

M/V MONTE D'ORO - AT 2019
DATES 01-DEC-2019 TO 28-DEC-2019 (DOCKING 01-DEC-2019 TO 28-DEC-2019)
BYZERTE

Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.1	<u>Visite 16000h DA1 / 16000h overhaul auxiliary engine 1</u> ACCOUNT CODE: ENT/2 REQUIREMENTS: Include Cleaning After Include Data/Inspection Report Materials - Owner Supply Survey by Class Representative Survey by Owners Representative Survey by Manufacturers Representative IN CHARGE : Electrician Engineer LOCATION : Local DA *** NOT AUTHORISED *** JOB DESCRIPTION: Visite des 16000h selon scope définie EQUIPMENT DETAILS: Wartsila VASA 6R22 DETAILED LOCATION: Auxiliary engine room deck 1 SPECIFICATION OF WORK 10:Scope 16000h Da en pièce jointe / 16000h aux engine's scope in joint file N.B: Pièces de rechange fournies par le bord. Spare parts delivered by the vessel 20:N.B: Le rodage devra être effectuée avant remise en eau du navire--> Coactivité avec peinture oeuvres vives. Procédure rodage en pièce jointe. The after overhaul will be maid before the vessel will be refloating-->coordination with the painting works. After overhaul procedure in the joint file 30:Visite sous la supervision d'un surveyor agréé Wartsila Overhaul lead by a Wartsila surveyor 40:Nettoyage réfrigérant air selon procédure Wartsila jointe Cleaning of the air cooler according to Wartsila's instructions joint 50:Coter cette visite avec un forfait global qui tient compte de tout le scope et de la logistique nécessaire pour la visite, MO includes:chantier +surveyor+24h de réfrigération eau de mer secours pour rodage en cale sèche si nécessaire (cas ou coussinets paliers remplacés) Fix the price of this overhaul with a global price including the scope and the necessary organisation Including : shipyard + surveyor + 24h of emergency sea water cooling for the after overhaul in dry dock if necessary (if the half-shells have to be replaced)

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Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.1	<u>Visite 16000h DA1 / 16000h overhaul auxiliary engine 1 (cont.)</u> 60:Attention disponibilité du DA rodé avant sortie cale sèche impérative The auxiliary diesel engine must be available before the end of the dry dock  ATTACHED FILES: Charge air cooler cleaning.pdf *Bilan Pièces 8000hdm DA.xls Procédure rodage DA.pdf Woodward ug8.pdf Scope 16000 DA1.doc

figure: 15-3 Water cleaning of charger**15.4 Allowable operation with damaged turbocharger**

In case of a serious breakdown of the turbocharger, a blanking device or a rotor locking device can be fitted according to the instructions in the turbocharger manual, section 3.1.

When the engines are in an emergency situation like this, they are able to operate temporarily at 20% output only in diesel mode. The thermal overload is a limiting factor on the diesel engine. Therefore, the exhaust gas temperatures must be carefully watched during operation with a locked rotor.

The exhaust gas temperature after the cylinder cover must not exceed 500° C.

Note!

Both of the turbochargers on a V-engine must be locked or blanked if one of them fails.

15.5 Maintenance of charge air cooler**15.5.1 General maintenance**

- 1 **Condensate from the air is drained** through a small hole/ pipe (6), [Fig 15-1] , at the bottom of the cooler housing, after the insert, and at the opposite end plate of the air manifold. Examine regularly that the pipe is open by checking the air flow when running.

If water keeps on dripping or flowing from the draining pipe for a longer period (unless running all the time in conditions with very high humidity), the cooler insert may be leaky and must be dismantled and pressure tested.

- 2 **At longer stops**, the cooler should be either completely filled or completely empty, as a half-filled cooler increases the risk of corrosion. If there is a risk of that the water level in the system goes down when the engine is stopped, drain the cooler completely. Open the air vent screw (3), [Fig 15-1] , to avoid vacuum when draining.
- 3 **Clean and pressure test the cooler** at intervals according to chapter [04] ., if the pressure difference over the air side of the cooler is too high or if the receiver temperature cannot be held within stipulated values at full load.
- 4 **Always when cleaning**, check for corrosion.

15.5.2 Cleaning of air cooler

Cleaning of the air side should be done early enough to avoid accumulations of soot and oil on the fins, which form a hard crust that is difficult to remove, as well as a deposition of other crack products that form a sulphuric acid (Compound with condensate) when left on the fins and tubes for some time.

Generally an increase of pressure drop (Δp) over the air side of the cooler with 100 mmH₂O compared to a new/clean cooler means that the cooler needs cleaning. The pressure drop should be measured at 100 % load or at least always at the same high load level. See [Fig 15-1] for connections.

Cleaning of the water and air side heat exchange surfaces is imperative for a long and trouble free operation of the engine and must be done at regular intervals.

15.5.3 Chemical cleaning

- 1 **Remove the support screws (9) and (10)**, see [Fig 15-5] .
- 2 **Remove the cooling water pipes.** Loosen the cooler flange screws and, on an in-line engine, withdraw the cooler until the thread or the hole (7) for the lifting tool is visible. On the V-engine, withdraw the cooler about 300 mm and fit the tool 846025 32.84G02. Screw on the tool by using four of the air cooler fastening screws. Then, withdraw the cooler completely towards the tool stop. If necessary, use screws in the two threaded extractor holes in the flange to loosen the cooler.

3 **Apply the lifting tool (shackle)** and lift off the cooler.

4 **Clean the air side of the cooler** by immersing it in a chemical cleaning bath for at least 24 hours. Recommend cleaning detergents, see section [15.5.4]. We recommend that cleaning tank should be equipped with perforated pipes on the bottom for the best cleaning effect, see [Fig 15-4]. During cleaning steam or pressurised air should be connected to the pipes to get a good circulation.

When cleaning is completed, the cooler should be flushed thoroughly by water.

Note!

The use of a high pressure water jet for flushing, should be avoided because:

- it will pack the dirt into the middle of the cooler.
- the risk of damaging the cooler fins is great.

Both of above will result in an increased pressure drop over the cooler.

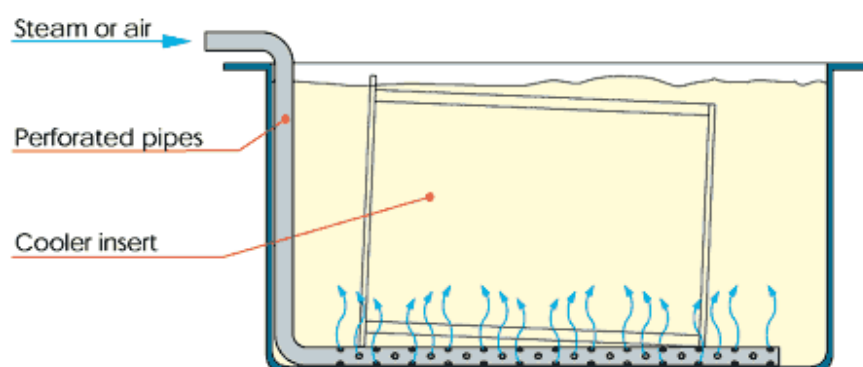


figure: 15-4 Air cooler cleaning tank

5 **Clean the water side** by detaching the headers (4) and (5) from the cooler bundle and immersing the tube bundle into a chemical cleaning bath for at least 24 hours. Upon completion, follow the direction given for the air side.

6 **Change the gaskets** before reassembling the headers.

7 **It is also recommended to pressure test** the cooler before mounting it on the engine.

8 **Mount the cooler on the engine** and tighten the flange screws (8) to stated torque, see section [07.1].

9 **Apply water resistant grease** onto the upper (9) and lower (10) support screws.

10 **Tighten the upper support screws** (9) by hand until the contact to the cooler is reached. Tighten the counter nuts.

11 **Tighten the lower support screws** (10) to a torque of 40 Nm. Tighten the counter nuts.

12 **Vent the cooler** and check the tightness when starting up.

8. Screw
9. Screw
10. Screw

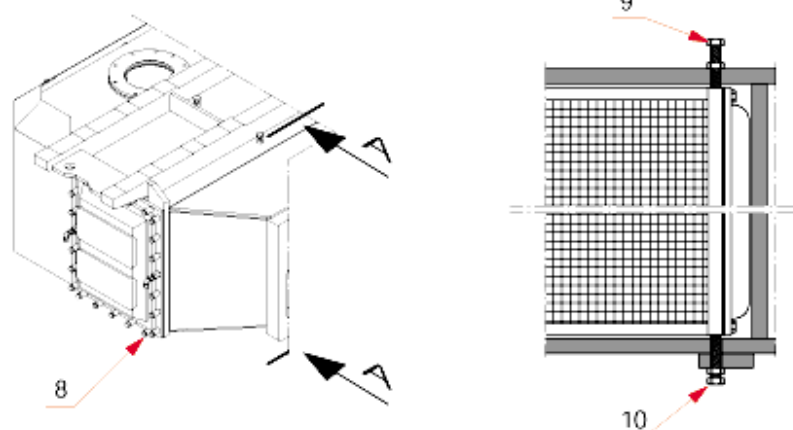


figure: 15-5 Supporting of air cooler

15.5.4 Recommended detergents

The instructions and handling guidelines provided by the manufacturer of the detergent in question should always be observed when using the chemical.

Recommended cleaning detergents	
Supplier	Product designation
Basol Ltd	Basol 77
Clensol Ltd	Industrial Clegris
Drew Ameroid Marine Division Ashland Chemical Company One Drew Plaza Boonton, NJ 07005, USA	Ameroid ACC9
Henkel KGaA Düsseldorf	P3-Grato 90
Houseman Ltd The Priory, Burnham Slough SL 1 7LS, UK	H.D. Powder W.1.H.D.S phenol
Nalco Chemical Company One Nalco Centre Naperville, Illinois 60566 - 1024 USA	Nalfleet ACC
Vecom Holding BV PO Box 27 3140 AA Maassluis, Holland	Vecom B-85

15.5.5 Combi Degreaser Cleaning

When an air cooler is due for cleaning Wärtsilä recommend using the new cleaning method together with the latest type of Wärtsilä Biodegradable cleaning concentrate, Wärtsilä Combi Degreaser, product number C51003.

This Wärtsilä Combi Degreaser concentrate is environmentally friendly not harmful for health, not fire hazardous, does not affect O-rings and gaskets and is not corrosive.

For inquiries and price quotation for the product, contact your nearest Wärtsilä office or Wärtsilä Finland, Service department.

15.5.5.1 Description of the cleaning process

The cleaning effect is based on the new cleaning liquid, Wärtsilä Combi Degreaser, in combination with the flow of the liquid, transporting the dirt out of the cooler.

The work procedure for cleaning the air cooler, airside according to the new procedure is as follows:

- 1 **Dismantle the air cooler from the engine**, see section [15.5.3] , step 1 and 2.
- 2 **Put the air cooler in a suitable stainless steel or plastic tank** with a filterscreen in the bottom (replaceable filter pad).
- 3 **Install the funnel-shaped cover** on the coolers air outlet side.
- 4 **Fill up the tank with the cleaning liquid**, Wärtsilä Combi Degreaser, mixing ratio 1:4 of water.
- 5 **The liquid needs to be heated to about 60°C** for best cleaning effect.
- 6 **Connect a rubber hose from the circulation pump unit** to the cover and a suction hose from the tank.
- 7 **Circulate the liquid for , 4 to 8 hours** depending on degree of fouling.
- 8 **Check the pH value** (it should not exceed 3 for best cleaning result).
- 9 **Flush the cooler with fresh clean water after cleaning.**

Note!

The use of a high pressure water jet for flushing, should be avoided because:

- it will pack the dirt into the middle of the cooler.
- the risk of damaging the cooler fins is great.

Both of above will result in an increased pressure drop over the cooler.

This new procedure can be combined with ultrasonic equipment if available.

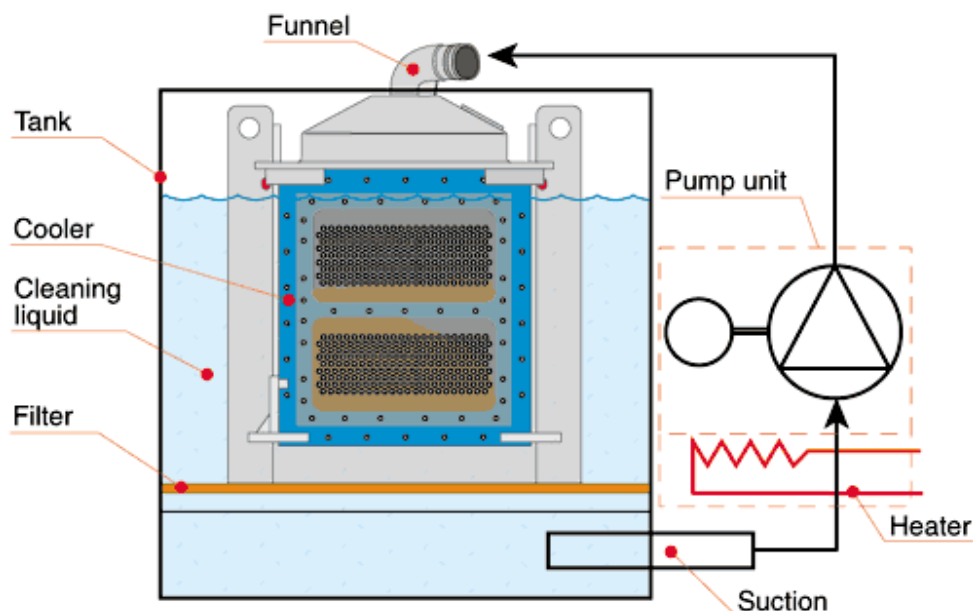


figure: 15-6 Principle schema of the Combi Degreaser cleaning system

15.5.6 Ultrasonic cleaning

Cleaning with ultrasonic equipment will loosen the deposits but it has to be combined with an efficient flushing to remove the deposits from the cooler. It is also important that the correct settings, temperature and detergent is used when cleaning with ultrasonic cleaning.

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Pièces DA2 MORO Selon SPEC VASA 6L22 (6 Cylindres)

Qté dispo au 25/09/17

Pièces systématiques

Pièces conditionnelles

Paliers principaux

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd	C B Q	C B Q		Qté	Désignation	Code Wartsilä
100	1	Coussinets sup	22 100 146	3808			1				2	Pion de centrage palier B	22 100 252
100	1	Coussinets inf	22 100 145	3809			1				4	kit Bague de butée X4	22 100 250
											1	Coussinet palier butée inf su	22 100 013
											8	Coussinets sup	22 100 146
											8	Coussinets inf	22 100 145

Portes de carter

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
107	6	Joint de cache culbuteur	22 107 054	3 651			6				96	Goujons de porte de carter	22 100 254
107	6	Joint de porte de carter AAC	22 107 135	3 673			6				96	Ecrou de porte de carter	22 107 136
107	12	Joint de porte inf	22 107 118	3662			12						
107	1	Joint de carter AAC end	22 107 134	3659			1						
107	1	Joint de couvercle coté VM	22 107 138	3 658			1						
107	2	Joint torique de ppe	22 107 088	3668			2						
107	12	Petit joint de cache culb	22 107 056	3 652			12						

Chemises

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
100	2	Joint de chemise	22 100 041	3806			2				6	Chemise	22 100 325

Bielles

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
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111	1	Jeu de Coussinet de bielles	22 111 159	4 133			1				6	Douille de pied de bielle	22 111 153
111	2	Goujons de bielles	22 111 154	4 128			2				6	Bielles	22 111 150
											12	Ecrout de bielle	22 111 155

Pistons

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
113	1	Kit de 4 sgmt	22 113 115	4 080			1				6	Piston complet	22 113 025
113	2	Circlips	22 113 118	4 081			2				8	Axe de piston	22 113 126

Culasses

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
120	1	Kit de visite culasse	22 120 180	3873			1				32	Guide de soupape	22 120 004
120	4	Vis de fixation culbuteur	22 120 040	3872			4				12	Rotateur echappement	22 120 017
120	2	Goujons d'injecteurs	22 120 039	3857			2				12	Siège d'echapp de culasse	22 120 031
120	2	Ecrous de fixation injecteurs	22 120 041	6015			2					Siège d'echapp +2	
120	2	soupape d'echap	22 121 015	9311			2				12	Joint de siege echapp	22 120 032
120	2	soupape d'admission	22 121 020	75414			2				24	Joint de siege echapp	22 120 033
											16	Siege d'admission	22 120 030
100	32	Joint de tirants de culasse	22 100 018	3820			32				5	Kit de visite culasse	22 120 180
											10	soupape d'echap	22 121 015
											10	soupape d'admission	22 121 020
											12	Grain mobile de palonniers	22 143 064
											12	Ecrout de grain palonniers	22 143 065
											12	Grain mobile de culbuteur	22 143 005
											12	Ecrout de grain culbuteur	22 143 006
											12	Douille de culbuteur	22 143 003
											2	Circlips de Culbuteur	22 143 017

Culasses

145	1	joint de couvercle sup	22 145 012	3928			1				12	galet complet	22 145 001
145	1	joint de couvercle inf	22 145 013	4692			1						
145	1	petit joint torique	22 145 024	3924			1						
145	1	Kit de pieces galet	22 145 003	6016			1						

Culasses

125	1	Kit de joint pour robinet	22 125 447	4091			1				6	robinet	22 125 445
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										5	Kit de joint pour robinet	22 125 447
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Arbre à cames													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
							0				6	Douille d'AAC	22 108 030
							0				2	Douille d'AAC	22 108 031
							0				8	Joint torique	22 108 036
											1	Joint	22 108 035
							0				2	Joint torique	22 108 037
											1	Pignon arbre à came	

Injection / Combustible														
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä	
165	6	Kit de visite de ppe	22 165 110	4111			0				6	Galet	22 165 078	
165							0				6	circlips	22 165-073	
165	6	Kit Element de pompe	22 165 060	4096			0				6	chapeau	22 165-081	
165	6	Ressort	22 165 062	4106			0				6	coupelle inf	22 165-075	
165	6	Ressort	22 165 063	4105			0				6	vis	22 165-068	
165	6	Kit de cale	22 165 080	76449			0							
											6	Tuyau d'injection	22 167 161	
165	6	Nez d'injecteur	22 167 151	3883			6				6	Cane d'injection	22 167 153	
167	6	Joint interne	22 167 145	3881			6							
167	18	Joint sup corps X3	22 167 160	4692			18							
167	6	Joint inf corps X1	22 167 159	496			6							
167	12	Pion de centrage	22 167 140	3893			12							
	6	Ressort de tarage	22 167 147	3882			6							
Injecteurs	0	quantité déjà en stock à bord.												

Pompes ED BT HT													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
107	2	Kit de visite ppe	22 191 232	77 453			2				2	Pompe complète BT	22 191 040

Vanne thermostatique BT													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
183	2	Joint torique	22 196 165	504			2						
183	3	Joint torique	22 196 164	368			3						
183	1	Joint torique	22 196 163	1021			1						
183	1	Element thermo	22 196 166	1024			1						
183	1	Element thermo	22 196 167	NC			1						
183	1	Element thermo	22 196 168	1025			1						
183	1	Element thermo	22 196 169	NC			1						
183	2	Joint torique	22 196 181	373			2						

Vanne thermostatique HT													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
196	2	Joint torique	22 196 402	3 983			2						
196	1	Joint Plat	22 196 404	3982			1						
196	2	Joint Plat	22 196 420	3981			2						
196	2	Joint Plat	22 196 025	NC			2						
196	1	Element thermo	22 196 103	NC			1						
196	2	Joint torique de tige	32 196 274	1077			2						

Pompes à Huile														
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd					Qté	Désignation	Code Wartsilä
181	1	Joint	22 181 114	652			1					5	Douille palier	22 181 101
181	1	Joint	22 181 115	653			1							
181	1	Joint	22 181 030	648			1							
181	1	Rondelle frein	22 181 111	NC			1							
181	1	Joint de reglante	22 181 007	3 928			1							
181	1	Joint cuivre de soupape	22 181 010	4 086			1							
181	1	Bille	22 181 014	76 992			1							
181	1	ressort	22 181 013	NC			1							

Vanne thermostatique huile													
ORGANE		Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
183	1	Joint torique	22 183 015	24679			1						
183	1	Joint torique	22 183 007	194			1						
183	1	Joint	22 183 104	NC			1						
183	3	Joint	22 183 120	NC			3						
183	2	Sealing ring	22 183 006	3 983			2						
183	1	Element sensible	22 183 013	NC			1						

Echappement													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
511	6	thermometre ech	22 511 140	789			6				1	Compensateur	22 200 180
511	6	Joint	22 511 102	393			6				1	Compensateur	22 200 181
											2	Compensateur	22 200 253
											2	Joints	22 200 185
											2	Joints	22 200 135
											4	Joints	22 200 255

Tuyauterie eau													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
355	6	Joint plat	22 354 105	3991			6						
355	4	Joint plat	22 354 129	24680			4						
355	4	Joint plat	22 354 101	77018			4						
355	4	Joint plat	22 354 119	4005			4						
355	4	Joint plat	22 354 117	4008			4						
355	6	Joint torique	22 355 034	3999			6						
355	12	Joint torique	22 355 068	NC			12						
355	2	Joint plat	22 355 118	4539			2						
355	2	Joint plat	22 355 220	4538			2						
355	2	Joint plat	22 355 254	3998			2						

355	2	Joint plat	22 355 087	4008			2					
355	2	Joint plat	22 355 094	3991			2					
355	2	Joint plat	22 355 096	3995			2					
355	2	Joint torique	22 355 098	3986			2					
355	2	Joint plat	22 355 460	NC			2					

Tuyauterie combustible													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
350	24	Joint de pompe	22 350 213	3886			24						
350	4	Joint de tuyau de pompe	22 350 220	4086			4						
165	6	Petit joint	22 165 146	4098			6						
358	24	Joint de retour	22 358 187	543			24						
358	12	joint de rampe	22 358 179	541			12						
358	12	Joint troique du circuit	22 350 207	153			12						

Tuyauterie d'huile													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
352	2	Joint torique	22 352 031	3832			2						
352	2	Joint torique	22 352 034	4021			2						
352	5	Joint torique	22 352 069	24679			5						
352	5	Joint plat	22 352 333	4020			5						
352	/	joint torique	22 352 024	4022			6						
352	2	Joint plat	22 352 334	4014			2						
352	12	Joint torique de rampe d'huile	22 352 300	4011			12						

Tuyauterie air													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä

Lancement													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
123	1	Joint de sppe de lct sur cul	22 123 066	4 086			1				6	sspe complete	22 123 065
123	1	Joint de sppe de lct sur cul	22 123 071	38			1				12	Vis de fixation sppe	22 123 069
											1	Joint de distributeur	22 211 007
											6	doigts	22 211 003
											6	douille	22 211 002
											6	Joints	22 211 005

Vibration Damper													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
		kit de prelevt	## ### ###										

Refrigérant Air sural													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
156	1	Joints	22 156 035	4 170			2						
156	2	Joints	22 156 036	4 171			4						
476	1	Joint plat	22 476 021	4 198			2						
476	1	Joint plat	22 476 020	4 197			2						
476	1	Joint plat cassette	22 476 040	4 199			2						

Refrigérant D'huile													
ORGANE	Qté	Désignation		Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä

476	4	Joint Torique	22 474 024	4 194			8					
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Refrigerant ED

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
	2	Jeu joints réfrigérant		3 964			2						

Divers

ORGANE	Qté	Désignation		Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
	1	servo-booster		DNCD 11286			1						
	12	thermometre echappement		789			12						

					A cmder cond selon moi
Code Gestech	Qté dipo mag	Qté dispo bord	C B Q	CB QM N	
76984					2
3812					4
3810					1
3808					8
3 809					8

Code Gestech	Qté dipo mag	Qté dispo bord			
33					96
76 972					96

Code Gestech	Qté dipo mag	Qté dispo bord			
3805					6

Code Gestech	Qté dipo mag	Qté dispo bord			

4 130					6
4 134					6
4 131					12

Code Gestech	Qté dipo mag	Qté dispo bord			
4 078					6
4 079					8

Code Gestech	Qté dipo mag	Qté dispo bord			
3863					32
NC					12
3865					12
77 021					
3 866					12
6 473					24
3 864					16
3 873					5
9311					10
75414					10
3937					12
3942					12
3935					12
3931					12
3931					12
3939					2
NC					12
175					6

4091					5
------	--	--	--	--	---

Code Gestech	Qté dipo mag	Qté dispo bord			
178					6
4120					2
1023					8
4019					1
4117					2
3875					1

Code Gestech	Qté dipo mag	Qté dispo bord			
4110					6
5929					6
4115					6
4107					6
4099					6
3894					6
3879					6

Code Gestech	Qté dipo mag	Qté dispo bord			
4065					2

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			
76993					5

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			
4063					1
NC					1
4062					2
4060					2
4061					2
6374					4

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			
4 083					6
4 082					12
6024					1
4055					6
4056					6
556					6

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

--	--	--	--	--	--

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Pièces pour visite du MP 1

WARTSILÄ type 12V32D

sens horaire

Fait le : 20/12/2011

ORGANE	Quantité à commander	Code Gestech	Désignation	Code Wartsilä	Stock bord	Stock terre
100		31	jeu de joints pour vérins	32 100 050	2	19
107		70	joint torique	32 107 123		54
377		569	joint torique pour porte anti-déflagration	32 377 002	6	4
377		NC	ressort	32 377 001		
107		37	écrou de portes de carter	32 107 041	10	8
107		690	toriques porte de distribution	32 107 038		31
100			goujon	32 100 088		
jeu de 2 demi paliers (32100096+32100097)		17877	coussinet supérieur de palier principal	32 100 096		5 jeux complets
			coussinet inférieur	32 100 097		
100		36708	coussinets de palier butée	32 100 113		1
100		4411	patins de butée	32 100 112		2
100		17929	bague anti polissage	32 100 156		2
100		53	joint torique	32 100 111		12
100		51	torique	32 100 109	13	24
120		121	water jacket de chemise (étanchéité chemise culasse + passage d'eau)Fuite importante sur MP1 ET 4	32 120 008		5
120		51	torique de water jacket	32 120 006		
100		52	Chemise complète	32 100 110		5
111		10102	coussinet de tête de bielle supérieur	32 111 004		

		10103	coussinet de tête de bielle inférieur	32 111 005		
111		107	douille axe de piston	32 111 002		4
111		109	tirant de tête de bielle	32 111 008		4
111		108	ecrou de tirant de tête de bielle	32 111 006		30
111		NC	bielle complète	32 111 003		
113		4479	jeu de segments	32 113 013	2	11
113		48111 (flotte)	torique	32 113 004		20
113		5971	piston complet	32 113 025	1	
113		46667	jupe de piston	32 113 021	1	
113		115	axe de piston	32 113 014		1
113			goujons de tete de piston	32 113 008		18
113			ecrous de tete de piston	32 113 009		5
120		4432	culasse complete	32 120 060	2	7
120		146	jeu complet joints pour culasse	32 120 070		46
120		36792	siege pour soupapes échappement cote reparation +1	32 120 009		
121		4460	rotocap admission/ échappement)	32 121 030		4
120		131	Guide de soupape (admission/ échappement)	32 120 022		6
121		152	demi lune	32 121 002	21	126
121		153	torique	32 121 004	48	106
107		64	torique pour capot culbuteur	32 107 011	25	20
121		162	soupape admission	32 121 010		7
121		154	soupape echappement	32 121 006		8
200		4509	colliers echappement	32 200 025	16	
200		657	vis pour collier echappement culasse	32 200 026	10	18
200		658	ecrou pour collier	32 200 027		12
200		659	vis	32 200 028	8	44
200		394	frein d'ecrou de colliers échappement	32 200 188		38

123		170	jeu de joints pour soupapes de lancement	32 123 035	2	6
125		172	joints pour soupape sureté	32 125 002		2
125		176	pour joints décompresseur	32 125 447	2	
355		510	torique de manchette ED HT	32 355 112	21	89
355		507	torique de manchette ED HT	32 355 109	52	32
355		NC	Bride de manchette	32 355 110		28
511		789	thermomètre échappement de culasse	32 511 101	7	6
511		393	joint de thermometre echappement	32 511 102	101	40
100		41	ecrou pour tirant culasse	32 100 091	5	76
100		44	tirant de culasse	32 100 094		8
143		nc	douille de culbuteur	32 143 005		41
143		185	circlips	32 143 031		108
143		180	culbuteur complet	32 143 035		6
507		788	doigt de gant de sonde de température d'échappement	32 507 041		1
107		690	torique de porte d'arbre à cames	32 107 038		31
148		6289	Troncon d'arbre à came ligne A sens horaire	32 148 001	1	2
148		6290	Troncon d'arbre à came ligne B sens horaire	32 148 002		1
148		206	Vis pour troncon	32 148 013	40	24
148		NC	téton de centrage	32 148 009		78
148		NC	torique pour téton	32 148 010	2	52
148		36858	palier arbre à cames	32 148 011		
145		192	torique pour guide	32 145 008	49	16
145		194	torique	32 145 010	83	10
145		74	torique	32 145 003		12
145		4476	Galet	32 145 013		15
145		199	bague	32 145 014	3	27
145		200	axe de galet	32 145 015		23
120		262	ecrou nylstop de culbuteur	32 120 032	7	100

165		36916	jeu de joints pour remise en état d'une pompe à injection (bouchons d'érosion inclus)	32 165 178	1	
100		262	ecrou d'assise de pompe	32 100 099		
167		3886	torique	32 167 032		27
167		3885	torique de canne	32 167 033	54	
350		153	torique de lyres de pompe	32 350 018	48	106
228		463	torique	32 228 101		4
228		468	torique	32 228 106		8
228		NC	pipe union	32 228 105		
228		465	ressort	32 228 103	1	24
228		NC	corps de vérin	32 228 102		17
167		274	jeu de joints pour injecteur	32 167 046	13	29
167		261	nez d'injecteur	32 167 020		46
167		270	poussoir injecteur	32 167 011		52
167		271	goupilles	32 167 012		98
181		652	joint de bride	32 181 160		1
pour reconditionnement ppe à huile attelée en atelier		287	paliers	32 181 101		12
		291	torique	32 181 157		4
		652	joint	32 181 160		1
181		329	torique	32 181 171	8	7
181		38	torique	32 181 166	20	80
181		556	joint cuivre	32 181 162		1
473		595	jeu de joints pour glacier	32 473 040	6	3
471		593	kit de joints pour 3 filtres huile (entrée /sortie bati des filtres)	32 471 235		
183		3983	torique	32 183 020	4	47
183		NC	torique	32 183 027		
183		1043	element sensible	32 183 025	4	6
183		19426	joints de vanne	32 183 024		5
196		3983	torique	32 196 251		
196		1077	torique	32 196 274	12	18
196		4695	element sensible	32 196 264	7	12
196		356	joints de vanne	32 196 258	4	1

196		NC	torique	32 196 271		
196		NC	torique	32 196 275		
196		370	element sensible	32 196 166		4
196		NC	joints de vanne	32 196 273		
pour reconditionnement ppe ED attelée en atelier		6454	roulement	32 191 009		1
		338	roulement	32 191 010		7
		343	garniture	32 191 015		6
		348	torique	32 191 052	2	9
		32897	rouet pour moteur CCW	32 191 058		3
pour reconditionnement ppe ED attelée en atelier		6454	roulement	32 191 009		
		338	roulement	32 191 010		
		343	garniture	32 191 015		
		348	torique	32 191 052		
		32897	rouet pour moteur CCW	32 191 058		
200		3358	soufflet echappement dans sarcophage moteur	32 200 137	1	10
200		381	collier pour soufflet	32 200 014	2	1
200		382	vis	32 200 015	8	
200		164	ecrou de collier	32 200 016	26	46
476		4634	joint de plaque (2 réfrigérants)	32 476 005		5
476		4635	Joint	32 476 006	3	4
476		4633		32 476 004	2	5
211		399	tiroir pilote	32 211 007		3
211		400	ressort	32 211 008		7
211		NC	torique	32 211 016		
211		NC	entretoise	32 211 013		
217		4512	disque	32 217 008		
217		NC	ressort	32 217 004		
217		4513	joint	32 217 003	7	11
217		NC	ressort	32 217 030		
217		37070	torique	32 217 025	5	7
217		4515	torique	32 217 029		3
217		429	spare part for bonnet assembly and sealing set	32 217 046	4	3

357		38	torique	32 357 007		
357		536	torique	32 357 163		32
357		531	torique	32 357 001	26	80
357		4584	pipe air	32 357 002		13
357		NC	pare flamme	32 357 011		1
357		329	torique	32 357 012	8	7
378		38	torique	32 378 002		
378		27211	clapet	32 378 006		10
228		NC	torique	32 228 042		
228		NC	torique	32 228 043		
228		480	ressort	32 228 004		
228		6045	torique	32 228 024		
228		NC	torique	32 228 019		
228		48388	ressort intérieur	32 228 239		2
228		72145	ressort extérieur	32 228 240		2
214		408	torique	32 214 005	1	1
214		409	torique	32 214 006	2	27
358		543	joint	32 358 154		30
110	2	NC	torique	32 110 066		
110	2	NC	torique	32 110 067		
110	1	NC	torique	32 110 019		
110	1	NC	torique	32 110 023		

Qmn	Qstk	
175	1	27
176	2	8
207	2	19
256	2	2
294	2	19
300	0	0
305	1	2
306	1	1
556	2	7
573	16	122
1077	4	1
3651	2	2
3818	0	0
3846	0	0
3928	10	17
3931	0	16
3937	0	0
3939	0	48
3942	0	0
4041	0	3
6020	1	20
6374	4	63
16123	0	0
20633	0	0
23001	0	0
23956	2	0
33252	0	0
33635	0	18
33907	1	21
33946	0	20
34388	0	0
40416	1	0
40417	0	0
40418	0	0
40422	0	0
40428	0	0
40433	4	12
40444	0	0
40452	0	10
40472	0	
40486	0	0
40491	0	0
40493	0	0
40494	0	0
40498	0	1
40511	0	8
40512	0	0
40514	0	0
40516	0	0
40517	0	0

40519	0	0
40520	0	0
40523	0	0
40525	0	0
40537	0	0
40538	1	3
40539	2	3
40540	0	0
40542	0	9
40566	0	0
40567	0	0
40622	0	17
40646	0	0
40653	0	0
40677	0	0
40687	0	0
40693	8	0
40694	9	9
40698	8	0
40700	8	10
40701	8	9
40713	2	1
40723	0	0
40725	0	0
40730	0	0
40736	0	0
40742	0	0
40744	0	0
40747	0	0
40750	0	0
40755	0	0
40756	0	0
40757	0	0
40759	0	0
40761	1	1
40776	1	3
40788	0	0
40790	0	0
40791	0	0
40794	0	0
40795	0	90
40798	0	100
40812	0	0
40816	0	3
40834	0	0
40858	0	0
40859	0	0
40873	0	0
40879	0	0
40880	0	0
40881	0	0

40935	0	0
41012	0	0
41028	0	2
41042	0	0
41043	0	0
41056	0	0
41157	2	2
41158	0	0
41264	0	0
41324	0	1
41328	0	16
41329	0	16
41331	0	0
41332	0	0
41333	0	0
41336	2	0
41340	2	12
41342	0	2
41343	0	2
41345	0	0
41351	0	7
41365	0	1
41366	0	2
41369	0	0
41370	2	0
41373	2	0
41468	0	0
41469	0	0
41479	0	0
41481	1	2
41482	1	2
41494	0	1
41495	0	1
42160	1	2
42166	2	4
42168	1	1
42171	1	0
42173	0	0
43094	0	2
48168	0	4
48169	0	0
74653	0	1
76975	8	0

NC

1 **Clean the centrifugal lubricating oil filters.** If the deposits are thicker than 20 mm, reduce the cleaning interval to retain filtering efficiency. Maximum deposit capacity is 40 mm.

2 **Keep the injection pump racks clean** (free from sticky deposits), check that the parts of the fuel control shaft system move easily. Is to be done on a stopped engine.

3 **Clean the turbine side of the turbocharger** by injecting water. See chapter [15] and the instruction book of the turbocharger.

03.3.3 Once a month or after every 500 running hours

1 **Check content of additives** in the circulating water.

2 **Check the cylinder pressures.** At the same time, note the load of the engine (the position of the load indicator or the injection pump racks offers an accurate measure of the engine load).

Note!

Measurement of cylinder pressures without simultaneous notation of the engine load is practically worthless.

3 **Check the function** of the load dependent "inverse" cooling system with engine loaded below 30 % of rated output.

03.3.4 In connection with maintenance work

1 **Record the following steps** and the running hours in the engine log:

- lubricating oil sampling (record also operating time of oil). Lubricating oil analyses without statement of operating time is of limited value ("go - no go" only),
- lubricating oil changes,
- cleaning of centrifugal lubricating oil filters,
- change of lubricating and fuel oil filter cartridges,
- change of parts in connection with maintenance according to chapter [04] .

03.3.5 General

1 **There is no automatic supervision** or control arrangement that can replace an experienced engineer's observations. LOOK at and LISTEN to the engine!

2 **Forms**, "Operating data" and "Service Report", are delivered with every installation. Use them!

3 **Strong gas blow-by** past the pistons is one of the most dangerous things that can occur in a diesel engine. If gas blow-by is suspected (e.g. because of a sudden increase of the lubricating oil consumption) check the crankcase pressure. If the pressure exceeds 30 mm H₂O, check the crankcase venting system, if in order, pull the pistons!

4 **Operation at loads below 20 %** of rated output should be limited to maximum 100 hours continuously when operating on heavy fuel by loading the engine above 70 % of rated load for one hour before continuing the low load operation or shutting down the engine. Continuous operation on marine diesel fuel at loads below 10 % of rated output should be limited to maximum 100 hours by loading the engine by more than 70 % of rated output for one hour before continuing the low load operation or shutting down the engine.

Idling (i.e. main engine declutched, generator set disconnected) should be limited as much as possible. Warming-up of the engine for more than 3 - 5 minutes before loading, as well as idling more than 1 minute before stopping is unnecessary and should be avoided.

03.4 Start after a prolonged stop (more than 8 h)

03.4.1 Manual start

1 **Check**

- the lubricating oil level,
- the circulating water level in the expansion tank,
- the raw water supply,
- the fuel oil level in the day tank (troublesome and time consuming job to vent the fuel system if the feed pump has sucked air!),
- the starting air pressure - minimum 15 bar,
- that the control shaft system and the injection pump racks move freely. Otherwise **risk of overspeed**.

2 **Observe all points** in chapter 03 pos. [03.1.1] . **Point 3 grows more important the longer the engine has been stopped.**

3 **After starting,** check that the starting air distributing pipe is not heated at any cylinder (leakage from the starting valve).

4 **Vent fuel and lubricating oil filters.**

03.5 Start after overhaul

1 **Check that the connection** between the speed governor, overspeed trip and injection pumps is set correctly (especially the injection pump rack position) and does not jam, and that all connections are properly locked and the injection pump racks move freely in the pumps.

2 **The speed governor control lever** being in maximum position and the stop lever in work position, release the overspeed trip manually. Check that all injection pump racks move to a value less than 4 mm.

3 **If the injection pumps,** camshaft or its driving mechanism have been touched, check the injection timing. If the camshaft or its driving mechanism have been touched, check the valve timing of one cylinder, at least (on each cylinder bank in a V-engine).

4 **Check the cooling water system** for leakage, especially:

- the lower part of the cylinder liners,
- the oil cooler,
- the charge air cooler.

5 **Check/adjust the valve clearances.** Guidance values, see chapter [06] .

6 **Vent the fuel oil system** if it was opened.

7 **Start the priming pump.** Vent the lubricating oil filters. Check that lubricating oil appears from all bearings and lubricating nozzles, from the piston cooling oil outlet and from the valve mechanism. Check that there is no leakage from the pipe connections inside or outside the engine.

8 **Rags or tools left in the crankcase,** untensioned or unlocked screws or nuts (those which are to be locked), worn-out self-locking nuts, MAY CAUSE total breakdown.

Well cleaned oil spaces (oil sump and camshaft spaces) save the oil pump and oil filter.

9 **See the instructions** in section [03.1] and [03.4] when starting.

03.6 Operation supervision after overhaul

1 **At the first start,** listen carefully for possible jarring sounds. If anything suspected, stop the engine immediately, otherwise stop the engine after 5 minutes' idling at normal speed. Check at least the temperatures of the main and big end bearing and of all other bearings which have been opened.

If everything is in order, restart.

2 **Check that there is no leakage** of gas, water, fuel, heating oil or lubricating oil. Especially observe the fuel lines, injection pumps and injection valves. Watch the quantities emerging from the leak oil pipes!

3 **Check that the starting air distributing pipe is not heated** at any cylinder (leaky starting valve). May cause **explosion!**

4 **After overhauling,** the following instructions are especially important:

- check pressure and temperature gauges,
- check the automatic alarm and stop devices,
- check the pressure drop over the fuel filter and lubricating oil filter,
- check the oil level in the oil sump/oil tank. Estimate the condition of the oil,
- check the ventilation of the engine circulating water system,

- check the quantity of leak fuel,
- check the gossip holes of the coolers,
- check the content of additives in the circulating water,
- check the cylinder pressures,
- listen for jarring sounds,
- check the crankcase pressure,
- check the starting air pipes,
- vent the filters.

03.7 Running-in

The running-in of a new engine must be performed according to programme B in [Fig 03-2] . It is also recommended that running-in procedure is performed after following maintenance jobs.

1 After piston overhaul, follow programme A in [Fig 03-2] , as closely as possible. The piston rings have slid into new positions and need time to refit. If the program cannot be followed, **do not load the engine fully for 4 h, at least.**

2 After changing piston rings, pistons or cylinder liners, after honing of cylinder liners, follow programme B in [Fig 03-2] , as closely as possible.

If the program cannot be followed, **do not load the engine fully for 10 h, at least.**

Avoid "running-in" at continuous and constant low load!

The important thing is to vary the load several times. The ring groove will have a different tilting angle at each load stage, and consequently the piston ring a different contact line to the cylinder liner.

The running-in may be performed either on distillate or heavy fuel, using the normal lubricating oil specified for the engine.

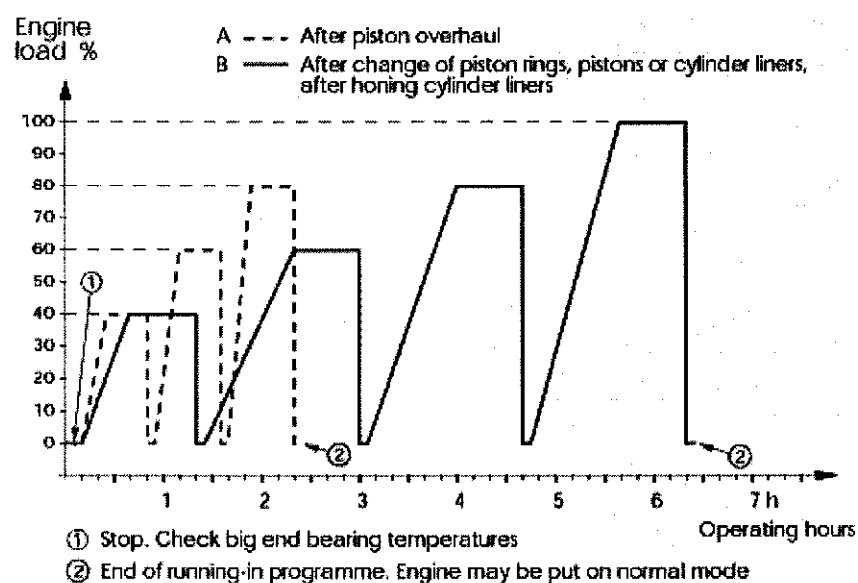


figure: 03-2 Running-in programme

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04 Maintenance Schedule

version : 04-9845-03

04.1 General

The maintenance necessary for the engine depends on the operating conditions in the main. The periods stated in this schedule are guidance values, only, but must not be exceeded during the guarantee period. When using diesel oil or intermediate fuels of comparatively good quality as fuel oil it may be possible to lengthen the stated maintenance intervals considerably depending on the engine load. See also the instruction books of the turbocharger and the governor, separate instructions for additional equipment and chapter [03] .

1 Before any steps are taken, carefully read the corresponding item in this manual.



Installation and Operation Manual



UG Dial Governor

UG-5.7/UG-8/UG-10 Dial

Manual 03040D

**WARNING**

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

**CAUTION**

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.

**IMPORTANT DEFINITIONS**

WARNING—indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION—indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment.



NOTE—provides other helpful information that does not fall under the warning or caution categories.

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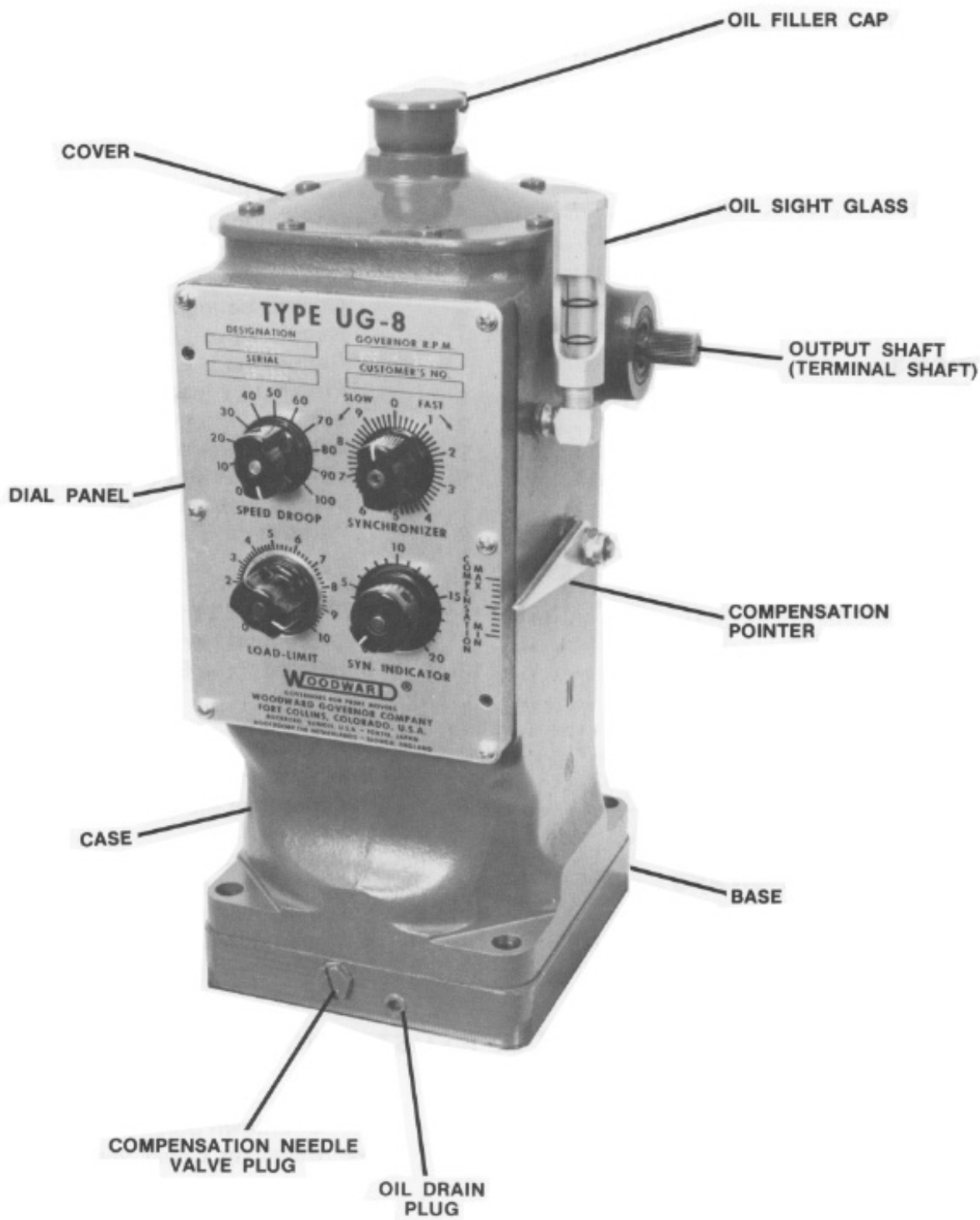


Figure 1-1. UG-8 Dial Governor

Chapter 1.

General Information

Introduction

The UG Dial governor is available in three different work outputs:

- UG-5.7—7.1 N·m (5.2 lb-ft)
- UG-8—13.2 N·m (9.7 lb-ft)
- UG-10—15.9 N·m (11.7 lb-ft)

The UG-5.7 and UG-8 both use 827 kPa (120 psi) oil pressure, and the UG-10 uses 1034 kPa (150 psi).

Basic operation, adjustment, troubleshooting, and replacement of parts are similar for the UG-5.7, UG-8, and UG-10.

Description

The UG is a mechanical-hydraulic governor for controlling diesel, gas, or dual fuel engines, or steam turbines. The UG is mechanically linked to the fuel racks or to the fuel valves, depending on the system.

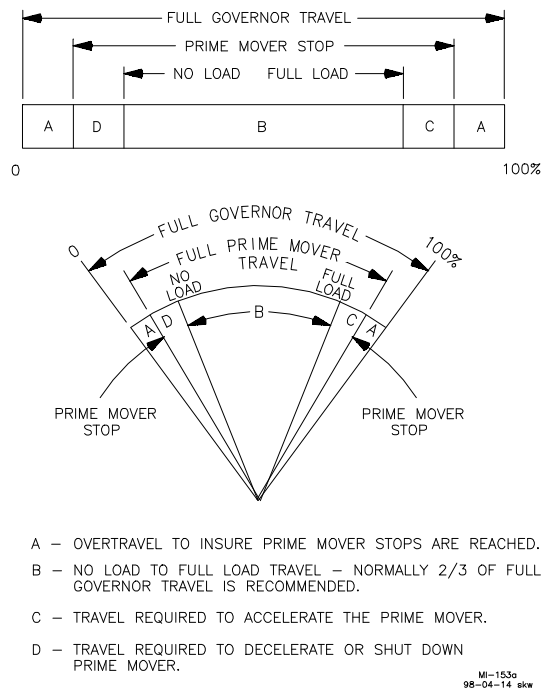
The maximum travel of the output (terminal) shaft is 42°. The recommended travel of the output shaft is 28° from no load to full load, which allows sufficient overtravel at each end so that the governor can shut down the prime mover and also give maximum fuel when required. See Figure 1-2 for recommended output shaft travel adjustment.

Normally, the UG operates isochronously (constant speed) regardless of load on the engine, except as described in Chapter 3, Principles of Operation.

Speed droop is incorporated in the UG Dial governor to divide and balance load between units driving the same shaft or paralleled in an electrical system.

A load limit control is also a standard feature on the UG Dial governor. It limits the amount of fuel supplied by restricting the travel of the governor output shaft. An indicator dial shows the governor output shaft limit position.

The load limit control may also be used for shutting down the prime mover by turning it to zero.



MAXIMUM WORK CAPACITY OVER FULL GOVERNOR TRAVEL OF 42" IS * . SEE ABOVE FOR RECOMMENDED GOVERNOR OUTPUT TRAVEL. IN SPECIAL APPLICATIONS MIN AND MAX PRIME MOVER STOPS MAY BE OUTSIDE THE GOVERNOR STOPS.

* UG-5.7—7.1 N·m (5.2 lb-ft)

* UG-8—13.2 N·m (9.7 lb-ft)

* UG-10—15.9 N·m (11.7 lb-ft)

Figure 1-2. Recommended Output Shaft Travel Adjustment

References

The publications listed below are available on Woodward's website (www.woodward.com). Some of the manuals are briefly covered in Chapter 7, Auxiliary Equipment.

Pub. Type	Pub. Number	Title
Manual	03013	Shutdown Solenoid for UG Governors
Manual	03016	Low Lube Oil Pressure Shutdown for UG Governors
Product Spec.	03029	UG-5.7/8/10 Governor
Manual	03035	PM Speed Adjusting Motor
Manual	03505	Speed Adjusting (Synchronizing) Motor Parts Catalog and Lubrication Guide
Manual	25071	Oils for Hydraulic Controls
Manual	25075	Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls
Manual	36052	Magnetic Speed Pickup for PG, UG-8, and UG-40 Governors
Manual	36684	Booster Servomotor
Application Note	50516	Governor Linkage for Butterfly Throttle Valves
Repair Manual	56103	UG Dial Governor Repair Procedure

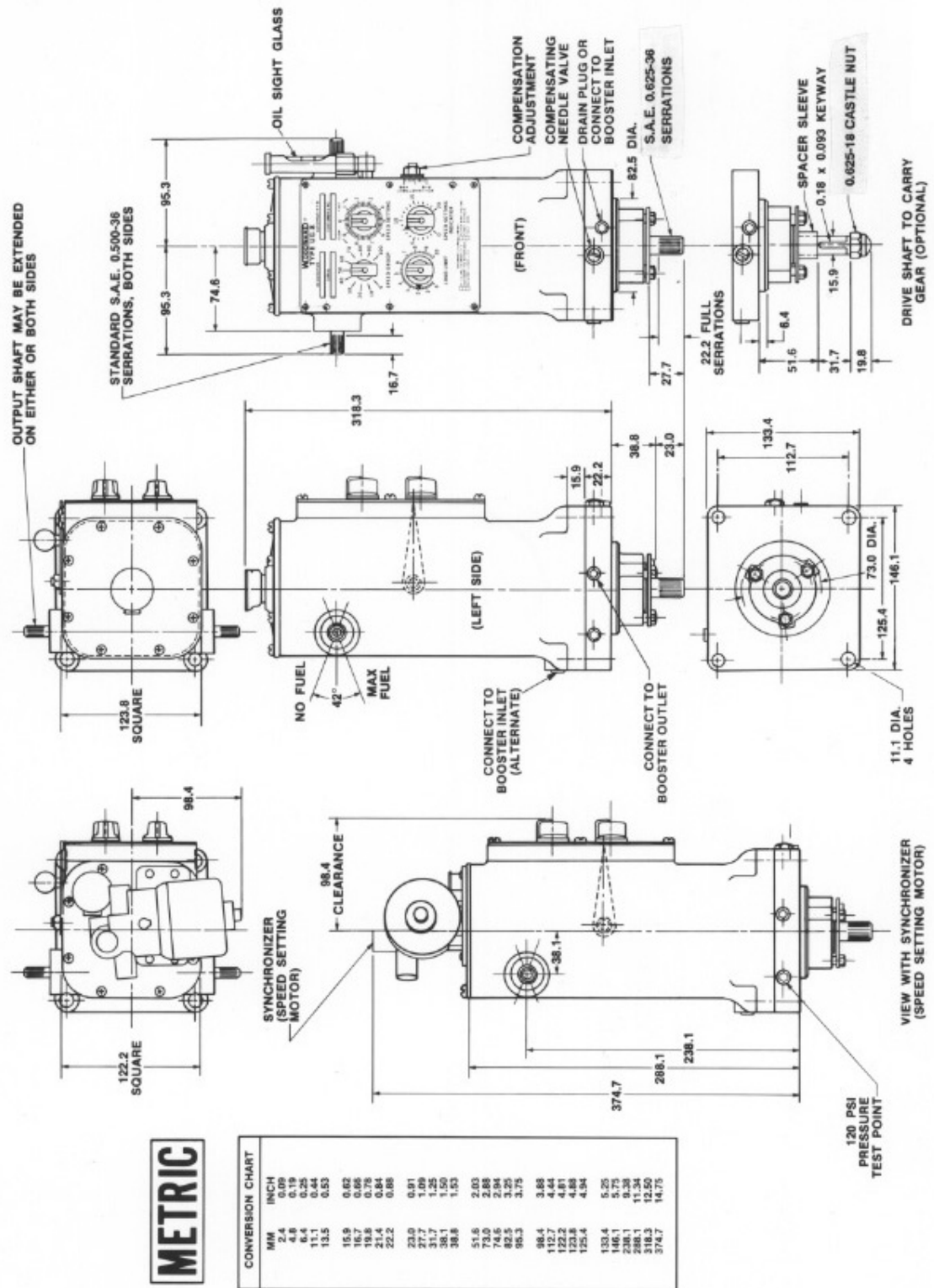


Figure 1-3. UG Dial Governor Outline Drawing

Chapter 2. Installation Procedures

Introduction

This chapter provides information necessary for receiving, storage, mounting, and start-up adjustments.

Receiving

When you receive your UG governor, it will be bolted to a wooden platform in a vertical position. After testing the governor at the factory, it is drained of oil. This leaves a light film of oil covering the internal parts, preventing rust. No internal cleaning is required before installation.

Some drive shafts are sprayed with a light film of oil while others (depending on customer requirements) are covered with soft seal. Before installation, remove the soft seal with a rag saturated with mineral spirits.

Storage

If a governor is being stored for any period of time, please refer to Woodward manual 25075, *Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls*.

Mounting Requirements

1. Make sure the drive shaft rotates freely.
2. Select the correct length of coupling between the governor and the prime mover drive.
3. Mount the governor squarely on its mounting pad.
4. Make sure there is no force pushing the drive shaft into the governor.
5. See the outline drawing (Figure 1-3) for mounting hole sizes and governor dimensions.
6. Make sure the coupling rotates freely but without backlash. Incorrect alignment of the governor shaft to the coupling, or not enough clearance between any of the parts, can result in excessive wear and/or seizure of parts. It can also cause an undesirable high frequency vibration or "jiggle" in the governor output shaft (see Definitions in Chapter 5 for more information).

The standard UG governor drive gives few installation problems if the alignment of the governor shaft to the drive coupling is kept.

**WARNING**

In the event of a misaligned or broken drive shaft, an overspeed condition or runaway engine can develop. An overspeeding or runaway engine can result in extensive damage to the equipment, personal injury and/or loss of life.

If an optional keyed drive is used when installing the governor, take care to avoid the following undesirable conditions:

- a. Rough gear teeth:
Rough gear teeth, or shaft out of round, can cause vibrations which can be transmitted to the governor and cause a jiggle in the governor output shaft. The jiggle can be transmitted to the fuel control resulting in an undesirable condition. Replace gears if necessary.
 - b. Incorrect shimming:
Check backlash and re-adjust if necessary to obtain proper mesh without binding or excessive backlash. Refer to the prime mover manufacturer's specifications for the correct amount of backlash.
7. Mount the governor flush with the engine drive pad. If the engine drive pad is at an angle (from 0° to 45° maximum), the UG must be installed with the front panel in the upper position. Use a gasket between the governor and the engine drive pad.

Be sure there is adequate space available around the governor to provide easy access for installing the control linkage, filling the governor with oil, and adjusting the speed and compensation system. See the outline drawing (Figure 1-3) for mounting hole sizes and governor dimensions.

The recommended rated speed range for the governor drive is 1000 to 1500 rpm. The drive power requirement is 249 W (1/3 hp) at normal speed and operating temperature. The UG governor may be driven either clockwise or counterclockwise.

Operating temperature range for the UG governor is -29 to +99 °C (-20 to +210 °F).

Linkage Attachments

Adjustment of the fuel linkage must provide for control of fuel from "OFF" to "FULL FUEL" within the limits of the 42° of governor output shaft travel. It must also provide for approximately 30° output shaft travel between "NO LOAD" and "FULL LOAD".

Attach the fuel rack linkage to the governor output shaft. There must be no lost motion or binding in this linkage. Adequate locking methods must be employed on the linkage connections.

**WARNING**

Be sure to allow sufficient overtravel at each end of the terminal shaft. Failure to provide sufficient overtravel at maximum fuel position can prevent the prime mover from giving maximum fuel when required. Failure to provide sufficient overtravel at minimum fuel position can prevent the governor from shutting down the prime mover and result in possible damage to equipment and personal injury.

A linear linkage arrangement is used in applications where the governor output shaft positioning is directly proportional to the torque output of the prime mover. Thus, the governor output shaft travel will be directly proportional to the amount of fuel delivered to the prime mover.

A linear linkage is a linkage arrangement which provides as much movement of the governor output shaft per increment of valve movement at light loads as it does at heavy loads.

In applications where a governor is controlling a butterfly valve, such as on a gas engine, a linear linkage should not be used.

This is due to the inherent design of the butterfly valve which requires only a small amount of valve travel (for example, 10°) to bring an engine from no load to half load. By contrast, this design requires a much greater movement of valve travel (for example, 30°) to bring the engine from half load to full load.

In order to improve governing control at light loads, a compensating linkage is devised ("non-linear" linkage). This linkage provides greater movement of the governor per increment of valve movement at light loads than it does at heavy loads. Figure 2-1 illustrates the relationship between governor output shaft and butterfly positions obtained with simple linkage of maximum non-linearity. When installing this linkage, make sure that the two following conditions are obtained when the linkage is in the no-load position:

1. The lever which is attached to the governor and the connecting link is in line with the governor output shaft and the point of attachment of the connecting link to the butterfly lever.
2. The butterfly lever must be at 90° with the connecting link.

See also Table 5-2 for a satisfactory relationship between governor output shaft travel and butterfly valve travel in a non-linear system.

For more information on non-linear linkage, please refer to Woodward Application Note 50516, *Governor Linkage for Butterfly Throttle Valves*.

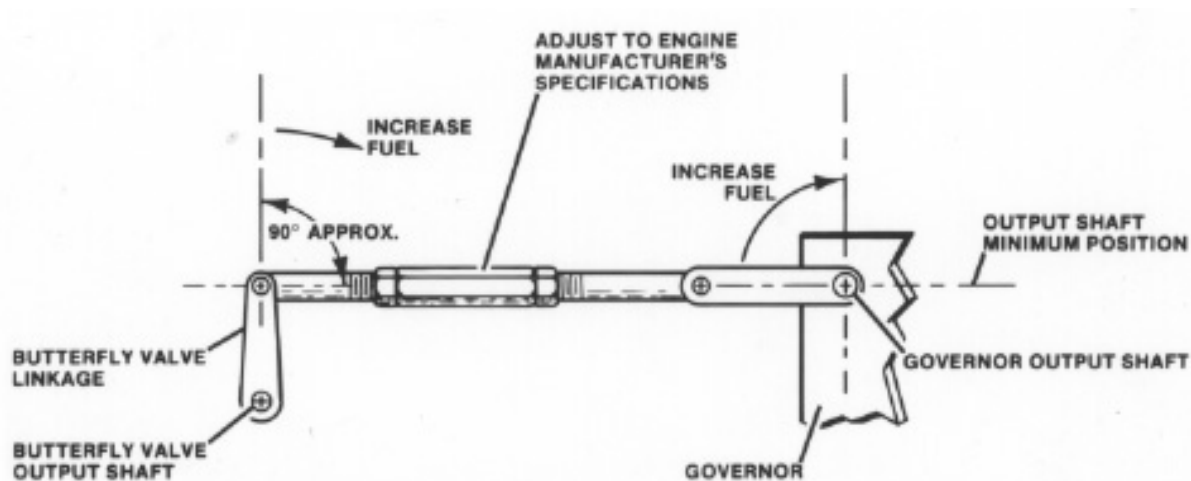


Figure 2-1. Linkage Arrangement (for non-linear fuel systems)

Oil Supply

Use an oil depending on operating temperature for the governor (see Table 2-1).



NOTE

Primary concern is for the oil properties in the governor.

Fill the governor with approximately two quarts of oil to the mark on the oil sight glass. After the engine is started and the governor is at operating temperature, add oil if necessary. Oil must be visible in the glass under all operating conditions.

Use the information given in Tables 2-1 and 2-2 as a guide in the selection of a suitable lubricating/hydraulic oil. Oil grade selection is based on the operating temperature range of the governor. Also, use this information to aid in recognizing and correcting common problems associated with oils used in governors.

For applications where the governor shares the oil supply with the engine, use the oil recommended by the engine manufacturer.

Governor oil is both a lubricating oil and a hydraulic oil. It must have a viscosity index that allows it to perform over the operating temperature range, and it must have the proper blending of additives that cause it to remain stable and predictable throughout this range.

Governor oil must be compatible with seal materials (particularly nitrile, polyacrylic, and fluorocarbon). Many automotive and gas engine oils, industrial lubricating oils, and other oils of mineral or synthetic origin meet these requirements. Woodward governors are designed to give stable operation with most oils with the viscosity, at the operating temperature, between 50 and 3000 SUS (Saybolt Universal Seconds). At the normal operating temperature, the viscosity should be between 100 to 300 SUS. Poor actuator response or instability may be an indication that the oil viscosity is outside this range.

Excessive component wear or seizure in a governor indicates the possibility of:

1. Insufficient lubrication caused by:
 - a. An oil that flows slowly when it is cold, especially during start-up.
 - b. No oil in the governor.
2. Contaminated oil caused by:
 - a. Dirty oil containers.
 - b. A governor exposed to heating up and cooling down cycles, which creates condensation of water in the oil.
3. Oil not suitable for the operating conditions caused by:
 - a. Changes in ambient temperature.
 - b. An improper oil level which creates foamy, aerated oil.

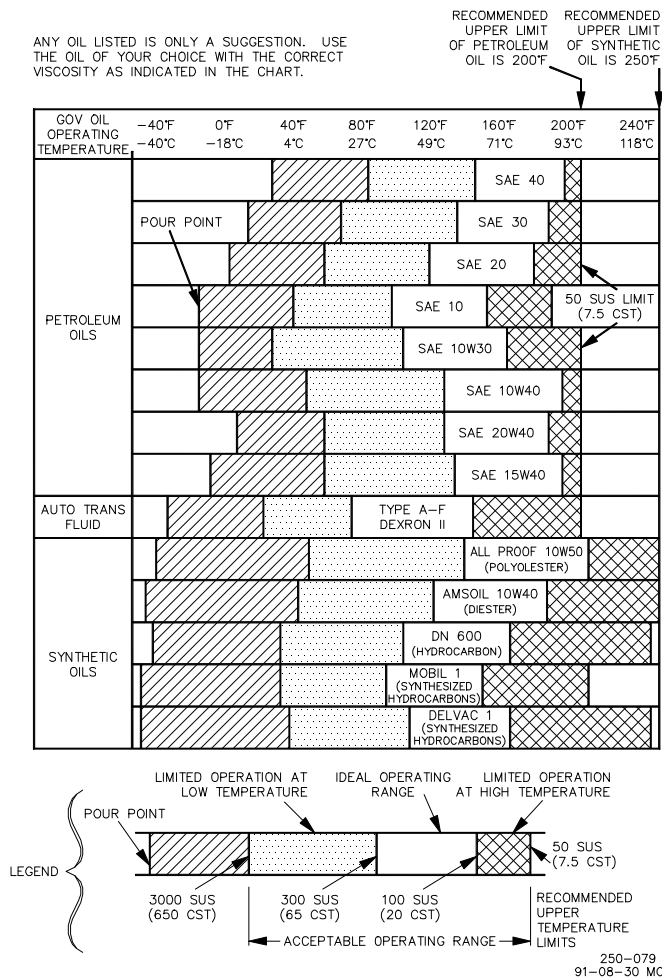


Table 2-1. Oil Chart

VISCOSITY COMPARISONS				
CENTISTOKES (CST, CS, OR CTS)	SAYBOLT UNIVERSAL SECONDS (SUS) NOMINAL AT 100 DEGREES F	SAE MOTOR (APPROXIMATE)	SAE GEAR (APPROXIMATE)	ISO
15	80	5W		15
22	106	5W		22
32	151	10W	75	32
46	214	10	75	46
68	310	20	80	68
100	463	30	80	100
150	696	40	85	150
220	1020	50	90	220
320	1483	60	115	320
460	2133	70	140	460

250-087
97-11-04 skw

Table 2-2. Viscosity Comparisons

Operating a governor continuously beyond the high limit temperature of the oil will result in oil oxidation. This is identified by varnish or sludge deposits on the governor parts. To reduce oil oxidation, lower the actuator operating temperature with a heat exchanger or other means, or change to an oil more oxidation-resistant at the operating temperature.

**WARNING**

A loss of stable governor control and possible prime mover overspeed may result if the viscosity exceeds the 50 to 3000 SUS range. An overspeeding and/or runaway prime mover can result in extensive damage to the equipment, personal injury and/or loss of life.

Specific oil viscosity recommendations are given on the oil chart (Table 2-1). Select a readily available good brand of oil, either mineral or synthetic, and continue using that same brand. Do NOT mix the different classes of oils. Oil that meets the API (American Petroleum Institute) engine service classification in either the "S" group or the "C" group, starting with "SA" or "CA" through "SF" and "CD" is suitable for governor service. Oils meeting performance requirements of the following specifications are also suitable: MIL-L-2104A, MIL-L-2104B, MIL-L-2104C, MIL-L-46152, MIL-L-46152A, MIL-L-46152B, MIL-L-45199B.

Replace the governor oil if it is contaminated, also change it if it is suspected of contributing to the governor instability. Drain the oil while it is still hot and agitated; flush the governor with a clean solvent having some lubricating quality (such as fuel oil or kerosene) before refilling with new oil. If drain time is insufficient for the solvent to completely drain or evaporate, flush the governor with the same oil it is being refilled with to avoid dilution and possible contamination of the new oil. To avoid recontamination, the replacement oil should be free of dirt, water, and other foreign material. Use clean containers to store and transfer oil.

**WARNING**

Observe the manufacturer's instructions or restrictions regarding the use of solvents. If no instructions are available, handle with care. Use the cleaning solvent in a well ventilated area away from fires or sparks.

Failure to follow the safety instructions above can result in dangerous fires, extensive damage to equipment, personal injury and/or loss of life.

Oil that has been carefully selected to match the operating conditions and is compatible with governor components should give long service between oil changes. For governors operating under ideal conditions (minimum exposure to dust and water and within the temperature limits of the oil), oil changes can be extended. If available, a regularly scheduled oil analysis is helpful in determining the frequency of oil changes.

Any persistent or recurring oil problems should be referred to a qualified oil specialist for solution.

The recommended continuous operating temperature of the oil is 60 to 93 °C (140 to 200 °F). The ambient temperature limits are -29 to +93 °C (-20 to +200 °F). Measure the temperature of the governor on the outside lower part of the case. The actual oil temperature will be slightly warmer, approximately 6 °C (10 °F).

Chapter 3.

Principles of Operation

Introduction

Basic UG operation is similar for all types. The only difference is in the method of setting the speed. Auxiliary devices provide different functions but do not alter the basic operation of the governor.

Along with the text, a schematic diagram (Figure 3-1) is provided for visual means of understanding the operation of the UG Dial governor. This schematic shows a basic design and does not include any auxiliary equipment.

Component Description

Before getting into the operation of the UG, a brief description of the components will facilitate understanding the operation.

Oil Pump

The purpose of the oil pump (14) is to provide oil pressure for the governor.

The pump gets its oil from the self-contained sump (15). The oil pump is a positive displacement gear pump with four check valves (13) for either direction of rotation. One pump gear is part of the rotating bushing, and the other is part of the laminated drive. The rotating bushing is driven by the governor drive shaft which is driven by the prime mover. As the bushing rotates, it rotates the laminated drive. The oil pump gears can be driven either clockwise or counterclockwise.

Oil flow is directed through the check valve system into the accumulator system (11).

Accumulator

The purpose of the accumulator (11) is to store oil under pressure for the operation of the UG governor. The accumulator (two cylinders) also acts as a pressure relief valve if oil pressure increases above 827 kPa/120 psi (UG-5.7 and UG-8) or 1034 kPa/150 psi (UG-10).

The accumulator (11) consists of two spring loaded pistons. Oil is pumped into the cylinders and pressure is increased as the accumulator springs are compressed. When the oil pressure exceeds 827 kPa/120 psi (UG-5.7 and UG-8), or 1034 kPa/150 psi (UG-10), oil is released back to sump through a relief port (12) in each cylinder.

Oil flows from the accumulator through passages to the top of the power piston and to the pilot valve system.

Power Piston

The purpose of the power piston (9) is to rotate the governor output shaft to the increase or decrease fuel position.

The power piston is a differential type with oil pressure on both sides of the piston. The top end of the power piston is connected to the governor output shaft (6) through a power lever and link assembly.

The bottom of the power piston has a larger area than the top of the piston. Therefore, less oil pressure is needed on the bottom than on the top to maintain the piston stationary. If the oil pressure is the same on both the top and bottom of the piston, the piston moves up to rotate the governor output shaft in the increase fuel direction. The piston moves down only when oil under the piston is released to sump.

Oil to and from the bottom of the power piston is regulated by the pilot valve system.

Pilot Valve System

The purpose of the pilot valve plunger and bushing is to control the flow of oil to or from the bottom of the power piston.

The pilot valve system includes the rotating bushing (38) and the pilot valve plunger (39). The bushing (38) is rotated by the drive shaft (36) while the pilot valve plunger is held stationary. Through this rotation, friction between the pilot valve and bushing is reduced. The pilot valve plunger has a control land that regulates oil flow through ports in the bushing.

When the pilot valve plunger (39) is lowered, high pressure oil flows under the power piston (9), raising it. When the pilot valve plunger is raised, oil is released to sump from under the power piston (9), lowering it. The higher pressure on top of the power piston(9) forces the piston down. When the pilot valve plunger (39) is in its centered position, the control land covers the control port as shown in the schematic (Figure 3-1), and there is no movement of the power piston.

The movement of the pilot valve plunger (39) is controlled by the ballhead system (23) and the dashpot compensation pistons (34) and (35).

Ballhead System

The purpose of the ballhead system (23) is to sense speed changes of the prime mover as compared to the speed setting reference given by the speeder spring (25) and to position the pilot valve plunger (39).

The ballhead system includes a ballhead (23), flyweights (24), a speeder spring (25), a thrust bearing (30), a speeder plug (29), and a speed setting rod (21).

As the governor drive shaft (36) rotates, the gear on the laminated drive (32) turns and rotates the ballhead gears (23). The flyweights (24) are attached to the ballhead with pivot pins, and a thrust bearing (30) rides on the toes of the flyweights (24). The speeder spring (25) is held in position against the thrust bearing (30) by the speeder plug (29). The speeder plug (29) is used to set a pressure on the speeder spring (25).

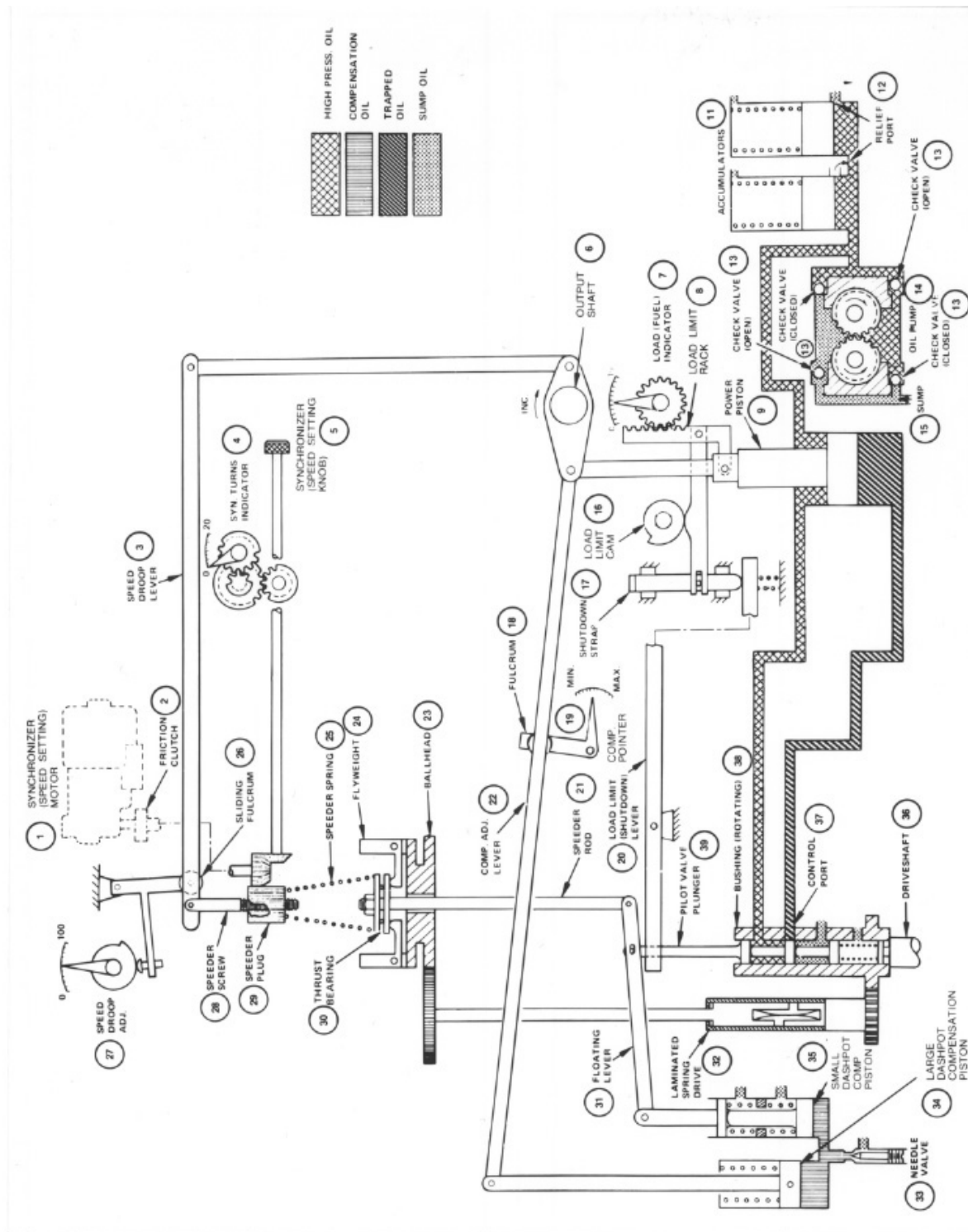


Figure 3-1. UG Dial Governor Schematic Diagram

As the ballhead (23) rotates, the flyweights (24) pivot outward due to the centrifugal force. At the same time the speeder spring (25) forces the thrust bearing (30) downward on the flyweight toes. This downward force opposes the centrifugal force of the flyweights. Increasing the drive speed increases the centrifugal force. Compressing the speeder spring (25) with the speeder plug (29) increases the downward force applied to the flyweight toes, and in turn, increases the governor speed setting. The prime mover must run faster to generate a centrifugal force greater than the speeder spring force to balance the system again.

Speeder spring force or speed setting (25) is controlled manually through the synchronizer (speed setting) adjusting knob (5). It can also be controlled from a remote area if the governor is equipped with a speed setting motor (1).

Compensation System

The purpose of the compensation system is to give stability to the governor and obtain steady state speed control. Also, when correctly adjusted, the compensation system effectively regulates the amount of fuel necessary to bring the engine to the required output to adjust to a decrease or increase in load.

The compensation system creates a small temporary change of speed setting with governor output shaft movement to produce a stabilizing speed droop characteristic in the governor. The change of speed setting is followed by a slow return of speed setting to its original value. Compensation is simply another word for temporary speed droop characteristic.

The compensation system includes a large dashpot compensation piston (34), a small dashpot compensation piston (35), a floating lever (31), a compensation adjusting lever (22) with a pivotable fulcrum (18), and a needle valve (33). See Figure 3-1.

The large dashpot compensation piston (34) is connected to the governor output shaft (6) by a compensation adjusting lever (22). A pivotable fulcrum (18) rides on the compensation adjusting lever (22). Changing the fulcrum's (18) position allows the compensation lever (22) to control the amount of stroke available for the large dashpot compensation piston (34).

The small dashpot compensation piston (35) is connected through a floating lever (31) to the pilot valve plunger (39) and the speeder rod (21).

Moving the large dashpot compensation piston (34) down forces oil under the small dashpot compensation piston (35). As the small dashpot compensation piston (35) is forced upward, it lifts the pilot valve plunger (39) to close off the control port which stops the flow of oil to the bottom of the power piston (9).

The needle valve (33) is a variable orifice which controls the flow of oil between both the large (34) and the small dashpot compensation (35) pistons, and the oil sump.



NOTE

Compensation must be properly adjusted to the particular engine and load to provide stable operation (see Chapter 4, Compensation Adjustments).

Load Limit Control

The purpose of the load limit control is to hydraulically and mechanically limit the load that can be placed on the engine by restricting the travel of the governor output shaft in the increase fuel direction, and consequently the amount of fuel supplied to the engine.

The load limit control may also be used for shutting down the engine by turning it to zero.



CAUTION

Do not manually force prime mover linkage to increase fuel without first turning the load limit control knob to maximum position (10). Failure to do so may cause damage and/or failure of governor internal parts.

The load limit control consists of an indicator disc (7) geared to a load limit rack (8). The control knob is also attached to the load limit cam (16).

Load is limited mechanically by positioning the load limit knob (cam 16). When the load indicator reaches the preset point, the pilot valve plunger (39) is lifted, stopping any further increase in fuel.

Turning the load limit control to zero to shut down the engine turns the cam (16) forcing the load limit (shutdown) lever (20) and shutdown strap (17) down. As the right end of the load limit (shutdown) lever (20) is forced downward, it pivots about its fulcrum and lifts the pilot valve plunger (39), releasing oil from under the power piston (9). Pressure oil acting on top of the power piston (9) forces it downward, rotating the governor output shaft (6) to minimum fuel and causing the prime mover to shut down.

Synchronizer

The synchronizer is the speed adjusting control, and is used to change engine speed for a single unit. On engines paralleled with other units, it is used to change engine load.

The upper knob (called "SYNCHRONIZER" on most models or "SPEED SETTING KNOB" on later models) is the control knob.

The lower knob ("SYN. INDICATOR") has no function of its own but has an indicator disc which shows the number of revolutions of the synchronizer (speed setting) control knob.

Speed Droop

Speed droop, or simply droop, is one method of creating stability in a governor. Droop is also used to divide and balance load between units driving the same shaft or paralleled in the electrical system.

Droop is the decrease in speed that occurs when the governor output shaft moves from the minimum to the maximum fuel position in response to a load increase, expressed as a percentage of rated speed.

If instead of a decrease in speed, an increase takes place, the governor shows a negative droop. Negative droop will cause instability in a governor.

Too little droop can cause instability in the form of hunting, surging, or difficulty in response to a load change. Too much droop can result in slow governor response in picking up or dropping off a load.

Using an example where the governor speed is 1500 rpm at no load and 1450 rpm at full load, droop can be calculated with the formula:

$$\% \text{Droop} = \frac{\text{No load speed} - \text{full load speed}}{\text{full load speed}} \times 100$$

$$\% \text{Droop} = \frac{1500 \text{ rpm} - 1450 \text{ rpm}}{1450 \text{ rpm}} \times 100 = 3.5\%$$

If the decrease in speed is greater than 50 rpm when the governor output shaft moves from the minimum to the maximum fuel position, droop greater than 3.5% is shown by the governor. If the decrease in speed is less than 50 rpm, droop less than 3.5% is shown by the governor.



NOTE

If the governor output shaft does not use the full 30° of available travel from “NO LOAD” to “FULL LOAD”, droop will also be reduced proportionately.

Marks on the droop adjustment scale on the dial panel are reference numbers only, and do not represent droop percentages. Thus the 100 mark does not represent 100% droop. It represents the maximum droop percentage available on that particular UG governor model.

Speed droop consists of a control knob, cam, and linkage, which when preset, varies the compression of the speeder spring as the output shaft rotates. Increasing the fuel reduces speeder spring compression and, in turn, the governor speed setting. The unit gradually reduces its speed as load is applied. This relationship between load and speed acts as a resistance to load changes when the unit is interconnected with other units either mechanically or electrically.

Reducing droop to zero allows the unit to change load without changing speed. Normally, set zero droop on units running alone. On interconnected units, set the least amount of droop possible to provide satisfactory load division.

For ac generating units tied in with other units, set droop sufficiently high (reference numbers 30 to 50 on the dial) to prevent interchange of load between units. If one unit in the system has enough capacity, set its governor on zero droop, and it will regulate the frequency of the prime mover system. If its capacity is not exceeded, this unit will handle all load changes.

Operate the SYNCHRONIZER knob of the governor with zero droop to adjust the system's frequency. Operate the SYNCHRONIZER knobs of the governors that have speed droop to distribute load between units.

Operation of the UG Dial Governor

General Information

Refer to Figure 3-1 with the text to better understand the operation of the UG Dial governor. This schematic diagram is of a basic design and does not include any auxiliary equipment.

Changes in governor speed setting produce the same governor movements as do changes in load on the engine. The description that follows is based upon speed changes caused by load changes.

Decrease in Load

When the prime mover is running on speed, the flyweights (24) are in a vertical position for normal steady state operation. The pilot valve plunger (39) is centered over the control port of the rotating bushing, and the control land stops the flow of pressure oil through the bushing (38) control port. There is no movement of the power piston (9), and no movement of the governor output shaft (6).

When a decrease in load occurs and the same fuel setting is maintained, speed increases. This generates the following sequence of governor movements:

1. As speed increases, the centrifugal force of the flyweights (24) increases and becomes stronger than the force of the speeder spring (25).
2. The flyweights (24) tip outward and raise the speeder rod (21) and the right end of the floating lever (31).
3. This raises the pilot valve plunger (39), opening the control port in the rotating bushing (38). Oil is released from the bottom of the power piston (9) to sump.
4. Pressure oil on the top side of the power piston (9) moves it downward, rotating the governor output shaft in the decrease fuel direction.
5. Linkage from the governor output shaft (6) lowers the compensation adjusting lever (22), which rotates at the fulcrum (18), raising the large dashpot compensation piston (34).
6. Suction is thus applied to the chamber of the small dashpot compensation piston (35), lowering the left end of the floating lever (31).
7. This lowers the pilot valve plunger (39) closing the control port (37).
8. As sump oil flows through the needle valve (33) from the sump into the dashpot compensation piston assembly (34 and 35), the small dashpot compensation piston (35) is returned to its normal centered position by the compensation spring at the same rate as the speeder rod (21). This keeps the pilot valve plunger (39) in its centered position.
9. The control port in the rotating bushing (38) is kept closed by the land on the pilot valve plunger (39).
10. This stops the governor output shaft and power piston movement in the new decreased fuel position. This is the position needed to run the prime mover at the selected speed setting with the new load.

Increase in Load

When an increase in load occurs and the same fuel setting is maintained, speed decreases. This generates the following sequence of governor movements:

1. As speed decreases, the centrifugal force of the flyweights (24) decreases and the opposing speeder spring (25) force is now greater than the centrifugal force of the flyweights (24).
2. The flyweights (24) tip inward and lower the speeder rod (21) and the right end of the floating lever (31).
3. This lowers the pilot valve plunger (39), opening the control port in the rotating bushing (38). Pressure oil is released through the control port into the lower cylinder of the power piston (9).
4. The power piston is forced upward by the pressure oil acting on the larger lower surface area of the power piston, and the governor output shaft is rotated in the increase fuel direction.
5. Linkage from the governor output shaft (6) lifts the compensating adjusting lever (22), which rotates at the fulcrum (18), lowering the large dashpot compensation piston (34).
6. Pressure oil is applied to the bottom side of the small dashpot compensation piston (35), raising the left end of the floating lever (31).
7. This raises the pilot valve plunger (39) closing the control port (37).
8. As pressure oil flows through the needle valve (33) from the dashpot compensation piston assembly (34 and 35), the small dashpot compensation piston (35) is returned to its normal centered position by the compensation spring, at the same rate as the speeder rod (21). This keeps the pilot valve plunger (39) in its centered position.
9. The control port in the rotating bushing (38) is kept closed by the land on the pilot valve plunger (39).
10. This stops the governor output shaft and power piston movement in the new increased fuel position. This is the position needed to run the prime mover at the selected speed setting with the new load.

In both cases, a decrease or increase in load, the compensation system operates in opposite directions. The compensation or amount of movement of the large dashpot compensation piston (34) is controlled by the compensation adjustment, that is, the position of the fulcrum (18).

The rate at which the small dashpot compensation piston (35) is returned to normal is controlled by the needle valve adjustment, that is, the rate of flow of oil through the needle valve (33).

Chapter 4.

Governor Operation and Adjustments

Introduction

This chapter describes initial operation and basic adjustments of the UG Dial governor when placing a new or repaired governor into service.

Initial Operation for a New Governor

Before initial operation of the UG Dial governor, check that all previous installation steps have been correctly accomplished and that all linkages are secure and properly attached. See Chapter 2, Installation Procedures. Also, read all of Chapter 4.

Fill the governor with oil to the top mark on the oil sight glass. Close the needle valve carefully (clockwise) using a Phillips screwdriver and open it (counterclockwise) 1/2 to 3/4 turn. Loosen the nut holding the compensation adjusting pointer enough to move the pointer and set the pointer in the center of the scale. Tighten the nut.

If replacing a governor, the initial compensation setting can be the same as the governor just removed.



WARNING

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Use the prime mover manufacturer's instructions to start the engine.

Adjustments

Normally, the only adjustments for putting a new governor into service are bleeding entrapped air and adjusting compensation to obtain satisfactory stability and response. All other operating adjustments were made during factory calibration in accordance with the manufacturer's specifications and should not require further adjustments.



NOTE

Do not attempt internal adjustment of the governor unless you are thoroughly familiar with the proper procedures.

Compensation Adjustments

The compensation needle valve and pointer are adjustable parts of the compensation system. Their settings directly affect governor stability.

Compensation must be properly adjusted to the particular engine and load to provide stable operation.

When the prime mover is started for the first time after the governor has been filled with oil, the governor may be stable at constant speed, yet may need adjustment. High overspeeds and underspeeds after load changes and slow return to normal speed indicate the need for compensation adjustment.

**NOTE**

Maximum compensation settings generally provide stable steady state operation, but result in greater offspeeds on load changes.

After the oil in the governor has reached its normal operating temperature, make the following compensation adjustments without load on the prime mover to be certain that the governor gives optimum control. See Figure 1-1 for location of the adjustment parts.

1. To bleed trapped air from the governor oil passages, first loosen the nut holding the compensation adjusting pointer and set the pointer at its extreme upward position for maximum compensation. Tighten the nut.

Next, remove the needle valve access plug and open the needle valve two turns counterclockwise. Use a Phillips screwdriver to avoid damage to the threads inside the bore and to the needle valve.

Damage to the threads or to the needle valve will cause the governor to change fuel rhythmically. This is called governor hunt. See Chapter 5 for more information on hunting.

There are two screwdriver slots in the needle valve, a shallow and a deep slot, located at right angles to each other. The deeper slot is used to expand the head of the needle valve and increase friction to prevent vibrations from changing the needle valve setting. If a plain screwdriver must be used, be sure to use the shallow slot of the needle valve.

Allow the prime mover to hunt for approximately 30 seconds to bleed trapped air from the governor oil passages.

2. Loosen the nut holding the compensation pointer and set the pointer as far as it will go towards minimum compensation. Tighten the nut.
3. Gradually close the needle valve until hunting just stops. If hunting does not stop, open the needle valve one turn and move the compensation pointer up by one mark on the front panel indicator scale. Again gradually close the needle valve until hunting stops.

If hunting does not stop, set the needle valve 1/4 turn open and repeat setting the compensation pointer up by one mark. Retest the governor until hunting stops.

**NOTE**

The objective of the compensation adjustment procedure is to find the particular settings for the compensation needle valve and compensation adjustment pointer at which the prime mover will return quickly to speed (needle valve adjustment) after a speed disturbance with only a slight over- or undershoot (compensation pointer adjustment).

4. From this setting, open the needle valve one turn and momentarily disturb governor stability by turning the load limit knob to increase the load slightly and bringing it back quickly to its original position. Gradually close the needle valve until the governor returns to speed with only a small overshoot or undershoot and:
 - a. The needle valve is between 1/8 to 1/4 turn open on a governor with an oil sight glass located in the center of the dial panel.
 - b. The needle valve is between 3/8 and 3/4 turn open on a governor with an oil sight glass located on the side of the governor.

Compensation adjustment determines offspeed and needle valve adjustment determines recovery time.

**NOTE**

For most responsive governor control, use as little compensation as possible. Too much compensation causes excessive speed overshoots and undershoots upon load changes.

**NOTE**

Closing the needle valve more than indicated in (a) and (b) above makes the governor slow to return to normal speed after a load change.

Opening the needle valve more than indicated above decreases governor stability and can cause hunting.

Once the needle valve adjustment is correct, it is not necessary to change the setting except for large, permanent changes in temperature which affect governor oil viscosity.

When the compensation adjustment is correct, tighten the compensation pointer nut and install the needle valve access plug with a copper washer. The plug and the washer will seal oil seepage around the needle valve.

Initial Operation for a Repaired or Reassembled Governor

After disassembly or repair, it is very important to test the governor on a test stand. If a test stand is not available, testing of the governor can be done on the engine.

**WARNING**

If testing of the governor is done on the engine, the operator must be careful to manually control engine speed until he has proven that the governor will control engine speed.

Attach a serration wrench to the output shaft in addition to the normal linkage to manually control engine speed with the serration wrench.

When satisfied that the governing system is fully operational, remove the serration wrench.

If accurate tests and adjustments are to be made, it is best to use a test stand since it is difficult to make them when the governor is mounted on an engine. Write or phone Woodward for a test specification for the governor part number shown on the nameplate fastened to the governor.

Table 4-1 is a list of tools that are necessary only if a large number of governors is being tested. For a small number of governors, only the pressure gauge is needed to check oil pressure during testing.

Table 4-1. Test Stand Tools

Tool Description	Woodward Number	Application
Woodward Test Stand		Engine simulator. Drives governor. Supplies pressure oil. Includes gauges for testing.
Electronic Counter and Frequency Pickup		Indicates governor drive speed. Must have an output of at least 60 cycles per revolution on a one second time base. Must indicate speed to within ± 1 rpm. Readouts of display time must not exceed 5 seconds.
Pressure Gauge (0–1380 kPa/0–200 psi)		To check governor oil pressure.
Dial Indicator	8995-037	To check and adjust droop setting.

Before installation, be sure speed droop is not negative. To check droop, first set the speed droop control knob to zero.

1. Put a dial indicator (tool 8995-037) on the governor with the indicator rod touching the top of the speed setting gear.
2. Place the serration wrench on the governor output shaft.
3. Rotate the governor output shaft from minimum to maximum fuel position, and check the dial indicator.
4. No movement of the indicator is zero droop. If movement is greater than 0.05 mm (0.002 inch), adjustment is needed (Clockwise movement of the indicator is positive droop. Counterclockwise movement of the indicator is negative droop).

Loosen the locknut (190) on the speed droop screw (189) and turn the screw counterclockwise to reduce droop. Turn the screw clockwise to increase droop.

When zero droop is obtained (0.05 mm/0.002 inch or less counterclockwise movement), tighten the locknut again (190).

Check the adjustment again by moving the governor output shaft from minimum to maximum fuel position. Droop can be zero or positive, it must not be negative. Check the final droop setting with the governor operating on the prime mover as shown in "Test Procedures" in this chapter.

Before operating a repaired governor for the first time, check that all installation steps have been correctly completed. See Chapter 2, Installation Procedures. Also, read all of Chapter 4.

**WARNING**

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Test Procedures

1. Remove the pipe plug (33) in the base of the governor on the side to the left of the needle valve plug (30), and attach a 0–1380 kPa/0–200 psi pressure gauge. (See Figure 1-3 for Pressure Test Point.)
2. Install the governor on a test stand or on the engine pad. See Chapter 2, Installation Procedures.
3. Fill the governor with oil. See Chapter 2, Oil Supply. The oil level must be to the mark on the oil sight glass.
4. If the governor is being tested on the engine, start the prime mover according to the instructions from the manufacturer.

Run the governor until it is at operating temperature.

5. Check that the governor has a 758–827 kPa (110–120 psi) oil pressure (UG-5.7/UG-8) or 965–1034 kPa (140–150 psi) oil pressure (UG-10) at normal operating speed.
6. Close the needle valve (32) and open it just enough to cause a small hunt, using a Phillips screwdriver. If a plain screwdriver must be used, make sure to use only the shallow slot of the needle valve to avoid damage to the threads inside the bore and to the needle valve.

Let the prime mover hunt for approximately 30 seconds to remove trapped air from the governor oil passages.

7. Close the needle valve and open it again one half turn. If the governor continues to hunt, repeat step 6.
8. Adjust the compensation system. See Compensation Adjustments in this chapter.



NOTE

Maximum speed for constant operation of the UG Dial governor is 1500 rpm.

9. While the engine is running, re-check the governor for zero droop. Turn the speed droop knob to zero and run the governor at normal operating speed near 0% load. Then load the engine near 100% load. Speed must be within 0 to 3 rpm lower.

If the engine cannot be run at full load and must be run at partial load only, the rpm decrease must be proportional to the partial load.

10. If adjustment is needed to obtain zero droop, follow this procedure:

Loosen the locknut (190) on the speed droop screw (189) and turn the screw (189) counterclockwise to reduce droop. Turn the screw clockwise to increase droop. Tighten the locknut.

Repeat the above procedure until speed is within 0 to 3 rpm lower when running the engine from no load to full load positions.

11. To prevent speed setting changes because of engine vibrations, a friction drive (255) is installed in the speed setting mechanical drive of the UG governor.

The friction drive (255) must be tight enough to avoid a speed setting change due to vibrations, and also tight enough to permit the speed setting motor, if used, to turn the speed setting gear.

If the friction drive is too tight, the synchronizer (speed setting) knob can no longer be turned manually.

To adjust the friction on the friction drive, first remove the governor cover (214), then the retaining ring (250) on the friction drive using a No. 1 Truarc pliers. Do not let the cover (214) or the spring (252) fall into the governor as the friction drive cover is under spring compression.

Check the torque of the friction drive and set it at 0.17 to 0.28 N·m (1.5 to 2.5 lb-in) with manual speed setting or 0.45 to 0.62 N·m (4.0 to 5.5 lb-in) with speed setting motor. To increase friction, turn the nut on the shaft clockwise while holding the speed setting knob. To decrease friction, turn the nut counterclockwise.

12. Reassemble the friction drive.
13. Set the maximum and/or minimum speed limit on the governor. This adjustment can also be made with the prime mover running. To make the adjustment, first remove the governor dial plate (see Figure 4-1).

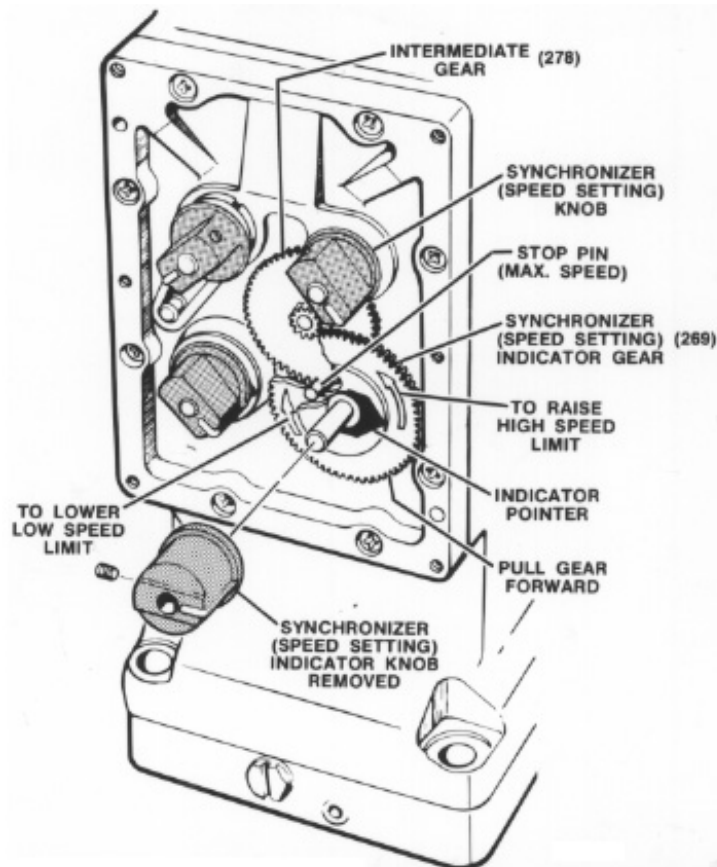


Figure 4-1. Maximum/Minimum Speed Stop Adjustment on the Governor

Turn the synchronizer (speed setting) knob clockwise to increase the speed setting of the governor from its specified maximum plus 10 rpm.

If the friction drive slips before reaching the required high speed setting, mark the intermediate (278) and the synchronizer (269) (speed setting) indicator gears, disengage the synchronizer (speed setting) gear (269), index it one tooth counterclockwise to allow a higher speed setting, and engage gear again.

The amount of rpm change is not the same if the speeder screw (177) has a coarse thread (0.7 threads/mm or 18 threads/inch) or a fine thread (1.3 threads/mm or 32 threads/inch).

Re-engage the synchronizer indicator gear (269) with the high-speed stop pin, engaging the intermediate gear (278) to prevent further increase in speed. The high-speed stop pin is the pin closest to the gear center.

On governors equipped with an electric speed adjusting motor, be sure the motor can run the governor up to its maximum-speed stop and down to its minimum speed. Reset the torque on the friction drive, if necessary, as in step 11 above.

On governors equipped with a two-position high-speed stop (overspeed test device), set the overspeed-test speed as described above, then the lever catch will provide the normal high-speed stop for the governor. If necessary, set the high-speed stop to the lever engaged position and then disengage the lever and advance to the normal high-speed stop position to achieve the overspeed-test speed.

14. To set the minimum speed limit, turn the synchronizer (speed setting knob) counterclockwise to decrease the speed setting of the governor to its minimum speed position.
15. Set the synchronizer knob at zero on the dial.
16. Set the synchronizer indicator dial panel pointer at zero.
17. Position the synchronizer indicator knob about 1.6 mm (0.06 inch) from the surface of the dial. This prevents the knob from binding the synchronizer system gear train.
18. On governors equipped with micro switches, operate the governor at the required high and low speeds to verify correct positioning of the cams that operate the micro switches.

Adjust the cams by loosening the screws and turning the cams on the shaft. Tighten the screws again.

19. On governors equipped with solenoid shutdown, please refer to Woodward manual 03013 for set-up procedures.
20. Turn the load limit knob to zero. The load limit indicator must move to zero. The governor output shaft will move to its minimum fuel position. Reset the load limit knob to maximum load.
21. Shut down the engine. Remove the pressure gauge and install a 1/8" socket pipe plug. Apply a pipe sealer to the threads, and torque the pipe plug to 10 N·m (90 lb-in).

22. Install the governor cover and dial plate.

Test Completion

For operation of units running alone, set droop at zero. Reducing droop to zero allows the unit to change load without changing speed (zero droop operation is also called isochronous operation).

On units connected in parallel or to a single shaft, set the least amount of droop possible to provide satisfactory load division. Droop allows load division between two or more prime movers that drive the same shaft or are paralleled in an electrical system.

For ac generating units tied in with other units, set droop sufficiently high (reference number 30 to 50 or more on the dial) to prevent interchange of load between units.

If one unit in the system has enough generating capacity, set its governor on zero droop, and it will regulate the frequency of the prime mover system. If its capacity is not exceeded, this unit will handle all load changes.

Operate the SYNCHRONIZER knob of the governor with zero droop to adjust the system's frequency. Operate the SYNCHRONIZER knobs of the governors that have speed droop to distribute load between units.

When two units are set up for optimum single unit performance, paralleling problems can be encountered. For example, governor response can be too fast on one governor, requiring too high a speed droop setting to prevent a constant load interchange between the two governors. When this occurs, the compensation setting should be moved towards maximum, reducing the single unit transient performance capability but allowing stable parallel operation within the allowable speed droop range. Also, check the amount of output shaft travel on each governor. Too little output shaft travel on a governor can require too high a droop setting on that governor to obtain steady state control.



NOTE

Compensation must be properly adjusted to the particular engine and load to provide stable operation (see Compensation Adjustments).

When UG governors are used on generator sets operating in parallel and the lead unit is shifted to slave and vice versa, zero droop must be set on the lead unit to maintain the frequency for which it is set, and droop must be set on the slave unit for load distribution between the two units.

For more information on load sharing, please refer to manual 25195, *Governing Fundamentals*.

Chapter 5. Troubleshooting

Introduction

This chapter provides instructions for troubleshooting.

It is impossible to anticipate every kind of problem that is encountered in the field. This manual covers the most common problems experienced. Poor governing may be due to faulty governor performance, or it may be due to the governor attempting to correct for faulty operation of the prime mover or the equipment driven. The effect of any auxiliary equipment on the overall control required of the governor must also be considered.



WARNING

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Troubleshooting

Oil

Keep the governor oil level to-the mark on the oil sight glass with the unit operating. The correct oil level is 19 to 32 mm (0.75 to 1.25 inch) below the top of the governor case.

Dirty oil causes most governor problems. Use clean new or filtered oil. Oil containers used must be perfectly clean. Oil contaminated with water breaks down rapidly, causing foaming, and corrodes internal governor parts.

Compensating Adjustment and Needle Valve

The compensating adjustment and needle valve must be correctly adjusted with the governor controlling the engine or turbine, even though the compensation may have been previously adjusted at the factory or on governor test equipment.

Although the governor may appear to be operating satisfactorily because the unit runs at constant speed without load, the governor still may not be correctly adjusted to the load and to the engine it is to control.

High overspeeds and low underspeeds, or slow return to speed, after a load change or speed setting change, are some of the results of an incorrect setting of the compensating adjustment and needle valve.

Definitions

Use the troubleshooting chart (Table 5-1) on the following pages to determine the probable causes of faulty operation and to correct these problems.

Terms used in the chart are defined as follows:

Hunt—A rhythmic variation of speed which can originate in the governor or in the prime mover. (See Table 5-1, Par. 1A, for troubleshooting information.) A hunt usually has a frequency of less than 5 cycles per minute.

Surge—A sudden variation of speed occurring at periodic intervals which can also originate in the governor or in the prime mover. (See Table 5-1, Par. 1A, for troubleshooting information.)

Jiggle—A high frequency vibration of the governor output shaft and fuel linkage. Do not confuse this with normal controlling action of the governor. A jiggle has a frequency of more than 50 cycles per minute.

Preliminary Inspection

Governor problems are usually revealed in speed variations of the prime mover, but it does not necessarily follow that such variations are caused by the governor. When improper speed variations appear, the following procedure should be performed:

1. Check the load to be sure the speed changes are not the result of load changes beyond the capacity of the prime mover.
2. Check engine operation to be sure all cylinders are firing properly and that the fuel injectors are in good operating condition and properly calibrated.
3. Check the linkage between the governor and fuel racks or valve. There must be no binding or lost motion.
4. Check the setting of the needle valve and compensation adjustment. (See Chapter 4, Compensation Adjustments.)
5. Check that the oil is clean and oil level is correct at operating temperature.

The source of most problems in any hydraulic governor stems from dirty oil. Grit and other impurities can be introduced into the governor with the oil, or form when the oil begins to break down (oxidize) or becomes sludgy.

The internal moving parts are continually lubricated by the oil within the unit. Valves, pistons, and plungers will stick and even “freeze” in their bores, due to grit and impurities in the oil.

If this is the case, erratic operation and poor response can be corrected (if wear is not excessive) by flushing the unit with fuel oil or kerosene.

The use of commercial solvents is not recommended as they may damage seals or gaskets.

Change the oil and flush the governor twice a year if possible.

To change oil, remove the drain plug and drain out the old oil. Flush the governor by filling it with fuel oil, and with the prime mover running at low speed, cycle the governor by opening the needle valve two or three turns.

Let the governor hunt for a minute or two, then stop the engine and drain the governor. Flush the governor once again. Refill the governor with oil (see Chapter 2, Oil Supply).

Restart the engine and reset the compensation adjustment and needle valve.

6. Check that the drive to the governor is correctly aligned and free of roughness, side loading, and excessive backlash.

Table 5-1. Troubleshooting Chart

Problem	Possible Cause	Correction
1. The prime mover hunts or surges.	A. The problem may be originating in the governor or prime mover.	Block the throttle, fuel racks or steam valve in the direction of increase fuel. (Never block the governor output shaft in the direction that would prevent a complete shutdown.) The same blocking action can be performed by using the load limit knob on the governor panel. If hunting and/or surging continues while the governor output shaft is blocked, the problem is in the prime mover. If, after removing the block, hunting and/or surging starts again, the problem can be in the governor or in the prime mover. Go through the compensation adjustment procedure for the governor (see Chapter 4, Compensation Adjustments). If the problem is still there, replace the governor with a replacement governor. Go through the compensation adjustment procedure for the replacement governor. If the hunting and/or surging continues, the problem is in the prime mover.
	B. Compensation adjustments incorrect.	Adjust needle valve and compensation adjusting pointer.
	C. Dirty oil (sludge) in governor.	Drain oil, clean governor, and refill.
	D. Oil varnish, which causes sticking of parts.	Add oil to the mark on oil sight glass. If oil level decreases and no external oil leaks can be seen on the governor, check the drive shaft for oil leak. If foaming continues, drain oil and refill using a different type oil.
	E. Lost motion in engine linkage or fuel pumps.	Repair governor.
	F. Lost motion in engine linkage or fuel pumps.	Repair linkage and/or pumps.
	G. Binding in engine-to-governor linkage or fuel pumps.	Repair and realign linkage and/or pumps.
	H. Governor output shaft travel too short to provide full fuel.	Adjust travel until proper travel is obtained.
	I. Spring on yield linkage to fuel racks too weak.	Install heavier spring.

Problem	Possible Cause	Correction
1. The prime mover hunts or surges. (continued)	J. Low oil pressure. Normal operating pressure is 758 to 827 kPa (110 to 120 psi) for the UG-5.7 and UG-8; 965 to 1034 kPa (140 to 150 psi) for the UG-10. (See outline drawing, Figure 1-3, for pressure test point location.)	Return governor to factory for repair.
	Pump check valves are not seating or accumulator springs weak.	
	K. Power piston is sticking.	Check for side play or binding of output shaft.
	L. Voltage regulator not operating properly.	Check voltage regulator. Operate in voltage droop or manual. Do not disconnect voltage regulator. Adjust, repair, or replace voltage regulator.
	M. Fuel linkage incorrectly set. This might occur if the governor has been changed or removed and replaced. Relationship of governor travel to power output of engine should be linear.	Rework or reset the linkage from governor to unit to obtain the linear relationship.
	N. Faulty linkage.	Linkage should be free of binding and lost motion throughout service life of unit. Check yield links, shutdown arrangements, etc, to be sure that prime mover torque changes for very small increments of governor output shaft travel. Stability and good steady-state performance will suffer unless this condition is met.
	O. Incorrect non-linear relationship between governor travel and power output of the prime mover. Engine may hunt with light loads and be stable with a heavy load.	Adjust linkage from governor to gas valve to obtain linear relationship between governor travel and engine output. See Figure 2-1. Also, see application Note 50516.
	P. Gas or steam pressure too high.	Adjust gas or steam pressure.
	Q. Engine misfiring (bad fuel injector or low pilot fuel on dual-fuel engine).	Check pyrometer readings of each cylinder and make necessary repairs or adjustments.
	R. Load limit indicator binding on nameplate or load limit shaft bent.	Damaged indicator disc or nameplate must be corrected or replaced. Load limit shaft must be replaced if bent.
2. Fuel racks do not open quickly when cranking prime mover.	S. Negative droop when speed droop knob at zero.	Droop calibration out of adjustment. Reset (see Chapter 4, Governor Operation and Adjustments).
	T. Governor worn.	Return governor to factory for repairs.
	A. Low oil pressure in governor.	See Item 1J.
	B. Cranking speed too low.	May be necessary to use a booster servomotor. See manual 36684, <i>Booster Servomotor</i> .
	C. Booster servomotor (if used) not functioning properly.	Check action of automatic air starting valve. See manual 36684, <i>Booster Servomotor</i> .

Problem	Possible Cause	Correction
3. Jiggle at governor output shaft.	A. Rough engine drive or governor drive.	Inspect drive mechanism. a. Check alignment of gears. b. Inspect for rough gear teeth, eccentric gears, or excessive backlash in gear train. c. Check gear keys and nuts or set screws holding drive gears to shafts. d. Check for bent drive shaft. e. Check serrated or spline coupling for wear and alignment. f. Tighten chain between crankshaft and camshaft (if used). g. Check engine vibration damper (if used).
	NOTE If a keyed drive is used, backlash must be checked and the gear shimmed so that there is no binding and the backlash is not too great. This should be done each time a new or replacement governor is installed. If a serrated drive is used, concentricity of shaft to coupling should be maintained. Coupling should be as long as possible to permit greater flexibility.	
	B. Governor is not aligned properly.	Loosen governor mounting screws and move the governor slightly on its mounting pad to align the drive shaft with its coupling.
	C. Failure of flexible drive in flyweight head.	Return governor to factory for repairs.
	D. Other possible causes are: —dirty or worn ballhead bearing —rough or worn gear teeth —bent speeder spring —damaged drive shaft seal retainer	Return governor to factory for repairs. or Replace seal retainer.
	E. Air in governor system can cause a jiggle during start-ups or transients.	Bleed air (see Chapter 4, Test Procedures).
4. Load does not divide properly on interconnected prime movers.	A. Speed droop adjustment incorrect.	Readjust droop to divide load properly. Increase droop to resist picking up (or dropping off) load. Decrease droop to increase picking up (or dropping off) load.
	B. Speed settings of the governors are not the same.	Adjust speed setting so both prime movers run at the same speed.
5. The prime mover is slow to respond to a speed change or a load change.	A. Needle valve adjustment incorrect.	Readjust compensating needle valve. Open further if possible to do so without causing instability when running without load. Compensation pointer may be too far toward maximum.
	B. Governor is not sensitive in measuring speed change (deadband).	Friction or wear on flyweight toes—sludge in governor, return to factory.
	C. Low oil pressure in governor.	Return governor to factory to inspect pump and check valves if oil pressure is low.
	D. Engine may be overloaded.	Reduce load.
	E. Restricted fuel supply.	Clean fuel supply filters.
	F. Load limit knob set to restrict fuel.	Increase load limit setting.

Problem	Possible Cause	Correction
6. The prime mover will not pick up rated full load.	A. Fuel racks will not open far enough, or governor at end of its stroke and the load indicator is set at 10.	Adjust engine-to-governor fuel linkage. Adjust load limiting device or fuel pump stops. Check compression of load limit friction spring. Low compression may permit load limit cam to gradually work toward reduced load position.
	B. Restricted fuel supply.	Clean fuel supply filters. Gas pressure low. Gas with different calorific value.
	C. Voltage regulator (if used) not functioning.	Readjust or repair.
	D. Engine misfiring.	Check pyrometer readings of each cylinder and make necessary repairs or adjustments.
	E. Slipping clutch or belts between engine and driven load.	Make adjustments.
	F. Load limit knob set to restrict fuel.	Increase load limit setting.
7. Governor does not respond to synchronizer motor switch.	Slipping clutch. Binding or worn bevel gears.	Increase compression on clutch spring. Repair or return governor to factory.
8. The speed of the prime mover increases with an increase in load.	Droop is negative when adjustment is zero on the panel. Droop calibration out of adjustment.	Reset droop. See Chapter 4, Governor Operation and Adjustments.

Additional Information for Steam Turbines, Gas and Gasoline Engines

The engine torque versus throttle position for a steam turbine gives a wide variety of non linear relations. Each type must be compensated for with the correct compensating linkage to bring the error output shaft movement back into a near linear relation with the prime mover torque output. Please refer to the prime mover manufacturer's handbook for the correct linkage selection and installation.

The torque vs throttle position curve for a gas and gasoline engine which is controlled through a butterfly valve is always very non-linear. When adapting a governor to this type of engine, if the linkage is made linear, operation at idle and light loads is never very stable.

The proper procedure for adapting a governor to this engine with the butterfly valve is to make the linkage so that it requires greater movement of the governor per increment of butterfly movement at light load than it does at high load.

This linkage tends to linearize the relation between engine-developed torque and governor output shaft position (see Figure 2-1).

The table below shows a satisfactory angular position of the governor output shaft for different openings of the butterfly valve in order to have a more stable operation at idle and at light loads.

Table 5-2. Governor Output Shaft Travel vs Butterfly Valve Travel

Governor Output Shaft Travel	Butterfly Valve Shaft Travel
0°	0°
6°	3°
12°	9°
15°	20°
18°	30°
24°	82°

Governor Field Repairs

Seals and bearings of the governor output shaft and drive shaft can be replaced in the field.

Seals and bearing replacement require only a partial disassembly of the governor. See Figures 5-1 and 5-2, and tables 5-3 and 5-4, for a list of common bench tools and normal field repair tools.

Seals and bearings can be replaced without these tools, however replacement of parts is made easier if these tools are available.

Order tools from Woodward (see Chapter 8, Service Options). Include in order:

1. The tool description
2. The tool number or part number of the tool required
3. The manual number (this manual 03040)

Removal of Governor from Engine

To replace a governor on the engine, or to replace seals or bearings on the governor, remove the governor from the engine as follows:



CAUTION

Use care in handling and resting of the governor on the work area. Do not strike or rest the governor on the end of the drive shaft as damage may result to the drive shaft, oil seal, bearing, or other internal parts or surfaces. Set the governor on wooden block(s) to protect the drive shaft when performing maintenance operations.

1. Drain the oil from the governor and install the drain plug again. Some governors are equipped with a drain cock for draining.
2. Clean exterior surfaces using a cloth moistened with cleaning solvent.
3. Disconnect auxiliary device wiring, and pneumatic or hydraulic tubing connections if applicable.
4. Before detaching the output shaft and speed setting linkages, mark both shaft and lever so they may be easily reinstalled at their original positions.
5. Remove the four stud nuts holding the governor to the mounting pad and lift the governor off. Remove the gasket between the governor and governor mounting pad.

6. Set the governor on wooden blocks to protect the drive shaft. Be very careful to avoid striking the end of the drive shaft. Damage to internal parts of the governor may result.

Table 5-3. List of Common Bench Tools

Tool Description	Ref. Number	Tool Number	Application
T-handle hex wrench 7/16"	1	189440	Various bolts on UG
T-handle Allen wrench 3/16"	2	8995-047	To install 1/8" pipe plugs
Standard Allen wrench 5/64"	3	8995-048	For No. 8:32 headless set screw
Bench block	4	011971	To press out small bearings and bushings
No. 2 Phillips head screwdriver	5	8995-049	Various screws on UG
Hooked scribe	6	189792	Removing and installing cotter pins



Figure 5-1. Common Bench Tools

Table 5-4. List of Normal Field Repair Tools

Tool Description	Ref. Number	Tool Number	Application
William pliers	7	8995-023	Replace retaining ring on drive shaft
Bearing seater	8	8995-024	Replace drive shaft bearing
Seal protector (use with 030952)	9	030951	Fit on output shaft to protect seal
Dial indicator w/ base	10	8995-017	To check droop adjustment
Seal installing tool (Micarta type)	11	030952	Install output shaft seals (for extra long shafts only)
Bushing driver	12	8995-028	To adjust output shaft bushings
Serration wrench	13	030943	Turning output shaft or drive shaft
Torque wrench w/ 7/16" socket	14	8995-038	25 lb-in torque on drive shaft bearing retainer plate screws

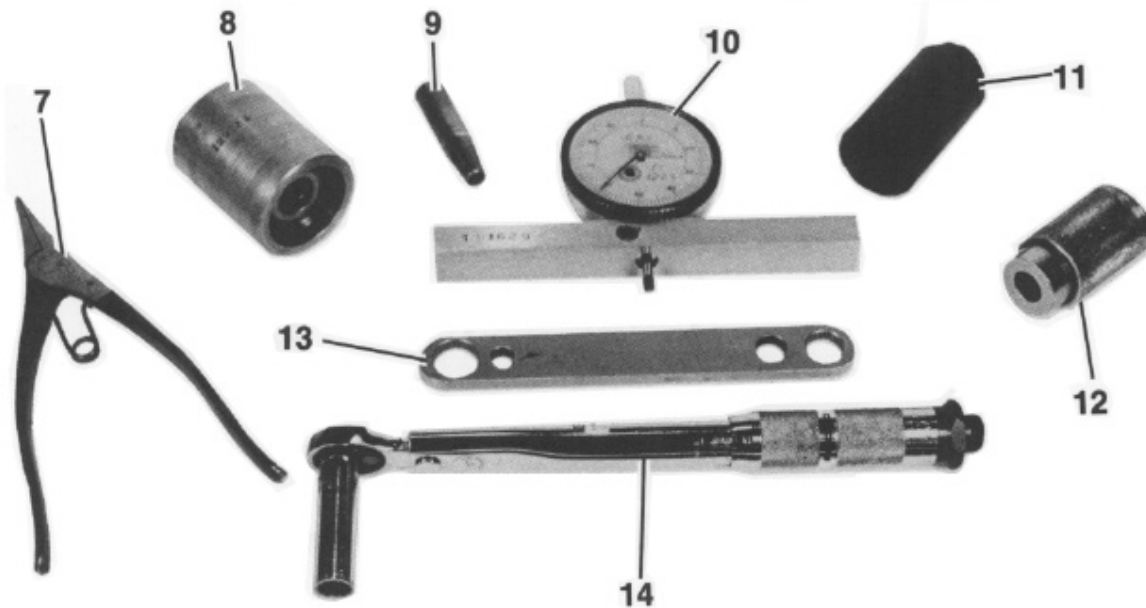


Figure 5-2. Normal Field Repair Tools

Chapter 6. Replacement Parts

Replacement Parts Information

When ordering replacement parts, include the following information:

- Governor serial number and part number shown on nameplate
- Manual number (this is manual 03040)
- Parts reference number in parts list and description of part or part name

**WARNING**

Refer to repair manual 56103 for correct and safe procedures when disassembly and assembly are required. Personal injury may result if accumulator springs are released suddenly. Use an arbor press to release or to install the compressed accumulator spring.

Parts List for Figure 6-1a

Ref. No.	Part Name	Quantity
03040-1	Retainer ring, 1.283" OD	2
03040-2	Washer, 1.185" OD	2
03040-3	Accumulator spring	2
03040-3A	Accumulator spring (used in UG-10 only)	2
03040-4	Accumulator piston	2
03040-5	Soc hd pipe plug, 1/8"	1
03040-6	Soc hd pipe plug, 1/8"	1
03040-7	Cotter pin, .060 x 1/2"	1
03040-8	Laminated drive shaft assembly	1
03040-9	Sleeve retainer	1
03040-10	Spirol pin	1
03040-11	Retainer ring .671 ID	1
03040-12	Washer	1
03040-13	Driver assembly	1
03040-14	Laminated drive spring	12
03040-15	Pump gear assembly	1
03040-16	Straight pin	1
03040-17	Large dashpot compensation piston	1
03040-18	Large dashpot compensation spring	1
03040-19	Large dashpot compensation link	1
03040-20	Oilite bushing	2
03040-21	Retainer ring, 1.283" OD	2
03040-22	Pilot valve bushing	1
03040-23	Check valve	4
03040-24	Dowel pin	2
03040-25	Dowel pin	2
03040-26	Base	1
03040-27	Washer	5
03040-28	Cap screw, 1/4-28 x 1.000"	5
03040-29	Pipe plug, 1/8" soc hd	1
03040-30	Needle valve plug	1
03040-31	Washer	1
03040-32	Needle Valve	1
03040-33	Pipe plug, 1/8" soc hd	1
03040-34	Power piston	1
03040-35	Controlet	1
03040-36	Soc hd pipe plug, 1/8"	1
03040-37	Soc hd pipe plug, 1/8"	1
03040-38	Ballhead drive gear	1
03040-39	Connecting lever	1
03040-40	Straight pin	1
03040-41	Cotter pin, .030 x 3/8"	2
03040-42 through 49		Not Used

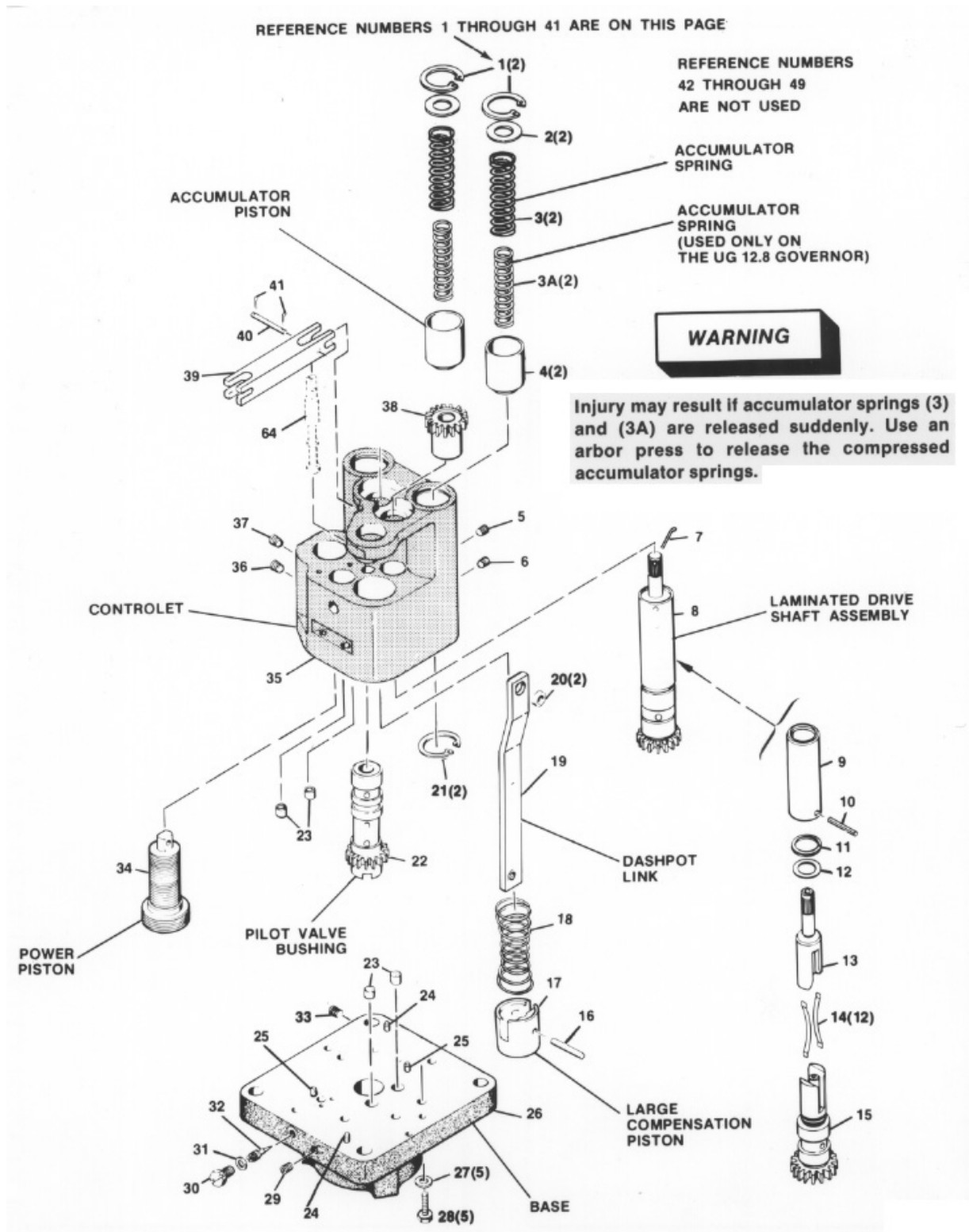


Figure 6-1a. Parts Illustration for the UG Dial Governor

Parts List for Figure 6-1b

Ref. No.	Part Name	Quantity
03040-50	Plug	1
03040-51	Output shaft (optional)	1
03040-52	Set screw, 1/4-28 x 5/16"	2
03040-53	Output shaft bushing	2
03040-54	Oil seal, 1.128 OD	2
03040-54A	Compensation adjustment lever pin stop	2
03040-55	Washer, 7/16 x 5/8 x 1/32"	1
03040-56	Compensation adj. pointer	1
03040-57	Washer, .328 x .562 x .064 thick	1
03040-58	Elastic stop nut 5/16-24	1
03040-59	Keyed drive shaft	1
03040-60	Key .188 x .190 x 1.062"	1
03040-61	Spacer	1
03040-62	Nut, 5/8-18 castle	1
03040-63	Cotter pin, 1/8 x 1-1/2"	1
03040-64	Pilot valve plunger	1
03040-65	Spring seat	1
03040-66	Pilot valve spring	1
03040-67	Drive shaft	1
03040-68	Ball bearing	1
03040-69	Snap ring	1
03040-70	Bearing retainer plate	1
03040-71	Dr hd cap screw, 1/4-28 x 5/8"	3
03040-72	Oil seal, 1.379" OD	1
03040-73	Oil seal retainer	1
03040-74	Seal retainer gasket	1
03040-75	Small dashpot compensation piston assembly .	1
03040-76	Small dashpot compensation spring	2
03040-77	Small dashpot spring seat (not shown)	1
03040-78	Small dashpot compensation piston guide	1
03040-79	Hex lock nut, 1/4-28	1
03040-80	Dashpot nut	1
03040-81	Shutdown lever bracket	1
03040-82	Spring	1
03040-83	Washer, .178 ID	1
03040-84	Cotter pin	1
03040-85	Headed pin	1
03040-86	Shutdown lever	1
03040-87	Washer	2
03040-88	Screw	2
03040-89	Cotter pin	1
03040-90	Washer	1
03040-91	Power piston link	1
03040-92	Cotter pin	1
03040-93	Power lever	1
03040-94	Taper pin, No.3 x 1-1/4"	2
03040-95	Pin	1
03040-96	Cotter pin, .060 x 3/4"	1
03040-97	Compensation lever	1
03040-98	Straight pin	1
03040-99	Drilled straight pin	1
03040-100	Cotter pin, .060 x 3/4"	1
03040-101	Straight pin	1
03040-102	Compensation link	1
03040-103	Compensation lever fulcrum	1
03040-104	Compensation lever assembly	1
03040-105	Preformed Packing Ring, .301 1 D x .070"	1
03040-106	Case	1
03040-107	Output shaft	1
03040-108 through 149		Not Used

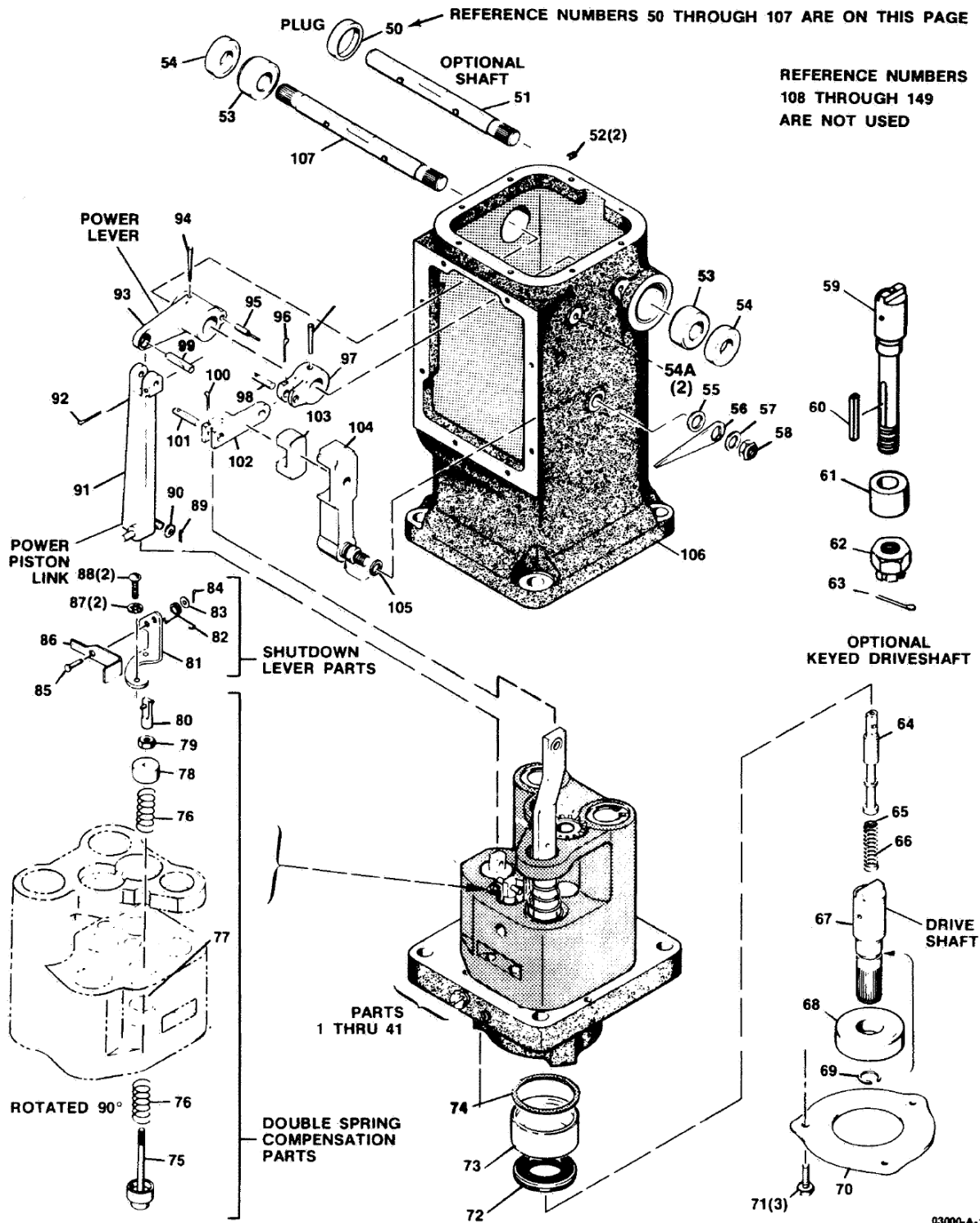


Figure 6-1b. Parts Illustration for the UG Dial Governor

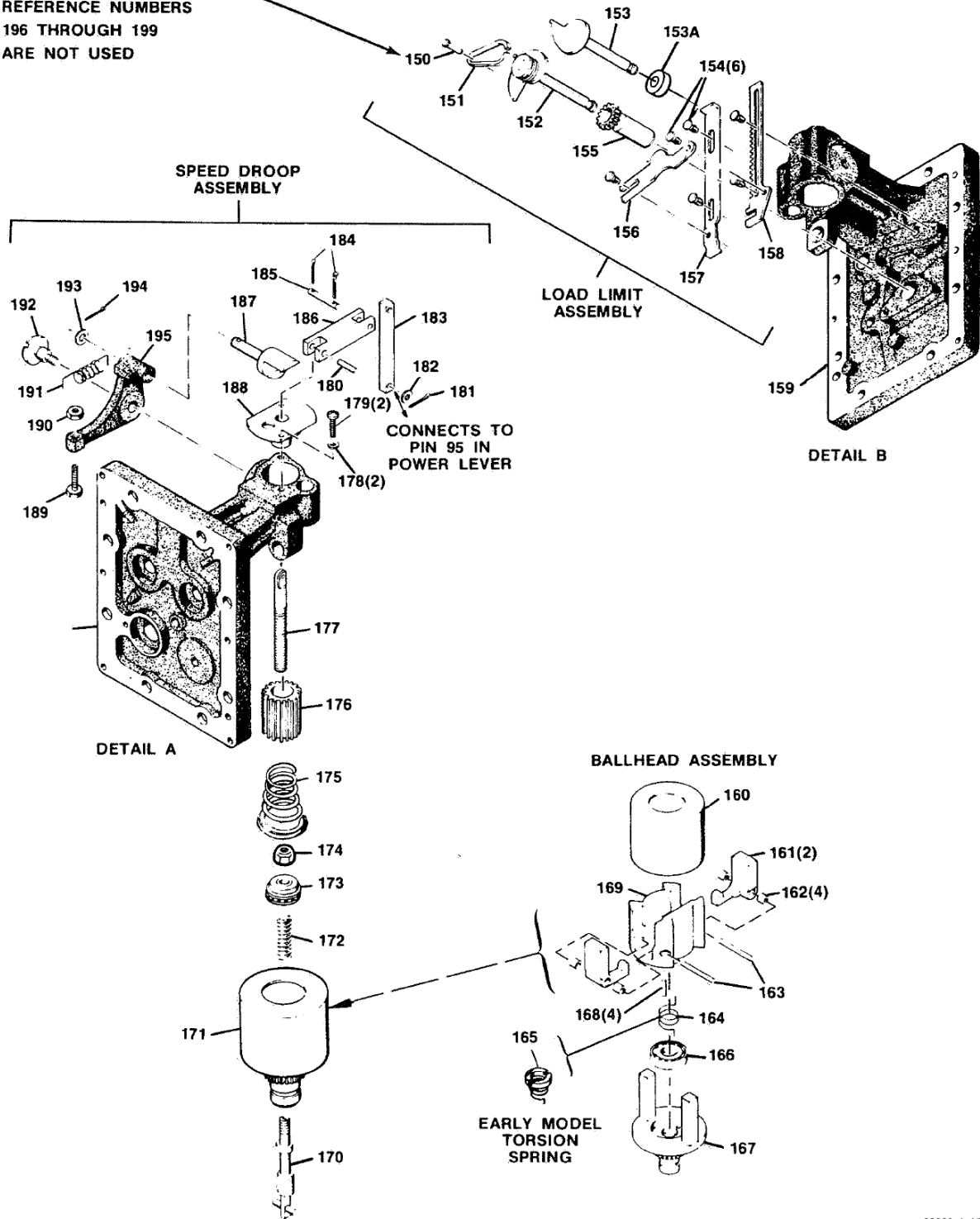
03000-A-156

Parts List for Figure 6-1c

Ref. No.	Part Name	Quantity
03040-150	Friction spring pin	1
03040-151	Load limit speed droop spring	1
03040-152	Load limit cam	1
03040-153	Speed droop cam assembly	1
03040-153A	Washer, .265 ID x .438 OD x .207-.197 thick....	1
03040-154	Rack pin	6
03040-155	Load indicator gear (includes items 285 & 286)	1
03040-156	Load limit lever	1
03040-157	Load limit strap	1
03040-158	Load limit rack	1
03040-159	Dial panel	1
03040-160	Ballhead cover	1
03040-161	Flyweight	2
03040-162	Flyweight bearing	4
03040-163	Flyweight pin	2
03040-164	Torsion spring	1
03040-165	Torsion spring (early model)	1
03040-166	Ball bearing	1
03040-167	Ballhead gear assembly	1
03040-168	Spirol pin	4
03040-169	Spring damped ballhead	1
03040-170	Speeder rod	1
03040-171	Ballhead assembly	1
03040-172	Speeder rod spring	1
03040-173	Thrust bearing	1
03040-174	Flexloc stop nut	1
03040-175	Speeder spring assembly	1
03040-176	Speeder gear	1
03040-177	Speeder screw	1
03040-178	Shakeproof washer, No.8	2
03040-179	Phil. hd screw, 8-32 x .375	2
03040-180	Speed setting screw pin	1
03040-181	Cotter pin, .030 x .375	1
03040-182	Washer, .375 OD	1
03040-183	Speed droop link	1
03040-184	Cotter pin, .030 x .375	2
03040-185	Drilled straight pin	1
03040-186	Speed droop lever	1
03040-187	Speed droop fulcrum	1
03040-188	Speed setting screw guide	1
03040-189	Speed droop screw	1
03040-190	Nut, 8-32	1
03040-191	Extension spring	1
03040-192	Speed droop lever screw	1
03040-193	Washer, .500 OD	1
03040-194	Cotter pin, .060 x .500	1
03040-195	Speed droop lever	1
03040-196 through 199		Not Used

REFERENCE NUMBERS 150 THROUGH 195 ARE ON THIS PAGE

REFERENCE NUMBERS
196 THROUGH 199
ARE NOT USED



03000-A-157

Figure 6-1c. Parts Illustration for the UG Dial Governor

Parts List for Figure 6-1d

Ref. No.	Part Name	Quantity
03040-200	115 Vac/dc Bodine motor.....	1
03040-201	Motor seal spring	1
03040-202	Phil fl hd screw, 10-32 x .375	4
03040-203	Oil Cup.....	1
03040-204	Phillips hd screw, 10-32 x 1/2"	8
03040-205	Lock washer, No.10	8
03040-206	Cover gasket.....	1
03040-207	Soc hd pipe plug, 1/8"	1
03040-208	Base gasket.....	1
03040-209	Washer	4
03040-210	Cap screw, 1/4-28 x 1.000"	4
03040-211	Front panel gasket.....	1
03040-212	Elbow, 1/8"	1
03040-213	Oil sight glass	1
03040-214	Cover	1
03040-215	Motor bracket.....	1
03040-216	Shakeproof washer, No.8	4
03040-217	Phil rd hd screw, 8-32 x .312	4
03040-218	Oil filler cap (optional)	1
03040-219	Cover (optional)	1
03040-220 through 249		Not Used

REFERENCE NUMBERS 200 THROUGH 219 ARE ON THIS PAGE

REFERENCE NUMBERS
220 THROUGH 249
ARE NOT USED

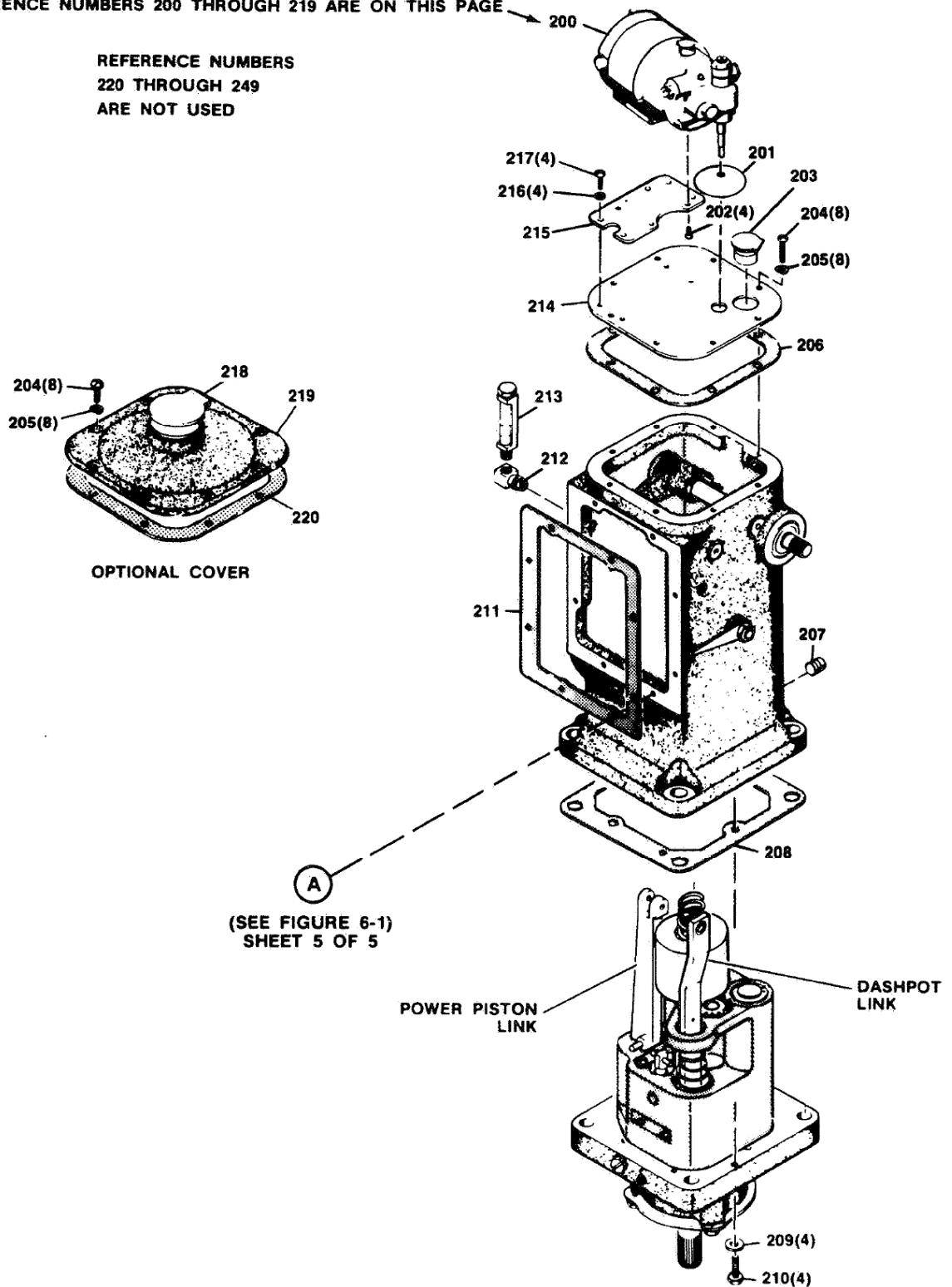


Figure 6-1d. Parts Illustration for the UG Dial Governor

Parts List for Figure 6-1e

Ref. No.	Part Name	Quantity
03040-250	Retainer	1
03040-251	Friction drive cover	1
03040-252	Friction drive spring	1
03040-253	Elastic stop nut, .250-28	1
03040-254	Friction drive spring	1
03040-255	Friction drive case	1
03040-256	Drive plate	1
03040-257	Roll pin, .094 dia. x.500	1
03040-258	Needle bearing	1
03040-259	Needle bearing	1
03040-260	Needle bearing	1
03040-261	Horiz. synch. adj. gear	1
03040-262	Taper pin, 6/0	1
03040-263	Needle bearing	1
03040-264	Synch. adj. shaft	1
03040-265	Lock washer, No.10	8
03040-266	Socket hd screw 10-32 x 5/8"	8
03040-267	Synchronizer indicator shaft	1
03040-268	Spring clip	1
03040-269	Synchronizer indicator gear	1
03040-270	Indicator pointer	2
03040-271	Set screw	4
03040-272	Knob	1
03040-273	Plug	1
03040-274	Dial plate	1
03040-275	Knob	1
03040-276	Taper pin, 6/0 x .750	3
03040-277	Shaft	1
03040-278	Idler shaft gear assembly	1
03040-279	Straight pin	1
03040-280	Oil seal	1
03040-281	Knob	1
03040-282	Load limit comp. spring	1
03040-283	Washer, .365 OD	1
03040-284	Preformed Packing Ring, .239 ID x.070	1
03040-285	Bushing included in item 209	1
03040-286	Bushing included in item 209	1
03040-287	Oil seal	1
03040-288	Knob	1
03040-289	Roll pin, .094 dia. x.500	1
03040-290	Speed droop collar	1
03040-291	Load limit speed droop spring	1
03040-292	Oil seal	1
03040-293	Phillips hd screw, 8-32 x 3/81,	6
03040-294	Set screw 6-32	1
03040-295	Cover-friction	1
03040-296	Friction disc	1
03040-297	Washer.750 OD	1
03040-298	Friction washer spring	1
03040-299	Screw-speed adjust	1

REFERENCE NUMBERS 250 THROUGH 293 ARE ON THIS PAGE

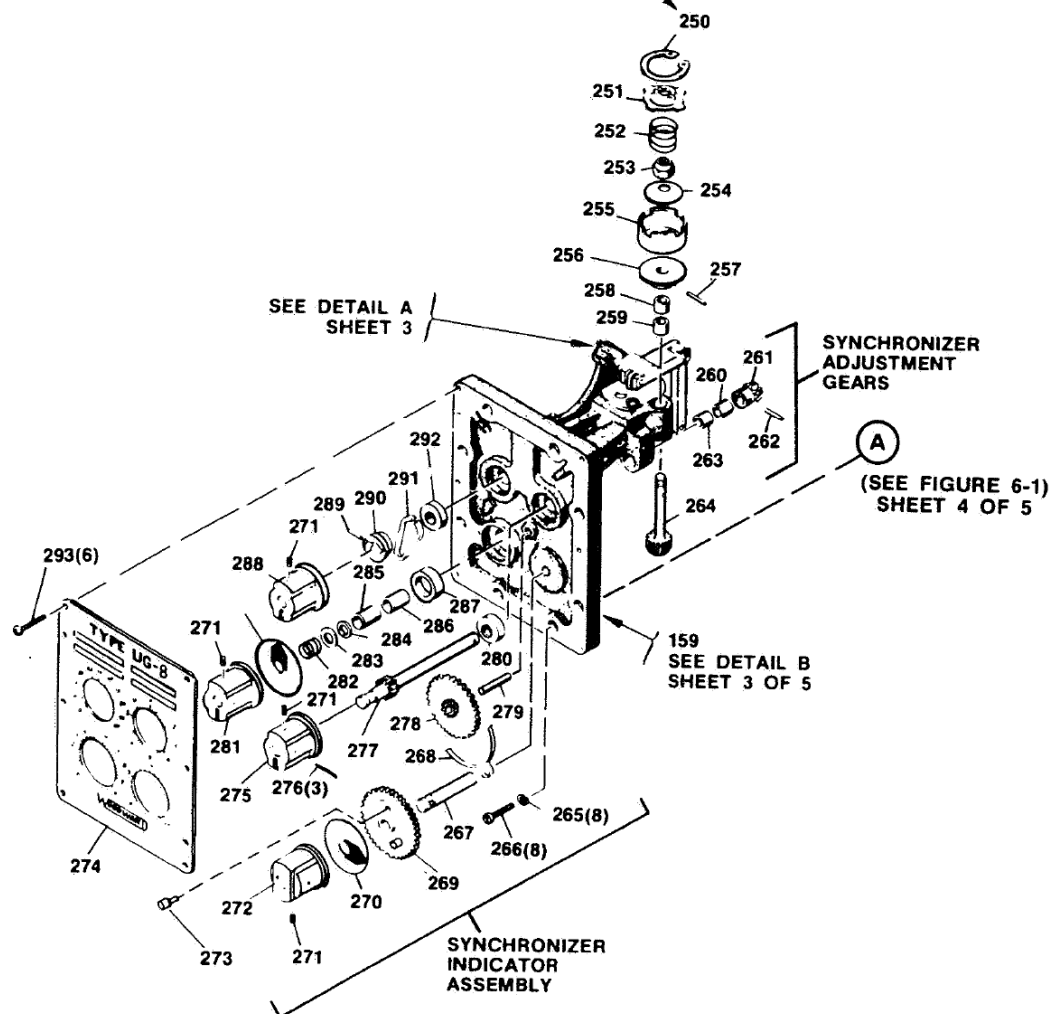


Figure 6-1e. Parts Illustration for the UG Dial Governor

Chapter 7. Auxiliary Equipment

Introduction

A number of optional auxiliary features and devices are available for use with the UG Dial Governor. These devices permit the governor to perform other secondary functions such as fuel limiting, low lube oil pressure shutdown, or effect a shutdown through an electrical solenoid. Auxiliary equipment should be supplied as original equipment on the governor. It is recommended that the customer contact Woodward if field installations are desired.

The following paragraphs provide a brief description of the auxiliary equipment available and list the manuals where detailed information may be obtained.

Synchronizer Motor and Solenoid Shutdown

Early models of the synchronizer (speed setting) motor use an ac-dc Bodine motor, externally mounted, and available in any of the following voltages: 12, 24, 32, 48, 64, 115, 125, 230, and 250. Late models use a PM (permanent magnet) motor using a 115 Vac, or 24 and 32 Vdc, internally mounted.

Figure 7-1 shows a UG cover equipped with solenoid shutdown. It also shows the synchronizer (speed setting) motor as used on the UG Dial governor.

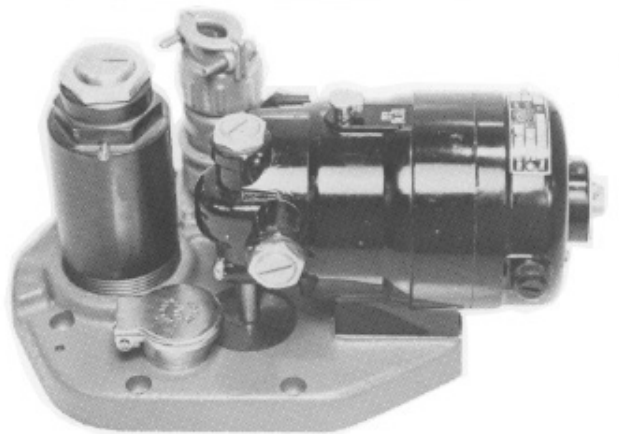


Figure 7-1. UG Cover with Bodine Motor and Shutdown Solenoid

Two models of the shutdown solenoid are available. One provides shutdown when energized, and the other when de-energized. Each can be equipped with or without latch. See manual 03013 for set-up procedures and parts breakdown.



WARNING

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

The synchronizer (speed setting) motor is available separately or with the solenoid shutdown. It provides the ability to remotely control the governor's speed setting. Thus, alternator frequencies can be matched or, when operating in droop mode, load distribution may be changed as required, remotely. Refer to manual 03505 for the parts reference and lubrication guide.

Figure 7-2 shows the method for installing the cover (267) when equipped with a motor. Turn the synchronizer knob to align the clutch with the motor's shaft as the cover is lowered into position.

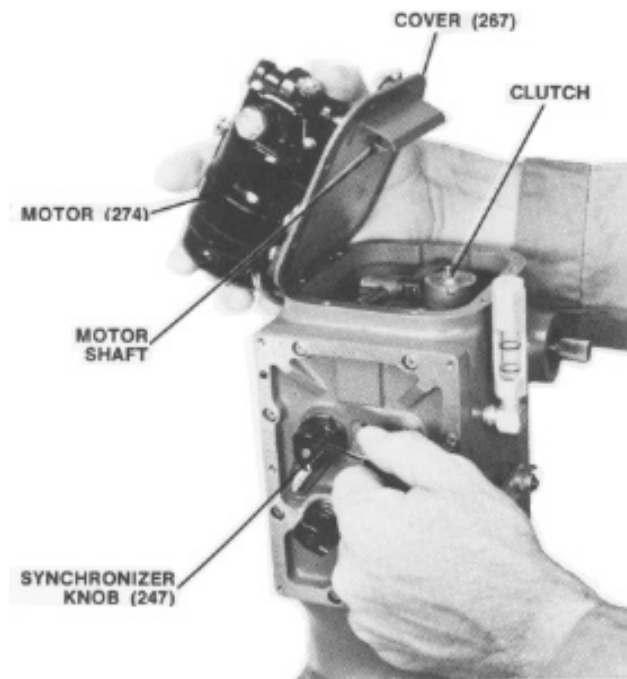


Figure 7-2. Installing Cover with Bodine Synchronizer Motor

Figure 7-3 shows the completed UG-8 Dial governor equipped with a Bodine synchronizer motor.



Figure 7-3. UG-8 Dial Governor Equipped with Bodine Synchronizer Motor

PM Synchronizer Motor with Housing

Figure 7-4 shows a UG-8 Dial governor with a permanent magnet synchronizer motor (speed setting motor) and a shutdown solenoid, enclosed in a weatherproof housing.

At rest, the permanent magnet motor acts as a brake to resist speed changes due to vibrations.

The weatherproof housing for the PM synchronizer motor can also be equipped with a shutdown solenoid. There are several supply voltages available for the solenoid. Contact Woodward for additional information. A conduit connection and a pin-type connector are also available.

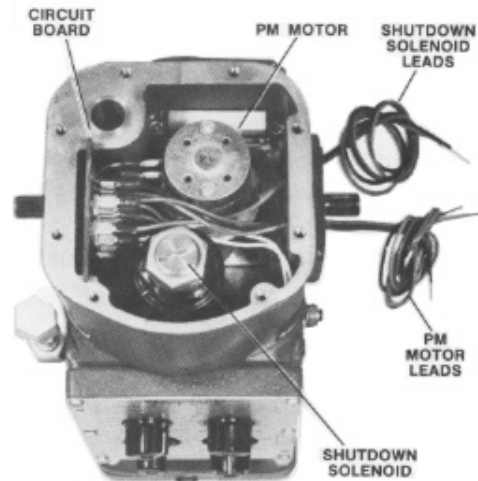


Figure 7-4. Top View of Weatherproof Housing with PM Synchronizer Motor and Shutdown Solenoid

Figure 7-5 shows the UG-8 governor with PM motor and weatherproof housing.

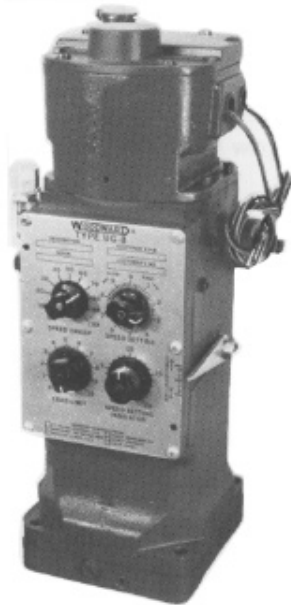


Figure 7-5. UG-8 Governor with PM Motor, Shutdown Weatherproof Housing

An explosion-proof housing (UL listed) is also available for use in hazardous areas. The housing is equipped with a 24 Vdc permanent magnet motor and, as an option, a 24 Vdc shutdown solenoid (energize-to-shutdown type only).

Low Lube Oil Pressure Shutdown

Figure 7-6 shows a low lube oil pressure shutdown. This device stops the prime mover when engine oil pressure falls below a safe level. There is no additional external linkage required.

For more information and parts illustration, see manual 03016.

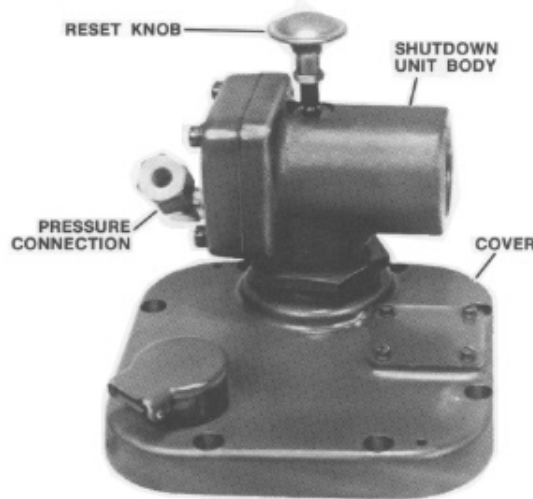


Figure 7-6. Low Lube Oil Pressure Shutdown



WARNING

Any failure that would cause the governor to be inoperative would also cause the shutdown solenoid to be Inoperative.

Magnetic Speed Pickup

The magnetic speed pickup monitors governor speed without having to provide an additional drive pad on the engine. Figure 7-7 shows the assembly on a UG governor.

For more information, see manual 36052.

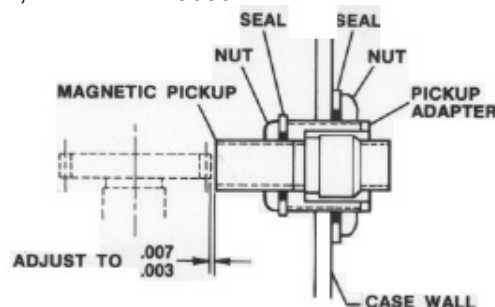


Figure 7-7. Magnetic Speed Pickup

**WARNING**

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Micro Switches and Wiring Harness

Micro switches are mounted on the synchronizer indicator shaft as shown in Figures 7-8 and 7-9. Also shown are the wiring connections and terminal strip.

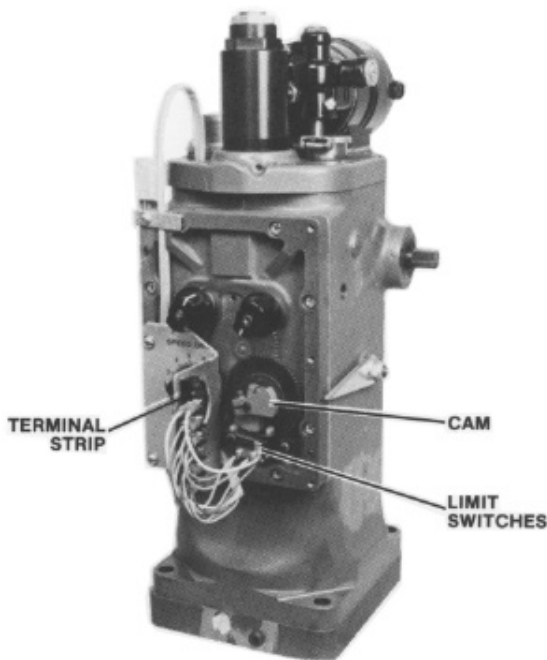


Figure 7-8. Micro Switches and Wiring

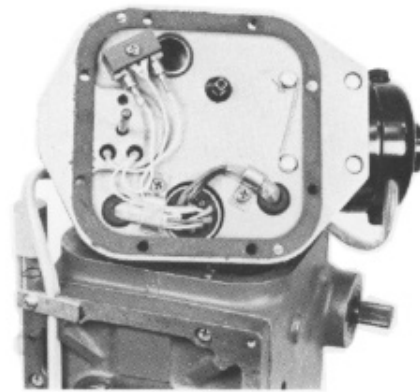


Figure 7-9. Wiring Harness on Cover

The micro switches are used in one of two ways.

1. They energize a light which indicates the motor has reached its minimum or maximum speed-setting position.
2. Instead of energizing a light, they may be used to shut off the electric motor after reaching the minimum or the maximum speed-setting position.

When used to shut off the electric motor, micro switches also protect the synchronizer (speed setting) motor should the operator run the speed adjustment to its limit.

The external wiring to the governor is not provided by Woodward and should be wired into the connector for the particular application as required.

Chapter 8. Service Options

Product Service Options

The following factory options are available for servicing Woodward equipment, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is purchased from Woodward or the service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

If you are experiencing problems with installation or unsatisfactory performance of an installed system, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In most cases, your problem can be resolved over the phone. If not, you can select which course of action you wish to pursue based on the available services listed in this section.

Replacement/Exchange

Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is also a flat rate structured program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Woodward facility as explained below (see “Returning Equipment for Repair” later in this chapter).

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned to Woodward within 60 days, Woodward will issue a credit for the core charge. [The core charge is the average difference between the flat rate replacement/exchange charge and the current list price of a new unit.]

Return Shipment Authorization Label. To ensure prompt receipt of the core, and avoid additional charges, the package must be properly marked. A return authorization label is included with every Replacement/Exchange unit that leaves Woodward. The core should be repackaged and the return authorization label affixed to the outside of the package. Without the authorization label, receipt of the returned core could be delayed and cause additional charges to be applied.

Flat Rate Repair

Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture

Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in "like-new" condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned to Woodward for repair, please contact Woodward in advance to obtain a Return Authorization Number. When shipping the item(s), attach a tag with the following information:

- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.



CAUTION

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

Return Authorization Number

When returning equipment to Woodward, please telephone and ask for the Customer Service Department [1 (800) 523-2831 in North America or +1 (970) 482-5811]. They will help expedite the processing of your order through our distributors or local service facility. To expedite the repair process, contact Woodward in advance to obtain a Return Authorization Number, and arrange for issue of a purchase order for the item(s) to be repaired. No work can be started until a purchase order is received.



NOTE

We highly recommend that you make arrangement in advance for return shipments. Contact a Woodward customer service representative at 1 (800) 523-2831 in North America or +1 (970) 482-5811 for instructions and for a Return Authorization Number.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

How to Contact Woodward

In North America use the following address when shipping or corresponding:

Woodward Governor Company
PO Box 1519
1000 East Drake Rd
Fort Collins CO 80522-1519, USA

Telephone—+1 (970) 482-5811 (24 hours a day)
Toll-free Phone (in North America)—1 (800) 523-2831
Fax—+1 (970) 498-3058

For assistance outside North America, call one of the following international Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

<u>Facility</u>	<u>Phone Number</u>
Brazil	+55 (19) 3708 4800
India	+91 (129) 230 7111
Japan	+81 (476) 93-4661
The Netherlands	+31 (23) 5661111

You can also contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (www.woodward.com) for the name of your nearest Woodward distributor or service facility.

Engineering Services

Woodward Industrial Controls Engineering Services offers the following after-sales support for Woodward products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Contact information:

Telephone—+1 (970) 482-5811

Toll-free Phone (in North America)—1 (800) 523-2831

Email—icinfo@woodward.com

Website—www.woodward.com

Technical Support is available through our many worldwide locations or our authorized distributors, depending upon the product. This service can assist you with technical questions or problem solving during normal business hours. Emergency assistance is also available during non-business hours by phoning our toll-free number and stating the urgency of your problem. For technical support, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Technical Support**.

Product Training is available at many of our worldwide locations (standard classes). We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability. For information concerning training, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Product Training**.

Field Service engineering on-site support is available, depending on the product and location, from one of our many worldwide locations or from one of our authorized distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface. For field service engineering assistance, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Technical Support**.

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

General

Your Name _____
 Site Location _____
 Phone Number _____
 Fax Number _____

Prime Mover Information

Engine/Turbine Model Number _____
 Manufacturer _____
 Number of Cylinders (if applicable) _____
 Type of Fuel (gas, gaseous, steam, etc) _____
 Rating _____
 Application _____

Control/Governor Information

Please list all Woodward governors, actuators, and electronic controls in your system:

Woodward Part Number and Revision Letter _____

Control Description or Governor Type _____

Serial Number _____

Woodward Part Number and Revision Letter _____

Control Description or Governor Type _____

Serial Number _____

Woodward Part Number and Revision Letter _____

Control Description or Governor Type _____

Serial Number _____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please include the manual number from the front cover of this publication.



PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

Email and Website—www.woodward.com

**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.

05/6/F



SCOPE DA1 VISITE 16000 hdm

Mise à jour : 17/07/2019

VASA22 N°5001

2010 : 66877

2012 : 74832

2014 : 82263 (8000hdm)

2015 : (16000h)

2017 : (8000h)

CULBUTEURS

Dépose des culbuteurs
Démontage des balanciers
Contrôle des douilles de balancier
Double contrôle de serrage culbuterie

POUSOIR DE CULBUTEURS

Dépose
Changement de tous les axes, galets et douilles
Changement des joints

CULASSES

Dépose des culasses
Démontage de l'ensemble des éléments
Démontage et nettoyage des orifices d'admission et d'échappement
Epreuve hydraulique à 9 bars de l'ensemble des culasses, **remplacement des sièges de soupapes si nécessaire --- * Voir bulletin de service wartsila 2014 pour côtes.**
Rodage des portées de joint de culasse

SOUPAPES DE LANCEMENT

Démontage des soupapes
Contrôle du ressort de rappel
Rodage des portées de soupapes
Visite soupape lancement principale

INJECTEURS

Dépose des injecteurs
Démontage de l'ensemble
Contrôle des ressorts
Contrôle des poussoirs
Changement des nez d'injecteurs
Tarage selon préconisation : 320 bars

PISTONS

Dépose des attelages
Nettoyages des pistons : têtes et jupes
Remplacement de tous les segments
Ressuage des ailes d'axe de piston
Prise des jeux de segments

BIELLES

Désaccouplement des bielles de leurs pistons



Nettoyage
 Contrôle des portées des douilles de pied de bielle
 Changement des douilles de pied de bielle si nécessaire
 Contrôle par ressuage des dents d'accouplement
 Serrage et contrôle dimensionnel des têtes de bielle
 Remplacement des coussinets

ARBRE MANIVELLE

Prise des déflexions avant et après
 Prise des jeux de paliers de têtes de bielle et de palier principal
 Contrôle et remplacement des coussinets si nécessaire
 Remplacement des joints spi sortie arbre manivelle (V-ring sortie d'arbre 110054, 110055, 110056)

CHEMISES

Dépose des chemises
 Nettoyage complet
 Remplacement des joints toriques de la partie basse
 Contrôle dimensionnel des alésages
 Déglacage des alésages
 Rodage des portées

VILEBREQUIN

Prise des jeux axiaux avant et après démontage (constructeur : 0.18/0.25)
 Changement des coussinets de paliers
 Changement des butées

ARBRE A CAMES

Prise des jeux axiaux avant et après démontage (constructeur : 0.14/0.25)
 Prise des jeux de dents de pignon avant et après démontage (constructeur : 0.15/0.35 maxi 0.50)
 Changement de l'ensemble des douilles de paliers
 Changement des douilles de butées
 Vérification des galets et contrôle de la surface de contact came / galets de poussoir

PIGNON INTERMEDIAIRE

Prise des jeux avant et après démontage (constructeur : 0.10/0.45)
 Dépose du pignon
 Changement des douilles paliers

POMPE A EAU HT

Dépose de la pompe
 Changement de l'ensemble des pièces internes
 Changement de l'arbre principal si nécessaire

POMPE A EAU BT

Dépose de la pompe
 Changement de l'ensemble des pièces internes
 Changement de l'arbre principal

POMPE A HUILE

Dépose de la pompe
 Changement des douilles de paliers
 Changement des garnitures



POMPE A INJECTION

Remplacement des pompes à injection

DISTRIBUTEUR D'AIR DE LANCEMENT

Dépose du distributeur

Changement des pistons, des ressorts de rappel, des joints.

ENTRAINEMENT REGULATEUR

Dépose de l'ensemble

Changement des deux douilles palier

Remontage avec prise de jeux (constructeur : 0.10/0.20 maxi 0.30)

REGULATEUR

Dépose du régulateur pour visite

Vidange huile

Contrôle de l'usure de tous les maillons de raccordement entre le régulateur et les pompes d'injection

LIMITEUR DE FUEL

Contrôle du bon fonctionnement

COLLECTEUR D'ECHAPPEMENT

Contrôle des tirants, remplacer si nécessaire

Vérification de tous les écrous :

- écrous de connections à brides
- écrous des boulons latéraux à l'intérieur de la boîte d'isolement.

Remplacer thermomètre d'échappement

DAMPER

Prise d'un échantillon de silicone pour analyse

SURVITESSE

Dépose et visite

SOUPAPE THERMOSTATIQUE

Dépose de la soupape

Visite complète avec changement de joints

Contrôle des éléments thermostatiques

SOUPAPE THERMOSTATIQUE D'HUILE

Dépose de la soupape

Visite complète avec changement de joints

Contrôle des éléments thermostatiques

REFRIGERANT D'AIR

Démontage et nettoyage

Contrôle du bon état

REFRIGERANT D'HUILE

Démontage et nettoyage

Contrôle du bon état



SECURITES MOTEUR

Essais de la sécurité
Stop par pression d'huile très basse
Contrôle du déclenchement de la survitesse mécanique

DIVERS

Nettoyage complet du moteur
Contrôle des égouttures
Changement de tous les joints de porte de carter
Nettoyage complet du carter d'huile
Visite pompe de prégraissage
Visite de booster en atelier

ESSAI

Mise en œuvre et rodage du groupe électrogène conformément à la procédure WARTSILA

REFRIGERANT BT

Démontage et nettoyage
Contrôle du bon état
Remplacement des anodes
Remplacements des anodes filtre edm DA

M/V MONTE D'ORO - AT 2019
DATES 01-DEC-2019 TO 28-DEC-2019 (DOCKING 01-DEC-2019 TO 28-DEC-2019)
BYZERTE

Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.2	<u>Visite 16000h DA2 / 16000h overhaul aux engine 2</u> ACCOUNT CODE: ENT/2 REQUIREMENTS: Include Cleaning After Include Data/Inspection Report Materials - Owner Supply Survey by Class Representative Survey by Owners Representative Survey by Manufacturers Representative IN CHARGE : Electrician Engineer LOCATION : Local DA *** NOT AUTHORISED *** JOB DESCRIPTION: Visite des 16000h selon scope définie 16000h overhaul according to Wartsila's recommendations EQUIPMENT DETAILS: Wartsila VASA 6R22 DETAILED LOCATION: Local DA pont 01 Auxiliary engines room deck 1 SPECIFICATION OF WORK 10:Scope 16000h Da en pièce jointe / 16000h aux engine's scope in joint file N.B: Pièces de rechange fournies par le bord. Spare parts delivered by the vessel 20:N.B: Le rodage devra être effectuée avant remise en eau du navire--> Coactivité avec peinture oeuvres vives. Procédure rodage en pièce jointe. The will be maid before the vessel refloating-->coordination with the painting works. Roding procedure in the joint file 30:Visite sous la supervision d'un surveyor agréé Wartsila Overhaul lead by a Wartsila surveyor 40:Nettoyage réfrigérant air selon procédure Wartsila jointe Cleaning of the air cooler according to Wartsila's instructions joint 50:Coter cette visite avec un forfait global qui tient compte de tout le scope et de la logistique nécessaire pour la visite, MO includes:chantier +surveyor+24h de réfrigération eau de mer secours pour rodage en cale sèche si nécessaire (cas ou coussinets paliers remplacés) Fix the price of this overhaul with a global price including the scope and the necessary organisation Including : shipyard + surveyor + 24h of emergency sea water cooling for the rodage in dry dock if necessary (if the half-shells have to be replaced)

M/V MONTE D'ORO - AT 2019
DATES 01-DEC-2019 TO 28-DEC-2019 (DOCKING 01-DEC-2019 TO 28-DEC-2019)
BYZERTE

Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.2	<u>Visite 16000h DA2 / 16000h overhaul aux engine 2 (cont.)</u> 60:Attention disponibilité du DA rodé avant sortie cale sèche impérative The auxiliary diesel engine must be available before the end of the dry dock  ATTACHED FILES: Charge air cooler cleaning.pdf *Bilan Pièces 8000hdm DA.xls Procédure rodage DA.pdf Woodward ug8.pdf Scope 16000 DA2.doc

figure: 15-3 Water cleaning of charger**15.4 Allowable operation with damaged turbocharger**

In case of a serious breakdown of the turbocharger, a blanking device or a rotor locking device can be fitted according to the instructions in the turbocharger manual, section 3.1.

When the engines are in an emergency situation like this, they are able to operate temporarily at 20% output only in diesel mode. The thermal overload is a limiting factor on the diesel engine. Therefore, the exhaust gas temperatures must be carefully watched during operation with a locked rotor.

The exhaust gas temperature after the cylinder cover must not exceed 500° C.

Note!

Both of the turbochargers on a V-engine must be locked or blanked if one of them fails.

15.5 Maintenance of charge air cooler**15.5.1 General maintenance**

- 1 **Condensate from the air is drained** through a small hole/ pipe (6), [Fig 15-1] , at the bottom of the cooler housing, after the insert, and at the opposite end plate of the air manifold. Examine regularly that the pipe is open by checking the air flow when running.

If water keeps on dripping or flowing from the draining pipe for a longer period (unless running all the time in conditions with very high humidity), the cooler insert may be leaky and must be dismantled and pressure tested.

- 2 **At longer stops**, the cooler should be either completely filled or completely empty, as a half-filled cooler increases the risk of corrosion. If there is a risk of that the water level in the system goes down when the engine is stopped, drain the cooler completely. Open the air vent screw (3), [Fig 15-1] , to avoid vacuum when draining.
- 3 **Clean and pressure test the cooler** at intervals according to chapter [04] ., if the pressure difference over the air side of the cooler is too high or if the receiver temperature cannot be held within stipulated values at full load.
- 4 **Always when cleaning**, check for corrosion.

15.5.2 Cleaning of air cooler

Cleaning of the air side should be done early enough to avoid accumulations of soot and oil on the fins, which form a hard crust that is difficult to remove, as well as a deposition of other crack products that form a sulphuric acid (Compound with condensate) when left on the fins and tubes for some time.

Generally an increase of pressure drop (Δp) over the air side of the cooler with 100 mmH₂O compared to a new/clean cooler means that the cooler needs cleaning. The pressure drop should be measured at 100 % load or at least always at the same high load level. See [Fig 15-1] for connections.

Cleaning of the water and air side heat exchange surfaces is imperative for a long and trouble free operation of the engine and must be done at regular intervals.

15.5.3 Chemical cleaning

- 1 **Remove the support screws (9) and (10)**, see [Fig 15-5] .
- 2 **Remove the cooling water pipes.** Loosen the cooler flange screws and, on an in-line engine, withdraw the cooler until the thread or the hole (7) for the lifting tool is visible. On the V-engine, withdraw the cooler about 300 mm and fit the tool 846025 32.84G02. Screw on the tool by using four of the air cooler fastening screws. Then, withdraw the cooler completely towards the tool stop. If necessary, use screws in the two threaded extractor holes in the flange to loosen the cooler.

3 **Apply the lifting tool (shackle)** and lift off the cooler.

4 **Clean the air side of the cooler** by immersing it in a chemical cleaning bath for at least 24 hours. Recommend cleaning detergents, see section [15.5.4] We recommend that cleaning tank should be equipped with perforated pipes on the bottom for the best cleaning effect, see [Fig 15-4] . During cleaning steam or pressurised air should be connected to the pipes to get a good circulation.

When cleaning is completed, the cooler should be flushed thoroughly by water.

Note!

The use of a high pressure water jet for flushing, should be avoided because:

- it will pack the dirt into the middle of the cooler.
- the risk of damaging the cooler fins is great.

Both of above will result in an increased pressure drop over the cooler.

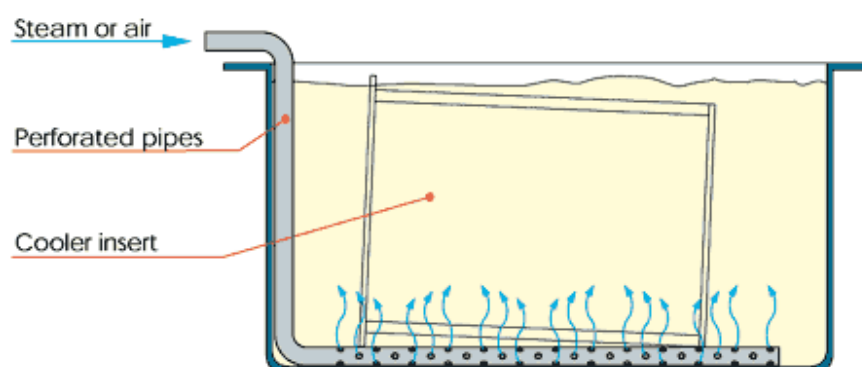


figure: 15-4 Air cooler cleaning tank

5 **Clean the water side** by detaching the headers (4) and (5) from the cooler bundle and immersing the tube bundle into a chemical cleaning bath for at least 24 hours. Upon completion, follow the direction given for the air side.

6 **Change the gaskets** before reassembling the headers.

7 **It is also recommended to pressure test** the cooler before mounting it on the engine.

8 **Mount the cooler on the engine** and tighten the flange screws (8) to stated torque, see section [07.1] .

9 **Apply water resistant grease** onto the upper (9) and lower (10) support screws.

10 **Tighten the upper support screws** (9) by hand until the contact to the cooler is reached. Tighten the counter nuts.

11 **Tighten the lower support screws** (10) to a torque of 40 Nm. Tighten the counter nuts.

12 **Vent the cooler** and check the tightness when starting up.

8. Screw
9. Screw
10. Screw

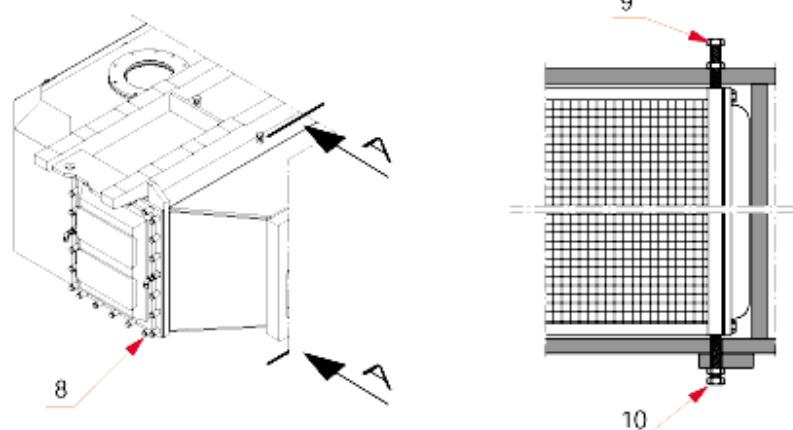


figure: 15-5 Supporting of air cooler

15.5.4 Recommended detergents

The instructions and handling guidelines provided by the manufacturer of the detergent in question should always be observed when using the chemical.

Recommended cleaning detergents	
Supplier	Product designation
Basol Ltd	Basol 77
Clensol Ltd	Industrial Clegris
Drew Ameroid Marine Division Ashland Chemical Company One Drew Plaza Boonton, NJ 07005, USA	Ameroid ACC9
Henkel KGaA Düsseldorf	P3-Grato 90
Houseman Ltd The Priory, Burnham Slough SL 1 7LS, UK	H.D. Powder W.1.H.D.S phenol
Nalco Chemical Company One Nalco Centre Naperville, Illinois 60566 - 1024 USA	Nalfleet ACC
Vecom Holding BV PO Box 27 3140 AA Maassluis, Holland	Vecom B-85

15.5.5 Combi Degreaser Cleaning

When an air cooler is due for cleaning Wärtsilä recommend using the new cleaning method together with the latest type of Wärtsilä Biodegradable cleaning concentrate, Wärtsilä Combi Degreaser, product number C51003.

This Wärtsilä Combi Degreaser concentrate is environmentally friendly not harmful for health, not fire hazardous, does not affect O-rings and gaskets and is not corrosive.

For inquiries and price quotation for the product, contact your nearest Wärtsilä office or Wärtsilä Finland, Service department.

15.5.5.1 Description of the cleaning process

The cleaning effect is based on the new cleaning liquid, Wärtsilä Combi Degreaser, in combination with the flow of the liquid, transporting the dirt out of the cooler.

The work procedure for cleaning the air cooler, airside according to the new procedure is as follows:

- 1 **Dismantle the air cooler from the engine**, see section [15.5.3] , step 1 and 2.
- 2 **Put the air cooler in a suitable stainless steel or plastic tank** with a filterscreen in the bottom (replaceable filter pad).
- 3 **Install the funnel-shaped cover** on the coolers air outlet side.
- 4 **Fill up the tank with the cleaning liquid**, Wärtsilä Combi Degreaser, mixing ratio 1:4 of water.
- 5 **The liquid needs to be heated to about 60°C** for best cleaning effect.
- 6 **Connect a rubber hose from the circulation pump unit** to the cover and a suction hose from the tank.
- 7 **Circulate the liquid for , 4 to 8 hours** depending on degree of fouling.
- 8 **Check the pH value** (it should not exceed 3 for best cleaning result).
- 9 **Flush the cooler with fresh clean water after cleaning.**

Note!

The use of a high pressure water jet for flushing, should be avoided because:

- it will pack the dirt into the middle of the cooler.
- the risk of damaging the cooler fins is great.

Both of above will result in an increased pressure drop over the cooler.

This new procedure can be combined with ultrasonic equipment if available.

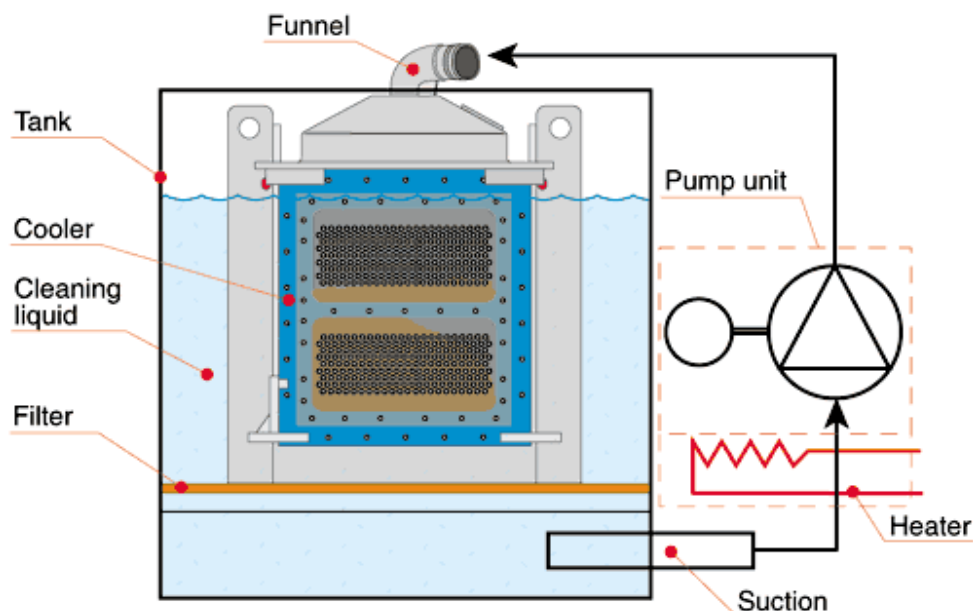


figure: 15-6 Principle schema of the Combi Degreaser cleaning system

15.5.6 Ultrasonic cleaning

Cleaning with ultrasonic equipment will loosen the deposits but it has to be combined with an efficient flushing to remove the deposits from the cooler. It is also important that the correct settings, temperature and detergent is used when cleaning with ultrasonic cleaning.

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Pièces DA2 MORO Selon SPEC VASA 6L22 (6 Cylindres)

Qté dispo au 25/09/17

Pièces systématiques

Pièces conditionnelles

Paliers principaux

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd	C B Q	C B Q		Qté	Désignation	Code Wartsilä
100	1	Coussinets sup	22 100 146	3808			1				2	Pion de centrage palier B	22 100 252
100	1	Coussinets inf	22 100 145	3809			1				4	kit Bague de butée X4	22 100 250
											1	Coussinet palier butée inf su	22 100 013
											8	Coussinets sup	22 100 146
											8	Coussinets inf	22 100 145

Portes de carter

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
107	6	Joint de cache culbuteur	22 107 054	3 651			6				96	Goujons de porte de carter	22 100 254
107	6	Joint de porte de carter AAC	22 107 135	3 673			6				96	Ecrou de porte de carter	22 107 136
107	12	Joint de porte inf	22 107 118	3662			12						
107	1	Joint de carter AAC end	22 107 134	3659			1						
107	1	Joint de couvercle coté VM	22 107 138	3 658			1						
107	2	Joint torique de ppe	22 107 088	3668			2						
107	12	Petit joint de cache culb	22 107 056	3 652			12						

Chemises

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
100	2	Joint de chemise	22 100 041	3806			2				6	Chemise	22 100 325

Bielles

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
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111	1	Jeu de Coussinet de bielles	22 111 159	4 133			1			6	Douille de pied de bielle	22 111 153
111	2	Goujons de bielles	22 111 154	4 128			2			6	Bielles	22 111 150
										12	Ecrou de bielle	22 111 155

Pistons													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
113	1	Kit de 4 sgmt	22 113 115	4 080			1				6	Piston complet	22 113 025
113	2	Circlips	22 113 118	4 081			2				8	Axe de piston	22 113 126

Culasses													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
120	1	Kit de visite culasse	22 120 180	3873			1				32	Guide de soupape	22 120 004
120	4	Vis de fixation culbuteur	22 120 040	3872			4				12	Rotatateur echappement	22 120 017
120	2	Goujons d'injecteurs	22 120 039	3857			2				12	Siège d'echapp de culasse	22 120 031
120	2	Ecrous de fixation injecteurs	22 120 041	6015			2					Siège d'echapp +2	
120	2	soupape d'echap	22 121 015	9311			2				12	Joint de siege echapp	22 120 032
120	2	soupape d'admission	22 121 020	75414			2				24	Joint de siege echapp	22 120 033
											16	Siege d'admission	22 120 030
100	32	Joint de tirants de culasse	22 100 018	3820			32				5	Kit de visite culasse	22 120 180
											10	soupape d'echap	22 121 015
											10	soupape d'admission	22 121 020
											12	Grain mobile de palonniers	22 143 064
											12	Ecrou de grain palonniers	22 143 065
											12	Grain mobile de culbuteur	22 143 005
											12	Ecrou de grain culbuteur	22 143 006
											12	Douille de culbuteur	22 143 003
											2	Circlips de Culbuteur	22 143 017
Culasses													
145	1	joint de couvercle sup	22 145 012	3928			1				12	galet complet	22 145 001
145	1	joint de couvercle inf	22 145 013	4692			1						
145	1	petit joint torique	22 145 024	3924			1						
145	1	Kit de pieces galet	22 145 003	6016			1						
Culasses													
125	1	Kit de joint pour robinet	22 125 447	4091			1				6	robinet	22 125 445

										5	Kit de joint pour robinet	22 125 447
--	--	--	--	--	--	--	--	--	--	---	---------------------------	------------

Arbre à cames													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
							0				6	Douille d'AAC	22 108 030
							0				2	Douille d'AAC	22 108 031
							0				8	Joint torique	22 108 036
											1	Joint	22 108 035
							0				2	Joint torique	22 108 037
											1	Pignon arbre à came	

Injection / Combustible														
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä	
165	6	Kit de visite de ppe	22 165 110	4111			0				6	Galet	22 165 078	
165							0				6	circlips	22 165-073	
165	6	Kit Element de pompe	22 165 060	4096			0				6	chapeau	22 165-081	
165	6	Ressort	22 165 062	4106			0				6	coupelle inf	22 165-075	
165	6	Ressort	22 165 063	4105			0				6	vis	22 165-068	
165	6	Kit de cale	22 165 080	76449			0							
											6	Tuyau d'injection	22 167 161	
165	6	Nez d'injecteur	22 167 151	3883			6				6	Cane d'injection	22 167 153	
167	6	Joint interne	22 167 145	3881			6							
167	18	Joint sup corps X3	22 167 160	4692			18							
167	6	Joint inf corps X1	22 167 159	496			6							
167	12	Pion de centrage	22 167 140	3893			12							
	6	Ressort de tarage	22 167 147	3882			6							
Injecteurs	0	quantité déjà en stock à bord.												

Pompes ED BT HT													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
107	2	Kit de visite ppe	22 191 232	77 453			2				2	Pompe complète BT	22 191 040

Vanne thermostatique BT													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
183	2	Joint torique	22 196 165	504			2						
183	3	Joint torique	22 196 164	368			3						
183	1	Joint torique	22 196 163	1021			1						
183	1	Element thermo	22 196 166	1024			1						
183	1	Element thermo	22 196 167	NC			1						
183	1	Element thermo	22 196 168	1025			1						
183	1	Element thermo	22 196 169	NC			1						
183	2	Joint torique	22 196 181	373			2						

Vanne thermostatique HT													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
196	2	Joint torique	22 196 402	3 983			2						
196	1	Joint Plat	22 196 404	3982			1						
196	2	Joint Plat	22 196 420	3981			2						
196	2	Joint Plat	22 196 025	NC			2						
196	1	Element thermo	22 196 103	NC			1						
196	2	Joint torique de tige	32 196 274	1077			2						

Pompes à Huile														
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd					Qté	Désignation	Code Wartsilä
181	1	Joint	22 181 114	652			1					5	Douille palier	22 181 101
181	1	Joint	22 181 115	653			1							
181	1	Joint	22 181 030	648			1							
181	1	Rondelle frein	22 181 111	NC			1							
181	1	Joint de reglante	22 181 007	3 928			1							
181	1	Joint cuivre de soupape	22 181 010	4 086			1							
181	1	Bille	22 181 014	76 992			1							
181	1	ressort	22 181 013	NC			1							

Vanne thermostatique huile													
ORGANE		Désignation	Code Wartsilä	Code Gestech	Qté dipo	Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
183	1	Joint torique	22 183 015	24679			1						
183	1	Joint torique	22 183 007	194			1						
183	1	Joint	22 183 104	NC			1						
183	3	Joint	22 183 120	NC			3						
183	2	Sealing ring	22 183 006	3 983			2						
183	1	Element sensible	22 183 013	NC			1						

Echappement													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
511	6	thermometre ech	22 511 140	789			6				1	Compensateur	22 200 180
511	6	Joint	22 511 102	393			6				1	Compensateur	22 200 181
											2	Compensateur	22 200 253
											2	Joints	22 200 185
											2	Joints	22 200 135
											4	Joints	22 200 255

Tuyauterie eau													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
355	6	Joint plat	22 354 105	3991			6						
355	4	Joint plat	22 354 129	24680			4						
355	4	Joint plat	22 354 101	77018			4						
355	4	Joint plat	22 354 119	4005			4						
355	4	Joint plat	22 354 117	4008			4						
355	6	Joint torique	22 355 034	3999			6						
355	12	Joint torique	22 355 068	NC			12						
355	2	Joint plat	22 355 118	4539			2						
355	2	Joint plat	22 355 220	4538			2						
355	2	Joint plat	22 355 254	3998			2						

355	2	Joint plat	22 355 087	4008			2					
355	2	Joint plat	22 355 094	3991			2					
355	2	Joint plat	22 355 096	3995			2					
355	2	Joint torique	22 355 098	3986			2					
355	2	Joint plat	22 355 460	NC			2					

Tuyauterie combustible													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
350	24	Joint de pompe	22 350 213	3886			24						
350	4	Joint de tuyau de pompe	22 350 220	4086			4						
165	6	Petit joint	22 165 146	4098			6						
358	24	Joint de retour	22 358 187	543			24						
358	12	joint de rampe	22 358 179	541			12						
358	12	Joint troique du circuit	22 350 207	153			12						

Tuyauterie d'huile													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
352	2	Joint torique	22 352 031	3832			2						
352	2	Joint torique	22 352 034	4021			2						
352	5	Joint torique	22 352 069	24679			5						
352	5	Joint plat	22 352 333	4020			5						
352	/	joint torique	22 352 024	4022			6						
352	2	Joint plat	22 352 334	4014			2						
352	12	Joint torique de rampe d'huile	22 352 300	4011			12						

Tuyauterie air													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä

Lancement													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
123	1	Joint de sppe de lct sur cul	22 123 066	4 086			1				6	sspe complete	22 123 065
123	1	Joint de sppe de lct sur cul	22 123 071	38			1				12	Vis de fixation sppe	22 123 069
											1	Joint de distributeur	22 211 007
											6	doigts	22 211 003
											6	douille	22 211 002
											6	Joints	22 211 005

Vibration Damper													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
		kit de prelevt	## ### ###										

Refrigérant Air sural													
ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
156	1	Joints	22 156 035	4 170			2						
156	2	Joints	22 156 036	4 171			4						
476	1	Joint plat	22 476 021	4 198			2						
476	1	Joint plat	22 476 020	4 197			2						
476	1	Joint plat cassette	22 476 040	4 199			2						

Refrigérant D'huile													
ORGANE	Qté	Désignation		Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä

476	4	Joint Torique	22 474 024	4 194			8					
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Refrigerant ED

ORGANE	Qté	Désignation	Code Wartsilä	Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
	2	Jeu joints réfrigérant		3 964			2						

Divers

ORGANE	Qté	Désignation		Code Gestech		Qté dispo bord	Qté à cmd				Qté	Désignation	Code Wartsilä
	1	servo-booster		DNCD 11286			1						
	12	thermometre echappement		789			12						

Code Gestech	Qté dipo mag	Qté dispo bord			

4 130					6
4 134					6
4 131					12

Code Gestech	Qté dipo mag	Qté dispo bord			
4 078					6
4 079					8

Code Gestech	Qté dipo mag	Qté dispo bord			
3863					32
NC					12
3865					12
77 021					
3 866					12
6 473					24
3 864					16
3 873					5
9311					10
75414					10
3937					12
3942					12
3935					12
3931					12
3931					12
3939					2
NC					12
175					6

4091					5
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Code Gestech	Qté dipo mag	Qté dispo bord			
178					6
4120					2
1023					8
4019					1
4117					2
3875					1

Code Gestech	Qté dipo mag	Qté dispo bord			
4110					6
5929					6
4115					6
4107					6
4099					6
3894					6
3879					6

Code Gestech	Qté dipo mag	Qté dispo bord			
4065					2

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			
76993					5

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			
4063					1
NC					1
4062					2
4060					2
4061					2
6374					4

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			
4 083					6
4 082					12
6024					1
4055					6
4056					6
556					6

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

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Code Gestech	Qté dipo mag	Qté dispo bord			

Code Gestech	Qté dipo mag	Qté dispo bord			

Pièces pour visite du MP 1

WARTSILÄ type 12V32D

sens horaire

Fait le : 20/12/2011

ORGANE	Quantité à commander	Code Gestech	Désignation	Code Wartsilä	Stock bord	Stock terre
100		31	jeu de joints pour vérins	32 100 050	2	19
107		70	joint torique	32 107 123		54
377		569	joint torique pour porte anti-déflagration	32 377 002	6	4
377		NC	ressort	32 377 001		
107		37	écrou de portes de carter	32 107 041	10	8
107		690	toriques porte de distribution	32 107 038		31
100			goujon	32 100 088		
jeu de 2 demi paliers (32100096+32100097)		17877	coussinet supérieur de palier principal	32 100 096		5 jeux complets
			coussinet inférieur	32 100 097		
100		36708	coussinets de palier butée	32 100 113		1
100		4411	patins de butée	32 100 112		2
100		17929	bague anti polissage	32 100 156		2
100		53	joint torique	32 100 111		12
100		51	torique	32 100 109	13	24
120		121	water jacket de chemise (étanchéité chemise culasse + passage d'eau)Fuite importante sur MP1 ET 4	32 120 008		5
120		51	torique de water jacket	32 120 006		
100		52	Chemise complète	32 100 110		5
111		10102	coussinet de tête de bielle supérieur	32 111 004		

		10103	coussinet de tête de bielle inférieur	32 111 005		
111		107	douille axe de piston	32 111 002		4
111		109	tirant de tête de bielle	32 111 008		4
111		108	ecrou de tirant de tête de bielle	32 111 006		30
111		NC	bielle complète	32 111 003		
113		4479	jeu de segments	32 113 013	2	11
113		48111 (flotte)	torique	32 113 004		20
113		5971	piston complet	32 113 025	1	
113		46667	jupe de piston	32 113 021	1	
113		115	axe de piston	32 113 014		1
113			goujons de tete de piston	32 113 008		18
113			ecrous de tete de piston	32 113 009		5
120		4432	culasse complete	32 120 060	2	7
120		146	jeu complet joints pour culasse	32 120 070		46
120		36792	siege pour soupapes échappement cote reparation +1	32 120 009		
121		4460	rotocap admission/ échappement)	32 121 030		4
120		131	Guide de soupape (admission/ échappement)	32 120 022		6
121		152	demi lune	32 121 002	21	126
121		153	torique	32 121 004	48	106
107		64	torique pour capot culbuteur	32 107 011	25	20
121		162	soupape admission	32 121 010		7
121		154	soupape echappement	32 121 006		8
200		4509	colliers echappement	32 200 025	16	
200		657	vis pour collier echappement culasse	32 200 026	10	18
200		658	ecrou pour collier	32 200 027		12
200		659	vis	32 200 028	8	44
200		394	frein d'ecrou de colliers échappement	32 200 188		38

123		170	jeu de joints pour soupapes de lancement	32 123 035	2	6
125		172	joints pour soupape sureté	32 125 002		2
125		176	pour joints décompresseur	32 125 447	2	
355		510	torique de manchette ED HT	32 355 112	21	89
355		507	torique de manchette ED HT	32 355 109	52	32
355		NC	Bride de manchette	32 355 110		28
511		789	thermomètre échappement de culasse	32 511 101	7	6
511		393	joint de thermometre echappement	32 511 102	101	40
100		41	ecrou pour tirant culasse	32 100 091	5	76
100		44	tirant de culasse	32 100 094		8
143		nc	douille de culbuteur	32 143 005		41
143		185	circlips	32 143 031		108
143		180	culbuteur complet	32 143 035		6
507		788	doigt de gant de sonde de température d'échappement	32 507 041		1
107		690	torique de porte d'arbre à cames	32 107 038		31
148		6289	Troncon d'arbre à came ligne A sens horaire	32 148 001	1	2
148		6290	Troncon d'arbre à came ligne B sens horaire	32 148 002		1
148		206	Vis pour troncon	32 148 013	40	24
148		NC	téton de centrage	32 148 009		78
148		NC	torique pour téton	32 148 010	2	52
148		36858	palier arbre à cames	32 148 011		
145		192	torique pour guide	32 145 008	49	16
145		194	torique	32 145 010	83	10
145		74	torique	32 145 003		12
145		4476	Galet	32 145 013		15
145		199	bague	32 145 014	3	27
145		200	axe de galet	32 145 015		23
120		262	ecrou nylstop de culbuteur	32 120 032	7	100

165		36916	jeu de joints pour remise en état d'une pompe à injection (bouchons d'érosion inclus)	32 165 178	1	
100		262	ecrou d'assise de pompe	32 100 099		
167		3886	torique	32 167 032		27
167		3885	torique de canne	32 167 033	54	
350		153	torique de lyres de pompe	32 350 018	48	106
228		463	torique	32 228 101		4
228		468	torique	32 228 106		8
228		NC	pipe union	32 228 105		
228		465	ressort	32 228 103	1	24
228		NC	corps de vérin	32 228 102		17
167		274	jeu de joints pour injecteur	32 167 046	13	29
167		261	nez d'injecteur	32 167 020		46
167		270	poussoir injecteur	32 167 011		52
167		271	goupilles	32 167 012		98
181		652	joint de bride	32 181 160		1
pour reconditionnement ppe à huile attelée en atelier		287	paliers	32 181 101		12
		291	torique	32 181 157		4
		652	joint	32 181 160		1
181		329	torique	32 181 171	8	7
181		38	torique	32 181 166	20	80
181		556	joint cuivre	32 181 162		1
473		595	jeu de joints pour glacier	32 473 040	6	3
471		593	kit de joints pour 3 filtres huile (entrée /sortie bati des filtres)	32 471 235		
183		3983	torique	32 183 020	4	47
183		NC	torique	32 183 027		
183		1043	element sensible	32 183 025	4	6
183		19426	joints de vanne	32 183 024		5
196		3983	torique	32 196 251		
196		1077	torique	32 196 274	12	18
196		4695	element sensible	32 196 264	7	12
196		356	joints de vanne	32 196 258	4	1

196		NC	torique	32 196 271		
196		NC	torique	32 196 275		
196		370	element sensible	32 196 166		4
196		NC	joints de vanne	32 196 273		
pour reconditionnement ppe ED attelée en atelier		6454	roulement	32 191 009		1
		338	roulement	32 191 010		7
		343	garniture	32 191 015		6
		348	torique	32 191 052	2	9
		32897	rouet pour moteur CCW	32 191 058		3
pour reconditionnement ppe ED attelée en atelier		6454	roulement	32 191 009		
		338	roulement	32 191 010		
		343	garniture	32 191 015		
		348	torique	32 191 052		
		32897	rouet pour moteur CCW	32 191 058		
200		3358	soufflet echappement dans sarcophage moteur	32 200 137	1	10
200		381	collier pour soufflet	32 200 014	2	1
200		382	vis	32 200 015	8	
200		164	ecrou de collier	32 200 016	26	46
476		4634	joint de plaque (2 réfrigérants)	32 476 005		5
476		4635	Joint	32 476 006	3	4
476		4633		32 476 004	2	5
211		399	tiroir pilote	32 211 007		3
211		400	ressort	32 211 008		7
211		NC	torique	32 211 016		
211		NC	entretoise	32 211 013		
217		4512	disque	32 217 008		
217		NC	ressort	32 217 004		
217		4513	joint	32 217 003	7	11
217		NC	ressort	32 217 030		
217		37070	torique	32 217 025	5	7
217		4515	torique	32 217 029		3
217		429	spare part for bonnet assembly and sealing set	32 217 046	4	3

357		38	torique	32 357 007		
357		536	torique	32 357 163		32
357		531	torique	32 357 001	26	80
357		4584	pipe air	32 357 002		13
357		NC	pare flamme	32 357 011		1
357		329	torique	32 357 012	8	7
378		38	torique	32 378 002		
378		27211	clapet	32 378 006		10
228		NC	torique	32 228 042		
228		NC	torique	32 228 043		
228		480	ressort	32 228 004		
228		6045	torique	32 228 024		
228		NC	torique	32 228 019		
228		48388	ressort intérieur	32 228 239		2
228		72145	ressort extérieur	32 228 240		2
214		408	torique	32 214 005	1	1
214		409	torique	32 214 006	2	27
358		543	joint	32 358 154		30
110	2	NC	torique	32 110 066		
110	2	NC	torique	32 110 067		
110	1	NC	torique	32 110 019		
110	1	NC	torique	32 110 023		

Qmn	Qstk	
175	1	27
176	2	8
207	2	19
256	2	2
294	2	19
300	0	0
305	1	2
306	1	1
556	2	7
573	16	122
1077	4	1
3651	2	2
3818	0	0
3846	0	0
3928	10	17
3931	0	16
3937	0	0
3939	0	48
3942	0	0
4041	0	3
6020	1	20
6374	4	63
16123	0	0
20633	0	0
23001	0	0
23956	2	0
33252	0	0
33635	0	18
33907	1	21
33946	0	20
34388	0	0
40416	1	0
40417	0	0
40418	0	0
40422	0	0
40428	0	0
40433	4	12
40444	0	0
40452	0	10
40472	0	
40486	0	0
40491	0	0
40493	0	0
40494	0	0
40498	0	1
40511	0	8
40512	0	0
40514	0	0
40516	0	0
40517	0	0

40519	0	0
40520	0	0
40523	0	0
40525	0	0
40537	0	0
40538	1	3
40539	2	3
40540	0	0
40542	0	9
40566	0	0
40567	0	0
40622	0	17
40646	0	0
40653	0	0
40677	0	0
40687	0	0
40693	8	0
40694	9	9
40698	8	0
40700	8	10
40701	8	9
40713	2	1
40723	0	0
40725	0	0
40730	0	0
40736	0	0
40742	0	0
40744	0	0
40747	0	0
40750	0	0
40755	0	0
40756	0	0
40757	0	0
40759	0	0
40761	1	1
40776	1	3
40788	0	0
40790	0	0
40791	0	0
40794	0	0
40795	0	90
40798	0	100
40812	0	0
40816	0	3
40834	0	0
40858	0	0
40859	0	0
40873	0	0
40879	0	0
40880	0	0
40881	0	0

40935	0	0
41012	0	0
41028	0	2
41042	0	0
41043	0	0
41056	0	0
41157	2	2
41158	0	0
41264	0	0
41324	0	1
41328	0	16
41329	0	16
41331	0	0
41332	0	0
41333	0	0
41336	2	0
41340	2	12
41342	0	2
41343	0	2
41345	0	0
41351	0	7
41365	0	1
41366	0	2
41369	0	0
41370	2	0
41373	2	0
41468	0	0
41469	0	0
41479	0	0
41481	1	2
41482	1	2
41494	0	1
41495	0	1
42160	1	2
42166	2	4
42168	1	1
42171	1	0
42173	0	0
43094	0	2
48168	0	4
48169	0	0
74653	0	1
76975	8	0

NC

1 **Clean the centrifugal lubricating oil filters.** If the deposits are thicker than 20 mm, reduce the cleaning interval to retain filtering efficiency. Maximum deposit capacity is 40 mm.

2 **Keep the injection pump racks clean** (free from sticky deposits), check that the parts of the fuel control shaft system move easily. Is to be done on a stopped engine.

3 **Clean the turbine side of the turbocharger** by injecting water. See chapter [15] and the instruction book of the turbocharger.

03.3.3 Once a month or after every 500 running hours

1 **Check content of additives** in the circulating water.

2 **Check the cylinder pressures.** At the same time, note the load of the engine (the position of the load indicator or the injection pump racks offers an accurate measure of the engine load).

Note!

Measurement of cylinder pressures without simultaneous notation of the engine load is practically worthless.

3 **Check the function** of the load dependent "inverse" cooling system with engine loaded below 30 % of rated output.

03.3.4 In connection with maintenance work

1 **Record the following steps** and the running hours in the engine log:

- lubricating oil sampling (record also operating time of oil). Lubricating oil analyses without statement of operating time is of limited value ("go - no go" only),
- lubricating oil changes,
- cleaning of centrifugal lubricating oil filters,
- change of lubricating and fuel oil filter cartridges,
- change of parts in connection with maintenance according to chapter [04] .

03.3.5 General

1 **There is no automatic supervision** or control arrangement that can replace an experienced engineer's observations. LOOK at and LISTEN to the engine!

2 **Forms**, "Operating data" and "Service Report", are delivered with every installation. Use them!

3 **Strong gas blow-by** past the pistons is one of the most dangerous things that can occur in a diesel engine. If gas blow-by is suspected (e.g. because of a sudden increase of the lubricating oil consumption) check the crankcase pressure. If the pressure exceeds 30 mm H₂O, check the crankcase venting system, if in order, pull the pistons!

4 **Operation at loads below 20 %** of rated output should be limited to maximum 100 hours continuously when operating on heavy fuel by loading the engine above 70 % of rated load for one hour before continuing the low load operation or shutting down the engine. Continuous operation on marine diesel fuel at loads below 10 % of rated output should be limited to maximum 100 hours by loading the engine by more than 70 % of rated output for one hour before continuing the low load operation or shutting down the engine.

Idling (i.e. main engine declutched, generator set disconnected) should be limited as much as possible. Warming-up of the engine for more than 3 - 5 minutes before loading, as well as idling more than 1 minute before stopping is unnecessary and should be avoided.

03.4 Start after a prolonged stop (more than 8 h)

03.4.1 Manual start

1 **Check**

- the lubricating oil level,
- the circulating water level in the expansion tank,
- the raw water supply,
- the fuel oil level in the day tank (troublesome and time consuming job to vent the fuel system if the feed pump has sucked air!),
- the starting air pressure - minimum 15 bar,
- that the control shaft system and the injection pump racks move freely. Otherwise **risk of overspeed**.

2 Observe all points in chapter 03 pos. [03.1.1] . **Point 3 grows more important the longer the engine has been stopped.**

3 After starting, check that the starting air distributing pipe is not heated at any cylinder (leakage from the starting valve).

4 Vent fuel and lubricating oil filters.

03.5 Start after overhaul

1 Check that the connection between the speed governor, overspeed trip and injection pumps is set correctly (especially the injection pump rack position) and does not jam, and that all connections are properly locked and the injection pump racks move freely in the pumps.

2 The speed governor control lever being in maximum position and the stop lever in work position, release the overspeed trip manually. Check that all injection pump racks move to a value less than 4 mm.

3 If the injection pumps, camshaft or its driving mechanism have been touched, check the injection timing. If the camshaft or its driving mechanism have been touched, check the valve timing of one cylinder, at least (on each cylinder bank in a V-engine).

4 Check the cooling water system for leakage, especially:

- the lower part of the cylinder liners,
- the oil cooler,
- the charge air cooler.

5 Check/adjust the valve clearances. Guidance values, see chapter [06] .

6 Vent the fuel oil system if it was opened.

7 Start the priming pump. Vent the lubricating oil filters. Check that lubricating oil appears from all bearings and lubricating nozzles, from the piston cooling oil outlet and from the valve mechanism. Check that there is no leakage from the pipe connections inside or outside the engine.

8 Rags or tools left in the crankcase, untensioned or unlocked screws or nuts (those which are to be locked), worn-out self-locking nuts, MAY CAUSE total breakdown.

Well cleaned oil spaces (oil sump and camshaft spaces) save the oil pump and oil filter.

9 See the instructions in section [03.1] and [03.4] when starting.

03.6 Operation supervision after overhaul

1 At the first start, listen carefully for possible jarring sounds. If anything suspected, stop the engine immediately, otherwise stop the engine after 5 minutes' idling at normal speed. Check at least the temperatures of the main and big end bearing and of all other bearings which have been opened.

If everything is in order, restart.

2 Check that there is no leakage of gas, water, fuel, heating oil or lubricating oil. Especially observe the fuel lines, injection pumps and injection valves. Watch the quantities emerging from the leak oil pipes!

3 Check that the starting air distributing pipe is not heated at any cylinder (leaky starting valve). May cause explosion!

4 After overhauling, the following instructions are especially important:

- check pressure and temperature gauges,
- check the automatic alarm and stop devices,
- check the pressure drop over the fuel filter and lubricating oil filter,
- check the oil level in the oil sump/oil tank. Estimate the condition of the oil,
- check the ventilation of the engine circulating water system,

- check the quantity of leak fuel,
- check the gossip holes of the coolers,
- check the content of additives in the circulating water,
- check the cylinder pressures,
- listen for jarring sounds,
- check the crankcase pressure,
- check the starting air pipes,
- vent the filters.

03.7 Running-in

The running-in of a new engine must be performed according to programme B in [Fig 03-2] . It is also recommended that running-in procedure is performed after following maintenance jobs.

1 After piston overhaul, follow programme A in [Fig 03-2] , as closely as possible. The piston rings have slid into new positions and need time to refit. If the program cannot be followed, **do not load the engine fully for 4 h, at least.**

2 After changing piston rings, pistons or cylinder liners, after honing of cylinder liners, follow programme B in [Fig 03-2] , as closely as possible.

If the program cannot be followed, **do not load the engine fully for 10 h, at least.**

Avoid "running-in" at continuous and constant low load!

The important thing is to vary the load several times. The ring groove will have a different tilting angle at each load stage, and consequently the piston ring a different contact line to the cylinder liner.

The running-in may be performed either on distillate or heavy fuel, using the normal lubricating oil specified for the engine.

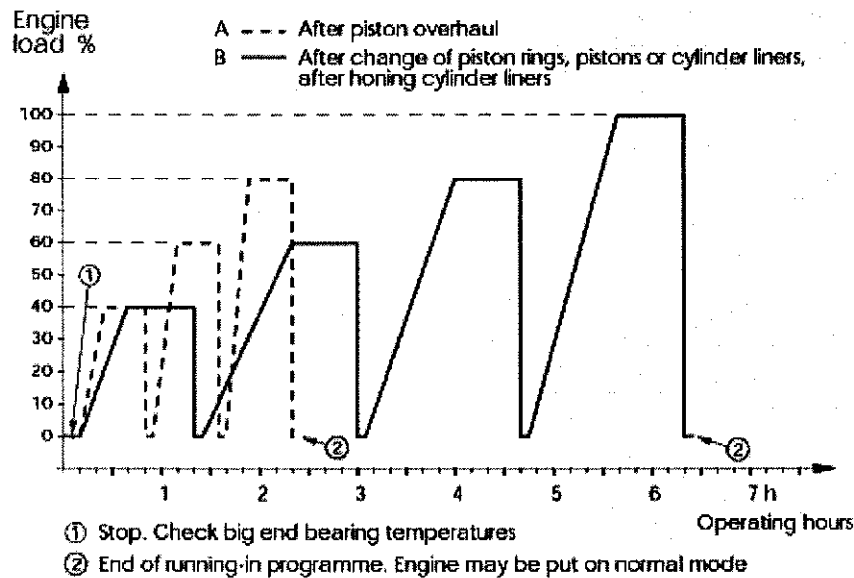


figure: 03-2 Running-in programme

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04 Maintenance Schedule

version : 04-9845-03

04.1 General

The maintenance necessary for the engine depends on the operating conditions in the main. The periods stated in this schedule are guidance values, only, but must not be exceeded during the guarantee period. When using diesel oil or intermediate fuels of comparatively good quality as fuel oil it may be possible to lengthen the stated maintenance intervals considerably depending on the engine load. See also the instruction books of the turbocharger and the governor, separate instructions for additional equipment and chapter [03] .

1 Before any steps are taken, carefully read the corresponding item in this manual.



Installation and Operation Manual



UG Dial Governor

UG-5.7/UG-8/UG-10 Dial

Manual 03040D



WARNING

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.



CAUTION

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.



IMPORTANT DEFINITIONS

WARNING—indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION—indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment.



NOTE—provides other helpful information that does not fall under the warning or caution categories.

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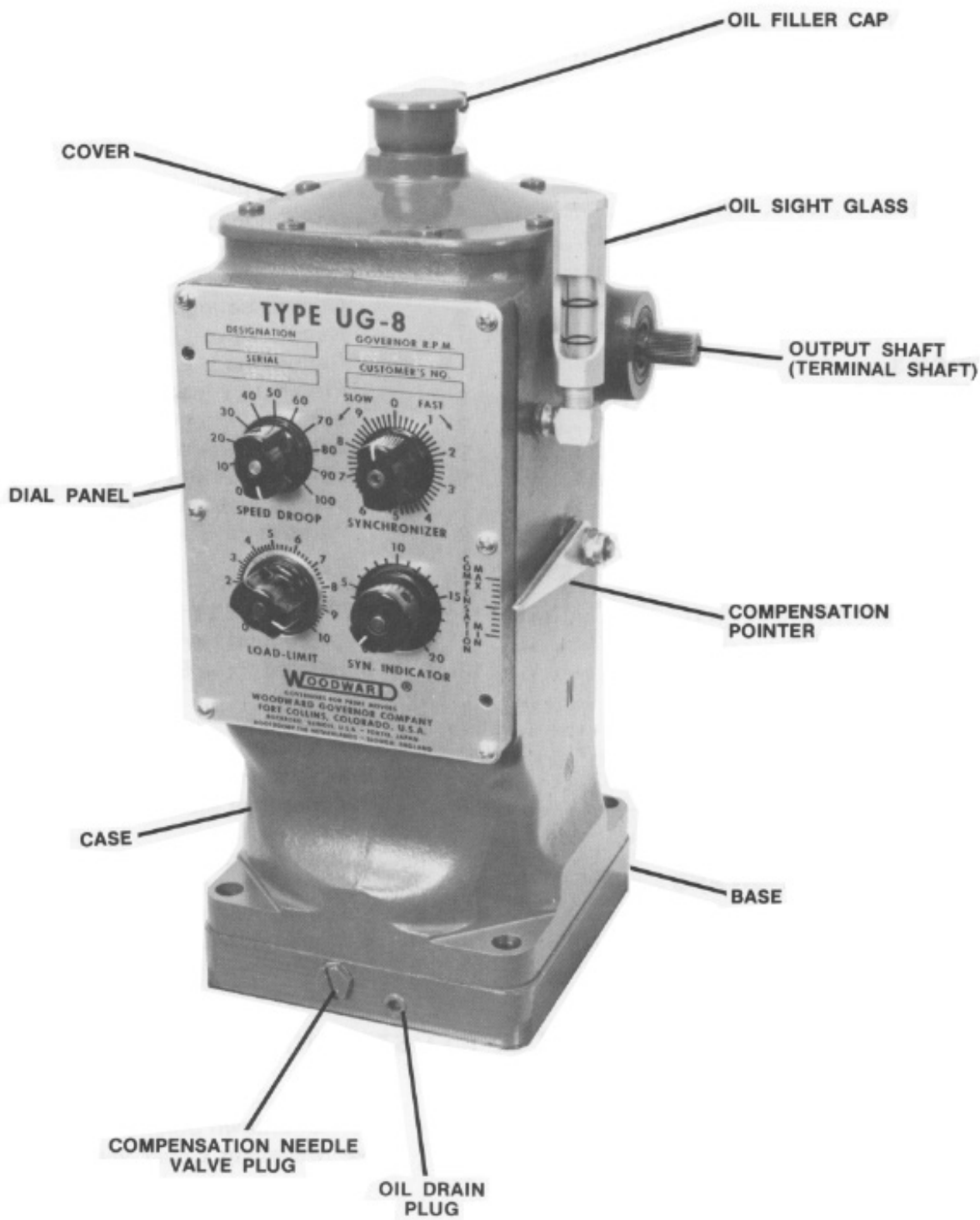


Figure 1-1. UG-8 Dial Governor

Chapter 1.

General Information

Introduction

The UG Dial governor is available in three different work outputs:

- UG-5.7—7.1 N·m (5.2 lb-ft)
- UG-8—13.2 N·m (9.7 lb-ft)
- UG-10—15.9 N·m (11.7 lb-ft)

The UG-5.7 and UG-8 both use 827 kPa (120 psi) oil pressure, and the UG-10 uses 1034 kPa (150 psi).

Basic operation, adjustment, troubleshooting, and replacement of parts are similar for the UG-5.7, UG-8, and UG-10.

Description

The UG is a mechanical-hydraulic governor for controlling diesel, gas, or dual fuel engines, or steam turbines. The UG is mechanically linked to the fuel racks or to the fuel valves, depending on the system.

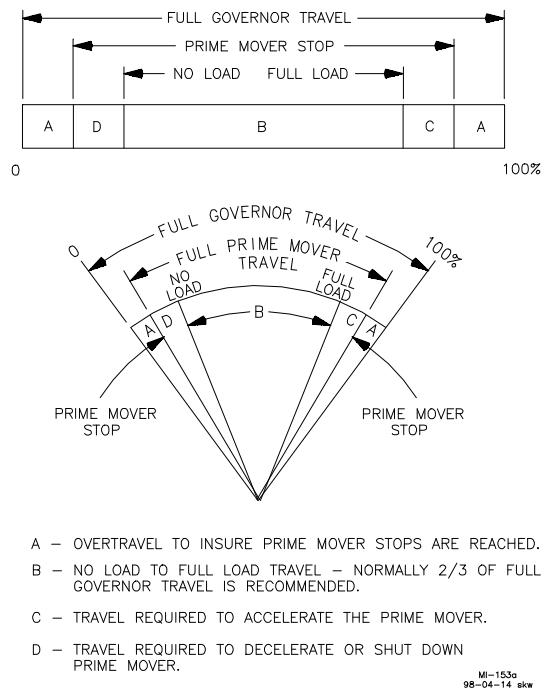
The maximum travel of the output (terminal) shaft is 42°. The recommended travel of the output shaft is 28° from no load to full load, which allows sufficient overtravel at each end so that the governor can shut down the prime mover and also give maximum fuel when required. See Figure 1-2 for recommended output shaft travel adjustment.

Normally, the UG operates isochronously (constant speed) regardless of load on the engine, except as described in Chapter 3, Principles of Operation.

Speed droop is incorporated in the UG Dial governor to divide and balance load between units driving the same shaft or paralleled in an electrical system.

A load limit control is also a standard feature on the UG Dial governor. It limits the amount of fuel supplied by restricting the travel of the governor output shaft. An indicator dial shows the governor output shaft limit position.

The load limit control may also be used for shutting down the prime mover by turning it to zero.



MAXIMUM WORK CAPACITY OVER FULL GOVERNOR TRAVEL OF 42" IS * . SEE ABOVE FOR RECOMMENDED GOVERNOR OUTPUT TRAVEL. IN SPECIAL APPLICATIONS MIN AND MAX PRIME MOVER STOPS MAY BE OUTSIDE THE GOVERNOR STOPS.

* UG-5.7—7.1 N·m (5.2 lb-ft)

* UG-8—13.2 N·m (9.7 lb-ft)

* UG-10—15.9 N·m (11.7 lb-ft)

Figure 1-2. Recommended Output Shaft Travel Adjustment

References

The publications listed below are available on Woodward's website (www.woodward.com). Some of the manuals are briefly covered in Chapter 7, Auxiliary Equipment.

Pub. Type	Pub. Number	Title
Manual	03013	Shutdown Solenoid for UG Governors
Manual	03016	Low Lube Oil Pressure Shutdown for UG Governors
Product Spec.	03029	UG-5.7/8/10 Governor
Manual	03035	PM Speed Adjusting Motor
Manual	03505	Speed Adjusting (Synchronizing) Motor Parts Catalog and Lubrication Guide
Manual	25071	Oils for Hydraulic Controls
Manual	25075	Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls
Manual	36052	Magnetic Speed Pickup for PG, UG-8, and UG-40 Governors
Manual	36684	Booster Servomotor
Application Note	50516	Governor Linkage for Butterfly Throttle Valves
Repair Manual	56103	UG Dial Governor Repair Procedure

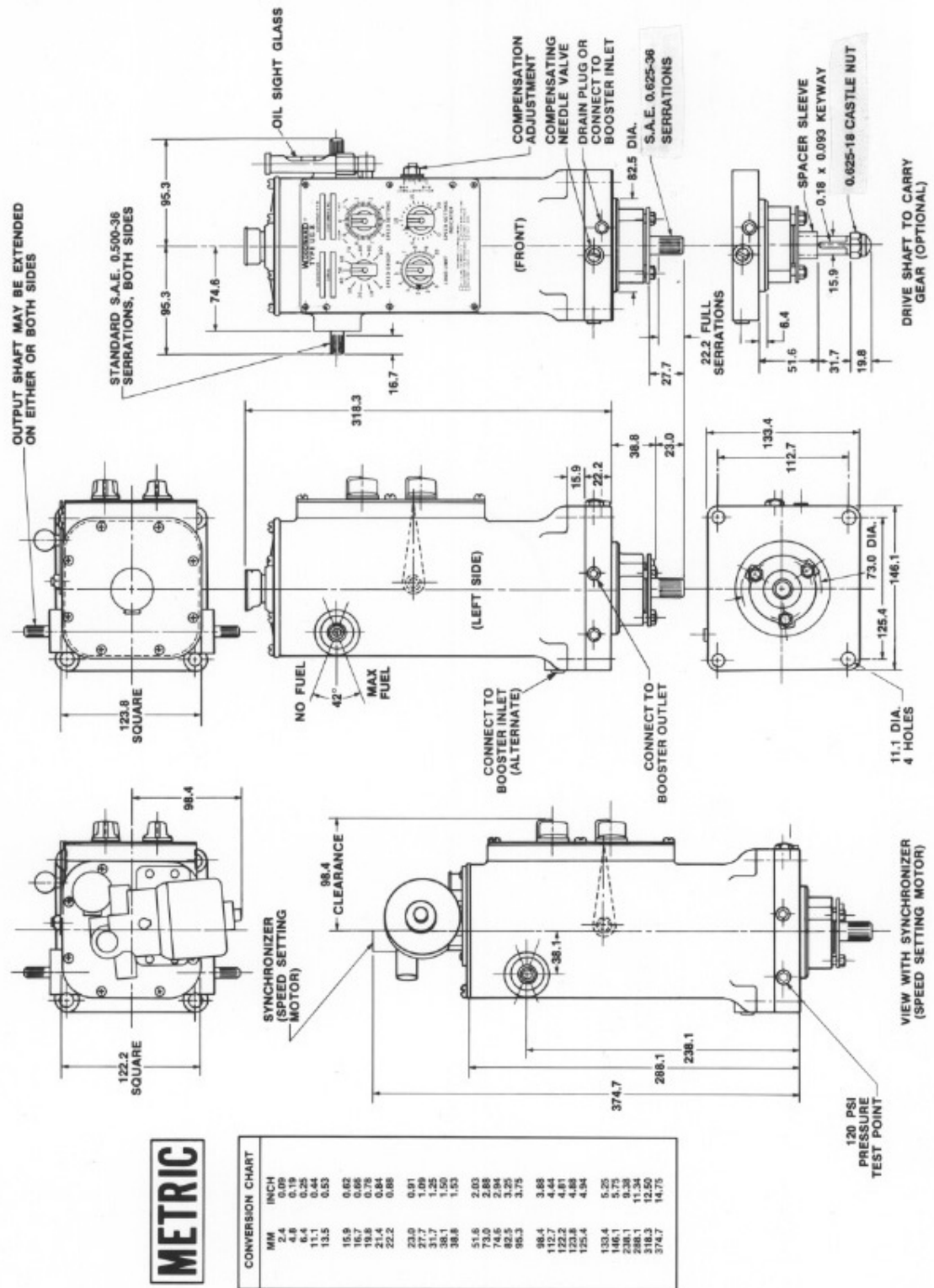


Figure 1-3. UG Dial Governor Outline Drawing

Chapter 2. Installation Procedures

Introduction

This chapter provides information necessary for receiving, storage, mounting, and start-up adjustments.

Receiving

When you receive your UG governor, it will be bolted to a wooden platform in a vertical position. After testing the governor at the factory, it is drained of oil. This leaves a light film of oil covering the internal parts, preventing rust. No internal cleaning is required before installation.

Some drive shafts are sprayed with a light film of oil while others (depending on customer requirements) are covered with soft seal. Before installation, remove the soft seal with a rag saturated with mineral spirits.

Storage

If a governor is being stored for any period of time, please refer to Woodward manual 25075, *Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls*.

Mounting Requirements

1. Make sure the drive shaft rotates freely.
2. Select the correct length of coupling between the governor and the prime mover drive.
3. Mount the governor squarely on its mounting pad.
4. Make sure there is no force pushing the drive shaft into the governor.
5. See the outline drawing (Figure 1-3) for mounting hole sizes and governor dimensions.
6. Make sure the coupling rotates freely but without backlash. Incorrect alignment of the governor shaft to the coupling, or not enough clearance between any of the parts, can result in excessive wear and/or seizure of parts. It can also cause an undesirable high frequency vibration or "jiggle" in the governor output shaft (see Definitions in Chapter 5 for more information).

The standard UG governor drive gives few installation problems if the alignment of the governor shaft to the drive coupling is kept.

**WARNING**

In the event of a misaligned or broken drive shaft, an overspeed condition or runaway engine can develop. An overspeeding or runaway engine can result in extensive damage to the equipment, personal injury and/or loss of life.

If an optional keyed drive is used when installing the governor, take care to avoid the following undesirable conditions:

- a. Rough gear teeth:
Rough gear teeth, or shaft out of round, can cause vibrations which can be transmitted to the governor and cause a jiggle in the governor output shaft. The jiggle can be transmitted to the fuel control resulting in an undesirable condition. Replace gears if necessary.
 - b. Incorrect shimming:
Check backlash and re-adjust if necessary to obtain proper mesh without binding or excessive backlash. Refer to the prime mover manufacturer's specifications for the correct amount of backlash.
7. Mount the governor flush with the engine drive pad. If the engine drive pad is at an angle (from 0° to 45° maximum), the UG must be installed with the front panel in the upper position. Use a gasket between the governor and the engine drive pad.

Be sure there is adequate space available around the governor to provide easy access for installing the control linkage, filling the governor with oil, and adjusting the speed and compensation system. See the outline drawing (Figure 1-3) for mounting hole sizes and governor dimensions.

The recommended rated speed range for the governor drive is 1000 to 1500 rpm. The drive power requirement is 249 W (1/3 hp) at normal speed and operating temperature. The UG governor may be driven either clockwise or counterclockwise.

Operating temperature range for the UG governor is -29 to +99 °C (-20 to +210 °F).

Linkage Attachments

Adjustment of the fuel linkage must provide for control of fuel from "OFF" to "FULL FUEL" within the limits of the 42° of governor output shaft travel. It must also provide for approximately 30° output shaft travel between "NO LOAD" and "FULL LOAD".

Attach the fuel rack linkage to the governor output shaft. There must be no lost motion or binding in this linkage. Adequate locking methods must be employed on the linkage connections.

**WARNING**

Be sure to allow sufficient overtravel at each end of the terminal shaft. Failure to provide sufficient overtravel at maximum fuel position can prevent the prime mover from giving maximum fuel when required. Failure to provide sufficient overtravel at minimum fuel position can prevent the governor from shutting down the prime mover and result in possible damage to equipment and personal injury.

A linear linkage arrangement is used in applications where the governor output shaft positioning is directly proportional to the torque output of the prime mover. Thus, the governor output shaft travel will be directly proportional to the amount of fuel delivered to the prime mover.

A linear linkage is a linkage arrangement which provides as much movement of the governor output shaft per increment of valve movement at light loads as it does at heavy loads.

In applications where a governor is controlling a butterfly valve, such as on a gas engine, a linear linkage should not be used.

This is due to the inherent design of the butterfly valve which requires only a small amount of valve travel (for example, 10°) to bring an engine from no load to half load. By contrast, this design requires a much greater movement of valve travel (for example, 30°) to bring the engine from half load to full load.

In order to improve governing control at light loads, a compensating linkage is devised ("non-linear" linkage). This linkage provides greater movement of the governor per increment of valve movement at light loads than it does at heavy loads. Figure 2-1 illustrates the relationship between governor output shaft and butterfly positions obtained with simple linkage of maximum non-linearity. When installing this linkage, make sure that the two following conditions are obtained when the linkage is in the no-load position:

1. The lever which is attached to the governor and the connecting link is in line with the governor output shaft and the point of attachment of the connecting link to the butterfly lever.
2. The butterfly lever must be at 90° with the connecting link.

See also Table 5-2 for a satisfactory relationship between governor output shaft travel and butterfly valve travel in a non-linear system.

For more information on non-linear linkage, please refer to Woodward Application Note 50516, *Governor Linkage for Butterfly Throttle Valves*.

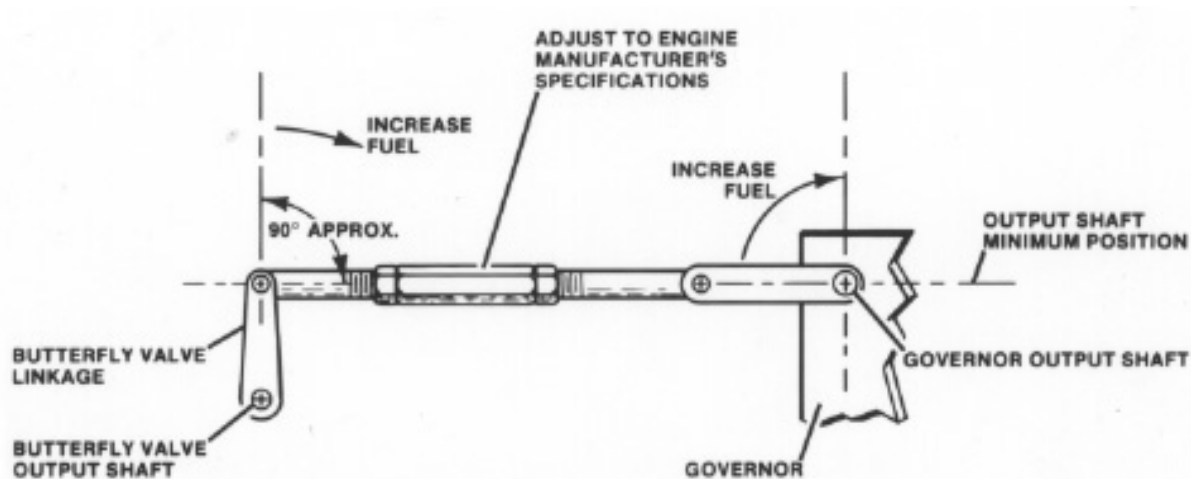


Figure 2-1. Linkage Arrangement (for non-linear fuel systems)

Oil Supply

Use an oil depending on operating temperature for the governor (see Table 2-1).



NOTE

Primary concern is for the oil properties in the governor.

Fill the governor with approximately two quarts of oil to the mark on the oil sight glass. After the engine is started and the governor is at operating temperature, add oil if necessary. Oil must be visible in the glass under all operating conditions.

Use the information given in Tables 2-1 and 2-2 as a guide in the selection of a suitable lubricating/hydraulic oil. Oil grade selection is based on the operating temperature range of the governor. Also, use this information to aid in recognizing and correcting common problems associated with oils used in governors.

For applications where the governor shares the oil supply with the engine, use the oil recommended by the engine manufacturer.

Governor oil is both a lubricating oil and a hydraulic oil. It must have a viscosity index that allows it to perform over the operating temperature range, and it must have the proper blending of additives that cause it to remain stable and predictable throughout this range.

Governor oil must be compatible with seal materials (particularly nitrile, polyacrylic, and fluorocarbon). Many automotive and gas engine oils, industrial lubricating oils, and other oils of mineral or synthetic origin meet these requirements. Woodward governors are designed to give stable operation with most oils with the viscosity, at the operating temperature, between 50 and 3000 SUS (Saybolt Universal Seconds). At the normal operating temperature, the viscosity should be between 100 to 300 SUS. Poor actuator response or instability may be an indication that the oil viscosity is outside this range.

Excessive component wear or seizure in a governor indicates the possibility of:

1. Insufficient lubrication caused by:
 - a. An oil that flows slowly when it is cold, especially during start-up.
 - b. No oil in the governor.
2. Contaminated oil caused by:
 - a. Dirty oil containers.
 - b. A governor exposed to heating up and cooling down cycles, which creates condensation of water in the oil.
3. Oil not suitable for the operating conditions caused by:
 - a. Changes in ambient temperature.
 - b. An improper oil level which creates foamy, aerated oil.

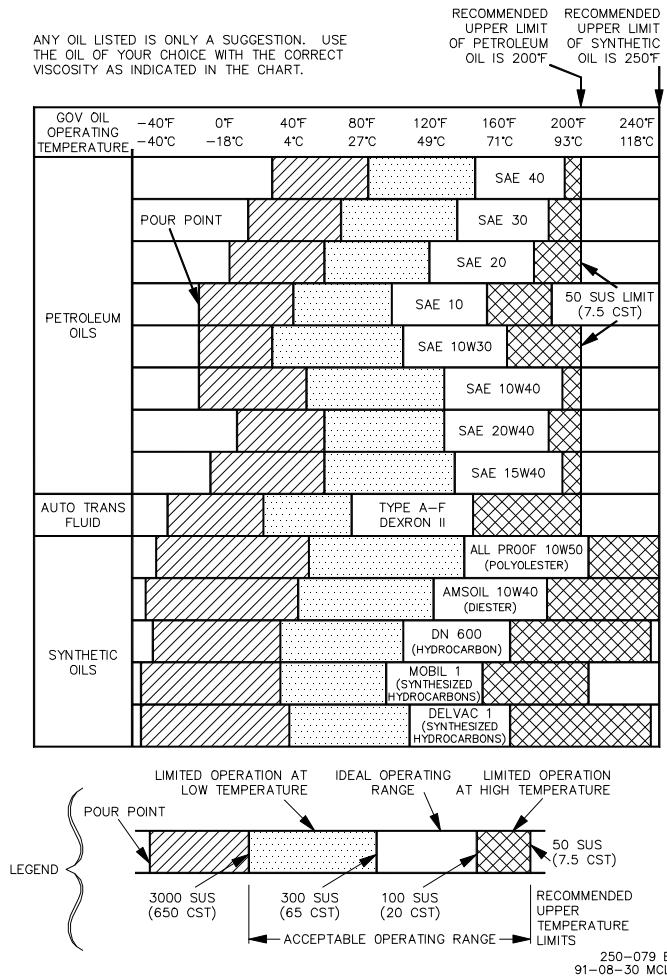


Table 2-1. Oil Chart

VISCOSITY COMPARISONS				
CENTISTOKES (CST, CS, OR CTS)	SAYBOLT UNIVERSAL SECONDS (SUS) NOMINAL AT 100 DEGREES F	SAE MOTOR (APPROXIMATE)	SAE GEAR (APPROXIMATE)	ISO
15	80	5W		15
22	106	5W		22
32	151	10W	75	32
46	214	10	75	46
68	310	20	80	68
100	463	30	80	100
150	696	40	85	150
220	1020	50	90	220
320	1483	60	115	320
460	2133	70	140	460

250-087
97-11-04 skw

Table 2-2. Viscosity Comparisons

Operating a governor continuously beyond the high limit temperature of the oil will result in oil oxidation. This is identified by varnish or sludge deposits on the governor parts. To reduce oil oxidation, lower the actuator operating temperature with a heat exchanger or other means, or change to an oil more oxidation-resistant at the operating temperature.

**WARNING**

A loss of stable governor control and possible prime mover overspeed may result if the viscosity exceeds the 50 to 3000 SUS range. An overspeeding and/or runaway prime mover can result in extensive damage to the equipment, personal injury and/or loss of life.

Specific oil viscosity recommendations are given on the oil chart (Table 2-1). Select a readily available good brand of oil, either mineral or synthetic, and continue using that same brand. Do NOT mix the different classes of oils. Oil that meets the API (American Petroleum Institute) engine service classification in either the "S" group or the "C" group, starting with "SA" or "CA" through "SF" and "CD" is suitable for governor service. Oils meeting performance requirements of the following specifications are also suitable: MIL-L-2104A, MIL-L-2104B, MIL-L-2104C, MIL-L-46152, MIL-L-46152A, MIL-L-46152B, MIL-L-45199B.

Replace the governor oil if it is contaminated, also change it if it is suspected of contributing to the governor instability. Drain the oil while it is still hot and agitated; flush the governor with a clean solvent having some lubricating quality (such as fuel oil or kerosene) before refilling with new oil. If drain time is insufficient for the solvent to completely drain or evaporate, flush the governor with the same oil it is being refilled with to avoid dilution and possible contamination of the new oil. To avoid recontamination, the replacement oil should be free of dirt, water, and other foreign material. Use clean containers to store and transfer oil.

**WARNING**

Observe the manufacturer's instructions or restrictions regarding the use of solvents. If no instructions are available, handle with care. Use the cleaning solvent in a well ventilated area away from fires or sparks.

Failure to follow the safety instructions above can result in dangerous fires, extensive damage to equipment, personal injury and/or loss of life.

Oil that has been carefully selected to match the operating conditions and is compatible with governor components should give long service between oil changes. For governors operating under ideal conditions (minimum exposure to dust and water and within the temperature limits of the oil), oil changes can be extended. If available, a regularly scheduled oil analysis is helpful in determining the frequency of oil changes.

Any persistent or recurring oil problems should be referred to a qualified oil specialist for solution.

The recommended continuous operating temperature of the oil is 60 to 93 °C (140 to 200 °F). The ambient temperature limits are -29 to +93 °C (-20 to +200 °F). Measure the temperature of the governor on the outside lower part of the case. The actual oil temperature will be slightly warmer, approximately 6 °C (10 °F).

Chapter 3.

Principles of Operation

Introduction

Basic UG operation is similar for all types. The only difference is in the method of setting the speed. Auxiliary devices provide different functions but do not alter the basic operation of the governor.

Along with the text, a schematic diagram (Figure 3-1) is provided for visual means of understanding the operation of the UG Dial governor. This schematic shows a basic design and does not include any auxiliary equipment.

Component Description

Before getting into the operation of the UG, a brief description of the components will facilitate understanding the operation.

Oil Pump

The purpose of the oil pump (14) is to provide oil pressure for the governor.

The pump gets its oil from the self-contained sump (15). The oil pump is a positive displacement gear pump with four check valves (13) for either direction of rotation. One pump gear is part of the rotating bushing, and the other is part of the laminated drive. The rotating bushing is driven by the governor drive shaft which is driven by the prime mover. As the bushing rotates, it rotates the laminated drive. The oil pump gears can be driven either clockwise or counterclockwise.

Oil flow is directed through the check valve system into the accumulator system (11).

Accumulator

The purpose of the accumulator (11) is to store oil under pressure for the operation of the UG governor. The accumulator (two cylinders) also acts as a pressure relief valve if oil pressure increases above 827 kPa/120 psi (UG-5.7 and UG-8) or 1034 kPa/150 psi (UG-10).

The accumulator (11) consists of two spring loaded pistons. Oil is pumped into the cylinders and pressure is increased as the accumulator springs are compressed. When the oil pressure exceeds 827 kPa/120 psi (UG-5.7 and UG-8), or 1034 kPa/150 psi (UG-10), oil is released back to sump through a relief port (12) in each cylinder.

Oil flows from the accumulator through passages to the top of the power piston and to the pilot valve system.

Power Piston

The purpose of the power piston (9) is to rotate the governor output shaft to the increase or decrease fuel position.

The power piston is a differential type with oil pressure on both sides of the piston. The top end of the power piston is connected to the governor output shaft (6) through a power lever and link assembly.

The bottom of the power piston has a larger area than the top of the piston. Therefore, less oil pressure is needed on the bottom than on the top to maintain the piston stationary. If the oil pressure is the same on both the top and bottom of the piston, the piston moves up to rotate the governor output shaft in the increase fuel direction. The piston moves down only when oil under the piston is released to sump.

Oil to and from the bottom of the power piston is regulated by the pilot valve system.

Pilot Valve System

The purpose of the pilot valve plunger and bushing is to control the flow of oil to or from the bottom of the power piston.

The pilot valve system includes the rotating bushing (38) and the pilot valve plunger (39). The bushing (38) is rotated by the drive shaft (36) while the pilot valve plunger is held stationary. Through this rotation, friction between the pilot valve and bushing is reduced. The pilot valve plunger has a control land that regulates oil flow through ports in the bushing.

When the pilot valve plunger (39) is lowered, high pressure oil flows under the power piston (9), raising it. When the pilot valve plunger is raised, oil is released to sump from under the power piston (9), lowering it. The higher pressure on top of the power piston(9) forces the piston down. When the pilot valve plunger (39) is in its centered position, the control land covers the control port as shown in the schematic (Figure 3-1), and there is no movement of the power piston.

The movement of the pilot valve plunger (39) is controlled by the ballhead system (23) and the dashpot compensation pistons (34) and (35).

Ballhead System

The purpose of the ballhead system (23) is to sense speed changes of the prime mover as compared to the speed setting reference given by the speeder spring (25) and to position the pilot valve plunger (39).

The ballhead system includes a ballhead (23), flyweights (24), a speeder spring (25), a thrust bearing (30), a speeder plug (29), and a speed setting rod (21).

As the governor drive shaft (36) rotates, the gear on the laminated drive (32) turns and rotates the ballhead gears (23). The flyweights (24) are attached to the ballhead with pivot pins, and a thrust bearing (30) rides on the toes of the flyweights (24). The speeder spring (25) is held in position against the thrust bearing (30) by the speeder plug (29). The speeder plug (29) is used to set a pressure on the speeder spring (25).

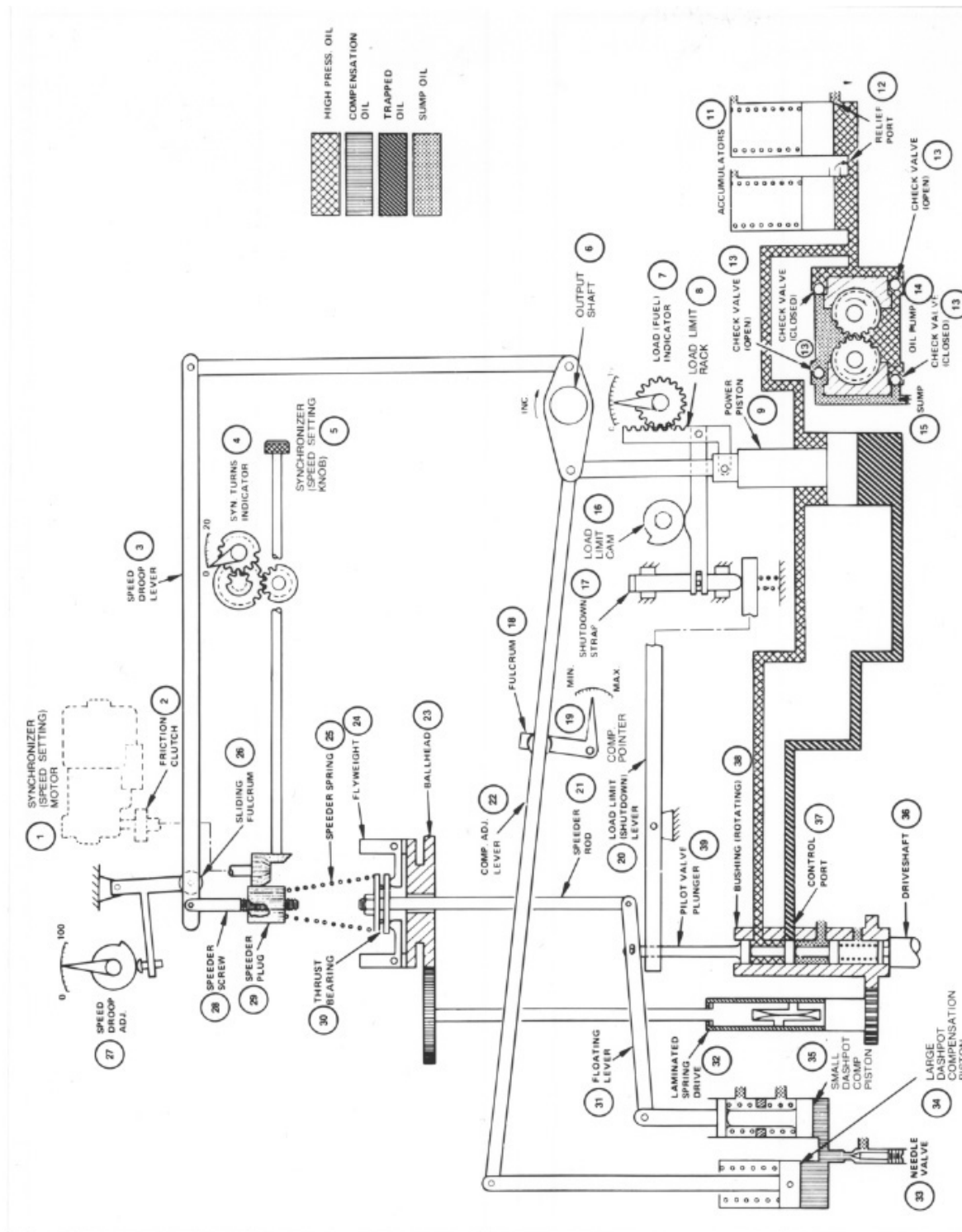


Figure 3-1. UG Dial Governor Schematic Diagram

As the ballhead (23) rotates, the flyweights (24) pivot outward due to the centrifugal force. At the same time the speeder spring (25) forces the thrust bearing (30) downward on the flyweight toes. This downward force opposes the centrifugal force of the flyweights. Increasing the drive speed increases the centrifugal force. Compressing the speeder spring (25) with the speeder plug (29) increases the downward force applied to the flyweight toes, and in turn, increases the governor speed setting. The prime mover must run faster to generate a centrifugal force greater than the speeder spring force to balance the system again.

Speeder spring force or speed setting (25) is controlled manually through the synchronizer (speed setting) adjusting knob (5). It can also be controlled from a remote area if the governor is equipped with a speed setting motor (1).

Compensation System

The purpose of the compensation system is to give stability to the governor and obtain steady state speed control. Also, when correctly adjusted, the compensation system effectively regulates the amount of fuel necessary to bring the engine to the required output to adjust to a decrease or increase in load.

The compensation system creates a small temporary change of speed setting with governor output shaft movement to produce a stabilizing speed droop characteristic in the governor. The change of speed setting is followed by a slow return of speed setting to its original value. Compensation is simply another word for temporary speed droop characteristic.

The compensation system includes a large dashpot compensation piston (34), a small dashpot compensation piston (35), a floating lever (31), a compensation adjusting lever (22) with a pivotable fulcrum (18), and a needle valve (33). See Figure 3-1.

The large dashpot compensation piston (34) is connected to the governor output shaft (6) by a compensation adjusting lever (22). A pivotable fulcrum (18) rides on the compensation adjusting lever (22). Changing the fulcrum's (18) position allows the compensation lever (22) to control the amount of stroke available for the large dashpot compensation piston (34).

The small dashpot compensation piston (35) is connected through a floating lever (31) to the pilot valve plunger (39) and the speeder rod (21).

Moving the large dashpot compensation piston (34) down forces oil under the small dashpot compensation piston (35). As the small dashpot compensation piston (35) is forced upward, it lifts the pilot valve plunger (39) to close off the control port which stops the flow of oil to the bottom of the power piston (9).

The needle valve (33) is a variable orifice which controls the flow of oil between both the large (34) and the small dashpot compensation (35) pistons, and the oil sump.



NOTE

Compensation must be properly adjusted to the particular engine and load to provide stable operation (see Chapter 4, Compensation Adjustments).

Load Limit Control

The purpose of the load limit control is to hydraulically and mechanically limit the load that can be placed on the engine by restricting the travel of the governor output shaft in the increase fuel direction, and consequently the amount of fuel supplied to the engine.

The load limit control may also be used for shutting down the engine by turning it to zero.



CAUTION

Do not manually force prime mover linkage to increase fuel without first turning the load limit control knob to maximum position (10). Failure to do so may cause damage and/or failure of governor internal parts.

The load limit control consists of an indicator disc (7) geared to a load limit rack (8). The control knob is also attached to the load limit cam (16).

Load is limited mechanically by positioning the load limit knob (cam 16). When the load indicator reaches the preset point, the pilot valve plunger (39) is lifted, stopping any further increase in fuel.

Turning the load limit control to zero to shut down the engine turns the cam (16) forcing the load limit (shutdown) lever (20) and shutdown strap (17) down. As the right end of the load limit (shutdown) lever (20) is forced downward, it pivots about its fulcrum and lifts the pilot valve plunger (39), releasing oil from under the power piston (9). Pressure oil acting on top of the power piston (9) forces it downward, rotating the governor output shaft (6) to minimum fuel and causing the prime mover to shut down.

Synchronizer

The synchronizer is the speed adjusting control, and is used to change engine speed for a single unit. On engines paralleled with other units, it is used to change engine load.

The upper knob (called "SYNCHRONIZER" on most models or "SPEED SETTING KNOB" on later models) is the control knob.

The lower knob ("SYN. INDICATOR") has no function of its own but has an indicator disc which shows the number of revolutions of the synchronizer (speed setting) control knob.

Speed Droop

Speed droop, or simply droop, is one method of creating stability in a governor. Droop is also used to divide and balance load between units driving the same shaft or paralleled in the electrical system.

Droop is the decrease in speed that occurs when the governor output shaft moves from the minimum to the maximum fuel position in response to a load increase, expressed as a percentage of rated speed.

If instead of a decrease in speed, an increase takes place, the governor shows a negative droop. Negative droop will cause instability in a governor.

Too little droop can cause instability in the form of hunting, surging, or difficulty in response to a load change. Too much droop can result in slow governor response in picking up or dropping off a load.

Using an example where the governor speed is 1500 rpm at no load and 1450 rpm at full load, droop can be calculated with the formula:

$$\% \text{Droop} = \frac{\text{No load speed} - \text{full load speed}}{\text{full load speed}} \times 100$$

$$\% \text{Droop} = \frac{1500 \text{ rpm} - 1450 \text{ rpm}}{1450 \text{ rpm}} \times 100 = 3.5\%$$

If the decrease in speed is greater than 50 rpm when the governor output shaft moves from the minimum to the maximum fuel position, droop greater than 3.5% is shown by the governor. If the decrease in speed is less than 50 rpm, droop less than 3.5% is shown by the governor.



NOTE

If the governor output shaft does not use the full 30° of available travel from “NO LOAD” to “FULL LOAD”, droop will also be reduced proportionately.

Marks on the droop adjustment scale on the dial panel are reference numbers only, and do not represent droop percentages. Thus the 100 mark does not represent 100% droop. It represents the maximum droop percentage available on that particular UG governor model.

Speed droop consists of a control knob, cam, and linkage, which when preset, varies the compression of the speeder spring as the output shaft rotates. Increasing the fuel reduces speeder spring compression and, in turn, the governor speed setting. The unit gradually reduces its speed as load is applied. This relationship between load and speed acts as a resistance to load changes when the unit is interconnected with other units either mechanically or electrically.

Reducing droop to zero allows the unit to change load without changing speed. Normally, set zero droop on units running alone. On interconnected units, set the least amount of droop possible to provide satisfactory load division.

For ac generating units tied in with other units, set droop sufficiently high (reference numbers 30 to 50 on the dial) to prevent interchange of load between units. If one unit in the system has enough capacity, set its governor on zero droop, and it will regulate the frequency of the prime mover system. If its capacity is not exceeded, this unit will handle all load changes.

Operate the SYNCHRONIZER knob of the governor with zero droop to adjust the system's frequency. Operate the SYNCHRONIZER knobs of the governors that have speed droop to distribute load between units.

Operation of the UG Dial Governor

General Information

Refer to Figure 3-1 with the text to better understand the operation of the UG Dial governor. This schematic diagram is of a basic design and does not include any auxiliary equipment.

Changes in governor speed setting produce the same governor movements as do changes in load on the engine. The description that follows is based upon speed changes caused by load changes.

Decrease in Load

When the prime mover is running on speed, the flyweights (24) are in a vertical position for normal steady state operation. The pilot valve plunger (39) is centered over the control port of the rotating bushing, and the control land stops the flow of pressure oil through the bushing (38) control port. There is no movement of the power piston (9), and no movement of the governor output shaft (6).

When a decrease in load occurs and the same fuel setting is maintained, speed increases. This generates the following sequence of governor movements:

1. As speed increases, the centrifugal force of the flyweights (24) increases and becomes stronger than the force of the speeder spring (25).
2. The flyweights (24) tip outward and raise the speeder rod (21) and the right end of the floating lever (31).
3. This raises the pilot valve plunger (39), opening the control port in the rotating bushing (38). Oil is released from the bottom of the power piston (9) to sump.
4. Pressure oil on the top side of the power piston (9) moves it downward, rotating the governor output shaft in the decrease fuel direction.
5. Linkage from the governor output shaft (6) lowers the compensation adjusting lever (22), which rotates at the fulcrum (18), raising the large dashpot compensation piston (34).
6. Suction is thus applied to the chamber of the small dashpot compensation piston (35), lowering the left end of the floating lever (31).
7. This lowers the pilot valve plunger (39) closing the control port (37).
8. As sump oil flows through the needle valve (33) from the sump into the dashpot compensation piston assembly (34 and 35), the small dashpot compensation piston (35) is returned to its normal centered position by the compensation spring at the same rate as the speeder rod (21). This keeps the pilot valve plunger (39) in its centered position.
9. The control port in the rotating bushing (38) is kept closed by the land on the pilot valve plunger (39).
10. This stops the governor output shaft and power piston movement in the new decreased fuel position. This is the position needed to run the prime mover at the selected speed setting with the new load.

Increase in Load

When an increase in load occurs and the same fuel setting is maintained, speed decreases. This generates the following sequence of governor movements:

1. As speed decreases, the centrifugal force of the flyweights (24) decreases and the opposing speeder spring (25) force is now greater than the centrifugal force of the flyweights (24).
2. The flyweights (24) tip inward and lower the speeder rod (21) and the right end of the floating lever (31).
3. This lowers the pilot valve plunger (39), opening the control port in the rotating bushing (38). Pressure oil is released through the control port into the lower cylinder of the power piston (9).
4. The power piston is forced upward by the pressure oil acting on the larger lower surface area of the power piston, and the governor output shaft is rotated in the increase fuel direction.
5. Linkage from the governor output shaft (6) lifts the compensating adjusting lever (22), which rotates at the fulcrum (18), lowering the large dashpot compensation piston (34).
6. Pressure oil is applied to the bottom side of the small dashpot compensation piston (35), raising the left end of the floating lever (31).
7. This raises the pilot valve plunger (39) closing the control port (37).
8. As pressure oil flows through the needle valve (33) from the dashpot compensation piston assembly (34 and 35), the small dashpot compensation piston (35) is returned to its normal centered position by the compensation spring, at the same rate as the speeder rod (21). This keeps the pilot valve plunger (39) in its centered position.
9. The control port in the rotating bushing (38) is kept closed by the land on the pilot valve plunger (39).
10. This stops the governor output shaft and power piston movement in the new increased fuel position. This is the position needed to run the prime mover at the selected speed setting with the new load.

In both cases, a decrease or increase in load, the compensation system operates in opposite directions. The compensation or amount of movement of the large dashpot compensation piston (34) is controlled by the compensation adjustment, that is, the position of the fulcrum (18).

The rate at which the small dashpot compensation piston (35) is returned to normal is controlled by the needle valve adjustment, that is, the rate of flow of oil through the needle valve (33).

Chapter 4.

Governor Operation and Adjustments

Introduction

This chapter describes initial operation and basic adjustments of the UG Dial governor when placing a new or repaired governor into service.

Initial Operation for a New Governor

Before initial operation of the UG Dial governor, check that all previous installation steps have been correctly accomplished and that all linkages are secure and properly attached. See Chapter 2, Installation Procedures. Also, read all of Chapter 4.

Fill the governor with oil to the top mark on the oil sight glass. Close the needle valve carefully (clockwise) using a Phillips screwdriver and open it (counterclockwise) 1/2 to 3/4 turn. Loosen the nut holding the compensation adjusting pointer enough to move the pointer and set the pointer in the center of the scale. Tighten the nut.

If replacing a governor, the initial compensation setting can be the same as the governor just removed.



WARNING

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Use the prime mover manufacturer's instructions to start the engine.

Adjustments

Normally, the only adjustments for putting a new governor into service are bleeding entrapped air and adjusting compensation to obtain satisfactory stability and response. All other operating adjustments were made during factory calibration in accordance with the manufacturer's specifications and should not require further adjustments.



NOTE

Do not attempt internal adjustment of the governor unless you are thoroughly familiar with the proper procedures.

Compensation Adjustments

The compensation needle valve and pointer are adjustable parts of the compensation system. Their settings directly affect governor stability.

Compensation must be properly adjusted to the particular engine and load to provide stable operation.

When the prime mover is started for the first time after the governor has been filled with oil, the governor may be stable at constant speed, yet may need adjustment. High overspeeds and underspeeds after load changes and slow return to normal speed indicate the need for compensation adjustment.

**NOTE**

Maximum compensation settings generally provide stable steady state operation, but result in greater offspeeds on load changes.

After the oil in the governor has reached its normal operating temperature, make the following compensation adjustments without load on the prime mover to be certain that the governor gives optimum control. See Figure 1-1 for location of the adjustment parts.

1. To bleed trapped air from the governor oil passages, first loosen the nut holding the compensation adjusting pointer and set the pointer at its extreme upward position for maximum compensation. Tighten the nut.

Next, remove the needle valve access plug and open the needle valve two turns counterclockwise. Use a Phillips screwdriver to avoid damage to the threads inside the bore and to the needle valve.

Damage to the threads or to the needle valve will cause the governor to change fuel rhythmically. This is called governor hunt. See Chapter 5 for more information on hunting.

There are two screwdriver slots in the needle valve, a shallow and a deep slot, located at right angles to each other. The deeper slot is used to expand the head of the needle valve and increase friction to prevent vibrations from changing the needle valve setting. If a plain screwdriver must be used, be sure to use the shallow slot of the needle valve.

Allow the prime mover to hunt for approximately 30 seconds to bleed trapped air from the governor oil passages.

2. Loosen the nut holding the compensation pointer and set the pointer as far as it will go towards minimum compensation. Tighten the nut.
3. Gradually close the needle valve until hunting just stops. If hunting does not stop, open the needle valve one turn and move the compensation pointer up by one mark on the front panel indicator scale. Again gradually close the needle valve until hunting stops.

If hunting does not stop, set the needle valve 1/4 turn open and repeat setting the compensation pointer up by one mark. Retest the governor until hunting stops.

**NOTE**

The objective of the compensation adjustment procedure is to find the particular settings for the compensation needle valve and compensation adjustment pointer at which the prime mover will return quickly to speed (needle valve adjustment) after a speed disturbance with only a slight over- or undershoot (compensation pointer adjustment).

4. From this setting, open the needle valve one turn and momentarily disturb governor stability by turning the load limit knob to increase the load slightly and bringing it back quickly to its original position. Gradually close the needle valve until the governor returns to speed with only a small overshoot or undershoot and:
 - a. The needle valve is between 1/8 to 1/4 turn open on a governor with an oil sight glass located in the center of the dial panel.
 - b. The needle valve is between 3/8 and 3/4 turn open on a governor with an oil sight glass located on the side of the governor.

Compensation adjustment determines offspeed and needle valve adjustment determines recovery time.

**NOTE**

For most responsive governor control, use as little compensation as possible. Too much compensation causes excessive speed overshoots and undershoots upon load changes.

**NOTE**

Closing the needle valve more than indicated in (a) and (b) above makes the governor slow to return to normal speed after a load change.

Opening the needle valve more than indicated above decreases governor stability and can cause hunting.

Once the needle valve adjustment is correct, it is not necessary to change the setting except for large, permanent changes in temperature which affect governor oil viscosity.

When the compensation adjustment is correct, tighten the compensation pointer nut and install the needle valve access plug with a copper washer. The plug and the washer will seal oil seepage around the needle valve.

Initial Operation for a Repaired or Reassembled Governor

After disassembly or repair, it is very important to test the governor on a test stand. If a test stand is not available, testing of the governor can be done on the engine.

**WARNING**

If testing of the governor is done on the engine, the operator must be careful to manually control engine speed until he has proven that the governor will control engine speed.

Attach a serration wrench to the output shaft in addition to the normal linkage to manually control engine speed with the serration wrench.

When satisfied that the governing system is fully operational, remove the serration wrench.

If accurate tests and adjustments are to be made, it is best to use a test stand since it is difficult to make them when the governor is mounted on an engine. Write or phone Woodward for a test specification for the governor part number shown on the nameplate fastened to the governor.

Table 4-1 is a list of tools that are necessary only if a large number of governors is being tested. For a small number of governors, only the pressure gauge is needed to check oil pressure during testing.

Table 4-1. Test Stand Tools

Tool Description	Woodward Number	Application
Woodward Test Stand		Engine simulator. Drives governor. Supplies pressure oil. Includes gauges for testing.
Electronic Counter and Frequency Pickup		Indicates governor drive speed. Must have an output of at least 60 cycles per revolution on a one second time base. Must indicate speed to within ± 1 rpm. Readouts of display time must not exceed 5 seconds.
Pressure Gauge (0–1380 kPa/0–200 psi)		To check governor oil pressure.
Dial Indicator	8995-037	To check and adjust droop setting.

Before installation, be sure speed droop is not negative. To check droop, first set the speed droop control knob to zero.

1. Put a dial indicator (tool 8995-037) on the governor with the indicator rod touching the top of the speed setting gear.
2. Place the serration wrench on the governor output shaft.
3. Rotate the governor output shaft from minimum to maximum fuel position, and check the dial indicator.
4. No movement of the indicator is zero droop. If movement is greater than 0.05 mm (0.002 inch), adjustment is needed (Clockwise movement of the indicator is positive droop. Counterclockwise movement of the indicator is negative droop).

Loosen the locknut (190) on the speed droop screw (189) and turn the screw counterclockwise to reduce droop. Turn the screw clockwise to increase droop.

When zero droop is obtained (0.05 mm/0.002 inch or less counterclockwise movement), tighten the locknut again (190).

Check the adjustment again by moving the governor output shaft from minimum to maximum fuel position. Droop can be zero or positive, it must not be negative. Check the final droop setting with the governor operating on the prime mover as shown in "Test Procedures" in this chapter.

Before operating a repaired governor for the first time, check that all installation steps have been correctly completed. See Chapter 2, Installation Procedures. Also, read all of Chapter 4.

**WARNING**

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Test Procedures

1. Remove the pipe plug (33) in the base of the governor on the side to the left of the needle valve plug (30), and attach a 0–1380 kPa/0–200 psi pressure gauge. (See Figure 1-3 for Pressure Test Point.)
2. Install the governor on a test stand or on the engine pad. See Chapter 2, Installation Procedures.
3. Fill the governor with oil. See Chapter 2, Oil Supply. The oil level must be to the mark on the oil sight glass.
4. If the governor is being tested on the engine, start the prime mover according to the instructions from the manufacturer.

Run the governor until it is at operating temperature.

5. Check that the governor has a 758–827 kPa (110–120 psi) oil pressure (UG-5.7/UG-8) or 965–1034 kPa (140–150 psi) oil pressure (UG-10) at normal operating speed.
6. Close the needle valve (32) and open it just enough to cause a small hunt, using a Phillips screwdriver. If a plain screwdriver must be used, make sure to use only the shallow slot of the needle valve to avoid damage to the threads inside the bore and to the needle valve.

Let the prime mover hunt for approximately 30 seconds to remove trapped air from the governor oil passages.

7. Close the needle valve and open it again one half turn. If the governor continues to hunt, repeat step 6.
8. Adjust the compensation system. See Compensation Adjustments in this chapter.



NOTE

Maximum speed for constant operation of the UG Dial governor is 1500 rpm.

9. While the engine is running, re-check the governor for zero droop. Turn the speed droop knob to zero and run the governor at normal operating speed near 0% load. Then load the engine near 100% load. Speed must be within 0 to 3 rpm lower.

If the engine cannot be run at full load and must be run at partial load only, the rpm decrease must be proportional to the partial load.

10. If adjustment is needed to obtain zero droop, follow this procedure:

Loosen the locknut (190) on the speed droop screw (189) and turn the screw (189) counterclockwise to reduce droop. Turn the screw clockwise to increase droop. Tighten the locknut.

Repeat the above procedure until speed is within 0 to 3 rpm lower when running the engine from no load to full load positions.

11. To prevent speed setting changes because of engine vibrations, a friction drive (255) is installed in the speed setting mechanical drive of the UG governor.

The friction drive (255) must be tight enough to avoid a speed setting change due to vibrations, and also tight enough to permit the speed setting motor, if used, to turn the speed setting gear.

If the friction drive is too tight, the synchronizer (speed setting) knob can no longer be turned manually.

To adjust the friction on the friction drive, first remove the governor cover (214), then the retaining ring (250) on the friction drive using a No. 1 Truarc pliers. Do not let the cover (214) or the spring (252) fall into the governor as the friction drive cover is under spring compression.

Check the torque of the friction drive and set it at 0.17 to 0.28 N·m (1.5 to 2.5 lb-in) with manual speed setting or 0.45 to 0.62 N·m (4.0 to 5.5 lb-in) with speed setting motor. To increase friction, turn the nut on the shaft clockwise while holding the speed setting knob. To decrease friction, turn the nut counterclockwise.

12. Reassemble the friction drive.
13. Set the maximum and/or minimum speed limit on the governor. This adjustment can also be made with the prime mover running. To make the adjustment, first remove the governor dial plate (see Figure 4-1).

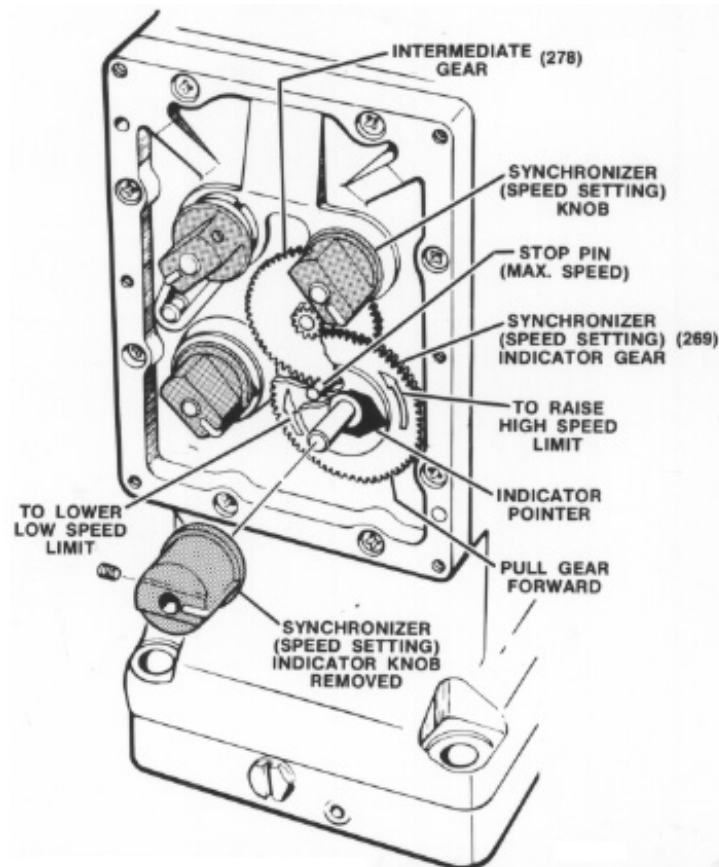


Figure 4-1. Maximum/Minimum Speed Stop Adjustment on the Governor

Turn the synchronizer (speed setting) knob clockwise to increase the speed setting of the governor from its specified maximum plus 10 rpm.

If the friction drive slips before reaching the required high speed setting, mark the intermediate (278) and the synchronizer (269) (speed setting) indicator gears, disengage the synchronizer (speed setting) gear (269), index it one tooth counterclockwise to allow a higher speed setting, and engage gear again.

The amount of rpm change is not the same if the speeder screw (177) has a coarse thread (0.7 threads/mm or 18 threads/inch) or a fine thread (1.3 threads/mm or 32 threads/inch).

Re-engage the synchronizer indicator gear (269) with the high-speed stop pin, engaging the intermediate gear (278) to prevent further increase in speed. The high-speed stop pin is the pin closest to the gear center.

On governors equipped with an electric speed adjusting motor, be sure the motor can run the governor up to its maximum-speed stop and down to its minimum speed. Reset the torque on the friction drive, if necessary, as in step 11 above.

On governors equipped with a two-position high-speed stop (overspeed test device), set the overspeed-test speed as described above, then the lever catch will provide the normal high-speed stop for the governor. If necessary, set the high-speed stop to the lever engaged position and then disengage the lever and advance to the normal high-speed stop position to achieve the overspeed-test speed.

14. To set the minimum speed limit, turn the synchronizer (speed setting knob) counterclockwise to decrease the speed setting of the governor to its minimum speed position.
15. Set the synchronizer knob at zero on the dial.
16. Set the synchronizer indicator dial panel pointer at zero.
17. Position the synchronizer indicator knob about 1.6 mm (0.06 inch) from the surface of the dial. This prevents the knob from binding the synchronizer system gear train.
18. On governors equipped with micro switches, operate the governor at the required high and low speeds to verify correct positioning of the cams that operate the micro switches.

Adjust the cams by loosening the screws and turning the cams on the shaft. Tighten the screws again.

19. On governors equipped with solenoid shutdown, please refer to Woodward manual 03013 for set-up procedures.
20. Turn the load limit knob to zero. The load limit indicator must move to zero. The governor output shaft will move to its minimum fuel position. Reset the load limit knob to maximum load.
21. Shut down the engine. Remove the pressure gauge and install a 1/8" socket pipe plug. Apply a pipe sealer to the threads, and torque the pipe plug to 10 N·m (90 lb-in).

22. Install the governor cover and dial plate.

Test Completion

For operation of units running alone, set droop at zero. Reducing droop to zero allows the unit to change load without changing speed (zero droop operation is also called isochronous operation).

On units connected in parallel or to a single shaft, set the least amount of droop possible to provide satisfactory load division. Droop allows load division between two or more prime movers that drive the same shaft or are paralleled in an electrical system.

For ac generating units tied in with other units, set droop sufficiently high (reference number 30 to 50 or more on the dial) to prevent interchange of load between units.

If one unit in the system has enough generating capacity, set its governor on zero droop, and it will regulate the frequency of the prime mover system. If its capacity is not exceeded, this unit will handle all load changes.

Operate the SYNCHRONIZER knob of the governor with zero droop to adjust the system's frequency. Operate the SYNCHRONIZER knobs of the governors that have speed droop to distribute load between units.

When two units are set up for optimum single unit performance, paralleling problems can be encountered. For example, governor response can be too fast on one governor, requiring too high a speed droop setting to prevent a constant load interchange between the two governors. When this occurs, the compensation setting should be moved towards maximum, reducing the single unit transient performance capability but allowing stable parallel operation within the allowable speed droop range. Also, check the amount of output shaft travel on each governor. Too little output shaft travel on a governor can require too high a droop setting on that governor to obtain steady state control.



NOTE

Compensation must be properly adjusted to the particular engine and load to provide stable operation (see Compensation Adjustments).

When UG governors are used on generator sets operating in parallel and the lead unit is shifted to slave and vice versa, zero droop must be set on the lead unit to maintain the frequency for which it is set, and droop must be set on the slave unit for load distribution between the two units.

For more information on load sharing, please refer to manual 25195, *Governing Fundamentals*.

Chapter 5. Troubleshooting

Introduction

This chapter provides instructions for troubleshooting.

It is impossible to anticipate every kind of problem that is encountered in the field. This manual covers the most common problems experienced. Poor governing may be due to faulty governor performance, or it may be due to the governor attempting to correct for faulty operation of the prime mover or the equipment driven. The effect of any auxiliary equipment on the overall control required of the governor must also be considered.



WARNING

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Troubleshooting

Oil

Keep the governor oil level to-the mark on the oil sight glass with the unit operating. The correct oil level is 19 to 32 mm (0.75 to 1.25 inch) below the top of the governor case.

Dirty oil causes most governor problems. Use clean new or filtered oil. Oil containers used must be perfectly clean. Oil contaminated with water breaks down rapidly, causing foaming, and corrodes internal governor parts.

Compensating Adjustment and Needle Valve

The compensating adjustment and needle valve must be correctly adjusted with the governor controlling the engine or turbine, even though the compensation may have been previously adjusted at the factory or on governor test equipment.

Although the governor may appear to be operating satisfactorily because the unit runs at constant speed without load, the governor still may not be correctly adjusted to the load and to the engine it is to control.

High overspeeds and low underspeeds, or slow return to speed, after a load change or speed setting change, are some of the results of an incorrect setting of the compensating adjustment and needle valve.

Definitions

Use the troubleshooting chart (Table 5-1) on the following pages to determine the probable causes of faulty operation and to correct these problems.

Terms used in the chart are defined as follows:

Hunt—A rhythmic variation of speed which can originate in the governor or in the prime mover. (See Table 5-1, Par. 1A, for troubleshooting information.) A hunt usually has a frequency of less than 5 cycles per minute.

Surge—A sudden variation of speed occurring at periodic intervals which can also originate in the governor or in the prime mover. (See Table 5-1, Par. 1A, for troubleshooting information.)

Jiggle—A high frequency vibration of the governor output shaft and fuel linkage. Do not confuse this with normal controlling action of the governor. A jiggle has a frequency of more than 50 cycles per minute.

Preliminary Inspection

Governor problems are usually revealed in speed variations of the prime mover, but it does not necessarily follow that such variations are caused by the governor. When improper speed variations appear, the following procedure should be performed:

1. Check the load to be sure the speed changes are not the result of load changes beyond the capacity of the prime mover.
2. Check engine operation to be sure all cylinders are firing properly and that the fuel injectors are in good operating condition and properly calibrated.
3. Check the linkage between the governor and fuel racks or valve. There must be no binding or lost motion.
4. Check the setting of the needle valve and compensation adjustment. (See Chapter 4, Compensation Adjustments.)
5. Check that the oil is clean and oil level is correct at operating temperature.

The source of most problems in any hydraulic governor stems from dirty oil. Grit and other impurities can be introduced into the governor with the oil, or form when the oil begins to break down (oxidize) or becomes sludgy.

The internal moving parts are continually lubricated by the oil within the unit. Valves, pistons, and plungers will stick and even “freeze” in their bores, due to grit and impurities in the oil.

If this is the case, erratic operation and poor response can be corrected (if wear is not excessive) by flushing the unit with fuel oil or kerosene.

The use of commercial solvents is not recommended as they may damage seals or gaskets.

Change the oil and flush the governor twice a year if possible.

To change oil, remove the drain plug and drain out the old oil. Flush the governor by filling it with fuel oil, and with the prime mover running at low speed, cycle the governor by opening the needle valve two or three turns.

Let the governor hunt for a minute or two, then stop the engine and drain the governor. Flush the governor once again. Refill the governor with oil (see Chapter 2, Oil Supply).

Restart the engine and reset the compensation adjustment and needle valve.

6. Check that the drive to the governor is correctly aligned and free of roughness, side loading, and excessive backlash.

Table 5-1. Troubleshooting Chart

Problem	Possible Cause	Correction
1. The prime mover hunts or surges.	A. The problem may be originating in the governor or prime mover.	Block the throttle, fuel racks or steam valve in the direction of increase fuel. (Never block the governor output shaft in the direction that would prevent a complete shutdown.) The same blocking action can be performed by using the load limit knob on the governor panel. If hunting and/or surging continues while the governor output shaft is blocked, the problem is in the prime mover. If, after removing the block, hunting and/or surging starts again, the problem can be in the governor or in the prime mover. Go through the compensation adjustment procedure for the governor (see Chapter 4, Compensation Adjustments). If the problem is still there, replace the governor with a replacement governor. Go through the compensation adjustment procedure for the replacement governor. If the hunting and/or surging continues, the problem is in the prime mover.
	B. Compensation adjustments incorrect.	Adjust needle valve and compensation adjusting pointer.
	C. Dirty oil (sludge) in governor.	Drain oil, clean governor, and refill.
	D. Oil varnish, which causes sticking of parts.	Add oil to the mark on oil sight glass. If oil level decreases and no external oil leaks can be seen on the governor, check the drive shaft for oil leak. If foaming continues, drain oil and refill using a different type oil.
	E. Lost motion in engine linkage or fuel pumps.	Repair governor.
	F. Lost motion in engine linkage or fuel pumps.	Repair linkage and/or pumps.
	G. Binding in engine-to-governor linkage or fuel pumps.	Repair and realign linkage and/or pumps.
	H. Governor output shaft travel too short to provide full fuel.	Adjust travel until proper travel is obtained.
	I. Spring on yield linkage to fuel racks too weak.	Install heavier spring.

Problem	Possible Cause	Correction
1. The prime mover hunts or surges. (continued)	J. Low oil pressure. Normal operating pressure is 758 to 827 kPa (110 to 120 psi) for the UG-5.7 and UG-8; 965 to 1034 kPa (140 to 150 psi) for the UG-10. (See outline drawing, Figure 1-3, for pressure test point location.)	Return governor to factory for repair.
	Pump check valves are not seating or accumulator springs weak.	
	K. Power piston is sticking.	Check for side play or binding of output shaft.
	L. Voltage regulator not operating properly.	Check voltage regulator. Operate in voltage droop or manual. Do not disconnect voltage regulator. Adjust, repair, or replace voltage regulator.
	M. Fuel linkage incorrectly set. This might occur if the governor has been changed or removed and replaced. Relationship of governor travel to power output of engine should be linear.	Rework or reset the linkage from governor to unit to obtain the linear relationship.
	N. Faulty linkage.	Linkage should be free of binding and lost motion throughout service life of unit. Check yield links, shutdown arrangements, etc, to be sure that prime mover torque changes for very small increments of governor output shaft travel. Stability and good steady-state performance will suffer unless this condition is met.
	O. Incorrect non-linear relationship between governor travel and power output of the prime mover. Engine may hunt with light loads and be stable with a heavy load.	Adjust linkage from governor to gas valve to obtain linear relationship between governor travel and engine output. See Figure 2-1. Also, see application Note 50516.
	P. Gas or steam pressure too high.	Adjust gas or steam pressure.
	Q. Engine misfiring (bad fuel injector or low pilot fuel on dual-fuel engine).	Check pyrometer readings of each cylinder and make necessary repairs or adjustments.
	R. Load limit indicator binding on nameplate or load limit shaft bent.	Damaged indicator disc or nameplate must be corrected or replaced. Load limit shaft must be replaced if bent.
	S. Negative droop when speed droop knob at zero.	Droop calibration out of adjustment. Reset (see Chapter 4, Governor Operation and Adjustments).
2. Fuel racks do not open quickly when cranking prime mover.	T. Governor worn.	Return governor to factory for repairs.
	A. Low oil pressure in governor.	See Item 1J.
	B. Cranking speed too low.	May be necessary to use a booster servomotor. See manual 36684, <i>Booster Servomotor</i> .
	C. Booster servomotor (if used) not functioning properly.	Check action of automatic air starting valve. See manual 36684, <i>Booster Servomotor</i> .

Problem	Possible Cause	Correction
3. Jiggle at governor output shaft.	A. Rough engine drive or governor drive.	Inspect drive mechanism. a. Check alignment of gears. b. Inspect for rough gear teeth, eccentric gears, or excessive backlash in gear train. c. Check gear keys and nuts or set screws holding drive gears to shafts. d. Check for bent drive shaft. e. Check serrated or spline coupling for wear and alignment. f. Tighten chain between crankshaft and camshaft (if used). g. Check engine vibration damper (if used).
	NOTE If a keyed drive is used, backlash must be checked and the gear shimmed so that there is no binding and the backlash is not too great. This should be done each time a new or replacement governor is installed. If a serrated drive is used, concentricity of shaft to coupling should be maintained. Coupling should be as long as possible to permit greater flexibility.	
	B. Governor is not aligned properly.	Loosen governor mounting screws and move the governor slightly on its mounting pad to align the drive shaft with its coupling.
	C. Failure of flexible drive in flyweight head.	Return governor to factory for repairs.
	D. Other possible causes are: —dirty or worn ballhead bearing —rough or worn gear teeth —bent speeder spring —damaged drive shaft seal retainer	Return governor to factory for repairs. or Replace seal retainer.
	E. Air in governor system can cause a jiggle during start-ups or transients.	Bleed air (see Chapter 4, Test Procedures).
4. Load does not divide properly on interconnected prime movers.	A. Speed droop adjustment incorrect.	Readjust droop to divide load properly. Increase droop to resist picking up (or dropping off) load. Decrease droop to increase picking up (or dropping off) load.
	B. Speed settings of the governors are not the same.	Adjust speed setting so both prime movers run at the same speed.
5. The prime mover is slow to respond to a speed change or a load change.	A. Needle valve adjustment incorrect.	Readjust compensating needle valve. Open further if possible to do so without causing instability when running without load. Compensation pointer may be too far toward maximum.
	B. Governor is not sensitive in measuring speed change (deadband).	Friction or wear on flyweight toes—sludge in governor, return to factory.
	C. Low oil pressure in governor.	Return governor to factory to inspect pump and check valves if oil pressure is low.
	D. Engine may be overloaded.	Reduce load.
	E. Restricted fuel supply.	Clean fuel supply filters.
	F. Load limit knob set to restrict fuel.	Increase load limit setting.

Problem	Possible Cause	Correction
6. The prime mover will not pick up rated full load.	A. Fuel racks will not open far enough, or governor at end of its stroke and the load indicator is set at 10.	Adjust engine-to-governor fuel linkage. Adjust load limiting device or fuel pump stops. Check compression of load limit friction spring. Low compression may permit load limit cam to gradually work toward reduced load position.
	B. Restricted fuel supply.	Clean fuel supply filters. Gas pressure low. Gas with different calorific value.
	C. Voltage regulator (if used) not functioning.	Readjust or repair.
	D. Engine misfiring.	Check pyrometer readings of each cylinder and make necessary repairs or adjustments.
	E. Slipping clutch or belts between engine and driven load.	Make adjustments.
	F. Load limit knob set to restrict fuel.	Increase load limit setting.
7. Governor does not respond to synchronizer motor switch.	Slipping clutch. Binding or worn bevel gears.	Increase compression on clutch spring. Repair or return governor to factory.
8. The speed of the prime mover increases with an increase in load.	Droop is negative when adjustment is zero on the panel. Droop calibration out of adjustment.	Reset droop. See Chapter 4, Governor Operation and Adjustments.

Additional Information for Steam Turbines, Gas and Gasoline Engines

The engine torque versus throttle position for a steam turbine gives a wide variety of non linear relations. Each type must be compensated for with the correct compensating linkage to bring the error output shaft movement back into a near linear relation with the prime mover torque output. Please refer to the prime mover manufacturer's handbook for the correct linkage selection and installation.

The torque vs throttle position curve for a gas and gasoline engine which is controlled through a butterfly valve is always very non-linear. When adapting a governor to this type of engine, if the linkage is made linear, operation at idle and light loads is never very stable.

The proper procedure for adapting a governor to this engine with the butterfly valve is to make the linkage so that it requires greater movement of the governor per increment of butterfly movement at light load than it does at high load.

This linkage tends to linearize the relation between engine-developed torque and governor output shaft position (see Figure 2-1).

The table below shows a satisfactory angular position of the governor output shaft for different openings of the butterfly valve in order to have a more stable operation at idle and at light loads.

Table 5-2. Governor Output Shaft Travel vs Butterfly Valve Travel

Governor Output Shaft Travel	Butterfly Valve Shaft Travel
0°	0°
6°	3°
12°	9°
15°	20°
18°	30°
24°	82°

Governor Field Repairs

Seals and bearings of the governor output shaft and drive shaft can be replaced in the field.

Seals and bearing replacement require only a partial disassembly of the governor. See Figures 5-1 and 5-2, and tables 5-3 and 5-4, for a list of common bench tools and normal field repair tools.

Seals and bearings can be replaced without these tools, however replacement of parts is made easier if these tools are available.

Order tools from Woodward (see Chapter 8, Service Options). Include in order:

1. The tool description
2. The tool number or part number of the tool required
3. The manual number (this manual 03040)

Removal of Governor from Engine

To replace a governor on the engine, or to replace seals or bearings on the governor, remove the governor from the engine as follows:



CAUTION

Use care in handling and resting of the governor on the work area. Do not strike or rest the governor on the end of the drive shaft as damage may result to the drive shaft, oil seal, bearing, or other internal parts or surfaces. Set the governor on wooden block(s) to protect the drive shaft when performing maintenance operations.

1. Drain the oil from the governor and install the drain plug again. Some governors are equipped with a drain cock for draining.
2. Clean exterior surfaces using a cloth moistened with cleaning solvent.
3. Disconnect auxiliary device wiring, and pneumatic or hydraulic tubing connections if applicable.
4. Before detaching the output shaft and speed setting linkages, mark both shaft and lever so they may be easily reinstalled at their original positions.
5. Remove the four stud nuts holding the governor to the mounting pad and lift the governor off. Remove the gasket between the governor and governor mounting pad.

6. Set the governor on wooden blocks to protect the drive shaft. Be very careful to avoid striking the end of the drive shaft. Damage to internal parts of the governor may result.

Table 5-3. List of Common Bench Tools

Tool Description	Ref. Number	Tool Number	Application
T-handle hex wrench 7/16"	1	189440	Various bolts on UG
T-handle Allen wrench 3/16"	2	8995-047	To install 1/8" pipe plugs
Standard Allen wrench 5/64"	3	8995-048	For No. 8:32 headless set screw
Bench block	4	011971	To press out small bearings and bushings
No. 2 Phillips head screwdriver	5	8995-049	Various screws on UG
Hooked scribe	6	189792	Removing and installing cotter pins



Figure 5-1. Common Bench Tools

Table 5-4. List of Normal Field Repair Tools

Tool Description	Ref. Number	Tool Number	Application
William pliers	7	8995-023	Replace retaining ring on drive shaft
Bearing seater	8	8995-024	Replace drive shaft bearing
Seal protector (use with 030952)	9	030951	Fit on output shaft to protect seal
Dial indicator w/ base	10	8995-017	To check droop adjustment
Seal installing tool (Micarta type)	11	030952	Install output shaft seals (for extra long shafts only)
Bushing driver	12	8995-028	To adjust output shaft bushings
Serration wrench	13	030943	Turning output shaft or drive shaft
Torque wrench w/ 7/16" socket	14	8995-038	25 lb-in torque on drive shaft bearing retainer plate screws

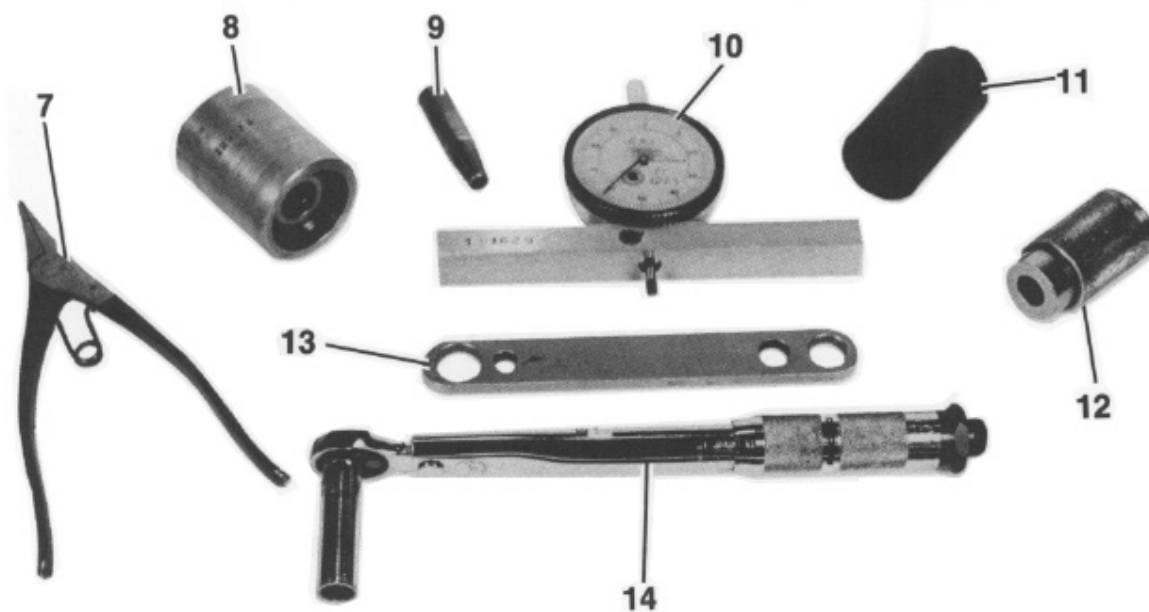


Figure 5-2. Normal Field Repair Tools

Chapter 6. Replacement Parts

Replacement Parts Information

When ordering replacement parts, include the following information:

- Governor serial number and part number shown on nameplate
- Manual number (this is manual 03040)
- Parts reference number in parts list and description of part or part name

**WARNING**

Refer to repair manual 56103 for correct and safe procedures when disassembly and assembly are required. Personal injury may result if accumulator springs are released suddenly. Use an arbor press to release or to install the compressed accumulator spring.

Parts List for Figure 6-1a

Ref. No.	Part Name	Quantity
03040-1	Retainer ring, 1.283" OD	2
03040-2	Washer, 1.185" OD	2
03040-3	Accumulator spring	2
03040-3A	Accumulator spring (used in UG-10 only)	2
03040-4	Accumulator piston	2
03040-5	Soc hd pipe plug, 1/8"	1
03040-6	Soc hd pipe plug, 1/8"	1
03040-7	Cotter pin, .060 x 1/2"	1
03040-8	Laminated drive shaft assembly	1
03040-9	Sleeve retainer	1
03040-10	Spirol pin	1
03040-11	Retainer ring .671 ID	1
03040-12	Washer	1
03040-13	Driver assembly	1
03040-14	Laminated drive spring	12
03040-15	Pump gear assembly	1
03040-16	Straight pin	1
03040-17	Large dashpot compensation piston	1
03040-18	Large dashpot compensation spring	1
03040-19	Large dashpot compensation link	1
03040-20	Oilite bushing	2
03040-21	Retainer ring, 1.283" OD	2
03040-22	Pilot valve bushing	1
03040-23	Check valve	4
03040-24	Dowel pin	2
03040-25	Dowel pin	2
03040-26	Base	1
03040-27	Washer	5
03040-28	Cap screw, 1/4-28 x 1.000"	5
03040-29	Pipe plug, 1/8" soc hd	1
03040-30	Needle valve plug	1
03040-31	Washer	1
03040-32	Needle Valve	1
03040-33	Pipe plug, 1/8" soc hd	1
03040-34	Power piston	1
03040-35	Controlet	1
03040-36	Soc hd pipe plug, 1/8"	1
03040-37	Soc hd pipe plug, 1/8"	1
03040-38	Ballhead drive gear	1
03040-39	Connecting lever	1
03040-40	Straight pin	1
03040-41	Cotter pin, .030 x 3/8"	2
03040-42 through 49		Not Used

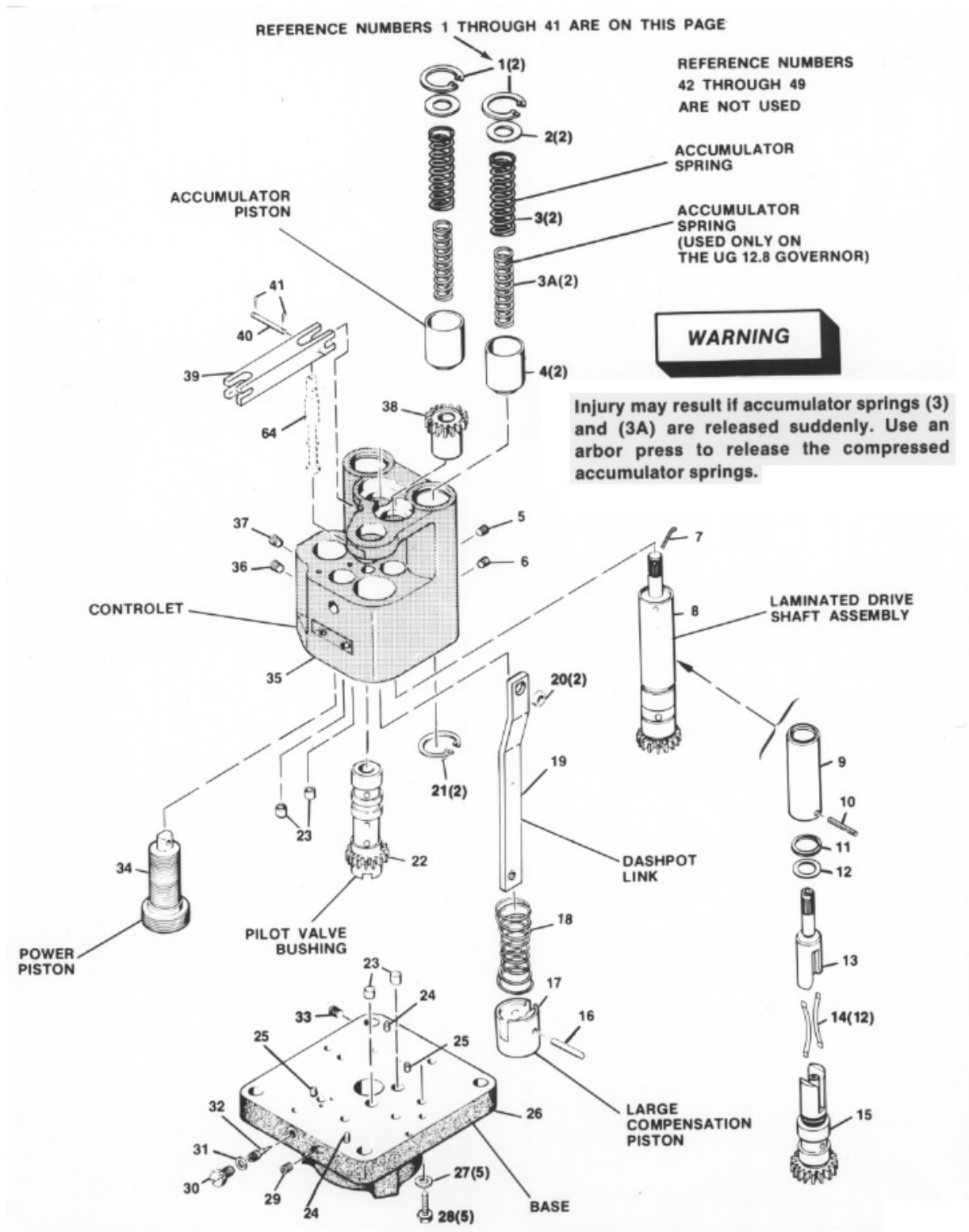
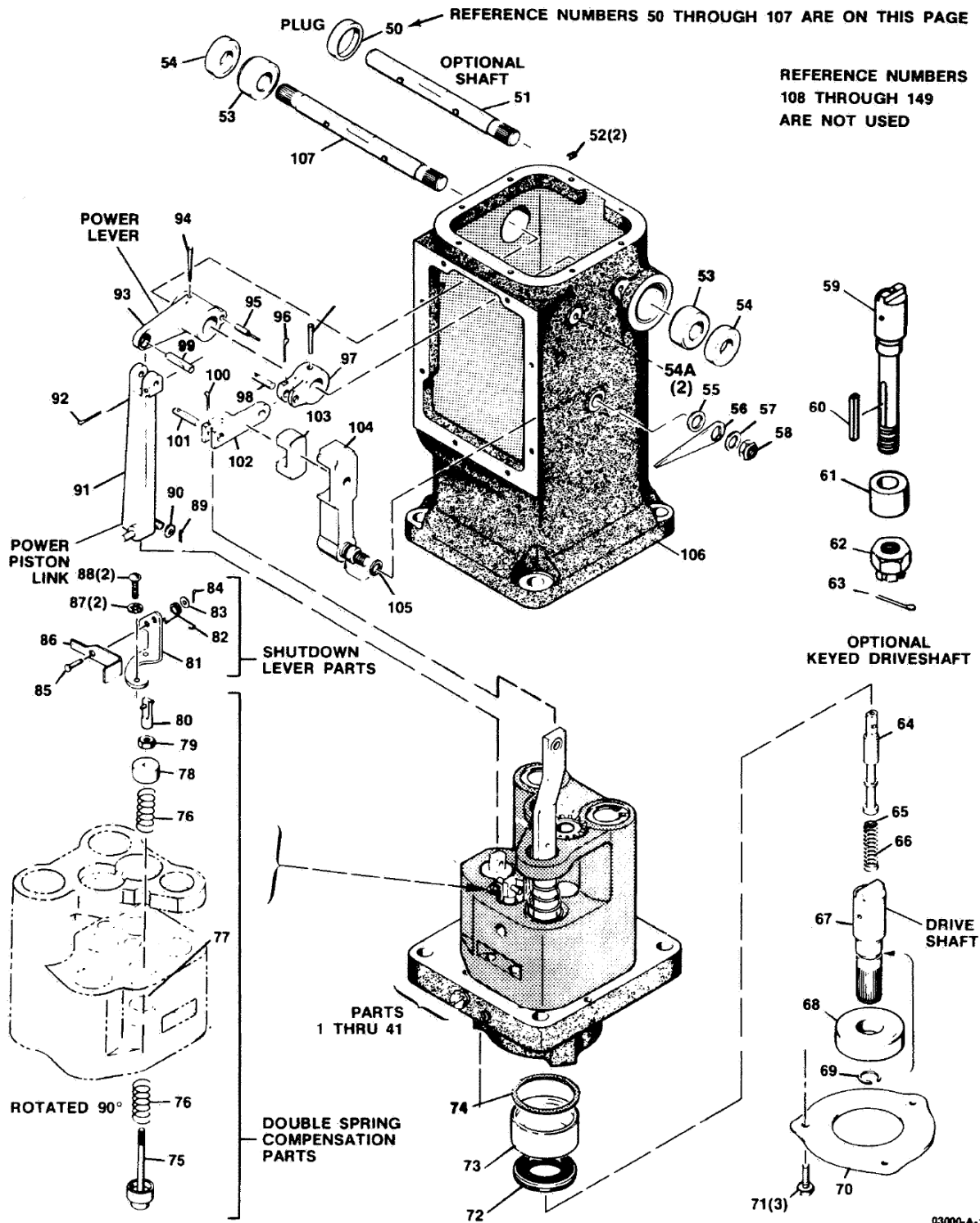


Figure 6-1a. Parts Illustration for the UG Dial Governor

Parts List for Figure 6-1b

Ref. No.	Part Name	Quantity
03040-50	Plug	1
03040-51	Output shaft (optional)	1
03040-52	Set screw, 1/4-28 x 5/16"	2
03040-53	Output shaft bushing	2
03040-54	Oil seal, 1.128 OD	2
03040-54A	Compensation adjustment lever pin stop	2
03040-55	Washer, 7/16 x 5/8 x 1/32"	1
03040-56	Compensation adj. pointer	1
03040-57	Washer, .328 x .562 x .064 thick	1
03040-58	Elastic stop nut 5/16-24	1
03040-59	Keyed drive shaft	1
03040-60	Key .188 x .190 x 1.062"	1
03040-61	Spacer	1
03040-62	Nut, 5/8-18 castle	1
03040-63	Cotter pin, 1/8 x 1-1/2"	1
03040-64	Pilot valve plunger	1
03040-65	Spring seat	1
03040-66	Pilot valve spring	1
03040-67	Drive shaft	1
03040-68	Ball bearing	1
03040-69	Snap ring	1
03040-70	Bearing retainer plate	1
03040-71	Dr hd cap screw, 1/4-28 x 5/8"	3
03040-72	Oil seal, 1.379" OD	1
03040-73	Oil seal retainer	1
03040-74	Seal retainer gasket	1
03040-75	Small dashpot compensation piston assembly .	1
03040-76	Small dashpot compensation spring	2
03040-77	Small dashpot spring seat (not shown)	1
03040-78	Small dashpot compensation piston guide	1
03040-79	Hex lock nut, 1/4-28	1
03040-80	Dashpot nut	1
03040-81	Shutdown lever bracket	1
03040-82	Spring	1
03040-83	Washer, .178 ID	1
03040-84	Cotter pin	1
03040-85	Headed pin	1
03040-86	Shutdown lever	1
03040-87	Washer	2
03040-88	Screw	2
03040-89	Cotter pin	1
03040-90	Washer	1
03040-91	Power piston link	1
03040-92	Cotter pin	1
03040-93	Power lever	1
03040-94	Taper pin, No.3 x 1-1/4"	2
03040-95	Pin	1
03040-96	Cotter pin, .060 x 3/4"	1
03040-97	Compensation lever	1
03040-98	Straight pin	1
03040-99	Drilled straight pin	1
03040-100	Cotter pin, .060 x 3/4"	1
03040-101	Straight pin	1
03040-102	Compensation link	1
03040-103	Compensation lever fulcrum	1
03040-104	Compensation lever assembly	1
03040-105	Preformed Packing Ring, .301 1 D x .070"	1
03040-106	Case	1
03040-107	Output shaft	1
03040-108 through 149		Not Used



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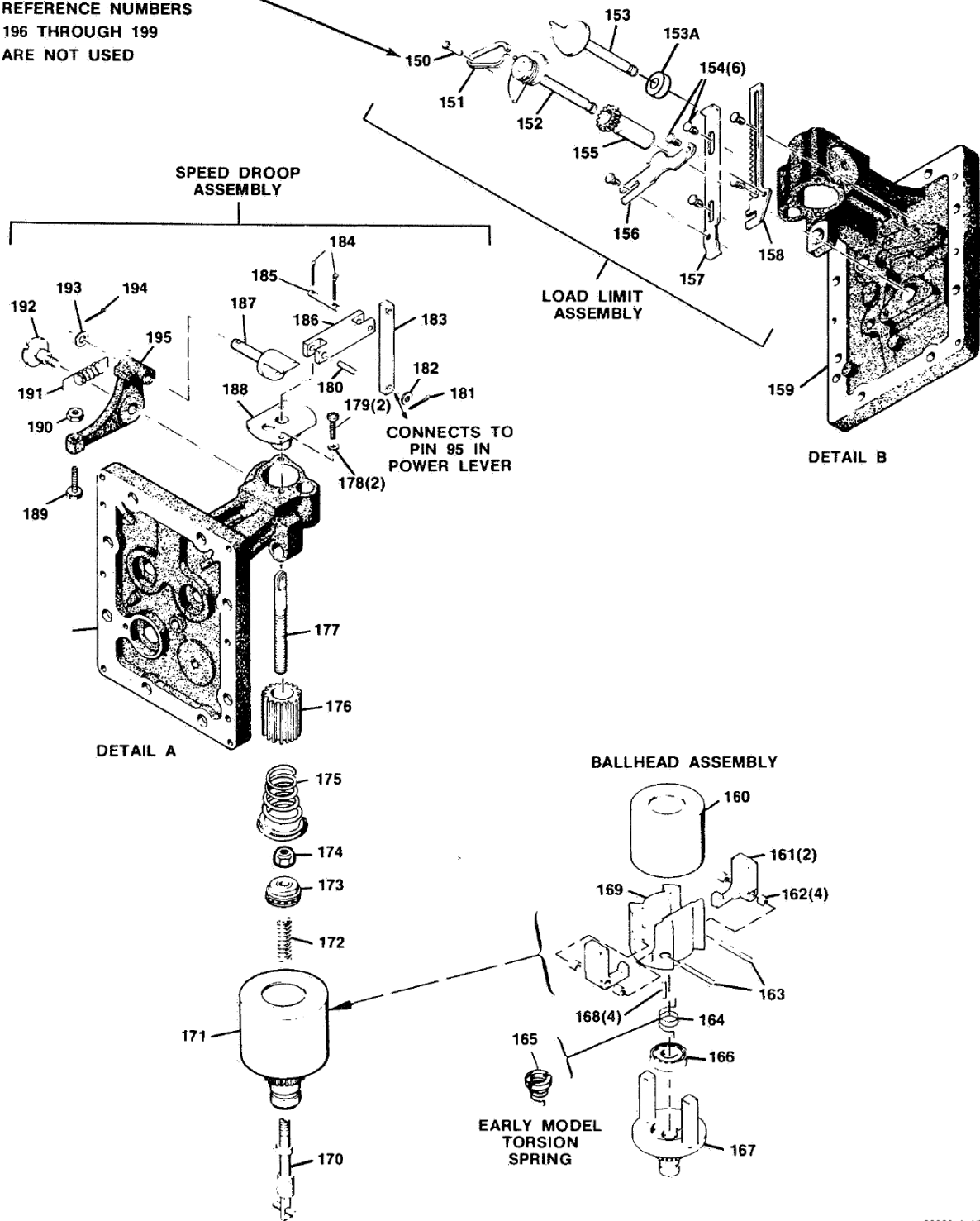
Figure 6-1b. Parts Illustration for the UG Dial Governor

Parts List for Figure 6-1c

Ref. No.	Part Name	Quantity
03040-150	Friction spring pin	1
03040-151	Load limit speed droop spring	1
03040-152	Load limit cam	1
03040-153	Speed droop cam assembly	1
03040-153A	Washer, .265 ID x .438 OD x .207-.197 thick....	1
03040-154	Rack pin	6
03040-155	Load indicator gear (includes items 285 & 286)	1
03040-156	Load limit lever	1
03040-157	Load limit strap	1
03040-158	Load limit rack	1
03040-159	Dial panel	1
03040-160	Ballhead cover	1
03040-161	Flyweight	2
03040-162	Flyweight bearing	4
03040-163	Flyweight pin	2
03040-164	Torsion spring	1
03040-165	Torsion spring (early model)	1
03040-166	Ball bearing	1
03040-167	Ballhead gear assembly	1
03040-168	Spirol pin	4
03040-169	Spring damped ballhead	1
03040-170	Speeder rod	1
03040-171	Ballhead assembly	1
03040-172	Speeder rod spring	1
03040-173	Thrust bearing	1
03040-174	Flexloc stop nut	1
03040-175	Speeder spring assembly	1
03040-176	Speeder gear	1
03040-177	Speeder screw	1
03040-178	Shakeproof washer, No.8	2
03040-179	Phil. hd screw, 8-32 x .375	2
03040-180	Speed setting screw pin	1
03040-181	Cotter pin, .030 x .375	1
03040-182	Washer, .375 OD	1
03040-183	Speed droop link	1
03040-184	Cotter pin, .030 x .375	2
03040-185	Drilled straight pin	1
03040-186	Speed droop lever	1
03040-187	Speed droop fulcrum	1
03040-188	Speed setting screw guide	1
03040-189	Speed droop screw	1
03040-190	Nut, 8-32	1
03040-191	Extension spring	1
03040-192	Speed droop lever screw	1
03040-193	Washer, .500 OD	1
03040-194	Cotter pin, .060 x .500	1
03040-195	Speed droop lever	1
03040-196 through 199		Not Used

REFERENCE NUMBERS 150 THROUGH 195 ARE ON THIS PAGE

REFERENCE NUMBERS
196 THROUGH 199
ARE NOT USED



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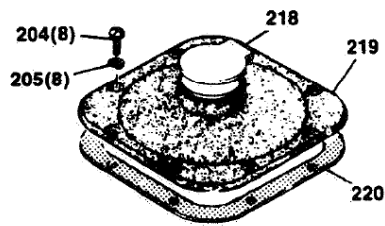
Figure 6-1c. Parts Illustration for the UG Dial Governor

Parts List for Figure 6-1d

Ref. No.	Part Name	Quantity
03040-200	115 Vac/dc Bodine motor.....	1
03040-201	Motor seal spring	1
03040-202	Phil fl hd screw, 10-32 x .375	4
03040-203	Oil Cup.....	1
03040-204	Phillips hd screw, 10-32 x 1/2"	8
03040-205	Lock washer, No.10	8
03040-206	Cover gasket.....	1
03040-207	Soc hd pipe plug, 1/8"	1
03040-208	Base gasket.....	1
03040-209	Washer	4
03040-210	Cap screw, 1/4-28 x 1.000"	4
03040-211	Front panel gasket.....	1
03040-212	Elbow, 1/8"	1
03040-213	Oil sight glass	1
03040-214	Cover	1
03040-215	Motor bracket.....	1
03040-216	Shakeproof washer, No.8	4
03040-217	Phil rd hd screw, 8-32 x .312	4
03040-218	Oil filler cap (optional)	1
03040-219	Cover (optional)	1
03040-220 through 249		Not Used

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REFERENCE NUMBERS
220 THROUGH 249
ARE NOT USED



OPTIONAL COVER

(SEE FIGURE 6-1)
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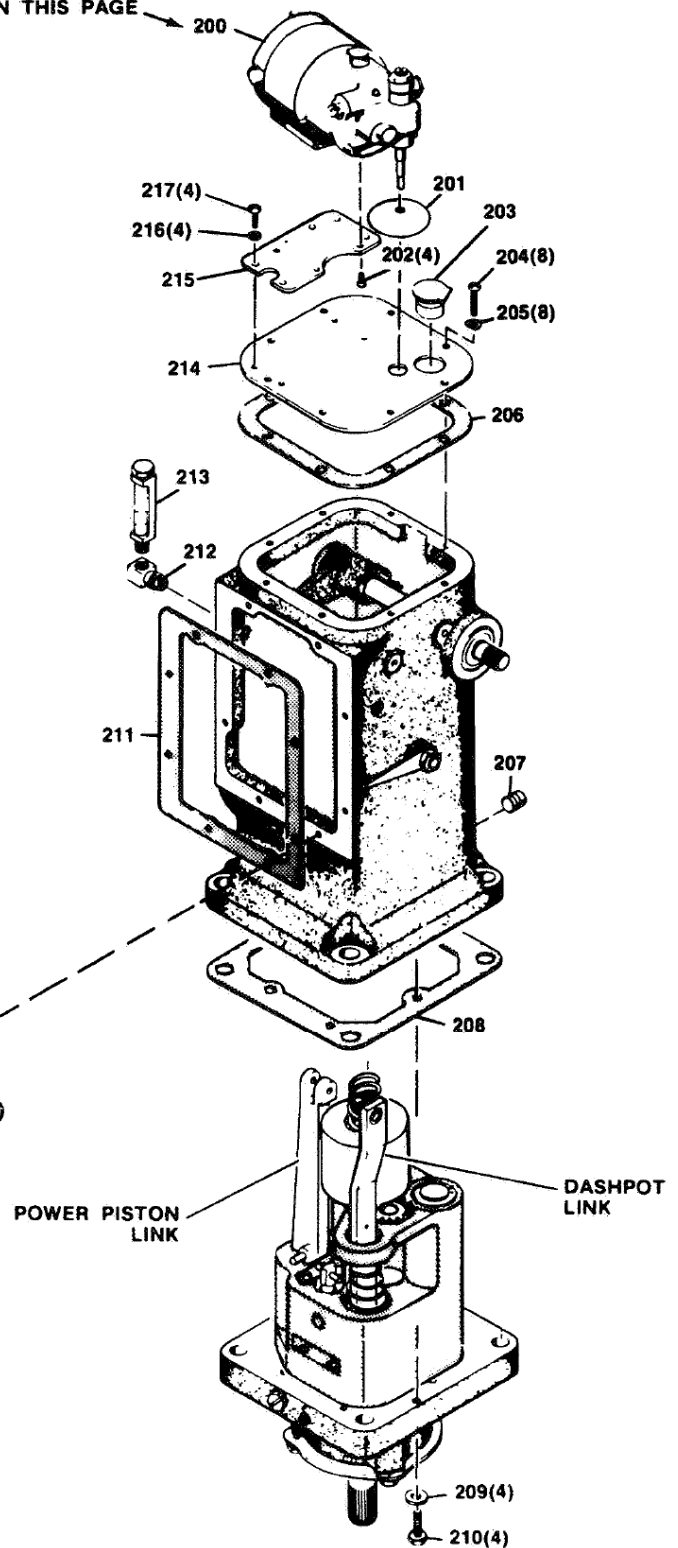


Figure 6-1d. Parts Illustration for the UG Dial Governor

Parts List for Figure 6-1e

Ref. No.	Part Name	Quantity
03040-250	Retainer	1
03040-251	Friction drive cover	1
03040-252	Friction drive spring	1
03040-253	Elastic stop nut, .250-28	1
03040-254	Friction drive spring	1
03040-255	Friction drive case	1
03040-256	Drive plate	1
03040-257	Roll pin, .094 dia. x.500	1
03040-258	Needle bearing	1
03040-259	Needle bearing	1
03040-260	Needle bearing	1
03040-261	Horiz. synch. adj. gear	1
03040-262	Taper pin, 6/0	1
03040-263	Needle bearing	1
03040-264	Synch. adj. shaft	1
03040-265	Lock washer, No.10	8
03040-266	Socket hd screw 10-32 x 5/8"	8
03040-267	Synchronizer indicator shaft	1
03040-268	Spring clip	1
03040-269	Synchronizer indicator gear	1
03040-270	Indicator pointer	2
03040-271	Set screw	4
03040-272	Knob	1
03040-273	Plug	1
03040-274	Dial plate	1
03040-275	Knob	1
03040-276	Taper pin, 6/0 x .750	3
03040-277	Shaft	1
03040-278	Idler shaft gear assembly	1
03040-279	Straight pin	1
03040-280	Oil seal	1
03040-281	Knob	1
03040-282	Load limit comp. spring	1
03040-283	Washer, .365 OD	1
03040-284	Preformed Packing Ring, .239 ID x.070	1
03040-285	Bushing included in item 209	1
03040-286	Bushing included in item 209	1
03040-287	Oil seal	1
03040-288	Knob	1
03040-289	Roll pin, .094 dia. x.500	1
03040-290	Speed droop collar	1
03040-291	Load limit speed droop spring	1
03040-292	Oil seal	1
03040-293	Phillips hd screw, 8-32 x 3/81,	6
03040-294	Set screw 6-32	1
03040-295	Cover-friction	1
03040-296	Friction disc	1
03040-297	Washer.750 OD	1
03040-298	Friction washer spring	1
03040-299	Screw-speed adjust	1

REFERENCE NUMBERS 250 THROUGH 293 ARE ON THIS PAGE

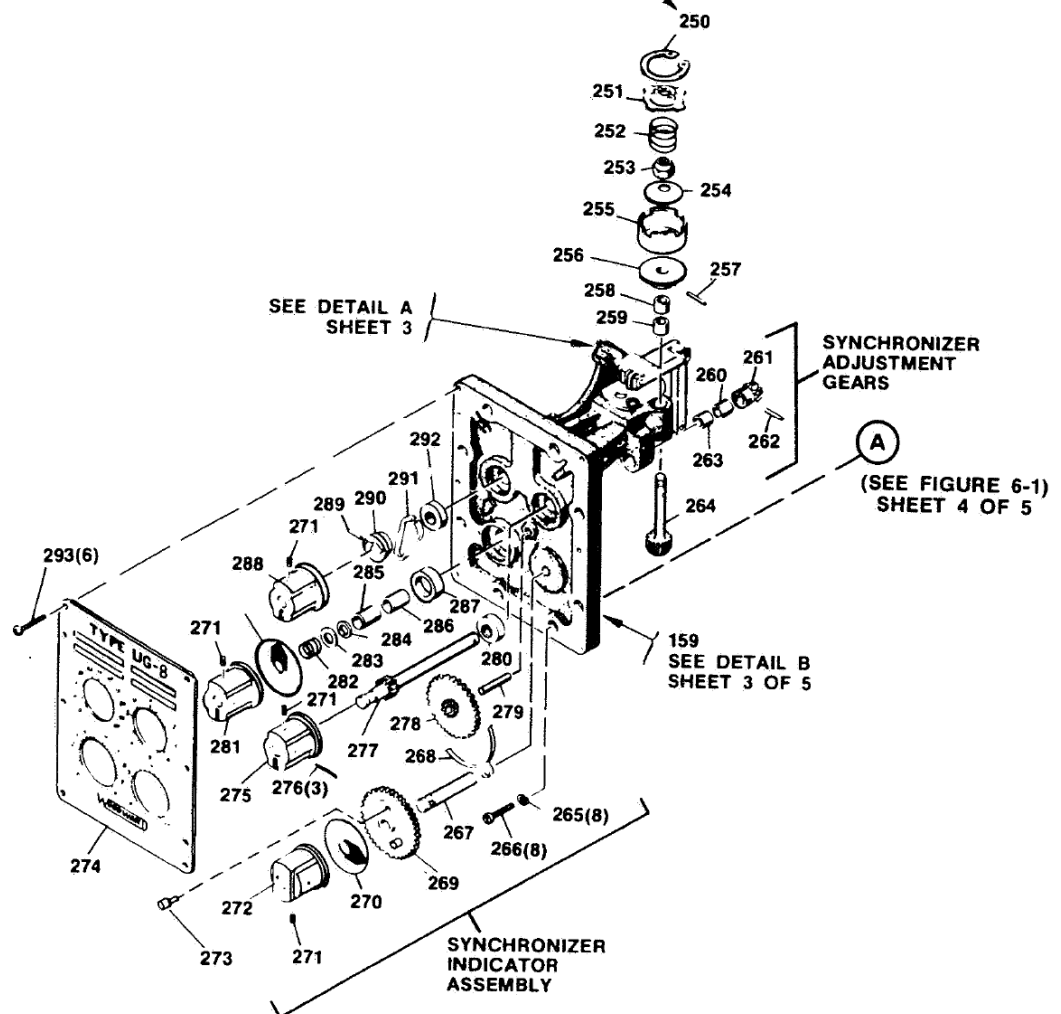


Figure 6-1e. Parts Illustration for the UG Dial Governor

Chapter 7. Auxiliary Equipment

Introduction

A number of optional auxiliary features and devices are available for use with the UG Dial Governor. These devices permit the governor to perform other secondary functions such as fuel limiting, low lube oil pressure shutdown, or effect a shutdown through an electrical solenoid. Auxiliary equipment should be supplied as original equipment on the governor. It is recommended that the customer contact Woodward if field installations are desired.

The following paragraphs provide a brief description of the auxiliary equipment available and list the manuals where detailed information may be obtained.

Synchronizer Motor and Solenoid Shutdown

Early models of the synchronizer (speed setting) motor use an ac-dc Bodine motor, externally mounted, and available in any of the following voltages: 12, 24, 32, 48, 64, 115, 125, 230, and 250. Late models use a PM (permanent magnet) motor using a 115 Vac, or 24 and 32 Vdc, internally mounted.

Figure 7-1 shows a UG cover equipped with solenoid shutdown. It also shows the synchronizer (speed setting) motor as used on the UG Dial governor.

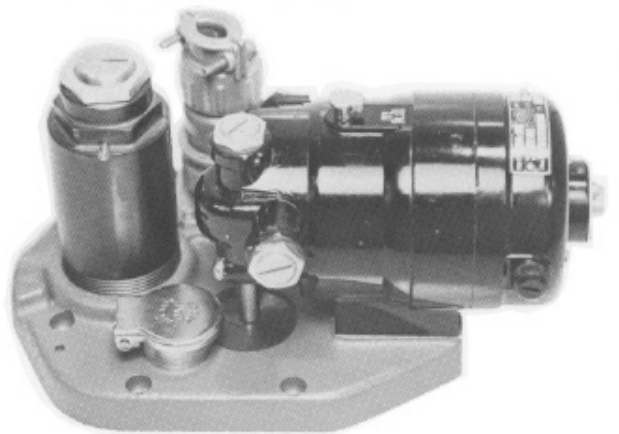


Figure 7-1. UG Cover with Bodine Motor and Shutdown Solenoid

Two models of the shutdown solenoid are available. One provides shutdown when energized, and the other when de-energized. Each can be equipped with or without latch. See manual 03013 for set-up procedures and parts breakdown.



WARNING

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

The synchronizer (speed setting) motor is available separately or with the solenoid shutdown. It provides the ability to remotely control the governor's speed setting. Thus, alternator frequencies can be matched or, when operating in droop mode, load distribution may be changed as required, remotely. Refer to manual 03505 for the parts reference and lubrication guide.

Figure 7-2 shows the method for installing the cover (267) when equipped with a motor. Turn the synchronizer knob to align the clutch with the motor's shaft as the cover is lowered into position.

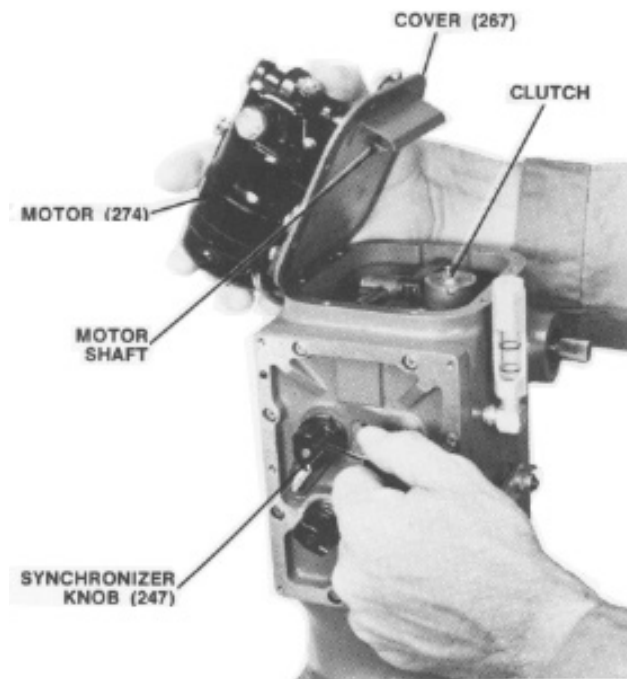


Figure 7-2. Installing Cover with Bodine Synchronizer Motor

Figure 7-3 shows the completed UG-8 Dial governor equipped with a Bodine synchronizer motor.



Figure 7-3. UG-8 Dial Governor Equipped with Bodine Synchronizer Motor

PM Synchronizer Motor with Housing

Figure 7-4 shows a UG-8 Dial governor with a permanent magnet synchronizer motor (speed setting motor) and a shutdown solenoid, enclosed in a weatherproof housing.

At rest, the permanent magnet motor acts as a brake to resist speed changes due to vibrations.

The weatherproof housing for the PM synchronizer motor can also be equipped with a shutdown solenoid. There are several supply voltages available for the solenoid. Contact Woodward for additional information. A conduit connection and a pin-type connector are also available.

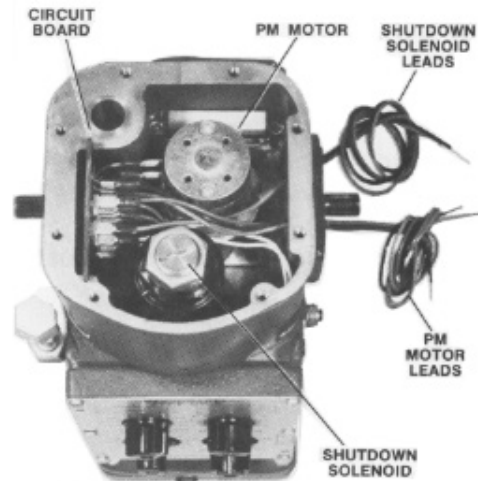


Figure 7-4. Top View of Weatherproof Housing with PM Synchronizer Motor and Shutdown Solenoid

Figure 7-5 shows the UG-8 governor with PM motor and weatherproof housing.

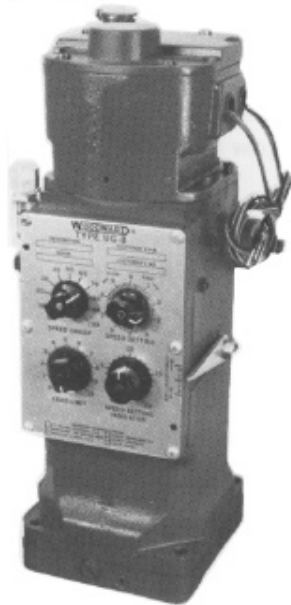


Figure 7-5. UG-8 Governor with PM Motor, Shutdown Weatherproof Housing

An explosion-proof housing (UL listed) is also available for use in hazardous areas. The housing is equipped with a 24 Vdc permanent magnet motor and, as an option, a 24 Vdc shutdown solenoid (energize-to-shutdown type only).

Low Lube Oil Pressure Shutdown

Figure 7-6 shows a low lube oil pressure shutdown. This device stops the prime mover when engine oil pressure falls below a safe level. There is no additional external linkage required.

For more information and parts illustration, see manual 03016.

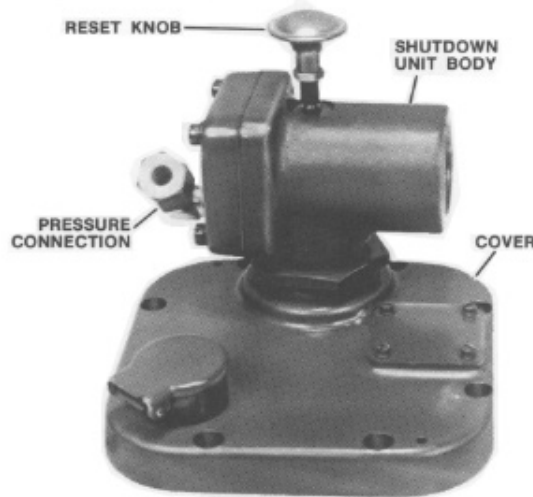


Figure 7-6. Low Lube Oil Pressure Shutdown



WARNING

Any failure that would cause the governor to be inoperative would also cause the shutdown solenoid to be Inoperative.

Magnetic Speed Pickup

The magnetic speed pickup monitors governor speed without having to provide an additional drive pad on the engine. Figure 7-7 shows the assembly on a UG governor.

For more information, see manual 36052.

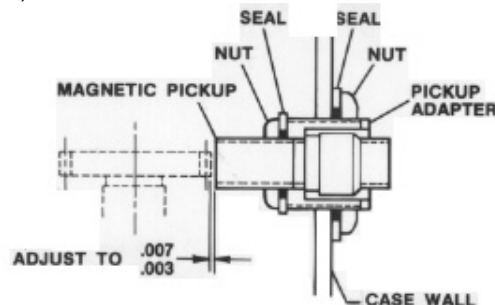


Figure 7-7. Magnetic Speed Pickup

**WARNING**

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

Micro Switches and Wiring Harness

Micro switches are mounted on the synchronizer indicator shaft as shown in Figures 7-8 and 7-9. Also shown are the wiring connections and terminal strip.

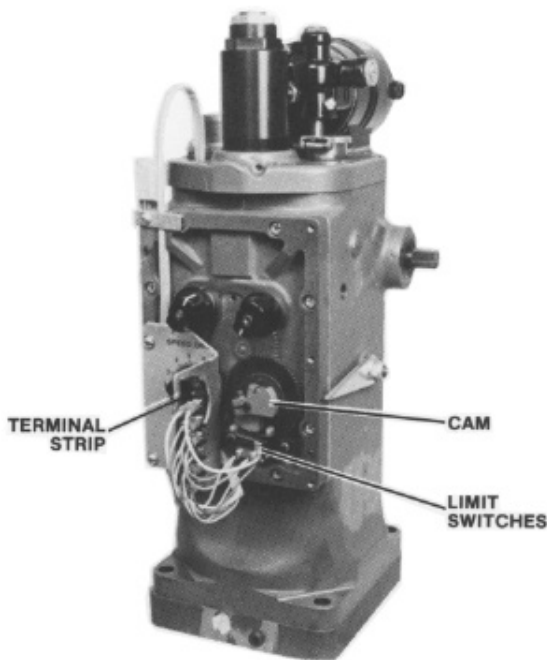


Figure 7-8. Micro Switches and Wiring

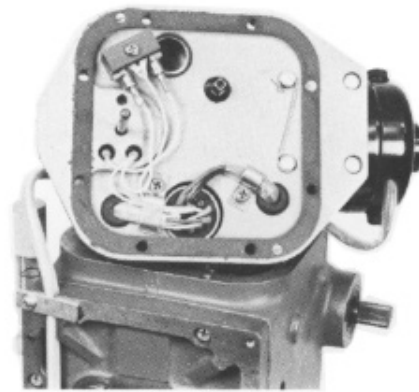


Figure 7-9. Wiring Harness on Cover

The micro switches are used in one of two ways.

1. They energize a light which indicates the motor has reached its minimum or maximum speed-setting position.
2. Instead of energizing a light, they may be used to shut off the electric motor after reaching the minimum or the maximum speed-setting position.

When used to shut off the electric motor, micro switches also protect the synchronizer (speed setting) motor should the operator run the speed adjustment to its limit.

The external wiring to the governor is not provided by Woodward and should be wired into the connector for the particular application as required.

Chapter 8. Service Options

Product Service Options

The following factory options are available for servicing Woodward equipment, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is purchased from Woodward or the service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

If you are experiencing problems with installation or unsatisfactory performance of an installed system, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In most cases, your problem can be resolved over the phone. If not, you can select which course of action you wish to pursue based on the available services listed in this section.

Replacement/Exchange

Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is also a flat rate structured program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Woodward facility as explained below (see “Returning Equipment for Repair” later in this chapter).

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned to Woodward within 60 days, Woodward will issue a credit for the core charge. [The core charge is the average difference between the flat rate replacement/exchange charge and the current list price of a new unit.]

Return Shipment Authorization Label. To ensure prompt receipt of the core, and avoid additional charges, the package must be properly marked. A return authorization label is included with every Replacement/Exchange unit that leaves Woodward. The core should be repackaged and the return authorization label affixed to the outside of the package. Without the authorization label, receipt of the returned core could be delayed and cause additional charges to be applied.

Flat Rate Repair

Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture

Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in "like-new" condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned to Woodward for repair, please contact Woodward in advance to obtain a Return Authorization Number. When shipping the item(s), attach a tag with the following information:

- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.



CAUTION

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

Return Authorization Number

When returning equipment to Woodward, please telephone and ask for the Customer Service Department [1 (800) 523-2831 in North America or +1 (970) 482-5811]. They will help expedite the processing of your order through our distributors or local service facility. To expedite the repair process, contact Woodward in advance to obtain a Return Authorization Number, and arrange for issue of a purchase order for the item(s) to be repaired. No work can be started until a purchase order is received.



NOTE

We highly recommend that you make arrangement in advance for return shipments. Contact a Woodward customer service representative at 1 (800) 523-2831 in North America or +1 (970) 482-5811 for instructions and for a Return Authorization Number.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

How to Contact Woodward

In North America use the following address when shipping or corresponding:

Woodward Governor Company
PO Box 1519
1000 East Drake Rd
Fort Collins CO 80522-1519, USA

Telephone—+1 (970) 482-5811 (24 hours a day)
Toll-free Phone (in North America)—1 (800) 523-2831
Fax—+1 (970) 498-3058

For assistance outside North America, call one of the following international Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

<u>Facility</u>	<u>Phone Number</u>
Brazil	+55 (19) 3708 4800
India	+91 (129) 230 7111
Japan	+81 (476) 93-4661
The Netherlands	+31 (23) 5661111

You can also contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (www.woodward.com) for the name of your nearest Woodward distributor or service facility.

Engineering Services

Woodward Industrial Controls Engineering Services offers the following after-sales support for Woodward products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Contact information:

Telephone—+1 (970) 482-5811

Toll-free Phone (in North America)—1 (800) 523-2831

Email—icinfo@woodward.com

Website—www.woodward.com

Technical Support is available through our many worldwide locations or our authorized distributors, depending upon the product. This service can assist you with technical questions or problem solving during normal business hours. Emergency assistance is also available during non-business hours by phoning our toll-free number and stating the urgency of your problem. For technical support, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Technical Support**.

Product Training is available at many of our worldwide locations (standard classes). We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability. For information concerning training, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Product Training**.

Field Service engineering on-site support is available, depending on the product and location, from one of our many worldwide locations or from one of our authorized distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface. For field service engineering assistance, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Technical Support**.

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

General

Your Name _____
 Site Location _____
 Phone Number _____
 Fax Number _____

Prime Mover Information

Engine/Turbine Model Number _____
 Manufacturer _____
 Number of Cylinders (if applicable) _____
 Type of Fuel (gas, gaseous, steam, etc) _____
 Rating _____
 Application _____

Control/Governor Information

Please list all Woodward governors, actuators, and electronic controls in your system:

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please include the manual number from the front cover of this publication.



PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

Email and Website—www.woodward.com

**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.

05/6/F



SCOPE DA2 VISITE 16000 hdm

Mise à jour : 10/01/2019

VASA22 N°5001

2010 : 66877

2012 : 74832

2014 : 82263 (8000hdm)

2015 : (16000h)

2017 : (8000h)

CULBUTEURS

Dépose des culbuteurs
Démontage des balanciers
Contrôle des douilles de balancier
Double contrôle de serrage culbuterie

POUSOIR DE CULBUTEURS

Dépose
Changement de tous les axes, galets et douilles
Changement des joints

CULASSES

Dépose des culasses
Démontage de l'ensemble des éléments
Démontage et nettoyage des orifices d'admission et d'échappement
Epreuve hydraulique à 9 bars de l'ensemble des culasses, **remplacement des sièges de soupapes si nécessaire --- * Voir bulletin de service wartsila 2014 pour côtes.**
Rodage des portées de joint de culasse

SOUPAPES DE LANCEMENT

Démontage des soupapes
Contrôle du ressort de rappel
Rodage des portées de soupapes
Visite soupape lancement principale

INJECTEURS

Dépose des injecteurs
Démontage de l'ensemble
Contrôle des ressorts
Contrôle des poussoirs
Changement des nez d'injecteurs
Tarage selon préconisation : 320 bars

PISTONS

Dépose des attelages
Nettoyages des pistons : têtes et jupes
Remplacement de tous les segments
Ressuage des ailes d'axe de piston
Prise des jeux de segments

BIELLES

Désaccouplement des bielles de leurs pistons



Nettoyage
 Contrôle des portées des douilles de pied de bielle
 Changement des douilles de pied de bielle si nécessaire
 Contrôle par ressuage des dents d'accouplement
 Serrage et contrôle dimensionnel des têtes de bielle
 Remplacement des coussinets

ARBRE MANIVELLE

Prise des déflexions avant et après
 Prise des jeux de paliers de têtes de bielle et de palier principal
 Contrôle et remplacement des coussinets si nécessaire
 Remplacement des joints spi sortie arbre manivelle (V-ring sortie d'arbre 110054, 110055, 110056)

CHEMISES

Dépose des chemises
 Nettoyage complet
 Remplacement des joints toriques de la partie basse
 Contrôle dimensionnel des alésages
 Déglacage des alésages
 Rodage des portées

VILEBREQUIN

Prise des jeux axiaux avant et après démontage (constructeur : 0.18/0.25)
 Changement des coussinets de paliers
 Changement des butées

ARBRE A CAMES

Prise des jeux axiaux avant et après démontage (constructeur : 0.14/0.25)
 Prise des jeux de dents de pignon avant et après démontage (constructeur : 0.15/0.35 maxi 0.50)
 Changement de l'ensemble des douilles de paliers
 Changement des douilles de butées
 Vérification des galets et contrôle de la surface de contact came / galets de poussoir

PIGNON INTERMEDIAIRE

Prise des jeux avant et après démontage (constructeur : 0.10/0.45)
 Dépose du pignon
 Changement des douilles paliers

POMPE A EAU HT

Dépose de la pompe
 Changement de l'ensemble des pièces internes
 Changement de l'arbre principal si nécessaire

POMPE A EAU BT

Dépose de la pompe
 Changement de l'ensemble des pièces internes
 Changement de l'arbre principal

POMPE A HUILE

Dépose de la pompe
 Changement des douilles de paliers
 Changement des garnitures



POMPE A INJECTION

Remplacement des pompes à injection

DISTRIBUTEUR D'AIR DE LANCEMENT

Dépose du distributeur

Changement des pistons, des ressorts de rappel, des joints.

ENTRAINEMENT REGULATEUR

Dépose de l'ensemble

Changement des deux douilles palier

Remontage avec prise de jeux (constructeur : 0.10/0.20 maxi 0.30)

REGULATEUR

Dépose du régulateur pour visite

Vidange huile

Contrôle de l'usure de tous les maillons de raccordement entre le régulateur et les pompes d'injection

LIMITEUR DE FUEL

Contrôle du bon fonctionnement

COLLECTEUR D'ECHAPPEMENT

Contrôle des tirants, remplacer si nécessaire

Vérification de tous les écrous :

- écrous de connections à brides
- écrous des boulons latéraux à l'intérieur de la boîte d'isolement.

Remplacer thermomètre d'échappement

DAMPER

Prise d'un échantillon de silicone pour analyse

SURVITESSE

Dépose et visite

SOUPAPE THERMOSTATIQUE

Dépose de la soupape

Visite complète avec changement de joints

Contrôle des éléments thermostatiques

SOUPAPE THERMOSTATIQUE D'HUILE

Dépose de la soupape

Visite complète avec changement de joints

Contrôle des éléments thermostatiques

REFRIGERANT D'AIR

Démontage et nettoyage

Contrôle du bon état

REFRIGERANT D'HUILE

Démontage et nettoyage

Contrôle du bon état



SECURITES MOTEUR

Essais de la sécurité
Stop par pression d'huile très basse
Contrôle du déclenchement de la survitesse mécanique

DIVERS

Nettoyage complet du moteur
Contrôle des égouttures
Changement de tous les joints de porte de carter
Nettoyage complet du carter d'huile
Visite pompe de prégraissage
Visite de booster en atelier

ESSAI

Mise en œuvre et rodage du groupe électrogène conformément à la procédure WARTSILA

REFRIGERANT BT

Démontage et nettoyage
Contrôle du bon état
Remplacement des anodes
Remplacements des anodes filtre edm DA

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BYZERTE

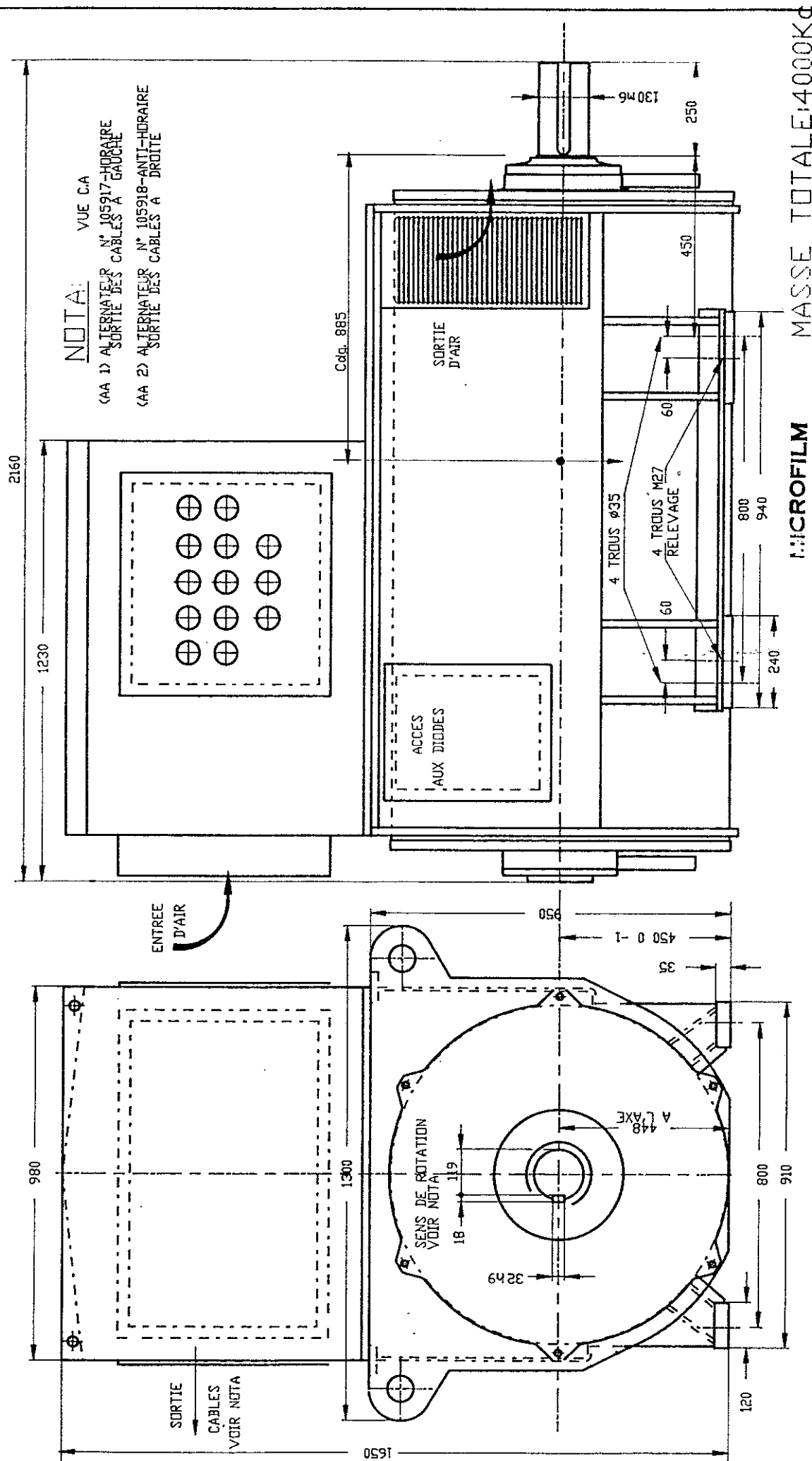
Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.3	<u>Nettoyage/dépoussiérage AA /Td-Cleaning/Undusting of the alternators</u> ACCOUNT CODE: ENT/2 REQUIREMENTS: External Assistance - Specialist Include Cleaning After Include Function Testing Materials - Owner Supply Survey by Ships Staff IN CHARGE : Electrician Engineer LOCATION : Local MPx *** NOT AUTHORISED *** JOB DESCRIPTION: Cleaning, dust removal of the alternator Stbd EQUIPMENT DETAILS:AA Td /JEUMONT SCHNEIDER APM 82 B4 DETAILED LOCATION:Aft main engine room deck 1 PREPARATION REQUIRED:Electrical isolation SPECIFICATION OF WORK 10:Nettoyage, dégraissage avec usage d'un solvant sur le stator et le rotor (sur site)de l'alternateur attelé Tribord Cleaning, dust and grease removal with a degreasing agent on the stator and the rotor. 20:Rincage à l'eau chaude et séchage avec des soufflants. Warm water flushing and air drying with blowers. 30:Utiliser le produit solvant suivant préconisations du constructeur. Use the degreasing agent recommended by the manufacturer. 40:Fournir les spécifications du produit (FDS) Give the product specifications 50:Remplacer les 2 roulements de l'alternateur Replace the Std alternator's bearings. 60:Repeindre le caisson de l'alternateur Paint the alternator's casing 70: Prise index de polarisation (et isolement) avant et après travaux 80: Essai avec le bord Fournir rapport / prendre en considération le temps de séchage pour rendre l'alternateur disponible à J-7

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Section 861, GENERATORS/ALTERNATORS

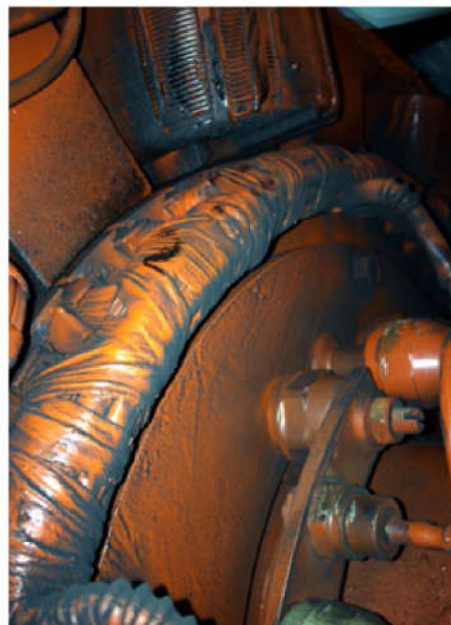
Job	Job Description
861.3	<u>Nettoyage/dépoussiérage AA /Td-Cleaning/Undusting of the alterna (cont.)</u> ATTACHED FILES: DTAT AA.pdf DTAT AA2.pdf Sans titre.png 280 EL 20-9 C Groupe électrogène GE1 Altern. A1-Altern.pdf 280 EL 20-10 Groupe électrogène GE2 - Alternateurs A2-.pdf

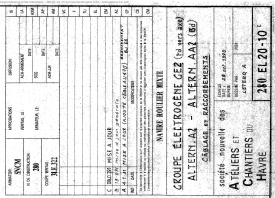


MICROFILM

MASSE TOTALE: 4000KG

ALTERNATEUR A.C.GENERATOR		TYPE APM 82 B4 ROULEMENTS	
SNACH		ENCOMBREMENT	
JEUMONT SCHNEIDER DME/DET Champagne sur seine		FAB 95300047 C de L95300033	
EDITION	21/09/89	MISE A JOUR 08/11/89 A	DOCUMENT N° 21D9225 A





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DATES 01-DEC-2019 TO 28-DEC-2019 (DOCKING 01-DEC-2019 TO 28-DEC-2019)
BYZERTE

Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.4	<u>visite alternateur DA1</u> ACCOUNT CODE: ENT/2 REQUIREMENTS: Include Access Work Include Cleaning After Include Cranage/Lifting Include Data/Inspection Report Include Function Testing Include Non Destructive Test After Work Include Personal Protective Equipment Include Staging Include Test Certificate Include Internal Transportation Include External Transportation Materials - Yard Supply Survey by Class Representative IN CHARGE : Electrician Engineer LOCATION : local DA *** NOT AUTHORISED *** JOB DESCRIPTION: Visite alternateur DA1 EQUIPMENT DETAILS: DETAILED LOCATION: local DA, DA1 Td DRAWING REFERENCE: 280 EL 20-9 C Groupe electrogène GE1 Altern. A1-Altern. AA1 REMOVALS FOR ACCESS:<Remplir ou supprimer> PREPARATION REQUIRED: Dépose de l'alternateur SPECIFICATION OF WORK 10: Prestation de dépose de l'alternateur DA comprenant : - Préparation du chantier - Mise en place de boucles supplémentaires soudées en plafond - Manutention de l'ensemble du matériel nécessaire en salle machine - Récupération de l'autorisation de travail - Déplacement d'une équipe à bord - Mise en place des moyens de levage - Débranchement électrique avec repérage de l'alternateur - Contrôle de l'entrefer avant dépose - Désaccouplement de l'alternateur - Dépose des rampes de sécurité - Manutention de l'alternateur complet vers le PT2 - Récupération des moyens de levage - Cloture, nettoyage et sécurisation du chantier - Transfert de l'alternateur vers les ateliers

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BYZERTE

Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.4	<u>visite alternateur DA1 (cont.)</u> 20: Réception et expertise de l'alternateur comprenant: - Démontage complet de l'alternateur - Mesure des isolements et index de polarisation sur stator, roue polaire, stator d'excitation et rotor d'excitation - Mesure des résistances ohmiques - Contrôle des sondes de température - Contrôle du bobinage et des connexions - Contrôle du câblage Révision de la roue polaire comprenant: - Dépollution et étuvage roue polaire - Contrôle de la métrologie roue polaire - Tests et essais électriques - Mesure des isolements et index de polarisation - Pulvérisation d'un vernis antifiash sur bobinage - Equilibrage dynamique sur banc avec fourniture d'un rapport d'équilibrage - Montages du roulement Révision de la partie excitation comprenant : - Dépollution et étuvage stator et rotor d'excitation - Tests et essais électriques - Mesure des isolements et index de polarisation - Pulvérisation d'un vernis antifiash sur bobinage Révision de la partie commande comprenant : - Identification de l'ensemble des composants (diodes, TI,) - Fourniture et remplacement systématique des diodes - Tests et essais électriques - Mise au propre par nettoyage au chiffon et microbillage pour les connexions Révision de l'alternateur comprenant : - Fourniture roulement 6228 massif C3 - Dépollution et étuvage stator - Tests et essais électriques - Mesure des isolements et index de polarisation - Pulvérisation d'un vernis antifiash sur bobinage - Passage au four et sablage de l'ensemble des pièces mécaniques - Remontage de l'alternateur. - Reconditionnement de la boîte à bornes. 30: Essais finaux de l'alternateur comprenant : - Mesure des isolements et index de polarisation sur bobinage stators, rotor et excitatrice Finitions et conditionnement comprenant : - Mise en peinture et finition - Rédaction d'un rapport de travaux 40: Transport retour de l'alternateur avec assurance spécifique:

M/V MONTE D'ORO - AT 2019
DATES 01-DEC-2019 TO 28-DEC-2019 (DOCKING 01-DEC-2019 TO 28-DEC-2019)
BYZERTE

Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.4	<u>visite alternateur DA1 (cont.)</u> -Imprégnation de la roue polaire par trempage avec résine classe H sans solvant Polymérisation en étuve ventilée avec mise en rotation -Imprégnation sous vide et pression du stator avec résine classe H sans solvant Polymérisation en étuve ventilée -Imprégnation sous vide et pression du stator et rotor d'excitation avec résine classe H sans solvant Polymérisation en étuve ventilée 50: Repose alternateur: - Retour à bord d'une équipe pour remise en place des moyens de manutention et de l'ensemble du matériel nécessaire -Transport de l'alternateur - Récupération de l'autorisation de travail - Manutention et repose de l'alternateur sur son châssis - Rapprochement de l'alternateur pour son accouplement - Accouplement, alignement laser et contrôle de l'entrefer selon accessibilité - Recablage électrique de l'alternateur - Récupération des moyens de levage - Cloture et nettoyage du chantier - Validation des valeurs d'entrefer - Essais - Signature vibratoire de référence suivant norme ISO 10816-3 avec remise d'un rapport - Rédaction d'un rapport technique sur l'ensemble de l'intervention 10: Removal service of the alternator DA comprising: - Site preparation - Installation of additional loops welded on the ceiling - Handling of all necessary equipment in the machine room - Recovery of the work permit - Moving a team on board - Establishment of lifting means - Electrical disconnection with identification of the alternator - Control of the gap before removal - Disconnection of the alternator - Removal of safety ramps - Handling the complete alternator to the deck 2 - Recovery of lifting equipment - Closing, cleaning and securing the site - Transfer of the alternator to the workshops 20: Reception and expertise of the alternator including: - Complete disassembly of the alternator - Insulation measurement and polarization index on stator, pole wheel,

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Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.4	<u>visite alternateur DA1 (cont.)</u> excitation stator and excitation rotor - Ohmic resistance measurement - Control of temperature probes - Checking windings and connections - Control of the wiring Revision of the polar wheel including: - Polar wheel depollution and steaming - Control of the polar wheel metrology - Electrical tests and tests - Measurement of isolations and polarization index - Spraying of antifeash varnish on winding - Dynamic balancing on bench with provision of balancing report - Bearing assemblies Revision of the excitation portion comprising: - Stain removal and stator quenching and excitation rotor - Electrical tests and tests - Measurement of isolations and polarization index - Spraying of antifeash varnish on winding Revision of the control part comprising: - Identification of all components (diodes, TI, - Supply and systematic replacement of diodes - Electrical tests and tests - Cleaning by rag and drip cleaning for connections Revision of the alternator including: - Supply bearing 6228 solid C3 - Pollution control and stoving stator - Electrical tests and tests - Measurement of insulation and polarization index - Spraying of antifeash varnish on winding - Baking and sanding of all mechanical parts - Reassembly of the alternator - Reconditioning of the terminal box. 30: Final tests of the alternator comprising: - Measurement of insulation and polarization index on winding stators, rotor and exciter Finishes and packaging including: - Painting and finishing - Writing a report of works 40: Transport return of the alternator with specific insurance: -Impregnation of the polar wheel by immersion with resin class H without solvent Polymerization in ventilated oven with rotation -Vitrogen impregnation and stator pressure with resin class H without solvent Polymerization in a ventilated oven -Vitrogen impregnation and stator pressure and excitation rotor with class H resin without solvent Polymerization in a ventilated oven

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BYZERTE

Section 861, GENERATORS/ALTERNATORS

Job	Job Description
861.4	<u>visite alternateur DA1 (cont.)</u> 50: Alternator comes back on board: - Back on board a team to put back handling equipment and all necessary equipment - Transport of the alternator - Recovery of the work permit - Handling and rests the alternator on its chassis - Reconciliation of the alternator for its coupling - Coupling, laser alignment and gap control according to accessibility - Electrical rewiring of the alternator - Recovery of lifting equipment - Closing and cleaning the site - Validation of the air gap values - Tests - Vibratory reference signature according to ISO 10816-3 standard with delivery of a report - Writing a technical report on the whole of the intervention ATTACHED FILES: alternateur DA DORO.pdf 280 EL 20-9 C Groupe electrogène GE1 Altern. A1-Altern.pdf devis LORELEC.pdf

ABB Drives

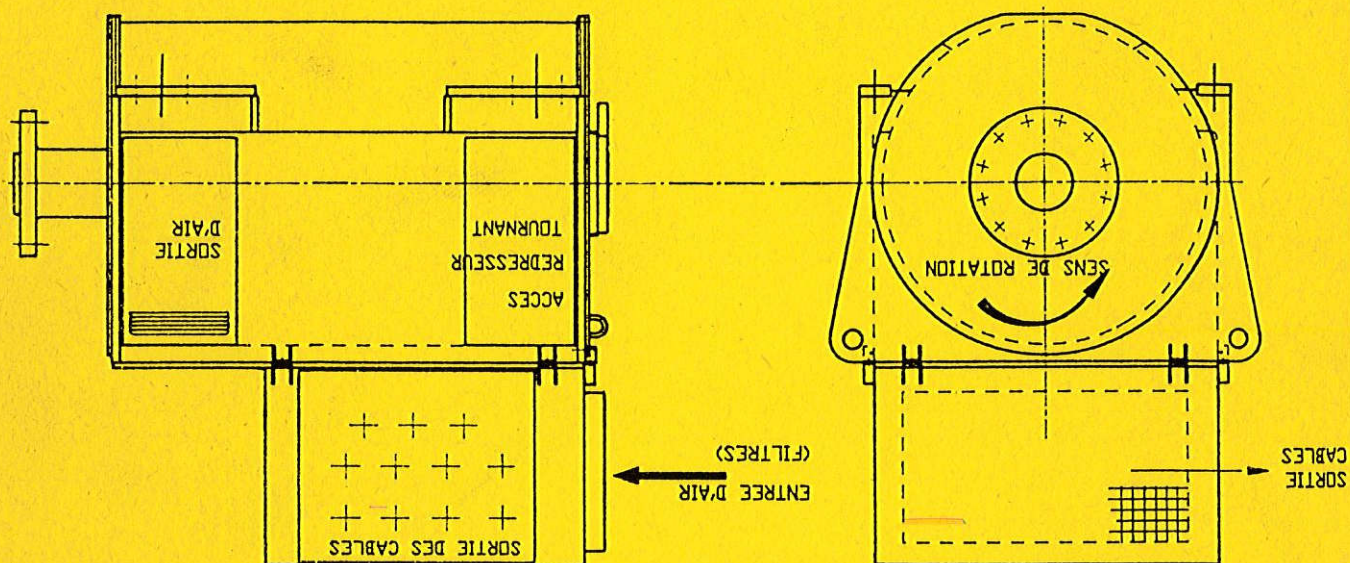
ABB
ASEA BROWN BOVERI

28.06.91

EDITION

FICHE TECHNIQUE

24 J 7031.1



ALTERNATEUR DA

DESCRIPTION-INSTALLATION-MAINTENANCE

MACHINES SYNCHRONES

24 J 7031.2 FICHE TECHNIQUE			ASCA BROWN BOVERI ABB	ABB Drives 77430 CHAMPAIGNE SUR SEINE
		EDITION		

ABB-DRIVES

AC-MACHINES

POUR JOINDRE VOTRE CONSTRUCTEUR

Adresse Rue du Général de Gaulle - 77430 Champaigne-sur-Seine Téléphone 64 69 40 00 Télécopie 64 23 27 07 Télex 691442 ABBJS	
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Références ABB Drives n° de fabrication 95300048	Références client Société CHANTIERS DU HAVRE Marché L 95300033
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Type de machine APM 92 C6 Nombre 2	n° de(s) machine(s) 105919 / 105920
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IDENTIFICATION

ALTERNATEUR SYNCHROME

FICHE TECHNIQUE

Puissance nominale 1250 kVA

Température ambiante maxi

°C

Classe d'isolation

Rotor
Stator

H
H

Tension nominale 380 V

Mode de refroidissement

IC 04

Résistance stator
d'isolation à °C

MΩ

Courant nominal (ln) 1893 A

Couple de démarrage
Couple nominal

V

Valeur max de
la composante inverse/ln

ln

Courant rotor (lr) A

Couple maxi
Couple nominal

ln

Substrans a Vide l'ln

ln

Courant de démarrage/ln

Couple résistant maxi
à l'enclenchement
Couple nominal

ln

Substrans en charge l'ln

ln

Facteur de puissance 0,8

Couple résistant maxi
à la synchronisation
Couple nominal

ln

Réactances a Fn
Synch directe xd

ln

Fréquence nominale (Fn) 50 Hz

Couple de décrochage

doN.m

Trans x 3

ln

Vitesse nominale 1000 t/min

Subr x 2

ln

Constante de temps :

ln

Vitesse synchrone 1000 t/min

Temps de mise en vitesse

s

En CT de l'inducteur

s

Survitesse 1200 t/min

Angle de couplage admis

°Elec

Facteur harmonique FHT
téléphonique FHT

%

Nombre de phases 3

Courant nominal
d'excitation

A

MD² moteur

kg.m²

Couplage des enrroulements Y

Tension nominale
d'excitation

V

MD² entrainé

kg.m²

Degré de protection IP 23S

Echauffement

K

70

ABB Drives

ABB

EDITION

FICHE TECHNIQUE

24 J 7031-3

FICHE TECHNIQUE ALTERNATEUR SYNCHRON D'EXCITATION		Type E 500/60		Puissance nominale 4,74 kVA	
Tension nominale 69,3 V		Fréquence nominale 133,3 Hz		Courant nominal 64,2 A	
Classe d'isolement Stator H Rotor H		Nombre de phases 3		Couplage des enroulements Y	
Courant nominal d'excitation 5,1 A		Tension nominale d'excitation 50,4 V		EDITION	
ABB Drives 77420 COURMAYEUR SUD 3824		ABB ASEA BROWN BOVERI		FICHE TECHNIQUE 24 J 7031.4	

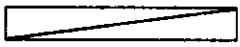
24 J 7031-5 FICHE TECHNIQUE				ASSEA BROWN BOVERI 	77000 CHAMPAIGN SUR SONNE ABB Drives
MANUTENTION					
MASSES :					
Machine complète	6100	kg			
Rotor	2249	kg			
Stator (Carcasse + bobinage)	3851	kg			
Socle		kg			
Plaques de base		kg			
CONSIGNES :					
- Les opérations de manutention doivent être exécutées en conformité avec les règles de sécurité. - Les machines seront manutentionnées avec le blocage rotor en place. - Toujours utiliser la totalité des points de levage prévus sur les machines. - Ne jamais poser les machines ou éléments de machine directement sur le sol, toujours interposer des calages pour les isoler. - Lorsque l'élingage porte sur des surfaces usinées, celles-ci devront être protégées mécaniquement aux zones en contact avec les élingues. - NE JAMAIS SOLICITER LES BOBINAGES. - Eviter que les élingues forment entre-elles un angle plus grand que 60°. - Si la température est voisine ou inférieure à 0°C, il faut utiliser des appareils de manutention et de levage largement dimensionnés et si la température est particulièrement basse, il est déconseillé, voire interdit, de faire des manutentions. - Pour certaines machines, sur demande du client, il pourra être établi un plan spécifique de manutention. Ce plan sera joint à ceux contenus dans cette notice (voir annexe).					

ABB Drives 77000 GUYANNE SUR MER	ABB ASEA BROWN BOVERI	EDITION				24 J 7031-6 FICHE TECHNIQUE
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LIVRAISON-STOCKAGE-DESTOCKAGE

I - INSPECTION A LA LIVRAISON DE LA MACHINE

- Le matériel, même, rendu "Franco", voyage aux risques et périls du destinataire.
- Procéder à un examen minutieux avant de prendre livraison.
- Tout dommage survenu pendant le transport doit faire l'objet de réserves expresses auprès du transporteur et le fournisseur devra en être immédiatement informé. A défaut d'avoir fait les réserves d'usage, confirmées par lettre recommandée dans les 3 jours qui suivent la réception du matériel, le client ne pourra formuler aucune réclamation concernant l'état du matériel à l'arrivée même si ABB a assumé la responsabilité du transport.
- S'assurer que la livraison est bien complète par rapport à la liste de colisage et signaler au fournisseur tout élément ou accessoire manquant.

II - EMBALLAGE

Si l'expédition sur le chantier est assurée par le client de ABB celui-ci devra respecter les consignes suivantes :

- S'assurer que la boîte à bornes est correctement fermée avec tous les joints, rondelles et visserie prévus par le constructeur, que les entrées de câbles, que les entrées et sorties d'eau et / ou d'huile sont correctement obturées.
- Si la machine est expédiée séparément de la machine entraînée (entraînante) le dispositif de blocage du rotor prévu par le constructeur devra être remis en place.
- Si la machine est expédiée accouplée avec la machine entraînée (entraînante) sur un socle rigide, la ligne d'arbre du groupe devra être bloquée par un dispositif approprié de façon à éviter la détérioration des roulements ou des coussinets pendant le transport.
- S'assurer que les parties usinées (bout d'arbre, clavette, bride de fixation, pattes) soient bien enduites de vernis de protection anti-rouille.

L'emballage devra être conçu pour protéger efficacement la machine de tous chocs ou vibrations pouvant endommager les paliers et la carcasse notamment les pattes, la bride de fixation, les ailettes.

24 J 7034.7 FICHE TECHNIQUE			ABB ASEA BROWN BOVERI	77400 0447402 200 2004 ABB Drives						
LIVRAISON-STOCKAGE-DESTOCKAGE Dans le cas de transport maritime, l'emballage devra être conforme à la catégorie 5 de la "spécification des Emballeurs Industriels". De plus, prévoir une protection totale par housse étanche (classe I) avec adjonction de deshydratant ! les parties saillantes du matériel seront protégées pour éviter tous risques de détérioration de l'enveloppe étanche. La machine devra être boulonnée par ses trous de fixation. Les efforts de calage ne devront pas être supportés directement par les pattes ou la bride ou les ailettes. III - STOCKAGE ET PRESERVATION APRES DEBALLAGE Le sol du lieu de stockage ne doit pas être soumis à des vibrations. Si tel n'est pas le cas, isoler la machine, par exemple en plaçant des cales en caoutchouc sous ses pattes. a) Stockage de courte durée (moins de 2 mois) Les machines déballées doivent être stockées dans un endroit propre et ventilé à une humidité relative ambiante ne dépassant pas 75%. Si l'humidité relative risque de dépasser cette valeur trois procédés de réchauffage peuvent être utilisés : * Alimentation des bobinages sous TENSION REDUITE C'est le procédé le plus efficace, car la source de chaleur est au cœur du bobinage. Il peut être appliqué à toute machine, même déjà en service et quelqu'en soit la taille. 1. Machines asynchrones à cage : Tension nécessaire : environ 1/20 de la tension nominale soit par exemple : <table style="margin-left: auto; margin-right: auto;"> <tr> <td>- 12 V pour</td> <td>220 V</td> </tr> <tr> <td>- 24 V pour</td> <td>380 V</td> </tr> <tr> <td>- 220 V pour</td> <td>5 500 V</td> </tr> </table> Intensité maximale : 1/3 de l'intensité nominale ! pour respecter ce paramètre, il peut être nécessaire d'ajouter une résistance en série ou d'alimenter la machine avec une tension plus faible.					- 12 V pour	220 V	- 24 V pour	380 V	- 220 V pour	5 500 V
- 12 V pour	220 V									
- 24 V pour	380 V									
- 220 V pour	5 500 V									

24 J 7034.8 FICHE TECHNIQUE			ABB ASEA BROWN BOVERI	77400 044746 001 000 ABB Drives
LIVRAISON-STOCKAGE-DESTOCKAGE 2° Autres machines : Tension continue nécessaire : environ 1/20 de la tension alternative nominale, soit par exemple : - 12 V D.C. pour 220 V A.C. - 24 V D.C. pour 380 V A.C. - 220 V D.C. pour 500 V A.C. Intensité maximale : 1/3 de l'intensité nominale ; pour respecter ce paramètre, il peut être nécessaire d'ajouter une résistance en série ou d'alimenter la machine avec une tension plus faible. Il convient par ailleurs de s'assurer que la vapeur d'eau peut s'échapper facilement lorsqu'on réchauffe les enroulements par application d'un courant. * Emploi de résistance de réchauffage : Si la machine en est équipée, mettre celle-ci sous tension (vérifier la valeur sur la plaque signalétique "RECHAUFFAGE"). * Etuvage : Démonter la machine et faire circuler de l'air chaud et sec au travers de ses parties internes. Quelque soit le procédé de réchauffage employé (sauf usage de la résistance de réchauffage) il convient de surveiller l'échauffement des enroulements pendant toute la durée du séchage. Le gradient de température ne doit pas dépasser 5°C/heure et la température des enroulements sera comprise entre 80 et 90°C pour éviter que la vapeur d'eau éliminée n'endommage les isolants. Le temps de séchage varie de 8 à 24 heures. Appliquer un air sec à la machine aide à réaliser un séchage efficace. b) Stockage prolongé (au delà de 3 mois) En complément des opérations prévues au paragraphe "stockage courte durée" il y a lieu : - De relever les balais et d'enduire les bagues d'une légère couche de vaseline. - D'obturer les orifices (ouïes de ventilation, sorties de câbles, entrée(s) et sortie(s) d'eau du(des) refroidissant etc...) pour interdire toute pénétration de poussières.				

24.1 7031-9 FICHE TECHNIQUE				 ASSEA BROWN BOVERI	77400 GENEVE ABB Drives
LIVRAISON-STOCKAGE-DESTOCKAGE - De protéger le bout d'arbre contre les chocs possibles et l'oxydation. - De vérifier l'état de la protection antirouille des parties non peintes. - De ne pas poser directement sur le sol des parties mécaniques usinées, les faire reposer sur un calage de bois sec avec interposition d'une feuille de laton pour éviter l'oxydation. - De vérifier, lorsqu'il existe, que le dispositif de blocage rotor est bien immobilisé. - De déviter le rotor d'environ 10 tours tous les 2 ou 3 mois pour éviter de marquer les roulements ou les portées de coussinets. La rotation sera telle que l'arbre ne retrouvera pas sa position d'origine. Pour contrôler le virage, des repères auront été préalablement placés et les dates d'exécution consignées. - Pour les machines équipées de paliers à coussinets, il est nécessaire, de remplir les paliers d'huile (conforme à celle indiquée sur la plaque signalétique). - De protéger totalement la machine par housse étanche avec adjonction de déshydratant dans le cas de stockage sur chantier ou OFF SHORE. c) Stockage à des températures de - 25°C à - 60°C : Toutes les dispositions nécessaires devront être prises pour assurer une protection efficace des pièces en fonte contre les chocs et les vibrations. Pendant toute la période de stockage, s'assurer sur toutes les machines (en fonte ou non) que les (la) boîtes à bornes sont correctement fermées avec tous les joints, rondelles et vis prévus par le constructeur et que l'entrée des câbles est obturée. Vérifier également que le bout d'arbre est bien protégé de l'oxydation par de la graisse. S'ils existent, vider l'eau contenue dans les hydrofugés et les serpents de refroidissement des paliers. Toutes les précautions à prendre pour un stockage prolongé sont applicables à l'exception de la mise en oeuvre du réchauffage qui n'est pas nécessaire.					

LIVRAISON-STOCKAGE-DESTOCKAGE

IV - DESTOCKAGE

Enlever toutes les parois d'obturation.

Retirer le dispositif de blocage du rotor.

Pour les machines équipées de paliers à roulements, il n'y a pas de précautions à prendre en ce qui concerne la graisse si la durée de stockage est inférieure à un an, dans le cas contraire, procéder à un graissage complet en introduisant, par le graisseur une quantité de graisse double de celle préconisée sur la plaque signalétique, la machine étant en fonctionnement.

Pour les machines équipées de paliers à coussinets ou paliers à roulements lubrifiés à l'huile, qui ont fait l'objet d'un remplissage lors du stockage, vidanger entièrement et remplir avec de l'huile neuve conforme à celle indiquée sur la plaque signalétique.

Au destockage du matériel venant de l'extérieur d'une température inférieure à - 25°C, n'effectuer aucune intervention avant que celui-ci n'ait repris une température suffisante (5 à 10°C).

Le passage d'une température froide à la température ambiante peut provoquer, à l'intérieur des machines, le dépôt d'une rosée dangereuse pour le bobinage. Il est donc IMPÉRATIF, avant mise en service, de vérifier la résistance d'isolement du bobinage - voir chapitre "PRÉPARATION LA MISE EN ROUTE" paragraphe "Préparation électrique" - si la valeur relevée est inférieure au minimum requis il convient de procéder à un séchage des bobinages suivant l'une des procédures décrites au chapitre - "STOCKAGE ET PRÉSERVATION APRES DEBALLAGE" paragraphe "Stockage de courte durée" -.

Pour les machines équipées de paliers à coussinets ou de paliers à roulements lubrifiés à l'huile, vérifier que la fluidité de l'huile est suffisante pour assurer la lubrification.

Pour les machines équipées, de paliers à roulements lubrifiés à la graisse dont la durée de stockage a été supérieure ou égale à un an, il y a lieu de procéder à un examen des roulements.

Si la graisse est sèche ou de couleur uniforme, dure au toucher, procéder à un nettoyage des roulements puis graisser à nouveau. Dans le cas où la graisse semble en assez bon état, procéder, seulement, à un graissage comme décrit précédemment.

ABB Drives

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EDITION

FICHE TECHNIQUE

24 J 7031.10

INSTALLATION

CONDITIONS DU SITE ET FONDATIONS :

- Prévoir autour du lieu d'installation de la machine un espace suffisant pour permettre l'exécution des opérations d'inspection et d'entretien de routine ; ce lieu devra être pourvu des matériels nécessaires aux différentes phases de maintenance.

- * Les locaux seront suffisamment dimensionnés et équipés pour assurer au matériel une ventilation correcte.
- * Si la ventilation s'effectue par gaines, veillez à ce que la section de celles-ci soit compatible avec les débits et pertes de charges exigés.

- * Si la machine est du type "ouvert" l'air circulant dans celle-ci devra être propre et ne comporter aucune poussière ou vapeurs corrosives, abrasives ou susceptibles de perturber le refroidissement et l'isolation de la machine (suie, vapeurs d'huile, etc...), ces mêmes consignes doivent être respectées si la machine est raccordée sur des buses de ventilation.

Dans le cas de machines à bague l'air ambiant du dispositif collecteur doit être légèrement humide.

- Les fondations ou structures supportant la machine doivent être rigides, suffisamment isolées des vibrations externes et pouvoir résister aux couples mécaniques transitoires se produisant au démarrage et au court circuitage des machines.

- * Le seuil de vibrations admis au niveau de l'axe de la machine doit se situer dans les limites prévues par la "NORME NFE 90-300" (sauf spécification particulière prévue au contrat).

- * Les machines devront être posées sur des plaques de base, socle ou plaques métalliques scellées en regard des surfaces d'appui prévues.

- * Ces plaques métalliques devront avoir une épaisseur minimum de 30mm (épaisseur à respecter également pour les plaques de base) et une aire au moins égale aux surfaces d'appui de la machine.

ABB Drives

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EDITION

FICHE TECHNIQUE

24 J 7031-11

ABB Drives 77430 OLIVIERE SUD 5000		ABB ASEA BROWN BOVERI		EDITION	FICHE TECHNIQUE	24 J 7031-12
INSTALLATION NOTA : L'installation des machines est placée sous la responsabilité du client (sauf conditions particulières spécifiées au contrat). ABB ne pourra être tenu responsable des détériorations pouvant survenir sur son propre matériel ou sur celui environnant à la suite : - de vibrations excessives transmises, - d'une mauvaise conception des fondations et/ou structures, - d'une mauvaise installation, - d'un défaut de lignage, - de mauvaises conditions de stockage, - du non respect des consignes de vérification avant démarrage, - d'un mauvais raccordement électrique.						

FICHE TECHNIQUE 24 J 4031-13	EDITION	ASSEA BROWN BOVERI 	7100 QUARTIER 201 2002 ABB Drives
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LIGNAGE

Les surfaces de pose des machines (pattes de carcasse - bride pour machine verticale) sont toujours usinées avec soin pour réaliser un plan ou une surface plane.

Le réglage du plan de pose (socle, plaques de base, plaques d'appuis) doit être effectué de manière à permettre un accouplement correct avec la machine entraînée ou entrainante.

Le plan de pose doit être tel que la fixation des ensembles ou éléments de machine sur ce plan, n'entraîne pas de déformations dommageables de ces derniers (écart de planéité > 0,2 mm par mètre avec un maximum de 0,3 mm).

Les demi-accouplements doivent être montés sur l'arbre selon la procédure adéquate, en utilisant les outils appropriés, faute de quoi les paliers pourront être détériorés.

L'outillage permettant de réaliser le lignage devra, au moins, être composé de :

- Jeux de cales d'épaisseur en tôle d'acier
- Vis de mise à niveau pour le positionnement vertical de la machine ainsi que de vis de réglage ou de vérins hydrauliques pour son positionnement axial et latéral.
- comparateurs à cadran, instruments de mesure adéquats, dispositifs de dévissage du rotor.

LE LIGNAGE DOIT ETRE REALISE SELON LES RECOMMANDATIONS PRESCRITES PAR LE CONSTRUCTEUR DE L'ACCOUPEMENT.

Pour obtenir des valeurs fiables de lignage, il ne faut pas se fier à la précision d'usinage et d'assemblage des demi-accouplements, il faut IMPERATIVEMENT faire tourner les deux arbres ensemble.

Il est quelquefois nécessaire pour concilier le plan de pose et le lignage de faire des calages non pas parallèle (Fig.1) mais en gradins dont la hauteur n'excèdera pas 0,2 mm (Fig.2). Les calages ne doivent jamais se composer de plus de 5 épaisseurs superposées.

Pour réaliser un excellent lignage, il peut être nécessaire de tenir compte de l'élévation de température des machines accouplées.

Cas particulier du lignage des machines monopaler avec arbre à plateau.

Figure 1

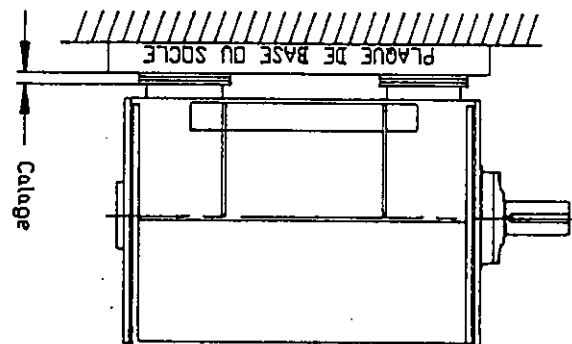
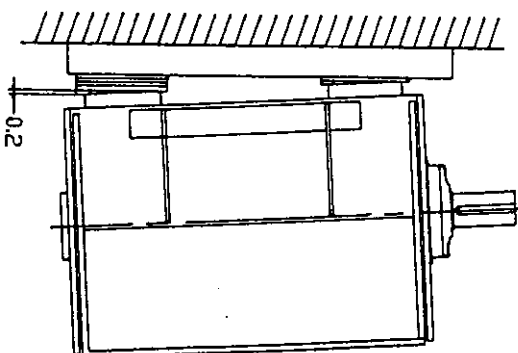


Figure 2



LANGUAGE

24 J 7031 - 15 FICHE TECHNIQUE			ABB ASEA BROWN BOVERI	7750 QUAI ABB Drives
POSITIONNEMENT DU ROTOR LE ROTOR D'UNE MACHINE ELECTRIQUE DOIT ETRE CORRECTEMENT POSITIONNE POUR EVITER : - Le frottement entre pièces qui ne doivent pas être en contact tels que écran de ventilation et ventilateur. Pare-huile ou Pare-graisse entre eux - etc... - La détérioration de la butée d'arbre et/ou de coussinet, du roulement de butée, lorsque ceux-ci ne sont pas prévus pour supporter une poussée axiale ou si leur capacité à pouvoir reprendre un tel effort est insuffisante. - Le mauvais positionnement axial des canaux de ventilation stator et rotor, des balais sur les bagues. - La transmission de poussée axiale exagérée à la machine entraînée ou entraînante. LE POSITIONNEMENT DU ROTOR PEUT-ETRE REALISE DE PLUSIEURS FACONS : 1° La machine comporte une butée limitant le déplacement axial du rotor (coussinet ou roulement de butée) : - si la ligne d'arbre comporte une seule butée, celle-ci reprend la totalité des poussées axiales (doivent être définies au contrat) - si la ligne d'arbre comporte une deuxième butée, chacune reprend ses propres efforts ainsi que les réactions d'accouplement. Les poussées extérieures seront parfaitement définies. REMARQUE : On veillera à ce que les jeux dans chacun des paliers de butée soient compatibles afin d'éviter tout transfert d'effort d'une machine sur l'autre. 2° La machine ne comporte pas de butée : - La position du rotor à respecter est donnée à partir d'un élément fixe (pare-huile, obturateur...) et un épaulement de l'arbre. La valeur de la cote à respecter est indiquée sur une plaque signalétique				

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POSITIONNEMENT DU ROTOR

3° La machine ne comporte qu'un seul palier (accouplement rigide par plateaux) :

- Pour les machines équipées d'un palier à roulement la position du rotor est donnée à partir d'un élément fixe (obturateur) et l'extrémité de l'arbre. La valeur de la cote à respecter est indiquée sur une plaque signalétique (voir fig.4).
- Pour les machines équipées d'un palier à coussinet, retirer le chapeau de palier et le demi - coussinet supérieur et mesurer les jeux entre les épaulements de l'arbre et le coussinet. La valeur des cotes à respecter est indiquée sur une plaque signalétique

Après la mise en place de la machine sur son plan de pose, effectuer l'emboîtement des deux plateaux d'accouplement en déplaçant l'ensemble de la machine par la carcasse, NE JAMAIS TIRER SUR L'ARBRE POUR REALISER L'APPROCHE.

Mettre en place deux boulons d'accouplement provisoires NON SERRÉS, puis retirer l'outillage de maintien du rotor.

Réaliser le réglage de la ligne d'arbre en se référant au parallélisme des plateaux d'accouplement non plaqués, terminer l'approche des faces d'accouplement, vérifier que le rotor est correctement positionné, que les faces d'accostage sont parallèles, que les emboîtements sont coaxiaux et serrer à l'aide de 4 boulons minimum. Vérifier, éventuellement, que les contraintes sont admissibles sur la machine entraînée ou entraînante (arbre manivelle de diesel par exemple).

REMARQUE :

Les opérations de calage sont identiques à celles utilisées pour les machines bi-paliers.

24 J 4031.17 FICHE TECHNIQUE	EDITION	ABB ASEA BROWN BOVERI	7750 04748E 001 2004 ABB Drives
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PREPARATION A LA MISE EN SERVICE

PREPARATION MECANIQUE :

- Pour les machines équipées de paliers à roulements lubrifiés à l'huile ou de paliers à coussinets, il convient de les vider puis de les remplir jusqu'au niveau indiqué avec la quantité et la qualité de l'huile figurant sur la plaque signalétique et de huiler copieusement la fusée. L'arbre ne doit pas reposer à sec.
- Pour les machines équipées d'un jeu de bagues, retirer la protection placée entre le jeu de bagues et les balais, ou, si la machine a fait l'objet d'un stockage prolongé, dégraisser les bagues et les essayer avec un chiffon sec, redescendre les balais ; dans tous les cas s'assurer que ceux-ci coulissent bien dans leur gaine et sont bien en contact avec les bagues.
- Les machines sont équilibrées dynamiquement avec 1/2 clavette, s'assurer que l'accouplement ou la poulie est bien équilibré dynamiquement en conséquence.

PREPARATION ELECTRIQUE :

La valeur minimale acceptable de la résistance d'isolement des enroulements à la température ambiante (25°C) doit être égale à :

(TENSION NOMINALE DE L'ENROULEMENT, en KV + 1) MΩ

- Pour réaliser la mesure de la résistance d'isolement, le mégohmmètre utilisé doit être branché successivement entre chaque enroulement et la carcasse de la machine, tous les autres enroulements (phases) étant reliés à la carcasse et à la terre. Les sondes de température PT-100 doivent également être mises à la terre.
- Les enroulements MT et HT (tension de fonctionnement > 3 KV) sont soumis à une tension d'essai de 2 500 V. Les autres enroulements sont soumis à une tension de 1 000 V. Les dispositifs auxiliaires (à l'exception des sondes de température PT 100) sont soumis à une tension d'essai de 500 V.

24 J 7031-18 FICHE TECHNIQUE			ASCEA BROWN BOVERI 	77430 CHATELAIN SUR SEINE ABB Drives
PREPARATION A LA MISE EN SERVICE Les sondes de température Pt 100 sont essayées sous une tension de 100 V. Les indications de résistance d'isolement sont lues après une minute d'application de la tension d'essai. REMARQUE : La résistance d'isolement diminue lorsque la température de l'enroulement augmente. Cette diminution est égale à 50 % pour chaque augmentation de 10 à 15°C de la température de l'enroulement. PRECAUTION DE SECURITE : La carcasse et les enroulements non essayés doivent impérativement être mis à la terre pendant l'essai de résistance d'isolement. L'enroulement essayé doit être mis à la terre immédiatement après l'essai pour en éliminer les charges électriques résiduelles. * Séchage des enroulements : Se reporter au chapitre "STOCKAGE ET PRESERVATION APRES DEBALLAGE" paragraphe "Stockage de courte durée". * Branchements électriques : Etudier très soigneusement les schémas de branchements fournis avec la machine avant d'entreprendre les opérations de raccordements électriques de la machine. - S'assurer que tension et la fréquence d'alimentation correspondent bien aux valeurs indiquées sur la plaque signalétique pour la machine principale. - Pour les auxiliaires se reporter aux caractéristiques fournies par les constructeurs. - S'assurer que la section et l'isolation des câbles sont adaptées à l'intensité et à la tension du courant véhiculé. - S'assurer que les presse-étoupe et autres accessoires sont du type et de la taille adéquats.				

FICHE TECHNIQUE 24 J 7031-19	EDITION	ASSEA BROWN BOVERI ABB	ABB Drives 77420 CHAMPAIGN SUR SAONE
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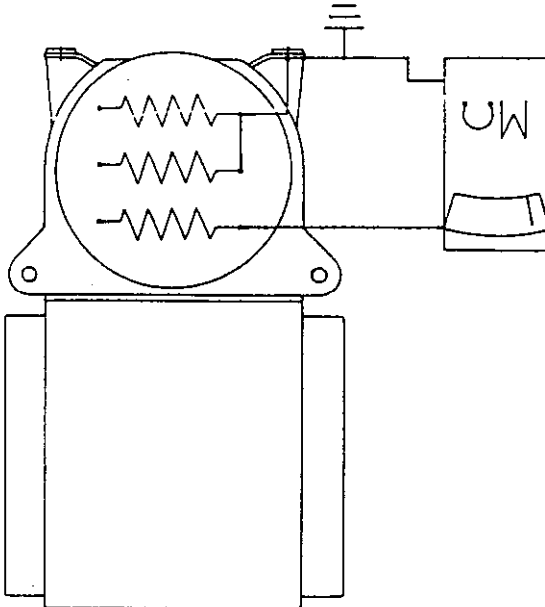


Figure 6

Certains machines entraînées ou entraînantes ne peuvent pas fonctionner en sens inverse.

Le sens de rotation des moteurs peut être observé en alimentant brièvement le stator.

ATTENTION :

L'inversion du sens de rotation ne présente aucun danger pour la machine, mais elle ne pourra être mise en charge seulement dans le sens de rotation spécifiée.

appareils d'excitation.

- Pour les machines synchrones, le changement du ou des ventilateurs, du repérage des bornes, du câblage des
- Pour les machines asynchrones, le changement du ou des ventilateurs et du repérage des bornes.

Le changement du sens de rotation implique :

Les machines sont normalement prévues pour fonctionner dans un seul sens, indiqué par une flèche placée côté accouplement.

*** Sens de rotation :**

- S'assurer que l'alimentation est isolée et que les câbles d'alimentation sont reliés à la terre. Respecter scrupuleusement toutes les précautions de sécurité applicables.

PRÉPARATION A LA MISE EN SERVICE

CONTROLES AVANT DEMARRAGE

CONTROLE DE LA LUBRIFICATION :

Paliers lubrifiés à l'huile :

* Lubrification par barbotage

Vérifier que :

- la qualité de l'huile est celle préconisée par la plaque signalétique,

- les paliers sont remplis jusqu'au niveau indiqué,

- les bagues de graissage tournent librement.

* Lubrification par circulation d'huile

Vérifier que :

- la qualité de l'huile est celle préconisée par la plaque signalétique,

- les bagues de graissage tournent librement,

- les circuits d'huile ont bien été rincés,

- les filtres sont propres,

- le débit et la pression de l'huile circulant dans les paliers sont conformes aux préconisations,

- les dispositifs de sécurité du circuit d'huile ont été essayés,

- les paliers ne laissent échapper aucune fuite d'huile.

Paliers lubrifiés à la graisse :

Vérifier que :

- le premier graissage a bien été effectué,

- la qualité de la graisse est celle préconisée par la plaque signalétique,

- les graisseurs et la pompe à graisse sont propres.

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FICHE TECHNIQUE

24 J 7031-20

ABB Drives 77430 OLIVIERAUX SUR SEINE	ABB ASEA BROWN BOVERI	EDITION	24 J 7031-21	FICHE TECHNIQUE
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CONTROLES AVANT DEMARRAGE

CONTROLES MECANIQUE :

Vérifier que :

- tous les éléments ont bien été montés,
- la visserie est correctement serrée et freinée,
- la machine est bien fixée sur son assise,
- le couplage de positionnement est bien réalisé,
- l'accouplement est en état de fonctionner et en particulier qu'il est bien lubrifié,
- qu'il ne reste aucun corps étranger dans et/ou sur la machine,
- les entrées et les sorties d'air sont bien dégagées,
- la ventilation ne va pas aspirer des matières nuisibles au fonctionnement de la machine (poussières - eau - corps légers - vapeurs...),
- les refroidissants, s'il y en a, sont bien alimentés en eau (vérifier le débit et la pression),
- lorsque la machine est équipée d'un jeu de bagues, les bagues, les isolants (entre bagues et entre supports de porte-balais) sont propres,
- lorsque la machine est équipée de porte-balais, ceux-ci sont bien fixés et à une distance correcte des bagues, que les balais sont bien rodés, qu'ils appliquent correctement sur les bagues et qu'ils coulissent facilement dans les portes-balais, que leurs shunts sont bien positionnés et qu'il n'y a aucun risque de court-circuit,
- s'ils sont prévus, les balais de courant d'arbre sont bien en place.

CONTROLES AVANT DEMARRAGE

CONTROLES ELETTRICI :

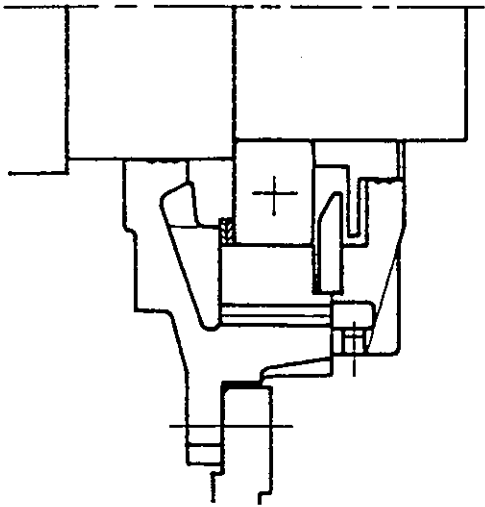
Verfügt über

- la résistance d'isolement du stator est correcte,
- s'il y a une isolation prévue contre les courants d'arbre, elle est propre et non court-circuitée,
- les bornes de terre sont bien raccordées
- les protections électriques sont bien en service et qu'elles fonctionnent,
- le raccordement du stator a bien été fait en respectant l'ordre des phases,
- les boîtes à bornes sont bien fermées,
- s'il s'agit d'une machine asynchrone à bagues :
- * la résistance d'isolement du bobinage rotor est correcte
- s'il s'agit d'une machine synchrone :
- * les résistances d'isolement des bobines du rotor et des circuits d'excitation sont correctes.

24 J 7031.23 FICHE TECHNIQUE				ABB ABB BROWN BOVERI	77 130 044 14 000 000 000 ABB Drives
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PALIERS

A ROULEMENTS :



COTE OPPOSE ACCOUPLEMENT

La figure montre le montage des roulements et leur système de lubrification à la graisse.

Les paliers des machines sont équipés de roulements à billes ! Le roulement côté accouplement est généralement bloqué axialement et sert de butée, il n'est, en principe, pas prévu pour supporter des charges axiales et radiales générées par la machine entraînée ou entraînée (sauf spécifications particulières mentionnées au contrat) !

Le roulement côté opposé est libre, permettant ainsi la dilatation de l'arbre, précontraint et isolé électriquement pour éviter sa détérioration par d'éventuels courants de circulation.

Le graissage de chaque roulement est assuré par l'intermédiaire d'un graisseur type "hydraulique" ; la graisse en excès ou usagée est refoulée hors de la machine par une soupape à graisse et récupérée dans un réceptacle qu'il convient de nettoyer suivant la périodicité mentionnée sur la plaque de graissage.

Lors des opérations de graissage, il convient de s'assurer que le pistolet de graissage utilisé est bien complètement rempli pour éviter la présence de bulles d'air dans la graisse. La graisse utilisée ne doit pas comporter d'eau ou de corps étrangers.

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PALIERS

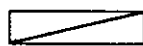
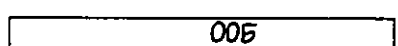
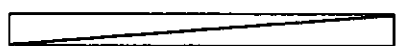
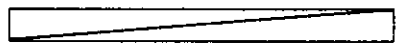
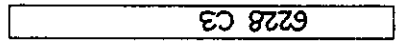
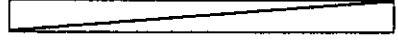
Le pistolet de graissage doit délivrer une quantité connue de graisse à chaque actionnement. Nettoyer soigneusement les raccords de graissage, pour éviter que des saletés ne pénètrent dans le roulement.

Les roulements des machines sont lubrifiés en usine, il est cependant recommandé de les lubrifier de nouveau avant la mise en route initiale de la machine.

La lubrification s'effectue pendant le fonctionnement normal de la machine.

Les critères de lubrification ont été définis en tenant compte de la taille et du type de roulement, de la vitesse et du type de montage de la machine ainsi que des conditions d'environnement.

Caractéristiques techniques :

Type de roulement côté accouplement Type de roulement côté opposé à l'accouplement * Charge axiale * Charge radiale côté accouplement * Charge radiale côté opposé à l'accouplement Températures admissibles	   500 6228 C3     
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* Ces charges sont celles qui ont été retenues pour les calculs des paliers

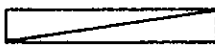
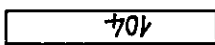
(1) Alarme (2) Déclenchement

24 J 7031-25 FICHE TECHNIQUE				ASCEA BROWN BOVERI 	7700 DIVISION 200 5000 ABB Drives
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Lubrification

PALIER

Quantité de graisse

côté accouplement	côté opposé accouplement	Qualité de la graisse
		SHELL ALVANIA G3
cm3	cm3	

Intervalle de graissage	Réceptacle	Nettoyage
1600	30000	30000
H	H	Roulement H

Une machine remise en route après un arrêt prolongé doit être lubrifiée après quelques heures de fonctionnement.

Une machine ayant supporté un emballage doit immédiatement être relubrifiée.

Lubrifiants :

- Utiliser exclusivement de la graisse pour roulements de première qualité.
- Il est fortement recommandé d'utiliser la graisse correspondante de type EP (par exemple, Esso Beacon EP 2) lorsque les paliers sont soumis à des charges importantes ou lorsque le moteur fonctionne à basse vitesse.
- Utiliser de la graisse pour températures élevées lorsque l'intervalle de lubrification devient très réduit en raison d'un échauffement important des paliers (80° C ou plus).
- Utiliser des graisses pour basses températures, comme la graisse Esso Beacon 325 ou qualité équivalente, lorsque la température ambiante reste inférieure à - 25° C.
- Lorsqu'on passe à une autre qualité de graisse non miscible avec la précédente, lubrifier les paliers à fond plusieurs fois de suite pour bien éliminer toute l'ancienne graisse.

24 J 7031.26 FICHE TECHNIQUE	EDITION	ASSEA BROWN BOVERI ABB	7720 CHAUFFAGE DU SOUS ABB Drives
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PALIERS

Montage et démontage des paliers à roulements :

Il est essentiel, pour le bon fonctionnement des roulements, que leur montage ou démontage soit réalisé avec compétence et dans des conditions de propreté rigoureuse.

Les roulements doivent être manipulés avec précaution. Il est important de choisir une méthode de montage ou démontage correcte et d'utiliser des outils appropriés.

* Démontage d'un roulement :

- côté accouplement retirer l'accouplement,
- démonter la boîte à graisse,
- retirer le flasque de palier (démonter tous les accessoires susceptibles de gêner : sonde, thermomètre, tube de graissage, capteur de vibrations, etc...)
- retirer l'obturateur extérieur,
- retirer la soupape à graisse (utiliser un moyen de chauffage - chalumeau par exemple - et deux pinces à talon),
- retirer la boîte à roulement,
- disposer l'outillage d'extraction,
- retirer le(s) roulement(s) - le chauffage de celui-ci facilite le démontage.

Si la place nécessaire pour le positionnement de l'outillage de démontage est insuffisante, se servir de l'obturateur intérieur : cette méthode ne devra être employée que dans le cas d'absolue nécessité et sera particulièrement déconseillée lorsque l'obturateur sera fabriqué en fonte. (Dans cette dernière hypothèse, prendre toutes les dispositions nécessaires pour éviter les risques de rupture).

* Remontage d'un roulement :

- procéder de la manière inverse à ci - dessus,
- les pièces ajustées "serrees" (roulement - soupape à graisse - etc...) pourront être chauffées dans un bain d'huile très propre à une température de 120 à 140 °C,
- lors des opérations de remontage, lorsque le palier est isolé, bien s'assurer qu'aucun élément ne vienne détruire l'isolation ; s'assurer de l'excellent état des pièces isolantes.

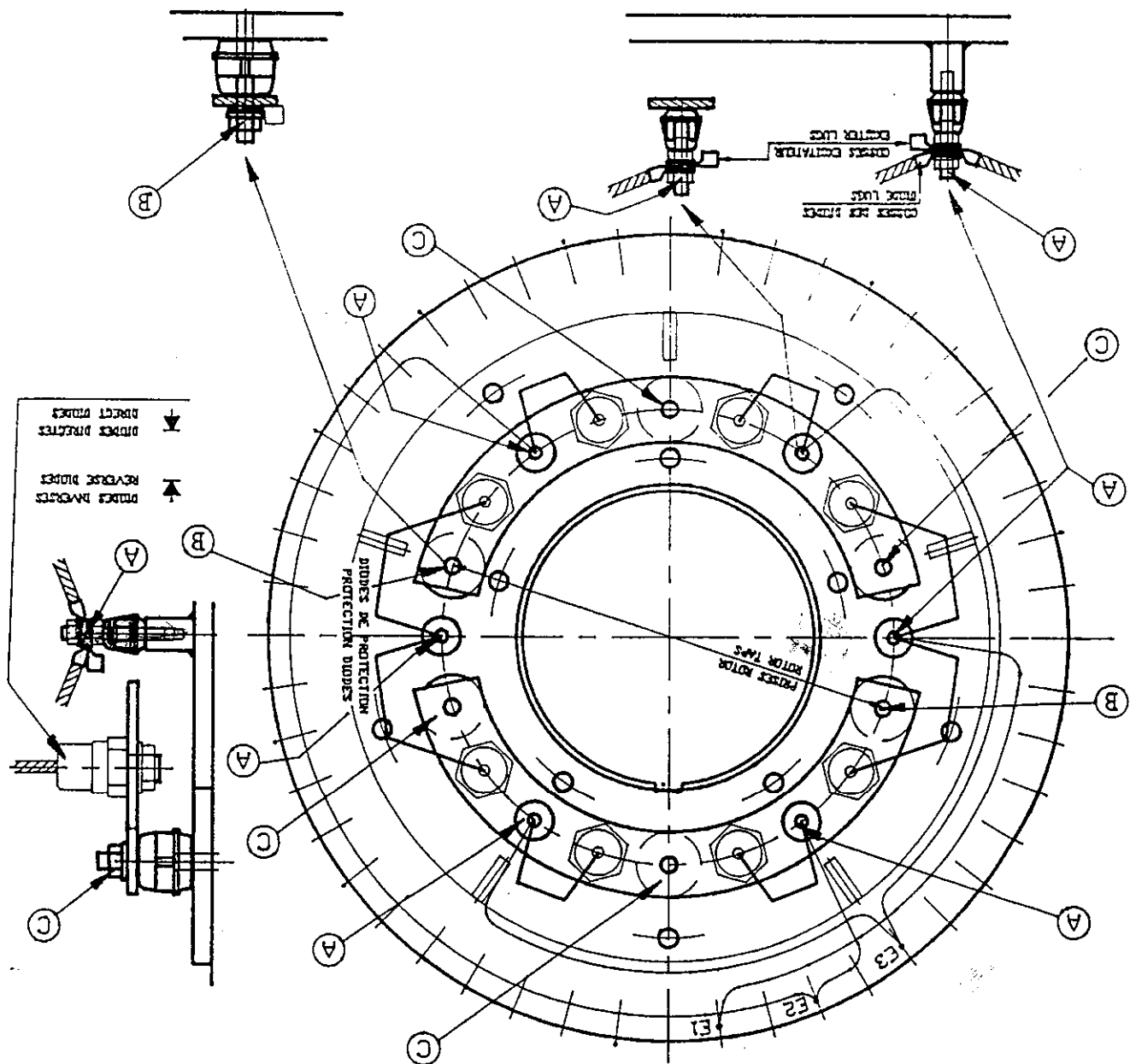
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EDITION

FICHE TECHNIQUE
24 J 7031-27

- Démonter la roue à diodes :
- Changement d'une diode :
- déconnecter en "A" à l'aide d'une clé à douille de 13 puis en "B" à l'aide d'une clé à douille de 17.
 - retirer les secteurs porte diodes en dévissant les écrous en "C" à l'aide d'une clé à douille de 17.



ROUE A DIODES

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Nota : Operer de préférence sur la roue à diodes démontée.

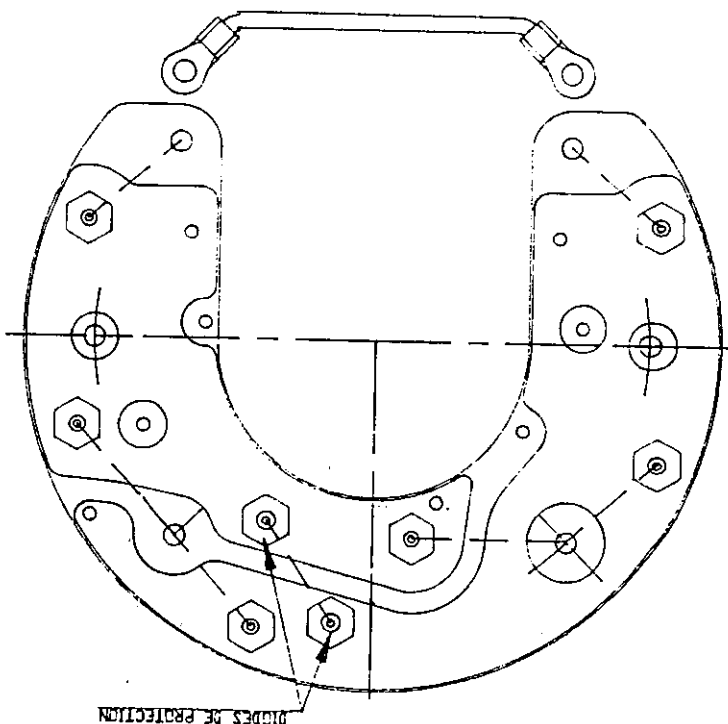
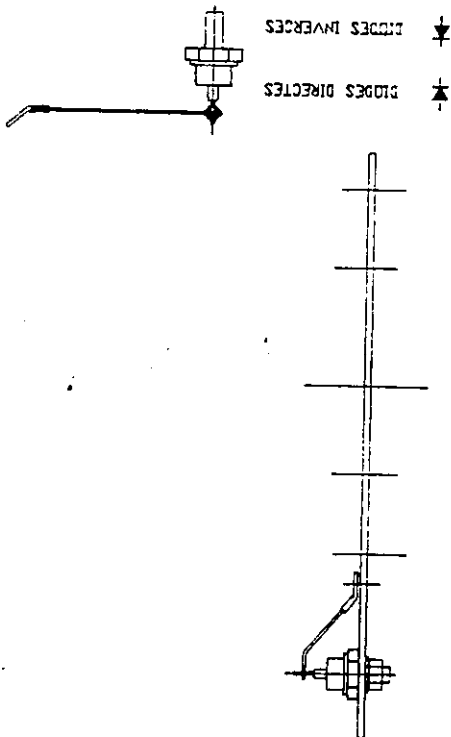
AUCUN EFFORT EN ROTATION NE DOIT S'EXERCER SUR LA QUEUE DE LA DIODE

- * Maintenir la diode par le boîtier à l'aide d'une clé de 17
- * Mettre en place la rondelle M6 et l'écrou HM6 sur la tige filetée de la diode.
- * Serrer l'écrou au moyen d'une clé à couple munie d'une douille de 10 avec un couple de serrage compris entre 0,29 et 0,34 daN.m.
- * Veiller à ce que la diode reste parfaitement orientée dans sa position d'origine.
- * Connecter au moyen de la vis et de l'écrou le shunt de la diode en veillant bien à ce que cette queue ne subisse aucune contrainte en flexion ni en torsion.

- Serrage et fixation de la diode :
- Positionner la diode dans le trou du disque en orientant son shunt vers la borne reliée à la connexion
- Enduire la surface de contact de la nouvelle diode de graisse contact (ALCOA NO2 EJC par exemple).

Après démontage de la diode détériorée :

Changement d'une diode :



ROUE A DIODES

ROUE A DIODES

- Démonter la diode détériorée
- Enduire la surface de contact de la nouvelle diode de graisse contact (ALCOA N02 EJC par exemple)
- Positionner la diode dans le trou du disque
- Serrage et fixation de la diode :

* maintenir la diode par le boîtier à l'aide d'une clé de 32

* Mettre en place la rondelle M16 et l'écrou HM16 sur la tige filetée de la diode

* serrer l'écrou au moyen d'une clé à couple munie d'une douille de 24 avec un couple de serrage de 3 dan.m

* connecter après remontage des secteurs porte-diodes au moyen de l'écrou (clé à douille de 17) le shunt de la diode

AUCUN EFFORT DE ROTATION NE DOIT S'EXERCER SUR LA QUEUE DE LA DIODE

ABB Drives			ABB			FICHE TECHNIQUE			24 J 7031 - 30		
7700 QUALITE SUR 3000			ASEA BROWN BOVERI			EDITION					

ABB Drives			77430 QUALIFANT SUR SECT		ASCA BROWN BOVERI	
ABB			ABB		ABB	
EDITION			FICHE TECHNIQUE		24 J 7031-31	
NATURE DE L'AVARIE			CAUSES POSSIBLES		ACTIONS CORRECTIVES	
ECHAUFFEMENT DES PALIERS	* Manque d'huile ou de graisse	* Qualité d'huile ou de graisse non adaptée	* Huile ou graisse chargée de poussières ou d'impuretés	* Poussée axiale non prévue subie par la machine par l'intermédiaire de l'accouplement	* Charge radiale trop importante	* Mauvais alignement
* Faire l'appoint, d'huile ou de graisse peut être cause d'échauffement	* Remplir avec l'huile ou la graisse après avoir enlevé toute trace de l'ancien lubrifiant	* Changer l'huile ou la graisse, pour les paliers lubrifiés à l'huile pratiquer un rinçage au white spirit et vérifier l'état des filtres éventuels	* Faire supporter la poussée axiale non prévue par la machine accouplée	* Rendre la charge radiale correcte	* Refaire l'alignement	* Vérifier et ajuster la bague de graissage qui doit être parfaite sans ressaut aux joints

AVARIES-DEPANNAGE

AVARIES-DEPANNAGE

NATURE DE L'AVARIE	CAUSES POSSIBLES	ACTIONS CORRECTIVES
ECHAUFFEMENT DES PALIERS (suite)	* Mauvaise portée de la fusée dans les coussinets ou mauvais état des surfaces frottantes des coussinets * Inefficacité du refroidissement par les ailettes sales du corps de palier * Palier situé près d'une source de chaleur * Portée de coussinet détériorée par passage de courant * Vibration de la machine accouplée	* Ajuster la portée des coussinets par un léger gratage * Nettoyer les faces externes des corps de palier * Isoler ou éloigner la source de chaleur * Changer les coussinets - rétablir l'isolation * Remédier aux causes de vibrations

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EDITION

FICHE TECHNIQUE

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ABB Drives			ABB		ASFA BROWN BOVERI		24 J 7034-33		FICHE TECHNIQUE	
NATURE DE L'AVARIE			CAUSES POSSIBLES		EDITION					
VIBRATIONS	* Vibrations dues à la machine accouplée (le moteur ou l'alternateur ne vibre pas lorsqu'il est désaccouplé)	* Manque de rigidité du socle	* Balourd dans le rotor d'origine : - Mécanique - Thermique - Magnétique Un défaut au rotor est souvent accompagné d'un battement important sur l'aiguille de l'am-pérémètre	* Mauvais état des paliers	* Désalignement provoqué par la déformation du massif de fondation	* Balourd de la poulie ou du manchon d'accouplement	* Fonctionnement en régime déséquilibré	* Remédier aux causes de vibrations, vérifier l'alignement et l'équilibrage	* Renforcer le socle	* Equilibrer dynamiquement le rotor. Vérification du circuit d'excitation rotorique. Mesure de l'impédance de chaque pôle
	* Vérifier en particulier l'alignement et l'équilibrage	* Renforcer le socle	* Equilibrer dynamiquement le rotor. Vérification du circuit d'excitation rotorique. Mesure de l'impédance de chaque pôle	* Vérifier et réparer	* Renforcer le massif de fondation et réaligner	* Equilibrer	* Vérification des tensions entre les phases			
AVARIES-DEPANNAGE			ACTIONS CORRECTIVES							

ABB Drives 77430 CHAMPAIGNE SUR SÈNE ABB ASEA BROWN BOVERI		EDITION FICHE TECHNIQUE 24 J 7031-34										
AVARIES-DEPANNAGE <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">NATURE DE L'AVARIE</th> <th style="width: 33%;">CAUSES POSSIBLES</th> <th style="width: 33%;">ACTIONS CORRECTIVES</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> BRUITS ANORMAUX </td> <td style="vertical-align: top;"> * Détérioration des Paliers * Défaut dans le bobinage du rotor </td> <td style="vertical-align: top;"> * Contrôler et réparer * CONTROLER : - l'isolement et la résistance des bobinages - l'état du système balais bagues - l'état du système redresseur tournant et de l'alternateur d'excitation ou de la génératrice asynchrone * REPARER le bon serrage des vis de fixation * Vérifier et réparer </td> </tr> <tr> <td style="vertical-align: top;"> * Mauvais serrage du moteur ou de l'alternateur sur ses plaques de base * Déformation ou desserrage d'un ventilateur ou d'un capot </td> <td></td> <td></td> </tr> </tbody> </table>				NATURE DE L'AVARIE	CAUSES POSSIBLES	ACTIONS CORRECTIVES	BRUITS ANORMAUX	* Détérioration des Paliers * Défaut dans le bobinage du rotor	* Contrôler et réparer * CONTROLER : - l'isolement et la résistance des bobinages - l'état du système balais bagues - l'état du système redresseur tournant et de l'alternateur d'excitation ou de la génératrice asynchrone * REPARER le bon serrage des vis de fixation * Vérifier et réparer	* Mauvais serrage du moteur ou de l'alternateur sur ses plaques de base * Déformation ou desserrage d'un ventilateur ou d'un capot		
NATURE DE L'AVARIE	CAUSES POSSIBLES	ACTIONS CORRECTIVES										
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AVARIES-DEPANNAGE

NATURE DE L'AVARIE	CAUSES POSSIBLES	ACTIONS CORRECTIVES
DEF AUT DE MASSE STATOR FONCTION- NEMENT DE LA PROTECTION DE LA MASSE	* Mise à la masse accidentelle * Rupture d'isolant	* Faire un essai à la masse de l'enroule- ment au moyen d'un transformateur d'essai en appliquant une tension progres- sive jusqu'à ce qu'un arc s'amorce et le courant débite fait fumer l'isolation à l'endroit du défaut * Réisolier la partie accidentée
DEF AUT ENTRE PHASES STATOR FONCTIONNE- MENT DE LA PROTECTION DIFFERENTIELLE EVENTUELLEMENT	* Défaut d'isolement entre phases	Défaut généralement grave se manifestant dans les têtes de bobines Son importance est telle qu'on le localise sans diffi- culté * Faire remplacer le bobinage stator

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AVARIES-DEPANNAGE

NATURE DE L'AVARIE	CAUSES POSSIBLES	ACTIONS CORRECTIVES
DEFAUT DE MASSE ROTOR ISOLEMENT MESURE INFERIEURE A 50 000 OHMS ODEUR DE BRULE	* Mise à la masse accidentelle * Rupture d'isolant	Déconnecter le rotor Alimenter entre l'enroulement et la masse avec un trans- formateur d'essai en appliquant une tension progressive jusqu'à ce qu'on reconnaisse un point chaud ou que la fumée sorte. Déconnecter le pôle détecté et s'assurer à la magnéto que c'est bien le pôle avarié * Changer le pôle avec la bobine ou le rotor bobiné entier

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77430 CHAMPAGNE SUR SEINE			ASEA BROWN BOVERI			ABB			24 J 7031-37		
ABB Drives									FICHE TECHNIQUE		
						EDITION					
AVARIES-DEPANNAGE											
NATURE DE L'AVARIE				CAUSES POSSIBLES				ACTIONS CORRECTIVES			
COURT CIRCUIT ENTRE SPIRES AU ROTOR RESISTANCE A 20°C NETTEMENT INFÉRIEURE A LA VALEUR DONNÉE DANS LE TABLEAU DE CARACTERISTIQUES				* Détérioration de l'isolant entre spires				Alimenter le rotor à 6 V. Mesurer la tension et l'intensité aux bornes. Si les valeurs trouvées correspondent à une résistance $R = U/I$ inférieure à la valeur du tableau, répéter l'opération pôle par pôle après avoir déconnecté les pôles. La comparaison des lectures fera apparaître le ou les pôles dont la résistance est inférieure à la valeur donnée divisée par le nombre de pôles. * Changer le pôle avec la bobine ou le rotor bobiné entier			

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77400 CHAMPAGNE SUR SEINE		ABB		ABB	
FICHE TECHNIQUE		24 J 7031-38		EDITION	

AVARIES-DEPANNAGE

NATURE DE L'AVARIE	CAUSES POSSIBLES	ACTIONS CORRECTIVES
DECROCHAGE DE LA MACHINE	* Coupure de l'exci- - au niveau des bobines - au niveau des inductrices - au niveau des liaisons	* Contrôler, rechercher la ou les causes et réparer.
		- Dans le cas de répara- - tions importantes au niveau des bobines, - nous consulter.

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ENTRETIEN

I. PLAN D'ENTRETIEN

Régulièrement surveiller et contrôler :

- Le bruit, l'odeur, les vibrations, la lubrification (pression d'huile, débit, niveau, rotation des bagues, fuites d'huile), la propreté, les crachements aux balais, la température de l'eau, les fuites d'eau au(x) réfrigérant(s), l'état de colmatage des filtres, la température ambiante.

Certaines opérations d'entretien seront exécutées par nécessité comme :

- changer les balais lorsqu'ils ont atteint la limite d'usure,
- rajouter de l'huile dans les paliers à réserver quand le niveau atteint sa valeur mini,
- graisser les roulements et enlever la graisse usagée accumulée dans le bac à graisse suivant les prescriptions de la plaque de graissage,
- renouveler la graisse des accouplements (suivre les instructions du fournisseur de l'accouplement),
- nettoyer les filtres,
- décolmater les réfrigérants.

Mensuellement, il conviendra de :

- nettoyer en particulier le jeu de bagues, les portes balais,
- contrôler le coulisement des balais,
- contrôler visuellement le faux rond des bagues, leur état (rayures, piqures, patine),
- contrôler visuellement la couleur de l'huile.

Annuellement :

Stator :

- Contrôle des résistances d'isolement.
- Examen du bobinage : la propreté, les cales d'encoche, la ligature des développantes, les blessures sur bobinage.
- Examen du circuit magnétique : les blessures, les points chauds, les intercalaires.

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			EDITION	

ENTRETIEN

Carcasse :

- Examen des soudures.
- Corrosion.

Accouplement :

- Vérification du lignage.
- Vérification du serrage et état des doigts d'accou-
plements.
- Vérification des mouvements de massif.

Bagues et Balais :

- Mesurer le faux rond au comparateur.
- Vérifier la présence de chanfrein aux rainures
hélicoïdales.
- Contrôler l'usure des bagues.
- Contrôler l'état des bagues : brûlures, rayures,
piqûres, rugosité, corrosion, patine. Rectifier si
nécessaire.
- Vérifier la pression des balais ; vérifier l'état des
balais ;
- Vérifier l'état des shunts

Rotor :

- Contrôle de l'isolement.
- Examen du bobinage : la propreté, les connexions
- Examen des amortisseurs ou de la cage d'écureuil : la
couleur, la brasure.
- Contrôler les fretages
- Contrôler toutes les vis de fixation des parties
tournantes.
- Vérifier leur serrage et leur blocage. Les changer si
l'allongement est trop important.

Plan de Pose :

- Examen et serrage de la visserie
- Corrosion

Paliers :

- à roulements : Etat de la graisse, état du roulement.
- à coussinets : La portée, le jeu, la couleur du métal,
les bagues de graissage, le contrôle de l'isolement.
- Nettoyer les faces extérieures des corps de paliers.

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ENTRETIEN

Réfrigérants :

- Visite des boîtes à eau.
- Inspection des tubes des réfrigérants : corrosion,
- cavitation, blessure, encrassement par dépôts.
- Changer les joints si nécessaire.

Divers :

- Etalonnage des appareils de mesure et de contrôle.
- Vérification du bon fonctionnement des divers protections électriques ou mécaniques avec contrôle du seul de fonctionnement et de l'action des relais.
- Resserrage de toutes les jonctions électriques tant des câbles de puissance, que des câbles de protection ou signalisation.
- Tous les 3 ANS, il est conseillé d'effectuer un contrôle diélectrique des bobinages.
- Tous les 5 ANS, on peut faire une extraction du rotor avec visite détaillée de la machine, et nettoyage complet, ainsi qu'un contrôle diélectrique.
- Nous conseillons à nos clients d'établir une fiche machine où sont consignées les différentes opérations d'entretien avec leur date.

II - ENTRETIEN DU BOBINAGE

Les interventions sur le bobinage sont à effectuer dans les cas suivants :

- * résistances d'isolement insuffisantes.
- * visite systématique révélant des défauts.

Les principaux défauts constatés et les interventions correspondantes sont les suivantes :



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III - ENTRETIEN DES HYDROREFRIGERANTS :

La fréquence des opérations d'entretien des hydrorefrigérants dépend de l'état de l'eau de refroidissement.

N.B. : Les interventions sur le bobinage ne doivent être faites que par des spécialistes qualifiés. Toute réparation mal réalisée peut avoir des conséquences extrêmement graves. Il est vivement conseillé de faire appel au constructeur.

NATURE DE DEFAUT	INTERVENTION CORRESPONDANTE
HUMIDITE	Sécher par circulation d'air chaud à 40 °C jusqu'à obtention d'un index de polarisation satisfaisant.
POUSSIERES SECHES	Essuyer le bobinage avec un chiffon propre et sec. Aspirer.
POUSSIERES GRASSES	Essuyer avec un chiffon propre et sec humecté de solvant pour matériel électrique (chloroforme N.U. ou Baitane).
FORTE POLLUTION	Nettoyer avec un chiffon propre et sec imbibé de solvant (voir ci-dessus). Sécher à l'air chaud à 40 °C.
BLESSURES DE L'ISOLANT DEPLACÉ- MENTS OU RUPTURES DE CALAGES	Consulter le constructeur.

ENTRETIEN

ENTRETIEN

Deux Interventions importantes :

Pour ces interventions, fermer les vannes d'arrivée et sortie d'eau.
Vidanger l'appareil en dévissant le bouchon de purge situé à la partie supérieure de la coquille de raccordement d'eau et ensuite le bouchon de vidange situé à la partie inférieure.

1° Intervention :

La durée des électrodes de protection, situées sur les coquilles, est fonction de la corrosivité de l'eau. Leur contrôle, et éventuellement leur remplacement, est à effectuer tous les 2 mois. Utiliser des électrodes en fer extra doux ou en zinc pur.

2° Intervention :

- Procéder au nettoyage périodique du circuit d'eau par rinçage à l'eau douce immédiatement après l'arrêt des machines (1 ou 2 fois par an selon l'état de propreté de l'eau).

- Puis démonter les coquilles, pour cela dévisser les écrous de fixation, visser les vis de décollage pour éloigner la coquille de la plaque (desserrer immédiatement ces vis afin de ne pas être gêné au montage).

- Vérifier l'état de propreté des tubes et au besoin les nettoyer à l'aide d'une brosse à écouvillons souple (par exemple en nylon). Ne pas utiliser une brosse dure en acier pour éviter l'enlèvement de la couche oxydée protectrice des surfaces.

- Changer les joints si nécessaires.

- Enduire les joints, après les avoir bien nettoyés, de graisse graphitée.

- Remonter les coquilles.

- Visser et bloquer le bouchon de vidange.

- Ouvrir lentement la vanne d'arrivée d'eau afin de remplir entièrement l'hydropneumatique (bouchon de purge enlevé).

- Visser et bloquer le bouchon de purge.

- Ouvrir lentement la vanne de sortie d'eau.

- Reconduire l'opération si nécessaire.

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ENTRETIEN Lors de la dépose de la coquille arrière, vérifier l'état des électrodes de protection et les changer éventuellement. Dans le cas d'écoulement de l'eau par la conduite de fuite, (hydoréfrigérant double tube) ou de fuites sur les tubulures (hydoréfrigérant simple tube), profiter du démontage des coquilles pour repérer les tubes défectueux qui fuient. Obstruer alors les tubes en question par bouchons coniques en plastique résistant à l'eau de réfrigération ou de préférence par des bouchons en bronze alu. En cas de défectuosité d'un nombre trop important de tubes, remplacer le faisceau tubulaire. IV - ENTRETIEN DES PALIERS A ROULEMENTS - Pour fonctionner avec fiabilité, les roulements doivent être correctement lubrifiés de façon à éviter un contact métallique direct entre éléments roulants, chemins de roulement et cage, à empêcher l'usure et à protéger les surfaces de la corrosion. - Le choix du lubrifiant, les intervalles de relubrification et de nettoyage doivent donc être scrupuleusement respectés. Toutes ces indications figurent sur la plaque de graissage. - On obtient des températures de fonctionnement les plus favorables lorsque le roulement reçoit la quantité de lubrifiant minimale nécessaire pour assurer une lubrification fiable, il est donc important de respecter les consignes du constructeur de la machine. - Un excès de lubrifiant entraîne une augmentation rapide de la température de fonctionnement en particulier aux vitesses de rotation élevées. - Lorsque, pour une raison quelconque, il est nécessaire de passer d'une graisse à une autre, il est important de prendre en considération la miscibilité des lubrifiants. - Si l'on mélange des graisses incompatibles, la consistance peut devenir très différente et la température maximale d'utilisation du mélange si faible, qu'une avarie de roulement surviendra.				

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ENTRETIEN - La relubrification des roulements doit toujours être effectuée alors que celui-ci est encore lubrifié de façon satisfaisante, l'opération sera toujours réalisée machine en marche - l'opération de relubrification doit, impérativement, être exécutée après chaque emballage de la machine - . Les appoints de graisse seront faits conformément aux indications figurant sur la plaque de graissage. Comme toutes les pièces essentielles d'une machine, les roulements doivent être nettoyés et vérifiés périodiquement. La fréquence de l'opération et le procédé à utiliser dépendent, avant tout, des conditions de fonctionnement. Il convient de nettoyer complètement et de vérifier les bagues, la cage, les éléments roulants ainsi que toutes les autres pièces du montage. Pour le nettoyage, on utilise de préférence du "WHITE SPIRIT", du pétrole de bonne qualité, de l'essence ou du Benzol. Après cette opération, les pièces seront immédiatement enduites d'huile ou de graisse pour les protéger contre l'oxydation. V - ENTRETIEN DES PALIERS A COUSSINETS Après la mise en service, il faut contrôler les paliers pendant les premières heures de service et cela de façon permanente. Le contrôle s'applique à : * la température du palier : Celle-ci doit monter progressivement jusqu'à la température de l'équilibre thermique, si la température ne se stabilise pas en dessous de la température d'alarme mentionnée au paragraphe "caractéristiques techniques" il faut arrêter la machine et en rechercher les causes.				

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ENTRETIEN

*** L'étanchéité du palier :**

Les paliers ne doivent pas perdre d'huile par les alésages latéraux, par le plan de joint ou bien aux niveaux d'huile, aux boulonnages, etc... Vérifier que les trous de branchement non utilisés soient bien bouchés. Les bouchons de plastique s'y trouvant ne sont pas étanches à l'huile.

Dans le cas de paliers à lubrification autonome la perte d'huile peut conduire, rapidement à la destruction des surfaces de frottement.

*** la stabilité :**

Si des vibrations apparaissent au cours de la mise en service, il faut immédiatement arrêter l'installation et en trouver les raisons.

Il est recommandé, après 5 à 10 heures de fonctionnement, de démonter les coussinets et de vérifier si les surfaces de frottement ne sont pas endommagées (pression sur les bords, formation de rayures, traces de pression) et le cas échéant de les supprimer par un gratage soigneux. Il convient de veiller à ne pas retirer trop de régule sinon la géométrie des surfaces de frottement s'en trouverait détruite.

En cours de service, la fréquence de nettoyage avec vidange des paliers auto lubrifiés est d'environ 8 000 heures de travail. Elle est d'environ 20 000 heures de travail pour des paliers lubrifiés par circulation d'huile.

Des fréquences de vidange plus rapprochées sont nécessaires en cas, par exemple de démarrages et arrêts fréquents, de températures d'huile élevées ou d'un encrassement important sous l'effet d'influences extérieures.

ENTRETIEN

Avaries possibles :

AVARIE	CAUSE POSSIBLE	ACTIONS A MENER
FUITES D'HUILE	Débit d'huile trop important	Régler le débit
	Chicanes usées	Remplacer
	Chicanes mal montées	Refaire le montage
	Retour d'huile insuffisant	Vérifier la pente et l'état des canalisations de retour d'huile et réparer
	Remplissage sur cuve à huile insuffisant	Augmenter sa dimension

Les dérangements mentionnés ci-dessous sont détectés lors d'une visite d'entretien à la suite d'une alarme ou d'un déclenchement dû à un échauffement des paliers :				
Manque d'huile	Faire l'appoint	Débit insuffisant	Régler	Utiliser l'huile préconisée et éventuellement nous consulter si les conditions d'utilisation ne sont pas celles prévues lors de la construction de la machine
Huile sale	Vidanger, rincer le circuit d'huile et les carters avec du pétrole ou de l'huile de rinçage. Remettre de l'huile neuve ou épurée.	Qualité de l'huile inadaptée		
Mauvais fonctionnement de la bague de graissage	Vérifier la viscosité de l'huile et la forme géométrique de la bague. Si nécessaire réparer la bague qui doit être parfaitement ronde et avec des joints sans ressauts.			

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ENTRETIEN			
AVARIE			
CAUSE POSSIBLE			
ACTIONS A MENER			
MAUVAISE PORTEE ET USURE	Désalignement	Vérifier les fondations	
	Charge radiale trop importante	Ramener la charge aux valeurs retenues pour la construction de la machine	
	Charge axiale trop importante	Rechercher les causes de la poussée et y remédier : la machine électrique ne doit pas subir de charge axiale en provenance de la partie mécanique entrainante ou entrainée. Saut cas parti- culiers prévus spécifique- ment dans le cahier des charges.	
	Passage d'un courant d'arbre	Rétablir l'isolation du palier, la maintenir propre Attention à ne pas court- circuiter par les différentes gaines et tuyauteries.	
PIGURES DE LA FUSEE ET DU REGULE		Procéder comme pour le cas des rayures. Si le stockage doit se reproduire, consul- ter la notice "stockage".	
	Stockage trop long dans de mauvaises conditions		
RAYURES		Présence de corps étrangers ou arrachement de métal Pour le règle : gratter légèrement les parties concernées. Avant le remon- tage s'assurer que l'ensem- ble du coussinet porte bien sur la fusée. Continuer l'opération de gratage jusqu'à l'obtention d'un bon contact. Pour la fusée : Plier les parties concernées. Ne pas utiliser de toile émeril. Les grains d'émeril peuvent s'incruster dans la fusée et provoquer des dégâts importants. Attention : Une rayure pro- fonde sur le règle ou la fusée peut être tolérée si, étant limitée en surface, elle ne perturbe pas la répartition de l'huile entre les parties flottantes.	

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FICHE TECHNIQUE

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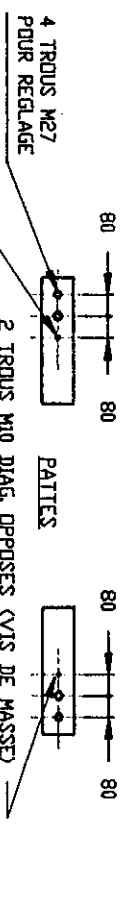
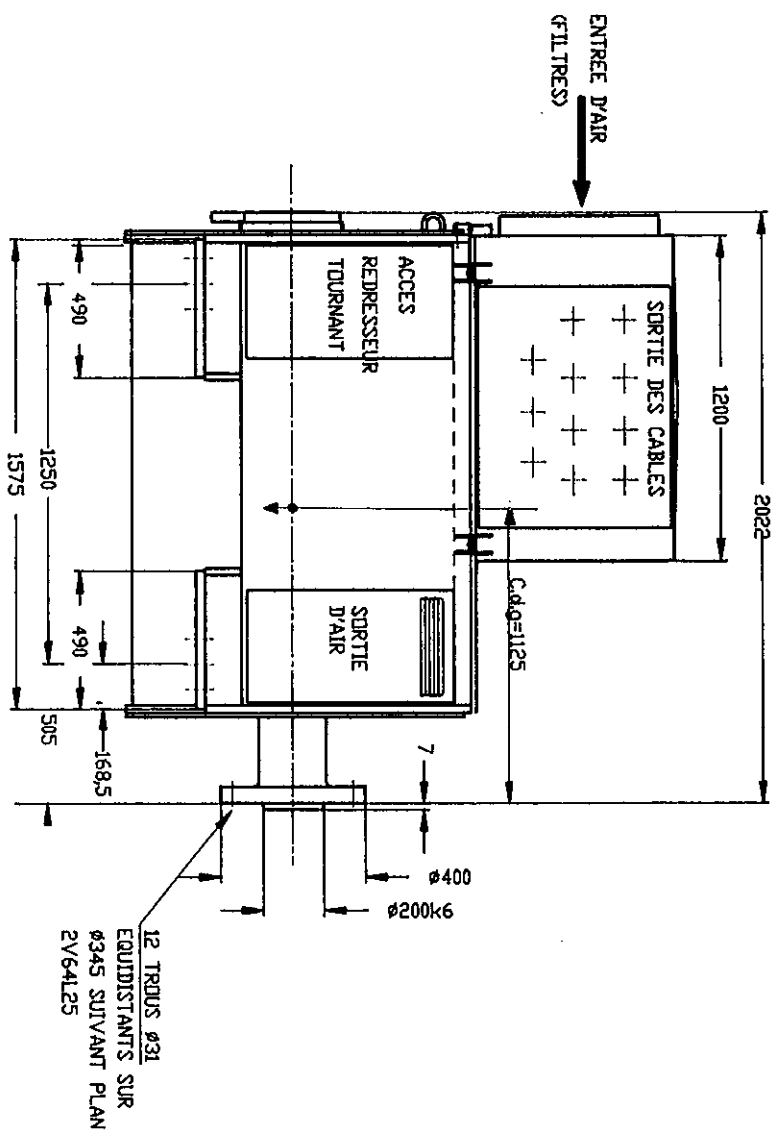
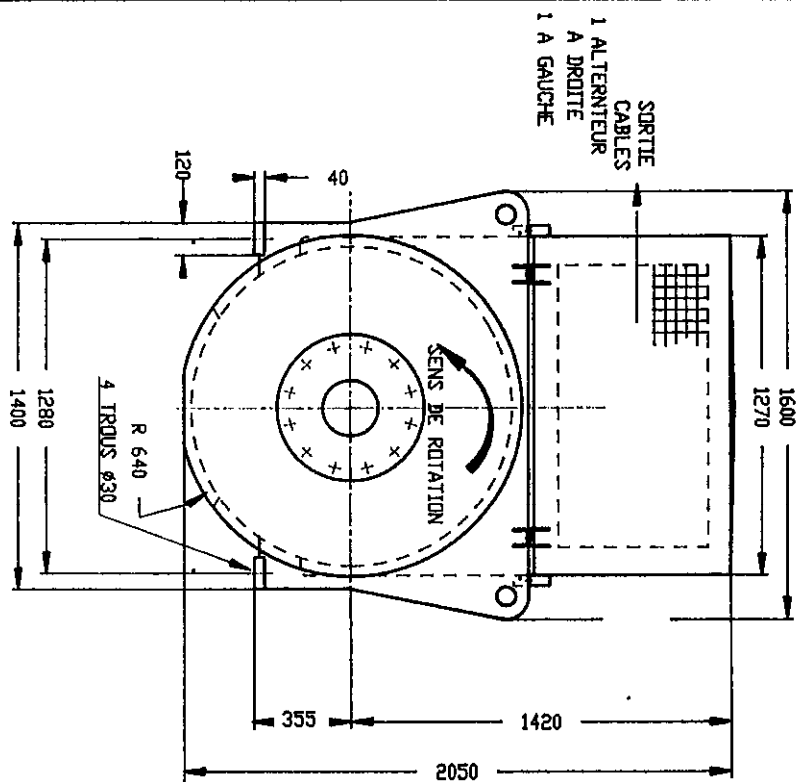
ABB Drives		ABB		ASEA BROWN BOVERI	
FICHE TECHNIQUE		24 J 7031-49		EDITION	

ENTRETIEN

AVARIE	CAUSE POSSIBLE	ACTIONS A MENER
USURE DE LA FUSEE A L'EMPLACEMENT DE LA BAGUE DE GRAISSAGE	Fonctionnement intermittent de la bague de graissage	Voir plus haut : "Mauvais fonctionnement de la bague de graissage".

Lorsque les défauts sont trop importants pour être réparés par un simple grattage ou pèrrage, il y a lieu de procéder au remplacement des coussinets ou au passage du rotor sur un tour, pour y subir des opérations de galetage ou de rechargement superficiel et d'usinage.

C'est le cas lorsque le régime a fondu ou a chauffé, au point de perdre ses qualités mécaniques et en arriver, par exemple, à se casser en de multiples fragments.



AXE MACHINE

VU DESSUS

MICROFILM

MASSE TOTALE: 6100Kg

1000 KW 1250KVA 1000 tr/mn

JEUMONT **S** SCHNEIDER
DME/DET Champagne sur seine

ALTERNATEUR TYPE

APM920-6 POLES BT -1 ROULEMENT

SNACH

ENCOMBREMENT

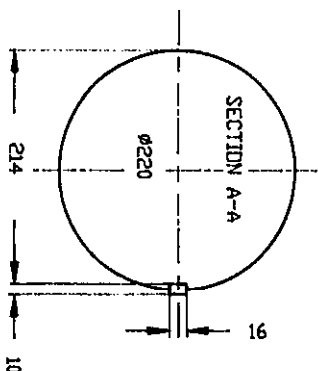
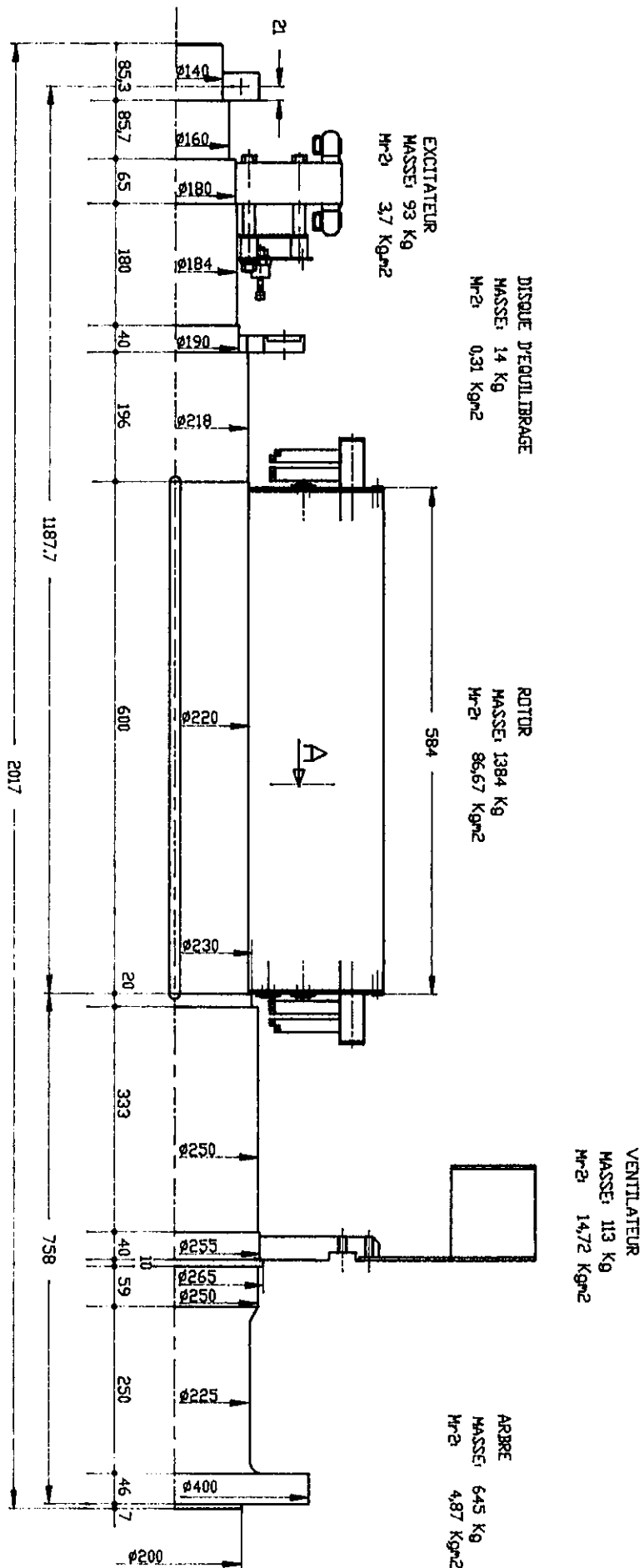
FAB 953.00048
C de L9530.0033

EDITION

06/09/89

MISE A JOUR
08/11/89 A

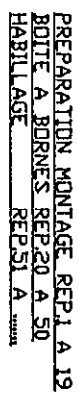
DOCUMENT N° 21D9222 A



Cde.95300048
 CLIENT: SNACH

MASSE TOTALE: 2249 Kg Mr2: 110,27 Kg.m²

SAUF INDICATION CONTRAIRE				COTES NON TOLERANCEES	
R0 = $\sqrt{\text{Furture}}$				0 ± 0,25 ± 0,5	1000 ± 2000 ± 15
Les autres vases seront obsoles				215 ± 1000 ± 0,8	2000 ± 4000 ± 2
On s'engage à garantir pour				Donnée par	Vérifiée par
service maintenance pour				NAUTVAIS	
utilisation au constructeur					
à son titre					
COTE					
ARBRE ET CHARGES					
APM 92 C6 BT					
MICROFILM					
JEUMONT SCHNEIDER					
DNE/DET Champagne sur seine					
Ind					
Date					
Nature					
Edition					
Visa					
25/09/89					
A					
21D0161					

[illegible]

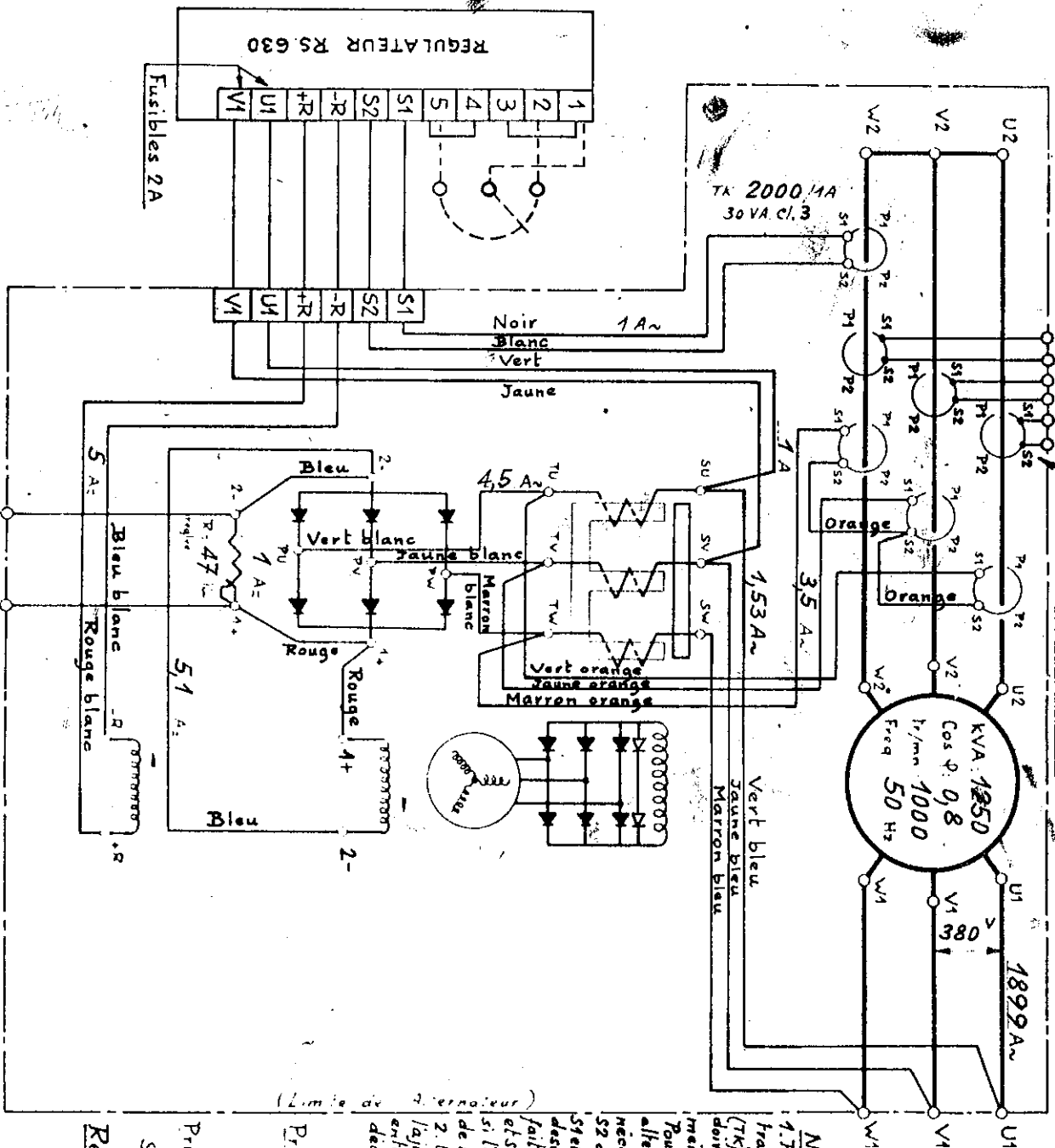
E.R.T.C.R

Protection différentielle
2000/5A.15VA.Cl.5.P10

N° Fabrication : 953.00048
Commande : L9530.0033

Machine N° 1059

APM 92 C6



NOTA:

1. Pour la marche sur un réseau isolé le transformateur d'intensité de couplage (TK) est pas nécessaire. Les bornes S1 et S2 du régulateur et découp circuler les bornes S1 et S2. Vérifier qu'une charge inductive fait descendre la tension. Si une charge inductive fait monter la tension, inverser les bornes S1 et S2 du TK. Le statorisme en tension augmente si l'on augmente la valeur de la résistance de réglage du statorisme.

2. Un rhéostat extérieur (470Ω.25W) pour l'ajustage de la tension peut être branché entre les bornes 1.2.5 du régulateur (fabriqué découp circuitage des bornes 1.3 et 4.5)

Prises réalisées sur les T1

0-80-543-670

Prises réalisées sur les T1

S1 0 S2 543

Régulateur

A 24.1.90. Ajoute protection différentielle

ABB.JS

30.8.89

DOCUMENT DE BASE S1 J 4537

1700EX790

A

**LORELEC**

48, Avenue du Général de Gaulle
54425 PULNOY

VENTE RÉPARATION MOTEURS & POMPES
THERMOGRAPHIE INFRAROUGE
MAINTENANCE INDUSTRIELLE
EQUILIBRAGES DYNAMIQUES
ANALYSES VIBRATOIRES
ELECTROMECHANIQUE
LIGNAGE LASER
BOBINAGE

V/correspondant : Romain CHODOT
Tél : 06.38.12.36.37
Fax :
e-mail : romain.chodot@lorelec.com

Copie à : Romain CHODOT - N°Port : 06.38.12.36.37

DEVIS N° : 51486 du 20/05/19

CORSICA LINEA SAS

42, rue de Ruffi
Bâtiment G
13003 MARSEILLE

Tél : 04.91.56.48.18
Fax : 04.91.56.36.36

A l'attention de : **Bruno ROGIER**

Vos réf.:

VAT Registration No. FR49815243

Page : 1 / 6

Prestation de dépose-révision-repose de l'alternateur DA 1 du
bâtiment MONTE D'ORO

Désignation	Quantité	P.U. Net H.T.	Montant HT
Dépose alternateur			
TE1700303			
Prestation sur votre navire MONTE D'ORO de dépose de l'alternateur DA comprenant :	1	12 600,00	12 600,00
- Préparation du chantier			
- Mise en place de boucles supplémentaires soudées en plafond par la société ESTC	1	2 890,00	2 890,00
- Manutention de l'ensemble du matériel nécessaire en salle machine			
- Récupération de l'autorisation de travail			
- Déplacement d'une équipe à bord du MONTE D'ORO, début des travaux à quai sur MARSEILLE			
- Mise en place des moyens de levage			
- Débranchement électrique avec repérage de l'alternateur	1	5 600,00	5 600,00
- Contrôle de l'entrefer avant dépose			
- Désaccouplement de l'alternateur			
- Dépose des rampes de sécurité			
- Manutention de l'alternateur complet vers le PT3			
- Récupération des moyens de levage			
- Cloture, nettoyage et sécurisation du chantier			
- Transfert de l'alternateur vers les ateliers d'ATEM			
NOTA : Les interventions de dépose et décablage se dérouleront en continuité lors des traversées du Navire (prévoir les titres de transports techniciens et véhicules ainsi que les cabines)			
Total Dépose alternateur.			21 090,00
ALTERNATEUR Triphasé JEUMONT SCHNEIDER APM 92 C6			
N° Usine : DA 1			
1 250 KVA 1000 TR/M			
Transport retour de l'alternateur avec assurance spécifique	1	1 550,00	1 550,00
Réception et expertise de l'alternateur comprenant :			2 100,00
- Démontage complet de l'alternateur			
- Mesure des isollements et index de polarisation sur stator, roue polaire, stator d'excitation et rotor d'excitation			
- Mesure des résistances ohmiques			

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Page : 2 / 6

Prestation de dépose-révision-repose de l'alternateur DA 1 du
 bâtiment MONTE D'ORO

Désignation	Quantité	P.U. Net H.T.	Montant HT
- Contrôle des sondes de température - Contrôle du bobinage et des connexions - Contrôle du câblage			
Révision de la roue polaire comprenant : - Dépollution et étuvage roue polaire. - Contrôle de la métrologie roue polaire - Tests et essais électriques - Mesure des isollements et index de polarisation - Pulvérisation d'un vernis antiflash sur bobinage - Equilibrage dynamique sur banc avec fourniture d'un rapport d'équilibrage - Montages du roulement			2 450,00
Révision de la partie excitation comprenant : - Dépollution et étuvage stator et rotor d'excitation - Tests et essais électriques - Mesure des isollements et index de polarisation - Pulvérisation d'un vernis antiflash sur bobinage			700,00
Révision de la partie commande comprenant : - Identification de l'ensemble des composants (diodes, TI,) - Fourniture et remplacement systématique des diodes - Tests et essais électriques - Mise au propre par nettoyage au chiffon et microbillage pour les connexions			1 150,00
Révision de l'alternateur comprenant : - Fourniture roulement 6228 massif C3 - Dépollution et étuvage stator - Tests et essais électriques - Mesure des isollements et index de polarisation - Pulvérisation d'un vernis antiflash sur bobinage - Passage au four et sablage de l'ensemble des pièces mécaniques - Remontage de l'alternateur. - Reconditionnement de la boîte à bornes.	1	461,00	4 200,00 461,00

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Page : 3 / 6

Prestation de dépose-révision-repose de l'alternateur DA 1 du
bâtiment MONTE D'ORO

Désignation	Quantité	P.U. Net H.T.	Montant HT
Essais finaux de l'alternateur sur notre plate forme comprenant : - Mesure des isolements et index de polarisation sur bobinage stators, rotor et excitatrice			300,00
Finitions et conditionnement comprenant : - Mise en peinture et finition - Rédaction d'un rapport de travaux			600,00
Transport retour de l'alternateur avec assurance spécifique	1	1 550,00	1 550,00
Imprégnation de la roue polaire par trempage avec résine classe H sans solvant Polymérisation en étuve ventilée avec mise en rotation			2 200,00
Imprégnation sous vide et pression du stator avec résine classe H sans solvant Polymérisation en étuve ventilée			1 800,00
Imprégnation sous vide et pression du stator et rotor d'excitation avec résine classe H sans solvant Polymérisation en étuve ventilée			1 100,00
TRAVAUX SUPPLEMENTAIRES : Se référer à l'article 5 chapitre 1 et 2 de l'annexe de nos CGV.			
Total Alternateur JEUMONT 1250KVA			22 261,00
Repose alternateur			
TE1700315			
Réception de l'alternateur révisé complet dans les ateliers d'ATEM conditionnement pour sa manutention à bord	1		
Prestation sur votre navire MONTE D'ORO de repose de l'alternateur DA 1 comprenant : - Retour à bord d'une équipe pour remise en place des moyens de manutention et de l'ensemble du matériel nécessaire	1	16 890,00	16 890,00

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Prestation de dépose-révision-repose de l'alternateur DA 1 du
bâtiment MONTE D'ORO

Désignation	Quantité	P.U. Net H.T.	Montant HT
- Transport de l'alternateur - Récupération de l'autorisation de travail - Manutention et repose de l'alternateur sur son châssis - Rapprochement de l'alternateur pour son accouplement - Accouplement, alignement laser et contrôle de l'entrefer selon accessibilité - Recablage électrique de l'alternateur - Récupération des moyens de levage - Cloture et nettoyage du chantier - Validation des valeurs d'entrefer - Essais en présence de LORELEC - Signature vibratoire de référence suivant norme ISO 10816-3 avec remise d'un rapport - Rédaction d'un rapport technique sur l'ensemble de l'intervention	1	5 600,00	5 600,00
Total Repose alternateur.			22 490,00
Mise en service			
TE1700360			
Prestation de mise en service en mer de la machine avec rédaction d'un PV			4 100,00
NOTA : L'intervention sera réalisée en mer lors de la mise en service de l'alternateur selon date définie par CORSICA			
Prestation prévue sur une durée de 1 jour Toute journée supplémentaire sera facturée 1 150,00 € HT			
Total Mise en service.			4 100,00
Garantie			
TE1700361			
GARANTIE : 12 mois pièces détachées et main d'oeuvre à la date de mise en service en mer Cette garantie pourra être renouvelée sur une période de 12 mois si une campagne de contrôles électriques préventifs est réalisée avant la seconde année d'exploitation			

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Prestation de dépose-révision-repose de l'alternateur DA 1 du
bâtiment MONTE D'ORO

Désignation	Quantité	P.U. Net H.T.	Montant HT
Total Garantie			0,00
NOTA : Les interventions de dépose et décablage se dérouleront en continuité lors des traversées du Navire (prévoir les titres de transports techniciens et véhicules ainsi que les cabines) NOTA : Le client reconnaît être informé que les temps d'attente de personnel LORELEC et (ou) de nos sous-traitants qui résulteraient de sa responsabilité (temps d'attente consignation, pont roulant indisponible...) ainsi que les travaux supplémentaires sollicités lors de notre intervention et qui n'auraient pas été prévus et compris dans le présent devis, feront l'objet d'un complément de facturation. NOTA : Sous réserve des pièces détachées défectueuses et des travaux mécaniques et électriques identifiés après expertise LORELEC certifié ISO 9001 depuis le 19 Janvier 2017 Nous réalisons les maintenances sur site de vos moteurs AC et DC Analyses vibratoires - Indices de polarisation - Mesures d'isolement Certification MASE - Certification SAQR'ATEX			

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A l'attention de : **Bruno ROGIER**

Prestation de dépose-révision-repose de l'alternateur DA 1 du bâtiment MONTE D'ORO

Désignation		Quantité	P.U. Net H.T.	Montant HT
<u>Délai</u> :		0	0 %	
<u>Condition livraison</u> :		2	0 %	Total net HT : 69 941,00
<u>Cond. de paiement</u> : Net 60 jours				TVA : 0,00
<u>Mode de règlement</u> : Virement				Total TTC : 69 941,00

Dans l'attente de vous lire pour accord, recevez nos sincères salutations.

NOM :

861.4 - visite alternateur DA1 - devis LORELEC.pdf