Customer: Please make sure to review all installation procedures to ensure best possible performance of your new Nickies cylinders. If you have any questions about these procedure or warranty, please feel free to contact LN Engineering directly at 815-472-2939 or via email at info@LNengineering.com.

Warranty Disclaimer

Due to the nature of performance applications, all products sold by LN Engineering LLC are sold without any expressed warranty of merchantability or fitness for a particular purpose. LN Engineering shall not under any circumstances, be liable for any special, incidental or consequential damages, including but not limited to, damages for loss of property or equipment, loss profits or revenue, cost of purchased which may arise and/or result from the sale, installation or use of these parts. LN Engineering reserves the right to make product improvements or changes without notice and without incurring liability with respect to similar products previously manufactured. **Any modifications or changes including, but not limited to o-ring grooving, shortening, decking, honing, re-machining or clearancing of cylinders can be made at the sole risk of the user and voids all warranties and claims thereof. Any modifications requested by the customer to the aforementioned product are made to customer specifications/instructions, sold as is, and non-refundable.** Limited lifetime warranty on cylinder plating is provided by Millennium Technologies, LLC and all warranty repairs must be accompanied by an RGA authorized by the aforementioned MT, LLC. Re-honing of cylinders after normal wear and tear is not covered under the lifetime warranty. The products sold by LN Engineering are designed primarily for off highway use. Check State and Federal laws and emission regulations. Not legal for sale or use on pollution controlled vehicles.

If your cylinders need to be shorter, please contact LN Engineering for further assistance. Any modifications to the cylinders are at customer's own risk and void your warranty if cylinders are modified in any way, shape, or form. For warranty/non-warranty service, return your Nickies to LN Engineering or Millennium Technologies. Millennium Technologies must authorize warranty repairs. Any incurred shipping or modification costs are the responsibility of the customer.

Returns

All returns must be accompanied by an RMA number and is subject to a minimum 25% restocking fee unless otherwise specified. Purchases of custom cylinders and/or pistons are non-refundable. Modified cylinders and/or pistons are non-returnable. Deposits on custom cylinders and/or pistons are non-refundable once your order has been placed.

Cylinder Installation

We recommend lapping the cylinder into the cylinder head prior to cleaning and assembly.

Scrub cylinder walls and mating surfaces with hot water and soap then **clean thoroughly with denatured alcohol** or similar solvent until wipes come out clean. **Using Chem-wipes** is recommended for this, as they will show even the slightest discoloration from the residual Nikasil/honing oil mix left on the bores. We recommend a light coat of non-synthetic oil motor on the cylinder walls for initial installation- a 50/50 mix of SAE 30 oil and STP (red bottle) or GM EOS can be used for this. **Do not install the rings and cylinders dry!**

We also recommend using sealant such as **Curil T on cylinder bases or base gaskets** regardless of application to ensure a leak free installation, even with cylinders that are o-ringed. **Make sure head studs do not bind anywhere on your cylinders!**

Case cylinder spigots and/or cylinder shims will require chamfering to prevent binding and/or catching of the radius on the skirt of the cylinder to the case. **Verify base shims or cylinder is seating properly flat on the case and not binding on the radius between the cylinder skirt and base and deck height is even between cylinders.**

Additionally, base shims must be checked to ensure they do not bind on this radius and that sufficient clearance is supplied so that base shims do not bind when the cylinder is hot, when using steel base shims because the cylinder expands faster than the shim. You can check for this condition by putting the shim on the cylinder and putting the cylinder in the oven. Make sure the shim still can move on the cylinder base when hot. Additionally, care must be taken to ensure base shims are flat, as shim stock has the tendency to vary in thickness, which can lead to head leaks or oil leaks at the case if the cylinders do not sit and seal squarely on the case and heads.

Cylinders should be inspected at room temperature using instruments capable of accurately measuring in .0001" increments with adequate resolution and repeatability. Cylinders should not be measured in a torque plate and should be measured at 65-72F free-standing. For any given bore, we allow +.0005" -0" for all dimensions. Head to deck lengths of cylinders should be matched to within .001" (+/- .0005") or .025mm, which is the Porsche specification for height groupings. Taper should be less than .001" from top to bottom and ovality should be less than .0005" total. Cylinders with extremely thin skirts may have additional ovality near the bottom of the cylinders, but this is normal and will not affect operation. Any blemishes in the nikasil plated must be identified and reported prior to operation so that we can correct them under warranty.

At no time should total piston to clearance be less than .001" (.0012" for turbo) unless piston skirts have been coated with a break-in coating (or unless otherwise specified). Recommended piston to cylinder clearance specified by Porsche for normally aspirated engines is .001-.0015" (.025-.042mm). Do not exceed .002" total piston cylinder clearance. We may provide pistons with additional clearance if the pistons are going to have their skirts coated as typically these coatings will reduce the clearance or make the clearance negative. Used pistons are not recommended unless their skirts have been coated and the cylinders have been match honed to each piston. Pistons should not have any offset, as using pistons with an offset with the very tight piston to cylinder clearances can cause premature piston and or cylinder wear and can affect ring seal.

We recommend .040-.060" deck height and min. clearance .100" deep and .050" radially valve to piston. Cylinder shims can be used to correct deck height. Make sure you measure the shims to ensure they are a matched set. Shims must be checked to ensure they are of equal thickness and have been deburred and are not tight on cylinder skirts.

Ring Installation

The top ring should have a slightly tighter gap than the second ring; >= .015" for the oil ring rail gaps is recommended. Oversize rings may be required to get file to fit. When in doubt, please refer to Porsche specifications for ring gap and installation. Depending on the application and ring composition, a ring gap of .0031"-.0034" per inch of bore may be optimal. A minimum of .002" per inch of bore and a maximum of .0042" per inch of bore ring end gap is recommended for top and second rings, measured at room temperature, unless otherwise specified. When running rings tigher than the recommended .0031"-.0034" per inch of bore ring end gap, we recommend putting your Nickies cylinder in the freezer <32F and fitting the rings into a cold cylinder (as cold as you can get it) to verify that you have positive end gap clearance (minimum of .001-.002" below freezing with a feeler or go-no go gauge) since some ring materials cause rings to vary in gap greatly from cold to room temperature and again to operating temperature. Typically, rings can be run tighter than typically gapped with cast iron cylinders due to the expansion of your Nickies cylinder, but care must be taken to verify zero clearance is not reached at any operating temperatures (cold start up temperatures) and may require both hot and cold ring gap measurement to ensure that ring end gaps do not but up at any operating temperatures. **Do not treat aluminum cylinders like cast iron cylinders when gapping your rings!**

Do not use any ring break in lube specifically unless otherwise instructed. Do not use assembly lube on rings, pistons, or cylinder bore. We recommend a light coat of oil on the cylinder walls for initial installation- a 50/50 mix of SAE 30 oil and STP (red bottle) or GM EOS can be used for this. **Do not install pistons, rings, pins, or cylinders dry.**

We also recommended reviewing piston manufacturer supplied ring installation guidelines for additional pertinent installation information. We do not recommend using piston rings other than those supplied or recommended by LN Engineering. **We do not recommend the use of total seal or similar gapless rings with Nickies**. **Low tension rings are recommended**. In most cases, ultra low tension Goetze style rings or low tension conventional rings (less than <12 Lbs tension) are appropriate for most applications (low tension chrome rings and oil control rails can be used in certain instances only). Use of standard or high tension (chrome or non-chrome) rings will result in high ring/cylinder wear and will void warranty. If you did not purchase pistons or rings from LN Engineering, it is up to the end user to make the determination that the rings being used are appropriate.

Break in addtn'l comments

For complete information on proper engine break in technique and recommended oils for your engine, please visit http://www.LNengineering.com/oil.html before running your engine the first time.

Do not use synthetic oil for break-in! Use a SAE 30 or appropriate weight non-synthetic motor oil. We recommend GM EOS assembly lube on all critical engine components and in the crankcase fill at time of break-in. We recommend Brad Penn Racing SAE 30 Break-in oil until the engine is broken in, or at least the first 100 to 200 miles of operation.

Prime the engine for oil pressure before starting; do not pre-fill the oil filter and it is also recommended to put a bit of petroleum jelly in the oil pump gears- this helps pre-lube the oiling system. You want oil pressure as quickly as possible. When possible, use a dyno to break in the engine, as best results are achieved this way. Run the engine between 2500-4000 rpm for at least 15 minutes. Shut down and let cool. Excessively rich fuel mixes will wash oil off the cylinders leading to premature ring failure, scuffing of the bores, and high oil consumption. Change oil, filter, and adjust valves. Continue to use Brad Penn Racing SAE 30 Break-in oil and/or GM EOS. Repeat again at 100 and 500 miles. Constantly vary engine load during break-in. Do not hold any given speed or rpm for an extended interval. Applying loads to the engine for short periods of time causes increased ring pressure against cylinder walls and helps to seat the rings. Run the engine hard (avoid excessive rpm or lugging of the motor), do not baby it! The use of engine breaking if breaking in the engine in the car on the road will help the rings seat better and faster. We do not recommend using synthetic until after a minimum of 1000 miles or preferably, not until after 3-5000 miles. If cylinders are damaged due to improper break-in or cam/lifter failure, over-lean, over-boost, over-rich, improper installation and/or failure of rings, improper assembly or prep, any repairs and/or replacement of product is at customer's expense. Proper oil and air filtration is required as wear due to lack of proper filtration also is not warranted.

Head studs & Thru-bolts

We recommend ARP products exclusively with our Nickies cylinders. We recommend on all four cylinder applications to torque the ARP head studs to **24 ft/lbs** (do not exceed 28 ft/lbs) with ARP moly lube when used with aluminum cylinders. Be sure to use a calibrated torque wrench. Over-torqued cylinders may fail to have proper ring and head seal. Torque thru-bolts to factory specs with ARP lube. For the Porsche 356, Raceware or Porsche 993TT Dilivar head studs are also compatible with Nickies. Raceware studs can also be used with the VW Type 1 or Type 4. For Porsche 911, 930, and 993 ARP head studs please follow the instructions as provided by ARP with their head stud kit or the factory specification in lieu of the ARP spec. We recommend your cylinder heads should be re-torqued after the break-in procedure, once everything has had a chance to heat-cycle and settle in. Not doing this step or at least checking the heads may result in head leaks or oil leaks. Prior to installing the head studs, recommend running the appropriate thread chase or an oil stud with solvent to clean up any damaged or blocked threads. Do not bottom out head studs, but rather bottom them out and turn out ¼ turn, so that they are not pre-loaded against the bottom of the tapped hole. Use blue loctite on the ends going into the case if desired. Torque heads using factory specified pattern or sequence to the torque specifications provided. Re-torque heads if necessary after break-in using the factory specified torquing sequence. To inspect used head studs for re-use, measure overall lengths- all head studs should be the same length; if out of spec, we recommend replacing all head studs as a matched set. Same goes with case thru-bolts, however rarely do they need replacing. Case savers are required for all

magnesium cases and recommended for all vw type 1 cases regardless of material. If case savers/timeserts are used, studs should be test fit and pitch and diameter should be verified prior to installation in case; spigot registers in case should be machined after timeserts/case savers are changed or installed. If head studs are too long, we recommend shortening them by hand to size as required to remove excess threads. Alternatively,

Pistons

We do not recommend the use of 4032 forging alloys with Nickies cylinders except in bore sizes over 4" inches. Please read and follow the instructions provided by JE Pistons or the appropriate piston manufacturer for your pistons. Custom pistons are designed based on average head cc's, case height, and a .040"-.060" deck height; specified compression ratio may or may not be an exact representation of the actual compression ratio. Shims may or may not be required to set actual deck height and or compression ratio. We recommend .040-.060" deck height and min. clearance .100" deep and .050" radially valve to piston. Optimal connecting rod to piston clearance is .050" min. Pistons should be clayed during the assembly process to ensure that proper piston to valve clearance is maintained. Any modification of the pistons and/or cylinder heads is part of the normal engine rebuilding process and is the responsibility of the user; minimum .250" crown thickness should be maintained at all times per JE's recommendations for street use. If the piston needs to be machined thinner, please contact JE to ensure the strength of the piston is not compromised. Pistons should always be balanced. We do not recommend the use of any cast pistons in Nickies cylinders. It is up to the user to determine fuel and ignition requirements for any given application when considering any given compression ratio. We recommend that JE pistons should be cryogenically treated and coated to ensure the longest service life possible. If you coat your pistons, it is your responsibility to ensure a minimum .001" total piston to cylinder clearance is maintained to prevent your piston from seizing, unless otherwise specified. Wrist pin locks should not be reused and wrist pin buttons (aluminum, Teflon, etc.) should not be used.

R&R Pro Connecting Rods

Please refer to the instructions provided with your connecting rods. **Bolts should be installed using stretch method**. Entire rotating assembly must be dynamically balanced. Engine blueprinting is required to verify proper operating clearances. Any modifications and/or clearancing are the responsibility of the engine assembler and/or end user and may require re-balancing of engine components. Rods previously used or with unknown history should be inspected and rebuilt if necessary along with new connecting rod bolts. Please refer to factory specifications for rod side clearance for steel rods; Porsche 356 is .004-.012", 77 and earlier 911s are .0078-.0157", and 78 and later 911s are .0078-.0137" side clearances with a steel rod. Aluminum and Titanium rods may require more side clearances. R&R Pro Connecting rods have already been cryogenically treated and further cryo treating is not recommended.

Base shims

Base shims may be required to properly set your deck height and/or valve to piston clearance. When using base shims, we recommend using the minimum number of shims to make your correction. We can, for a nominal fee, make custom base shims out of copper, aluminum, or steel. It is imperative that a non-curing sealant be used between the cylinder and case and on any shims used, such as Curil T. You may need to by hand chamfer the I.D. of a base shim or case cylinder spigot such that the radius on the base of the cylinder does not interfere with clamping and mating the sealing surfaces. **Base shims must be checked to ensure they do not bind on this radius and that sufficient clearance is supplied so that base shims do not bind when the cylinder is hot, when using steel base shims because the cylinder expands faster than the shim**. You can check for this condition by putting the shim on the cylinder and putting the cylinder in the oven. Make sure the shim still can move on the cylinder base when hot. Additionally, care must be taken to ensure base shims are flat, as shim stock has the tendency to vary in thickness, which can lead to head leaks or oil leaks at the case if the cylinders do not sit and seal squarely on the case and heads. Some cylinders come already set up with a slight undercut to prevent binding (additional fee may apply). If you find your cylinders bind on the shims when hot, we can either modify your shims or your cylinders for a small fee. Additionally, you should check to make sure you have an even deck height by checking to make sure all shims are of equal thickness.

If using Nickies Version 2.0 cylinders for the Porsche 914, special base shims are required to properly support cylinder bases and ensure the clamping load is properly distributed. Use of any shim other than the LN Engineering supplied shims is not recommended and voids any warranty. LN Engineering also offers the correct shims for the Porsche 356 88 and 90mm big bore kits in various sizes and normally has these in stock for rapid delivery.

Coatings

If pistons are ordered coated, we will coat piston crowns, ring lands, and/or skirts. Although we can specify minimum thicknesses on the skirts of approximately .001", because of the very tight clearances we run on Nickies, it may be required to hone the cylinders to fit the pistons with the proper clearance. If you are concerned with the total clearance being too small, please contact us and we can have the cylinders properly honed for a small fee. If you hone them yourself or have anyone other than Millennium Technologies hone them, your warranty will be null and void. As far as coatings on the crowns are concerned, we are not responsible for re-coating pistons that need to be cut for addition valve relief or for any other modifications. We are also not responsible for your cylinders if anyone other than ourselves or Millennium Technologies hones them. We also are not responsible for pistons not fitting after being coated if we did not sell you the pistons and piston coatings together.

Cylinder Head Gaskets/Flame Rings

In most cases, Nickies cylinders should be run with an aluminum-to-aluminum sealing surface, with cylinders lapped to the cylinder head for optimal performance. A mix of ajax or comet and water or very fine clover compound can be used to **lap the cylinders to the heads**. Make sure to thoroughly clean the cylinders and heads thoroughly after this has been done. Copper head gaskets are not recommended on four cylinder applications. Nickies are not provided with any provision for head gaskets, flame rings, or o-rings; it is the responsibility of the user to make a determination on what if any of these are used. Unless sealing surfaces are supplied surface ground (additional fee may apply), some of LN Engineering's Nickies cylinders have a .0015-.003" taper across the sealing surface per Porsche's spec for the 3.2 Carrera's for optimal sealing without the need for additional physical intermediary seals. O-rings on cylinder bases are not required; we recommend the use of a non-curing sealant such as **Curil T on cylinder bases** and a light misting of **Copper Spray-A-Gasket (Permatex # 80696) on the heads** where the cylinders seal, after cylinders and heads have been lapped together and cleaned for final assembly.

Documenting your Build

We recommend recording your ring gaps, piston number (located on bottom of wrist pin boss on JE Pistons), and cylinder serial number. In the future this will help us answer any questions about your pistons and cylinders and will in the case of a rebuild in the future, allow you to measure ring wear and re-usability, and provide faster service to you. This should be done in the normal process of blueprinting your engine.

Reconditioning your Nickies

In the unlikely event that your Nickies need to be reconditioned, we recommend that your pistons and cylinders are returned to us for proper re-honing and that any used pistons have their skirts coated (or re-coated) to fill in any piston wear or scuffing. At this time, new rings must also be fit for the best longevity of your rebuild. Re-honing is not considered warranty repair, but if your cylinders are found to have an unacceptable level of scuffing or wear upon inspection, either re-honing or re-plating will be provided at no cost to you upon our inspection and issuance of an RGA by Millennium Technologies.

REV. 03/17/2008