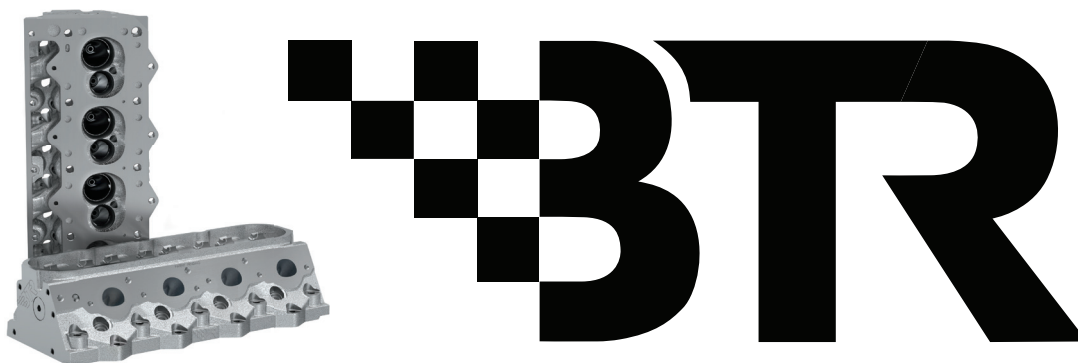




BTR CANTED-VALVE LS CYLINDER HEAD INSTRUCTIONS

WARRANTY: All returns/warranties need to be sent directly to BTR. See page 5 of this document for warranty & support info.

ATTENTION: PLEASE READ THROUGH ALL INSTRUCTIONS BEFORE ATTEMPTING CYLINDER HEAD INSTALLATION.

4-BOLT / 6-BOLT USAGE: BTR HEADS SHIP IN A 6-BOLT CONFIGURATION FOR BLOCKS THAT HAVE EXTRA BOSSES FOR M8 BOLTS AT THE TOP & BOTTOM OF EACH CYLINDER. THESE EXTRA M8 BOSSES ON THE CYLINDER HEAD CAN BE LEFT ALONE OR MACHINED OFF FOR CLEARANCE IF NEEDED.

VALVE SPRINGS: IT IS THE CUSTOMER'S RESPONSIBILITY TO VERIFY INSTALLED HEIGHT, SUFFICIENT CLEARANCE TO COIL BIND, AND CORRECT SPRING RATE FOR APPLICATION.

IMPORTANT: APPLY THE RECOMMENDED LUBRICANT TO ANY TORQUED FASTENER PER THE FASTENER MANUFACTURERS' DIRECTION. ANTI-SEIZE ON SPARK PLUGS IS IDEAL BEST PRACTICE, PLEASE MAKE SURE CYLINDER HEAD HAS COOLED BEFORE SERVICING.

WARNING: PISTON DOME TO CYLINDER HEAD CLEARANCE MUST BE CHECKED PRIOR TO FINAL ASSEMBLY OF ENGINE. PISTON TO VALVE CLEARANCE ALSO MUST BE CHECKED, PAY SPECIAL ATTENTION TO THE OUTSIDE EDGE OF THE INTAKE & EXHAUST VALVES TO THE INSIDE EDGES OF THE VALVE RELIEFS IN THE PISTON. RADIAL CLEARANCE NEEDS TO BE AT MINIMUM 0.050". IN TESTING, BTR FOUND THE CVH HEAD CLEARED ALL STOCK STYLE FLAT TOP 4.8/5.3/5.7/6.0/6.2 GEN III & IV LS PISTONS WITH CAMSHAFTS DESIGNED TO CLEAR A STOCK TRADITIONAL INLINE VALVE HEAD. IF YOUR CAMSHAFT REQUIRES VALVE RELIEFS CURRENTLY, IT IS LIKELY THAT YOU WILL NEED TO ADD VALVE CLEARANCE BY FLYCUTTING THE PISTON. BTR OFFERS A [PISTON FLYCUT TOOL](#) AND [SPECIAL PISTONS WITH RELIEFS FOR THE CANTED VALVE LOCATIONS](#).



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HEAD GASKETS: Head gasket bore should match the diameter of the finished combustion chamber, not the bore of the engine unless the bore exceeds finished chamber diameter. For both cathedral and square port CV heads, BTR recommends MLS LS3 / LS9 style head gaskets like [BTR22033-2](#) / [BTR-10046-2](#) unless the chamber is modified.

INTAKE GASKETS: Typically uses a factory o-ring style gasket, refer to your intake manifold manufacturer for guidance.

EXHAUST GASKETS: Use factory style LS exhaust gaskets like [BTR17944-2](#).

VALVE COVER GASKETS: Use factory style LS o-ring style gasket like [BTR-37683-2](#) unless your valve covers dictate otherwise.

HEAD BOLTS & STUDS: All fasteners should use OEM LS1 torque specs unless otherwise dictated by your fastener manufacturer. For stock hardware, see chart on page 4. BTR CV heads are drilled for M11 main and M8 top/inner row fasteners. Be sure to use Gen 3 or Gen 4 LS bolts or studs appropriate to your block. LS blocks have head bolt holes that are typically blind holes and do not need thread seal, but cleaning threads in the block and using compressed air to clean out bolt holes prior to assembly is important.

VERY IMPORTANT: You cannot re-use the factory LS head bolts. They are "torque to yield" design and can only be used once.

ROCKER ARMS: Stock cathedral-port LS1 rockers are to be used for CVH square AND cathedral port heads. BTR Part # [LS1RKRS-16](#) is a set of fully assembled rockers and trunnions perfect for this application. Bolts are available as BTR Part # [TK/BOLTS02-16](#). The intake pedestal bolt requires Teflon/PTFE thread sealer such as Permatex 80632 to be applied to the pedestal bolt threads. Without thread sealer, oil is drawn into the intake port under vacuum, causing excessive smoking. Longer LS1 length rocker arm bolts are preferred.

VALVE SEATS: Both intake and exhaust valve seats are heat-treated and compatible with unleaded fuels.

SPARK PLUGS: Uses OEM Gen V LT style plugs with longer reach than LS style. [NGK 6510](#) (LTR7IX) / [NGK 95811](#) (R7448A-10) for example. Plug selection is dictated by many factors including rpm level, compression ratio and

type of fuel. Forced induction or nitrous applications usually required 1 to 2 heat ranges colder, such as R4778A-8 (2 steps colder) and R4778A-9 (one step colder).

COOLANT: It is important to maintain a 50/50 mix of antifreeze in the cooling system to prevent corrosion of aluminum heads. Don't use tap water, use distilled water. Most supermarkets have purified or distilled water. Check labeling to verify purified through deionization.

CLEANING: BTR thoroughly cleaned your heads prior to shipment. During some machining operations chips are wedged into the water jacketing and occasionally come loose in transit. It is not unusual if you blow high pressure air into the water jacketing to see additional foreign debris, or chips finding their way out. BTR recommends that you thoroughly blow out your heads prior to installation. Make sure head and block deck surfaces are true and clean.

DIPSTICK NOTE: M10x1.5 Accessory hole commonly used for dipstick is shallower than OEM to prevent water jacket intrusion, please check your dipstick bolt prior to final assembly.

VALVE TIPS: CVH valves have hardened tips which cannot be ground past a maximum of .010" from the tip. Tip saver kits are recommended and available from BTR for damaged tips.

PUSHROD LENGTH: There are too many variables for BTR to quote a specific length. Block deck height, head milling, gasket thickness, camshaft base circles, lifter and rocker arm design just to name a few. With a hydraulic roller and OEM height deck face, you will likely end up with an intake pushrod typical length of [7.925-8.025"](#) & [exhaust length of 7.900-8.000"](#). We recommend the use of an [adjustable length pushrod](#) to calculate the correct length for your individual application. Note that the LSx family is a pedestal mount system and pushrod length does not effect the wipe pattern of the tip, it only directly effects the lifter preload. [Our BTR LS7 lifters](#) require 3/4 to 1-1/2 turns of preload of the stock rocker arm bolt (about .075"-.110" preload at the lifter) but beware that some brands of aftermarket lifters call out for less preload. Consult with the lifter manufacturer for that information.

AFTERMARKET VALVES: BTR CVH heads accept OEM [LT1 intake](#) & [exhaust valves](#), and optionally you can use the GM L8T Inconel™ exhaust valves ([GM PN# 12733470](#)), and the titanium LT4 intake valves. (GM PN# [12650770](#)) **YOU CANNOT GRIND, REFACE OR LAP IN THE 45 DEGREE SEAT AREA OF THESE VALVES.** [Lash caps](#) are mandatory for Ti valves to prevent tip mushrooming. Be wary, heavier aftermarket SS valves may reduce valvetrain stability.



BTR LS CANTED-VALVE CYLINDER HEAD INSTRUCTIONS

Valve Spring Specifications

BTR Platinum dual valve springs come standard on assembled BTR cylinder heads. These are made of high quality spring wire and supply the proper spring rate for most general applications when using the recommended BTR valve part numbers. Keep in mind that forced induction, Nitrous, high RPM, and or even modest RPM with aggressively designed (faster) cam lobes or heavier valves will require additional spring rates. BTR offers higher rate valve spring sets such as our [SP010 dual springs](#) which can install using all the factory hardware for the [SP001](#) spring (Full [SK707](#) Platinum Plus kit not required if re-using .660 valvetrain hardware). See below for valve spring specifications and recommended part numbers. If you're questioning the spring requirement for your particular application, we advise you contact BTR directly.

Valve spring pressures may vary plus or minus 5%. It is the customer's responsibility to verify springs are correct for their application. Failure to do so could result in engine damage See below for recommended valve spring information -

Part # & Application	Size (in)	Installed & Open Load (lbs/in)	Valve Spring Description	Coil Bind (in)	Gross Max Lift General Guideline	Max RPM General Guideline
BTR SP001 Included in BTR assembled	1.306 OD .949 ID	155 lbs. @ 1.780 400 lbs. @ 1.130	BTR Gen V Platinum Dual Spring	1.07	.660	7200-7500
BTR SP010 Not Included	1.297 OD .951 ID	170 lbs. @ 1.800 450 lbs. @ 1.150	BTR Gen Platinum Plus Dual Spring	1.00	.685	7500-8000

Recommended Supporting Parts

BTR Pushrod Length Checker - [BTR-PRC2](#)
 BTR LS valve covers - [VCA-02](#) or [VCA-03](#) series
 LS1 rocker arms w/BTR trunnions - [LS1RKRS-16](#)
 Rocker bolts - [TK/BOLTS02-16](#)
 Head bolts (Gen III) - [BTR98545](#)
 Head bolts (Gen IV) - [BTR00568](#)
 Head studs (Gen III) - [ARP 234-4316](#)
 Head studs (Gen IV) - [ARP 234-4345](#)
 Head gasket (LS9/LS3) - [BTR22033-2/BTR-10046-2](#)
 Valve cover gaskets - [BTR-37683-2](#)
 Exhaust gaskets - [BTR17944-2](#)
 LT4 Ti intake valve upgrade - [12650770](#)
 LT4 Ti intake valve lash caps - [19302366](#)
 LT8 Inconel exhaust valve upgrade - [12733470](#)
 Platinum Plus .685 full spring kit - [SK707/0560/BB](#)
 Platinum Plus .685 springs ONLY - [SP010-16](#)
[Canted-Valve designed pistons from 3.780-4.125"](#)
[Wide range of hardened BTR pushrods available](#)

Recommended Service Parts

Intake valve - [BTR-29513](#)
 Exhaust valve - [BTR-74746](#)
 Spring locator - [SL505060-1](#)
 Spring retainer - [SR008-1](#)
 Valve lock - [VL7°8MM-1](#)
 Valve seal kit - [VS LS KIT](#)
 Platinum spring - [SP001](#)
 Piston flycut tool - [BTR-PFCT](#)

Please call us at us at (888) 959 - 8865 for special parts below

Coolant plug - ORB-SPECIAL-PGA-012
 Intake valve guide - PMG500-275-2210-5DG
 Exhaust valve guide - PMG500-275-2110

BTR LS CANTED-VALVE CYLINDER HEAD INSTRUCTIONS

Installation Instructions

Installation is the same as for original equipment cylinder heads. Consult a factory service manual for specific procedures, if necessary. Factory manuals can be purchased direct from Helm® at: www.helminc.com. Be sure that the surface of the block and the surface of the head are thoroughly cleaned to remove any oily film before installation. Use alcohol or lacquer thinner on a lint-free rag to clean. Head gaskets should be installed DRY unless otherwise dictated by part instruction. Make sure the correct side is facing up and front/rear bias is correct per the head gasket instructions.

NOTE: Be VERY careful to remove any coolant or other fluids that may be in the cylinder head bolt holes in the block. These bolt holes are sealed at the bottom, and any fluid trapped in the holes will cause the block to crack when you torque the bolts.

When using the GM factory head bolts, be sure to replace all of the bolts with new bolts, and to follow the factory recommended installation procedures. The factory bolts and installation procedures do not call for the use of oil or any lubricant on the threads.

When using aftermarket bolts or studs, follow the manufacturer's recommended torque specifications (See Figure 1 for factory tightening sequence). **NOTE:** A Torque Angle Gauge is required for proper installation. Torque to yield fasteners are not designed to be re-torqued after installation.

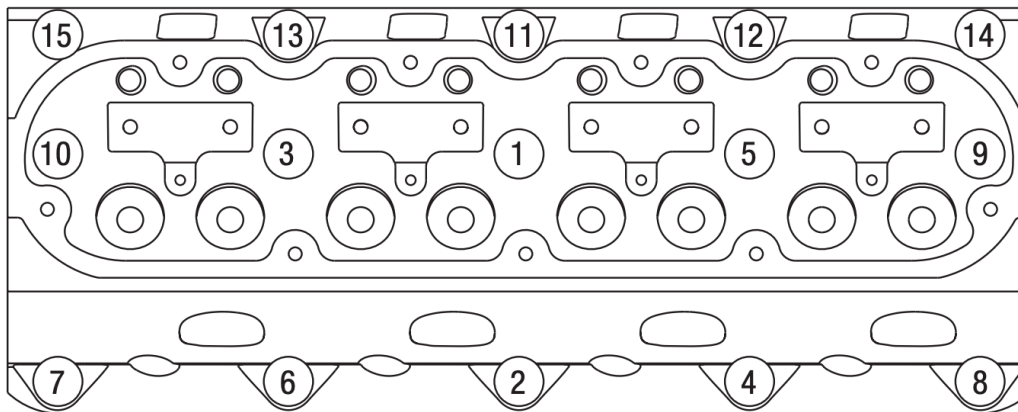


Figure 1 - Factory Cylinder Head Bolt Torque Sequence

First Design Blocks (8 long, 2 medium length M11 bolts per cylinder head)

- First Pass: Torque all M11 bolts (1-10) in sequence, to 22 ft./lbs.
- Second Pass: Turn all M11 bolts (1-10) in sequence, an additional 90 degrees.
- Final Pass: Turn all long M11 bolts (1-8) in sequence, an additional 90 degrees. Turn medium M11 bolts (9-10) an additional 50 degrees. Tighten M8 bolts (11-15) in sequence shown to 22 ft./lbs.

Second Design Blocks (10 long, M11 bolts per cylinder head)

- First Pass: Torque all M11 bolts (1-10) in sequence, to 22 ft./lbs.
- Second Pass: Turn all M11 bolts (1-10) in sequence, an additional 90 degrees.
- Final Pass: Turn all M11 bolts (1-10) in sequence, an additional 70 degrees. Tighten M8 bolts (11-15) in sequence shown to 22 ft./lbs.

NOTE: First to Second design change-over date is roughly mid December 2003 for block manufacturing date. Always refer to your vehicles service manual for specific torque procedures.

After securing the cylinder heads to the block, install all rocker arms and pushrods. Pushrod guide plates are not needed for pedestal mount applications, but hardened pushrods are recommended for any valvespring package shipped with BTR cylinder heads. BTR CV heads will clear up to 3/8" diameter pushrods.



RETURNED MERCHANDISE

To request a return, call us or login to your account at BrianTooleyRacing.com and open the order you would like to return. At the top of the order will be a return button. Clicking that button will allow you to begin the returns process for that order.

All returns are subject to inspection. Returned items must be in the condition you received them and in the original box and/or packaging, including all paperwork and instructions. If you return a product to Brian Tooley Racing without all parts included in the original package, Brian Tooley Racing retains the right to refuse the refund of the item in question. Brian Tooley Racing is not responsible for any labor charges associated with a defect, a failure or improperly installed component. The installer will be liable to inspect and review all components before the installation process. Once your return arrives at our warehouse, please allow 1-3 business days for proper inspection, processing, and refunds to be issued. Please note; we will release your funds as soon as the return process is completed, but your financial institution can hold funds for 1-5 business days after we release them. Send returns to:

**Brian Tooley Racing
Returns Department
2100 Filiatreau Ln
Bardstown, KY 40004**

If you are not 100% satisfied with your purchase, you can return your order for a full refund for up to 90 days from the delivery/pickup date. Following are the specific time periods of our return and exchange policy:

**Up to 30 days from the delivery/pickup date
Full refund**

**Between 31-60 days from the delivery/pickup date
Full refund less 10% restocking fee**

**Between 61-90 days from the delivery/pickup date
Full refund less 20% restocking fee**

BRIAN TOOLEY RACING LIMITED WARRANTY LIMITED WARRANTY

Brian Tooley Racing, Inc. ("BTR"), provides this limited warranty ("Limited Warranty") on select products ("Warranted Products"). Products which are not designated in writing to be Warranted Products shall be sold as-is, where-is, with no warranty whatsoever. The Limited Warranty on Warranted Products begins at the date of sale and continues for a period of 12 months (the "Warranty Term"). BTR warrants that its Warranted Products will be free of defects in materials or workmanship, and will conform to any written specifications for such Warranted Product provided by BTR. During the Warranty Period, BTR will, at its option, (a) repair or replace any Warranted Product found to have been defective in materials or workmanship; or (b) issue the original customer a full refund. This shall be BTR's sole and maximum obligation, and shall be the customer's sole and exclusive remedy, for any warranty claim. BTR DISCLAIMS ANY AND ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. WITHOUT LIMITING THE FOREGOING, BTR DOES NOT COVER ANY LABOR CHARGES OR ANY OTHER CHARGES ASSOCIATED WITH REPLACEMENT OF WARRANTED PRODUCTS OR PARTS. The United Nations Convention for the International Sale of Goods shall not apply to any sale of BTR products.

EXCLUSIONS AND LIMITATIONS

This Limited Warranty does not cover any of the following:

- Failure due to misuse, abuse or negligence
- Failure caused by improper installation
- Failure caused by deficient maintenance practices
- Any failure based on performance level
- Failure caused by accident or collision
- Improper break-in process
- Improperly timed camshaft and/or piston-to-valve issues
- Incorrect tuning calibrations such as fuel washed cylinders
- Crankshaft thrust damage such as torque converter or clutch issues
- Crankshaft damage from centrifugal blower load on snout
- Hydrolocked engine and/or bent connecting rods from H2O or fuel
- Damage from foreign objects (spark plugs, bolts, valves)
- Improperly installed oiling components such as oiling system, windage tray, or pickup tube/O-ring or contaminated oil
- Damage from fuel delivery, fuel quality or tuning issues, such as torched pistons, broken pistons from detonation, lifted/melted heads/head gaskets, fire-slotted block, etc.