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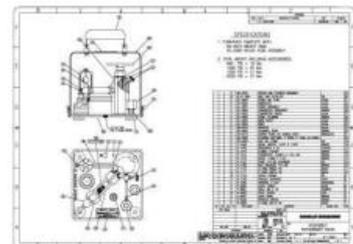
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Deadweight pressure testing: a saga

This document was written by Tony Lee of Banbury and District MES and was published by FMES in the newsletter of July 2023

A Deadweight Tester Saga

Over recent years our Club has been fortunate to have had access to a facility that provided pressure gauge calibration at no cost to us, but that arrangement has now come to an end. As our Club is small in number of members and our only means of income is through membership subscription, we were faced with having to make a decision on whether it is viable to continue to provide a boiler inspection service with its attendant costs when not necessarily relevant for all members. This was of personal concern as I expect to have boilers to test, so I decided to investigate what, if any, possibilities existed for us to calibrate our boiler testing pressure gauge. It very quickly became apparent that buying new calibration equipment was out of the question as prices start at four figures and only go up from there. Second hand/used/pre-loved was therefore the only option. I focussed on deadweight testers as they are a technology that's been in use for a very long time and raised the possibility of finding something affordable. However, the market in the UK does not appear to be particularly big; I did put a bid on one that appeared on Ebay but it went for more than I thought it was worth (little did I know!). I turned my attention to international offerings – again on Ebay because it's easy; there were quite a number of listings of deadweight testers mainly in the USA, ranging from very old (almost museum pieces) to more up to date. On the face of it prices were reasonable but the costs of shipping and duties soon made them less attractive. However, one did catch my eye, it was cheap but the description was not encouraging. It included comments of “parts missing”, “lid doesn't fit”, “not tested” and an admission from the vendor that they didn't know how it worked. The listing included a number of photos. Close examination showed that the oil reservoir was missing, but apart from that I couldn't see anything obviously wrong with it. The tester was manufactured by Chandler Engineering in the USA and I found on-line a copy of their deadweight tester manual dated 2006 that included the specification and parts list for the listed tester. Finding that added to my possibly misplaced confidence and after much weighing up of potential risk v. cost/benefit (the cost of shipping/duties in effect doubled the cost) – suddenly the deed was done and it started its journey from Wichita to North Oxfordshire.



Checking it on arrival confirmed that the oil reservoir was missing but its platform and pipework were OK; the lid fitted perfectly once an oversized knob on one of the valves was changed, the pump's screw shaft had quite a lot of play in its bronze nut and there weren't enough weights to give the testing range we need. Importantly, the piston assembly moved freely and showed no signs of leakage or other wear. Renovation started with the reservoir. I discovered that the plastic pot of an individual cheesecake dessert was just the right size and was completed with a 3D printed cap. The pump was next and its cup seal replacement was sourced from a heritage car parts supplier as a Girling rear brake cylinder is the same size. The thread on the screw shaft did not seem to match any listed thread. I eventually discovered it to be American USS thread which I gather predates and was largely superseded by the UNF/UNC thread forms. I was pleased to find a supplier in Coventry who had stock of the required USS tap, so perhaps not as obsolete as I thought, and I could replace the threaded bronze bush in the pump body. The weights that came with the tester were only sufficient to test up to 60psi (the capacity of the tester is 2,000 psi) so additional weights were machined from 2" round brass bar. The original weights were used as a basis and with an old laboratory balance (10 quid off Ebay) the machined weights were sized and adjusted to give proper increments up to a total that provides a test capacity of 460psi. So, things were going very well until, on attendance at last year's Seminar for Boiler Inspectors, the assembled throng were told in no uncertain terms that a deadweight tester without UKAS certification is of no use. This caused a few sharp intakes of breath, not least from me and some ponderings on the drive home. But, as I didn't want to be left with just a large table ornament, investigations resumed, this time into UKAS certification. I found there is a UKAS accredited metrology company just 15 miles from home and they were helpful in explaining the process. The condition of the tester is examined, the weights are also certified and each weight has to be individually marked. The certification process tests combinations of weights to cover increments throughout the range rather than each weight individually. There is no expiry date on the UKAS certificate for a deadweight tester as its accuracy in normal use doesn't degrade with time. It is up to the operator to decide if any incidents of wear or damage to the tester or weights warrants re-certification. The cost of certification doubled the total outlay so far but if the tester and weights are treated with care, it could be years before that cost would need to be repeated. On that basis, and digging the hole ever deeper, the tester and weights were submitted for certification.



A few days later I collected the tester and its UKAS certificate. The results show that the variance was generally around 0.5psi across the whole range up to 460psi, well within the accuracy appropriate for our use. The tester is now on permanent loan to the Club and operated only by those trained to use it. We keep a log of its use and the weights are kept in a small padded case. Hopefully that level of care will put off any need for re-certification for a very long time.



Was this a cost-effective solution? Probably not, but it does save the Club from having to cover another expense arising every year or two and removes an uncertainty about the continued viability of boiler testing in the Club. It was a gamble that has turned out OK although at greater cost than originally contemplated, but has certainly been an interesting and enlightening process to go through.