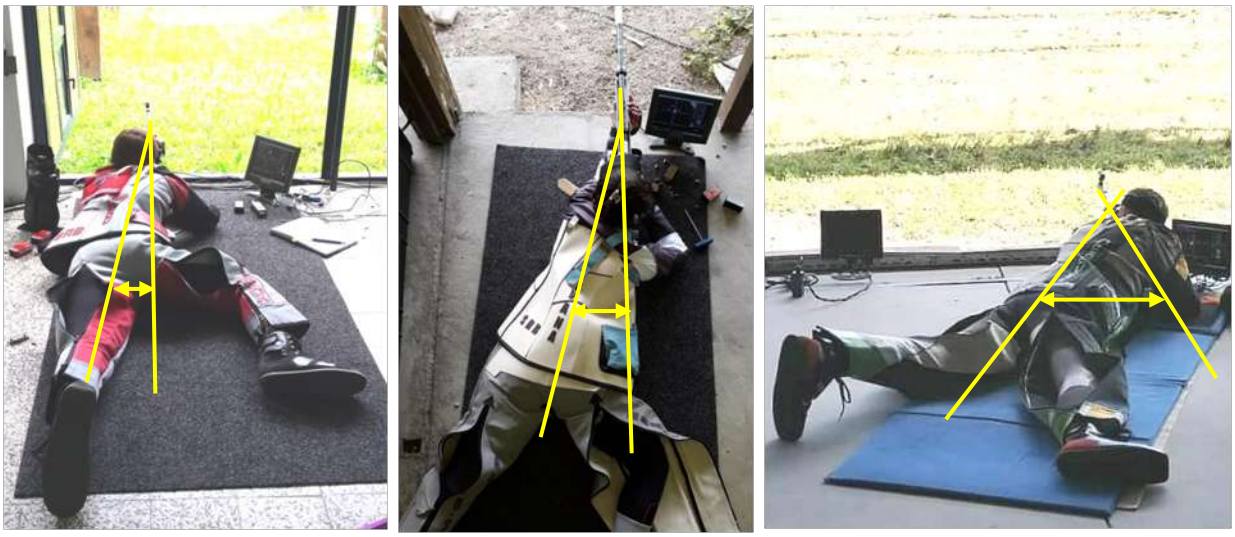
4. PRONE SHOOTING POSITION

Biomechanical analysis

The prone position is the most stable shooting position. The reason is the largest support area of the body while the center of gravity is at the lowest height. This gives the best stability to a system shooter-rifle.

From the biomechanical aspect, the most important area of interest is the combination of shoulder, arms and head positioning. The highest stability of a position is achieved when the COG of the rifle is as close to the centre of this zone as possible. Therefore, the shooter's body should be rotated no more than 20 degrees in relation to the shooting line. Higher rotations cause the COG of the rifle to move to the right and instabilities in the shooting position.

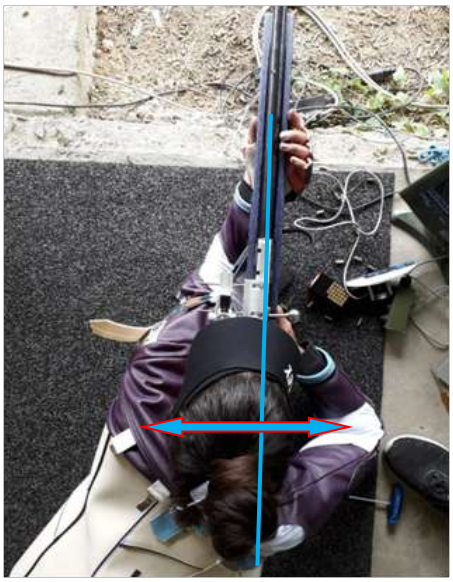


Straight forward | App. 20 degree body angle | Bigger body angle

In addition, the forces that appear in the position need to be balanced.

The forces going straight back-forth should be equal, as should the ones going up-down. This means that the left-hand pressure on the rifle should be equal to the pressure of the stock in the shoulder. Based on that, the length of the stock and the sling is determined, as well as the balancing of the rifle.

In the sagittal plane, the pressure of the head on the cheek piece should be equal to the pressure of the right arm and hand. This acts as a parameter to determine the position of the right elbow.

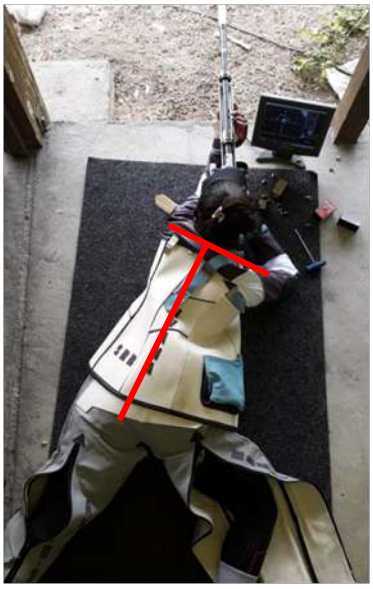


The angles of the left forearm and upper arm should be the same according to the supporting area. In that case the force is going straight back.

The basic prone position consists of the following elements (right-handed shooters):

Upper body and legs

Body of the shooter should be slanting so that the vertical axis of the shooter and the shooting line is forming an angle of 0-20 degrees. The spine is straight. The spine and shoulders are approximately T–shaped. The left shoulder is drawn forward to slightly open the alignment of the shoulders. The right shoulder should be relaxed.



Slanting in this position is more comfortable for the shooter as the rib cage is not tight and provides freer breathing. It also provides the shooter with ideal conditions for leaning of the

head onto the cheek-piece, and positioning of the butt plate onto the shoulder. With these adjustments, the shooter should have more correct aiming.

Legs should be spread without any tension; the left leg should be leaned onto the ground with the tip of the toes. It is more beneficial to shoot in the shooting shoes because they provide the stability of the left leg with their flat front. The left leg is exactly in line with the rest of the body and is parallel to the spine. The right leg should be bent at the knee (about 45 degrees) and the right foot should completely lie on the ground with its inner side. Bending of the right leg makes breathing easier and avoids pulsation in the stomach as the shooters weight is primarily on their left hip.

Arms

Left arm is bent at the elbow and placed as far forward as possible to the hand stop, but to the limits prescribed by the regulations (the smallest angle between the forearm and the ground is 30 degrees).

Left elbow is placed slightly to the left of the rifle.

If the elbow is placed directly under (or further to the right) the rifle, it will typically result in muscle pain in the shoulder area. When too much pressure is given to the left side of the body, balance is also affected. In order to maintain this position, the elbow has to stay exactly in the same place throughout the whole shooting session or a competition. Left arm has to be as relaxed as possible.

The wrist of the left arm is straight, with a straight line going from the shoulder to the upper arm. This straight line continues through the forearm to the supporting hand. The left wrist should have minimal bending and should be relaxed. The fingers on the left hand should not be tight around the stock. The rifle is leaned onto the middle of the hand, a little toward the thumb.

Majority of the rifles weight is placed upon the left arm.

The placement of **the right arm** is very important in prone.

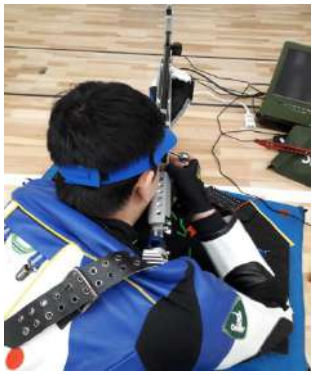
The right hand holds the pistol grip with a moderate grip. The wrist of the right hand should be straight while the base of the trigger-finger should be separated from the pistol grip. This provides the best feeling for triggering - the shooter should feel as though they are hugging the rifle with his right hand.

The right elbow should be neither pushed near the body, nor separated with effort aside. Once the pistol grip is taken, the elbow is freely put to the ground. The elbow must always be lowered to the same place in order to maintain alignment of the position.

Butt Plate and Length of the Stock

The butt plate is placed on the inside of the shoulder as close to the head as possible.

The length of the stock should be determined so as to allow good contact in the shoulder. The pressure in the shoulder should almost be the same as the pressure of the rifle to the left hand. If this pressure is weak, the stock should be extended - if the rifle pushes the shoulder backward, the stock should be shortened. The hook should be between the back and the arm, and should not exert pressure on either side.



Head

The head is in front of the spine and leans on the front of the cheek-piece of the stock. The head must not be turned to the right or angled down as it will cause the shooter to aim astray or aim under the forehead (eyebrow). The head should be relaxed. The belt on the right part of the jacket should be tightened to avoid pressure on the neck.

Sling

The sling should firmly connect the left arm and the hand stop on the fore-end stock. The sling should form the firm triangle composed of the left forearm, left upper arm and the sling. This triangle should act as the artificial support for the rifle, which will release the muscles of the left arm while holding the rifle. The sling must not be loose or too tight. If it is loose, the stability decreases and the muscles of the left arm are included into holding the rifle. If it is over-tight, the weapon shakes and there is a pulsation due to the poor blood circulation.

The sling can be put on the upper arm at two places - at the lower part, near the elbow - at the lower position and high, near the shoulder - at the high position. The sling must not be positioned at the middle of the upper arm because then it directly lies in the middle of the triceps and causes the interruption of blood circulation. The sling should be placed as horizontal as possible.

Low position

High position

Position Height

The prone position, concerning the position of the left forearm, can be high, low or medium - all three positions are correct. The only condition is that when using the low position, the angle between the forearm and the ground must be larger than 30 degrees.

Low

Medium

High

Each of these three positions has its own advantages and disadvantages and the height of the position depends on the shooter's body proportions.

The low position is the most stable for shooting as the bodies center of gravity is the lowest. It is a less convenient position as it; presses the rib cage, affects breathing, creates pulsation disturbance, makes it difficult to keep the head correctly positioned, causes tension of the neck muscles. These all add up to the consequence of poorer visibility of the sights, because aiming takes place under the forehead (eyebrow). Because of the inconvenient shooting conditions in this position, but with the greatest stability, the shooter who uses this position should have a fast rhythm of shooting.

The high position relaxes the rib cage, makes keeping the head correctly positioned easier. This position is very good for aiming but it causes a disadvantage as the center of gravity of the system shooter-rifle is high. With this higher center of gravity, the stability of the rifle and shooter are considerably smaller, and the pressure placed on the left elbow is much

stronger than other positions. This high center of gravity also causes the muscles to tighten, which causes the shooter to become fatigued more quickly than in other positions.

The medium position is most frequent with the shooters because it avoids bad and keeps good sides both of the low and high position.

The position modifications depending on the body constitution

Tall shooters

Tall shooters should adjust the position to a longer arm length. They typically assume the higher position, as it provides the most benefits to taller shooters. The sling is in the high position on the upper arm. The left elbow is more to the left, while the right elbow is closer to the body and the right shoulder is higher. As the hand stop is moved forward in this position, the balance of the rifle is shifted backwards, so it is advisable to use the weights on the front of the stock to move the balance of the rifle closer to the left hand.

Short shooters

Because of their shorter arms, short shooters should take a lower position. Position of the sling on the upper arm is set up on the lower position. The left elbow is placed closer to the rifle, while the right elbow is positioned away from the body and the right shoulder is lower in order for the shooter to reach the required target alignment.

Plump shooters and female shooters with big breasts

Shooters with this body type typically take a higher position. The right leg is bent more and they lean on the left hip, as it makes breathing easier and avoids putting the pressure and pulsation on – and pulsation in - the stomach.

SELF - EVALUATING QUESTIONS:

From the biomechanical aspect, which is the most important area of interest in the prone position?

Describe the position of the butt plate in the shoulder and the fore-end of the stock on the left hand?

Which is the smallest angle of the left forearm allowed by the rules of ISSF?

Prone position

I phase – assuming a position without a rifle and equipment

- The shooter should lie on the mat facing straight at the target with his hands folded under his chin;
- Turn the body to the left about 10-20 degrees. The body is completely straight while the left leg is parallel to the spine;
- Exhale the air from the lungs and bend the right leg as long as the shooter can inhale comfortably, but not more than 45 degrees, because it causes too much movement onto the left hip and the position will be uncomfortable;
- Stretch the left arm towards the target and rest the right arm on the elbow;

After assuming the provisional position, the shooter should aim between the thumb and index finger to the target, fully relax the body and feel the position of the arms. Adjust the position so the aiming line is straight to the target.

II phase – with rifle

The shooter remains in position and the coach sets the rifle in position.

- Put the rifle along the heel of the left hand and place the butt in the shoulder;

- Move the left hand by gripping the fore-end of the stock, keeping the sights on the target;
- Left arm must be placed in such a way that the angle between the forearm and the ground is at least 30 degrees.
- Left elbow is set slightly to the left of the rifle. Left arm is straight in the vertical plane;
- Provisionally adjust the butt plate – in the upper position with the hook slightly to the right, adjust the length of the butt. The right wrist should be straight;
- Lower the rifle and fix the hand stop 1 cm in front of the left hand position. This position may make better contact of the butt plate with the shoulder.

The shooter should place the left elbow so the weight of the rifle is completely on the left arm. When it is set, he should close his eyes and remember the position.

III phase – full setting of the position with the rifle and equipment

- As the shooter is wearing the shooting equipment, we should first set the sling on the left upper arm in the right place and on the right way. We will start with the sling fixed on the upper part of the upper arm, turning a quarter circle to the left. This will

prevent the sleeve from moving to the right during shooting, particularly if the shooter does not have a quality jacket.

- Then we need to determine the starting length of the sling. The shooter should bend the left arm so the hand is the same height as the left shoulder. The length of the sling is equal to the distance between the connecting point on the upper arm and the space between the thumb and the index finger of the hand. The sling passes over the back of the hand.
- We are now ready to attach the sling to the hand stop and assume the position. The position of the fore-end stock on the palm should be closer to the thumb. The wrist should be straight;
- The shooter places the left elbow on the mat slightly to the left of the mark for the direction of the target so the rifle should be located exactly in the direction of the target;
- He then puts the butt plate in the shoulder as close to the head as possible, grasp the grip and lower the right elbow to the mat;
- Adjust the position of the legs and body as in the previous phase;
- Any adjustments to the sling length can be made while the left arm is completely relaxed and the sights are on the target. The length of the sling is directly related to the position of the hand stop. If the length decreases the hand stop moves backwards and vice versa;
- Check the intensity of the pressure of the butt on the shoulder - if it is weak, extend the butt; if the rifle pushes the shoulder backward, shorten the stock;
- Adjust the butt plate so that it rests completely in the shoulder. The hook should be between the body and the shoulder, without any pressure on the body;

- Place the cheek so that it is on the forward portion of the cheek-piece. If needed, adjust the cheek-piece so that the shooter looks directly through the sights;
- The right hand grasps the grip moderately with a straight wrist, allowing the trigger-finger to make a straight rearward movement;

- Check the firmness of the position and the position of the left elbow by pressing the top of the barrel and releasing it abruptly. If the barrel returns vertically to the original position, the position is correct. If it returns to the left of the target, the elbow is too close to or below the rifle;
- The shooter should adjust the position so when the right hand is lowered to the ground, ie. does not hold the grip, the rifle should be aimed towards the middle of the target;
- The recoil of the rifle shows a lot about position and hold. The recoil should be straight up and back, so the sling should be parallel with the rifle and the ground. If there is big recoil with no control: the sling is not tight enough, the left elbow is too far forward, or the hand stop is too close. If the rifle goes down first and then up: it is most likely that the left arm is not completely relaxed or the sling is too tight. If the rifle is returned aside the middle of the target: the position of the elbow is not good. The shooter should then reposition the elbow so the recoil is straight up.

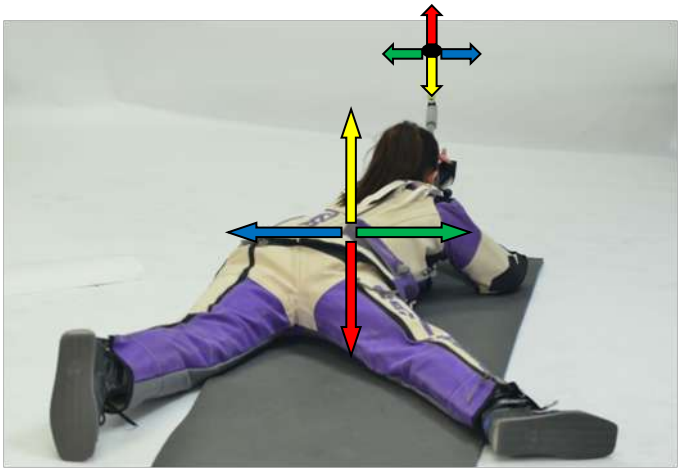
Position correction and correction by setting rifle elements

Alignment with the body

If there are any corrections with the body, the left elbow remains fixed.

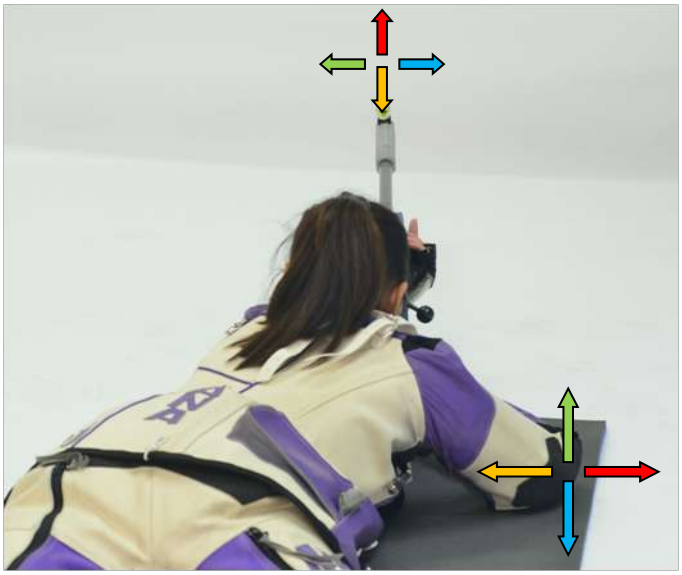
Body - by moving the body to the left, the zero point moves to the right and opposite. These movements cannot be too big. We should follow the basic rule that the body is at an angle of 0 to 20 degrees to the left of the firing line. Any other position will disturb the balance of the body–rifle system.

By moving the body forward, the zero point moves down and opposite. With these movements, we must pay attention to keep the left elbow in the correct position.



Legs – left leg should remain in the parallel position with the spine. We can make small corrections by changing the bending angle of the right leg. Primarily the changes relate to the recoil of the rifle. If the recoil is to the right we need to bend the leg more and vice versa.

Right elbow – very small adjustments of the zero point can be made by changing the support point of the right elbow. By placing the elbow closer to the body, the zero point moves down and opposite and by placing the elbow forward, the zero point moves left and opposite.

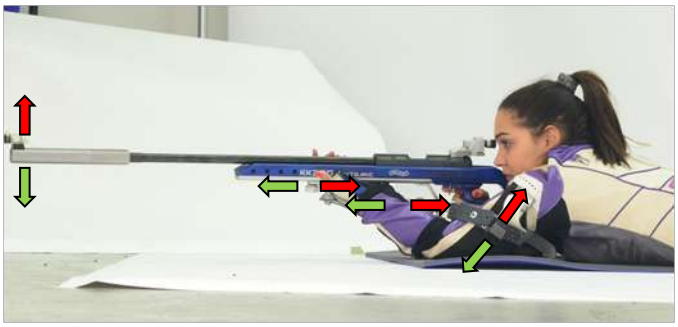


These corrections are usually used by shooters when using the ``shading`` technique when shooting in the wind.

Very often shooters, especially younger shooters, place the right elbow on the edge of the mat or the rubber part on the mat. This leads to errors on the target because the elbow is not always in the same place. More importantly - both elbows should not be close to the edges of the mat.

Head – by placing the head further forward, the zero point moves up and opposite. The position of the head must always be in the same place, to alleviate errors associated with height.

Sling – the position of the sling on the left upper arm is directly related to the height of the position. At the lower shooting position the sling is in the lower position and vice versa. Do not place the sling in the middle of the upper arm. By shortening the length of the sling, the zero point moves upwards and vice versa. Changing the length of the sling is directly related to the position of the hand stop. When we shorten the sling, we should move the hand stop backwards and vice versa. In this way we maintain the same firmness of the position.



Alignment by setting the rifle elements

Butt plate - the principle of zero point correction by means of butt plate setting is the same in all three positions. By moving the butt plate up, the zero point moves up and vice versa. The difference from the prone position to the other positions is that the upper part of the butt plate is placed further forward to achieve better contact in the shoulder.

Hand stop – by moving the hand stop forward, the zero point is going down and vice versa. We use these displacements to fine-tune the zero point using very small adjustments that can also reduce the movement of the rifle along the horizontal axis.

Kneeling position

I phase – assuming a position without a rifle and equipment

- First, the shooter should place the roll directly in the sighting line and rotate it about 45 degrees towards the target. He should then make a depression in the middle of the roll to make the foot rest more comfortable and stable;
- The shooter places the foot in the depression on the roll, taking care that the ankle is in the middle of the roll. The shooter will then sit on his heel so that the end of the spine is on the heel. The right leg is at an angle of about 45 degrees to the sighting line, i.e. at the right angle to the roll and the knee is leaning slightly against the ground;