A pair of small-volume magnesium ion chambers has been constructed with the aim of making measurements in BNCT and BNCEFNT (Boron Neutron Capture Enhanced Fast Neutron Therapy) beams. One of the chambers, denoted as the Mg(B) chamber, has a 25 µm thick metallic glass foil containing 3.6% ¹⁰B lining the inner surface of the chamber wall. The difference between the two chamber responses represents the collected charge due to boron neutron capture events. These chambers provide a direct means of measuring the boron neutron capture dose, rather than calculating it from foil activation measurements. The attenuation of the thermal fluence by the foil is calculated to be a` proximately 3%. The chambers provide a way of quickly and easily obtaining treatment planning data for BNCT and BNCEFNT. Both chambers have been thoroughly characterized for saturation, collection efficiency, and Ar gas flow rate in a ⁶⁰Co beam. They have also been calibrated against a Farmer chamber in ⁶⁰Co. The reproducibility of the calibration value is within the accuracy of the Farmer chamber calibration measurement. Scans have been performed in the Harper Hospital cyclotron d(48.5)+Be fast neutron beam, and in a modified fast neutron beam proposed for BNCEFNT. The fraction of the collected charge in the Mg(B) chamber due to the boron neutron capture reaction is on the order of 92% and 97% for the fast and modified beams, respectively. Results agree well with other dosimetry measurements made under identical conditions.