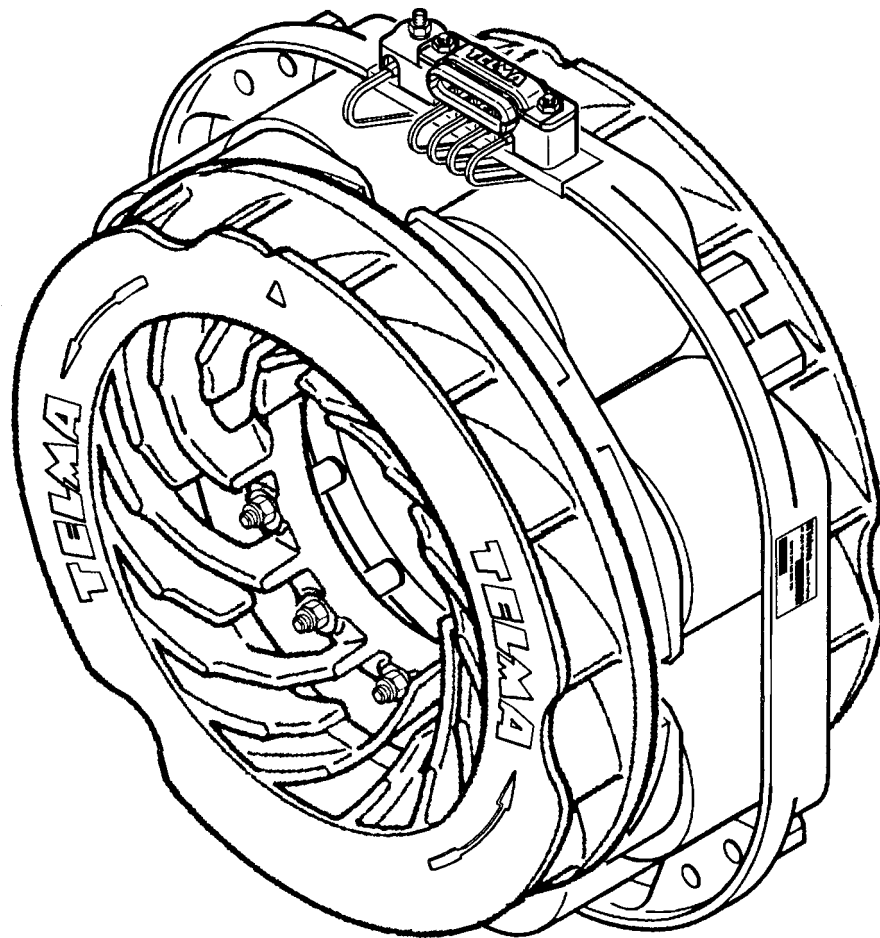


Telma

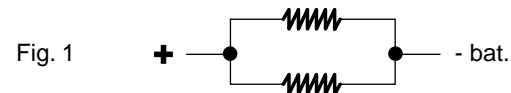
SPARE PARTS CATALOGUE OF THE FOCAL RETARDERS FN, FP and FV SERIES



Technical specifications of the FOCAL retarders – FV series

RETARDER MODEL		FV60–90 (F90)	FV61–00 (F100)	FV61–30 (F130)	FV61–31	FV61–40 (F141)	FV71–50 (F151)	FV71–70 (F170)	FV71–90 (F191)	(F250)	FV82–60 (F272)	FV82–70 (F271)	FV83–00 (F301)
RETARDER CODE		FU	FU	FJ	FJ	FJ	FD	FD	FD	FF	DR	FF	FF
For gearbox mounting		63	/	62	80	74	39	62	74	66	20	74	70
For axle mounting		63	83	62	81	79	83	61	79	/	/	/	75
MAXIMUM BRAKING TORQUE	Nm	900	1000	1300	1300	1400	1500	1700	1900	2500	2650	2700	3000
	lb-ft	664	737	958	958	1032	1105	1253	1400	1843	1956	1990	2211
APPLICATION RANGE G.C.W. (1)	t	6/10	6/10	9/15	9/15	9/15	13/17	15/17	15/19	26/44	32/44	32/44	40/44
TOTAL MASS	kg	116	116	129	130	130	149	168	170	233	204	245	247
	lb	256	256	284	286	286	328	370	374	514	447	540	545
Stator mass	kg	67	67	80	81	81	85	104	106	155	126	167	169
	lb	148	148	176	178	178	187	229	233	342	278	368	373
Rotors mass (without intermediate flange)	kg	49	49	49	49	49	64	64	64	78	78	78	78
	lb	108	108	108	108	108	141	141	141	172	172	172	172
ROTORS INERTIA	kgm ²	1.23	1.23	1.23	1.23	1.23	2	2	2	3.1	3.1	3.1	3.1
	lb-ft ²	29.2	29.2	29.2	29.2	29.2	47.5	47.5	47.5	74	74	74	74
AIR-GAP	(0 -0.15) mm	1.3	1.3	1.3	1.5	1.3	1.4	1.4	1.4	1.7	1.7	1.7	1.7
	(0 -0.006) inch	0.051	0.051	0.051	0.059	0.051	0.055	0.055	0.055	0.066	0.066	0.066	0.066
RESISTANCE PER CIRCUIT ± 5 % at 20°C (68°F)	12 Volts	Ω	0.33	0.33	0.23	/	0.23	0.25	0.25	0.21	0.2	/	0.19
	24 Volts	Ω	1.3	1.3	0.91	0.91	0.91	1.02	1	0.86	0.79	0.6	0.78
RESISTANCE PER COIL ± 5 % at 20°C (68°F)	Ω	0.65	0.65	0.46	0.46	0.46	0.51	0.50	0.43	0.39	1.21	0.39	1.31
AMPERAGE PER CIRCUIT ± 5 % at 20°C (68°F)	12 Volts	A	37	37	52.5	/	52.5	47.1	48	55.8	60.9	/	61.5
	24 Volts	A	18.5	18.5	26.2	26.2	26.2	23.5	24	27.9	30.6	38.5	30.8
INSULATION RESISTANCE	MΩ	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1
CIRCUIT DIAGRAM (see figures 1 and 2)	12V	1	1	1	1	1	1	1	1	1	/	1	/
	24V	2	2	2	2	2	2	2	2	2	1	2	1

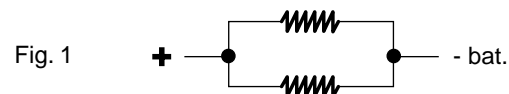
(1) For all specific application, please consult our Technical Department.



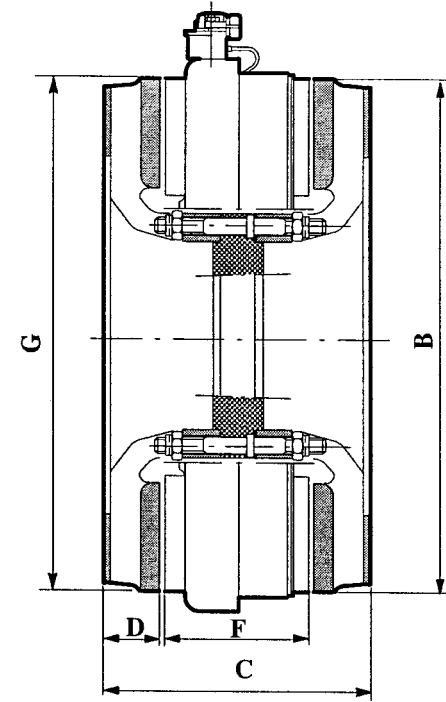
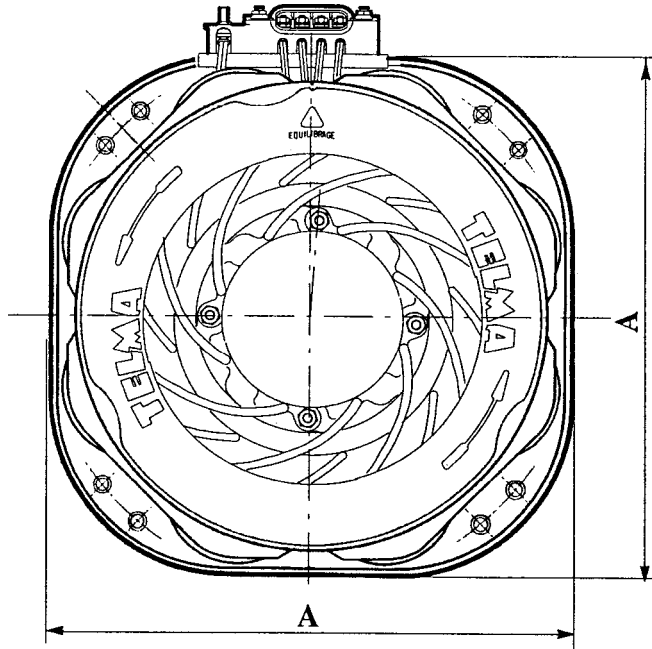
Technical specifications of the FOCAL retarders – FN and FP series

RETARDER MODEL		FN72-00 (F2000)	FN72-20 (F2200)	FN72-40 (F2400)	FN82-70 (F2700)	FN83-00 (F3000)	FN83-30 (F3300)	FP82-00 (F200)	FP82-70
RETARDER CODE		DH	DJ	DK	DL	DN	DP	FS	DS
For gearbox mounting		20	20	20	20	20	20	62	20
For axle mounting		31	31	31	/	31	/	/	/
MAXIMUM BRAKING TORQUE	Nm	2000	2200	2400	2700	3000	3300	2000	2600
	lb-ft	1474	1621	1769	1990	2211	2432	1474	1917
APPLICATION RANGE	t	16/22	19/26	19/26	32/44	40/44	40/50	19/26	18/26
TOTAL MASS	kg	174	174	185	249	257	255	209	200
	lb	383	383	407	549	567	562	461	441
Stator mass	kg	107	107	118	167	175	173	137	128
	lb	236	236	260	368	386	381	302	282
Rotors mass (without intermediate flange)	kg	67	67	67	82	82	82	72	72
	lb	147	147	147	181	181	181	159	159
ROTORS INERTIA	kgm ²	2.33	2.33	2.33	3.33	3.33	3.33	2.7	2.7
	lb-ft ²	55.3	55.3	55.3	79	79	79	64	64
AIR-GAP	<i>(0 -0.15)</i> mm	1.4	1.4	1.4	1.7	1.7	1.7	1.5	1.5
	<i>(0 -0.006)</i> inch	0.055	0.055	0.055	0.066	0.066	0.066	0.059	0.059
RESISTANCE PER CIRCUIT ± 5 % at 20°C (68°F)	12 Volts	Ω	0.21	0.18	0.17	0.19	/	/	/
	24 Volts	Ω	0.83	0.7	0.69	0.78	0.72	0.56	0.79
RESISTANCE PER COIL ± 5 % at 20°C (68°F)	Ω	0.42	0.35	0.34	0.39	1.43	1.12	0.4	0.28
AMPERAGE PER CIRCUIT ± 5 % at 20°C (68°F)	12 Volts	A	57.8	68.6	69.8	61.5	/	/	/
	24 Volts	A	28.9	34.3	34.9	30.8	33.5	43	30.3
INSULATION RESISTANCE	MΩ	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1
CIRCUIT DIAGRAM (see figures 1 and 2)	12V	1	1	1	1	/	/	/	/
	24V	2	2	2	2	1	1	2	2

(1) For all specific application, please consult our Technical Department.



Identification of the FOCAL retarders by their dimensions (mm)

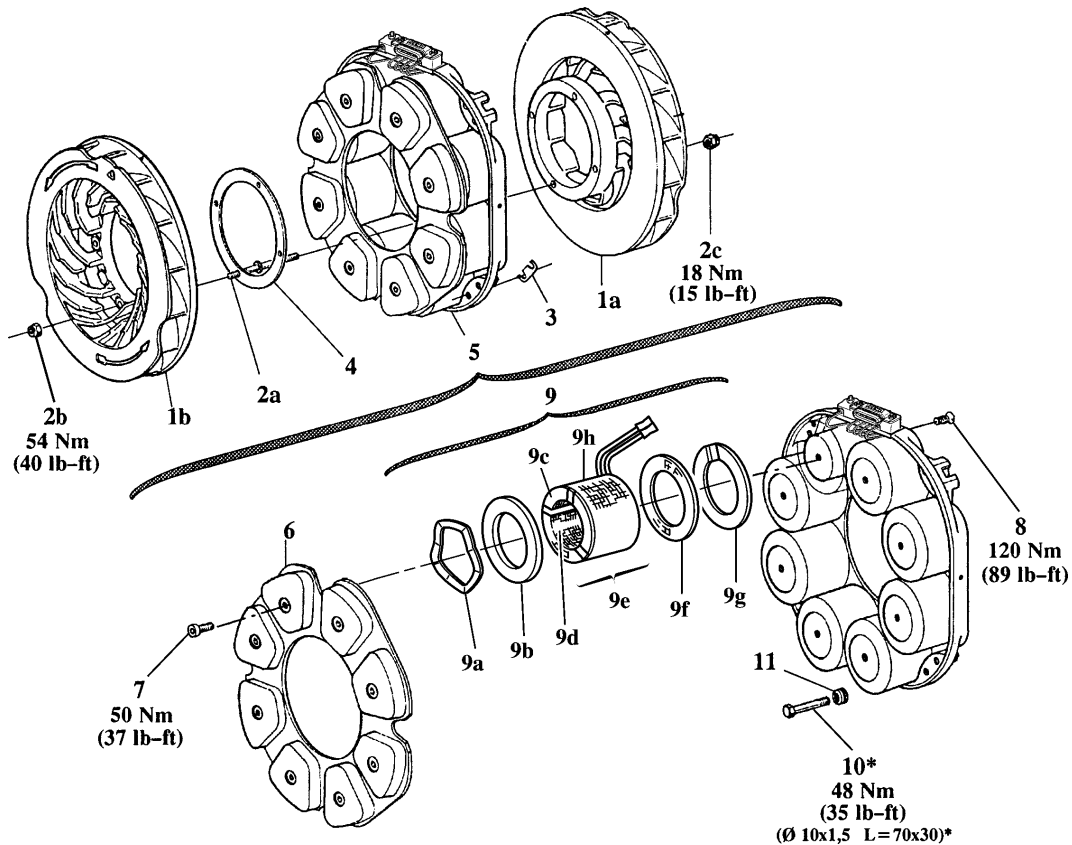


Dimension	RETARDER																
	FV60-90 (F90)	FV61-00 (F101)	FV61-30 (F130)	FV61-31 FV61-40 (F141)	FV71-50 (F151)	FV71-70 (F170)	FV71-90 (F191)	(F250)	FV82-60 (F272)	FV82-70 (F271)	FV83-00 (F301)	FN72-00 (F2000) FN72-20 (F2200)	FN72-40 (F2400)	FN82-70 (F2700)	FN83-00 (F3000) FN83-30 (F3300)	FP82-00 (F200)	FP82-70
A	463	463	463	463	516	516	516	562	562	562	562	516	516	562	562	562	562
B	Ø 430	Ø 430	Ø 430	Ø 430	Ø 475	Ø 475	Ø 475	Ø 510	Ø 510	Ø 510	Ø 510	Ø 485	Ø 485	Ø 528	Ø 528	Ø 510	Ø 510
C	216	216	216	216	239,3	239,3	239,3	294	294	294	294	239,3	241,8	283	283	262	246
D	46	46	46	46	54	54	54	66	66	66	66	54	54	60,5	60,5	50	50
F	121,4	121,4	121,4	121,4	128,5*	128,5*	128,5*	158,5	158,5	158,5	158,5	128,5*	131	158,5	158,5	158,5	142,5
G	/	/	/	/	/	/	/	/	/	/	/	/	/	Ø 518	/	/	/

* 129.5 with truncated pole shoes

Exploded view and list of spare parts

Types: FV60-90 (F90) FV61-30 (F130)

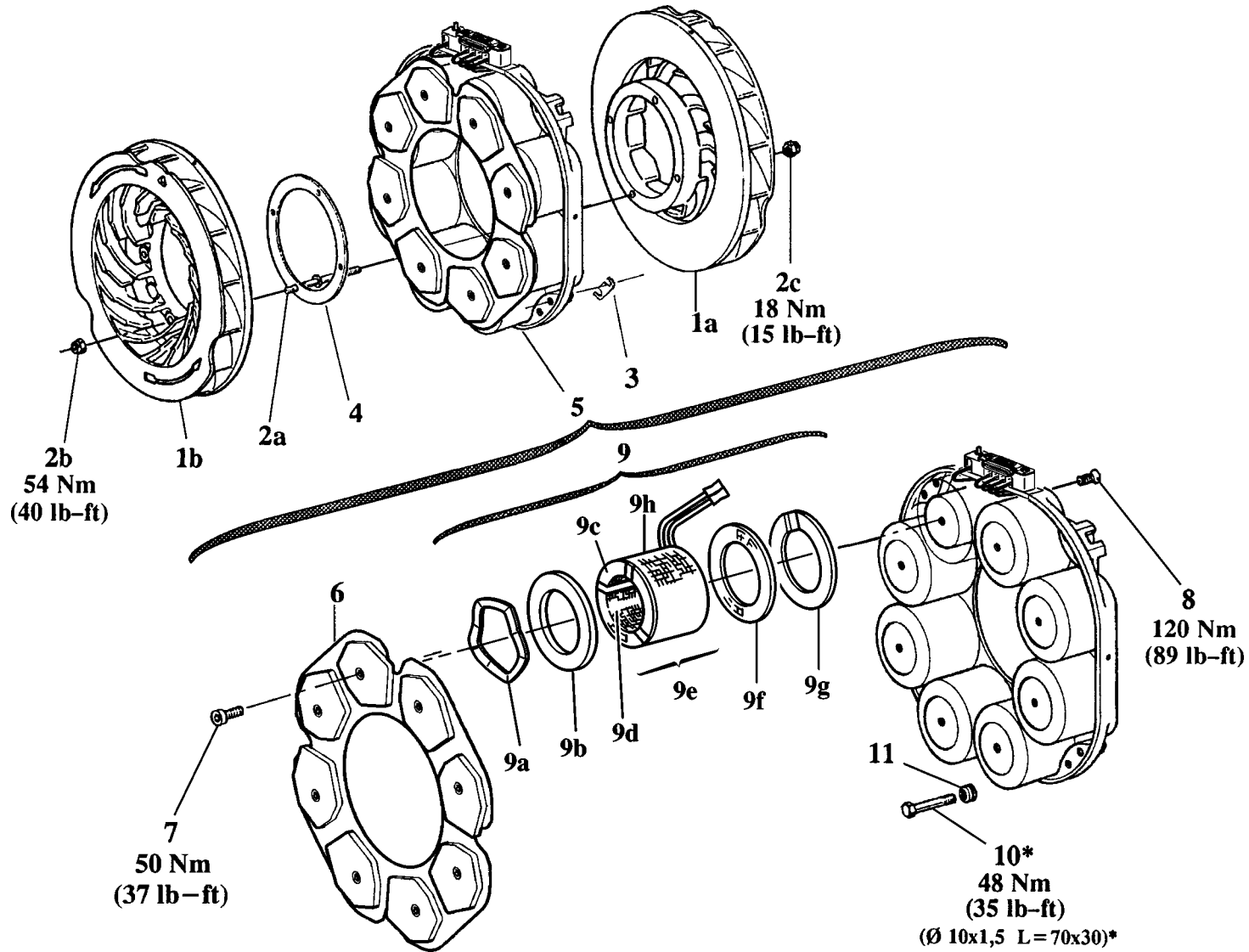


		FOCAL RETARDER TYPE		FV60-90 (FOCAL 90)	FV61-30 (FOCAL 130)
		Retarder part number	12V	FU631100	FJ621100
			24V	FU632100	FJ622100
Item	Description	Qty	PART NUMBERS		
1	Balanced rotors assembly, including:	1	VB106710	VB106710	
1a	1 clockwise rotor		The rotors are only supplied as a matched balanced pair		
1b	1 counter clockwise rotor				
2	Set of rotor fasteners, including:	1	VB200610	VB200610	
2a	4 shouldered studs		VF130530	VF130530	
2b/2c	8 metal locknuts		VF120140	VF120140	
3	Set of stator air gap adjusting shims	1	VB200320	VB200320	
4	Set of rotor air gap adjusting shims	1	VB200290	VB200290	
5	Stator assembly 12V	1	VB107423	VB106754	
	Stator assembly 24V	1	VB107412	VB106758	
6	Pole shoe plate	1	VB101180	VB101180	
7	Socket cap screw M10x1.5	8	VF108280	VF108280	
8	90° countersunk screw M14x2	8	VF109110	VF109110	
9	Spare coil assembly	8	VD310504	VD310437	
10	Stator securing screw	8	VF100360	VF100360	
11	Trep washer	8	VF201390	VF201390	

* NOTE: screw length L may vary for some applications.

Exploded view and list of spare parts

Types: FV61-00 (F101) FV61-31 FV61-40 (F141)



* NOTE: screw length L may vary for some applications.

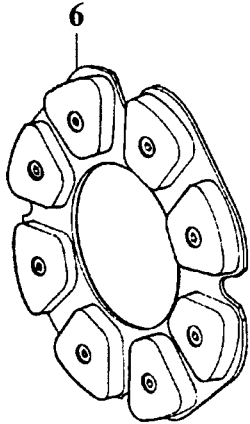
Exploded view and list of spare parts

Types: FV61-00 (F101) FV61-31 FV61-40 (F141)

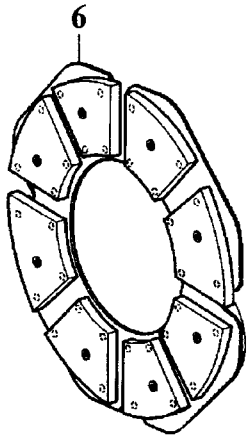
FOCAL RETARDER TYPE Fitting on gearbox or on axle			FV61-00 (FOCAL 101)		FV61-31		FV61-40 (FOCAL 141)	
			Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting
Retarder part number		12V	not available	FU831100	not available		not available	
		24V		FU832100	FJ802100	FJ812100	FJ742100	FJ792100
Item	Description	Qty	PART NUMBERS					
1	Balanced rotors assembly, including:	1	/	VB106710	VB106710		VB106710	
1a	1 clockwise rotor		The rotors are only supplied as a matched balanced pair					
1b	1 counter clockwise rotor							
2	Set of rotor fasteners, including:	1	/	VB200610	VB200610		VB200610	
2a	4 shouldered studs		/	VF130530	VF130530		VF130530	
2b/2c	8 metal locknuts		/	VF120140	VF120140		VF120140	
3	Set of stator air gap adjusting shims	1	/	VB200320	VB200320		VB200320	
4	Set of rotor air gap adjusting shims	1	/	VB200290	VB200290		VB200290	
5	Stator assembly 12V	1	/	VB107424	not available		not available	
	Stator assembly 24V	1	/	VB107759	VB106727	VB106979	VB106727	VB106979
6	Pole shoe plate	1	/	VB106976	VB106610	VB106976	VB106610	VB106976
7	Socket cap screw M10x1.5	8	/	VF108280	VF108280		VF108280	
8	90° countersunk screw M14x2	8	/	VF109110	VF109110		VF109110	
9	Spare coil assembly	8	/	VD310504	VD310437		VD310437	
10	Stator securing screw	8	/	VF100360	VF100360		VF100360	
11	Trep washer	8	/	VF201390	VF201390		VF201390	

Exploded view and list of spare parts

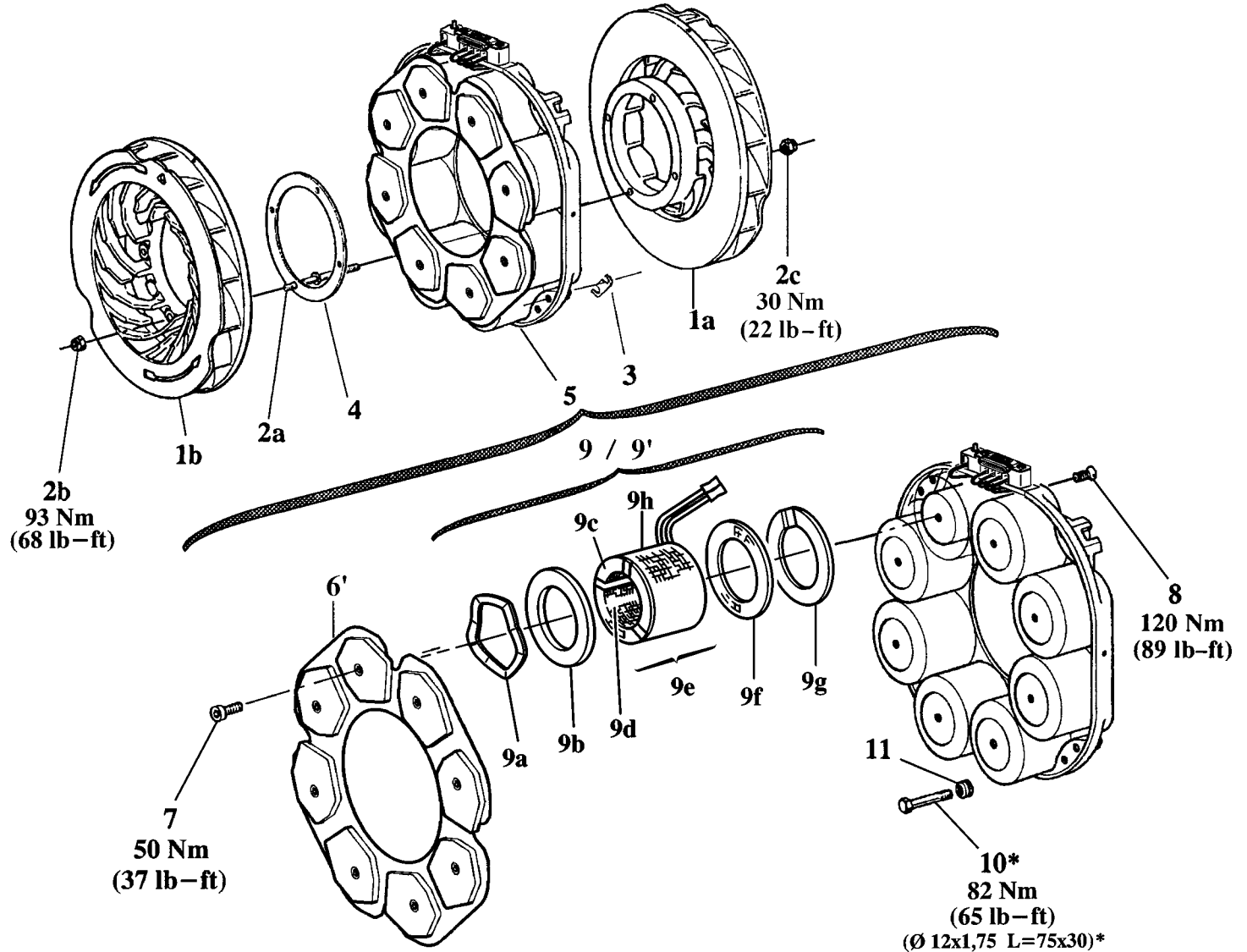
Types: FV71-50 (F151) FV71-70 (F170) FV71-90 (F191)



F170 up to serial number F181189



F191 up to serial number F180897
F151 up to serial number F182468



* NOTE: screw length L may vary for some applications.

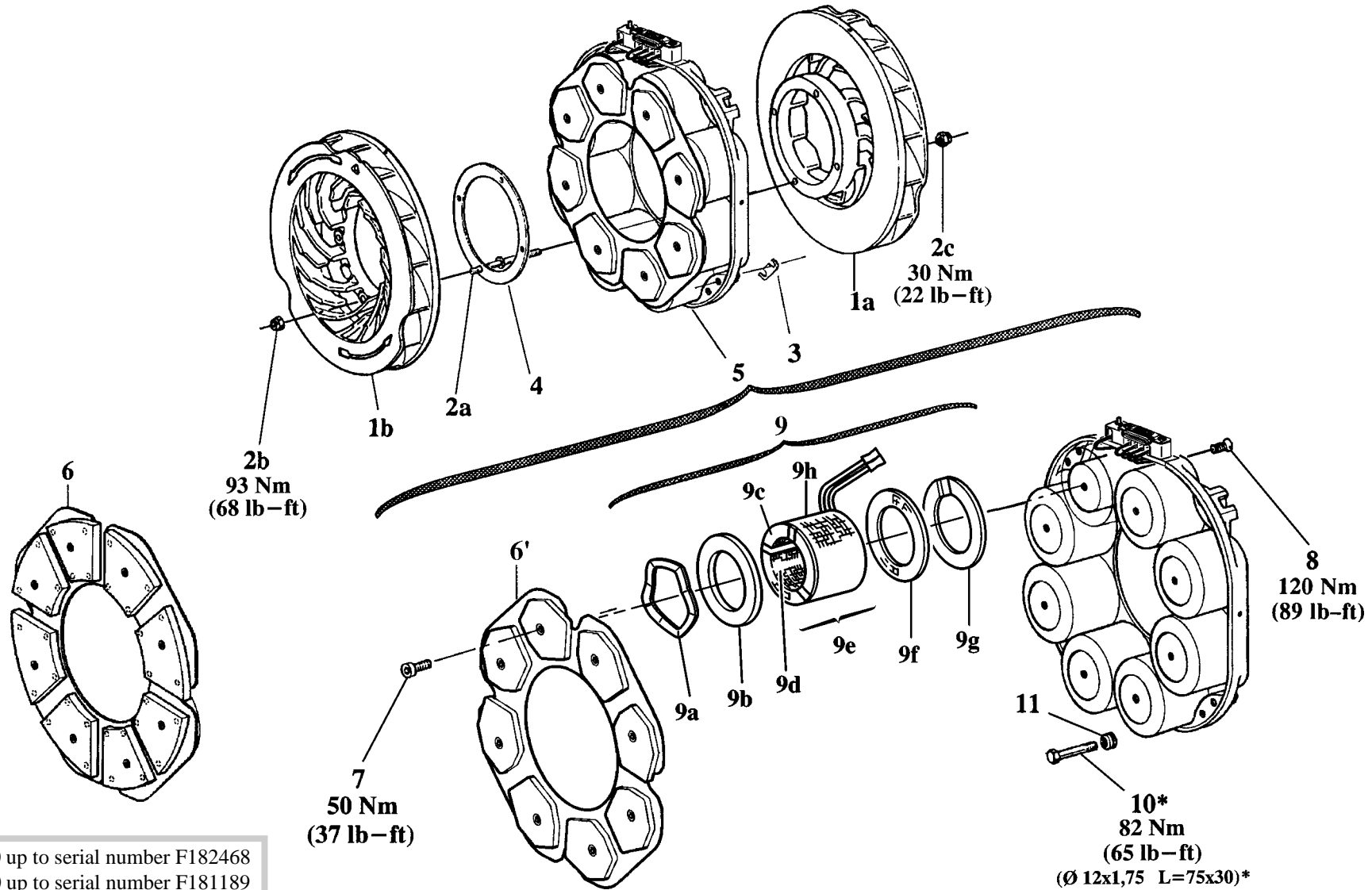
Exploded view and list of spare parts

Types: FV71–50 (F151) FV71–70 (F170) FV71–90 (F191)

FOCAL RETARDER TYPE			FV71–50 (FOCAL 151)		FV71–70 (FOCAL 170)		FV71–90 (FOCAL 191)		
Fitting on gearbox or on axle			Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	
Retarder part number			12V	not available	FD831100	FD621100	FD611100	not available	FD791100
			24V	FD392100	FD832100	FD622100	FD612100	FD742100	FD792100
Item	Description	Qty	PART NUMBERS						
1	Balanced rotors assembly, including:	1	VB101390		VB101390		VB101390		
	1a 1 clockwise rotor		The rotors are only supplied as a matched balanced pair						
	1b 1 counter clockwise rotor								
2	Set of rotor fasteners, including:	1	VB200620		VB200620		VB200620		
	2a 4 shouldered studs		VF130540		VF130540		VF130540		
	2b/2c 8 metal locknuts		VF120160		VF120160		VF120160		
3	Set of stator air gap adjusting shims	1	VB200330		VB200330		VB200330 or VB202068**		
4	Set of rotor air gap adjusting shims	1	VB200300		VB200300		VB200300		
5	Stator assembly 12V	1	not available	VB107490	VB107480	VB107488	not available	VB107491	
	Stator assembly 24V	1	VB107486	VB107494	VB107484	VB107492	VB107487	VB107495	
6 or 6'	Pole shoe plate *	1	VB105600	VB105610	VB101200		VB105600	VB105610	
	Pole shoe plate	1	VB107541	VB107540	VB107541	VB107540	VB107541	VB107540	
7	Socket cap screw M10x1.5	8	VF108280		VF108280		VF108280		
8	90° countersunk screw M14x2	8	VF109110		VF109110		VF109110		
9 or 9'	Spare coil assembly *	8	VD310438		VD310439		VD310439		
	Spare coil assembly	8	VD310571		VD310572		VD310573		
10	Stator securing screw	8	VF100630		VF100630		VF100630		
11	Trep washer	8	VF201400		VF201400		VF201400		
** only for FD472100 retarder			* up to serial number F182468		* up to serial number F181189		* up to serial number F180897		

Exploded view and list of spare parts

Types: FN72-00 (F2000) FN72-20 (F2200) FN72-40 (F2400)



F2000 up to serial number F182468
 F2200 up to serial number F181189

* NOTE: screw length L may vary for some applications.

Exploded view and list of spare parts

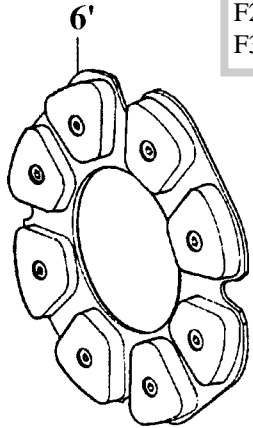
Types: FN72-00 (F2000) FN72-20 (F2200) FN72-40 (F2400)

FOCAL RETARDER TYPE		FN72-00 (FOCAL 2000)		FN72-20 (FOCAL 2200)		FN72-40 (FOCAL 2400)		
		Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	
Fitting on gearbox or on axle		12V	not available	DH311100	not available	DJ311100	not available	DK311100
		24V	DH202100	DH312100	DJ202100	DJ312100	DK202100	DK312100
Retarder part number								
Item	Description	Qty	PART NUMBERS					
1	Balanced rotors assembly, including:	1	VB106807		VB106807		VB106807	
1a	1 clockwise rotor		The rotors are only supplied as a matched balanced pair					
1b	1 counter clockwise rotor							
2	Set of rotor fasteners, including:	1	VB200620		VB200620		VB200620	
2a	4 shouldered studs		VF130540		VF130540		VF130540	
2b/2c	8 metal locknuts		VF120160		VF120160		VF120160	
3	Set of stator air gap adjusting shims	1	VB200330		VB200330		VB200330 ou VB202068**	
4	Set of rotor air gap adjusting shims	1	VB200300		VB200300		VB202045	
5	Stator assembly 12V	1	not available	VB107547	not available	VB107551	not available	VB107372
	Stator assembly 24V	1	VB107544	VB107545	VB107548	VB107549	VB107255	VB107388
6 or 6'	Pole shoe plate *	1	VB106220	VB106980	VB106220	VB106980	/	/
	Pole shoe plate	1	VB107541	VB107540	VB107541	VB107540	VB107541	VB107540
7	Socket cap screw M10x1.5	8	VF108280		VF108280		VF108280	
8	90° countersunk screw M14x2	8	VF109110		VF109110		VF109110	
9	Spare coil assembly	8	VD310452		VD310453		VD310497	
10	Stator securing screw	8	VF100630		VF100630		VF100630	
11	Trep washer	8	VF201400		VF201400		VF201400	
** only for DK322100 retarder			* up to serial n° F182468		* up to serial n° F181189			

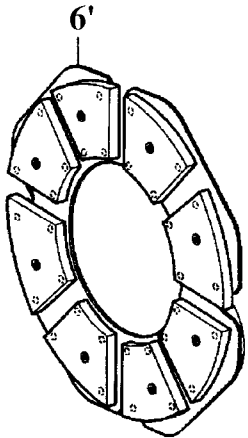
Exploded view and list of spare parts

Types: (F250) FV82-70 (F271) FV82-60 (F272) FV83-00 (F301)

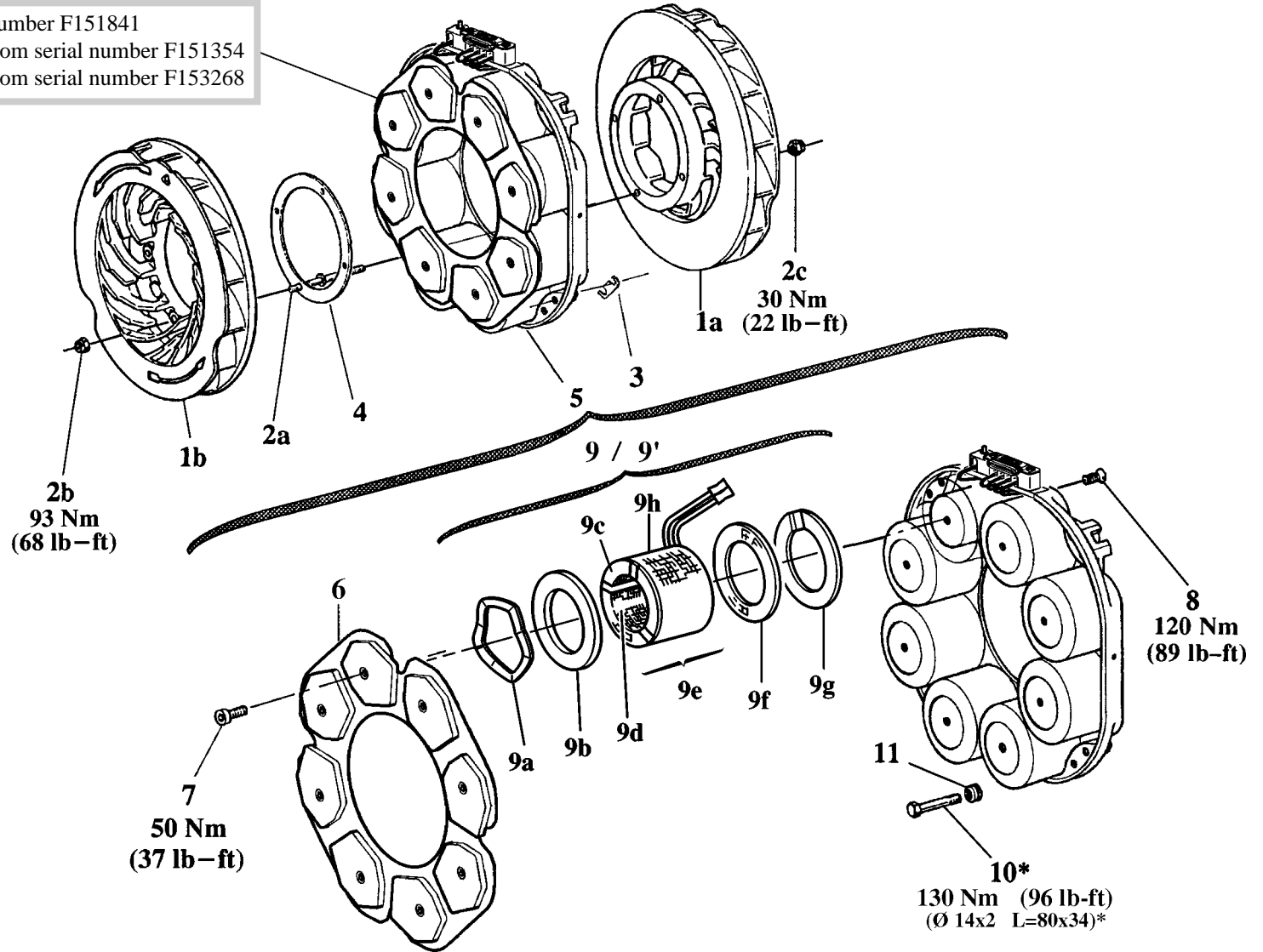
F250 from serial number F151841
 F271 / FV82-70 from serial number F151354
 F301 / FV83-00 from serial number F153268



F250 up to serial number F151840



F271 up to serial number F151353
 F301 up to serial number F153267



* NOTE: screw length L may vary for some applications.

Exploded view and list of spare parts

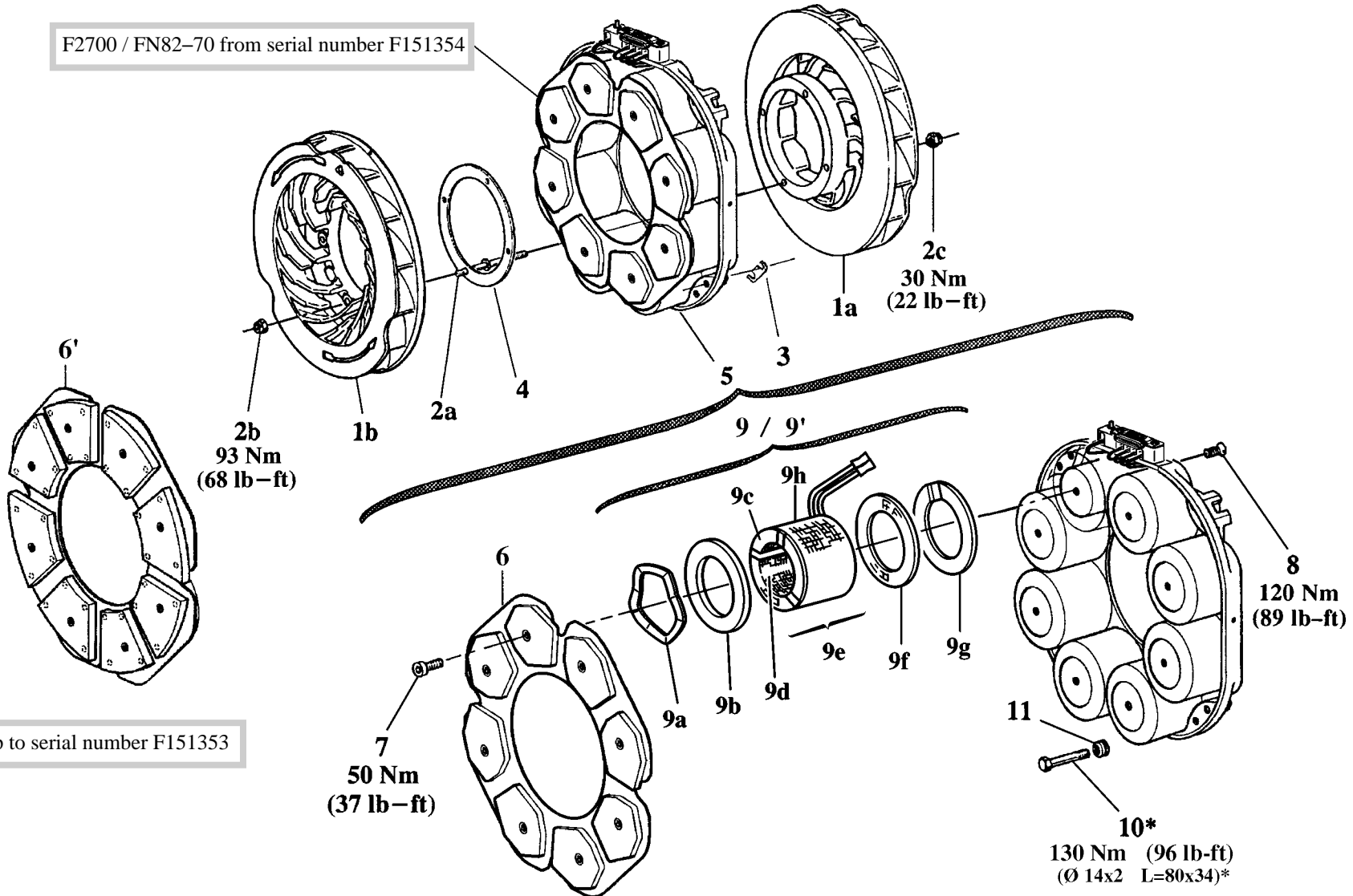
Types: (F250) FV82-70 (F271) FV82-60 (F272) FV83-00 (F301)

FOCAL RETARDER TYPE		(FOCAL 250)		FV82-70 (FOCAL 271)		FV82-60 (FOCAL 272)		FV83-00 (FOCAL 301)		
		Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	
Retarder part number		12V	not available	not available	not available	not available	not available	not feasible	not feasible	
		24V	FF662100	not available	FF742100	not available	DR202100	not available	FF702100	FF752100
Item	Description	Qty	PART NUMBERS							
1	Balanced rotors assembly, including:	1	VB101400	/	VB101400	/	VB101400	/	VB101400	/
1a	1 clockwise rotor		The rotors are only supplied as a matched balanced pair							
1b	1 counter clockwise rotor									
2	Set of rotor fasteners, including:	1	VB200630	/	VB200630	/	VB200630	/	VB200630	
2a	8 shouldered studs		VF130540	/	VF130540	/	VF130540	/	VF130540	
2b/2c	16 metal locknuts		VF120160	/	VF120160	/	VF120160	/	VF120160	
3	Set of stator air gap adjusting shims	1	VB200340	/	VB200340	/	VB200340	/	VB200340	
4	Set of rotor air gap adjusting shims	1	VB200310	/	VB200310	/	VB200310	/	VB200310	
5	Stator assembly 12V	1	not available	/	not available	/	not feasible	/	not feasible	not feasible
	Stator assembly 24V	1	VB107426	/	VB107427	/	/	/	VB107428	VB107760
6 or 6'	Pole shoe plate *	1	VB101220	/	VB105620	/	/	/	VB105620	/
	Pole shoe plate	1	VB106904	/	VB106904	/	VB106904	/	VB106904	VB106981
7	Socket cap screw M10x1.5	8	VF108280	/	VF108280	/	VF108280	/	VF108280	
8	90° countersunk screw M14x2	8	VF109110	/	VF109110	/	VF109110	/	VF109110	
9 or 9'	Spare coil assembly *	8	VD310441	/	VD310441	/	/	/	VD310442	/
	Spare coil assembly	8	VD310524	/	VD310525	/	VD310627	/	VD310526	
10	Stator securing screw	8	VF100870	/	VF100870	/	VF100870	/	VF100870	
11	Trep washer	8	VF201410	/	VF201410	/	VF201410	/	VF201410	
			* up to serial number F151840				* up to serial number F151353		*up to serial number F153267	

Exploded view and list of spare parts

Types: FN82-70 (F2700) FN83-00 (F3000) FN83-30 (F3300)

F2700 / FN82-70 from serial number F151354



F2700 up to serial number F151353

Exploded view and list of spare parts

Types: FN82–70 (F2700) FN83–00 (F3000) FN83–30 (F3300)

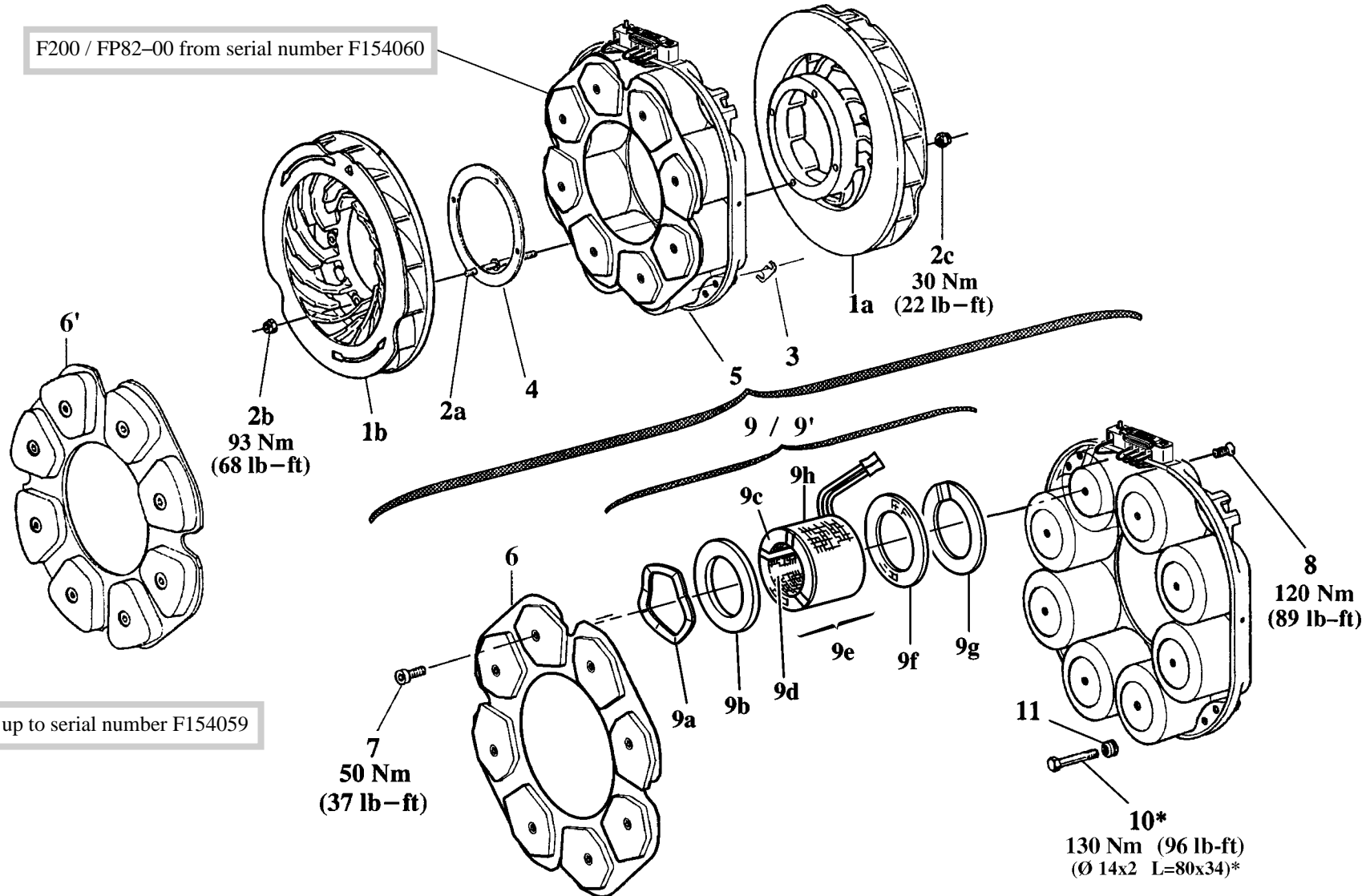
FOCAL RETARDER TYPE		FN82–70 (FOCAL 2700)		FN83–00 (FOCAL 3000)		FN83–30 (FOCAL 3300)		
		Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	
Fitting on gearbox or on axle		12V	not available	not available	not feasible	not feasible	not feasible	not feasible
Retarder part number		24V	DL202100	not available	DN202100	DN312100	DP202100	DP312100
Item	Description	Qty	PART NUMBERS					
1	Balanced rotors assembly, including:	1	VB107433	/	VB106808		VB106808	
1a	1 clockwise rotor		The rotors are only supplied as a matched balanced pair					
1b	1 counter clockwise rotor							
2	Set of rotor fasteners, including:	1	VB200630	/	VB200630		VB200630	
2a	8 shouldered studs		VF130540	/	VF130540		VF130540	
2b/2c	16 metal locknuts		VF120160	/	VF120160		VF120160	
3	Set of stator air gap adjusting shims	1	VB200340	/	VB200340		VB200340	
4	Set of rotor air gap adjusting shims	1	VB200310	/	VB200310		VB200310	
5	Stator assembly 12V	1	not available	/	not feasible	not feasible	not feasible	not feasible
	Stator assembly 24V	1	VB107427	/	VB106790	VB107761	VB106902	VB107762
6 or 6'	Pole shoe plate *	1	VB105620	/	/	/	/	/
	Pole shoe plate	1	VB106904	/	VB106904	VB106981	VB106904	VB106981
7	Socket cap screw M10x1.5	8	VF108280	/	VF108280		VF108280	
8	90° countersunk screw M14x2	8	VF109110	/	VF109110		VF109110	
9 or 9'	Spare coil assembly *	8	VD310441	/	/		/	
	Spare coil assembly	8	VD310525	/	VD310454		VD310466	
10	Stator securing screw	8	VF100870	/	VF100870		VF100870	
11	Trep washer	8	VF201410	/	VF201410		VF201410	

* up to serial number **F151353**

Exploded view and list of spare parts

Types: FP82-00 (F200) FP82-70

F200 / FP82-00 from serial number F154060



F200 up to serial number F154059

* NOTE: screw length L may vary for some applications.

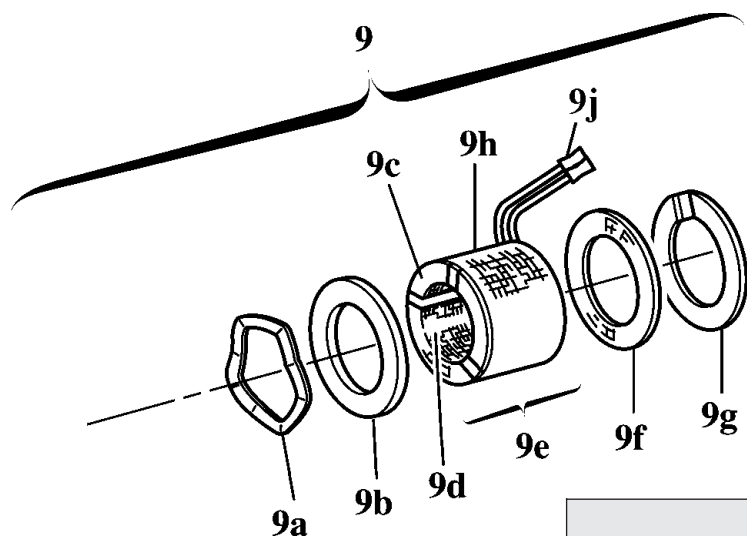
Exploded view and list of spare parts

Types: FP82-00 (F200) FP82-70

FOCAL RETARDER TYPE		FP82-00 (FOCAL 200)		FP82-70		
		Gearbox mounting	Axle mounting	Gearbox mounting	Axle mounting	
Fitting on gearbox or on axle		12V	not available	not available	not available	
Retarder part number		24V	FS622100	not available	DS202100	
Item	Description	Qty	PART NUMBERS			
1	Balanced rotors assembly, including:	1	VB105300	/	VB105300	/
1a	1 clockwise rotor		The rotors are only supplied as a matched balanced pair			
1b	1 counter clockwise rotor					
2	Set of rotor fasteners, including:	1	VB200630	/	/	/
2a	8 shouldered studs		VF130540	/	VF130591	/
2b/2c	16 metal locknuts		VF120160	/	VF120160	/
3	Set of stator air gap adjusting shims	1	VB200340	/	VB200340	/
4	Set of rotor air gap adjusting shims	1	VB200310	/	VB200310	/
5	Stator assembly 12V	1	not available	/	not available	/
	Stator assembly 24V	1	VB107425	/	VB107763	/
6 or 6'	Pole shoe plate *	1	VB101220	/	/	/
	Pole shoe plate	1	VB106904	/	VB106904	/
7	Socket cap screw M10x1.5	8	VF108280	/	VF108280	/
8	90° countersunk screw M14x2	8	VF109110	/	VF109110	/
9 or 9'	Spare coil assembly *	8	VD310481	/	/	/
	Spare coil assembly	8	VD310523	/	VD310633	/
10	Stator securing screw	8	VF100870	/	VF100870	/
11	Trep washer	8	VF201410	/	VF201410	/

* up to serial number **F154059**

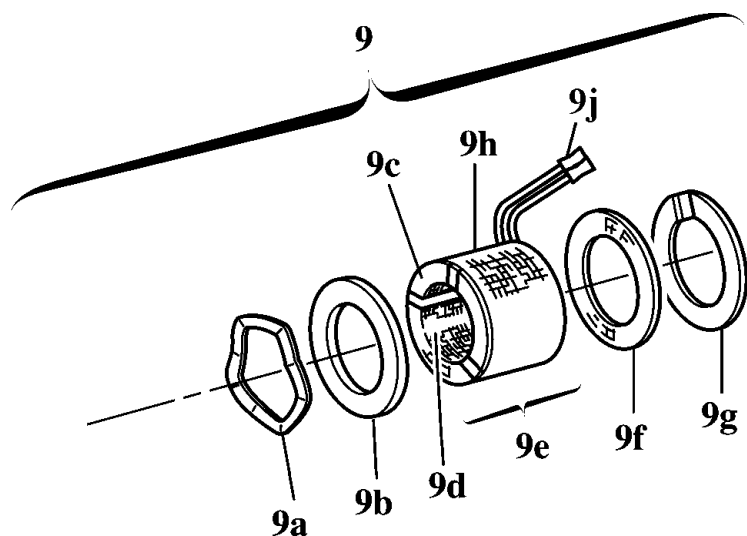
Spare coil assembly



FOCAL types									
FV60-90 (FOCAL 90)	FV61-30 (FOCAL 130)	from serial number			up to serial number		FN72-00 (FOCAL 2000)	FN72-20 (FOCAL 2200)	FN72-40 (FOCAL 2400)
	FV61-31	F182469	F181190	F180898	F182468	F181189 F180897			
FV61-00 (FOCAL 101)	FV61-40 (FOCAL 141)	FV71-50 (FOCAL 151)	FV71-70 (FOCAL 170)	FV71-90 (FOCAL 191)	FOCAL 151	FOCAL 170 FOCAL 191			

Item	Description	Part numbers									
9	Spare coil assembly, including:	VD310504	VD310437	VD310571	VD310572	VD310573	VD310438	VD310439	VD310452	VD310453	VD310497
9a	Pressure washer	VB501460	VB501460	VB514766	VB514766	VB514766	VB514766	VB514766	VB514766	VB514766	VB515405
9b	Coil end protective cover	VD503659	VD503517	VD503688	VD503689	VD503689	VD503624	VD503523	VD503522	VD503522	VD503624
9c	Coil end insulator (pole shoe plate side)	/	/	/	/	/	VD503632	VD503575	/	/	/
9d	Set of 8 pole insulators	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038
9e	Impregnated coil	supplied under the coil assembly number									
9f	Coil end insulator (stator housing side)	VD503569	VD503569	VD503632	VD503632	VD503632	VD503632	VD503632	VD503632	VD503632	VD503625
9g	Protective washer	VD503543	VD503543	VD503544	VD503544	VD503544	VD503544	VD503544	VD503544	VD503544	VD503627
9h	Set of 8 external protective sleeves	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036
9j	Set of 16 crimp connectors	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491

Spare coil assembly



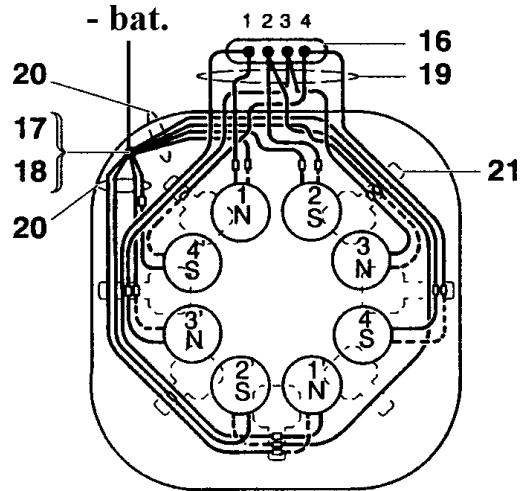
FOCAL types										
from serial number				up to serial number			FV82-60 (F272)	FP82-70	FN83-00 (FOCAL 3000)	FN83-30 (FOCAL 3300)
F154059	F151840	F151353	F153267	F154060	F151841 F151354	F153268				
FP82-00 (FOCAL 200)	(FOCAL 250)	FV82-70 (FOCAL 271) FN82-70 (FOCAL 2700)	FV83-00 (FOCAL 301)	FOCAL 200	FOCAL 250 FOCAL 271 FOCAL 2700	FOCAL 301				

Item	Description	Part numbers										
9	Spare coil assembly, including:	VD310523	VD310524	VD310525	VD310526	VD310481	VD310441	VD310442	VD310627	VD310633	VD310454	VD310466
9a	Pressure washer	VB510410	VB510410	VB510410	VB510410	VB509770	VB509770	VB509770	VB510410	VB510410	VB510410	VB510410
9b	Coil end protective cover	VD503652	VD503653	VD503654	VD503583	VD503633	VD503520	VD503519	VD503583	VD503653	VD503583	VD503583
9c	Coil end insulator (pole shoe plate side)	/	/	/	/	VD503634	VD503532	VD503572	/	/	/	/
9d	Set of 8 pole insulators	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038	VB202038
9e	Impregnated coil	supplied under the coil assembly number										
9f	Coil end insulator (stator housing side)	VD503576	VD503576	VD503576	VD503576	VD503572	VD503572	VD503572	VD503576	VD503576	VD503584	VD503584
9g	Protective washer	VD503547	VD503547	VD503547	VD503547	VD503546	VD503546	VD503546	VD503547	VD503547	VD503547	VD503547
9h	Set of 8 external protective sleeves	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036	VB202036
9j	Set of 16 crimp connectors	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491	VD408491

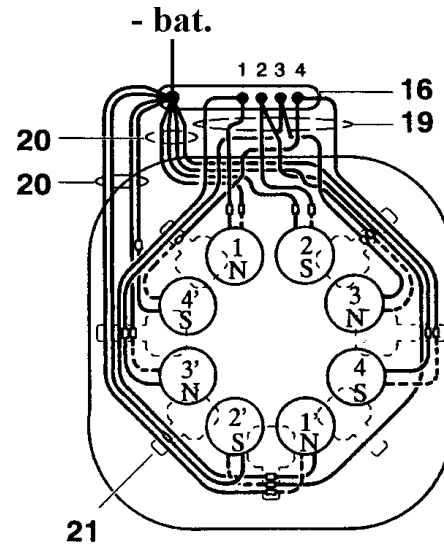
Internal wiring assembly

Wiring assembly – Figure 1

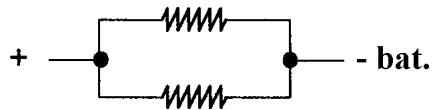
Up to serial number F181463



From serial number F181464



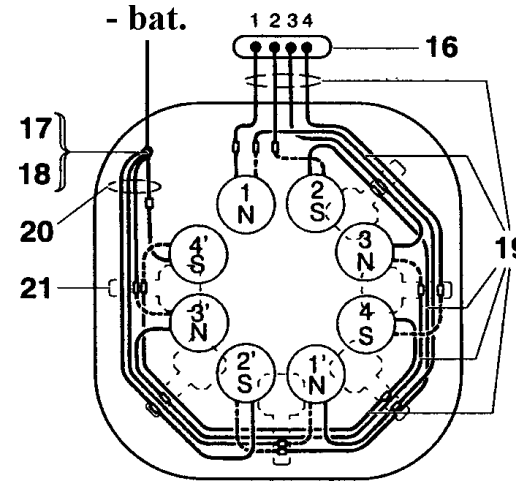
Layout of one stage 12V



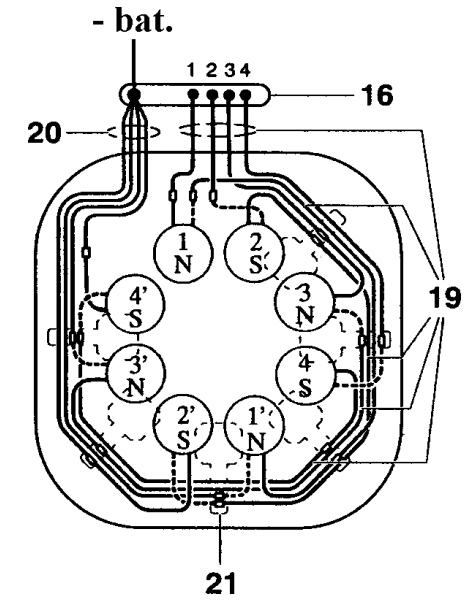
— red sleeve
 - - - blue sleeve

Wiring assembly – Figure 2

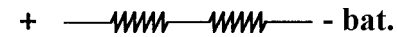
Up to serial number F181463



From serial number F181464



Layout of one stage 24V



— red sleeve
 - - - blue sleeve

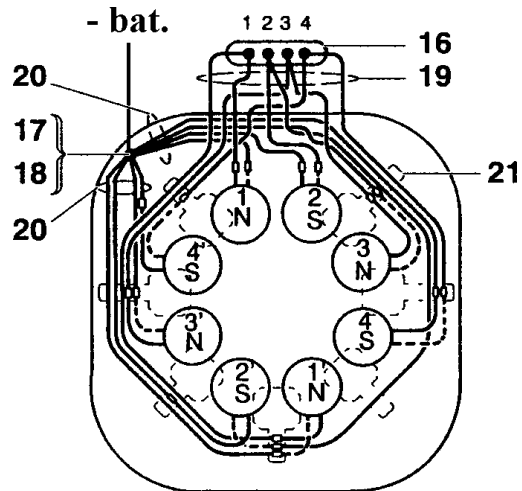
Internal wiring assembly

Item	Description	Qty	Part numbers for 12 V stator Wiring assembly fig. 1					Part numbers for 24 V stator Wiring assembly fig. 2					
			FV60-90 Focal 90	FV61-00 Focal 101	FV61-30 Focal 130	FV61-31	FV61-40 Focal 141	FV60-90 Focal 90	FV61-00 Focal 101	FV61-30 Focal 130	FV61-31	FV61-40 Focal 141	
			FV71-50 Focal 151	FV71-70 Focal 170	FV71-90 Focal 191			FV71-50 Focal 151	FV71-70 Focal 170	FV71-90 Focal 191			
			FN72-00 Focal 2000	FN72-20 Focal 2200	FN72-40 Focal 2400				FN72-00 Focal 2000	FN72-20 Focal 2200	FN72-40 Focal 2400		
16	Connecting block assembly (page 30)	1	VD408074 or VD408041					VD408074 or VD408041					
17	Earth terminal (page 31)	1	VD408298					VD408298					
18	Earth cable terminal	1	See table on page 31					See table on page 31					
19	Wiring assembly	1	VD408565					VD408566					
20	Earth wiring assembly	2	VD408564					/					
		1	/					VD408564					
21	Set of 8 cable securing plates	1	VD408047					VD408047					
	1 kg can of araldite for bonding the coils on the poles		VH510160					VH510160					
	400 g can of hardener for araldite		VH510310					VH510310					
	1 l can of cable protective varnish		VH510440					VH510440					
	Tube of silicone compound		VH510130					VH510130					

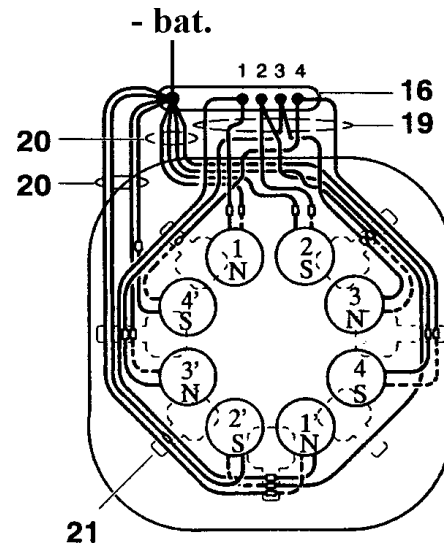
Internal wiring assembly

Wiring assembly – Figure 1

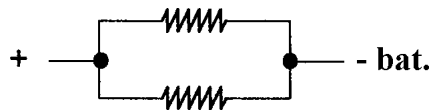
Up to serial number F181463



From serial number F181464



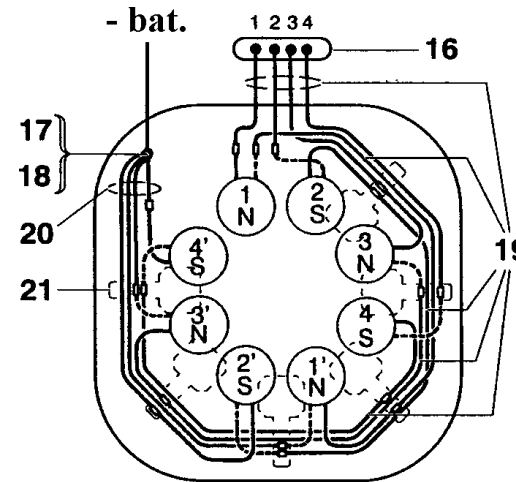
Layout of one stage 12V



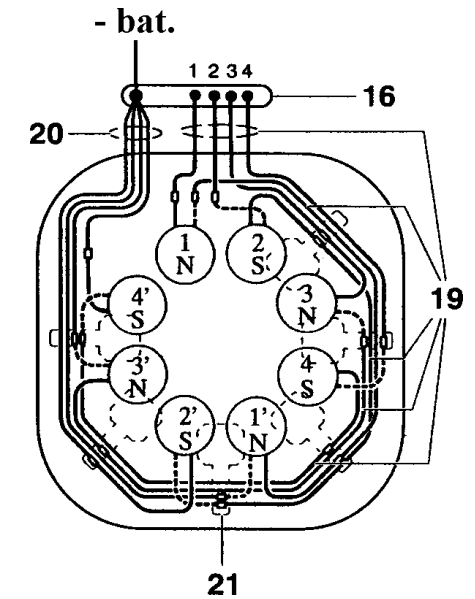
— red sleeve
 - - - blue sleeve

Wiring assembly – Figure 2

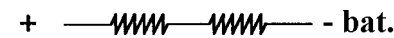
Up to serial number F181463



From serial number F181464



Layout of one stage 24V



— red sleeve
 - - - blue sleeve

Internal wiring assembly

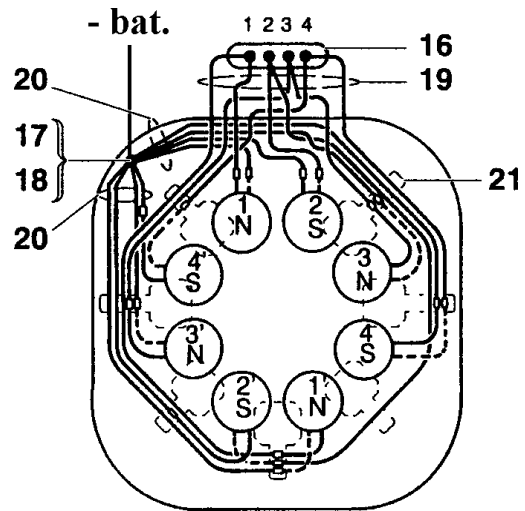
Item	Description	Qty	Part numbers for 12 V stator Wiring assembly fig. 1				Part numbers for 24 V stator Wiring assembly fig. 2			
			FP82-70 Focal 250	FV82-70 Focal 271	FN82-70 Focal 2700	FP82-00 Focal 200 ***	FP82-70 Focal 250	FV82-70 Focal 271	FN82-70 Focal 2700	
16	Connecting block assembly (page 30)	1	VD408074 or VD408041				VD408074 or VD408041			
17	Insulated earth terminal (page 31)	1	VD408046				VD408046			
18	Earth cable terminal	1	See table on page 31				See table on page 31			
19	Wiring assembly	1	VD408565				VD408566			
20	Earth wiring assembly	2	VD408564				/			
		1	/				VD408564			
21	Set of 8 cable securing plates	1	VD408047				VD408047			
	1 kg can of araldite for bonding the coils on the poles		VH510160				VH510160			
	400 g can of hardener for araldite		VH510310				VH510310			
	1 l can of cable protective varnish		VH510440				VH510440			
	Tube of silicone compound		VH510130				VH510130			

*** : F200, 24V from serial number F154060 (for the previous serial numbers, see page 25)

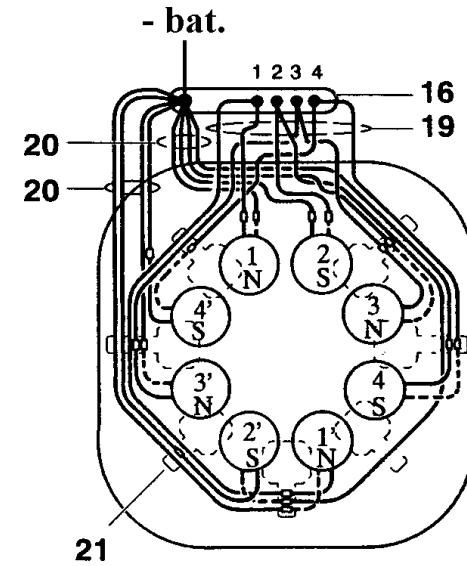
Internal wiring assembly

Wiring assembly – Figure 1

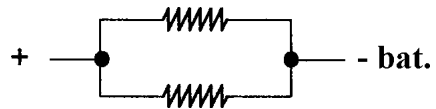
Up to serial number F181463



From serial number F181464



Layout of one stage



— red sleeve
 - - - blue sleeve

Internal wiring assembly

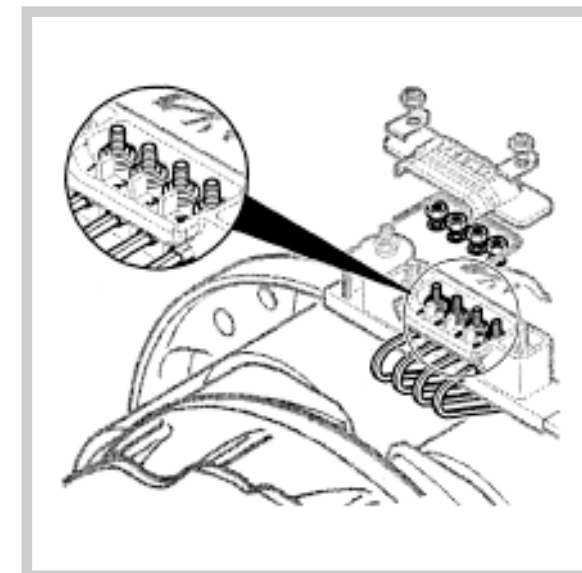
Item	Description	Qty	Part numbers for 24 V stator Wiring assembly fig. 1				
			Focal 200 **	FV82-60 Focal 272	FV83-00 Focal 301	FN83-00 Focal 3000	FN83-30 Focal 3300
16	Connecting block assembly (page 30)	1	VD408074 or VD408041				
17	Insulated earth terminal (page 31)	1	VD408046				
18	Earth cable terminal	1	See table on page 31				
19	Wiring assembly	1	VD408565				
20	Earth wiring assembly	2	VD408564				
21	Set of 8 cable securing plates	1	VD408047				
	1 kg can of araldite for bonding the coils on the poles		VH510160				
	400 g can of hardener for araldite		VH510310				
	1 l can of cable protective varnish		VH510440				
	Tube of silicone compound		VH510130				

** : F200, 24 V up to serial number F154059

Chart for cutting the single wires on the connecting block and the wires between the coils

According to retarder type, cut the 8 wires to the dimensions I1, I2, I3, I4 and L (4x) and remove 5 mm insulation from each end.

Retarder type	Figure 1				Figure 2
	Terminal 1	Terminal 2	Terminal 3	Terminal 4	4 wires between the coils
	I1	I2	I3	I4	L
F90 / FV60-90 F101 / FV61-00 F130 / FV61-30 FV61-31 F141 / FV61-41	215 mm 8.5 "	215 mm 8.5 "	635 mm 25 "	505 mm 19.9 "	840 mm 33.1 "
F151 / FV71-50 F170 / FV71-70 F191 / FV71-90 F2000 / FN72-00 F2200 / FN72-20 F2400 / FN72-40	230 mm 9.1 "	230 mm 9.1 "	660 mm 26 "	540 mm 21.3 "	920 mm 36.2 "
* F200 / FP82-00 F250 F271 / FV82-70 FP82-70 F2700 / FN82-70	250 mm 9.8 "	250 mm 9.8 "	690 mm 27.2 "	580 mm 22.8 "	1010 mm 39.8 "



* for F200 / FP82-00 from serial number F154060

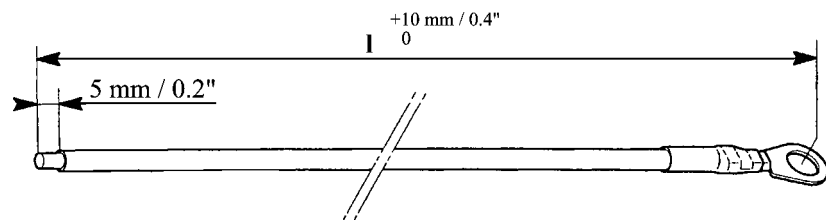


Figure 1

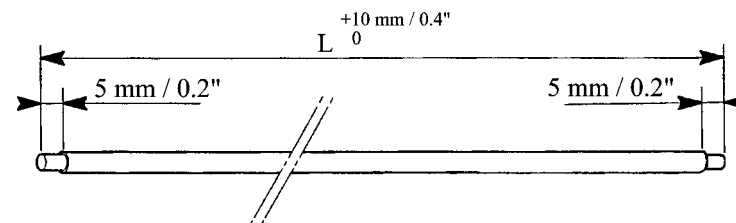


Figure 2

Chart for cutting the double wires on the connecting block

According to retarder type, cut the 8 wires to the dimensions I1, I2, I3, I4, L1, L2, L3 and L4 and remove 5 mm insulation from each end.

Retarder type	Terminal 1		Terminal 2		Terminal 3		Terminal 4	
	I1	L1	I2	L2	I3	L3	I4	L4
F90 / FV60-90 F101 / FV61-00 F130 / FV61-30 FV61-31 F141 / FV61-41	235 mm 9.2 "	885 mm 34.8 "	235 mm 9.2 "	885 mm 34.8 "	525 mm 20.7 "	655 mm 25.8 "	525 mm 20.7 "	655 mm 25.8 "
F151 / FV71-50 F170 / FV71-70 F191 / FV71-90 F2000 / FN72-00 F2200 / FN72-20 F2400 / FN72-40	250 mm 9.8 "	970 mm 38.2 "	250 mm 9.8 "	970 mm 38.2 "	600 mm 23.6 "	680 mm 26.8 "	600 mm 23.6 "	680 mm 26.8 "
* F200 F272 / FV82-60 F301 / FV83-00 F3000 / FN83-00 F3300 / FN83-30	290 mm 11.4 "	1080 mm 42.5 "	290 mm 11.4 "	1080 mm 42.5 "	650 mm 25.6 "	720 mm 28.3 "	650 mm 25.6 "	720 mm 28.3 "

* for F200 up to serial number F154059.

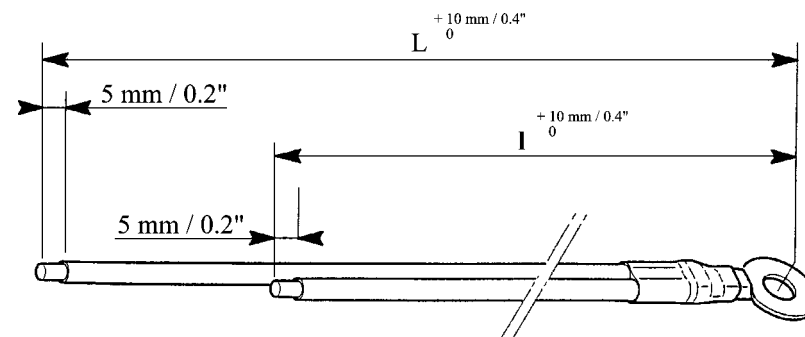
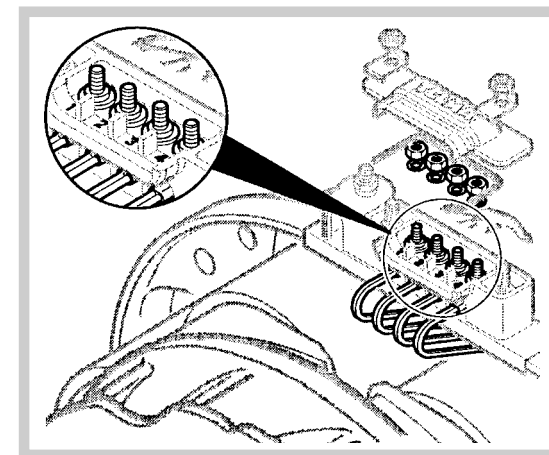


Chart for cutting the earth return wires (version of connecting block with integrated earth)

According to retarder type, cut the 4 wires to the dimensions L1, L2, L3 and L4 and remove 5 mm insulation from each end.

Retarder type	Voltage	L1	L2	L3	L4
F90 / FV60-90 F101 / FV61-00 F130 / FV61-30 FV61-31 F141 / FV61-41	12V	245 mm 9.6 "	595 mm 23.4 "	655 mm 25.8 "	1015 mm 40 "
	24V	455 mm 17.9 "	535 mm 21.1 "	835 mm 32.9 "	905 mm 35.6 "
F151 / FV71-50 F170 / FV71-70 F191 / FV71-90 F2000 / FN72-00 F2200 / FN72-20 F2400 / FN72-40	12V	315 mm 12.4 "	645 mm 25.4 "	695 mm 27.4 "	1095 mm 43.1 "
	24V	495 mm 19.5 "	595 mm 23.4 "	915 mm 36 "	995 mm 39.2 "
F200 / FP82-00 F250 F271 / FV82-70 FP82-70 F2700 / FN82-70	24V	555 mm 21.8 "	645 mm 25.4 "	985 mm 38.8 "	1075 mm 42.3 "
F272 / FV82-60 F301 / FV83-00 F3000 / FN83-00 F3300 / FN83-30	24V	245 mm 9.6 "	715 mm 28.1 "	755 mm 29.7 "	1175 mm 46.2 "

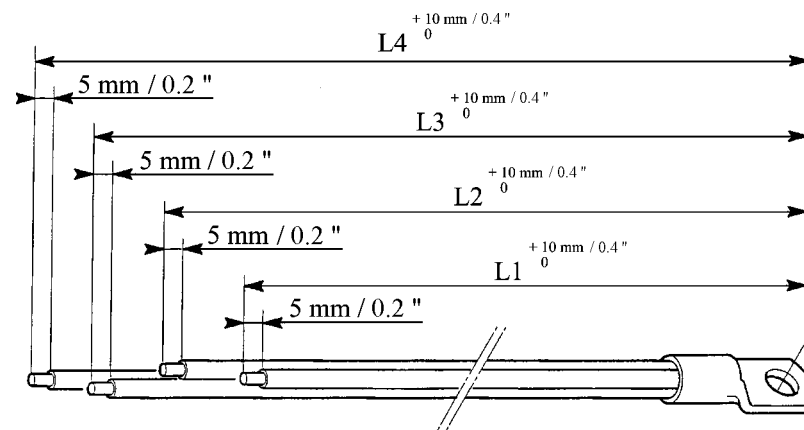
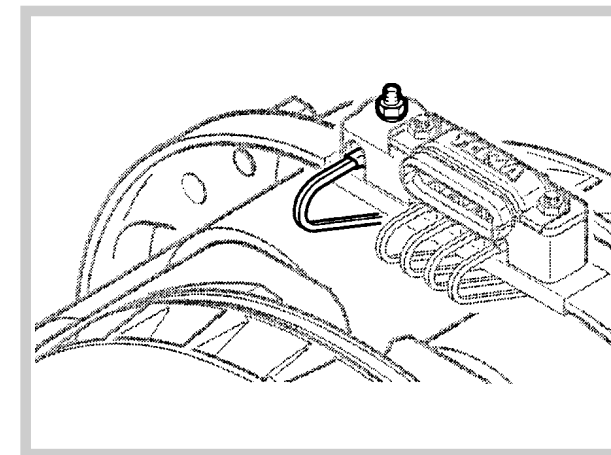
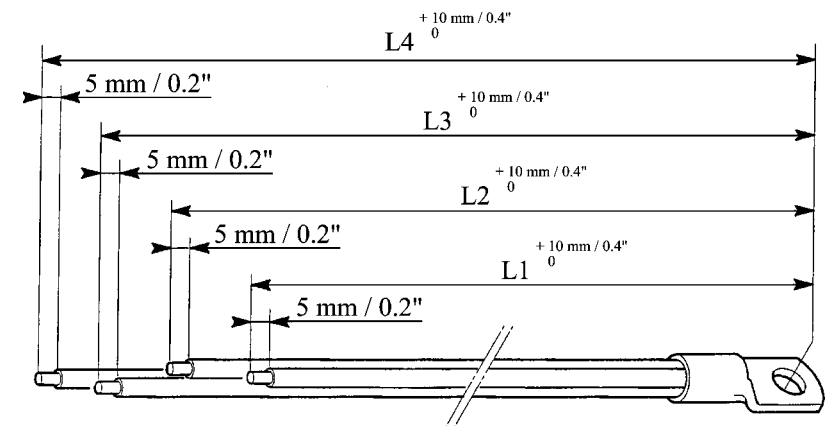
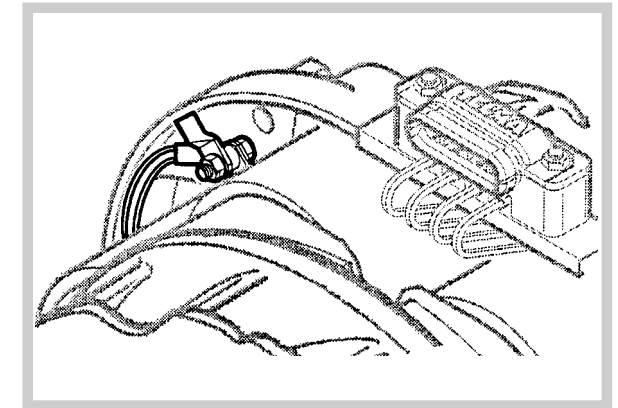


Chart for cutting the earth return wires (version with earth return terminal on the stator housing)

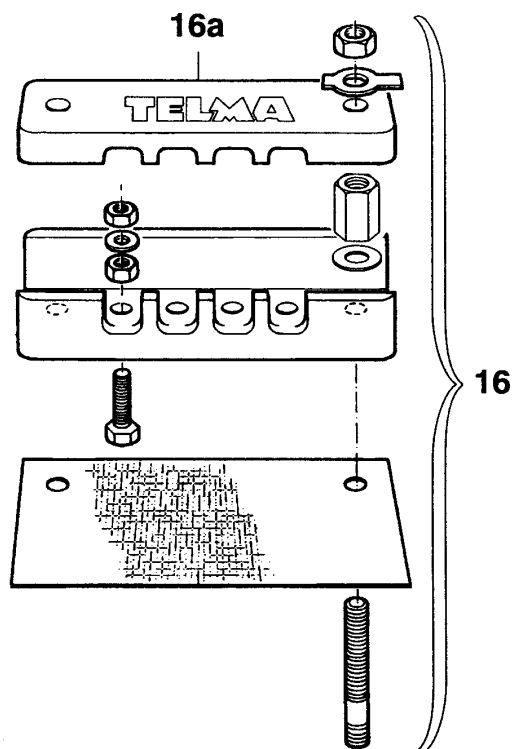
According to retarder type, cut the 8 wires to the dimensions L1, L2, L3 and L4 and remove 5 mm insulation from each end.

Retarder	Voltage	L1	L2	L3	L4
F90 / FV60-90 F101 / FV61-00 F130 / FV61-30 FV61-31 F141 / FV61-41	12V and 24V	245 mm 9.6 "	345 mm 13.6 "	625 mm 24.6 "	715 mm 28.1 "
F151 / FV71-50 F170 / FV71-70 F191 / FV71-90 F2000 / FN72-00 F2200 / FN72-20 F2400 / FN72-40	12V and 24V	275 mm 10.8 "	375 mm 14.8 "	685 mm 27 "	795 mm 31.3 "
F200 / FP82-00 F250 F271 / FV82-70 FP82-70 F2700 / FN82-70 F272 / FV82-60 F301 / FV83-00 F3000 / FN83-00 F3300 / FN83-30	24V	335 mm 13.2 "	435 mm 17.1 "	775 mm 30.5 "	905 mm 35.6 "

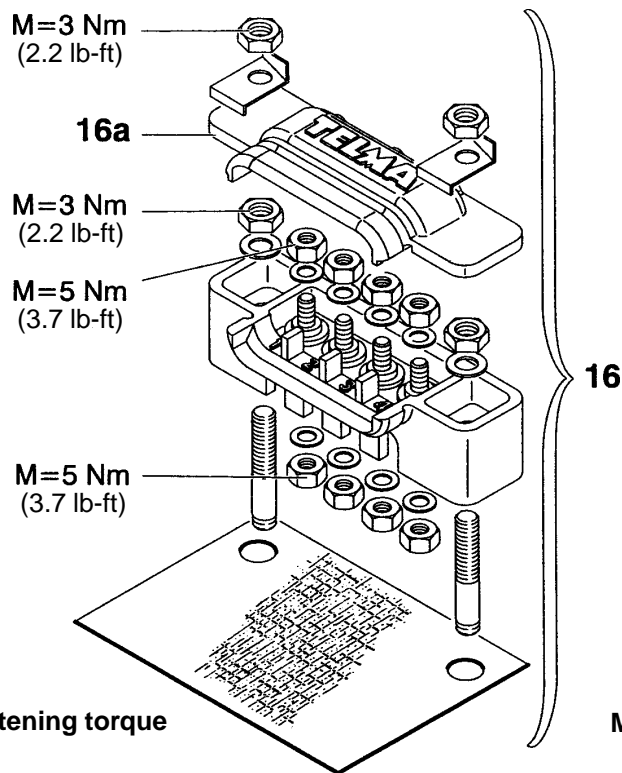


Connecting block assembly

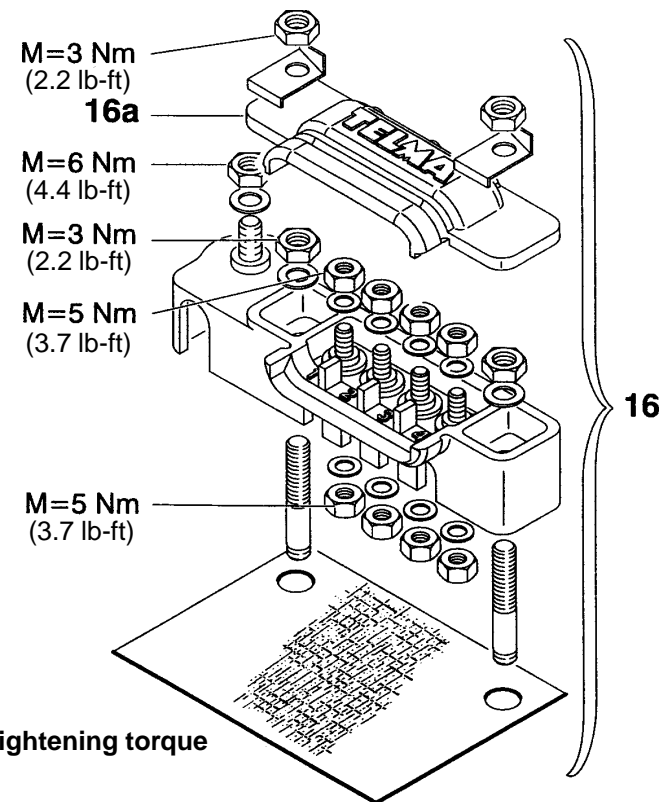
Up to serial number F130995



From serial number F130996
to serial number F181463



From serial number F181464



Item	Description	Qty	Part number
16	Connecting block assembly with cover	1	See NOTE
16a	Cover for connecting block	1	VD500480

Item	Description	Qty	Part number
16	Connecting block assembly with cover	1	VD408041
16a	Cover for connecting block	1	VD503622

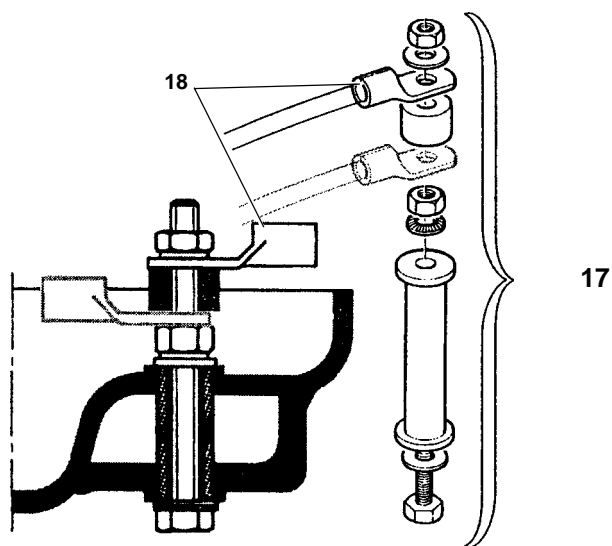
Item	Description	Qty	Part number
16	Connecting block assembly with cover	1	VD408074
16a	Cover for connecting block	1	VD503622

NOTE: This connecting block assembly is replaced by the new interchangeable assembly VD408074, shown on next figure.

Earth terminal assembly

Part number: VD408298 (item 17)

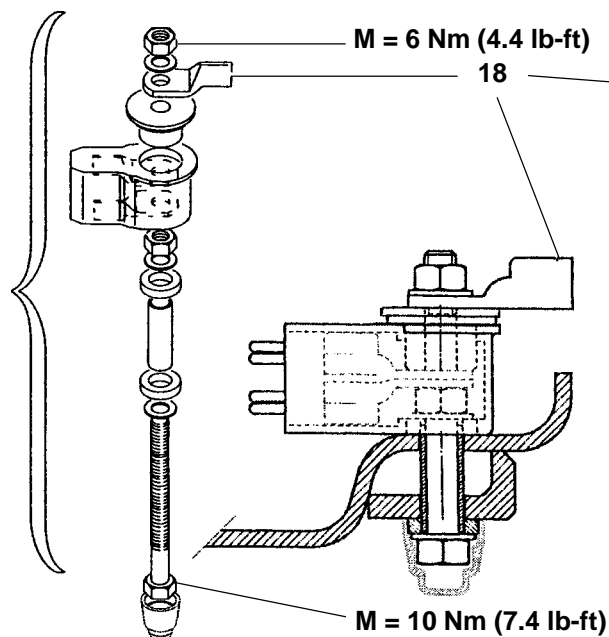
**for retarder
F90/101/130/141/151/170/191/2000/2200/2400
and all other up to serial number F130995**



M = tightening torque

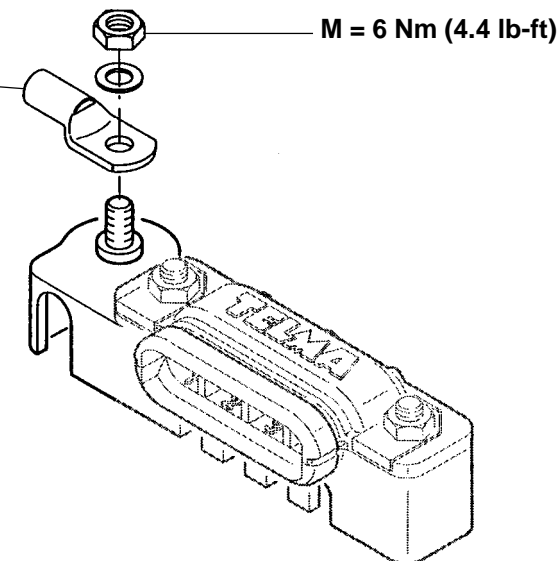
Part number: VD408046 (item 17)

**For retarder
F250/271/301/2700/3000/3300
From serial number F130996
to serial number F181463**



M = 10 Nm (7.4 lb-ft)

**For all retarder
from serial number F181464
Integrated in connecting block
VD408074**

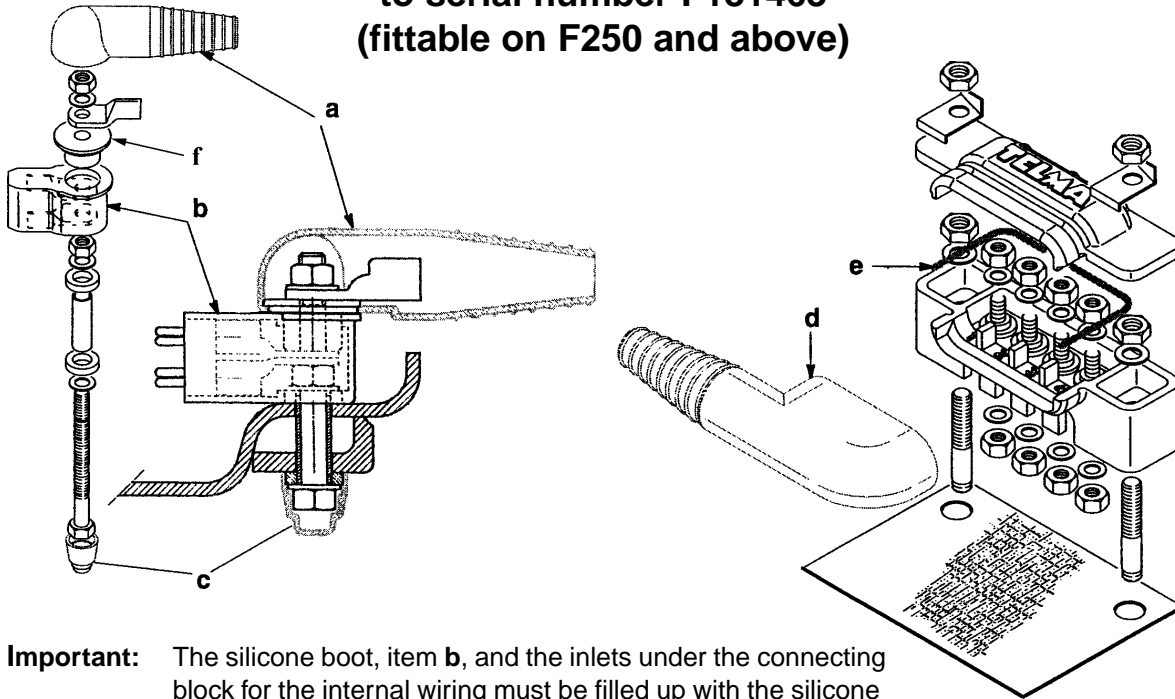


M = 6 Nm (4.4 lb-ft)

Item	Description	Reference	12 V Retarder	24 V Retarder
18	Earth cable terminal 25 mm ²	VG510331		FV60-90 (F90) / FV61-00 (F101)
18	Earth cable terminal 35 mm ²	V 510332	FV60-90 (F90) / FV61-00 (F101)	from FV61-30 (F130) to FN72-00 (F2000)
18	Earth cable terminal 50 mm ²	VG510333	from FV61-30 (F130) to FN72-00 (F2000)	from FN72-20 (F2200) to FN83-30 (F3300)
18	Earth cable terminal 70 mm ²	VG510334	FN72-20 (F2200) / FN72-40 (F2400) / FV82-70 (F271)	

Sealing kit – Ref. VB107322

From serial number F130996
to serial number F181463
(fittable on F250 and above)

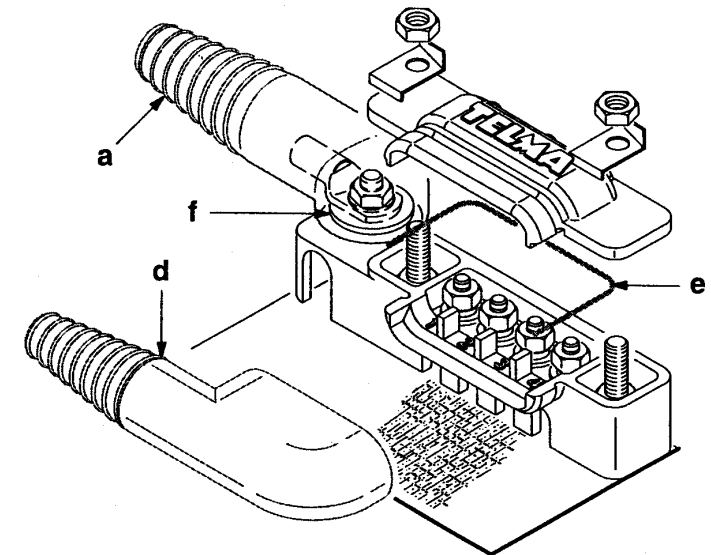


Important: The silicone boot, item **b**, and the inlets under the connecting block for the internal wiring must be filled up with the silicone compound included in this sealing kit. The items **c** and **e** must be bonded respectively to the earth screw and inside the cover of the connecting block.

Item	Description	Qty
a	Silicone boot for earth cable	1
b	Silicone boot for internal earth terminal	1
c	Silicone boot for earth screw	1
d	Silicone boot for connecting block	1
e	Silicone grommet	1
f	Stepped washer	1
/	Tube of silicone compound	1

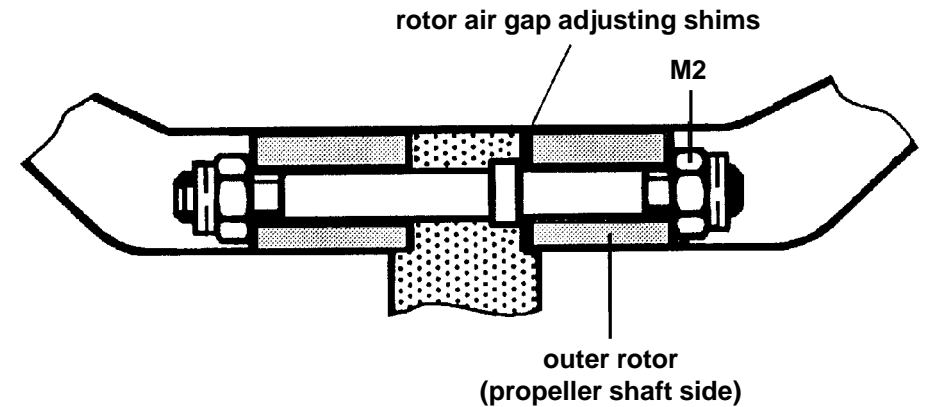
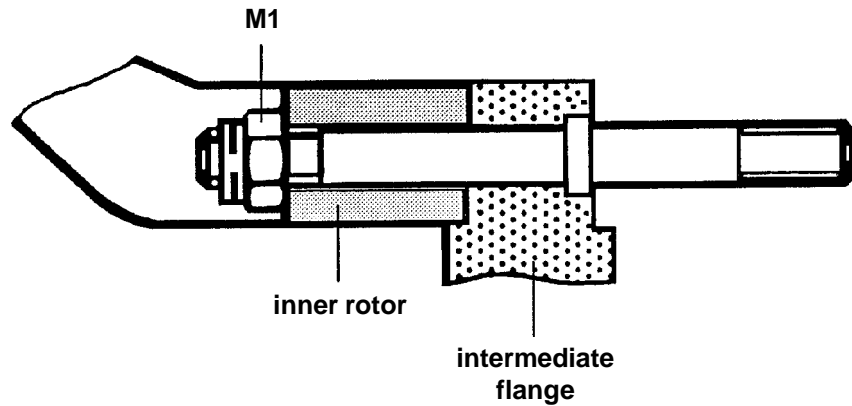
Sealing kits

From serial number F181464



Item	Description	Sealing kit VB107556	Sealing kit VB107377
		Quantity	
a	Silicone boot for earth cable	1	/
d	Silicone boot for connecting block	1	1
e	Silicone grommet	1	1
f	Stepped washer	1	/

Rotors securing - Layout and tightening torques

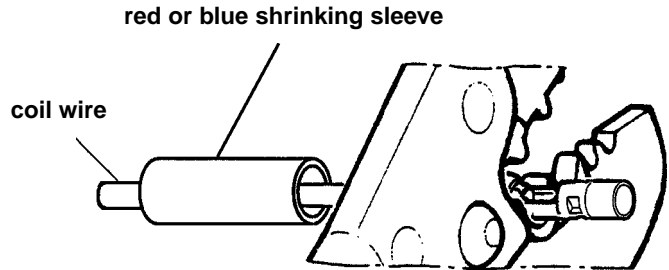
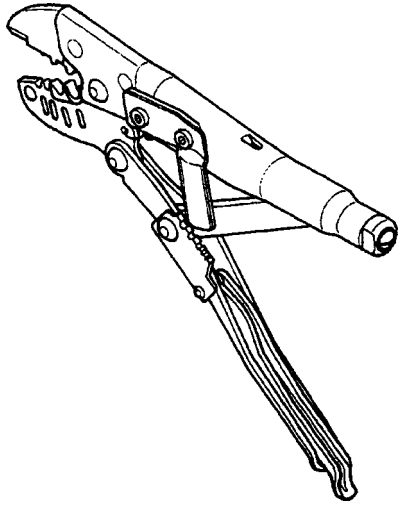


RETARDER TYPE									ROTOR FASTENERS		TIGHTENING TORQUES	
									Quantity	Dimensions	M1 (Nm / lb-ft)	M2 (Nm / lb-ft)
FV60-90 (F90)	FV61-00 (F101)	FV61-30 (F130)	FV61-31	FV61-40 (F141)					4	M10x1	18 / 15	54 / 40
FV71-50 (F151)	FV71-70 (F170)	FV71-90 (F191)	FN72-00 (F2000)	FN72-20 (F2200)	FN72-40 (F2400)				4	M12x1.5	30 / 22	93 / 68
FP82-00 (F200)	FP82-70		FV82-60 (F272)	FV82-70 (F271)	FV83-00 (F301)	FN82-70 (F2700)	FN83-00 (F3000)	FN83-30 (F3300)	8	M12x1.5	30 / 22	93 / 68

Crimping tool and wiring repair kit

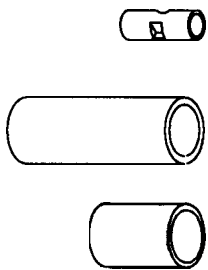
In certain cases, it is necessary to replace coil tabs.

Only genuine TELMA parts and a suitable crimping tool **RKG n° 69003** or **TELMA n° JZ800380**, should be used.



IMPORTANT: Remove the insulating varnish of the coil wires before crimping the crimp connector.

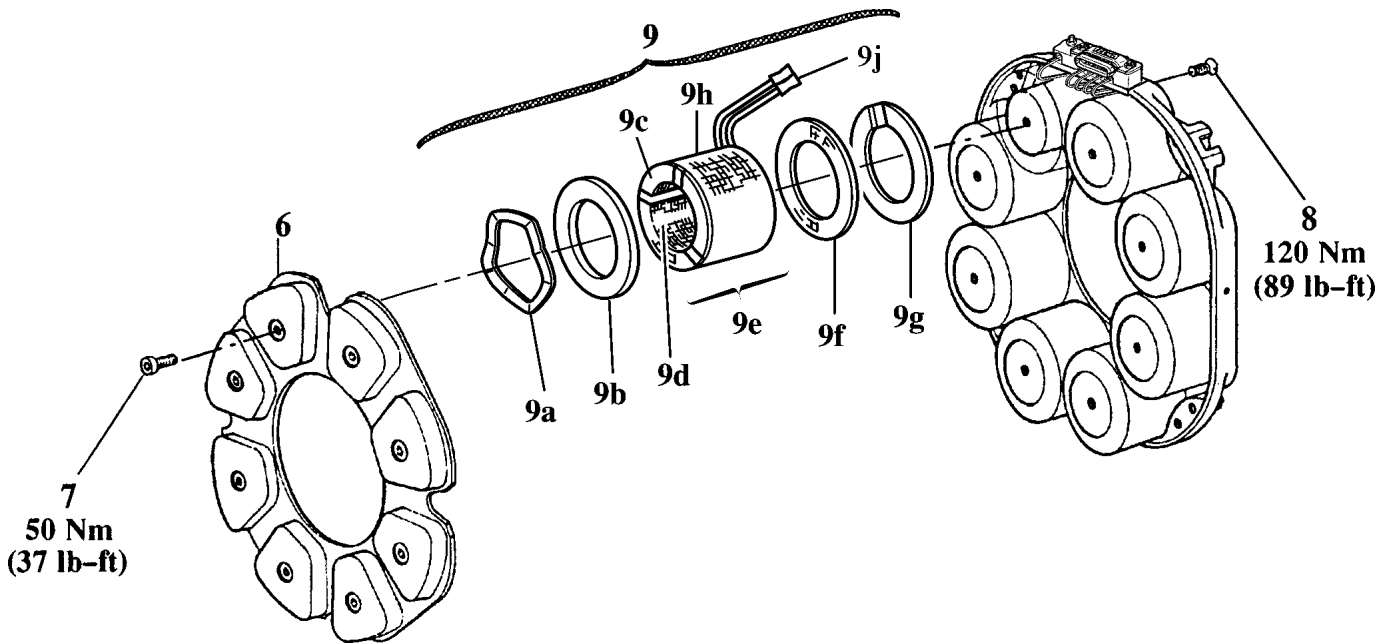
Set **VD408491** of connecting parts, including:



Description	Qty
crimp connector	16
Viton sleeve	16
red shrinking sleeve	8

After the repair, protect the wiring with varnish (1 liter can: **VH510440**).

Replacement of a coil



1 – REMOVING OF A DAMAGED COIL

- Mark the position of the pole shoe plate (item 6) with regard to the connecting block of the stator.
- Unlock the 8 socket cap screws (item 7) and remove the pole shoe plate.

Note: • On the stators with «sealed wiring», the internal wiring is moulded in Araldite. In this case, the wires must be removed carefully in order not to damage their insulators.

This work can be made easier by softening the Araldite with a hot air appliance.

DO NOT USE A TORCH.

- On «impregnated stators», the internal wiring is hold by means of securing plates (item 21) which must be deformed for dismantling the cables.
- After having identified the coil to be replaced, remove from the stator both connecting wires and mark both of them with red and blue sleeves prior to cutting the connecting wires near the crimp connectors.
- From the pole, remove the pressure washer (item 9a), the defective coil (item 9e), the coil end insulator (item 9f) and the stainless protective washer (item 9g).
- Should be coil be locked to the pole, unlock and remove the countersunk screw (item 8) which secures the pole and the coil assembly to the stator housing. Mark the position of the pole with regard to the housing in order to refit it in its original position and remove the pole and coil assembly.
- Separate the coil from the pole by using a press.

2 – CLEANING OF THE STATOR

- Remove all traces of varnish, insulating material and Araldite which may be stuck on the pole, the pole shoe plate and the stator housing.
- Reassemble the pole on the stator in its genuine position using a new screw (item 8), tightening torque: 120 Nm (= 89 lb-ft).
- Paint protective varnish, part n° VH510440, red color, on the inner side of the stator housing.

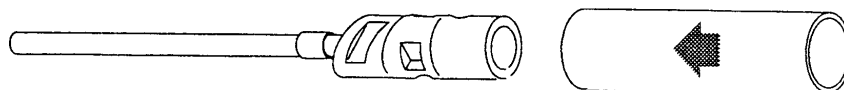
IMPORTANT :

Before bonding the coil with Araldite, make a preliminary test installation to check that the set consisting in the coil itself, the insulation washers, the protective cover and the pressure washer fit properly on the pole. The mating face for the pressure washer on the coil must be below the face of the pole in order for the pressure washer to be properly compressed by the pole shoe plate (item 6).

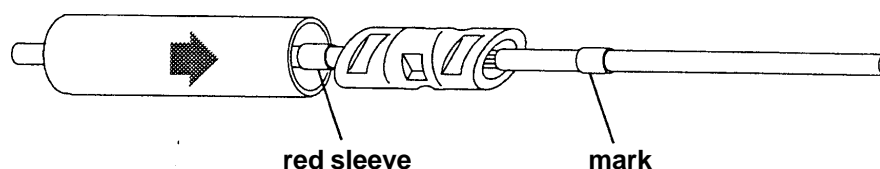
Replacement of a coil

3 – FITTING THE NEW COIL

- Place on the stator housing the new protective washer (item 9g) with the notch inside the recess of the housing for the coil wire location.
- Place the coil end insulation (item 9f) above the protective washer.
- Fit the new coil (item 9e), placing the wires inside the notch of the protective washer.
- Check that there is no excessive play between the coil and the pole, otherwise the coil must be stuck by using Araldite (refer to paragraph 4).
- Slide a viton sleeve on both wires of the new coil.



- Remove 5 mm insulation from the ends of the connecting wires.
- Following the suitable internal wiring diagram and the marks made during the disassembly, install the ends of the connecting wires inside the crimp connectors of the coil and crimp the connector.



- Slide the viton sleeve over the connector and heat shrink it.



- Depending on the type of wiring protection (sealed or impregnated), bond the terminal connections with silicone compound, part n° VH510130 or clamp them with the small cable securing plates (item 21).
- Fit the stainless protective cover (item 9b) and the pressure washer (item 9a).
- Relocate the pole shoe plate (item 6) in its original position and check that all pressure washers are properly fitted against the coils.
- Secure the pole shoe plate with 8 new screws (item 7), tightening torque: 50 Nm (= 37 lb-ft).
- After tightening, check that the coils do not turn, otherwise the other pressure washers must also be replaced.
- Make the electrical checks of the stator.

4 – PREPARATION OF THE MIXTURE OF ARALDITE AND HARDENER

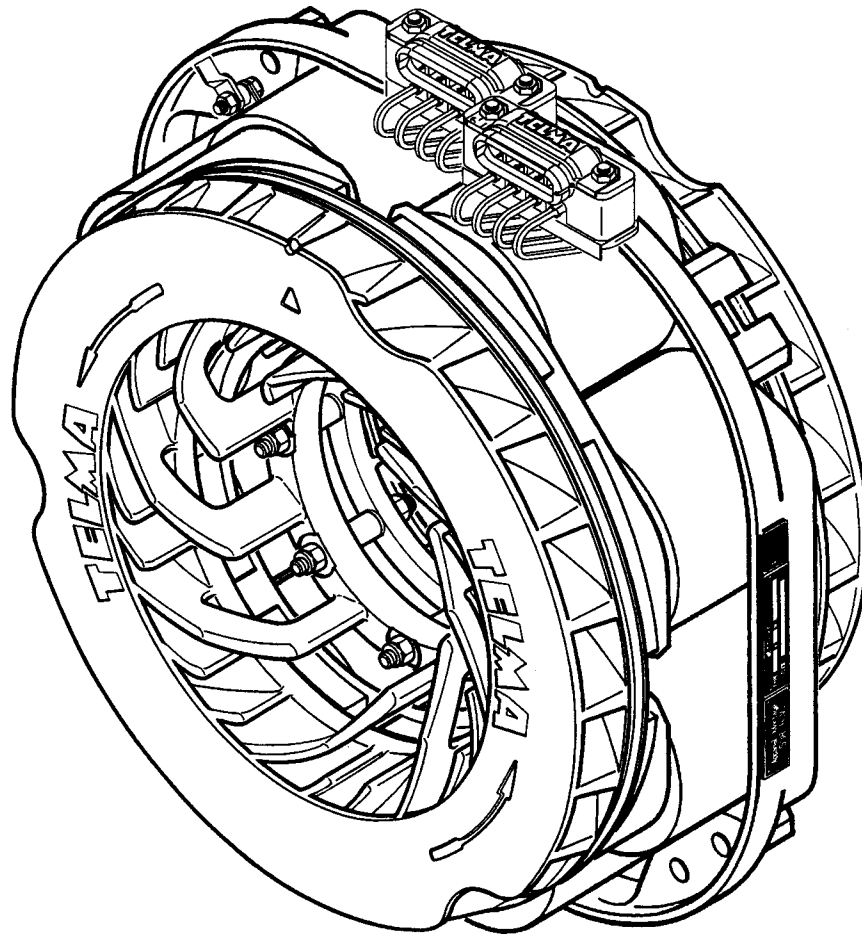
In the following text, the mixture will be designated by Araldite.

IMPORTANT : For hygiene and health reason it is recommended not to breath Araldite vapour. The contact of Araldite with the skin must also be avoided. Therefore use gloves and keep the tools and the workbench clean.

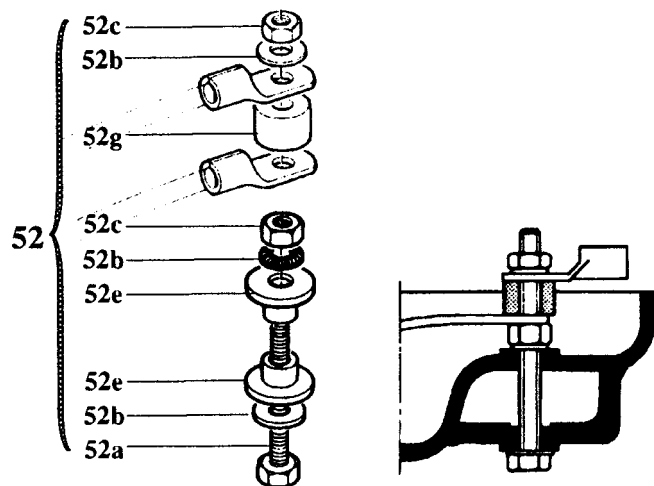
- The coils are bonded to the poles with an Araldite/hardener mixture, to be prepared with:
 - a 1 kg can of Araldite** n° : **VH510160**
 - a 400 g can of hardener** n° : **VH510310**
- The required quantity of mixture depends on the number of coils to be bonded. Approximately 60 grams of mixture are required per coil.
- Take a very clean metal container and just before use, mix 40 parts of hardener with 100 parts of Araldite for each coil to be bonded.

Polymerization time at ambient temperature of 20°C (68°F): approx. 12 hours.

FOCAL Retarders with thermal protection

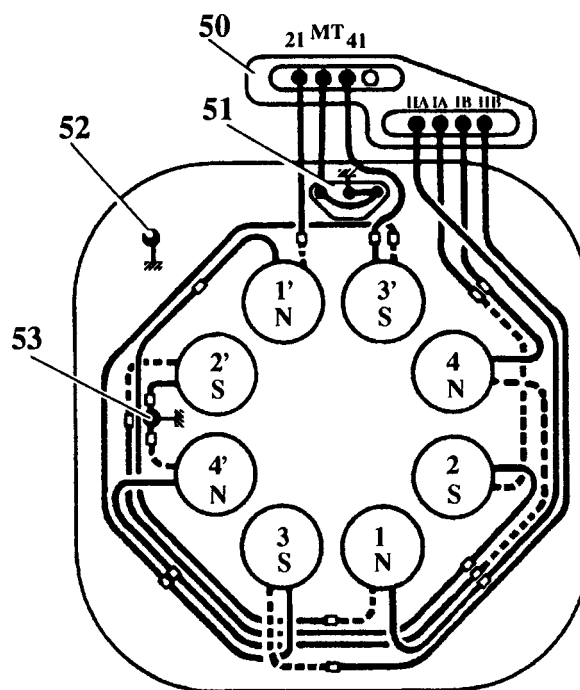


Earth terminal assembly thermal protection

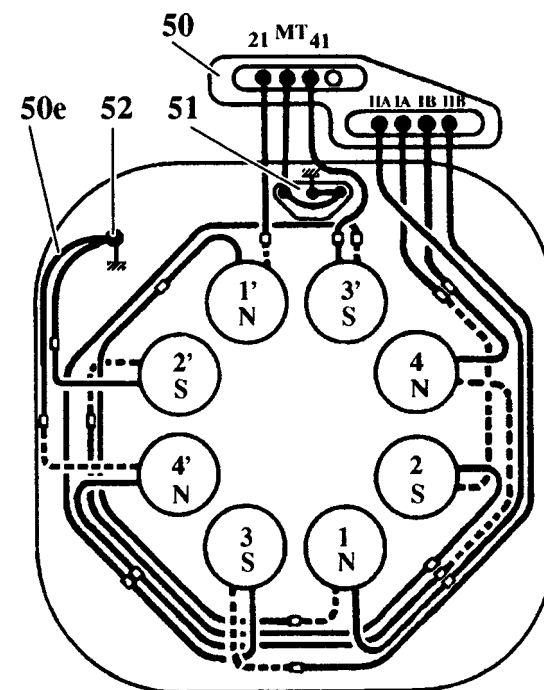


Internal wiring schematics with thermal protection (24 V layout only)

From serial number F089407
to serial number F123432

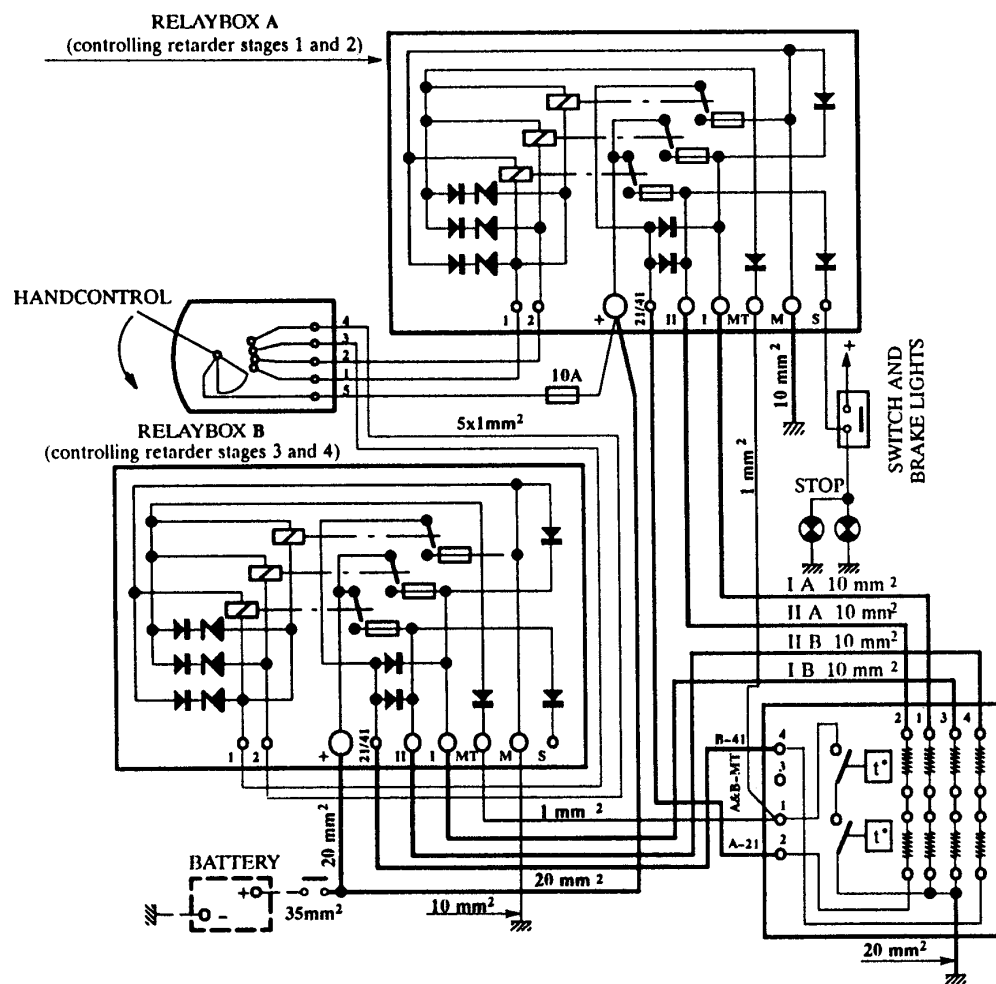


From serial number F123433

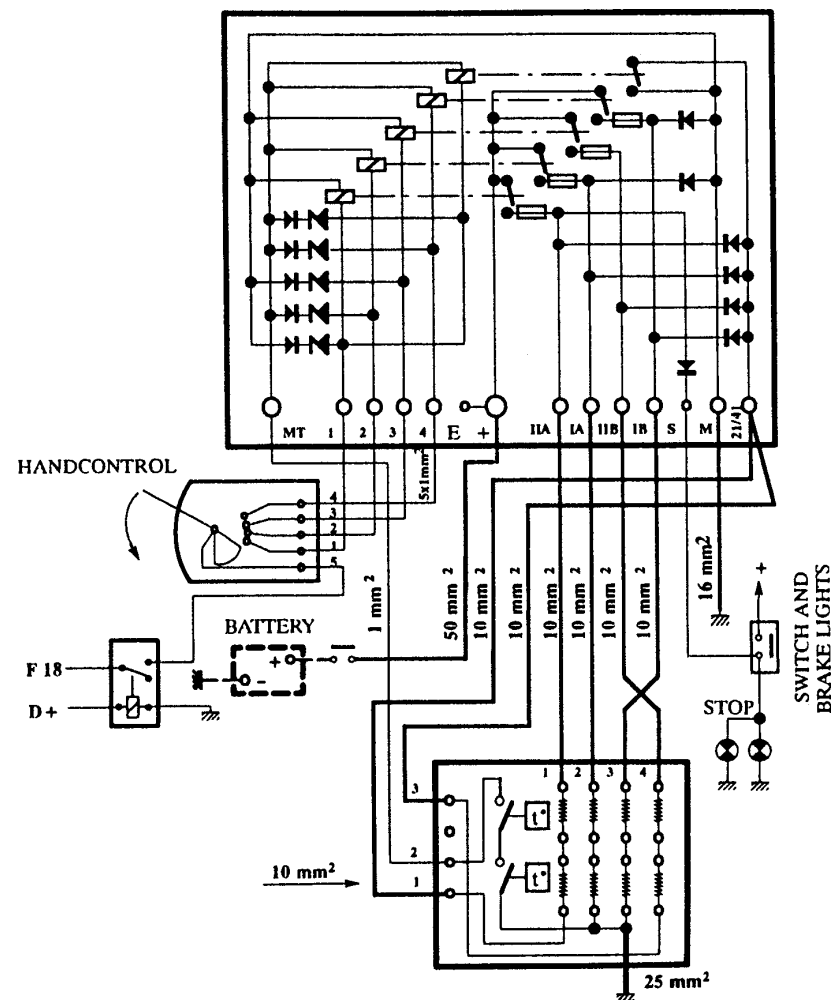


Installation wiring diagrams for FOCAL retarders with a thermal protection

Old layout with 2 relayboxes with 3 relays each
n° JD112106



Present layout with 1 relaybox with 5 relays
n° JD242110



Telma

28, rue Paul Painlevé – Z.A. du Vert Galant
F-95310 SAINT OUEN L'AUMONE – FRANCE
B.P. 692 F-95004 CERGY Cedex – FRANCE
Tel. (+33) (0) 1 34 48 54 00 – Fax : (+33) (0) 1 30 37 63 69

TELMA S.A. au capital de 24 540 450 Euros
Siège Social : 28, rue Paul Painlevé F-95310 Saint-Ouen l'Aumône
410 163 125 – R.C.S. Pontoise

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