

## Quartz

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### IDENTIFICATION

**Quartz**  
Silicon dioxide  
Silica

**ZVG No:** 4110  
**CAS No:** 14808-60-7  
**EC No:** 238-878-4

### CHARACTERISATION

#### SUBSTANCE GROUP CODE

126200 Silicon dioxide, crystalline

#### STATE OF AGGREGATION

The substance is solid.

#### PROPERTIES

crystalline  
colourless to white  
odourless

#### CHEMICAL CHARACTERISATION

Non-combustible substance.  
Practically insoluble in water.

Activities or processes in which workers are exposed to alveolar dusts of crystalline silicon dioxide in the form of quartz and cristobalite are considered carcinogenic.

[Substance information in Wikipedia](#)

#### DUST EXPLOSIVENESS

No risk of dust explosion.  
Quelle: 99999

### FORMULA



**Molar mass:** 60,08 g/mol

## PHYSICAL AND CHEMICAL PROPERTIES

[Melting point](#) | [Boiling point](#) | [Density](#) | [Solubility](#) | [Hazardous reactions](#)

### MELTING POINT

Melting point: 1610 °C

Reference: [00419](#)

### BOILING POINT

Boiling Point: > 2200 °C

Reference: [01211](#) [02110](#)

### DENSITY

DENSITY

Value: 2,65 g/cm<sup>3</sup>

Temperature: 20 °C

Reference: [01211](#)

### SOLUBILITY IN WATER

practically insoluble in water

Reference: [01211](#)

### HAZARDOUS REACTIONS

#### Hazardous chemical reactions

The substance can react dangerously with:  
alkali hydroxide

difluorine dioxide; hydrogen fluoride; sodium (heat); xenon hexafluoride

## OCCUPATIONAL HEALTH AND FIRST AID

[Routes of exposure](#) | [Toxic effects](#) | [First Aid](#) | [Occupational health check](#)

### ROUTES OF EXPOSURE

#### Main routes of exposure

The main route of exposure for quartz dust (QD) is via the respiratory tract. [07744]

#### Respiratory tract

The average quartz portion contained in fine dusts (crystalline particles of waste material) in the coal mining sector is estimated to amount to 2%, whereby the highest weights in the grain size distribution range between 1 und 4 µm.

In the surface coal mining industry the quartz portion varies within broad limits (0%-20%, in extreme cases up to 80%).

The occurrence of the fine dust portion with a corresponding quartz content depends on the processing technology and amounts to roughly 14 weight % at an average grain size distribution of 8 µm.

Fine dusts with grain sizes of < 5 µm are of particular toxicological relevance. [07619]

The major mechanism for the removal of particles that enter the alveoli is phagocytosis through alveolar macrophages, followed by mucociliary transport via the upper respiratory tract or routing via the lymphatic system.

Although QD is poorly soluble in water, a minor portion is also dissolved in biological fluids with subsequent absorption (increased Si level in the blood). [07866]

### Skin

A health-impairing absorption of QD via the intact skin is expected to be ruled out. [99999]

### Gastrointestinal tract

No direct information available. [99983]

Although the minor solubility in biological fluids described above must be emphasised, acute systemic effects due to absorption via the gastrointestinal tract are ruled out. [99999]

However, a certain direct absorption of particles into the blood circulation appears to be possible. [07619]

## TOXIC EFFECTS

### Main toxic effects

Acute effects:

Eye damage after direct contact is possible (depending on the grain size); [07744]

Chronic effects:

Lung-damaging (silicosis). [99983]

### Acute toxicity

Information pertaining to humans is not available. [99983]

Rabbit eyes (application of fine dusts in the connective tissue of the cornea) only showed minor reactions.

However, single insertion into the anterior eye chamber triggered inflammatory reactions after 3-5 weeks and caused the formation of fibrotic nodes (in the iridocorneal angle). [07744]

### Chronic toxicity

Increased tooth abrasions due to mechanical erosion through activities involving exposures to QD that were performed over several years were confirmed. [99997]

Silicosis (pneumoconiosis) can be induced through permanent large dust deposits in the lungs during persistent high exposures even without the triggering of morphological tissue changes through an impairment of the mucociliary clearance path after primary damage of the alveolar macrophages. [07619]

According to a hypothesis abnormal growth factors (macrophage fibrogenic factor) are released as a consequence of long-term cytotoxic reactions with the macrophages. [99997]

This might result in changes in the lung tissue structures (silicosis) that can occur over very different periods (a few months to 20 years) depending on the characteristics and the amount of QD. [07744] The morphological changes reach from a sparse mesh of reticulin and collagen fibres to cell-free hyaline silicosis nodules. [07884]

Changes in the lymph system (nodule formation) that mostly start with damage in the bronchioles are followed by progressive nodular conglomeration that leads to massive fibrosis.

Symptoms that might also be intensified by a transient tendency to develop lung tissue infections and cardiac dysfunctions include: Coughing, shortness of breath, wheezing and unspecific chest pain.

Smoking and old age can intensify the symptoms that in many cases progress even after the termination of high exposure. [07744]

Silicosis and tuberculosis can influence each other in an unfavourable way during all the developmental stages (asymmetrically, relatively rapidly occurring or very soon radiologically verifiable changing abnormal lung findings, weight loss, increased temperature, circumscribed moist catarrh via the lungs, increased blood sedimentation, changes in the blood count, lung bleeding). [07884]

Autopsies also revealed pulmonary emphysema.

It is noteworthy that the severity of the symptoms does not necessarily correspond to the severity of the radiologically visible lung findings, at least in the initial phase. [99997]

Animal experiments showed that in cases of simultaneous exposures to QD and inert dusts, the inert dusts are transported to the lung tissues and the lymph system and retained there to a much higher extent than the QD (retarding effect of QD). [07619]

Chronic irreversible kidney diseases were also diagnosed as effects of an absorptive potential (?) in persons suffering from silicosis. [99997]

Some further findings in silicosis patients (increased gamma globulin level in the plasma, scleroderma, rheumatic arthritis, lupus erythematosus) also point to disorders of the immune system. [07866]

### **Reproductive toxicity, mutagenicity, carcinogenicity**

For classifying the reproductive toxicity and mutagenic and carcinogenic potential see list in Annex VI of the CLP regulation / TRGS 905 / List of MAK values (see section REGULATIONS).

Reproductive toxicity:

There is no reason to fear a risk of damage to the developing embryo or foetus when MAK and BAT values are observed.

Mutagenicity:

No sufficient information available. [99983]

Carcinogenic potential:

Due to the results available by 1984 a causal connection between QD inhalation (monofactorial, without contaminations with carcinogenic or co-carcinogenic potential) and lung tumours cannot be established. [07619]

Internationally, this assessment has, to a certain degree, recently been relativized. [07866]

An association between silicosis caused by QD exposures and stomach cancer has, on the basis of epidemiological results, also been discussed. [07784]

This measure requires further examination. [07619]

### **Biotransformation and excretion**

A minor portion of QD is dissolved from the deposits, absorbed as silicate and eliminated with the urine. [07784]

The mechanism of the cytotoxic reaction of QD to the alveolar macrophages has long been investigated.

According to a hypothesis the surfaces of freshly broken, but aged quartz particles contain radical groups (Si and SiO radicals) whose number and kind depend on mechanical, chemical and possibly biological impacts.

These groups can act as carrier or transmitter of activated oxygen species that are associated with the cytotoxic potential.

Another, less documented hypothesis considers QD particles as retarding calcium that is massively released in the interior of the cells and causes their elimination. [99983]

### **Annotation**

This occupational health information was compiled on 06.03.1995.

It will be updated if necessary.

This information was translated from German into English by Übersetzungsbüro Branco.

### **FIRST AID**

#### **Eyes**

Rinse the affected eye with widely spread lids for 10 minutes under running water whilst protecting the unimpaired eye.

Arrange medical treatment.

[99992]

#### **Skin**

Rinse the contaminated skin with running water.

#### **Respiratory tract**

If dust has been inhaled transport the casualty on fresh air.

If there are complaints:

Arrange medical treatment.

#### **Swallowing**

Quartz-containing dust particles that enter the gastrointestinal tract do not cause any digestive disorders; medical first aid measures are not necessary.

### **Information for physicians**

Fine, respirable QD does not cause injuries to the eyes; larger particles can induce a mechanically irritating foreign matter effect.

With regard to industrial hygiene QD in crystalline form of free silicic acid is neither toxic for, nor irritative to the skin.

Acute damage to the respiratory tract - for instance with perceivable immediate effects - through quartz-containing alveolar dust does not exist.

Silicosis is not subject to medical first aid.

From the beginning of the exposure up to the onset of the disease 11 months to several years may elapse, in whose 'silent interval' the initially non-reactive dust deposit develops a cytotoxic quartz effect directed against the phagocytes, which are followed by silicogenesis and thus the precursors of silicosis.

These stages devolve into the silicotic tissue structure – now histologically verifiable – that only after sufficient manifestation exhibit in turn the first radiographically certifiable image deviations in the form of increased lung markings. [99992]

This slight silicosis that persists for a prolonged period does not show any clinical symptoms, but is by this time no longer reversible; further degeneration can only be halted by immediate termination of the exposures.

This is a particularly clear evidence of the extreme importance of prophylaxis (medical check up according to G 1.1; technical measures to minimize the risk factors and thus the silicosis incidence rate). [07606]

Treatment of the progressive silicosis depends on the symptoms, i.e., on the effects and complications:

The recommended measures to be taken include: mucolytic, secretomotor, antiphlogistic and bronchodilatory agents, aerosol inhalation, intermittent chemotherapy, tuberculostatic agents as required, endoscopic pulmonary toilet, cardiac support through cardiac glycosides.

Polyvinylpyridine-N-oxide that proved supportive in the prevention of QD-induced pulmonary fibrosis in animal experiments can presently not yet be applied within the framework of a therapy concept for human silicosis.

Silicogenesis inhibition by other fine dusts (lime, iron, aluminium) is not obligatory and is controversial with regard to its connections, so that prophylactic conclusions can, therefore, not be based upon it. [99992]

## Recommendations

Provide the physician information about the substance/product and treatment already administered.

## Annotation

This first aid information was compiled on 06.03.1995.

It will be updated if necessary.

This information was translated from German into English by Übersetzungsbüro Branco.

## OCCUPATIONAL HEALTH CHECK

**Prophylaxis offer:** Occupational medical prevention has to be offered when, conducting activities with this substance, an exposure cannot be excluded.

**Obligatory prophylaxis:** The employer shall arrange occupational medical prophylaxis if, exerting activities with this substance, the occupational exposure limit value is exceeded or repeated exposure cannot be excluded.

**Subsequent prophylaxis:** After termination of activities with exposure to this substance subsequent occupational medical prophylaxis has to be offered.

**Deadlines:** Employees may exert activities with this substance only after participation in obligatory prophylaxis. Prophylaxis offer has to be made prior to taking up work. Deadlines for the inducement or proposal of regularly recurrent occupational medical prevention and subsequent prophylaxis are to gather from the Occupational Health Rule (Arbeitsmedizinische Regel) "[AMR Nummer 2.1](#)".

## SAFE HANDLING

Handling | Storage | Fire and explosion protection | Organisational measures | Personal protection | Disposal considerations | Accidental release measures | Fire fighting measures

## PRELIMINARY NOTE

The following information applies to activities in which employees are exposed to alveolar dusts of crystalline silicon dioxide in the form of quartz and cristobalite.

## TECHNICAL MEASURES - HANDLING

### Workplace

Provision of good ventilation in the working area.

The cleaned air should not be returned to the working area. Air that has been pumped out can only be returned if it has been sufficiently cleaned using an acknowledged method.

For details see the Technical Rule for Hazardous Substances 559 ([TRGS 559](#)).

Washing facility at the workplace required.

### Equipment

Use closed apparatus if possible.

If release of the substance cannot be prevented, then it should be suctioned off at the point of exit.

Consider emission limit values, a purification of waste gases if necessary.

Containers are to be marked clearly.

### Advice on safer handling

Do not leave container open.

Sufficient ventilation must be guaranteed for refilling, transfer, or open use.

Fill only into clearly marked containers.

Avoid rising dust.

### Cleaning and maintenance

Avoid dust formation. Dust formation that cannot be avoided must be collected regularly.

Use tested industrial vacuum cleaners of class M.

Do not raise dust while cleaning.

Use of a blower for cleaning is not permitted.

Alternative: clean damp.

## TECHNICAL MEASURES - STORAGE

### Storage

The following measures are suitable for avoiding dust turbulence in the case of openly stored dusty materials, for example:

1. keeping the stored materials moist,
2. cover with tarpaulins,
3. storage protected from the wind (e.g. by partition walls, earth walls, windbreak planting, windbreak fences, lowered storage areas).

### Conditions of collocated storage

Storage class 10 - 13 (Other liquids and solids)

Only substances of the same storage class should be stored together.

Collocated storage with the following substances is prohibited:

- Pharmaceuticals, foods, and animal feeds including additives.
- Infectious, radioactive and explosive substances.
- Strongly oxidizing substances of storage class 5.1A.

Under certain conditions the collocated storage with the following substances is permitted (For more details see [TRGS 510](#)):

- Gases.
- Flammable liquids of storage class 3.
- Other explosive substances of storage class 4.1A.
- Pyrophoric substances.
- Substances liberating flammable gases in contact with water.
- Oxidizing substances of storage class 5.1B.
- Ammonium nitrate and preparations containing ammonium nitrate.

- Organic peroxides and self reactive substances.
  - Combustible and non combustible acutely toxic substances of storage classes 6.1A and 6.1B.
- The substance should not be stored with substances with which hazardous chemical reactions are possible.

## TECHNICAL MEASURES - FIRE AND EXPLOSION PROTECTION

### Technical, constructive measures

Substance is non-combustible. Select fire and explosion prevention measures according to the other used substances.

## ORGANISATIONAL MEASURES

The employer must inform the employees about the protective measures concept in accordance with [TRGS 559](#) and the plan of measures as part of the instruction in accordance with § 14 paragraph 2 GefStoffV.

The MAK commission's carcinogenic rating for this substance must be clearly indicated.

It must be ensured that the assessment standard of 0.05 mg/m<sup>3</sup> a-dust is complied with. If this value is exceeded, additional protective measures are required in accordance with the Ordinance on Hazardous Substances. For exceptions see [TRGS 559](#).

Only employees are permitted to enter operating areas with high dust exposure. Appropriate signs must be attached.

## PERSONAL PROTECTION

### Body protection

No special requirements.

### Respiratory protection

In exceptional situations (e.g. unintentional substance release, exceeding the assessment standard of 0.05 mg/m<sup>3</sup>), respiratory protection must be worn. Observe wearing time limits.

Respiratory protection: Particle filter P2, colour code white.

Use insulating device for concentrations above the usage limits for filter devices, for oxygen concentrations below 17% volume, or in circumstances which are unclear.

### Eye protection

Wear glasses with side protection.

### Hand protection

Select hand protection according to the other used substances.

### Occupational hygiene

Foods, beverages and other articles of consumption must not be consumed at the work areas. Suitable areas are to be designated for these purposes.

Avoid inhalation of dust.

Avoid contact with clothing. Contaminated clothes must be exchanged and cleaned carefully.

The skin must be washed with soap and water before breaks and at the end of work.

Apply fatty skin-care products after washing.

## DISPOSAL CONSIDERATIONS

Emptied bags are a significant source of dust. They must therefore, if possible, be compressed in the area of a dust extraction system or in a special empty bag compactor for disposal.

## ACCIDENTAL RELEASE MEASURES

Wear a dust mask.

Pick up without creating dust.

Afterwards ventilate area and wash spill site.



Endangerment of watert:

No hazards to sources of water are to be feared if released into water, drainage, sewer, or the ground.

## FIRE FIGHTING MEASURES

### Instructions

Substance is incombustible. Select fire fighting measures according to the surrounding conditions.

## REGULATIONS

[GHS Classification/Labelling](#) | [Workplace labelling](#) | [Water hazard class](#) | [Air quality control](#) | [EC-Threshold limit values](#) | [MAK recommendations](#) | [Restriction of use](#) | [Technical rules](#) | [Regulations of accident insurers](#) | [Occupational health check](#)

## EUROPEAN GHS CLASSIFICATION AND LABELLING

No classification is given for quartz or quartz dust in the Regulation (EC) No 1272/2008 or in the German [TRGS 905](#). Nevertheless, occupational activities including quartz and cristobalite are classified as carcinogenic activities according to the German [TRGS 906](#). So quartz is not legally classified when placed on the market, but for any activities including quartz the measures for carcenogenic substances according to the German Hazardous Substances Ordinance have to be applied.

Quartz is not subject to specific labelling under current EU regulations.

Reference: [99999](#)

Checked: 2023

## WORKPLACE LABELLING ACCORDING TO GERMAN [ASRA1.3](#)

### Prohibition label



No Smoking



No admittance for unauthorized persons

### Precept label



Use safety goggles

## GERMAN WATER HAZARD CLASS

Substance No: 849

non-hazardous to waters

Scope: silicon dioxide

Classification according to the announcement of the list of substances hazardous to water in the Federal Register of 10.08.2017, last update 24.11.2023

## TECHNICAL INSTRUCTIONS ON AIR QUALITY CONTROL ([TA LUFT](#))

Chapter 5.2.7.1.1 Carcinogenic substances

Quartz fine dust PM<sub>4</sub> (quartz and cristobalite)

As minimum requirement, the following values are in all not allowed to be exceeded in the exhaust gas:

Mass flow: 1,5 g/hr

or

Mass conc.: 0,5 mg/m<sup>3</sup>

## EC OCCUPATIONAL EXPOSURE LIMIT VALUES

Directive 2019/130/EU

**Binding occupational exposure limit value** of the European Union

8 hours limit value: 0,1 mg/m<sup>3</sup>

Scope: Silica, crystalline, (respirable fraction)

## RECOMMENDATIONS OF MAK-COMMISSION

This data is recommended by scientific experience and is not established law.

Carcinogenic: Category 1

Substances which cause cancer and make a considerable contribution to the risk of cancer

Scope: Silica, crystalline, (respirable fraction)

## RESTRICTIONS OF USE / BANS OF USE

### Ordinance on Prohibitions of Use of Plant Protection Products

Attachment 3, Section A to §§ 3 and 4

The utilisation of quartz flour in grain stocks and in rooms that are used for the storage of grain is prohibited.

The application in nature protection areas and national parks is forbidden.

Further information on restrictions and exceptions can be taken from the Ordinance on Prohibitions of Use of Plant Protection Products.

## TECHNICAL RULES FOR HAZARDOUS SUBSTANCES

### [TRGS 500](#)

Schutzmaßnahmen; Ausgabe September 2019

### [TRGS 509](#)

Lagern von flüssigen und festen Gefahrstoffen in ortsfesten Behältern sowie Füll- und Entleerstellen für ortsbewegliche Behälter; Ausgabe Juni 2022

### [TRGS 510](#)

Lagerung von Gefahrstoffen in ortsbeweglichen Behältern; Ausgabe Januar Dezember 2020

### [TRGS 559](#)

Quarzhaltiger Staub; Ausgabe April 2020, zuletzt berichtigt Juni 2020

Beurteilungsmaßstab für Quarz (A-Staub)

GMBI 2016, S. 623 v. 29. Juli 2016

Der AGS hat einen Beurteilungsmaßstab zu Quarz (A-Staub) von 0,05 mg/m<sup>3</sup> (Überschreitungs faktor 8) beschlossen. Der Beurteilungsmaßstab ist bei der Gefährdungsbeurteilung und zur Kontrolle der Wirksamkeit der Schutzmaßnahmen zu berücksichtigen und einzuhalten.

Beurteilungsmaßstäbe erfüllen nicht die Kriterien der Arbeitsplatzgrenzwerte ([TRGS 900](#)) oder Exposition-Risiko-Beziehung ([TRGS 910](#)) und sind nicht technikbasiert.

Nach der Veröffentlichung der stoffspezifischen [TRGS 559](#) sollte der Beurteilungsmaßstab in der [TRGS 900](#) oder [TRGS 910](#) mit Hinweisen auf die TRGS in einer Fußnote veröffentlicht werden.

## [TRGS 906](#)

Verzeichnis krebserzeugender Tätigkeiten oder Verfahren nach § 2 Abs. 3 Nr. 4 GefStoffV; Ausgabe April 2023  
Tätigkeiten, bei denen aufgrund eines Arbeitsverfahrens eine Exposition gegenüber Quarzfeinstaub besteht.

## REGULATIONS OF GERMAN ACCIDENT INSURERS

DGUV Guideline 350-001 (BGG 904): Guidelines for occupational medical examinations  
G 1.1 : Mineral Dust, Part 1: Respirable crystalline silica dust

## [DGUV Regel 112-190](#)

Benutzung von Atemschutzgeräten, Ausgabe November 2021  
(in German only)

## LINKS

[Statement concerning the rating as carcinogenic, mutagenic or toxic for reproduction \(in german only, source BAuA\)](#)

[Statement concerning the Occupational Exposure Limit Value \(in german only, source BAuA\)](#)

[Statement concerning the assessment benchmark \(in german only, source BAuA\)](#)

[International Limit Values](#)

[OECD Screening Information DataSet \(SIDS\)](#)

[OECD Screening Information DataSet \(SIDS\)](#)

[OECD Screening Information DataSet \(SIDS\)](#)

[The MAK Collection for Occupational Health and Safety](#)

[BGIA-Report 8/2006: Quarzexpositionen am Arbeitsplatz \(in German only\)](#)

## REFERENCES

Quelle: 00001

IFA: Erfassungs- und Pflegehandbuch der GESTIS-Stoffdatenbank (nicht öffentlich)  
Data acquisition and maintenance manual of the GESTIS substance database (non-public)

Quelle: 00419

CHEMINFO - Chemical Profiles Created by CCOHS

Quelle: 01211

GHS-Sicherheitsdatenblatt, Merck  
GHS Material Safety Data Sheet, Merck

Quelle: 02110

National Center for Biotechnology Information:  
PubChem  
<https://pubchem.ncbi.nlm.nih.gov/>

Quelle: 05300

[TRGS 510](#) "Lagerung von Gefahrstoffen in ortsbeweglichen Behältern" Ausgabe Dezember 2020

Quelle: 05301

[TRGS 559](#) "Quarzhaltiger Staub", Ausgabe April 2020

Quelle: 06002

L. Roth, U. Weller  
"Gefährliche Chemische Reaktionen" Loseblattsammlung mit Ergänzungslieferungen, ecomed-Verlag  
("Dangerous chemical reactions" loose-leaf collection with supplement deliveries)

Quelle: 07580

Bekanntmachung der Liste der wassergefährdenden Stoffe im Bundesanzeiger vom 10.08.2017, zuletzt geändert 24.11.2023

Quelle: 07606

Wirth, Gloxhuber "Toxikologie" 4.Auflage, Thieme Verlag 1985

Quelle: 07619

DFG Deutsche Forschungsgemeinschaft: The MAK-Collection for Occupational Health and Safety, nach Veröffentlichungsdatum zu finden unter:

bis 2002 Verlag Chemie

ab 2002 Online: <http://onlinelibrary.wiley.com/book/10.1002/3527600418/topics?filter=#>

ab 2020 Online:

<https://series.publisso.de/en/pgseries/overview/mak/dam/allContents/alphabetical>

Quelle: 07744

NIOSH OSHA "Occupational Health Guidelines for Chemical Hazards" Cincinnati 1988

Quelle: 07784

M.L. Richardson, S. Gangolli "The Dictionary of Substances and their Effects" Royal Society of Chemistry, 1992

Quelle: 07866

G.D. Clayton, F.E. Clayton (ed.) "Patty's Industrial Hygiene and Toxicology" Volume II "Toxicology" Fourth Edition, John Wiley & Sons, New York 1993

Quelle: 07884

Bundesministerium für Arbeit "Merkblätter für die ärztliche Untersuchung zu den einzelnen Berufskrankheiten der Anlage 1 zur Berufskrankheitenverordnung"

Quelle: 08112

DFG Deutsche Forschungsgemeinschaft: MAK- und BAT-Werte-Liste 2023, Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe, Mitteilung 59; GMS PUBLISSO

Quelle: 99983

Liste arbeitsmedizinisch-toxikologischer Standardwerke (2)

List of standard references regarding occupational health and toxicology (2)

Quelle: 99992

Projektgebundene Literatur zur Ersten Hilfe

(Project related bibliographical references regarding first aid)

Quelle: 99997

Projektgebundene arbeitsmedizinisch-toxikologische Literatur (1)

Project related bibliographical references regarding occupational health and toxicology (1)

Quelle: 99999

Angabe des Bearbeiters

Indication of the editor

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