

Release

4

HH Roberts



GL-Series

220Volt AC

Replacement Head Manual

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Operator Panel

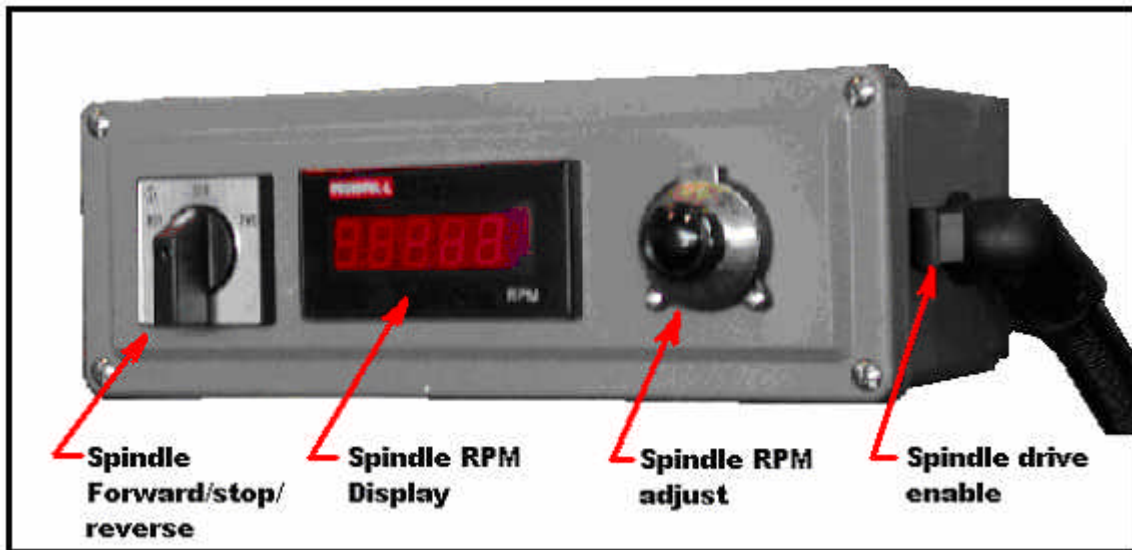


Figure 1

Above is the main Operator Panel for the GL Series Replacement head. When power is first applied to the head the Spindle RPM display will light up and you should hear the main spindle motor cooling fan running. At this point you can not run the spindle until the Spindle Lock (see figure 2) is disengaged and you have pushed the Spindle drive enable button in order to activate the drive. The Spindle drive enable button is a safety feature. If you lose power to the head when the spindle forward / reverse switch is in the run position the spindle will not restart until the operator resets the drive. At this point the switch must be moved back to the off position before you can select forward or reverse. Once the drive has been enabled you can use the Forward / Reverse switch to select the direction of the spindle. The RPM of the spindle is displayed on the control panel. By using the RPM adjustment knob you can set the desired RPM.



Figure 2

Spindle Lock

Please note on the left side of the head there is a spindle lock cam. When engaged the spindle is locked and cannot rotate. This is used to hold the spindle rigid in order to change collets or tool holders. At this point it will activate a limit switch that will disable the drive.

Using The Speed Ranges

Depending on the pulley set supplied with the 4 GL Series Replacement head the available speed ranges are 0-6000 RPM or 0-4000 RPM.

On the 5 GL Series Replacement head standard is a two-step pulley that is capable of selecting either 0-6000 RPM or 0-4000 RPM. Below are the steps required to change the speed ranges on a 5 GL Series Replacement head.

Selecting the pulley set

In order to select a speed range you must move the drive belt to the desired pulley set. This is done by removing the right side cover of the belt housing (see figure 3) to gain access to the two-step motor pulley. Then by removing the four 19 mm hex nuts holding the main spindle motor to the belt housing you will be able to slide the motor to appropriate position (see figure 4) in order to place the drive belt on to the correct pulley set. Move the drive belt to the top (larger) of the motor pulley for 0-6000 RPM or the lower (smaller) of the motor pulley for 0-4000 RPM. At this point you must change the display speed range by flipping the switch mounted to the display.

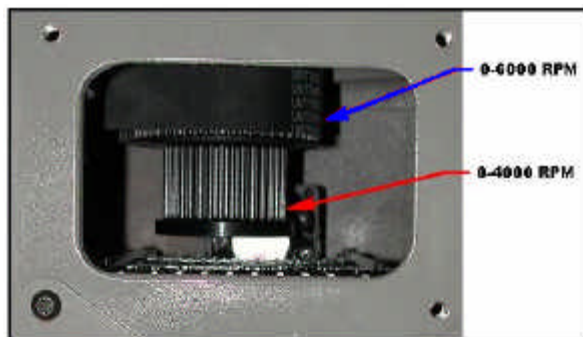


Figure 3

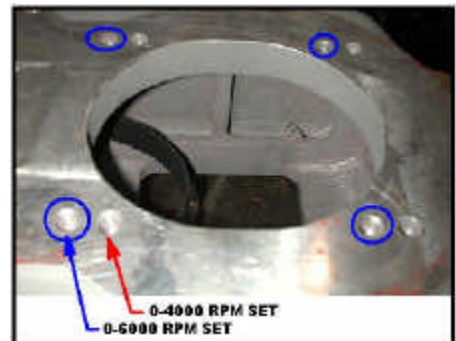


Figure 4

Spindle Drive used in the GL Series Head

The vector drive used in the GL Series Head operates the three phase rotary AC spindle motor without the need of a sensor. The leading edge SensorlessServo™ technology replaces the physical sensors such as encoder and resolver with a software algorithm. The algorithm calculates speed and torque information from current and voltage measurements. The rotor speed is fed to the PI servo system within the drive. The result is a three-phase sinusoidal vector drive without the need for a physical sensor on the motor.

Three Phase Connection

Please note the GL Series Replacement Heads are powered by an AC vector drive and can only be wired for 200-240V AC. Any other voltage will lead to a catastrophic failure of the drive, and will not be covered under any form of warranty. When connecting to a three Phase installation make the line connections as you would in any installation.

Single Phase Connection

Please note the GL Series Replacement Heads are powered by an AC vector drive and can only be wired for 200-240VAC any other voltage will lead to a catastrophic failure of the drive. And will not be covered under any form of warranty. When connecting to a single Phase installation make the line connections to L1 and L2. Then remove the L3 wire.

Input Line Considerations

All wiring must comply with the requirements of the National Electric Code (NEC) and/or other codes as required by the authority having jurisdiction over the installation or machine on which the GL Series Replacement Head is installed. The installer must ensure that the electrical connections at the site conform to the connection diagrams provided in this manual.

Note: Ensure that the most recent version of the codes is used when installing the GL Series Replacement Head.

Table 1 provides an overview of the GL Series Replacement Head electrical specifications.

Head Model	Nominal HP	Input Voltage 3 Ph VAC	Input Freq. Hz	Input RMS Amps	Output Voltage	Output Freq. Hz	Output RMS Amps	Wire Size 100m or less	Wire Size 100m or more
4GL	3	200-240	50/60	11	0-240	0-400	20	14	8
5GL	5	200-240	50/60	17	0-240	0-400	30	12	6

Table 1

- The input line conductors must be made of copper with a temperature rating of at least 167° F (75° C). Use a conductor of at least the size specified in **Table 1** above.

- Note: Verify that the input line conductor size and branch circuit overload protection are in accordance with applicable local code requirements.
- The input line and branch circuit overload protection must be rated for the input voltage and current stated on the nameplate of the drive, and repeated here in **Table 1**.
- For the GL Series head the maximum wire size is #8 AWG

An input line fuse is always required to limit the current available to a failed semiconductor device. The fuse limits or eliminates the collateral damage that can occur when a drive fails catastrophic and the possibility of fire could occur. While this is a remote circumstance, it is important that all reasonable precautions should be taken to avoid the chance of consequential damages. Refer to table 2 for more details on determining the correct fuse type and rating for your application. The recommended line input fuse vendor is:

Cooper Bussmann, Inc.
 Post Office Box 14460
 St. Louis, MO 63178-4460
 Phone: 314-394-2877
 Fax: 800-544-2570

Fuse recommendations are listed in **Table 2**.

Head Model	Nominal HP	Input Voltage 1 Ph or 3 Ph VAC	1 Ph Amps	3 Ph Amps	Fuse Class	Branch Circuit Breaker
4GL	3	200-240	KTK-25	KTK-25	KTK	20
5GL	5	200-240	JJN-40	JJN-40	300V T	30

Table 2.

Fuse Class Branch Circuit Breaker (Bussmann types shown)

Grounding Connections

For personal safety and reliable equipment operation, *firmly* connect each chassis to earth ground. Use a copper or aluminum conductor.

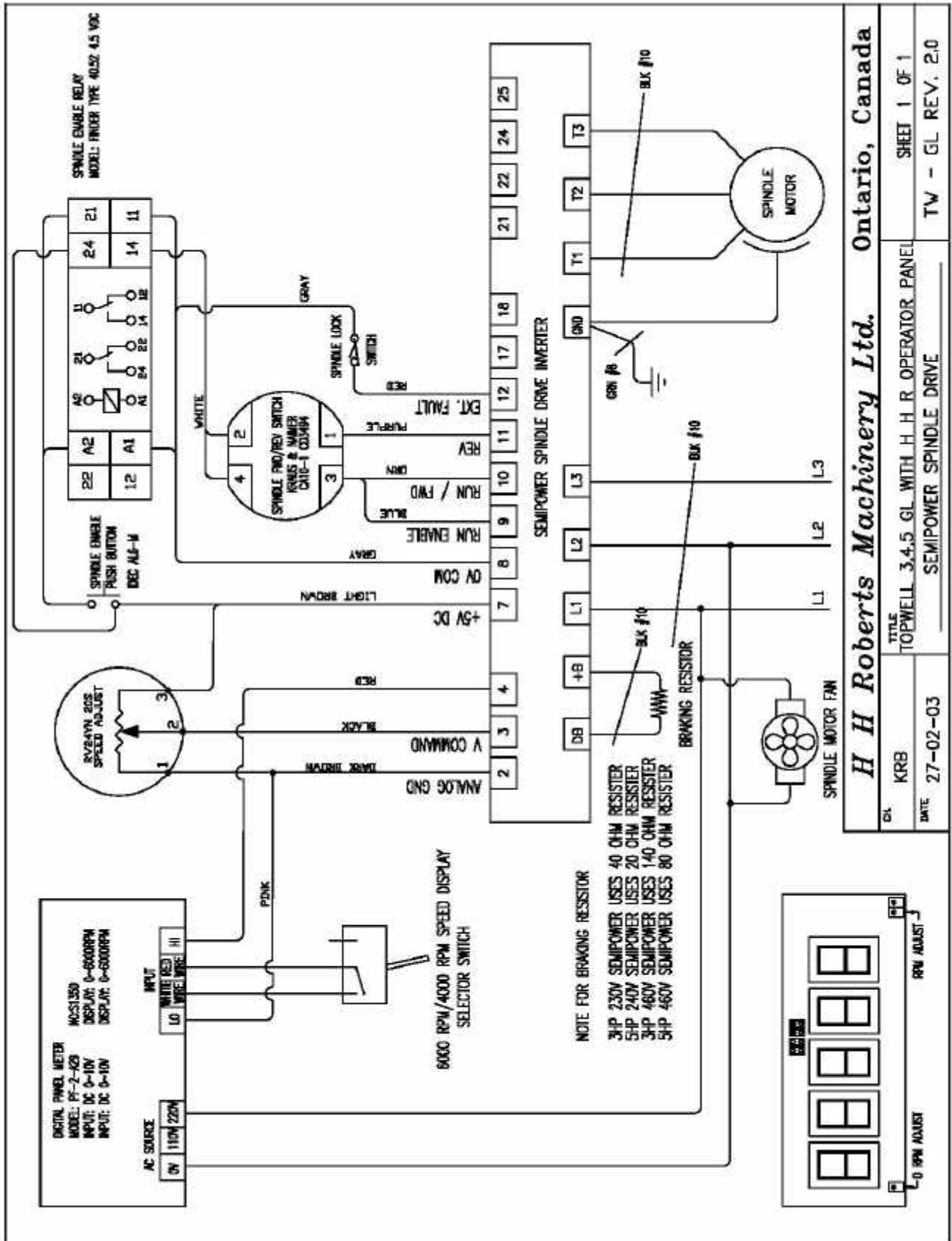
Error codes

If for any reason the drive will not start please check the drive power LED to make sure the drive is powered up as well as to check and see if the drive is in a fault condition.

Fault Led Blink Count	Description	Fault Led Blink Count	Description
1	Sat Fault	2	DB Overload Fault
3	Phase Over current	4	Not Used
5	DC Link Under voltage	6	DC Link Over voltage
7	Not Used	8	A/D Offset out of Range
9	Motor Fault	10	Heat sink Overheat
11	Motor Thermal Overload	12	Communication Loss
13	External Fault	14	EPROM Fault
15	Parameter Error		

For more information on the above alarms please consult the Semi power manual.

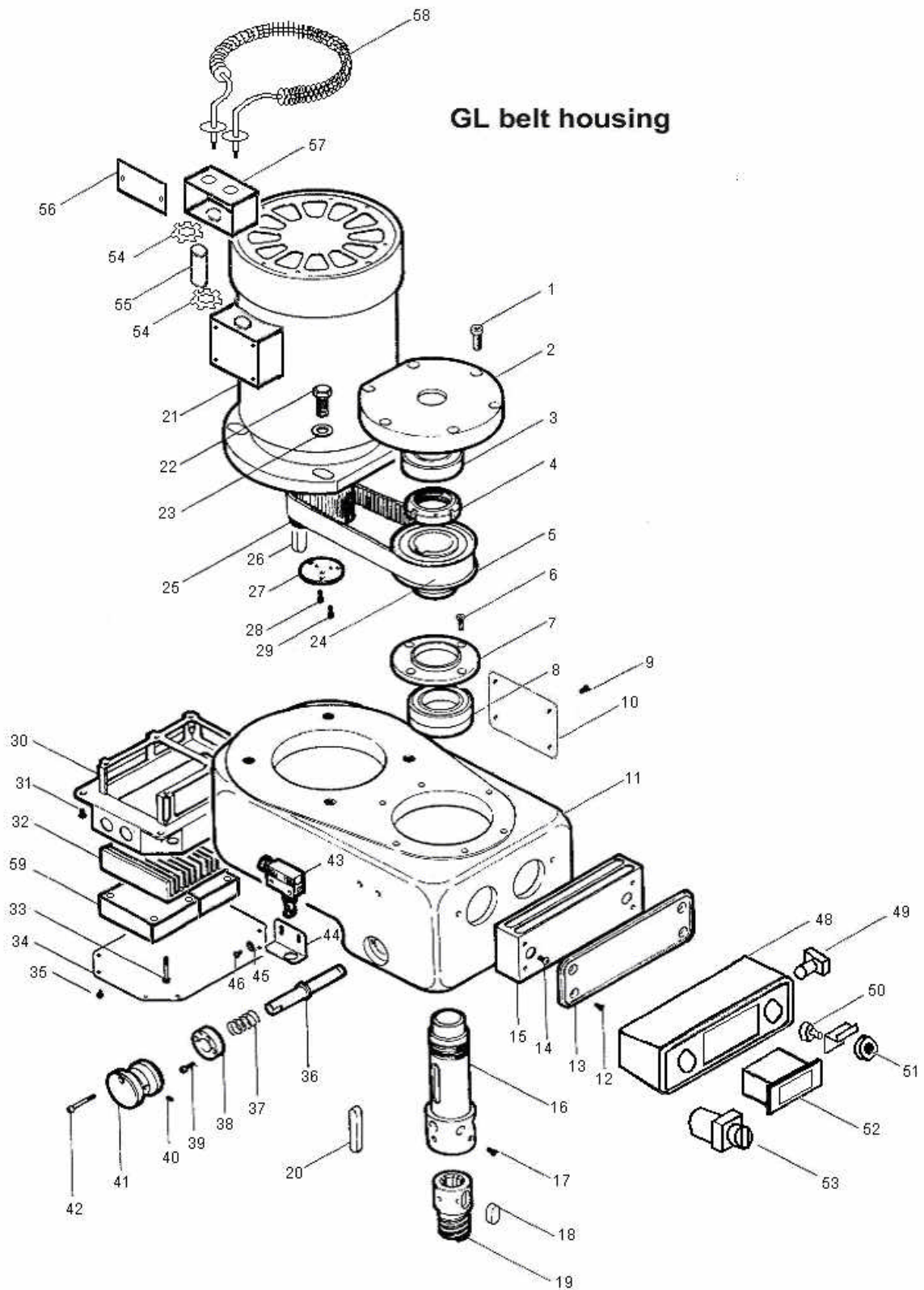
Fault #13 "External Fault" is used for the spindle lock.



H H Roberts Machinery Ltd. Ontario, Canada

DATE: 27-02-03
 TITLE: TOPWELL 3.4.5 GL WITH H.H.R OPERATOR PANEL
 SHEET 1 OF 1

SEMIPOWER SPINDLE DRIVE
 TV - GL REV. 2.0



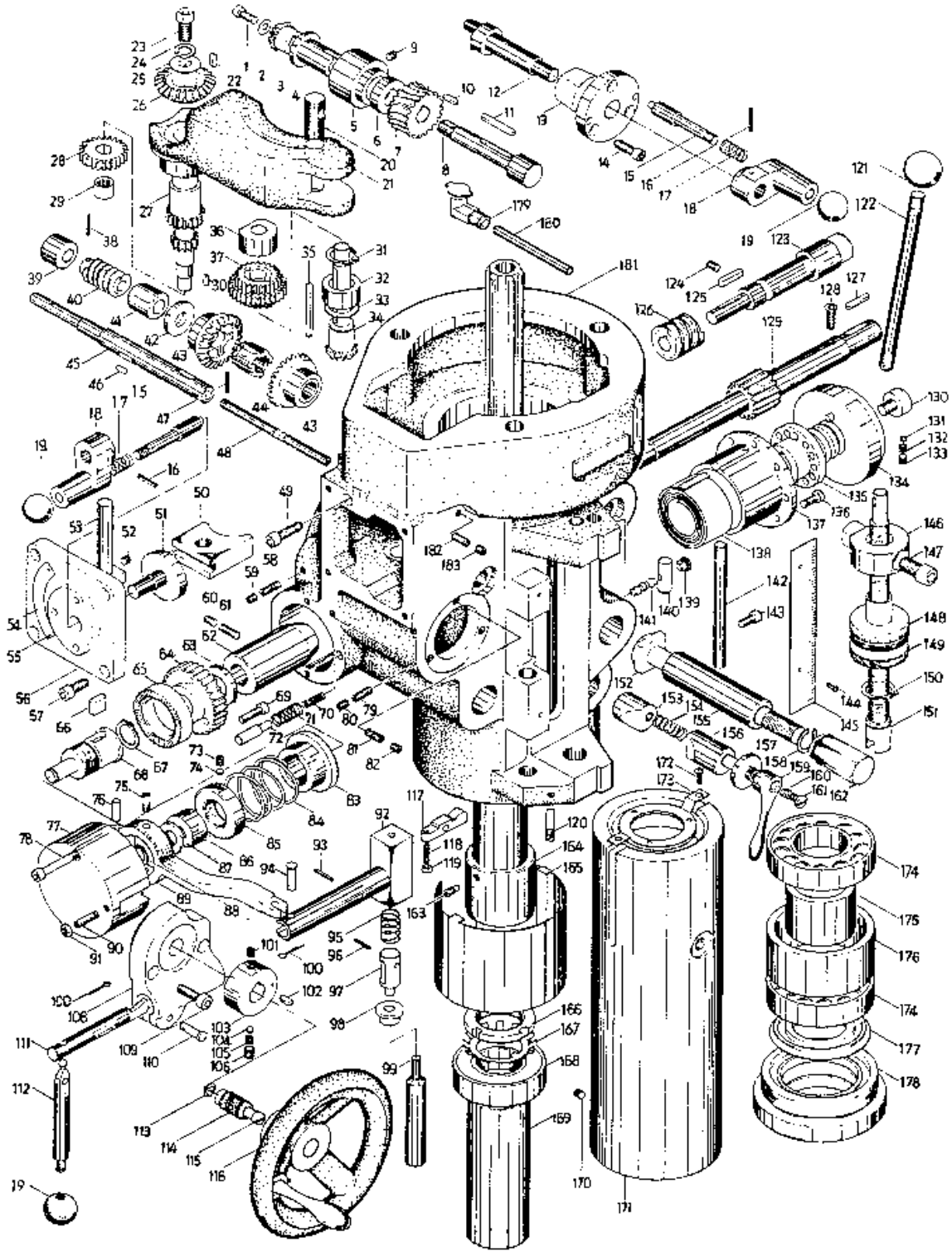
4 GL Head Belt Housing

ITEM NO.	PARTS NO.	DESCRIPTION	ITEM NO.	PARTS NO.	DESCRIPTION
1	5K8001	Socket Head Cap Screw	33	5K6013F-2	Socket Head Cap Screw (M5 x 55) (6 Req)
2	5K7013F	Top Bearing Cap	34	5K6013-F-1B	Cover
3	5K8004	Bearing (6209 LLB)	35	5K-6013F-6	Socket Head Cap Screw (M5 x 10) (8 Req)
4	TRH8034-2	Precision Locknut (MF-50)	36	H8074F	Locking Pin
5	TRH6048HN	Spindle Timing Pulley (5 GT-66 T)	37	5A2029	Spring
6	TRH8053-2	Socket Head Cap Screw (M6 x 20) (2 Req)	38	TR8074-2	Fixed Position Block
7	TRH8053-1	Bearing Retainer Ring	39	TR8074-3	Socket Head Cap Screw (M5 x 16) (2 Req)
8	TRH8054	Bearing (6010 LB) (2 Req)	40	TR8074-4	Set Screw (M6 x 10)
11	H8010F	Belt Housing	41	TR8074-1	Fixed Position Handle
12	TL4068	Socket Head Cap Screw (M4 x 12) (4 Req)	42	TR8074-5	Socket Head Cap Screw (M5 x 50)
13	TL4067A	Name Plate	43	5K6013F-7	Limit Switch (D4E-1B20N)
14	TRH6013-3	Socket Head Cap Screw (M6 x 10) (2 Req)	44	3B7071-1	Limit Switch Bracket
15	TRH6013-2	Ventilation Housing	45	5K6013F-9	Washer (M6) (2 Req)
16	TRH8034	Spindle Pulley Hub	46	5K6013F-8	Socket Head Cap Screw (M6 x 10) (2 Req)
17	TRH8034-3	Socket Head Cap Screw (M6 x 10) (3 Req)	47	5K6013F-3	Cover (For CNC Model)
18	TRH8034-2	Key (10 x 8 x 35)	48	GL9000	Enclosure 5GL Operator panel
19	H7039Q	Splined-Worm Hub	49	GL9001	Push Button (Idec AL-6M)
20	TRH8035	Key (8 x 7 x 60)	50	GL9002	Trim Pot (B2002)
21	3BI6001	3HP Inverter Motor	51	GL9003	Micro Turn Knob
22	TRH4044	Hex. HD. Screw (M12 x 30) (4 Req)	52	GL9004	RPM Display (PF-2-A29)
23	TRH4044-1	Washer (M12) (4 Req)	53	GL9005	FWD/STOP/REV Selector Switch
24	TRH4038	Timing Belt (5GT-720-30)	54	GL9006	½" Locknut (GLN050) (3 Req)
25	TL4050	Motor Timing Pulley 5GT-55T	55	GL9007	½" X 2" Rigid Nipple (GRN 050200)
26	TRH4056	Key (10 x 8 x 60)	56	GL9008	Junction Box Cover (BC-11-C4)
27	TA4040	Pulley Washer	57	GL9009	Junction Box (BC-1110)
28	5B6009-1	Socket Head Cap Screw (M5 x 16) (6 Req)	58	4GL9010	40 Ohm 1500W 240V Braking Resister
30	5K6013F-1A	Inverter Framework	58A	4GL9011	140 Ohm 1500W 460V Braking Resister
31	5K6013F-5	Socket Head Cap Screw (M5 x 10) (4 Req)	59	4GL9020	3HP SpindleBlok 240V (SDM1003D)
32	5K6013F-4	Aluminum Radiation	59A	4GL9021	3HP SpindleBlok 460V (SDM1003E)

5 GL Head Belt Housing

ITEM NO.	PARTS NO.	DESCRIPTION	ITEM NO.	PARTS NO.	DESCRIPTION
1	5K-8001	Socket Head Cap Screw (M8 x 40) (6 Req)	32	5K-6013F-4	Aluminum Radiation
2	5K-7013F	Top Bearing Cap	33	5K-6013F-2	Socket Head Cap Screw (M5 x 55) (6 Req)
3	5K-8004	Bearing (6209 LLB)	34	5K-6013F-1B	Cover
4	TRH-8034-2	Precision Locknut (MF-50)	35	5K-6013F-6	Socket Head Cap Screw (M5 x 10) (8 Req)
5	TRH-6048H	Spindle Timing Pulley (5GT-66 T)	36	TR-8074	Locking Pin
6	TRH-8053-2	Socket Head Cap Screw (M6 x 20) (4 Req)	37	5A-2029	Spring
7	TRH-8053-1	Bearing Retainer Ring	38	TR-8074-2	Fixed Position Block
8	TRH-8054	Bearing (6010 LB) (2 Req)	39	TR-8074-3	Socket Head Cap Screw (M5 x 16) (2 Req)
9	TRH-7015	Socket Head Cap Screw (M6 x 10) (4 Req)	40	TR-8074-4	Set Screw (M6 x 10)
10	6013I-1	Cover	41	TR-8074-1	Fixed Position Handle
11	5K-6013F	Belt Housing	42	TR-8074-5	Socket Head Cap Screw (M5 x 50)
12	TL-4068	Socket Head Cap Screw (M4 x 12) (4 Req)	43	5K-6013F-7	Limit Switch (D4E-1B20N)
13	TL-4067A	Name Plate	44	3B-7071-1	Limit Switch Bracket
14	TRH-6013-3	Socket Head Cap Screw (M6 x 10) (2 Req)	45	5K-6013F-9	Washer (M6)
15	TRH-6013-2	Ventilation Housing	46	5K-6013F-8	Socket Head Cap Screw (M6 x 10) (2 Req)
16	TRH-8034	Spindle Pulley Hub	47	5K-6013F-3	Cover (For CNC Model)
17	TRH-8034-3	Socket Head Cap Screw (M6 x 10) (3 Req)	48	GL9000	Enclosure 5GL Operator panel
18	TRH-8034-2	Key (10 x 8 x35)	49	GL9001	Push Button (Iddec AL-6M)
19	7039Q	Splined-Worm Hub	50	GL9002	Trim Pot (B2002)
20	TRH-8035	Key (8 x 7 x 60)	51	GL9003	Micro Turn Knob
21	5BI-6001	5HP Inverter Motor	52	GL9004	RPM Display (PF-2-A29)
22	TRH-4044	Hex. HD. Screw (M12 x 30) (4 Req)	53	GL9005	FWD/STOP/REV Selector Switch
23	TRH-4044-1	Washer (M12) (4 Req)	54	GL9006	½" Locknut (GLN050) (3 Req)
24	TRH-4038	Timing Belt (5GT- 720- 30)	55	GL9007	½" X 2" Rigid Nipple (GRN 050200)
25	TRH-6009	Motor Timing Pulley (5GT-55T / 5GT-37T)	56	GL9008	Junction Box Cover (BC-11-C4)
26	TRH-4056	Key (10 x 8 x 60)	57	GL9009	Junction Box (BC-1110)
27	TRH-6009E	Pulley Washer	58	4GL9030	20 Ohm 1500W 240V Braking Resister
28	TRH-6009E-2	Socket Head Cap Screw (M5 x 12) (3 Req)	58A	4GL9031	80 Ohm 1500W 460V Braking Resister
29	TRH-6009E-1	Socket Head Cap Screw (M5 x 35) (3 Req)	59	4GL9040	5HP SpindleBlok 240V (SDM1005D)
30	5K-6013F-1A	Inverter Framework	59A	4GL9041	5HP SpindleBlok 460V (SDM1005E)
31	5K-6013-F-5	Socket Head Cap Screw (M5 x 10) (4 Req)			

4 GL Head

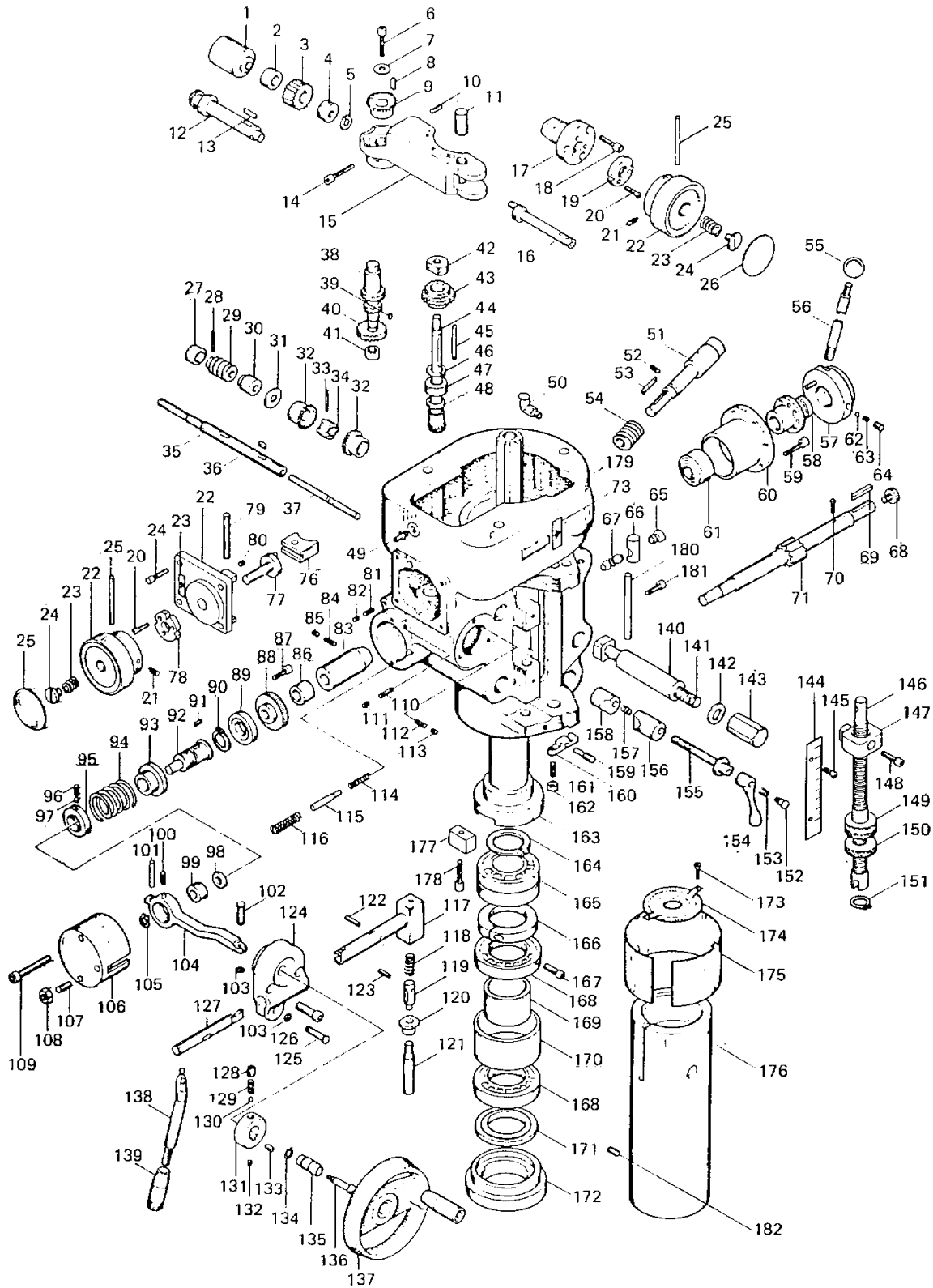


4GL HEAD

ITEM NO.	PARTS NO.	DESCRIPTION	ITEM NO.	PARTS NO.	DESCRIPTION
1	6141	RD, HD, Screw	46	6230	Key
2	6140	Bevel Pinion Washer	47	6217	Roll Pin
3	6139	Feed Bevel Pinion	48	6216	Reverse Clutch Rod
4	6138	Feed Worm Gear Shaft Sleeve	49	6121-1	Cap Screw
5	6137	Worm Cradle Bushing	50	6162	Feed Gear Shift Fork
6	6136	Worm Gear Spacer	51	6166	Cluster Gear Shift Crank
7	6134	Feed Drive Worm Gear	52	6164	Set Screw
8	6133	Feed Drive Worm Gear Shaft	53	6163	Feed Shift Rod
9	6123	Set Screw	54	6256	Vari-Speed Dial
10	6142	Key	55	6256-1	Drive Screw (2 Req.)
11	6135	Key	56	6161	Cluster Gear Cover
12	6126	Worm Gear Cradle Throw-out	57	6165	Cap Screw (4 Req.)
13	6125	Shift Sleeve	58	6227-1	Set Screw
14	6132	Cap Screw (3 Req.)	59	6227-2	Set Screw
15	6169	Gear Shift Plunger (2 Req.)	60	6186-1	Set Screw
16	6128	Roll Pin (2 Req.)	61	6186-2	Set Screw
17	6170	Compression Spring (2 Req.)	62	6186	Quill Pinion Shaft Bushing
18	6168	Shift Crank (2 Req.)	63	6190	Pinion Shaft Worm Gear Spacer
19	6131	Black Plastic Ball (3 Req.)	64	6187	Overload Clutch Worm Gear
20	6122	Feed Engage Pin	65	6188	Overload Clutch Ring
21	6121	Worm Gear Cradle	66	6195-1	Key
22	6147	Cluster Gear Key	67	6188-1	Snap Ring
23	6150	Cap Screw	68	6195	Overload Clutch Sleeve
24	6149-1	Spring Washer	69	6189	Round Head Screw (3 Req.)
25	6149	Washer	70	6191	Compression Spring
26	6148	Feed Reverse Bevel Gear	71	6192	Compression Spring
27	6143	Feed Driving Gear	72	6193	Overload Clutch Lever Spring
28	6144	Feed Driving Gear			Plunger
29	6252	Needle Bearing BA66#	73	6199	Set Screw
30	6145	Key	74	6199-1	Brass Plug
31	6158	Snap Ring	75	6202	Clutch Ring Pin (2 Req.)
32	6156	Bevel Gear Bearing	76	6204	Pin
33	6159	Bevel Gear Thrust Spacer	77	6205	Clutch Arm Cover
34	6151	Cluster Gear Shaft	78	6206	Cap Screw (2 Req.)
35	6160	Cluster Gear Key	79	6224-1	Set Screw
36	6157	Cluster Gear Shaft Upper Bearing	80	6224-2	Set Screw
37	6153	Cluster Gears Assembly	81	6156-1	Set Screw
38	6226	Roll Pin	82	6156-2	Set Screw
39	6227	Bushing	83	6194	Overload Clutch
40	6225	Worm	84	6197	Safety Clutch Spring
41	6224	Feed Worm Shaft Bushing	85	6198	Overload Clutch Locknut
42	6223	Feed Worm Shaft Thrust Washer	86	6200	Clutch Ring
43	6220	Feed Reverse Bevel Gear(2 Req.)	87	6201	Overload Clutch Washer
44	6222	Feed Reverse Clutch	88	6195-1	Snap Ring
45	6209	Feed Worm Shaft	89	6203	Overload Clutch Trip Lever
			90	6207	Socket Set Screw
			91	6208	Chem Blacked Locknut

ITEM NO.	PARTS NO.	DESCRIPTION	ITEM NO.	PARTS NO.	DESCRIPTION
92	6236	Cam Rod Sleeve Assy	139	6114	Reverse Trip Ball Lever Screw
93	6237	Roll Pin	140	6109	Feed Reverse Trip plunger
94	6236-1	Dowel Pin	141	6110	Reverse Trip Ball Lever
95	6242	Compression Spring	142	6251	Set Bar
96	6241	Roll Pin	143	6251-1	Cap Screw
97	6240	Trip Plunger	144	6244	Chem Blacked RD. HD. Screw (2 Req.)
98	6118-1	Trip Plunger Bushing	145	6243	Micrometer Scale
99	6118	Feed Trip Plunger	146	6105	Quill stop Knob
100	6257	Cotter Pin (2 Req.)	147	6106	Screw
101	6219	Set Screw	148	6107	Micrometer Nut
102	6229	Key	149	6108	Quill Micro-stop Nut
103	6218	Handwheel Clutch	150	6115	Snap Ring
104	6255	Steel Ball	151	6104	Quill Stop Micro-screw
105	6219-2	Compression Spring	152	5036	T-Bolt Assy (4. Req.)
106	6219-1	Handwheel Clutch Spring Screw	153	6116B	Quill Lock Sleeve
107	6257	Cotter Pin	154	6116-1	Compression Spring
108	6231	Feed Trip Bracket	155	6120	Lower Clamping Bolt Spacer (2 Req.)
109	6232	Cap Screw	156	6116A	Quill Lock Sleeve Tapped
110	6231-1	Dowel Pin	157	6117	Quill Lock Bolt
111	6239	Cam Rod	158	5037	Spring Washer
112	6234	Trip Handle	159	6119	Lock Handle
113	6215	Snap Ring	160	6117-1	Spring
114	6213	Reverse Knob	161	6117-2	Spring Screw
115	6214	Feed Reverse Knob Stud	162	5038	Locknut (4 Req.)
116	6210	Handwheel	163	6253	Special Socket Set Screw
117	6111	Feed Trip Lever	164	6084	Spindle
118	6113	Socket Set Screw	165	6086	Quill Skirt
119	6113-1	Locknut	166	6090	Locknut
120	6112	Trip Lever Pin	167	6091	Lockwasher
121	6173	Black Plastic Ball Handles	168	6092	Bearing
122	6174	Pinion Shaft Hub Handle	169	6094	Sleeve
123	5040	ADJ Worm Shaft	170	6085-1	Set Screw
124	5042	Socket Set Screw	171	6085	Quill
125	5041	Key	172	6088-1	Felt Washer Screw (2 Req.)
126	5039	Worm Gear	173	6088	Felt Washer
127	6184	Key	174	6093	Bearing (2 Req.)
128	6172-1	Cap Screw	175	6096	Bearing Spacer-Large
129	6172	Quill Pinion Shaft	176	6095	Bearing Spacer-Small
130	6183	Pinion Shaft Hub Screw	177	6097	Spindle Dirt Shield
131	6176	Steel Ball	178	6098	Nose-Piece
132	6175	Compression Spring	179	6258	Oil Cap
133	6177	Steel Ball	180	6259	Copper Pipe
134	6178	Rack Feed Handle Hub	181	6101	Quill Housing
135	6182	Pinion Shaft Hub Sleeve	182	6157-1	Set Screw
136	6180-1	RD. Head Screw (2 Req.)	183	6157-2	Set Screw
137	6180	Spring Cover			
138	6181	Clock Spring (Clock Spring Assy)			

5-GL Head



5K/5VK HEAD

ITEM NO.	PARTS NO.	DESCRIPTION	ITEM NO.	PARTS NO.	DESCRIPTION
1	5K-6137	Worm Cradle Bushing	51	5K-5040	ADJ. Worm Shaft
2	5K-6136	Worm Gear Spacer	52	5K-5042	Socket Set Screw
3	5K-6134	Feed Drive Worm Gear	53	5K-5041	Key
4	5K-6136-1	Worm Gear Bushing	54	5K-5039	Worm Gear
5	5K-6140	Snap Ring	55	5K-6173	Black Plastic Ball Handles
6	5K-6150	Cap Screw	56	5K-6174	Pinion Shaft Hub Handle
7	5K-6149	Washer	57	5K-6178	Rack Feed Handle Hub
8	5K-6147	Key	58	5K-6182	Pinion Shaft Hub Sleeve
9	5K-6148	Feed Reverse Bevel Gear	59	5K-6180-1	Cap Screw (2 Req)
10	5K-6123	Set Screw	60	5K-6180	Spring Cover
11	5K-6122	Feed Engage Pin	61	5K-6181	Clock Spring
12	5K-6139	Feed Bevel Pinion	62	5K-6176	Steel Ball
13	5K-6135	Key	63	5K-6175	Compression Spring
14	5K-6124	Cap Screw	64	5K-6177	Set Screw
15	5K-6121	Worm Gear Cradle	65	5K-6114	Reverse Trip Ball Lever Screw
16	5K-6126	Worm Gear Cradle Throw-out	66	5K-6109	Feed Reverse Trip Plunger
17	5K-6125	Shift Sleeve	67	5K-6110	Reverse Trip Ball Lever
18	5K-6132	Cap Screw (3 Req)	68	5K-6183	Pinion Shaft Hub Screw
19	5K-6127	Adj. Block	69	5K-6184	Key
20	5K-6130	Cap Screw (7 Req)	70	5K-6172-1	Cap Screw
21	5K-6169	Set Screw (2 Req)	71	5K-6172	Quill Pinion Shaft
22	5K-6168	(2 Req)	72	5K-6161	Cluster Gear Cover
23	5K-6170	Compression Spring (2 Req)	73	5K-6256-1	Plate
24	5K-6128	Spring Screw (2 Req)	74	5K-6165	Cap Screw (4 Req)
25	5K-6129	Roll Pin (2 Req)	75	5K-6256	Vari-Speed Dial
26	5K-8061	Quill Feed Namepleta	76	5K-6162	Feed Gear Shift Fork
27	5K-6227	Bushing	77	5K-6166	Cluster Gear Shift Crank
28	5K-6226	Roll Pin	78	5K-6167	ADJ. Block
29	5K-6225	Worm	79	5K-6163	Feed Shift Rod
30	5K-6224	Feed Worm Shaft Bushing	80	5K-6164	KP. Set Screw
31	5K-6223	Feed Worm Shaft Thrust Washer	81	5K-6228	Mock-it Lockscrew
32	5K-6220	Feed Reverse Bevel Gear (2 Req)	82	5K-6228-1	Socket Set Screw
33	5K-6217	Roll Pin	83	5K-6186	Quill Pinion Shaft Bushing
34	5K-6222	Feed Reverse Clutch	84	5K-6246	Lockscrew
35	5K-6209	Feed Worm Shaft	85	5K-6246-1	Socket Set Screw
36	5K-6230	Key	86	5K-6190	Pinion Shaft Worm Gear Spacer
37	5K-6216	Reverse Clutch Rod	87	5K-6189	Round Head Screw (3 Req)
38	5K-6143	Feed Driving Gear	88	5K-6187	Overload Clutch Worm Gear
39	5K-6145	Key	89	5K-6188	Overload Clutch Ring
40	5K-6144	Feed Drive Gear	90	5K-6188-1	Snap Ring
41	5K-6252	Needle Bearing	91	5K-6196	Key
42	5K-6157	Cluster Gear Shaft Upper Bearing	92	5K-6195	Overload Clutch Sleeve
43	5K-6153	Cluster Gears Assembly	93	5K-6194	Overload Clutch
44	5K-6151	Cluster Gear Shaft	94	5K-6197	Safety Clutch Spring
45	5K-6160	Cluster Gear Key	95	5K-6198	Overload Clutch Locknut
46	5K-6158	Snap Ring	96	5K-6199	Socket Set Screw
47	5K-6156	Bevel Gear Bearing	97	5K-6199-1	Brass Plug
48	5K-6159	Bevel Gear Thrust Spacer	98	5K-6201	Overload Clutch Washer
49	5K-6131	Grease Nipple	99	5K-6200	Clutch Ring
50	5K-6133	Oil Cap	100	5K-6202	Clutch Ring Pin

ITEM NO.	PARTS NO.	DESCRIPTION	ITEM NO.	PARTS NO.	DESCRIPTION
101	5K-6204	Pin	142	5K-5037	Spring Washer (4 Req)
102	5K-6236-1	Dowel Pin	143	5K-5038	Locknut (4 Req)
103	5K-6231-2	Snap Ring (2 Req)	144	5K-6243	Micrometer Scale
104	5k-6203	Overload Clutch Trip Lever	145	5K-6244	Chem Blacked RD. HD. Screws (2 Req)
105	5K-6195-1	Snap Ring	146	5K-6104	Quill Stop Micro-Screw
106	5K-6205	Clutch Arm Cover	147	5K-6105	Quill Stop Knob
107	5K-6207	Socket Set Screw	148	5K-6106	Screw
108	5K-6208	Chem Blacked Locknut	149	5K-6107	Micrometer Nut
109	5K-6206	Cap Screw (2 Req)	150	5K-6108	Quill Micro-stop Nut
110	5K-6228	Socket Set Screw	151	5K-6115	Snap Ring
111	5K-6228-1	Mock-it Lockscrew	152	5K-6117-2	Spring Screw
112	5K-6246	Socket Set Screw	153	5K-6117-1	Spring
113	5K-6246-1	Lockscrew	154	5K-6119	Lock Handle
114	5K-6191	Compression Spring	155	5K-6117	Quick Lock Bolt
115	5K-6193	Overload Clutch Lever Spring Plunger	156	5K-6116A	Quill Lock Sleeve Tapped
116	5K-6192	Compression Spring	157	5K-6116-1	Compression Spring
117	5K-6236	Cam Rod Sleeve Assy	158	5K-6116B	Quill Lock Sleeve
118	5K-6242	Compression Spring	159	5K-6112	Trip Lever Pin
119	5K-6240	Trip Plunger	160	5K-6111	Feed Trip Lever
120	5K-6118-1	Trip Plunger Bushing	161	5K-6113	Socket Set Screw
121	5K-6118	Feed Trip Plunger	162	5K-6113-1	Chem Blacked Locknut
122	5K-6237	Roll Pin	163	5K-6084	Spindle 40*
123	5K-6241	Roll Rin	164	5K-6090	Snap Ring
124	5K-6231	Feed Trip Bracket	165	5K-6092	Bearing (2 Req)
125	5K-6231-1	Dowel Pin	166	5K-6094	Nut
126	5K-6232	Cap Screw (2 Req)	167	5K-6094-1	Cap Screw
127	5K-6239	Cam Rod	168	5K-6093	Bearing (2 Req)
128	5K-6219-1	Handwheel Clutch Spring Screw	169	5K-6096	Bearing Spacer-Small
129	5K-6219-2	Compression Spring	170	5K-6095	Bearing Spacer-Large
130	5K-6255	Steel Ball	171	5K-6097	Spindle Dirt Shield
131	5K-6218	Handwheel Clutch	172	5K-6098	Nose-Piece
132	5K-6219	Socket Set Screw	173	5K-6088-1	Felt Washer Screw (2 Req)
133	5K-6229	Key	174	5K-6088	Felt Washer
134	5K-6215	Snap Ring	175	5K-6086	Quill Skirt
135	5K-6213	Reverse Knop	176	5K-6085	Quill
136	5K-6214	Feed Reverse Knob Stud	177	5K-6099	Keeper Key
137	5K-6210	Handwheel	178	5K-6100	Cap Screw
138	5K-6234	Trip Handle	179	5K-6101	Quill Housing
139	3H-7069	Plastic Handle	180	5K-6251	Set Bar
140	5K-6120	Lower Clamping Bolt Spacer (2 Req)	181	5K-6253	Cap Screw
141	5K-5036	T-Bolt Assy (4 Req)	182	5K-6085-1	Set Screw