



MANUAL SHOP



BE75 HYDRAULIC EXCAVATOR

APPL. EQPT. SL. NO. : 10001 & UP

BE75

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BE75

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FOREWORD

This shop manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgments. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop.

For ease of understanding, the manual is divided into chapters for each main group of components; these chapters are further divided into the following sections.

STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

TESTING AND ADJUSTING

This section explains checks to be made before and after performing repairs, as well as adjusting to be made at completion of the checks and repairs.

Troubleshooting charts correlating "Problems" to "Causes" are also included in this section.

DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

MAINTENANCE STANDARD

This section gives the judgment standards when inspecting disassembled parts.

NOTICE

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your BEML Marketing for the latest information.

IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for the safe operation of your machine. The service and repair techniques recommended by **BEML** and described in this manual are both effective and safe methods of operation. Some of these operations required the use of tools specially designed by **BEML** for the purpose.

To prevent injury to workers, the symbols \triangle and \checkmark are used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary action to deal with situation.

SAFETY

GENERAL PRECAUTIONS

Mistakes in operation are extremely dangerous. Read the Operation and Maintenance manual carefully BEFORE operating the machine.

- 1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.
- 2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
 - Always wear safety glasses when hitting parts with a hammer.
 - Always wear safety glasses when grinding part with a grinder etc.,
- 3. If welding repairs are needed, always have a trained, experienced welder to carry out the work. When carrying out welding work, always wear welding gloves, apron, glasses, cap and other clothes suited for welding work.
- 4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
- 5. Keep all tools in good condition and learn the correct way to use them.

 Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

PREPARATIONS FOR WORK

- 7. Before adding oil or making any repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
- 8. Before starting work, lower blade, ripper, bucket or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
- 9. When disassembling or assembling, support the machine with blocks, jacks or stands before staring work.
- 10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

PRECAUTIONS DURING WORK contd...

- When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
 Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.
- The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned.
 Wait for the oil and water to cool before carrying out any work on the oil or water circuits.
- 13. Before staring work, remove the leads from the battery. Always remove the lead from the negative (-) terminal first.
- 14. When raising heavy components, use a hoist or crane. Check that the wire rope, chain and hook are free from damage. Always use lifting equipment which has ample capacity. Install the lifting equipment at the correct places. Use a hoist or crane and operate slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
- 15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides, Slowly release the pressure, then slowly loosen the bolts to remove.
- 16. When removing components, be careful not to break or damage the wiring. Damaged wiring may cause electrical fires.
- 17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips on to the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.

- 18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
- 19. Be sure to assemble all parts again in their original places.
 - Replace any damaged parts with new parts.
 When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
- 20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also, check that connecting parts are correctly installed.
- 21. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
- 22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
- 23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
- 24. Take care when removing or installing the tracks of track-type machines. When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

HOISTING INSTRUCTIONS

- Heavy parts (25 kg or more) must be lifted with a hoist etc. In the Disassembly and Assembly section, every part weighed 25 kg or more is indicated clearly.
- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made.
 - Check for removal of all bolts fastening the part to the relative parts.
 - Check for existence of another part causing interference with the part to be remove.

2. Wire ropes

 Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

Wire ropes (Standard "Z" or "S" twist ropes without galvanising)			
Rope diameter	Allowable load		
in mm	in tons		
10	1.0		
11.2	1.4		
12.5	1.6		
14	2.2		
16	2.8		
18	3.6		
20	4.4		
22.4	5.6		
30	10.0		
40	18.0		
50	28.0		
60	40.0		

The allowable load value is estimated to be on-sixth or on-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook to avoid slipping of rope during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.



Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound on to the load.

3)

Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load (kg) when hoisting is made with two ropes, each of which is allowed to sling up to 1000 kg vertically, at various hanging angles. When two ropes sling a load vertically, up to 2000 kg of total weight can be suspended. This weight becomes 1000 kg when two ropes make a 120[°] hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 4000 kg if they sling a 2000 kg load at a lifting angle of 150°.



STANDARD TIGHTENING TORQUE

1. STANDARD TIGHTENING TORQUE OF BOLTS AND NUTS

The following charts give the standard tightening torques of bolts and nuts. Exceptions are given in sections of "**Disassembly and Assembly**".

Threaded diameter of bolt (mm)	Width across flat (mm)	kgm	Nm
6	10	1.35+0.15	13.2 <u>+</u> 1.4
8	13	3.2+0.3	31.4 <u>+</u> 2.9
10	17	6.7+0.7	66 <u>+</u> 6.8
12	19	11.5+1	113 <u>+</u> 9.8
14	22	18+2	117 <u>+</u> 19
16	24	28.5+3	279 <u>+</u> 29
18	27	39+4	382 <u>+</u> 39
20	30	56+6	549 <u>+</u> 58
22	32	76+8	745 <u>+</u> 78
24	36	94.5+10	927 <u>+</u> 98
27	41	135+15	1320 <u>+</u> 140
30	46	175+20	1720 <u>+</u> 190
33	50	225+25	2210 <u>+</u> 240
36	55	280+30	2750 <u>+</u> 290

This torque table does not apply to the bolts with which nylon packings or other non-ferrous metal washers are to be used, or which require tightening to otherwise specified torque.

2. TIGHTENING TORQUE OF SPLIT FLANGE BOLTS

USE THESE TORQUES FOR SPLIT FLANGE BOLTS

Threaded diameter	Width across	Tightening torque	
of bolt (mm)	flat (mm)	kgm	Nm
10	14	6.7+0.07	65.7 <u>+</u> 6.8
12	17	11.5+1	117 <u>+</u> 9.8
16	22	28.5+3	279 <u>+</u> 29

STANDARD TIGHTENING TORQUE

3. TIGHTENING TORQUE FOR NUTS OF FLARED

Width across	Tightening torque	
flat of nut part (mm)	kgm	Nm
19	2.5 <u>+</u> 0.5	24.5 <u>+</u> 4.9
24	5 <u>+</u> 2	49 <u>+</u> 19.6
27	8 <u>+</u> 2	78.5 <u>+</u> 19.6
32	14 <u>+</u> 3	137.3 <u>+</u> 29.4
36	18 <u>+</u> 3	176.5 <u>+</u> 29.4
41	20 <u>+</u> 5	196.1 <u>+</u> 49
46	25 <u>+</u> 5	245.2 <u>+</u> 49
55	30 <u>+</u> 5	294.2 <u>+</u> 49
	Width across flat of nut part (mm) 19 24 27 32 36 41 46 55	Width across flat of nut part (mm)Tighten19 2.5 ± 0.5 24 5 ± 2 27 8 ± 2 32 14 ± 3 36 18 ± 3 41 20 ± 5 46 25 ± 5 55 30 ± 5

Use these torque for nut part of flared.

COATING MATERIALS

The recommended coating materials prescribed in BEML Shop Manuals are listed below

Nomenclature	Beml code	Application	
	C6011-07	Used to apply rubber pads, rubber gaskets and cork plugs	
Adhesives	C6011-09	Used to apply resin, rubber, metallic and non- metal ic parts when a fast, strong seal is needed	
	C6011-08*	Preventing bolts, nuts and plugs from loosening and leaking oil.	
	LT-3	Provides an airtight, electrically insulating seal. Used for aluminium surfaces.	
	LG-1	Used with gaskets and packings to increase sealing effect.	
	LG-3	Heat-resistant gasket for precombustion cham bers and exhaust piping.	
Liquid gasket	LG-4	Used by itself on mounting surfaces on the final drive and transmission cases. (Thickness after tightening: 0.07-0.08mm)	
	C6011-05	Used by itself to seal grease fittings, tapered screw fittings and tapered screw fittings in hy draulic ciruits of less than 50 mm in diameter.	
Antifriction compound (Lubricant including molybdenum disulfide)	C6003-03	Applied to bearings and taper shafts to facilitate press fitting and to prevent sticking, burning or rusting.	
Grease (Lithium grease)	C6003-04	Applied to bearings, sliding parts and oil seals for lubrication, rust prevention and facilitation of assembling work.	
Vaseline		Used for protecting battery electrode terminals from corrosion	
Courti-bo is also called LOCTTE III the shop manuals			

GENERAL 01 TECHNICAL DATA & DIMENSIONS

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GENERAL VIEW



- 1. Bucket
- 2. Bucket cylinder
- 3. Arm
- 4. Arm cylinder
- 5. Boom
- 6. Boom cylinder
- 7. Idler
- 8. Track frame
- 9. Sprocket / Final drive
- 10. Track shoe
- 11. Dozer Blade
- 12. Dozer Blade Cylinder

WORKING RANGE AND DIGGING FORCES



Description	Standard (ARM,1650MM)(BOOM,3710MM)
WORKING RANGE (mm)	
A. Max. digging height	7120
B. Max. dumping height	4995
C. Max. Bucket loading clearance	5000
D. Max. vertical wall digging depth	3580
E. Max. digging depth of cut	3775
for 2440 mm level bottom	
F. Max. digging reach at ground level	6225
G.Max.digging depth	4090
H.Min reach at ground reference plane	818
J.Reach at Max. Height	2705
K.Max. reach	6385
L.Reach to bucket pin center at Max.	
height	2530
M.Max. bucket hinge pin height	6065
FORCES kN (kg)	
Bucket digging force	48.3(4923)
Arm digging force	37.4(3802)





DIMENSIONS (mm)			
A - Overall length / B - Width	5850/2280		
C - Overall htTop of boom / D - Cab	2615/ 2495		
E - Track length on ground / K - Height	2060 / 680		
F - Track gauge / T - Width	1700/450		
G - Min ground clearance / J-Cwt.	405/ 760		
H - Tail swing radius	1830		
L - Crawler overall length	2645		
M - Sprocket axis to axis of rotation	1030		
N - Cab width / P-length / R-height	940/1590/1615		
S - Shipping height	1865		

SPECIFICATIONS

GENERAL

Machine model			BE75		
Serial Numbers			B10011 AND UP		
	Eng	ine model		KOEL4R1040NA Diesel, 4 Stroke, Water cooled,	
	Туре			Direct injection, Naturally aspirated	
	No.	of cylinder - bore x stroke	(mm)	4, In-line - 105x120	
	Tota	al displacement	(cc)	4160	
	Flyv	vheelhorsepower	(HP/rpm)	57/2000	
	Мах	imum torque (kgi	m/rpm)	28/1500	
	Higl	n idling speed (rpm))	2050 <u>+</u> 50	
INE	Low	idling speed (rpm))	600 ~ 700	
ENG	Min	imum fuel consumption ratio	(g/Hph)	167	
	Star	ting motor		24V	
	Alte	rnator		24V, 40A	
	Battery			2x12V, 75 Ah	
	Тур	e of radiator core		Fin type	
ВE	Carrier roller (one side)		(one side)	1	
DER	Trad	ck rollers	(one side)	5	
CAN	Trad	ck shoe		40 (TRIPLE GROUSER)	
	LIC	Typenumber		VARIABLE DISPLACEMENT AXIAL PISTON PUMP GEAR PLIMP x 1	
	DRAU MP	Delivery	(l/min)	PISTON TYPE:144 LPM @2000 RPM, GEAR TYPE:72 @2000 RPM,	
	ΗΥΙ	Set pressure (kg/c	:m²)	MAIN, BOOM/ARM/BUCKET/TRAVEL:250 SWING : 130 AND PILOT : 30	
	rrol 'E	Type, number		COMPACT PILOT OPERATED LOAD SENSING 6 SPOOL VALVE.	
Σ	CONT	Control lever operation		(INCL.1 SERVICE SPOOL) PILOT TYPE	
γST	AULIC R	Travel motor		2 NOS. OF 2 SPEED AXIAL PISTON MOTORS WITH BUILT-IN COUNTER BALANCE VALVES	
JLIC 8	Swing motor			1 NO. AXIAL PISTON MOTOR WITH SWING MECHANICAL BRAKE.	
DRAI	Hyd	raulic cylinder		DOUBLE ACTING PISTON	
ΗΥΙ	Hyd	raulic tank		CLOSED BOXED TYPE	
	Hyd	raulic filter		TANK RETURN SIDE	
	Hyd	raulic cooler		AIR COOLED	

UNIT: kg

Machine	model	BE75
Serial Number	'S	BE10011 AND UP
Engine Assemb	bly	521.2
 Engine 		495
 Flexible 	e Coupling	7
● Main p	ump	45
Radiator and O	il Cooler Assembly	70
Hydraulic tank	(without hydraulic oil)	132.8
Fuel tank (with	out fuel)	60.45
Revolving frame		511.6
Operator's cab	(incl.operators seat)	338
Swing drive		76
Main control val	ve	65
Center swivel jo	pint assembly	35
Counterweight		650
Track frame as:	sembly	2303.2
•	Trackframe	832
•	Carrier roller assembly (2 Nos.)	5.7x2
•	Track roller assembly (10 Nos.)	14.7x10
•	Idler assembly with recoil spring (2 Nos.)	73.5x2
•	Final drive assembly (2 Nos.)	90x2
•	Sprocket (2 Nos.)	23.4x2
•	Swing circle	90
•	Track chain assembly (2 Sets)	437x2
BACKHOE		
•	Boom Structure	428
•	Arm Structure	163
•	Bucket Structure(empty)	227
•	Boom cylinder assembly(1 No)	82.5
•	Arm cylinder assembly (1 No)	80.3
•	Bucket cylinder assembly (1 No)	52.06
•	Blade cylinder assembly (1 No)	50.65
•	Arm Link (2 Nos)	6.87x2
•	Bucket Link (1 No)	25.77
•	Boom pin	8.5
•	Arm pin	6
•	Bucket pin	7.25
•	Link pin	7.25

		unit : Itr.
System	Refill capacity	Remarks
Engine cooling water	10	Water (incl. radiator)
Fuel tank	122	High Speed Diesel
Engine oil pan	9.5	Engine oil SAE20W40
Final drive case (each side)	0.8	Engine oil SAE90
Hydraulic tank	60	Engine oil SAE30

ENGINE 02 STRUCTURE AND FUNCTION

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ENGINE ASSEMBLY





ENGINE MOUNT AND FUEL TANK WITH PIPING



VIEW X





Air Cleaner assembly
 Pre-cleaner assembly
 Restriction Indicator
 Mud Collector
 Water Collector
 Fuel Inlet Hose
 Spill Hose
 Fuel Tank
 Cap
 Fuel Ivel sensor
 Valve
 Cushion
 Bolt
 Washer

- The tightening torque for items 13 shall be 28.5 Kgm.
- The fuel level sensor is installed inside the fuel tank. When the fuel level monitor indicates EMPTY, there is still 36 I of fuel remaining in the tank

RADIATOR AND OIL COOLER

The radiator core is in-line with oil cooler core. Air is sucked in as the fan rotates passing first through the oil cooler and then to the radiator.





- 1. Radiator cap
- 2. Radiator inlet hose
- 3. Radiator stay rod
- 4. Fan gaurd
- 5. Radiator outlet hose
- 6. Drain valve
- 7. Radiator mount
- 8. Hydraulic oil cooler
- 9. Hydraulic oil cooler inlet hose
- 10. Hydraulic oil cooler outlet hose

Specifications

	Core type	Heat dissipation rate(kcal/hr)
Radiator	Fin & Tube	36000
Hydraulic oil cooler	Wire wound copper tube	18035

FLEXIBLE COUPLING



FUNCTION

- The rotating torque of the engine is not constant, and there is always a considerable amount of rotational vibration. To prevent this vibration from being transmitted to the gear and piston pumps, a flexible coupling is installed to absorb the vibration.
- In this way, the durabality of the gear and piston pumps are increased by absorbing engine vibration and shock torque generated during sudden acceleration and heavy duty excavation.

STRUCTURE

 Flexible coupling (1) is installed to the engine flywheel and the flexible coupling hub (2) is fitted on the pump shaft (3). Thus the power is transmitted from engine to the pump shaft and any vibrations of the engine is absorbed by this flexible coupling.

ADJUSTMENT OF ENGINE CONTROL SYSTEM



1. Contact the plate portion of the fuel control lever (1) to piston (2) of the engine governor lever so that the engine governor lever is at "idling" position. And connect cable (3) while holding its postion.

2. Operate the fuel control lever so that the governor lever is in "full" postion. Then adjust the clearence between stopper bolt (4) and fuel control lever (1) 3 mm. Then locate the governor lever "stop" postion and adjust the stopper bolt so that the clearence between stopper bolt (5) and pistion (2) is 3mm.

Procedure of clearence adjustment is as follows :

* Place the governor lever in "stop" position and push stopper bolt (5) against piston (2).

* Return the stopper bolt by 2 turns, so that the clearence is about 3 mm.

ENGINE 03 DIS-ASSEMBLY AND ASSEMBLY

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DIS-ASSEMBLY AND ASSEMBLY

RADIATOR AND OIL COOLER

REMOVAL OF RADIATOR AND OIL COOLER ASSEMBLY

- 1. Loosen drain valve (1) on radiator and drain cooling water. (fig 1)
- 2. Remove drain plug (2) on hydraulic tank and drain oil from hydraulic tank. (fig 2)
- 3. Sling hood (3), disconnect stay (4), then remove 2 mounting bolts (5) and lift off hood. (fig 3 & 4)

Hood weight:

- 4. Dis-connect radiator inlet (6) and outlet (7) hose.
- 5. Disconnect oil-cooler inlet (8) and outlet (9) hose
- 6. Dis-connect radiator stay (10). (fig 3)
- 7. Sling radiator and oil cooler assembly, Remove 4 lower mounting bolts (11). (fig 5)
- 8. Lift off radiator and oil cooler assembly.

ROC assembly weight :

INSTALLATION OF RADIATOR AND OIL COOLER ASSEMBLY

- 1. Raise radiator and oil cooler assembly, Set in position on the frame and then tighten 4 lower mounting bolts(11). (fig 5)
- 2. Connect stay (10). (fig 3)
- 3. Connect radiator inlet (6) and outlet (7) hose. (fig 3)
- 4. Fit o-rings and connect oil-cooler inlet (8) and outlet (9) hose. (fig 5)
- Raise hood (3) and set in postion on the frame. Tighten 2 mounting bolts (5), then connect stay (4). (fig 3 & 4)
- Tighten drain valve (1) and add water through water filler
 (12) on radiator to specified level. (fig 1 & 6)
- 7. Tighten drain plug (2) and add oil through oil filler (13) on hydraulic tank to specified level. (fig 2 & 3)
- * Run the engine to circulate the water through the system. Then check water level again.
- 8. Close hood and lock with catch.







REMOVAL OF ENGINE AND MAIN PUMP ASSEMBLY

Lower the work equipment completely to the ground and stop the engine. Operate the control lever several times to relaease the remaining pressure in the hydraulic piping. Then loosen the oil filler cap slowly to relaese the pressure inside the hydraulic tank.

Disconnect the lead from the negative (-) termainal of the battery.

1. Draining water

Loosen drain valve (1) and drain cooling water. (fig 1)



2. Draining hydraulic oil

Fig 1



Remove drain plug (2) from hydraulic tank & drain oil from hydraulic tank. (fig 2) Hydraulic oil quantity : 90l

Fig 2

3. Pre- cleaner assembly

Remove hose clamps (3) and remove pre-cleaner assembly (4). (fig 3)



Fig 3

4. Hood, covers

SLING HOOD (5), DIS-CONNECT STAY (6) THEN REMOVE THE 2 MOUNTING BOLTS (7) AND LIFT OFF HOOD. REMOVE TOP COVER (8). (FIG 4, 5 & 15)

5. Air-cleaner assembly

Sling air cleaner assembly, remove hose clamps (9) then remove air-cleaner assembly (10). (fig 6)

6. Pump piping

- * After dis-coonecting, fit blind plugs in the tubes and hoses to prevent dust from entering.
- * Mark hoses with tags to show their mount ing position.

6. Pump piping contd..

- a) Remove hoses (11, 12 & 14) between pump and control valves. (fig 7)
- b) Remove hoses (15,16) between pump and manifold block. (fig 18)
- c) Disconnect hoses (13,28) between pump and hydraulic tank. (fig 17)

7. Accelarator/Stop Cable

Disconnect accelarator (17) and stop cable (18) from the engine. (fig 9)

8. Starting motor wiring

Dis-connect starting motor wiring (19). (fig 10)

9. Ground connection

Disconnect ground connection (20). (fig 10)

10. Fuel supply hose

Disconnect fuel supply hose (21). After disconnecting the hose tie with string or wire to prevent the hose from bending and spilling fuel. (fig 12)

11. Spill hose

Disconnect spill hose (22). (fig 12)

12. Radiator piping

- a) Remove radiator inlet hose (23). (fig 4)
- b) Disconnect water pump inlet hose (24). (fig 4)
- c) Disconnect wiring connector of water tempearture sensor (25). (fig 13)

13. Fan guard

Remove fan guard (26). (fig 4)

14. Engine and main pump assembly

Remove 4 mounting bolts of engine. (2 in front and 2 in rear)

Engine and main pump assembly : 558.5 kg

INSTALLATION OF ENGINE AND MAIN PUMP ASSEMBLY

1. Engine and main pump assembly

Raise engine and main pump assembly horizontally and set in position on frame

Tighten 4 mounting bolts of engine.

Tightening torque : 28.5 kgm

2. Fan guard

Install fan guard (26). (fig 4)

3. Radiator piping

- a) Connect water pump inlet hose (24). (fig 4)
- b) Install radiator inlet hose (23). (fig 4)

4. Spill hose

Connect spill hose (22). (fig 12)

5. Fuel supply hose

Connect fuel supply hose (21). (fig 12)

6. Ground connection

Connect ground connection (20). (fig 10)

7. Starting motor wiring

Connect starting motor wiring (19). (fig 10)

8. Accelarator/Stop Cable

Connect accelarator (17) and stop cable (18). (fig 9)

9. Pump Piping

- Tighten the connections of each hose to the following tightening torques
- Install hose without twisting or interferance.
 When inatalling hose connect them to the
- places marked when the hoses were discoonected.

Pump Piping contd...

9.

a) b)

c)

10. Air cleaner assembly

Raise air cleaner assembly (10) and set in postion on frame. Tighten hose clamp (9).

11. Pre-cleaner assembly

Postion pre-cleaner assembly (4) on air cleaner and tighten hose clamp (3). (fig 3)

12. Refilling with hydraulic oil

Tighten drain plug (2) on hydraulic tank and fill oil through oil filler to specified level. (fig 2)

13. Refilling with water

Tighten drain valve (1) and add water through water filler to specified level. (fig 1)

- Connect lead to (-) negative terminal of battery.
- Run the engine to circulate water through the syatem. then check the water level again.

14. Cover, engine hood

Install top cover (8) and engine hood (5) . Lock with catch. (fig 4) $\,$



Fig 5

9c 9b

ENGINE AND MAIN PUMP



10 _9a

Fig 6

ľ

B

AIR INTAKE TO ENGINE

0

Fig 7



Fig 8



Fig 10



Fig 12



Fig 13

25



Fig 15

POWER TRAIN 04 STRUCTURE AND FUNCTION

SWIVELJOINT	04-02
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SWING MACHINERY	04-04
SPECIFICATION	04-05

SWING DRIVE.....04-07

STRUCTURE AND FUNCTION



The swivel joint is used for the piping between the upper structure (which swings) and the under carriage (which is fixed).Oil is sent from the control valves installed in the upper structure and goes to the travel motors installed in the undercarriage.

The oil from the travel control valve enters the hole in the port of body (2),flows through the grooves on the outside circumference of the body (2) and enters the vertical holes on shaft (6).From here it is sent to the travel motor.

Slipper seal (3) is installed to prevent the oil from leaking outside or from flowing into the neighboring port.
TRAVELCONNECTIONS





Tightening of bolts as per standard torque. Apply thread sealant to bolts before tightening. While mounting the bearing care shall be taken to place the soft zone in the direction as indicated. Coat internal gear teeth with grease. Fill grease through grease filler port upto level indicated, approximate quantity of grease is 6 litres. Fill swing machinery with oil as indicated in operation and maintenance manual. Approximate quantity of oil to be used is 1.5 litres. Port details of swing machinery shown in swivel joint (03-2).

SPECIFICATIONS :

	DISPLACEMENT	44.1 cm ³ /rev			
	GEARBOX RATIO			1:18.01	
	INTERPITTENT FOR	72 L/min			
	HYDRUALIC MOTO	1587 rpm			
	MAX. PRESSURE	208 bar			
	GEARBOX MAX. O	UTPUT SPEED		87 rpm	
	GEARBOX MAX. O	UTPUT TORQUE		2359 Nm	
	RELIEF VALVE SE	T PRESSURE		209 bar @ 72 L/min	
	PARKING BRAKE	TORQUE		180 Nm	
	MIN. PARKING BR	AKE	MIN.	15 bar	
ICAL DATA	RELEASE PRESSU	RE	MAX.	48 bar	
	SPOOL OPERATING	4 bar			
	PARKING BRAKE	5 ±1.5 SEC. WITH OIL VG46 @ 50°			
ίΗΝ	MAX. DRAIN PRESSURE CONT.			1 bar	
TEC		3 bar			
	MIN. ANTICAVITAT	3 bar			
	OIL QUANTITY	L 3 ±10%			
	DRY WEIGHT	Kg 52 ±10%			
	PINION DATA : m=8 , Z=10, PA=20°, x=0.5, d=80,				
	da=101.4, b=67,				
		E E C Z O O 1 Z	0.0		
R	DRAWING NO.	5.563.2.013	.00		
NDC	MODEL CODE	703T2K GEA	R BOX +	KYB MSF44P	
VEN	ADDRESS	M/s. TRANS TRANSMITTAL	MITTAL BO DIVISION	nfiglioli Riduttori S.p.A , ITALY	
	THIS PART IS APPLICABLE FROM EQPT.SL.NO.10011 AND UP				

SWING DRIVE (7 03 T 2 K F5FA1 AA 18 F044NP35T) / 2T256300081 M/s.BONFIGLIOLI-TRANSMITAL

GENERAL INFORMATIONS

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GENERAL INFORMATION

1.1 Manual aim

This manual has been devised by the manufacturer to give necessary information to those authorised to work on this product for example the design engineers, installers, repair and maintenance technicians.

Besides helping one understand the rules of good manufacturing techniques used, the information given must be read attentively and strictly put into action.

Failure to observe this information may lead to health and safety risks to persons as well as economic loss.

Information:A strict and consistent compliance with the specifications of this technical manual ensure the minimum operating costs and a longer unit life.

Photographic documentation and drawings are supplied for educational purposes, so as to safely and properly carry out maintenance operations.

Minor deviations from pictures of this manual may appear on the actual gearbox. However, these discrepancies are not relevant to the main parameters, or maintenance functions.

1.2 Information on safety

Carefully read the instructions given in this instruction manual as well as the ones attached to the productand make sure to follow the information concerning safety.

Personnel, which perform any type of work on the product during its life span, must possess precise technical qualifications as well as recognised skills and experience gained in the specific sector. Failure to do so may lead to health and safety risks to persons.

It is recommended that when handling the product attention is paid to the information given in this manual or simply follow the instructions given on the packaging (if present).

Utilise the product only for the use specified by the manufacturer. Improper use of the product could lead to health and safety risks to persons as well as economic loss and furthermore will invalidate the guarantee given by the manufacturer.

Keep the product in perfect working order by following the scheduled maintenance procedure set out by the manufacturer. Good maintenance will ensure the best performances, a longer period of operation and a constant safeguard towards security requirements.

To undertake maintenance procedures in areas which are hard to reach or otherwise dangerous it is important to follow adequate safety conditions for one self and for others in compliance with the rules and regulations that govern safety in the workplace.

When replacing worn parts, use original spare parts. Use oils and greases recommended by the manufacturer. Doing this, will ensure that the product works properly and that the safety level is "acceptable".

2.0 PRODUCT IDENTIFICATION

The identification data of the unit are shown on two name plates put on the gearbox and on the motor.

Information

For all enquiries regarding general information on the product, spare parts, assitance, always give the identification data stamped on the ID plate. The plate must be removed or damaged during the life of the product.

3.0 NOTES

3.1 Delivery conditions

Gearboxes are supplied by BONFIGLIOLI TRASMITAL at the following standard conditions:

• Ready for installation in the mounting position specified when ordering.

• To guarantee their reliability, the internal parts are properly lubricated with a layer of oil, the same as the one used in the final test of the gearbox and compatible with the recommended oil.

Lubricating oil has not been added (as shown on the card).

• All unmachined parts and surfaces to be coupled are appropriately trated by antioxidants.

• External surfaces are protected with an antioxidantwater resistant grey color suitable for finish painting. Machined surfaces are not painted. Finish coat to be applied by the customer.

• Tested toin-house specifications.

• Appropriately packaged to facilitate handling, transport and storage.

Information: When the product arrives, ensure that it meets the information contained in the purchase agreement and that there are no damages or irregularities. If there are any problems contact the manufacturers' sales network directly.

3.2 Transport

We recommend that the box containing gearboxes is handled carefully in order to avoid damages during transport. When removing gearboxes from their packaging, extra caution should be taken to avoid impacts, which may damage sensitive parts.

The illustrations show the more common types of packaging.

3.3 Storage

Observe the following instructions to ensure correct storage of delivered products:

1. Do not store outdoors, in areas exposed to weather or with excessive humidity.

2. Always place boards of wood or other material between floor and products, to avoid direct contact with the floor.

3. For storage periods of over 60 days, all machined surfaces such as flanges, shafts and couplings must be protected with a suitable antioxidation product (SHELL ENSIS FLUID SDC or equivalent product).

The following measures must be taken for products which expected storage period exceeds 6 months:

4. Cover outer machined parts and mating parts with grease to avoid oxidation.

5. Fill completely the gearboxes with lubticant oil.

6. Fill completely the slew drives with hydraulic oil (use possibly the same oil of the hydraulic circuit).

Information: Before use, the gearboxes should be filled with the proper amount of lubricant of the recommended type.

3.4 Lifting and handling

If the handling occurs when the product is still packaged, simply follow the instructions given on thepackaging and/or use normal hoisting means.

Warning: Considering that the size and form of the product do not allow manual shifting, in particular handlings, (e.g. installation) it is necessary to use accessories that guarantee human safety and which also avoid damages to the product.

To lift and handle the product, after having opened the packaging, follow the information given below:

1. By using a tackle lift and handle with care avoidingimpacts.

Information Under no circumstance remove the plastic lid from the power supply ports of the hydraulic motor; this will help avoid the accidental introduction of foreign bodies into the motor, until the hoses are assembled.



4.0 TECHNICAL INFORMATION

The units of the series decribed in this manual is designed and built for upper structures slew drives formobile machines.

The unit includes:

a Hydraulic motor

Axial piston fixed displacement motor including: • Double shockless relief valve

- Anticavitation valves
- Negative parking brake hydraulically actuated
- Brake retarder valve (timer valve)

b Planetary gearbox

- Two reduction stages
- Output pinion shaft supported by two bearings
- Connecting flange to the machine frame
- Motor and gearbox have single lubrication

The functional scheme is shown on the scketch below:

A-B	PF	1/2"G	JIS	В	2351	Motor p	ort

Μ PF 3/4" JIS B 2351 Anticavitation port

> PF 3/8" JIS B 2351 Drain port

- **DB1** M18x1,5 Gearmotor raining port SH
- PF 1/4" JIS B 2351 Parking brake pilot port **PG** PF 1/4" JIS B 2351
 - Parking brake release port
- **PV** | PF 3/8" JIS B 2351 Vent port



DB

5.0 INSTALLATION

5.1 Installation of the slew drive on the machine

1. Move the slew drive in the mounting area applying lifting methods shown in section 3.4.

2. Clean the mating surfaces from oils or paint and fit the slew drive on the machine frame (for the correct orientation refe to the installation drawing).

3. Fix the slew drive to the machine frame by using nos.10 screws M12 minimum grade 8.8, tightened by a torque wrench at 86 Nm torque.



5.2 Direction of rotation

When connecting the main ports hoses on the motor, see the following drawing to check the direction of the rotation of the pinion shaft.

Oil Inlet Port	Oil Outlet Port	Direction of rotation of the pinion shaft (view from pinion shaft)	
А	В	Clocwise	
В	Α	Counter clockwise	





In case the air inside the slew drive cannot flows out from the draining port "DB", remove the plug "PV" from the base plate to allow air bleed.

5.3 Slew drive oil filling

The gearbox is lubricated with the drain oil of the hydraulic motor. Before the start up, fill the slew drive completely with the same type of oil used for the hydraulic circuit from the drain port "DB", located on the hydraulic motor.



5.4 Connection of the hydraulic system

1. Make sure that the entire hydraulic system meets the cleaning standard as given in level 9 according NAS 1638 or 18/15 ISO/DIS 4406.

Information: Clean hoses thoroughly prior to connection and remove any internal obstructions.

Prevent any foreign particles from getting into the hoses by removing the plastic caps only at the time of the assembly.

After hoses are connected to the motor, flow the hydraulic circuit and filter the oil from all the particles that may have contamined it.

2. Clean the surface to be connected on the hydraulic motor.

Information: Under no circumstance remove the plastic lid from the power supply ports of the hydraulic motor; this will help avoid the accidental introduction of foreign bodies into the motor, until the hoses are assembled.

3. Connect the hoses to the hydraulic motor ports (for hoses sizes and dimensions refer to the installation drawing).

- a. Service ports: A-B
- b. Anticavitation port: M
- c. Drain port: DB
- d. Parking brale release ports: PG
- a. Parking brake pilot port: SH



5.5 Connection of the brake

The slew drive is supplied with a safety negative

multidisc brake, fitted into motor, with hydraulic

control release (parking brake).

For information regarding the characteristics of the brake refer to the installation drawing.

The pressure values "PB-SH" are shown.



The drain pressure must be lower than the values shown below:

Motor drain pressure

Continuous running - Less than 1 bar Max. intermittent - Less than 3 bar

Drain pipe "DB" must be directly and independently connected to the tank. If the oil level in the tank is below the motor, connect the drain pipe as shown in the drawing fig.1.

In case the oil level in the tank is above the motor, it's possible to connect the drain pipe also as shown in the drawing fig.2.



Brake technical data

Min. pressure for brake release (PG) Min 15 bar Max 49 bar Brake pilot pressure (SH) Min 4 bar Max 49 bar Motor brake torque Static 160 Nm

1. To operate the brake connect the brake pilot pipes to the ports:

PG Brake release pressure port.

SH Brake pilot pressure port. This pressure comes from the control valve/ joystick.

04-12



Information: The brake is engaged with a time delay of $5,7\pm1,5$ sec. with oil VG 46 at the temperature of 50°C after the pressure at port "SH" is cancelled.

5.6 Connecting of the draining port

If the frame of the machine does not allow the access to the plug, it is necessary, during the slew drive installation, to fit an extention which takes the oil away from the machine.

1. Remove the drain plug and screw on a pipe to the drain port (for hose size and dimension refer to the installation drawing).

5.7 Characteristics of the Hydraulic System

The hydraulic motor lubrication has to be mineral hydraulic oil with additive against wear (EP) and anticorrosive type HLP (DIN 51526) or HM (ISO 6743/4) VISCOSITY ISO VG 46 having filtration on grade max.10 im (contamination level has to meet level 9 according NAS 1638 or 18/15 according ISO DIS 4406).

Hydraulic fluids with different properties should not be mixed.

Use filter with a visual indicator which can detect clogging from the outside, and with a reliefvalve which by-passes the oil when the filter element is clogged.

Should the machine operate at very low temperature we recommend that the motor and the hydraulic oil are heated under no load prior to start operation.





As the temperature of the hydraulic oil may be a critical factor we recommend that it be checked. High operational temperatures will causea corruption of the oxidation resistance level and will accelerate the deterioration process of the hydraulic oil.

The following precautions should be taken: 1. The temperature ranges of the hydraulic oil during operation have to be within $25^{\circ}C \div 90^{\circ}C$.

2. The temperature of oil should reach -20°C prior to start operation.

3. During operation the oil temperature can rise to 90°C but this temperature is acceptable only for very short periods of time.

These temperatues have been set to take into consideration general degrading in viscosity as well as the wear resisting additives used in the oil. The lifetime of motor will be reduced significantly if it should continuously above 90°C.

6.0 START UP AND RUNNING IN

In this first stage it is advised to follow the measures given below:

1. Check the correctly lubrication of the unit.

2. Bleed air from every part of the hyraulic and add oil in the tank if necessary.

Information: The presence of residual air in the hydraulic circuit will manifest itself with the presence of foam in the tank and will lead to a jerking of the motor as well as excessive noise coming from the motor and the valves.

3. Start the gearmotor at a low speed and gradually increase it after having verified that it is functioning correctly without any noises or vibrations.

Information: Do not reach maximum pressure unless the entire system has been filtered to eliminate any particles of dirt that may be present.

During the running-in stage follow the steps given below.

4. Check the correct revolution and direction of rotation.

5. Make sure that the functioning is regular and without any excessive noises and vibrations.

6. Make sure that the oil temperature does not exceed 85-90°C intermittent.

After having terminated this first running-in follow the steps given below.

7. Check that there are no oil leakages. If present, proceed to remove them.

8. Check the level of lubricating oil in the gearmotor.

9. It could happen that due to the presence of air, during the first start up, the opening action of the brake could be slowed down. It is advised to repeat the opening and closing function of the brake.

10. Check that there are no other problems in general.

5.0 MAINTENANCE

Under normal operating circumstances, no routine maintenance is required, except routine oil checks and oil changes. As recommended in this manual, unusual operating characteristics, such as noise or overheat, should indicate further investigation.

For a proper maintenance of the gearbox, the following checks and operations have to be done.

Inspection	Frequency	Action	
Tightening screws	After the first 50 operating hours of the gearbox	Screws tightening torque check	
Pinion- slewing ring meshing	Every 150 operating hours of the gearbox	Grease (if lubrication is required)	

Information In case of important and complex maintenance operations, make reference to The Spare Part Lists Exploded View which can be supplied under request or the suggestions of this manual.

Do not hesitate to contatct the gearbox distributor or manufacturer if further instructions are necessary or in case of particular problems.

4.2. Troubleshooting The following table is a troubles in slew drive 7	realized to localize 200TK series.	MAINTENANCE INFORMATIONS Cause / Causes Remedies				
		Overheating				
		Hydraulic oil too warm	Check the hydraulic circuit			
From the midportion (reduction stages) O-ring damaged	Replace O-ring	Brake not fully released	Check the brake release pressure			
From the pinion shaft		Insufficient torque				
Seal ring damaged	Replace seal ring	Internal motor parts damaged	Check the hydraulic motor			
From the plugs		Malfunctioning valves	Check valves			
Plug seal damaged	Replace plug seal	Insufficient speed				
Plug loose	Tighten the plug					
From the hydraulic mo	tor	Motor reed not correct	Check the hydraulic circuit			
Internal motor parts	Seals damaged	Low volumetric efficiency	Check the hydraulic motor			
damaged Check the hydraulic motor		Insufficient braking torque				
Check valves	Replace valve seals	Internal motor damaged	Check the hydraulic motor			
Inside the hydraulic motor		Malfunctioning valves	Check valves			
Internal motor parts Check the hydraulic motor damaged		Parking brake malfunctioning				
		Pressure values at PG-SH Brake discs worn ports not correct				
Hydraulic noise (during the slowing down of the motor speed)		Damaged parts Timer	valve malfunctioning			
Internal motor parts	Check the hydraulic motor	Check back pressure on the brake release port PG-SH				
damaged		Replace brake disc pack				
Hydraulic circuit malfun	ctioning	Check brake components				
Check the pressure to the	ne anticavitation	Check the timer valve correct functioning				
port is = 3 bar Verify hydraulic circuit		Upper structure locked				
Inside the gearmotor		Hydraulic motor locked				
(reductions)		Check hydraulic motor				
Internal damage	Check the gearbox	Parking brake locked				
Pinion shaft output		Check the brake release pressure				
Bearings damaged	Bearings damaged Check the gearbox		Mechanical components damaged			
Nut loose Check the gearbox		Replace damaged parts				

4.3. Dismounting the Slew Drive

In the case that it was necessary to undergo a (partialor total) revision, it will be necessary to dismount the gearmotor from the machine. As this is known as an out of the ordinary maintenance procedure, it is important that only personnel with specific skills and experience undertake it. It is also important that this procedure is undertaken in a workshop that is adequately tooled. As well as normal workshop tools it will be necessary to use special tools that can be made (see special tools attachment) or may be requested from the manufacturer.

Special Tools

Nut adapter	Code / : ATZ.03.028.0
Bearing puller	Code / : ATZ.05.015.0
Pad	.Code / : ATZ.06.020.0
Pad	.Code / : ATZ.06.021.0
Pad	.Code / : ATZ.06.022.0
Pad	.Code / : ATZ.06.025.0
Pad	.Code / : ATZ.06.046.0
Pad	.Code / : ATZ.06.052.0
Socket box wrench	Code / : ATZ.08.009.0
To be able to produce	these equipments refer

To be able to produce these equipments refer to the production drawings at the end of this manual.

In the following pages all the procedures for disassembling and reassembling the gearmotor are given, it is important to strictly adhere to them.

Proceed with these operations using all the necessary safety measures, like for example:

1. Cutting off all the hydraulic system connections on the gearmotor to avoid the introduction of any foreign bodies in the circuit and the gearmotor.

2. Making sure that the coupling surfaces are not damaged.

3. Following the handling so as to be sure that there are no risks for human safety and to guarantee the reliability of the gearmotor.

4. Making available a work area that is in line with work and health safety in the workplace guidelines. Initial inspection of hydraulic motor and gears, can be made without disassembling the slew drive from the machine. According to the service that has to be made on the hydraulic motor, some disassembly and reassembly steps here described, can be skipped.

NOTE: Below are all the steps to follow during these operations. Numbers in brackets in the text correspond to the references in the exploded view.





POWER TRAIN 04a DIS-ASSEMBLY AND ASSEMBLY

Disassembly.....04a-02 Assembly.....04a-20



DISASSEMBLY

1. Trace a line on the gearbox housing in order to have a reference point for the components in the reassembling stage.

2. Unscew the nos.16 socket head screws M10x110(19) grade 12.9 of the hydraulic motor(49) by a male hex head wrench.

3. By using a tackle, raise the hydraulic motor(49).



4. remove the O-ring seal(11) from the hydraulic motor.

5. Take out the !st reduction sun gear(17).

6. Takeout the toothed ring(12).

7. Take out the !st reduction(16).



8. Remove the O-ring(11) from the spacer(15).

9. Take out the spacer(15).

10.Remove the O-ring(11) from the spacer(15).

11. Take out the 2nd reduction sun gear(14).



12. Take out the toothed ring(12).

13. Take out the 2nd reduction(13).

14. Remove the O-ring seal(11) from the gearbox housing(5).



15. Lift the staking of the ring nut(8).

16. Assemble the equipment(ATZ.03.028.0) and (ATZ.08.009.0) on the ring nut(8).

17. By using a torque multiplier(1:25) unscrew the ring nut(8).

18. Take out the ring nut(8).



19. Take out the spacer(7).

20. Place the puller in the gearbox housing (5) and turn the screw until the pinion shaft comes out(1).

21. Take out the bearing inner ring(6).

22. Take out the gearbox housing(5).



23. Assemble the puller (ATZ.05.015.0) between the pinion shaft (1) and the nilos ring (2).

24. By using a puller, turn the screw until the bearing inner ring (3) comes out.

25. By using a stopper, take out the seal ring (4) from the gearbox housing (5).

26. Place the puller in the gearbox housing (5) and turn the screws until the bearing outer ring (3) comes out.

27. Turn the gearbox housing upside down (5),place the puller and turn the screws until the bearing outer ring (6) comes out.



Brake Retarder disassembling

28. Unscrew the nos.2 socket head screws M6x30 (50),grade 8.8,of the retarder valve (51) by a male hex head wrench.

29. Remove the nos.2 O-ring seals(52) from the hydraulic motor (49).

30. Unscrew the plug (55) from the retarder valve (51).

31. Remove the O-ring seal (54) from the retarder valve plug (55).



32. Remove the retarder valve spring and spool (51).

- 33. Anticavitation valve disassembling Unscrew nos.2 socket head screws M14x40
 (9) grade 12.9,of the base plate (23) by a male hex head wrench,to permit the disassembly of the anticavitation valves.
- 34. Unscrew the nos.2 plugs (4).

35. Remove the nos.2 O-ring seals (3) from the plugs (4).



36. Remove the nos.2 springs (2).

37. Remove the nos.2 check valves (1) from the base plate (23).

38. Disassembly of the relief valve assy. Unscrew the nos.2 relief valve kits (14).

39. Take out the nos.2 relief valve kits (14).



40. Remove the O-ring seal (18) and the backup ring (17) from their seat in the poppet seat.

41. remove the poppet seat.

42. Remove the O-ring seal (15) and the backup ring (16) from their seat in the relief valve (14).

43. Take out the free piston from the relief valve (14).



44. Remove the O-ring (11) and the backup rings (10) from their seats in the free piston.

45. Remove the O-ring seal (13) from relief valve (14).Repeat the same steps for the 2nd relief valve disassembly.

46. Disassembly of the base plate assy. Unscrew the plugs (8) from the base plate(23).

47. Remove the O-ring seals (7) from its seats in the plugs (8).

DISASSEMBLY



48. Unscrew the plug (6) from the base plate (23).

49. Remove the O-ring seals (5) from its seats in the plugs (6).

50. Unscrew the nos 4 socket head screws M14x40 (9) grade 12.9,of the base plate (23) by a male hex head wrench.

Caution

Remove carefully the base plate (23) until pins (19-24) are completely out.



51. Remove the valve plate (22).

52. Take out the pins (19).

53. By using a puller, remove the bearing (21) from the base plate (23).

54. Disassembly of motor shaft and cylinder block

Unscrew the plugs (47) from the motor housing (49).



55. Remove the O-ring seals (48) from its seats in the plugs (47).

56. Take out the pins (24).

57. Remove the O-ring seal (25) from its seat inthe motor housing (49).

58. Remove the springs (26-27) from the brake piston (28).



59. Mark the position of the brake piston (28) as a reference for the reassembling step.

60. By using two screws M6,take out the brake piston (28).

61. Remove the O-ring seals (29-30) from the brake piston (28).

62. Remove the cylinder block (39).



63. Take out the nos.3 pins (40) from their seats in the cylinder block (39).

64. Take out the spherical bush (41).

65. Disassemble the pistons-retainer plate unit (43-42).

66. Take out the pistons (43) from the retainer plate (42).



caution

By using a puller hook the brake spacer (31) and remove it and, at the same time, the discs pack (33-34).

67. Remove the O-ring (32) from the brake spacer (31).

68. Remove the thrust plate (44).

69. By using pliers remove the circlip (18) from the motor shaft (45).

ASSEMBLY



70. Take out the motor shaft (45) and the bearing (46) from the motor housing (49).

71.by using a puller,take out the bearing (46) from the motor shaft (45).

ASSEMBLY

Hydraulic motor reassembling method

 Reassembly of motor shaft and cylinder block Place the bearing (46) on the motor shaft (45).



2. By using rubber hammer and a tool push the bearing (46) against the motor shaft shoulder (45).



3. Place the bearing-motor shaft unit (46-45) in the seat inside the motor housing (49).

4. By using a rubber hammer push the bearingmotor shaft unit (46-45) againest the motor housing shoulder (49)

5. Insert the place (44) in the motor housing (49)

6. Assemble the no's 3 pins (40) in their seals in the cylinder block (39)

ASSEMBLY



STRUCTURE AND FUNCTION

7. Assemble the spherical bush (41) on the cylinder block (39)

8. Piston onfices (43) must be open and free of dust or dirt.

9. Assemble correctly the no's 9 pistons (43) in the retainer plate.

10. Assemble the pistons-retainer plate unit (43-42) in the cylinder block (39)


11. Assemble the cylinder block unit (39) into the motor housing (49) on the motor shaft spline (45)

12. Assemble the brake discs package according to the following order. firstly, insert one friction disc with internal teeth. (33)

13. Then insert, an externally toothed steel disc (34). Repeat the operation untill all 3 friction discs and 2 steel discs have been assembled.

14. Fit the O-ring seal (32) in the brake spacer outer seat (31)



15. Assemble the O-ring seals (29-30) into its seats in brake piston (28).

16. Assemble the spacer (31) to the brake piston (28),paying attention not to damage the seals already fitted.

17. Assemble the brake piston (28) respecting the markings set out previously and being careful not to damage the already fitted.

18. Assemble the O-ring seal (25) into its seat in the motor housing (49).

STRUCTURE AND FUNCTION



19. Insert the no's 2 pins (24) into their seats in the motor housing (49).

20. Insert the springs (26-27) in their seats in the brake piston (28).

21. By using the tool (ATZ.06.021.0) assemble the O-ring seals (48) on the plugs (47).

22. Tighten the plugs (47) onto the motor housing (49) by a male hex.head torqure wrench at 22.6 Nm torque.

ASSEMBLY



23. Assemble the bearing (21) into its seat in the base plate (23).

24. By using a rubber hammer, punch the bearing (21) in its seat in the base plate (23).

25. Insert the no's 2 pins (19) into their seats in the base plate (23).

26. Assemble the valve plate (22) to the base plate (23).

STRUCTURE AND FUNCTION



27. Assemble the base plate (23).

28. Tighten the no's 4 socket hear screws M14x40 (9) grade 12.9 of the base plate (23), by a male hex.head torque wrench @177±10Nm.

29. By using the tool (ATZ.06.022.0) assemble the O-ring seals (7) on the plugs (8).

30. Tighten the plugs (8) on to the base plate (23) by a male hex.head torque wrench @16 \pm 1 Nm torque.



31. By useing the tool (ATZ.06.022.0) assemble the O-ring seals (5) on the plug (60.

32. Tighten the plug (6) onto the base plate (23) by a male hex.head torque wrench $@70\pm2.5$ Nm torque.

33. By using the stopper (ATZ.06.022.0) assemble the O-ring seal (13) in its seat in the relief valve (14).

34. Assemble the O-ring seal (15) into its seat in the relief valve (14).

STRUCTURE AND FUNCTION



35. Assemble the backup ring (16) into its seat in the relief valve (14).

36. Assemble the 1st backup-ring (10) into its seat in the free piston.

37. Assemble the O-ring seal (11) into its seat in the free piston. After this step assembly the 2nd backup ring (10) as shown on the sketch.

38. Insert the free piston in the relief valve (14) checking that the chamfer side is turned toward the inside of the motor.



39. Insert the poppet seat in the relief valve (14).

40. Assemble the backup ring (17) into its seat in the poppet seat.

41. Assemble the O-ring seal (18) into its seat in the poppet seat.

42. Insert the relief valve assy (14) in the base plate (23).



43. Tighten the relief valve assy (14). on to the base plate (23) by a male hex. head torque wrench @ 373 ± 20 Nm torque.

Re-assembly of the anticavitation valve.

44. By using the tool (ATZ.06.046.0) assemble the O-ring seals (3) on the plugs (4).

45. Insert the check valves (1) and the springs (2) in the plugs (4).

46. Screw the nos 2 plugs (4) in the valve housing (23).



47. Tighten the plug (4) on to the base plate (23) by a male hex.head torque wrench @177±10 Nm.

48. Tighten the no's 4 socket head screws M14x40 (9) grade 12.9 of the base plate (23), by a male hex head torque wrench at 177 ± 10 Nm.

49. Insert the spool and the spring in the reterder valve housing (51).

50. By using the tool (ATZ.06.021.0) assemble the O-ring seal (54) on the plug of the reterder valve plug (55).



51. Tighten the plug (55) of the reterder valve plug (51) by a male hex head torque wrench @22.6 \pm 1 Nm.

52. Assemble the no's 2 O-ring seals (52).

53. Place the reterder valve (51) on the hydraulic motor. Tighten the no's 2 socket head screws M6x30 (50), grade 8.8 of the reterder valve (51), by a male hex head torque wrench @ 10 ± 1 Nm. torque.



54. Insert the nillos (2) on the piston shaft (1).

55. Fill the nilos (2) with grease SHELL RETINAX HD-2 or similar product.

56. Apply a coat of grease, SHELL RETINAX HD-2 or similar product, on the bearing's inner ring (3).

57. Insert the bearing inner ring (3) on the pinion shaft (1).By using a press and a pad, push the ring until it touches the spacer.

STRUCTURE AND FUNCTION



58.Insert the bearing outer ring (3) in the gearbox housing (5).By using a press and a pad, push the ring to the limit stop.

59.Turn the gearbox housing (5) upside down and insert the bearing outer ring (6).By using a press and a pad, push the ring to the limit stop.

60. Insert the sealing ring (4) in the gearbox housing (5).By using a rubber hammer and the pad(ATZ.06.052.0),push the ring to the limit stop.

61.Turn the gearbox housing (5) upside down and fill with grease SHELL RETINAX HD-2 or similar product the bearing chamber.

ASSEMBLY



62. Put the gearbox housing (5) on the pinion shaft (1).

63. Insert the bearing inner ring (6) on the pinion shaft (1).

64.By using a rubber hammer and a pad, push the bearing (6) to the limit stop.

65. Insert the spacer (7) on the shaft (1).





66. Applicare LOC	TITE 243 sulla	fliettatura di una
ghiera (8) NU(DVA.	

Apply LOCTITE 243 on the threading of a NEW ring nut (0).

INFORMAZIONI SULLA MANUTENZIONE

- 81 -

MAINTENANCE INFORMATIONS

67. Assemble the equipments (ATZ.03.028.0) and (ATZ.08.009.0) on the ring nut (8).

68.By using a multiplier (1:25), tighten the ring nut M60x2 (8), by a torque wrench at 40 ± 2 Nm torque corresponding to an output multiplier torque of 1000 ± 50 Nm.

69. Stake the ring nut (8) next to 6 spaces at 60° of the pinion shaft spline (1).

70. Assemble the O-ring seal (11) into its seat in the gearbox housing (5).



Z.08.009.0

STRUCTURE AND FUNCTION



71. Insert the 2nd reduction (13).

72. Assemble the toothed ring (12) respecting the markings set out previously.

73. Insert the 2nd reduction sun gear (14).

74.Assemble the O-ring seal (11) in the seat of the spacer (15).

ASSEMBLY



75. Assemble the spacer (15) respecting the markings set out previously.

76. Assemble the O-ring seal (11) in the seat o fthe spacer (15).

77. Assemble the toothed ring (12) respecting the markings set out previously.

78. Insert the 1st reduction (16).

STRUCTURE AND FUNCTION



82.Tighten the nos.16 socket head screws M10x110 (19),grade 12.9,by a male hex haed torque wrench at 85 Nm torque.

79. Insert the 1st reduction sun gear (17).

INFORMATION

With the use of an inside caliper,check the orrect assembly o fthe gearbox by assessing the axial quota given in the diagram.

80. Assemble the O-ring (11) into its seat in the hydraulic motor (49).

81. By using a tackle, assemble the hydraulic motor (49) on the gearbox respecting the markings set out previously.



UNDERCARRIAGE 05 STRUCTURE AND FUNCTION

Track group	05-02
Idler	05-03
Recoil spring	05-04
Track roller	05-05
Carrier roller	05-06
Track shoe	05-07

TRACK GROUP



- 1. Idler
- 2. Track frame
- 3. Carrier roller
- 4. Track roller
- 5. Center guard
- 6. Recoil spring
- 7. Front guard
- 8. Track
- 9. Sprocket

The tracks which bear and spread the weight of the machine on the ground convert the driving power transmitted from the sprockets into tractional force. The track group includes track frame structure (2), front idlers (1), carrier rollers (3) and track rollers (4). The track (8) looped around each front idler is driven by the sprocket wheel sprocket (9) and its rolling is guided by the front idler, carrier roller and track rollers. The track roller guards (5) and (7) attached on the bottom surface of each track frame prevents the track from slipping off due to intrusion of stones.

IDLER



The front idler (1) mounted at the front-end of track frame and is supported on the idler shaft (5) through the guide and bushing (6).

The idler assembly including the yoke, which is connected to the idler shaft bearings, is slidable back and forth along the track frame between guide plates. The idler provides a guide for smooth rolling of the track chain.

Lubricating oil enters the oil hole provided in the shaft to lubricate the sliding surface of the bushing. Each end of the bushing is provided with a floating seal to prevent both leakage of oil and intrusion of mud and water.

- 1. Idler
- 2. Support
- 3. Idler shaft
- 4. Ring seal
- 5. Bushing
- 6. Lubricating plug

RECOIL SPRING



The idler cushion is mounted on the track frame between the front idler and the sprocket wheel. It performs the following functions:

- 1) Maintaining proper tension
- 2) Absorbing shocks which the front idler is subjected to during traveling of the machine

One end of the rod (1) is connected to the idler yoke and the other end to the support (2). The recoil spring support (2) and the piston (3) are always pushed toward the forward part of the machine by the recoil spring (4), and the rod is also pushed forward by the piston through the grease filled in the cylinder.

When the front idler, connected to the recoil spring through the adjusting cylinder, is subjected to an impact exceeding the initial preload of the recoil spring, the recoil spring will retract to absorb the shock. Also when mud stones or snow get lodged between the track and the sprocket wheel, the recoil spring will absorb the shock caused by a sudden increase of track tension, thus preventing damage to the track, sprocket or other rollers. The adjusting cylinder is provided with the lubricator. Feeding grease through the lubricator causes the cylinder piston to push the idler forward so that track tension is increased. On the other hand, track tension is decreased by loosening the lubricator to discharge the grease.

To loosen track tension, loosen the lubricator by one turn. If grease does not ooze out easily, try moving the machine back and forth a short distance. Do not loosen the lubricator more than one complete turn in order to prevent dangerous spurting of grease under high pressure. Although the protector is provided to prevent the lubricator from flying out, this precaution should be kept in mind for safety

TRACK ROLLER



TRACK ROLLER
 LUBRICATING PLUG
 BUSHING
 RING SEAL
 BRACKET
 SHAFT

Track rollers are mounted below the track frame. They distribute the machine weight evenly onto the tracks.

CARRIER ROLLER



- 1.SHAFT
- 2. COLLAR
- 3. SEAL
- 4. CARRIER ROLLER
- 5. BEARING
- 6. SPACER
- 7. COVER

Carrier rollers are arranged above the track frame. They support the upper half of the track loop thus preventing the track from dangling by its own weight.

TRACK SHOE





- 1. Bush master
- 2. Spacer
- 3. Shaft master
- 4. Bush regular
- 5. Shaft regular 6. Shoe
- 7. Link
- 8. Shoe bolt

450 mm triple shoe Link pitch : 140 mm Number of shoe : 40

UNDERCARRIAGE 06 DISASSEMBLY AND ASSEMBLY

Removal and Installation 06	6-02
TRACK ROLLER ASSEMBLY	
Removal and Installation	6-03
CARRIER ROLLER ASSEMBLY	
Removal and Installation	6-04
TRACK SHOE ASSEMBLY	
Removal and Installation 06	6-05

REMOVAL OF IDLER, RECOIL SPRING ASSEMBLY

- 1. Remove track shoe assembly. For details see REMOVAL OF TRACK SHOE ASSEMBLY.
- 2. Sling the idler and recoil spring assembly (1), and pull out to the front to remove.

Idler recoil spring assembly : kg

3. Remove recoil spring assembly (3) from idler assembly (2)

INSTALLATION OF IDLER, RECOIL SPRING ASSEMBLY.

- 1. Fix recoil spring assembly to idler assembly
- 2. Sling and raise idler and recoil spring assembly (1) and push into track frame.
- 3. Install track shoe assembly.

For details see INSTALLATION OF TRACK SHOE ASSEMBLY.





REMOVAL OF TRACK ROLLER ASSEMBLY

- 1. Loosen lubrication (1) to relieve track tension.
- The adjustment cylinder is under extremely high pressure. Never loosen the lubricator more than one turn. If the track tension is not relieved, move the machine backwards and forwards.
- Remove 4 mounting bolts of track roller (2). Then swing the work equipment 90 deg, jack up the machine and remove the track roller assembly

Track roller assembly : kg

INSTALLATION OF TRACK ROLLER ASSEMBLY

- 1. Set track roller assembly in the mounting postion, operate the work equipment levers to lower the machine slowly then partially tighten the mounting bolts.
- 2. Operate the work equipment levers to completely lower the machine, then fully tighten bolts fully.
- 3. Install lubricator (1) then pump in grease to adjust track tension.
- * Adjust the track tension to give a clearance of 40-80 mm between the contact surfaces of the track link and track roller between 3rd and 4th roller from the sprocket when the track is raised from the ground.





REMOVAL OF CARRIER ROLLER ASSEMBLY

- 1. Using hydraulic jack (1)(10 ton), push up track.
- 2. Remove 2 mounting bolts, then remove carrier roller assembly (2).



INSTALLATION OF CARRIER ROLLER ASSEMBLY

- 1. Using hydraulic jack (1) (10 ton), push up track.
- 2. Install carrier roller assembly (2), then tighten 2 mounting bolts.
- 3. Release hydraulic jack (1) slowly to return track to original position.

REMOVAL OF TRACK SHOE ASSEMBLY

Special tools :	Remover & installer
	Cylinder (100t)
	Pump

- 1. Stop machine with master pin midway between sprocket and carrier roller.
- * Make sure that there is enough space to lay out the track shoe behind and in front of the machine.
- 2. Lower the work equipment completely to the ground. Loosen lubricator (1) to relieve track tension.
- The adjustment cylinder is under extremely high pressure. Never loosen the lubricator more than one turn. If the track tension is not relieved, move the machine backwards and forwards.
- 3. Using tool A, remove master pin.
- 4. Remove tool A, insert a temporary pin and move machine forward so that temporary pin is in front of idler, then set block (1) in position.
- 5. Remove temporary pin (2) and move machine in reverse to remove track (2).

INSTALLATION OF TRACK SHOE ASSEMBLY.

- 1. Position track under track frame, fit link bushing in sprocket, then move machine slowly forward to wind on track (2).
- * Assemble the track with the link bushing at the front.
- Set block (1) in position, assemble spacer
 (3) on link, then insert temporary pin (2).
- 3. Move machine in reverse, and stop when temporary pin is midway between idler and carrier roller.
- 4. Using tool A, press fit master pin.
- 5. Install lubricator (1) then pump in grease to adjust track tension.
- Adjust the track tension to give a clearance of 40-80 mm between the contact surfaces of the track link and track roller between 3rd and 4th roller from the sprocket when the track is raised from the ground.





UNDERCARRIAGE 07 MAINTENANCE STANDARD

Track frame & Recoil spring	07-02
Idler	07-03
Track roller	07-04
Carrier roller	07-05
Track shoe	07-06

TRACK FRAME AND RECOIL SPRING





Unit: mm

No.	Check item	Criteria				Remedy		
1 Vertical width of idler guide	Track fram	е	62		66		Rebuild or	
	er guide Idler support 60			replace 58		replace		
2 Horizontal width of idler guide	Track frame 163		168		168	Rebuild or replace		
	ide Idler support 160			158				
	3 Recoil spring	Standa	rd s	ize		Repa	ir limit	
3 Recoil spring		Installed length	In Io	stalled ad	Fr ler	ee ngth	Installed load	Replace
		305	4(000			3600	
IDLER



No	Chock itom	Criteria	Remedy	
INO.	Check lielli	Standard size Repair limit		
1	Outside dia of protrusion	412	402	
2	Outside dia of tread	380	368	Pobuild or
3	Width of protrusion	53	43	replace
4	Tool width	110	102	
5	Width of tread	28.5	33.5	

TRACK ROLLER



No	Chack itom	Criteria	Pomody		
INO.	Check item	Standard size	Repair limit	Reffieldy	
1	Outside dia of flange	160	150		
2	Outside dia of tread	135	125	Rebuild or replace	
3	Width of flange	14			

CARRIER ROLLER



No	Check item	Criteria	Pomody	
INO.	Check liem	Standard size	Repair limit	Kemedy
1	Outside dia of flange	120		
2	Outside dia of tread	90	80	Rebuild or replace
3	Width of flange	31	38	

TRACK SHOE





Nia	Chock itom	Criteria			Romody	
INO.	Check lien	Standard size		Repair limit		- Keineuy
1	Link pitch	141		145		Turn or
2	Outside dia of bushing	42.6		40.30		replace
3	Height of grouser	18		10		Lug welding rebuild or replace
4	Height of link	70		65		Rebuild or replace
5	Clearence of link matching	Std. clearence (one side)	Std. cle (both s	earence ide)	Clearence limit (both side)	Replace
	surface	0.4	0.8			
6	Tightening torque of shoe bolt	Tightening torque : 23 <u>+</u> 3 kg-m			Tighten	

HYDRAULIC SYSTEM 08 STRUCTURE AND FUNCTION

Hydraulic piping	08-02
Hydraulic circuit diagram	08-03
Accumulator	08-04
Hydraulic circuit	08-05
Main pump	08-07
Main Control Valve	08-27
Swing Control Valve	08-47
Manifold Block	08-51

NOTE CO: Cut-Off Valve PPC: Proportional Pressure Valve

HYDRAULIC PIPING

- Hydraulic pumps driven by the engine consists of two main pumps : variable displacement piston pump and one charge pump (gear pump) The main pump delivers the oil from the hydraulic tank to the control valve, while the charging pump delivers oil to the remote control valves.
- Flow compensation makes the main pumps to help save energy and keep the hydraulic pressure loss to a minimum .
- The travel, steering, swing and work equipment operations are all hydraulically controlled from corresponding pilot pressure remote control valves by operating the hydraulic motors and hydraulic cylinders.
- The main pressure relief valves in the circuit between the hydraulic pumps and control valve Keeps the maximum pressure of the oil delivered from the hydraulic pump at the preset value.
- The safety valves located in the circuit between the control valve and the hydraulic motors protects the hydraulic equipment from external over loading when the control valve is in neutral and ensures operational safety.
- Suction cum anti cavitation valve prevents the occurrence of negative pressure in the circuit.
- An oil cooler is provided in the hydraulic circuit to prevent the oil from getting overheated and to minimize the degradation of hydraulic oil.
- All the oil passes through a filter inside the tank at the time of suction and through the filter in the return line of hydraulic tank to protect the hydraulic equipment from contamination.
- Each boom and arm circuits are catered by independent pumps for faster implement speeds. When arm and swing combined operations are performed.

- 1) Bucket Cylinder
- 2) Arm Cylinder
- 3) Boom Cylinder
- 4) R.H. Travel Motor
- 5) Hydraulic Tank
- 6) Swing Motor
- 7) Oil Cooler
- 8) Main Pump
- 9) Charging Pump (Gear pump)
- 10) L.H. Travel Motor
- 11) Control Valve
- 12) L.H. PPC Valve (for Arm, Swing)
- 13) Swing Machinery
- 14) Centre Swivel Joint
- 15) R.H. PPC Valve (for Boom, Bucket)

PPC valve





ACCUMULATOR Function

1. The accumulator uses a flexible rubber bag (3) containing nitrogen (N2) gas to maintain the hydraulic oil pressure.



- 1. Cap
- 2. Cover
- 3. Rubber bag
- 4. Body

Operation

1. When the PPC valve ia at neutral, the chamber A in the rubber bag (3) (nitrogen gas capacity:480cc) is compressed by the oil pressure in chamber B.(Fig.1)

2. As oil pressure in chamber B lowers to 30 kg/cm2 or below when relieving residual pressure, the rubber bag (3) expands due to the nitrogen. The working pressure is 12 to 30 kg/cm2. (Fig.2)

Nitrogen is sealed in the bag



Fig. 2

A3 SIZE HYDRAULIC CIRCUIT DIAGRAM TO BE ADDED SEPERATELY

MAIN PUMP (A10VSO M/S REXROTH)

- Specification of main pump......08-08 - General guidelines.....08-09
- Pump disassembly......08-10

SPECIFICATIONS :

DISPLACEMENT			71 cm ³ /rev	
MAX. SPEED		at V _g	max.	2200 rpm
MAX. FLOW		at no	max.	156 L/min
		at n _e	=1500 rpm	107 L/min
MAX POWER ($\triangle P=280$ by		<u>at</u> n₀	max.	73 kW
		at n _e	=1500 rpm	50 kW
MAX. TORQUE (\triangle P=2	280 bar)	at V _g	max.	316 Nm
TORQUE (\P=280 bar) bei Vg max.				113 Nm
MOMENT OF INERTIA AT DRIVE AXIS				0.0083
FILLING CAPACITY				0.6 L
WEIGHT (WITHOUT FLUID)				33 Kg
PERMISSIBLE LOADING OF DRIVE SHAFT: MAX. AXIAL FORCE			2400 N	
MAX. RADIAL FORCE ²)			1900 N	
PART NO	02447958-99.9206.41.100			-EBZ
CODE	A10V074DFSR/31R-VSC62ł			<02
ADDRESS	M/s. BOSCH REXROTH (IN PLOT NO. 96, PHASE—III PEENYA INDUSTRIAL ESTAT BANGALORE — 560 058			DIA) LTD
	DISPLACEMENT MAX. SPEED MAX. FLOW MAX. FLOW MAX. POWER ($\triangle P=28$ MAX. TORQUE ($\triangle P=280$ bold MOMENT OF INERTIA FILLING CAPACITY WEIGHT (WITHOUT FLU PERMISSIBLE LOADING MAX. AXIAL FORCE MAX. RADIAL FORCE ² PART NO CODE ADDRESS	DISPLACEMENT MAX. SPEED MAX. FLOW MAX. FLOW MAX. POWER (\triangle P=280 bar) MAX. TORQUE (\triangle P=280 bar) TORQUE (\triangle P=280 bar) MOMENT OF INERTIA AT DRIVE FILLING CAPACITY WEIGHT (WITHOUT FLUID) PERMISSIBLE LOADING OF DRIV MAX. AXIAL FORCE MAX. RADIAL FORCE ²) PART NO CODE ALDORESS M/s. BO PLOT NO PEENYA BANGAL	DISPLACEMENT MAX. SPEED at Vg MAX. FLOW $\frac{\text{at n}_{\text{a}}}{\text{at n}_{\text{e}}}$ MAX. POWER ($\triangle P=280$ bar) $\frac{\text{at n}_{\text{a}}}{\text{at n}_{\text{e}}}$ MAX. TORQUE ($\triangle P=280$ bar) at Vg TORQUE ($\triangle P=280$ bar) bei V MOMENT OF INERTIA AT DRIVE AXIS FILLING CAPACITY WEIGHT (WITHOUT FLUID) PERMISSIBLE LOADING OF DRIVE SHA MAX. AXIAL FORCE ²) PART NO 02447958–99 CODE A10V074DFSR ADDRESS M/s. BOSCH PLOT NO. 96, PEENYA INDUS BANGALORE -	$\begin{array}{c c c c c c c } DISPLACEMENT & at V_{g max}. \\ MAX. SPEED & at V_{g max}. \\ MAX. FLOW & at n_{e} =1500 \ rpm \\ MAX. POWER (\bigtriangleup P=280 \ bar) & at n_{o} \ max. \\ at n_{e} =1500 \ rpm \\ MAX. TORQUE (\bigtriangleup P=280 \ bar) & at V_{g \ max}. \\ TORQUE (\bigtriangleup P=280 \ bar) & bei V_{g \ max}. \\ TORQUE (\bigtriangleup P=280 \ bar) & bei V_{g \ max}. \\ MOMENT OF INERTIA \ AT DRIVE \ AXIS \\ FILLING \ CAPACITY & WEIGHT (WITHOUT \ FLUID) \\ PERMISSIBLE \ LOADING \ OF \ DRIVE \ SHAFT: \\ MAX. \ AXIAL \ FORCE & \\ MAX. \ RADIAL \ FORCE \ 2 \) \\ PART \ NO & 02447958-99.9206.41.100 \\ CODE & A10V074DFSR/31R-VSC624 \\ ADDRESS & M/s. \ BOSCH \ REXROTH \ (IND \ PLOT \ NO. \ 96, \ PHASE-III \ PENYA \ INDUSTRIAL \ ESTATE \ BANGALORE \ - \ 560 \ 058 \end{array}$









Attention!

Observe the following guidelines when carrying out repairs on hydraulic units!

Close off all openings of the hydraulic unit.

Replace all of the seals. Use only original BEML Ltd. geniune spare parts.

Check all sealing and sliding surfaces for wear.

Attention: Re-work of the sliding surfaces by using, for example abrasive paper, can damage the surface.

Fill the hydraulic unit with hydraulic oil before commissioning.



Drive shaft pos.2

Bearing kit and small parts pos.3

Rotary group pos.4 4





Control valve pos.6a

Horse power valve pos.6b

Control pipe pos.7

9 Housing port plate, control device, coupling pos. 8, 9, 10, 11





1. Circilp 2. Shaft seal



Protect the drive shaft. Remove the circlip. Remove the shaft seal.



12 Change the shaft seal and check its sliding surface (drive shaft) and housing, grease the sealing ring.

13 Assemble the sealing ring. Fitting tool holds the correct position of the sealing ring in the pump housing

14 Assembly of snap ring.

15 Assemble the snap ring in the correct position.



Note!

This discription showes how th change the drive shaft sealing ring but it isn't the way of serial assembly. The sealing ring is assembled together with the taper roller bearing from inside the motor housing normally to get a secure sealing condition. If you decide to repair the motor in the shown way be very careful while handling so that the drive shaft wouldn't be damaged during disassembly of the shaft sealing ring.





18 Disassemble the pump



19 Sealing / cleaning the horse power valve



valve DFR.



21 Disassembly position Mark the location of the connection plate on the housing.



- 22 Remove the connection plate fixing bolts, remove the connection plate.
 - Δ

Distributor plate and adjustment piston can drop down.







 Remove distributor plate. Take note of the orientation.
 Remove bearing with withdrawal tool. Do not damage the sealing surface.

24 Remove the rotary group in a horizontal position.

25 Remove swash plate and bearing shells.



- 26 Remove the circlip and the shaft seal.



27 Remove the drive shaft through rear side.





29 Pre-tension the spring using a suitable device.



30 Remove circlip Remove spring and pressure pins. 31 Use bearing puller to remove outer bearing race of front bearing out of housing press seat. 32 Remove the control plate. 33 Use bearing puller to remove outer bearing of rear bearing - press seat. 34 Disassemble the guide of control piston (Mounting position: pilot valve side). 35 Disassemble the guide of the opposite piston.

08-19



BE75

37 Renew all bearings.

- 38 1. Wear on slines, fretting
 - 2. Drive shaft seal wear grooves
 - 3. Bearing seat
 - 4. Splines for cylinder drive
 - 5. Bearing seat

Sliding surface free of grooves.

Bearing surfaces

That the retaining plate is free of grooves and that there is no wear in the slipper pad





47 Check! Check running conditions of the control piston.



48 Check! Check running conditions of the opposite piston.



49 Adjustment of taper roller bearing set Cast iron housing must have initial tension of the bearings: 0 0,05 mm, grind Pos. 12 if necessary.





52 Fit pressure pins using an assembly aid.



53 Pre tension the spring using a suitable device





55 Assemble piston with retaining plate..

Note: Oil piston and slipper pad.

- Kar
- 56 Fit rotary group !



Aseembly aid: Hold the pistons by using an o-ring.

Fit O-ring (Pos.1)





57 Fit bearing (1) in connection plate.
Fit cyilindrical pin (2).
Fit O-rings (3) 4 pieces.
Fit adjustment spool (4) and guide piston (4a).
Fit distributor plate (5) (direction of rotation dependent)

Assembly: Hold the components in place with grease.

58 Fit distributor plate Assembly aid: Grease

- 59 For clockwise rotation pumps the distributor plate is off-set by 4₀ to the right from the centre position. (Clockwise and anti-clockwise rotation distributor plates are not identical).
- 60 For anti-clockwise rotation pumps the distributor plate is off-set by 4 deg. to the left from the centre position.



61 Fit connection plate, control valve and control pipe

MAIN CONTROL VALVE (SX 14 M/s.Rexroth)

- Circiut diagram of main control vale	
- Specification of main control valve	
- Fundamental rules	
- Removal / installation of SX 14 control block	
- Removal of the SX 14 control block	08-30
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- "Open center" removal	08-35
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- Solenoid valve, "clamps" and shuttle valve removal	08-37
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CIRCUIT DIAGRAM OF MAIN CONTROL VALVE





SPECIFICATIONS :

ATA:			7SX14 L2X/ S250		
	TRAVEL LEFT	1	JA 70-70 H200 QQ		
	TRAVEL RIGHT	2	JA 70-70 H200 QQ		
\Box	воом	3	EA 130-100 H230 H300 H300		
AL	STICK	4	EA 135-120 H230 H300 H300		
NIC	BUCKET	5	EA 120-110 H230 H300 H300		
CH	DOZER BLADE	6	EA 40-30 H200 QQ		
	SPARE	7	EA 120-120 H200 QQ		
			R V01		
	PART NO	08 277 427			
ЛR	CODE	7SX14 L2X/ S250			
VEND(ADDRESS	M/s. BOSCH REXROTH (INDIA) LTD PLOT NO. 96, PHASE-III PEENYA INDUSTRIAL ESTATE BANGALORE - 560 058			

3 FUNDAMENTAL RULES

3.1 General information concerning control block connection

When removing the block, all openings must be plugged immediately to prevent any contamination of the hydraulic system. When replacing the block, remove the plastic plugs from the openings and lines just before making the connections.

Do not tighten connectors to a torque greater than that specified in the assembly instructions.

Check the hydraulic installation's oil quality and filtration capacity during all servicing/maintenance operations.

The use of Teflon tape, hemp and joint filler is prohibited.

Hydraulic lines and connections must not be under any strain whatsoever.

4 Removal / installation of the SX 14 control block

4.1 General recommendations

BEFORE REMOVING THE SX 14 CONTROL BLOCK FROM THE MACHINE, THE BLOCK AND ITS SURROUNDINGS MUST BE THOROUGHLY CLEANED (DO NOT DIRECT THE JET OF A PRESSURE WASHING UNIT DIRECTLY AT THE UNIT). NO IMPURITIES MUST ENTER THE HYDRAULIC SYSTEM. PLASTIC PLUGS ARE TO BE FITTED ON LINES AND ORIFICES



IMMEDIATELY FOLLOWING THEIR REMOVAL.

Wear protective clothing and use suitableequipment to prevent accidents, particularly concerning the hydraulic fluid.

Use the lifting eyes and suitable handling equipment.

Set all actuators connected to the machine in neutral position (on the ground, at lower limit ...) to avoid accidents which could result from uncontrolled movements of the equipment when the hydraulic system is disconnected.

With the machine off, release the pressure remaining in the system by manipulating all of the distribution spools. This is performed by moving the handle in all directions.

4.2 Removal of the SX 14 control block Install a vacuum pump on the tank to limit oil leakagewhen connections are removed.

After disconnecting the lines from the block, immediately fitthe sealing plugs. Make sure to collect any possible oil leakage in a suitable receptacle.

Unscrew the mounting screws and remove the control block.

4.3 Installation of the SX 14 control block Contact faces must be perfectly clean.

Check the evenness of support area on the machine (Tolerance: 0.5 mm).

Check the condition of line connector seals.

Clean the block if it has been in storage for a long period of time.

Correctly place and secure the control block onto the machine with the mounting screws.

Connect the lines to the block as per the connecting diagram and tighten to the torque specification (refer to the table in the Data sheet).

Ensure that hoses are not twisted or rub. Once correctly installed, the unit can be placed into operation.

4.4 Starting, maximal pressure set up

- Decalibrate the LS pressure relief valve (19 mm open end spanner on counternut) before starting the machine,

- Maintain one of the control block spool valve in action before the linked hydraulic receiver is at the end of stroke .

CAUTION

ON THE SPOOL VALVE, THE VALUE OF THE SECONDARY VALVE PRESSURE MUST BE GREATER THAN THAT OF THE LS PRESSURE RELIEF VALVE TO ADJUST.

- Adjust the maximum pressure measured in M using the LS pressure relief valve (6 mm socket wrench).

- Tighten the counternut of the adjusting screw to the torque :

20 ± 10% N.m.

HYDRAULIC SYSTEM 5 Inlet and outlet elements repair procedure

5.1 LS pressure relief valve replacement

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- place all of the machine's actuators connected to the control block in neutral position,
- release stored pressure by operating all the spools.
- NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation. Collect possible leaks with a suitable receptacle.

On the inlet element, unscrew the LS pressure relief valve (24 mm open end spanner).

Reassembly:

- install the LS pressure relief valve on the inlet element, torque : 45 ± 10% N.m.
- set the LS pressure relief valve to the specified value (see § 4.4)
- fit a new appropriate locking cover.

5.2 Flow regulator replacement

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- place all of the machine's actuators connected to the control block in neutral position,
- release stored pressure by operating all the

spools.

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.

On the inlet or outlet element:

- unscrew the LS pressure relief valve (see § 5.1)
- unscrew the flow regulator (22 mm open end spanner).

Reassembly :

- install the flow regulator on the inlet or outlet element, - torque : 20 ± 10% N.m.



Flow regulator filter replacement Using pliers, extract the filter from the end of the flow regulator. Be careful not to damage the seal and the end of the flow regulator. Reassemble parts in reverse order.





5.3 Flow divider replacement

NOTE : The control block does not need to be removed from the machine to perform this operation.



- Machine off:
- place all of the machine's actuators connected
- to the control block in neutral position,
- release stored pressure by manipulating all the spools.
- NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation. Collect possible leaks with a suitable recented.





On the inlet element, unscrew the plug (12 mm socket wrench). Reassembly : - replace the plug O-ring,

- torque : 100 ± 10% N.m.

Remove : - shim,

- stop,
 - spring,
 - the piston assembly.

Replace defective parts.

Reassemble parts in reverse order.


5.4 Removal of the flushing valve for "closed center"

NOTE : The control block does not need to be removed from the machine to perform this operation.



- Machine off:place all of the machine's actuators connected to the control block in neutral position,
- release stored pressure by manipulating all the spools.
- NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation. Collect possible leaks with a suitable receptacle.



On the inlet element, unscrew the flushing valve plug (12 mmsocket wrench).

Reassembly :

- replace the plug O-ring,
- torque: 100 ± 10% N.m.



Remove : - spring, - shims,

- piston.

Reassemble parts in reverse order.



5.5 "Closed center" removal

NOTE : The control block does not need to be removed from the machine to perform this operation



Machine off:

place all of the machine's actuators connected to the control block in neutral position,
release stored pressure by manipulating all the spools.

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.



On the inlet element, unscrew the plug from the "closed center" (12 mm socket wrench). Reassembly :

- replace the plug O-ring,
- torque: 100 ± 10% N.m.



Remove the piston. Reassemble parts in reverse order.



5.6 "Open center" removal

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- place all of the machine's actuators
- connected to the control block in neutral position,
- release stored pressure by manipulating all thespools.



NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation. Collect possible leaks with a suitable receptacle. On the inlet element, remove the "open center" plug (12 mm socket wrench). Reassembly : - replace the plug O-ring, - torque: 100 ± 10% N.m.



Remove:

- spring,
- shim,
- piston.

Reassemble parts in reverse order.



5.7 Removal of the outlet element flushing valve

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off: - place all of the machine's actuators connected to the control block in neutral position, - release stored pressure by manipulating all the spools.

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation. Collect possible leaks with a suitable receptacle.



On the outlet element, unscrew the flushing valve plug. (12 mm socket wrench). Reassembly : - replace the plug O-ring, - torque: 100 ± 10% N.m.



Remove : - spring, - shims, - piston. Reassemble parts in reverse order.



5.8 Solenoid valve, "clamps" and shuttle valve removal (installed on backhoe loader)

NOTE : The control block does not need to be removed from the machine to perform this operation.

 place all of the machine's actuators connected to the control block in neutral position,

- release stored pressure by manipulating all the spools.

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation. Collect possible leaks with a suitable receptacle.

Solenoid replacement

On the outlet element, unscrew the knurled knob from the solenoid.

Pull the solenoid off the stem of the 2-ways valve.

Reassembly :

- replace the 2 seals of the solenoid,
- torque : 3,5 ± 10% N.m.

2-ways valve replacement

Unscrew the 2-ways valve (24 mm wrench). Reassembly : torque : 45 ± 10% N.m.

Shuttle valve or selector removal

On the outlet element, unscrew the upper seat (4 mm socket wrench).

Reassembly : torque : 20 ± 10% N.m.

Remove the ball using a magnet.

Unscrew the lower seat (4 mm socket wrench).

Reassembly : torque : 20 ± 10% N.m.

Replace shuttle valve parts. Apply a droplet of **Loctite 542 pneumatic / hydraulic sealant** on the seats thread.

CAUTION DO NOT PUT LOCTITE ON THE BALL

Reassemble parts in reverse order.





6 Distribution element repair procedure

6.1 Secondary valves replacement

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

▲ · place all of the machine's actuators connected to the control block in neutral position, · release stored pressure by manipulating all the spools.

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation. Collect possible leaks with a suitable receptacle. Position 1 and 2

Pressure relief valve replacement

On the distribution element in question, unscrew the secondary pressure relief valve (24 mm open end spanner).

Reassembly :

- set the pressure relief valve to the specified value,
- install the secondary pressure relief valve on the distribution element,
- torque : 70 ± 10% N.m.
- fit a new appropriate locking cover.

Replace valve seals or pressure relief valve.



Plug replacement

On the distribution element in question, unscrew the plug (8 mm socket wrench).

Reassembly : torque : 70 ± 10% N.m. Replace plug seals or plug.

6.2 Spool stroke measurement (3 positions)

Move the control lever of the element in question in al _ possible positions, and measure the corresponding spool stroke values at the tongue.



HYDRAULIC SYSTEM

6.3 Removal of spool with spring return and lip seal

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- place all of the machine's actuators
- connected to the control block in neutral position,
 - release stored pressure by manipulating all the spools.

NOTE : Install a vacuum pump on the tank to limit oil leakage during this operation.

Collect possible leaks with a suitable receptacle.

Tongue side

Remove : - mounting screws (L=12 mm) (screwdriver Torx Tx30),

- the boot and its plate,
- plate.
- . Reassembly :
- replace the lip seal,
- torque : 10 ± 10% N.m.

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE.

THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED

ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE. (see § 7) SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.

Cover side

Remove the mounting screws (L=16 mm) and the cover (screwdriver Torx Tx30).

. Reassembly :

- replace the lip seal,

- torque : 10 ± 10% N.m.

CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDETHE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE. (see § 7) SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.











MAIN CONTROL VALVE

MAIN CONTROL VALVE

Return system removal for lip seal replacement

NOTE : Use the spool clamp and a vice to secure the spool.

CAUTION

IN ORDER TO AVOID BREAKING THE CLAMP, PLACE IT APPROXIMATELY 15 MM FROM THE END OF THE SPOOL (NEVER IN THE CENTRE).

Before hand, heat the spool to 200° C in an oven or, failing that, with a heat gun.



Wear thick protective gloves when handling the hot spool.

Remove the adapter (5 mm socket wrench). Remove: - 2 spring retainers,

- spring,
- plate,
- lip seal.

Reassembly :

- replace lip seal,

CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE.

THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITS TIGHTNESS PROPERTY DOES NOT DETERIORATE(see § 7) SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.

- grease the spring,

- apply a droplet of loctite 262 on the end of the spool internal

thread,

- reassemble the return syste

CAUTION

WAIT FOR 8 HOURS BEFORE USING THE MACHINE TO LET THE LOCTITE

Tongue replacement (if necessary)

Beforehand, heat the spool to 200° C in an oven or, failing that, with a heat gun.

Wear thick protective gloves when handling thehot spool.









DO NOT USE A WELDING TORCH TO HEAT THE TONGUE AS SPOOL DEFORMATION MAY RESULT.

Loosen the tongue with an open end spanner (8 mm open end spanner).

Reassembly :

- apply a droplet of loctite 262 on the end of the tongue thread & torque : 10 \pm 10% N.m

CAUTION

WAIT FOR 8 HOURS BEFORE USING THE MACHINE TO LET THE LOCTITE DRY COMPLETELY

6.4 Hydraulic operation removal

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:

- place all of the machine's actuators connected to the control block in neutral position,

LO

D-rinc

Cover

- release stored pressure by manipulating all the spools,

- do not modify the (adjustable) stop screw setting.

NOTE : Install a vacuum pump on the reservoir to limit oil leakage during this operation. Collect possible leaks with a suitable receptacle

Adjustable stop nut seal replacement

NOTE : Using a vernier, measure before replacement the dimension **y** between the stopnut screw and the nut tip (see diagram below).

This value \mathbf{y} is to be thoroughly respected when reassembling to ensure an identical flow adjustment.



Mounting screw

Stopnut screw

Nut



Remove the nut :

- Gaz (22 mm open end spanner)

- UNF (27 mm open end spanner)

Reassembly :

- replace the nut O-ring or replace the nu stopnut screw assembly,

- torque : 40 ± 10% N.m.

CAUTION

WHILE TIGHTNING THE NUT, BLOCK THE STOPNUT SCREW USING A 6 MM SOCKET WRENCH.

Hydraulic control housing removal

Remove the 4 mounting screws (screwdriver Torx Tx30).

Reassembly :

- replace the O-ring on the body,
- torque : 10 ± 10% N.m.

Reassemble parts in reverse order



O-ring

MAIN CONTROL VALVE

6.5 Removal of mechanical detent system (pull function only) with lip seal

NOTE : The control block does not need to be removed from the machine to perform this operation.

Machine off:



 place all of the machine's actuators connected to the control block in neutral position,

- release stored pressure by manipulating all the spools.

NOTE : Install a vacuum pump on the reservoir to limit oil leakage during this operation. Collect possible leaks with a suitable receptacle.

Tongue side :

Cover side

Remove the 2 mounting screws and the cover (screwdriver Torx Tx30). Remove the spool from the working section.

Reassembly:

- replace the O-ring on the spacer,

- replace the spool lip seals on the spacer side and tongue side

(see § 6.3),

- torque :10 ± 10% N.m.

CAUTION

POSITION THE METALLIC PART OF THE LIP SEAL ON THE OUTSIDE

THE LIP SEAL MUST BE FITTED ON THE END OF THE SPOOL SO THAT IT IS NOT DAMAGED ON THE SPOOL GROOVES AND ITSTIGHTNESS PROPERTY DOES NOT DETERIORATE.SLIDE THE LIP SEAL PERPENDICULARLY ONTO THE SPOOL.

NOTE : Use the spool clamp (DSI.-No: 08 103 002) and a vice to secure the spool.

CAUTION

IN ORDER TO AVOID BREAKING THE CLAMP, PLACE IT APPROXIMATELY 15 MM FROM THE END OF THE SPOOL (NEVER IN THE CENTRE). Using a metal rod (min. length = 80 mm, ø6), push the central ball while extracting the detent bush. **A Mark the orientation of the detent bush**

Λ for the reassembly.

Remove the balls and the spring.

Reassembly :

- introduce the spring into the adapter,

- place the 3 balls into the radial holes of the adapter and hold them with a small amount of grease,

- position the central ball against with the spring,

- slip the detent bush onto a metal rod,

- using the rod, press the central ball into the adapter, then slide the detent bush onto the adapter, making sure that the 3 balls are still











MAIN CONTROL VALVE

6.6 Control block Disassembly / Assembly Preliminary operations

Remove the control block from the machine Remove the 3 nuts (16 mm or 17 mm ring wrench) Reassembly : torque : 42 ± 10% N.m.

Remove the outlet element.



replace the O-rings located between the working sections, the inlet element and the outlet element.
check the cleanliness of the element faces.

- place the control block horizontally on an even support area to tight the nuts. If the inlet element is to be replaced, remove the tie rods. Reassembly :

- make sure that the tie rods are tightened to the specified torque.

Reassemble parts in reverse order.



Individual pressure compensator removal

Unscrew the compensator plug (8 mm socket wrench). Reassembly :

- replace the plug O-ring,
- torque : 60 ± 10% N.m.

Remove the compensator piston using a magnet to extract it from its bore.

Clean the piston's nozzle with compressed air to remove all traces of pollution.

Check the condition of the bore in the distribution element body.

Reassemble parts in reverse order.



Check valve removal Unscrew the check valve plug (5 mm socket wrench). Reassembly :

- replace the plug O-ring,

- torque : $30 \pm 10\%$ N.m.

Visually check the condition of parts :

7 Precaution when replacing the spool lip seal

The lip seals are not interchangeable with the other spool seals (O-ring + wiper ring). This maintenance instructions is only adapted to SX14 comprised of spool lip seals.

Place the spool in the working section.



Slide the lip seal perpendicularly onto the spool, positioning the metallic part of the lip seal on the outside.

NOTE : The lip seal must be fitted on the end of the spool so that it is not damaged on the spool grooves and its tightnessproperty does not deteriorate.



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SWING CONTROL VALVE (1SM12 L1X/AV140/P001 H200 QQ RM01 M/s.Rexroth)

- SWING CONTROL VALVE	08-48
- CIRCUIT DIAGRAM	08-49

SWING CONTROL VALVE

(1SM12L1X/AV140/P001H200QQRM01)



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SWING CONTROL VALVE :

Swing control valve is a directional control valve which main function is to control the required pressure and flow to swing drive (swing machinery).

Swing is independent in BE71 excavator no control between main control valve and swing control valve, it works based on open loop hydraulic system.

Details of the port sizes and connections are indicated in circuit diagram. Pilot pressure connections are also shown in the connection diagram.

Т	G3/4"
Р, А, В	G1/2"
M	G1/4"

CIRCUIT DIAGRAM



No relief valve adjutment in the swing control valve. Main pressure to drive swing is 130 ± 2 bar. This pressure can be adjusted on the swing drive (swing machinery).

Pressure setting procedure is shown seperately ref

Swing is 11.8 rpm

MANIFOLD BLOCK, SK-BLR-1054-4-0 M/s.Rexroth

MANIFOLD BLOCK	08-50
MANIFOLD BLOCK CIRCUIT DIAGRAM	08-51

MANIFOLD BLOCK

SK-BLR-1054-4-0



In manifold block consists of four functions they are;

- 1. Pressure reducing ,
- 2. Travel brake release,
- 3. Swing brake release and
- 4. Second speed of Travel.
- 1. Pressure reducing function:

One output line of main pump and gear is connected to manifold block P1 and P2 ports. The port-Pac will get required pressure for pilot operation of the excavator implements.

Output pressure of main pump and gear pump is max.250 bar (Kg/sq.cm) i.e., Port - P1 & P2.

Out put pressure of manifold block i.e., at port-Pac is between 30 to 35 kg/sq.cm when engine ruinng at 2050 rpm (high idle condition).

2. Travel brake release function:

Port -Atr is connected through swivel joint to travel drive of port-X which is required to release the travel brake.

3. Swing brake release function:

Swing brake always in applied condition when LH joy stck operation the swing brake get releases through manifold block function.

4. Second speed of Travel:

When second speed switch is "ON" in RH control box of cabin the travel speed increases from 3.5 kmph to 5 kmph through solenoid operation in manifold block. Manifold Block Circuit diagram:



1.	MAX, FLOW	30 lpm
2.	WORKING PRESSURE	35 bar
3.	TEST PRESSURE	60 bar
4.	TYPE OF OIL TO BE USED	ISO VG 68
5.	PORT SIZES : ALL PORTS	1/4" BSP

- 1. Manifold block
- 2. Shuttle valve
- 3. Shuttle valve
- 4. Pressure reducing valve
- 6. Pressure relief valve
- 7. Solenoid valve
- 9. Directional Control Valve
- 10. Orifice

.

HYDRAULIC SYSTEM 09 TESTING AND ADJUSTING

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Before performing inspection, adjustment or trouble shooting park the machine on level ground and check the safety pin and lock

When perfroming joint work make appropiate signals and allow only authorised personnel near the machine

When checking the water level allow the engine to cool down before removing the radiator cap to prevent the risk of being scalded by hot water which may sprut out if the engine is hot.

Take great care to avoid getting caught in rotating parts such as fan etc.

TABLE OF JUDGEMENT STANDARD VALUE

Classi- fication	Item	Condition	n		Standard value	Permissible value
	Engine low idling speed (rpm)				600-700	-
	Engine high idling speed (rpm)				2120-2160	-
	Engine rated speed (rpm)				2000	
Engine	Exhaust gas (Bosch Units)					
	Oil Pressure (Kg/sq.cm)					
	Belt Tension (alternator) (mm)	Deflection when po with finger force o 6 Kg	ressed f approx			
Engine Speed (rpm)	At 1-pump relief	 Engine oil tempe in corr Engine water te in c Hydraulic oil ter 	perature: rrect range temperature: correct range emperature: 48-55°C			
	Boom control	At engine full speed			$3.0^{+0.5}_{-0.8}$	3.4
force	Arm control	Hydraulic oil			2.5 ^{+0.5} _{0.8}	2.7
ating	Bucket control	45-55°C			2.5 ^{+0.5}	2.7
opera (g)	Swing control	Hook push-pull scale on center			3.0 ^{+0.5}	3.4
ever (k		of lever knob to		Forward	5.5±1.1	8.3
rol le		measure	Pedal Reverse	6.0±1.2	9	
Cont	Fuel control lever	Low idling - Full s	speed		9±2	15
	Boom control lever	At centre of	Neutral Raise a	- and Lower	65±10	65±10
	Arm control lever	lever knob	Neutral Arm In	- and Out	65±10	65±10
vel	Bucket control lever	Measurement at end of travel	Neutral Curl and	- d Dump	65±10	65±10
er tra	Swing control lever	Engine stopped	Neutral R.H. an	- Id L.H.swing	65±10	65±10
l leve (mm)	Travel pedal		Neutral -	- F	45±5	45±5
Sontro			and Revers	e R	40±5	40±5
Ũ	Fuel control lever	Low idling - Full speed			175±30	175±30

TABLE OF JUDGEMENT STANDARD VALUE

Classi- fication	Item	Condition	Standard value	Permissible value
	Boom circuit			
sure	Arm circuit	• Hydraulic oil temperature: 45-55°C		
pres m²)	Bucket circuit	Relief pressure at engine full speed	250 ⁺⁵ -2	250 ⁺⁵
ilic kg/cn	Travel circuit			
/drau (ŀ	Swing circuit	(Be relieved oil in only measuring circuit)	130 ⁺⁵ -2	130 ⁺⁵ -2
f	Charging circuit		30 ⁺¹⁵	30±3
Air pressure	In hydraulic tank (kg/cm²)	 Hydraulic oil temperature: 45-55°C Open filler cap and run engine for 5 minutes. Fix filler cap and operate work equipment to measure air pressure in tank 	Max.0.39	±0.15
Leakage	In Hydraulic Cylinder	 Hydraulic oil temperature: 45-55°C Engine at High Idle Relieve circuit to be measured 		
	In Center Swivel Joiint			
	From Swing motor (I/min)	 Engine speed: Full Speed Hydraulic oil temperature: 45-55°C Relieve oil in swing circuit Measure leakage from swing motor with measuring cylinder 		
	From Travel motor (I/min)	 Engine speed: Full speed Hydraulic oil temperature: 45-55°C Relieve oil in travel circuit by locking track shoe. 		
Discharge volume of Hydraulic pump	Piston pump (l/min)	 Engine speed: 2000rpm Hydraulic oil temperature: 45-55°C Relief pressure: kg/cm² 		
	Gear pump (I/min)	 Engine speed: 2000rpm Hydraulic oil temperature: 45-55°C Relief pressure: kg/cm² 		

Classi- fication	Item	Condition		Standard value	Permissible value
Β	Over run while stopping swing (degrees)	Arm cylinder fully retracted fully extended (Fig.1) Engine speed: High Idle Work equipment in posture in Fig Hydraulic oil temperature: 45-55 Bucket unloaded Stop after swinging one turn an measure distance that swing cirr moves. Measure distance of movement on outside circumfere of swing circle	g.1 5°C d cle nce	65±10	75
	Time taken to start swing	 Engine speed: Full speed Hydraulic oil temperature: 45-55°C Bucket unloaded Measure time taken for 90° and 180° swing from starting 	90°	2.3±0.3	2.9
ng sys	(sec.)	and 180° swing from starting point with work equipment in posture in Fig.1		3.3±0.5	3.9
Swin	Time taken to swing (sec.)	 Engine speed: Full speed Hydraulic oil temperature: 45-55°C Measure time taken to swing for turns, after swinging one turn as an approach swing. 	xx	xx	
	Hydraulic drift of swing (mm)	 Engine speed: Stopped Hydraulic oil temperature: 45-55 Work equipment posture Stop the machine on 15° slope al set boom at 90° angle across the slope Write the match marks on the sw circle outer race and track frame After 5 minutes, measure the lag match marks. 	Engine speed: Stopped Hydraulic oil temperature: 45-55°C Work equipment posture Stop the machine on 15° slope and set boom at 90° angle across the slope Write the match marks on the swing circle outer race and track frame. After 5 minutes, measure the lag of match marks.		0

TESTING AND ADJUSTING

Classi- fication	Item	Condition	Standard value	Permissible value
	Travel speed (1)	 Engine speed: Full speed Hydraulic oil temperature: 45 - 55°C Raise track on one side, then measure time taken to rotate for 5 turns after rotating one turn as an approach travel Repeat same way with track on other side 	24±2	24 ⁺⁵
	(sec.)	Machine posture with track spinning		
Travel	Travel speed (2) (sec.)	 Engine speed: Full speed Hydraulic oil temperature: 45-55°C Machine on ground level Measure time taken to travel for 20m after traveling 10m as at an approach travel 	24±2 12±2	24 ⁺⁴ -2
	Travel deviation (mm)	 Travel posture A⁵ Question Q	Max.200	220

Classi- fication	Item	Condition	Standard value	Permissible value
Travel	Hydraulic drift of travel (mm)	 Engine speed: Stopped Hydraulic oil temperature: 45-55°C Stop the machine on 12deg slope with setting sprocket on uphill side. Measure distance moved by machine in 5 min. 		
Work equipment Hydraulic drift	Total work equipment (hydraulic drift at tip of bucket teeth) (mm) Boom cylinder (amount of retraction of cylinder) (mm) Arm cylinder (amount of extension of cylinder) (mm) Bucket cylinder (amount of retraction of cylinder) (mm)	 (Fig. 2) Engine speed: Stopped Hydraulic oil temperature: 45-55°C Bucket Rated loaded. Horizontal flat ground Levers at nuetral Work equipment in posture in Fig.2 (Top of Boom:Horizontal; Arm Cyl:Fully retracted; Buc.Cyl:Fully retracted; Buc.Cyl:Fully extended) Measure amount bucket tooth moved down in 15 min. Measure extension or retraction of cylinder every 5 min.and judge 		

Class ficatio	i- in	Item	Condition	St	andard value	Permissible value					
Work equipment	Boom Bucket teeth in contact with ground cylinder fully extended (sec) Posture of work equipment No load • Engine speed: High Idle • Hydraulic oil temperature: 45-55°C	Boom Bucket teeth contact with ground	Boom Bucket teeth in contact with ground	Posture of work equipment	RAISE	3.5±0.3	3.5±0.3				
		LOWER	3.0±0.3	3.0±0.3							
	nt speed	Arm Cylinder fully retracted	Posture of work equipment	Z	3.6±0.4	3.6±0.4					
	Work equipmer	fully extended (sec.)	 Engine speed: High Idle Hydraulic oil temperature: 45-55°C Top of boom is in horizontal, and bucket cylinder fully extended. 	OUT	2.8±0.3	2.8±0.3					
			Posture of work equipment								
							Bucket Cylinder fully retracted		CURL	3.1±0.3	3.1±0.3
		fully extended (sec.)	 No load Engine speed: High Idle Hydraulic oil temperature: 45-55°C Top of boom is in horizontal, and arm cylinder fully retracted. 	AMUD	2.1±0.2	2.1±0.2					

Classi- fication		Item	Condition	Standard value	Permissible value
Work equipment		Boom (sec)	 Engine speed: Low Idling Hydraulic oil temperature: 45-55°C Bucket unloaded Arm and bucket cylinder fully retracted. Lower bucket to ground and measure time taken for chassis to rise from ground 		
	Timelag	Arm (sec.)	 Top of boom is in horizontal, and arm cylinder fully retracted Operate arm cylinder and measure time taken when arm stops for a moment when arm is in vertical condition 		
		Bucket (sec.)	 Top of boom is horizontal and arm + bucket cylinder is fully retracted Operate bucket cylinder and measure time taken when bucket stops for a moment 		
Heat balance		Hydraulic oil temperature	 Oil levels and coolant level within specifications Convert the atmospheric temperature reading in °F to °C, using the formula 5/9 (F-32)=C. 	Max. 100	Max. 100
		Engine coolant temperature	 Estimate the temperature inside the cab on the basis of the known temperature difference between the atmospheric temperature Drain the antifreeze and use a focibly 	Max. 100	Max. 100
		Engine oil temperature	 open type thermostat. Wind velocity, maximum 5m/sec.: Do not conduct test in extremely bad weather Surface conditions: Flat and sandy soils with Nd value 10 - 20 Nd: niobium 	Max. 120	Max. 120
		Swing gear case oil temperature	 With engine running at run speed, dig a ditch whose width is about the same as the machine and whose depth is about 2/3 the max. digging depth, swing 900, and dump. Continue until the heat balance is achieved 	Max. 120	Max. 120
		Final drive case oil temperature	 As far as possible, keep the oil pressure below the set pressure of the relief valve ans use simultaneous operations while digging. 	Max. 120	Max. 120

TOOLS FOR TESTING, ADJUSTING AND TROUBLE-SHOOTING

Check or measurement	Symbol		Part Name	Remarks	
item					
Engine speed	A		Tachometer	Digital display:60-5000rpm	
Water and oil					
temperatures	В		Temperature gauge	0 – 120°c	
		1	Pressure gauge	25,60,400 kg/cm ²	
				Both male and female :	
				M14x1.5	
				(Female PT 1/8)	
Hydraulic pressure	С	2	Adapters	Both male and female :	
				M22x1.5	
				(Female PT 1/8)	
				Male: 10x1.25,female:	
				PT 1/8 2 places	
Exhaust gas	D		Smoker meter		
Operating force	E		Push-pull scale		
Stroke, hydraulic drift	F		Scale		
Work equipment speed	G		Stop watch		
Pump performance	Н		Flowmeter kit		
Engine oil pressure	Ι		Hydraulic gauge	10 kg/cm ²	

TESTING TRAVEL AND OPERATING FORCE

INSPECTION OF SWING BEARING CLEARANCE

1. TESTING TRAVEL OF CONTROL LEVERS

Special Tool Measuring Scale

(a) Measuring Travel:

Set the scale on the bottom of the knob (1) of the control lever and measure the travel need to move the lever to each position.

★ If the result of the measurement shows that the travel is not within the standard value, disassemble the PPC valve and check.





2. TESTING OPERATING FORCE OF CONTROL LEVERS

When measuring operating force, engine is at full speed and hydraulic oil temperature is 45 - 55 °C.

(b) Measuring Operating Force:

Hook push - pull scale 1 on the bottom of knob (1) of the control lever, and measure the force needed to move the lever to reach position.

★ If the result of the measurement shows that the travel is not within the standard value, disassemble the PPC valve and check.





INSPECTION OF SWING BEARING CLEARANCE

Method of inspecting swing circle bearing clearance on machine

1. Fix a dial gauge equipped with a magnet to the outer race (or inner race) of the swing circle, and put the probe in contact with the end face of the inner race (or outer race). Set the dial gauge at the front or rear.



- 2. Set the work equipment to the maximum reach with the tip of the bucket at the height of the bottom surface of the frame. In this condition, the front of the upper structure will go down, and the rear will go up.
- 3. Set the dial gauge to the 0 point.



- 4. Set the arm at 90deg perpendicular to the ground surface, then lower the boom until the front of the track comes off the ground. The front of the upper structure will go up, and the rear will go down.
- 5. With the machine in this condition, read the value on the dial gauge.

This reading of the dial gauge is the clearance of the swing circle bearing.

When carrying out the measurement, do not put your hands or feet under the undercarriage.

6. Return the machine to the condition in Step2, and check that the dial gauge has returned to the 0 point. If the dial gauge has not returned to the 0 point, repeat Steps 2 - 5.



MEASURING HYDRAULIC OIL TEMPERATURE

Special Tool — Thermistor Temperature gauge

- Lower the work equipment completely to the ground (as shown in fig.(1)) and stop the engine. Operate the control lever several times to release the remaining hydraulic pressure in the hydraulic piping. Then unlock the cover(1),fig(2)and remove cap assembly(2), fig(3) slowly to release the pressure in the hydraulic tank.
- Remove filler neck (3), fig(3), by removing six screws then measure the oil temperature after inserting the probe of thermistor temperature guage and record.
- When hydraulic oil temperature is lower than 45°C, raise the oil temperature as follows after placing back the cover(2)&(3), fig(3).
- Start the engine, operate the arm or bucket control lever fully to relieve oil through the main relief valve so that oil temperature is raised.

Do not operate under the above condition for more than 30 seconds.

★ Ensure cleanliness by cleaning the cover plate and surroundings before opening the hydraulic tank cover.

Note:

If the operating temperature does not reach 45°C then repeat the above procedure.

Posture of work equipment



Fig 1







AIR BLEEDING

Air bleeding item	Air bleeding procedure						
	1	2	3	4	5	6	
Nature of work	Bleed air from pump	Start engine	Bleed air from cylinders	Bleed air from swing motor	Bleed air from travel motor	Start operations	
Charge hydraulic oilClean strainer	0 -	→ 0 -	→ 0 -	→ O +1 -	→ 0 _{*1} -	→ O	
Replace return filter element		0 –					
 Replace or repair pump Remove suction piping 	0 -	→ O -	→ 0 -			→ O	
Replace or repair control valve		0 -	→ O -	→ 0	→ O -	→ O	
 Replace cylinder Remove cylinder piping 		0 -	→ · O -			→ O	
 Replace swing motor Remove swing motor piping 		0 -		→ O -	· · · · · ·	→ O	
 Replace travel motor or swivel Remove travel motor or swivel piping 		0 -		-	→ 0 -	→ O	

ORDER FOR OPERATION AND PROCEDURE FOR BLEEDING AIR

★ 1 Bleed air from the swing motor and travel motors only when the oil inside the motor case has been drained

1. BLEEDING AIR FROM CYLINDERS

- 1) Start the engine and run at low idling for 5 minutes.
- 2) Raise and lower the boom at 5 times repeatedly in engine at low idle.
- ★ When operating, stop the piston rod 100 mm before the end of stroke. Do not relieve the circuit.
 - 3) Operate procedure (2) with engine at high idle.
 - 4) After step (3) run engine at low idle and operate the piston rod to the end of stroke to relieve the circuit.
 - 5) Carry out the procedure in Steps 2), 3) and 4) for arm and bucket cylinders.

2. BLEEDING AIR FROM MAIN PUMP

To prevent pump inner parts seizing when replacing or dismounting the main pump, or when the suction pipe of the pump is removed, bleed the air according to the following procedure.

- 1) Remove the air vent plug R then fill the pump with oil through it.
- 2) Start the engine and run at low idle. Bleed the air until oil flows out of R.

If the pump is not filled with oil and is driven, abnormal heat will occur and the pump will soon break down.



3. BLEEDING AIR FROM TRAVEL MOTOR

- 1) Start engine and run for about 5 min. at low idling speed.
- At low idling, loosen drain hose (1) until oil comes out without air.Never work in front of plug because oil is spurted out often
- 3) After completing the air bleeding, tighten hose (1).



4. BLEEDING AIR FROM SWING MOTOR

- 1) Disconnect hose (1) at the tank port of hydraulic motor.
- 2) Fill oil into swing motor through T port.
- 3) Start engine and run at low idle. Bleed air till oil flows out of port T.
- 4) Connect back hose (1).


MEASURING INTERNAL LEAKAGE OF CYLINDER

If the hydraulic drift of the work equipment is not with in the standard value, measure the amount of leakage inside the cylinder as follows to judge if the cause of the hydraulic drift is in the cylinder or in the control valve.

- ★ If the amount of leakage is within the standard value the problem is with the control value
- If the amount of leakage is not within the standard value the problem is with the cylinder.

Oil temperature when measuring: 45 - 55 deg C

- 1. Fully extend the rod of the cylinder to be measured.
- 2. Disconnect piping (1) at the head end and block the piping with a blind plug.
- Be careful not to dis-connect the piping at the bottom end.
- 3. Start the engine and run at high idle. Apply the relief pressure to the rod end of the cylinder.
- 4. Wait for 30 seconds then measure the amount of oil that leaks during the next minute.

Posture when measuring Boom Cylinder



Posture when measuring Arm, Bucket Cylinder





Boom Cylinder



Arm Cylinder

Bucket Cylinder

TESTING LOCATIONS CAUSING HYDRAULIC DRIFT OF WORK EQUIPMENT

If there is any hydraulic drift in the work equipment (cylinders), check as follows to determine if the cause is in the cylinder packing or in the control valve.

1. Checking for defective cylinder packing

- 1) Checking boom and bucket cylinders
- i) Set in the same posture as when measuring hydrau1ic drift, and stop the engine.
- ii) Operate .the boom control lever to RAISE or the bucket control lever to CURL.
 - ★ If the lowering speed increases, the packing is defective.
 - ★ If there is no change, the holding valve (boom) or the control valve (bucket) is defective.
- 2) Checking arm cylinder
- i) Operate the arm cylinder to move the arm in fully, then stop the engine.
- ii) Operate the arm control lever to IN.
 - ★ If the lowering speed increases, the packing is defective.
 - ★ If there is no change, the controlvalve is defective.
- ★ If the pressure in the accumulator has been lost, run the engine for approx. 10 seconds to charge the accumulator again before operating.

[Reference]

If the cause of the hydraulic drift is in the packing, and the above operation is carried out, the downward movement becomes faster because of the following reasons.

- If the work equipment is set to the above posture (holding pressure applied to the bottom end), the oil at the bottom end leaks to the head end. However, the volume at the head end is smaller than the volume at the bottom end by the volume of the rod, so the internal pressure at the head end increases because of the oil flowing in from the bottom end.
- 2) When the internal pressure at the head end increaes, the balance is maintained by a certain pressure (this differes according to the amount of leakage) in proportion to it.





[Reference] contd.....

3) When the pressure is balanced. the downward movement becomes slower. If the lever is then operated according to the procedure given above. the circuit of the head end is opened to the drain circuit (the bottom end is closed by the check valve). so the oil at the head end flows to the drain circuit and the downward movement

METHOD OF LOCATING DEFECTIVE EQUIPMENT WHEN THERE IS TRAVEL DEVIATION

The ports of the piston pump, control valve, and swivel joint are connected to the travel motors as shown in Fig(1). Therefore, if there is any deviation in travel, the cause is one of the following:

- 1) If the deviation is as shown in Fig (2), the packing at the swivel joint is defective.
- If the deviation is in the same direction when traveling in both forward and reverse, the problem is not in the swivel joint but in one of the following.

To judge which of these three the problem is in, do as follows:

- Reverse the pump-1 and pump-2 hoses between the piston pump and the control valve as shown in Fig(1).
 - ★ If the problem is reversed, the hydraulic pump is defective; if it is not reversed, the control valve or travel motor are defective.
 - Reverse the left and right hoses at the swivel joint end between the control valve and swivel joint.
 - ★ If the problem is reversed, the control valve is defective; if it is not reversed, the travel motors are defective.



FIG-1 : PIPING FOR TRAVEL SYSTEM



FIG-2 : LOCATION OF DEFECTIVE SWIVEL JOINT PACKING AND DIRECTION OF DEVIATION IN TRAVEL.

TESTING OIL LEAKAGE FROM SWIVEL JOINT

Special Tools - (1) Cap Plug (2) Plate

- If there is any abnormality (deviation, lack of speed in the travel system, and there is no abnormality in the hydraulic pump, control valve, or travel motor assembly, test as follows.
- ★ Oil temperature when measuring: 45 55 °C.

Testing for leaking from packing inside swivel joint

Inlet port of	Direction of	Port to measure
swivel joint	rotation of travel	leakage inside
-	motor	swivel joint
H1		H2 & L8(DRAIN)
H2	RH REVERSE	H1 & H3
Н3	RH FORWARD	H2 & H4
H4	LH REVERSE	H3 & H5

1) Oil leakage from port H1

- i) Put a block at the rear of the right track, move the machine slowly to put the track in contact with the block, then stop the engine.
 - Loosen the oil filler cap slowly to release pressure inside the hydraulic tank. ii) Disconnect the drain hoses **L8** at the top and bottom of the swivel joint, and block both hoses with caps.
 - iii) Disconnect the hose at port **H2** for measuring oil leakage and block hose with cap.
 - iv) Start the engine, and run at full throttle to check. Relieve the circuit slowly.
 - v) Catch the oil leaking from the measuring port
 H2 and the lower drain port L8 in a measuring cylinder.
 - vi) Wait for one minute, then measure the leakage for the next minute.

2) Oil leakage from port H2

 i) Put a block at the rear of the right track, move the machine slowly to put the track in contact with the block, then stop the engine.

Loosen the oil filler cap slowly to release pressure inside the hydraulic tank.

- ii) Disconnect the drain hoses L8 at the top and bottom of the swivel joint, and block both hoses with caps.
- iii) Disconnect the hose at port H1 & port H3 for measuring oil leakage and block both hoses with caps.
- iv) Start the engine, and run at full throttle to check. Relieve the circuit slowly.
- v) Catch the oil leaking from the measuring port H1 & port H3 and the lower drain port L8 in a measuring cylinder.
- vi) Wait for one minute, then measure the leakage for the next minute.

3) Oil leakage from port H3

- i) Put a block at the rear of the left track, move the machine slowly to put the track in contact with the block, then stop the engine.
 - Loosen the oil filler cap slowly to release pressure inside the hydraulic tank.
- ii) Disconnect the drain hoses L8 at the top and bottom of the swivel joint, and block both hoses with caps.
- iii) Disconnect the hose at port H2 & port H4 for measuring oil leakage and block both hoses with caps.
- iv) Start the engine, and run at full throttle to check. Relieve the circuit slowly.
- v) Catch the oil leaking from the measuring port H2 & port H4 and the lower drain port L8 in a measuring cylinder.
- vi) Wait for one minute, then measure the leakage for the next minute.

4) Oil leakage from port H4

 Put a block at the rear of the left track, move the machine slowly to put the track in contact with the block, then stop the engine.

Loosen the oil filler cap slowly to release pressure inside the hydraulic tank.

- ii) Disconnect the drain hoses L8 at the top and bottom of the swivel joint, and block both hoses with caps.
- iii) Disconnect the hose at port H3 & port H5 for measuring oil leakage and block both hoses with caps.
- iv) Start the engine, and run at full throttle to check.Relieve the circuit slowly.
- v) Catch the oil leaking from the measuring port
 H3 & port H5 and the lower drain port L8 in a measuring cylinder.
- vi) Wait for one minute, then measure the leakage for the next minute.

MEASURING OIL LEAKAGE OF SWING AND TRAVEL MOTOR

- * Oil temperature when measuring: 45-55°C
- * Lower the work equipment completely to the ground and stop the engine.
- Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

1. Travel motor

- 1) Disconnect drain hose (2) of the travel motor, and install a blind plug at the hose end.
- 2) Start the engine, and fit a block (1) under the track on the side to be measured to lock the track in position.
- When measuring oil leakage, mistaken operation of levers may cause accidents, so always give signals and check carefully before operating them.
- 3) Run the engine at full throttle, and measure the leakage at dis-connected drain hose when the circuit is relieved for one minute.

2. Swing motor

- Disconnect drain hose (3) of the swing motor, and install a blind plug at the hose end.
- 2) Start the engine, and lock the upper structure with swing lock pin.
- 3) Run the engine at full throttle, and measure the leakage at dis-connected hose when the circuit is relieved for one minute.
- * When measuring, move the motor slightly (change the position of the valve plate and cylinder, and piston and cylinder) and measure several times. Turn the swing motor 180° when measuring.







HYDRAULIC SYSTEM 10 DISASSEMBLY AND ASSEMBLY

- TRACK DRIVE (7 05 C 2 K B A 53 G044VP41 / 2T268500101) M/s.BONFIGLIOLI - TRANSMITAL

Disassembly of hydraulic motor	10-02
Reassembly of hydraulic motor	10-21

- HYDRAULIC CYLINDERS

Removal and installation of Boom cylinder	10-46
Removal and installation of Arm cylinder	.10-47
Removal and installation of Bucket cylinder	.10-48
Removal and installation of Dozer blade cylinder	.10-49



DISASSEMBLY OF HYDRAULIC TRACK DRIVE/TRAVEL DRIVE

1. Unscrew and remove the plugs (1) from the end cover (2) and discharge the oil according to instructions specified in section 6.3

2. Use pliers to remove the elastic ring(4)

3. Place the wrench into the plug (1), jack and remove the end cover (2).

4. By using the plier remove the pad (3).



5. Remove the o ring seal (5) from its seat in the gear box housing (6).

6. Remove the 1st stage sun gear (7)

7. Remove the 1st reduction assembly (6)

8. Using pliers remove the circlips (9) from their seats placed in the hydraulic motor's pins (19).



9. By using a puller. turn the screw untill 2nd reduction planet assembly (10) comes out.

Information : In order to proceeed with the gear box disassembly, it is now necessary to remove it from the machine and bring it to a properly equipped workshop.



10. Assemble the torque multiplier by using the equipments shown below and operate it to loose the nut (11).

11. Take out the nut (11)



12. By using a puller, push on the stopper to remove the hydraulic motor (19) from the housing (6).

13. Remove the spacer (14)

14. Remove the bearing inner ring (12)

15. Assemble the torque multiplier by using the equipments shown below and operate it to loose the nut (16).



16. Take out the nut (16)

17. Remove the O ring seal (15)

18. By using the puller, push on the stopper to remove the bearings (12) from the gearbox housing (6)

Warning: In case of oil leakges, it might be necessary to check and eventually replace the lifetime seal, which means both the steel rings and the o ring seals.



19. Remove the 1st half seal (17) from the hydraulic motor (19).

20. Using a screw drive remove the 2nd half seal(17) from the hydraulic motor (19).



21. Loosen the plugs of the relief valves from the valve housing (T19).

22. Unscrew the nos.4 socket head screws M8x40(T21) grade 12.9 of the valve housing (T20) by a male hex head wrench.

23. Remove the valve housing (T20).

24. Remove the O-ring seals (T16-T17) from their seats in the valve housing (T20).

DISASSEMBLY



25. Remove the plugs of the relief valves from the valve housing (T19) previously loosened.

26. Take out the shims from the plug of each relief valve without mixing together.

27. Remove the O-ring (T18) from each plug.

28. Remove the spring from each relief valve.



29. Take out the spring seat from each relief valve (T19).

30. By using a puller remove the relief valves (T19) from the valve housing (T20).

31. loosen the plugs (T1) of the base plate (T15) without remove them.

32. Unscrew the nos.8 socket head screws M12x25 (M30), grade 12.9 of the base plate (T15) by a male hex head wrench.



WARNING Remove carefully the base plate (T15) until pins (M29) are completely out.

34. Remove the O-ring seals (M31) from their seats in the base plate (T15).

35. Remove the valve plate (M21).

36. By using a puller, remove the bearing (M22) from the base plate (T15).



37. Unscrew and remove the plugs (T11) from the base plate (T15).

38. Unscrew and remove the orifices (T13) from the base plate (T15).

39. Unscrew the plugs (T13) from the base plate(T15).

40. Remove the O-ring seals (T14) from its seat in the plugs (T13).



41. Unscrew the plug (T22) from the base plate (T15).

42. Remove the O-ring seal (T8) from its seat in the plug(T22).

43. Unscrew the plug (T7) from the base plate (T15).

44. Remove the O_ring seal (T8) from its seat in the plug (T7).



45. Take out the two speed spool (T10).

46. Take out the spring (T9).

- 47. View of the loose parts.

48. Unscrew the plugs (T1) from the base plate (T15) previously loosened.



49. Remove the O-ring seals (T2) from its seat in the plugs (T1).

50. Remove the springs (T3).

51. Push right the plunger assy (T5) to remove easily the spring seat (T4).

52. Take out the 1st spring seat(T4) from the plunger assy (T5).



53. Take out the plunger assy (T5) from the opposite side in order to remove also the 2nd spring seat (T4).

54. Take out the 2nd spring seat (T4).

55. Remove the caulking with a M5 tap before unscrew the orifices (T6).

56. Unscrew the orifices (T6) from the base plate (T15).



57. Remove the springs (M28-M33) from the brake piston (M27).

58. Remove the O-ring seal (M6) from its seat in the flanged hub (M2).

59. Remove the cylinder block assy (M16).

60. Take out the spherical retainer plate holder (M13).

DISASSEMBLY



61. Take ut the nos.3 pins (M15) from their seats in the cylinder block (M16).

62. Disassemble the pistons and the retainer plate (M11-M12).

63. Take out the pistons (M11) from the retainer plate (M12).

64. By using a puller,turn the screw until the brake piston (M27) comes out.



65. Remove the O-ring seals (M24-M25) and the backup rings (M23-M26) from their seats in the brake piston (M27).

66. Take out the brake disc (M14).

67. Remove the swash plate (M10) from the flanged hub (M2).

68. Take out the nos.2 two speed control pistons (M5) from the flanged hub (M2).



69. Take out the nos.2 two speed control springs (M4) from their seats in the flanged hub (M2).

70. Take out the nos. steel balls (M3) from their seats in the flanged hub (M2).

71. By using a puller,take out the motor shaft (M9) and the bearing (M8) from the flanged hub (M2).

72. By using a puller, take out the bearing (M8) from the motor shaft (M9).



73. INFORMATION Disassemble the seal ring only in case of replacement,because this will damage it.



HYDRAULIC TRAVEL DRIVE/TRACK DRIVE

ASSEMBLY

1. Place the seal ring (M7) into its seat in the flanged hub (M2).



2. Apply a coat of grease on the seal ring (M7).



3. By using the tool (ATZ.06.042.0) and a rubber hammer push the seal ring (M7) against the seat shoulder.

4. Assemble the nos.steel balls (M3) into their seats in the flanged hub (M2).

5. Assemble the nos.2 two sped springs (M4) into their seats in the flanged hub (M2).

6. ATTENTION-Assemble the nos.2 two speed pistons (M5) into their seats inside the flanged hub (M2).

WARNING-Be sure that the pistons can move freely onto the seats.



7. Place the bearing (M8) on the motor shaft (M9).

8. By using a stopper and a rubber hammer push the bearing (M8) against the motor shaft shoulder (M9).

9. ATTENTION-Be careful when inserting the shaft inside the motor seal.that must be greased.

10. By using a plstic hammer push the bearingmotor shaft unit (M8-M9) against the flanged hub shoulder (M2).



11. Insert the swash plate (M10) inside the flanged hub (M2) being careful that spherical housings matches with the 2 steel balls (M3).

12. Assemble the nos.3 pins (M15) in their seats in the cylinder block (M16).

13. ATTENTION-Assemble the nos.3 pins (M15) in their seats in the cylinder block (M16). **WARNING-**The two splines must be alinged together.

14. Piston orifice (M1) must be open and free of dust or dirt.



15.Assemble correctly the nos.9 pistons (M11) in the retainer plate (M12).



16. Assemble the pistons-retainer plate unit (M11-M12) in the cylinder block (M16).

17. Insert the brake disc (M14) in the cylinder block (M16).

18. Assemble the cylinder block sub assembly (M16) into the flanged hub (M2) on the motor shaft spline (M9).



19. Assemble the backup ring (M26) into its seat in the brake piston (M27).

20. Assemble the O-ring seals (m25-M24) into its seat in the brake piston (M27).

Assemble the backpu ring (M23) into its seat as shown on the sketch below.



INFORMATION: The O-ring and a the backup ring must be fitted in the seat according the mutual position as shown in the scheme.



21. Insert the brake piston (M27) inside the flanged hub (M2), being careful not to damage the seals already fitted.

22. Assemble the O-ring seal (M6) into its seat in the flanged hub (M2).

23. Insert th esprings (M28) in their seats in the brake piston (M27).

24. Insert the springs (M33).



25.Insert the orifices (T12) in the base plate (T15) and tighten by a torque wrench at $2,5\pm0.5$ Nm torque.

26. Tighten the plugs (T11) in the base plate (T15) by a torque wrench at 10 \pm 1 Nm torque.

27. By using the stopper (ATZ.06.020.0) assemble the O-ring (T14) in its seat in the plug (T13).

28. Tighten the plug (T13) by a torque wrench at 54 ± 5 Nm torque.



29. Assemble the bearing (M22) into its seat in the base plate (T15).

30. ATTENTION:Place the valve plate (M21) on the base plate (T15). **WARNING:**Bronze layer surface must be upwards.

31. Assemble the nos.2 O-ring seals (M31) onto the two speed control holes of the base plate (T15).

32. Assemble the O-ring seal (M31) into the brake pilot hole of the base plate (T15).



33.ATTENTION:Place the base plate (T15) on the flanged hub (M2).

WARNING: The base plate is centered by two pins and the second oil passages must match together.

34. Fix the base plate (T15) to flanged hub (M220 by using mos 8 socket head screws 12x25 (M300 grade 12.9, tightened by a torque wrench at 128 ± 7 Nm torque.

35. By using the stopper (**ATZ.06.020.0**) assemble the O-ring (T80 in its seat in the plug (T7).

37. Tighten the plug (T7) by a torque wrench at 54 ± 5 Nm torque.


37. Insert the spring (T9) in the two speed spooll (T10) $\,$

38.

ATTENTION : Insert the two speed spool (T10) in the base plate.

WARNING : Two speed spool have to move smoothly inside its seat in the base plate (T10).

39. By using the stopper (**ATZ.06.020.0**) assemble the O-ring seal (T8) in its seat in the plug (T22).

40. Tighten the plug (T22) by a torque wrench at 54 ± 5 Nm torque.

HYDRAULIC SYSTEM



41. Insert the orifices (T6) in the base plate (T15) and tighten by a torque wrench at 2.5 ± 0.5 Nm torquce. By using a punch caulk the threaded hole.

42. insert the 1st spring seat (T6) on the counter balance valve spool (T5).

43. Insert the 1st spring (T3) on the counter balance valve spool (T5).

44. Slide the counter balance valve spool (T5) inside the base plate (T15).

HYDRAULIC SYSTEM



45. Assemble the O-ring seal (T2) in its seat in the 1st plug (T10. $\,$

46. Tighten the plug (T1) by a torque wrench at 325 ± 10 Nm torque.

47. Insert the 2nd spring seat (T4) in the opposite side of the counter balance valve spool (T5).

48. Insert the 2nd spring (T3) on the counter balance valve spool (T5).



49. Assmble the 2nd O-ring seal (T2) in its seat in the 2nd plug (T1).

50. Tighten the 2nd plug (T1) by a torque wrench at 325 ± 10 Nm torque.

51. Assemble the relief valve (T19) into the valve housing (T20).

52. Insert the spring seat in each relief valve (T19).

HYDRAULIC SYSTEM



53. Assemble the spring into its seat in each relief valve (T19).

54. By using the tool (ATZ.06.022.06) assemble the O-ring (T18) in its seat in the plug of each relief value (T19).

55. Insert the shims in the plug of each relief valve (T19) without mixing together.

56. Screw the nos 2 plugs of the relief valves (T19) in the valve housing (T20).

HYDRAULIC SYSTEM



57. Tighten the nos 2 plugs of the relief valves (T19) in the valve housing (T20), by a torque wrench 170 ± 10 Nm torque.

58. Assemble the O-rings (T16,T-17) into their seats in the valve housing (T20).

59. Place the valve housing (T20) on the base plate (T15).

60. Tighten the nos 4 socket head screws M8x40 (T21), grade 12.9, by a male hex head torque wrench at 29.5 ± 2 Nm torque.



61. Place correctly the bearing inner ring (12) inside the gearbox housing (6).



62. Place correctly the bearing outer ring (12) inside the gearbox housing (6).

63. By using a puller push on the stopper to assemble the bearing outer ring (12) againest the gearbox shoulder (6).



64. Insert the spacer.



65. Place correctly the bearing outer (12) inside the gearbox housing (6).



66. By using a puller push on the stopper to assemble the bearing outer ring (12) againest the gearbox housing shoulder (6).



67. Lubrication with grease the O-ring seat (15) in the gearbox housing (6).

68. Assemble the O-ring seal (15) into its seat in the gearbox housing (6).

69. position the nut (16) on the gearbox (6).



71. Insert the spacer (13).

72. Place correctly the bearing inner ring (12) inside the gearbox housing (6).



Makeready of the lifetime seal

Instruction to properly assemble the lifetime seal:

1. Carefully clean the seats "1" and "2" using.If necessary,metal brushes or solvent (surfaces in contact with or "3" must be perfectly clean and dry).

2. Make sure that sealing surfaces "4" of metal rings "5" are free from scratches, dinges or foreign subtances; metal ring surfaces must be perfectly clean and dry.

3. Carefully clean the lapped surface "4" of metal rings "5" and remove dust or fingerprints. Then lubricate them with a thin oil film, taking care not to oil the other components.





74. Assemble the 1st half seal (17) on the gearbox housing (6).

75. Assemble,by using the same tool (ATZ.07.007.0),the 2nd half seal clean carefully the metal faces of the half-seals.

76. Lubricate the metallic surfaces of the lifetime seal (17) with oil.

77. Place the gearbox housing (6) on the spacer against the shoulder of the bearing inner ring (12) (as shown in the scheme).



78. Place the hydraulic motor (19) on the gearbox housing.By using a press push on the hydraulic motor until assembly of the unit is complete.

79. Position the nut (11) on the gearbox (6).

80. Assemble the torque multiplier by using the equipments shown below. Tighten the ring nut (11), by a torque wrench at 95-100 Nm 2900-3100 Nm.

Equipments: ATZ.09.001.1(1:30,7) ATZ.03.021.0 ATZ.03.022.0

81. Stake the ring nut (11) near 2 seats at 180° of the hydraulic motor (19).





82. Place correctly the 2nd reduction planet assemblies (10) on the pins of the hydraulic motor (19).

83. By using a puller push the 2nd reduction planet assemblies (10) against the shoulder.

84. By using pliers assemble the circlips (9) on the pins of the hydraulic motor (19).

85.Assemble the 1st reduction assembly (8).



86. Insert the 1st stage sun gear (7).

87. Assemble the O-ring seal (5) into its seat in the gearbox housing (6).

88. By using a puller, turn the screw to assemble the pad (3) into its seat in the end cover (2).

89. Assemble the cover (2).



90. By using pliers, assemble the elastic ring (4) into its seat in the gearbox housing (6).

91. Fill the gearbox with the lubricant oil as shown in section 6.2. Tighten the plugs (1) by a male hex head torque wrench at 20-30 Nm torque.

CYLINDER

REMOVAL OF BOOM CYLINDER

Extend the arm and bucket fully, lower the work equipment completely to the ground and stop the engine

- 1. Remove lock bolt and lock plate (A)
- 2. Sling boom cylinder assembly (B)
- 3. Start engine & retract piston rod fully.

Tie the rod with wire to prevent it from coming out.

Stop the engine and release the hydraulic pressure in the hydraulic piping. For details see TESTING AND ADJUSTING. Bleedign pressure from hydraulic circuit in machines with PPC valve.

4. Raise boom cylinder assembly (B) then set on stand.

5. Disconnect hoses (C).

6. Sling boom cylinder assembly (B) and remove the lock plate (D) using forcing screws 2, remove pin (E) then lift of boom cylinder assembly (B).

INSTALLATION OF BOOM CYLINDER ASSEMBLY.

1. Raise boom cylinder assembly (B) and position connection pin hole on frame. Assemble spacer, knock in pin (E) and install lock plate (D).

* Adjust with spacers so that the clearance between the revolving frame and the cylinder bottom is less than 1mm.

2. Fit O-rings and connect hoses (C). Start engine extend piston rod and align with pin hose, then knock in pin.

Fit lock plate then secure with lock bolt.

* Run the engine to circulate the oil through the system. Then add oil to the hydraulic tank to the specified level.



REMOVAL OF ARM CYLINDER

! Position the equipment with arm cylinder fully extended position. Keep the complete work attachment on ground and stop the engine.

1. Sling arm cylinder assembly (A), remove pin lock plate by removing the bolts (D) and then pull out pin (C).

2. Start engine & retract piston rod fully.

! Tie the rod with wire to prevent it from coming out.

! Stop the engine and release the hydraulic pressure in the hydraulic piping. For details see TESTING AND ADJUSTING. Bleeding pressure from hydraulic circuit in machines with PPC valve.

3. Disconnect arm cylinder hoses (F) at cylinder end.

4. Remove lock plate(E) pull out pin (B), then lift of arm cylinder assembly (B)

INSTALLATION OF ARM CYLINDER ASSEMBLY.

1. Raise arm cylinder assembly (A) and position bottom connection pin hole. Knock in pin (B) then secure with lock plate (E).

2. Connect hoses (F)

3. Start engine, extend piston rod, knock in pin then secure with lock plate

* Adjust with spacers so that the clearance between the boom and arm cylinder bottom is less than 0.5mm.

* Run the engine to circulate the oil through the system. Then add oil to the hydraulic tank to the specified leve.



BUCKET

REMOVAL OF BUCKET CYLINDER

! Position the equipment with bucket cylinder fully extended position. Keep the complete work attachment on ground and stop the engine.

1. Sling bucket cylinder assembly (D), remove pin lock plate by removing the bolts and then pull out pin (A).

2. Start engine & retract piston rod fully.

! Tie the rod with wire to prevent it from coming out, proper care should be taken not to fall or hang.

! Stop the engine and release the hydraulic pressure in the hydraulic piping. For details see TESTING AND ADJUSTING, Bleeding pressure from hydraulic circuit in machines with PPC valve.

3. Disconnect and cylinder hoses (B) and pipes (C) at cylinder end ports.

4. Tie arm cylinder assembly with wire and provide proper support.

5. Remove the lock bolt and pull out pin (E).

Lift bucket cylinder assembly

INSTALLATION OF ARM CYLINDER ASSEMBLY.

1. Raise bucket cylinder assembly (D) and position bottom connection pin hole. Knock in pin (E) then secure with lock bolt.

2. Connect hoses (C), pipes (C).

3. Start engine, extend piston rod, knock in pin then secure with lock plate

* Adjust with spacers so that the clearance between the boom and arm cylinder bottom is less than 0.5mm.

* Run the engine to circulate the oil through the system. Then add oil to the hydraulic tank to the specified leve.





DISASSEMBLY AND ASSEMBLY

REMOVAL OF DOZER BLADE CYLINDER

! Position the equipment with bucket cylinder fully extended position. Keep the complete work attachment on ground and stop the engine.

1. Sling bucket cylinder assembly (D), remove pin lock plate by removing the bolts and then pull out pin (A).

2. Start engine & retract piston rod fully.

! Tie the rod with wire to prevent it from coming out, proper care should be taken not to fall or hang.

! Stop the engine and release the hydraulic pressure in the hydraulic piping. For details see TESTING AND ADJUSTING, Bleeding pressure from hydraulic circuit in machines with PPC valve.

3. Disconnect and cylinder hoses (B) and pipes (C) at cylinder end ports.

4. Tie arm cylinder assembly with wire and provide proper support.

5. Remove the lock bolt and pull out pin (E).

Lift bucket cylinder assembly

INSTALLATION OF ARM CYLINDER ASSEMBLY.

1. Raise bucket cylinder assembly (D) and position bottom connection pin hole. Knock in pin (E) then secure with lock bolt.

2. Connect hoses (C), pipes (C).

3. Start engine, extend piston rod, knock in pin then secure with lock plate

* Adjust with spacers so that the clearance between the boom and arm cylinder bottom is less than 0.5mm.

* Run the engine to circulate the oil through the system. Then add oil to the hydraulic tank to the specified leve.





DISASSEMBLY AND ASSEMBLY

ELECTRICAL SYSTEM 11 STRUCTURE AND FUNCTION

1. Instrumentation system	11-02
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INSTRUMENTATION SYSTEM:

It consists of two instrument modules having FUEL,WATER TEMPERATURE,ENGINE- OIL PRESSURE AND LCD HOUR METER.The warning cluster provides two warning windows.

In addition to the gauges five rocker switches have been provided for regular electrical function. Front panel diagram is shown in figure.

The system is powered from vehicle battery 24 V through key switch and battery relay. Details of gauges, warnings, switches and connections are listed in table I, II, III and IV. The system is protected by 15A fuse link (blade type) against short circuit.

Pressure, temperature and fuel level sensors have been installed at different sub-systems which send the electrical signals to their respective gauges. When key is switched ON, water temperature, and fuel level gauges indicate their actual reading. Engine oil pressure gauge does not show any value till engine is started. Battery charge indication disappears on starting engine. Wiring diagram is shown in figure.

Though the system is protected against the likely accidents, it is advisable to observe the following precautions to prevent any damage/hazard occurring to the system.

I. Avoid reverse polarity connection to the cluster gauges

- 2.Use fuses of correct rating (15A).
- 3. Direct splashing of water on the dashboard should be avoided especially during cleaning of vehicle.

4. Pull male and female plastic connectors body in opposite direction to disconnect. Avoid pulling of cables.

Table - I : Details of gauges

SI. No.	Gauge description	Range/Color	Sensing details
01.	2 in 1 instrument cluster a. Water temperature guage	40-75xc;white 75-95xc;green 95-120xc;red	Tempt. sensor, (marked as vdo) Thread M16X1.5 Mounted on engine water jacket block
	b. Engine oil pressure gauge	0-1 bar;red 1-10 bar; green	Pressure sensor, Thread 1/8-27 NPTF Mounted on engine oil pressure port.
2.	2 in 1 instrument cluster a. Fuel level gauge	0-1/4; red 1/4-1/1;green	Float,fitted on fuel tank.
	b.Hour meter display		Alternator voltage at 'WL'terminal

NOTE:1) Range/Color band is indicated on sticker.

2) All Gauges are provided with backlights except Hour Meter.

Table -	П	:	Details	of	warnings
---------	---	---	---------	----	----------

SI. No.	Description	Type of Conta sensor	cts under conditions	Switch	ning point/ Remarks
			Normal	Abnormal	
1	2 in 1 instr- ument cluster				
	a.Battery charge	Tapped from WL terminal of alternator	_	switch —	es off when engine is started & alternator starts charging the battery
	d.Engine oil pressure	pressure switch	open	close	Below 0.8 bar

Table -		: Details	of	dashboard	switches
---------	--	-----------	----	-----------	----------

SI.no	Description	Type/ color
1. 2 3. 4. 5.	SPEED selector sw Boom lamp switch Gauge lamp switch Wiper switch Screen washer switch	Rocker,ON/OFF;black Rocker,ON/OFF;black Rocker,ON/OFF;black Rocker,ON/ON;black Rocker,MOM ON;red

Note: All switches are of 16A/250V rating

Table	-	IV	:	Gauge	connection	details.
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SI. No	Gauge description	Pin	Description	Cable code No
01	2 in 1 gauge (fuel &water temp)	1	positive power supply	R
	(2	Water temp.	GB
		3	Ground	В
		4	Fuellevel Sensor.	Y
		5	Illumination	RY
02	2 in 1 gauge	1	HMR signal	L
	(Engine oil	2	Pressure sensor	or
	pressure & LCD	3	Ground	В
	hour meter)	4	Positive power R	
			supply	
		5	Illumination	RY
	54321		5432	1

Note: Connector details as viewed from rear side of the gauge.

SI. No	Gauge description	Pin	Description	Cable code no
04	Warning display.	1	Engine oil Pressure	YG
		2	Engine oil pressure indicator	R
		5	Charge	L
		6	Charge indicator	R
			Pin 3,4,7,8 not used.	
L	87654321		8765	4 3 2 1

Note:Connector details as viewed from rear side of the guage.

Table - V : WT sensor resistance values

Sensor type : Water temperature						
Temperature (°c)	Ambient	40	60	80	100	120
Resistance (ohms)	389	287±20	134±13	69±8	38.5±4.3	22±3

Table - VI: EOP / FL sensor resistance values

Sensor type : Engine oil pressure							
Pressure (bar)	0	2	4	6	8	10	
Resistance (ohms)	10±3/5	54±4	88±4	124±5	155±6	184±6	
Sensor type : Float (fuel level)							
Resistance (ohms)	Maximum :	180±5	Minimum	: 3±2			



8 9 SWITCH (ON-ON) SWITCH (ON/OFF)

1 1

PRECAUTIONS WHEN CARRYING OUT MAINTENANCE

To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct operation, maintenance and inspection, troubleshooting, and repairs must be carried out. This section deals particularly with correct repair procedures for electronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on "Handling elecric equipment".

PRECAUTIONS WHEN HANDLING ELECTRIC EQUIPMENT

1) Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protector or tubes used for protecting the wiring. Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.

Main failures occurring in wiring harness

- (1) Defective contact of connectors (defective contact between male and female) Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces.
- (2) Defective compression or soldering of connectors The pins of the male and female connectors are in contact at the compressed terminal or soldered portion, but there is excessive force on the wiring, and the plating peels to cause improper correction or breakage.



PRECAUTIONS

- (3) Disconnections in wiring If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the compression of the connector may be lost, or the soldering may be damaged, or the wiring may be broken.
- (4) High pressure water entering connector The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector depending on the direction of the water jet. The connector is designed to prevent water from entering, but at the same time, if the water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be shortcircuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.
- (5) Oil or dirt stuck to connector If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease or dirt stuck to the connector, wipe it off with a dry cloth or blow dry with air, and spray it with a contact restorer.
 - * When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.
 - * If there is water or oil in the air, it will increase the contamination of the points, so clean with air from which all the water and oil has been removed.







2) Removing, installing, and drying connectors and wiring harnesses

Disconnecting connectors

- Hold the connectors when disconnecting.
 When disconnecting the connectors, hold the connectors and not the wires. For connctors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.
- (2) Action to take after removing connectors After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.

Connecting connectors

- (1) Check the connector visually.
- Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
- b. Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.
- c. Check that there is no damage or breakage to the outside of the connector.
- * If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.
- * If there is any damage or breakage, replace the connector.



- (2) Fix the connector securely. Align the position of the connector cor- rectly, then insert it securely. For connectors with lock stopper Push in the connector until the stopper clicks into position.
- (3) Correct any protrusion of the boot and any misalignment of the wiring hanress For connectors fitted with boots, correct any protrusion or the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.

* When blowing with dry air, there is danger that the oil in the air may cause improper contact, so clean with air from which all the water and oil has been removed.

Drying wiring harness If there is any oil or dirt on the wiring har- ness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high pressure water or steam directly on the wiring harness. If water gets directly on the connector, do as follows.

(1) Disconnect the connector and wipe off the water with a dry cloth.

* If the connector is blown dry with air, there is the risk that oil in the air may cause defective contact, so avoid blowing with air.

(2) Dry the inside of the connector with a dryer. If water gets inside the connector, use a dryer to dry the connector.

* Hot air from the dryer can be used, but be careful not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.



- (3) Carry out a continuity test on the connector. After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits be- tween pins caused by water.
- After completely drying the connec- tor, blow it with contact restorer and reassemble.

3) Handling control box

- The control box contains a microcomputer and electronic control circuits. These control all of the electronic cir- cuits on the machine, so be extremely careful when handling the control box.
- (2) Do not open the cover of the control box unless necessary.
- (3) Do not place objects on top of the control box.
- (4) Cover the control connectors with tape or a vinyl bag.
- (5) During rainy weather, do not leave the control box in a place where it is ex- posed to rain.
- (6) Do not place the control box on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand)
- (7) Precautions when carrying out arc welding When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the control box. Fit an arc welding ground close to the welding point.



CHECKS BEFORE TROUBLESHOOTING

	Item	Judgement standard	Remedy
	01. Check for loose or correded battery		
Electrical equipments	terminals	-	Tighten or replace
	02. Check for loose or correded alternator		
	terminals	-	Tighten or replace
	03. Check for loose or correded starting motor		
	terminals	-	Tighten or replace
	04. Check battery voltage (engine stopped)	20 - 30V	Replace
	05. Check level of battery electrolyte	-	Add or replace
	06. Check for missing wiring clamps, hanging		
	wires	-	Repair
	07. Checks for water leaking onto wiring .		Disconnect connector
	(check carefully water leakage at connectors		and dry connection
	and terminals)		
	08. Check for broken or corroded fuses	-	Replace
	09. Check alternator voltage	27.5-29.6V	Replace
	(engine running at over half throttle)		
	10. Noise when battery relay is operated	-	Replace

TROUBLE SHOOTING GUIDELINES

Probable failures and different steps are listed below for checking and identifying the cause of failure. However ensure proper battery voltage,operation of battery relay and healthy fuse link in order to energise the instrument clusters. Refer wiring diagram (Annexure-II) for wiring checking. Multimeter, inspection lamp & a few wires will be sufficient to carryout trouble shooting.

Problem: If panel is not getting on and none of the meters are functioning.

Check:

- 1. ground connection.
- 2. fuse
- 3. key switch
- 4. battery relay.
- 5. panel connectors are properly inserted

Problem: Water temperature gauge (WT) shows maximum deflection, no deflection or abnormal reading.

Check:

- i) Gauge excitation (24V) and proper ground connection at the gauge connector.
- WT sensor wire SHORT CIRCUIT. for max.deflection and open circuit for no deflection.
- iii) Sensor resistance as per table.

Problem: Water temperature gauge (WT) does not deflect.

Check:

- i) Gauge excitation (24V) and proper ground connection at the gauge connector.
- ii) WT sensor wire OPEN CIRCUIT
- iii) Respective sensor resistance as per Table V.

Problem: Engine oil pressure (EOP) or fuel level gauge indicate maximum deflection,no deflection or abnormal reading.

Check:

- i) Gauge excitation (24V) and proper ground connection at the gauge connector.
- ii) EOP or fuel sensor wire OPEN CIRCUIT for max.deflection and SHORT CIRCUIT for no deflection.
- iii) Respective sensor resistance as per Table VI.

Problem: Hour meter does not function.

Check:

- Wiring continuity between alternator "WL" terminal and cluster gauge signal pin.
- ii) Voltage at 'WL'terminal shall be 26<u>+</u>2 V when alternator is charging the battery.

Problem: No charge indication upon turning key switch ON.

Check:

- i) Excitation voltage (24V at pin 6 of 8 way gauge connector).
- ii) Proper mating of connector on the gauge
- iii) Bulb filament.
- iv) Wiring continuity between Pin 5 to alternator "WL" terminal.
- "WL" terminal voltage should be 0 or less than 2 volt when engine is not running."WL" voltage should be 24V when engine is running and alternator is charging.

Problem: During power on system check, Problem: Back light of gauges not workengine oil pressure lamp does not glow ing with gauge light switch put on and before engine is started.

Check:

- Excitation voltage (24V) at Pin 2 of 8 i) way connector of warning lamp as sembly.
- Wiring continuity between Pin 1 of same iii) ii) 8 way connector and pin 7 of 17 pole controller connector.
- iii) Pressure switch should be N/O con tact below 0.8 bar before starting of the engine. Switch becomes N/C con tact above 0.8 bar after starting of the engine.
- iv) Defective bulb.
- Power supply(24V) at pin 17 & ground i) V) at pin 2 of CN-24 in controller. ii)
- Defective controller. vi)

Problem: Engine oil pressure warning iv) occurs after starting of the engine though engine oil pressure is more than 0.8 bar.

- i) Excitation voltage (24V) at pin 17 and ground at pin 2 of CN-24 in controller.
- Wiring continuity between pressure ii) sensor and controller at pin 11 of CN-24.
- iii) Engine oil pressure switch is defec tive.

key switch turned on

Check:

- i) Light switch wiring.
- ii) Excitation voltage (24V at Pin 5 in both 5 way connector)
 - Proper mating of connector on respec tive gauges
- Gauge light switch defective iv)

Problem: Boom lights or head lights not working

Check:

- Light switch wiring.
- Power supply (+24V) for light switch and respective fuse link.
- iii) Light switch continuity.
 - Defective bulb.

A3 SIZE ELECTRICAL CIRCUIT DIAGRAME TO BE INCLUDED

ELECTRICAL SYSTEM
ELECTRICAL SYSTEM 12 TROUBLESHOOTING

Points to remember when troubleshooting	12-02
Sequence of events in troubleshooting	12-03
Precautions when carrying out maintenance	12-04
Checks before troubleshooting	12-06

POINTS TO REMEMBER WHEN TROUBLESHOOTING

Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted. When carrying out the operation with two or more workers, keep strickly to the agreed signals, and do no allow any unauthorized person to come near.

Be extremely careful not to touch any hot parts or to get caught in any rotating parts. When disconnecting wiring, always disconnect the negative (-) terminal of the battery first.

When removing the plug from a location which is under pressure from oil, water, or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent reoccurrence of the failure. When carrying out troubleshooting, and important point is of course to understand the structure and function. However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible cases of the failure that would produce the reported symptoms.

 When carrying out troubleshooting, do not hurry to disassemble the components. If components are disassembled immediately any failure occurs:

Parts that have no connection with the failure or other unneces~ary parts will be disassembled.

It will become impossible to find the cause of the failure.

It will also cause a waste of manhours, parts, or oil or grease, and at the same time, will also lose the confidence of the user or operator. For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.

2. Points to ask user or operator

- Have any other problems occured apart from the problem that has been reported?
- 2) Was there anything strange about the machine before the failure occurred?
- 3) Did the failure occur suddenly, or were there problems with the machine condition before this?
- 4) Under what conditions did the failure occur?
- 5) Had any repairs been carried out before the failure?
- When were these repairs carried out?Has the same kind of failure occurred before?

3. Check before troubleshooting

- 1) Check the oil level.
- Check for any external leakage of oil from the piping or hydraulic equipment.
- 3) Check the travel of the control levers.
- Check the stroke of the control valve spool.
- 5) Other maintenance items can be checked externally, so check any item that is considered to be necessary.
- Confirming failure Confirm the extent of the failure your self, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.

* When operating the machine to reenact the torubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.

- Troubleshooting: Use the results of the investigation and inspection in Items 2 - 4 to narrow down the causes of failure, then use the troubleshooting flowchart to locate the position of the failure exactly.
 - * The basic procedure for troubleshooting is as follows.
 - 1) Start from the simple points.
 - 2) Start from the most likely points.
 - 3) Investigate other related parts for information.
- Measures to remove root cause of failure: Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again. To prevent this, always investigate why the problem occurred. Then, remove the root cause.

SEQUENCE OF TROUBLESHOOTING



PRECAUTIONS WHEN CARRYING OUT MAINTENANCE

To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct operation, maintenance and inspection, troubleshooting, and repairs must be carried out. This section deals particularly with correct repair procedures and is aimed at improving the quality of repairs. For this purpose, it gives section on "Handling hydraulic equipment". (particularly hydraulic oil).

POINTS TO REMEMBER WHEN HANDLING HYDRAULIC EQUIPMENT

With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic cirucit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

- Be careful of the operating environment. Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.
- 2) Disassembly and maintenance work in the field If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to confirm the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be confirmed with special test equipment.
 - Sealing openings After any piping on equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this. Do not simply drain oil out on to the ground, collect it and ask the customer to dispose of it, or take it back with you for disposal.







4) Do not let any dirt or dust get in during refilling operations.

Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil con tainers. If an oil cleaning device is used, it is possible to filter out the dirt that has collect ed during storage, so this is an even more effective method.

5) Change hydraulic oil when the temperature is high

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit togeth- er with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Do not drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

6) Flushing operations

After disassembling and assembling the equipment. or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit. Normally, flushing is carried out twice: pri- mary flushing is carried out with flushing oil. and secondary flushing is carried out with the specified hydraulic oil.

7) Cleaning operations

After repairing the hydraulic equipment (pump, control valve. etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit. The oil cleaning equipment is used to remove the ultrafine (about 3,u) particles that the filter built into the hydraulic equip- ment cannot remove, so it is an extremely effective device.





CHECKS BEFORE TROUBLESHOOTING

		Item	Judgement standard	Remedy
Check before starting items	j water	1. Check fuel level	-	Add fuel
		2. Check for dirt or water in fuel	-	Clean, drain
		3. Check hydraulic oil level	-	Add oil
	coolinç	4. Check hydraulic oil strainer	- Clean, drain	
	Lubricating oil,	5. Check swing machinery oil level	-	Add oil
		6. Check engine oil level (level of oil in pan)	-	Add oil
		7. Check cooling water level	-	Add water
		8. Check condition of dust indicator	-	Clean or replace
Other check items	al ts	12 Check for abnormal noise or smell	-	Repair
	'aulic, hanic; pmen	13. Check for oil leakage	-	Repair
	Image: Signal	Bleed air		

BE75 B/H EXCAVATOR REXROTH HYDRAULICS CIRCUIT DIAGRAM







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