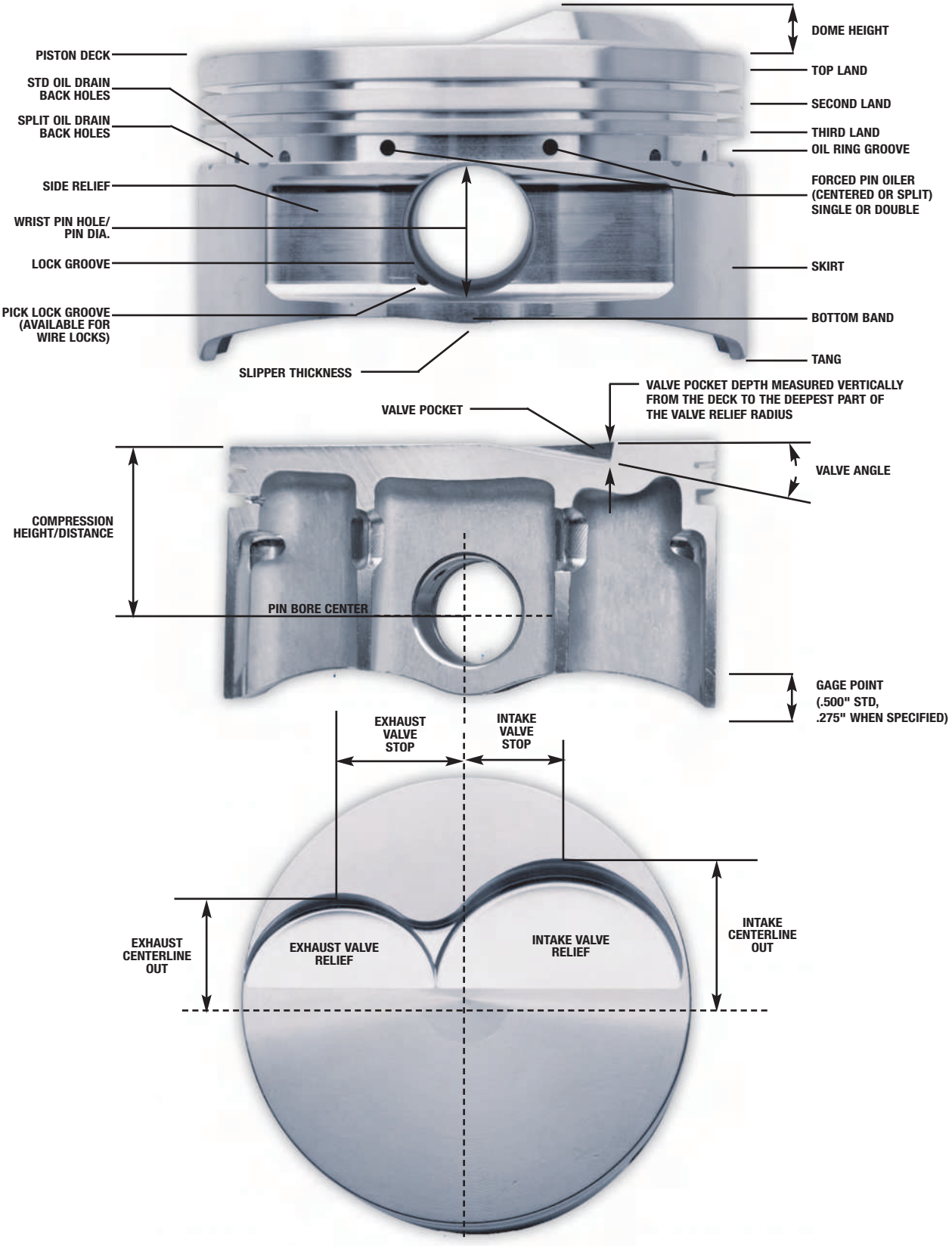
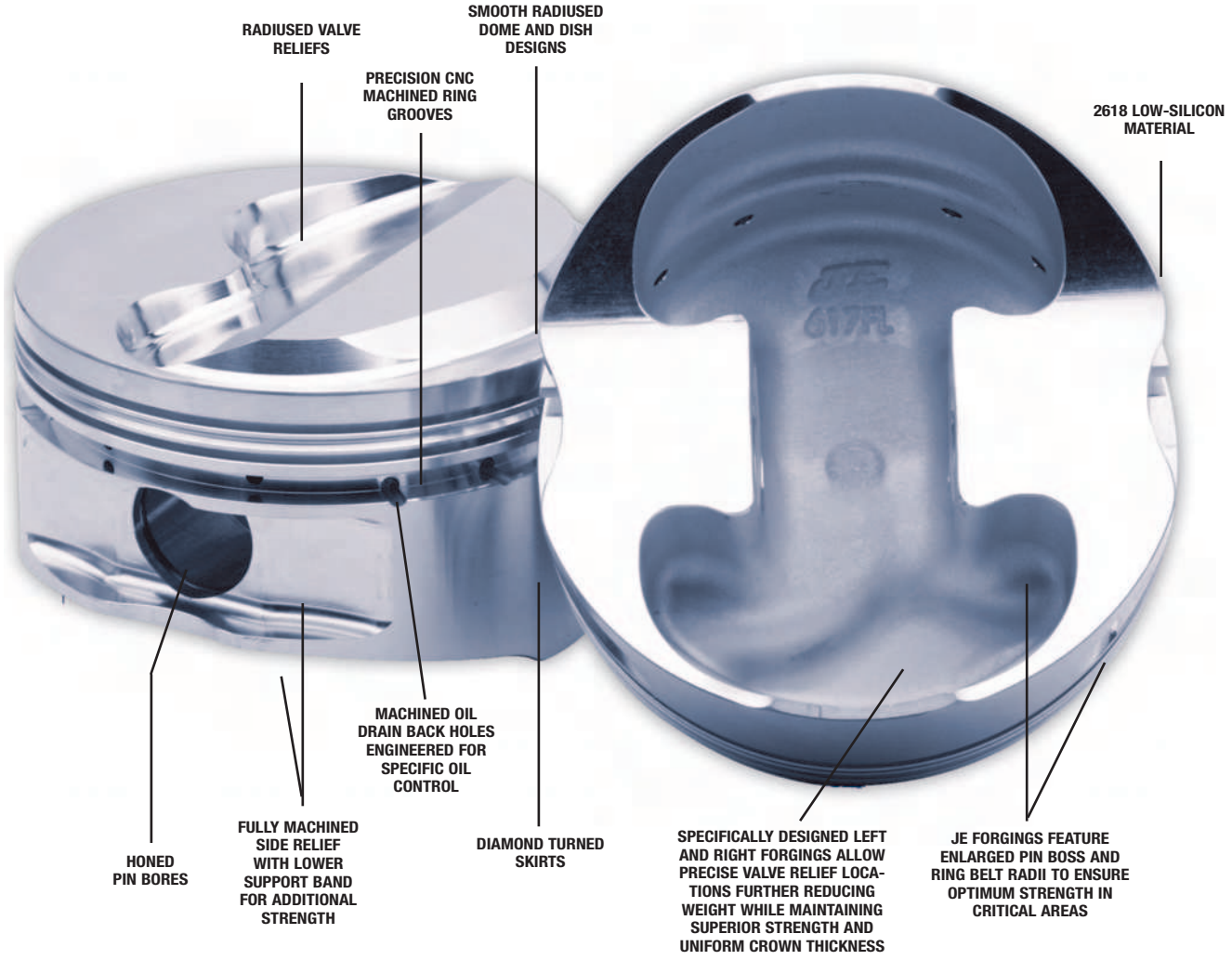
Sportsman Racing Products

PISTON TERMINOLOGY



SHELF PISTON TERMINOLOGY

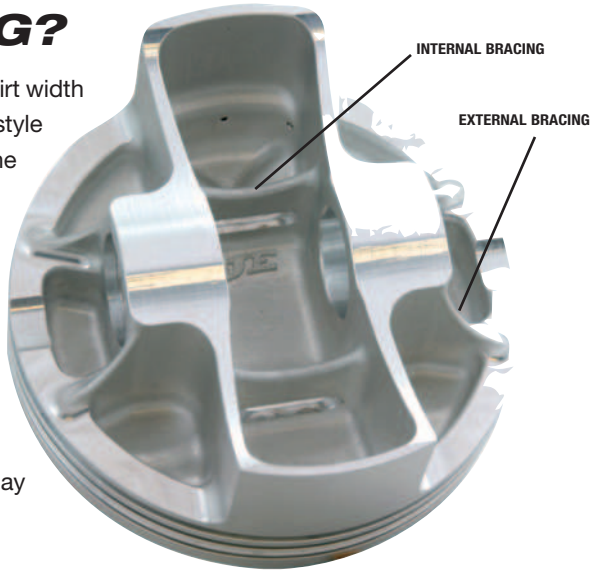
With over 300 individual forgings to choose from, JE is able to achieve specific piston design requirements while reducing overall weight.



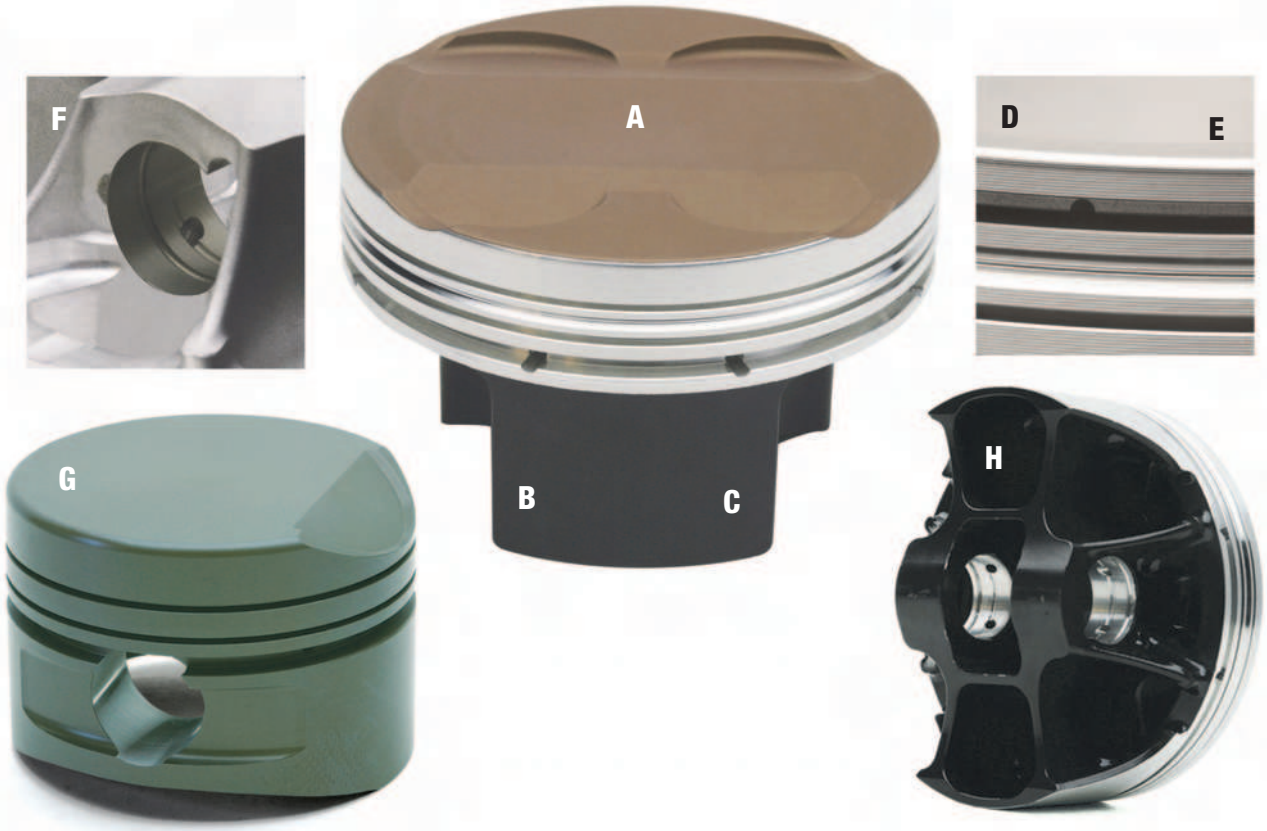
WHAT IS AN FSR FORGING?

FSR (Forged Side Relief) forging designs feature a reduced skirt width and shorter wrist pin when compared to traditional “full round” style forgings. The narrow skirt helps minimize piston contact with the cylinder wall that can cause friction and power loss while the shortened wrist pins reduces the overall weight.

Some FSR forgings feature internal and external bracing to provide a more rigid construction while minimizing overall weight. With thousands of race miles logged in the most demanding applications like NASCAR, NHRA Pro Stock and IRL, these pistons provide the ultimate combination of low-friction, lightweight design with increased stability and strength. (Tech note: In extreme horsepower applications the use of oil squirters may be required)



PISTON COATINGS



A. The thermal barrier crown coating is applied to the top of the piston and is designed to reflect heat into the combustion chamber, thereby increasing exhaust gas velocity and greatly improving scavenging potential. The .0015" thick coating can also assist in extending piston life by decreasing the rate of thermal transfer.

B. Skirt Coating, This is a "break-in" coating applied to the skirt of the piston only, designed to show wear. This coating is a .0003" to .0005" thick spray-on dry film that will help reduce friction and inhibit galling. No manufacturing allowance is required as this application is made to wear in to the cylinder wall.

C. Tuff Skirt is a JE Pistons' trademark coating that is a lubricating, anti-friction / anti-wear coating applied to the piston skirt only. Unlike our standard Skirt Coating, Tuff Skirt will not wear and is designed to withstand many different types of endurance applications, similar to those commonly found in NASCAR. Buildup is .0005" per surface and finished diameter of skirt should include the coating buildup.

D. Top groove hard anodize, this coating has proven to increase power output by allowing for extremely tight ring clearances. Available exclusively to top-level racing teams until now, this top ring groove coating creates a hard mating surface which virtually eliminates micro-welding while decreasing ring groove wear. Buildup is .00025" per surface and clearance must be added during manufacturing to accommodate the change.

E*. Anodize option B, also a ring groove coating, Offers twice the buildup of the standard process (.0005" per surface). Through extensive R & D and field-testing, the Option B process has shown to be more durable in maximum effort, high endurance applications. Appropriate manufacturing allowances apply.

F*. Anodize Option C, This coating is the same material as the Anodize Option B except is applied to the wrist pin bore instead of the top ring groove. This coating provides increased lubricity, smoother oil transfer, and better wear in the pin bore. The wrist pin hole must be honed both before and after anodizing.

G. KoolKote is an aerospace quality hard anodize applied to all surfaces of the piston with a buildup of .001". This coating is designed for use in nitro-methane engines such as Top Fuel Drag Racing to endure the corrosive effects of this fuel type. It will withstand greater temperatures and will not flake, chip or peel. This coating does alter the heat transfer and expansion characteristics of the piston. Consult the JE Pistons technical department for specific applications. Manufacturing allowances are required on all surfaces.

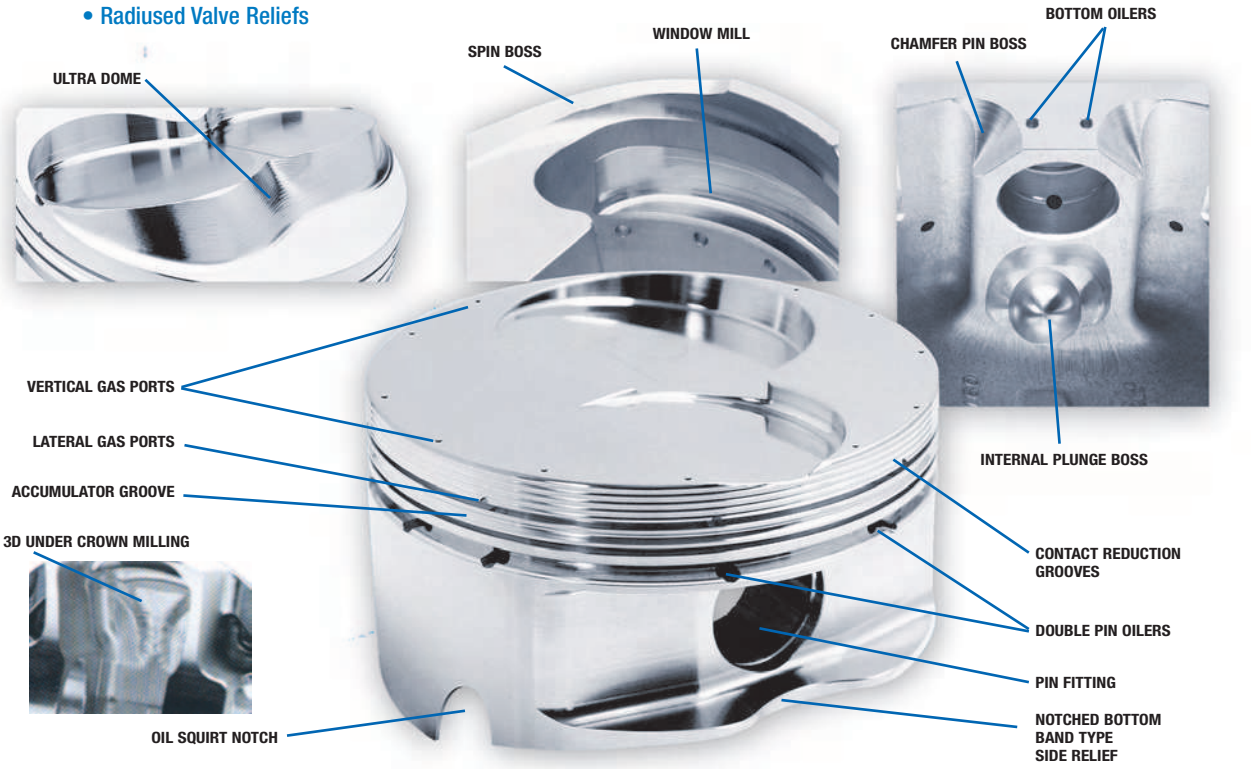
H. Oil Shed coating, this coating is applied to the underside of the piston. It is intended to reduce the reciprocating weight by repelling oil quicker than an untreated part. No additional manufacturing is required.

CUSTOM PISTONS

Custom pistons do not come with pins, locks or rings. Please see the components section of this catalog to find the proper parts you need to complete your order.

STANDARD CUSTOM PISTON FEATURES

- Fully CNC Machined Piston
- Precision Machined CNC Ring Grooves
- 2618 Low-Silicon or optional 4032 High Silicon Material Available on some applications
- Diamond Turned Skirts
- Radiused Valve Reliefs
- Single Forced Pin Oilers
- Pick Lock Grooves (for use with wire locks)
- Machined Side Reliefs on full round forgings
- Lock Grooves Machined for Carbon Steel Spiro Locks (other options available)



Ultra Crown Dome Ultra Crown Inverted Dome: The Ultra Crown machining process allows incredibly precise dome to cylinder head tolerances. By mapping the exact shape of a piston or cylinder head, optimum compression and quench characteristics can be achieved.

3D Under Crown Milling: The Under Crown machining process allows for uniform deck thickness, therefore creating a lighter and more durable piston.

Vertical Gas Ports: Vertical holes in the deck of the piston, allows combustion pressure to directly enter behind the top ring on the power stroke, thus pressurizing the area behind the top ring for greater ring to cylinder wall seal. During the rest of the cycle, the ring has normal tension for reduced friction. (Most commonly used for drag race applications).

Lateral Gas Ports: This process mills slots into the top of the top ring groove and provides a pathway for combustion pressure to get behind the top ring. This process helps to increase ring seal and is most common in circle track applications.

Ultra Groove: Ultra Groove is a special ring groove machining process that provides near perfect groove flatness and surface finish. Tolerances are held to millionths of an inch.

Spin Boss & Window Milling: In certain applications window milling will remove a significant amount of weight from the skirt of the piston while maintaining its strength and integrity. Spin Boss refers to machining on the bottom of the pin boss, which removes weight where it is not needed for strength.

Plunge Boss & Chamfer Pin Boss: Machining process that removes additional material for added weight savings.

Contact Reduction Grooves: The purpose of machining these grooves is to reduce the amount of contact area against the cylinder wall when the piston "rocks over". Contact reduction also serves to disrupt the flame travel into the crevice area thus helping to reduce detonation.

Accumulator Grooves: An accumulator groove is machined into the land between the top and second ring. It provides additional volume where residual combustion gases that have "blown by" the top ring can collect. This additional volume helps to reduce pressure between the top & second ring, thus aiding in top ring seal and minimizing ring flutter.

Double Pin Oilers: Double Pin Oilers deliver twice the amount of oil to the wrist pin as compared to the standard single pin oiler.

Pin Fitting: The pin bore is precision honed to attain an exact pin clearance. Clearances typically range from .0003 to .0010 between the wrist pin and pin bore.

Oil Squirt Notch: Notching can be done on pistons for motors with oil squirters, or to avoid contact between pistons and/or pistons and crankshaft.

Bottom Oilers: This process machines one or two holes into the bottom of the pin boss to assist in splash pin lubrication.

Tulip Valve Pockets: Most commonly used on Hemi and motorcycle engines, this process leaves a raised area on plunged valve pockets to achieve maximum compression.

2618 INSTALLATION TIPS

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Piston to cylinder wall clearance

1. Piston diameter must be measured at gauge point which, in most cases, is .500" up from the bottom of skirt. (See fig. 1).
Dimensions listed are gauged at a temperature of 68 degrees fahrenheit. Note: aluminum expands and contracts with temperature variations.
2. Your pistons are manufactured from 2618 low-silicon aerospace aluminum alloy.
3. Clearance is built into piston based upon finished bore for normal operating conditions. (See Table. 1).
4. Clearances listed below are minimum. Some applications such as supercharged, turbo, nitrous and endurance applications may require .001-. 003" to be added to the minimum clearances in Table 1. Cold water pickup marine applications may require an additional .002"-.004" clearance.

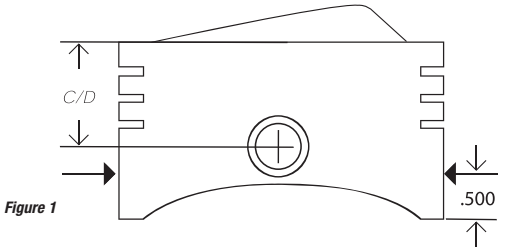


Figure 1

Table 1	**Bore Range**	**Min. Clearance**
Sport compact	2.500 to 3.625"	.0030 to .0035"
Sport compact	3.626 to 3.999"	.0035 to .0040"
SB applications	4.000 to 4.200"	.0035 to .0045"
BB applications	4.200 to 4.600"	.0040 to .0050"

Piston to valve clearance

Piston to valve clearance is determined by cam lift, lobe separation, duration, valve margin, head design, and aftermarket milling of cylinder head. Minimum recommended clearance for intake & exhaust valve would be 0.100" deep and .050" radially. Check by using clay or follow cam manufacturers recommendations for checking clearance, making sure the cam is degreed exactly as it will be during operation.

Cylinder/Liner/Block preparation

We strongly recommend that you chamfer or slightly relieve the bottom edges of your cylinders/liners/blocks. If a sharp edge is present it will cause excessive piston skirt wear. This is very important in stroker applications where the piston skirt travels past the bottom of the cylinder.

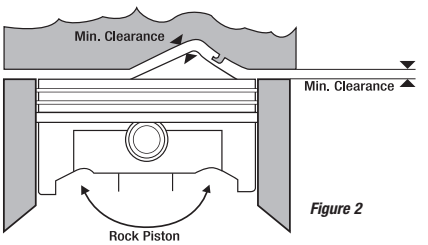


Figure 2

Piston/dome to head and spark plug clearance

Due to the large selection of aftermarket cylinder heads available, and wide variety of combustion chambers, you should always check piston/dome to head and spark plug clearance to assure proper clearance (See fig.2). Minimum clearance for steel rod =.040", aluminum =.060". Check using clay with piston installed on rod at TDC, rock piston to get minimum clearance.

Crank counterweight to piston clearance

Always check counterweight to piston clearance ar BDC. Recommended minimum is .060"

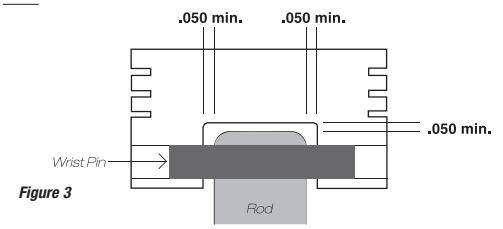


Figure 3

Connecting rod to piston clearance

Due to the large variation in rod widths and material thickness above pin, always check for proper piston to connecting rod pin end clearance. Recommended clearance is .050" min per side and .050" min from top of rod to piston. With the piston installed on the rod, rock the piston side to side and rotate forward and backward to ensure proper clearance. (fig. 3)

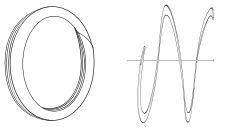

NOT TO SCALE! *Approximate 1/8-1/4"*

Figure 4
WARNING: ***Do not over-stretch spiro locks.***

Spiro locks

For installing Spiro locks, grip each end of the lock and pull apart (approx. 3/8" – 7/16"). The lock will resemble a small coil (fig.4).The lock can then be spiraled into place almost as if you were screwing them into a groove (fig. 5). When the locks are properly seated, only half of the lock will be visible above the groove. **Most** SRP pistons that require spiral locks will need 4 locks per piston, 2 at each end of the pin. **WARNING:** It is important that the correct number of locks are installed in each piston or severe engine damage may occur. **WARNING:** Do not over stretch spiro locks and do not reuse spiro locks!

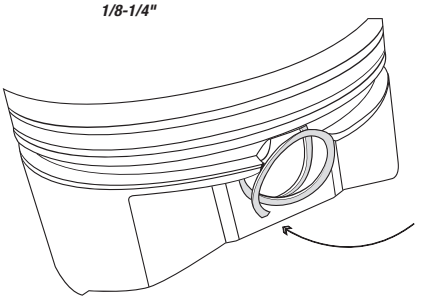


Figure 5

Wire locks

Install the end of one lock at 90 degrees from the pick lock groove. Use a stiff small bladed screwdriver and insert the tip into the pick lock groove while you wedge the lock into the groove without kinking or deforming the lock. After the first lock is in place, seat the lock by solidly hitting the wrist pin with a brass drift pin. Now install the connecting rod and the second lock. Seat the 2nd lock in the same manner as the first. Just as a precaution, we recommend hitting each side of the wrist pin with the brass drift pin an additional time. Perform these functions on a cloth towel or soft rubber pad so no damage to the piston occurs.

Cleaning

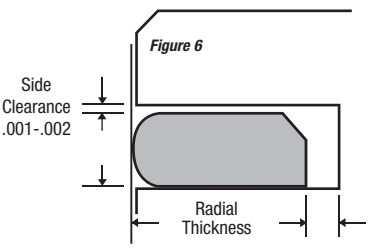
Thoroughly scrub pistons and cylinder walls with an automotive parts type cleaning solvent or hot water and soap before installation. JE recommends a light coat of assembly oil (Marvel Mystery Oil or similar) on the pistons' skirt, rings and cylinder walls for initial installation and start up. WE DO NOT RECOMMEND USING SYNTHETIC OIL OR ANY AFTERMARKET OIL ADDITIVES until the rings have properly seated. Be sure to thoroughly lubricate wrist pins and piston pin bores with an assembly oil to prevent galling on initial fire-up. It is also a very good idea to double check forced piston pin oiler holes for foreign matter or debris before ring installation. During trial assembly or mock-up, verify the dome and valve pockets on the pistons match the combustion chamber and valve diameters of your cylinder heads. As a rule, four-valve piston exhaust pockets are located above the JE logo on the underside of the piston. Many JE/SRP piston designs have special offset domes and /or specific valve pocket "left" or "right" hand positions. It is the responsibility of the engine builder to ensure non-symmetrical (left or right designed pistons) valve pocket pistons are installed in the correct cylinder location.

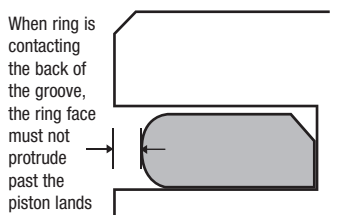
RING INSTALLATION GUIDELINES

IMPORTANT: BEFORE FILING RINGS – Check each individual ring in its corresponding piston ring groove to ensure proper ring groove depth (radial back clearance) and side clearance (thickness)(fig. 6). Proper cylinder finish (honing), ring end-gap, and lubrication are critical to achieving optimum ring seal.

Ring End Gap Table *(Use as a guideline only.)*

	Top Ring	2nd Ring	Oil Ring Rails
Application	Min. Gap Per Inch of Bore		Minimum Gap
High Perf Street Strip	Bore x .0045"	Bore x .0050"	min .015"
Street Moderate Turbo/Nitrous	Bore x .0050"	Bore x .0055"	min .015"
Late Model Stock	Bore x .0050"	Bore x .0053"	min .015"
Circle Track / Drag Race	Bore x .0055"	Bore x .0057"	min .015"
Nitrous Race Only	Bore x .0070"	Bore x .0073"	min .015"
Blown Race Only	Bore x .0060"	Bore x .0063"	min .015"





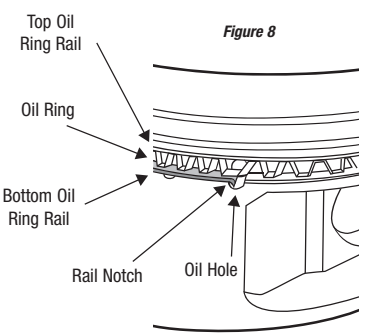
End Gap

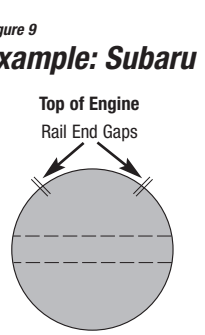
End gap is the clearance between the two ends of a piston ring as it is installed in a cylinder (fig. 7). Most high performance and racing engine builders purchase piston rings slightly oversized in order to file fit them to very precise end gaps. Testing has shown measurable increases in horsepower and decreases in blow-by as a result of properly fitting the ring end gap to the operating conditions. Factors such as supercharging, turbocharging, nitrous oxide, endurance racing and different fuels determine proper ring end gap. Proper ring end gap can more than double from one engine to the next depending upon the above factors.

Precise machining of the cylinder bores is critical, and is the reason why rings should be fitted to the cylinder in which they are to be installed. A diameter variance from one cylinder to the next changes the end gap of the rings in that cylinder by a factor of pi (3.1416). For example, a cylinder .001" larger in diameter will increase the ring end gap by .001 x 3.1416 = .003", rounding off. The second ring end gap should always be larger than the top ring end gap.

Ring Sets Containing Rail with a Tab

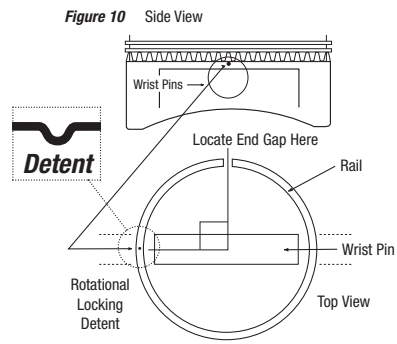
When installed in a horizontally opposed engine, oil rail gaps should be installed as shown at below (fig. 9). The tab rail must be installed below the oil ring expander with the tab facing toward the bottom of the ring groove extending into the split oil drain back holes (fig. 8). Use caution not to install the rail tab into the wrist pin oil hole.

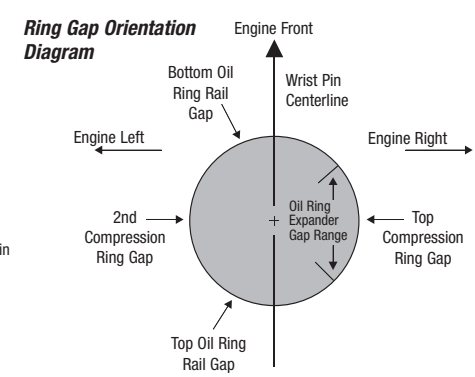




Oil Ring Support Rail Installation

1. *Install oil ring support rails on the bottom of the oil ring groove with the antirotational locking detent facing downward.*
2. *Rotate the oil ring support rail until antirotational locking detent falls between the opening at intersection of ring groove and wrist pin hole.* (fig. 10)
3. *Install oil ring assembly as usual.*





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Dimensions listed are gauged at a temperature of 68 degrees fahrenheit. Note: aluminum expands and contracts with temperature variations.
2. Your pistons are manufactured from 4032 high silicon aluminum alloy.
3. Clearance is built into piston based upon finished bore for normal operating conditions. (See Table. 1).
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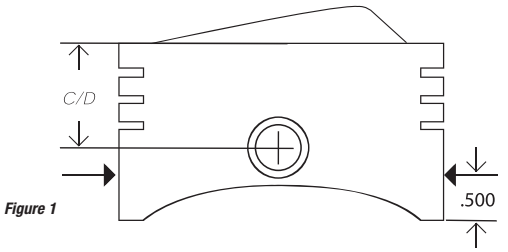

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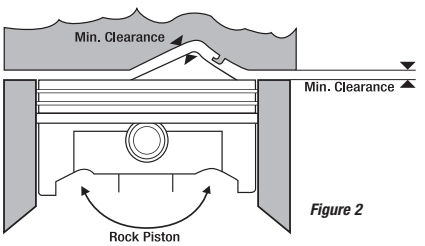

Figure 2

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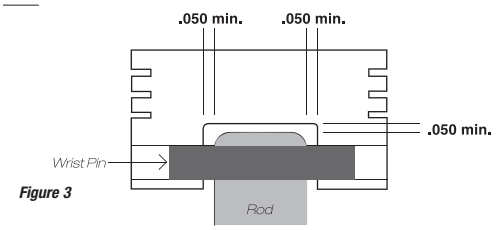

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Crank counterweight to piston clearance

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Connecting rod to piston clearance

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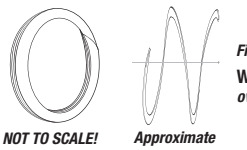
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Figure 4

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Spiro locks

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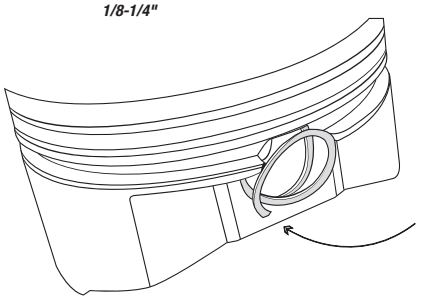
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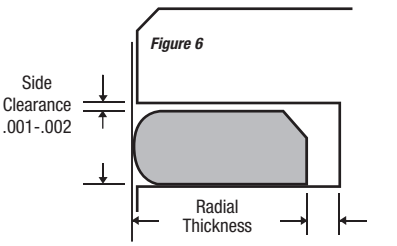
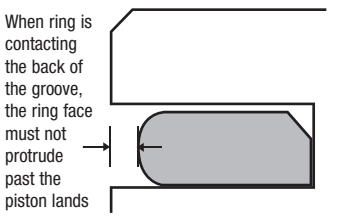
Circle Track / Drag Race	Bore x .0055"	Bore x .0057"	min .015"
Nitrous Race Only	Bore x .0070"	Bore x .0073"	min .015"
Blown Race Only	Bore x .0060"	Bore x .0063"	min .015"





End Gap

End gap is the clearance between the two ends of a piston ring as it is installed in a cylinder (fig. 7). Most high performance and racing engine builders purchase piston rings slightly oversized in order to file fit them to very precise end gaps. Testing has shown measurable increases in horsepower and decreases in blow-by as a result of properly fitting the ring end gap to the operating conditions. Factors such as supercharging, turbocharging, nitrous oxide, endurance racing and different fuels determine proper ring end gap. Proper ring end gap can more than double from one engine to the next depending upon the above factors.

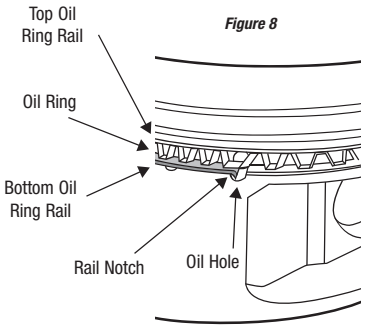
Precise machining of the cylinder bores is critical, and is the reason why rings should be fitted to the cylinder in which they are to be installed. A diameter variance from one cylinder to the next changes the end gap of the rings in that cylinder by a factor of pi (3.1416). For example, a cylinder .001" larger in diameter will increase the ring end gap by .001 x 3.1416 = .003", rounding off. The second ring end gap should always be larger than the top ring end gap.

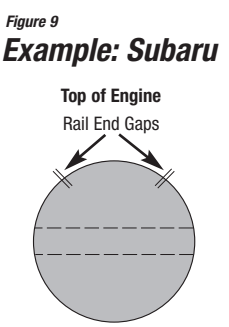
Ring Sets Containing Rail with a Tab

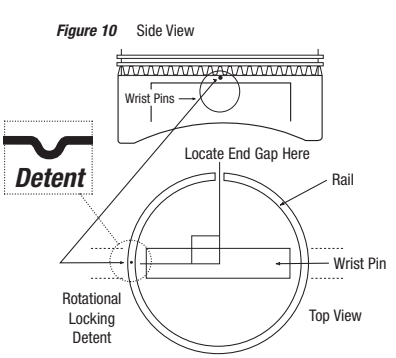
When installed in a horizontally opposed engine, oil rail gaps should be installed as shown at below (fig. 9). The tab rail must be installed below the oil ring expander with the tab facing toward the bottom of the ring groove extending into the split oil drain back holes (fig. 8). Use caution not to install the rail tab into the wrist pin oil hole.

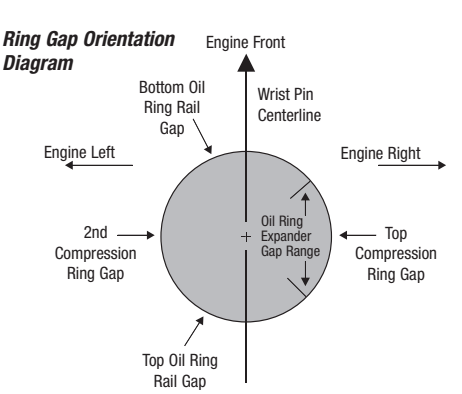
Oil Ring Support Rail Installation

1. *Install oil ring support rails on the bottom of the oil ring groove with the antirotational locking detent facing downward.*
2. *Rotate the oil ring support rail until antirotational locking detent falls between the opening at intersection of ring groove and wrist pin hole.* (fig. 10)
3. *Install oil ring assembly as usual.*







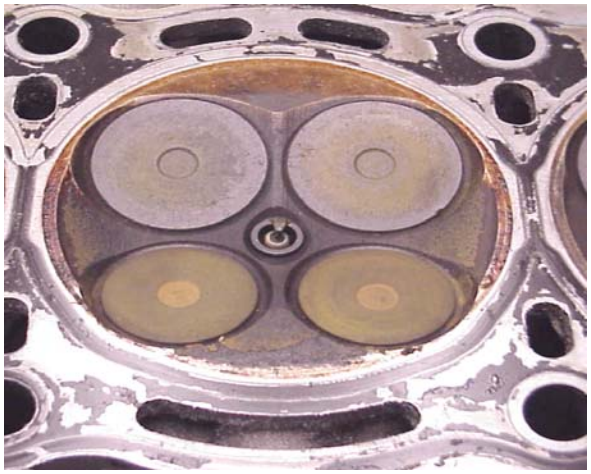


Sample Cylinder Head Requirements

1. Heads should be as clean as possible.
2. Please include enough hardware for one cylinder: correct valves, spark plug, and a head gasket are required. If head is left assembled, please install light test springs on one cylinder.
3. Please verify that all samples and components are clearly tagged and, if possible, marked with a permanent marker with the customer name and account number.

Surface contamination reduces accuracy of measurements!

BAD



GOOD

COMBUSTION CHAMBER MOLD MAKING INSTRUCTIONS

JE recommends using a rigid mold compound such as Auto Body Dent Filler or equivalent. Do not use flexible or brittle materials such as latex, modeling clay, or plaster because they cannot be scribed or measured accurately.

The following molds are examples of chamber molds not accepted by JE.



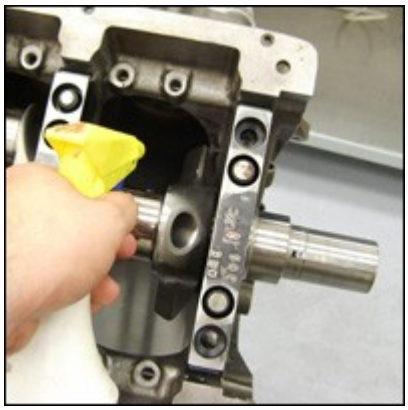

Different resin based materials are available, but be careful as they may readily bond with metal surfaces and can be difficult to separate once cured.

There are two common procedures for mold making:

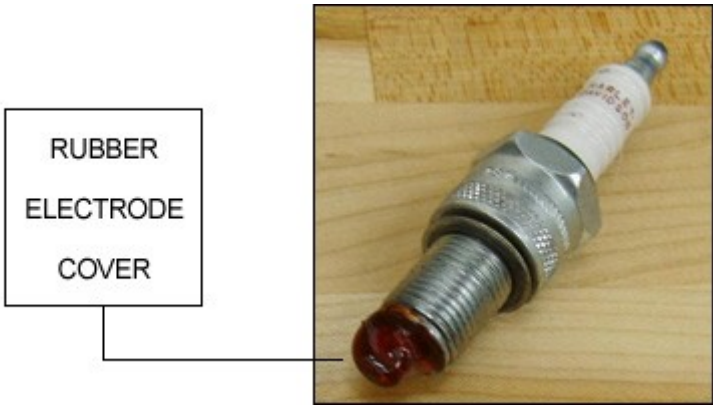
Procedure 1:

The combustion chamber and valves must be clean and free of carbon deposits. Casting flash or tooling marks should be removed or reasonably smoothed.

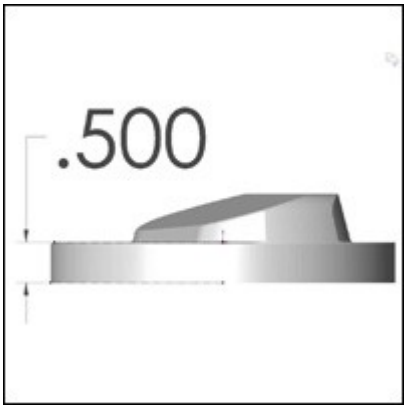
Apply a release agent, such as WD-40, to the chamber and bore surfaces before pouring the mold compound.

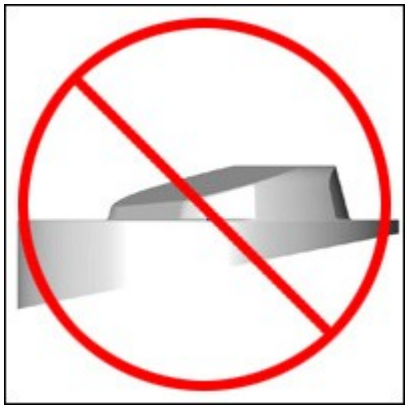



Install the dowel pins in the block and then install the valves and spark plug in the cylinder head. A rubber electrode cover on the spark plug will help the mold separate easier. This cover can be made from tool dip, which can be purchased at hardware stores such as Home Depot. See picture below.

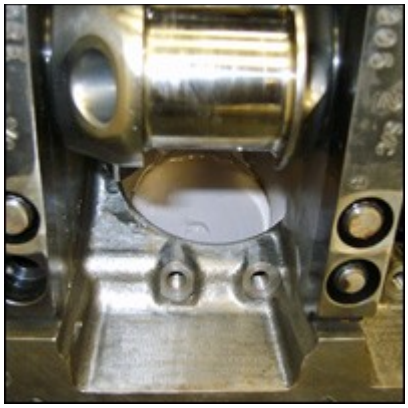


With the block fastened to an engine stand, bolt the head to the block and rotate it until the deck of the block is level with the floor and upside down. The bottom of the mold must be flat and parallel to the deck, so it is essential that the deck is level and horizontal.

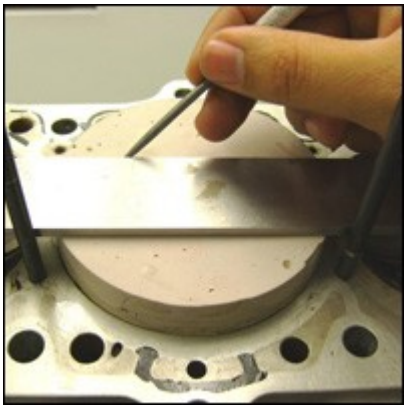
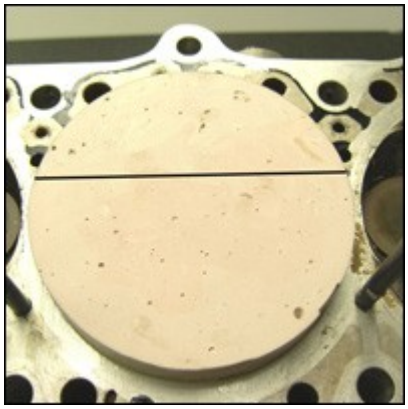




Pour the mold compound through the crankcase. The more "liquid" or "fluid" the molding compound, the better it will conform and allow bubbles to rise away from the chamber. Thicker compounds may need some pressure to ensure it conforms completely (an old piston works well for this). Allow the molding compound to extend into the bore ½" - 2"

Once the compound has cured, rotate the assembly right side up and remove the cylinder head. Using the dowel pins and a straight edge, scribe a line across the base of the mold. This scribed line must be parallel to the pin axis as shown in picture below.

Note: Centerline doesn't have to be on center of the chamber mold, but it is critical that it is parallel to the wrist pin axis.

Once the line is scribed, remove the mold from the chamber.

Procedure 2:

The combustion chamber and valves must be clean and free of carbon deposits. Casting flash or tooling marks should be removed or reasonably smoothed.

Apply a release agent, such as WD-40, to the chamber and bore surfaces before pouring the mold compound. (Do not apply release agent to the piston).

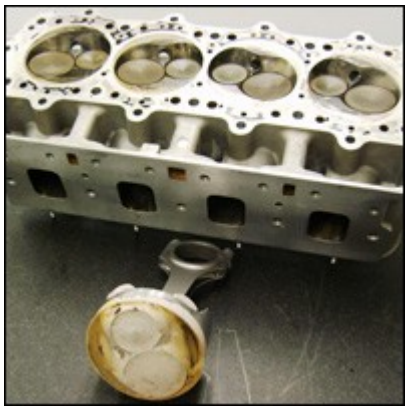
Drill three or four holes (1/8" - 3/8" dia) through the top of an old piston and assemble it on a connecting rod (rings and pin locks are not necessary).

Install the piston/rod assembly on the crankshaft with the main bearings in place.


Install the dowel pins in the block, then install the valves and spark plug in the cylinder head. (Use an electrode cover on the spark plug as described in procedure one.) Then pour the molding compound on top of the piston as shown in the picture below.


With the block fastened to an engine stand, bolt the head to the block and rotate it until the deck of the block is level with the floor and upside down. Then rotate the crankshaft, pressing the piston into the mold compound and allowing the compound to squish through the drilled holes.

Once the compound has cured, remove the cylinder head from the block, the connecting rod from the crank, and piston/mold from the connecting rod.

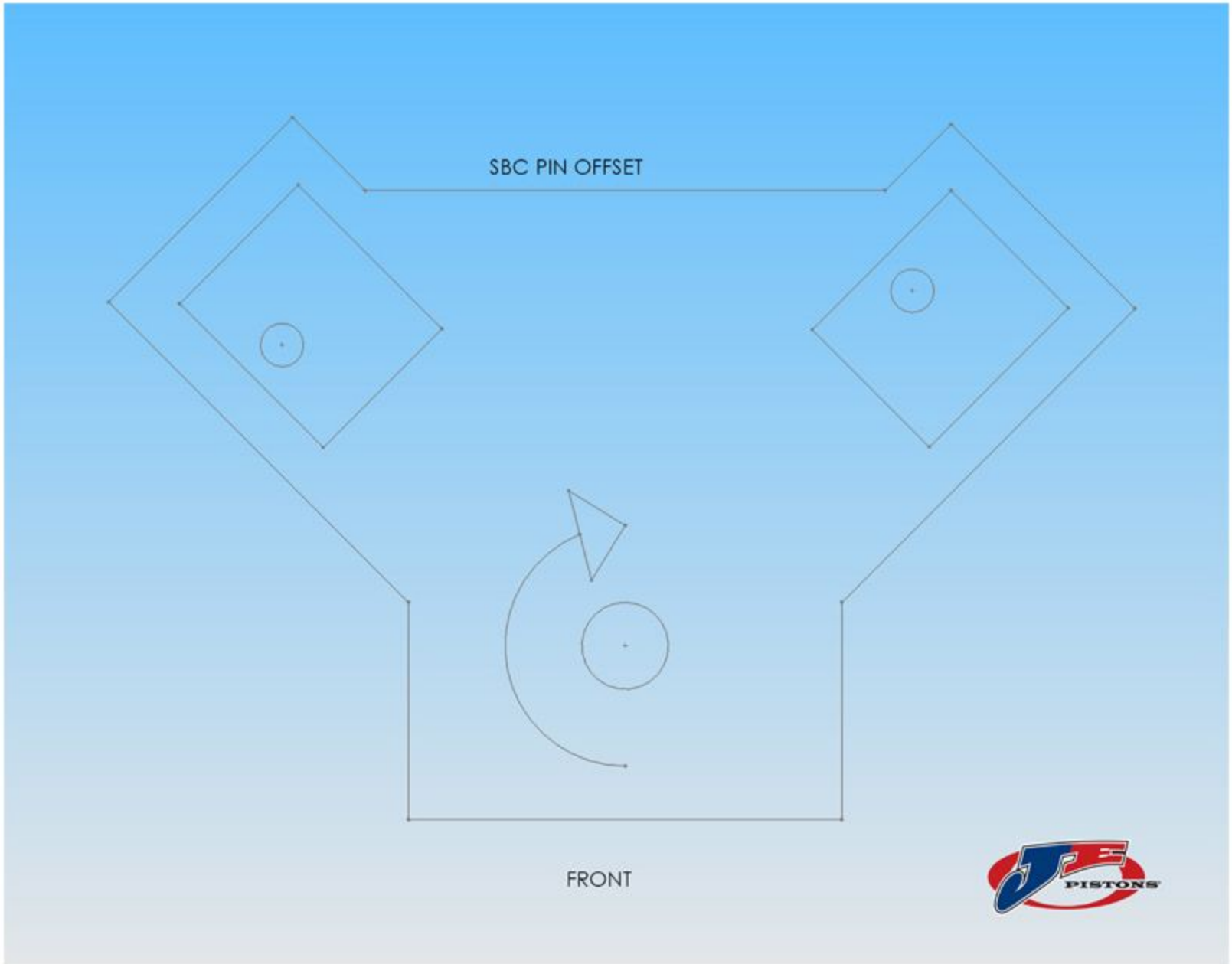
Plug reliefs and/or flame slots can either be put in place with clay beforehand or cut out of the finished mold.

Note: The position of the mold in relation to the bore and wrist pin centerline is critical! Please mark it on the mold with a thin, sharp scribed line. Lines made with Sharpie markers are not accurate enough to be used.

Note: Allow molding compound to completely cure before disassembly!

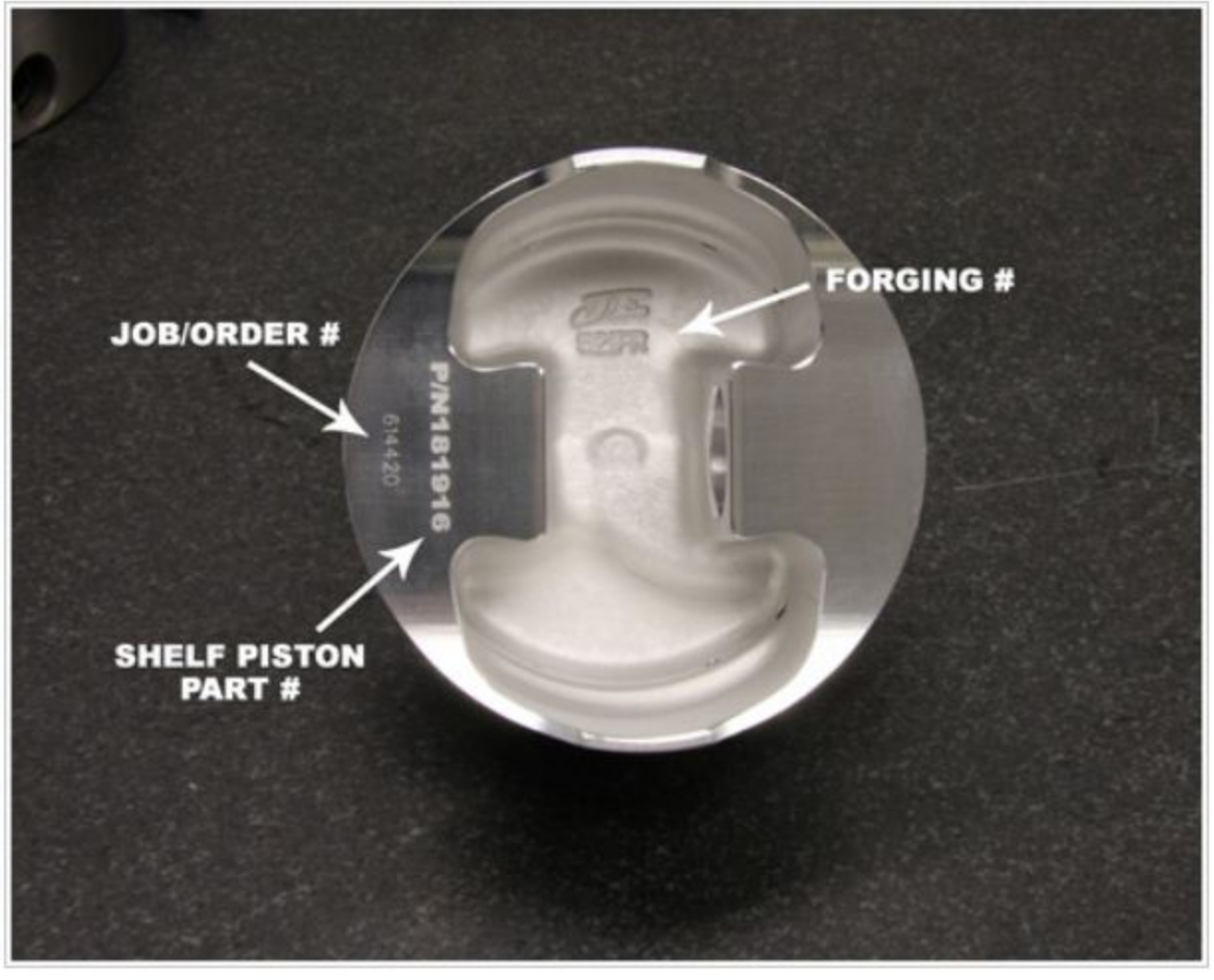
Note: Do not send press fit piston/rod assemblies as we cannot press them apart at our plant!

WRIST PIN OFFSET EXAMPLE



HOW TO IDENTIFY JE/SRP PISTONS

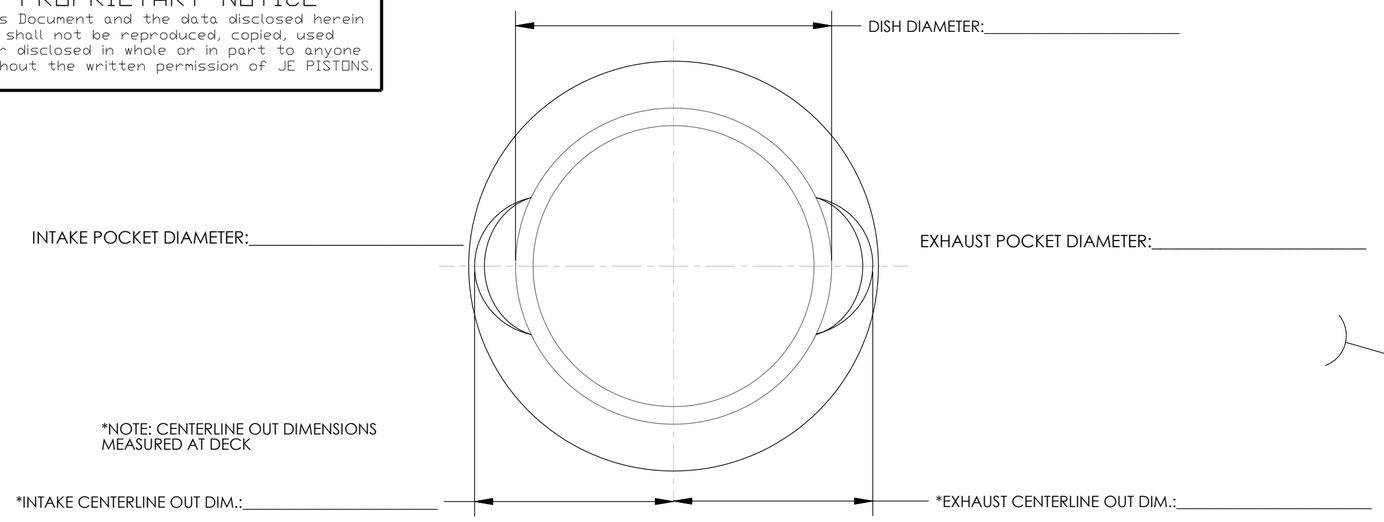
All JE and SRP Pistons will have "JE" or "SRP" forged or laser engraved on the underside of the piston. If your piston does not have these marks, it was not manufactured by JE or SRP Pistons. Please use the information below to identify your piston.

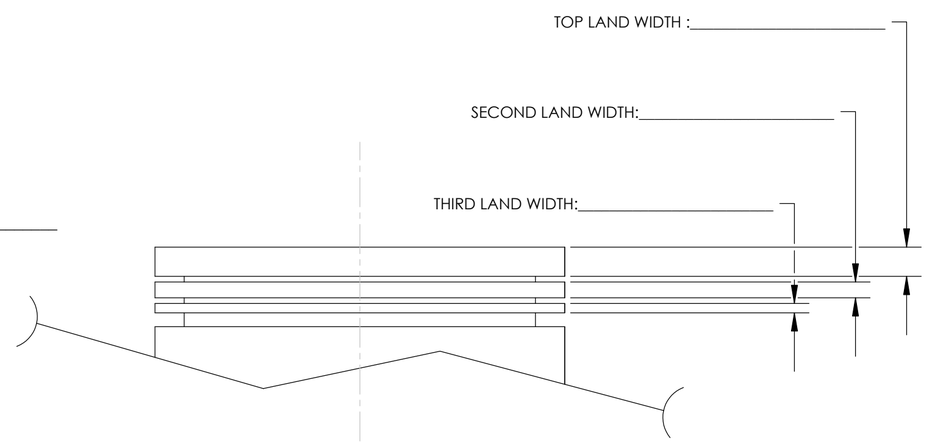


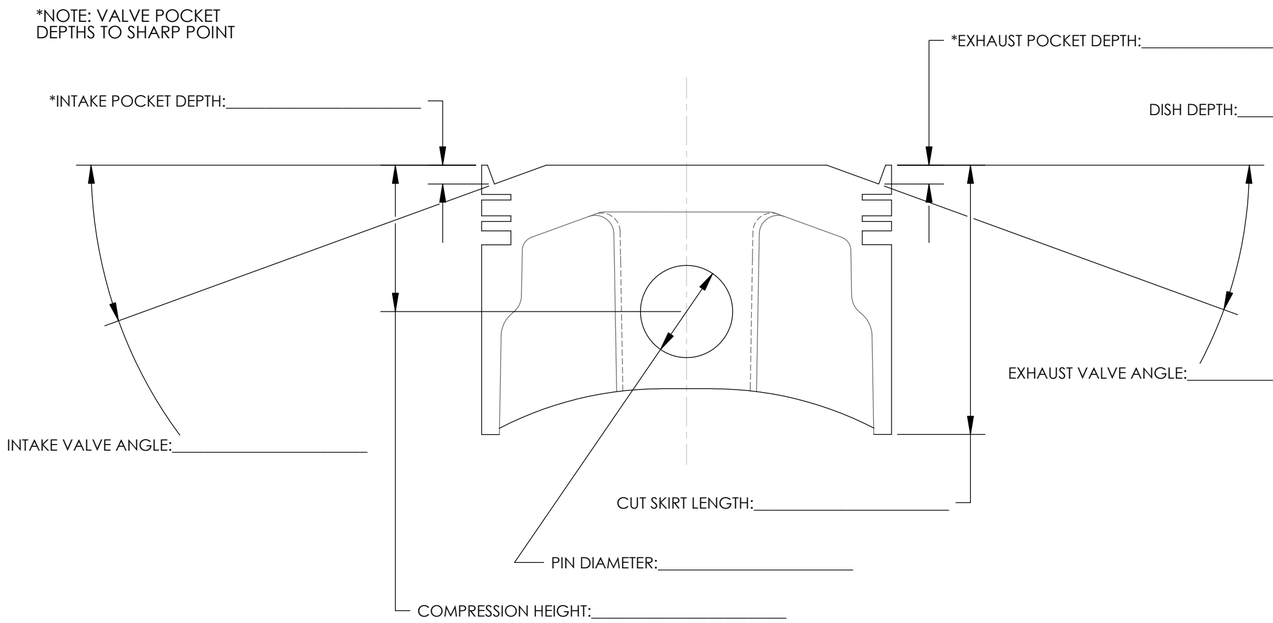
Job # : This 6-digit number is located on both custom and off-the-shelf pistons. Use this number to reorder custom pistons and/or locate replacement components for custom pistons (wrist pins/locks/rings).

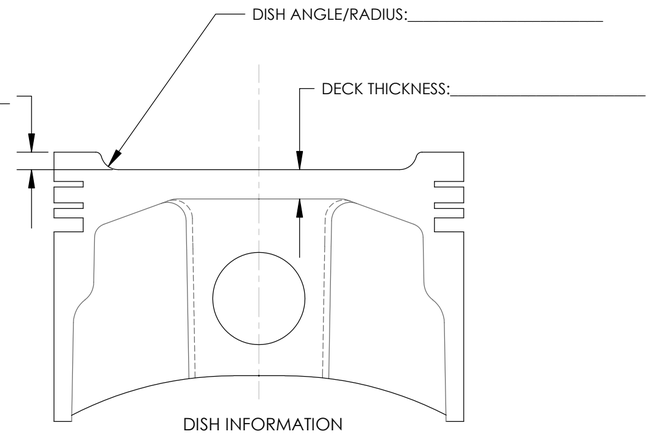
Shelf Piston Part # : A 6-digit number beginning with P/N indicates an off-the-shelf, catalog item. Use this number to re-order off-the-shelf pistons. Custom pistons will not have this number.

Forging # : This number ONLY identifies the raw forging that was used to manufacture the piston. A large variety of bore sizes, compression heights and other design features can be applied to a single forging.





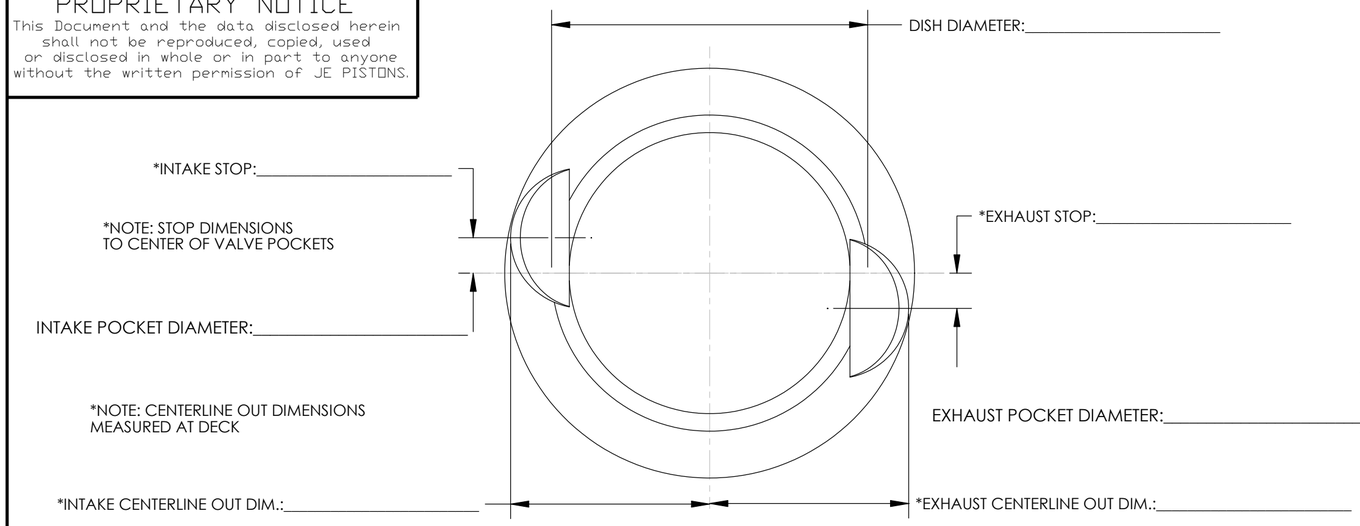


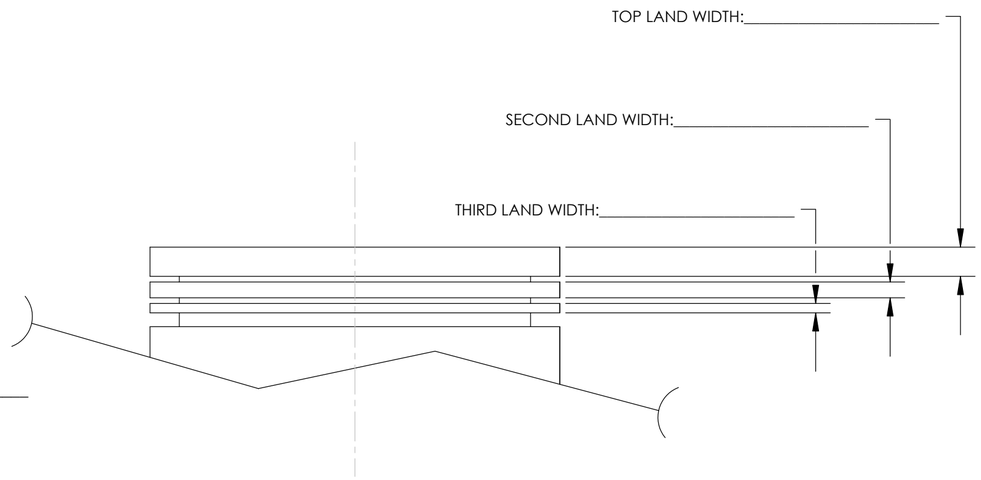


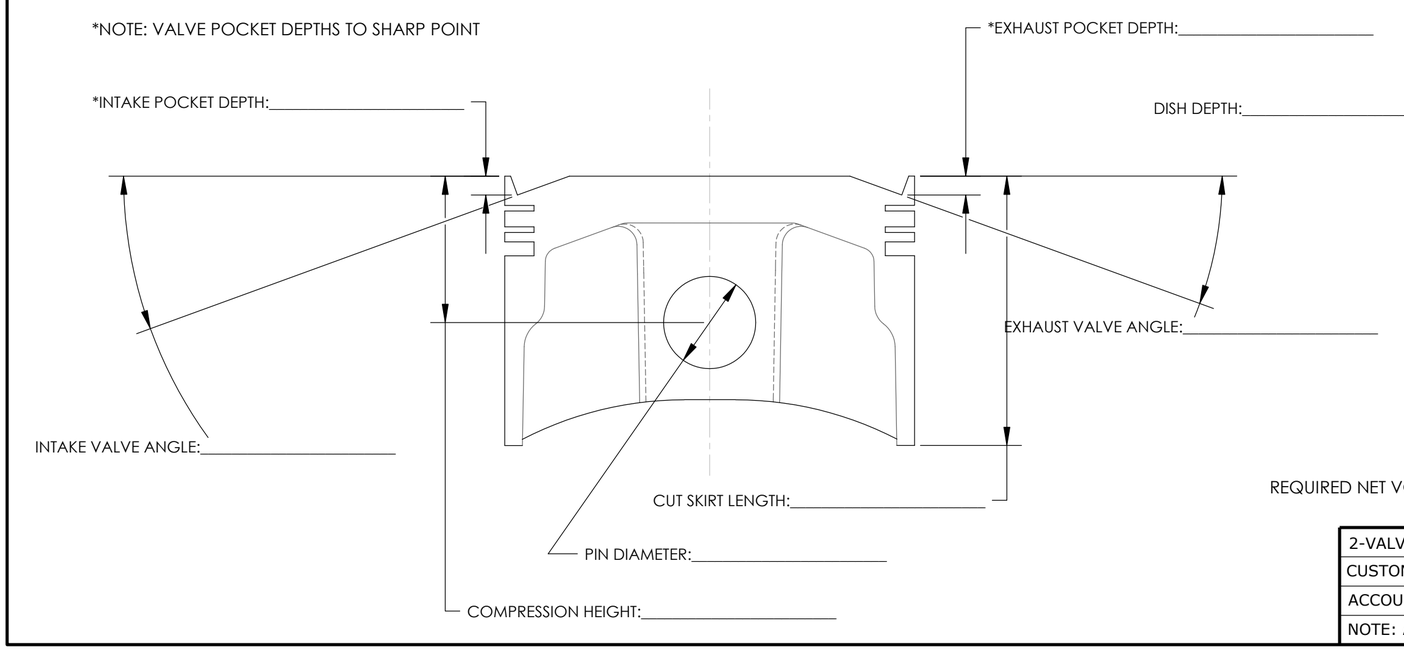
DISH INFORMATION

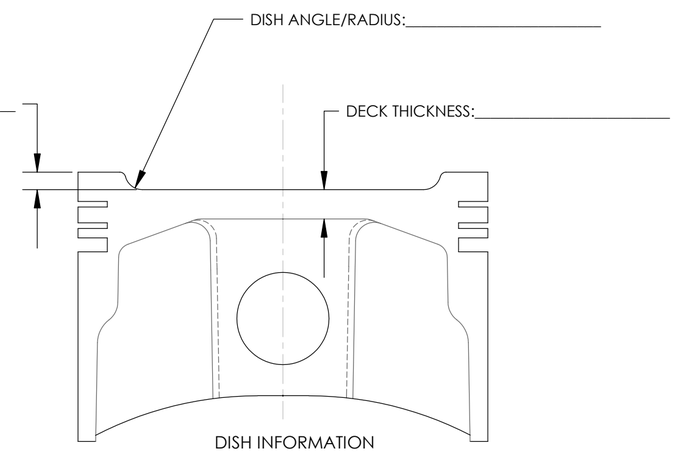
REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:

2-VALVE DISH PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	







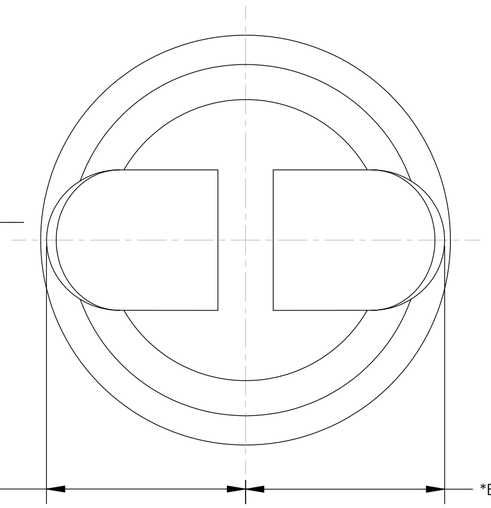


REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:

2-VALVE DISH PISTON OFFSET STOPS	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

INTAKE POCKET DIAMETER:_____

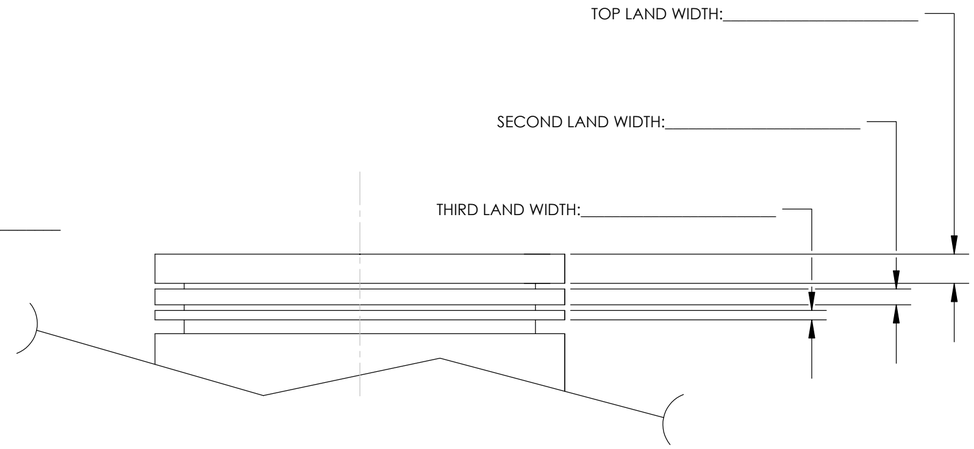
EXHAUST POCKET DIAMETER:_____



*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

*INTAKE CENTERLINE OUT DIM.:_____

*EXHAUST CENTERLINE OUT DIM.:_____

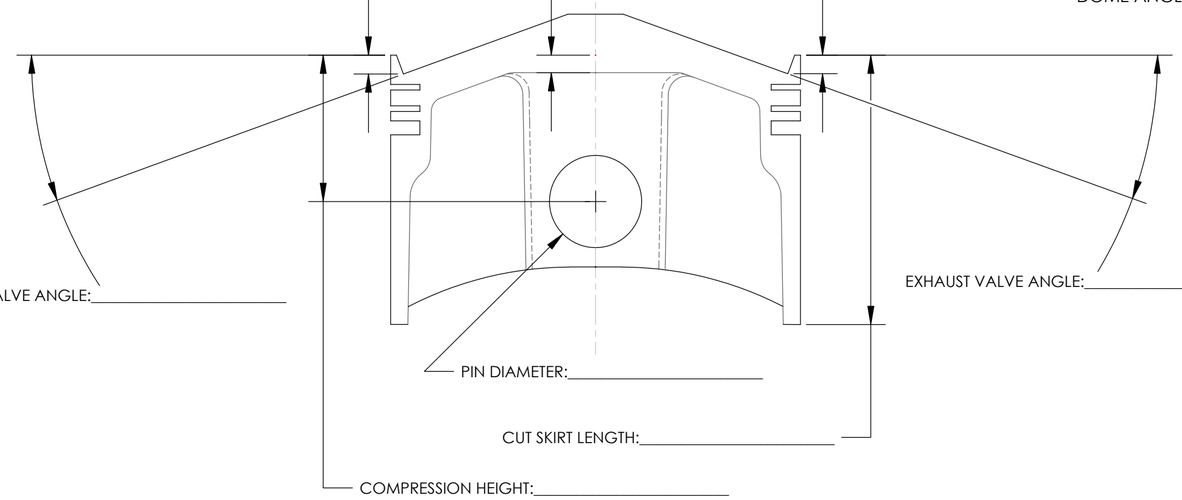


*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

*INTAKE POCKET DEPTH:_____

DECK THICKNESS:_____

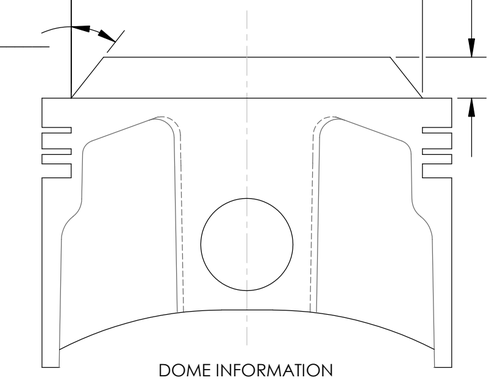
*EXHAUST POCKET DEPTH:_____



DOME DIAMETER:_____

DOME HEIGHT:_____

DOME ANGLE:_____



DOME INFORMATION

REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:_____

2-VALVE DOME PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

*INTAKE STOP:_____

*NOTE: STOP DIMENSIONS TO CENTER OF VALVE POCKETS

*EXHAUST STOP:_____

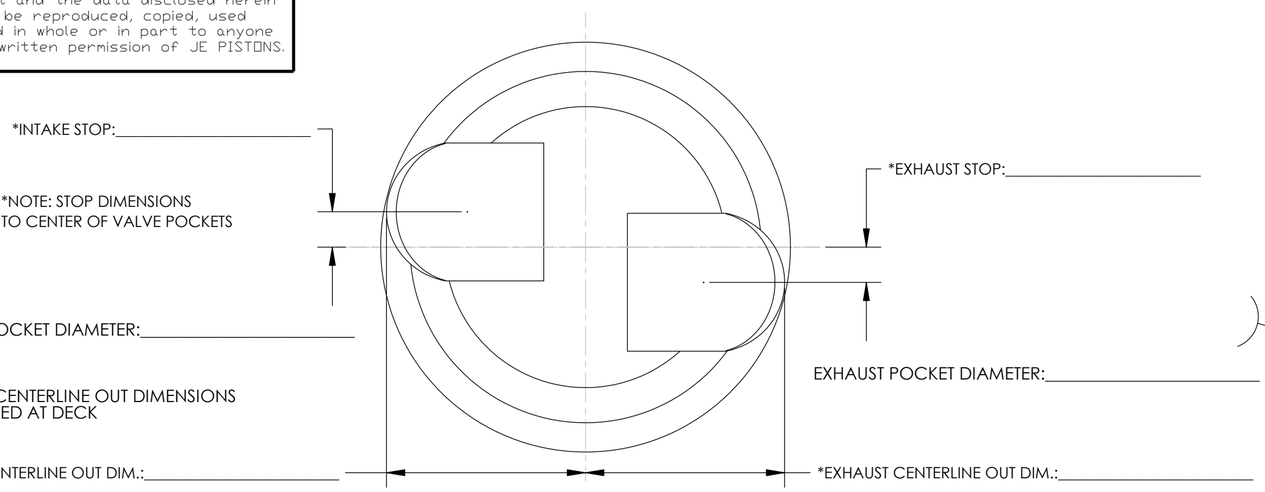
INTAKE POCKET DIAMETER:_____

EXHAUST POCKET DIAMETER:_____

*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

*INTAKE CENTERLINE OUT DIM.:_____

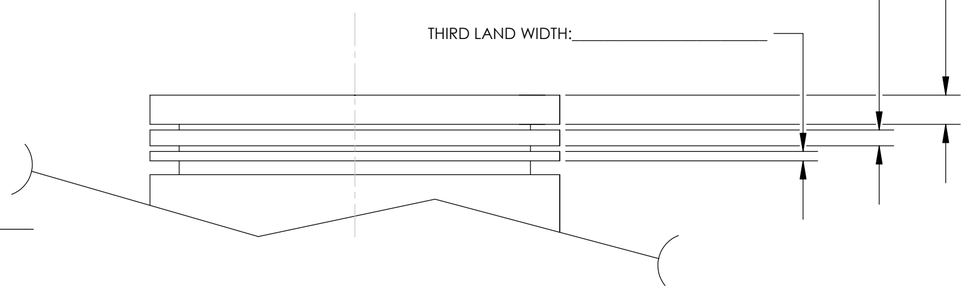
*EXHAUST CENTERLINE OUT DIM.:_____



TOP LAND WIDTH:_____

SECOND LAND WIDTH:_____

THIRD LAND WIDTH:_____



DECK THICKNESS:_____

*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

*INTAKE POCKET DEPTH:_____

*EXHAUST POCKET DEPTH:_____

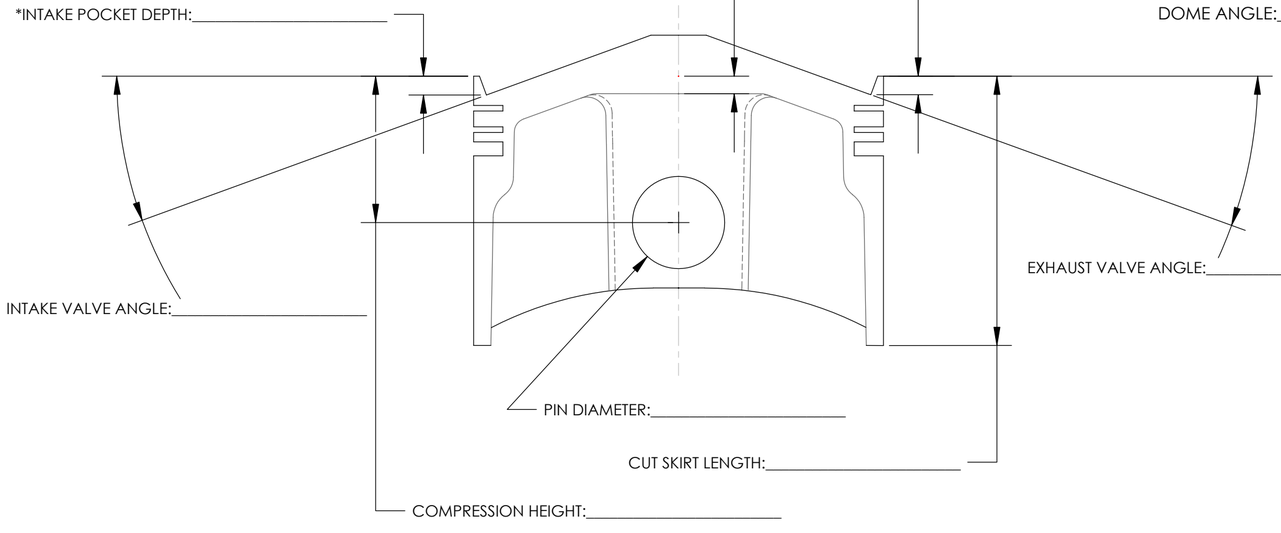
INTAKE VALVE ANGLE:_____

EXHAUST VALVE ANGLE:_____

PIN DIAMETER:_____

CUT SKIRT LENGTH:_____

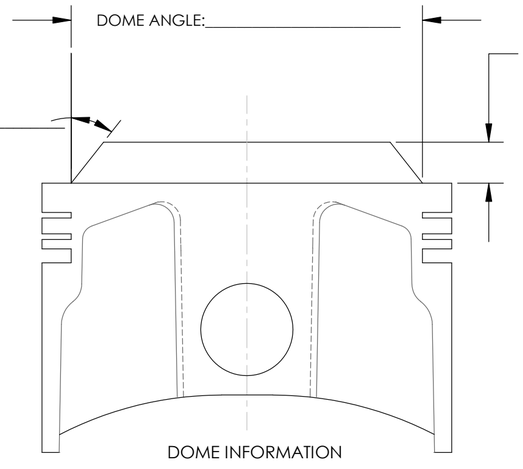
COMPRESSION HEIGHT:_____



DOME ANGLE:_____

DOME HEIGHT :_____

DOME ANGLE:_____



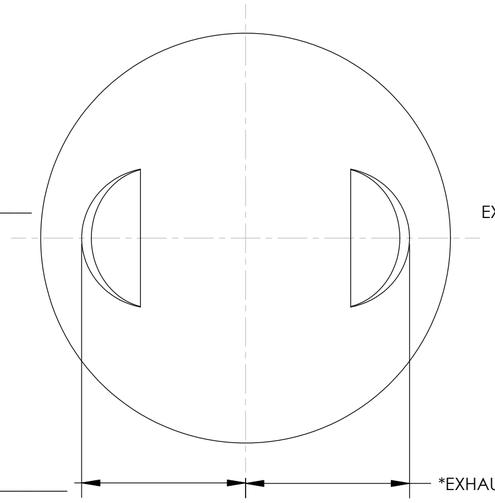
DOME INFORMATION

REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:_____

2-VALVE DOME PISTON OFFSET STOPS	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

INTAKE POCKET DIAMETER:_____

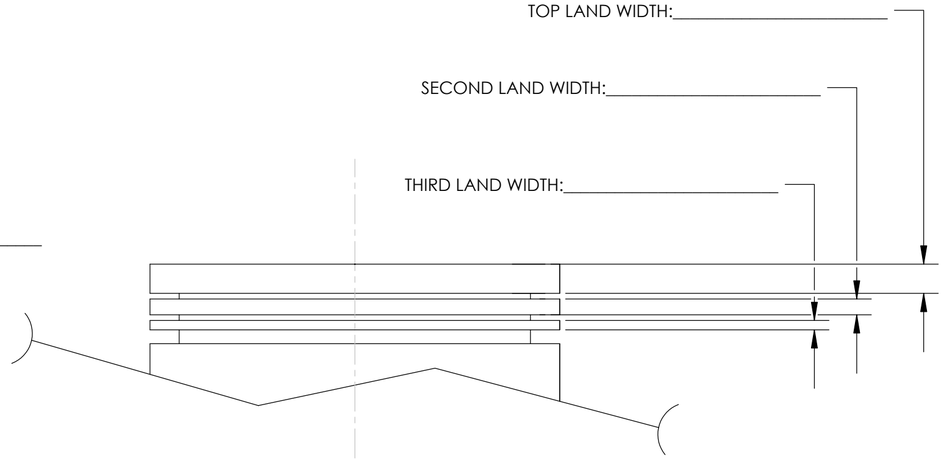
EXHAUST POCKET DIAMETER:_____



*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

*INTAKE CENTERLINE OUT DIM.:_____

*EXHAUST CENTERLINE OUT DIM.:_____

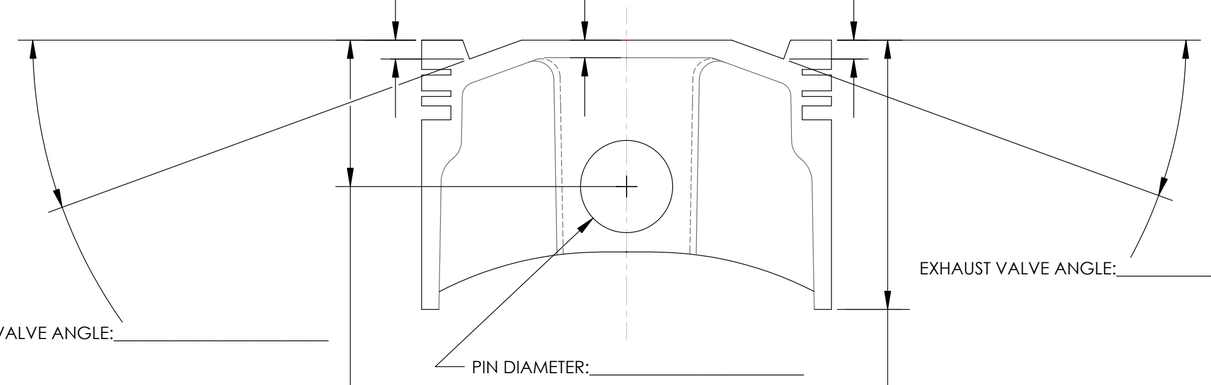


DECK THICKNESS:_____

*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

*INTAKE POCKET DEPTH:_____

*EXHAUST POCKET DEPTH:_____



EXHAUST VALVE ANGLE:_____

INTAKE VALVE ANGLE:_____

PIN DIAMETER:_____

COMPRESSION HEIGHT:_____

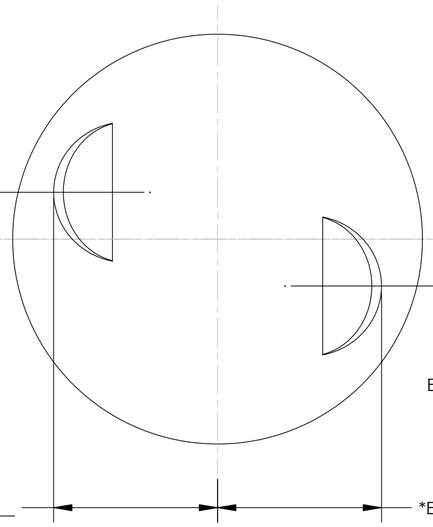
CUT SKIRT LENGTH:_____

2-VALVE FLAT TOP PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

*INTAKE STOP:_____

*NOTE: STOP DIMENSIONS TO CENTER OF VALVE POCKETS

*EXHAUST STOP:_____



INTAKE POCKET DIAMETER:_____

EXHAUST POCKET DIAMETER:_____

*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

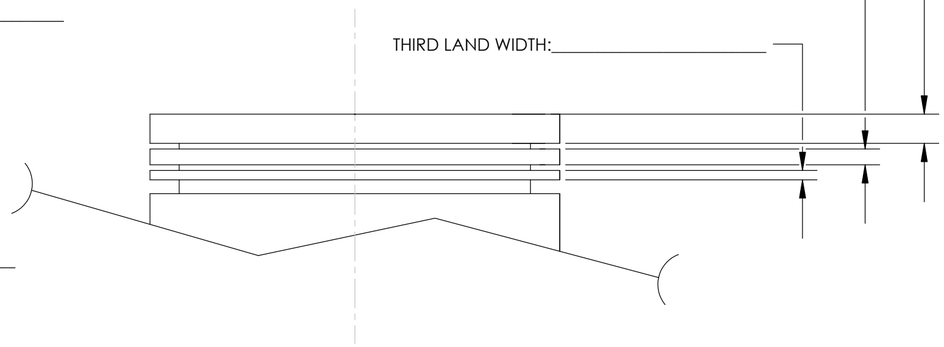
*INTAKE CENTERLINE OUT DIM.:_____

*EXHAUST CENTERLINE OUT DIM.:_____

TOP LAND WIDTH:_____

SECOND LAND WIDTH:_____

THIRD LAND WIDTH:_____

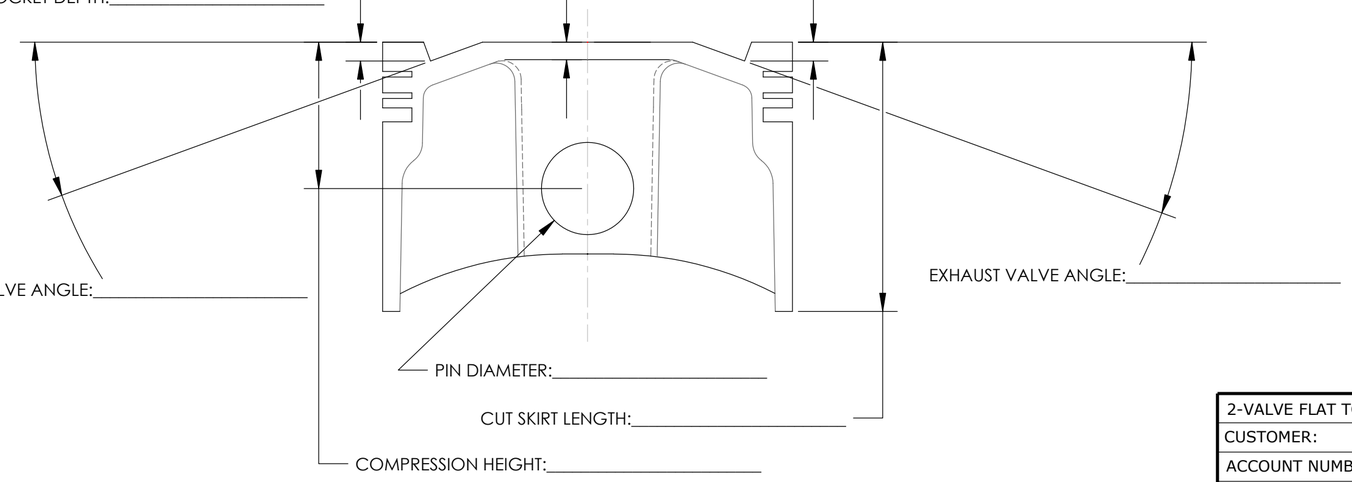


*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

DECK THICKNESS:_____

*INTAKE POCKET DEPTH:_____

*EXHAUST POCKET DEPTH:_____



INTAKE VALVE ANGLE:_____

EXHAUST VALVE ANGLE:_____

PIN DIAMETER:_____

CUT SKIRT LENGTH:_____

COMPRESSION HEIGHT:_____

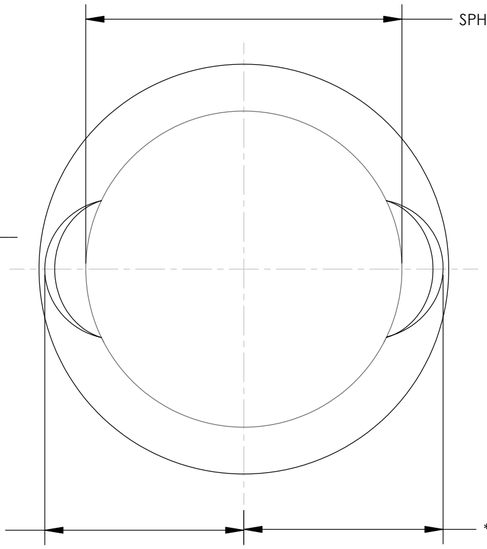
2-VALVE FLAT TOP PISTON OFFSET STOPS	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

SPHERICAL DISH DIAMETER:_____

INTAKE POCKET DIAMETER:_____

EXHAUST POCKET DIAMETER:_____

*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK



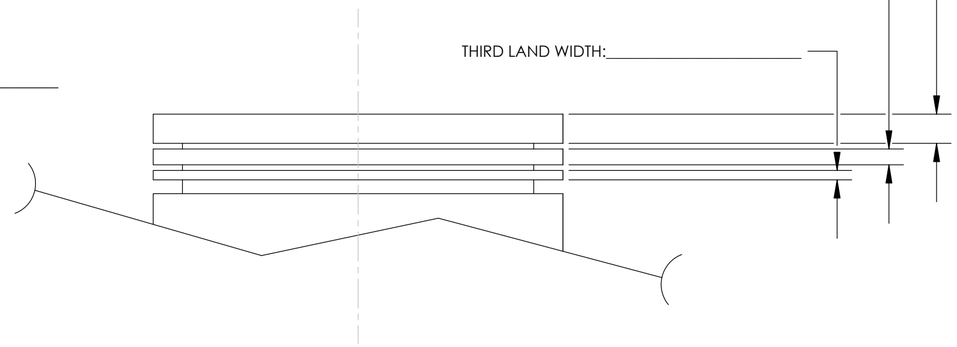
*INTAKE CENTERLINE OUT DIM.:_____

*EXHAUST CENTERLINE OUT DIM.:_____

TOP LAND WIDTH:_____

SECOND LAND WIDTH:_____

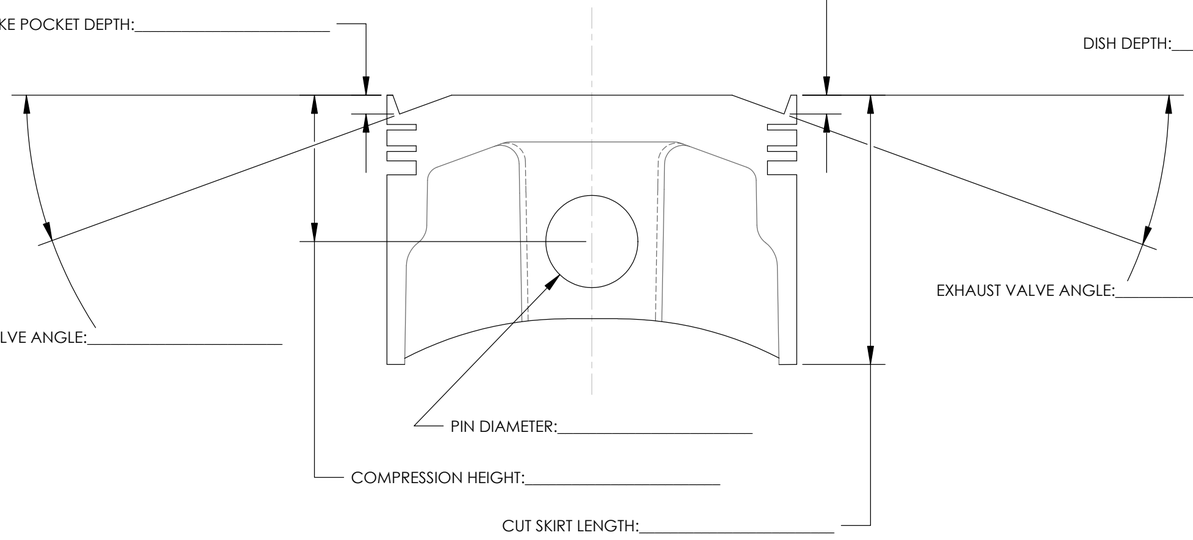
THIRD LAND WIDTH:_____



*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

*INTAKE POCKET DEPTH:_____

*EXHAUST POCKET DEPTH:_____



INTAKE VALVE ANGLE:_____

EXHAUST VALVE ANGLE:_____

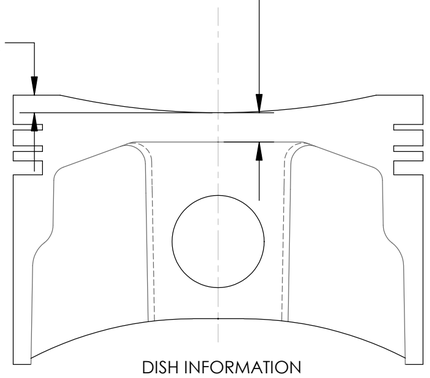
PIN DIAMETER:_____

COMPRESSION HEIGHT:_____

CUT SKIRT LENGTH:_____

DISH DEPTH:_____

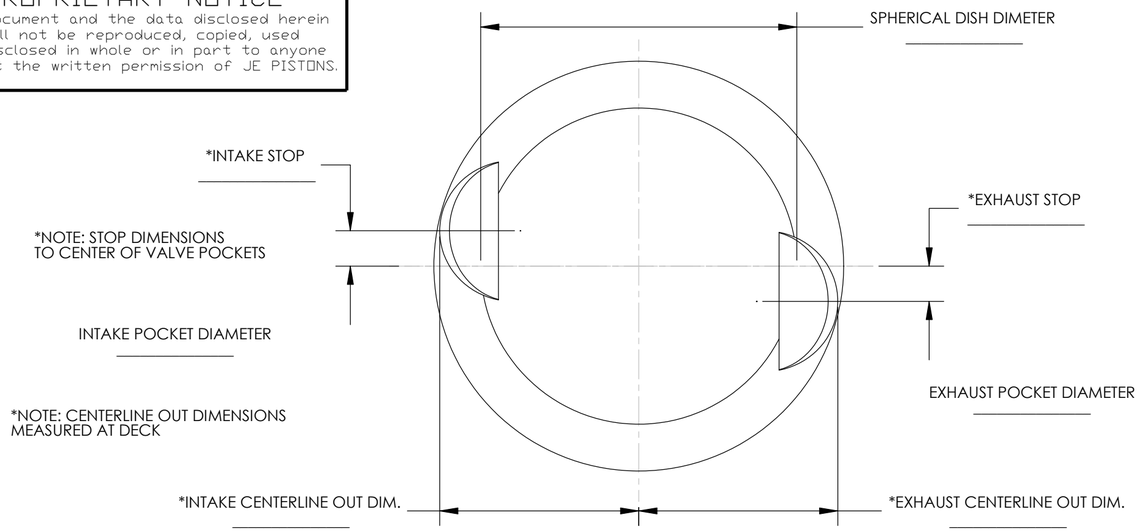
DECK THICKNESS:_____

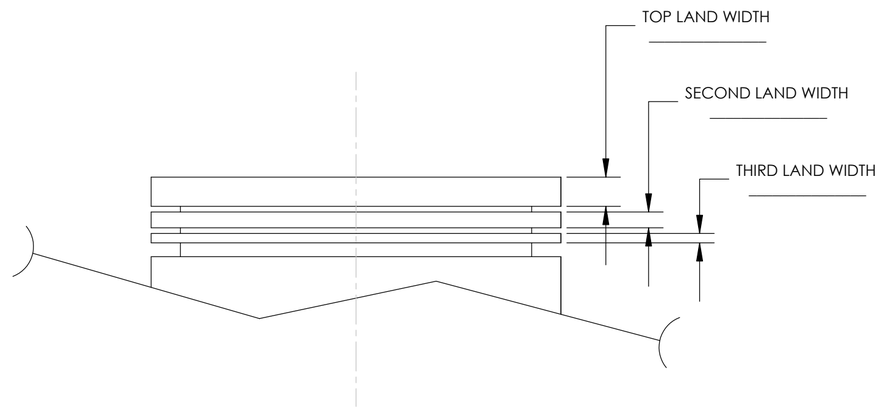


DISH INFORMATION

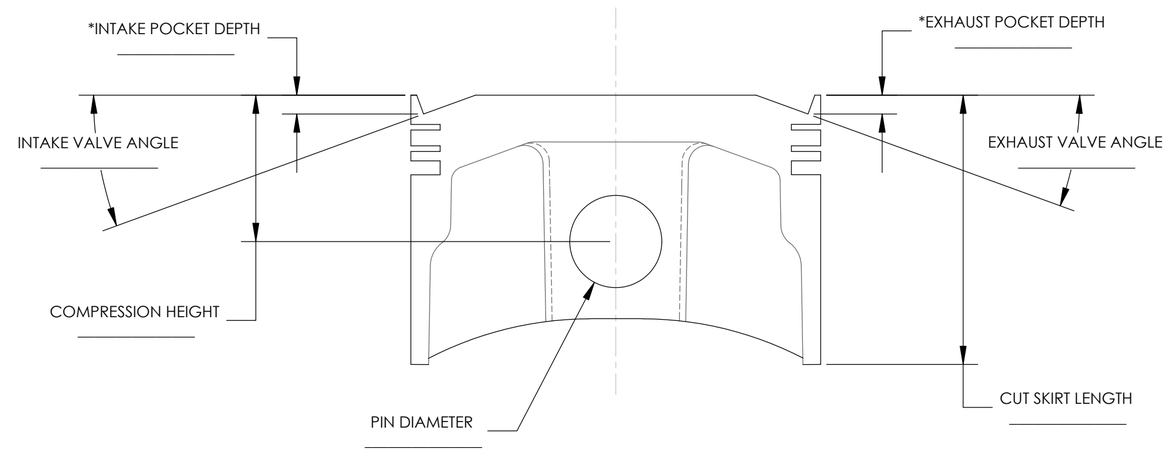
REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:_____

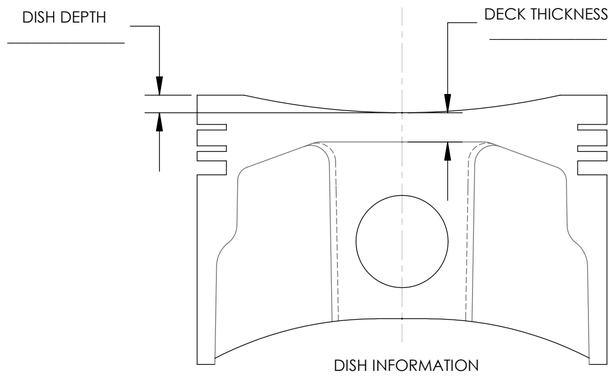
2-VALVE SPHERICAL DISH PISTON CONFIG.	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	





*NOTE: VALVE POCKET DEPTHS TO SHARP POINT





REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:

2-VALVE SPHERICAL DISH OFFSET STOPS	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

DISH DIAMETER:_____

*INTAKE STOP:_____

*EXHAUST STOP:_____

*NOTE: STOP DIMENSIONS TO CENTER OF VALVE POCKETS

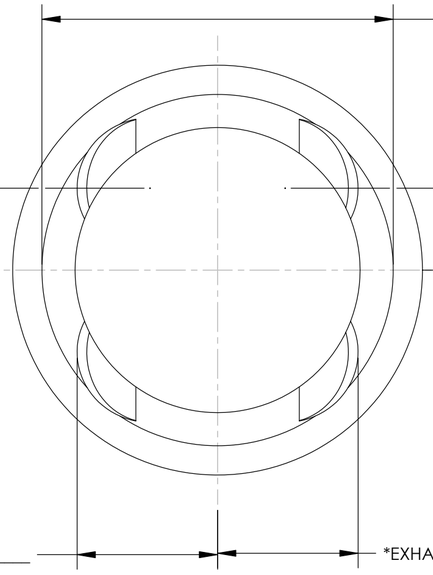
INTAKE POCKET DIAMETER:_____

EXHAUST POCKET DIAMETER:_____

*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

*INTAKE CENTERLINE OUT DIM.:_____

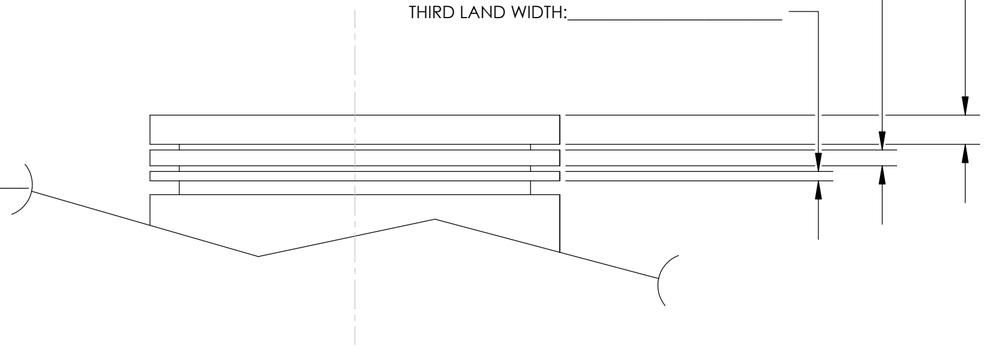
*EXHAUST CENTERLINE OUT DIM.:_____



TOP LAND WIDTH:_____

SECOND LAND WIDTH:_____

THIRD LAND WIDTH:_____

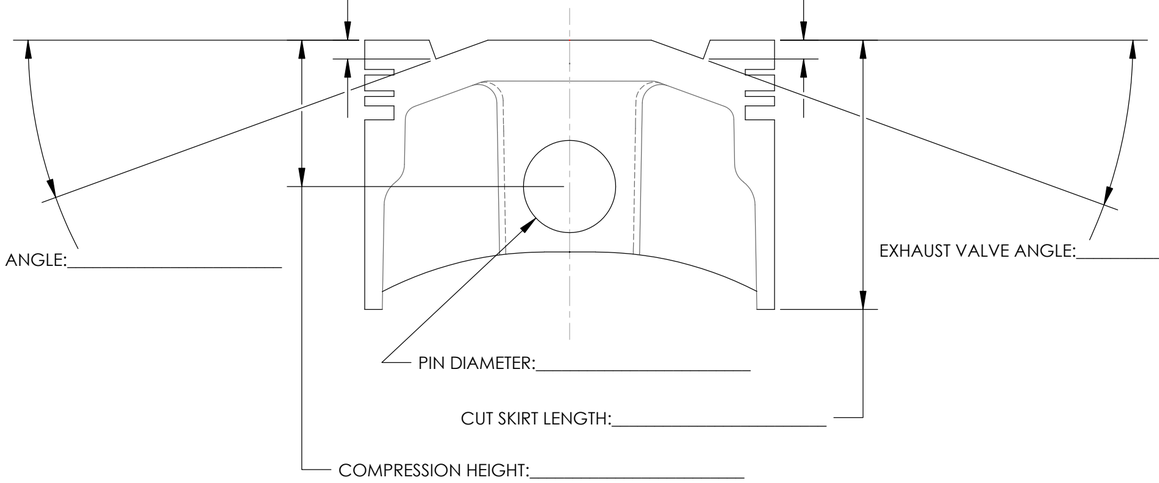


*EXHAUST POCKET DEPTH:_____

*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

*INTAKE POCKET DEPTH:_____

DISH DEPTH:_____



INTAKE VALVE ANGLE:_____

EXHAUST VALVE ANGLE:_____

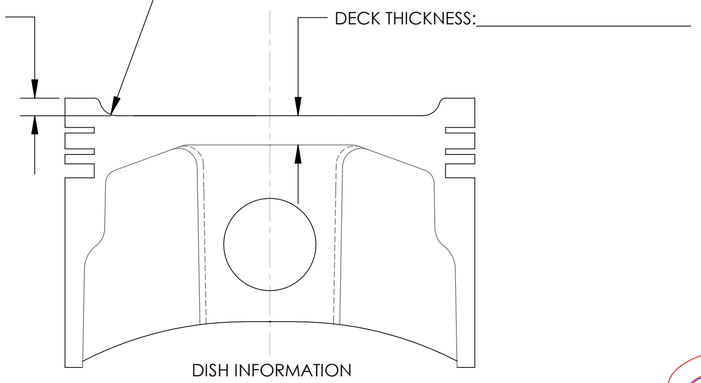
PIN DIAMETER:_____

CUT SKIRT LENGTH:_____

COMPRESSION HEIGHT:_____

DISH ANGLE/RADIUS:_____

DECK THICKNESS:_____



DISH INFORMATION

REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:_____

4-VALVE DISH PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

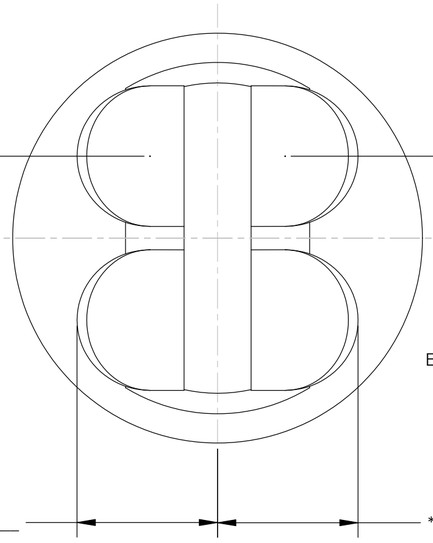
*INTAKE STOP:_____

*NOTE: STOP DIMENSIONS TO CENTER OF VALVE POCKETS

INTAKE POCKET DIAMETER:_____

*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

*EXHAUST STOP:_____



*INTAKE CENTERLINE OUT DIM.:_____

*EXHAUST CENTERLINE OUT DIM.:_____

DOME ANGLE:_____

DOME DIAMETER:_____

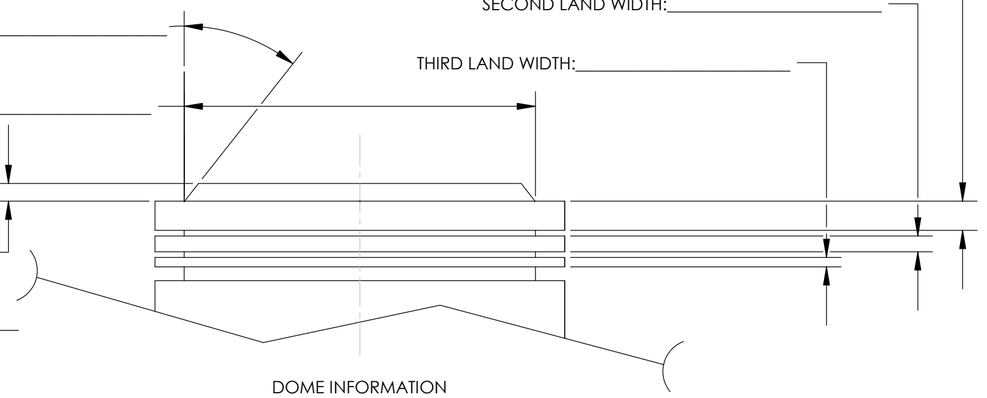
DOME HEIGHT:_____

EXHAUST POCKET DIAMETER:_____

TOP LAND WIDTH:_____

SECOND LAND WIDTH:_____

THIRD LAND WIDTH:_____



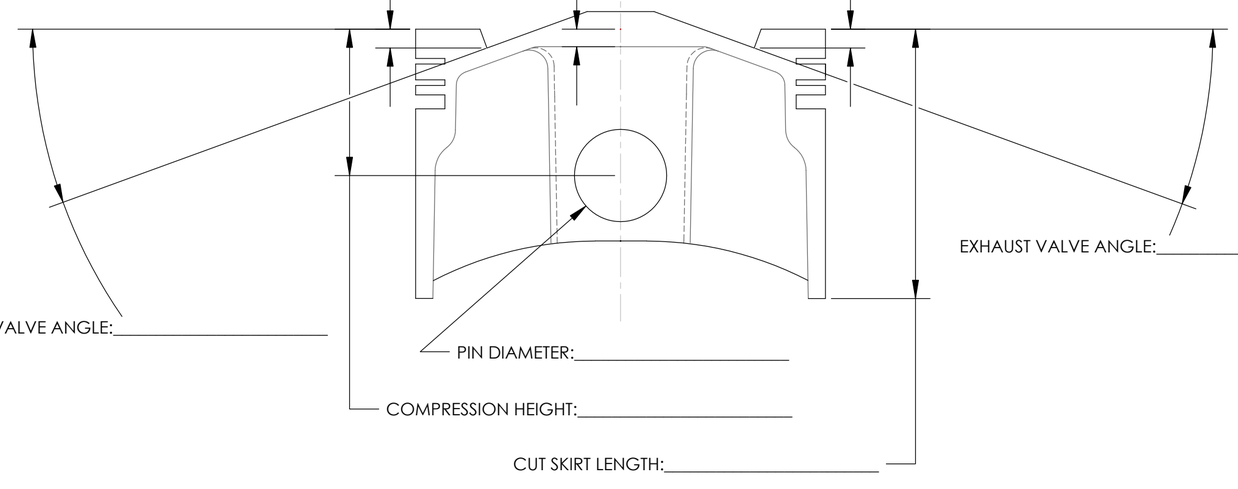
DOME INFORMATION

*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

*INTAKE POCKET DEPTH:_____

DECK THICKNESS:_____

*EXHAUST POCKET DEPTH:_____



INTAKE VALVE ANGLE:_____

PIN DIAMETER:_____

COMPRESSION HEIGHT:_____

CUT SKIRT LENGTH:_____

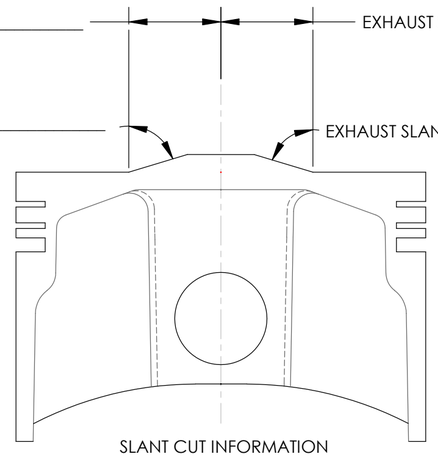
EXHAUST VALVE ANGLE:_____

INTAKE SLANT CL OUT:_____

EXHAUST SLANT CL OUT:_____

INTAKE SLANT CUT ANGLE:_____

EXHAUST SLANT CUT ANGLE:_____



SLANT CUT INFORMATION

REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:_____

4-VALVE DOME PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

*INTAKE STOP:_____

*EXHAUST STOP:_____

*NOTE: STOP DIMENSIONS TO CENTER OF VALVE POCKETS

INTAKE POCKET DIAMETER:_____

EXHAUST POCKET DIAMETER:_____

*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

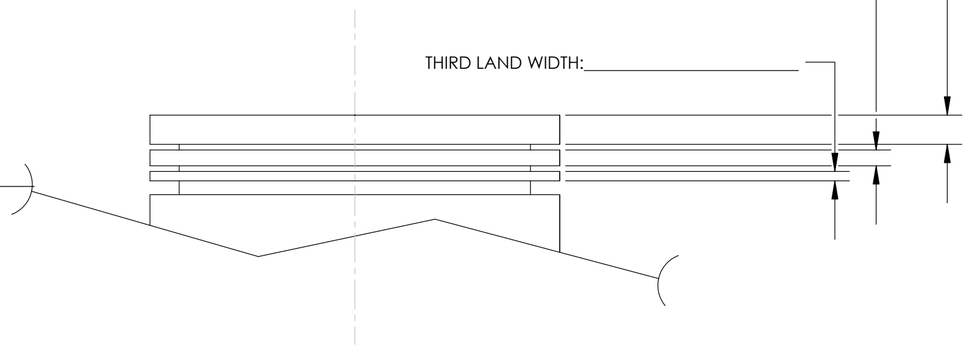
*INTAKE CENTERLINE OUT DIM.:_____

*EXHAUST CENTERLINE OUT DIM.:_____

TOP LAND WIDTH:_____

SECONE LAND WIDTH:_____

THIRD LAND WIDTH:_____

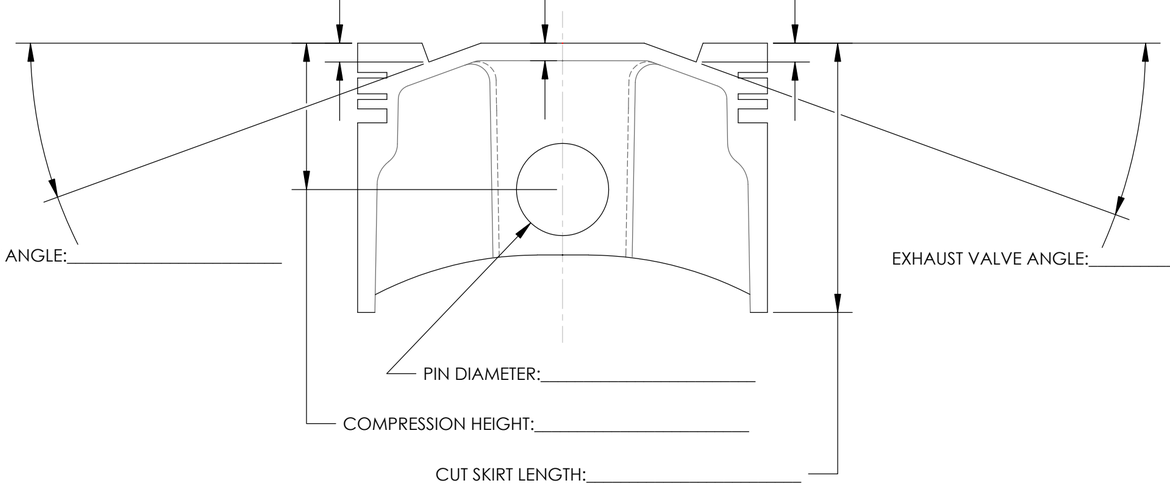


*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

DECK THICKNESS:_____

*EXHAUST POCKET DEPTH:_____

*INTAKE POCKET DEPTH:_____



INTAKE VALVE ANGLE:_____

EXHAUST VALVE ANGLE:_____

PIN DIAMETER:_____

COMPRESSION HEIGHT:_____

CUT SKIRT LENGTH:_____

4-VALVE FLAT TOP PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

SPHERICAL DISH DIAMETER:_____

*INTAKE STOP:_____

*EXHAUST STOP:_____

*NOTE: STOP DIMENSIONS TO CENTER OF VALVE POCKETS

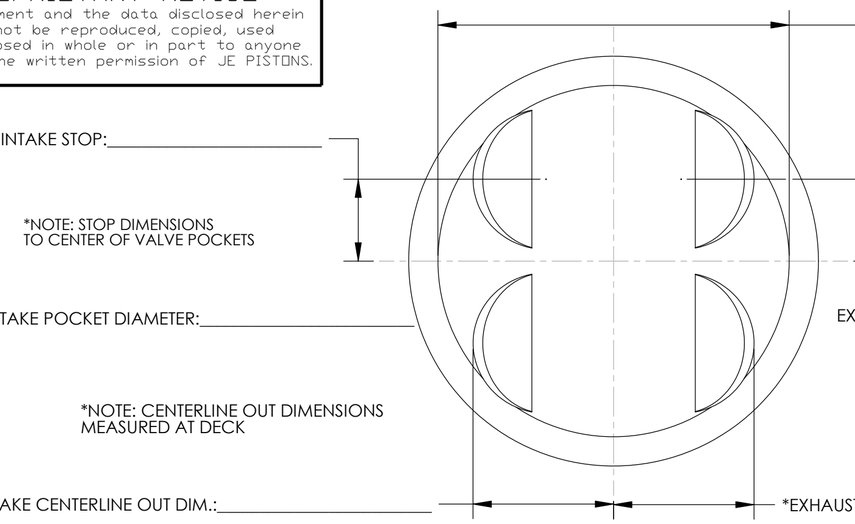
INTAKE POCKET DIAMETER:_____

EXHAUST POCKET DIAMETER:_____

*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

*INTAKE CENTERLINE OUT DIM.:_____

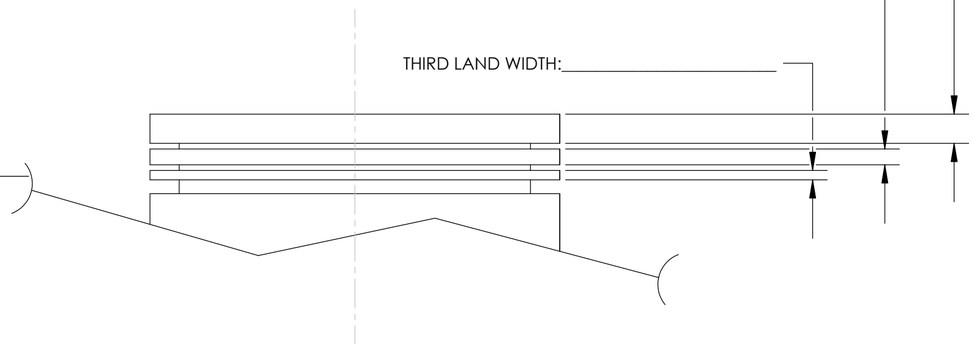
*EXHAUST CENTERLINE OUT DIM.:_____



TOP LAND WIDTH:_____

SECOND LAND WIDTH:_____

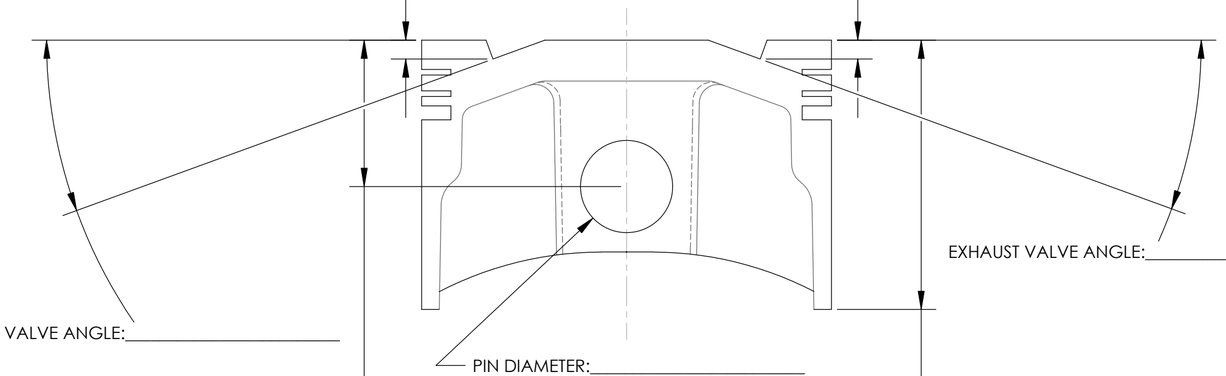
THIRD LAND WIDTH:_____



*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

*INTAKE POCKET DEPTH:_____

*EXHAUST POCKET DEPTH:_____



INTAKE VALVE ANGLE:_____

EXHAUST VALVE ANGLE:_____

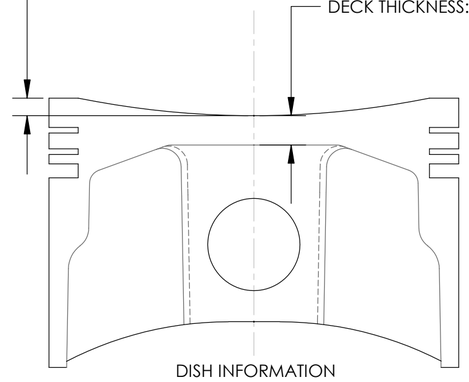
PIN DIAMETER:_____

COMPRESSION HEIGHT:_____

CUT SKIRT LENGTH:_____

DISH DEPTH:_____

DECK THICKNESS:_____

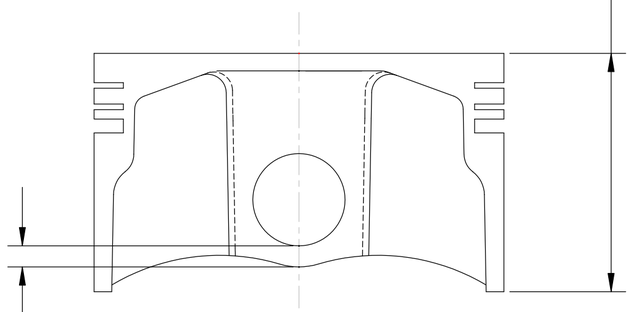


DISH INFORMATION

REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:_____

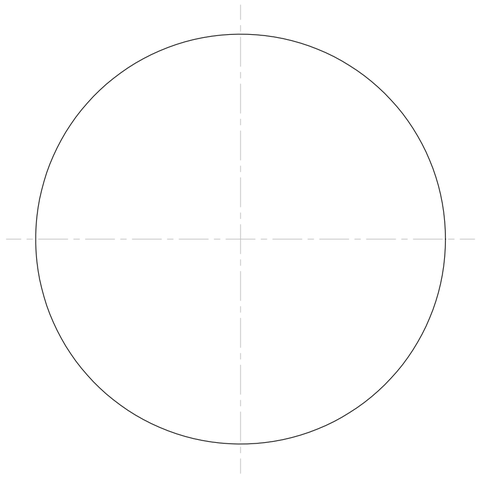
4-VALVE SPHERICAL DISH PISTON CONFIG.	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

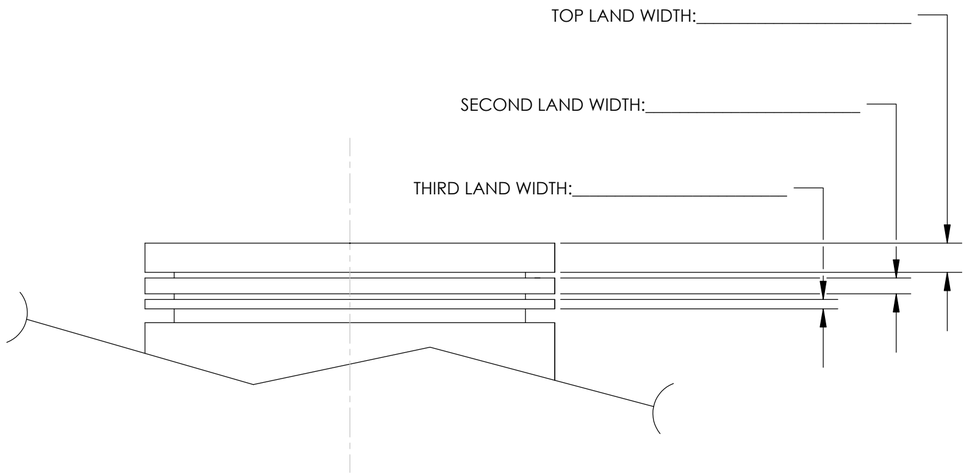
CUT SKIRT LENGTH:_____

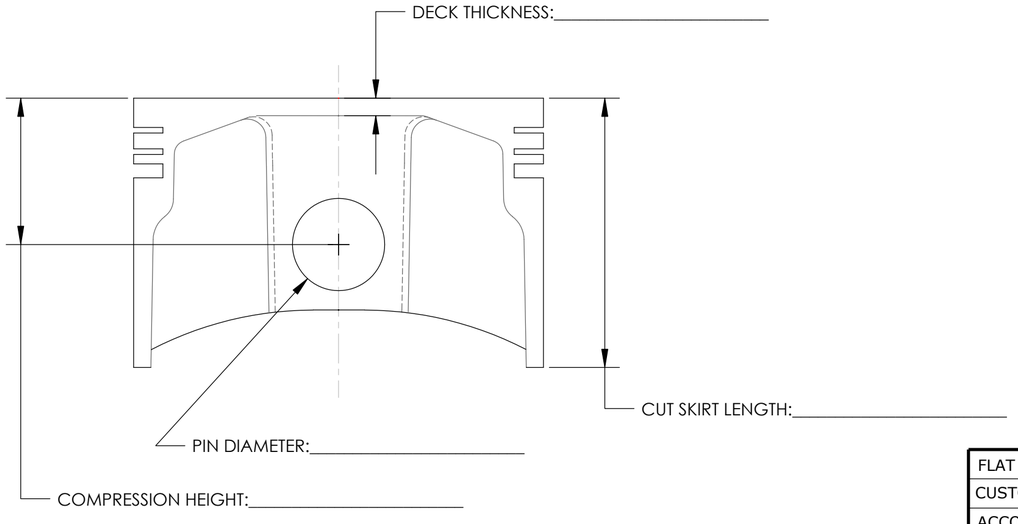


SLIPPER THICKNESS:_____

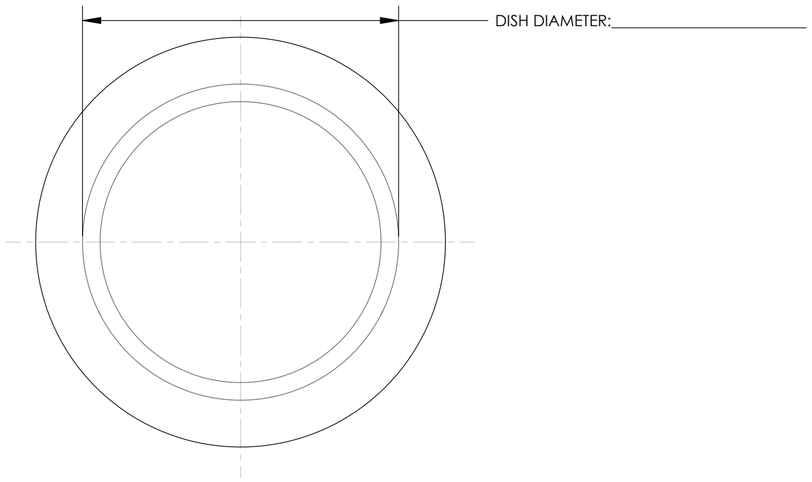
CONTOUR TANG DRAWING	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

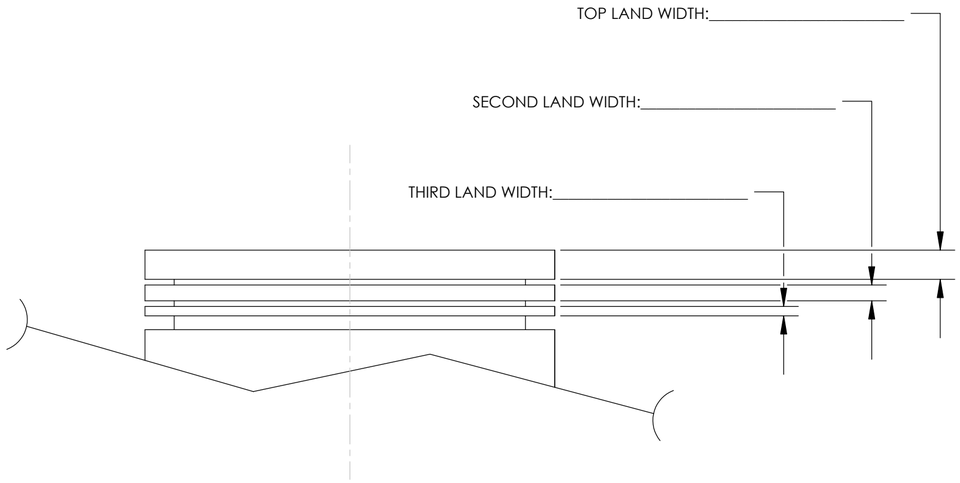


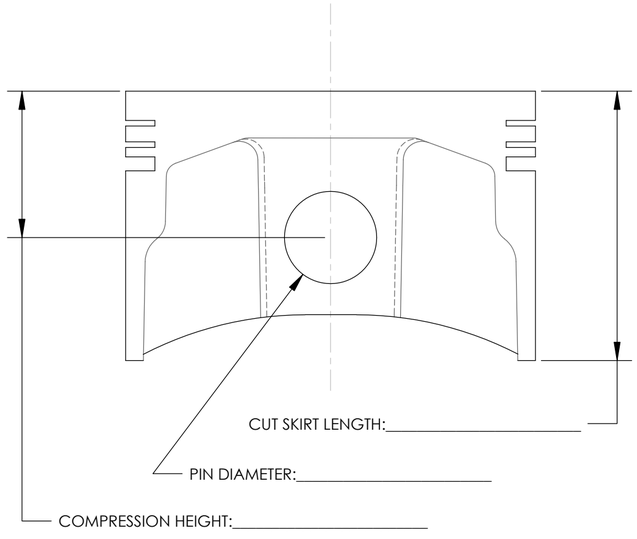


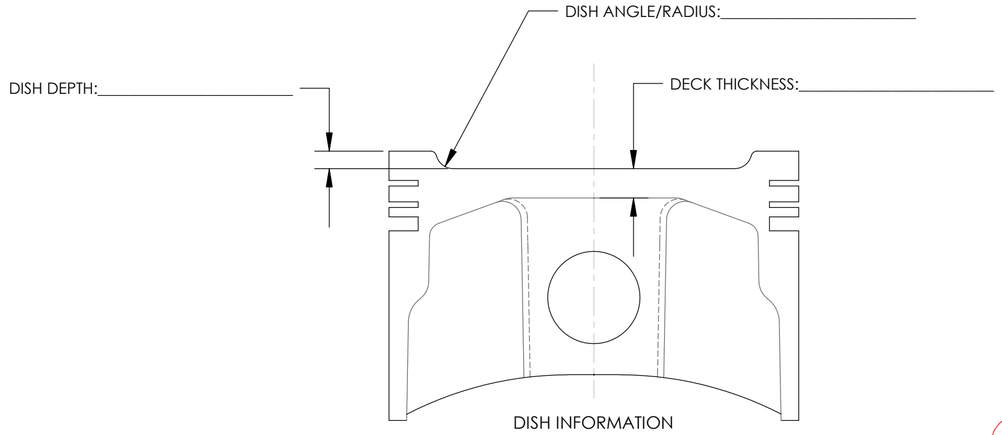


FLAT TOP PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	





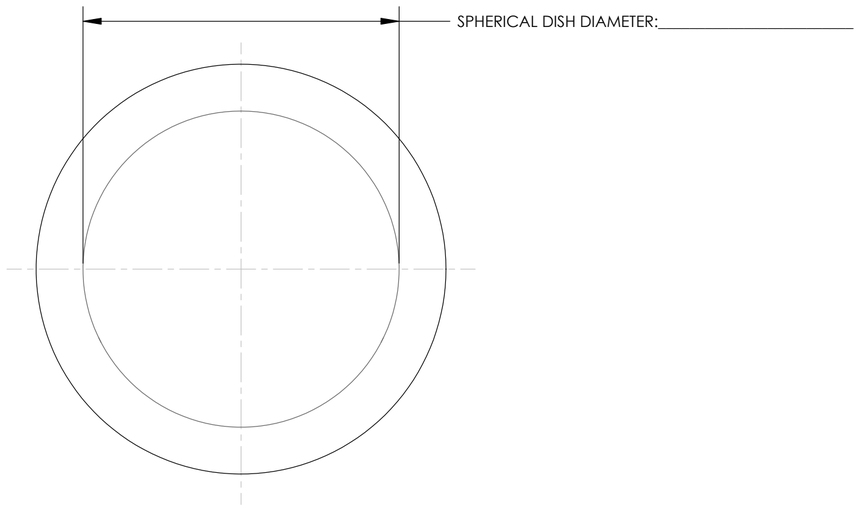


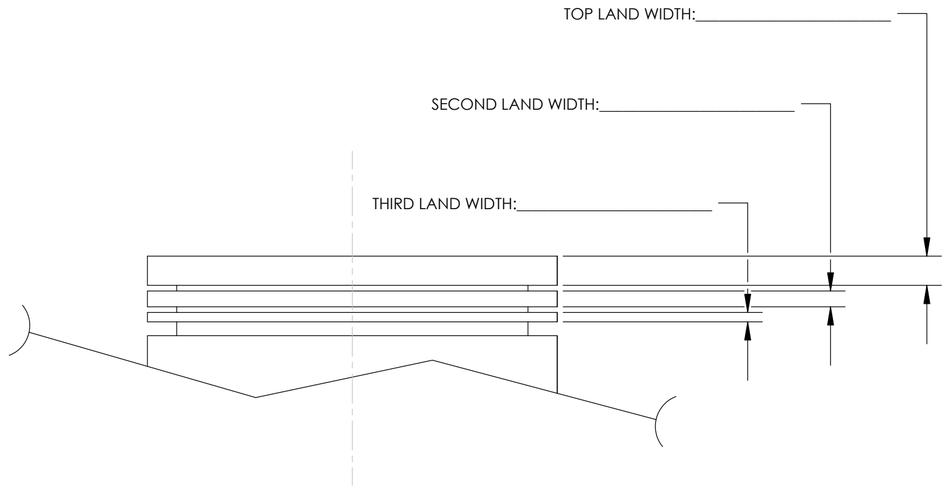


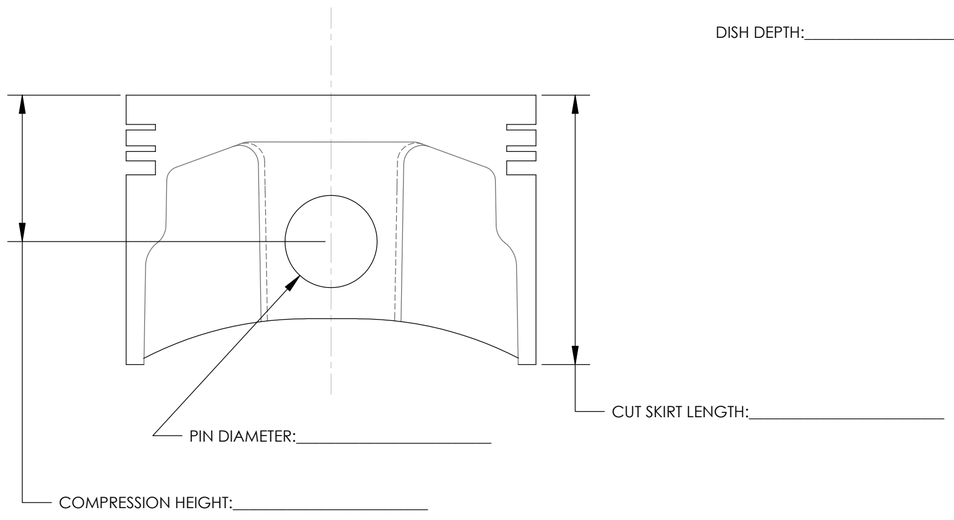
DISH INFORMATION

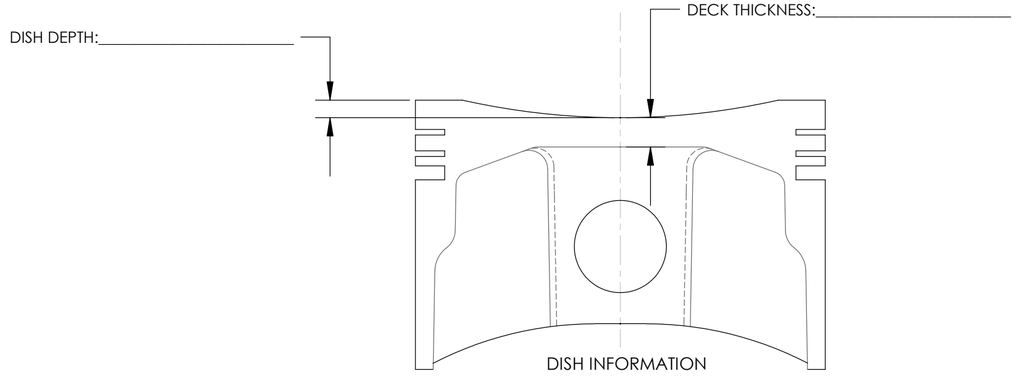
REQUIRED NET VOLUME IN CC:_____

FLAT TOP DISH PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	







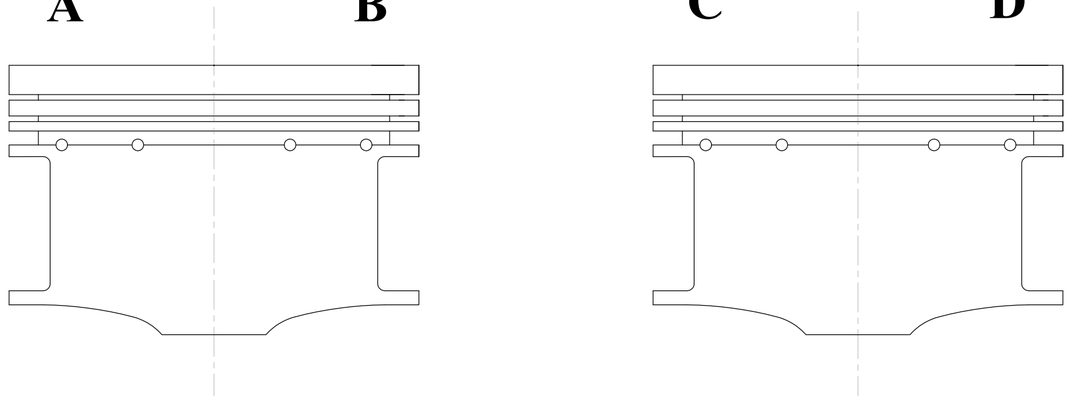


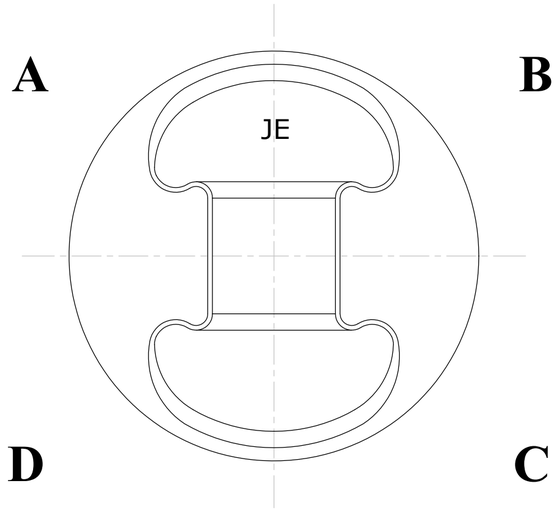
REQUIRED NET VOLUME IN CC:_____

FLAT TOP SPHERICAL DISH PISTON CONFIG.	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

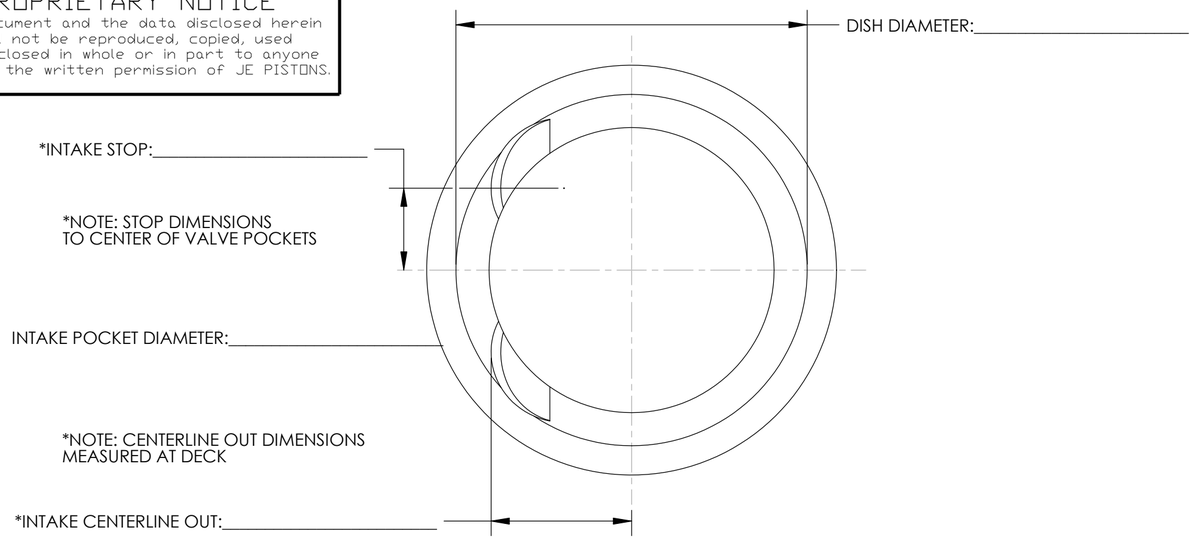
EXHAUST SIDE

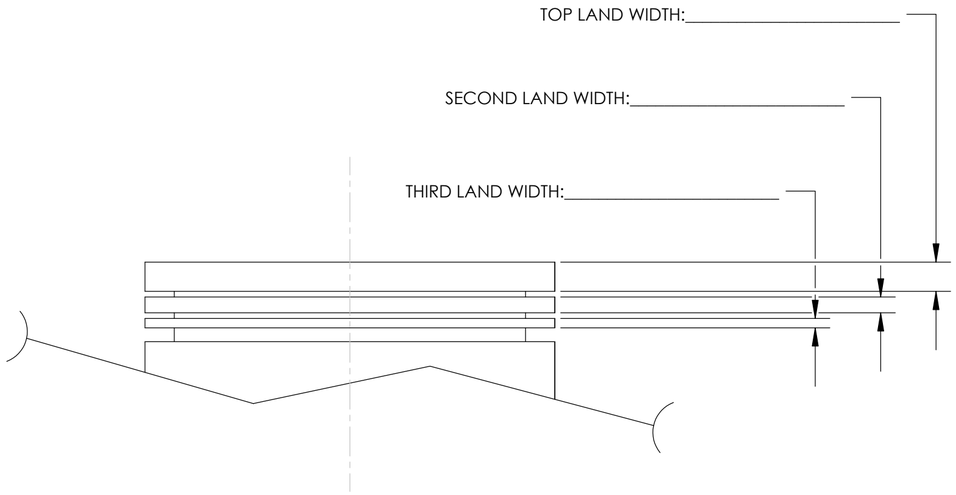
INTAKE SIDE

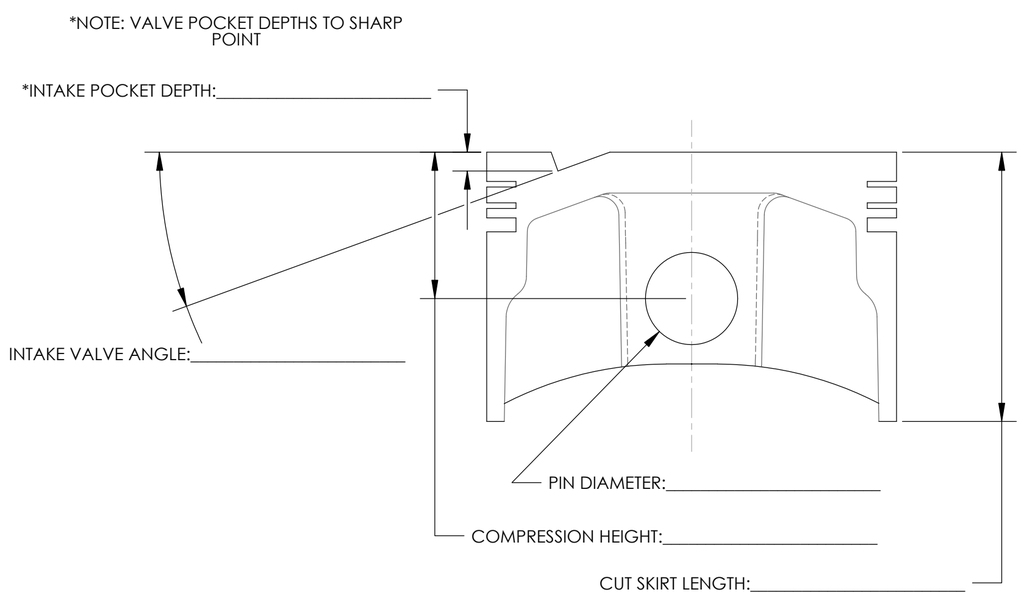


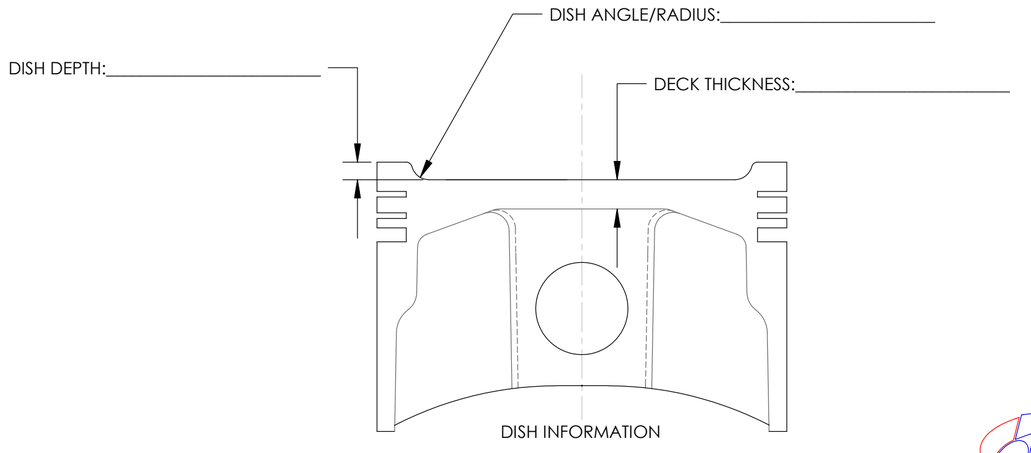


OIL SQUIRTER NOTCH DRAWING	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	





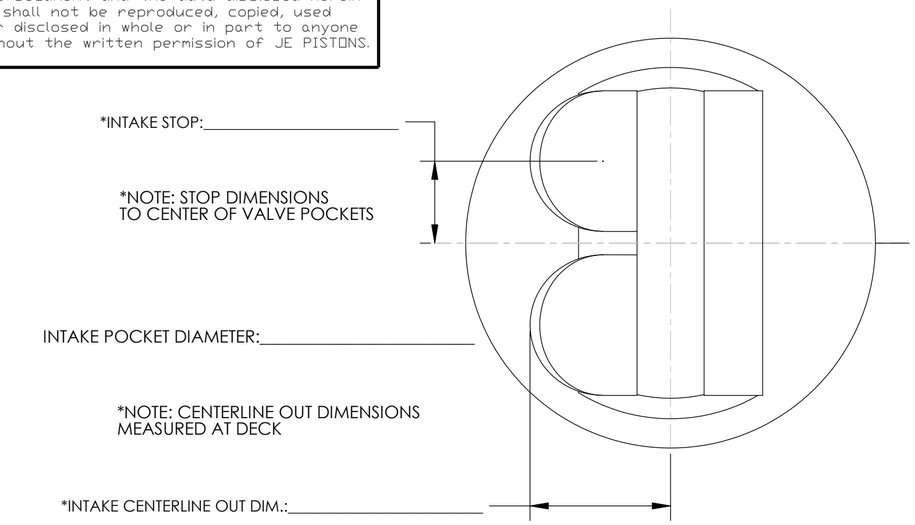


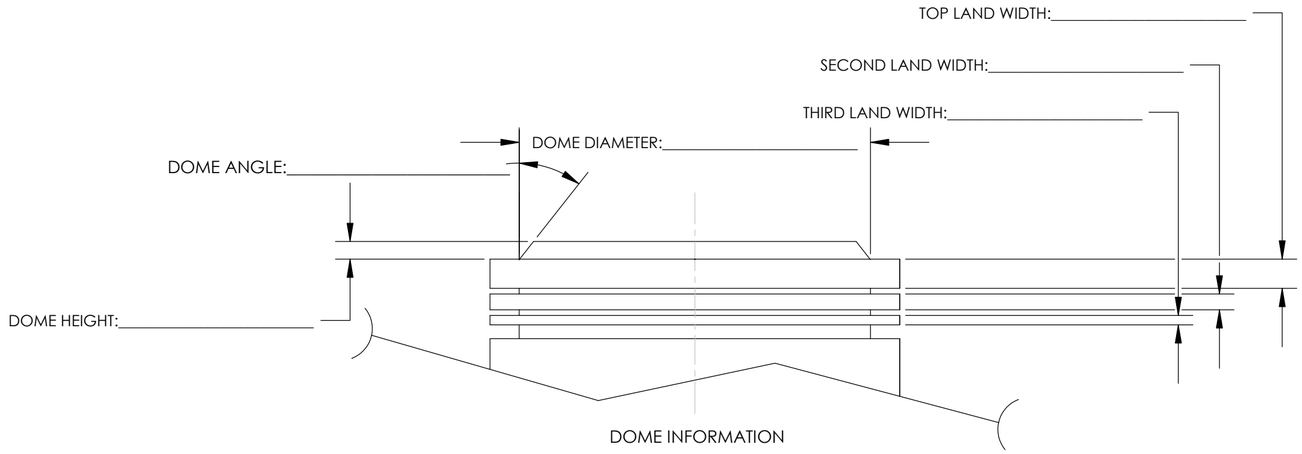


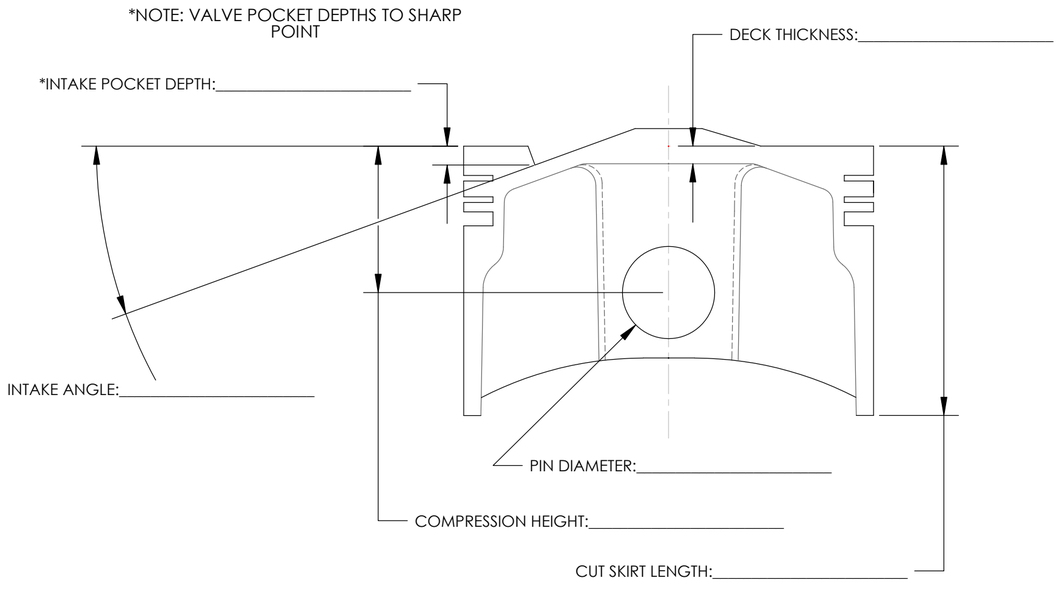
DISH INFORMATION

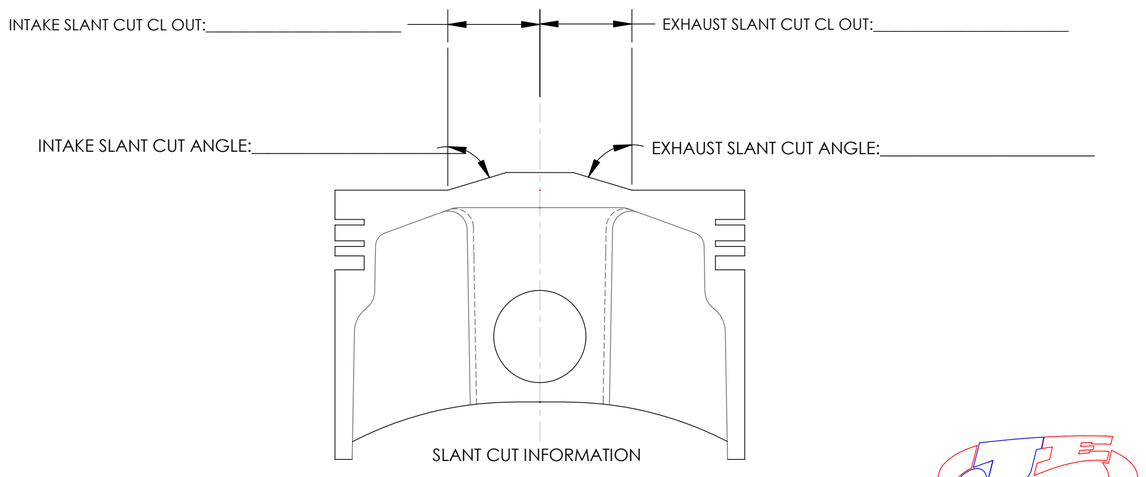
REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:

WEDGE DISH PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	



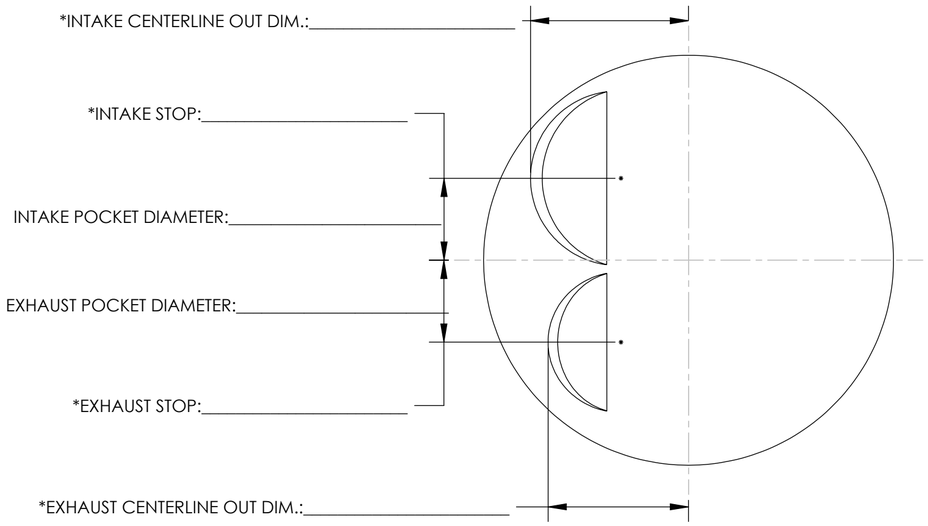






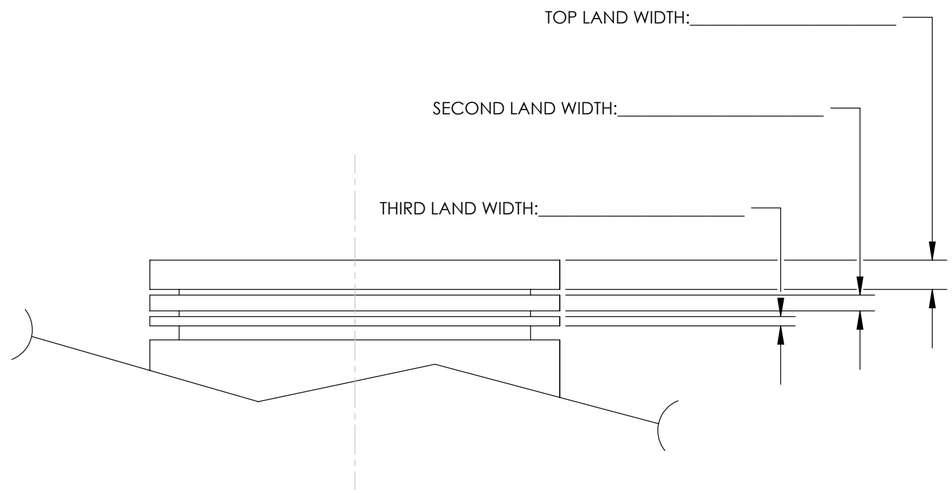
REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:

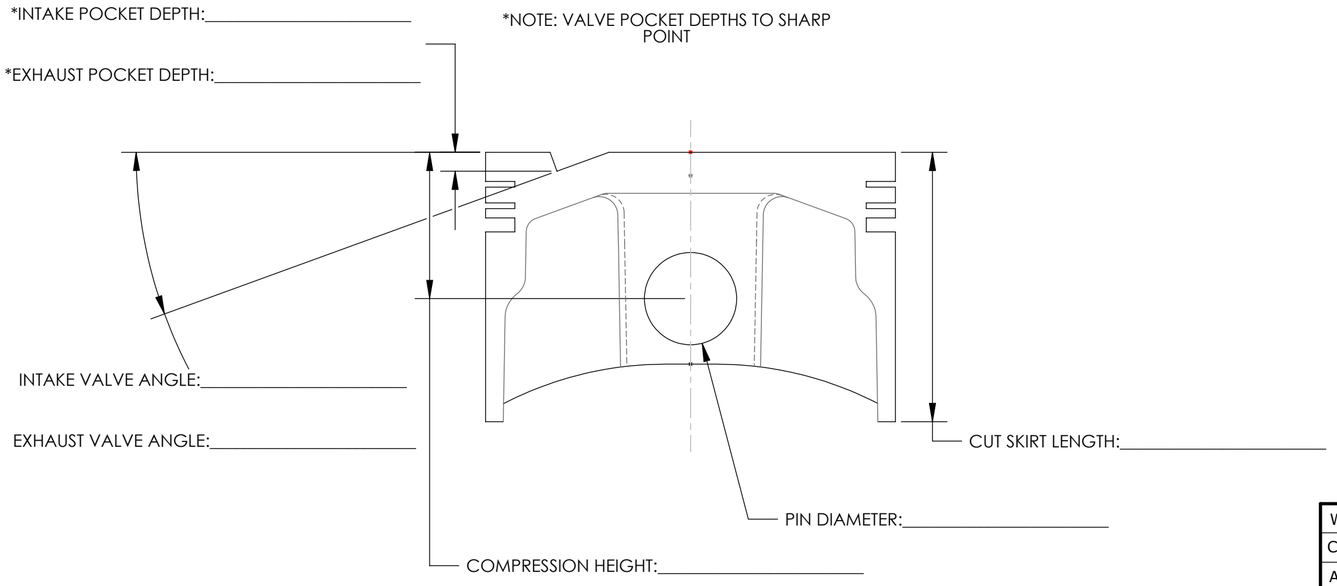
WEDGE DOME PISTON CONFIGURATION	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	



*NOTE: STOP DIMENSIONS
TO CENTER OF VALVE POCKETS

*NOTE: CENTERLINE OUT DIMENSIONS
MEASURED AT DECK





ENG-1036-CUSTOM PISTON DRAWING-WEDGE UNSYMMETRICAL FLAT TOP REV NC

WEDGE UNSYM. FLAT TOP PISTON CONFIG.	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	

SPHERICAL DISH DIAMETER:_____

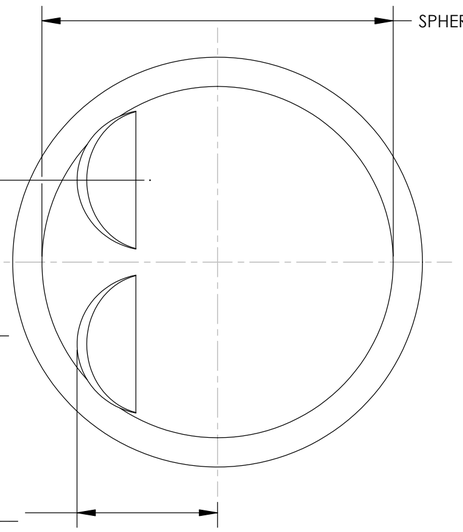
*INTAKE STOP:_____

*NOTE: STOP DIMENSIONS TO CENTER OF VALVE POCKETS

INTAKE POCKET DIAMETER:_____

*NOTE: CENTERLINE OUT DIMENSIONS MEASURED AT DECK

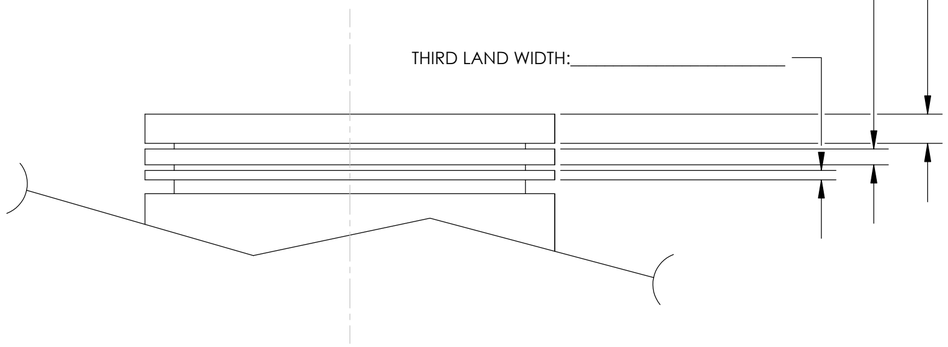
*INTAKE CENTERLINE OUT DIM.:_____



TOP LAND WIDTH:_____

SECOND LAND WIDTH:_____

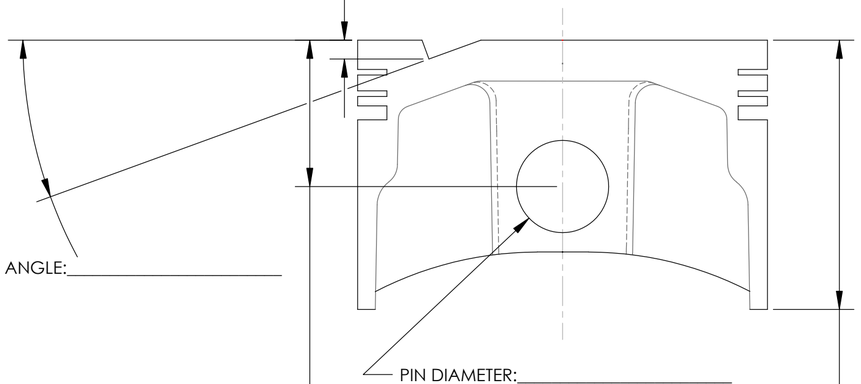
THIRD LAND WIDTH:_____



*NOTE: VALVE POCKET DEPTHS TO SHARP POINT

*INTAKE POCKET DEPTH:_____

INTAKE VALVE ANGLE:_____



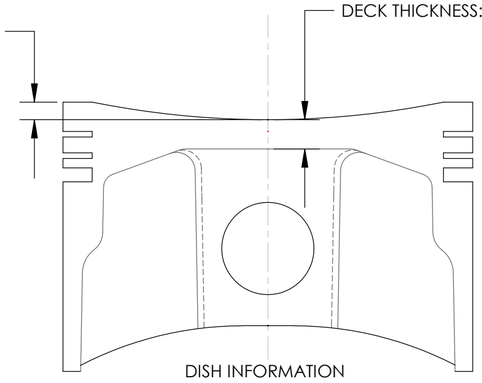
PIN DIAMETER:_____

CUT SKIRT LENGTH:_____

COMPRESSION HEIGHT:_____

DISH DEPTH:_____

DECK THICKNESS:_____



DISH INFORMATION

REQUIRED NET VOLUME (INCLUDING VALVE POCKETS) IN CC:_____

WEDGE SPHERICAL DISH PISTON CONFIG.	PO NUMBER:
CUSTOMER:	SALESMAN:
ACCOUNT NUMBER:	DATE:
NOTE: ALL DRAWINGS MUST BE ACCOMPANIED WITH A CUSTOM PISTON ORDER FORM	