

SUMMARY OF PRODUCT CHARACTERISTICS

1. NAME OF THE VETERINARY MEDICINAL PRODUCT

Isothesia 1000 mg/g Inhalation Vapour, Liquid (AT, BE, CZ, DE, DK, EL, NL, FI, FR, IE, IT, PL, RO, SE)

Isofane 1000 mg/g Inhalation Vapour Liquid (ES)

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Each g contains:

Active Substance:

Isoflurane 1000 mg

3. PHARMACEUTICAL FORM

Inhalation vapour, Liquid.
Clear, colourless, mobile, heavy liquid

4. CLINICAL PARTICULARS

4.1 Target Species

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

4.2 Indications for use, specifying the target species

Induction and maintenance of general anaesthesia.

4.3 Contraindications

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

4.4 Special warnings for each target species

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 patients such as the old or young, and those with impaired hepatic, renal or cardiac function.

4.5 Special precautions for use

Special precautions for use in animals

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 patients with cardiac disease should be considered only after a risk/ benefit 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 CO₂ 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.
- *Advice to Doctors:* Ensure a patent airway and give symptomatic and supportive treatment. Note that adrenaline and catecholamines may cause cardiac dysrhythmias.

Other Precautions

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.

4.6 Adverse reactions (frequency and seriousness)

Isoflurane produces hypotension and respiratory depression in a dose- related manner. Cardiac arrhythmias and transient bradycardia have been reported rarely. Malignant hyperthermia has been reported very rarely in susceptible animals.

The frequency of adverse reactions is defined using the following convention:

- very common (more than 1 in 10 animals treated displaying adverse reaction(s))
- common (more than 1 but less than 10 animals in 100 animals treated)
- uncommon (more than 1 but less than 10 animals in 1,000 animals treated)
- rare (more than 1 but less than 10 animals in 10,000 animals treated)
- very rare (less than 1 animal in 10,000 animals treated, including isolated reports).

4.7 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.

4.8 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 4.9.

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.

4.9 Amounts to be administered and administration route

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 ED₅₀ 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.

HORSE

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, guaifenesin, 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.

DOG

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 propranolol 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.

CAT

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/ED₅₀ 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 ED₅₀ 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

4.10 Overdose (symptoms, emergency procedures, antidotes) if necessary

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.

4.11 Withdrawal period(s)

Horses:

Meat and offal: 2 days

Not authorised for use in mares producing milk for human consumption.

5. PHARMACOLOGICAL PROPERTIES

Pharmacotherapeutic group: Anaesthetic, general - halogenated hydrocarbons

ATCvetcode: QN01AB06

5.1 Pharmacodynamic properties

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°C 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.

5.2 Pharmacokinetic particulars

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.

6. PHARMACEUTICAL PARTICULARS

6.1 List of excipients

None

6.2 Major incompatibilities

Isoflurane has been reported to interact with dry carbon dioxide absorbents to form carbon monoxide. In order to minimise 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.

6.3 Shelf life

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

6.4 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.

6.5 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 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.

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

Any unused veterinary medicinal product or waste material derived from such veterinary medicinal products should be disposed of in accordance with local requirements.

7. MARKETING AUTHORISATION HOLDER

Piramal Critical Care B.V.
Rouboslaan 32 (ground floor), 2252 TR
Voorschoten
The Netherlands

8. MARKETING AUTHORISATION NUMBER

To be completed nationally

9. DATE OF FIRST AUTHORISATION

To be completed nationally

10. DATE OF REVISION OF THE TEXT

To be completed nationally

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.

PARTICULARS TO APPEAR ON THE OUTER PACKAGE

{Carton 100 ml and 250 ml}

1. NAME OF THE VETERINARY MEDICINAL PRODUCT

Isothesia 1000 mg/g Inhalation Vapour, Liquid (AT, BE, CZ, DE, DK, EL, NL, FI, FR, IE, IT, PL, RO, SE, CZ)

Isofane 1000 mg/g Inhalation Vapour Liquid (ES)

2. STATEMENT OF ACTIVE AND OTHER SUBSTANCES

Isoflurane 1000 mg/g

3. PHARMACETICAL FORM

Inhalation Vapour, Liquid

4. PACKAGE SIZE

100 ml

250 ml

5. TARGET SPECIES

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

6. INDICATION(S)**7. METHOD AND ROUTE(S) OF ADMINISTRATION**

Inhalation use.

Read the package leaflet before use.

8. WITHDRAWAL PERIOD(S)

Withdrawal periods:

Horses:

Meat and offal: 2 days

Not authorised for use in mares producing milk for human consumption.

9. SPECIAL WARNING(S), IF NECESSARY

Read the package leaflet before use.

10. EXPIRY DATE

EXP

11. SPECIAL STORAGE CONDITIONS

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

This medicine contains fluorinated greenhouse gases.

Isoflurane 100 ml bottle -Each container contains 149.6 g of isoflurane corresponding to 0.0806 tonne CO₂ equivalent (global warming potential GWP = 539)

Isoflurane 250 ml bottle - Each container contains 374 g of isoflurane corresponding to 0.2016 tonne CO₂ equivalent (global warming potential GWP = 539)

12. SPECIFIC PRECAUTIONS FOR THE DISPOSAL OF UNUSED PRODUCTS OR WASTE MATERIAL, IF ANY

Disposal: Read Package leaflet

13. THE WORDS “FOR ANIMAL TREATMENT ONLY” AND CONDITIONS OR RESTRICTIONS REGARDING SUPPLY AND USE, IF APPLICABLE

For animal treatment only.

To be supplied only on veterinary prescription.

14. THE WORDS “KEEP OUT OF THE SIGHT AND REACH OF CHILDREN”

Keep out of the sight and reach of children.

15. NAME AND ADDRESS OF THE MARKETING AUTHORISATION HOLDER

Piramal Critical Care B.V.
Rouboslaan 32 (ground floor), 2252 TR
Voorschoten
The Netherlands

16. MARKETING AUTHORISATION NUMBER

To be completed nationally

17. MANUFACTURER’S BATCH NUMBER

To be completed nationally

PARTICULARS TO APPEAR ON THE IMMEDIATE PACKAGE

{LABEL 100 ml and 250 ml}

1. NAME OF THE VETERINARY MEDICINAL PRODUCT

Isothesia 1000 mg/g Inhalation Vapour, Liquid (AT, BE, CZ, DE, DK, EL, NL, FI, FR, IE, IT, PL, RO, SE, CZ)

Isofane 1000 mg/g Inhalation Vapour Liquid (ES)

2. STATEMENT OF ACTIVE AND OTHER SUBSTANCES

Isoflurane 1000 mg/g

3. PHARMACETICAL FORM

Inhalation Vapour, Liquid

4. PACKAGE SIZE

100 ml

250 ml

5. TARGET SPECIES

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

6. INDICATION(S)**7. METHOD AND ROUTE(S) OF ADMINISTRATION**

Inhalation use.

Read the package leaflet before use.

8. WITHDRAWAL PERIOD(S)

Withdrawal periods:

Horses:

Meat and offal: 2 days

Not authorised for use in mares producing milk for human consumption.

9. SPECIAL WARNING(S), IF NECESSARY

Read the package leaflet before use.

10. EXPIRY DATE

EXP

11. SPECIAL STORAGE CONDITIONS

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

Contains fluorinated greenhouse gases.

12. SPECIAL PRECAUTIONS FOR THE DISPOSAL OF UNUSED PRODUCTS OR WASTE MATERIAL, IF ANY**13. THE WORDS “FOR ANIMAL TREATMENT ONLY” AND CONDITIONS OR RESTRICTIONS REGARDING SUPPLY AND USE, IF APPLICABLE**

For Animal treatment only.

To be supplied only on veterinary prescription.

14. THE WORDS “KEEP OUT OF THE SIGHT AND REACH OF CHILDREN”

Keep out of the sight and reach of children.

15. NAME AND ADDRESS OF THE MARKETING AUTHORISATION HOLDER

Piramal Critical Care B.V.
Rouboslaan 32 (ground floor), 2252 TR
Voorschoten
The Netherlands

16. MARKETING AUTHORISATION NUMBER

To be completed nationally

17. MANUFACTURER'S BATCH NUMBER
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To be completed nationally

PACKAGE LEAFLET

Isothesia 1000 mg/g Inhalation Vapour, Liquid (AT, BE, CZ, DE, DK, EL, NL, FI, FR, IE, IT, PL, RO, SE)

Isofane 1000 mg/g Inhalation Vapour Liquid (ES)

1. NAME AND ADDRESS OF THE MARKETING AUTHORISATION HOLDER AND OF THE MANUFACTURING AUTHORISATION HOLDER RESPONSIBLE FOR BATCH RELEASE, IF DIFFERENT

Marketing authorisation holder:

Piramal Critical Care B.V.
Rouboslaan 32 (ground floor), 2252 TR
Voorschoten
The Netherlands

Manufacturer responsible for batch release:

Piramal Critical Care B.V.
Rouboslaan 32 (ground floor), 2252 TR
Voorschoten
The Netherlands

2. NAME OF THE VETERINARY MEDICINAL PRODUCT

Isothesia 1000 mg/g Inhalation Vapour, Liquid
Isoflurane

3. STATEMENT OF THE ACTIVE SUBSTANCE(S) AND OTHER INGREDIENT(S)

Active Substance: Isoflurane 1000 mg/g
Inhalation vapour, Liquid
Clear, colourless, mobile, heavy liquid.
The veterinary medicinal product contains no excipients.

4. INDICATION(S)

Induction and maintenance of general anaesthesia.

5. 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/or other halogenated inhalation anaesthetics.

6. ADVERSE REACTIONS

Isoflurane produces hypotension and respiratory depression in a dose- related manner. Cases of Cardiac arrhythmias and transient bradycardia have been reported rarely.

Malignant hyperthermia has been reported very rarely in susceptible animals.

The frequency of adverse reactions is defined using the following convention:

- very common (more than 1 in 10 animals treated displaying adverse reaction(s))
- common (more than 1 but less than 10 animals in 100 animals treated)
- uncommon (more than 1 but less than 10 animals in 1,000 animals treated)
- rare (more than 1 but less than 10 animals in 10,000 animals treated)
- very rare (less than 1 animal in 10,000 animals treated, including isolated reports).

If you notice any side effects, even those not already listed in this package leaflet or you think that the medicine has not worked, please inform your veterinary surgeon.

Alternatively you can report via your national reporting system.

7. TARGET SPECIES

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

8. DOSAGE FOR EACH SPECIES, ROUTE(S) AND METHOD OF ADMINISTRATION

The product should only be used in an isoflurane specific vapouriser.

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 ED₅₀ 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.

HORSE

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.

DOG

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 propranolol 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.

CAT

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/ED₅₀ 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 ED₅₀ 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

9. ADVICE ON CORRECT ADMINISTRATION

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

10. WITHDRAWAL PERIOD(S)

Horses:

Meat and offal: 2 days

Not authorised for use in mares producing milk for human consumption.

11. SPECIAL STORAGE PRECAUTIONS

Keep out of the sight and reach of children.

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.

Do not use this veterinary medicinal product after the expiry date which is stated on the label after EXP. The expiry date refers to the last day of that month.

12. SPECIAL WARNINGS(S)

Special warnings for each target species:

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 patients 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 patients 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.

Special precautions for use in animals:

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 patients with cardiac disease should be considered only after a risk/ benefit 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 CO₂ 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.
- Advice to Doctors: Ensure a patent airway and give symptomatic and supportive treatment. Note that adrenaline and catecholamines may cause cardiac dysrhythmias.

Other Precautions

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.

Pregnancy and lactation:

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.

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.

Isoflurane has a weaker sensitising action on the myocardium, to the effects of circulating dysrhythmic catecholamines, than halothane.

Overdose (symptoms, emergency procedures, 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.

Incompatibilities:

Isoflurane has been reported to interact with dry carbon dioxide absorbents to form carbon monoxide. In order to minimise 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.

13. SPECIAL PRECAUTIONS FOR THE DISPOSAL OF UNUSED PRODUCT OR WASTE MATERIALS, IF ANY

Unused medicinal products or waste derived from medicinal products should not be disposed of via wastewater or household waste but must be given in the appropriate collection systems and disposal for unused or expired medicines.

14. DATE ON WHICH THE PACKAGE LEAFLET WAS LAST APPROVED:

To be completed nationally

15. OTHER INFORMATION

Pack sizes: 100 ml, 250 ml

Not all pack sizes may be marketed

This medicine contains fluorinated greenhouse gases.

Isoflurane 100 ml bottle -Each container contains 149.6 g of isoflurane corresponding to 0.0806 tonne CO₂ equivalent (global warming potential GWP = 539)

Isoflurane 250 ml bottle - Each container contains 374 g of isoflurane corresponding to 0.2016 tonne CO₂ equivalent (global warming potential GWP = 539)