AZ31B magnesium alloy have been hugely applied in the aerospace, automotive, and electronic industries. However, welding thin sheet AZ31B was challenging due to its properties which is easily to evaporated especially using conventional fusion welding method such as metal inert gas (MIG). Laser could be applied to weld this metal since it produces lower heat input. The application of fiber laser welding has been widely since this type of laser could produce better welding product especially in the automotive sectors. Low power fiber laser was used to weld this non-ferrous metal where pulse wave (PW) mode was used. Double fillet lap joint was applied to weld as thin as 0.6 mm thick of AZ31B and the effect of pulsed energy on the strength was studied. Bond width, throat length, and penetration depth also was studied related to the pulsed energy which effecting the joint. Higher pulsed energy contributes to the higher fracture load with angle of irradiation lower than 3 °