# RHEL Boot Sequence: Absolute Minimum Requirement and Order of Operation

## Absolute Minimum Requirement for RHEL Bootup

1. **1. Power-on & firmware**BIOS/UEFI initializes hardware and reads the boot device table; Locates a valid bootloader on MBR (BIOS) or EFI System Partition (UEFI)
2. **2. Bootloader (GRUB2)**Stage 1 (in MBR or EFI stub) loads Stage 2 from /boot/grub2 (BIOS) or EFI partition; Configuration: /boot/grub2/grub.cfg (BIOS) or /boot/efi/EFI/redhat/grub.cfg (UEFI); Minimal files: /boot/vmlinuz-<version>, /boot/initramfs-<version>.img
3. **3. Kernel + initramfs**GRUB loads vmlinuz and initramfs into memory and passes control; Kernel decompression and basic driver setup; initramfs must contain only what’s needed to discover and mount the real root filesystem and pivot\_root
4. **4. Real root filesystem**Kernel mounts the root (/) read-only, then pivot\_root swaps to it; Minimum bits on /: /sbin/init (symlink to systemd), critical libraries for systemd and any kernel modules not built-in, /lib/modules/<version>/ or built-in drivers for remaining hardware
5. **5. init (systemd)**Kernel execs /sbin/init (PID 1); systemd loads its configuration (/etc/systemd/system/\*.target); Brings up: /proc, /sys, /dev (via systemd-udevd), mounts any other filesystems (/etc/fstab), starts the default target (multi-user.target)
6. **6. Userspace services**Network (network.service or NetworkManager.service), Login services (sshd.service, getty@tty\*.service), Any other daemons

## Order-of-Operation Map

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| --- | --- | --- | --- |
| Step | Component | Minimal artifacts | Handoff to… |
| 1 | BIOS/UEFI | Boot device table | GRUB2 |
| 2 | GRUB2 Stage 1/2 | /boot/grub2/grub.cfg; vmlinuz-<ver>; initramfs-<ver>.img | Kernel + initramfs |
| 3 | Kernel | Built-in drivers | initramfs /init |
| 4 | initramfs | /init, essential modules to mount real root | pivot\_root → real root / |
| 5 | Real root filesystem | /sbin/init (→ systemd), /lib/modules or built-ins | systemd |
| 6 | systemd (PID 1) | /etc/systemd/\*.service, /etc/fstab | Userspace services & targets |
| 7 | Userspace services | Network, getty, SSH, etc. | Fully-functional OS session |