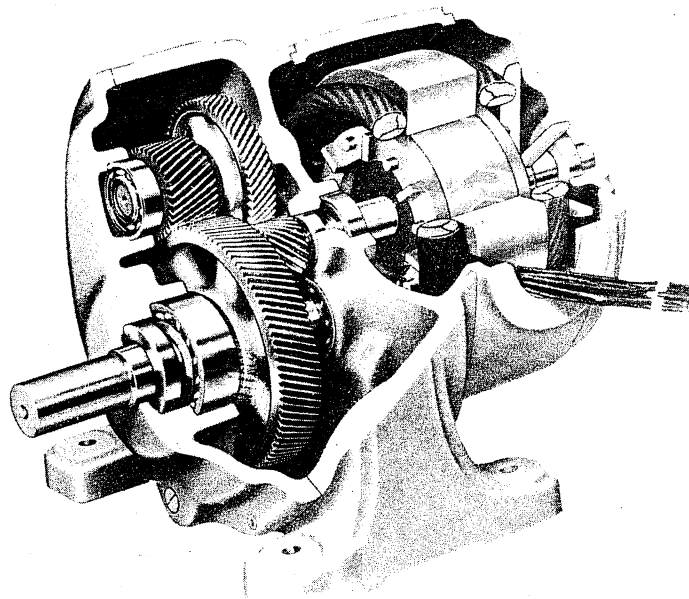


INSTRUCTION MANUAL

SLO - SPEED GEAR MOTORS



STERLING
ELECTRIC, INC.

<u>DESCRIPTION</u>	<u>CONTENTS</u>	<u>PAGE</u>
A. Warranty		2
B. General Information		3
Storage Instrutions		3
C. Installation Instructions		3
D. Replacement Parts - Views		4
Basic Parts, Bearings, Seals		5
E. Instructions for Ordering Parts		6
F. Lubrication Instructions		6
1. General		6
2. Bearings, Motor & Gear Case		6
3. Oil Seals		6
4. Recommended Oils		7
5. Gear Case Oil Capacities		7
6. Oil Instructions - Single, Double & Triple Reduction		8
G. Trouble Shooter's Guide		9-11

WARRANTY

STERLING ELECTRIC, INC. herein called the Company, warrants that all of its own manufactured products will be of the kind and quality described in its specifications and no other warranty, except of title, shall be implied. The conditions of any test shall be mutually agreed upon, and the Company shall be notified of any and may be represented at all tests that may be made. If any failure to comply with the specifications appears within one year from the date of shipment, the purchaser shall notify the Company thereof immediately, and the Company shall thereupon correct the defect, or defects, by repair or by replacement, f.o.b. factory, of the defective part or parts. The liability of the Company arising out of the supplying of said products or its use, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the products, and upon expiration of said one year, all such liability shall terminate.

It is understood, however, that if any Purchaser fails to comply with the stipulated conditions of operation or fails to permit the Company to inspect defects before repairing, or alters the product in any way, the Company's responsibility shall terminate.

The Company will not be responsible for any damage resulting from improper storage or handling.

This instruction manual covers the following gear case sizes:

SINGLE REDUCTION	DOUBLE REDUCTION	TRIPLE REDUCTION
11F	21	313
11	22	323
12	23	324
13	24	325
14	25	326
15	26	335
16	27	336
17		346
		356

The Frame Coding can be explained as follows:

Frame 184T-24

Represents the motor frame size 184 ——— Represents the gear case size T
 ——— Represents the number of reductions 24

The Sterling Slo-Speed Gear Motor is an AC Squirrel Cage Motor mounted integrally to a single, double or triple reduction gear case. This compact design enables the Sterling Slo-Speed gear motor to be mounted in virtually any area that would be required for a standard motor. Sterling Slo-Speed gear motors and separate motor reducers are designed for applications requiring constant low speeds. They are rugged, compact, quiet operating, efficient and durable.

STORAGE

Unless special packaging has been specified on the order, Sterling gear motors are prepared for clean, dry, indoor storage (+32°F to +104°F). If storage under other conditions is required, refer to factory for special instructions.

INSTALLATION

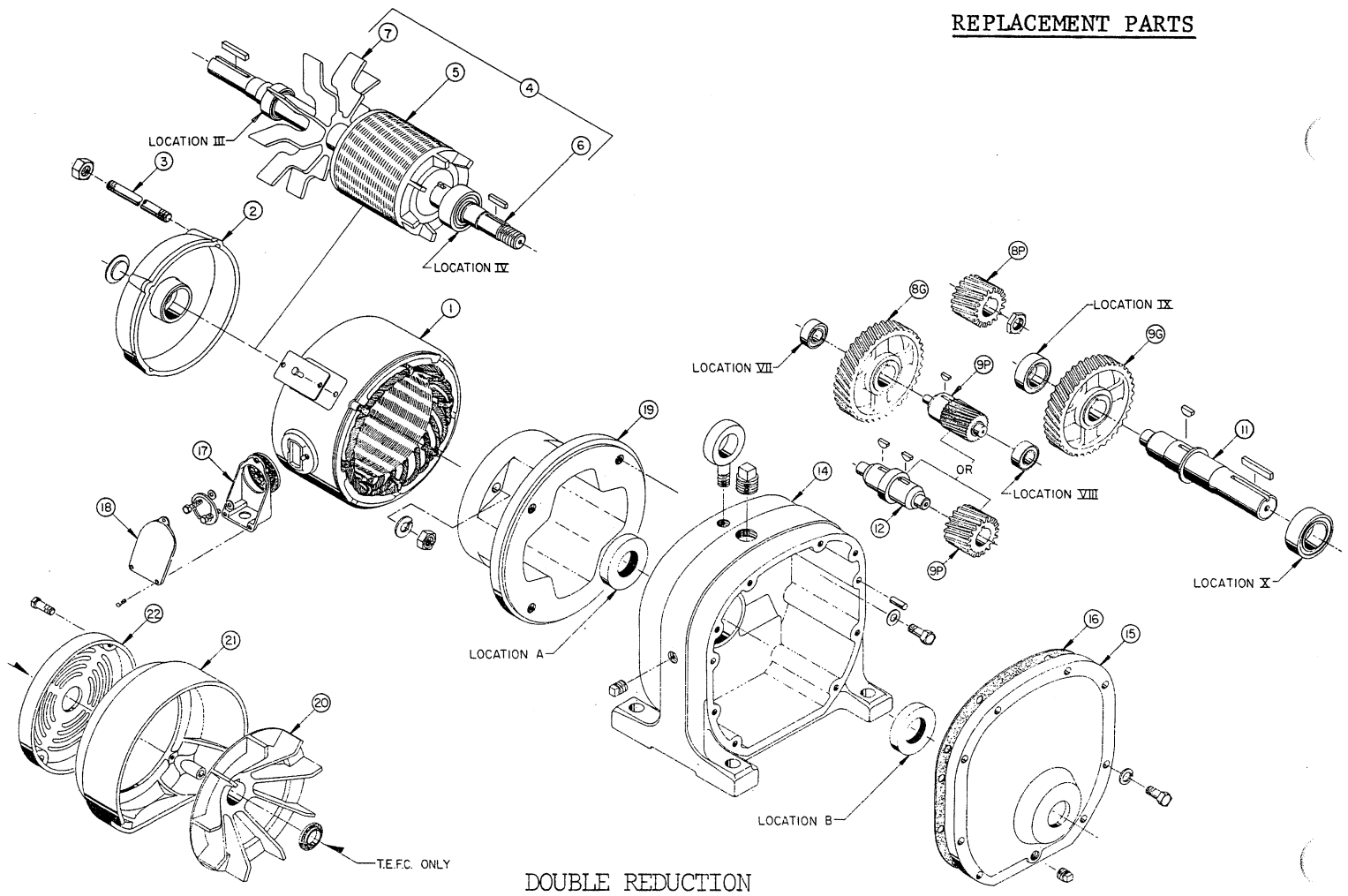
Your Slo-Speed Gear Motor has been designed and manufactured for outstanding performance. A few precautions taken at the time of installation will assure many years of trouble-free service.

CAUTION: Be Sure to Check: Phase
 Cycle
 Voltage
 Connections and other nameplate data against
 operating conditions

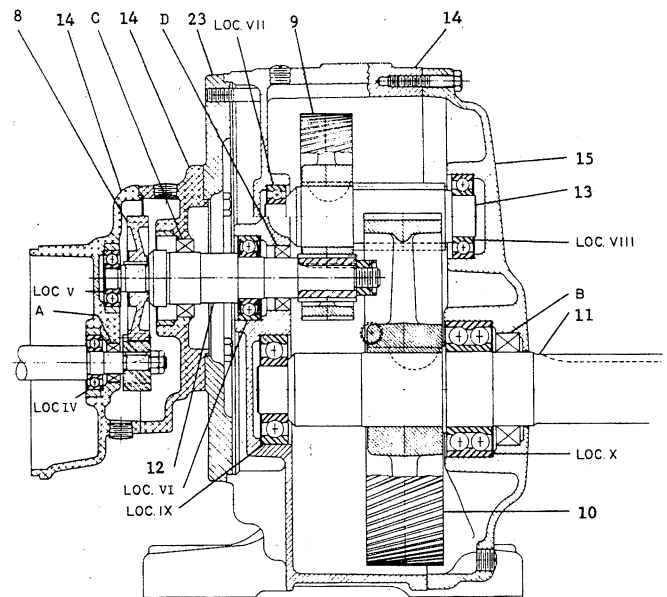
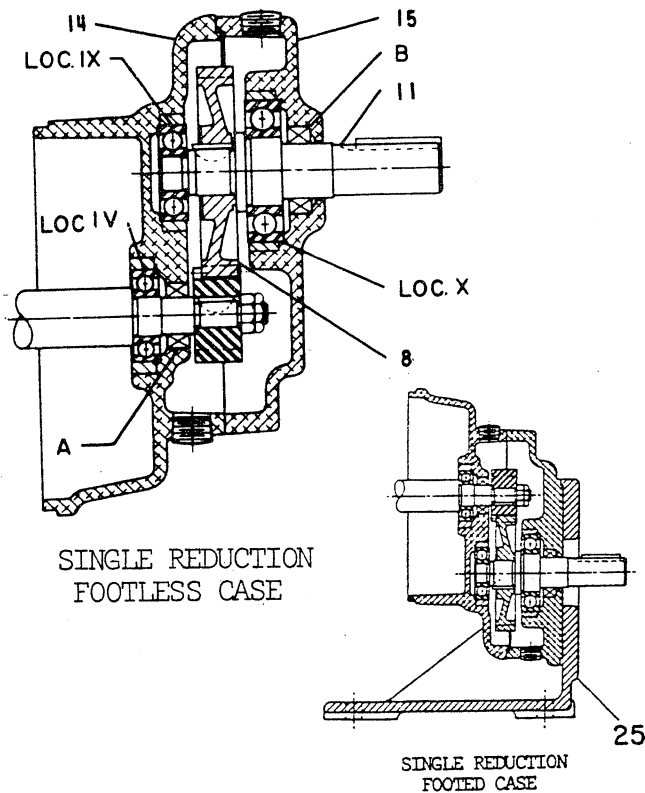
Check the specifications and operating conditions and be certain the unit is being installed according to plan.

Mount the unit with output shaft in perfect alignment with the drive shaft of the machine. Shims may be necessary to accomplish this. Should chain and sprocket or belt drive be mounted on output shaft, caution should be taken to maintain alignment and proper tension.

REPLACEMENT PARTS



DOUBLE REDUCTION



TRIPLE REDUCTION

REPLACEMENT PARTS

Call Out No.	Part Name	Reduction			Call Out No.	Part Name	Reduction			Call Out No.	Part Name	Reduction		
		Sgl.	Dbl.	Trpl.			Sgl.	Dbl.	Trpl.			Sgl.	Dbl.	Trpl.
1	Stator & Frame	X	X	X	9	2nd Gear Set		X	X*	16	Gasket	X	X	X
2	Bracket, Motor	X	X	X	10	3rd Gear Set			X*	17	Terminal Box	X	X	X
3	Thru Bolt	X	X	X	11	Shaft Output	X	X	X	18	T.B. Cover	X	X	X
4	Rotor Assembly	X	X	X	12	1st Counter-shaft		X	X	19	Adaptor	X	X	X
5	Rotor Core	X	X	X	13	2nd Counter-shaft			X	20	Outside Fan	X	X	X
6	Shaft	X	X	X	14	Gear Case	X	X	X	21	Fan Cover	X	X	X
7	Fan	X	X	X	15	Gear Case Cover	X	X	X	22	Fan Grill	X	X	X
8	1st Gear Set	X	X	X						23	Intermediate Adaptor Foot			X
										25		X		

* Pinion integral with shaft on some ratios.

BALL BEARINGS-SAE NUMBERS SHOWN

REFERENCE: S.S. - Single Shield D.S. - Double Shield D.R. - Double Row

BEARING LOCATION	GEAR REDUCTION																TRIPLE							
	SINGLE								DOUBLE															
	11F	11	12	13	14	15	16	17	21	22	23	24	25	26	27	313	323	324	325	326	335	336	346	356
III	D.S. 205	D.S. 205	D.S. 204	D.S. 206	D.S. 306	D.S. 307	D.S. 309	D.S. 310	D.S. 205	D.S. 204	D.S. 206	D.S. 306	D.S. 307	D.S. 309	D.S. 310	D.S. 205	D.S. 204	D.S. 204	D.S. 204	D.S. 204	D.S. 206	D.S. 206	D.S. 306	D.S. 307
IV	D.S. 202	D.S. 204	D.S. 204	D.S. 205	D.S. 206	D.S. 306	D.S. 309	D.S. 311	D.S. 204	D.S. 204	D.S. 205	D.S. 206	D.S. 306	D.S. 309	D.S. 311	D.S. 204	D.S. 204	D.S. 204	D.S. 204	D.S. 204	D.S. 205	D.S. 205	D.S. 206	D.S. 306
V	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	OPEN 202	OPEN 203	OPEN 203	OPEN 203	OPEN 203	OPEN 206	OPEN 206	OPEN 206	OPEN 207
VI	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	D.S. 205	D.S. 205	D.S. 206	D.S. 306	D.S. 309	D.S. 306	D.S. 309	D.S. 309	D.S. 309
VII	---	---	---	---	---	---	---	---	OPEN 302	OPEN 202	OPEN 203	OPEN 204	OPEN 206	OPEN 207	D.R. OPEN 5310	OPEN 203	OPEN 203	OPEN 204	OPEN 206	OPEN 207	OPEN 206	OPEN 207	OPEN 207	OPEN 207
VIII	---	---	---	---	---	---	---	---	OPEN 302	OPEN 204	OPEN 204	OPEN 206	OPEN 208	OPEN 308	D.R. OPEN 5310	OPEN 204	OPEN 204	OPEN 206	OPEN 208	OPEN 308	OPEN 208	OPEN 308	OPEN 308	OPEN 308
IX	OPEN 203	OPEN 202	OPEN 203	OPEN 206	OPEN 206	OPEN 207	OPEN 208	OPEN 313	OPEN 302	OPEN 304	OPEN 306	OPEN 307	OPEN 308	OPEN 310	OPEN 314	OPEN 306	OPEN 306	OPEN 307	OPEN 308	OPEN 310	OPEN 308	OPEN 310	OPEN 310	OPEN 310
X	OPEN 204	S.S. 205	OPEN 206	OPEN 207	OPEN 208	OPEN 211	OPEN 213	D.R. OPEN 5217	OPEN 306	D.R. OPEN 207	D.R. OPEN 209	D.R. OPEN 211	D.R. OPEN 212	D.R. OPEN 215	D.R. OPEN 5218	D.R. OPEN 209	D.R. OPEN 209	D.R. OPEN 211	D.R. OPEN 212	D.R. OPEN 215	D.R. OPEN 212	D.R. OPEN 215	D.R. OPEN 215	D.R. OPEN 215

OIL SEALS - National numbers shown

SEAL LOCATION	GEAR REDUCTION															
	SINGLE REDUCTION								DOUBLE REDUCTION							
	11F	11	12	13	14	15	16	17	21	22	23	24	25	26	27	
A	450008	450009	450027	450208	450948	450948	450352	450303	450009	450027	450208	450948	450948	450352	450303	
B	470029	450032	450160	450169	450262	450312	455655	455004	450160	450169	450291	450314	455321	455153	455137	
	TRIPLE REDUCTION															
	313	323	324	325	326	335	336	346	356							
A	450009	450027	450027	450027	450027	450208	450208	450948	450312							
B	450291	450291	450314	455321	455153	455321	455153	455153	455153							
C	450067	450169	450169	450169	450312	450312	450312	450312	450948							
D	450208	450208	450948	450948	450352	450948	450352	450352	450352							

INSTRUCTIONS FOR ORDERING PARTS

When ordering parts from this manual, the following information must be given:

Quantity
Call-Out Number and Part Name
Horsepower
Serial Number
Output RPM
Type
Frame
Motor Speed

The above information should be obtained from the nameplate (similar to the one shown on back cover) attached to the unit.

LUBRICATION INSTRUCTIONS

Slo-Speed Gear Motors and separate motor reducers are shipped without oil. They may be mounted in any vertical or horizontal position without modification. Universal mounting is possible only with Sterling's oil sealing method and dip-splash lubrication system. The capacities and recommended oils to be used are shown on Page 7.

UNIT IS SHIPPED WITHOUT OIL. For instructions refer to decals shown on Page 8.

Check oil level and overall running condition at frequent intervals.

MOTOR BEARING

Pre-lubricated double shield ball bearings have been installed with extra lubricant in the bearing housing. No further lubrication is required unless motor is furnished with grease fittings.

GEAR CASE BEARINGS

Open ball bearings have been installed and are splash lubricated by gears running through the oil in the reservoir.

For bearing locations and SAE numbers refer to Pages 4 and 5.

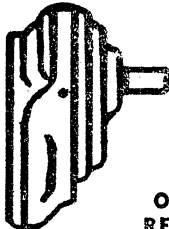
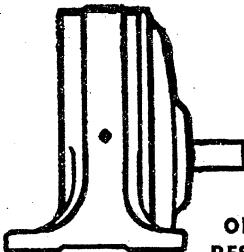
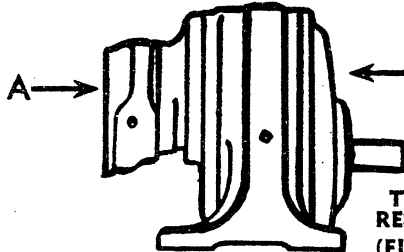
OIL SEALS

Positive oil seals are mounted on highly polished, micro-finish shafts and will give full sealing protection for any mounting position. For seal locations refer to Page 4.

GENERAL OIL SPECIFICATIONS

The following oils (or equivalent) are recommended by the respective oil companies. They meet the specifications as shown on the decals (Page 3) and serve as a guide in selecting the proper lubricant for best performance.

OIL FOR STERLING HELICAL GEAR REDUCERS		
MANUFACTURER	FOR OPERATION AT -20°F to +40°F AGMA #5EP1040SUS at 100°F	FOR OPERATION AT +40°F to +120°F AGMA #8EP3000SUS at 100°F
Chevron Oil	NL Gear Guard Compound 220	NL Gear Compound 680
Exxon Petroleum	Spartan EP220	Sparton EP680
Mobil Oil Company	Mobilgear 630-220	Mobilgear 636-680
Shell Oil Corporation	Omala 71-220	Omala 81-680
Texaco Oil Company	Meropa 220	Meropa 680
Atlantic Richfield	Pennant NL S1000-220	Pennant NL S1000-680

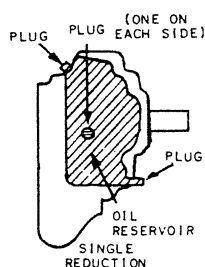
 <p>ONE OIL RESERVOIR</p> <p>SINGLE REDUCTION GEAR CASE</p>	 <p>ONE OIL RESERVOIR</p> <p>DOUBLE REDUCTION GEAR CASE</p>	 <p>TWO OIL RESERVOIRS (FILL EACH)</p> <p>TRIPLE REDUCTION GEAR CASE</p>	
BASIC SIZE	BASIC SIZE	RESERVOIR	
		BASIC SIZE	"A" "B"
11F.....1 Pint	21.....1 Qt.	313.....1 Pint	10 Qts.
11.....1 Pint	22.....2½ Qts.	323.....1 Pint	10 Qts.
12.....1 Pint	23.....5 Qts.	324.....1 Pint	4 Gals.
13.....1 Qt.	24.....8 Qts.	325.....1 Pint	6½ Gals.
14.....1½ Qts.	25.....13 Qts.	326.....1 Pint	13½ Gals.
15.....2 Qts.	26.....27 Qts.	335.....1 Qt.	6½ Gals.
16.....3 Qts.	27.....10 Qts.	336.....1 Qt.	13½ Gals.
17.....5 Qts.		346.....1½ Qts.	13½ Gals.
		356.....2 Qts.	13½ Gals.

The basic gear case size can be found in the last group of numbers in the frame block on the nameplate.

The quantities of oil shown are approximates only. Fill as directed.

LUBRICATION INSTRUCTIONS

SINGLE REDUCTION



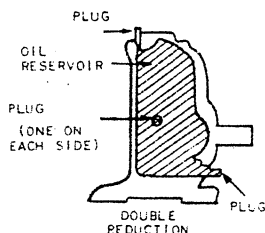
The gear end of this unit is shown to the left. Four plugs provide a fill, level and drain. Mounting can be made on floor, wall or ceiling, either horizontal or vertical. Regardless of mounting position, the plug at the highest elevation is the "fill". The plugs at the middle elevation are "level" plugs. The lowest plug is for draining. Change oil after first 200 hours of operation, thereafter change oil every 2000 hours.

Before running, remove "fill" and "level" plugs and add oil. Oil level should not be above "level" plug.

LUBRICATION OIL SPECIFICATIONS

High grade non-lead ed gear compound. For +40°F. to 120°F. use AGMA-8EP Viscosity 3000SUS at 100°F. For -20°F. to +40°F. use AGMA - 5EP Viscosity 1040SUS at 100°F. NOTE: For temperatures above or below those listed, consult the factory.

DOUBLE REDUCTION



The gear end of this unit is shown to the left. Four plugs provide a fill, level and drain. Mounting can be made on the floor, wall or ceiling, either horizontal or vertical. Regardless of mounting position, the plug at the highest elevation is the "fill". The plugs at the middle elevation are "level" plugs. The lowest plug is for draining. Change oil after first 200 hours of operation, thereafter change oil every 2000 hours.

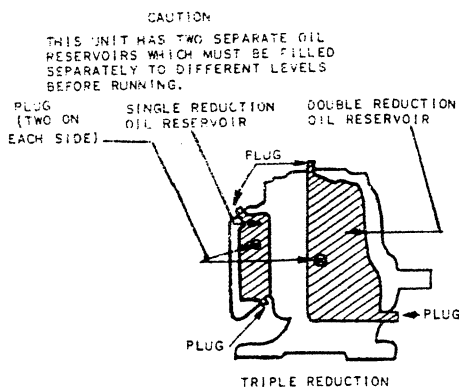
MAXIMUM OUTPUT SPEEDS ABOVE 47 RPM--Before running, remove "fill" and "level" plugs and add oil. Oil level should not be above "level" plugs.

MAXIMUM OUTPUT SPEEDS 47 RPM AND BELOW--Before running, remove "fill" plug. Do not remove "level" plugs. Fill oil reservoir to within 1" of oil fill plug hole. This supplies necessary air space.

LUBRICATION OIL SPECIFICATIONS

High grade non-lead ed gear compound for +40°F. to 120°F. use AGMA-8EP Viscosity 3000SUS at 100°F. For -20°F. to +40°F. use AGMA-5EP Viscosity 1040SUS at 100°F. NOTE: For temperatures above or below those listed, consult the factory.

TRIPLE AND QUADRUPLE REDUCTION



The gear end of this unit is shown to the left. Four plugs for each separate oil reservoir provide a fill, level and drain. Mounting can be made on floor, wall or ceiling, either horizontal or vertical. For each separate reservoir, regardless of mounting position, the plug at the highest elevation is the "fill". The plugs at the middle elevation are "level" plugs. The lowest plug is for draining.

Before running, remove "fill" and "level" plugs from first stage oil reservoir (see picture), and add oil. Oil level should not be above "level" plug.

Then remove "fill" plug from second stage oil reservoir. Do not remove "level" plugs. Oil reservoir must be filled completely to within 1" of "fill" plug hole, second stage. This provides necessary air space. Change oil in both reservoirs after 200 hours of operation, thereafter change oil every 2000 hours.

LUBRICATION OIL SPECIFICATIONS

High grade non-lead ed gear compound. For +40°F. to 120°F. use AGMA-8EP Viscosity 3000SUS at 100°F. For -20°F. to +40°F. use AGMA-5EP Viscosity 1040SUS at 100°F. NOTE: For temperatures above or below those listed, consult the factory.

TROUBLE SHOOTER'S GUIDE BASED ON SYMPTOMS

ELECTRICAL MALFUNCTION

SYMPTOMS	CAUSE	RESULT	REMEDY
1. Motor does not start.	a. Incorrectly connected.	a. Burnout	a. Connect correctly per diagram on motor.
	b. Incorrect power supply.	b. Burnout	b. Use only with correct rated power supply.
	c. Fuse out, loose or open connection.	c. Burnout	c. Correct open circuit condition.
	d. Open control circuit.	d. None	d. Correct open circuit condition.
	e. Rotating parts of motor may be jammed mechanically.	e. Burnout	e. Check and correct: 1. Bent shaft 2. Broken housing 3. Damaged bearing 4. Foreign material in motor.
	f. Driven machine may be jammed.	f. Burnout	f. Correct jammed condition.
	g. No power supply.	g. None	g. Check for voltage at motor and work back to power supply.
2. Motor starts but does not come up to speed.	a. Same as 1-a, b, c above.		
	b. Overload.	b. Burnout	b. Reduce load to bring current to rated limit. Use proper fuses and overload protection.
3. Motor noisy electrically	a. Same as 1-a, b, c above.		
4. Motor runs hot (Exceeds rating)	a. Same as 1-a, b, c above.		
	b. Overload.	b. Burnout	b. Reduce load.
	c. Impaired ventilation.	c. Burnout	c. Remove obstruction.
	d. Frequent start or stop.	d. Burnout	d. 1. Reduce number of starts or reversals. 2. Secure proper motor for this duty.
	e. Misalignment between rotor and stator laminations.	e. Burnout	e. Realign.

TROUBLE SHOOTER'S GUIDE BASED ON SYMPTOMS

MECHANICAL MALFUNCTION

SYMPTOMS	CAUSE	RESULT	REMEDY
5. Noisy (Mechanically).	a. Misalignment of coupling or sprocket.	a. Bearing failure, broken shaft, stator burnout due to motor drag.	a. Correct misalignment.
	b. Mechanical unbalance of rotating parts.	b. Same as 5-a.	b. Find unbalanced part, then balance.
	c. Lack of or improper lubricant.	c. Bearing failure.	c. Use correct lubricant, replace parts as necessary.
	d. Foreign material in lubricant.	d. Same as 5-c.	d. Clean out and replace bearings.
	e. Overload.	e. Same as 5-c.	e. Remove overload condition. Replace damaged parts.
	f. Shock loading	f. Same as 5-c.	f. Correct causes and replace damaged parts.
	g. Mounting acts as amplifier of normal noise.	g. Annoying.	g. Isolate motor from base.
	h. Rotor dragging due to worn bearings, shaft or bracket.	h. Burnout.	h. Replace bearings, shaft or bracket as needed.
6. Bearing failure.	a. Same as 5-a, b, c, d, e.	a. Burnout, damaged shaft, damaged housing.	a. Replace bearings and follow 5-a, b, c, d, e.
	b. Entry of water or foreign material into bearing housing.	b. Same as 6-a.	b. Replace bearings and shield against entry of foreign material (water, dust, etc.) - use proper motor.
7. Gear failure.	a. Same as 5-c, d, e, f.	a. Machine stoppage.	a. Same as 5-c, d, e, f. b. Install shear pin safety link.
8. Oil leak.	a. Improper lubricant.	a. Gear failure, bearing failure, burnout.	a. Use specified lubricant.
	b. Too much lubricant.	b. Gear failure, bearing failure, burnout if oil level gets too low.	b. Fill only to level plug.
	c. Worn oil seal or shaft.	c. Same as b.	c. Replace necessary parts.
	d. Loose gear case cover.	d. Same as b.	d. Tighten bolts, replace gasket if necessary.
	e. Loose level or drain plug.	e. Same as b.	e. Tighten and seal plugs.
	f. Misaligned sprocket or coupling.	f. Same as b.	f. Correct misalignment.
	g. Overload.	g. Same as b.	g. Reduce load.
	h. Shock load.	h. Same as b.	h. Remove condition causing shock.

TYPICAL BURNOUT PATTERNS

SYMPTOM	CAUSED BY	APPEARANCE
1. Shorted Coil	a. Moisture, chemicals, foreign material in motor, damaged winding.	A. Black or burned coil with remainder of winding good.
2. 100%	a. Overload. b. Stalled. c. Impaired ventilation. d. Frequent reversal or starting. e. Incorrect power.	a. Burned equally all around winding. b. Burned equally all around winding. c. Burned equally all around winding. d. Burned equally all around winding. e. Burned equally all around winding.
3. Single phase condition	a. Open circuit in one line. The most common causes are loose connection, one fuse out, loose contact in switch.	a. If 1800 RPM motor - four equally burned groups at 90° intervals. b. If 1200 RPM motor - six equally burned groups at 60° intervals. c. If 3600 RPM motor - two equally burned groups at 180° NOTE: If Y connected each burned group will consist of two adjacent phase groups. If delta connected each burned group will consist of one phase group.
4. Other	a. Improper connection. b. Ground	a. Irregular burned groups or spot burns.

Many burnouts occur within a short period of time after being started up. This does not necessarily indicate that the motor was defective but usually is due to one or more of the above mentioned causes. The most common of these are improper connection, open circuit in one line, incorrect power supply or overload.

TYPICAL GEAR FAILURES

APPEARANCE	CAUSE
1. Worn evenly around the entire circumference.	1. a. Lack of lubrication at start up or at some later time. b. Improper lubricant. c. Foreign material in lubricant. d. Overload.
2. Teeth stripped.	2. Shock load.
3. Gear broken.	3. Shock load.



STERLING
ELECTRIC, INC.

A SUBSIDIARY OF A. O. SMITH CORPORATION



VARIABLE SPEED DRIVE ☐

GEAR MOTOR ☐

A.C. MOTOR ☐

H.P.

SER.
NO.

MOTOR
INPUT R.P.M.

S.F.

MAX.
R.P.M.

MIN.
R.P.M.

FRAME

TYPE

BELT
NO.

GEAR
RATIO

MAX.
AMB.

°C

ENCL

CLASS

DESIGN

INS.

VOLTS

CODE

PHASE

HERTZ

AMPS