

BOMAG

Service Training



Tandem Rollers **BW 141 - 151 AD/AC-4** **BW 154 AD/AC-4**

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Foreword

Reliable construction equipment is of greatest advantage for all parties involved:

- for the customer/user it is a basis for an exact calculation of utilization periods and the completion of projects as scheduled.
- in the rental business it means that the equipment can be reliably used and planned without having to stock a large number of stand-by machines.
- for the manufacturer it means that customers are satisfied, provides him with a good image and gives him a feeling of confidence.

It is BOMAG's philosophy to design and produce the machines with highest possible reliability. This aspect of simple and easy maintenance was one of the key issues when developing and designing the machine:

- the location of components in the machine eases maintenance work,
- the high quality standard of BOMAG is the basis for the considerable extension of the service and maintenance intervals.
- the After Sales Service of BOMAG, including excellent operating and maintenance instruction manuals, high quality training courses and on-site machine demonstrations helps the customer to maintain their machines in good condition over a long period of time.

Permanent training of BOMAG's own service personnel as well as the service personnel of BOMAG Profit Centres and dealers is therefore a general prerequisite for BOMAG's excellent world-wide service.

This program of permanent training is only possible with appropriate and up-to-date training material for trainers as well as persons attending the training courses.

This training manual has not only been written as a support for the professional work of the trainer, but also for the trainees attending these training courses.

The different levels of product training demand, that the training performed by BOMAG, its Profit Centres or its dealers reflects the high quality of the training conducted at the Training Centre at BOMAG in Boppard. For this reason we invested a lot of time in the preparation of these materials .

The structure of this training manual enables us to change or up-date individual chapters in case of alterations to the machine.

Documentation

For the BOMAG machines described in this training manual the following documentation is additionally available:

Attention!

The currently valid part numbers for the documents can be taken from the Doclist or the Customer Service page in the BOMAG (BOMAG Secured Area) in accordance with the serial number of the machine.

- 1. Operating and maintenance instructions**
- 2. Spare parts catalogue**
- 3. Wiring diagram ***
- 4. Hydraulic diagram ***
- 5. Repair instructions**
- 6. Service Information**

* The document versions valid at the date of printing are part of this training manual.

General

The tandem rollers of series BW 141 - 154 AD/AC-4 are high performance machines for the extremely difficult use in asphalt compaction and earth work.

The machines of this series are powered by engine oil cooled Deutz diesel engines of series BF4M 2011.

Engine driven pumps transfer the engine output power via hydrostatic circuits for travel and vibration systems to the drums. These hydrostatic drives ensure lowest possible power losses and a high efficiency. The steering and crab-walk functions as well as the additional edge cutter option are supplied by gear pumps driven by the auxiliary engine output.

The machines are equipped with a 2 cylinder operated articulated steering and a crab-walk function with a separate hydraulic cylinder to offset the front frame laterally relative to the rear frame.

For the first time a machine of this product range is equipped with axial piston drum drive motors with reduction gears. The discs of the parking brakes are integrated in the reduction gears. When starting the engine and opening the brake valve the brakes are relieved by charge pressure. When closing the brake valve or when shutting the engine down the brakes are automatically applied by spring pressure. These parking brakes should not be used as service brake, because the deceleration effect is extremely high and the braking process may damage the brake discs.

The drums are equipped with an exciter shaft and two vibrator units each. The exciter shafts are driven by hydraulic motors via Bowex couplings. Vibration of the drum is caused by the centrifugal forces generated by the exciter shaft mounted eccentric weights.

Since the machines are designed for operation with two different frequencies and amplitudes, the sense of rotation of the exciter shaft can be reversed. Changing the sense of rotation also changes the position of the change-over weights inside the eccentric weights on the exciter shafts.

This also changes the centrifugal force and the amplitude. The rotary speed of the exciter shaft is also different to both directions of rotation. This means, that the vibration frequency will also change.

In combination with the hydraulic vibration drive the change-over weights are arranged in such a way, that the high amplitude works with low frequency and vice-versa.

The combination of high amplitude and low frequency is particularly suitable for compaction work in earthwork with high lift heights and for preliminary compaction. For soil compaction the combination of low amplitude and high frequency should be used for the finishing passes.

The individual machine functions like travel system, vibration and steering are described in more detail in the corresponding chapters. Optional equipment, such as BAM, BOMAG Asphalt Manager (Variomatic) and chip spreader etc. is not included in this training manual.

Technical data and adjustment values

The following pages contain technical data valid at the date of printing (see front page of this manual).

Attention!

The currently valid technical data and adjustment values can be taken from the BOMAG Intranet or Extranet (BOMAG Secured Area) in accordance with the serial number of the machine.

BOMAG Central Service - Technical data and adjustment values**Status: 2005-06-22**

Product type:	BW 141 AD Serie 4
Type No.:	920 00
Serial numbers from:	101 920 00 1001
Engine:	
Type:	BF4M 2011
Combustion principle:	4-stroke-Diesel
Cooling:	Oil
Number of cylinders:	4
Power acc. to ISO 9249:	60 kW
Power data at nominal speed of:	2500 1/min
Low idle speed:	850 +/- 150 1/min
High idle speed:	2700 +/- 50 1/min
Spec. fuel consumption:	245 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	210 +8 bar
Starter voltage:	12 V
Travel pump:	
Type:	A4VG 56 HW/32
System:	Axial piston-swash plate
Max. displacement:	56 cm ³ /U
Max. flow ratio:	136,1 l/min
High pressure limitation:	440 bar
Pressure override:	400 +/- 10 bar
Charge pressure, high idle:	25 +3/-1 bar
Travel motors:	
Type:	A2 FE 32
Number:	2
System:	Axial piston
Displacement stage 1:	32 cm ³ /U
Perm. leak oil quantity:	2 l/min
Flushing quantity:	5 l/min
Reduction gear, drum:	
Type:	705 C 2H
Transmission ratio:	48
Number:	2
Vibration pump:	
Type:	A10VG 45 EZ
System:	Axial piston-swash plate
Max. displacement:	45 cm ³ /U

Starting pressure: 360+/-20 bar
 Operating pressure, soil dependent: ca.100 bar

Vibration motor:

Type: A4FM 22
 Number: 2
 System: Axial piston-swash plate
 Displacement: 22 cm³/U
 Frequency: 40/60 Hz
 Amplitude: 0,7/0,34 mm

Steering and charge pump:

Type: HY/ZFFS11/11+8
 System: Tandem-/Gear pump
 Displacement: 11 / 8 cm³/U
 Max. steering pressure: 200 +/-5 bar

Steering valve:

Type: OSPF 400 LS
 System: Rotary valve

Filling capacities:

Engine oil: 13 l (SAE 15W-40, API CG-4 (for details see maintenance manual))
 Hydraulic oil: 60 l (HVLP 46 VI 150)
 Vibration bearing housing: 7,5 l (SAE 15W-40, API SJ/CF)
 Reduction gear, drum: 1,5 l (SAE 90 EP, API GL 5)
 AC refrigerant: 1100 g (R 134a)
 Compressor oil (filling the system): 100 ml (PAG Öl)

BOMAG Central Service - Technical data and adjustment values**Status: 2005-06-23**

Product type:	BW 154 AD Serie 4
Type No.:	920 31
Serial numbers from:	101 920 31 1001
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Engine:	
Type:	BF4M 2011
Combustion principle:	4-stroke-Diesel
Cooling:	Oil
Number of cylinders:	4
Power acc. to ISO 9249:	60 kW
Power data at nominal speed of:	2500 1/min
Low idle speed:	850 +/-150 1/min
High idle speed:	2700+/-50 1/min
Spec. fuel consumption:	245 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	210 +8 bar
Starter voltage:	12 V
<hr/>	
Travel pump:	
Type:	A4VG 56 HW/32
System:	Axial piston-swash plate
Max. displacement:	56 cm ³ /U
Max. flow ratio:	136,1 l/min
High pressure limitation:	440 bar
Pressure override:	400+/-10 bar
Charge pressure, high idle:	25 +3/-1 bar
<hr/>	
Travel motors:	
Type:	A2 FM 32
Number:	4
System:	Axial piston
Displacement stage 1:	32 cm ³ /U
Perm. leak oil quantity:	2 l/min
<hr/>	
Reduction gear, drum:	
Type:	GFT 7 G2801
Transmission ratio:	25,1
Number:	4
<hr/>	
Vibration pump:	
Type:	A10VG 45 EZ
System:	Axial piston-swash plate
Max. displacement:	45 cm ³ /U
Starting pressure:	360+/-20 bar

Operating pressure, soil dependent: ca.100 bar

Vibration motor:

Type: A4FM 22
Number: 2
System: Axial piston-swash plate
Displacement: 22 cm³/U
Frequency: 40/60 Hz
Amplitude: 0,7/0,34 mm

Steering and charge pump:

Type: HY/ZFFS11/11+8
System: Tandem-/Gear pump
Displacement: 11 / 8 cm³/U
Max. steering pressure: 200 +/-5 bar

Steering valve:

Type: OSPF 400 LS
System: Rotary valve

Filling capacities:

Engine oil: 13 l (SAE 15W-40, API CG-4 (for details see maintenance manual))
Hydraulic oil: 60 l (HVLV 46 VI 150)
Vibration bearing housing: 7,5 l (SAE 15W-40, API SJ/CF)
AC refrigerant: 1100 g (R 134a)
Compressor oil (filling the system): 100 ml (PAG Öl)

BOMAG Central Service - Technical data and adjustment values

Status: 2005-06-22

Product type:	BW 154 AD AM Serie 4
Type No.:	920 51
Serial numbers from:	101 920 51 1001
Engine:	
Type:	BF4M 2011
Combustion principle:	4-stroke-Diesel
Cooling:	Oil
Number of cylinders:	4
Power acc. to ISO 9249:	60 kW
Power data at nominal speed of:	2500 1/min
Low idle speed:	850 +/- 150 1/min
High idle speed:	2700 +/- 50 1/min
Spec. fuel consumption:	245 g/kWh
Valve clearance, inlet:	0,3 mm
Valve clearance, outlet:	0,5 mm
Opening pressure, injection valves:	210 +8 bar
Starter voltage:	12 V
Travel pump:	
Type:	A4VG 56 HW/32
System:	Axial piston-swash plate
Max. displacement:	56 cm ³ /U
Max. flow ratio:	136,1 l/min
High pressure limitation:	440 bar
Pressure override:	400 +/- 10 bar
Charge pressure, high idle:	25 +3/- 1 bar
Travel motors:	
Type:	A2 FM 32
Number:	4
System:	Axial piston
Displacement stage 1:	32 cm ³ /U
Perm. leak oil quantity:	2 l/min
Reduction gear, drum:	
Type:	GFT 7 G2801
Transmission ratio:	25,1
Number:	4
Vibration pump:	
Type:	A10VG 45 EZ
System:	Axial piston-swash plate
Max. displacement:	45 cm ³ /U
Starting pressure:	360 +/- 20 bar

Operating pressure, soil dependent: ca.100 bar

Vibration motor:

Type: A4FM 28
 Number: 1
 System: Axial piston-swash plate
 Displacement: 28 cm³/U
 Frequency: 46 Hz
 Amplitude: 0,2 / 0,55 mm

Vibration motor, VARIOMATIC:

Type: A4FM 28
 System: Axial piston-swash plate
 Displacement: 28 cm³/U
 Frequency: 46 Hz
 Amplitude: 0,84 mm

Steering and charge pump:

Type: U 1636 11+8+2,5
 System: Tandem-/Gear pump
 Displacement: 11 / 8 / 2,5 cm³/U
 Max. steering pressure: 200 +/-5 bar

Steering valve:

Type: OSPF 400 LS
 System: Rotary valve

Swashing motor, VARIO:

Type: STF04-000-013
 System: piston-gear rack

Filling capacities:

Engine oil: 13 l (SAE 15W-40, API CG-4 (for details see maintenance manual))
 Hydraulic oil: 60 l (HVLP 46 VI 150)
 Vibration bearing housing: 7,5 l (SAE 15W-40, API SJ/CF)
 Drum filling VARIO: 2 x 30 l (50% Water, 50% Anti-freeze agent on Ethane-diol-basis)
 AC refrigerant: 1100 g (R 134a)
 Compressor oil (filling the system): 100 ml (PAG Öl)

Maintenance

The products of series BW 141...154 AD/AC-4 are high performance machines for the extremely difficult use in asphalt compaction and earth work. To be able to meet these demands the machines must always be ready to be loaded up to their limits. Furthermore, all safety installations, protections and guards must always be in place and fully functional.

Thorough maintenance of the machine is therefore mandatory. This not only guarantees a remarkably higher functional safety, but also prolongs the lifetime of the machine and of important components.

The time required for thorough maintenance is only minor when being compared with the malfunctions and faults that may occur if these instructions are not observed.

The maintenance intervals are given in operating hours. It is quite obvious that with each maintenance interval all the work for shorter preceding intervals must also be performed. During the 2000 hours interval you must also perform the work described for the service intervals after 50, 250 and 500 hours.

During maintenance work you must only use the fuels and lubricants mentioned in the table of fuels and lubricants (oils, fuels, grease etc.).

This training manual is handed out together with the presently valid operation and maintenance manual. For the individual maintenance intervals and the description of the maintenance work involved please refer to these maintenance instructions.


5.3 Fuels, lubricants and filling capacities

Assembly	Fuel or lubricant		Quantity approx.
	Summer	Winter	Attention Observe the level marks
Engine	Engine oil ACEA: E3-96/E5-02 API: CG-4/CH-4 SAE 10W/40 (-20 °C to +30 °C) SAE 10W/40 (-10 °C to +40 °C) SAE 30 (+5 °C to +30 °C) SAE 40 (+25 °C to +40 °C)		13 litres without oil filter
		SAE 10W (-5 °C to -30 °C) SAE 20W/20 (-10 °C to +10 °C)	
	Fuel Diesel		160 litres
		Winter diesel fuel (down to -12 °C)	
Hydraulic system	Hydraulic oil (ISO), HV46, kinem. viscosity 46 mm ² /s at 40 °C or ester based biodegradable hydraulic oil		60 litres
Sprinkler system	Water	Anti-freeze mixture and water *	800 litres
Drum	SAE 15W/40		5,3 litres (BW 141 AD-4)
- Exciter shaft tube			6,3 litres (BW 151 AD-4) 6,3 litres (BW 151 AC-4)
Travel gear, drum	SAE 80W-90, API GL5		approx. 1.5 litres
Steering chains	High pressure grease (lithium saponified)		as required
Oscillating articulated joint	High pressure grease (lithium saponified)		as required

* Mix water and anti-freeze agent by following the instructions of the manufacturer

5.4 Running-in instructions

The following maintenance work must be performed when running in new machines or overhauled engines:

 **Caution**

Up to approx. 250 operating hours check the engine oil level twice every day.

Depending on the load the engine is subjected to, the oil consumption will drop to the normal level after approx. 100 to 250 operating hours.

Maintenance after 50 operating hours

Check the engine for leaks.

Retighten bolted connections on intake and exhaust tubes, oil sump and engine mounts.

Retighten the bolted connections on the machine.

Maintenance after 250 operating hours

1st oil change in drum drive gear.

Maintenance after 500 operating hours

2nd oil change in drum drive gear.

Special intervals

Switch the heating system* on every month for about 10 minutes.

Switch the air conditioning* on every month for about 10 minutes.

* Optional equipment

5.5 Maintenance chart

No.	Maintenance work	Remark	Running-in instructions after 250 operating hours	every 10 operating hours, daily	every 250 operating hours	every 500 operating hours	every 1000 operating hours	every 2000 operating hours	every 3000 operating hours	every 5000 operating hours	as required
5.6	Check the engine oil level	Dipstick mark		X							
5.7	Check the water separator			X							
5.8	Check the fuel level			X							
5.9	Check the hydraulic oil level	Inspection glass		X							
5.10	Check the water level			X							
5.11	Clean the cooling fins on engine and hydraulic oil cooler				X						
5.12	Check the oil level in vibrator shaft tube				X						
5.13	Change the engine oil*	min. 1x per year				X					
5.14	Change the engine oil filter cartridge**	min. 1x per year				X					
5.15	Servicing the air conditioning*** (summer operation)					X					
5.16	Service the battery	Pole grease				X					
5.17	Change the fuel filter cartridge						X				
5.18	Change the fuel pre-filter cartridge						X				
5.19	Change the oil in the drum drive gear						X				
5.20	Check, tension, lubricate the steering chain						X				
5.21	Check the engine mounts						X				
5.22	Check, tension, replace the V-belt						X				

Maintenance

No.	Maintenance work	Remark	Running-in instructions after 250 operating hours	every 10 operating hours, daily	every 250 operating hours	every 500 operating hours	every 1000 operating hours	every 2000 operating hours	every 3000 operating hours	every 5000 operating hours	as required
5.23	Checking, tensioning, replacing the refrigerant compressor V-belt						X				
5.24	Changing the oil in the vibrator shaft tube						X				
5.25	Change hydraulic oil and breather filter ^{***}	at least every 2 years						X			
5.26	Change the hydraulic oil filter ^{****}	at least every 2 years						X			
5.27	Grease the articulated joint ^{*****}	at least every 2 years						X			
5.28	Replace the injection valve								X		
5.29	Service the combustion air filter	min. 1x per year, safety cartridge at least every 2 years									X
5.30	Clean the water tank										X
5.31	Clean the water filter										X
5.32	Water sprinkler system, maintenance in the event of frost										X
5.33	Fill the provision tank for the wind-screen washer system										X
5.34	Adjusting the scrapers										X
5.35	Tightening torques										X
5.36	Engine conservation										X

* Oil change intervals depend on quality of oil and fuel (sulphur content)

** Oil change intervals depend on quality of oil and fuel (sulphur content)

*** Optional equipment

**** Also in case of repair in the hydraulic system.

*****Also in case of repair in the hydraulic system.

*****Also in case of repair in the hydraulic system.

Deutz diesel engine

Single drum rollers of series BW141/154 AD-4 are powered by a Deutz diesel engine of product range BF4M 2011. In contrast to the engines 1011/1012 previously used by BOMAG, this engine comes with external oil cooling, i.e. a separate oil cooler with a hydraulically driven fan, instead of the well known integrated oil cooler/fan system.

This automotive engine is characterized by the following features:

- short and compact design,
- low noise level,
- low vibration running,
- low fuel consumption,
- low exhaust emissions,
- good access to all service points and
- extended maintenance intervals (5000 h) for toothed timing belt, in comparison to the predecessor 1011 F, by installation of an automatic tensioning device and improved enclosure of the belt drive.

The engine is a 4-cylinder 4-stroke inline engine with direct fuel injection.

The combustion method with direct fuel injection enables the use of a less expensive casting for the cylinder head, highest possible utilization of fuel and minimum heat transfer to the coolant.

This in turn enables the use of a smaller and more compact radiator.

Both the crankcase with cylinders as well as the cylinder head of this engine are made of a cast iron alloy. This provides strength and ensures high wear resistance.

The forged steel conrods are fitted with compensation weights near the conrod bearing seats. This weight compensates manufacturing tolerances with respect to weight and centre of gravity.

The pistons are made of an aluminium alloy. The combustion trough has been specially designed for efficient combustion. All pistons are fitted with three piston rings and are lubricated by an oil mist.

Each cylinder is fitted with one intake and one exhaust valve. The valve guides are shrunk into the cylinder head.

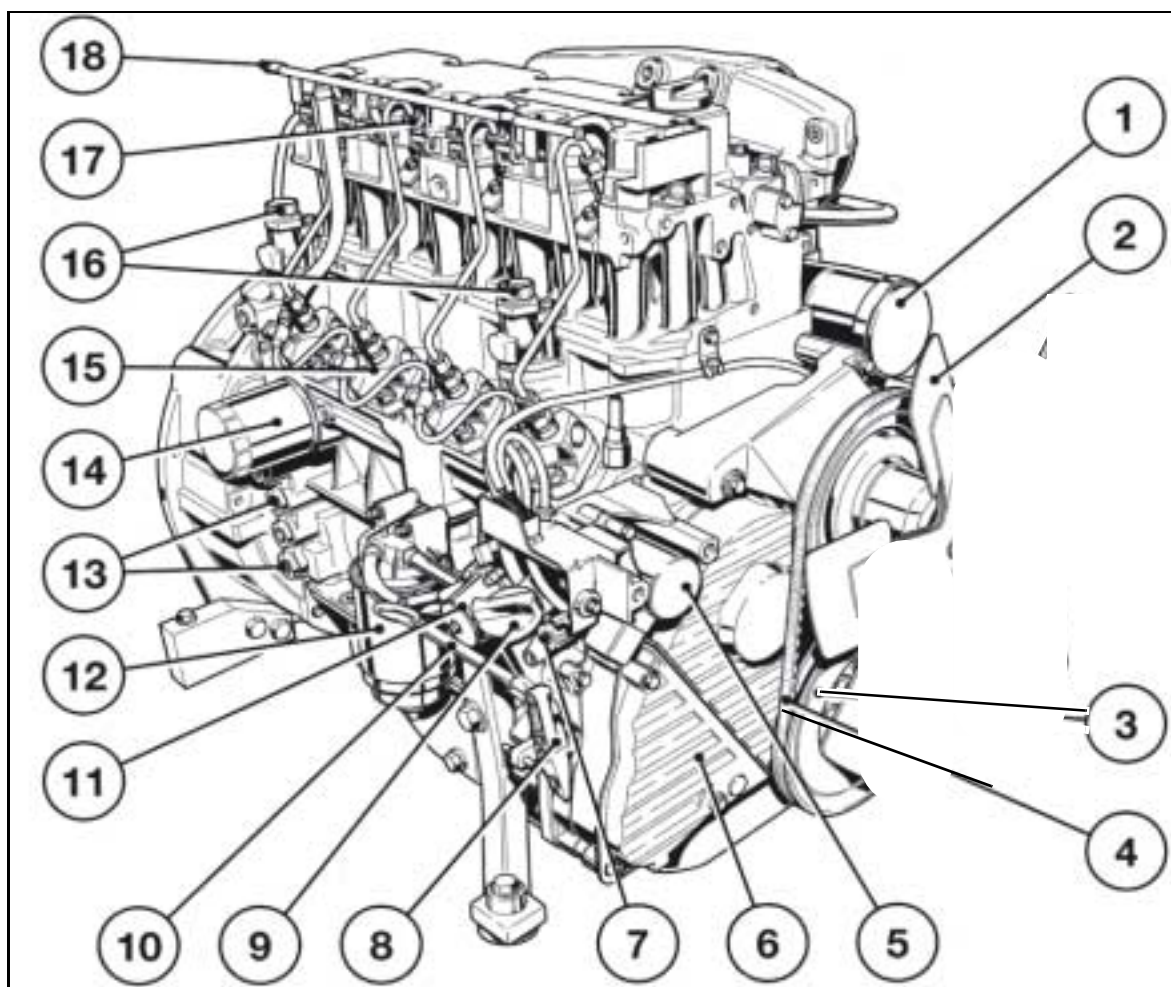
Control side

Fig. 1: Control side BFM 2011

- | | | | |
|----|--|----|------------------------------------|
| 1 | Suction tube | 2 | <u>without</u> fan and fan bracket |
| 3 | V-belt pulley on crankshaft | 4 | Narrow V-belt |
| 5 | Fuel shut-off solenoid | 6 | Toothed belt cover |
| 7 | Shut-down lever | 8 | Control lever |
| 9 | Oil filler neck (on side of crankcase) | 10 | Oil dipstick |
| 11 | Fuel lift pump | 12 | Fuel filter |
| 13 | Port for oil heating | 14 | Lubrication oil filter |
| 15 | Injection pumps | 16 | Oil cooler port |
| 17 | Injection valves | 18 | Fuel return line |