FIATALLIS®

FX480LC

PHOENIX SERIES

CRAWLER EXCAVATOR

SERVICE MANUAL

73176979

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Reprinted

⚠ FUNDAMENTAL SAFETY INSTRUCTIONS

Organizational measures

2261965

The operating instructions must always be at hand at the place of use of the machine, e.g. by stowing them in the tool compartment or tool-box provided for such purpose.

In addition to the operating instructions, observe and instruct the user in all other generally applicable legal and other mandatory regulations relevant to accident prevention and environmental protection.

These compulsory regulations may also deal with the handling of hazardous substances, issuing and/or wearing of personal protective equipment or traffic regulations.

The operating instructions must be supplemented by instructions covering the duties involved in supervising and notifying special organizational features, such as job organization, working sequences or the personnel entrusted with the work.

Personnel entrusted with work on the machine must have read the operating instructions and in particular the chapter on safety before beginning work. Reading the instructions after work has begun is too late. This applies especially to persons working only occasionally on the machine, e.g. during setting up or maintenance.

Check - at least from time to time - whether the personnel is carrying out the work in compliance with the operating instructions and paying attention to risks and safety factors.

For reasons of security, long hair must be tied back or otherwise secured, garments must be close-fitting and no jewellery, such as rings, may be worn. Injury may result from being caught up in the machinery or from rings catching on moving parts.

Use protective equipment wherever required by the circumstances or by law.

Observe all safety instructions and warnings attached to the machine.

See to it that safety instructions and warnings attached to the machine are always complete and perfectly legible.

In the event of safety-relevant modifications or changes in the behaviour of the machine during operation, stop the machine immediately and report the malfunction to the competent authority/person.

Never make any modifications, additions or conversions which might affect safety without the supplier's approval. This also applies to the installation and adjustment of safety devices and valves as well as to welding work on load-bearing elements.

Spare parts must comply with the technical requirements specified by the manufacturer. Spare parts from original equipment manufacturers can be relied to do so.

Replace hydraulic hoses within stipulated and appropriate intervals, even if no safety-relevant defects have been detected.

Adhere to prescribed intervals or those specified in the operating instructions for routine checks and inspections.

For the execution of maintenance work, tools and workshop equipment adapted to the task on hand are absolutely indispensable.

The personnel must be familiar with the location and operation of fire extinguishers.

Observe all fire-warning and fire-fighting procedures.

Service Data General

Service Data FX 480

Hydraulikanlage
Hydraulic system

Prüf- und Einstelldaten Checking and setting data	Einheit Unit	FX 480 Nr. / No. 77 301 -
Servosteuerdruck / Servo pressure	bar/psi	45 / 653
Primärdruckabsicherung / Primary pressure relief	bar/psi	360 / 5225
Druckabschneidung für Arbeitspumpen Pressure cut-off for working pumps	bar/psi	320 / 4644
Sekundärdruckabsicherung für - Auslegerzylinder Secondary pressure relief for boom cylinder	bar/psi	380 / 5515
- Stielzylinder / stick cylinder	bar/psi	380 / 5515
- Löffelzylinder / backhoe cylinder	bar/psi	380 / 5515
- Schaufelzylinder / bucket cylinder	bar/psi	380 / 5515
- Klappenzylinder / clamshell cylinder	bar/psi	380 / 5515
- Fahrbremsventil / travel retarder valve	bar/psi	380 / 5515
Schwenkkreis - Arbeitsdruck max. Swing circuit working pressure max.	bar psi	390 5660
- Speisedruck / charge pressure	bar/psi	25 / 363
- Sekundärdruck / secondary pressure	bar/psi	420 / 6095
- Momentenregelventil Federkennlinie P_V / P_{HD} torque control valve with spring characteristic P_V / P_{HD}	bar / bar psi / psi	20 / 140 - 200 290 / 2030 - 2900
Primärdruckabsicherung für "Greifer drehen" Primary pressure relief for "grab rotation"	bar psi	110 1596
Rohrbruchsicherungsdruck (Ausleger-, Stiel- und Löffelzylinder) Pipe-burst safeguards pressure (Boom-, stick- and backhoe cylinder)	bar psi	380 5515
Kombikühler (Kühlflüssigkeit / Hydrauliköl) Combi cooler (coolant / hydraulic oil)		
- Betriebsdrehzahl-Lüfter operating speed-fan	min^{-1} rpm	ca. / approx. 1400
Steuerkolbenhub Steuerblock - Ausrüstung / Fahren Piston stroke control block - equipment / travelling	mm inch	13 [1,2)] 0.51 [1,2)]
Vorspannventil für Leitung Hydraulikölbehälter Pressurizing valve for oil reservoir line	bar psi	5 73
Bypassventil - Öffnungsdruck (Filterkammer) By-pass valve opening pressure (filter chamber)	bar psi	1,5 22
Vorspannventil - Hydraulikölbehälter Pressurizing valve on hydraulic oil reservoir	bar psi	0,35 - 0,45 5 - 6.5

1) Hubwege der Steuerkolben aus Nullage gemessen
Piston stroke measured from the neutral position

2) bei Funktion "Ausleger senken" = 12 mm
for function "lower boom" = 0.47 inch

Anziehdrehmomente
Tightening torques

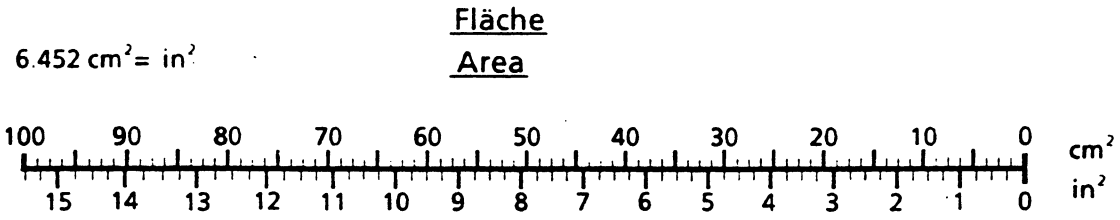
		FX 480 Nr. / No. 77 301 -		
		Unterwagen Undercarriage		Oberwagen Superstructure
Drehverbindung Swing bearing	Gewindegröße Thread size	M 20[1] / 10.9 / SW 30		M 20[1] / 10.9 / SW 30
	Sach-Nr. Part No.	73171007		73171006
	Anziehdrehmoment Tightening torque	**490 Nm 361 lbft**		**490 Nm 361 lbft**
Gegengewicht Counter weight	Gewindegröße Thread size	M 36[1] / 10.9 / SW 55		
	Sach-Nr. Part No.	73172489		
	Anziehdrehmoment Tightening torque	**3900 Nm 2877 lbft**		
Schwenkgetriebe Swing gear	Gewindegröße Thread size	M 16[2] / 10.9 / SW 14		
	Sach-Nr. Part No.	73172371		
	Anziehdrehmoment Tightening torque	**250 Nm 184 lbft**		
Motorlagerung Engine bracket	Gewindegröße Thread size	M 10[1]/10.9/SW 17	M 16[1]/10.9/SW 24	M 16 x 1,5[1]/10.9/ SW 24
	Sach-Nr. Part No.	73170567	73172378	73170563
	Anziehdrehmoment Tightening torque	**60 Nm 44 lbft**	**250 Nm 184 lbft**	**270 Nm 199 lbft**

[1] Sechskantschraube, leicht geölt
Hex. hd. screw, lightly oiled

[2] Zylinderkopfschraube, leicht geölt
Cyl. hd. screw, lightly oiled

UMRECHNUNG VON FLÄCHENMASSEN
CONVERSION FOR UNITS OF AREA

Fläche Area	in^2	ft^2	yd^2	sqmile	acre	cm^2	m^2
1 square inch (Quadratzoll)	1	0,0069				6,4516	
1 square foot (Quadratfuß)	144	1	0,111			929,03	0,0929
1 square yard (Quadratyard)	1 296	9	1		0,00021	8361,3	0,8361
1 square mile (Quadratmeile)				1	640		
1 acre		43 560	4 840	0,00156	1		4 046,9
1 cm^2	0,1550					1	0,0001
1 m^2	1 550,0	10,764	1,1960			10 000	1



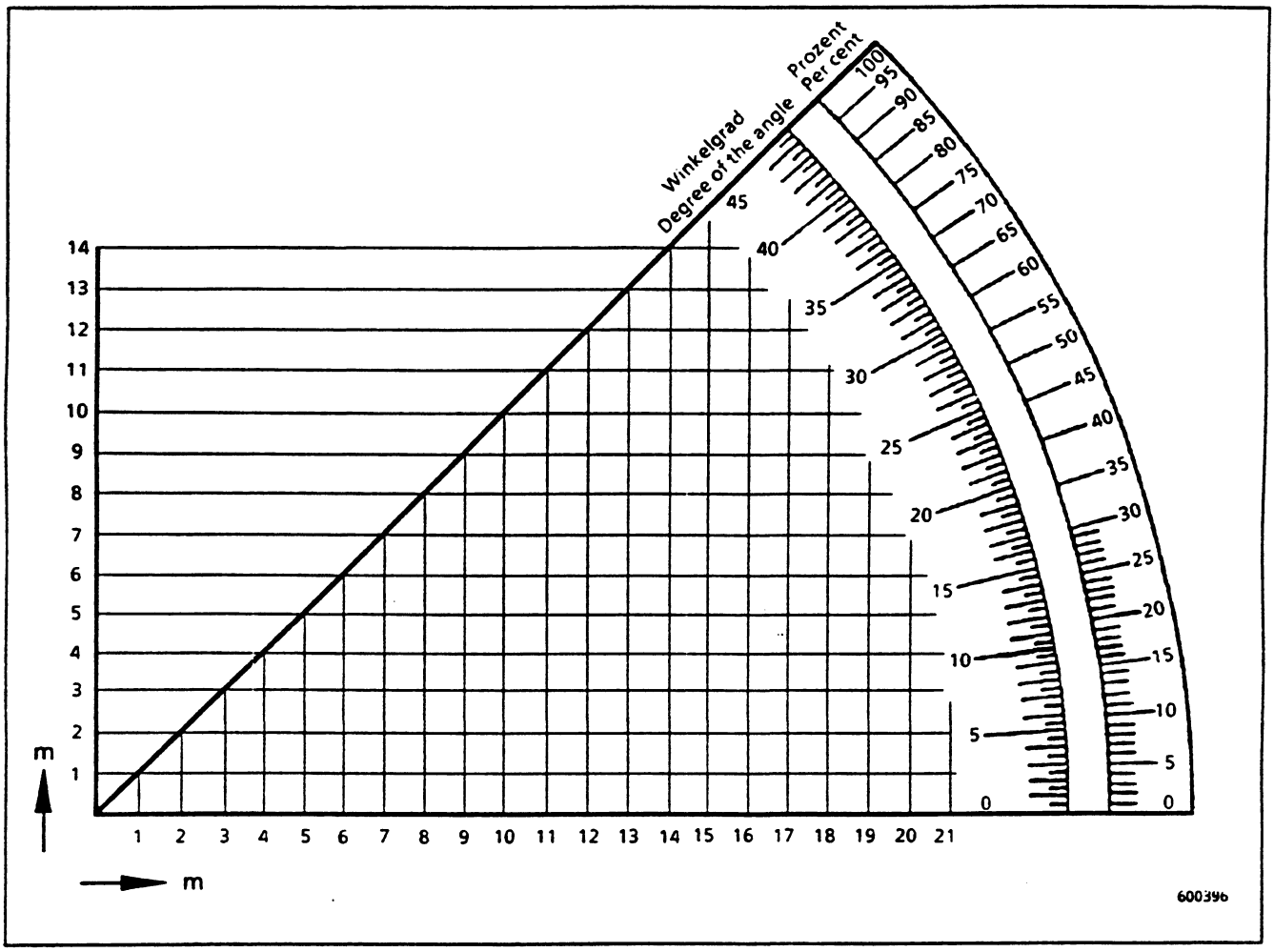
UMRECHUNGSTABELLE FÜR DRUCKEINHEITEN VON GASEN, DÄMPFEN UND FLÜSSIGKEITEN
CONVERSION TABLE FOR UNITS OF PRESSURE IN GASES, STEAM AND FLUIDS

mit 1 Pa = 1 N/m^2 = $\frac{1}{9{,}81}$ kp/m^2 = 0,102 kp/m^2

	Pa	bar	kp/m^2	at	atm	Torr
1 Pa (= 1 N/m^2) =	1	10^{-5}	0,102	$0{,}102 \times 10^{-4}$	$0{,}987 \times 10^{-5}$	0,0075
1 bar (= 0,1 MPa) =	100 000 = 10^5	1 (= 1000 mbar)	10 200	1,02	0,987	750
1 kp/m^2 =	9,81	$9{,}81 \times 10^{-5}$	1	10^{-4}	$0{,}968 \times 10^{-4}$	0,0736
1 at (= 1 kp/cm^2) =	98 100	0,981	10 000	1	0,968	736
1 atm (= 760 Torr) =	101 325	1,013 (= 1013 mbar)	10 330	1,033	1	760
1 Torr (= $\frac{1}{760}$ atm) =	133	0,00133	13,6	0,00136	0,00132	1

BERECHNUNGSBEISPIELE
CALCULATION EXAMPLES

Steigungswinkel
Angles of slope



Fahrgeschwindigkeiten
Travel speeds

$$V = \frac{360}{t}$$

V = km/h
t = Sekunden auf 100 m
Seconds needed for 100 m

Beispiel: Bei einer konstanten Geschwindigkeit werden für eine Strecke von 100 m 18 Sekunden benötigt.

Example: At a constant speed, a travel time of 18 seconds is needed for a distance of 100 meters.

$$V_{(km/h)} = \frac{360}{18} = 20 \text{ km/h}$$

RAUM- UND MASSEGRÖSSEN
QUANTITIES OF SPACE AND MASS

Größe Quantity	Formelzeichen Symbol	Einheit Unit			Umrechnung Conversion		Erläuterungen und Bemerkungen Explanations and Remarks
		alt old	neu new		Für genaue Rechnungen	für überschlägige Rechnungen (2 % Ungenaugikeit)	
			SI-Einheit SI-Units	Auswahl weitere Einheiten Selection of additional units	for exact calculation	for rough calculation appr. 2 % inexact	
Länge Length	l	µm, mm, cm dm, m, km	m	µm, mm, km			
Fläche Area	A	mm^2, cm^2, dm^2, m^2	m^2	mm^2, cm^2			
Volumen Volume	V, Vm	mm^3, cm^3, dm^3, m^3, l	m^3	mm^3, cm^3, dm^3, l			
Masse Mass	m	µg, mg, g, kg, Mg = t, (kp s^2/m)	kg	µg, mg, g Mg, t			
Dichte Density	ϱ	g/cm^3, kg/dm^3, kg/m^3, (kp s^2/m^4)	kg/m^3	g/cm^3, kg/dm^3			
Massenträgheitsmoment Inertia moment	J	kp m^2, (kp m s^2)	kg m^2	Mg m^2	1 kp m s^2 = 9,81 kg m^2	1 kp m s^2 = 10 kg m^2	
Spezifisches Volumen Specific volume	v	m^3/kg, m^3/t	m^3/kg	m^3/Mg			

NM	0	1	2	3	4	5	6	7	8	9
2810	2072.543	2073.281	2074.019	2074.756	2075.494	2076.231	2076.969	2077.706	2078.444	2079.181
2820	2079.919	2080.656	2081.394	2082.132	2082.869	2083.607	2084.344	2085.082	2085.820	2086.557
2830	2087.295	2088.032	2088.770	2089.507	2090.245	2090.982	2091.720	2092.458	2093.195	2093.933
2840	2094.670	2095.408	2096.145	2096.883	2097.620	2098.358	2099.095	2099.833	2100.571	2101.308
2850	2102.046	2102.783	2103.521	2104.259	2104.996	2105.734	2106.471	2107.209	2107.946	2108.684
2860	2109.421	2110.159	2110.896	2111.634	2112.372	2113.109	2113.847	2114.584	2115.322	2116.059
2870	2116.797	2117.535	2118.272	2119.010	2119.747	2120.485	2121.222	2121.960	2122.698	2123.435
2880	2124.173	2124.910	2125.648	2126.385	2127.123	2127.860	2128.598	2129.335	2130.073	2130.811
2890	2131.548	2132.286	2133.023	2133.761	2134.499	2135.236	2135.974	2136.711	2137.449	2138.186
2900	2138.924	2139.661	2140.399	2141.136	2141.874	2142.612	2143.349	2144.087	2144.824	2145.562
2910	2146.299	2147.037	2147.774	2148.512	2149.250	2149.987	2150.725	2151.462	2152.200	2152.937
2920	2153.675	2154.413	2155.150	2155.888	2156.625	2157.363	2158.100	2158.838	2159.575	2160.313
2930	2161.051	2161.788	2162.526	2163.263	2164.001	2164.738	2165.476	2166.214	2166.951	2167.689
2940	2168.426	2169.164	2169.901	2170.639	2171.376	2172.114	2172.852	2173.589	2174.327	2175.064
2950	2175.802	2176.539	2177.277	2178.014	2178.752	2179.490	2180.227	2180.965	2181.702	2182.440
2960	2183.177	2183.915	2184.653	2185.390	2186.128	2186.865	2187.603	2188.340	2189.078	2189.815
2970	2190.553	2191.291	2192.028	2192.766	2193.503	2194.241	2194.978	2195.716	2196.453	2197.191
2980	2197.929	2198.666	2199.404	2200.141	2200.879	2201.616	2202.354	2203.092	2203.829	2204.567
2990	2205.304	2206.042	2006.779	2207.517	2208.254	2208.992	2209.729	2210.467	2211.205	2211.942
3000	2212.680	2213.417	2214.155	2214.893	2215.630	2216.368	2217.105	2217.843	2218.580	2219.318
3010	2220.055	2220.793	2221.531	2222.268	2223.006	2223.743	2224.481	2225.218	2225.956	2226.693
3020	2227.431	2228.168	2228.906	2229.644	2230.381	2231.119	2231.856	2232.594	2233.332	2234.069
3030	2234.807	2235.544	2236.282	2237.019	2237.757	2238.494	2239.232	2239.969	2240.707	2241.445
3040	2242.182	2242.920	2243.657	2244.395	2245.132	2245.870	2246.608	2247.345	2248.083	2248.820
3050	2249.558	2250.295	2251.033	2251.771	2252.508	2253.246	2253.983	2254.721	2255.458	2256.196
3060	2256.933	2257.671	2258.408	2259.146	2259.884	2260.621	2261.359	2262.096	2262.834	2263.572
3070	2264.309	2265.047	2265.784	2266.522	2267.259	2267.997	2268.734	2269.472	2270.209	2270.947
3080	2271.685	2272.422	2273.160	2273.897	2274.635	2275.372	2276.110	2276.847	2277.585	2278.323
3090	2279.060	2279.798	2280.535	2281.273	2282.010	2282.748	2283.486	2284.223	2284.961	2285.698
3100	2286.436	2287.173	2287.911	2288.648	2289.386	2290.124	2290.861	2291.599	2292.336	2293.074
3110	2293.811	2294.549	2295.287	2296.024	2296.762	2297.499	2298.237	2298.974	2299.712	2300.449
3120	2301.187	2301.925	2302.662	2303.400	2304.137	2304.875	2305.612	2306.350	2307.087	2307.825
3130	2308.562	2309.300	2310.038	2310.775	2311.513	2312.250	2312.988	2313.726	2314.463	2315.201
3140	2315.938	2316.676	2317.413	2318.151	2318.888	2319.626	2320.364	2321.101	2321.839	2322.576
3150	2323.314	2324.051	2324.789	2325.526	2326.264	2327.002	2327.739	2328.477	2329.214	2329.952
3160	2330.689	2331.427	2332.165	2332.902	2333.640	2334.377	2335.115	2335.852	2336.590	2337.327
3170	2338.065	2338.802	2339.540	2340.278	2341.015	2341.753	2342.490	2343.228	2343.966	2344.703
3180	2345.441	2346.178	2346.916	2347.653	2348.391	2349.128	2349.866	2350.604	2351.341	2352.079
3190	2352.816	2353.554	2354.291	2355.029	2355.766	2356.504	2357.241	2357.979	2358.717	2359.454
3200	2360.192	2360.929	2361.667	2362.405	2363.142	2363.880	2364.617	2365.355	2366.092	2366.830
3210	2367.567	2368.305	2369.042	2369.780	2370.518	2371.255	2371.993	2372.730	2373.468	2374.205
3220	2374.943	2375.681	2376.418	2377.156	2377.893	2378.631	2379.368	2380.106	2380.844	2381.581
3230	2382.319	2383.056	2383.794	2384.531	2385.26 9	2386.006	2386.744	2387.481	2388.219	2388.957
3240	2389.694	2390.432	2391.169	2391.907	2392.645	2393.382	2394.120	2394.857	2395.595	2396.332
3250	2397.070	2397.807	2398.545	2399.282	2400.020	2400.758	2401.495	2402.233	2402.970	2403.708
3260	2404.445	2405.183	2405.920	2406.658	2407.396	2408.133	2408.871	2409.608	2410.346	2411.083
3270	2411.821	2412.559	2413.296	2414.034	2414.771	2415.509	2416.246	2416.984	2417.721	2418.459
3280	2419.197	2419.934	2420.672	2421.409	2422.147	2422.884	2423.622	2424.360	2425.097	2425.835
3290	2426.572	2427.310	2428.047	2428.785	2429.522	2430.260	2430.998	2431.735	2432.473	2433.210
3300	2433.948	2434.685	2435.423	2436.160	2436.898	2437.635	2438.373	2439.111	2439.848	2440.586
3310	2441.323	2442.061	2442.799	2443.536	2444.274	2445.011	2445.749	2446.486	2447.224	2447.961
3320	2448.699	2449.437	2450.174	2450.912	2451.649	2452.387	2453.124	2453.862	2454.599	2455.337
3330	2456.075	2456.812	2457.550	2458.287	2459.025	2459.762	2460.500	2461.238	2461.975	2462.713
3340	2463.450	2464.188	2464.925	2465.663	2466.400	2467.138	2467.875	2468.613	2469.351	2470.088
3350	2470.826	2471.563	2472.301	2473.039	2473.776	2474.514	2475.251	2475.989	2476.726	2477.464
3360	2478.201	2478.939	2479.677	2480.414	2481.152	2481.889	2482.627	2483.364	2484.102	2484.839
3370	2485.577	2486.314	2487.052	2487.790	2488.527	2489.265	2490.002	2490.740	2491.478	2492.215
3380	2492.953	2493.690	2494.428	2495.165	2495.903	2496.640	2497.378	2498.115	2498.853	2499.591
3390	2500.328	2501.066	2501.803	2502.541	2503.278	2504.016	2504.754	2505.491	2506.229	2506.966
3400	2507.704	2508.441	2509.179	2509.917	2510.654	2511.392	2512.129	2512.867	2513.604	2514.342
3410	2515.079	2515.817	2516.554	2517.292	2518.030	2518.767	2519.505	2520.242	2520.980	2521.718
3420	2522.455	2523.193	2523.930	2524.668	2525.405	2526.143	2526.880	2527.618	2528.355	2529.093
3430	2529.831	2530.568	2531.306	2532.043	2532.781	2533.518	2534.256	2534.993	2535.731	2536.469
3440	2537.206	2537.944	2538.681	2539.419	2540.156	2540.894	2541.632	2542.369	2543.107	2543.844
3450	2544.582	2545.319	2546.057	2546.794	2547.532	2548.270	2549.007	2549.745	2550.482	2551.220
3460	2551.957	2552.695	2553.433	2554.170	2554.908	2555.645	2556.383	2557.120	2557.858	2558.595
3470	2559.333	2560.071	2560.808	2561.546	2562.283	2563.021	2563.758	2564.496	2565.233	2565.971
3480	2566.708	2567.446	2568.184	2568.921	2569.659	2570.396	2571.134	2571.872	2572.609	2573.347
3490	2574.084	2574.822	2575.559	2576.297	2577.034	2577.772	2578.510	2579.247	2579.985	2580.722
3500	2581.460	2582.197	2582.935	2583.672	2584.410	2585.148	2585.885	2586.623	2587.360	2588.098

GESCHWINDIGKEITEN
SPEED

1 km / h	=	0,27778 m / s	1 m / s	=	3,6 km / h
1 mile / h	=	1,60934 km / h	1 km / h	=	0,62137 mile / h
1 kn (Knoten)	=	1,852 km / h	1 km / h	=	0,53996 kn
1 ft / min	=	0,3048 m / min	1 m / min	=	3,28084 ft / min

	Umrechnung von Conversion for								
	km / h	**m / s**	**km / h**	**mile / h (mph)**	**kn**	**ft / min**	**km / h**	**mile / h (mph)**	**km / h**
	in m / s	in km / h	in mile / h	in km / h	in km / h	in m / min	in Zeit / km	in Zeit / km	in Zeit / 100 km
10	2,78	36,0	6,21	16,1	18,52	3,05	6 min	3 min 44 s	10 h
20	5,56	72,0	12,4	32,2	37,04	6,10	3 min	1 min 52 s	5 h
30	8,33	108	18,6	48,3	55,56	9,14	2 min	1 min 15 s	3 h 20 min
40	11,1	144	24,9	64,4	74,08	12,2	1 min 30 s	55,9 s	2 h 30 min
50	13,9	180	31,1	80,5	92,60	15,2	1 min 12 s	44,7 s	2 h
60	16,7	216	37,3	96,6	111	18,3	1 min	37,3 s	1 h 40 min
70	19,4	252	43,5	113	130	21,3	51,4 s	32,0 s	1 h 26 min
80	22,2	288	49,7	129	148	24,4	45 s	28,0 s	1 h 15 min
90	25,0	324	55,9	145	167	27,4	40 s	24,9 s	1 h 6,7 min
100	27,8	360	62,1	161	185	30,5	36 s	22,0 s	1 h
110	30,6	396	68,4	177	---	33,5	32,7 s	20,3 s	54 min 33 s
120	33,4	432	74,6	193	---	36,6	30 s	18,6 s	50 min
130	36,1	468	80,8	209	---	39,6	27,7 s	17,2 s	46 min 9 s
140	38,9	504	87,0	225	---	42,7	25,7 s	16,0 s	42 min 51s
150	41,7	540	93,2	241	---	45,7	24 s	14,9 s	40 min
160	44,4	576	99,4	257	---	48,8	22,5 s	14,0 s	37 min 30 s
170	47,2	612	106	274	---	51,8	21,2 s	13,2 s	35 min 18 s
180	50,0	648	112	290	---	54,9	20,0 s	12,4 s	33 min 20 s
190	52,8	684	118	306	---	57,9	18,9 s	11,8 s	31 min 35 s
200	55,6	720	124	322	---	61,0	18 s	11,2 s	30 min
250	59,4	900	155	402	---	76,2	14,4 s	8,9 s	26 min
300	83,3	1080	186	483	---	91,4	12 s	7,5 s	20 min
400	111	1440	249	644	---	122	9 s	5,8 s	15 min
500	139	1800	311	805	---	152	7,2 s	4,5 s	12 min
600	167	2160	373	966	---	183	6 s	3,7 s	10 min
800	222	2880	497	1287	---	244	4,5 s	2,8 s	7 min 30 s
1000	278	3600	621	1609	---	305	3,6 s	2,2 s	6 min
1200	333 1)	---	746	---	---	366	3 s	---	5 min
1400	389	---	870	---	---	427	2,6 s	---	4 min 17 s

Die Machzahl Ma (keine gesetzliche Einheit) gibt an, wieviel mal schneller ein Körper sich bewegt als der Schall. Ma = 1,3 bedeutet also 1,3fache Schallgeschwindigkeit.

The Mach number 'Ma' (no official unit of measurement) gives the factor by which a body is faster, than the speed of sound.
Thus 'Ma' = 1.3 means 1.3 times as fast as the speed of sound.

1) Etwa Schallgeschwindigkeit in Luft.
Approximate velocity of sound in the air.

CONTENTS

VACUUM PUMP

During the removal of hydraulic lines and hydraulic pumps, hydraulic oil will flow out of the hydraulic reservoir. For this reason, a vacuum pump for the machine is available as an option which prevents emptying of the hydraulic reservoir when properly used.
The pump can be ordered under P/N 73176683.
For more extensive repair operations, a box containing a complete set of environment protection plugs can be ordered under P/N 73176697. These plugs can be used to close the dismantled lines.

Connecting the vacuum pump

The vacuum pump is connected to the vehicle batteries. The pumping operations should therefore be carried on only for a short time, e.g. for changing hoses or for fitting the supplied environment-protection plugs.

- Depressurize the hydraulic reservoir. To do so, screw out drain plug (1, Fig. 1).

- Screw out the breather filter (2, Fig. 1).

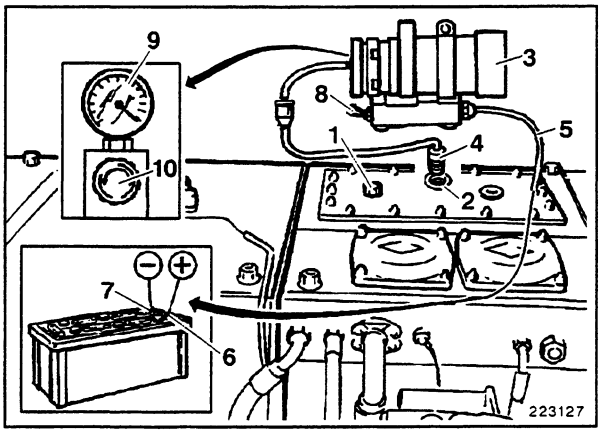


Fig. 1

- Place the vacuum pump (3) on top of the hydraulic reservoir. The pump must be installed above the oil level.

- Press hose connection (4) gently into opening (2).

- Lay cable (5) to the batteries. Connect first the positive terminal (6) to the positive pole and then the negative terminal (7) to the negative pole of the battery.

- Switch on the vacuum pump (3) with switch (8). The oil in the hydraulic system will first be drawn back into the hydraulic reservoir before air is constantly sucked into the reservoir through the oil filling so that the oil surface is bubbling. The vacuum thus created prevents the hydraulic reservoir from being emptied. The pressure indicated by gauge (9) must be 0.2 bars. If the pressure indicated is different, use rotary switch (10) to set the correct pressure.

⚠ CAUTION

Before carrying out any works as, for instance, replacing hydraulic lines, close all openings with the environment-protection plugs. Do not stop the vacuum pump while plugging the openings.

Shut off the vacuum pump when the work is finished.
Disconnect cable (5) from the battery. Disconnect first the negative cable and then the positive one from the respective battery poles.
Remove the pump by proceding in reverse order.

□

Item	Quan.	Description	Weight kg / lb	Torque				
				Thread size	Material grade	Wrench size mm	M_A Nm	Torque lbft.
1	72	Hex. bolt		M 20	10.9	30	580	427
2	18	Bottom roller	75 / 165					
3	2	Track chain	1028 / 2270					
4	8	Hex. bolt		M 16	10.9	24	295	217
5	4	Top roller	35 / 77					
6	106	Track pad	37 / 82					
7	400	Nut						
8	400	Hex. bolt		3/4"x16 UNF	12.9	28	585	431
9	2	Master pin						
10	1	Chain segment	16	36				
11	4	Sealing washer						
12	4	End washer						
13	2	End bushing						
14	4	Step	24 / 53					
15	16	Hex. bolt		M16	8.8	24	170	125
16	16	Washer						
17	4	Chain guide						
18	32	Washer						
19	32	Hex. bolt		M20	10.9	30	490	360

Components of the idler

Item	Quan.	Description	Weight kg / lb	Torque				
				Thread size	Material grade	Wrench size mm	M_A Nm	Torque lbft.
1	2	Locking pin						
2	2	Slider piece	39 / 86					
3	2	Bushing						
4	2	O-Ring						
5	1	Shaft	26 / 57					
6	1	Screw plug						
7	1	Sealing ring						
8	1	Idler	220 / 485					
9	2	Duo-cone seal						
10	1	Spacer piece	72 / 160					
11	4	Lock washer						
12	4	Hex. bolt		M 16	8.8	24	170	125
13	1	Tensioning cylinder	432 / 950					
14	1	Grease cylinder	63 / 140					
15	1	Scraper						
16	1	Sealing ring						
17	4	Hex. bolt		M 20	8.8	30	350	258
18	4	Lock washer						
19	2	Disk						
20	8	Locking pin						
21	1	Grease valve						
22	1	Cover						
23	2	Lock washer						
24	2	Hex. bolt		M 8	8.8	13	--	--
25	2	Hex. bolt		M 16	8.8	24	170	125
26	2	Lock washer						

Travel gearbox

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Removal and installation

The removal and installation of the travel gearbox is described in chapter 07. □

⚠ WARNING

Securing the working equipment

Before carrying out assembly work, the machine and the attachments must be secured against inadvertent and unauthorized starting, e.g. by placing chocks under the wheels or tracks and by setting the working equipment on the ground.

Set the working equipment on the ground in such a way that no movements can be made when mechanical or hydraulic connections become detached.

Secure any equipment or component which is to be mounted or dismantled or whose position is to be changed using hoists or appropriate slinging/supporting devices to prevent them from moving, slipping or falling inadvertently.

Systems and units (e.g. pipes, accumulators, etc.) must be properly depressurized before being opened.

Protective devices on moving machine parts may be opened or removed only when the drive unit is stationary and protected against inadvertent starting.

Before recommissioning, all protective devices must be refitted.

⚠ WARNING

Hydraulic and lubricating system

Always observe the safety regulations applicable to the product when handling oils, greases and other chemical substances.

Unused but open bores, pipelines and hose connections must be closed in a pressure-tight manner.

Refill collected hydraulic oil back into the hydraulic system only through the return-flow filters.

Dispose of waste oil without polluting the environment.

Observe the correct working sequence when fitting or replacing components or equipment.

The working sequence has been specified and tested by qualified experts.

Replace defective, mechanically prestressed units only as an entirety. Never open them.

In exceptional cases, open only when the system and the operating sequence are precisely known. The Technical Manual contains no information on such work. When the machine is at operating temperature, the consumables are at least at the same temperature. Precautions must therefore be taken to prevent burning or scalding.

Be careful when handling acids, e.g. battery acid. Acid splashes may injure the eyes and the skin.

Do not smoke when handling flammable liquids.

Be careful with open flames and unprotected light.

Not only fuel but also other consumables often have a low flash point and catch fire easily.

Installing the swing bearing

- If a new swing bearing is to be installed, first remove the anti-corrosion coating.
- Clean all contact surfaces on the superstructure and the undercarriage thoroughly. The contact surfaces must be bright, dry and grease-free. Remove any roughness and burrs. Clean drilled holes in the undercarriage. Clean the threaded holes on the superstructure carefully, checking threads and recutting them if damaged.
- Apply a bonding agent (P/N 73171476) to the contact surface on the undercarriage, using a paint roller, a hard brush or a plastic spatula.

⚠ WARNING

Keep the bonding agent away from the drilled holes. Any bonding agent in the threads causes increased friction and consequently to invalidates the tightening torque data.

- Take the new swing bearing into the lifting tackle. Turn inner and outer raceway until the "S"-mark on the outer raceway is at 90 degrees to the travelling direction, and the "S"-mark on the inner raceway is opposite (Fig. 7).

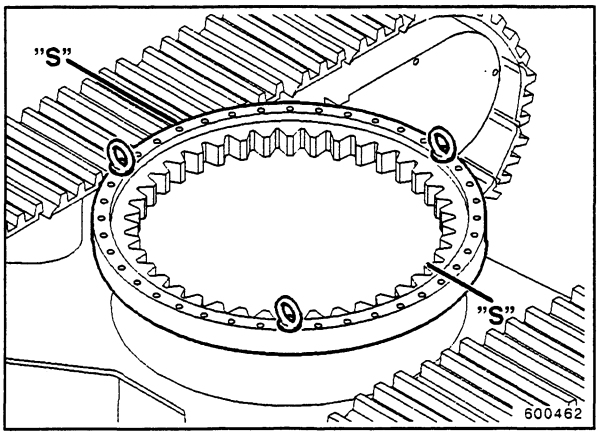


Fig. 7

Swing bearings are hardened inductively. The "S"-mark marks those points between start and end of raceway hardening, which, due to the hardening process - could not be hardened. The swing bearing is therefore deliberately installed in such a way that those points are outside the main stress zone.

- Swing the bearing above the undercarriage, swing it above the contact surface without setting it down. Screw in at least three new screws (4, Fig. 6) with spacers (3) as a guide. Set down slewing ring carefully.
- Remove lifting tackle from slewing ring.
- Screw in the other new screws with the spacers and tighten crosswise with a torque wrench (see table for tightening torque).
  Mark tightened screws.
- Apply the bonding agent to the contact surface of the superstructure, as described above.
- Apply grease generously to the teeth of the swing bearing until the gaps between the teeth are filled with grease.
- Swing the superstructure above the undercarriage and swing it above the swing bearing without setting it down.
- Continue to lower the superstructure carefully, guiding the pinion into the teeth.
- Screw in at least three new screws (6, Fig. 6) with spacers (7) as a guide.
- Lower the superstructure carefully.
- Screw in the other new screws with spacers and tighten crosswise with a torque wrench (see table for tightening torque).
  Mark tightened screws. (A screw cannot be mounted in the slewing gearbox area for structural reasons).
- Re-install the rotor locking element (Fig. 4).
- Connect all hydraulic lines to the rotor.
- Remove the lifting tackle from the superstructure.
- Start up the machine and check all hydraulic lines at the rotor for tightness.
- The bonding agent between slewing ring and undercarriage / superstructure increases the load capacity of the screwed connection while sealing the joint gaps.
  The bonding agent hardens without exposure to air. The ultimate strength is attained after six hours. Only then may the machine be fully loaded.

□

Installing the coupling

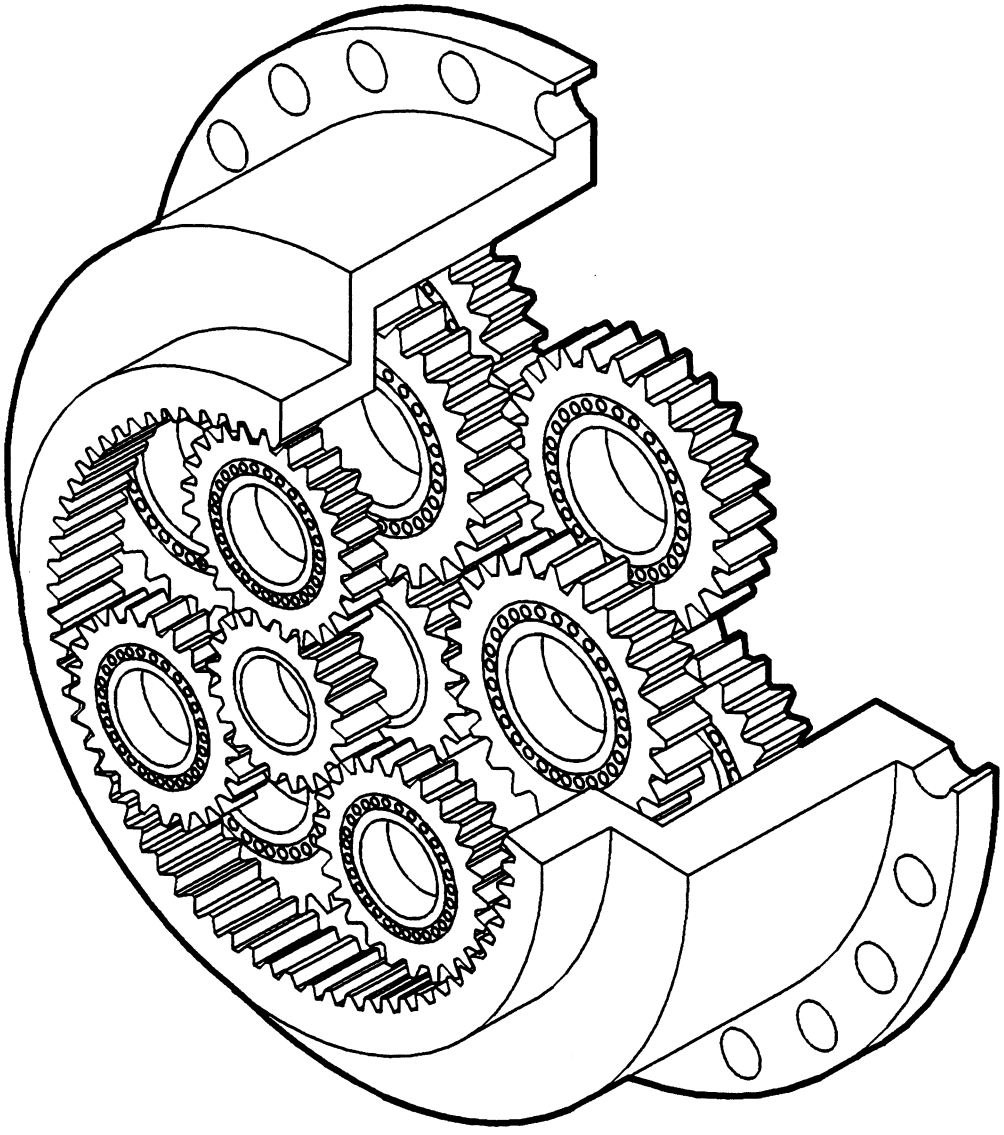
- Check all coupling components for damage; replace any damaged components.
- Push the coupling hub (1, Fig. 2) onto the pump shaft as far as the limit stop, tighten the setscrew (4) with a torque wrench (see table for tightening torques).
- Mount the coupling flange (4, Fig. 1) with the bolts (3) on engine flywheel (see table for tightening torques).
- Insert resilient coupling element (2, Fig. 2).
- Take the hydraulic pumps into the lifting tackle and position them for installation so that the coupling components engage.
- Install the bolts (2, Fig. 1) and tighten them with a torque wrench (see table for tightening torques).
- Connect the intake, pressure and control lines to the hydraulic pumps.
- Vent the air from the hydraulic pumps and the hydraulic system (see Owner's Manual). □

Traveling Gearbox

FIATALLIS®

Technical Handbook

Traveling Gearbox
Type F 100



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⚠ WARNING

Handling Oil and Grease

Contact of your skin with waste oil may be dangerous to your health.

Avoid skin contact. Wear gloves and close workwear.

Thoroughly wash soiled skin with warm soap water and apply protective skin cream. Do not use fuel or solvents to clean your skin.

If you have swallowed oil, do not vomit and consult a doctor immediately.

Apparent Oil Loss

In case of apparent oil loss, repair the leakage (or have it repaired) immediately.

Leaking oil endangers the environment!

Remove leak oil by an absorbent. Take the oil absorbent and do not dispose of together with other waste.

⚠ WARNING

Environmentally Favorable Disposal

Dispose of oil, grease, cleaners, solvents and oily components such as filters, cleaning rags, replaced wear parts and useless machine parts in an environmentally favourable manner and separate of one another.

Do not add such materials to your normal domestic waste.

Fill such materials into the containers provided for them.

Do not let oil and oily waste penetrate into the ground or into waters to prevent pollution of the environment.

□

Always replace a slide ring seal after a running time of 1500 hrs.

If slide rings are still in exellant condition, replace the O-rings in any case.

For ordering numbers, please refer to the List of Spare Parts.

Check the tapered roller bearing and replace, if necessary. For gear repairing on site, tapered roller bearings only have to be replaced rarely.

If necessary, rework the thread on the axle tube with a thread restorer and clean thoroughly.

Always replace the slotted round nut!

Try on a new slotted round nut and the adjusting nut (S1).

The new slotted nut must go freely across the entire thread length of the axle tube.

Thoroughly debur the snap ring groove and the pocket (brake oil duct) in the axle tube.

Clean and check all parts. □

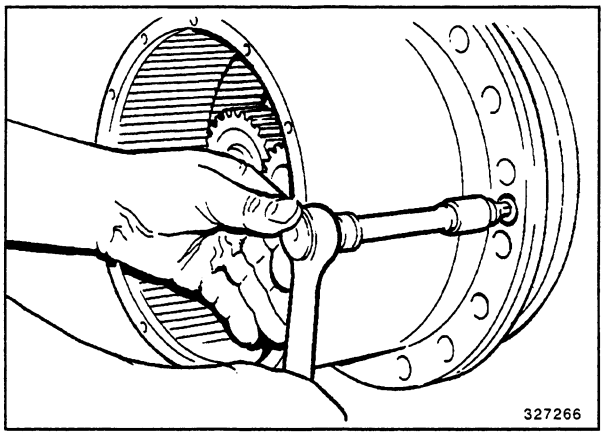

Fig. 58
Secure the ring gear fastening screws with liquid screw locking agent (P/No. 73171473) and tighten.
For the tightening torque, refer to Table 1 in the Annex.

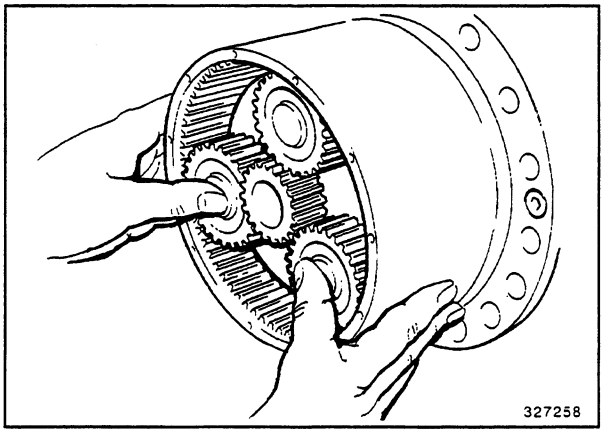

Fig. 59
Insert planetary stage 2.

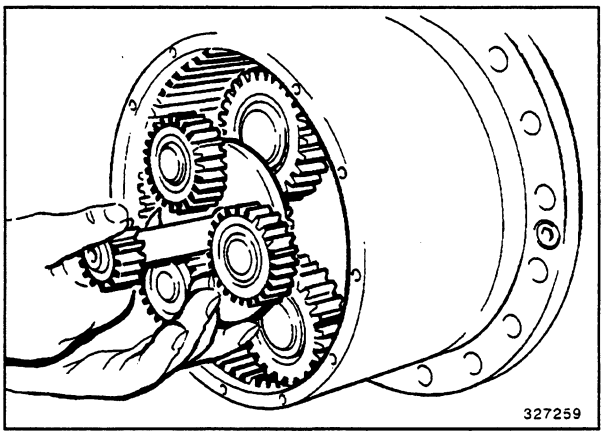

Fig. 60
Insert planetary stage 1.
Insert the drive shaft and turn the shaft until the teeth engage.

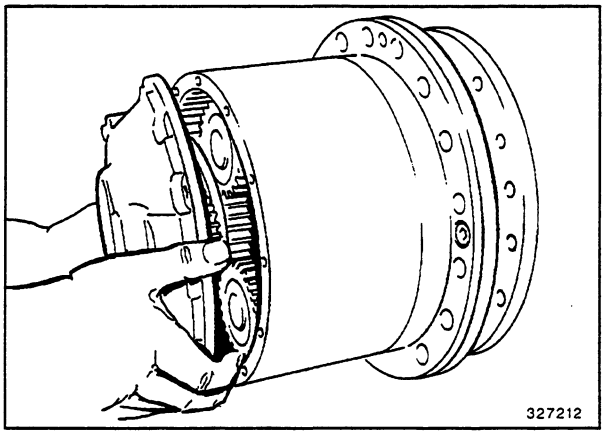

Fig. 61
Fit the cover with a new O-ring. Seal the parting line between the cover and the ring gear with cement (P/No. 73171476).

Table 1

Gearbox Model: F 100

Screw Item	Thread (mm)	Quality	Tightening Torque M_A Nm (lbft)	Screw Locking P/No. 73171473
126	M 212 x 2	-	-	1)
180	M 10	12.9	75 (55)	X
184	M 12	8.8	92 (68)	X
190	M 16 x 1,5	-	35 (25)	-
404	M 20	8.8	470 (346)	X

1) Lock slotted round nut by staking.

Dismantling the swing gearbox

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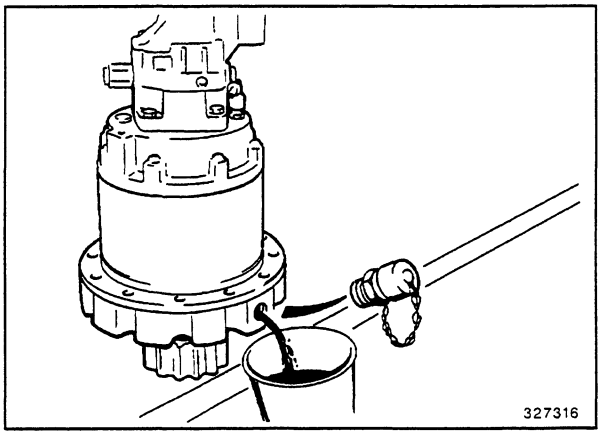


Fig. 1
Drain off oil through the drain plug.
Screw out the drain plug to remove any remaining amounts of oil in the gearbox.
Mark all parts mounted together such as swing motor/multiple-disk brake and multiple-disk brake/ring gear with a prick punch.

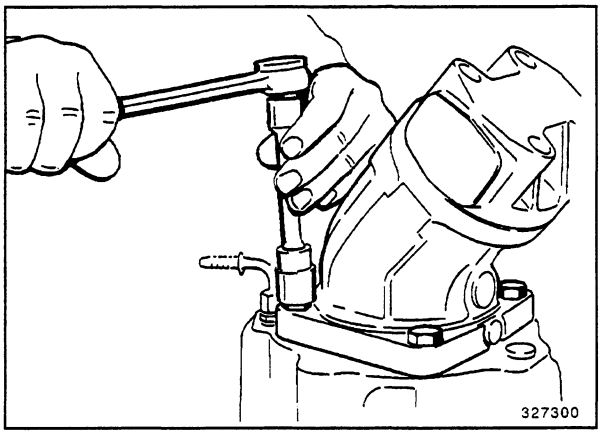


Fig. 2
Loosen the hex bolts at the swing motor.
Lift off the swing motor.

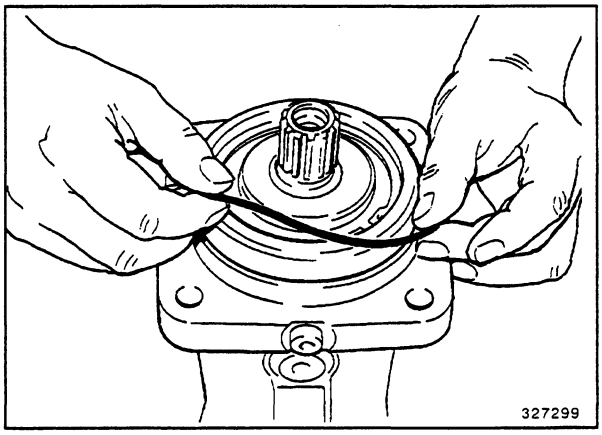


Fig. 3
Remove the O-ring.

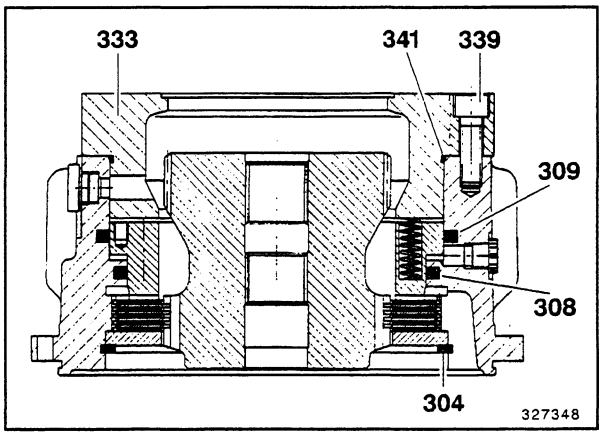


Fig. 4
Swing gearbox S 13, S 16 only:

⚠ WARNING

The cylinder-head screws (339) and the flange (333) are under high spring pressure.

Loosen the cylinder-head screws only if the multiple-disk brake must be dismantled, too. See chapter "Dismantling multiple-disk brake S 13/16".

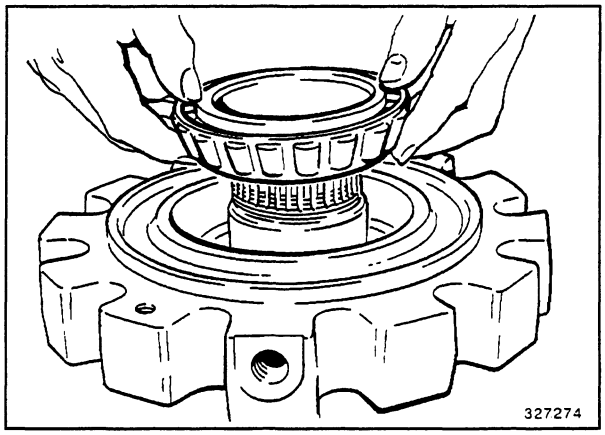


Fig. 17
Insert the inner ring of the tapered roller bearing.

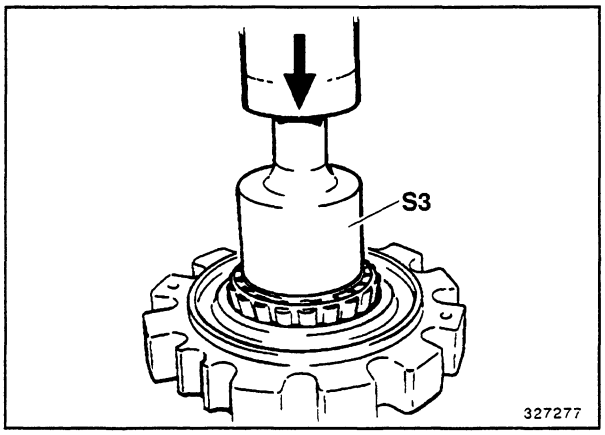


Fig. 18
Press inner ring of bearing completely down the housing using a suitable bushing or the fitting sleeve (S3).

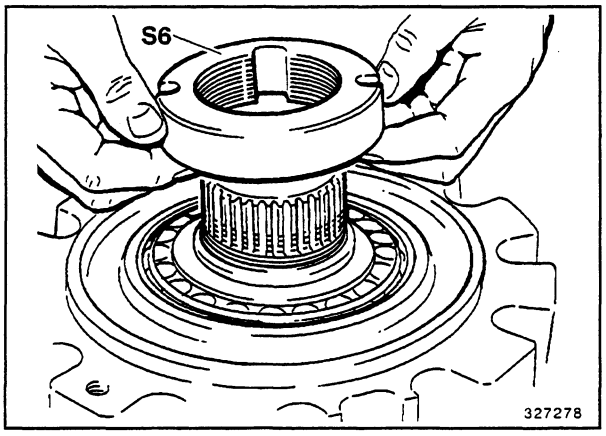


Fig. 19
Screw on the adjusting nut (S6).

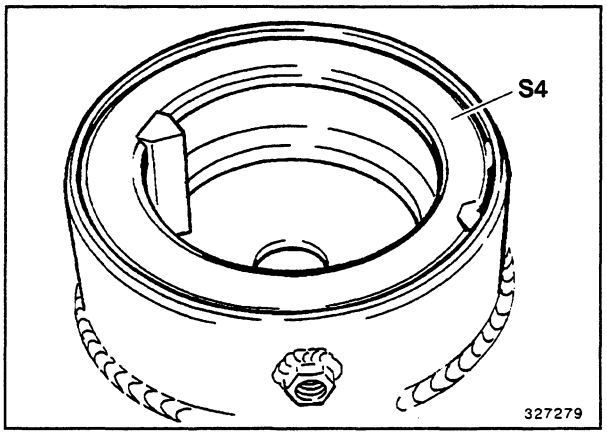


Fig. 20
Fitting device (S4) for swing pinion assembly. Different inserts are available depending on the gearbox or the swing pinion.

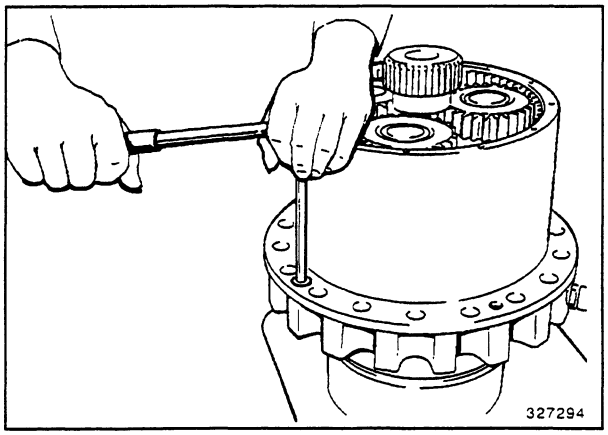


Fig. 52
Tighten the two cylinder-head screws alternately.
The tightening torque is set out in table 1 in the Annex.

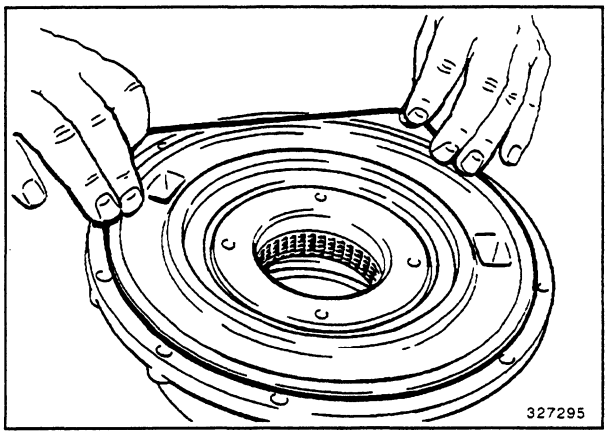


Fig. 53
Place the O-ring into the circumferential groove on the flange of the multiple-disk brake oiling the ring lightly.

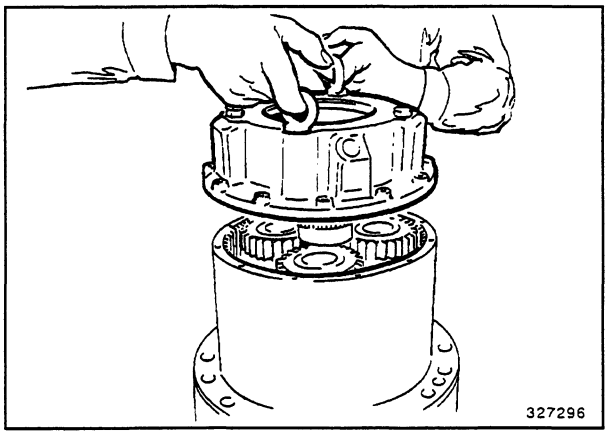


Fig. 54
Place multiple-disk brake on disk carrier and ring gear.
Observe the marks applied on the brake/ring gear during the dismantling operations.

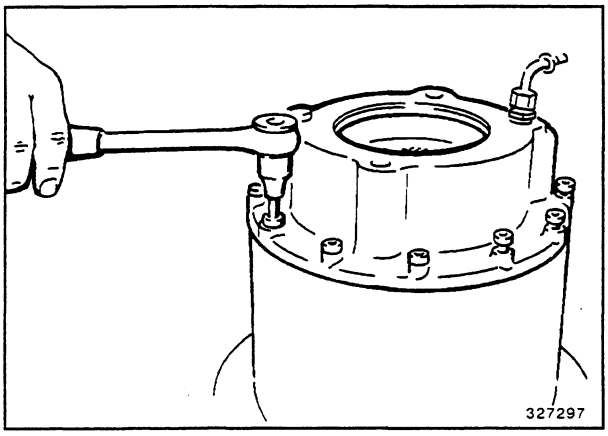


Fig. 55
Secure the cylinder-head screws with liquid screw fixer P/N 73171473 and tighten crosswise.
The tightening torque is set out in table 1 in the Annex.

SWING GEARBOX

Item	Quantity	Designation
1	1	Swing gearbox
3	1	Swing brake
7	1	Axial-piston motor
10	4	Hex bolt
12	1	O-ring
201	1	Spur-wheel set
202	1	Disk
203	1	Planetary carrier
204	3	Retaining ring
223	1	Ring gear
224	1	Pinion
225	1	Spur wheel
227	2	Cylinder-head screw
251	1	Spur-wheel set
252	1	Disk
253	1	Planetary carrier
254	4	Retaining ring
340	12	Cylinder-head screw
343	2	Eye bolt
344	1	Connecting piece
345	1	Plug
347	1	O-ring
348	1	Screw plug
349	1	Pipe bend
551	1	Housing
552	1	Pinion
553	1	Nut
554	1	Ring
556	1	Tapered roller bearing
557	1	Tapered roller bearing
558	1	Rotary shaft seal
559	1	Nilos ring
560	1	Plug
561	1	Adjusting shim 0.15 mm
562	1	Adjusting shim 0.2 mm
563	1	Adjusting shim 0.3 mm
564	1	Toroidal sealing ring
566	1	Sealing ring
573	1	Nilos ring

Bolts with metric fine thread DIN 13 - 13

Thread nominal Ø	Material quality	Tightening torques M_A in Nm		
		µ total 0.10[1]	µ total 0.12[2]	µ total 0.16 (L)[3]
M 8x1	8.8	22	24.5	30
	10.9	32	36	43
	12.9	38	43	51
M 10x1	8.8	45	52	62
	10.9	67	76	91
	12.9	78	89	107
M 10x1.25	8.8	43	49	58
	10.9	64	72	86
	12.9	74	84	100
M 12x1.25	8.8	77	87	104
	10.9	112	125	150
	12.9	130	150	180
M 14x1.5	8.8	121	135	165
	10.9	175	200	240
	12.9	205	235	280
M 16x1.5	8.8	180	205	250
	10.9	270	300	370
	12.9	310	360	430
M 20x1.5	8.8	380	430	530
	10.9	540	620	750
	12.9	630	720	880
M 22x1.5	8.8	510	580	700
	10.9	720	820	1000
	12.9	840	960	1170
M 24x2	8.8	640	730	890
	10.9	920	1040	1250
	12.9	1070	1220	1500
M 27x2	8.8	940	1070	1300
	10.9	1350	1500	1850
	12.9	1550	1800	2150
M 30x2	8.8	1370	1490	1740
	10.9	1940	2120	2480
	12.9	2270	2480	2900

[1] Screw and/or nut electro-galvanized.

[2] Screw black-plated or phophatized, thread oiled.

[3] Screws with liquid screw fixer, e.g. Loctite 242, 243.

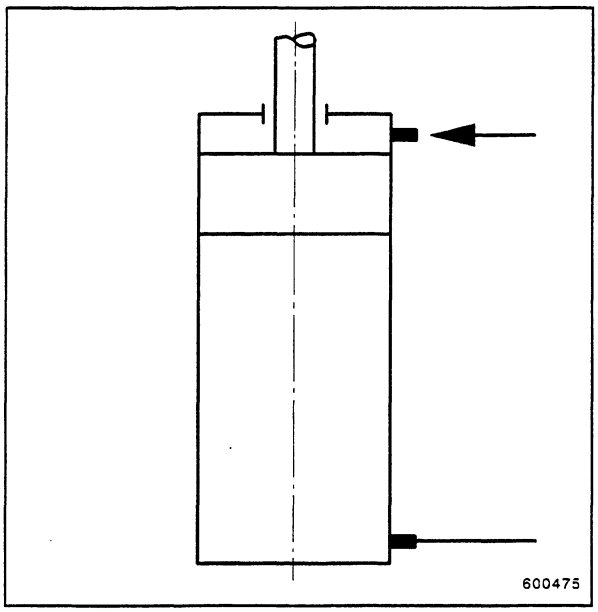


Fig. 8

- The first filling must be done with a reduced, controlled oil flow. So retract or extend piston rod as slowly as possible.
- After installation, the cylinder or group of cylinders must be retracted and extended to the limit stops at least 5 times.
- If the wearing parts of hydraulic cylinders are to be replaced, all sliding components, guide belts and sealing elements must be lubricated with oil from the hydraulic system. Never use grease for this purpose.
- During oil change, repairs or replacement of units involving the unscrewing of threaded hydraulic connections, care must be taken to ensure that the quantity of oil in the cylinders is not reduced.
  If this has proved unavoidable, the affected cylinders must subsequently be vented again.

After venting

Start up motor and check hydraulic system under load. Pay attention to any pump noise. Jerky movements are an indication of residual air pockets. These can be removed by actuating all hydraulic functions.

The system is fully vented when all functions can be performed smoothly and uniformly and the oil in the tank is foam-free. □

No.	Quantity	Designation	Location
91			
92			
93			
94			
95	1	Load limit regulator PMS3	Cab
96			
97			
98			
99			
100	2	Travel drive complete, with:	Travel unit
101	2	Travel oil motor A6VE107HZ/61W	Travel gearbox
102			
103			
104			
105			
106			
107			
108			
109			
110			
111			
112			
113			
114			
115			
116			
117			
118			
119			

□

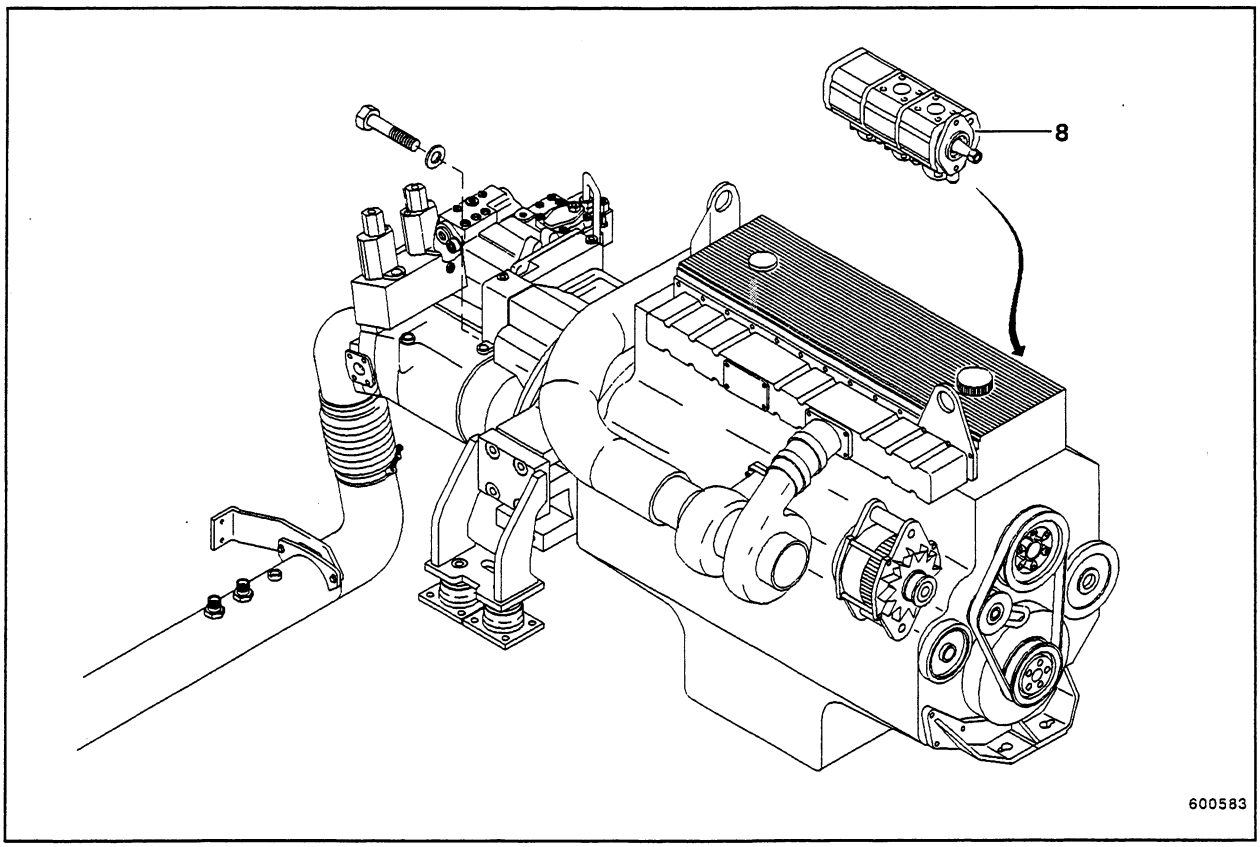


Fig. 5

Triple gear pump (8, Fig. 5)

The pump is flange-mounted at the PTO of the diesel engine and feeds the following circuits:

- fan drive for oil cooling
- servo control
- grab rotation (optional)

Valve assembly (35 - 39, Fig. 13)

The valve assembly is supplied with servo control oil by the servo control pump (7) through a filter (6). The link comprises the base unit and flange-mounted solenoid valves.
Components:

- Base unit with
  - pressure relief for servo control pressure
  - proportional valve, load limit regulator
  - High-speed solenoid valve
- Diaphragm-type accumulator (36) and check valve
- Solenoid valve (38) for superstructure holding
- Solenoid valve (39) for power boost function
- Sealing plug (37), internal

Base unit (35):
The adjustable pressure-limiting valve limits the servo pressure. This pressure is available via check valve (36) at accumulator (36) and at the solenoid valve for servo pressure shut-off (64). The pressure measuring port is located on top of the base unit.

The servo pressure acts at the same time on the proportional valve and on the high-speed solenoid valve.

The proportional valve converts the electrical signals of the load-limit regulator proportionally into hydraulic pressure.

The high-speed solenoid valve switches the travel oil motors to minimum volume and thus to higher speed.

Diaphragm-type accumulator (36, Fig. 13)

The accumulator is loaded by the servo control pressure and provides the pressure energy to the servo control system when the engine has stopped for pressure relief of the working hydraulic system or for emergency lowering of the equipment. The check valve in front of the accumulator prevents a pressure drop in the accumulator towards the servo control pump when the engine has stopped.

Sealing plug (37, Fig. 13)

The plug separates the stagnation-pressurized reservoir channel of the base unit (35) from the reservoir channel of the flange-mounted solenoid valve.

Solenoid valve (38, Fig. 13)

The valve is operated electrically from the control panel. With no power being supplied to the valve, the line to the holding brake is pressureless so that the brake is blocked. If power is supplied to the valve, the brake is released by the servo pressure.
The valve is equipped with an emergency unlock function.

Solenoid valve (39, Fig. 13)

This valve is activated electrically with the power boost key, blocking the pressure cut-off in the pump regulators by servo pressure. The working pressure is then limited by the primary valves (30).

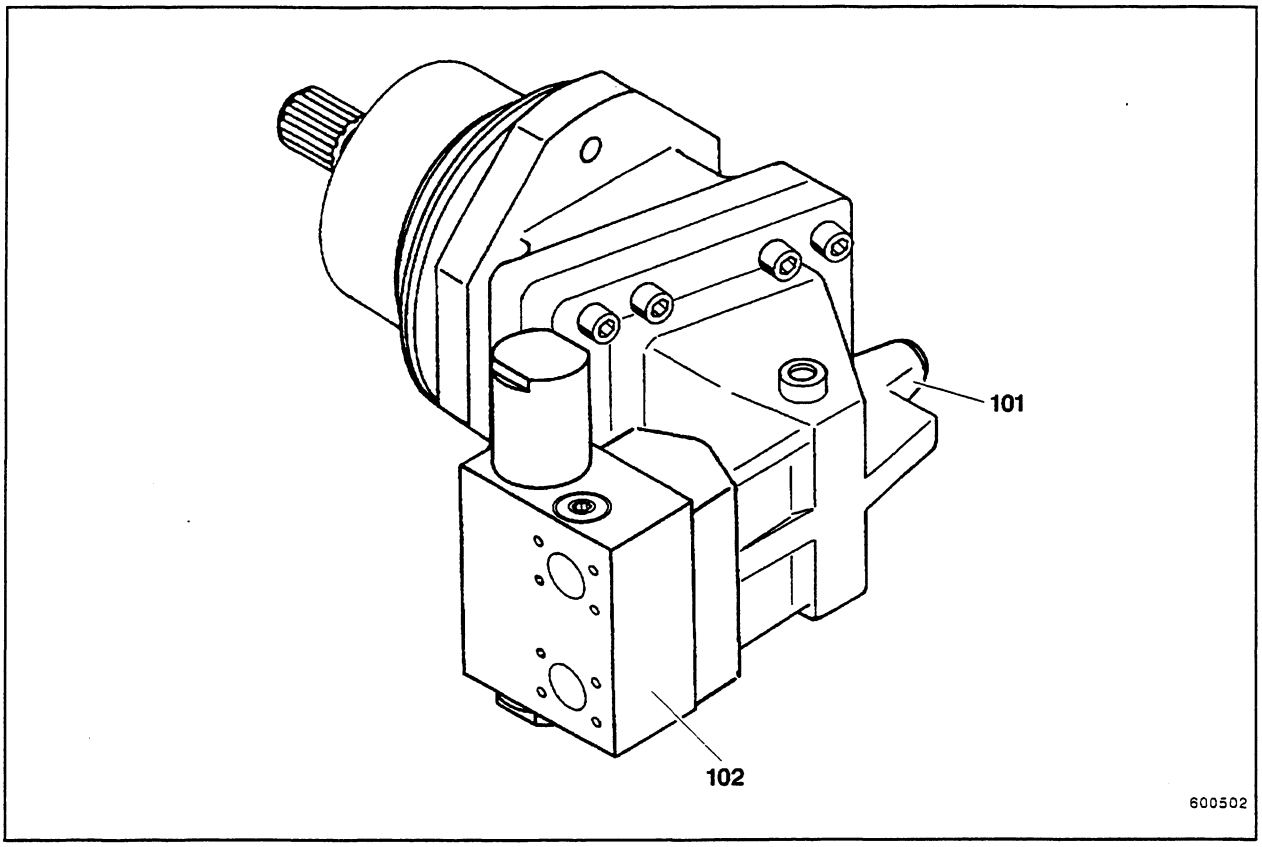


Fig. 22

Hydraulic travel motor (101, Fig. 22)

The hydraulic travel motors are variable displacement axial-piston motors in tilted-axis design. The hydraulic angle adjustment mechanism is housed in the connection plate of the hydraulic motor.

A wide angle at the hydraulic motor means high take-off torque and traction force on the track at low travel speed.

A narrow angle at the hydraulic motor means low take-off torque with high travel speed ("overdrive").

Adjustable secondary valves with fixed setting and replenishing valves are also present as a protection against excess pressure and lack of oil in the hydraulic motors.

Travel brake valve (102, Fig. 22)

The travel brake valves flange-mounted on the hydraulic travel motors (101) protect the hydraulic motors from overspeeding during downhill travel.

Mode of functioning:
During downhill travel, the pump pressure to the hydraulic is reduced and the travel brake valve piston restricts the return flow from the travel motor, so that the travel speed is controlled.

In addition, brake-bleeding valves are provided for automatic release of the track unit brakes. When the travel movement is ended, the parking brake is applied by spring force. For starting up, pump pressure is used to release the brake by means of shuttle valve, pressure relief valve and brake release valve. □

PCS tester (Fig.1)

2796824

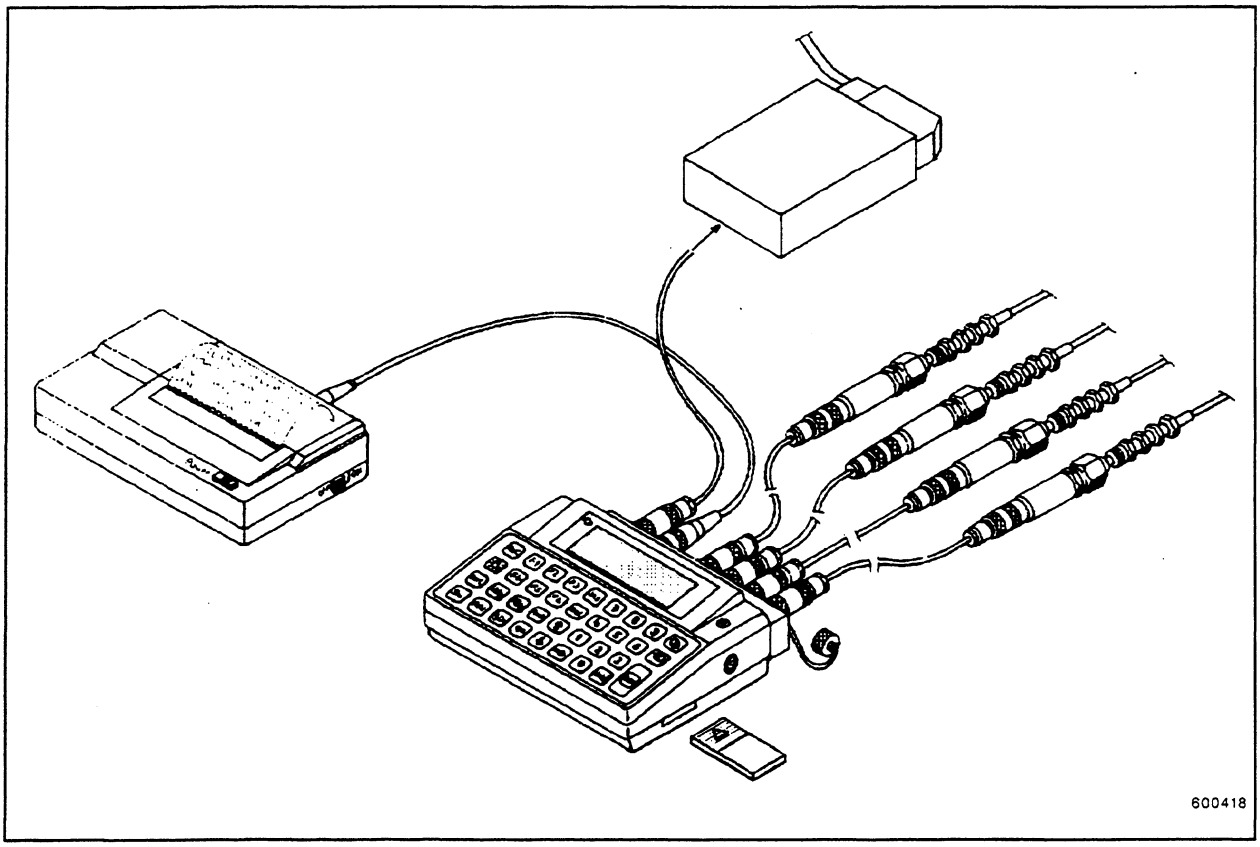


Fig. 1

Big leather test case with contents

Individual parts

PCS - tester with leather case:	73175280	Couplings:	4 x 73175288
Printer with power supply:	73175290	Mains adapter:	73176677
Printing paper, spare roll:	73175286	RAM-Card, multi-lingual	73175292
Cable - printer:	73175285		
Cable - OOC:	73175281		
Cable - sensors:	4 x 73175284		
Measuring hose:	4 x 73175289		
Pressure sensor 600 bars:	2 x 73175283		
Pressure sensor 90 bars:	2 x 73175282		
Pressure gauge connection:	4 x 73175287		

2796748

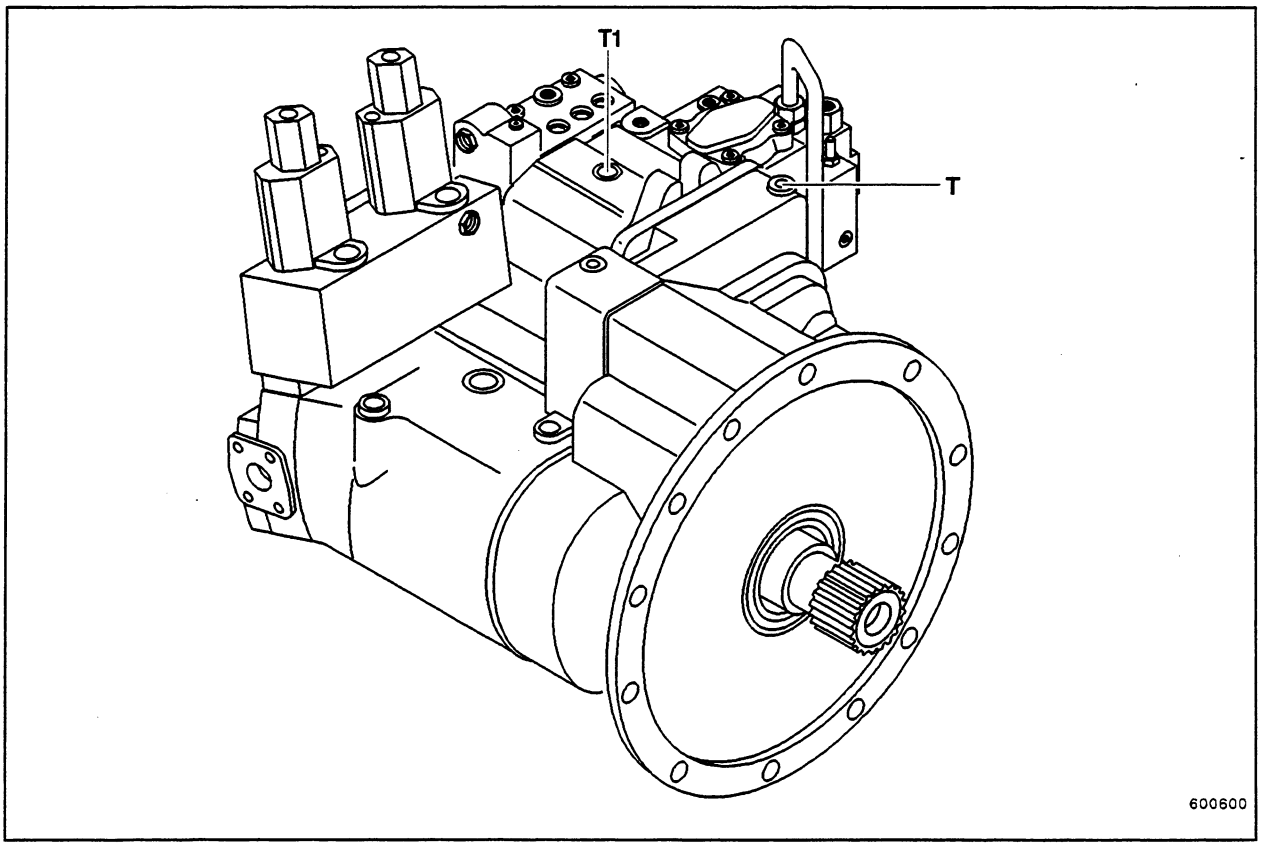


Fig. 1

Installing and dismantling the hydraulic pumps

Dismantling a pump

- Close shut-off valves between hydraulic reservoir and suction line of the pumps.
- Drain hydraulic oil from reservoir into clean container. Note quantity.
- Disconnect hydraulic lines carefully at pump. Collect escaping oil in a suitable container.
- Remove hydraulic lines. Close open connections to prevent dirt from penetrating.
- Attach pump to lifting tackle, unscrew fastening screws and remove pump.
- When removing gear pumps and swing pump, there is no need to drain the oil out of the reservoir (use vacuum pump if necessary).

Installing a pump

- Coat toothed connection of pump and coupling with lubricant paste P/N 73171484.
- Attach pump to lifting tackle and install. Turn in fastening screws and tighten with tightening torque shown in table.
- Reconnect all hydraulic lines.
  Fill hydraulic oil reservoir again.
- Open shut-off valves at hydraulic reservoir again.

  Vent pump.

  See chapter "Venting the hydraulic system". □

Bearing eye, double-pieces

Dismantling and checking:

- Use spirits to loosen the corrosion inhibitor between flange (4, Fig. 4 and 5) and piston rod (8) - see also THB "Sealing, protective, checking and cleaning agents" (Part-No. 2 796 730).
- Attach lifting tackle to eye and loosen bolts (5, Fig. 7).

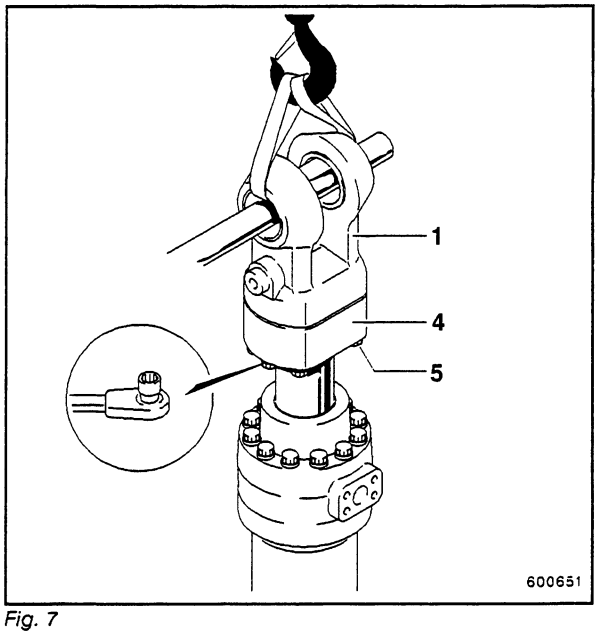


Fig. 7

- Lift the eye off the piston rod (Fig. 8).

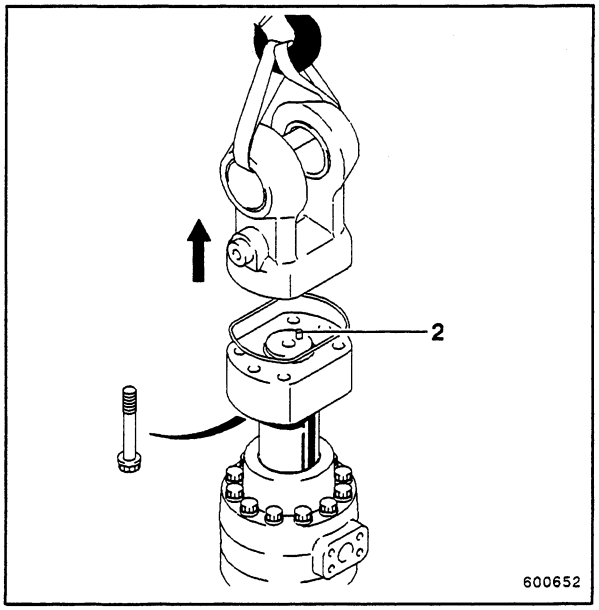


Fig. 8

- Check dowel pin (2) for damage - change if necessary.
- Unscrew flange (4, Fig. 9) from rod.

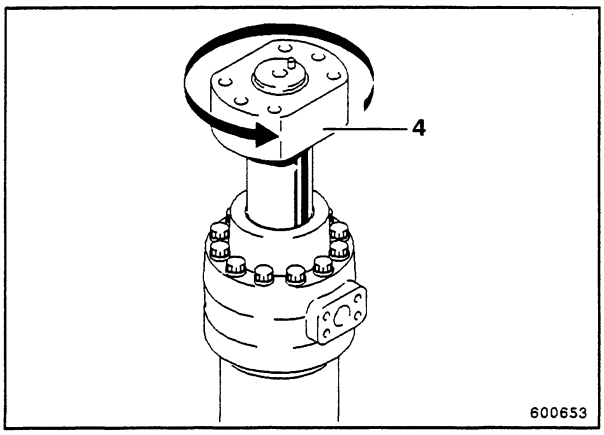


Fig. 9

Assembly:

- Check bearing eye (1, Fig. 4 and 5). Seating surface (B) to piston rod must be metallically clean and free of damage.
- Coat thread of rod (8) with corrosion inhibitor Part-No. 73171467 (see THB "Sealing, protective, checking and cleaning agents" Part-No. 2 796 730).

  The end surface of the piston rod (B) must remain free and must be clean and free of damage.
- Place a new seal ring (3, Fig. 10) around the piston rod.

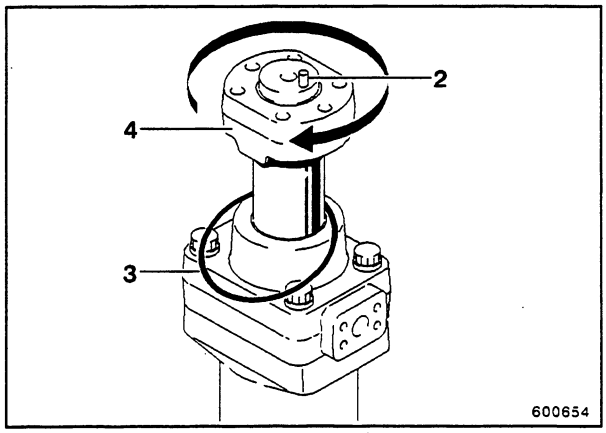


Fig. 10

Troubleshooting guide

2800130

The troubleshooting guide covers the detection and elimination of faults in the event of a malfunction.

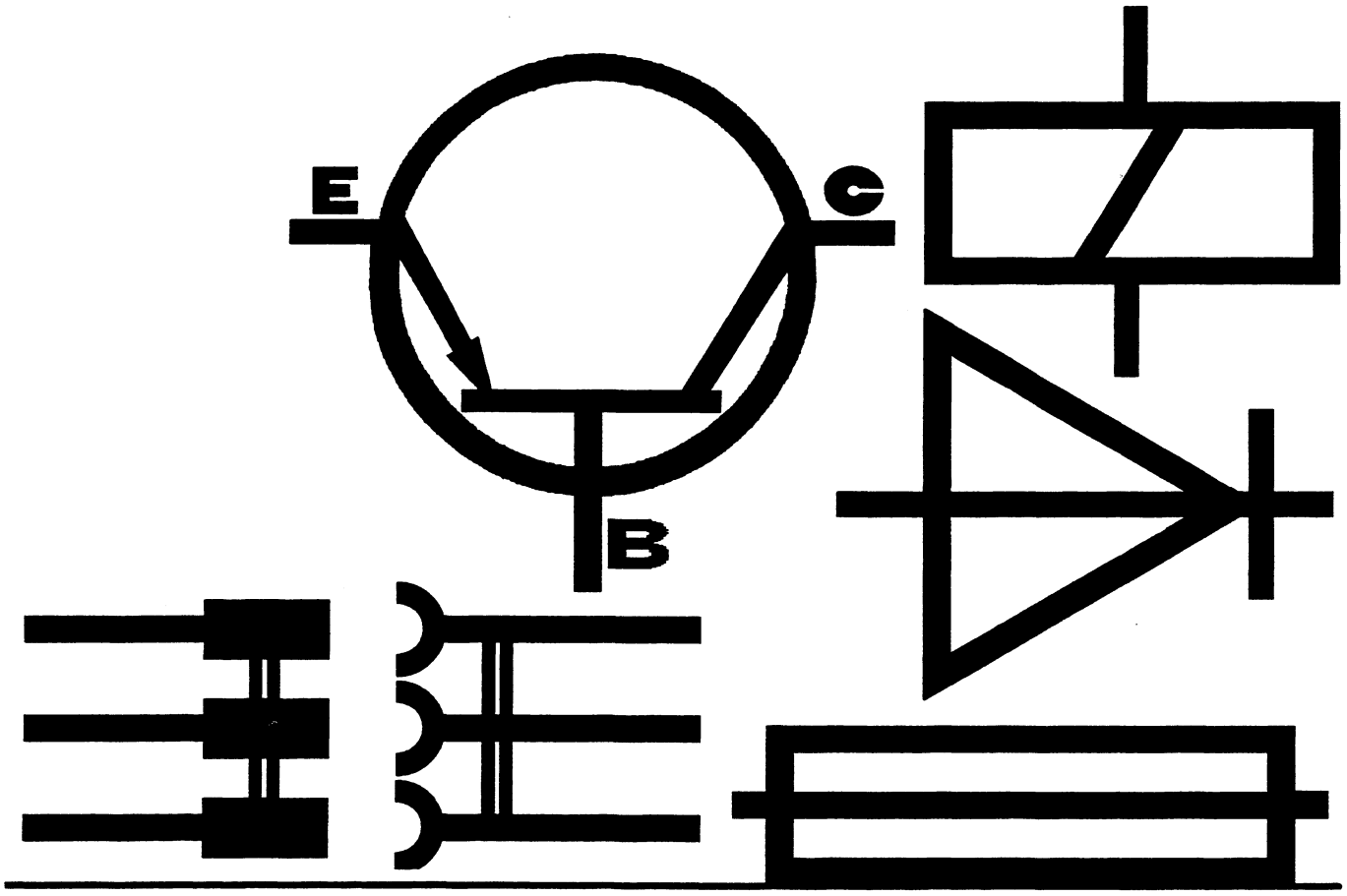
It is possible that a malfunction may have other causes not listed here.
In such a case where a fault cannot be located, contact your FIATALLIS Service Dept.

	Fault	Possible cause	Remedy
1.	No working, travel and swinging functions possible	No servo control pressure	
		• PRV servo control pressure defective	Check; repair and adjust if necessary.
		• Servo control circuit filter contaminated	Replace filter cartridge.
		• Servo control pump not pumping oil	Check drive; repair if necessary. Check pump; replace if necessary.
		• Servo control oil escaping to tank through defective servo control valve or pedal	Check which valve is leaking. Repair or replace defective valve.
		Servo control pressure o.k.	
		• Servo control pressure cutout solenoid defective	Check whether LED in plug is illuminated; if not, repair electrical system or work with manual standby activation.
2.	Working, travel and swinging functions slow	Diesel engine speed	Check speed adjustment or control PMS programming.
		Output stage	Switch over output stage.
		Servo control pressure too low	Check and correct.
3.	Working and travel function slow. Swinging function o.k.	Insufficient diesel engine output, speed o.k.	
		• PMS reducing output of working pumps. No fault display	Check air filter, fuel filter etc.; replace/change if necessary.
		• PMS reducing output of working pumps. Fault code display	Locate fault from fault code table and eliminate problem.
		Regulators of working pumps receiving incorrect pressure demand signals	Check pressure demand control, determine and eliminate fault.

FIATALLIS®

Technical Handbook

Fundamentals of electrical engineering



2 796 980.00 us

Free electron

If an electron has left its path and is equally far from another nucleus as from its own, it is no longer bound to its nucleus - it is free.

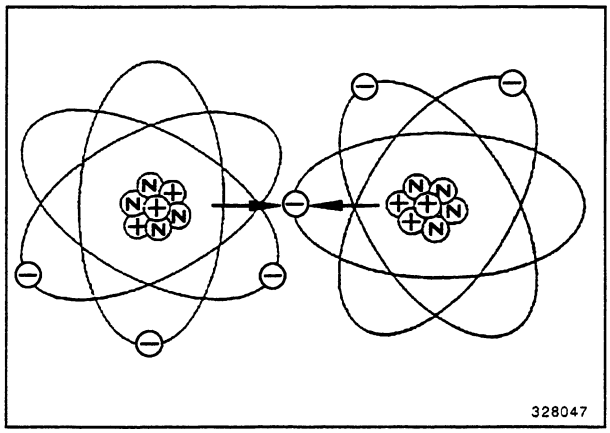


Fig. 2

The electron of nucleus A has entered a neutral path. As atom B is electrically neutral and atom C electrically non neutral (one electron is missing), the electron is attracted by nucleus C, and nucleus A thus becomes non-neutral.

It attracts another electron which has entered a neutral path. If an electron from nucleus C, which is now neutral, returns to a neutral path, it is also attracted by a non-neutral nucleus (etc.).

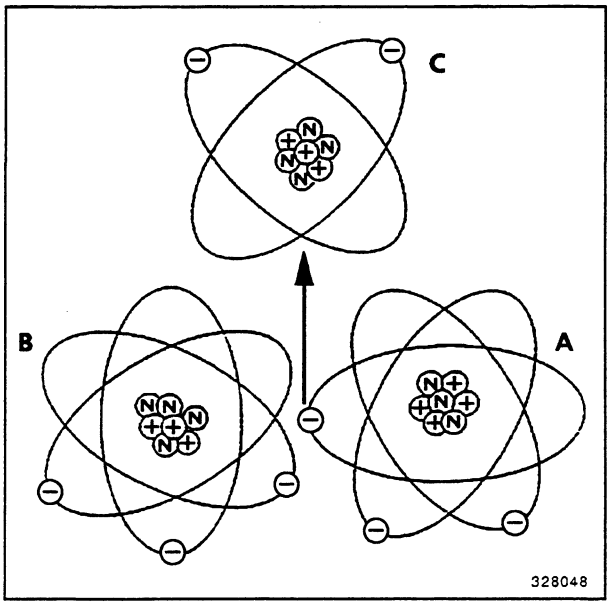


Fig. 3

A relatively large number of free electrons are present in noble metals and non-ferrous metals. If a conductor (e.g. a copper wire) is moved in a magnetic field, the free electrons are forced into one direction or another.

Mixing fresh battery acid

Important:
When mixing new battery acid, care must be taken that concentrated sulphuric acid is always poured into the distilled water and never the other way round to avoid back-splashing of sulphuric acid. Wear goggles and protective clothes and observe the accident prevention rules.

The volumetric ratio of concentrated sulphuric acid (96 %) to distilled water is set out in the table below.

Mixing instructions

Desired acid density kg/l	Volumetric ratio of concentrated sulphuric acid (96 %) to distilled water
1.23	1 : 3,8
1.26	1 : 3,2
1.28	1 : 2,8
1.30	1 : 2,6
1.34	1 : 2,3

Maintenance

The term "maintenance" encompasses all measures of battery care required for an optimal function of the battery over its whole lifetime.

- Topping up the electrolyte level
- Periodic recharging during storage
- Immediate recharging after discharges
- Avoiding overcharging
- Avoiding exhaustive discharging

FUNDAMENTALES OF AUTOMOTIVE ELECTRICAL SYSTEMS

Current, voltage, resistance and power

Current (I)

Electric current is the flow of free electrons in a conductor. The current is measured with an ammeter which must be connected in series with the consumer. The quantity of electric current is designated by "I" and the unit of current is symbolized by "A" (ampere).

Voltage (U)

Voltage is the potential difference existing between two conductors. Voltage is measured with a voltmeter which must be connected in parallel with the consumer or across the two points of different potential. The quantity of electric voltage is designated by "U" and the unit of voltage is symbolized by "V" (volt).

Resistance (R)

Electric resistance is the resistance offered to the electric current. The electric resistance depends on the material of the resistor and its dimensions. The quantity of electric resistance is designated by "R" and the unit of resistance is symbolized by "Ω" (ohm).

Power (W)

Electric power is the current flowing through a consumer at a constant voltage. Power is symbolized by "P" and the unit of measure is symbolized by "W" (watt).

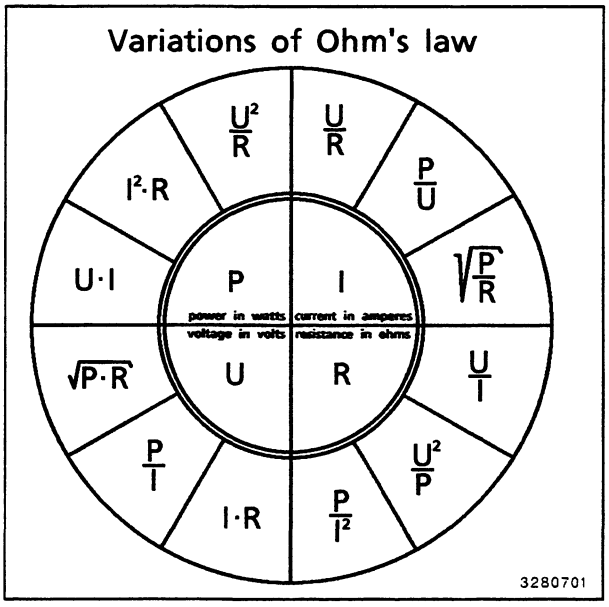
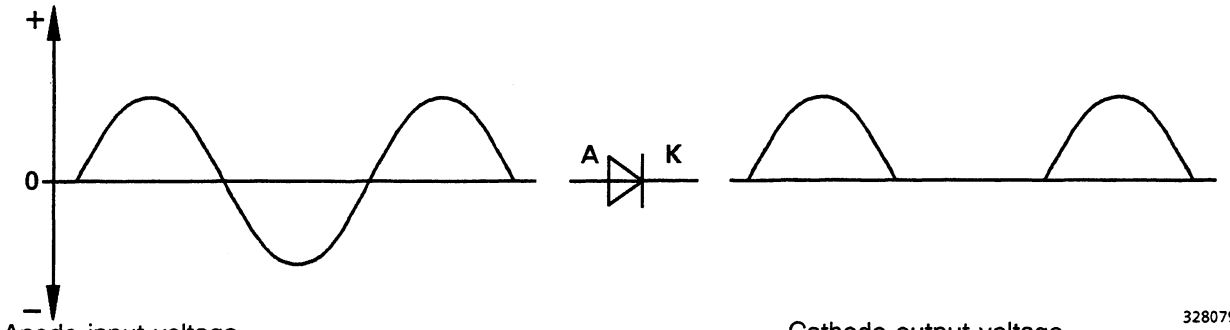


Fig. 1



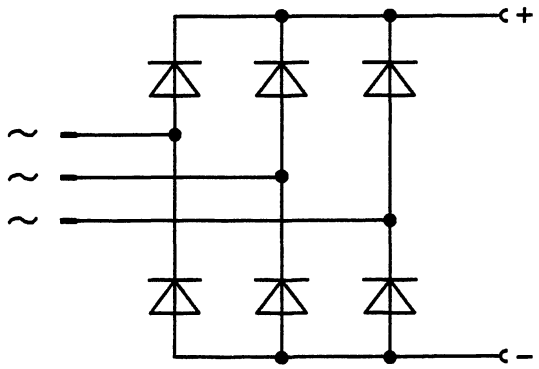
Anode input voltage

Cathode output voltage

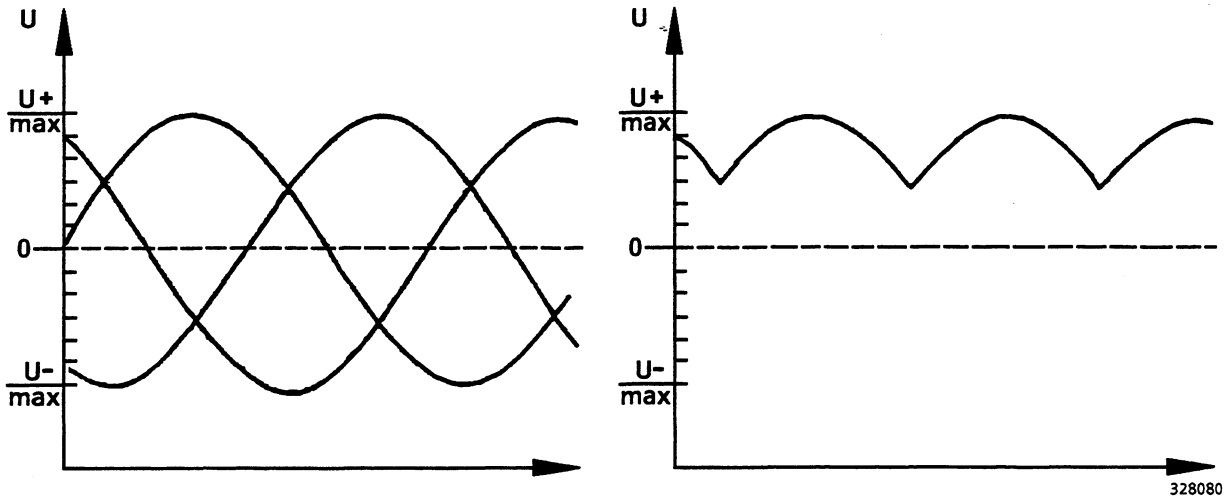
As we see from the diagram, only the positive (plus) voltage is left at the cathode.

If we consider the principle of rectifying three-phase currents, we see that several diodes are connected to form a bridge, as can be seen from the diagram below.

Three-phase current
Input



Direct current
Output



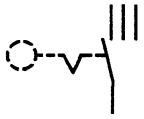
Three-phase current - Input
into the bridge circuit

Direct current - Output
from bridge circuit

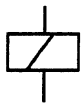
As we have seen from the above diagrams, only positive half-waves are left at the rectifier bridge output, which means that the output carries only d.c. currents or d.c. voltages.

This d.c. current is used to buffer the battery.

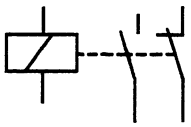
Important:
The individual diodes of this bridge are designated by the term of "main diodes".



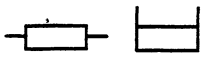
Example: ignition switch
(notched in Pos. 0 and 1)



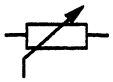
Electromechanical drive, e.g. with indication of an effective coil



Example: relay with make and break contacts



Resistor, general; also symbol for glow-plugs and heating resistors



Variable resistor, e.g. potentiometer

Capacitor, general

Electrolytic capacitor

Light bulb

Bulb with two filaments, e,g. Bilux

V = Voltmeter
A = Ammeter
Ω = Ohmmeter
W = Wattmeter
etc.

D.C. Generator

Alternator, general

328085

7. Cable cross-section

The following number refers to the cross-section of the cable **10** meaning that this cable has a conductor cross-section of 10 mm^2.

8. Identification of contacts

The numbers at relay contacts or at switch connections at contacts are identical with the numbers found on the components themselves.

Example:

Label **S113, 1,4** means:

The switch is the S113 with connections at contacts 1 and 4.

9. Cable number

The cable number (**94** in this case) is printed on the insulation at intervals of several centimeters. This number together with number of the connector permits easy identifaction of a cable even in a cable harness or by the connector (e.g. for continuity checking). The connectors are also marked with their specific number (e.g **X101**). The connection tables showing the pin assignment of each connector can be found after the wiring diagram (e.g. **X101**, Fig. 4).
If a cable is defective and if you don't know which components are linked by this specific cable, then this can be determined from the connection tables.

The example (Fig. 2 and 4) shows how to identify cable **94** in connector **X 101:**
One end is connected to terminal **5** of switch **S 1.7** (cable cross-section 1.5 mm^2) and the other end to solenoid valve **Y 1.3** (cable cross-section 2.5 mm^2). The cable is connected to pin **12** of the connector which is part of the "engine cable harness". The exact location of the connector at the machine and the corresponding order number are set out in the "WIRING DIAGRAM LEGEND".

END POINT	CABLE NO.	C mm²	NO	• mm²	CABLE NO.	END POINT
A10X1: 24	86	0.5	1	1	86	B10.1: A
S1: 8(50a) FX20: 1	87 87.1	2.5	2	2.5	87	K1: 5
A100X2: 11/X117: 12	26 26.1	0.5	3			S13: 1 (OPTIONAL)
A100X2: 25	40	0.5	4	1		X101: 5
A10X1: 3	88	0.5	5	1		X101: 4
A10X1: 5	89	0.5	6	1	89	B13: 1
N. C.			7			
A100X2: 24	39	0.5	8			N. C.
A100X2: 16	31	0.5	9			N. C.
			10			
K7: 30 (OPTIONAL)	341	0.5	11	1	341	H7.1 (OPTIONAL)
S1.7: 5	94	1.5	12	2.5	94	Y1: 3
X115: 2	95	0.5	13			N. C.
			14			ENCODING PIN
X13: 1	96	0.5	15			N. C.
CONNECTION TABLE PLUG/SOCKET			X101			CABLE MOTOR

328331

Fig. 4

10. Electronic units (Fig. 3)

Electronic units (e.g. Central Electronic Unit, Load Limit Governor) are displayed in the wiring diagram as black boxes. □

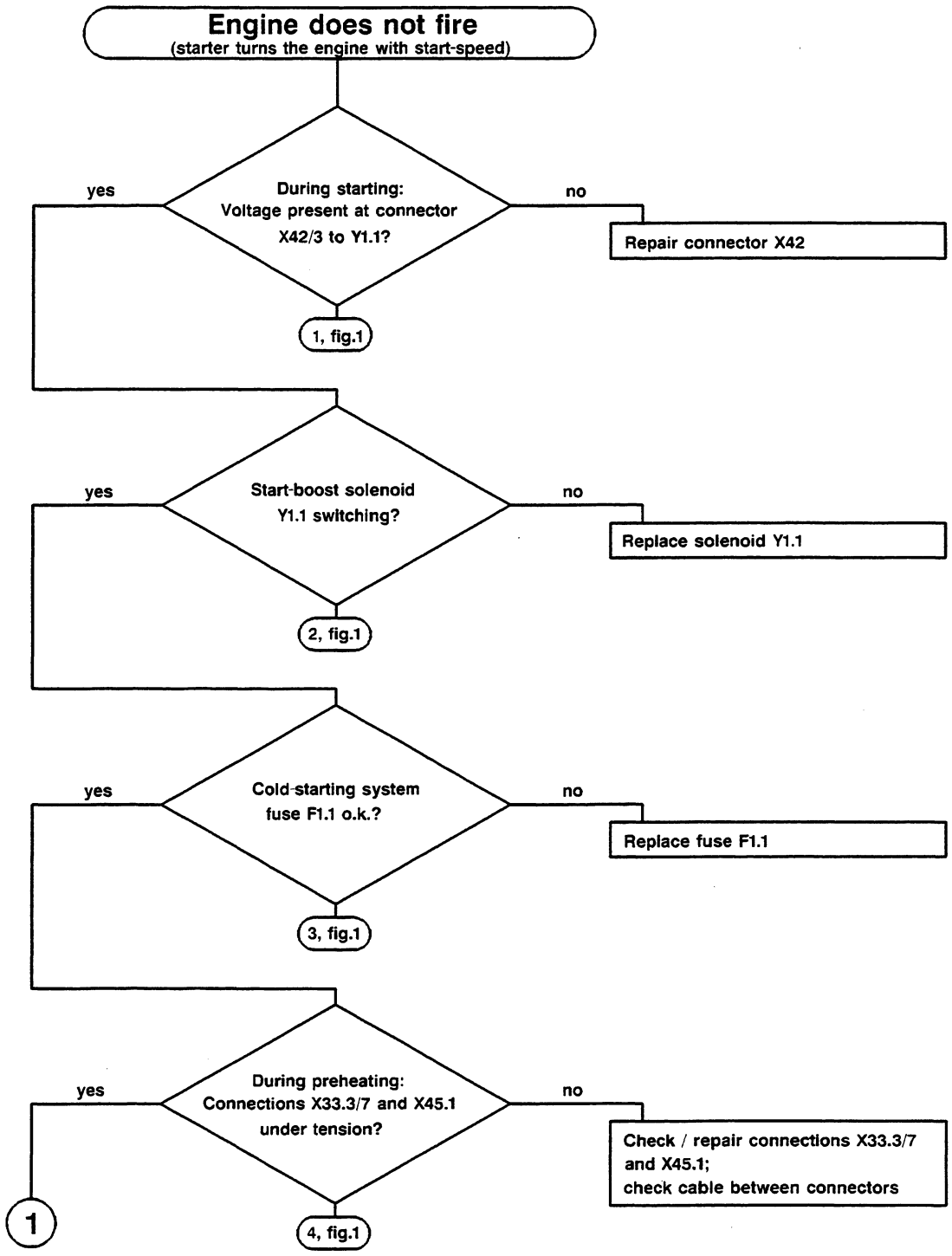


Fig. 2

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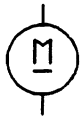
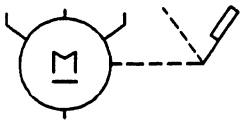
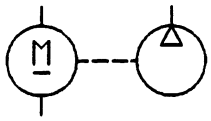
Motors, alternators



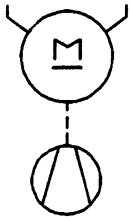
DC motor, general (f.ex. engine starter motor)



Windscreen wiper motor



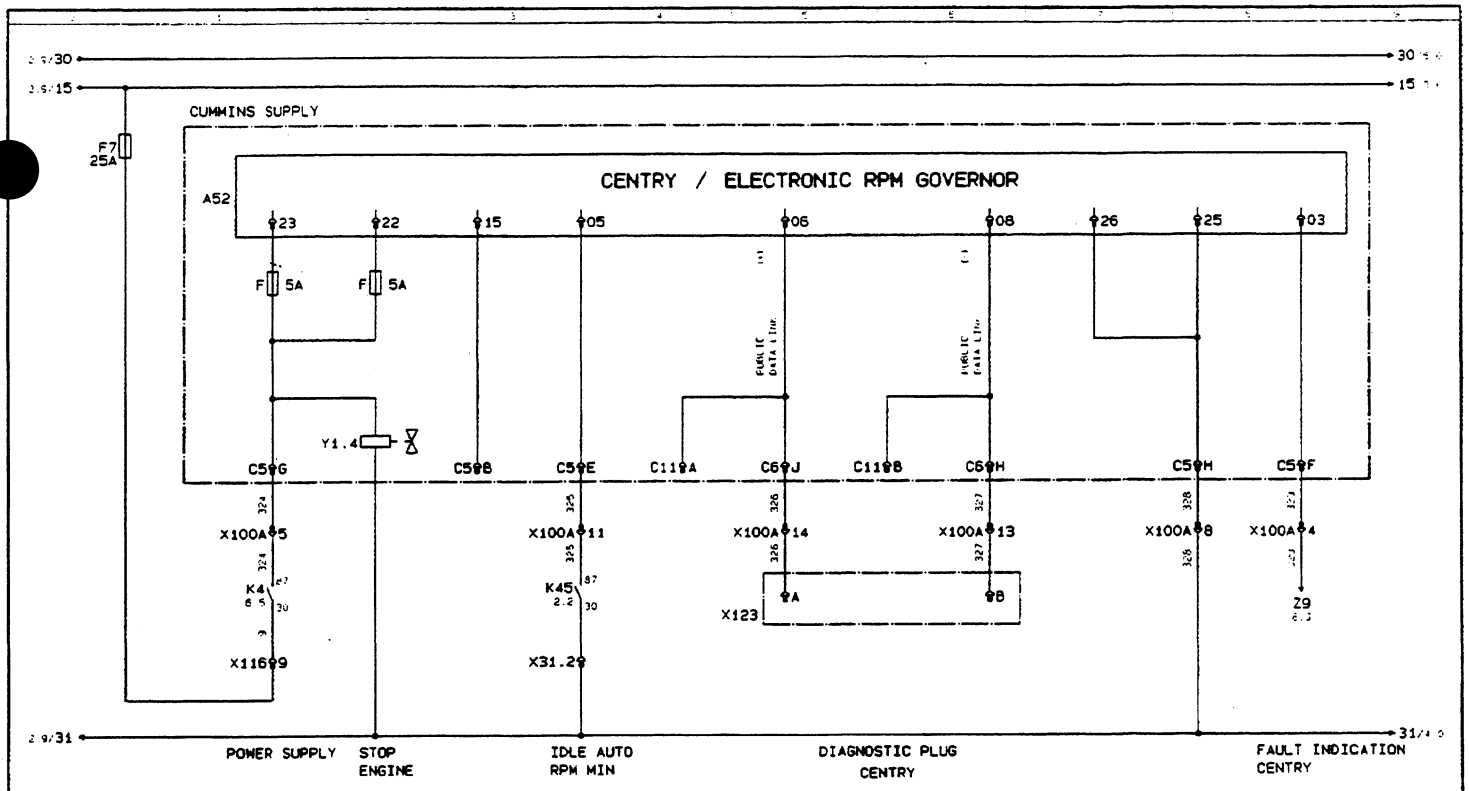
DC motor with pump



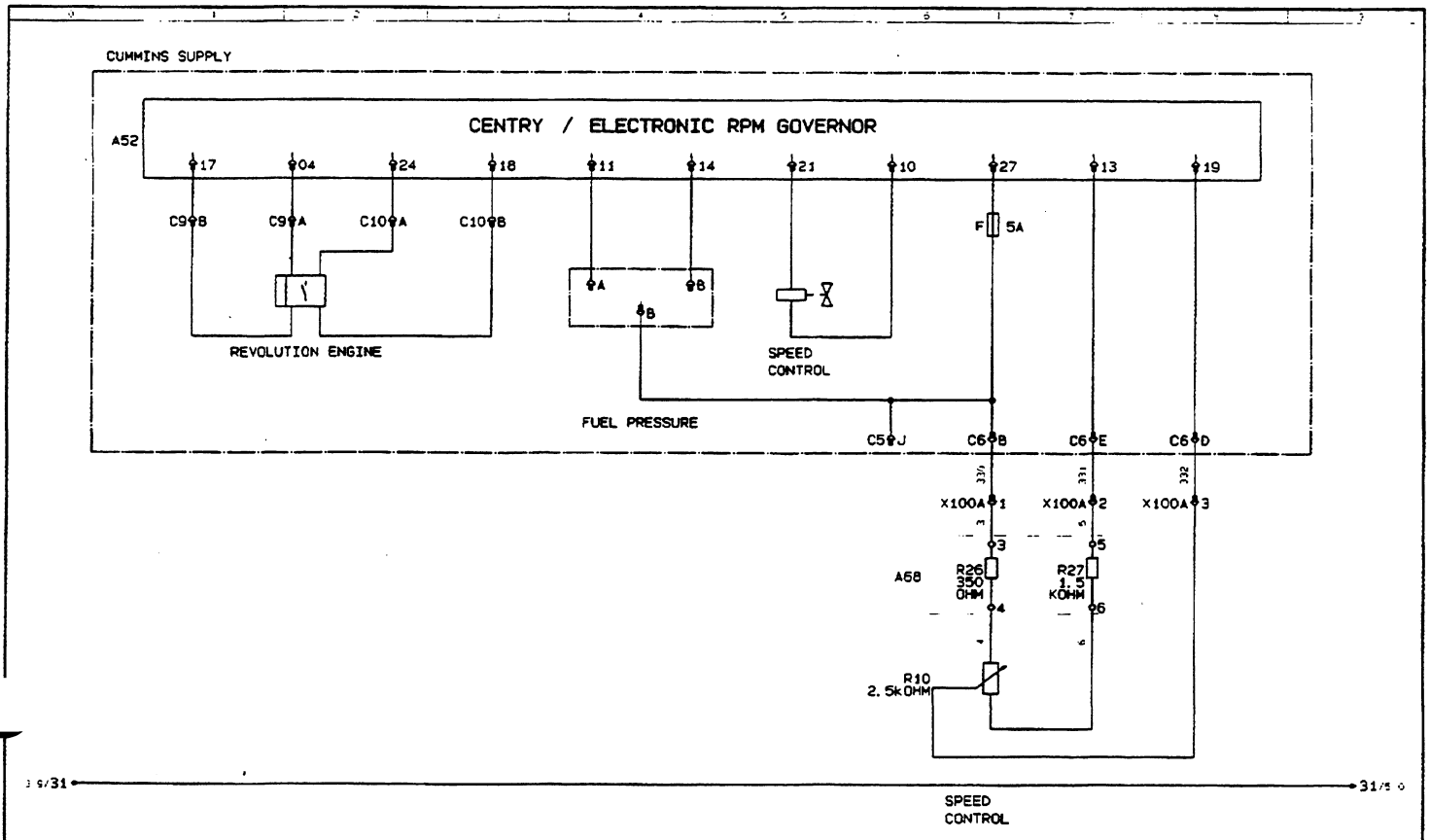
Fan motor

3-phase alternator with rectifier

3282121



316	31	052	50							
	60	U6G	CH				Datum/Date	Name	WIRING DIAGRAM	Sach-Nr. Part-No 2460250-12
KZ/FX480					Bearb./Written	07.11.97	Semlir			4
					Gepr./Checked					
					Norm/St. Check					



316	31	052	50						
						Datum/Date	Name	Sach-Nr. Part-No 2460250-12	4
					Bearb./Written	07.11.97	Semlir		

FIATALLIS

Electrical components in circuit diagram

31.050 -

2460251	Circuit diagram No.	T 2460251 - 000
		B 2460250 - 010

Part	Quantity	Description and function	Curr. Path	Location	Part no.
A10	1,000	LOAD LIMIT GOVERNOR	2 - 0/58 -	CONTROL PANEL	
A10X4	1,000	DIAGNOSTIC UNIT CONNECTOR	6 - 3/18 -	CONTROL PANEL	73172588
A10X4	1,000	FLANGE	6 - 3/18 -	CONTROL PANEL	73172589
A52	1,000		3 - 1/21 -	ENGINE	
A68	1,000		2 - 2/86 -	SEAT CONSOLE,RH	73175260
A100	1,000	CENTRAL ELECTRONIC UNIT	2 - 1/16 -	CONTROL PANEL	73172003
B10	1,000	PRESSURE SENSOR - TRAVEL	10 - 0/84 -	SUPERSTRUCTURE	
B10.1	1,000	SPEED SENSOR	2 - 9/89 -	ENGINE	
E3.1	1,000	WORKING LIGHT DRIVERS CAB LEFT	8 - 1/87 -	BOOM	73172602
E3.1	1,000	BULB	8 - 1/87 -	BOOM	73172510
E3.3	1,000	WORKING LIGHT, COUNTERWEIGHT LEFT	8 - 4/87 -	BOOM	73172602
E3.3	1,000	BULB	8 - 4/87 -	BOOM	73172510
E3.8	1,000		8 - 4/87 -	BOOM	73172602
E3.8	1,000	BULB	8 - 4/87 -	BOOM	73172510
E4.1	1,000	WORKING LIGHT DRIVERS CAB RIGHT	8 - 1/87 -	BOOM	73172602
E4.1	1,000	BULB	8 - 1/87 -	BOOM	73172510
E4.2	1,000	WORKING LIGHT, TANK MODULE RIGHT	8 - 2/87 -	BOOM	73172602
E4.2	1,000	BULB	8 - 2/87 -	BOOM	73172510
E4.7	1,000		8 - 3/87 -	BOOM	73172602
E4.7	1,000	BULB	8 - 3/87 -	BOOM	73172510
E9	1,000	INTERIOR LIGHT	6 - 3/74 -	CAB	73172604
E9	2,000	BULB	6 - 3/74 -	CAB	73172605
F	1,000		3 - 1/37 -	ENGINE	73175137
F	1,000	FUSE INSERT	3 - 2/37 -	ENGINE	73175137
F	1,000	FUSE INSERT	4 - 6/30 -	ENGINE	73175137
F1	1,000	FUSE	6 - 3/16 -	CONTROL PANEL	73172606
F2	1,000	FUSE	1 - 7/16 -	CONTROL PANEL	73172606
F3	1,000	FUSE	2 - 0/18 -	CONTROL PANEL	73172606
F4	1,000	FUSE	7 - 1/16 -	CONTROL PANEL	73172607
F5	1,000	FUSE	7 - 5/16 -	CONTROL PANEL	73172608
F6	1,000	FUSE	11 - 1/16 -	CONTROL PANEL	73172606
F7	1,000	FUSE	3 - 0/18 -	CONTROL PANEL	73175156
F8	1,000	FUSE	6 - 0/16 -	CONTROL PANEL	73172606

⚠ WARNING

Selecting the attachments

The machine can be equipped with various attachments. The components of the attachments are assembled with hydraulic cylinders and connectors. Components can be combined in various ways for optimum adaptation of the attachments to the specific application.

Operate the machine only with the equipment and component combinations expressly approved by FIATALLIS.

□

Securing the machine 2472317

⚠ WARNING

Risk of injury!

The machine must not be started by unauthorized persons.

Therefore, the machine must be secured.

The machine must be secured as described below:

- before fitting or changing the working equipment, and
- before carrying out any servicing or repair work on the machine.

- Park machine on level and firm ground.
- Stand working equipment on the ground.
- Shut off engine.
- Turn key switch to position **I** (ignition ON).
- Depressurize the hydraulic system.
- Switch off pilot control.
- Withdraw key from key switch of the electrical system.
- Before carrying out work on the electrical system or welding work on the machine, the batteries must be disconnected.
  Insulate connecting clamps. □

PCS III functional description

PCS III Troubleshooting

Fault signalling in the ODC (ON-BOARD DIAGNOSTIC SYSTEM)

Description of PCS III

The main components of the PCS III are the Control Panel (A100, Fig. 4) and the On-Board Computer (A10).

Both electronic modules are interconnected by means of a CAN data bus system (Control Area Network) permitting the mutual exchange of informations. The On-Board Computer receives real-time data such as diesel engine rpm, sensor data and switching status data and controls the proportional valve ensuring the output regulation of the hydraulic system.

At the same time, the computer assumes the task of monitoring the engine and hydraulic system temperatures and of permanently checking the sensors for broken cables and short-circuits (ODC: ON-BOARD DIAGNOSTIC SYSTEM).

An integrated non-volatile data memory block stores all essential data in the event of malfunctions and facilitates subsequent troubleshooting.

A specially designed hand-held tester (EDS III) can be used to read out system parameters and, if necessary, to perform system programming operations via a parallel interface (A10X4).

The Control Panel (A100) assumes application-related tasks such as:

- display functions
- monitoring functions in the conventional electrical system
- controlling of operator functions

All switching conditions essential for the overall functioning and data are transmitted over the CAN bus to the On-Board Computer and vice versa.

PCS III switching conditions:

- Engine speed
- Warm-up
- Auto-Idle
- Power Boost
- Swing-MODE
- Swing brake
- Power-MODE
- Hydraulic hammer (optional)

The Power-MODE can be used to adapt machine performance to the job on hand for 6 different kinds of applications. (engine speed and pump output are here in a fixed relationship).

HEAVY 100% -	Maximum machine performance
ECO 90% -	Normal jobs with optimized engine / pump setting
LIFT 65% -	Handling and lifting of heavy loads
DRIVE 110% - (Option)	Increased travelling performance on and off the road (engine-dependent)
Power boost 65% -	Lifting of heavy loads with increased pressure
Hammer max. 100% - (Option)	power transfer up to 100% with one pump

The electrical engine speed adjusting system (R10/M10) permits superposing a freely chosen speed independent of the MODE selected.
To reduce noise and and exhaust emissions, the PCS III has a low-level and a high-level speed reduction function.

Low-level reduction:	30 - 100 RPM in loadfree phases (always active).
High-level reduction:	Low idling 850 - 900 RPM if the work is interrupted for more than 10 seconds (can be deactivated with the Auto-Idle switch).

Diesel speed actuator (M10)

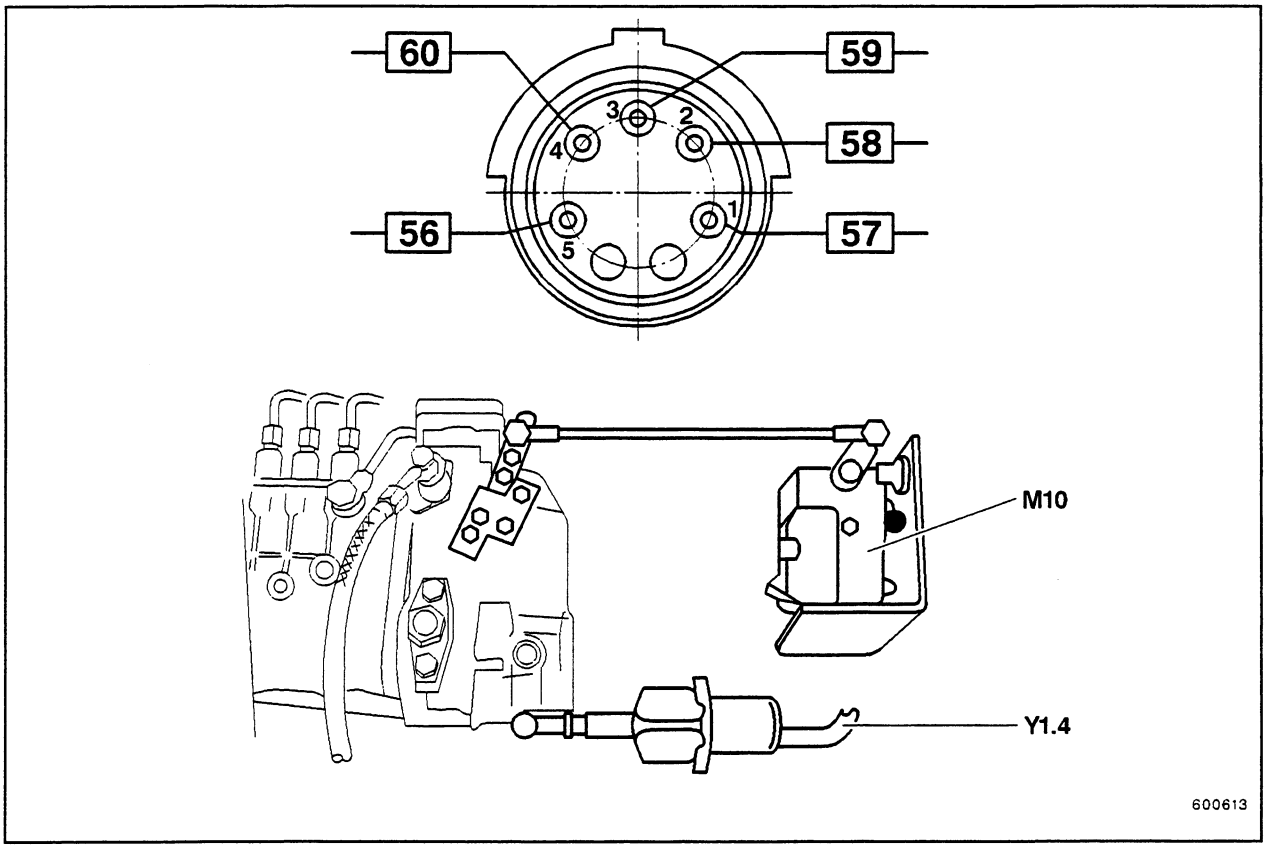


Fig. 6

Connector M10 (Fig. 6):

ITT Cannon 5 poles

Cable

56 - to central electrical system X100.7 to panel X3.16
57 - to central electrical system X100.8 to panel X3.17
58 - to central electrical system X100.9 to panel X3.18
59 - to central electrical system X100.10 to panel X3.19
60 - to central electrical system X100.11 to panel X3.20

Measuring port (X3) at main pumps

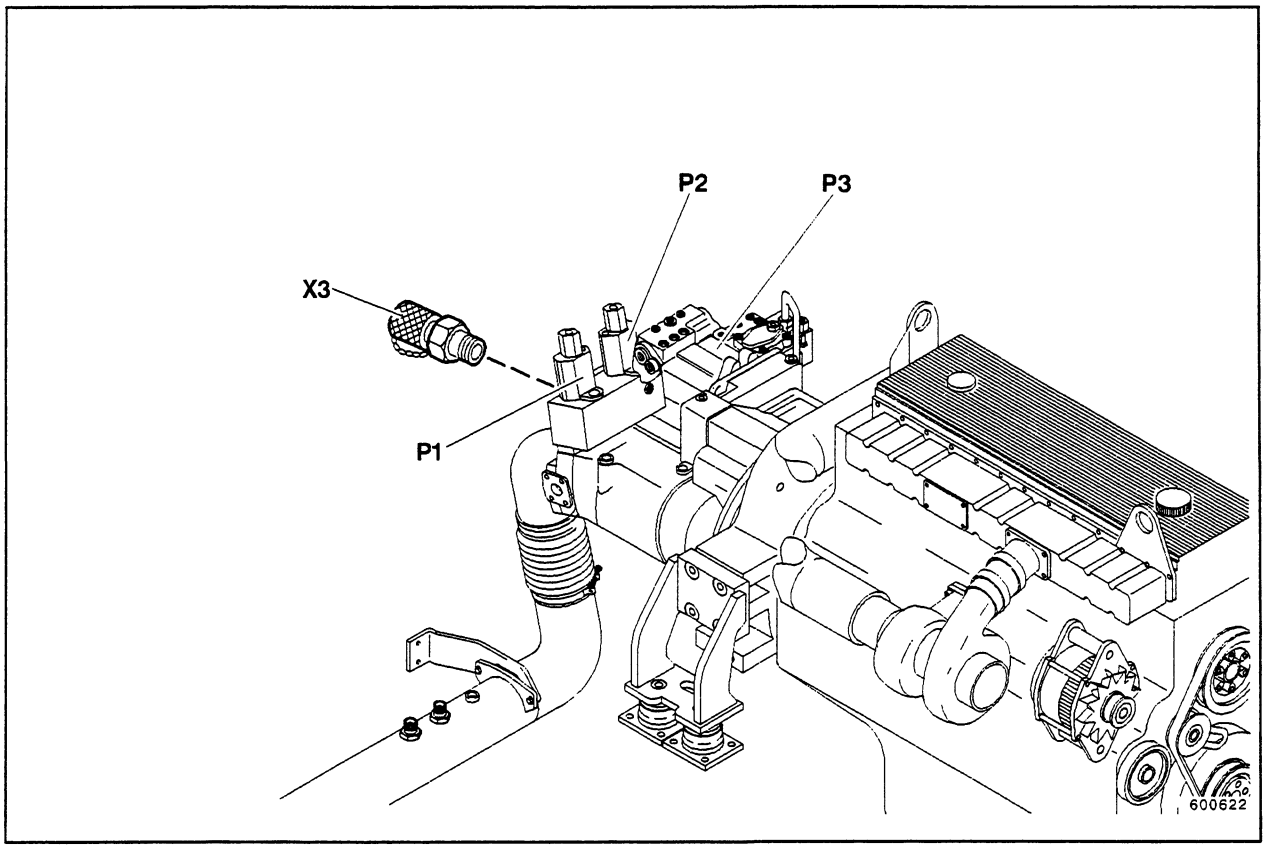


Fig. 18

Port (X3, Fig. 18)) serves to measure the control pressure from the proportional valve output.

Depending on the preselcted power mode and the operating mode, the pressure values range from 5 bars - 40^{+2} bars (180 mA - 800 mA).

⚠ CAUTION

Individual machine types have fixed control pressure values (cf. the Service Data belonging to the respective machine).

Changing the machine start disabling code

In the "Control Panel" menu (Fig. 5), key F2 (Fig. 6) can be used to select the code enabling the start function of the machine from any number between 0 and 15 (Fig. 8).

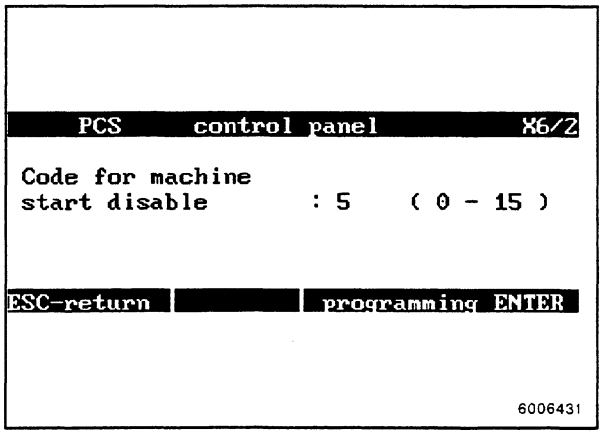


Fig. 8

Entering the new number with the ENTER key and confirming the selection with "1" programs the new code into the system (Fig. 9).

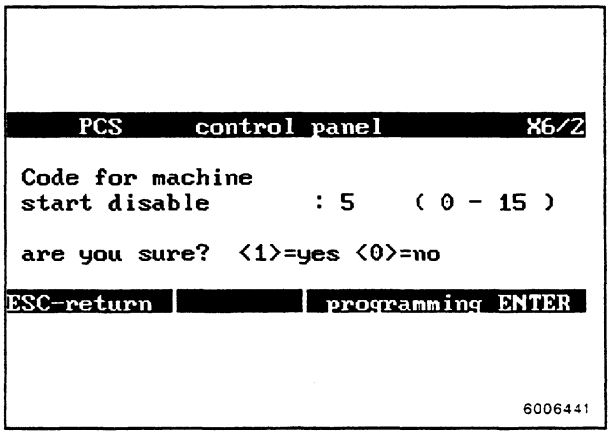


Fig. 9

Applying the superstructure holding brake

2472274

The superstructure holding brake can be used in three modes of operation:

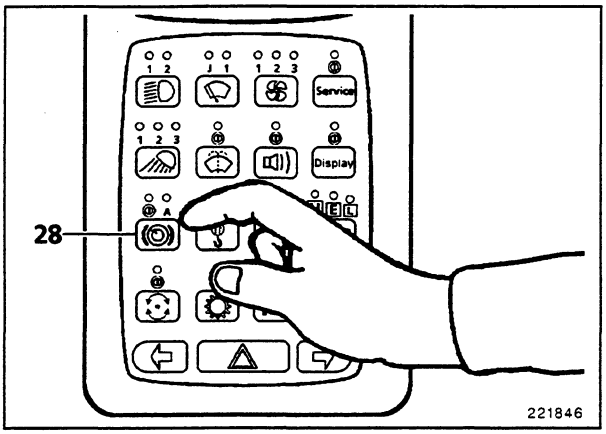


Fig. 1

- Key (28, Fig. 1) not depressed, LEDs extinguished:
  holding brake released, superstructure free to slew.
- Key (28) depressed once, LED **I** lit up:
  holding brake applied, superstructure braked.
- Key (28) depressed twice, LED **A** lit up:
  automatic mode, the holding brake is being applied automatically when the superstructure is stationary and released when a slewing movement is initiated. This mode is activated automatically when the engine is started.

Releasing the superstructure holding brake

- Depress key (28, Fig. 1) until the LEDs above the key are extinguished. The holding brake is released and the superstructure is free to slew.

In the "Automatic" mode of operation with LED **A** lit up, the holding brake is released as soon as the slewing control lever is deflected.

This mode is activated automatically when the engine is started. □

Operating Instructions

Electronic diagnostic System (EDS)

for Pump Control System (PCS 3)

Do not connect or disconnect any connections to the EDS tester while the plug-in power supply unit (item 15) is in the socket.

Connecting sequence:

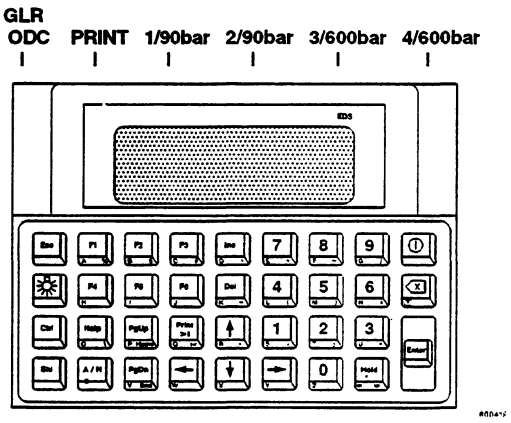
- Connect printer to PRINT (through cable, item 11).
- Connect EDS voltage supply port (24 V DC) to plug-in power supply unit (item 15).
- Insert RAM card with program (item 2).
- Insert plug-in power supply unit into socket.
- Switch on EDS tester by the ⏻ key.

List of the labelled connections:

ODC = Cable connection to the load sensing device, EDS voltage supply and, at the same time, serial data link with the ODC.

PRINT = Cable connection for the log printer. The printer is battery powered.

The connections are located on the rear side of the EDS tester.



Never disconnect the link between the mains adapter and the connection cable (item 14) while the EDS tester is on and the plug-in power supply unit (item 15) is in the socket, or software loss on the RAM card may impend.

Hydraulic System and Drive Engine

Main Menu

```
E D S  PCS TESTER    (PCS III) 3.0

Trouble-shooting      :  F1
Failure memory        :  F2
Programming mode      :  F3
Special functions     :  F4
```

Start display of tester functions.

for Troubleshooting: display and documentation of equipment and process data without modification intervention.

for fault memory: to read out, print out and delete the PCS-box-internal failure memory.

for programming: equipment data (type, no., current values, configuration).

for the special functions: log, time program, file management, extension, control panel.

PCS Troubleshooting Submenu

```
O&K PCS -Trouble-shooting-
  Equipment data          :  F1
  Speed, switch, current  :  F2
  Speed, temp., current   :  F3
  Pump and motor values   :  F4
  Operating hydraulics    :  F5
  Slewing hydraulics      :  F6
ESC-return
```

Selecting the data and measuring values pages known by the PCS

The 

, 

, 

, 

, 

, 

keys switch over to those data pages recorded in the menu that currently are reading valid settings and measuring values.

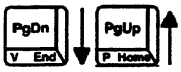
With the 

key, you can return to the submenu from any data display.

PCS Speed, Switch, F2/1

```
PCS -Speed, switch, current-  F2/1

High idling.:   0 RPM GLR-curr.:  18  mA
On-load spd.:   0 RPM GLR-press:   0 bar
Rated speed :   0 RPM
Mode         : ECO     Lowering: off
Press. switch: FSA + DSF + DSL
ESC-return | PgDn | Hold-offError F1
```



The PCS control process data and operating conditions essential for control at one glance:

Mode = working range selector switch at Heavy - Eco - Lift position.
Press. switch = active pressure and function selector switches
DSF-DSL-DSH-DSS-FSA.
(The pressure switches are located within the hydraulic system and actuate an electric contact at a hydraulic minimum pressure.)

PCS Pressure Switch F2/2

```
PCS   -Pressure switch-      F2/2

  DSL   on      HEAVY  off
  DSF   on      ECO    on
  DSS   off     LIFT   off
  DSH   off
  FSA   on
ESC-return | PgUp |        | Help
```

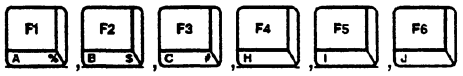
DSL = load pressure switch.
DSF = travelling pressure switch.
DSS = special equipment pressure switch.
DSH = hammer pressure switch.
FSA = lowering pressure switch.

Electrical speed adjustment

Programming mode submenu

```
PCS -Programming mode-
Equipment data                : F1
Load limit sensing control    : F2
Motor adjustment              : F3
Configuration                 : F4
Overload warning system       : F5
Control parameters            : F6
ESC-return
```

Selection of the configuration and setting pages necessary for PCS programming.

Keys 

are used to select the individual data items of the menu in the opposite column where programming is possible.

Mit 

returns from all data screens back to the programming mode submenu.

PCS programming mode P3/1
Electrical speed adjustment

```
PCS -Programming mode-                    P3/1
++ Electrical speed adjustment ++
high IDLE: 110 mA   high IDLE: 1800 RPM
HEAVY    : 110 mA   HEAVY    : 1800 UPM
ECO      : 200 mA   ECO      : 1700 UPM
LIFT     : 225 mA   LIFT     : 1600 UPM
low IDLE : 330 mA   low IDLE :  820 UPM
ESC-return | PgDn | programming ENTER
```

Function: Setting of currents for the speed-adjusting servo actuator to bring the diesel engine to the correct speed depending on the existing operating conditions.
Beispiel: The operator sets the Power switch on the control panel from ECO to HEAVY. The speed-adjusting servo actuator is being driven with 110mA instead of 200mA. The servo actuator adjusts the diesel engine's injection pump until a working speed of 1800 rpm is reached. This setting of the injection pump is maintained by the servo actuator.

Programming is performed by editing the current values (see under "Programming of machine data ").

```
PCS    programming mode          P3/2
********** engine regulation **********

engine warm-up phase      : 600 sec
nominal speed detection   :  24 sec
warm-up phase engine temp:  40 °C

ESC back | PgUp
```

??????????????????????????????????

Control panel (in driver's cab)

Special functions submenu

```
PCS  Special Functions
Log                    :  F1
Time program           :  F2
Filemanagement         :  F3
Extension              :  F4

Control panel          :  F6
ESC-return
```

Selection of the special functions pages required for general handling of data.

Keys 

, 

, 

, 

and 

are used to select the individual data items of the menu in the opposite column.

goes back from all data screens to the special functions submenu.

Control panel (in driver's cab) X6

```
PCS      control panel              X6

reset servicing interval       : F1
code for machine start disable : F2
factor for speedometer         : F3

ESC back
```

When the EDS tester is connected to the diagnosis socket, the **control panel of the machine** is connected via the machine's data bus to the tester. Therefore, it is possible to use the EDS tester also for changing control panel settings.

Functions: Changing of the parameters for servicing interval, start inhibit code and speedometer indication conversion factor stored in the control panel memory.

Resetting of servicing interval

```
PCS      control panel              X6/1

reset servicing interval!_

are you sure?  <1>=yes <0>=no

ESC back
```

Servicing intervall:

??????????????????????

(yes) executes function 

(no)

quits the programming mode and switches over to the Control panel menu screen X6.

INTRODUCTION

The various units of a machine are interconnected by pipe or hose lines so that the transfer of consumables, energy and control commands becomes possible. The hydraulic, brake and fuel supply systems of a machine are just such units.

Numerous line and coupling systems are available, especially in the spheres of hydraulics and pneumatics. It is from this wide range that FIATALLIS has chosen those systems that best comply with the special design criteria and operational demands of FIATALLIS machines.

This handbook is intended to give an impression of the pipe and hose lines, as well as their coupling elements, as applied by FIATALLIS. Working directions are also included for servicing procedures which involve the re-routing or changing of such line and coupling systems.

Cutting pipes:

Pipes are always to be cut at right angles to their longitudinal axes (Figs. 4 & 5). A pipe cutting clamp, as shown in Fig. 3 (P/N 73171493) facilitates the cutting of pipes at right angles.

Pipe cutters are not to be used on account of the cold deformation of the pipe which occurs.

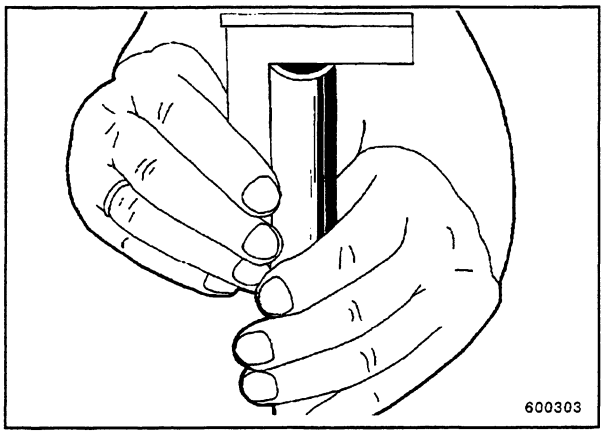


Fig. 4

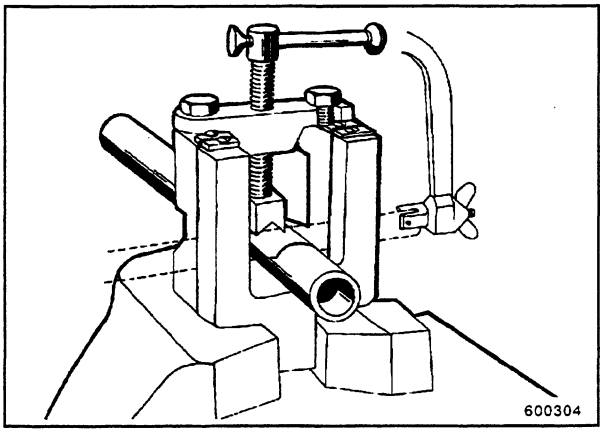


Fig. 5

After cutting, deburr the pipe inside and out (Figs. 6 and 7).

⚠ WARNING

Any metal particles inside the pipe must be removed.

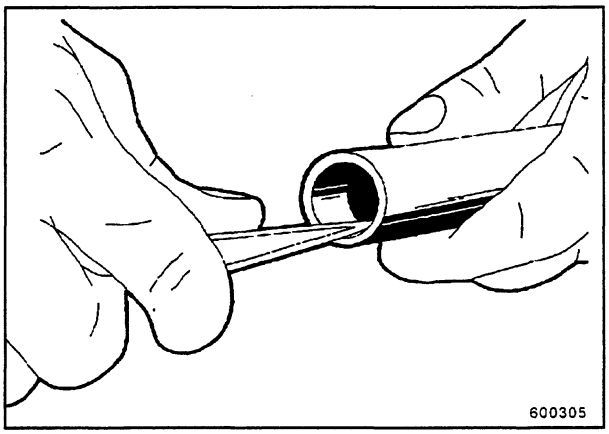


Fig. 6

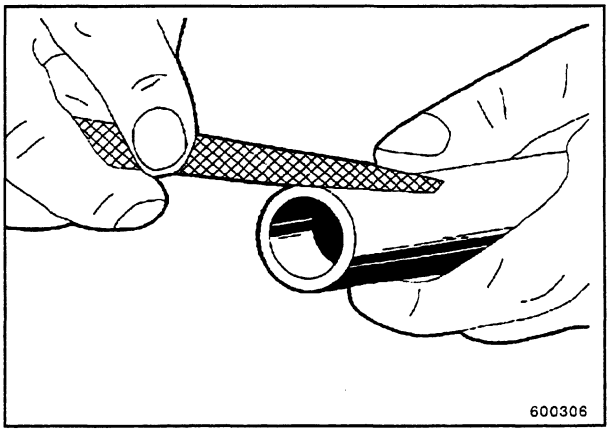


Fig. 7

Male nipples with metric or Imperial (inch) threads require a recess to accommodate the O-ring to seal the nipple (Fig. 6).

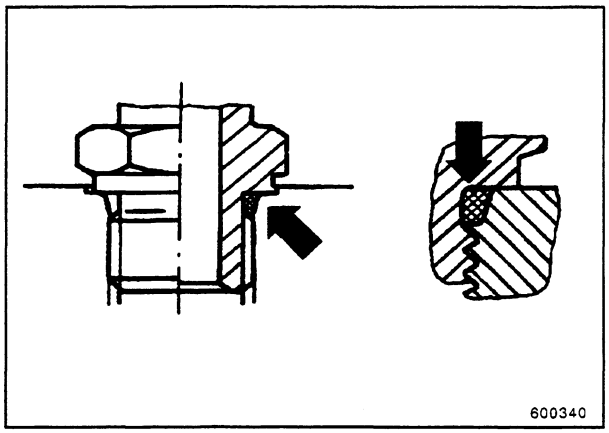


Fig. 6

In hydraulic systems, straight male nipples with sealing rings are often used. The ring is then rectangular in cross section (Stircomatic ring) or round (O-ring). Fig. 7 shows:

1 - Straight male nipple
2 - Stircomatic or O-ring
3 - Component to be sealed

If leakages occur, the nipple (1) should first be tightened up. If no improvement is reached, the seal ring must be changed.

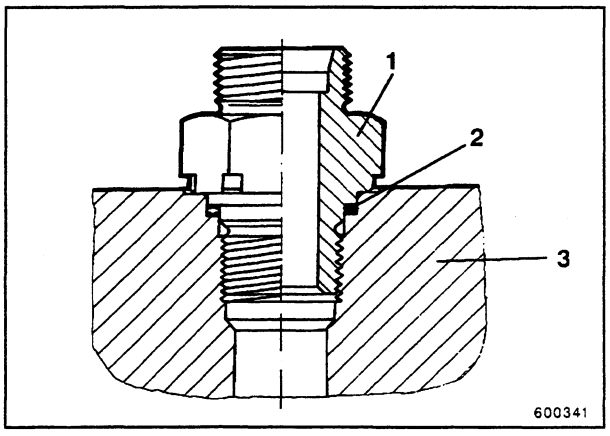


Fig. 7

Stircomatic seal rings

Stircomatic seal rings have been developed for control units, port plates, valves, threaded flanges and other connecting elements. They can be used with hydraulic oil, water and emulsions.

Fig. 1 shows the shape and construction of a Stircomatic seal ring:

1 - Cutting edge
2 - Textile inlay
3 - Rubber

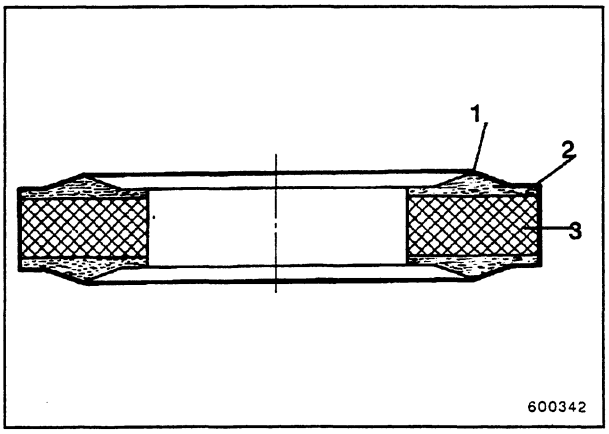


Fig. 1

Stircomatic seal rings have long-term pressure stability and high resistance to deformation.

O-rings previously used at such points can be replaced by Stircomatic rings.

Assembling flange couplings

The descriptions cover the following flange couplings:

1 - Pipe / connection surface
2 - Hose / connection surface
3 - Pipe / hose
4 - Hose / hose
5 - Pipe / pipe

Flange coupling - pipe / connection surface, F-system

Figs. 1 & 2 show:

1 - Connection surface
2 - Seal ring
3 - F-ring (wedge ring)
4 - Flange
5 - Double-hex bolt
6 - Pipe

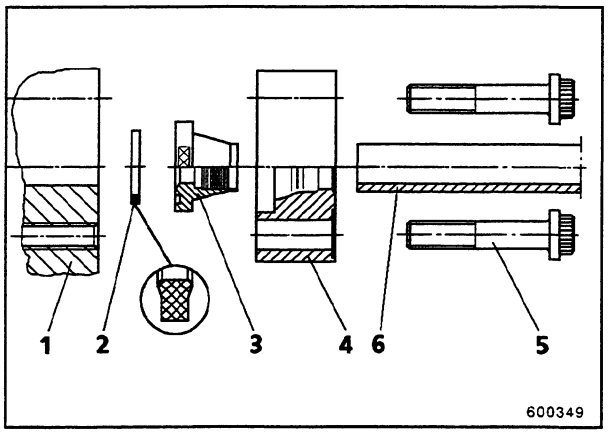


Fig. 1

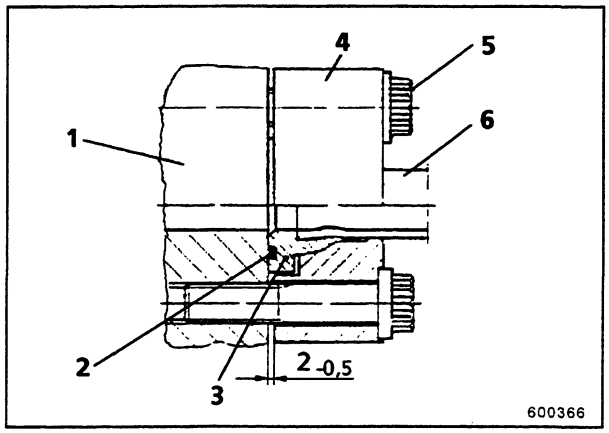


Fig. 2

Assembly:

1. Pipe preparation

   Saw the pipe off at right-angles (do not use pipe cutters). De-burr pipe inside and out.

2. Oil threads of double-hex bolts (5) and inside contour of flange (4) to reduce assembly forces

3. Push flange (4) and wedge ring (3) onto pipe (6). If wedge ring has a seal groove, fit seal first.

⚠ WARNING

Do NOT grease ring or groove.

Push pipe (6) against shoulder of wedge ring (3) and then push flange (4), with wedge ring, against connection surface (1). Insert double-hex bolts (5) and tighten as far as possible by hand.

Pipe (6) must be free of tension and at right-angles to surface (1).

4. Tighten double-hex bolts (5) diagonally in stages of max. 1/2 turn each time.

   The coupling is correctly assembled when the gap between parallel faces of connection surface and flange edge is $\mathbf{2_{0.5}}$ **mm** (Fig. 3) (gap for first installation/assembly).

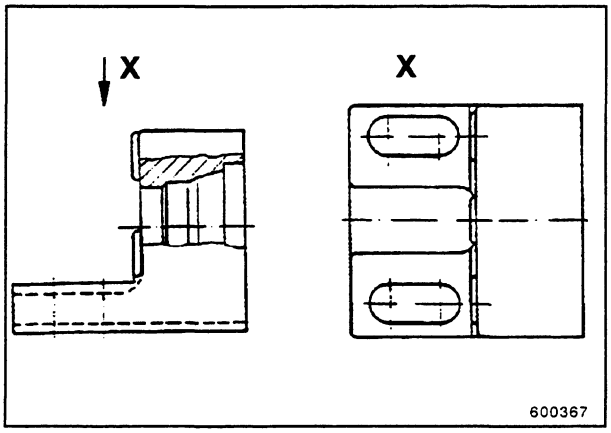


Fig. 3

Accessories

Pre-assembly aids for pipe flange couplings

1. Flanit system

Following pre-assembly units can be used:

Parts No. 73175994

- electro-hydraulic unit, comprising
  - control unit with foot switch
  - assembly cylinder
  - connecting hose

Parts No. 73175995

- manual hydraulic unit, comprising
  - hand pump
  - assembly cylinder
  - connecting hose

In addition, the following pre-assembly jaw blocks and counter-rings are also necessary.

Pre-assembly jaw blocks		Counter-ring	
Size	**Parts No.**	**Pipe dimensions**	**Parts No.**
3/4"	73175999	25 x 3 28 x 2	73176146 73176147
1"	73176000	30 x 3,5	73176148
1 1/4"	73176001	35 x 2 38 x 4	73176149 73176150
1 1/2"	73176002	42 x 2	73176151
2"	73176003	50 x 2	73176152

2. Zako system

Following pre-assembly units can be used:

Parts No. 73175996

- electro-hydraulic unit, comprising
  - control unit with foot switch
  - assembly cylinder
  - connecting hose

Parts No. 73175997

- manual hydraulic unit, comprising
  - hand pump
  - assembly cylinder
  - connecting hose

In addition, a set of jaws for pipe 50 x 6, Parts No. 73175998, is also required.

TABLE OF CONTENTS

1.4.5 Practical experience

In order to lower the weight of components, designers often resort to materials with higher strength values and to plates of lower thicknesses with no changes to the shape of the component.

In this respect it should not be overlooked, however, that the stability of the structural element only depends on the geometrical dimensions and the modulus of elasticity E of the material. E is basically the same for an S690Q and an S355J2G3.

This means that a component consisting of thinner plates is subject to stronger deformations and thus loses some of its service properties. Moreover, the effects of notches on the strength of the materials are increased.

High-strength fine-grained structural steels such as S690Q offer advantages over ordinary fine-grained structural steel S355J2G3 only in cases of static or predominantly static loading and reduced notching (fig. 19).

With the strength of the material increasing, the susceptibility of structural steel elements to notching becomes greater.

For machines subject to alternating loads and equipped with notched structural steel elements it is therefore recommended to use an S355J2G3.

In this context, notches resulting from marks left by usage have to be considered as well.

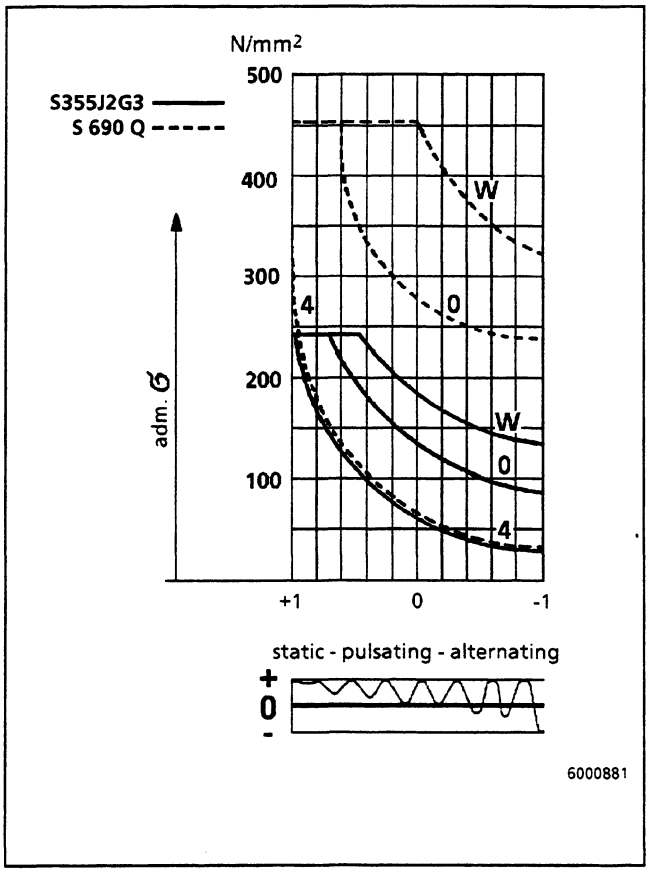


Fig. 19

Location and shape of curves W, O and 4 refer to:

material: S355J2G3, S690Q

no. of load cycles: $\geq 2 \cdot 10^6$ (2 million)

group of stress intensities: small, medium and high stresses with approx. the same frequency

2.3 Scope of repair work

The most suitable procedure to be followed in a case of damage is shown in the diagram below.

After damage has been reported, one of the 3 following decisions is to be taken (fig. 1).

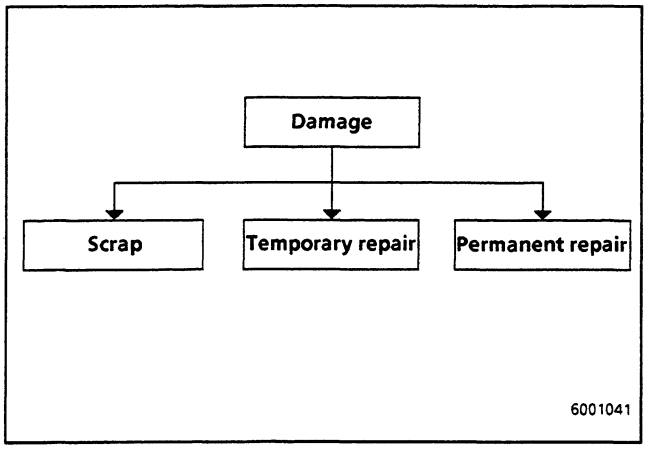


Fig. 1

2.3.1 Scrapping of components

The damage has reached such an advanced stage that a proper repair is either technically no longer feasible or linked with extremely high costs.

The limit for this decision is not a fixed one. Whereas at home and in most industrialized countries the decision to scrap is taken relatively early, it may be necessary in other countries to carry out the repair because the procurement of a new part is difficult for various reasons and sometimes even impossible. The reasons for this situation may lie, for example, in the lack of foreign exchange, in high customs duties, long delivery periods and extended standstill periods for the machine. Relatively low wage costs can also be a reason in favour of the repair.

2.3.2 Temporary repair

The component must be repaired immediately in order to maintain the machine's availability, e.g. because the machine is used for a job with fixed time limits (fig. 2).

In spite of being a matter of urgency, temporary repairs must nevertheless be performed carefully in order to avoid new damage.

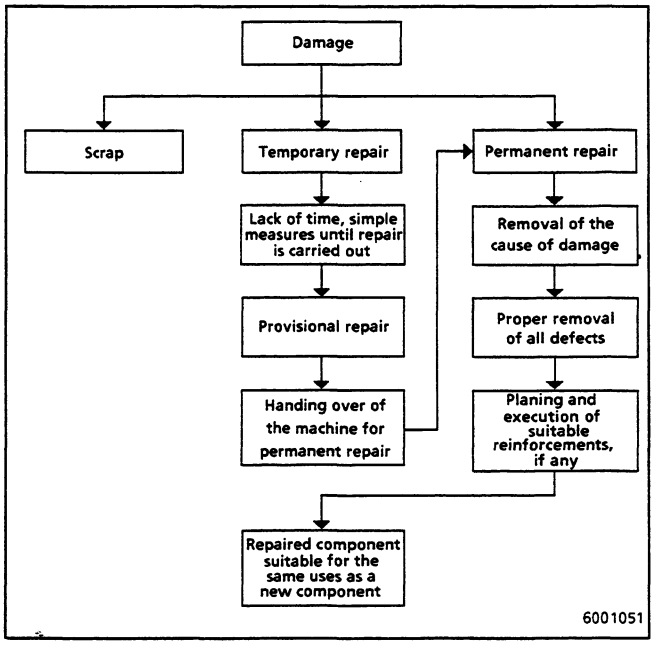


Fig. 2

3.4 Cracks in box-type sections

Gouging and welding of cracks only from the outside cannot be recommended.

Welding without backing strips usually leads either to an incomplete filling of the root area or to a drop-through at the root (fig. 21).

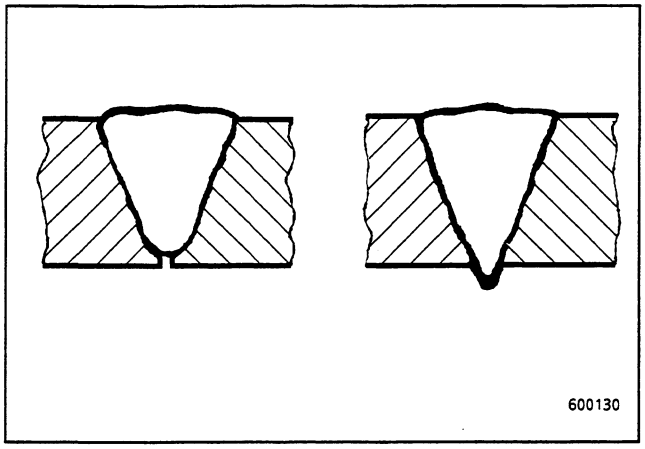


Fig. 21

In both cases, the mechanical notches in the root area will lead to the formation of new cracks.

Welding on backing strips introduced through the joint can equally not be recommended (fig. 22).

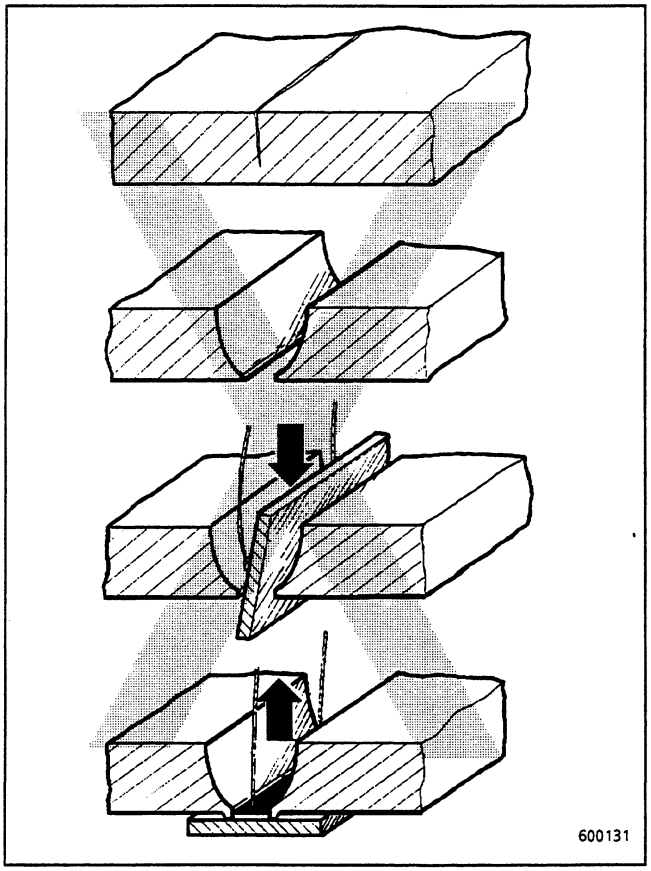


Fig. 22

The backing strips will not come to rest properly on the base metal.

Flashes and slag residues on the under-side cannot be removed.

The resulting mechanical notches will cause new damage.

3.7.2 Closing a web-plate opening

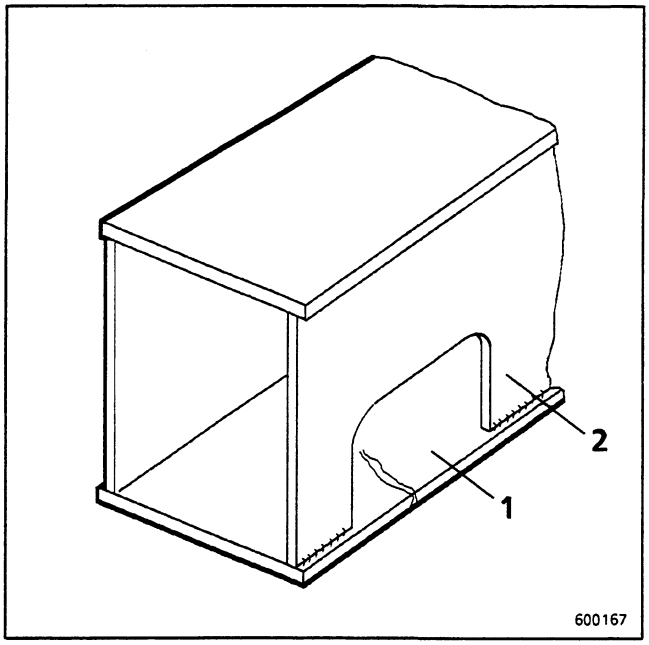


Fig. 57

1. At the web-plate (2, figs. 57 + 58), chamfer the edges to be welded with approximately 10°. Width b of the chamfer in reldition to the plate thickness can be seen in fig. 70, page 42.

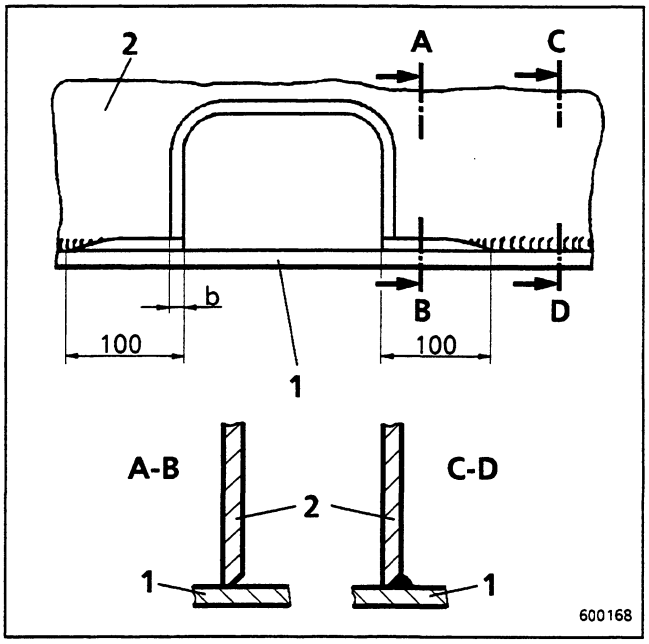


Fig. 58

2. Gouge out the longitudinal seams between chord plate (1) and web plate (2) over a distance of approximately 100 mm (fig. 58).

3. Attach backing strip (3, fig. 59), but only to the web-plate edges.

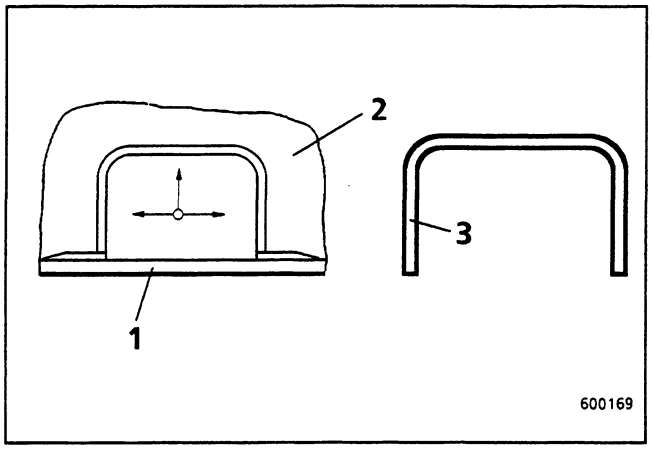


Fig. 59

Prepare backing strip (3) from flat steel 30 x 4 bent on edge or burn out of 4 mm thick plate. Do not tack-weld backing strips from flat-steel bars for lack of cover at the rounded corners.

4. Attach backing strip (3) to the web plate (2) by means of screw clamps (fig. 60). Do not tack-weld but rather weld with a 3 mm fillet seam running all around (fig. 61).

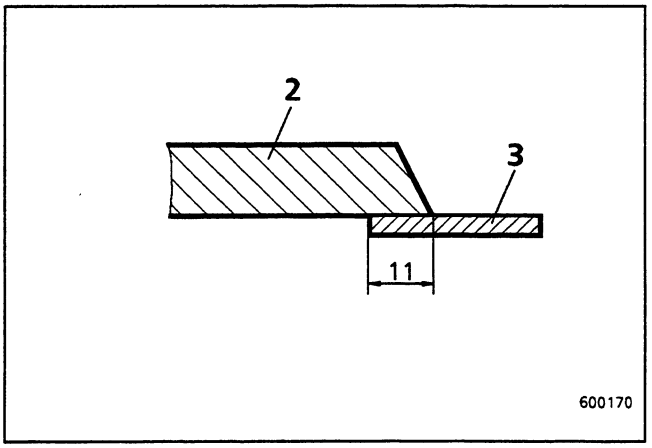


Fig. 60

After welding the fillet seam, clean the contact surface for the cover plate by removing all traces of weld spatter (arrow, fig. 61).

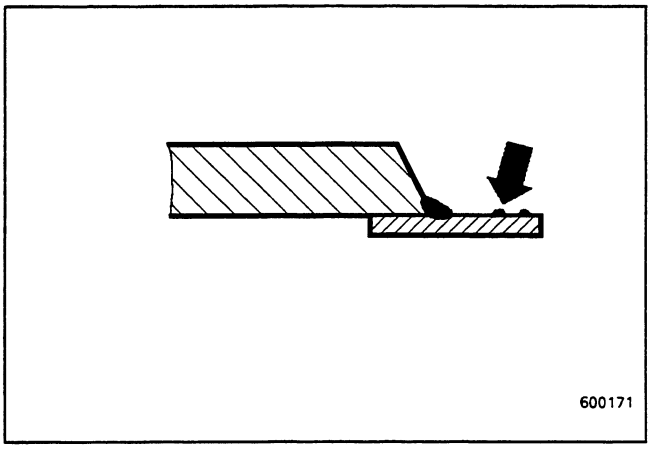


Fig. 61

4. Reinforcing of steel components

The reinforcement of components by welding can be done in the following ways:

- Covering up a damaged area after repair by reinforcing plates, with the aim of reducing the mechanical stresses σ (N/mm²) in the repair area.
- Eliminating deficiencies caused by changes in shape, e.g. the problematic case of "open sections/closed sections", shape of stiffening ribs, configuration of frame corners, etc.
- Eliminating deficiencies by means of changes in shape by build-up welding, e.g. on cast-steel parts.

The necessity of a component reinforcement should, if possible, have been proved by a simple analysis.

4.1 Reinforcing plates

4.1.1 Dimensions

- **Length of reinforcing plates**
  The ends of reinforcing plates are places where metallurgical and shape-induced notches occur which may lead to damage by the concentration of stresses (Part A, fig. 1).

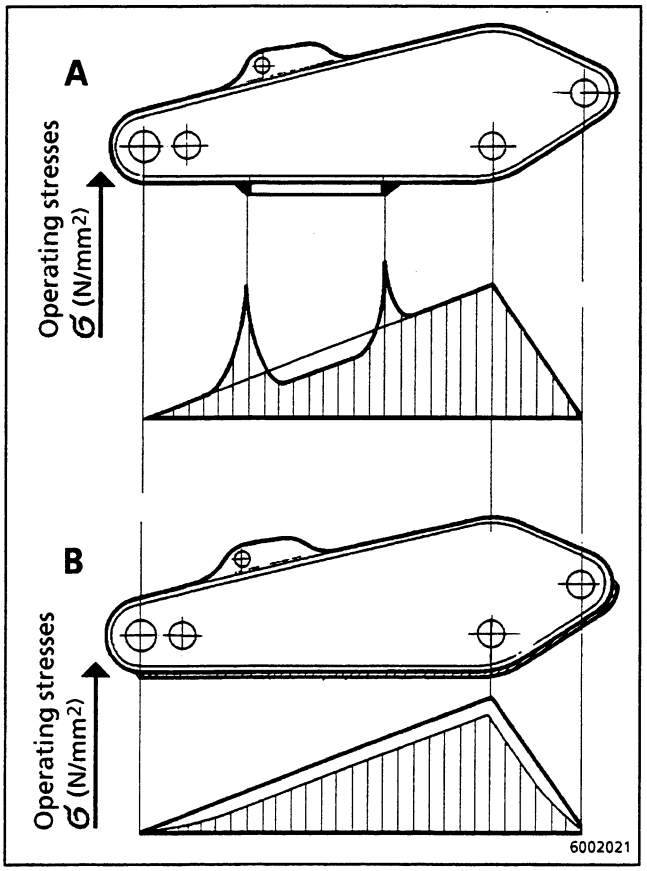


Fig. 1

Reinforcing plates should therefore be dimensioned in such a way that they end in areas with low basic stresses (Part B, fig. 1).

- **Thickness of reinforcing plates**
  The thickness of reinforcing plates should be max. 60 % of the thickness of the plate to be reinforced (fig. 2).

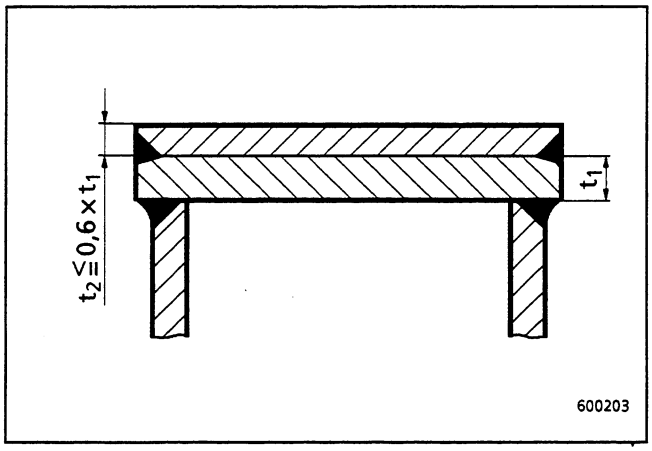


Fig. 2

An analysis shows that thicker reinforcing plates cannot be connected to the plate to be reinforced as the welding seams required would be too large. Thicker plates moreover lead to large shape-induced notches and make the component heavier than is really necessary.

- **Width of reinforcing plates**
  In steel components, stresses are often highest near the edges. The reinforcing plate should therefore be as wide as the plate to be reinforced (A, fig. 3).

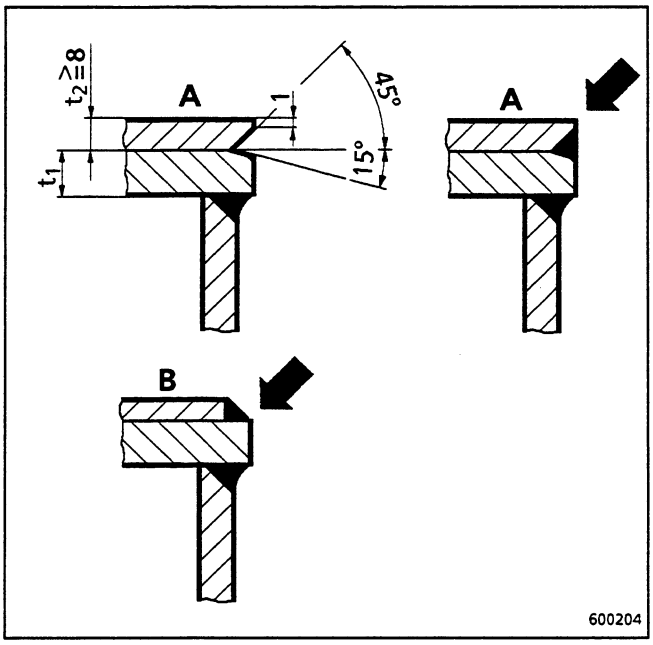


Fig. 3

For practical reasons, reinforcing plates of less than 8 mm thickness can not be chamfered. In such cases, the reinforcing plate (B, fig. 3) must be narrower to leave enough space for a fillet weld.

The upper edges (arrow, fig. 3) of the plate to be reinforced and of the reinforcing plate should not be melted away.

Plate	Plate	Plate
DIN EN 10113-2-S460N(ex.St E460)	EN 10037 - S690QL(ex.St E690)	Wear plate 500 HB LV 2 270 002
Fine-grained structural steel weldable normalized	Fine-grained high strength structural steel weldable quenched and tempered	Fine-grained structural steel high strength weldable quenched and tempered
Normalized or in an equivalent state induced by normalizing rolling	quenched and tempered in fluid	quenched and tempered in fluid
550 - 720 210 460 17 $\geq$ 40 J ISO-V - 20°C	790 - 940 ~ 300 $\geq$ 690 $\geq$ 16 $\geq$ 27 J ISO-V - 40°C	1550 ~ 450 - 540 $\geq$ 1300 $\geq$ 8 $\geq$ 20 J ISO-V - 10°C
See DIN EN 10113-2	See EN 10037	See manufacturer's instructions
Weldable; see 1.5.8 and 6.1 Possible at temperatures between 400 and 850°C Possible, but observe DIN 18800, Part 1	Readily weldable; see 1.5.8 and 6.1 Not possible without postweld quenching and tempering Possible by rolling	Weldable as wear protection; preheating to + 100°C Not possible Possible with very large radius by rolling (plate thickness)
Used mainly for hubs on equipment for construction machinery	Used for wear-prone parts, e.g. excavating tools, blades, wearing edges	Wearing plates welded onto excavating tools
See page 61	See page 61	See page 61

6.5 Stress-relieving of steel components

As a stress-relief annealing of repaired components is feasible only in rare cases and as machined surfaces may lose their dimensional accuracy in the annealing process, it is necessary to take other measures for the reduction of stresses.

6.5.1 Warming of components

One means of reducing high local internal stresses, which may occur, for example, after build-up welding or weld seam repairs, consists in stress relieving of the component area concerned.

The area around presumed stress concentrations must be heated up to 250 to 300°C (480 to 570°F). Electric heating mats, gas jets or gas burners can be used as sources of heat.

Heating up must be done at a rate of approx. 30°C/h (90°F/h).

For simply designed components with a wall thickness of less than approx. 25 mm, a retaining period of 3 h is sufficient. For more compact components with wall thicknesses of more than approx. 25 mm, a retaining period of 5 h is necessary.

Cooling-down must be done at a rate of approx. 30°C/h (90°F/h).

The component must be covered with insulant mats throughout the heating-up process.
The temperature differential in the component, e.g. between high-volume and compact areas and thin-walled, ribbed areas must not exceed 50°C (120°F).

6.5.2 Peening of weld seams

Shrinkage impediments produced during cooling of the weld seam may lead to high internal stresses (tensile stress) and to cracks. Unimpeded shrinking may produce material deformations (angular shrinkage).

Both these undesired conditions can be remedied by peening.

6.5.2.1 Method of peening

Peening is performed after completion of a weld pass which may also consist of several weld beads. Peening of individual beads of a pass is not allowed.

During peening, the temperature of the weld seam should be below 200°C (390°F/h). Except for root and cover passes, all weld passes are to be peened. Before peening, all traces of slag and spatter on the weld seam are to be removed. Inadmissible elevations, notches and pores are to be properly eliminated.

The peening chisel has to be run two to three times over the same area of the weld seam at a speed of abt. 100°cm/minute. Peening must not produce any sharp notches, grooves and material overlaps. The surface of the weld pass is to be uniformly treated by peening.

9.4 Repair of build-up welds

Worn-out build-up welds must be repaired by rewelding, if required.

Rewelding should be performed as long as remaining parts of the buffer layer are still visible.

Before rewelding, a surface crack test has to be carried out.
It is absolutely essential to gouge out any cracks in the base metal or the buffer layer before welding is performed. Cracks should never be overwelded!

9.4.1 State of wear

The repair measures to be taken depend on the material's state of wear.

State of wear 1 (fig. 8)

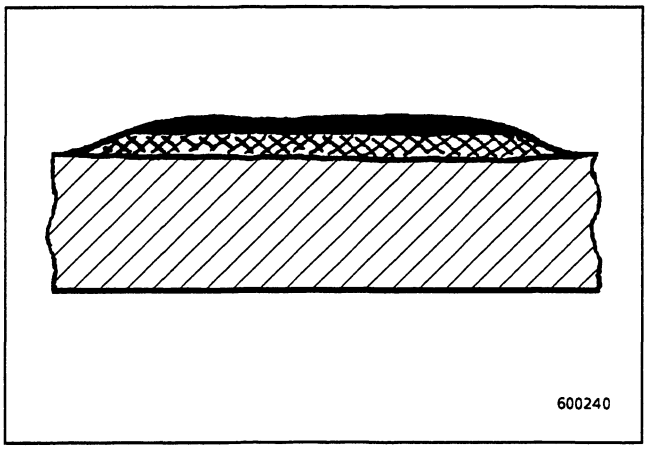


Fig. 8

- The hard-facing layer is almost worn out.
- The buffer layer is still fully intact.

Repair measure: Weld 2 new hard-facing layers.

State of wear 2 (fig. 9)

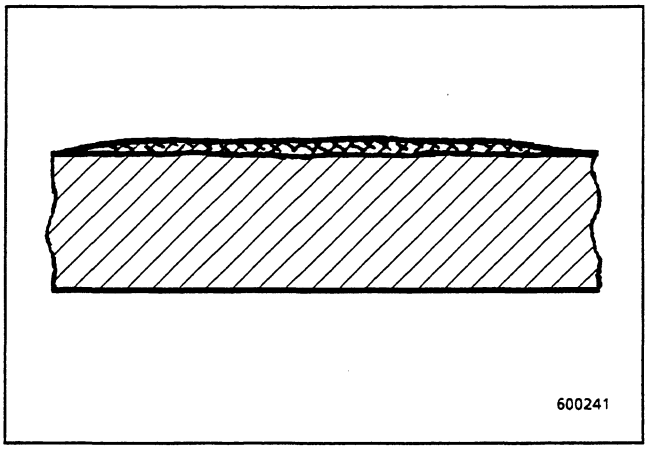


Fig. 9

- The hard-facing layer is completely worn out.
- The buffer layer is almost worn out.

Repair measure: Weld 1 new buffer layer and 2 new hard-facing layers.

State of wear 3 (fig. 10)

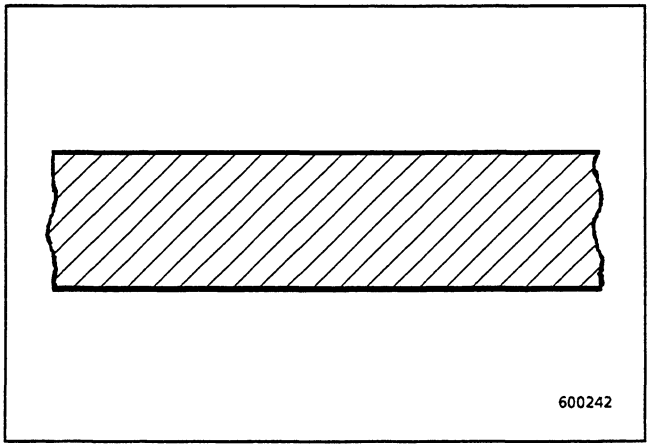


Fig. 10

- Hard-facing and buffer layers have been completely abraded down to the base metal.

Repair measure: Weld 1 new buffer layer and 2 new hard-facing layers.

9.9 Welding cutting edges onto digging tools of excavators

Prefabricated cutting edges (1, fig. 37) of high-strength, tempered steel can be welded to the excavating tool (2) as a wear-protection material with good cutting capability.

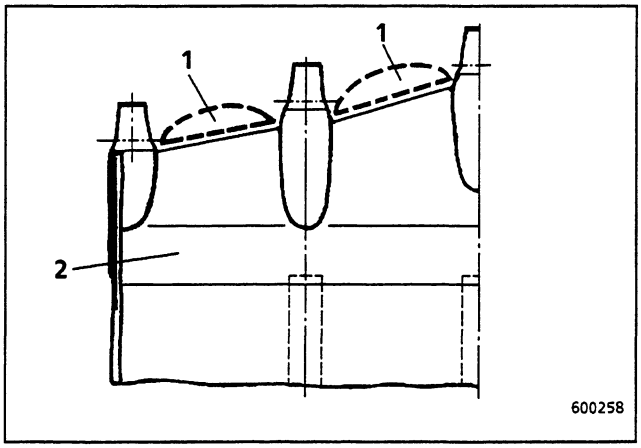


Fig. 37

9.9.1 Working sequence

- The contour of the worn-out cutting segment is to be cut straight by means of a flame torch. Before flame-cutting, preheat to 50°C (120°F). Grind flame-cut edges down to the bare metal.
- Make a replacing part with the help of a template. Material: wear-resistant tempered steel; pre-shaped, available e.g. from the FIATALLIS spare-parts service.
- For cutting out the contour and for chamfering the weld grooves, preheat the material to 50°C (120°F).
  Grind the weld groove surfaces smooth down to the bare metal.
- Attach replacing part (fig. 38).

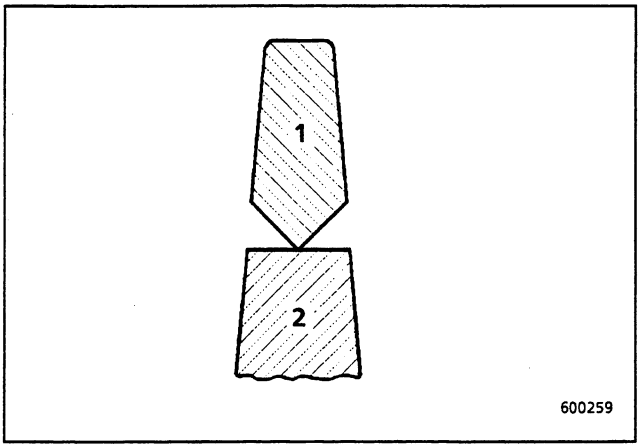


Fig. 38

To facilitate fastening and welding, the excavating tool should be placed with its blade in a vertical position.

For welding, preheat blade cutting-edge and replacing part to 150°C (300°F).

9.9.2 Welding sequence (fig. 39) and filler metals

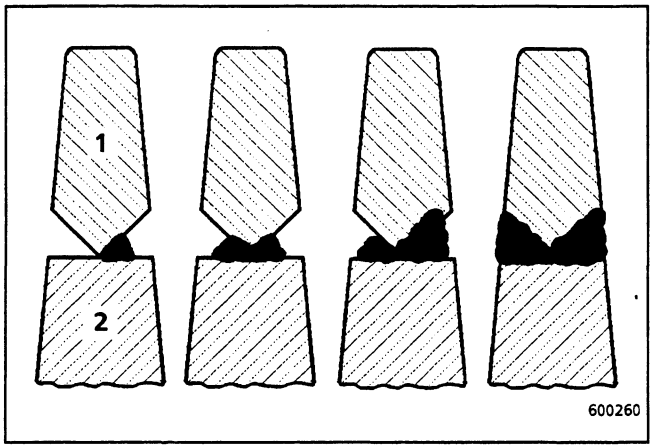


Fig. 39

Weld first the root and 1 interpass from one side using soft filler metals.

Filler metals (soft) for root and 1st interpass

Rod electrodes
EN 499: E 38 4 B 42
AWS 5.1: E 7018

Wire electrodes
EN 440: G4 Si 1
AWS 5.18: ER 70S-6

Grind out the root pass from the other side and weld 2 layers as on the other side.

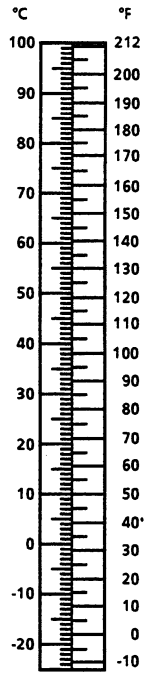
Finish the remaining weld with filler metals adapted to the material of the cutting edge (cf. page 86). Weld stringer beads; interpass welding temperature max. 250°C (480°F).

Work alternately on both sides in order to avoid distortion of the replacing part.

APPENDIX

Temperatur - Einheiten und Umrechnungsformeln
Temperature units and conversion formulas

Einheiten Units		Umrechnung in Conversion into			
Benennung Nomenclature Kurzzeichen Symbol		**K**	**°C**	**°R**	**°F**
Kelvin	K	1	(K-273.16°)	4/5 (K-273.16°)	9/5 (K-273.16°) + 32°
Celsius	°C	°C + 273.16°	1	4/5 °C	9/5 °C + 32°
Réaumur	°R	5/4 °R + 273.16°	5/4 °R	1	9/4 °R + 32°
Fahrenheit	°F	5/9 (°F-32°) + 273.16°	5/9 (°F-32°)	4/9 (°F -32°)	1



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Beispiel: Umrechnung von °R in °C : °C = 4/5 °R
Example: Conversion from

Die Grundeinheit der Temperatur ist Kelvin (K).
The fundamental temperature unit is the Kelvin (K).

Als Formelzeichen wird T verwandt.
The symbol used is the T.

Die ebenfalls benutzte absolute Temperatur degree (Grad) Rankin errechnet sich zu
The likewise used Rankine temperature scale for absolute temperatures is related to K as follows:

°Rank = 9/5 K.

INTRODUCTION

This Technical Handbook (THB) provides a compilation of the directions for using FIATALLIS recommended sealing, protective, testing and cleaning agents.

All of these agents have FIATALLIS approval and are necessary for various assembly procesures.

The agents can all be ordered from FIATALLIS Spare Parts Service.

Products from other manufacturers are only to be used when they possess the same characteristics and qualities as those of the agents stated.

If in doubt, ask the FIATALLIS After-Sales Service.

Further descriptions and directions (over and above those given here) are to be found in the relevant manufacturer's instructions and literature.

FUNDAMENTAL SAFETY INSTRUCTIONS

Complies with VDMA recommendation "Operating Instructions"

Warnings and symbols

The following signs are used in the manual to designate instructions of particular importance:

⚠ WARNING

Precautionary rules and measures designed to protect the machine operator and other persons from life-threatening danger or injuries and to prevent extensive damage.

⚠ CAUTION

Information and precautionary measures designed to prevent damage to the machine or other property.

HETAL ADHESIVES

The following products are approved by FIATALLIS :

Omnifit Rapid 200 H / FIATALLIS P/No. 73171476

Application on FIATALLIS machines:

Swing bearing and track pad mountings.

Application:

Clean all traces of paint and grease from all contact surfaces using AK-PHTH-thinner DV 2404 (FIATALLIS P/No. 73171477).

Apply a continuous strip, approx. 1 mm thick, in a ring around each bolt hole. Keep the ring a slight distance sawy from the bolt hole to prevent adhesive being squeezed into the thread when the bolts are tightened up.

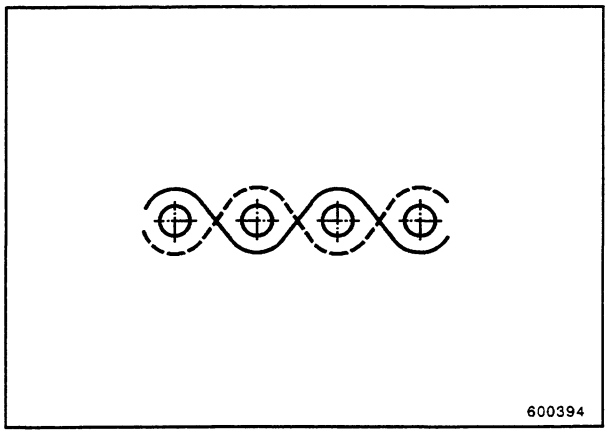

Fig. 1

Tighten the bolts within 30-45 minutes.
Hardening begins after adhesive has been applied and has contact to the air.

Re-tighten the bolts after 50-60 operating hours and in the intervals given in the machine's Servicing and Inspection Instructions.

Disasselably:

Before lifting off a swing bearing, loosen it at several points using a crowbar.
On small swing bearings, it is usually sufficient to hit the undercarriage or superstructure mounting surfaces with a hammer. Large swing bearings can be lifted off as soon as the bolts have been loosened.
Once the bolts have been removed, the small fissures in the adhesive film (dure to unevenness) increase in size and cause the adhesive to crumble away.