HGT BELLHOUSING

INSTALLATION GUIDELINES

VERNIERBELL™

DESCRIPTION

HGT Bell housings are designed from the ground up using 3D modelling techniques. They are rigid and robust with strength equal to or exceeding most OEM parts. OEM attachment holes and dowel positions are replicated onto model specific bellhousings. There is a hydraulic line access hole towards the top of the bell housing and an inspection window towards the bottom, these holes can be covered with removable attachment plates if desired by the user.

In addition, all new bellhousings are supplied with our HGT Patented Vernierbell™ adjusting ring system.

INSTALLATION

Due to slight differences in tolerances, machine processes, engine block variability, possible line bore work etc. it is highly advised that every new bellhousing should be indexed to the actual engine block it will be used on. The indexing of the bell housing process is the normal practice of professional race car teams and builders. This important step is sometimes overlooked which can in turn cause difficult shifting as well as premature wear of the clutch, transmission and engine. When performed correctly, the indexing procedure ensures the smooth, proper and reliable operation of the transmission & clutch.

The first step is to ensure your bellhousing fits properly onto the engine block, it is important to ensure both dowels are in good condition and indeed present. If either both dowels are missing or just one dowel missing, this is not acceptable, you cannot proceed until the correct dowels have been installed. The fit of the bell housing over these dowels should be a snug or a slight press fit. If it is found that excessive clearance is present (sometimes due to old dowels or previously rusty dowels), then this should be corrected before the alignment procedure. A small amount of clearance, say up to 0.3mm can be taken up with a coating on the dowels or within the dowel holes, such as an epoxy based application.

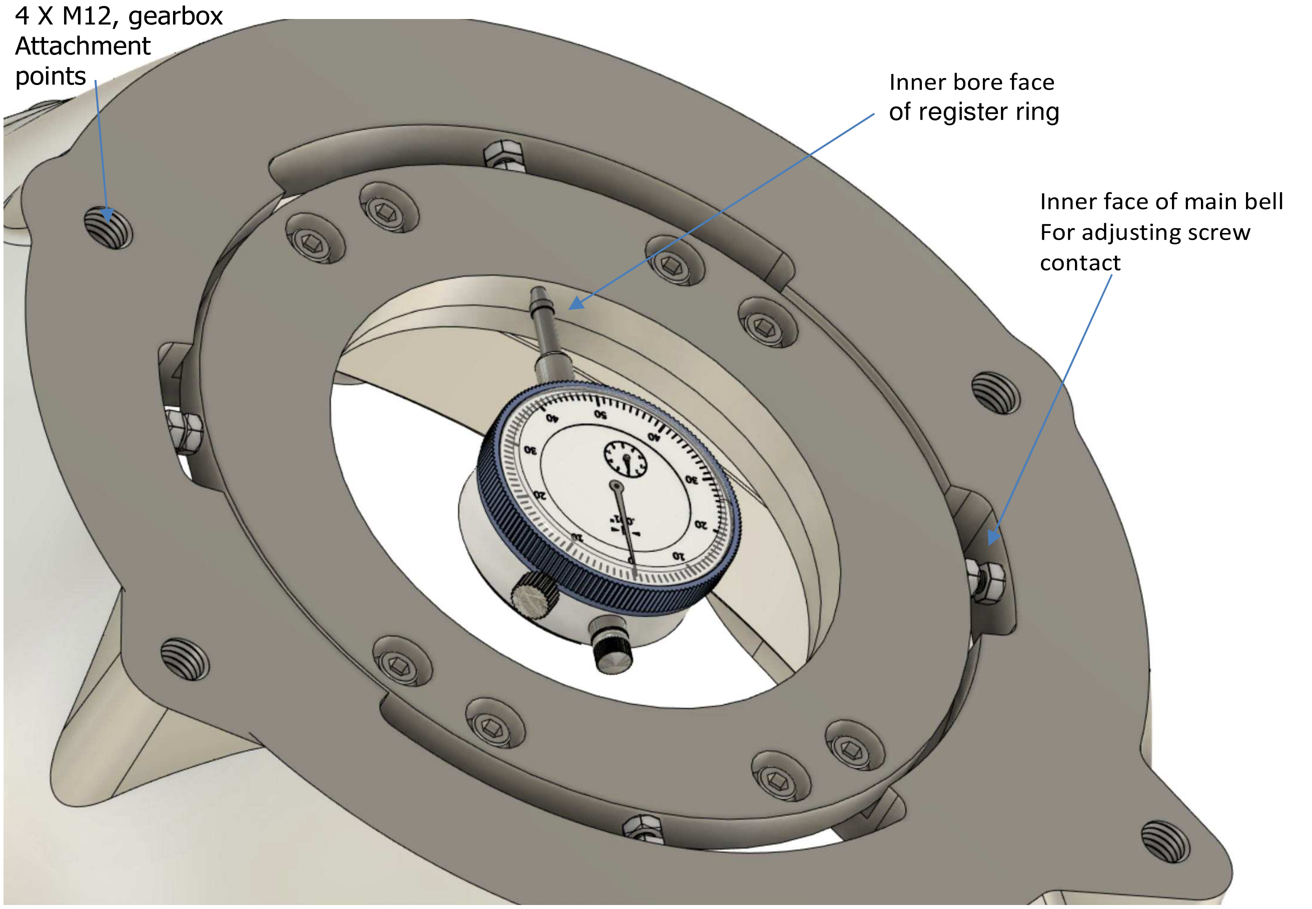
The procedure for checking the alignment of the bellhousing starts out essentially the same way as the conventional process. I.e. by using a magnetic base style dial test indicator, a "DTI", similar to that enclosed in the picture below, this being attached to the crankshaft/flywheel and rotating it ¼ or ½ turn at time. It is usually easier to have the flywheel attached in place to give a good flat metal base for the magnet to secure against. It is not necessary to have all the flywheel bolts attached for this procedure, just three will do, but do make sure the flywheel is sufficiently secure so that it does not move around during rotation of the engine.

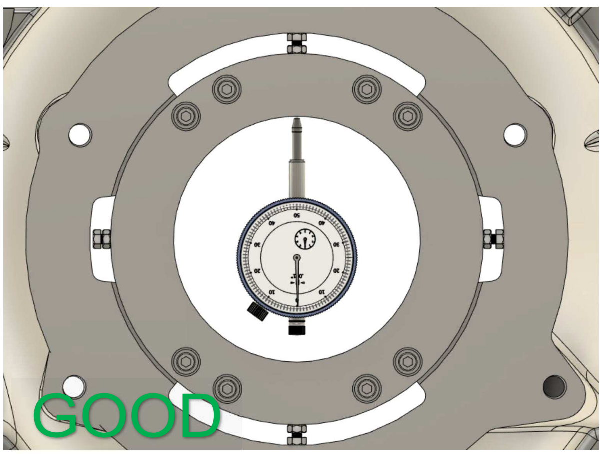
Rotation of the crankshaft is carried out with a socket wrench on the front pulley attachment nut of the crankshaft coupled to a long torque lever arm for ease and control. It is usually better to remove the spark plugs for ease during this operation.

Whilst the task can be carried out with the engine in the vehicle if it's unavoidable, it is much easier performed with the engine out of the car and positioned in a convenient working position or on a bench. Access is needed to the flywheel side making most engine stands not suitable. Either way, make sure it is secure and safe to prevent damage or serious injury by dropping.

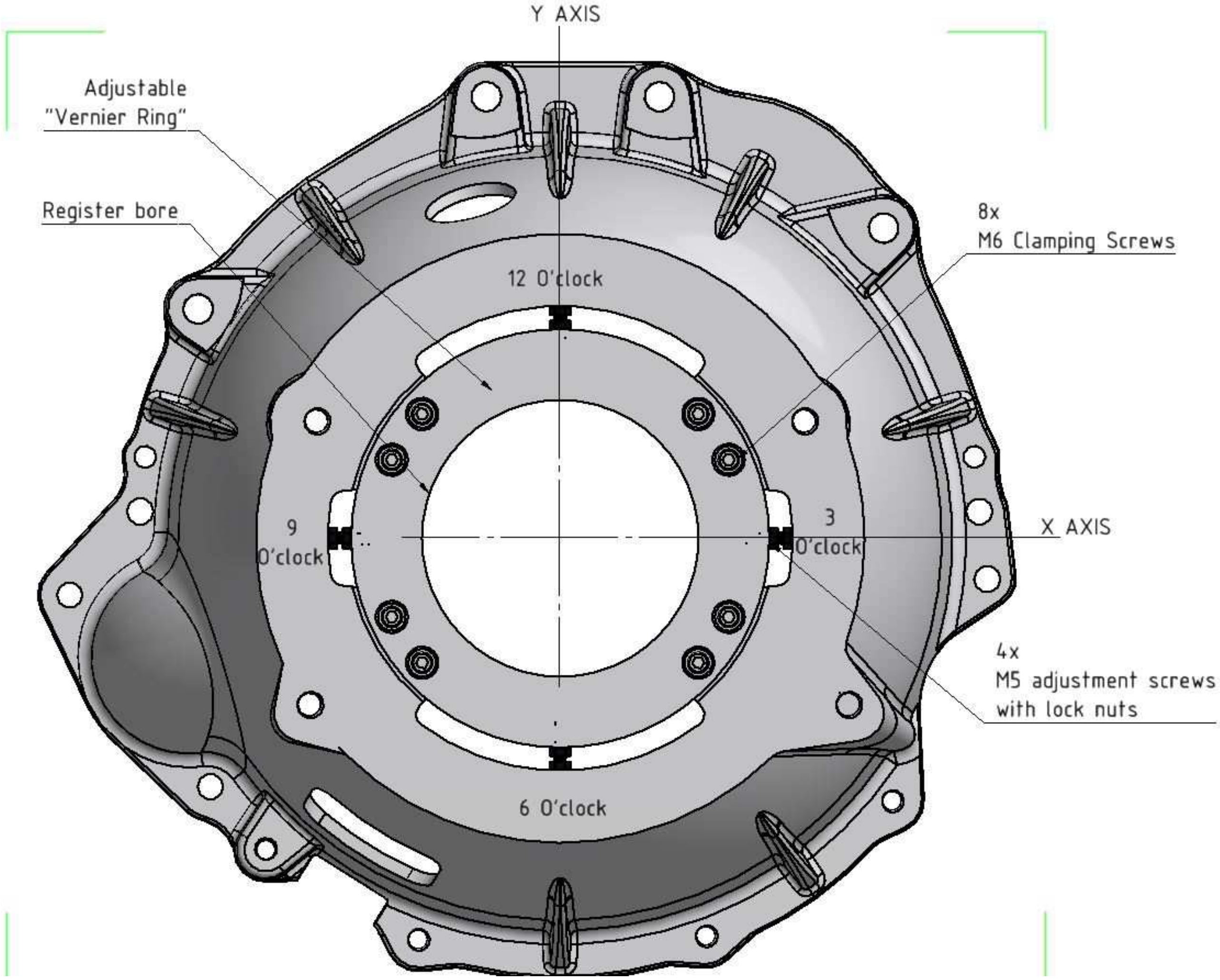
There currently exists a wealth of information and media such as on YouTube describing the conventional procedure of bellhousing indexing. Once familiar with this procedure, you are ready to start. Keep in mind the changeover point in the indexing process starts when correctional adjustment is required. At this stage of the procedure, rather than using offset dowels to achieve the adjustment required, the Vernier system steps in and makes the adjustment task much easier to accomplish to a high degree of accuracy.

Attach the magnetic base of the DTI to the crankshaft/flywheel, use the multi part adjustable support arm of the DTI to obtain the best tip contact position, this make take a little time and patience for those unfamiliar. Placement of the DTI should be as radial as possible, avoid tangential angle if possible. Ensure the tip of the DTI is against the inner bore of the register ring. (Not the main bore of the bellhousing)





If there is a large tangential angle that is unavoidable, such as the image on the right, then the readings to be taken might not be reliable, and several more rounds of checks during the procedure may be required.



PROCEDURE

In the example below of the process, we will use some assumptions to explain the logic.

There are two basic ways to proceed. Treat the X and Y axes independently and adjust them one at a time, or carry out both X and Y measurements and adjustments at the same time. Experienced race car builders or mechanics would be able to confidently carry out X and Y at the same time. For the purposes of this example and for an easier way to understand & accomplish the task, we will treat and adjust one axis at a time.

Become familiar with the DTI instrument and its direction as well as scaling. (We will assume for this example that a push inward movement of the plunger into the DTI gauge, represents a positive +ve displacement value) Either a metric mm scale DTI or am imperial Inch DTI can be used. The example below is in metric, demonstrates the principle that applies to metric or inch readings.

Y AXIS - Step 1

Loosen off the 8 x M6 clamping screws, then slightly tighten just two of them to prevent the adjustment ring moving during the checking procedure.

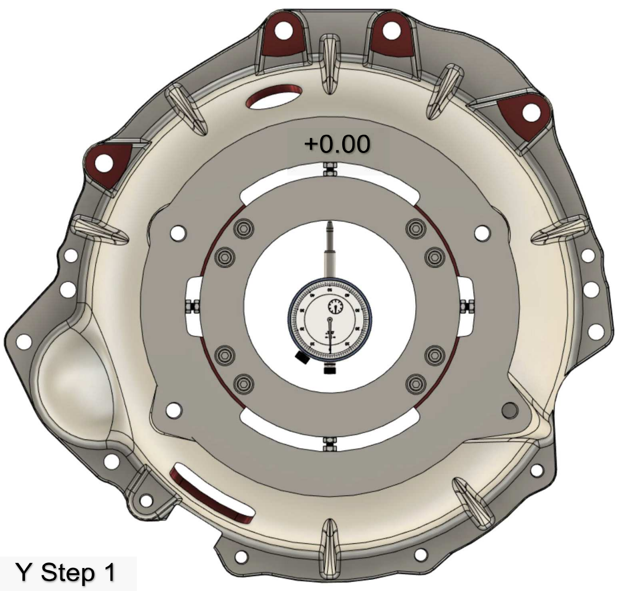
Loosen off the lock nuts on the 4x M5 adjustment screws.

Back off the 4 x M5 adjustment screws and retighten them finger tight only, so that they are touching the inner face of the bellhousing main body. This means the Vernier adjusting ring cannot move.

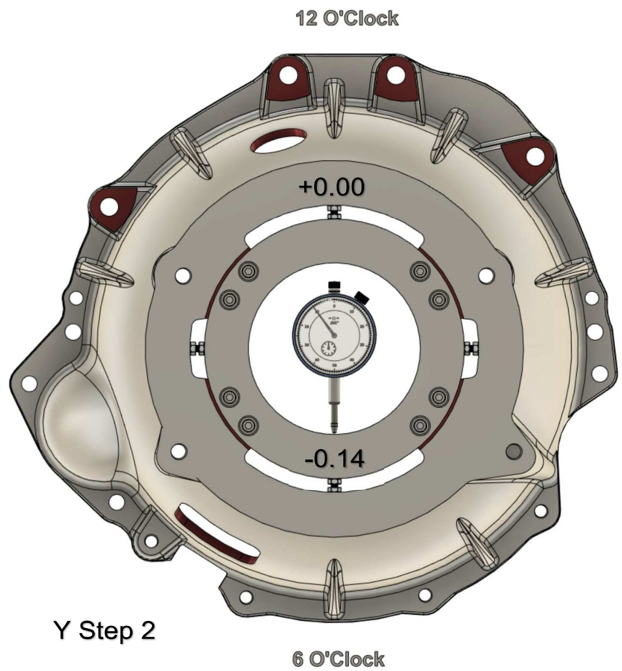
Ensure the DTI is adjusted correctly to allow for the likely amount of positive and negative displacement with some initial compression of say a few millimetres internally inside the DTI. Ensure the inner bore face of the adjusting ring is smooth and clean free from and burrs or damage.

Rotate the crankshaft of the engine so that the DTI is pointing to 12 O'clock position.

Zero the DTI at this step as the starting point for readings



Y Step 1



Y Step 2

Y AXIS - Step 2

Rotate the crankshaft of the engine again by 180 degrees so that the DTI is pointing to the 6 O'clock position.

Now make a note of the displacement on the DTI at this 6 O'clock position. A felt tip pen writing directly onto the bell housing at the 6 O'clock position is usually a convenient way.

So - we will make an assumption in this example that this measurement is = + 0.14 mm

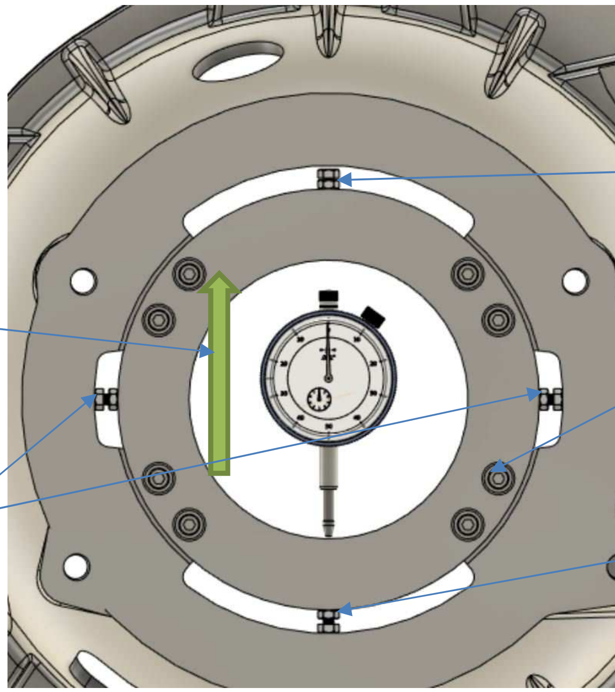
Now study this reading to understand that a correctional adjustment is required in the Y axis as follows:

From the 12 O'clock position, zeroed starting point and 6 O'clock reading of -0.14mm in this example, the plunger is extended out from the gauge meaning the Vernier ring is sitting too far towards 6 O'clock direction.

So a movement in the Y Axis of half of the difference of this amount will be required by the Vernier ring to bring the new Y axis alignment to centre.

(-0.14 - 0.00) /2 = -0.07mm, the ring needs to move in the direction towards 12 O'clock by 0.07mm

The procedure for this will be:



As in the diagram above, back off the otherwise finger tight 12 O'clock position M5 adjustment screw, because the Vernier ring needs to move in this direction by 0.07mm

Loosen off those two otherwise slightly tight M6 clamping screws so that the Vernier adjusting ring is now free to move.

Now carefully adjust the opposite, i.e., the 6 O'clock adjustment screw with a small open ended spanner, rotating it anticlockwise. This will cause the screw to move out of its threaded hole reacting on the bellhousing body inner face causing the Vernier adjusting ring to move towards 12 O'clock. Some judgment will be required to know how much rotation of the small screw is needed to achieve the amount required, however it is possible with practice to actually see the movement occur if the DTI is located in the 12 O'clock or 6 O'clock position.

Note - It will be found that only a small rotation of the M5 screw is required to produce the movement required.

After adjustment, tighten up just two of the M6 six clamping screws to hold the ring in place for now, finger tighten the 12 O'clock M5 adjustment screw as well as ensuring the 6 O'clock M5 adjustment screw also remains finger tight.

Now carry out another Y axis check as per in the beginning to check to see how well the adjustment has worked out. It might be necessary to carry out the procedure several times. It might be also a good idea to carry out the X Axis adjustment before returning to the Y Axis for final checks.

X AXIS - Step 1

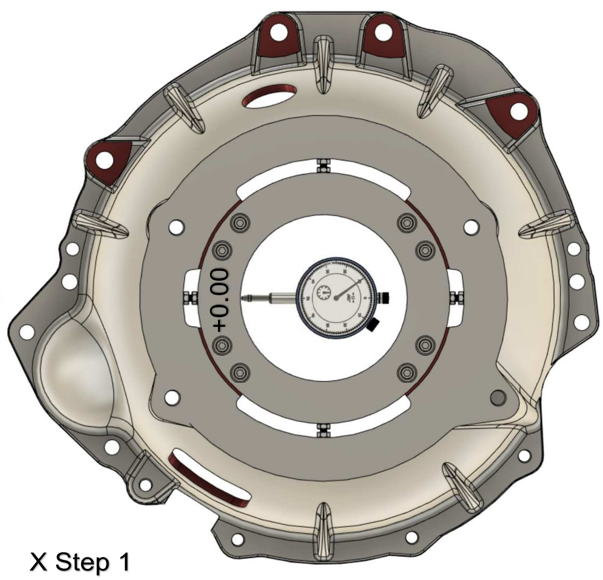
As per the 1st step previously for Y Axis adjustment, with the 8x M6 clamping screws loose but with just two of them slightly tight to prevent the adjustment ring moving during the checking procedure.

With the 4x M5 lock nuts of the adjustment screws loose

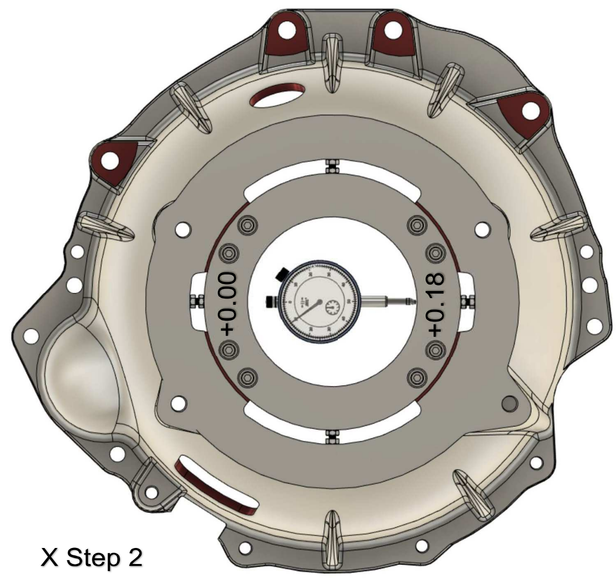
Back off the 4 x adjustment screws and re tighten then, but just finger tight for now.

Rotate the crankshaft of the engine so that the DTI is pointing to 9 O'clock position.

Zero the DTI at this step as the starting point for readings



X Step 1



X Step 2

X AXIS - Step 2

Rotate the crankshaft of the engine again by 180 degrees so that the DTI is pointing to 3 O'clock position.

Now make a note of the displacement on the DTI at this 3 O'clock position.

We will make an assumption in this example that it is + 0.18 mm at the 3 O'clock position.

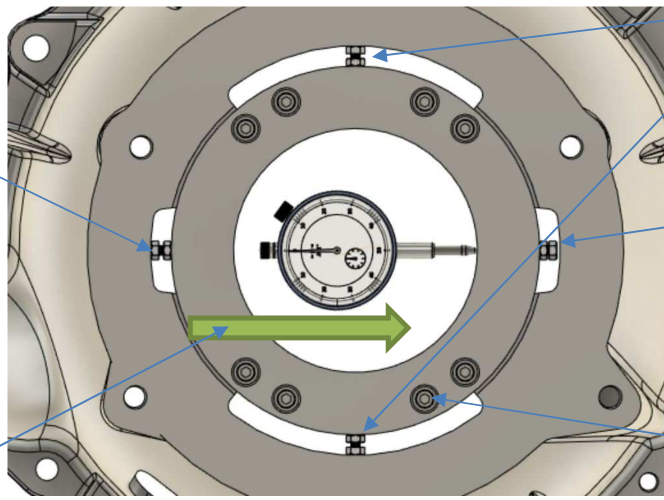
Now study this reading to understand that a correctional adjustment is required in the X axis as follows:

From the 9 O'clock position, zeroed starting point and the 3 O'clock reading of +0.18mm in this example, then a movement in the X Axis of half of the difference of this amount will be required to bring the X axis alignment to centre.

Take note of the notation of the reading, or in other words direction of movement, in this case the value is positive, which means the plunger of the DTI moved into the gauge. This means the adjusting ring is too far towards 9 O'clock.

(+0.18 - 0.00) /2 = +0.09mm, the ring needs to move in the direction towards 3 O'clock by 0.09mm

The procedure for this will be:



As in the diagram above, back off the otherwise finger tight 3 O'clock position M5 adjustment screw, thread it into the ring to leave a small gap, because the Vernier ring needs to move in this direction by 0.09mm

Loosen off those two otherwise slightly tight M6 clamping screws so that the Vernier adjusting ring is now free to move or float.

Now carefully adjust the opposite screw, i.e. the 9 O'clock adjustment screw, with a small open ended spanner, rotating it anticlockwise. This will cause the screw to move out of its threaded hole reacting on the bellhousing inner face causing the Vernier adjusting ring to move towards 3 O'clock. Some judgment will be required to know how much rotation of the small screw is needed to achieve the movement required.

After adjustment, tighten up just two of the M6 six clamping screws, finger tighten the 3 O'clock M5 adjustment screw as well as ensuring the 9 O'clock M5 adjustment screw also remains finger tight.

Now carry out another X Axis check as per in the beginning to check to see how well the adjustment has worked out. It might be necessary to carry out the procedure several times.

Final checks:

Once these steps have been completed, it is a good idea to check the Y axis once again as it is sometimes possible for adjustment in the X direction to influence the previously set Y direction. This influence will diminish the closer to the desired setting it becomes. In any case once you are set up and actively carrying out this process, it will become straight forward exercise, it is a good idea to repeat the procedure several times to achieve the best possible result. The Vernier bell system enables a high degree of alignment accuracy in a short space of time.

DATA:

Desired index tolerance target = within +/- 0.025mm (+/- 0.001")

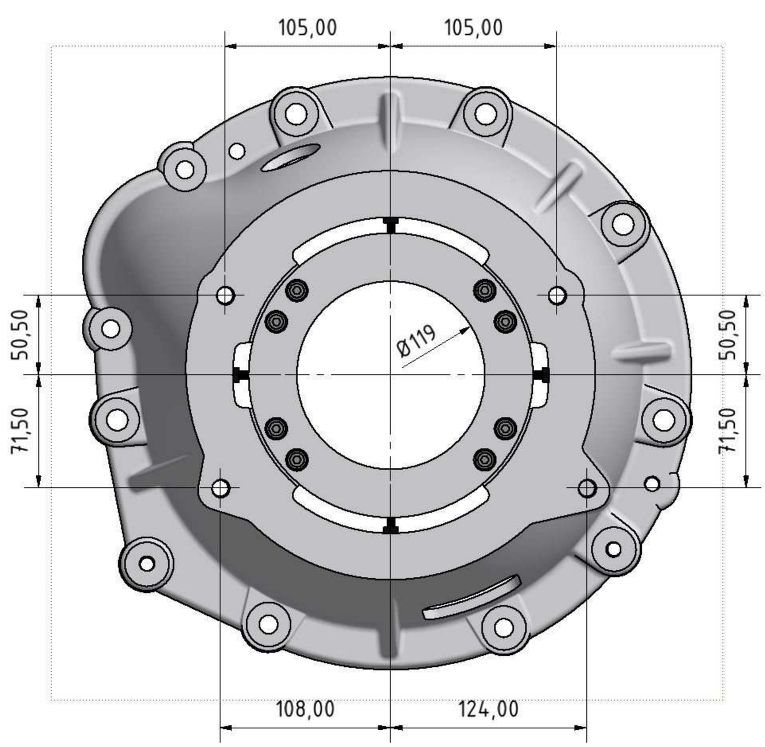
Maximum adjustment possible of the Vernier Ring = +/- 0.25mm (+/- 0.01")

Torque for 4 x M12 fastening screws to HGT gearbox = 80 Nm (60 ft. lb)

Torque for 8 x M6 clamping screws = 12 Nm (9 ft. lb)

Screws attaching the bell housing to the engine – follow the OEM screws specifications

Gearbox mounting holes pattern with 119 mm diameter bore register, dimensions shown are in millimetres:



As with any other work carried out in connection with a gearbox and transmission line components on a race vehicle, or road car, the work should be carried out by competent and experienced