5.1 Common parts which are prone to failure, Their reasons of failure & Remedial measures

→ Every part of every equipment has a particular life. After completion of its life, generally it fails down.

→ Parts which are prone to frequent failure:

(i) Gears
(ii) Seals, Packing & Gaskets
(iii) Bearings
(iv) Keys
(v) Chains
(vi) Clutches
(vii) M/C Spindles
5.1.1 Gears

A gear may be defined as a toothed element which is used for transmitting rotary motion from one shaft to another.

→ Reasons of Failure →

(i) If the meshing of two gears is not proper.
(ii) If the gear ratio is not proper.
(iii) If the teeth of gears worn out.
(iv) If the error is present in the pitch.
(v) Due to absence of lubrication.

→ Remedial Measures →

(i) Use proper lubricanty for lubrication.
(ii) Clean the surface of gears.
(iii) Select the proper materials for gears.
(iv) Avoid overloading.
(v) Check the alignment of the shaft.
5.1.2 Seal, Packing & Gaskets

Seal is used to stop leakages of fluids. Packing & gaskets are also used for the same purpose.

→ Causes of failure:

(i) Due to wear of seals.
(ii) Due to age of seals, packing or gaskets.
(iii) Due to overheating.
(iv) If the fitting of gaskets is not proper.
(v) Due to lack of lubrication.

→ Remedial measures:

(i) Avoid overheating & overload.
(ii) Material should be of high quality.
(iii) Fit the seals/gaskets properly.
(iv) Provide lubrication properly.
5.1.3. **Bearings**

Rotating shafts are supported on bearings. The long shaft is supported at suitable intervals by bearings.

→ **Causes of failure:**

(i) Dirt causes rupture & removal of lining while rubbing.

(ii) Due to long running time, the bearing fail due to fatigue.

(iii) Due to hot shot phenomenon. Due to insufficient oil flow.

(iv) Due to fretting (load concentration)

(v) Due to overheating.

→ **Remedial measures:**

(i) Clean the inner surface of bearing.

(ii) Grinding & polishing the journal surfaces.

(iii) Provide proper lubrication.

(iv) Desired level of oil film thickness.
5.1.4. **Keys**

Keys are temporary fasteners & are used to hold pulleys, wheels, gears, crank arms & flanges of coupling etc.

→ **Causes of Failure**

(i) Due to overload.
(ii) Due to improper filling of key in keyways & key seat.
(iii) Due to improper material of key.
(iv) If the procedure of fitting of key is not proper.
(v) If the size of key chosen is not proper.

→ **Remedial measures**

(i) Choose the right size of keys.
(ii) Before using key, smooth down the outer surfaces of keys.
(iii) Select the right type of key according to use.
(iv) Use proper method for fitting or disassemble the key.
(v) Avoid overloading.

5.1.5 Chains

In order to avoid this slipping phenomenon, chain drives are used. Chain drives provide a positive transmission & slip is not present as in case of belt & rope drives.

→ Causes of failure

(i) If speed is more than 15 m/sec.
(ii) If there is lack of lubrication.
(iii) If the links after chain are loose.
(iv) If the chain is too much tight.
(v) If the distance b/w sprockets and bearing is large.
Remedial measures

(i) Speed should not be increased more than 15 m/s.

(ii) Proper lubrication of chain

(iii) Replace the worn out sprocket

(iv) Replace New chains should not be installed over a worn out sprocket.

(v) Loosen the chain, if it is too much tight.

5.1.6 Clutches

Clutch is a mechanical device used to connect or disconnect the driven shaft from the driving shaft at the will of the operator while power is transmitted from driving to driven shaft.
Causes of failure

(i) Due to excessive wear of plates.
(ii) If cam surfaces are worn out.
(iii) Improper lubrication.
(iv) Improper use of discs.
(v) Not proper disengagement of driver & driven shaft.

Remedial measures

(i) Clean the disks & friction lining properly.
(ii) Replace the worn out plates.
(iii) Check the condition of lubrication film.
(iv) Check the condition of spring & pressure plates.
(v) Washing the clutch with kerosene.
Machine Spindle

It is used to mount chuck, centre, face plate, dog carriers, etc. The accuracy of nfc spindle like machine guides greatly influences the jobs being machined on the machine.

→ Causes of failure

(i) Due to tightness of bearings.
(ii) Due to improper alignment.
(iii) Due to rusty material.
(iv) Due to absence of lubrication.
(v) If the spindle is thin or long.

→ Remedial measures

(i) Proper lubrication.
(ii) Replace the worn bearing.
(iii) Replace the seal.
(iv) Clean the surface of bearing & spindle.
(v) Proper coating to avoid corrosion.
5.2 Parts which require frequent repair & maintenance

5.2.1 Belts

Belts are used for transmitting power from one shaft to another shaft. Belts run over the pulleys. Belts are used where the distance b/w the shafts is large.

→ Causes of belt drive failure

(i) If groove surfaces are worn-out in case of V-belt.
(ii) If belts are worn-out.
(iii) If speed is too much high.
(iv) If joints of belts are not proper.
(v) If surface of belts is not clean.
(vi) Improper lubrication of belts.
Repair & Maintenance

(i) Replace worn out belts.
(ii) Check the drive for alignment.
(iii) Keep the belt grooves clean and in good condition.
(iv) New & old belts should not run together.
(v) Extra load should be avoided.
(vi) Never use idler on the top side of a Vee-belt.

5.2.2 Couplings

Long line shaft is composed of a no. of small shaft pieces, put together end-to-end joined by coupling & supported by bearings. Couplings are also used to connect the shafts of
two machines so that the power can be supplied directly from one m/c shaft to the other m/c shaft.

→ Causes of Coupling failure

(i) Due to defective materials used during construction.
(ii) Improper tolerance.
(iii) Improper selection of coupling.
(iv) Improper alignment of shafts.
(v) Improper lubrication.

→ Repair & Maintenance of Coupling

(i) Provide proper lubrication film.
(ii) Proper selection of coupling.
(iii) Should not be any excessive looseness b/w the coupling hub & shaft.
(iv) Speed of rotating shafts should not be too high.
(v) Check proper alignment before using coupling.
52.3 Threaded Fasteners (Nuts, Bolts, Studs)

These are those temporary fasteners which hold the parts together through the medium of a screw thread. These are used in pairs for their action. A nut & a bolt or stud comprises a screwed pair.

→ Causes of Failure

(i) Improper sizes of nuts & bolts
(ii) Due to rust
(iii) Due to over-tightness
(iv) Due to high vibrations of machines/equipment
(v) Improper lubrication
(vi) Due to different types of threads used for nuts & bolts.
Repair & Maintenance

(i) Provide proper lubrication film.
(ii) Clean the surfaces of the nuts & bolts.
(iii) Check the threads of nuts & bolts before winding.
(iv) Use nuts & bolts with proper tightening.
(v) Do proper coating over the surfaces to avoid corrosion.

5.3 Repair & Maintenance of Heat Engines

An engine which is used to convert heat energy of fuel into mechanical work is termed as Heat engine.

1. Inspection (I)

(a) Check the working of the engine.
(b) Check the leakage in the cylinders head.
Check the condition of fuel used.
Check the working of valves.
Check the lubrication oil, engine oil.

2. Small Repair - (S):

(a) Disassemble some minor units of the engine.
(b) Clean all the disassembled parts.
(c) Prepare the list of defects.
(d) Tighten all the loose nuts & bolts.
(e) Repair or replace the worn-out parts.

3. Medium Repair - (M):

(a) Disassemble all the major units of engine.
(b) Wash the each parts of disassembled unit.
(c) Repair or replace the piston.
(d) Replace the piston rings.
(e) Replace the engine oil.
4. Complete Overhaul - (C)!

(a) Dismenttal all the parts of the engine.
(b) Clean & wash all the parts of the engine.
(c) Replace all the worn-out parts.
(d) Check the condition of lubrication oil & replace it if necessary.
(e) Replace the connecting rod if necessary.
(f) Replace or repair crank pin & replace the piston rings.
(g) Assemble all the parts.
(h) Check the performance of engine.
5.4 Repair & Maintenance of Compressors

An air compressor is a machine which compresses the air & raises its pressure. The air compressor sucks air from the atmosphere, compresses it & delivers the compressed air to a storage vessel.

1. Inspection: (I) -

(a) Inspect the working of compressor visually.
(b) Check the oil level available in crank case.
(c) Check the noise & heating of the compressor parts.
(d) Check the inlet & outlet pressure.
(e) Check the alignment of crankshaft.
(f) Clean the oil filter.
2. **Small Repair** - (S) -

(a) Disassemble few selected parts of the compressor.
(b) Check the condition of fasteners & replace them if necessary.
(c) Clean the parts properly.
(d) Clean the passages properly.
(e) Repair the inner surfaces of cylinders.
(f) Repair or replace the crankpin.

3. **Medium Repair** - (M) -

(a) Disassemble more parts of compressor.
(b) Replace the piston rings.
(c) Replace the inlet valve & outlet valve.
(d) Replace the lubrication oil.
(e) Replace the worn-out bearings.
(f) Replace the crankshaft if necessary.
4. **Complete Overhaul** - 

(a) Disassemble all the parts of the compressor.
(b) Replace the lubricating oil.
(c) Replace the fasteners.
(d) Replace the oil filter.
(e) Replace the valve & valve seats.
(f) Run the compressor & note the noise, vibration & heating.
(g) Check the pressure developed.
5.5 **Repair & Maintenance of Boilers**

A steam boiler is usually a closed vessel made of steel. Its function is to transfer the heat produced by the combustion of fuel to water, and ultimately to generate steam.

1. **Inspection - (I):**
   
   (a) First check the boiler visually.
   (b) Check the pressure gauges.
   (c) Check the working of water level indicator.
   (d) Check the working of feed pump.
   (e) Inspect the tubes & shell properly.
   (f) Prepare the list of defects.

2. **Small Repair - (S):**
   
   (a) Dismental 2 to 3 unity of boiler.
   (b) Clean all the parts of unit.
(c) Replace the old nuts & bolts.
(d) Check the leakage in pipes.
(e) Wash & clean all the tubes.
(f) Clean all the mountings &
    accessories.
(g) Prepare the list of defects.

3. Medium Repair - (M) :-
(a) Disassemble all the major units of
    boilers.
(b) Clean properly all the parts.
(c) Tighten all the loose fasteners.
(d) Replace/repair the sensitive mountings.
(e) Replace all the damaged tubes.
(f) Paint all the unmachined surfaces.

4. Complete Overhaul - (C) :-
(a) Disassemble all the parts of the
    boilers.
(b) Wash all the parts thoroughly.
(c) Replace all the damaged tubes.
(d) Repair/Replace all the mountings & accessories.
(e) Change the oil.
(f) Check & repair the pumps.
(g) Check the fuel quality.
(h) Check the working of boilers acc. to norms.