Audio Restoration Project: Repair B&O Bang and Olufsen BeoGram 4500 Type 59xx Tangential Turntable

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Bang and Olufsen introduced the world's first tangential-tracking turntable (Zero tracking error) - the BeoGram 4000, in 1972. It has a permanent place in the NY Museum of Modern Art. The updated models (produced from 1974 to 1980) were available as the BG4002 - a stereo version (without a built-in RIAA amplifier), and as the BG6000 quadraphonic version with a built in CD4 demodulator / RIAA amplifier.

They were superseded by a cheaper and much lighter range of models (Type 59xx) produced from 1985 to 1994. They all looked very similar from the outside, and inside had identical circuit boards, and operating mechanisms.

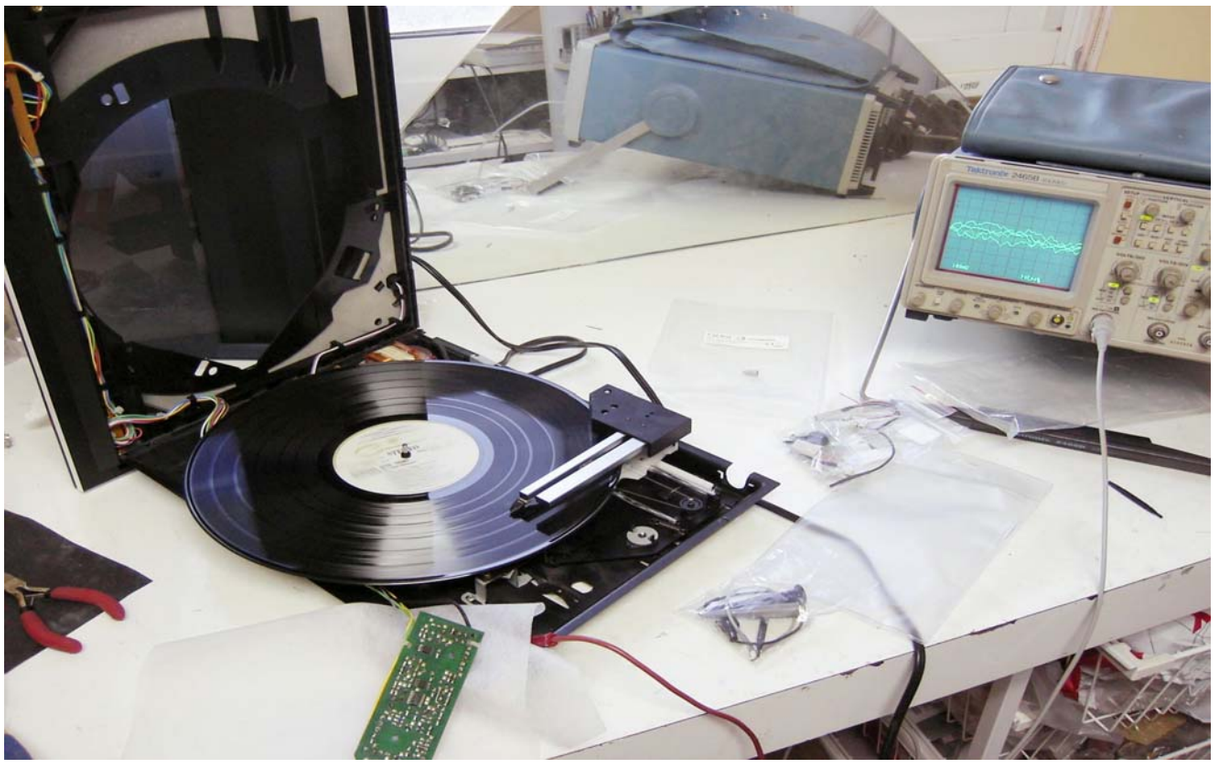
They have proven very reliable over the subsequent 20 or so years, with only a small number of consistent defects, beyond regular wear and tear.

This article describes how to perform a complete restoration of this model, including taking care of all known failures and defects. The Manufacturer's Service Manual, available from BeoWorld, is an integral component of the proper restoration process.

This article covers, by and large, the following BeoGram type numbers:
BeoGram 3000* – 5901 , 5903 , 5905
BeoGram 3300 – 5931 , 5933 , 5935
BeoGram 3500* – 5976 , 5977 , 5978
BeoGram 4500* - 5951 , 5953 , 5954 , 5955
BeoGram 5005 – 5921 , 5923 , 5924 , 5925
BeoGram 5500 – 5941 , 5943 , 5944 , 5945
BeoGram 6500* – 5946 , 5948 , 5949 , 5950
BeoGram 7000* – 5981 , 5983 , 5984 , 5985
BeoGram 8500 - 5971 , 5973
BeoGram 9000 – 5961 , 5963 , 5964
BeoGram 9500 – 5966 , 5968 , 5969 , 5970
BeoGram TX2 – 5911, 5913

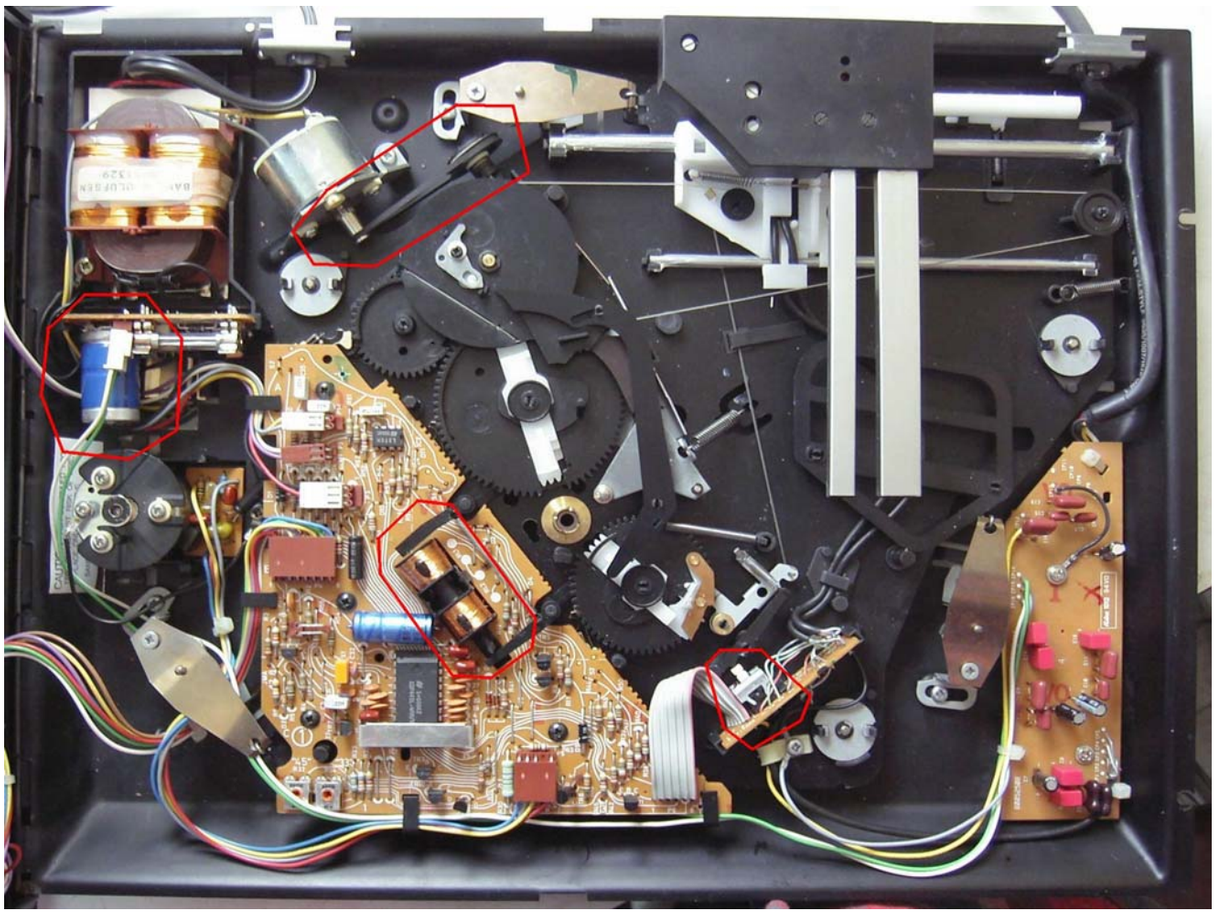
Those marked with an asterisk* have the built-in RIAA pre-amplifier, so they do not require an external phono-stage amplifier to play back LP's through a modern AV Receiver.

To open the unit, first remove the cartridge stylus, then slide the tone-arm all the way to the left, remove 2 small screws on the right panel underside, and raise up the right edge to the vertical, as it is hinged on the left side.



1. Replace the Rubber Drive Belts

You will start to hear wow-and-flutter when the belt starts to slip and is no longer able to maintain correct speed consistently. There are 2 belts – a large flat one for the turntable, and a smaller one on the logic mechanism.

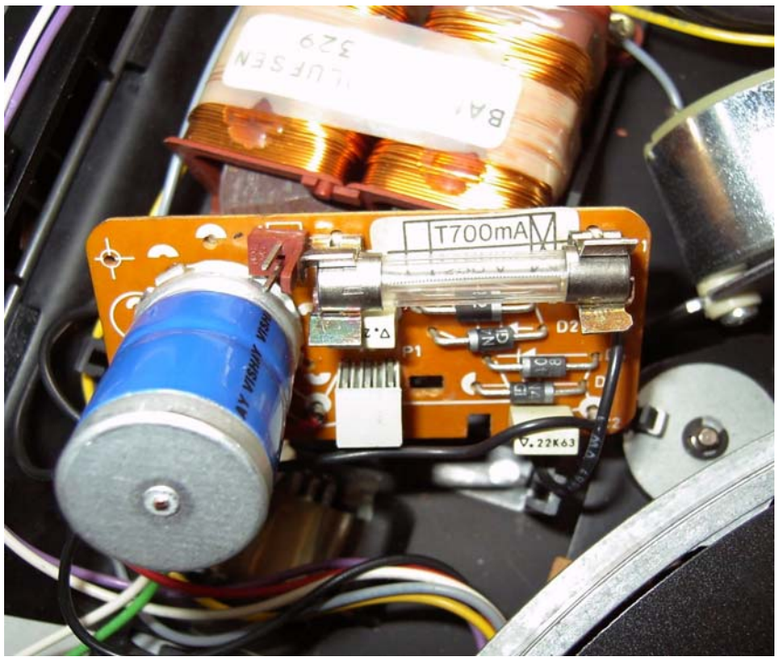


2. Lubrication

Lubricate the drive shaft (top-right, under the tone-arm) with lithium grease, after removing all old solidified grease.

3. Power Supply PCB Modification

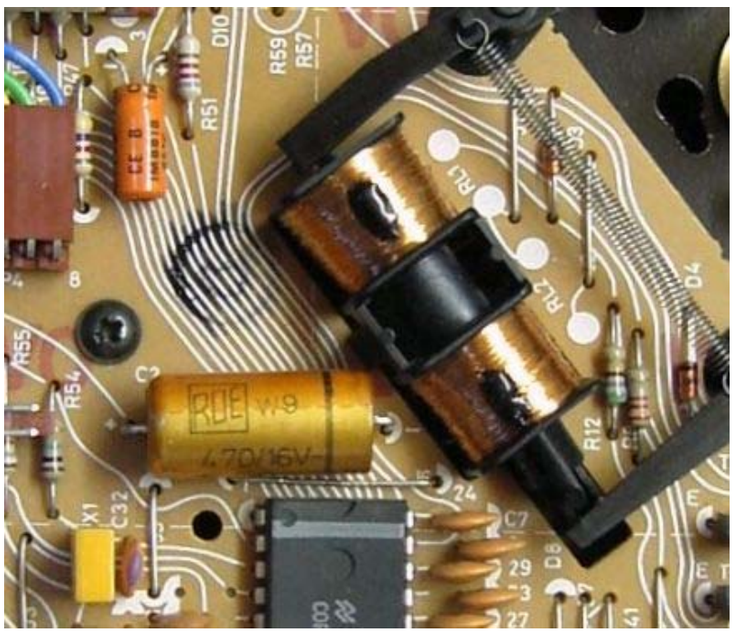
The Large Snap-in 1000uF 40V was replaced by an identical Vishay (Philips) AML138 1000uF 40V.



The 4 diodes making up the Full-wave Bridge Rectifier are clearly visible. These are regular 1N4002 diodes, and may be replaced with Vishay 11DQ10 Schottky units for improved stability.

4. Main PCB Modification

There are 2 electrolytic capacitors which need replacement - the large gold axial 470uF 16V in the centre, and the smaller orange 2.2uF 50V above and to the left.
Read my article about Choosing Replacement Capacitors for these units.
Here I used an axial low-ESR blue Vishay (Philips) 138AML 470uF 50V and a black Panasonic EB 2.2uF 50V – see the new capacitors in the above main picture.



5. Solenoid Piston Rebuild

OK, this is the Big Fix, the "Universal Solution". You press PLAY, and NOTHING happens, zilch. No response from the turntable at all. Yes, you've checked that the main fuse is fine, and that good power exists inside the turntable.

Every single one of these turntables WILL require this repair sooner or later, and NO, there are no spare parts available. Even if you find an intact one inside a junker turntable, it's only a matter of time before that one will break down too, so don't waste your money.

This part is definitely THE weak link in the entire system, and many of these fine turntables have been junked, because the technician **a.** didn't know how to identify the cause of the problem, and/or **b.** he didn't want to rebuild the part, after discovering that no parts are available.

Basically, the plastic **Piston** inside the **Solenoid** tunnel is deformed, creating more friction than the solenoid field-strength is able to overcome.

1. Remove the spring which holds the piston support arms together.

2. Loosen the main PCB's screws which secure the PCB to the chassis.
Then gently twist and pull the piston out of the solenoid tunnel.

3. Keep a bottle of colored nail varnish handy; to immediately mark the longitudinal orientation of the tubular magnet as it falls out of the tunnel, to ensure reassembly in the same correct magnetic orientation.

4. Once you have the 3 parts of the piston out of the tunnel, spray the inside of the tunnel with Silicon spray. Wait about 20 minutes and then wipe through with a tissue, to remove any oily residue.

5. The deformed piston, if not already broken, soon will be!
We want it in 3 parts – the forward plastic part, the middle magnet (oriented correctly), and the rear plastic part.
We will dispose of the thin, central plastic cradle, which is the deformed part – do not try to salvage it, and BTW, plastic drinking straws are not an acceptable substitute.

6. You need slow-set (24-hour) 2-part epoxy to rebuild this.
With a fine metal file, file rough the 2 edges of the plastic parts which will contact the 2 edges of the magnet.
7. Apply epoxy to the 2 edges of the magnet and attach the 2 plastic parts.

8. Allow to rest on a perfectly flat surface for about 1/2 hour.

9. The epoxy will have cured partially by now, but can still be manipulated.

10. Make sure, and adjust if necessary, that the 3-part piston is straight as an arrow.

11. Once it is fully cured, test-insert it inside the solenoid tunnel, and ensure that it moves freely with no friction at all.

12. Remove the piston from the solenoid tunnel, and spray with Silicon-spray. Allow to dry for about 20 minutes and then wipe down to remove oily residue.

13, Reassemble the solenoid, the spring, and secure the PCB to the chassis.

You should now be back to full and normal operation, when pressing PLAY!!!

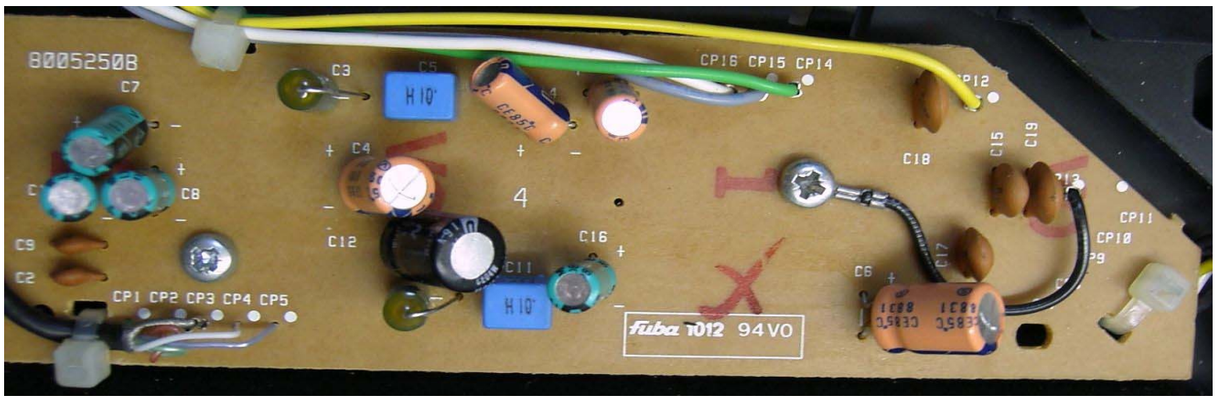
6. Muting Switch Bypass (only in RIAA-equipped turntables)

The white Muting switch (S1), on the vertical PCB next to the ribbon cable, grounds the audio signals of both Left and Right channels when the tone-arm is at rest, resulting in an absolutely quiet audio signal being fed to the stereo-system's main amplifier.
However, sometimes this switch malfunctions on either channel, so that no sound is audible on that channel.
Bypassing this switch – see the Service Manual – results in this turntable behaving like 95% of the other turntables on the market. Obviously, if everything is functioning fine, do not bypass this switch.

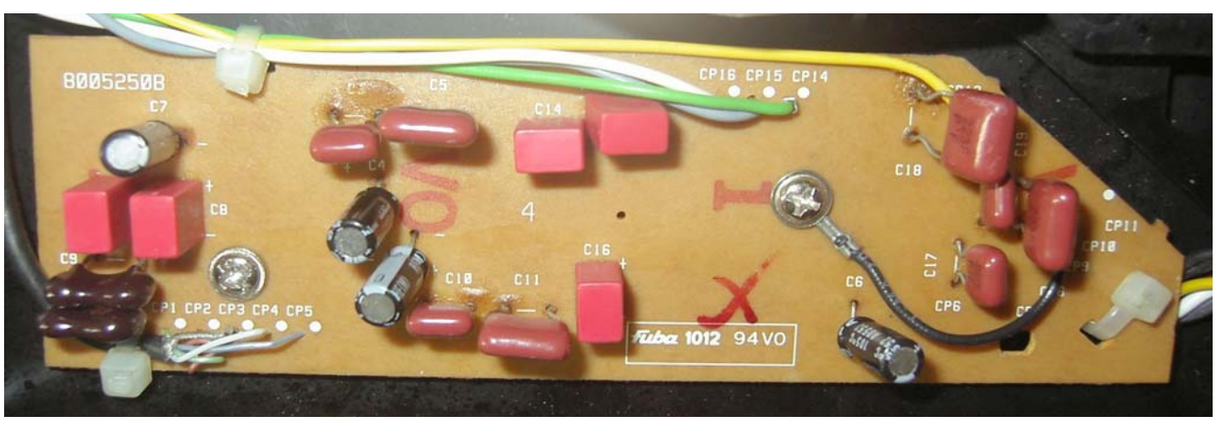
7. RIAA PCB 8005250B or 8005269 Modification

It is very easy to modify this high-quality RIAA amplifier. I selected audio-grade capacitors, and replaced the 2 op-amps. You need to be skilled with this operation – the foil-traces are fragile, and SMD components are not forgiving of clumsiness.

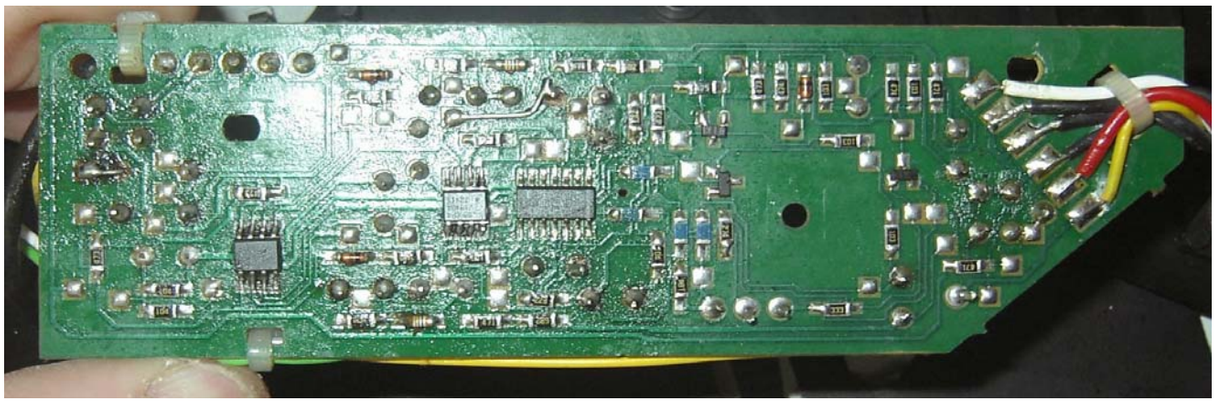
The original components are very mediocre quality – regular ELNA electrolytic capacitors, and standard ceramic capacitors, known for their grainy sound.



Basically, I replaced all the Electrolytics with Nichicon HE, and Wima MKS2 (red); the ceramics with Panasonic ECQP (brown) film caps. C2 and C9 got special treatment and were replaced with Mica caps, as they have to be very stable in the oscillating circuit.

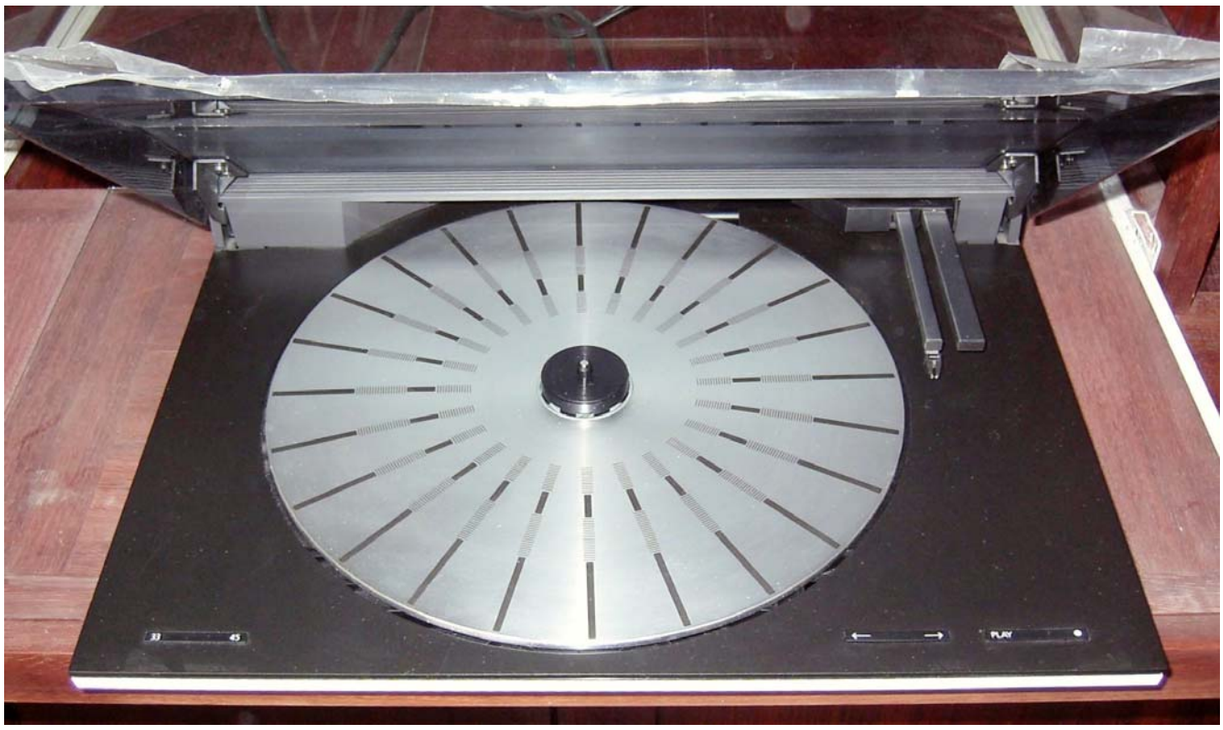


On the rear SMD side, is an LM833 and a LM4558 op-amp. Both were replaced by OPA2134UA units.



8. Front view

This is the interior, showing the black plastic pressure-switch in the centre, which "senses" when there is a record on the platter, and therefore allows all functions to operate.



9. Parts for this restoration

Parts and advice are available for owners who wish to tackle this project by themselves.

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