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Fiero

RACE CAR CONSTRUCTION DETAILS

SUPER DUTY ENGINE GUIDE

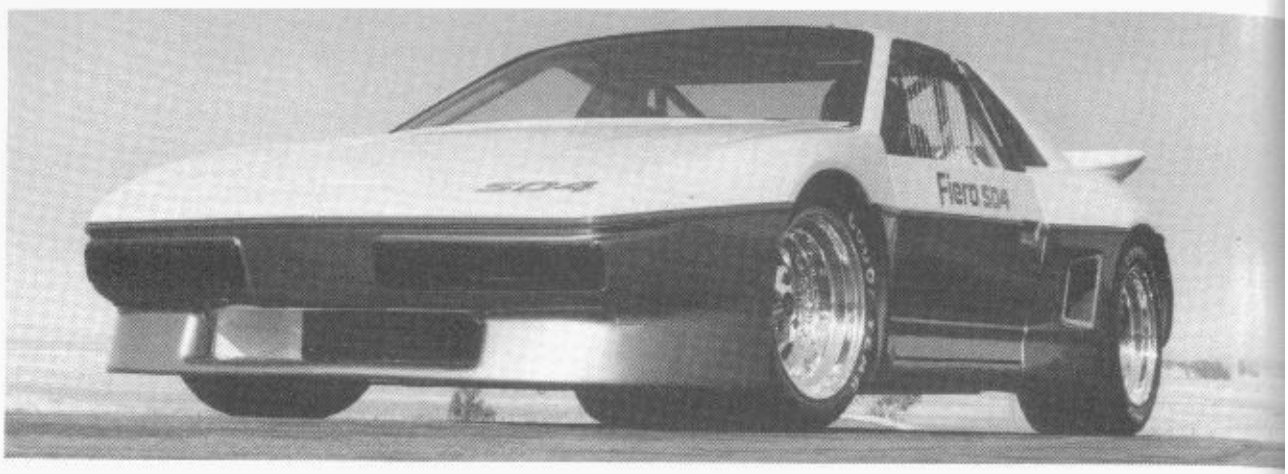
By the Editors of HOT ROD Magazine

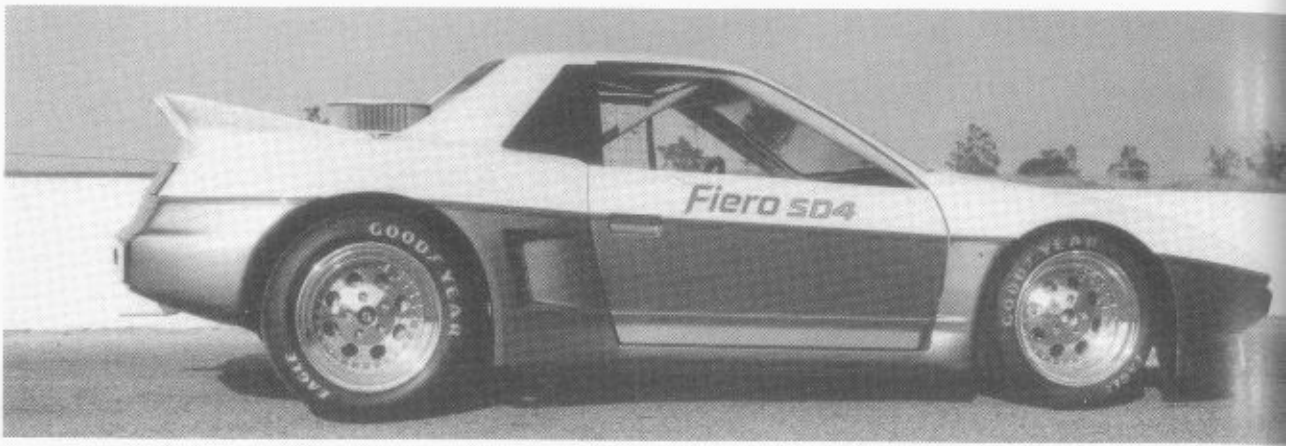
PONTIAC'S SUPER DUTY COMPONENTS ARE DESIGNED AND MANUFACTURED FOR OFF-ROAD USE ONLY.

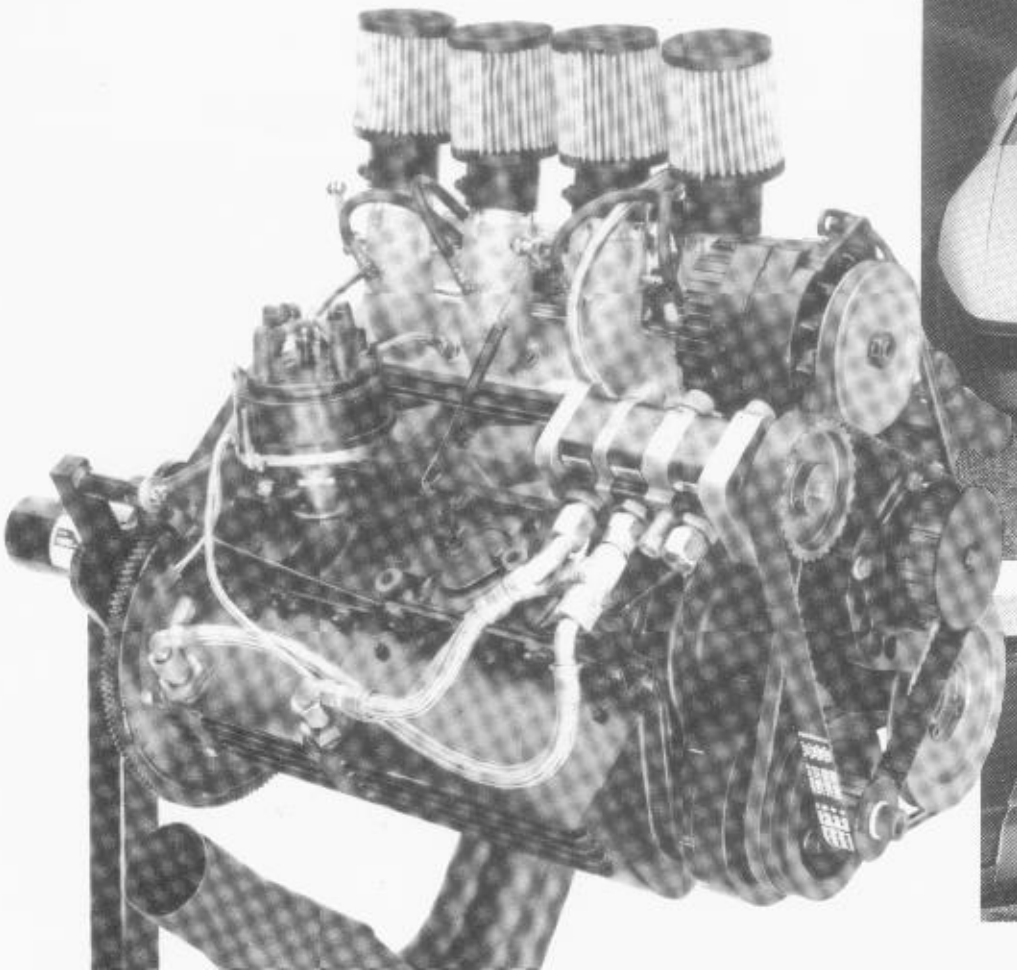
Welcome to a new era of high-performance automobiles; a period in which Pontiac is leading the way with high-technology Super Duty four-cylinder engines. Exciting new cars like the Pontiac Firebird and the all-new Pontiac Fiero are staking their claim to the open road, and Pontiac's new Super Duty performance program gives them the muscle to back it up. Four-cylinder engines can and do run hard, and Pontiac's Super Duty engine is the undisputed leader of the pack. Pontiac's Super Duty performance handbook contains all the information you need to build a high-performance Super Duty engine for off-road performance applications. Although Super Duty engine components are fully interchangeable with production 151-cid four-cylinder engine pieces, their use is only intended for off-road racing events. In this exclusive environment, the Super Duty engine is a superior racing powerplant. It delivers the performance you need to win consistently. Pontiac's Super Duty engine is your ticket to off-road excitement because performance is what Pontiac is all about.

Pontiac's Fiero race car program is one of the most exciting race car development programs ever devised because it relates specifically to the personal involvement of everyday Pontiac enthusiasts. With Pontiac's design expertise to back you up, you can build your own Fiero race car for a variety of off-road racing categories. This publication gives you all the construction details and lists specific suppliers who support the program with hardware designed exclusively for the Fiero race car.

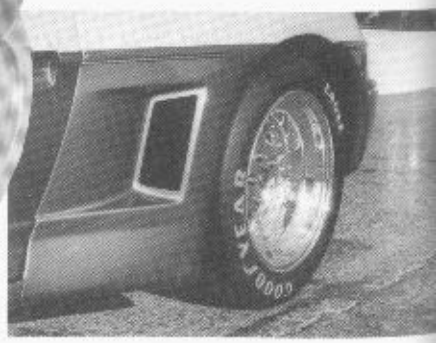
As Pontiac enthusiasts, you are an important part of our organization. Pontiac builds some of the most exciting cars on the road today and we think it's time for you to get into the act. At Pontiac, We Build Excitement. So what are we waiting for, partner?


Fiero SD4


Fiero SD4
GOODYEAR
EAGLE




SD4


GOODYEAR

CONTENTS

The Super Duty engine and Fiero race car programs would never have come together without the combined efforts of many people throughout Pontiac Motor Division, its manufacturing associates, and the aftermarket suppliers who contributed to the design and development of high-performance Super Duty components. Members of this Super Duty team are too numerous to mention here, but their finest efforts will not go unrewarded. In an unprecedented team effort, they have delivered one of the strongest performance programs ever developed. When Super Duty Pontiac's start carving their place in the record books, the team's accomplishments will undoubtedly gain the recognition they deserve.

ACKNOWLEDGEMENTS

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SUPER DUTY CYLINDER BLOCK PREPARATION

Pontiac's Super Duty four-cylinder engine is a competition-bred powerplant designed to accommodate the full spectrum of severe duty off-road applications. With only basic preparation, it is capable of phenomenal power levels and superior reliability. Super Duty components were designed with strict adherence to proven competition principles. The cylinder block incorporates maximum structural rigidity to promote stable cylinder walls and superior ring sealing. It will accept a maximum bore of 4.020 inches and is 25 pounds heavier than a standard production block.

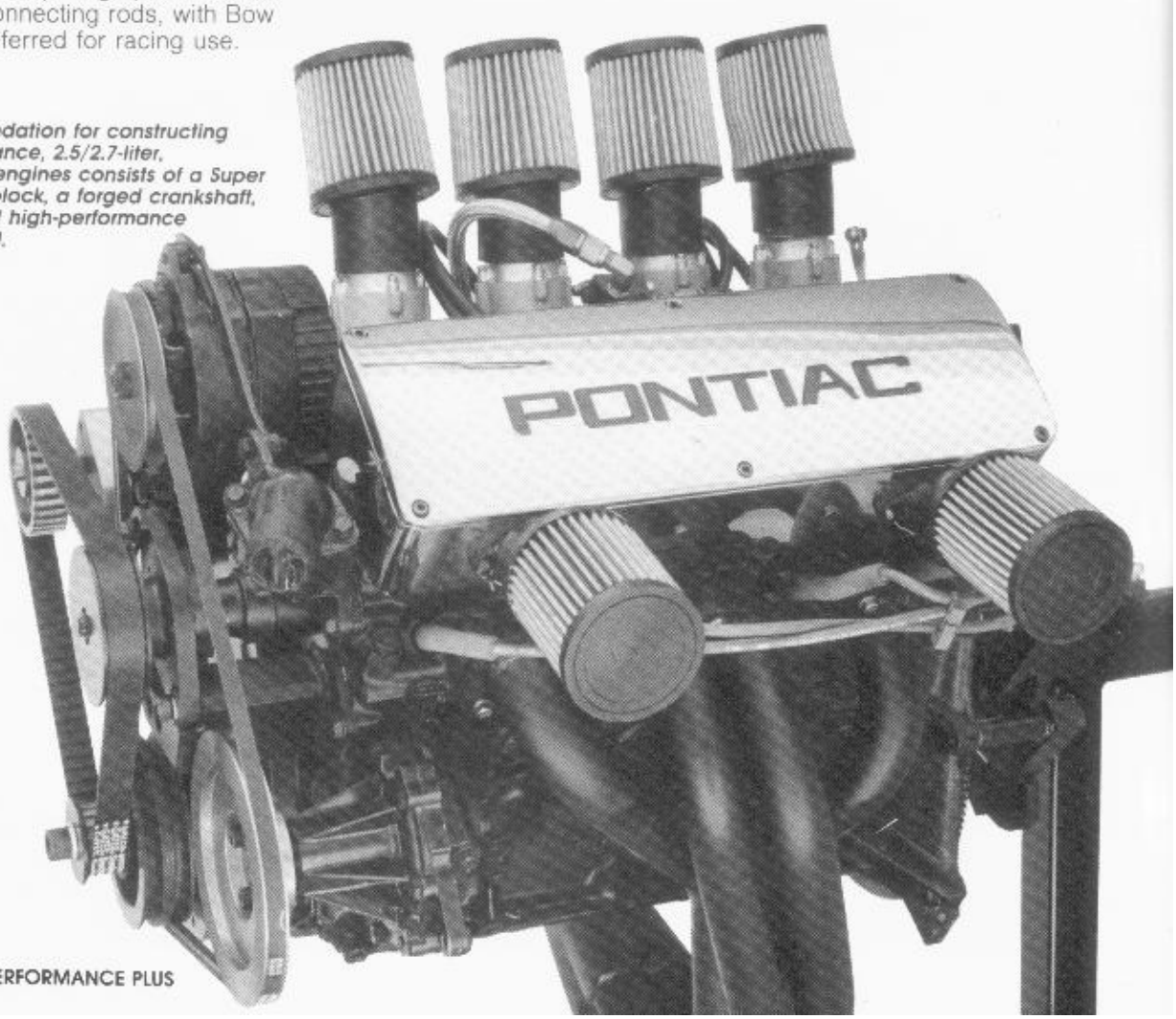
Crankshafts are fully counterweighted, 5140 alloy forgings available with stroke lengths of 3.00 inches and 3.25 inches, plus a raw forging for special applications. Journal sizes are common to '83 production engines and they are cross-drilled for optimal lubrication. Rod journal cleanout traps are incorporated to catch errant debris in the oil. Super Duty crankshafts were designed to accept high-performance Chevrolet connecting rods, with Bow Tie rods preferred for racing use.

The Super Duty cylinder head is a cross-flow design with revised intake and exhaust ports. It features improved structural rigidity and a revised coolant jacket design to promote even cylinder-to-cylinder temperature gradients. Super Duty heads will accept large 2.02-inch-diameter intake valves and 1.625-inch exhaust valves, or the more conventional 1.94-inch intake valves and 1.6-inch exhaust valves. With careful porting procedures, these heads will flow all the air you need for the maximum possible engine size and speed requirements.

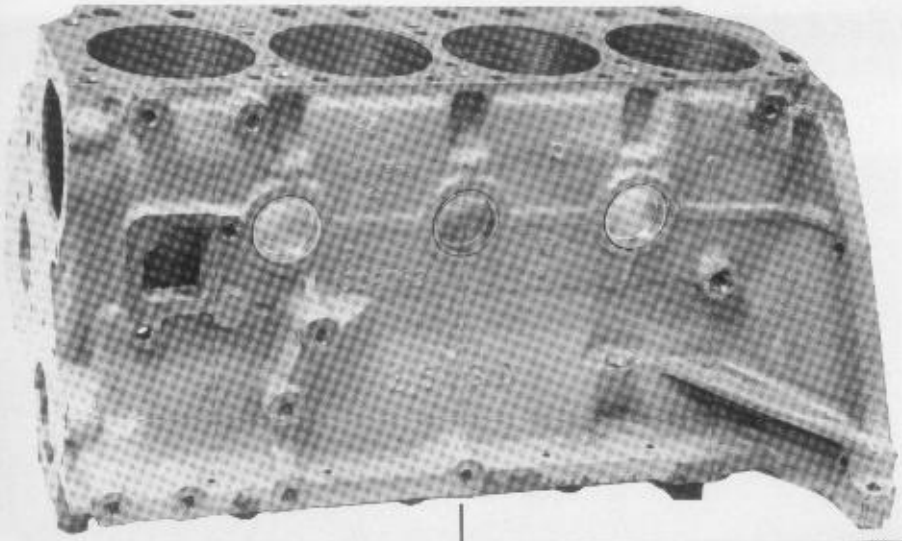
Aftermarket components for the Super Duty engine are specifically designed to complement its high-performance intent. Thus, with Pontiac supplying the basic hardware, Super Duty enthusiasts can tailor their powerplants to specific applications by applying aftermarket components to suit their needs. All Super Duty components are interchangeable with production engine pieces, although some items require modification as detailed in the Super Duty engine guide.

In this section you will find detailed instructions for the preparation of off-road, competition Super Duty engines. Many procedures and modifications are applicable to streetable engines, but they are not recommended where their application might affect emission levels. If you plan to construct a maximum-effort Super Duty engine for road racing, drag racing, or off-road racing, you must follow the specific procedures outlined in this publication. Failure to do so may result in poor engine performance and/or actual component damage during engine operation.

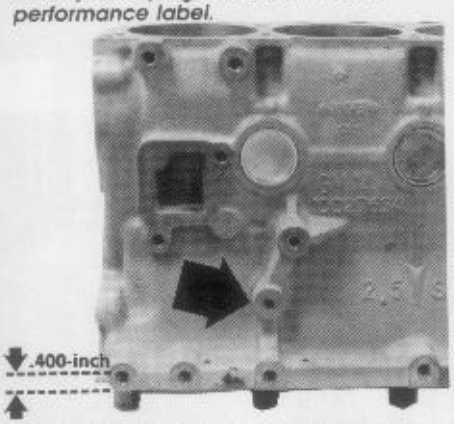
All Super Duty engine components have been designed for maximum strength, reliability, and compatibility. They are the best pieces available, and their application considerably lessens the effort required to pull maximum power from the Super Duty engine.



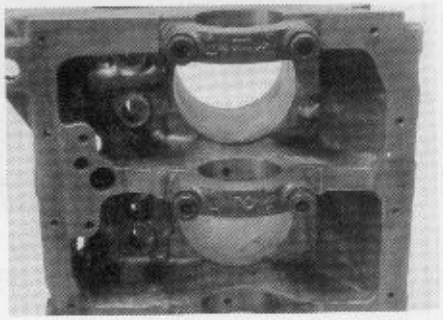
Pontiac's foundation for constructing high-performance, 2.5/2.7-liter, four-cylinder engines consists of a Super Duty engine block, a forged crankshaft, and a special high-performance cylinder head.



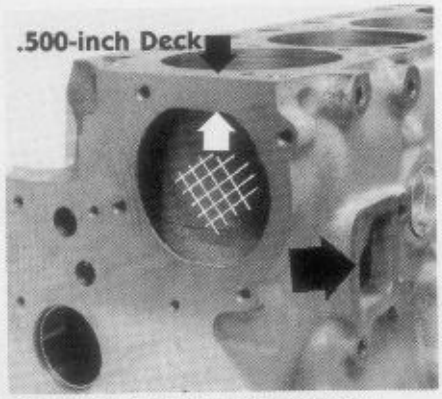
The Super Duty semi-finished block assembly features 3.962-inch rough-bored cylinders that can be enlarged to 4.020 inches without loss of cylinder wall integrity. Over-the-counter blocks will include camshaft bearings, water jacket plugs and an off-road performance label.



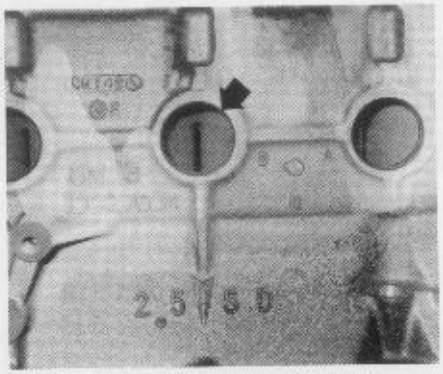
Deck surface thickness is .500 inch minimum, and oil pan rail thickness has been doubled to .400 inch. External bosses and ribs have been enlarged or strengthened (arrow), and the block is identified by the "2.5 SD" cast into the side. Blocks are cast with semi-siamesed cylinders and the cylinder head bolt bosses are deeper by .354 inch.



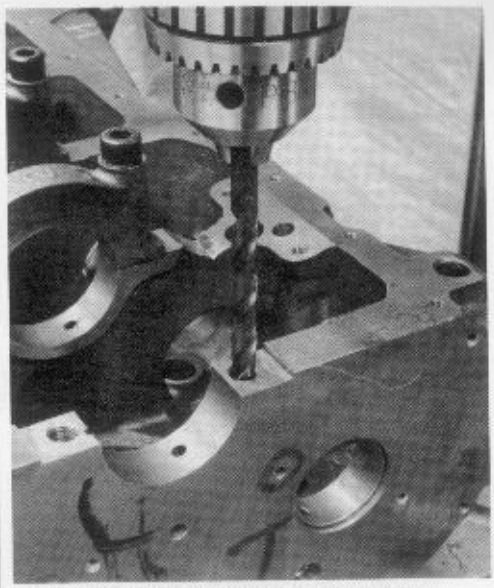
Because Super Duty blocks are run on the standard production line, they are drilled for 11mm bolts in their gray iron main caps. The block and caps have to be drilled and tapped for ½×13 Grade 8 bolts available in Moroso kit number 3849. Note that the main bearing bulkheads have been thickened to ¾ inch from the oil pan rails to the bottom of the cylinder bores.



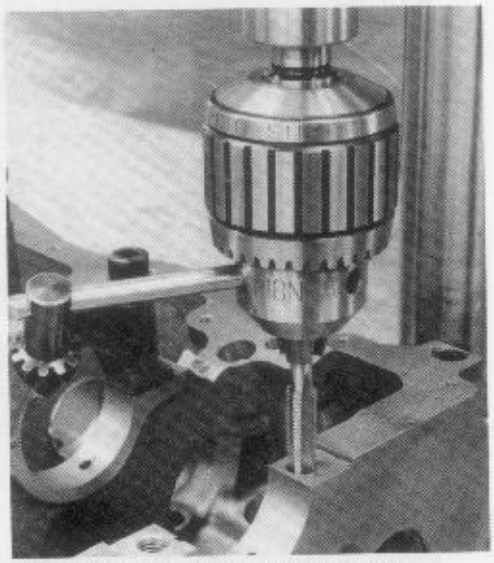
Production blocks have a flat area milled in the front cylinder wall to clear the water pump impeller. This area is left intact on the SD block to preserve cylinder wall thickness. Super Duty engines must use the side-mounted, transverse water pump PN12309677.



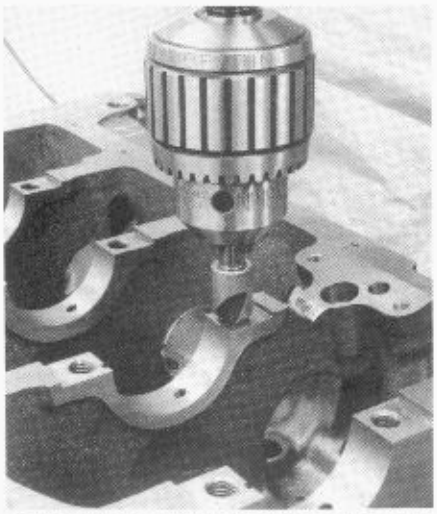
Peering through the open freeze plug openings you can see the semi-siamesed cylinders. Material is siamesed between the cylinders at the top and bottom, but the center area is left open for improved water circulation.



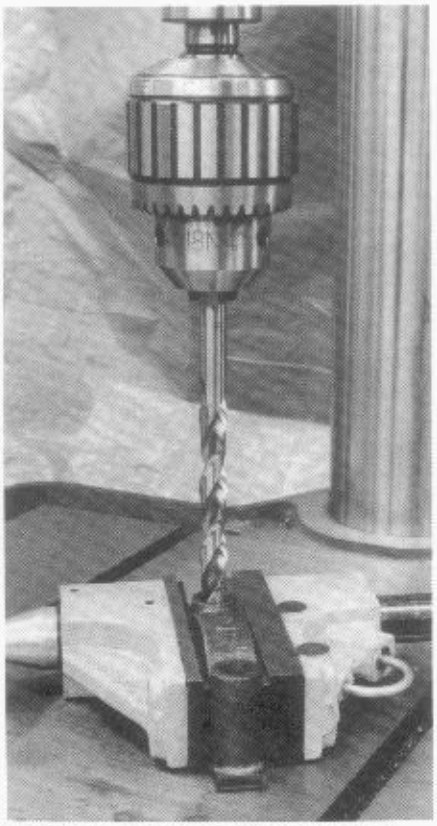
Begin prepping the cylinder block by drilling the main cap bolt holes to a depth of 1 3/16 inch from the oil pan rail surface with a 27/64-inch drill bit. Use a transfer punch in the chuck to align each hole for accurate drilling.



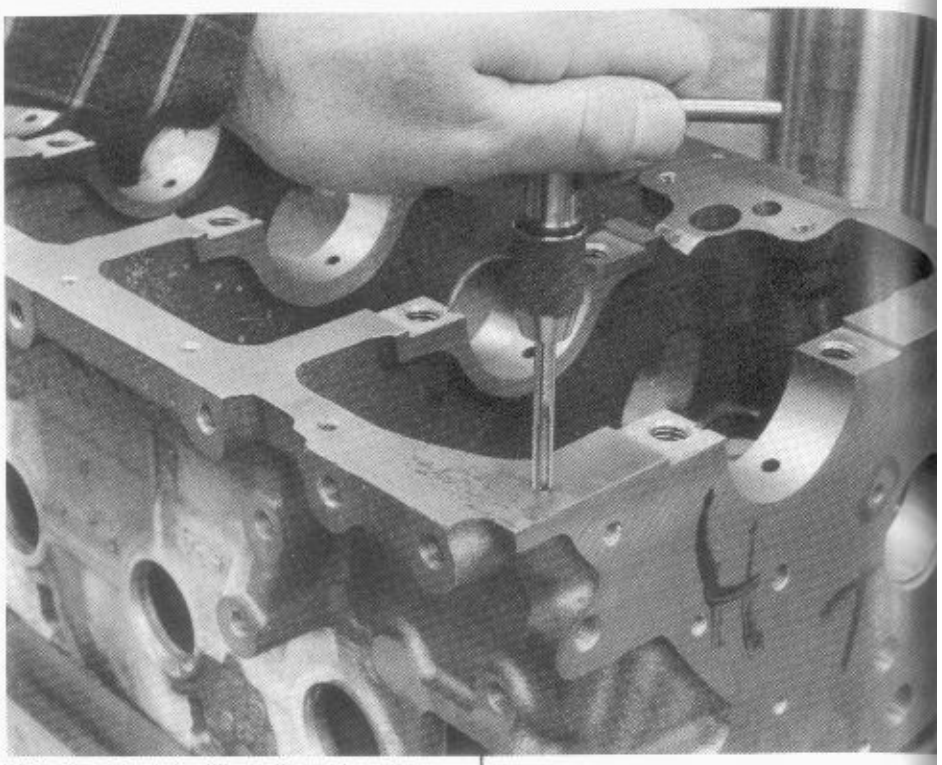
After each hole is drilled, it should be tapped before the block is repositioned for the next hole. This will ensure perfect alignment of the ½×13 NC tap. Make certain the tap starts straight by installing it in the chuck and using the chuck key to rotate it by hand. Be careful not to start the drill motor when the chuck key is inserted in this position. Never leave the chuck key in the chuck.



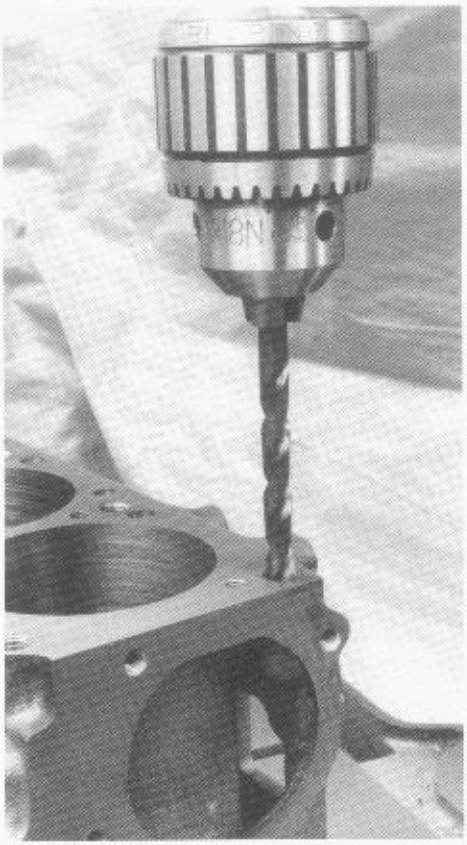
After drilling and tapping the main cap holes, carefully chamfer them to prevent thread pullout when the bolts are torqued.



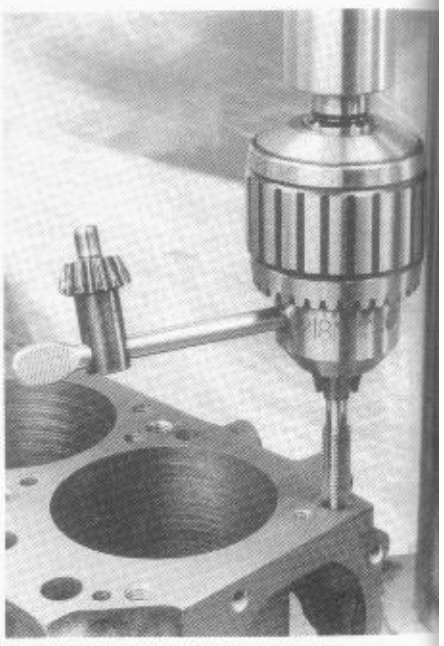
To accommodate the ½×13 Grade 8 Moroso bolts, the main caps are drilled with a 33/64-inch drill bit. Once again, an appropriately sized transfer punch is used to align each hole before drilling.



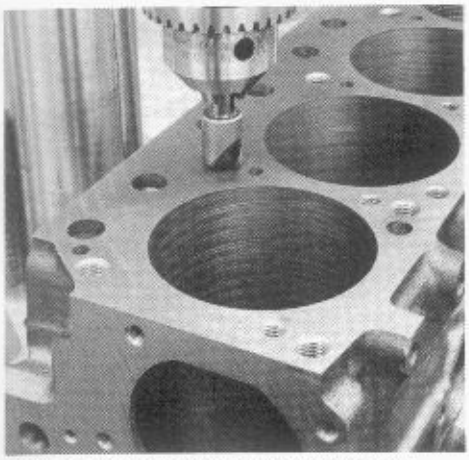
While the block is still positioned on its deck surface, the oil pan attachment bolt holes are tapped to maximum depth with a 6mm tap.



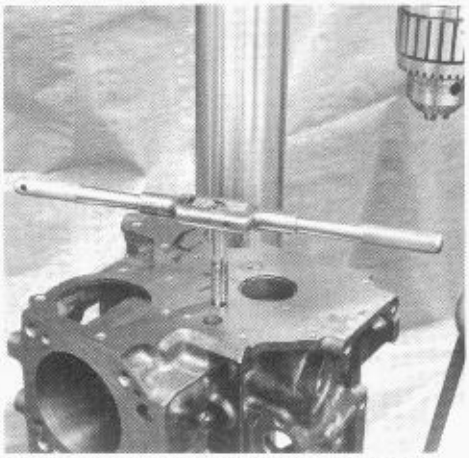
Prepare the cylinder head bolt holes by carefully aligning each one with a transfer punch and drilling with a 27/64-inch drill bit. Drill and tap each hole to a depth of 1⅝ inch from the deck surface before moving on to the next hole.



Tap the head bolt holes with the same ½×13 NC tap. Put the tap in the chuck and slowly start it by hand using the chuck key as a handle to rotate the tap. Once you have started several straight threads on each hole you can come back later and finish tapping them by hand. Again, never leave the chuck key in the chuck.

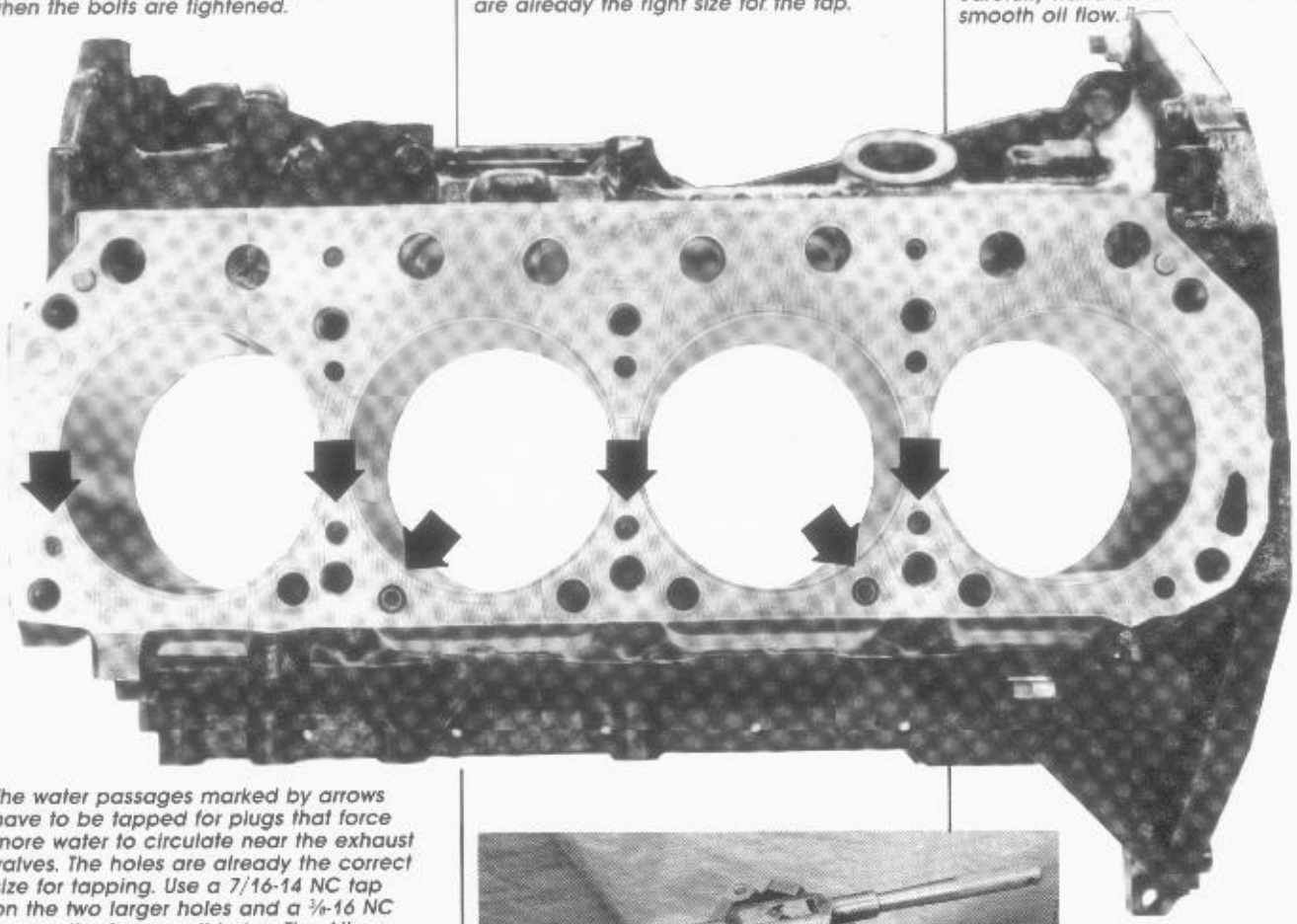


After tapping all the appropriate holes on the deck surface, carefully chamfer each hole to prevent thread pullout when the bolts are tightened.

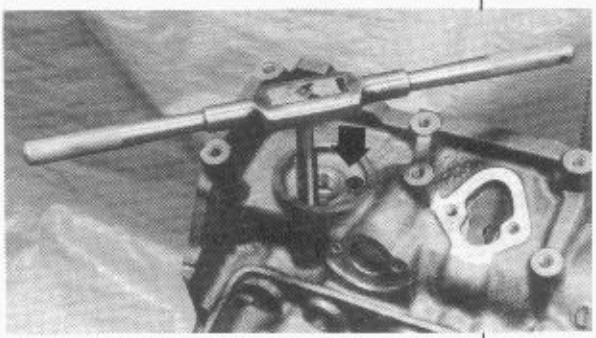


At each end of the block, tap the main oil gallery openings with a ⅜-18 NC tap. Drilling isn't necessary, since the holes are already the right size for the tap.

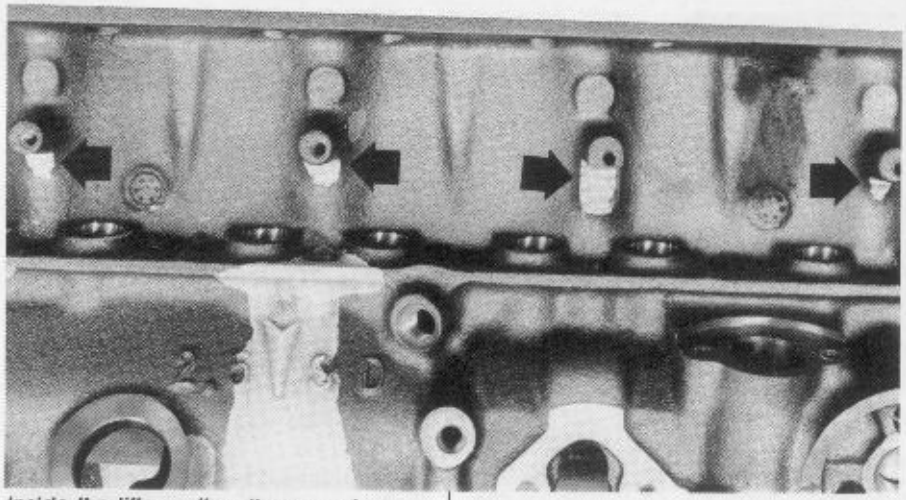
The main feed gallery from the oil pump to the oil filter should be chamfered and carefully hand-blended to ensure smooth oil flow.



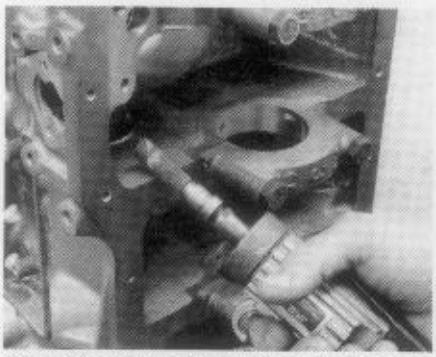
The water passages marked by arrows have to be tapped for plugs that force more water to circulate near the exhaust valves. The holes are already the correct size for tapping. Use a 7/16-14 NC tap on the two larger holes and a ⅜-16 NC tap on the four small holes. The Allen head plugs are available in Moroso kit number 3770.



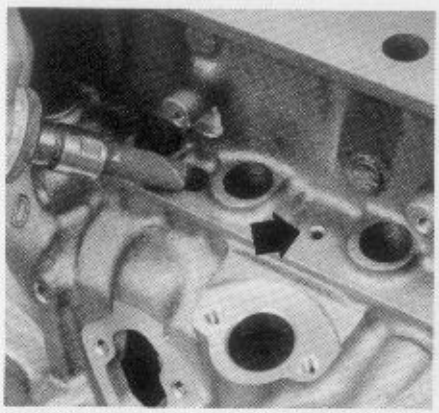
If you're going to run a dry-sump oiling system, the oil filter bypass opening will have to be plugged. Tap the hole for a ⅝-18 NC plug. Tap the smaller adjacent hole for a 9/16-18 NC plug. For wet-sump applications, plug the larger hole to ensure full oil filtration. Do not use a bypass valve and change oil filters frequently.



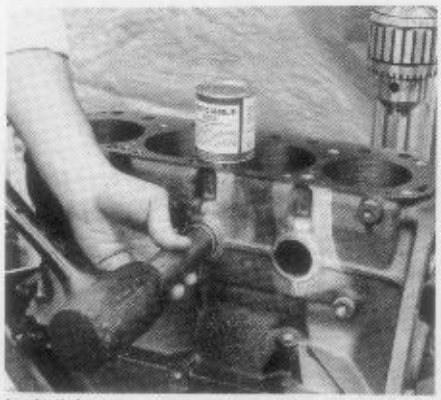
Inside the lifter gallery there are four bosses used to mount the side cover. In applications where Crane roller lifters are used, the bottom of each boss should be ground up to (but not into) the threads to provide ample clearance for the roller lifter locator bars.



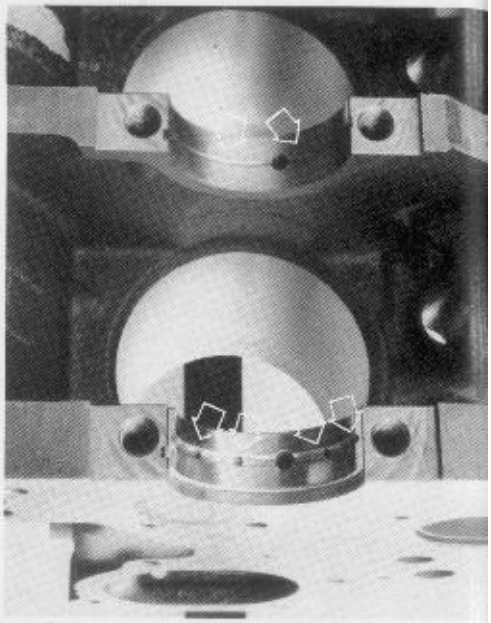
Deburring all sharp edges on the block is standard procedure on all competition-engine buildups. Break and radius all edges with a rotary sanding roll or drum.



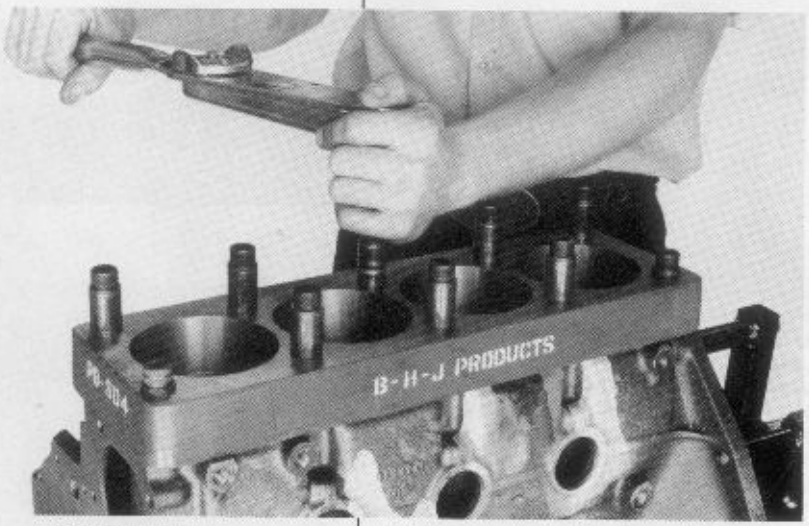
The large oil drainback holes in the lifter gallery should be radiused with a sanding roll, and the two small holes directly above the oil pump drive and the distributor drive should be lightly chamfered with a small counterbore.



Install freeze plugs with a liberal coating of quality sealer such as Devcon B plastic steel. Use a short length of appropriately sized pipe to drive the plugs in squarely.



To ensure adequate rod bearing lubrication at very high engine speeds, the main bearing saddles are fully grooved with a .050×.050-inch machined groove. The upper half of the main bearing insert is then drilled with four evenly spaced .116-inch holes (with a number 32 drill bit) in the oiling groove. These holes are spaced around the existing oiling hole which is enlarged to ¼ inch. The intent is to provide the rod bearing oiling passage a shot at four additional full-pressure oiling holes as the crank spins. This provides an increased lubrication capacity that yields excellent rod bearing life in very high-rpm engines.



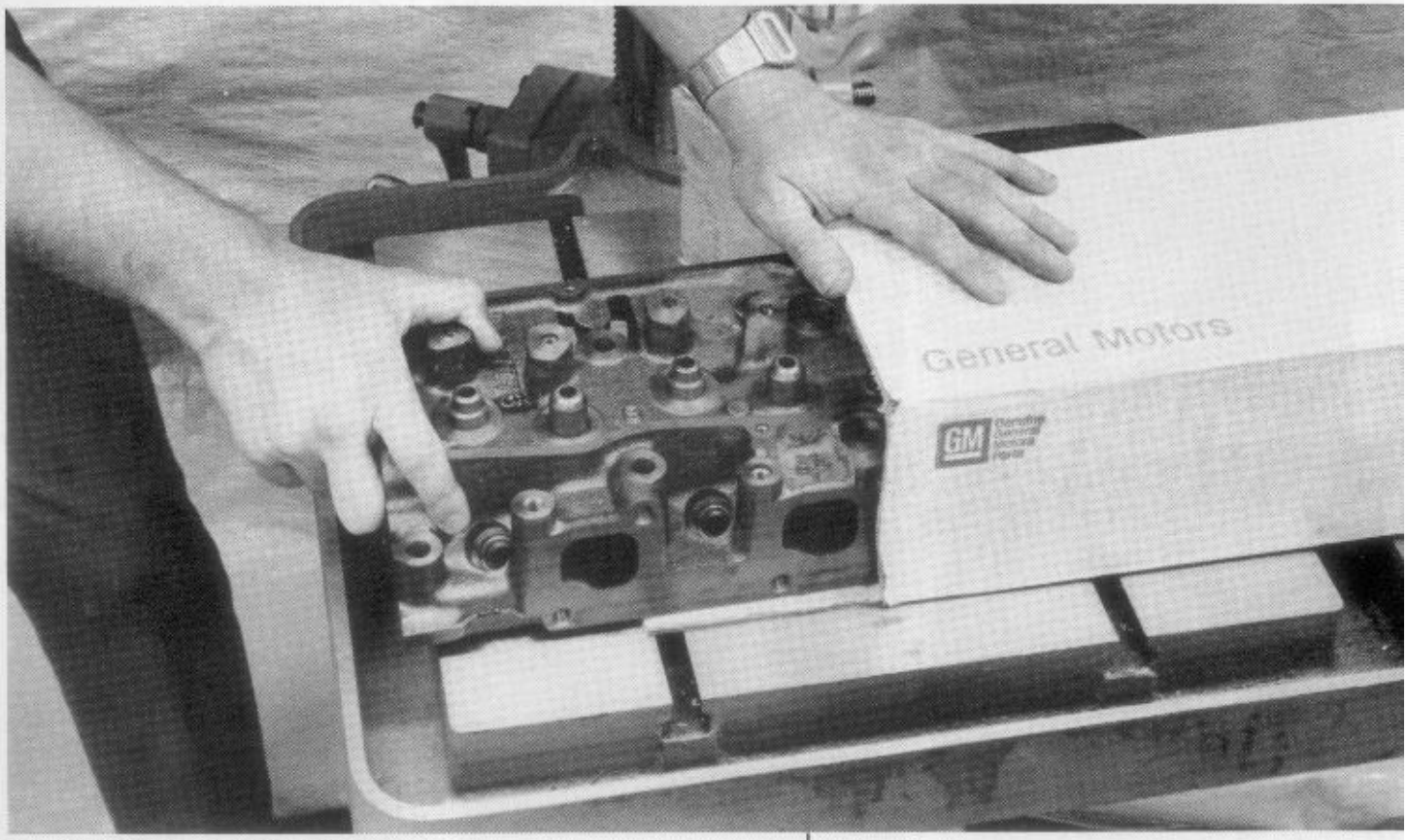
Whenever cylinder block machining procedures are performed, the torque plate should be installed with a new gasket and 105 lbs.-ft on the bolts. Main caps should also be installed to stress the block properly during machining.

SPARK PLUGS

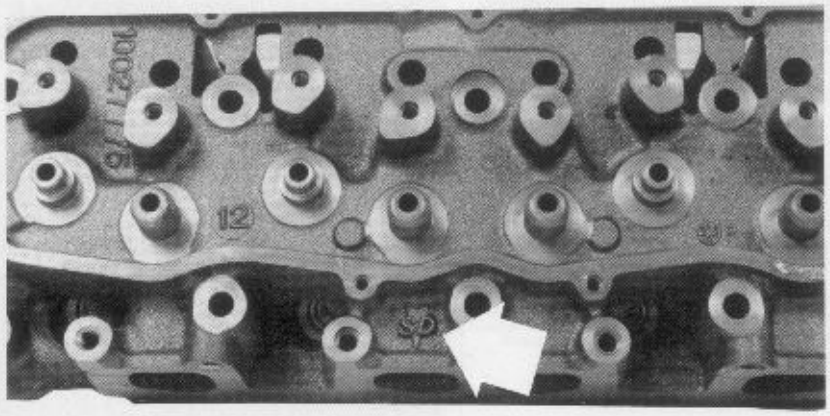
MAKE	RACING	STREET
AC	436T	436T
CHAMPION	BL-57, BL-60	BL-60

SPARK ADVANCE.....34-38 degrees total lead
ENGINE OIL.....20W-50 weight ashless racing oil. Union 76 racing oil is recommended
TRANSMISSION OIL.....Union 76 transmission oil number ECOAZ-19580-B is recommended
FUEL.....Union 76 racing fuel

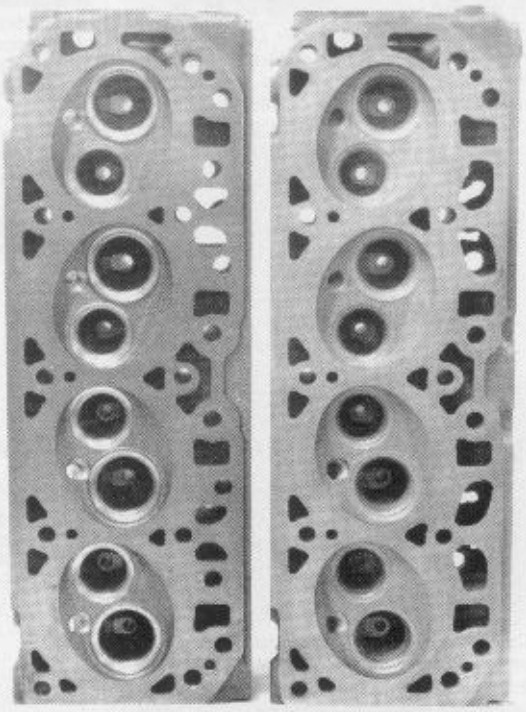
SUPER DUTY CYLINDER HEAD PREPARATION



The new Super Duty head from Pontiac is a formidable piece right out of the box. It flows 88 percent better than a stock casting. Combustion chamber wall thickness has been increased by .170 inch and the EGR passage has been eliminated. The Super Duty head is the key element of high-horsepower Super Duty engines.

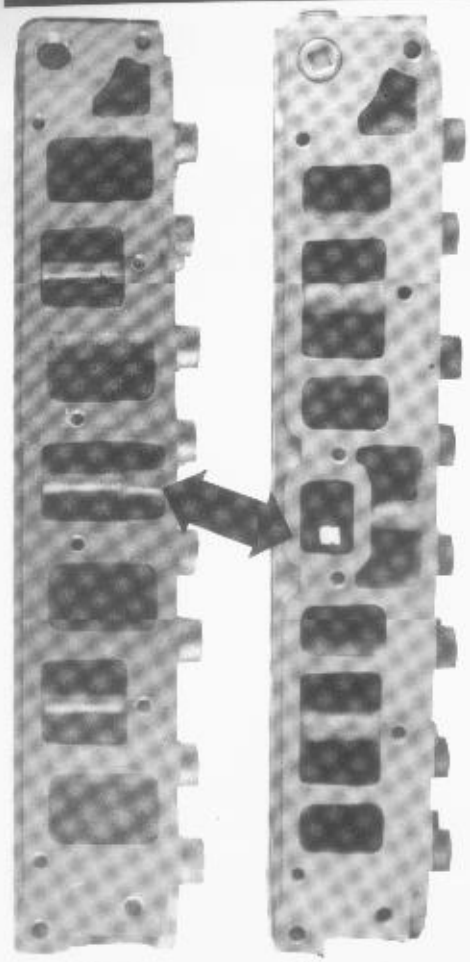


The cross-flow cylinder head is highlighted by a Pontiac SD emblem cast over one exhaust port. There is plenty of room for large-diameter racing valve springs and other competition modifications. The semi-finished bare head features enlarged, raised, and recontoured intake and exhaust ports that will accept 1.94-inch intake valves and 1.6-inch exhaust valves.



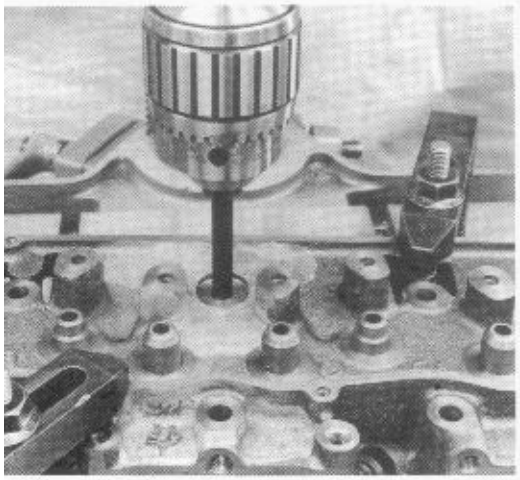
S.D. **Stock**

Super Duty heads are run on the same factory production line, and the same cutter is used to open the valve pocket so the valve guide can be drilled. The openings don't look any larger, but underneath the bowl area is much larger.

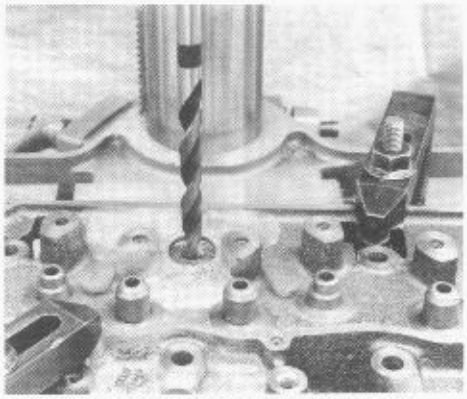


S.D. **Stock**

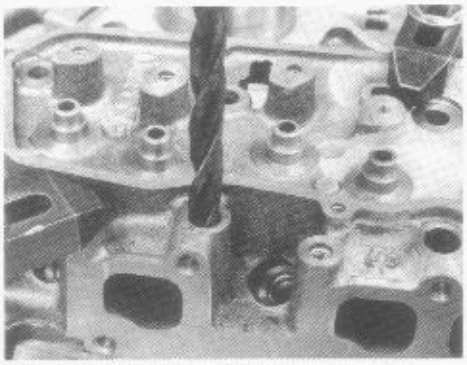
High-performance Super Duty heads are meant for high-flow, high-speed running. Note the difference in the size of the intake ports and the absence of an EGR passage on the SD casting (left).



Cylinder head preparation begins with enlargement of the head bolt holes. A transfer punch is used to accurately align the head on the drill table. Each hole is aligned and drilled before the head is repositioned for the next hole. Be certain the head is anchored securely during all drilling, reaming and tapping operations.



A 17/32-inch drill bit is used to enlarge the head bolt holes. Drill all head bolt holes except the three holes adjacent to the exhaust ports; these holes receive special attention.

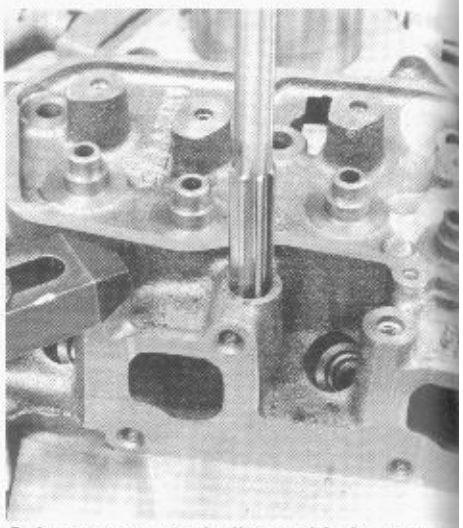


When drilling the three head bolt holes adjacent to the exhaust ports, it is possible to break into the ports. These holes must be drilled oversized and sleeved. Begin by drilling with a ⅜-inch drill bit that has been aligned with a transfer punch.

PUSHROD GUIDE AND EXHAUST PORT HEAD BOLT SLEEVES **11 REQUIRED**

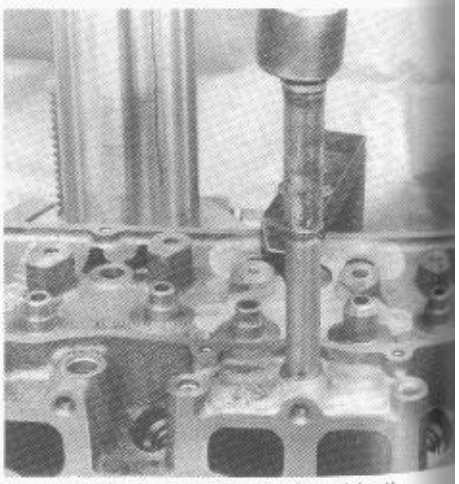
Material: Seamless steel tubing .6875-inch o.d. May be .0005 inch over, but not under. Must be .065-inch wall.

Cut each sleeve to 3 1/16 inches, then face one side square and reduce length to three inches. The square side is necessary to ensure a square face for the installation tool.



Before moving on to the next hole, ream the drilled hole with an 11/16-inch reamer. Each hole must be aligned, drilled and reamed before another hole is started.

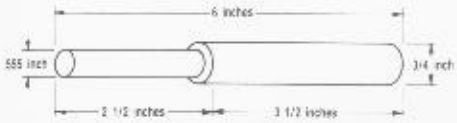
After the three holes are drilled and reamed to the proper size, coat the openings with Devcon B plastic steel to seal the sleeves to the casting. Note that Devcon B requires a full 24 hours to cure properly.

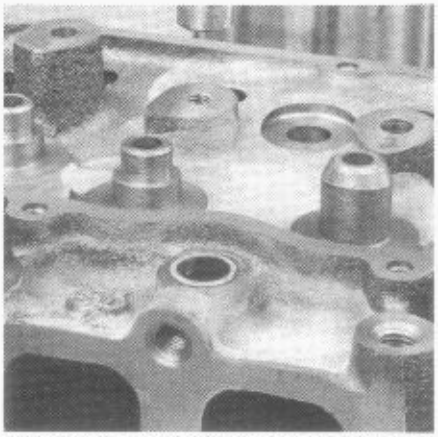


To avoid bell mouthing the head bolt sleeves, you'll have to make an installation tool like the one shown. It should fit snugly but easily into the sleeve so you can drive it into the head.

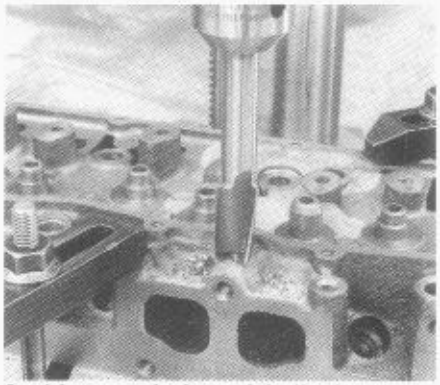
PUSHROD GUIDE AND HEAD BOLT SLEEVE INSTALLATION TOOL

Fashion the installation tool from a six-inch length of 3/4-inch stock. Machine one end to a diameter of .555 inch for a distance of 2 1/2 inches.

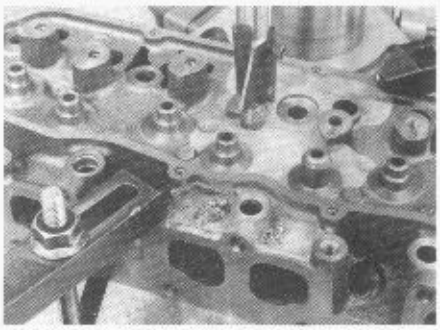




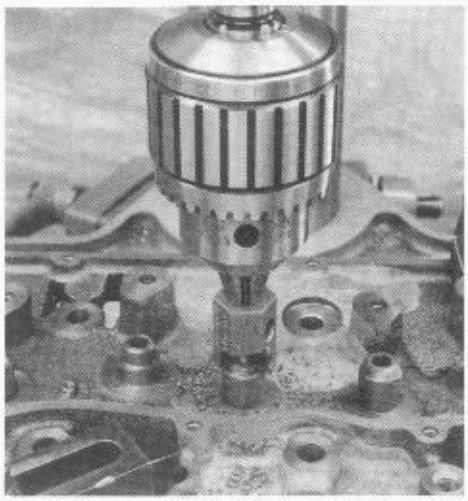
Drive the sleeves into the head until they protrude about .030 inch. Do not drive them in flush. At this point, the sleeve should also protrude from the deck surface by .005-.010 inch. Excess material will be removed when the head is surfaced.



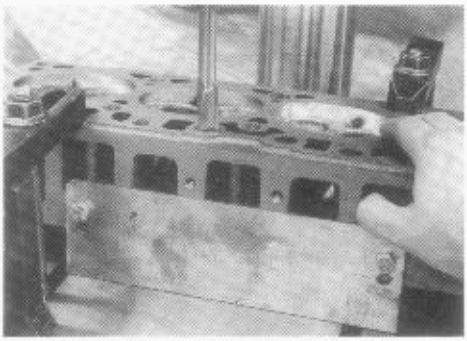
Spot face each sleeve into the head material to provide a smooth seat for the head bolt washer to bear against. If you fail to do this, the head bolt will torque against the sleeve instead of the head, resulting in improperly torqued head bolts and a potential blown head gasket.



After spot facing, the head bolt holes should look like this. Don't cut away any more material than is absolutely necessary to achieve a proper seat.

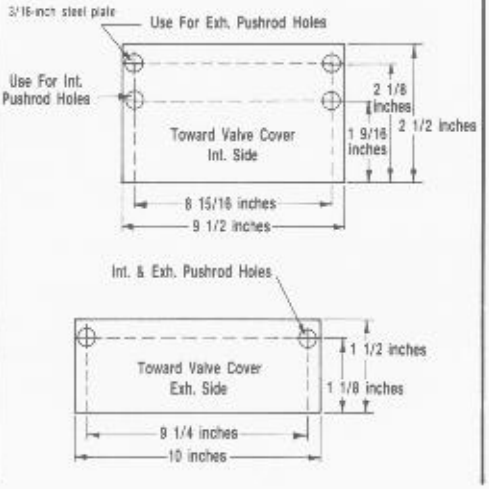


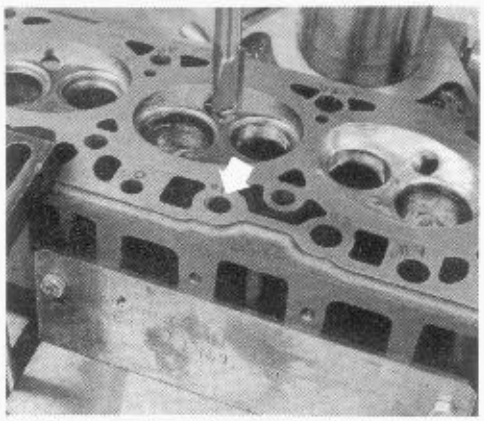
Using the appropriate cutter, cut the valve guides to accept PC16-1811 seals. Cutters are available from major camshaft grinders or at your local machine tool outlets.



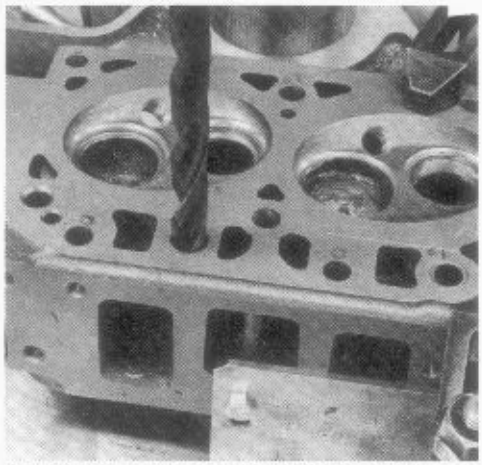
To prepare the heads for the pushrod guide sleeves, special fixture plates are fashioned to place the head at the proper angle for installing guide sleeves. The exhaust sleeves run at a different angle from the intake sleeves. The first step is to spot face the bottom of the existing pushrod guide holes so they can be drilled oversized. The exhaust side fixture is bolted to the head and remains in place. The intake side fixture is installed with the lower holes for drilling the intake guides and repositioned to the upper holes for the exhaust pushrod guides.

CYLINDER HEAD FIXTURE PLATES FOR DRILLING PUSHROD GUIDE HOLES

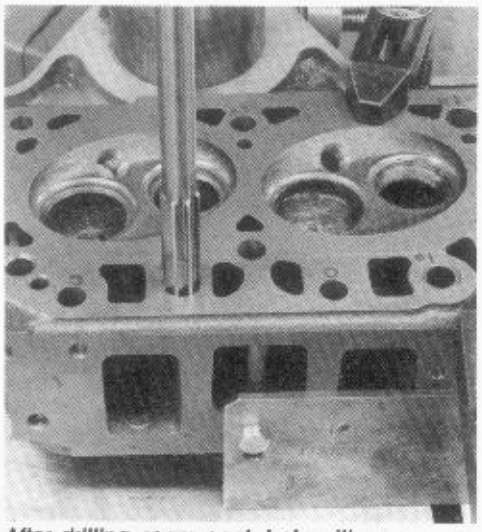




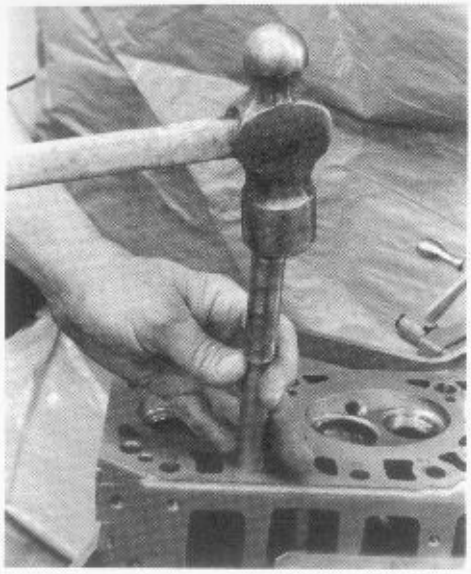
Spot face each pushrod guide hole flush with the inside edge of the hole on the deck side. This provides a straight surface for the drill.



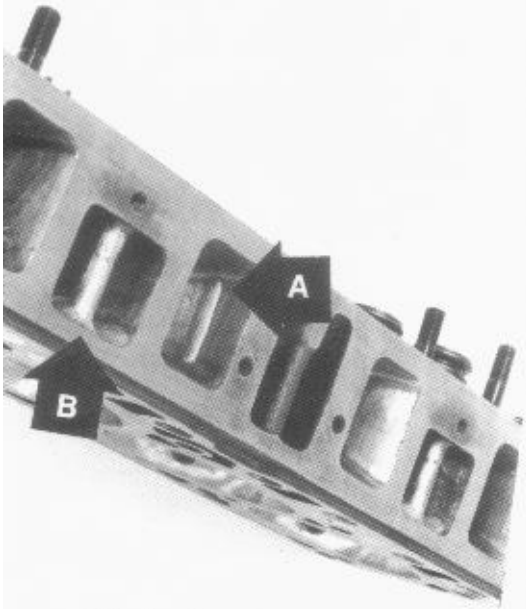
As with all previous operations, the hole is aligned with a transfer punch. Then it is drilled with a multi-flute ⅝-inch drill bit.



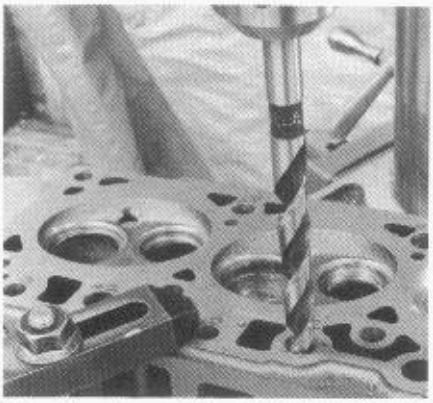
After drilling, ream each hole with an 11/16-inch reamer. To maintain alignment, drill and ream each hole before starting on the next.



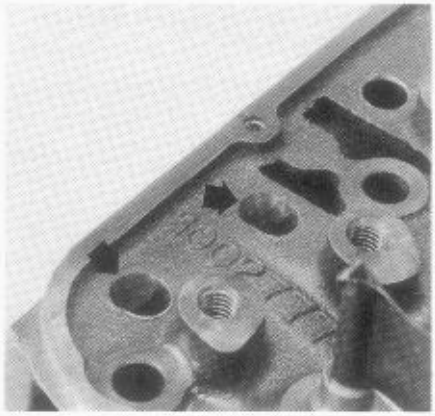
With the installation tool you fashioned earlier, drive the sleeve in until it is flush with the deck surface on the outside edge closest to the intake side of the head. Excess sleeve material will be removed when the head is surfaced.



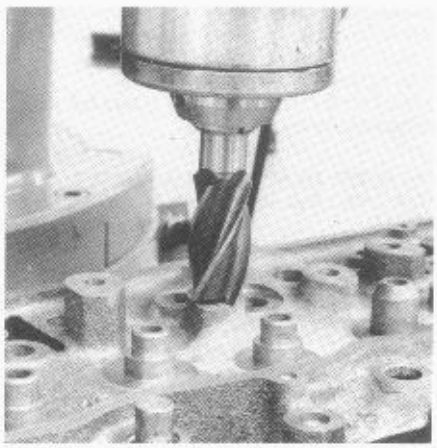
This view shows how the pushrod guide tubes actually protrude into the intake ports (arrow A). The area should be carefully blended after the tube has been installed with Devcon B. Arrow B indicates the cylinder head oil evacuation ports which match up directly with a boss on the intake manifold. The arrangement will allow racers to effectively dry-sump the head and eliminate the need for restricting upper engine oiling. It also promotes longer valve spring life in endurance racing applications.



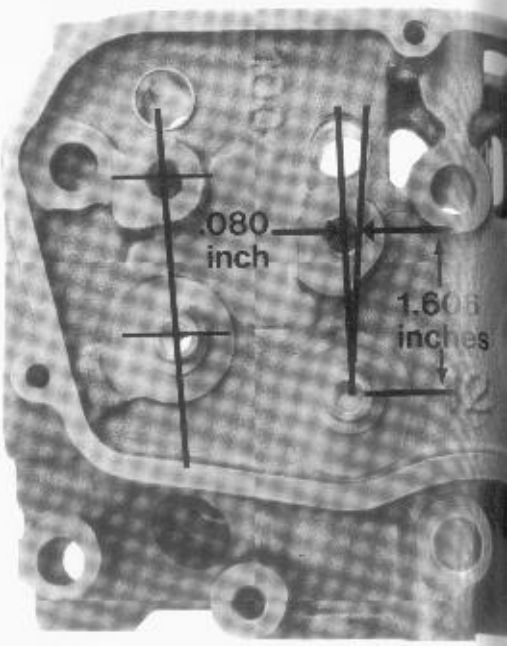
Align the sleeve with a transfer punch and drill with a 39/64-inch drill bit. Perfect alignment is critical if you want to avoid breaking through the wall of the sleeve.



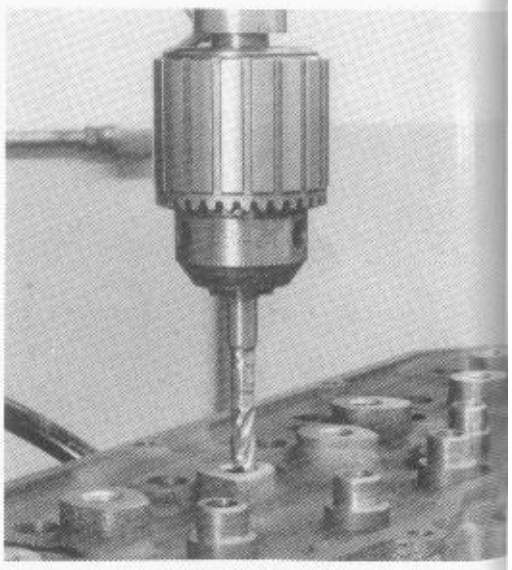
Even with the enlarged and sleeved pushrod guides installed, there is still the possibility of pushrod interference at the top of the sleeve. Grind the outside half of each sleeve to a depth of ½ inch and blend it smoothly into the casting to ensure adequate clearance.



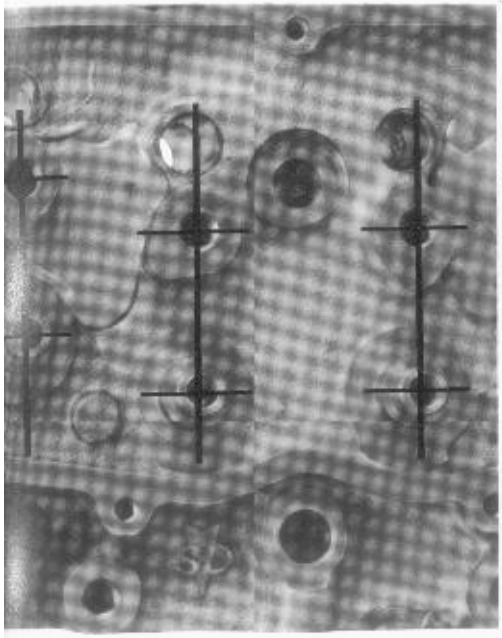
On a production head, the intake and exhaust stud bosses are machined at different angles and different heights, but testing has shown that competition heads can have all the studs installed in a vertical plane. Since the exhaust stud bosses are approximately .080-inch taller than the intake bosses, an .080-.100-inch cleanup cut is taken to equalize their height. Then all bosses are machined an additional .312 inch. You must use Crane rocker arm studs PN99160.

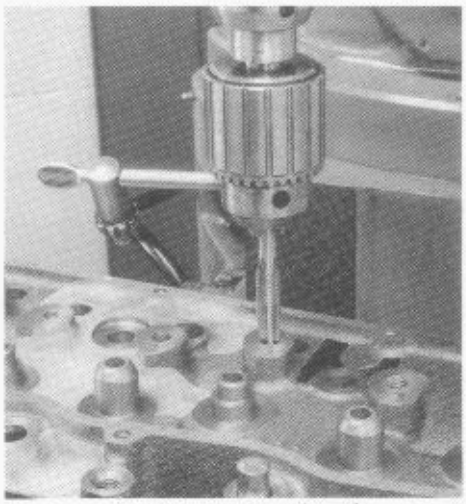


To properly locate the rocker arm studs, you have to center off each valve guide with a transfer punch. On cylinders two and three, the stud holes are located exactly 1.606 inches straight back from the centerline of the valve guides. You have to move back 1.606 inches and then .080 inch toward the front of the head on cylinder number one, and .080 inch toward the rear of the head on cylinder number four. The holes for cylinders two and three are located straight back from the valve guides on a valve guide centerline 90 degrees from the front to rear axis of the head.

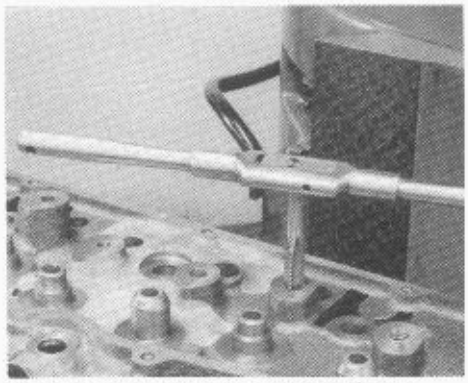


The new hole will be slightly off register from the existing hole and the drill bit will have a tendency to walk into the hole instead of drilling straight. To avoid this, use a four-fluted end mill 5/16 inch in diameter. It will cut a slightly elongated hole, but it will clean up when it is tapped. Prior to tapping, redrill the hole with a "Q" drill bit.

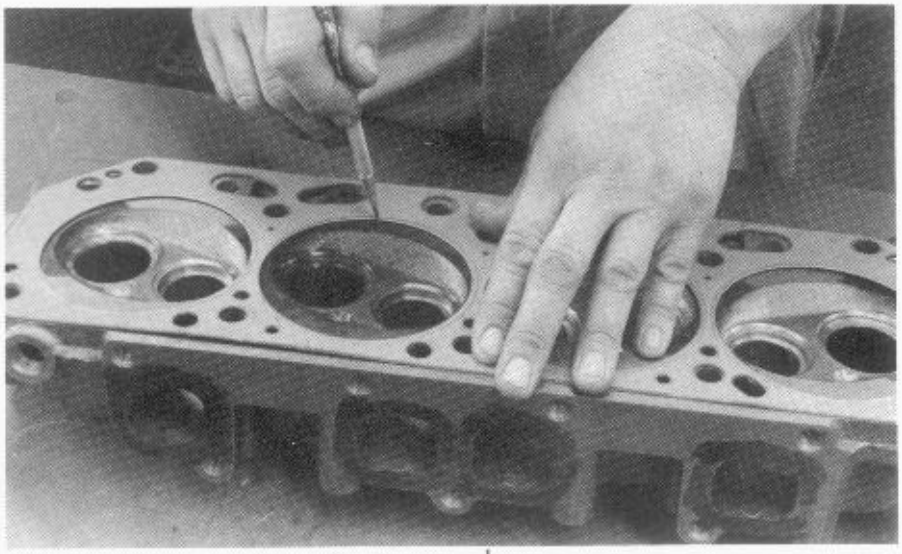




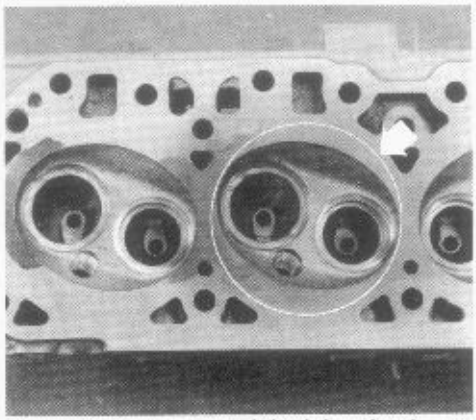
Center on each hole with a transfer punch and begin tapping with a 7/16-14 NC tap installed in the drill press chuck. This helps you start the tap straight. Remember, never leave the chuck key in the chuck.



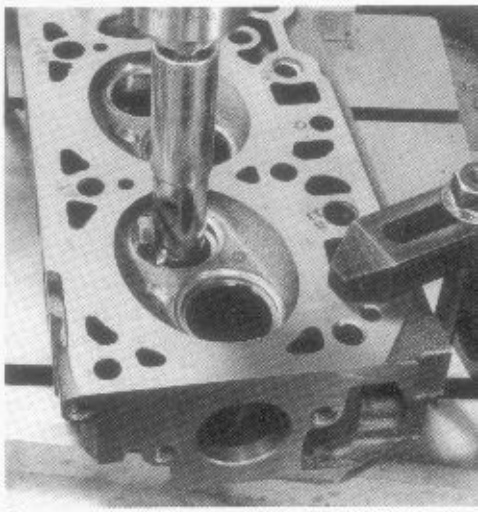
Finish tapping each hole by hand and then go back and carefully chamfer the holes to ensure stud shoulder clearance.



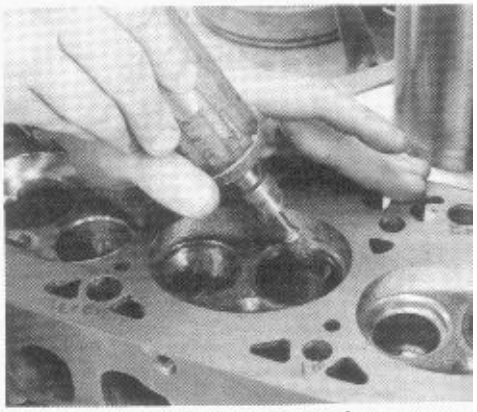
Apply machinist's bluing around each chamber. Then, use the head gasket as a template to scribe a line indicating the relative position of the cylinder bore. Align the gasket by installing cylinder head pin dowels loosely in the head. An excellent way to double-check the accuracy of this procedure is to install the bare head on the block with several bolts holding it snug. Then use a strong inspection light to peer up from the bottom of the cylinder. Inspect the relationship between the edges of the combustion chambers and the top of the cylinder bores. In some cases, minor adjustment of your scribed line may be necessary to match the chambers and gasket to the cylinders.



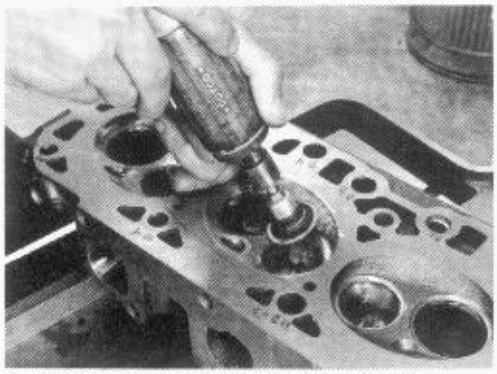
Once you have accurately determined the location of the cylinder bore in relation to the combustion chamber, use the scribed line as a guide for all future combustion chamber work. All modifications must be kept within the scribed line. If you're going to have headwork done by an outside source, complete this procedure prior to shipping them the head.



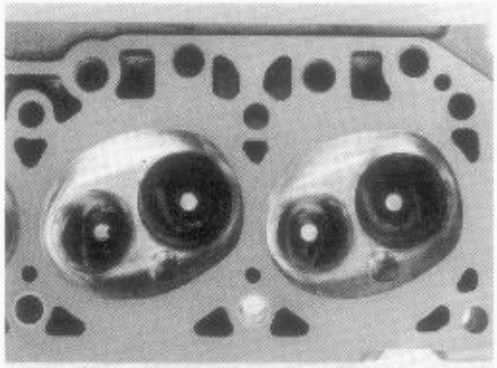
To open the valve pockets, use a cutter adjusted to cut a diameter .030 inch less than the inside diameter of the valve seat as measured on the valve. Cut to a depth of 3/16 inch.



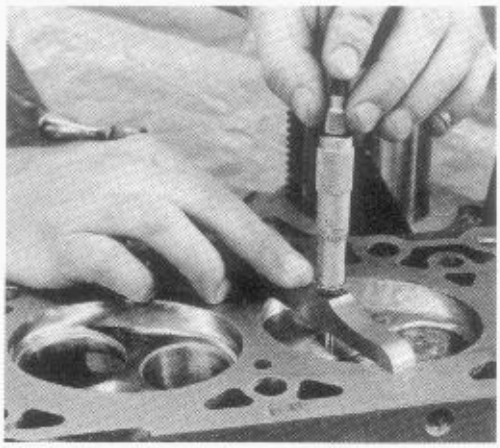
Rough-in the seat area with a rotary grinder, blending all rough edges into the seat area and down into the valve pocket.



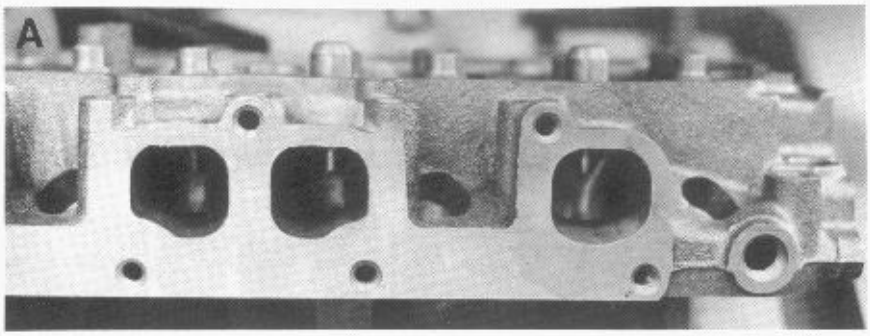
A small-diameter rotary sanding disc is used to polish the chamber. Take care not to cut into the valve seat area or beyond the scribed line marking the location of the cylinder wall.



This head was prepared by Engine Prototype Development in Carson City, Nevada–(702)849-2515. It has produced the best flow numbers of all heads tested to date. Your cylinder head will make good power with chambers modified in this manner.



During the valve grinding operation, measure carefully to control and equalize valve seat depth. Sneak up on it slowly until you have the proper seat widths and all the valves are installed at the same depth. See the accompanying diagram for suggested valve seat angles. Valve seat width is controlled by the final top cut.



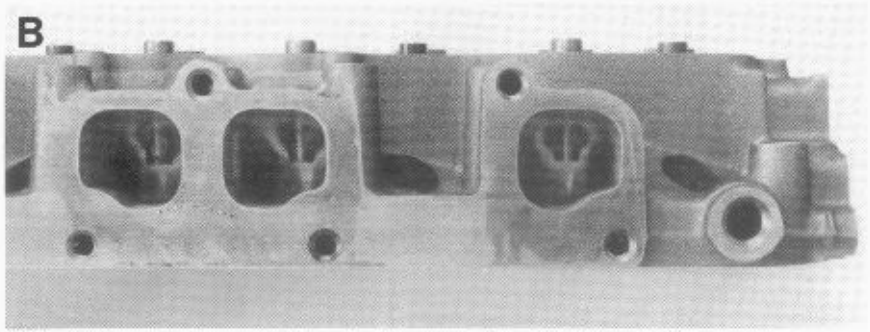
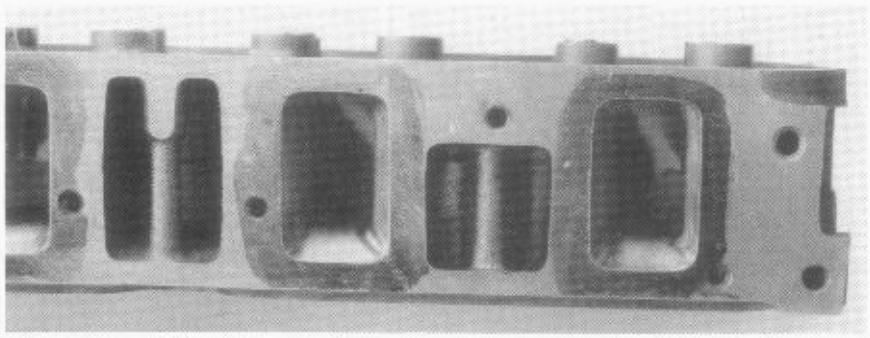
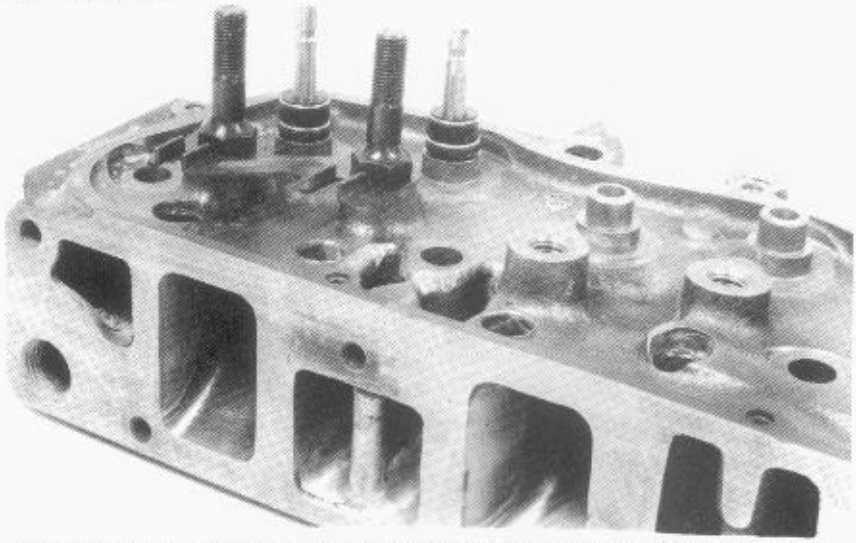


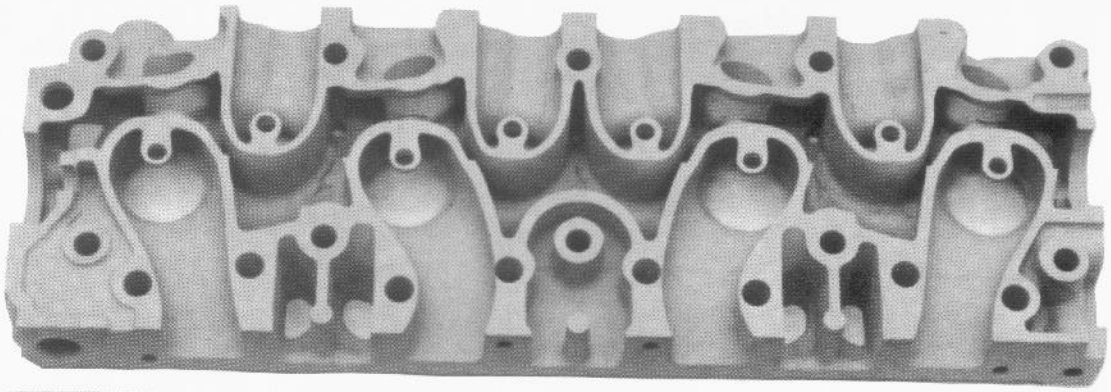
Photo A shows a Super Duty head with one exhaust port ported to maximum size. You cannot completely remove the hump in the lower corner of the port because the water jacket passes under this area. Photo B shows the fully ported exhaust side as done by EPD. Their head actually outflows the head in Photo A, and they left the hump in the port virtually intact.



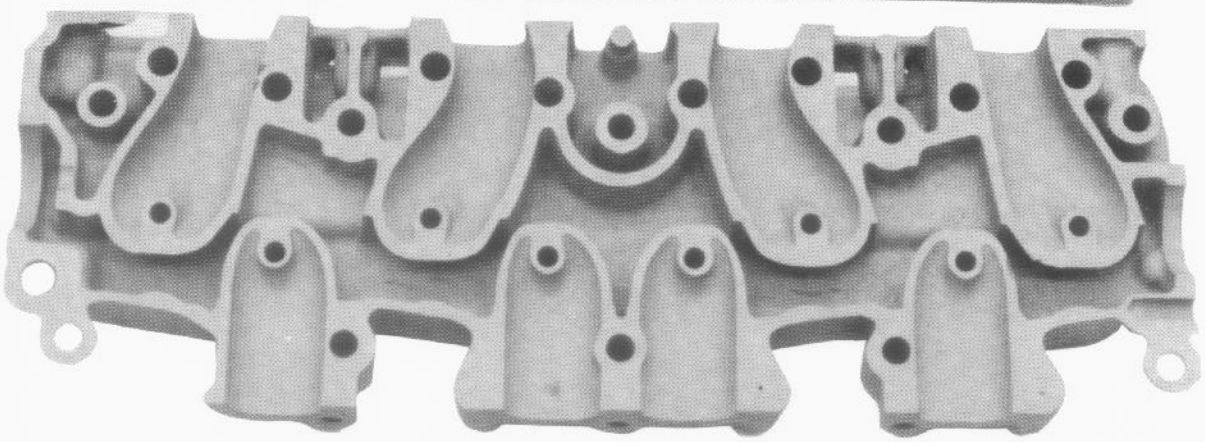
EPD's intake port is matched to the Mr. Gasket intake gasket. The intake side features more of a line of sight path to the valve as opposed to the exhaust side, which maintains a larger and higher radius where the port floor turns into the chamber.

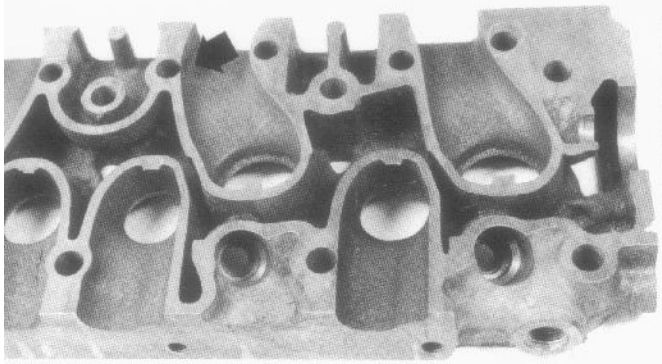


Valve guides are fitted with number 16-1811 PC seals, a Chevy-style seal that any parts outlet will have in stock. Rocker arm stud bosses are fitted with big-block, Chevy-style 7/16-inch studs from Crane Cams (PN99160), and factory guide plates that come in the Super Duty Engine Build kit. Studs are torqued to 65 lbs.-ft.



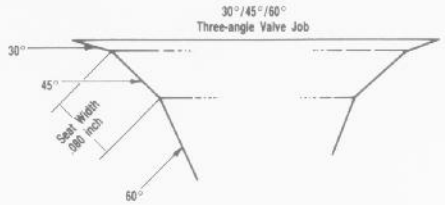
A cutaway view shows the generous port area and "line of sight" path to the valves. Note the amount of water jacket area around the valves, especially the exhaust valves.



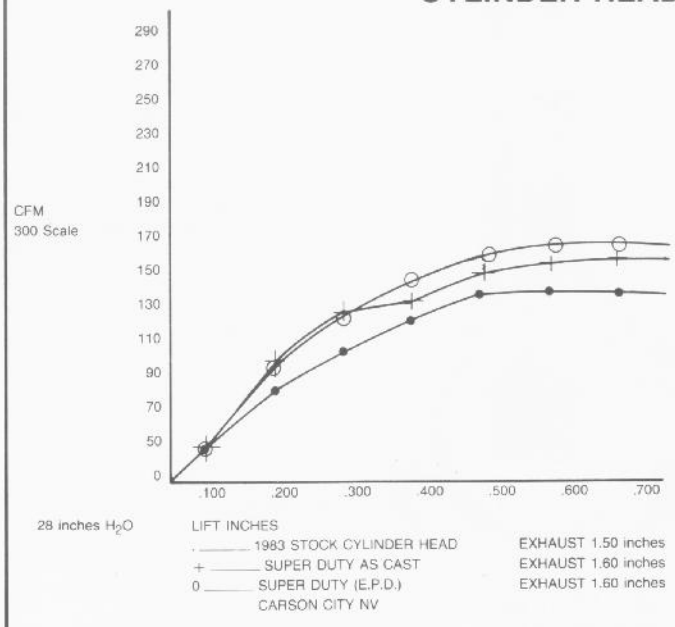


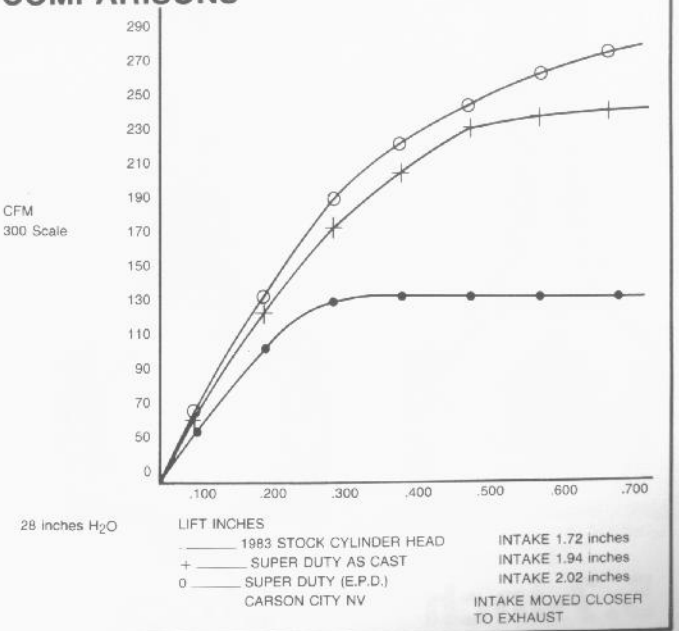
The arrow indicates where a drilled pushrod guide hole has broken through into the intake port. This is why the holes are sleeved during the head prep procedure.

RECOMMENDED COMPETITION VALVE JOB FOR SUPER DUTY CYLINDER HEADS

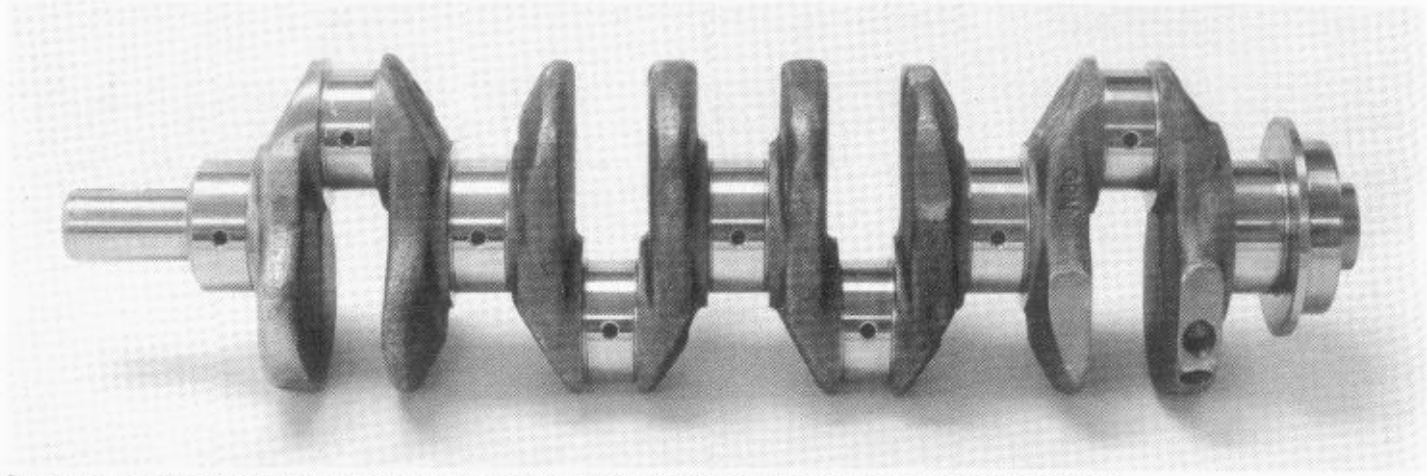


SUPER DUTY
CYLINDER HEAD COMPARISONS

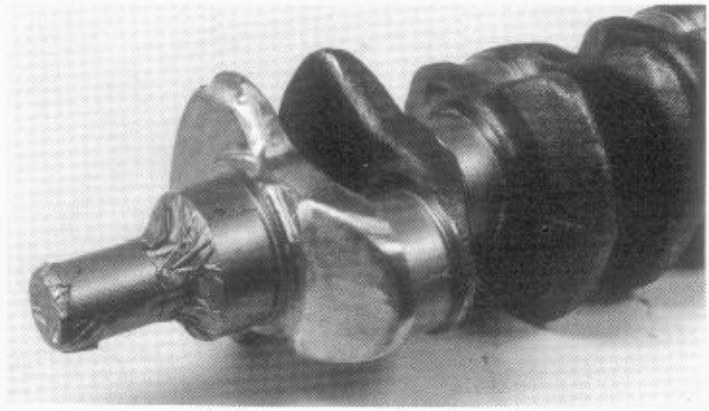


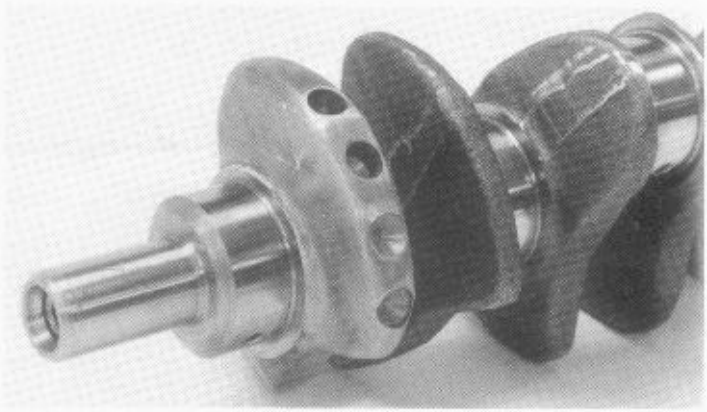


SUPER DUTY COMPONENT & ACCESSORY PREPARAT

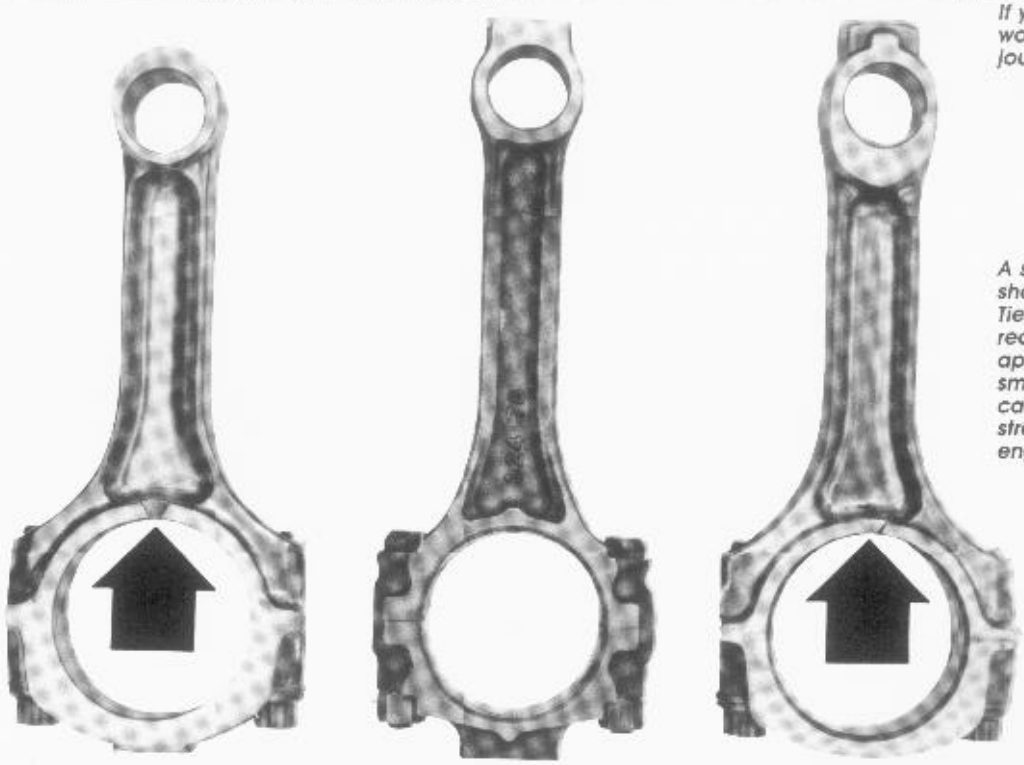


The Super Duty crankshaft is available in two different stroke lengths: 3.00 inches and 3.25 inches. Current crankshafts have journals that are .025 inch oversize. Next run of cranks will be ground to finished journal size.

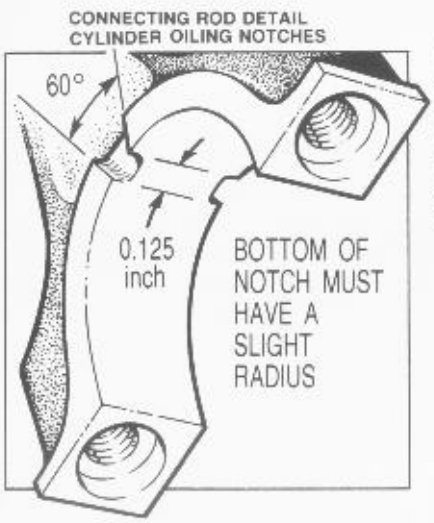




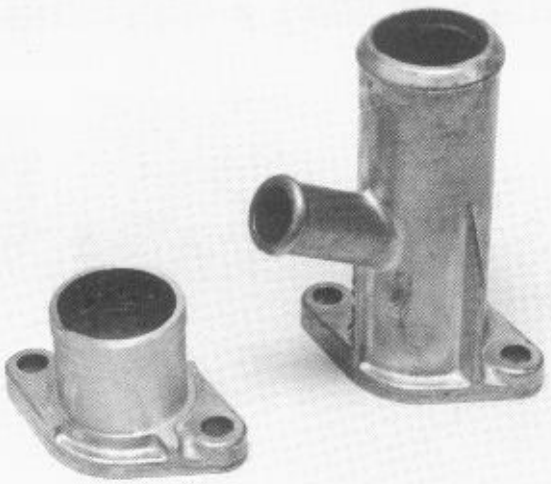
If you plan to perform additional crank work, be certain to tape off all the crank journals to prevent accidental damage.



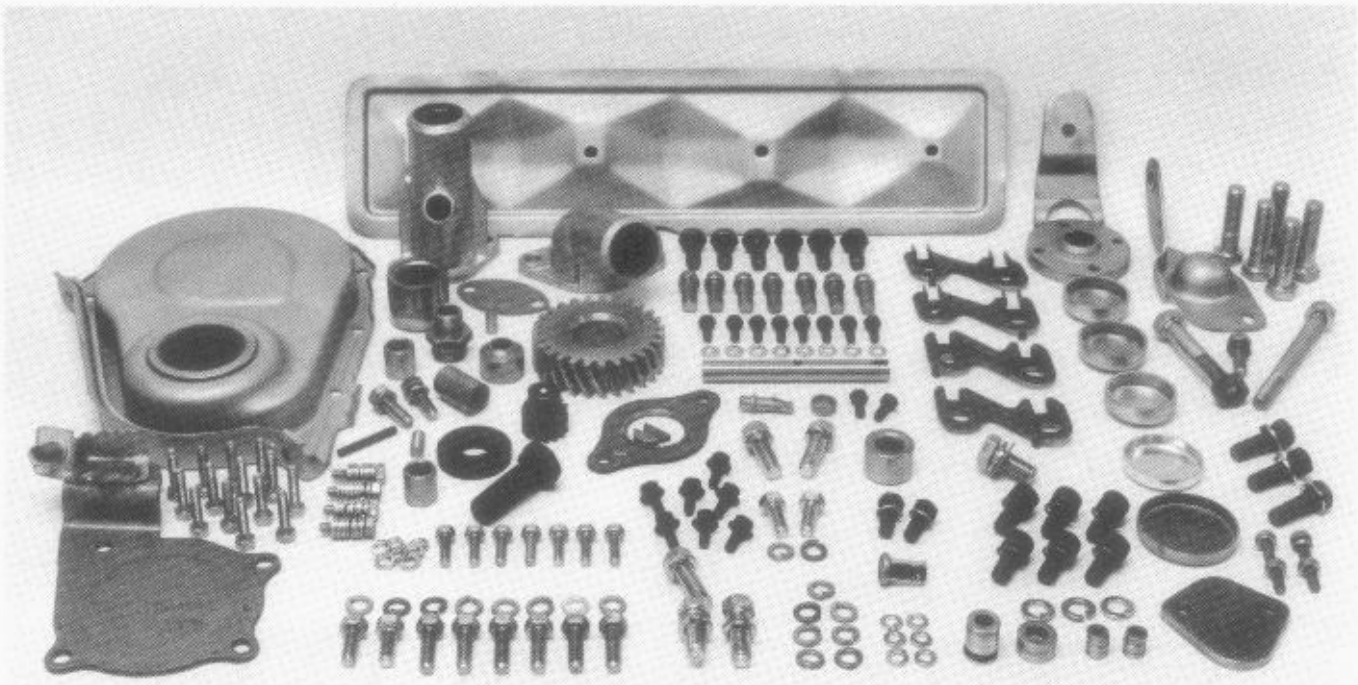
A standard 151-cid connecting rod is shown in the center with Chevrolet Bow Tie rods on either side. Bow Tie rods are recommended for all Super Duty applications, but properly massaged small-block Chevy rods with good bolts can be employed in high-performance street applications and some racing engines, depending on severity of use.



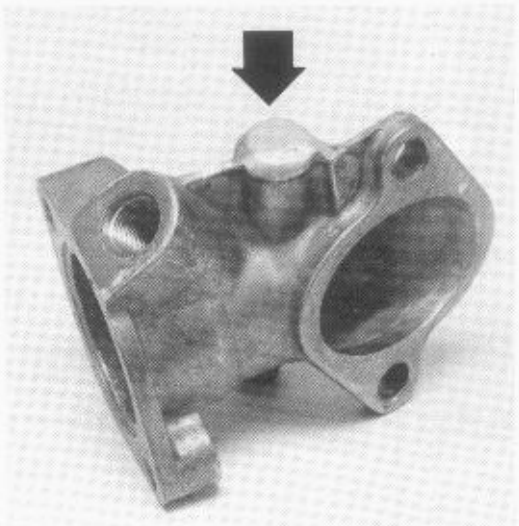
The illustration shows the oiling modifications made to the connecting rods. Each "V" must have a proper radius at the bottom to avoid making a fracture source. This modification is highly recommended, as it enhances proper cylinder wall lubrication.

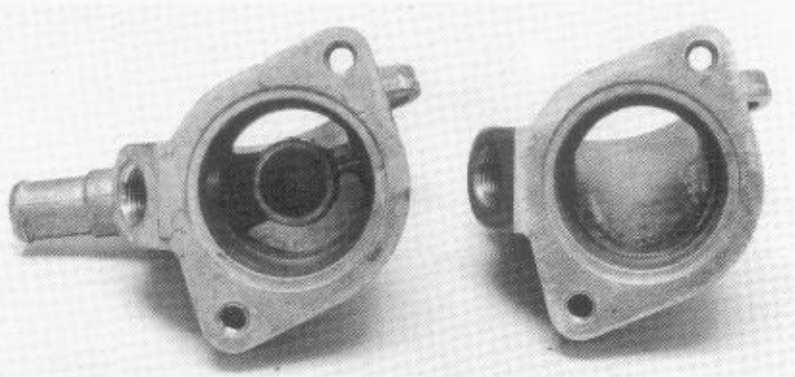


The water pump outlet housing does not require a bypass for high-performance applications, so it's modified as shown here. Leave 1⅛ inches of material with a small lip to grab the water hose.



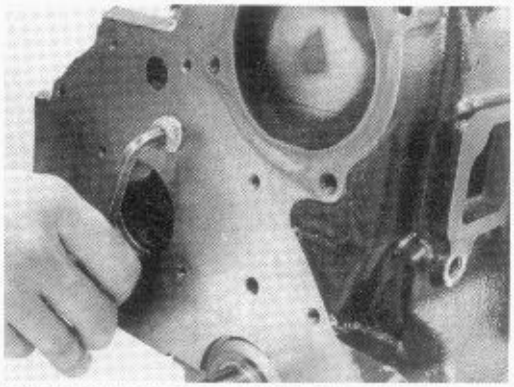
The Super Duty Engine Build Package (PN10031328) provides everything needed to complete an engine buildup. It includes all fasteners, plugs, covers and attachments to completely assemble a Super Duty engine.



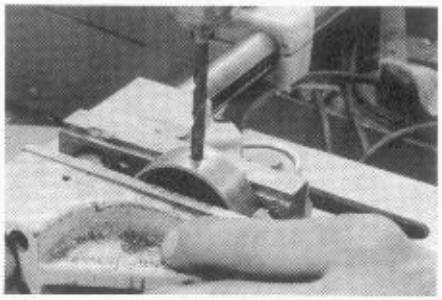


Similarly, the thermostat housing is modified to remove the bypass outlet. The external water neck is removed and welded up (arrow) and the internal water pickup is removed as shown in the comparison of a modified housing with a standard part. Since all bypass is eliminated you cannot use a thermostat. Use a restriction plate with a 1.0-inch hole.

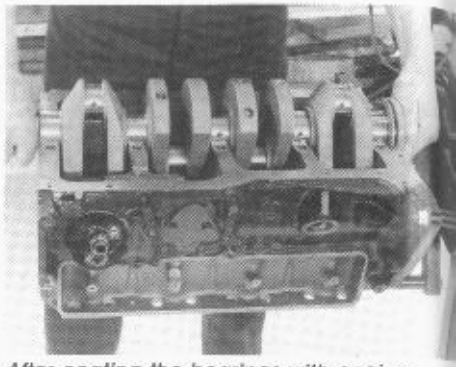
SUPER DUTY ENGINE ASSEMBLY GUIDE



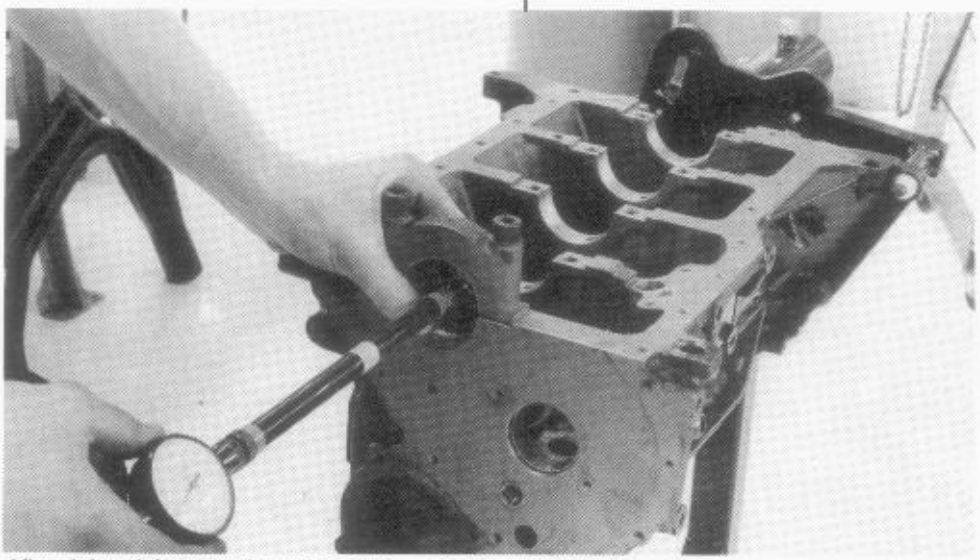
Install the front and rear oil gallery plugs and the water passage block-off plugs in the deck surface using a quality pipe sealant or red Loctite (PN2223).



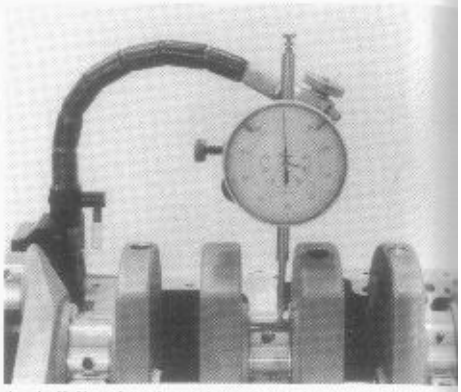
Once the correct bearings have been selected, you have to match the oiling hole in the upper bearing insert to the oil feed hole in the main bearing saddle. Use a ⅛-inch drill bit to enlarge the hole and then carefully deburr and chamfer by hand. When drilling, use a slow speed and slow-feed rate.



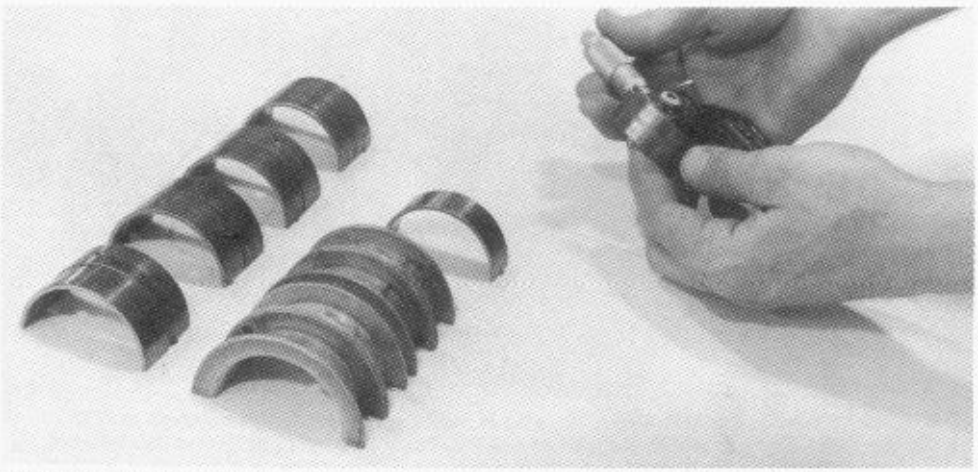
After coating the bearings with engine oil, install the rear main seal and carefully lower the crank into the block.



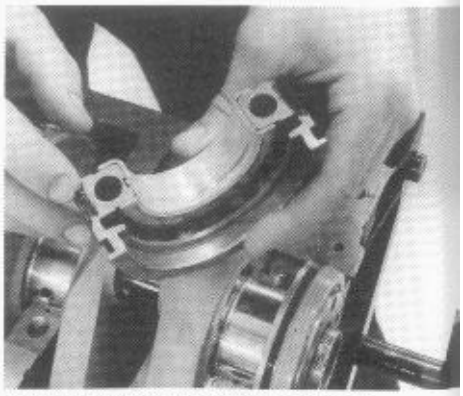
After determining exact crankshaft journal size, main bearing sets are installed with the main caps torqued to 105 lbs.-ft. Bearing diameter is checked with a dial-bore gauge and compared with crank journal size to check clearances. The torque plate should always be installed during this procedure. When torquing main cap bolts and head bolts, you must use the 4130 hardened washers that come in the Moroso bolt kit to obtain proper torque.



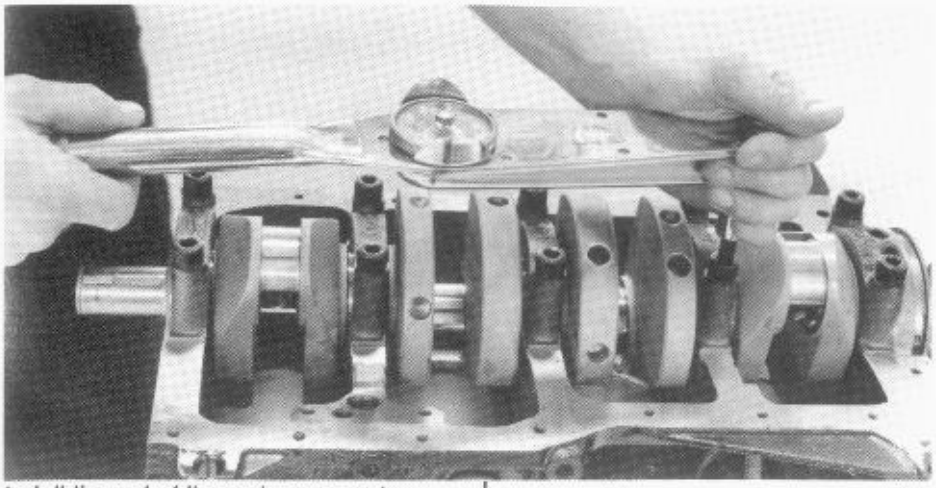
Install the front and rear main caps and torque to 105 lbs.-ft. Then rig a dial indicator to read runout on the center main bearing journal. The indicator spindle should be located to one side of the journal to avoid the oil hole as the crank is turned. Runout should not exceed .001 inch.



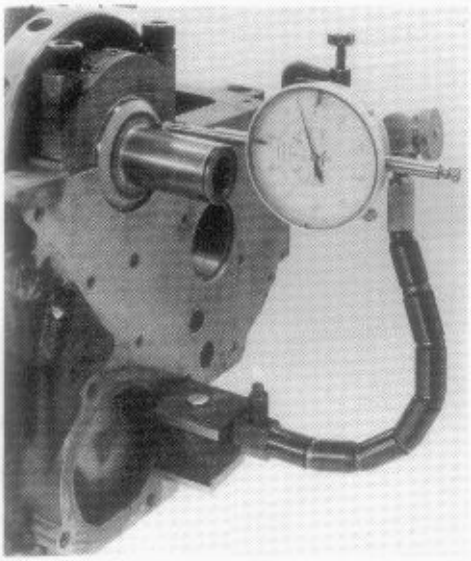
Select fitting of bearings is often the best way to arrive at the proper clearance. Several sets of bearings are mic'ed to determine variation in thickness. Individual bearings can vary up to .0005 inch and you can mix and match to optimize clearances.



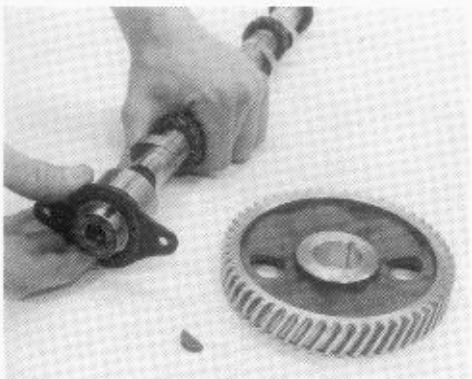
Prior to installing the rear main cap, apply sealer along the edges to prevent oil from seeping past the rear main seal. Set the thrust bearing by rapping sharply on the front and rear of the crank with a large rubber hammer.



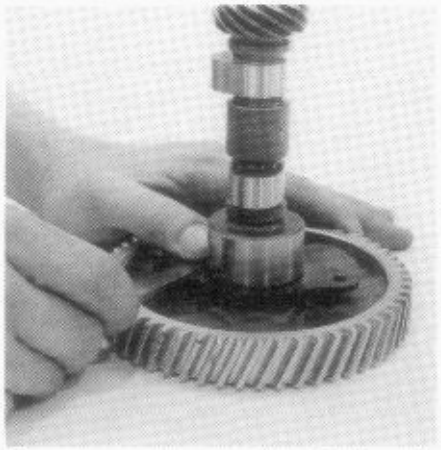
Install the rest of the main caps and torque to 105 lbs.-ft. Main caps are numbered in sequence and each cap has an arrow to indicate the front.



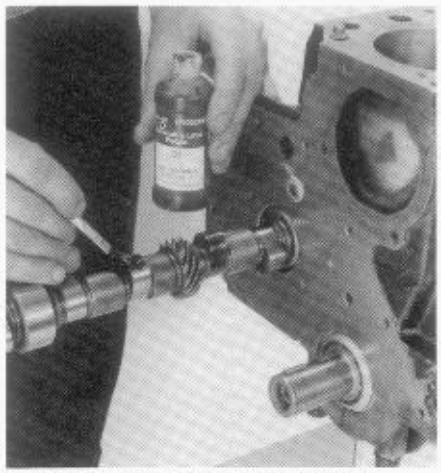
Affix a dial indicator to the front of the cylinder block and read crankshaft end play by prying the crank back and forth with a large screwdriver. End play should be .0035-.0055 inch.



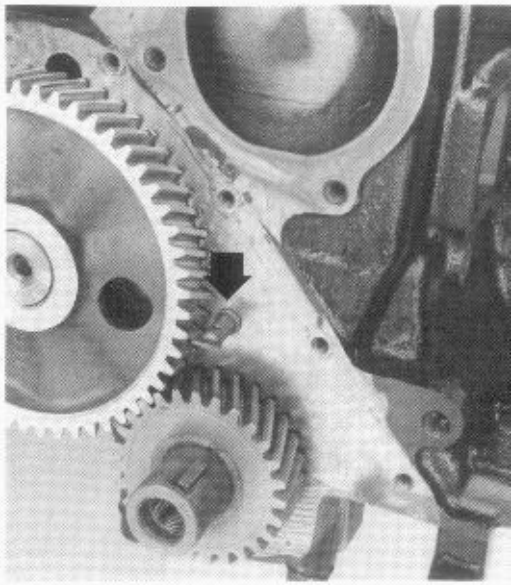
The camshaft thrust plate is installed before the cam timing gear is pressed onto the cam. The chamfer on one side of the thrust plate spacer must face the cam to accommodate the small radius on the front cam journal.



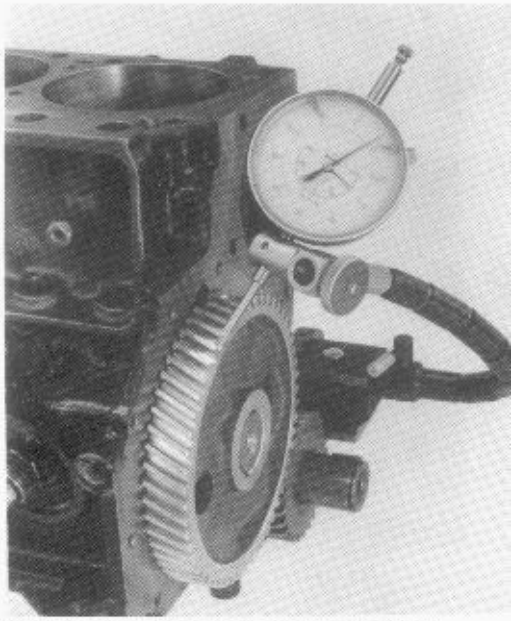
Clearance on the cam thrust plate must be maintained at .015 inch.



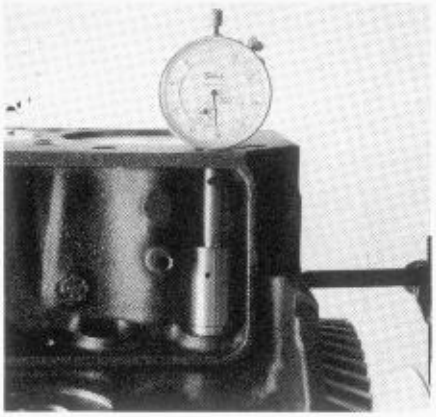
As the camshaft is installed into the engine, coat each lobe with GM Camshaft & Lifter Prelube PN1052365. This lube should also be applied to the distributor drive gear and the fuel pump eccentric to prevent excessive wear during initial engine fire-up.

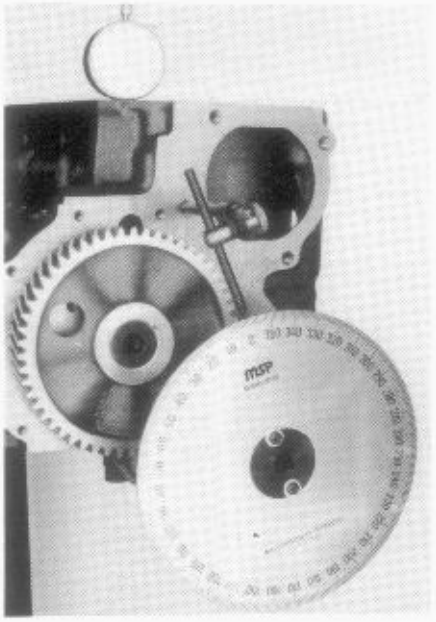


While you're installing the camshaft and the crankshaft timing gear, it's a good idea to install the cam gear oiler (arrow) so you don't overlook it when installing the front cover. Use a dab of red Loctite and drive the piece straight in with the pinched end parallel to the deck surface. The small spit-through hole with a deflector protruding from it should point straight down toward the crank gear.

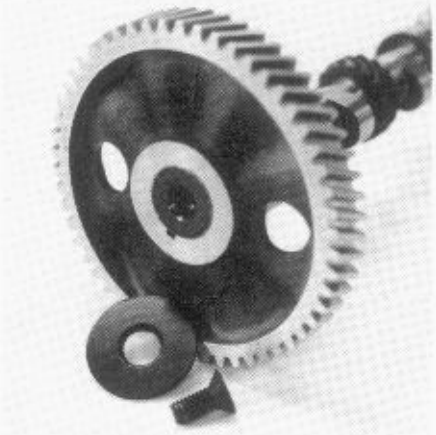


Attach a dial indicator to the front of the block and check the backlash on the timing gears. The acceptable range is .002-.008 inch. If the lash is out of spec, you'll have to try different gears to bring it into line.





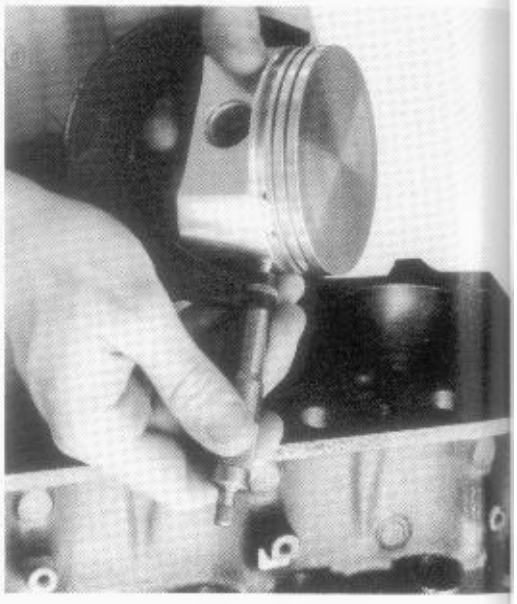
Mills Specialty Products manufactures this special camshaft-checking tool that can be used with a standard dial indicator. It allows you to check cam timing directly off the cam lobe to ensure maximum accuracy.

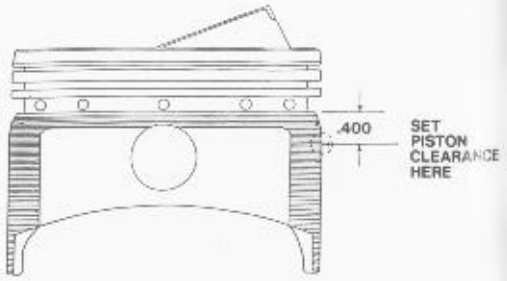


To prevent the cam gear from backing off the cam at high rpm, a Moroso retaining washer and bolt assembly number 3771 is installed and torqued to 40 lbs.-ft. with Loctite.

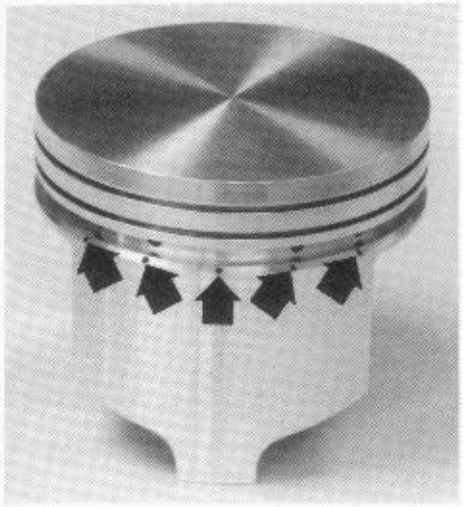
The standard racing combination for the Super Duty engine consists of Chevrolet Bow Tie connecting rods, BRC or Arias racing pistons, and Speed Pro piston rings. See the separate instructions for specific details on connecting rod preparation. In any racing application where select fit rings are used, they should be hand-fitted to each bore with an end gap of .018 inch on both the top ring and the second ring.

Use a dial-bore gauge to verify cylinder diameter after receiving the block from your machinist. Verification of all machine work is an essential element of competition-engine assembly.

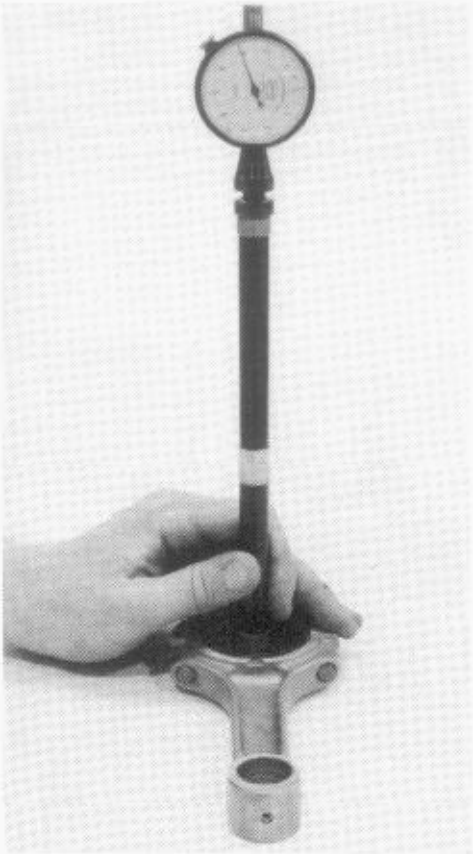




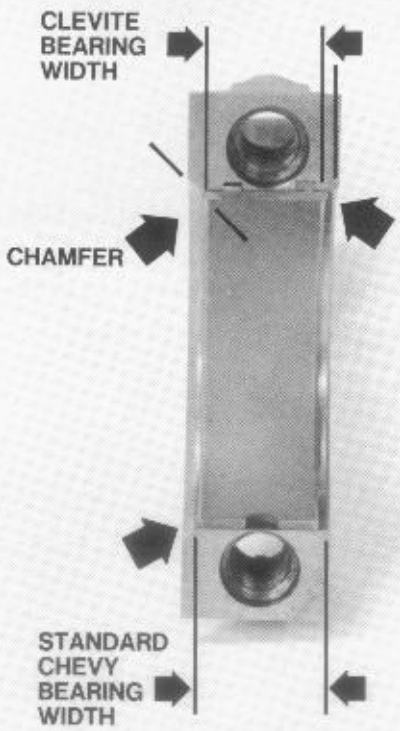
Measure piston clearance at the exact point specified by the manufacturer. This is usually a specific distance down the skirt from the bottom of the oil ring groove. The diagram shows the recommended procedure for setting piston clearance on BRC pistons.



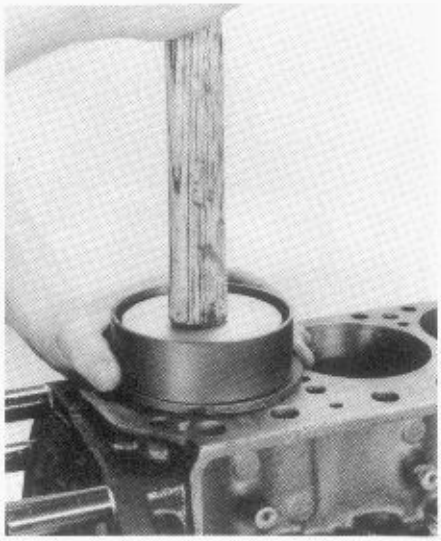
Oil relief holes are drilled below the oil ring to help the oil ring scraper control the additional oil thrown on the walls by the "V" notches in the connecting rod. A 45-degree chamfer is cut on the bottom of the oil ring land. It should be .060-.080-inch wide and the oil control holes should be .050 inch in diameter, perpendicular to the surface of the chamfer.



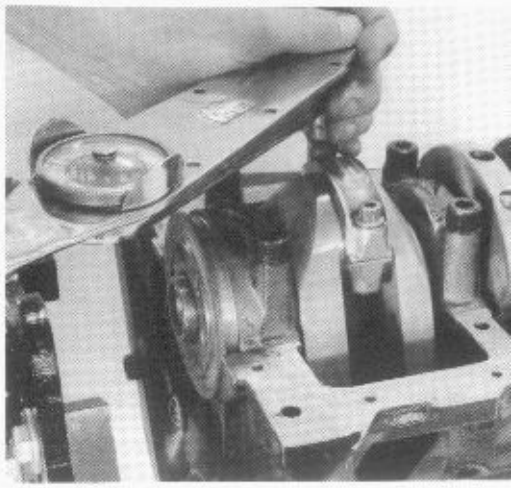
Torque rod bolts to 70 lbs.-ft. with bearing inserts installed. Measure rod bearing clearance with a dial-bore gauge and select fit bearings the same way you did the main bearings. Clevite rod bearings have an upper and lower insert that cannot be mixed up. If installed incorrectly, you won't have the proper clearance for the crank journal radius.



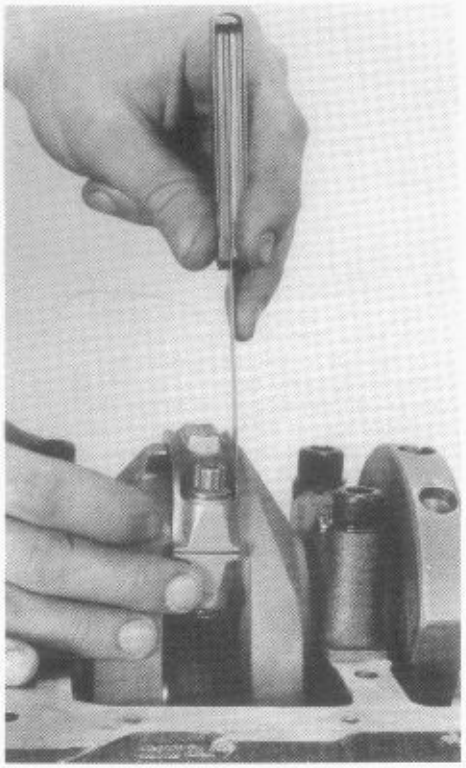
If you study this photo carefully, you'll see why you have to use the specific upper and lower Clevite bearings manufactured for this application. Even though you're using a small-block Chevy connecting rod, you can't use a standard Chevy bearing because they are designed for an application where you have two rods on a common journal. On the Super Duty engine there is only one rod per journal and you have a radius fillet on both sides of the rod. The Clevite bearings are the only ones that will clear the radius properly.



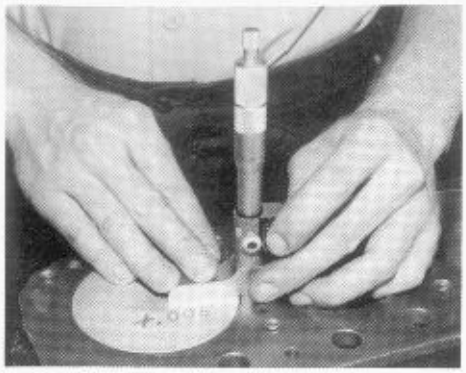
Install pistons with the end gaps centered over opposite ends of the wrist pins. The opening of the oil ring expander goes to the left side of the engine with the upper and lower rails positioned approximately one inch to either side of the gap.



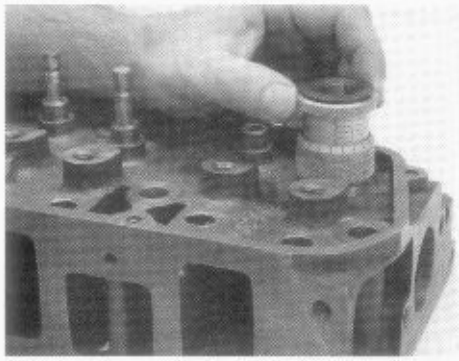
Rod bolts are torqued to 70 lbs.-ft. Pull them up to 50, 60, 65, and finally 70 lbs.-ft. to ensure uniform bearing crush. Be certain to oil the threads and washers lightly before tightening.



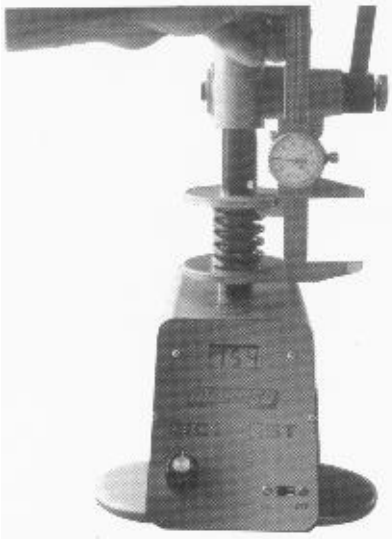
Side clearance should have already been established during mock-up assembly of the engine, but it should always be verified during final assembly. The suggested clearance is .020-.022 inch.



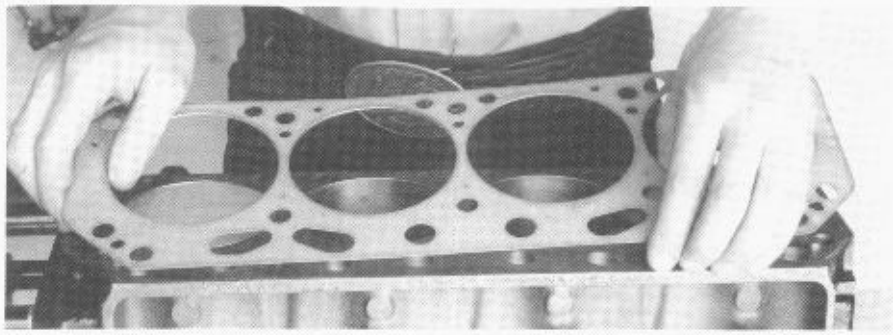
During trial assembly, all the rods and pistons should be installed in the engine so that deck heights can be verified. A zero deck height is recommended for most Super Duty engines. The piston shown here is checking at .005 inch above deck, indicating that the top of the piston will have to be machined .005 inch to arrive at the proper deck height.



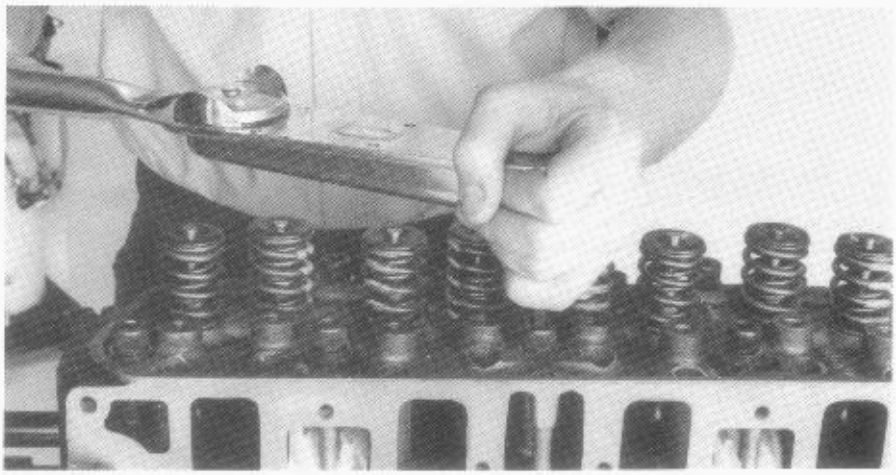
Check valve spring installed height with a Hite Mike from Mills Specialty Products. Shim springs to the recommended pressure. Installed height is not really critical as long as you maintain enough available spring travel to avoid coil bind. Correct pressure is what you want; installed height is secondary except for its effect on spring travel.

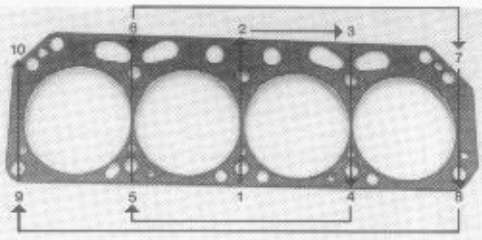


Crane's recommended valve spring (PN99838) is designed to provide 165 pounds at 1.750-inch installed height, and 412 pounds at 1.151-inch compressed height. Spring pressure must be checked with the retainer installed to ensure proper tension.

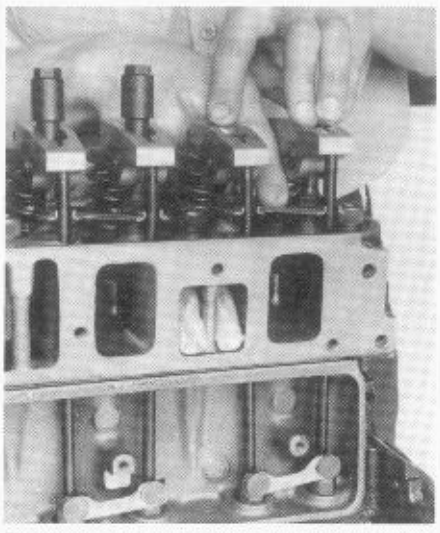


The Fel-Pro head gasket is installed dry, with the part number facing up.

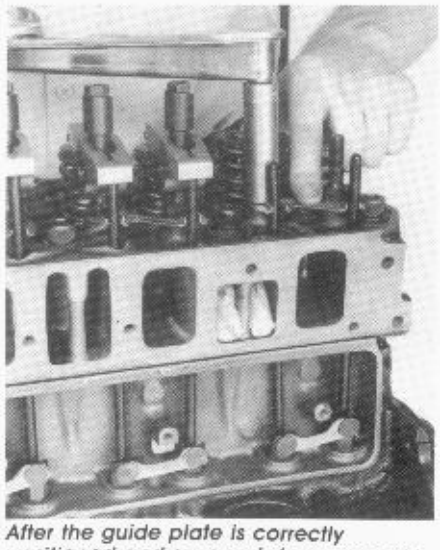




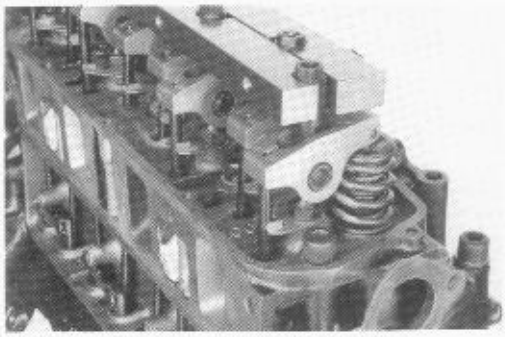
Torque head bolts to 105 lbs.-ft. following the accompanying torque sequence. Use hardened Moroso washers and light oil on the threads. Torque bolts in sequence starting at 50, 75, 80, 90, 100, and finally 105 lbs.-ft.



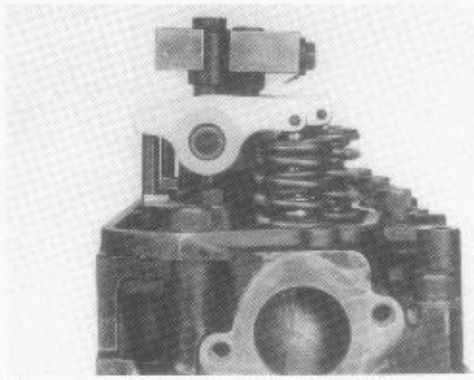
The rocker arm studs cannot be torqued until they are properly positioned. The guide plates do not extend far enough to completely pick up the pushrods, so the holes have to be ground oblong. Rockers and pushrods are installed, and the guide plate is pushed forward and held in the proper location while the studs are snugged down prior to torquing.



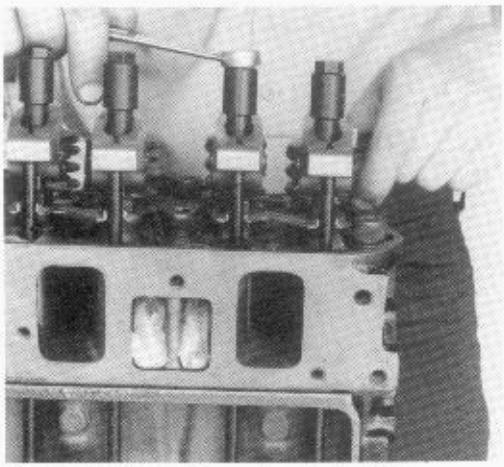
After the guide plate is correctly positioned and snugged down, remove the rocker arms and pushrods and torque the studs to 65 lbs.-ft. None of the stud holes should go into the water jacket, but some of them do break into the intake ports. To prevent leaks, install studs with a coat of sealer or red Loctite.



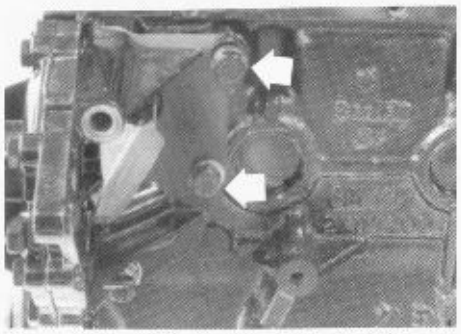
It's important to install the rocker arm stud girdle as high as possible to prevent rocker arm interference. The top of the bar should be flush with the top of the rocker arm adjuster, leaving only the hex nut protruding above the girdle.



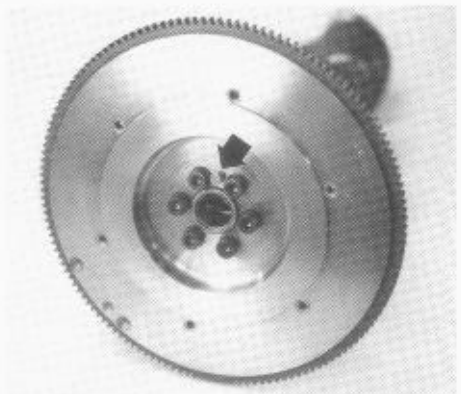
When checking rocker arm geometry during trial assembly, try to view the rocker arm assembly from the side. Adjust the rocker arm to zero lash with the lifter on the base circle of the cam. Rotate the engine until the rocker arm is at one half of full valve lift. When viewed from the side, the roller tip should be exactly centered on the valve stem. If contact is near the extreme outer edge of the valve stem, the pushrod is too long; if contact is near to the extreme inner edge of the valve stem, the pushrod is too short. When rocker arm geometry is correct, the roller will be slightly to the inside when the valve is closed. Then it will move across the center and slightly to the outside at full lift.



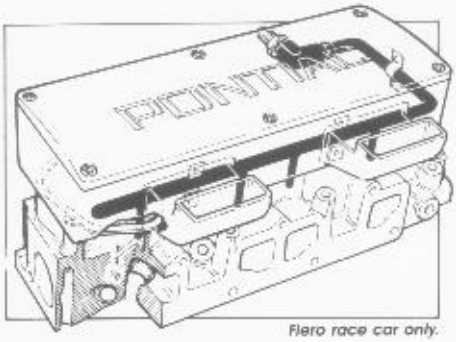
Valve adjustment is made with the lifters on the base circle of the cam. The stud girdle is normally left in place for valve adjustments, but it has been removed here for clarity.



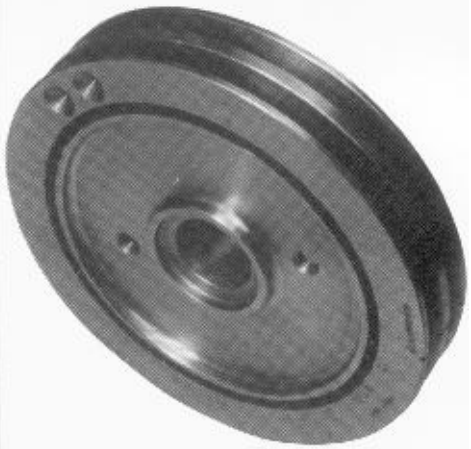
Some of the water pump bolts go into the water jacket, so be certain to apply sealer when the pump is installed.



To prevent shearing of the flywheel bolts at high accel/decel rates, the flywheel and crank flange are bolted together and drilled and reamed to .375 inch. Moroso dowel pin number 3771 is .3752 inch in diameter and must be press-fit in the crank and the flywheel to work effectively.

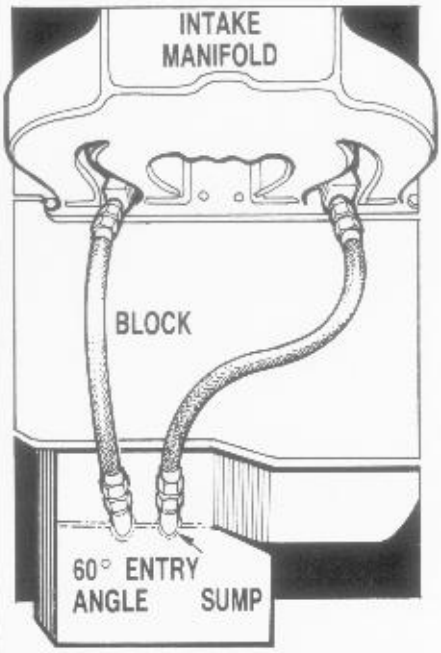


Fiero race car only.

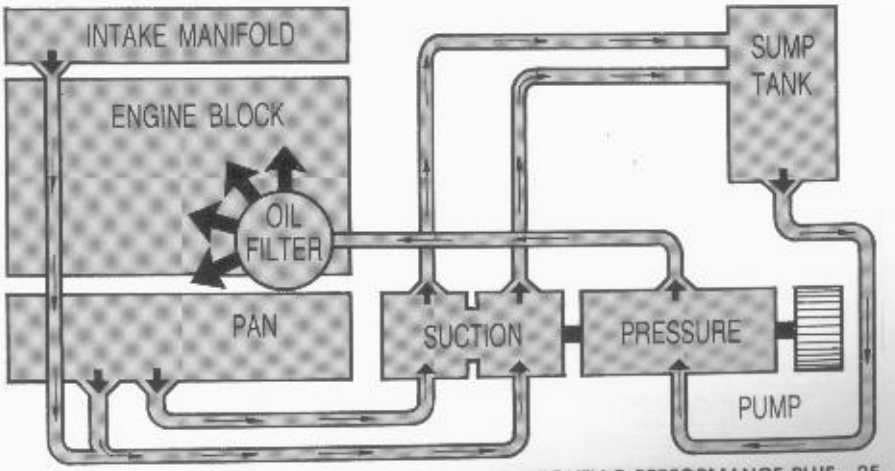


The SD dampener features integral dual-pulley grooves and provisions for maintaining accessory drive components. Torque the dampener bolt to 160 lbs.-ft.

TYPICAL CYLINDER HEAD OIL EVACUATION SYSTEM



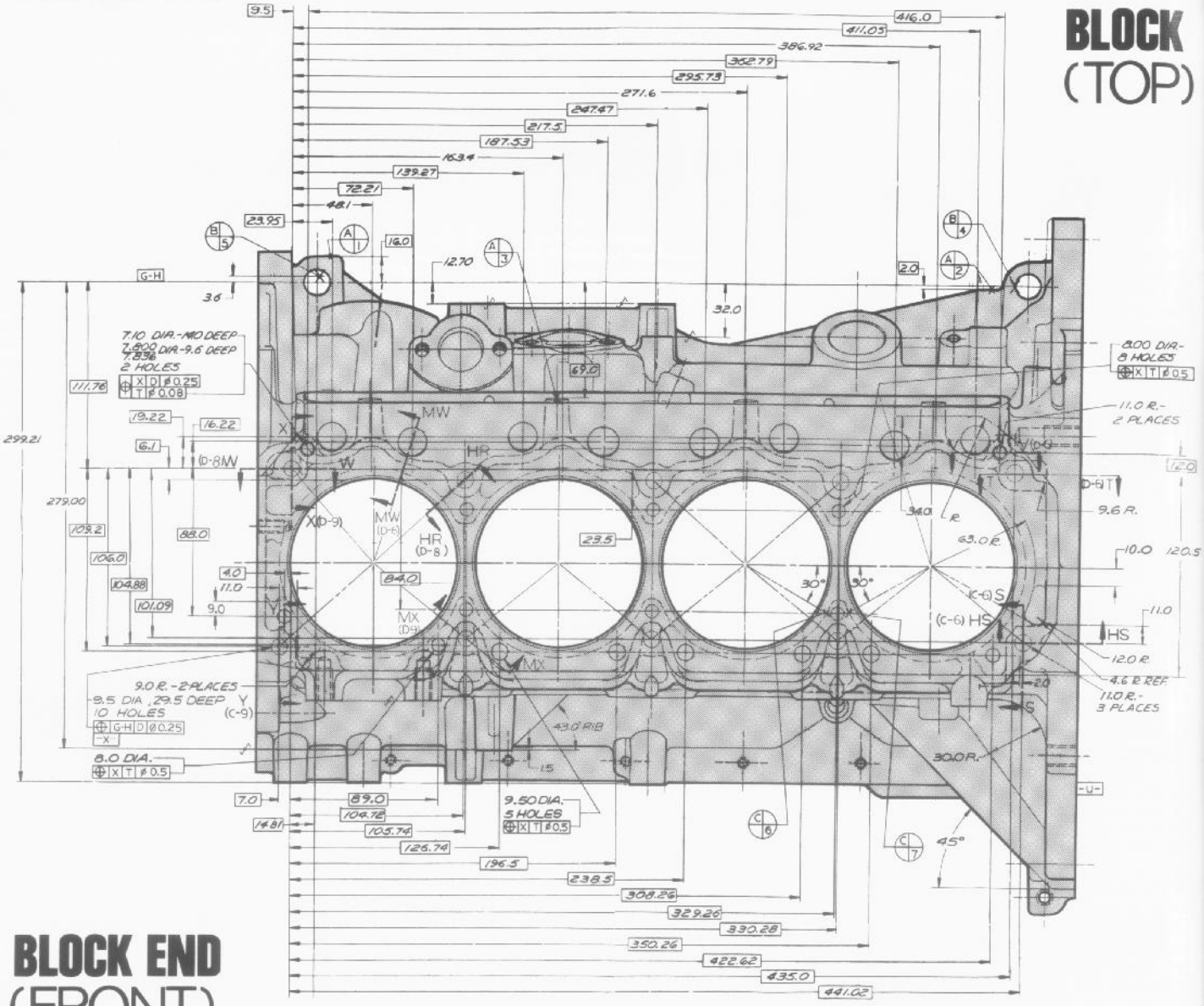
SUPER DUTY DRY SUMP SCHEMATIC



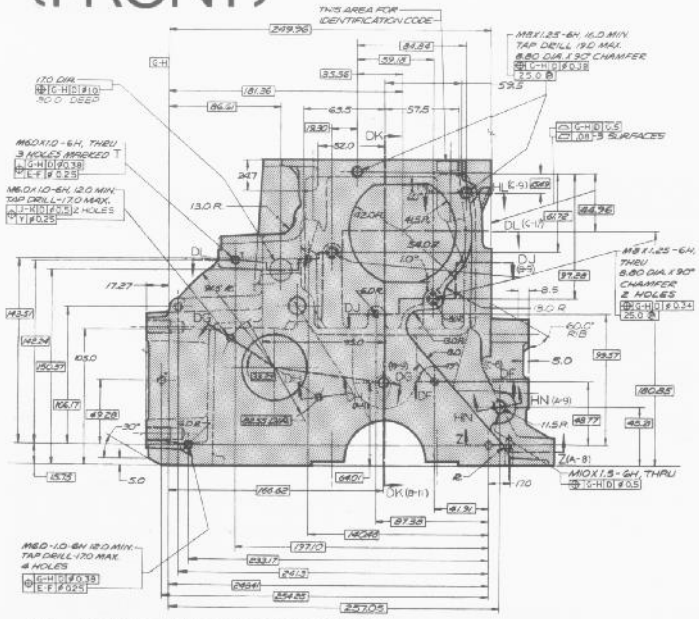
SUPER DUTY SPECIFICATIONS

All dimensions in millimeters

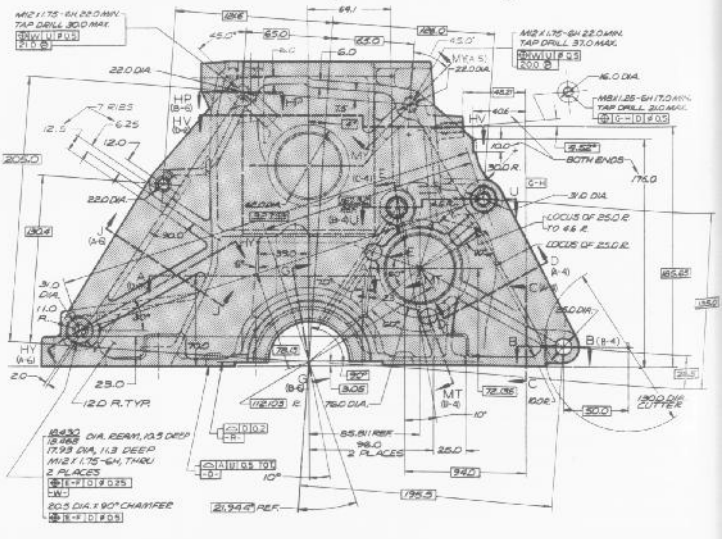
BLOCK (TOP)



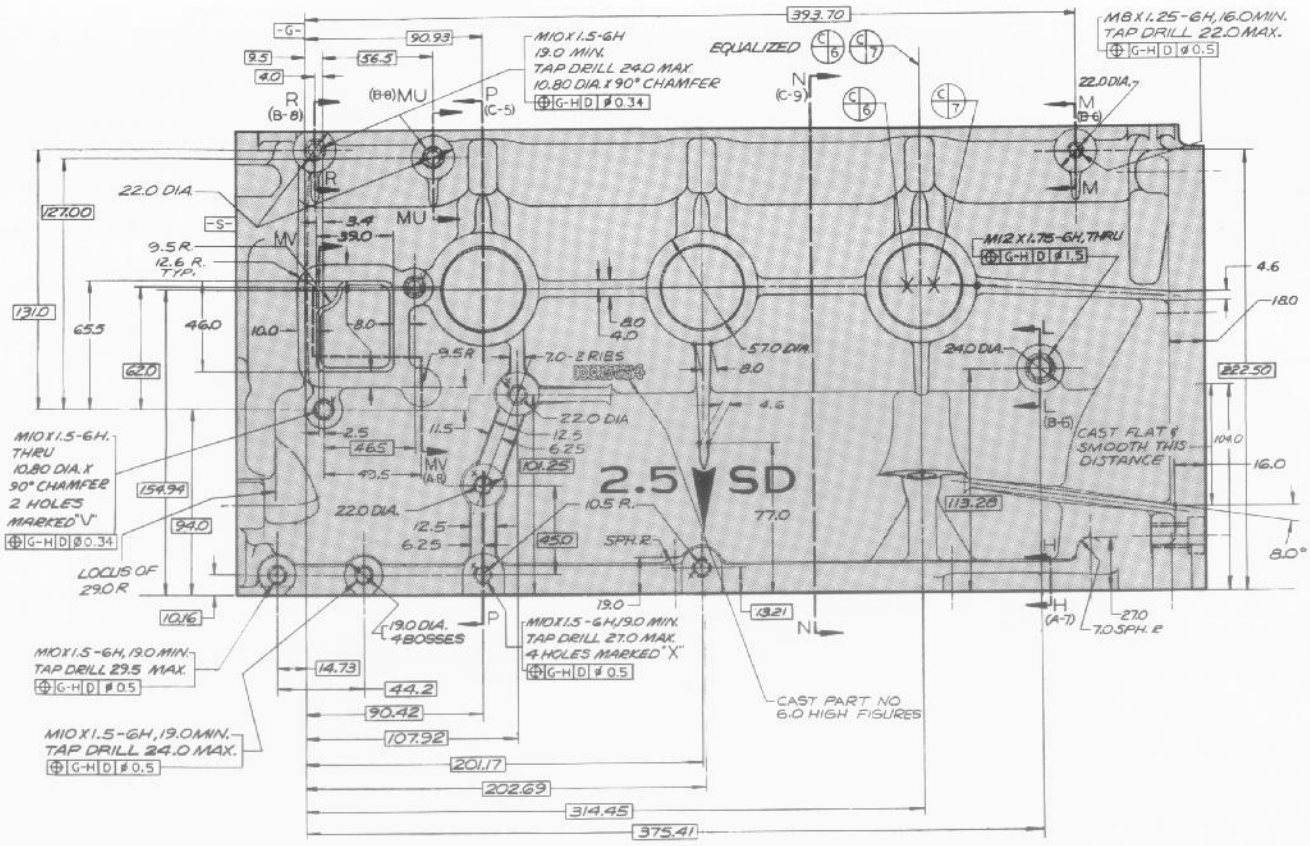
BLOCK END (FRONT)



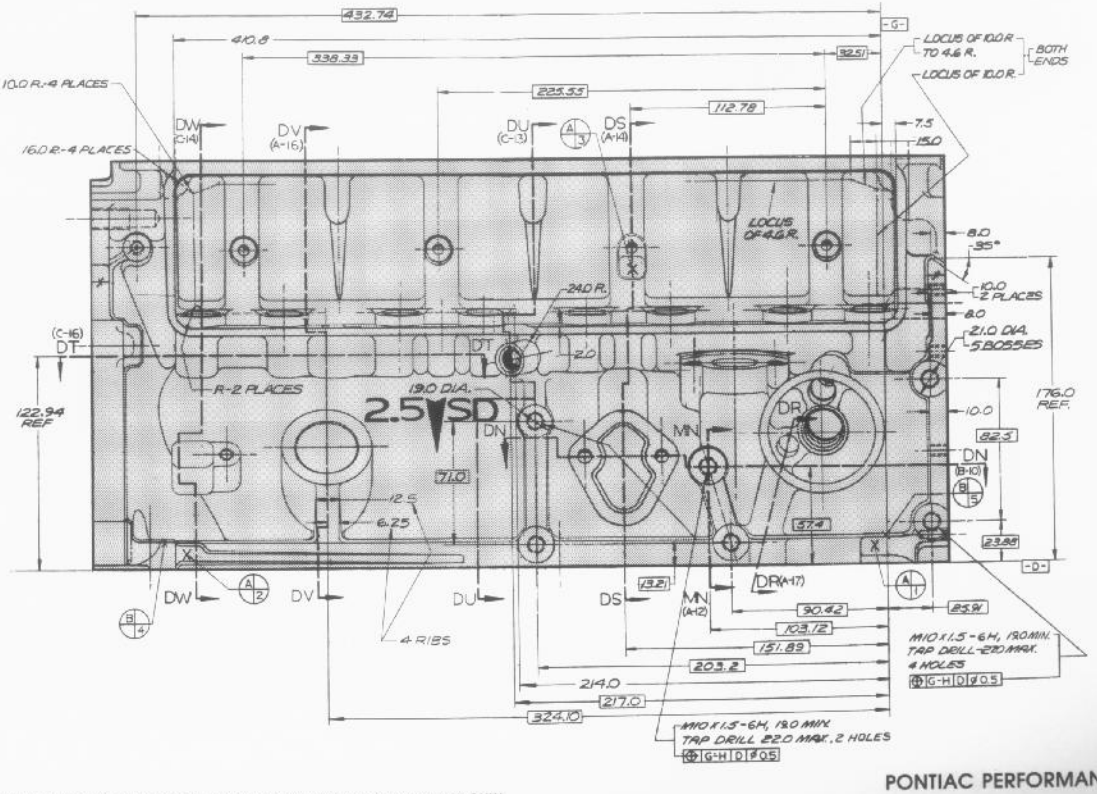
BLOCK END (REAR)



BLOCK (LEFT SIDE)



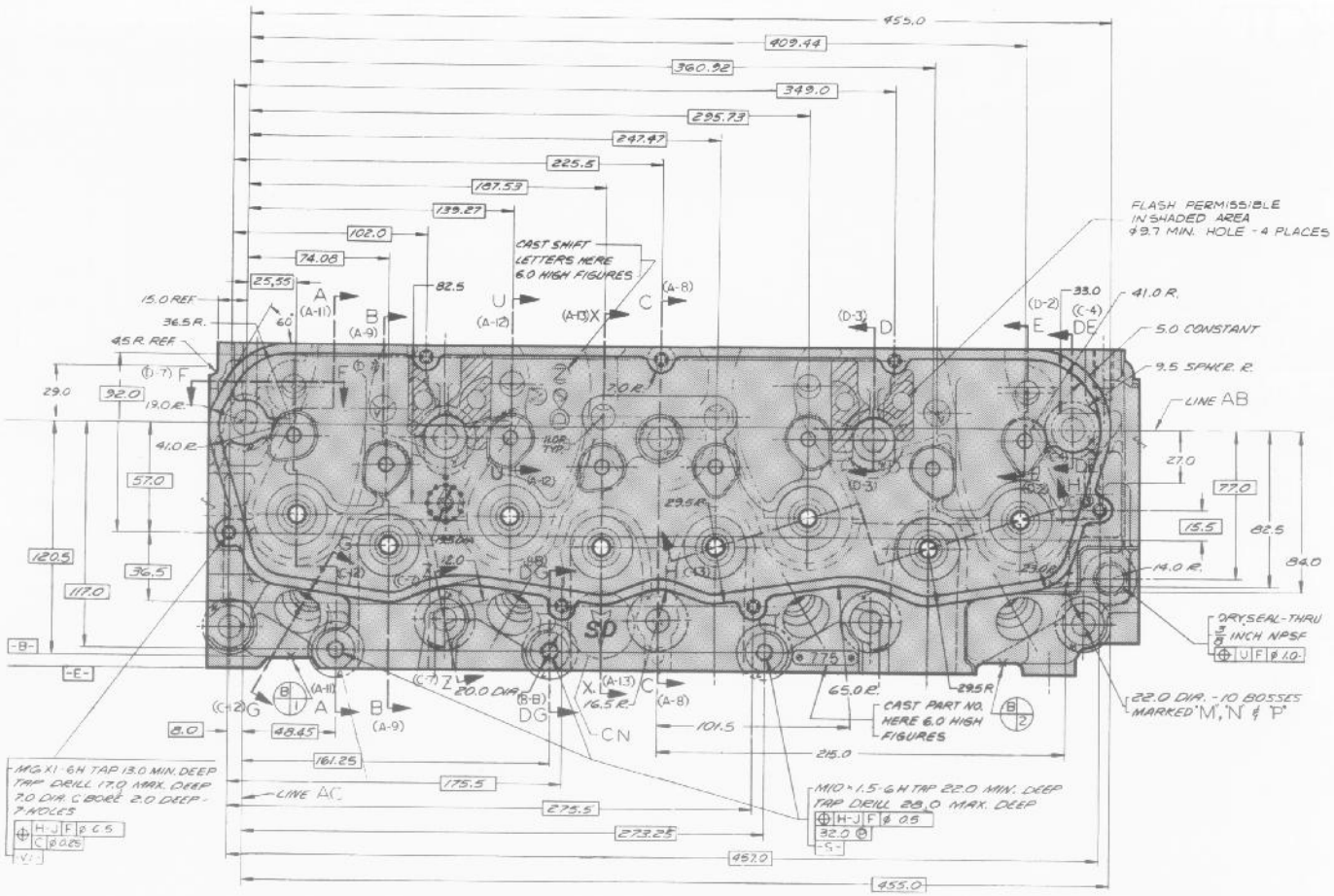
BLOCK (RIGHT SIDE)



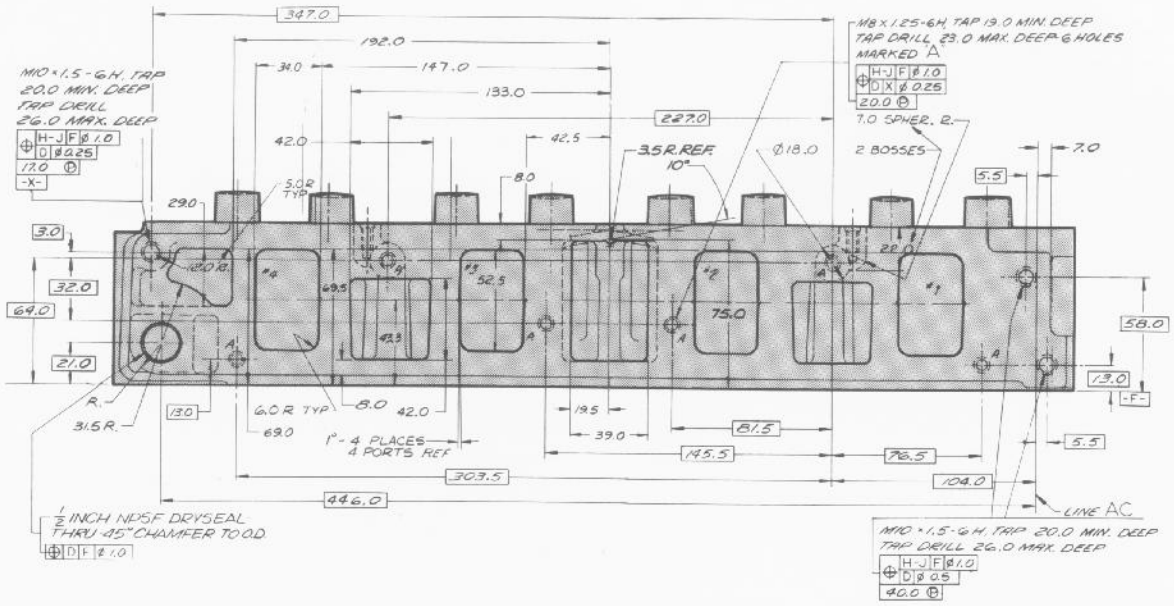
SUPER DUTY SPECIFICATIONS

All dimensions in millimeters

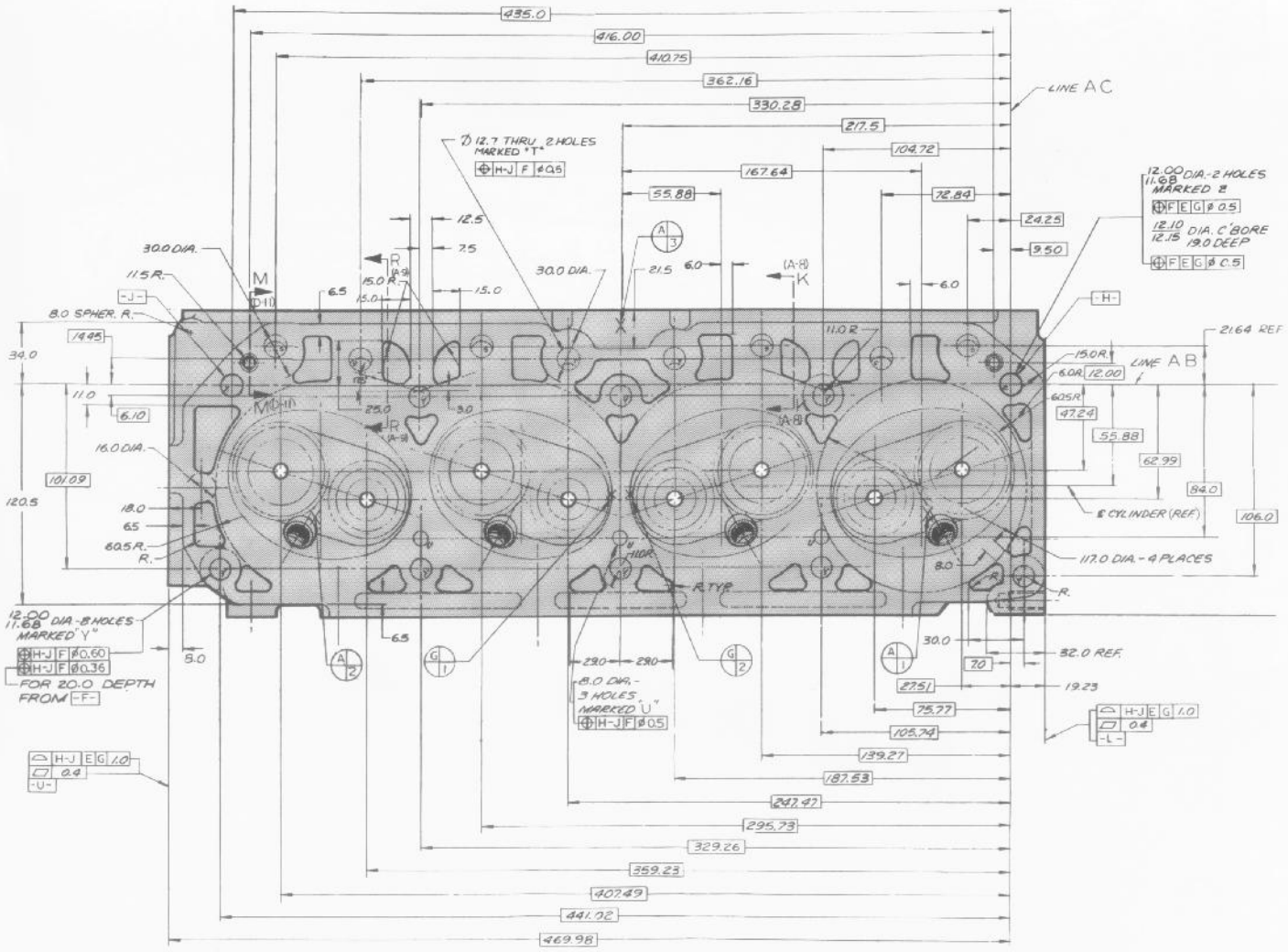
HEAD (TOP)



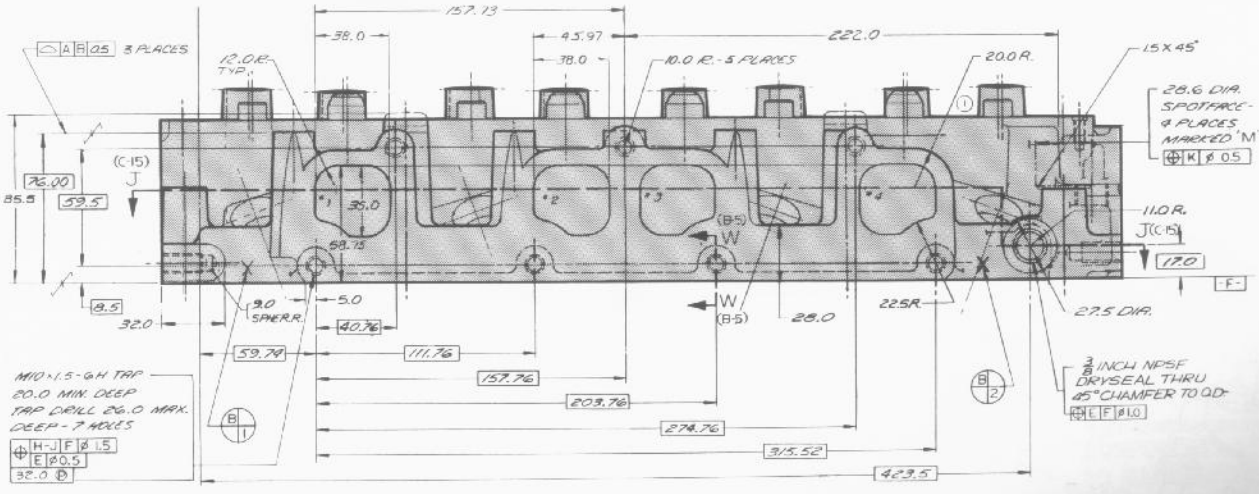
HEAD (INTAKE SIDE)



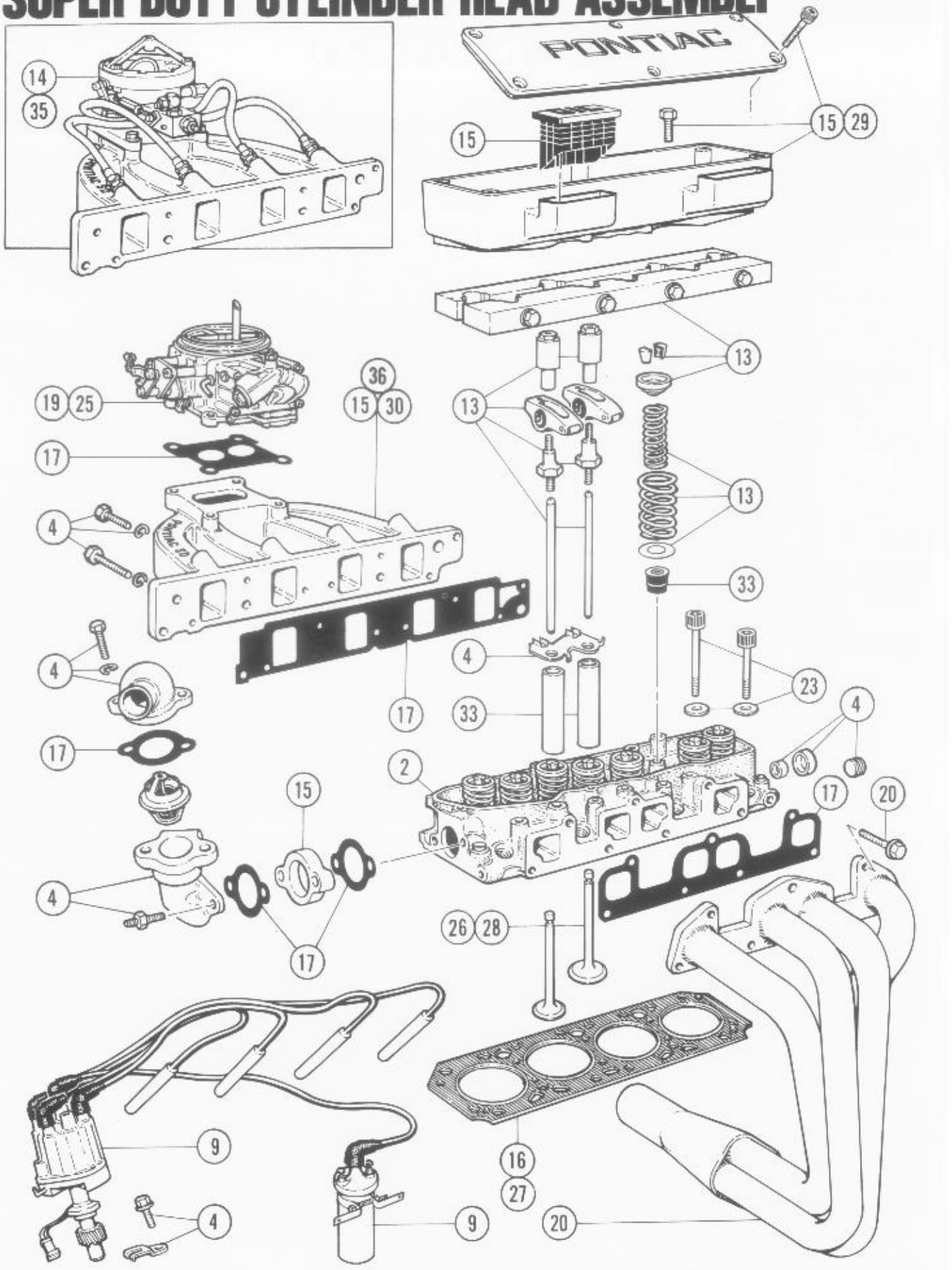
HEAD (BOTTOM)



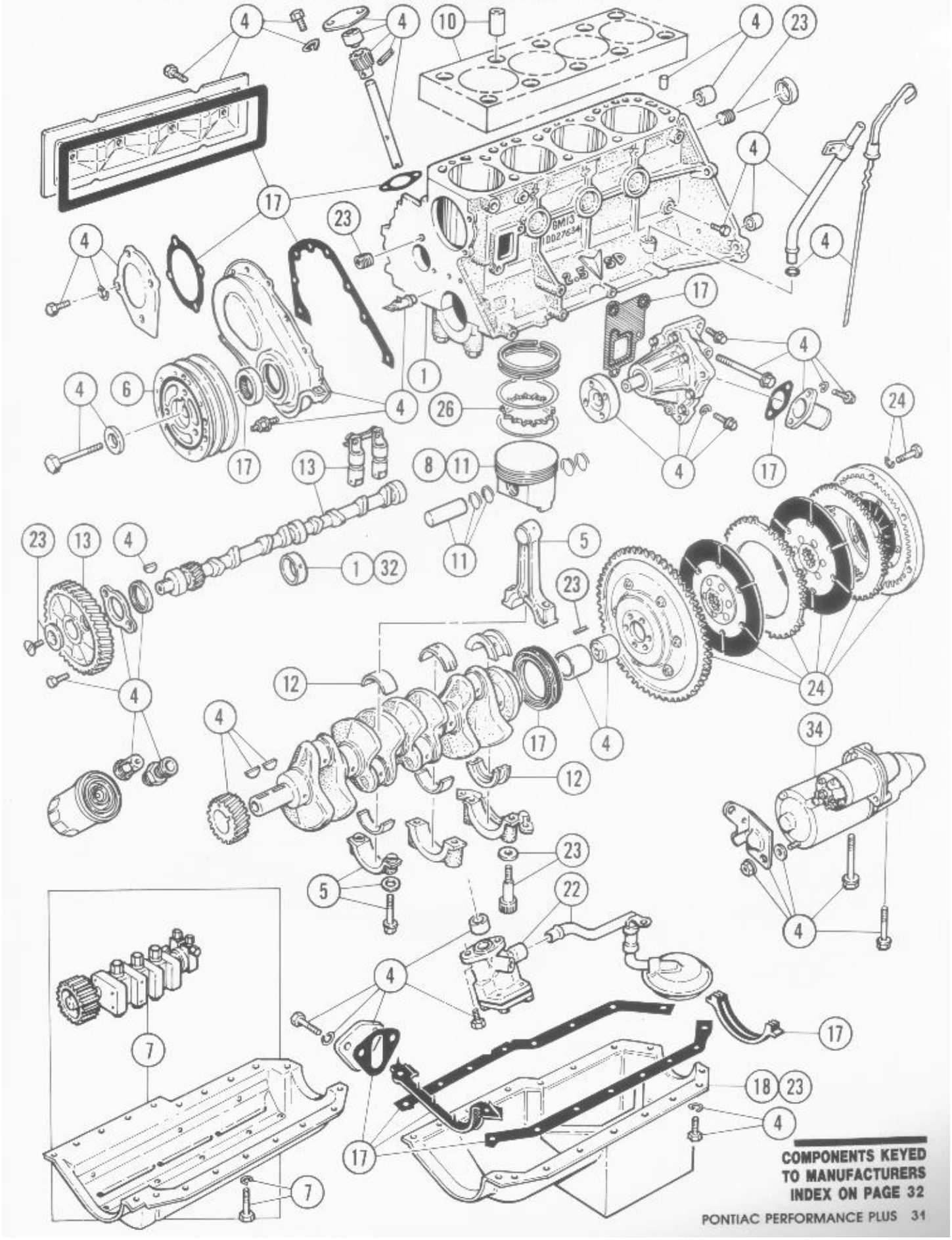
HEAD (EXHAUST SIDE)



SUPER DUTY CYLINDER HEAD ASSEMBLY



SUPER DUTY CYLINDER BLOCK ASSEMBLY



COMPONENTS KEYED TO MANUFACTURERS INDEX ON PAGE 32

MANUFACTURERS INDEX

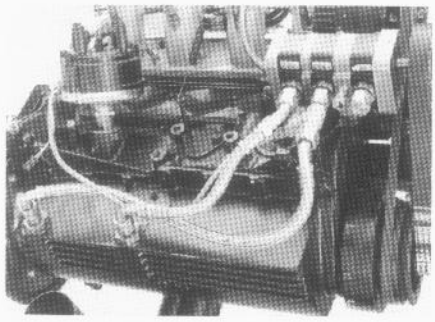
PONTIAC DEALERS: AVAILABLE OFF-ROAD PARTS

(1)	SUPER DUTY BLOCK	10027633
(2)	SUPER DUTY CYLINDER HEAD	10027776*
(3)	SUPER DUTY CRANKSHAFT (AS FORGED)	10027777
(3)	SUPER DUTY CRANKSHAFT 3.00-inch STROKE	10027778
(3)	SUPER DUTY CRANKSHAFT 3.25-inch STROKE	10027779
(27)	SUPER DUTY HEAD GASKET	10031324
(28)	SUPER DUTY EXHAUST VALVE 1.600 inches	10031325
(28)	SUPER DUTY INTAKE VALVE 1.94 inches	10031326
(28)	SUPER DUTY EXHAUST VALVE 1.625 inches	10031338
(28)	SUPER DUTY INTAKE VALVE 2.020 inches	10031339
(29)	SUPER DUTY ROCKER COVER ASM	10031327
(4)	SUPER DUTY ENGINE BUILD PKG.	10031328**
(30)	SUPER DUTY INTAKE MANIFOLD RACING	10031330
(30)	SUPER DUTY INTAKE MANIFOLD STREET	10031340
(5)	SUPER DUTY 5.7-inch CONNECTING ROD (CHEV)	14011090
(5)	SUPER DUTY 6.0-inch CONNECTING ROD (CHEV)	14011091
(31)	SUPER DUTY REBUILT WATER PUMP	12309677
(6)	SUPER DUTY DAMPENER	10031581
(32)	SUPER DUTY CAM BEARING	14002525
(33)	SEE CYLINDER HEAD PREP. SECTION	
(34)	STARTER	1109533

* ***10027776 discontinued after October '83 (PN10031322 W/O EGR) (PN10031323 W/EGR). These new parts will not require pushrod sleeves or exhaust sleeves. PN10031322 valve seat not machined. PN10031323 valve seat machined for 1.94-inch intake and 1.600-inch exhaust.***

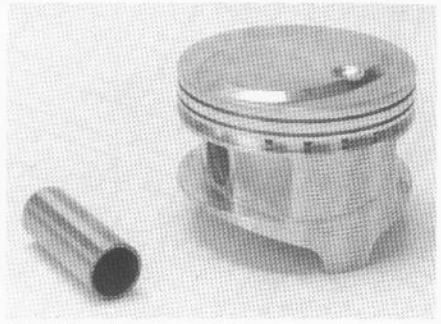
** ***Engine build package gives you all of the necessary fasteners and sheetmetal parts to complete engine build. See illustration. All parts marked "4" come in kit.***

AFTERMARKET MANUFACTURERS: SUGGESTED SUPPLIERS

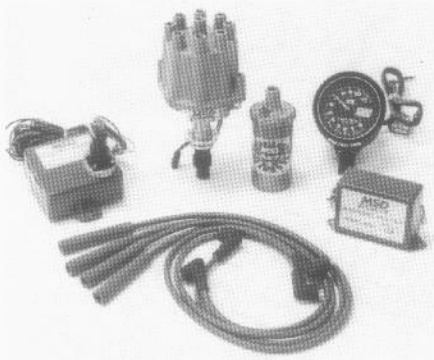


(7) A.R.E. Dry-Sump Systems
(916) 929-0496

Oil Pan & Screen Fittings	1220
Fiero Race Car Oil Pan & Screen Fitting	1220-P
Drive Pulley Kit	NPN
Pump	2000
Tank	3000
Cooler	5016
Filter Adapter	4200

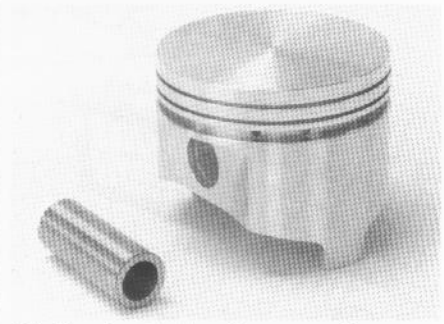


(7) Arias Racing Pistons
(213) 532-9737
Pistons, Ratios 6:1 to 14:1

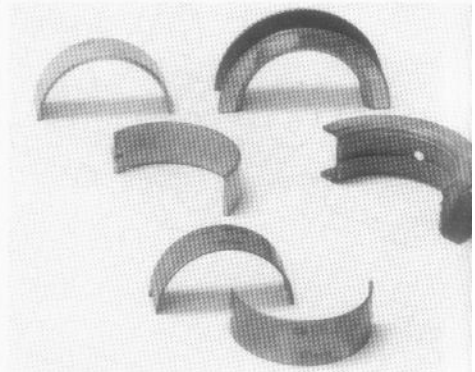


(9) Autotronic Control Corp.
(915) 772-7431

MSD Extra Duty Ignition	5420
MSD Extra Duty Distributor	8490
Blaster 2 Coil	8203
Coil Bracket	8213
11,000rpm Tachometer	8900
Electronic Telltale	8905
Ignition Kit	3151



(11) Brooks Racing Components
(714) 893-0595
Pistons, Ratios 6:1 to 14:1

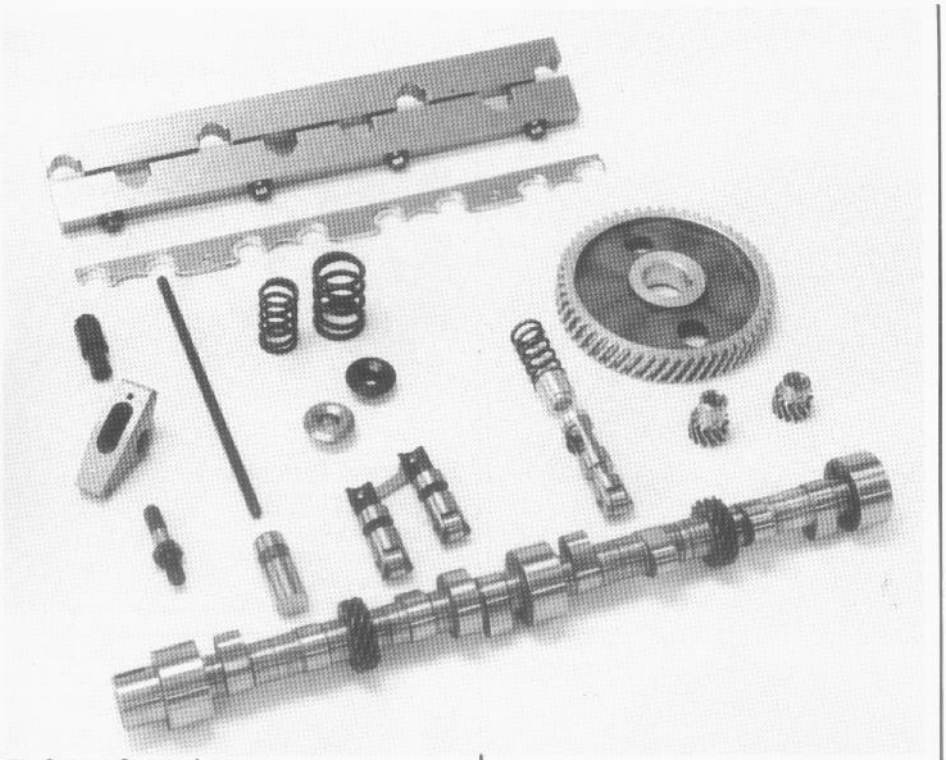


(12) Clevite or Seal Power Bearings
(See local parts dealer)

Connecting Rod Bearing	CB1285P	Std.
	CB1285P-1	.001 inch
	CB1285P-10	.010 inch
Main Bearing Set (Includes all main bearings)	MS616P	Std.
	MS616P-1	.001 inch
	MS616P-10	.010 inch
	MS616P-20	.020 inch

(10) B.H.J. Products
(415) 797-6780

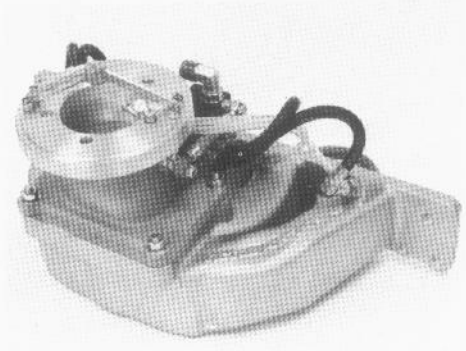
Deck Plate	POSD4



⑬ Crane Cams, Inc.
(305) 457-8888

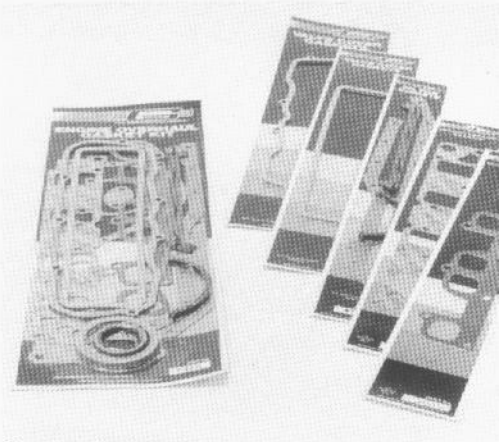
Roller Cams
(All grinds available)

1.55 Roller Rockers	13751
Pushrods	29621
Roller Lifters	20518
Rocker Stud Girdle	29601
(Straight-cut stud bosses)	
(Angle-cut stud bosses)	
High Rev. Kit	29580
7/16-inch Rocker Studs	99160
Valve Springs	99838
Keepers	99097B
Retainer (Titanium)	99654
Retainer (Steel)	99953
Hydraulic Lifter	99250
Aluminum Cam Gear	20992
Bronze Oil Pump Drive Gear	20990
Bronze Distributor Gear	29990
Adjuster Nut	99804
1.65 Roller Rockers (Available)	
1.70 Roller Rockers (Available)	



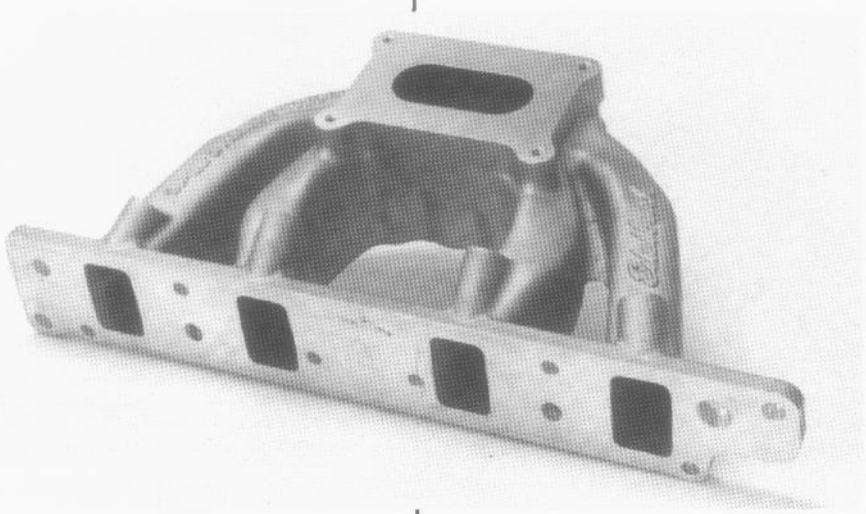
⑭ E.V.M. Injector
(414) 793-4467

4-Throttle Plate Injector	10100
Fuel Pump	10133
Single-Throttle Manifold Inj.	10101



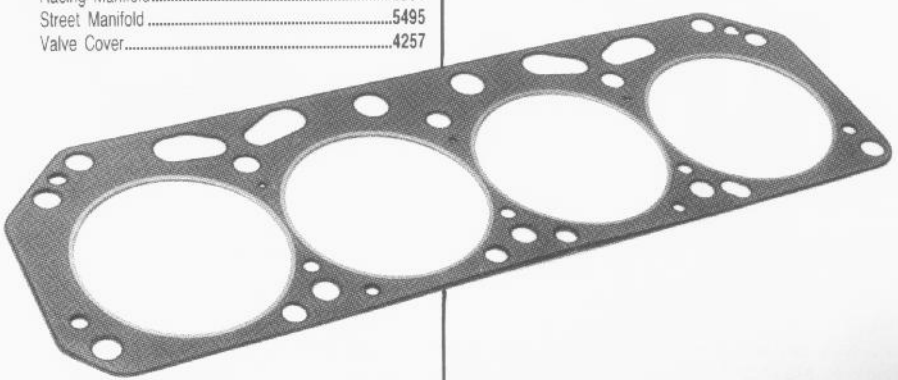
⑰ Mr. Gasket Co.
(216) 398-8300

Intake Gasket	507
Exhaust Gasket	555S
Valve Cover Gasket	574
Side Cover Gasket	595
Oil Pan Set	596
Service Kit (Everything except head gasket)	1425



⑮ Edelbrock Corp.
(213) 322-7310

Racing Manifold	2981
Street Manifold	5495
Valve Cover	4257

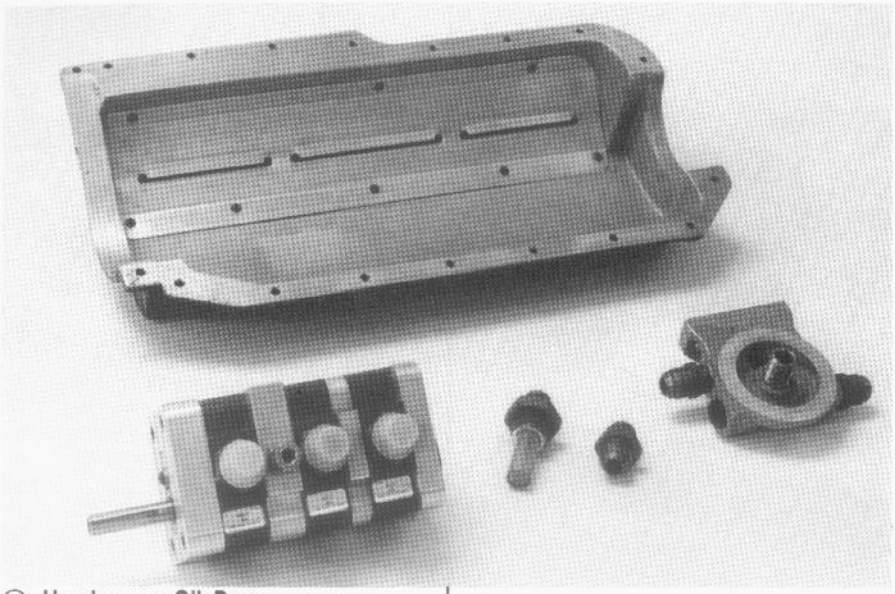


⑯ Fel-Pro Head Gasket
(See local parts dealer)

2.5L–2.7L SD, .038-inch thick	9058PT

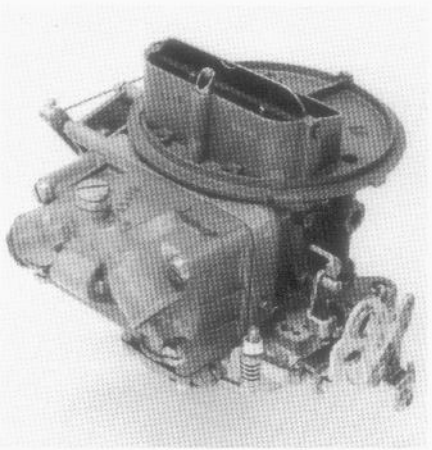
PONTIAC'S SUPER DUTY COMPONENTS ARE DESIGNED AND MANUFACTURED FOR OFF-ROAD USE ONLY.

ENGINE PREPARATION MANUFACTURERS INDEX



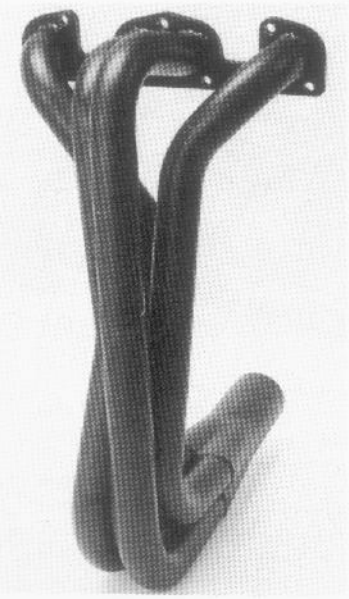
⑱ Hamburger Oil Pans
(201) 240-3888

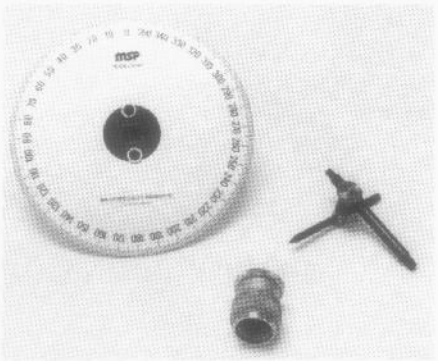
Aluminum oil pans built by order for any application.



⑲ Holley

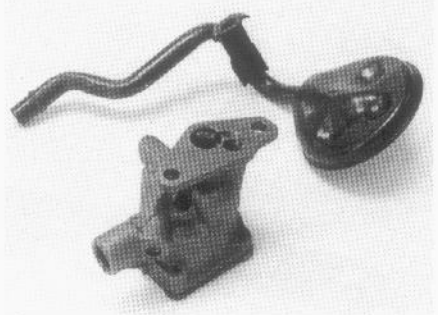
500 CFM 2V 4412





㉑ M.S.P. Valvetrain Tools
(815) 235-7946

Hite Mike Model	1318B
Crank Snout Socket	250S
8-inch Degree Wheel	D100
Universal Pointer	P6-1
Cam-Checker	CC27P
Dial Indicator	2416



㉒ Melling Tool Co.
(517) 787-8172

Oil Pump (Wet-sump)	M62CHV
Oil Pump Screen S.D. 4-Cyl.	62CS2

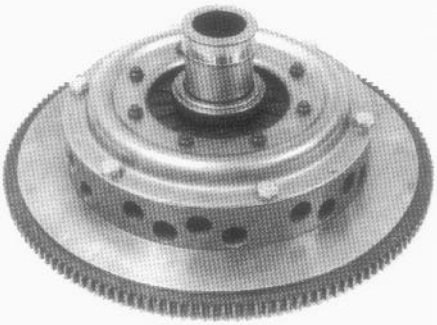
⑳ Hooker Headers
(714) 983-5871

1¾-inch Header (Firebird)	2221
Larger Headers	Special Order
Fiero Tri-Y Header	4703
Indy Pace Car Header	4702
Chrome Rollbar	18619

㉓ Moroso Performance
(800) 243-6536

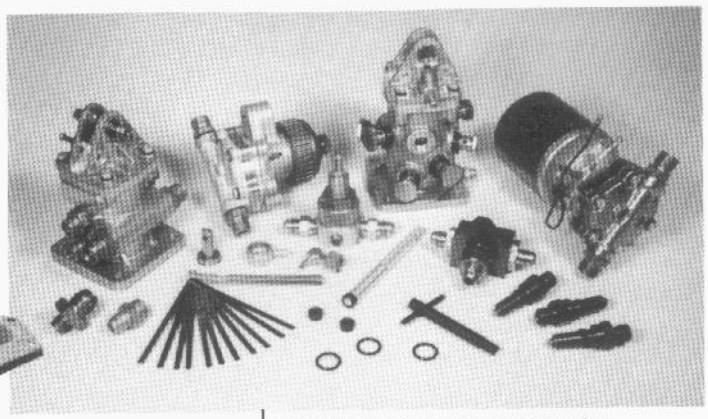
Circle Track Pan
(Other pans available)
Road Race Pan

Fiero Street Pan	2035
Head Bolt Set	3807
Main Cap Bolt Kit	3849
Allen Head Plug Kit	3770
Cam & Flywheel Bolt Kit	3771



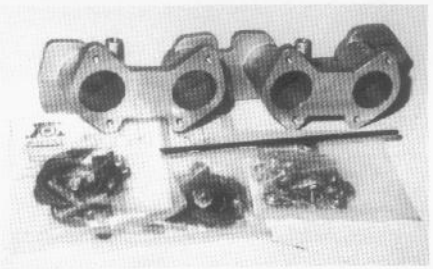
㉔ Quartermaster Ind.
(312) 593-8999

Fiero, Firebird Flywheel and Clutch Asm. (Racing)	299-500
Fiero Throwout Bearing (Racing)	209-24P
Firebird Throwout Bearing (Racing)	209-520
Fiero, Firebird Flywheel and Clutch Asm. (Street)	299-500ORG
Fiero Throwout Bearing (Street)	209-24PORG
Firebird Throwout Bearing (Street)	209-520ORG



㉟ KINSLER FUEL INJECTION
(313) 362-1145

Lucas Timed Port Injection (turbocharged) 3810651
Lucas Timed Port Injection
(non-turbocharged) 3810422



㊱ CANNON ENGINEERING
(805) 962-0028

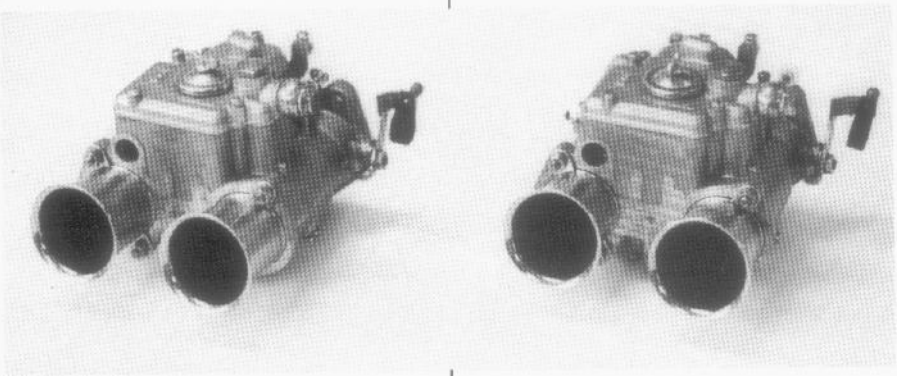
Dual Weber Manifold 3891

SUGGESTED ENGINE CLEARANCES

Main Bearings	.0020–.0022 inch
Rod Bearings	.0020–.0025 inch
Rod Side Clearance	.0180–.0220 inch
Crank End Play	.0035–.0055 inch
Piston Wall Clearances	(See piston manufacturer)
Block Main Bearing Bore Size	2.4905–2.4920 inches
Crank Centerline To Deck	9.164 inches
Valve Tip To Cylinder Head Deck	4.950-inch Intake
Valve Tip To Cylinder Head Deck	4.900-inch Exhaust
Spring Seat To Deck	2.910 inches (Stock)
Cylinder Head Combustion Chamber	52.2cc (1cc = .007 inch)
Clearance Cam Thrust Plate To Gear	.0150 inch
Cam Gear To Crank Gear Backlash	.002–.008 inch

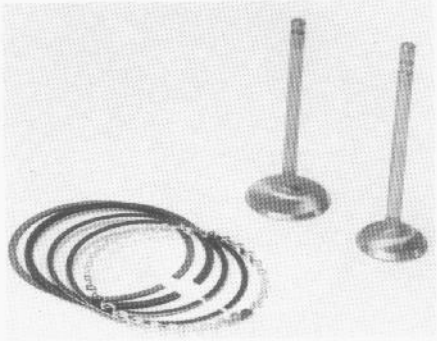
SUGGESTED ENGINE TORQUE SPECIFICATIONS

Head And Main Bolt (Moroso) ½ inch-13 N.C.	105 ft.-lbs.
Rocker Studs (7/16 Crane)	65 ft.-lbs.
Connecting Rods (14011090-91)	70 ft.-lbs.
Pan Bolts	75 in.-lbs.
Manifold Bolts–Intake	29 ft.-lbs.
Manifold Bolts–Exhaust	44 ft.-lbs.
Flywheel Bolts	44 ft.-lbs.
Front Dampener/Crank	160 ft.-lbs.
Clutch To Flywheel	23 ft.-lbs.
Valve Cover	90 in.-lbs.
Lifter Cover	90 in.-lbs.
Spark Plugs	15 ft.-lbs.
Timing Cover	90 in.-lbs.
Oil Pump to Block	22 ft.-lbs.
Bolt Camshaft Thrust Plate To Block	7 ft.-lbs.



㉕ Red Line, Inc.
(213) 538-3233

Weber Carb. Systems
Carburetor 45 DCOE9



㉖ Speed Pro Valves & Rings
(616) 724-5011

Piston Ring Sets
(Various sizes available)

1.94-inch Intake Valve	V-2054R
1.600-inch Exhaust Valve	V-2051R
2.020-inch Intake Valve	V-2276R
1.625-inch Exhaust Valve	V-2275R

SUGGESTED ENGINE BUILDER

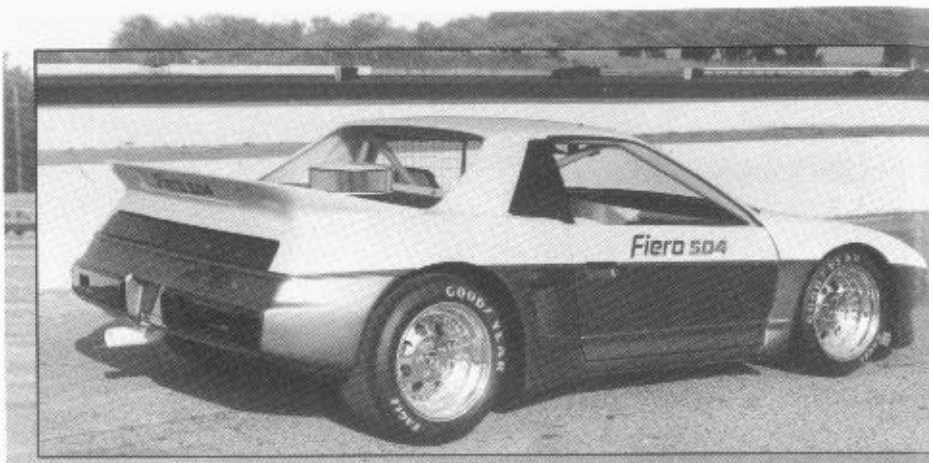
Vanderley Engineering
(601) 435-1582

INSIDE THE FIERO RACE CAR

The 1984 Pontiac Fiero is a unique, two-passenger sedan designed to provide rapid, economical transportation for urban commuters. It is also an aerodynamic, mid-engine sport coupe with potential for application to a variety of contemporary racing formulas like SCCA's Trans-Am series and IMSA's GTU category. From a handling standpoint, the Fiero's basic chassis and drivetrain are well suited to their intended purpose and they exhibit remarkably agile qualities when pushed to the perimeter of their performance envelope. The Fiero SE with the WS6 suspension package generally exceeds requirements set forth in its original performance profile; however, the necessity of design limitations to accommodate federal regulations and established parameters for economical operation have compromised its overall effectiveness in a pure racing environment. The Fiero concept suggests a dandy race car, but its true potential can only be realized with the application of real engineering expertise and the construction of a totally built-to-purpose car.

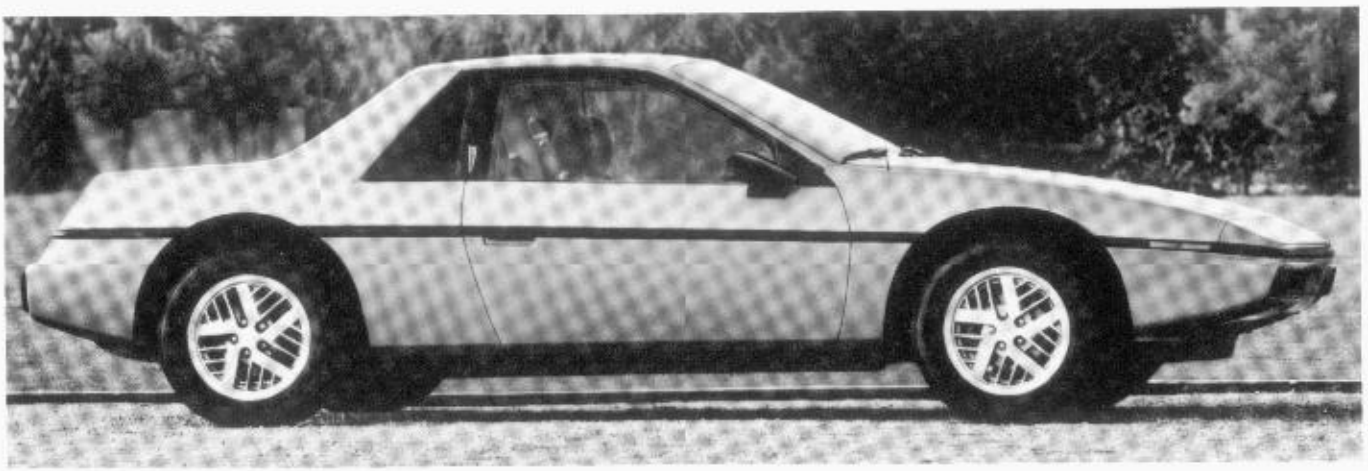
Most successful race cars are not built from scratch; they are usually constructed within the framework of an existing production vehicle. These cars often bear little resemblance to the original vehicle once they have been modified for racing, but the Fiero race car remains surprisingly consistent with its original styling. Constructing a competitive race car within the general sphere of a production vehicle represents a formidable challenge, but one that is commonly met and overcome by talented race car builders around the country. To this end, Pontiac has initiated a program to help aspiring racers construct competitive Fiero race cars by supplying high-tech assistance in the form of engineering expertise and a well established parts network similar to that developed for the Super Duty engine.

The Fiero race car program came together in less than 11 months—primarily because program manager John Callies was able to draw from the vast sea of engineering experience available

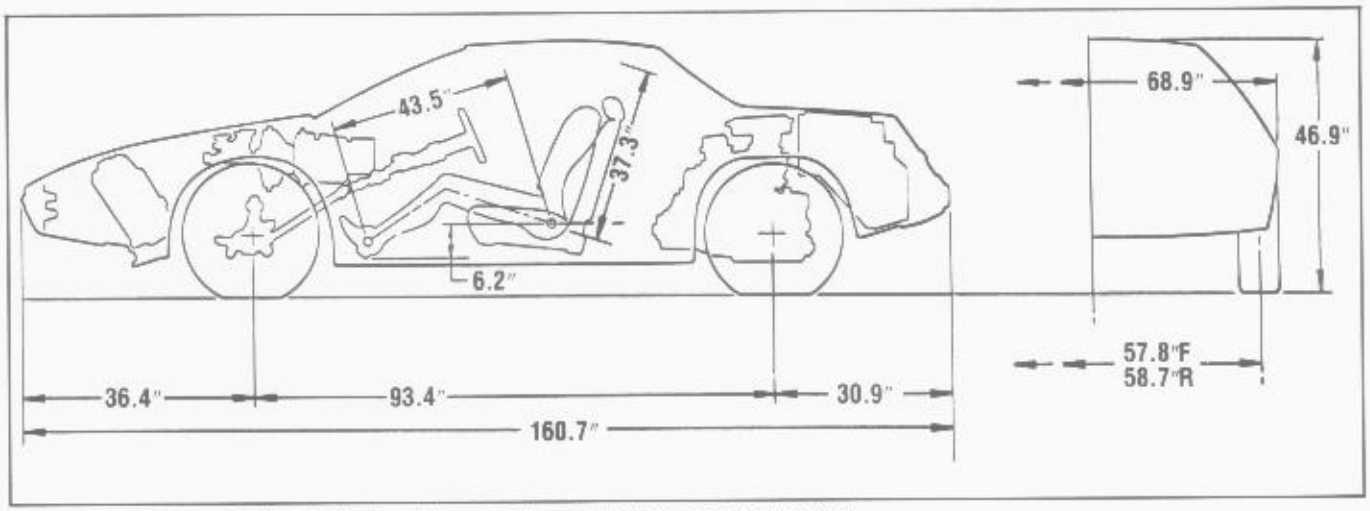


Pontiac's Fiero race car is a state-of-the-art racing machine that can be duplicated by racers interested in competing in SCCA's Trans-Am series or IMSA's GTU series.

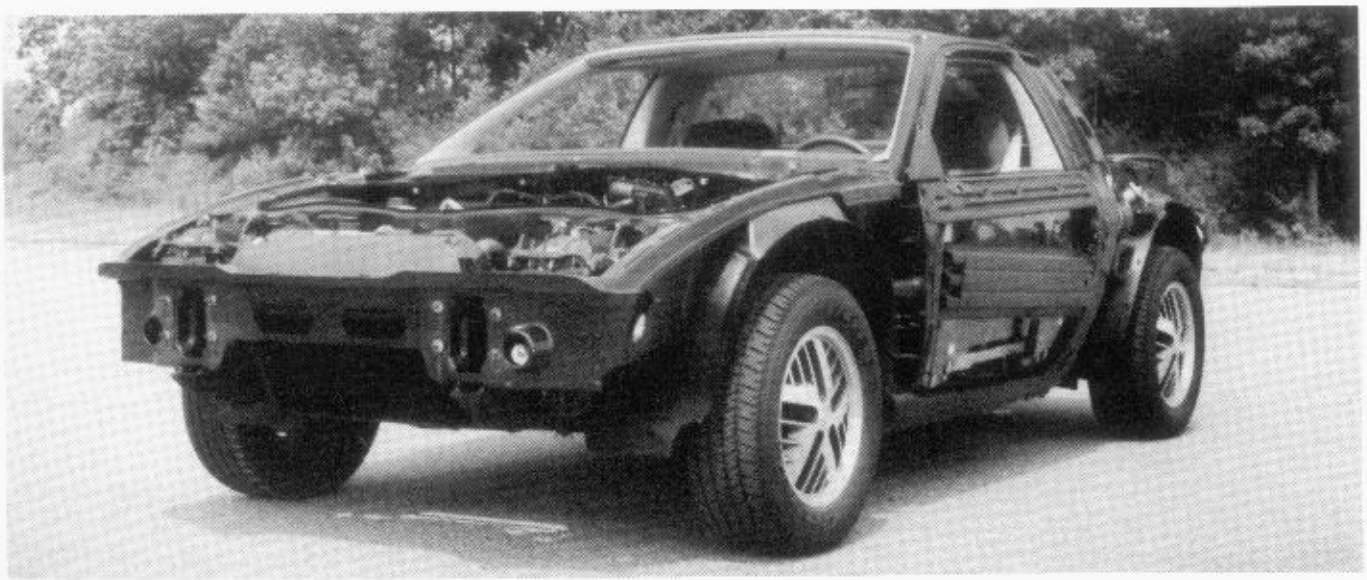
PONTIAC'S SUPER DUTY COMPONENTS ARE DESIGNED AND MANUFACTURED FOR OFF-ROAD USE ONLY.



The 1984 Fiero has been called one of the most handsome cars ever designed. It combines subtle styling excellence with a fuel efficient four-cylinder engine to achieve economical performance wrapped in a stunning sports car body. The addition of Super Duty engine components are all that's required to transform it into a modern-day musclecar.



Production Fiero packaging is designed to provide adequate space and seating comfort for even the bulkiest passengers. Compare this drawing to the plan views of the race car located in the foldout section at back of the book.



The Fiero is built around a unitized space frame that provides a stable platform for the inevitable engineering and styling changes sure to follow through the years. It's a very well-mannered car on a twisty road, but for all-out competition you need the Fiero race car as designed and tested by Pontiac Engineering.

within the ranks of Pontiac Motor Division. This approach ensured state-of-the-art design sophistication and the ability to test, evaluate, and re-engineer as the car developed. As an in-house project, the Fiero race car retained its unique Pontiac identity throughout the initial design stages, and while Pontiac isn't planning to construct race cars for you, they have built several evaluation cars to test the integrity of their initial design elements.

In this context, it is important to keep in mind the basic limitations of the production car. Within its overall size and shape, advanced chassis design engineer Terry Satchel has incorporated all the proven principles of race car construction while adhering closely to the rules and specifications of the appropriate sanctioning bodies. The Fiero race car represents a major packaging coup—one that Pontiac enthusiasts can duplicate by following procedures established in the blueprint package available from Pontiac.

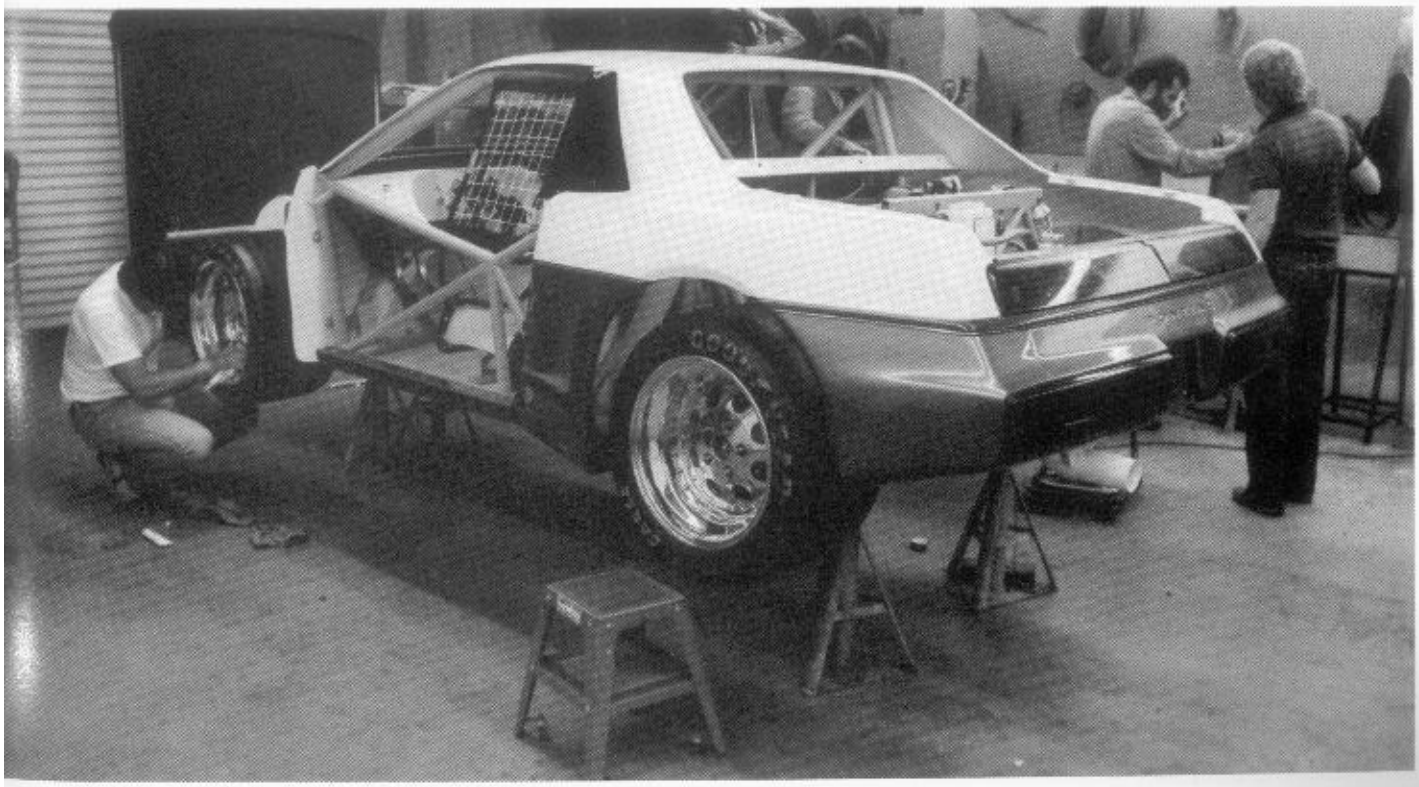
What we really have then, is a Fiero kit car designed for racing. Pontiac has done the basic engineering and design work to place the racer at the most advantageous starting point. Their intent was to design a proper race car and source the components so racers can construct cars optimized to suit their specific requirements. As with the Super Duty engine program, all the major racing components have been sourced through outside vendors so racers can buy them direct. Pontiac is providing maximum engineered potential—anything beyond that is strictly up to the racer's individual talents.

Advanced chassis engineers began with a basic vehicle packaging drawing (see foldout). A side view silhouette was established with a driver located in the normal production seating position to maintain good visibility. To accommodate a full range of drivers, the car was developed around a 95% person (six feet, four inches in height). This provided plenty of room for even the largest drivers to be seated comfortably—driver comfort being one of the established axioms of superior race car construction.

Consideration was then given to establishing tire sizes and rim widths. Because 16-inch-diameter wheels are current state-of-the-art as applied to contemporary Trans-Am and IMSA racing, Goodyear racing tire engineers were consulted for specific recommendations based on targeted vehicle mass projections. Goodyear's 16-inch development program is far more active than their 15-inch program, and you have to use the current tires or you lose the advantages of the latest development compounds. Moreover, 16-inch rims provide room for larger brakes and the opportunity to push the suspension farther into the wheel to achieve a reduced scrub radius. Based on established parameters and vehicle mass distribution, Goodyear designers recommended 23.5 x 11.5 x 16 front tires and 25.5 x 12.5 x 16 rear tires.

With the establishment of tire and wheel sizes, real design work could begin. After choosing front and rear wheel travel limits, the tires are added to the side view drawing and a ground line is established. With the front and rear suspension at full bump, the bottom of the chassis will clear the ground by ¼ inch. Then the rocker-to-ground attitude of the car is established, bringing the suspension back down to a design position of three inches in front and four inches in the back.

A front view of the car was developed to help determine track width. A variety of considerations were important here, not the least of which was product identification. To limit lateral weight transfer with a rear wheel weight bias, the rear track had to be wider than the front—and the front track had to be compatible with the overall styling theme of the car because IMSA and SCCA rules prohibit a radical departure from OEM styling.



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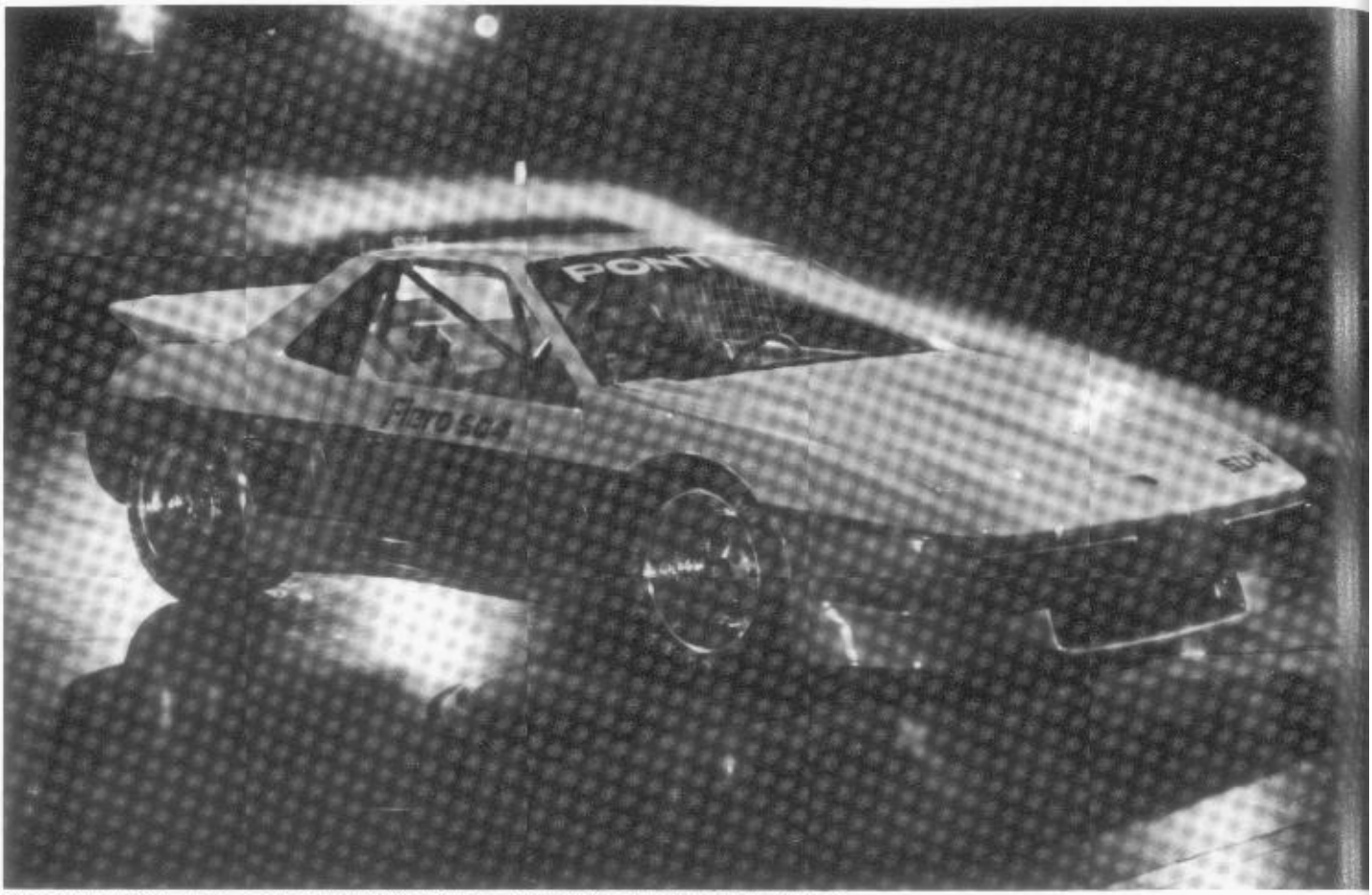
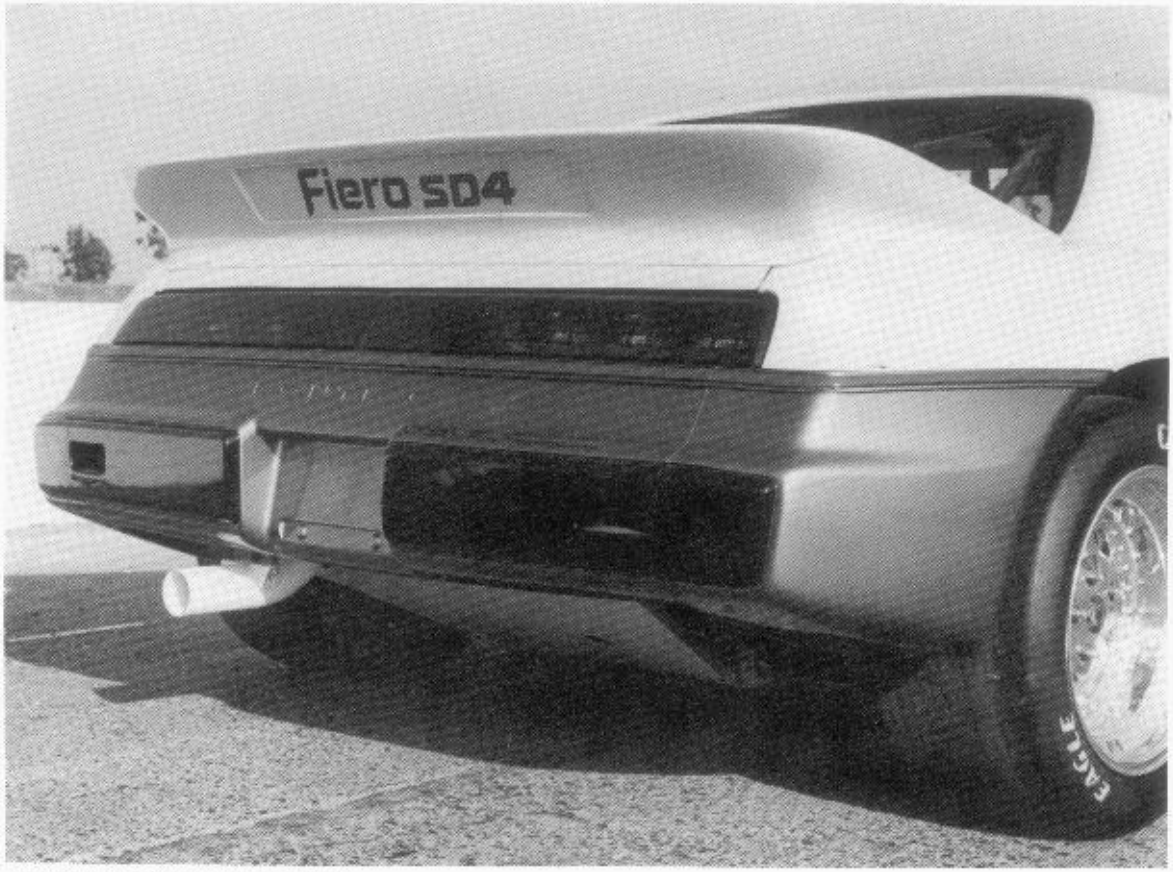


The original Fiero race car in the GM wind tunnel. Production aerodynamics were so good that only minor revisions were required to cover the tires and optimize downforce with a minimum of drag.



The rear spoiler absorbed the greatest amount of development time. Originally designed as a wing, it evolved to its present saucer-like configuration which provides the greatest amount of downforce on the car.

Pontiac's own product identity must also be maintained, and this helped dictate a 56-inch front track and a 63-inch rear track.

With the vehicle attitude set and the tires and track widths chosen, clay styling exercises could begin to determine an identity-based profile for the fender flares, front air dam and rear spoiler. Under the guidance of the advanced Fiero design staff, the Fiero's shape was carefully refined to suit its racing intent. Using handmade wheels that permitted the installation of wheels and tires on a production suspension at the proper track widths, clay modeling began. An old prototype P-car served as the model.

In addition to the product identity requirement, the design had to be tailored to fit SCCA and IMSA programs. In a cooperative effort, designers worked closely with SCCA technical director John Tamanus, IMSA technical director Roger Bailey, and IMSA president John Bishop. Rules considerations included requirements to maintain original door lines in the production location, as well as firewall and floor board placement. Consultants from Diversified Glass Products helped determine the best possible break points for the take-apart body. The roof and A-pillar had to be one piece to establish the windshield angle, and all panels had to be easily removable so racers could work on the cars.

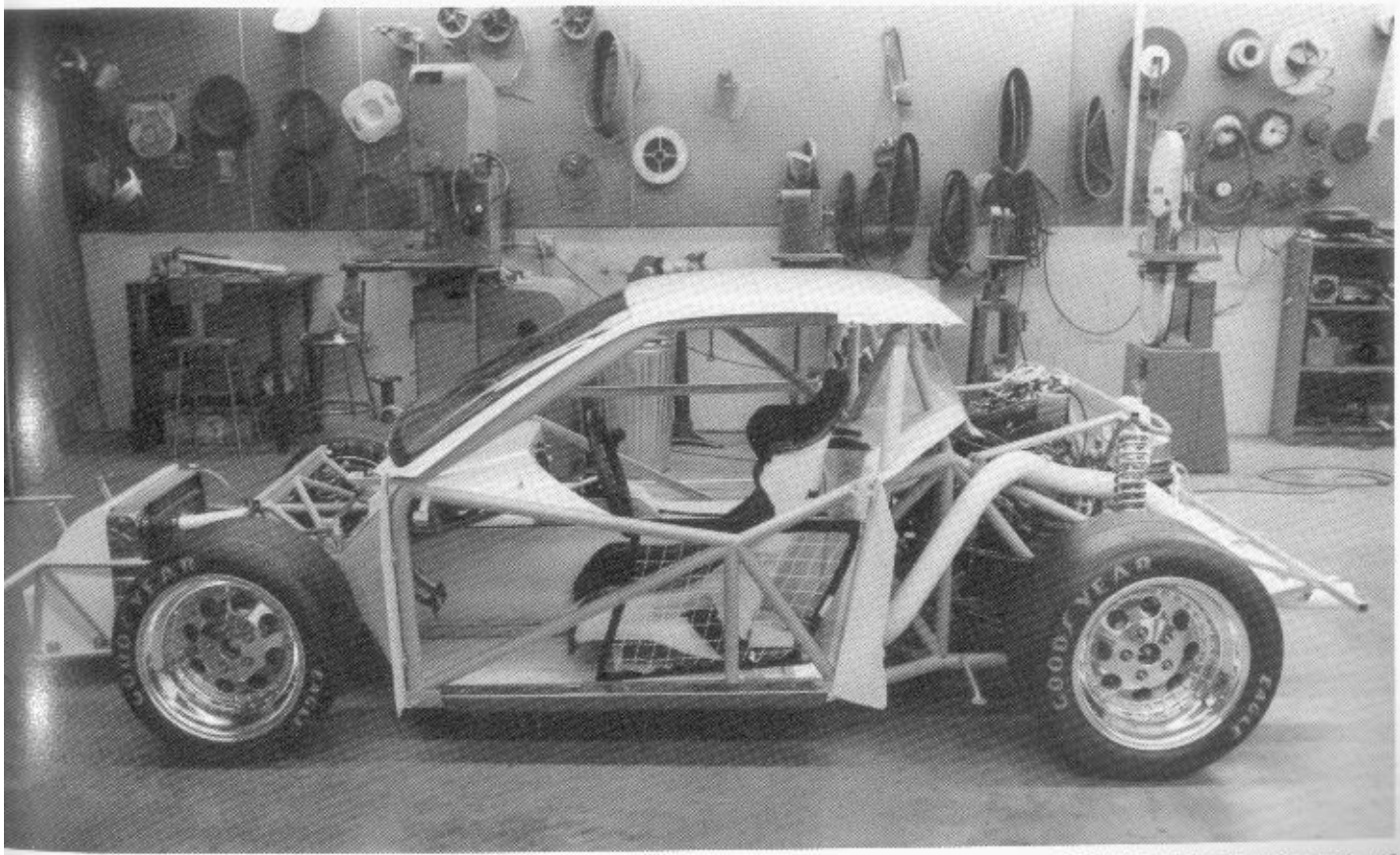
The final clay revision was placed in the GM wind tunnel facility to evaluate various front and rear spoiler combinations. The most difficult problem for Pontiac aerodynamic engineers was minimizing drag while providing optimum downforce. The problem was compounded by the Fiero's notchback design. A rear-engine car requires a lot of downforce and the greatest amount of time was spent developing a rear spoiler that would optimize downforce without drastically affecting drag.

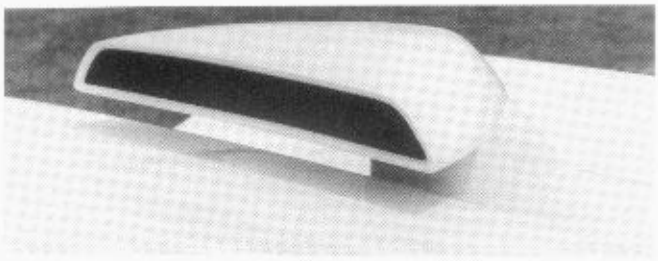
While the exterior shape was coming together, chassis design work continued. With IMSA's GTU endurance racing category in mind, the largest allowable fuel cell was incorporated in the same location as the production fuel tank: between the seats in the drive tunnel. Minor reshaping was performed several times and the resulting 29-gallon cell is a relatively simple shape located in the safest possible location. This location also minimizes mass distribution changes as fuel is burned off.

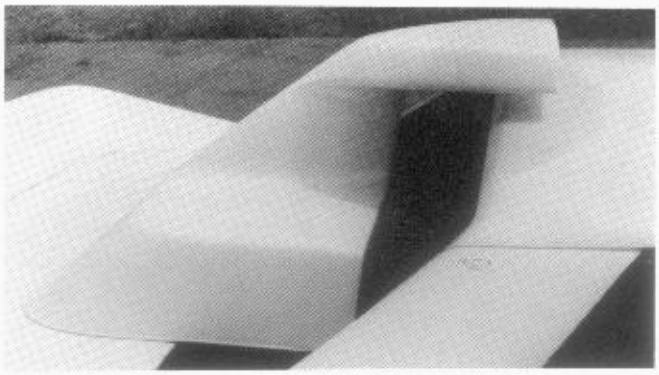
Because the rear wheel centers are higher at design position than on the production car, the transaxle output shaft centers were too low, causing undesirable drive axle joint angles. This was overcome by rotating the engine 16 degrees around the crank centerline, tilting the valve cover forward, and bringing the transaxle up to desired height. At this point, all the major components were located within the Fiero framework. The driver, front wheels, rear wheels, engine, transaxle and fuel cell are all critically positioned for optimum compatibility.

Before specific suspension geometry could be worked out, several overall performance parameters had to be calculated. Vertical wheel rates were calculated by estimating sprung and unsprung masses and selecting the desired ride frequencies. Using wheel rates, wheelbase, and the estimated CG height, the amount of brake dive and acceleration squat was determined. To minimize suspension motion during braking and acceleration, anti-features were incorporated. The desired amounts were determined by calculation and "educated engineering judgment."

Other specific suspension parameters that were established

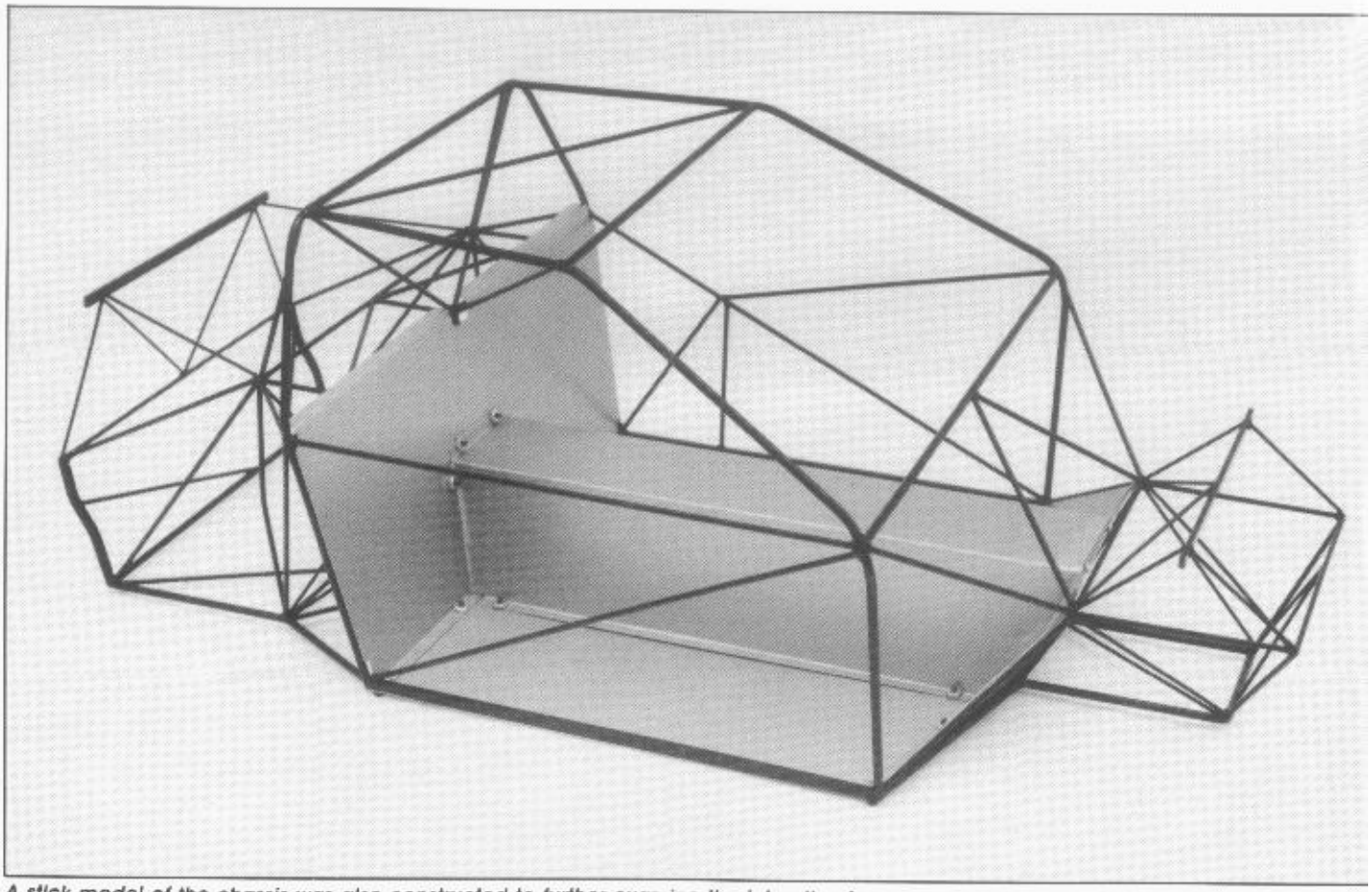






When stylists designed the air scoop, they had to accommodate a full-size Edelbrock air cleaner which is offset to the right side of the rear deck. The scoop incorporates 12 square inches of inlet area centered above the roof of the car. The lower portion is offset to enclose the air cleaner and provide a ram air effect (with the air filter being used to straighten and smooth inlet air flow as well as filter the air).

The race car chassis was developed using a variety of sophisticated techniques, including CAD/CAM analysis and computer modeling of all suspension and handling parameters.



A stick model of the chassis was also constructed to further examine the integrity of the computer designed chassis. The chassis is extremely rigid with a minimum of bending inputs.

by calculation or engineering judgment included roll center heights, rate of roll center change, roll gain, roll camber, roll steer, scrub radius, spindle lengths, caster angle, kingpin angle, initial camber, compliance effects, overall steering ratio, spring rates and stabilizer bar sizes. Computer programs were used extensively to optimize the location of all suspension pivot points and provide proper geometry characteristics.

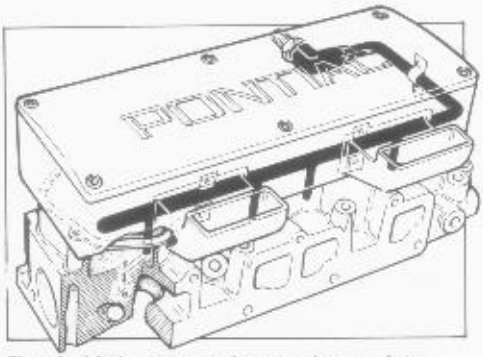
Suspension design usually requires numerous iterations because all the components must fit within a defined space and have clearance to move through full travel without interference or binding. The first packaging problem is out at the steering knuckle. The centerline and width of the wheels had been set, but wheel offset was still undetermined. Specific hardware such as wheel bearings, ball joints, brake rotors, top hats and calipers must fit into the wheel while still providing the proper kingpin angle and scrub radius. Based on the packaging study, a one-inch negative offset was selected and the clearance requirement drawings were sent to Center Line Tool Co., which handled the wheel fabrication.

Super Bell Axle Co. developed the aluminum uprights, but car number one is equipped with hard fabricated steel uprights. Specific hardware selections were based on ease of availability to the racer. In some cases that meant using existing brake components, shocks, radiator, steering gear, and uprights from reliable vendors (see manufacturers guide). Wherever possible, current production GM parts were utilized, as long as they were equally suitable for the job at hand. The front lower ball joint from the B-car was employed, as were front and rear wheel bearings from the A-car diesel.

Control arms and pivot points were the next order of concern. To properly size these components, input forces for cornering, braking, acceleration and vertical bumps at the wheel were fed into a computer program that resolves all the forces and moments in each link of the system. These data, along with stick model and CAD/CAM analysis, allowed strength requirements for each component to be calculated. All analysis was done assuming mild steel stress limitations.

An important part of the finite analysis is the basic frame and rollcage structure that ties the vehicle together. Initially, the rollcage had to be established with regard to specific IMSA and SCCA requirements. From this basic framework, tubing is connected to pick up all the suspension hard points and the engine mount locations. The frame is fully triangulated with an absolute minimum of bending inputs. To finalize tubing and wall size thicknesses, a finite element beam model of the frame and suspension was constructed. Forces and moments were fed into the spindles and stress and deflection plots were read out. Tubing size and placement was revised until a low stress, torsionally stiff framework was realized. The torsional stiffness values targeted in the computer are actually stiffer than required because the model assumes perfectly stiff joints, and no bends were modeled to expedite the analysis.

Total vehicle handling was analyzed in a computer program to gain proper direction for establishing stabilizer bar stiffness requirements. This analysis was done to provide a starting point for actual on-track development. Computer design can never provide the optimum settings because each car is slightly different, and varying conditions always require adjustments to optimize performance. The basis for Pontiac's design and development work was to optimize a standard platform from which individual race teams can develop faster, more competitive mounts. From an engineering viewpoint, the platform established by Pontiac's design team is competitive and correct, thus giving racers an excellent starting point from which to develop race winning Fieros.



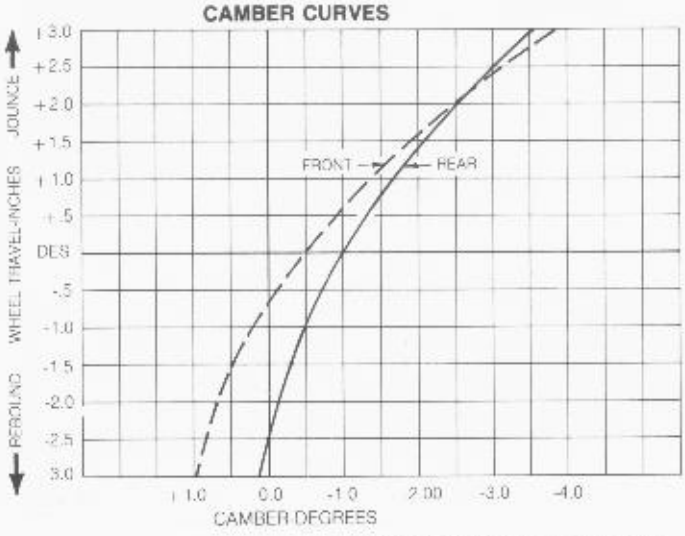
Fiero's 16-degree engine angle requires specific top end oil scavenging. Use a 5/16-inch main tube with ⅛-inch suction tubes between exhaust valves and spring bases.

OIL SPECIFICATIONS

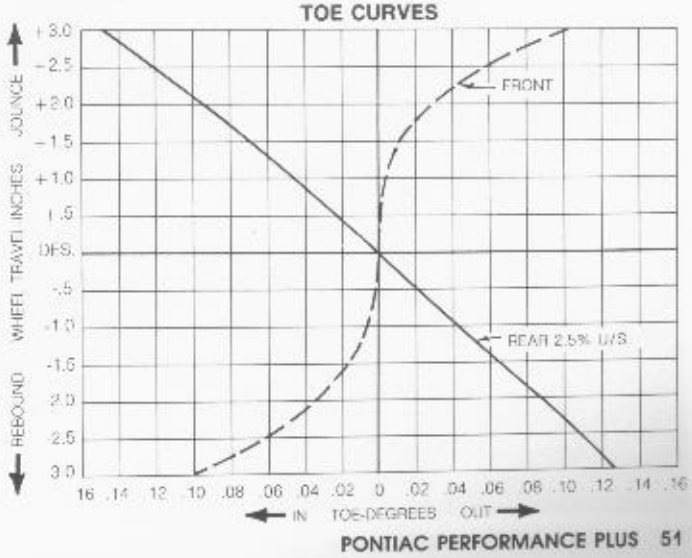
ENGINE OIL ..... 20W-50 weight ashless racing oil; Union 76 racing oil is recommended

TRANSMISSION OIL ..... Union 76 transmission oil number EOAZ-19580-B is recommended

CAMBER CURVES



TOE CURVES



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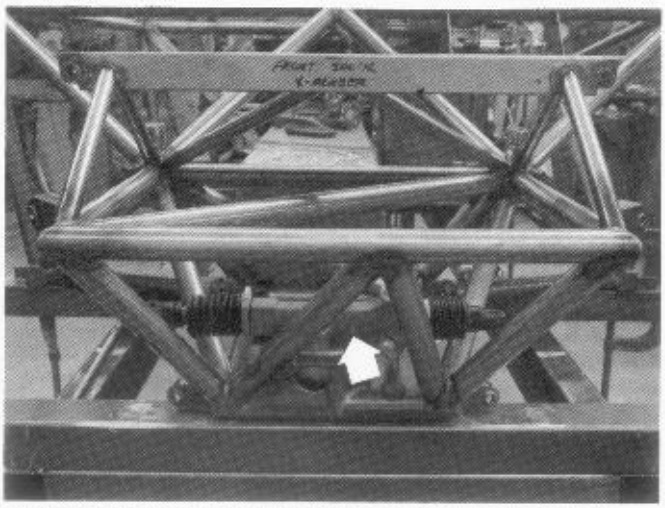
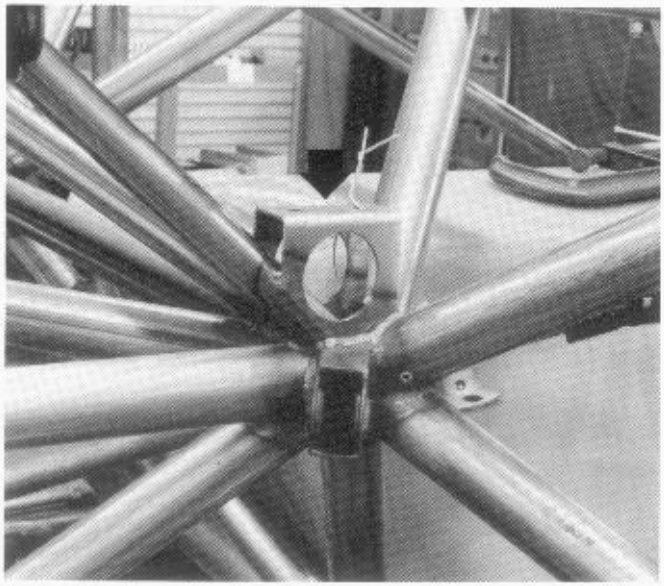
FRONT BAY

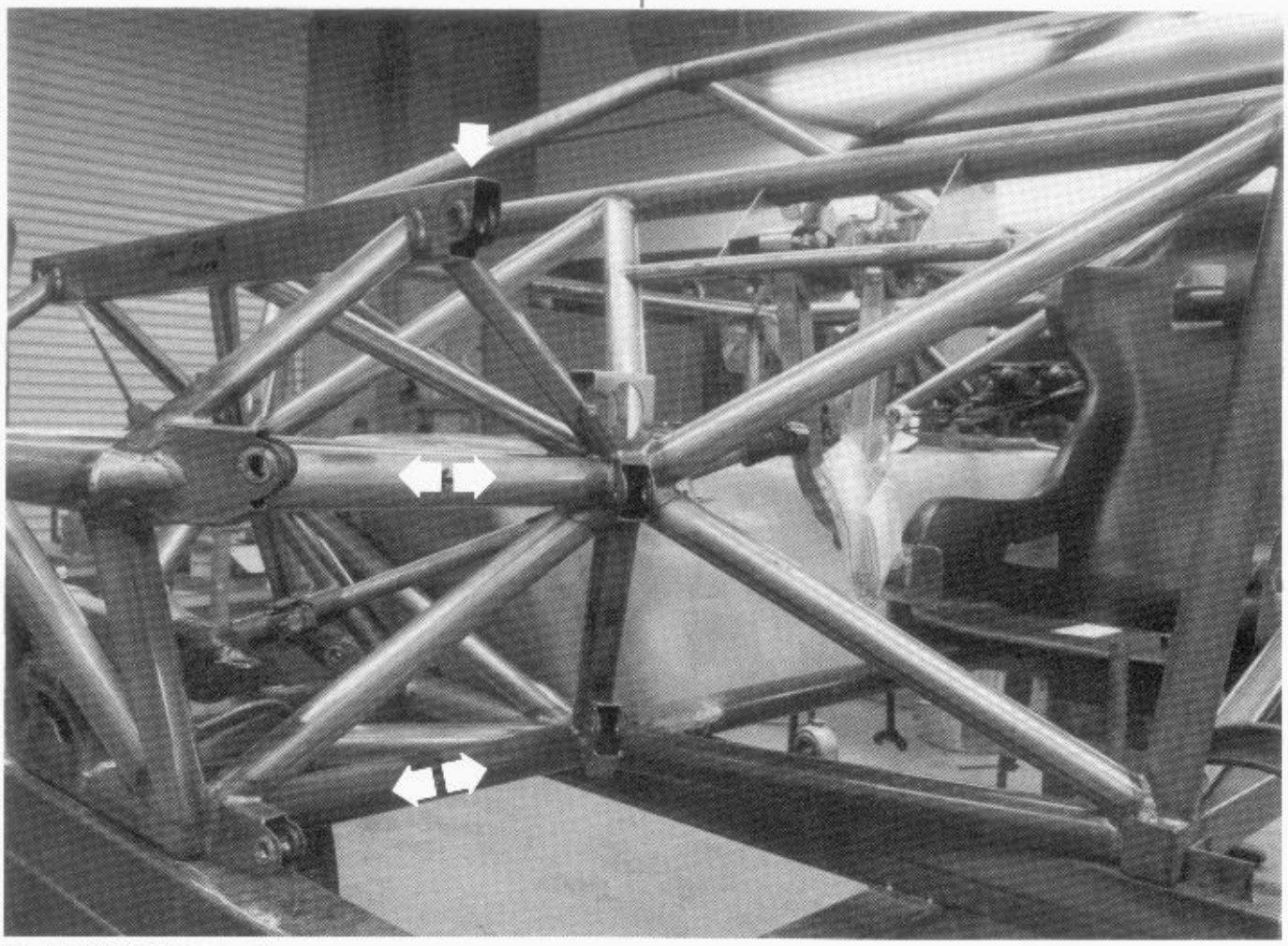


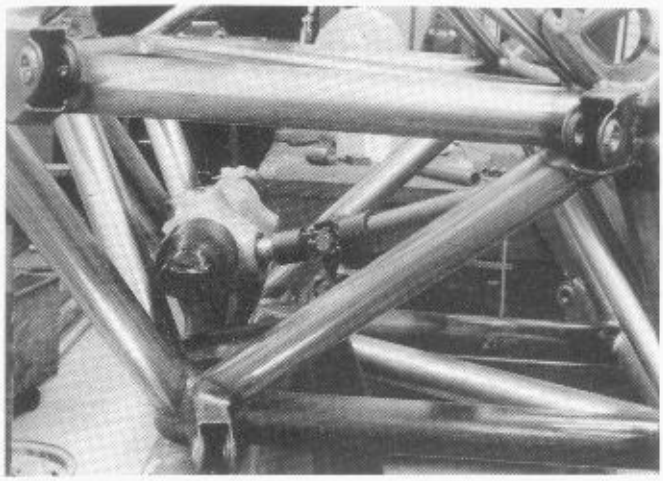
The front bay is of extremely rigid construction because it absorbs a tremendous amount of punishment during high-speed maneuvers. The front shock absorber crossmember is clearly marked, and the Sweet Manufacturing rack and pinion steering unit is indicated by an arrow.

A ¾-front view of the left front suspension bay shows careful triangulation of major structural components. The upper and lower control arm mounts and the upper shock mount are indicated by arrows.



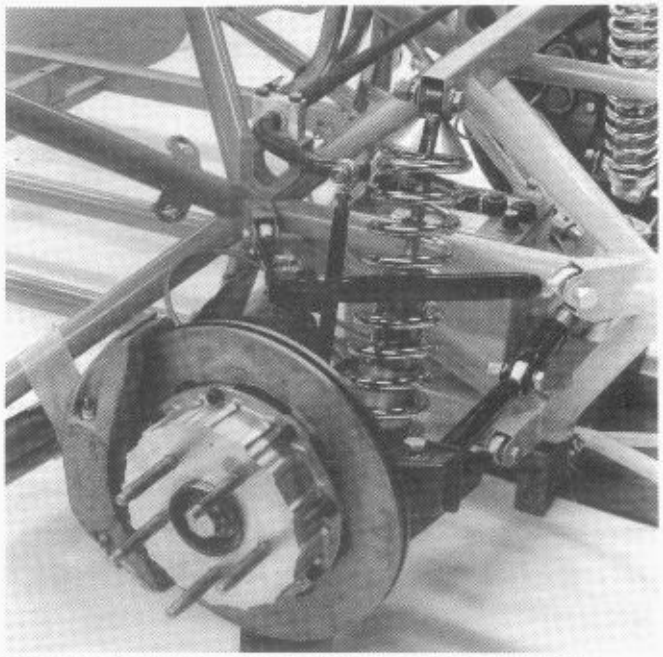
A closeup view of the rear upper control arm mount shows how the mount is angled so the rod end will be installed directly in line with the mount. Most designs mount the rod end straight out so a bending moment is applied to the parts. An arrow indicates the location of the sway bar mount. Once again, note how the suspension hardpoints (control arm mounts) are heavily triangulated.



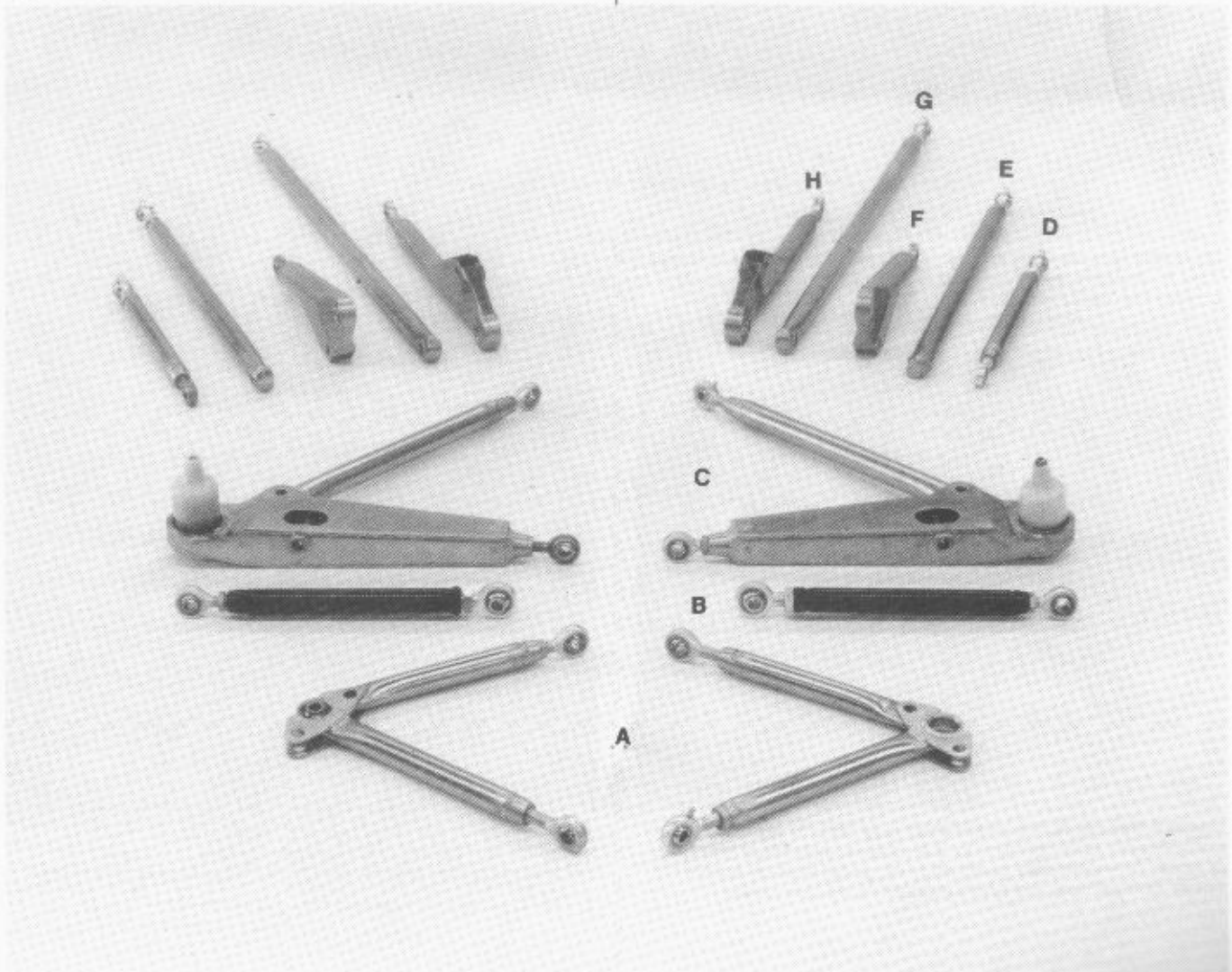


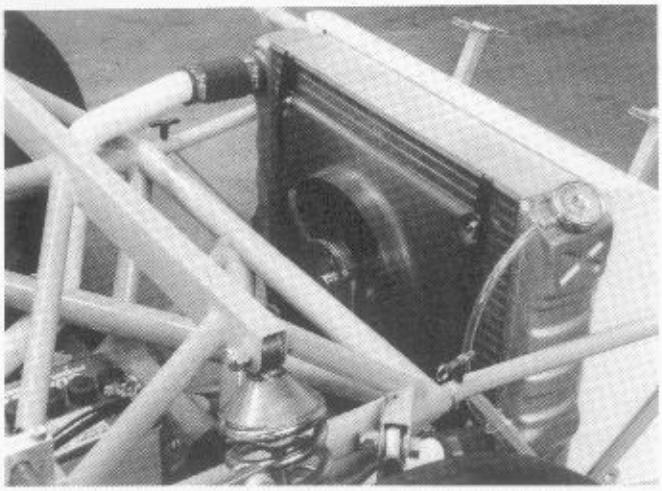
This view shows how all the control arm mounts are angled toward the spindle to eliminate bending moments in the control arm and rod end assembly. This area is very strongly reinforced to support suspension components and the steering gear.

Suspension components as manufactured by Huffaker Engineering include (A) front upper control arms, (B) front tie rods, (C) front lower control arms, (D) rear tie rods, (E) lower rear radius rods, (F) upper rear control arm, (G) upper rear radius rod, and (H) lower rear control arm. These pieces can also be fabricated from the blueprints available from Huffaker Engineering (see manufacturers index).

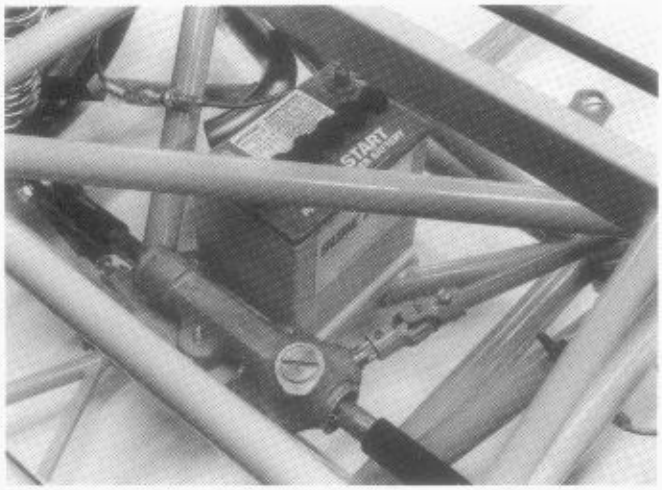


The basic front suspension layout is seen here. Stock Car Products brakes are installed on hand-fabricated uprights (aluminum uprights are now available from Super Bell Axle Co.). Note that all rod ends are mounted in double shear—that is, with a through-bolt and mount material on both sides of the rod end.

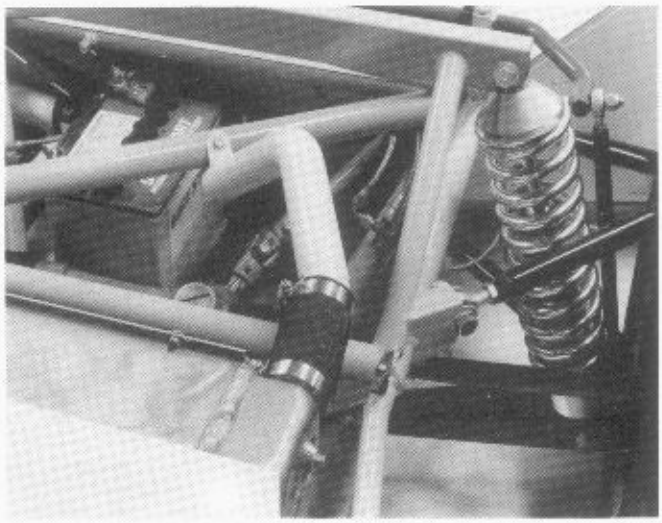




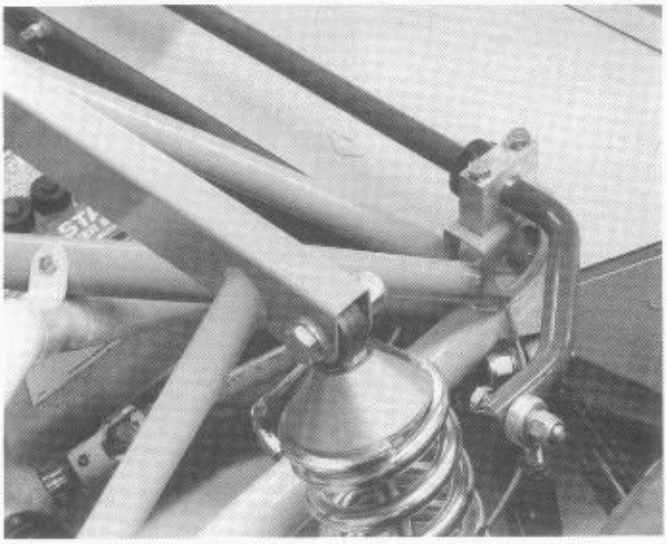
The removable front structure mounts the Modine radiator with a special shroud to direct air through the core. This structure is also used to support the front body panels.



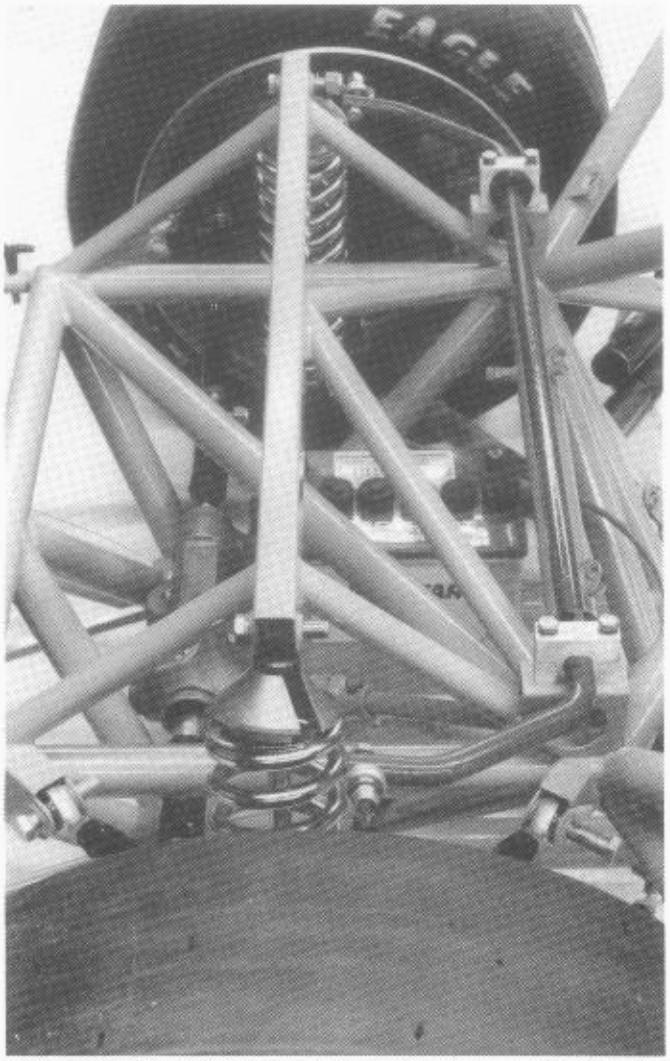
Since this is a rear-engine car, the battery is relocated to the front to improve weight distribution. It is mounted securely behind the steering assembly.



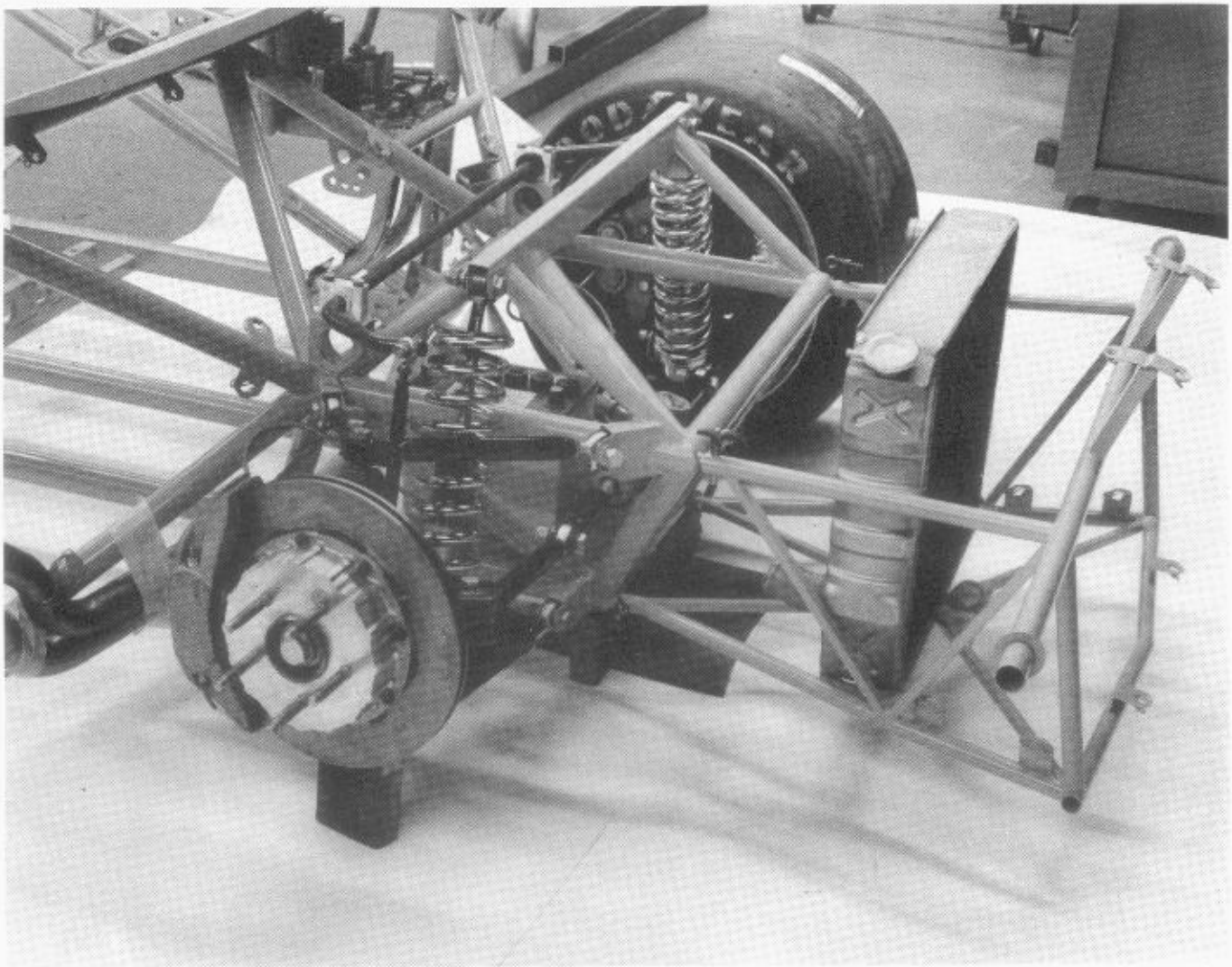
Coolant transfer tubes snake their way around the suspension components and connect to the radiator with short sections of hose. This view also gives another good look at a front upper control arm rod end mounted in double shear.



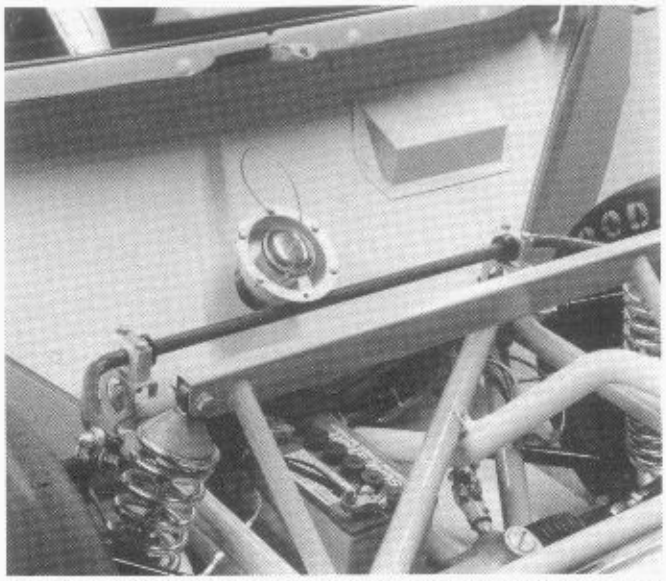
The sway bar mounts with an aluminum pillow block. The upper shock mount is also in double shear—a preferred method wherever possible.



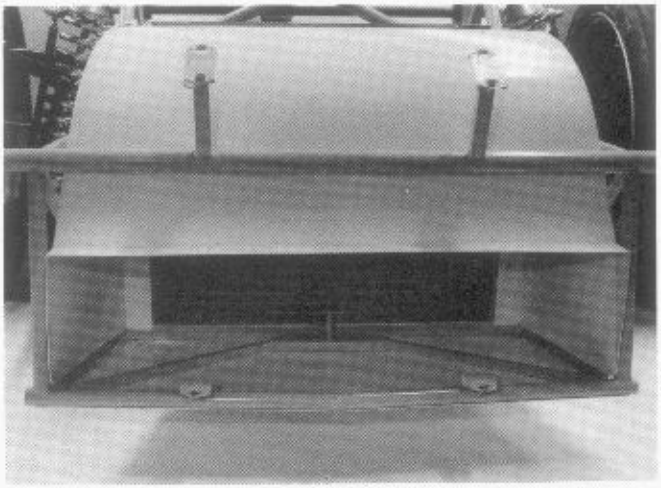
An overview of the sway bar and shock mounts looks complex, but all the components operate in simple relationships that require only basic adjustments to function properly.



This is the overall front suspension layout while the car is still being assembled. Now you can see how the front bay incorporates all the suspension and steering components, along with the cooling system, battery, and the front body support.

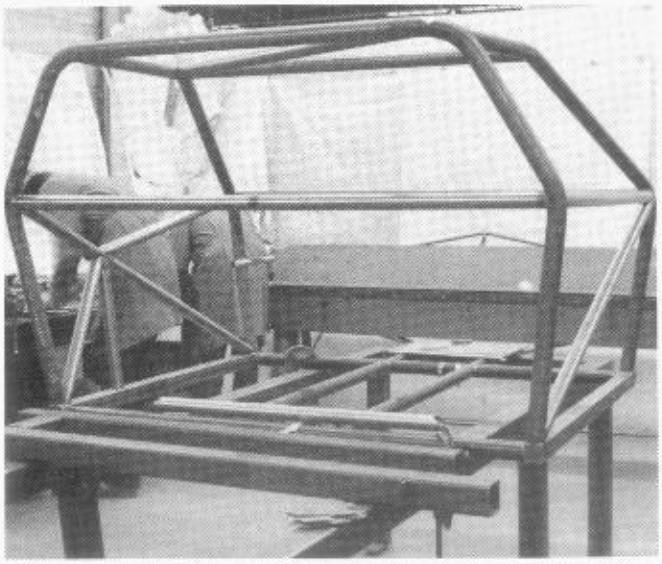


The fuel filler location shown here is only partially correct. The cap and spill cup are only dummied in place during assembly. When the car is complete, these components will mount on the left front fender and connect to the fuel cell via a length of fuel-resistant hose.

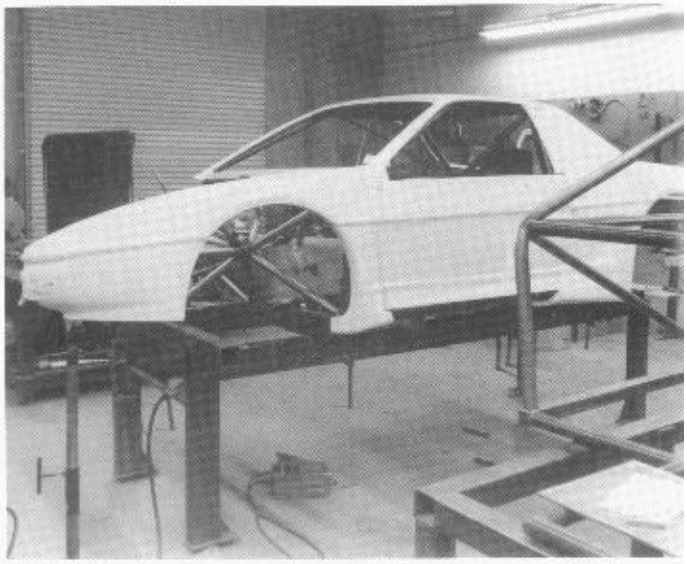


A fabricated front air intake shroud fits into the front body structure and routes incoming air through the radiator core. Racers would normally install a protective screen at the front of the opening to protect the radiator core from debris.

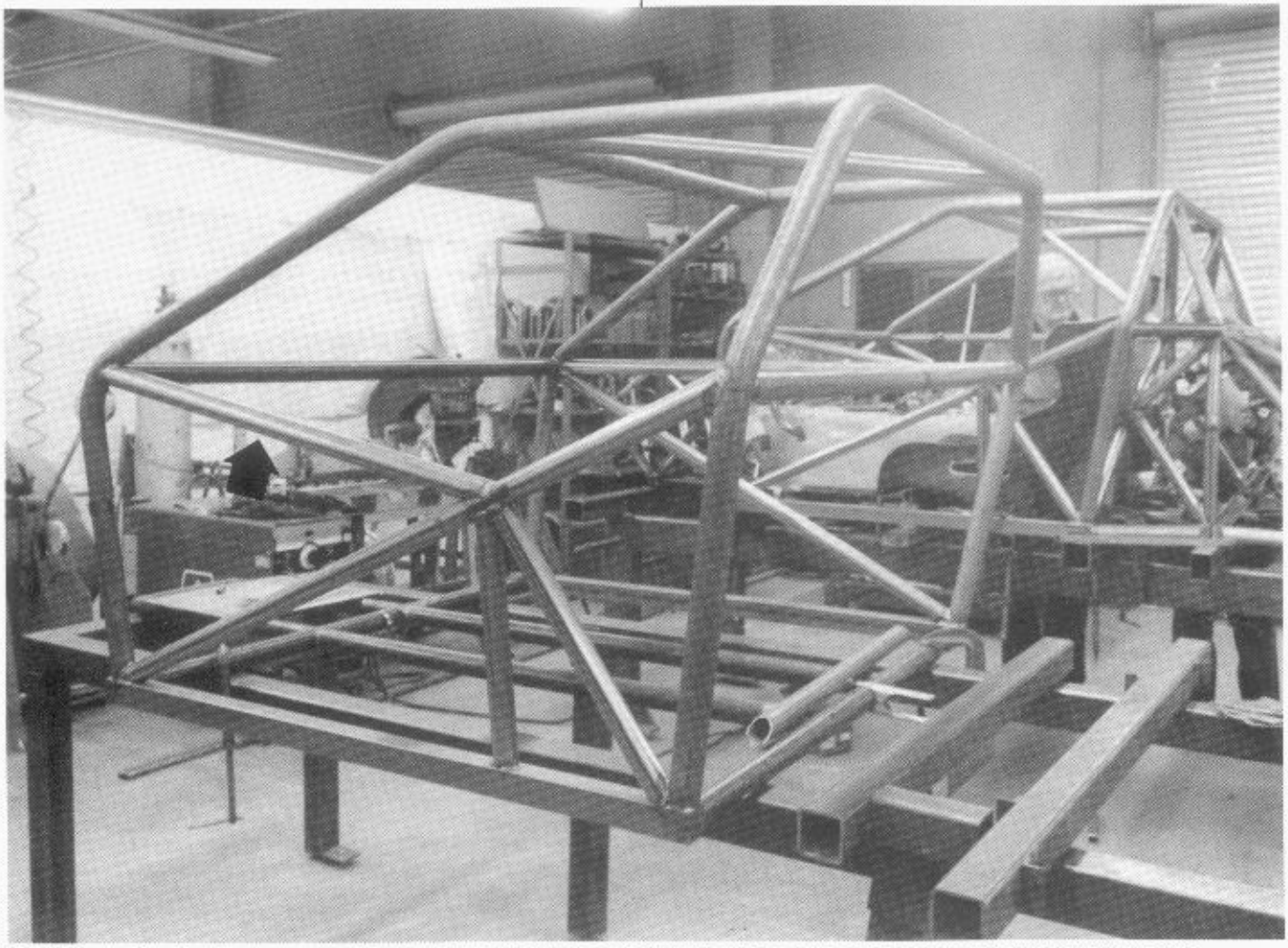
CENTER BAY



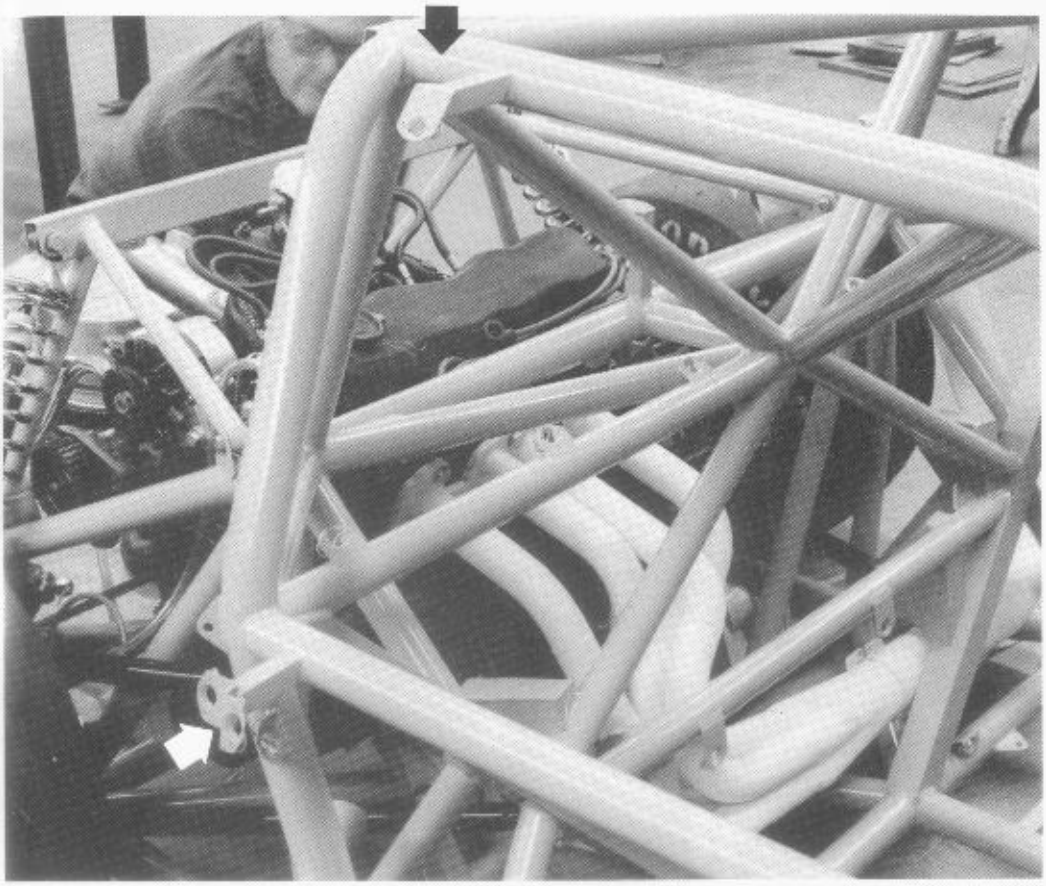
The Fiero race car chassis is comprised of three separate bays. The center bay forms the basic rollcage structure around the driver. It is constructed from mild steel tubing according to design specifications.

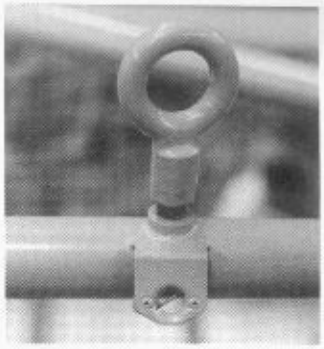


Periodic fit checks are made during chassis construction to ensure compatibility between the chassis and the shape of the Diversified Glass Products body panels. This also provides an opportunity to make notes regarding the eventual placement of body fasteners.



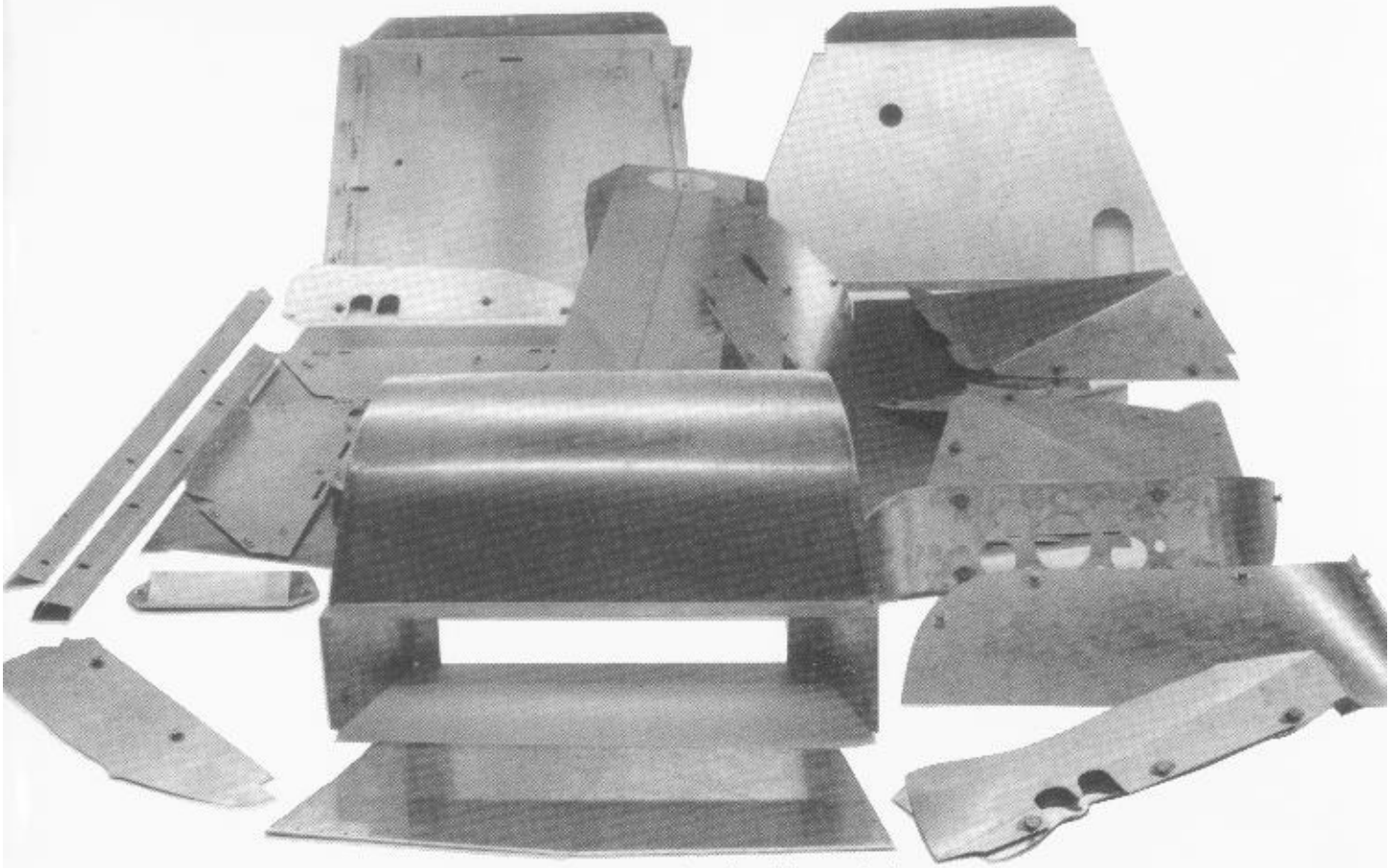
Basic triangular structures are used to support major stress points such as the main hoop and the front A-pillar bars. The right side of the bay is supported by a straight side bar with one diagonal strut. Because the driver enters on the left side of the car, a straight side bar was not feasible. The left diagonal support was reversed and a front support (arrow) was added with additional triangular bracing at the bottom.



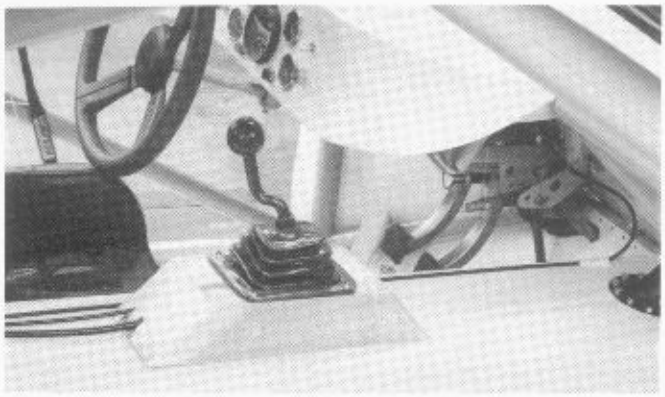


ABOVE—A nice touch is the addition of this removable eye hook in the center of the main hoop. This is a balanced lift point where the car can be lifted and carried from the track in the event of a mishap.

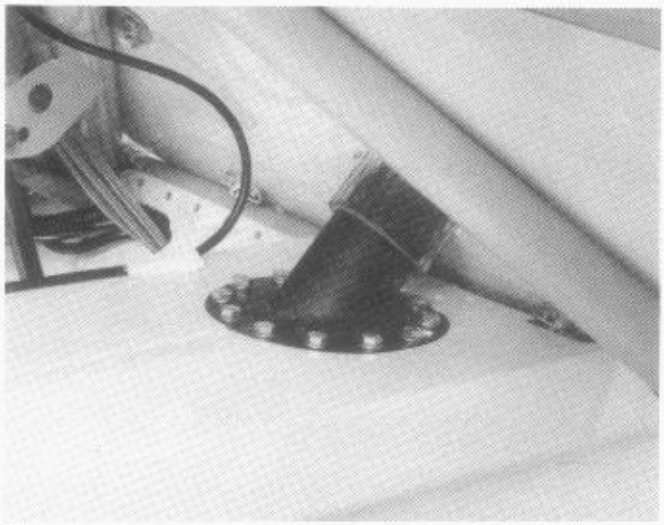
LEFT—A mockup engine is installed as the chassis is assembled. This allows you to check for interference problems on various components such as the Hooker headers shown here. On this nearly completed chassis you can see several body mounts (arrows) and the bulletproof rollcage assembly that is formed with the addition of the rear bay.



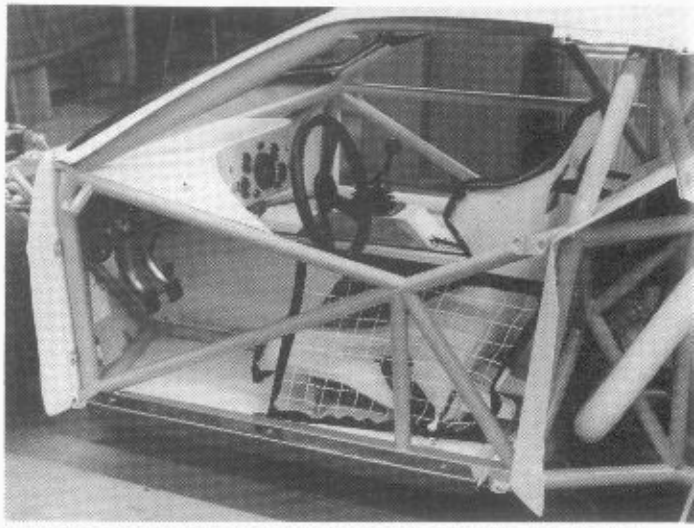
A finished car requires a substantial amount of tinwork to enclose the driver and all the important systems. You can fashion it all yourself or purchase it from Huffaker Engineering (PN 60-81-100).



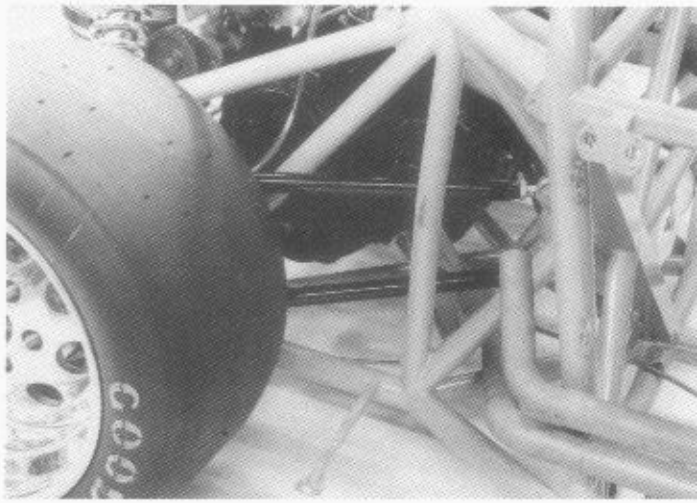
A stock shifter and cable mechanism is installed in a special housing on top of the central cavity containing the fuel cell. Dzus fasteners are used to provide easy access to the internal components.

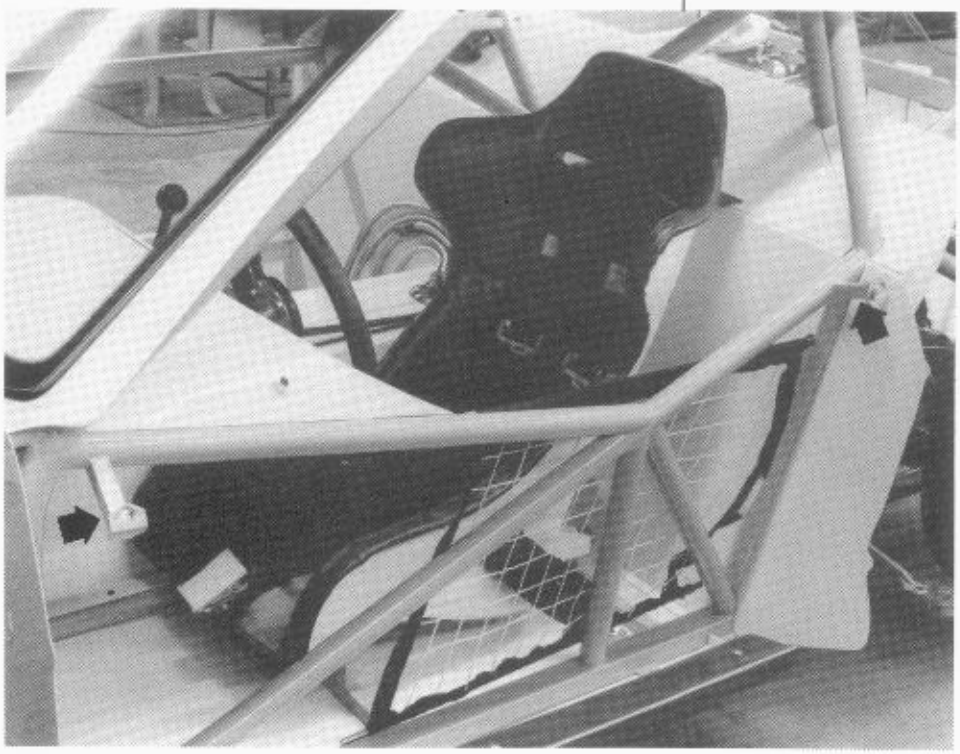


The no-spill fuel filler neck passes through the front bulkhead and the central cavity housing to reach the Don Allen 29-gallon fuel cell (PN 2M4).



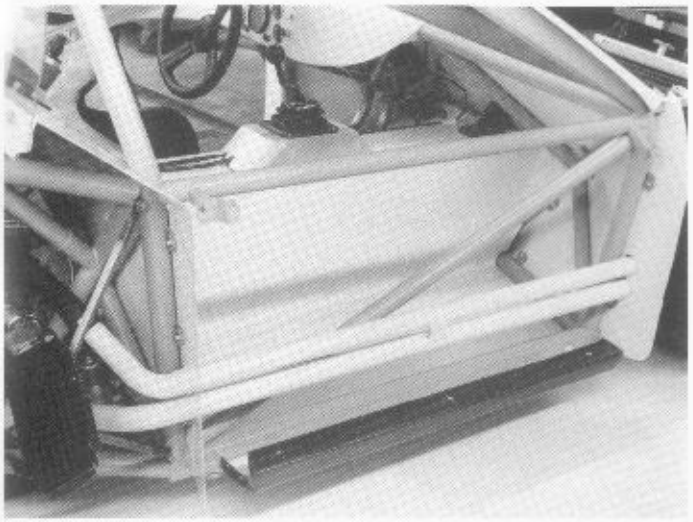
Note the substantial amount of structure behind and around the driver. The Fiero race car was designed with driver safety a major focal point.



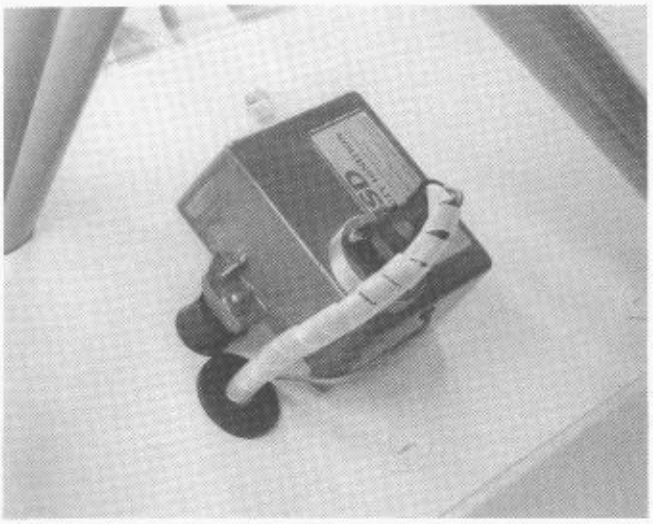


ABOVE—This view shows how the coolant transfer lines are routed into the engine bay and around the suspension components. Flexible connections are made at this point, but they have to pass over and under the right rear radius rods without interference.

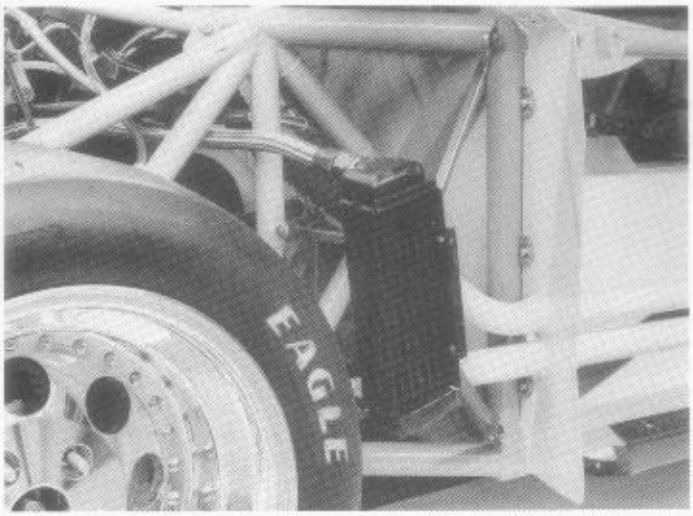
LEFT—This view shows how the left side framework is designed to aid driver entry and exit. A lightweight fiberglass racing seat, Simpson harnesses and window safety net, are all part of the package. The seat is custom-installed to fit the driver, though there are some adjustments.



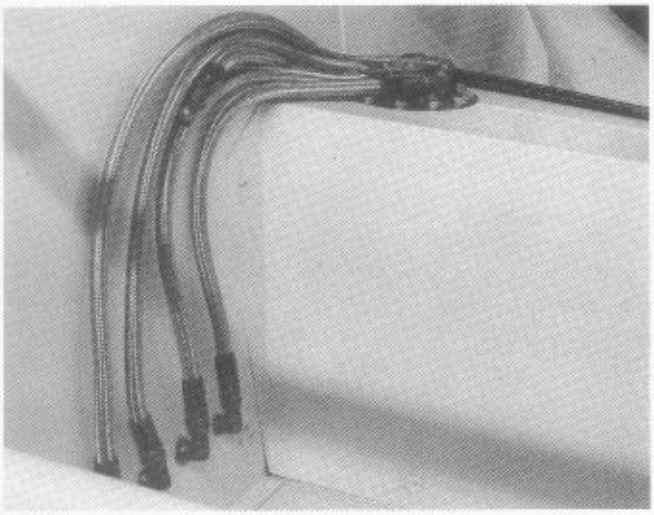
The complete coolant transfer system passes down the right side of the car, through the tin bulkheads, and into the engine bay. In the front bay, the lines have to snake their way around the front suspension before they can be attached to the radiator.



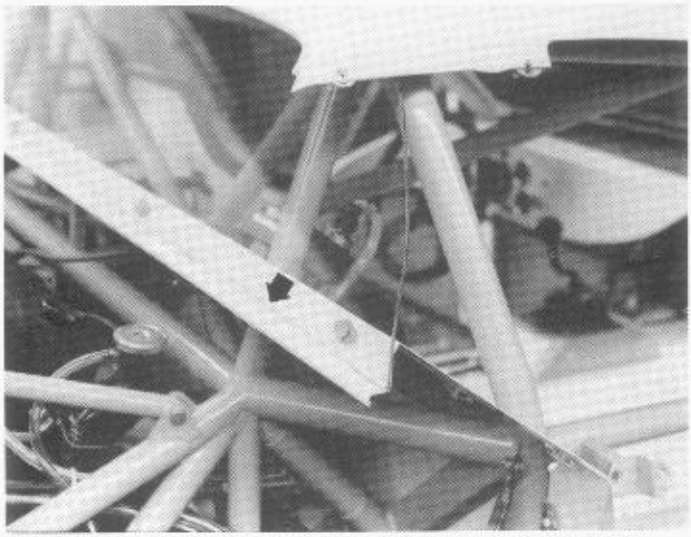
An MSD Extra Duty ignition control module and rev limiter is shock-mounted in a cool airflow location on the upper portion of the rear bulkhead. Once again, note the carefully fitted tinwork and placement of Dzus fasteners for easy removal.



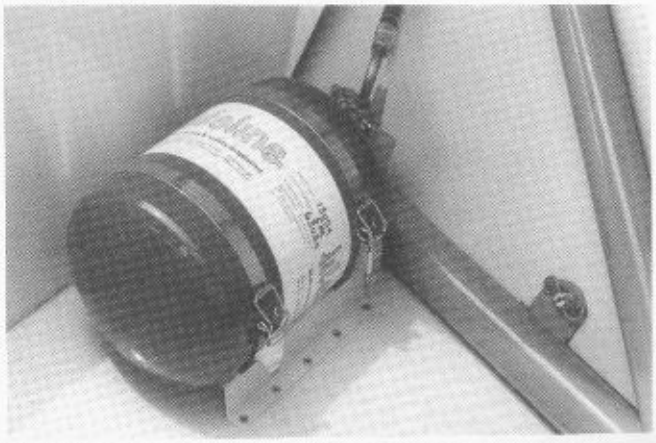
The Modine engine oil cooler is installed where it will pick up airflow through a vent in the right rear wheel flare. Also note the careful placement of Dzus fastener mounts for the tinwork.



Fuel lines are run from the pickup point at the rear of the fuel cell, down the rear bulkhead, and through bulkhead fittings to the fuel pumps mounted directly behind the panel. Russell Performance Products braided steel lines and hardware are used. A fabricated tin cover is fashioned to conceal the fuel lines. It attaches with Dzus fasteners and is easily removable to service the lines.

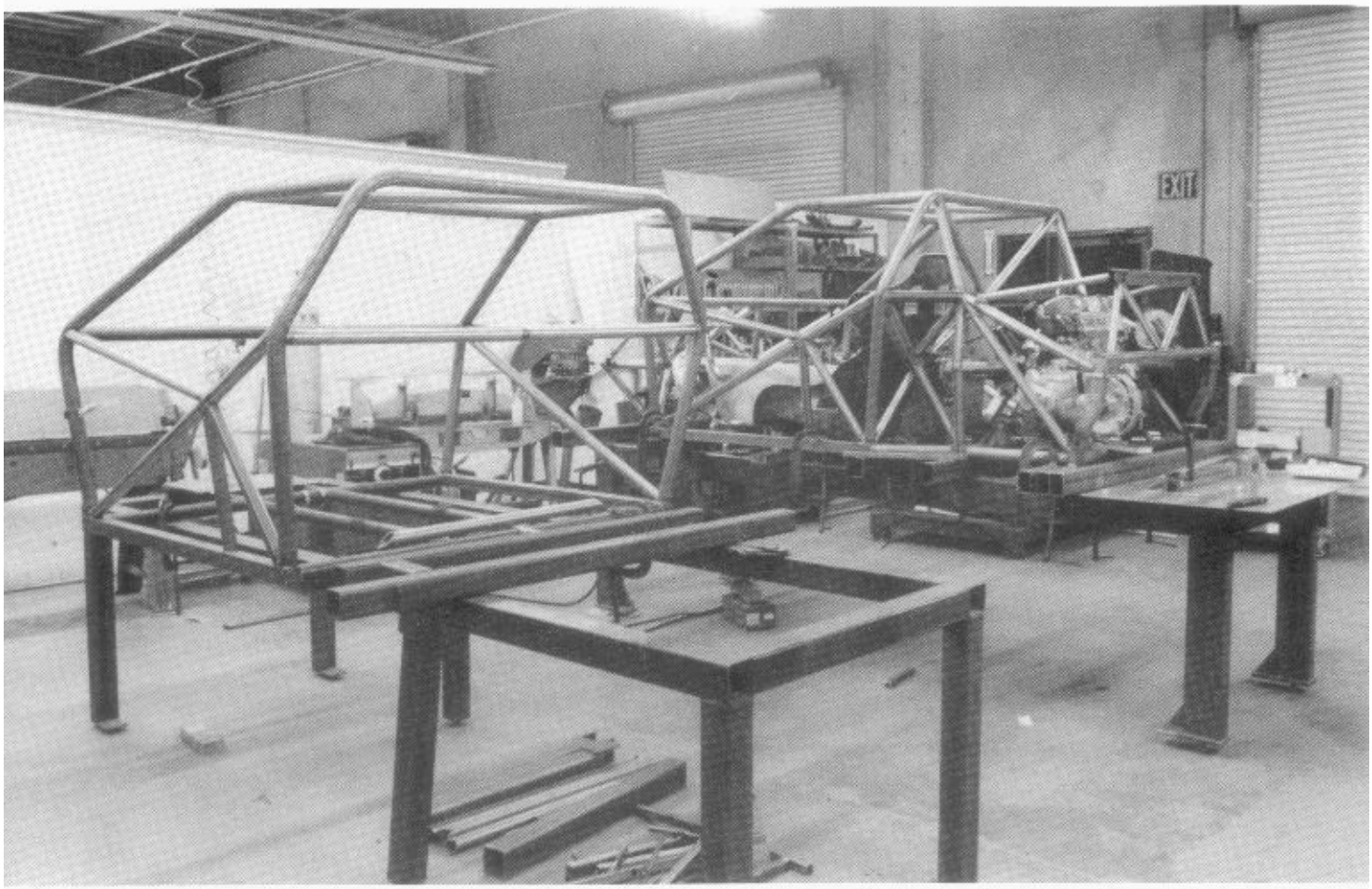


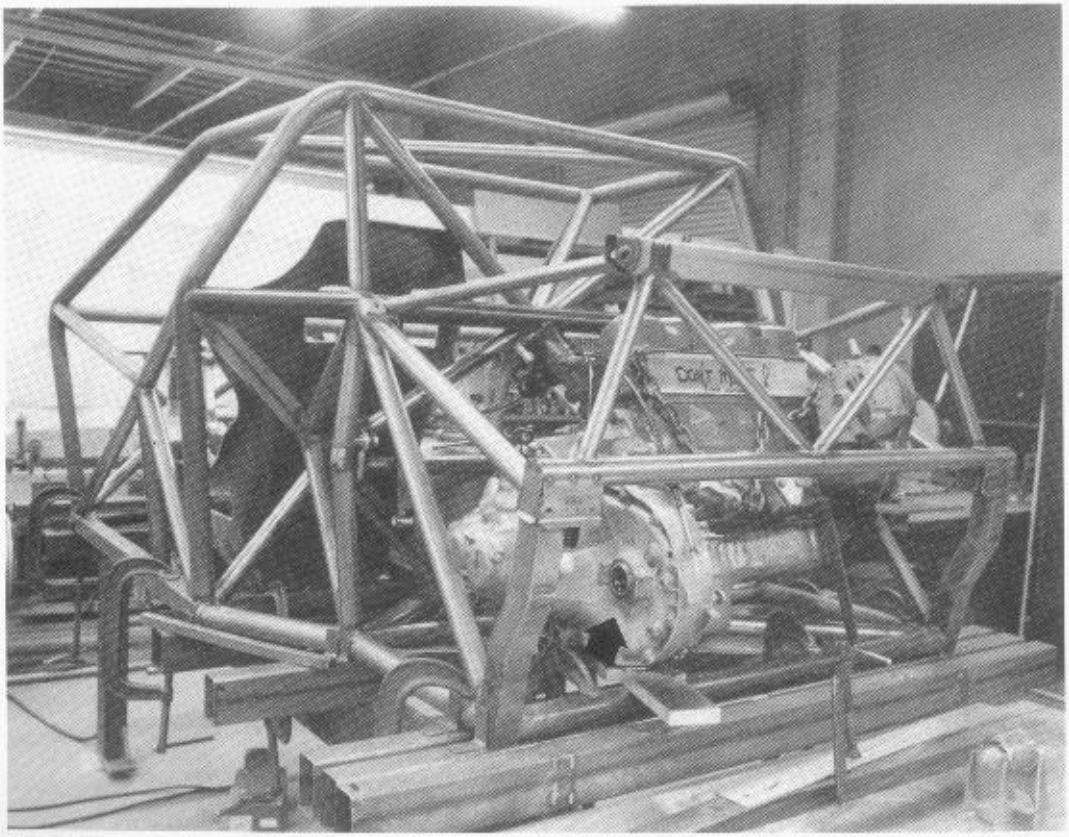
The Lexan rear window is installed with Dzus fasteners at the rear bulkhead. It requires a slight notch along the bottom (arrow) to accept the front portion of the rear deck fiberglass.



The Lifeline Systems fire bottle (PN A6DE) is mounted next to the fuel cell cavity at the right front side of the driver's compartment. It is plumbed to protect the driver, the engine and the fuel tank.

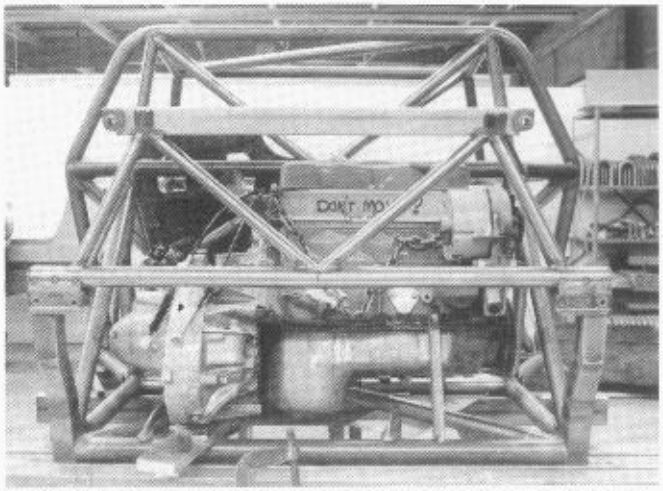
REAR BAY



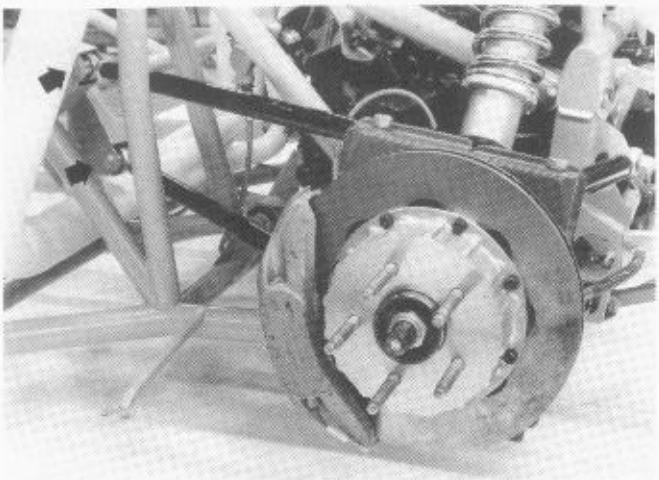


ABOVE—A center bay section rests on one jig, while another unit with rear bay and mockup engine is assembled nearby. A chassis jig is essential, but it can be a simple one-shot arrangement as long as it is straight and level.

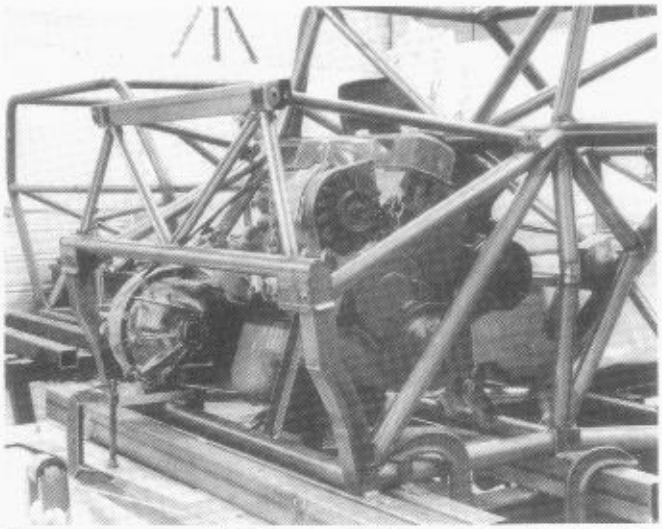
LEFT—The rear bay is a beefy structure designed to mount the engine, transaxle and rear suspension. A removable upper structure is also incorporated to mount the body. You can also see how the engine was tilted forward around the crank centerline to swing the drive axle centerline (arrow) upward to provide more favorable drive axle joint angles.



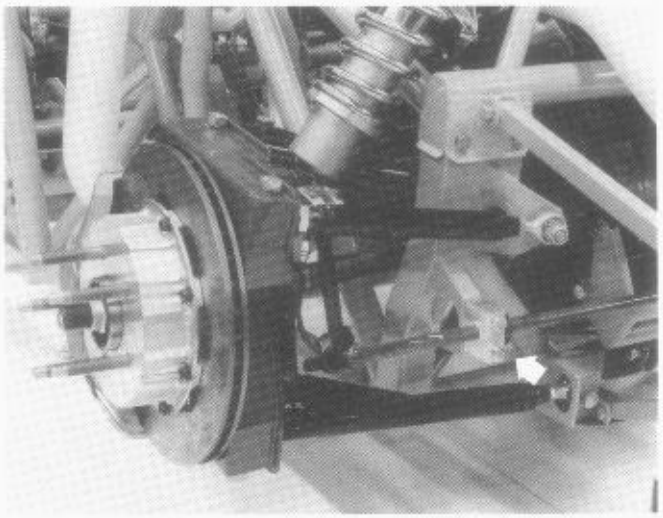
A mockup engine is necessary to verify clearance around all major components. It should be dressed to ensure compatibility of all components with the structure around them.



Stock Car Products brakes are used on all four corners. In this view, you can see the front mount pivot points for the radius rods (arrows).

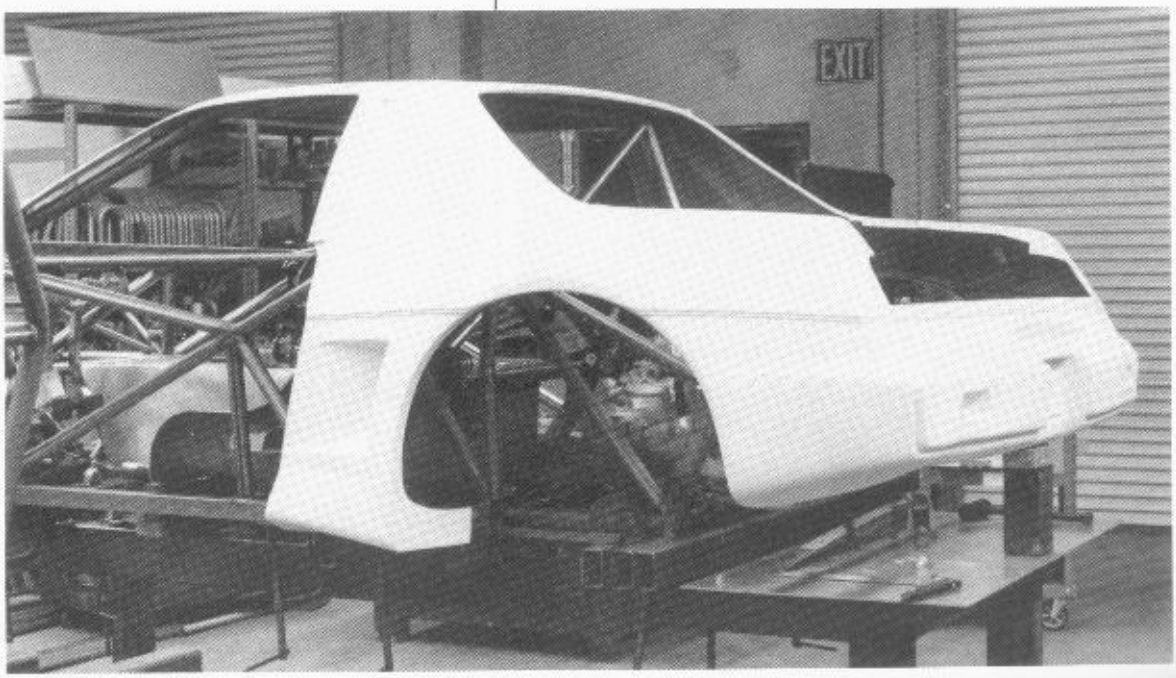


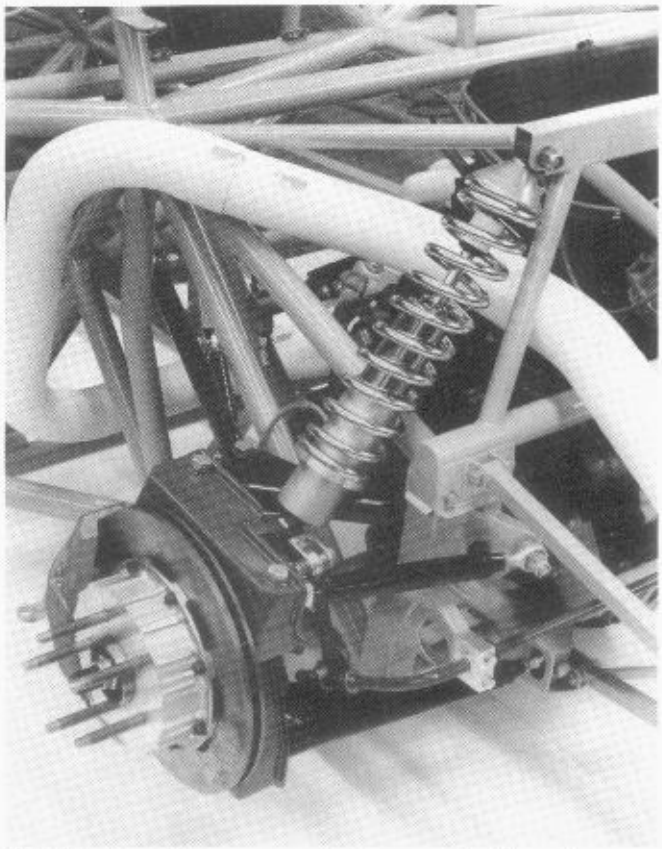
The rear bay completely surrounds the engine and transaxle, but the removable upper structure provides plenty of room for working on the engine in the car.



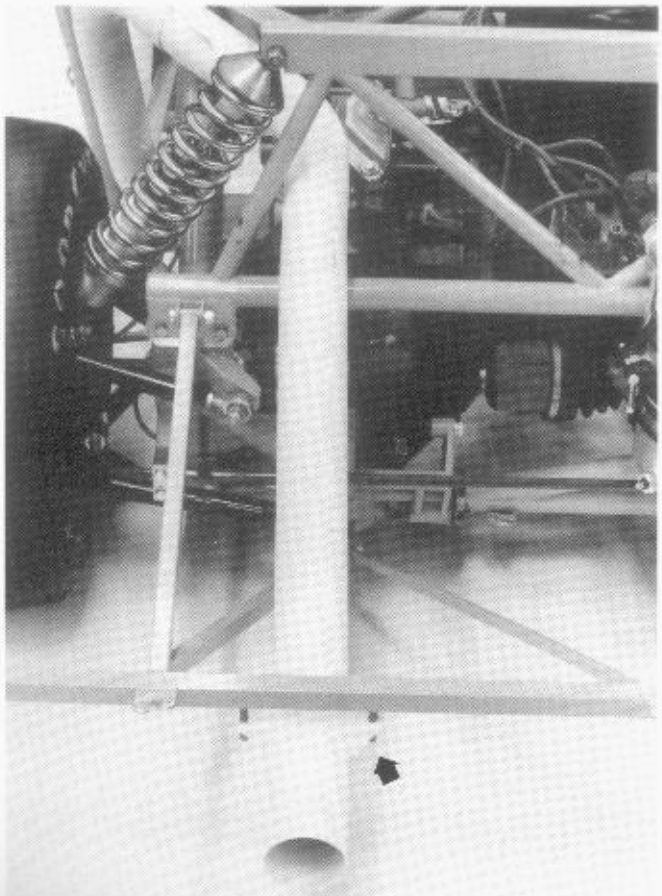
Special uprights from Super Bell Axle Co. mount the hub and rotor assembly. The lower control arm attaches with the lower radius rod just like the upper arms. The toe rod (arrow) adjusts to control wheel alignment. Note the mount location for the rear stabilizer bar.

Frequent body panel fit checks will ensure compatibility of all finished components and ensure a straight, well anchored body shell.

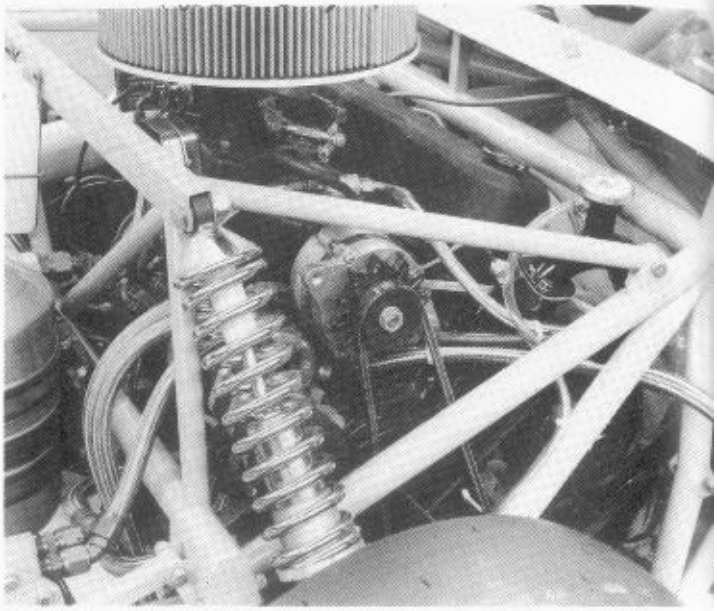




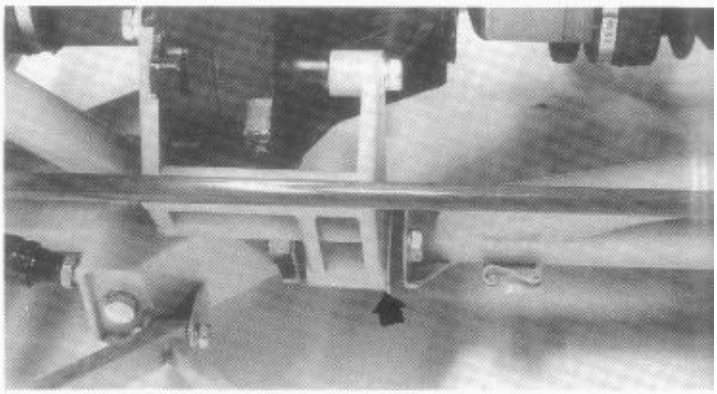
This view shows the upper control arms and radius rod geometry, and the Carrera coil-over shock mount locations.



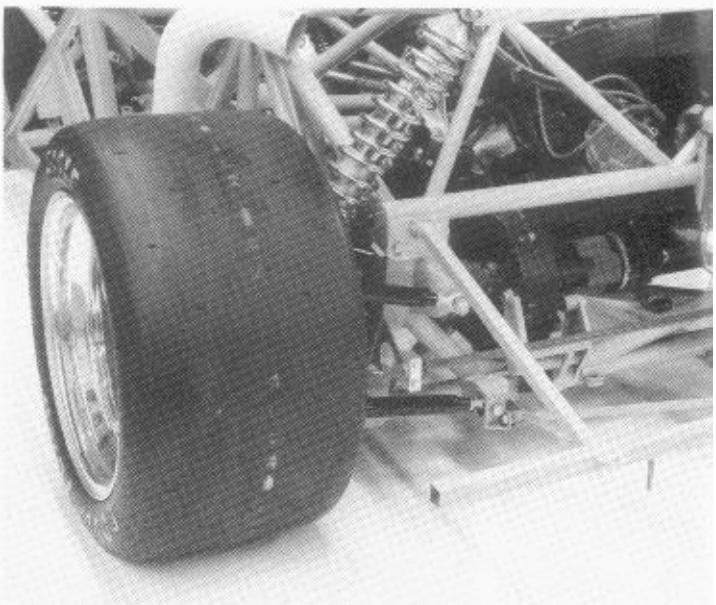
The exhaust system tailpipe is secured to the lightweight body support frame (arrow).



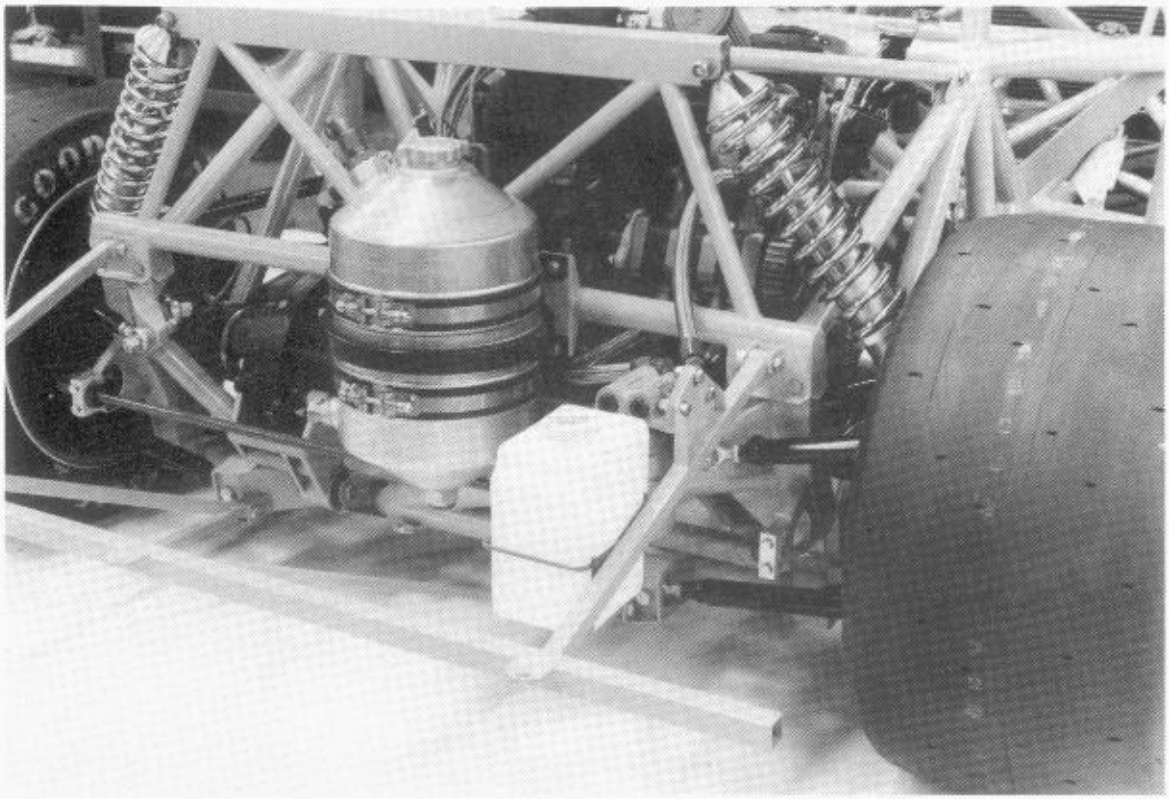
The engine is well hidden under the upper body and shock mount structure, but it isn't difficult to work on. With the upper structure removed, most engine components are easy to reach.



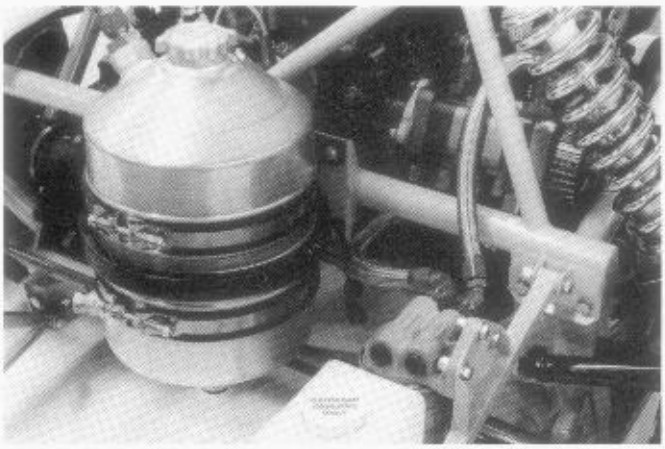
The engine and transaxle rest on factory-style isolation mounts. This is required due to second-order vibrations—solid mounting is not advised.



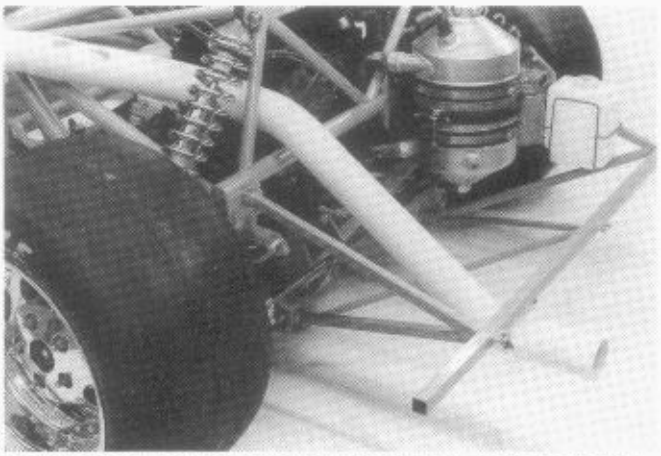
With a Goodyear tire and Center Line wheel assembly installed, you can get an idea of the general suspension layout and the ride height.



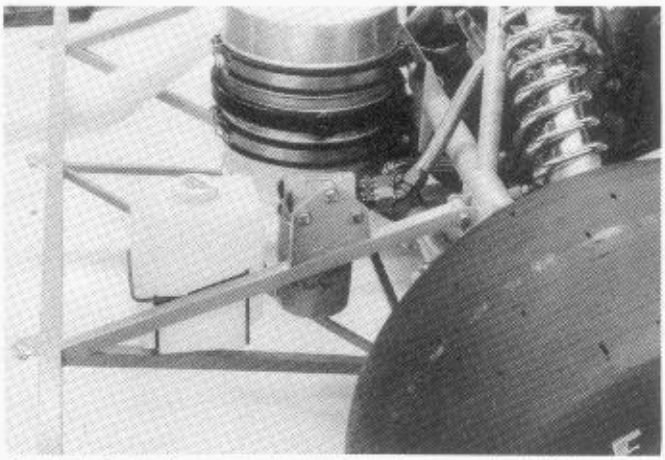
Accessory elements are mounted behind the rear bay, under the body shell.



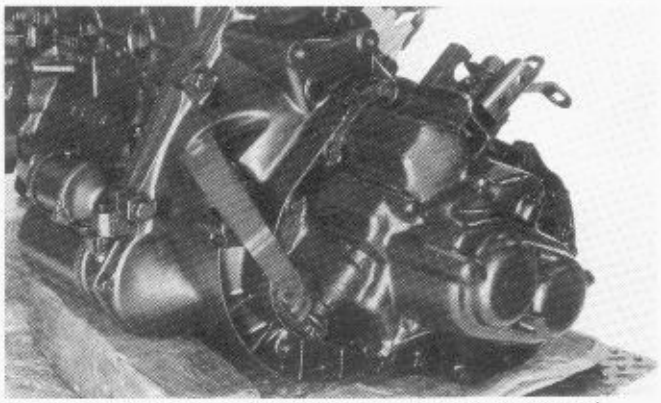
The A.R.E. dry-sump tank is mounted directly behind the engine. The scavenger pump can be seen behind the shock absorber.



With the body panels removed, you can see that most of the major components are relatively accessible for service or adjustments. This is a race car that will be easy to work on in the pits.



A coolant-overflow recovery tank and a remote oil filter are mounted on the right hand side of the rear body support.

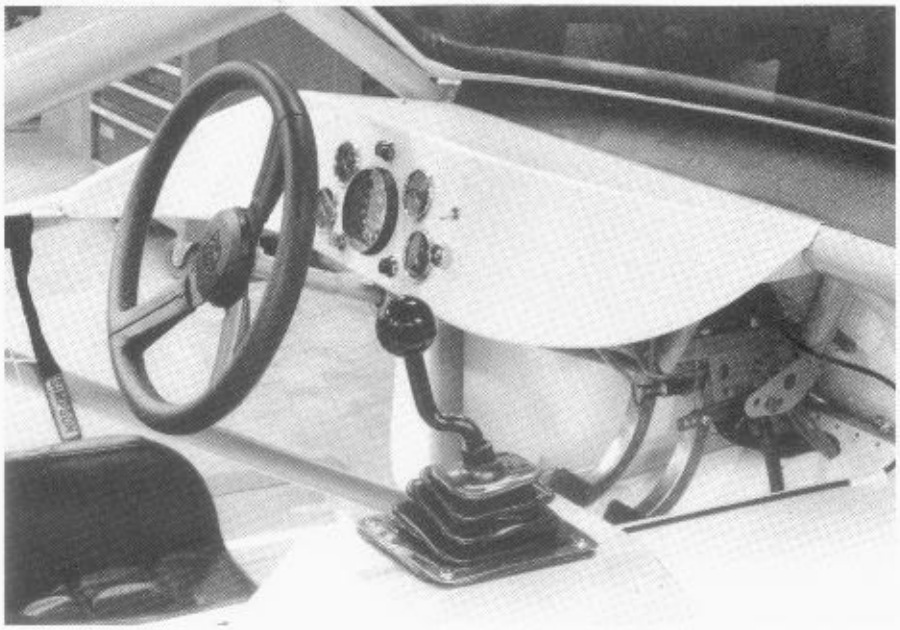


See the manufacturers index for a complete selection of quick-change, high-performance gears for the production transaxle. These components are available from Webster Gears, Inc.

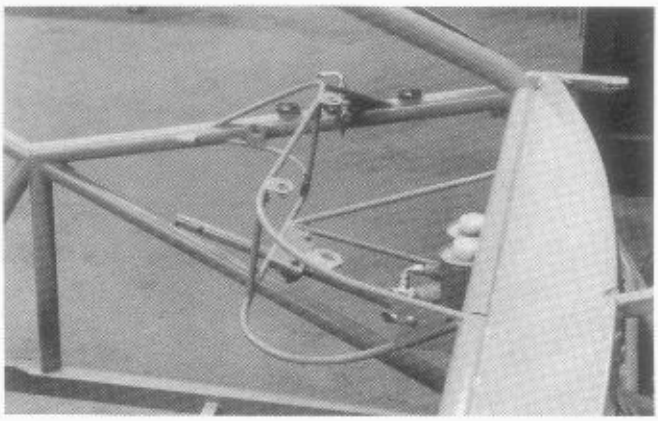
DASH DETAIL

These four views of the custom instrument panel are designed to give you all the details you need to fabricate a similar arrangement in your race car. You can personalize your efforts, but we think you'll agree that this Huffaker-designed unit is just about perfect. It's light, easy to read, and it comes out in a flash. Other interesting features to be seen are the battery cutoff switch on the left hand side of the dash panel cover, Auto Meter gauges, and the production Fiero steering wheel. In photo C you can also see how a carefully fabricated piece of tin is used to give the desired amount of support to the fiberglass A-pillar. This is important since a production windshield and windshield molding are used on the race car.

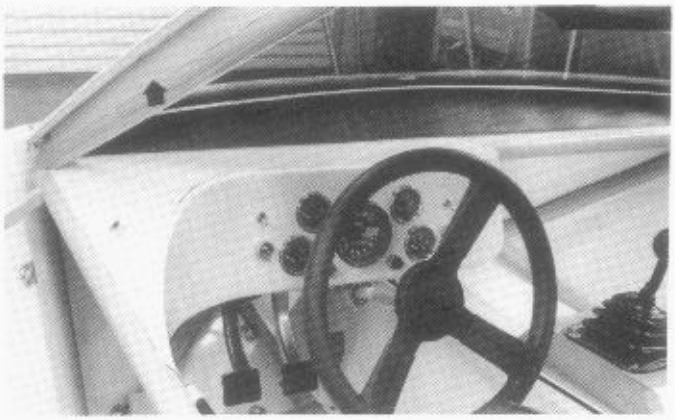
A



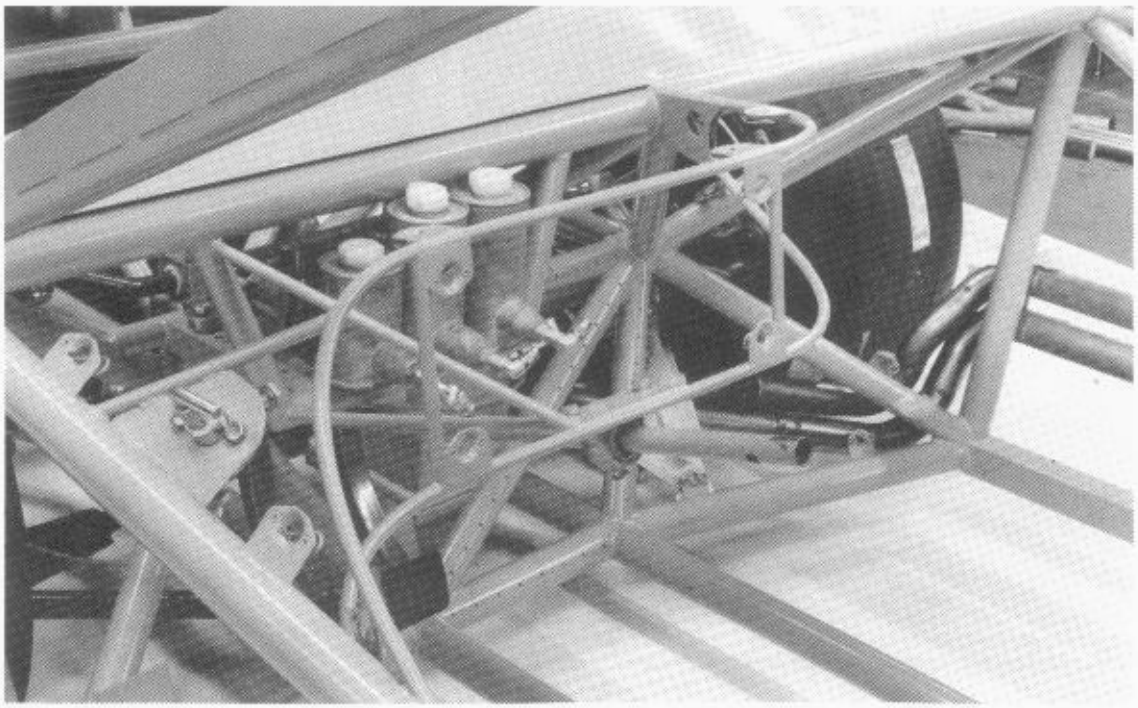
B



C

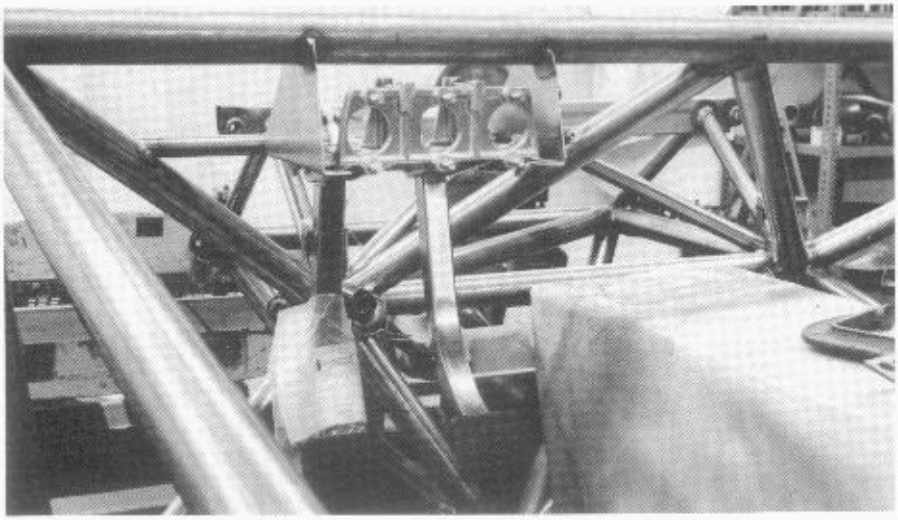


D



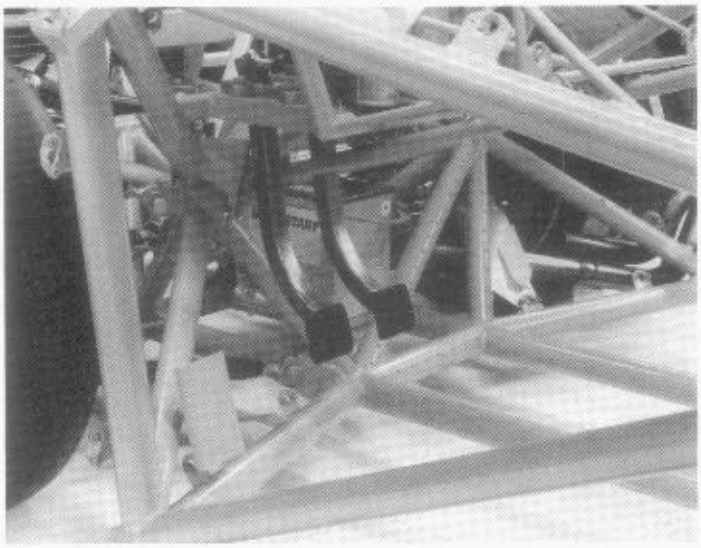
PEDAL ASSEMBLY

A

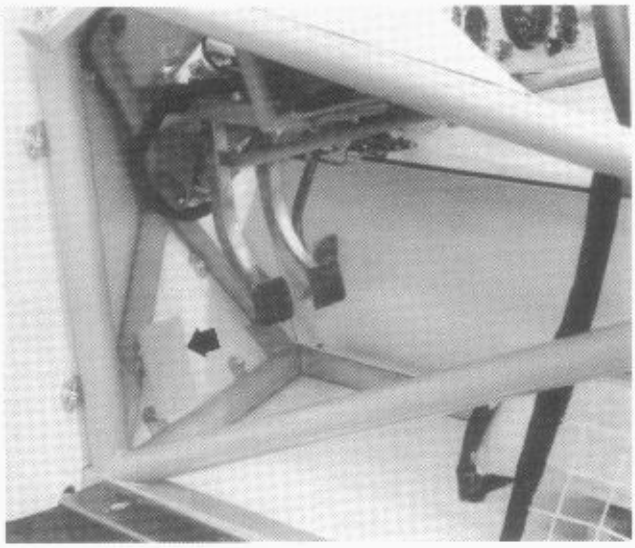


Photos A through C show the Tilton Engineering pedal assembly during various stages of construction: first the bare chassis with pedal assembly hung in place, then the completed chassis with pedals installed, and last the final configuration with all the tinwork installed. Note the foot brace on the left side of the front support (arrow). Photos D, E and F show the pedals from the front side: first with the basic pedal assembly installed on the chassis, then with the tinwork installed and the inspection hole fabricated, and finally with the inspection and service cover fastened in position.

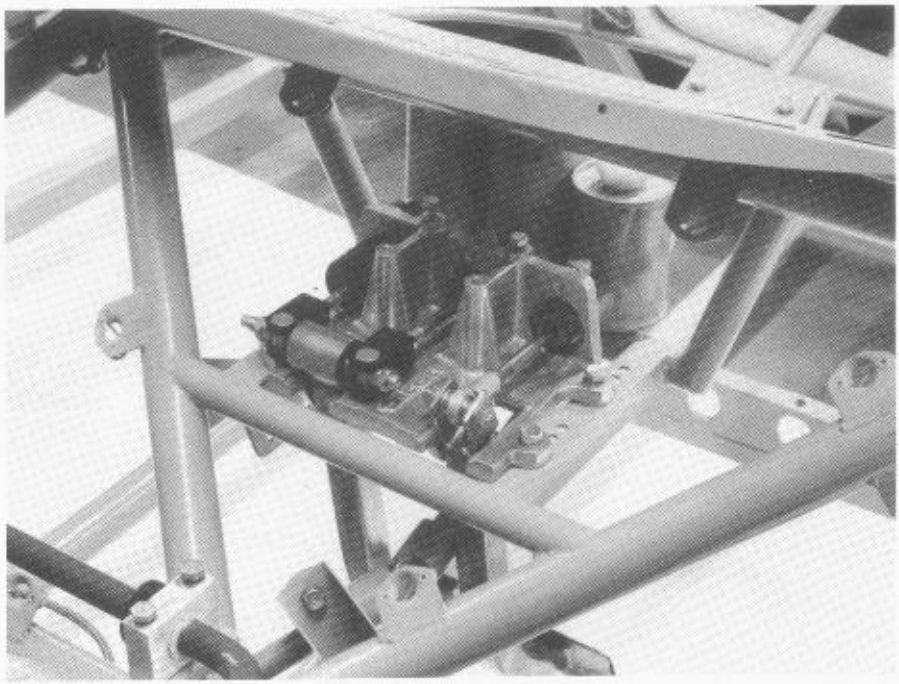
B



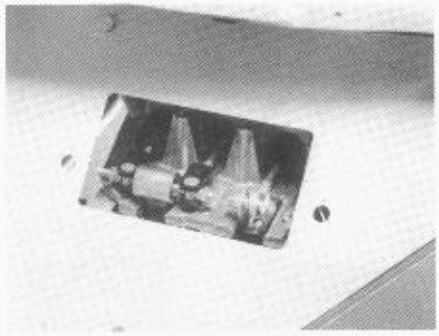
C



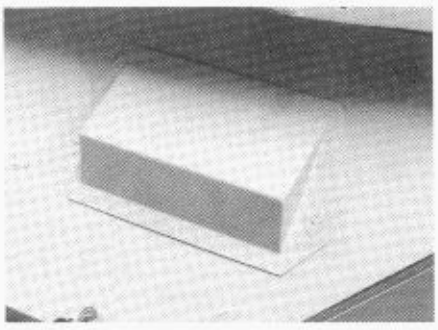
D



E



F



MANUFACTURERS INDEX

PONTIAC DEALERS: AVAILABLE PRODUCTION PARTS

WINDSHIELD WIPER SYSTEM
- Motor Asm. 22030809
- Transmission-RH 22039336
- Transmission-LH 22039337
- Arms 20302338
- Blades 20364747

TRANSMISSION CONTROLS
- Control Asm.–Transmission 10026655
- Knob–Trans. Control Lever 10030989
- Cable Asm.–Trans. Control 10026619
- Cable Asm.–Trans. Control 10026626

CLUTCH SYSTEM–HYDRAULIC
- Slave Cylinder 10026326
- Bracket–Slave Cyl. to Trans. 10028098
- Lever Asm.–Clutch Fork 10030026

WHEEL BEARINGS
- Bearing Asm.–Wheel 14035594

FRONT BALL JOINT
- Ball Joint Kit–Front LCA 9767113

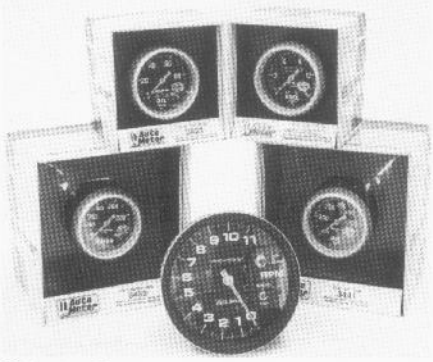
DRIVE AXLE SHAFTS (FIERO RACE CAR ONLY)
- Axle-RH 7845336
- Axle-LH 7845337
- Axle Seal Kit (RH & LH Outer) 7842034
- Axle Seal Kit RH Inner 7842040
- Axle Seal Kit LH Inner 7842039

ENGINE MOUNT "BUSHINGS"
- Bushing Asm. 10000953

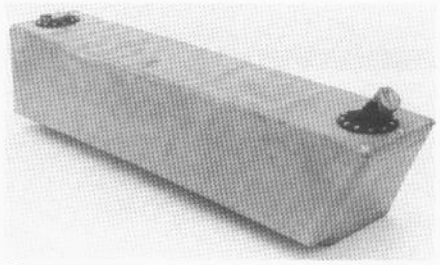
WINDSHIELD 20479012
STEERING WHEEL 17980171
STEERING WHEEL HUB 10028355
TAIL LAMP HOUSING 16500453/54
TAIL LAMP OUTER LENS 16500461/62
TAIL LAMP INNER LENS 16500457/58
6 SPRINGS REQUIRED 5949351
BACK UP LENS 16500460

FIERO RACE CAR PARTS: SUGGESTED SUPPLIERS

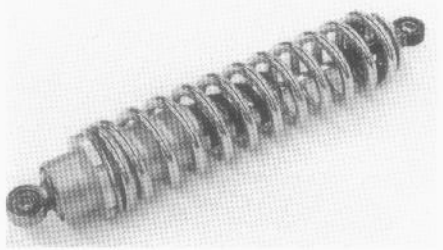
① A.R.E. Dry-Sump Systems
(916) 929-0496
- Engine Oil Pan 1220-P



② Auto Meter Instruments
(815) 895-8141
- 11,000 RPM Tach 5826
- In-Dash Mounting Bracket 1251
- Fuel Pressure Gauge 3411
- Oil Pressure Gauge 3421
- Oil Temp Gauge 3442
- Water Temp Gauge 3433

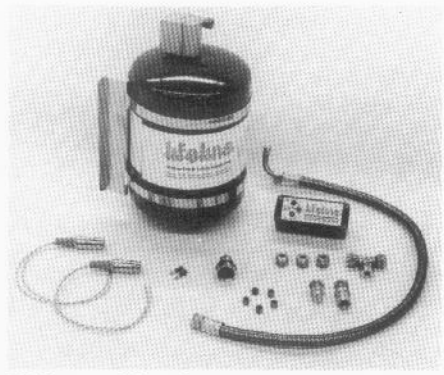


③ Don Allen Fuel Cells
(503) 479-2949
- Fuel Cell 2M4

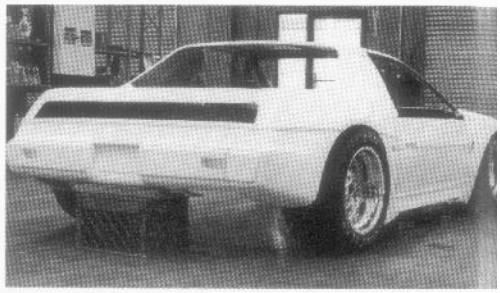


④ Carrera Shocks
(404) 451-8811
- Coil-Over Shocks Front 5176TSAXX
- Coil-Over Shocks Rear 5175TSAXX
- Spring Selection:
- 260 lb/in (Chrome Silicone Steel) 13CS260
- 310 lb/in (Chrome Silicone Steel) 13CS310
- 375 lb/in (Chrome Silicone Steel) 13CS375
- Rear Spring Selection:
- 220 lb/in (Chrome Silicone Steel) 13CS220
- 260 lb/in (Chrome Silicone Steel) 13CS260
- 310 lb/in (Chrome Silicone Steel) 13CS310
- Jounce Bumpers (Pair) 1864B

⑤ Center Line
(213) 921-9637
- 12"x16" Front & Rear Wheels X610-515-65

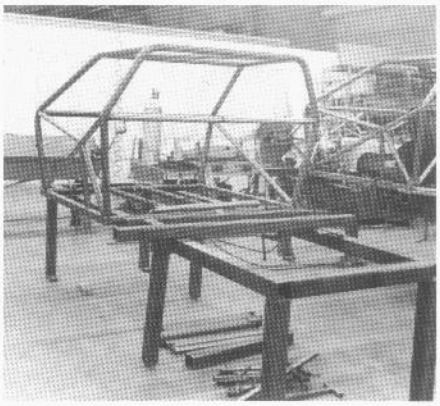


⑥ Competition Systems
(206) 285-4811
- Lifeline Fire System
- 11 lbs. Inert Gas Fire System
- Electronic Activated A6DE



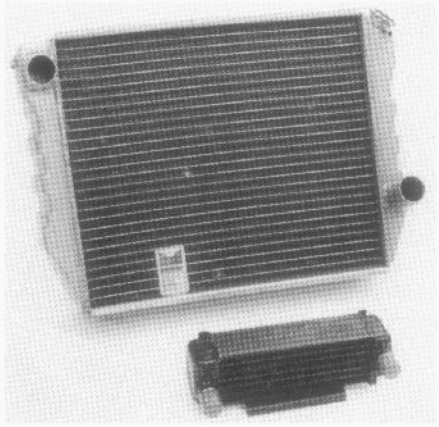
⑦ Diversified Glass Products, Inc.
(313) 373-7575
- Complete Body Asm. 84PCBA
- Roof Cap & Windshield Sun-around 84PRWS
- Front Center Bumper 84PFCB
- Right Front Fender 84PRFF
- Left Front Fender 84PLFF
- Center Lower Spoiler 84PCLS
- Right Door w/Rocker 84PRDR
- Left Door w/Rocker 84PLDR
- Right Rocker Panel 84PRRP
- Left Rocker Panel 84PLRP
- Right Rear Fender W/Sail 84PRRFS
- Left Rear Fender W/Sail 84PLRFS
- Rear Engine & Vent Cover 84PREVC
- Front Hood & Headlight Cover 84PFHH
- Rear Center Bumper 84PRCB
- Rear Deck Spoiler 84PRDS
- Air Intake Scoop 84PAIS

⑧ Goodyear Tire Company
- Front 23-11.5x16
- Rear 25-12.5x16



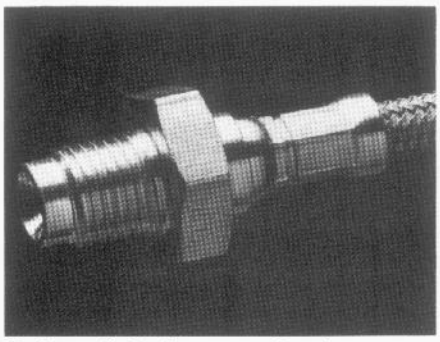
⑨ Huffaker Engineering
(707) 763-6842/7141

Control Arm & Radius Rods w/Rods Ends (Full Car Set) All Required
Aluminum Panels 60-81-100
Frame (includes Front & Rear Subframes) 60-81-200
Lifeline Distributor 30-10-150
Roller Chassis 70-81-001
Complete Cars 70-81-050
Complete SD 4-Cyl Engines 10-81-001
Chassis and Frame Blueprints 70-801



⑩ Modine
(414) 636-1200

Aluminum Racing Radiators 1R784
Aluminum Engine Cooler 1B109



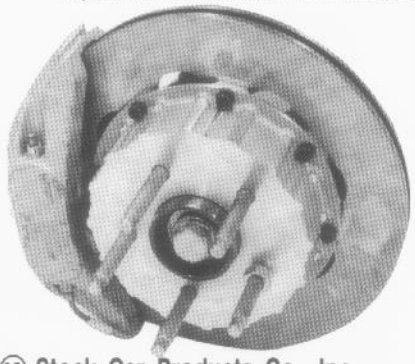
⑪ Russell Performance Products
(213) 639-7151

Fiero Fuel Sys. Hoses & Line Ftgs. 9900
Fiero Oiling Sys. Hoses & Line Ftgs. 9901
Fiero Brake Sys. Hoses & Line Ftgs. 9902

FOR CHASSIS AND FRAME BLUEPRINTS SEE HUFFAKER ENGINEERING.

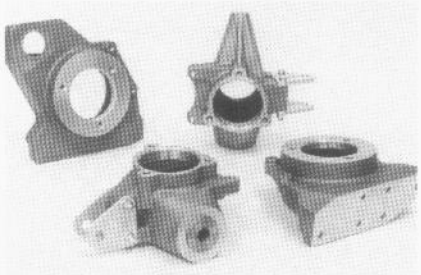
⑫ Simpson Safety Equipment
(213) 320-7231

Belt Harness 5-Way 29041
Window Net 31504
Helmet ..... Model 14
Suit-2 Layer Nomex III 1-Piece 10000
Head Sock 23000
Socks 24000
Under Suit 20200
Gloves 21500
Shoes 26000
Bag 28000



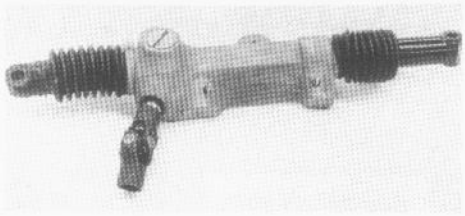
⑬ Stock Car Products Co., Inc.
(213) 698-9913

Rotors D-875
Calipers Left Side 3596
Calipers Right Side 3597
Hats D-1875
Hats, Bolts & Washers ..... 32 Required



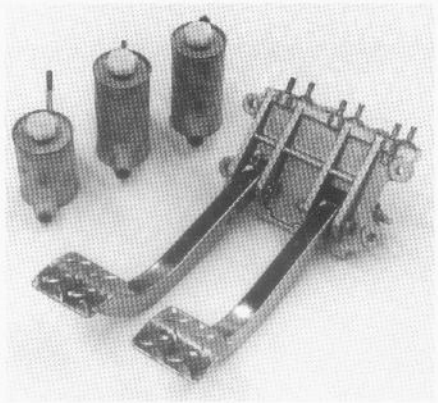
⑭ Super Bell Axle Co.
(209) 445-1601

Right Front Upright 77602004
Left Front Upright 77602003
Right Rear Upright 77603003
Left Rear Upright 77603004



⑮ Sweet Mfg., Inc.
(616) 344-2086

Rack & Pinion Asm. 2200



⑯ Tilton Engineering
(805) 688-2353

Pedal Set 72-621
Brake Master 1" CP2143-9LR
Brake Master ⅞" CP2143-8LR
Clutch Master ⅞" CP2143-8

⑰ Webster Gears, Inc.
(415) 388-2728

Transmission Internal Quick-Change Gear Sets for GM 4-Speed Transmissions

Transmission will have quick-change ring and pinions and quick-change 1st, 2nd, 3rd and 4th gear ratios.

a. 1st gear cut on input shaft.

Ring and pinion ratios:

4.82:1	Will take some case modifications	• Pinion
4.72:1	" " "	• gear
4.64:1	" " "	• cut on
4.50:1	" " "	• output
4.40:1	" " "	• shaft.
4.26:1	Quick-change pinion.	
4.16:1	Will be shelf-stocked.	" " "
4.00:1	" " " "	" " "
3.85:1	" " " "	" " "
3.66:1	" " " "	" " "
3.45:1	" " " "	" " "
3.26:1	" " " "	" " "

1st gear ratios:
2.69, 2.47, 2.28, 2.11

2nd gear ratios:
1.95, 1.81, 1.68, 1.57, 1.46, 1.36, 1.27, 1.19, 1.11, 1.07, 1.03, 1.00, .97

3rd gear ratios:
1.57, 1.46, 1.36, 1.27, 1.19, 1.11, 1.07, 1.03, 1.00, .95

4th gear ratios:
1.19, 1.11, 1.07, 1.03, 1.00, .97

SUGGESTED ENGINE BUILDERS

VANDERLEY ENGINEERING
(601) 435-1582
HUFFAKER ENGINEERING
(707) 763-6843

HOT ROD Magazine

Pontiac's Rolling Showcase for Their Super Duty Engine Program

By John Baechtel

SUPERBIRD

Look again, friend; that was no Trans Am that just blew by you on the backstretch. It was Pontiac's new Super Duty Firebird—a screaming, four-cylinder-powered Firebird constructed to IMSA Kelly Girl specifications by Pontiac Engineering. It was built to demonstrate the potential of Pontiac's four-cylinder Super Duty engine in a variety of racing applications, and although the car is still a little too heavy for the Kelly Girl series, its performance is nevertheless impressive. It has a top speed of better than 150 mph and does the quarter-mile in 13.2 seconds at more than 100 mph.

That's rather impressive for a 165-cid four-banger in a 2700-pound car, but this is no ordinary engine. It develops 272 hp at 7600 rpm, and it's packed full of the same high-performance Super Duty hardware already available to everyone—not just selected racers. The engine is based on Pontiac's Super Duty cylinder block, crankshaft and cylinder head. To this potent combination the engineers added a carefully selected blend of aftermarket speed equipment designed with Pontiac's blessing and manufactured expressly for Super Duty applications.

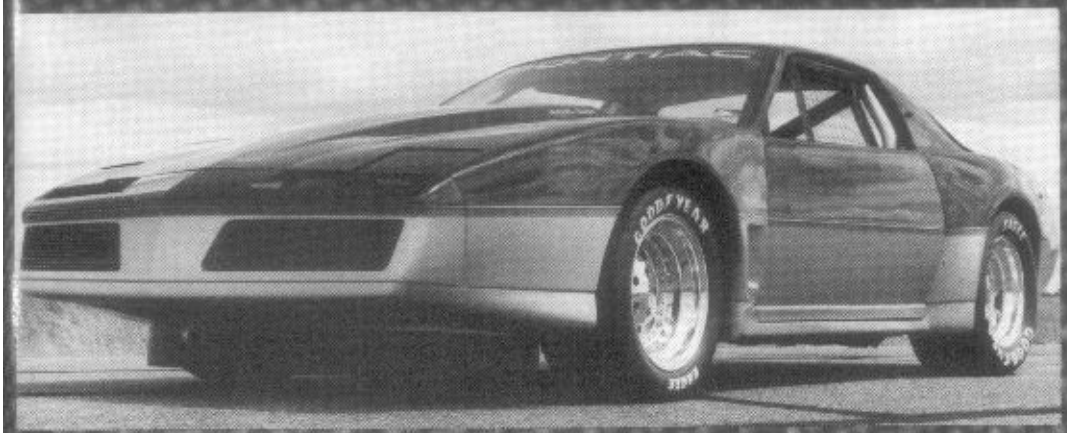
Naturally these pieces work best in conjunction with factory Super Duty engine components, but many of them are also applicable to the 151-cid base Firebird engine for street use. Most of these parts have already been detailed in our Super Duke story (HOT ROD, December '82), but more are being developed all the time and Pontiac will soon make available a Super Duty engine book describing all the Super Duty engine pieces and their specific applications in step-by-step form.

The chassis was constructed by Pontiac with the application of as many standard production components as possible. It features a full rollcage tied in at all the suspension mounting points and fully welded body seams throughout the unibody structure. Production disc brakes are used at all four corners, and they're fitted with semi-metallic linings normally reserved for use on front brakes only. The transmission is a standard '83 Borg-Warner T-5 five-speed, and the rear axle is a standard '83 unit fitted with 4.11s.

Center Line tooled up the special 16-inch wheels that are available in different widths so they can be applied to street cars as well as race cars. Their use on a street car depends on whether or not you have modified the bodywork with the stylish fiberglass body panels from Diversified Glass (313/373-7575.) As shown in the accompanying chart, a stock Firebird will accept the 16 × 8-inch wheels with no modifications other than the addition of 16-inch tires that are now available (Goodyear's Corvette tires). If a guy wants to build a street machine with the swoopy bodywork by Diversified, he can use the 16 × 10 race wheel on the rear and a special 16 × 9 inch front wheel designed to provide more tire clearance for street driving. Race cars, of course, will use the 16 × 10-inch wheels.

The 9-inch front wheel gets you around a steering arm interference problem encountered with the 16 × 10-inch racing wheel. With the 10-inch wheel you have to relocate the front steering knuckles, something you want to avoid in a street application. If you simply want to add these trick looking wheels to your street Firebird, they are available from Center Line under two different part numbers because the offset is different on the front and rear wheels.

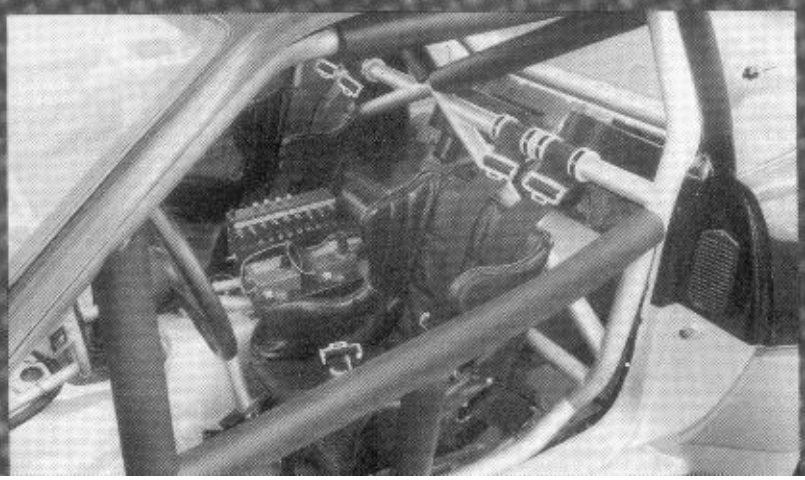
Other interesting aspects of the car include the specially formed Lexan rear window from Cope



The car's rugged good looks convey its sinister purpose, and that aesthetic image is easily available from Diversified Glass Products. The whole 13-piece kit goes for about $1400—probably less than the body shop price for fenders alone.

The full rollcage was constructed to IMSA specifications and designed to tie the structure of the car together with hard points corresponding to all suspension attachment points. Padded fiberglass racing seats are used with harnesses.

Center Line's new 16-inch wheels are available in the proper sizes for racing or street applications, and Goodyear already has 16-inch Eagle GT tires to suit your combination. See the accompanying chart for exact applications.



SUPERBIRD

Plastics (309/691-0905); fiberglass racing seats; weight jacks in all four corners; a fire system with four separate outlets that cover the engine, driver, and fuel cell; engine, transmission, and rear axle oil coolers; and special provisions to retain the standard production fuel filler cap on the new rear quarter panel.

It's all part of a carefully orchestrated plan to place Pontiac performance cars in the limelight. Every effort has been made to ensure that first-class, dependable components are made available to Pontiac enthusiasts at every level.

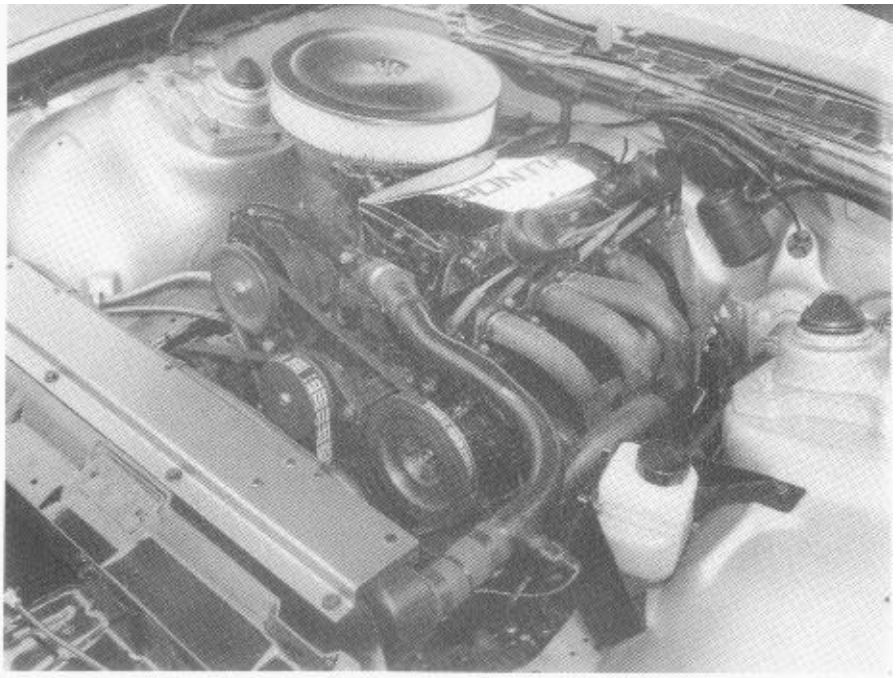
The Super Duty Firebird represents the level of sophistication you can achieve by applying everything in one package, but the beauty of the program is that selected pieces are easily applied to street machines, and that's a credit to Pontiac's foresight. You see, Pontiac is the GM division responsible for four-cylinder engine development even though the 151-cid four-cylinder engine (formerly termed the "Iron Duke") is used in a variety of GM cars. That means four-cylinder Camaro owners and other GM four-cylinder owners can benefit from Pontiac's performance awareness. In the years to come, when four-cylinder engines really become the rage, the Pontiac Super Duty engine will undoubtedly be one of the largest and most powerful of the breed. **HR**

PONTIAC SUPER DUTY PARTS

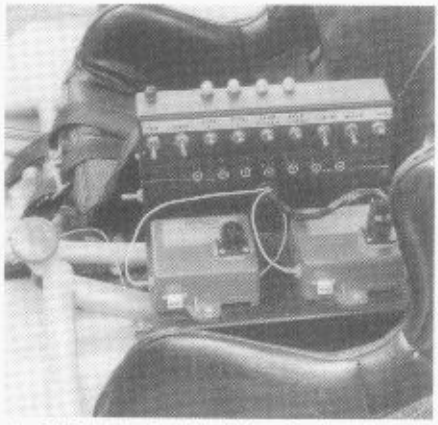
SD Engine Block	10027633
SD Cylinder Head	10027776
SD Crankshaft	10027778 (3.00-inch stroke)
SD Crankshaft	10027779 (3.25-inch stroke)

The following manufacturers produce parts for Super Duty engines

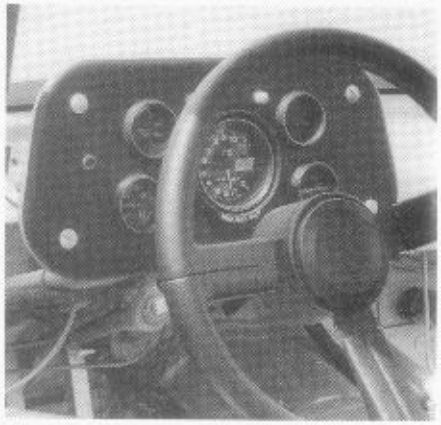
Fel-Pro	Head Gaskets	Local	Outlets
Mr. Gasket Co.	Gaskets	(216)	398-8300
B.H.J. Products	Torque Plates	(419)	797-6780
A.R.E.	Dry Sumps	(916)	929-0496
Moroso Performance	Oil Pans, Bolt Kits	(800)	243-6536
Hamburger Oil Pans	Oil Pans	(201)	240-3888
Melling Tool Co.	Oil Pumps	(517)	787-8172
Quartermaster Ind.	Clutch and Drive Systems	(312)	593-8999
Edelbrock Corp.	Manifolds	(213)	323-7310
Red Line, Inc.	Weber Carbs	(213)	538-3233
Brooks Racing Co.	Pistons	(714)	893-0595
Arias Racing Pistons	Pistons	(213)	532-9737
Crane Cams, Inc.	Cams and Valve Gear	(305)	457-8888
Hooker Industries	Headers	(714)	983-5871
E.V.M. Injectors	Fuel Injection	(414)	793-4467
Autotronic Controls	MSD Ignitions	(915)	772-7431
Speed Pro	Piston Rings	(616)	724-5011



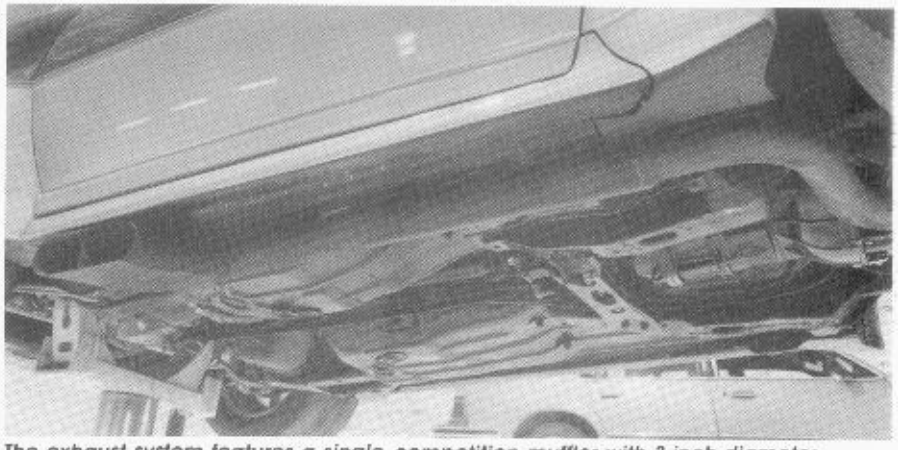
Hooker Industries competition header and Edelbrock's Pro Flow racing air cleaner are evident here, and you have a better view of the valve cover which would be an outstanding addition to any four-cylinder-powered street machine. Note also the upper strut mount extensions incorporated to lower the front of the car.



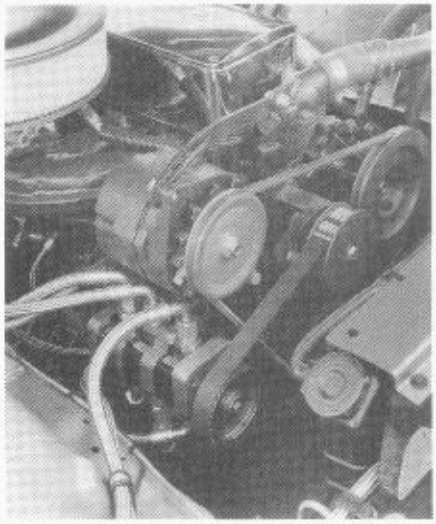
An MSD Extra Duty Ignition System from Autotronic Controls Corporation keeps the potent little four-cylinder humming smoothly. A spare ignition module provides backup for the one in use (rear), and a fully fused switch panel places control of the car's electrical systems in one convenient location.



The starkly functional instrument panel contains Stewart-Warner gauges to monitor the car's vital signs and MSD's Fast Tach with the electronic telltale feature to indicate maximum rpm reached during engine operation.

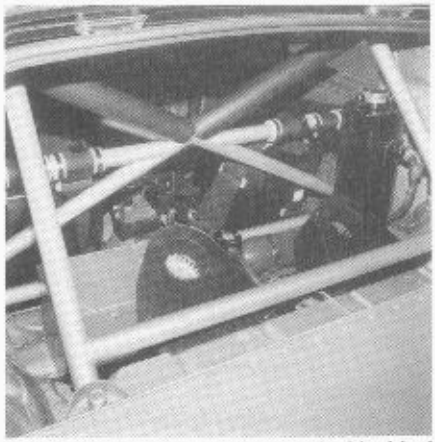


The exhaust system features a single competition muffler with 3-inch-diameter tubing from the header to the expanded dual outlet. The bottom of the car doesn't look altered at first glance, but a closer inspection will show that all body seams in the unibody structure have been welded to increase the structural integrity of the chassis.



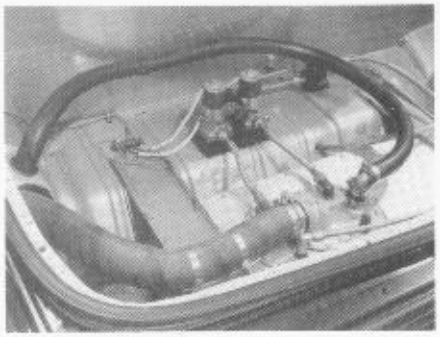
Armstrong Racing Equipment's dry-sump system occupies the lower portion of the engine compartment, and you can also see the plastic prototype intake manifold fashioned by Edelbrock. The real version of this manifold is now finished and available, as is the special two-piece racing valve cover also manufactured by Edelbrock.

Special gussets have been installed in strategic places to increase the strength of operating components. Here the lower control arm mount is braced to the frame rail to prevent any deflection that would affect the car's handling characteristics.

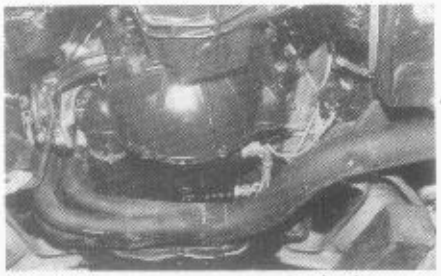


The dry-sump reservoir is located behind the passenger seat, and the two blower housings mounted behind the main hoop of the rollbar structure are used in conjunction with the transmission and rear axle oil coolers mounted directly underneath them with openings at the bottom of the car.

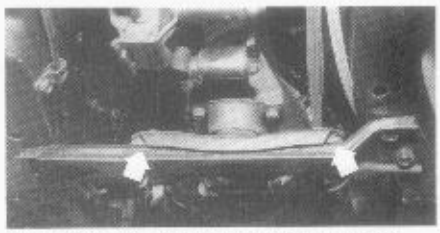
This view shows the '83 production rear axle fitted with 4.11 gears and safety straps. Above the track bar you can see the transmission and rear axle oil coolers.



The fuel cell is mounted in the rear cavity and dual Holley electric fuel pumps are plumbed into the system. The large tube coming in from the left is the filler tube that permits retention of the stock fender mounted filler cap on the new fiberglass fender.

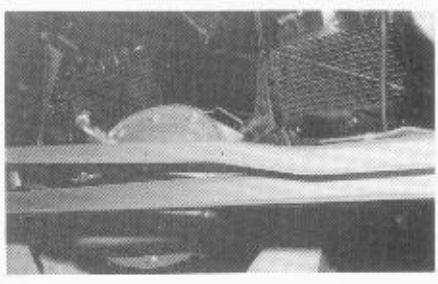


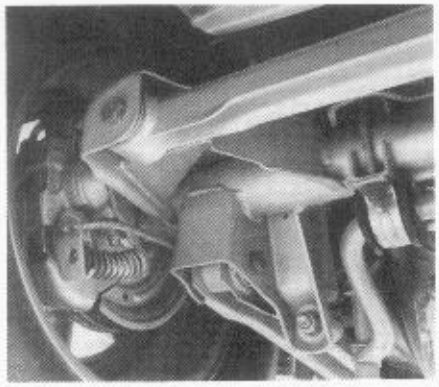
Hooker's competition header features 1⅞-inch primary tubes that hug the bottom of the car as they cross under the engine. The transmission is a production '83 five-speed driven by Quartermaster Industries dual-disc driveline components.



A stock transmission mount was used, but the intermediate mount was attached solidly to the crossmember to reduce deflection.

Fuel and oil lines are braided steel and they pass through the floor pan via bulkhead fittings. These lines are for the dry-sump reservoir mounted directly above them in the rear portion of the cockpit.





Rear suspension mounting points all feature solid bushings to reduce deflection. The track bar and lower control arms are all solidly mounted.

DIVERSIFIED GLASS PRODUCTS

(313) 373-7575

'82-'83 Firebird Glass Products

Front Bumper	PSFB-83
Front Left Fender	PIKLFF
Front Right Fender	PIKRFF
Rear Left Fender	PIKLRF
Rear Right Fender	PIKRRF
Rear Bumper	PSRB
Hood	PIKHRH
Right Lower Door Air Skirt	PLRDAD
Left Lower Door Air Skirt	PLLDAD
Right Lower Spoiler	PIKRLS
Left Lower Spoiler	PIKLLS
Center Lower Spoiler	PIKCLS
Deck Lid	PSRT

SUPER DUTY FIREBIRD SPECIFICATIONS

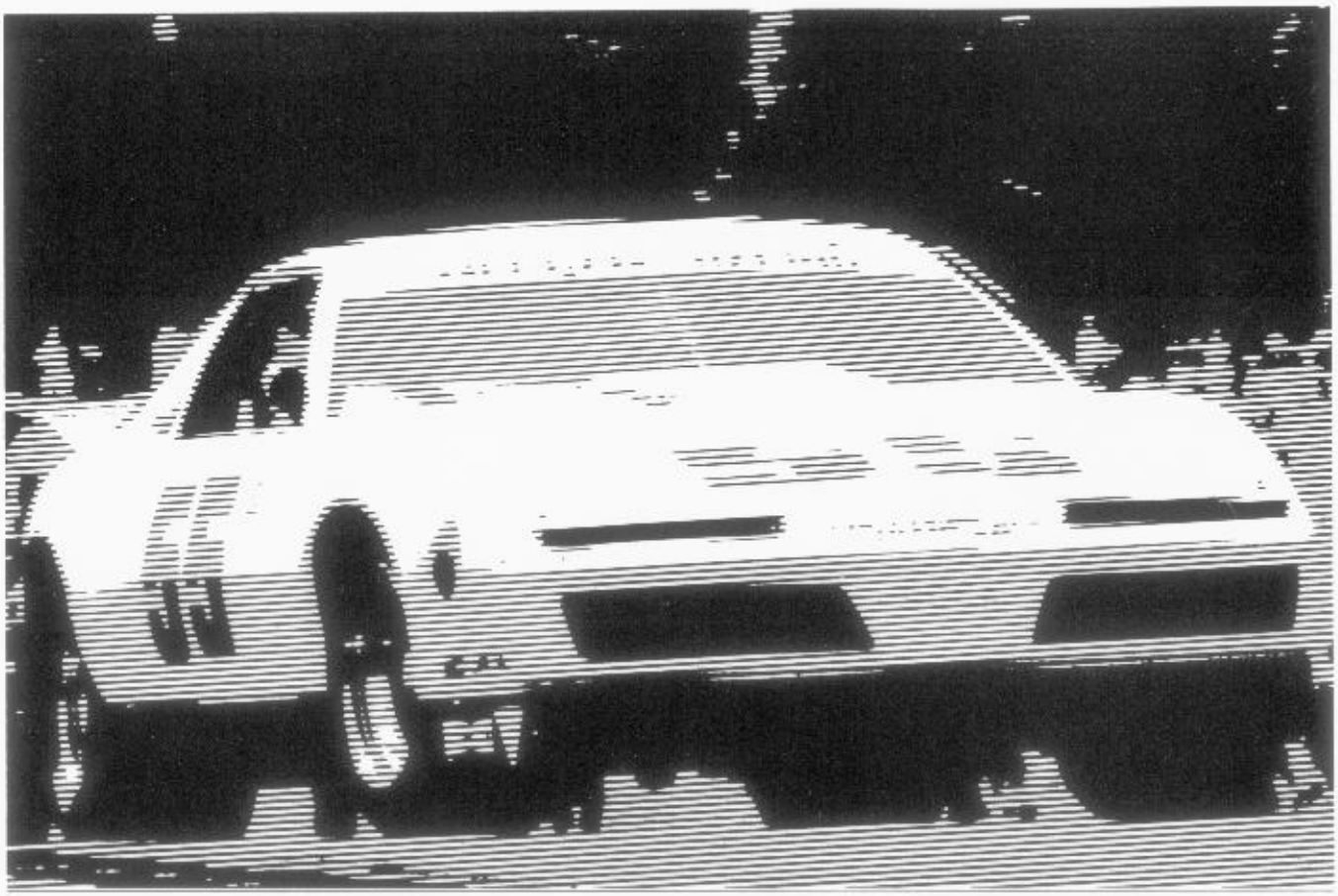
ENGINE	2.7L, 165 cid Pontiac Super Duty
HORSEPOWER	272 @ 7600 rpm
FUEL	Union 76 Racing Gas
TRANSMISSION	Borg-Warner T-5 5-speed
REAR AXLE	'83 Production Firebird, 4.11 ratio
WHEELS	Center Line 16x10 aluminum
TIRES	Goodyear Eagle racing tires; Front: 25.5x11.0-16; Rear: 27.0x12-16
WEIGHT	2700 pounds
WEIGHT DISTRIBUTION	Front: 51 percent; Rear: 48 percent
TOP SPEED	151.4 mph
CORNERING CAPACITY	1.084G (216 ft. skid pad)

CENTER LINE WHEELS

(213) 921-9637

'82-'83 Firebird Racing Wheels

WHEEL	PART NO.	APPLICATION
16x10	X610-547-45	Race cars with Diversified Glass fenders and the rear of street machines equipped with these fenders and quarter panels. Steering modifications required.
16x9	X690-547-35	Special offset wheel for use on the front of street machines equipped with Diversified Glass fenders and quarter panels. No steering modifications required.
16x8	X680-547-45	Fit standard production cars. Special offset for use on front only.
16x8	X680-547-50	Fit standard production cars. Special offset for use on rear only.



WE WON!
AND SO DID YOU.

When Pontiac's sensational Firebird Trans Am made its debut in 1982, enthusiasts all across America called it a winner. And how right they were!

Because the Firebird Trans Am is the winner of the Sports Car Club of America's Trans Am Series for 1982! Elliott Forbes-Robinson, driving his specially modified Mecham Racing Trans Am, ran away with the Driver's Championship. And Pontiac, competing against Porsche, Datsun, Ford and Mercedes-Benz, was awarded the Trans Am Series Manufacturers' Championship for the first time ever!

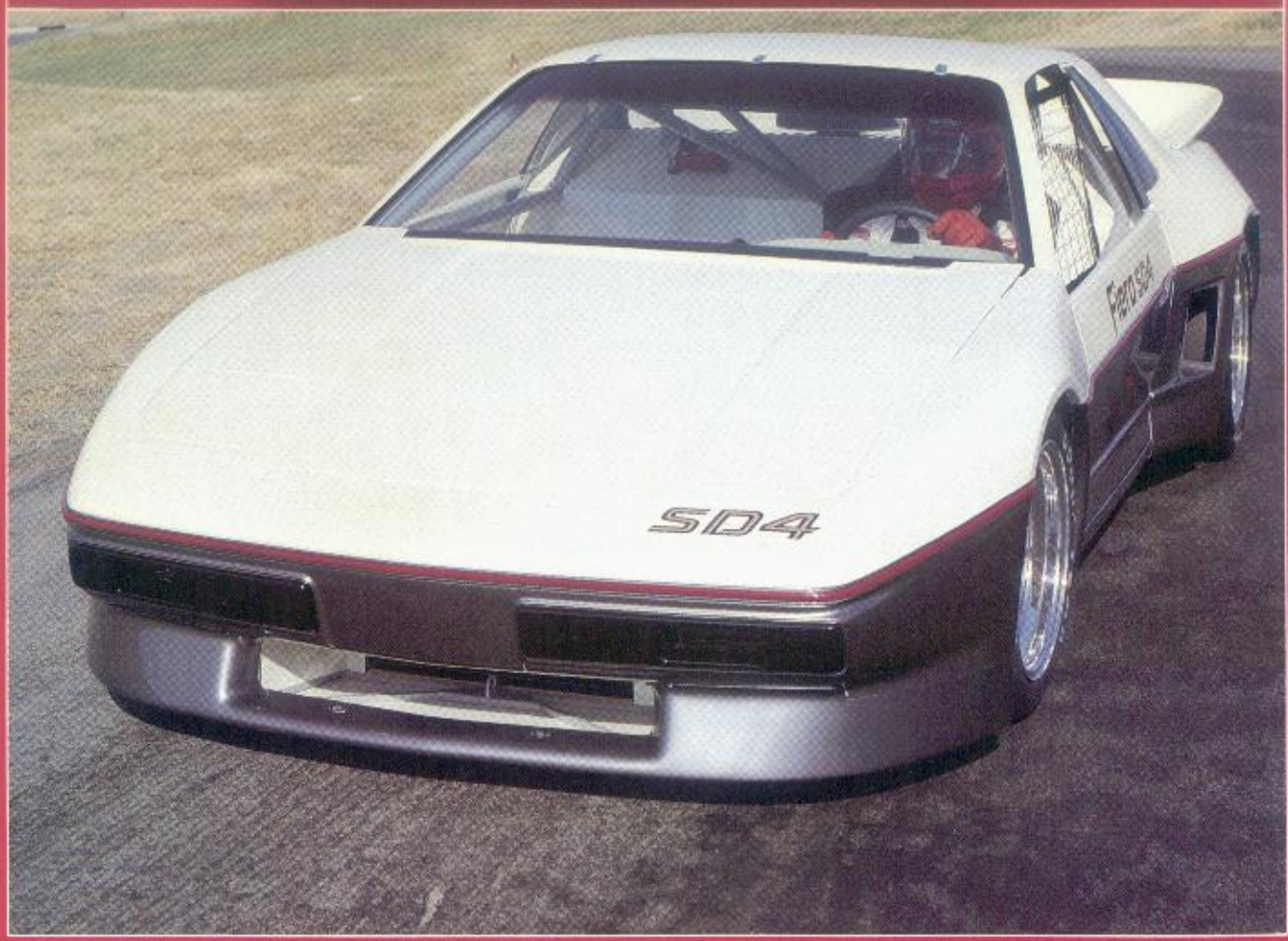
And the fact that we won in 1982 makes you a winner today. Because the 1983 Firebirds are cars with a true winning heritage!

Come on in today and get in on the driving excitement. Test-drive a sleek new 1983 Firebird Trans Am and experience the thrills for yourself—at the home of the SCCA Champion!

PONTIAC WE BUILD EXCITEMENT

GM


Fiero SD4
MADE IN
DETROIT


SD4
Fiero SD4