

# A Review on Filter Regulator Lubricator

S. Kennedy, Department of Mechanical Engineering,  
Galgotias University, Yamuna Expressway  
Greater Noida, Uttar Pradesh  
Email ID: kennedy.s@Galgotiasuniversity.edu.in

**ABSTRACT:** *Filter Regulator Lubricator (FRL) is a combined unit which performs three functions to clean, control pressure and lubricate the air. A number of units are available varying in the type of filter, regulator and lubricator used in the unit wherein each has its own merits and demerits. In this paper different types of FRL components are discussed which are present till date. FRL is mainly used for industrial purposes to provide clean air used in different tools used in the industry that are operated upon air pressure known as pneumatic tools. This unit is necessary as it cleans the air because compressed air coming from the compressor contains a number of undesirable particles, oil, moisture etc. which can damage the tools and the pipeline through which it passes. Thus this review will help to understand the importance of the FRL unit in the industry more specifically for those where pneumatic tools are used. These tools are operated with this compressed high pressurized air and this compressed air is filtered with this FRL unit before reaching the tools to protect the operator from the harmful effects of the unfiltered air.*

**KEYWORDS:** *Boiling Point, Dew Point, Filter Regulator, Freezing Point, Lubricator, Moisture, Pneumatic, Purge air.*

## INTRODUCTION

Filter, Regulator, and Lubricator (FRL) is a combined unit that is used to deliver clean air, at a fixed pressure, and lubricated (if needed) to ensure proper pneumatic component operation and increase their operation for a long time. The air supplied by compressors is often contaminated, over pressurized and non-lubricated meaning that an FRL unit is required to prevent damage to equipment[1]. Filters, regulators, and lubricators can be bought individually or as a package depending on what is needed to ensure the proper air specifications are being met for downstream equipment. It is recommended to install these devices while using pneumatic tools and equipment; installing an HVAC system; clean air is required at your facility or workplace; requirement for compliance to ISO, OSHA, ASHRA or other air quality standards; need to improve the service life, safety and reliability of your air system.

### Working of FRL

An FRL unit is comprised of a filter (F), regulator (R), and a lubricator (L). They are often used as one unit to ensure clean air in a pneumatic system but can also be used separately depending upon the requirement because sometimes we need to use 2 units or one unit[1].

*Filter (F)* – Filter removes water, dirt and other harmful debris from an air system. This is often the first step in improving the air quality. To remove the micron and sub-micron particles present in the entering air of compressor[2]. It is used to separate out contaminants like dust, dirt particles from the compressed air.

*Regulator (R)* – Regulators adjust and control the air pressure of a system to ensure that down-line components do not exceed their maximum operating pressures. This is the second step in the FRL system. In pneumatic system the pressure of compressed air may not stable due to possibility of line fluctuation. Hence there is a need to maintain and regulate the air pressure. This function is performing by regulator.

*Lubricator (L)* – Lubricators reduce the internal friction in tools or equipment by releasing a controlled mist of oil into the compressed air. This is often done last and/or right before the component needing lubrication. Sliding components like spool, a pneumatic cylinder has sliding motion between parts. It may cause friction and wear and tear at mating parts. To reduce friction, lubricating oil particles are added in the compressed air with the help of lubricator.

### Selection of FRL unit

There are varieties of FRL units available and the selection of the particular type of FRL is made on the basis of the four main parameters which are: environment, type of FRL, thread size and the tool's air flow requirements. Now after selecting the specific kind of FRL unit there is need to achieve the best

performance of the pneumatic tool because of the airline setup[3]. To achieve the best performance the following points that needed to be kept in mind.

- a.) To achieve the best performance from the pneumatic tool, it is ensured to use particular FRL unit for a single tool because using more than one tool on the single FRL unit can decrease the air pressure for both the tools that is required and the lubrication of the air will also get decreased which can also damage the tool.
- b.) FRL unit must be mounted as close as much possible to the pneumatic tool of the pneumatic system so that require amount of lubrication can reach the tool or the system and there is also no loss of pressure
- c.) Oil level of the lubricator is always checked either during operation or before starting the use of the pneumatic tool. The oil level must be top up to the required level and the oil used must be of the recommended quality.
- d.) The inside filters of the unit must be maintained in proper condition on the regular basis. Their maintenance also depends on the usage and the above four mentioned parameters which decide the selection of the FRL unit.

### **Filtration of the compressed air**

One cubic foot of compressed air can contain millions of dirt particles, considerable amounts of water and oil — and even heavy metals like lead, cadmium and mercury. If they are not filtered out, trouble-free operation of the system components, like valves and cylinders, cannot be guaranteed in the long term. Poorly prepared compressed air can contaminate control valves, and causes the seals to swell and wear prematurely. As a result, the right amount of compressed air preparation is essential for reducing machine downtime, and for reducing maintenance and energy costs[4].

Filtration of the compressed air is also required because it is used for the operation of the pneumatic tools, cleaning the surfaces, cleaning the components and all this work is done most of the time with the bare hands means there is direct contact of the compressed air with the skin of the person and thus if compressed air is not cleaned properly before using then it will surely affect the skin of the person carrying out the above operations. If unfiltered air falls on skin of a person it may lead to skin problems due to the presence of harmful germs particles in the air. Filtration of the air required because unfiltered air contains dust particles of variable size and the compressed air also passes at very high pressure which can damage the tools or can decrease the life of the tools by depositing the dust particles in the tools. So, it can be said that the use of the unfiltered air can increase the maintenance cost of the tools.

### **Importance of lubricator in airline**

It is the lubricating part of the airline system and it help in increasing the life of the tools and airline which remains under the constant pinging of the high pressure compressed air. This high pressure compressed can make the tools and the airline rough so to make them smooth in working there is requirement of the lubricator unit or in short it reduces the friction of the components. Most of the tools, pneumatic motors, cylinder, valve or any other pneumatic tools needs the lubrication for their long life[5]. There is need of one time setting to release the required amount of lubricant to be released for the lubrication of the tools and the airline and this unit also solves the conventional problems associated with the pneumatic tools due to the use of the grease oil or gun which were supplied manually or has to be carried with the tool to be used and there was not a fixed quantity of oil to be supplied but this unit supplies the metered amount of the lubricant to the tools neither less nor more.

### **Types of Filters and Air Treatment Equipment**

There are different types of air treatment components for removing contaminants, such as solid particles, liquid water, water vapor and oil vapors, odorants, and even bacteria and viruses. For most automation applications, the focus is to remove solid particles and water. Water Separators remove condensate, either with a centrifugal design or a coalescing principle. A centrifugal separator causes a rotary motion in the air, forcing particles to accelerate in a radial outward movement. Once they reach the outside, they drain into the bowl. These are effective for removing water droplets, as well as dust and dirt particles larger than 5 microns in size[6]. No maintenance is required for this process.

## Types of Pressure Regulators

Pressure regulators reduce and control air pressure in compressed air systems, including rotary screw air compressors. Regulators are also frequently known by PRVs (Pressure reducing valves). A pressure regulator maintains a constant pressure regardless of variations in the input and downstream flow requirements[7]. Pressure regulators are used to control pressure of: Air tools, blow guns, air gauging equipment, air cylinders, air bearings, air motors, spraying devices etc. In general purpose is relieving or non-relieving. Relieving regulators can be adjusted from high to low pressure. Main purpose is that that allow the excess downstream pressure to be exhausted and causes a loud hissing sound while non-relieving don't allow the downstream pressure to escape instead the trapped air will need to be released in some other way by operating a downstream valve.

A lubricator adds controlled quantities of tool oil; into a compressed air system to reduce the friction of moving components to add the life of attached pneumatic tools. It solves the problem of conventional grease gun or oil methods providing either too much or too less oil because it provides optimal quantity of oil to the air[8]. Once the lubricator is adjusted an accurate metered value of oil will be transferred each time. Adding lubricator also washes away compressor oils that travel through the system in vapor form. Lubricators are available in 2 types:

- Oil fog
- Micro fog

Oil fog lubricators are used for heavy applications such as single tools, cylinders and valves while micro can be used for multiple applications. In oil fog all the oil droplets are visible in the sight dome are added directly into the air flow while in micro fog oil droplets visible in the sight dome are atomized and collected in the are above the oil in the bowl.

## CONCLUSION

The present study briefly focuses on filter regulator lubricator unit along with its constituents. Different combinations of the three units of FRL can be made as per the specific requirement of the industry like if a line is supplying the compresses air then the air can be made to pass through all the three combined units. But for the further extension, there is no need to filter the filtered air, but the air can again be regulated and lubricated for the specific requirement relative to the type of application and requirement or need is there for use. Each component has its specific importance for the specific purposes and the cost factor also decides the use of the particular unit[9]. Some industries from the cost point of view uses the most required component of the FRL unit and thus drops the idea of using the other units. But it is always recommended to use the FRL unit while using airline system to protect the longevity of the pneumatic tools and health of the workers using the tools. If quality of air supplied is good it will not affect the worker but if it is of bad quality, it can cause skin problems or may be other problems. Like machines, tools and other infrastructure are the assets of an organization, workers or employees are also an asset of the organization. Different combination can be made depending upon the use and economic factor of the organization.

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