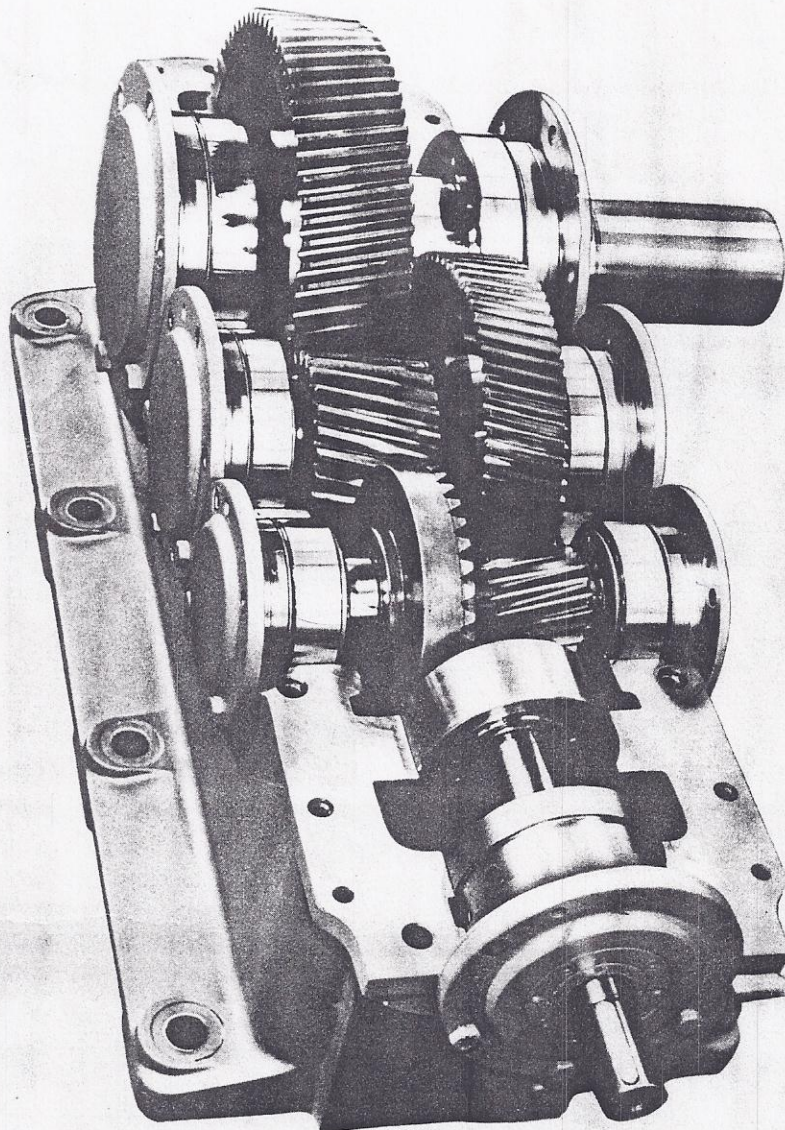


Maintenance Instructions for Helical and Bevel-Helical Gear Speed Reducers

Please give to Alec Bierman



V 24-4 EN 4.83



ELENDER

API OPGB		API		n.DIN 3990		A		Weight		Weight		Preisverhältnis bez	
Std II	Size	Peak torque	T ₂	T ₂	S	SDN	lbs	lbs	lbs	lbs	lbs	auf OPGB 40	~ var
Size	Size	(in lbs)	(in lbs)	(in lbs)	(in lbs)	(in lbs)	(in lbs)	(in lbs)	(in lbs)	(in lbs)	(in lbs)	Kompl	
40	40	40000	58000	145	145	160	850	530	1000	0,500			
57	57	57000	81510	143	143	180	1100	685	1294	0,647			
80	80	80000	117445	147	147	200	1430	895	1515	0,774			
114	114	114000	167492	147	147	225	1900	1210	1794	0,926			
160	160	160000	247893	155	155	250	2500	1590	2,176	1,154			
228	228	228000	319359	140	140	280	3300	2030	2,603	1,432			
320	320	320000	479070	150	150	320	4400	2800	3,265	1,960			
456	456	456000	659044	145	145	360	5700	3660	4,412	2,603			
640	640	640000	967366	151	151	400	7700	4810	5,588	3,412			
912	912	912000	1351594	148	148	450	10200	6400	7,059	4,324			
1280	1280	1280000	1900000	148	148	500	12900	8150	8,971	5,471			

API OPGB		High speed shaft		Brake shaft		Low speed shaft		Main dimensions (inch)										Mounting dimensions (inch)										Foot bolts																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Std II 2	Size	d ₁	s ₁	d ₂	s ₂	d ₃	s ₃	d ₄	s ₄	G ₁	G ₂	G ₃	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈	L ₉	L ₁₀	L ₁₁	L ₁₂	L ₁₃	L ₁₄	L ₁₅	L ₁₆	L ₁₇	L ₁₈	L ₁₉	L ₂₀	L ₂₁	L ₂₂	L ₂₃	L ₂₄	L ₂₅	L ₂₆	L ₂₇	L ₂₈	L ₂₉	L ₃₀	L ₃₁	L ₃₂	L ₃₃	L ₃₄	L ₃₅	L ₃₆	L ₃₇	L ₃₈	L ₃₉	L ₄₀	L ₄₁	L ₄₂	L ₄₃	L ₄₄	L ₄₅	L ₄₆	L ₄₇	L ₄₈	L ₄₉	L ₅₀	L ₅₁	L ₅₂	L ₅₃	L ₅₄	L ₅₅	L ₅₆	L ₅₇	L ₅₈	L ₅₉	L ₆₀	L ₆₁	L ₆₂	L ₆₃	L ₆₄	L ₆₅	L ₆₆	L ₆₇	L ₆₈	L ₆₉	L ₇₀	L ₇₁	L ₇₂	L ₇₃	L ₇₄	L ₇₅	L ₇₆	L ₇₇	L ₇₈	L ₇₉	L ₈₀	L ₈₁	L ₈₂	L ₈₃	L ₈₄	L ₈₅	L ₈₆	L ₈₇	L ₈₈	L ₈₉	L ₉₀	L ₉₁	L ₉₂	L ₉₃	L ₉₄	L ₉₅	L ₉₆	L ₉₇	L ₉₈	L ₉₉	L ₁₀₀	L ₁₀₁	L ₁₀₂	L ₁₀₃	L ₁₀₄	L ₁₀₅	L ₁₀₆	L ₁₀₇	L ₁₀₈	L ₁₀₉	L ₁₁₀	L ₁₁₁	L ₁₁₂	L ₁₁₃	L ₁₁₄	L ₁₁₅	L ₁₁₆	L ₁₁₇	L ₁₁₈	L ₁₁₉	L ₁₂₀	L ₁₂₁	L ₁₂₂	L ₁₂₃	L ₁₂₄	L ₁₂₅	L ₁₂₆	L ₁₂₇	L ₁₂₈	L ₁₂₉	L ₁₃₀	L ₁₃₁	L ₁₃₂	L ₁₃₃	L ₁₃₄	L ₁₃₅	L ₁₃₆	L ₁₃₇	L ₁₃₈	L ₁₃₉	L ₁₄₀	L ₁₄₁	L ₁₄₂	L ₁₄₃	L ₁₄₄	L ₁₄₅	L ₁₄₆	L ₁₄₇	L ₁₄₈	L ₁₄₉	L ₁₅₀	L ₁₅₁	L ₁₅₂	L ₁₅₃	L ₁₅₄	L ₁₅₅	L ₁₅₆	L ₁₅₇	L ₁₅₈	L ₁₅₉	L ₁₆₀	L ₁₆₁	L ₁₆₂	L ₁₆₃	L ₁₆₄	L ₁₆₅	L ₁₆₆	L ₁₆₇	L ₁₆₈	L ₁₆₉	L ₁₇₀	L ₁₇₁	L ₁₇₂	L ₁₇₃	L ₁₇₄	L ₁₇₅	L ₁₇₆	L ₁₇₇	L ₁₇₈	L ₁₇₉	L ₁₈₀	L ₁₈₁	L ₁₈₂	L ₁₈₃	L ₁₈₄	L ₁₈₅	L ₁₈₆	L ₁₈₇	L ₁₈₈	L ₁₈₉	L ₁₉₀	L ₁₉₁	L ₁₉₂	L ₁₉₃	L ₁₉₄	L ₁₉₅	L ₁₉₆	L ₁₉₇	L ₁₉₈	L ₁₉₉	L ₂₀₀	L ₂₀₁	L ₂₀₂	L ₂₀₃	L ₂₀₄	L ₂₀₅	L ₂₀₆	L ₂₀₇	L ₂₀₈	L ₂₀₉	L ₂₁₀	L ₂₁₁	L ₂₁₂	L ₂₁₃	L ₂₁₄	L ₂₁₅	L ₂₁₆	L ₂₁₇	L ₂₁₈	L ₂₁₉	L ₂₂₀	L ₂₂₁	L ₂₂₂	L ₂₂₃	L ₂₂₄	L ₂₂₅	L ₂₂₆	L ₂₂₇	L ₂₂₈	L ₂₂₉	L ₂₃₀	L ₂₃₁	L ₂₃₂	L ₂₃₃	L ₂₃₄	L ₂₃₅	L ₂₃₆	L ₂₃₇	L ₂₃₈	L ₂₃₉	L ₂₄₀	L ₂₄₁	L ₂₄₂	L ₂₄₃	L ₂₄₄	L ₂₄₅	L ₂₄₆	L ₂₄₇	L ₂₄₈	L ₂₄₉	L ₂₅₀	L ₂₅₁	L ₂₅₂	L ₂₅₃	L ₂₅₄	L ₂₅₅	L ₂₅₆	L ₂₅₇	L ₂₅₈	L ₂₅₉	L ₂₆₀	L ₂₆₁	L ₂₆₂	L ₂₆₃	L ₂₆₄	L ₂₆₅	L ₂₆₆	L ₂₆₇	L ₂₆₈	L ₂₆₉	L ₂₇₀	L ₂₇₁	L ₂₇₂	L ₂₇₃	L ₂₇₄	L ₂₇₅	L ₂₇₆	L ₂₇₇	L ₂₇₈	L ₂₇₉	L ₂₈₀	L ₂₈₁	L ₂₈₂	L ₂₈₃	L ₂₈₄	L ₂₈₅	L ₂₈₆	L ₂₈₇	L ₂₈₈	L ₂₈₉	L ₂₉₀	L ₂₉₁	L ₂₉₂	L ₂₉₃	L ₂₉₄	L ₂₉₅	L ₂₉₆	L ₂₉₇	L ₂₉₈	L ₂₉₉	L ₃₀₀	L ₃₀₁	L ₃₀₂	L ₃₀₃	L ₃₀₄	L ₃₀₅	L ₃₀₆	L ₃₀₇	L ₃₀₈	L ₃₀₉	L ₃₁₀	L ₃₁₁	L ₃₁₂	L ₃₁₃	L ₃₁₄	L ₃₁₅	L ₃₁₆	L ₃₁₇	L ₃₁₈	L ₃₁₉	L ₃₂₀	L ₃₂₁	L ₃₂₂	L ₃₂₃	L ₃₂₄	L ₃₂₅	L ₃₂₆	L ₃₂₇	L ₃₂₈	L ₃₂₉	L ₃₃₀	L ₃₃₁	L ₃₃₂	L ₃₃₃	L ₃₃₄	L ₃₃₅	L ₃₃₆	L ₃₃₇	L ₃₃₈	L ₃₃₉	L ₃₄₀	L ₃₄₁	L ₃₄₂	L ₃₄₃	L ₃₄₄	L ₃₄₅	L ₃₄₆	L ₃₄₇	L ₃₄₈	L ₃₄₉	L ₃₅₀	L ₃₅₁	L ₃₅₂	L ₃₅₃	L ₃₅₄	L ₃₅₅	L ₃₅₆	L ₃₅₇	L ₃₅₈	L ₃₅₉	L ₃₆₀	L ₃₆₁	L ₃₆₂	L ₃₆₃	L ₃₆₄	L ₃₆₅	L ₃₆₆	L ₃₆₇	L ₃₆₈	L ₃₆₉	L ₃₇₀	L ₃₇₁	L ₃₇₂	L ₃₇₃	L ₃₇₄	L ₃₇₅	L ₃₇₆	L ₃₇₇	L ₃₇₈	L ₃₇₉	L ₃₈₀	L ₃₈₁	L ₃₈₂	L ₃₈₃	L ₃₈₄	L ₃₈₅	L ₃₈₆	L ₃₈₇	L ₃₈₈	L ₃₈₉	L ₃₉₀	L ₃₉₁	L ₃₉₂	L ₃₉₃	L ₃₉₄	L ₃₉₅	L ₃₉₆	L ₃₉₇	L ₃₉₈	L ₃₉₉	L ₄₀₀	L ₄₀₁	L ₄₀₂	L ₄₀₃	L ₄₀₄	L ₄₀₅	L ₄₀₆	L ₄₀₇	L ₄₀₈	L ₄₀₉	L ₄₁₀	L ₄₁₁	L ₄₁₂	L ₄₁₃	L ₄₁₄	L ₄₁₅	L ₄₁₆	L ₄₁₇	L ₄₁₈	L ₄₁₉	L ₄₂₀	L ₄₂₁	L ₄₂₂	L ₄₂₃	L ₄₂₄	L ₄₂₅	L ₄₂₆	L ₄₂₇	L ₄₂₈	L ₄₂₉	L ₄₃₀	L ₄₃₁	L ₄₃₂	L ₄₃₃	L ₄₃₄	L ₄₃₅	L ₄₃₆	L ₄₃₇	L ₄₃₈	L ₄₃₉	L ₄₄₀	L ₄₄₁	L ₄₄₂	L ₄₄₃	L ₄₄₄	L ₄₄₅	L ₄₄₆	L ₄₄₇	L ₄₄₈	L ₄₄₉	L ₄₅₀	L ₄₅₁	L ₄₅₂	L ₄₅₃	L ₄₅₄	L ₄₅₅	L ₄₅₆	L ₄₅₇	L ₄₅₈	L ₄₅₉	L ₄₆₀	L ₄₆₁	L ₄₆₂	L ₄₆₃	L ₄₆₄	L ₄₆₅	L ₄₆₆	L ₄₆₇	L ₄₆₈	L ₄₆₉	L ₄₇₀	L ₄₇₁	L ₄₇₂	L ₄₇₃	L ₄₇₄	L ₄₇₅	L ₄₇₆	L ₄₇₇	L ₄₇₈	L ₄₇₉	L ₄₈₀	L ₄₈₁	L ₄₈₂	L ₄₈₃	L ₄₈₄	L ₄₈₅	L ₄₈₆	L ₄₈₇	L ₄₈₈	L ₄₈₉	L ₄₉₀	L ₄₉₁	L ₄₉₂	L ₄₉₃	L ₄₉₄	L ₄₉₅	L ₄₉₆	L ₄₉₇	L ₄₉₈	L ₄₉₉	L ₅₀₀	L ₅₀₁	L ₅₀₂	L ₅₀₃	L ₅₀₄	L ₅₀₅	L ₅₀₆	L ₅₀₇	L ₅₀₈	L ₅₀₉	L ₅₁₀	L ₅₁₁	L ₅₁₂	L ₅₁₃	L ₅₁₄	L ₅₁₅	L ₅₁₆	L ₅₁₇	L ₅₁₈	L ₅₁₉	L ₅₂₀	L ₅₂₁	L ₅₂₂	L ₅₂₃	L ₅₂₄	L ₅₂₅	L ₅₂₆	L ₅₂₇	L ₅₂₈	L ₅₂₉	L ₅₃₀	L ₅₃₁	L ₅₃₂	L ₅₃₃	L ₅₃₄	L ₅₃₅	L ₅₃₆	L ₅₃₇	L ₅₃₈	L ₅₃₉	L ₅₄₀	L ₅₄₁	L ₅₄₂	L ₅₄₃	L ₅₄₄	L ₅₄₅	L ₅₄₆	L ₅₄₇	L ₅₄₈	L ₅₄₉	L ₅₅₀	L ₅₅₁	L ₅₅₂	L ₅₅₃	L ₅₅₄	L ₅₅₅	L ₅₅₆	L ₅₅₇	L ₅₅₈	L ₅₅₉	L ₅₆₀	L ₅₆₁	L ₅₆₂	L ₅₆₃	L ₅₆₄	L ₅₆₅	L ₅₆₆	L ₅₆₇	L ₅₆₈	L ₅₆₉	L ₅₇₀	L ₅₇₁	L ₅₇₂	L ₅₇₃	L ₅₇₄	L ₅₇₅	L ₅₇₆	L ₅₇₇	L ₅₇₈	L ₅₇₉	L ₅₈₀	L ₅₈₁	L ₅₈₂	L ₅₈₃	L ₅₈₄	L ₅₈₅	L ₅₈₆	L ₅₈₇	L ₅₈₈	L ₅₈₉	L ₅₉₀	L ₅₉₁	L ₅₉₂	L ₅₉₃	L ₅₉₄	L ₅₉₅	L ₅₉₆	L ₅₉₇	L ₅₉₈	L ₅₉₉	L ₆₀₀	L ₆₀₁	L ₆₀₂	L ₆₀₃	L ₆₀₄	L ₆₀₅	L ₆₀₆	L ₆₀₇	L ₆₀₈	L ₆₀₉	L ₆₁₀	L ₆₁₁	L ₆₁₂	L ₆₁₃	L ₆₁₄	L ₆₁₅	L ₆₁₆	L ₆₁₇	L ₆₁₈	L ₆₁₉	L ₆₂₀	L ₆₂₁	L ₆₂₂	L ₆₂₃	L ₆₂₄	L ₆₂₅	L ₆₂₆	L ₆₂₇	L ₆₂₈	L ₆₂₉	L ₆₃₀	L ₆₃₁	L ₆₃₂	L ₆₃₃	L ₆₃₄	L ₆₃₅	L ₆₃₆	L ₆₃₇	L ₆₃₈	L ₆₃₉	L ₆₄₀	L ₆₄₁	L ₆₄₂	L ₆₄₃	L ₆₄₄	L ₆₄₅	L ₆₄₆	L ₆₄₇	L ₆₄₈	L ₆₄₉	L ₆₅₀	L ₆₅₁	L ₆₅₂	L ₆₅₃	L ₆₅₄	L ₆₅₅	L ₆₅₆	L ₆₅₇	L ₆₅₈	L ₆₅₉	L ₆₆₀	L ₆₆₁	L ₆₆₂	L ₆₆₃	L ₆₆₄	L ₆₆₅	L ₆₆₆	L ₆₆₇	L ₆₆₈	L ₆₆₉	L ₆₇₀	L ₆₇₁	L ₆₇₂	L ₆₇₃	L ₆₇₄	L ₆₇₅	L ₆₇₆	L ₆₇₇	L ₆₇₈	L ₆₇₉	L ₆₈₀	L ₆₈₁	L ₆₈₂	L ₆₈₃	L ₆₈₄	L ₆₈₅	L ₆₈₆	L ₆₈₇	L ₆₈₈	L ₆₈₉	L ₆₉₀	L ₆₉₁	L ₆₉₂	L ₆₉₃	L ₆₉₄	L ₆₉₅	L ₆₉₆	L ₆₉₇	L ₆₉₈	L ₆₉₉	L ₇₀₀	L ₇₀₁	L ₇₀₂	L ₇₀₃	L ₇₀₄	L ₇₀₅	L ₇₀₆	L ₇₀₇	L ₇₀₈	L ₇₀₉	L ₇₁₀	L ₇₁₁	L ₇₁₂	L ₇₁₃	L ₇₁₄	L ₇₁₅	L ₇₁₆	L ₇₁₇	L ₇₁₈	L ₇₁₉	L ₇₂₀	L ₇₂₁	L ₇₂₂	L ₇₂₃	L ₇₂₄	L ₇₂₅	L ₇₂₆	L ₇₂₇	L ₇₂₈	L ₇₂₉	L ₇₃₀	L ₇₃₁	L ₇₃₂	L ₇₃₃	L ₇₃₄	L ₇₃₅	L ₇₃₆	L ₇₃₇	L ₇₃₈	L ₇₃₉	L ₇₄₀	L ₇₄₁	L ₇₄₂	L ₇₄₃	L ₇₄₄	L ₇₄₅	L ₇₄₆	L ₇₄₇	L ₇₄₈	L ₇₄₉	L ₇₅₀	L ₇₅₁	L ₇₅₂	L ₇₅₃	L ₇₅₄	L ₇₅₅	L ₇₅₆	L ₇₅₇	L ₇₅₈	L ₇₅₉	L ₇₆₀	L ₇₆₁	L ₇₆₂	L ₇₆₃	L ₇₆₄	L ₇₆₅	L ₇₆₆	L ₇₆₇	L ₇₆₈	L ₇₆₉	L ₇₇₀	L ₇₇₁	L ₇₇₂	L ₇₇₃	L ₇₇₄	L ₇₇₅	L ₇₇₆	L ₇₇₇	L ₇₇₈	L ₇₇₉	L ₇₈₀	L ₇₈₁	L ₇₈₂	L ₇₈₃	L ₇₈₄	L ₇₈₅	L ₇₈₆	L ₇₈₇	L ₇₈₈	L ₇₈₉	L ₇₉₀	L ₇₉₁	L ₇₉₂	L ₇₉₃	L ₇₉₄	L ₇₉₅	L ₇₉₆	L ₇₉₇	L ₇₉₈	L ₇₉₉	L ₈₀₀	L ₈₀₁	L ₈₀₂	L ₈₀₃	L ₈₀₄	L ₈₀₅	L ₈₀₆	L ₈₀₇	L ₈₀₈	L ₈₀₉	L ₈₁₀	L ₈₁₁	L ₈₁₂	L ₈₁₃	L ₈₁₄	L ₈₁₅	L ₈₁₆	L ₈₁₇	L ₈₁₈	L ₈₁₉	L ₈₂₀	L ₈₂₁	L ₈₂₂	L ₈₂₃	L ₈₂₄	L ₈₂₅	L ₈₂₆	L ₈₂₇	L ₈₂₈	L ₈₂₉	L ₈₃₀	L ₈₃₁	L ₈₃₂	L ₈₃₃	L ₈₃₄	L ₈₃₅	L ₈₃₆	L ₈₃₇	L ₈₃₈	L ₈₃₉	L ₈₄₀	L ₈₄₁	L ₈₄₂	L ₈₄₃	L ₈₄₄	L ₈₄₅	L ₈₄₆	L ₈₄₇	L ₈₄₈	L ₈₄₉	L ₈₅₀	L ₈₅₁	L ₈₅₂	L ₈₅₃	L ₈₅₄	L ₈₅₅	L ₈₅₆	L ₈₅₇	L ₈₅₈	L ₈₅₉	L ₈₆₀	L ₈₆₁	L ₈₆₂	L ₈₆₃	L ₈₆₄	L ₈₆₅	L ₈₆₆	L ₈₆₇	L ₈₆₈	L ₈₆₉	L ₈₇₀	L ₈₇₁	L ₈₇₂	L ₈₇₃	L ₈₇₄	L ₈₇₅	L ₈₇₆	L ₈₇₇	L ₈₇₈	L ₈₇₉	L ₈₈₀	L ₈₈₁	L ₈₈₂	L ₈₈₃	L ₈₈₄	L ₈₈₅	L ₈₈₆	L ₈₈₇	L ₈₈₈	L ₈₈₉	L ₈₉₀	L ₈₉₁	L ₈₉₂	L ₈₉₃	L ₈₉₄	L ₈₉₅	L ₈₉₆	L ₈₉₇	L ₈₉₈	L ₈₉₉	L ₉₀₀	L ₉₀₁	L ₉₀₂	L ₉₀₃	L ₉₀₄	L ₉₀₅	L ₉₀₆	L ₉₀₇	L ₉₀₈	L ₉₀₉	L ₉₁₀	L ₉₁₁	L ₉₁₂	L ₉₁₃	L ₉₁₄	L ₉₁₅	L ₉₁₆	L ₉₁₇	L ₉₁₈	L ₉₁₉	L ₉₂₀	L ₉₂₁	L ₉₂₂	L ₉₂₃	L ₉₂₄	L ₉₂₅	L ₉₂₆	L ₉₂₇	L ₉₂₈	L ₉₂₉	L ₉₃₀	L ₉₃₁	L ₉₃₂	L ₉₃₃	L ₉₃₄	L ₉₃₅	L ₉₃₆	L ₉₃₇	L ₉₃₈	L ₉₃₉	L ₉₄₀	L ₉₄₁	L ₉₄₂	L ₉₄₃	L ₉₄₄

Maintenance Instructions for Helical and Bevel-Helical Gear Speed Reducers

FLENDER gear units are precision manufactured and carefully assembled to assure reliable performance and extended service life.

If it becomes necessary, for any reason, to dismantle the speed reducer, follow the procedures outlined in these instructions. Only careful adherence to correct gear settings, bearing adjustments and precautionary procedures will ensure continued reliability and long service life.

Illustrations and procedures are representative of right angle gear drives and vary slightly for larger sizes. These instructions can be followed for right angle gear drives with one or more helical gear stages, including shaft mounting types, the difference being added intermediate gear stages, parts of which can be easily replaced if it should ever become necessary, but the basic disassembly and assembly procedure remains the same.

Before attempting to service the gear unit refer to the cross-section assembly drawing and exploded view contained in this manual.

Preparation for dismantling

The following operations should be completed before any disassembly work is started on the gear drives:

- A. Drain The oil.
- B. Disconnect oil piping in case of pressure lubricated units.
- C. Disconnect high and low speed couplings.
- D. Remove speed reducer from its mountings and move to a suitable work area, preferably a workbench that allows access from all sides.
- E. Remove coupling halves from shaft ends.

Equipment required for servicing:

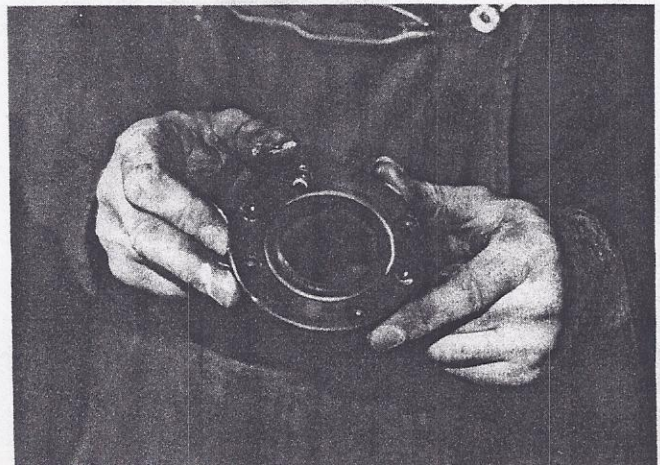
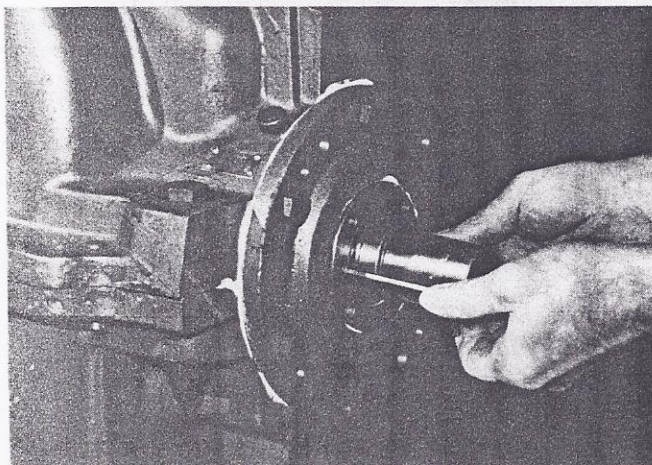
in addition to standard metric mechanic's tools: hoists, slings, eye bolts, bearing pullers, torque wrenches, feeler gauges, micrometers, dial indicator, oven or oil bath, arbor press and sealing compound such as Loctite.

When ordering parts or requesting information, specify name plate details (order No.) and part number of item(s) required for replacement.

Seal replacement only

Before removing shaft seals take out the keys then wrap shaft extensions with tape or plastic film and coat wrapping with grease so that seals will slide off easily without damage from keyways or sharp edges.

The high speed shaft seal is located in a seal housing, fig. 1 + 2. To remove this seal housing remove cap screws and use two of them as jacking screws in tappings provided. To remove low speed shaft seal take out all screws holding L.S. bearing cover in position and remove cover. Inspect oil seals for nicks and deformities. If oil seals are to be replaced drive them out of the bores and remove accumulations of dirt and residues of sealing compound from bores. If unit is being dismantled, DO NOT replace seals until instructed in the assembly procedure.



Dismantling the gear unit.

General:

- A. Clean all surfaces adjacent to removable end covers and the housing joint flange to prevent any dirt entering the housing interior.
- B. During disassembly keep old shim packs, spacers, retaining rings and other related components in due sequence with the respective sub-assemblies for later reference.

Dismantling

1. Remove any lube piping on larger units or components that will interfere with disassembly or could be damaged during handling.
2. Remove dipstick.
3. Gently tap the taper dowels (30) out of the housing split flange from the underside.

Remove all bearing cover screws; through bolts and nuts from upper housing part. Attach slings to lugs and lifting hole of upper housing. Carefully break casing joint with jack screws, lift cover straight up, taking care not to damage any gear teeth or gear case contact surfaces.

Remove remaining bearing cover screws and take off the covers. Install eye bolts in output shaft ends, see page 18 for size. Adjust sling straps for equal tension and raise output shaft assembly very carefully to clear pinion mesh to avoid tooth damage, figs. 3, 4, 5.

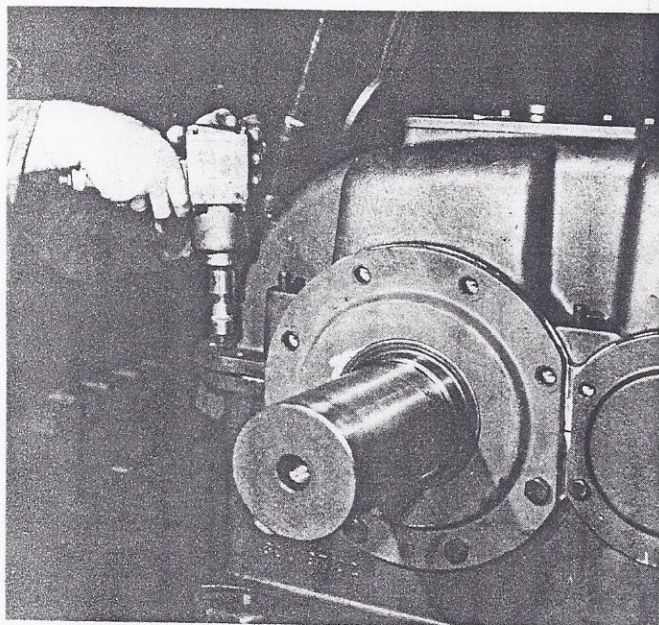


Fig. 3

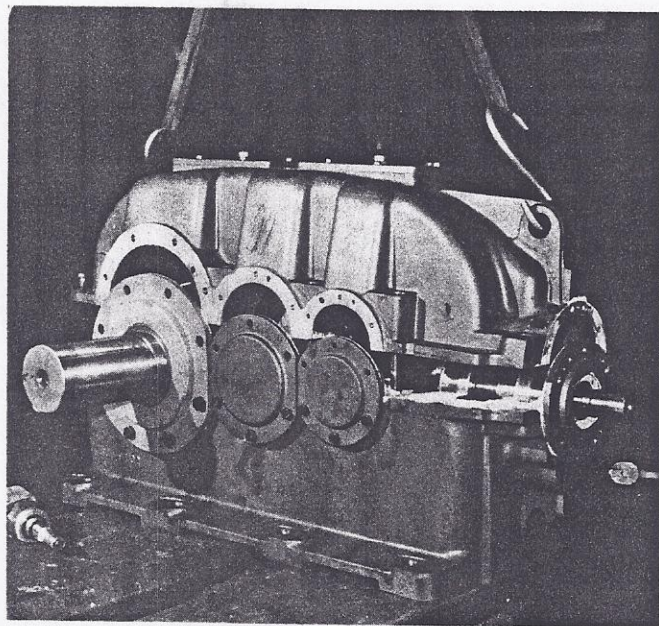
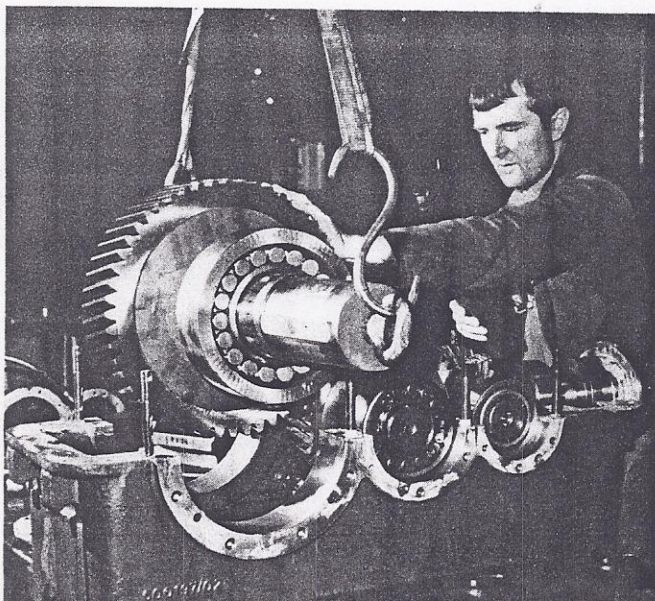


Fig. 4



Follow same procedure through gear train including bevel gear wheel and bevel pinion shaft assembly. Move all sub-assemblies to a suitable work area where a press, bearing puller and other necessary equipment are available.

With a suitable solvent clean the remnants of sealing compound from all mating surfaces of the housing split flange and end covers. Thoroughly clean and flush both housing halves.

Wash assemblies in solvent and leave to dry. Carefully check all rolling elements and races for wear. Do not spin bearings when dry to avoid scoring. When removing bearings from shafts, apply force only to inner race, never to cage or roller assemblies. To ease removal, apply heat to inner race. Do not exceed 80 °C if bearing is to be re-used.

Be careful when handling gears to avoid damage to the case-hardened gear teeth. Larger gears are provided with tapped holes in side faces for handling purposes, fig. 6.

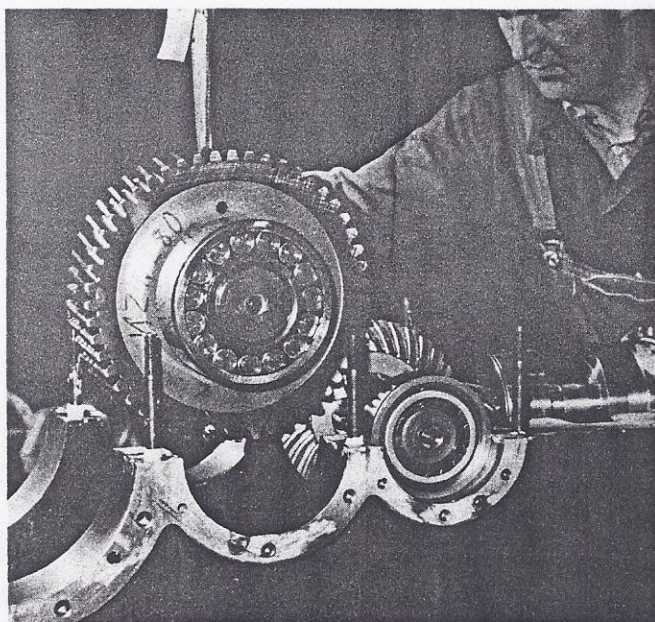


Fig. 6

Carefully check for damaged, worn or cracked teeth. Bevel gear sets must always be replaced in matched sets. Helical gears should be replaced in sets, but are available as individual items.

Removal of bearings and gears from shafts

Do not remove bearings or gears that don't require replacement. Gears can be heated to ease removal. Apply heat evenly around the hub of the gear adjacent to the bore.

Do not direct heat too close to the shaft or exceed 120 °C at any one point around the gear. Place assembly in a press. Provide uniform support under the gear body as close to the shaft as practicable and press gear off its shaft seat. Remove bearing races and spacers as they come off the shaft and do not allow the shaft to drop onto a hard surface. The inner races of the remaining bearings can be removed with a wheel puller.

If necessary, carefully remove in a similar fashion the bevel gear wheel from the pinion shaft including bearing cones and roller assemblies.

Removal of bevel pinion bearings (151 + 150).

- Loosen set screw and remove internal locknut (125), fig. 7 + 8.
- Remove locknut, washer (109 + 110) and spacer (113).
- Slide outer bearing cage (120) off bearing set (150), fig. 9 + 10.
- Place bevel pinion shaft in a press, with the pinion facing down and place supports against the inner race of the inner bearing (151).
- Now press slowly and remove components of the outer bearing set (150), spacer (114) and inner bearing (151) as they come free of the shaft (100), fig. 11.
- If it is necessary to examine or replace inner bearing (151) remove retaining ring (163) and press bearing out of housing (154).

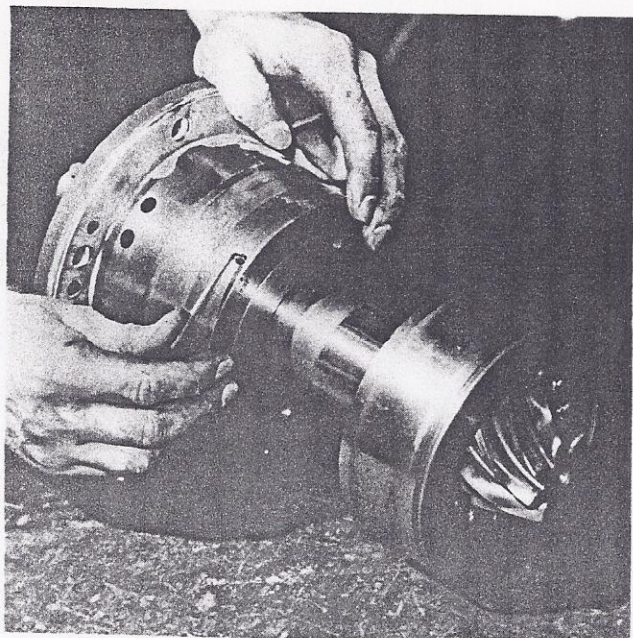


Fig. 7

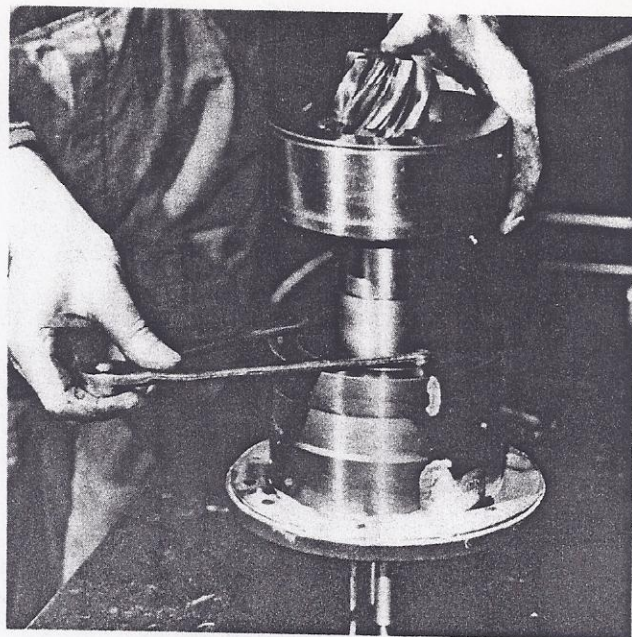


Fig. 8



Fig. 9

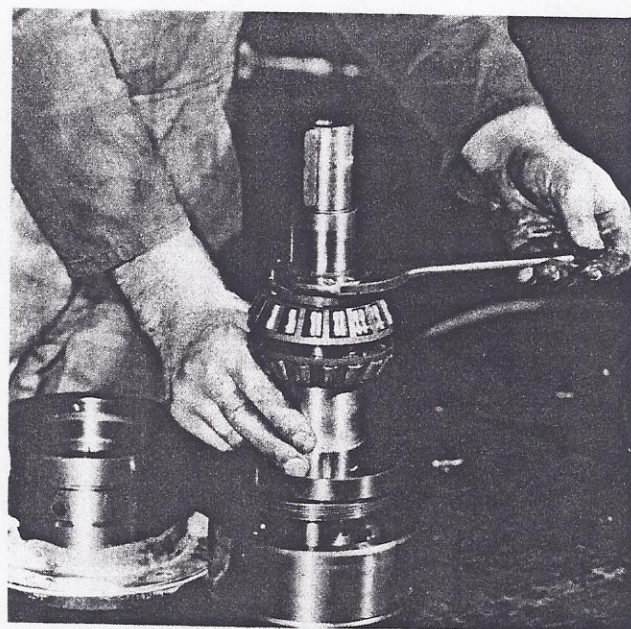
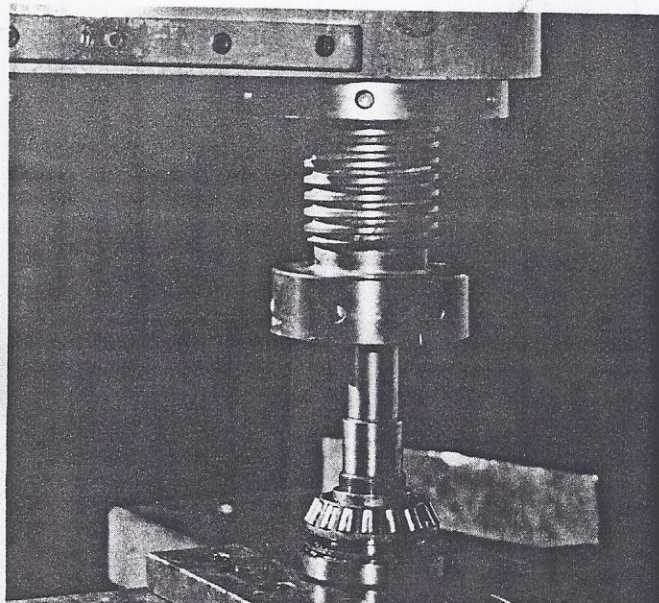
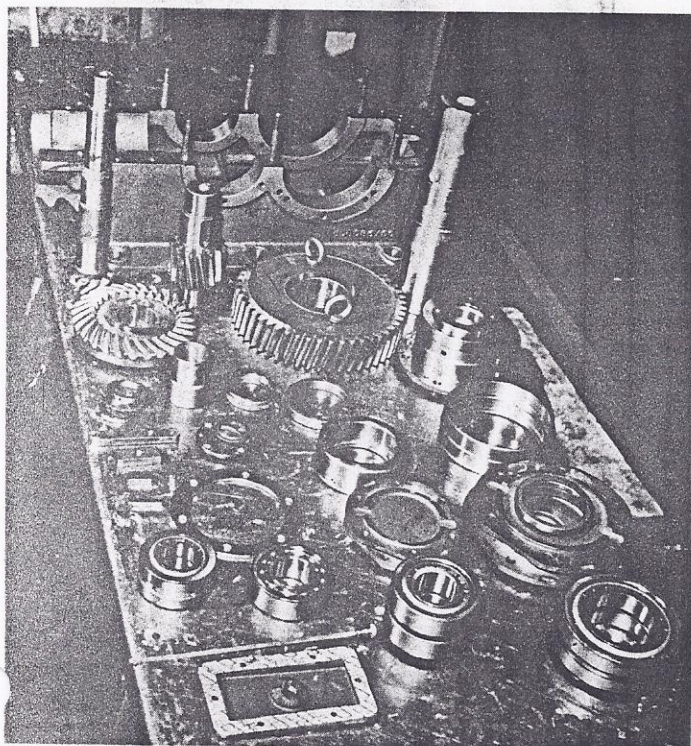


Fig. 10



Gear unit assembly

It is recommended that interference fit gears and bearing components are heated, mounted on their respective shafts and allowed to cool, well in advance of the major assembly procedure to reduce any chance of injury due to handling hot parts and to allow checks for tightness between components. Helical and bevel gears should be heated to 120 °C, bearing inner races to 80 °C in an oven or oil bath that will provide even heat distribution. Allow approximately 1 hour per 25 mm material thickness when estimating the heating time. If all assemblies have been dismantled, group all cleaned single components into sub-assemblies and begin to assemble the low speed shaft components.



Components of a KEN 250 type speed reducer

1. Heat low speed gear to 120 °C (202) and both bearing cone assemblies to 80 °C (250).
2. Insert low speed gear key (206), a drop of Loctite will hold it in place.
3. Slide on low speed gear (202) tightly against the shaft shoulder. Use eye-bolt holes provided in the top face of the gear for handling purposes, fig. 12.
4. Slide spacer (214) onto the shaft and install the upper bearing firmly against the spacer, fig. 13.



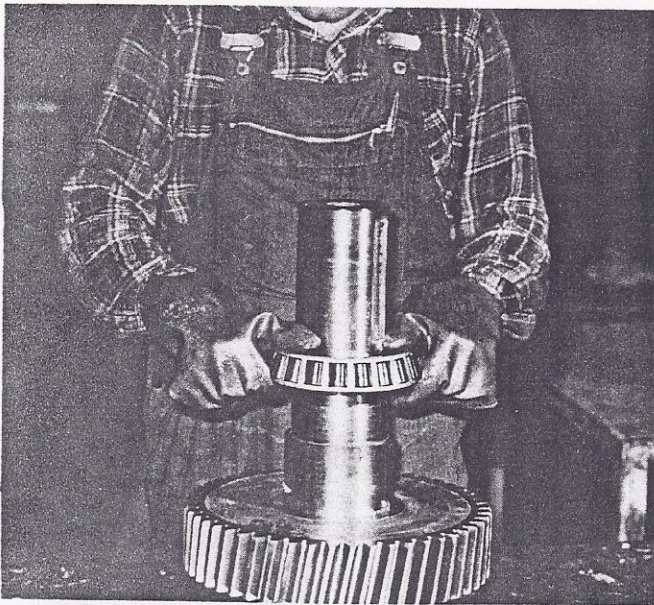


Fig. 14

5. Turn output shaft over and install lower bearing firmly against shaft shoulder, fig. 14. Proceed with pinion stage in the same way.
6. Allow gears and bearings to cool. Weights placed on the gear bodies should prevent creep. Check the cooled assemblies for zero clearance between bottom of gear and shaft shoulder, press tight if necessary.

Assembly of bevel gear wheel - helical pinion, shaft (1st intermediate shaft)

Ensure that during reassembly the parts will be mounted in the correct sequence! (The spacer (315)* is situated either side of the bevel gear (302) depending on the ratio in the bevel stage.)



Fig. 15



Fig. 16



Heat bevel gear (302) and bearing inner races (150). Slide spacer (315) onto helical pinion shaft (300) (when applicable! See above). Insert bevel gear key (306) and slide on bevel gear firmly against the sleeve/shaft shoulder (gear facing pinion), fig. 15. Fit spacer above gear (when applicable). Fit heated bearing above sleeve/gear, fig. 16. Turn shaft over and fit bearing on other side, fig. 17.

- * KE units part no. 315
 KZ units part no. 415
 KD units part no. 515
 Similarly for other part nos.

Bevel pinion shaft sub-assembly

Heat inner race of inner bearing (151) and outer bearing set races. Stand bevel pinion on pinion face. Slide parallel roller bearing inner race over pinion shaft against shoulder of pinion. Place outer race of bearing (151) into housing (154), replace circlip and slide assembly down over inner race, fig. 18.

Slide on shaft spacer (114), internal locknut (125) and allow to rest loosely on pinion end bearing, fig. 19.

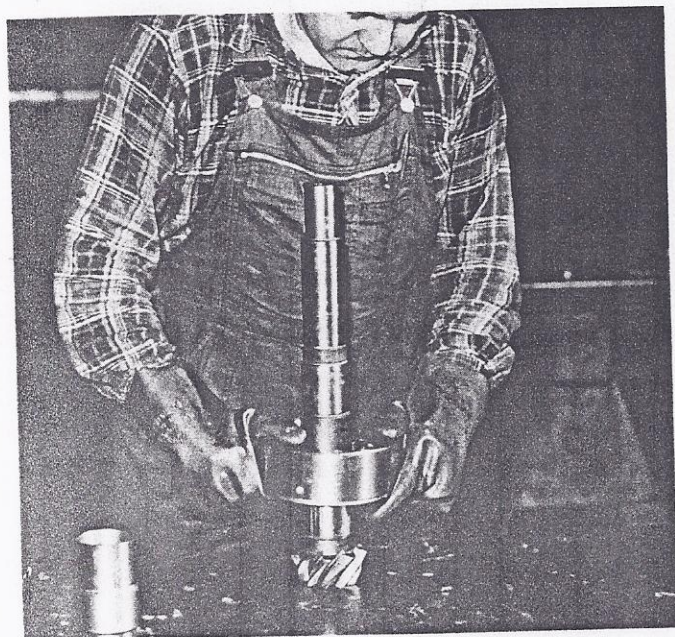


Fig. 18

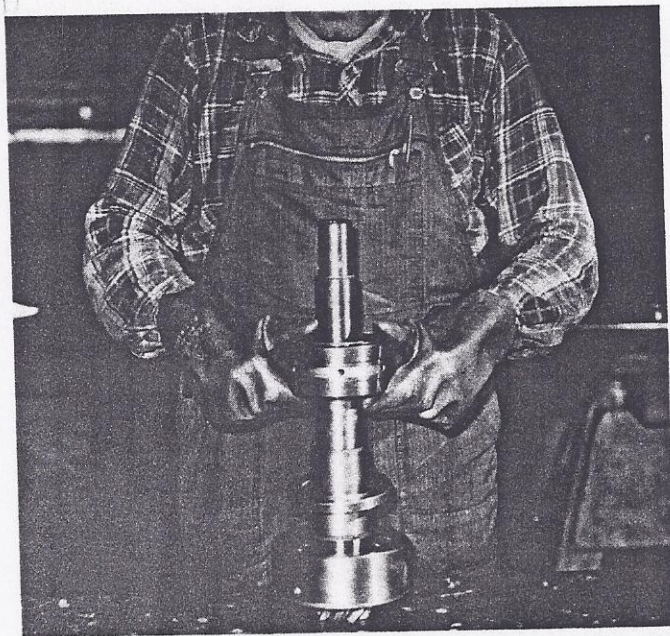


Fig. 19

Slide on one bearing cup (150) with taper facing away from pinion and the ground bearing spacer and allow to rest loosely on internal locknut.

Install the other outer bearing set cup into the bearing cartridge (120) thickest section against shoulder. Slide heated bearing cone (150) and roller assemblies on the bevel pinion shaft, tight against spacer (114). Place spacer (113) lockwasher (110) and loosely tighten locknut (109) to hold bearings in place. Do not tighten until bearing cones have cooled.

Note: Ensure that the inner races, spacer (114), bearing (151) are very snug together against the pinion and remain that way as bearings cool.

After the bearings have cooled, clamp assembly into a vice, tighten locknut securely and set lockwasher tabs. Check to make sure spacer (114) does not rotate. Put assembly aside.

Take taper bearing cartridge (120), rest flange side down on suitable packing to allow shaft to pass through. Place remaining taper cup ensuring face is snug against cartridge inner shoulder, fig. 20.



Take pinion shaft assembly and carefully lower shaft into cartridge taking care not to damage cup face with shaft end etc. Hold clear components already assembled on shaft. Supporting the shaft, slide the bearing cup into cartridge (120) to make contact with spacer. Slide down lock-nut (125) and enter into thread of cartridge. Slowly screw down locknut onto bearing cup whilst rotating shaft gently to settle and align rollers, until fully tightened, fig. 21.

Tighten locknut set screw (126). If previous dimple in locknut thread does not line up, dimple thread before entering set screw. Protect bearings from drilling swarf while dimpling, fig. 22 + 23.

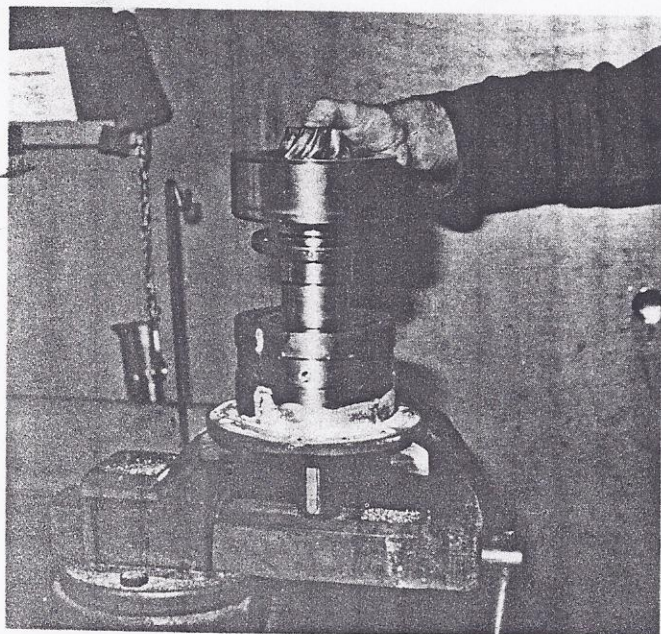


Fig. 22

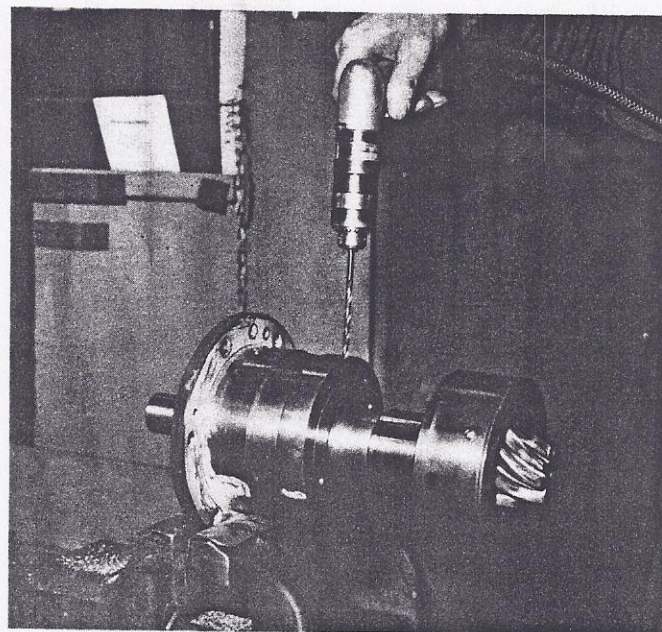


Fig. 23

Place bevel pinion assembly into housing base ensuring that recess in pinion end bearing housing locates over dowel, fig. 24.

Oil priming hole in bearing cartridge must be positioned up, fig. 25.

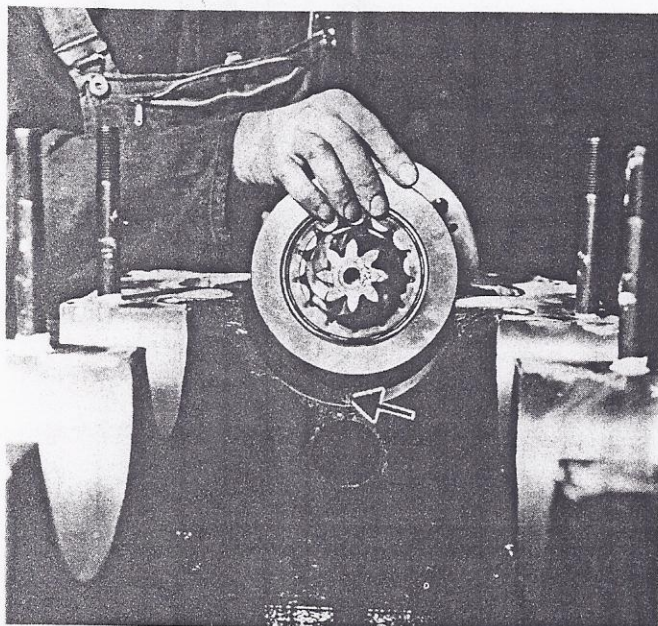


Fig. 24

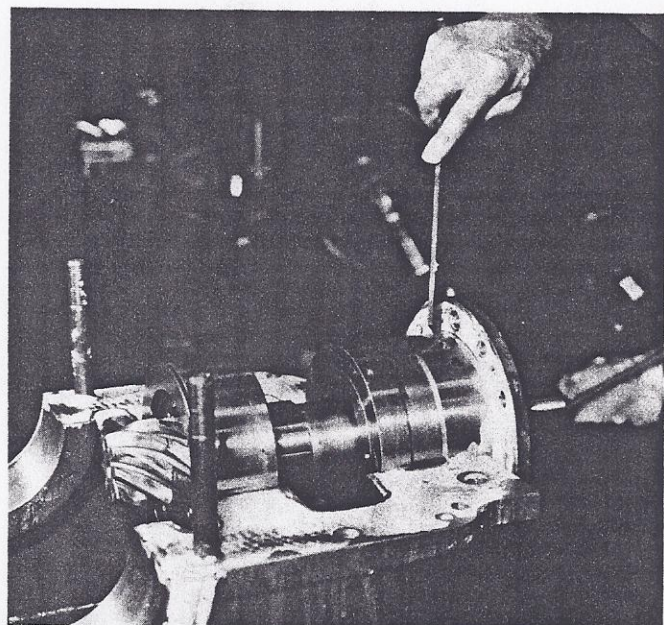
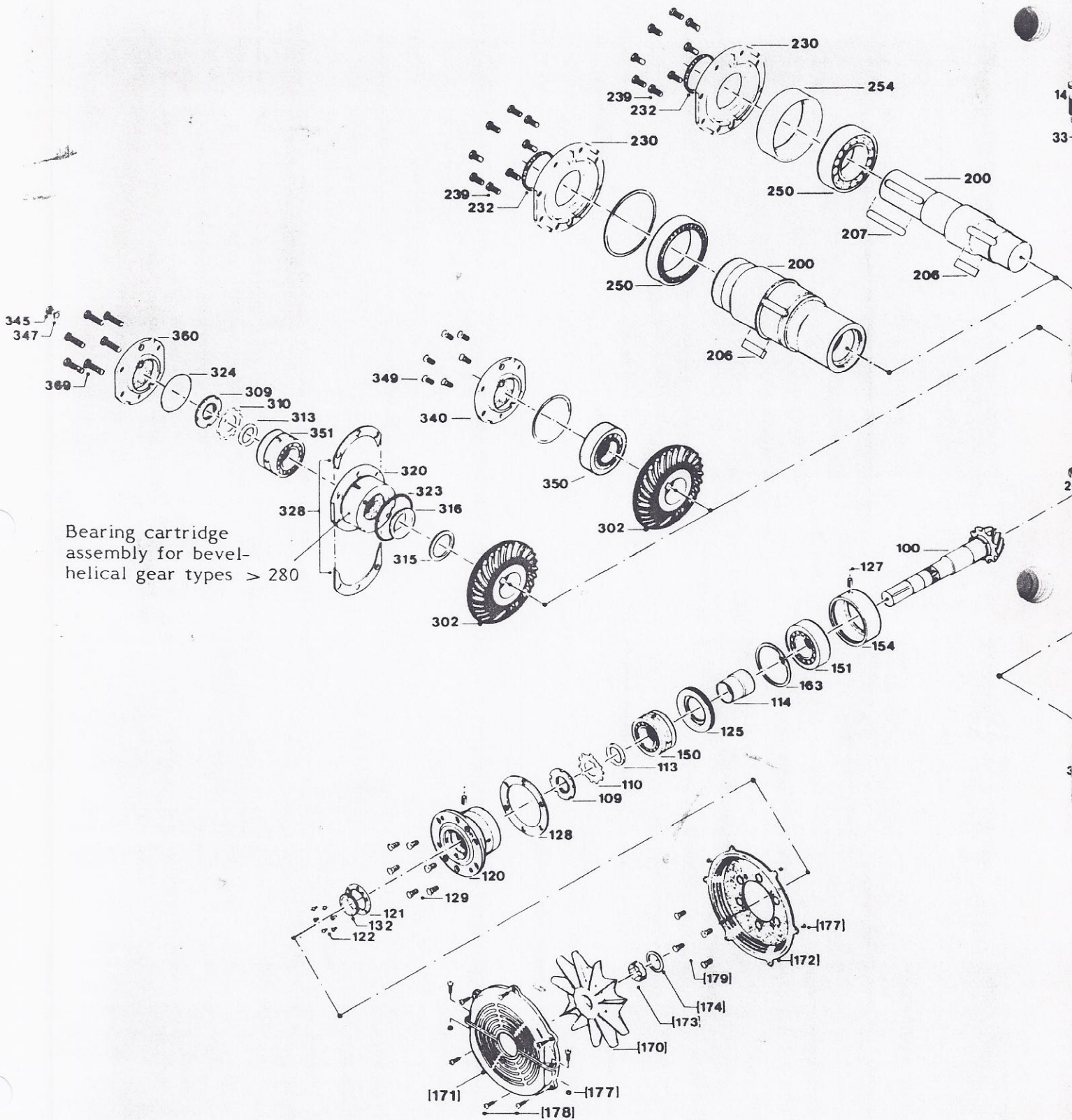
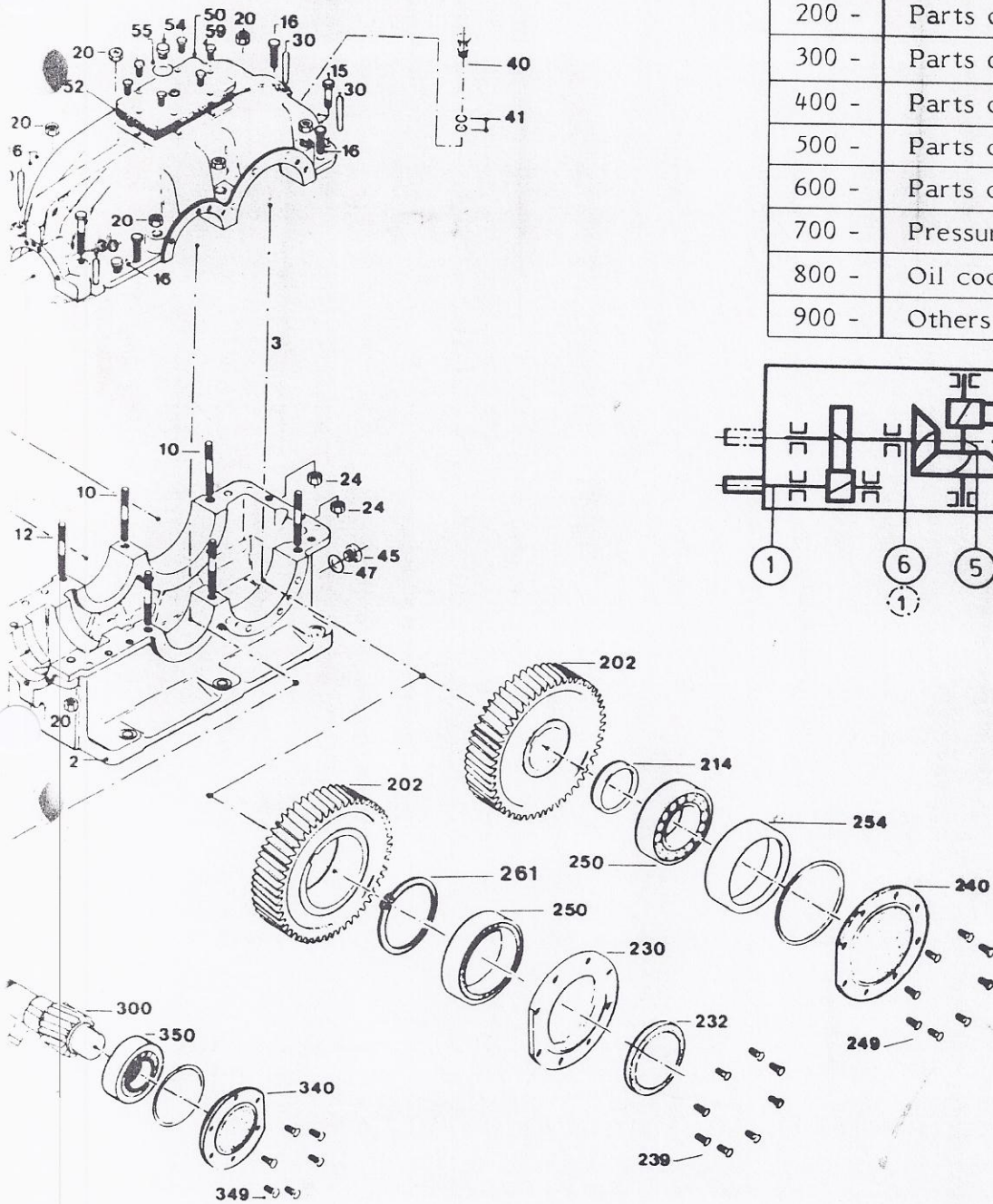
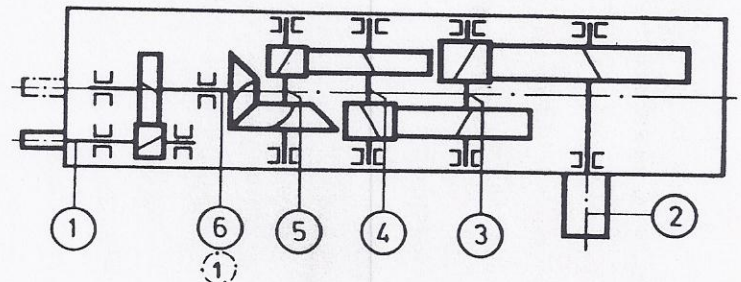


Fig. 25

Install the first intermediate shaft assembly in housing complete with bearing outer rings and spacer (315), if fitted, over gear end of shaft. Mount bearing cover (340) on bevel gear side and tighten with screws (349). Attention should be paid to mount all bearing covers such that an oil return recess is positioned at the bottom. Shims, if fitted, must be reinserted between bearing



Main groups	
1 -	Housing parts
100 -	Parts of input shaft assembly D ₁
200 -	Parts of output shaft assembly D ₂
300 -	Parts of intermediate shaft 1
400 -	Parts of intermediate shaft 2
500 -	Parts of intermediate shaft 3
600 -	Parts of intermediate shaft 4
700 -	Pressure lubrication
800 -	Oil cooling
900 -	Others



The shim thickness is determined by measuring the distance from housing flange to bearing minus length of the bearing cover centering shoulder. Insert shims of required thickness, taking into account design clearance for bearings. Taper roller bearings are mounted practically without clearance. For other type bearings however it is difficult to issue instructions that are generally applicable and for this reason, before a bearing is dismantled, definite facts should be obtained from an assembly drawing or otherwise of how a bearing is to be mounted. Mount bearing cover and tighten bottom half screws. Fig. 26, 27, 28

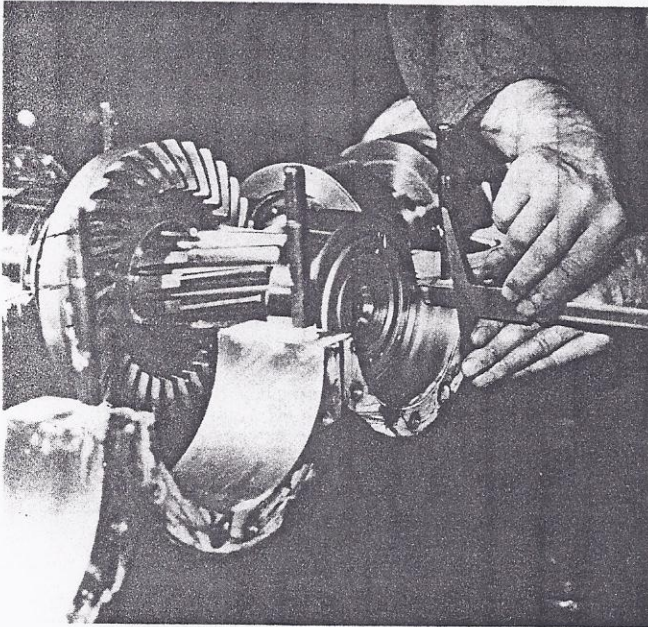


Fig. 26

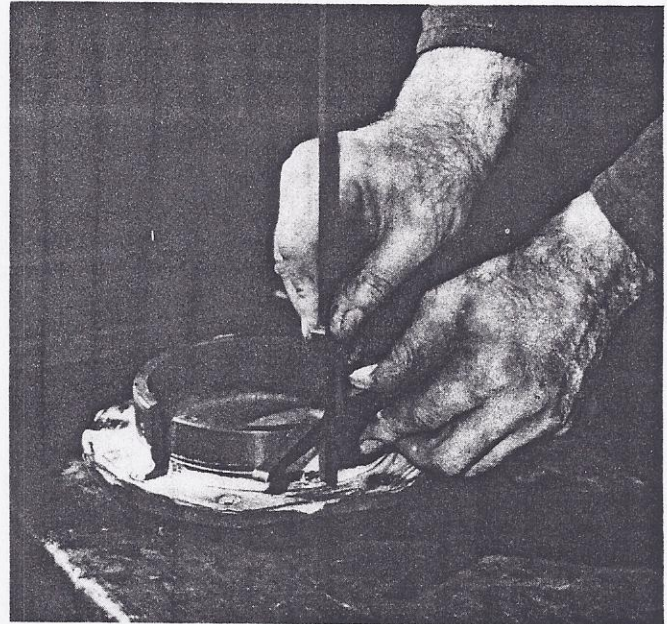


Fig. 27

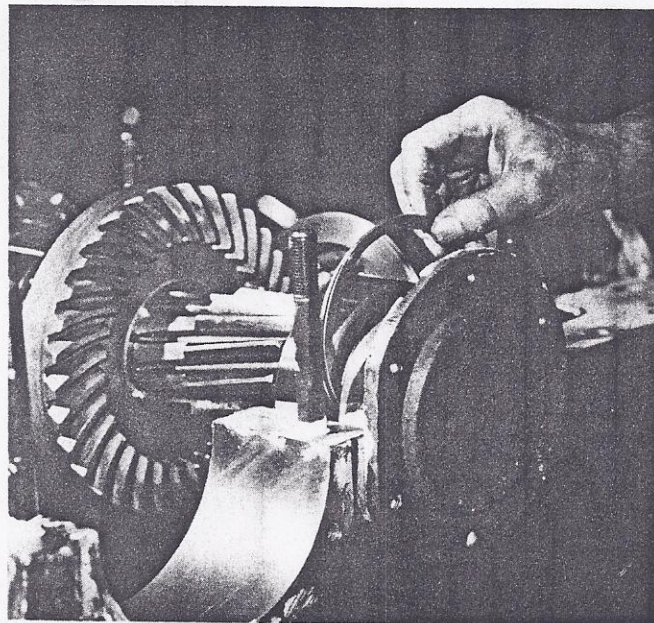


Fig. 28

Fitting and adjustment of the bevel gear input stage

Teeth of mating bevel gears are marked in their lapping position and must be brought into mesh according to these markings. They are etched either on the front face of the small pinion, fig. 29, or on the large diameter of the gear, fig. 30. This is of special significance when the ratio between numbers of teeth in gear and pinion is an integral number, for instance:

$$\frac{Z_2}{Z_1} = \frac{28}{14} = 2$$

or when the number of teeth in pinion and gear have a common integral factor, for instance:

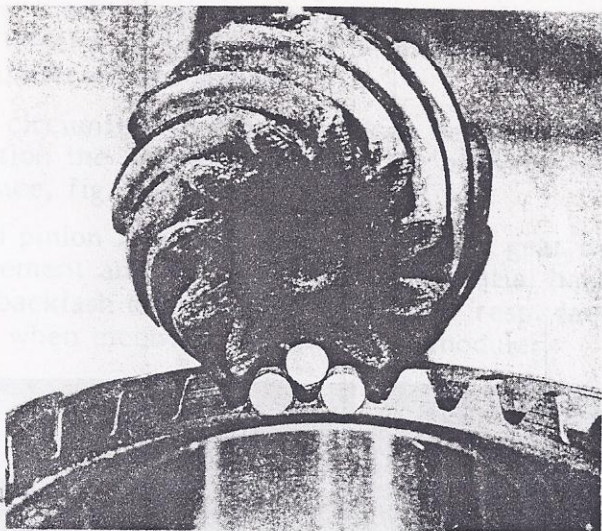


Fig. 29

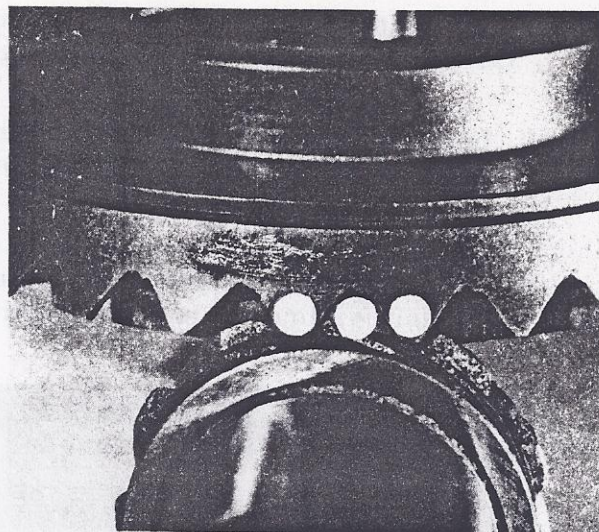


Fig. 30

Only the correct adjustment of pairs of bevel gears offers a safeguard against undue wear and tooth failure due to high tooth loadings. To achieve the correct and optimum contact pattern resp. must be kept to according to fig. 31. The dimension "x" has to be found in order to fit the pinion. Measure gear shaft dia. and obtain radius "r", fig. 31, subtract "r" from "E" (E is stamped on pinion end, fig. 29) to obtain dimension "x", fig. 31. Set a vernier caliper to dimension "x" and set pinion using the vernier between gear shaft and pinion face.

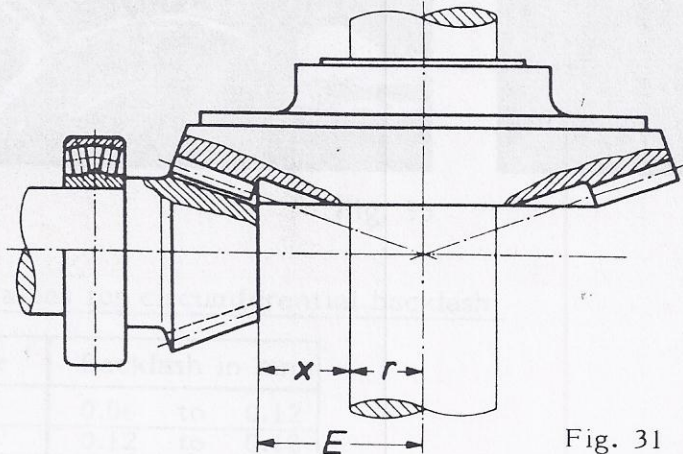
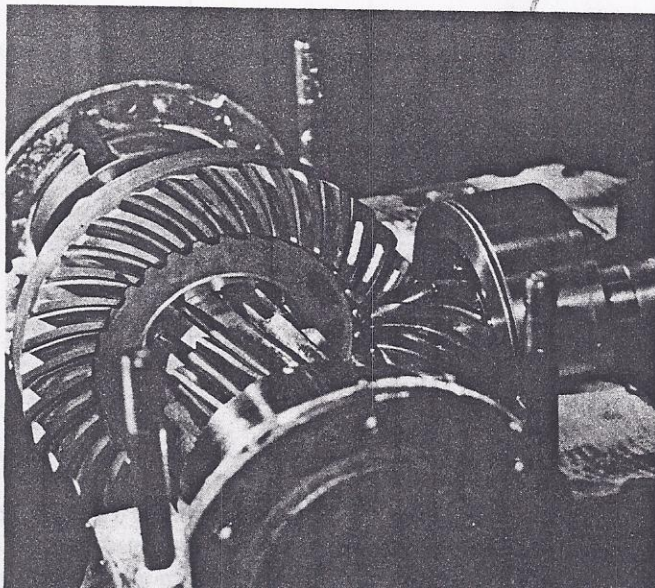


Fig. 31

In order to obtain the correct bevel gear meshing pattern, coat both flanks of a bevel pinion tooth with engineer's blue and rotate the bevel pinion in both directions for a few revolutions until a definite pattern shows as a clean, shiny surface, fig. 32.





Fit ground spacer, replace bevel pinion assembly and tighten with lower half cartridge flange bolts. The bevel gear set must now show a satisfactory contact pattern after fitting, running loaded or unloaded. If necessary, the bevel gear set has to be adjusted again after a loaded trial run, fig. 35.

Fig. 35

Correction of tooth contact pattern

Vertical adjustment of the contact pattern

What to do, when after fitting, this contact pattern shows?	Action	Resulting in normal contact

Horizontal adjustment of the contact pattern

What to do, when after fitting, this contact pattern shows?	Action	Resulting in normal contact

Fig. 36

Directions above refer to a driving bevel pinion where: V = forward flank, R = back flank

Speed reducers with bearing cartridge assembly on bevel gear shaft

Assemble in the appropriate order, the spacer (315), key (306) and bevel gear onto the shaft (300). Place bearing set (350) into bearing cartridge (320).

Determine shim thickness by measuring depth from flange face of cartridge to the bearing outer face and subtract length of bearing cover centering shoulder. Add fractional mm shim to this measured value to ensure the bearing outer rings will be held firmly together.

Place shims into bearing cartridge and tighten bearing cover to bearing cartridge with two screws. Heat this sub-assembly and mount on shaft (300) after spacers (315) and (316) have been installed first. Now take off bearing end cover (360), assemble ring (313), tab washer (310) and screw down slotted nut (309), secure with tab.

Place O-ring (324) onto end cover (360) and screw end cover to bearing cartridge flange with two screws. Place bevel gear assembly into housing and mesh with pinion. Adjustment of the bevel gear stage as described previously.

After adjustment determine thickness of split ring (328) with feeler gauges. If necessary grind ring (328) to size.

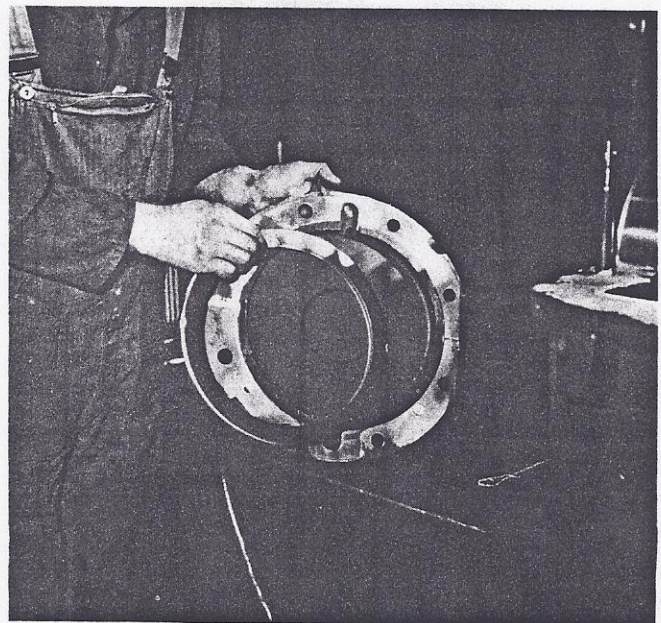
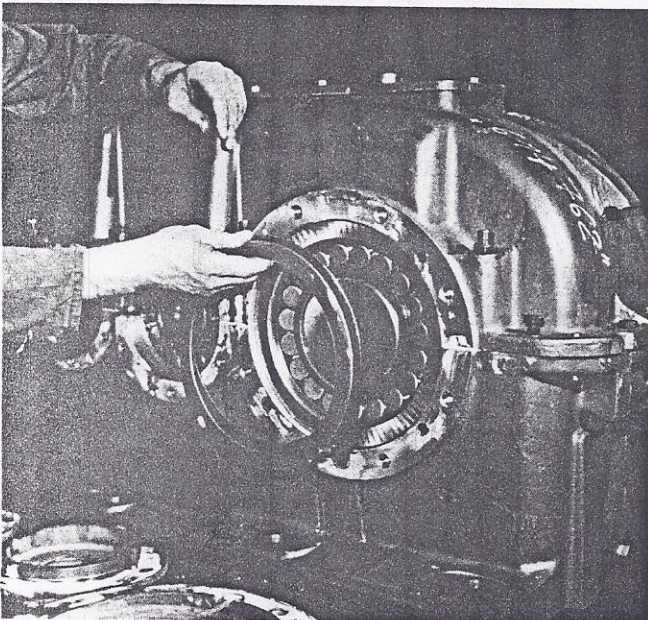
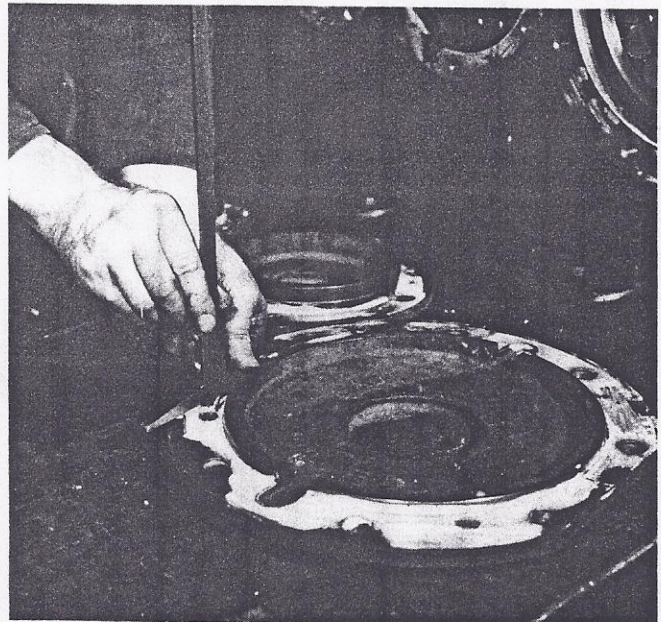
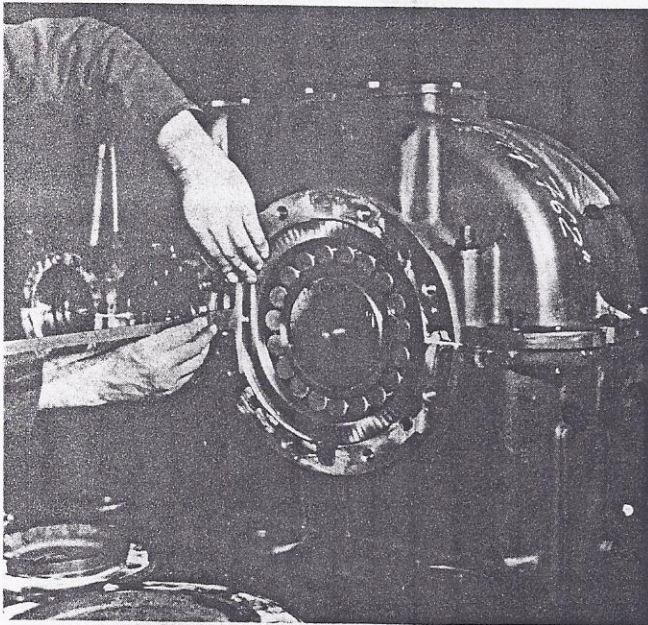
Remove the two holding screws, place O-ring (323) and spacer (328) and assemble end cover (360).

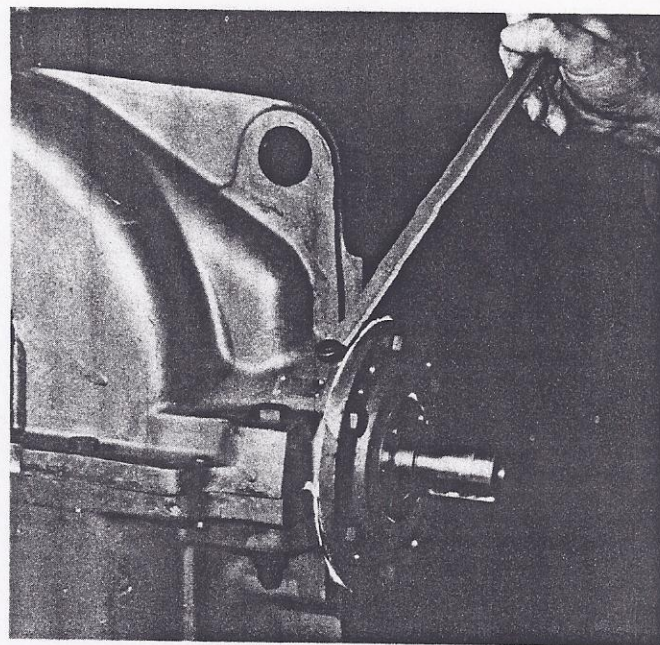
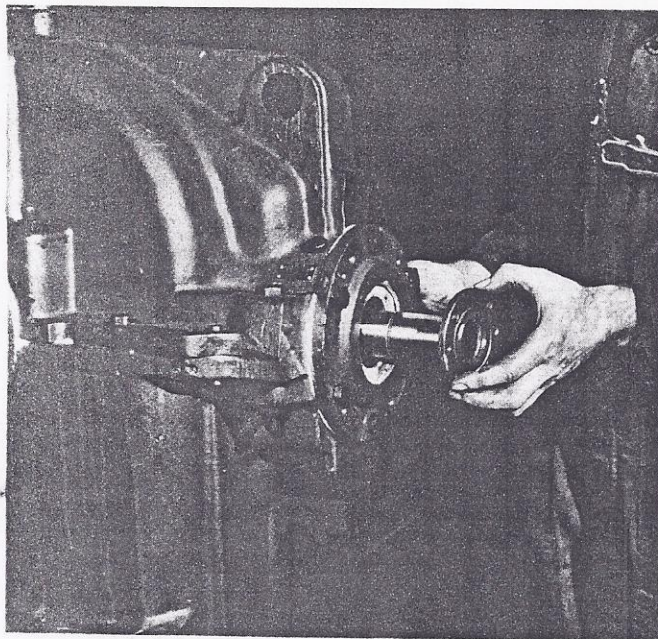
Assembly of remaining shaft(s)

Assemble the remaining intermediate and output shafts in a similar manner to the first intermediate (bevel gear) shaft. Carefully fit intermediate stage or stages with bearing clearance according to drawing specifications. Coat gear teeth lightly with engineer's blue, rotate against pinion. Tooth contact will show as a shiny pattern on gear tooth. The correct unloaded pattern should show contact over the face of the tooth extending across the centre.

Final assembly

Recoat the split housing flange with a good sealer, preferably Loctite and the gear case cover can then be lowered carefully over studs onto bottom housing half. Locate dowels in their positions, insert bolts and thread nuts into place. Tighten fully with bolt tightening torques listed on next page. Now replace bearing end covers including appropriate shims and tighten. If required, fit new shaft seal in output shaft cover and high speed seal housing and mount.





Oil priming port for pinion shaft bearing before first start up

Rotate the input shaft by hand to check that nothing is binding. Return speed reducer to installation site. Recheck bolts and screws for proper tightness. Remount couplings and establish proper alignment. Complete assembly by reconnecting oil lines and other assemblies (if fitted). Fill unit with recommended grade of oil to the required level. Prime pinion shaft bearing cartridge with the required amount of oil.

Reassembly is followed by a test run - during which the sounds emitted by the bearings are ascertained by placing an ear against the handle of a screwdriver and with its other end pressed against the bearing housing. A whistling sound can be caused by insufficient lubrication whilst noisy running is mostly due to the presence of foreign particles in the bearing. Temperature rise in the bearings must also be noted during the test run, because the bearing temperature indicates whether it has been fitted properly and is supplied with the right lube quantity.

Bolt tightening torques

Tightening torques are based on ISO material grade 8.8. The material grade is shown on bolt or screw heads.

Bolt tightening torques in Nm

Bolt size

M 6	=	12.5
M 8	=	31.5
M 10	=	62
M 12	=	108
M 16	=	265
M 20	=	520
M 24	=	900

For speed reducers with pressure lubricating systems, please pay attention to the special instructions in manual V 200.

Speed reducers supplied with cooling fan

Mount fan flange (172) onto bearing cartridge flange (120). Mount spacer (174) and tolerance ring (173) onto shaft (100). Press fan hydraulically onto the tolerance ring.

Position fan cover and tighten screws (178). Use puller holes in hub when dismantling the fan.

Backstop

For units furnished with a backstop observe installation and operating instructions V 2046.

Eye bolt sizes for various shaft diameters:

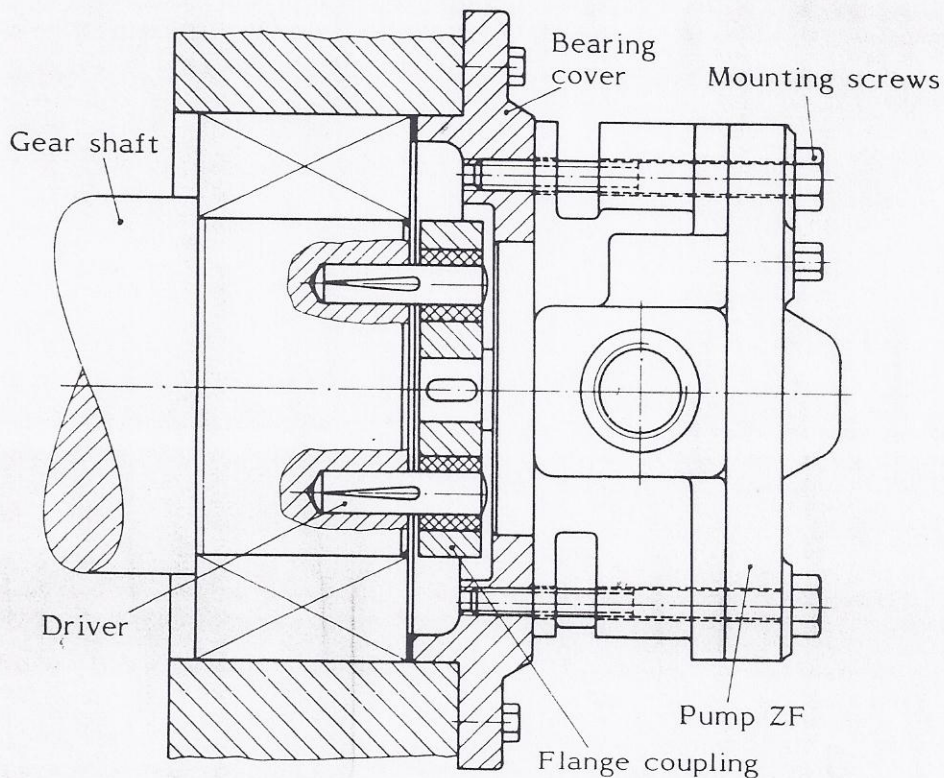
over 16 to 21 = M 6
 over 21 to 24 = M 8
 over 24 to 30 = M 10
 over 30 to 38 = M 12
 over 38 to 50 = M 16

over 50 to 85 = M 20
 over 85 to 130 = M 24
 over 130 to 225 = M 30
 over 225 to 320 = M 36
 over 320 to 500 = M 42

Lube pumps

For speed reducers furnished with a standard ZF lube pump see drawing for details.

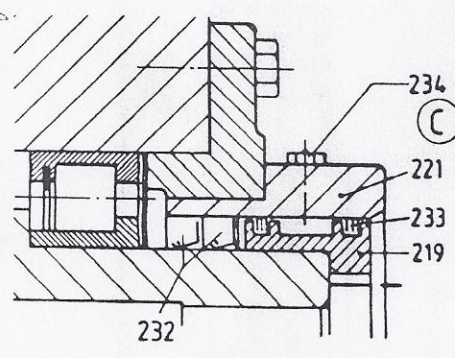
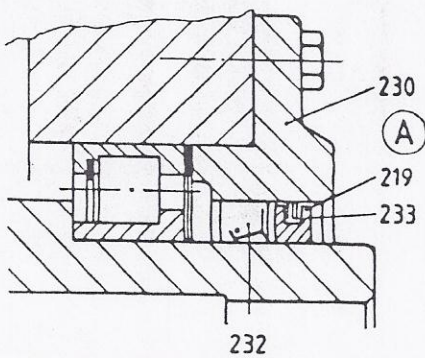
Installation example



Taconite seals

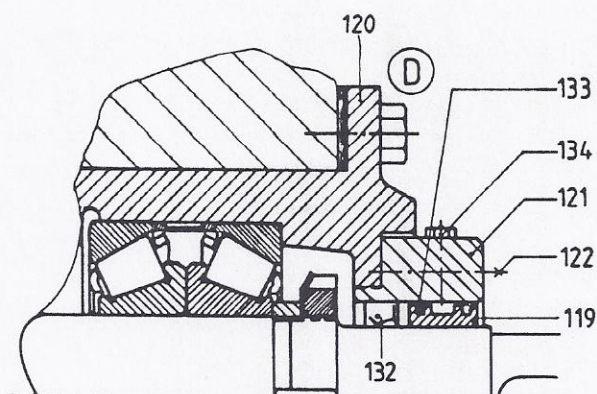
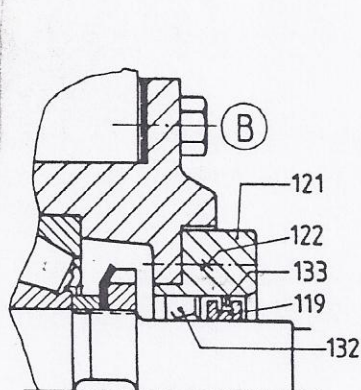
A + C Remove bearing cover completely (for type C with seal housing) with the help of jacking screws.

Heat Fey ring carrier (to soften bonding agent) and remove.



B + D Loosen screws of seal housing 122/222, if fitted; otherwise heat to approx. 100 °C and remove (if necessary use gripping pliers) and force it off or insert 2 pins into tappings and remove by turning.

Heat Fey ring carrier (to soften bonding agent) and remove.

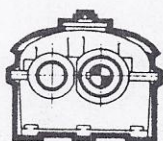


Spare parts: Fey-ring carrier
Fey lamellar rings (set)
Shaft seals

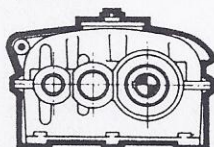
When mounting use Loctite 601 as bonding agent.

REDUREX Speed Reducers

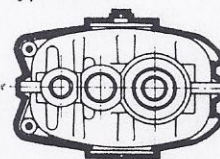
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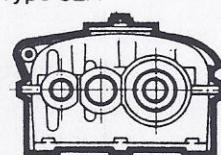
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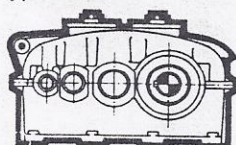
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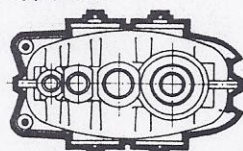
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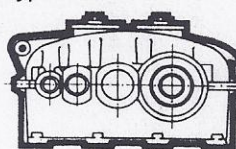
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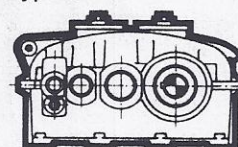
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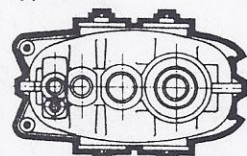
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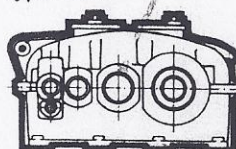
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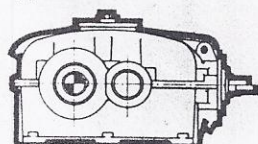
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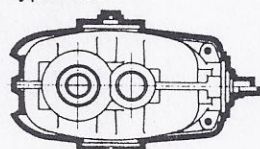
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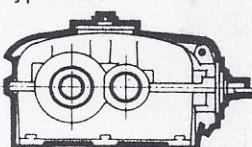
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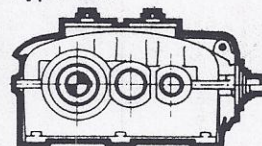
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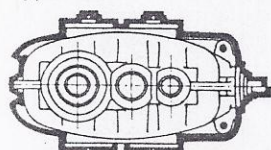
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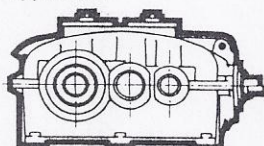
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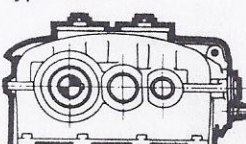
Type KZO



Type KZA



Type KDN



Type KDA

