Installation and Maintenance of

HSM SPEED REDUCERS

SIZES 107C – 608M

Identification

For the purposes of this document Sumitomo's Western Hemisphere operations will be referred to as SDT, or Sumitomo Drive Technologies.
On the nameplate of the unit, identify the MODEL number and SERIAL number. Also, confirm the ratio of the unit. HSM units are available in 11 MODEL sizes: 107C, 115D, 203E, 207F, 215G, 307H, 315J, 407S, 415K, 507L, and 608M. There are 5 ratios: 5, 9, 13, 20, and 25 to 1. SERIAL numbers are a combination date code and manufacturing sequence number. The SERIAL number is not always needed, but will help factory support personnel identify certain units.
List all accessories mounted to the reducer, such as motor mount, motor frame size, backstop, screw conveyor adapter, screw conveyor shaft size, etc. Also, note the Taper Grip Bushing bore diameter.

Installation

Study these instructions carefully before installing and operating the drive. Make sure that this information is readily available to all persons involved in the operation and maintenance of the drive. All appropriate safety regulations must be observed when installing a drive. Suitable safety covers or guarding must be provided for all rotating shafts. The drive is designed exclusively for use as specified in the catalog, any other use is considered improper. The manufacturer accepts no liability for damage as a result thereof. Before switching on or starting up the machine, make sure that nobody can be endangered by the machine/system start-up. Owner modifications and/or alterations which affect the safety of the drive are not permitted. Bearing and seal spare parts are available in all sizes. Spare parts are available for sizes 307H and larger. All owner-sourced parts must comply with the technical requirements specified by SUMITOMO DRIVE TECHNOLOGIES. This is always ensured with original spare parts from SDT.

For Taper_Grip® Bushing unit applications:

1 Follow Taper_Grip® Bushing installation instructions.

2 Install pulley on input shaft as close to the reducer as possible. See fig. 1.

3 Install motor and V-Belt drive with the belt pull at approximately 90° to the centre line between driven and input shafts. See fig. 2. This will permit tensioning of the V-Belt drive with the torque-arm, which should preferably be in tension [not compression].

4 Install torque-arm on reducer by placing the clevis end over the suitable torque-arm case bolt hole and inserting the bolt supplied. Tighten the nut/bolt to the torque stated on page 2

5 Install torque-arm fulcrum on a rigid support so that the torque-arm will be at approximately right angles to the center line through the driven shaft and the torque-arm case bolt. See fig. 3. Make sure there is sufficient take up in the turnbuckle for belt tension adjustment if the torque arm is being employed for that purpose.

7 Fill with suitable lubricant as detailed on page 3.

N.B. Backstops: A backstop for mounting inside the reducer to prevent reversal of direction is available for all reducers. For installation instructions see pages 6 through 8.

Figure1

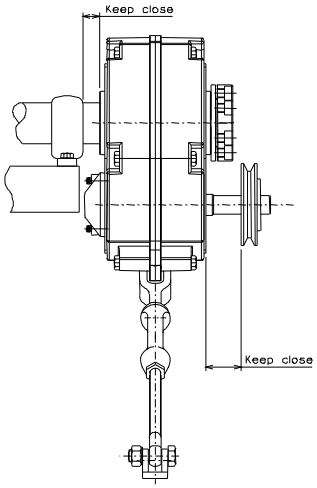


Figure2

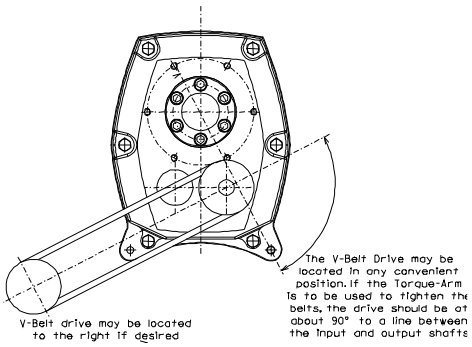
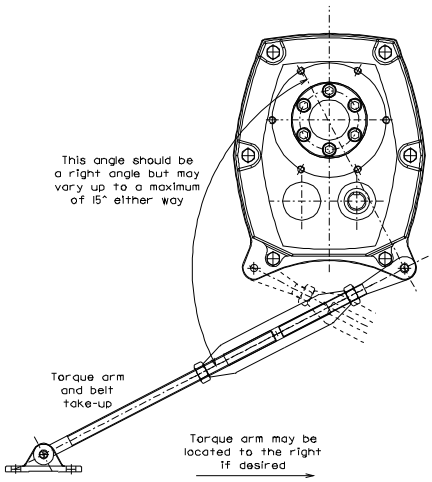


Figure3



TORQUE-ARM CLEVIS BOLT TIGHTENING TORQUES

Reducer size	107C	115D to 203E	207F to 415K	507L	608M
Torque Nm	20	30	80	480	950
Torque Lb. Ft.	15	22	27	355	703

Lubrication

IMPORTANT
The reducer is shipped without oil. It must be filled as instructed before running. Use high grade oil as shown on lubrication chart supplied attached to the breather plug or alternative grades stated below. Fill to level plug when reducer is not running. The approximate quantities are shown in table below. Drain, flush and refill every six months of operation, check oil level regularly. Positions of filler, breather and drain plug for different mounting positions are shown in fig. 4.

CAUTION
Too much oil will cause over-heating, possible leaks, and even premature failure. Too little oil will cause premature failure.

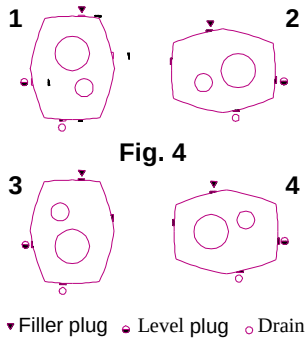


Fig. 4

▾ Filler plug ◒ Level plug ○ Drain plug

Units are fitted with filler, level and drain plugs generally in position shown

APPROXIMATE OIL QUANTITES (Litres)
REQUIRED FOR DIFFERENT MOUNTING POSITIONS. (See Fig. 4)
Fluid References: 128 ounces per gallon/32 ounces per quart/16 ounces per pint

Unit Size	Approximate Capacity - OUNCES							
	5:1				13:1 & 20:1			
Mounting Position	1	2	3	4	1	2	3	4
107	16.9	16.9	16.9	20.3	13.5	20.3	16.9	20.3
115	27.1	30.4	27.1	33.8	23.7	30.4	27.1	30.4
203	40.6	57.5	47.3	60.9	33.8	60.9	47.3	54.1
207	84.5	87.9	81.2	84.5	77.8	87.9	81.2	74.4
215	111.6	108.2	108.2	111.6	101.4	108.2	108.2	108.2
307	138.6	179.2	138.6	196.1	128.5	186.0	142.0	172.5
315	192.7	290.8	199.5	290.8	182.6	287.4	199.5	280.7
407	368.6	622.2	459.9	622.2	307.7	554.6	426.1	520.7
415	514.0	733.8	852.1	700.0	429.4	733.8	530.9	649.2
507					760.8	1166.6	1758.3	913.0
608					1217.3	1690.7	2671.3	1521.6

Normal operating positions are shown in fig. 4. Note that the reducer is supplied with four plugs. After the reducer has been mounted in its running position, the plugs must be located as shown in fig. 4 for the appropriate mounting position. If the reducer is not within 20° of one of the positions shown, the oil level plug cannot be safely used to check the oil level. This can be overcome by disconnecting the torque-arm and swinging the reducer around to one of the positions shown. Because of the many positions of the reducer it may be necessary, or desirable, to make special adaptations using the plug holes in the reducer with locally available standard pipe fittings, standpipes or oil level gauges.

RECOMMENDED LUBRICANTS

MINERAL OIL

	Amb. Temp °C	5:1 RATIO GEARBOX				13:1 AND 20:1 & 25:1 RATIO GEARBOX						
		0-100 rev/min	101-200 rev/min	210-400 rev/min		0-20 rev/min		21-50 rev/min	51-120 rev/min		0-50 rev/min	51-80 rev/min
		107-415	107-415	107-115	203-415	107-415	107-203	207-415	107-203	207-415	507-608	
ISO. Visc Grade	-10 to +5	100	100	100	68	150	150	150	100	100	100	100
	6 to 25	460	320	320	220	680	680	460	460	320	320	220
	26 to 40	800	680	680	460	800	800	800	680	460	460	320

When using the table above, Sumitomo Drive Technologies recommends:

Mobil Mobilgear & SHC mineral oils
Mobil SHCX 620 synthetic oil as suitable for all ambient temperatures and all input speeds
Other approved oils for HSM:
BP – Energol GR-XP
Castrol – Alphazan ORSP
Shell – Omala
Texaco – Meropa
Exxon – Spartan

Parts & Overhaul

IMPORTANT
Using tools normally found in a maintenance department, the reducer can be dismantled and re-assembled. Cleanliness is very important to prevent the introduction of dirt into the bearings and other parts of the reducer. A tank of clean solvent, an arbor press and equipment for heating bearings and gears should be available for shrinking these parts on the shafts.
Rubber type oil seals are fitted and great care should be taken during dismantling and re-assembling to avoid damage to the lip surfaces.

The keyseat in the input shaft and any holes in the output hub that the seal lips must pass should be covered with electrical tape or other suitable smooth material. Any burrs on shaft or hub surfaces should be carefully removed before re-fitting seals.

SDT only repairs HSM reducers for warranty considerations. For customers without adequate repair facilities, a local EASA shop is a good first contact when opting for rebuild and/or repair.

ORDERING PARTS
Bearings and seals are available for all sizes from SDT. Other spare parts are only available for sizes 307H through 608M. For smaller sizes SDT recommends reducer replacement, as it is generally more economical. When ordering parts for a reducer, please specify Reducer Size, Serial No., part name, and quantity required.
It is strongly recommended that when a pinion or gear is replaced the mating gear or pinion be replaced also. If the large gear on the output hub must be replaced, it is recommended that an output hub assembly of a gear assembled on a hub be ordered to renew damaged surfaces on the outer hub where the oil seals rub. However, if it is desired to use the old output hub, press the gear and bearing off and examine the rubbing surfaces under the oil seal carefully for possible scratching or other damage resulting from the pressing operation. To prevent oil leakage at the shaft oil seals, the smooth surface of the output hub must not be damaged.
If any parts must be pressed from a shaft or from the output hub, this should be done before ordering parts to make sure that none of the bearings or other parts are damaged on removal. Do not press against the outer race of any bearing.
Because old shaft oil seals and gaskets may be damaged in dismantling, it is always advisable to order replacements for these parts.

SEAL REPLACEMENT & DISASSEMBLY
Before seal replacement or disassembly, clean the reducer exterior thoroughly and prepare a clean working area. Drop cloths and cardboard are suitable to use and may help protect a unit as it is dismantled. Clean the exposed portions of the input shaft and the output hub thoroughly. Cover the input shaft with electrical tape to cover the keyseat.
To replace the outboard [input side] seals, the unit may be left mounted to the driven shaft. To replace the inboard seal on the output hub, the unit must be removed from the driven shaft. See removal instruction for the Taper_Grip® Bushing.

Seal removal/replacement:

1. Use a center punch to make two indentations on the face of each seal to be replaced. Be careful not to drive the seals further into the housing bores.
2. Use tape on a 1/8 inch drill bit to form a penetration stop at about ¼ inch. Drill into the face of the seal using the indentations as starts. Be careful not to use an angle when drilling that will cause damage to the housing bores or shaft seal journals.
3. Insert ¾" long sheet metal screws into the holes no more than ¼ inch deep.
4. Use a small pry bar or similar device underneath the screw head to extract this seal.

[Note: a screwdriver may be used to pierce and lever out seals on larger units, but extra care should be taken not to damage seal journals and housing bores]

5. Remove any metal or rubber chips from the area and flush the unit and bearing area to remove any residual debris.
6. Remove any sealant remaining from the housing bore.
7. Inspect the shaft seal journal for any wear or damage. Worn and damaged seal journals may be fitted with aftermarket wear sleeves if necessary.
8. Check the shaft again for cleanliness and check the security of the tape used to guard against any sharp edges [e.g. keyseat edges].
9. Apply a light coating of grease to the shaft and fully fill the cavity between the inner and outer seal lips.

[Note: Excess grease will be purged during assembly and during initial operation of the unit]

10. If seal OD's are not coated with rubber, apply an anaerobic sealant to the OD of the new seal.
11. Use a cylindrical tool without burrs or damage to tap the seal in place and flush with the unit housing. Do not tap on the seal itself. Be careful not to drive the seal too deep into the housing.
12. Measure the axial runout of the seal using a dial indicator mounted on the shaft and adjust to .010 inch or less.

Unit Disassembly:

1. With the unit on a bench, remove all housing perimeter bolts and set them aside. On older units [serial numbers beginning with H02 through H05], a drift may be used to move the two solid hollow dowels to one side of the housing. On newer units, a small housing cut-out is provided to allow for placement of a screwdriver or pry bar to aid disassembly [newer spring hollow dowels cannot be drifted]. Note that internal components may be easier to remove if the unit is dismantled with the input shaft pointing down. Remove the backstop/high speed shaft cover, if installed, before proceeding.
2. Using a pry bar or similar device, work the two housing halves apart. Additionally, the tapped holes on the face of the unit may be fitted with eyelets and the unit may be lifted slightly. The weight of the unit will aid in the disassembly. Be careful to not to damage the mating surfaces of the housing halves excessively.
3. Remove all of the shaft assemblies [2 in 5:1 units, 3 in all other ratios].
4. Tap out seals if they are to be replaced [highly recommended by SDT] and clean all housing bores thoroughly.
5. Check the input shaft/pinion for signs of wear on the gear teeth, seal journals, and backstop riding surface. Replace the pinion if significant wear is present in any of these areas.
6. Inspect all other gears for excessive wear or cracked/broken teeth. When deciding to replace any gear, it is also recommended that the mating gear be replaced at the same time. A press or puller must be used to remove the gears.
7. Inspect all bearings for wear/scoring and replace as necessary. Tapered roller bearings should be replaced in complete cup/cone sets.

Unit Reassembly:

1. Clean the unit parts and lubricate ONLY BEARINGS with heavy oil.
2. Heat bearing cones/inner races/assemblies and gears to 250F in an oven and slide onto the appropriate bearing journals and keyed hub areas of the shafts. Be careful not to damage bearings by applying force to the outer race of assembled bearing sets… apply force only to the inner race. Also take care not to damage the seal journal areas. Allow the assemblies to cool completely.
3. Heat the housing halves and install all roller bearing cups/outer races into the housing bores. Allow the housing halves to cool completely. Note that some outer races may fit loosely into the housing bores by design.
4. Bearing adjustments and axial float are preset for cylindrical bearing supported shafts. When compared to axial float allowances for tapered roller bearing [TRB] supported shafts, the allowances for cylindrical bearings may seem quite large, but are no cause for concern. For shafts supported by tapered roller bearings, axial float is measured [jigs may be necessary] and then set using shims. HSM sizes 107C-415K have TRB on the output hub shafts only. HSM sizes 507L and 608M have TRB on all shafts. Float for all TRB shafts is .001 to .004 inches [one to four thousandths]. Steps for adjusting TRB shafts are:
    a. Attach any housing covers to the input projection housing half and add the output hub assembly.
    b. Assemble the output housing half on top and secure using the perimeter bolts.
    c. Using a dial indicator positioned on the output housing half to measure output hub axial movement, rotate the output hub clockwise and counter-clockwise while applying axial force. Note the float measured.
    d. Disassemble the housing halves and position the proper number of shims behind the input housing TRB cup to obtain proper float. As an example, if .050 float is measured, then the shim stack added should measure .051 to .054
    e. Reassemble the unit with the output hub/shim AND the intermediate shaft assembly inserted [for sizes 107C through 415K, all other internal components may be inserted]. Secure the housing halves and recheck the output hub axial float setting.
    f. For sizes 507L and 608M, repeat the axial float adjustments for the intermediate shaft, then the high-speed shaft using shims and the external bearing covers.
    g. Before final assembly of the housing halves, make sure dowel pins are centered and apply a bead of Loctite 5910 orThree-bond 1215 to the machined seam of one of the housing halves. The bead may be smoothed using a putty knife for a more effective final seal. Use the same sealant and technique for all housing covers and cross-tighten all fasteners. Please refer to **Table** ____ for case bolt tightening torques.
5. Reinstall seals as previously described to finish the reassembly process.

BEARING & SEAL SCHEDULE

SIZE		H.S. Oil Seal	** S.S. Oil Seal	** H.S. Bearing	** Inter. Bearing	** S.S. Bearing
107C	SDT part	531N204010--G	531N65808---G	500NJ204----G	500NJ204----G	50032013----G
	Size	D20x40x10	D65x80x8	NJ204	NJ204	32013
115D	SDT part	531N254710--G	531N759010--G	500NJ205----G	500NJ205----G	50032015----G
	Size	D25x47x10	D75x90x10	NJ205	NJ205	32015
203E	SDT part	531N305210--G	531N8510010-G	500NJ206----G	500NJ206----G	50032017----G
	Size	D30x52x10	D85x100x10	NJ206	NJ206	32017
207F	SDT part	531N306210--G	531N10012010G	500NJ306----G	500NJ306----G	50032020----G
	Size	D30x62x10	D100x120x10	NJ306	NJ306	32020
215G	SDT part	531N357010--G	531N11013012G	500NJ307----G	500NJ307----G	50032022X---G
	Size	D35x70x10	D110x130x12	NJ307	NJ307	32022
307H	SDT part	531N459010--G	531N13016012G	500NJ309----G	500NJ309----G	50032026X---G
	Size	D45x90x10	D130x160x12	NJ309	NJ309	32026
315J	SDT part	531N509010--G	531N15018012G	500NJ310----G	500NJ310----G	50032030----G
	Size	D50x90x10	D150x180x12	NJ310	NJ310	32030
407S	SDT part	531N6011010-G	531N16020012G	500NJ312----G	500NJ312----G	50032032----G
	Size	D60x110x10	D160x200x12	NJ312	NJ312	32032
415K	SDT part	531N6512012-G	531N18021012G	500NJ313----G	500NJ313----G	50032936----G
	Size	D65x120x12	D180x210x12	NJ313	NJ313	32936
507L	SDT part	531N7510010-G	531N20023015G	500415647/10G	500718149/10G	50067983/20-G
	Size	D75x100x10	D200x230x15	JH415647/JH415610	JM718149/JM718110	67983/67920
608M	SDT part	531N9011013-G	531N24027015G	500318448/10G	500318448/10G	5008578/20--G
	Size	D90x110x13	D240x270x15	JHM318448/JHM318410	JHM318448/JHM318410	8578/8520

Note: Oil Seal Size in Millimeters

** 2 pieces required per unit

BACKSTOP INSTALLATION SIZE 107C ONLY

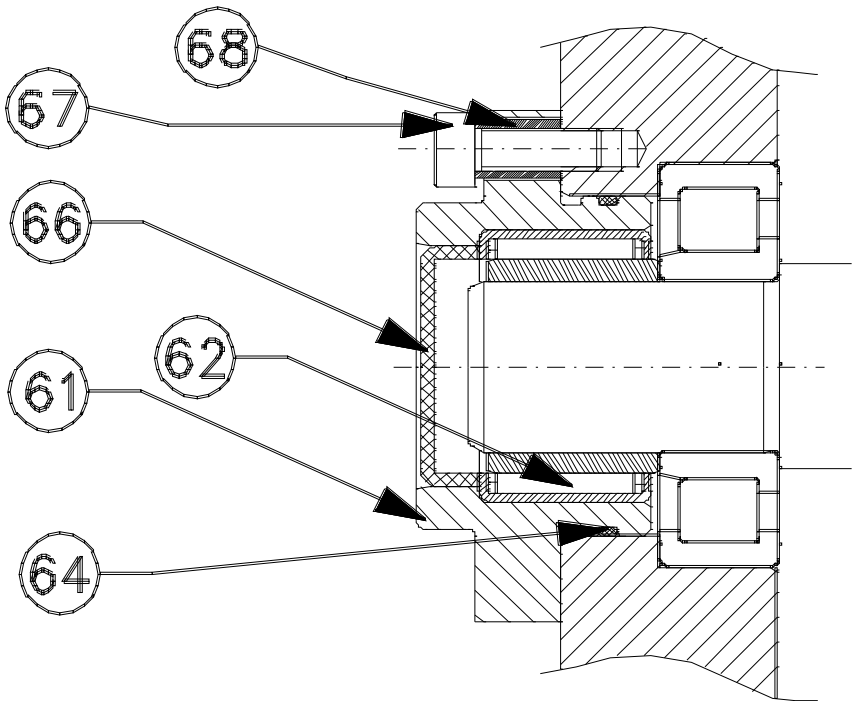
PREPARATION TO INSTALL BACKSTOP
If reducer is filled with oil, drain off oil before proceeding further.

Step 1.
Remove high speed shaft/backstop cover. Remove all traces of sealant from backstop cover and gear case faces.

Step 2.
Determine direction of required shaft rotation. The shaft is free to rotate in the direction of the arrow marked on the backstop cage.
For input shaft clockwise rotation fit the sprag clutch to the outer race entering the sprag clutch 'printed face' first.
Reverse the sprag clutch for counterclockwise rotation.
With the backstop cage in the correct orientation, press the backstop into the outer race.
Fit the 'O' ring seal onto the outer race, ensuring the ring is seated fully in the groove.
Liberally grease the internal bore of the sprag clutch.
CAREFULLY push the assembly into the housing. It may help to rotate the assembly as it is inserted.
Fit a hollow sleeve into each screw hole and secure the outer race using the screws provided .
Finally, after checking for correct shaft rotation, fit the new cover cap into the outer race.
Discard the original high speed shaft/ backstop cover.

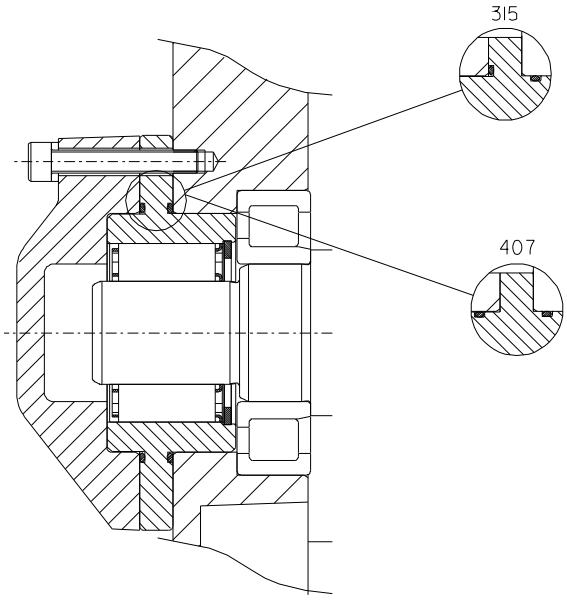
Step 3.
Refill the reducer with correct grade of oil.

IMPORTANT
When pushing the backstop assembly into the housing, it is important not to hammer the assembly at any time. The assembly may be tapped gently if necessary.
To change the backstopping direction at any time, it is necessary to remove the sprag assembly and turn it end-for-end.



BACKSTOP INSTALLATION SIZES 115D to 415K

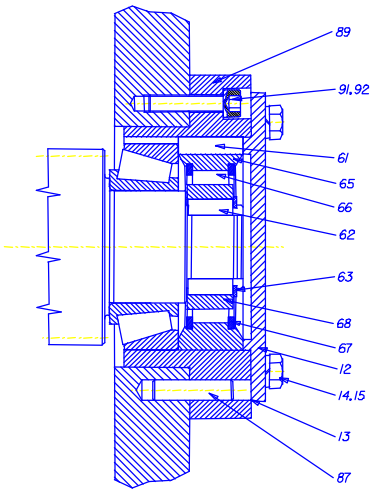
Follow preparations and step 1 above.
Step 2
Fit the internal circlip into the groove in the outer race.
Slide the 'O' rings over each end of the outer race and ensure both rings are fully engaged in their respective grooves. Note that on size 315 the two 'O' rings are different diameters.
With the backstop race fitted in the correct direction into the outer race, feed the assembly into the housing, rotating the shaft in its free direction will assist.
When the outer race is fully home, rotate the shaft in its backstopping direction. If the assembly is correct, the outer race will now rotate with the shaft. Use this feature to align the screw holes. To reverse the backstopping direction, slide out the backstop race, turn end for end and refit.
Place the original backstop cover onto the projecting outer race spigot and secure the complete assembly using the screws provided.
Follow Step 3 and remaining guidelines above.



BACKSTOP INSTALLATION SIZES 507L to 608M

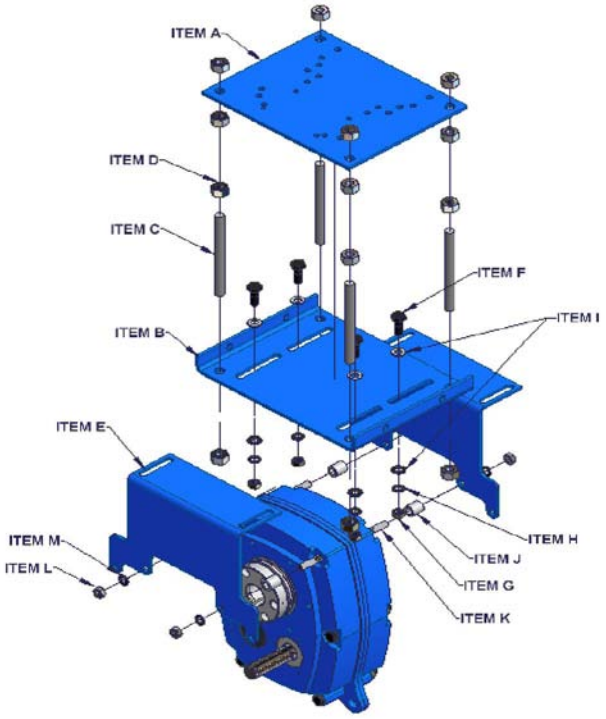
Follow preparation steps above.
Step 1.
Remove backstop cover and recover the gasket (where fitted) ref. 12 & 13 and input bearing distance piece (ref. 88).
Step 2.
With the backstop assembly (65, 66, 67 & 68) held up to the housing (89), check the direction of rotation by rotating the inner race by hand, This indicates that the input shaft will rotate freely in this direction. It is important that the required direction of rotation is correctly determined. To reverse the direction of rotation, turn the backstop assembly end for end.
Step 3.
Place the two inner race keys (ref. 62) in the input shaft keyways. For ease of installation the backstop, complete with inner race, should be pushed into the reducer as a unit. When pushing backstop into reducer it is important not to hammer on the backstop, but it can be tapped gently if necessary.
Place circlip (ref. 63) into groove in input shaft.
Step 4.
Line up keyway in backstop outer race with keyway in backstop housing by rotating the input shaft in the opposite direction to its driving rotation. If the backstop is properly installed it will rotate with the input shaft.
Step 5.
Insert key (ref. 61) in the aligned keyways.
Step 6.
Replace gasket and backstop cover and refill reducer with oil.
Step 7.
Check input shaft for end-float 0.05mm max.
IMPORTANT
If for any reason it is necessary to remove a backstop from an operational unit it is essential that Pt. No. 88, the input bearing distance piece, is fitted into the vacant backstop housing, and the input shaft end-float checked before restarting the unit.

Note: Do not use E.P. oils or any lubricant other than those recommended by SDT when using a backstop.



TOP MOUNT ASSEMBLY & PART LISTING

ITEM	DESCRIPTION
A	Motor Mount Top Plate
B	Motor Mount Bottom Plate
C	Top Mount Stud
D	Nut, Heavy Duty
E	Top Mount Bracket
F	Hex-Head Bolt
G	Hex-Nut
H	Lock Washer, Spring
I	Flat Washer
J	Top Mount Spacer
K	Top Mount Casing Stud
L	Hex-Nut, DIN 934-8
M	Lock Washer, Spring, DIN 127B

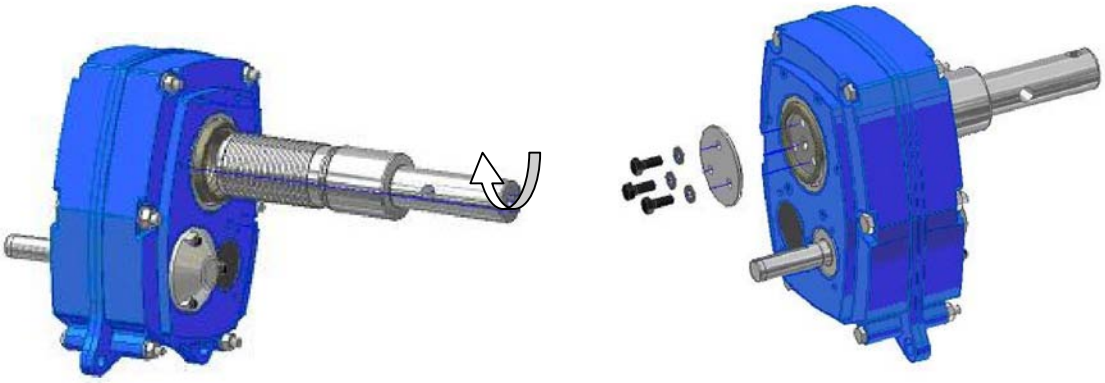


Steps to install:

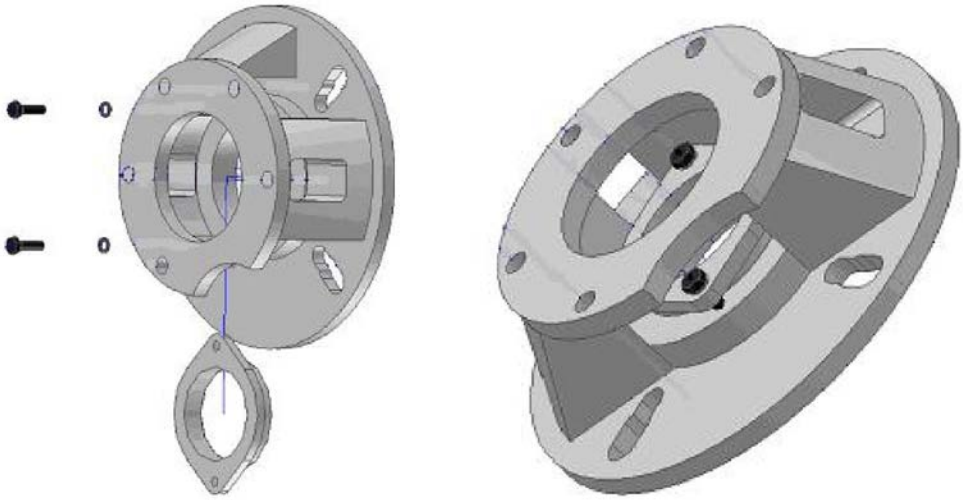
1. Remove the two case bolts relative to the position in which the motor mount is to be used and replace with double ended studs [item K]
2. Slide spacers over studs [item J] and secure mount brackets with nut and lockwasher combination [items M & L]
3. Attach motor mount bottom plate to brackets using bolts, nuts and washers [items F, G H, & I]
4. Attach motor mount top plate [item A], the the bottom plate using heavy duty studs and nuts [items C & D]
5. Attach motor to top plate and adjust for proper belt tension and alignment. Only use enough tension to prevent belt slippage
6. Most input drives have more capacity than necessary. Because of this surplus in capacity, excessive belt tension is not necessary
7. Belt tension directly affects the reducer life cycle. The ideal belt tension for any reducer input drive is the lowest tension setting that does not result in belt slippage
8. Mount input drive components as close as possible to the reducer and motor housings to maximize bearing life cycle

SCREW CONVEYOR SHAFTS AND ADAPTERS

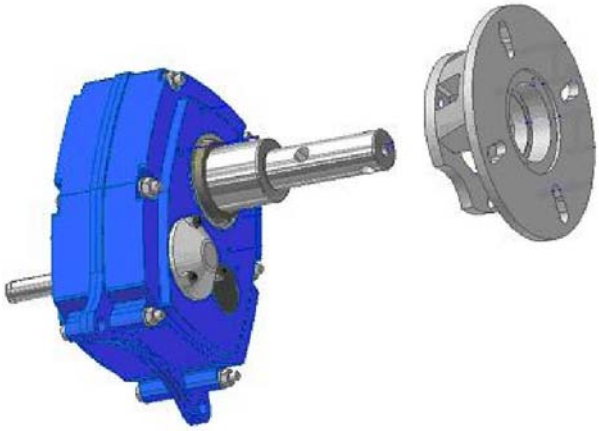
1. To begin **screw conveyor drive assembly**, unstall the output shaft hand tight.
2. Attach the output shaft keeper plate to the shaft with the bolts and washers. Tighten the shaft retaining bolts to the appropriate torques specified in Table 1.



3. Install the gland cover onto the adapter. Finger-tighten the gland cover bolts. Do not tighten them completely with a wrench during this step.



4. Slide the adapter onto the output shaft so it is flush against the reducer housing.
5. The adapter mounting hole tolerances are tight so that the holes may serve as alignment features. Loosely thread the adapter shoulder bolts with their washers into their holes. In a “star-pattern”, tighten the bolts with a wrench only after all of the shoulder bolts are properly threaded into their holes. Please refer to Table 1 for the recommended bolt tightening torques. Insert braided packing, or oil seal, or both into the packing gland.



6. Tighten the gland cover bolts with a wrench after the reducer is attached to the screw conveyor trough. Tighten the bolts to the value specified in Table 1.

7. After the reducer has been running for a period of 20 to 30 hours, check to ensure that the shaft, adapter and gland bolts are tight. Re-tighten as necessary. Bolt torques should be subsequently checked at normal service intervals (i.e. every 6 months).

Table 1: Bolt Tightening Torques

Unit Size	Shaft Retaining Bolts		Adapter/Housing Bolts		Gland Cover Bolts	
	Qty. x Bolt Size	Bolt Torque (ft·lbs)	Qty. x Bolt Size	Bolt Torque (ft·lbs)	Qty. x Bolt Size	Bolt Torque (ft·lbs)
107 A & B	2 x M8	18	4 x M10	29	2 x M8	15
115 A & B	2 x M8	18	4 x M10	29		
203 A & B	2 x M10	40	5 x M10	29		
207	2 x M10	40	5 x M12	51		
215	2 x M12	70	5 x M16	125		
307	2 x M16	160	5 x M20	245		
315	2 x M16	160	7 x M20	245		
407	2 x M20	350	8 x M20	245		

Disassembly:

Reverse the above procedures.

To remove the shaft from the reducer:

- Remove keeper plate bolts and keeper plate.
- Rap the keeper plate end of the shaft with a dead blow hammer to dislodge the shaft from the wedges of tapered helix threads. Try to measure that movement has occurred before proceeding.
- Unscrew the shaft. Use a jig to clamp the input shaft in place and prevent rotation. Use a rod through one of the output shaft holes for leverage if needed.