

# Measurement Of Retained Oil in MAC Compressor

Vishalsingh Rajput<sup>1</sup>, Shivani Hagawane<sup>2</sup>, Sonika Walunj<sup>3</sup>, Prasad Alhat<sup>4</sup>, Rajiv Mane<sup>5</sup>

<sup>1,2,3,4,5</sup>Mechanical Department, N.M.I.E.T, Maharashtra, India.

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**Abstract** - In conventional method, we cannot measure the oil in separate parts of Mobile Air Conditioning (MAC) system. In this method, oil and refrigerant from the MAC system is recovered by using recovery and recharging machine. Then the oil gets separated in machine using oil separator. After separation of oil and refrigerant, quantity of oil is measured. In this method we cannot measure oil separately in the compressor.

In this paper, we have developed a method on vehicle level for measuring the quantity of retained oil in compressor by adopting ball valves in the circuit before and after compressor.

The major advantages of this project is, we can measure the retained oil in compressor which was not possible by the conventional method.

**Key Words:** Compressor; valves; adapters; unions; oil; oil balancing.

## 1.INTRODUCTION

Refrigerant and oil are circulated through the components of HVAC system. Oil is used to reduce the wear of the moving parts of the compressor. Optimum oil retention is necessary for proper compressor operation; however, it is difficult to know where the oil gets accumulated in an actual system. In hermetic and semi hermetic compressors, minimum quantity of oil must be maintained for proper lubrication and safe working of compressor.

In air conditioning system, oil is an important factor. Oil is used for lubrication purpose in compressor of the system. But some oil mixes with the refrigerant in the system. For proper working of compressor, oil is required for proper lubrication to avoid damage & failure. For this we must know the optimum oil quantity required in the compressor. As mentioned in the title we have to measure the quantity of the oil in compressor. In conventional method, we cannot measure the oil in separate parts. So to overcome the drawbacks of this method a new method is developed that can measure the accurate oil quantity present in compressor when the vehicle is run and parked for a long time.

Amount of oil in each of the major components of an R134a Air conditioning system can be measured by following three methods described as: "remove and weigh", "Flushing" and "Mixing and sampling". This paper is based on remove and weigh technique. [1]

## 1.1 Existing Method

The existing method includes flushing. In this technique a chemical solvent or a refrigerant is used to force it to the HVAC system so that the solvent removes the lubricant. The solvent is extracted and lubricant is then separated determining its amount. The recycling device fills a section with liquid phase R134a, circulates the R134a and lubricant mixture, recovers the mixture, and then separates the lubricant and purges it into the vessel. Experimenting with such a commercial recycling device demonstrated that it is effective in removing lubricant from a section. It is found that amount of lubricant extracted from the recycling device does not match with the amount of lubricant filled in after one flush. The disadvantage of this technique is that it is incapable of completely remove the solvent-oil mixture, so the process must be repeated until an acceptably small quantity of oil is found from the last flush. An uncertainty of  $\pm 15g$  for more than 100g of lubricant in a section was found while using recycling device.[2]

## 1.2 Proposed Method

This method includes modifying the suction and discharge pipes of the compressor. Compressor is isolated with the help of two ball valves at each side. Combined weight of valves, compressor, suction and discharge side and other small components must be known for oil balancing. At the desired test condition valves are simultaneously closed. As the compressor is now isolated from its surrounding, it may be removed and weighed. After the removal of refrigerant from the compressor, the combined weight of compressor and oil is measured. The difference between this weight and weight of empty compressor is the weight of the oil.

## 2. SCHEMATIC LAYOUT

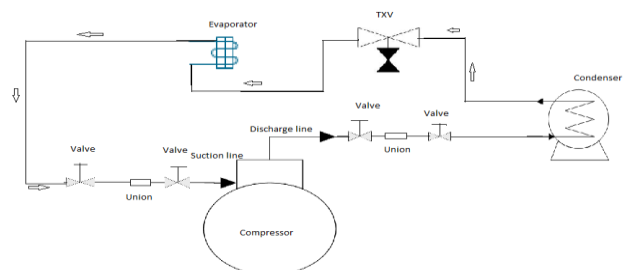


Fig - 1: Schematic layout of modified setup

### 3. OPERATING PROCEDURE

As per the aim, a condition was developed where a vehicle is started after a long period of time and accordingly following procedure was carried out.

- For installing the modified setup, the suction line & discharge line from the vehicle was removed.
- The dimensions of the default setup were taken to design the new setup accordingly.
- A rough setup was made according to the dimensions of the default setup.
- The positioning of the entire setup including valves, adapters and unions were finalized.
- The actual setup preparation was started.
- The nearest possible position of the valves from the compressor was fixed to prevent the leakage of gas while removing the compressor. Minimum distance was kept between the two valves. The unions were placed between the two valves for separating the rest of the setup with the compressor.
- According to the finalized positions of valves and adapters, the required length of pipe was cut.
- Adapters & unions were brazed with the cut portion of pipe and further the valves were fitted to them.
- After brazing, the Teflon seals were inserted at the inner portion of the valves and on that rubber O-rings were rested.
- Teflon tape was wrapped on threading of the adapters to prevent leakage.
- The discharge pipe was re-routed for accommodation of valves.
- In this way setup was made.
- The compressor was removed.
- Weight of empty compressor was taken.
- Weight of suction & discharge side setup was taken.
- Total setup weight (suction side, discharge side & compressor) was taken.
- 100 ml oil was filled in the compressor.
- The total setup weight with oil (suction side, discharge side & compressor) was taken.
- The total setup was installed on the vehicle.
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- 600 g of refrigerant was charged in the vehicle.
- The vehicle was run for 10 km and kept idle with AC on for 2 hours.
- The vehicle was then parked for 15 days.
- After 15 days, the compressor was removed by closing the valves.
- Then the total setup weight was taken.
- The refrigerant was recovered from the setup & then again the total setup weight was taken.
- Then the remaining oil & refrigerant was recovered from the MAC system using recovery & recharging machine.

- Flushing of the MAC system was done using the recovery and recharging machine & oil was recovered.
- The verification of readings were done.



Fig - 2: Original System

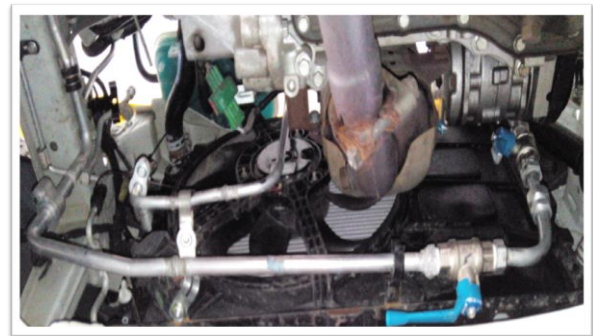


Fig - 3: Modified System

The above procedure was followed & accordingly the readings were taken & the following results were obtained. After performing two iterations as explained in procedure the results obtained are as follows.

A) iteration 1:

oil remained in system was 80ml  
and oil retained in compressor was 20 ml

B) iteration 2:

oil remained in system was 81ml  
and oil retained in compressor was 19ml.

Table -1: Result Table

Iteration no.	Description	Weight in gram
1	Retained oil in compressor after first test	20
2	Retained oil in compressor after second test	19

#### 4. CONCLUSION

1. A method has been developed which is capable of accurately measuring the amount of oil retained in compressor.
2. The Valve technique allows the mass of oil in a component to be determined in a fundamental manner without having to completely flush all oil from complicated geometries.
3. According to the health test taken, there was no effect of the modified setup on AC performance of the system.
4. From the result table, we concluded that around 20 gm oil is retained in compressor and around 80 gm oil remains in other MAC system.

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