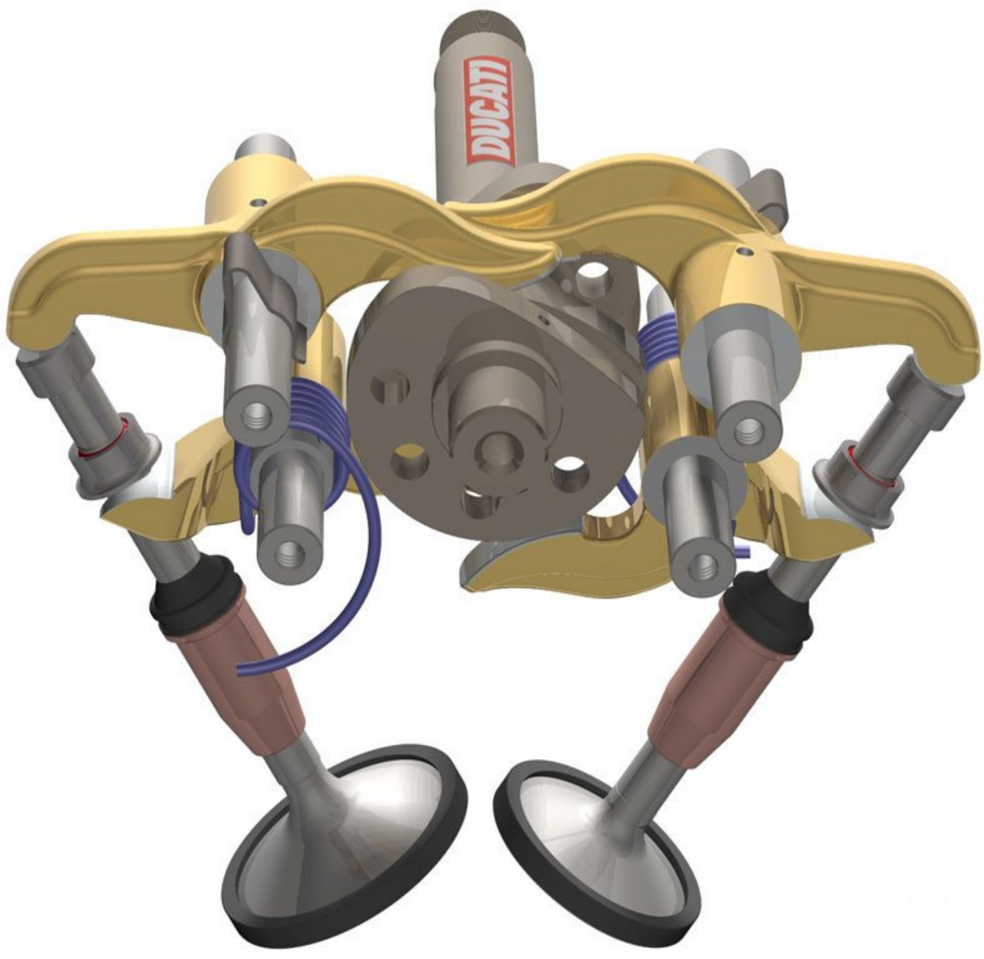


PASO

CAM TIMING

Paso Cam Timing

There are already plenty of internet articles written that cover the effects of advancing or retarding the cam timing so I'm going to concentrate on the procedure rather than the technical side. After reading many articles and talking with Brad Black at http://www.bikeboy.org I have discovered that even the factory settings are far from perfect. Brad used to work as a technician at Moto One. He now runs his own business and specialises in service, repairs and modifications to Aprilia, BMW, Ducati, Moto Guzzi and MV Agusta motorcycles. I have found by checking mine that the timing can be out by as much as 6^0 which is most likely why it has had an annoying backfire for many years. Since I adjusted the cams my bike starts, idles and runs so much better. I was trying to tune the Weber before I changed the cam timing and was getting nowhere fast. Timing the cams made the Weber so much easier to set up, small changes to the carburettor were so much easier to pick up and analyse. Timing the cams should be carried out as part of a holistic approach to tuning your bike.
As for carrying out the job, it is not very difficult, just time consuming. There is no point in rushing it anyway, because the consequence of getting it wrong can be very costly. For my own piece of mind I checked every measurement at least 4 times.

Cheers Ken

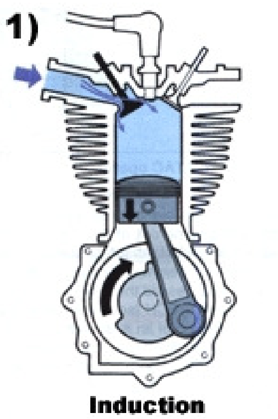
Disclaimer

I'm not a tuning guru and my knowledge is presently limited to working on my own 906 Paso. I am offering these instructions in good faith. If you wish to follow them, then I wish you good tuning but I will take no responsibility if things go pear shaped. The settings and opinions that are contained within this document are my own and may differ greatly from others. If you are not confident about working on your own bike then leave it to the professionals.

A basic introduction to cams and the 906

Considerable information has been recorded about numerous aspects of the four stroke internal combustion engine. First, it is very important to understand the relationship between piston travel directions and valve timing events. The reason this relationship is important is because it is one of the few things that is relatively easy to adjust/change. The camshaft which opens and closes the valves makes ONE complete revolution (360 degrees) while the crankshaft moving the piston up and down the cylinder rotates TWICE (720 degrees). Camshaft timing is usually expressed in terms of crankshaft degrees relative to the piston location in the cylinder. That is, relative to Top Dead Centre (TDC) and Bottom Dead Centre (BDC), respectively. Note that during the four strokes of a piston in an internal combustion engine the crankshaft will rotate 720 degrees and the piston will be at each TDC and BDC twice.

THE FIRST STROKE.

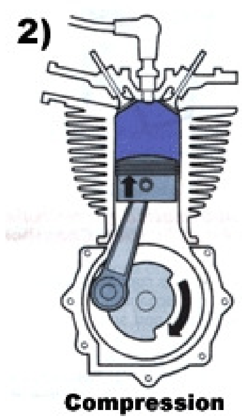


Starting at TDC, the piston starts from zero velocity and moves down the cylinder during the intake stroke; first picking up speed and then slowing down again when it reaches the bottom of the stroke. As the piston moves down the cylinder, the intake valve is opening. Some air/gas mixture starts to flow into the cylinder as the valve opens, but the greatest gulp comes when the pressure differential is the greatest. This occurs when the piston reaches its maximum velocity somewhere between 70 to 80 degrees ATDC. What governs piston velocity is the stroke, rod length, RPM, and piston pin off-set. The maximum piston speed of the engine is then limited by the resistance to gas flow of the engine and/or the stresses due to the inertia of the moving parts. You must be wondering why I'm talking about piston velocity during the first stroke.

FACT ONE: Volumetric efficiency is directly related to piston velocity!

Volumetric efficiency is a measure of the effectiveness of an engine's intake system and there are about 200 miles of air above the engine just waiting to fill the cylinder with 14.7 psi at sea level. The intake valve is almost closed as the piston reaches BDC, but it does not close completely until after BDC, when the piston is on its way back up the cylinder. The reason for this is because the incoming air/fuel mixture still has momentum even though the piston has slowed way down. We are now starting,

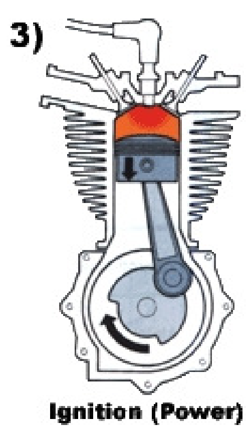
THE SECOND STROKE.



The piston compresses the air/fuel mixture to a high enough

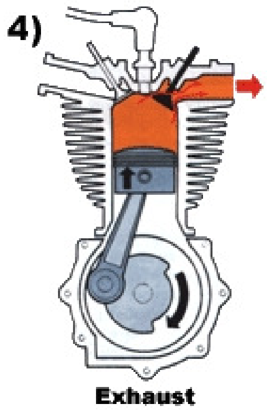
pressure and temperature to permit spark plug ignition. We hope that this results in a CONTROLLED BURN, rather than an explosion (detonation), that produces POWER and moves the piston down for,

THE THIRD STROKE.

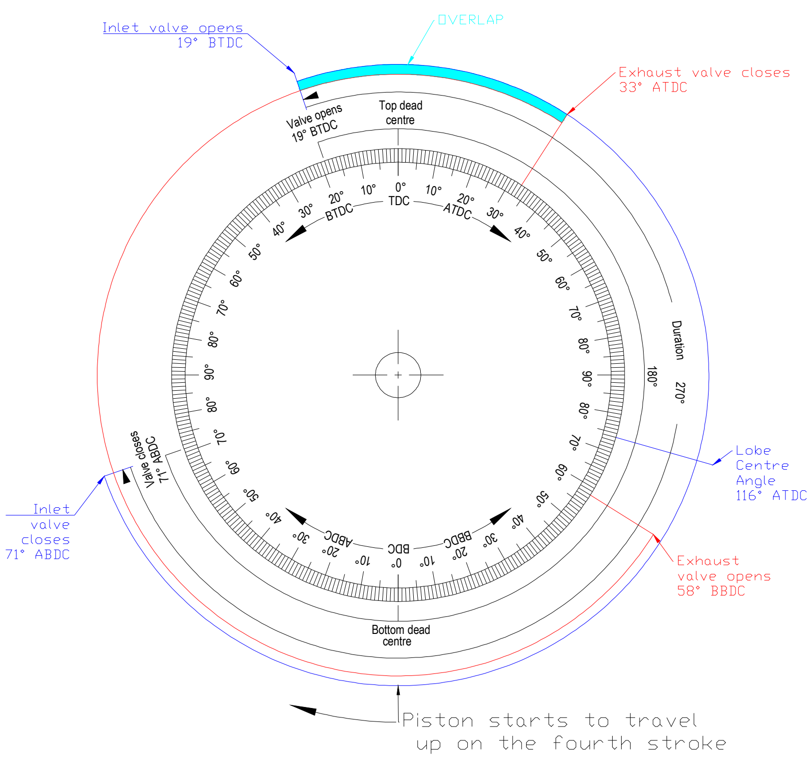


Power is produced while the gases in the cylinder expand and cool. In most instances, the gases are at a relatively low pressure by the time the crankshaft reaches 90 degrees After Top Dead Centre (ATDC), so we can safely open the exhaust valve Before Bottom Dead Centre (BBDC) to take advantage of blow- down. Otherwise, the piston would have to push ALL the exhaust out. When the piston reaches BDC we begin,

THE FOURTH STROKE.



The exhaust valve is opening at a fairly rapid rate, the piston is going up, and if the exhaust valve is not open a lot by the time the piston reaches maximum velocity, there will be resistance in the cylinder caused by excessive exhaust gas pressure. This produces conditions which are referred to as pumping losses. As the piston reaches the top of the cylinder, the end of the fourth stroke, you will see the exhaust valve is almost closed, but, lo and behold, the intake valve is just beginning to rise off the seat! At TDC at the end of the fourth stroke, both the intake and exhaust valves are open just a little. For this reason, this part of the stroke is called the OVERLAP PERIOD.



During the overlap period you will often find that both valves will be open an equal amount. This condition is referred to as SPLIT OVERLAP. On the 906 engine, the valves are open together for approximately 50 degrees of crankshaft rotation. As you might expect, with this much overlap the low speed running is very poor and a lot of the intake charge goes right out the exhaust pipe.

Let us review the four strokes again and add some timing events to calculate the total valve duration.

For illustrative purposes, we can use the 906 cam *(My Measurements)* with a 270 degree duration and 116 degree lobe centres. (The lobe centre angle is the angle in camshaft degrees between full intake cam lift and full exhaust cam lift).
As we discussed above, at the end of the fourth stroke both valves are open and the next stroke is the intake stroke. Referring to fig. 1, we see that the intake valve began to open at 19 degrees BTDC. The piston moves down the cylinder after the crankshaft passes TDC, and the valve reaches full lift at 116 degrees ATDC (lobe centre). Note also that the intake valve is still open when the piston reaches BDC. The valve doesn't close until 71 degrees ABDC. We can start to add things up now. The crankshaft has rotated 180 degrees from TDC to BDC on the first stroke and the intake valve opened 19 degrees BTDC and closed 71 degrees ABDC, so the total crankshaft rotation so far is 19 + 180 + 71 = 270 degrees. Note that even though the second stroke is the compression stroke, we see that it starts while the intake valve is still open!

FACT TWO: In the lower RPM range, the engine does not have any compression until the intake valve closes. As the engine speed increases, there is a ram or inertia effect which begins compression progressively sooner with engine speed.

Now, we compress the air/fuel mixture and ignite it at the proper time in order to maximize the push down on the power stroke, or stroke three. Remember, I said most of the cylinder pressure is gone by 90 degrees ATDC, and you can see that with our 270 degree cam, that the exhaust valve begins to open 58 degrees BBDC, that is, before the exhaust stroke actually begins. So adding again, we have 58 + 180 (stroke four) = 238 degrees. Thus at TDC at the end of the exhaust stroke, the intake valve has opened but the exhaust has not closed. The exhaust valve remains open for 270 - 238 = 32 degrees ATDC. With the intake valve opening at 19 degrees BTDC and the exhaust closing at 32 degrees ATDC we have a total of 31 degrees of overlap.
Now, with the basics down, we can start discussing duration, lift, lobe centres, compression, and cylinder flow.

VALVE TIMING EVENTS - ORDER OF IMPORTANCE

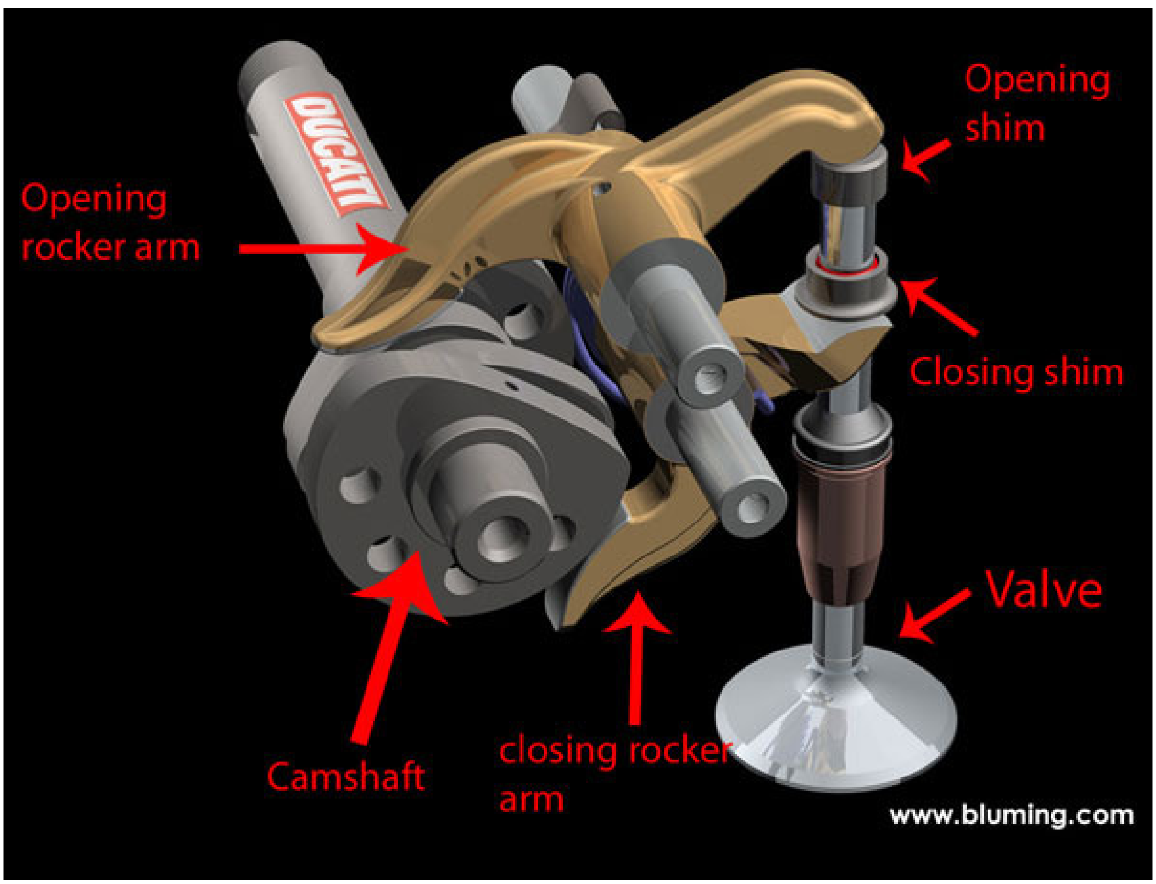
Let us now take the four valve timing events and put them in order of importance. The LEAST important is the exhaust valve opening. It could open anywhere from 50 degrees to 90 degrees BBDC. If it opens late, close to the bottom, you will take advantage of the expansion, or power, stroke and it will be easier to pass a smog test, but you will pay for it with pumping losses by not having enough time to let the cylinder blow-down. You must let the residual gas start out of the exhaust valve early enough so that the piston will not have to work so hard to push it out. Opening the exhaust valve earlier will give the engine a longer blow-down period which will reduce pumping losses. But, if you are only interested in low speed operation, say up to 4000 RPM, you can open the exhaust valve later.
The next least important timing point is the exhaust valve closing. If it closes early, say around 15 degrees ATDC, you will have a short valve overlap period. Less overlap makes it easier to pass the smog test, but it does not help power at the higher engine speeds. Closing the exhaust valve later, in the vicinity of 40 degrees ATDC, will mean a longer valve overlap period and a lot more intake charge dilution that will translate into poor low-speed operation. Some compromise must clearly be made to determine just how much overlap one needs to use. Many factors such as idle quality, low speed throttle response, fuel economy, port size, and combustion chamber design must be considered in making this choice.
A somewhat more important timing event is the intake valve opening. Early opening allows for a greater valve overlap period and adds to poor response at low engine speeds. Now, for the high performance enthusiast, low engine speed could mean 3000 RPM, but I would not consider such an engine as appropriate for normal street use! If you are not concerned about passing the smog test, then early intake valve opening will help the power output of the engine. That is, earlier valve opening will have the valve open further when the piston reaches maximum velocity and that, in turn, will increase volumetric efficiency.
Now, the last timing event is the most important, and the most critical to engine performance - THE CLOSING OF THE INTAKE VALVE. This event governs both the engine's RPM range and its effective compression ratio. If the intake valve closes early, say about 50 degrees ABDC, then it limits how much air/fuel mixture can enter the cylinder. Such an early closing will provide very nice low speed engine operation, but at the same

time it limits the ultimate power output as well as RPM. Another problem with early intake valve closing that most people do not consider is that if you have a high compression engine, say 10:1 or higher, you will have more pumping loss trying to compress the mixture. This might even lead to head gasket and/or piston failure! These observations suggest that if you close the intake valve later the cylinder will have more time to take in more air/fuel and the RPM will move up. That seems simple enough, doesn't it? The later the intake valve closes the higher the RPM and therefore the more power, MAYBE? It turns out that if the intake valve closes past 75 degrees ABDC, you could lose most of your low-speed torque and if your static compression ratio is only 8:1, the engine will not be able to reach its horsepower potential. This should give you a better understanding of why the intake valve closing is the most important timing event.

Dimitri N. Elgin

Link to four stroke animation:
http://auto.howstuffworks.com/camshaft.htm

Glossary of Terms:
BTDC: Before top dead centre.
ATDC: After top dead centre.
BBDC: Before bottom dead centre.
ABDC: After bottom dead centre.



The Desmodromic Valve System

Tools

To measure the timing you will need the following tools.

- Degree wheel
- Pointer
- Crank turning tool
- Piston stop
- Dial Indicator
- Mount for dial indicator (Magnetic Base)
- Plunger extension for dial indicator
- Cam pulley removal tools (If you need to adjust the timing)
- Cam pulley holding tool (Adjustable pulleys)
- Torque Wrench

They can be purchased from aftermarket Ducati parts suppliers and good tool suppliers. I found a couple of companies that sell them:

- http://www.roadandrace.com.au/parts/parts/Ducati_degree_wheel.htm
- http://www.ca-cycleworks.com/shop/catalog/ducati/maint.html
- http://www.ducati-kaemna.de/cms_en/katalog.htm?&view=artikel&artikel=549

I made all my tools because I'm lucky enough to have access to a machine shop. I have included drawings of all the tools that I made if you want to make them yourself.

- Degree Wheel

I have included a template as part of this document. An alternative template for the wheel can be found in the Paso 750 magazine articles section here; http://forums.ducatipaso.org/viewtopic.php?f=1&t=1551 I printed mine, laminated it, and then glued it to a steel disc.

- Pointer

I made mine out of 3/8" tube. Don't take any notice of the copper washers; all they are there for is to make up for one's inability to read a ruler properly. The length of the pointer will alter for the oil cooled motor.

- Crank Turning Tool

Machined out of a 20 x 50mm bolt and a 20mm nut.

- Piston Stop

The piston stop is made out of an old spark plug. Just knock out the ceramic centre and thread an 8mm bolt into it. I ground a groove down one side of the bolt and drilled a hole in the side of the plug to let the pressure out when winding the crank over. Round off the end of the bolt so that it doesn’t damage the top of the piston.

- Dial Indicator, Mount & Plunger Extension

The plunger extension is made from a M2.5 screw, 2 nuts and an oversize washer. An alternative to the mount that I made would be to get your hands on a magnetic base that could be attached to the frame. They can be purchased from any good tool supplier.

Note: When purchasing a dial indicator, one with 10mm of travel will do the job, but try and get one that has a range of at least 0-12.5mm (0-1/2”).

Cam pulley removal tools

Pulley extractor.
It doubles as an alternator cover puller.

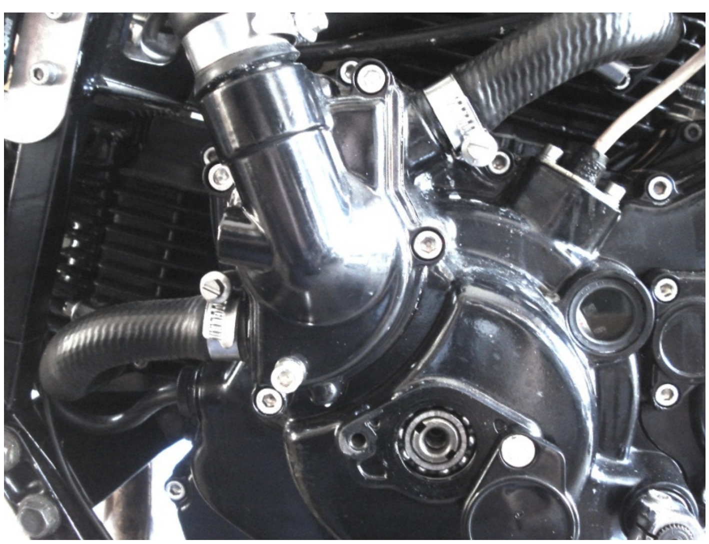
Cam pulley retaining wrench

Right, let's get started. I'll assume that the body work and tank is off. You will have to remove the radiator (906,907) or oil coolers (750) so that the horizontal inlet valve cover can be accessed. The air box will have to come off to get at the vertical inlet valve cover.

Mounting the Degree Wheel

1. Remove both spark plugs so that the engine will spin freely.

2. Remove the small cover on the alternator side of the engine and mount the crank turning tool and degree wheel on the alternator end of the crank.



3. Mount the pointer. All I have to do is remove the top bolt from the water pump cover and screw the pointer in its place.

4. Rotate the engine forward (anti-clockwise) using the crank turning tool and bring the piston to the start of the compression stroke.

Tip: To find the compression stroke, place you finger over the plug hole and seal it off. When the piston starts to come up the crank will become hard to turn and you will feel a pressure build up.

5. Screw in the piston stop, a little more than hand tight, and *very, very gently* continue to rotate the engine forward until the piston rests against the stop.

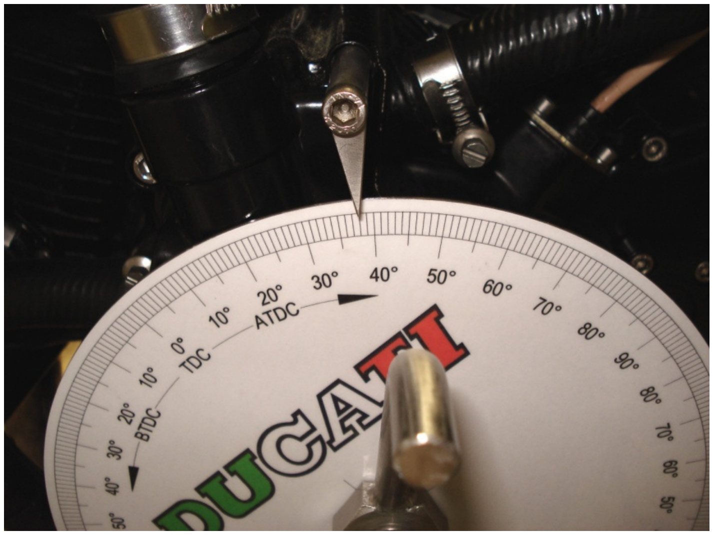
A word of warning:

BE VERY,VERY GENTLE WHEN ROTATING THE ENGINE WITH THE PISTON STOP IN AS YOU DON'T WANT TO PUT THE STOP THROUGH THE TOP OF THE PISTON.ALSO, DO NOT ROTATE THE CRANK A FULL 360 DEGREES WITH THE STOP IN AS THERE IS A CHANCE THAT THE VALVES MAY MAKE CONTACT WITH THE STOP.

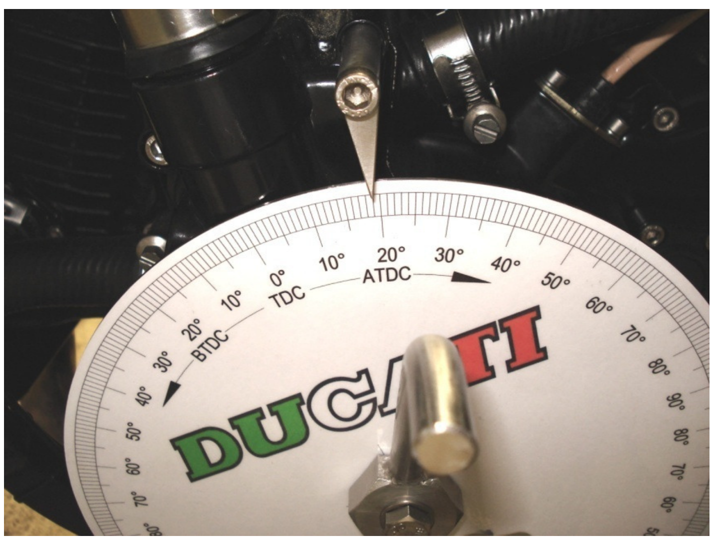
6. Loosen the nut holding the degree wheel and set the degree wheel to 0^0 TDC, *without moving the crank.* Tighten the nut so the degree wheel will not move on its own.

7. Remove the stop and rotate the crank past TDC just enough to allow the stop to be screwed back in.
My stop takes up 38^0 of rotation so I rotate the crank about 50^0. Insert the stop, tighten, then rotate the crank *very, very gently* in reverse (clockwise) until the piston rests against the stop again.

8. Take note of the angle on the degree wheel. As mentioned earlier mine is 38^0.



9. Now loosen the nut holding the degree wheel and set it to half of the angle noted in step 8, *without moving the crank*. E.g. If the angle noted was 38^0 then you would set the degree wheel to 19^0. Tighten the nut again.

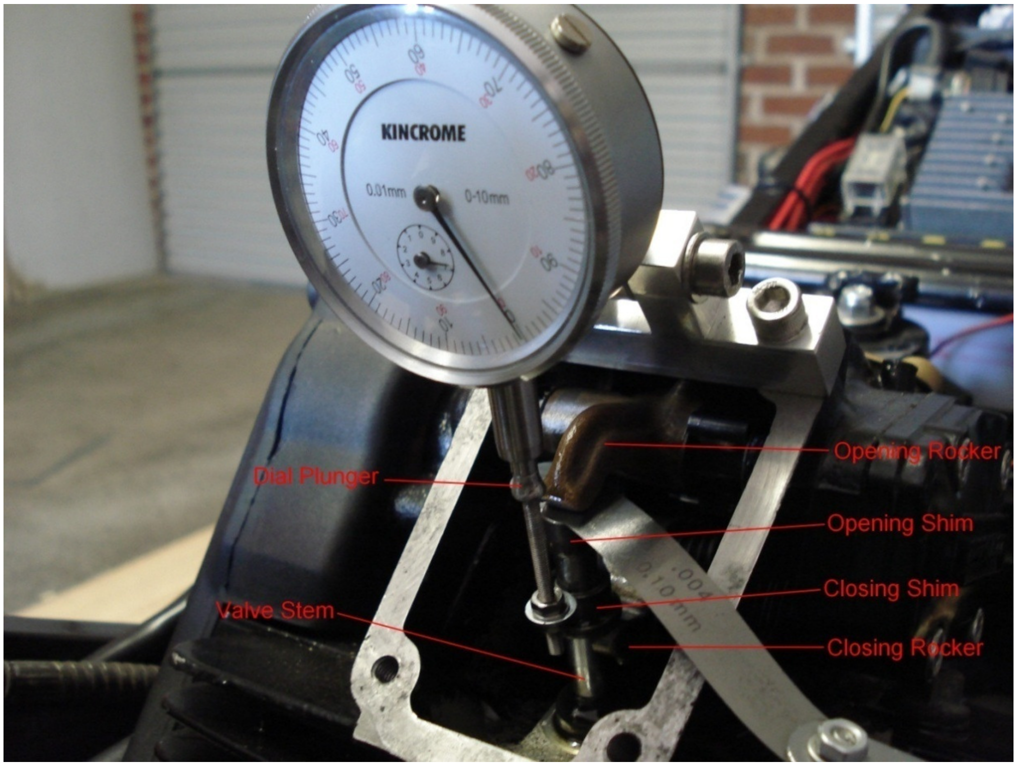


10. Unscrew the stop again and rotate the crank forward just enough to allow the stop to be screwed back in, rotate the crank back *gently* until the piston touches the stop again. Repeat until the degree wheel reads the same either side of 0.The wheel is now set correctly and the piston will be at TDC whenever the wheel reads 0^0 TDC. Remove the stop, it is not required from this point.

Mounting the Dial Indicator

This is probably the trickiest part of the operation and will require a fair bit of patience.
I recommend starting with the vertical piston/cam as it is the easiest to get at. When it comes time to measure the horizontal piston/cam you will have to reset the degree wheel to the TDC of the horizontal piston using the same procedure as the vertical cylinder.

1. Remove the inlet valve cover and screw the dial and mount in its place.



2. Ensure the piston is at top dead centre by rotating the engine until the degree wheel reads zero on the compression stroke.
3. Rest the washer, on the plunger extension, on top of the closing shim.
4. The dial should be positioned so that the plunger is almost all the way in when the valve is closed i.e. the dial should have about 0.5 mm of movement left. It should also be mounted so the angle of the dial plunger is the same as the valve stem. Ensure that nothing else makes contact with the plunger or dial during the cycle of the valve as this will upset the readings.
5. Insert a feeler gauge to take up the valve clearance; mine was .01mm (.004"). *The feeler gauge must stay in while all the measurements are taken.*
6. Set the dial to zero.

Because not all valve clearances are the same, the valve clearance needs to be taken up so that accurate cam timing measurements can be taken.
All the valve clearances should be checked as part of a holistic approach to tuning your bike. If the clearances are not set properly then the desired effect of timing the cams may not be realized. Ducati recommends that the valve clearances be checked every 3000 km (1900 mi).
The valve clearance should be;

Inlet Opening: 0.10 - 0.12mm	Exhaust Opening: 0.12 - 0.15mm
Inlet Closing: 0.00 - 0.02mm	Exhaust Closing: 0.00 - 0.02mm

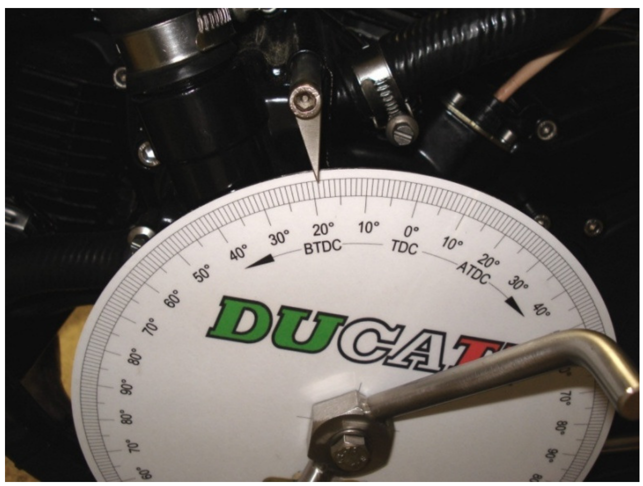
Finding the Lobe Centre Angle

When measuring the cam timing the most common method is to measure the lobe centre angle. The lobe centre or, point of highest valve lift, is midway between the valve's opening and closing points. On a two valve motor it is only necessary to measure the inlet lobes to check if the timing needs to be adjusted because the inlet and exhaust lobes are part of the same cam. When we measure cam timing we measure the cycle where the inlet valve is opening and closing.

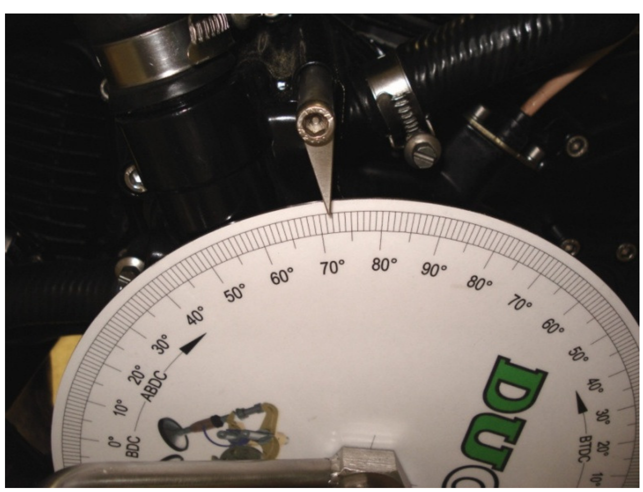
All measurements should be taken while rotating the engine forward (anti-clockwise) only.

If you over-rotate past your mark and rotate the engine back you will get an incorrect reading due to gear lash. I found a difference of around 2^0 when I was measuring mine. Also, it is a good idea to measure everything at least 3-4 times to make sure you get the same result, plus it makes for good practice. If at any time you think that the degree wheel has moved don't hesitate to put the stop back in and check the position of the wheel.

1. Rotate the crank forward until the inlet valve starts to open, continue to rotate the crank until the dial indicator reads 1mm (0.040").Take note of the angle on the degree wheel, mine was 19^0 btdc.



2. Continue rotating the crank forward until the indicator reads 1mm (0.040") before the inlet valve closes. This will take a couple of go's to get rigbut counting the number of rotations on the dial that it takes to open and close the valve will help. Take note of the angle on the degree wheel, mine was 71.5^0 abdc.



Calculating the Lobe Centre Angle

After measuring both cams I came up with the following angles:

	Inlet Opening BTDC	Inlet Closing ABDC	Inlet Duration	Inlet Centreline
Vertical Cam	19^0	71^0	270^0	116^0
Horizontal Cam	24^0	68^0	272^0	112^0
Preferred Settings				
Vertical Cam	28^0	62^0	270^0	106^0
Horizontal Cam	32^0	62^0	272^0	106^0

The formula for working out the lobe centre angle is this:

Inlet opening + inlet closing + 180 = duration

Duration / 2 = half duration

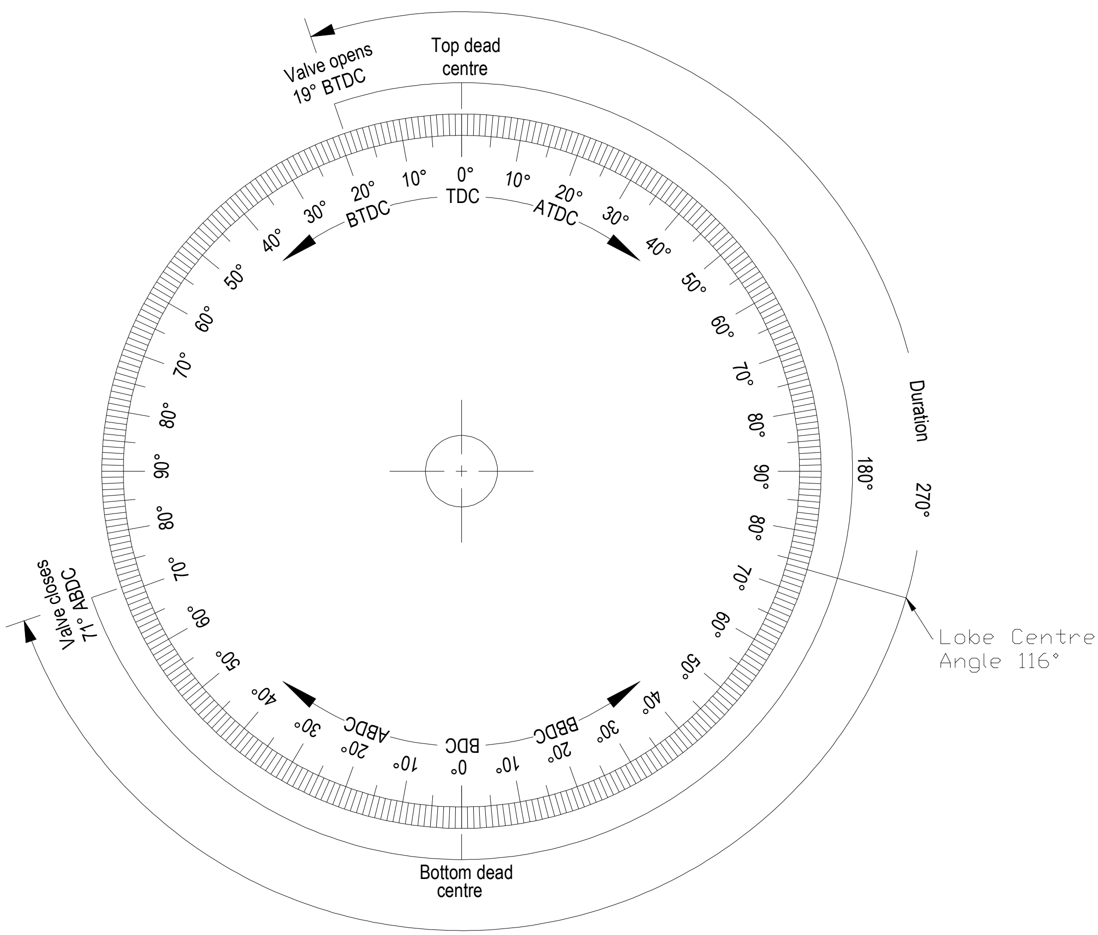
Half duration – Inlet Opening = Lobe Centre Angle

So in my case for the vertical inlet:

$19^0 + 71^0 + 180 = 270^0$

$270^0 / 2 = 135^0$

$135^0 – 19^0 = 116^0$ degrees Lobe centre angle



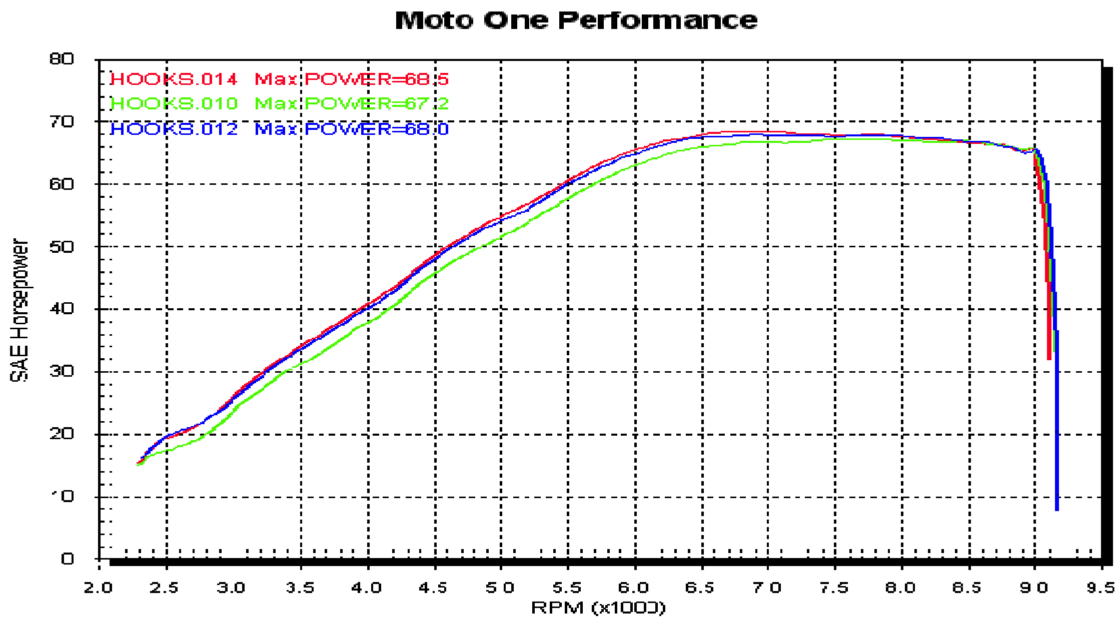
Recommended settings

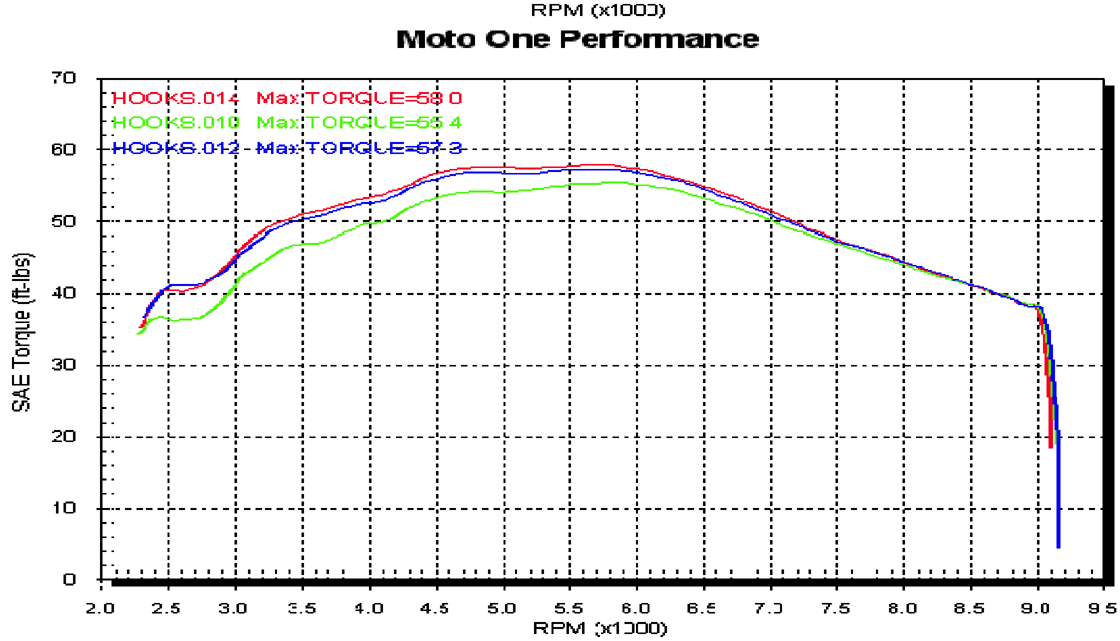
The Ducati factory specification for the 750, 906 and 907 recommends a Lobe Centre Angle of 118.5^0, 110^0 and 110^0 respectively. After discussing my findings with Brad at http://www.bikeboy.org recommended I advance my timing to 106^0 on both cams, which is an adjustment from the factory settings and those settings were likely not accurate anyway. The most a cam should be advanced to is 105^0. Any more than this and it starts causing problems with clearance between the valves and piston.

Cam timing preferences depend on the engine model, so if we have preferred settings for the 906 the task is to check one's cam setting and as needed adjust it in line with preferred settings will improve performance.

So far, what I have discovered is that by advancing the timing to 106^0 increases the bottom end and mid-range power/torque but sacrifices some top end which the following dyno charts will show.

Green is timing on spec, blue is 5 degrees advanced, red is 7 degrees. Being 113, 108 and 106 degree inlet centrelines respectively. No top end fall away because it's all over by 7,000 RPM. Power first, then torque.





Road Tests

I rode with the cams set at 106^0 for a few weeks and I was happy with how the bike was starting, idling, running. I found the bike was great around town. As I mentioned earlier it moved the power and torque lower in the rev range which is great for getting away from the traffic lights. The bike accelerated well in 6th gear from 2800 rpm. It also performed well on the open road, passing cars was a breeze. I took it up to “way above the speed limit” and it felt smooth all the way through the rev range, no sign of pinging.

I changed the timing to 110^0 a couple of weeks ago. So far the only noticeable difference is a little more torque at the higher end rpm, above 6500rpm. More suited to the open road or high speed tracks. The weather is starting to turn colder here so the desire to go for rides is fading. I want to try the timing at 114 deg before winter gets here, but my preference so far would be to set it back at 106^0 and leave it at that.
to be cont.........

Methods of Adjustment

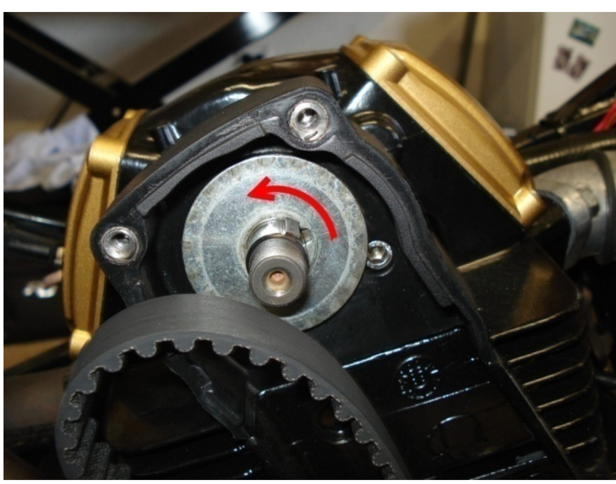
For some reason, only known to the designers, the early belt drive motors had no form of cam timing adjustment. Strange considering that most, if not all Ducati tuners will say that the timing was not ideal when they came from the factory.

Offset keys

Installing offset keys is a simple operation.

1. Remove the cam belt covers and mark the belt where it lines up with the timing mark on the pulley. It is probably not a good idea to mark directly on the belt so I recommend sticking a bit of tape on the belt and marking on the tape instead.
2. Loosen the bolts on the belt tensioner.
3. Undo the retaining nut and remove the pulley. I had to make up a pulling tool to get the pulleys off (I have included a drawing if you need make one).
4. Use a small, flat bladed screw driver to dig out the old key and replace it with the new offset key.

Shown here are a couple of offset keys. Notice the 5 punch marks on the top. Each mark denotes 2^0 of crank rotation because the crank turns twice for every turn of the cam. My vertical cam measured 116^0, which was 10^0 ‘crank angle’ out from my desired angle of 106^0. To adjust the cam to the desired position I needed an offset key with 5^0 offset (10^0 crank angle). The horizontal cam was 6^0 out so it requires an offset key with 3^0 offset. While these are simplistic in design they provide no further adjustability so can become expensive in the long term if several adjustments are required over time.
The following images show the forward directional rotation of the cams and the offset key located on the cam in the advanced position.



Adjustable pulleys

Vee Two

Corsemeccanica

Epicycle

Advantages of Adjustable Pulleys

Adjustable pulleys provide the greatest amount of freedom to adjust the timing. They come standard on most late model 2 and 4 valve Ducati's. There are also a couple of different aftermarket types available.

These pulleys allow the cam timing to be set for each individual camshaft, independent of crank angle. This enables the tuner to obtain proper cam timing easily and quickly. The adjustable cam pulleys are a direct replacement for the originals with no modification to the cam or woodruff key necessary.

Fitting Instructions (Vee Two Pulleys)

1. Firstly, determine if the pulley is in the 'stock timing' position. To do this, observe the 3mm alignment holes position relative to the three components of the pulley (outer pulley, inner hub, clamp washer). This hole should be aligned in all components. (see figure one)

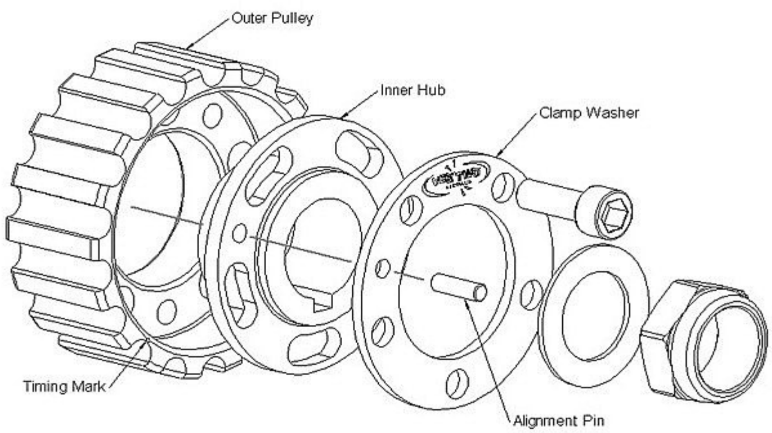


Figure 1

2. If your adjustable cam pulley is not in alignment, loosen the 5 Allen head cap screws holding the clamp ring on. You can now rotate the inner hub relative to the outer pulley/clamp washer. Rotate the inner hub until the 3mm holes line up. Use a 3mm alignment pin e.g. 3mm drill bit or similar to line up the holes. Tighten the pulley clamp screws to 11-14 Nm (8-10 ft-lbs).

3. Remove the original pulleys from the engine to allow you to install the adjustable pulleys. Refer to the Ducati workshop manual for instructions.

Tip: This is the large guide washer that is fitted behind the original pulley (shown below), It must remain in place behind the new pulley.

4. Install the pulley on the camshaft as per the standard pulley installation instructions in the workshop manual, using the timing mark on the pulley as your stock timing reference. Tighten the pulley nut to 68-73 Nm (50-54 ft-lbs)

5. Install the cam pulley retaining nut onto the camshaft and torque the nut to the factory specifications. Use Loctite 262, or similar, on the threads of this nut.

6. Adjust your timing belts to the factory recommended tension.

7. Your engine should now be set to stock cam timing specifications.

Timing Adjustment (Vee Two pulleys)

1. Once you have fitted the adjustable cam pulleys, refit the cam belts and tension them to the factory specs.

2. Check the cam timing as per the "Measuring the Timing" instructions, you can then use your cam pulleys to advance or retard the cam timing of each cam independently.

3. To adjust the cam timing, set the degree wheel to TDC zero on the compression stroke. Loosen the 5 Allen head cap screws on the pulley you wish to adjust. While holding the **camshaft** in a fixed position, rotate the crankshaft in the anti clockwise direction to the appropriate amount of desired advance. Tighten the 5 screws on the pulley so it doesn't move.

4. **Recheck your cam timing.**

5. Apply Loctite 242 (or similar) to the threads of the 5 adjustable pulley clamp screws, one at a time, and tighten to 11-14 Nm (8-10 ft-lbs) of torque, and **recheck your cam timing.** Complete this operation for each cam you wish to adjust.

6. Finally, recheck that all 5 Adjustable Cam Pulley clamp screws on both pulleys are tight. **Rotate engine several times to ensure that it rotates smoothly.** Refit the belt and valve covers.

7. Your bike is ready to start.

There is a wealth of information on the internet; the following links will provide you with additional know-how on cam timing.

- http://www.docv.org/cgi-bin/news/newsscript.pl?record=17&template=site
- http://www.docv.org/cgi-bin/news/newsscript.pl?record=18&template=site
- http://www.docv.org/cgi-bin/news/newsscript.pl?record=19&template=site
- http://www.bikeboy.org/camtime2v.html

Special Thanks

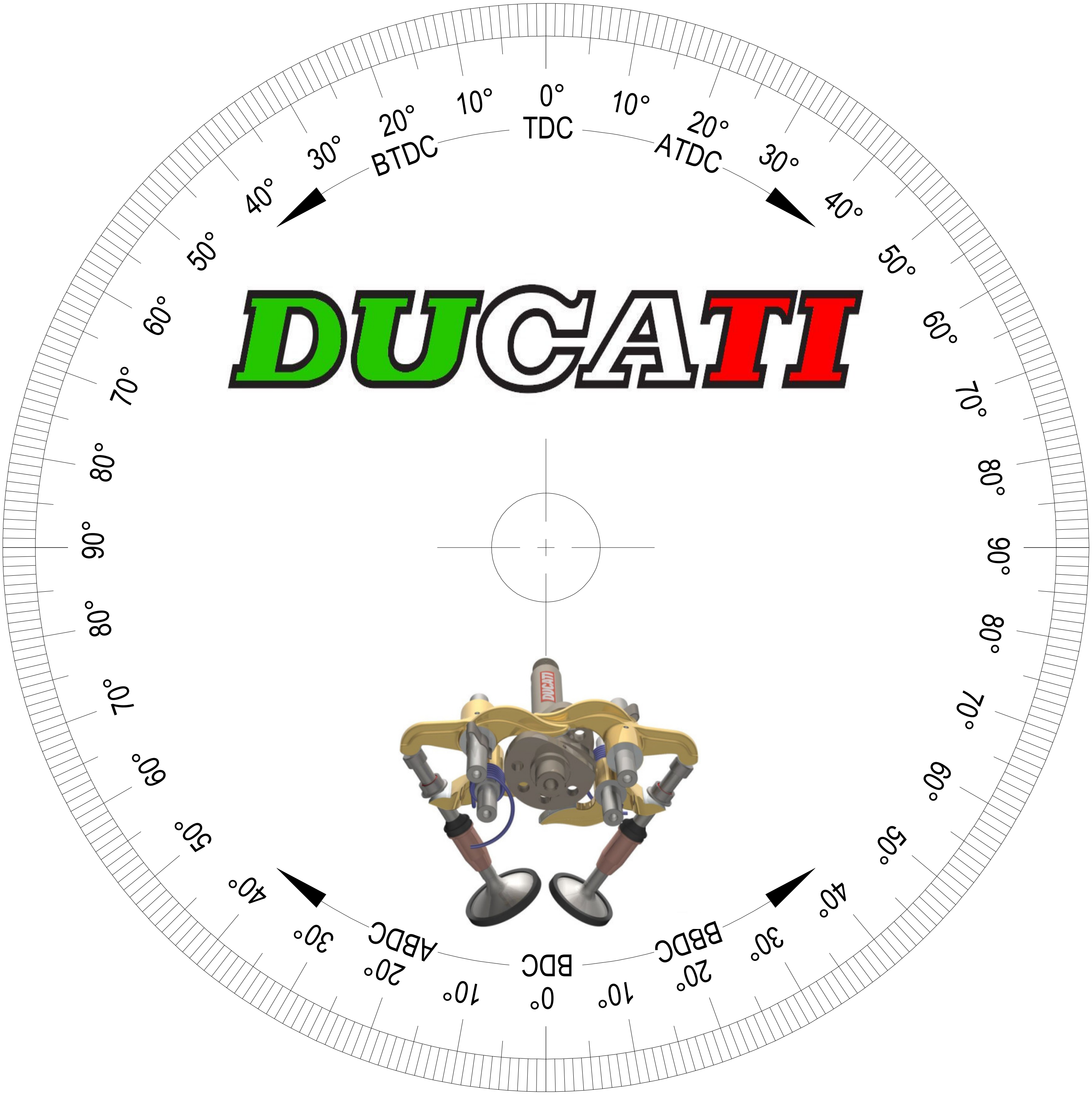
I would like to thank Brad Black for his expert advice and tips as well as Mark at Automotive Technology Group (Vee Two) for his help with the adjustable pulleys.
I would also like to thank everyone at http://forums.ducatipaso.org/ for their advice and input.

References:

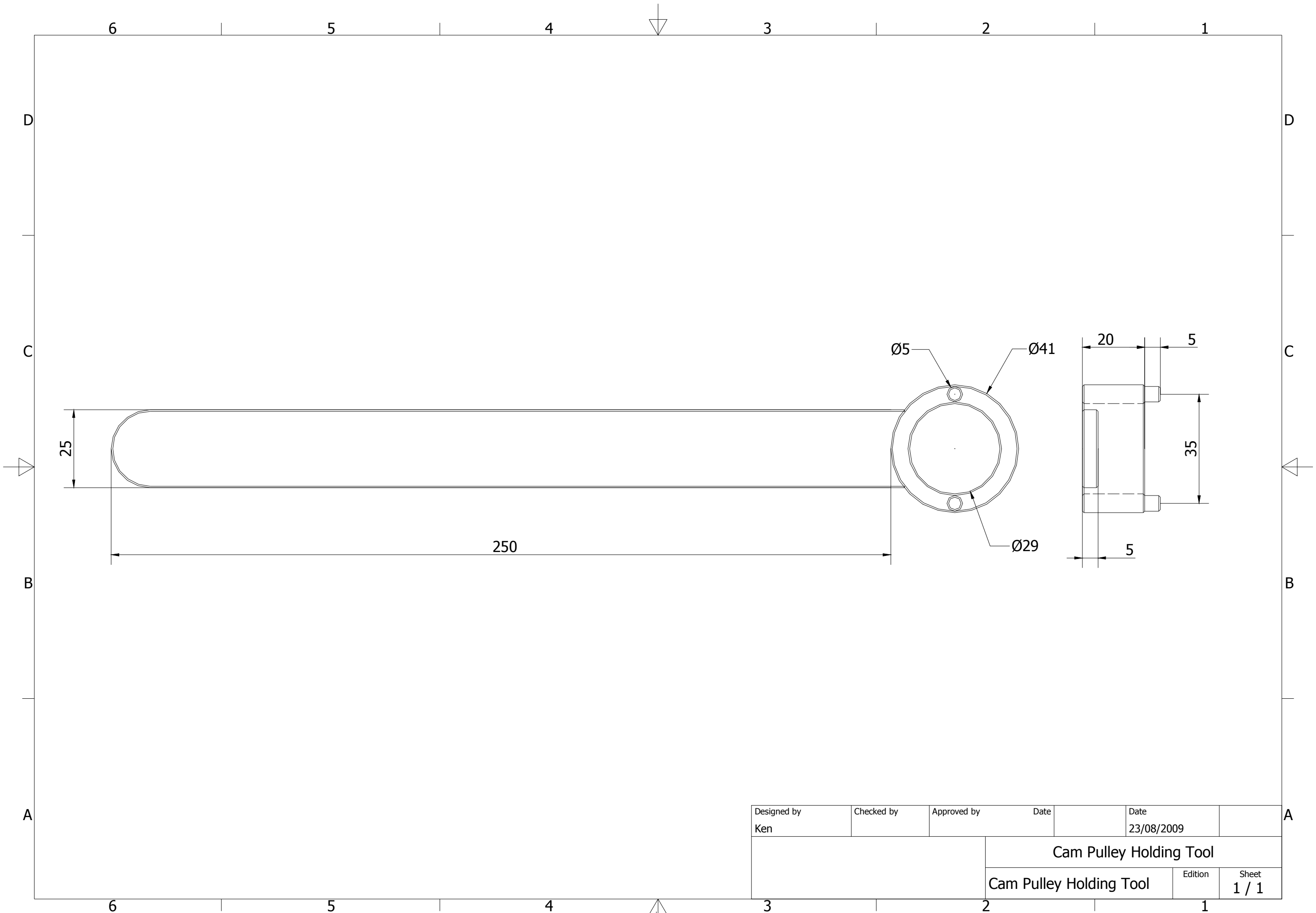
1. http://www.bikeboy.org/index.html
2. http://www.docv.org/front.shtml
3. http://www.elgincams.com/
4. ***Vee Two Product Bulletin No:*** *V2-12-700* (**Cam Pulleys** Adjustable)

Updates

Please check here for any updates;
http://forums.ducatipaso.org/viewtopic.php?f=2&t=3869



Tip: Print the wheel out separate to the rest of the document.
Set the printer to borderless A4.It should print out with a diameter of around 195 mm.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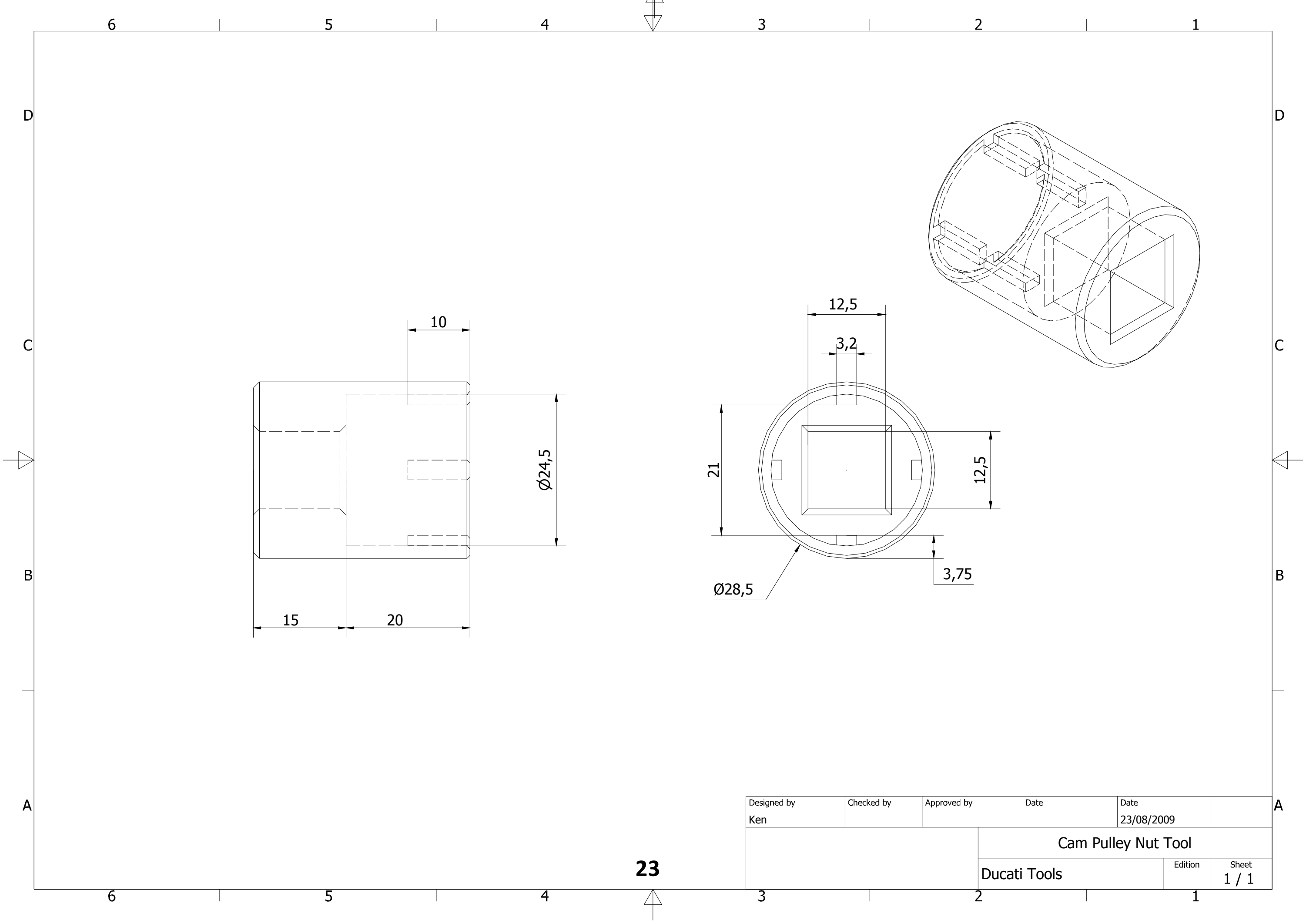
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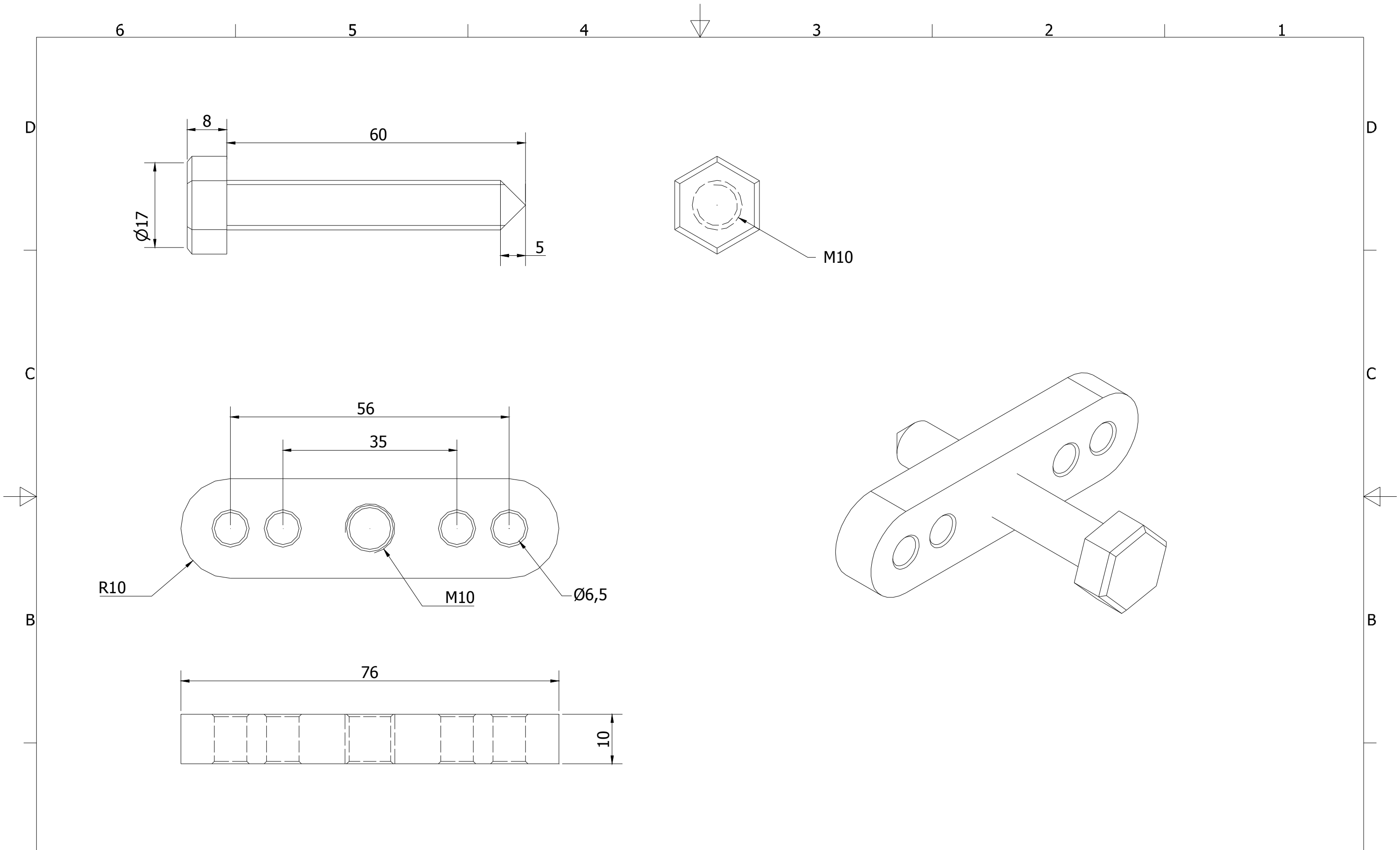

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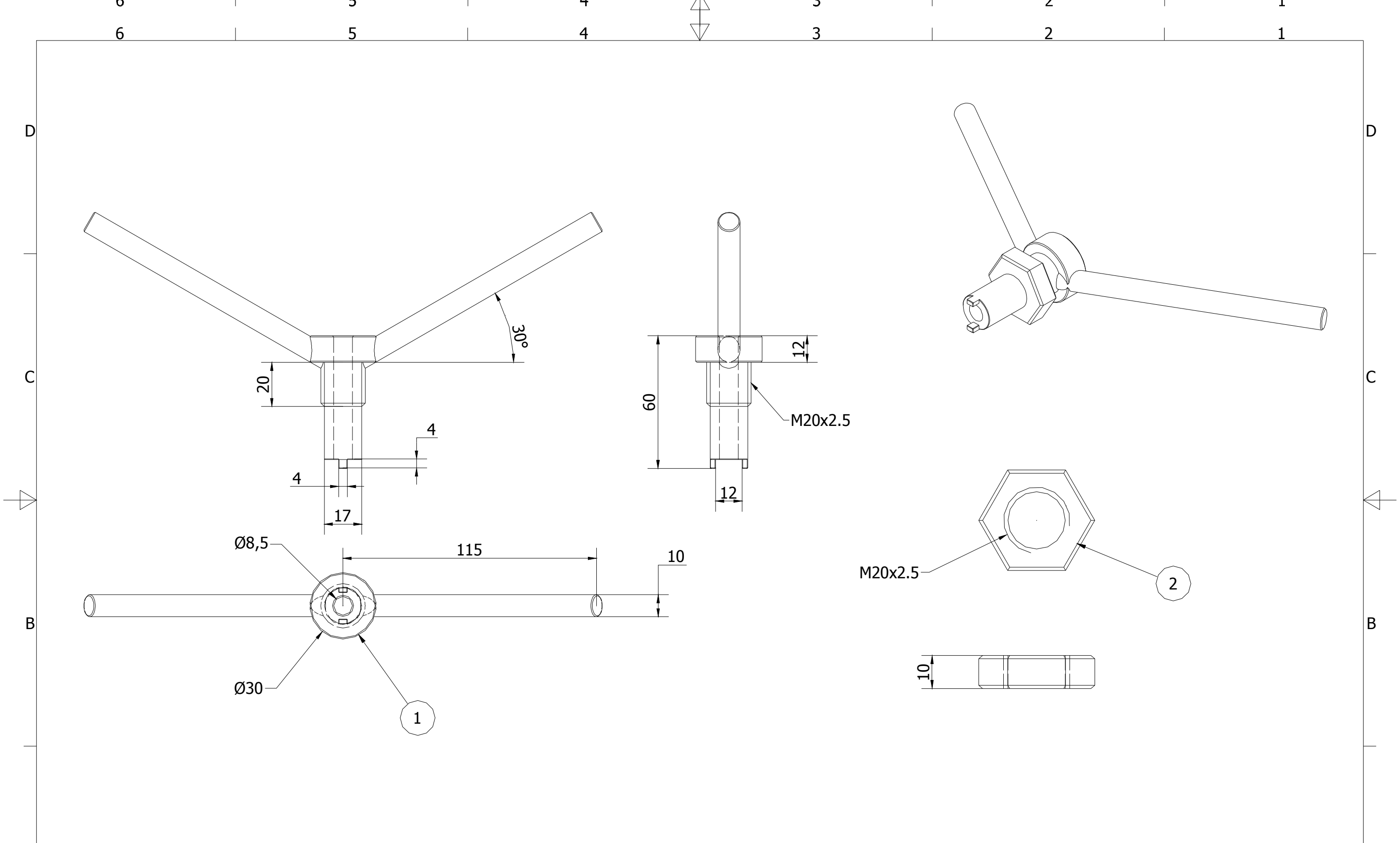
Cam Pulley Puller		
Ducati Tools	Edition	Sheet 1 / 1



Parts List		
ITEM	QTY	DESCRIPTION
1	1	M20 x 50 Bolt
2	1	M20 Nut

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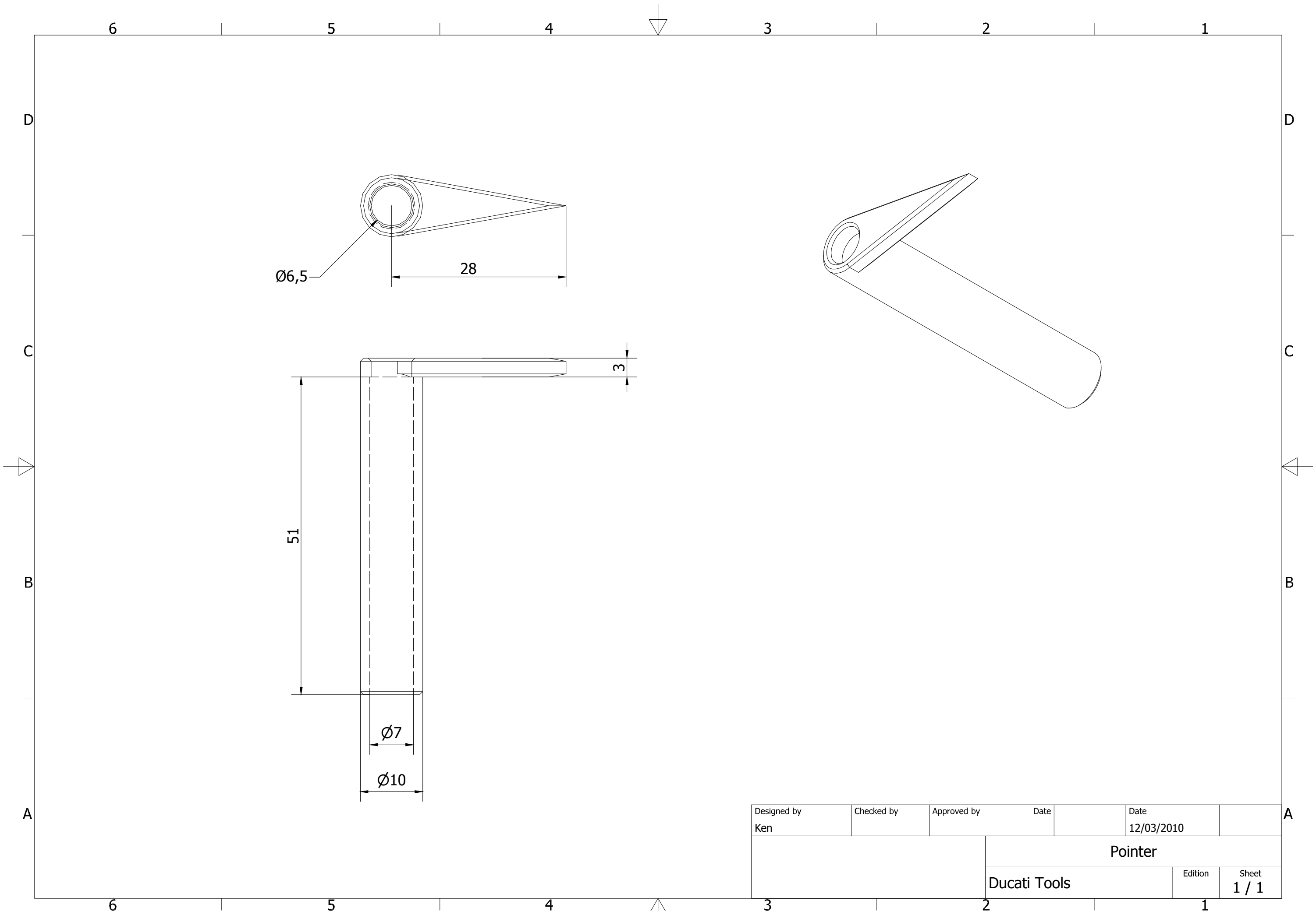
Ken				11/03/2010

Crank Turning Tool		
Ducati Tools	Edition	Sheet 1 / 1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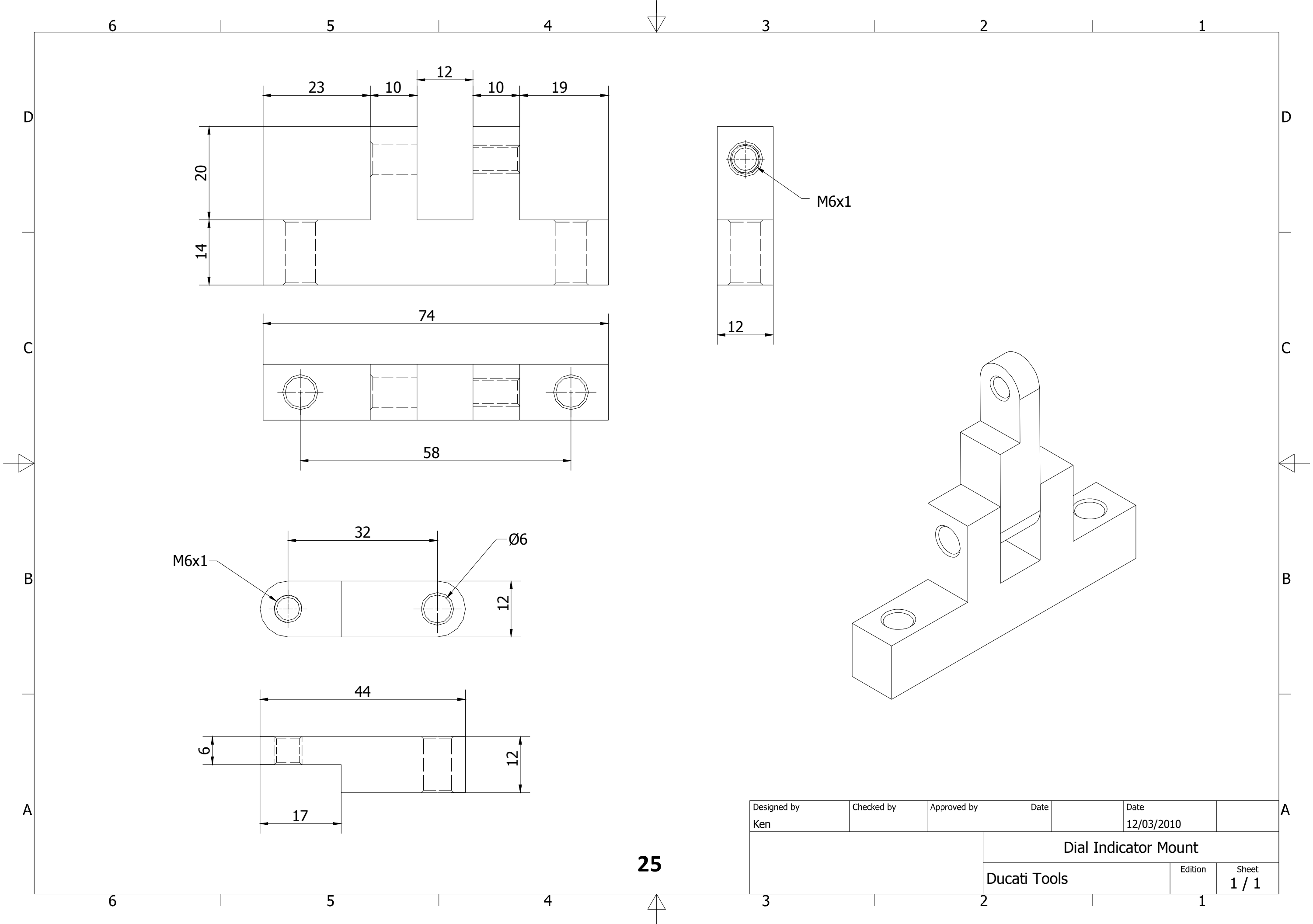
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