

Gas Mixture (15% arsine, 85% hydrogen)

Safety Data Sheet P-4871

This SDS conforms to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.

Date of issue: 01/01/1985 Revision date: 10/26/2016 Supersedes: 01/16/2015

SECTION 1: Product and company identification

1.1. Product identifier

Product form : Mixture
 Name : Gas Mixture (15% arsine, 85% hydrogen)
 Formula : Mixture of 15 percent arsine and 85 percent hydrogen
 Other means of identification : Ion Implantation Mixture (AsH₃ - H₂)

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Industrial use. Use as directed.

1.3. Details of the supplier of the safety data sheet

Praxair, Inc.
 10 Riverview Drive
 Danbury, CT 06810-6268 - USA
 T 1-800-772-9247 (1-800-PRAXAIR) - F 1-716-879-2146
www.praxair.com

1.4. Emergency telephone number

Emergency number : Onsite Emergency: 1-800-645-4633

CHEMTREC, 24hr/day 7days/week
 — Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887
 (collect calls accepted, Contract 17729)

SECTION 2: Hazard identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Gas 1 H220
 Compressed gas H280
 Acute Tox. 1 (Inhalation:gas) H330
 Carc. 1A H350
 STOT RE 2 H373

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :



GHS02

GHS04

GHS06

GHS08

Signal word (GHS-US) :

DANGER

Hazard statements (GHS-US) :

H220 - **EXTREMELY FLAMMABLE GAS**
 H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED
 H330 - FATAL IF INHALED
 H350 - MAY CAUSE CANCER
 H373 - MAY CAUSE DAMAGE TO ORGANS THROUGH PROLONGED OR REPEATED EXPOSURE

Precautionary statements (GHS-US) :

P201 - Obtain special instructions before use
 P202 - Do not handle until all safety precautions have been read and understood
 P210 - Keep away from Heat, Open flames, Sparks, Hot surfaces. - No smoking
 P260 - Do not breathe gas
 P271 - Use and store only outdoors or in a well-ventilated area
 P280 - Wear protective gloves, protective clothing, eye protection, face protection
 P284 - [In case of inadequate ventilation] wear respiratory protection
 P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing.

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P308+P313 - If exposed or concerned: Get medical advice/attention
 P310 - Immediately call a poison center or doctor/physician
 P314 - Get medical advice/attention if you feel unwell
 P320 - Specific treatment is urgent (see First aid measures on this label)
 P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely
 P381 - Eliminate all ignition sources if safe to do so
 P403 - Use and store only outdoors or in a well-ventilated place
 P403+P233 - Store in a well-ventilated place. Keep container tightly closed
 P405 - Store locked up
 P410+P403 - Protect from sunlight. Store in a well-ventilated place
 P501 - Dispose of contents/container in accordance with container Supplier/owner instructions

2.3. Other hazards

Other hazards not contributing to the classification : Asphyxiant in high concentrations.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/Information on ingredients

3.1. Substance

Not applicable

3.2. Mixture

| Name | Product identifier | % |
|----------|--------------------|----|
| Hydrogen | (CAS No) 1333-74-0 | 85 |
| Arsine | (CAS No) 7784-42-1 | 15 |

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

First-aid measures after skin contact : Adverse effects not expected from this product.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Contact an ophthalmologist immediately.. Get immediate medical attention.

First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

No additional information available

4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

SECTION 5: Firefighting measures

5.1. Extinguishing media

No additional information available

5.2. Special hazards arising from the substance or mixture

Reactivity : No reactivity hazard other than the effects described in sub-sections below.

5.3. Advice for firefighters

Firefighting instructions : Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.

Protection during firefighting : Compressed gas: asphyxiant. Suffocation hazard by lack of oxygen.

Special protective equipment for fire fighters : Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.

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Specific methods : Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas containers to rupture. Cool endangered containers with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems

Stop flow of product if safe to do so

Use water spray or fog to knock down fire fumes if possible.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Wear self-contained breathing apparatus when entering area unless atmosphere is proven to be safe. Ensure adequate air ventilation. Evacuate area. Try to stop release. Monitor concentration of released product. Evacuate area. Ensure adequate ventilation. Stop leak if safe to do so.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

Try to stop release. Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g. wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store in a cool, well-ventilated place. Store and use with adequate ventilation. Store only where temperature will not exceed 125°F (52°C). Firmly secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

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7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

| Arsine (7784-42-1) | | |
|----------------------|-------------------------------------|-----------------------|
| ACGIH | ACGIH TLV-TWA (ppm) | 0.005 ppm |
| USA OSHA | OSHA PEL (TWA) (mg/m ³) | 0.2 mg/m ³ |
| USA OSHA | OSHA PEL (TWA) (ppm) | 0.05 ppm |
| Hydrogen (1333-74-0) | | |
| ACGIH | Remark (ACGIH) | Simple asphyxiant |
| USA OSHA | Not established | |

8.2. Exposure controls

| | |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Appropriate engineering controls | : Provide adequate general and local exhaust ventilation. Alarm detectors should be used when toxic gases may be released. Product to be handled in a closed system. Ensure exposure is below occupational exposure limits (where available). Product to be handled in a closed system and under strictly controlled conditions. |
| Eye protection | : Wear safety glasses with side shields. |
| Respiratory protection | : When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA). |
| Environmental exposure controls | : Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment. |
| Other information | : Wear leather safety gloves and safety shoes when handling cylinders. |

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

| | |
|---------------------------------------------|----------------------------|
| Physical state | : Gas |
| Color | : Colorless |
| Odor | : No data available |
| Odor threshold | : No data available |
| pH | : Not applicable. |
| Relative evaporation rate (butyl acetate=1) | : No data available |
| Relative evaporation rate (ether=1) | : Not applicable. |
| Melting point | : No data available |
| Freezing point | : No data available |
| Boiling point | : No data available |
| Flash point | : No data available |
| Auto-ignition temperature | : No data available |
| Decomposition temperature | : No data available |
| Flammability (solid, gas) | : No data available |
| Vapor pressure | : Not applicable. |
| Relative vapor density at 20 °C | : No data available |
| Relative density | : No data available |
| Relative gas density | : 0.463 |
| Solubility | : Water: No data available |
| Log Pow | : Not applicable. |

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Log Kow : Not applicable.
 Viscosity, kinematic : Not applicable.
 Viscosity, dynamic : Not applicable.
 Explosive properties : Not applicable.
 Oxidizing properties : None.
 Explosion limits : No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

No additional information available

10.5. Incompatible materials

No additional information available

10.6. Hazardous decomposition products

No additional information available

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Inhalation:gas: FATAL IF INHALED.

| Ion Implantation Mixture (AsH3 - H2) | |
|---------------------------------------------|----------------|
| ATE US (gases) | 66.667 ppmV/4h |
| Arsine (7784-42-1) | |
| LC50 inhalation rat (ppm) | 10 ppm/4h |
| ATE US (gases) | 10.000 ppmV/4h |
| Hydrogen (1333-74-0) | |
| LC50 inhalation rat (ppm) | > 15000 ppm/1h |

Skin corrosion/irritation : Not classified
 pH: Not applicable.
 Serious eye damage/irritation : Not classified
 pH: Not applicable.
 Respiratory or skin sensitization : Not classified
 Germ cell mutagenicity : Not classified
 Carcinogenicity : MAY CAUSE CANCER.

| Arsine (7784-42-1) | |
|---------------------------|----------------------------|
| IARC group | 1 - Carcinogenic to humans |

Reproductive toxicity : Not classified
 Specific target organ toxicity (single exposure) : Not classified
 Specific target organ toxicity (repeated exposure) : MAY CAUSE DAMAGE TO ORGANS THROUGH PROLONGED OR REPEATED EXPOSURE.

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Aspiration hazard : Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : No ecological damage caused by this product.

12.2. Persistence and degradability

Ion Implantation Mixture (AsH3 - H2)

| | |
|-------------------------------|----------------------------------------------|
| Persistence and degradability | No ecological damage caused by this product. |
|-------------------------------|----------------------------------------------|

Arsine (7784-42-1)

| | |
|-------------------------------|-------------------------------------|
| Persistence and degradability | Not applicable for inorganic gases. |
|-------------------------------|-------------------------------------|

Hydrogen (1333-74-0)

| | |
|-------------------------------|----------------------------------------------|
| Persistence and degradability | No ecological damage caused by this product. |
|-------------------------------|----------------------------------------------|

12.3. Bioaccumulative potential

Ion Implantation Mixture (AsH3 - H2)

| | |
|---------------------------|----------------------------------------------|
| Log Pow | Not applicable. |
| Log Kow | Not applicable. |
| Bioaccumulative potential | No ecological damage caused by this product. |

Arsine (7784-42-1)

| | |
|---------------------------|-------------------------------------|
| Log Pow | Not applicable for inorganic gases. |
| Bioaccumulative potential | No data available. |

Hydrogen (1333-74-0)

| | |
|---------------------------|----------------------------------------------|
| BCF fish 1 | (no bioaccumulation expected) |
| Log Pow | Not applicable. |
| Log Kow | Not applicable. |
| Bioaccumulative potential | No ecological damage caused by this product. |

12.4. Mobility in soil

Ion Implantation Mixture (AsH3 - H2)

| | |
|------------------|--------------------|
| Mobility in soil | No data available. |
|------------------|--------------------|

Arsine (7784-42-1)

| | |
|----------------|---------------------------------------------------------------------------------------------|
| Ecology - soil | Because of its high volatility, the product is unlikely to cause ground or water pollution. |
|----------------|---------------------------------------------------------------------------------------------|

Hydrogen (1333-74-0)

| | |
|------------------|----------------------------------------------|
| Mobility in soil | No data available. |
| Ecology - soil | No ecological damage caused by this product. |

12.5. Other adverse effects

Effect on ozone layer : None

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Avoid release to the environment. Do not attempt to dispose of residual or unused quantities. Return container to supplier.

SECTION 14: Transport information

In accordance with DOT


| | |
|--------------------------------|--------------------------------------------------------|
| Transport document description | : UN1953 Compressed gas, toxic, flammable, n.o.s., 2.3 |
| UN-No.(DOT) | : UN1953 |
| Proper Shipping Name (DOT) | : Compressed gas, toxic, flammable, n.o.s. |
| Class (DOT) | : 2.3 - Class 2.3 - Poisonous gas 49 CFR 173.115 |

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| | |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hazard labels (DOT) | : Poison Gas 2.3 - Poison gas 2.1 - Flammable gas |
| |  |
| DOT Symbols | : G - Identifies proper shipping name (PSN) requiring the addition of technical name(s) in parentheses following the PSN |
| DOT Special Provisions (49 CFR 172.102) | : 1 - This material is poisonous by inhalation (see 171.8 of this subchapter) in Hazard Zone A (see 173.116(a) or 173.133(a) of this subchapter), and must be described as an inhalation hazard under the provisions of this subchapter |

Additional information

| | |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Other information | : No supplementary information available. |
| Special transport precautions | : Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted. |

Transport by sea

| | |
|-----------------------------|--------------------------------------------|
| UN-No. (IMDG) | : 1953 |
| Proper Shipping Name (IMDG) | : COMPRESSED GAS, TOXIC, FLAMMABLE, N.O.S. |
| Class (IMDG) | : 2 - Gases |

Air transport

| | |
|-----------------------------|--------------------------------------------|
| UN-No. (IATA) | : 1953 |
| Proper Shipping Name (IATA) | : Compressed gas, toxic, flammable, n.o.s. |
| Class (IATA) | : 2 |

SECTION 15: Regulatory information

15.1. US Federal regulations

Ion Implantation Mixture (AsH3 - H2)

| | |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| SARA Section 311/312 Hazard Classes | Immediate (acute) health hazard Delayed (chronic) health hazard Sudden release of pressure hazard Fire hazard |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------|

All components of this product are listed on the Toxic Substances Control Act (TSCA) inventory.

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Arsine (7784-42-1)

| | |
|----------------------------------------------------|--------|
| Listed on the United States SARA Section 302 | |
| SARA Section 302 Threshold Planning Quantity (TPQ) | 100 lb |

15.2. International regulations

CANADA

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Arsine (7784-42-1)

Listed on the Canadian DSL (Domestic Substances List)

Hydrogen (1333-74-0)

Listed on the Canadian DSL (Domestic Substances List)

EU-Regulations

Arsine (7784-42-1)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

15.2.2. National regulations

Arsine (7784-42-1)

Listed on IARC (International Agency for Research on Cancer)
 Listed on the AICS (Australian Inventory of Chemical Substances)
 Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)
 Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory
 Listed on the Korean ECL (Existing Chemicals List)
 Listed on NZIoC (New Zealand Inventory of Chemicals)
 Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)
 Japanese Poisonous and Deleterious Substances Control Law
 Japanese Pollutant Release and Transfer Register Law (PRTR Law)
 Listed on the Canadian IDL (Ingredient Disclosure List)
 Listed on INSQ (Mexican National Inventory of Chemical Substances)

15.3. US State regulations

Ion Implantation Mixture (AsH3 - H2)(I)

| | |
|---------------------------------------------------------------------|----|
| U.S. - California - Proposition 65 - Carcinogens List | No |
| U.S. - California - Proposition 65 - Developmental Toxicity | No |
| U.S. - California - Proposition 65 - Reproductive Toxicity - Female | No |
| U.S. - California - Proposition 65 - Reproductive Toxicity - Male | No |

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer, developmental and/or reproductive harm

Arsine (7784-42-1)

| | | | | |
|-------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------|
| U.S. - California - Proposition 65 - Carcinogens List | U.S. - California - Proposition 65 - Developmental Toxicity | U.S. - California - Proposition 65 - Reproductive Toxicity - Female | U.S. - California - Proposition 65 - Reproductive Toxicity - Male | Non-significant risk level (NSRL) |
| No | No | No | No | |

Hydrogen (1333-74-0)

| | | | | |
|-------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------|
| U.S. - California - Proposition 65 - Carcinogens List | U.S. - California - Proposition 65 - Developmental Toxicity | U.S. - California - Proposition 65 - Reproductive Toxicity - Female | U.S. - California - Proposition 65 - Reproductive Toxicity - Male | Non-significant risk level (NSRL) |
| No | No | No | No | |

Arsine (7784-42-1)

U.S. - Massachusetts - Right To Know List
 U.S. - New Jersey - Right to Know Hazardous Substance List
 U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List
 U.S. - Pennsylvania - RTK (Right to Know) List

Hydrogen (1333-74-0)

U.S. - Massachusetts - Right To Know List
 U.S. - New Jersey - Right to Know Hazardous Substance List

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Hydrogen (1333-74-0)

U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

Other information

: When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product

Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc, it is the user's obligation to determine the conditions of safe use of the product

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NFPA health hazard

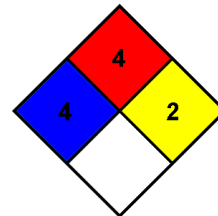
: 4 - Very short exposure could cause death or serious residual injury even though prompt medical attention was given.

NFPA fire hazard

: 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.

NFPA reactivity

: 2 - Normally unstable and readily undergo violent decomposition but do not detonate. Also: may react violently with water or may form potentially explosive mixtures with water.



HMIS III Rating

Health : 4 Severe Hazard - Life-threatening, major or permanent damage may result from single or repeated overexposures

Flammability : 4 Severe Hazard

Physical : 3 Serious Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.