BAB VI

KESIMPULAN DAN SARAN

6.1 KESIMPULAN

Berdasarkan hasil penelitian dan pembahasan yang telah dikemukakan pada bab sebelumnya maka diperoleh beberapa kesimpulan sebagai berikut :

1. Jenis kerusakan yang sering terjadi terdapat 5 jenis kerusakan komponen, yang diperoleh berdasarkan 5 prosentase terbesar dari 12 jenis kerusakan yang terjadi yaitu :
   a. Bearing cone aus (22.67 %)
   b. Bearing aus (17.33 %)
   c. Setting pinion dan ring gear (10.67 %)
   d. Pinion cage cap aus (8 %)
   e. Setting putaran mesin (8 %)

2. Berdasarkan uji keseragaman data dengan pengujian Kruskal-Wallis, diketahui bahwa ketiga mesin mempunyai laju interval kerusakan yang seragam yang berasal dari satu populasi yang sama, dimana dalam hasil perhitungan didapat nilai 0,2504 yang berarti bahwa nilai hitung kurang dari nilai tabel sebesar

5,591, yang berarti asumsi bahwa data seragam diterima dan berasal dari populasi yang sama. Adapun rata-rata interval waktu kerusakan mesin Gearbox adalah, untuk mesin I, rata-rata interval waktu kerusakan mesin adalah 27 hari. Untuk mesin II, rata-rata interval waktu kerusakan mesin adalah 26 hari, dan untuk mesin III, rata-rata waktu interval kerusakan mesin adalah 21 hari. Distribusi waktu kerusakan untuk mesin Gearbox I. II dan III mempunyai distribusi eksponensial yang teruji melalui uji kesesuain distribusi menggunakan metode goodness of fit test (uji kebaikan suai).

3. Dengan interval perawatan preventif berdasarkan nilai kesiapan [A(tp)] maksimum dan dengan biaya [C(Tp)] rendah, maka diperoleh keluaran sebagai berikut :
    a. Interval perawatan yang optimal adalah 14 hari.
    b. Nilai kesiapan pada interval 14 hari adalah sebesar 0.99150.
    c. Biaya perawatan pada interval 14 hari adalah Rp. 1.423,- perjam.
    d. Ekspektasi penghematan biaya dengan interval 14 hari dibandingkan dengan perawtan sebelumnya 30 hari adalah Rp. 2.577,- perjam.

6.2 SARAN-SARAN

Berdasarkan hasil penelitian yang diperoleh, maka perlu dikemukakan saran-saran sebagai berikut :

1. Perusahaan menerapkan interval perawatan pada mesin-mesin gearbox setiap 14 hari secara konstan, karena selain biaya perawatan yang lebih rendah juga kesiapan mesin tinggi sehingga kemungkinan rusak sedikit.
2. Perawatan yang dilakukan tiap 14 hari lebih diutamakan kepada komponen atau jenis kerusakan yang paling sering rusak untuk menghindari sampai terjadinya kerusakan sehingga dikeluarkan biaya yang lebih sedikit.
3. Perusahaan lebih membuat persiapan yang diperlukan untuk menerapkan kebijakan perawatan dengan prosedur yang lebih jelas dan dimengerti oleh karyawan.

DAFTAR PUSTAKA

1. Assauri, Sofjan., ***Manajemen Produksi dan Operasi.***, Lembaga Penerbit FEUI., Jakarta., 1993.
2. Corder, Anthony., ***Teknik Manajemen Pemeliharaan.***, Penerbit Erlangga ., Jakarta., 1992.
3. Heizer, jay., ***Production and Operation Manajemen.***, Allyn and Bacon Inc. Boston., 1991.
4. Jardine, AKS., ***Maintenance, Replacement, and Reliability.***, Pitman Publishing. New York., 1973.
5. Schonberger, Richard J., ***Operation Management; Productivity and Quality.***, Business Publication, Inc. Texas., 1985.
6. Miller, Irwin and John E. Freund., ***Probability and Statistic for Engineers.***, Third Edition.
7. Ertas, Atila and Jesse C. Jones., ***The Engineering Design Process.***, Second Edition., John Willey & Son Inc. USA., 1993.
8. Walpole, Ronald E., ***Pengantar Statistika.***, Edisi ke 3., PT Gramedia Pustaka Utama., Jakarta., 1995.
9. Walpole, Ronald E dan Myers, Raymond H., ***Ilmu Peluang dan Statistika Untuk Insinyur dan Ilmuwan.***, Edisi ke 4., Penerbit ITB., 1995.

LAMPIRAN 1

* IntervalWaktu Kerusakan Mesin
* Grafik Distribusi Kerusakan Mesin I,II dan III

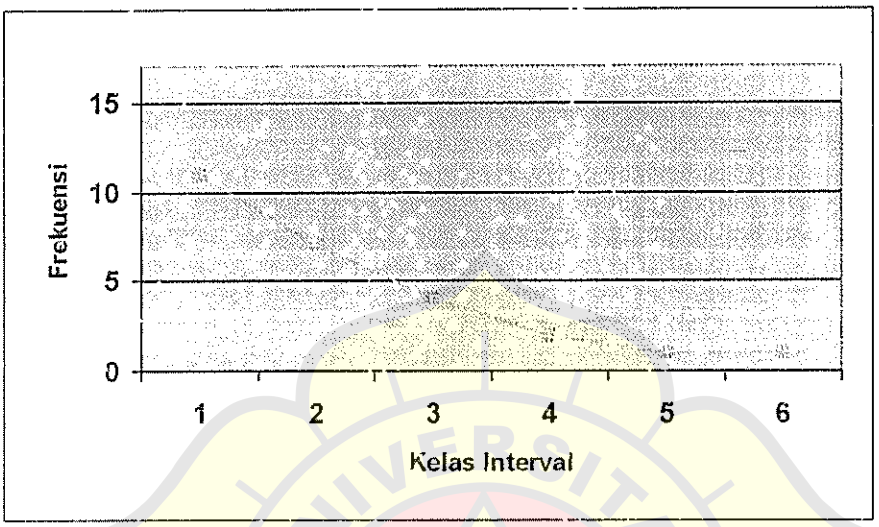
Lampiran 1

Data Interval Waktu Kerusakan Mesin Gearbox I,II dan III

Interval Kerusakan ke	Interval Kerusakan Gearbox I (hari)	Interval Kerusakan Gearbox II (hari)	Interval Kerusakan Gearbox III (hari)
1	10	19	4
2	25	29	17
3	9	37	45
4	17	4	27
5	32	62	16
6	5	13	31
7	39	17	8
8	23	51	16
9	49	12	36
10	15	9	12
11	51	27	77
12	20	35	26
13	10	8	13
14	61	16	7
15	29	27	21
16	37	13	17
17	11	35	9
18	29	85	29
19	87	9	15
20	13	13	13
21	35	21	7
22	9	33	35
23	15	25	14
24	26	17	13
25	20	17	
26	17		

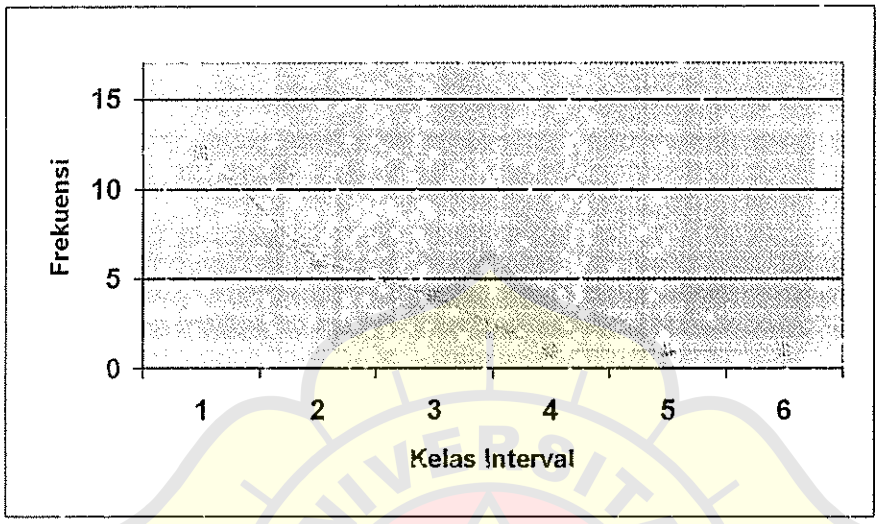
Lampiran 1

Grafik Distribusi Kerusakan Mesin I



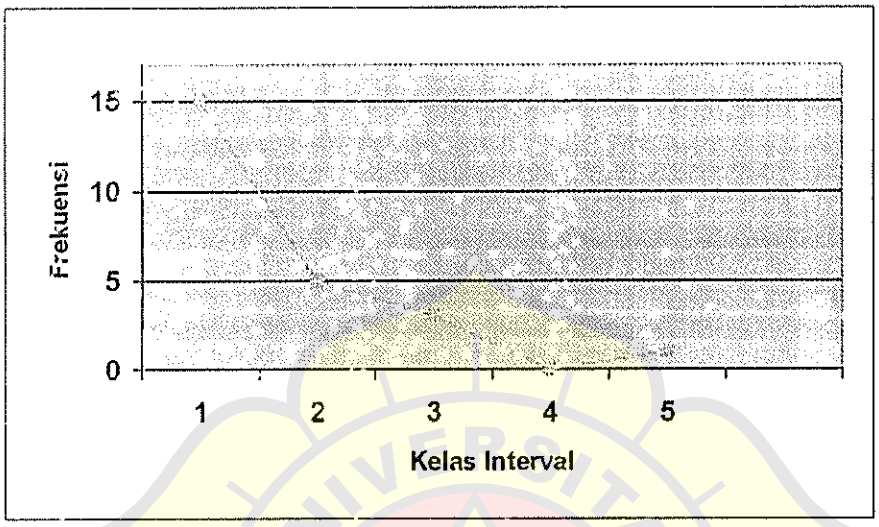
Lampiran 1

Grafik Distribusi Kerusakan Mesin II



Lampiran 1

Grafik Distribusi Kerusakan Mesin III



LAMPIRAN 2

* Nilai X^2 dari Interval Kerusakan Mesin
* Tabel X^2

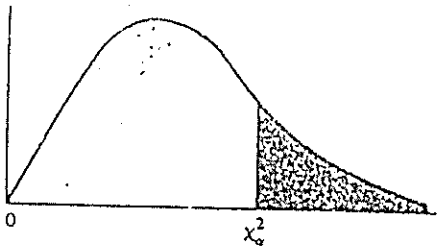
Lampiran 2

Nilai X^2 dari Interval Kerusakan Mesin

Interval Kerusakan ke	Mesin Gearbox I	Mesin Gearbox II	Mesin Gearbox III
1	13.5	39	1.5
2	45.5	53.5	35
3	10	64.5	67
4	35	1.5	50
5	57	72	30
6	3	20.5	56
7	56	35	6.5
8	44	69.5	30
9	68	16.5	63
10	26.5	10	16.5
11	69.5	50	73
12	40.5	60.5	47.5
13	13.5	6.5	20.5
14	71	30	4.5
15	53.5	50	42.5
16	64.5	20.5	35
17	15	60.5	10
18	53.5	74	53.5
19	75	10	26.5
20	20.5	26.5	20.5
21	60.5	42.5	4.5
22	10	58	60.5
23	15	45.5	24
24	47.5	35	20.5
25	40.5	35	
26	35		
Jumlah	1053.5	986.5	798.5

TABEL A.6*

Nilai Kritik Sebaran Khi-Kuadrat



ν	α							
	0.995	0.99	0.975	0.95	0.05	0.025	0.01	0.005
1	0.0^4393	0.0^3157	0.0^3982	0.0^2393	3.841	5.024	6.635	7.879
2	0.0100	0.0201	0.0506	0.103	5.991	7.378	9.210	10.597
3	0.0717	0.115	0.216	0.352	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	11.070	12.832	15.086	16.750
6	0.676	0.872	1.237	1.635	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	36.415	39.364	42.980	45.558
25	10.520	11.524	13.120	14.611	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	43.773	46.979	50.892	53.672

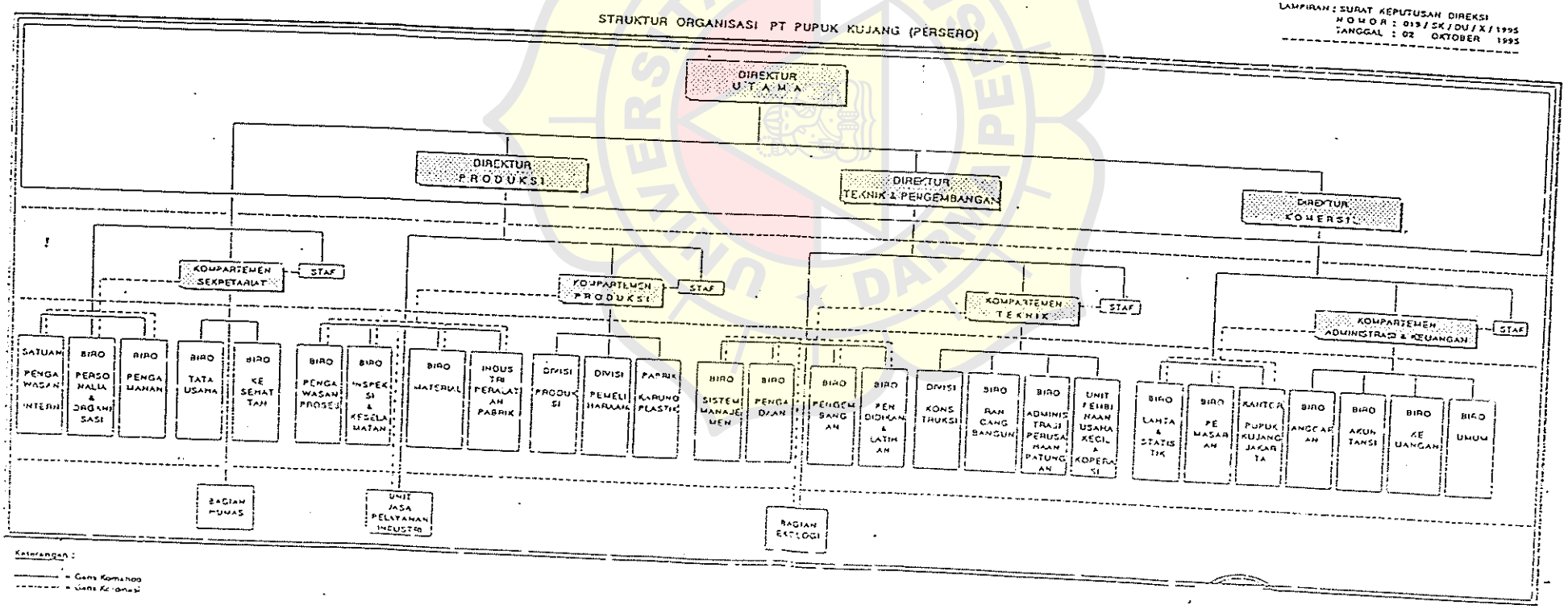
*Diringkas dari Tabel 8 *Biometrika Tables for Statisticians*, Vol. 1, dengan izin dari E. S. Pearson dan Biometrika Trustees.

LAMPIRAN 3

* Struktur Organisasi PT. Pupuk Kujang, Cikampek.
* Manual Instruction of Gearbox

LAMPIRAN : SURAT KEPUTUSAN DIREKSI
NOMOR : 019 / SK / DU / X / 1995
TANGGAL : 02 OKTOBER 1995

STRUKTUR ORGANISASI PT PUPUK KUJANG (PERSERO)



COOLING TOWER FAN 2204-U.

141

KUJANG FERTILIZER CO., LTD.

c/o PULLMAN KELLOGG
THREE GREENWAY PLAZA EAST
HOUSTON, TEXAS 77046

Phone (713) 960-4942
Telex 762-556

REF: PKH/PKC 243

DATE: 28 January 1983

file
2204 U
(Fan cooling tower)

P.T. Pupuk Kujang
Jl. Jend. A. Yano
Dawuan, Cikampek
Jawa Barat, Indonesia

Attention: Ir. Djaenudin

Subject: Marley Gear Box
Repair Manual

Gentlemen:

Please find attached the Field Repair Instructions for Marley Gear Box per your request PKCX-PKH/024.

for

Kiki Subrata

KS:mr
cc: File PKH w/attachment

BAGIAN PERENCANAAN PENGAWASAN MATERIAL

Tgl. Diterima :

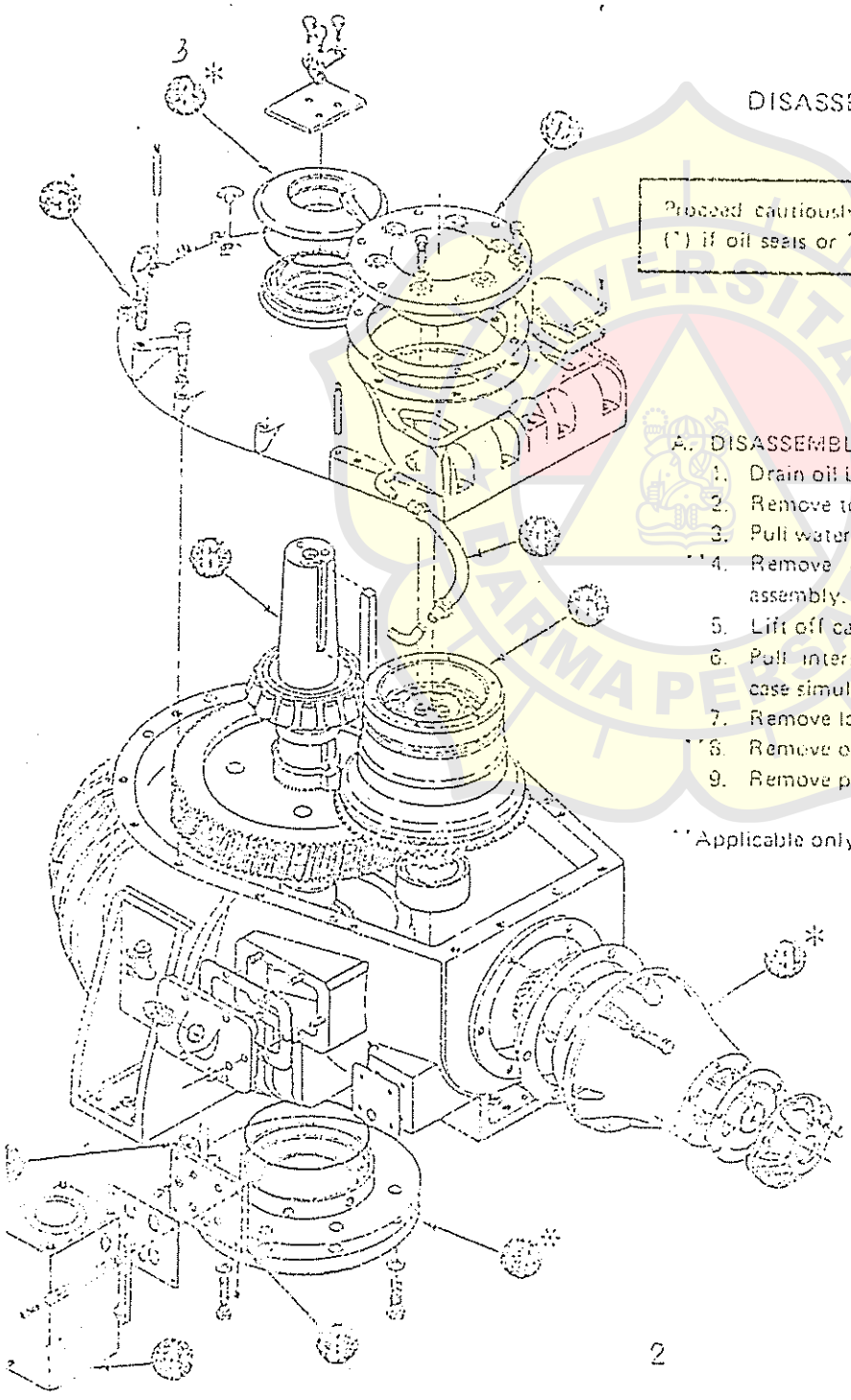
PERHATIAN UTK.	FILE	PR...
Rotating	✓	✓
Non-Rotating		
Elect/Inst.		
Consumable		
Administrasi		
Seluruh Crews		

NOTES :

MARLEY
Series 36 & 38 Geareducers
Field Repair Instructions

Marley recommends that Geareducers in need of extensive repair be returned to its plant at Olathe, Kansas in exchange for a factory reconditioned unit. Obtain "Customer Return Material" tag from Marley sales office or representative to affix to the Geareducer for return. A factory reconditioned Geareducer carries the same one year guarantee against defects in material and workmanship as does a new unit.

Geareducers can be repaired in the field, however, majo repairs require the use of a fully equipped machine sho When field repair or replacement of parts is necessary, th following procedure is recommended for the disassembl and assembly of the unit.



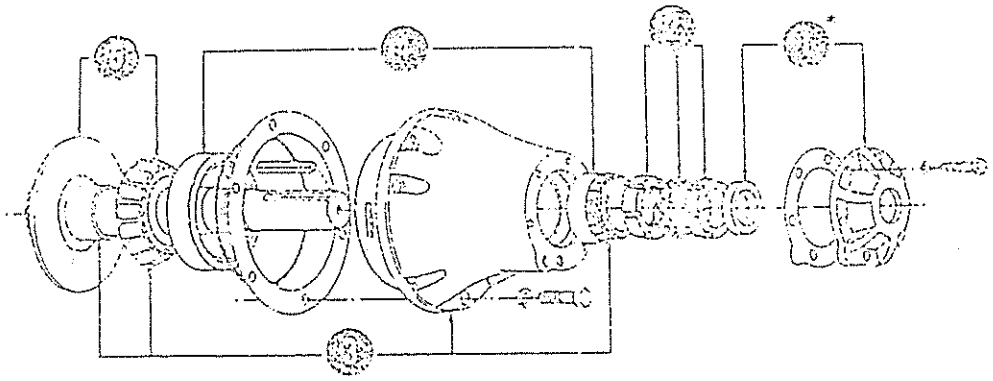
DISASSEMBLY OF GEAREDUCER

Proceed cautiously when removing parts noted by asterisk (*) if oil seals or "O" rings are to be reused.

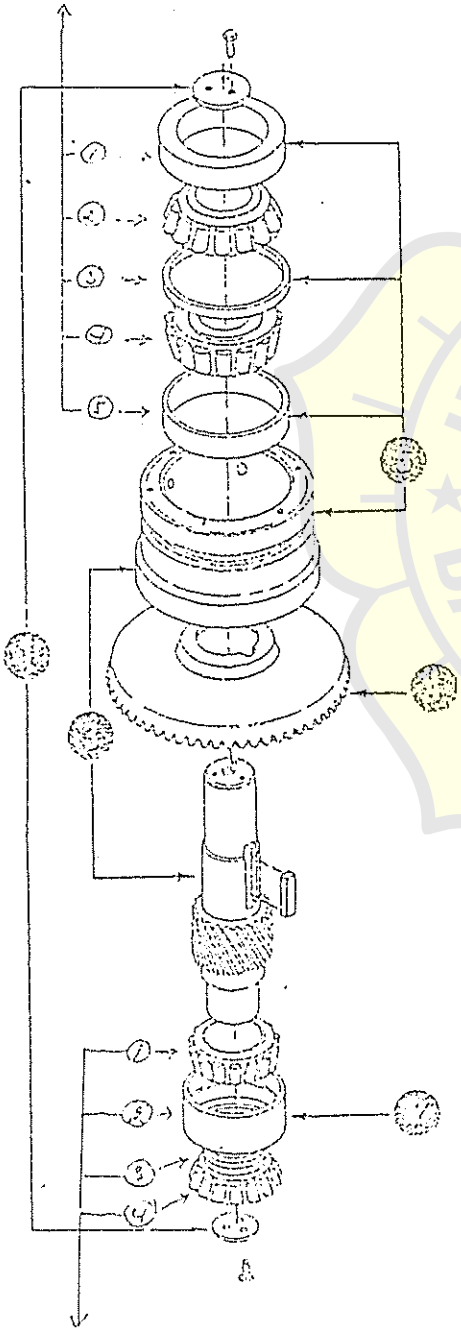
A. DISASSEMBLY OF MAJOR SUBASSEMBLIES

1. Drain oil by removing drain plug.
2. Remove top interstage cap.
3. Pull water slinger off fan shaft.*
4. ** Remove oil supply tube, plugs, and filter case assembly.
5. Lift off case cover.
6. Pull interstage and fan shaft subassemblies out of case simultaneously.
7. Remove lower fan shaft cap.*
8. ** Remove oil return assembly.
9. Remove pinion cage subassembly.*

** Applicable only to units having oil filters.



1. set (bvg. inter stage) s/c : 1990766. no : mike · · 98708/98550
IN OUT



B. DISASSEMBLY OF PINION CAGE

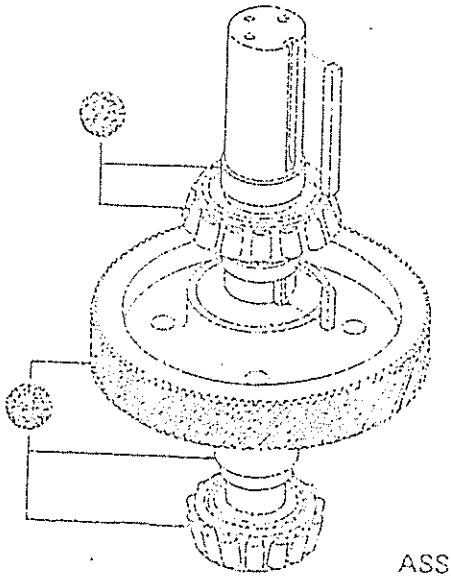
1. Remove pinion cage cap.*
2. Remove locknuts and washer from pinion shaft.
3. Press pinion shaft with head bearing cone out of pinion cage. (This will free cone of tail bearing.)
4. Remove bearing cups from pinion cage.
5. If bearing cone on head of pinion shaft is to be replaced, it will be necessary to press off oil slinger and bearing cone at the same time.

*See page 2.

C. DISASSEMBLY OF INTERSTAGE

1. Remove top and bottom interstage bearing discs.
2. Pull bottom bearing, two cones with spacer and one cup, from shaft.
3. Push shaft out of upper bearing and retainer.
4. Remove spiral bevel ring gear from shaft.
5. Pull upper bearings from top interstage retainer.

1. set (bvg. inter stage / double row roller)
s/c : 1990611 no number : 3420/3494
OUT IN



D. DISASSEMBLY OF FAN SHAFT

1. Press helical ring gear, lower fan shaft spacer and lower cone from shaft.
2. Remove upper bearing cone and water slinger spacer.
3. Remove upper fan shaft bearing cup from case cover. (Not illustrated)
4. Remove lower fan shaft bearing cup from case (not illustrated.)

ASSEMBLY OF GEAREDUCER

GEAR MATCH NUMBERS & SETTING DATA

Before assembling a new pinion gear in the pinion cage, check match numbers on pinion gear and spiral bevel ring gear to be certain that they are a matched set. Gears are lapped in matched sets at the factory and should not be separated. Numbers are etched on both the pinion and ring gear as illustrated in Fig. 1.

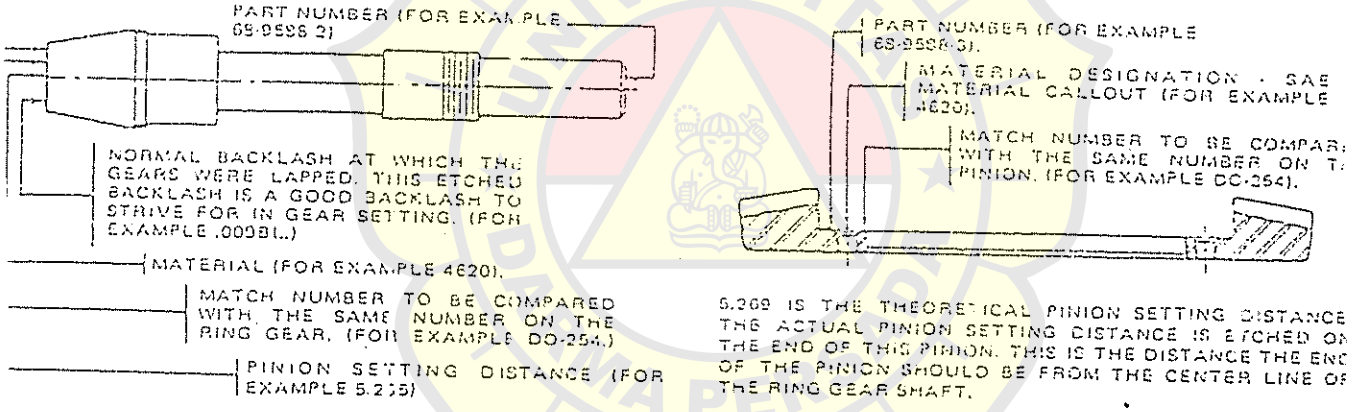
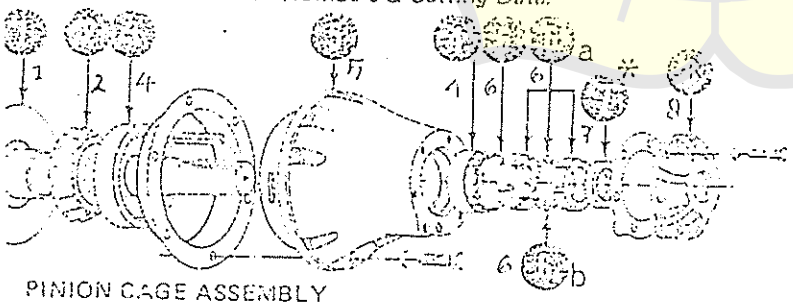


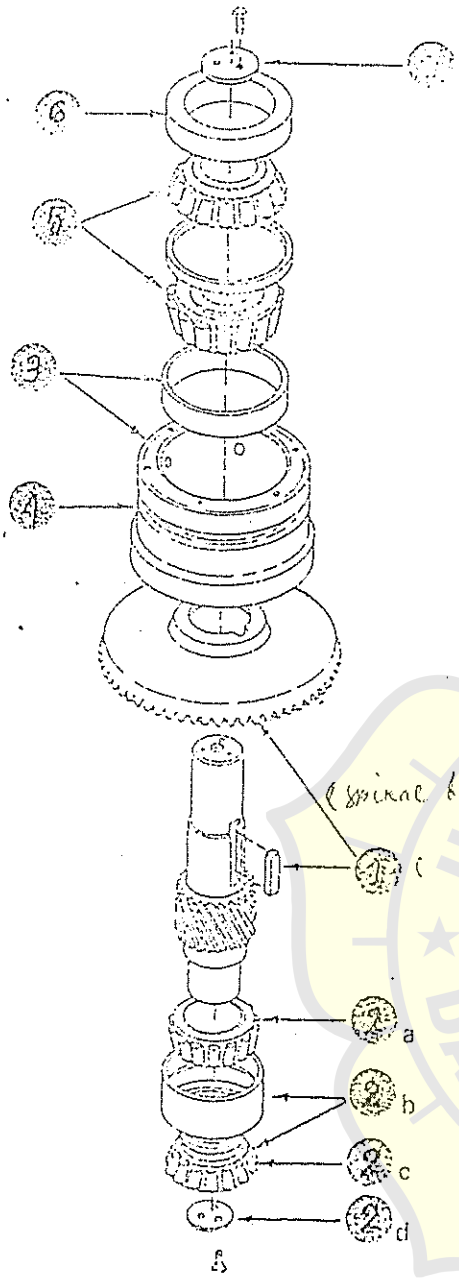
Figure 1. Gear Match Numbers & Setting Data.



PINION CAGE ASSEMBLY

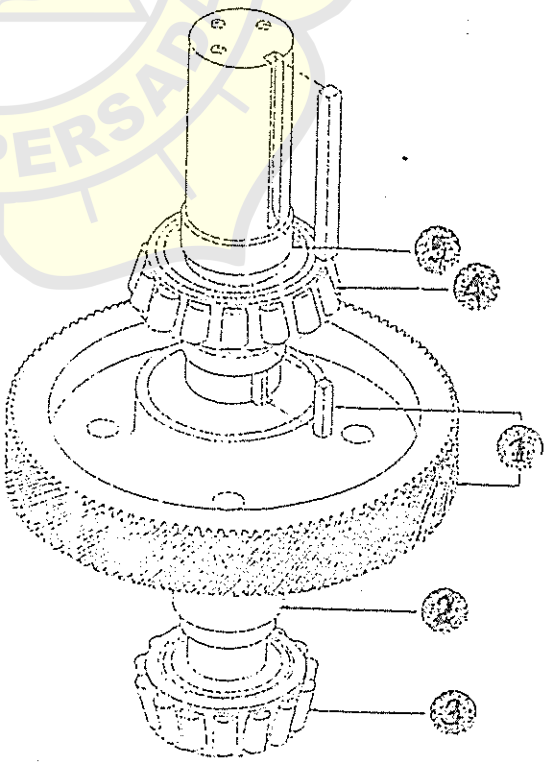
1. Press oil slinger onto pinion shaft.
2. Install pinion head bearing cone on pinion shaft pushing tight against shoulder.
3. Press pinion head bearing cup into pinion cage.
4. Press pinion tail bearing cup into pinion cage.
5. Lower pinion cage over pinion shaft until head bearing cone mates with cup.
6. Press tail bearing cone onto pinion shaft.
   (a) Lock with locknuts and lockwasher to provide bearing preload of 10-18 inch pounds (resistance to rotation of pinion shaft.)
   (b) Crimp ears of lockwasher to locknuts after obtaining proper preload.
7. Install pinion shaft oil seal in pinion cage cap. Protect oil seal from damage when installing over keyway of pinion shaft. (See Marley Oil Seal Service Manual.)
8. Assemble pinion cage cap to pinion cage with gasket.

*Marley recommends that new oil seals, "O" rings and gaskets be installed during a major overhaul. If oil seals, "O" rings or gaskets are to be reused, they should be carefully inspected for damage before being reinstalled.



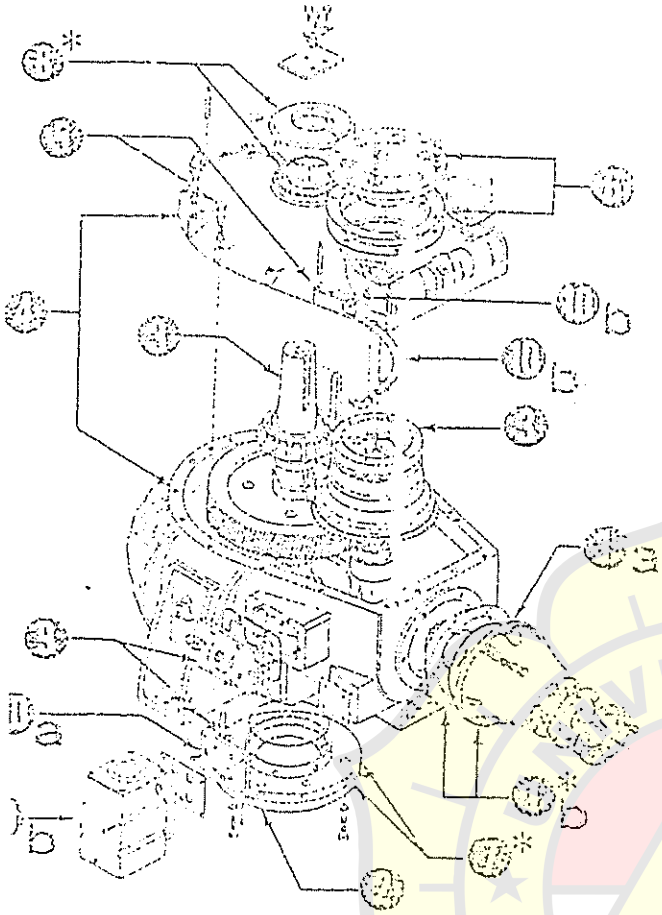
B. INTERSTAGE ASSEMBLY

1. Install key and spiral bevel ring gear on interstage shaft.
2. (a) Press top cone of bottom interstage bearing onto interstage shaft.
   (b) Install double cup and spacer of bottom interstage bearing.
   (c) Press bottom cone into place.
   (d) Install disc with place bolts. (Tighten to 50-55 ft. lbs. torque.)
3. Press lower cup of upper interstage bearing into retainer.
4. Lower retainer over interstage shaft.
5. Press upper bearing cones onto shaft.
6. Press upper cup and spacer into retainer.
7. Install disc with place bolts (tighten to 140-150 ft. lbs. torque.)



FAN SHAFT ASSEMBLY

1. Install key and press helical gear on fan shaft.
2. Place lower bearing spacer on fan shaft.
3. Press bottom bearing cone onto fan shaft.
4. Press upper bearing cone on fan shaft.
5. Install water slinger spacer.



ee page 2.

SE AND COVER ASSEMBLY
ot illustrated)

(a) Install upper fan shaft bearing cup in case cover.
(b) Install lower fan shaft bearing cup in case.

JAL ASSEMBLY

(a) Install "O" ring onto pinion cage subassembly.
(b) Bolt pinion cage subassembly to case and cover subassembly using proper number of shims to give indicated pinion setting distance which is etched on front face of pinion gear. (See Figure 1, page 4.)

Temporarily install lower fan shaft cap and secure to case with cap screws. Leave a minimum of 1/8" clearance between cap and case. Do not install "O" rings or shims at this time.

Lower fan shaft and interstage shaft subassemblies into case simultaneously.

Engage marked spiral bevel ring gear teeth with marked spiral bevel pinion tooth.

Apply a coat of Permatex No. 2 to surface of case which mates with case cover.

Lower case cover subassembly onto case, leaving both shaft subassemblies into their respective bores.

Install dowel pins to align bearing bores. Fasten case cover to case with cap screws tightening to 70-75 ft./lbs. torque.

(a) Position top interstage cap shims and install cap with place bolts.
(b) Adjust shims to give proper backlash (.007-.009 normal) between spiral bevel gears. See "GEAR SETTING PROCEDURE".

7. Fan Shaft bearings must be preloaded to .001"-.003" in the following manner:
   (a) Assemble fan shaft subassembly in case-cover initially with a quantity of shims between case and bottom cap to insure that axial bearing end play exists.
   (b) Mount a dial indicator to measure axial movement of fan shaft. Support indicator stand on the cover or interstage cap adjacent to fan shaft and position indicator to read on machined top surface of fan shaft.
   (c) Rotate fan shaft slowly in one direction until all downward movement stops. Rotation is necessary in order to align the bearing rollers and seat roller ends on cone lip. Record dial indicator reading or zero the indicator.
   (d) Move shaft in opposite axial direction by either lifting on shaft by attaching to the shaft with a swivel joint and hoist or by turning Geareducer over allowing the weight of the shaft assembly to seat the bearings. If a hoist is used, lifting force should be 600 lbs. This is sufficient to overcome the weight of the fan shaft assembly. Rotate shaft slowly in one direction until all axial movement stops. Record dial indicator reading.
   (e) The difference in dial indicator readings (steps c and d) is the initial fan shaft bearing end play. In order to achieve the prescribed preload of .001" to .003", remove an amount of shims from between the case and bottom cap equal to the measured end play plus .001" to .003". For example, if the measured end play is .005", remove a total of .006" to .008" shim thickness.
   Caution: If Geareducer is in the upright position when bottom cap is removed, block under the ring gear to prevent gear from dropping down onto lower interstage bearing retainer (roller cage).
   (f) Install "O" ring in bottom cap and install bottom cap. Tighten cap screws to 75-80 ft./lbs. torque.
8. (a) Coat labyrinth recess in case cover with Permatex No. 2 and install labyrinth ring.
   (b) Fill grooves of labyrinth ring and water slinger with a lithium-base grease of NLGI No. 2 consistency.
   (c) Install water slinger and its "O" ring on fan shaft.
9. Install inspection cover, gasket, and drain plug.
10. FOR ASSEMBLY WITH INTEGRAL OIL FILTER
   (a) Install oil return assembly with gasket into case. If cap screws are black socket head, tighten to 30 ft./lbs. torque. If stainless steel socket head screws are used, tighten to 20 ft./lbs. torque.
   (b) Install oil filter case assembly. Tighten cap screws to 35-40 ft./lbs. torque. Install oil supply lines and fittings.
11. FOR ASSEMBLY WITHOUT OIL FILTER (not illustrated)
   Install oil return cover with gasket. Install oil supply fitting in case cover.

R SETTING PROCEDURE

proper mounting of the gear set is essential to obtain life and smooth operation of the gears. The pinion position adjustment is obtained by shims under the of the pinion cage. Shims are placed under the top tage bearing cap to adjust ring gear position. The gear y may require several attempts before obtaining the r backlash and tooth contact pattern.

ear and pinion are match-marked when lapped and be assembled the same way. The ring gear has the end teeth marked "X" and the pinion has one tooth so d; the gears should be engaged with the X-marked tooth between those marked on the ring gear. Match can be checked through the inspection opening.

he marked teeth of the gear engaged, check backlash dial indicator (see Fig. 2). The indicator can be

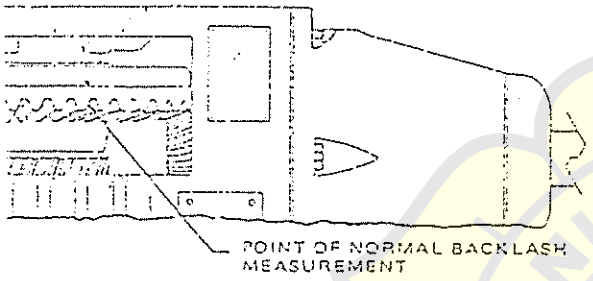


Figure 2. Gear Backlash Measurement

d through the inspection cover opening. Change under top interstage bearing cap until backlash is n .007 to .009" normal to ring gear tooth.

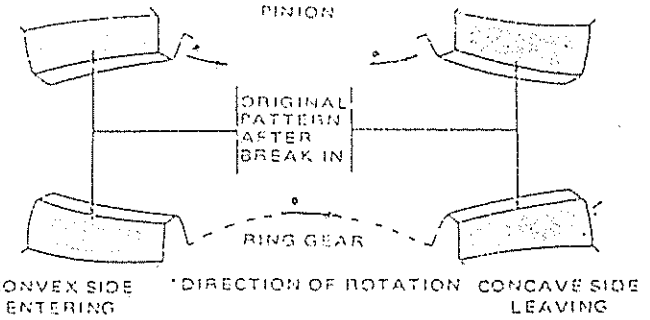
ears adjusted for proper backlash, blue (Prussian Blue the gear teeth. Drive the pinion by turning ring gear directions for several revolutions. Observe the con- ttern on both gears on both sides of the teeth. The t pattern should be as shown at the top of Fig. 3.

ect tooth contact pattern is not obtained on first efer to sketches at bottom of Fig. 3; these sketches he two cases of "out-of-position contact" in the ex- One of the remedies indicated will correct the out-of- contact; compare the tooth contact pattern with s shown in Fig. 3, and choose the required remedy.

roper tooth contact has been obtained, recheck the t at marked teeth. If it is within the desired range o .009"), check backlash with dial indicator at 2 al points 120° apart (with inspection cover re- , and as shown in Fig. 2. All backlash readings must in the specified range. If backlash is not within the djust ring gear height with shims until it is, checking described.

th contact pattern should again be checked to deter- adjusting the backlash has produced any shift. If it ted, move the pinion in the opposite direction the gear was moved with respect to the cone center. If the gear mounting distance is reduced, increase pinion setting distance, and vice versa, (see Fig. 1, page 4) an amount proportional to the number of teeth in the respective members. For example: on a 10 to 1 gear set, if the ring gear was moved .010", the pinion should be moved 0.001". This would be necessary only if the contact pattern had visually shifted due to movement of the ring gear while adjusting backlash.

CORRECT PINION & RING GEAR TOOTH CONTACT PATTERNS



INCORRECT RING GEAR TOOTH CONTACT PATTERN

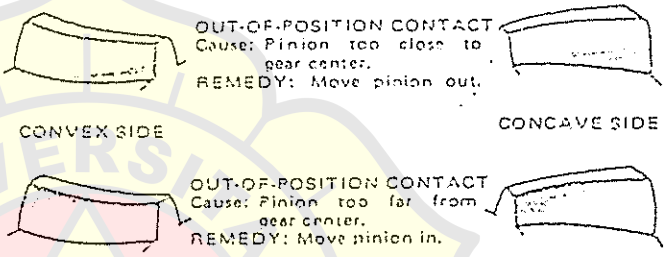


Figure 3. Tooth Contact Pattern, Correct and Incorrect.

When setting a used set of gears, follow the method outlined above. However, depending upon the amount of wear, it may be necessary to set the gears up with slightly greater backlash in order to obtain proper contact. *Proper tooth contact pattern is the most important factor of correct installation.*

Should a condition be encountered where correct contact cannot be obtained as described in this manual, the Gearedducer should be returned to Marley's Olathe, Kansas plant in exchange for a factory reconditioned unit.

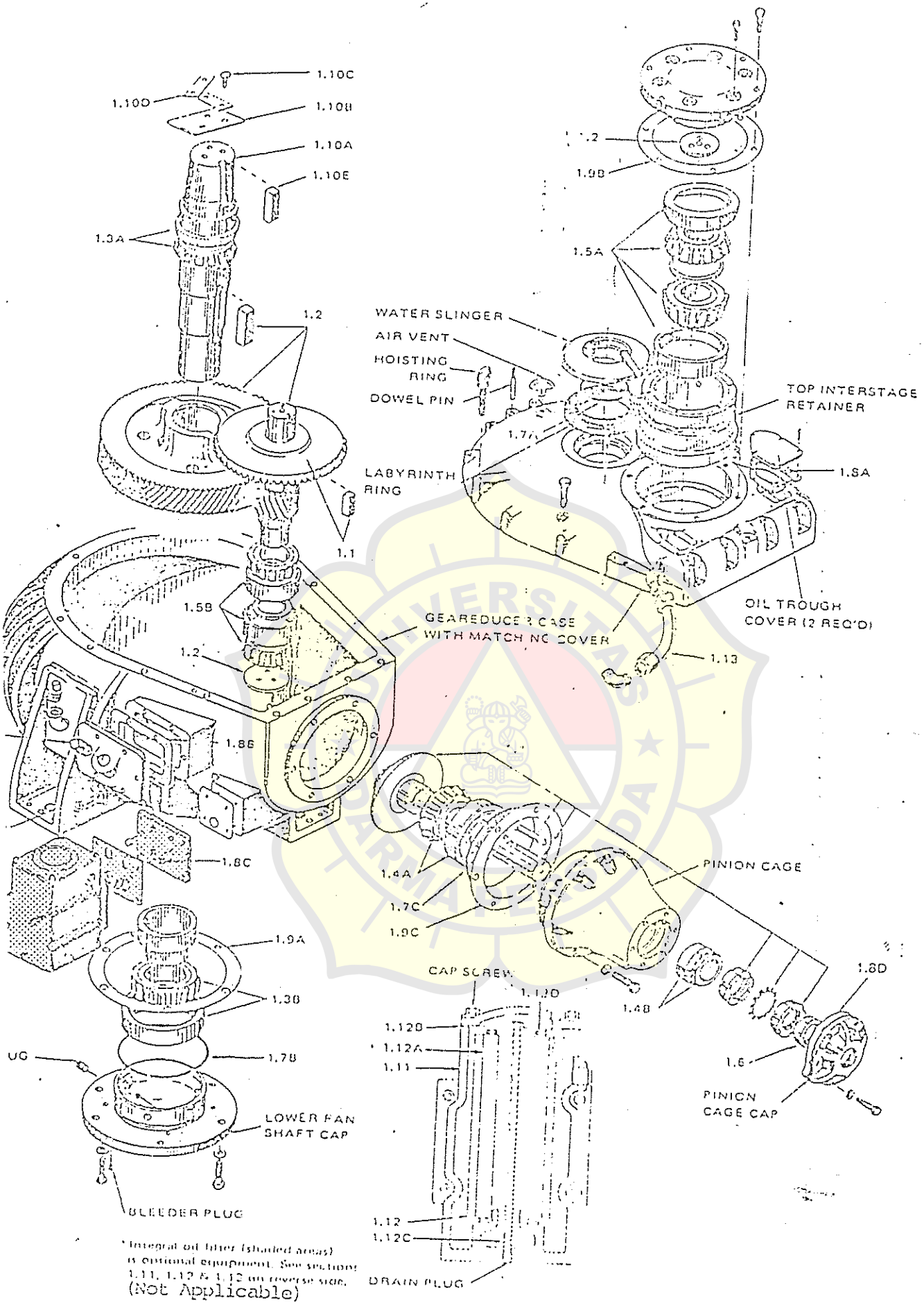
INSTALLATION AND LUBRICATION

The Gearedducer must be installed level and properly aligned with the motor shaft. Connect drain line and vent line. Fill Gearedducer with recommended oil (Table I) to full mark on case. Refer to Marley Gearedducer and Drive shaft service manuals for complete instructions.

TABLE I
TURBINE TYPE MINERAL OILS FOR SPIRAL BEVEL GEAREDUCERS

Listed below are typical turbine type mineral oils recommended for use in Marley Series 36 and 38 Geareducers by the companies shown. Seasonal temperature changes require one viscosity of oil for summer operation and another for winter operation. If it is necessary to use any oil which is not listed in this table, that oil must not contain any additives which are adversely affected by moisture. The responsibility for use of lubricants other than those listed below lies with the customer/user and the lubricant supplier.

MANUFACTURER	AIR TEMPERATURE AT GEAREDUCER	
	WINTER Below 32°F SAE 20 Viscosity S.U.S. At 100°F 230-310	SUMMER Above 32°F SAE 40 Viscosity S.U.S. At 100°F 750-1000
	LUBRICANT DESIGNATION	
American Oil Co.	American Ind. Oil No. 31	American Ind. Oil No. 95
Ashland Pet. Co.	Ashland ETC Oil K-30	Ashland ETC Oil K-75
Atlantic Richfield Co. (ARCO)	Rubilene S-315	Rubilene S-700
Borne-Scrymser Co.	Turbo Gear Oil	Bornes Motor Oil No. 50L
Chevron Oil Co.	Chevron OC Turbine Oil 68	Chevron OC Turbine Oil 220
Cities Service Co. (CITGO)	Citgo Pacemaker T-30	Citgo Pacemaker T-80
Continental Oil Co.	Dectol 33 R&O	Dectol 76 R&O
Crydien Oil Co.	Sulgrave 2 Paradene 430	Sulgrave 4 Paradene 490
Exxon	Nuto 53 Teresso 52	Nuto 76 Teresso 85
Farmland Ind., Inc.	Co-op Indol 5	Co-op Indol 9
Gulf Oil Corp	Gulf Harmony 53	Gulf Harmony 77
Imperial Oil, Ltd.	Teresso 52	Teresso 85
Keystone Precision Lubricants	KLC No. 5	KLC No. 3
Leon Oil Co.	Azalea T-2 Azalea C	Azalea T-4 Azalea E
Mobil Oil Corp	DTE 26	DTE BB
National Ref. Co.	Enarco ETC Oil K30	Enarco ETC Oil K75
Pennzoil Co.	Hyd. Oil No. 3	Hyd. Oil No. 7
Phillips Petroleum Co.	MM Motor Oil 4020	MM Motor Oil 4040
Shell Oil Co.	Shell Tellus Oil 33	Shell Tellus Oil 71
Skelly Oil Co.	Skelvis SAE 20	Skelvis SAE 50
Standard Oil of Indiana	Amer. Ind. Oil No. 31	Amer. Ind. Oil No. 95
Standard Oil of Ohio	Factovis 52	Factovis 30
Sun Oil Co.	Sunvis 931 Sun R&O 300	Sunvis 999 Sun R&O 950
Sunray DX Oil Co.	502	564
The Texas Co. (TEXACO)	Regal Oil C (R&O)	Regal Oil G (R&O)
Tidewater Oil Co.	Veedol Atlurbric 60	Veedol Atlurbric 77
Union Oil of Calif. (East)	UNAX RX 315	UNAX RX 700
Union Oil of Calif. (West)	Turbine Oil 315	Turbine Oil 1000
Valvoline Oil Co.	Valvoline ETC Oil K-30	Valvoline ETC Oil K-75



*Integral oil filter (shaded areas) is optional equipment. See sections 1.11, 1.12 & 1.13 on reverse side.

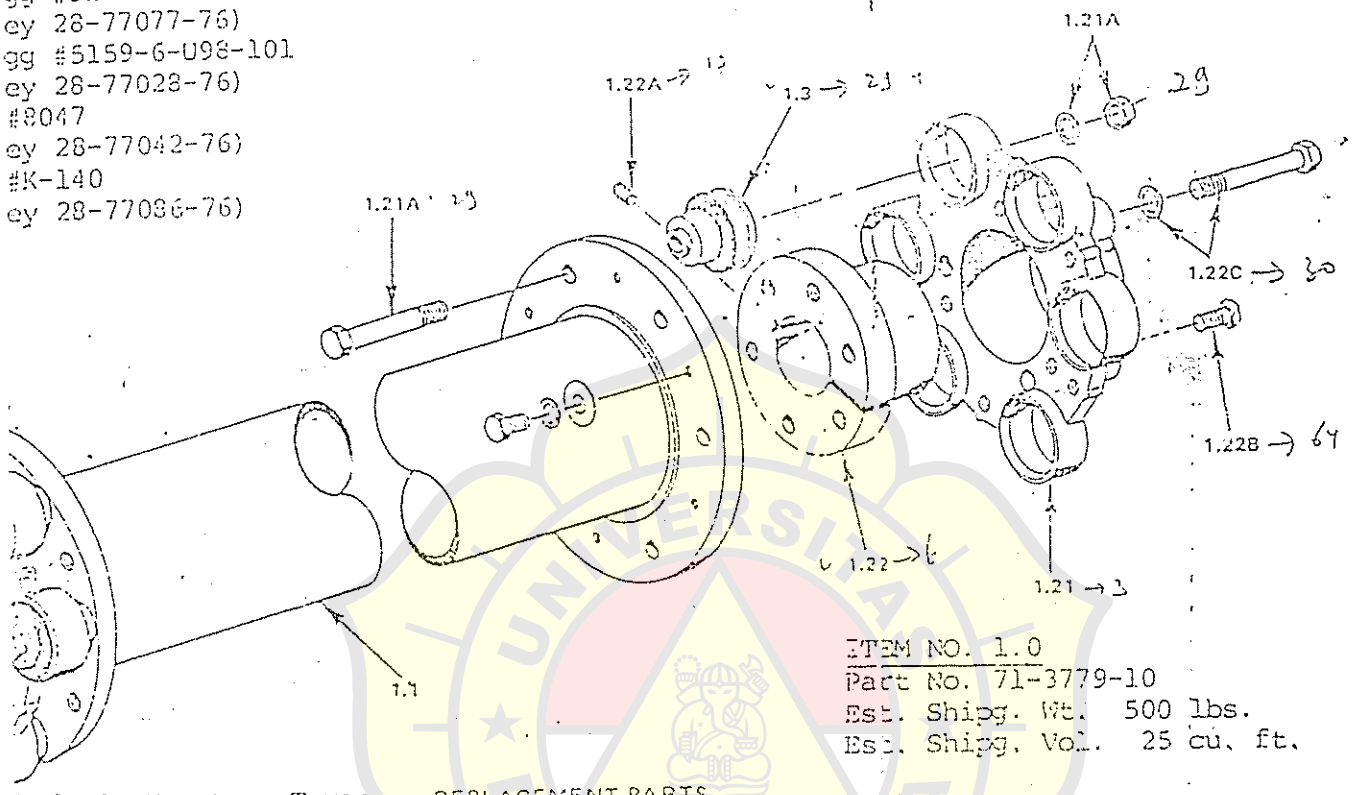
(Not Applicable)

MARLEY PROPOSAL NO: P-77009-77
Date: July 1, 1977 PL-301-C3

MARLEY

PARTS MANUAL SHEET

ellogg Co., Inc. SERIES 301 CLASS III DRIVE SHAFTS
d for following towers: All Stainless Steel
gg #5182-50-U98-101
ey 28-77077-76)
gg #5159-6-U98-101
ey 28-77028-76)
#8047
ey 28-77042-76)
#K-140
ey 28-77086-76)



ITEM NO. 1.0
Part No. 71-3779-10
Est. Shipg. Wt. 500 lbs.
Est. Shipg. Vol. 25 cu. ft.

ked FOB Houston, Texas REPLACEMENT PARTS

1.0 COMPLETE DRIVE SHAFT ASSEMBLY, READY FOR INSTALLATION.

1.1 TUBE AND FLANGE ASSEMBLY.

1.2 YOKE ASSEMBLY, COMPLETE WITH SPLIT TAPERED BUSHINGS, CAP SCREWS, SET SCREWS, MACHINE BOLTS, LOCKWASHERS AND NUTS (GEAREDUCER OR MOTOR END).

1.21 YOKE (TWO REQUIRED PER DRIVESHAFT).

A. MACHINE BOLTS WITH LOCKWASHERS AND NUTS (SIX REQUIRED PER YOKE).

1.22 BUSHING, SPLIT TAPERED (GEAREDUCER OR MOTOR END).

A. SET SCREW (ONE REQUIRED PER BUSHING).

B. SET SCREWS (THREE REQUIRED PER BUSHING)

C. CAP SCREWS WITH LOCKWASHERS (THREE REQUIRED PER BUSHING).

001.3 ach) BONDED RUBBER BUSHINGS, (TWELVE REQUIRED FOR EACH COMPLETE DRIVE SHAFT ASSEMBLY).

NOTE: Complete drive shaft assemblies are dynamically balanced at the factory. When replacement parts are installed, drive shaft must be re-balanced. Refer to Series 301 Service Manual.

When ordering parts always provide original Marley order number and tower serial number. Contact the Marley sales office or representative in your area for assistance.

NOTE: Prices Subject To Change Without Notice.