

TECHNICAL TRAINING SCHOOL REME

ZEROING OF RIFLES

Except in the case of the zeroing of the Rifle No. 4 Mk 1 (T) and Mk 1* (T), which entails the adjustment of a Telescope and has been dealt with in Précis No. SA/18, the zeroing of Rifles can be dealt with as a single subject.

By the term "zeroing" we mean the adjustment of the sights of a weapon so as to give the correct position of the shots on the target in relation to the point of aim.

An Armourer is always concerned with the permanent zeroing of a Rifle, which is effected by the adjustment of, or the fitting of a new blade to the Foresight. In passing it is as well to remember that a temporary adjustment for errors in elevation, can be made by altering the Backsight, e.g. if the mean point of impact (MPI) of a group of shots is below the correct position it can be corrected by raising the Backsight, similarly if an error above the correct position is obtained it can be corrected by lowering the Backsight. If the Rifle is fitted with a Windgauge Backsight, errors of deflection can be adjusted in the same way. It will be seen that in each case the Backsight is moved AWAY from the error.

In adjusting the Foresight however, the opposite rule applies. If a Rifle is shooting low the Foresight must be moved down or TOWARDS the error (i.e. a lower blade must be fitted).

To enable Rifles to be zeroed, a moveable blade is fitted into a dovetail base, thereby allowing the blade to be moved from side to side to correct lateral errors. The Foresight Blades are also made in varying heights so that the vertical errors can be corrected by the replacement of the existing blade by one of a different height. There are varying sets of blades for the different types of Rifles, but on all those Rifles dealt with in the foregoing instructions there is one common rule. A blade marked "O" is provided, the tip of which when fitted to the Rifle is exactly one inch above the axis of the bore. All other blades graduate from this "O" or zero blade either above or below it in constant increments. In the case of British Rifles this increment is .015". If a blade is lower than the zero blade it is referred to as a "minus" blade, and if it is above it becomes a "plus" blade.

All blades are marked so as to be easily recognised, those below the zero having as a prefix the minus sign e.g. —.015". The "plus" sign is not used, therefore a blade with only a figure, e.g. .015", is always a plus blade.

The Mean Sight Radius is the distance from the aperture or "U" of the Backsight to the tip of the Foresight, and this differs on the various Rifles.

It will be appreciated that the Sight Radius governs the amount of adjustment made on the target by the fitting of a different size of blade foresight. The longer the Sight Radius the smaller will be the angle made between a line from the Backsight to the old blade and a line from the Backsight to the new blade.

To assess the difference which will be made by a change of Foresight use the following formula:—

$$\frac{\text{RANGE X DIFFERENCE IN HEIGHT OF BLADES}}{\text{SIGHT RADIUS OF WEAPON}} = \text{VARIATION ON TARGET.}$$

To give a simple example, assume that we are going to replace an "O" blade with a —.015" blade on a Rifle No. 4, the Sight Radius of which is 28.74" and our range is 100 yards. By fitting a LOWER blade the resultant MPI will be HIGHER by:—

$$\frac{100 \times 36 \times .015}{28.74} = 1.87''$$

As we included the figure 36 in our top line, thereby bringing our 100 yards to inches, our answer is in inches. So that by replacing an "O" blade with a —.015" on a Rifle No. 4 we would raise our MPI by 1.87" at 100 yards.

With a Leaf Backsight fitted to a Rifle, the aperture or slide should be set at the lowest graduation, namely 200 yards. It is not however satisfactory to zero a Rifle at this range, and the ranges used are 100 yards or 25 yards. It will be seen therefore, that the resultant MPI. to be correct, would have to be somewhere above the point of aim, so that when actually firing at 200 yards, or at other ranges with the correct reading on the sight the shots will group AT the point of aim.

In the case of Rifle No. 4 fitted with a Mk 2 Backsight, the apertures of which are sighted for 300 and 600 yards, the Rifle will be zeroed using the 300 yard aperture with a Bayonet fixed. Therefore the correct position of the MPI at 100 yards or 25 yards would be even higher than with a leaf sight.

The following table shows the various particulars applicable to each type of Rifle. This table does not include the Rifle No. 2, as this Rifle fires .22 inch ammunition and therefore the zeroing rules are rather different.

RIFLE ZEROING TABLE

RIFLE	No. of Blades	Lowest Blade	Highest Blade	Range	Variation in MPI with one alteration of Blade	Correct Position of MPI in relation to Point of Aim
No. 1	7	-.06"	.03"	100 yds 25 yds	2.77" 0.69"	3" directly above ½" directly above
No. 3	9	-.015"	.135"	100 yds 25 yds	1.70" 0.50"	3" directly above ½" directly above
No. 4	8	-.03"	.075"	100 yds 25 yds	1.87" 0.475"	3" directly above ½" directly above
No. 4 with Mk 2 Back Sight	8	-.03"	.075"	100 yds 25 yds	1.87" 0.475"	6" directly above 1½" directly above
No. 5	8	-.03"	.075"	100 yds 25 yds	2.33" 0.582"	3" directly above ½" directly above

Lateral adjustment will be made to the Foresight with the aid of a "Tools Foresight, Cramp." There are different patterns of these for the various Rifles, namely:—

Tools Foresight, Cramps No. 1. For the No. 1 and No. 2 Rifles

"	"	"	No. 2.	"	"	No. 3	"
"	"	"	No. 3.	"	"	No. 4	"
"	"	"	No. 4.	"	"	No. 5	"

On the Cramps Nos. 1 and 2 there is a deflection scale to guide adjustment.

Rifles No. 2 will always be zeroed at 25 yards. The sight reading on the Backsight is not important as it will never be necessary, or possible, to fire the Rifle at any great range. It is advisable however, to zero all No. 2 Rifles with a reading of 200 yards on the Backsight, bearing in mind that the MPI must be AT the point of aim and not above it. Lateral errors can be adjusted with the Cramps Foresight No. 1.

is flush with the side of the Block. If further lateral adjustment is needed, the Rifle should be examined for fit of Fore-end. Bolt and condition of Barrel etc.

If an Armourer is satisfied that the Rifle is mechanically sound i.e. correctly assembled and adjusted, and that all possible adjustment has been made during zeroing; and finds that (a) the Rifle still fails to group, or (b) the MPI is still incorrectly positioned, he will carry out the test as detailed in Small Arms Training, Vol. 1., Pamphlet 1., Appx. 1. This lays down that a group of ten shots will be fired at 200 yards (Rifle rested) and should form a group 8" X 8" with an MPI not more than 4" from the point of aim. If the Rifle does not pass this test, the position of the shots will be accurately marked on an AF B 202, and the Rifle together with the diagram will be forwarded with an AF G 1045 to the nearest REME Workshop.

In the case of Rifles No. 2 this test should be carried out at 25 yards. Two groups of five rounds each should be fired and form a group 1½" X 1½". with an MPI at the point of aim. When forwarding a Rifle No. 2 to REME Workshops after a Barrel Test, the targets should accompany the Rifle with an AF B 202.

The following is a list of faults which would tend to give inaccurate shooting. These points should be checked before attempting to zero and re-checked before carrying out the Barrel Test:—

1. Badly fitting Stock Fore-end.
2. Loose Butt.
3. Loose Screws.
4. Loose or damaged Blade Foresight.
5. Loose Block Band Foresight.
6. Badly fitting Bolts Breech { resistance column and resistance lug
should bear evenly with Bolt closed
7. Condition of Barrel for wear, bends, bulges or cordwear.
8. Loose Backsight.

FORMULA FOR ADJUSTMENT OF LATERAL ERRORS

One complete turn of the screw cramp \times Range in inches.

Sighting Radius.

EXAMPLE: — Weapon — Rifle No. 4.
 Cramp No. 3 — 25 threads per inch (1/25th)
 Range — 100 yds. (3600 ins.)
 S.R. — 28.74 ins.

$$= \frac{.040'' \times 3600''}{28.74''}$$

$$= 5.010''.$$

= One complete turn of the screw cramp at 100 yds.

FORESIGHT CRAMPS LATERAL ADJUSTMENTS

Rifle	Cramp	One turn		One Width of Blade	
		25x	100x	25x	100x
No. 1	No. 1. MK. 1	1.6''	7.4''	2''	8''
	No. 1. MK. 2	2''	8''	2''	8''
No. 4	No. 3.	1''	5''	1 1/2''	6''
No. 5	No. 4.	1 1/2''	6''	2''	8''