

LS9 Crate Engine (19201990) Specifications Specifications Part Number 19242951

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This publication provides general information on components and procedures which may be useful when installing or servicing an LS9 Crate engine. **Please read this entire publication before starting work.**

This LS9 Crate engine is assembled using brand new, premium quality components. Due to the wide range of engine applications, if you are retrofitting a previous application, you may encounter installation differences between the LS9 crate engine assembly and the previous engine. These differences may require modifications or additional components not included with the LS9 engine, including cooling, fuel, electrical, and exhaust systems. Some fabrication work may be required.

It is not the intent of these specifications to replace the comprehensive and detailed service practices explained in the GM service manuals. Reference a service manual for a 2009 Chevrolet Corvette ZR1 (LS9) for any additional information not included in this specification.

For information about warranty coverage, please contact your local GM Performance Parts dealer.

Observe all safety precautions and warnings in the service manuals when installing this LS9 crate engine in any vehicle. Wear eye protection and appropriate protective clothing. When working under or around the vehicle support it securely with jackstands. Use only the proper tools. Exercise extreme caution when working with flammable, corrosive, and hazardous liquids and materials. Some procedures require special equipment and skills. If you do not have the appropriate training, expertise, and tools to perform any part of this conversion safely, this work should be done by a professional.

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	04FE09	Initial Release - Anthony Cubr	

Legal and Emissions Information

This publication is intended to provide information about the LS9 crate engine and related components. This manual also describes procedures and modifications that may be useful during the installation of an LS9 crate engine. It is not intended to replace the comprehensive service manuals and parts catalogs which cover General Motors engines and components. Rather, it is designed to provide supplemental information in areas of interest to “do-it-yourself” enthusiasts and mechanics.

This publication pertains to engines and vehicles which are used off the public highways except where specifically noted otherwise. Federal law restricts the removal of any part of a federally required emission control system on motor vehicles. Further, many states have enacted laws which prohibit tampering with or modifying any required emission or noise control system. Vehicles which are not operated on public highways are generally exempt from most regulations, as are some special interest and pre-emission vehicles. The reader is strongly urged to check all applicable local and state laws.

Many of the parts described or listed in this manual are merchandised for off-highway application only, and are tagged with the “Special Parts Notice” reproduced here:

Special Parts Notice

This part has been specifically designed for Off-Highway application only. Since the installation of this part may either impair your vehicle’s emission control performance or be uncertified under current Motor Vehicle Safety Standards, it should not be installed in a vehicle used on any street or highway. Additionally, any such application could adversely affect the warranty coverage of such an on-street or highway vehicle.

The information contained in this publication is presented without any warranty. All the risk for its use is entirely assumed by the user. Specific component design, mechanical procedures, and the qualifications of individual readers are beyond the control of the publisher, and therefore the publisher disclaims all liability incurred in connection with the use of the information provided in this publication.

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Package contents:

Item	Description	Quantity	GM Part Number
1	Engine Assembly	1	19201990
2	Engine Instructions	1	19242951

Technical Information and Operational Requirements:

Supercharger/Intercooler System:

The LS9 Roots-type supercharger is a positive displacement pump that consists of 2 counter-rotating rotors installed into the lower intake manifold housing. The rotors are designed with 4 lobes and a helical twist. The rotors of the supercharger are designed to run at a minimal clearance, not in contact with each other or the housing and are timed to each other by a pair of precision spur gears which are pressed onto the rotor shafts. The rotors are supported at each end by self-lubricating non-serviceable bearings. The drive belt pulley is pressed onto the input shaft. The input shaft is coupled to the rotor shaft. Both the belt pulley and torsional isolator are also non-serviceable.

The cover assembly has an integrated intercooler. The intercooler uses conventional coolant and must be separate from the engine cooling system. The intercooler assembly includes the cover, two charge air coolers/heat exchangers, a water manifold assembly, two service bleed ports, a factory coolant fill port, and a variety of sensors to monitor air temperature and pressure. The water manifold, located at the front of cover transfers coolant to the cover via four internal transfer tubes. The transfer tubes and water manifold are sealed with O-rings and press-in-place seals. Coolant enters the inlet port of the water manifold assembly, is directed into and through the two charge air coolers/heat exchangers, and exits back into the water manifold. Coolant then exits the water manifold outlet port.

An intercooler cooling system is required to ensure that heat can be removed from the coolant. The system must include appropriately sized lines, radiator, and pump (minimum 5.5 gallons per minute flow rate recommended) to ensure the coolant temperature remains in an acceptable range, especially during high boost operating ranges (i.e. heavy accelerations, high throttle positions, etc). **For optimal performance, it is recommended that the coolant temperature be kept below 95 degrees F at the intercooler inlet. It is critical that this temperature be kept below 175 degrees F for safe engine operation.** Use of production components is recommended whenever possible, a list of these parts is included below.

Fuel System:

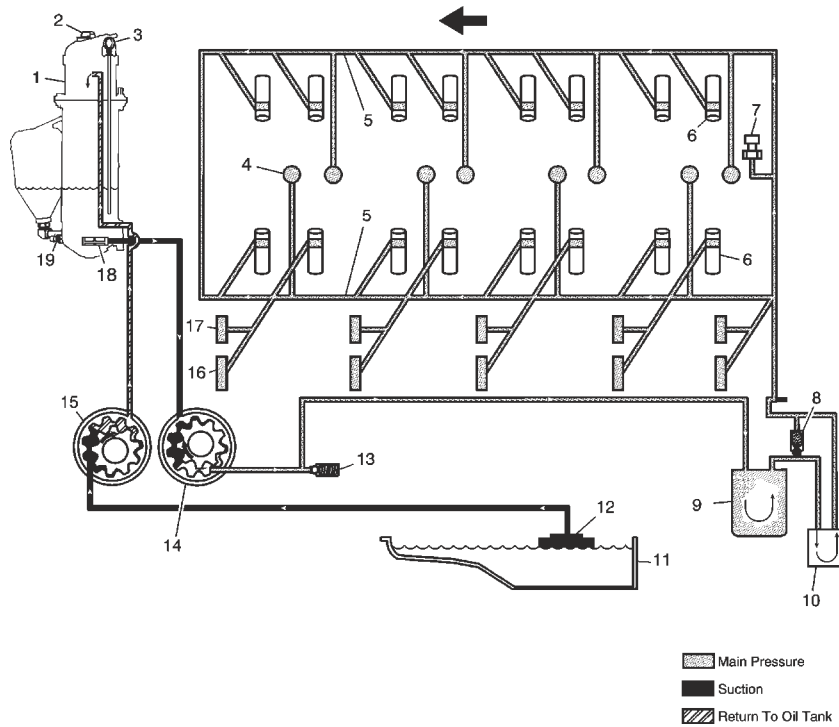
The production LS9 application operates with a variable fuel pressure system to allow for best performance and driveability. By varying the fuel pressure over the operating range, the required high RPM / high throttle fuel flow can be achieved while still providing the ability to maintain excellent mid-range driveability and a smooth idle. Under this system, fuel pressure of 87 psi is delivered at high RPM (above 5200 RPM) and high throttle operation to provide adequate fuel flow. Pressure of 73 psi is delivered between 1500 and 5200 RPM, and 36 psi below 1500 RPM for best idle stability and quality. Additionally, the fuel system must be capable of flowing 75 gph at 87 psi. It is critical that constant 75 gph of fuel at 87 psi be available at high RPM / high throttle operating ranges or performance and/or engine durability will be adversely affected.

Oil System:

The LS9 Crate Engine is configured as a dry sump oiling system (see diagram below). A remote oil tank and appropriate oil lines are required for this type of installation (the production Corvette oil tank is GM part number 12629421 and is shown in the diagram). GM Performance Parts 25534412 is an adapter kit to allow use of AN -12 hoses at the oil pan. Engine lubrication is supplied by a gerotor type oil pump assembly. The oil pump assembly consists of 2 pump housings, 2 separate gear sets, and 1 pressure relief valve. The front or forward gear set is the secondary pump (15). The rear or rearward gear set is the primary pump (14). The pump assembly is mounted at the front of the engine and driven directly by the crankshaft sprocket. The primary pump (14) gears rotate and draw oil from the engine oil tank (3) through the oil tank screen (18). The oil is pressurized as it passes through the primary pump and is sent through the engine block lower oil gallery. Contained within the primary pump is a pressure relief valve (13) that maintains oil pressure within a specified range. Pressurized oil is directed through the engine block lower oil gallery to the full flow oil filter (10) where harmful contaminants are removed. A bypass valve is incorporated into the oil filter, which permits oil flow in the event the filter becomes restricted. Oil exits the oil filter and is then directed to the external oil cooler (1). A bypass valve (9) is incorporated into the oil cooler assembly in the event oil flow within the cooler is restricted. Oil returns from the oil cooler and is directed to the upper main oil galleries (6). Oil from the left upper oil gallery is directed to the crankshaft bearings (16), valve lifters 1, 3, 5, and 7, camshaft bearings (17), and piston oil nozzles 1, 3, 5, and 7. Oil from the right upper oil gallery is directed to the valve lifters 2, 4, 6, and 8 and piston oil nozzles 2, 4, 6, and 8. The piston oil nozzle assemblies are designed to provide oil to the bottom side of the piston for cooling purposes. The piston oil nozzles have an internal check ball that is held in the normally closed position by the spring until system oil pressure exceeds 20.7 kPa (43.5 psi). Oil exits the valve lifters and is then pumped through the pushrods to lubricate the valve rocker arms and valve stems. Oil returns to the oil pan (11), where the secondary pump (15) draws oil through a oil pump screen (12). The secondary pump (15) returns oil to the engine oil tank (3). Incorporated within the engine oil tank assembly are the oil level indicator (4), oil fill cap (5), oil temperature sensor (2), positive crankcase ventilation (PCV) fresh air port, and a serviceable oil pump screen (18). The engine oil pressure sensor (8) is located at the top rear of the engine assembly.

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| 1. Engine Oil Tank | 10. Engine Oil Cooler |
| 2. Oil Fill Cap | 11. Oil Pan Sump |
| 3. Oil Level Indicator | 12. Oil Pump Screen |
| 4. Piston Oil Nozzle | 13. Pressure Relief Valve - Oil Pump |
| 5. Upper Main Oil Galleries | 14. Oil Pump - Primary |
| 6. Valve Lifters | 15. Oil Pump - Secondary |
| 7. Oil Pressure Sensor | 16. Crankshaft Bearings |
| 8. Bypass Valve - Oil Cooler | 17. Camshaft Bearings |
| 9. Oil Filter | 18. Oil Tank Screen |
| | 19. Oil Temperature Sensor |

Accessory Drive

The LS9 Crate Engine requires an accessory drive system. GM Performance Parts kit 19243524 includes all of the 2009 LS9 Corvette accessory drive components, a list of individual components (by part number) is also included below.

Engine Control System

An engine control system is required to operate the LS9 Crate Engine. Check with your GM Performance Parts dealer or gmpartsparts.com for the Performance Parts system as it becomes available.

Additional parts that are needed:

Starter

The LS9 crate engine does not include a starter. GM part number 89017847 is matched to this application and is recommended. See your GM Performance Parts dealer for details.

Air Induction

A high-quality, high-flow/low restriction air filter/cleaner should be used to protect the engine. Additionally, your engine control system may have recommendations for air cleaners and intake systems for best performance.

Start-up and Break-in Procedures

Safety first. If the vehicle is on the ground, be sure the emergency brake is set, the wheels are chocked and the car cannot fall into gear. Verify everything is installed properly and nothing was missed.

1. **This engine assembly needs to be filled with oil.** After installing the engine, ensure the oil system has been filled with the appropriate motor oil to the recommended oil fill level. The LS9 crate engine requires a special oil meeting GM Standard GM4718M (this will be specified on the oil label). Mobil 1 is one such recommended oil. Other oils meeting this standard may be identified as synthetic. However, not all synthetic oils will meet this GM standard. Look for and use only an oil that meets GM Standard GM4718M. If using GM 12629421 oil tank, make sure that the oil level falls within the cross hatched area on the dipstick once the oil is warm. Also check and fill as required any other necessary fluids such as coolant, power steering fluid, etc.
2. The engine should be primed with oil before starting. Install an oil pressure gauge (the existing oil pressure sensor location at the upper rear of the engine may be used) and disconnect the engine control system (removing power from the engine control module is generally recommended, but check your engine control system information for additional details). Note: Disconnecting only ignition or fuel injector connectors is not recommended – make sure the control system will not provide ignition or fuel to the engine.
3. Once the engine control system has been disconnected, crank the engine using the starter for 10 seconds and check for oil pressure. If no pressure is indicated, wait 30 seconds and crank again for 10 seconds. Repeat this process until oil pressure is indicated on the gauge.
4. Reconnect the engine control system. Start the engine and listen for any unusual noises. If no unusual noises are noted, run the engine at approximately 1000 RPM until normal operating temperature is reached.
5. When possible, you should always allow the engine to warm up prior to driving. It is a good practice to allow the oil sump and water temperature to reach 180°F before towing heavy loads or performing hard acceleration runs.
6. The engine should be driven at varying loads and conditions for the first 30 miles or one hour without wide open throttle (WOT) or sustained high RPM accelerations.
7. Run five or six medium throttle (50%) accelerations to about 4000 RPM and back to idle (0% throttle) in gear.
8. Run two or three hard throttle (WOT 100%) accelerations to about 4000 RPM and back to idle (0% throttle) in gear.
9. Change the oil and filter. Replace the oil per the specification in step 1, and replace the filter with a new UPF48R AC Delco oil filter. Inspect the oil and the oil filter for any foreign particles to ensure that the engine is functioning properly.
10. Drive the next 500 miles (12 to 15 engine hours) under normal conditions. Do not run the engine at its maximum rated engine speed. Also, do not expose the engine to extended periods of high load.
11. Change the oil and filter. Again, inspect the oil and oil filter for any foreign particles to ensure that the engine is functioning properly.

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LS9 Engine Specifications

Type 6.2L Gen IV Small Block V8
 Displacement 376 cubic inches
 Bore x Stroke 4.065 inch x 3.62 inch
 Compression 9.1:1
 Supercharger Boost Ratio..... 10.5:1
 Block Cast aluminum, six bolt cross-bolted main caps
 Cylinder Head Cast aluminum rectangle port
 Valve Diameter (Intake/Exhaust) 2.16"/1.59"
 Chamber Volume 68cc
 Crankshaft Forged Steel, internally balanced
 Connecting Rods Forged Titanium
 Pistons Forged aluminum
 Camshaft Hydraulic roller tappet
 Lift562" intake, .558" exhaust
 Duration 211° intake, 230° exhaust @.050" tappet lift
 Rocker Arm Ratio 1.7:1
 Oil Pressure (Minimum, with hot oil) 6 psig @ 1000 RPM
 18 psig @ 2000 RPM
 24 psig @ 4000 RPM
 Recommended Oil 5w30 Mobil 1 motor oil or equivalent (must meet GM4718M
 specification, which will be specified on the oil label)
 Oil Filter..... AC Delco Part Number UPF48R
 Fuel Premium unleaded - 92 (R+M/2)
 Maximum Engine Speed 6600 RPM
 Spark Plugs GM 12571165
 AC Delco # 41-104
 Spark Plug Gap040"
 Firing Order 1-8-7-2-6-5-4-3

Information may vary with application. All specifications listed are based on the latest production information available at the time of printing.

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Recommended Components

Accessory Drive Kit 19243524 (includes the following 2009 Corvette LS9 Components):

Part Number	Name	Qty
12552922	BOLT-A/C COMPRESSOR	1
12556447	STUD-A/C COMPRESSOR	1
11514597	NUT-A/C COMPRESSOR	1
12627522	BELT-A/C COMPRESSOR	1
12623062	TENSIONER ASM-A/C COMPRESSOR BELT	1
11518637	BOLT-A/C COMPRESSOR BELT TENSIONER	1
12568996	PULLEY ASM-A/C COMPRESSOR BELT IDLER	1
12602288	BRACKET ASM-A/C COMPRESSOR	1
11515768	BOLT-A/C COMPRESSOR BRACKET	1
11516360	BOLT-A/C COMPRESSOR UPR FRT BRACKET	1
11098341	BOLT-A/C COMPRESSOR LWR FRT BRACKET	1
89019076	COMPRESSOR ASM,A/C	1
12623061	TENSIONER ASM-DRIVE BELT	1
11515767	BOLT-DRIVE BELT TENSIONER	3
12598653	PULLEY ASM-BELT IDLER	1
12598654	PULLEY ASM-BELT IDLER	1
11588743	BOLT-BELT IDLER PULLEY	1
11518631	BOLT-BELT IDLER PULLEY	1
12627521	BELT-SUPERCHARGER & W/PMP & P/S PUMP	1
25888947	GENERATOR ASM	1
11571051	BOLT-GENERATOR	2
11518630	BOLT-GENERATOR	2
15857665	PUMP ASM-P/S	1
11588733	BOLT-P/S PUMP	2
12625875	BRACKET ASM-P/S PUMP	1
11518634	BOLT-P/S PUMP BRACKET	4
15285644	RESERVOIR, PS FLUID	1

Intercooler Cooling System Components (2009 LS9 Corvette):

Part Number	Name	Qty
15870574	PUMP-INTERCOOLER COOLANT	1
15870557	RADIATOR-INTERCOOLER COOLANT	1
25948317	RESERVOIR-INTERCOOLER COOLANT	1

See your GM Performance Parts Dealer for additional production component information.

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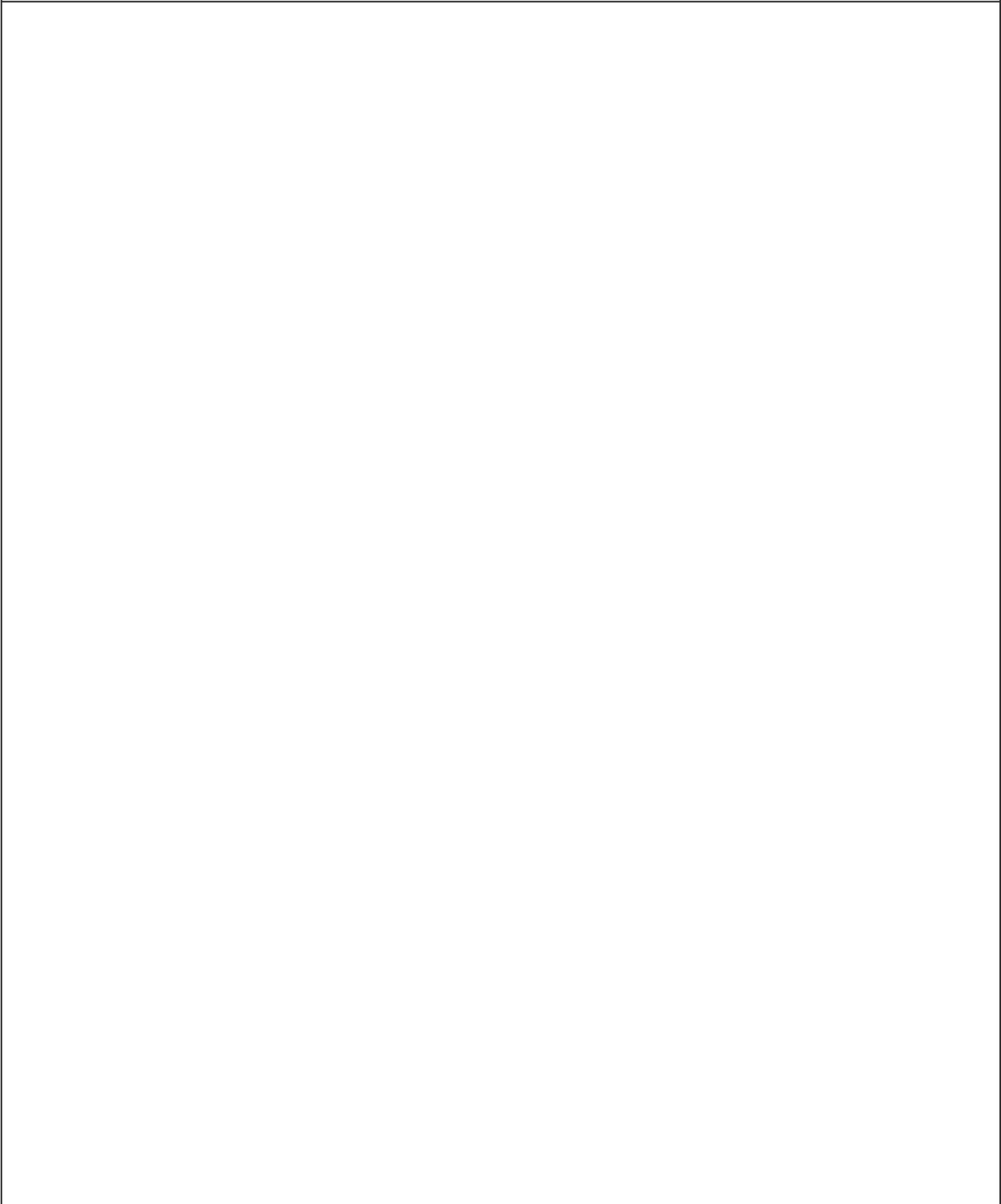
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