5000 LBF.FT/5000 N.M
CALIBRATION MACHINE

MODEL 21517

OPERATORS HANDBOOK (PART NO. 34241)

NORBAR TORQUE TOOLS LTD, Beaumont Road, Banbury, Oxfordshire, OX16 7XJ, UNITED KINGDOM.
Tel: + 44 (0) 1295 270333, Fax: + 44 (0) 1295 753643

CONTENTS

5000 LBF.FT CALIBRATION BEAM

INTRODUCTION

To meet the increasing demand for certification equipment this MKII 5000 lbf.ft test beam has been developed.

The beam and its associate stand have been robustly constructed to ensure only torque is applied to the transducer under test, minimising loss of torque (through bending or bearing loss) to the device being tested.

The whole apparatus being free standing.

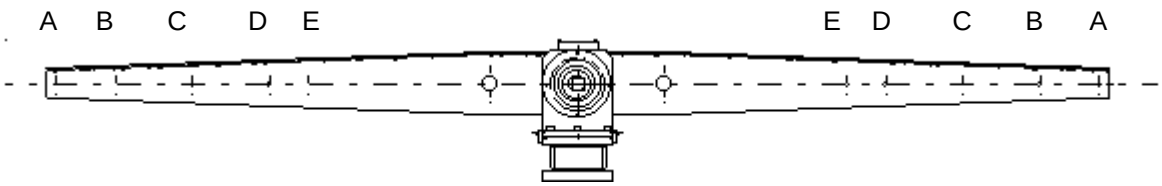
A self locking gearbox provides an easy method of aligning the beam once loaded.

The beams and iron weights are guaranteed within a tolerance of accuracy and traceable certification provided.

WEIGHT SETS AVAILABLE

TABLE 1

LOAD POINT	WEIGHT SET	
	500 LBF (21482)	1000 LBF (21481)
A	2500 lbf.ft	5000 lbf.ft
B	3000 N.m	6000 N.m
C	2500 N.m	5000 N.m
D	2000 N.m	4000 N.m
E	1750 N.m	3500 N.m



PRINCIPLE OF OPERATION

A known torque is applied to the transducer to be calibrated by the principle of a known force (weights) applied at a known distance (on a beam) from the centre of rotation of the torque transducer under test. Reaction is taken at the other end of the transducer via a reaction plate fixed to a bed. The beams and bearing housing assembly are also fixed to this bed; the whole assembly being fixed to a pedestal base. Both clockwise and anti-clockwise calibration is available, (the beams are symmetrical).

Torque = Force x distance (can be applied through either beam).

Force = Weight applied.

Distance = Distance from point at which load is applied to centre of rotation of transducer.

TEMPERATURE COMPENSATION

All Norbar test beams should be used in a temperature controlled environment of 20 degrees C +/- 2 degrees C.

If the beam must be used outside these limits, the temperate must be stable (within 1 degrees C change per hour) and the effective length of the beam calculated according to the details below.

The temperature coefficient for steel is 12×10^{-6}/degrees C.

The formula for calculating the effective beam length at any given temperature away from 20 degrees C is:-

Radius of beam x Coefficient of Expansion x Change in temperature in degrees C from 20 degrees nominal.

Example: A nominally 1 metre radius beam at 24 degrees C has and effective increase in length of $1.00000 \times 12 \times 10^{-6} \times 4$. The new length is therefore 1.000048 metres.

GRAVITATIONAL EFFECTS

It is very important that the gravitational value for the Laboratory is established. The effect of not doing this in the UK could be a variation in the force produced by the weight (masses) of up to approximately 0.05%, which is five times the 0.01% tolerance of the weight. Outside the UK this variation in force could be significantly more.

It is therefore strongly recommended that you establish the local value of gravity (g) for your Laboratory and use weights that have been calibrated at that gravitational constant.

Norbar will supply weights calibrated to gravitational constants specified by the customer. However, if the customer does not specify a value for 'g' they will have been calibrated at the standard UK gravitational constant of 9.81500 m/s^2. As already noted this figure is subject to approximately 0.05% variation across the UK.

BUOYANCY EFFECTS

The Norbar system uses calibrated masses to generate a force downwards. It differs from mass balances where masses are compared like with like, because the masses are compared with transducers.

This means that Archimedes principle applies which means there is a force upwards on the masses caused by air under them. This force reduces the effective force generated by the masses and they should be increased to allow for this.

Under standard conditions, (ie. air pressure 1.2kg/m^3 and 20 degrees centigrade) and working in conventional mass terms the increase required is by a factor of: $\frac{1}{(1 - 1.2/8000)}$

For example, assuming that the masses are being calibrated on a mass balance, instead of being adjusted to show an effective force of 1.00000 Newtons, they should show an effective force of:

$$1 \quad \left[\frac{1}{(1 - 1.2/8000)} \right]$$

Masses purchased from Norbar will already have this factor taken into account.

It should also be noted that the double ended beam design employed by Norbar means that each half of the beam is balanced with regard to buoyancy of the beam. This is a significant advantage over single-arm counterbalanced systems.

CALIBRATION PROCEDURE

1. The force centre distance of the test beam is constant, and the applied torque can only be varied by weights applied to the weight carriers.

2. Select weight set required, by looking at Table 1. Using the Scirror action trolley (21821), position the weight set beneath the required load point, and connect to the beam.

   NOTE: *Connect the balancing weight (21819) to the corresponding load point on the opposite beam.*

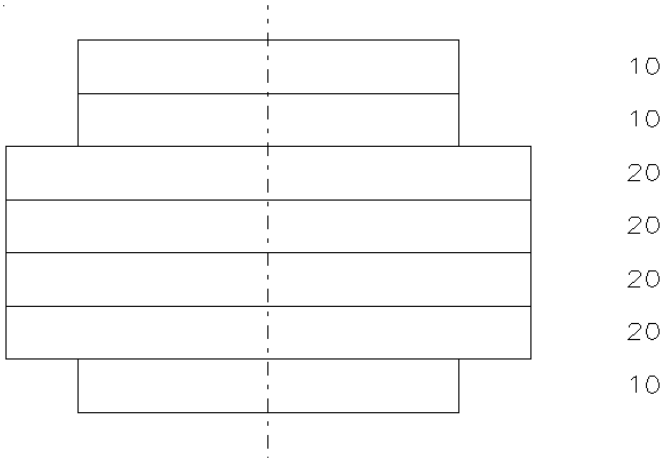
3. Connect transducer to be tested up with its display unit and allow sufficient time for unit to stabilize. (See manufacturers handbook for recommended time).

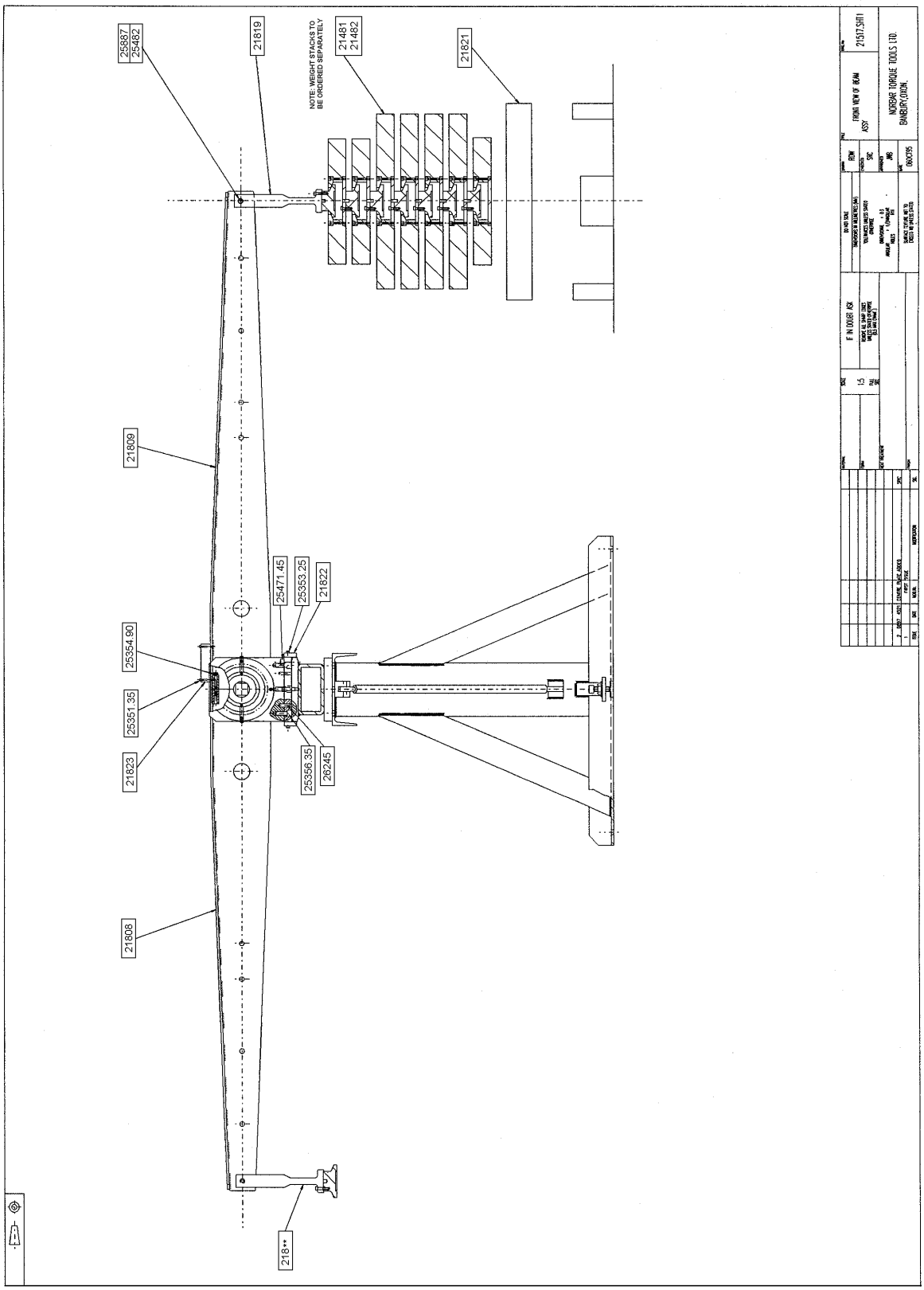
   NOTE: *Do not attach to the test beam at this stage.*

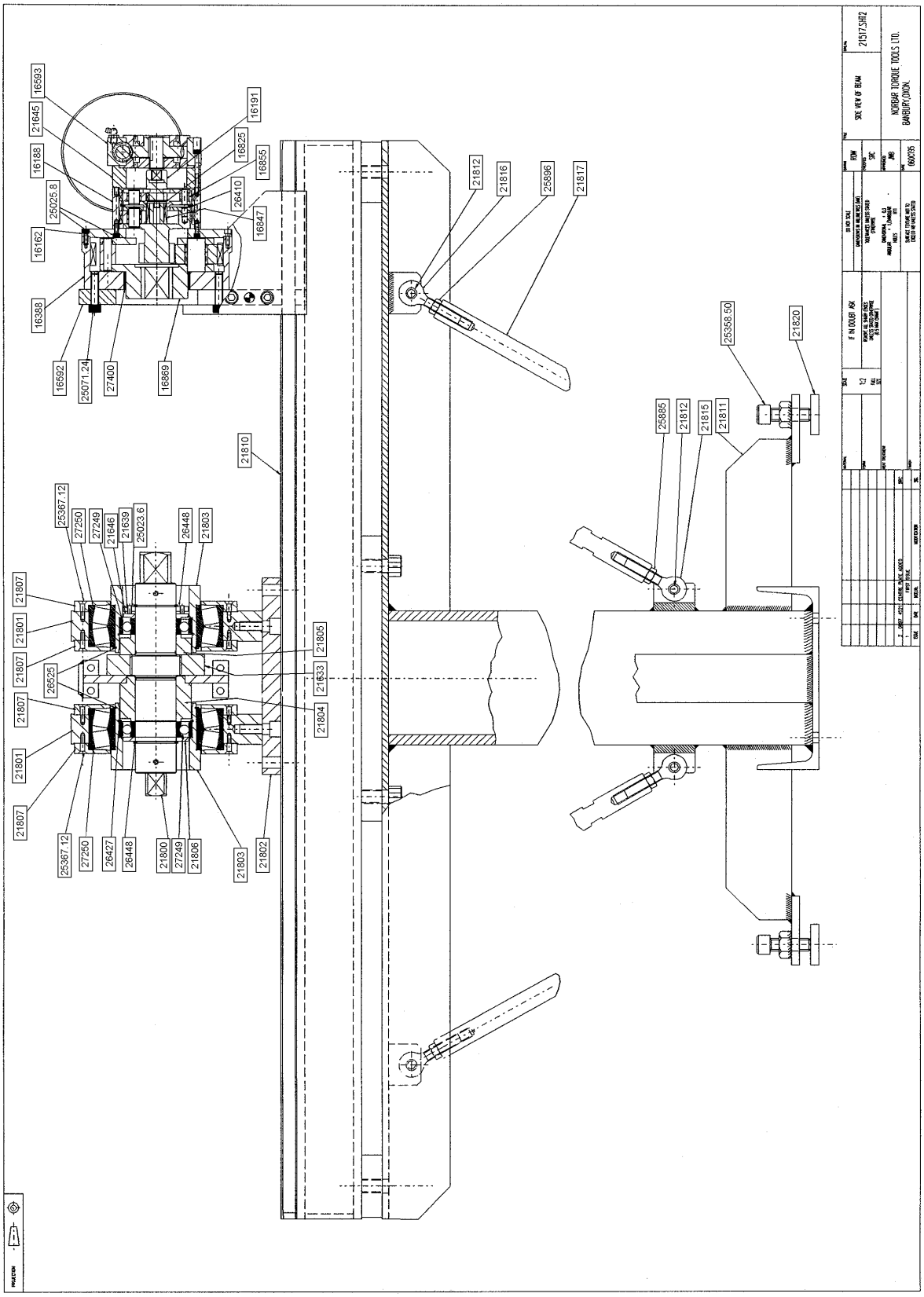
4. Connect the transducer to the test beam, and apply all 7 weights (110%). Then remove the weight and zero your display. You are now ready to calibrate the transducer, do this by following the relevant BS/NAMAS standards.

   NOTE: When applying a weight, do so by lowering the trolley table until the weight makes contact with the weight stack hanging from the beam. Now level beam, using gearbox on the reaction plate, this will free the weight from the trolley stack and also reduce the bouncing effect caused by applying the weight quickly.

   The gap between the weight stack on the trolley and on the beam, should be approximately 5 - 15 mm.




25887
25482
21819
NOTE: WEIGHT STACKS TO BE ORDERED SEPARATELY
21481
21482
21821
21809
25471.45
25353.25
21822
25354.90
25351.35
21823
25356.35
26245
21808
218**
NORBAR TORQUE TOOLS LTD.
BANBURY,OXON.


16593
21645
16191
16188
16825
16855
25025.8
26410
16162
16847
16388
16592
25071.24
27400
16869
21812
21816
25896
21817
25368.50
21820
25885
21812
21815
21811
21810
25367.12
27250
27249
21646
21639
25023.6
26448
21803
21807
21801
21807
26525
21807
21801
21807
21805
21633
21804
25367.12
27250
26427
26448
21800
27249
21806
21803
21802
NORBAR TORQUE TOOLS LTD.
BANBURY,OXON.