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|  | Material Safety Data Sheet | CAS No. | 7722 – 84 – 1 | |
| | HYDROGEN PEROXIDE 45wt% | Rev. Date | 2021 – Oct. – 15th | |
| | | Rev. No. | 3 | 1/13 |

1. CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

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|----------------------------------|---|---|
| A. PRODUCT NAME | : | Hydrogen Peroxide |
| B. CHEMICAL NAME | : | Hydrogen Peroxide |
| C. SHIPPING NAME | : | Hydrogen Peroxide |
| D. CHEMICAL FAMILY | : | Hydrogen Peroxide Solution |
| E. CHEMICAL FORMULA | : | H ₂ O ₂ |
| F. MANUFACTURER'S NAME | : | Taekwang Industrial Petrochemical 2 nd Plant |
| G. MANUFACTURER'S ADDRESS | : | #46, Sanan-ro, Nam-gu, Ulsan, Korea |
| H. TELEPHONE NUMBER | : | (82) – 52 – 259 – 9870~1 |
| I. FACSIMILE NUMBER | : | (82) – 52 – 260 – 6259 |

2. HAZARDS IDENTIFICATION

A. Hazard Classification

- Oxidizing Liquids – Category 2
- Acute Toxicity(Oral) – Category 4
- Acute Toxicity (Inhalation, vapour, dust/mist) – Category 4
- Serious Eye Damage / Eye Irritation – Category 1
- Skin Corrosion / Irritation – Category 1
- Specific Target Organ Toxicity Single Exposure – Category 3
- Specific Target Organ Toxicity Repeated Exposure – Category 2

B. Label Element

- Signal Word : Danger
- Hazard Symbol



- Hazard Statement
 - H272 : May intensify fire; oxidizer.
 - H302 : Harmful if swallowed.
 - H314 : Cause severe skin burns and eye damage.
 - H318 : Cause serious eye damage.
 - H332 : Harmful if inhaled.

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- H335 : May cause respiratory irritation.
- H373 : May cause damage to organs through prolonged or repeated exposure.

o Precautionary Statement

Prevention:

- P210 : Keep away from heat/spark/open flames/hot surface. – No Smoking
- P220 : Keep / Store away from combustible materials.
- P221 : Take any precaution to avoid mixing with combustibles.
- P260 : Do not breathe fume/ mist/vapours/spray.
- P261 : Avoid breathing dust/ fume/ gas/ mist/vapours/ spray.
- P264 : Wash thoroughly after handling.
- P270 : Do not eat, drink or smoke when using this product.
- P271 : Use only outdoors or in a well-ventilated area.
- P280 : Wear protective gloves/protective clothing/eye protection/face protection.

Response:

- P301 + P312 : If swallowed or feel unwell, call a POISON CENTER or doctor/physician.
- P301 + P330 + P 331 : If swallowed, rinse mouth. Do not induce vomiting.
- P303 + P361 + P 353 : If on skin, remove/take off immediately all contaminated clothing. Rinse skin with water/shower.
- P304 + P340 : If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P305 + P351 + P338 : If on eyes, rinse cautiously with water for several minutes. Remove contact lenses if presented easy to do. Continue rinsing.
- P310 : Immediately call a POISON CENTER or doctor/physician.
- P312 : If feel unwell, call a POISON CENTER or doctor/physician.
- P314 : Get medical advice/attention if you feel unwell.
- P321 : Specific treatment reference to supplement first aid instruction.
- P330 : Rinse mouth.
- P363 : Wash contaminated clothing before reuse.
- P370 + P378 : In case of fire: Use water spray and extinguishing media with CO₂ or Halon for extinction.

Storage :

- P403 + P233: Store in a well-ventilated place. Keep container tightly closed.
- P405 : Store locked up.

Disposal :

- P501 : Dispose of contents/container in accordance to with local/regional/national/international regulations.

C. NFPA RATINGS (SCALE 0-4): HEALTH 2 FIRE 0 REACTIVITY 3

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3. COMPOSITION AND INFORMATION ON INGREDIENTS

| Chemical Name | CAS No. | EC No. | Weight (%) |
|-------------------|---------------|---------------|------------|
| Hydrogen Peroxide | 7722 - 84 - 1 | 231 - 765 - 0 | 45 |
| Water | 7732 - 18 - 5 | 231 - 791 - 2 | 55 |

4. FIRST AID MEASURES

A. INHALATION

- Perform artificial respiration if necessary.
- Maintain airway, blood pressure and respiration.
- Keep warm and at rest. Treat symptomatically and supportively.
- Get medical attention immediately.
- Qualified medical personnel should consider administering oxygen.

B. SKIN CONTACT

- Remove contaminated clothing, shoes, etc. immediately.
- Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains. (at least 15-20 minutes)
- If burns occur, proceed with the following:
Cover affected area securely with sterile, dry, loose-fitting dressing.
- Treat symptomatically and supportively.
- Get medical attention immediately.

C. EYE CONTACT

- Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains. (at least 15 – 20 minutes)
- Continue irrigating with normal saline until the pH has returned to normal. (30-60 minutes)
- Cover with sterile bandages.
- Get medical attention immediately.

D. INGESTION

- If the person is conscious and not convulsing, give 2-4 glasses of water to dilute the chemical.
- Use gastric tube to relieve the pressure caused by evolved oxygen.
(Dreisbach, Handbook of Poisoning, 12th Ed.)
- Treat symptomatically and supportively.
- Intubation should be performed by qualified medical personnel.
- Get medical attention immediately.

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E. Acute and delayed symptoms/effects

- Inhalation
 - Short term exposure: May cause alveolar emphysema in addition to severe congestion of lung
 - Repeated or prolonged exposure : May cause nasal discharge, oedematous feet, irritation of skin in the groin, hair loss.
- Skin contact
 - Short term exposure: May cause irritation combined with delayed epidermal necrosis and sloughing.
 - Repeated or prolonged exposure: May results in a significant dysfunction of the horny layer of the skin.
- Eye contact
 - Short term exposure: May cause irreversible corneal injury (corrosion), severe iritis and severe Conjunctivitis.
- Ingestion
 - Short term exposure: May cause irritation.
 - Repeated or prolonged exposure: May cause significant reduction of the body weight gain, a slightly higher spleen weight, and a decreased haematocrit and plasma proteins.

F. Indication of immediate medical attention and notes for physician:

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- Contaminated clothing may be a fire risk when dry.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

5. FIRE-FIGHTING MEASURES

A. Suitable Extinguishing Media

- **Small Fire**
 - Use water. Do not use dry chemicals or foams. CO₂ or Halon may provide limited control.
 - **Large Fire**
 - Flood fire area with water from a distance.
 - Do not move cargo or vehicle if cargo has been exposed to heat.
 - Move containers from fire area if you can do it without risk.
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- **Fire involving Tanks or Car/Trailer Loads**

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles.

B. Specific hazards arising from the chemical

- These substances will accelerate burning when involved in a fire.
- Some may decompose explosively when heated or involved in a fire.
- May explode from heat or contamination.
- Some will react explosively with hydrocarbons. (fuels)
- May ignite combustibles. (wood, paper, oil, clothing, etc.)
- Containers may explode when heated.
- Inhalation, ingestion or contact (skin, eyes) with vapors or substance may cause severe injury, burns or death.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may cause pollution.
- Runoff may create fire or explosion hazard.

C. Special protective equipment and precautions for fire-fighters

- Wear positive pressure self-contained breathing apparatus. (SCBA)
- Wear chemical protective clothing that is specifically recommended by the manufacturer.
- It may provide little or no thermal protection.
- Structural firefighters' protective clothing will only provide limited protection.

6. ACCIDENTAL RELEASE MEASURES

A. Personal precautions, protective equipment and emergency procedures

- Keep combustibles (wood, paper, oil, etc.) away from spilled material.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Do not get water inside containers.
- Isolate area.
- Approach from upwind.
- Avoid materials and products which are incompatible with the product (see section 10).
- In case of contact with combustible materials, avoid product drying out by dilution with water.

B. Environmental precautions and protective procedures

- Atmosphere: no data available
- Land: If possible dam large quantities of liquid with sand or earth.
- Underwater: Prevent entry into waterways, sewers, basements or confined areas.

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C. The methods of purification and removal

- Dilute with large quantities of water.
- Do not add chemical products.
- For disposal methods, refer to section 13.
- In order to avoid the risk of contamination, the recovered product must not be returned to the original tank/container.
- **Small Liquid Spill:**
 - Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal.
- **Large Spill:**
 - Dike far ahead of liquid spill for later disposal.
 - Following product recovery, flush area with water.

7. HANDLING AND STORAGE

A. Precautions for safe handling

- Do not get water inside container.
- Isolate hazard area and deny entry.
- Operate in a well-ventilated area.
- Prevent all contact with organics.
- Use equipment and containers which are compatible with the substances.
- Container and equipment used to handle hydrogen peroxide should be used exclusively for hydrogen peroxide.

B. Storage

- Avoid impurities and heat effect.
- Keep away from incompatible products.
- Before all operations, passivate the piping circuits and vessels.
- Never return unused product to storage container.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

A. Occupational Exposure limits

- | | | |
|---------|----------------|----------------------------------|
| • CEFIC | TWA (8-hour) | : 1 ppm (1.4 mg/m ³) |
| | STEL (5~15min) | : 3 mg/m ³ |
| • ACGIH | TWA | : 1 ppm (1.4 mg/m ³) |
| • NIOSH | TWA | : 1 ppm (1.4 mg/m ³) |
| • DFG | MAK | : 1.4 mg/m ³ |
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B. Appropriate engineering controls

- Operate in a well-ventilated area.
- Provide local exhaust or process enclosure ventilation to meet published exposure limits.

C. Personal protective equipment

• Eye/Face protection

- Employee must wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with this substance.
- Employee must wear appropriate protective (impervious) clothing and equipment to prevent any possibility of skin contact with this substance.

• Hand protection

- Employee must wear appropriate protective gloves to prevent contact with this substance.

• Respiratory protection

- NIOSH Pocket Guide to Chemical Hazards
- 10 ppm Any supplied-air respirator
- 25 ppm Any supplied-air respirator operated in a continuous-flow mode
- 50 ppm Any self-contained breathing apparatus with a full facepiece
Any supplied-air respirator with a full facepiece
- 75 ppm Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|--|-----------------------------------|
| A. APPEARANCE | Colorless liquid, very light blue |
| B. ODOUR | Pungent |
| C. ODOUR THRESHOLD | Not available |
| D. pH | < 3 |
| E. MELTING/ FREEZING POINT | - 46 °C |
| F. BOILING POINT | 112 °C |
| G. FLASH POINT | Not applicable |
| H. EVAPORATION RATE | Not available |
| I. FLAMMABILITY (solid, gas) | Not flammable |
| J. UPPER/LOWER FLAMMABILITY OR EXPLOSIVE LIMITS | Not applicable |
| K. VAPOUR PRESSURE | 15 hPa (20 °C) |
| L. SPECIFIC GRAVITY | 1.175 (20 °C) |
| M. SOLUBILITY | Completely miscible |
| N. PARTITION COEFFICIENT (n-octanol/water) | -1.5 (estimated) |

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| O. AUTO-IGNITION TEMPERATURE | Not applicable |
| P. DECOMPOSITION TEMPERATURE | 150-152°C decomposition (for 100% pure H ₂ O ₂) |
| Q. VISOSITY | 1.14 (1*10 ⁻³ kg/m.s) |
| R. MOLECULAR WEIGHT | 34.01 g/mol |

10. STABILITY AND REACTIVITY

A. REACTIVITY

- May decompose on prolonged storage or heating with evolution of oxygen.
- Tightly closed containers may rupture due to an increase in internal pressure
- Thermal decomposition becomes self-sustaining at 141°C and is accelerated by agitation, contact with rough surfaces, alkalies, finely divided metals and many other substances.

B. Condition to avoid

- May ignite other combustible materials. (wood, paper, oil, etc.)
- Reaction with fuels may be violent.
- Flammable poisonous gases may accumulate in tanks and hopper cars.
- Runoff to sewer may create fire or explosion hazard.

C. Materials to avoid: Acids, Bases, Metals, Salts of metals, Reducing agents, organic materials, Flammable substances

D. Hazardous decomposition products: Thermal decomposition releases oxygen and heat.

11. TOXICOLOGICAL INFORMATION

A. Information on the likely routes of exposure

- Inhalation: May cause nasal discharge, oedematous feet, irritation of skin in the groin, hair loss
- Oral: May cause burning sensation in the throat, epigastrium and substernal area and vomited
- Skin contact: May cause moderate irritation combined with delayed epidermal necrosis and sloughing.
- Eye contact: May irreversible corneal injury (corrosion), severe iritis and severe conjunctivitis

B. Symptoms related to the physical, chemical and toxicological characteristics

- **Oxidizing liquid:** Category 2, Hydrogen peroxide is an oxidiser.
- **Explosives:** Not classified, Hydrogen peroxide in itself (at NTP) is stable. Also pure aqueous solutions in clean inert containers are relatively stable.
- **Flammable liquid:** Not classified, Hydrogen peroxide is not flammable.

C. Delayed, acute and chronic toxic effect for short and long term exposure

- **Acute toxicity (Oral)** Category 4
Rat (Sprague-Dawley), LD50: 1,518 mg/kg
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| • Acute toxicity (Dermal) | Not classified Rabbit, LD50 > 2,000 mg/kg (limit test) |
| • Acute toxicity (Inhalation: Gas) | Not applicable |
| • Acute toxicity (Inhalation: Vapor) | Category 4 Rat, LC50(4 h): 2,000 mg/m ³ , calculated 2 mg/L |
| • Acute toxicity (Inhalation: Dust/Mist) | Not applicable |
| • Skin Corrosion/ Irritation | Category 1 Regarding a study (35% H ₂ O ₂ , New Zealand White rabbits, treated with 0.5 ml for 4 hr), slight to moderate erythema, oedema and/or brown areas in the application sites. Thus, the finding revealed moderate irritation combined with delayed epidermal necrosis and sloughing. |
| • Serious Eye Damage/ Irritation | Category 1 The test study (10 and 12% H ₂ O ₂ , rabbits) showed severe, penetrating, irreversible corneal injury (corrosion), severe iritis and severe conjunctivitis in rabbit eyes. (FHSA method) In other test, it was observed highly irritating with slight corneal opacities, iritis and severe conjunctivitis on unwashed eyes, but severe corneal opacities, severe iritis and conjunctivitis on Washed eyes. |
| • Respiratory sensitizer | Not available |
| • Skin Sensitization | Not classified 3% H ₂ O ₂ preparations was studied appeared not to sensitise with guinea pigs using a modification of the Magnusson-Kligman procedure. Also, some case studies in human show all negative results. |
| • Mutagenicity | Not classified in vitro- 1) gene mutation assays (ames test): positive 2) beacterial DNA damage and repair: positive 3) mammalian cell gene mutation assays: positive 4) sister chromatid exchange: positive 5) cytogenetic assays: positive in vivo- 1) genetic toxicity: negative - Rat (Wistar, male) hepatocyte unscheduled DNA synthesis (UDS) - Mouse (Swiss HIM/OF1) micronucleus assay of bone marrow polychromatic erythrocytes - Drosophila melanogaster drosophila SLRL test |

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• **Carcinogenicity**

Not classified

In a study (rats, drinking water administration) seemed not to be associated with the occurrence of tumours, and there were no tumours in the gastrointestinal tract at all. Other studies of similar design have not shown carcinogenic or promotion activity.

- IARC Group 3, ACGIH Group A3

- NTP, OSHA: Not classified

• **Reproductive toxicity**

Not classified

The study (mice and rats, exposed by drinking water) showed that there is the effect to sperm motility, the effect to estrous cycle of female, the effect to the decrease of the number of delivery maternal animal, and the weight decrease of offspring. But it was presumed that because of the rapid degradation of the substance on absorption and due to local effects, studies would be unlikely to reveal any specific developmental effects.

• **Specific target organ toxicity (single exposure)**

Category 3

In the reported cases (H₂O₂ has often been used for irrigation of surgical wounds), patients suddenly lost consciousness, showed cardiac shock and fell to coma which lasted for 15 min. And some had a burning sensation in the throat, epigastrium and substernal area and vomited in human. In addition, Mice and rats exposed (whole-body) to the vapour of hydrogen peroxide for 4-8 hours showed alveolar emphysema in addition to severe congestion of lung.

- LOAEL for acute oral toxicity: 100 mg/kg bw

- LOAEL for irritant effects in the eyes: 3.5-10 mg/m³

- LOAEL for irritant effects on the skin 20 g/m³

• **Specific target organ toxicity (repeated exposure)**

Category 2

Oral administration (drinking water) in mice gave NOAELs of 26 mg/kg bw/day in males and 37 mg/kg bw/day in females based on a dose-related reduction of food and water consumption and local effect (duodenal mucosal hyperplasia). There is suggestive evidence from animal studies causing some concern that levels of about 10 mg/m³ may be associated with local changes in the lungs, reminiscent of oxygen toxicity, as well as local effects in the skin.

• **Aspiration Hazard**

Not available

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12. ECOLOGICAL INFORMATION

A. Aquatic Ecotoxicity

- **Acute toxicity** : Not classified
 - Fish: 96h-LC50=16.4 mg/l (measured), Pimephales promelas/test method: US EPA
 - Invertebrates: 48h-EC50=2.4 mg/l (measured), Daphnia pulex/test method: US EPA
 - Algae: 72h-EC50=2.5 mg/l, Sceletonema costatum(marine diatom) / test method: OECD 201
- **Chronic toxicity** : Not classified
 - Invertebrates: 56d-NOEC= 2 mg/l, zebra mussels

B. Persistence and degradability

- **Persistence** : log Kow = -1.5 (estimated)
- **Degradability** : Photolysis in air: half-life of 24 hours (Photolysis in water is not expected.)

C. Bioaccumulative potential

- **Biodegradation** : readily biodegradable
 - Hydrogen peroxide is biologically degradable. Aerobic bacteria produce catalase enzymes that convert H₂O₂ to water and oxygen. Catalase is present in most aerobic bacteria and therefore biological degradation starts readily when H₂O₂ is in contact with microbial material.
- **Bioaccumulation** : low potency of bioaccumulation
 - BCF=1.4(fish), 3.3(earthworm)

D. Mobility in soil : low potency of mobility to soil

log Koc = 0.2 (Mackay Model 1, TGD, QSAR for nonhydrophobics)

13. DISPOSAL CONSIDERATIONS

- Observe all federal, state and local regulations when disposing of this substance.
- Disposal must be in accordance with standards applicable to generators of hazardous waste, 40 CRF 262.EPA Hazardous Waste Number D002.
- 100 pound CERCLA Section 103 Reportable Quantity.

14. TRANSPORT INFORMATION

A. UN Number: 2014

B. UN Proper shipping name: Hydrogen Peroxide, aqueous solution with not less than 20% but not than 60% hydrogen peroxide (stabilized as necessary)

C. Transport Hazard class: 5.1 (subsidiary risk 8)

D. Packing group: II

E. Marine pollutant: Not applicable

F. Special safety response for transportation or transportation measure

- Emergency schedule for fire: F-H
 - Emergency schedule for spillage: S-Q
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15. REGULATORY INFORMATION

A. Korea

- Korea Occupational Safety and Health Regulation: Listed in occupational exposure assessment, Hazardous agent, Occupational exposure limits and Health examination agent
- Toxic Chemical Control Act. : Listed in Poisonous substance
- Dangerous Material Safety Management Regulation: Class 6, Hydrogen peroxide 300 kg

B. EU Classification

- Classification: R5, O; R8 , C; R35, Xn; R20/22
- Risk phrases : R5, R8, R20/22, R35
- Safety phrases : S1/2, S17, S26, S28, S36/37/39, S45

C. U.S.A. management information

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|---|---|
| • TSCA Inventory Status | Y |
| • CERCLA Section 103 (40CFR 302.4) | N |
| • SARA Section 302 (40CFR 355.30) | Y, TPQ = 1000 pound |
| • SARA Section 304 (40CFR 355.40) | Y, RQ = 1 pound |
| • SARA Section 313 (40CFR 372.65) | N |
| • OSHA Process Safety (29CFR 1910.119) | Greater than 52% TQ = 7500 pound |
| • California Proposition 65 | N |
| • SARA Hazard Categories, | SARA Sections 311/312 (40CRF 370.21) |
| - Acute Hazard/ Fire Hazard/Reactivity Hazard | Y |
| - Chronic Hazard/ Sudden Release Hazard | N |

16. OTHER INFORMATION

A. Information source and references

- ECB:ESIS (European chemical Substances Information System) (<http://ecb.jrc.it/esis>)
 - European Union Risk Assessment Report (RAR)
 - IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man
Geneva: World Health Organization, International Agency for Research on Cancer, 1972-
PRESENT (Multivolume work)., p. S7 216 (1987)
 - REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 16 December 2008
 - OECD SIDS: (<http://www.chem.unep.ch/irptc/sids/OECD/SIDS/Naco.pdf>)
 - Korea Occupational Health & Safety Agency: <http://www.kosha.net>
 - National chemicals information systems (<http://ncis.nier.go.kr>)
 - U.S. National library of Medicine (NLM) Hazardous Substances Data Bank (HSDB):
(<http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.htm>)
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- Incorporated Administrative Agency National Institute of Technology and Evaluation
(<http://www.safe.nite.go.jp/japan/sougou/data/pdf/hazard/hyokasyo/No-32.pdf>)

B. Issuing date: 2012. 03. 08.

C. Revision number and date:

- **Revision number:** 3
- **Revision date:** 2021. 10. 15.

D. Other material safety data sheet information:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. It is intended for use only by persons having the necessary technical skills and at their own discretion and risk.