while Fig. L.14.4 presents a low magnification view of PRPM-initiated laser cut.

Fig. L.14.1 *Laser cut with blast piercing.*

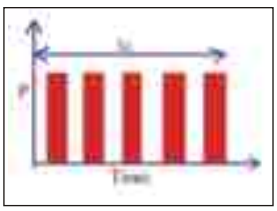

Fig. L.14.2(a) *PM power.*

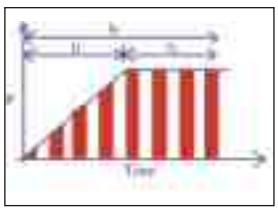

Fig.L.14.2(b) *PRPM power.*

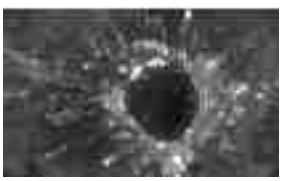

Fig. L.14.3(a) *PM (360m).*

Fig. L.14.3(b) *PRPM (250m).*

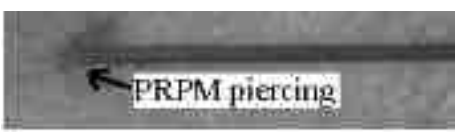

Fig. L.14.4 *Laser cut with PRPM piercing.*

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L.15 Development of a 120kW programmable switch mode power supply for 10kW CO_2 laser

A 120kW programmable switch mode power supply (SMPS) has been developed for 10 kW transverse flow CW CO_2 laser. Laser power modulation is useful in many material-processing applications to control dynamic laser material interaction involved. The SMPS has been used to modulate discharge current in the laser, which in turn, modulates laser power. Output current of power supply can be programmed for three different modes viz. (i) Continuous mode (ii) Pulsed periodic mode (iii) Retriggerable single shot mode. Power supply is based on the modular concept i.e. two numbers of 60kW SMPS are connected in series to increase output rating. The individual modules are based on IGBT-switched, full bridge topology with a switching frequency of 25kHz and phase shift pulse width modulation (PSPWM) control strategy. A complex programmable logic device (CPLD) is used to shift the gate drives of the IGBTs of module-2 by 90° in phase with respect to module-1. An 8-bit micro-controller (μC) AT89C52 is used to generate reference signal for PSPWM controller. Each module delivers 1.5kV and 40amps, thus providing combined output rating of 3.0kV and 40amps. The prime advantage of the scheme is: the output ripple frequency is four times of the switching frequency of the individual module, therefore, requires low LC filter component values and yields higher modulation bandwidth of the SMPS. The SMPS has a modulation bandwidth of ~ 2.0kHz. The full load efficiency of 95% has been achieved. The μC not only performs supervisory functions such as error announcement, trip indication etc., but also detects fault conditions in the SMPS and promptly blocks gate drive to IGBTs, thus protecting them. Fig. L.15.1 and Fig. L.15.2 present block diagrams of SMPS and its operation in pulse periodic mode at 500Hz. The SMPS is housed in a standard 19inch x 6feet tall rack.

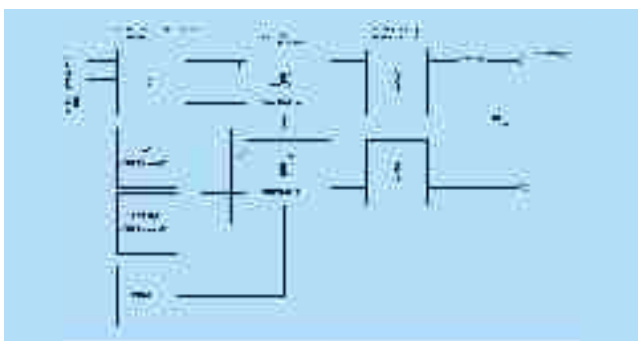

Fig. L.15.1 *Block diagram of 3.0 kV, 40 amps compact SMPS.*

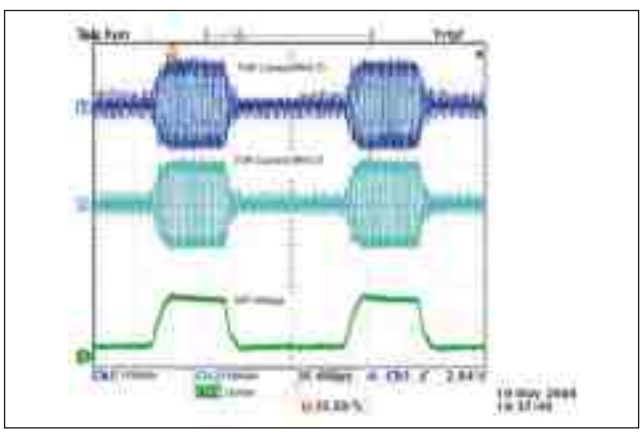

Fig. L.15.2 *Operation of SMPS in pulse periodic mode at 500 HZ.*

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