Industrial electron RF linacs, including the 10 MeV RF Linac and 3 MeV DC Accelerator, have been indigenously designed and developed at Accelerator & Pulse Power Division, BARC, India. Several industrial applications such as plastic modification, semiconductor irradiation have been demonstrated with these accelerators. 6 MeV and 9 MeV linacs as x-ray sources for cargo-scanning and radiography have been built and characterized. These linacs operate in the pulsed mode, which requires the use of pulse modulators for the RF source as well as the electron guns.

**MODULATORS FOR E-GUNS**
- Pulse electron guns are injectors to RF linacs and are powered by modulators
- Ratings 40-85kV, Peak current ranging from 1-4A. Pulse width varies between 3-10µs, with a pulse repetition rates between 250-400 Hz
- Both line-type and solid-state modulators have been designed and developed indigenously.

**Line Type modulators**
- For Electron Gun of 6 MeV Compact linac
- Rated for 4 A with 6 µs pulse width and 250 Hz repetition rate
- 10-stage PFN capacitor (72 H) charged resonantly through charging choke of 20 H
- PFN impedance 50Ω
- 18 kV/4 kA hydrogen thyratron as switch
- 1:20 pulse transformer to obtain 85 kV at its secondary

**Solid-state e-gun modulators**
- 84-stage Marx adder transformerless configuration
- 40 kV, 10 µs pulse at 250 Hz with rise time of <250 ns achieved

**MAGNETRON MODULATORS**
- For 6 MeV compact linac
- Ratings of 38 kV with 4.5 µs pulse at 250 Hz

**Line Type Modulator**
- 7-stage PFN, 16.6 ohm 25 kV/ 2 kA thyratron as switch
- 1:3.7 pulse transformer with amorphous cut-C cores
- Dual voltage mode with 2 set-points for the charging voltage

**Solid-state modulators**
- Output voltage of 38 kV with 4.5 µs pulse at 300 Hz
- Tested on Magnetron (MGS028)
- Based on 1 kV IGBTs with fractional-turn windings

**KLYSTRON MODULATORS**
- Line type Pulsed modulator of 150kV/110A/7µs/250 Hz
- Peak RF power of 7.5 MW has been achieved with klystron as load

**CONCLUSION**
Indigenous design and development of line-type and solid-state modulators has been successfully demonstrated. Design standardization for production of line-type modulators for various linac systems is under way. Prototype solid-state modulators have been successfully developed and will be tested with their respective loads.