There are currently no calibration models that allow whole body density in professional footballers to be estimated. As such, there is a need to develop practical calibration models in order to make sound body composition judgements. The aim of this thesis is threefold. Firstly, to examine the measurement reliability of a range of anthropometric measures, residual lung volume, air displacement plethysmography and hydrostatic weighing (HW). Secondly, to establish reliability and precision of body composition measures used within existing calibration models which estimate whole body density (D_b) from the criterion of HW. Thirdly, to develop and cross-validate new calibration models for professional footballers. Data was gathered from n = 206 male professional footballers ($\bar{x} \pm s$; age = 24.1 ± 5.4 years, body mass = 78.8 ± 8.4 kg and stature = 180.1 ± 7.0 cm) playing in leagues ranging from Barclays Premier to Blue Square Premier. The reliability of all directly measured variables (n = 28) was measured by providing a comparison between inter-tester methods by applying TEM%, and intra-observer test-retest methods by applying the Bland and Altman 95% Limits of Agreement (LoA) method (1986). Following an analysis of TEM%, LoA and the study's *a priori* criteria (± 3.8%), all 28 anthropometric variables were found to be statistically significant (P = < 0.01) and demonstrated reliability. Therefore it is judged to be of practical use with this population. Study 2 assessed the agreement and validity of estimating D_b from 15 existing calibration models by providing a comparison with a criterion method of HW in professional footballers. LoA approaches were used to determine bias and random variation and found that (on average) estimated D_b derived from HW was greater than D_b derived from the 15 models. This analysis suggested that bias ranged from - 0.005 to + 0.015 g ml^{-1} and random errors ranged from 1.012 to 1.090 g ml^{-1}. An *a priori* criteria (± 3.8% P = < 0.05 (g ml^{-1})) was set which found that (on average) in 13 calibration models, the estimated D_b derived from HW was greater than D_b derived from the models. A rank order of LoA identified the best model to use, however, it was not narrow enough for measurements to be of practical use and in most instances, it was concluded that existing models are not appropriate for estimating D_b in professional footballers. Study 3 determined the most reliable measures as potential predictors in the development of two calibration models that were capable of estimating D_b with a sample of n = 140 professional footballers. Additionally, this study aimed to cross-validate the newly developed calibration models on n = 66 participants to determine the validity using LoA. A forced stepwise – backwards regression analysis approach on a sample of n = 140 footballers with nine predictors which met the acceptance criteria (r = 0.950, R^2 = 90%, and β weights) was conducted to develop a 'best fit' and a 'practical' calibration model. Results indicated that the 'best fit' calibration model had the lowest SEM (0.115 g ml^{-1}), the highest R^2 (6.6%) and was statistically significant (P = < 0.005). Results indicated that the 'practical' calibration model had the lowest SEM (0.115 g ml^{-1}), the highest R^2 (4.7%) and was statistically significant (P = < 0.005). The validity of the two new calibration models, wase determined through cross-validation methods on n = 66 professional footballers where both calibration models were normally distributed and findings were within acceptable limits of the study's *a priori* criteria (± 3.8% P < 0.05 (g ml^{-1})). Heteroscedasticity plots illustrated r values = 0.271 and 0.596 and R^2 (%) coefficients = 0.3526 for the 'best fit' and 'practical' calibration models (P = 0.01). Results from LoA were considered narrow enough to be of practical use to estimate D_b of professional footballers. In conclusion, the two calibration models can provide an ecologically and statistically valid contribution to applied sport science knowledge, which ultimately can provide sound judgements about professional footballers' body composition.