## 1. NAME OF THE VETERINARY MEDICINAL PRODUCT

Isothesia 1000 mg/g Inhalation Vapour, Liquid

## 2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Each g contains:

**Active Substance:**

Isoflurane 1000 mg

Clear, colourless, mobile, heavy liquid
The veterinary medicinal product contains no excipients.

## 3. CLINICAL INFORMATION

### 3.1 Target Species

Horses, dogs, cats, ornamental birds, reptiles, rats, mice, hamsters, chinchillas, gerbils, guinea pigs and ferrets.

### 3.2 Indications for use for each target species

Induction and maintenance of general anaesthesia.

### 3.3 Contraindications

Do not use in cases of known susceptibility to malignant hyperthermia.
Do not use in cases of hypersensitivity to isoflurane or to other halogenated agents/ halogenated inhalation anaesthetics.

### 3.4 Special warnings

The ease and rapidity of alteration of the depth of anaesthesia with isoflurane and its low metabolism, may be considered advantageous for its use in special groups of animals such as the old or young, and those with impaired hepatic, renal or cardiac function.
The absorption, distribution and elimination of isoflurane are rapid, and it is eliminated largely unchanged via the lungs. These characteristics may make it suitable for groups of animals including the young or old, or those with impaired hepatic, renal or cardiac function, however anaesthetic protocols should be decided on a case by case basis.

### 3.5 Special precautions for use

Special precautions for safe use in the target species:
Isoflurane has little or no analgesic properties. Adequate analgesia should always be given before surgery. The analgesic requirements of the patient should be considered before general anaesthesia is ended.

The use of the product in animals with cardiac disease should be considered only after a benefit-risk assessment by the veterinarian.

It is important to monitor breathing and pulse for the frequency and its features. Respiratory arrest should be treated by assisted ventilation. It is important to maintain airways free and properly oxygenate tissues during the maintenance of anaesthesia. In the case of cardiac arrest, perform a complete cardio pulmonary resuscitation.

The metabolism of isoflurane in birds and small mammals, can be affected by decreases in body temperature, that may occur secondary to a high surface area to body weight ratio. Therefore body temperature should be monitored and kept stable during treatment. Drug metabolism in reptiles is slow and highly dependent upon environmental temperature. Reptiles may be difficult to induce with inhalation agents due to breath holding.

Like other inhalation anaesthetics of this type, isoflurane depresses the respiratory and cardiovascular systems.

When using isoflurane to anaesthetise an animal with a head injury, consideration should be given as to whether artificial ventilation is appropriate to help avoid increased cerebral blood flow by maintaining normal $CO_2$ levels.

Special precautions to be taken by the person administering the veterinary medicinal product to animals:

- Do not breathe the vapour. Users should consult their National Authority for advice on Occupational Exposure Standards for isoflurane.
- Operating rooms and recovery areas should be provided with adequate ventilation or scavenging systems to prevent the accumulation of anaesthetic vapour.
- All scavenging/ extraction systems must be adequately maintained.
- Pregnant and/or breast- feeding women should not have any contact with the product and should avoid operating rooms and animal recovery areas.
- Avoid using masking procedures for prolonged induction and maintenance of general anaesthesia.
- Use cuffed endotracheal intubation when possible for the administration of isoflurane during maintenance of general anaesthesia.
- Care should be taken when dispensing isoflurane, with any spillage removed immediately using an inert and absorbent material e.g. sawdust.
- Wash any splashes from skin and eyes, and avoid contact with the mouth.
- If severe accidental exposure occurs remove the operator from the source of exposure, seek urgent medical assistance and show this label.
- Halogenated anaesthetic agents may induce liver damage. In case of isoflurane this is an idiosyncratic response very rarely seen after repeated exposure.
- To the physician: Ensure a patent airway and give symptomatic and supportive treatment. Note that adrenaline and catecholamines may cause cardiac dysrhythmias.

Special precautions for the protection of the environment:

Although anaesthetics have a low potential for damage to the atmosphere, it is good practice to use charcoal filters with scavenging equipment, rather than to discharge them into the air.

## 3.6 Adverse events

Horses, dogs, cats, ornamental birds, reptiles, rats, mice, hamsters, chinchillas, gerbils, guinea pigs and ferrets.

| | |
|---|---|
| Rare<br>(1 to 10 animals / 10,000 animals treated): | Cardiac arrhythmia<br>Transient bradycardia* |
| Very rare<br>(<1 animal / 10,000 animals treated, including isolated reports): | Malignant hyperthermia*** |
| Undetermined frequency (cannot be estimated from the available data) | Hypotension**<br>Respiratory Depression** |

*Transient.

** Dose related.

***In susceptible animals

Reporting adverse events is important. It allows continuous safety monitoring of a veterinary medicinal product. Reports should be sent, preferably via a veterinarian, to either the marketing authorisation holder or the national competent authority via the national reporting system. See the package leaflet for respective contact details.

## 3.7 Use during pregnancy, lactation or lay

Pregnancy:
Use only accordingly to the benefit-risk assessment by the responsible veterinarian.
Isoflurane has been safely used for anaesthesia during caesarean section in the dog and cat.

Lactation:
Use only accordingly to the benefit-risk assessment by the responsible veterinarian.

## 3.8 Interaction with other medicinal products and other forms of interaction

The action of muscle relaxants in man, especially those of the nondepolarising (competitive) type such as atracurium, pancuronium or vecuronium, is enhanced by isoflurane. Similar potentiation might be expected to occur in the target species, although there is little direct evidence to this effect. Concurrent inhalation of nitrous oxide enhances the effect of isoflurane in man and similar potentiation might be expected in animals.

The concurrent use of sedative or analgesic drugs is likely to reduce the level of isoflurane required to produce and maintain anaesthesia. For example, opiates, alpha-2-agonists, acepromazine, and benzodiazepines have been reported to reduce the MAC values.

Some examples are given in 3.9

Isoflurane has a weaker sensitising action on the myocardium, to the effects of circulating dysrhythmogenic catecholamines, than halothane.
Isoflurane may be degraded to carbon monoxide by dried carbon dioxide absorbents.

## 3.9 Administration routes and dosage

Inhalation Use.
Isoflurane should be administered using an accurately calibrated vaporiser in an appropriate anaesthetic circuit, since levels of anaesthesia may be altered rapidly and easily.

Isoflurane may be administered in oxygen or oxygen/nitrous oxide mixtures.
The MAC (minimal alveolar concentration in oxygen) or effective dose $ED_{50}$ values and suggested concentrations given below for the target species should be used as a guide or starting point only. The actual concentrations required in practice will depend on many variables, including the concomitant use of other drugs during the anaesthetic procedure and the clinical status of the patient.

Isoflurane may be used in conjunction with other drugs commonly used in veterinary anaesthetic regimes for premedication, induction and analgesia. Some specific examples are given in the individual species information. The use of analgesia for painful procedures is consistent with good veterinary practice.

Recovery from isoflurane anaesthesia is usually smooth and rapid. The analgesic requirements of the patient should be considered before the termination of general anaesthesia.

### HORSES

The MAC for isoflurane in the horse is approximately 1.31%

Premedication

Isoflurane may be used with other drugs commonly used in veterinary anaesthetic regimes. The following drugs have been found to be compatible with isoflurane: acepromazine, alfentanil, atracurium, butorphanol, detomidine, diazepam, dobutamine, dopamine, guaiphenesin, ketamine, morphine, pentazocine, pethidine, thiamylal, thiopentone and xylazine. Drugs used for premedication should be selected for the individual patient. However, the potential interactions below should be noted.

Interactions

Detomidine and xylazine have been reported to reduce the MAC for isoflurane in horses.

Induction

As it is not normally practicable to induce anaesthesia in adult horses using isoflurane, induction should be by the use of ketamine, guaifenesin or a short acting barbiturate such as thiopentone sodium.Concentrations of 3 to 5% isoflurane may then be used to achieve the desired depth of anaesthesia in 5 to 10 minutes

Isoflurane at a concentration of 3 to 5% in a high flow oxygen may be used for induction in foals.

Maintenance

Anaesthesia may be maintained using 1.5% to 2.5% isoflurane.

Recovery

Recovery is usually smooth and rapid.

**DOGS**

The MAC for isoflurane in the dog is approximately 1.28%.

Premedication

Isoflurane may be used with other drugs commonly used in veterinary anaesthetic regimes. The following drugs have been found to be compatible with isoflurane: acepromazine, atropine, butorphanol, buprenorphine, bupivacaine, diazepam, dobutamine, ephedrine, epinephrine, etomidate, glycopyrrolate, ketamine, medetomidine, midazolam, methoxamine, oxymorphone, propofol, thiamylal, thiopentone and xylazine. Drugs used for premedication should be selected for the individual patient. However, the potential interactions below should be noted.

Interactions

Morphine, oxymorphone, acepromazine, medetomidine, medetomidine plus midazolam have been reported to reduce the MAC for isoflurane in dogs.

The concomitant administration of midazolam/ketamine during isoflurane anaesthesia may result in marked cardiovascular effects, particularly arterial hypotension.

The depressant effects of propanolol on myocardial contractility are reduced during isoflurane anaesthesia, indicating a moderate degree of β-receptor activity.

Induction

Induction is possible by face mask using up to 5% isoflurane, with or without premedication.

Maintenance

Anaesthesia may be maintained using 1.5% to 2.5% isoflurane.

Recovery

Recovery is usually smooth and rapid.

**CATS**

The MAC for isoflurane in the cat is approximately 1.63%.

Premedication

Isoflurane may be used with other drugs commonly used in veterinary anaesthetic regimes. The following drugs have been found to be compatible with isoflurane: acepromazine, atracurium, atropine, diazepam, ketamine, and oxymorphone. Drugs used for premedication should be selected for the individual patient. However, the potential interactions below should be noted.

Interactions

Intravenous administration of midazolam- butorphanol has been reported to alter several cardio-respiratory parameters in isoflurane- induced cats as has epidural fentanyl and medetomidine. Isoflurane has been shown to reduce the sensitivity of the heart to adrenaline (epinephrine).

Induction

Induction is possible by face mask using up to 4% isoflurane, with or without premedication.

Maintenance

Anaesthesia may be maintained using 1.5% to 3% isoflurane.

Recovery

Recovery is usually smooth and rapid.

**ORNAMENTAL BIRDS**

Few MAC/$ED_{50}$ values have been recorded. Examples are 1.34% for the Sandhill crane, 1.45% for the racing pigeon, reduced to 0.89% by the administration of midazolam, and 1.44% for cockatoos, reduced to 1.08% by the administration of butorphanol analgesic.

The use of isoflurane anaesthesia has been reported for many species, from small birds such as zebra finches, to large birds such as vultures, eagles and swans.

Drug interactions/compatibilities

Propofol has been demonstrated in the literature to be compatible with isoflurane anaesthesia in swans.

Interactions

Butorphanol has been reported to reduce the MAC for isoflurane in cockatoos. Midazolam has been reported to reduce the MAC for isoflurane in pigeons.

Induction

Induction with 3 to 5% isoflurane is normally rapid. Induction of anaesthesia with propofol, followed by isoflurane maintenance, has been reported for swans.

Maintenance

The maintenance dose depends on the species and individual. Generally, 2 to 3% is suitable and safe.
Only 0.6 to 1% may be needed for some stork and heron species.
Up to 4 to 5% may be needed for some vultures and eagles.
3.5 to 4% may be needed for some ducks and geese.
Generally, birds respond very rapidly to changes in concentration of isoflurane.

Recovery

Recovery is usually smooth and rapid.

## REPTILES

Isoflurane is considered by several authors to be the anaesthetic of choice for many species. The literature records its use on a wide variety of reptiles (eg. various species of lizard, tortoise, iguanas, chameleon and snakes).
The $ED_{50}$ was determined in the desert iguana to be 3.14% at 35˚C and 2.83% at 20˚C.

Drug interactions/ compatibilities

No specific publications on reptiles have reviewed compatibilities or interactions of other drugs with isoflurane anaesthesia.

Induction

Induction is usually rapid at 2 to 4% isoflurane.

Maintenance

1 to 3% is a useful concentration

Recovery

Recovery is usually smooth and rapid

## RATS, MICE, HAMSTERS, CHINCHILLAS, GERBILS, GUINEA PIGS AND FERRETS

Isoflurane has been recommended for anaesthesia of a wide variety of small mammals.

The MAC for mice has been cited as 1.34%, and for the rat as 1.38%, 1.46% and 2.4%.

Drug interactions/ compatibilities

No specific publications on small mammals have reviewed compatibilities or interactions of other drugs with isoflurane anaesthesia.

Induction

Isoflurane concentration 2 to 3%.

Maintenance

Isoflurane concentration 0.25 to 2%.

Recovery

Recovery is usually smooth and rapid.

**Summary table**

| Species | MAC (%) | Induction (%) | Maintenance (%) | Recovery |
|---|---|---|---|---|
| Horses | 1.31 | 3.0 – 5.0 (foals) | 1.5 – 2.5 | Smooth and rapid |
| Dogs | 1.28 | Up to 5.0 | 1.5 – 2.5 | Smooth and rapid |
| Cats | 1.63 | Up to 4.0 | 1.5 – 3.0 | Smooth and rapid |
| Ornamental birds | See posology | 3.0 – 5.0 | See posology | Smooth and rapid |
| Reptiles | See posology | 2.0 – 4.0 | 1.0 – 3.0 | Smooth and rapid |
| Rats, mice, hamsters, chinchillas, gerbils, guinea pigs and ferrets | 1.34 (mouse) 1.38/1.46/2.40 (rat) | 2.0 – 3.0 | 0.25 – 2.0 | Smooth and rapid |

## 3.10 Symptoms of overdose (and where applicable, emergency procedures and antidotes)

Isoflurane overdose may result in profound respiratory depression. Therefore, respiration must be monitored closely and supported when necessary with supplementary oxygen and/ or assisted ventilation.
In cases of severe cardiopulmonary depression, administration of isoflurane should be discontinued, the breathing circuit should be flushed with oxygen, the existence of a patent airway ensured, and assisted or controlled ventilation with pure oxygen initiated. Cardiovascular depression should be treated with plasma expanders, pressor agents, antiarrhythmic agents or other appropriate techniques.

## 3.11 Special restrictions for use and special conditions for use, including restrictions on the use of antimicrobial and antiparasitic veterinary medicinal products in order to limit the risk of development of resistance.

For administration by a veterinarian or under their direct supervision.

## 3.12 Withdrawal period(s)

Horses:
Meat and offal: 2 days
Not inimized for use in mares producing milk for human consumption.

## 4. PHARMACOLOGICAL INFORMATION

### 4.1 ATCvetcode: QN01AB06

### 4.2 Pharmacodynamics

Isoflurane produces unconsciousness by its action on the central nervous system. It has little or no analgesic properties.
Like other inhalation anaesthetics of this type, isoflurane depresses the respiratory and cardiovascular systems.
Isoflurane is absorbed on inhalation and is rapidly distributed via the bloodstream to other tissues, including the brain.
Its blood/gas partition coefficient at 37℃ is 1.4. The absorption and distribution of isoflurane and the elimination of non-metabolised isoflurane by the lungs are all rapid, with the clinical consequences of rapid induction and recovery and easy and rapid control of the depth of anaesthesia.

### 4.3 Pharmacokinetics

Metabolism of isoflurane is minimal (about 0.2%, mainly to inorganic fluoride) and almost all of the administered isoflurane is excreted unchanged by the lungs.

## 5. PHARMACEUTICAL PARTICULARS

### 5.1 Major incompatibilities

Isoflurane has been reported to interact with dry carbon dioxide absorbents to form carbon monoxide. In order to inimize the risk of formation of carbon monoxide in rebreathing circuits and the possibility of elevated carboxyhaemoglobin levels, carbon dioxide absorbents should not be allowed to dry out.

### 5.2 Shelf life

Shelf-life of the veterinary medicinal product as packaged for sale: 5 years

### 5.3 Special precautions for storage

Do not store above 25°C. Protect from direct sunlight and direct heat.
Store in tightly closed original container in order to protect from moisture.

### 5.4 Nature and composition of immediate packaging

Type III amber glass bottles containing 100 ml or 250 ml of isoflurane, fitted with a black phenolic/urea or polypropylene screw cap with a low-density polyethylene cone insert.

Pack sizes:
Bottle of 100ml
Bottle of 250 ml
Not all pack sizes may be marketed.

### 5.5 Special precautions for the disposal of unused veterinary medicinal products or waste materials derived from the use of such products

Medicines should not be disposed of via wastewater or household waste.
Use take-back schemes for the disposal of any unused veterinary medicinal product or waste materials derived thereof in accordance with local requirements and with any national collection systems applicable to the veterinary medicinal product concerned. These measures should help to protect the environment.

## 6. NAME OF THE MARKETING AUTHORISATION HOLDER

Piramal Critical Care B.V.

## 7. MARKETING AUTHORISATION NUMBER

VPA22583/002/001

## 8. DATE OF FIRST AUTHORISATION

09/04/2020

## 9. DATE OF THE LAST REVISION OF THE SUMMARY OF THE PRODUCT CHARACTERISTICS

03/09/2026

## PROHIBITION OF SALE, SUPPLY AND/OR USE

Not to be sold to animal owners.
To be supplied only on veterinary prescription.
Exclusive use of the veterinary surgeon. Sale to the public is prohibited. The detention and the supply are allowed exclusively to the veterinary surgeon upon presentation of three copies veterinary prescription not renewable.

## 10. CLASSIFICATION OF VETERINARY MEDICINAL PRODUCTS

Veterinary medicinal product subject to prescription.
Detailed information on this veterinary medicinal product is available in the Union Product Database (https://medicines.health.europa.eu/veterinary).