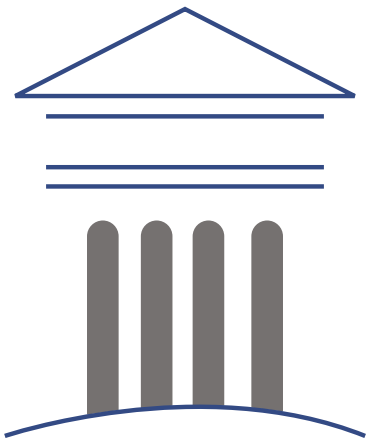
Scope Mounting Lab (#)
Lab: 2162

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** Please note that from time-to-time tools for the lab lessons may be unavailable. Should this occur, we will substitute an appropriate kit that will meet the objective of this lesson. Based on market availability, the exact manufacturers of these pieces vary from time to time. We strive to provide quality tools to our students to use as they gain the knowledge of the Gunsmithing industry. Our students realize that they will be responsible for purchasing additional tools for their businesses.*

Introduction

Installing telescopic sights on a rifle can be a profitable undertaking. All you need is a scope, rings to attach the scope to the firearm, and a mounting base. The mounting base is a machined surface that is either part of the firearm, or a removable plate that is securely fastened to the firearm. Scopes can be installed on rifles, shotguns, and handguns.

Most centerfire bolt-action rifles manufactured during the past couple of decades are factory-drilled and tapped to accept telescopic scope mounts. Other rifles have a grooved receiver or an integral scope base. Also, many high-power handguns have a provision for scope mounting.

Rifles that have been drilled and tapped at the factory for scope sights are easy to work with. You should experience little difficulty in doing a good job provided the project is done in recommended sequences.

The installation of scope sights on rifles that have no factory provisions can be quite a task for amateurs and professionals. Poor technique in this phase of gunsmithing is common. In most cases, shoddy sight work is usually attributed to aligning the sight mounts in their correct positions by the eye alone. Marking the location for screw holes by crude and inaccurate methods is another factor. There is a right and wrong way of installing sights, and this kit will give you the proper methods and principles which will always result in correct sight installation.

Kit Contents

The parts that you have received in this kit are listed to the below. Check the material that you received against the parts list to make sure that your kit is complete. If any part is obviously defective or has been damaged during shipment, please return the damaged part to the Sonoran Desert Institute for replacement.

Part	Description
GS22	Shot saver
GS23	14-piece Bore Stud Set
BO148	Jack First Catalog Volume I
BO149	Jack First Catalog Volume II

Mounting Scope Sights

There are two classifications of scope rings: Weaver and Redfield. Weaver rings, shown in Figure 1, are designed to fit over the mount. They fasten to the mount by a clamp on the ring. Redfield rings, shown in Figure 2, are designed to fit into a hole in the front mount. The rear ring fastens to the base by way of a windage screw on the base itself.

GROOVED RECEIVERS

Most .22 rimfire rifles including the .22 Winchester Magnum have grooved receivers, as shown in Figure 3. This groove on the receiver is the actual scope mount and accommodates Weaver-style scope rings designed especially for these rifles.

Many of the scopes designed for .22 rimfire rifles are furnished with rings at no extra cost. Other scopes require rings to go with the scope. The majority of these rings will be either $^{7}/_{8}$" or 1" in diameter. These rings are designed especially for grooved receivers on .22 rifles.

The rings are installed on the scope before it is installed on the rifle. Remove the screws that fasten the top half of the ring to the bottom half, and remove the top of the ring. Place the scope in the bottom of the ring and replace the top of the ring. Install the screws, but do not tighten them completely at this time. The screws should be tight enough to hold the scope in position, but you should be able to rotate the scope in the ring with moderate finger pressure.

The installation of a scope requires aligning the mounting clips in the receiver groove, and sliding the scope and rings into position. Before final tightening, however, snug the screw clamps up so that the scope and mounts will slide in the groove. Then, test the scope for correct eye relief, or distance between the eye and the scope. Tighten the retaining screws by hand, and turn the final one-quarter twist with a screwdriver.

There is no correct measurement for eye relief. The correct eye relief allows the shooter to see through the scope without any shadow when the head is in normal shooting position. This varies, since people hold their heads in different positions when

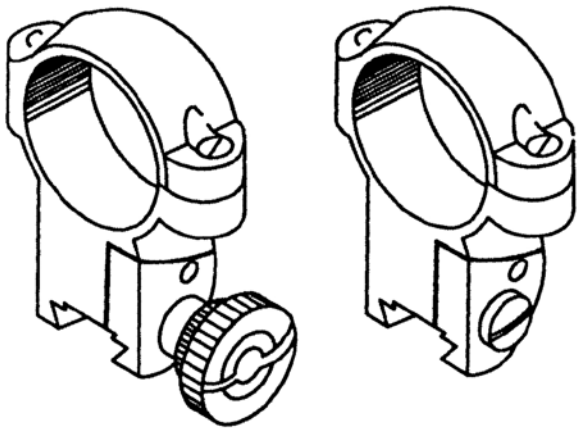


***Figure 1**: Weaver-style rings are designed to fit over a dovetail base.*

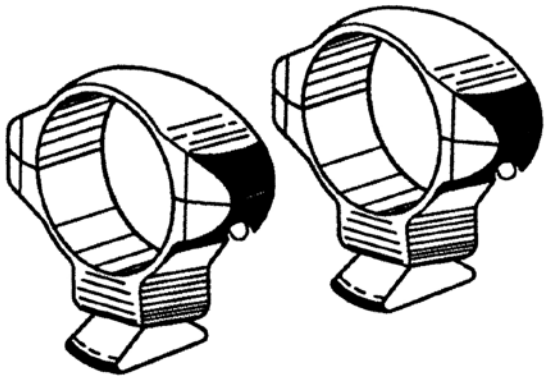


***Figure 2**: Redfield-style rings are designed to fit into a slotted base.*



***Figure 3**: The receiver on the Marlin .22 rifle is grooved for scope rings.*

they shoot. When installing a scope for a customer, you may have to re-adjust the eye relief after you have zeroed the scope.

INTEGRAL SCOPE MOUNTS

Some rifles and handguns have integral scope mounts. These mounts are machined into the receiver (Figure 4). Firearms with these mounts usually have Weaver-type rings included.

Mounting scopes on this type of firearm is as easy as mounting a scope on a grooved receiver. First, place the rings on the mounts and tighten the mounting clamps securely. Remove the top half of the rings and place the scope in the rings. Replace the top half of the rings and loosely install the ring screws. Slide the scope in the rings to set the eye relief, and tighten the ring screws slightly. You should still be able to rotate the scope in the rings.

DRILLED AND TAPPED RECEIVERS

While scope mounts for .22 rimfire rifles normally use universal clamps that fit into the factory-grooved receivers, centerfire rifles are different. With centerfire rifles that are drilled and tapped for bases, a base or mount that exactly fits the particular rifle must be obtained.

Depending on the rifle, the scope mounts may be either a one- or two-piece base. To select the proper base for a given rifle, refer to a chart like the one in Figure 5, on page 6, to find the model and make of the rifle. Find the catalog or model number of the scope base; this is the one you need for your particular rifle. You will also need scope rings to match both the scope and base mounts.

For the best accuracy, a telescopic sight must be mounted solidly to the rifle in such a way that it stays secure shot after shot. Precision-machined mounts that are designed for a particular



***Figure 4**: Integral scope mounts.*



***Figure 4A**: Redfield JR system.*

Model of Firearm	Notes	Top Mount Bases					Steel Lock Mounts Complete System Matte	Side Mount Bases	Grand Slam Top Mount Bases				Grand Slam Dovetail Bases	
		Standard		Extensions					Standard		Extensions		1-PC Base	2-PC Base
		Rear	Front	1-PC	Rear	Front			Rear	Front	Rear	Front		
1885 High Wall (Octagon Barrel)	1,3	11 (48011)	29 (48029)											
22 Auto	18			60A (48064)										
Sako Actions in 243, 308, 22-250, 222 & 222 Mag.		72 (48072)	71 (48071)											
A-Bolt, A-Bolt 22 Stalker; Medallion		47 (48047)	47 (48047)				49719						48922 L/A	48904
Black													48924 S/A	48904
Matte		47M (48503)	47M (48503)						S47 (48228)	S47 (48228)			48923 L/A	48905
Matte													48925 S/A	48905
Silver		47S (48003)	47S (48003)											
A-Bolt Shotgun (Matte)		47M (48503)	419M (48437)											
A-Bolt (European Model), Mod 52, 52C	5	85 (48085)	85 (48085)											
Bolt Action BBR, Hi-Power, Other Cal. (Older Mod.)		45 (48045)	46 (48046)			402 (48108)	49721	5 (48405)	S45 (48226)	S46 (48227)		S402 (48247)		
Silver		45S (48510)	46S (48004)			402S (48430)								
BAR, BAR II, Mark II, BLR Lightning (Lever), BPR	5	54 (48054)	54 (48054)				49720						48932	
Matte									S54 (48230)	S54 (48230)			48933	
BLR (Lever Action)		25 (48025)	25 (48025)						S25 (48223)	S25 (48223)				
BLR with Flat Top Receiver (Older Models)		28 (48028)	28 (48028)											
BBR (Bolt Action), Long & Short Actions		47 (48047)	46 (48046)			402 (48108)	49718							
Matte		47M (48503)	46M (48502)			402M (48429)			S47 (48228)	S46 (48227)		S402 (48247)		
Silver		47S (48003)	46S (48004)			402S (48430)								
A-Bolt WSSM		427 (48450)	47 (48047)											48911 (matte)
BAR (Matte)				432M (48456)										
T-Bolt	27	15 (48015)	15 (48015)											

Figure 5: A scope mount base chart.



Figure 6: (A) Strap-type scope ring, Weaver style, and (B) bored-type scope ring, also Weaver style.

scope and rifle cost more than some of the imported varieties, but the extra cost will pay off in dependability and increased accuracy. Also, remember that your reputation rides on every job. Be sure that you always use quality parts.

A one-piece mount, such as the Redfield JR system (Figure 4A), is the most dependable scope mounting system available. Of course, this type of mount cannot be adapted to all rifles, but it is the recommended mount when it can be used. The rotary dovetail feature cams the ring into a mating dovetail in the base for a solid fit. This type of mount also allows you to remove the scope, not the base, and replace it without losing the zero.

The split rings that hold the scope to the mount should be precision-bored to the exact diameter of the telescopic sight, usually one inch. If the rings are precision-bored so that a full radius contact with the scope is maintained, an even pressure is provided around the tube. This eliminates the problem of squeezing the tube out of round, which sometimes happens with strap-type mounting rings. Figure 6 shows a strap-type and a bored-type scope ring. Both rings are to be used with 1" scopes.

Once the scope and mount have been obtained, remove the tap screws that prevent dirt and other foreign material from entering the screw holes. In most cases, there will be four. Position the mount or mounts in place, use the screws that accompany the mount, and snug these screws down to hold the mount or bases firmly in place. Do not tighten firmly at this time. Now operate the action of the rifle to see if it functions smoothly. Often, in the case of bolt-action rifles, the factory-supplied screws protrude too deeply and will jam the bolt, preventing it from sliding smoothly. In this case, the screws will have to be shortened, either by cutting or grinding. Try the action again, and repeat this procedure until the action works smoothly.

Remove the screws and mount bases from the receiver. Then thoroughly clean the screw holes and screws with a degreaser. Apply Loctite to the mount screws and reinstall them in the bases. Tighten the mounting screws as firmly as possible to prevent them from shooting loose. This is especially important with a rifle with heavy recoil.

DRILLING AND TAPPING FOR SCOPE MOUNTS

Most of the older rimfire and centerfire rifles, especially those designed for military use, were not supplied with drilled and tapped holes or grooves for mounting scope sights. Some of the older sporting rifles adapt well to telescopic sights, but many of the military rifles and some sporting rifles require major alterations to enable a scope sight to be used satisfactorily. Your regular lessons cover these alterations.

Scope-drilling jigs, like the one shown in Figure 7, are used almost exclusively for drilling and tapping scope mounts. Many professionals make their own, although numerous types are available from gunsmith supply houses. By using these jigs, screw holes can be located and drilled in a fraction of the time it once took. There is little reason for professional shops to use any other method.

The jig shown in Figure 7 is supplied with the correct drill and tap. To use this jig, remove the bolt of the rifle and insert the drill jig. It automatically locates holes in reference to the recoil shoulder, and aligns and spaces holes vertically on the centerline of the receiver.

Place the #31 drill bit that is included with the drilling jig in a drill press. Place the receiver on the drill table so the jig is under the drill bit. Align one hole in the drilling jig with the drill bit. Be sure the jig is level, and clamp the barrel and receiver to the table of the press. Use padding to protect the finish of the firearm. Drill the first hole and repeat this procedure for the remaining holes. The hole spacing matches the mounts made by Weaver and Redfield.



Figure 7: A scope-drilling jig.

Remove the receiver from the press and remove the drilling jig from the receiver. The next step is to tap the holes. The drilling jig includes a 6 x 48 tap which is used to cut the threads in the holes. Before using this tap, however, clean the holes so they are free of metal shavings.

Mount the receiver in a padded vise. Place the tap in the hole and turn the tap clockwise one-quarter turn. Pour a small amount of oil in the grooves of the tap and proceed to cut the threads. With a wrench, turn the tap one turn clockwise, then a half turn counterclockwise. This will keep the teeth of the tap clean. Continue in this manner until the tap bottoms out in the hole.

Some of the receivers will allow you to drill a hole completely through them. If you do, be sure to dress the bottom of the hole with a file. This will prevent binding of the action.

Once the holes are drilled, tapped, and thoroughly cleaned, the scope mounts are installed as discussed previously.

Zeroing the Scope

Some shooters mount their scopes, take their rifles to the range, and attempt to sight-in. If a large enough target is available this will sometimes work, but usually at the cost of many rounds of ammunition. A better way is to first boresight the rifle so the scope will be approximately aligned prior to shooting live ammunition. The optical boresighter provides a fast, accurate way to sight-in a rifle and saves ammunition.

Place the rifle on a steady rest, such as sandbags, a padded vise, or the gun-cleaning fixture discussed in a previous kit. Position the rifle so that it is perfectly vertical in a heel-to-receiver orientation. Look through the scope and rotate it so the crosshairs are exactly horizontal and vertical.



***Figure 8**: The 14 studs included in this kit will fit bores from .17 to .45.*

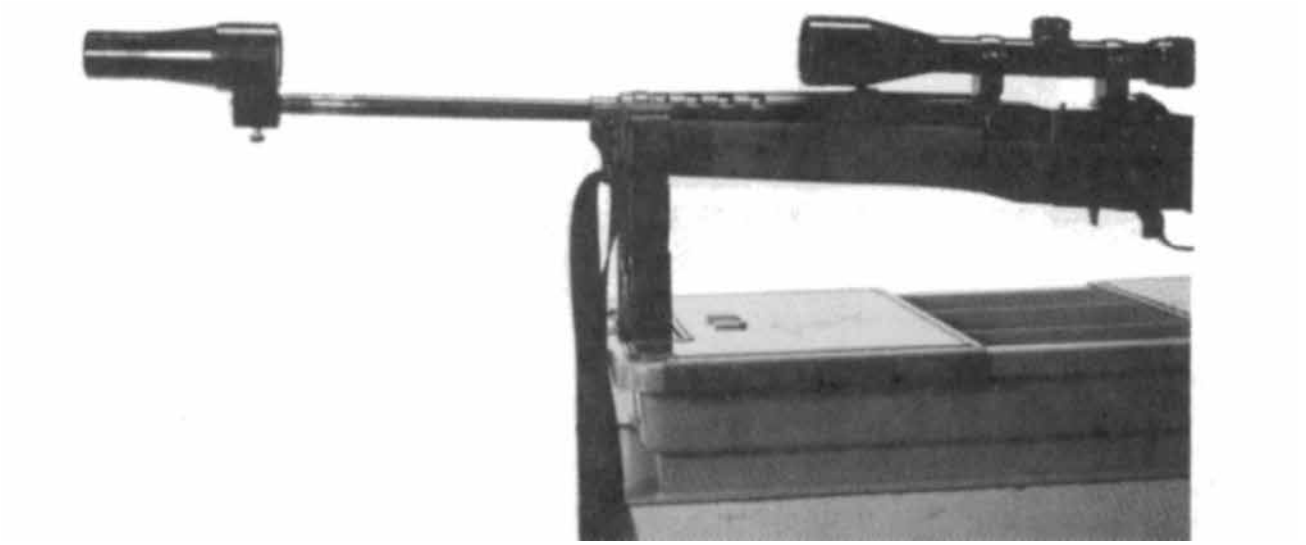


***Figure 9**: Push the collimator into the bore so it is flush against the muzzle.*

Once the rifle and scope are in the correct positions, carefully tighten the scope ring screws (one turn or less on each screw until all are snug) to hold the scope firmly in the desired position. If you tighten one screw more than another, the scope could be pulled out of line by the screw pressure. Then, tighten each of the eight ring screws about a half turn in rotation until the desired tension has been obtained.

COLLIMATOR

The collimator is a simple optical device — an objective lens with a target grid at the end. Through the scope, the target grid is in focus. In use, this sighting grid is viewed in relationship to the crosshairs, or reticle, of the scope. Windage and elevation adjustment of the scope, or windage adjustment of the mount, brings the sights into alignment with the bore of the firearm. The collimator can be used with all scopes for rifles and handguns.

To use the collimator, clamp it to a stud. From the 14 studs shown in Figure 8, choose the stud that is the correct size for the bore of the rifle being sighted-in. Position the stud so the screw in the collimator contacts the flat part of the stud. Insert the stud in the muzzle of the gun and push the collimator into the bore so it is flush against the muzzle, as shown in Figure 9.

Many shooters will prefer a scope ring that allows them to use either the factory sights for short shots or a scope for long shots. This see-through scope ring, shown in Figure 10, mounts the scope higher than normal. To use the collimator



***Figure 10**: See-through scope rings mount the scope higher than normal.*

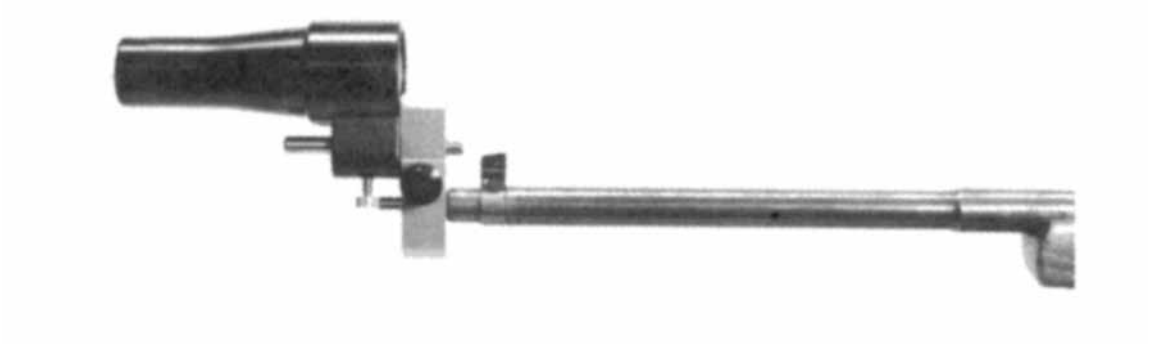


Figure 11: *Boresighting a rifle with see-through rings will require an adapter between the stud and the collimator.*

with this type of ring, you will need an adapter like the one shown in Figure 11. This will raise the collimator so it is in line with the scope.

Once the collimator is in place, remove the adjustment turret caps on the scope, as shown in Figure 12. The elevation knob is marked "UP" on most scopes, with an arrow indicating the direction to move the point of impact up on the target. The windage knob is marked "R" for right, with a similar marking.

The increments marked on the graduated scale around the knobs indicate the amount of point-of-impact movement in minutes of angle (MOA). One MOA equals $^{1}/_{60}$ of a degree of arc. Since point-of-impact change is measured in angles, the amount of actual movement on the target increases as the distance to the target increases. For convenience, one MOA equals 1" at 100 yards.

Using the scope adjustments described, align the scope reticle intersection with the center of the grid. The scope is now parallel to the axis of the bore. This adjustment will enable the first shot to be placed well within the edges of a target 12"-18"square. You are now ready to sight-in the rifle.

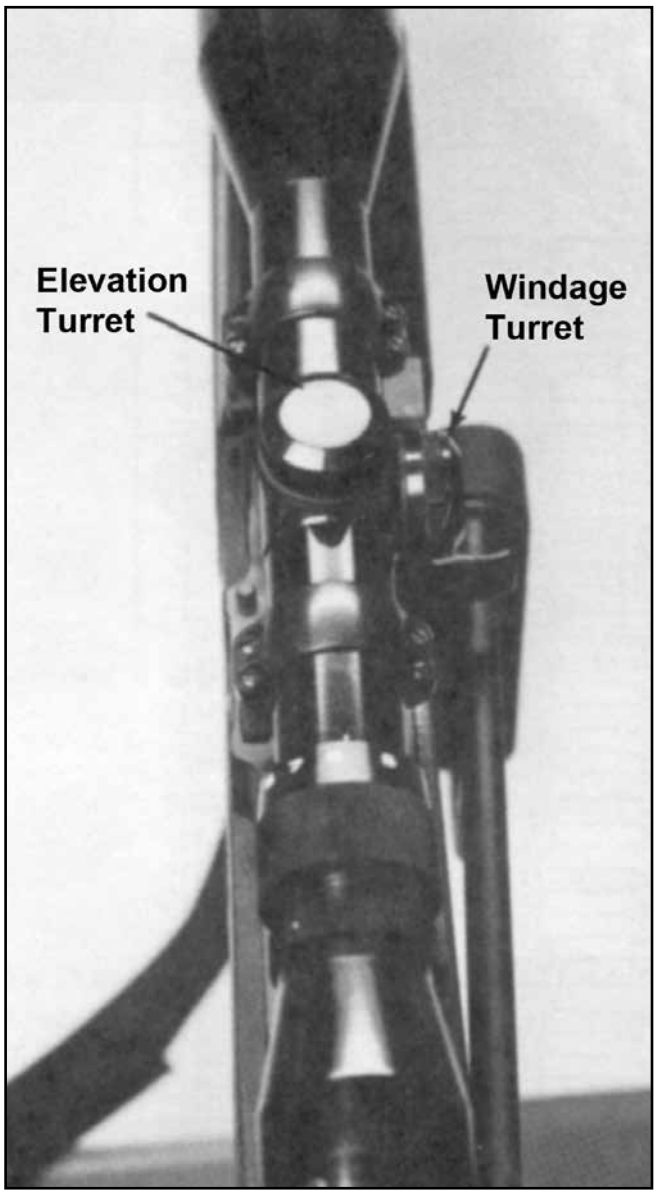


Figure 12*: The windage and elevation adjustment on most scopes are covered with caps.*

SIGHTING-IN

When sighting-in a rifle, it is best to use a target at the distance you normally expect to be shooting. However, the length of the range you have access to may prevent this. For example, your customer may want the rifle sighted in at 200 yards. Your range is only 100 yards. This problem can be overcome by using ballistic tables like the one in Figure 13.

For example, if you wanted to sight-in a .308 Winchester for 200 yards, and the maximum distance of your range was only 100 yards, the ballistics table would give you the trajectory of the bullet. As you can see from the chart, you will need to know the weight of the bullet and the velocity. Using the chart for a 130-grain bullet at a velocity of 3,700 feet per second (fps), the bullet will impact the target 0.8" above center at 100 yards with a 200-yard zero. Adjusting the scope so the bullet impact is 0.8" above the point of aim at 100 yards would produce a zero at 200 yards.

BALLISTICS TABLES

Hornady
HANDBOOK

30 CALIBER (.308" Dia.) 130 GRAIN SPIRE POINT

SECTIONAL DENSITY: .196 BALLISTIC COEFFICIENT: .299

RANGE	MUZZLE	100 yds.	200 yds.	300 yds.	400 yds.	500 yds.	600 yds.
VELOCITY (fps)	3700	3337	2994	2672	2372	2096	1844
ENERGY (ft. lbs.)	3953	3215	2589	2061	1624	1269	982
TRAJ: 100 yd. zero	– 1.5"	0.0"	– 1.6"	– 7.3"	– 18.0"	– 35.1"	– 60.1"
TRAJ: 200 yd. zero	– 1.5"	.8"	0.0"	– 4.8"	– 14.6"	– 30.9"	– 55.1"
TRAJ: 300 yd. zero	– 1.5"	2.4"	3.2"	0.0"	– 8.2"	– 22.9"	– 45.5"
TRAJ: 400 yd. zero	– 1.5"	4.5"	7.3"	8.2"	0.0"	– 12.5"	– 33.1"
TRAJ: 550 yd. zero	– 1.5"	7.0"	12.4"	13.8"	10.1"	0.0"	– 18.0"
TRAJ: 600 yd. zero	– 1.5"	10.0"	18.4"	22.8"	22.1"	15.0"	0.0"
VELOCITY (fps)	3600	3242	2905	2588	2295	2026	1780
ENERGY (ft. lbs.)	3742	3035	2437	1935	1521	1185	915
TRAJ: 100 yd. zero	– 1.5"	0.0"	– 1.8"	– 7.9"	– 19.3"	– 37.3"	– 64.1"
TRAJ: 200 yd. zero	– 1.5"	.9"	0.0"	– 5.1"	– 15.5"	– 32.6"	– 58.5"
TRAJ: 300 yd. zero	– 1.5"	2.7"	3.4"	0.0"	– 8.8"	– 24.0"	– 48.2"
TRAJ: 400 yd. zero	– 1.5"	4.8"	7.8"	6.5"	0.0"	– 13.1"	– 35.2"
TRAJ: 500 yd. zero	– 1.5"	7.5"	13.1"	14.4"	10.5"	0.0"	– 19.4"
TRAJ: 600 yd. zero	– 1.5"	10.7"	19.5"	24.1"	23.5"	16.2"	0.0"
VELOCITY (fps)	3500	3148	2816	2506	2219	1956	1717
ENERGY (ft. lbs.)	3537	2861	2290	1813	1422	1105	851
TRAJ: 100 yd. zero	– 1.5"	0.0"	– 2.0"	– 8.7"	– 20.9"	– 40.4"	– 68.9"
TRAJ: 200 yd. zero	– 1.5"	1.0"	0.0"	– 5.5"	– 16.8"	– 35.2"	– 62.6"
TRAJ: 300 yd. zero	– 1.5"	2.9"	3.7"	0.0"	– 9.3"	– 25.9"	– 51.5"
TRAJ: 400 yd. zero	– 1.5"	5.2"	8.4"	7.0"	0.0"	– 14.1"	– 37.4"
TRAJ: 500 yd. zero	– 1.5"	8.1"	14.1"	15.6"	11.4"	0.0"	– 20.4"
TRAJ: 600 yd. zero	– 1.5"	11.5"	20.9"	25.8"	25.0"	17.0"	0.0"
VELOCITY (fps)	3400	3054	2728	2423	2143	1887	1655
ENERGY (ft. lbs.)	3338	2693	2149	1696	1327	1028	791
TRAJ: 100 yd. zero	– 1.5"	0.0"	– 2.3"	– 9.3"	– 22.3"	– 43.2"	– 74.1"
TRAJ: 200 yd. zero	– 1.5"	1.2"	0.0"	– 5.8"	– 17.6"	– 37.4"	– 67.1"
TRAJ: 300 yd. zero	– 1.5"	3.1"	3.9"	0.0"	– 9.8"	– 27.6"	– 55.4"
TRAJ: 400 yd. zero	– 1.5"	5.6"	8.8"	7.4"	0.0"	– 15.3"	– 40.6"
TRAJ: 500 yd. zero	– 1.5"	8.7"	15.0"	16.6"	12.3"	0.0"	– 22.2"
TRAJ: 600 yd. zero	– 1.5"	12.4"	22.4"	27.7"	27.1"	18.5"	0.0"
VELOCITY (fps)	3300	2960	2639	2342	2069	1819	1595
ENERGY (ft. lbs.)	3144	2529	2011	1583	1238	955	735
TRAJ: 100 yd. zero	– 1.5"	0.0"	– 2.5"	– 10.2"	– 24.3"	– 46.6"	– 79.4"
TRAJ: 200 yd. zero	– 1.5"	1.3"	0.0"	– 6.3"	– 19.2"	– 40.1"	– 71.7"
TRAJ: 300 yd. zero	– 1.5"	3.4"	4.3"	0.0"	– 10.6"	– 29.4"	– 58.9"
TRAJ: 400 yd. zero	– 1.5"	6.1"	9.6"	8.0"	0.0"	– 16.1"	– 42.9"
TRAJ: 500 yd. zero	– 1.5"	9.3"	16.0"	17.7"	12.9"	0.0"	– 23.5"
TRAJ: 600 yd. zero	– 1.5"	13.2"	23.9"	29.5"	28.6"	19.6"	0.0"
VELOCITY (fps)	3200	2885	2551	2261	1994	1751	1536
ENERGY (ft. lbs.)	2957	2371	1879	1476	1149	886	681
TRAJ: 100 yd. zero	– 1.5"	0.0"	– 2.7"	– 11.1"	– 26.4"	– 50.5"	– 86.6"
TRAJ: 200 yd. zero	– 1.5"	1.4"	0.0"	– 6.9"	– 20.8"	– 43.6"	– 78.2"
TRAJ: 300 yd. zero	– 1.5"	3.7"	4.8"	0.0"	– 11.6"	– 32.0"	– 64.3"
TRAJ: 400 yd. zero	– 1.5"	6.6"	10.4"	8.7"	0.0"	– 17.5"	– 46.9"
TRAJ: 500 yd. zero	– 1.5"	10.1"	17.4"	19.2"	14.0"	0.0"	– 25.9"
TRAJ: 600 yd. zero	– 1.5"	14.4"	26.1"	32.2"	31.3"	21.6"	0.0"
VELOCITY (fps)	3100	2771	2464	2180	1921	1685	1468
ENERGY (ft. lbs.)	2775	2218	1753	1373	1065	820	622
TRAJ: 100 yd. zero	– 1.5"	0.0"	– 3.1"	– 12.0"	– 28.3"	– 54.6"	– 92.7"
TRAJ: 200 yd. zero	– 1.5"	1.6"	0.0"	– 7.3"	– 22.1"	– 46.8"	– 83.3"
TRAJ: 300 yd. zero	– 1.5"	4.0"	4.9"	0.0"	– 12.2"	– 34.5"	– 68.5"
TRAJ: 400 yd. zero	– 1.5"	7.1"	11.1"	9.2"	0.0"	– 19.1"	– 50.1"
TRAJ: 500 yd. zero	– 1.5"	10.9"	18.7"	20.7"	15.3"	0.0"	– 27.1"
TRAJ: 600 yd. zero	– 1.5"	15.5"	27.8"	34.3"	33.4"	22.6"	0.0"
VELOCITY (fps)	3000	2677	2377	2101	1848	1621	1412
ENERGY (ft. lbs.)	2599	2070	1631	1274	986	758	575
TRAJ: 100 yd. zero	– 1.5"	0.0"	– 3.5"	– 13.3"	– 31.1"	– 59.4"	– 100.8"
TRAJ: 200 yd. zero	– 1.5"	1.8"	0.0"	– 8.0"	– 24.1"	– 50.7"	– 90.3"
TRAJ: 300 yd. zero	– 1.5"	4.5"	5.4"	0.0"	– 13.3"	– 37.2"	– 74.1"
TRAJ: 400 yd. zero	– 1.5"	7.8"	12.1"	10.0"	0.0"	– 20.4"	– 54.0"
TRAJ: 500 yd. zero	– 1.5"	11.9"	20.3"	22.3"	16.4"	0.0"	– 29.5"
TRAJ: 600 yd. zero	– 1.5"	16.8"	30.1"	37.1"	36.1"	24.6"	0.0"

Figure 13: A page from a ballistics table.

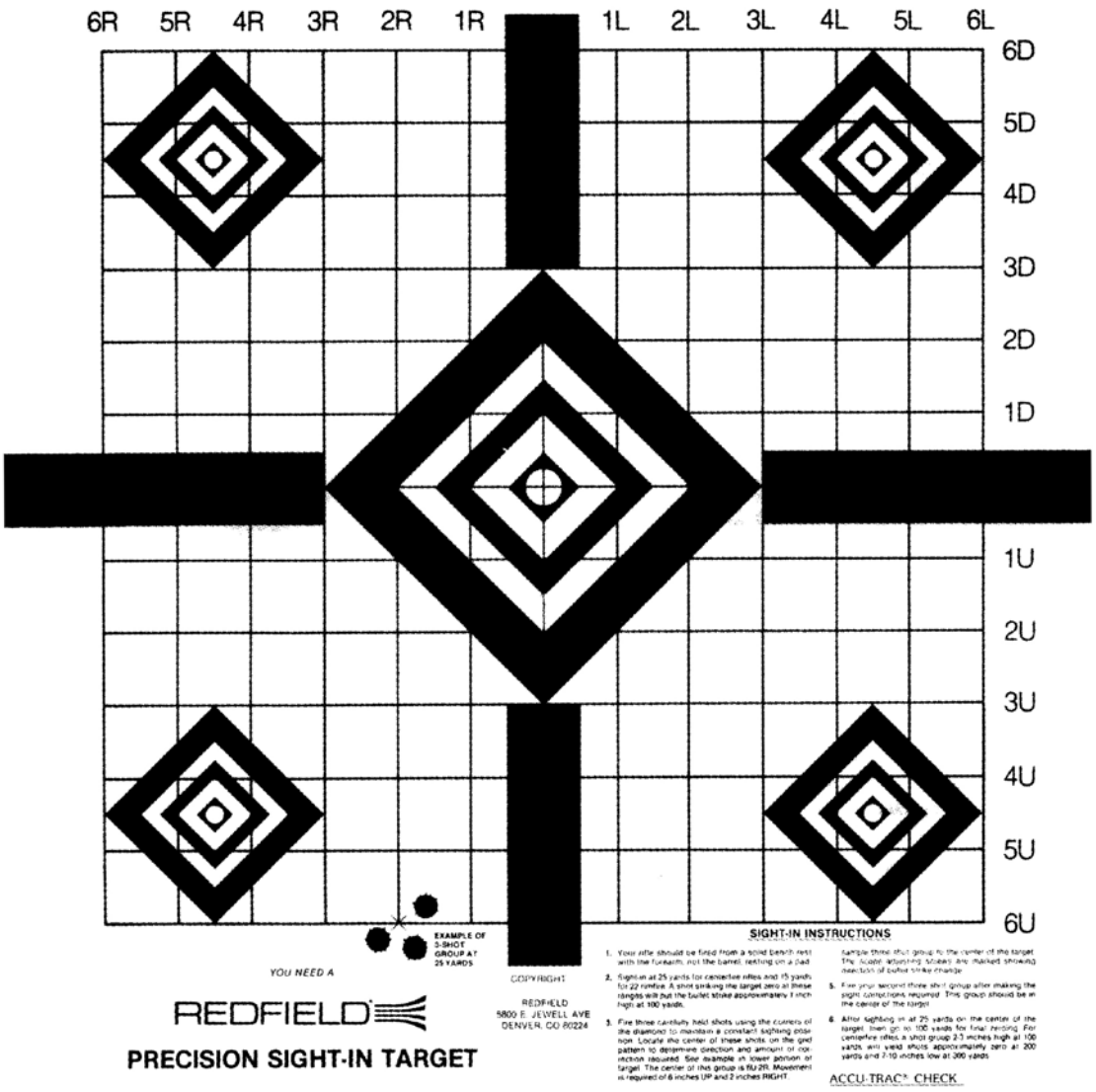


Figure 14: A sight-in target.

Sighting-in should be done from a steady rest, such as a solid bench rest, tripod, or sandbags. Use a sight-in target like the one shown in Figure 14. These targets are graduated in 1" squares to allow easy alignment of a scope. Normally, the paper of these targets is white, which makes it easy to see the bullet holes through a spotting scope or the rifle scope.

To zero-in the rifle, fire a minimum of three shots at the desired range, using the center of the multi-shot group as the hypothetical point of impact. The target in Figure 15 is a five-shot group fired from a Ruger Mini-14 at 100 yards. As you can see, the center of the group is 1" high and ½" to the left.

To adjust the zero of the scope, use a coin or screwdriver and turn the adjusting dials. The scope used for the Ruger Mini-14 has an adjustment of 14" per click at 100 yards. This is usually marked on the dial of the scope as shown in Figure 16, or in the instructions that come with the scope.

Since the target was shot at 100 yards, the windage adjustment would be two clicks counterclockwise. The elevation adjustment would be four clicks clockwise. If this target was shot at 200 yards, the adjustments would have been only half as much. After the adjustment is made, another string is shot to verify the hit.

The rifle should be zeroed-in just prior to target shooting or hunting, and whenever a different ammunition is used. The two targets in Figure 17 were shot with the same rifle and the same scope setting. The only difference was the type of ammunition used. Figure 17(A) was shot with factory ammunition and Figure 17(B) was shot with reloaded ammunition.

Humidity and other changes in the weather will also alter the bullet impact on the target. So, from time to time, recheck your rifle to see if it is holding its original point of impact. If not, adjust accordingly.

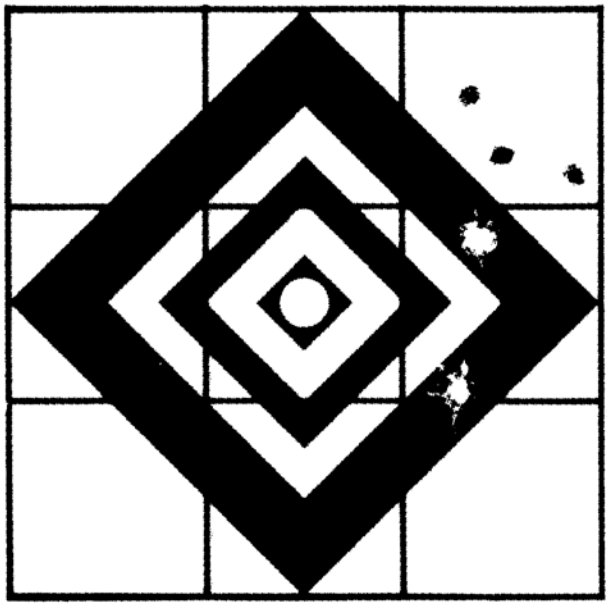


***Figure 15**: This group was fired from a Ruger Mini-14 at 100 yards.*

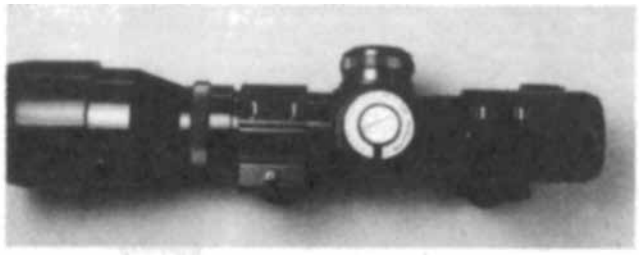


***Figure 16**: This scope has a ¼" per click adjustments.*

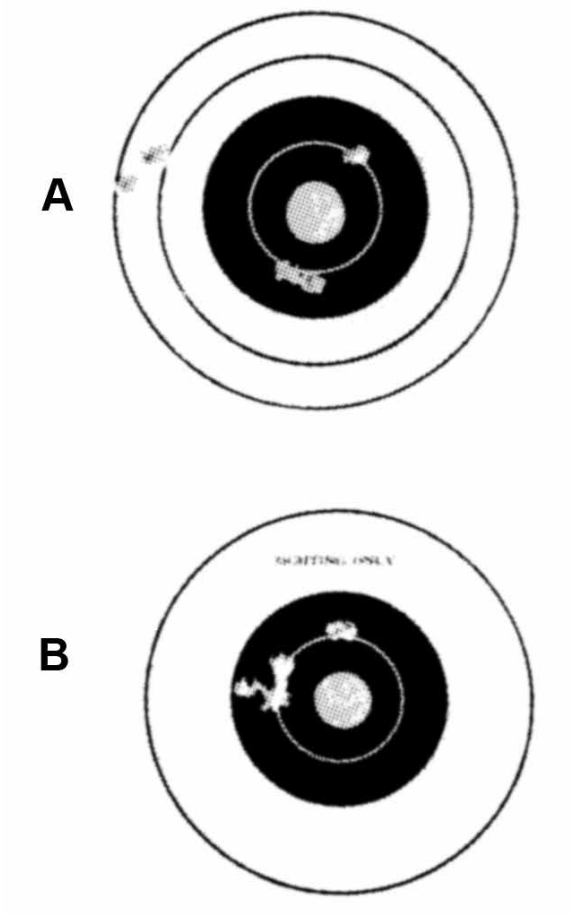


***Figure 17**: (A) This group was fired using factory ammunition. (B) This group was fired using reloads.*

Jack First Catalogs

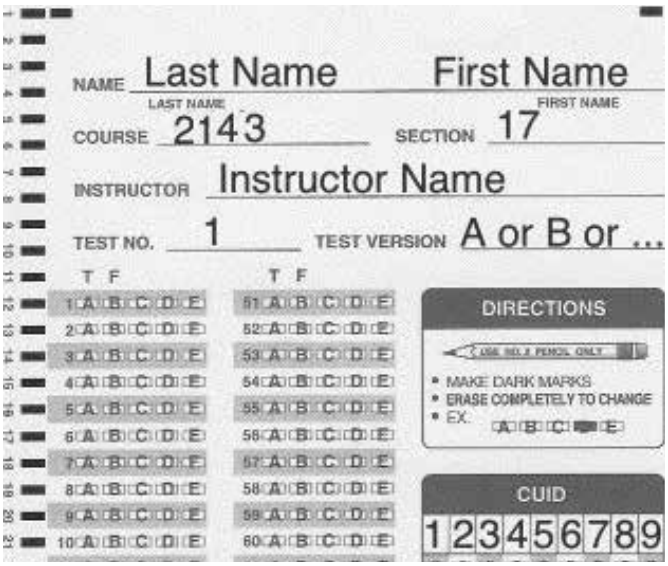
Also included in this kit are Jack First Catalogs, Volumes I and II. Volume I focuses upon currently produced firearms. Volume II covers some obsolete firearms. Ordering information is contained in Volume I. Discounts to gunsmiths apply only when an FFL and business license are provided. www.jackfirstgun.com

The catalogs serve as more than a parts directory. The exploded views of the firearms also serve as a disassembly guide. By careful examination of the drawings, you will be able to understand how the various parts are held in place and their relationships to other parts.

Examination Questions

THIS IS EXAMINATION NUMBER 2162.

Make sure you print your name, student number, and examination number (Lesson No.) in the space provided on the Answer Form. Be sure to fill in the circles beneath your student number and examination number (Lesson No.).



REMINDER: A properly completed Answer Form allows us to evaluate your answers and speed the results and additional study material to you as soon as possible. Do not hold your Answer Forms to send several at one time. You may run out of study material if you do not send your answers for evaluation promptly.

You may also complete your exam online at www.sdi.edu, click on the *online exams* tab.

1. **Most rimfire rifles have**
   a. Integral mounts.
   b. Grooved receivers.
   c. Two-piece bases.
   d. One-piece bases.

2. **The screws that hold the mount to the receiver should be coated with Loctite before they are tightened.**
   a. True.
   b. False.

3. **A shot group is 2" high at 50 yards. The scope has an adjustment of ¼" per click at 100 yards. How many clicks are necessary to bring the shot group down to zero?**
   a. 2.
   b. 4.
   c. 8.
   d. 16.

4. **What is the minimum shot string that should be fired to determine the group placement?**
   a. 2.
   b. 3.
   c. 4.
   d. 5.

5. **Eye relief is adjusted after the scope is zeroed.**
   a. True.
   b. False.

6. **The normal eye relief distance is**
   a. 8 inches.
   b. 12 inches.
   c. Varies with each shooter.
   d. Unimportant.

7. **When a customer wants a rifle sighted-in at 200 yards and you only have access to a 100-yard range, what can be used to produce the correct zero?**
   a. A boresighter.
   b. Ballistic tables.
   c. An offset boresighting stud.
   d. See-through mounts.

8. **Bullet drop in ballistic tables varies according to velocity and**
   a. Wind.
   b. Range length.
   c. Bullet weight.
   d. Point of aim.

9. **When mounting a scope to a rifle with integral mounts, the first step is to**

   a. Install the bottom of the ring to the mount.

   b. Install the ring on the scope.

   c. Install the base to the receiver.

   d. Set the eye relief of the scope.

10. **When using a collimator, you will not have to shoot the firearm to test the scope zero.**

    a. True.

    b. False.