

Maximum Heart Rate (Max HR)

Before answering the question ‘How do I determine the maximum heart rate of a horse?’ It is important that you are aware of some of the following facts about a horse’s maximum heart rate:

1. Maximum heart rate is genetically determined so there will obviously be the possibility of big differences between individual horses. For example, maximum heart rates of 190 to 255 beats per minute have been reported in the equine scientific literature. However, it would seem that a ‘ball park’ figure of 230 beats per minute is a reasonable approximation for the maximum heart rate declines with age according to the formula: $\text{Max HR} = 220 - \text{age}$. However, there seems to be no predictable relationship between age and maximum heart rate in horses.
2. Maximum heart rates that are high do not predict better racing performance, just as maximum heart rates that are low do not predict worse racing performance.
3. Maximum heart rate does not increase with training or fitness.
4. Maximum heart rate can be affected by the type of exercise the horse is performing. For example, the maximum heart rate for a horse swimming may be significantly different to that for galloping. This, of course, has implications when it comes to setting heart rate training zones for swimming and running.

You should not assume that maximum heart rates will be the same for all types of exercise.

5. Drugs can affect maximum heart rate.
6. Maximum heart rate can be reduced as a result of over training and fatigue.
7. It seems horses can achieve their maximum heart rate in a very short period of time. One study which examined thoroughbreds (Krzywanek et al, 1970) reported a rise in heart rate from 121 to 221 beats per minute within 7.5 seconds! However, on average, it took 22 seconds for the heart rate to rise from the pre-start level to the peak heart rate level. However, in standardbreds trotting at speeds of 12.0 to 12.5 meters per second, maximum heart rates were not reached until after 700 meters or 56 to 58 seconds.

Determining the maximum heart rate of your horse...

As is the case with human athletes, maximum heart rate can either be predicted or measured. Both techniques have advantages and disadvantages.

Prediction

For humans, the formula of $220 - \text{age}$ is often used to predict the maximum heart rate of an individual. While this formula is reasonably accurate, there doesn't seem to be a predictable link between horse's age and its maximum heart rate. As a starting point, it would seem that the figure of 230 beats per minute would be a reasonable 'guesstimate' for your horse's maximum heart rate.

Keep in mind that while the prediction method requires no effort and gives you a starting point for setting heart rate training zones, it is not specific to swimming and may be an over or under estimation of what the true maximum heart rate of your horse really is.

Measurement

The best way to actually identify the true maximum heart rate of your horse is to measure it during a strenuous exercise session. The following are some suggested methods:

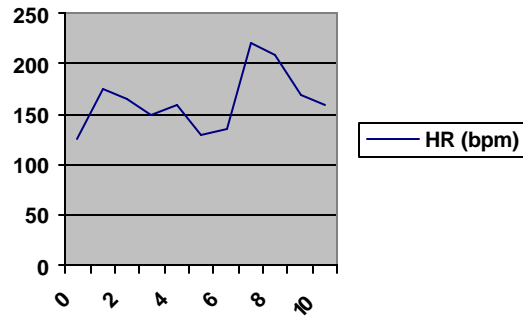
- ? An all-out trial over 1000 – 1600 meters
- ? A continuous progressive test
- ? A hill test

An all-out trial over 1000 – 1600 metres:

It is not uncommon for horses to be barrier trialed under competition conditions during their preparation-training phase. This is an excellent opportunity to measure maximum heart rate (assuming the horse goes 'all-out' during the trial).

Figure 1: gives an example of a horse's heart rate response during a 1000 meter trial. The heart rate at the end of the race can be assumed to be a good indication of the horse's maximum heart rate. In general, maximum heart rate in a horse can be measured after one minute of maximum effort, provided the horse has undertaken a suitable warm-up.

Figure 1: Horse's heart rate response during 1000 m trial



A continues progressive test

This test requires progressive increases in galloping speed, in steps, over a period of 2-3 minutes until maximum effort is achieved. An example of this type of test is given below. Remember that the galloping speeds you use will vary depending on the fitness and ability of the horse. The test itself could quite easily take the place of the training session.

Table 1: Results of a continuous progressive test

Step	Galloping Speed	Heart Rate	Time to Cover 400m	Accumulated Time
1	11 m/sec or 39.6 kph	174 bpm	36 sec	36 sec
2	12 m/sec or 43.2 kph	191 bpm	33 sec	69 sec
3	13 m/sec or 46.8 kph	207 bpm	31 sec	100 sec
4	14 m/sec or 50.4 kph	224 bpm	29 sec	129 sec
5	15 m/sec or 54.0 kph	230 bpm	27 sec	156 sec
6	All-out	231 bpm	N/A	

The above test would take approximately 2.5 -3 minutes to complete with only the last three steps being really strenuous. Step 6 requires an all-out effort – maybe which lasts only for 5-10 seconds. The maximum heart rate ought to occur at the end of the test.

A hill test

Many trainers prefer to use a long steep hill to identify their horse's maximum heart rates. However, before attempting the test, it is suggested the horse has traveled the hill many times in training at gradually increasing speeds over several weeks.

It is suggested to roll into the hill and gradually increase running speed until you get to the top or until the horse starts to tire (hopefully both occur at the same time). Check the heart rate at the end of the climb.

Irrespective of which method you decide to use, you should include the following procedures:

- ✍ Where possible, try and standardize conditions such as the time of day (morning, afternoon, or evening) and weather conditions (cool, warm or hot). Record these each time you conduct the test.
- ✍ Plan the time of your horse's feed before it takes the test. Wait at least 2-3 hours after a medium to large feed, before you conduct the test.
- ✍ A true maximum heart rate can only be established when the horse is fully rested. At least one recovery or easy training day before the test is necessary, if the horse has exercised or trained hard 1-2 days beforehand, you have very little chance of reaching its true maximum heart rate.
- ✍ Warm-up and Cool-down the horse thoroughly!
- ✍ If you and/or the horse are inexperienced in conducting the maximum heart rate test, you may wish to repeat it a few days later in order to verify the reading.
- ✍ With some Polar watches (receivers) you can record the heart rate in the memory and retrieve the information at the end of the test. This function certainly makes it easier for the rider who can concentrate on 'horse control' and riding speed.