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Ford 2300 OHC engine 1974 to 1997
Identified by 4 cam towers (under the cam cover). Made in Lima Ohio, and Brazil. The earlier Pinto 2000 engine 1971-74 (made in Germany) has 3 cam towers, and is not covered in this information sheet.
Pinto 1974-80, Mustang ll 74 -78 both above engines are front sump oil pan. Drilled dipstick hole in block must match oil pan sump location.
All later engines are rear sump with corresponding dipstick hole location drilled towards the rear of the block: Mustang lll 1979-98 and Capri lll (fox body), Thunderbird/Cougar 1983-88 (turbocharged)., and the Ranger truck.

Ranger truck also came as 2000 cc. (same block/crank, but block is cast with smaller bore. This block cannot be bored to 2300 cc and is only used as a 2000 cc., but all other 2300 components are generally the same as on the 2000 cc block.
Ranger truck also came as a 2500 cc: It uses a unique '92-on style block (with small main journals), and a stroker crank.
This 2500 cc version of the 2300 block used 5.457" length rods and different compression height hyperutectic pistons. It has an unusual oil pump setup different than earlier 2300's.
Also, Capri 2, and Merkur (both German made cars using the USA built 2300). Both of these cars use a Bosch starter and have a unique flywheel ring gear that only takes the Bosch starter rather than the Ford USA starter).

Blocks
'Turbo' blocks, cranks and rods are not any better quality or different metal content. All engine blocks are basically the same except:

A) Front or rear sump oil pan ...dipstick location ((above)

B) Pre '85 blocks have a 2 piece rear main oil seal, '85 and later have a one piece rear main oil seal at the crankshaft. The one-piece seal is also the same size seal as is used on the later model 302 V8's. Earlier crankshafts that are used with the 2 piece rear seal will not fit in the'85 and later blocks unless the oil slinger on the crankshaft is machined off. This is common procedure in most crankshafts grinding shops.

C) Most '92 and later 2300 blocks including the stroker 2500 cc version use a smaller diameter crank main journal size.

Bare block large main block measures 2.58" at the main bearing inner diameter with no bearing fitted. The later small main bearing block measures 2.39".

D) Turbo blocks '83 and later (not the '79-80 Mustang turbo blocks) has an oil drainback hole cast into the exhaust (passenger) side of the block, just
drainback.
E) Fuel injected engines , 1987 and later do not have an opening for the mechanical fuel pump near the distributor. The auxiliary shaft that comes in the '87 and later fuel injected cars does not have the cam eccentric cast on the shaft to drive the mechanical fuel pump. To use a mechanical fuel pump on a '87 or later block the earlier shaft must be used and the opening on the side of the block must be drilled out.

Cylinder heads/ intake manifolds: over 13 different cylinder heads have been made for the 2300 to date. Basically they all interchange. There are 4 main categories:
(1) the oval port (intake portholes are oval), generally made before 1981.
(2) D port (intake port holes are oval on top and squared off on the bottom) 1981 and late
(3) Round port (intake holes are round) as used on most Ranger truck engines,
(4) The twin plug Ranger truck head that has 8 spark plugs (2 per cylinder) which is not often used for racing.
Oval port and D port heads perform about the same. The intake manifold should match the cylinder head, so the fuel flows smoothly from the crab through the manifold and into the intake hole in the cylinder head. An oval port manifold will not match up very well to a D port head.
Since most mini stock rules require a stock 2 bbl crab or a Holley 350 or 500 2 bbl. carb the manifold choice is sometimes difficult to find.**Oval port heads** (and oval port intake manifolds) came on all Pinto and Mustang 2's We sell adapters to mount any of the 3 carb choices to these manifolds.
D port heads came with a 2 bbl on 1981 and 1982 Mustang 3's, then they went to a 1 bbl carb for a few years and then to EFI (electronic fuel injection) in 1987. So the D port 2 bbl carb intake manifold (1981-82) is desirable as a salvage yard item and can be hard to find.
The **EFI (electronic fuel injection) manifold** comes on later years. We also make an adapter to put a 2 bbl carb on the base of an EFI manifold that bolts to the D port head. A very popular setup, and the best intake manifold/2 bbl setup.

Pistons:
Three types available: Cast (stock), hyperutectic (good quality cast), and forged(best quality race). They all run different piston to wall clearance (the difference between the piston diameter and the cylinder hole diameter measured about ½" below the wrist pin on the piston side skirt).
Stock cast pistons run .001", Hyperutectic race pistons run .002"-.0025" and forged pistons run .004"-.005". This is because the pistons have different expansion rates when they heat up after the first few minutes of running. The engine shop should have the piston in hand when they bore the block so they can bore to the clearance required. They measure this clearance with micrometers. The nickel budget guy can shove a flat feeler gauge up between the piston skirt and the bore to get an approximation of piston to wall clearance.
Cast pistons are fairly hopeless in a 2300 race engine. Hyperutectic (we sell KB) have done well in race engines, and are the best choice for a street rebuild. but if they do crack, they shatter and take the block with them. A forged piston is a much different type of grain structure and is more forgiving if the engine has a problem. They will melt down, but not shatter, so the connecting rod stays in place....and hopefully you can get that .030" over block cleaned up at .040 and try again!
We sell Wiseco forged pistons. They or JE brand seem to have the best reputation. Some forged piston brands seem to need much more clearance (up to .008" piston to wall, as they expand that much), so that is why we sell Wiseco...we assume it has to do with the mix of the aluminum in the forging.

The **piston rings** that we sell with the .030 and .040 over race pistons are 'oversized' so you have to file fit the ends of the rings to fit the bore of the block. To do this you take the piston ring and push it into the finished / bored engine block (about 2" down into the bore) and push it down with a plain upside down piston (so it is nice and square in the bore) Then you stick a flat feeler gauge, vertically, into the space between the ends of the rings. It should be about .012-.017" and you will have to hand file (with a good fine file) the piston ring end (either end!) to get the clearance required. KB pistons are an exception, and run a larger top ring end gap of .030" This is a time consuming task, but very important. If there is not a big enough end gap the ring ends will butt and cause a meltdown in the piston. Better to have too much piston ring end gap than not enough! Too much, you just lose very little power. Up to .025" won't hurt anything.
Piston rings come in different widths. And the ring width must match the piston. Most racing pistons have 'thin' 1/16" rings and are not interchangeable with pistons that are made for stock 'wider' rings. Even the stock rings used different widths over the years so have a knowledgeable person check this out for you if there is a question.

When assembling and engine you need a piston ring compressor to get the piston with the rings on (and the connecting rod) into the bore. If you have never done this, get someone with experience to help and watch them. It is too difficult to explain the details, and easy to screw it up. A piston ring compressor such as our part # 1780 makes it much easier than a universal type ring compressor.

Rods:
All 2300 rods are the same. Some think the turbo engine has better rods, but it does not. All stock rods are 'press fit' wrist pin type, which means the rod small end is heated (with a propane type torch, or rod heating machine) and the piston pin and piston are quickly assembled before the rod cools, locking the rod onto the wrist pin. This setup makes the engine difficult to service during the race season, but is fine for a low maintenance engine. All stock Ford engines are press fit rod engines.
Most race engine connecting rods have 'floating' wrist pins where the rod turns in both the connecting rod and the piston. The connecting rod must be machined for a bronze bushing in the small end of the rod so the wrist pin can turn freely. This set up uses wrist pin 'circlips' that keep the pin located in the rod/piston. You *don't* use circlips with a pressed on setup and you *must* use circlips with a floating pin setup. We use spiroloc type circlips. They are a pain to put in, but very reliable. Use a very small screwdriver with a notched blade to get the spiroloc started.

The floating pin setup allows you to easily remove the piston from the rod to replace either a piston or rod if needed. Stock rod bolts are adequate, and usually fail due to repeated torqueing (tightening to specs) during rebuilds. If a rod bolt is accidentally 'overtorqued', or tightened more than the torque specs call for..it will fail for sure. So you need a good torque wrench to tighten the rod bolts and if you think you screwed it up, get another new rod bolt! Rod bolts should have 30 weight oil on the bolt threads when torqueing We sell a stronger rod bolt that is a direct replacement for the 2300.
We sell a variety of rod choices listed in our catalog by length and strength. The stock 2300 rod is quite adequate. The Chevy 6 cylinder 5.7"rod should be held below 7200 rpm for reliability. The Crower Sportsman rod is a best choice for weight and reliability and the choice of our shop for all of our race engines. The Ferrea rod is a bit heavier, and very strong for turbocharged high HP use.

Flywheel bolts do have a history of failure and should be replaced with ARP or equivalent higher rated bolts.
Crankshafts that came from an automatic trans engine do not have a pilot bearing. One must be fitted when used with a manual transmission to accept the imput shaft from the trans. All 2300 pilot bearings are the same size over the years.
Flywheels vary over the 25 years of this engines life. Some are heavier and 'thicker' (1987 and later with the T5 trans) so attention should be given to the proper throwout bearing to be sure that the clutch release arm has adequate travel for the flywheel/clutch/trans combination. T5 transmissions have a deeper bellhousing to accommodate the thicker flywheel of those later years. We offer 3 different length throwout bearings to help with mismatches.
Lighter flywheels are critical to oval track performance, and are a most important performance addition. The lighter the better for quicker acceleration.

Getting started:
Buy or borrow an engine stand. best $50-$60 spent to assemble an engine.

The block and cylinder head should be stripped and sent to and engine shop to get hot tanked and bored. This is an acid bath to get all the crud out of those passages in the block and the boring is to fit new, larger pistons in the bores

Boring / cylinder size:
Most any engine will need to be bored and fitted with new pistons. Stock pistons in a 2300 are cast type pistons and as the piston to bore clearance gets larger as the engine wears, they often crack the side of the piston. The piston rocks in the bore, and at high rpms (over 4500) the piston 'skirt' (side) cracks.
2300's are often bored + .030", .040" or .060". the engine shop will measure (or look at) the block and tell you if it will 'clean up' by boring An engine that will clean up at .030" or .040" overbore is best, as there are more choices for good piston rings in these 2 sizes. A .060" overbore engine is not desirable. The walls are getting too thin and this is a last resort situation. If you start with a .030" over engine at least you might be able to reuse it as an .040" engine in the future.

If you are on a nickel budget you can pull the pistons and just run a cylinder hone down the bore and replace them , hopefully with new piston rings. Least expensive cast type piston rings will seat faster than chrome rings.
When assembling the block and head a good clean well lighted shop is essential. The block and crankshaft must have a tap run through the head bolt, main bearing, and crank/flywheel bolt holes. These 3 locations are critical for proper torque, so the holes must be clean and free of any foreign matter for the proper torque settings. Three tap sizes that will cover most 2300 engine bolts are 6mm x 1mm (oil pan, cam cover), 8mmx1.25mm (flywheel bolts), 12mm x 1.75mm (head bolts, main bearing bolts).

The 2300 does not have an oiling or head gasket problem. It should be a very reliable engine if assembled and set properly. Stock main capend head bolts should be fine, stock oil pump is adequate. Head/main studs give better clamping and are 'insurance', but we fell they are not critical Same with the hi volume oil pump. Regular inspection of the main bearings is more important, and we have run 7500 rpm engines with 32 lbs. oil pressure, reliably, if the bearings are in good shape.

Total ignition timing: Often misunderstood by new engine builders. This is the combination of <u>initial</u> ignition timing (set by turning the distributor), <u>plus</u> vacuum advance (if the distributor has a vacuum advance tube going to the base of the carb), <u>and</u> centrifugal advance (weights that are in the base of the distributor that change ignition timing as rpms increase ...up to about 2800 rpm). To check total timing, get a flashing type timing light and point it down at the crank shaft dampener where the timing marks are located and rev the engine, (usually to about 3000-3500 rpm) until the timing shown by the flashing timing light on the crank pulley does not change or 'advance' any further. This is 'total timing' or the most ignition advance (ignition timing) that the engine will see no matter how high you rev the engine. This number should be around 34-36 degrees on most 2300 race engines. **Set total timing** by running the engine to about 3500 rpm or until the timing marks 'stop moving' on the crank dampener as you rev the engine, then turn the distributor until the flashing timing light shows the timing at 34 degrees on the crank dampener. Tighten the distributor hold down bolt.

Too much advance will cause detonation and will blow a head gasket or melt a piston. Turbocharged engines usually run 25-28 degree total timing,due to the forced induction of the turbo. Ideal or total timing is a function of engine cylinder head design, compression ratio and quality (octane) of fuel used. Most normally aspirated (non turbo) engines run in the 34-36 degree range. This means that the spark plug is firing a 34 engine degrees before the piston gets to top dead center.

The speed of the piston and the time that it takes for the fuel to explode means that the force of the explosion finally gets to the top of the piston just as it reaches top dead center. If you have too much initial timing, say 40 degrees, the piston will be still coming up towards top dead center and will be hit by the force of the exploding gas before it gets to the top. Not good, and detonation or melt down will occur. Since you can't hear 'pinging' in race cars (too much noise), total timing is important the first time out on the track

VALVE TO PISTON CLEARANCE

This is the distance between the valve and piston when the engine is running and the valves are fully open. Is easily checked with modeling clay (available from Walmart in the kids department).

When you 1)change to a higher lift cam or 2)a longer duration cam, or 3) mill the head, *the valves get closer to the piston*. If you advance the camshaft (move the camshaft/gear clockwise a notch on the cam belt standing in front of the car) The intake valve will get closer to hitting the piston.

If you retard the cam (move the camshaft / gear counterclockwise) the exhaust valve will get closer to hitting the piston.

In engines with high lift cams, domed pistons, milled heads, etc. there is a limit of camshaft advance and retard before the valve hits the piston.

We find these two limits (advance and retard) be using a mechanical lash adjuster in the #1 exhaust valve position (because it is in a convenient location...could be any valve). We set the lash to 'zero' (no lash) by adjusting the mechanical lash adjuster to the base of the cam (lobe pointing straight up), by turning the adjuster out by hand.

Place a butter pat size piece of modeling clay on the #1 intake and exhaust valve and bolt the head to the block with no head gasket and just 2 head bolts. Set the cam timing belt to specs: crank keyway at 12 o'clock, cam keyway at 6 o'clock. distributor setting doesn't matter for this checking operation. This is known as straight up, or split overlap for the cam. adjust the belt with the tensioner, and turn the engine over twice (2 rotations of the crank) A dial indicator is set on the retainer of the valve spring and the engine is rotated until the cam lifts the #1 exhaust valve .050". Mark the crank pulley.

This mark on the crank pulley is your reference for accurately resetting the head on the block. At .050" valve lift (shown on the dial indicator) the crank timing pointer should be on the mark on the crank pulley. Now remove the head and look at the clay. You should have .100" (1/10") thickness to the clay for final assembly. (you will have an additional .043" clearance when you put the head gasket on for final assembly).

Try advancing the cam with the adjustable pulley or a full notch on the belt, reassemble, mark the crank pulley when you get the #1 exhaust valve to lift .050" again and turn the engine over twice. Look at the clay again, and you will see that the intake valve is closer to the piston.

Continue through this tedious procedure until you realize the limits of advance and retard for that engine/cam/piston combination.

By marking the crank at the limits of advance and retard at .050" lift on the exhaust valve (as we use)...you can safely advance and retard the cam at the track or on the dyno as long as it is within the limits you marked on the crank. You will need a dial indicator and one mechanical lash adjuster if the engine uses hydraulic lifters.

2300 Ford cylinder heads

YEAR	combustion chamber	INT.SHAPE	TYPICAL CASTING #
74-75 CARS SPARK PLUG HOLES FULLYTAPPED	open	OVAL	D42E/D4Z3
75-80 CARS 77-80 COURIER TRUCK SPARK PLUG HOLES HALFTAPPED	open	OVAL	D52E,D6EE,D7EE,D8EE D9EE
79-81 TURBO MUSTANG OIL DRAIN BACK FOR TURBO IS IN HEAD	open	OVAL	D9EE,D9ZE,E1ZE
81-83 CAR W/O TURBO **1ST YEAR FOR "D'PORT** 83-84 CAR W/TURBO COURIER TRUCK	open	D-PORT	E1BE
84 CAR W/O TURBO	HEART SHAPED	D-PORT	E4ZE-DA
83-85 RANGER W/O EFI	MODIFIED "D"	ROUND	E27E-DA
85-88 CAR W/O TURBO 85-88 RANGER/AEROSTAR W/O RLR CAM	HEART SHAPED	D-PORT	E59E
85-88 CAR W/TURBO 85-90 CAR W/EFI 85-88 RANGER/AEROSTAR W/O RLR CAM	HEART SHAPED	D-PORT	E5ZE,E6ZE
87-88 RANGER W/RLR CAM	HEART SHAPED	D-PORT	E69E
89-up RANGER DUAL PLUG HEAD 91-up CAR			

The oval port head is a good head, and very very close to the D port head in performance. We feel the D-port head is a slightly better flowing head and seems to be the head of choice. If you are allowed to port and polish the head, then we suggest using the "heart" shaped D-port head. For this head to work properly with big valves, the valves will have to be unshrouded (grinding the cylinder head combustion chamber walls near the valves so fuel can flow past the vales into the combustion chamber) The Ranger head is a good head, except there are no stock intakes that work well with this head. As of now we have not done any work with the dual plug head.

The 2300 head can be milled up to the intake bolt holes (approximately .130").
Using a flattop piston, generally, .040" off of the head equals about 1 compression point increase for the engine. The heart shaped combustion chamber cylinder head gives a slightly higher compression ratio.

Miscellaneous notes:
Valve spring pressure of 95-115 lbs. on the seat (valve closed) and 230-260 lbs. open (valve fully open) is adequate for high rpm use.

Roller cams are very reliable. Roller followers can be used and transferred from one cam or one lobe to another without problem.
Flat tappet cams over .450 lift should consider the 'insert type follower' for better cam reliability. (see catalog). On flat tappet cams the follower must be new and stay with that cam

lobe for the life of the cam, as they wear in to each other on initial startup. If a flat tappet cam fails and wipes out a cam follower, the engine should be disassembled and cleaned (a big job) as the metal from the failed cam is in the oiling system and will cause more cam failures. Changing oil and filter doesn't do it.

Header gaskets can be reused if they are smeared with silver 'antisieze' paste available from most auto supply or marine supply stores. The antisieze keeps them from sticking to the cylinder head or header.

horsepower we know of for the 2300. We stock them at $5.00 ea. The main jets are down in the float bowl. A # 52 drill is a good starting point for jet size for the main jets on most 2300 race engines.

Most race engines **using the stock 32-36mm Pinto Holley/Weber carbs** will see a 8-10 hp increase on the dyno by changing the air corrector jets from the 185-190 that they come with to a set of 160 air correctors. These air corrector jets are visible at the top of the carb when you take the carb top plate off (easily changed with a screwdriver). Cheapest

Milling the head is also a least expensive path to power on the 2300.
Milling the head (up to the intake manifold bolt holes / .130") requires higher octane fuel or less ignition timing to be safe with the higher compression.

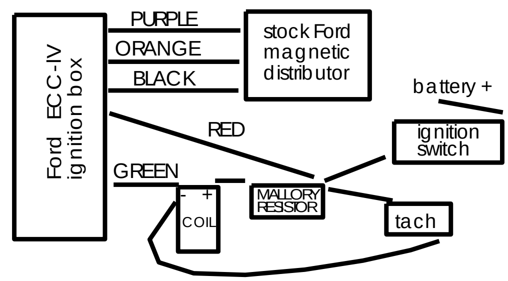
Carburetors: On short tracks (any oval stock car track) the **350 Holley 2 bbl** will often give faster lap times due to quicker throttle response and fuel flow over the larger 500 Holley 2 bbl. Both carb are designed for V8's, not 4 cylinder use, so they run too rich on initial throttle 'tip in'. A basic over rich condition can be cured by using our restrictor kit under the power valve in the metering block between the float bowl and main carb body. On an unmodified carb, when the power valve opens as manifold vacuum drops on initial acceleration, the carb gets too much fuel through the power valve enrichment channels under the power valve) and the engine bogs badly. Our carb restrictors (or a power valve block off plug) will get it back to a usable amount of fuel for the 4 cylinders needs. As a starting point try # 74 carb jets for the 500 Holley, and #56 for the 350 Holley.

The **accelerator pump squirters** also tend to keep dribbling fuel into the engine due to the vibration of the 4 cylinder engine. Our carb vibration isolator (a rubber gasket under the carb) will help cure this.
Also, **adjusting the carb idle** too high (at the throttle cable) where the idle is at, say 1800 rpm, will not allow the butterflies to close fully as you lift off the throttle going into a corner. The carb will continue to draw fuel and will cause a over rich condition when you get back on the throttle coming out of the corner.....a very difficult problem to diagnose. Try to get the idle setting down to 1000 rpm or so, to be sure that the butterflies close adequately going into the corner.
2 lbs. fuel pressure at highest rpm is enough fuel pressure. 2-8 is normal fuel pressure for most 4 cyl carbureted engines. You just don't want the carb float bowl to run dry at the end of the straight.

Engine miss diagnosis:
If the valve springs are too weak for the rpms used, or the hydraulic lifters will not keep up with the engine rpms, the engine miss will be at the *exact same rpm* every time. If it is electrical, such as ignition point bounce in a point type distributor, the engine miss will be at the *exact same rpm* every time.
If you can pump the throttle to cure the miss or *get it to change rpm*, then it is fuel...either too much or not enough.

Any 2300 engine we have run on any dyno will pick up at least 10 hp no matter how much time we spend assembling and setting everything. A dyno session usually costs $300-400 and is the best money you can spend. Cam timing, ignition timing and carb jetting are easily set for best power. The exact measuring capability of the engine dyno can do this better than any at track testing. Engine dynos are more accurate than chassis dynos, particularly on the relatively low HP 4 cylinder engine.

Duraspark ignition is a simple wiring hookup (shown below) to use a stock 2300 (or Ford V8) magnetic pickup distributor in a race car. Most all late 70's- early 80's Fords(4 cylinder and V8) used this ignition setup with 3 wires going from the stock Ford ignition box to the distributor (black, purple, and orange wires). The green wire to the negative side of the coil. The red wire to the positive side of the coil, with a Mallory resistor part #700 spliced into this red line. The ignition switch connects to the resistor on the side towards the Ford ignition box as does the tach pickup. The other side of the ignition switch goes to the battery positive. The other side of the tach wiring goes to the negative on the coil. The white wire out of the ignition box is not used (tape it off). Use a good coil, like the Mallory voltmaster. The starter button is separate from the ignition described above and goes from the battery positive to the starter solenoid. (the diagram below says ECC-IV, but that is incorrect. It should be Duraspark ignition from '70's 80's Fords)



TORQUE SPECS / 2300 ENGINE / using stock (factory) bolts

ITEM			SIZE		LB-FT
auxiliary shaft gear	bolt	m	-10	28-40	
cam gear	bolt	m	-12	50-71	
connecting rod nut		**m-9**		**30-36**	
crankshaft dampener	bolt	m	-14	100-120	
cylinder head		**bolt**	**m**	**-12**	**80-90**
distributor clamp	bolt	m	-10	14-21	
flywheel to crankshaft bolts		**m**	**-10**	**56-64**	
fuel pump to cylinder	block	m	-8	14-21	
intake manifold to cylinder head		m	-8	14-21	
main bearing cap	**bolt**	**m**	**-12**	**80-90**	
oil pump pickup tube to pump		m	-18	14-21	
oil pump to		block	m	-8	14-21
oil pan drain plug to	pan	m	-14	15-25	
oil pan to	block	m	-6	6-8	
oil pan to	block	m	-8	8-10	
spark plug to cylinder	head	m	-14	5-1	