Tomos Streetmate A52/A55
Information and Tuning Manual

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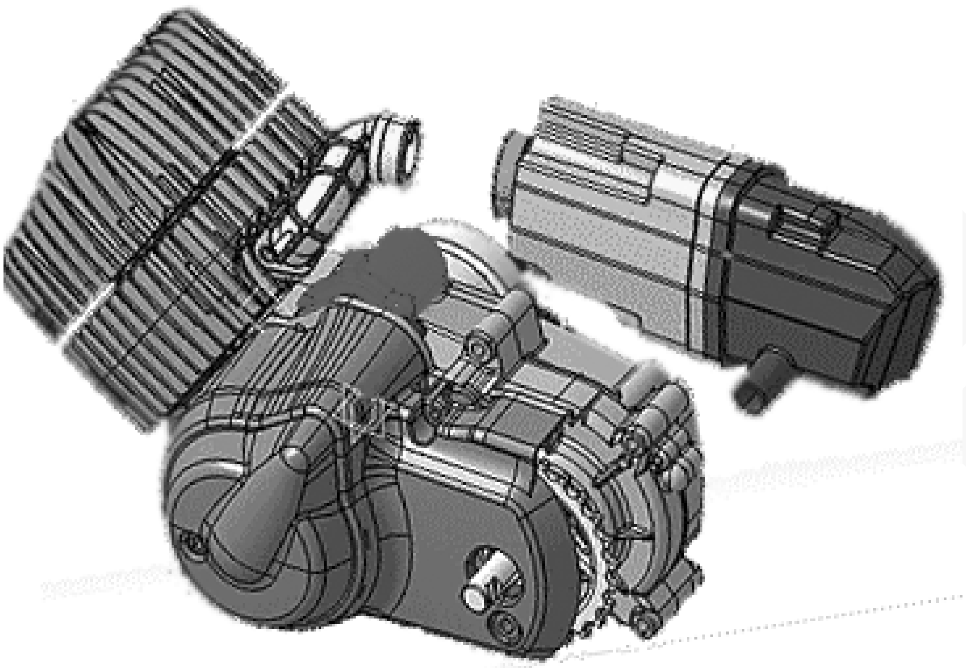
Note: Standard specifications can deviate throughout the years since there are always small differences with the production of engines inside a factory. With that said, a moped could also differ in carburetion when rolling out of the factory. Different jetting is most of the time applied with one size upjetting or downjetting. In addition, not everything might be described accurately as of now, but it will stay updated as long as information is getting my way. The main reason for this document to serve you to achieve the best running of your moped.

Version History:
Update 1.3.5/2008-11-13: Added Sprocket Ratio / Fuel Consumption / Revs

Update 1.3.4/2008-11-11: Specifications page updated. Improved 'design flaw page'. PHBN carburetor compatibility explanation added. Clutch Tuning section added.

Update 1.3.3/2008-11-10: Improved the design flaw page for a more clarifying explanation of replacing certain parts. Cylinder information section updated. Specifications page updated. Needle information added.



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Specifications Streetmate for Standard version (45km/h, part nr. 236260)

Engine/Cylinder: A52/A55, Piston Displacement 49cc, Material: Aluminum (Nicasil), 2 Piston Rings.
Engine Power: 2.3KW, ~5720RPM
Compression Ratio: 10:1
Carburetor: Dell'Orto PHVA 14 (mm) (Needle Type),
Tuning Possibilities: Main/Choke/Pilot Jet, Needle, Air Mixture Screw, Idle speed screw.
Main Jet/Size Dell'Orto 6mm (Big), Size: 55
Pilot Jet/Size: 25
Choke Jet/Size: 40
Needle: Dell'Orto A07 Tapered, E-clip 5th position (Needle raised)
Throttle Slide: 40
Intake Rubber (Elbow) to Intake Manifold: ~14mm
Intake Manifold: 15mm
Ignition: ISKRA Elec. 12V, 80W 4 coils, Stator Plate indication approx. or ~1.5mm below upper timing mark.
Battery: 12V 4A, **Fuse:** 7.5A
Air Filter: Original with Rubber Junction Sleeve (~15mm diameter)
Exhaust: A55 Catalyst Exhaust straight-bended curve. (Wider exhaust flange)
Spark Plug: BR8ES, Thread Diameter 12mm, Long Thread (19mm), Electrode clearance: 0.8-1.0mm
Front Tooth Sprocket (Offset Sprocket): 26
Rear Tooth Sprocket: 31
Chain: 104 Rollers
Internal Chain: 32 Rollers
Rear Shock Absorbers: Original Closed Chrome
Tank Size: 2.5L + 1L Reserve
Oil tank: 0.8L
Fuel Consumption: 1:40/50 (150-190km with 3.5 Liters (Setup/drive style Dependent)
Handlebar Width: 22mm

Differing Specifications for Restricted version (25km/h, part nr. 236265)

Main Jet: 53
Needle position: 4th position (Needle raised)
Intake Rubber (Elbow) Diameter: 9mm
Throttle Slide: 30
Exhaust: A55 Catalyst Exhaust S-bended curve. (Narrow exhaust flange)
Spark Plug: BR6ES
Rear Tooth Sprocket: 37
Stator Plate setting: Stator plate indication on lower timing mark.
Engine Power: 1KW, 2950-2970 RPM. Compression Ratio: 8:1
Carburetor: PHVA 10 (mm)
Cylinder Head Gasket: Two gaskets
Sound Level: 77dB
Chain: 106 Rollers

Design Flaws and Recalls by Tomos

Throughout the production line of the A52/A55 based vehicles, several mopeds built in a specific year where recalled by Tomos. It is, of course, completely normal that errors in new designs can occur. However, not all mopeds have been recalled. Also, many Streetmates, and I do not know whether this also applies to other A55 based vehicles, have been modified by Tomos Nederland before leaving the factory for selling because of some faults. These errors include the following:

- Added three base gaskets to enhance port timing.
- Added extra fuel filter between tank and carburetor.

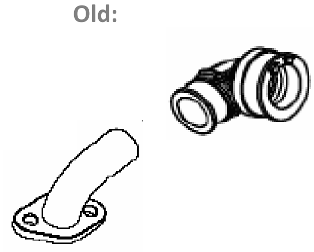
Tomos have done a recall for some vehicles under warranty in the United States from 2002 up until 2005. Some old models needed some parts to be added/replaced/modified, new parts include:

- 1st Gear Clutch
- Fuel Tube Spring
- Release Valve (Tank Bleeding)
- Fuel Filter (Fuel Feed Tap)

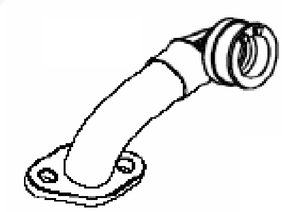
Other important replacement parts are as follow.

Replace: Intake Manifold (233713) with Intake Manifold Including Vulcanized Rubber (233721):
Reason for replacement is because of distorting mixture flow at the connection between the normal intake manifold and separate intake manifold rubber, the new part includes both pieces installed onto each other, fixing this issue.

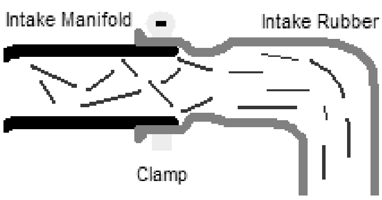
Old:



New:



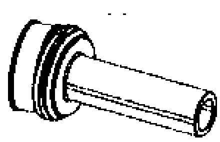
Problem
Distorted mixture flow is caused by the following in the illustration:



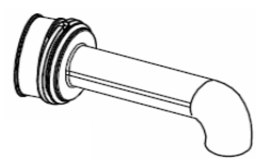
Meaning, that the air flow should stabilize with the new intake manifold because of the smoother inner wall (surface). Decreased chance for air leakage as well.

Replace: Air Filter Junction Sleeve Straight (233748) with Junction Sleeve with Elbow (233748) (Same part number)
Reason for replacement is for improving the air flow, more silencing, possibly less dirt being drawn.

Old



New



Replace: Cylinder Head (233702) with Cylinder Head different combustion chamber (233702) (Same part nr.)
Replace: Right Engine Cover Chrome (Different Shape)
Replace: Main Jet from 52 to 56
Replace: Pilot Jet from 29 to 25
Replace: Starter Jet (Choke) from 50 to 40

Other modifications include; Spark Plug gap adjustment to 0.85mm, re-set the air mixture screw from 2½ to 1¾ rotations.

This means, that not all models have been affected by these 'problems' as for engine running mostly. In addition, the early A52/A55 engines are not affected by most of these problems, but upgrading certain parts could surely result in better engine running. Some mopeds <u>do</u> run properly on the bad parts, while others won't.

Electrical Ignition Explanation

Ignition begins at a point where the piston crown reaches the top dead center (abbr. TDC). Pre-ignition is a term that describes the piston some millimeters before TDC when the spark actually takes place. The reason why pre-ignition is very important for our 2-stroke engines is due to the fact that we want the most possible power in combination with fuel consumption, due to the fact that 2-stroke engines are not so economical. Nevertheless, most importantly, without pre-ignition, we would miss a big deal of power.

Back to the subject, if we would give a spark at the time when the piston is at the exact TDC (0mm), the explosion would begin where the piston would already travel back to the bottom dead center (abbr. BDC) pushing the piston crown back with less power. Here, you should consider that the explosion and the front of the explosion, called the 'flame front' also have a limited traveling speed. Thus, it would be more efficient to ignite the fuel mixture some millimeters before TDC.

Explanation; the ignition is taking place some millimeters before the TDC, creating an explosion which will be at maximum power at the time the piston is at TDC. The flame front has time to hit the piston crown with relative more force, at the end resulting in more power. In addition, the engine tends to run more smooth because of the explosion actually makes the piston to be pushed back smoother, but with more power.

If the pre-ignition timing would be too high, the explosion would be held compressed for too long inside of the combustion chamber and piston crown before the piston would be pushed back to BDC. The extended period of time the explosion is residing inside the combustion chamber could be fatal because of the extent temperatures. The exhaust gases cannot escape fast enough which would further rise the temperature inside the cylinder.

More important is, and would mostly not be expected, but happens, is detonation. Where the engine temperature would rise to such an extent, the spark plug electrodes would begin to melt. With extreme temperatures this high, gasoline reaches a temperature, which has the intention to explode before the initial ignition takes place, creating extreme turbulence inside of the combustion chamber. Two or more explosions would occur at the same time during the power stroke, creating much turbulence and explosions that would interfere each other, and creating much stress on all parts of the cylinder and crankshaft. Detonation is thereby one of the most known causes for engine failure, besides inadequate lubrication of the cylinder/piston (rings).

Pre-ignition with the Tomos Streetmate is partly dependent on the stator plate location in terms of degrees, and partly dependent on the CDI (Capacitive Discharge Ignition). The stator plate indicates the maximum pre-ignition, and is mainly based on Idle and low RPM, while at increased RPM the pre-ignition will decrease to about ~0.3-0.6 mm by the CDI unit.

Electrical Ignition Tuning

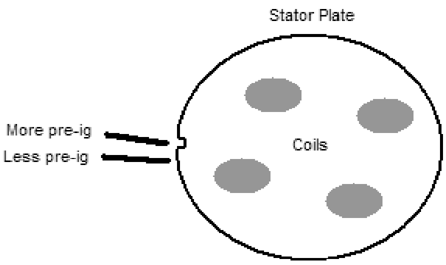
In this section, we will explain how to change the pre-ignition timing by shifting the stator plate to another degree. The most important thing is to get a correct timed spark. Hereafter we go on with tuning the carburetor. Unlike a point-type ignition system, it is more difficult to determine the right pre-ignition. For now, the only way to actually check the pre-ignition is by using a stroboscope. We do know that the default pre-ignition timing should be approx. 1.5mm before TDC for the A55 engines. By rotating the stator plate to the right, the hall-sensor moves synchronous with the plate. As the flywheel's pickup point passes the hall-sensor some millimeters later, we advance pre-ignition. Reversing the base plate will reduce pre-ignition.

1. First, we will remove the kick-starter, followed by the Dell'Orto Oil pump and flywheel cover. When the cover is disassembled from the engine, we can remove the electrical start mechanism.
   Be careful of the oil pump and pump hoses, these are very fragile. Also when leaking occurs, you could have a problem. The oil hoses could be quite inflexible. When this is the case, replace them immediately before they get porous.

2. For the flywheel to be taken off, we will need to block the crankshaft from moving. We do this with a piston stop tool that can be mounted into the hole of the cylinder head where the spark plug is normally installed.

3. Now, we remove the flywheel nut (M10), which is at the same time the nut that makes it possible for the oil pump to do its job. We can disassemble the flywheel itself by using a flywheel puller, or we could use a rubber hammer and try to smash it out gently, using some strong object put between the flywheel and engine itself. This is actually a workaround if no flywheel puller can be used for some reason. Under normal conditions, the flywheel should be disassembled fairly easy. Otherwise, try to use some penetrating oil like WD-40 to loosen it. The flywheel should not just fall of the axle, because of the magnetos holding the flywheel in place. *Caution: The flywheel is positioned in place with a small locker inside the axle.*
   It is not recommended to smash on the flywheel, because the crankshaft could disposition or destabilize! Also the crankshaft bearings could undertake too much force.

4. Disassemble the four coils from the base plate, so that we can easily rotate the plate to the desired direction. As seen, there are two indication-timing marks on the crankcase's side just at the left side of the plate. Those marks correspond to the amount of pre-ignition and a fast factory adjustment for Tomos to switch from restricted and unrestricted versions.



The lowest mark is mostly probably the setting for the restricted model, which has less pre-ignition (~1.2). The highest line is more pre-ignition (~1.5mm), normally set for the standard model. To know how to set the stator plate to match one of the lines, check the stator plate on the left side, there should be a carved gap. With this indication, you could set the pre-ignition to match any of the two marks, or you could try a setting for yourself. The pre-ignition difference between the two lines is about 0.3mm.

So to reach a pre-ignition of approximately 1.8mm, rotate the stator plate to the right, exactly as the distance between the lowest mark indication and highest mark indication.

Note: Not all models, and now I refer to the early A52/A55 models produced in 2003/2004, have a carved gap on the stator plate. If this is the case, try to acquire one second handed because this part is not for purchase by Tomos as an individual part. In addition, 1.8mm timing is not necessarily the best timing as well. It could very well differ. Tomos actually recommends for the stock standard model the base plate indication to be set 1 or 2mm under the highest timing mark, which should indicate about 1.5 – 1.4mm pre-ignition, and would work best for the A55 engines.

5. Remount all of the components in reverse order, and tighten the stator plate with allen screws to prevent the plate from moving caused by vibrations of the moped.

Point-type Ignition System Quick Tuning **(Not applicable on A55 models)**

To adjust the pre-ignition on a Point-type ignition system we need the following:

- Caliper
- Feeler Gauge
- Ignition Points
- Desired amount of pre-ignition in millimeters. (We'll use 1.1mm in this example)

1. Take of the cover where the ignition is located, and take out the spark plug from the cylinder head. We will first check if the ignition points are worn out. They should be visually flat on both sides where the points touch each other, if this is not the case, they should be replaced.

2. Move the flywheel to the direction of normal engine running conditions and measure the gap between the points at the maximum possible distance. The distance should be about 0.35-0.45mm but could be specified different on a wide range of mopeds. If the gap is wider or narrower, you should adjust this with a feeler gauge.

3. Place the piston on the BDC, and put the depth probe of the caliper into the cylinder head. Now, rotate the flywheel at least 360 degrees so the piston touches the caliper at TDC, and move it back. With the new value on the caliper in mm, we continue to the next step. We want to have a value on where the pre-ignition begins, so we recalculate this into the known value. Add the desired 1.1mm pre-ignition value to the known caliper value. Put the caliper back into the spark plug hole with the piston down to BDC. Rotate the flywheel slowly so the piston softly touches the end of the caliper.

4. When this happens, the piston is exactly at the pre-ignition point, and the ignition points should open up at this exact location. If this is not the case, we shift the stator plate so that the ignition points open up earlier or at a later time.

5. Repeat this procedure until the desired pre-ignition is accomplished.

When the piston touches the caliper's depth probe, be sure that the value does not change on the caliper itself.

Intake port, Transfer ports, Exhaust port Timing

There have had been some other ‘design flaws’ that could impact the engine’s performance and / or stability. Some models produced between 2003 and 2004 could have these problems as for port timing; the piston would partially cover the exhaust and transfer ports at bottom dead center so they will not fully open. Tomos recommends for these ‘flaws’ A55 cylinders to use three base gaskets to lift the cylinder to enhance port timing and opening state.

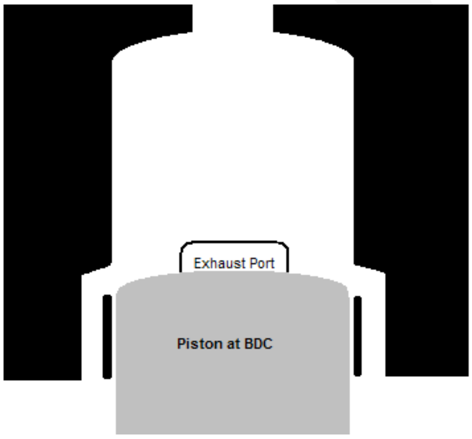
Let us assume a base gasket is 0.4mm width. All ports, including the transfer ports, will be lifted up by about 1.2 mm. There are two advantages about this modification. The timing is different, meaning;

- The burned gasses can escape faster, when the piston is heading back to BDC, less heat.
- Transfer ports open up faster, meaning new mixture can enter the cylinder at a faster rate.
- Both three ports have a wider opening at precise BDC.

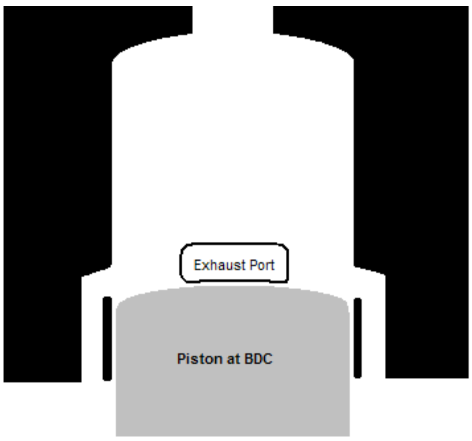
This modification is also dependent on how far the exhaust port and transfer ports are fully opened on a stock cylinder when the piston is positioned at BDC. If the ports are fully opened by default, your moped does not cover this problem and there is no necessity to change the port timing then. Small disadvantages over changing port timing with multiple base gaskets are as follow;

- Intake port opens at a later time, less time to draw fresh mixture.
- Combustion chamber compression is decreased, as is the squish clearance.

Meaning we should compensate for the compression chamber again.



Exhaust and Transfer ports are only partially opened because of this ‘design flaw’.



Exhaust and Transfer ports are fully opened, and timing is advanced because of the lifted cylinder.

The best port timing should be tested, but the ports should at least be fully opened when the piston is at the exact Bottom Dead Center. If not, this should be corrected nonetheless.

Spark Plug / Heat Dissipation

The heat range of the spark plug is quite important for a good running engine, spark, and lifetime of the spark plug and possibly the cylinder. The spark plug heat range specifies the amount of heat from the center electrode that can be transferred to the cylinder head through the spark plug's thread. The default spark plugs we mostly use in our Tomos mopeds are made by NGK. In addition, the spark plug cap / cable is also made by NGK, used on most Streetmates. So we assume the NGK spark plugs works best with our Tomos mopeds for a reasonable price as well. NGK classifies their spark plugs as hot, with lower numbers. While cold plugs have higher numbers. This might be confusing at times, but with enough practical experience, it will become quite clear.

The center electrode (also called the tip) and secondly the side electrode is being exposed to the highest temperatures, because of the ignition that creates a spark between these electrodes, igniting the mixture here. The tip and side electrode should have the right temperature value to ignite the best possible spark, without carbon deposits that could interfere the spark itself, and on the other side maintaining the health of the spark plug by not overheating. A cold rated spark tends to leave carbon on the electrodes and thread which could interfere with the spark's ability to make a good jump, while on the other hand a hot rated plug could suffer extreme temperatures, which could cause the electrodes to melt. Every heat range difference means a reduction or raise by approximately 85C Celsius. What we actually want to reach is a situation where the spark plug electrodes would burn itself clean at mainly the surface of both the electrodes, this is called The Self-Cleaning Temperature, and is reached by about 450-500C Celsius. On the other hand, we would not want the spark plug to get too hot, resulting in detonation triggering and melting electrodes. Although a temperature of 200C Celsius difference would seem to be a big jump, but mostly in a practical situation, there is no huge difference to be noticed in terms of performance.

The spark plug has a porcelain insulator, which, depending on the heat range, touches the thread of the spark plug more, or less. More porcelain that contacts the thread will dissipate heat faster (Cold Spark Plug) while less porcelain dissipates the heat slower. (Hot Spark Plug).

Because it can be hard to see whether the center electrode or the back of the side electrode has deposits on them, it could be easier to check the thread surface on the combustion chamber side for deposits. This could be a bold indication of whether the heat range has been correctly chosen. It can be said that, if the side ring of the spark plug is clean, the heat range is either correct or too hot. While carbon deposits, which can hardly be removed from the spark plug, indicates a too cold heat range.

Revolutions per Minute
The reason why there are so many different heat ranges can be explained by the fact that there are much different engines. The most important reason is the difference in Revolutions per Minute. Every time the piston goes up and down, ignition takes place. Every time this happens, heat is produced. The more ignitions per minute the more heat is produced per minute. This means that fast cylinders mostly have colder plugs to dissipate their heat faster. A low rpm cylinder produce less heat and doesn't have to dissipate heat at a high rate. In addition, on a low rpm moped, installing a cold plug would definitely foul the spark plug much faster.

If we look at the picture from another view, the best situation is to achieve the highest temperature in when it will not rise any further, with the correct heat plug, and cooling, the engine will have a maximum temperature whereas the spark plug has an optimal temperature. From this state, it could only cool down.

Electrode Clearance
The electrode clearance is the distance of the two electrodes where the spark takes place. The distance of the gap tells something about the spark intensity. The spark should have to touch enough fuel particles to be sure of a good chain reaction and therefore a clean burn. The gap clearance for the Streetmate should be about 0.8 – 1.0 mm. The electrical ignition from the Streetmate is strong enough to engage the spark to jump from this distance, if we assume everything is in a good condition.

If the gap is narrower than ~0.50mm, there is a certainty for the ignition to spark with every cycle. However, there is also a chance that the intensity of the spark is too low for the fuel particles to be sufficiently ignited.

If the gap is wider than ~0.80mm, there is a possibility that some sparks will misfire, especially on higher RPM. This is also depending on the quality of the ignition / ignition coil / spark plug cable and overall condition of the moped's electrical circuit. Let us assume that the ignition sparks at all times, the wider gap will bring a more powerful spark and more chance for a full clean burn for every cycle.

Another thing to bear in mind; when the moped is running Idle, the flywheel rotates at a slower frequency and might result in less power for the spark to ignite with a wide spark plug clearance.

The spark plug for the Streetmate should be around BR6ES for the restricted version and BR8ES for the standard version. However, this is also setup dependent.

In addition, if the temperature of the outside environment drastically changes over time, it could be just the cause of sudden spark plug fouling. This could indicate that a warmer/colder spark plug is needed. Also temperature changes over a longer period could make you to replace the plug with a colder or warmer plug.

Compression
The compression of the combustion chamber changes when a spark plug of another heat range is installed. Because of the insulator that has more or less volume to dissipate the heat, this also affects the compression ratio. A difference of one or two heat ranges will not give much effect on compression, but going from five to nine in an instance could change compression ratios more drastically. Still, this is not the primary function of the spark plug heat range.

Carburetion: Main tuning, mid tuning, fine tuning

Before we are prepared to tune the mixture sent to the cylinder, we will first have to take some things into consideration. We need to make sure the cylinder is at a working temperature at every step of the tuning process. If you have recently upgraded to a fast exhaust, you should at least have a 12+mm carburetor. Lower ones do not always cope well with fast exhausts because of the overall more mixture being requested.

1. Before we can adjust the underlying functions of the carburetor, like positioning the needle and adjusting the air mixture screw, we'll first choose the correct main jet. The main jet is the maximum opening where fuel can pass through, thus controlling the right amount of atomized particles at full throttle opening. So by changing the main jet, all underlying adjustments of the carburetor are influenced. This is the base for the tuning process. To prevent the engine from overheating, we begin testing by using an oversized jet (~60). We will test drive at full throttle opening for a while and determine whenever the cylinder is creating a noticeable 4-stroke-like sound. This sound is actually created because of the spark plug, which cannot ignite every cycle because of the over-rich mixture. Downjet every test with two sizes until the desired result is reached, and the 4-stroke-like sound has disappeared. And most important; running flawlessly at top speed. The reason why we want to reach the maximum reachable RPM is because of the fuel in the mixture increases at a higher rate than the air at the same proportions. There is a secondary test if you prefer performance over temperature; like the first test, drive the moped at full speed, and while doing so, at the same time disconnect the fuel supply. At this point, it would take about 400 meters before the float chamber runs empty, reducing the fuel added to the air stream. When this happens, and the moped has an increase of 2 to 3 km/h for an instance, you could downjet one or two more sizes. This would be the perfect setup, and the mixture would be ignited most sufficiently (Leaving the smallest trace of unburned gasoline into the exhaust pipe). On the other hand, if you prefer more cooling from the fuel, you could choose not to downjet.

2. We can now begin with adjusting the tapered needle. The mixture of the needle is mostly related to $1/4^{th}$ to $3/4^{th}$ of the throttle slide. You can either fine tune the needle at this moment, or choose to tune the air mixture screw at first. Because the needle mixture is actually the mixture between the main jet and idle mixture, you could later make the transition from idle-$1/8^{th}$ to full throttle smoother. Part 6. will explain on adjusting the needle.

3. With the air mixture screw, we can fine-tune the Idle-$1/8^{th}$ mixture so the idle mixture and transition to opening the throttle / half throttle mixture is perfectly aligned. The standard Streetmate screw setting is 2.0 rotations or 720 degrees from zero point (Closed state). But this is just a guide and can very well be too rich or lean. The idle mixture can have a positive or negative influence when opening the throttle, depending on the mixture proportions. To adjust this screw, begin rotating the screw to the right (Richer) or to the left (Leaner) and determine where the most possible RPM are achieved, this is the right adjustment and mixture. With this adjustment, the moped should start without problems. This mixture also affects the way the moped accelerates, when the mixture is too rich, it could stall because it has troubles igniting the rich mixture. When this mixture is lean, it might accelerate at a higher rate, but could give starting troubles or a overheating cylinder when running Idle for a long period.

4. The Idle jet cooperates together with the idle air mixture screw, to fill the cylinder in a decent way on idle speed. Also here, cylinder fill is of great importance for a good response. In normal conditions, with the stock engine, cylinder fill is good enough. But upgrading to another (fast) exhaust causes the mixture to lean. This could be compensated with the air mixture screw, but it is necessary to upgrade the idle jet to approximately size 30-35.

5. The Idle speed screw actually controls the throttle slide opening on Idle where the air is drawn from. Turn the screw left or right to decrease or increase the engine's RPM. Adjust this screw so, that the engine runs soft and smooth, but does not have the intention to stall. Adjusting the throttle slide too high can result in rattling from the clutch. Also, the clutch shoes might undertake more wear.

6. From here, we will go back on adjusting the position of the tapered needle. Since we have all other functions adjusted correctly. We can make the transition from Idle to Top speed even smoother. In very simple terms, by raising the needle every notch, the mixture at half throttle will enrich. Lowering the needle will lean the mixture. Mostly there are five positions on the needle to adjust the mixture. With help of an e-clip, the needle will stay in it's place without moving. The moped should run fine with a sudden throttle opening. Also a slow transition from and back to Idle should be smooth, without experiencing bogs or poor running.

Spark Plug Color / Mixture (Visual/noticeable result after Tuning)

Spark plugs recolor within a specific time after one or more drives with the moped. Depending on the conditions and setup, the spark plug colors at a slower or faster rate, but on the other hand could actually take some 100 kilometers. The colorization from a new white spark plug actually happens because of burned gasoline and oil, which deposits their color onto the spark plug electrodes and insulator. Moreover, more or less onto the thread inner surface, which are mainly black deposits. High temperatures would however burn off all carbon or other deposits and shows us a clean white spark plug. A perfect combination of mixture, spark plug heat range, and pre-ignition, should show us a brownish/tan color. Both temperatures and mixture have some influence on the coloring of the spark plug.

Gray/white can have the following causes:

- The mixture is too lean and temperatures will get high. (Air leakage can also occur)
- The spark plug heat range is hot which will also result in higher temperatures.
- Too much pre-ignition will also result in high temperatures.

Black can have the following causes:

- The mixture is too rich and the temperature will stay lower then normal.
- The spark plug heat range is too cold which will also result in lower temperatures
- Leakage in the right seal ring of the crankshaft chamber
- Exhaust is clogged; the cylinder is choking in his own ignited residue gas.

Tan/Brown can have the following causes:

- The Air/Fuel mixture ratio, as well as the spark plug heat range and ignition is correct.

This overview also explains that the coloring of the spark plug is not always 100% accurate. Both temperatures and mixture cause the color. This explains that, for example, a rich running engine could still have a whitish colored spark plug with the wrong spark plug (Too hot). Mostly, a wet residue is still seen on the thread of the spark plug because of the rich mixture. The reversed situation is also more ore less possible, but occurs less frequent; running lean with a too cold spark plug, results in a blackish spark plug reading.

Plug Chop (Spark Plug Color Test)

Doing a plug chop actually means driving on a certain sustained speed / throttle opening; firstly, you will let the moped run for approximately 10 minutes to warm up. While driving on the sustained speed, preferably on top speed, we will accidentally stop the engine from running and at the same time releasing the throttle handle. The reason for doing this; If we wouldn’t release the throttle handle, or turn of the moped, the other mixtures could influence the spark plug’s color. Now, disassemble the spark plug from the moped and check the color of mainly the side electrode, center electrode (tip), and less important would be the insulator color (Changes at a slower rate).

This is no accurate way of testing for the correct mixture, because different throttle positions might recolor the spark plug as well. Giving false colors. Also, when shutting off the engine, there could still be some residue mixture that could be drawn from the carburetor. Even the type of lubrication 2-stroke oil can change the way of the spark plug.

With the proper mixture, pre-ignition, and heat range, you should at least get a brownish / tan color on the spark plug. If this color cannot be achieved for some reason, it is most likely the cause of some unexpected situations;

- Too much pre-ignition
- Spark Plug too Hot
- Lean mixture (Air leakage)
- Inadequate Cylinder fill (Fast exhaust, small carburetor)

Mixtures affect Mixtures on different throttle slide levels. (Overlapping)
Before another mixture from another function of the carburetor replaces a mixture, it can take some time before the cylinder has processed the old mixture. If one of the mixture levels on the carburetor aren't aligned with the rest, it could be just the cause of a temporal engine failure or poor running at this point. Most of the time, the mixture is slowly replaced by the correct mixture, but it could also stall the engine's running. The best transitions between throttle slides will be achieved whenever all adjustable mixture levels are correctly tuned or a little leaner. Having a too rich mixture on any of the carburetor levels could make the moped choppy on some transitions;

If the Idle mixture is too rich, slowly transitioning the cylinders fill to a richer mixture, the cylinder could bog and stutter when opening the throttle handle. The Idle system also controls the accelerating mixture until the tapered needle replaces its function. With a sudden throttle opening, the cylinder wants to make more revolutions, but cannot succeed because of the over-rich mixture that can hardly be ignited.

When the mixture on full throttle slide opening is over-rich, a sudden throttle close would fall back to idle mixture, but stalls for some seconds until the over-rich mixture has left the cylinder. Misfires could let un-ignited fuel to escape trough the exhaust port. Also, Un-ignited fuel in fluid state mostly isn't pushed back into the cylinder because of the backpressure from the exhaust. In the contrary to atomized fuel particles. This is one way of clogging an exhaust.

Knowing this, you could test if a mixture on a certain position is too lean or too rich. As example, half-throttle mixture is too rich when opening the throttle, and eventually tries to stalls the engine there. Now, by screwing the idle mixture out and leaning the Idle mixture, you could compensate the richer mixture on half throttle somewhat. Making the transition to full throttle a little better.

Temperatures inside and outside – Reconsider adjustments

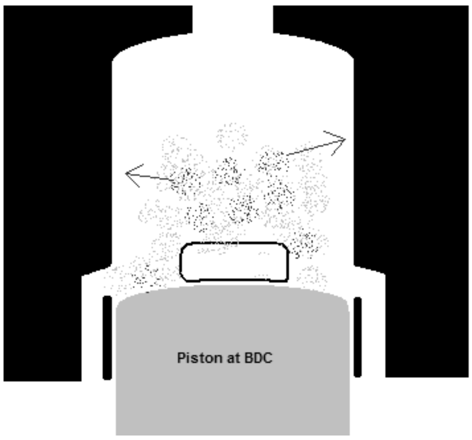
Mixture ratio and Cylinder fill

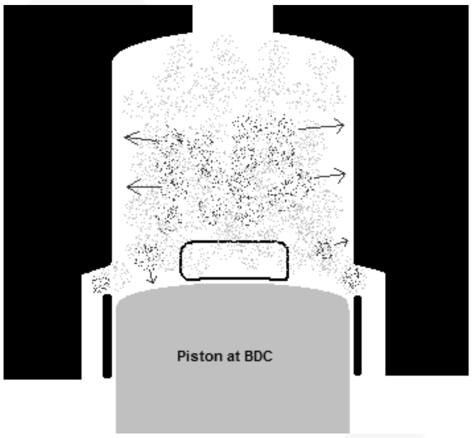
The perfect mixture ratio is of most importance at maximum speed, because of the cylinder is exposed to a tremendous amount of stress and temperature in this state. This is especially true on a warm summer day, when cool, moving air, is almost absent. Thus, it is very important to cool the internal cylinder parts by giving the cylinder a correct mixture. Lean mixtures at high environment temperatures are fatal for the engine. If this would be the case, the piston and cylinder wall would expand rapidly, leaving almost no room for the piston to move over the oil film on the cylinder wall, and eventually damaging the piston and / or cylinder wall. Air leakage could also be the cause of a lean mixture. However, since Nicasil based cylinders are produced, it is more likely to damage the piston and piston rings, because of the extreme hard Nicasil surface. Nevertheless, it should still be considered dangerous.

Not only the mixture ratio itself is important to retain enough cooling, cylinder fill could be even more important. The atomized gasoline particles also have a property of cooling the cylinder wall / head and piston. The cylinder fill is actually the most efficient mixture when the proportions and volume are both correct. By raising the main jet, or better jet, raising the carburetor to a bigger size, will have a positive effect on cylinder fill thus cooling and ignition. Some examples:

First picture illustrates a cylinder that is being fed with a small (10 mm) carburetor. This setup will cool less cylinder parts while having the same example ratio (1:15) as the situation in the second picture.

The second picture illustrates the cylinder, which is fed with a larger (14 mm) carburetor with more fuel delivery. More fuel particles will cool the parts of the cylinder wall with the same Air / Fuel proportions (Also 1:15).





Light particles = Air
Dark particles = Fuel

Example Ratio:
1:15 (Fuel / Air)

If we would for example, only send half of the normal rate of air and fuel to the cylinder, the mixture would still be the same in proportion, but much less overall mixture is available, which could raise the temperature inside of the cylinder as well. A perfect mixture also means fast ignition and flame front speed, because it takes the heat away faster if the piston is pushed back with the most available power, and makes the exhaust port to open sooner.

The main idea is to ignite the mixture as efficient possible, with the best cylinder fill and mixture ratio, and to release the exploded gas as fast as possible, exposing the piston and cylinder for the shortest time with the highest power output. The density of the cylinder fill is important for a good, clear ignition as well.

Indication of a too high cylinder temperature is mostly noticeable when rode for a long period. You will mostly see the environment air moving rapidly around the surface of the cylinder and cooling fins. A smell of burned materials could sometimes be noticed as well. However, the aluminum A55 cylinder should dissipate its heat fast enough under normal conditions.

Environment temperatures
As soon as the environment temperature changes, or if the combustion chamber / cylinder warms up, the end mixture changes proportions.

With a cylinder temperature change, the actual mixture send by the carburetor has not changed. But since this mixture is passing trough the intake manifold and crankcase, which are relatively hot, and even the cylinder and piston which will raise the mixtures temperature, the end mixture is changed before it has been ignited. The air in the mixture stream is less dense with high temperatures, so it will change the mixture to a richer one.

However, if the environment temperature changes over time, the mixture will change at the carburetor's level, because of air density changes. When the environment air temperature drops, the air will become denser, meaning a leaner mixture. When the environment air temperature raises, the air becomes less dense, meaning a richer mixture.

	Cold Cyl.	Hot. Cyl
Low temp.	- -	-
High temp.	+	++

- - = Leaner
- = Lean
+ = Rich
++ = Richer

Adjusting carburetor for temperature changes.
As you might understand, you should periodically or instantly re-adjust the carburetor to adapt on the environment changes. This is mostly achieved with one or two jet sizes. A change of 10 degrees would be relative to one size jet difference, while 15+ degrees would be relevant to two sizes of jet difference. There is another advantage over a lean mixture; temperatures inside the cylinder should rise, which will enrich the mixture also. So this could be seen as a small compensation.

Symptoms of air leakage

If the perfect mixture can't be accomplished for some reason after adjusting the carburetor, or the mixture changes rapidly over small time intervals (minutes/days) without drastic environment changes, there might be an air leak causing this. Air leaks mostly happen between the air filter (where the nominal fixed air is drawn) and exhaust. Air leakage could occur constantly at a fixed rate, but can also occur variably. Variable air leakage is mostly caused by a leak that is of some flexible material that can be stretched out when more mixture is being drawn from the carburetor. There could very much be no air being drawn from a leakage at idle and half throttle opening, and could suddenly pass air trough at higher engine revolutions. Therefore, fluctuating air leakage is sometimes difficult to analyze.

The most common places for air leaks are:

- Air filter, must be connected properly and needs a fixed intake diameter.
- Throttle Slide Cover (Gasket available)
- Oil intake
- Connection between Carburetor and Intake rubber
- Intake rubber itself (Rubber could get porous)
- Connection between Intake rubber and intake manifold
- Connection between Intake manifold and Cylinder head (Gasket available)
- Connection between cylinder and engine (Cylinder base gasket)
- Connection between cylinder and cylinder head (Cylinder head gasket)
- Spark Plug
- Left Crankcase Seal Ring
- Right Crankcase Seal Ring

To make sure we are dealing with air leakage, we first turn on the moped and let it run for about 10 minutes. We can use a spray can with a inflammable substance. We spray it onto the suspected parts. Because of the inflammable particles, these particles could be drawn into the cylinder through the leakage. We can now hear if the engine changes rpm. Also, the spray could cover the leakage which would change the mixture. If RPM drops or rises, there is most likely an air leak. However, this test is not always 100% accurate, so even if no result is observed, there is still a possibility for air leakage. Sometimes, the only way to really exclude air leakage is to remove and remount the suspicious parts and to use new gaskets.

Exhaust
A exhaust which hasn't been mounted correctly, cannot draw air. But it can change the mixture ratio which will result in bad engine behavior. The rate of change is not this great from my experience however. Fluctuations of the mixture can always occur with badly mounted engine parts, resulting in variable gas reactions and engine revolutions.

Carburetor Gas Gasket
The Streetmate has a carburetor with a throttle slide cover. Between the cover and carburetor's aluminum chassis a rubber gasket is located. If this gasket is damaged or not available, air leakage could also occur on this spot. Most people tend to oversee this. This is also a variable air leakage because of the different throttle slide positions, air can be drawn between the slide cover and carburetor, and finally through the holes of the throttle slide, into the air stream.

Crankcase Seal Rings
Even these two rings are sometimes forgotten when discussing air leakage. Sometimes the right, and more probably the left seal ring can draw air, at the ignition side.

Sprocket Ratio – Revolutions / Fuel Consumption – Drive Style

Here we will explain the relation between Sprocket ratio's and revolutions of the engine, and fuel consumption. Fuel is being drawn from the carburetor everytime the piston moves to the top dead center, so the more revolutions the engine is running, the more fuel is being consumed. So in logical thinking, you might want to keep the rev's as low as possible. Actually, it is much more efficient to keep the revolutions as low as possible. Certainly if you prefer consumption above real power. Ofcourse, a 4-stroke is actually running at less revolutions as well, therefore a 4-stroke will be more economical under normal conditions. Running at lower revolutions doesn't automatically mean there is less power also. Take this as an example:

A moped with a 10mm carburetor has less cylinder fill, but could achieve quite some revolutions still. Ofcourse acceleration will suffer from a 10mm carburetor. This is because of the smaller and less intense explosion inside of the combustion chamber.

Now, with a 14mm carburetor, the cylinder is filled up higher with a stronger explosion as a result. If the moped is tuned to run at less revolutions, the engine itself still has enough power to keep up with the 10mm moped.

There are some ways to reduce the amount of revolutions but still maintaining enough power. Some of them are:

- Good cylinder fill, by using a bigger carburetor (14mm) and wide intake manifold (~14mm)
- Smaller rear sprocket. (26<)
- Small combustion chamber and tuned squish.
- Stock, low rev. exhaust.

Such a setup will lower the revolutions and will have a positive effect on the fuel consumption. The reason why the standard version is more economical than the restricted version at the same drive speed, is mostly to be attributed by the smaller rear sprocket.

Relation of Sprockets and Revolutions

To efficiently transfer the power created by the engine to the secondary gears, we should choose a specific rear sprocket. The real difference between a big rear sprocket and a small rear sprocket is as follow; with a small rear sprocket, the rear tire will rotate much faster at the same revolutions from the engine as when a big sprocket is used. With other words, using a small rear sprocket, acceleration will be reduced, but top speed will be affected in a positive way. A example comparison:

The moped with a big rear sprocket will run at 7000rpm, the rear tire will make less rotations meaning lower top speed.

The moped with a small rear sprocket will run at 7000rpm as well, but the rear tire will make more rotations meaning higher top speed.

Ofcourse for the first moped with a big tooth sprocket, the acceleration will be at a more powerful rate. For the examples, you would say that the 2nd moped will be more economical because it reaches a higher top speed with the same amount of engine revolutions. So when running at top speed for long periods of time, the fuel consumption is positively affected.

A rear sprocket with 26-28 tooths, you could still expect reasonable acceleration with a 14mm carburetor.
A rear sprocket with 22~ tooths, the acceleration is effectively reduced.

Internal gearing

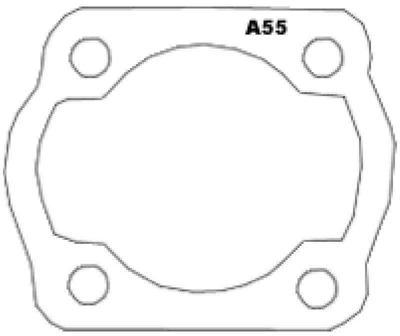
Because it takes longer for the moped to accelerate because the ratio's are changed, it also means that the shifting from 1st to 2nd transmission will engage at a higher speed.

Cylinder / Gaskets / Cylinder head / Piston / Intake Data

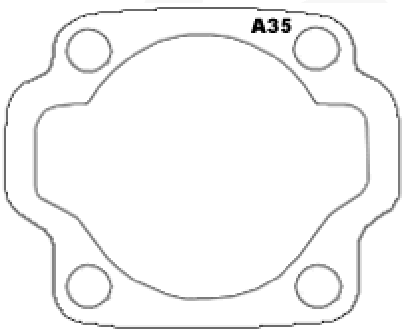
Cylinder
This is, as far as we know, the first Tomos cylinder made from aluminum with a processed Nicasil (Nickel Silicon-Carbide) coating surface. This new kind of cylinder can dissipate its heat faster than a cast iron cylinder, because of its aluminum material. The inner surface of the cylinder is much harder and can take much more friction (More wear resistant). The aluminum used for the rest of the cylinder is much lighter in weight as well.

Specifications:
Piston displacement: 49cc
Cylinder Bore Diameter: 38.0mm
Cylinder Perimeter: 119mm (11.9cm)
Cylinder Piston Stroke: 43mm
Cylinder Piston Length: 50mm
Cylinder Piston Type: Closed (Not ported)
Cylinder Needle Bearing Dimensions: 12x15x15
Cylinder Wrist Pin Width: 12mm
Cylinder Spring Circlips: 12mm
Cooling: AC (Air-cooled)
Standard Piston Rings: Two, 38mm x 1.5C (Class C)
Crankcase Mounting Stud Bolts: M7 at crankcase side, M6 at cylinder head side, Length: 115mm
Exhaust Stud Bolts: M6 / 24mm

Cylinder base gasket differences
As seen hereunder, the base gasket of the A55 engine differs slightly with the one used by the A35 engines. The left and right sides are the openings to the transfer ports; those are also widened, with the intention of more mixture that could be pushed through the transfer ports to the cylinder. The stud bolts are exactly placed in the same position, which automatically means that a A35 base gasket could very well fit on the A55 engine with some small cut and paste modifications. Most Tomos dealers do not have the new gaskets in their standard assortment. The standard A55 base gasket size is 0.4mm.



Part nr. (233714)



Cylinder head gasket
The standard cylinder head gasket (233717) is measured 0.25mm and only a single one is installed on the standard version. While the restricted version has two gaskets installed to reduce compression. The first gasket for the restricted version is the same as the unrestricted standard version which has a 0.25mm gasket installed.

On top of the standard gasket, a thicker gasket is installed with a measurement of 1.20mm and has a different part number (233722). The total width of both gaskets for the restricted version is: 1.45mm.

Cylinder heads
There are not any separate A55 cylinder heads to slow down restricted models, and to decrease the combustion chamber compression. The only thing Tomos does do, and probably to reduce costs, is to apply two head gaskets right on top of each other. Also, the restricted version runs at less RPM, thus a warmer spark plug is installed. This warmer spark plug also increases the overall combustion chamber volume and decreasing compression. A35 head gaskets can be used, but is not recommended. I recommend to use gaskets specially for the A55 because these are thinner (0.25mm) which makes you to measure and control the squish clearance / compression more efficient.

Piston
The standard piston shipped with the A55 engine is a closed piston without ports. These are used by piston-controlled intakes. In addition, there is no performance gain by using a ported piston. Ported pistons are commonly used by Reed Valve-controlled intake systems. (Some reed valve-systems use a closed piston to restrict the moped's power however)

Company Vertex Pistons has fabricated pistons especially for Tomos A55 engines; the inner surface has been carved with the words; Tomos (And) Vertex at the other side. These pistons are of very good quality.

There seem to be differences with the restricted and unrestricted versions of the A55 engine, but not in terms of open/closed ported pistons, but perhaps with timing.

- Standard Version Piston (233709)
- Standard Version Piston (236805)

Restricted version:

- Restricted Version Piston (233710)
- Restricted Version Piston (236806)

I really do not think there is much difference with all those parts anyway, I did not notice any difference between by old restricted piston and a normal Airsal piston as well.

Tested and working replacement parts:
Airsal Piston Kit 38.0mm for Puch Maxi (Average Quality, rings could rattle. Ring type B)

Cylinder Base
There is also a difference in part numbers for the Cylinder Base part. There are no / minor changes for this part, and does not really restrict. But there is not much information on these parts as well.

Standard version:

- Standard Version Cylinder Base (233711)
- Standard Version Cylinder Base (236807)

Restricted version:

- Restricted Version Cylinder Base (233712)
- Restricted Version Cylinder Base (236808)

Piston Rings

The Tomos engine has typically two piston rings;

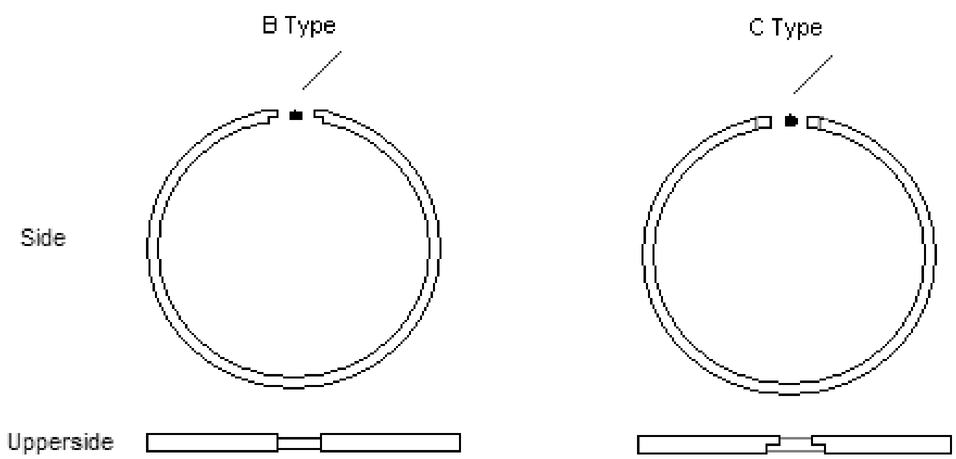
The main functions of these rings are to make compression within the combustion chamber, and to create a vacuum area on the backside of the piston to draw new mixture to the crankcase. The two rings actually divide the work; the front ring is more committed to build up compression, while the second ring is both a backup for the first ring, and to make vacuum. The second function is to lubricate the cylinder wall and piston (rings) to prevent excessive wear. They also keep the piston from directly moving and scratching the inner surface of the cylinder. Because of the finished inner surface of the cylinder, the piston ring is moving over the surface with a small oil film between it, created by the 2-stroke oil injected. Also, both rings are some kind of oil scrapers because of dividing the oil on the whole inner surface. The third function is actually to transfer the heat of the piston rings / piston to the cylinder wall and therefore to the cylinder's aluminum cooling fins.

If one of the piston rings wears out, there is always a backup ring, which could take over most of the work. While some fast cylinders only use one ring, mostly to prevent too much friction and to achieve the best performance, two rings guarantee the best compression.

To check for piston wear, move the piston to the TDC, and from the exhaust port, use a small thin piece of metal to press against the rings. If the rings can be significantly pushed into the piston, they are most probably worn out. When having a blow-by, which can be easily spotted by checking the sides of the piston just between the piston rings and piston crown, black deposits are analyzed. This can either mean a broken or worn piston ring.

There are actually three types of piston rings mainly used in 2-stroke / 4-stroke mopeds, but we will only show you the two mostly used 2-stroke rings here. The Streetmate used the type C with the standard piston, width; 1.5mm.

Piston Type B: The ring-ends are positioned completely over the indicated pin.
Piston Type C: The ring-ends are positioned half under the indicated pin.



Depending on what piston is used, on the standard piston the two pins are pointed just left and right to the intake port. But on a similar replaced piston they very well could be at the exhaust side, as long as they don't overlap any port, everything should be alright.

Compression and Vacuum
Here, we will explain how the procedure works with mixture entering the cylinder in a A55 engine, at a time when the explosion just have taken place:

1. **Intake Stroke:** The piston moves back to the bottom dead center after the explosion, opening up the cylinder exhaust port and releasing the burnt gases. When the piston is moving back further, the new waiting mixture inside the crankcase is ready to be squished into the cylinder due to the piston moving further to BDC. At the same time, the piston opens up the transfer ports at each side of the cylinder, where the new mixture will be pushed through. Meanwhile, old gasses are still somewhat released by the exhaust port, and new mixture takes it’s place. The new mixture however, could escape trough the exhaust port as well. But because of the backpressure created by the exhaust, a shockwave of old gasses pushes the escaped mixture back into the cylinder. In this period, the new mixture cools down the cylinder inside wall / surface.

2. **Power Stroke:** Because of the weight of the flywheel, the piston heads back to Top Dead Center at this point, closing the transfer ports, and later the exhaust port as well, to make new compression. So, when the piston is moving back to TDC, a vacuum area behind the piston, in the crankcase, is created. Also, at the back of the piston, the intake manifold opens up drawing new mixture from the carburetor into the crankcase. The hall sensor picks up the spot on the flywheel, receiving a new signal to the CDI charge unit to fire the spark. The cycle repeats itself.

There is a continuous compression and vacuum situation going on. This procedure is called a piston-controlled intake, because there are no separate parts controlling the intake manifold, like a reed valve. The only real disadvantage of this system is, that there could be new mixture pushed back into the intake manifold when the piston heads back to BDC and is overlapping the intake port.

The first A3 engine was piston controlled, while the A35 engine was reed valve controlled. The reason why Tomos chose this system again is probably reliability and reducing wear because the absence of a reed valve system.

Squish type cylinder
The squish room defines the space that remains between the edge of the cylinder head and edge of the piston head, when the piston is located at top dead center. This margin should not be less than 0.6mm. But to play it safe, we should leave this space at least 0.8mm. Depending on the cylinder’s internal conditions, the piston might expand and retract in a greater rate when the temperatures rise and rpm increases. The piston could hit the cylinder head and damage to the piston, crankshaft, and bearings will occur.

Most 2-stroke engines use this type of cylinder model, because this type of cylinder is the most practical model by means of handling warmth, reliability and effectiveness of the ignited fuel. Because at first, the mixture being compressed is pushed at the closest to the spark plug, with better ignition as a result. The squish edge room prevents most flame heat to be exposed onto the edge of the piston crown. This way, the piston’s temperature is reduced.

To measure the current squish space, we will use a 10 cm long, 2 mm thick solder piece. Form the piece into an L shape, so we can easily place the piece of solder trough the spark plug’s hole with the end tip touching the edge of the cylinder. Now we squish the solder piece by using the flywheel or kick-starter; we’ve measured the squish room. Hereafter, we could play with the base and heat gasket, and possibly other adjustments to modify the squish room.

Dell’Orto PHVA 10, 12, 14, 16, 17.5 Carburetors

Carburetor Sizes (Intake/outlet) and Mounting Measurements
The A55’s have been equipped, depending on the restrictions, with a Dell’Orto PHVA 10 (233750) or 14 (233730) carburetor. The opening size numbers of this carburetor model define the narrowest part of the venturi, which is actually the size of the carburetor in millimeters. The PHVA carburetor doesn’t have different intake and outlet sizes, because they are evenly bored.

PHVA 14 (mm) is the standard model which most A55 (Streetmate) engines have. Meaning the intake and outlet size at the venturi are both 14 mm in diameter. While the restricted version is equipped with a PHVA 10 (mm) carburetor. A 12 mm version is not officially used but could also be easily mounted, as for other PHVA carbs. A PHVA 16 has also been spotted on a original Streetmate. The largest size PHVA carburetor is the 17.5 (mm). Specifications on the mounting sides:

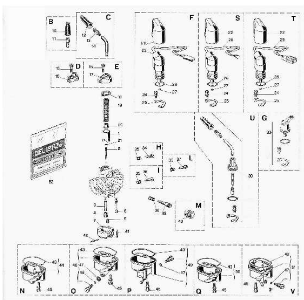
- Air intake mount inside diameter: ~32mm, Outside diameter: ~35mm
- Mixture outlet mount inside diameter: ~21mm, Outside diameter: ~24mm

If a fast exhaust is assembled on the vehicle, it is recommended to upgrade to a 12mm+ carburetor. These bigger carburetors are mostly better tunable for faster setups, because of more mixture that can fill the cylinder. But to make full use of the moped’s capabilities by means of balancing the carb with the intake and air filter’s air-stabilizing snorkel size, a 14mm carburetor is for the best reliability. There is not much use for the 14mm snorkel diameter to give a stable air supply to a 10mm carburetor.

Carburetor Functionalities and Gaskets:
Main jet, Idle jet, Choke (Starter) jet, Needle adjusting (Five positions), Air-mixture screw, Idle speed screw, Oil pump connection.

Throttle Slide cover gasket (Rubber), Float Chamber gasket (Rubber), Choke Handle gasket

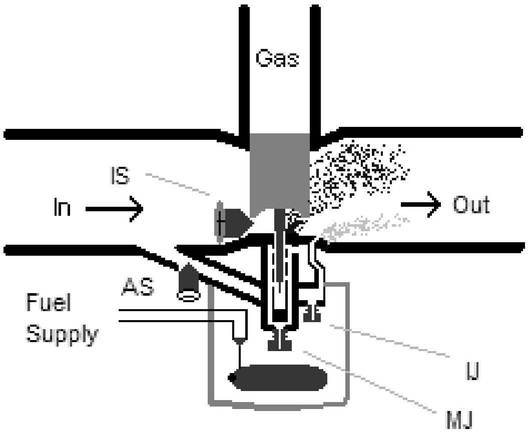
Identification of the carburetor
The first letter after the PHVA model name normally indicates the type of fitting on the engine side. A; would be a clamp fitting, while B; means a rubber sleeve fitting. Since the A55 mopeds all have the same intake manifold which requires a rubber sleeve, this identification refers to a specific application when separately sold (Electrical Choke, different float chamber, etc.). This can than be checked in the PHVA parts diagram (See attachements);



The second identification number after the first one indicates whether the idle speed and Mixture screw is located on the left side of the carburetor, or on the right side.

S: Control screws on the left side of the carburetor.
D: Control screws on the right side of the carburetor. (Standard for A55 engines)

Internal Working
When the piston is moving to top dead center, creating vacuum behind the piston inside the crankcase, air is being expelled from the air filter through the venturi of the carburetor. Because of the narrowing (Venturi), air is temporarily accelerating. Because of this accelerated air, backpressure inside the float chamber is created, and gasoline particles are waiting to be atomized and pulled from the atomizer / needle housing into the air stream, creating a Air / Fuel mixture.



Legend:
IS = Idle Speed Screw
AS = Idle Mixture screw
MJ = Main Jet
IJ = Idle Jet
In = Intake
Out = Outlet

Idle Mixture Screw / Idle jet (Standard Size 25 or 30)
The Idle system is mainly to give the engine the right mixture on Idle to prevent the engine from stalling or stopping. When Idle, there is not enough flow at the venturi to atomize the fuel on the main nozzle for half and full throttling. Therefore, the idle system takes its place, until the throttle is opened. An extra nozzle just before the main nozzle is atomizing fuel from the Idle Jet, as seen in the picture. Combined with a separate air supply mixture screw, the idle mixture can be properly tuned. When the throttle is opening to 1/8th, the needle housing / atomizer is slowly taking its place as fuel deliverance. This transition always encounters a small loss in air speed, because the wider venturi is temporarily slowing the air, but is compensated with the idle system still atomizing its part as well. (This transition is called 'Progression'). Because of the carburetor is stabilizing again, the flow is increasing and the Idle system is mostly neglected. A specific Idle mixture can experience different engine behavior when Idle-ing or suddenly opening the throttle handle.

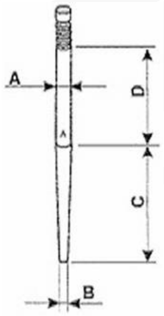
- When the idle mixture is too rich, a sudden opening in the throttle handle could choke the engine, stalling it. On the other hand, the cylinder is properly cooled at idle.
- When the idle mixture is too lean, a sudden opening in the throttle handle would make the moped to accelerate with faster rpm's. But the cylinder will be less cooled with fuel. Also the moped could have troubles with starting when cold.

Tapered Needle System / Throttle Slide (Half-Throttle) and Atomizer
While the tapered needle controls the amount of fuel being expelled from the atomizer / needle housing, the throttle slide controls the amount of air being passed through the slide, from the air filter. Because of these two parts are actually working as one, the A/F mixture is kept in proportion at all throttle positions from ¼th to ¾th of the throttle handle. When all holes inside the atomizer are open, the needle loses its functionality and full fuel passage is possible, which means the full throttle position totally depends on the main jet. When going back to 1/8th throttle, the Idle system takes over again.

Back to the tapered needle which, in normal idle conditions, descend into a needle housing / atomizer with a certain amount of holes for fuel to pass through. When the needle is lowered by the throttle slide, holes are closing and letting less fuel to merge into the air stream. On the other hand, when lifting the needle, holes will open, letting more and more fuel to be atomized into the air stream. When all holes are open, the needle has done most of its job. From here, the main jet takes over again. There are five notches on the top of the needle to reposition the needle up or down. With help of an e-clip, the needle is kept in place. By raising the needle, the mixture gets richer, while lowering the needle will lean out the mixture.

Main Jet (Maximum fuel delivery)
The maximum amount of fuel that can be expelled is controlled by the main jet. A very common misconception is that the main jet is atomizing the fuel itself, which is not entirely true. It is merely the first opening to the atomizer / needle housing and nozzle, thereby controlling the mixture for half throttle and full throttle (The Idle mixture is controlled with a separate system). The jet sizes for the Dell'Orto carburetors are most of the time ranging from 50 to 65~ under normal conditions, where these numbers directly indicate the opening diameter in millimeters after the comma (example; 0.50, 0.55, 0.80 mm). When changing the main jet, all underlying functions will be affected in terms of mixture ratios.

Needle
The standard needle in the PHVA carburetor is type A07.



Every needle model has different form factors, the A07 needle has the following dimensions in millimeters:

AØ: 2 **BØ:** 1 **C:** 18 **D:** 14

Where Ø is relating to diameters, otherwise normal length is declared. A full overview for all needles can be found in the attachements.

Carburetor's mixture functions and Effective throttle range for PHVA from practical experiences.
Here is a table where the throttle range is effectively based on. You can actually see a logical pattern:

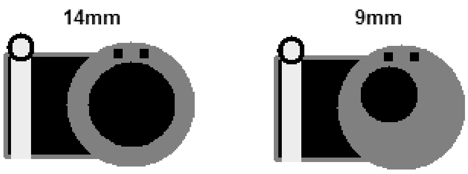
	1/8	¼	½	¾	Full
Main jet			L	M	H
Conical Needle part.		M	H	M	
Straight Needle part.	L	M	L		
Idle Jet / Air screw	H	L			
Needle pos.		M	H	M	

Influence Table:
H = High
M = Mediocre (Medium)
L = Low
(Empty) = None

Choke jet (Starter jet, standard size 40 or 50)
In certain conditions, where the environment temperature drops to a very low level, engine-starting troubles can occur. Dense air, which will make the mixture lean, as well as cold engine parts like the cylinder, and intake which will not positively affect the mixture ratio. In some situations, the first expelled atomized fuel drops have the intention to condense on the inlet parts of the carburetor and cylinder, and sometimes have the intention not to atomize at all. To avoid these problems, we can make use of the choke handle that opens a secondary jet and forces extra fuel particles into the air stream. Older Dell'Orto SHA carburetors used a piece of metal that covers a part of the air intake to enrich the mixture.

Air Filter (Junction Sleeve)
The standard air filter for the A55 engines is <u>not</u> restricted in any way as long as no carburetor bigger then 15mm is used. The I or L type (There are two types) junction sleeve is more of a silencer and a technical solution for the carburetor not to draw too much air at once (Called a temporary lean mix). The diameter of the snorkel is about 14/15mm, so doesn't function as a restriction. It is also wise to use a 14mm carburetor because of the stable airflow. There are two different versions of this part; the new part has an elbow at the end. Also, check the Design Flaw Section.

Intake rubber (Elbow) connection from carburetor to Intake Manifold
This part connects the carburetor to the intake manifold. Personally, I think this part is one of the design flaws for the A55 based mopeds, causing some mopeds to run less reliable and smooth than they could. Because of the longer passage for the mixture to reach the cylinder, gas reaction is decreases. Also, more mixture could end at the surface of the outlet parts before they even reach the cylinder. There are two different versions of this part, the standard part's diameter is 14mm, while the restricted version has a passage of just 9mm, and is filled up with rubber. In addition to the 9mm version, the pumped oil has more trouble getting into the 9mm opening because of its strange location. Remember that the oil is not being atomized, but actually spits into the intake manifold for the most part. There is a replacement for the whole Intake manifold + intake rubber available (Check Design Flaw section)



Dell'Orto (PLA S24) Oil pump
The oil pumped to the carburetor is controlled by an oil pump that is driven by the crankshaft / flywheel. The amount of oil delivered is dependent on the crankshaft's rotating, thus the engine's RPM. The oil is pumped from the oil reservoir through the oil pump to the carburetor's outlet. So the carburetor isn't actually drawing oil from the tube itself, but is injected by the pump.

A positive thing about this separate oil system is, under normal conditions, there is less chance of an engine failure because the oil is not dependent on the carburetor's adjustments. Therefore, you would say that this system is more reliable than tanking premixed fuel. However, there is also a small side effect we should be aware of, and it's not yet proven to be a design flaw, or if it can cause engine failure, however;

Because the oil pumped to the cylinder is dependent on the revolutions of the crankshaft, there could be situations where the cylinder is being heavily stressed with low oil pumping at that time. As example, when we would drive at full throttle up a hill, the crankshaft is rotating at fewer revolutions, causing less oil to be pumped at this specific moment. That would mean the cylinder is quite stressed because of the relative good cylinder fill, but oil is delivered at a poor rate. This situation should be held in mind.

But, from practical experiences, the crankcase, bearings, and back of the piston are very lubricated. Meaning, and should also be seen as some kind of 'oil reservoir' for these situations. In addition, this situation is also compensated because of the 1st gear end also produces quite some rpm.

Another advantage over this system is the possibility to use pre-selected 2-stroke oil, which could result in less carbon deposits and clogged exhausts.

There have been some reports about oil pumps that fail after approximately 500km, but there hasn't been a single proof that one of the internal parts have failed. The most plausible problem would be the oil tubes that get porous and inflexible, or the tubes might have been mounted too tight.

Oil / Fuel ratio: 1:50
20ml is used on 1 liters of gasoline
70ml is used on 3.5 liters of gasoline

If desirable; to double the lubrication, you could add about 60 to 70ml of oil into the gasoline tank reservoir before tanking. This could also be applied if one is distrusting about the oil pump. It might be wise to periodically check the oil pump anyhow.

PHBN Carburetor
The PHBN carburetor is for the most parts the same as the PHVA carburetor. This means that most parts are interchangeable, except for the choke-connection part. The mounting sides are also identical.

Exhausts and Mounting

Several different exhausts have been produced with the new black design and built-in catalyst system, while the first prototypes were actually created for the A35 engines, but now mainly used on A55 engines. Differences for the standard and restricted models inherit; bending, width, mounting. There have been some design flaws with this exhaust as well, clogging up the exhaust, especially the early types (2003-2005).
Known Tomos models to fit the most recent standard A55 exhausts at the mounting and exhaust port side are Streetmate, Streetmate R, Revival (A55), Revival TS, Funtastic, Arrow.

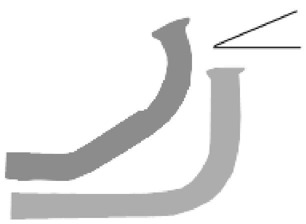
Other new catalyst exhausts have a different mounting end are: Youngster, Flexer, Spor'R and often use Tomos Part Number 236213. The only strange thing about this exhaust is, it has a S-bended flange as well, still it's marked as 'Tomos 45'. The flange inner diameter is 17mm.

This new exhaust is quite sensitive to weather and moisture causing quick rust forming. Frequently treat the exhaust, and specially the flange, with some WD-40 to drive away the moisture.

Current Restricted and Unrestricted editions.
The restricted versions (233725) have a S-bended, narrow 17mm flange, which purpose is to reduce the amount of power that can escape from the cylinder. The narrowing, in combination with the S-type bend also tends to increase the rate of exhaust clogging inside the bend.

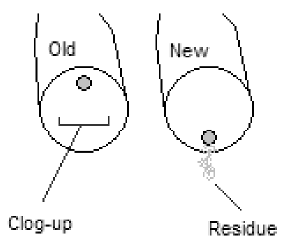
The unrestricted versions (233724) have a straight, thicker bend (~20 mm inner diameter) which makes the ignited gases to escape at a faster and more powerful rate.

Exhaust Flange difference.
When comparing the stock A35 cylinder exhaust port with the A55 version, we can see a clear angle difference of approximately 25 degrees. The exhaust's gasket layout is the same however.



Left = A55 Exhaust bend
Right = A35 Exhaust bend
Angle = ~25 degrees

Design flaw (2003-2005)
On the old type exhausts, a design flaw was causing some exhausts to clog up with unburned fuel / oil residue. The escape hole for burned gases on the end of the muffler was drilled on top, leaving empty space on the lower end muffler for oil, fuel, and carbon to bottle up. Later, this problem was redeemed by creating the escape route on the downside of the exhausts muffler end. So remainings could eventually leak away.



Aftermarket parts:
Tecno Funtastic Exhaust (Exhaust Flange diameter: 22mm, quite loud on idle, bad on low/mid-range)
Tecnigas Next R

ISKRA 12V 80W Electrical Ignition (Hall Effect sensor) / CDI / Ignition Coil

The Tomos Electrical ignition works with a Hall-effect sensor / Pickup device that can sense changes in magnetic fields. The spark timing is dependent on the spot on the flywheel, which gives a signal when the spot on the flywheel passes the sensor. The ISKRA ignition has four coils which all have a individual function of powering certain parts on the moped. The total power output is 12V (Alternating Current) and 6.66A which is a total of 80W energy.

Approximate distribution of power:

Coil 1: Headlight High Beam 12V/2.9A/35W
Coil 2: Headlight Low Beam 12V/0.416A/5W, Taillight 12V/0.416A/5W
Speedometer Light 12V/0.16A/2W, Speedometer High Beam/Power light 12V/0.20A/2.4W
Coil 3: Battery 12V/0.5A/6W
Coil 4: Ignition, 12V/2A/25W

A total of 6.66A and 80W of energy.

Voltage Regulator
The wires that connect to the voltage regulator are powered by coil 3. The alternating current in the voltage regulator is converted into direct current to charge the battery.

CDI/Hall-effect Sensor
Meanwhile, electricity is being sent from the ignition coil 4 to the Capacitive Discharge Ignition (CDI) device, where the low voltage is converted to a potential difference of approximately 500V and the current is reduced to 0.050mA by a transformer. The output energy is unchanged (25W). The current is being sent to the CDI charge-unit where it will charge a capacitor ready to be released over the ignition coil. Whenever the flywheel's spot is passing the hall-effect sensor, the capacitor will get a signal on his turn, to release the spark to the spark plug over the ignition coil.

Ignition Coil
The 500V potential that has been released by the capacitor will work its way to the primary windings of the ignition coil, and after that, to the secondary windings. Hereby the voltage is being raised again to about ~15.000V depending on the Ignition Coil itself, reducing the current to ~0.001mA. After passing the ignition coil, the spark reaches the spark plug.

Engine Internals

We have found that most internal parts are the same as in the A35 engine, aside for some small differences and improvements. Here, we will discuss the (small) internal parts which apply to the engine.

(Rubber) Seal Rings

The seal rings in the engine are to isolate the transmission oil from leaking out of the engine. There are a total of three important seal rings. It is also dependent on whether to have the kick- or pedal versions. And some metal seal rings are also located on some spots. First of all, we have the seal ring located behind the front tooth sprocket. Here, the axle reaches the outside of the engine's case. When this ring is worn out, oil will eventually lubricate the chain and foul the chrome rims, also reducing the transmission oil! The size format is:

A35 x 47 x 7 (The A35 is referring to the inside diameter, 47 is outside diameter, 7 for width. In millimeters)

The two other seal rings are to keep the oil from leaking into the crankcase chamber. Because if this happens, the mixture would get distorted by the transmission fluid, with much performance loss and poor engine running. Also, air could pass through with air leakage as a result. The rings are located at the left (Ignition side) and right (Transmission Side) of the crankcase. The size format is:

A17 x 35 x 7/6 (Left) (A17 is referring to the inside diameter, 35 for the outside diameter, 7/6 for width.)
A17 x 35 x 7 (Right) (A17 is referring to the inside diameter, 35 for the outside diameter, 7 for width.)

To remove a worn out seal ring, the easiest way of doing so is to use a screw and screw it in a side of the ring. When done, pull the seal ring out with a plier. When using a screwdriver, there is a chance of damaging the engine casing.

Ball Bearings

The ball bearings in the engine are to support the axles to move freely in the engine with the least of wear. There are two ball bearings at each side of the crankcase just after the seal rings to support the crankshaft with moving. The format for both bearings are:

17 x 40 x 12 (Inside diameter x Outside diameter x Width, in millimeters)

The ball bearing at the right-end of the crankshaft, which is mounted in the right engine cover, size:

8 x 22 x 7 (Inside diameter x Outside diameter x Width)

Furthermore, the second axle (Counter/drive shaft) where the 1^{st} and 2^{nd} gears are placed, have a ball bearing at each side of the axle:

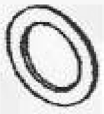
12 x 32 x 10 (Left side)
10 x 26 x 8 (Right side)

And finally behind the front tooth sprocket, a big ball bearing is located:

30 x 62 x 16

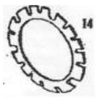
Clutch Clearance (And ratteling)
Some people have reported rinking of the clutches because of some clearance on certain A35 engines. This problem could also occur on A55 engines and should be checked. I am now referring to Tomos Part Numbers:

209073 (0.3mm shim)
209119 (0.5mm shim)



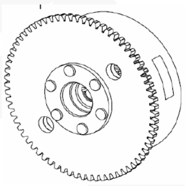
As displayed, the second shim is 0.2mm thicker and should be replaced with the first shim <u>if neccesary</u>, to reduce the clearance and clutch ratteling.

In addition, the rinking or ratteling could be caused by a spring washer with Tomos Part Number 209002, which could wear out and loses it’s strength.



Remaining Subjects

Tomos Revival (Possibly Others) Flywheel / Stator plate
The appearance of the Revival flywheel is nearly the same as the Streetmate flywheel, but there is a difference in where the ‘spot’ for the Hall-effect sensor is placed. Therefore, the Revival flywheel will not work with the Streetmate’s ignition. Nonetheless, the base plate can be used as a replacement for the stock base plate, as they are exactly the same.



2-stroke oil
The 2-stroke oil’s main function is to lubricate the cylinder wall, piston, and crankshaft bearings. There is a wide variety of 2-stroke oils around, like mineral oils and synthetic oils. The best option is mostly to use synthetic based or full synthetic oil to keep carbon residue inside the exhaust to a minimum level. To enhance lubrication, you could add about 50-60ml of oil into the tank before fueling.

Tomos A55 Frame
The Tomos frame is sturdier then thought, and very well built. Most people would often say that a Tomos frame is poorly built; this is especially the case because the frame also functions as a gas tank. Inside the tank, there are several reinforced construction to strengthen the frame, including cross tubes. The wall itself also has a width of several millimeters. Also, a second passenger on the vehicle carries the most weight on the rear suspension, causing less strain on the frame itself.

The maximum allowed weight is about ~170kg calculated without driver.

Streetmate Colors
The Silver colors have no RAL color codes defined by Tomos, there are however, Tomos color numbers:

Tomos Streetmate Silver: 070
Tomos Revival TS Red: 064

There have some minor color differences with the Tomos Streetmates, most probably depending on in what factory they were built. The default color is Silver metallic, while the differing color is more dull and gray.

A52 versus A55
There is no real engine difference between the A52 and A55. The early A55’s were just named A52 because of their production year (~2003-2005) and very minor differences, including ‘flaws’. Also, the cylinder isn’t noticably different than the earlier models.

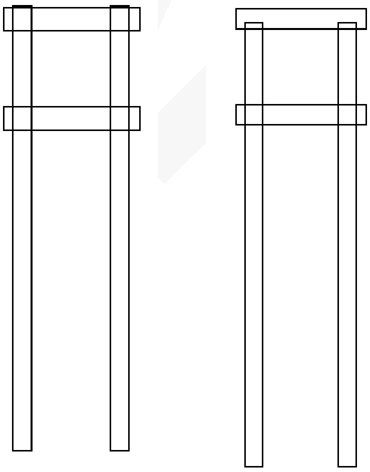
But, the very early A52 models had larger modifications, like a A35 cylinder, SHA carburetor. Also the intake manifold and the exhaust was still for a A35 engine.

Streetmate Visual Modifications (How-to)

Some people find the Streetmate moped to be too small in length and height, but with some modifications, you could visually enhance your moped in this aspect. By lifting it up, stretching it out, and more. Be aware of these are quite small modifications, and inherit no extreme difficult actions. First of all, we begin by modifying the front fork and rear shock absorbers;

Since it is quite difficult to replace the whole front fork with a longer one, and since there are no stock Tomos front forks which are longer, we decide to push the existing forks out of the upper Triple Tree and lower it to about 1-2 centimeters. This might seem to be a small change, but the overall result could be worth it;

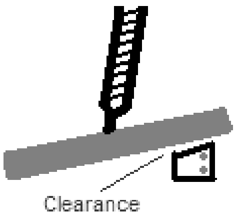
Standard: Lowered 1-2 cm



There should be no worry about stability or anything as long as the forks are strictly tightened. This mod will give you a 1-2 cm increase on the front of the moped.

As we progress, we would also want to lift the back of the vehicle to increase the overall height.

We can lift up the back of the moped by using replacement shock absorbers with a maximum length of roughly 335mm. Above this length, the swing arm would most probably hit the mounting part of the exhaust. If a longer shock absorber is really demanded, a solution would be to file off a part of the mounting side.



To give the moped a big look, in proportion with the driver, is to replace the handlebar with a higher one. The most obvious candidate would be a Tomos Revival handlebar, which is actually a higher duplicate of the Streetmate handlebar. Also, the cables are just long enough to prevent troubles.

Another thing that will make the moped look longer in length is to pull the rear tire back as far as possible, and if necessary lengthen the chain. Also, a larger rear tooth sprocket shows off.

At last, but not least, is to install two mirrors that will extend the handlebar to a whole.

Remaining modifications

To give the front of the vehicle a better look, we could relocate the horns on the vehicle to be placed directly at the sides of the headlight. This also looks way better. (Left; old situation, Right; new situation)

Replace Piston / Piston rings (How-to)

This is a how-to on how to replace the piston and / or piston rings in a A55 engine in a responsible, but fast way. This procedure isn't very difficult, but requires some precaution and patience. The most important rule is never to force anything in any stage of the process, meaning; if something does not fit, there is most likely something wrong.

Especially, check for the right type of piston rings. The piston itself might also be damaged, and having trouble fitting into the cylinder. Also, when removing the cylinder, make sure to cover the crankcase to prevent dirt or sand to fall into the casing, this could permanently damage the cylinder. In addition, the piston and cylinder wall must be clear of any sand pieces and must be lubricated before reinstalling the parts.

Replacing Piston Rings

1. Remove the carburetor, spark plug cable, and exhaust from the cylinder, so the cylinder head and cylinder itself can be easily pulled from the stud bolts.
2. Unscrew the four nuts on the stud bolts so we can remove the cylinder head and cylinder of the stud bolts. Under normal conditions, the intake manifold would gently scratch the mopeds frame and removing the cylinder is not much of a problem. If any troubles occur or there is not enough room for the cylinder to be taken off, remove the three bolts holding the engine to the chassis. This way, the engine can be moved anyhow.
3. When the cylinder has been taken off, you can gently remove the piston rings and replace them with new ones. Be aware to use exactly the same type piston rings or else the piston would never fit into the cylinder.

Replacing the Piston

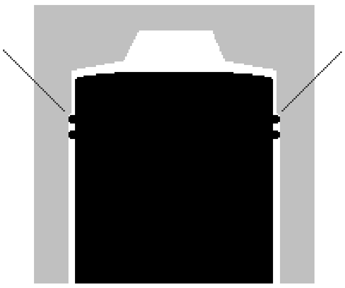
4. If replacing the piston, remove the two circlips on each side of the piston, and gently push the piston pen out of the piston. Replace the piston in reverse order.
5. If the new piston is placed, be sure that the circlips are correctly positioned. Now remount all parts and use new gaskets to prevent air leakage. Lubricate every neccesary part and use the kick-starter for one minute before actually running the engine.

Break-in period

New parts should first break-in for the piston rings to seal to the cylinder's wall properly. Before begin driving with the new internal parts, we should first warm up the cylinder for some minutes. As soon as the temperature rises to normal working conditions, begin with opening the throttle nice and slowly. The hard and good finished cylinder wall doesn't require a long-extent break-in period, but the main rule is not to open the throttle for an extended amount of time. Quick steps on how to break-in, for replaced piston rings:

1. Let the cylinder run hot for 5 to 10 minutes. After that, open up the throttle handle nice and slowly and ride with the vehicle like this for about one kilometer.
2. In the first five kilometers, drive the bike gently without sustaining to much speed. Slowly progress the speed to higher revolution and from time to time fully open the throttle in bursts of 10 seconds.
3. After 15 kilometers, open up the throttle wider and wider and drive at full speed for a longer period of time.
4. After 40 kilometers, you should not have to worry about speed limits anymore.

This procedure also applies to a replaced piston, but double the interval of each step. People might think that running on 1/4th gas should help the break-in period, but since the Nicasil cylinder wall is so hard, there is actually no need to worry about the cylinder itself. The piston and piston rings should adapt more the cylinder wall. We also want to achieve the piston rings to seal perfectly onto the cylinder wall as well, the best way to do this is to 'not to be' so gently with breaking-in the cylinder / piston (rings)



Previously, with cast iron cylinders, the cylinder was much more sensitive to the break-in period. Because of the cylinder wall that would wear at a higher rate with the break-in period. When breaking in for a long period of time with only half throttle, the piston could hit the created break-in edge when the engine is suddenly exposed to higher revolutions and temperatures caused by expansion and retraction.

Cut Clutch Springs (Transmission Tuning how-to)

The 1st and 2nd transmission clutches engage at certain rounds per minute (rpm) to optimally transfer the power to the secondary gears, this is called a Centrifugal Clutch. Normally, the 1st transmission clutch will engage at a rate of (a rough approximate) 1700rpm, and slowly progressing to higher rpm. As soon as the crankshaft and clutches reaches high enough rpm, the second clutch engages to the transmission housing, shifting over the the 2nd transmission.

The clutches are being held together by two springs at each clutch until a certain centrifugal force has been reached. The strength of those clutch springs are thus important for the clutches to engage at a specific rotational force.


There is a way to adjust the clutches to engage at a different rate of crankshaft revolutions. To cut away about one / two centimeters of a spring, the spring strength is increasing, which automatically means that the spring at the specific clutch will engage at a higher rpm. Now, for the 1st transmission spring, it means:

At Idle, the engine will engage the first transmission at a higher rpm, meaning the moped will accelerate at a faster rate. Also, there is more room for the driver to do short bursts of gasing before the clutch engages. The disadvantage about this is, that the clutch shoes's (cork) wear will increase.

For the second transmission spring, it means that the 1st gear will run longer before shifting into the second transmission.

I will not fully get into this section because it takes some man-power to do the job, and it could be quite difficult as well. The only thing that needs to be done is to remove the right engine cover, remove the whole clutch housing and separate both clutches. At this point, the springs can be removed and shortened.

More lubrication

Another way of affecting the transmission clutches without cutting the springs, is to use a certain amount of lubrication. The normal amount of oil that should be added to the engine is a rough estimate of ~225ml. Changing this value will affect the following:

More lubrication means less friction and more clutch slipping, but possibly smoother engine running and a small difference on when the clutches engage.

Less lubrication means more friction on the clutch housing and shoes, the result will be reversed.

Maintenance Schedule

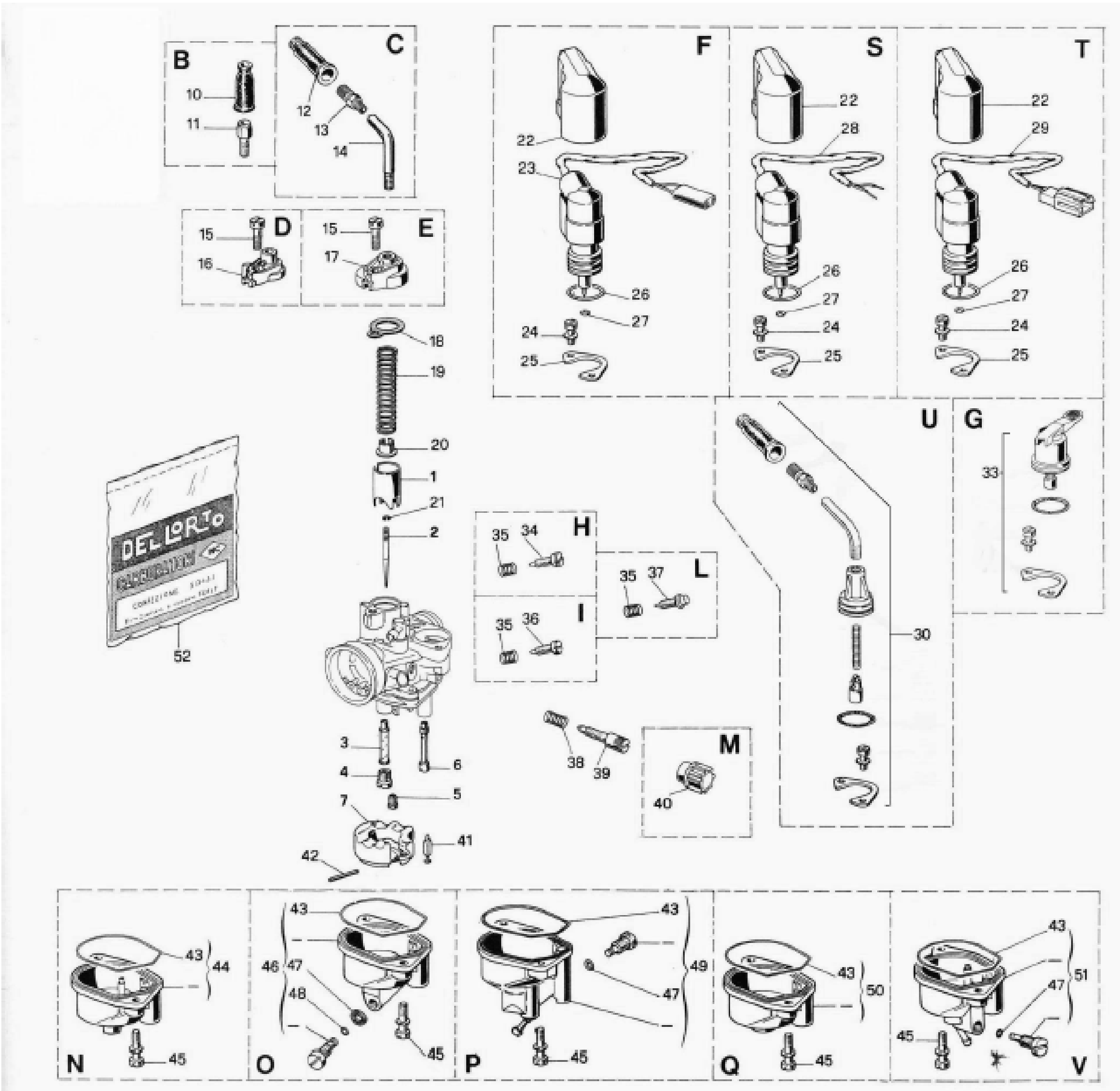
Maintaining the moped is always positively affecting wearing of the (internal) parts and prevents unexpected high costs of possible replacement of worn out parts. You could comply with the default Tomos maintenance schedule, or you could use this schedule from practical experiences;

Intervals (Every)	500km	1000km	2000km	4000km	6000KM	10000km
Oil Pump	C					
Oil Tubes			C			R
Possible leakage	C					
Chain (Oil and Tighten) / Sprockets	C	M			R	
Clean / Protect Chrome parts	M					
Tire pressure			C+M			R
Clean and lubricate Air filter (pad)			C+M			
Transmission Oil			R			
Brakes (pads)				C+M	R	
Spark Plug (Color)	C+M		R			
Front Sprocket Seal Ring			C		R	
Cylinder head (Internal)				M		
Piston				C+M		R
Piston Rings				C	R	
Crankcase Right and Left Seal Rings					R	
Tires					C	R
(Crankcase) Engine Bearings					C	R
Exhaust				C+M		R?

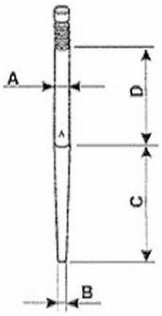
C = Check
M = Maintain
R = Replace

When checked, replace if necessary. Always check the spark plugs condition and color with every maintenance check. This is an indication of how the moped's internal engine conditions are.

Dell'Orto PHVA Parts Diagram



Dell'Orto Needle Specifications for PHVA / PHBN Carburetors



Thanks to http://www.thisoldtractor.com/gtbender for this information.

Type	Value X	Characteristic expressed in millimeters			
		ØA	ØB	C	D
A02	02	2	0.6	20	12
A07	07	2	1	18	14
A08	08	2	1	20	12
A10	10	2.02	0.6	18	14
A11	11	2.02	0.6	20	12
A12	12	2	1.79	20	12
A13	13	2	1.79	22	10
A14	14	2.07	1	18	14
A15	15	1.98	1.77	20	12
A18	18	2.04	0.61	21.9	10.07
A19	19	1.93	1.77	20.3	11.7
A20	20	2	1.6	20	12
A21	21	1.99	1.79	18.1	13.8
A23	23	1.98	1	18	14
A24	24	1.99	1	20	12
A25	25	2.02	1.4	20	12
A26	26	2	1.9	20	12
A27	27	1.98	1.8	20	12
A28	28	1.99	1.8	20	12
A29	29	2.02	1.2	20	12
A30	30	1.99	1.40	20	12
A31	31	1.98	1.40	20	12
A32	32	1.98	1.70	20	12
A33	33	2	1	21	11