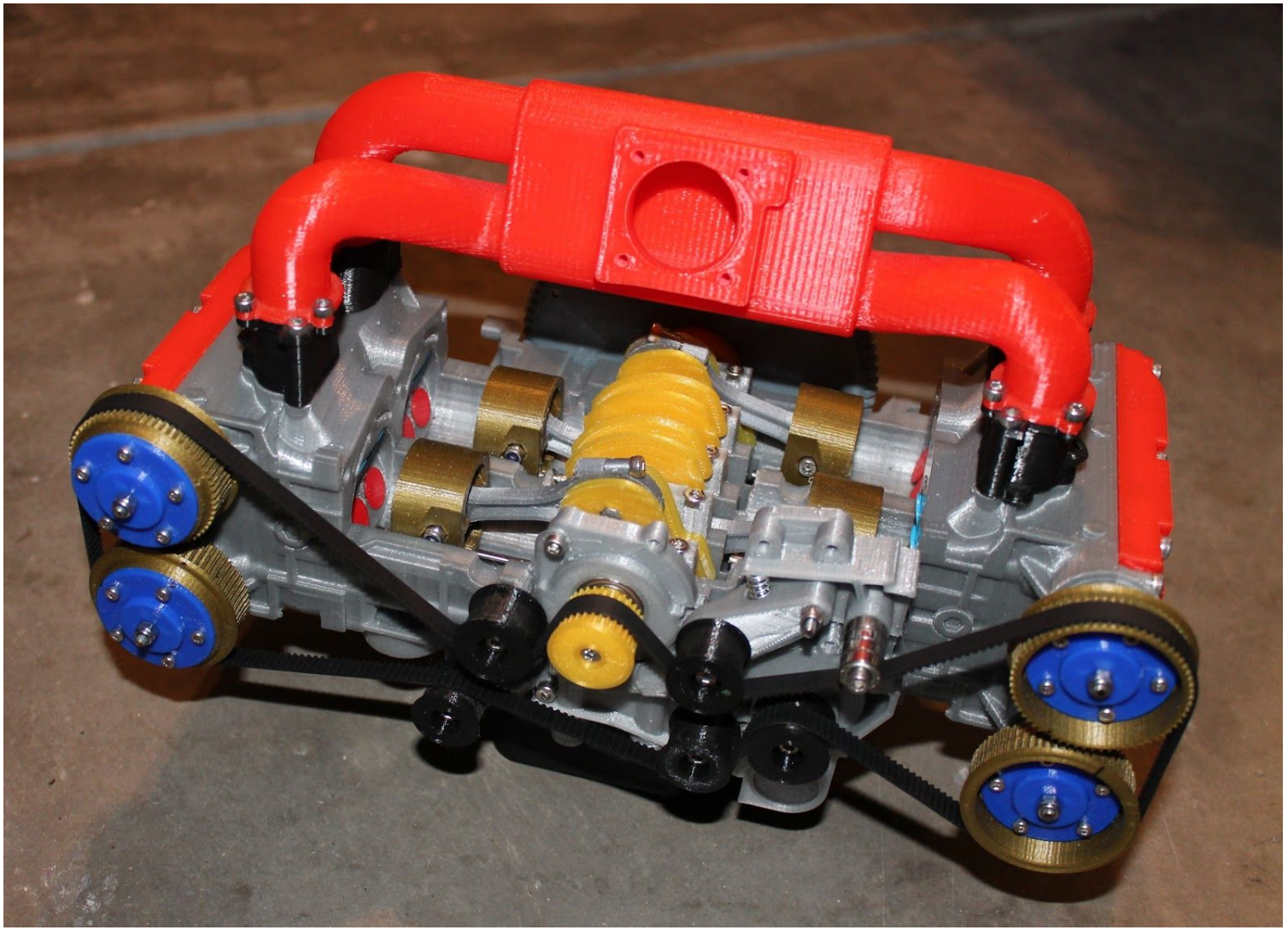
EJ20 Cut Away Model
Assembly Instructions



Recommended Tools

Assortment of drill bits. Small metric or numbered assortment.
Pin vise for drill bits
M3 Tap
Hack saw or dremel with cut off wheel
Super Glue - Thin and Medium Gap Filling
Thread Locker
Small file set
Sand Paper
Allen keys. 1.5, 2, and 2.5mm. Best to have ball end
Lubricant for cam lobes. Recommend SuperLube grease
Soldering Iron for electronics

Print valve assembly jig, 3mm drill stop, and 4mm drill stop.

Time….

Printed Parts List		
Part	Notes	QTY.
engine block 1 - Split	Print with support touching build plate @ 80 degree overhang. 20% Infill	1
engine block 2 - Split	Print with support touching build plate @ 80 degree overhang. 20% Infill	1
engine block 1 - Split - Cover	Print with support touching build plate @ 80 degree overhang. 20% Infill	1
engine block 2 - Split - Cover	Print with support touching build plate @ 80 degree overhang. 20% Infill	1
Main Bearing Cap - Cut Away	Print with higher infill percentage.	5
EJ20 Head - Drivers Side - Cut Away	Print with support touching build plate @ 80 degree overhang. 20% Infill	1
EJ20 Head - Cut Away	Print with support touching build plate @ 80 degree overhang. 20% Infill	1
Passenger Side Valve Cover - Cut Away	No supports needed	1
Driver Side Valve Cover - Cut Away	No supports needed	1
Crank Gear - Cut Away	Print with support touching build plate. 80% Infill. May need to adjust nozzle size to print teeth.	1
Crankshaft 1 - Cut Away	Print with support touching build plate. 80% Infill	3
Crankshaft 2 - Cut Away	Print with support touching build plate. 80% Infill	5
Connecting Rod Bearing Spacer - CutAway	80% Infill	8
Crankshaft rear flange	Print with support touching build plate. 80% Infill	1
Connecting rod	Print with higher infill percentage. Tap bottom holes for M3 threads	4
Connecting rod bearing cap	Print with higher infill percentage.	4
Piston - Modified for cut away - WithBushings	Print with support touching build plate. If not using nylon bushings, print regular piston.	4
Passenger Intake Cam Gear	Print with support touching build plate. Print slow. May need to adjust nozzle size to print teeth.	1
Passenger Exhuast Cam Gear	Print with support touching build plate. Print slow. May need to adjust nozzle size to print teeth.	1
Drivers Intake Cam Gear	Print with support touching build plate. Print slow. May need to adjust nozzle size to print teeth.	1

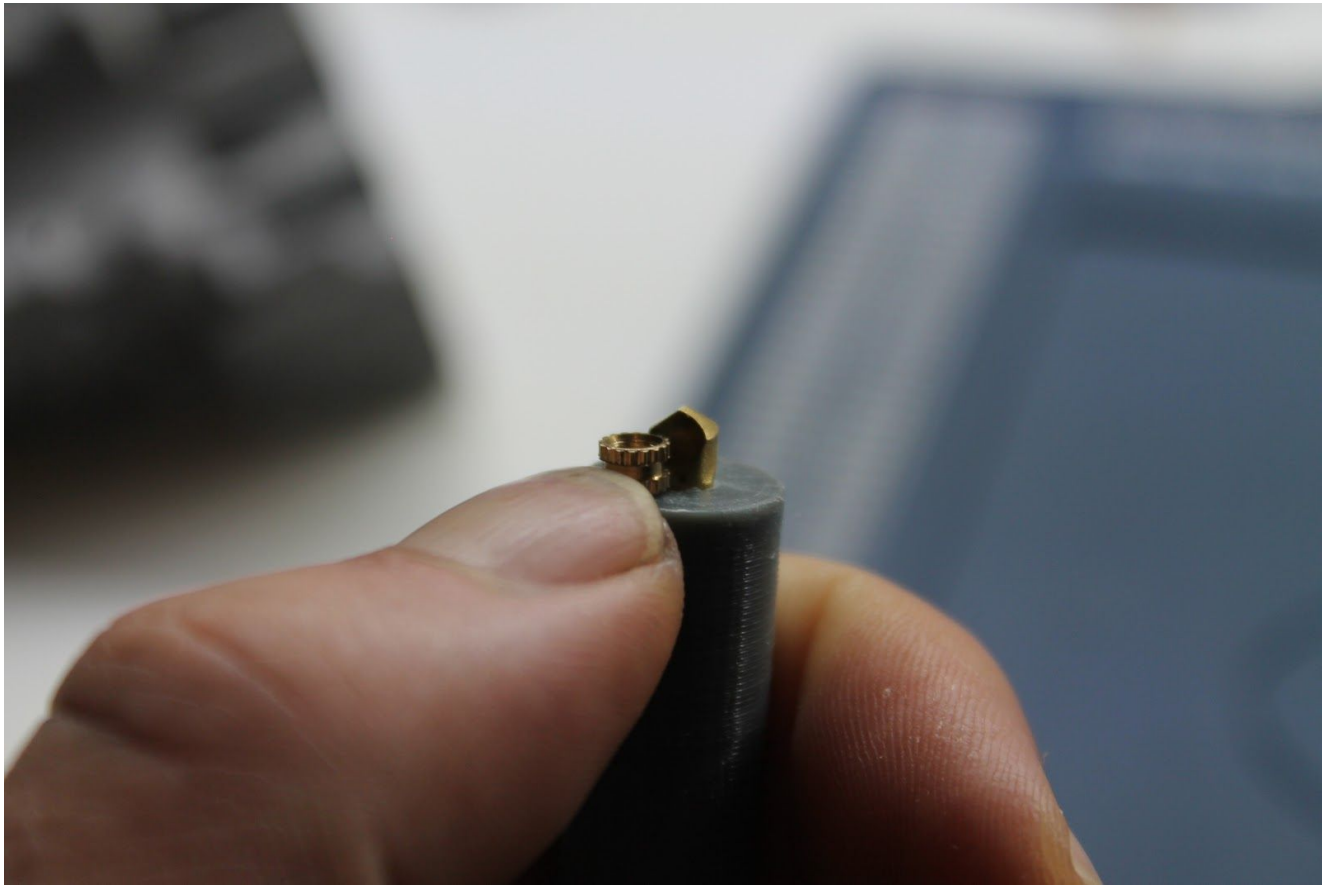
Drivers Exhuast Cam Gear	Print with support touching build plate. Print slow. May need to adjust nozzle size to print teeth.	1
Cam bearing cap 1	Print with higher infill percentage.	4
Cam bearing cap 2	Print with higher infill percentage.	8
Cam Spacer 1	Make sure your slicer prints with infill instead of two thin walls.	4
Cam Spacer 2	Make sure your slicer prints with infill instead of two thin walls.	16
Cam Spacer 3	Make sure your slicer prints with infill instead of two thin walls.	4
Cam Spacer 4	Make sure your slicer prints with infill instead of two thin walls.	4
Cam Spacer 5 - Flange	Make sure your slicer prints with infill instead of two thin walls. Print with higher infill percentage.	2
Cam Spacer 6 - Flange	Make sure your slicer prints with infill instead of two thin walls. Print with higher infill percentage.	2
Cam Gear Face		4
Valve Lobe	Print slow	16
Spring retainer	Print with support touching build plate.	16
Valve spring puck	May need to adjust nozzle size to print perimeter	16
Exhuast Valve		8
Intake Valve		8
Intake Manifold	Print with support touching build plate @ 80 degree overhang. 20% Infill	1
Intake manifold spacer		2
Flywheel	No support needed	1
oil pan - electric motor - no electronics	No support needed. But some printers may not be able to bridge this large.	1
Oil pan drive gear		1
Waterpump Tensioner Bracket	Print with support touching build plate.	1
Tensioner		1
Timing pulley 2 - 780 belt		3
Timing pulley 1 - 780 belt		2
Oil Pump		1

Non printed parts list		
Item	Notes	Quantity Needed
M3 x 5mm SHCS	Valve Cover, Intake Manifold	32
M3 x 10mm SHCS	Flywheel, Crankshaft	17
M3 x 12mm SHCS	Cam Bearing Caps, Main Bearing Caps (Cut Away)	43
M3 x 16mm SHCS	Engine Block, Water Pump	5
M3 x 18mm SHCS	Crankshaft, Water Pump, Timing Belt Tensioner Bracket	7
M3 x 20mm SHCS	Engine Block, Water Pump	10
M3 x 25mm SHCS	Pistons	4
M3 x 30mm SHCS	Head Bolts for Cut Away	7
M3 x 35mm SHCS	Crankshaft, Engine Block	3
M3 x 45mm SHCS	Use 16 for valve stems. Cut off head first, then cut threads. Final length should be 35mm with as much smooth shaft as possible. Engine block	24
M3 x 10mm Hex Head Cap Screw	Crankshaft	4
M3 x 8mm Set Screw	Oil Pan alignment, DC Geared motor set screw	3
M3 x 6mm Button Cap Screw	DC Gear motor mount. Make sure to download most recent version of oil pan	2
M3 Jam Nut	Crankshaft, camshaft, pistons, Valve retainerd, etc	55
3mm Brass Insert	For Cut Away version	43
3mm Washers	Timing pulleys	9
3mm Nylon Bushing	Linear guides for Cut Away model	8
623zz Bearings	Timing Pulleys, Cam Bearings	25
6700ZZ Bearing	Connecting rod bearings	4
6701ZZ Bearing	Main Bearings	6

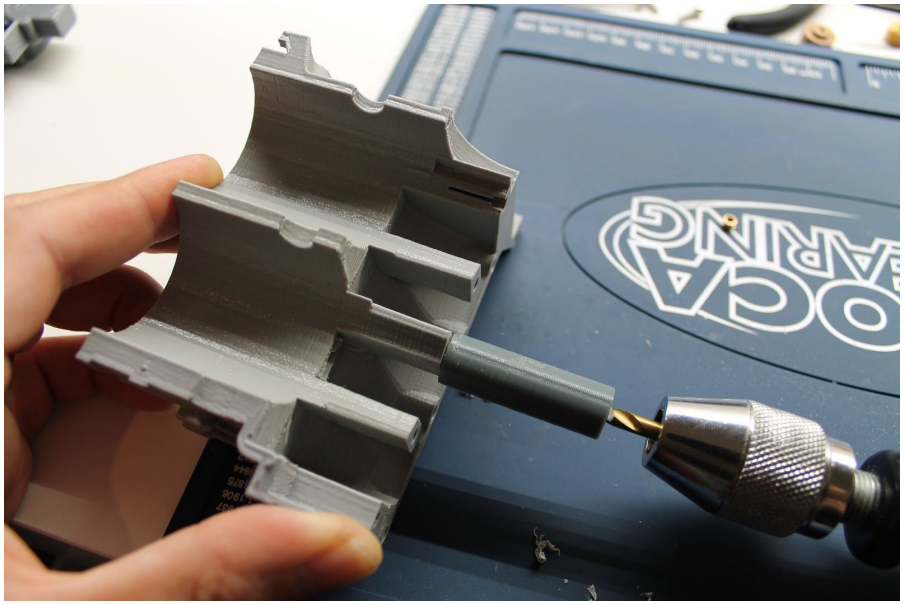
4mm x 2mm Disc Magnet	Intake manifold, heads	78
3mm x200mm Round Stainless rod	Linear rails for pistons. Cut into 48mm pieces after assembling crankshaft.	1
M3 Threaded Rod x 112mm	Cut down to proper length after cam assembly	4
Valve Spring		16
Timing Belt Tensioner Spring	Cut down length if needed	1
760mm long 6mm wide gt2 closed-loop belt		1
500 RPM DC Geared Motor		1
PWM Speed Controller		1
12V 1A Power Supply		1
Female Barrel Jack Panel Mount Plug		2
Male Barrel Jack Dongle		1

How to install threaded inserts

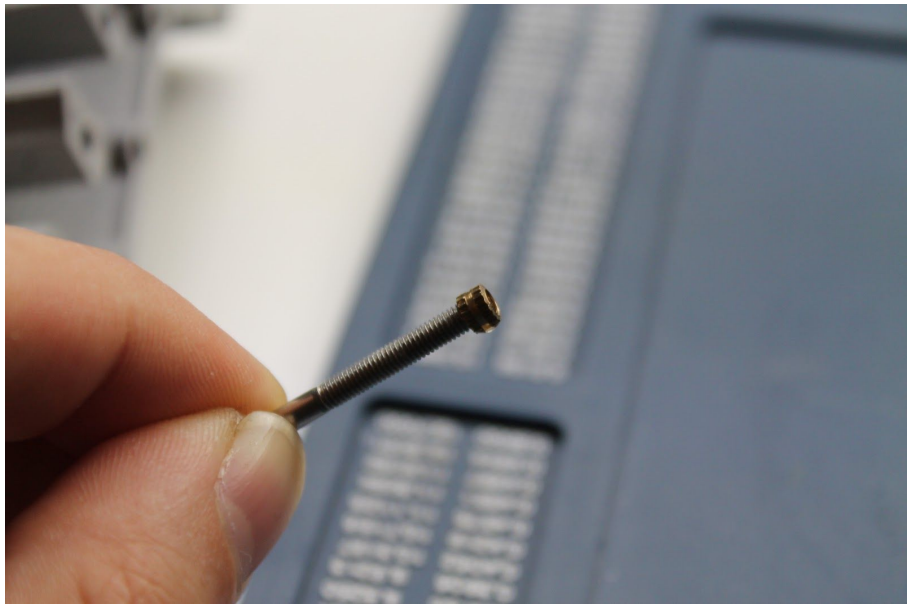
Using a #20 drill bit or similar, set depth stop to slightly deeper than insert.



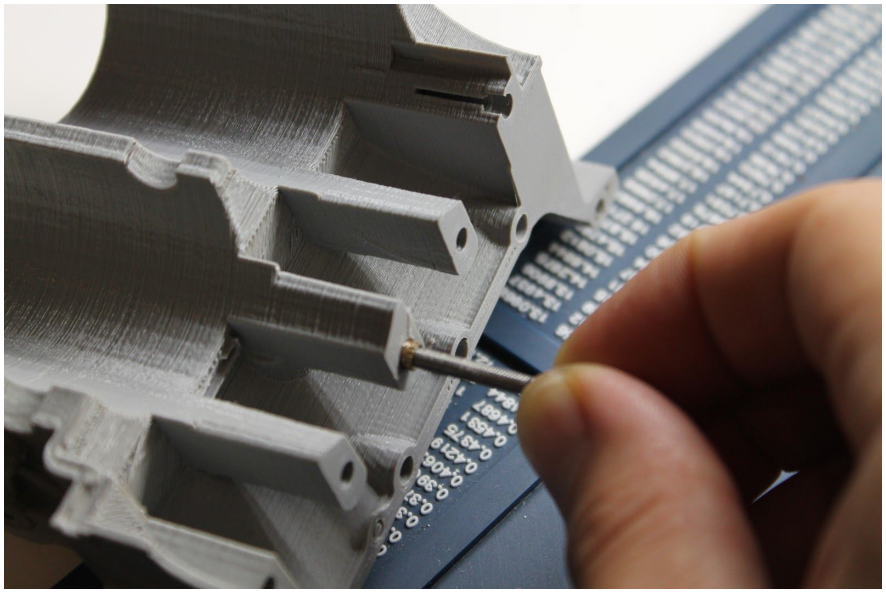
Drill out hole for insert

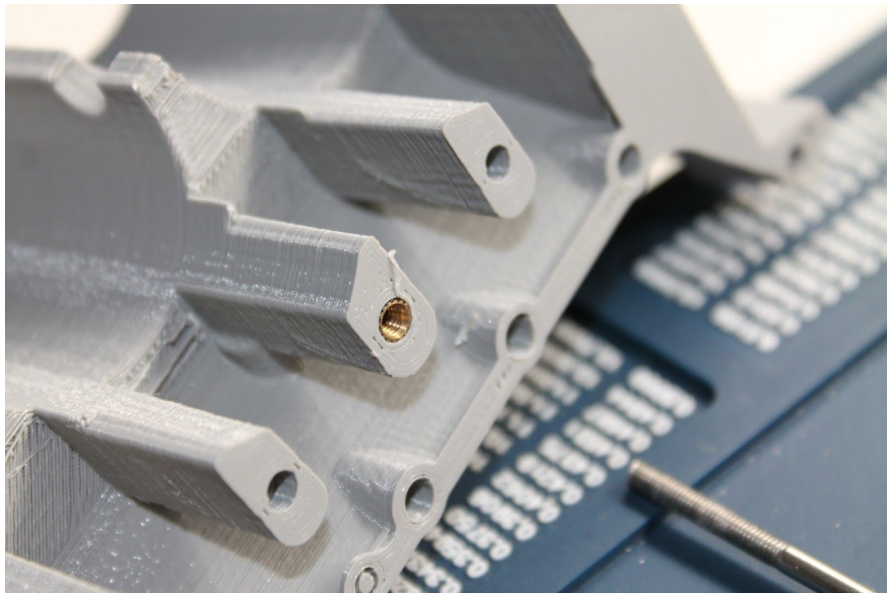


Using an M3 screw as a holder, apply super glue to the outside of the threaded insert. Medium build super glue works best.
Tip: Grease can be applied to the threads of the screw to prevent super gluing the insert to the screw.



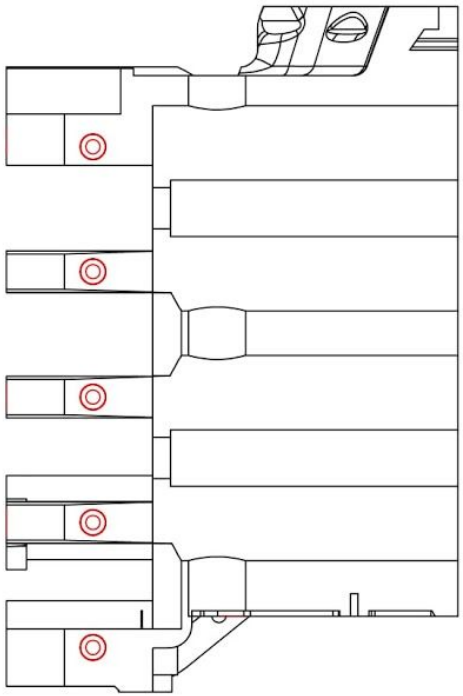
Install insert and remove screw. Making sure that insert is aligned with hole.



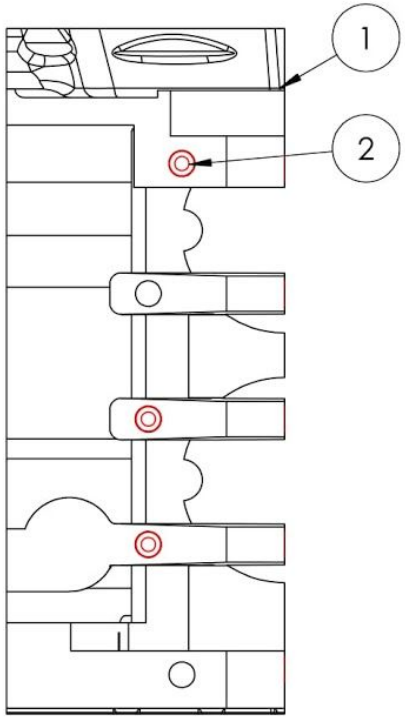


Drivers Side Lower Engine Block

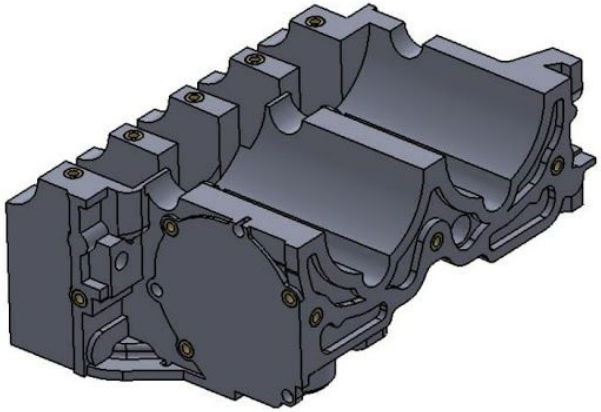
ITEM NO.	PART NUMBER	QTY.
1	engine block 2 - Split	1
2	M3 x 3mm Threaded Insert	15

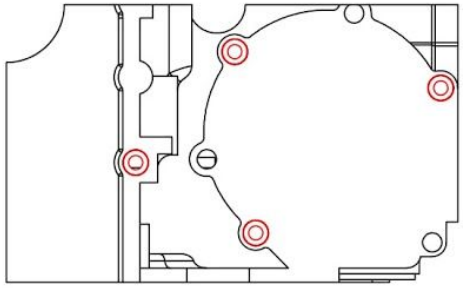


Top

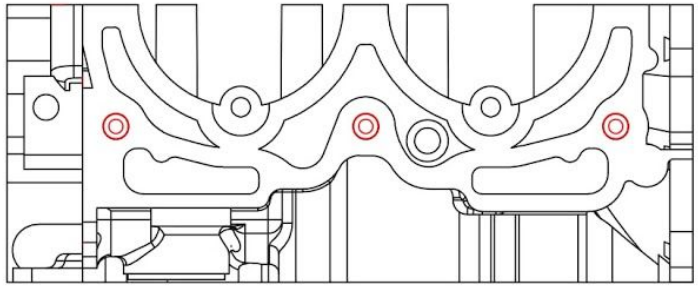


Left Side





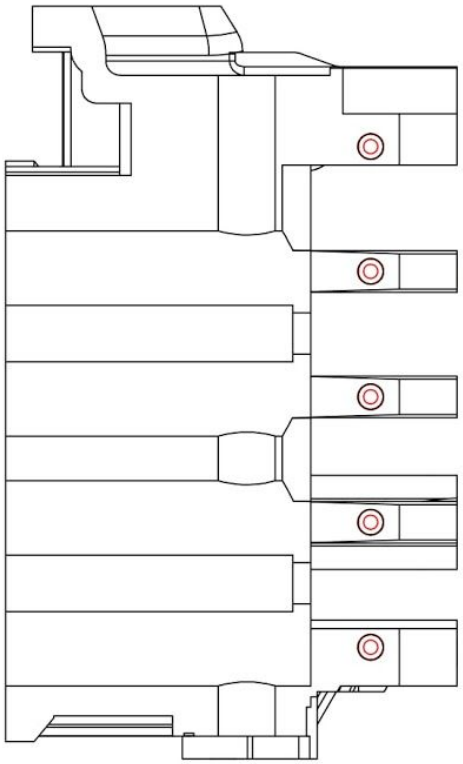
Front



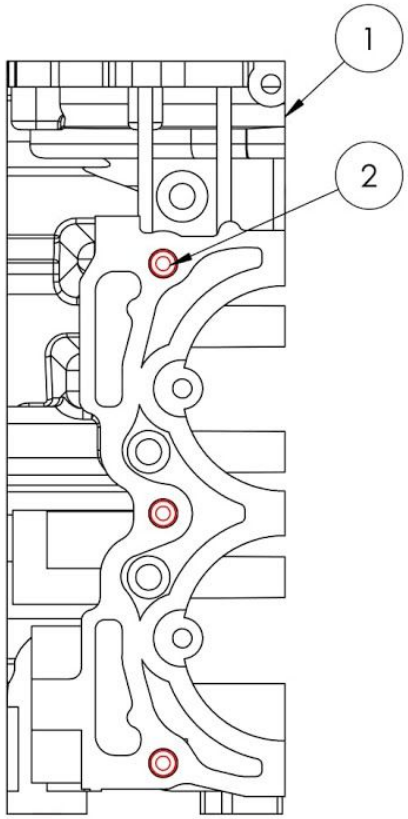
Right Side

Passenger Side Lower Engine Block

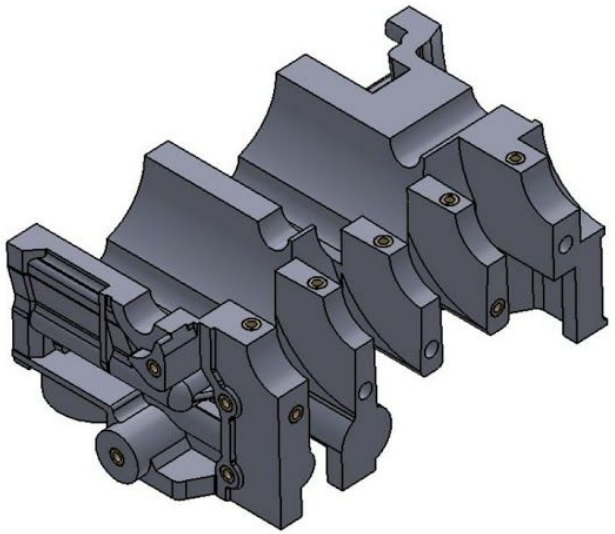
ITEM NO.	PART NUMBER	QTY.
1	engine block 1 - Split	1
2	M3 x 3mm Threaded Insert	14

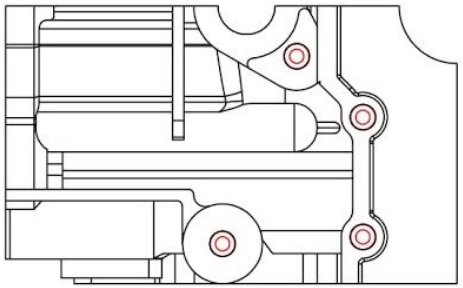


Top

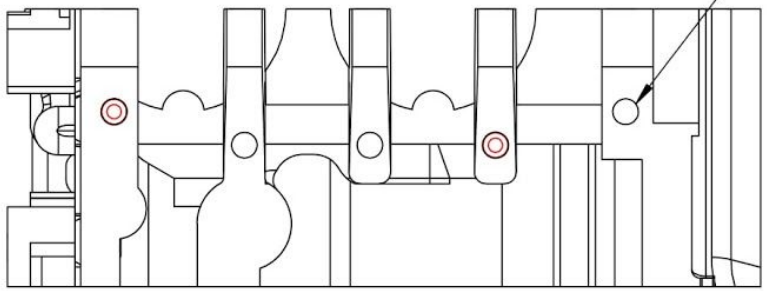


Left Side





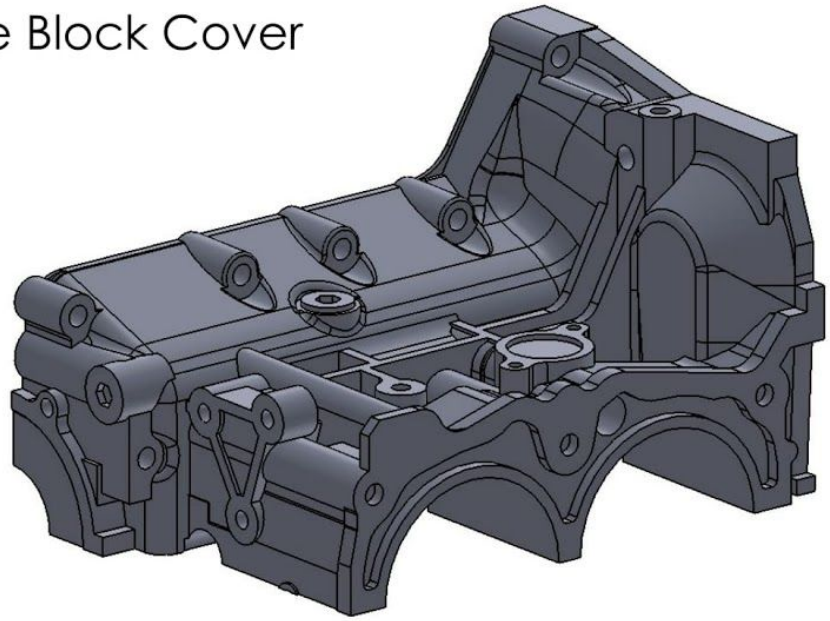
Front

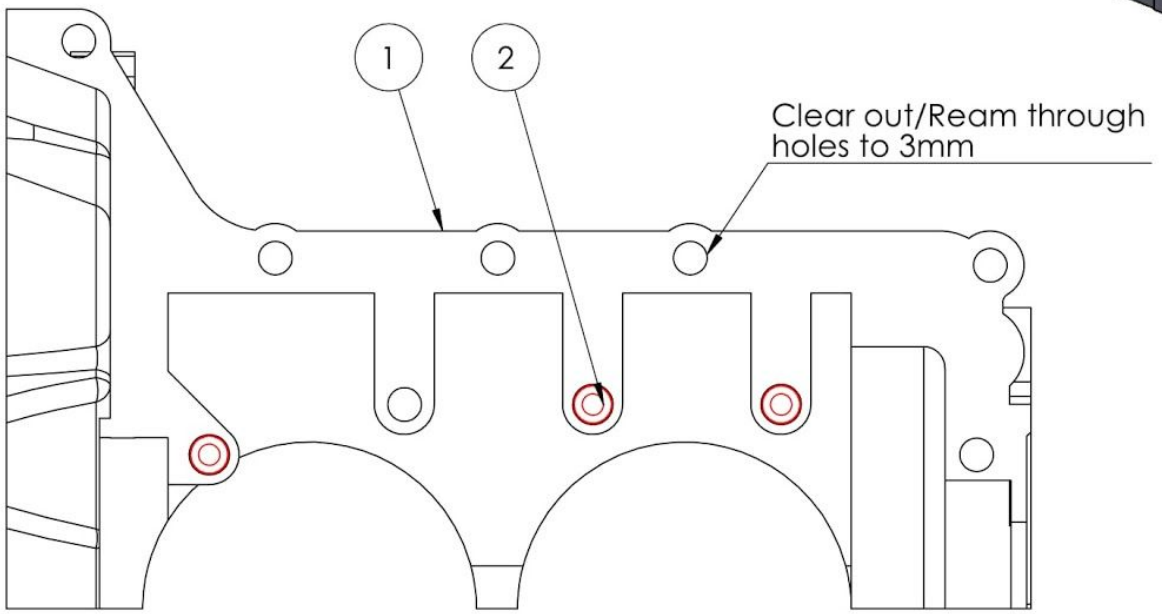


Right Side

Driver Side Engine Block Cover

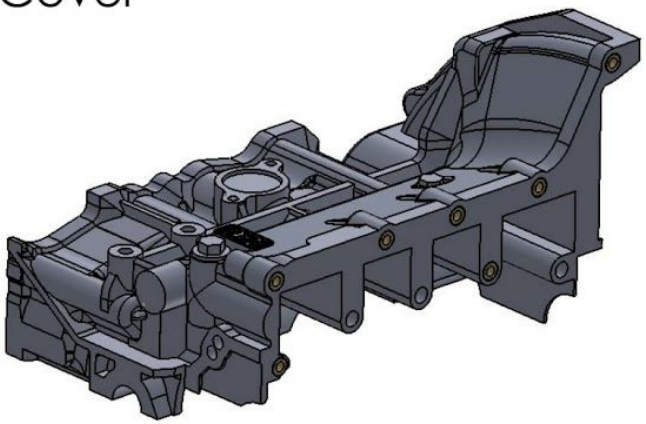
ITEM NO.	PART NUMBER	QTY.
1	engine block 2 - Split - Cover	1
2	M3 x 3mm Threaded Insert	3

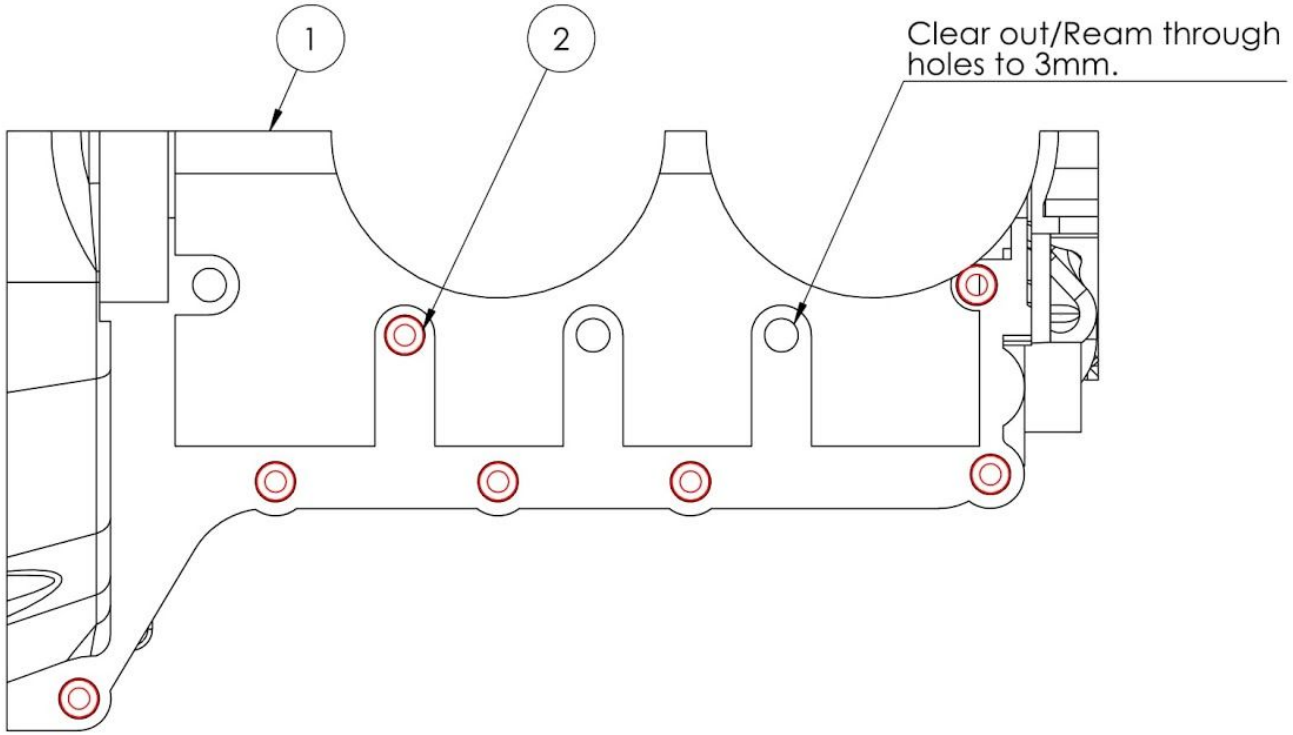




Passenger Side Engine Block Cover

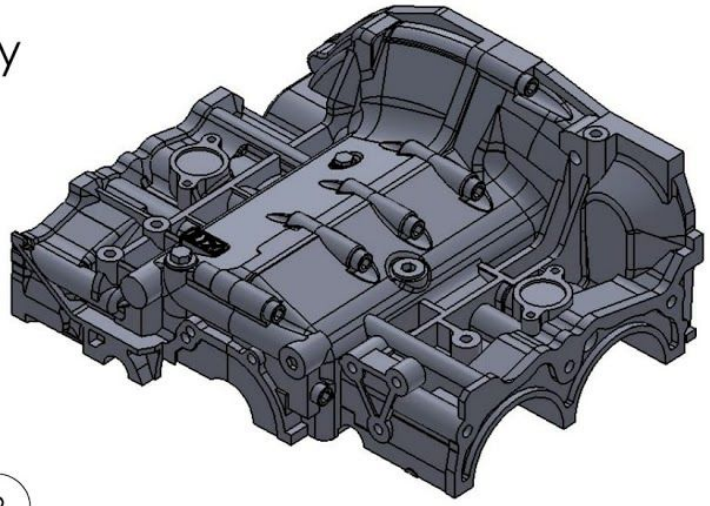
ITEM NO.	PART NUMBER	QTY.
1	engine block 1 - Split - Cover	1
2	M3 x 3mm Threaded Insert	7

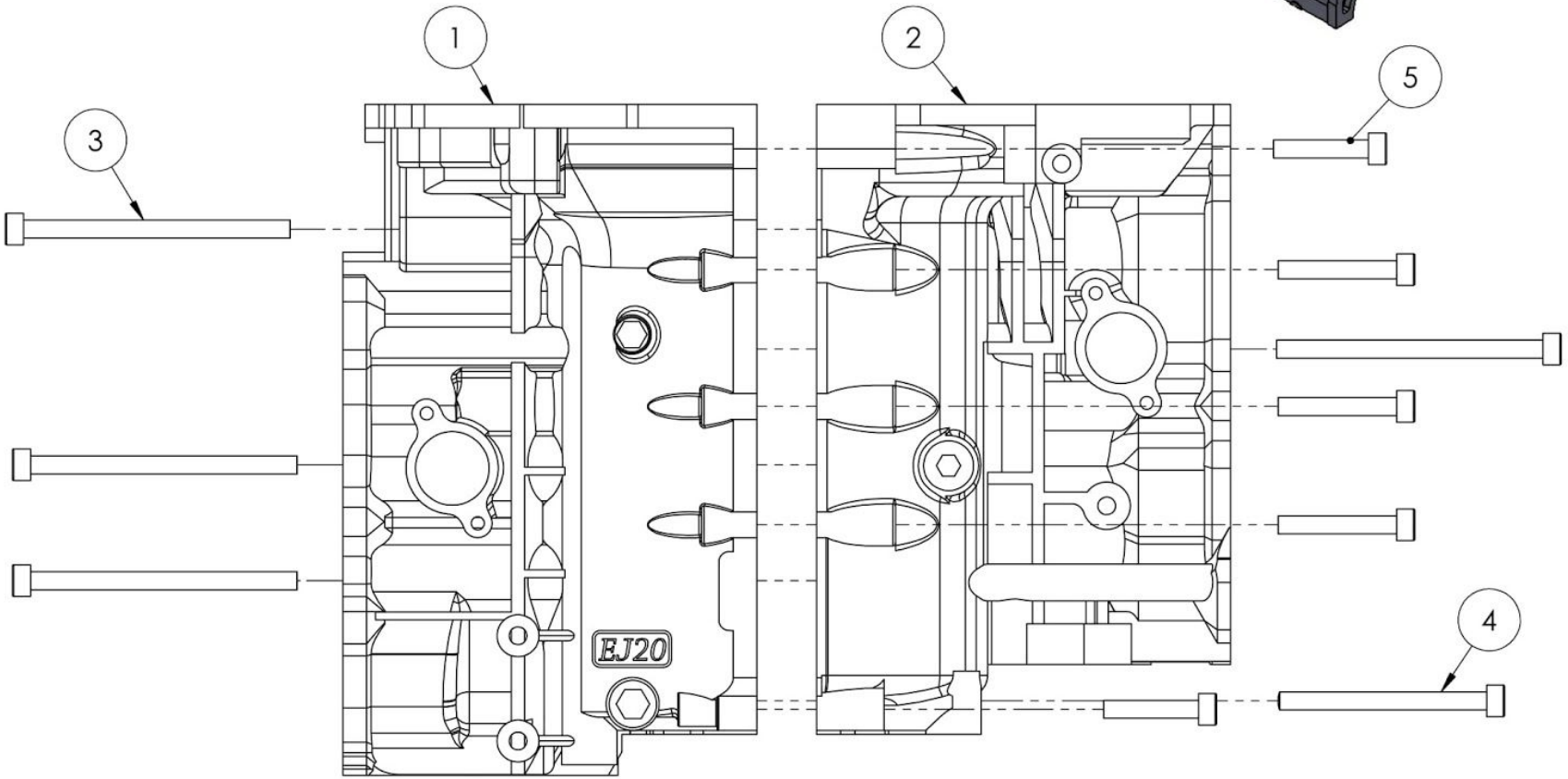




Top Cover Assembly

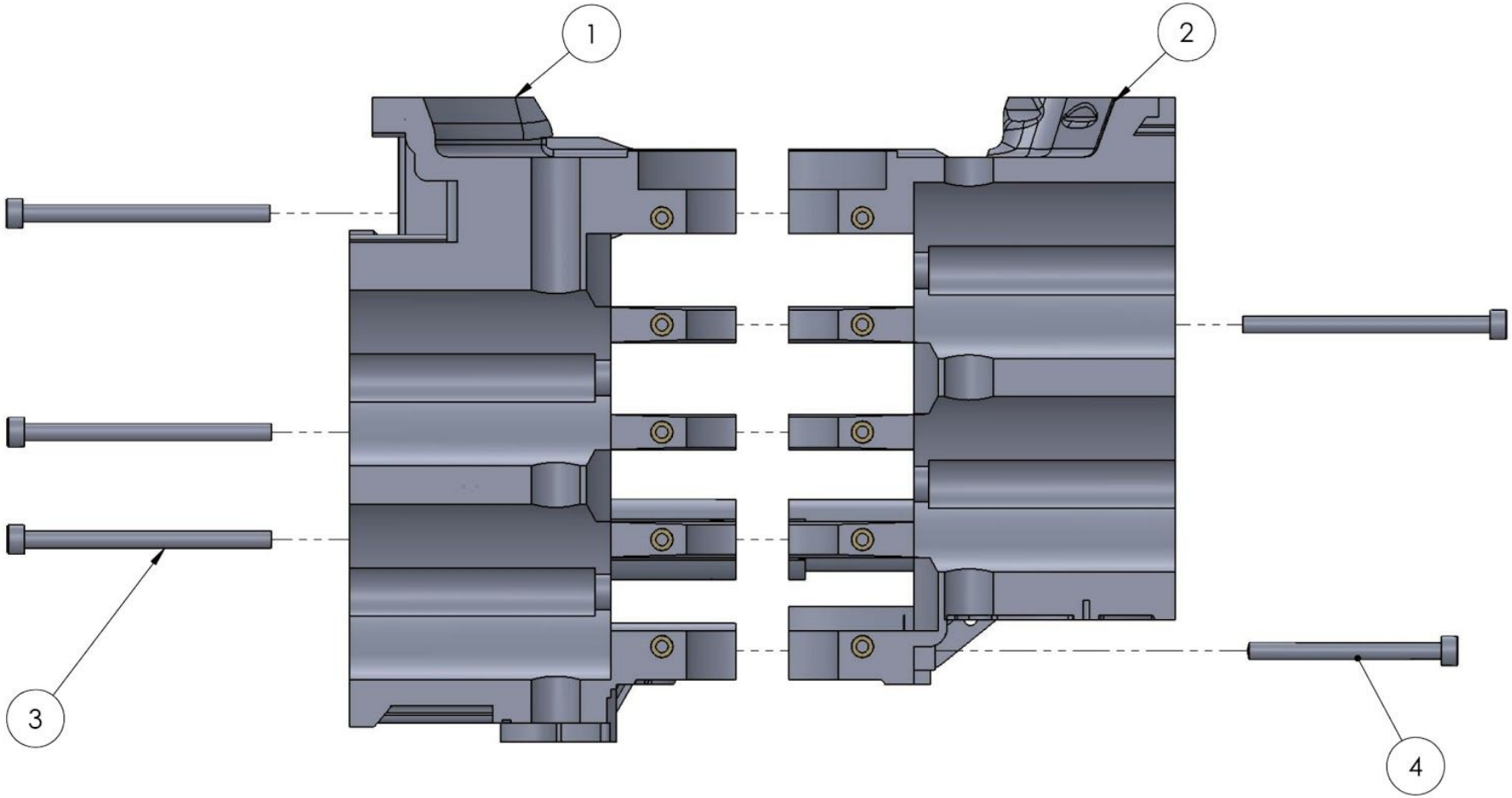
ITEM NO.	PART NUMBER	Cover assembly/QTY.
1	Passenger Side Top Cover With Inserts	1
2	Drivers Side Top Cover With Inserts	1
3	m3 45mm SHCS	4
4	m3 35mm SHCS	1
5	m3 16mm SHCS	2
6	m3 20mm SHCS	3



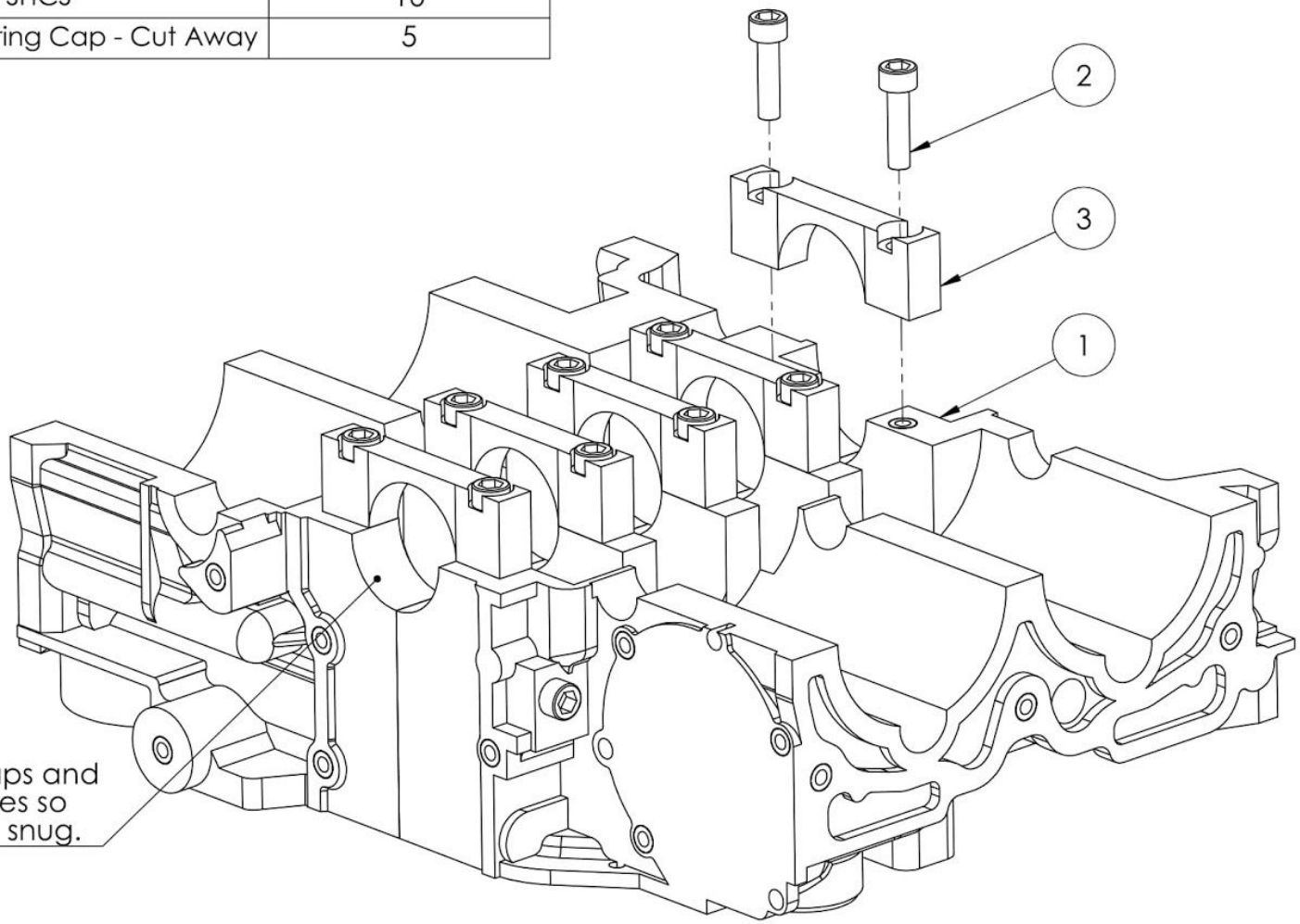


Lower Block Assembly

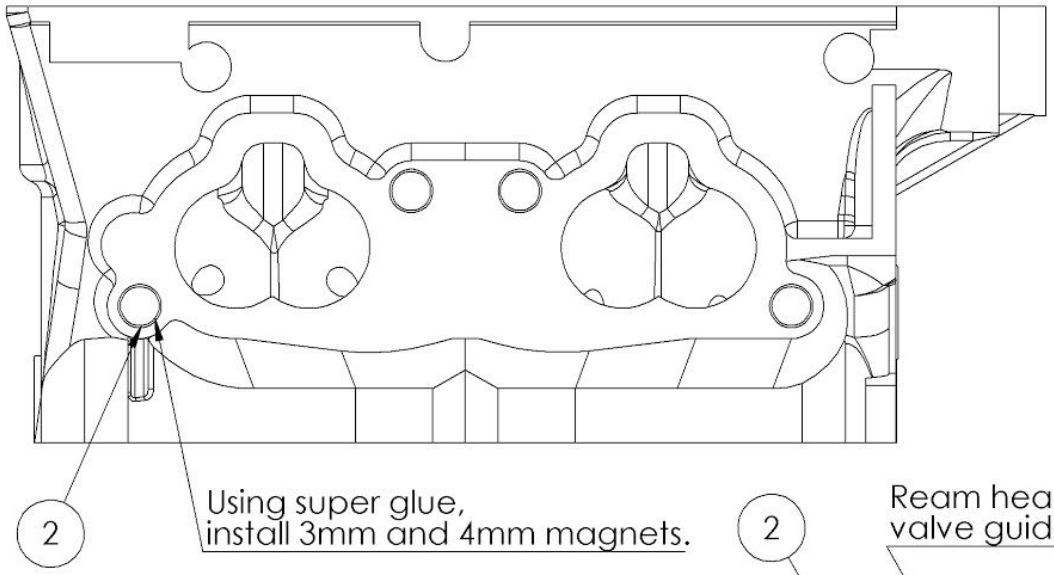
ITEM NO.	PART NUMBER	Lower Block Assembly/QTY.
1	Block - Passenger Side Lower - Cut Away	1
2	Block - Driver Side Lower - Cut Away	1
3	m3 45mm SHCS	4
4	m3 35mm SHCS	1

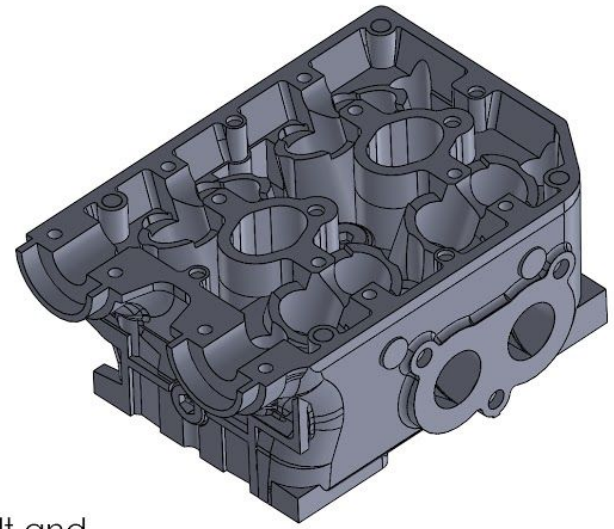


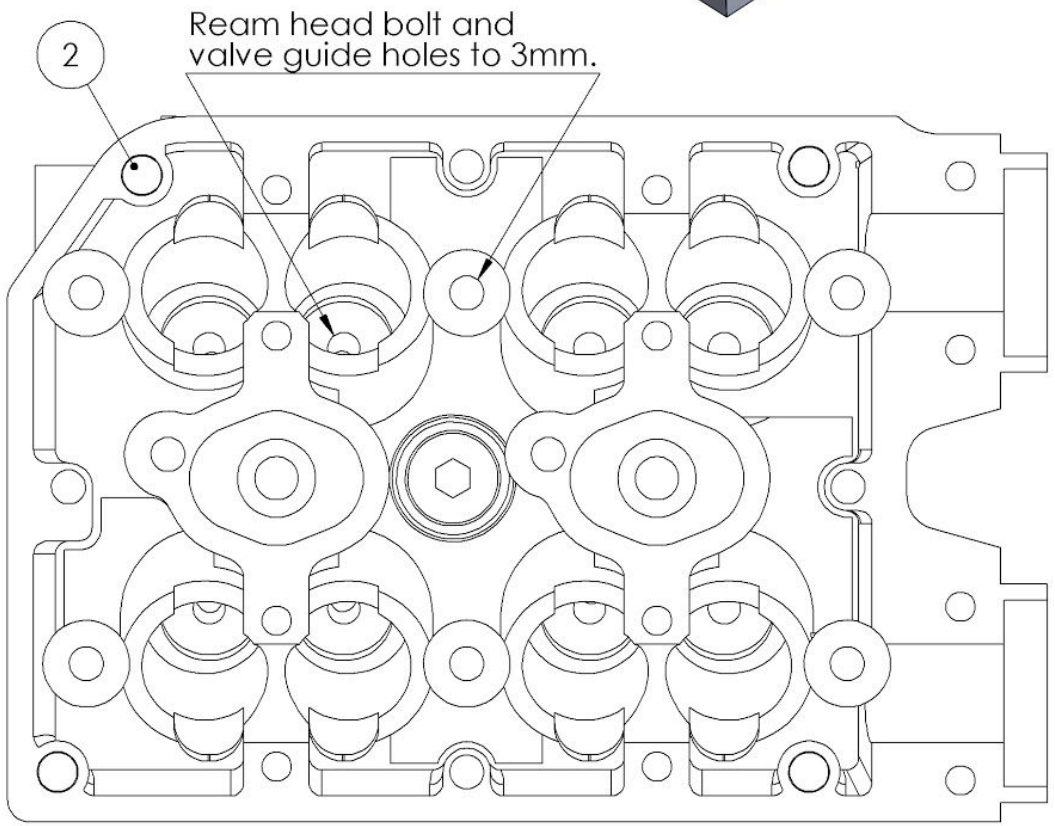
ITEM NO.	PART NUMBER	Lower block and main caps/QTY.
1	Lower Block Assembly	1
2	m3 12mm SHCS	10
3	Main Bearing Cap - Cut Away	5



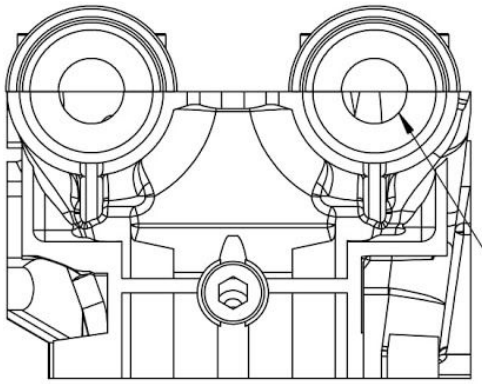
Install main bearing caps and clearance bearing holes so that 6701zz bearing fits snug.





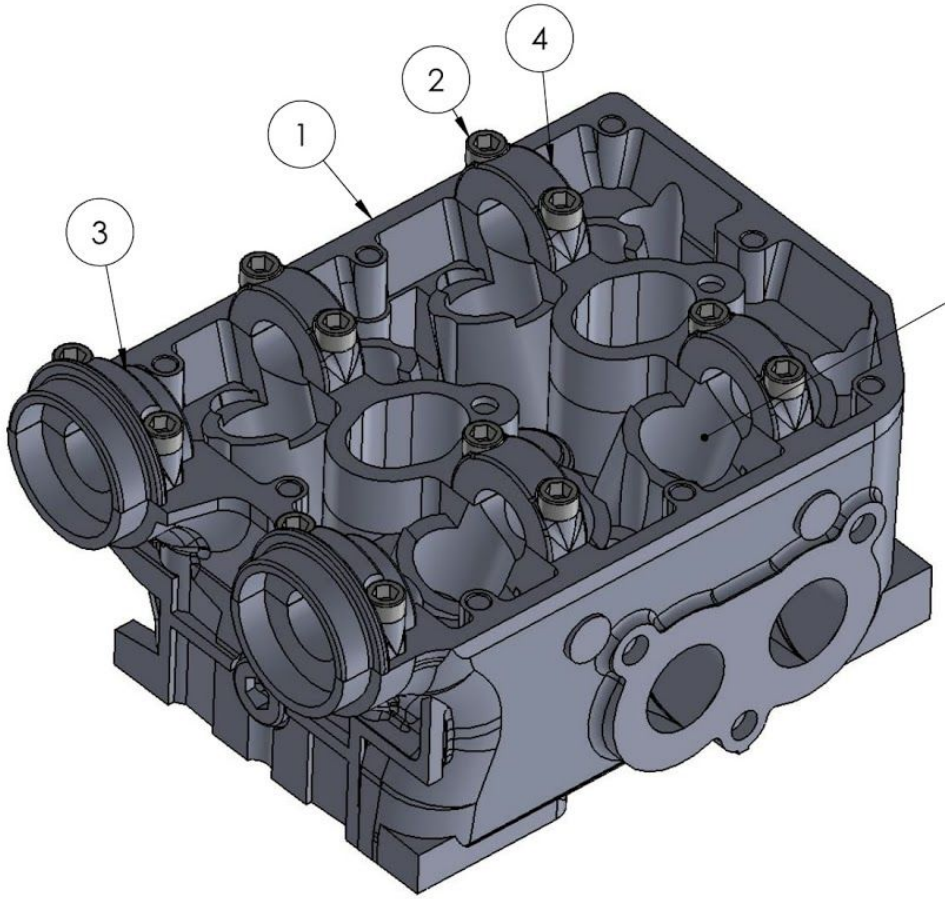


ITEM NO.	PART NUMBER	QTY.
1	EJ20 Head - Drivers Side - Cut Away	1
2	4mm x 2mm disc magnet	8



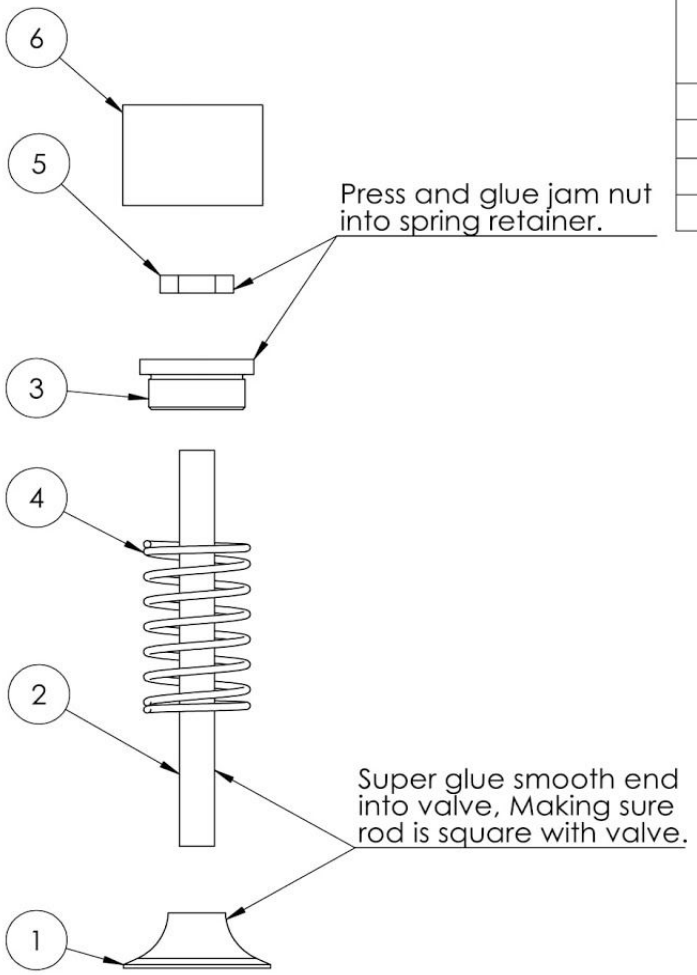
With cam bearing caps installed, ream cam bearing holes with drill bit slighty smaller than 10mm.

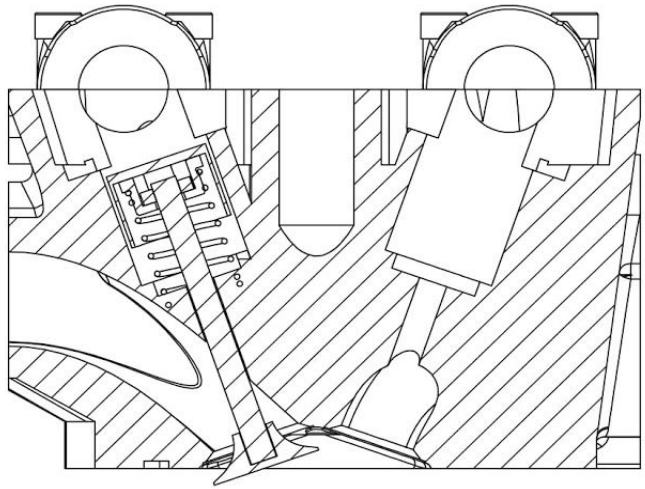
ITEM NO.	PART NUMBER	QTY.
1	Head with magnets installed	1
2	m3 12mm SHCS	12
3	Cam bearing cap 1	2
4	Cam bearing cap 2	4



Clean out valve puck holes so that valve puck slides smoothly.

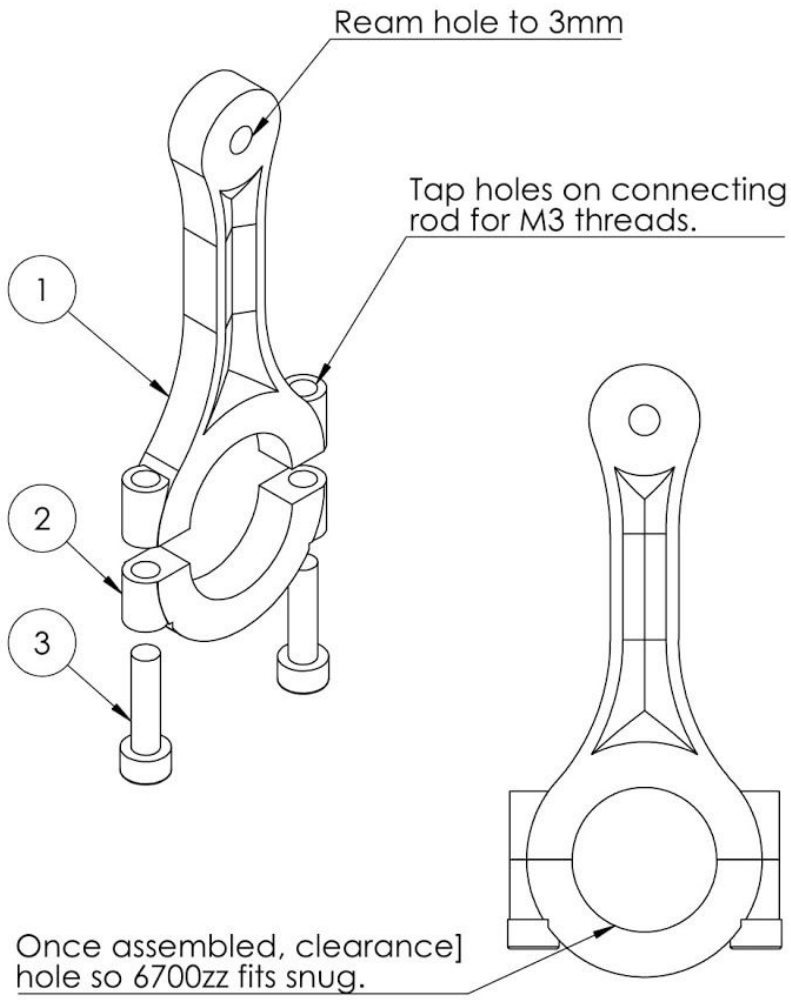
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Intake Valve		1
2	M3 35mm Rod	45mm SHCS Cut down to 35mm with as much smooth shaft as possible	1
3	Spring retainer		1
4	Valve Spring		1
5	m3 jam nut		1
6	Valve spring puck		1



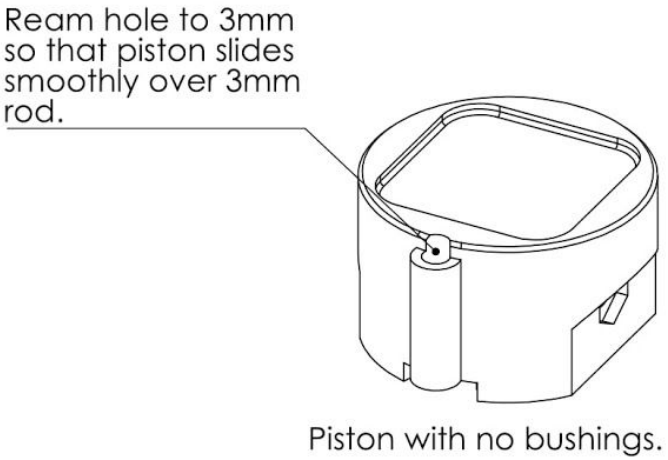


SECTION A-A

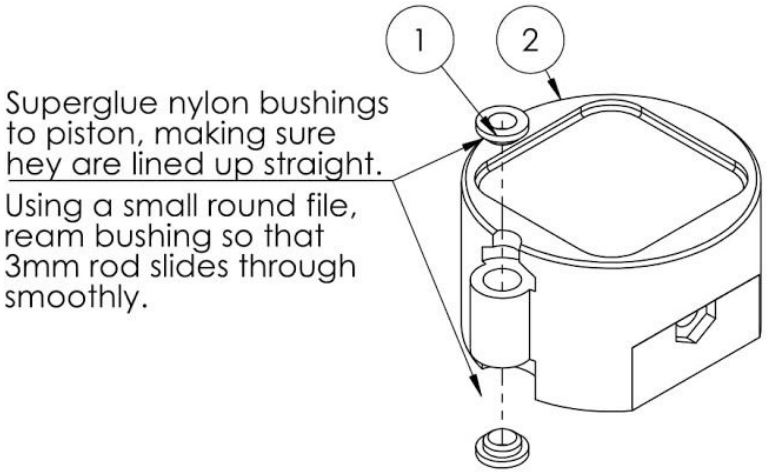
Note: Use printed Valve jig to glue valve to rod for best alignment.



ITEM NO.	PART NUMBER	QTY.
1	Connecting rod	1
2	Connecting rod bearing cap	1
3	m3 12mm SHCS	2



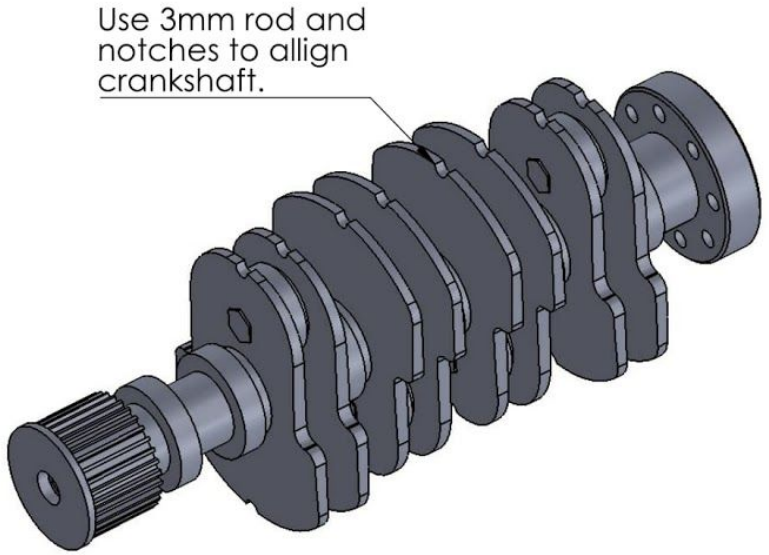
Piston with no bushings.

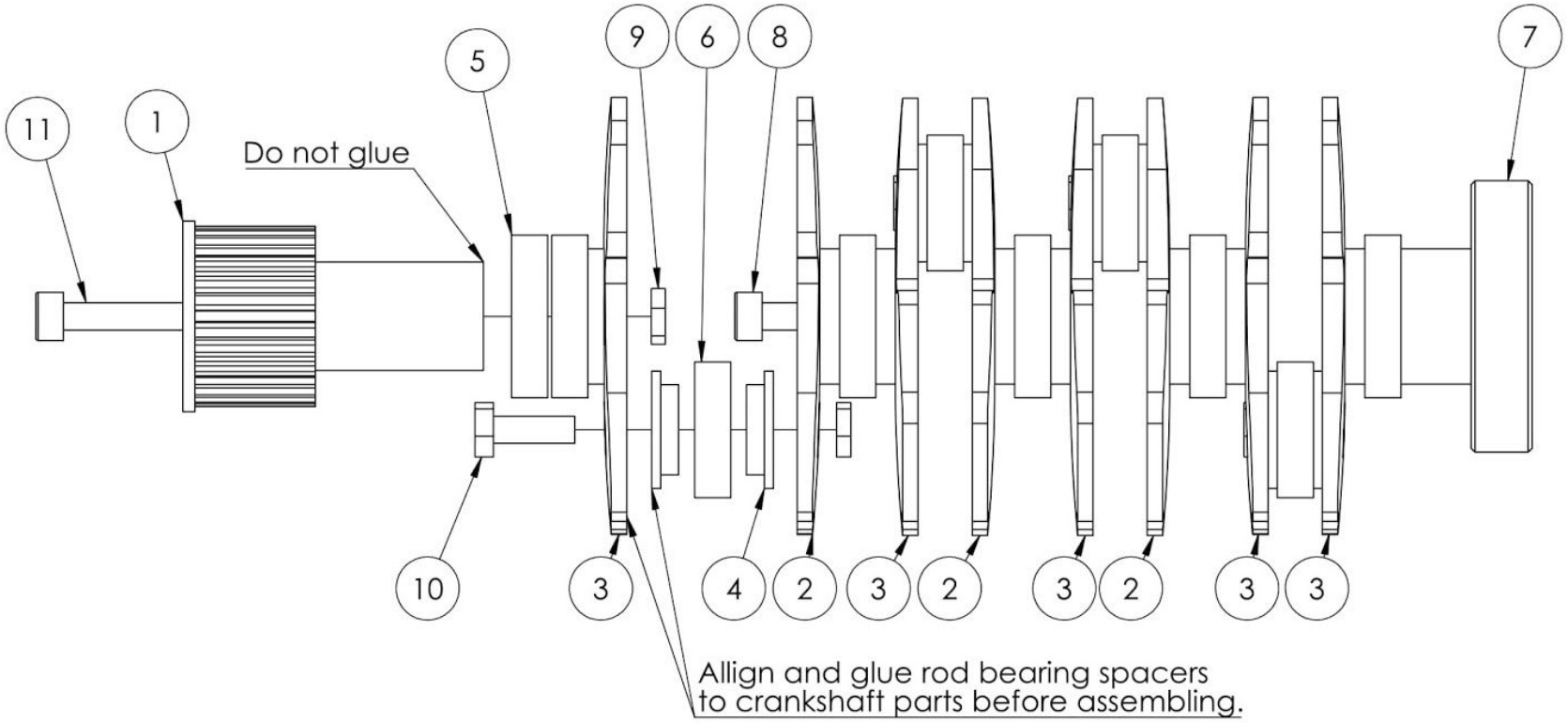


Piston with nylon bushings

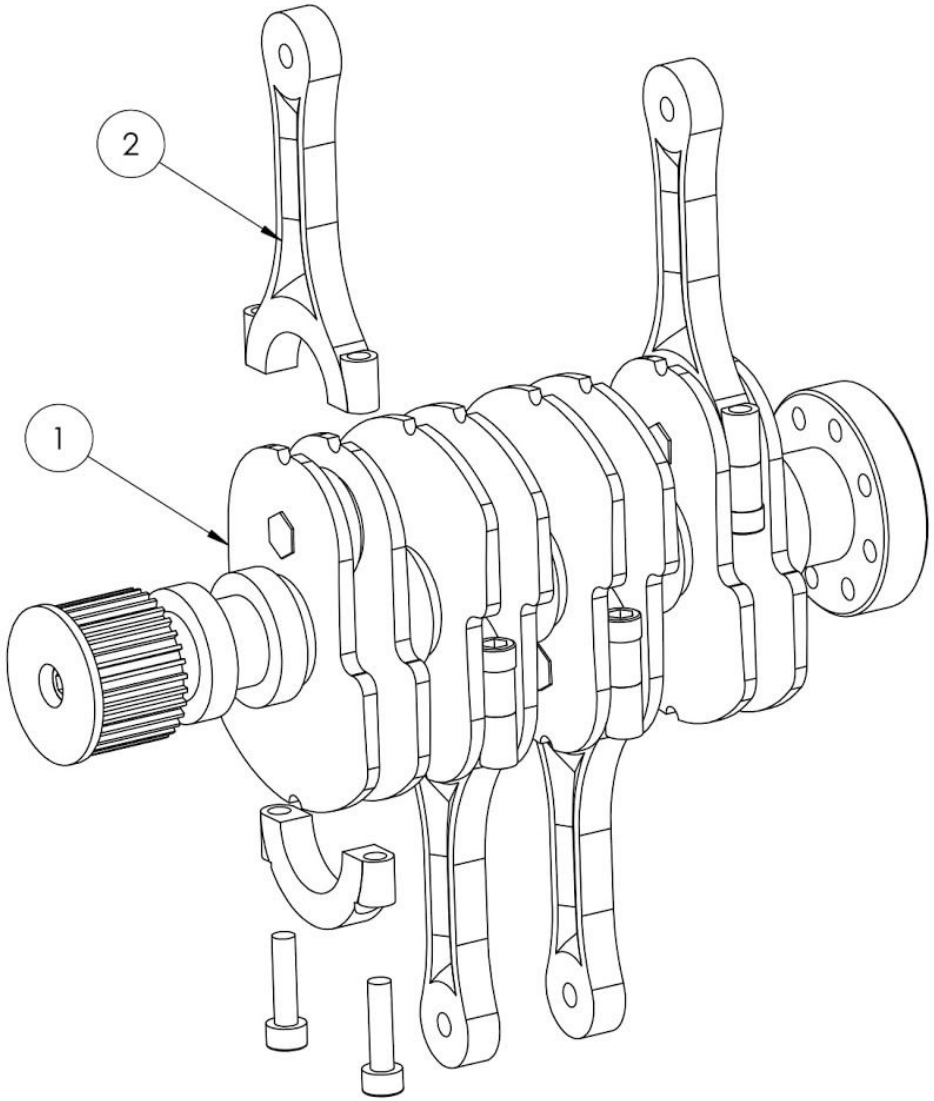
ITEM NO.	PART NUMBER	QTY.
1	3mm Nylon Bushing	2
2	Piston - Modified for cut away - With Bushings	1

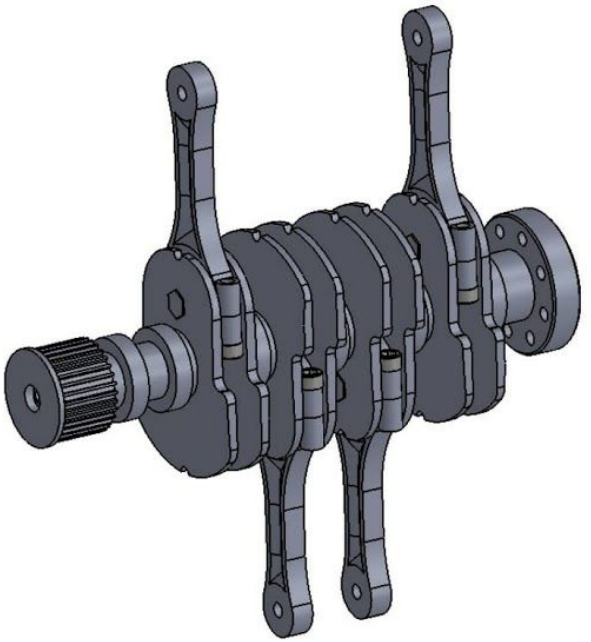
ITEM NO.	PART NUMBER	QTY.
1	Crank Gear - Cut Away	1
2	Crankshaft 1 - Cut Away	3
3	Crankshaft 2 - Cut Away	5
4	Connecting Rod Bearing Spacer - Cut Away	8
5	6701zz Bearing	6
6	6700zz Bearing	4
7	Crankshaft rear flange	1
8	m3 10mm SHCS	3
9	m3 jam nut	9
10	M3 x 9mm Hex Head Screw	4
11	m3 35mm SHCS	1
12	m3 18mm SHCS	1



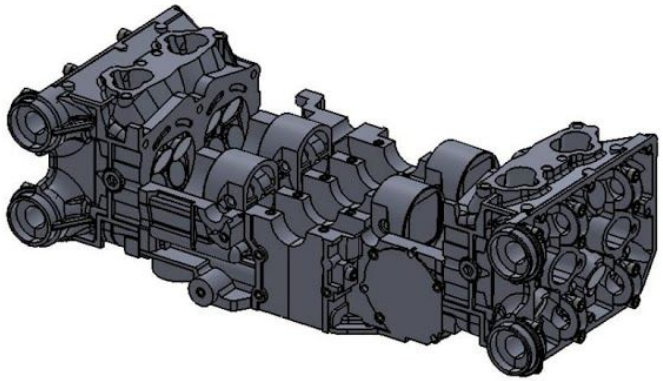


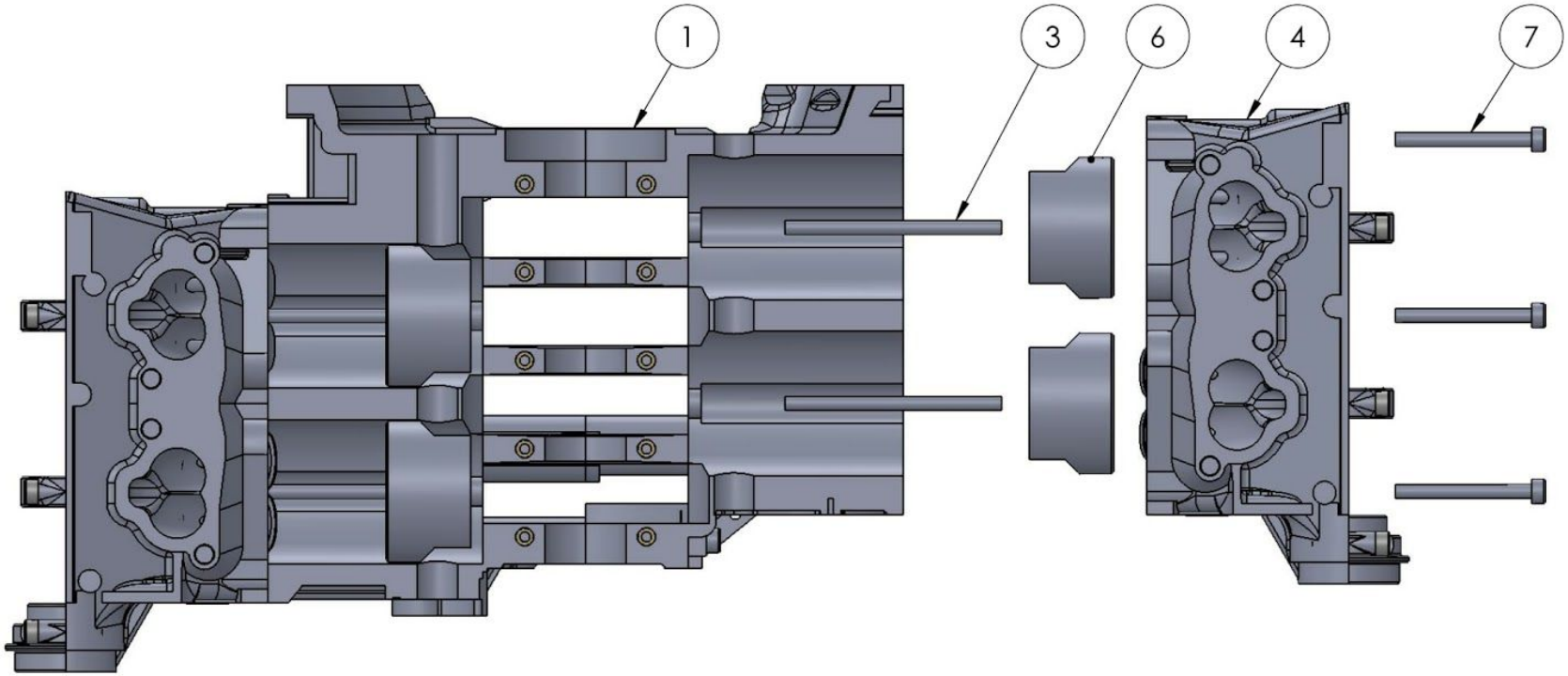
ITEM NO.	PART NUMBER	QTY.
1	Crankshaft Assembly	1
2	Connecting Rod Assembly	3





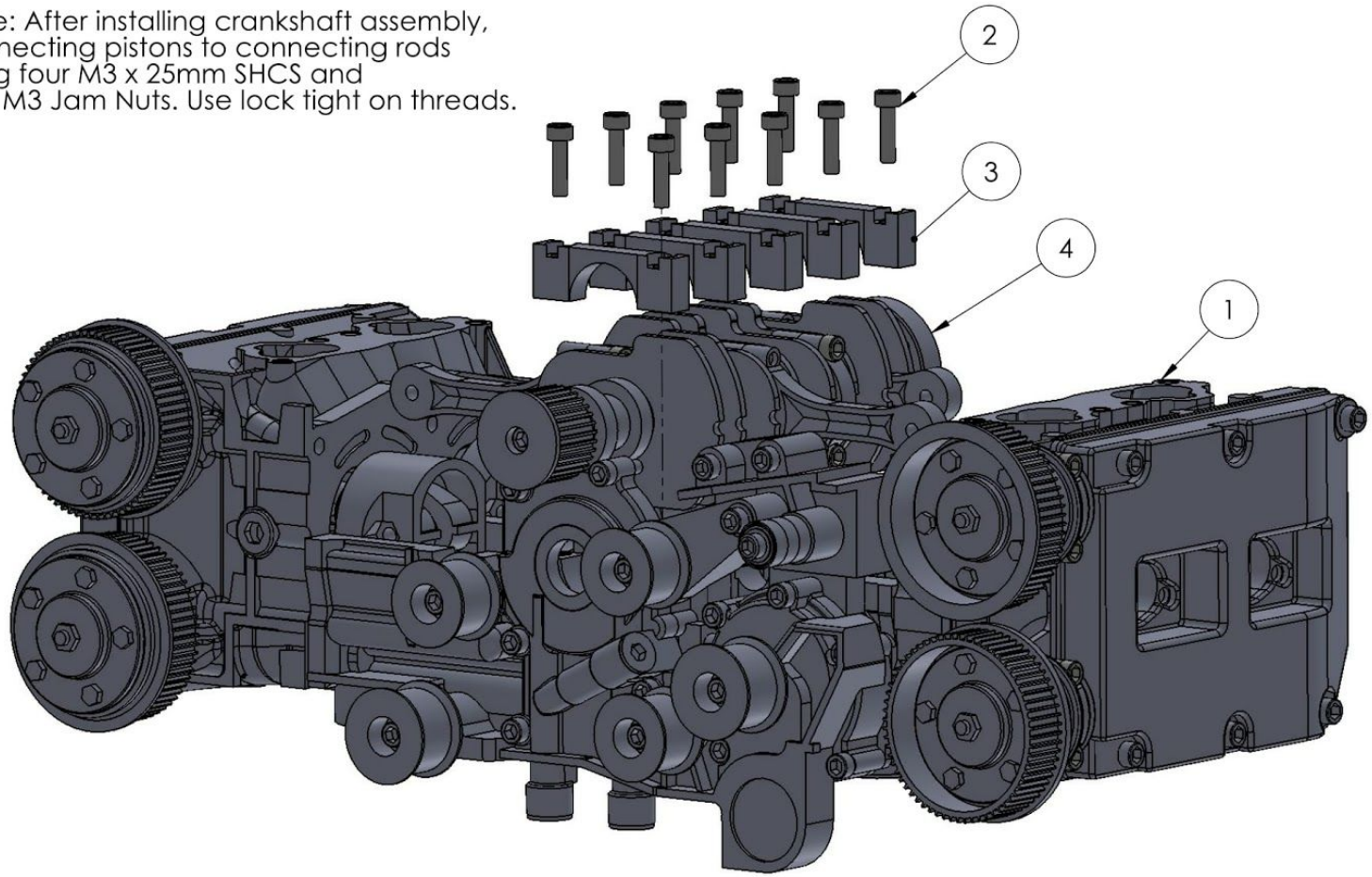
ITEM NO.	PART NUMBER	Block and Head Assembly/QTY.
1	Lower Block Assem - Cut Away	1
2	Top Cover Assem - Cut Away	1
3	3mm x 48mm rod	4
4	Drivers Side Head Assembly	1
5	Passenger Side Head Assembly	1
6	Piston - Modified for cut away	4
7	m3 30mm SHCS	6



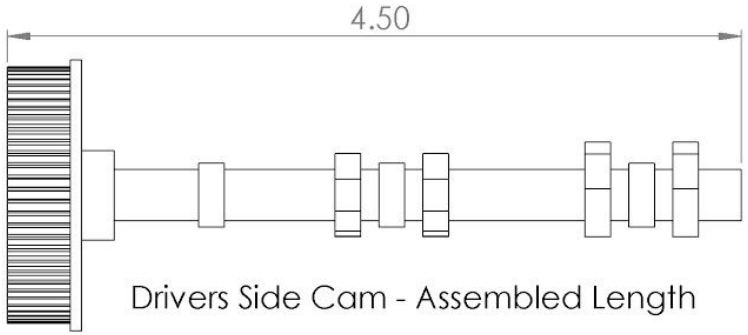


ITEM NO.	PART NUMBER	Crankshaft to Block Assem/QTY.
1	Lower Block Assembly	1
2	m3 12mm SHCS	10
3	Main Bearing Cap	5
4	Crankshaft Assembly	1

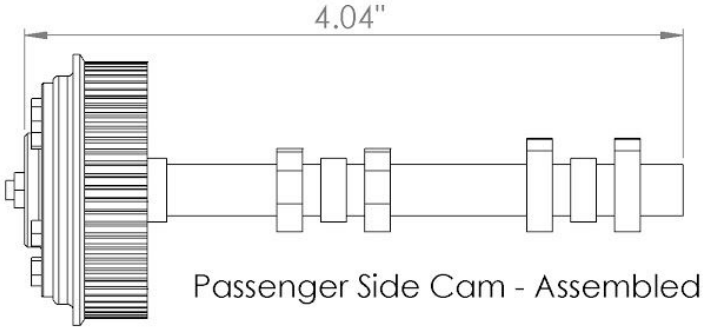
Note: After installing crankshaft assembly, connecting pistons to connecting rods using four M3 x 25mm SHCS and four M3 Jam Nuts. Use lock tight on threads.



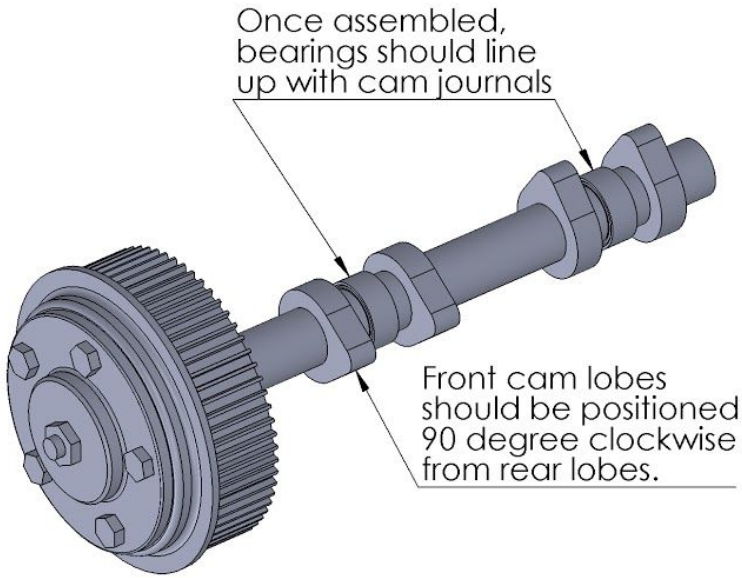
Note: Disregard accessories and cams mounted to engine.



Drivers Side Cam - Assembled Length

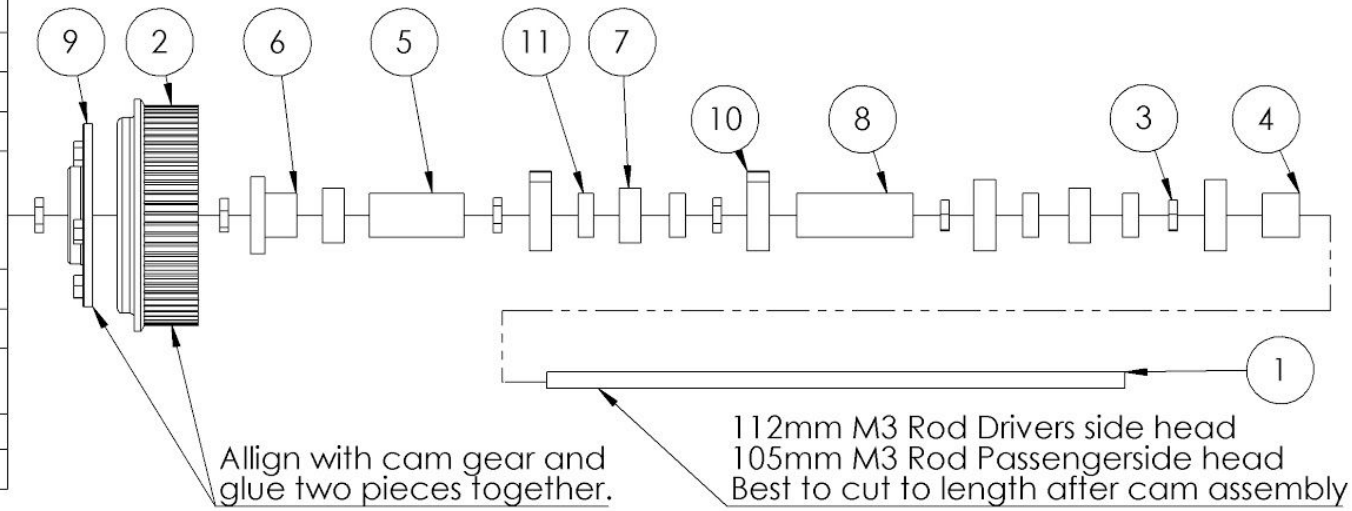


Passenger Side Cam - Assembled Length

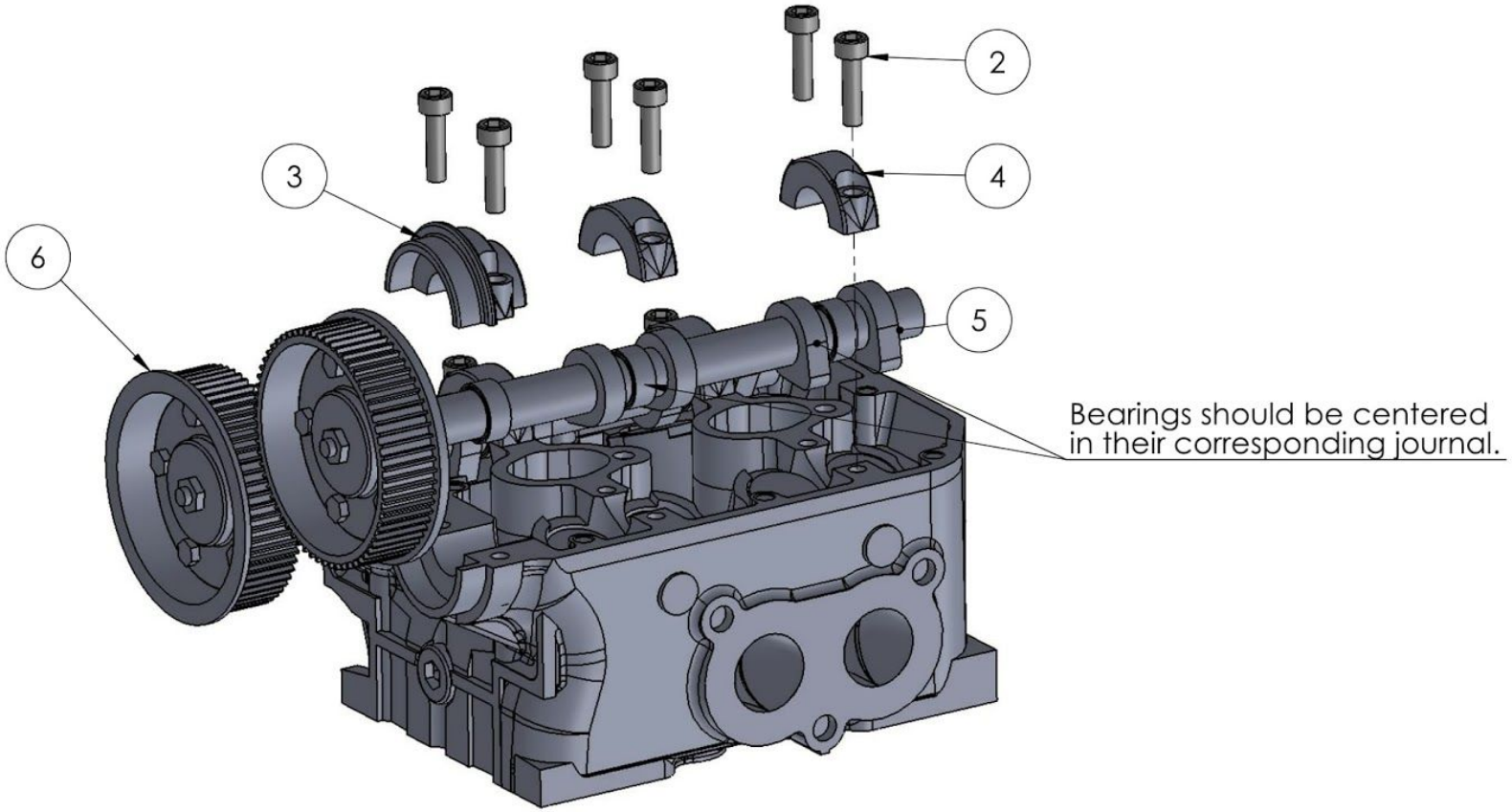


NOTE: Cam lobes and spacers are held together with m3 nuts. Assembly is done one peice at a time. If cam lobes don't like up, re index lobe on nut and retighten. Apply superglue or thread locker to threads for final assembly.

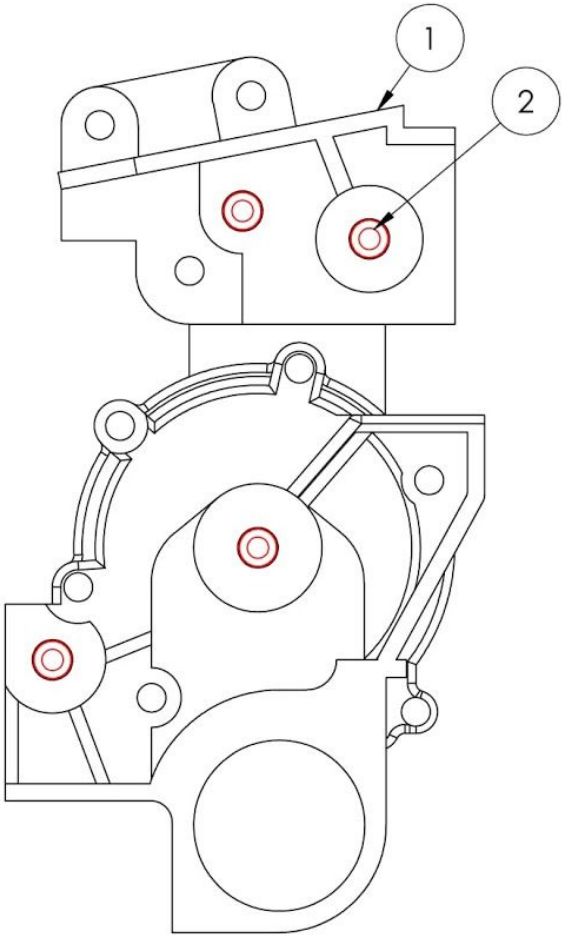
ITEM NO.	PART NUMBER	QTY.
1	M3 x 105mm Rod	1
2	Passenger Exhuast Cam Gear	1
3	m3 jam nut	6
4	Cam Spacer 3	1
5	Cam Spacer 4	1
6	Cam Spacer 6 - Flange (Cam Spacer 5 for drivers side cam)	1
7	623zz bearing	3
8	Cam Spacer 1	1
9	Cam Gear Timing Gear	1
10	Valve Lobe	4
11	Cam Spacer 2	4



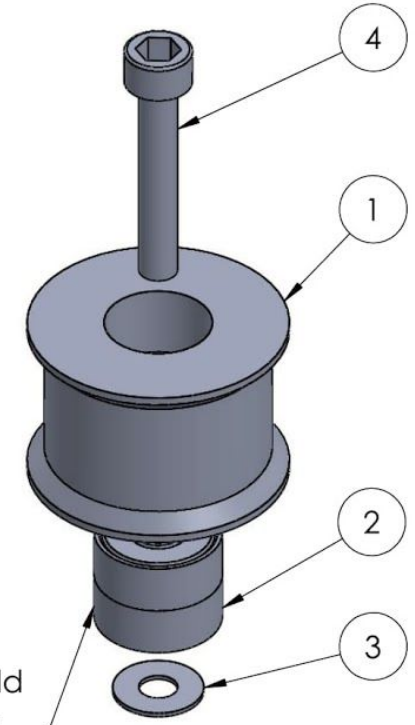
ITEM NO.	PART NUMBER	Cam assembly drawing/QTY.
1	Drivers Side Head Assembly with magnets	1
2	m3 12mm SHCS	12
3	Cam bearing cap 1	2
4	Cam bearing cap 2	4
5	Driver side Exhuast Cam Assembly	1
6	Driver side Intake Cam Assembly	1
7	Exhuast Valve Assembly	4
8	Intake Valve Assembly	4



ITEM NO.	PART NUMBER	Insert assembly/QTY.
1	Waterpump Tensioner Bracket	1
2	M3 x 3mm Threaded Insert	4

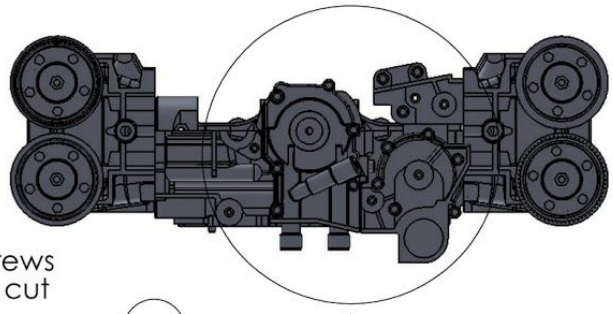


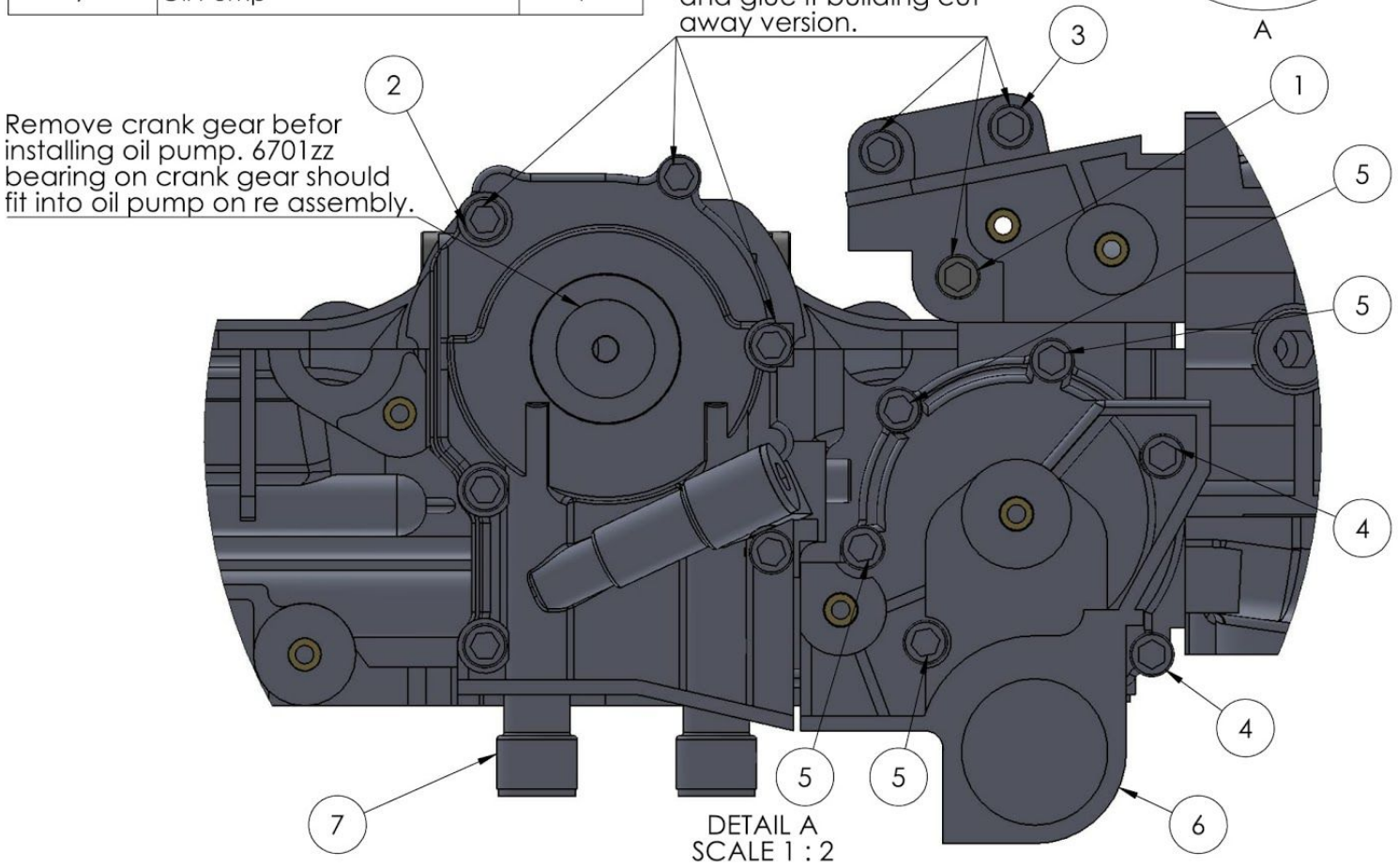
ITEM NO.	PART NUMBER	QTY.
1	Timing pulley 1 - 780 belt	1
2	623zz bearing	2
3	3mm washer	1
4	m3 18mm SHCS	1



623zz bearings should press in and fit tight. If not, glue bearing into pulley.

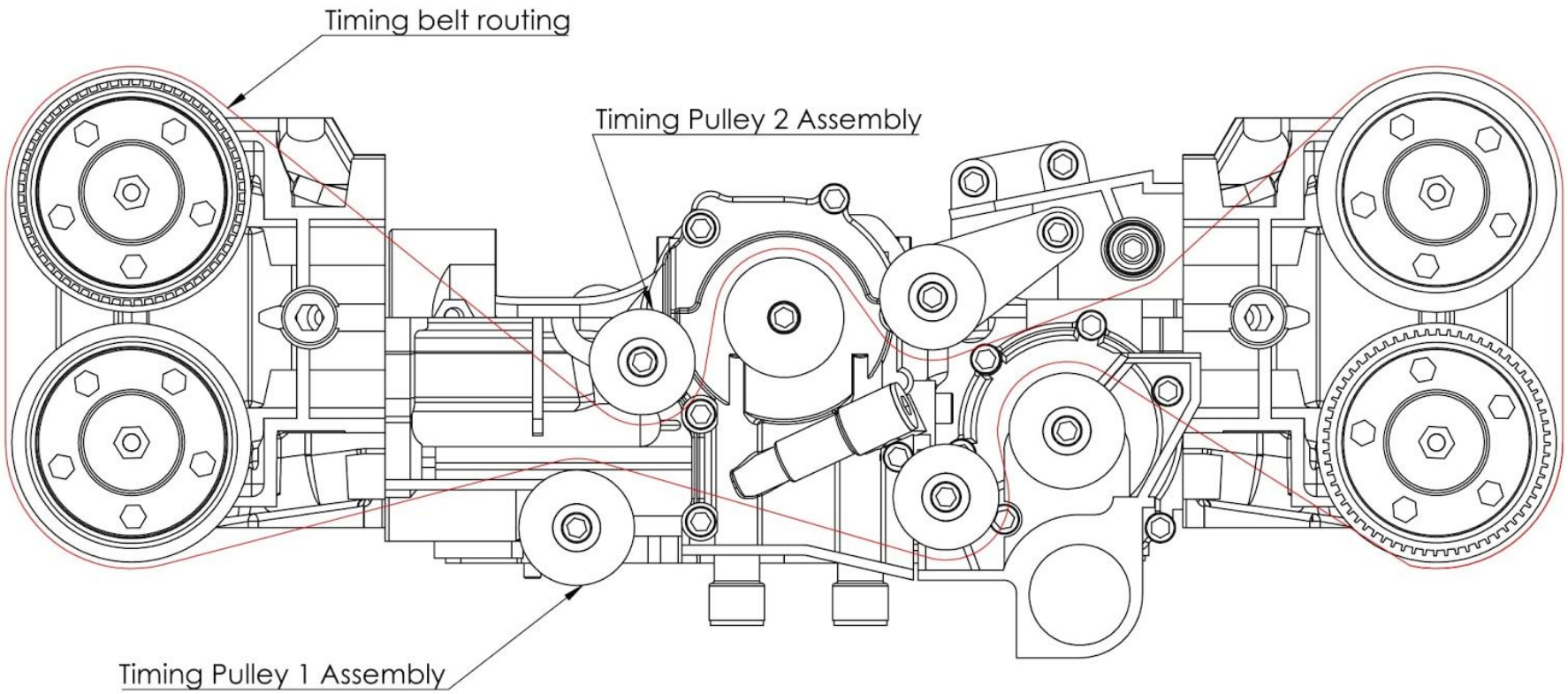
ITEM NO.	PART NUMBER	QTY.
1	m3 12mm SHCS	1
2	m3 10mm SHCS	6
3	m3 18mm SHCS	2
4	m3 16mm SHCS	2
5	m3 20mm SHCS	4
6	Waterpump Tensioner Bracket	1
7	Oil Pump	1





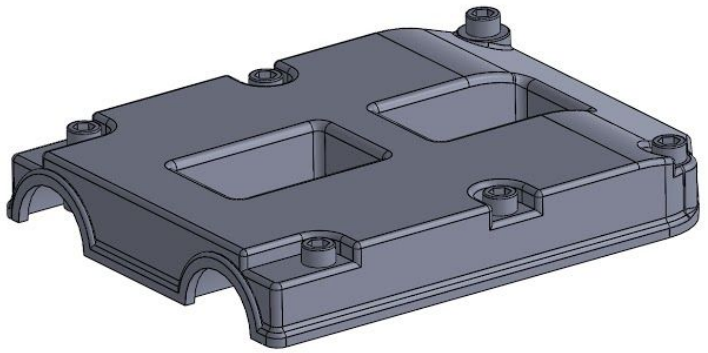
Note: Can use 5mm SHCS from intake manifold spacers if desired. Instead of cutting screws.

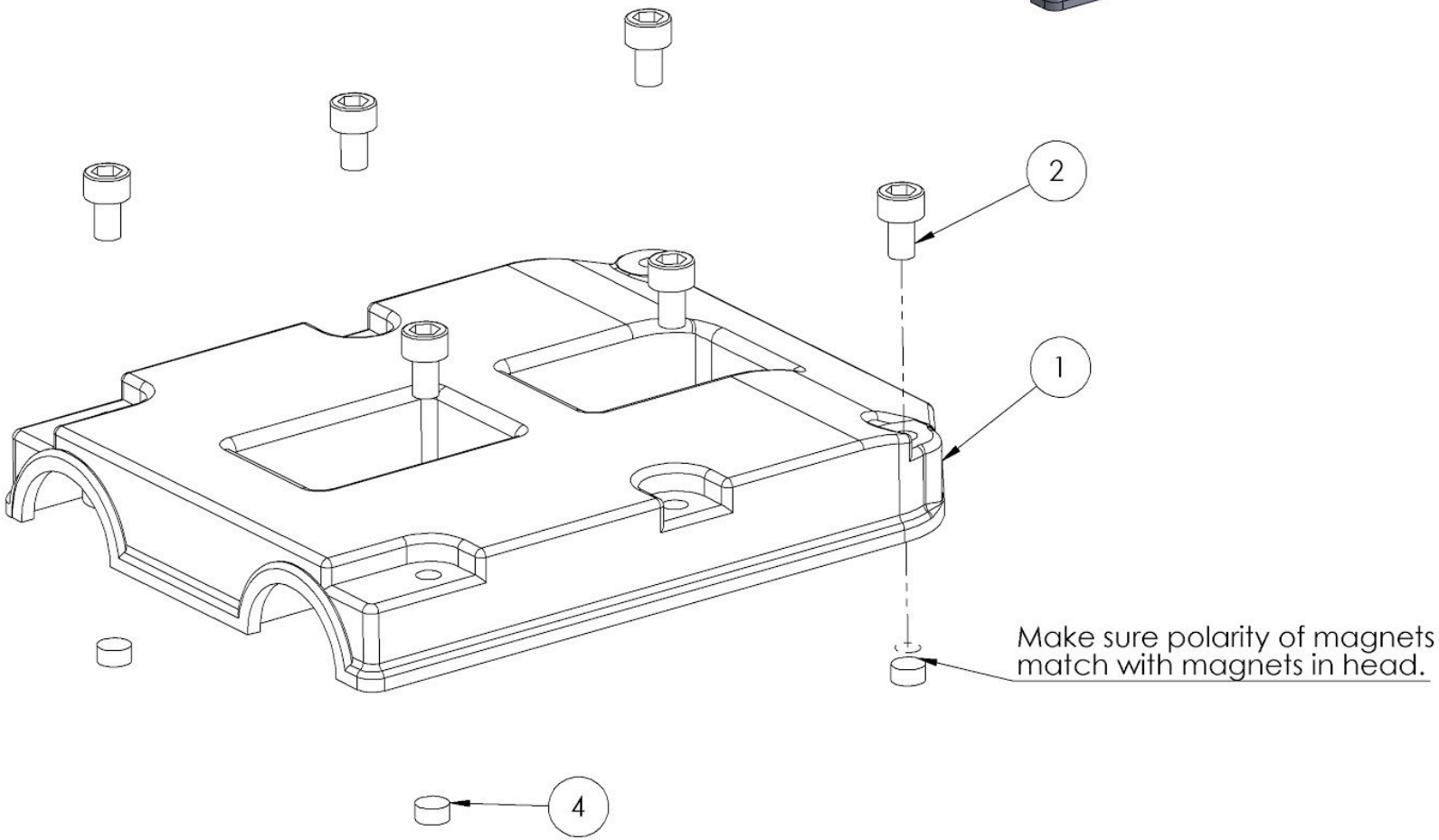
Timing Belt Routing Diagram



ITEM NO.	PART NUMBER	QTY.
1	Driver Side Valve Cover - Cut Away	1
2	m3 5mm SHCS	6
4	4mm x 2mm disc magnet	4

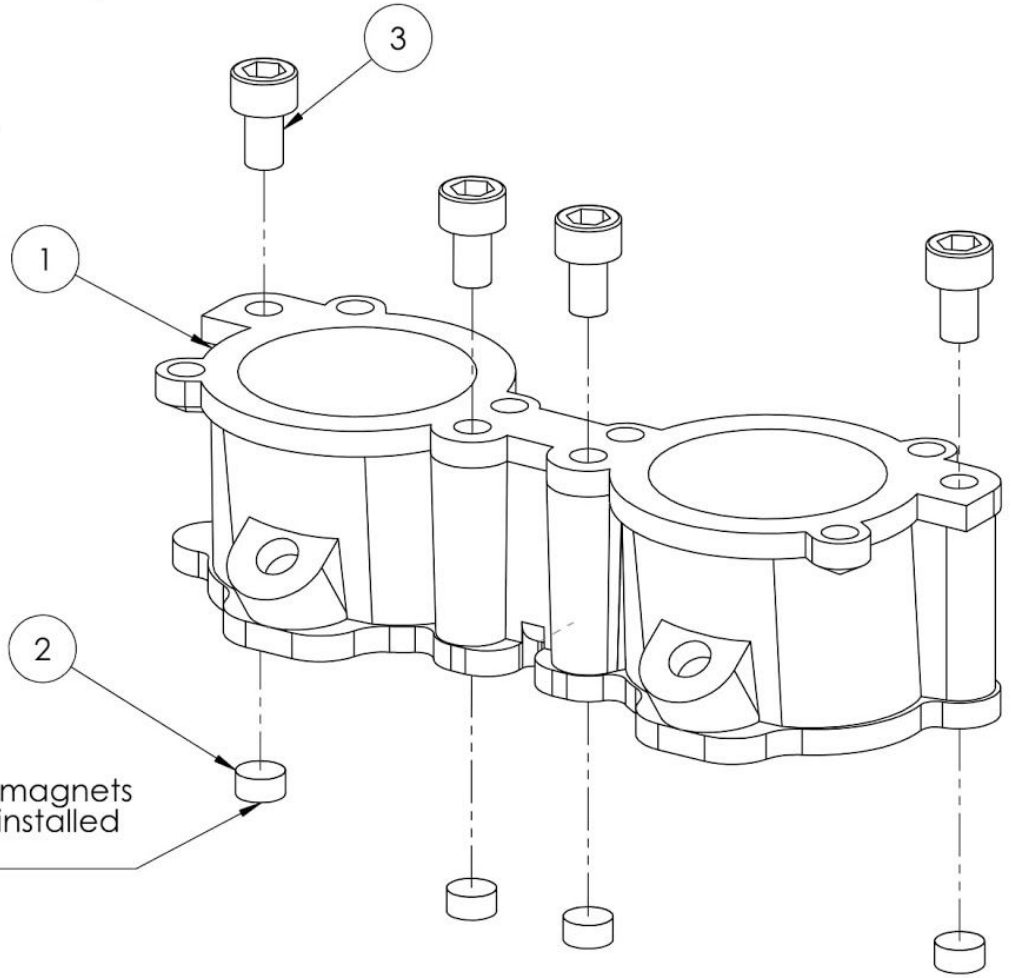
Note: Test fit valve cover on assembled head before gluing magnets.



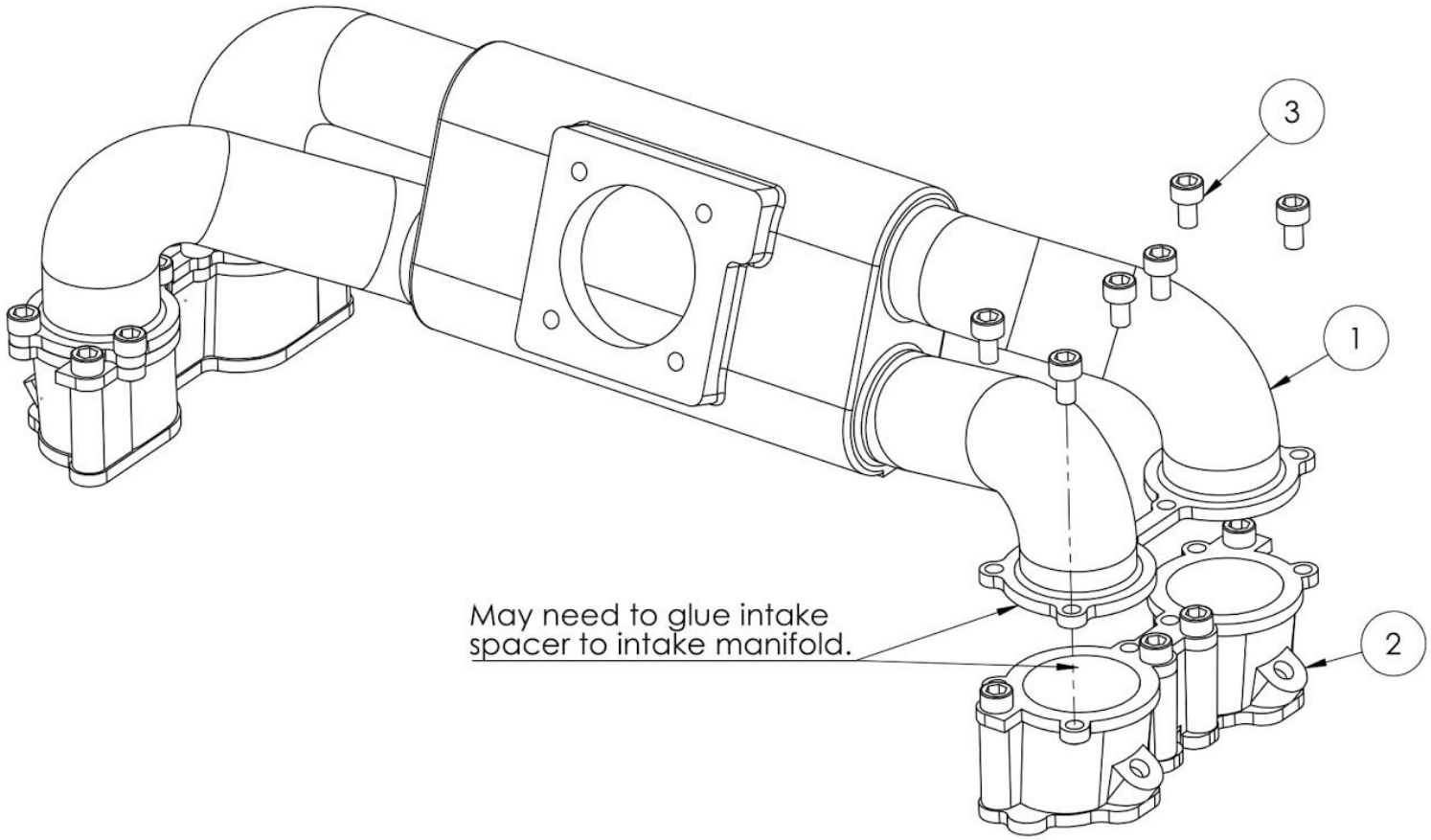


ITEM NO.	PART NUMBER	QTY.
1	Intake manifold spacer	1
2	4mm x 2mm disc magnet	4
3	m3 5mm SHCS	4

Note: 5mm SHCS can be used for oil pump and waterpump if desired.



ITEM NO.	PART NUMBER	Exploded view/QTY.
1	Intake Manifold	1
2	Intake manifold Spacer With Magnets - Cut Away	2
3	m3 5mm SHCS	12



ITEM NO.	PART NUMBER	QTY.
1	oil pan - electric motor - no electronics	1
2	500rpm geared motor	1
3	m3 6mm Button Head Cap Screw	2
4	Oil pan drive gear	1
5	M3 8mm Set Screw	1
6	m3 jam nut	1

Note: Attach oil pan to engine block using 4x2mm magnets and set screws as guides. If planning on mounting to an engine stand, use screws.