

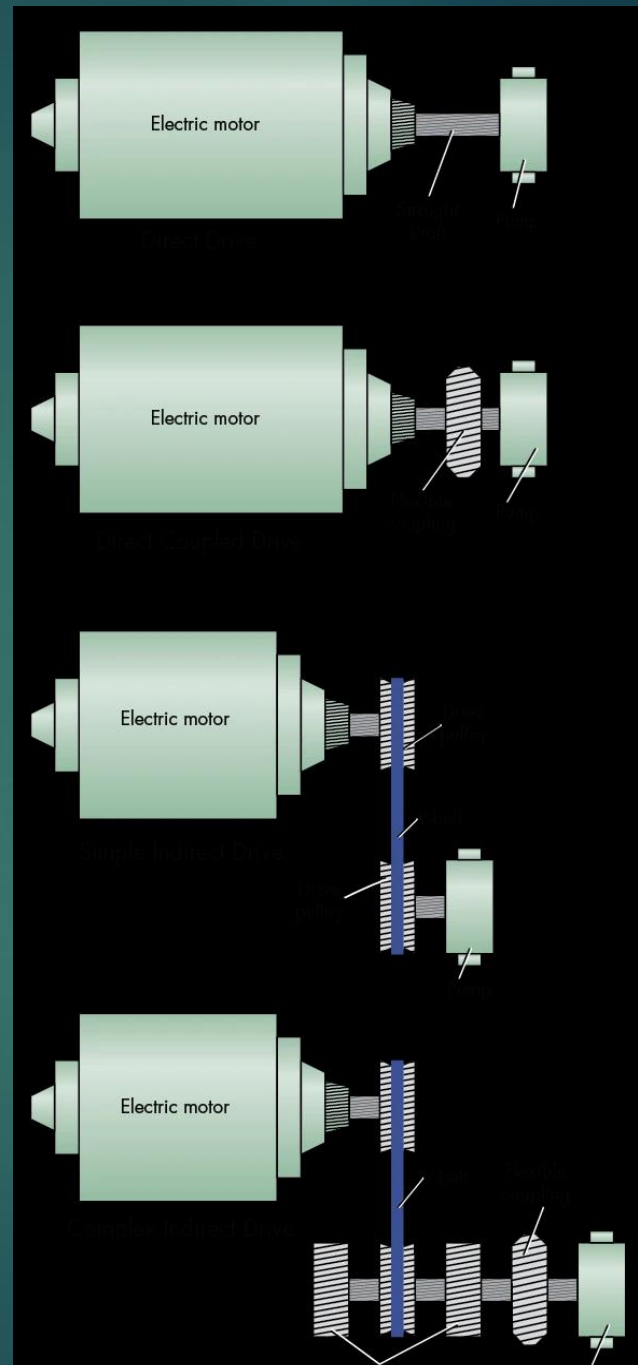
# Micro Hydro Power

LECTURE 7:

ELECTROMECHANICAL COMPONENTS OF MICRO HYDRO

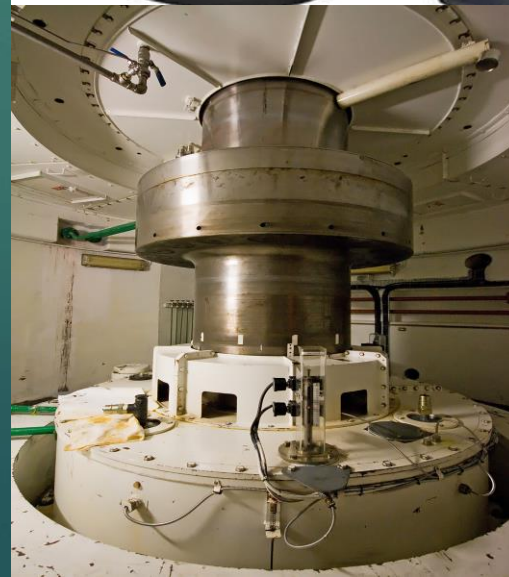
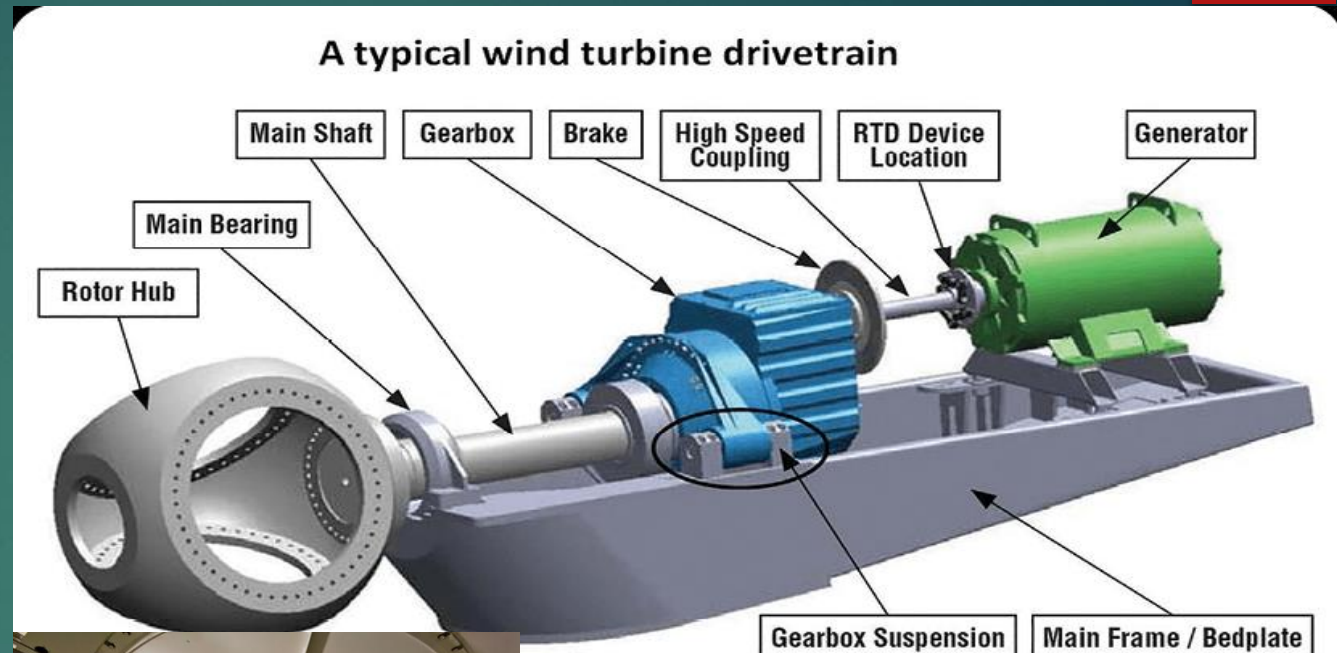
# Drive Systems

- ▶ The system that is used to transmit power from turbine to generator with minimum loss in the transmission system at correct speed and at a suitable direction
- ▶ It also has the function of changing the rotational speed from the one shaft to the other when the turbine speed is different to the required speed of the alternator or device



# Essential elements of Drive System

- ▶ Generator shaft
- ▶ Turbine shaft
- ▶ Bearing to support those shafts
- ▶ Coupling to connect shafts
- ▶ Pulleys, belt, gearboxes other components used to change speed or operation of the shafts

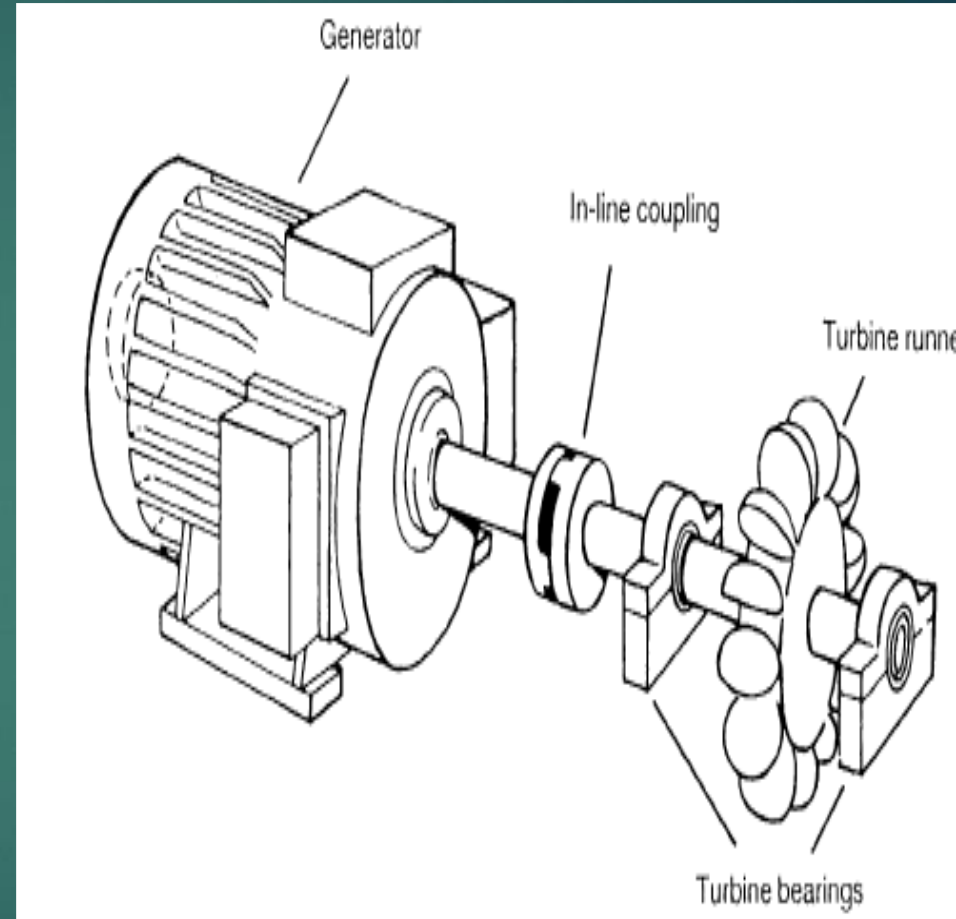


# Types of Drive System

- ▶ Direct coupled drive system
- ▶ Wedge belt drive system
- ▶ Wedge belt drive system with extra bearings
- ▶ Quarter turn belt drive
- ▶ Direct coupled turbine and geared motor used as alternator
- ▶ Turbine rotor mounted on generator shaft

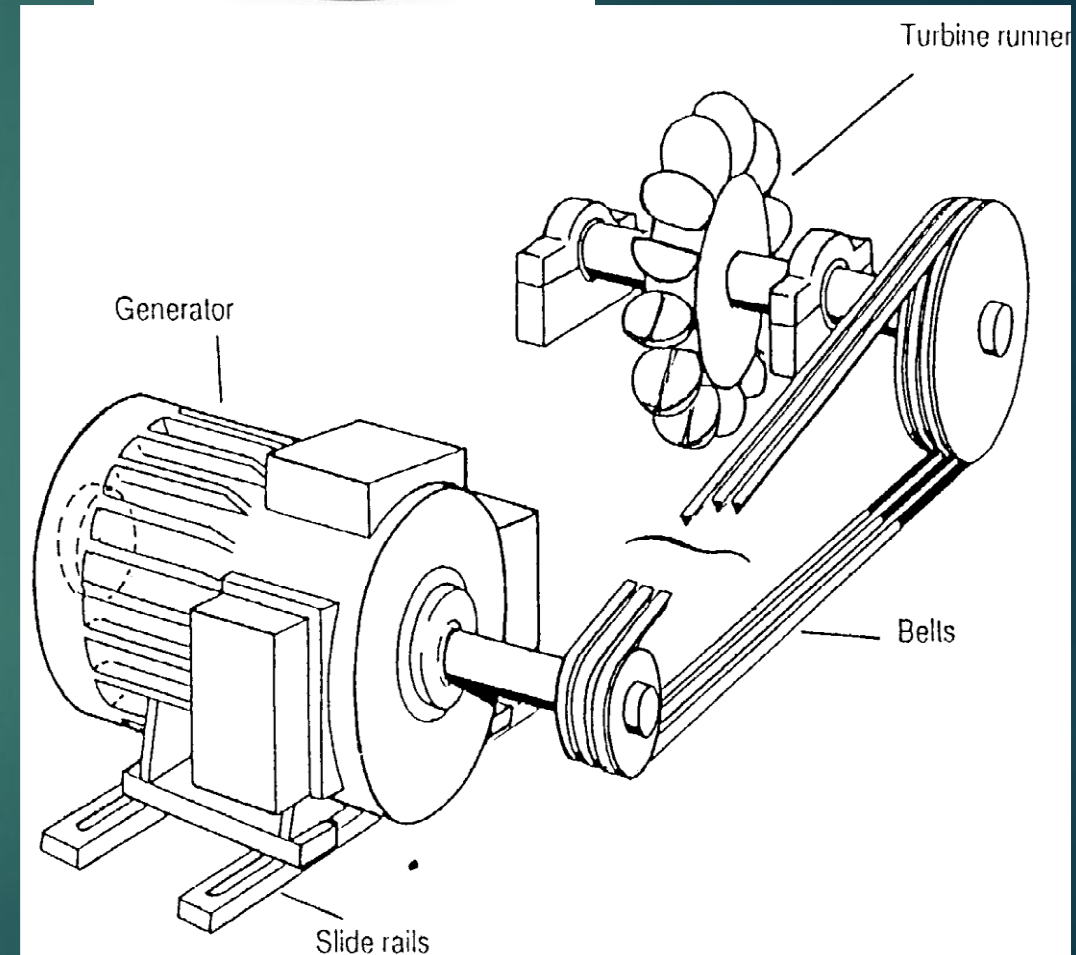
# Direct coupled drive system

- ▶ Compact, simple; efficiency approaches 100%
- ▶ Drive imposes no additional loads on bearings
- ▶ Both turbine and generator may be bolted to concrete foundation but metal packing is required to bring both shafts to the same height
- ▶ Alignment of shafts must be correct to prevent failure of coupling or bearing
- ▶ Flexible inline coupling is needed because shaft alignment is never perfect
- ▶ No speed change between turbine and generator is possible



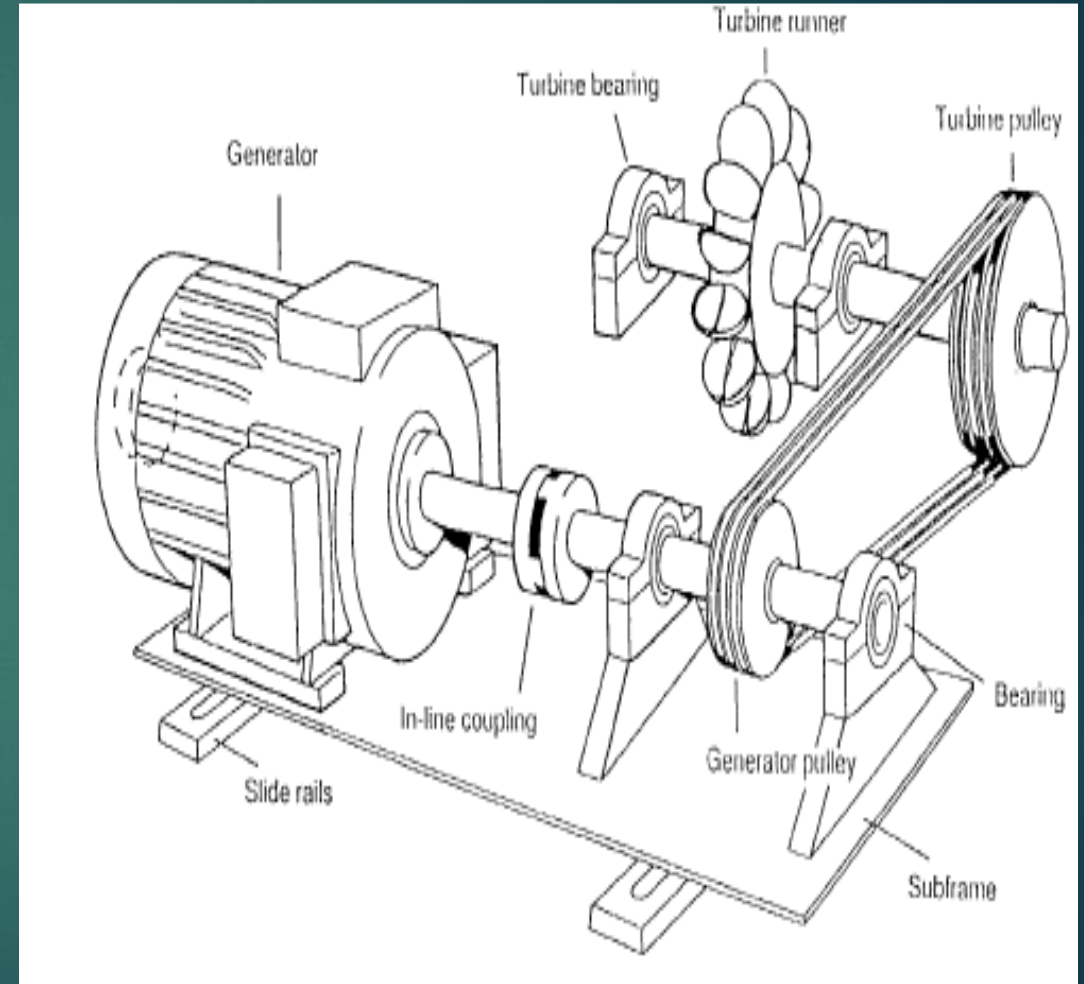
# Wedge Belt Drive System

- ▶ An alternative arrangement could have flat belt instead of wedge belts
- ▶ Generator is mounted on slide rails to obtain belt tension
- ▶ This drive applies loads to generator and turbine bearings. Check that the bearings are adequate
- ▶ Turbine and generator may run at different speeds
- ▶ Turbine and generator may be at different heights. Shafts must be parallel and pulleys in line but alignment is not as critical as in direct drive system
- ▶ Direction of rotation should pull on the lower part of the belts



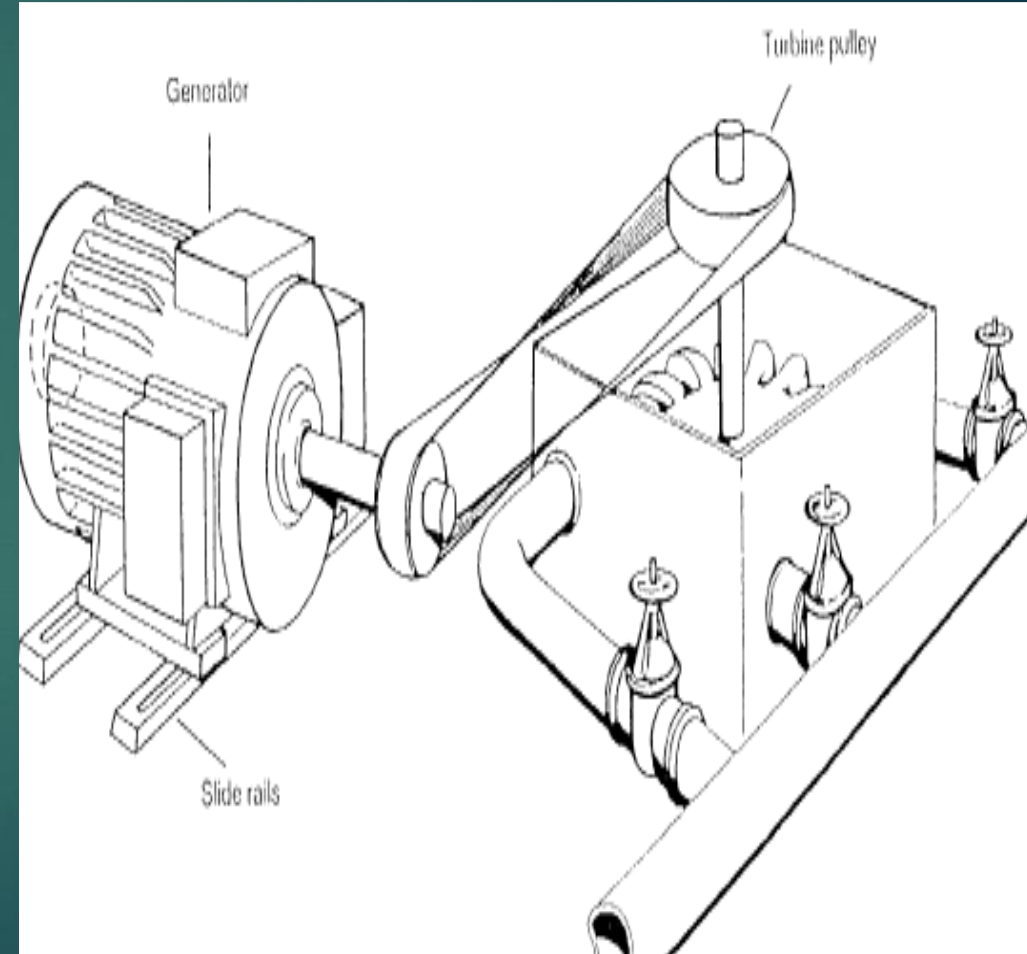
# Wedge belt drive system with extra bearings

- ▶ Alternative arrangement could have flat belt instead of wedge belts
- ▶ Turbine may have an extra shaft and bearings as shown for the generator
- ▶ The generator extension shaft must be removable from the bearings to enable belts to be changed
- ▶ Turbine and generator may run at different speeds
- ▶ Flexible in-line coupling required
- ▶ Direction of rotation should pull on the lower part of the belts
- ▶ Belt tensioning must be achieved with a jockey pulley (not shown) or the generator with its extra shaft and bearings must be mounted on a sub frame which can slide to obtain belt tension



# Quarter Turn belt drive

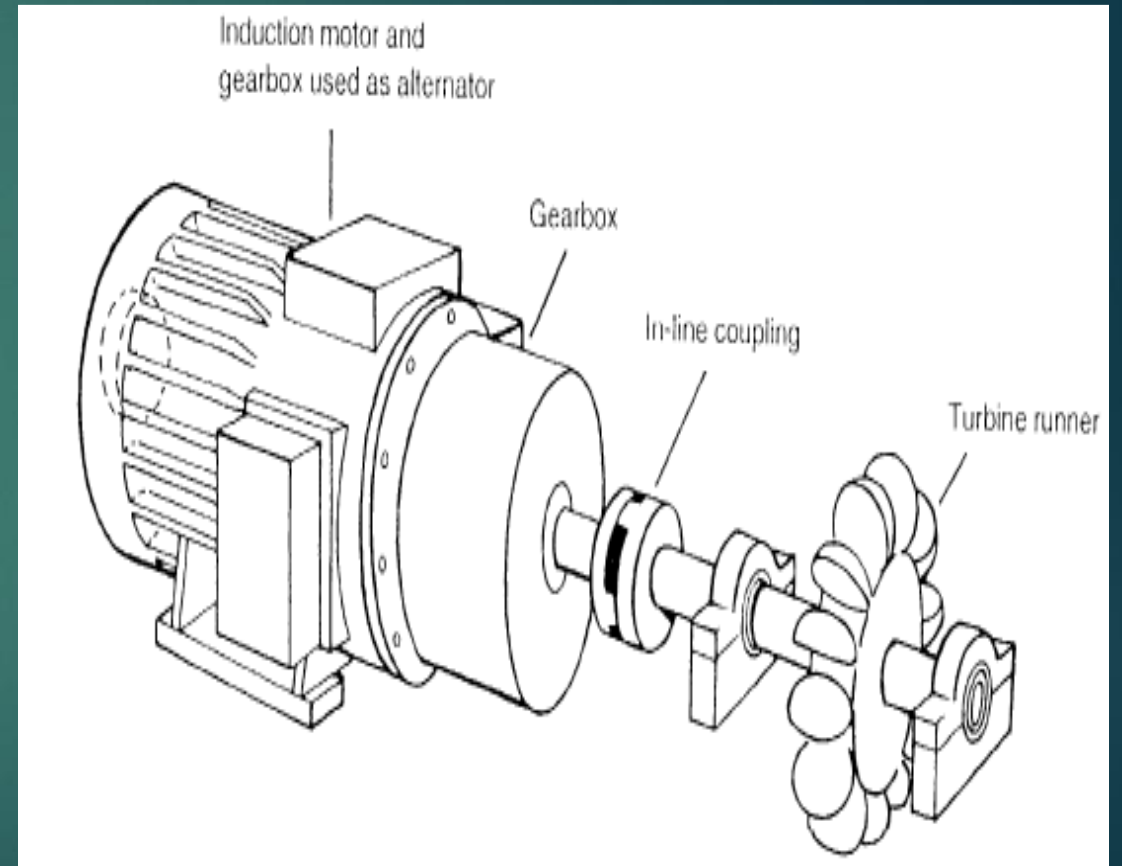
- ▶ Alternative arrangement could have wedge belts in place of flat belt
- ▶ Generator mounted on slide rails to obtain belt tension. This drive applies loads to the generator and turbine bearings. Check that the bearings are adequate
- ▶ Extra bearings, shafts and couplings may be used
- ▶ Turbine and generator pulleys must be aligned with care
- ▶ Not always permissible – consult manufacturer





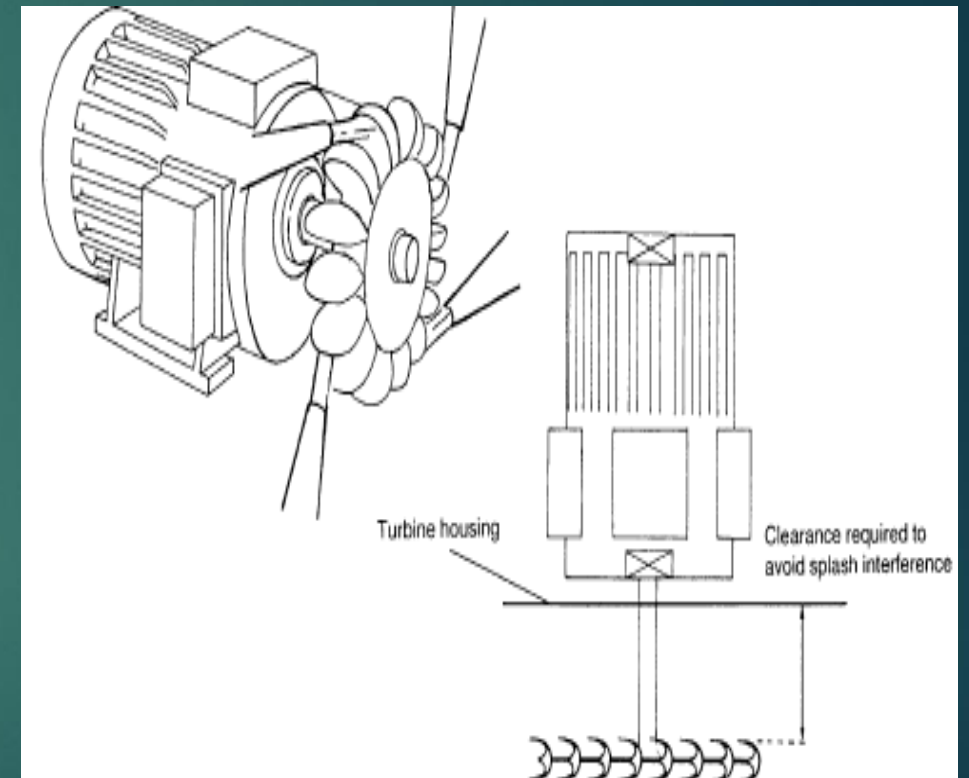
# Direct coupled turbine and geared motor used as alternator

- ▶ The use of induction motors as alternators is considered. Geared motor units are available from many manufacturers in wide ranges of powers and speed ratios.
- ▶ Various types of gears are used. Spur gears, helical gears and bevel gears are suited to speed increasing drives.
- ▶ The cost of a geared motor unit is significantly less than the cost of separate motor and gearbox
- ▶ The gearbox provides the speed change between turbine and generator



# Turbine rotor mounted on generator shaft

- ▶ A geared motor unit may be used as an alternator .
- ▶ The turbine rotor would then be mounted on the gearbox shaft
- ▶ A very neat, trouble-free installation results, providing:
  - ▶ The speed match
  - ▶ The shaft is long enough to give clearance
  - ▶ The bearing can tolerate the side load of the turbine



Thank You