAD
The surface area on the back of the wheel's center that contacts the brake drum or rotor surface.

ALUMINUM WHEEL BASICS

OFFSET

Offset is the distance between the centerline of the wheel and the mounting pad. It has a significant effect on elements of vehicle suspension and steering geometry, all of which affect the load and handling characteristics of a vehicle. Wheel assembly width and fitment of calipers and other suspension components are also factors considered in the design of offset. Positive offset is when the mounting pad is toward the outboard side of the wheel and in negative offset the mounting pad is moved toward the inboard or brake side of the wheel centerline, like on deep face wheels.

MEASURING AND CALCULATING OFFSET

First measure the distance from the mounting pad to the back of the wheel. You can do this by placing a straight edge across the back of the wheel while scaling the distance between the two points. Since, that distance is technically referred to as the wheel ***backspace****, let's call that the B dimension. Next, measure the total width of the wheel and call that the W dimension. Now you can calculate the wheel offset by subtract half of the W dimension from the B dimension. With the values as stated above, the actual equation looks like this:*

$$Offset = B - (W/2)$$

If the value is negative, the offset is negative.

NEGATIVE OFFSET

When the mounting pad is closer to the disk/drum (Inside) of the wheel. Or the mounting pad is behind the centerline of the wheel. This type of wheel is commonly referred to as a deep-dish wheel. This offset is common in older vehicles and many of today's trucks and will bring the wheel/tire combination out away from the vehicle.

POSITIVE OFFSET

The mounting pad is forward of the centerline of the wheel, towards the street side of the wheel. This is common in most front wheel drive cars and some newer trucks. Generally speaking a positive offset wheel brings the wheels closer to the center of the vehicle.

25.4 CONVERSION (Inches/Millimeters)

When wheel or tire related dimensions are metric and you want to convert them to inches (or vice-versa), just remember the number 25.4. If you want to convert a metric value to inches, divide the value by 25.4. If you want to convert inches to a metric value, multiply by the ***decimal*** *value by 25.4. For example if you used a ruler and determined that a wheel offset was 1 5/8" you would first convert that measurement to decimal inches, or 1.625". Then multiplying by 25.4 would give you a metric value of 41.275mm.*

PLUS 1/ PLUS 2 SIZING

A concept to improve handling and performance through the mounting of lower profile tires to wheels that are 1, 2 or even 3" greater in diameter. The overall ride height remains the same.

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RIM WIDTH
The width of the wheel, measured from bead seat to bead seat not edge to edge.

RIM DIAMETER
The overall diameter of the wheel's bead seat, not the diameter of the rim edge.

RIM or WHEEL WEIGHT FLANGE
The outermost edge of the wheel's rim that the clip-on weights attach to on most wheels.

SAFETY HUMP
The raised area circling the rim of the wheel and located slightly inward from the bead seat.

STAR PATTERN
The proper way for sequential torquing of the nuts in a 5-lug bolt circle.

STRUCTURAL INTEGRITY
The capability of a wheel to withstand all weight bearing driving forces.

TORQUING
The securing of the wheel/tire assembly to the automobile by the tightening of the wheel's lug nuts to the studs of the vehicle's hub. Wheels should always be torqued with a manual torque wrench (not an impact air wrench) to torque rating specifications.

TORQUE RATING
The proper pressure to be applied in foot pounds when tightening lug nuts to secure the wheel/tire assembly to the automobile.

UNSPRUNG WEIGHT
The total weight of the vehicle not supported by the suspension system, such as wheels and tires.

ZERO OFFSET
The distance from the mounting pad to the centerline of the wheel is 0

MANUFACTURER WHEEL MARKINGS
It is mandated by law that the manufacturer is to leave a lasting mark on the wheel that readily identifies the company that made the wheel. Some markings are casting or forging information, some reveal alloy content and some wheels even have serial numbers. Symbols JWL and VIA are also frequently forged or cast into a wheel. These refer to Japanese standards. No wheel can be used in Japan unless it bears one of these symbols. The JWL standard (Japanese Light Alloy Wheel) is a set of requirements for aluminum alloy wheels established by the Japanese Government. The standard for trucks and buses have the same symbol with a T added JWL-T. Wheels bearing these symbols are certified to meet the standards. The VIA symbol is the Vehicle Inspection Association of Japan, which indicates that wheel was also independently tested to meet all Japanese quality standards.

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MATERIAL AND HARDNESS

Over 90% of the aluminum wheels in North America are an A356 T6 alloy. The bulk of the remaining wheels are 6061 T6 alloy. The A356 and 6061 describes the chemistry of the alloy and the T6 refers to the heat treat. Both A356 and 6061 have a Brinell hardness range of about 50-70Bhn prior to heat treating. The Brinell hardness is typically specified at 80-95Bhn for the finished wheel. The Rockwell B scale is also used to classify the hardness of softer metals. The chart below is an approximate comparison of the Rockwell and Brinell scales.