

5. HOW TO DIAGNOSE AND RESOLVE BELT DRIVE PROBLEMS



DRIVEN BY POSSIBILITY™

BELT DRIVE PROBLEM DIAGNOSIS

TROUBLESHOOTING CHECKLIST



When troubleshooting a drive problem, the goal is to identify the cause(s), then take appropriate corrective action. The following steps should be followed to help with this process.

1. Describe the drive problem as accurately as possible.
2. Go through the list of "Drive Symptoms". Check those symptoms that are observed and record them, as well as observations of anything unusual about the drive.
3. Go through the "Problem/Solution Summary Table". List the probable cause(s) and corrective action. Also, review the list of observations.
4. After identifying probable causes and corrective action, review and implement.

What to Do When All Else Fails?

If the problem still exists after all troubleshooting efforts have been exhausted, contact the local Gates distributor. If the local distributor cannot solve the problem, a qualified Gates representative can be contacted. Save the failed belt(s) for further inspection.

Gates Power Transmission Product Application engineers are also available at pteusupport@gates.com or the local application engineer to answer additional drive design and troubleshooting questions.

STEP BY STEP CHECKLIST

STEP 1 - DESCRIBE THE PROBLEM.

- What is the belt tension value?
- What is wrong?
- When did it happen?
- How often does it happen?
- What is the drive application?
- Have the machine operations or output changed?
- What kind of belt(s) are being used?
- What are the expectations for belt performance in this application?

STEP 2 - IDENTIFY SYMPTOMS AND RECORD OBSERVATIONS OF ANYTHING UNUSUAL.

To determine the cause of a drive problem, you can rely on a range of tools from the surprisingly simple to the technical - some of which are available from Gates. An overview of the possibilities:

EYES, EARS, NOSE AND HANDS

Observing the drive while in operation or at rest may indicate problem areas. Can you see anything unusual about the way the belt travels around the drive? Do you smell warm rubber? Is the drive frame flexing under load? Do you hear chirping, squealing or grinding noises? Is there an accumulation of fabric dust under the drive which may interfere with the belts?

Feel the pulley grooves. They should be smooth, free of nicks and debris. Inspect the belt for unusual wear patterns, signs of burning or cracking.

BELT AND SHEAVE GAUGE - AVAILABLE FROM GATES

If you suspect a belt-to-pulley groove mismatch in a V-belt drive, belt and sheave gauges can be used to check dimensions. These are also handy for identifying a belt section for replacements, and for checking pulley grooves for wear.

LONG STRAIGHT EDGE

While V-belts can be somewhat forgiving of misalignment, this condition can still affect V-belt performance. Even slight misalignment can cause major problems on a synchronous drive.

Use a long straight edge to quickly check drive alignment. Simply lay the straight edge across the pulley faces and note the points of contact (or lack of contact). Remember to check whether pulleys are identical before starting.



Belt and sheave gauge

BELT DRIVE PROBLEM DIAGNOSIS

PROBLEMS ON V-BELT DRIVES



If you are replacing V-belts, take time to examine the old belts, pulleys and related drive components. They provide all the clues you need to determine whether your drive is functioning properly. Use below information to pinpoint the cause of the problem and take the required corrective measures. You will be rewarded with better-performing, longer-lasting drives.

WHAT TO LOOK FOR

Premature belt failure

- Broken belt(s)
- Belt(s) fail(s) to carry load (slip), without visible reason
- Edge cord failure
- Belt delamination or undercord separation

Severe or abnormal belt wear

- Wear on belt top surface
- Wear on belt top corners of belt
- Wear on belt sidewalls
- Wear on belt bottom corners
- Wear on belt bottom surface of belt
- Undercord cracking
- Burn or hardening on bottom or sidewall
- Extensive hardening of belt exterior
- Belt surface flaking, sticky or swollen
- Belt stretch

V-belts turn over or come off drive

- Single belt
- One or more belts in a set
- Joined or PowerBand® belts

Belt stretches beyond available take-up

- Single belt
- Multiple belts stretch unequally
- All belts stretch equally
- Belts do not match

Belt noise

- Squeal or “chirp”
- Slapping noise
- Rubbing sound
- Grinding sound
- Unusually loud drive

Unusual vibration

- Belts flapping
- Excessive vibration in drive system

Joined (PowerBand®) belt problems

- Tie-band separation
- Top of tie-band frayed, worn or damaged
- PowerBand® comes off drive
- One or more ribs run outside of pulley

Problems with pulleys

- Broken or damaged pulley
- Severe, rapid groove wear

Problems with drive components

- Bent or broken shafts
- Damaged guard

Hot bearings

- Belt overtensioned
- Pulleys too small
- Poor bearing condition
- Pulleys too far out on shaft
- Belt slippage

Performance problems

- Incorrect DriveN speeds

BELT DRIVE PROBLEM DIAGNOSIS

PROBLEMS ON V-BELT DRIVES



	Symptoms	Possible cause	Solution
Premature belt failure	Broken belt(s)	<ol style="list-style-type: none"> Underdesigned drive Belt rolled or prised onto pulley Object falling into drive Severe shock load 	<ol style="list-style-type: none"> Redesign using Gates Drive Design Software Use drive takeup when installing Provide adequate guard or drive protection Redesign to accommodate shock load
	Belt fails to carry load (slip); no visible reason	<ol style="list-style-type: none"> Underdesigned drive Damaged tensile member Worn pulley grooves Centre distance movement 	<ol style="list-style-type: none"> Redesign using Gates Drive Design Software Follow correct installation procedure Check for groove wear, replace as needed Check drive for centre distance movement during operation
	Edge cord failure	<ol style="list-style-type: none"> Pulley misalignment Damaged tensile member 	<ol style="list-style-type: none"> Check and correct alignment Follow installation procedure
	Belt delamination or undercord separation	<ol style="list-style-type: none"> Pulleys too small Back idler too small 	<ol style="list-style-type: none"> Check drive design, replace with larger pulleys Increase back idler to acceptable diameter
Severe or abnormal belt wear	Wear on belt top surface	<ol style="list-style-type: none"> Rubbing against guard Idler malfunction 	<ol style="list-style-type: none"> Replace or repair guard Replace idler
	Wear on belt top corners	<ol style="list-style-type: none"> Belt-to-pulley fit incorrect (belt too small for groove) 	<ol style="list-style-type: none"> Use correct belt-to-pulley combination
	Wear on belt sidewalls	<ol style="list-style-type: none"> Belt slip Misalignment Worn pulleys Incorrect belt 	<ol style="list-style-type: none"> Retension until slipping stops Realign pulleys Replace pulleys Replace with correct belt size
	Wear on belt bottom corners	<ol style="list-style-type: none"> Belt-to-pulley fit incorrect Worn pulleys 	<ol style="list-style-type: none"> Use correct belt-to-pulley combination Replace pulleys
	Wear on belt bottom surface	<ol style="list-style-type: none"> Belt bottoming on pulley groove Worn pulleys Debris in pulleys 	<ol style="list-style-type: none"> Use correct belt/pulley match Replace pulleys Clean pulleys
	Undercord cracking	<ol style="list-style-type: none"> Pulley diameter too small Belt slip Back idler too small Improper storage 	<ol style="list-style-type: none"> Use larger diameter pulleys Fit new belt at correct tension Use larger diameter back idler Do not coil belt too tightly, kink or bend. Avoid heat and direct sunlight.
Severe or abnormal belt wear	Burn or hardening on bottom or sidewall	<ol style="list-style-type: none"> Belt slip Worn pulleys Underdesigned drive Shaft movement 	<ol style="list-style-type: none"> Retension to specified belt tension Replace pulleys Redesign using Gates Drive Design Software Check for centre distance changes
	Extensive hardening of belt exterior	<ol style="list-style-type: none"> Drive operating temperature exceeded temperature range of belt 	<ol style="list-style-type: none"> Improve ventilation to drive
	Belt surface flaking, sticky or swollen	<ol style="list-style-type: none"> Excessive oil or chemical contamination 	<ol style="list-style-type: none"> Do not use belt dressing. Eliminate sources of oil, grease or chemical contamination

BELT DRIVE PROBLEM DIAGNOSIS

PROBLEMS ON V-BELT DRIVES



	Symptoms	Possible cause	Solution
Belt noise	Squeal or "chirp"	1. Belt slip 2. Contamination	1. Retension to specified belt tension 2. Clean belts and pulleys
	Slapping noise	1. Loose belts 2. Misalignment	1. Retension to specified belt tension 2. Realign pulleys so all belts share load equally
	Rubbing sound	1. Guard interference	1. Repair, replace or redesign guard
	Unusually loud drive	1. Incorrect belt 2. Worn pulleys 3. Debris in pulleys	1. Use correct belt size 2. Replace pulleys 3. Clean pulleys, improve shielding, remove rust, paint or dirt from grooves
Unusual vibration	Belts flapping	1. Belts undertensioned 2. Pulley misalignment	1. Retension to specified belt tension 2. Align pulleys
	Excessive vibration in drive system	1. Incorrect belt 2. Poor machine or equipment design 3. Pulley worn 4. Loose drive components	1. Use correct belt section in pulley 2. Check structure and brackets for adequate strength 3. Replace pulley 4. Check machine components
Banded (joined) belt problems	Tie-band separation	1. Worn pulleys 2. Improper groove spacing	1. Replace pulleys 2. Use correct pulleys
	Top of tie-band frayed, worn or damaged	1. Interference with guard 2. Back idler malfunction or damaged	1. Check guard 2. Repair or replace back idler
	PowerBand® comes off drive	1. Debris in pulleys 2. Misalignment	1. Clean grooves & use single belts to prevent debris from being trapped in grooves 2. Realign drive
	One or more ribs run outside of pulley	1. Misalignment 2. Undertensioned	1. Realign drive 2. Retension to specified belt tension
pulley Problems	Broken or damaged pulley	1. Incorrect pulley installation 2. Foreign objects falling into drive 3. Excessive rim speeds 4. Incorrect belt installation	1. Do not tighten bushing bolts beyond recommended torque values 2. Use adequate drive guard 3. Use pulleys capable of running at given rim speeds 4. Do not prise belts onto pulleys
	Severe, rapid groove wear	1. Excessive belt tension 2. Sand, debris or contamination	1. Retension to specified belt tension 2. Clean and shield drive as well as possible
Problems with other drive components	Bent or broken shaft	1. Extreme belt overtension 2. Overdesigned drive* 3. Accidental damage 4. Machine design error	1. Retension to specified belt tension 2. Check drive design, may need to use smaller or fewer belts 3. Redesign drive guard 4. Check machine design
	Damaged guard	1. Accidental damage or poor guard design	1. Repair, redesign for durability
Performance problems	Incorrect DriveN speeds	1. Design error 2. Belt slip	1. Use correct DriveR / DriveN pulley size for desired speed ratio 2. Retension drive to specified belt tension

BELT DRIVE PROBLEM DIAGNOSIS

PROBLEMS ON SYNCHRONOUS BELT DRIVES



Identifying the cause of synchronous belt drive failure can be challenging. In this section, we will diagnose some of the most common synchronous belt drive problems, so you will be prepared to correct them and take preventive measures in the future.

WHAT TO LOOK FOR

Belt problems

- Unusual noise
- Tension loss
- Excessive belt edge wear
- Tensile break
- Belt cracking
- Premature tooth wear
- Tooth shear
- Belt ratcheting
- Land area worn

Pulley problems

- Flange failure
- Unusual pulley wear
- Rusted or corroded

Performance problems

- Belt tracking problems
- Excessive temperature: bearings, housings, shafts, etc.
- Shafts out of synchronisation
- Vibration
- Incorrect DriveN speeds

	Symptoms	Possible cause	Solution
Problems with synchronous belts	Unusual noise	<ol style="list-style-type: none"> 1. Misaligned drive 2. Too low or high tension 3. Back idler 4. Worn pulley 5. Bent guide flange 6. Belt speed too high 7. Incorrect belt profile for pulley (i.e. HTD®, GT, etc) 8. Subminimal diameter pulleys / idlers 9. Excess load 	<ol style="list-style-type: none"> 1. Correct alignment 2. Adjust to specified belt tension 3. Check Idler location / alignment 4. Replace pulley 5. Replace guide flange 6. Redesign drive 7. Use specified belt/pulley combination 8. Redesign drive using larger diameters 9. Redesign drive for increased capacity
	Tension loss	<ol style="list-style-type: none"> 1. Weak support structure 2. Excessive pulley wear 3. Fixed (non-adjustable) centres 4. Excessive debris 5. Excessive load 6. Subminimal diameter pulleys / idlers 7. Unusual belt degradation 	<ol style="list-style-type: none"> 1. Reinforce structure 2. Use other pulley material 3. Use idler for belt adjustment 4. Remove debris, check guard 5. Redesign drive for increased capacity 6. Redesign drive using larger diameters 7. Use a belt specified for given environment
	Excessive belt edge wear	<ol style="list-style-type: none"> 1. Damage due to handling 2. Flange damage 3. Belt too wide 4. Belt tension too low 5. Rough flange surface finish 6. Improper tracking 7. Belt hitting drive guard or bracketry 	<ol style="list-style-type: none"> 1. Follow proper handling instructions 2. Repair flange or replace pulley 3. Use proper width pulley 4. Adjust tension to recommended value 5. Replace or repair flange (to eliminate abrasive surface) 6. Correct alignment 7. Remove obstruction or use inside idler
	Tensile break	<ol style="list-style-type: none"> 1. Excessive shock load 2. Subminimal diameter pulleys / idlers 3. Improper belt handling and storage prior to installation 4. Debris or foreign object in drive 5. Extreme pulley run-out 	<ol style="list-style-type: none"> 1. Redesign drive for increased capacity 2. Redesign drive using larger diameters 3. Follow proper handling and storage procedures 4. Remove object and check guard 5. Replace pulley

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PROBLEMS ON SYNCHRONOUS BELT DRIVES



	Symptoms	Possible cause	Solution
Problems with synchronous belts	Belt cracking	<ol style="list-style-type: none"> 1. Subminimal diameter pulleys 2. Back idler 3. Extreme low temperature at start-up 4. Extended exposure to harsh chemicals 	<ol style="list-style-type: none"> 1. Redesign drive using larger diameter 2. Use inside idler or increase diameter of back idler 3. Pre-heat drive environment 4. Protect drive or use belt specified to run in given environment
	Premature tooth wear	<ol style="list-style-type: none"> 1. Too low or too high belt tension 2. Belt running partly off unflanged pulley 3. Misaligned drive 4. Incorrect belt profile for pulley (i.e. HTD®, GT, etc) 5. Worn pulley 6. Rough pulley grooves 7. Damaged pulley 8. Pulley not to dimensional specification 9. Belt contacting drive structure 10. Excessive load 11. Insufficient hardness of pulley material 12. Excessive debris 	<ol style="list-style-type: none"> 1. Adjust to specified belt tension 2. Correct alignment 3. Correct alignment 4. Use specified belt/pulley combination 5. Replace pulley 6. Replace pulley 7. Replace pulley 8. Replace pulley 9. Modify structure or use idler 10. Redesign drive for increased capacity 11. Use a more wear-resistant pulley 12. Remove debris, check guard
	Tooth shear	<ol style="list-style-type: none"> 1. Excessive shock loads 2. Less than 6 teeth in mesh 3. Extreme pulley run-out 4. Worn pulley 5. Back idler 6. Incorrect belt profile for pulley (i.e. HTD®, GT, etc) 7. Misaligned drive 8. Belt undertensioned 	<ol style="list-style-type: none"> 1. Redesign drive for increased capacity 2. Redesign drive 3. Replace pulley 4. Replace pulley 5. Use inside idler 6. Use specified belt/pulley combination 7. Correct alignment 8. Adjust tension to specified value
Pulley problems	Flange failure	<ol style="list-style-type: none"> 1. Belt forcing flange off 	<ol style="list-style-type: none"> 1. Correct alignment or properly secure flange to pulley
	Unusual pulley wear	<ol style="list-style-type: none"> 1. Pulley has too little wear resistance (e.g. plastic, soft metals, aluminium) 2. Misaligned drive 3. Excessive debris 4. Excessive load 5. Too low or too high belt tension 6. Incorrect belt profile for pulley (i.e. HTD®, GT, etc) 	<ol style="list-style-type: none"> 1. Use alternative pulley material 2. Correct alignment 3. Remove debris, check guard 4. Redesign drive for increased capacity 5. Adjust tension to specified value 6. Use specified belt/pulley combination
Performance problems	Belt tracking problems	<ol style="list-style-type: none"> 1. Belt running partly off unflanged pulley 2. Excessive belt edge wear 	<ol style="list-style-type: none"> 1. Correct alignment 2. Correct alignment
	Vibration	<ol style="list-style-type: none"> 1. Incorrect belt profile for pulley combination (i.e. HTD®, GT, etc) 2. Too low or too high belt tension 3. Bushing or key loose 	<ol style="list-style-type: none"> 1. Use specified belt/pulley 2. Adjust tension to specified value 3. Check and reinstall as per specified belt tension

What to do when all else fails?

We have made every effort to cover all of the common drive problems that you may encounter. However, if the problem still exists after all your troubleshooting efforts have been exhausted, contact your Gates distributor. If he cannot solve the problem for you, he will put you in touch with a Gates representative. Expert help is always available to you.