

⚠ WARNING

- Read and follow all instructions carefully.
- Disconnect and lock-out power before installation and maintenance.
Working on or near energized equipment can result in severe injury or death.
- Do not operate equipment without guards in place. Exposed equipment can result in severe injury or death.

⚠ CAUTION

- Periodic inspections should be performed. Failure to perform proper maintenance can result in premature product failure and personal injury.

TROUBLESHOOTING GUIDE FOR BROWNING® GEARS

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Excessive gear wear	Insufficient lubrication.	Provide adequate lubrication. Refer to the "Gear Engineering" section of the BROWNING catalog for correct "type" lubrication.
	Gears not hardened.	Check drive HP requirement. Replace gear set with hardened gears of the same size. Replace gear set with gears having a greater face width.
	Drive underdesigned for application.	Check drive HP requirement. Redesign drive and replace with one of sufficient capacity.
	Gear drive subjected to abrasive environment.	Provide an adequate cover for the drive. Replace drive with hardened gears.
Excessive drive noise.	Gear set improperly adjusted for correct backlash.	Check Drive and adjust for correct backlash.
	Inadequate lubrication.	Provide correct lubrication. Refer to the "Gear Engineering" section of the BROWNING catalog for correct "type" lubrication.
	Misalignment.	Realign drive
	Worn Gears.	Check drive for wear. Replace gear set.
	Drive speed too high	Check gear pitch line velocity. Refer to the "Gear Engineering" section of the BROWNING catalog for specification.
Gear breakage	Overload or shock loads.	Eliminate overload or shock load conditions. Replace drive with wider gears or 20 degree pressure angle gears.
	Foreign material in drive	Provide an adequate cover for the drive.
Gear tooth deformation (plastic flow)	Drive overloaded.	Remove overload condition. Replace gear set with hardened gears. Replace gear set with wider gears.

**TROUBLESHOOTING GUIDE FOR
BROWNING® AND MORSE® ROLLER CHAIN DRIVES**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Chain climbs sprocket	Chain does not properly fit on sprocket.	Check for sprocket oversize bottom diameters and replace if necessary.
	Chain badly worn.	Replace chain
	Sprockets badly worn.	Replace chain and sprocket (on some drives, sprockets can be reversed.)
	Insufficient chain wrap	Redesign drive to get more teeth in contact with chain. Design a BROWNING Drive Tightener into the drive to accomplish additional chain wrap.
	Excessive chain slack.	Take up for proper slack or adjust center distance.
	Material build-up in sprocket tooth pockets.	Clean the sprockets. Provide a cover to protect drive from foreign material. Sprockets with "mud relief" may be helpful.
	Sprocket out of pitch.	Replace sprocket.
Excessive drive noise	Sprocket misalignment.	Check alignment and correct.
	Inadequate lubrication.	Provide the correct "Type" lubrication as dictated by the drive specifications. Where correct lubrication cannot be applied, MORSE LL chain may provide a satisfactory solution.
	Chain or sprockets badly worn.	Replace chain and/or sprockets. Driver sprocket should be hardened.
	Chain pitch size too large for drive.	Redesign drive and replace.
	Moving parts rubbing stationary parts.	Tighten and align supports, casing and chain. Remove dirt or other interfering matter.
Excessive wear on link plate and/or sides of sprocket teeth.	Drive misalignment.	Realign drive.
Chain breakage	Chain speed too high for pitch and sprocket size.	Redesign a smaller pitch drive.
	Shock loads.	Remove condition causing shock load.
	Material build-up in sprocket tooth pockets.	Clean the sprockets. Provide a cover to protect drive from foreign material.
	Inadequate lubrication.	Provide the correct "Type" lubrication as dictated by the drive specifications. Where correct lubrication cannot be applied, MORSE LL chain may provide a satisfactory solution.
	Chain or sprocket corrosion.	Protect drive from corrosion causing conditions.
	Badly worn sprockets.	Check sprockets for wear and replace.
	Misalignment.	Correct alignment.
Chain clings to sprockets	Badly worn sprockets.	Check sprockets for wear and replace.
Chain whip	Excessive chain slack.	Take up for proper slack or adjust centers.
	Heavy pulsating loads	Reduce loads or redesign to a heavier drive.
		Install an idler take-up system.

**TROUBLESHOOTING GUIDE FOR
BROWNING® AND MORSE® ROLLER CHAIN DRIVES**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Chain gets stiff	Long center distance. Inadequate lubrication.	Provide the correct "Type" lubrication as dictated by the drive specifications. Where correct lubrication cannot be applied, MORSE LL chain may provide a satisfactory solution.
	Corrosion.	Protect drive from corrosion causing conditions.
	Material build-up in chain joint.	Provide a cover to protect drive from foreign material.
Broken sprocket teeth.	Cast iron sprockets.	Replace with BROWNING stock steel sprockets (available hardened in smaller sizes).
	Excessive shock loads.	Reduce shock loads or redesign and replace with a larger drive.
	Misalignment.	Correct alignment.
	Sprocket hardened excessively.	Replace sprocket.
Non-symmetrical wear on sprockets or rollers	Shafts not parallel or not in same plane.	Realign shafts.
Wear on inside of roller plates or side of sprocket teeth	Sprockets offset or not parallel.	Realign drive.
Wear on tips of sprocket teeth	Chain elongated excessively.	Replace chain.
Excessive vibration	Broken or missing roller.	Repair or replace chain.
Premature chain elongation	Inadequate lubrication.	Provide proper lubrication
	Drive overload	Redesign drive.

**TROUBLESHOOTING GUIDE FOR
BROWNING® V-BELT DRIVES**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Belt stretch beyond takeup	Worn sheaves.	Replace sheaves
	Underdesigned drive.	Redesign and replace drive.
	Takeup slipped.	Reposition takeup.
	Drive excessively tensioned.	Properly tension drive.
	Damaged cord section during installation.	Replace belt and properly install.
Excessive vibration	Damaged belt cord section.	Replace belt
	Loose belt.	Tension belt
	Belts improperly tensioned	Tension drive with slack of each belt on the same side of the drive.
Belt too long at installation	Insufficient takeup	Use shorter belts.
	Drive improperly set up.	Recheck driver and driven machine set up.
	Wrong size belt.	Use correct size belt.
Belt too short at installation	Insufficient takeup.	Use longer belt.
	Drive improperly set up.	Recheck driver and driven machine set up.
	Wrong size belt.	Use correct size belt.
Belts mismatched at installation	Belts matched by code number only.	Replace belts with BROWNING machine matched belts.
	Old belts and new belts used together on same drive.	Replace with new belts.
	Different brand name belts used together on same drive.	Replace with a set of BROWNING machine matched belts.
	Driver and driven shafts not parallel.	Realign drive.
	Worn sheaves.	Replace sheaves.
Belts mismatched after service.	Belts improperly tensioned, causing more stretch of some belts than others.	Replace belts and tension drive with slack of each belt on the same side of the drive.
	Old belts and new belts used together on same drive.	Replace with new belts.
	Different brand name belts used on same drive	Replace with a set of BROWNING machine matched belts.
	Driver and driven shafts shifted from parallel.	Realign drive.
	Belt cord section damaged during installation.	Replace belts and install properly.

**TROUBLESHOOTING GUIDE FOR
BROWNING® V-BELT DRIVES**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Short belt life	Spin burns from belt slipping on driver sheave under stalled load conditions or when starting.	Tension belt.
	Gouges or extreme cover wear caused by belt rubbing on drive guards or other objects.	Eliminate obstruction or realign drive to provide clearance.
	High ambient temperature.	Use Gripnotch® belts. Provide ventilation. Shield belt.
	Grease or oil on belt.	Check for leaky bearings. Clean belt and sheaves.
	Underdesigned drive.	Redesign drive.
	Worn Sheaves.	Replace sheaves.
Belts turn over in groove	Damaged cord section in belts. Frayed or gouged belts.	Replace belts.
	Excessive vibration.	Tension belts. Replace belts if damaged. Use banded belts.
	Flat idler pulley misaligned.	Realign idler.
	Worn Sheaves.	Replace sheaves.
	Sheave misalignment.	Realign drive.
Belt squeal	High starting load. Belt not tensioned properly. Excessive overload.	Tension drive or redesign and replace drive.
	Insufficient arc of contact.	Increase center distance or use Gripnotch belts.
Belt breakage	Foreign material in drive.	Provide drive guard.
	Belt damaged during installation.	Follow BROWNING V-belt Drive installation instructions.
	Shock or extreme overload.	Eliminate overload cause or redesign drive.

**TROUBLESHOOTING GUIDE FOR
BROWNING® MVP® VARIABLE SPEED BELT DRIVES**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Short belt life	Spin burns from belt slipping on driver sheave under stalled load conditions or when starting.	Tension belt.
	Gouges or extreme cover wear caused by belt rubbing on drive guards or other objects.	Eliminate obstruction or realign drive to provide clearance.
	High ambient temperature.	Provide ventilation. Shield belt. Use Gripnotch® belts.
	Grease or oil on belt.	Check for leaky bearings. Clean belt and sheaves.
	Worn sheaves.	Replace sheaves.
	Misalignment	Use companion sheave and align with center grooves.
Belts turn over in groove	Damaged cord section in belts. Frayed or gouged belts.	Replace belts.
	Excessive vibration.	Tension belts. Replace belts if damaged.
	Flat idler pulley misaligned.	Realign idler.
	Worn Sheaves.	Replace sheaves.
	Sheave misalignment.	Realign drive.
Belt squeal	High starting load. Belt not tensioned properly. Excessive overload.	Tension drive or redesign and replace drive.
	Insufficient arc of contract.	Increase center distance or use Gripnotch belts.
Belt breakage	Foreign material in drive.	Provide drive guard.
	Belt damaged during installation.	Follow BROWNING V-belt Drive Installation instructions.
	Shock or extreme overload.	Eliminate overload cause or redesign drive.
Belt stretch beyond takeup	Worn sheaves.	Replace sheaves.
	Underdesigned drive.	Redesign and replace drive.
	Takeup slipped.	Reposition takeup.
	Drive excessively tensioned.	Properly tension drive.
	Damaged cord section during installation.	Replace belt and properly install.
Excessive vibration	Damaged belt cord section	Replace belt.
	Loose belt.	Tension belt.
Belt too long at installation	Insufficient takeup.	Use shorter belt.
	Drive improperly set up.	Recheck driver and driven machine set up.
	Wrong belt size.	Use correct size belt.
Belt too short at installation	Insufficient takeup.	Use longer belt.
	Drive improperly set up.	Recheck driver and driven machine set up.
	Wrong size belt.	Use correct size belt.

**TROUBLESHOOTING GUIDE FOR
BROWNING® MVP® VARIABLE SPEED BELT DRIVES**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Belts mismatched at installation	Belts matched by code number only.	Replace belts with BROWNING machine matched belts.
	Old belts and new belts used together on same drive.	Replace with new belts. Never mix old and new belts on the same drive.
	Different brand name belts used together on same drive.	Replace with a set of BROWNING machine matched belts.
	Driver and driven shafts not parallel.	Realign drive.
	Worn sheaves.	Replace sheaves.
Belts mismatched after service.	Belts improperly tensioned, causing more stretch of some belts than others.	Replace belts and tension drive with slack of each belt on the same side of the drive.
	Old belts and new belts used together on same drive.	Replace with new belts. Never mix old and new belts on the same drive.
	Different brand name belts used on same drive.	Replace with a set of BROWNING machine matched belts.
	Driver and driven shafts shifted from parallel.	Realign drive.
	Belt cord section damaged during installation.	Replace belts and install properly.
Sheave fails to adjust.	Fretting corrosion (Drive allowed to operate at one speed over a period of time.)	Replace sheave and align sheave by the center groove.
Sheave flange breaks	Misalignment (possible if a companion sheave is not used where required)	Replace sheave and align sheave by the center grooves.

TROUBLESHOOTING GUIDE FOR SYNCHRONOUS BELT DRIVES

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Belt tooth shear	Less than 6 teeth in mesh (TIM)	Increase TIM or use next smaller pitch.
Belt tensile break	Excessive load.	Increase load-carrying capacity of drive.
	Sub-minimum pulley diameter.	Increase pulley diameters.
Excessive drive noise	Misalignment.	Correct alignment.
	Excessive installation tension.	Reduce tension.
	Excessive load.	Increase drive load-carrying capacity.
	Sub-minimum pulley diameter.	Increase pulley diameter.
	Excessive speed.	Reduce speed.
Unmounting of flange	Misalignment.	Correct alignment.
Apparent belt stretch	Reduction of center distance of non-rigid mounting.	Retension drive and/ or reinforce mounting.
Cracks or premature wear at belt tooth root	Improper pulley groove top radius.	Regroove or install new pulleys.
Excessive belt edge wear	Misalignment or non-rigid centers.	Check alignment and/or reinforce mounting.
	Bent flange.	Straighten flange.
Jacket wear on pressure-face side of belt tooth	Excessive overload and/ or excessive belt tightness.	Reduce installation tension and/ or increase drive load-carrying capacity.
Excessive jacket wear between belt teeth (exposed tension members)	Excessive installation tension.	Reduce installation tension.
Cracks in neoprene backing	Exposure to excessive low temperature (below -30 degrees F).	Eliminate low temperature condition or consult Technical Services for proper belt construction.
Softening of neoprene backing	Exposure to excessive heat (+200 degrees F) and/ or oil.	Eliminate high temperature and oil condition or consult Technical Services for proper belt construction.
Excessive pulley tooth wear (on pressure-face and/ or OD)	Excessive overload and/ or excessive belt tightness.	Reduce installation tension and/ or increase drive load-carrying capacity.
	Insufficient hardness of pulley material.	Surface-harden pulley or use harder material.

**TROUBLESHOOTING GUIDE FOR
SEALMASTER® AND BROWNING® MOUNTED BEARINGS**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Noise (high pitch)	Misalignment.	Correct alignment. Replace unit with a SEALMASTER or BROWNING self-aligning bearing.
Noise (low pitch)	Bearing brinelled.	Replace bearing.
Noise (intermittent rumbles and rattles)	Too much shaft to bearing bore clearance.	Use proper size shaft. Replace bearing with correct size unit.
	Dirt in bearing.	Purge bearing with grease. If necessary, replace unit.
	Loose machine parts.	Tighten machine parts.
Bearing gets excessively hot	First start after relubrication (grease redistribution).	Allow machine parts to cool and restart.
	Over lubrication	Use less lubricant.
	No lubricant.	Add lubricant.
	Excessive load.	Check bearing loads. Replace with a larger unit. If thrust load is caused by shaft expansion, an expansion type bearing should be used.
	Bearing located near a heat source.	Shield the bearing or move it away from the heat source.
	Bearing over misaligned.	Correct alignment.
	Excessive speed.	Check bearing ratings and speed limitations. Replace with a unit that is capable of high speed operation.
Excessive vibration	Unbalanced machine parts.	Balance machine parts.
	Loose machine parts.	Check and tighten machine parts.
	Improper shaft to bearing bore fit.	Check shaft size. Replace unit with correct bearing.
	Bent shaft.	Straighten or replace shaft.
	Bearing brinelled.	Replace bearing.
Shaft binds when rotated	Bent shaft.	Straighten or replace shaft.
	Misalignment.	Correct alignment. Replace unit with a SEALMASTER or BROWNING self-aligning bearing.
	Dirt in bearing.	Purge bearing with grease. If necessary, replace unit.
	Rotate interference.	Check clearance of rotating parts.
Wear of shaft seat	Too much shaft to bearing bore clearance.	Correct shaft fit. Use new shaft.
	Poor shaft finish.	Use new shaft. Smooth turn or grind shaft to next smaller standard bore and install new bearing.

**TROUBLESHOOTING GUIDE FOR
BROWNING® CONCENTRIC REDUCERS (HELICAL)**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Overheating (Over 200 degrees F oil temperature)	Load exceeds reducer's mechanical and/ or thermal capacity.	Decrease load. Check catalog rating of the drive. Redesign drive and replace unit with one of sufficient capacity.
	Insufficient oil level.	Check oil level. Adjust oil level as indicated in the installation and maintenance instructions.
	Too much oil. Excessive heat generated by the fluid friction of the churning action of the oil.	Check oil level. Adjust oil level as indicated in the Concentric installation and maintenance instructions.
	Wrong grade of oil.	Flush reducer and refill as indicated in the installation and maintenance instructions.
	Excessive input speed.	Consult BROWNING Technical Services relating all particulars including mounting position. May be able to lower oil level or change to lower ratio reducer.
	Reducer located near a heat source.	Shield the reducer from the heat or move reducer away from it.
Excessive noise and vibration	Worn bearings.	Check bearings for wear and replace worn bearings. Replace all seals. Flush reducer and refill with oil. Check thrust loads and overhung loads. If excessive, correct these conditions or replace with a larger unit.
	Drive underdesigned causing premature excessive gear wear.	Redesign drive and replace with a drive of sufficient capacity.
	Insufficient oil level.	Check oil level. Adjust oil level as indicated in the Concentric installation and maintenance instructions.
	Improper connection with other machinery.	Inspect drive for loose bolts, nuts and screws and tighten where needed. Check coupling alignment.
	Excessive input speed.	Consult BROWNING Technical Services if suspected.
	Bent shaft.	Check with a dial indicator and replace if bent.
Excessive shaft end play	Worn bearings.	Check bearings for wear and replace worn bearings. Replace all seals. Flush reducer and refill with oil.
	Loose end cover bolts.	Check and cover capscrews and tighten where necessary.
Excessive backlash	Worn gears.	Replace worn gears. Always replace mating gear.
	Worn keys.	Replace worn keys. Inspect keyways for wear. An oversize key may be required.
	Loose bearings.	Check bearings for wear and replace worn bearings. Always replace seals. Check end covers for loose bolts.
	Excessive backlash in driven machinery.	Check driven machinery.

**TROUBLESHOOTING GUIDE FOR
BROWNING® CONCENTRIC REDUCERS (HELICAL)**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Oil leakage	Oil Level too high.	Check oil level. Adjust oil level as indicated in the Concentric installation and maintenance instructions.
	Clogged breather plug.	Remove and clean breather plug.
	Seal damaged.	Replace seal.
	Loose bolts.	Tighten bolts. A thread locking agent may help prevent further problems.
	Breather plug in wrong hole.	Relocate breather plug to proper hole.
Reducer shafts will not turn when drive is actuated.	Backstop installed for reverse shaft rotation.	Remove backstop, turn end for end and re-install.
	Driven machinery binding or locked up.	Check for free operation of driven machinery.
Backstops wear out prematurely.	Reducer mounted so that backstop is not flooded with oil.	Change reducer mounting so that backstop is flooded with oil.
	Backstop overloaded.	Reduce load or replace with a larger drive.
	Oil level too low.	Check oil level and refill as necessary.
Premature upper bearing failure (reducer mounted in vertical position).	Standard reducer mounted in vertical position.	Replace unit with a vertical unit.
	Failure to lubricate upper bearing.	Lubricate bearings.
	Failure to install upper bearing grease fittings.	Make sure fittings are installed in upper cover.
Premature input bearing failure.	Excessive overhung load.	Check overhung load capacity. Check to insure that sheave is mounted as close to housing as possible. It may be necessary to install a larger sheave on the input shaft. Check to insure that belts are not over tensioned.

**TROUBLESHOOTING GUIDE FOR
BROWNING® HELICAL SHAFT MOUNT REDUCERS**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Overheating (Over 200 degrees F oil temperature)	Load exceeds reducer's mechanical and/or thermal capacity.	Decrease load. Check catalog rating of the drive. Redesign drive and replace unit with one of sufficient capacity or add a fan to the unit.
	Insufficient oil level.	Check oil level. Adjust oil level as indicated by the Shaft Mount Reducers "Installation and Maintenance Manual" or as specified on the reducer nameplate.
	Too much oil. Excessive heat generated by the fluid friction of the churning action of the oil.	Check oil level. Adjust oil level as indicated by the Shaft Mount Reducers "Installation and Maintenance Manual" or as specified on the reducer nameplate.
	Wrong grade of oil.	Flush reducer and refill as indicated by the Shaft Mount Reducer "Installation and Maintenance Manual" or as specified on the reducer nameplate.
	Excessive input speed.	Consult BROWNING Technical Services relating all particulars including mounting position. May be able to lower oil level or change to lower ratio reducer.
	Reducer located near a heat source.	Shield the reducer from the heat source or move reducer away from it.
Excessive noise and vibration	Improper installation of torque arm.	Check mounting instructions and correct. Check mounting bolts and tighten.
	Worn bearings.	Check bearings for wear and replace worn bearings. Replace all seals. Flush reducer and refill with oil. Check thrust loads and overhung loads. If excessive, correct these conditions or replace with a larger unit.
	Drive underdesigned causing premature excessive gear wear.	Redesign drive and replace with a drive of sufficient capacity.
	Insufficient oil level.	Check oil level. Adjust oil level as indicated by the Shaft Mount Reducers "Installation and Maintenance Manual" or as specified on the reducer nameplate.
	Improper connection with other machinery	Inspect drive for loose bolts, nuts, and screws and tighten where needed. For the finished bore type, check output shaft bushings and insure that the keyed bushing has been installed toward the driven machine. For the TorqTaper Plus® bushed bore reducer, check bushing capscrews for tightness to insure that the bushing is properly seated on the shaft and in the reducer.
	Bent driven shaft.	Inspect runout of driven shaft. Straighten or replace shaft.
	Driven shaft undersize.	Turn driven shaft down to next standard bushing size and use bushing.
Excessive shaft end play	Driven shaft not extending far enough into the Torq Taper bushing or the hollow output shaft of finished bore reducers.	Replace driven shaft with a shaft of sufficient length or, if possible, move reducer farther onto shaft.
	Worn bearings.	Check bearings for wear and replace worn bearings. Replace all seals. Flush reducer and refill with oil.
	Loose end cover bolts.	Check and cover capscrews and tighten where necessary.

**TROUBLESHOOTING GUIDE FOR
BROWNING® HELICAL SHAFT MOUNT REDUCERS**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Excessive backlash	Worn gears.	Replace worn gears. Always replace both gears of a mating pair.
	Worn keys.	Replace worn keys. Inspect keyways for wear. An oversize key may be required.
	Loose bearings.	Check bearings for wear and replace worn bearings. Always replace seals. Check end covers for loose bolts.
	Excessive backlash in driven machinery.	Check driven machinery.
Oil Leakage	Oil level too high causing oil leakage out of breather plug.	Check oil level. Adjust oil level as indicated by the Shaft Mount Reducers "Installation and Maintenance Manual" or as specified on the reducer nameplate.
	Clogged breather plug.	Remove and clean breather plug.
	Seal damaged.	Replace seal.
	Loose bolts.	Tighten bolts.
	Breather plug in wrong hole.	Refer to Shaft Mount Reducers "Important Instructions" Sheet for proper location of breather plug.
	Vertical mounted reducer without vertical mount breather kit.	Install vertical mount breather kit.
Reducer shaft will not turn when drive is actuated.	Backstop installed for reverse shaft rotation.	Remove backstop, turn end for end and re-install.
	Driven machinery binding or locked up.	Check for free operation of driven machinery and correct if necessary.
Backstops wear out prematurely.	Reducer mounted so that backstop is not flooded with oil.	Change reducer mounting so that backstop is flooded with oil.
	Backstop overloaded.	Reduce load or replace with a larger drive.
Premature input bearing failure.	Excessive overhung load.	Check minimum sheave diameter and replace with a larger sheave. Check to insure that sheave is mounted as close to housing as possible. Check to insure that belts are not over tensioned.
Premature output bearing failure.	Excessive overhung load.	Check minimum sprocket diameter and replace with a larger sprocket. Check to insure that sprocket is mounted as close to housing as possible. Check to insure that drive is not over tensioned.

**TROUBLESHOOTING GUIDE FOR
MORSE® WORM GEAR REDUCERS**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Overheating (Over 200 degrees F oil temperature)	Reducer overloaded (Operating in excess of thermal HP rating)	Remove overload conditions. Compare thermal HP rating with actual load and replace with a unit of sufficient thermal capacity fans are available for some units.
	Insufficient oil level.	Adjust oil level to oil level plug or dipstick designation (if provided). Reducer capacity can be determined from nameplate or Worm Gear Speed Reducers Instruction sheets.
	Too much oil. Excessive heat generated by the churning action of the high oil level.	Adjust oil level to oil level plug or dipstick designation (if provided). Reducer capacity can be determined from nameplate or Worm Gear Speed Reducers Instruction sheets.
	Dirty or contaminated oil.	Flush and refill to proper level.
	Wrong grade of oil	Flush reducer and refill to proper level
	High surrounding ambient temperature.	Increase air circulation. Equip reducer with a fan. Replace reducer with a unit of higher thermal capacity.
	Excessive belt tension on the input shaft.	Adjust belts to proper tension. Check input bearing for possible damage.
Excessive noise and vibration	Improper installation.	Check Foundation bolts and tighten as required. Check C-face mounting bolts for tightness. Use lock washers on all bolts.
	Worn bearings.	Check bearings for wear and replace worn bearings. Replace all seals. Flush reducer and refill with oil. Check allowable output thrust loads and output overhung loads. If excessive, correct these conditions or replace with a larger unit.
	Drive underdesigned causing premature excessive gear wear.	Redesign drive and replace with a unit of sufficient capacity.
	Improper connection with other machinery.	Inspect input and output drives and insure that these drives have been properly engineered. Inspect drive for loose bolts, nuts, and screws and tighten where needed. Check shaft keys for proper fit. If coupling connected, check alignment.
Excessive input and/ or output shaft end play	Excessive input speed.	For speeds in excess of 3600 RPM, consult Engineering.
	Worn bearings.	Check bearings for wear and replace worn bearings. Replace all seals. Flush reducer and refill with oil.
	Loose end cover bolts.	Check end cover capscrews and tighten where necessary.
Excessive backlash	Worn gears.	Replace worn gears. A new worm gear may be mated with an old worm if the worm shows little evidence of wear. If the worm needs to be replaced the worm gear should also be replaced. Black or blue color or distortion of worm indicates no oil, low oil level, or excessive load. Bronze dust on worm gear indicates reducer ran without oil.
	Worn keys.	Replace worn keys. Inspect keyways for wear. An over-size key may be required. Distortion of key or keyway indicates excessive torque load.

**TROUBLESHOOTING GUIDE FOR BROWNING®
MORSE® WORM GEAR REDUCERS**

WHAT HAPPENED	PROBABLE CAUSE	WHAT TO DO
Oil Leakage	Too much oil causing leakage at breather plug.	Adjust oil level to oil level plug or dipstick designation (if provided).
	Clogged breather causing leakage at seals or pipe plug.	Remove and clean breather plug.
	Seal damaged.	Replace seal. Under severe operating conditions, install two seals on each shaft.
	Loose bolts.	Check and tighten bolts where necessary. Use Permatex*.
	Breather plug in wrong hole.	Breather plug location can be determined from Worm Gear Speed Reducer "Instruction sheets".
	Input vertical mounting, input shaft down.	Requires two seals on worm shaft not recommended. Consult Engineering.
Premature bearing failure.	Oil level too low.	Adjust oil level.
	Excessive overhung load.	Remove condition causing excessive overhung load.
Input or output shaft breakage.	Excessive overhung load.	Remove condition causing excessive overhung load.
	Improper positioning of overhung load.	Move overhung load closer to reducer case.
	Reducer overload (torque load and/ or overhung load).	Remove overload condition. Check keys and keyways. Distortion of either indicates excessive torque load.

* Permatex is a trademark of Illinois Tool Works, and are not controlled by Regal Beloit Corporation.

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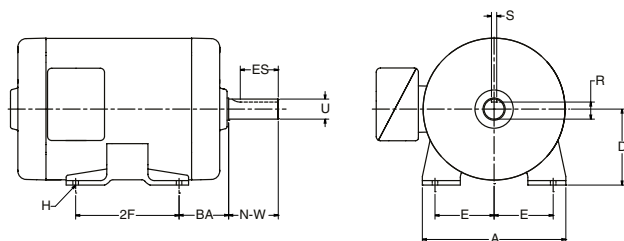
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60H100SF - 60H150SF	D-11	72XXH200J, 72XXH300J	D-18
60H200SF - 60H300SF	D-12	72XXH400M, 72XXH500M	D-18
60JA11 - 60JA13	G-30	750H075 - 750H300	D-12
60LH050 - 60LH100	D-6	770XH200 - 770XH400	D-13
60LP050 - 60LP100	D-6		
60L050SD - 60L100SD	D-7		
60Q31 - 60R112	G-28		
60SK32 - 60SF96	G-29		
60TB32 - 60TB84	G-57	8B86E - 8B154E	A-43
60XHR200	D-1	8B70R - 8B380R	A-39

ALPHA-NUMERICAL PART NUMBER INDEX

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A GUIDE TO NEMA MOTOR FRAMES AND SHAFT DIMENSIONS

The motor dimensions and ratings shown in the table below are for "General Purpose Motors". They are shown as a guide only and are subject to change without notice. Before finalizing a drive system design, consult with the motor manufacturer to obtain current motor dimensions.



NEMA FRAME No.	DIMENSIONS (IN.)								KEYSEAT			APPROX. MAX HP FOR TEFC MOTORS AT VARIOUS RPM			
	A MAX	D	E	2F	BA	H	U	N-W	ES MIN	S	R	3600	1800	1200	900
FRACTIONAL HORSEPOWER MOTORS															
48	-	3.00	2.12	2.75	2.50	0.34◆	0.500	1.50	-	FLAT	0.453	0.5	0.333	0.167	-
56	-	3.50	2.44	3.00	2.75	0.34◆	0.625	1.88	1.41	0.188	0.517	1	1	0.5	-
INTEGRAL HORSEPOWER MOTORS															
143T	7.0	3.50	2.75	4.00	2.25	0.34	0.875	2.25	1.41	0.188	0.771	1.5	1	.75	.5
145T	7.0	3.50	2.75	5.00	2.25	0.34	0.875	2.25	1.41	0.188	0.771	2	2	1	.75
182T	9.0	4.50	3.75	4.50	2.75	0.41	1.125	2.75	1.78	0.250	0.986	3	3	1.5	1
184T	9.0	4.50	3.75	5.50	2.75	0.41	1.125	2.75	1.78	0.250	0.986	5	5	2	1.5
213T	10.5	5.25	4.25	5.50	3.50	0.41	1.375	3.38	2.41	0.312	1.201	7.5	7.5	3	2
215T	10.5	5.25	4.25	7.00	3.50	0.41	1.375	3.38	2.41	0.312	1.201	10	10	5	3
254T	12.5	6.25	5.00	8.25	4.25	0.53	1.625	4.00	2.91	0.375	1.416	15	15	7.5	5
256T	12.5	6.25	5.00	10.00	4.25	0.53	1.625	4.00	2.91	0.375	1.416	20	20	10	7.5
284T	14.0	7.00	5.50	9.50	4.75	0.53	1.875	4.62	3.28	0.500	1.591	-	25	15	10
284TS*	14.0	7.00	5.50	9.50	4.75	0.53	1.625	3.25	1.91	0.375	1.416	25	-	-	-
286T	14.0	7.00	5.50	11.00	4.75	0.53	1.875	4.62	3.28	0.500	1.591	-	30	20	15
286TS*	14.0	7.00	5.50	11.00	4.75	0.53	1.625	3.25	1.91	0.375	1.416	30	-	-	-
324T	16.0	8.00	6.25	10.50	5.25	0.66	2.125	5.25	3.91	0.500	1.845	-	40	25	20
324TS*	16.0	8.00	6.25	10.50	5.25	0.66	1.875	3.75	2.03	0.500	1.591	40	-	-	-
326T	16.0	8.00	6.25	12.00	5.25	0.66	2.125	5.25	3.91	0.500	1.845	-	50	30	25
326TS*	16.0	8.00	6.25	12.00	5.25	0.66	1.875	3.75	2.03	0.500	1.591	50	-	-	-
364T	18.0	9.00	7.00	11.25	5.88	0.66	2.375	5.88	4.28	0.625	2.021	-	60	40	30
364TS*	18.0	9.00	7.00	11.25	5.88	0.66	1.875	3.75	2.03	0.500	1.591	60	60	-	-
365T	18.0	9.00	7.00	12.25	5.88	0.66	2.375	5.88	4.28	0.625	2.021	-	75	50	40
365TS*	18.0	9.00	7.00	12.25	5.88	0.66	1.875	3.75	2.03	0.500	1.591	75	75	-	-
404T	20.0	10.00	8.00	12.25	6.62	0.81	2.875	7.25	5.65	0.750	2.45	-	-	60	50
404TS*	20.0	10.00	8.00	12.25	6.62	0.81	2.125	4.25	2.78	0.500	1.845	-	-	-	-
405T	20.0	10.00	8.00	13.75	6.62	0.81	2.875	7.25	5.65	0.750	2.45	-	100	75	60
405TS*	20.0	10.00	8.00	13.75	6.62	0.81	2.125	4.25	2.78	0.500	1.845	100	100	-	-
444T	22.0	11.00	9.00	14.50	7.50	0.81	3.375	8.50	6.91	0.875	2.88	-	125	100	75
444TS*	22.0	11.00	9.00	14.50	7.50	0.81	2.375	4.75	3.03	0.625	2.021	125	125	-	-
445T	22.0	11.00	9.00	16.50	7.50	0.81	3.375	8.50	6.91	0.875	2.88	-	150	125	100
445TS*	22.0	11.00	9.00	16.50	7.50	0.81	2.375	4.75	3.03	0.625	2.021	150	150	-	-

"*" Standard short shaft for direct coupled connection.

◆ Indicates slots rather than holes.

DECIMAL-MILLIMETER EQUIVALENTS

FRACTION	DECIMAL	M.M.	FRACTION	DECIMAL	M.M.
1/64	.015625	.397	3/64	.515625	13.097
1/32	.03125	.794	17/32	.53125	13.494
3/64	.046875	1.191	55/64	.546875	13.891
1/16	.0625	1.588	9/16	.5625	14.288
5/64	.078125	1.985	97/64	.578125	14.684
3/32	.09375	2.381	19/32	.59375	15.081
7/64	.109375	2.778	59/64	.609375	15.478
1/8	.125	3.175	5/8	.625	15.875
9/64	.140625	3.572	41/64	.640625	16.272
5/32	.15625	3.969	21/32	.65625	16.669
11/64	.171875	4.366	43/64	.671875	17.066
3/16	.1875	4.763	11/16	.6875	17.463
13/64	.203125	5.159	45/64	.703125	17.859
7/32	.21875	5.556	23/32	.71875	18.256
15/64	.234375	5.953	47/64	.734375	18.653
1/4	.250	6.350	3/4	.750	19.050
17/64	.265625	6.747	49/64	.765625	19.447
9/32	.28125	7.144	25/32	.78125	19.844
19/64	.296875	7.541	51/64	.796875	20.241
5/16	.3125	7.938	13/16	.8125	20.638
21/64	.328125	8.334	53/64	.828125	21.034
11/32	.34375	8.731	27/32	.84375	21.431
23/64	.359375	9.128	55/64	.859375	21.828
3/8	.375	9.525	7/8	.875	22.225
25/64	.390625	9.922	57/64	.890625	22.622
13/32	.40625	10.319	29/32	.90625	23.019
27/64	.421875	10.716	59/64	.921875	23.416
7/16	.4375	11.113	15/16	.9375	23.813
29/64	.453125	11.510	61/64	.953125	24.209
15/32	.46875	11.906	31/32	.96875	24.606
31/64	.484375	12.303	63/64	.984375	25.003
1/2	.500	12.700	1	1.000	25.400

One Millimeter = .03937 inch.

HORSEPOWER AND TORQUE

Horsepower is the common unit of mechanical power.

$$\text{H.P.} = \frac{\text{Force} \times \text{Feet per Minute}}{33000}$$

$$\text{H.P.} = \frac{\text{Torque in In.-Lbs.} \times \text{R.P.M.}}{63025}$$

One H.P. = .746 Kilowatt

One Kilowatt = 1.34 H.P.

Torque is a twisting moment or turning effort.

Torque in inch-pounds = Force x Lever Arm (Inches)

$$\text{Torque in inch-pounds} = \frac{63025 \times \text{H.P.}}{\text{R.P.M.}}$$

The following table gives the torque in Inch-Pounds for one H.P. at various speeds.

TORQUE AT ONE HORSEPOWER

R.P.M.	In.-Lbs.	R.P.M.	In.-Lbs.	R.P.M.	In.-Lbs.	R.P.M.	In.-Lbs.
3500	18	580	109	90	700	14	4502
3000	21	500	126	80	788	12	5252
2400	26	400	158	70	900	10	6300
2000	32	300	210	60	1050	8	7878
1750	36	200	315	50	1260	6	10504
1600	39	180	350	40	1576	5	12605
1200	53	160	394	30	2101	4	15756
1160	54	140	450	20	3151	3	21008
1000	63	120	525	18	3501	2	31513
870	72	100	630	16	3939	1	63025

To Find torque at any horsepower multiply values in table above by the horsepower required.

For intermediate speeds interpolate values in table above or solve the Torque Formula above.

MINIMUM SHEAVE SIZES

NEMA STANDARDS

The **NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION** recommends certain limitations on sheave diameter and width for satisfactory motor operation. The selected sheave diameter should not be smaller nor the width greater than the dimensions below. These dimensions are from NEMA Standard MG1-14.42.

FRAME	HORSEPOWER AT				V-BELT SHEAVE (INCHES)			
	SYNC SPEED, RPM				CONVENTIONAL		358	
					A, B, C, D AND E SECTIONS		3V, 5V AND 8V SECTIONS	
	3600	1800	1200	900	MIN. PITCH DIA.	MAX. WIDTH	MIN. OUTSIDE DIA.	MAX. WIDTH
143T	1 1/2	1	3/4	1/2	2.2	4 1/4"	2.2	2 1/4"
145T	2-3	1 1/2-2	1	3/4	2.4	4 1/4"	2.4	2 1/4"
182T	3	3	1 1/2	1	2.4	5 1/4"	2.4	2 3/4"
182T	5	-	-	-	2.6	5 1/4"	2.4	2 3/4"
184T	-	-	2	1 1/2	2.4	5 1/4"	2.4	2 3/4"
184T	5	-	-	-	2.6	5 1/4"	2.4	2 3/4"
184T	7 1/2	5	-	-	3.0	5 1/4"	3.0	2 3/4"
213T	7 1/2-10	7 1/2	3	2	3.0	6 1/2"	3.0	3 3/8"
215T	10	-	5	3	3.0	6 1/2"	3.0	3 3/8"
215T	15	10	-	-	3.8	6 1/2"	3.8	3 3/8"
254T	15	-	7 1/2	5	3.8	7 3/4"	3.8	4
254T	20	15	-	-	4.4	7 3/4"	4.4	4
256T	20-25	-	10	7 1/2	4.4	7 3/4"	4.4	4
256T	-	20	-	-	4.6	7 3/4"	4.4	4
284T	-	-	15	10	4.6	9	4.4	4 5/8"
284T	-	25	-	-	5.0	9	4.4	4 5/8"
286T	-	30	20	15	5.4	9	5.2	4 5/8"
324T	-	40	25	20	6.0	10 1/4"	6.0	5 1/4"
326T	-	50	30	25	6.8	10 1/4"	6.8	5 1/4"
364T	-	-	40	30	6.8	11 1/2"	6.8	5 7/8"
364T	-	60	-	-	7.4	11 1/2"	7.4	5 7/8"
365T	-	-	50	40	8.2	11 1/2"	8.2	5 7/8"
365T	-	75	-	-	9.0	11 1/2"	8.6	5 7/8"
404T	-	-	60	-	9.0	14 1/4"	8.0	7 1/4"
404T	-	-	-	50	9.0	14 1/4"	8.4	7 1/4"
404T	-	100	-	-	10.0	14 1/4"	8.6	7 1/4"
405T	-	-	75	60	10.0	14 1/4"	10.0	7 1/4"
405T	-	100	-	-	10.0	14 1/4"	8.6	7 1/4"
405T	-	125	-	-	11.5	14 1/4"	10.5	7 1/4"
444T	-	-	100	-	11.0	16 3/4"	10.0	8 1/2"
444T	-	-	-	75	10.5	16 3/4"	9.5	8 1/2"
444T	-	125	-	-	11.0	16 3/4"	9.5	8 1/2"
444T	-	150	-	-	-	-	10.5	8 1/2"
445T	-	-	125	-	12.5	16 3/4"	12.0	8 1/2"
445T	-	-	-	100	12.5	16 3/4"	12.0	8 1/2"
445T	-	150	-	-	-	-	10.5	8 1/2"
445T	-	200	-	-	-	-	13.2	8 1/2"

To obtain the minimum pitch diameters for flat belt, Gearbelt® belt, chain or gear drives, multiply the **358 SHEAVE PITCH DIAMETERS** in the table above by the following factors:

DRIVE	FACTOR
Chain	0.70
Flat Belt (Single ply)	1.33
Gearbelt	0.90
Helical Gear	0.85
Poly-V	1.00
Spur Gear	0.75

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