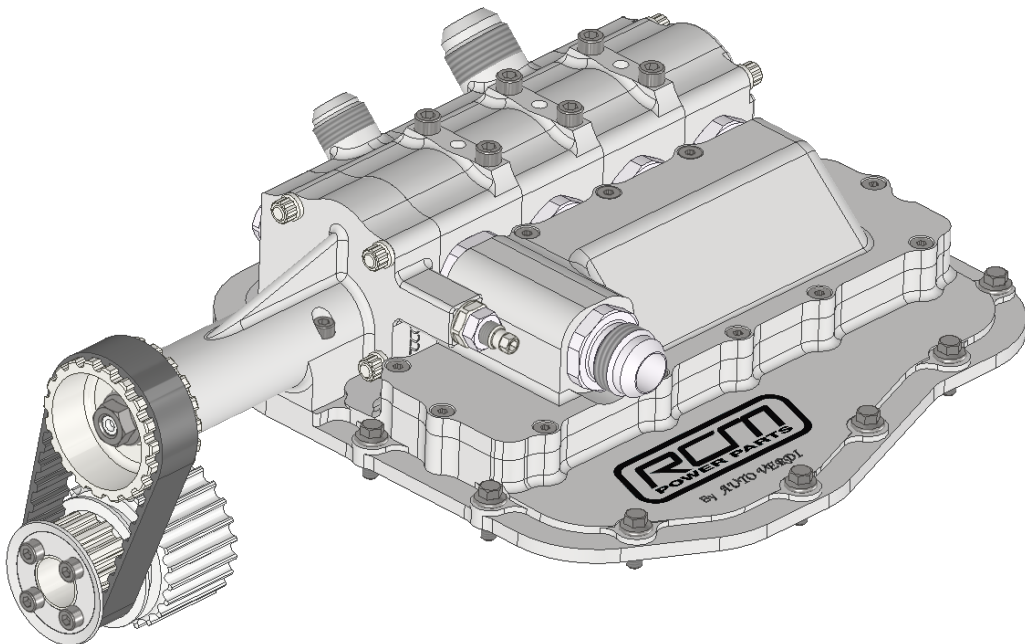




Installation Instructions for RCM Dry Sump System

Subaru EJ20/22/25



Introduction

Thank you for purchasing your new RCM 4 Stage Dry Sump System, the ultimate oiling solution for your EJ Series Subaru engine!

This latest generation RCM dry sump system has been developed with world renowned motorsport engineering specialist Auto Verdi Racing. With multiple NASCAR titles alongside other major championship series already won using Auto Verdi components, this kit provides the same level of performance for your engine as those competing at the very highest level of motorsport.

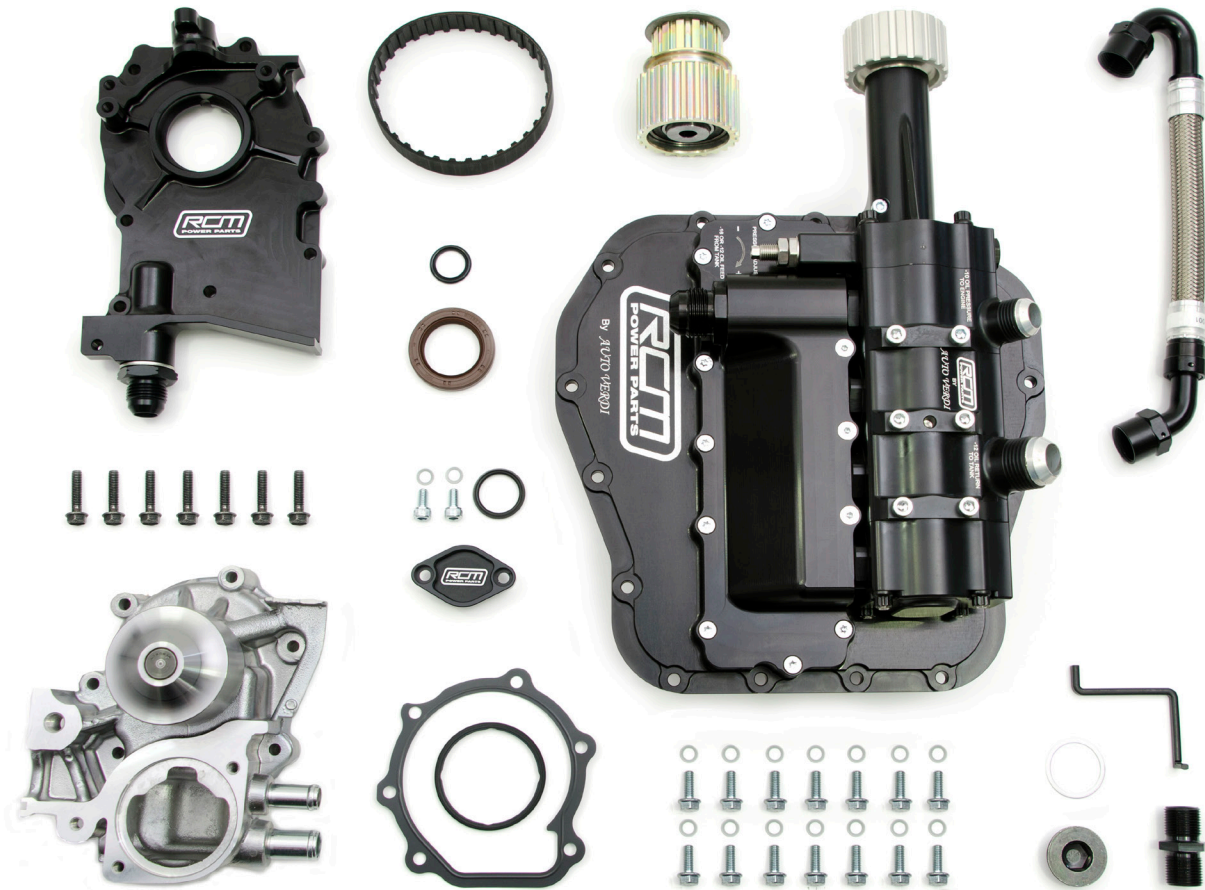
Throughout the 15 year history of our RCM Gobstopper race car programme we have utilised the benefits offered by dry sump oiling systems on the Subaru engine platform. Constantly striving for perfection through extensive testing and development to ultimately improve both the performance and reliability of these systems has now culminated in the release of this new 4 Stage Dry Sump System.

By incorporating 3 ultra-efficient rotor style scavenge stages and 1 spur gear pressure stage neatly packaged in a comprehensive and convenient layout specific to the EJ engine range, we are confident our system not only provides the best in Subaru oiling performance but the most user friendly installation on the market too!

Advantages of this product

- Auto Verdi dry sump oil pumps offer more than just enough oil flow and pressure to your race engine. With lower internal friction losses they take less power away from your engine to run at maximum horsepower. The free horsepower and best available scavenge give your engine every advantage. Use this extra horsepower to get ahead of the competition.
- Housings and scavenge rotors are made out of a very rigid high quality aircraft aluminium alloy. The material allows for a very tight machining tolerances without distortion under maximum loads. The aluminium parts are anodized before PTFE-coating to make for better adhesion and overall running friction.
- Pressure gears are made out of the same quality steel as transmission gears. They are very hard and precision ground to withstand long cycle periods. A DLC coating is also applied for minimum friction.
- Auto Verdi oil pumps have been proven in NASCAR to stand many 500-mile races without maintenance. The rigid construction of our oil pumps makes them very durable in any kind of racing.
- Optional spring kit for wide ranging pressure adjustment RCM3187 available.

Kit Contents



- 1x RCM oil pan fitted with scavenge filters and windage tray
- 1x RCM oil pan O ring and bolt kit
- 1x RCM 4 Stage oil pump
- 1x Dash 10 Oil Feed pipe & fittings
- 1x RCM combined toothed cambelt idler & Oil pump drive pulley (replaces OEM toothed idler).
- 1x Drive belt
- 1x RCM Oil Pump replacement cover.
- 1x RCM Oil Pump replacement cover Male / Male feed adapter
- 1x M22 Dowety Seal
- 1x Front crank oil seal
- 1x Oil Pump cover "O" Ring
- 7x RCM Oil Pump replacement cover bolts
- 1x Male / Male Oil Cooler Modine delete adapter
- 1x Cylinder Block Water Gallery Blank
- 1x Cylinder Block Water Gallery Blank Gasket
- 1x Water Pump
- 1x Water pump gasket
- 1x Water pump casting seal
- 1x Thermostat seal
- 1x RCM Oil Filler Neck Delete Plate
- 1x Timing Belt Cover Modification template
- 1x Oil Filler Neck blanking plate & screws
- 1x RCM High Performance Oil Filter

Torque Settings

- Water pump -10N/m
- Oil pump blank -10N/m
- Sump plate -10N/m
- Oil pump to sump plate -10N/m
- Oil filter adapter -40N/m
- Male/male cover adaptor -40N/m
- Toothed drive pulley -35N/m
- Drive pulley guide plate -8N/m

Installation

The operation of the RCM dry sump system relies on it being correctly plumbed in with the components supplied in the kit, in conjunction with a suitable good quality tank with some provision for air/oil separation.

Key Kit Components

- Oil Supply line from Tank - De-aerated oil from the base of the tank is drawn along the oil feed line to the inlet of the high pressure stage of the pump. This is marked on the pump as “-12 Oil supply from tank”. The line should be a minimum of -12 JIC (3/4”) but for long lines -16 (1”) may need to be considered.
- Oil Pressure line to Engine - Oil from the high pressure stage of the pump is fed to the oil pump replacement cover, directed through the block via an internal oil gallery to the oil filter, then into the engine at system pressure. -10 JIC is used. This is marked on the pump as “-10 Oil Pressure to Engine”.
- Oil Return line to Tank - Oil and air scavenged from the oil pan is fed along this pipe at low pressure to the oil cooler and then back to the top of the oil tank. A -12 JIC line is used. This is marked on the pump as “-12 Oil return to tank”.
- Oil cooler - An oil cooler of suitable size for the application can be used in the feed (option 2) or return line (option 1). Please refer to the diagram overleaf for the relevant pipework layout for each option.
- Oil Tank - This acts as the reservoir for the oil and is also used to separate air from the oil once returned from the engine.
- Breather lines - The engine breathes into the top of the dry sump tank, allowing any oil to be separated. X2 12mm lines from each head “T’d” together and a single 16mm line from the block breather. The dry sump tank also then breathes to atmosphere.

Oil Tank Notes

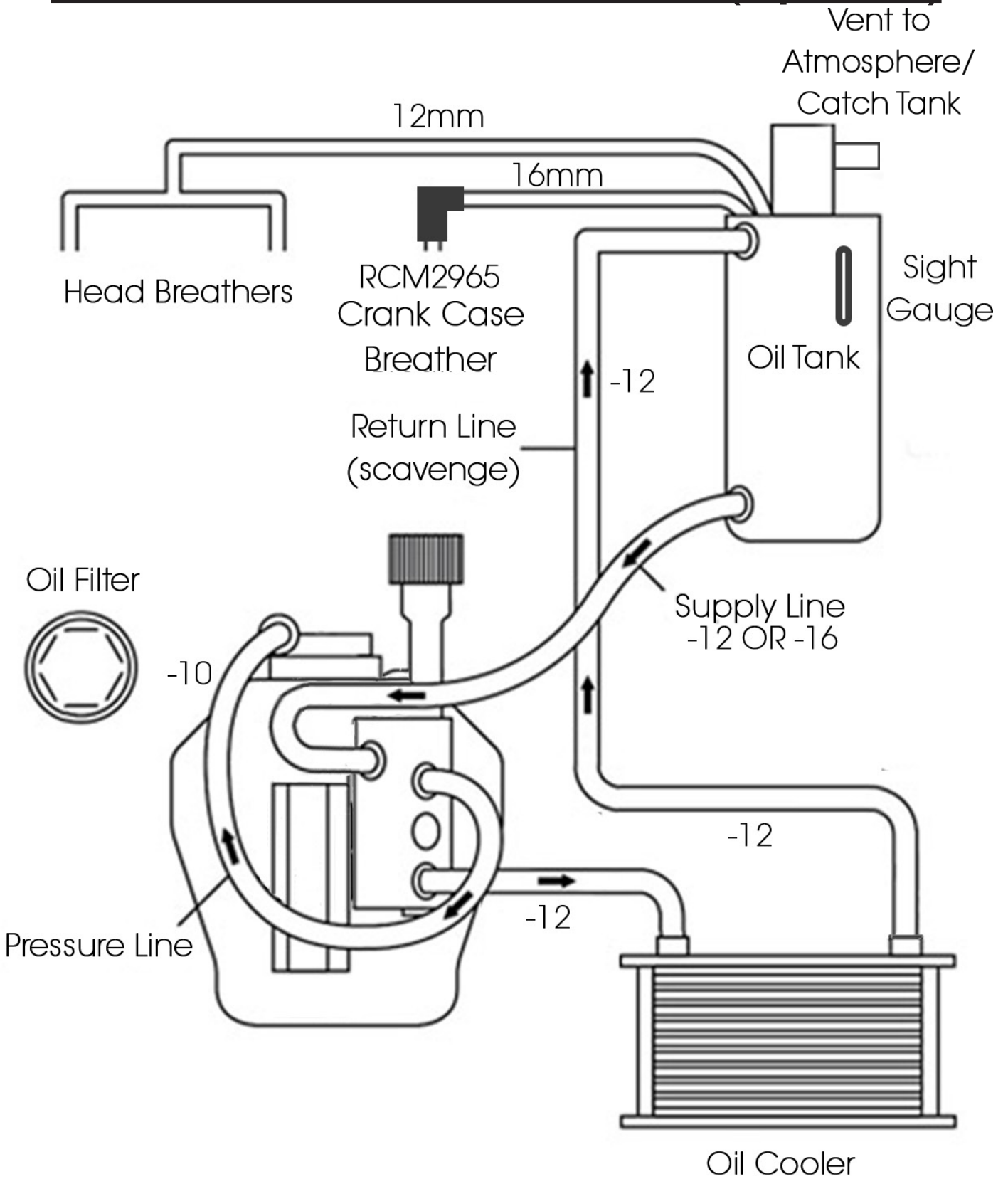
The oil tank is a key component of the dry sump system, but does much more than just store the oil. The oil returned to the tank will be highly aerated especially when oil temps, RPM and cornering forces are high. The oil tank therefore is used to separate the air from the oil and let it escape via the oil tank’s own breather. Dry sump oil tanks use a fast swirling action combined with a baffle plate. The swirling motion uses centrifugal forces to separate the bulk of the air, and the baffle plate then helps smaller bubbles propagate out of the thin layer of oil running over it.

*****IMPORTANT*****

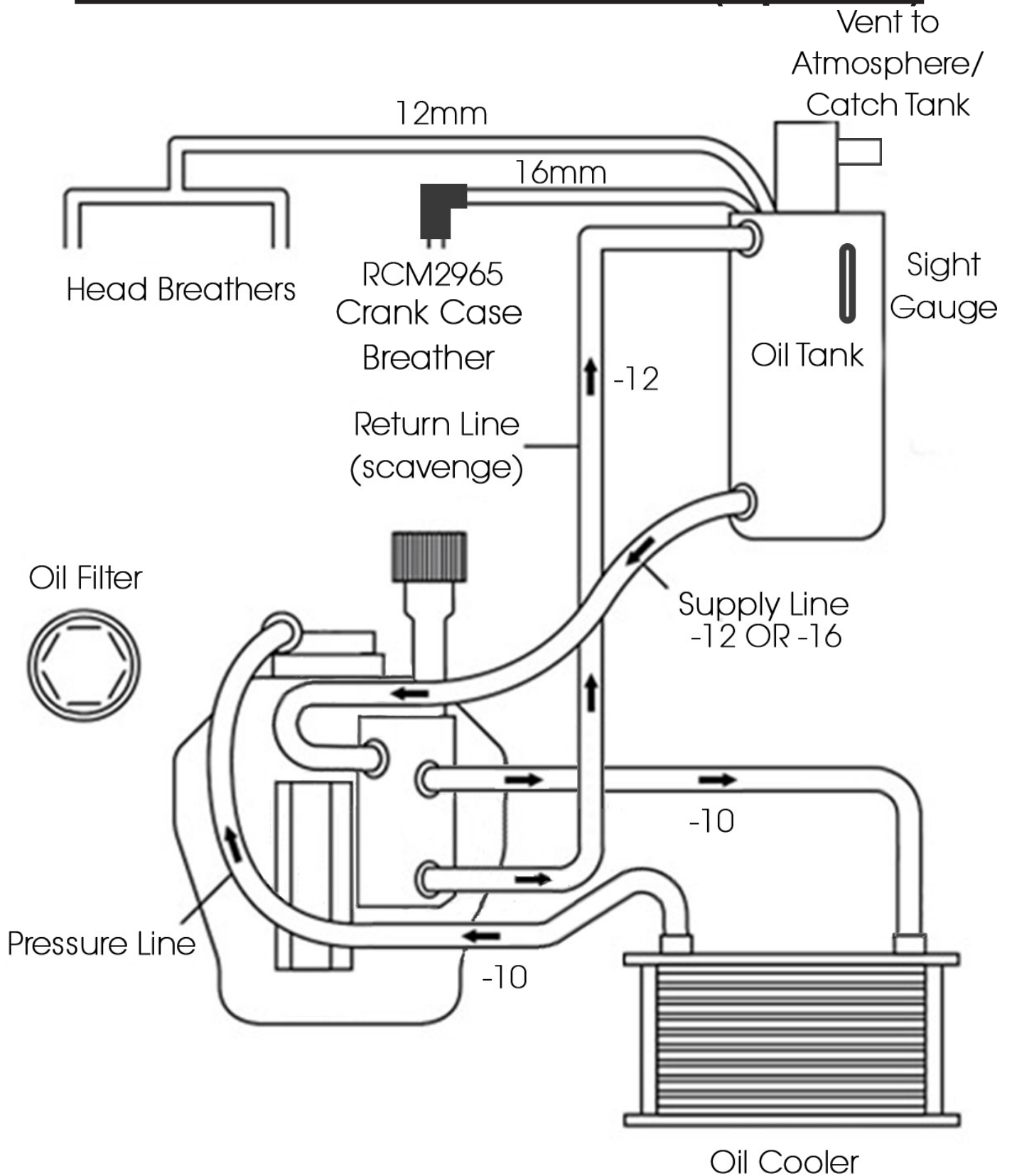
ALL DRY SUMP TANKS REQUIRE A VOLUME OF AIR TO FUNCTION PROPERLY! THIS IS APPROXIMATELY $\frac{3}{4}$ OIL TO $\frac{1}{4}$ AIR SPACE!

This means that you can easily overfill your oil tank. The correct level for most dry sump oil tanks is just below the top baffle plate when the oil is hot and the engine is running. Typically when using the RCM Dry Sump System with the RCM tank supplied, around 8 litres of oil in total would be required.

Oil Cooler fitted to Return Line (Option 1)



Oil Cooler fitted to Feed Line (Option 2)



Due to pressure drop across the oil cooler core, you will get approximately 0.5 bar less oil pressure when using this configuration (Having the oil cooler on the pressure side)

Prime engine with pump only

- The oil system can be primed without turning the engine. To do this ensure the drive belt has NOT been fitted.
- Ensure system is correctly plumbed in, and oil is present in the oil tank at the correct level.
- Using an air ratchet or battery drill with a 15mm socket you can carefully drive the dry sump pump clockwise. DO NOT USE IMPACT GUNS.
- After around 15 seconds you should see oil being recycled through the system. Oil returning to the tank is visible through the dry sump tank oil filler cap when removed.
- Re Check the oil level once the above procedure has been completed.

Fit drive belt

- You can fit the drive belt by sliding it on without the flange in place.
- Once the belt is fitted, place the flange on the drive pulley and secure with two M5x35 cap head bolts, fitted with mild threadlock.

Final checks

- Dry crank the engine, check the drive belt runs true and that oil pressure is present.
- If oil pressure is present, start the engine and let fast idle; ensure oil pressure is at least 3 bar at low speed; if not stop engine immediately.
- Use the following guidelines as a starting point for optimal oil pressure.
 - 1200rpm - low idle 4 – 7 bar cold 2 – 3 bar hot
 - 2500rpm - fast idle 5 – 8 bar cold 4 – 5 bar hot
 - 6000rpm - N/A cold 5 – 6 bar hot
 - 7500rpm - N/A cold 5.5 – 6 bar hot
- Setting the oil pressure for your particular engine is an essential part of the overall installation. You can adjust the threaded preload screw on the side of the oil pump (with locknut). As a starting point we have pre-set the pressure relief valve adjuster to give approximately 6 bar of oil pressure but this may vary from engine to engine depending on bearing clearances and other variables such as the use of under piston oil jets and oil controlled VVT systems utilised on certain EJ engine variants.

Ideal oil pressure recommendations

- Your final oil pressure should be determined using the oil you intend to use. The nature of the dry sump system means less oil pressure (compared to a normal wet sump systems) is required to ensure good oil supply throughout the engine. Wet sump systems suffering from low oil pressure due to surge, they do so because the oil is full of air bubbles. This foamy oil is not good for bearing life, as such, constant oil pressure on a dry sump system is ensuring good quality oil to the engine at all times.
- With your chosen oil, you should be able to get the oil temperature up to around 90°C and check the pressure at 7000rpm. We recommend a minimum of 5 bar and a maximum of 7 bar. Most applications should target 6 bar at 7000rpm with hot oil.
- Recommended Oil Type – We recommend Motul 15W/50 V300 or Castrol Edge 10W/60.

FAQ

- **Where can I put the oil tank?**

The oil tank can be located anywhere within the car. The oil tank we provide in our RCM under bonnet installation kit options (RCM2670 for GC8 models or RCM3300 for GDB models) is designed to fit in the engine bay of RHD vehicles. However, with the correct hose sizing, our in car split oil tank (RCM2041) can be used pretty much anywhere in the car. We have proven examples of engine bay, passenger foot-well and boot mounted systems.

- **How often should the belt be replaced?**

There is relatively little load on the belt, but we would recommend replacement once a year, or sooner based on periodic inspection of the belt.


- **Are there any other parts that wear or require periodic maintenance or replacement?**

The pickup filters in the sump pan should be cleaned periodically.
Pump drive pulleys inspected for wear and replaced as necessary.
Pump drive belt inspected for wear and replaced as necessary.

- For heavier oil pressure relief springs, use RCM3187. The pump is fitted as standard with the blue spring.

Spring Colour

Yellow	Soft
No Colour	
Black	
Green	
Red	
Blue	
Silver	
Gold	
White	Hard



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