INSTALLATION/REINSTALLATION OF ROTOR & WHEEL TO HUB.

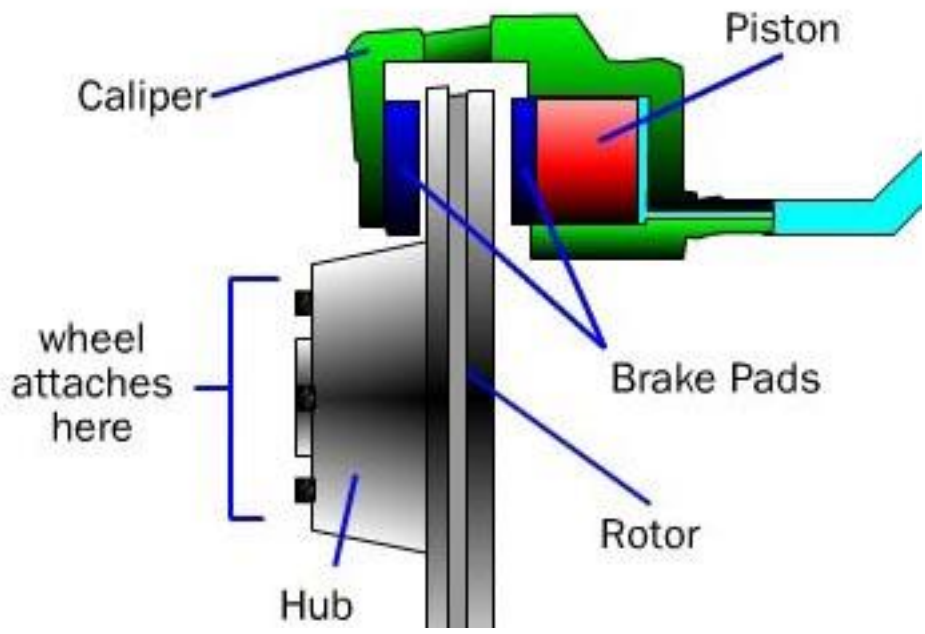
The cleaning of the WHEEL HUB / ROTOR / WHEEL interfaces is a critical part of the disc brake job (this applies to tyre rotation also).

When a car rolls of the production line, the WHEEL HUB / ROTOR / WHEEL mount faces are bright metal to metal finish, accurately torqued to a designed torque setting with no preservative greases, oils or other preservatives to disrupt the bearing interfaces mating flush and parallel, metal to metal providing a clamp fitting.

There are a number of mounting interfaces, namely:

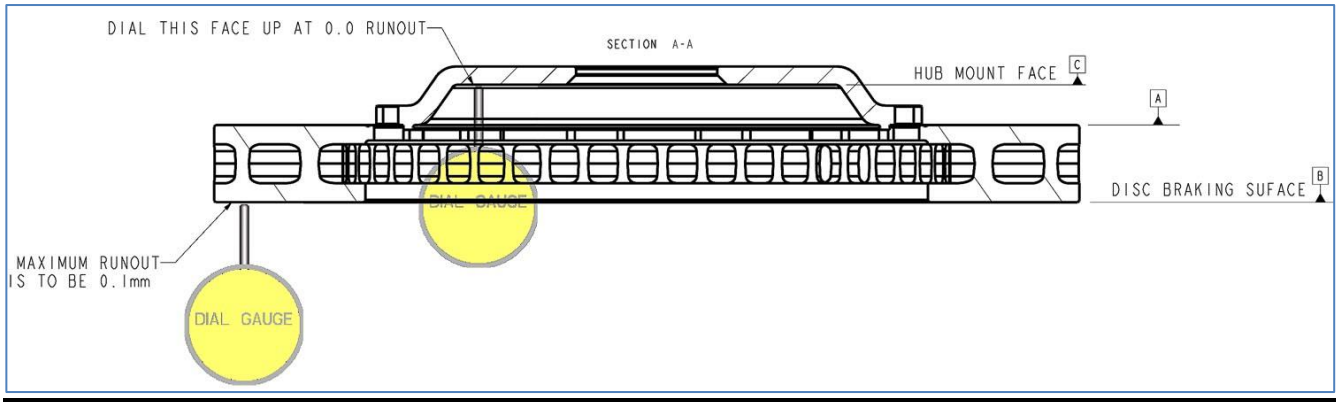
1. **OEM Hub mount face including Spigot interface,**
2. **Rotor inner mount face,**
3. **Rotor outer mount face,**
4. **Wheel mount face including Hub Spigot engagement**
5. **Pad bearing surface interfaces**

(Drawing below refers and illustrates relationship OF THE MOUNT FACES, all flush metal to metal and parallel to each other).



All these mount faces are bright metal to metal clamp fittings and should be. within a maximum of 0.1mm or less runout.

OEM INSTALLATION TOLERANCES FOR MAXIMUM ROTOR RUNOUT MEASURED BY DIAL INDICATOR 10mm IN FROM THE OUTER DIAMETER OF THE ROTOR IS A MAXIMUM OF 0.1mm (Drawing below refers).
You should aim for a target of less than 0.1mm



ON REINSTALLATION/ROTATION, OEM requirement is that all mount faces of the WHEEL HUB / ROTOR / WHEEL must be cleaned back to bright metal, FREE OF ANY RUST, SCALE OR OXIDISATION before the installation/reinstallation is commenced to ensure that the bearing surfaces mate fully flush.
This will ensure that the installation tolerances can be adhered to.

Note: Clean only, do not remove metal.

Cleaning of these surfaces is MANDATORY. If not cleaned properly, the RUST, SCALE & CORROSION will prevent the bearing surfaces mating fully flush and after a short period of time, the **RUST, SCALE & CORROSION** will shift/move under load, leading to **misalignment of the hub face and the rotor** and will almost certainly result in the onset of **DISC THICKNESS VARIATION (DTV).**

DTV (**OFTEN INCORRECTLY AS DISC WARPING)** will start to occur approximately 3000-4000 kilometers after installation where rust, scale and corrosion was not removed. It does not manifest itself in initial testing after installation.

DTV leads to braking problems such as:

1. **Pedal pulsation when stopping,**
2. **Vibrations,**
3. **Judder,**
4. **Pad knockback,**
5. **Uneven pad wear and more.**

EXAMPLES: Shots of RUST, SCALE & CORROSION build up (with comments).

Slip-on Rotor requiring force to remove it from Spigot.

The reason was the rust and scale build up around the Spigot Centre Hole and generally on inner face of the rotor and OEM Hub.

Reinstall without cleaning.
DTV GUARANTEED
A RECALL WAITING TO HAPPEN

OEM Hub Interface and Spigot

Rotor inner bearing interface

Rotor outer bearing interface

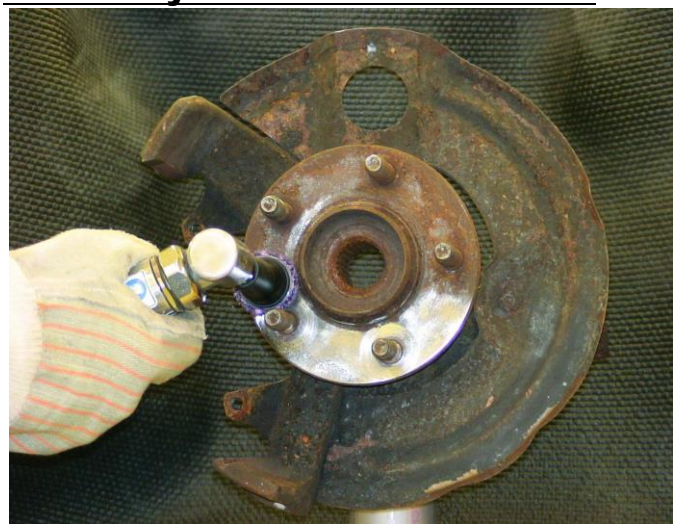
Wheel bearing interface

It is not possible to comply with OEM INSTALLATION TOLERANCES if any other the above are reinstalled without cleaning back to BRIGHT METAL.

1. OEM WHEEL HUB & STUD CLEANING

1.Clean Studs & area around studs
Clean only – do not remove metal.

2.Clean balance of Hub
Clean only – do not remove metal.



3.Clean Spigot & balance of Hub
Crevasses where Tool cannot fit
Clean only – do not remove metal.

3

4.Clean up – Spray with Brake Cleaner and wipe with clean rag

5.Hub – Cleaned
Ready for reinstallation

6. Comments:

Installation without cleaning dirty hubs above will lead to:

1. Pedal pulsation,
2. Vibrations,
3. Judder,
4. Pad knockback,
5. Uneven pad wear and more.

It is not possible to comply with OEM INSTALLATION TOLERANCES without cleaning back to BRIGHT METAL.

2. ROTOR (DISC) CLEANING

1. Clean outer interface
Do not remove metal.

2. Clean inner interface
Do not remove metal.

3. Outer/Inner Centre Hole – Cleaned
Do not remove metal.

4.Clean up – Spray with Brake Cleaner and wipe with clean rag

Outer interface – Cleaned.
Ready for reinstallation

Inner interface – Cleaned.
Ready for reinstallation

It is not possible to comply with OEM INSTALLATION TOLERANCES without cleaning back to BRIGHT METAL.

3. MAG / STEEL WHEEL HUB CLEANING

1. Clean inner interface
Do not remove metal.

2. Centre Hole – Cleaned
Do not remove metal.

3.Clean up – Spray with Brake Cleaner and wipe with clean rag

4. Inner interface – Cleaned. Ready for reinstallation

It is not possible to comply with OEM INSTALLATION TOLERANCES without cleaning back to BRIGHT METAL.

4. REINSTALLATION

THE USE OF TORQUE STICKS, SELECTED TO THE OEM TORQUE SPECIFICATION IS HIGHLY RECOMMENDED WHEN USING A RATTLE GUN.

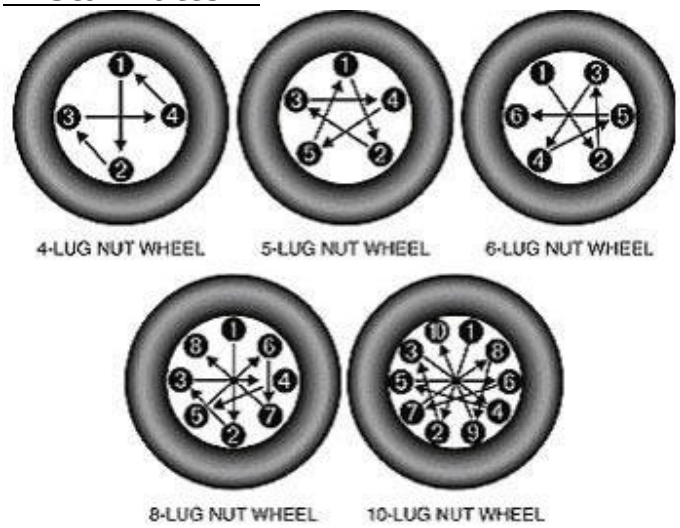
THE USE OF RATTLE GUNS ONLY IS NOT RECOMMENDED.

1. Initial Tightening

Torque specifications are typically for clean threads that are free of dirt, grit and foreign materials, including lubricants.

Tighten the fasteners following the traditional **star** pattern sequence shown at the right. This is very important even at the pre-torque stage. At this point, all that's needed is to get all of the hardware even, **with no looseness or wobble in the wheel – 50 to 60 foot-pounds are enough for a good, snug fit.**

2. Star Pattern



3. Initial Tighten to OEM Torque Specification using Torque Sticks

4. Final tighten check to OEM Torque Specification using Torque Wrench.

5. CORRECT TORQUING TECHNIQUE:

LUBRICANTS:
Torque specifications are typically for clean threads that are free of dirt, grit and foreign materials, including lubricants.

Lubricants change the properties of a fastener, and it will not torque the way it was designed.

If applying anti-seize, it is important that it only be applied to the fasteners, not the stud.
The anti-seize compound must not be used on either the seat of the hardware or on the wheel.

Avoid cleaners that contain lubricants.

OVER-TIGHTENING:

Over-tightening is a huge problem and can be as unsafe as under-tightening.

Over-tightening stretches the stud or bolt past its yield level. Once stretched past its yield level, a fastener will not return to its original dimensions.

It is permanently weakened, and it may break during installation or when the wheel is being removed. Even if it does not break, the weakened fastener may no longer hold the wheel securely.

STAR PATTERN:

Proper Installation

Make sure there is nothing that has the potential of vibrating loose or affecting the clamping force between the wheel and the hub. A thread chaser or tap should be used to remove any burrs or obstructions on the threads.

The fastener should be easy to turn by hand until it meets the wheel's fastener seat.

Wheel fastener torque must be set to the recommended specification for the particular vehicle.

The seat of the fastener is the main point of friction where torque is measured, so extreme caution must be used as excess anti-seize compound can either drip or be pushed onto the fastener seat, resulting in inaccurate torque values.

Next install the wheel, being sure to hold it tightly to the hub and hand-tighten the fasteners. Once the fasteners are all started, the use of a tool with limited torque is recommended for consistency.

Final Torque

Brace the wheel to prepare it for final torque. Especially on heavy vehicles with high torque specifications, completely lowering the vehicle and putting all of its weight on the wheels is not recommended. Only lower it down enough to prevent the wheel from rotating during final torque. Wheel chocks can be used if necessary to lock the wheel in place.

Before applying final torque, set the torque wrench to the specifications provided by the wheel or vehicle manufacturer. Torque specifications vary widely, but the manufacturer's recommendation will always be a safe bet. The star pattern sequence should be used until all of the fasteners are tightened to the specified torque. It's best to have a regular procedure. By doing it the same way every time, all of the wheels on every vehicle you work on will be done exactly the same. It's important to be consistent; everybody on your race team or in your shop needs to know how wheels are to be mounted and those procedures must be followed every time. Resist the temptation of giving the wrench an extra click or two. On some cars, exceeding the torque value by 30–40-foot pounds will ruin the fasteners. That extra push defeats the purpose of the torque wrench. When it clicks (or, if it's electronic, does whatever it does to signal the proper torque has been achieved), stop. Especially when installing new wheels, the wheel fasteners should be re-torqued after 25 to 100 miles. The clamping force may have changed since the initial installation due to metal compression or elongation, and thermal stresses can affect the wheels. Parts will seat themselves and fastener torque may drop. Wheels should cool to ambient temperature before rechecking torque. All that is necessary is to loosen and retighten each fastener to the specified torque, in sequence.

Tool Options

A torque stick is used with an air impact wrench to avoid over-tightening fasteners when installing wheels. Torque sticks work by flexing (like a torsion bar) when a torque limit is reached. When the stick flexes, it resists further tightening of the fastener. The thicker the torque sticks, the higher the torque to the fastener. Torque sticks are useful, but they are no substitute for final torquing using a calibrated torque wrench.

STANDARD TORQUE VALUE CHART FOR METRIC FASTENERS
TORQUE - KILO-NEWTON

CLASS		4.6	4.8	5.8	8.8	9.8	10.9	12.9
PROOF LOAD Mpa		225	310	380	600	650	830	970
FASTENER								
	Dia (in.)							
M1.6x0.35	(0.063)		0.39			0.83		1.23
M2x0.4	(0.079)		0.64			1.35		2.01
M2.5x0.45	(0.098)		1.05			2.20		3.29
M3x0.5	(0.118)		1.56			3.27		4.88
M3.4x0.6	(0.138)		2.10			4.41		6.58
M4x0.7	(0.157)		2.72			5.71		8.52
M5x0.8	(0.197)	3.20	4.40	5.40		9.23	11.80	13.80
M6.3x1	(0.248)	5.09	7.01	8.59		14.70	18.80	21.90
M8x1.25	(0.315)	8.24	11.30	13.90		23.80	30.40	35.50
M10x1.5	(0.394)	13.10	18.00	22.00		37.70	48.10	56.30
M12x1.75	(0.472)	19.00	26.10	32.00		54.80	70.00	81.80
M14x2	(0.551)	25.90	35.70	43.70		74.80	95.40	112.00
M16x2	(0.630)	35.30	48.70	59.70	94.20	102.00	130.00	152.00
M20x2.5	(0.787)	55.10		93.10	147.00		203.00	238.00
M24x3	(0.945)	79.40		134.00	212.00		293.00	342.00
M30x3.5	(1.181)	126.00			337.00		466.00	544.00
M36x4	(1.417)	184.00			490.00		678.00	792.00

CONVERSION GUIDANCE
Class 4.6 is approximately equal to SAE Grade 1, and ASTM A307, Grade A.
Class 5.8 is approximately equal to SAE Grade 2.
Class 8.8 is approximately equal to SAE Grade 5, and ASTM A449.
Class 9.8 has properties approximately 9 percent stronger than SAE Grade 5, and ASTM A449.
Class 10.9 is approximately equal to SAE Grade 8, and ASTM A354, Grade BD.