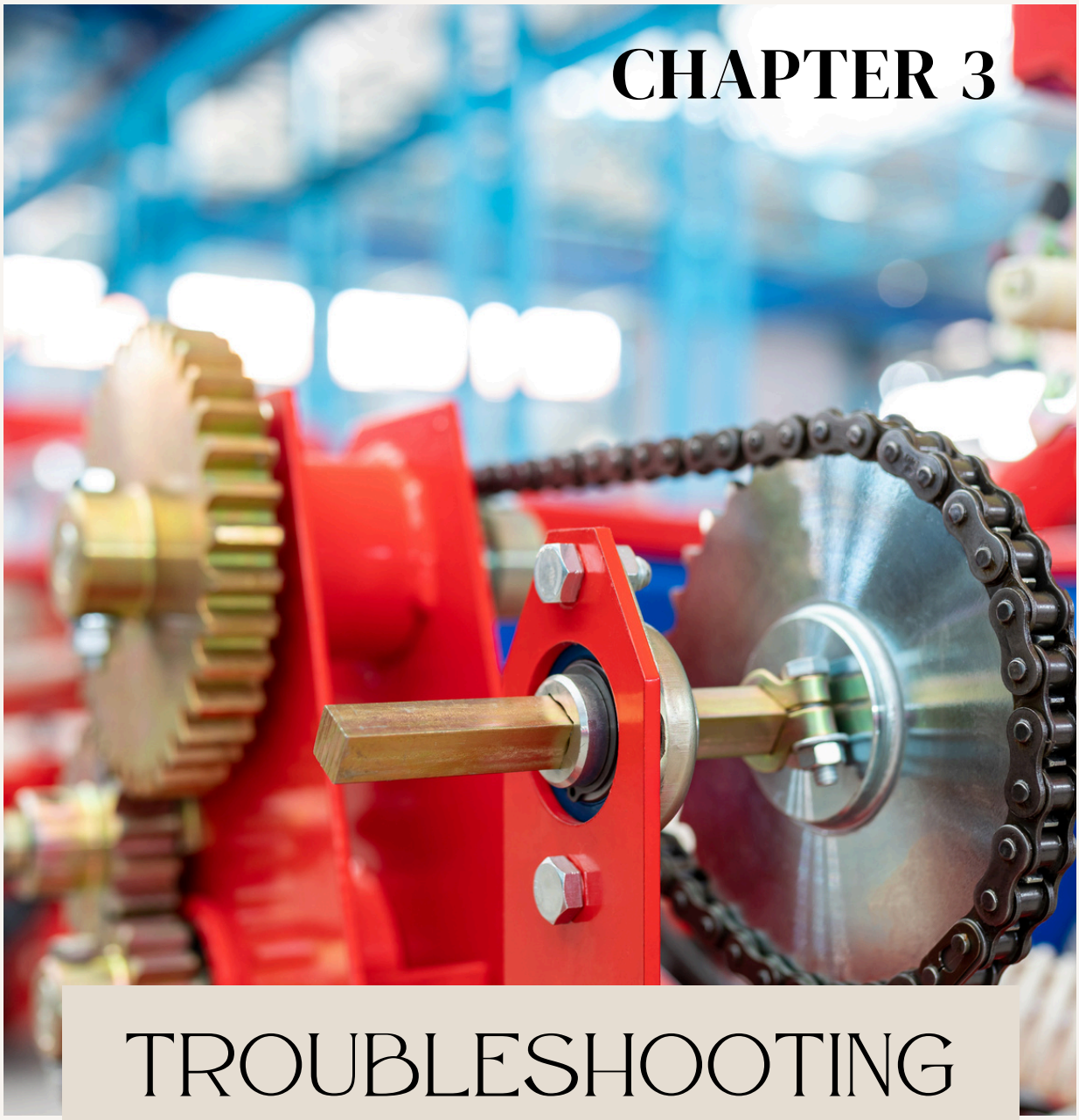


CHAPTER 3

# TROUBLESHOOTING AND MAINTENANCE FOR MECHANICAL COMPONENTS

Amizan Yahaya bin Jamil
Leanna binti Mohd Yunos

# TROUBLESHOOTING AND MAINTENANCE FOR MECHANICAL COMPONENTS

## Chapter 3 : Power Transmission

Amizan Yahaya bin Jamil
Leanna binti Mohd Yunos

# COPYRIGHT



**1st EDITION 2024**

Author :
Amizan Yahaya bin Jamil
Leanna binti Mohd Yunos

Published :

POLITEKNIK MUKAH SARAWAK
KM7.5, JALAN OYA
96400 MUKAH
SARAWAK

TEL : 084-874001
FAKS : 084874005

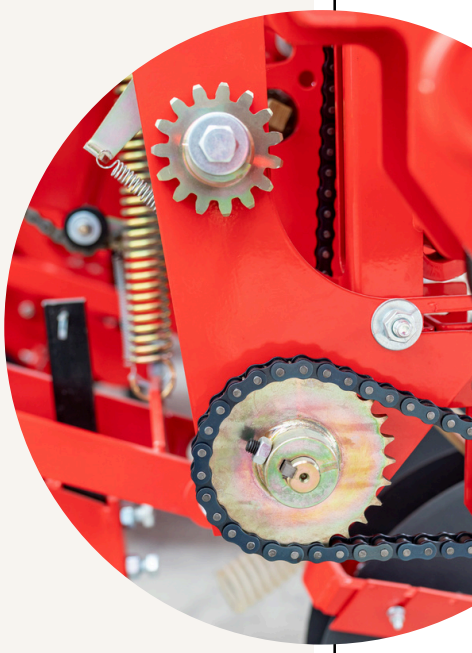
www,pmu.edu.my

Cataloguing-in-Publication Data

Perpustakaan Negara Malaysia

A catalogue record for this book is available from the National Library of Malaysia

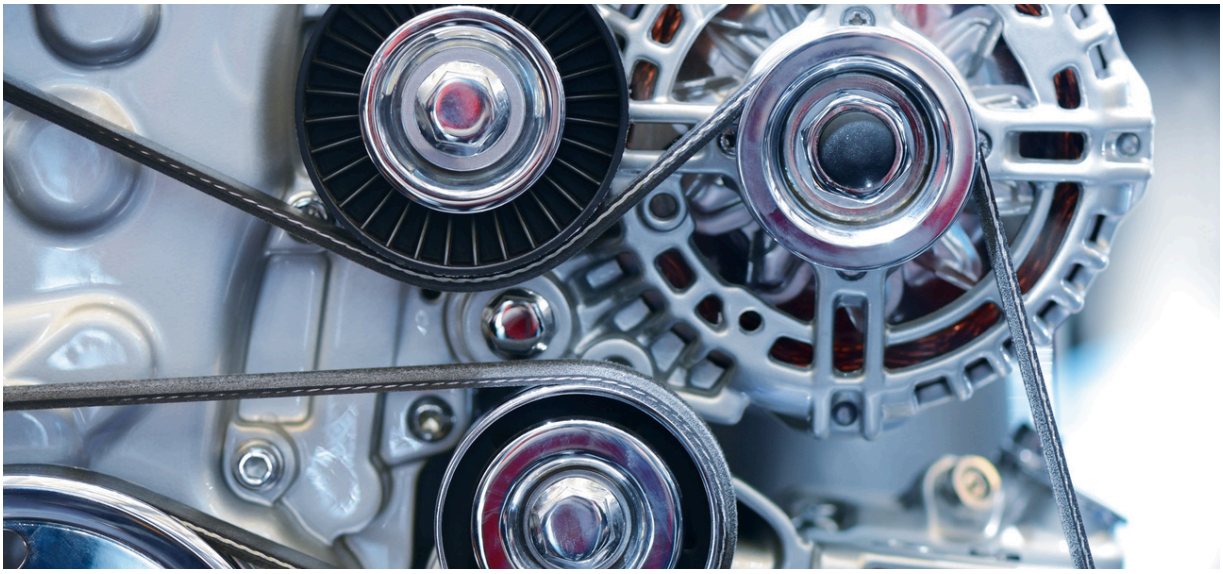
e ISBN 978-967-2097-93-8



# SINOPSIS

TROUBLESHOOTING AND MAINTENANCE FOR MECHANICAL COMPONENTS covers basic mechanical components needs in Industry. The topic includes maintenance & troubleshooting principles and procedures, lubrication, power transmission, bearing and pumps. This course also gives knowledge and skills regarding maintenance & troubleshooting of mechanical components and assemblies.

Editor



# ABOUT AUTHOR


## AMIZAN YAHAYA BIN JAMIL

Lecturer
Mechanical Engineering
Department
DH44

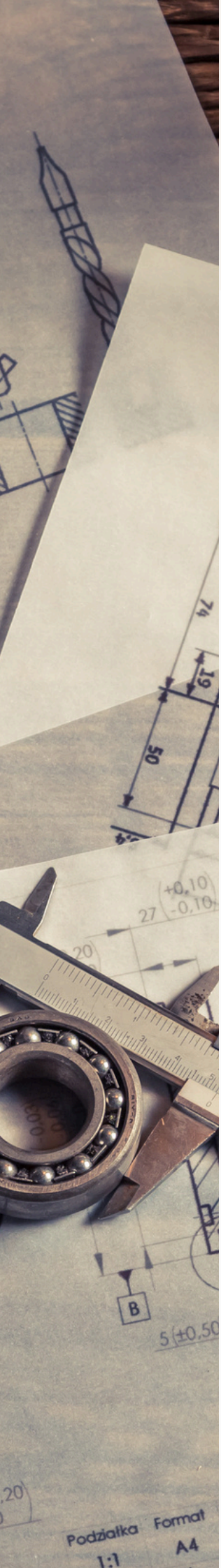
E-mel: amizan.jamil@pmu.edu.my



## LEANNA BINTI MOHD YUNOS

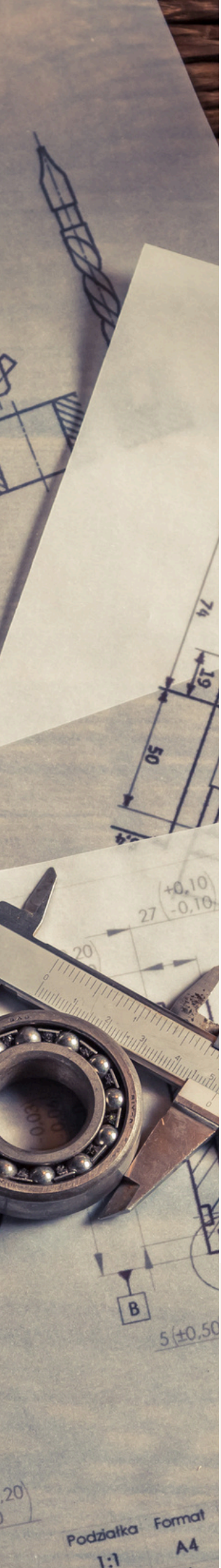
Lecturer
Mechanical Engineering
Department
DH44

E-mel: leanna@pmu.edu.my


# TABLE OF CONTENTS

## Chapter 3 :
## Power Transmission




3.3.4 Produce a check list for drive belts maintenance, failure symptoms and record observations for preventive maintenance.
- a. Premature belt failure.
- b. Severe or abnormal belt wear.
- c. Banded (joined) belt problems.
- d. Belt noise and unusual vibration.
- e. Problems with sheaves, belt stretches beyond take up.
- f. V-belt turn over or jump off sheave, etc.

3.3.5 Produce belt drive maintenance procedures.

04

## 3.4 Distinguish chain drive.

3.4.1 List the applications of the chain drive.
3.4.2 Classify the types of chains and their characteristics based on their functions.
3.4.3 Produce check list for chain drive maintenance and failure symptoms
3.4.4 Record observations for preventive maintenance.
3.4.5 Produce chain drive maintenance procedures.

05

## 3.5 Analyze friction drive, coupled shaft alignment or variable-speed drives.

3.5.1 Analyze the fundamentals of shaft alignment.
3.5.2 Demonstrate the use of the reverse dial indicator methods to correct shaft misalignment.

06

## 3.6 Perform troubleshooting on shaft failures.

3.6.1 Diagnose the shaft failures causing.
3.6.2 Troubleshoot the shaft failures causing to misalignment and wear and tear.

# OBJECTIVE

Upon completion of this course, student should be able to :

Apply the concept of mechanical components to solve related problems.

Organized appropriately experiments in groups according to Standart Operating Procedure

Perform the troubleshooting on mechanical components failure and damage

# CHAPTER 3 :
# POWER TRANSMISSION

**3.1 Distinguish the drive mechanism in the process of transforming power from one point to the other.**

3.1.1 Classisy types of drive mechanisms belt drive,chain drive,gear drive and friction drive.

## Belt Drive

- A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel.
- Belts may be used as a source of motion, to transmit power efficiently or to track relative movement.

## Chain Drive

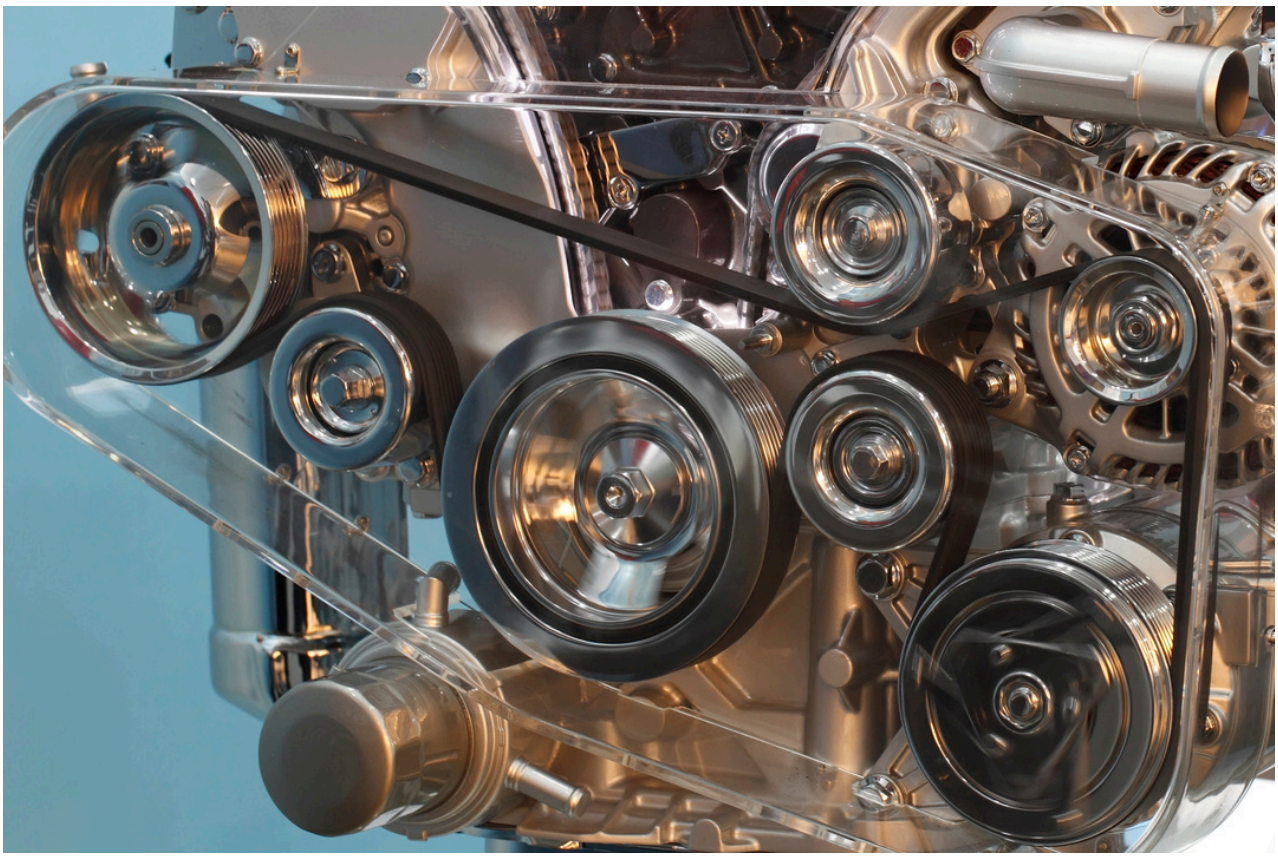
- Chain drive is a way of transmitting mechanical power from one place to another.

## Gear Drive

- Gear drives are packaged units used for a wide range of power-transmission applications

## Friction Drive

- A friction drive or friction engine is a type of transmission that utilises two wheels in the transmission to transfer power from the engine to the driving wheels



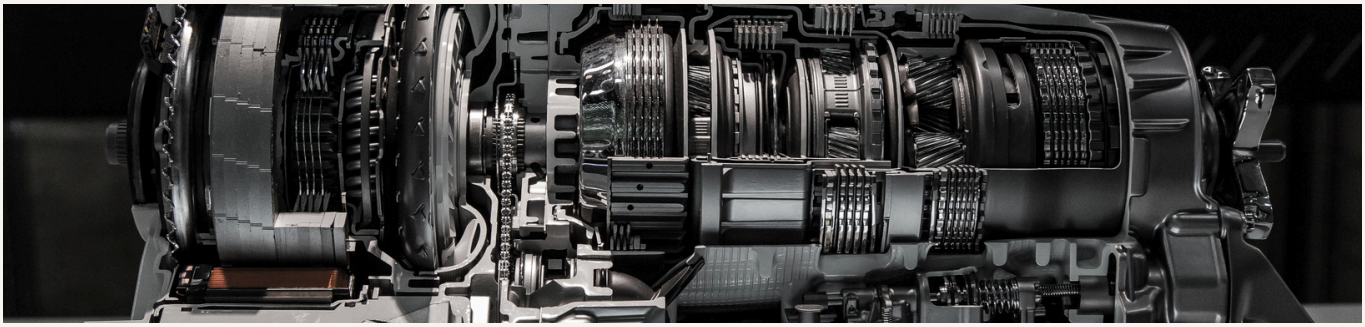
# 3.2 Calibrate gear in power transmission system.

## Gear Drive

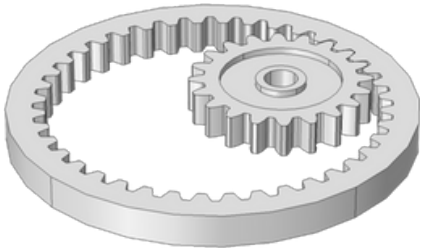
- A gear is a rotating machine part having cut teeth,which mesh another toothed part in order to transmit torque
- Two or more gears working in tandem are called a transmission and produce a mechanical advantage
- geared devices can change the speed,torque,and direction of a power source

## Gear Application

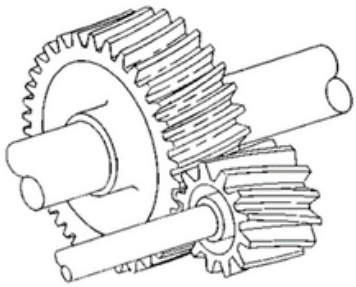
- Transmisson
- Direction
- Coupling
- Support Mechanism



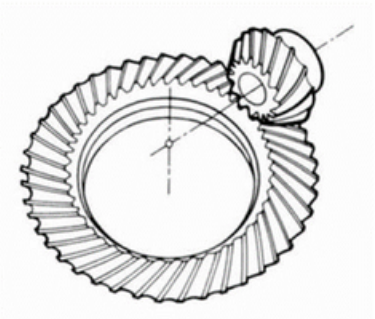
## Type of gear



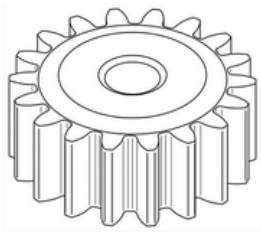
External & Internal gear



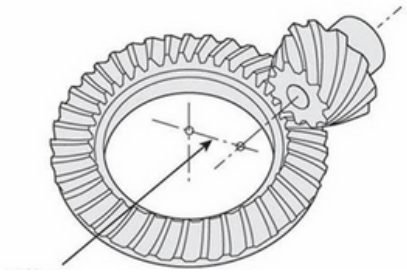
Helical gear



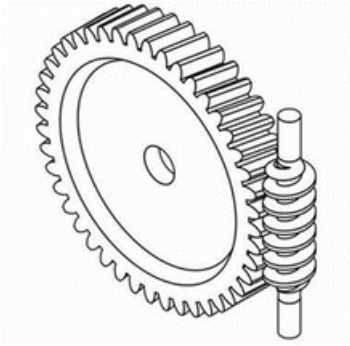
Bevel gear



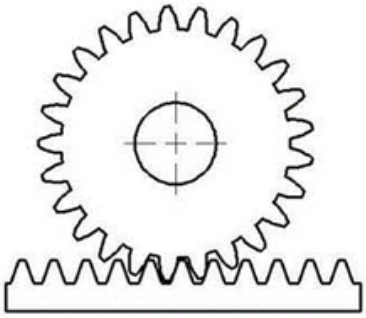
Spur gear



Hypoid gear



Worm & Worm wheel gear



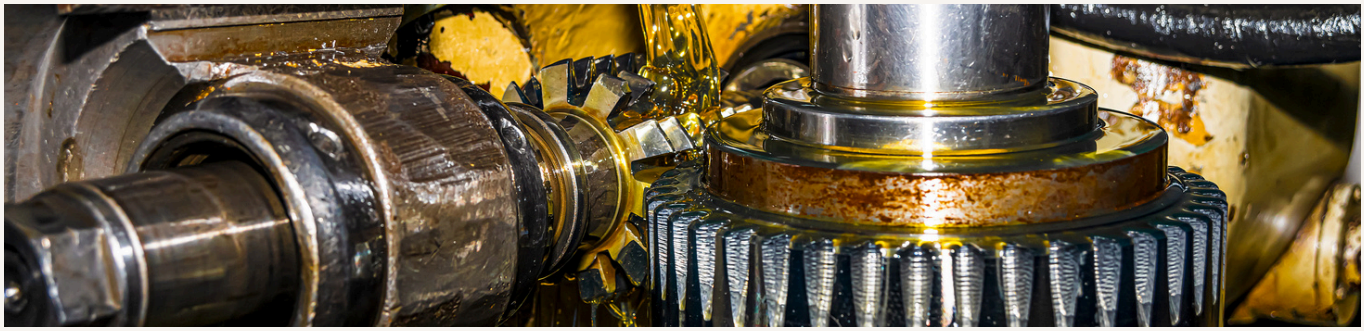
Rack and Pinion

## 3.2.1 Select the proper drive based on **AGMA** (American Gear manufacture Association).

AGMA is the global network for technical standards, education, and business information for manufacturers, suppliers, and users of gears and mechanical power transmission components.

AGMA standards address critical gearing topics, from design and analysis; manufacturing and quality; materials, metallurgy, and heat treatment; operation, maintenance, lubrication, and efficiency; and gear failure.

American Gear Manufacturers Association



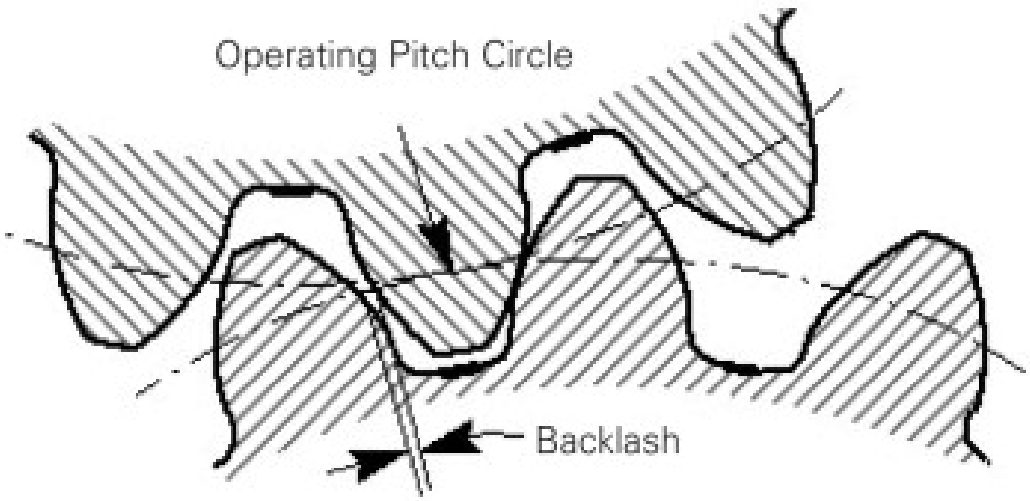
## 3.2.2 Differentiate gear meshing and backlash.

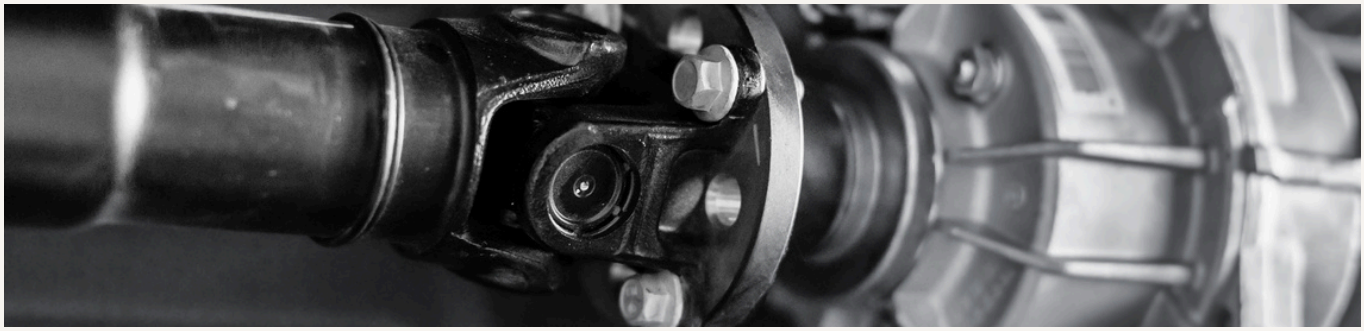
### Gear meshing

Gear meshing is when one gear engaged with other gear or pinion to transmitting torque or force

### Backlash

Backlash is define as the amount by witch width of tooth space exceeds the tooth thickness of engaged gear when measured on pitch circle





## 3.2.3 Apply coupling concept into gear system.

- Purpose of coupling is to join two pieces of rotating equipment while permitting some degree of misalignment.
- Gear are also used to connected two nominally coaxial shaft.
- This joint allows for minor misalignment such as installation errors and changes in shaft alignment due to operating conditions.
- Each joint consists of a 1:1 gear ratio internal/ external gear pair.
- The tooth flanks and outer diameter of the external gear arecrowned to allow for angular displacement between the two gears.

## Type of Coupling

Rigid Coupling

Sleeve Coupling

Flange Coupling

Clamp Coupling

Bushed Coupling

UniversalType

Gear Coupling

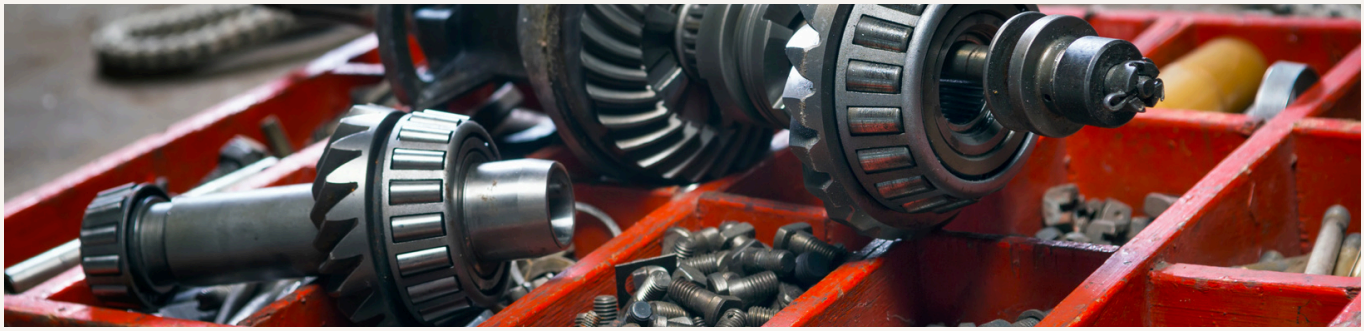
Oldham Coupling

Jaw Coupling

Bellow Coupling

Diaphragm Type

Fluid Coupling



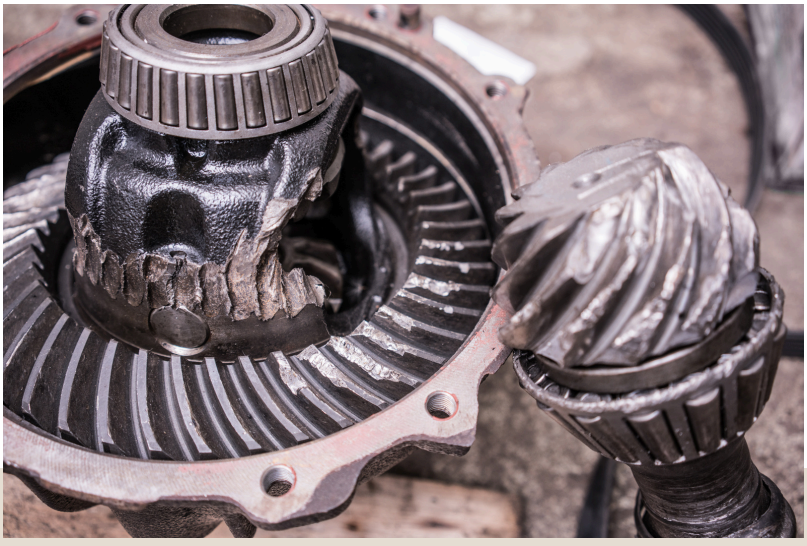
## 3.2.4 Identify gear maintenance practice such as daily routine inspection

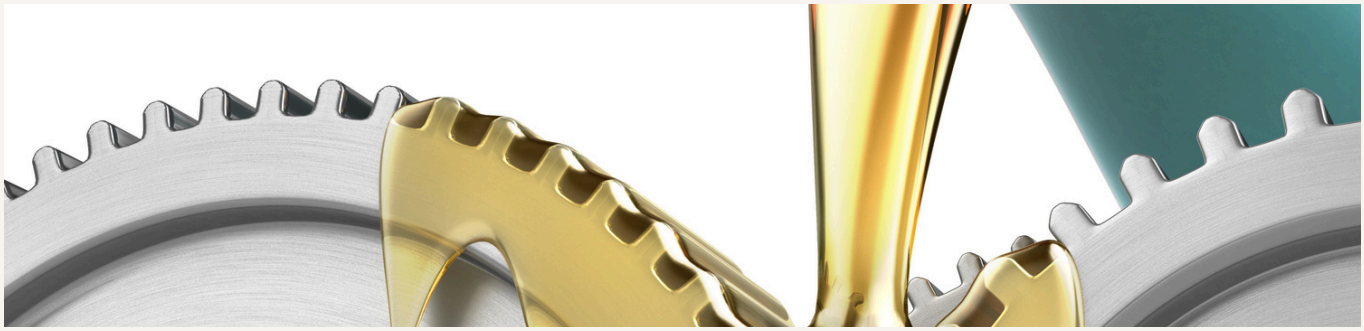
- Consisting of visual inspection and observation for oil leaks or unusual noises.
- If oil leaks are evident, the unit should be shut down, the cause leakage corrected and the oil level checked.
- If any unusual noises occur, the unit should be shut down untilthe cause of the noise has be determined and corrected.
- Check oil levels at least once a week.
- The operating of the gear drive unit is the temperature of the oil inside the case.
- Under normal condition the maximum operating temperature should not exceed 180 degree F.
- Pressure lubricated unit are equipped with a filter which should be cleaned periodically.

## 3.2.5 Construct the maintenance procedures:

### a. Gear tooth-wear and failure.

- Gears must mesh correctly, be properly aligned.
- If gears mesh too tightly, excessive force applied to teeth, as well as shafts and bearings in transmission.
- This will cause gear tooth wear, early power train failure.
- The sliding action that occurs between two gear also causes inherent wear that can lead to failure.





## b. Lubrication contamination and incorrect lubrication.

- If gears improperly lubricated, may show different types wear & damage due to friction between meshing surfaces.
- Pitting and burning two conditions often seen when lubrication insufficient or gears overheated.
- Filter will help keep wear particles out of the gear mesh
- If a gear continues to operate without adequate lubrication, the gear's tooth profiles will degrade to the point where replacement is the only remedy.
- Lubricant selection is based on many independent factors including gear type, load type, speed, operating temperatures, input power and reduction ratio

## c. Overheating.

- Excessive friction causes high temperatures in transmission which can break down, thin out fluid.
- Burned gear teeth often brittle and easily broken.

## d. Low oil level, etc.

- There will not be effective lubrication or ability to coolthe gears if the oil level is too low.
- But there will be excessive agitation loss if the oil level is too high.
- The oil level during operation must be monitored, as contrasted with the static level, in that the oil level will drop when the gears are in motion.
- This problem may be countered by raising the staticlevel of lubricant or installing an oil pan.

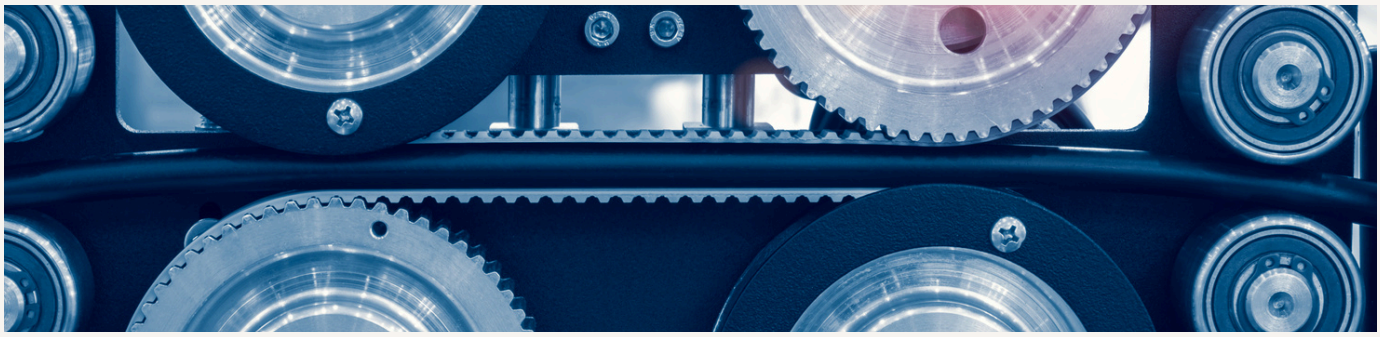
## 3.2.6 Produce a gear check list for preventive maintenance, symptoms and record observation for preventive maintenance, etc.

| SYMPTOMS | PROBLEM CAUSE | SOLUTION |
|---|---|---|
| Burned gear teeth often brittle and easily broken. | Methods of Lubrication | -Grease lubrication is suitable for any gear system that is open or enclosed, so long as it runs at low speed.<br>-Splash lubrication is used with an enclosed system. It needs at least 3 m/s tangential speed to be effective.<br>-Forced-circulation lubrication applies lubricant to the contact portion of the teeth by means of an oil pump. There are drop, spray and oil mist methods of application. |
| Moderate wear | - Inadequate lubrication film<br>-Dirt in lubrication system | -Specify a lubricant with a greater film strength, or with a higher viscosity.<br>-Speed to build up the lubricating film. |
| Excessive wear (pitting) | - The failure to notice early enough that wear is in progressive | -Using same methods given for moderate wear.<br>-Filter will help keep wear particles out of the gear mesh and ensure that lubricant is delivered to the working surface. |

| Problem | Cause | correction |
|---|---|---|
| Hard to crank landing gear | Damaged lift screw or lift nut. | Check landing gear for signs of impact (accident) damage. Disconnect cross shaft and crank legs individually to determine which leg is damaged. Replace damaged leg. |
| Shaft turns but legs do not operate | Broken pinion gear or bevel gear or gear pins. | Replace broken gear(s) or pin |
| Shaft does not turn | Seized lift screw or nut | Replace inner leg or entire landing gear leg |
| Crank shaft skips when cranking | Broken gear teeth. | Replace broken gear(s). |

## 3.2.7 Produce the gear maintenance procedure.

- Make sure the gears fit together properly to reduce the backlash between.
- To prevent overloading, be sure gear shafts positioned at correct angle.
- If possible overloads are anticipated, torque-limiting couplings may provide some protection
- Filter wear particles out of the gear mesh and ensure that lubricant is delivered to the working surface.
- Ensure gears properly manufactured or installed to prevent surface cracks.
- To avoid difficulties such as gear tooth wear and premature failure, the correct lubricant must be used.
- Different work gear will use the different methods of lubrication.
- When one gear in pair badly worn or damaged, both gears should be replaced
- If replace only one, teeth on new gear won’t mesh properly, and teeth will wear out quickly. Some gears only sold in matching sets.



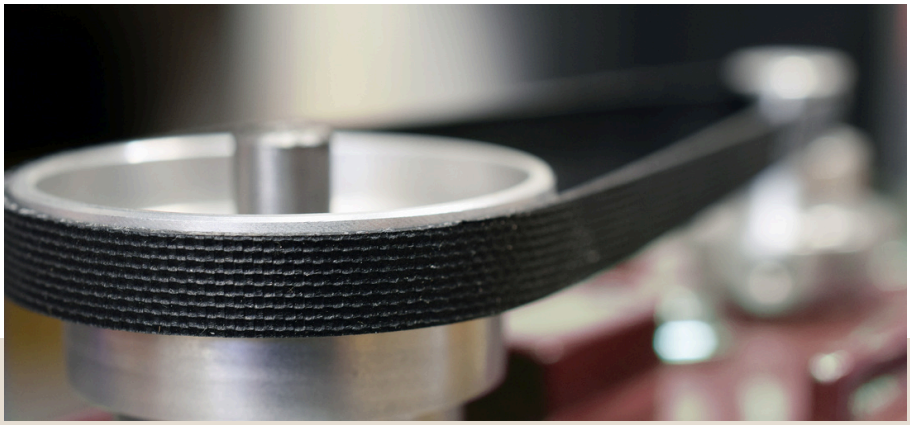
## 3.3 Classify belt drives in power transmission system.

- Belt is a loop of flexible material used to transfer rotarymotion between two shafts.
- The motion of the driving pulley is, generally, transferred to the driven pulley via the friction between the belt and the pulley.
- Main disadvantage is slip and creep hence velocity ratio is not fixed.
- Can used with high speed drive.

## 3.3.1 List the applications of belt drives.

There are various applications of a belt-drives which are used in various places like:

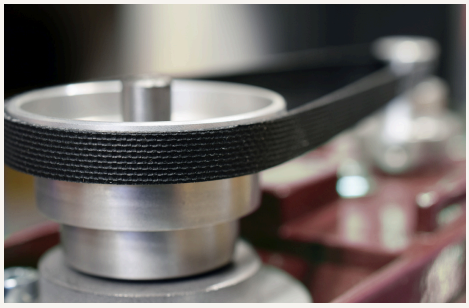
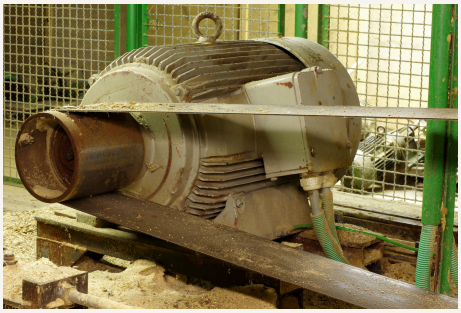
- A belt drive is used for transferring the power.
- The belt drive is used in the Mill industry.
- The belt drive is used in the Conveyor.
- The belt drive is powered by only a single belt.
- Belt drives are usually made up of synthetic material.
- This is not stronger as compared to the belt drive.



3.3.2 Classify types of belt drives and their characteristics based on their functions.

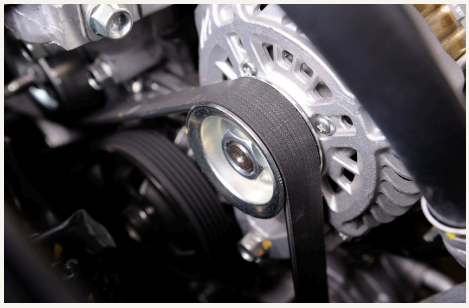
## TYPES OF BELTS

- Flat belt
- Vee Belt
- Timing Belt
- Round Belt
- Multi-Groove/ Polygroove Belts
- Ribbed Belts

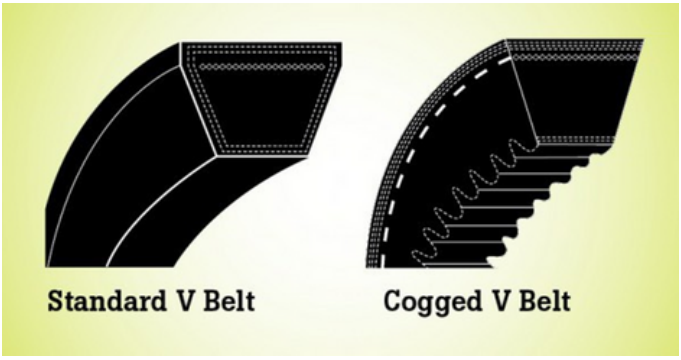
## Flat Belt

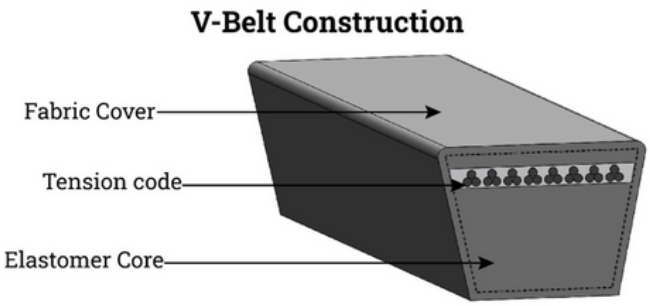
- Belt transfers torque by friction of the belt over a pulley.
- Flat belt drives are now mostly used for low power highspeed applications.
- Flat belts are also used for conveyance applications.
- A flat belt that transfers rotary motion between two shafts.

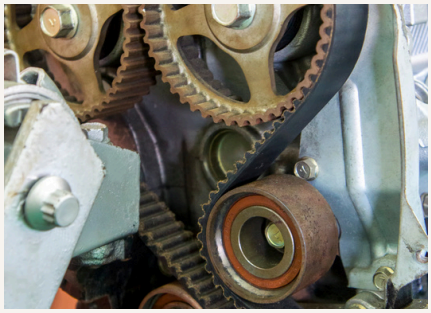
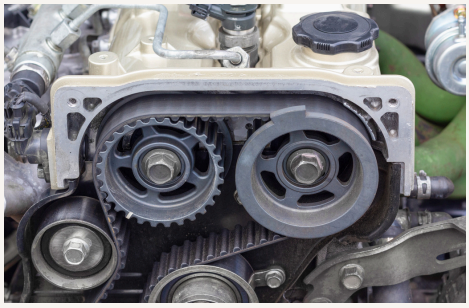
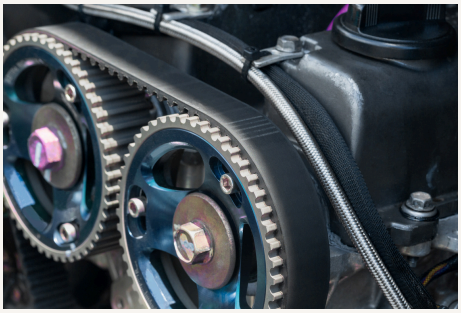




## Vee Belt

- It is also known as V-Belts or wedge rope.
- Provides the best combination of traction, speed of movement, long of the bearings, and long service life.
- Better torque transfer possible compared to flat belt.
- With a flat belt drive only one belt is used, with a vee belt drive a number of belts are used.
- Vee Belt Drives achieve drive efficiencies of

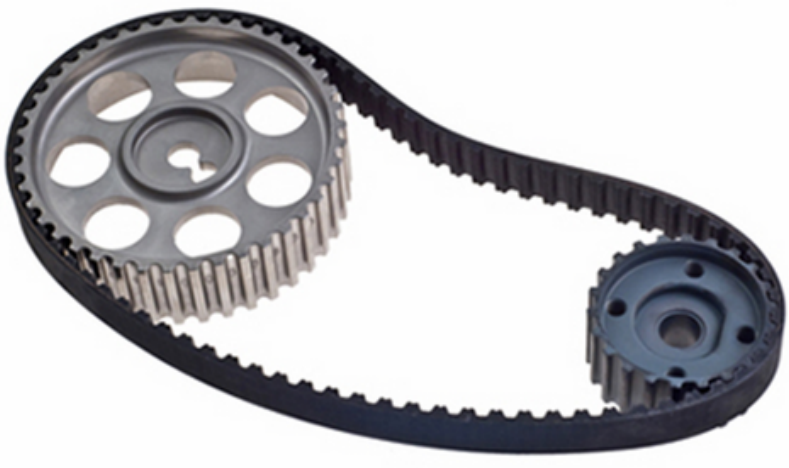


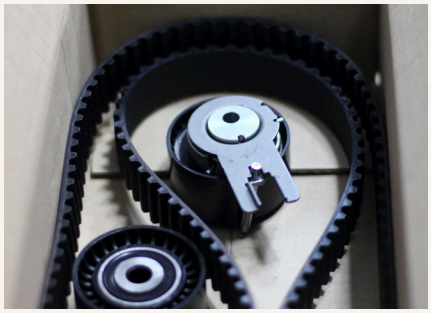



## Timing Belt

- These belts are used for power transfer and for synchronized drives to ensure that the driven pulley is always rotating at a fixed speed ratio to the driving pulley. Belt toothed on the inside driving via grooved pulleys.
- Limited power capacity compared to chain and Vee belt derivatives.
- Does not require lubrication. Circular cross section belts designed to run in a pulley with a circular (or near circular) groove.
- They are for use in low torque situations.
- This enables positive drive.

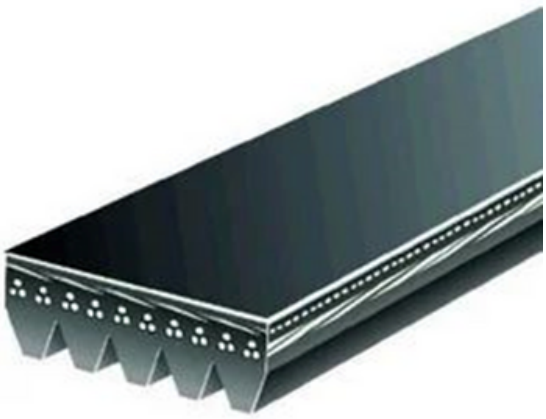




## Other Types

### Multi-groove/ Polygroove belts

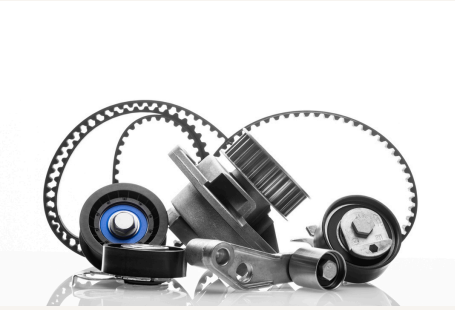
- Made up of 5 or 6“V” shapes along side each other. The added flexibility offers an improved efficiency



### Ribbed belts

- A power transmission belt featuring lengthwise grooves.

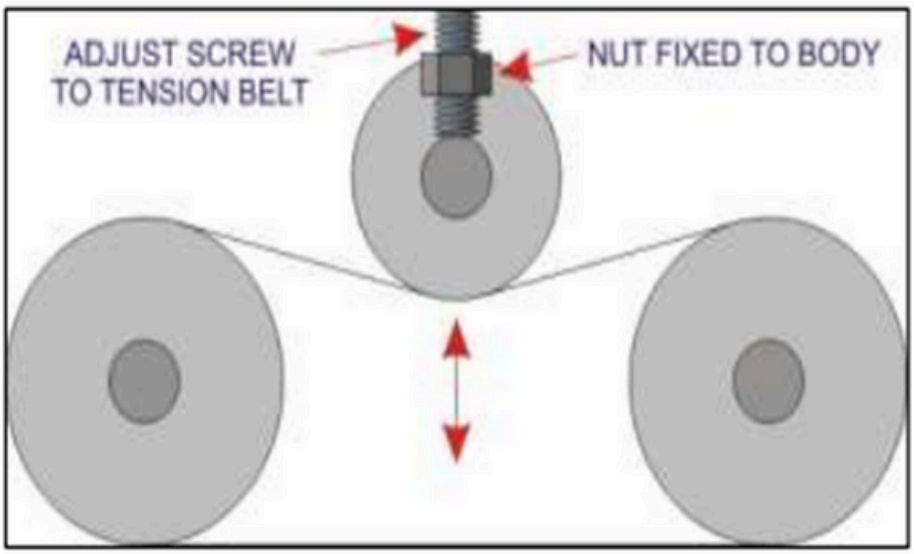




## 3.3.3 Classify belt tension and misalignment of belt drives.

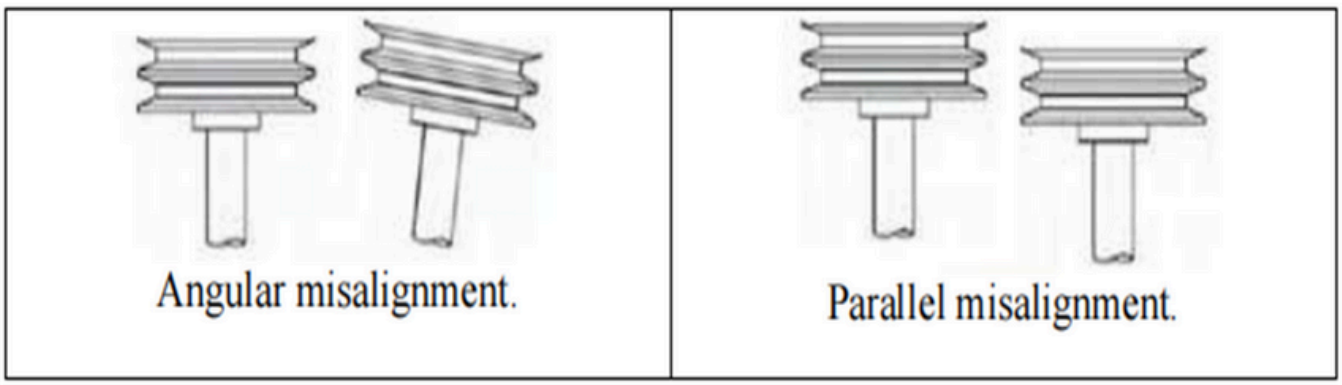
### Belt tension

- The ideal belt is that of the lowest tension which does not slip in high loads.
- Belt tensions should also be adjusted to belt type, size, speed, and pulley diameters.
- Belt tension is determined by measuring the force to deflect the belt a given distance per inch of pulley.
- Timing belts need only adequate tension to keep the belt in contact with the pulley.



## Misalignment

- Belt drive misalignment exists when the driver and driven sheaves are not properly aligned.
- Misalignment can take either the form of angular or parallel (offset)
- Misalignment, or a combination of both.
- Angular misalignment occurs when the faces of the sheaves do not form a straight line.
- With parallel misalignment, the sheaves may be in angular alignment, but their position on the shaft creates a parallel offset.



## 3.3.4 Produce a check list for drive belts maintenance, failure symptoms and record observations for preventive maintenance.

**There are several things need to be addressed before performing maintenance is charged which is:**

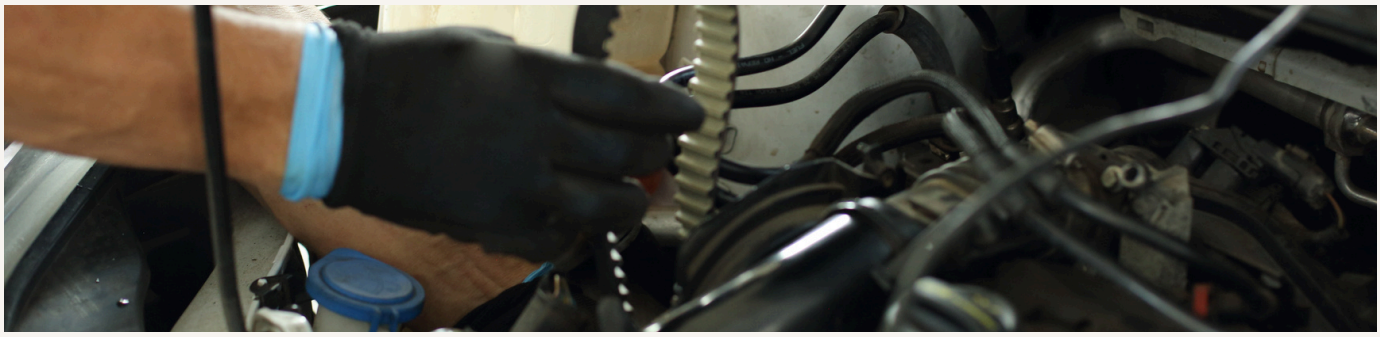
- Always shut off power, lock and tag control box.
- Place all machine components in safe position.
- Remove guard, inspect and clean.
- Inspect belt for wear, damage. Replace as needed.
- Inspect sheaves or sprockets for wear, alignment. Replace if worn.
- Inspect other drive components such as bearings, shafts, motor mounts and take up rails.
- Inspect static conductive grounding system (if used) and replace components as needed.
- Check belt tension and adjust as needed
- Recheck pulley alignment.
- Reinstall belt guard.
- Restart drive. Look and listen for anything unusual.

## Premature Belt Failure

| Symptoms | Probable Cause | Solutions |
|---|---|---|
| **Broken Belt** | 1. Under-designed drive | 1. Redesign using Drive Design Manual. |
| | 2. Belt rolled or prised onto pulley | 2. Use drive take up when installing. |
| | 3. Object falling into drive | 3. Provide adequate guard or drive protection |
| | 4.Severe shock load | 4. Redesign to accommodate shock load. |
| **Belt fail to carry load (slip); no visible reason** | 1. Under-designed drive | 1. Redesign using Drive Design Manual |
| | 2. Damaged tensile member | 2. Follow correct installation procedure. |
| | 3. Worn pulley grooves | 3. Check for groove wear. Replace as needed. |
| | 4. Contre distance movement | 4. Check drive for centre distance movement during operation. |

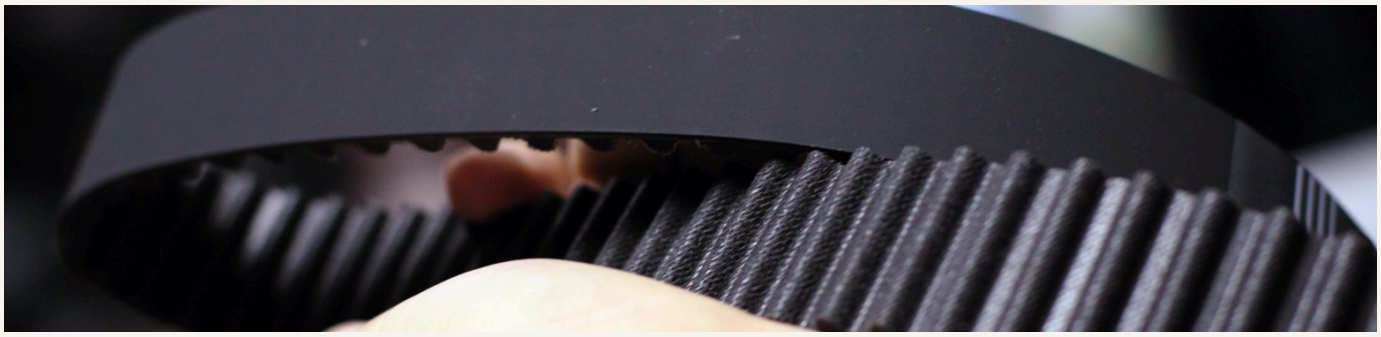
## Severe or abnormal belt wear.

| Symptoms | Probable Cause | Solutions |
|---|---|---|
| **Wear on belt bottom corners** | 1. Belt-to-pulley fit incorrect | 1. Use correct belt-to-pulley combination. |
| | 2. Worm pulleys | 2. Replace pulleys. |
| **Under cord cracking** | 1. Pulley diameter too small | 1. Use larger diameter pulleys. |
| | 2. Belt slip | 2. Retension. |
| | 3. Back idler too small | 3. Use larger diameter back idler. |
| | 4. Improper storage | 4. Do not coil belt too tightly, kink or bend. Avoid heat and direct sunlight. |



## Banded (joined) belt problems.

| Symptoms | Probable Cause | Solutions |
|---|---|---|
| **Tie-band separation** | 1. Worn pulleys | 1. Replace pulleys. |
| | 2. Improper groove spacing | 2. Use standard groove pulleys |
| **Top of tie-band frayed, worn or damaged** | 1. Interference with guard | 1. Check guard. |
| | 2. Back idler malfunction or damaged | 2. Repair' or replace back idler. |



## Belt noise and unusual vibration.

| Symptoms | Probable Cause | Solutions |
|---|---|---|
| **Squeal or "chirp"** | 1. Belt slip | 1. Retension. |
| | 2. Contamination | 2. Clean belts and pulleys |
| **Slapping noise** | 1. Loose belts | 1. Retension. |
| | 2. Mismatched set | 2. Install matched belt set. |
| | 3. Misalignment | 3. Realign pulleys so all belts share load equally |

## Problems with sheaves, belt stretches beyond take up.

| Symptoms | Probable Cause | Solutions |
|---|---|---|
| **Multiple belts stretch unequally** | 1. Misaligned drive | 1. Realign and retension drive. |
| | 2. Debris in pulleys | 2. Clean pulleys. |
| | 3. Broken tensile member or cord damaged | 3. Replace all belts, install properly. |
| | 4. Mismatched belt set | 4. Install matched belt set |
| **Single belt, or where all belts stretch evenly** | 1. Insufficient takeup allowance | 1. Check takeup. Use allowance specified in Drive Design Manual. |
| | 2. Grossly overloaded or under-designed drive | 2. Redesign drive. |
| | 3. Broken tensile members | 3. Replace belt, install properly |

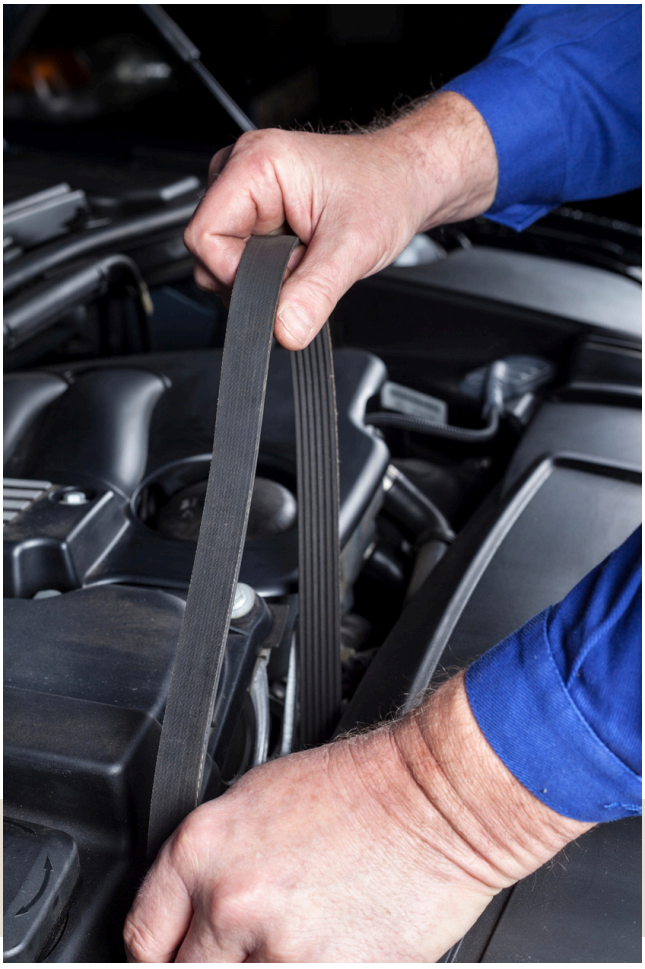
## V-belt turn over or jump off sheave, etc.

| Symptoms | Probable Cause | Solutions |
|---|---|---|
| **Involves single or multiple belts** | 1. Shock loading or vibration | 1. Check drive design. |
| | 2. Foreign material in grooves | 2. Shield grooves and drive. |
| | 3. Misaligned pulleys<br>Worn pulley grooves | 3. Realign pulleys. |
| | 4. Worn pulley grooves | 4. Replace pulleys. |
| | 5. Damaged tensile member | 5. Use correct installation and belt storage procedure. |
| | 6. Incorrectly placed flat idler pulley | 6. Carefully place flat idler on slack side of drive as close as possible to driver pulleys. |
| | 7. Mismatched belt set | 7. Replace with new set of matched belts. Do not mix old and new belts |
| | 8. Poor drive design | 8. Check for centre distance stability and vibration dampening. |

## 3.3.5 Produce belt drive maintenance procedures.

### Eight Steps for Belt Drive Maintenance:

1. Elements of a good maintenance program. Maintain a safe working environment
2. Maintain a safe working environment
3. Inspect regularly
4. What to look for
5. Install belts properly
6. Know your belts
7. Store belts properly
8. Troubleshooting



## 3.4 Distinguish chain drive.

- **A chain drive uses a sprocket and chain to drive machinery**
- **The chain drive is a positive or direct drive and does not allow slippage**

## 3.4.1 List the applications of the chain drive.

The three basic applications of chain drive are:

- Transmitting Power, chains, and sprockets are used as flexible gearing to transmit torque from one rotating shaft to another.
- Converting motion, chains are used to convey materials by using sliding, pushing, pulling or carrying.
- Timing or Synchronizing, chains are used as devices to synchronizing movements such as valve timing in automobiles or raising loads on an overhead chain hoist.

3.4.2 Classify the types of chains and their characteristics based on their functions.

## Roller Chains

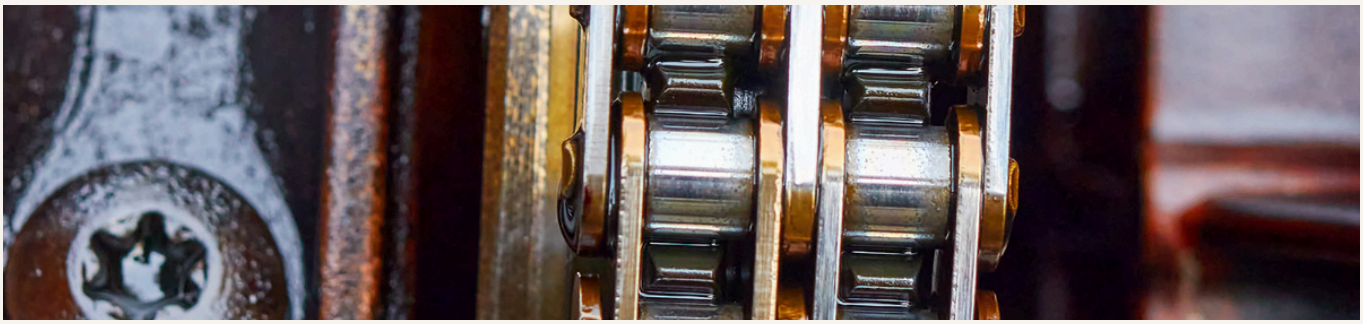
- Used in low-to-mid-speed drives at around 600-800 per minutes
- Has series of short cylindrical rollers which are held with other side links.
- Driven with the help of toothed wheel which is known as a sprocket.

Roller chains

## Silent Chains

- Also known as inverted tooth chain.
- Used for the camshaft drive of the mid-to large-size engine.
- Generating less noise than a gear drive
- High performance silent chains
- Transfer-case drive in four-wheel-drive vehicle.

Silent chains



## Leaf Chains

- Used for the purpose of lifting instead of power transmission.
- Low speed but tension are very high.
- Do not mesh with sprocket.
- Need high yield strength for large loads and not to be stretched permanently while carrying large loads.

Leaf chains

## Flat Top Chains

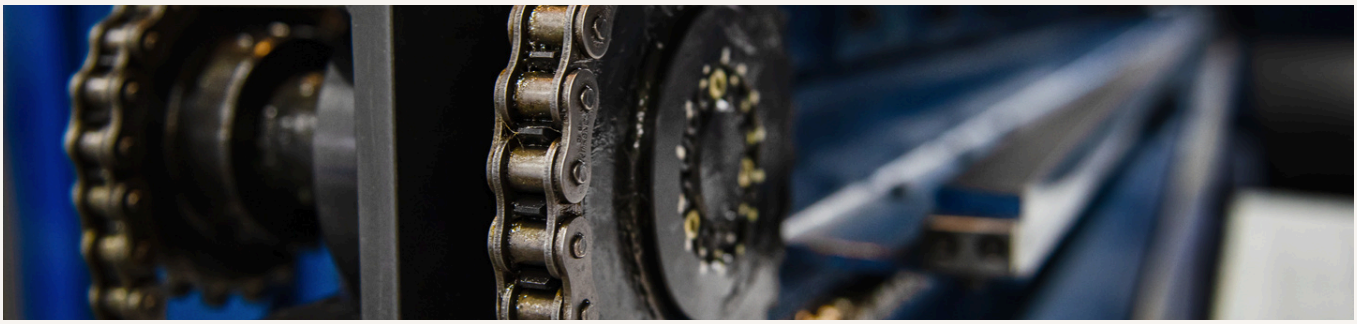
- Generally used in conveyor.
- Used in low-speed conveyor machine for material transportation in assembly lines.
- Allows movement only in one direction.

Flat top chains

## Engineering Steel Chains

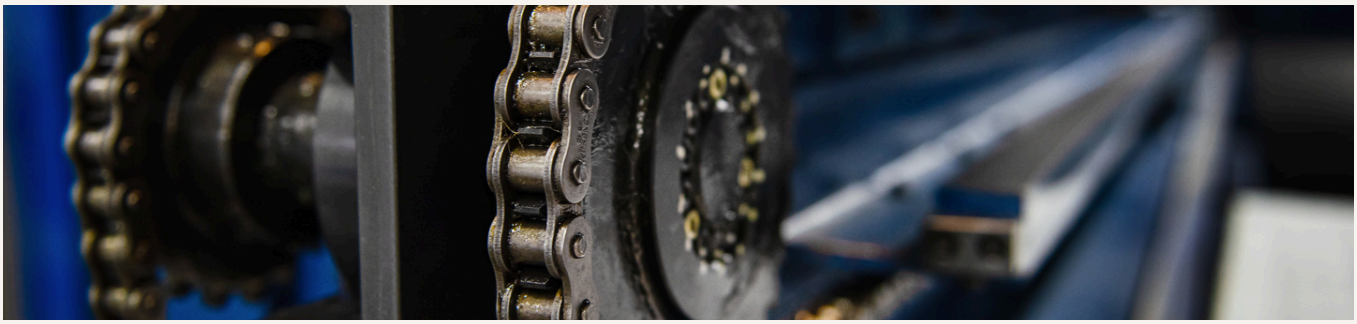
- This chain as design to handle the toughest environment.
- Large than other chains as it has to handle dust, dirt and abrasives under normal operating condition.
- Function as conveyor chains for material handling but some are also used in drivers.

Engineering steel chain



## 3.4.3 Produce check list for chain drive maintenance and failure symptoms

| **Problem** | **Reason** | **Solution** |
|---|---|---|
| Chain Noise | Something obstructing the path of the chain | Check for obstacles.Make adjustment.Lubricate the chain. |
| | Loose chain casing or axle bearing | Tighten all nuts and bolts |
| | Insufficient lubrication | Clean and lubricate the chain and sprockets |
| Chain Slipping | Improper tension of chain at installation or slack chain due to wear | Properly tension the chain.Periodically adjust the chain as wear occurs. |
| The chain jumping on the sprockets | Chain and sprocket don’t match. | Replace the chain or sprocket with the correct size part |
| | Excessive or uneven load on chain/sprocket | Reduce Load |
| | Excessive elongation of chain due to wear | Replace chain |

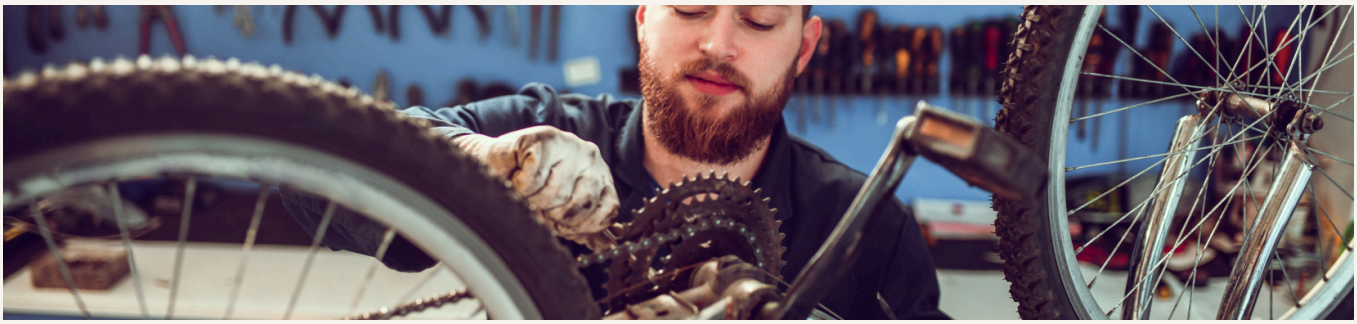


## Installation

1. The chain must be clean and free from grit and dirt before it is installed. Kerosene is highly effective cleaning agent.

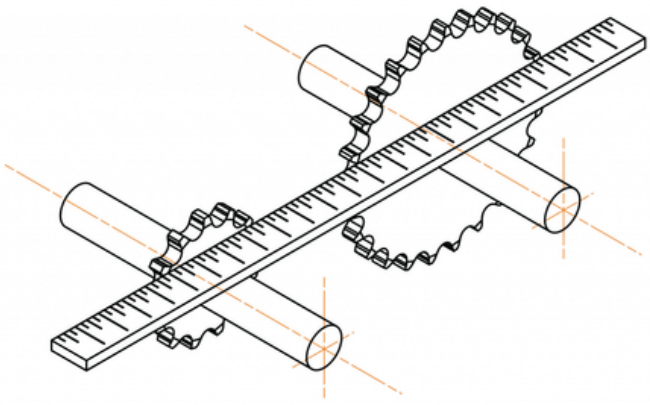
2. The chain should articulate freely. Make sure that part are not damaged or bent and that sprockets and shaft operate agent.

3. The drive must have adequate clearance. If chain lubrication is used the drive must be positioned correctly for chain clearance and the oil spray pipe adjusted properly.



## Shaft and sprocket alignment

- Mount the sprocket on their respectively shaft and align shaft horizontal with a machine's.
- Should made with Vernier caliper, or a feeler bar and the distance between shafts in both sides of the sprocket should be equal.
- Set screw must be tightened securely in sprocket hub to hold key in position and to guard against any lateral movement in the sprocket motors, bearings and etc.



Aligning Shaft

Aligning Sprocket

## Checking sprocket for wear

- Scored teeth or teeth with their tips worn off are sign of wear.

- The examples of teeth damage can be easily by making sure that the chain by ensuring that the chain is in good condition and by ensuring that the sprocket are in line as well as being made of hardened steel.

*Soft sprocket are the reason for this wear to cure this problem you must employ hardened teeth or you may wish to obtain sprocket that are hard throughout.*

## 3.4.4 Record observations for preventive maintenance.

### Check lubrication

- On slow speed drives, where manual lubrication is used, be sure the lubrication schedule is being followed. If the chain is covered with dirt and debris, clean the chain with kerosene and relubricate it.

***WARNING!***
***NEVER USE GASOLINE OR OTHER FLAMMEBLE SOLVENTS TO CLEAN A CHAIN. A FIRE MAY RESULT.***

- Check for adequate oil flow and proper application to the chain

- With bath or pump lubrication, check oil level and add oil if needed. Check oil for contamination and change oil if needed.

- Change oil after the first 100 hours of operation and each 500 hours thereafter.

- If pump lubrication is used, check each orifice to be sure it is clear and is directing oil onto the chain properly.

## Check chain tension

- Check chain tension and adjust as needed to maintain the proper sag in the slack span. If elongation exceeds the available adjustment, remove two pitches and reconnect the chain.

## Check chain wear

- Measure the chain wear elongation and if elongation exceeds functional limits or is greater than 3% (.36 inches in one foot) replace the entire chain.

- Do not connect a new section of chain to a worn chain because it may run rough and damage the drive.

- Do not continue to run a chain worn beyond 3% elongation because the chain will not engage the sprockets properly and it may damage the sprockets.

## Check Sprocket Tooth Wear

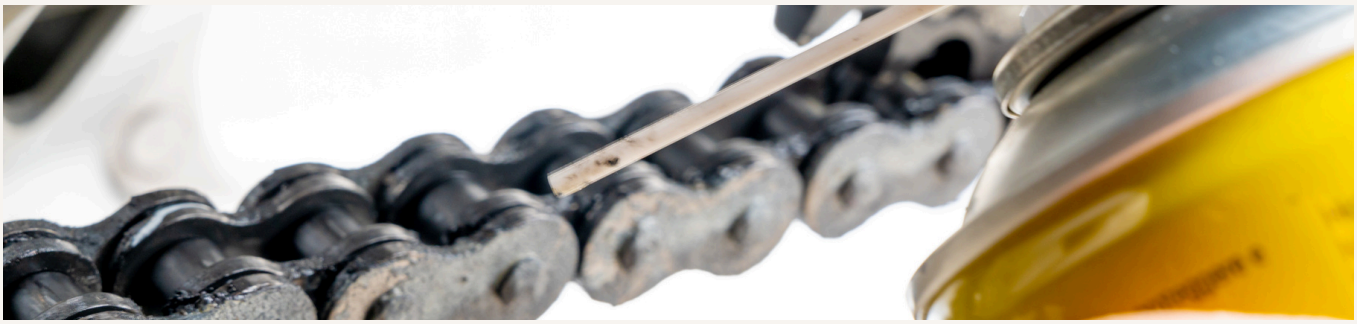
- Check for roughness or binding when the chain engages or disengages from the sprocket. Inspect the sprocket teeth for reduced tooth section and hooked tooth tips.

- If these conditions are present, the sprocket teeth are excessively worn and the sprocket should be replaced. Do not run new chain on worn sprockets as it will cause the new chain to wear rapidly.

- Conversely, do not run a worn chain on new sprockets as it will cause the new sprockets to wear rapidly.

## Check Sprocket Alignment

- If there is noticeable wear on the inside surface of the chain roller link plates, the sprockets may be misaligned. Realign the sprockets as outlined in the installation instructions to prevent further abnormal chain and sprocket wear.



## Check for Drive Interference

- Check for interference between the drive and other parts of the equipment.
- If there is any, correct it immediately.
- Check for and eliminate any build up of debris or foreign material between the chain and sprockets.

***A RELATIVELY SMALL AMOUNT OF DEBRIS IN THE SPROCKET ROLL SEAT CAN CAUSE TENSILE LOADS GREAT ENOUGH TO BREAK THE CHAIN IF FORCED THROUGH THE DRIVE.***

## Check for Failure

- Inspect the chain for cracked, broken or deformed parts. If any of these conditions are found, REPLACE THE ENTIRE CHAIN, even though portions of the chain appear to be in good condition. In all likelihood, the entire chain has been damaged.

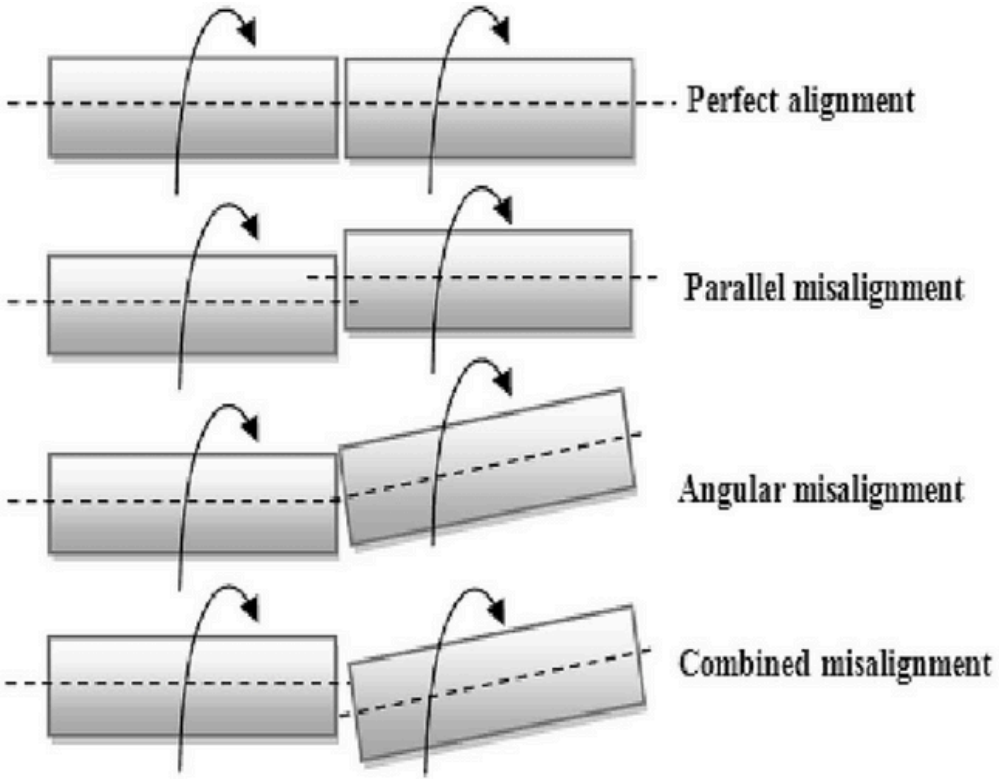
## 3.4.5 Produce chain drive maintenance procedures.

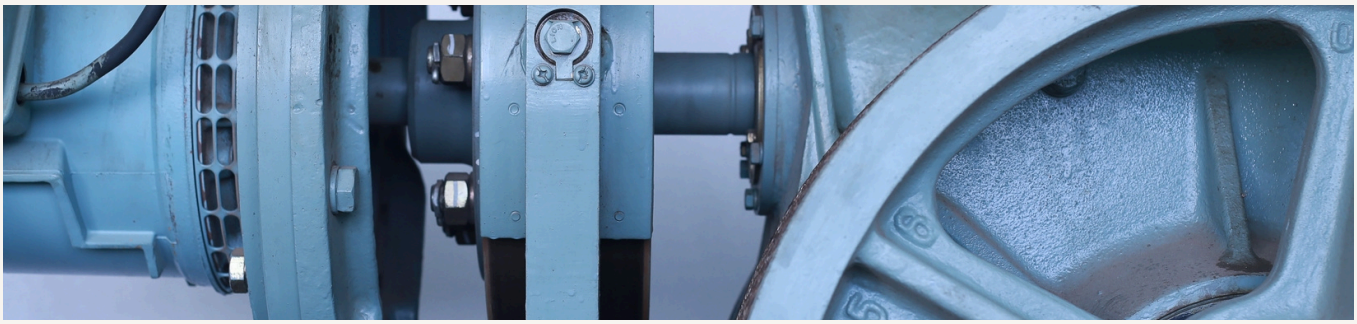
- Avoid crank link when used for high speed or heavily loaded applications
- To prolong the life of a chain is to clean and lube it regularly.
- Use a chain cleaner
- lube each roller individually
- keeping the lube away from the outside of the chain.
- Correct choices of lubricated is important because heavy oils and greases
- Oil is applied periodically with a brush or oil can
- once every eight hours of operation.
- Volume and frequency should be sufficient to just keep the chain wet with oil and allow penetration of clean lubricant into the chain joints.

# 3.5 Analyze friction drive, coupled shaft alignment or variable-speed drives.

## 3.5.1 Analyze the fundamentals of shaft alignment.

- Shaft alignment is the process of aligning two or more shafts with each other to within a tolerated margin





## 3.5.2 Demonstrate the use of the reverse dial indicator methods to correct shaft misalignment.

Reverse alignment is the measurement of the axis, or centerline, of one shaft to the relative position of the axis of an opposing shaft centerline

### Steps to correct the shaft misalignment using reverse dial

**Indicator Method :**

1. Identify machine components that have failed due to misalignment.
2. Identify parallel offset and angularity.
3. Use feeler gauges and dial indicators to test for irregular machine status.
4. Use magnetic base with dial indicator.
5. 5Complete a hands-on rough alignment using straight edge techniques.
6. Complete two computer simulated and two hands-on alignment jobs using reverse dial techniques

## 3.6 Perform troubleshooting on shaft failures.

3.6.1 Diagnose the shaft failures causing.

### Tension

- Changing torsional resonant frequency
- Improper shaft coupling
- Corrosive damage weakening the shaft

### Torsion

- Overload shaft
- Parelallel
- Sustained operation at excessive Rpm

### Compression

- Improper gear rations
- Stress due to torsional load
- Corrosive damege weakening the shaft

## 3.6.2 Troubleshoot the shaft failures causing to misalignment and wear and tear.

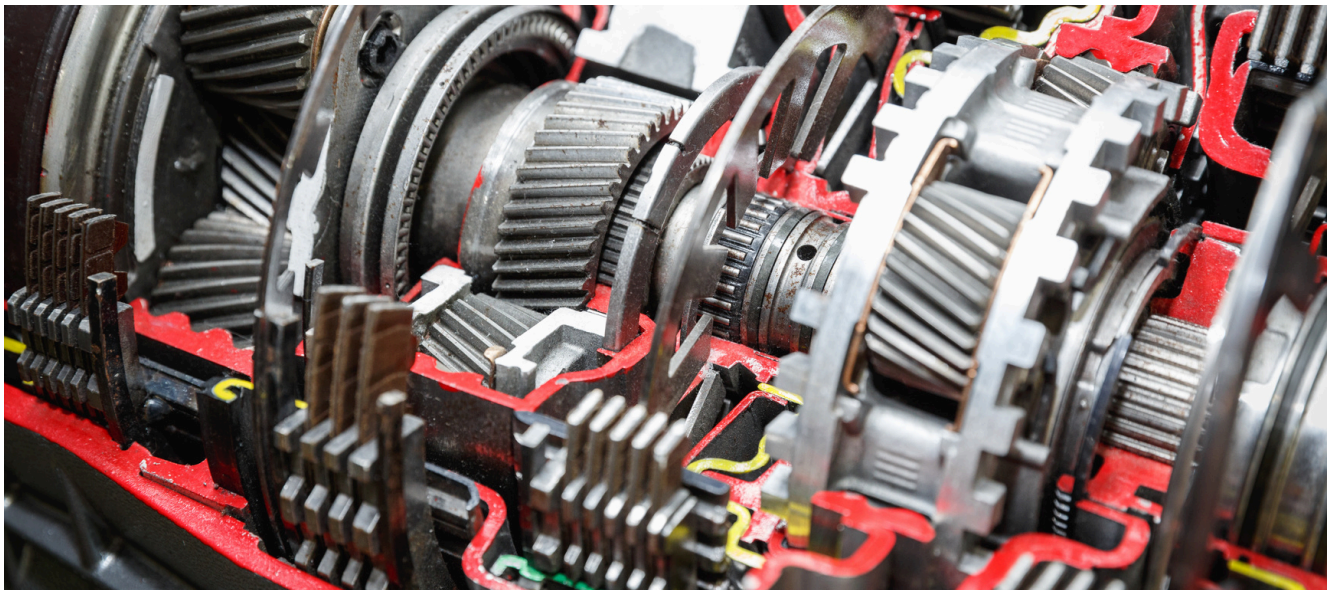
- Shaft misalignment is considered the second most prevalent source of vibration after imbalance, it occurs due to poor alignment between corresponding components, such as coupling halves, clutches, shafts, pulleys,

### What causes shaft misalignment?

- Settling of a baseplate resulting in soft foot.
- Shaft deformation caused by torsion during startup.
- Insufficient or poor-quality alignment measurements due to human error.
- Pipe strain that leads to parallel and angular misalignment

# REFERENCE


- Maintenance (technical) - Wikipedia
- Troubleshooting - Wikipedia
- https://en.wikipedia.org/wiki/Power_transmission
- https://fractory.com/mechanical-power-transmission/
- https://www.powertransmission.com/
- https://www.agma.org/
- https://fractory.com/belt-drives/
- https://www.cedengineering.com/userfiles/M06-031%20-%20Basic%20Fundamentals%20of%20Gear%20Drives%20-%20US.pdf
- https://www.iqsdirectory.com/articles/gearbox/gear-drive.html
- https://testbook.com/mechanical-engineering/types-of-chain-drives
- https://dizz.com/chain-drives/

Troubleshooting & Maintenance for Mechanical Components - Chapter 3

e ISBN 978-967-2097-93-8


Politeknik Mukah

(online)