

**MG set and rotary converter and inverter**

**Objectives:** At the end of this lesson you shall be able to

- list the advantages of direct current over alternating current
- list the methods of converting AC to DC
- state the advantages and disadvantages of MG-set
- describe the rotary converter construction and its working.

The AC system has been adopted universally for the generation, transmission and distribution of electric power. It is more economical than a DC system of generation, transmission and distribution. There are applications where DC is either essential or more advantageous over AC.

DC is essential in the following applications.

- Electrochemical process such as electroplating, electro-refining etc.
- Storage battery charging.
- Arc lamp for search light and cinema projectors.

Direct current is more advantageous in the following applications.

- Traction purposes - DC series motor.
- Operating telephones, relays, time switches.
- Rolling mills, paper mills, elevators where fine speed control, frequent starting against heavy torque and rotation in both directions are required, DC motors are more suitable.

The conversion of AC to DC has become a necessity due to the above reasons.

**Methods :** The methods of conversion of AC to DC

- Motor-generator set
- Rotary converter
- Mercury arc rectifier
- Metal rectifiers
- Semi-conductor diodes and SCR

Out of the above five the motor generator sets and semi-conductor rectifiers are now mostly in use. The other types have become obsolete for obvious reasons.

**Motor generator set :** It consists of a 3-phase AC motor directly coupled to a DC generator. In the case of larger units, the AC motor is invariably a synchronous motor and the DC generator is usually compound.

**Advantages**

- 1 The DC output voltage is practically constant. The output (DC) voltage is not affected by changes in AC supply voltage.
- 2 DC output voltage can be easily controlled by the shunt field regulator.

- 3 The M.G set can also be used for power factor correction, where synchronous motor is used for driving the generator.

**Disadvantages**

- 1 It has a comparatively low efficiency.
- 2 It requires more floor space.

**Rotary or synchronous converter**

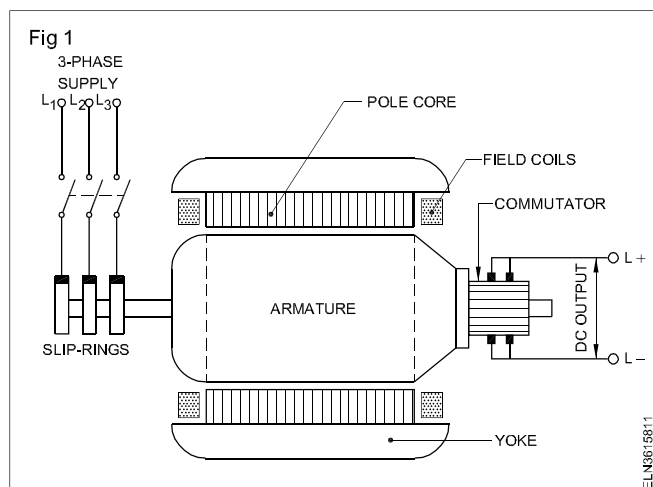
A rotary converter is used when a large DC power is required. It is a single machine with one armature and one field. It combines the function of a synchronous motor and a DC generator. It receives alternating current through a set of slip rings mounted on one side of the armature rotating synchronously ( $N_s = 120 f/P$ ) and delivers direct current from the opposite end through the commutator and brushes.

**Construction :** In general construction and design, a rotary converter is more or less like a DC machine. It has interpoles for better commutation. Its commutator is larger than that of a DC generator of the same size because it has to handle a larger amount of power.

The only added feature are -

- a set of slip-rings mounted at the end opposite to the commutator end
- dampers in the pole faces as in a synchronous motor.

A simple sketch illustrating the main parts of a rotary (synchronous) converter is shown in Fig 1.



The fact that the emf induced in the armature conductors of a DC generator is alternating and that it becomes direct (unidirectional) only due to the rectifying action of the commutator, the slip-rings are to be connected to some suitable points on the armature winding to use this machine as an alternator.

The rotary converter armature is mostly lap wound. The number of parallel paths in the armature is equal to the number of poles. Therefore the number of equi-potential points on the armature is equal to the number of pairs of poles. The number of tapings taken to each slip-ring is, therefore, equal to the number of pairs of poles. For a 3-phase lap wound rotary converter, it is essential that the number of armature conductors per pole should be divisible by 3.

**Operation :** In its normal role, the machine is connected to a suitable AC supply through the slip-rings and it delivers direct current at the commutator. In this application

the machine runs as a synchronous motor receiving AC power from the slip-ring side and as viewed from the commutator end, it runs as a DC generator delivering DC power.

**Mercury arc rectifier :** In general, a rectifier may be defined as a device which converts a fluctuating current of zero mean value (alternating current) into a fluctuating current of finite mean value (direct current). It is a device for converting AC to DC.

It has many advantages over the rotary converter and M.G.set. With the invention of semiconductor diodes which is more advantageous than mercury arc rectifier, nowadays no one wants to use mercury arc rectifier.

The comparison of the M.G.set, rotary converter and rectifier with regards to certain specific aspects are given in the tabular form below.

Converter Aspects for comparison	Rectifier	M.G.Set	Rotary converter
Machinery	No moving/rotating	Two machines i.e. one AC another one DC generator	Single machine
Cost	Cheap	Very costly	Costly
Noise	Noiseless	Noisy	Noisy
Efficiency	Good, as high as 95%	Very low because of two rotating machines	Low
Maintenance cost	Low	High	High
Overloading capacity	Can be overloaded up to 50%	Cannot be overloaded	Cannot be overloaded
Power factor of AC	Low power factor	Low power factor	Good power factor
Attention during its operation	Constant attention required	Less attention required	No attention required
Space required	High	Very high	Low

## Maintenance of MG set

**Objective:** At the end of this exercise you shall be able to

- list out the points to be considered for maintenance of MG set.

The MG set must be maintained by inspecting electrically and mechanically. The following points to be considered while carrying out maintenance.

### Electrical inspection list

- General cleaning of all electrical components and control panels
- Check/rectify motor insulation resistance by megger
- Check/rectify earth wiring
- Check/rectify main switch fuses
- Check/rectify stator, brushes etc.
- Check/rectify bearings of motor, rotating parts and use oil grease for proper lubrication
- Check/rectify/check starting panel
- Check/rectify over load relays
- Check/rectify loose connections and tighten them
- Replace damaged flexible conductors and cables
- Check/rectify the control system

- Replace the carburized non operative contactor if necessary.

Carry out the maintenance work in MG set by referring the mechanical inspection list and lubrication instruction given below

#### **Mechanical inspection list**

- Clean thoroughly and do visual inspection
- Check/rectify motor couplings and bearings
- Check for tightness of coupling, checking formulation both,
- Checking of pipeline flanger

- Check/rectify machine for functional operation and verify with the operator
- Lubrication, Maintenance prints
- Check/rectify the bearings for the lubrication
- Use oil gun/grease to lubricate the same.

**A separate register is to be maintained by the maintenance authority to keep the records for each maintenance on all working days.**

Attend the breakdown maintenance of mechanical and electrical nature, during the operation of the MG set.