ACADEMY / TECHNICAL TRAINING SERIES

CONVEYOR BELT FUNDAMENTALS

MODULE 01 / ASSESSOR GUIDE & ASSESSMENT RECORD

LEARNER NAME _____

DATE _____ TRAINER / ASSESSOR _____

ONLINE TRAINING / VIDEO LINK

_____

TRAINING SCOPE This introductory learning resource supports theoretical knowledge. Online completion alone does not demonstrate practical competence or authorise unsupervised vulcanising work.

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Module Overview

This module introduces the basic principles of conveyor belts and conveyor systems. Before anyone starts cutting, joining, clipping, vulcanising or replacing a belt, they need to understand how a conveyor works, what the main components do, and why belts fail.

A good belt splice starts long before the belt is joined. It starts with understanding the conveyor, the belt, the tension, the pulleys, the rollers, the loading area and the working conditions.

This module is designed for engineers, fitters, maintenance teams, apprentices, site operatives and companies wanting to improve their in-house conveyor belt knowledge.

This module can be used as a classroom training guide, toolbox talk, apprentice handout or self-training document.

Learning Objectives

By the end of this module, the learner should be able to:

1. Understand the basic layout of a conveyor system.
2. Identify the main conveyor components.
3. Explain the difference between the carrying side and return side of a conveyor belt.
4. Understand why belt tension, tracking and alignment are important.
5. Recognise common causes of belt damage and failure.
6. Understand why correct belt selection and preparation are important before splicing or repair work begins.

1. What Is a Conveyor Belt?

A conveyor belt is a continuous moving belt used to transport materials from one point to another. Conveyor belts are used across many industries, including quarrying, recycling, mining, agriculture, manufacturing, ports, construction and bulk material handling.

A conveyor system may look simple, but it relies on many parts working together correctly. If the belt, rollers, pulleys, tracking, loading or tension are wrong, the conveyor will not run properly and the belt may fail early.

A conveyor belt is not just a piece of rubber. It is a working component that carries load, transfers drive force, handles tension and runs over pulleys and rollers every time the conveyor operates.

A conveyor belt should always be treated as part of a complete system. Many belt failures are caused by problems with the conveyor, not just the belt itself.

2. Basic Conveyor Layout

Most belt conveyors include the following key areas:

Drive End

The drive end is where the motor and gearbox turn the drive pulley. The drive pulley transfers power into the belt and makes it move.

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Tail End

The tail end is normally at the opposite end of the conveyor from the drive. This is where the belt turns around and starts its journey back along the conveyor.

Carrying Side

The carrying side is the top side of the belt that carries the material.

Return Side

The return side is the underside of the conveyor where the belt travels back after discharging the material.

Loading Area

The loading area is where material is placed onto the belt. This area often includes impact rollers, impact beds, skirting and sealing systems.

Discharge Area

The discharge area is where material leaves the conveyor, usually over the head pulley or drive pulley.

If asked to describe a basic conveyor, a good answer would be:

A conveyor belt travels around a drive pulley and a tail pulley. The top side of the belt carries material from the loading area to the discharge area. The underside of the belt returns back to the tail end so the belt can continue running in a loop. Rollers support the belt, and the drive pulley provides the movement.

3. Main Conveyor Components

Conveyor Belt

The belt carries the material and transmits movement around the conveyor. Belts are available in many different types, strengths, covers and constructions.

Common belt types include:

- EP fabric belt
- Chevron belt
- Heat-resistant belt
- Oil-resistant belt
- Rip-resistant belt
- Steel cord belt
- PVC or PU light-duty belt
- Sidewall belt
- Modular plastic belt

The correct belt depends on the material being carried, conveyor length, incline, speed, loading conditions and working environment.

The conveyor belt is the moving part that carries the material. It must be strong enough for the load, suitable for the material, and suitable for the conveyor conditions.

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Drive Pulley

The drive pulley provides the traction needed to move the belt. It is connected to the motor and gearbox.

A drive pulley may be:

- Plain steel
- Rubber lagged
- Ceramic lagged
- Crowned
- Drum motor type

If the drive pulley has poor grip, contamination or incorrect lagging, the belt may slip.

The drive pulley turns the belt. It receives power from the motor and gearbox and transfers that power into the belt through friction or grip.

Tail Pulley

The tail pulley allows the belt to turn around at the opposite end of the conveyor. It may also help guide and tension the belt.

Tail pulleys must be clean, square and correctly aligned. Build-up around the tail pulley can cause belt tracking problems and damage.

The tail pulley allows the belt to return around the conveyor. If it is not aligned or becomes contaminated with material build-up, it can cause tracking problems and belt damage.

Rollers and Idlers

Rollers support the belt and allow it to move smoothly.

Common roller types include:

- Troughing rollers
- Return rollers
- Impact rollers
- Guide rollers
- Disc return rollers
- Spiral rollers
- Training idlers

Poor rollers can cause belt wear, tracking issues, noise, vibration and increased power draw.

Rollers support the belt on both the carrying side and return side. Damaged, seized or missing rollers can quickly damage the belt and cause tracking problems.

Impact Bed or Impact Rollers

Impact beds and impact rollers are used under loading points to support the belt where material drops onto it.

If the belt is not properly supported in the loading area, the belt can be damaged by impact, trapped material or excessive flexing.

Impact beds and impact rollers protect the belt at loading points. They help absorb the force of material landing on the belt.

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Scrapers and Cleaners

Belt scrapers remove carry-back material from the belt after discharge.

Poor belt cleaning can cause:

- Material build-up
- Roller seizure
- Tracking problems
- Belt wear
- Spillage
- Extra maintenance

Scrapers clean the belt after discharge. If material stays on the belt, it can build up on rollers and pulleys and cause tracking problems, wear and spillage.

Skirting and Sealing

Skirting helps keep material on the belt at the loading area. It must be adjusted correctly.

If skirting is too tight, it can damage the belt.

If skirting is too loose, material can escape and cause spillage.

Skirting controls material at the loading area. It should seal the load zone without applying too much pressure to the belt.

Take-Up or Tensioning System

The take-up system controls belt tension.

Common take-up systems include:

- Screw take-up
- Gravity take-up
- Hydraulic take-up
- Winch take-up

Correct tension is important. Too little tension can cause belt slip. Too much tension can damage the belt, pulleys, bearings and splice.

The take-up system adjusts belt tension. Correct tension helps the belt drive properly, track correctly and protect the splice.

4. Carry Side and Return Side

The carrying side is the side of the belt that transports material. This side usually has the most contact with material, impact, abrasion and contamination.

The return side is the side of the belt that travels back underneath the conveyor. It runs over return rollers and may contact snub pulleys, bend pulleys and tracking devices.

When inspecting a belt, always check both sides. Damage on the return side can be just as important as damage on the carrying side.

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The carrying side carries the material. The return side travels back underneath the conveyor after the material has been discharged. Both sides must be inspected because damage can occur on either side.

5. Why Belt Tracking Matters

Belt tracking means how well the belt runs centrally along the conveyor.

A correctly tracked belt should run straight and stay within the conveyor structure. A badly tracked belt may run to one side, rub against the frame, damage the belt edge, spill material or damage the splice.

Common causes of tracking problems include:

- Conveyor frame not square
- Pulleys not aligned
- Rollers seized or missing
- Material build-up
- Incorrect loading
- Belt damage
- Poor splice alignment
- Incorrect tension
- Uneven belt wear

Never assume tracking is only a belt problem. Very often, tracking problems are caused by the conveyor structure, pulleys, rollers or loading conditions.

Belt tracking is important because a belt should run centrally on the conveyor. If it runs to one side, it can damage the belt edge, cause spillage, damage the structure and shorten the life of the belt and splice.

6. Why Belt Tension Matters

Belt tension allows the conveyor to transfer drive force and carry material correctly.

If the belt is too loose, it may:

- Slip on the drive pulley
- Fail to start under load
- Track poorly
- Sag between rollers
- Cause material spillage
- Damage the splice

If the belt is too tight, it may:

- Overload bearings
- Damage pulleys
- Stretch the belt
- Damage the splice
- Increase power usage
- Cause premature belt failure

Before cutting or joining a belt, always consider the available take-up movement. If there is not enough adjustment left, the belt length or splice position may need to be reviewed.

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Correct belt tension is needed so the conveyor can drive the belt without slipping. Too little tension can cause slip and sag. Too much tension can damage the splice, pulleys, bearings and belt.

7. Common Causes of Belt Damage

Conveyor belts can fail for many reasons. Some failures are caused by the belt itself, but many are caused by the conveyor system or working conditions.

Common causes include:

Impact Damage

Heavy material dropping onto the belt can damage the top cover, carcass or splice area.

Abrasion

Sharp or abrasive material can wear the belt cover over time.

Belt Slip

A slipping drive pulley can burn or damage the underside of the belt.

Tracking Problems

A belt running off-centre can damage the edges and reduce belt life.

Trapped Material

Material trapped between the belt and pulley can cause cuts, holes or pulley build-up.

Poor Cleaning

Carry-back material can build up on rollers and pulleys, causing belt vibration, tracking issues and extra wear.

Incorrect Splicing

A badly prepared or misaligned splice can fail early.

Incorrect Belt Selection

Using the wrong belt for the application can lead to fast wear, poor tracking or splice failure.

Most belt damage is caused by impact, abrasion, poor tracking, trapped material, belt slip, poor cleaning, incorrect splicing or using the wrong belt for the application.

8. Basic Belt Construction

Many rubber conveyor belts are made from several layers.

A typical fabric belt may include:

Top Cover

The rubber layer on the carrying side of the belt. It protects the belt carcass from wear, impact and material damage.

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Carcass

The strength layer of the belt. This may be made from fabric plies or steel cords. The carcass gives the belt its tensile strength.

Bottom Cover

The rubber layer on the pulley side or return side of the belt. It protects the carcass and provides contact with pulleys and rollers.

Edges

The sides of the belt. Belt edges may be moulded or cut. Edge damage should always be checked before splicing or repair work.

Understanding belt construction is important because different belts require different splicing methods.

A standard rubber conveyor belt normally has a top cover, a strength layer called the carcass, and a bottom cover. The top cover protects against material wear, the carcass provides strength, and the bottom cover runs over pulleys and rollers.

9. Introduction to Belt Splicing

Belt splicing is the process of joining two ends of a conveyor belt together.

Common joining methods include:

Mechanical Fasteners

Mechanical fasteners are clips or hinges fitted to the belt ends. They are often used for fast repairs, temporary joints or where vulcanising is not practical.

Cold Bonding

Cold bonding uses adhesives and rubber materials to join or repair a belt without heat.

Hot Vulcanising

Hot vulcanising uses pressure, heat and uncured rubber to create a strong permanent splice.

Finger Splicing

Finger splicing uses interlocking fingers cut into the belt ends. It is often used on certain belt types where flexibility and smooth running are important.

Steel Cord Splicing

Steel cord splicing is used on steel cord belts and requires specialist training, correct materials and experienced supervision.

The correct splice method depends on the belt type, conveyor duty, working environment, available equipment and site requirements.

Belt splicing joins two ends of a conveyor belt. The main methods are mechanical fasteners, cold bonding, hot vulcanising, finger splicing and steel cord splicing. The correct method depends on the belt and the application.

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10. Good Working Practice

Before any belt work begins, always check:

- Has the conveyor been isolated and locked off?
- Is the belt safely supported?
- Is stored tension released or controlled?
- Is there enough take-up movement?
- Has the belt type been identified?
- Is the splice method suitable?
- Are the correct materials available?
- Are the tools clean and safe?
- Has the splice area been measured and marked correctly?
- Is the working area clean and dry?
- Is the team clear on the method and sequence of work?

Good belt work is about preparation. A rushed splice or repair often costs more time later.

Good working practice means preparing the job properly before starting. The conveyor must be isolated, the belt must be safe, the splice method must be correct, the materials must be suitable, and the work area must be clean, dry and organised.

Practical Exercise

Inspect a conveyor, conveyor drawing, photograph or training diagram and identify the following parts.

1. Drive Pulley

Suggested response: The drive pulley is normally found at the drive end of the conveyor. It is connected to the motor and gearbox and provides the force to move the belt.

2. Tail Pulley

Suggested response: The tail pulley is normally at the opposite end of the conveyor from the drive pulley. It allows the belt to turn around and travel back along the return side.

3. Carrying Side

Suggested response: The carrying side is the top side of the conveyor belt that carries the material.

4. Return Side

Suggested response: The return side is the underside of the belt that travels back after the material has been discharged.

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5. Loading Area

Suggested response: The loading area is where material is loaded onto the conveyor belt. This area may have impact rollers, impact beds, skirting and sealing.

6. Discharge Area

Suggested response: The discharge area is where material leaves the conveyor belt, usually over the head pulley or drive pulley.

7. Rollers

Suggested response: Rollers support the belt and allow it to move smoothly. Carry rollers support the loaded belt, and return rollers support the empty belt on its return path.

8. Belt Cleaner or Scraper

Suggested response: The belt cleaner or scraper removes material from the belt after discharge. This helps reduce carry-back, spillage and build-up.

9. Take-Up System

Suggested response: The take-up system controls belt tension. It may be a screw take-up, gravity take-up, hydraulic take-up or winch take-up.

10. Possible Areas Where Belt Damage Could Happen

Suggested response: Common damage areas include the loading point, tail pulley, drive pulley, return rollers, scraper area, belt edges, splice area and anywhere material can become trapped.

Knowledge Check

Question 1

What is the purpose of the drive pulley?

Model answer: The drive pulley transfers power from the motor and gearbox into the belt, causing the belt to move.

Question 2

What is the difference between the carrying side and return side of a conveyor belt?

Model answer: The carrying side transports the material. The return side travels back underneath the conveyor after the material has been discharged.

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Question 3

Name three common causes of belt tracking problems.

Model answer: Common causes include pulley misalignment, seized rollers, missing rollers, material build-up, poor loading, incorrect belt tension, conveyor frame issues, belt damage or poor splice alignment.

Question 4

Why is belt tension important?

Model answer: Correct belt tension helps the conveyor drive properly, prevents slipping, reduces sag and protects the belt, splice, pulleys and bearings.

Question 5

Why should belt construction be understood before splicing?

Model answer: Different belt constructions require different splice methods, preparation, materials and working practices. A fabric belt, steel cord belt, PVC belt or chevron belt may all require different treatment.

Question 6

What can happen if the belt is too loose?

Model answer: If the belt is too loose, it may slip on the drive pulley, sag between rollers, fail to start under load, track poorly, spill material or damage the splice.

Question 7

What can happen if the belt is too tight?

Model answer: If the belt is too tight, it can overload bearings, damage pulleys, stretch the belt, damage the splice, increase power usage and cause early belt failure.

Question 8

Why are impact beds or impact rollers used?

Model answer: They are used at loading points to support the belt and absorb the force of material landing on the belt. This helps reduce impact damage and belt flexing.

Question 9

Why is good belt cleaning important?

Model answer: Good belt cleaning reduces carry-back material. This helps prevent build-up on rollers and pulleys, reduces tracking problems, limits spillage and improves belt life.

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Question 10

What is belt splicing?

Model answer: Belt splicing is the process of joining two ends of a conveyor belt together to create a continuous belt.

Self-Assessment

Tick each statement once you understand it.

- I can identify the drive pulley.
- I can identify the tail pulley.
- I understand the carrying side and return side of a belt.
- I understand why belt tracking matters.
- I understand why belt tension matters.
- I can name common causes of belt damage.
- I understand basic belt construction.
- I can name common belt splicing methods.
- I understand why preparation is important before belt work starts.

Self-Assessment Answers

A learner should be confident with the following before moving to Module 2:

7. The drive pulley moves the belt.
8. The tail pulley turns the belt around at the opposite end.
9. The carrying side carries material.
10. The return side travels back underneath the conveyor.
11. Tracking means the belt runs centrally.
12. Tension must be correct to prevent slip, sag or damage.
13. Belt damage can be caused by impact, abrasion, tracking problems, trapped material, poor cleaning or poor splicing.
14. A belt normally has a top cover, carcass and bottom cover.
15. Belt splicing joins two belt ends together.
16. Good preparation improves safety and splice quality.

Trainer Notes

This first module should be kept simple and practical. The aim is not to turn the learner into a belt splicer in one session. The aim is to give them the foundation knowledge needed before moving into tools, safety, preparation and splicing methods.

Where possible, use real conveyor parts during the session. A belt sample, roller, pulley, scraper blade, fastener and small section of used belt will help learners understand the subject much faster than theory alone.

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Encourage learners to ask questions and relate the module to conveyors they have worked on before.

For self-training, the learner should read each section, review the self-study answers, complete the practical exercise and then check their understanding using the knowledge check.

Suggested Video Structure

Video Title

Conveyor Belt Basics — Free Training Module 1

Video Length

8–12 minutes

Video Sections

17. Introduction to The Conveyor Shop Academy and Vulca-fix
18. What a conveyor belt does
19. Main conveyor parts
20. Carry side and return side
21. Why tracking and tension matter
22. Common belt damage
23. Basic belt construction
24. Introduction to splicing methods
25. Summary and next module preview

Closing Line

In Module 2, we will look at working safely around conveyors, including isolation, stored energy, knife safety, hot work and safe preparation before any belt work begins.

Module Summary

A conveyor belt system is made up of many parts working together. Before carrying out belt splicing, repairs or maintenance, it is important to understand the conveyor layout, belt construction, tension, tracking and common causes of belt damage.

Correct preparation and good working practice improve safety, reduce downtime and help create better, longer-lasting belt repairs and splices.

This module is the foundation for the rest of the Conveyor Shop Academy belt training course.

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Assessment & sign-off

Assessment approach: review the ten knowledge-check responses, verify identification of ten conveyor features using a drawing, photograph or safely isolated training equipment, and discuss any gaps.

Suggested standard: all safety-critical points correct; at least 8/10 knowledge questions satisfactory and all practical identifications demonstrated or corrected and reassessed. This is an Academy suggested criterion, not an accredited standard.

Knowledge check (10 questions) Satisfactory ☐ Reassessment required ☐

Notes: _____

Identification exercise (10 items) Satisfactory ☐ Reassessment required ☐

Notes: _____

Safety awareness and limitations Satisfactory ☐ Reassessment required ☐

Notes: _____

Learner questions / areas for improvement Satisfactory ☐ Reassessment required ☐

Notes: _____

Outcome: ☐ Module completed (theory) ☐ Further learning required

Assessor name: _____ Date: _____

Assessor signature: _____

Learner signature: _____

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