HT S50
WEATHER-SEAL SILICONE SEALANT

1. Product and Company Identification

Product Name : HT S50
Company Identification : TWO NINE SIX O Trading Pte Ltd
21 Tuas West Avenue, Singapore 638435
Local Emergency Contact : +65 6267 1300

2. Hazards Identification

GHS Classification:
Serious eye damage / eye irritation : Category 2A
Skin sensitization : Category 1

GHS label elements and precautionary statements:
Hazard pictograms :

Signal Word : Warning
Hazard Statements : H317 May cause an allergic skin reaction.
H319 Causes serious eye irritation.
Precautionary Statements : Prevention:
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray. P264 Wash skin thoroughly after handling.
P272 Contaminated work clothing should not be allowed out of the workplace.
P280 Wear protective gloves/ eye protection/ face protection.

Response:
P302 + P352 IF ON SKIN: Wash with plenty of soap and water. P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P333 + P313 If skin irritation or rash occurs: Get medical advice/ attention.
P337 + P313 If eye irritation persists: Get medical advice/ attention.
P363 Wash contaminated clothing before reuse.

Disposal:
P501 Dispose of contents/ container to an approved waste disposal plant.

Other hazards which do not result in classification:
None known.

3. Composition Information

Substance / Mixture : Mixture
Chemical Nature : Silicone Sealant

Hazardous Components:

Chemical Name	CAS No.	Concentration (% w/w)
Methyltri(ethylmethylketoxime)silane	22984-54-9	>= 3 - < 5
Distillates (petroleum), hydrotreated middle	64742-46-7	>= 10 - < 20
Vinyltri (methylethylketoxime) silane	2224-33-1	>= 1 - < 1.5
3-Aminopropyltriethoxysilane	919-30-2	>= 0.5 - < 1
Poly dimethyl Siloxane	63148-62-9	>= 10 - < 20
Methyltri(ethylmethylketoxime)silane isomers and oligomers	Not Assigned	>= 0.1 - < 0.5
Methyltri(ethylmethylketoxime)silane	22984-54-9	>= 3 - < 5

4. First Aid Measures

General Advice	:	In the case of accident or if you feel unwell, seek medical advice immediately. When symptoms persist or in all cases of doubt seek medical advice.
Eye Contact	:	Immediately flush eyes with running water for at least 15 minutes. Seek medical treatment.
Skin Contact	:	Immediately wash out with soap and running water. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Seek medical treatment, depending on the symptoms.
Inhalation	:	Remove to fresh air. Rest in fresh air and seek medical treatment, depending on the symptoms.
Ingestion	:	DO NOT induce vomiting. Rinse mouth thoroughly with water. Get medical attention.
Most important symptoms and effects both acute and delayed	:	May cause an allergic skin reaction. Causes serious eye irritation.
Protection of first-aiders	:	First Aid responders should pay attention to self-protection, and use the recommended personal protective equipment when the potential for exposure exists.
Notes to physician	:	Treat symptomatically and supportively.

5. Fire Fighting Measures

Extinguishing Media	:	Water spray Alcohol-resistant foam Carbon dioxide (CO2) Dry chemical
Unsuitable extinguishing media	:	None known
Specific hazards during fire-fighting	:	Exposure to combustion products may be a hazard to health.
Hazardous combustion products	:	Carbon oxides Silicon oxides Formaldehyde Nitrogen oxides (NOx)
Specific extinguishing methods	:	Evacuate area. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Remove sources of combustibles. Remove undamaged containers from fire area if it is safe to do so. Use water spray to cool unopened containers. The firefighting should be done from the windward side.
Special protective equipment for firefighters	:	In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Follow safe handling advice and personal protective equipment recommendations.
Steps to be Taken if Material is Released or Spilled	:	Evacuate people on the leeward. Keep people away from the area. Remove sources of ignition. Wear proper protective equipment when in work. Work from the windward side. Put in an empty container for recovery after preventing spill by sand or sandbags, if the amount of spill is large. Put in an empty container for recovery after wiping or soaking up in an inert material, if the amount is small.

Environmental precautions	:	Discharge into the environment must be avoided. Prevent further leakage or spillage if safe to do so. Retain and dispose of contaminated wash water. Local authorities should be advised if significant spillages cannot be contained.

7. Handling and Storage

Handling	:	Wear eye, hand and respiratory protection when in handling. Avoid any source of ignition due to flammability. Ground equipment due expected sensitivity to static discharge. Use in a well-ventilated area to avoid breathing vapor. Use immediately after seal is opened. Protect from moisture. Be careful that moisture vapour DO NOT mix in this product, because this is cured by hydrolysis with moisture in air. This product release Methyl Ethyl Ketoxime during curing.
Materials to avoid	:	Do not store with the following product types: Strong oxidizing agents
Storage	:	Keep in properly labelled containers. Store in a dark, cool place indoors, with container tightly closed.
Shelf life	:	Use within Shelf life begins from date of manufacture.

8. Exposure Controls / Personal Protection

Administrative Exposure Limit	:	Not applied
Occupational Exposure Limit by Japanese Ministry of Labor (Japanese Industrial Health Society (1996))	:	Not applied
ACGIH TLV(1997)	:	Not applied

Equipment Measure	:	Well-ventilated area Eyewash station Practice normal industrial hygiene i.e., DO NOT eat eat, drink or smoke when using
Inhalation Protection	:	Gas mask for organic gas
Eye and Face Protection	:	Safety Glass / Goggles
Protective Gloves	:	Chemical-resistant gloves
Protective Clothes	:	Safety shoes / boots and impervious protective clothing i.e., aprons, gloves, etc.

9. Physical and Chemical Properties

Physical State	:	Paste
Color	:	White, Light Gray, Aluminium Grey, Dark Grey, Black
Odor	:	Faint odor
pH	:	Not applicable
Specific Gravity (Water = 1)	:	1.38 – 1.42 (23℃)
Boiling Point	:	242℃ ~ 270℃ (at hydrocarbon solvent)
Melting point / Freezing Point	:	No data available
Vapor Pressure	:	≤ 0.75mmHg/68℃ (at hydrocarbon solvent)
Volatility	:	None
Flash Point	:	81℃
Evaporation rate	:	Not applicable
Combustibility	:	For 3 tons or more, the material is regarded as a flammable solid family which belongs to the Japanese Fire Service Act Law designated flammable substances.
Self-ignition	:	The substance or mixture is not classified as pyrophoric. The substance or mixture is not classified as self-heating.
Upper explosive limit	:	No data available
Lower explosive limit	:	No data available

Auto-ignition temperature	:	450℃
Self-Reactivity & Explosibility	:	Non-self-reactive and non-explosive
Dust Explosivity	:	Non-dust-explosivity
Decomposition temperature	:	No data available
Water solubility	:	No data available

10. Stability and Reactivity

Stability and Reactivity	:	The substance or mixture is substantially stable under normal conditions of use and storage. Hazardous decomposition products will be formed upon contact with water or humid air. Hazardous decomposition products will be formed at elevated temperatures.
Conditions to Avoid	:	Exposure to moisture Use at elevated temperatures may form highly hazardous compounds.
Materials to Avoid	:	Oxidising agents Water
Hazardous Decomposition Products	:	Contact with water or humid air: Ethyl methyl ketoxime Thermal decomposition: Formaldehyde

11. Toxicological Information

Exposure routes	:	Skin contact Ingestion Eye contact
Acute toxicity	:	Not classified based on available information
Components:		
Methyltri(ethylmethylketoxime)silane:		
Acute oral toxicity	:	LD50 (Rat): > 2,520 mg/kg Assessment: The substance or mixture has no acute oral toxicity Remarks: On basis of test data
Distillates (petroleum), hydrotreated middle:		
Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg
Acute inhalation toxicity	:	LC50 (Rat): > 5,266 mg/m3 Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 3,160 mg/kg Assessment: The substance or mixture has no acute dermal toxicity
Limestone:		
Acute oral toxicity	:	LD50 (Rat): > 2,000 mg/kg Assessment: The substance or mixture has no acute oral toxicity
Vinyltri (methylethylketoxime) silane:		
Acute oral toxicity	:	LD50 (Rat): > 2,000 mg/kg Assessment: The substance or mixture has no acute oral toxicity Remarks: On basis of test data.
Acute dermal toxicity	:	LD50 (Rat): > 2,000 mg/kg Assessment: The substance or mixture has no acute dermal toxicity Remarks: On basis of test data.
3-Aminopropyltriethoxysilane:		
Acute oral toxicity	:	LD50 (Rat): 1.57 ml/kg Remarks: On basis of test data.
Acute dermal toxicity	:	LD50 (Rabbit): 4.29 ml/kg Remarks: Information taken from reference works and the literature.

Skin corrosion / irritation	:	Not classified based on available information
Components:		
Methyltri(ethylmethylketoxime)silane	:	Species: Rabbit Result: No skin irritation Remarks: Based on data from similar materials
Distillates (petroleum), hydrotreated middle	:	Species: Rabbit Method: OECD Test Guideline 404 Result: No skin irritation
3-Aminopropyltriethoxysilane	:	Species: Rabbit Result: Corrosive after 3 minutes to 1 hour of exposure Remarks: On basis of test data.
Serious eye damage / eye irritation	:	Causes serious eye irritation
Components:		
Methyltri(ethylmethylketoxime)silane	:	Species: Rabbit Result: Irritation to eyes, reversing within 7 days Remarks: On basis of test data.
Distillates (petroleum), hydrotreated middle	:	Species: Rabbit Result: No eye irritation Method: OECD Test Guideline 405
Vinyltri (methylethylketoxime) silane	:	Species: Rabbit Result: Irreversible effects on the eye Remarks: On basis of test data.
3-Aminopropyltriethoxysilane	:	Species: Rabbit Result: Irreversible effects on the eye Remarks: On basis of test data.
Methyltri(ethylmethylketoxime)silane isomers and oligomers	:	Species: Rabbit Result: Irritation to eyes, reversing within 7 days Remarks: Based on data from similar materials
Respiratory or skin sensitization:		
Skin sensitisation	:	May cause an allergic skin reaction.
Respiratory sensitisation	:	Not classified based on available information.
Components:		
Methyltri(ethylmethylketoxime)silane	:	Assessment: Probability or evidence of skin sensitisation in humans Test Type: Maximisation Test Species: Guinea pig Remarks: On basis of test data.
Distillates (petroleum), hydrotreated middle	:	Test Type: Maximisation Test Exposure routes: Skin contact Species: Guinea pig Result: negative Remarks: Based on data from similar materials
Vinyltri (methylethylketoxime) silane	:	Assessment: Probability or evidence of skin sensitisation in humans Test Type: Maximisation Test Species: Guinea pig Remarks: Based on data from similar materials
3-Aminopropyltriethoxysilane	:	Assessment: Probability or evidence of skin sensitisation in humans Test Type: Maximisation Test Species: Guinea pig Remarks: On basis of test data. Test Type: Buehler Test Species: Guinea pig Remarks: On basis of test data.
Methyltri(ethylmethylketoxime)silane isomers and oligomers	:	Assessment: Probability or evidence of skin sensitisation in humans Test Type: Maximisation Test Species: Guinea pig Remarks: Based on data from similar materials

Germ cell mutagenicity	:	Not classified based on available information
Components:		
Methyltri(ethylmethylketoxime)silane:		
Genotoxicity in vitro	:	Test Type: Mutagenicity (in vitro mammalian cytogenetic test) Result: negative Remarks: On basis of test data.
Distillates (petroleum), hydrotreated middle:		
Genotoxicity in vitro	:	Test Type: Bacterial reverse mutation assay (AMES) Result: negative
Genotoxicity in vivo	:	Test Type: Mutagenicity (in vivo mammalian bone-marrow cytogenetic test, chromosomal analysis) Species: Rat Application Route: Intraperitoneal injection Result: negative
Vinyltri (methylethylketoxime) silane:		
Genotoxicity in vitro	:	Test Type: Bacterial reverse mutation assay (AMES) Result: negative Remarks: On basis of test data.
Genotoxicity in vivo	:	Test Type: In vivo micronucleus test Species: Mouse Application route: Intraperitoneal injection Result: negative Remarks: On basis of test data.
Germ cell mutagenicity - Assessment	:	Animal testing did not show any mutagenic effects.
3-Aminopropyltriethoxysilane:		
Genotoxicity in vitro	:	Test Type: Bacterial reverse mutation assay (AMES) Result: negative Remarks: On basis of test data.
	:	Test Type: Chromosome aberration test in vitro Result: negative Remarks: On basis of test data.
	:	Test Type: Mutagenicity (in vitro mammalian cytogenetic test) Result: negative Remarks: On basis of test data.
	:	Test Type: In vitro sister chromatid exchange assay in mammalian cells Result: negative Remarks: On basis of test data
Genotoxicity in vivo	:	Test Type: Mammalian erythrocyte micronucleus test (in vivo cytogenetic assay) Species: Mouse Application route: Intraperitoneal injection Result: negative Remarks: On basis of test data.
Germ cell mutagenicity - Assessment	:	Animal testing did not show any mutagenic effects.
Carcinogenicity	:	Not classified based on available information
Components:		
3-Aminopropyltriethoxysilane	:	Species: Mouse Application route: Skin contact Result: negative Remarks: On basis of test data
Carcinogenicity - Assessment	:	Animal testing did not show any carcinogenic effects.
Reproductivity toxicity	:	Not classified based on available information.
Components:		
Methyltri(ethylmethylketoxime)silane:		
Effects on fertility	:	Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test Species: Rat, male and female Application route: Ingestion Symptoms: No effects on fertility Remarks: On basis of test data.

Effects on foetal development	:	Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test Species: Rat, male and female Application route: Ingestion Symptoms: No effects on foetal development Remarks: On basis of test data.
Reproductive toxicity - Assessment	:	No evidence of adverse effects on sexual function and fertility, or on development, based on animal experiments.
Distillates (petroleum), hydrotreated middle:		
Effects on fertility	:	Test Type: Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test Species: Rat Application route: Ingestion Method: OECD Test Guideline 422 Result: negative Remarks: Based on data from similar materials
Effects on foetal development	:	Test Type: Embryo-foetal development Species: Rat Application route: Ingestion Method: OECD Test Guideline 414 Result: negative
3-Aminopropyltriethoxysilane:		
Effects on fertility	:	Species: Rat, male and female Application route: Ingestion Symptoms: No effects on fertility Remarks: On basis of test data.
Effects on foetal development	:	Test Type: Prenatal development toxicity study (teratogenicity) Species: Rat Application route: Ingestion Symptoms: No effects on foetal development Remarks: On basis of test data.
Reproductive toxicity - Assessment	:	No evidence of adverse effects on sexual function and fertility, or on development, based on animal experiments.
STOT – single exposure	:	Not classified based on available information.
STOT – repeated exposure	:	Not classified based on available information.
Components:		
Methyltri(ethylmethylketoxime)silane	:	Exposure routes: Ingestion Target Organs: Blood Assessment: Shown to produce significant health effects in animals at concentrations of >10 to 100 mg/kg bw.
Vinyltri (methylethylketoxime) silane	:	Exposure routes: Ingestion Target Organs: Blood Assessment: Shown to produce significant health effects in animals at concentrations of >10 to 100 mg/kg bw.
3-Aminopropyltriethoxysilane	:	Exposure routes: Ingestion Assessment: No significant health effects observed in animals at concentrations of 100 mg/kg bw or less. Exposure routes: inhalation (dust/mist/fume) Assessment: No significant health effects observed in animals at concentrations of 0.2 mg/l/6h/d or less. Exposure routes: Skin contact Assessment: No significant health effects observed in animals at concentrations of 200 mg/kg bw or less.
Methyltri(ethylmethylketoxime)silane isomers and oligomers	:	Exposure routes: Ingestion Target Organs: Blood Assessment: Shown to produce significant health effects in animals at concentrations of >10 to 100 mg/kg bw.

Repeated dose toxicity
Components:

Methyltri(ethylmethylketoxime)silane	:	Species: Rat Application route: Ingestion Target Organs: Blood Remarks: On basis of test data.
Distillates (petroleum), hydrotreated middle	:	Species: Rat NOAEL: >= 5,000 mg/kg Application route: Ingestion Exposure time: 13 Weeks Remarks: Based on data from similar materials
Vinyltri (methylethylketoxime) silane	:	Species: Rat Application route: Ingestion Target Organs: Blood Remarks: Based on data from similar materials
3-Aminopropyltriethoxysilane	:	Species: Rat Application route: Ingestion Remarks: On basis of test data. Species: Rat Application route: inhalation (dust/mist/fume) Remarks: On basis of test data. Species: Rabbit Application route: Skin contact Remarks: Based on data from similar materials
Methyltri(ethylmethylketoxime)silane isomers and oligomers	:	Species: Rat Application route: Ingestion Target Organs: Blood Remarks: Based on data from similar materials

Aspiration toxicity : Not classified based on available information.
Components:

Distillates (petroleum), hydrotreated middle	:	The substance or mixture is known to cause human aspiration toxicity hazards or has to be regarded as if it causes a human aspiration toxicity hazard.

Further information
Product : Remarks: During use of the material, small amounts of methylethylketoxime (MEKO) will be released. Rodents exposed to chronic MEKO inhalation throughout their lifetimes showed significant increases in liver tumour rates.

12. Ecological Information

Ecotoxicity
Components:
Methyltri(ethylmethylketoxime)silane:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): > 120 mg/l Exposure time: 96 h Method: OECD Test Guideline 203 Remarks: Based on data from similar materials
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): > 120 mg/l Exposure time: 48 h Method: OECD Test Guideline 202 Remarks: Based on data from similar materials
Toxicity to algae	:	ErC50 (Selenastrum capricornutum (green algae)): 94 mg/l Exposure time: 72 h Method: OECD Test Guideline 201 Remarks: Based on data from similar materials

Limestone:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): > 120 mg/l Exposure time: 96 h

Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): > 120 mg/l Exposure time: 48 h
Toxicity to algae	:	EC50 (Selenastrum capricornutum (green algae)): 94 mg/l Exposure time: 72 h

Ecotoxicology Assessment

Acute aquatic toxicity	:	This product has no known ecotoxicological effects.

Components:

Distillates (petroleum), hydrotreated middle:

Toxicity to fish	:	LL50 (Scophthalmus maximus (turbot)): > 1,028 mg/l Exposure time: 96 h Test substance: Water Accommodated Fraction
Toxicity to daphnia and other aquatic invertebrates	:	LL50 (Acartia tonsa): > 3,193 mg/l Exposure time: 48 h Test substance: Water Accommodated Fraction
Toxicity to algae	:	EL50 (Skeletonema costatum (marine diatom)): > 10,000 mg/l Exposure time: 72 h Test substance: Water Accommodated Fraction
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOELR (Ceriodaphnia dubia (water flea)): > 100 mg/l Exposure time: 8 d Test substance: Water Accommodated Fraction
Toxicity to microorganisms	:	EC50: > 100 mg/l Exposure time: 3 h Method: OECD Test Guideline 209

Vinyltri (methylethylketoxime) silane:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): > 120 mg/l Exposure time: 96 h Method: OECD Test Guideline 203 LC50 (Oryzias latipes (Orange-red killifish)): > 100 mg/l Exposure time: 96 h Method: OECD Test Guideline 203

3-Aminopropyltriethoxysilane:

Toxicity to fish	:	LC50 (Danio rerio (zebra fish)): > 934 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia sp. (water flea)): 331 mg/l Exposure time: 48 h

Persistence and degradability:

Components:

Methyltri(ethylmethylketoxime)silane:

Biodegradability	:	Result: Not readily biodegradable. Biodegradation: 14.5 % Exposure time: 21 d Method: OECD Test Guideline 302B Remarks: Based on data from similar materials

Distillates (petroleum), hydrotreated middle:

Biodegradability	:	Result: Readily biodegradable. Biodegradation: 74 % Exposure time: 28 d Method: OECD Test Guideline 306

Vinyltri (methylethylketoxime) silane:

Biodegradability	:	Result: Not readily biodegradable. Biodegradation: 0 % Exposure time: 28 d Method: OECD Test Guideline 301A
Stability in water	:	Degradation half-life: < 1 min (2 °C) Method: OECD Test Guideline 111

Bioaccumulative potential:
Components:
Methyltri(ethylmethylketoxime)silane:
Partition coefficient: n-octanol/water : log Pow: 11.2
3-Aminopropyltriethoxysilane:
Bioaccumulation : Species: Cyprinus carpio (Carp)
Bioconcentration factor (BCF): < 100

Mobility in soil: : No data available
Other adverse effects: : No data available

13. Disposal Considerations

Disposal methods
Waste from residues : Dispose of in accordance with local regulations.
Contaminated packaging : Empty containers should be taken to an approved waste handling site for recycling or disposal. If not otherwise specified: Dispose of as unused product.

The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully complaint with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration should be made in approved chemical incinerator in accordance with regulations, or bury after cure 15cm pieces are made. Silica particulates are formed on incineration. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty container or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

14. Transport Information

Japanese Act:
Handle without any source of ignition. When the load is 3t or more, the substance belongs to the flammable solids of the Dangerous Articles.

External Act:
The substance is not regarded as a dangerous material for ship and air transportation.

International Regulations:

UNRTDG	Not regulated as a dangerous good
IATA-GGR	Not regulated as a dangerous good
IMDG-Code	Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:
Not applicable for product as supplied.

15. Regulatory Information

For 3 tons or more, the material is regarded as a flammable solid family which belongs to the Japanese Fire Service Act Law designated flammable substances.

Safety, health and environmental regulations/legislation specific for the substance or mixture:
Law on Chemicals No. 06/2007/QH12

The components of this product are reported in the following inventories:		
KECL	:	All ingredients listed or exempt.
EINECS	:	No subject chemicals.
TSCA	:	No subject chemicals.
MITI	:	No subject chemicals.
DSL	:	No subject chemicals.
AICSI	:	No subject chemicals.
IECSC	:	No subject chemicals.
PICCS	:	No subject chemicals.

16. Other Information

Quotation Documents : ACGIH TLV for Chemical Substances
Chemical safe administration data book (The Chemical Daily Co., Ltd.)

Precautions This material is developed and manufactured for building and construction application only. For medical or other special applications, use after performing safety testing on the product and confirming safety. Never use for human applications such as implant, impregnation, and possible residue-remaining in the body.

Any Other Precaution Other (an address, and telephone and fax number for information, references). The information herein is made based on references, information and data available at present. It may be revised when new information is available. The description herein is for formal handling. For special applications, make safety provisions suitable to them prior to use.

Please read and understand the entire SDS, as there is important information throughout the document.

Revision: 03.25
Date of revision: 28-03-2025